HARMONY SUBDIVISION FILING 16

Preliminary Drainage Report

DECEMBER 2022

Approved For One Year From This Date	
City Engineer	Date
Water Department	Date

PREPARED FOR:
Melcor/TC Aurora, LLC
C/O Marathon Land Company
Littleton, Colorado

PREPARED BY: Westwood

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PRELIMINARY DRAINAGE REPORT

Harmony Subdivision Filing 16
Aurora, Colorado

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A. INTRODUCTION

1. LOCATION

A. ADJACENT STREETS, SUBDIVISION NAME, LOT AND BLOCK, SITE PLAN NAME

Harmony Filing 16 is generally located south of I-70, in the northern ½ of Section 9, Township 4 South, Range 65 West of the 6th Principal Meridian, in the City of Aurora, Colorado. The roadways included within the project site and surrounding the site can be found below on the Vicinity Map.

B. VICINITY MAP

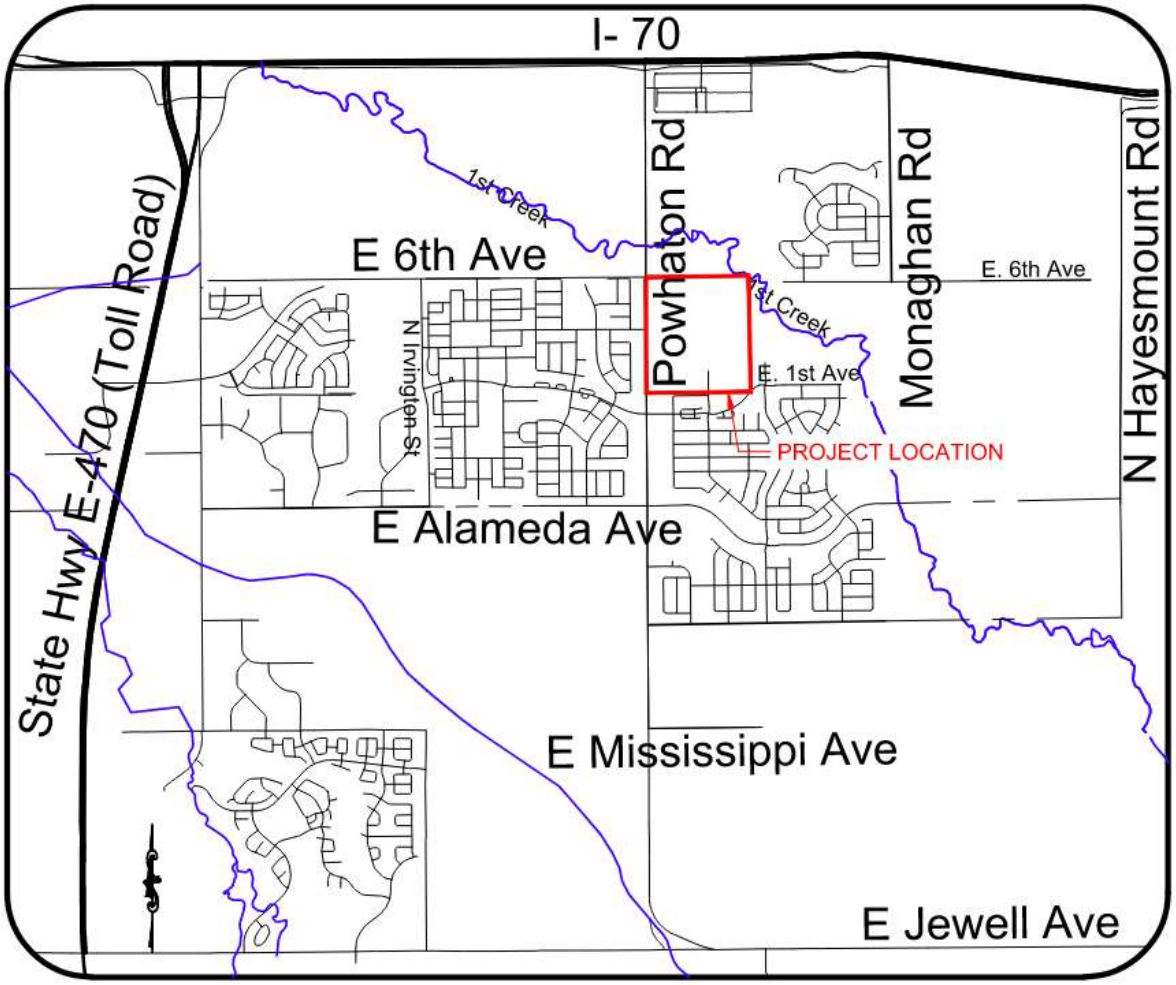


Figure 1. Project Vicinity Map

C. SURROUNDING DEVELOPMENTS

Harmony Filing 16 is bordered to the south by Harmony Filing 1, Harmony Filing 3, and the Harmony Ridge P-8 Stem School. A future Harmony phase will be constructed east of the site with Trussville St making the eastern border. To the west of the site is the Adonea development with Powhaton Rd making the western border. The northern border is 6th Avenue with undeveloped land north of the road. From here on, the Harmony Ridge P-8 Stem School will be referred to as "the school site".

2. PROPOSED DEVELOPMENT

A. PROPERTY DESCRIPTION

The Filing 16 area is generally rolling agricultural land that drains north to First Creek.

The hydrologic soil map created from the NRCS Web Soil Survey shows the Harmony Filing 16 project site is composed of 99% Group B soils and the remaining 1% is Group D soils. These maps were used for the Harmony MDR hydrologic analysis. The NRCS Web Soil Survey is in Appendix D.

B. TYPE OF DEVELOPMENT

The Filing 16 development will be residential. The proposed development contains single-family detached and multifamily attached products. The percent impervious values used for these residential areas are 60% and 75% based on Table 1 in the City of Aurora Standards and the typical products used throughout the Harmony development. Please see Table 1 below.

TABLE 1. CITY OF AURORA TABLE 1

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
Business:					
Commercial Areas	95	.87	.87	.88	.89
Neighborhood Areas	85	.60	.65	.70	.80
Residential:					
Single-Family (**)	(*)	.40	.45	.50	.60
Multi-Unit (detached)	60	.45	.50	.60	.70
Multi-Unit (attached)	75	.60	.65	.70	.80
1/2 Acre Lot or Larger	(*)	.30	.35	.40	.60
Apartments	80	.65	.70	.70	.80

C. REQUESTED VARIANCES

Variance 1

Section 6.53 in the COA SDDTC [Ref. 1] states that "In order to eliminate the use of cross-pans as much as possible, inlets shall be required at the upstream of streets intersection and drive entrances when there is an existing or proposed public storm sewer available." A variance from Section 6.53 is requested to allow the use of a cross pan instead of inlets at the intersection of E. 2nd Place and N. Trussville Street due to no proposed storm systems nearby. The closest storm system is about 500' from this intersection.

Variance 2

Section 6.32 in the COA SDDTC [Ref. 1] states that "The minimum freeboard for open space detention facilities is one-foot (1.0') above the computed 100-year water surface elevation. The emergency overflow weir sill shall be set at the freeboard elevation." A variance from Section 6.32 is requested to allow the emergency overflow weir sill to be set at the 100-year water surface elevation. This change will be included in the upcoming COA SDDTC revisions.

Variance 3

Section 5.22 in the COA SDDTC [Ref. 1] requires that one-hour rainfall depths are retrieved from Figures RA-1 through RA-6 in the USDCM [Ref. 2]. A variance from Section 5.22 is requested to allow one-hour rainfall depths to be retrieved from the NOAA Atlas 14. This change will be included in the upcoming COA SDDTC revisions.

B. HISTORIC DRAINAGE

The Site will cover approximately 150 acres of land that is currently undeveloped farmland. The topography of the Site is rolling, with slopes ranging from 0.5% to 5% Site. Elevations range from 5620 feet at the southern end of the site to 5585 feet near the northern end. The entire site is tributary to First Creek.

1. OVERALL BASIN DESCRIPTION

The following discussion provides details about the historic runoff conditions of the watershed. The Filing 16 area is generally split into two basins that overland flow to two natural swales before ultimately discharging to First Creek. The existing basins are separated by a meandering ridge that runs North – South. About 67% of the area is within in the western basin while about 33% of the area is within the eastern basin.

A. OFF-SITE BASINS

There is one large offsite basin that flows through the site from south to north. This basin is the APS P-8 school. The school site has a full spectrum detention pond that treats and detains runoff from the school site. In the existing condition, the pond outfalls into the undeveloped open space before reaching First Creek. In the proposed condition, the outflow from the school pond will be piped to Regional Pond T.

B. MAJOR DRAINAGE WAYS

The Harmony Filing 16 property is drained by First Creek. First Creek flows north just east of the Site before turning west just north of the Site. First Creek is a major drainageway that flows from the southeast to northwest and is tributary to the South Platte River.

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) [Ref. 7], the proposed Harmony Filing 16 area lies within “Zone X”, which is described as an area determined to be outside the 500-year floodplain limits or shallow flooding areas with average depths of less than one foot or drainage areas less than one square mile. The FIRM number is 08005C0206L and was revised February 17, 2017. A copy of the firm map can be found in Appendix D.

2. DRAINAGE PATTERNS THROUGH PROPERTY

The existing Harmony Filing 16 area generally slopes from south to north through overland flow and natural minor drainage swales.

3. OUTFALLS DOWNSTREAM OF PROPERTY

Runoff currently sheet flows to shallow natural swales that carry the flow to the north off the Filing 16 property where it collects with offsite flows in shallow conveyance channels that discharge into First Creek.

C. DESIGN CRITERIA

1. LIST OF REFERENCES

This Drainage Report is in accordance with the City of Aurora (COA) Storm Drainage Design and Technical Criteria (SDDTC) [Ref. 1] and Urban Storm Drainage Criteria Manual, VOL 1, 2 & 3 (USDCM) [Ref. 2].

Along with the above stated criteria manuals, this report also adheres to the general guidelines set forth by the "Master Drainage Report" by CVL Consultants, Inc, approved in May 2016 by the City of Aurora EDN 216065 [Ref 3], and Amendment No.3 to the MDR (currently under review, RSN 1527449). These documents outline the requirements for pond sizing and release rates in Filing 16.

2. HYDROLOGIC CRITERIA

A. RAINFALL

The City of Aurora advises the use of the NOAA Atlas 14 rainfall depths to estimate the one-hour rainfall depths for the 2-year and 100-year storm events. From the NOAA Atlas 14 rainfall depths, the 2-year storm event was determined to have a 0.85-inch per hour rainfall depth and the 100-year storm event was determined to have a 2.49-inch per hour rainfall depth. The NOAA Atlas rainfall tables can be found in Appendix D.

B. CALCULATION METHOD

Peak flow rates for the proposed stormwater infrastructure were developed using the Rational Method to establish flows at design points throughout the Site. The project consists of urban catchments of 90 acres or less. The Rational Method is the most applicable calculation method to calculate peak flows for this supporting analysis. Calculations were conducted using the Rational Method per COA Drainage Manual Section 5.20. Completed forms and associated supporting documentation are in Appendix A.

The Rational Method is based on the formula:

$$Q = CIA \tag{5-1}$$

Q = the peak rate of runoff (CFS)
C = Runoff Coefficient (unitless)
I = average intensity of rainfall for a duration equal to the time of concentration, t_c (inches/hour)

Per the COA SDDTC [Ref. 2], rainfall intensity is determined using the one-hour rainfall depth, P1, in the COA SDDTC Equation 5.5, as shown below:

$$I = \frac{28.5P_1}{(10 + T_C)^{0.786}} \tag{5.5}$$

I = rainfall intensity (inches per hour)
P_1 = 1-hour point rainfall depth (inches), from Figures RA-1 through RA-6 in USDCM, Volume 1
T_C = time of concentration (minutes)

Composite runoff coefficients were calculated based upon Table 1 of the COA SDDTC [Ref. 2]. National Resource Conservation Service Web Soil Survey of hydrologic soil groups is in Appendix D.

C. DETENTION POND SIZING

Pond T was designed as a full spectrum regional detention pond while Pond U was designed as full spectrum detention pond. Both ponds were designed in the Filing 16 Offsites project. Please see the pond designs included in Appendix D.

Existing Pond B (Harmony Filing 1) and Pond BB (Harmony Filing 12) will be combined into one regional pond in this project. The two ponds will be joined together with two large pipes that will have the capacity of the 100-year developed flow of Pond BB. Pond BB is two feet higher than Pond B so Pond BB will drain into Pond B. MHFD UD Detention sheet is used for the design. The new combined pond will be referred to as Regional Pond B.

As discussed in the Harmony Ridge P-8 Stem School Final Drainage Report, Harmony Filing 16 will also be responsible for routing the school pond outfall through the Filing 16 development to First Creek. The school pond's outlet pipe will be connected to the Filing 16 storm system and outfall into Regional Detention Pond T before outfalling into First Creek. The Harmony Ridge P-8 Stem School site is included in the sizing of Pond T. For more details see Section D.3. The school pond certification is attached in Appendix D.

The MHFD Detention calculation sheets are provided in Appendix B.

D. DESIGN FREQUENCIES

Per the SDDTCM Section 3.31, the 2-year storm event was used as the minor and the 100-year storm event as the major storm design frequencies appropriate for residential, business, and industrial land uses.

3. HYDRAULIC CRITERIA

The SDDTCM [Ref. 2] and the USDCM [Ref. 3] were used as the guidelines for the analysis and design provided in this report.

A. STREET CAPACITY

Street capacities are based on ponding requirements of the project design storms. Allowable street hydraulic capacity is estimated using MHFD UD-Inlet_v4.06.xls, which accounts for safety reduction factors. The combination of street conveyance and the subsurface storm drainage system will provide adequate capacity to meet the allowable pavement encroachment and depths of flow for the minor and major design storms. Inlet capacities, sizing, and hydraulic modeling will be evaluated at the final design stage.

B. CHANNEL DESIGN

The COA SDDTC [Ref. 1] and the USDCM [Ref. 2] are the design guidelines for the design and analyses provided in this report. The regional channel will have a geomorphically informed design that is MHFD maintenance eligible. There is one channel reach in Filing 16 that is referred to as Titus Tributary. Titus Tributary receives flows from Regional Pond B and routes these flows to First Creek. The channel layout and profiles are provided in the Preliminary Channel P&P sheets accompanying this report. Prelim design memo from a geomorphic sub-consultant (5 Smooth Stones) is provided in Appendix C. The tributary reaches are sized to contain the 100-year flow from the Regional Detention Pond B.

C. EMERGENCY OVERFLOW

The main conveyance emergency overflow paths for each detention facility and sump inlet are shown on the Preliminary Drainage Maps provided with this submittal. The overflow rates and paths calculated for

each pond are provided in Appendix B while the calculations for the sump inlets are provided in Appendix C. More information for the sump inlet overflow paths is described in Section D.2.A. For more information on the pond emergency overflow see Section D.3.B.

D. DRAINAGE PLAN

1. GENERAL CONCEPT

On-site runoff will generally be captured in on-grade inlets that have been designed to capture 100% of the 2-yr storm to prove that no cross-street flow occurs. Furthermore, on-grade inlets capture a percentage of the 100-year storm and the 100-year bypass flow has been calculated to bypass to the next downstream inlet, whether on-grade or sump. Therefore, on-grade inlets will not only have 2-yr capacity. All inlets will be considered functioning during the 100-year storm. All inlets and storm pipes have been designed for the 100-year storm. Please note that all storm infrastructure has been sized for the ultimate build-out condition which includes the Filing 16 Offsites (6th Ave and Powhaton) and this Filing 16 (interior residential development).

In compliance with the MHFD Criteria Manual (Ref 1) and the COA SDDTC (Ref 2), drainage from onsite basins each have Extended Detention Basin (EDB) ponds that provide water quality, EURV, and detention for onsite runoff. Regional Pond T and Detention Pond U is designed in the Filing 16 Offsites project. Pond T and Pond U are both sized for the ultimate build out condition, therefore, the Filing 16 developed basins were used to size the ponds. This includes the residential lots, interior streets, Powhaton, 6th Avenue, and the neighboring school site. See pond designs provided in Appendix D.

As discussed in MDR Amendment #3, Pond B (Filing No. 1, COA EDN 217051) and Pond BB (Filing No. 12, COA EDN 220183) will be combined into one regional pond. This will be done by connecting the two ponds with a large 2- 48" pipe culvert so any runoff collected in existing Pond BB will flow into existing Pond B. Existing Pond BB is two feet higher than existing Pond B, therefore with minimal grading changes, Pond BB will be modified to drain into Pond B. Pond B's outlet structure and outlet pipe will be utilized for the combined regional pond. This combined pond will be named Regional Pond B. These proposed changes are discussed in the MDR Amendment #3 (RSN 1527449).

A regional channel is proposed called Titus Tributary. Titis Tributary will carry flow from Regional Pond B to First Creek. Please see Section D.4.A. for more information.

A. OFFSITE DRAINAGE

The offsite drainage from the Harmony Ridge P-8 Stem School site will be conveyed through the Filing 16 development in storm pipe to Regional Pond T before discharging into First Creek. In addition to the residential development, existing Pond BB will be combined with Pond B and will now be designed to perform as a regional pond. This pond will be called Regional Pond B. Regional Pond B will outfall into the proposed Titus Tributary channel before discharging into First Creek.

B. COORDINATION WITH SURROUNDING DEVELOPMENTS

Coordination will take place with the Harmony Ridge P-8 Stem School regarding the outlet pipe from their detention pond.

2. SPECIFIC DETAILS

Harmony Filing 16 is delineated into two (2) major basins. Each onsite basin drains to a full spectrum EDB pond which provides WQCV and detention for the EURV and 100-year runoff. The overall drainage basins were delineated for each pond. The sub-basin areas are shown on the accompanying Harmony Filing 16 Preliminary Drainage Maps.

A. BASIN DESCRIPTIONS

T Basins

Basin T consists of 56 sub-basins located in Filing 16. Runoff generated in these basins sheet flows to the curb and gutter, is captured in inlets and is piped to Regional EDB Pond T. Please note that some of the Filing 16 Offsite basins are included here because revisions were made to the basins due to grading changes in this design.

Basin T-1

Basin T-1 contains paved roads, sidewalk, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 1-T. Any bypass flow from this inlet will continue east to DP 23-T.

Basin T-2

Basin T-2 contains single-family lots, paved roads, sidewalks, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 2-T. Any bypass flow from this inlet will continue north to DP 24-T.

Basin T-3

Basin T-3 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 3-T. Any bypass flow from this inlet will continue north to DP 6-T.

Basin T-4

Basin T-4 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 4-T. Any bypass flow from this inlet will continue north to DP 6-T.

Basin T-5

Basin T-5 contains paved roads, sidewalks, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 5-T. Any bypass flow from this inlet will continue north to DP 13-T.

Basin T-6

Basin T-6 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 6-T. Any bypass flow from this inlet will continue north to DP 14-T.

Basin T-7

Basin T-7 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 7-T. Any bypass flow from this inlet will continue north to DP 15-T.

Basin T-8

Basin T-8 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 8-T. Any bypass flow from this inlet will continue north to DP 23-T.

Basin T-9
Basin T-9 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 9-T. Any bypass flow from this inlet will continue north to DP 23-T.

Basin T-10
Basin T-10 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 10-T. Any bypass flow from this inlet will continue north to DP 15-T.

Basin T-11
Basin T-11 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 11-T. Any bypass flow from this inlet will continue north to DP 14-T.

Basin T-12
Basin T-12 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 12-T. Any bypass flow from this inlet will continue north to DP 13-T.

Basin T-13
Basin T-13 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 13-T. Any bypass flow from this inlet will continue north to DP 19-T.

Basin T-14
Basin T-14 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 14-T. Any bypass flow from this inlet will continue north to DP 20-T.

Basin T-15
Basin T-15 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 15-T. Any bypass flow from this inlet will continue north to DP 8-T.

Basin T-16
Basin T-16 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 16-T. Any bypass flow from this inlet will continue north to DP 8-T.

Basin T-17
Basin T-17 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 17-T. Any bypass flow from this inlet will continue north to DP 20-T.

Basin T-18
Basin T-18 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 18-T. Any bypass flow from this inlet will continue north to DP 19-T.

Basin T-19
Basin T-19 contains single-family lots, paved roads, sidewalks, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 19-T. Any bypass flow from this inlet will continue west to DP 27-T.

Basin T-20
Basin T-20 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 20-T. Any bypass flow from this inlet will continue northeast to DP 27-T.

Basin T-21
Basin T-21 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 21-T. Any bypass flow from this inlet will continue north to DP 28-T.

Basin T-22
Basin T-22 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 22-T. Any bypass flow from this inlet will continue north to DP 31-T.

Basin T-23
Basin T-23 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 23-T. Any bypass flow from this inlet will continue north to DP 31-T.

Basin T-24
Basin T-24 contains single-family lots, paved roads, sidewalks, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 24-T. Any bypass flow from this inlet will continue east to DP 23-T.

Basin T-25
Basin T-25 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 25-T. Any bypass flow from this inlet will continue north to DP 28-T.

Basin T-26
Basin T-26 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 26-T. Any bypass flow from this inlet will continue northeast to DP 27-T.

Basin T-27
Basin T-27 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 27-T. Any bypass flow from this inlet will continue north to DP 32-T.

Basin T-28
Basin T-28 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 28-T. Any bypass flow from this inlet will continue north to DP 32-T.

Basin T-29
Basin T-29 contains paved roads, sidewalks, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 29-T. Any bypass flow from this inlet will continue east to DP 31-T.

Basin T-30
Basin T-30 contains single-family lots, paved roads, sidewalks, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 30-T. Any bypass flow from this inlet will continue east to DP 31-T.

Basin T-30.1
Basin T-30.1 contains single-family lots, paved roads, sidewalks, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 30.1-T. Any bypass flow from this inlet will continue east to DP 31-T.

Basin T-31
Basin T-31 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to a sump inlet at DP 31-T which captures 100% of the 2-year and 100-year flows.

Basin T-32
Basin T-32 contains single-family lots, paved roads, sidewalks, and open space/parks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 32-T. Any bypass flow from this inlet will continue north to DP 38-T.

Basin T-33
Basin T-33 contains single-family lots and paved roads. Runoff generated by this basin sheet flows to an alley. Runoff then flows within the alley to DP 33-T where it bypasses to an on-grade inlet at DP 32-T. Any bypass flow from this inlet will continue north to DP 38-T.

Basin T-34
Basin T-34 contains single-family lots and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 34-T where it bypasses to an on-grade inlet at DP 37-T. Any bypass flow from this inlet will continue north to DP 38-T.

Basin T-35
Basin T-35 contains single-family lots, paved roads, sidewalks, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 35-T. Any bypass flow from this inlet will continue north to DP 39-T.

Basin T-36
Basin T-36 contains single-family lots, paved roads, sidewalks, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 36-T. Any bypass flow from this inlet will continue north to DP 39-T.

Basin T-37
Basin T-37 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 37-T. Any bypass flow from this inlet will continue north to DP 38-T.

Basin T-38
Basin T-38 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to a sump inlet at DP 38-T which captures 100% of the 2-year and 100-year flows.

Basin T-39
Basin T-39 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 39-T. Any bypass flow from this inlet will continue west to DP 38-T.

Basin T-40
Basin T-40 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 40-T. Any bypass flow from this inlet will continue west to DP 38-T.

Basin T-41
Basin T-41 contains multi-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 41-T. Any bypass flow from this inlet will continue west to DP 44-T.

Basin T-42
Basin T-42 contains multi-family lots and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 42-T where it bypasses to an on-grade inlet at DP 41-T. Any bypass flow from this inlet will continue west to DP 44-T.

Basin T-43
Basin T-43 contains multi-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to an on-grade inlet at DP 43-T. Any bypass flow from this inlet will continue west to DP 44-T.

Basin T-44
Basin T-44 contains paved roads and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 44-T. Any bypass flow from this inlet will continue west to DP 49-T.

Basin T-45
Basin T-45 contains multi-family lots and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 45-T where it bypasses to an on-grade inlet at DP 44-T. Any bypass flow from this inlet will continue west to DP 49-T.

Basin T-46
Basin T-46 contains multi-family lots and paved roads. Runoff generated by this basin sheet flows to the alleyr. Runoff then flows within the alley to DP 46-T where it bypasses to a sump inlet at DP 49-T which captures 100% of the 2-year and 100-year flows.

Basin T-47
Basin T-47 contains multi-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 47-T. Any bypass flow from this inlet will continue west to DP 49-T.

Basin T-48

Basin T-48 contains multi-family lots, open space, and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 48-T where it bypasses to a sump inlet at DP 49-T which captures 100% of the 2-year and 100-year flows.

Basin T-49

Basin T-49 contains multi-family lots, open space, sidewalks, and paved roads. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to a sump inlet at DP 49-T which captures 100% of the 2-year and 100-year flows.

Basin T-50

Basin T-50 is the basin for regional detention Pond T. The open space adjacent to Pond T overland flows into the pond before reaching the outlet structure. From here runoff will be routed to First Creek.

Basin T-55

Basin T-55 contains open space, sidewalks, and Pond T. Runoff generated by this basin will sheet flow to Pond T.

TABLE 2. T BASIN SUMMARY TABLE

Basin Summary						
Basin	**Area (acres)**	**% Imp.**	**Q2**	**Q100**	**C2**	**C100**
T-1	4.83	42.0	3.7	12.0	0.45	0.50
T-2	4.78	52.6	3.9	15.9	0.44	0.62
T-3	0.95	65.0	1.1	4.5	0.52	0.72
T-4	1.98	62.7	2.2	8.4	0.53	0.69
T-5	0.76	72.6	1.2	3.9	0.67	0.72
T-6	1.19	65.1	1.4	5.4	0.54	0.71
T-7	0.83	67.0	1.0	3.9	0.56	0.72
T-8	1.82	64.4	1.9	7.6	0.52	0.71
T-9	1.82	65.2	2.0	8.1	0.53	0.72
T-10	1.00	63.3	1.1	4.5	0.50	0.71
T-11	1.43	63.1	1.5	6.2	0.50	0.71
T-12	2.45	65.4	2.4	9.5	0.53	0.72
T-13	3.25	64.8	3.2	12.7	0.52	0.72
T-14	1.40	64.6	1.5	6.0	0.53	0.71
T-15	1.01	41.3	0.8	4.2	0.39	0.69
T-16	1.05	40.3	0.8	4.5	0.37	0.69
T-17	0.95	64.1	1.1	4.4	0.51	0.71
T-18	2.09	63.5	2.1	8.8	0.50	0.71
T-19	3.77	62.4	3.5	14.4	0.50	0.70
T-20	1.06	65.5	1.3	4.7	0.55	0.71
T-21	1.03	66.3	1.3	5.0	0.55	0.72
T-22	1.61	63.7	1.8	7.3	0.51	0.71
T-23	2.08	66.7	2.3	8.7	0.55	0.72
T-24	2.37	46.3	2.0	7.8	0.41	0.56
T-25	1.68	62.9	1.7	7.1	0.50	0.71

Basin Summary						
Basin	**Area (acres)**	**% Imp.**	**Q2**	**Q100**	**C2**	**C100**
T-26	0.90	62.6	1.0	4.0	0.49	0.71
T-27	2.83	63.3	2.7	11.0	0.51	0.70
T-28	1.27	65.2	1.5	5.7	0.54	0.71
T-29	0.19	51.6	0.2	0.7	0.52	0.57
T-30	3.21	48.8	2.7	10.8	0.43	0.58
T-30.1	2.19	64.0	2.2	9.0	0.51	0.71
T-31	2.72	65.7	2.9	11.4	0.54	0.72
T-32	2.42	54.5	2.1	9.3	0.46	0.69
T-33	0.74	67.2	0.9	3.8	0.53	0.74
T-34	0.35	68.3	0.5	1.9	0.54	0.75
T-35	1.94	23.6	1.0	7.7	0.25	0.66
T-36	1.91	48.3	1.6	7.5	0.41	0.66
T-37	2.13	63.5	2.2	8.8	0.52	0.70
T-38	3.97	67.1	4.1	16.6	0.54	0.73
T-39	1.67	65.9	1.8	7.0	0.54	0.72
T-40	1.38	63.8	1.4	6.0	0.51	0.71
T-41	0.70	76.1	1.1	3.8	0.65	0.78
T-42	0.99	80.4	1.7	6.3	0.66	0.83
T-43	0.47	77.5	0.9	3.1	0.68	0.78
T-44	0.40	69.0	0.7	2.2	0.64	0.70
T-45	0.85	78.4	1.4	5.2	0.64	0.82
T-46	0.37	81.9	0.7	2.4	0.67	0.84
T-47	0.47	78.7	0.9	3.0	0.69	0.79
T-48	1.78	64.8	2.3	8.4	0.56	0.70
T-49	1.24	68.9	1.7	5.6	0.64	0.70
T-50	1.30	37.7	0.9	3.9	0.34	0.51
T-51	2.07	43.0	1.9	6.2	0.46	0.50
T-52	0.20	26.7	0.2	0.5	0.34	0.38
T-53	1.61	64.7	2.5	8.1	0.61	0.67
T-54	2.33	53.0	2.9	9.2	0.53	0.58
T-55	8.15	7.1	3.1	11.1	0.19	0.24

U Basins

Basin U consists of 30 sub-basins located in Filing 16 designated with a U. Runoff generated in these basins sheet flows to the curb and gutter, is captured in inlets and is piped to EDB Pond U. Please note that some of the Filing 16 Offsites basins are included here because revisions were made due to grading changes in this filing.

Basin U-1

Basin U-1 contains multi-family lots, paved roads, sidewalk, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to a sump inlet at DP 1U which captures 100% of the 2-year and 100-year flows.

Basin U-1a
Basin U-1a contains multi-family lots, sidewalks, and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 1aU where it bypasses to a sump inlet at DP 1U which captures 100% of the 2-year and 100-year flows.

Basin U-1b
Basin U-1b contains multi-family lots, sidewalks, open space, and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 1bU where it bypasses to a sump inlet at DP 1U which captures 100% of the 2-year and 100-year flows.

Basin U-2
Basin U-2 contains multi-family lots, paved roads, sidewalk, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to a sump inlet at DP 2U which captures 100% of the 2-year and 100-year flows.

Basin U-2a
Basin U-2a contains multi-family lots, sidewalks, and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 2aU where it bypasses to a sump inlet at DP 2U which captures 100% of the 2-year and 100-year flows.

Basin U-2b
Basin U-2b contains multi-family lots, sidewalks, and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 2bU where it bypasses to a sump inlet at DP 2U which captures 100% of the 2-year and 100-year flows.

Basin U-2c
Basin U-2c contains multi-family lots, sidewalks, and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 2cU where it bypasses to a sump inlet at DP 2U which captures 100% of the 2-year and 100-year flows.

Basin U-3
Basin U-3 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 3U. Any bypass flow from this inlet will continue north to DP 2U.

Basin U-4
Basin U-4 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 4U. Any bypass flow from this inlet will continue east to DP 3U.

Basin U-5
Basin U-5 contains single-family lots, paved roads, sidewalk, and open space/parks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to a sump inlet at DP 5U which captures 100% of the 2-year and 100-year flows.

Basin U-6
Basin U-6 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 6U. Any bypass flow from this inlet will continue north to DP 5U.

Basin U-7
Basin U-7 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 7U. Any bypass flow from this inlet will continue north to DP 5U.

Basin U-8
Basin U-8 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 8U. Any bypass flow from this inlet will continue north to DP 2U.

Basin U-10
Basin U-10 contains single-family lots, paved roads, sidewalk, and open space/parks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to a sump inlet at DP 10U which captures 100% of the 2-year and 100-year flows.

Basin U-11
Basin U-11 contains single-family lots, paved roads, sidewalk, and open space/parks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to a sump inlet at DP 11U which captures 100% of the 2-year and 100-year flows.

Basin U-12
Basin U-12 contains single-family lots, paved roads, sidewalk, and open space/parks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to a sump inlet at DP 12U which captures 100% of the 2-year and 100-year flows.

Basin U-13
Basin U-13 contains multi-family lots, paved roads, sidewalk, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to a sump inlet at DP 13U which captures 100% of the 2-year and 100-year flows.

Basin U-13a
Basin U-13a contains multi-family lots and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 13aU where it bypasses to a sump inlet at DP 13U which captures 100% of the 2-year and 100-year flows.

Basin U-13b
Basin U-13b contains multi-family lots, open space, and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 13bU where it bypasses to a sump inlet at DP 13U which captures 100% of the 2-year and 100-year flows.

Basin U-13c
Basin U-13c contains multi-family lots and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 13cU where it bypasses to a sump inlet at DP 13U which captures 100% of the 2-year and 100-year flows.

Basin U-14
Basin U-14 contains paved roads and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 14U. Any bypass flow from this inlet will continue north to DP 12U.

Basin U-15
Basin U-15 contains single-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 15U. Any bypass flow from this inlet will continue north to DP 12U.

Basin U-16
Basin U-16 contains multi-family lots, paved roads, sidewalk, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to a sump inlet at DP 16U which captures 100% of the 2-year and 100-year flows.

Basin U-19
Basin U-19 contains multi-family lots, paved roads, and sidewalks. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 19U. Any bypass flow from this inlet will continue northeast to DP 16U.

Basin U-19a
Basin U-19a contains multi-family lots and paved roads. Runoff generated by this basin sheet flows to the alley. Runoff then flows within the alley to DP 19aU where it bypasses to an on-grade inlet at DP 19U.

Basin U-20
Basin U-20 contains paved roads, sidewalks, and open space. Runoff generated by this basin sheet flows to the curb and gutter. Runoff then flows within the curb and gutter to an on-grade inlet at DP 20U. Any bypass flow from this inlet will continue west to DP 16U.

Basin U-22
Basin U-22 contains open space and Pond U. Runoff generated by this basin will sheet flow to Pond U.

TABLE 3. U BASIN SUMMARY TABLE

Basin Summary						
Basin	**Area (acres)**	**% Imp.**	**Q2**	**Q100**	**C2**	**C100**
U-1	1.67	75.3	2.6	8.7	0.67	0.76
U-1a	0.98	75.9	1.4	5.2	0.63	0.79
U-1b	2.37	77.0	3.6	13.4	0.63	0.81
U-2	1.39	74.4	2.3	7.7	0.66	0.75
U-2a	0.37	80.0	0.7	2.5	0.65	0.83
U-2b	0.72	66.8	1.1	3.9	0.57	0.72
U-2c	1.03	80.0	1.7	6.4	0.65	0.83
U-3	1.03	67.2	1.6	5.9	0.56	0.72
U-4	1.03	65.2	1.2	4.6	0.53	0.72
U-5	2.84	54.1	3.3	14.8	0.46	0.70
U-6	0.52	64.3	0.6	2.5	0.52	0.71
U-7	1.36	64.7	1.5	5.8	0.52	0.71
U-8	2.31	63.7	2.3	9.6	0.51	0.71
U-10	5.15	42.7	4.0	20.9	0.37	0.67
U-11	1.84	62.3	1.9	7.9	0.51	0.71
U-12	4.16	60.6	4.1	16.9	0.50	0.71

Basin Summary						
Basin	**Area (acres)**	**% Imp.**	**Q2**	**Q100**	**C2**	**C100**
U-13	3.09	72.6	4.0	13.1	0.65	0.74
U-13a	1.49	76.0	2.4	9.0	0.62	0.80
U-13b	0.66	59.5	0.9	3.2	0.53	0.66
U-13c	1.19	75.5	1.7	6.3	0.62	0.79
U-14	0.17	75.5	0.3	1.1	0.69	0.75
U-15	1.68	62.4	1.7	7.2	0.49	0.70
U-16	4.13	58.9	5.2	16.8	0.57	0.62
U-17	0.35	41.3	0.4	1.4	0.44	0.49
U-18	0.34	61.4	0.6	1.9	0.57	0.65
U-19	0.13	75.1	0.2	0.8	0.68	0.75
U-19a	0.46	79.7	0.7	2.6	0.65	0.82
U-20	3.08	79.1	3.1	9.7	0.72	0.77
U-21	1.22	86.5	2.4	7.5	0.77	0.83
U-22	3.99	8.3	1.7	6.0	0.20	0.25

3. DETENTION POND DESIGN DETAILS

Regional Pond B was preliminarily designed using SWMM to estimate the required detention volume necessary to restrict the release rate into First Creek to meet the conditions in MDR Amendment #3. Pond B is estimated to be 15.11 ac-ft at the 100-year Water Surface Elevation (WSEL) of 5616.89 ft, with a discharge rate of 53.8 cfs. Pond B will outfall into Titus Tributary before reaching First Creek. Design calculations are provided in Appendix B.

Pond T and Pond U are designed in the Filing 16 Offsites project. Pond T and Pond U are both sized for the ultimate build-out condition, therefore, the Filing 16 basins were used to size the ponds. This includes the residential lots, interior streets, Powhaton, 6th Avenue, and the neighboring school site. Please see Pond T and Pond U designs provided in Appendix D.

The existing school pond (COA EDN 219058) outfall currently discharges to an open field and overland flows to First Creek. In Filing 16, this outfall will be piped through the proposed public streets to Regional Pond T. Pond T was sized to include the entire school site for WQCV, EURV, and 100-yr detention.

A. RELEASE RATES

For Regional Pond B, the final outlet structures will be sized to meet the maximum release rate determined in the MDR at 54.6cfs. Please see the MDR Amendment #3 references provided in Appendix D.

B. EMERGENCY OVERFLOW PATHS

For Regional Pond B, the existing Pond B (Filing No. 1, west of Pond BB) was built in 2018 with an overflow path directed to the northwest that previously went through an open field. This overflow path is now blocked by the APS school site that was built in 2019. Pond BB (Filing No. 12, east of Pond B) is now also built and Pond BB overflows into Pond B. In Filing 16, we are proposing to install an overflow structure for Regional Pond B that will convey the emergency overflow north to Titus Tributary.

The overflow structure for Pond B is designed to route the 100-year developed flow through an additional weir structure. This will be called the overflow weir. The invert of each overflow weir will be set just above

the 100-year WSEL and it will overflow through the structure to Titus Tributary. The emergency overflow ponding depth will be contained within the pond and a foot of freeboard will be provided from the emergency overflow WSEL to the top of pond.

To design these structures, a separate MHFD UD Detention sheet was used to get an accurate understanding of emergency overflow ponding depth, to size the overflow weir, and the outfall pipe. Please note that a 50% clogging factor was applied to the overflow weir grate to evaluate how it would operate if it was 50% clogged.

There are two UD Detention sheets for Pond B. Two UD Detention sheets are used because the overflow weir is serving as a "4th zone" (1. WQCV, 2. EURV, 3. 100-Year, 4. Emergency Overflow) and the MHFD UD Detention sheet only has 3 zones. The first UD Detention sheet is used to design the pond and the outlet structure when the pond is performing "normally" – outlet structure that is 50% clogged (COA SDDTC Section 6.52). This will determine the 100-year WSEL, WQCV WSEL, and EURV WSEL along with the outlet structure design and remaining pond design. The second UD Detention sheet is used to size the overflow weir and to determine the ponding depth of the emergency overflow. For the second UD Detention sheet, the same pond parameters are input on the first page, so the same volumes and inflows are generated. The second page is typically where the outlet structure is sized but, in this case, we are using it to size the overflow weir. Since the outlet structure is considered completely clogged and not functioning in an emergency scenario, the only zone considered is Zone 4 - the overflow weir zone. As mentioned before, the invert is set just above the 100-year WSEL, and the clogging factor is set to 50% for the grated top. Please see the attached UD Detention sheets for the overflow weir calculations.

The pipe culvert connecting Pond B and Pond BB is sized to convey the emergency overflow of Pond B. Please see the culvert calculations provided in Appendix C.

The APS school site has a full spectrum detention pond on the northwest corner of the school site. This pond currently overflows into an open field north of the school pond. The proposed Filing 16 lies within the school pond overflow path therefore a new emergency overflow path is proposed in this project. The new path overflows onto N. Robertsdale Street and travels north, turns west on E. 3rd Avenue, and then turns north onto N. Quantock Street before overflowing into Pond T.

Emergency overflow paths for each pond are indicated on the Preliminary Drainage Maps provided with this submittal.

4. OPEN CHANNELS

A. REGIONAL CHANNELS

The COA SDDTC [Ref. 1] and the USDCM [Ref. 2] are the design guidelines for the design and analyses provided in this report. The regional channel will have a geomorphically informed design that is MHFD maintenance eligible. There is one channel in Filing 16 that is referred to as Titus Tributary. Titus Tributary receives flows from Regional Pond B and routes these flows to First Creek. The channel layout and profiles are provided in the Preliminary Channel plan and profile sheets accompanying this report. The preliminary design memo from a geomorphic sub-consultant (5 Smooth Stones) is provided in Appendix C. The tributary reaches are sized to contain the 100-year flow from Regional Pond B.

A HEC-RAS analysis was performed to verify flood elevations with the proposed Titus Tributary channel. The 100-year water surfaces are provided on the drainage maps, and the HEC-RAS outputs are provided in Appendix C.

B. SWALE DESIGN

There are no swales proposed in this project.

C. CULVERT DESIGN

There is one culvert proposed in this project that connects Pond B and Pond BB. This culvert will be 2-48" pipes that allow runoff to flow from Pond BB to Pond B, connecting the two ponds. Emergency overflow will also be able to pass through the culvert to reach the overflow structure. The culvert was designed for the Pond B emergency overflow (100-year undetained flow). Please see the culvert calculations provided in Appendix C.

E. CONCLUSIONS

1. COMPLIANCE WITH STANDARDS

This Harmony Filing 16 Drainage Report is prepared in general conformance with the COA SDDTC [Ref. 1] and the USDCM [Ref. 2]. This report is also consistent with the overall drainage concept outlined in the *Harmony Master Drainage Amendment 3" by Westwood* (MDR A3) [Ref. 4].

2. SUMMARY OF CONCEPT

The proposed Harmony Filing 16 site is comprised of single-family and multi-unit attached residences in the City of Aurora. The proposed infrastructure includes roadways, over-lot grading, a channel, and a regional full-spectrum detention pond. The whole site will drain to two full spectrum detention ponds (Filing 16 Offsites) before outfalling into First Creek. The regional channel will convey flow from an offsite regional detention pond prior to joining First Creek. The proposed Harmony Filing 16 development and drainage facilities outlined in this report will result in no adverse impacts to the surrounding areas.

F. LIST OF REFERENCES

1. **City of Aurora Storm Drainage Design and Technical Criteria**, City of Aurora, Revised October 2010.

2. **Urban Storm Drainage Criteria Manual, Volumes 1,2,3**, Urban Drainage and Flood Control District, prepared by Urban Drainage and Flood Control District, April 2018.

3. **Master Drainage Report**, CVL Consultants of Colorado, Inc. Approved March 2016 (**EDN 216065)**.

4. **Master Drainage Report Amendment No. 3**, Westwood Professional Services. Currently under review (**RSN 1527449)**.

5. **First Creek Tributaries (Upstream of I-70) Master Drainageway Plan**. Merrick, October 2021.

6. **Web Soil Survey**, https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx, United States Department of Agriculture – Natural Resources Conservation Service, August 21, 2017.

7. **FIRM, Flood Insurance Rate Map**, Arapahoe County, Colorado, Map Number 08005C0206L, Federal Emergency Management Agency, Feburary 17, 2017.

8. **National Oceanic and Atmospheric Administration (NOAA)** NOAA Atlas 14: Precipitation Frequency Atlas of the United States, Volume 8 Version 2.0: Midwestern States; U.S. Department of Commerce, National Weather Service, April 2017

9. **Adjacent Subdivisions:**
   Harmony Filing 1 – EDN: 217051
   Harmony Filing 2 – EDN: 219116
   Harmony Filing 3 – EDN: 218052
   Harmony Filing 12 – EDN: 221042
   APS Harmony Filing 1 Subdivision – EDN: 219058
   Adonea Filing 3 – EDN: 206052

G. LIST OF APPENDICES

APPENDIX A – VICINITY MAP

Vicinity Map

APPENDIX B – HYDROLOGIC CALCULATIONS

Use Standard Forms
MHFD_Detention Calculations for Ponds

APPENDIX C - HYDRAULIC CALCULATIONS

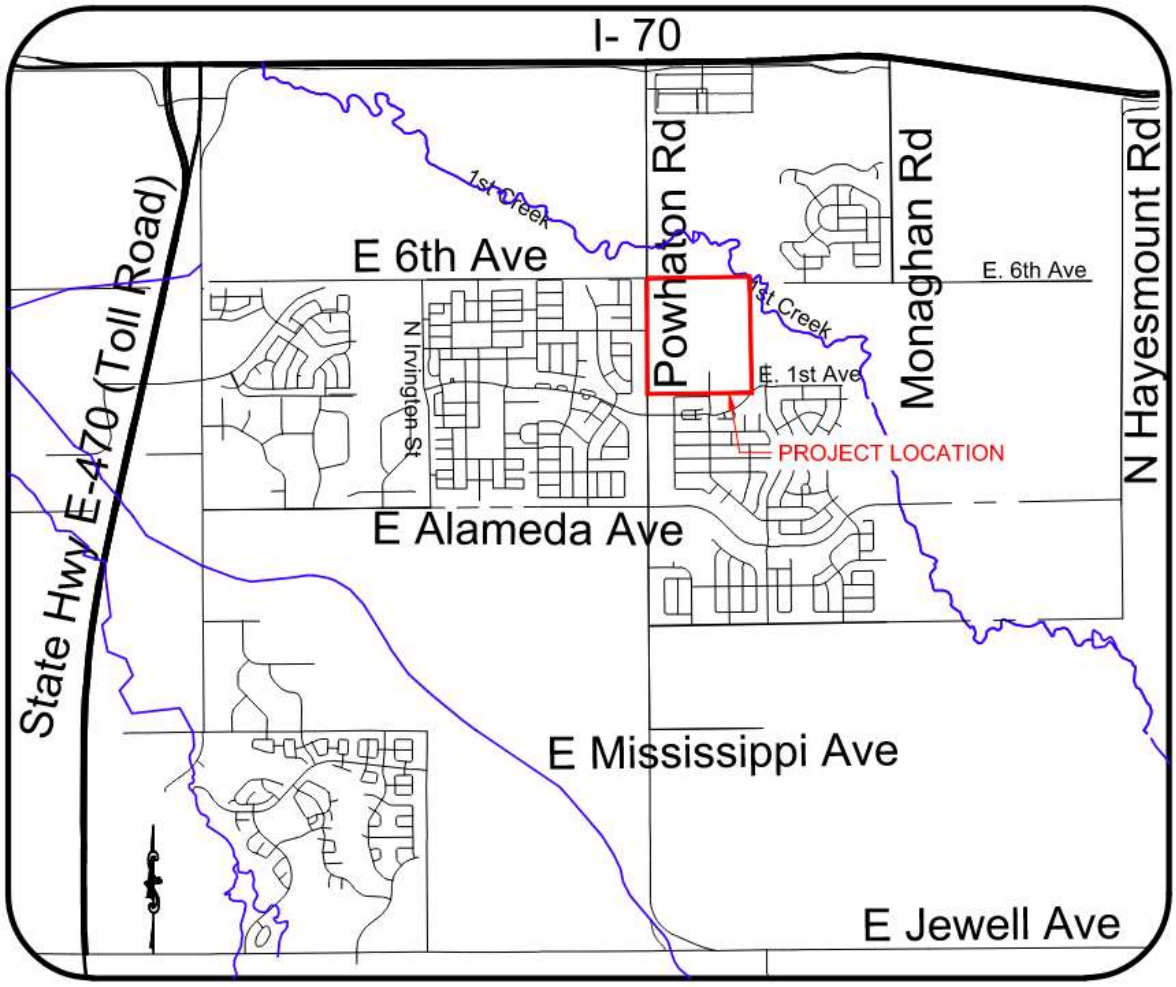
Street Capacity Calculations
Alley Calculations
Emergency Overflow Calculations
Culvert Calculations
Channel HEC-RAS Reports and Profile
Geomorphology Memo

APPENDIX D – REFERENCES

FIRM
Soils Report
NOAA Atlas 14 Rainfall Table
Harmony Filing 16 Offsites Pond T and Pond U Detention Sheets
Harmony Master Drainage Report
Excerpts from Approved Plans
Airport Influence Map

Appendix A

Vicinity Map


I- 70
State Hwy E-470 (Toll Road)
1st Creek
E 6th Ave
Powhaton Rd
Monaghan Rd
N Hayesmount Rd
E. 6th Ave
1st Creek
N Irvington St
E. 1st Ave
PROJECT LOCATION
E Alameda Ave
E Mississippi Ave
E Jewell Ave

Appendix B

Hydrologic Calculations

Standard Forms

T BASINS

SF-1 PROPOSED COMPOSITE BASIN LAND USE

Subdivision: Harmony Filing 16

Project Name: Harmony Filing 16
Project No.
Calculated By: RNM
Checked By: BS
Date: 12/13/2022

Basin	Total Area	Soil Type A	Soil Type B	Soil Type C/D	Multi Unit (Detatched)	Multi Unit (Attached)	Paved	Open Space (2-7%)	Park/Playground	Avg. Imp.	C_2	C_5	C_{100}
	(acres)	*(%)*	*(%)*	*(%)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(%)*			
T-1	4.83	0.0%	0.0%	100.0%	0.00	0.00	1.88	2.95	0.00	42.0	0.45	0.46	0.50
T-2	4.78	0.0%	0.0%	100.0%	3.09	0.00	0.60	1.08	0.00	52.6	0.44	0.48	0.62
T-3	0.95	0.0%	0.0%	100.0%	0.67	0.00	0.21	0.07	0.00	65.0	0.52	0.56	0.72
T-4	1.98	0.0%	0.0%	100.0%	1.09	0.00	0.57	0.32	0.00	62.7	0.53	0.56	0.69
T-5	0.76	0.0%	0.0%	100.0%	0.00	0.00	0.54	0.22	0.00	72.6	0.67	0.68	0.72
T-6	1.19	0.0%	0.0%	100.0%	0.67	0.00	0.37	0.16	0.00	65.1	0.54	0.58	0.71
T-7	0.83	0.0%	0.0%	100.0%	0.45	0.00	0.28	0.10	0.00	67.0	0.56	0.59	0.72
T-8	1.82	0.0%	0.0%	100.0%	1.24	0.00	0.42	0.16	0.00	64.4	0.52	0.56	0.71
T-9	1.82	0.0%	0.0%	100.0%	1.26	0.00	0.42	0.14	0.00	65.2	0.53	0.57	0.72
T-10	1.00	0.0%	0.0%	100.0%	0.81	0.00	0.15	0.05	0.00	63.3	0.50	0.54	0.71
T-11	1.43	0.0%	0.0%	100.0%	1.15	0.00	0.21	0.07	0.00	63.1	0.50	0.54	0.71
T-12	2.45	0.0%	0.0%	100.0%	1.65	0.00	0.61	0.20	0.00	65.4	0.53	0.57	0.72
T-13	3.25	0.0%	0.0%	100.0%	2.32	0.00	0.70	0.23	0.00	64.8	0.52	0.56	0.72
T-14	1.40	0.0%	0.0%	100.0%	0.88	0.00	0.37	0.15	0.00	64.6	0.53	0.57	0.71
T-15	1.01	0.0%	0.0%	100.0%	0.14	0.00	0.28	0.10	0.49	41.3	0.39	0.45	0.69
T-16	1.05	0.0%	0.0%	100.0%	0.31	0.00	0.19	0.06	0.50	40.3	0.37	0.43	0.69
T-17	0.95	0.0%	0.0%	100.0%	0.72	0.00	0.17	0.06	0.00	64.1	0.51	0.55	0.71
T-18	2.09	0.0%	0.0%	100.0%	1.64	0.00	0.34	0.11	0.00	63.5	0.50	0.54	0.71
T-19	3.77	0.0%	0.0%	100.0%	2.74	0.00	0.69	0.34	0.00	62.4	0.50	0.54	0.70
T-20	1.06	0.0%	0.0%	100.0%	0.53	0.00	0.37	0.16	0.00	65.5	0.55	0.58	0.71
T-21	1.03	0.0%	0.0%	100.0%	0.59	0.00	0.32	0.11	0.00	66.3	0.55	0.58	0.72
T-22	1.61	0.0%	0.0%	100.0%	1.23	0.00	0.28	0.09	0.00	63.7	0.51	0.55	0.71
T-23	2.08	0.0%	0.0%	100.0%	1.23	0.00	0.64	0.21	0.00	66.7	0.55	0.58	0.72
T-24	2.37	0.0%	0.0%	100.0%	1.23	0.00	0.32	0.82	0.00	46.3	0.41	0.44	0.56
T-25	1.68	0.0%	0.0%	100.0%	1.35	0.00	0.24	0.08	0.00	62.9	0.50	0.54	0.71
T-26	0.90	0.0%	0.0%	100.0%	0.74	0.00	0.12	0.04	0.00	62.6	0.49	0.53	0.71
T-27	2.83	0.0%	0.0%	100.0%	1.95	0.00	0.61	0.27	0.00	63.3	0.51	0.55	0.70
T-28	1.27	0.0%	0.0%	100.0%	0.77	0.00	0.36	0.14	0.00	65.2	0.54	0.57	0.71
T-29	0.19	0.0%	0.0%	100.0%	0.00	0.00	0.09	0.10	0.00	51.6	0.52	0.53	0.57
T-30	3.21	0.0%	0.0%	100.0%	1.61	0.00	0.55	1.05	0.00	48.8	0.43	0.46	0.58
T-30.1	2.19	0.0%	0.0%	100.0%	1.69	0.00	0.38	0.12	0.00	64.0	0.51	0.55	0.71
T-31	2.72	0.0%	0.0%	100.0%	1.75	0.00	0.73	0.25	0.00	65.7	0.54	0.57	0.72
T-32	2.42	0.0%	0.0%	100.0%	1.26	0.00	0.51	0.26	0.39	54.5	0.46	0.51	0.69
T-33	0.74	0.0%	0.0%	100.0%	0.60	0.00	0.13	0.00	0.00	67.2	0.53	0.57	0.74
T-34	0.35	0.0%	0.0%	100.0%	0.27	0.00	0.07	0.00	0.00	68.3	0.54	0.58	0.75
T-35	1.94	0.0%	0.0%	100.0%	0.15	0.00	0.21	0.10	1.47	23.6	0.25	0.34	0.66
T-36	1.91	0.0%	0.0%	100.0%	1.00	0.00	0.27	0.27	0.37	48.3	0.41	0.46	0.66
T-37	2.13	0.0%	0.0%	100.0%	1.44	0.00	0.48	0.21	0.00	63.5	0.52	0.55	0.70
T-38	3.97	0.0%	0.0%	100.0%	2.90	0.00	0.91	0.16	0.00	67.1	0.54	0.58	0.73
T-39	1.67	0.0%	0.0%	100.0%	1.09	0.00	0.44	0.14	0.00	65.9	0.54	0.57	0.72
T-40	1.38	0.0%	0.0%	100.0%	1.07	0.00	0.23	0.07	0.00	63.8	0.51	0.55	0.71
T-41	0.70	0.0%	0.0%	100.0%	0.00	0.33	0.28	0.09	0.00	76.1	0.65	0.68	0.78
T-42	0.99	0.0%	0.0%	100.0%	0.00	0.78	0.22	0.00	0.00	80.4	0.66	0.70	0.83
T-43	0.47	0.0%	0.0%	100.0%	0.00	0.14	0.26	0.08	0.00	77.5	0.68	0.70	0.78
T-44	0.40	0.0%	0.0%	100.0%	0.00	0.00	0.27	0.13	0.00	69.0	0.64	0.65	0.70
T-45	0.85	0.0%	0.0%	100.0%	0.00	0.73	0.12	0.00	0.00	78.4	0.64	0.68	0.82
T-46	0.37	0.0%	0.0%	100.0%	0.00	0.27	0.10	0.00	0.00	81.9	0.67	0.71	0.84
T-47	0.47	0.0%	0.0%	100.0%	0.00	0.14	0.26	0.07	0.00	78.7	0.69	0.71	0.79
T-48	1.78	0.0%	0.0%	100.0%	0.00	1.11	0.30	0.37	0.00	64.8	0.56	0.59	0.70
T-49	1.24	0.0%	0.0%	100.0%	0.00	0.10	0.76	0.38	0.00	68.9	0.64	0.65	0.70
T-50	1.30	0.0%	0.0%	100.0%	0.77	0.00	0.00	0.53	0.00	37.7	0.34	0.37	0.51
T-51	2.07	0.0%	0.0%	100.0%	0.00	0.00	0.83	1.24	0.00	43.0	0.46	0.47	0.50
T-52	0.20	0.0%	0.0%	100.0%	0.00	0.00	0.05	0.16	0.00	26.7	0.34	0.35	0.38
T-53	1.61	0.0%	0.0%	100.0%	0.00	0.00	1.01	0.60	0.00	64.7	0.61	0.62	0.67
T-54	2.33	0.0%	0.0%	100.0%	0.00	0.00	1.18	1.15	0.00	53.0	0.53	0.54	0.58
T-55	8.15	0.0%	0.0%	100.0%	0.00	0.24	0.00	7.91	0.00	7.1	0.19	0.20	0.24

COA SDDTCM TABLE 1

Land Use	% Imp.	C_2	C_5	C_{100}
Multi Unit (Detatched)	60	0.45	0.50	0.70
Multi Unit (Attached)	75	0.60	0.65	0.80
Paved	100	0.87	0.88	0.93
Open Space (2-7%)	5	0.18	0.19	0.22
Park/Playground	10.0	0.15	0.25	0.65
Pond	10.0	0.15	0.25	0.65

TOTAL AREA	
Sum of Areas =	99.91
Sum A*I =	5491.99
Weighted I =	**55.0%**

TOTAL POND T AREA	
Sum of Areas =	99.91
Filing 16 Sum A*I =	4719.41
Harmony Fil. 1 School Area =	18.02
Harmony Fil. 1 School I =	45
Harmony Fil. 1 School A*I =	810.90
Total Pond T Area =	**117.93**
Total Pond T A*I =	5530.31
Weighted I =	**46.9%**

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
Streets:					
Paved	100	.87	.88	.90	.93
Gravel	40	.15	.25	.35	.65
Concrete Drive and Walks	96	.87	.87	.88	.89
Roofs	90	.80	.85	.90	.90
Lawns, Sandy Soil (A and B Soils):	2				
2% Slope		.05	.06	.08	.10
2-7% Slope		.10	.11	.13	.15
>7% Slope		.15	.16	.18	.20
Lawns, Clay Soil (C and D Soils):	5				
2% Slope		.13	.14	.15	.17
2-7% Slope		.18	.19	.20	.22
>7% Slope		.25	.27	.30	.35

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
Business:					
Commercial Areas	95	.87	.87	.88	.89
Neighborhood Areas	85	.60	.65	.70	.80
Residential:					
Single-Family (**)	(*)	.40	.45	.50	.60
Multi-Unit (detached)	60	.45	.50	.60	.70
Multi-Unit (attached)	75	.60	.65	.70	.80
1/2 Acre Lot or Larger	(*)	.30	.35	.40	.60
Apartments	80	.65	.70	.70	.80
Industrial:					
Light Areas	80	.71	.72	.76	.82
Heavy Areas	90	.80	.80	.85	.90
Parks, Cemeteries	5	.10	.10	.35	.60
Playgrounds	10	.15	.25	.35	.65
Schools	50	.45	.50	.60	.70
Railroad Yard Areas	15	.40	.45	.50	.60
Undeveloped Areas:					
Historic Flow Analysis, Greenbelts, Agricultural	2	(See "Lawns")			
Off-Site Flow Analysis (when land use not defined)	45	.43	.47	.55	.65

SF-2 TIME OF CONCENTRATION FOR EACH SUB-BASIN

SUB-BASIN DATA		INITIAL/OVERLAND FLOW TIME				CHANNELIZED FLOW TIME					TOTAL Tc	FIRST DESIGN POINT T_c		EFFECTIVE
DATA											$T_c = T_I + T_T$	COA T_c Check		T_c
BASIN	D.A.	C_5	L	S	T_i	L	S	LAND SURFACE	VEL.	T_t	Tc	LENGTH	MIN. T_c	
ID	(AC)		FT	FT/FT	MINUTES	FT	FT/FT		FPS	MINUTES	MINUTES	FT	MINUTES	MINUTES
T-1	4.83	0.46	300	0.016	17.2	1370	0.01	Paved area	2.0	11.4	28.6	1670	19.3	19.3
T-2	4.78	0.48	95	0.02	8.7	1120	0.01	Paved area	2.0	9.3	18.0	1215	16.8	16.8
T-3	0.95	0.56	95	0.02	7.5	330	0.01	Paved area	2.0	2.8	10.3	425	12.4	10.3
T-4	1.98	0.56	130	0.02	8.8	550	0.015	Paved area	2.4	3.7	12.6	680	13.8	12.6
T-5	0.76	0.68	20	0.02	2.7	845	0.014	Paved area	2.4	6.0	8.6	865	14.8	8.6
T-6	1.19	0.58	95	0.02	7.3	575	0.014	Paved area	2.4	4.0	11.4	670	13.7	11.4
T-7	0.83	0.59	95	0.02	7.1	505	0.015	Paved area	2.4	3.4	10.6	600	13.3	10.6
T-8	1.82	0.56	125	0.02	8.7	715	0.014	Paved area	2.4	5.0	13.7	840	14.7	13.7
T-9	1.82	0.57	125	0.02	8.6	475	0.012	Paved area	2.2	3.6	12.2	600	13.3	12.2
T-10	1.00	0.54	150	0.02	9.8	240	0.012	Paved area	2.2	1.8	11.6	390	12.2	11.6
T-11	1.43	0.54	150	0.02	9.8	350	0.012	Paved area	2.2	2.7	12.5	500	12.8	12.5
T-12	2.45	0.57	130	0.02	8.7	1065	0.01	Paved area	2.0	8.9	17.6	1195	16.6	16.6
T-13	3.25	0.56	165	0.02	10.0	930	0.01	Paved area	2.0	7.8	17.7	1095	16.1	16.1
T-14	1.40	0.57	120	0.02	8.4	585	0.012	Paved area	2.2	4.5	12.8	705	13.9	12.8
T-15	1.01	0.45	120	0.02	10.2	470	0.012	Paved area	2.2	3.6	13.8	590	13.3	13.3
T-16	1.05	0.43	125	0.02	10.7	305	0.01	Paved area	2.0	2.5	13.3	430	12.4	12.4
T-17	0.95	0.55	125	0.02	8.8	285	0.015	Paved area	2.4	1.9	10.8	410	12.3	10.8
T-18	2.09	0.54	150	0.02	9.8	585	0.016	Paved area	2.5	3.9	13.6	735	14.1	13.6
T-19	3.77	0.54	125	0.02	9.0	975	0.012	Paved area	2.2	7.4	16.4	1100	16.1	16.1
T-20	1.06	0.58	95	0.02	7.2	600	0.012	Paved area	2.2	4.6	11.8	695	13.9	11.8
T-21	1.03	0.58	95	0.02	7.2	540	0.025	Paved area	3.2	2.8	10.1	635	13.5	10.1
T-22	1.61	0.55	125	0.02	8.9	480	0.025	Paved area	3.2	2.5	11.4	605	13.4	11.4
T-23	2.08	0.58	125	0.02	8.3	730	0.011	Paved area	2.1	5.8	14.1	855	14.8	14.1
T-24	2.37	0.44	300	0.015	18.0	400	0.015	Paved area	2.4	2.7	20.7	700	13.9	13.9
T-25	1.68	0.54	160	0.02	10.2	400	0.01	Paved area	2.0	3.3	13.5	560	13.1	13.1
T-26	0.90	0.53	160	0.02	10.3	185	0.011	Paved area	2.1	1.5	11.7	345	11.9	11.7
T-27	2.83	0.55	100	0.02	7.9	940	0.01	Paved area	2.0	7.8	15.7	1040	15.8	15.7
T-28	1.27	0.57	100	0.02	7.6	640	0.014	Paved area	2.4	4.5	12.1	740	14.1	12.1
T-29	0.19	0.53	189	0.02	11.3	120	0.01	Paved area	2.0	1.0	12.3	309	11.7	11.7
T-30	3.21	0.46	300	0.02	15.8	490	0.011	Paved area	2.1	3.9	19.7	790	14.4	14.4
T-30.1	2.19	0.55	125	0.02	8.8	660	0.01	Paved area	2.0	5.5	14.3	785	14.4	14.3
T-31	2.72	0.57	125	0.02	8.5	655	0.01	Paved area	2.0	5.5	13.9	780	14.3	13.9
T-32	2.42	0.51	90	0.02	8.1	880	0.01	Paved area	2.0	7.3	15.4	970	15.4	15.4
T-33	0.74	0.57	90	0.02	7.2	250	0.017	Paved area	2.6	1.6	8.8	340	11.9	8.8
T-34	0.35	0.58	90	0.02	7.1	130	0.012	Paved area	2.2	1.0	8.1	220	11.2	8.1
T-35	1.94	0.34	300	0.02	19.0	240	0.02	Paved area	2.8	1.4	20.4	540	13.0	13.0
T-36	1.91	0.46	300	0.02	15.9	270	0.013	Paved area	2.3	2.0	17.8	570	13.2	13.2
T-37	2.13	0.55	190	0.02	10.8	500	0.011	Paved area	2.1	4.0	14.8	690	13.8	13.8
T-38	3.97	0.58	130	0.02	8.6	765	0.011	Paved area	2.1	6.1	14.7	895	15.0	14.7
T-39	1.67	0.57	165	0.02	9.7	570	0.012	Paved area	2.2	4.3	14.0	735	14.1	14.0
T-40	1.38	0.55	160	0.02	10.0	380	0.013	Paved area	2.3	2.8	12.8	540	13.0	12.8
T-41	0.70	0.68	98	0.02	5.9	400	0.012	Paved area	2.2	3.0	9.0	498	12.8	9.0
T-42	0.99	0.70	70	0.02	4.8	290	0.012	Paved area	2.2	2.2	7.0	360	12.0	7.0
T-43	0.47	0.70	16	0.02	2.3	370	0.01	Paved area	2.0	3.1	5.4	386	12.1	5.4
T-44	0.40	0.65	25	0.02	3.2	425	0.01	Paved area	2.0	3.5	6.7	450	12.5	6.7
T-45	0.85	0.68	90	0.02	5.7	215	0.011	Paved area	2.1	1.7	7.4	305	11.7	7.4
T-46	0.37	0.71	70	0.02	4.6	190	0.01	Paved area	2.0	1.6	6.2	260	11.4	6.2
T-47	0.47	0.71	18	0.02	2.4	420	0.012	Paved area	2.2	3.2	5.6	438	12.4	5.6
T-48	1.78	0.59	60	0.02	5.6	570	0.011	Paved area	2.1	4.5	10.2	630	13.5	10.2
T-49	1.24	0.65	80	0.02	5.8	700	0.011	Paved area	2.1	5.6	11.3	780	14.3	11.3
T-50	1.30	0.37	300	0.02	18.1	283	0.01	Paved area	2.0	2.4	20.4	583	13.2	13.2
T-51	2.07	0.47	90	0.02	8.6	620	0.012	Paved area	2.2	4.7	13.4	710	13.9	13.4
T-52	0.20	0.35	152	0.03	11.7	27	0.015	Paved area	2.4	0.2	11.8	179	11.0	11.0
T-53	1.61	0.62	50	0.025	4.5	415	0.015	Paved area	2.4	2.8	7.3	465	12.6	7.3
T-54	2.33	0.54	138	0.045	7.2	487	0.025	Paved area	3.2	2.6	9.8	625	13.5	9.8
T-55	8.15	0.20	300	0.03	19.5	495	0.005	Paved area	1.4	5.8	25.3	795	14.4	14.4

$$t_c = t_i + t_t \qquad (5.2)$$

where t_c = time of concentration (minutes)
t_i = initial, inlet, or overland flow time (minutes)
t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (minutes)

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{\sqrt[3]{S}} \qquad (5.3)$$

where t_i = initial or overland flow time (minutes)
C_5 = runoff coefficient for 5-year frequency
L = length of overland flow, (ft., 500 ft. max.)
S = average basin slope (ft/ft)

$$t_c = \frac{L'}{180} + 10 \qquad (5.4)$$

Where t_c = time of concentration (minutes)

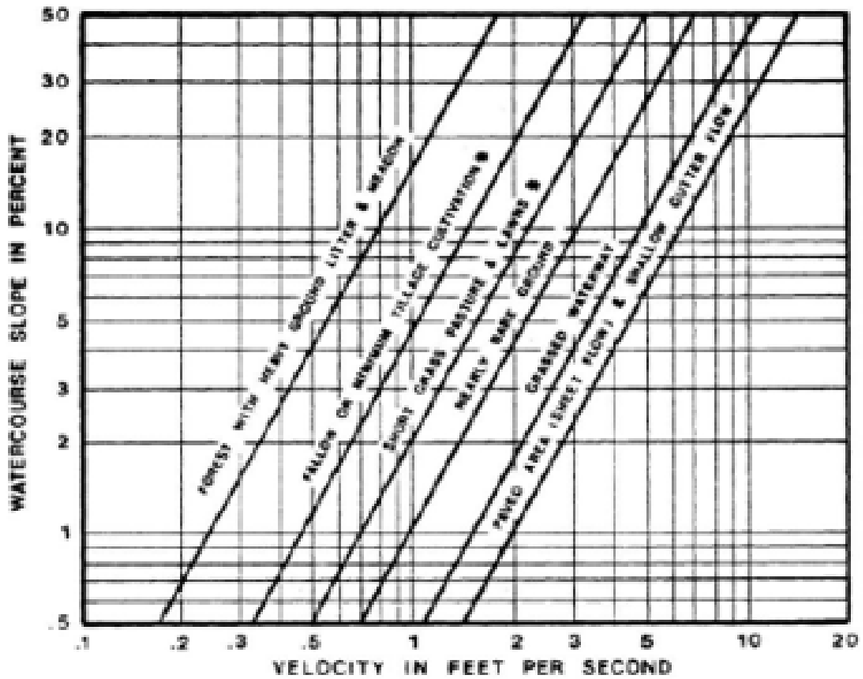


Figure RO-1—Estimate of Average Overland Flow Velocity for Use With the Rational Formula

$$I = \frac{28.5\ P_1}{(10 + T_C)^{0.786}} \qquad (5.5)$$

Where:

I = rainfall intensity (inches per hour)
P_1 = one-hour rainfall depth (inches) from Figures RA-1 through RA-6 in USDCM, Volume 1
T_c = time of concentration (minutes).

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

Subdivision Harmony Filing 16

Project Name: Harmony Filing 16
Project No. 0
Calculated By: RNM

Design Storm 2 YR
2-Year P1 = 0.85 in. NOAA ATLAS 14

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C2)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-1	1-T	T-1	4.83	0.45	19.3	2.17	1.7	3.7	10' COA TYPE R ON GRADE	3.7	0.0	19.3	2.17	1.7	3.7
	1-T	T-1										19.3	2.17	1.7	3.7
	1-T	T-1										19.3	0.00	1.7	0.0
T-2	2-T	T-2	4.78	0.44	16.8	2.11	1.8	3.9	10' COA TYPE R ON GRADE	3.9	0.0	16.8	2.11	1.8	3.9
	2-T	T-2										16.8	2.11	1.8	3.9
	2-T	T-2										16.8	0.00	1.8	0.0
T-3	3-T	T-3	0.95	0.52	10.3	0.50	2.3	1.1	10' COA TYPE R ON GRADE	1.1	0.0	10.3	0.50	2.3	1.1
	3-T	T-3										10.3	0.50	2.3	1.1
	3-T	T-3										10.3	0.00	2.3	0.0
T-4, T-50	4-T	T-4	1.98	0.53	12.6	1.05	2.1	2.2	10' COA TYPE R ON GRADE	2.9	0.0	14.2	1.49	2.0	2.9
	4-T	T-4										14.2	1.49	2.0	2.9
	4-T	T-4										14.2	0.00	2.0	0.0
T-5	5-T	T-5	0.76	0.67	8.6	0.51	2.4	1.2	10' COA TYPE R ON GRADE	1.2	0.0	8.6	0.51	2.4	1.2
	5-T	T-5										8.6	0.51	2.4	1.2
	5-T	T-5										8.6	0.00	2.4	0.0
T-6	6-T	T-6	1.19	0.54	11.4	0.65	2.2	1.4	10' COA TYPE R ON GRADE	1.4	0.0	11.4	0.65	2.2	1.4
	6-T	T-6										11.4	0.65	2.2	1.4
	6-T	T-6										11.4	0.00	2.2	0.0
T-7	7-T	T-7	0.83	0.56	10.6	0.46	2.2	1.0	10' COA TYPE R ON GRADE	1.0	0.0	10.6	0.46	2.2	1.0
	7-T	T-7										10.6	0.46	2.2	1.0
	7-T	T-7										10.6	0.00	2.2	0.0
T-8	8-T	T-8	1.82	0.52	13.7	0.95	2.0	1.9	10' COA TYPE R ON GRADE	1.9	0.0	13.7	0.95	2.0	1.9
	8-T	T-8										13.7	0.95	2.0	1.9
	8-T	T-8										13.7	0.00	2.0	0.0

STANDARD FORM SF-3
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Subdivision Harmony Filing 16

Project Name: Harmony Filing 16
Project No. 0
Calculated By: RNM

Design Storm 2 YR
2-Year P1 = 0.85 in. NOAA ATLAS 14

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C2)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-9	9-T	T-9	1.82	0.53	12.2	0.96	2.1	2.0	10' COA TYPE R ON GRADE	2.0	0.0	12.2	0.96	2.1	2.0
	9-T	T-9										12.2	0.96	2.1	2.0
	9-T	T-9										12.2	0.00	2.1	0.0
T-10	10-T	T-10	1.00	0.50	11.6	0.50	2.2	1.1	10' COA TYPE R ON GRADE	1.1	0.0	11.6	0.50	2.2	1.1
	10-T	T-10										11.6	0.50	2.2	1.1
	10-T	T-10										11.6	0.00	2.2	0.0
T-11	11-T	T-11	1.43	0.50	12.5	0.71	2.1	1.5	10' COA TYPE R ON GRADE	1.5	0.0	12.5	0.71	2.1	1.5
	11-T	T-11										12.5	0.71	2.1	1.5
	11-T	T-11										12.5	0.00	2.1	0.0
T-12	12-T	T-12	2.45	0.53	16.6	1.31	1.8	2.4	10' COA TYPE R ON GRADE	2.4	0.0	16.6	1.31	1.8	2.4
	12-T	T-12										16.6	1.31	1.8	2.4
	12-T	T-12										16.6	0.00	1.8	0.0
T-13	13-T	T-13	3.25	0.52	16.1	1.70	1.9	3.2	10' COA TYPE R ON GRADE	3.2	0.0	16.1	1.70	1.9	3.2
	13-T	T-13										16.1	1.70	1.9	3.2
	13-T	T-13										16.1	0.00	1.9	0.0
T-14	14-T	T-14	1.40	0.53	12.8	0.74	2.1	1.5	10' COA TYPE R ON GRADE	1.5	0.0	12.8	0.74	2.1	1.5
	14-T	T-14										12.8	0.74	2.1	1.5
	14-T	T-14										12.8	0.00	2.1	0.0
T-15	15-T	T-15	1.01	0.39	13.3	0.40	2.0	0.8	10' COA TYPE R ON GRADE	0.8	0.0	13.3	0.40	2.0	0.8
	15-T	T-15										13.3	0.40	2.0	0.8
	15-T	T-15										13.3	0.00	2.0	0.0
T-16	16-T	T-16	1.05	0.37	12.4	0.39	2.1	0.8	10' COA TYPE R ON GRADE	0.8	0.0	12.4	0.39	2.1	0.8
	16-T	T-16										12.4	0.39	2.1	0.8
	16-T	T-16										12.4	0.00	2.1	0.0

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Project Name: Harmony Filing 16
Project No. 0
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	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C2)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-17	17-T	T-17	0.95	0.51	10.8	0.48	2.2	1.1	10' COA TYPE R ON GRADE	1.1	0.0	10.8	0.48	2.2	1.1
	17-T	T-17										10.8	0.48	2.2	1.1
	17-T	T-17										10.8	0.00	2.2	0.0
T-18	18-T	T-18	2.09	0.50	13.6	1.05	2.0	2.1	10' COA TYPE R ON GRADE	2.1	0.0	13.6	1.05	2.0	2.1
	18-T	T-18										13.6	1.05	2.0	2.1
	18-T	T-18										13.6	0.00	2.0	0.0
T-19	19-T	T-19	3.77	0.50	16.1	1.90	1.9	3.5	10' COA TYPE R ON GRADE	3.5	0.0	16.1	1.90	1.9	3.5
	19-T	T-19										16.1	1.90	1.9	3.5
	19-T	T-19										16.1	0.00	1.9	0.0
T-20	20-T	T-20	1.06	0.55	11.8	0.59	2.2	1.3	10' COA TYPE R ON GRADE	1.3	0.0	11.8	0.59	2.2	1.3
	20-T	T-20										11.8	0.59	2.2	1.3
	20-T	T-20										11.8	0.00	2.2	0.0
T-21	21-T	T-21	1.03	0.55	10.1	0.57	2.3	1.3	10' COA TYPE R ON GRADE	1.3	0.0	10.1	0.57	2.3	1.3
	21-T	T-21										10.1	0.57	2.3	1.3
	21-T	T-21										10.1	0.00	2.3	0.0
T-22	22-T	T-22	1.61	0.51	11.4	0.82	2.2	1.8	10' COA TYPE R ON GRADE	1.8	0.0	11.4	0.82	2.2	1.8
	22-T	T-22										11.4	0.82	2.2	1.8
	22-T	T-22										11.4	0.00	2.2	0.0
T-23	23-T	T-23	2.08	0.55	14.1	1.15	2.0	2.3	15' COA TYPE R ON GRADE	2.3	0.0	14.1	1.15	2.0	2.3
	23-T	T-23										14.1	1.15	2.0	2.3
	23-T	T-23										14.1	0.00	2.0	0.0
T-24	24-T	T-24	2.37	0.41	13.9	0.98	2.0	2.0	10' COA TYPE R ON GRADE	2.0	0.0	13.9	0.98	2.0	2.0
	24-T	T-24										13.9	0.98	2.0	2.0
	24-T	T-24										13.9	0.00	2.0	0.0

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Design Storm 2 YR
2-Year P1 = 0.85 in. NOAA ATLAS 14

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C2)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-25	25-T	T-25	1.68	0.50	13.1	0.83	2.1	1.7	10' COA TYPE R ON GRADE	1.7	0.0	13.1	0.83	2.1	1.7
	25-T	T-25										13.1	0.83	2.1	1.7
	25-T	T-25										13.1	0.00	2.1	0.0
T-26	26-T	T-26	0.90	0.49	11.7	0.44	2.2	1.0	10' COA TYPE R ON GRADE	1.0	0.0	11.7	0.44	2.2	1.0
	26-T	T-26										11.7	0.44	2.2	1.0
	26-T	T-26										11.7	0.00	2.2	0.0
T-27	27-T	T-27	2.83	0.51	15.7	1.45	1.9	2.7	10' COA TYPE R ON GRADE	2.7	0.0	15.7	1.45	1.9	2.7
	27-T	T-27										15.7	1.45	1.9	2.7
	27-T	T-27										15.7	0.00	1.9	0.0
T-28	28-T	T-28	1.27	0.54	12.1	0.69	2.1	1.5	10' COA TYPE R ON GRADE	1.5	0.0	12.1	0.69	2.1	1.5
	28-T	T-28										12.1	0.69	2.1	1.5
	28-T	T-28										12.1	0.00	2.1	0.0
T-29	29-T	T-29	0.19	0.52	11.7	0.10	2.2	0.2	10' COA TYPE R ON GRADE	0.2	0.0	11.7	0.10	2.2	0.2
	29-T	T-29										11.7	0.10	2.2	0.2
	29-T	T-29										11.7	0.00	2.2	0.0
T-30	30-T	T-30	3.21	0.43	14.4	1.39	2.0	2.7	15' COA TYPE R ON GRADE	2.7	0.0	14.4	1.39	2.0	2.7
	30-T	T-30										14.4	1.39	2.0	2.7
	30-T	T-30										14.4	0.00	2.0	0.0
T-30.1	30.1-T	T-30.1	2.19	0.51	14.3	1.12	2.0	2.2	10' COA TYPE R ON GRADE	2.2	0.0	14.3	1.12	2.0	2.2
	30.1-T	T-30.1										14.3	1.12	2.0	2.2
	30.1-T	T-30.1										14.3	0.00	2.0	0.0
T-31	31-T	T-31	2.72	0.54	13.9	1.46	2.0	2.9	15' COA TYPE R IN SUMP	2.9	0.0	13.9	1.46	2.0	2.9
	31-T	T-31										13.9	1.46	2.0	2.9
	31-T	T-31										13.9	0.00	2.0	0.0

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Subdivision Harmony Filing 16

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	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C2)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-32, T-33, T-34	32-T	T-32	2.42	0.46	15.4	1.12	1.9	2.1	10' COA TYPE R ON GRADE	3.2	0.0	15.4	1.69	1.9	3.2
	32-T	T-32										15.4	1.69	1.9	3.2
	32-T	T-32										15.4	0.00	1.9	0.0
T-33	33-T	T-33	0.74	0.53	8.8	0.39	2.4	0.9	BYPASS	0.0	0.9	8.8	0.39	2.4	0.9
	33-T	T-33										8.8	0.00	2.4	0.0
	33-T	T-33										8.8	0.39	2.4	0.9
T-34	34-T	T-34	0.35	0.54	8.1	0.19	2.5	0.5	BYPASS	0.0	0.5	8.1	0.19	2.5	0.5
	34-T	T-34										8.1	0.00	2.5	0.0
	34-T	T-34										8.1	0.19	2.5	0.5
T-35	35-T	T-35	1.94	0.25	13.0	0.49	2.1	1.0	10' COA TYPE R ON GRADE	1.0	0.0	13.0	0.49	2.1	1.0
	35-T	T-35										13.0	0.49	2.1	1.0
	35-T	T-35										13.0	0.00	2.1	0.0
T-36	36-T	T-36	1.91	0.41	13.2	0.79	2.0	1.6	10' COA TYPE R ON GRADE	1.6	0.0	13.2	0.79	2.0	1.6
	36-T	T-36										13.2	0.79	2.0	1.6
	36-T	T-36										13.2	0.00	2.0	0.0
T-37	37-T	T-37	2.13	0.52	13.8	1.10	2.0	2.2	10' COA TYPE R ON GRADE	2.2	0.0	13.8	1.10	2.0	2.2
	37-T	T-37										13.8	1.10	2.0	2.2
	37-T	T-37										13.8	0.00	2.0	0.0
T-38	38-T	T-38	3.97	0.54	14.7	2.13	1.9	4.1	2-10' COA TYPE R IN SUMP	4.1	0.0	14.7	2.13	1.9	4.1
	38-T	T-38										14.7	2.13	1.9	4.1
	38-T	T-38										14.7	0.00	1.9	0.0
T-39	39-T	T-39	1.67	0.54	14.0	0.90	2.0	1.8	10' COA TYPE R ON GRADE	1.8	0.0	14.0	0.90	2.0	1.8
	39-T	T-39										14.0	0.90	2.0	1.8
	39-T	T-39										14.0	0.00	2.0	0.0

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	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C2)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-40	40-T	T-40	1.38	0.51	12.8	0.70	2.1	1.4	10' COA TYPE R ON GRADE	1.4	0.0	12.8	0.70	2.1	1.4
	40-T	T-40										12.8	0.70	2.1	1.4
	40-T	T-40										12.8	0.00	2.1	0.0
T-41, T-42	41-T	T-41	0.70	0.65	9.0	0.46	2.4	1.1	10' COA TYPE R ON GRADE	2.7	0.0	9.0	1.11	2.4	2.7
	41-T	T-41										9.0	1.11	2.4	2.7
	41-T	T-41										9.0	0.00	2.4	0.0
T-42	42-T	T-42	0.99	0.66	7.0	0.65	2.6	1.7	BYPASS	0.0	1.7	7.0	0.65	2.6	1.7
	42-T	T-42										7.0	0.00	2.6	0.0
	42-T	T-42										7.0	0.65	2.6	1.7
T-43	43-T	T-43	0.47	0.68	5.4	0.32	2.8	0.9	10' COA TYPE R ON GRADE	0.9	0.0	5.4	0.32	2.8	0.9
	43-T	T-43										5.4	0.32	2.8	0.9
	43-T	T-43										5.4	0.00	2.8	0.0
T-44, T-45	44-T	T-44	0.40	0.64	6.7	0.26	2.6	0.7	10' COA TYPE R ON GRADE	2.1	0.0	7.4	0.80	2.6	2.1
	44-T	T-44										7.4	0.80	2.6	2.1
	44-T	T-44										7.4	0.00	2.6	0.0
T-45	45-T	T-45	0.85	0.64	7.4	0.54	2.6	1.4	BYPASS	0.0	1.4	7.4	0.54	2.6	1.4
	45-T	T-45										7.4	0.00	2.6	0.0
	45-T	T-45										7.4	0.54	2.6	1.4
T-46	46-T	T-46	0.37	0.67	6.2	0.25	2.7	0.7	BYPASS	0.0	0.7	6.2	0.25	2.7	0.7
	46-T	T-46										6.2	0.00	2.7	0.0
	46-T	T-46										6.2	0.25	2.7	0.7
T-47	47-T	T-47	0.47	0.69	5.6	0.32	2.8	0.9	10' COA TYPE R ON GRADE	0.9	0.0	5.6	0.32	2.8	0.9
	47-T	T-47										5.6	0.32	2.8	0.9
	47-T	T-47										5.6	0.00	2.8	0.0

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	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C2)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-48	48-T	T-48	1.78	0.56	10.2	0.99	2.3	2.3	BYPASS	0.0	2.3	10.2	0.99	2.3	2.3
	48-T	T-48										10.2	0.00	2.3	0.0
	48-T	T-48										10.2	1.00	2.3	2.3
T-49, T-46, T-48	49-T	T-49	1.24	0.64	11.3	0.79	2.2	1.7	2-10' COA TYPE R IN SUMP	4.2	0.0	12.7	2.04	2.1	4.2
	49-T	T-49										12.7	2.04	2.1	4.2
	49-T	T-49										12.7	0.00	2.1	0.0
T-50	50-T	T-50	1.30	0.34	13.2	0.44	2.0	0.9	BYPASS	0.0	0.9	13.2	0.44	2.0	0.9
	50-T	T-50										13.2	0.00	2.0	0.0
	50-T	T-50										13.2	0.44	2.0	0.9
T-51	51-T	T-51	2.07	0.46	13.4	0.94	2.0	1.9	10' COA TYPE R ON GRADE	1.9	0.0	13.4	0.94	2.0	1.9
	51-T	T-51										13.4	0.94	2.0	1.9
	51-T	T-51										13.4	0.00	2.0	0.0
T-52	52-T	T-52	0.20	0.34	11.0	0.07	2.2	0.2	10' COA TYPE R ON GRADE	0.2	0.0	11.0	0.07	2.2	0.2
	52-T	T-52										11.0	0.07	2.2	0.2
	52-T	T-52										11.0	0.00	2.2	0.0
T-53	53-T	T-53	1.61	0.61	7.3	0.99	2.6	2.5	10' COA TYPE R IN SUMP	2.5		7.3	0.99	2.6	2.5
	53-T	T-53										7.3	0.99	2.6	2.5
	53-T	T-53										7.3	0.00	2.6	0.0
T-54	54-T	T-54	2.33	0.53	9.8	1.23	2.3	2.9	10' COA TYPE R IN SUMP	2.9		9.8	1.23	2.3	2.9
	54-T	T-54										9.8	1.23	2.3	2.9
	54-T	T-54										9.8	0.00	2.3	0.0
T-55	55-T	T-55	8.15	0.19	14.4	1.57	2.0	3.1	POND	3.1	0.0	14.4	1.57	2.0	3.1
	55-T	T-55										14.4	1.57	2.0	3.1
	55-T	T-55										14.4	0.00	2.0	0.0

$$I = \frac{28.5\ P_1}{(10 + T_C)^{0.786}} \qquad (5.5)$$

Where:

I = rainfall intensity (inches per hour)
P_1 = one-hour rainfall depth (inches) from Figures RA-1 through RA-6 in USDCM, Volume 1
T_c = time of concentration (minutes).

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

Subdivision Harmony Filing 16

Project Name: Harmony Filing 16
Project No. 0
Calculated By: RNM

Design Storm 100 YR
100-Year P1 = 2.49 in. NOAA ATLAS 14

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C100	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-1	1-T	T-1	4.83	0.50	19.3	2.40	5.0	12.0	10' COA TYPE R ON GRADE	8.0	4.0	19.3	2.40	5.0	12.0
	1-T	T-1										19.3	1.60	5.0	8.0
	1-T	T-1										19.3	0.80	5.0	4.0
T-2	2-T	T-2	4.78	0.62	16.8	2.96	5.4	15.9	10' COA TYPE R ON GRADE	9.1	6.8	16.8	2.96	5.4	15.9
	2-T	T-2										16.8	1.69	5.4	9.1
	2-T	T-2										16.8	1.27	5.4	6.8
T-3	3-T	T-3	0.95	0.72	10.3	0.68	6.7	4.5	10' COA TYPE R ON GRADE	4.5	0.0	10.3	0.68	6.7	4.5
	3-T	T-3										10.3	0.68	6.7	4.5
	3-T	T-3										10.3	0.00	6.7	0.0
T-4, T-50	4-T	T-4	1.98	0.69	12.6	1.36	6.1	8.4	10' COA TYPE R ON GRADE	7.8	3.9	14.2	2.02	5.8	11.7
	4-T	T-4										14.2	1.34	5.8	7.8
	4-T	T-4										14.2	0.67	5.8	3.9
T-5	5-T	T-5	0.76	0.72	8.6	0.55	7.1	3.9	10' COA TYPE R ON GRADE	3.9	0.0	8.6	0.55	7.1	3.9
	5-T	T-5										8.6	0.55	7.1	3.9
	5-T	T-5										8.6	0.00	7.1	0.0
T-6, T-4	6-T	T-6	1.19	0.71	11.4	0.85	6.4	5.4	10' COA TYPE R ON GRADE	6.6	1.6	16.5	1.52	5.4	8.2
	6-T	T-6										16.5	1.22	5.4	6.6
	6-T	T-6										16.5	0.30	5.4	1.6
T-7	7-T	T-7	0.83	0.72	10.6	0.60	6.6	3.9	10' COA TYPE R ON GRADE	3.9	0.0	10.6	0.60	6.6	3.9
	7-T	T-7										10.6	0.60	6.6	3.9
	7-T	T-7										10.6	0.00	6.6	0.0
T-8, T-16	8-T	T-8	1.82	0.71	13.7	1.30	5.9	7.6	10' COA TYPE R ON GRADE	6.3	1.3	14.8	1.30	5.9	7.6
	8-T	T-8										14.8	1.08	5.9	6.3
	8-T	T-8										14.8	0.22	5.9	1.3

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

Subdivision Harmony Filing 16

Project Name: Harmony Filing 16
Project No. 0
Calculated By: RNM

Design Storm 100 YR
100-Year P1 = 2.49 in. NOAA ATLAS 14

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C100	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-9	9-T	T-9	1.82	0.72	12.2	1.31	6.2	8.1	10' COA TYPE R ON GRADE	6.6	1.5	12.2	1.31	6.2	8.1
	9-T	T-9										12.2	1.06	6.2	6.6
	9-T	T-9										12.2	0.24	6.2	1.5
T-10	10-T	T-10	1.00	0.71	11.6	0.71	6.3	4.5	10' COA TYPE R ON GRADE	4.4	0.1	11.6	0.71	6.3	4.5
	10-T	T-10										11.6	0.70	6.3	4.4
	10-T	T-10										11.6	0.02	6.3	0.1
T-11	11-T	T-11	1.43	0.71	12.5	1.01	6.1	6.2	10' COA TYPE R ON GRADE	5.6	0.6	12.5	1.01	6.1	6.2
	11-T	T-11										12.5	0.92	6.1	5.6
	11-T	T-11										12.5	0.10	6.1	0.6
T-12	12-T	T-12	2.45	0.72	16.6	1.76	5.4	9.5	10' COA TYPE R ON GRADE	7.1	2.4	16.6	1.76	5.4	9.5
	12-T	T-12										16.6	1.32	5.4	7.1
	12-T	T-12										16.6	0.45	5.4	2.4
T-13, T-5, T-12	13-T	T-13	3.25	0.72	16.1	2.33	5.5	12.7	10' COA TYPE R ON GRADE	8.4	5.5	19.1	2.77	5.0	13.9
	13-T	T-13										19.1	1.68	5.0	8.4
	13-T	T-13										19.1	1.10	5.0	5.5
T-14, T-6, T-11	14-T	T-14	1.40	0.71	12.8	0.99	6.1	6.0	10' COA TYPE R ON GRADE	5.9	1.1	18.9	1.38	5.0	7.0
	14-T	T-14										18.9	1.17	5.0	5.9
	14-T	T-14										18.9	0.22	5.0	1.1
T-15, T-10	15-T	T-15	1.01	0.69	13.3	0.70	6.0	4.2	10' COA TYPE R ON GRADE	4.2	0.0	13.6	0.71	5.9	4.2
	15-T	T-15										13.6	0.71	5.9	4.2
	15-T	T-15										13.6	0.00	5.9	0.0
T-16	16-T	T-16	1.05	0.69	12.4	0.73	6.2	4.5	10' COA TYPE R ON GRADE	4.4	0.1	12.4	0.73	6.2	4.5
	16-T	T-16										12.4	0.71	6.2	4.4
	16-T	T-16										12.4	0.02	6.2	0.1

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

Subdivision Harmony Filing 16

Project Name: Harmony Filing 16
Project No. 0
Calculated By: RNM

Design Storm 100 YR
100-Year P1 = 2.49 in. NOAA ATLAS 14

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C100	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-17	17-T	T-17	0.95	0.71	10.8	0.68	6.5	4.4	10' COA TYPE R ON GRADE	4.4	0.0	10.8	0.68	6.5	4.4
	17-T	T-17										10.8	0.68	6.5	4.4
	17-T	T-17										10.8	0.00	6.5	0.0
T-18	18-T	T-18	2.09	0.71	13.6	1.48	5.9	8.8	10' COA TYPE R ON GRADE	6.9	1.9	13.6	1.48	5.9	8.8
	18-T	T-18										13.6	1.16	5.9	6.9
	18-T	T-18										13.6	0.32	5.9	1.9
T-19, T-13, T-18	19-T	T-19	3.77	0.70	16.1	2.63	5.5	14.4	10' COA TYPE R ON GRADE	9.3	8.1	25.6	4.05	4.3	17.4
	19-T	T-19										25.6	2.16	4.3	9.3
	19-T	T-19										25.6	1.89	4.3	8.1
T-20, T-14	20-T	T-20	1.06	0.71	11.8	0.75	6.3	4.7	10' COA TYPE R ON GRADE	4.6	0.1	22.0	0.75	6.3	4.7
	20-T	T-20										22.0	0.73	6.3	4.6
	20-T	T-20										22.0	0.02	6.3	0.1
T-21	21-T	T-21	1.03	0.72	10.1	0.74	6.7	5.0	10' COA TYPE R ON GRADE	4.9	0.1	10.1	0.74	6.7	5.0
	21-T	T-21										10.1	0.72	6.7	4.9
	21-T	T-21										10.1	0.01	6.7	0.1
T-22	22-T	T-22	1.61	0.71	11.4	1.15	6.4	7.3	10' COA TYPE R ON GRADE	6.2	1.1	11.4	1.15	6.4	7.3
	22-T	T-22										11.4	0.97	6.4	6.2
	22-T	T-22										11.4	0.17	6.4	1.1
T-23, T-1, T-8, T-9, T-24	23-T	T-23	2.08	0.72	14.1	1.50	5.8	8.7	15' COA TYPE R ON GRADE	12.5	4.0	23.2	3.66	4.5	16.5
	23-T	T-23										23.2	2.78	4.5	12.5
	23-T	T-23										23.2	0.89	4.5	4.0
T-24, T-2	24-T	T-24	2.37	0.56	13.9	1.34	5.9	7.8	10' COA TYPE R ON GRADE	8.2	4.3	20.9	2.60	4.8	12.5
	24-T	T-24										20.9	1.71	4.8	8.2
	24-T	T-24										20.9	0.90	4.8	4.3

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

Subdivision Harmony Filing 16

Project Name: Harmony Filing 16
Project No. 0
Calculated By: RNM

Design Storm 100 YR
100-Year P1 = 2.49 in. NOAA ATLAS 14

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C100	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-25	25-T	T-25	1.68	0.71	13.1	1.19	6.0	7.1	10' COA TYPE R ON GRADE	6.1	1.0	13.1	1.19	6.0	7.1
	25-T	T-25										13.1	1.02	6.0	6.1
	25-T	T-25										13.1	0.17	6.0	1.0
T-26	26-T	T-26	0.90	0.71	11.7	0.64	6.3	4.0	10' COA TYPE R ON GRADE	4.0	0.0	11.7	0.64	6.3	4.0
	26-T	T-26										11.7	0.64	6.3	4.0
	26-T	T-26										11.7	0.00	6.3	0.0
T-27, T-19, T-20	27-T	T-27	2.83	0.70	15.7	1.99	5.5	11.0	10' COA TYPE R ON GRADE	8.8	6.5	29.7	3.89	3.9	15.3
	27-T	T-27										29.7	2.24	3.9	8.8
	27-T	T-27										29.7	1.65	3.9	6.5
T-28, T-21, T-25	28-T	T-28	1.27	0.71	12.1	0.91	6.2	5.7	10' COA TYPE R ON GRADE	5.6	0.5	15.1	1.09	5.6	6.1
	28-T	T-28										15.1	1.00	5.6	5.6
	28-T	T-28										15.1	0.09	5.6	0.5
T-29	29-T	T-29	0.19	0.57	11.7	0.11	6.3	0.7	10' COA TYPE R ON GRADE	0.7	0.0	11.7	0.11	6.3	0.7
	29-T	T-29										11.7	0.11	6.3	0.7
	29-T	T-29										11.7	0.00	6.3	0.0
T-30	30-T	T-30	3.21	0.58	14.4	1.87	5.8	10.8	15' COA TYPE R ON GRADE	9.7	1.1	14.4	1.87	5.8	10.8
	30-T	T-30										14.4	1.68	5.8	9.7
	30-T	T-30										14.4	0.19	5.8	1.1
T-30.1	30.1-T	T-30.1	2.19	0.71	14.3	1.57	5.8	9.0	10' COA TYPE R ON GRADE	6.9	2.1	14.3	1.57	5.8	9.0
	30.1-T	T-30.1										14.3	1.20	5.8	6.9
	30.1-T	T-30.1										14.3	0.36	5.8	2.1
T-31, T-22, T-23, T-30, T-30.1	31-T	T-31	2.72	0.72	13.9	1.96	5.9	11.4	15' COA TYPE R IN SUMP	14.1	0.0	29.3	3.57	4.0	14.1
	31-T	T-31										29.3	3.57	4.0	14.1
	31-T	T-31										29.3	0.00	4.0	0.0

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

Subdivision Harmony Filing 16

Project Name: Harmony Filing 16
Project No. 0
Calculated By: RNM

Design Storm 100 YR
100-Year P1 = 2.49 in. NOAA ATLAS 14

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C100	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-32, T-27, T-28, T-33, T-34	32-T	T-32	2.42	0.69	15.4	1.67	5.6	9.3	10' COA TYPE R ON GRADE	8.9	6.5	33.4	4.22	3.7	15.4
	32-T	T-32										33.4	2.44	3.7	8.9
	32-T	T-32										33.4	1.77	3.7	6.5
T-33	33-T	T-33	0.74	0.74	8.8	0.55	7.1	3.8	BYPASS	0.0	3.8	8.8	0.55	7.1	3.8
	33-T	T-33										8.8	0.00	7.1	0.0
	33-T	T-33										8.8	0.54	7.1	3.8
T-34	34-T	T-34	0.35	0.75	8.1	0.26	7.3	1.9	BYPASS	0.0	1.9	8.1	0.26	7.3	1.9
	34-T	T-34										8.1	0.00	7.3	0.0
	34-T	T-34										8.1	0.26	7.3	1.9
T-35	35-T	T-35	1.94	0.66	13.0	1.28	6.0	7.7	10' COA TYPE R ON GRADE	6.3	1.4	13.0	1.28	6.0	7.7
	35-T	T-35										13.0	1.05	6.0	6.3
	35-T	T-35										13.0	0.23	6.0	1.4
T-36	36-T	T-36	1.91	0.66	13.2	1.25	6.0	7.5	10' COA TYPE R ON GRADE	6.3	1.2	13.2	1.25	6.0	7.5
	36-T	T-36										13.2	1.05	6.0	6.3
	36-T	T-36										13.2	0.20	6.0	1.2
T-37	37-T	T-37	2.13	0.70	13.8	1.50	5.9	8.8	10' COA TYPE R ON GRADE	6.8	2.0	13.8	1.50	5.9	8.8
	37-T	T-37										13.8	1.16	5.9	6.8
	37-T	T-37										13.8	0.34	5.9	2.0
T-38, T-32, T-37, T-39, T-40	38-T	T-38	3.97	0.73	14.7	2.91	5.7	16.6	2-10' COA TYPE R IN SUMP	19.4	0.0	35.8	5.51	3.5	19.4
	38-T	T-38										35.8	5.51	3.5	19.4
	38-T	T-38										35.8	0.00	3.5	0.0
T-39, T-35, T-36	39-T	T-39	1.67	0.72	14.0	1.20	5.8	7.0	10' COA TYPE R ON GRADE	6.9	2.2	15.7	1.64	5.5	9.1
	39-T	T-39										15.7	1.24	5.5	6.9
	39-T	T-39										15.7	0.40	5.5	2.2

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
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Subdivision Harmony Filing 16

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Design Storm 100 YR
100-Year P1 = 2.49 in. NOAA ATLAS 14

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C100	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-40	40-T	T-40	1.38	0.71	12.8	0.98	6.1	6.0	10' COA TYPE R ON GRADE	5.5	0.5	12.8	0.98	6.1	6.0
	40-T	T-40										12.8	0.90	6.1	5.5
	40-T	T-40										12.8	0.08	6.1	0.5
T-41, T-42	41-T	T-41	0.70	0.78	9.0	0.55	7.0	3.8	10' COA TYPE R ON GRADE	7.2	2.4	9.0	1.37	7.0	9.6
	41-T	T-41										9.0	1.03	7.0	7.2
	41-T	T-41										9.0	0.34	7.0	2.4
T-42	42-T	T-42	0.99	0.83	7.0	0.82	7.6	6.3	BYPASS	0.0	6.3	7.0	0.82	7.6	6.3
	42-T	T-42										7.0	0.00	7.6	0.0
	42-T	T-42										7.0	0.82	7.6	6.3
T-43	43-T	T-43	0.47	0.78	5.4	0.37	8.3	3.1	10' COA TYPE R ON GRADE	3.1	0.0	5.4	0.37	8.3	3.1
	43-T	T-43										5.4	0.37	8.3	3.1
	43-T	T-43										5.4	0.00	8.3	0.0
T-44, T-41, T-45	44-T	T-44	0.40	0.70	6.7	0.28	7.7	2.2	10' COA TYPE R ON GRADE	6.7	1.7	11.3	1.32	6.4	8.4
	44-T	T-44										11.3	1.05	6.4	6.7
	44-T	T-44										11.3	0.27	6.4	1.7
T-45	45-T	T-45	0.85	0.82	7.4	0.69	7.5	5.2	BYPASS	0.0	5.2	7.4	0.69	7.5	5.2
	45-T	T-45										7.4	0.00	7.5	0.0
	45-T	T-45										7.4	0.69	7.5	5.2
T-46	46-T	T-46	0.37	0.84	6.2	0.31	7.9	2.4	BYPASS	0.0	2.4	6.2	0.31	7.9	2.4
	46-T	T-46										6.2	0.00	7.9	0.0
	46-T	T-46										6.2	0.30	7.9	2.4
T-47	47-T	T-47	0.47	0.79	5.6	0.37	8.2	3.0	10' COA TYPE R ON GRADE	3.0	0.0	5.6	0.37	8.2	3.0
	47-T	T-47										5.6	0.37	8.2	3.0
	47-T	T-47										5.6	0.00	8.2	0.0

STANDARD FORM SF-3
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Subdivision Harmony Filing 16

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Design Storm 100 YR
100-Year P1 = 2.49 in. NOAA ATLAS 14

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C100	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
T-48	48-T	T-48	1.78	0.70	10.2	1.25	6.7	8.4	BYPASS	0.0	8.4	10.2	1.25	6.7	8.4
	48-T	T-48										10.2	0.00	6.7	0.0
	48-T	T-48										10.2	1.25	6.7	8.4
T-49, T-44, T-46, T-48	49-T	T-49	1.24	0.70	11.3	0.87	6.4	5.6	2-10' COA TYPE R IN SUMP	15.4	0.0	14.6	2.69	5.7	15.4
	49-T	T-49										14.6	2.69	5.7	15.4
	49-T	T-49										14.6	0.00	5.7	0.0
T-50	50-T	T-50	1.30	0.51	13.2	0.66	6.0	3.9	BYPASS	0.0	3.9	13.2	0.66	6.0	3.9
	50-T	T-50										13.2	0.00	6.0	0.0
	50-T	T-50										13.2	0.65	6.0	3.9
T-51	51-T	T-51	2.07	0.50	13.4	1.04	6.0	6.2	10' COA TYPE R ON GRADE	5.2	1.0	13.4	1.04	6.0	6.2
	51-T	T-51										13.4	0.87	6.0	5.2
	51-T	T-51										13.4	0.17	6.0	1.0
T-52	52-T	T-52	0.20	0.38	11.0	0.08	6.5	0.5	10' COA TYPE R ON GRADE	0.5	0.0	11.0	0.08	6.5	0.5
	52-T	T-52										11.0	0.08	6.5	0.5
	52-T	T-52										11.0	0.00	6.5	0.0
T-53	53-T	T-53	1.61	0.67	7.3	1.07	7.5	8.1	10' COA TYPE R IN SUMP	8.1	0.0	7.3	1.07	7.5	8.1
	53-T	T-53										7.3	1.07	7.5	8.1
	53-T	T-53										7.3	0.00	7.5	0.0
T-54	54-T	T-54	2.33	0.58	9.8	1.35	6.8	9.2	10' COA TYPE R IN SUMP	9.2		9.8	1.35	6.8	9.2
	54-T	T-54										9.8	1.35	6.8	9.2
	54-T	T-54										9.8	0.00	6.8	0.0
T-55	55-T	T-55	8.15	0.24	14.4	1.93	5.8	11.1	POND	11.1	0.0	14.4	1.93	5.8	11.1
	55-T	T-55										14.4	1.93	5.8	11.1
	55-T	T-55										14.4	0.00	5.8	0.0

U BASINS

SF-1 PROPOSED COMPOSITE BASIN LAND USE

Subdivision: HARMONY FILING 16

Project Name: HARMONY FILING 16
Project No.
Calculated By: RNM
Checked By: BS
Date: 12/13/2022

Basin	Total Area	Soil Type A	Soil Type B	Soil Type C/D	Multi Unit (Detatched)	Multi Unit (Attached)	Park/Playground	Paved	Open Space (2-7%)	Avg. Imp.	C_2	C_5	C_{100}
	(acres)	*(%)*	*(%)*	*(%)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(acres)*	*(%)*			
U-1	1.67	0.0%	0.0%	100.0%	0.00	0.46	0.00	0.89	0.31	75.3	0.67	0.69	0.76
U-1a	0.98	0.0%	0.0%	100.0%	0.00	0.73	0.00	0.20	0.06	75.9	0.63	0.67	0.79
U-1b	2.37	0.0%	0.0%	100.0%	0.00	1.96	0.00	0.35	0.06	77.0	0.63	0.67	0.81
U-2	1.39	0.0%	0.0%	100.0%	0.00	0.36	0.00	0.75	0.28	74.4	0.66	0.68	0.75
U-2a	0.37	0.0%	0.0%	100.0%	0.00	0.29	0.00	0.07	0.00	80.0	0.65	0.70	0.83
U-2b	0.72	0.0%	0.0%	100.0%	0.00	0.47	0.00	0.12	0.13	66.8	0.57	0.61	0.72
U-2c	1.03	0.0%	0.0%	100.0%	0.00	0.82	0.00	0.21	0.00	80.0	0.65	0.70	0.83
U-3	1.03	0.0%	0.0%	100.0%	0.55	0.00	0.00	0.35	0.12	67.2	0.56	0.59	0.72
U-4	1.03	0.0%	0.0%	100.0%	0.69	0.00	0.00	0.26	0.09	65.2	0.53	0.57	0.72
U-5	2.84	0.0%	0.0%	100.0%	1.48	0.00	0.58	0.59	0.20	54.1	0.46	0.51	0.70
U-6	0.52	0.0%	0.0%	100.0%	0.36	0.00	0.00	0.11	0.04	64.3	0.52	0.56	0.71
U-7	1.36	0.0%	0.0%	100.0%	0.94	0.00	0.00	0.31	0.11	64.7	0.52	0.56	0.71
U-8	2.31	0.0%	0.0%	100.0%	1.76	0.00	0.00	0.41	0.14	63.7	0.51	0.55	0.71
U-10	5.15	0.0%	0.0%	100.0%	2.32	0.00	1.84	0.60	0.38	42.7	0.37	0.43	0.67
U-11	1.84	0.0%	0.0%	100.0%	1.21	0.00	0.08	0.41	0.14	62.3	0.51	0.55	0.71
U-12	4.16	0.0%	0.0%	100.0%	2.59	0.00	0.31	0.92	0.34	60.6	0.50	0.54	0.71
U-13	3.09	0.0%	0.0%	100.0%	0.00	0.60	0.00	1.76	0.73	72.6	0.65	0.67	0.74
U-13a	1.49	0.0%	0.0%	100.0%	0.00	1.24	0.00	0.20	0.05	76.0	0.62	0.67	0.80
U-13b	0.66	0.0%	0.0%	100.0%	0.00	0.38	0.00	0.10	0.18	59.5	0.53	0.56	0.66
U-13c	1.19	0.0%	0.0%	100.0%	0.00	0.92	0.00	0.20	0.06	75.5	0.62	0.66	0.79
U-14	0.17	0.0%	0.0%	100.0%	0.00	0.00	0.00	0.13	0.04	75.5	0.69	0.70	0.75
U-15	1.68	0.0%	0.0%	100.0%	1.33	0.00	0.00	0.25	0.10	62.4	0.49	0.54	0.70
U-16	4.13	0.0%	0.0%	100.0%	0.00	0.15	0.00	2.24	1.75	58.9	0.57	0.58	0.62
U-17	0.35	0.0%	0.0%	100.0%	0.00	0.00	0.00	0.14	0.22	41.3	0.44	0.45	0.49
U-18	0.34	0.0%	0.0%	100.0%	0.00	0.07	0.00	0.16	0.12	61.4	0.57	0.59	0.65
U-19	0.13	0.0%	0.0%	100.0%	0.00	0.02	0.00	0.08	0.03	75.1	0.68	0.69	0.75
U-19a	0.46	0.0%	0.0%	100.0%	0.00	0.37	0.00	0.09	0.00	79.7	0.65	0.69	0.82
U-20	3.08	0.0%	0.0%	100.0%	0.00	0.00	0.00	2.40	0.68	79.1	0.72	0.73	0.77
U-21	1.22	0.0%	0.0%	100.0%	0.00	0.00	0.00	1.04	0.17	86.5	0.77	0.78	0.83
U-22	3.99	0.0%	0.0%	100.0%	0.00	0.19	0.00	0.00	3.80	8.3	0.20	0.21	0.25

COA SDDTCM TABLE 1

Land Use	% Imp.	C_2	C_5	C_{100}
Multi Unit (Detatched)	60	0.45	0.50	0.70
Multi Unit (Attached)	75	0.60	0.65	0.80
Park/Playground	10	0.15	0.25	0.65
Paved	100	0.87	0.88	0.93
Open Space (2-7%)	5	0.18	0.19	0.22

TOTAL AREA	
Sum of Areas =	50.77
Sum A*I =	3083.82
Weighted I =	**60.7%**

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
Streets:					
Paved	100	.87	.88	.90	.93
Gravel	40	.15	.25	.35	.65
Concrete Drive and Walks	96	.87	.87	.88	.89
Roofs	90	.80	.85	.90	.90
Lawns, Sandy Soil (A and B Soils):	2				
2% Slope		.05	.06	.08	.10
2-7% Slope		.10	.11	.13	.15
>7% Slope		.15	.16	.18	.20
Lawns, Clay Soil (C and D Soils):	5				
2% Slope		.13	.14	.15	.17
2-7% Slope		.18	.19	.20	.22
>7% Slope		.25	.27	.30	.35

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
Business:					
Commercial Areas	95	.87	.87	.88	.89
Neighborhood Areas	85	.60	.65	.70	.80
Residential:					
Single-Family (**)	(*)	.40	.45	.50	.60
Multi-Unit (detached)	60	.45	.50	.60	.70
Multi-Unit (attached)	75	.60	.65	.70	.80
1/2 Acre Lot or Larger	(*)	.30	.35	.40	.60
Apartments	80	.65	.70	.70	.80
Industrial:					
Light Areas	80	.71	.72	.76	.82
Heavy Areas	90	.80	.80	.85	.90
Parks, Cemeteries	5	.10	.10	.35	.60
Playgrounds	10	.15	.25	.35	.65
Schools	50	.45	.50	.60	.70
Railroad Yard Areas	15	.40	.45	.50	.60
Undeveloped Areas:					
Historic Flow Analysis, Greenbelts, Agricultural	2	(See "Lawns")			
Off-Site Flow Analysis (when land use not defined)	45	.43	.47	.55	.65

SF-2 TIME OF CONCENTRATION FOR EACH SUB-BASIN

SUB-BASIN DATA		INITIAL/OVERLAND FLOW TIME				CHANNELIZED FLOW TIME					TOTAL Tc	FIRST DESIGN POINT T_c		EFFECTIVE
DATA											$T_c = T_I + T_T$	COA T_c Check		T_c
BASIN	D.A.	C_5	L	S	T_i	L	S	LAND SURFACE	VEL.	T_t	Tc	LENGTH	MIN. T_c	
ID	(AC)		FT	FT/FT	MINUTES	FT	FT/FT		FPS	MINUTES	MINUTES	FT	MINUTES	MINUTES
U-1	1.67	0.69	43	0.031	3.4	888	0.015	Paved area	2.4	6.0	9.4	931	15.2	9.4
U-1a	0.98	0.67	74	0.006	7.9	261	0.008	Paved area	1.8	2.4	10.4	335	11.9	10.4
U-1b	2.37	0.67	108	0.037	5.2	561	0.016	Paved area	2.5	3.7	8.9	669	13.7	8.9
U-2	1.39	0.68	62	0.068	3.2	644	0.013	Paved area	2.3	4.7	7.9	706	13.9	7.9
U-2a	0.37	0.70	101	0.043	4.5	103	0.018	Paved area	2.7	0.6	5.2	204	11.1	5.2
U-2b	0.72	0.61	130	0.046	6.1	163	0.017	Paved area	2.6	1.0	7.2	293	11.6	7.2
U-2c	1.03	0.70	119	0.024	6.0	235	0.016	Paved area	2.5	1.5	7.5	354	12.0	7.5
U-3	1.03	0.59	10	0.041	1.8	597	0.013	Paved area	2.3	4.4	6.2	607	13.4	6.2
U-4	1.03	0.57	126	0.005	13.6	245	0.018	Paved area	2.7	1.5	15.1	371	12.1	12.1
U-5	2.84	0.51	16	0.024	3.2	604	0.012	Paved area	2.2	4.6	7.8	620	13.4	7.8
U-6	0.52	0.56	177	0.041	8.2	161	0.011	Paved area	2.1	1.3	9.5	338	11.9	9.5
U-7	1.36	0.56	116	0.008	11.3	522	0.015	Paved area	2.4	3.6	14.8	638	13.5	13.5
U-8	2.31	0.55	98	0.007	11.1	640	0.011	Paved area	2.1	5.1	16.2	738	14.1	14.1
U-10	5.15	0.43	300	0.028	14.9	249	0.011	Paved area	2.1	2.0	16.8	549	13.1	13.1
U-11	1.84	0.55	114	0.011	10.3	439	0.015	Paved area	2.4	3.0	13.3	553	13.1	13.1
U-12	4.16	0.54	116	0.009	11.3	690	0.02	Paved area	2.8	4.1	15.3	806	14.5	14.5
U-13	3.09	0.67	29	0.044	2.6	1578	0.012	Paved area	2.2	12.0	14.6	1607	18.9	14.6
U-13a	1.49	0.67	102	0.06	4.4	349	0.01	Paved area	2.0	2.9	7.3	451	12.5	7.3
U-13b	0.66	0.56	146	0.041	7.4	150	0.03	Paved area	3.5	0.7	8.1	296	11.6	8.1
U-13c	1.19	0.66	126	0.01	8.8	246	0.025	Paved area	3.2	1.3	10.1	372	12.1	10.1
U-14	0.17	0.70	32	0.039	2.6	207	0.029	Paved area	3.4	1.0	3.6	239	11.3	5.0
U-15	1.68	0.54	164	0.017	10.9	322	0.018	Paved area	2.7	2.0	12.9	486	12.7	12.7
U-16	4.13	0.58	16	0.049	2.2	1283	0.015	Paved area	2.4	8.7	11.0	1299	17.2	11.0
U-17	0.35	0.45	51	0.043	5.2	114	0.007	Paved area	1.7	1.1	6.3	165	10.9	6.3
U-18	0.34	0.59	20	0.015	3.6	242	0.016	Paved area	2.5	1.6	5.2	262	11.5	5.2
U-19	0.13	0.69	21	0.031	2.3	126	0.01	Paved area	2.0	1.1	3.4	147	10.8	5.0
U-19a	0.46	0.69	68	0.005	7.6	182	0.01	Paved area	2.0	1.5	9.1	250	11.4	9.1
U-20	3.08	0.73	26	0.005	4.3	3190	0.012	Paved area	2.2	24.3	28.6	3216	27.9	27.9
U-21	1.22	0.78	23	0.02	2.2	720	0.012	Paved area	2.2	5.5	7.7	743	14.1	7.7
U-22	3.99	0.21	223	0.072	12.5	249	0.005	Short pasture and lawns	0.5	8.4	20.9	472	12.6	12.6

$t_c = t_i + t_t$ (5.2)

where t_c = time of concentration (minutes)
t_i = initial, inlet, or overland flow time (minutes)
t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (minutes)

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{\sqrt[3]{S}} \quad (5.3)$$

where t_i = initial or overland flow time (minutes)
C_5 = runoff coefficient for 5-year frequency
L = length of overland flow, (ft., 500 ft. max.)
S = average basin slope (ft/ft)

$$t_c = \frac{L'}{180} + 10 \quad (5.4)$$

Where t_c = time of concentration (minutes)

L' = length of flow to first design point from the most remote point (feet)

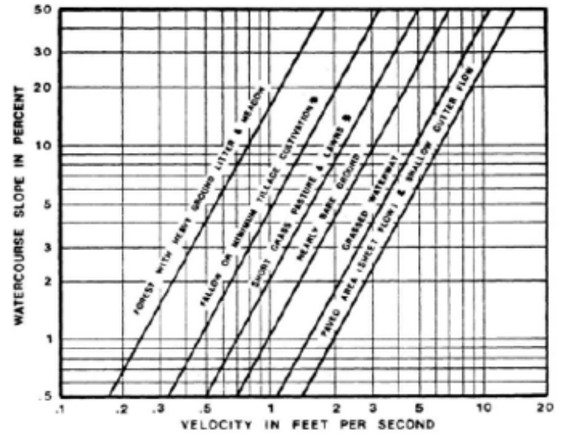

Figure RO-1—Estimate of Average Overland Flow Velocity for Use With the Rational Formula

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

Subdivision HARMONY FILING 16

Design Storm 2 YR
2-Year P1 = 0.85 in. NOAA Atlas 14

Project Name: HARMONY FILING 16
Project No. 0
Calculated By: RNM

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C2)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Preliminary Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
U-1, U-1a, U-1b	1U	U-1	1.67	0.67	9.4	1.11	2.4	2.6	2-10' COA TYPE R IN SUMP	6.4	0.0	14.3	3.22	2.0	6.4
	1U	U-1										14.3	3.22	2.0	6.4
	1U	U-1										14.3	0.00	2.0	0.0
U-2, U-2a, U-2b, U-2c	2U	U-2	1.39	0.66	7.9	0.92	2.5	2.3	2-10' COA TYPE R IN SUMP	5.4	0.0	9.1	2.24	2.4	5.4
	2U	U-2										9.1	2.24	2.4	5.4
	2U	U-2										9.1	0.00	2.4	0.0
U-3	3U	U-3	1.03	0.56	6.2	0.58	2.7	1.6	10' COA TYPE R ON GRADE	1.6	0.0	6.2	0.58	2.7	1.6
	3U	U-3										6.2	0.58	2.7	1.6
	3U	U-3										6.2	0.00	2.7	0.0
U-4	4U	U-4	1.03	0.53	12.1	0.55	2.1	1.2	10' COA TYPE R IN SUMP	1.2	0.0	12.1	0.55	2.1	1.2
	4U	U-4										12.1	0.55	2.1	1.2
	4U	U-4										12.1	0.00	2.1	0.0
U-5	5U	U-5	2.84	0.46	7.8	1.30	2.5	3.3	15' COA TYPE R IN SUMP	3.3	0.0	7.8	1.30	2.5	3.3
	5U	U-5										7.8	1.30	2.5	3.3
	5U	U-5										7.8	0.00	2.5	0.0
U-6	6U	U-6	0.52	0.52	9.5	0.27	2.4	0.6	10' COA TYPE R ON GRADE	0.6	0.0	9.5	0.27	2.4	0.6
	6U	U-6										9.5	0.27	2.4	0.6
	6U	U-6										9.5	0.00	2.4	0.0
U-7	7U	U-7	1.36	0.52	13.5	0.72	2.0	1.5	10' COA TYPE R ON GRADE	1.5		13.5	0.72	2.0	1.5
	7U	U-7										13.5	0.72	2.0	1.5
	7U	U-7										13.5	0.00	2.0	0.0
U-8	8U	U-8	2.31	0.51	14.1	1.17	2.0	2.3	10' COA TYPE R ON GRADE	2.3		14.1	1.17	2.0	2.3
	8U	U-8										14.1	1.17	2.0	2.3
	8U	U-8										14.1	0.00	2.0	0.0

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

Subdivision HARMONY FILING 16

Design Storm 2 YR
2-Year P1 = 0.85 in. NOAA Atlas 14

Project Name: HARMONY FILING 16
Project No. 0
Calculated By: RNM

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C2)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Preliminary Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
U-10	10U	U-10	5.15	0.37	13.1	1.92	2.1	4.0	2-10' COA TYPE R IN SUMP	4.0		13.1	1.92	2.1	4.0
	10U	U-10										13.1	1.92	2.1	4.0
	10U	U-10										13.1	0.00	2.1	0.0
U-11	11U	U-11	1.84	0.51	13.1	0.94	2.1	1.9	10' COA TYPE R IN SUMP	1.9		13.1	0.94	2.1	1.9
	11U	U-11										13.1	0.94	2.1	1.9
	11U	U-11										13.1	0.00	2.1	0.0
U-12	12U	U-12	4.16	0.50	14.5	2.07	2.0	4.1	10' COA TYPE R IN SUMP	4.1		14.5	2.07	2.0	4.1
	12U	U-12										14.5	2.07	2.0	4.1
	12U	U-12										14.5	0.00	2.0	0.0
U-13, U-13a, U-13b, U-13c	13U	U-13	3.09	0.65	14.6	2.02	2.0	4.0	2-10" COA TYPE R IN SUMP	7.9		14.6	4.04	2.0	7.9
	13U	U-13										14.6	4.04	2.0	7.9
	13U	U-13										14.6	0.00	2.0	0.0
U-14	14U	U-14	0.17	0.69	5.0	0.12	2.9	0.3	5' COA TYPE R ON GRADE	0.3		5.0	0.12	2.9	0.3
	14U	U-14										5.0	0.12	2.9	0.3
	14U	U-14										5.0	0.00	2.9	0.0
U-15	15U	U-15	1.68	0.49	12.7	0.83	2.1	1.7	10' COA TYPE R ON GRADE	1.7		12.7	0.83	2.1	1.7
	15U	U-15										12.7	0.83	2.1	1.7
	15U	U-15										12.7	0.00	2.1	0.0
U-16	16U	U-16	4.13	0.57	11.0	2.35	2.2	5.2	10' COA TYPE R IN SUMP	5.2		11.0	2.35	2.2	5.2
	16U	U-16										11.0	2.35	2.2	5.2
	16U	U-16										11.0	0.00	2.2	0.0
U-20	20U	U-20	3.08	0.72	27.9	2.21	1.4	3.1	15' COA TYPE R ON GRADE	3.1		27.9	2.21	1.4	3.1
	20U	U-20										27.9	2.21	1.4	3.1
	20U	U-20										27.9	0.00	1.4	0.0

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

Subdivision HARMONY FILING 16

Design Storm 2 YR
2-Year P1 = 0.85 in. NOAA Atlas 14

Project Name: HARMONY FILING 16
Project No. 0
Calculated By: RNM

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C2)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Preliminary Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
U-21	21U	U-21	1.22	0.77	7.7	0.94	2.5	2.4	10' COA TYPE R ON GRADE	2.4		7.7	0.94	2.5	2.4
	21U	U-21										7.7	0.94	2.5	2.4
	21U	U-21										7.7	0.00	2.5	0.0
U-22	22U	U-22	3.99	0.20	12.6	0.80	2.1	1.7	POND	1.7	0.0	12.6	0.80	2.1	1.7
	22U	U-22										12.6	0.80	2.1	1.7
	22U	U-22										12.6	0.00	2.1	0.0
U-1a	1aU	U-1a	0.98	0.63	10.4	0.62	2.3	1.4	ALLEY	0.0	1.4	10.4	0.62	2.3	1.4
	1aU	U-1a										10.4	0.00	2.3	0.0
	1aU	U-1a										10.4	0.62	2.3	1.4
U-2a	2aU	U-2a	0.37	0.65	5.2	0.24	2.9	0.7	ALLEY	0.0	0.7	5.2	0.24	2.9	0.7
	2aU	U-2a										5.2	0.00	2.9	0.0
	2aU	U-2a										5.2	0.24	2.9	0.7
U-2b	2bU	U-2b	0.72	0.57	7.2	0.41	2.6	1.1	ALLEY	0.0	1.1	7.2	0.41	2.6	1.1
	2bU	U-2b										7.2	0.00	2.6	0.0
	2bU	U-2b										7.2	0.41	2.6	1.1
U-2c	2cU	U-2c	1.03	0.65	7.5	0.68	2.6	1.7	ALLEY	0.0	1.7	7.5	0.68	2.6	1.7
	2cU	U-2c										7.5	0.00	2.6	0.0
	2cU	U-2c										7.5	0.68	2.6	1.7
U-13a	13aU	U-13a	1.49	0.62	7.3	0.93	2.6	2.4	ALLEY	0.0	2.4	7.3	0.93	2.6	2.4
	13aU	U-13a										7.3	0.00	2.6	0.0
	13aU	U-13a										7.3	0.93	2.6	2.4
U-13b	13bU	U-13b	0.66	0.53	8.1	0.35	2.5	0.9	ALLEY	0.0	0.9	8.1	0.35	2.5	0.9
	13bU	U-13b										8.1	0.00	2.5	0.0
	13bU	U-13b										8.1	0.35	2.5	0.9

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

Subdivision HARMONY FILING 16

Design Storm 2 YR
2-Year P1 = 0.85 in. NOAA Atlas 14

Project Name: HARMONY FILING 16
Project No. 0
Calculated By: RNM

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C2)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Preliminary Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
U-13c	13cU	U-13c	1.19	0.62	10.1	0.74	2.3	1.7	ALLEY	0.0	1.7	10.1	0.74	2.3	1.7
	13cU	U-13c										10.1	0.00	2.3	0.0
	13cU	U-13c										10.1	0.74	2.3	1.7
U-1b	1bU	U-1b	2.37	0.63	8.9	1.49	2.4	3.6	ALLEY	0.0	3.6	8.9	1.49	2.4	3.6
	1bU	U-1b										8.9	0.00	2.4	0.0
	1bU	U-1b										8.9	1.49	2.4	3.6
U-17	17U	U-17	0.35	0.44	6.3	0.16	2.7	0.4	10' COA TYPE R ON GRADE	0.4		6.3	0.16	2.7	0.4
	17U	U-17										6.3	0.16	2.7	0.4
	17U	U-17										6.3	0.00	2.7	0.0
U-18	18U	U-18	0.34	0.57	5.2	0.20	2.9	0.6	10' COA TYPE R ON GRADE	0.6		5.2	0.20	2.9	0.6
	18U	U-18										5.2	0.20	2.9	0.6
	18U	U-18										5.2	0.00	2.9	0.0
U-19, U-19a	19U	U-19	0.13	0.68	5.0	0.09	2.9	0.2	10' COA TYPE R ON GRADE	0.9		10.0	0.38	2.3	0.9
	19U	U-19										10.0	0.38	2.3	0.9
	19U	U-19										10.0	0.00	2.3	0.0
U-19a	19aU	U-19a	0.46	0.65	9.1	0.30	2.4	0.7	ALLEY	0.0	0.7	9.1	0.30	2.4	0.7
	19aU	U-19a										9.1	0.00	2.4	0.0
	19aU	U-19a										9.1	0.30	2.4	0.7

$$I = \frac{28.5\ P_1}{(10 + T_c)^{0.786}} \qquad (5.5)$$

Where:
I = rainfall intensity (inches per hour)
P_1 = one-hour rainfall depth (inches) from Figures RA-1 through RA-6 in USDCM, Volume 1
T_c = time of concentration (minutes).

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

Subdivision HARMONY FILING 16

Design Storm 100 YR
100-Year P1 = 2.49 in. NOAA Atlas 14

Project Name: HARMONY FILING 16
Project No. 0
Calculated By: RNM

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C100)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Preliminary Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
U-1, U-1a, U-1b	1U	U-1	1.67	0.76	9.4	1.27	6.9	8.7	2-10' COA TYPE R IN SUMP	22.9	0.0	14.3	3.95	5.8	22.9
	1U	U-1										14.3	3.95	5.8	22.9
	1U	U-1										14.3	0.00	5.8	0.0
U-2, U-3, U-8, U-2a, U-2b, U-2c	2U	U-2	1.39	0.75	7.9	1.04	7.4	7.7	2-10' COA TYPE R IN SUMP	16.9	0.0	17.1	3.19	5.3	16.9
	2U	U-2										17.1	3.19	5.3	16.9
	2U	U-2										17.1	0.00	5.3	0.0
U-3, U-4	3U	U-3	1.03	0.72	6.2	0.74	8.0	5.9	10' COA TYPE R ON GRADE	5.4	0.5	14.4	0.74	8.0	5.9
	3U	U-3										14.4	0.68	8.0	5.4
	3U	U-3										14.4	0.06	8.0	0.5
U-4	4U	U-4	1.03	0.72	12.1	0.74	6.2	4.6	10' COA TYPE R IN SUMP	4.5	0.1	12.1	0.74	6.2	4.6
	4U	U-4										12.1	0.72	6.2	4.5
	4U	U-4										12.1	0.02	6.2	0.1
U-5, U-7	5U	U-5	2.84	0.70	7.8	2.00	7.4	14.8	15' COA TYPE R IN SUMP	14.8	0.0	15.1	2.00	7.4	14.8
	5U	U-5										15.1	2.00	7.4	14.8
	5U	U-5										15.1	0.00	7.4	0.0
U-6	6U	U-6	0.52	0.71	9.5	0.37	6.9	2.5	10' COA TYPE R ON GRADE	2.5	0.0	9.5	0.37	6.9	2.5
	6U	U-6										9.5	0.37	6.9	2.5
	6U	U-6										9.5	0.00	6.9	0.0
U-7	7U	U-7	1.36	0.71	13.5	0.97	5.9	5.8	10' COA TYPE R ON GRADE	5.4	0.4	13.5	0.97	5.9	5.8
	7U	U-7										13.5	0.91	5.9	5.4
	7U	U-7										13.5	0.07	5.9	0.4
U-8	8U	U-8	2.31	0.71	14.1	1.64	5.8	9.6	10' COA TYPE R ON GRADE	7.2	2.4	14.1	1.64	5.8	9.6
	8U	U-8										14.1	1.23	5.8	7.2
	8U	U-8										14.1	0.41	5.8	2.4

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

Subdivision HARMONY FILING 16

Design Storm 100 YR
100-Year P1 = 2.49 in. NOAA Atlas 14

Project Name: HARMONY FILING 16
Project No. 0
Calculated By: RNM

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C100	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Preliminary Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
U-10	10U	U-10	5.15	0.67	13.1	3.47	6.0	20.9	2-10' COA TYPE R IN SUMP	20.9	0.0	13.1	3.47	6.0	20.9
	10U	U-10										13.1	3.47	6.0	20.9
	10U	U-10										13.1	0.00	6.0	0.0
U-11	11U	U-11	1.84	0.71	13.1	1.31	6.0	7.9	10' COA TYPE R IN SUMP	7.9	0.0	13.1	1.31	6.0	7.9
	11U	U-11										13.1	1.31	6.0	7.9
	11U	U-11										13.1	0.00	6.0	0.0
U-12, U-15	12U	U-12	4.16	0.71	14.5	2.95	5.7	16.9	10' COA TYPE R IN SUMP	17.1	0.0	16.2	3.13	5.5	17.1
	12U	U-12										16.2	3.13	5.5	17.1
	12U	U-12										16.2	0.00	5.5	0.0
U-13, U-13a, U-13b, U-13c	13U	U-13	3.09	0.74	14.6	2.28	5.7	13.1	2-10" COA TYPE R IN SUMP	27.7	0.0	14.6	4.84	5.7	27.7
	13U	U-13										14.6	4.84	5.7	27.7
	13U	U-13										14.6	0.00	5.7	0.0
U-14	14U	U-14	0.17	0.75	5.0	0.13	8.4	1.1	5' COA TYPE R ON GRADE	1.1	0.0	5.0	0.13	8.4	1.1
	14U	U-14										5.0	0.13	8.4	1.1
	14U	U-14										5.0	0.00	8.4	0.0
U-15	15U	U-15	1.68	0.70	12.7	1.18	6.1	7.2	10' COA TYPE R ON GRADE	6.1	1.1	12.7	1.18	6.1	7.2
	15U	U-15										12.7	1.00	6.1	6.1
	15U	U-15										12.7	0.18	6.1	1.1
U-16, U-20, U-21	16U	U-16	4.13	0.62	11.0	2.58	6.5	16.8	10' COA TYPE R IN SUMP	16.8	0.0	30.8	2.58	6.5	16.8
	16U	U-16										30.8	2.58	6.5	16.8
	16U	U-16										30.8	0.00	6.5	0.0
U-20	20U	U-20	3.08	0.77	27.9	2.39	4.1	9.7	15' COA TYPE R ON GRADE	8.9	0.8	27.9	2.39	4.1	9.7
	20U	U-20										27.9	2.19	4.1	8.9
	20U	U-20										27.9	0.20	4.1	0.8

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
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Subdivision HARMONY FILING 16

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Design Storm 100 YR
100-Year P1 = 2.49 in. NOAA Atlas 14

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C100)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Preliminary Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
U-21	21U	U-21	1.22	0.83	7.7	1.01	7.4	7.5	10' COA TYPE R ON GRADE	5.8	1.7	7.7	1.01	7.4	7.5
	21U	U-21										7.7	0.78	7.4	5.8
	21U	U-21										7.7	0.23	7.4	1.7
U-22	22U	U-22	3.99	0.25	12.6	0.99	6.1	6.0	POND	6.0	0.0	12.6	0.99	6.1	6.0
	22U	U-22										12.6	0.99	6.1	6.0
	22U	U-22										12.6	0.00	6.1	0.0
U-1a	1aU	U-1a	0.98	0.79	10.4	0.78	6.6	5.2	ALLEY	0.0	5.2	10.4	0.78	6.6	5.2
	1aU	U-1a										10.4	0.00	6.6	0.0
	1aU	U-1a										10.4	0.78	6.6	5.2
U-2a	2aU	U-2a	0.37	0.83	5.2	0.30	8.4	2.5	ALLEY	0.0	2.5	5.2	0.30	8.4	2.5
	2aU	U-2a										5.2	0.00	8.4	0.0
	2aU	U-2a										5.2	0.30	8.4	2.5
U-2b	2bU	U-2b	0.72	0.72	7.2	0.52	7.6	3.9	ALLEY	0.0	3.9	7.2	0.52	7.6	3.9
	2bU	U-2b										7.2	0.00	7.6	0.0
	2bU	U-2b										7.2	0.52	7.6	3.9
U-2c	2cU	U-2c	1.03	0.83	7.5	0.85	7.5	6.4	ALLEY	0.0	6.4	7.5	0.85	7.5	6.4
	2cU	U-2c										7.5	0.00	7.5	0.0
	2cU	U-2c										7.5	0.85	7.5	6.4
U-13a	13aU	U-13a	1.49	0.80	7.3	1.19	7.6	9.0	ALLEY	0.0	9.0	7.3	1.19	7.6	9.0
	13aU	U-13a										7.3	0.00	7.6	0.0
	13aU	U-13a										7.3	1.19	7.6	9.0
U-13b	13bU	U-13b	0.66	0.66	8.1	0.44	7.3	3.2	ALLEY	0.0	3.2	8.1	0.44	7.3	3.2
	13bU	U-13b										8.1	0.00	7.3	0.0
	13bU	U-13b										8.1	0.44	7.3	3.2

STANDARD FORM SF-3
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Subdivision HARMONY FILING 16

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Design Storm 100 YR
100-Year P1 = 2.49 in. NOAA Atlas 14

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C100)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Preliminary Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
U-13c	13cU	U-13c	1.19	0.79	10.1	0.94	6.7	6.3		0.0	6.3	10.1	0.94	6.7	6.3
	13cU	U-13c							ALLEY			10.1	0.00	6.7	0.0
	13cU	U-13c										10.1	0.94	6.7	6.3
U-1b	1bU	U-1b	2.37	0.81	8.9	1.91	7.0	13.4		0.0	13.4	8.9	1.91	7.0	13.4
	1bU	U-1b							ALLEY			8.9	0.00	7.0	0.0
	1bU	U-1b										8.9	1.91	7.0	13.4
U-17	17U	U-17	0.35	0.49	6.3	0.17	7.9	1.4		1.4	0.0	6.3	0.17	7.9	1.4
	17U	U-17							10' COA TYPE R ON GRADE			6.3	0.17	7.9	1.4
	17U	U-17										6.3	0.00	7.9	0.0
U-18	18U	U-18	0.34	0.65	5.2	0.23	8.4	1.9		1.9	0.0	5.2	0.23	8.4	1.9
	18U	U-18							10' COA TYPE R ON GRADE			5.2	0.23	8.4	1.9
	18U	U-18										5.2	0.00	8.4	0.0
U-19, U-19a	19U	U-19	0.13	0.75	5.0	0.10	8.4	0.8		3.2	0.0	10.0	0.47	6.7	3.2
	19U	U-19							10' COA TYPE R ON GRADE			10.0	0.47	6.7	3.2
	19U	U-19										10.0	0.00	6.7	0.0
U-19a	19aU	U-19a	0.46	0.82	9.1	0.38	7.0	2.6		0.0	2.6	9.1	0.38	7.0	2.6
	19aU	U-19a							ALLEY			9.1	0.00	7.0	0.0
	19aU	U-19a										9.1	0.38	7.0	2.6

$$I = \frac{28.5\ P_1}{(10 + T_c)^{0.786}} \qquad (5.5)$$

Where:
I = rainfall intensity (inches per hour)
P_1 = one-hour rainfall depth (inches) from Figures RA-1 through RA-6 in USDCM, Volume 1
T_c = time of concentration (minutes).

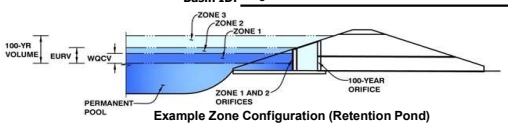
MHFD_Detention Calculations for Ponds

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Harmony Filing 16

Basin ID: Regional Pond B Combined



Example Zone Configuration (Retention Pond)

Stage 0 = 5610.50 **EURV Elev. =** 5615.07 **Top of Embankment =** 5619.00 **Q100 (cfs)** 53.8

WQ. Elev. = 5613.62 **100 YR Elev. =** 5616.89

Depth Increment = 1.00 ft

Combined Stage-Storage for Existing Pond B and Pond BB

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	--	--	--	48	0.001		
5611	--	0.50	--	--	--	709	0.016	189	0.004
5612	--	1.50	--	--	--	14,152	0.325	7,620	0.175
5613	--	2.50	--	--	--	59,520	1.366	44,455	1.021
5614	--	3.50	--	--	--	137,149	3.149	142,790	3.278
5615	--	4.50	--	--	--	175,358	4.026	299,043	6.865
5616	--	5.50	--	--	--	191,923	4.406	482,683	11.081
5617	--	6.50	--	--	--	203,767	4.678	680,528	15.623
5618	--	7.50	--	--	--	215,949	4.958	890,386	20.440
5619	--	8.50	--	--	--	228,380	5.243	1,112,551	25.541

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	119.74	acres
Watershed Length =	4,358	ft
Watershed Length to Centroid =	2,036	ft
Watershed Slope =	0.016	ft/ft
Watershed Imperviousness =	55.20%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Aurora - Municipal Center	

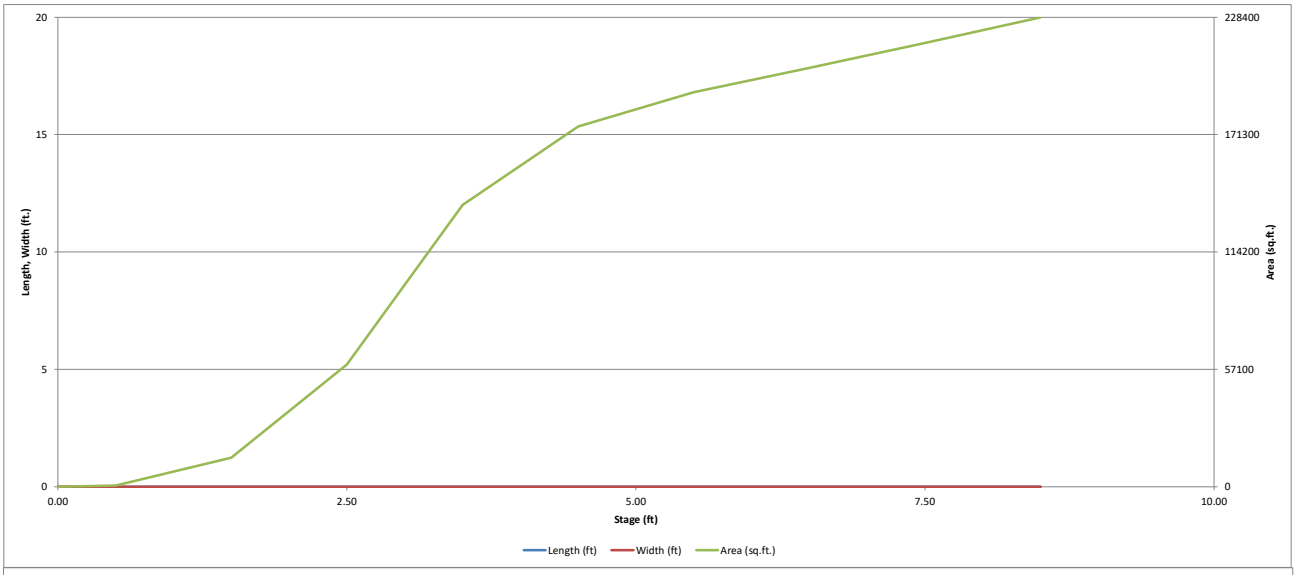
After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

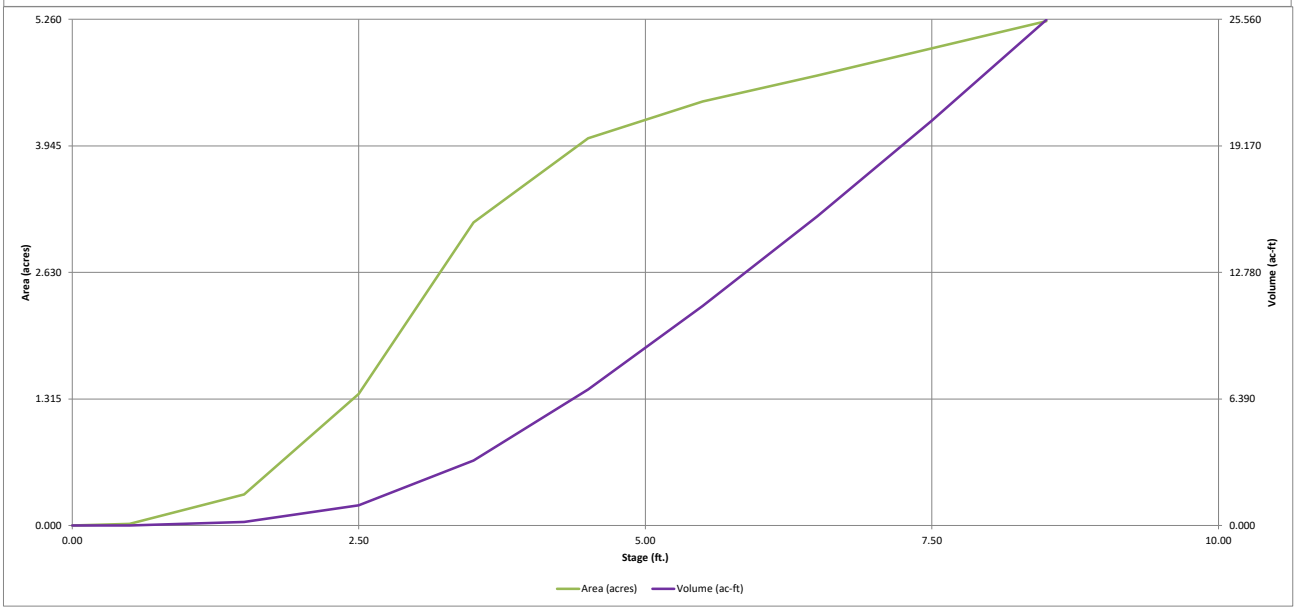
NOAA ATLAS 14

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	2.205	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	7.122	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 0.85 in.) =	4.244	acre-feet	0.85 inches
5-yr Runoff Volume (P1 = 1.14 in.) =	6.163	acre-feet	1.14 inches
10-yr Runoff Volume (P1 = 1.4 in.) =	8.422	acre-feet	1.40 inches
25-yr Runoff Volume (P1 = 1.79 in.) =	12.752	acre-feet	1.79 inches
50-yr Runoff Volume (P1 = 2.13 in.) =	16.170	acre-feet	2.13 inches
100-yr Runoff Volume (P1 = 2.49 in.) =	20.261	acre-feet	2.49 inches
500-yr Runoff Volume (P1 = 3.3 in.) =	28.788	acre-feet	inches
Approximate 2-yr Detention Volume =	3.878	acre-feet	
Approximate 5-yr Detention Volume =	5.609	acre-feet	
Approximate 10-yr Detention Volume =	7.703	acre-feet	
Approximate 25-yr Detention Volume =	9.365	acre-feet	
Approximate 50-yr Detention Volume =	10.340	acre-feet	
Approximate 100-yr Detention Volume =	11.903	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	2.205	acre-feet
Zone 2 Volume (EURV - Zone 1) =	4.917	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.781	acre-feet
Total Detention Basin Volume =	11.903	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


20
15
10
5
0
Length, Width (ft.)
228400
171300
114200
57100
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)


5.260
3.945
2.630
1.315
0.000
Area (acres)
25.560
19.170
12.780
6.390
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

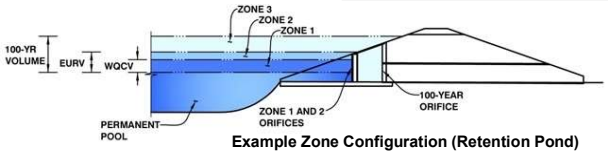
Outlet structure information was filled in based on Harmony Filing 1 Pond B outlet structure design (see attached CDs). This sheet will be updated when we obtain survey information for the built structure.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Harmony Filing 16**

Basin ID: **Pond B Combined**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.12	2.205	Orifice Plate
Zone 2 (EURV)	4.57	4.917	Orifice Plate
Zone 3 (100-year)	5.69	4.781	Weir&Pipe (Restrict)
Total (all zones)		11.903	

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 =	4.57	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

Highlighted value is a proposed revision to the orifice 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	1.50	3.00					
Orifice Area (sq. inches)	8.30	8.30	30.00					

	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 =	4.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.50	N/A	feet
Overflow Weir Front Edge Length =	6.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	3.95	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	18.98	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	9.49	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 =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.81	N/A	ft^2
Outlet Pipe Diameter =	42.00	N/A	inches	Outlet Orifice Centroid =	1.01	N/A	feet
Restrictor Plate Height Above Pipe Invert =	21.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.57	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Highlighted value is a proposed revision to the restrictor plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=		ft (r	ay Design Flow Depth=		feet
Spillway Crest Length =		feet	e at Top of Freeboard =		feet
Spillway End Slopes =		H:V	a at Top of Freeboard =		acres
Freeboard above Max Water Surface =		feet	e at Top of Freeboard =		acre-ft

Calculated Parameters for Spillway

Spillway calculations are not provided because we are proposing an emergency overflow structure for Regional Pond B. Please see the additional overflow structure calculations provided after this UD detention sheet. See the **Preliminary Drainage Report Section D.3.B.** for more discussion on the overflow structure calculation methods and why we chose this design.

Routed Hydrograph Results

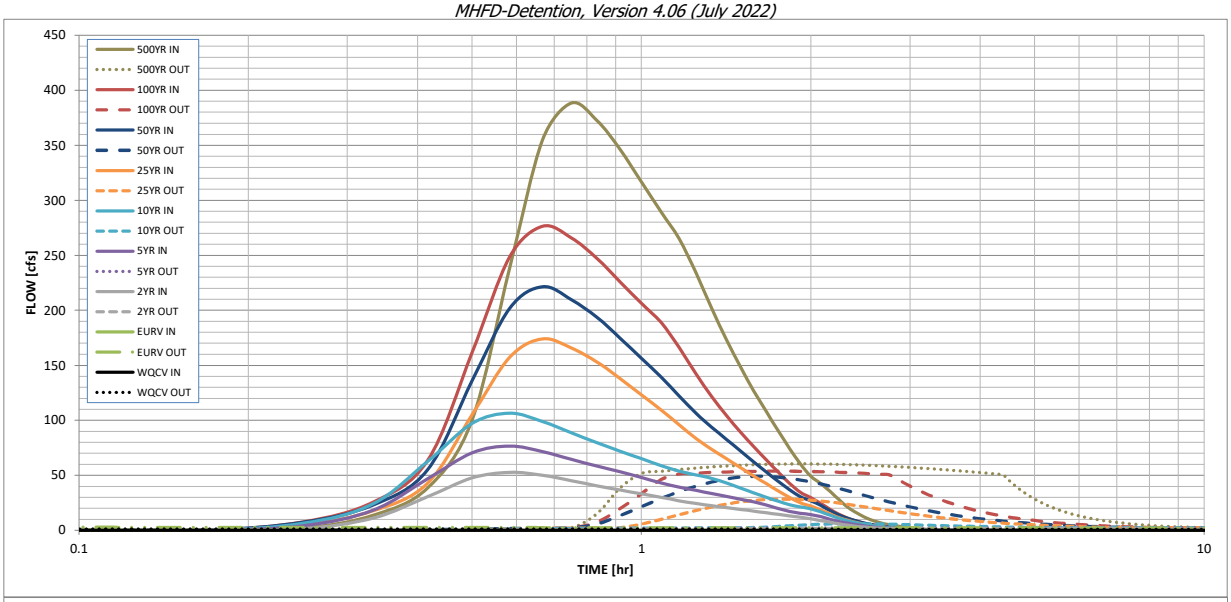
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

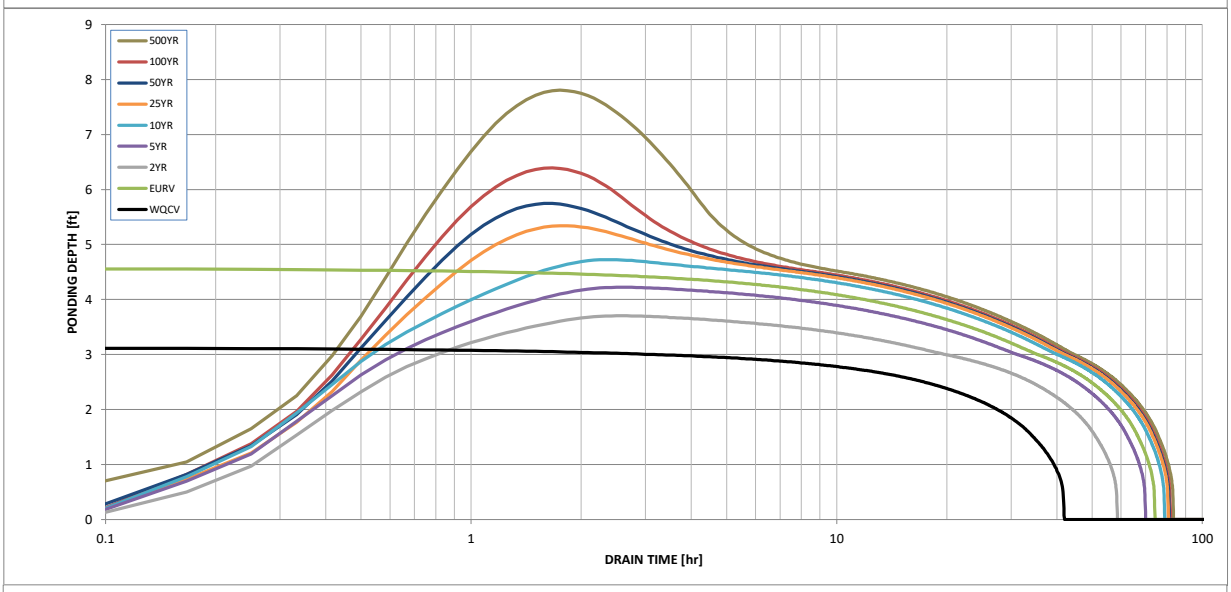
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.85	1.14	1.40	1.79	2.13	2.49
CUHP Runoff Volume (acre-ft) =	2.205	7.122	4.244	6.163	8.422	12.752	16.170	20.261
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.244	6.163	8.422	12.752	16.170	20.261
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.8	3.1	17.7	59.3	85.9	120.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.03	0.15	0.50	0.72	1.01
Peak Inflow Q (cfs) =	N/A	N/A	52.7	76.6	106.5	174.1	221.5	276.4
Peak Outflow Q (cfs) =	1.2	2.8	1.8	2.1	6.0	28.4	49.1	53.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.3	0.5	0.6	0.4
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	0.03	N/A	N/A	0.2	1.3	2.4	2.7
Max Velocity through Grate 2 (fps) =	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	66	53	62	69	68	67	65
Time to Drain 99% of Inflow Volume (hours) =	**41**	71	56	67	75	75	74	74
Maximum Ponding Depth (ft) =	3.12	4.57	3.70	4.22	4.73	5.34	5.75	6.39
Area at Maximum Ponding Depth (acres) =	2.47	4.05	3.32	3.78	4.11	4.35	4.47	4.65
Maximum Volume Stored (acre-ft) =	2.210	7.148	3.925	5.772	7.760	10.381	12.146	15.110

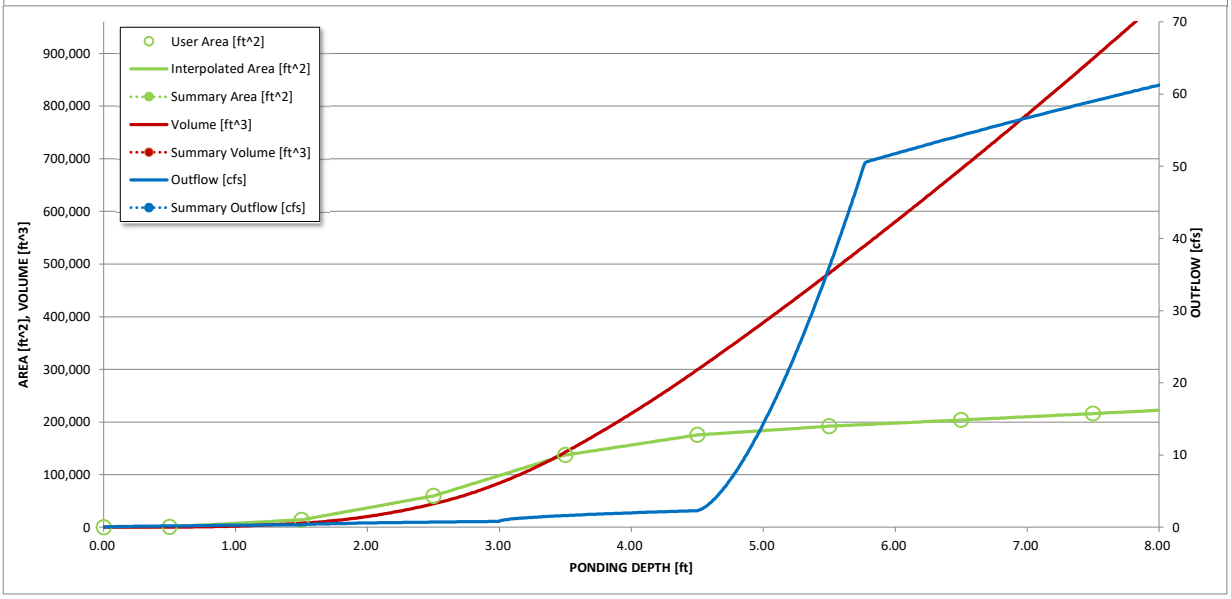
Since we are not providing a spillway for the overflow and the overflow structure is not designed on this sheet, the information presented in the 500 year column is not accurate. Since the 500 year information is not accurate, it will not be shown.

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	0.15	0.00	2.15
	0:15:00	0.00	0.00	1.45	4.21	6.25	5.01	7.35	7.64	13.67
	0:20:00	0.00	0.00	11.18	18.29	24.01	17.63	23.08	25.67	38.54
	0:25:00	0.00	0.00	30.64	46.78	62.67	42.72	54.97	63.30	100.15
	0:30:00	0.00	0.00	47.64	70.52	97.18	104.93	135.88	161.51	238.77
	0:35:00	0.00	0.00	52.68	76.57	106.49	157.27	202.02	248.70	354.52
	0:40:00	0.00	0.00	50.05	71.43	98.86	174.07	221.46	276.45	388.45
	0:45:00	0.00	0.00	45.11	64.43	88.76	165.68	209.77	265.95	372.59
	0:50:00	0.00	0.00	40.39	58.42	79.64	153.14	193.71	247.32	346.17
	0:55:00	0.00	0.00	36.51	53.11	71.95	137.91	174.67	225.84	316.57
	1:00:00	0.00	0.00	33.20	47.95	65.10	123.08	156.33	206.29	289.48
	1:05:00	0.00	0.00	30.02	43.12	58.87	109.46	139.44	188.94	265.22
	1:10:00	0.00	0.00	26.89	39.22	53.73	96.01	122.32	166.26	234.10
	1:15:00	0.00	0.00	24.30	36.26	50.46	83.56	106.39	142.10	201.74
	1:20:00	0.00	0.00	22.29	33.50	47.23	73.66	93.73	121.66	173.38
	1:25:00	0.00	0.00	20.57	30.77	42.94	65.03	82.66	104.36	148.59
	1:30:00	0.00	0.00	19.00	28.22	38.33	56.97	72.19	89.28	126.84
	1:35:00	0.00	0.00	17.46	25.80	34.02	49.39	62.26	76.12	107.88
	1:40:00	0.00	0.00	15.92	22.92	29.99	42.35	53.03	63.95	90.48
	1:45:00	0.00	0.00	14.42	19.85	26.33	35.84	44.57	52.81	74.57
	1:50:00	0.00	0.00	13.14	17.21	23.27	29.92	36.90	42.83	60.41
	1:55:00	0.00	0.00	11.78	15.50	21.19	24.94	30.50	34.59	49.20
	2:00:00	0.00	0.00	10.47	14.31	19.48	22.02	26.88	29.65	42.38
	2:05:00	0.00	0.00	8.86	12.37	16.75	18.55	22.58	24.49	35.09
	2:10:00	0.00	0.00	7.18	9.99	13.54	14.69	17.84	18.97	27.22
	2:15:00	0.00	0.00	5.72	7.90	10.73	11.36	13.76	14.34	20.59
	2:20:00	0.00	0.00	4.57	6.28	8.51	8.90	10.74	10.88	15.61
	2:25:00	0.00	0.00	3.62	4.97	6.69	6.93	8.32	8.18	11.73
	2:30:00	0.00	0.00	2.85	3.90	5.21	5.36	6.41	6.18	8.85
	2:35:00	0.00	0.00	2.23	3.01	3.99	4.12	4.91	4.75	6.76
	2:40:00	0.00	0.00	1.75	2.30	3.04	3.13	3.72	3.63	5.15
	2:45:00	0.00	0.00	1.35	1.75	2.33	2.40	2.84	2.81	3.98
	2:50:00	0.00	0.00	1.03	1.33	1.80	1.86	2.19	2.18	3.09
	2:55:00	0.00	0.00	0.76	0.98	1.34	1.39	1.64	1.63	2.31
	3:00:00	0.00	0.00	0.53	0.69	0.94	1.00	1.17	1.17	1.64
	3:05:00	0.00	0.00	0.34	0.46	0.62	0.67	0.78	0.77	1.09
	3:10:00	0.00	0.00	0.20	0.28	0.36	0.40	0.47	0.46	0.65
	3:15:00	0.00	0.00	0.10	0.15	0.18	0.21	0.23	0.23	0.32
	3:20:00	0.00	0.00	0.04	0.06	0.06	0.07	0.08	0.08	0.10
	3:25:00	0.00	0.00	0.01	0.01	0.01	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 [ft²]	Area [acres]	Volume [ft³]	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).

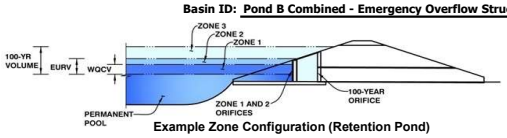
EMERGENCY OVERFLOW STRUCTURE DESIGN SHEET

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Harmony Filing 16

Basin ID: Pond B Combined - Emergency Overflow Structure



Example Zone Configuration (Retention Pond)

Qemer (cfs) = 276.4

Stage 0 = 5610.5

Emergency Overflow Ponding WSEL = 5618

Top of Embankment = 5619

Depth Increment = 1.00 ft

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	119.74	acres
Watershed Length =	4,358	ft
Watershed Length to Centroid =	2,036	ft
Watershed Slope =	0.016	ft/ft
Watershed Imperviousness =	55.20%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Aurora - Municipal Center	

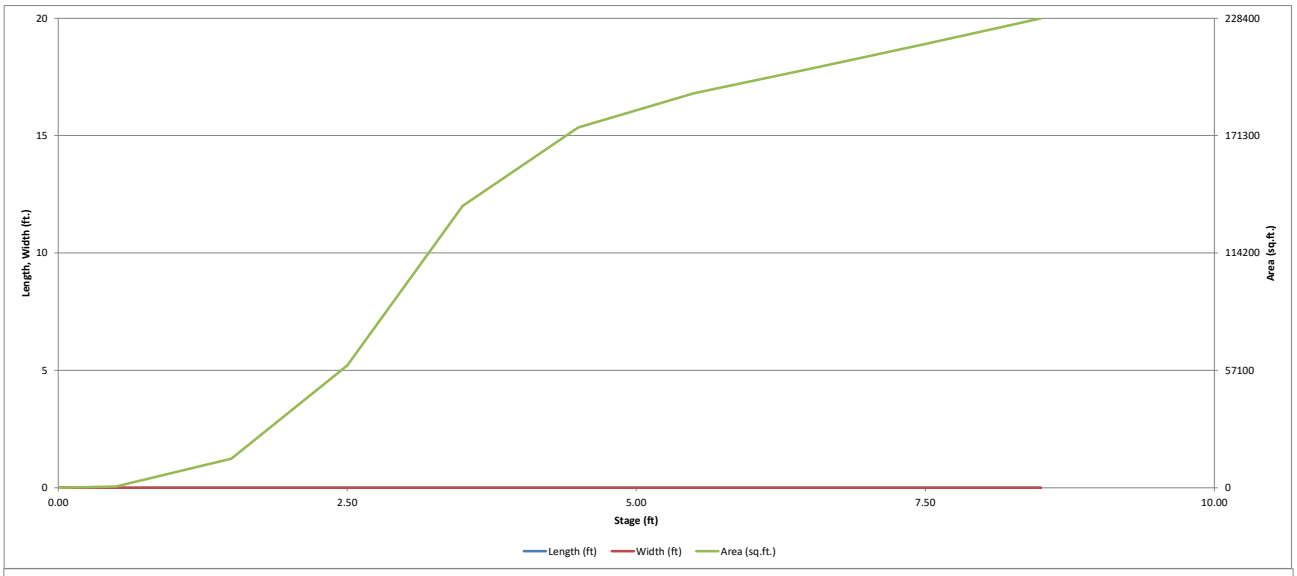
After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

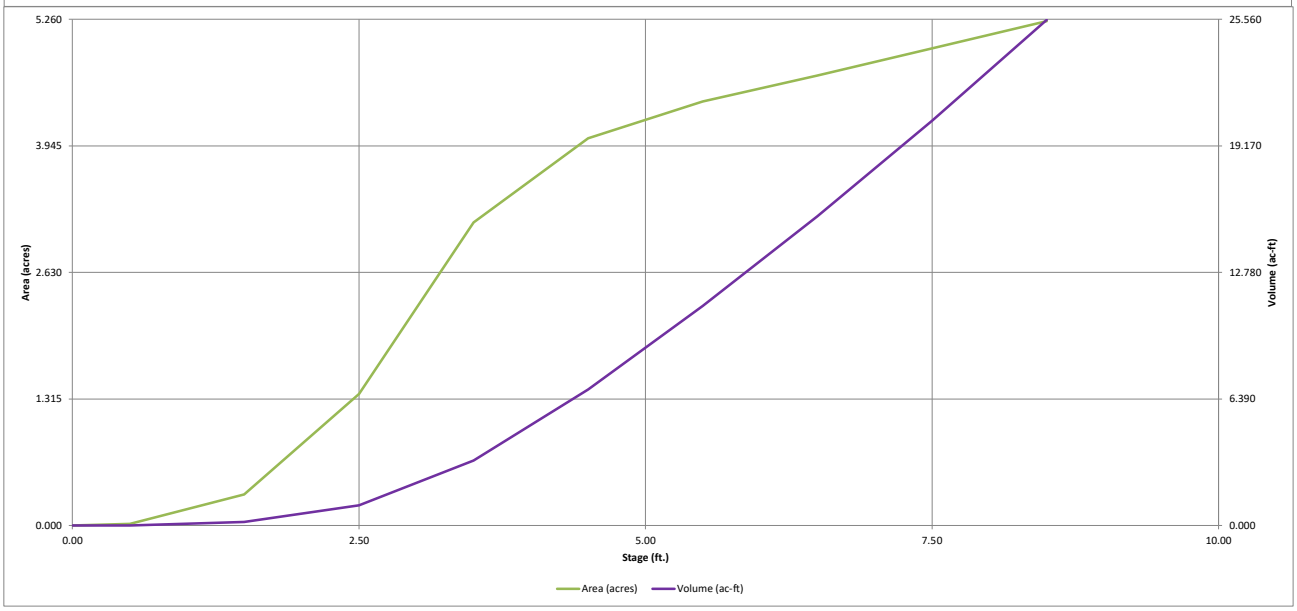
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	2.205	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	7.122	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.85 in.) =	4.244	acre-feet	0.85	inches
5-yr Runoff Volume (P1 = 1.14 in.) =	6.163	acre-feet	1.14	inches
10-yr Runoff Volume (P1 = 1.4 in.) =	8.422	acre-feet	1.40	inches
25-yr Runoff Volume (P1 = 1.79 in.) =	12.752	acre-feet	1.79	inches
50-yr Runoff Volume (P1 = 2.13 in.) =	16.170	acre-feet	2.13	inches
100-yr Runoff Volume (P1 = 2.49 in.) =	20.261	acre-feet	2.49	inches
500-yr Runoff Volume (P1 = 3.3 in.) =	28.788	acre-feet		inches
Approximate 2-yr Detention Volume =	3.878	acre-feet		
Approximate 5-yr Detention Volume =	5.609	acre-feet		
Approximate 10-yr Detention Volume =	7.703	acre-feet		
Approximate 25-yr Detention Volume =	9.365	acre-feet		
Approximate 50-yr Detention Volume =	10.340	acre-feet		
Approximate 100-yr Detention Volume =	11.903	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	2.205	acre-feet
Zone 2 Volume (EURV - Zone 1) =	4.917	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.781	acre-feet
Total Detention Basin Volume =	11.903	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

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	--	--	--	48	0.001		
5611	--	0.50	--	--	--	709	0.016	189	0.004
5612	--	1.50	--	--	--	14,152	0.325	7,620	0.175
5613	--	2.50	--	--	--	59,520	1.366	44,455	1.021
5614	--	3.50	--	--	--	137,149	3.149	142,790	3.278
5615	--	4.50	--	--	--	175,358	4.026	299,043	6.865
5616	--	5.50	--	--	--	191,923	4.406	482,683	11.081
5617	--	6.50	--	--	--	203,767	4.678	680,528	15.623
5618	--	7.50	--	--	--	215,949	4.958	890,386	20.440
5619	--	8.50	--	--	--	228,380	5.243	1,112,551	25.541


20
15
10
5
0
228400
171300
114200
57100
0
Length, Width (ft.)
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)


5.260
3.945
2.630
1.315
0.000
25.560
19.170
12.780
6.390
0.000
Area (acres)
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

FOR THE EMERGENCY SCENARIO, WE WILL ASSUME THE OUTLET STRUCTURE IS COMPLETELY CLOGGED AND NOT FUNCTIONING. THE ORIFICE PLATE THAT CONTROLS THE WQCV & EURV AND THE 100 YEAR WEIR ARE NOT UTILIZED ON THIS SHEET TO SIMULATE A 100% CLOGGED OUTLET STRUCTURE. ZONE 3 WILL BE SET TO THE EMERGENCY OVERFLOW STRUCTURE INVERT WHICH IS JUST ABOVE THE 100 YEAR WSEL. THIS WILL ALLOW US TO DESIGN THE OVERFLOW STRUCTURE FOR AN EMERGENCY EVENT. Q(EMER) = 100 YEAR DEVELOPED INFLOW.

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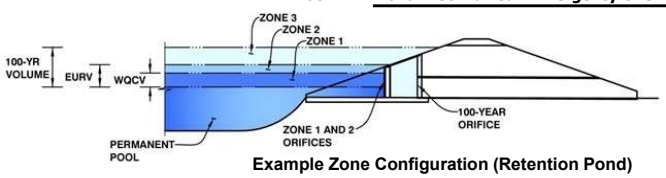
Basin ID: Pond B Combined - Emergency Overflow Structure



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.12	2.205	
Zone 2 (EURV)	4.57	4.917	
ne 3 (100-year)	5.69	4.781	Weir&Pipe (Rect.)
Total (all zones)		11.903	

THIS SECTION WILL BE USED TO DESIGN OVERFLOW STRUCTURE

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	ft²
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 =		ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =		ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =		inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =		sq. inches	Elliptical Slot Area =	N/A	ft²

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	0.00	0.00					
Orifice Area (sq. inches)								

	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	

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft²
Vertical Orifice Centroid =	N/A	N/A	feet

POND B 100 YEAR PONDING DEPTH IS 6.39' (SEE PREVIOUS POND B UD DETENTION SHEET). OVERFLOW INVERT SET TO 6.40' TO ENSURE OVERFLOW IS CAPTURED FOR ANY PONDING ABOVE 100 YEAR WSEL.

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 =	6.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	15.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	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 =	6.50	N/A	feet
Overflow Weir Slope Length =	6.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	2.22	N/A	
Overflow Grate Open Area w/o Debris =	71.19	N/A	ft²
Overflow Grate Open Area w/ Debris =	71.19	N/A	ft²

0% CLOGGING FATCOR APPLIED FOR SPECIAL GRATE THAT IS VERY UNLIKELY TO CLOG.

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

	Zone 3 Rectangula	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Rectangular Orifice Width =	96.00	N/A	inches
Rectangular Orifice Height =	48.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Rectangu	Not Selected	
Outlet Orifice Area =	32.00	N/A	ft²
Outlet Orifice Centroid =	2.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=		ft (rela
Spillway Crest Length =		feet
Spillway End Slopes =		H:V
Freeboard above Max Water Surface =		feet

SPILLWAY IS NOT PROPOSED THEREFORE NO DESIGN IS PROVIDED

Calculated Parameters for Spillway

illway Design Flow Depth=		feet
age at Top of Freeboard =		feet
Area at Top of Freeboard =		acres
Basin Volume at Top of Freeboard =		acre-ft

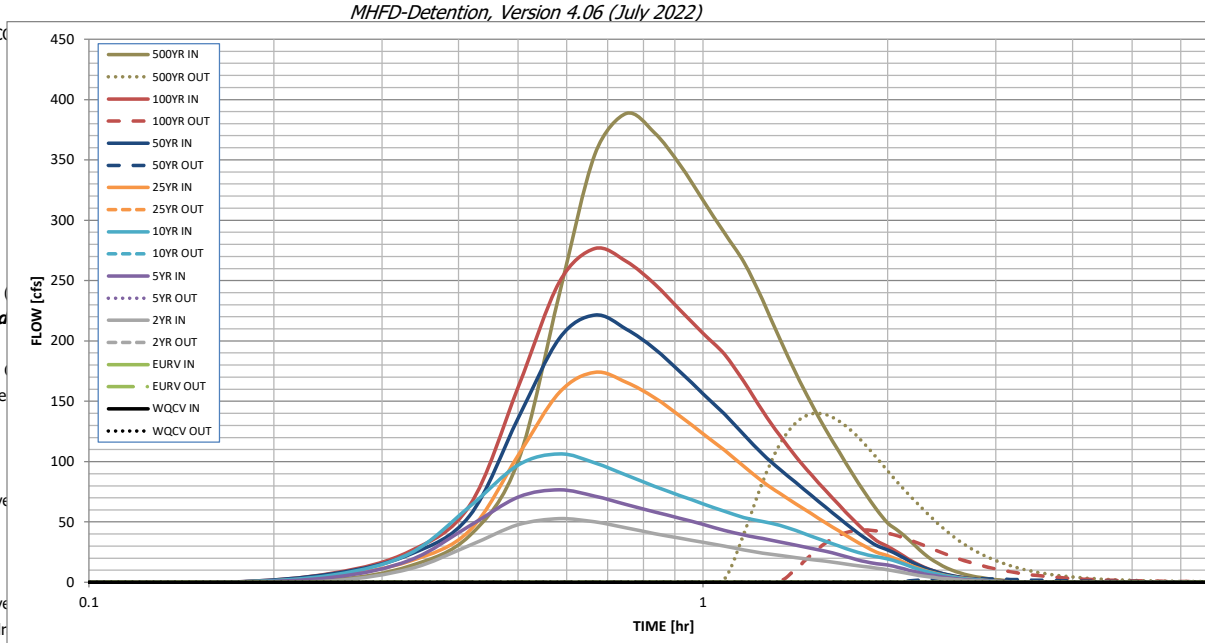
Q(EMER) = 100 YEAR DEVELOPED INFLOW FOR POND B

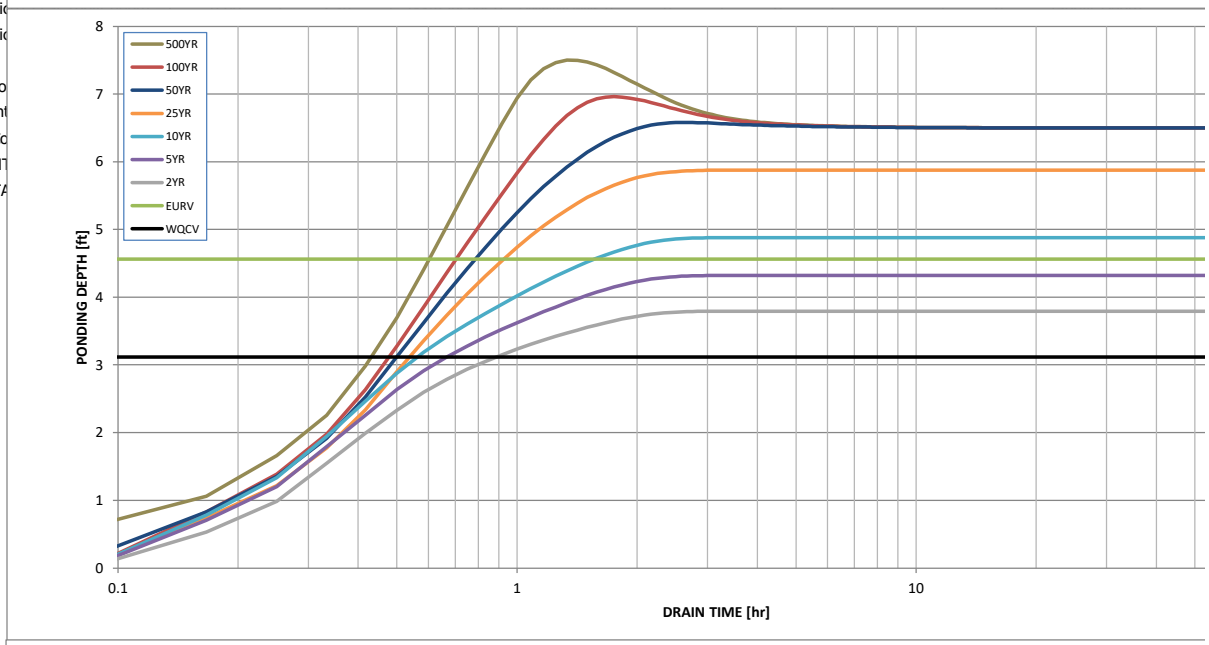
Routed Hydrograph Results

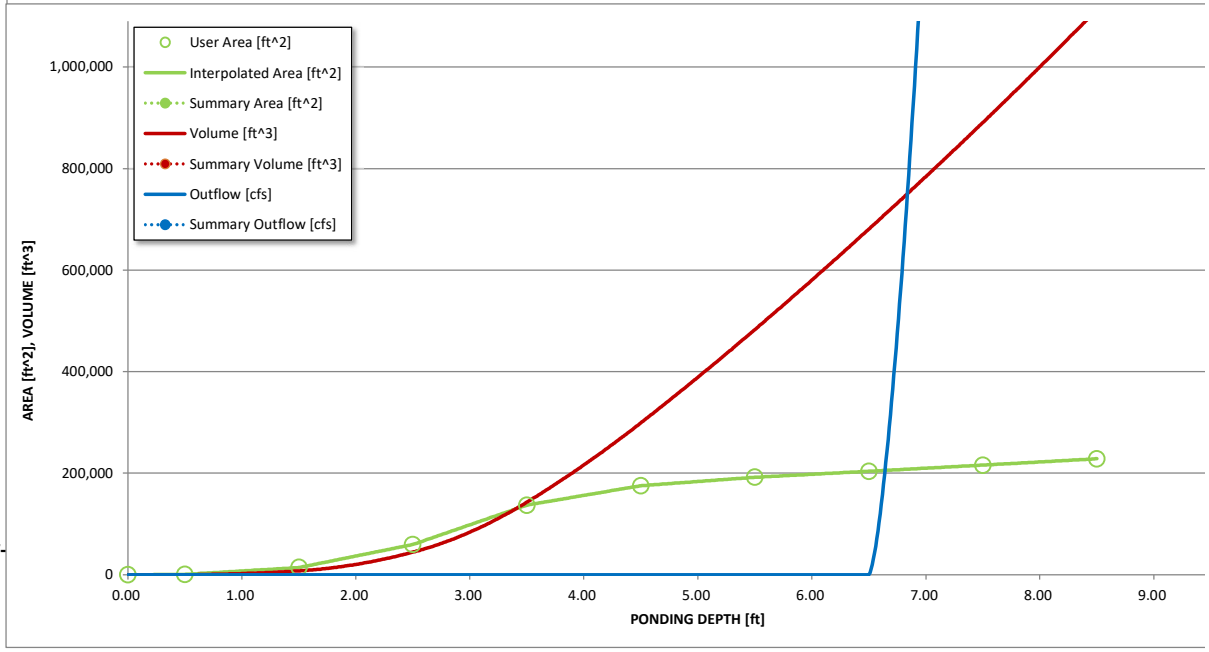
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through

	EMERGENCY OVERFLOW
Design Storm Return Period =	
One-Hour Rainfall Depth (in) =	3.30
CUHP Runoff Volume (acre-ft) =	28.788
Inflow Hydrograph Volume (acre-ft) =	28.788
CUHP Predevelopment Peak Q (cfs) =	185.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	276.4
Predevelopment Unit Peak Flow, q (cfs/acre) =	2.31
Peak Inflow Q (cfs) =	
Peak Outflow Q (cfs) =	139.5
Ratio Peak Outflow to Predevelopment Q =	0.5
Structure Controlling Flow =	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	2.0
Max Velocity through Grate 2 (fps) =	N/A
Time to Drain 97% of Inflow Volume (hours) =	>120
Time to Drain 99% of Inflow Volume (hours) =	>120
Maximum Ponding Depth (ft) =	7.50
Area at Maximum Ponding Depth (acres) =	4.95
Maximum Volume Stored (acre-ft) =	20.391

EMERGENCY PONDING DEPTH







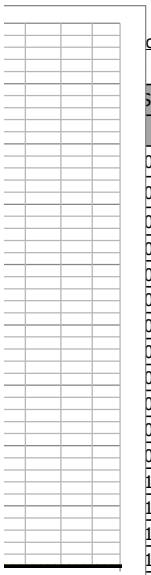
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

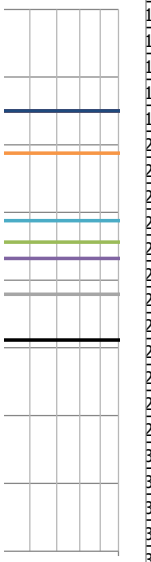
DETENTION BASIN OUTLET STRUCTURE DESIGN

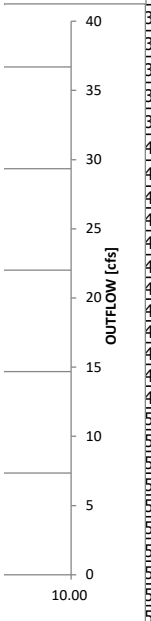
Outflow Hydrograph Workbook Filename:

ow Hydrographs

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	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]
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	0.15	0.00	2.15
0:15:00	0.00	0.00	1.45	4.21	6.25	5.01	7.35	7.64	13.67
0:20:00	0.00	0.00	11.18	18.29	24.01	17.63	23.08	25.67	38.54
0:25:00	0.00	0.00	30.64	46.78	62.67	42.72	54.97	63.30	100.15
0:30:00	0.00	0.00	47.64	70.52	97.18	104.93	135.88	161.51	238.77
0:35:00	0.00	0.00	52.68	76.57	106.49	157.27	202.02	248.70	354.52
0:40:00	0.00	0.00	50.05	71.43	98.86	174.07	221.46	276.45	388.45
0:45:00	0.00	0.00	45.11	64.43	88.76	165.68	209.77	265.95	372.59
0:50:00	0.00	0.00	40.39	58.42	79.64	153.14	193.71	247.32	346.17
0:55:00	0.00	0.00	36.51	53.11	71.95	137.91	174.67	225.84	316.57
1:00:00	0.00	0.00	33.20	47.95	65.10	123.08	156.33	206.29	289.48
1:05:00	0.00	0.00	30.02	43.12	58.87	109.46	139.44	188.94	265.22
1:10:00	0.00	0.00	26.89	39.22	53.73	96.01	122.32	166.26	234.10
1:15:00	0.00	0.00	24.30	36.26	50.46	83.56	106.39	142.10	201.74
1:20:00	0.00	0.00	22.29	33.50	47.23	73.66	93.73	121.66	173.38
1:25:00	0.00	0.00	20.57	30.77	42.94	65.03	82.66	104.36	148.59
1:30:00	0.00	0.00	19.00	28.22	38.33	56.97	72.19	89.28	126.84
1:35:00	0.00	0.00	17.46	25.80	34.02	49.39	62.26	76.12	107.88
1:40:00	0.00	0.00	15.92	22.92	29.99	42.35	53.03	63.95	90.48
1:45:00	0.00	0.00	14.42	19.85	26.33	35.84	44.57	52.81	74.57
1:50:00	0.00	0.00	13.14	17.21	23.27	29.92	36.90	42.83	60.41
1:55:00	0.00	0.00	11.78	15.50	21.19	24.94	30.50	34.59	49.20
2:00:00	0.00	0.00	10.47	14.31	19.48	22.02	26.88	29.65	42.38
2:05:00	0.00	0.00	8.86	12.37	16.75	18.55	22.58	24.49	35.09
2:10:00	0.00	0.00	7.18	9.99	13.54	14.69	17.84	18.97	27.22
2:15:00	0.00	0.00	5.72	7.90	10.73	11.36	13.76	14.34	20.59
2:20:00	0.00	0.00	4.57	6.28	8.51	8.90	10.74	10.88	15.61
2:25:00	0.00	0.00	3.62	4.97	6.69	6.93	8.32	8.18	11.73
2:30:00	0.00	0.00	2.85	3.90	5.21	5.36	6.41	6.18	8.85
2:35:00	0.00	0.00	2.23	3.01	3.99	4.12	4.91	4.75	6.76
2:40:00	0.00	0.00	1.75	2.30	3.04	3.13	3.72	3.63	5.15
2:45:00	0.00	0.00	1.35	1.75	2.33	2.40	2.84	2.81	3.98
2:50:00	0.00	0.00	1.03	1.33	1.80	1.86	2.19	2.18	3.09
2:55:00	0.00	0.00	0.76	0.98	1.34	1.39	1.64	1.63	2.31
3:00:00	0.00	0.00	0.53	0.69	0.94	1.00	1.17	1.17	1.64
3:05:00	0.00	0.00	0.34	0.46	0.62	0.67	0.78	0.77	1.09
3:10:00	0.00	0.00	0.20	0.28	0.36	0.40	0.47	0.46	0.65
3:15:00	0.00	0.00	0.10	0.15	0.18	0.21	0.23	0.23	0.32
3:20:00	0.00	0.00	0.04	0.06	0.06	0.07	0.08	0.08	0.10
3:25:00	0.00	0.00	0.01	0.01	0.01	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).

Appendix C

Hydraulic Calculations

Street Capacity Calculations

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 1-T	Inlet 2-T	Inlet 3-T	Inlet 4-T	Inlet 5-T	Inlet 6-T	Inlet 7-T	Inlet 8-T
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade	On Grade	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	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)	3.7	3.9	1.1	2.9	1.2	1.4	1.0	1.9
Major Q_{known} (cfs)	12.0	15.9	4.5	11.7	3.9	8.2	3.9	7.6

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 9-T	Inlet 10-T	Inlet 11-T	Inlet 12-T	Inlet 13-T	Inlet 14-T	Inlet 15-T	Inlet 16-T
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade	On Grade	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	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)	2.0	1.1	1.5	2.4	3.2	1.5	0.8	0.8
Major Q_{known} (cfs)	8.1	4.5	6.2	9.5	13.9	7.0	4.2	4.5

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 17-T	Inlet 18-T	Inlet 19-T	Inlet 20-T	Inlet 21-T	Inlet 22-T	Inlet 23-T	Inlet 24-T
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade	On Grade	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	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)	1.1	2.1	3.5	1.3	1.3	1.8	2.3	2.0
Major Q_{known} (cfs)	4.4	8.8	17.4	4.7	5.0	7.3	16.5	12.5

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 25-T	Inlet 26-T	Inlet 27-T	Inlet 28-T	Inlet 29-T	Inlet 30-T	Inlet 31-T	Inlet 32-T
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade	On Grade	On Grade	In Sump	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	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	1.0	2.7	1.5	0.2	2.7	2.9	3.2
Major Q_{known} (cfs)	7.1	4.0	15.3	6.1	0.7	10.8	14.1	15.4

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 35-T	Inlet 36-T	Inlet 37-T	Inlet 38-T	Inlet 39-T	Inlet 40-T	Inlet 41-T	Inlet 43-T
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	In Sump	On Grade	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	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)	1.0	1.6	2.2	4.1	1.8	1.4	2.7	0.9
Major Q_{known} (cfs)	7.7	7.5	8.8	19.4	9.1	6.0	9.6	3.1

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 44-T	Inlet 47-T	Inlet 49-T	Inlet 30.1-T
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	In Sump	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

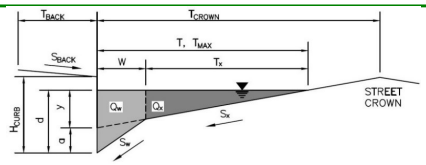
User-Defined Design Flows

Minor Q_{known} (cfs)	2.1	0.9	4.2	2.2
Major Q_{known} (cfs)	8.4	3.0	15.4	9.0

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 1-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.012	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.7	7.7	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.2	4.2	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 =**	**12.7**	**12.7**	**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} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.8	49.2	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.8	41.5	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.2	10.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	18.3	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.7	70.7	cfs
Average Flow Velocity Within the Gutter Section	V =	5.4	8.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.5	6.1	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.8**	**70.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

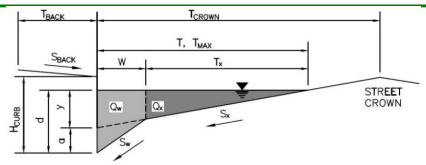
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**12.7**	**70.7**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 2-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

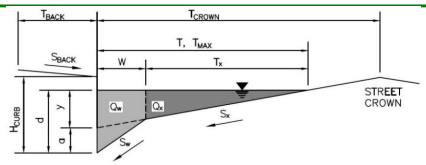
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 3-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	12.2	12.2	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	6.6	6.6	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 =**	**20.0**	**20.0**	**cfs**
Flow Velocity within the Gutter Section	V =	8.6	8.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	4.0	4.0	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	12.3	34.4	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	12.3	32.8	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	6.6	11.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.3	8.6	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	20.2	52.5	cfs
Average Flow Velocity Within the Gutter Section	V =	8.6	10.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	4.0	6.4	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	0.96	0.60	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**19.4**	**31.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.55	6.33	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.73	inches

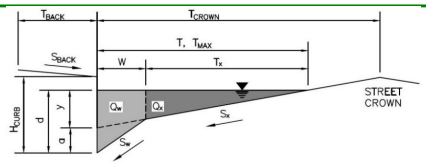
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**19.4**	**31.7**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 4-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	44.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	37.8	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	9.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	16.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	64.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	7.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	5.6	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**64.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

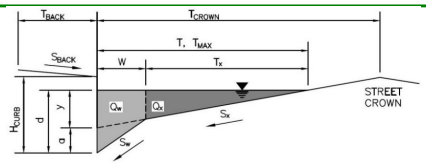
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.6**	**64.5**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 5-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	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 =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	6.8	6.8	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.7	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.2**	**11.2**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	6.9	43.6	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	6.9	36.7	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.7	9.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	16.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.3	62.5	cfs
Average Flow Velocity Within the Gutter Section	V =	4.8	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.2	5.4	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.3**	**62.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

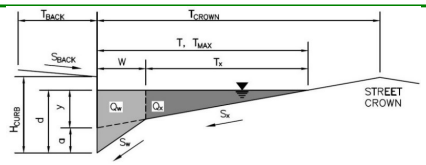
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.2**	**62.5**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 6-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	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 =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	6.8	6.8	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.7	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.2**	**11.2**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	6.9	43.6	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	6.9	36.7	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.7	9.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	16.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.3	62.5	cfs
Average Flow Velocity Within the Gutter Section	V =	4.8	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.2	5.4	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.3**	**62.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

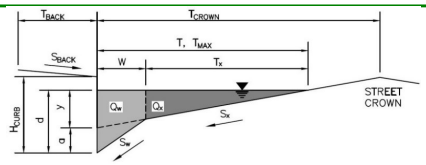
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.2**	**62.5**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 7-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	51.3	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	43.2	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	11.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	18.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	72.7	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	8.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	6.3	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**72.7**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

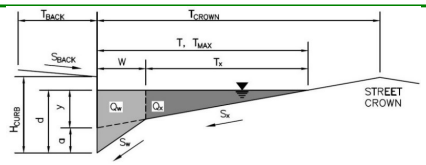
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**72.7**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 8-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	19.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	18.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	6.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	30.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	6.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	3.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**30.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

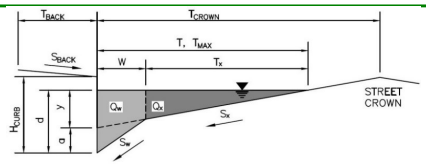
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.6**	**30.3**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 9-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

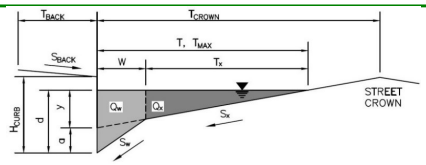
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 10-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

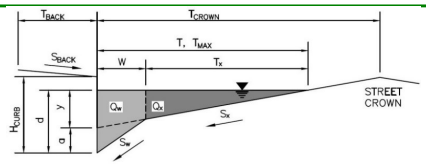
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 11-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

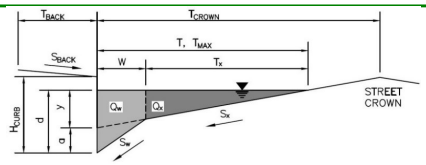
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 12-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	19.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	18.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	6.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	30.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	6.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	3.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**30.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

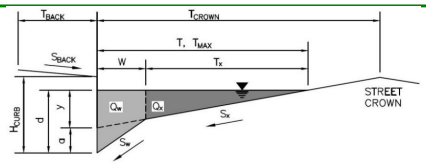
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.6**	**30.3**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 13-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	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 =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	6.7	6.7	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.6	3.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.7	4.7	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} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	6.7	42.6	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	6.7	35.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.6	9.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	15.9	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.0	61.2	cfs
Average Flow Velocity Within the Gutter Section	V =	4.7	6.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.2	5.3	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.0**	**61.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

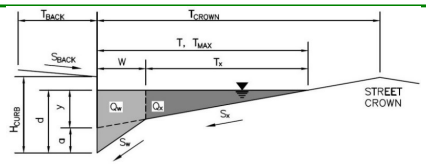
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.0**	**61.2**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 14-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	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 =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	6.8	6.8	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.7	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.2**	**11.2**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.2	2.2	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	6.9	43.6	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	6.9	36.7	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.7	9.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	16.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.3	62.5	cfs
Average Flow Velocity Within the Gutter Section	V =	4.8	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.2	5.4	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.3**	**62.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

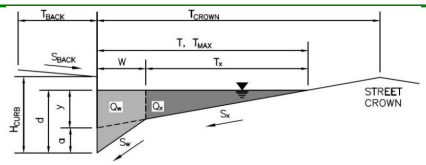
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.2**	**62.5**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 15-T**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

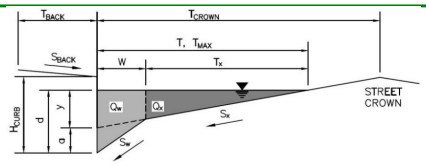
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 16-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	19.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	18.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	6.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	30.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	6.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	3.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**30.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

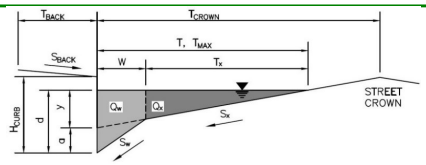
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.6**	**30.3**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 17-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

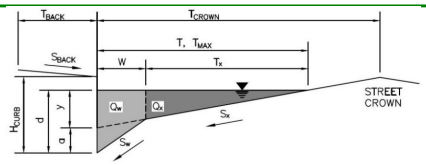
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 18-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

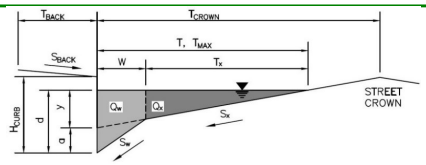
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 19-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	6.9	6.9	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.7	3.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.3**	**11.3**	**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} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	6.9	43.8	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	6.9	36.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.7	9.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	16.3	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.3	62.9	cfs
Average Flow Velocity Within the Gutter Section	V =	4.8	7.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	5.4	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.3**	**62.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

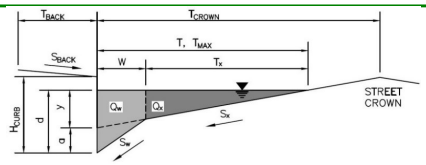
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.3**	**62.9**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 20-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.0	7.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.5**	**11.5**	**cfs**
Flow Velocity within the Gutter Section	V =	4.9	4.9	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} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.0	44.5	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.0	37.5	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	9.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	16.6	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.5	63.9	cfs
Average Flow Velocity Within the Gutter Section	V =	4.9	7.2	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	5.5	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.5**	**63.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

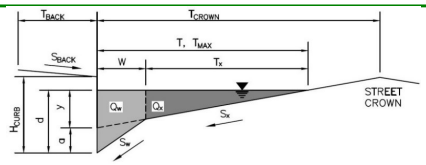
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.5**	**63.9**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 21-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	9.5	9.5	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	5.1	5.1	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 =**	**15.5**	**15.5**	**cfs**
Flow Velocity within the Gutter Section	V =	6.7	6.7	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} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	9.5	26.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	9.5	25.4	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	5.1	8.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.0	6.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	15.6	40.7	cfs
Average Flow Velocity Within the Gutter Section	V =	6.7	8.2	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.1	5.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	0.91	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**15.6**	**36.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.10	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.51	inches

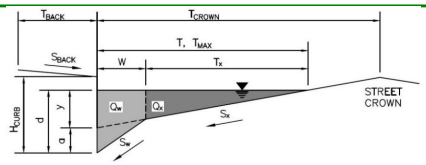
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**15.5**	**36.9**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 22-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

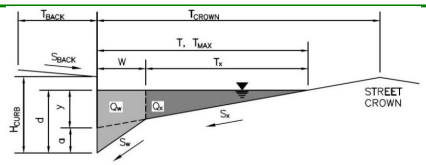
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 23-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	44.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	37.8	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	9.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	16.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	64.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	7.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	5.6	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**64.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

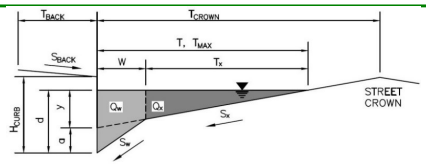
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.6**	**64.5**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 24-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

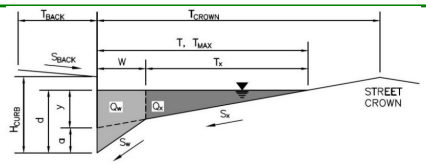
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 25-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.6	8.6	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.7	4.7	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 =**	**14.2**	**14.2**	**cfs**
Flow Velocity within the Gutter Section	V =	6.1	6.1	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} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.7	24.3	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.7	23.2	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.7	7.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.9	6.1	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	14.3	37.1	cfs
Average Flow Velocity Within the Gutter Section	V =	6.1	7.5	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.8	4.5	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**14.3**	**37.1**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

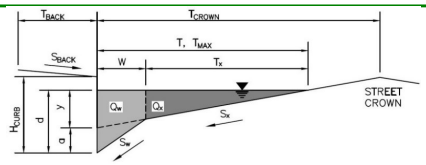
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**14.2**	**37.1**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 26-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.4	7.4	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.0	4.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**12.1**	**12.1**	**cfs**
Flow Velocity within the Gutter Section	V =	5.2	5.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.4	2.4	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.4	20.8	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.4	19.8	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.0	6.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.2	31.8	cfs
Average Flow Velocity Within the Gutter Section	V =	5.2	6.4	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.4	3.9	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.2**	**31.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

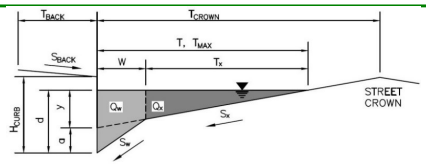
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**12.1**	**31.8**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 27-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	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 =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	6.7	6.7	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.6	3.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.7	4.7	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} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	6.7	42.6	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	6.7	35.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.6	9.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	15.9	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.0	61.2	cfs
Average Flow Velocity Within the Gutter Section	V =	4.7	6.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.2	5.3	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.0**	**61.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

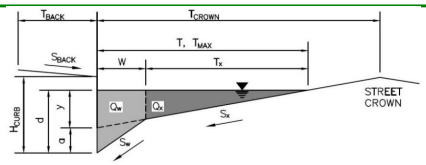
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.0**	**61.2**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 28-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

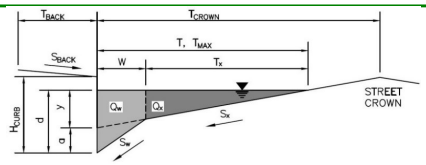
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 29-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	19.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	18.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	6.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	30.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	6.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	3.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**30.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

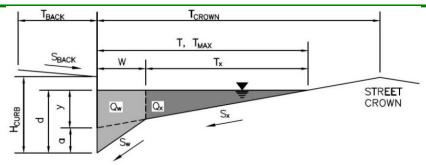
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.6**	**30.3**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 30-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	19.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	18.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	6.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	30.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	6.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	3.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**30.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

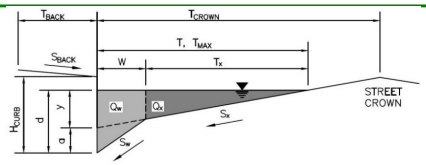
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.6**	**30.3**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 31-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - 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
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

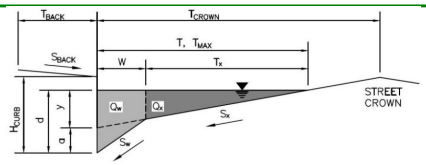
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (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 =	0.0	0.0	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 Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	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 based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 32-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	19.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	18.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	6.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	30.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	6.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	3.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**30.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

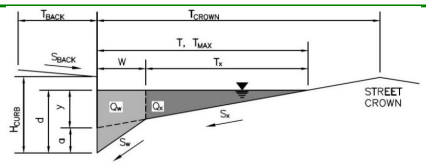
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.6**	**30.3**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 35-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	44.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	37.8	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	9.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	16.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	64.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	7.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	5.6	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**64.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

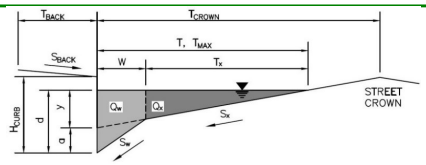
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.6**	**64.5**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 36-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

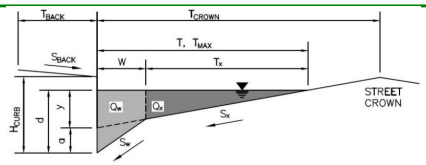
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 37-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.4	7.4	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.0	4.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**12.1**	**12.1**	**cfs**
Flow Velocity within the Gutter Section	V =	5.2	5.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.4	2.4	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.4	20.8	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.4	19.8	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.0	6.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.2	31.8	cfs
Average Flow Velocity Within the Gutter Section	V =	5.2	6.4	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.4	3.9	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.2**	**31.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

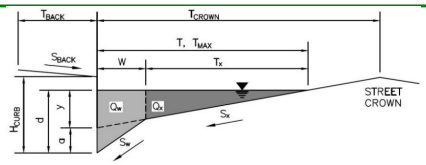
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**12.1**	**31.8**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 38-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - 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
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

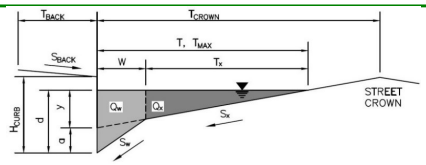
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (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 =	0.0	0.0	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 Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	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 based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 39-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	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 =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	6.7	6.7	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.6	3.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.0**	**11.0**	**cfs**
Flow Velocity within the Gutter Section	V =	4.7	4.7	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} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	6.7	42.6	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	6.7	35.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.6	9.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	15.9	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.0	61.2	cfs
Average Flow Velocity Within the Gutter Section	V =	4.7	6.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.2	5.3	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.0**	**61.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

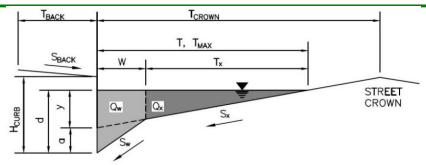
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.0**	**61.2**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 40-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

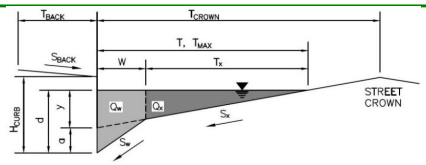
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 41-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

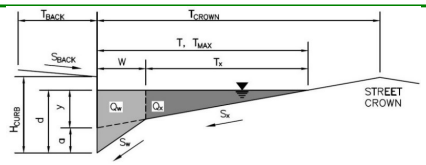
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 43-T**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	44.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	37.8	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	9.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	16.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	64.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	7.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	5.6	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**64.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	3.61	inches

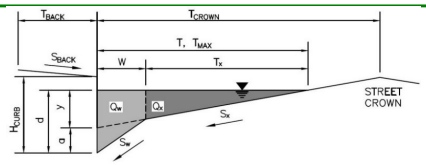
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.6**	**64.5**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 44-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	19.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	18.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	6.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	30.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	6.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	3.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**30.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

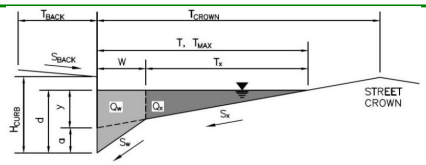
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.6**	**30.3**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 47-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	19.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	18.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	6.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	30.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	6.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	3.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**30.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

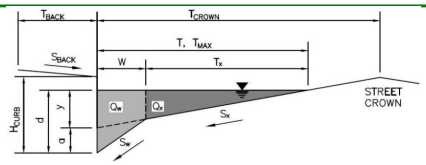
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.6**	**30.3**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 49-T**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - 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
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

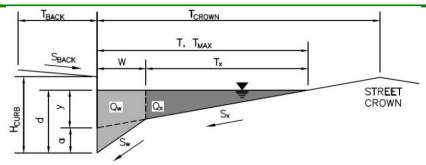
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (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 =	0.0	0.0	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 Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	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 based on Depth Criterion			
MAJOR STORM Allowable Capacity is based on Depth Criterion			
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 30.1-T**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.1	7.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.8	3.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.6**	**11.6**	**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} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.1	19.9	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.1	18.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.8	6.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	5.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	11.6	30.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	6.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.3	3.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**11.6**	**30.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	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} =**	**11.6**	**30.3**	**cfs**

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

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 1U	Inlet 2U	Inlet 3U	Inlet 4U
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	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)	6.4	5.4	1.6	1.2
Major Q_{Known} (cfs)	22.9	16.9	5.9	4.6

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 5U	Inlet 6U	Inlet 7U	Inlet 8U
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	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)	3.3	0.6	1.5	2.3
Major Q_{Known} (cfs)	14.8	2.5	5.8	9.6

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 10U	Inlet 11U	Inlet 12U	Inlet 13U
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	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)	4.0	1.9	4.1	7.9
Major Q_{Known} (cfs)	20.9	7.9	17.1	27.7

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 14U	Inlet 15U	Inlet 16U	Inlet 20U
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	In Sump	On Grade
Inlet Type	CDOT Type R Curb Opening	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)	0.3	1.7	5.2	3.1
Major Q_{Known} (cfs)	1.1	7.2	16.8	9.7

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet 21U	Inlet 17U	Inlet 18U	Inlet 19U
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

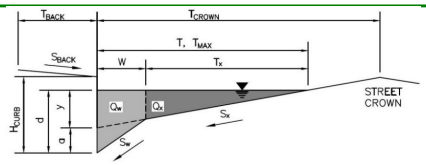
User-Defined Design Flows

Minor Q_{Known} (cfs)	2.4	0.4	0.6	0.9
Major Q_{Known} (cfs)	7.5	1.4	1.9	3.2

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 1U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	25.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.027	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	25.0	25.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.3	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 (Eq. ST-2)	y =	8.10	8.10	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.34	1.34	inches
Water Depth at Gutter Flowline	d =	9.44	9.44	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	23.0	23.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.223	0.223	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - 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
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

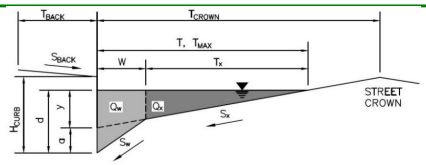
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	14.4	18.4	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	12.4	16.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.386	0.303	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (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 =	0.0	0.0	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 Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	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 based on Depth Criterion			
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 2U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - 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
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

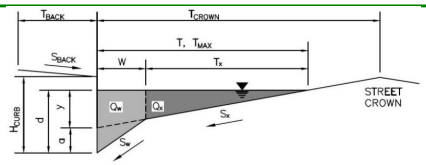
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (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 =	0.0	0.0	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 Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	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 based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 3U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.2**	**13.2**	**cfs**
Flow Velocity within the Gutter Section	V =	5.7	5.7	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.1	22.7	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.1	21.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.7	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.3	34.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	7.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.3**	**34.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

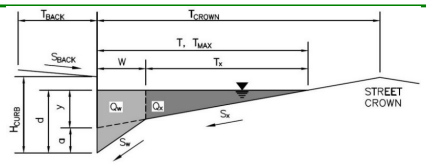
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.2**	**34.6**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 4U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.3	4.3	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 =**	**13.1**	**13.1**	**cfs**
Flow Velocity within the Gutter Section	V =	5.6	5.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.0	22.5	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.0	21.4	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.3	7.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.6	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.2	34.3	cfs
Average Flow Velocity Within the Gutter Section	V =	5.6	6.9	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.2**	**34.3**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

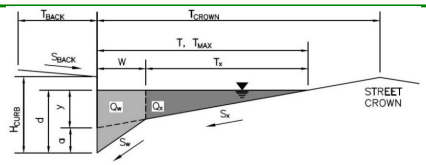
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**13.1**	**13.1**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 5U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - 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
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

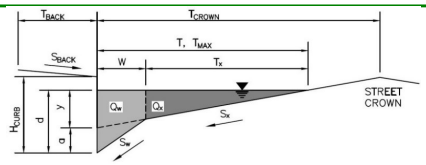
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (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 =	0.0	0.0	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 Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	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 based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 6U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.3	7.3	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	3.9	3.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**11.9**	**11.9**	**cfs**
Flow Velocity within the Gutter Section	V =	5.1	5.1	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.4	2.4	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.3	20.5	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.3	19.5	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	3.9	6.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	5.1	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.0	31.2	cfs
Average Flow Velocity Within the Gutter Section	V =	5.1	6.3	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.4	3.8	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.0**	**31.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

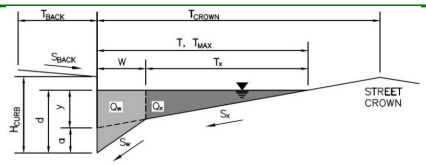
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.9**	**31.2**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 7U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.012	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.7	7.7	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.1	4.1	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 =**	**12.6**	**12.6**	**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} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.7	21.6	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.7	20.5	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.1	7.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.4	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.6	32.9	cfs
Average Flow Velocity Within the Gutter Section	V =	5.4	6.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.5	4.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.6**	**32.9**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

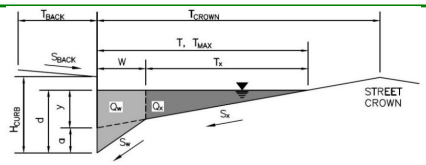
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**12.6**	**32.9**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 8U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.012	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.8	7.8	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.2	4.2	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 =**	**12.8**	**12.8**	**cfs**
Flow Velocity within the Gutter Section	V =	5.5	5.5	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.6	2.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.8	22.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.8	20.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.2	7.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.5	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.9	33.5	cfs
Average Flow Velocity Within the Gutter Section	V =	5.5	6.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.6	4.1	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.9**	**33.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	inches

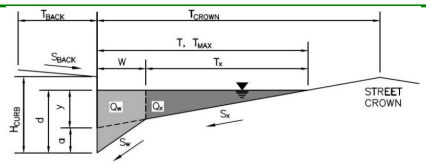
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**12.8**	**33.5**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 10U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - 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
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

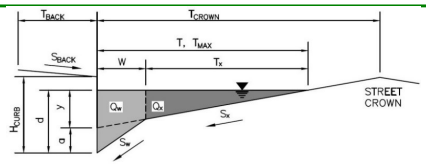
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (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 =	0.0	0.0	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 Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	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 based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 11U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - 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
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

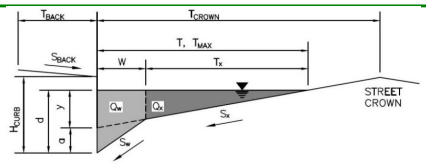
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (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 =	0.0	0.0	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 Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	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 based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 12U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.031	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	9.2	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - 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
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

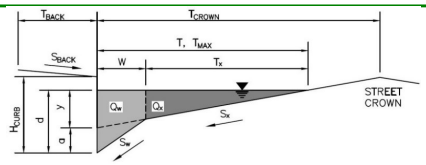
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (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 =	0.0	0.0	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 Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	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 based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 13U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.029	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	8.8	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - 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
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

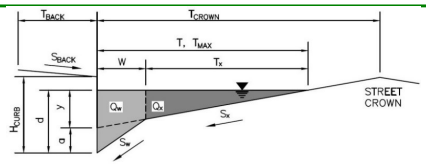
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	30.4	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	28.4	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.191	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (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 =	0.0	0.0	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 Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	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 based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 14U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.021	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.5	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	12.2	12.2	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	6.6	6.6	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 =**	**19.9**	**19.9**	**cfs**
Flow Velocity within the Gutter Section	V =	8.6	8.6	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	4.0	4.0	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	25.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	23.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.235	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	12.2	37.8	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	12.2	35.6	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	6.6	11.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.2	9.6	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	20.0	56.8	cfs
Average Flow Velocity Within the Gutter Section	V =	8.6	10.7	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	4.0	6.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	0.97	0.61	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**19.4**	**34.5**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.56	6.50	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.91	inches

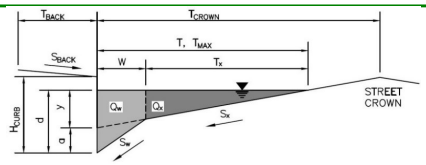
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**19.4**	**34.5**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 15U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.021	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} =	22.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.012	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	22.0	22.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.5	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 (Eq. ST-2)	y =	5.28	5.28	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	6.79	6.79	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	20.0	20.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.269	0.269	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	16.7	16.7	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	6.1	6.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	3.3	3.3	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**26.1**	**26.1**	**cfs**
Flow Velocity within the Gutter Section	V =	6.3	6.3	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	3.6	3.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.7	25.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	16.7	23.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.318	0.235	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	10.3	24.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	10.3	23.9	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.8	7.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	1.4	6.1	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	16.5	37.4	cfs
Average Flow Velocity Within the Gutter Section	V =	5.7	6.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.9	4.3	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**16.5**	**37.4**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	7.50	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.71	inches

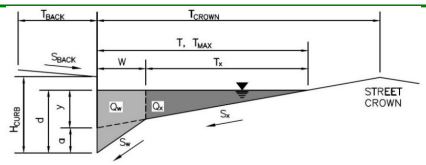
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**16.5**	**37.4**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 16U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	21.0	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} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	40.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	40.0	40.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	10.9	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 (Eq. ST-2)	y =	9.60	9.60	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	11.11	11.11	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	38.0	38.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.143	0.143	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - 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
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

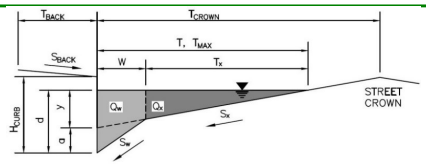
		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.7	39.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	16.7	37.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.318	0.147	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (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 =	0.0	0.0	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 Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	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 based on Depth Criterion			
MAJOR STORM Allowable Capacity is based on Depth Criterion			
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 20U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.019	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} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	25.0	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	25.0	25.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.2	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 (Eq. ST-2)	y =	6.00	6.00	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	7.51	7.51	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	23.0	23.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.235	0.235	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	23.1	23.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	7.1	7.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**30.9**	**30.9**	**cfs**
Flow Velocity within the Gutter Section	V =	6.5	6.5	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	4.1	4.1	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.7	32.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	16.7	30.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.318	0.181	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	9.9	47.1	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	9.9	46.2	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.6	10.4	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	5.1	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	14.4	61.6	cfs
Average Flow Velocity Within the Gutter Section	V =	5.5	7.6	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.8	5.8	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**14.5**	**61.6**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	9.20	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	1.69	inches

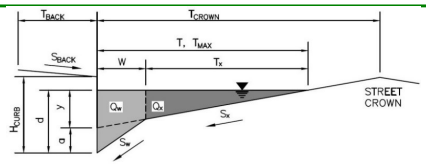
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**14.5**	**30.9**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 21U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	21.0	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} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	40.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	40.0	40.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	10.9	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 (Eq. ST-2)	y =	9.60	9.60	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	11.11	11.11	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	38.0	38.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.143	0.143	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	103.1	103.1	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	17.2	17.2	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	19.6	19.6	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**139.9**	**139.9**	**cfs**
Flow Velocity within the Gutter Section	V =	10.2	10.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	9.5	9.5	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.7	39.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	16.7	37.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.318	0.147	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	11.5	96.8	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	11.5	96.8	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	5.4	16.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	17.5	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	16.9	130.9	cfs
Average Flow Velocity Within the Gutter Section	V =	6.4	10.1	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	3.2	9.2	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**16.9**	**131.0**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	10.90	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.00	inches

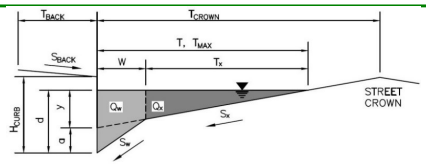
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**16.9**	**131.0**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 17U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	21.0	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} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	40.0	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 =	0.009	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	40.0	40.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	10.9	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 (Eq. ST-2)	y =	9.60	9.60	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	11.11	11.11	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	38.0	38.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.143	0.143	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	79.9	79.9	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	13.3	13.3	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	15.2	15.2	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**108.4**	**108.4**	**cfs**
Flow Velocity within the Gutter Section	V =	7.9	7.9	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	7.3	7.3	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	18.7	39.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	16.7	37.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.318	0.147	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	8.9	75.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	8.9	75.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.2	12.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	13.5	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	13.1	101.4	cfs
Average Flow Velocity Within the Gutter Section	V =	5.0	7.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.5	7.1	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**13.1**	**101.4**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	10.90	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.00	inches

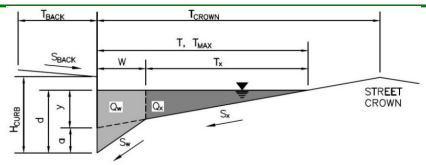
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.1**	**101.4**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 18U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.016	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} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.011	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 =	0.016	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		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	8.2	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 (Eq. ST-2)	y =	2.24	2.24	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	2.0	2.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	1.73	1.73	inches
Water Depth at Gutter Flowline	d =	3.97	3.97	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.417	0.417	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	3.3	3.3	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	2.4	2.4	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 =**	**5.7**	**5.7**	**cfs**
Flow Velocity within the Gutter Section	V =	4.8	4.8	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	1.6	1.6	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.2	49.0	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.2	47.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.412	0.127	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	3.4	69.4	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	3.4	44.5	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	2.4	10.1	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	15.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	5.8	69.6	cfs
Average Flow Velocity Within the Gutter Section	V =	4.8	8.4	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	1.6	5.8	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**5.8**	**69.4**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	4.00	8.19	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.03	4.22	inches

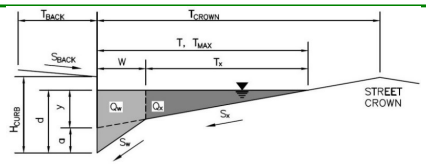
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**5.7**	**69.4**	**cfs**

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

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

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

Project: **HARMONY FILING 16**
Inlet ID: **Inlet 19U**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.6	7.3	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 (Eq. ST-2)	y =	4.08	4.08	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	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	d =	5.59	5.59	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	15.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.350	0.350	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	7.4	7.4	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	4.0	4.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.7	0.7	cfs
Maximum Flow Based On Allowable Spread	**Q_T =**	**12.1**	**12.1**	**cfs**
Flow Velocity within the Gutter Section	V =	5.2	5.2	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	2.4	2.4	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	17.0	24.1	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	15.0	22.1	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.349	0.244	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.4	20.8	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.4	19.8	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	4.0	6.7	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.8	5.2	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	12.2	31.8	cfs
Average Flow Velocity Within the Gutter Section	V =	5.2	6.4	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	2.4	3.9	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	**Q_d =**	**12.2**	**31.8**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.60	7.30	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.01	1.71	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} =**	**12.1**	**31.8**	**cfs**

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

Alley Capacity Calculations

Worksheet for Alley 1aU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Discharge	5.20 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	3.1 in
Roughness Coefficient	0.016
Elevation	5,280.26 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	2.2 ft²
Wetted Perimeter	16.97 ft
Hydraulic Radius	1.5 in
Top Width	16.96 ft
Normal Depth	3.1 in
Critical Depth	3.3 in
Critical Slope	0.007 ft/ft
Velocity	2.37 ft/s
Velocity Head	0.09 ft
Specific Energy	0.35 ft
Froude Number	1.165
Flow Type	Supercritical

Worksheet for Alley 1aU

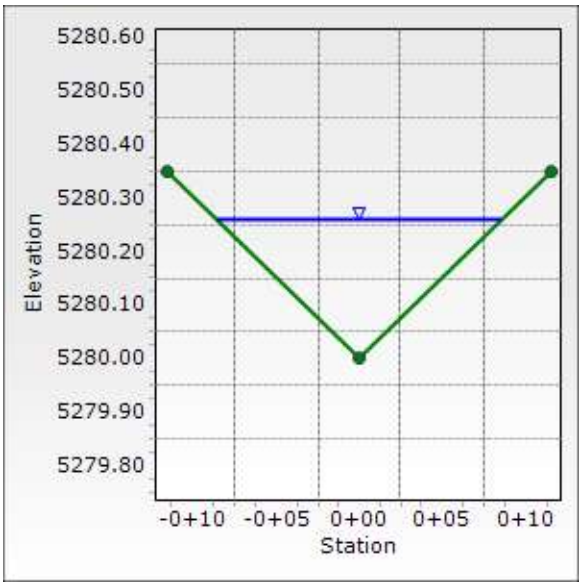
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.1 in
Critical Depth	3.3 in
Channel Slope	0.010 ft/ft
Critical Slope	0.007 ft/ft

Cross Section for Alley 1aU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	3.1 in
Discharge	5.20 cfs



Worksheet for Alley 1bU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.025 ft/ft
Discharge	13.40 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	3.7 in
Roughness Coefficient	0.016
Elevation	5,280.31 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	3.2 ft²
Wetted Perimeter	20.39 ft
Hydraulic Radius	1.9 in
Top Width	20.38 ft
Normal Depth	3.7 in
Critical Depth	4.7 in
Critical Slope	0.006 ft/ft
Velocity	4.24 ft/s
Velocity Head	0.28 ft
Specific Energy	0.59 ft
Froude Number	1.897
Flow Type	Supercritical

Worksheet for Alley 1bU

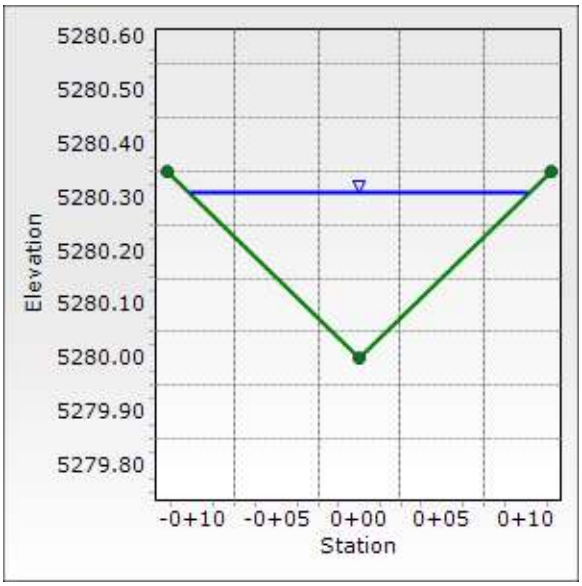
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.7 in
Critical Depth	4.7 in
Channel Slope	0.025 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for Alley 1bU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.025 ft/ft
Normal Depth	3.7 in
Discharge	13.40 cfs



Worksheet for Alley 2aU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.016 ft/ft
Discharge	2.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	2.2 in
Roughness Coefficient	0.016
Elevation	5,280.18 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	1.1 ft²
Wetted Perimeter	11.81 ft
Hydraulic Radius	1.1 in
Top Width	11.80 ft
Normal Depth	2.2 in
Critical Depth	2.5 in
Critical Slope	0.008 ft/ft
Velocity	2.36 ft/s
Velocity Head	0.09 ft
Specific Energy	0.27 ft
Froude Number	1.388
Flow Type	Supercritical

Worksheet for Alley 2aU

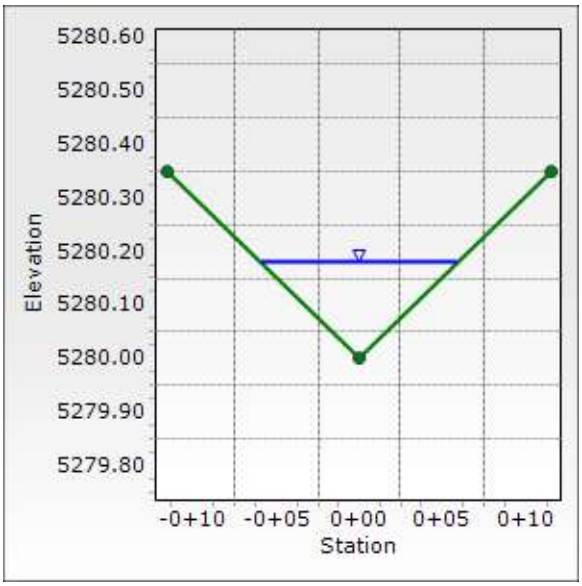
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.2 in
Critical Depth	2.5 in
Channel Slope	0.016 ft/ft
Critical Slope	0.008 ft/ft

Cross Section for Alley 2aU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.016 ft/ft
Normal Depth	2.2 in
Discharge	2.50 cfs



Worksheet for Alley 2bU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.014 ft/ft
Discharge	3.90 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	2.6 in
Roughness Coefficient	0.016
Elevation	5,280.22 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	1.6 ft²
Wetted Perimeter	14.31 ft
Hydraulic Radius	1.3 in
Top Width	14.31 ft
Normal Depth	2.6 in
Critical Depth	2.9 in
Critical Slope	0.008 ft/ft
Velocity	2.50 ft/s
Velocity Head	0.10 ft
Specific Energy	0.32 ft
Froude Number	1.338
Flow Type	Supercritical

Worksheet for Alley 2bU

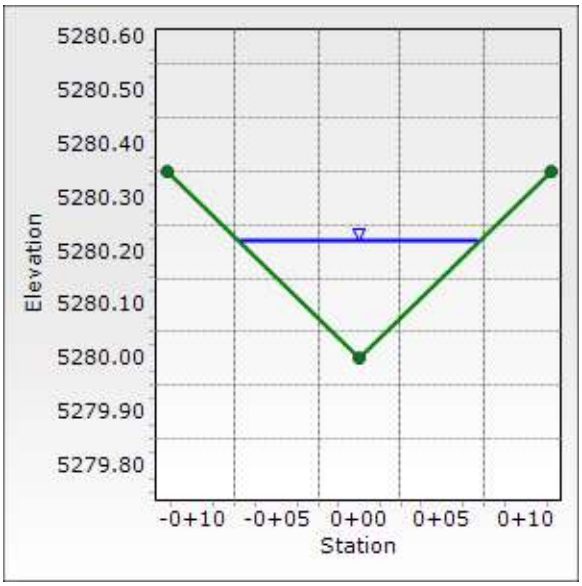
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.6 in
Critical Depth	2.9 in
Channel Slope	0.014 ft/ft
Critical Slope	0.008 ft/ft

Cross Section for Alley 2bU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.014 ft/ft
Normal Depth	2.6 in
Discharge	3.90 cfs



Worksheet for Alley 2cU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.013 ft/ft
Discharge	6.40 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	3.2 in
Roughness Coefficient	0.016
Elevation	5,280.27 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	2.4 ft²
Wetted Perimeter	17.60 ft
Hydraulic Radius	1.6 in
Top Width	17.59 ft
Normal Depth	3.2 in
Critical Depth	3.6 in
Critical Slope	0.007 ft/ft
Velocity	2.72 ft/s
Velocity Head	0.11 ft
Specific Energy	0.38 ft
Froude Number	1.310
Flow Type	Supercritical

Worksheet for Alley 2cU

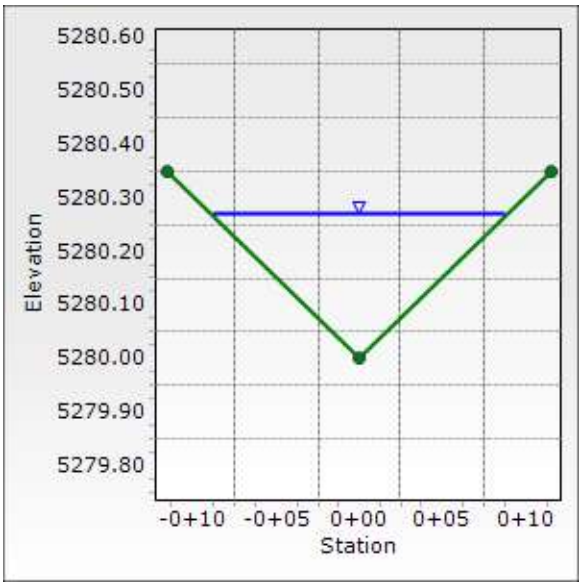
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.2 in
Critical Depth	3.6 in
Channel Slope	0.013 ft/ft
Critical Slope	0.007 ft/ft

Cross Section for Alley 2cU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.013 ft/ft
Normal Depth	3.2 in
Discharge	6.40 cfs



Worksheet for Alley 13aU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Discharge	9.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	3.8 in
Roughness Coefficient	0.016
Elevation	5,280.32 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	3.3 ft²
Wetted Perimeter	20.78 ft
Hydraulic Radius	1.9 in
Top Width	20.77 ft
Normal Depth	3.8 in
Critical Depth	4.1 in
Critical Slope	0.007 ft/ft
Velocity	2.74 ft/s
Velocity Head	0.12 ft
Specific Energy	0.43 ft
Froude Number	1.216
Flow Type	Supercritical

Worksheet for Alley 13aU

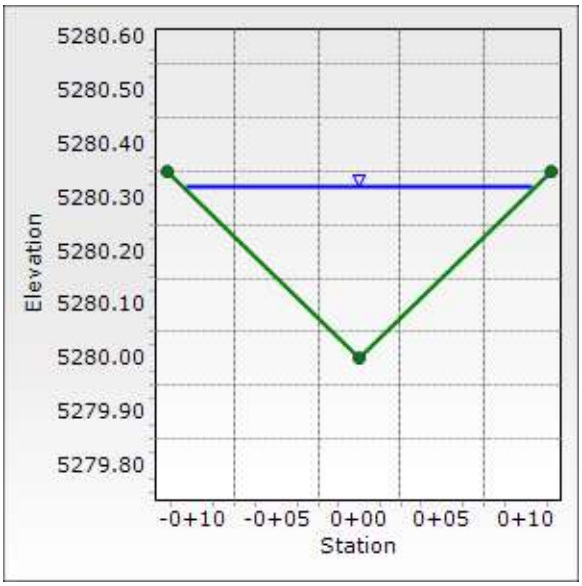
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.8 in
Critical Depth	4.1 in
Channel Slope	0.010 ft/ft
Critical Slope	0.007 ft/ft

Cross Section for Alley 13aU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	3.8 in
Discharge	9.00 cfs



Worksheet for Alley 13bU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.030 ft/ft
Discharge	3.20 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	2.1 in
Roughness Coefficient	0.016
Elevation	5,280.18 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	1.0 ft²
Wetted Perimeter	11.51 ft
Hydraulic Radius	1.0 in
Top Width	11.50 ft
Normal Depth	2.1 in
Critical Depth	2.7 in
Critical Slope	0.008 ft/ft
Velocity	3.18 ft/s
Velocity Head	0.16 ft
Specific Energy	0.33 ft
Froude Number	1.894
Flow Type	Supercritical

Worksheet for Alley 13bU

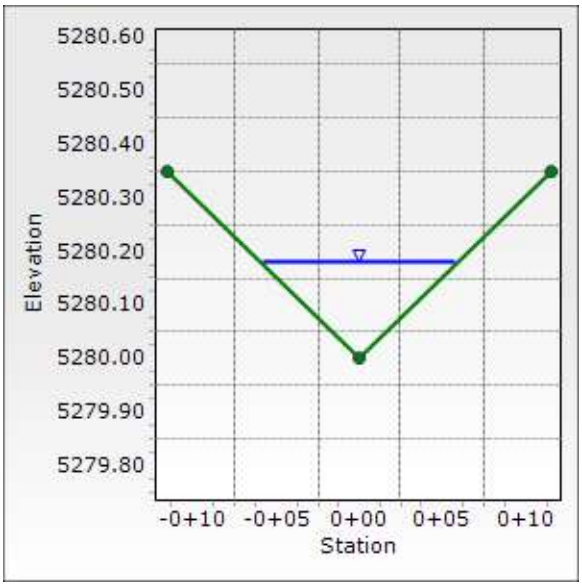
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.1 in
Critical Depth	2.7 in
Channel Slope	0.030 ft/ft
Critical Slope	0.008 ft/ft

Cross Section for Alley 13bU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.030 ft/ft
Normal Depth	2.1 in
Discharge	3.20 cfs



Worksheet for Alley 13cU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Discharge	6.30 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	3.3 in
Roughness Coefficient	0.016
Elevation	5,280.28 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	2.5 ft²
Wetted Perimeter	18.25 ft
Hydraulic Radius	1.7 in
Top Width	18.24 ft
Normal Depth	3.3 in
Critical Depth	3.6 in
Critical Slope	0.007 ft/ft
Velocity	2.49 ft/s
Velocity Head	0.10 ft
Specific Energy	0.37 ft
Froude Number	1.177
Flow Type	Supercritical

Worksheet for Alley 13cU

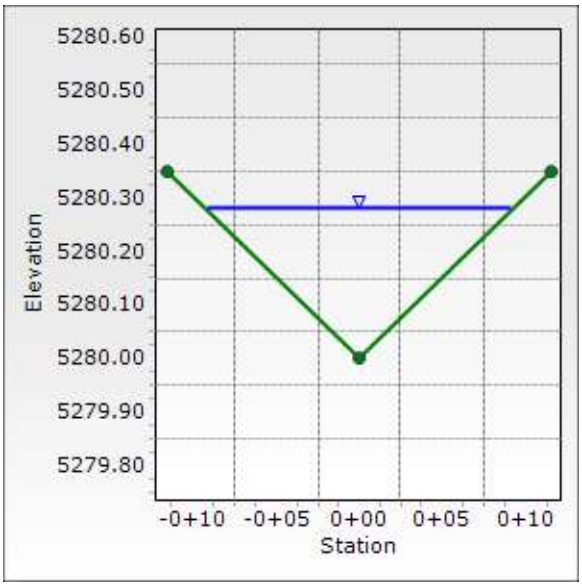
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.3 in
Critical Depth	3.6 in
Channel Slope	0.010 ft/ft
Critical Slope	0.007 ft/ft

Cross Section for Alley 13cU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	3.3 in
Discharge	6.30 cfs



Worksheet for Alley 19aU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.015 ft/ft
Discharge	2.60 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	2.2 in
Roughness Coefficient	0.016
Elevation	5,280.18 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	1.1 ft²
Wetted Perimeter	12.13 ft
Hydraulic Radius	1.1 in
Top Width	12.12 ft
Normal Depth	2.2 in
Critical Depth	2.5 in
Critical Slope	0.008 ft/ft
Velocity	2.32 ft/s
Velocity Head	0.08 ft
Specific Energy	0.27 ft
Froude Number	1.349
Flow Type	Supercritical

Worksheet for Alley 19aU

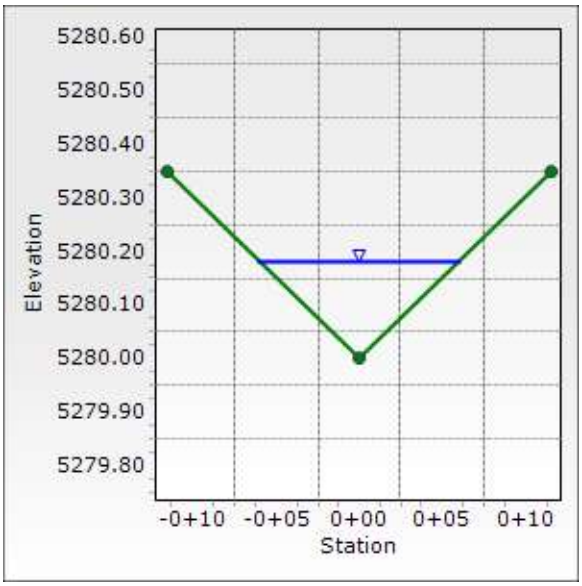
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.2 in
Critical Depth	2.5 in
Channel Slope	0.015 ft/ft
Critical Slope	0.008 ft/ft

Cross Section for Alley 19aU

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.015 ft/ft
Normal Depth	2.2 in
Discharge	2.60 cfs



Worksheet for Alley 33-T

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.017 ft/ft
Discharge	3.80 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	2.5 in
Roughness Coefficient	0.016
Elevation	5,280.21 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	1.4 ft²
Wetted Perimeter	13.68 ft
Hydraulic Radius	1.2 in
Top Width	13.67 ft
Normal Depth	2.5 in
Critical Depth	2.9 in
Critical Slope	0.008 ft/ft
Velocity	2.67 ft/s
Velocity Head	0.11 ft
Specific Energy	0.32 ft
Froude Number	1.460
Flow Type	Supercritical

Worksheet for Alley 33-T

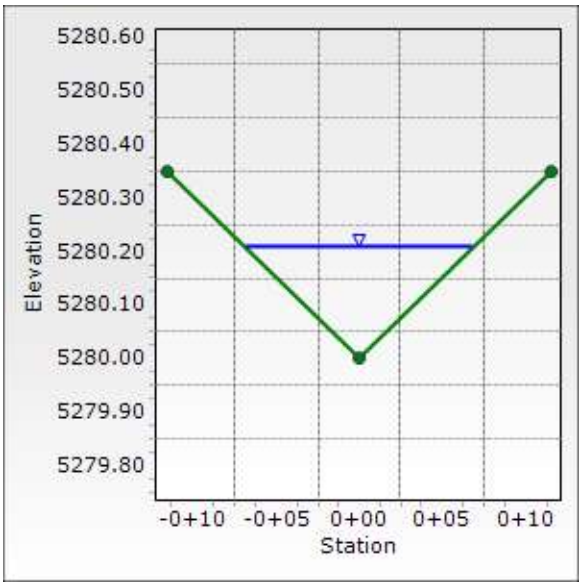
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.5 in
Critical Depth	2.9 in
Channel Slope	0.017 ft/ft
Critical Slope	0.008 ft/ft

Cross Section for Alley 33-T

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.017 ft/ft
Normal Depth	2.5 in
Discharge	3.80 cfs



Worksheet for Alley 34-T

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.011 ft/ft
Discharge	1.90 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	2.1 in
Roughness Coefficient	0.016
Elevation	5,280.17 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	1.0 ft²
Wetted Perimeter	11.42 ft
Hydraulic Radius	1.0 in
Top Width	11.42 ft
Normal Depth	2.1 in
Critical Depth	2.2 in
Critical Slope	0.008 ft/ft
Velocity	1.92 ft/s
Velocity Head	0.06 ft
Specific Energy	0.23 ft
Froude Number	1.146
Flow Type	Supercritical

Worksheet for Alley 34-T

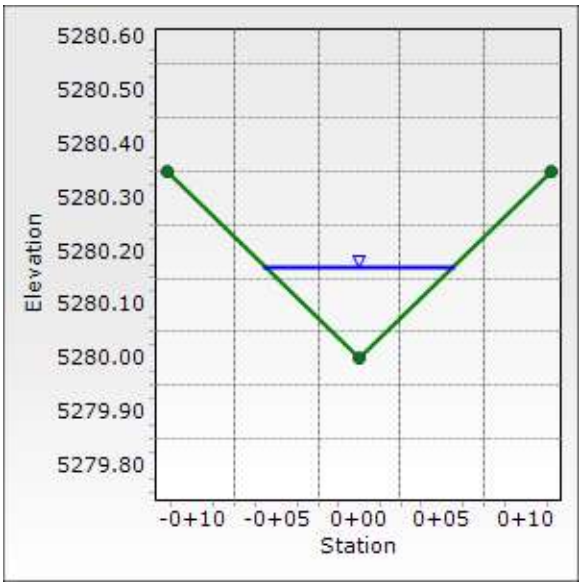
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.1 in
Critical Depth	2.2 in
Channel Slope	0.011 ft/ft
Critical Slope	0.008 ft/ft

Cross Section for Alley 34-T

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.011 ft/ft
Normal Depth	2.1 in
Discharge	1.90 cfs



Worksheet for Alley 42-T

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.012 ft/ft
Discharge	6.30 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	3.2 in
Roughness Coefficient	0.016
Elevation	5,280.27 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	2.4 ft²
Wetted Perimeter	17.66 ft
Hydraulic Radius	1.6 in
Top Width	17.65 ft
Normal Depth	3.2 in
Critical Depth	3.6 in
Critical Slope	0.007 ft/ft
Velocity	2.66 ft/s
Velocity Head	0.11 ft
Specific Energy	0.38 ft
Froude Number	1.279
Flow Type	Supercritical

Worksheet for Alley 42-T

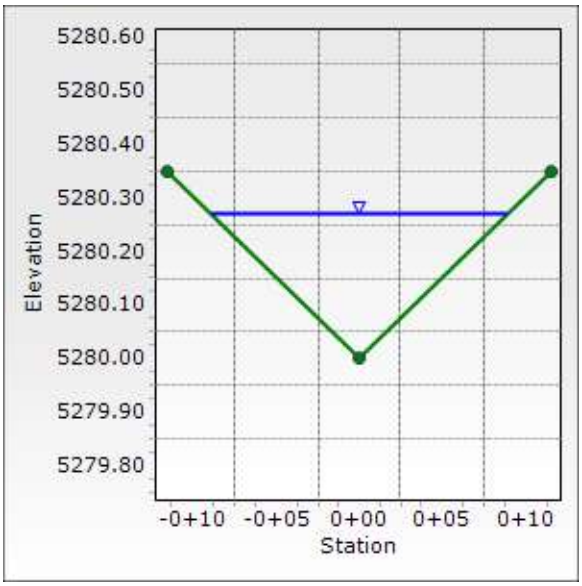
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.2 in
Critical Depth	3.6 in
Channel Slope	0.012 ft/ft
Critical Slope	0.007 ft/ft

Cross Section for Alley 42-T

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.012 ft/ft
Normal Depth	3.2 in
Discharge	6.30 cfs



Worksheet for Alley 45-T

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.011 ft/ft
Discharge	5.20 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	3.0 in
Roughness Coefficient	0.016
Elevation	5,280.25 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	2.1 ft²
Wetted Perimeter	16.56 ft
Hydraulic Radius	1.5 in
Top Width	16.55 ft
Normal Depth	3.0 in
Critical Depth	3.3 in
Critical Slope	0.007 ft/ft
Velocity	2.50 ft/s
Velocity Head	0.10 ft
Specific Energy	0.35 ft
Froude Number	1.240
Flow Type	Supercritical

Worksheet for Alley 45-T

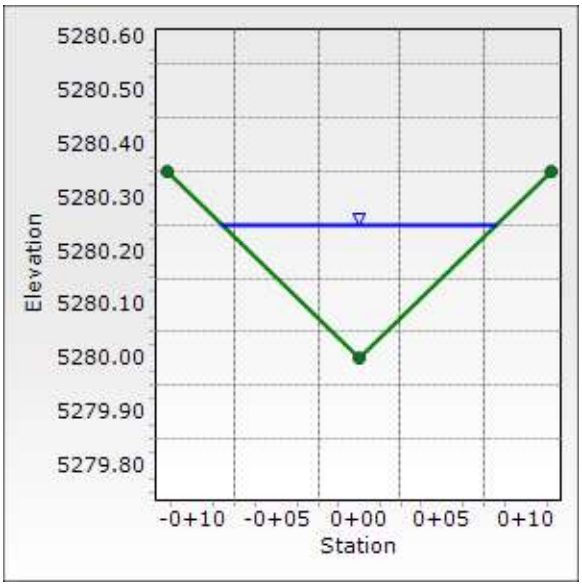
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.0 in
Critical Depth	3.3 in
Channel Slope	0.011 ft/ft
Critical Slope	0.007 ft/ft

Cross Section for Alley 45-T

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.011 ft/ft
Normal Depth	3.0 in
Discharge	5.20 cfs



Worksheet for Alley 46-T

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Discharge	2.40 cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+00.00, 5,280.00)	0.016
(0+00.00, 5,280.00)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	2.3 in
Roughness Coefficient	0.016
Elevation	5,280.19 ft
Elevation Range	5,280.00 to 5,280.35 ft
Flow Area	1.2 ft²
Wetted Perimeter	12.70 ft
Hydraulic Radius	1.2 in
Top Width	12.70 ft
Normal Depth	2.3 in
Critical Depth	2.4 in
Critical Slope	0.008 ft/ft
Velocity	1.96 ft/s
Velocity Head	0.06 ft
Specific Energy	0.25 ft
Froude Number	1.110
Flow Type	Supercritical

Worksheet for Alley 46-T

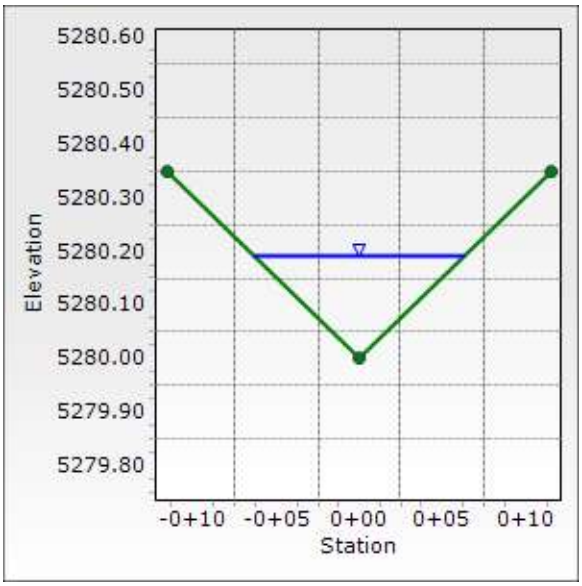
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	2.3 in
Critical Depth	2.4 in
Channel Slope	0.010 ft/ft
Critical Slope	0.008 ft/ft

Cross Section for Alley 46-T

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	2.3 in
Discharge	2.40 cfs



Worksheet for Alley 48-T

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.011	ft/ft
Discharge	8.40	cfs

Section Definitions

Station (ft)	Elevation (ft)
-0+11.50	5,280.35
0+00.00	5,280.00
0+11.50	5,280.35

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+11.50, 5,280.35)	(0+11.50, 5,280.35)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results		
Normal Depth	3.7	in
Roughness Coefficient	0.016	
Elevation	5,280.30	ft
Elevation Range	5,280.00 to 5,280.35	ft
Flow Area	3.0	ft²
Wetted Perimeter	20.00	ft
Hydraulic Radius	1.8	in
Top Width	19.99	ft
Normal Depth	3.7	in
Critical Depth	4.0	in
Critical Slope	0.007	ft/ft
Velocity	2.76	ft/s
Velocity Head	0.12	ft
Specific Energy	0.42	ft
Froude Number	1.249	
Flow Type	Supercritical	

GVF Input Data

Worksheet for Alley 48-T

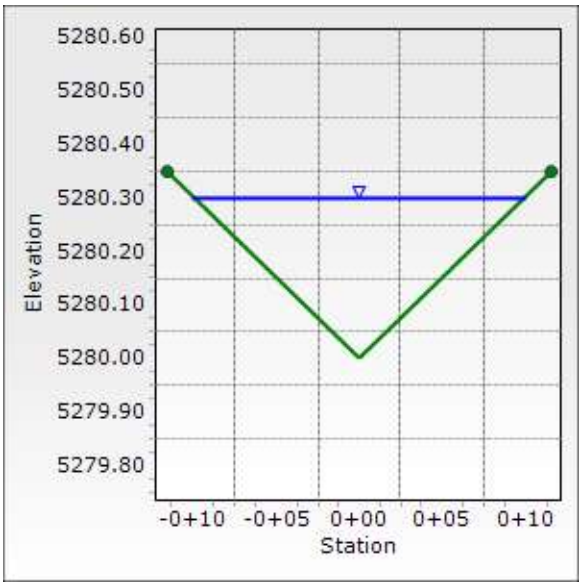
GVF Input Data	
Downstream Depth	0.0 in
Length	0.00 ft
Number Of Steps	0.00

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	3.7 in
Critical Depth	4.0 in
Channel Slope	0.011 ft/ft
Critical Slope	0.007 ft/ft

Cross Section for Alley 48-T

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.011 ft/ft
Normal Depth	3.7 in
Discharge	8.40 cfs



Emergency Overflow Calculations

Worksheet for EMERGENCY OVERFLOW SECT A-A

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	39.80 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.00 ft
Crest Surface Type	Paved
Crest Breadth	0.28 ft
Crest Length	150.0 ft

Results	
Headwater Elevation	0.19 ft
Headwater Height Above Crest	0.19 ft
Tailwater Height Above Crest	0.00 ft
Weir Coefficient	3.09 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.09 ft^(1/2)/s
Flow Area	29.2 ft²
Velocity	1.36 ft/s
Wetted Perimeter	150.4 ft
Top Width	150.00 ft

Worksheet for EMERGENCY OVERFLOW SECT B-B

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	16.90 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.00 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	150.0 ft

Results	
Headwater Elevation	0.11 ft
Headwater Height Above Crest	0.11 ft
Tailwater Height Above Crest	0.00 ft
Weir Coefficient	3.07 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.07 ft^(1/2)/s
Flow Area	16.6 ft²
Velocity	1.02 ft/s
Wetted Perimeter	150.2 ft
Top Width	150.00 ft

Worksheet for EMERGENCY OVERFLOW SECT C-C

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	33.50 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.00 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	150.0 ft

Results	
Headwater Elevation	0.17 ft
Headwater Height Above Crest	0.17 ft
Tailwater Height Above Crest	0.00 ft
Weir Coefficient	3.09 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.09 ft^(1/2)/s
Flow Area	26.0 ft²
Velocity	1.29 ft/s
Wetted Perimeter	150.3 ft
Top Width	150.00 ft

Worksheet for EMERGENCY OVERFLOW SECT D-D

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	48.90 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.00 ft
Crest Surface Type	Paved
Crest Breadth	0.28 ft
Crest Length	150.0 ft

Results	
Headwater Elevation	0.22 ft
Headwater Height Above Crest	0.22 ft
Tailwater Height Above Crest	0.00 ft
Weir Coefficient	3.09 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.09 ft^(1/2)/s
Flow Area	33.5 ft²
Velocity	1.46 ft/s
Wetted Perimeter	150.4 ft
Top Width	150.00 ft

Worksheet for EMERGENCY OVERFLOW SECT E-E

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	20.90 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.00 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	150.0 ft

Results	
Headwater Elevation	0.13 ft
Headwater Height Above Crest	0.13 ft
Tailwater Height Above Crest	0.00 ft
Weir Coefficient	3.08 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.08 ft^(1/2)/s
Flow Area	19.0 ft²
Velocity	1.10 ft/s
Wetted Perimeter	150.3 ft
Top Width	150.00 ft

Worksheet for EMERGENCY OVERFLOW SECT F-F

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	14.80 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.00 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	100.0 ft

Results	
Headwater Elevation	0.13 ft
Headwater Height Above Crest	0.13 ft
Tailwater Height Above Crest	0.00 ft
Weir Coefficient	3.08 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.08 ft^(1/2)/s
Flow Area	13.2 ft²
Velocity	1.12 ft/s
Wetted Perimeter	100.3 ft
Top Width	100.00 ft

Worksheet for EMERGENCY OVERFLOW SECT G-G

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	52.70 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.00 ft
Crest Surface Type	Paved
Crest Breadth	0.28 ft
Crest Length	100.0 ft

Results	
Headwater Elevation	0.31 ft
Headwater Height Above Crest	0.31 ft
Tailwater Height Above Crest	0.00 ft
Weir Coefficient	3.09 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.09 ft^(1/2)/s
Flow Area	30.8 ft²
Velocity	1.71 ft/s
Wetted Perimeter	100.6 ft
Top Width	100.00 ft

Worksheet for EMERGENCY OVERFLOW SECT H-H

Project Description	
Solve For	Headwater Elevation

Input Data	
Discharge	44.80 cfs
Crest Elevation	0.00 ft
Tailwater Elevation	0.00 ft
Crest Surface Type	Paved
Crest Breadth	0.50 ft
Crest Length	150.0 ft

Results	
Headwater Elevation	0.21 ft
Headwater Height Above Crest	0.21 ft
Tailwater Height Above Crest	0.00 ft
Weir Coefficient	3.09 ft^(1/2)/s
Submergence Factor	1.000
Adjusted Weir Coefficient	3.09 ft^(1/2)/s
Flow Area	31.6 ft²
Velocity	1.42 ft/s
Wetted Perimeter	150.4 ft
Top Width	150.00 ft

Pond B Culvert Calculations

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 150 cfs

Design Flow: 193.7 cfs

Maximum Flow: 250 cfs

Table 1 - Summary of Culvert Flows at Crossing: Crossing 1

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
5616.83	150.00	150.00	0.00	1
5616.94	160.00	160.00	0.00	1
5617.07	170.00	170.00	0.00	1
5617.20	180.00	180.00	0.00	1
5617.38	193.70	193.70	0.00	1
5617.48	200.00	200.00	0.00	1
5617.63	210.00	210.00	0.00	1
5617.79	220.00	220.00	0.00	1
5618.00	230.00	230.00	0.00	1
5618.29	240.00	240.00	0.00	1
5618.59	250.00	250.00	0.00	1
5622.00	341.32	341.32	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1

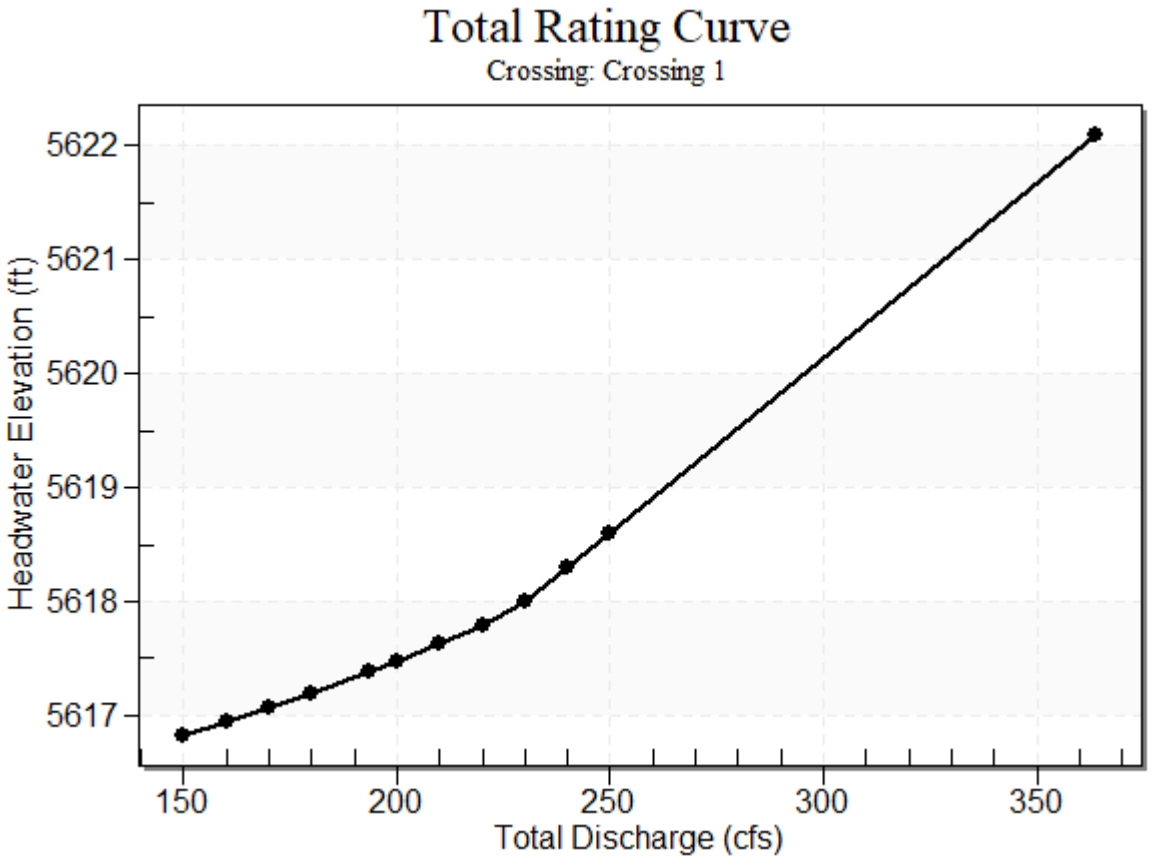


Table 2 - Culvert Summary Table: Culvert 1

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)
150.00	150.00	5616.83	4.126	4.830	7-A2f	-1.000	2.621	4.000	4.000	5.968	0.000
160.00	160.00	5616.94	4.326	4.945	7-A2f	-1.000	2.709	4.000	4.000	6.366	0.000
170.00	170.00	5617.07	4.534	5.067	7-A2f	-1.000	2.794	4.000	4.000	6.764	0.000
180.00	180.00	5617.20	4.751	5.196	7-A2f	-1.000	2.876	4.000	4.000	7.162	0.000
193.70	193.70	5617.38	5.064	5.385	7-A2f	-1.000	2.983	4.000	4.000	7.707	0.000
200.00	200.00	5617.48	5.215	5.476	7-A2f	-1.000	3.030	4.000	4.000	7.958	0.000
210.00	210.00	5617.63	5.464	5.627	7-A2f	-1.000	3.102	4.000	4.000	8.356	0.000
220.00	220.00	5617.79	5.726	5.786	7-A2f	-1.000	3.170	4.000	4.000	8.754	0.000
230.00	230.00	5618.00	6.001	5.952	7-A2t	-1.000	3.236	4.000	4.000	9.151	0.000
240.00	240.00	5618.29	6.290	6.126	7-A2t	-1.000	3.298	4.000	4.000	9.549	0.000
250.00	250.00	5618.59	6.592	6.307	7-A2t	-1.000	3.356	4.000	4.000	9.947	0.000

****

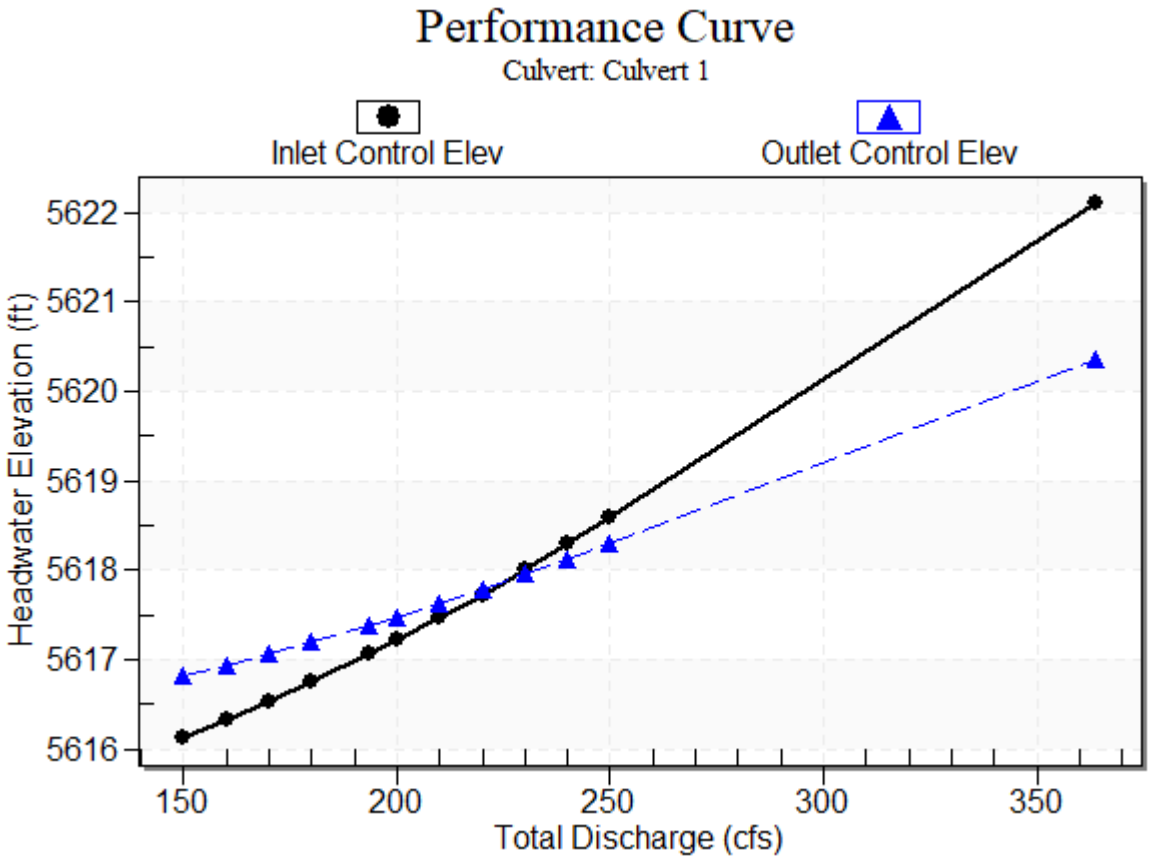
Straight Culvert

Inlet Elevation (invert): 5612.00 ft, Outlet Elevation (invert): 5613.00 ft

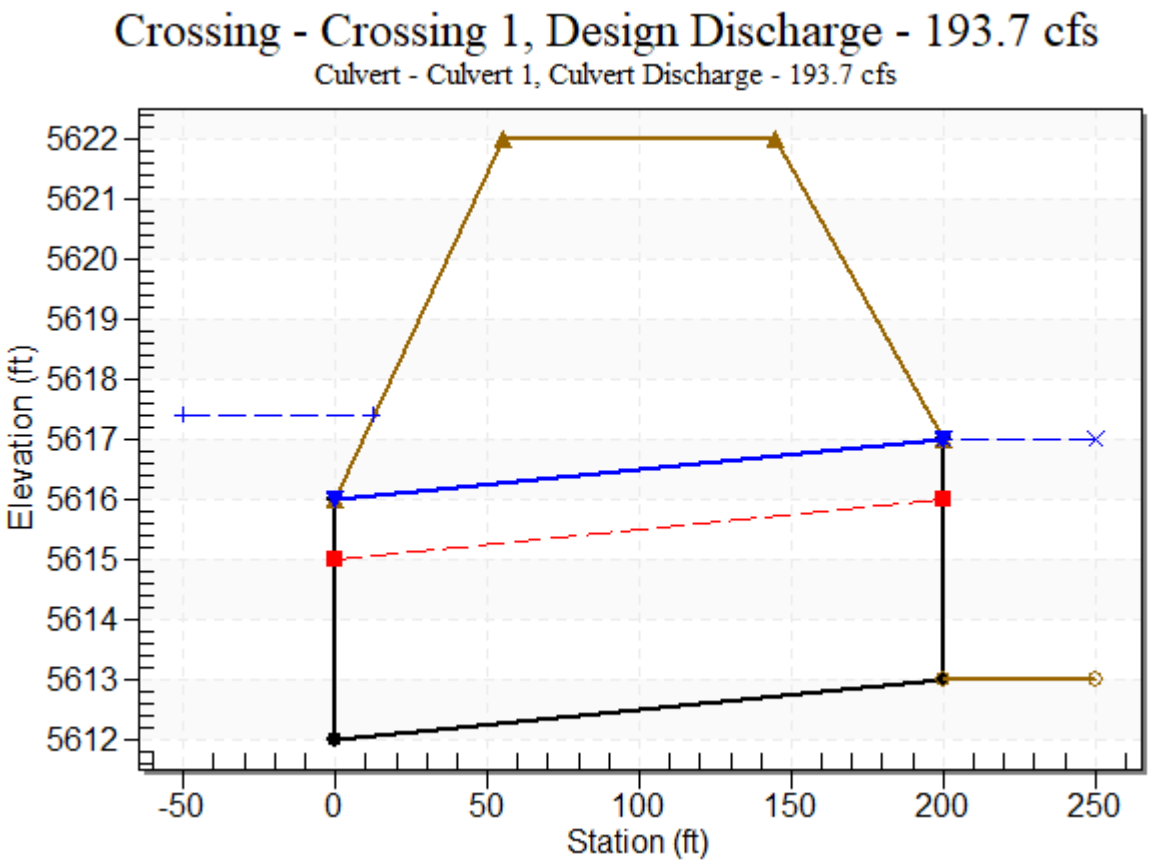
Culvert Length: 200.00 ft, Culvert Slope: -0.0050

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 5612.00 ft

Outlet Station: 200.00 ft

Outlet Elevation: 5613.00 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: Crossing 1)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
150.00	5617.00	4.00
160.00	5617.00	4.00
170.00	5617.00	4.00
180.00	5617.00	4.00
193.70	5617.00	4.00
200.00	5617.00	4.00
210.00	5617.00	4.00
220.00	5617.00	4.00
230.00	5617.00	4.00
240.00	5617.00	4.00
250.00	5617.00	4.00

Tailwater Channel Data - Crossing 1

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 5617.00 ft

Roadway Data for Crossing: Crossing 1

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 200.00 ft

Crest Elevation: 5622.00 ft

Roadway Surface: Paved

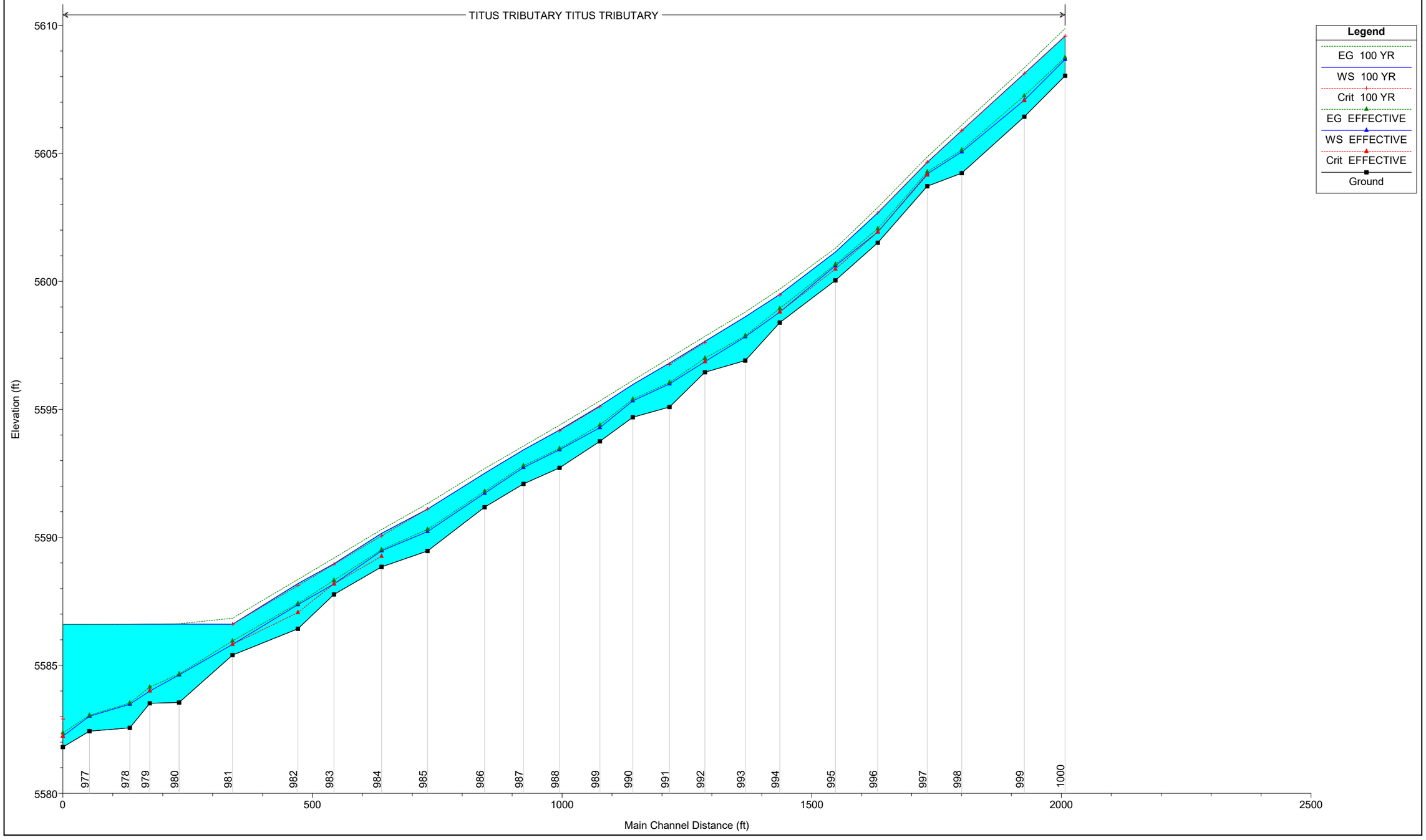
Roadway Top Width: 90.00 ft

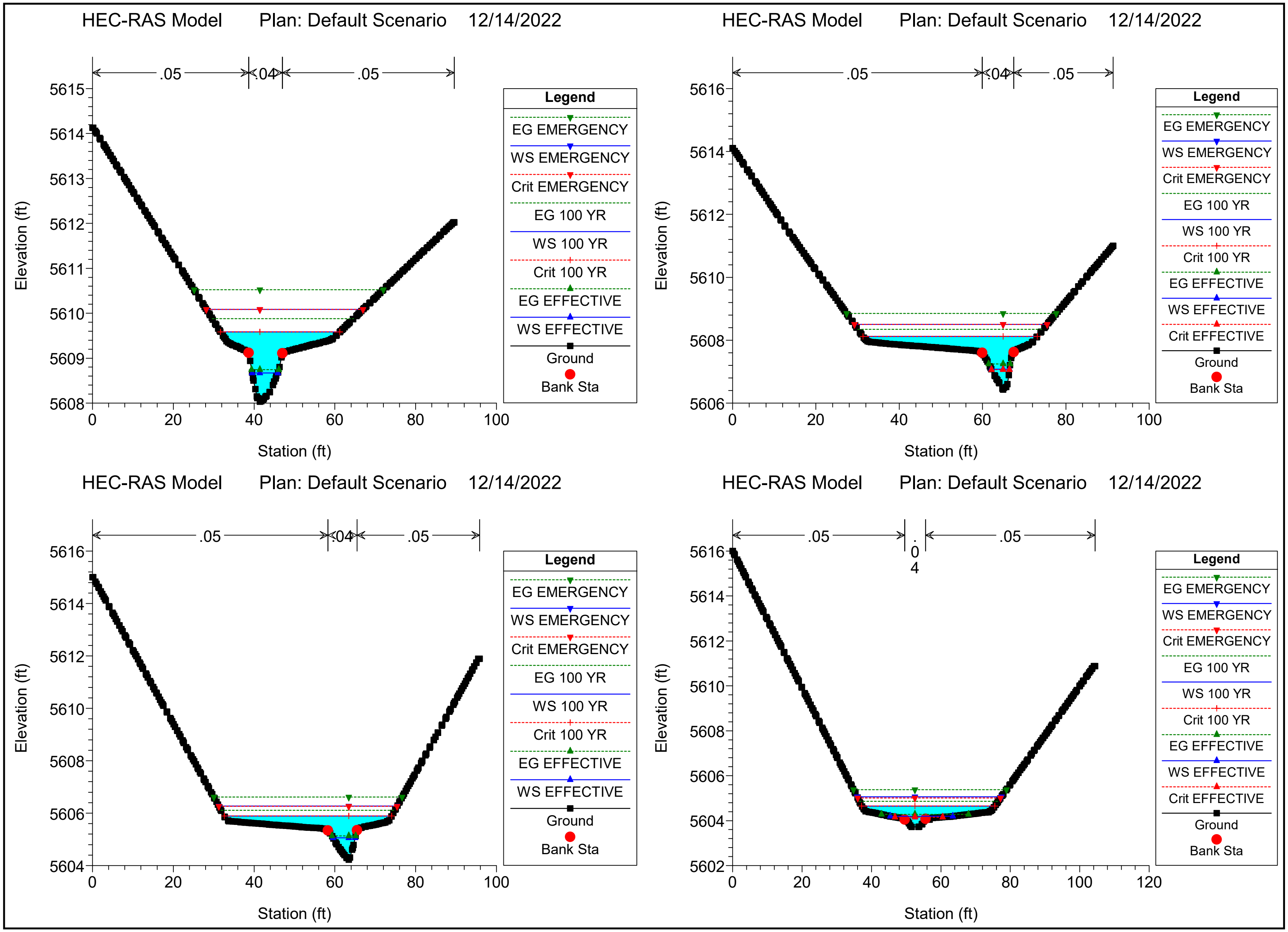
Channel HEC-RAS Reports

HEC-RAS Plan: Default Scenario River: TITUS TRIBUTARY Reach: TITUS TRIBUTARY

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
TITUS TRIBUTARY	1000	100 YR	55.00	5608.03	5609.58	5609.58	5609.88	0.014	4.73	15.72	29.54	0.77
TITUS TRIBUTARY	1000	EFFECTIVE	5.50	5608.03	5608.67		5608.75	0.012	2.17	2.54	6.42	0.61
TITUS TRIBUTARY	999	100 YR	55.00	5606.43	5608.12	5608.12	5608.35	0.013	4.46	19.22	41.85	0.74
TITUS TRIBUTARY	999	EFFECTIVE	5.50	5606.43	5607.08	5607.06	5607.25	0.030	3.27	1.68	4.39	0.93
TITUS TRIBUTARY	998	100 YR	55.00	5604.23	5605.89	5605.89	5606.11	0.013	4.43	19.66	41.48	0.73
TITUS TRIBUTARY	998	EFFECTIVE	5.50	5604.23	5605.06		5605.13	0.011	2.18	2.52	5.49	0.57
TITUS TRIBUTARY	997	100 YR	55.00	5603.72	5604.65	5604.65	5604.87	0.023	4.87	17.79	38.38	0.95
TITUS TRIBUTARY	997	EFFECTIVE	5.50	5603.72	5604.20	5604.16	5604.28	0.015	2.30	2.96	17.98	0.67
TITUS TRIBUTARY	996	100 YR	55.00	5601.51	5602.68	5602.68	5602.89	0.015	4.38	18.88	38.93	0.79
TITUS TRIBUTARY	996	EFFECTIVE	5.50	5601.51	5601.93	5601.93	5602.07	0.037	2.99	1.84	6.66	1.00
TITUS TRIBUTARY	995	100 YR	55.00	5600.04	5601.15		5601.29	0.013	4.11	21.22	37.53	0.73
TITUS TRIBUTARY	995	EFFECTIVE	5.50	5600.04	5600.61	5600.48	5600.66	0.008	1.98	3.61	19.14	0.51
TITUS TRIBUTARY	994	100 YR	55.00	5598.39	5599.49	5599.47	5599.70	0.017	4.39	18.14	36.68	0.83
TITUS TRIBUTARY	994	EFFECTIVE	5.50	5598.39	5598.80	5598.80	5598.94	0.039	3.00	1.83	6.91	1.03
TITUS TRIBUTARY	993	100 YR	55.00	5596.91	5598.62		5598.80	0.010	3.93	20.14	37.59	0.66
TITUS TRIBUTARY	993	EFFECTIVE	5.50	5596.91	5597.84		5597.88	0.005	1.64	3.35	6.43	0.40
TITUS TRIBUTARY	992	100 YR	55.00	5596.45	5597.66	5597.61	5597.85	0.013	4.20	19.01	35.19	0.75
TITUS TRIBUTARY	992	EFFECTIVE	5.50	5596.45	5596.86	5596.86	5597.00	0.037	2.98	1.85	6.69	1.00
TITUS TRIBUTARY	991	100 YR	55.00	5595.09	5596.81	5596.76	5597.00	0.011	4.15	19.52	34.41	0.68
TITUS TRIBUTARY	991	EFFECTIVE	5.50	5595.09	5596.00		5596.05	0.007	1.83	3.01	6.03	0.46
TITUS TRIBUTARY	990	100 YR	55.00	5594.69	5595.97		5596.13	0.013	3.94	20.55	38.49	0.72
TITUS TRIBUTARY	990	EFFECTIVE	5.50	5594.69	5595.33		5595.40	0.012	2.10	2.62	7.03	0.61
TITUS TRIBUTARY	989	100 YR	55.00	5593.75	5595.13	5595.10	5595.33	0.012	4.12	19.70	40.11	0.72
TITUS TRIBUTARY	989	EFFECTIVE	5.50	5593.75	5594.29		5594.39	0.019	2.54	2.16	6.09	0.75
TITUS TRIBUTARY	988	100 YR	55.00	5592.72	5594.20	5594.16	5594.38	0.011	4.02	20.25	40.09	0.69
TITUS TRIBUTARY	988	EFFECTIVE	5.50	5592.72	5593.42		5593.48	0.007	1.80	3.05	6.79	0.47
TITUS TRIBUTARY	987	100 YR	55.00	5592.09	5593.42		5593.57	0.011	3.78	21.65	41.52	0.68
TITUS TRIBUTARY	987	EFFECTIVE	5.50	5592.09	5592.73		5592.81	0.013	2.19	2.52	6.47	0.62
TITUS TRIBUTARY	986	100 YR	55.00	5591.18	5592.50		5592.69	0.012	3.97	20.02	37.86	0.69
TITUS TRIBUTARY	986	EFFECTIVE	5.50	5591.18	5591.72		5591.79	0.013	2.15	2.56	7.01	0.63
TITUS TRIBUTARY	985	100 YR	55.00	5589.47	5591.10	5591.10	5591.32	0.013	4.35	19.34	39.08	0.72
TITUS TRIBUTARY	985	EFFECTIVE	5.50	5589.47	5590.23		5590.31	0.013	2.34	2.35	5.33	0.62
TITUS TRIBUTARY	984	100 YR	55.00	5588.85	5590.16	5590.06	5590.31	0.009	3.66	22.19	39.13	0.63
TITUS TRIBUTARY	984	EFFECTIVE	5.50	5588.85	5589.48	5589.26	5589.52	0.006	1.61	3.41	7.93	0.43
TITUS TRIBUTARY	983	100 YR	55.00	5587.77	5588.97	5588.95	5589.19	0.015	4.44	17.65	33.19	0.80
TITUS TRIBUTARY	983	EFFECTIVE	5.50	5587.77	5588.19	5588.19	5588.32	0.038	2.99	1.84	6.77	1.01
TITUS TRIBUTARY	982	100 YR	55.00	5586.43	5588.20	5588.12	5588.36	0.009	3.80	21.45	36.88	0.61
TITUS TRIBUTARY	982	EFFECTIVE	5.50	5586.43	5587.37	5587.06	5587.42	0.005	1.68	3.28	6.28	0.41
TITUS TRIBUTARY	981	100 YR	55.00	5585.40	5586.61	5586.61	5586.84	0.016	4.51	17.29	32.57	0.80
TITUS TRIBUTARY	981	EFFECTIVE	5.50	5585.40	5585.82	5585.82	5585.95	0.036	2.92	1.88	6.98	0.99
TITUS TRIBUTARY	980	100 YR	55.00	5583.55	5586.61		5586.63	0.000	1.26	60.82	36.80	0.14
TITUS TRIBUTARY	980	EFFECTIVE	5.50	5583.55	5584.63		5584.66	0.004	1.50	3.68	6.41	0.35
TITUS TRIBUTARY	979	100 YR	55.00	5583.52	5586.61		5586.61	0.000	0.92	85.97	42.12	0.10
TITUS TRIBUTARY	979	EFFECTIVE	5.50	5583.52	5584.00	5584.00	5584.16	0.035	3.15	1.75	5.66	1.00
TITUS TRIBUTARY	978	100 YR	55.00	5582.56	5586.60		5586.61	0.000	0.74	109.25	46.64	0.07
TITUS TRIBUTARY	978	EFFECTIVE	5.50	5582.56	5583.49		5583.53	0.006	1.72	3.20	6.16	0.42
TITUS TRIBUTARY	977	100 YR	55.00	5582.43	5586.60		5586.60	0.000	0.50	160.35	56.74	0.04
TITUS TRIBUTARY	977	EFFECTIVE	5.50	5582.43	5583.02		5583.05	0.006	1.58	4.12	21.74	0.45
TITUS TRIBUTARY	976	100 YR	55.00	5581.81	5586.60	5582.90	5586.60	0.000	0.42	202.42	69.31	0.03
TITUS TRIBUTARY	976	EFFECTIVE	5.50	5581.81	5582.23	5582.23	5582.36	0.038	2.91	1.89	7.22	1.00

HEC-RAS Model Plan: Default Scenario 12/14/2022

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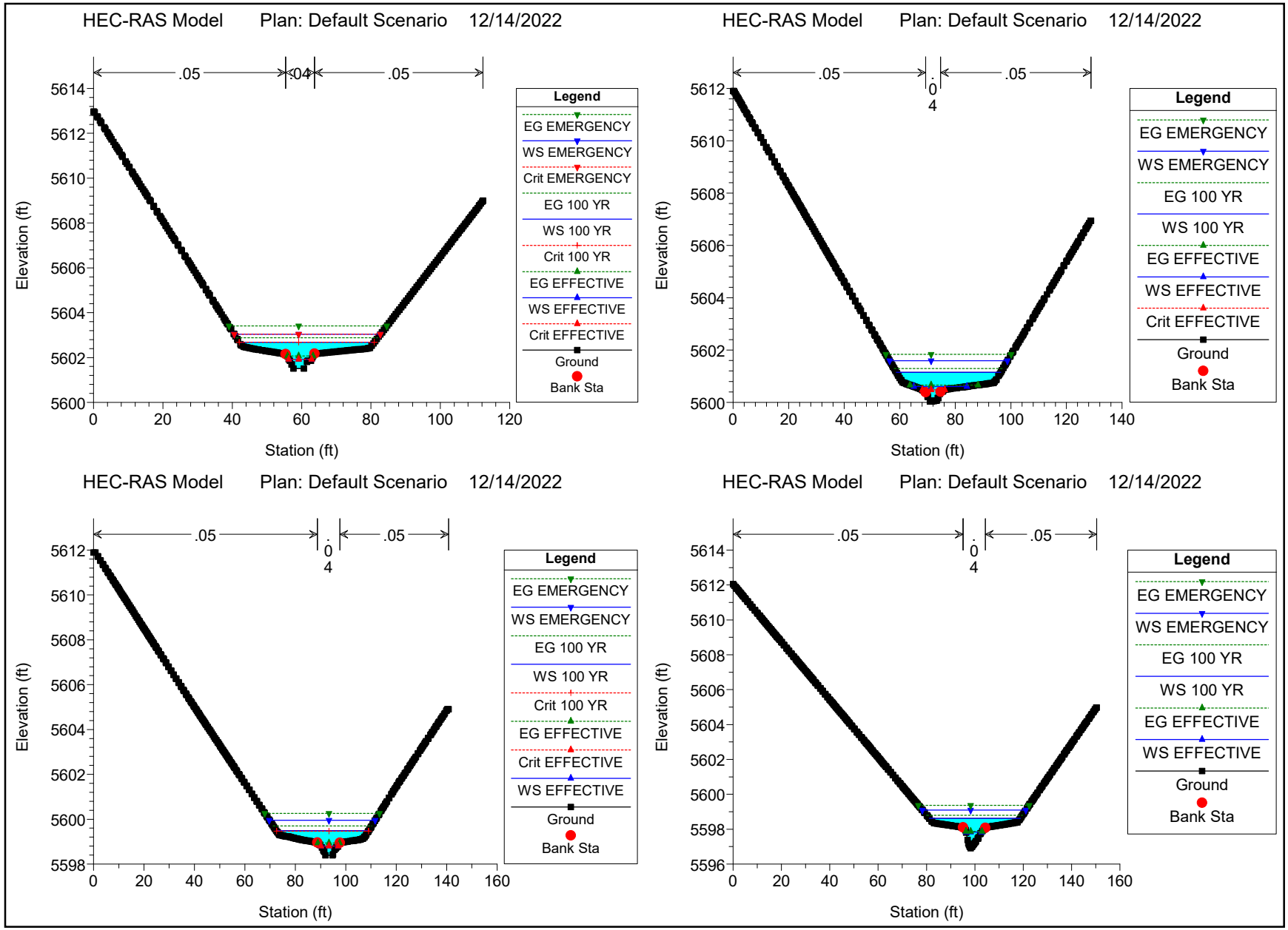
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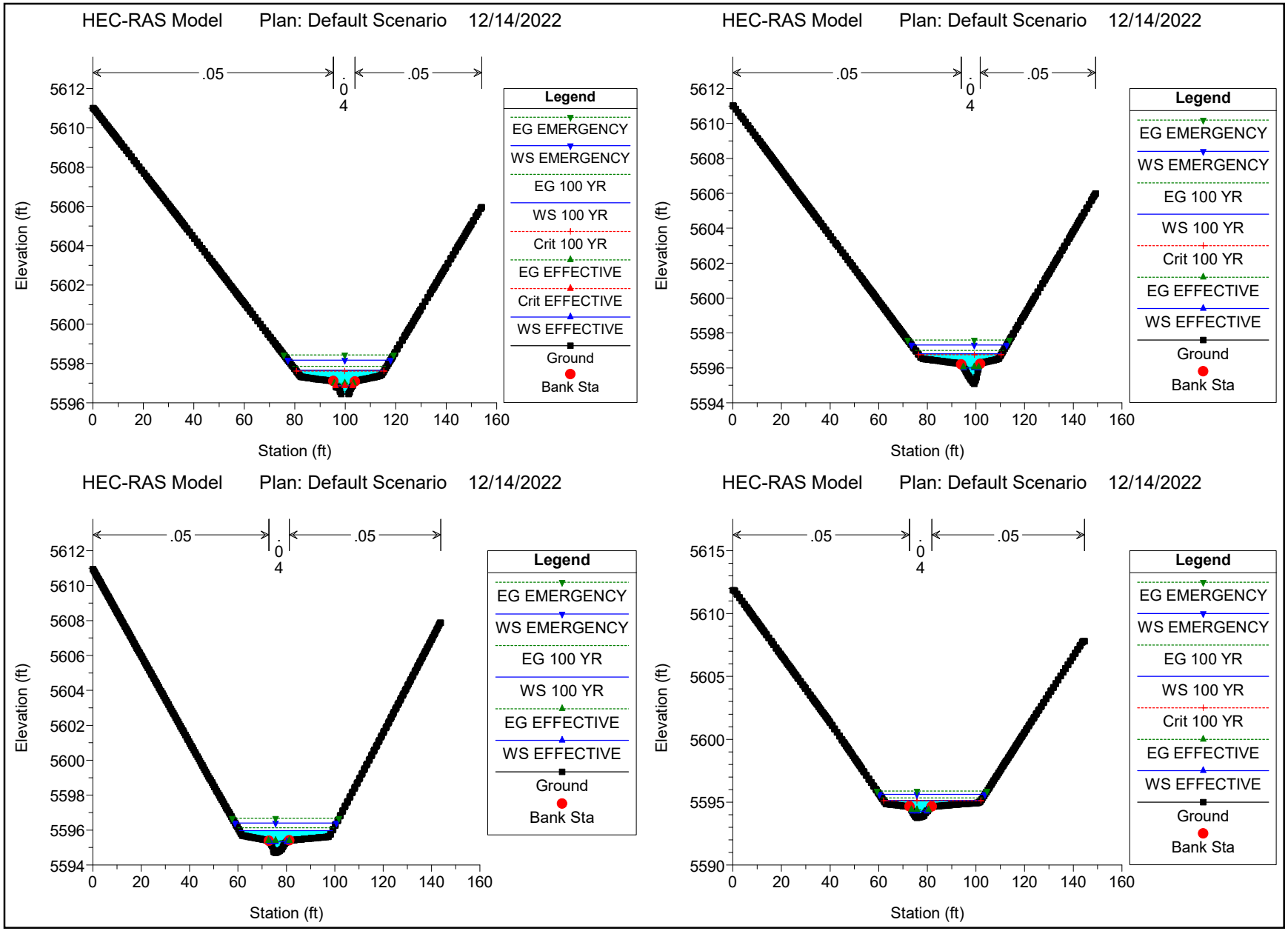
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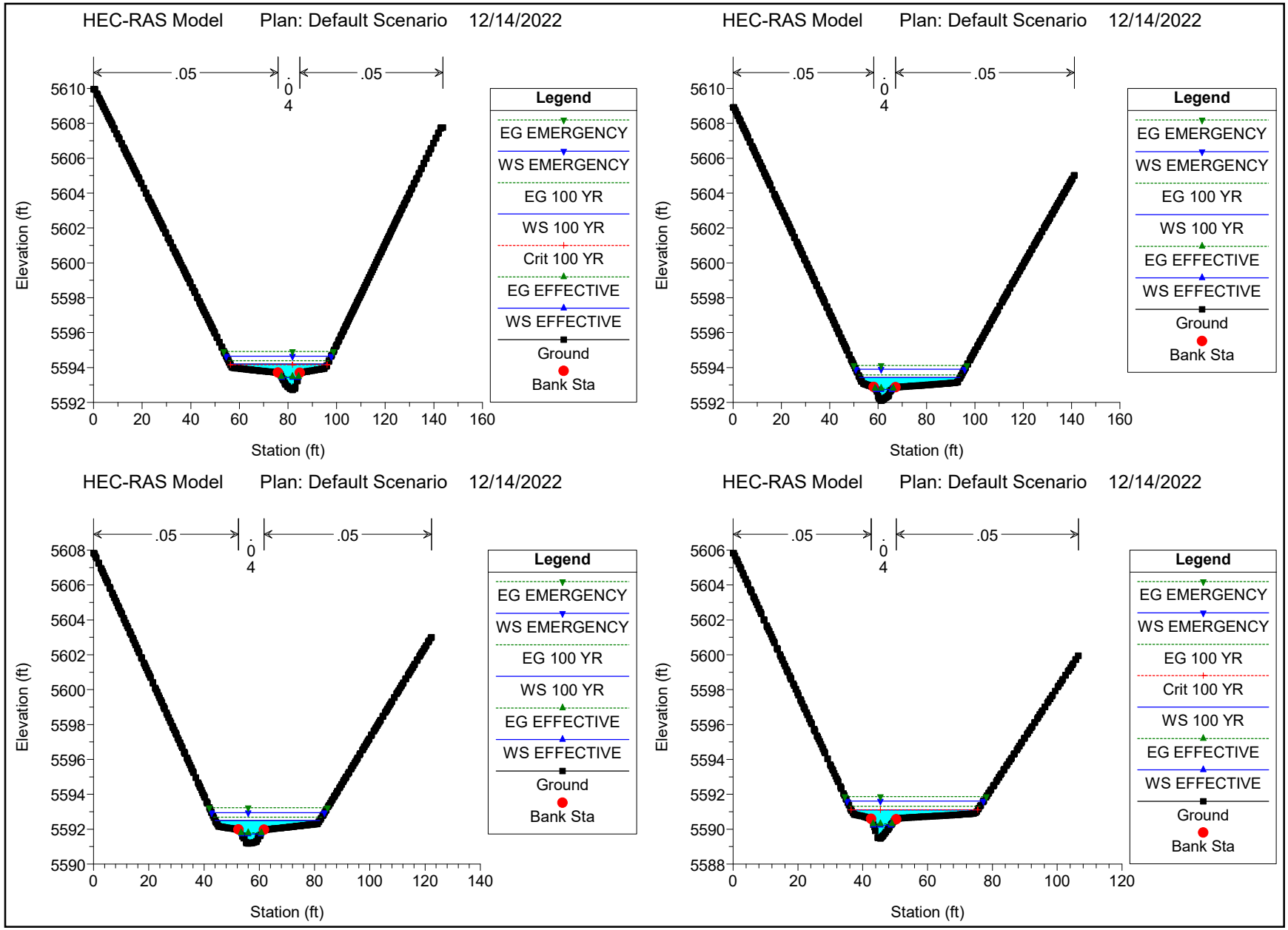
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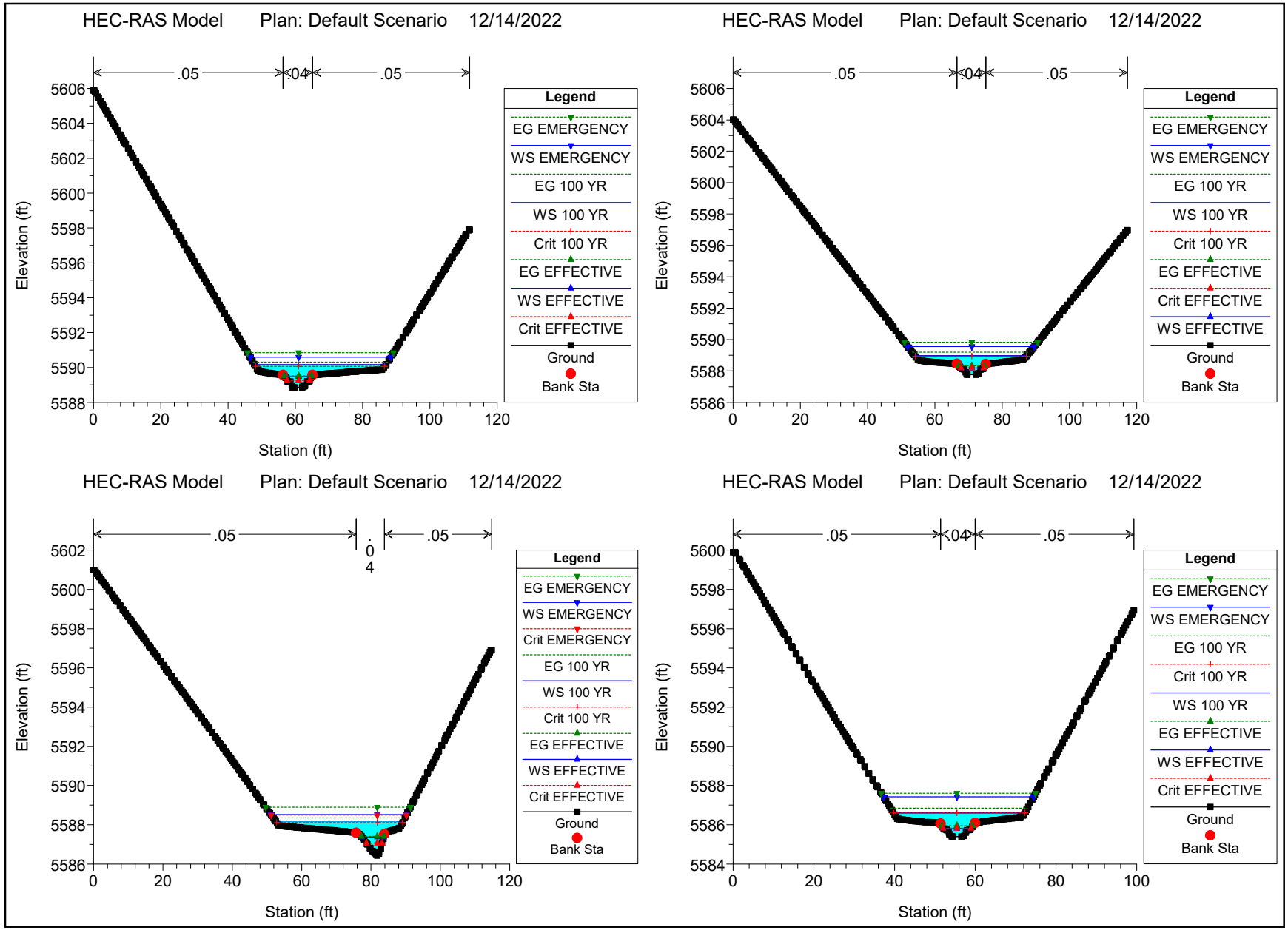
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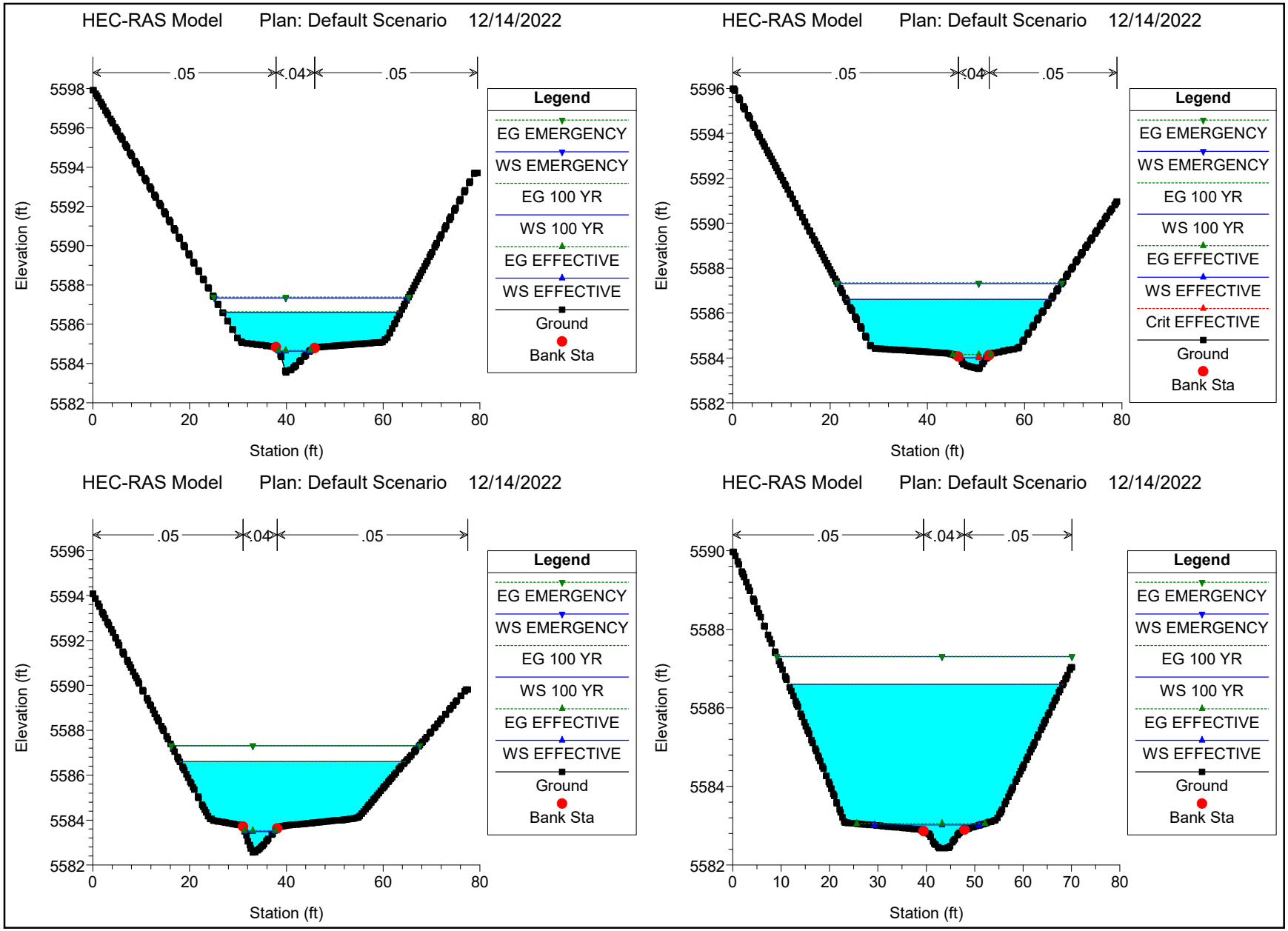
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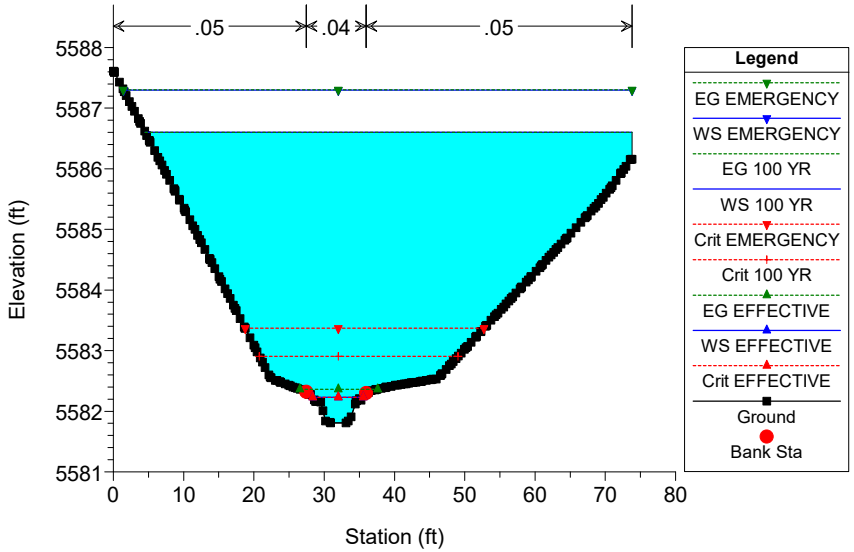


Geomorphology Memo

5 | SMOOTH STONES RESTORATION PLLC

To: Brian Schaffer

From: David Bidelspach, Five Smooth Stones Restoration, PLLC

CC: Mark Scheurer; Imanthie Bandara; Ken Lai

Date: 11/16/2022

Re: Preliminary Geomorphic Recommendations and Considerations at Sky Ranch Harmony Development – Titus Tributary Draft – Filing 17

Five Smooth Stones Restoration (5SSR) was tasked with developing geomorphic recommendations for Titus tributary to First Creek near the Monaghan Road Extension. This document will propose a new channel parameter based on average boundary shear stress that is primarily driven by the graded 100-yr channel slope. This proposed channel will collect the discharge from modified pond B and carry it north to first creek.

There are substantial differences between existing and future flows and the time between the start of construction and total buildout will be significant. The low flow channel is being designed for future conditions but needs to also consider the very low flow conditions of the existing hydrology. Our team realizes that the final channel design should incorporate a 3-stage channel, including a very small low flow or inner berm channel that will discourage excess sedimentation, encourage vegetation establishment on the depositional benches, and discourage the loss of flow capacity in the interim, bankfull stage for the bankfull storm events and 100-yr floodplain stage.

Project Objectives

5SSR identified four objectives to direct the design of the Titus tributary to first creek near the Monaghan Road Extension. The objectives of proposed designs are:

1. Design a right-of-way (ROW) for a channel capable of passing the 100-year flow, reducing flooding risk outside of the proposed channel corridor.
2. Design a 100-year floodplain ROW to the threshold applied shear stress below 1.0-1.2 pound per square foot (PSF).
3. Reduce fine sediment deposition and erosion throughout the project channels.
4. Improve the riparian functions of stability, habitat, and aesthetics.

Background Data

The project site is located between 6th Avenue to the north, N. Monaghan Road Extension on the east, E. Alameda Avenue to the south, and N. Powhaton Road on the west (Figure 1), in between 6th Ave and Alameda Avenue in the City of Aurora, Colorado. The development is known as the Sky Ranch Harmony Development. The Sky Ranch Harmony Development project site consists of a main water course: First Creek. Proposed Titus tributary origins near the junction of S Trussville St and E Elisworth Ave to the Northeast and connects to the First creek from the North. A temporary drainage is to the East of the proposed Titus tributary and is named temporary Titus drainage in this report. The existing Titus tributary is located on the East of the project site as shown on Figure 1.

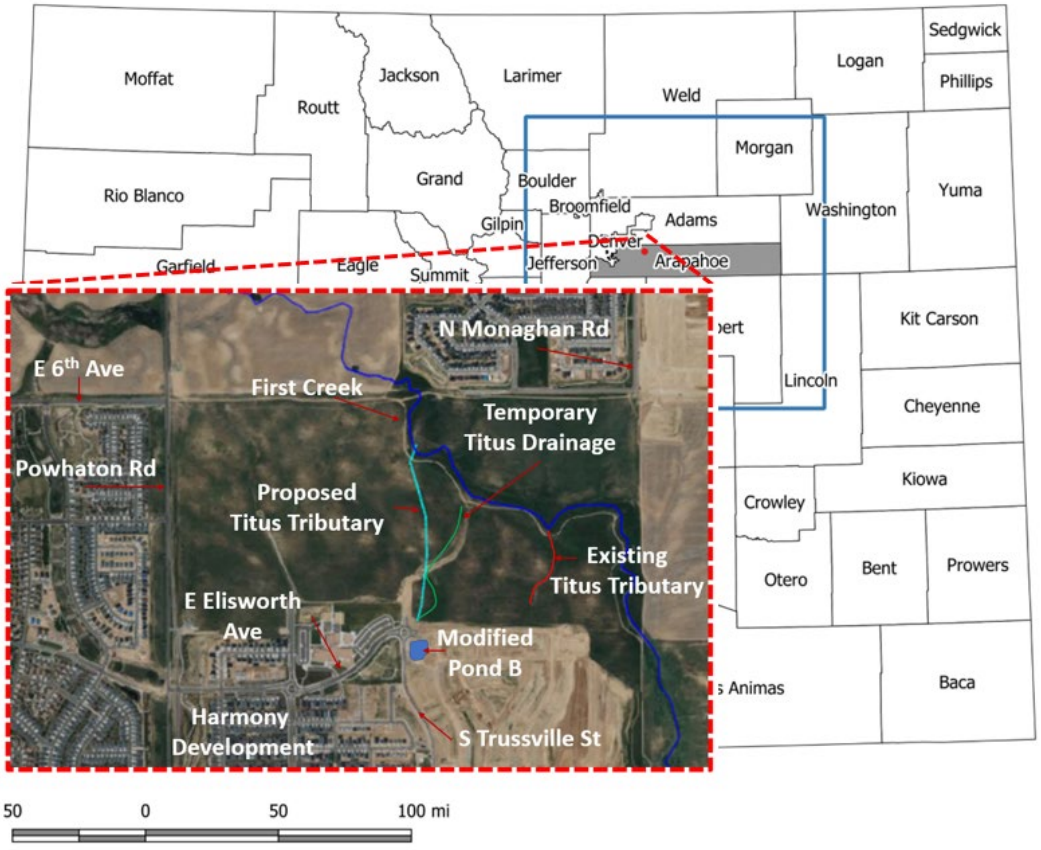


Figure 1: Sky Ranch Harmony Development Vicinity Map-Location of the Titus tributary to first creek.

Assumptions

- The existing surface provided by the Westwood defines the slope and valley configuration used for calculating several of the recommended design parameters. Geomorphic and floodplain parameters are dependent on the slope and configuration of the channel "valley" corridor.
- 100-year flows for First Creek were provided by Westwood.
- Drainage areas were obtained from USGS StreamStats. Site grading, stormwater management and routing may impact the effective drainage areas of the channels.
- Proposed Titus tributary will collect the discharge from modified pond B, by its outfall pipe with the 100-yr detained flow and carry it north to First creek.
- A site visit and geomorphic assessment survey has been conducted and future site visits will be conducted before these recommendations are finalized.

Geomorphic Assessment

Proposed Titus tributary to first creek is not a naturally occurring channel. An existing Titus tributary and a temporary Titus drainage is located to the East of the proposed tributary. A geomorphic survey was performed to evaluate existing conditions and inform potential stream restoration solutions.

The geomorphic assessment was completed by 5SSR for the proposed Titus tributary using an existing conditions surface provided by Westwood to develop design criteria. The slope of this profile showed an average slope of 1%. (Figure 2)

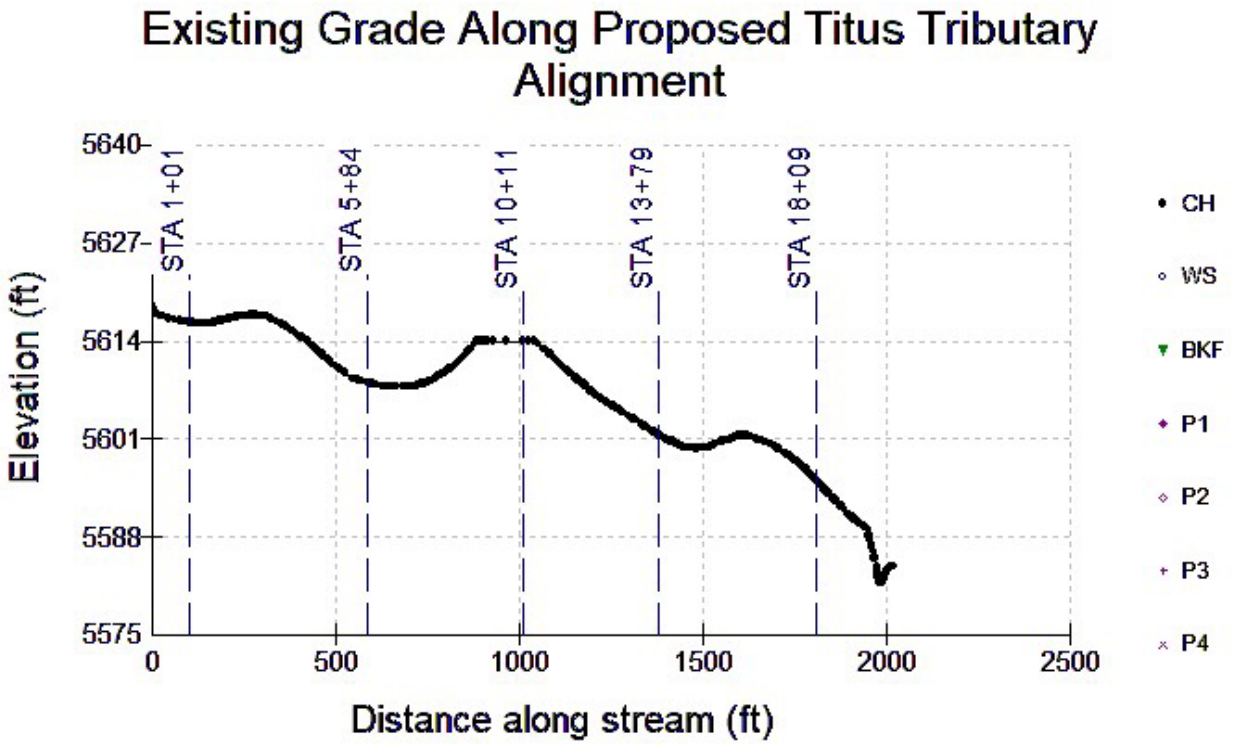


Figure 2: Proposed Titus Tributary Profile.

The geomorphic assessment was completed by 5SSR for the Temporary Titus drainage using an existing conditions surface provided by Westwood to develop design criteria. The slope of this profile showed an average slope of 1%. (Figure 3)

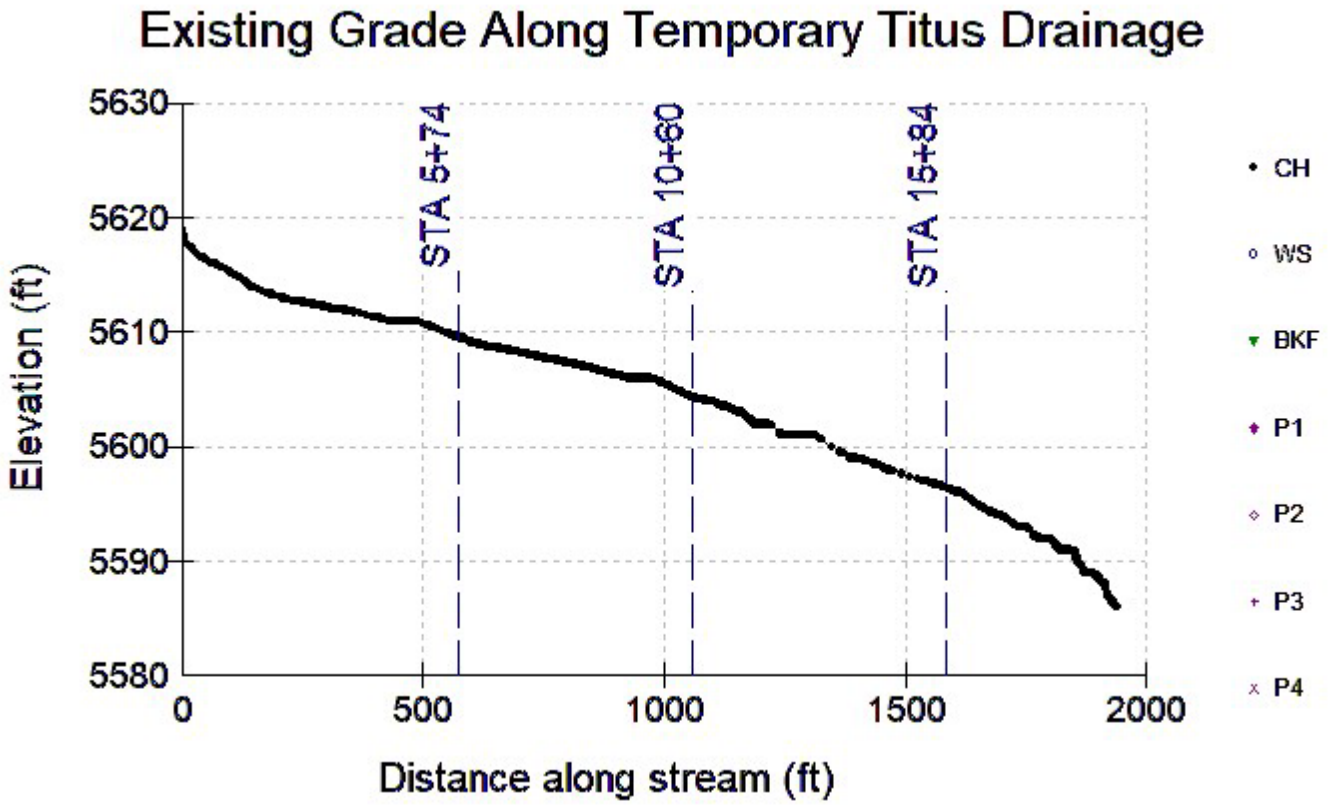


Figure 3: Profile of Temporary Titus Drainage to the west of the proposed Titus tributary.

Three cross sections were analyzed along the temporary Titus drainage profile**.** Figure (4) shows a cross section at STA 5+84 along the temporary Titus drainage profile.

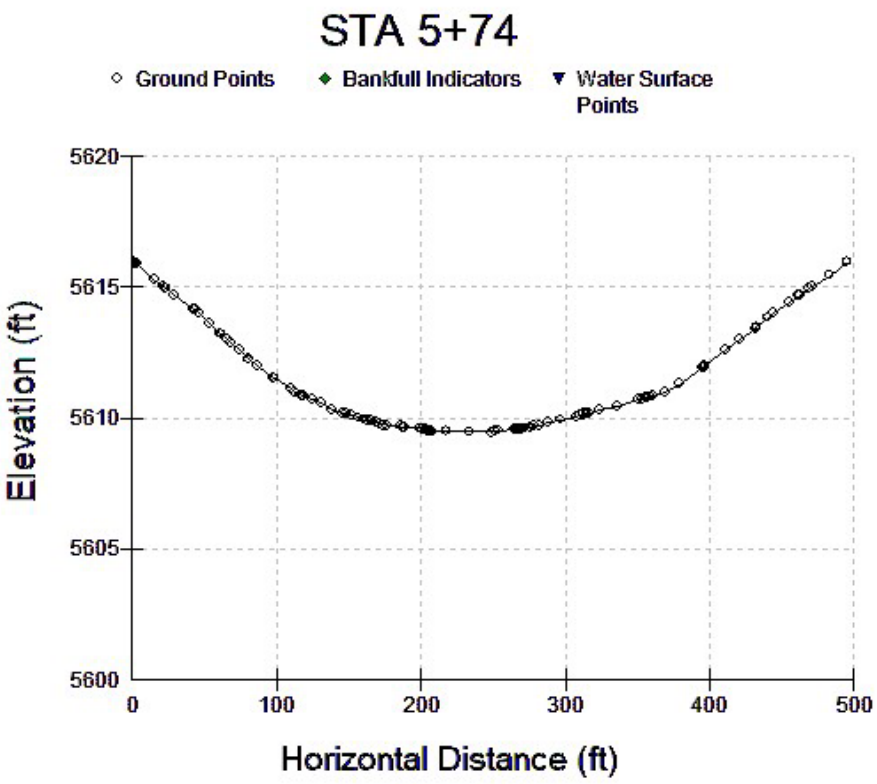


Figure 4: Existing Drainage near proposed Titus tributary Cross section, at STA 5+74

The project team surveyed 1,000 foot-long-profile of the existing Titus tributary. The slope of this profile showed an average slope of 2%. There were no head-cuts along the measured existing profile. (Figure 5).

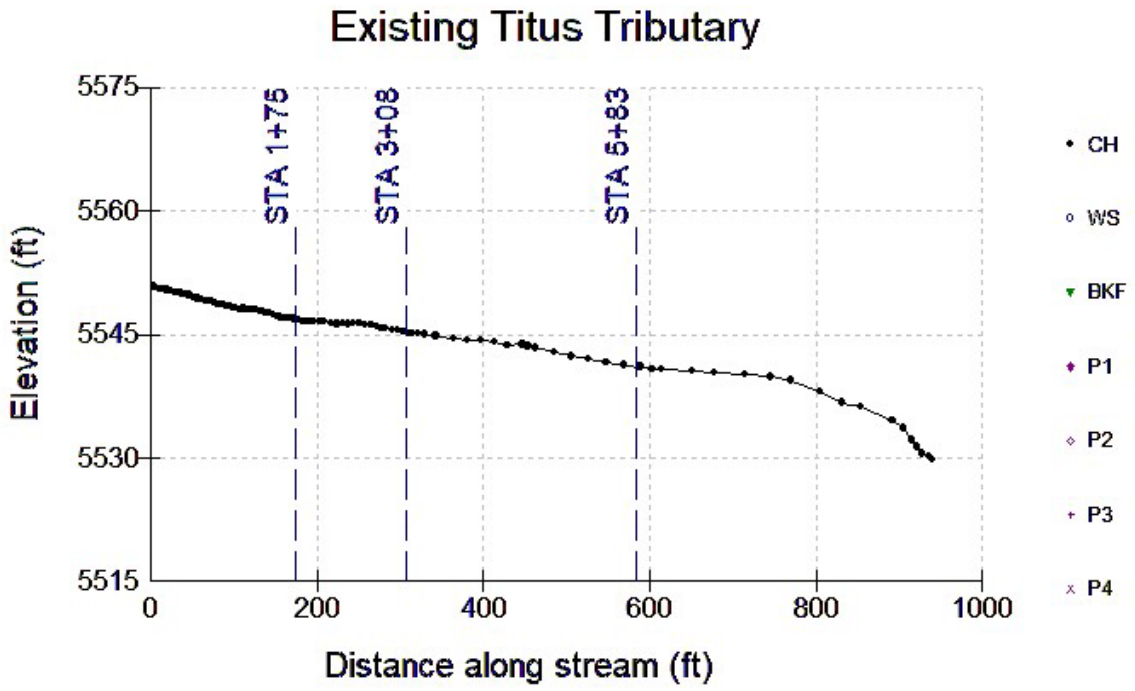


Figure 5: Existing Titus Tributary profile

Three cross sections were analyzed along existing Titus tributary profile**.** Figure (6) shows a cross section at STA 5+84 along the profile, where the bankfull width of the channel is approximately 6-12 feet.

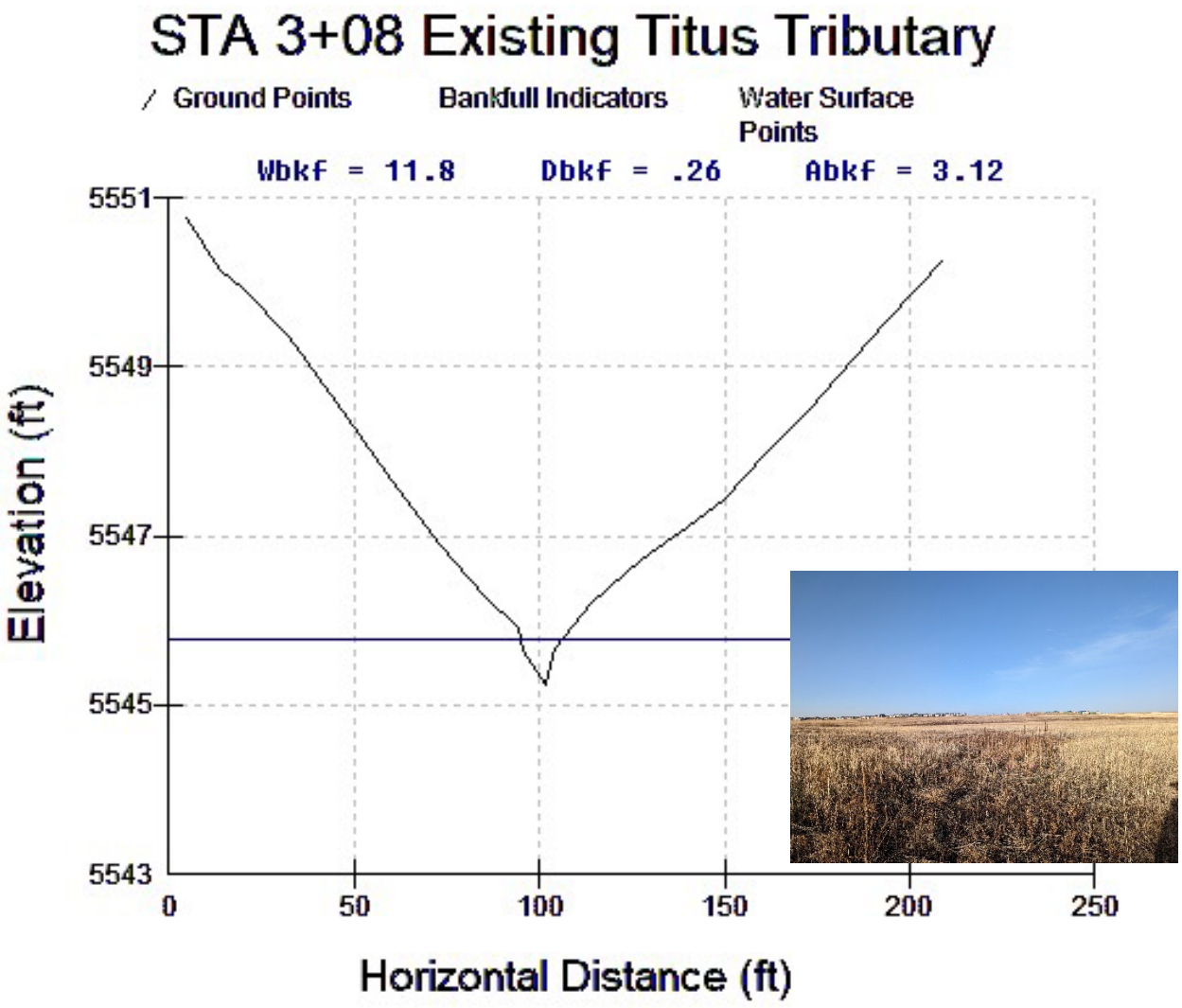


Figure 6: Existing Drainage near proposed Titus tributary Cross section, at STA 5+74

Design Considerations

The recommended design consists of three nested channels. The first being the low flow, or inner berm channel, followed by the bankfull channel and the floodplain (figure 7). Design considerations for the proposed channels are outlined below. The inner berm channel is discussed along with the bankfull channel.

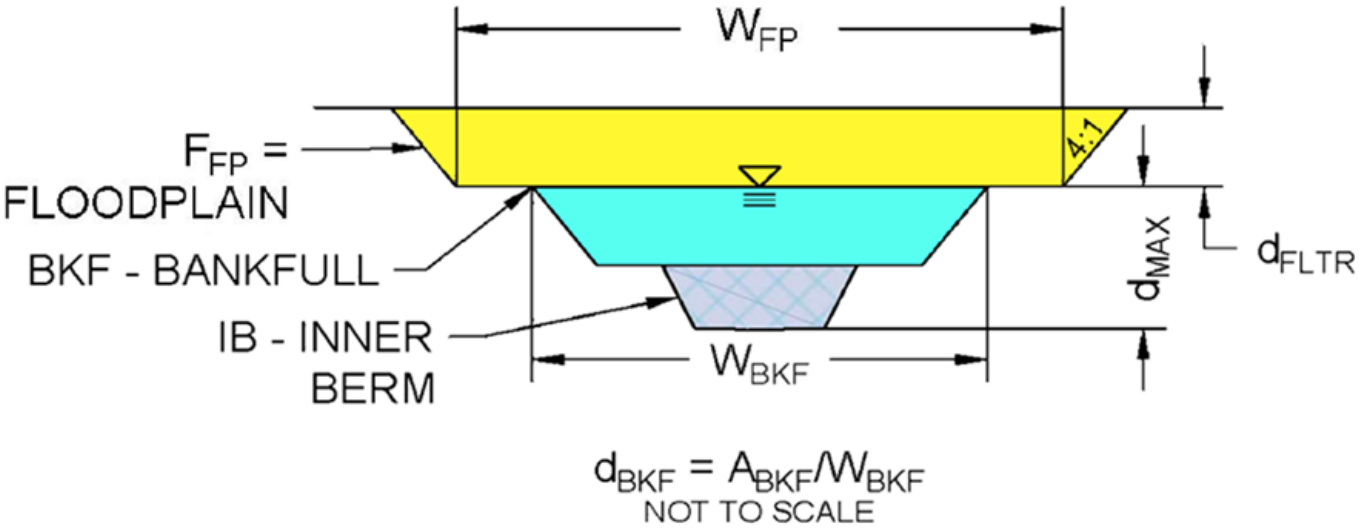


Figure 7: Typical riffle cross-sections showing typical abbreviations and measurements. Typical cross-section shows three nested channels.

Bankfull Channel Design

The section below describes recommendations for the pattern, profile, and cross-section of the proposed bankfull channel. The bankfull channel design parameters recommended below are based, in part, on theories of natural and threshold channel design as discussed in Part 654, Chapters 8 (Threshold Channel Design) and 11 (Rosgen Geomorphic Channel Design) in NRCS's National Engineering Handbook (NRCS 2007). A summary of design parameters can be found in Table 3 at the end of this memo.

USGS StreamStats (https://streamstats.usgs.gov) was used to calculate the existing drainage area (A) of 0.3 square miles and mean annual rainfall of 18.62 inches per year; for the proposed reach. (Table 1)

Table 1: Basin parameters for the two reaches. Drainage area and annual

Basin Parameters		
Reach	Annual Precip (IN/YR)[1]	Drainage Area (sq. mi.)[1]
Titus Tributary	18.62	0.30

[1] Annual Precip and drainage areas acquired from USGS StreamStats

The Southwest Regional Curve Intercept graph (**Figure 8**) is used to relate the mean annual rainfall to the cross-sectional area y-intercept, a.k.a. watershed response factor (WRF).

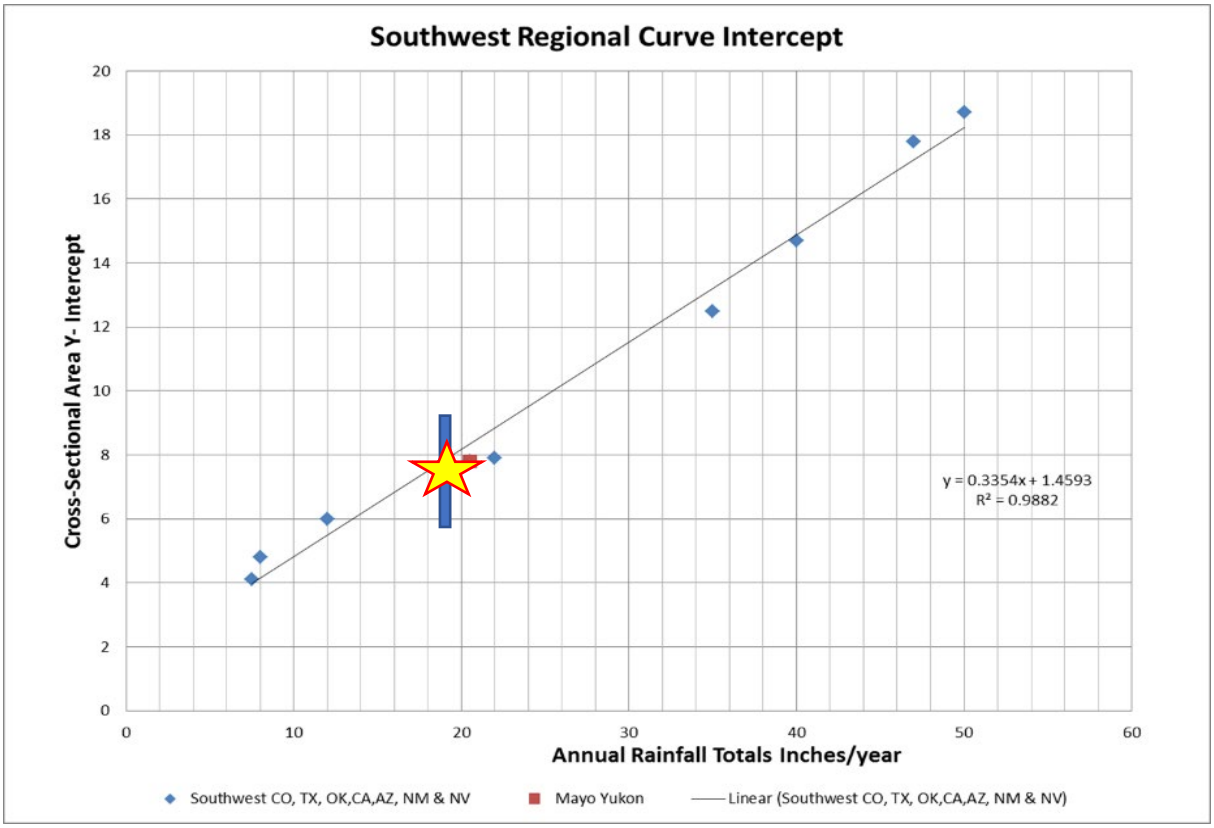


Figure 8: Southwest Regional Curve Intercept used to calculate the watershed response factor.

From the above Figure 8, WRF is found to be 7.8. This factor is used to calculate the preliminary recommended bankfull cross-sectional area, A_{BKF}, for the Titus tributary.

$$A_{BKF} = WRF * DA^{0.67}$$

A local mini-regional curve was also used to evaluate the validity of the suggested bankfull area from the watershed response factor. A local mini-regional curve is developed by collecting several bankfull cross-sectional areas at drainages in the region. Those areas are then compared to their associated drainage areas on a graph. Typically, there is a high correlation between the bankfull cross-sectional area and the associated drainage area. This is evident for this mini-regional curve, as can be seen in **Figure 9**.

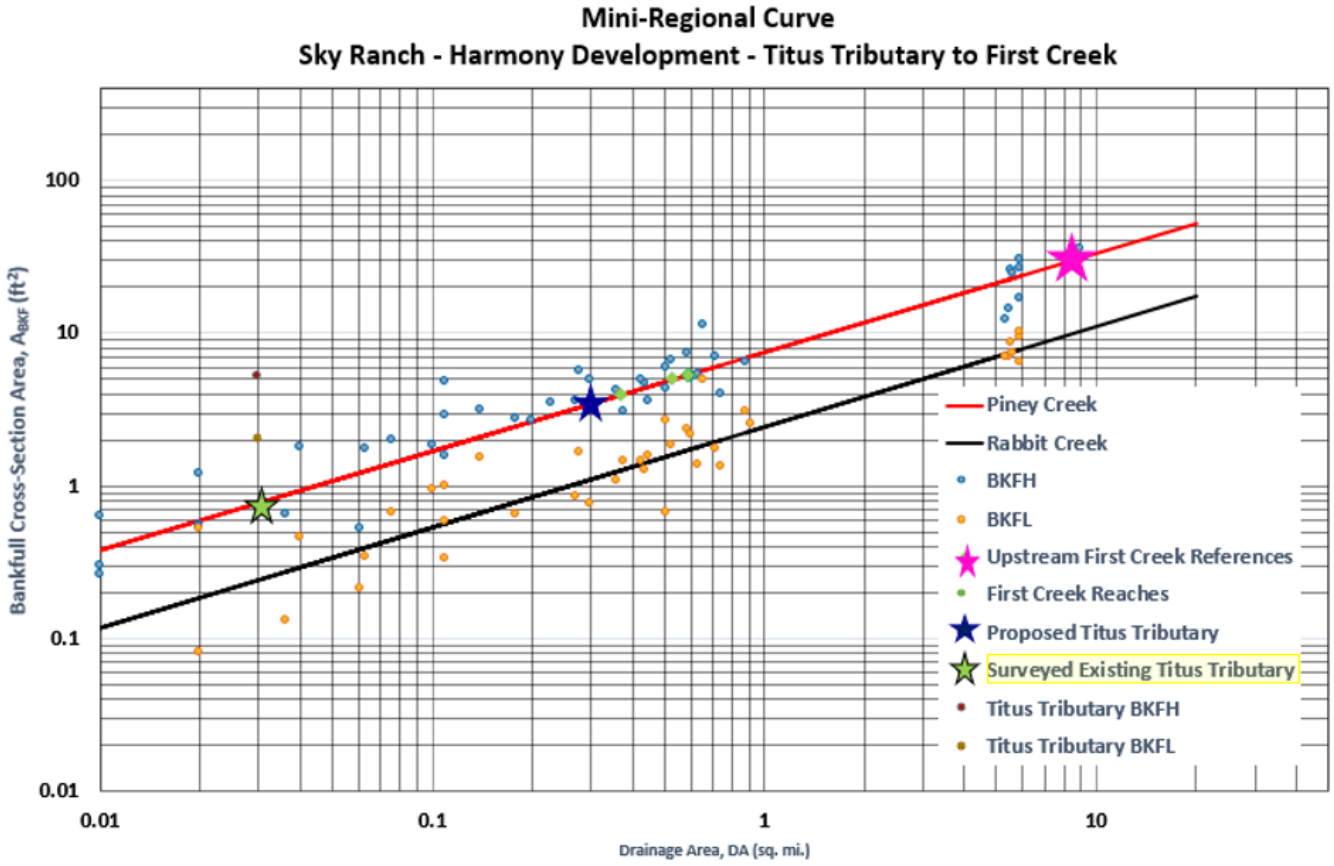


Figure 9: Piney Creek and Rabbit Creek mini-regional curve for comparison to design parameters. The Blue Star represents the Titus tributary.

Using both the WRF and local mini-regional curve methods, the preliminary recommended bankfull cross-sectional area of Titus tributary is approximately 3.4 square feet.

Reference design bankfull width-to-depth ratios (WDR_{BKF}) between 18 and 22 should be evaluated for the channel design based on reference reaches with 1% slope in Denver Metro area. The WDR is defined as the bankfull width (W_{BKF}) divided by the mean depth of the bankfull cross-section d_{BKF}. The existing WDR of the bankfull channel of Titus tributary is within this reference range of 18-22.

$$WDR = \frac{W_{BKF}}{d_{BKF}}$$

Using the WDR the recommended design bankfull widths can be calculated using:

$$W_{BKF} = \sqrt{WDR * A_{BKF}}$$

A WDR of 20 was used to calculate W_{BKF} for Titus tributary. These values can be found in Table 3.

Pattern

Reference dimensionless ratios, based on valley type, channel slope, and region, informed the recommended pattern design for this reach based on the proposed bankfull width. The pattern dimensions are listed in **Table 2** and **Figure 10** displays where these measurements are typically made.

Table 2: Bankfull Channel Pattern Dimensionless Ratios

Pattern Dimension	Reference Value
Pool to Pool Spacing; ft	5 -6 times Bankfull Width
Radius of Curvature (ROC); ft	2 - 4 times Bankfull Width
Tangent Lengths; ft	1.5 - 3 times Bankfull Width
Meander Wavelength; ft	9- 12 times Bankfull Width
Meander Belt Width; ft	2 - 3.5 times Bankfull Width

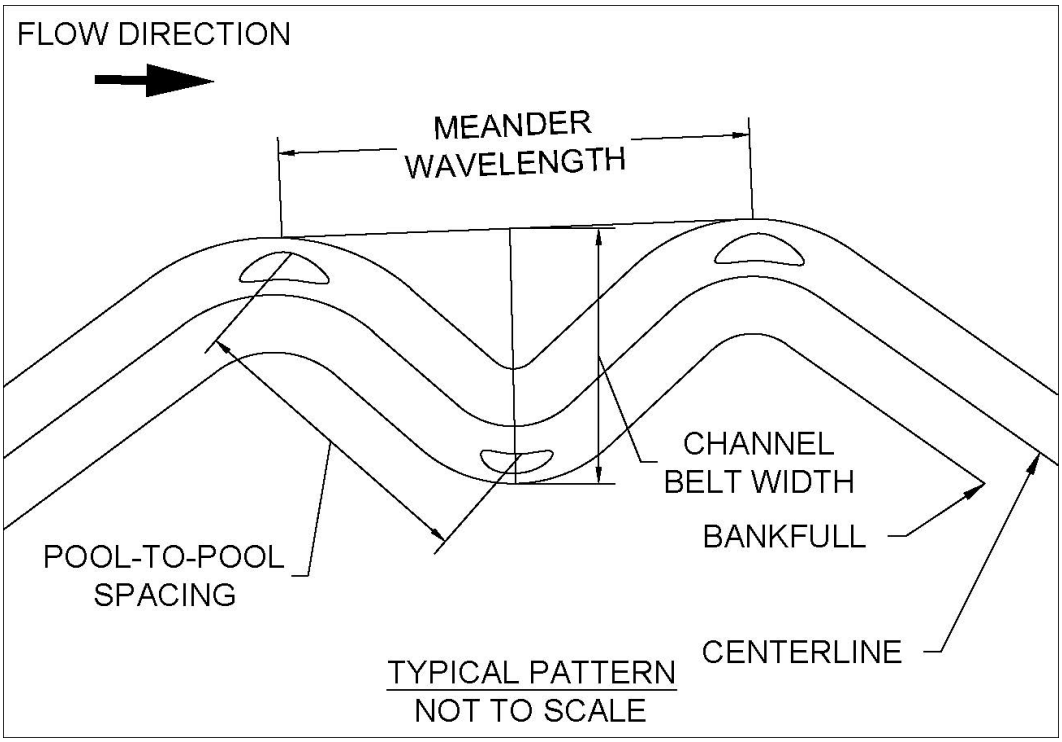


Figure 10: Typical bankfull pattern measurements.

Profile

The thalweg profile is driven by the channel pattern. The thalweg profile holds a constant slope from the point of tangency (PT) to the point of curvature (PC) of the curve along the centerline alignment. References to PTs and PCs are assuming the alignments direction is starting at the upstream end moving downstream. In the midpoint of the curve the thalweg

drops down to the max depth of the pool (offset from the centerline), or $d_{MAX,POOL}$, which is recommended to be three times that of the mean riffle depth, or d_{BKF}. From the midpoint of the curve the thalweg profile moves up to the head of the downstream riffle at the PT. **Figure 11** displays a typical thalweg profile for a bankfull channel.

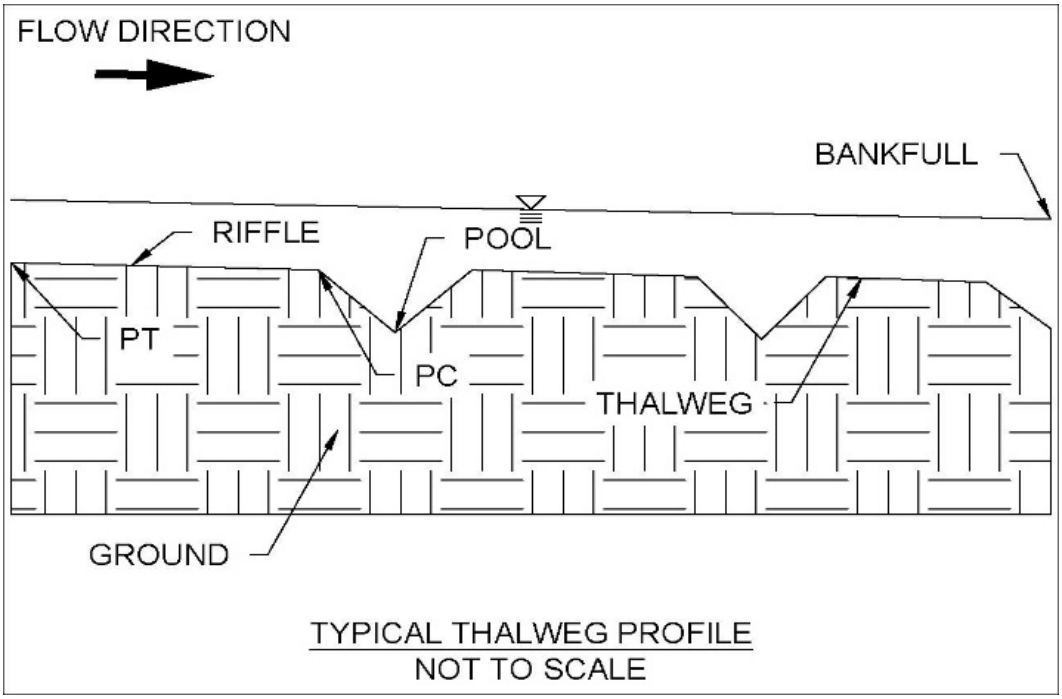


Figure 11: Typical bankfull channel thalweg and bankfull profile.

Floodplain Design

Westwood provided a 100-year flow of 55cfs for proposed Titus tributary. The design floodplain width and depth were designed to accommodate the estimated 100-year peak flood assuming a 100-year design shear stress not to exceed 1.0 psf. Discharge and velocity estimates were calculated assuming a manning's "n" of 0.06. This Manning's "n" value was used as a conservative estimate for evaluating vegetation growth on the 100-year floodplain for shear stress calculations. The proposed reach slope for Titus tributary is 1%, with a suggested 100-year floodplain width of 11 feet. While the suggested 100-yr floodplain width is 11ft the minimal recommended 100-year corridor width for Titus tributary for first creek is 30 feet to accommodate the floodplain geomorphology of the proposed Titus tributary drainage way.

Westwood provided a starting upstream invert of 5607.30' coming out of the junction from Pond B. The upstream outlet elevation of pond B is 5610'. The slope with both starting elevations will stay below 1.5% slope, this 1.5% slope has been included in reference in Table 3. In other words, the corridor width will not be dictated by the threshold shear stress but by the geomorphic corridor needed for the belt width. If there is room to slightly raise invert from 5607.30' towards 5610' that would be acceptable within the evaluation of this memo.

To calculate the recommended floodplain dimensions assuming a threshold applied shear stress value of 1.2 psf, the following equations and assumptions are used:

Floodplain depth:

$$d_{FP} = \frac{\tau}{slope \times \rho_{water}}$$

Where $d_{FP} = Floodplain\ depth$,

$$slope = bankfull\ channel\ slope\ (\frac{ft}{ft}),$$

$$\tau = shear\ stress\ (1.2\ psf),$$

$$and\ \rho_{water} = density\ of\ water\ (62.4\frac{lb}{ft^3})$$

The floodplain velocity is then calculated using Manning's equation:

$$v_{FP} = \frac{1.49}{n} d_{FP}^{2/3} \sqrt{slope}$$

Where $v_{FP} = floodplain\ velocity$,

$$n\ is\ Manning's\ n = (0.06),$$

$$and\ slope = bankfull\ slope\ (\frac{ft}{ft})$$

Using the calculated floodplain velocity and the provided discharge, the floodplain area is calculated as follows:

$$A_{FP} = \frac{Q_{100}}{v_{FP}}$$

Where $A_{FP} = floodplain\ area\ (ft^2),\ and\ Q_{100} = 100 - year\ discharge\ (ft^3/s)$

Using the calculated depth and area of the floodplain, the width is calculated as:

$$w_{FP} = \frac{A_{FP}}{d_{FP}}$$

Where $W_{FP} = floodplain\ width\ (ft)$

100-year floodplain design assumes that vegetation at Titus tributary can provide stability up to an applied shear stress of 1.2 psf. Bank stabilization can be used to reduce risk to areas that the applied shear stress nears, exceeds, or is expected to exceed 1.2 psf.

Common treatment methods based on shear stress are listed as follows:

- 0 – 1.2 psf – Treatment Seed and Straw with Riparian Plantings
- 1.2 –1.4 psf – Treatment Floodplain Coir Matting / Seed and Straw with Riparian Plantings
- 1.5 – 2.0 psf – Treatment Floodplain Boulder/ Log Sills, Floodplain Coir Matting / Seed, and Straw with Riparian Plantings
- 2.0 – 4.0 psf – Treatment Floodplain Vegetated Rip-Rap, Floodplain Coir Matting / Seed and Straw with Riparian Plantings

Drop Structures Evaluation

Channel Structure

In addition to the dimensions provided in the previous section, stabilization measures appropriate for each section are utilized to further stabilize the reach. The stabilization for the riffle sections and pool sections are described separately within the following subsections.

Riffle/Tangent Sections

If, in the future, base flow is augmented or increased it will be important to design a flood terrace channel, bankfull channel, and import gravel or other natural materials for bed stability. Augmenting each of the riffles with 4 to 8-inch riprap is recommended to reduce the risk of scour at the riffles. This is particularly important at regions downstream of "clear water" discharge points or where threshold riffle design, a riffle with minimal movement, is required. The 4–8-inch riprap will be stable in-place for all design discharges that have an applied shear stress less than 1.2 psf. **Figure 12** shows the Shield's/Rosgen Entrainment Function used for sizing particles for an applied shear stress.

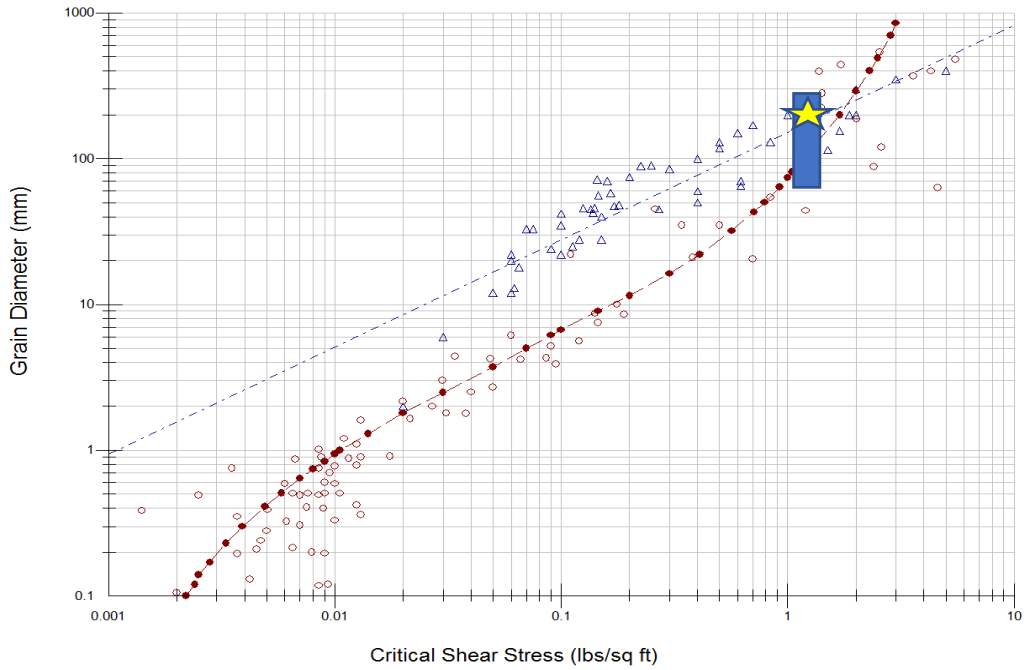


Figure 12: Shield's/Rosgen Entrainment Function. The red trendline represents the Shield's Function, while the blue line represents the Rosgen Function.

Pools/Curve Sections

Soil lift protection, haybale or toe wood treatments are recommended on the outside bends of these channels. These structures will prevent lateral migration of the channel and promote the development of lateral scour pools.

Performance Standards

Table 3: Performance Standards - Bankfull Channel Pattern - Flood Terrace and Floodplain Dimensions.

Performance Standards - Bankfull Channel Pattern - Flood Terrace and Floodplain Dimensions

Reach	Riffle Dimensions				Pool-to-Pool Spacing (ft)		Radius of Curvature (ft)		Riffle Length (ft)		Meander Wavelength (ft)		Belt Width (ft)		100-Year Floodplain					
	W_{BKF} (ft)	d_{BKF} (ft)	d_{max} (ft)	A_{BKF} (sq. ft.)	min	max	min	max	min	max	min	max	min	max	Q^1 (cfs)	Slope (%)	Design τ (psf)	W_{FP} (ft)	d_{FP} (ft)	A_{FP} (sq. ft.)
Proposed Titus Tributary	8.3	0.41	0.7	3.4	41	50	17	33	12	25	75	100	17	29	55	1.04	1.0	11	1.54	16
Proposed Titus Tributary @ 1.5%	8.3	0.41	0.7	3.4	41	50	17	33	12	25	75	100	17	29	55	1.50	1.0	16	1.07	17
Existing Titus Tributary	3.8	0.19	0.3	0.7	19	23	8	15	6	12	35	46	8	13	55	2.23	1.0	26	0.72	19

[1]Q 100-year discharge for maximum of either existing or "full buildout condition" provided by Westwood

W_{BKF} = Width bankfull, d_{BKF} = Mean depth bankfull, d_{MAX} = Max bankfull depth, A_{BKF} = Bankfull cross-sectional area, W_{FLTR} = Width flood terrace, d_{FLTR} = Depth flood terrace, A_{FLTR} = Area flood terrace,

W_{FP} = Width 100-year floodplain, d_{FP} = depth 100-yr floodplain, A_{FP} = Area 100-yr floodplain

References

NRCS. 2007. "Part 654, Chapter 11 - Rosgen Geomorphic Channel Design." In *National Engineering Handbook*. Washington D.C.

NRCS. 2007. "Part 654, Chapter 8 - Threshold Channel Design." In *National Engineering Handbook*, 8-1 to 8-43. Washington, D.C.

Appendix D

References

Flood Insurance Rate Map (FIRM)

104°41'15" 39°45'0" | 104°39'22.5" 39°45'0"

City of Aurora 080002 | Adams County Unincorporated Areas (AREA NOT INCLUDED) | City of Aurora 080002 | Arapahoe County Unincorporated Areas 080011

CITY OF AURORA / ADAMS COUNTY

ADAMS COUNTY / CITY OF AURORA

E SMITH ROAD | E COLFAX AVENUE | E 6TH AVENUE | E PARKVIEW PLACE | E CANAL PLACE | E 3RD AVENUE | E 3RD PLACE

N POWHATON ROAD | N MONAGHAN ROAD | N MILLBROOK STREET | N MUSCADINE COURT | N NEWCASTLE WAY | N MILLBROOK COURT | N NEWBERN WAY

PRIVATE ROAD | PRIVATE ROAD | PRIVATE ROAD

Harmony Filing 16

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 3 SOUTH, RANGE 65 WEST AND TOWNSHIP 4 SOUTH, RANGE 65 WEST.

First Creek — Profile Baseline — ZONE AE — Culvert

T. 3 S. / T. 4 S.

1695000 FT | 1690000 FT | 3230000 FT | 3235000 FT

39°43'7.5" 104°41'15" | 39°43'7.5" 104°39'22.5"

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT
HTTP://MSC.FEMA.GOV

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
OTHER AREAS	NO SCREEN Areas of Minimal Flood Hazard Zone X
	Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Accredited or Provisionally Accredited Levee, Dike, or Floodwall
	Non-accredited Levee, Dike, or Floodwall
	E 18.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
OTHER FEATURES	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

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

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 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 the community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided by the Arapahoe County and Cities of Aurora and Littleton GIS depts. The coordinate system used for production of the digital FIRM is Universal Transverse Mercator, Zone 13N, referenced to the North American Datum of 1983 and the GRS 1980 spheroid, Western Hemisphere.

SCALE

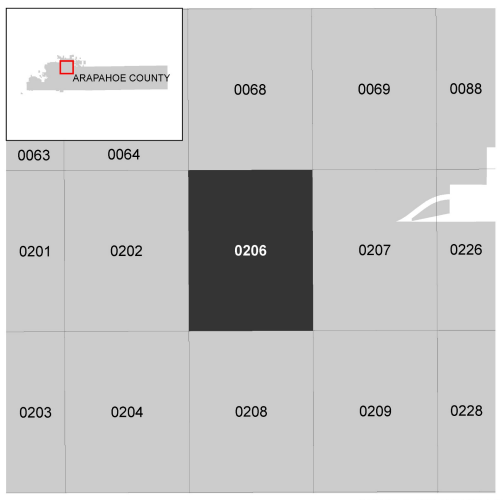
Map Projection:
NAD83 UTM Zone 13N
Western Hemisphere; Vertical Datum: NAVD88

1 inch = 500 feet 1:6,000

0 1,000 2,000 Feet

0 250 500 Meters

PANEL LOCATOR



* PANEL NOT PRINTED

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

ARAPAHOE COUNTY, COLORADO
And Incorporated Areas

PANEL 206 OF 725

Panel Contains:

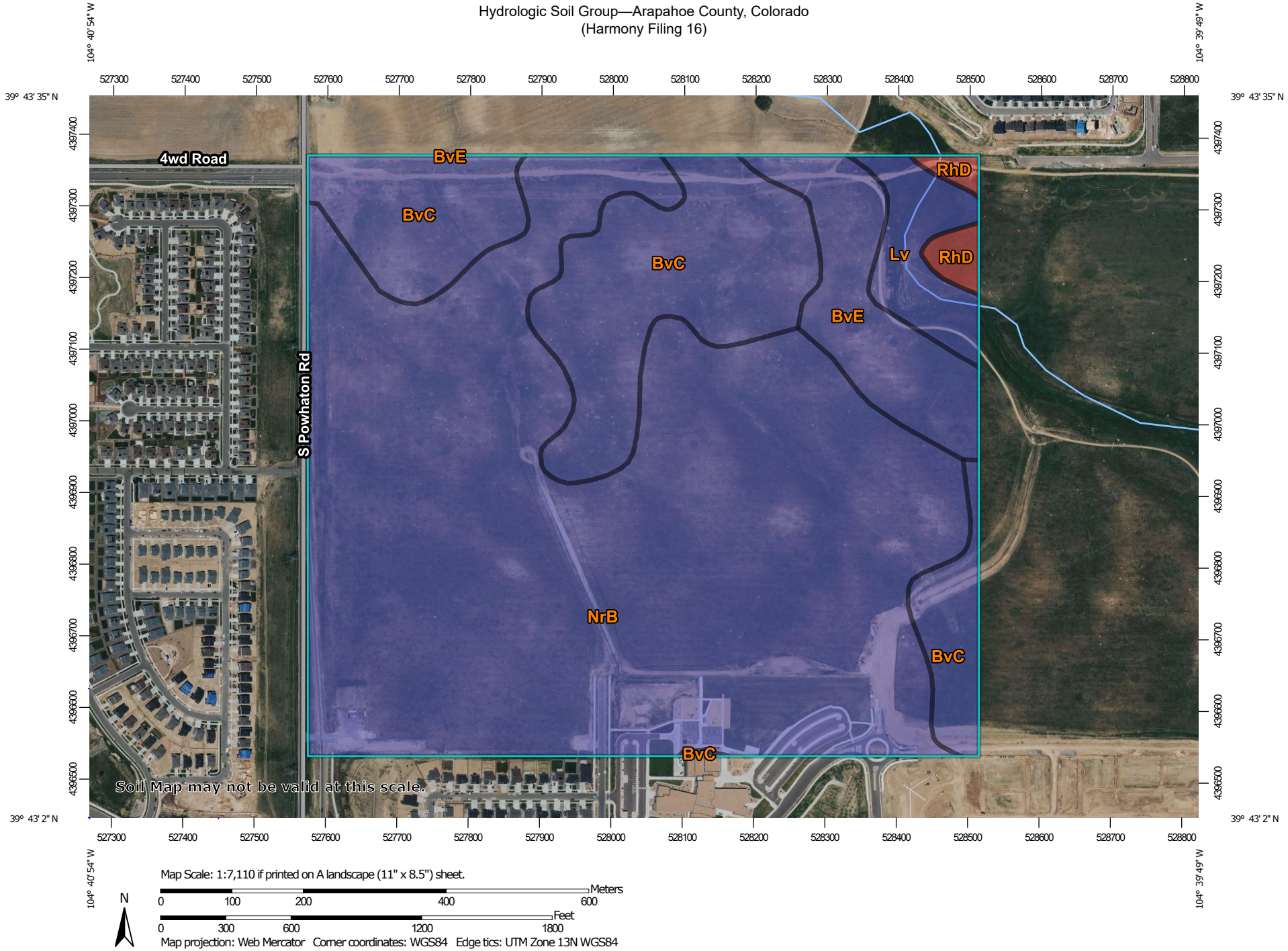
COMMUNITY	NUMBER	PANEL	SUFFIX
ARAPAHOE COUNTY	080011	0206	L
AURORA, CITY OF	080002	0206	L

VERSION NUMBER
2.3.3.2

MAP NUMBER
08005C0206L

MAP REVISED
FEBRUARY 17, 2017

USGS Soils Report


104° 40' 54" W
104° 39' 49" W
39° 43' 35" N
39° 43' 2" N
527300
527400
527500
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527800
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4wd Road
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BvE
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BvC
BvE
RhD
Lv
RhD
NrB
BvC
BvC
Soil Map may not be valid at this scale.
Map Scale: 1:7,110 if printed on A landscape (11" x 8.5") sheet.
N
Meters
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100
200
400
600
Feet
0
300
600
1200
1800
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 1:20,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Arapahoe County, Colorado
Survey Area Data: Version 18, Sep 1, 2022

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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
BvC	Bresser-Truckton sandy loams, 3 to 5 percent slopes	B	41.1	21.0%
BvE	Bresser-Truckton sandy loams, 5 to 20 percent slopes	B	12.9	6.6%
Lv	Loamy alluvial land	B	6.9	3.5%
NrB	Nunn-Bresser-Ascalon complex, 0 to 3 percent slopes	B	132.7	67.8%
RhD	Renohill-Buick loams, 3 to 9 percent slopes	D	2.1	1.1%
Totals for Area of Interest			**195.6**	**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

NOAA Atlas 14 Rainfall Table

NOAA Atlas 14, Volume 8, Version 2
Location name: Aurora, Colorado, USA*
Latitude: 39.7219°, Longitude: -104.6742°
Elevation: 5602.8 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.228 (0.184-0.284)	0.283 (0.228-0.352)	0.380 (0.305-0.475)	0.468 (0.374-0.587)	0.601 (0.468-0.791)	0.712 (0.539-0.946)	0.831 (0.606-1.13)	0.960 (0.670-1.33)	1.14 (0.766-1.63)	1.29 (0.838-1.85)
10-min	0.334 (0.269-0.416)	0.414 (0.333-0.516)	0.556 (0.447-0.695)	0.685 (0.547-0.860)	0.880 (0.685-1.16)	1.04 (0.789-1.39)	1.22 (0.888-1.65)	1.41 (0.982-1.95)	1.67 (1.12-2.38)	1.89 (1.23-2.71)
15-min	0.407 (0.329-0.507)	0.505 (0.407-0.629)	0.678 (0.545-0.848)	0.836 (0.667-1.05)	1.07 (0.835-1.41)	1.27 (0.962-1.69)	1.48 (1.08-2.01)	1.71 (1.20-2.38)	2.04 (1.37-2.91)	2.30 (1.50-3.30)
30-min	0.558 (0.450-0.695)	0.689 (0.555-0.859)	0.923 (0.741-1.15)	1.14 (0.907-1.43)	1.46 (1.13-1.92)	1.72 (1.31-2.29)	2.01 (1.47-2.73)	2.32 (1.62-3.23)	2.76 (1.85-3.94)	3.12 (2.03-4.47)
60-min	0.695 (0.561-0.866)	0.853 (0.687-1.06)	1.14 (0.913-1.42)	1.40 (1.12-1.76)	1.79 (1.40-2.37)	2.13 (1.61-2.83)	2.49 (1.82-3.38)	2.88 (2.01-4.00)	3.43 (2.30-4.89)	3.88 (2.52-5.57)
2-hr	0.832 (0.675-1.03)	1.02 (0.825-1.26)	1.35 (1.09-1.68)	1.66 (1.33-2.07)	2.13 (1.67-2.79)	2.53 (1.93-3.34)	2.96 (2.18-3.99)	3.43 (2.42-4.74)	4.10 (2.77-5.80)	4.65 (3.04-6.60)
3-hr	0.915 (0.745-1.13)	1.11 (0.905-1.37)	1.47 (1.19-1.82)	1.80 (1.45-2.24)	2.31 (1.82-3.02)	2.74 (2.10-3.61)	3.21 (2.37-4.31)	3.72 (2.64-5.12)	4.45 (3.03-6.26)	5.05 (3.32-7.13)
6-hr	1.10 (0.901-1.34)	1.32 (1.08-1.62)	1.73 (1.41-2.12)	2.11 (1.71-2.59)	2.68 (2.13-3.46)	3.16 (2.44-4.12)	3.69 (2.74-4.90)	4.26 (3.04-5.79)	5.07 (3.47-7.06)	5.73 (3.80-8.02)
12-hr	1.35 (1.12-1.64)	1.62 (1.33-1.96)	2.09 (1.72-2.54)	2.52 (2.06-3.07)	3.15 (2.51-4.02)	3.68 (2.86-4.74)	4.25 (3.18-5.58)	4.86 (3.49-6.53)	5.72 (3.94-7.87)	6.41 (4.29-8.89)
24-hr	1.64 (1.36-1.97)	1.96 (1.63-2.35)	2.50 (2.07-3.02)	2.98 (2.45-3.61)	3.68 (2.94-4.62)	4.24 (3.31-5.39)	4.83 (3.64-6.27)	5.46 (3.94-7.25)	6.33 (4.39-8.61)	7.02 (4.74-9.64)
2-day	1.93 (1.61-2.30)	2.29 (1.91-2.73)	2.90 (2.42-3.47)	3.43 (2.84-4.11)	4.17 (3.35-5.17)	4.76 (3.73-5.97)	5.37 (4.07-6.88)	6.00 (4.36-7.88)	6.86 (4.80-9.23)	7.53 (5.13-10.3)
3-day	2.10 (1.77-2.49)	2.48 (2.08-2.95)	3.11 (2.60-3.71)	3.65 (3.04-4.37)	4.42 (3.56-5.45)	5.03 (3.96-6.27)	5.65 (4.30-7.20)	6.30 (4.60-8.22)	7.18 (5.05-9.61)	7.87 (5.39-10.7)
4-day	2.24 (1.88-2.65)	2.62 (2.21-3.11)	3.27 (2.74-3.88)	3.83 (3.19-4.56)	4.61 (3.73-5.67)	5.24 (4.13-6.51)	5.88 (4.49-7.46)	6.54 (4.79-8.51)	7.45 (5.25-9.92)	8.15 (5.60-11.0)
7-day	2.56 (2.16-3.00)	2.98 (2.52-3.50)	3.68 (3.10-4.34)	4.28 (3.59-5.06)	5.12 (4.16-6.24)	5.78 (4.59-7.13)	6.46 (4.96-8.13)	7.15 (5.28-9.22)	8.10 (5.75-10.7)	8.83 (6.11-11.8)
10-day	2.84 (2.41-3.32)	3.29 (2.79-3.85)	4.04 (3.42-4.74)	4.67 (3.93-5.50)	5.55 (4.52-6.72)	6.24 (4.97-7.65)	6.94 (5.35-8.69)	7.66 (5.67-9.82)	8.63 (6.15-11.3)	9.37 (6.51-12.5)
20-day	3.67 (3.14-4.26)	4.19 (3.58-4.87)	5.06 (4.31-5.89)	5.77 (4.89-6.74)	6.76 (5.54-8.09)	7.52 (6.03-9.11)	8.28 (6.42-10.3)	9.05 (6.75-11.5)	10.1 (7.23-13.1)	10.8 (7.60-14.3)
30-day	4.34 (3.73-5.02)	4.95 (4.25-5.72)	5.94 (5.08-6.88)	6.74 (5.73-7.84)	7.83 (6.44-9.32)	8.66 (6.97-10.4)	9.48 (7.39-11.7)	10.3 (7.72-13.0)	11.4 (8.21-14.7)	12.2 (8.58-15.9)
45-day	5.17 (4.46-5.95)	5.91 (5.09-6.80)	7.09 (6.09-8.17)	8.04 (6.87-9.30)	9.31 (7.67-11.0)	10.2 (8.27-12.3)	11.2 (8.72-13.6)	12.1 (9.06-15.1)	13.2 (9.56-16.9)	14.0 (9.93-18.3)
60-day	5.86 (5.07-6.71)	6.73 (5.81-7.72)	8.11 (6.98-9.31)	9.20 (7.88-10.6)	10.6 (8.78-12.5)	11.7 (9.46-13.9)	12.7 (9.95-15.4)	13.7 (10.3-17.0)	14.9 (10.8-18.9)	15.7 (11.2-20.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

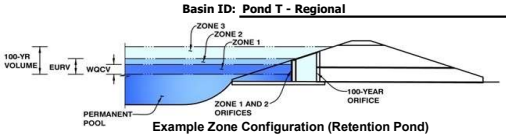
Harmony Filing 16 Offsites Pond T and Pond U Detention Sheets

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Harmony Phase 6 - Filing 16

Basin ID: Pond T - Regional



Example Zone Configuration (Retention Pond)

Stage 0 = 5581.50 **EURV Elev. =** 5585.54 **Top of Embankme** 5590.00 **Q100 (cfs) = 98.36**

WQ Elev. = 5584.34 **100 YR Elev. =** 5586.59

Depth Increment = 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		
5582	--	0.50	--	--	--	931	0.021	245	0.006
5583	--	1.50	--	--	--	19,153	0.440	10,287	0.236
5584	--	2.50	--	--	--	72,054	1.654	55,890	1.283
5585	--	3.50	--	--	--	151,519	3.478	167,676	3.849
5586	--	4.50	--	--	--	208,296	4.782	347,584	7.979
5587	--	5.50	--	--	--	230,593	5.294	567,028	13.017
5588	--	6.50	--	--	--	248,667	5.709	806,658	18.518
5589	--	7.50	--	--	--	259,008	5.946	1,060,496	24.346
5590	--	8.50	--	--	--	264,853	6.080	1,322,426	30.359

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	117.93	acres
Watershed Length =	4,055	ft
Watershed Length to Centroid =	2,169	ft
Watershed Slope =	0.010	ft/ft
Watershed Imperviousness =	46.90%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

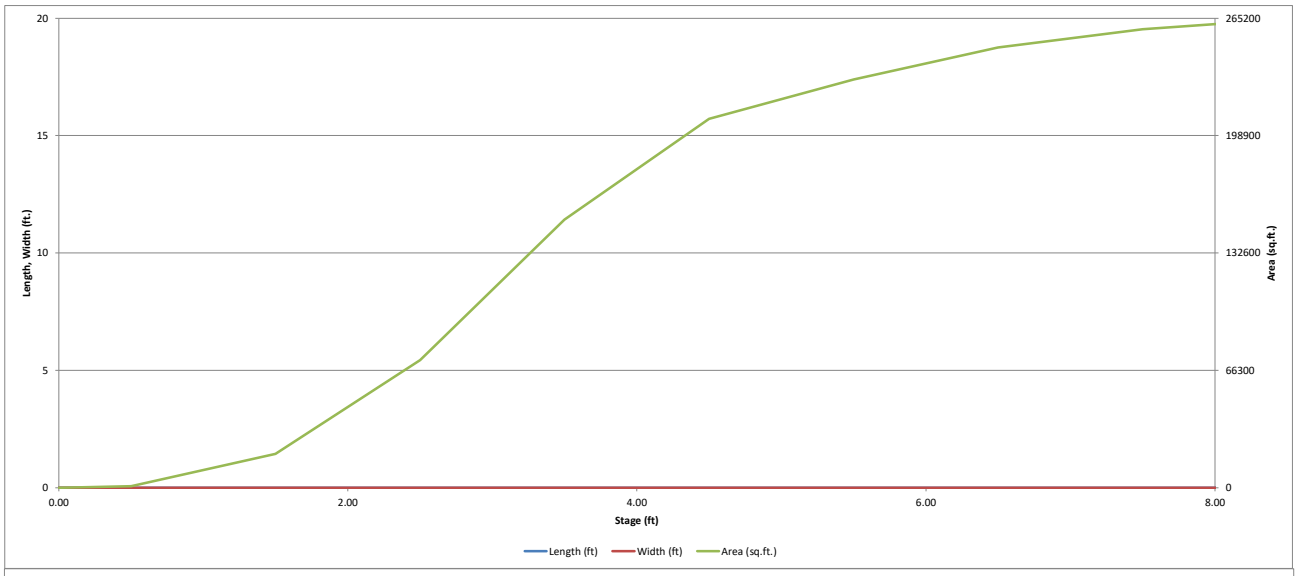
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.945	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	5.883	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.85 in.) =	3.480	acre-feet	0.85	inches
5-yr Runoff Volume (P1 = 1.14 in.) =	5.114	acre-feet	1.14	inches
10-yr Runoff Volume (P1 = 1.4 in.) =	7.220	acre-feet	1.40	inches
25-yr Runoff Volume (P1 = 1.79 in.) =	11.492	acre-feet	1.79	inches
50-yr Runoff Volume (P1 = 2.13 in.) =	14.800	acre-feet	2.13	inches
100-yr Runoff Volume (P1 = 2.48 in.) =	18.750	acre-feet	2.48	inches
500-yr Runoff Volume (P1 = 3.43 in.) =	28.532	acre-feet	3.43	inches
Approximate 2-yr Detention Volume =	3.160	acre-feet		
Approximate 5-yr Detention Volume =	4.618	acre-feet		
Approximate 10-yr Detention Volume =	6.506	acre-feet		
Approximate 25-yr Detention Volume =	8.010	acre-feet		
Approximate 50-yr Detention Volume =	8.867	acre-feet		
Approximate 100-yr Detention Volume =	10.368	acre-feet		

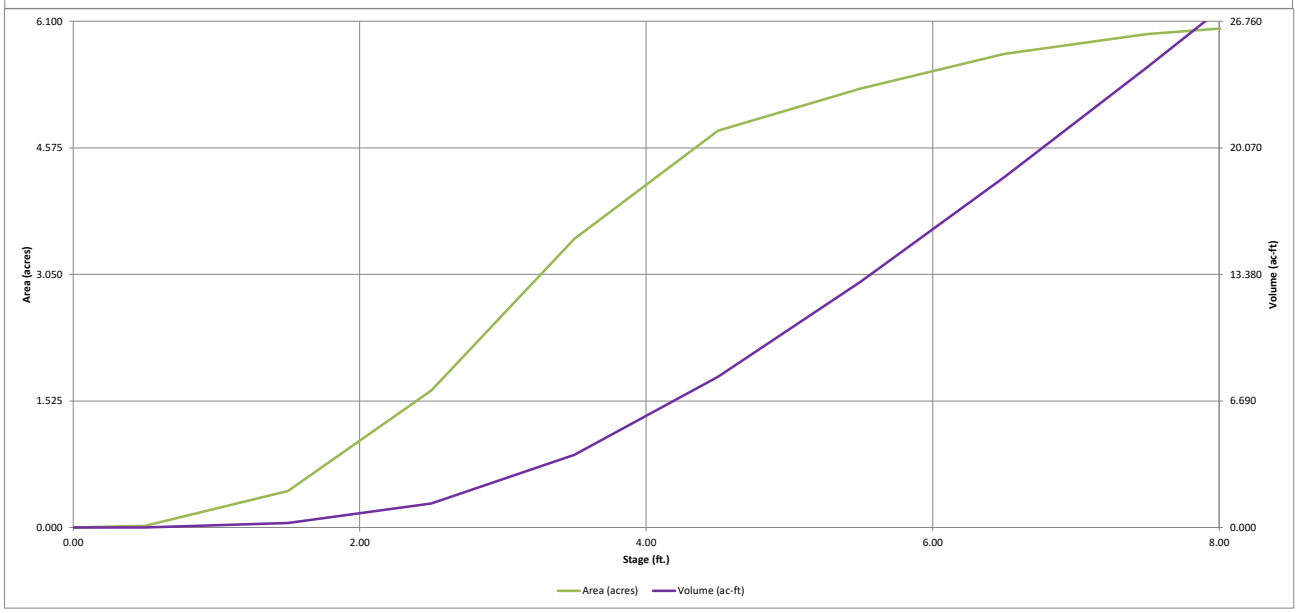
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.945	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.937	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.485	acre-feet
Total Detention Basin Volume =	10.368	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

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



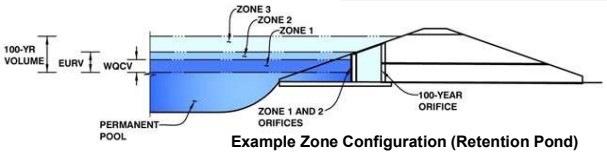


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Harmony Phase 6 - Filing 16**

Basin ID: **Pond T - Regional**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.84	1.945	Orifice Plate
Zone 2 (EURV)	4.04	3.937	Orifice Plate
Zone 3 (100-year)	4.99	4.485	Weir&Pipe (Rect.)
Total (all zones)		10.368	

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)

Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft^2

Underdrain Orifice Centroid = 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)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.10	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)	0.13	1.50	3.00					
Orifice Area (sq. inches)	7.07	12.57	28.27					

	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		Calculated Parameters for Vertical Orifice	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				

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		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.10	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.10	N/A	feet
Overflow Weir Front Edge Length =	28.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	8.44	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	88.59	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	44.30	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

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

	Zone 3 Rectangular	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Rectangular	Not Selected	
Depth to Invert of Outlet Pipe =	0.20	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	10.50	N/A	ft^2
Rectangular Orifice Width =	42.00	N/A	inches	Outlet Orifice Centroid =	1.50	N/A	feet
Rectangular Orifice Height =	36.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=		ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	feet
Spillway Crest Length =		feet	f Freeboard =	feet
Spillway End Slopes =		H:V	f Freeboard =	acres
Freeboard above Max Water Surface =		feet	f Freeboard =	acre-ft

Calculated Parameters for Spillway

Spillway calculations are not provided because we are proposing an emergency overflow structure for Regional Pond B. Please see the additional overflow structure calculations provided after this UD detention sheet. See the **Preliminary Drainage Report Section D.3.B.** for more discussion on the overflow structure calculation methods and why we chose this design.

Routed Hydrograph Results

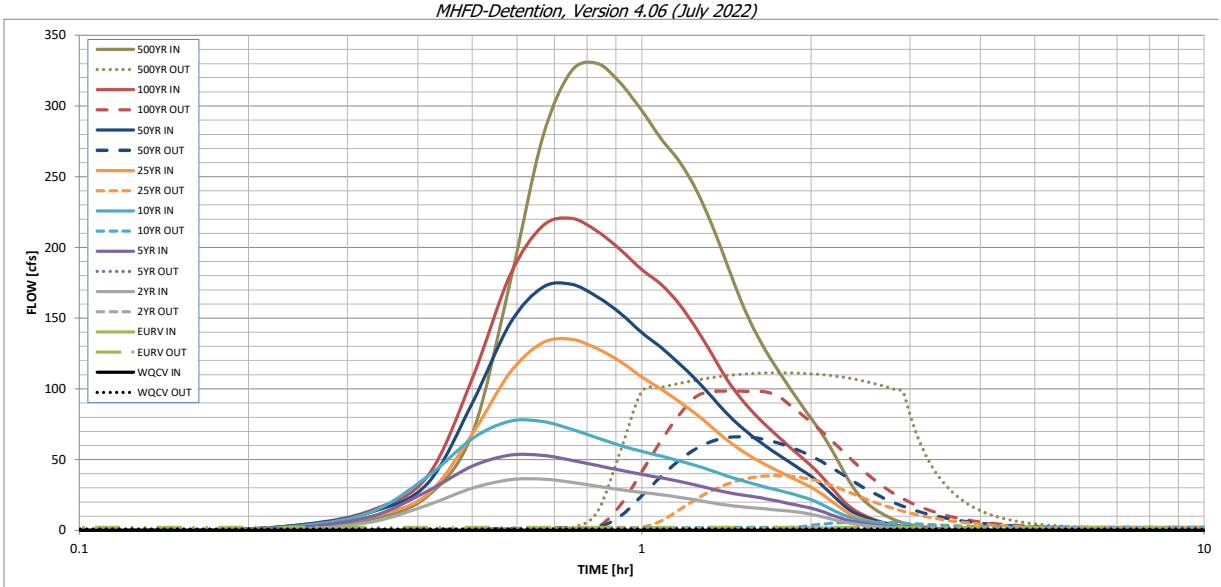
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

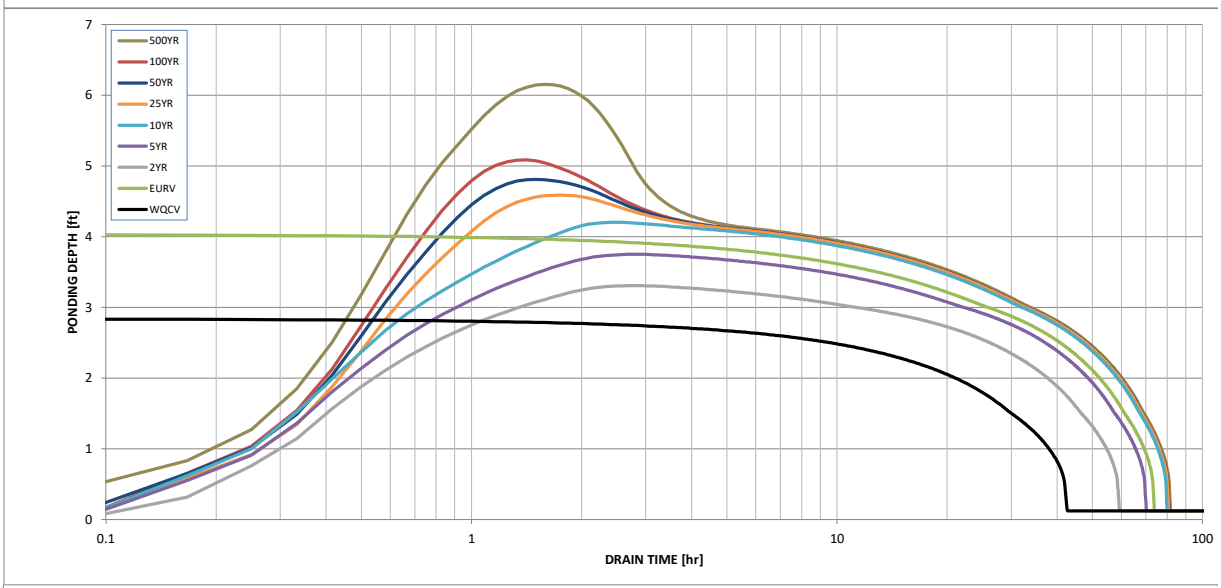
	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Design Storm Return Period =								
One-Hour Rainfall Depth (in) =	N/A	N/A	0.85	1.14	1.40	1.79	2.13	2.48
CUHP Runoff Volume (acre-ft) =	1.945	5.883	3.480	5.114	7.220	11.492	14.800	18.750
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.480	5.114	7.220	11.492	14.800	18.750
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.7	2.8	15.6	53.2	77.0	107.3
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	0.13	0.45	0.65	0.91
Peak Inflow Q (cfs) =	N/A	N/A	36.2	53.1	77.1	135.0	173.9	220.5
Peak Outflow Q (cfs) =	0.9	2.1	1.5	1.9	5.8	38.6	66.2	98.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.4	0.7	0.9	0.9
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.4	0.7	1.1
Max Velocity through Grate 2 (fps) =	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	64	53	61	68	65	63	61
Time to Drain 99% of Inflow Volume (hours) =	**41**	70	57	67	75	74	73	71
Maximum Ponding Depth (ft) =	2.84	4.04	3.31	3.75	4.20	4.59	4.81	5.09
Area at Maximum Ponding Depth (acres) =	2.27	4.18	3.11	3.79	4.39	4.82	4.94	5.08
Maximum Volume Stored (acre-ft) =	1.951	5.918	3.190	4.722	6.604	8.364	9.486	10.839

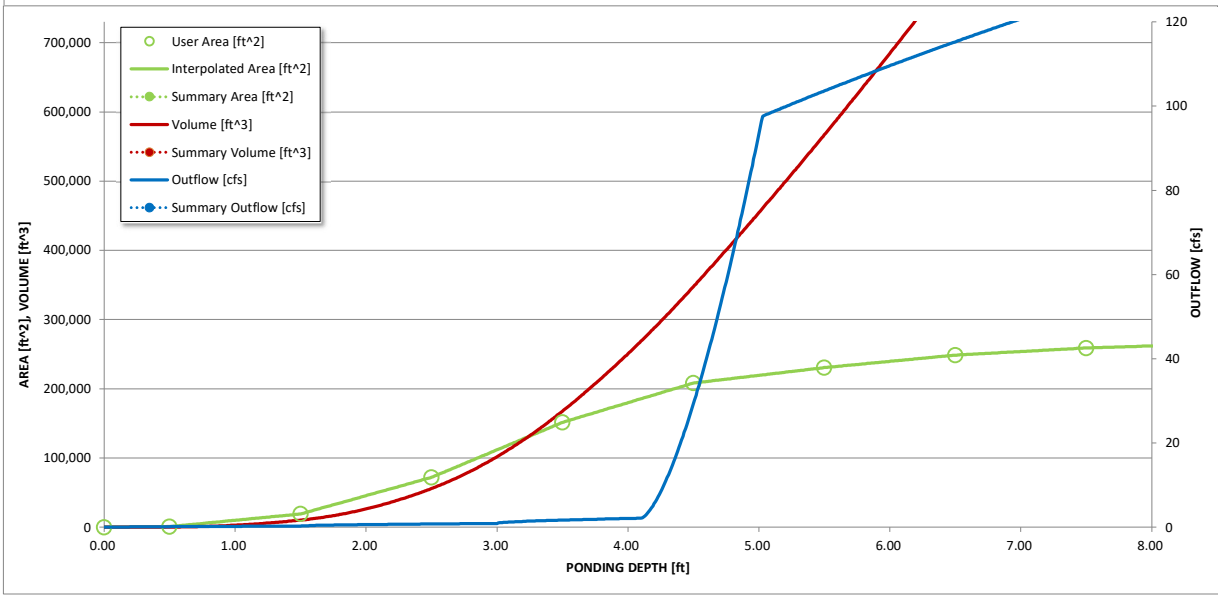
SINCE THE EMEREGNCY OVERFLOW IS NOT DESIGNED ON THIS SHEET, THE INFORMATION PROVIDED IN THIS COLUMN IS NOT ACCURATE AND THEREFORE, WILL NOT BE SHOWN. PLEASE SEE OVERFLOW STRUCTURE DESIGN PROVIDED AFTER THIS UD DETENTION SHEET.

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.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	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	0.00	1.36
	0:15:00	0.00	0.00	0.79	2.27	3.37	2.71	3.99	4.11	8.22
	0:20:00	0.00	0.00	6.18	10.28	13.60	10.06	13.27	14.63	24.26
	0:25:00	0.00	0.00	17.94	27.91	38.15	25.56	33.35	38.41	68.81
	0:30:00	0.00	0.00	29.94	45.43	64.90	68.26	90.20	107.67	174.81
	0:35:00	0.00	0.00	35.74	53.13	77.14	111.49	146.07	180.27	277.64
	0:40:00	0.00	0.00	36.17	53.02	76.91	132.57	171.83	215.06	324.73
	0:45:00	0.00	0.00	33.97	49.50	71.43	134.97	173.88	220.55	330.19
	0:50:00	0.00	0.00	31.14	45.84	65.42	128.47	165.14	211.47	316.26
	0:55:00	0.00	0.00	28.69	42.43	60.03	119.31	153.50	198.49	296.81
	1:00:00	0.00	0.00	26.74	39.52	55.81	108.45	139.87	184.43	276.63
	1:05:00	0.00	0.00	25.19	37.02	52.38	99.69	129.10	173.72	260.96
	1:10:00	0.00	0.00	23.41	34.59	49.05	90.93	117.92	159.90	240.84
	1:15:00	0.00	0.00	21.38	31.95	45.75	82.13	106.38	142.76	216.02
	1:20:00	0.00	0.00	19.40	29.17	42.16	72.96	94.31	124.55	188.94
	1:25:00	0.00	0.00	17.79	26.82	38.52	64.14	82.77	107.08	162.85
	1:30:00	0.00	0.00	16.66	25.10	35.41	56.84	73.34	93.39	142.40
	1:35:00	0.00	0.00	15.80	23.73	32.77	50.99	65.65	82.74	126.23
	1:40:00	0.00	0.00	15.05	22.21	30.40	46.13	59.17	73.98	112.78
	1:45:00	0.00	0.00	14.33	20.53	28.23	41.78	53.35	66.12	100.69
	1:50:00	0.00	0.00	13.62	18.87	26.17	37.84	48.08	58.93	89.64
	1:55:00	0.00	0.00	12.61	17.28	24.08	34.11	43.08	52.16	79.20
	2:00:00	0.00	0.00	11.35	15.69	21.73	30.50	38.29	45.76	69.34
	2:05:00	0.00	0.00	9.79	13.56	18.61	26.09	32.58	38.66	58.44
	2:10:00	0.00	0.00	8.05	11.09	15.10	21.11	26.23	30.99	46.63
	2:15:00	0.00	0.00	6.44	8.82	11.91	16.30	20.13	23.63	35.50
	2:20:00	0.00	0.00	5.14	7.06	9.53	12.10	14.89	17.32	26.41
	2:25:00	0.00	0.00	4.19	5.78	7.84	9.34	11.51	13.13	20.23
	2:30:00	0.00	0.00	3.47	4.77	6.49	7.34	9.04	10.11	15.65
	2:35:00	0.00	0.00	2.87	3.96	5.37	5.85	7.18	7.79	12.12
	2:40:00	0.00	0.00	2.38	3.26	4.40	4.64	5.67	5.96	9.29
	2:45:00	0.00	0.00	1.95	2.66	3.57	3.69	4.48	4.52	7.05
	2:50:00	0.00	0.00	1.59	2.15	2.86	2.91	3.50	3.40	5.30
	2:55:00	0.00	0.00	1.30	1.72	2.29	2.29	2.74	2.59	4.05
	3:00:00	0.00	0.00	1.06	1.38	1.83	1.84	2.19	2.09	3.23
	3:05:00	0.00	0.00	0.87	1.11	1.45	1.47	1.74	1.68	2.58
	3:10:00	0.00	0.00	0.69	0.87	1.14	1.16	1.37	1.34	2.05
	3:15:00	0.00	0.00	0.53	0.66	0.88	0.89	1.05	1.04	1.59
	3:20:00	0.00	0.00	0.40	0.49	0.66	0.67	0.78	0.77	1.18
	3:25:00	0.00	0.00	0.28	0.35	0.46	0.48	0.56	0.55	0.83
	3:30:00	0.00	0.00	0.19	0.23	0.31	0.32	0.37	0.36	0.54
	3:35:00	0.00	0.00	0.11	0.14	0.18	0.19	0.22	0.21	0.32
	3:40:00	0.00	0.00	0.06	0.08	0.09	0.10	0.11	0.10	0.15
	3:45:00	0.00	0.00	0.02	0.03	0.03	0.03	0.04	0.03	0.04
	3:50:00	0.00	0.00	0.01	0.01	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)

<u>Summary Stage-Area-Volume-Discharge Relationships</u>

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).

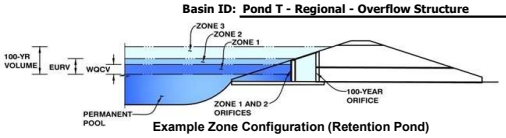
EMERGENCY OVERFLOW STRUCTURE DESIGN SHEET

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **Harmony Phase 6 - Filing 16**

Basin ID: **Pond T - Regional - Overflow Structure**



Example Zone Configuration (Retention Pond)

Stage 0 = **5581.50**

Emergency Overflow Ponding WSEL = **5587.91**

Top of Embankment = **5589.40**

Qemer (cfs) = **220.50**

Depth Increment = ft

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	117.93	acres
Watershed Length =	4,055	ft
Watershed Length to Centroid =	2,169	ft
Watershed Slope =	0.010	ft/ft
Watershed Imperviousness =	46.90%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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) =	1.945	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	5.883	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 0.85 in.) =	3.480	acre-feet	0.85 inches
5-yr Runoff Volume (P1 = 1.14 in.) =	5.114	acre-feet	1.14 inches
10-yr Runoff Volume (P1 = 1.4 in.) =	7.220	acre-feet	1.40 inches
25-yr Runoff Volume (P1 = 1.79 in.) =	11.492	acre-feet	1.79 inches
50-yr Runoff Volume (P1 = 2.13 in.) =	14.800	acre-feet	2.13 inches
100-yr Runoff Volume (P1 = 2.48 in.) =	18.750	acre-feet	2.48 inches
500-yr Runoff Volume (P1 = 3.43 in.) =	28.532	acre-feet	3.43 inches
Approximate 2-yr Detention Volume =	3.160	acre-feet	
Approximate 5-yr Detention Volume =	4.618	acre-feet	
Approximate 10-yr Detention Volume =	6.506	acre-feet	
Approximate 25-yr Detention Volume =	8.010	acre-feet	
Approximate 50-yr Detention Volume =	8.867	acre-feet	
Approximate 100-yr Detention Volume =	10.368	acre-feet	

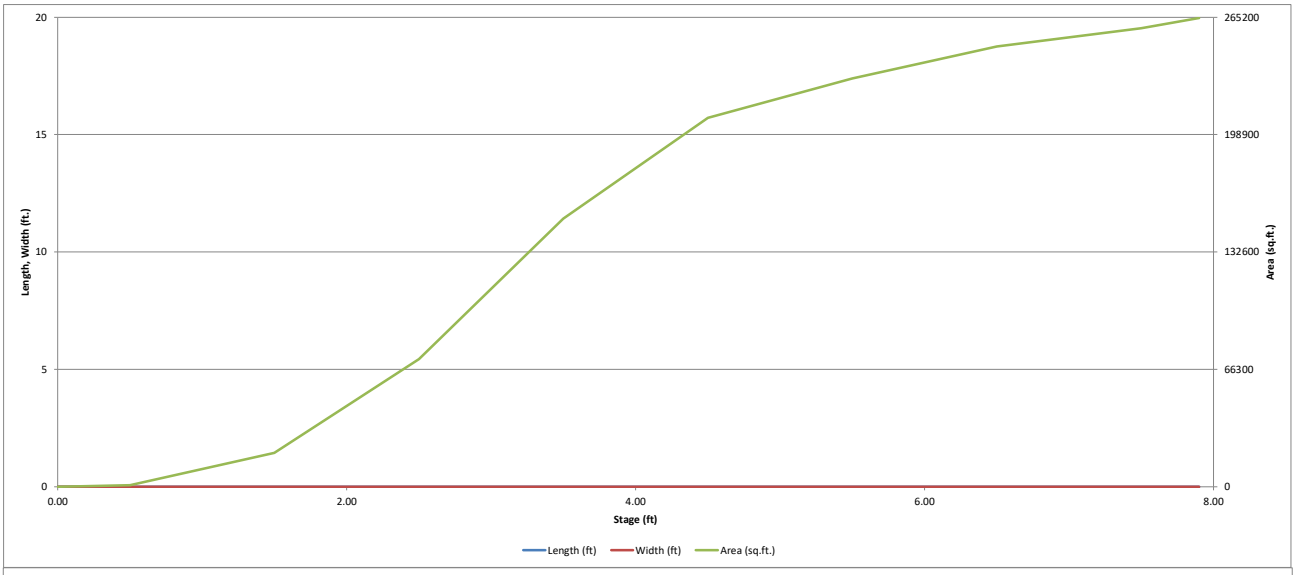
Define Zones and Basin Geometry

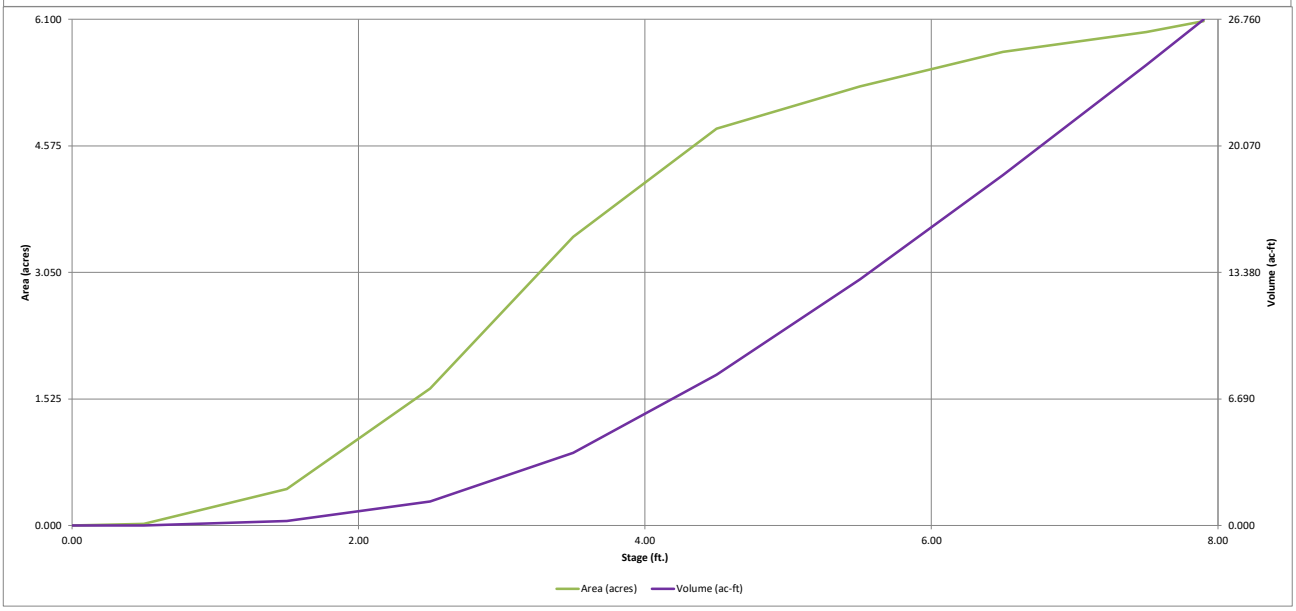
Zone 1 Volume (WQCV) =	1.945	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.937	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.485	acre-feet
Total Detention Basin Volume =	10.368	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention 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

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		
5582	--	0.50	--	--	--	931	0.021	245	0.006
5583	--	1.50	--	--	--	19,153	0.440	10,287	0.236
5584	--	2.50	--	--	--	72,054	1.654	55,890	1.283
5585	--	3.50	--	--	--	151,519	3.478	167,676	3.849
5586	--	4.50	--	--	--	208,296	4.782	347,584	7.979
5587	--	5.50	--	--	--	230,593	5.294	567,028	13.017
5588	--	6.50	--	--	--	248,667	5.709	806,658	18.518
5589	--	7.50	--	--	--	259,008	5.946	1,060,496	24.346
5589.4	--	7.90	--	--	--	264,853	6.080	1,165,268	26.751

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)





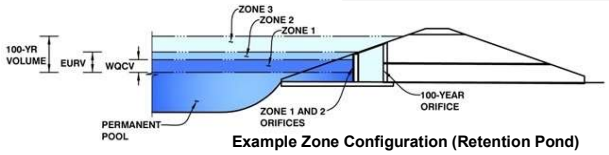
FOR THE EMERGENCY SCENARIO, WE WILL ASSUME THE OUTLET STRUCTURE IS COMPLETELY CLOGGED AND NOT FUNCTIONING. THE ORIFICE PLATE THAT CONTROLS THE WQCV & EURV AND THE 100 YEAR WEIR ARE NOT UTILIZED ON THIS SHEET TO SIMULATE A 100% CLOGGED OUTLET STRUCTURE. ZONE 3 WILL BE SET TO THE EMERGENCY OVERFLOW STRUCTURE INVERT WHICH IS JUST ABOVE THE 100 YEAR WSEL. THIS WILL ALLOW US TO DESIGN THE OVERFLOW STRUCTURE FOR AN EMERGENCY EVENT. Q(EMER) = 100 YEAR DEVELOPED INFLOW.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Harmony Phase 6 - Filing 16

Basin ID: Pond T - Regional - Overflow Structure



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.84	1.945	
Zone 2 (EURV)	4.04	3.937	
Zone 3 (100-year)	4.99	4.485	Weir&Pipe (Restrict)
Total (all zones)		10.368	

THIS SECTION WILL BE USED TO DESIGN OVERFLOW STRUCTURE

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)

Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²

Underdrain Orifice Centroid = 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 = ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = inches

Orifice Plate: Orifice Area per Row = sq. inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A ft²
Elliptical Half-Width =	N/A feet
Elliptical Slot Centroid =	N/A feet
Elliptical Slot Area =	N/A ft²

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)	ow 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Orifice Area (sq. inches)								

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	ow 16 (optional)
Stage of Orifice Centroid (ft)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	ft²
Vertical Orifice Centroid =	N/A	N/A	feet

POND T 100 YEAR PONDING DEPTH IS 5.08' (SEE PREVIOUS POND T UD DETENTION SHEET). OVERFLOW INVERT SET TO 5.10' TO ENSURE OVERFLOW IS CAPTURED FOR ANY PONDING ABOVE 100 YEAR WSEL.

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 =	20.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	8.00	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 =	5.10	N/A	feet
Overflow Weir Slope Length =	8.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	4.48	N/A	
Overflow Grate Open Area w/o Debris =	126.56	N/A	ft²
Overflow Grate Open Area w/ Debris =	63.28	N/A	ft²

50% CLOGGING FATCOR APPLIED TO GRATE.

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 =	0.20	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	72.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	72.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	28.27	N/A	ft²
Outlet Orifice Centroid =	3.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= ft (relative t

Spillway Crest Length = feet

Spillway End Slopes = H:V

Freeboard above Max Water Surface = feet

SPILLWAY IS NOT PROPOSED THEREFORE NO DESIGN IS PROVIDED

Calculated Parameters for Spillway

Spillway Design Flow Depth= feet

Stage at Top of Freeboard = feet

Area at Top of Freeboard = acres

Basin Volume at Top of Freeboard = acre-ft

Q(EMER) = 100 YEAR DEVELOPED INFLOW FOR POND T

Routed Hydrograph Results

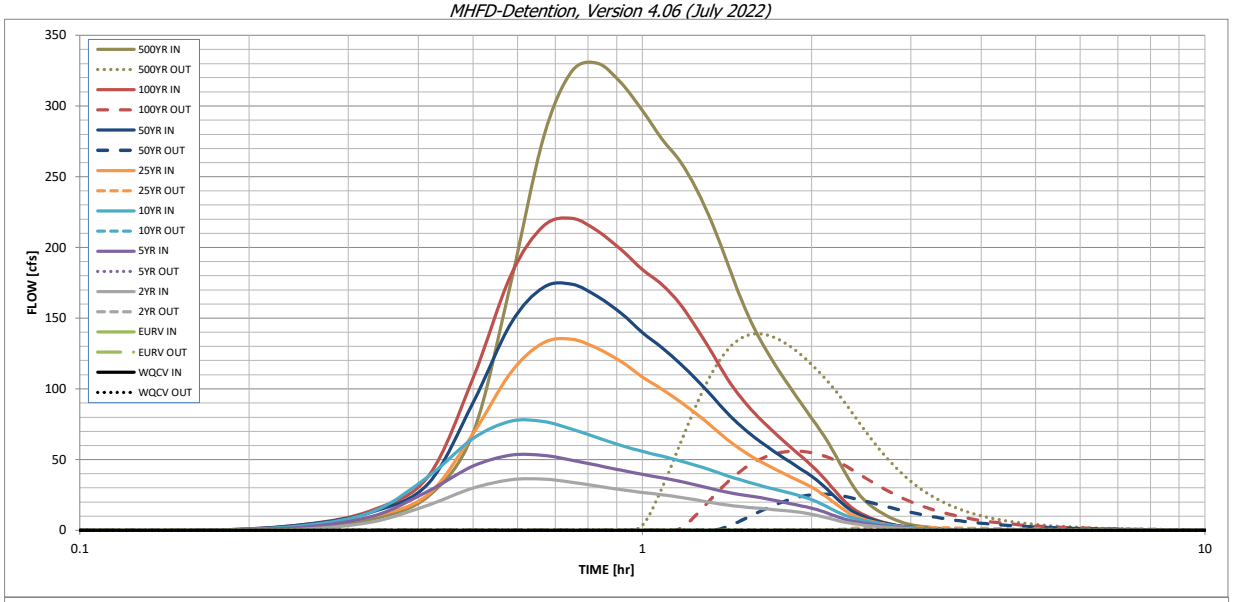
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

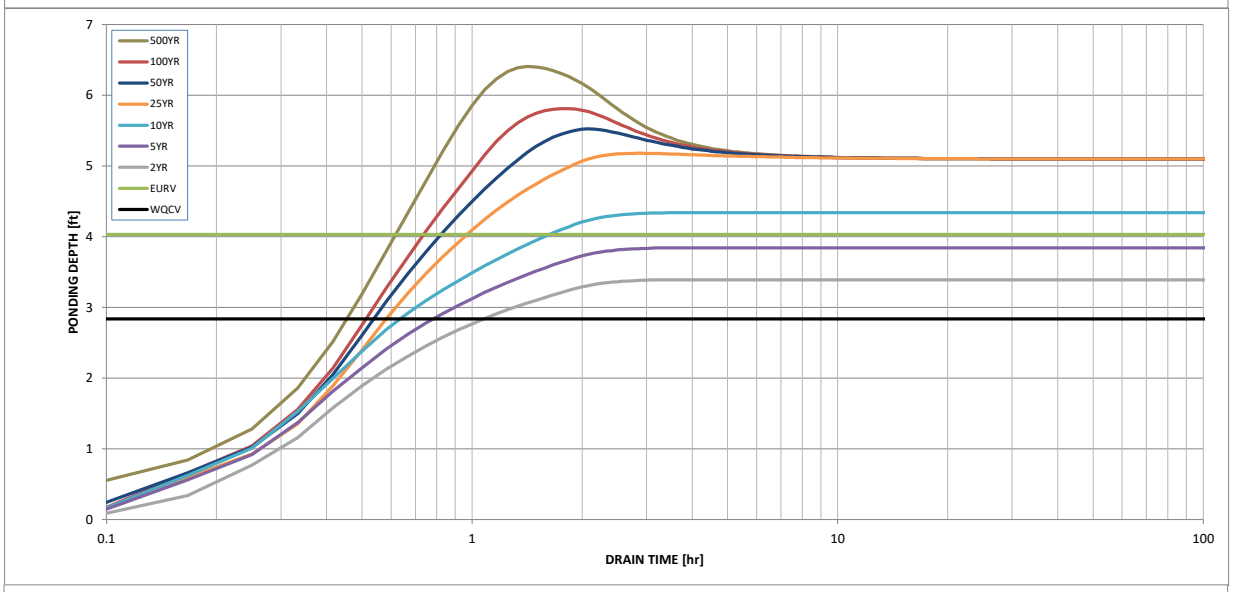
	EMERGENCY OVERFLOW
Design Storm Return Period =	
One-Hour Rainfall Depth (in) =	3.43
CUHP Runoff Volume (acre-ft) =	28.532
Inflow Hydrograph Volume (acre-ft) =	28.532
CUHP Predevelopment Peak Q (cfs) =	176.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	220.5
Predevelopment Unit Peak Flow, q (cfs/acre) =	1.87
Peak Inflow Q (cfs) =	
Peak Outflow Q (cfs) =	138.9
Ratio Peak Outflow to Predevelopment Q =	0.6
Structure Controlling Flow =	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	1.1
Max Velocity through Grate 2 (fps) =	N/A
Time to Drain 97% of Inflow Volume (hours) =	>120
Time to Drain 99% of Inflow Volume (hours) =	>120
Maximum Ponding Depth (ft) =	6.41
Area at Maximum Ponding Depth (acres) =	5.67
Maximum Volume Stored (acre-ft) =	17.950

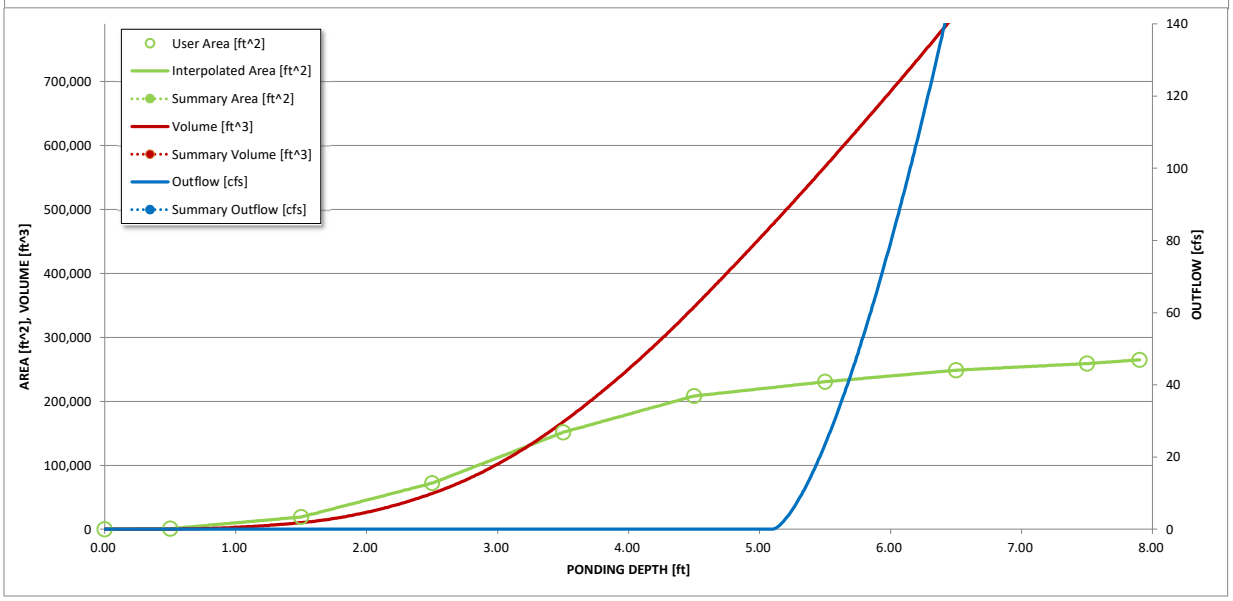
EMERGENCY PONDING DEPTH

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	0.00	1.36
	0:15:00	0.00	0.00	0.79	2.27	3.37	2.71	3.99	4.11	8.22
	0:20:00	0.00	0.00	6.18	10.28	13.60	10.06	13.27	14.63	24.26
	0:25:00	0.00	0.00	17.94	27.91	38.15	25.56	33.35	38.41	68.81
	0:30:00	0.00	0.00	29.94	45.43	64.90	68.26	90.20	107.67	174.81
	0:35:00	0.00	0.00	35.74	53.13	77.14	111.49	146.07	180.27	277.64
	0:40:00	0.00	0.00	36.17	53.02	76.91	132.57	171.83	215.06	324.73
	0:45:00	0.00	0.00	33.97	49.50	71.43	134.97	173.88	220.55	330.19
	0:50:00	0.00	0.00	31.14	45.84	65.42	128.47	165.14	211.47	316.26
	0:55:00	0.00	0.00	28.69	42.43	60.03	119.31	153.50	198.49	296.81
	1:00:00	0.00	0.00	26.74	39.52	55.81	108.45	139.87	184.43	276.63
	1:05:00	0.00	0.00	25.19	37.02	52.38	99.69	129.10	173.72	260.96
	1:10:00	0.00	0.00	23.41	34.59	49.05	90.93	117.92	159.90	240.84
	1:15:00	0.00	0.00	21.38	31.95	45.75	82.13	106.38	142.76	216.02
	1:20:00	0.00	0.00	19.40	29.17	42.16	72.96	94.31	124.55	188.94
	1:25:00	0.00	0.00	17.79	26.82	38.52	64.14	82.77	107.08	162.85
	1:30:00	0.00	0.00	16.66	25.10	35.41	56.84	73.34	93.39	142.40
	1:35:00	0.00	0.00	15.80	23.73	32.77	50.99	65.65	82.74	126.23
	1:40:00	0.00	0.00	15.05	22.21	30.40	46.13	59.17	73.98	112.78
	1:45:00	0.00	0.00	14.33	20.53	28.23	41.78	53.35	66.12	100.69
	1:50:00	0.00	0.00	13.62	18.87	26.17	37.84	48.08	58.93	89.64
	1:55:00	0.00	0.00	12.61	17.28	24.08	34.11	43.08	52.16	79.20
	2:00:00	0.00	0.00	11.35	15.69	21.73	30.50	38.29	45.76	69.34
	2:05:00	0.00	0.00	9.79	13.56	18.61	26.09	32.58	38.66	58.44
	2:10:00	0.00	0.00	8.05	11.09	15.10	21.11	26.23	30.99	46.63
	2:15:00	0.00	0.00	6.44	8.82	11.91	16.30	20.13	23.63	35.50
	2:20:00	0.00	0.00	5.14	7.06	9.53	12.10	14.89	17.32	26.41
	2:25:00	0.00	0.00	4.19	5.78	7.84	9.34	11.51	13.13	20.23
	2:30:00	0.00	0.00	3.47	4.77	6.49	7.34	9.04	10.11	15.65
	2:35:00	0.00	0.00	2.87	3.96	5.37	5.85	7.18	7.79	12.12
	2:40:00	0.00	0.00	2.38	3.26	4.40	4.64	5.67	5.96	9.29
	2:45:00	0.00	0.00	1.95	2.66	3.57	3.69	4.48	4.52	7.05
	2:50:00	0.00	0.00	1.59	2.15	2.86	2.91	3.50	3.40	5.30
	2:55:00	0.00	0.00	1.30	1.72	2.29	2.29	2.74	2.59	4.05
	3:00:00	0.00	0.00	1.06	1.38	1.83	1.84	2.19	2.09	3.23
	3:05:00	0.00	0.00	0.87	1.11	1.45	1.47	1.74	1.68	2.58
	3:10:00	0.00	0.00	0.69	0.87	1.14	1.16	1.37	1.34	2.05
	3:15:00	0.00	0.00	0.53	0.66	0.88	0.89	1.05	1.04	1.59
	3:20:00	0.00	0.00	0.40	0.49	0.66	0.67	0.78	0.77	1.18
	3:25:00	0.00	0.00	0.28	0.35	0.46	0.48	0.56	0.55	0.83
	3:30:00	0.00	0.00	0.19	0.23	0.31	0.32	0.37	0.36	0.54
	3:35:00	0.00	0.00	0.11	0.14	0.18	0.19	0.22	0.21	0.32
	3:40:00	0.00	0.00	0.06	0.08	0.09	0.10	0.11	0.10	0.15
	3:45:00	0.00	0.00	0.02	0.03	0.03	0.03	0.04	0.03	0.04
	3:50:00	0.00	0.00	0.01	0.01	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'.

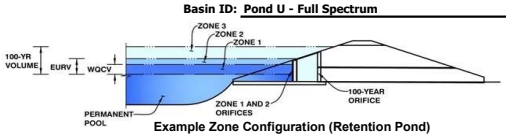
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Harmony Phase 6 - Filing 16

Basin ID: Pond U - Full Spectrum



Example Zone Configuration (Retention Pond)

Stage 0 = 5582.50 **EURV Elev. =** 5586.54 **Top of Embankm** 5591.00 **Q100 (cfs) =** 53.45

WQ Elev. = 5585.00 **100 YR Elev. =** 5587.58

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
5583	--	0.50	--	--	--	672	0.015	180	0.004
5584	--	1.50	--	--	--	18,112	0.416	9,572	0.220
5585	--	2.50	--	--	--	51,556	1.184	44,406	1.019
5586	--	3.50	--	--	--	71,546	1.642	105,957	2.432
5587	--	4.50	--	--	--	83,910	1.926	183,685	4.217
5588	--	5.50	--	--	--	89,293	2.050	270,287	6.205
5589	--	6.50	--	--	--	94,725	2.175	362,296	8.317
5590	--	7.50	--	--	--	104,237	2.393	461,777	10.601
5591	--	8.50	--	--	--	107,634	2.471	567,712	13.033

Watershed Information

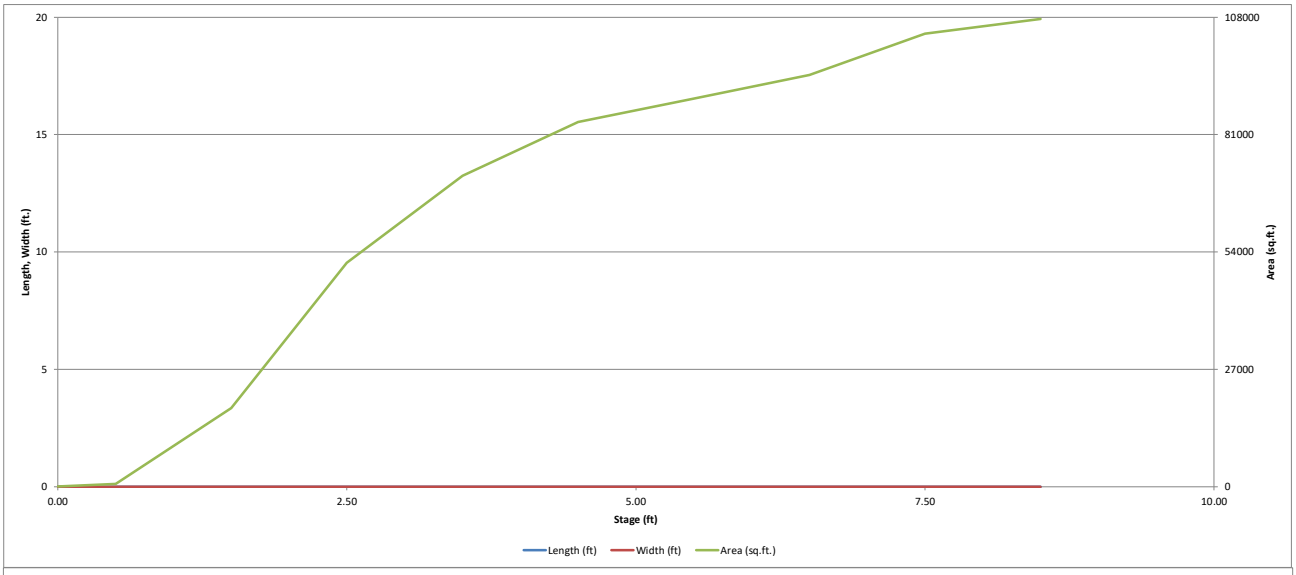
Selected BMP Type =	**EDB**	
Watershed Area =	50.77	acres
Watershed Length =	2,287	ft
Watershed Length to Centroid =	1,057	ft
Watershed Slope =	0.010	ft/ft
Watershed Imperviousness =	60.70%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

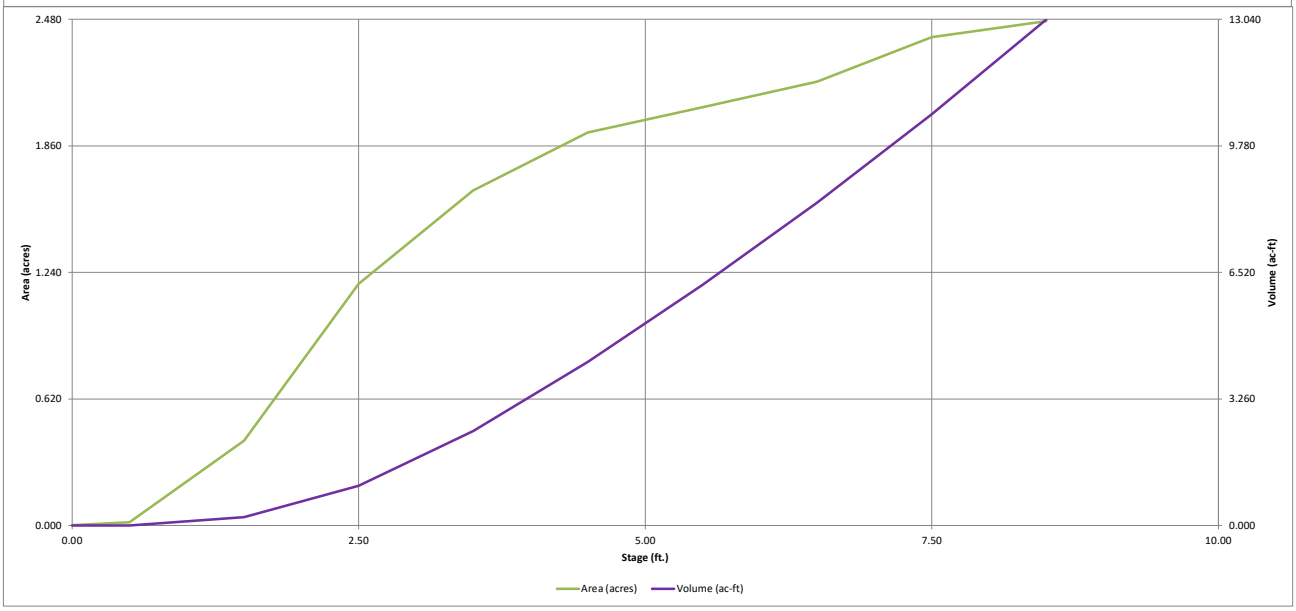
After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.009	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	3.346	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.85 in.) =	2.005	acre-feet	0.85	inches
5-yr Runoff Volume (P1 = 1.14 in.) =	2.869	acre-feet	1.14	inches
10-yr Runoff Volume (P1 = 1.4 in.) =	3.852	acre-feet	1.40	inches
25-yr Runoff Volume (P1 = 1.79 in.) =	5.674	acre-feet	1.79	inches
50-yr Runoff Volume (P1 = 2.13 in.) =	7.130	acre-feet	2.13	inches
100-yr Runoff Volume (P1 = 2.48 in.) =	8.803	acre-feet	2.48	inches
500-yr Runoff Volume (P1 = 3.43 in.) =	13.039	acre-feet	3.43	inches
Approximate 2-yr Detention Volume =	1.846	acre-feet		
Approximate 5-yr Detention Volume =	2.640	acre-feet		
Approximate 10-yr Detention Volume =	3.576	acre-feet		
Approximate 25-yr Detention Volume =	4.324	acre-feet		
Approximate 50-yr Detention Volume =	4.767	acre-feet		
Approximate 100-yr Detention Volume =	5.402	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.009	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.337	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.056	acre-feet
Total Detention Basin Volume =	5.402	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


20
15
10
5
0
Length, Width (ft.)
108000
81000
54000
27000
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

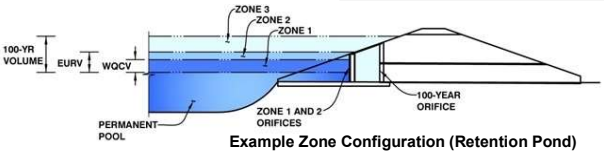

2.480
1.860
1.240
0.620
0.000
Area (acres)
13.040
9.780
6.520
3.260
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Harmony Phase 6 - Filing 16**

Basin ID: **Pond U - Full Spectrum**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.50	1.009	Orifice Plate
Zone 2 (EURV)	4.04	2.337	Orifice Plate
Zone 3 (100-year)	5.11	2.056	Weir&Pipe (Rect.)
Total (all zones)		5.402	

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 =	4.10	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)	0.10	1.50	3.00					
Orifice Area (sq. inches)	4.91	7.07	19.63					

	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 =	4.10	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.10	N/A	feet
Overflow Weir Front Edge Length =	16.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	9.35	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	50.62	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	25.31	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 Rectangular	Not Selected			Zone 3 Rectangular	Not Selected	
Depth to Invert of Outlet Pipe =	0.20	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	5.42	N/A	ft^2
Rectangular Orifice Width =	30.00	N/A	inches	Outlet Orifice Centroid =	1.08	N/A	feet
Rectangular Orifice Height =	26.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=		ft (rela	Flow Depth=	
Spillway Crest Length =		feet	f Freeboard =	feet
Spillway End Slopes =		H:V	f Freeboard =	acres
Freeboard above Max Water Surface =		feet	f Freeboard =	acre-ft

Calculated Parameters for Spillway

Spillway calculations are not provided because we are proposing an emergency overflow structure for Pond U. Please see the additional overflow structure calculations provided after this UD detention sheet. See the **Preliminary Drainage Report Section D.3.B.** for more discussion on the overflow structure calculation methods and why we chose this design.

Routed Hydrograph Results

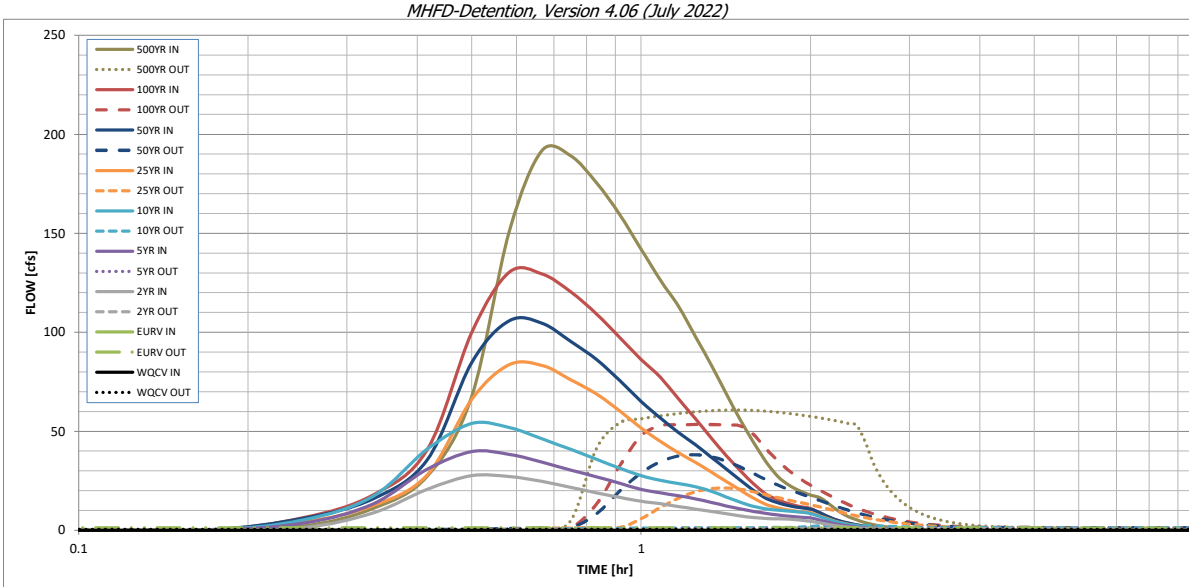
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

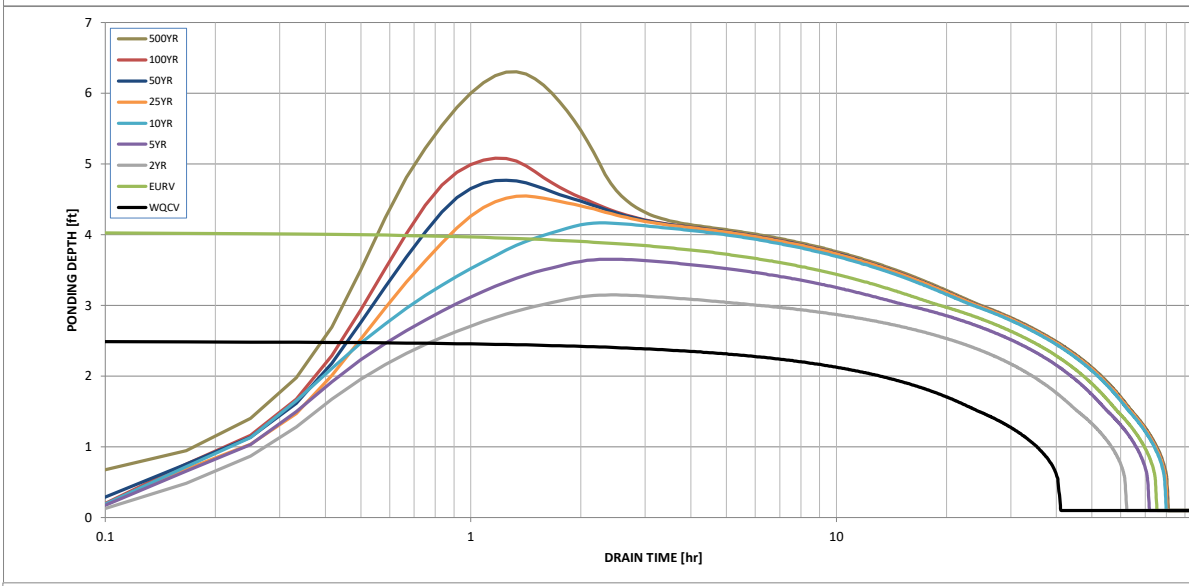
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.85	1.14	1.40	1.79	2.13	2.48
CUHP Runoff Volume (acre-ft) =	1.009	3.346	2.005	2.869	3.852	5.674	7.130	8.803
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.005	2.869	3.852	5.674	7.130	8.803
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.4	1.5	8.4	27.6	39.7	55.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.03	0.17	0.54	0.78	1.08
Peak Inflow Q (cfs) =	N/A	N/A	27.6	39.8	53.9	83.7	105.9	130.4
Peak Outflow Q (cfs) =	0.5	1.4	0.8	1.2	2.6	21.4	38.2	53.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.3	0.8	1.0	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.4	0.7	1.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	67	57	64	70	67	64	62
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	60	69	76	75	74	73
Maximum Ponding Depth (ft) =	2.50	4.04	3.15	3.65	4.17	4.55	4.77	5.08
Area at Maximum Ponding Depth (acres) =	1.18	1.80	1.48	1.69	1.83	1.93	1.96	2.00
Maximum Volume Stored (acre-ft) =	1.019	3.361	1.871	2.682	3.578	4.294	4.741	5.355

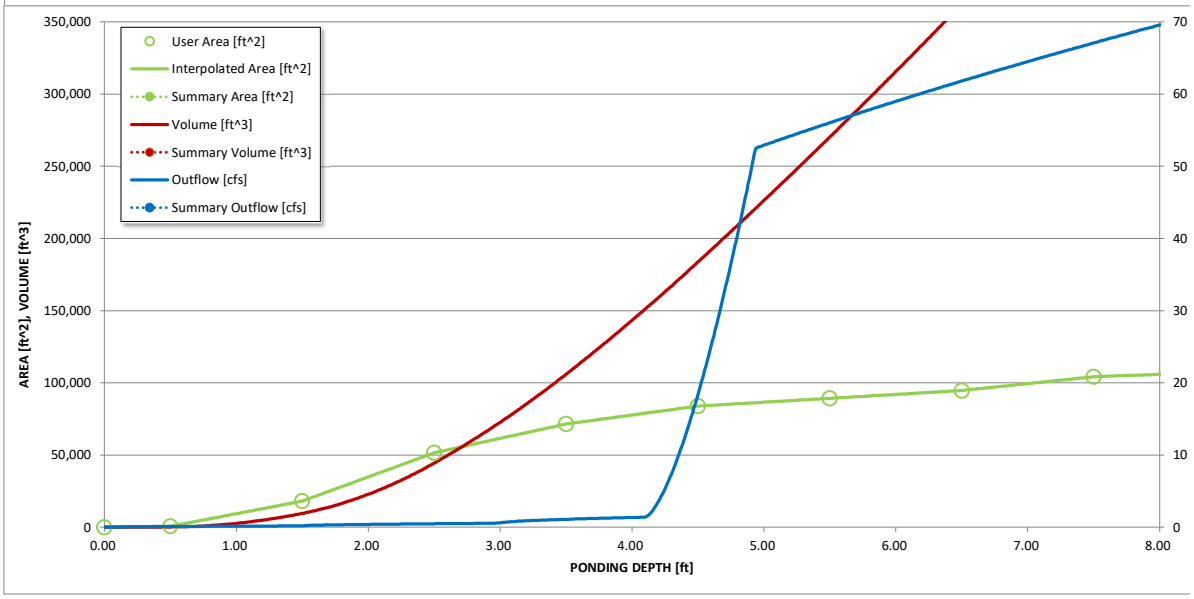
SINCE THE EMEREGNCY OVERFLOW IS NOT DESIGNED ON THIS SHEET, THE INFORMATION PROVIDED IN THIS COLUMN IS NOT ACCURATE AND THEREFORE, WILL NOT BE SHOWN. PLEASE SEE OVERFLOW STRUCTURE DESIGN PROVIDED AFTER THIS UD DETENTION SHEET.

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
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]
0 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	0.12	0.00	2.05
	0:15:00	0.00	0.00	1.23	3.48	5.16	4.13	5.98	6.23	10.97
	0:20:00	0.00	0.00	8.71	13.33	17.16	12.41	15.92	17.79	27.30
	0:25:00	0.00	0.00	20.75	30.85	40.98	27.97	35.63	40.69	67.63
	0:30:00	0.00	0.00	27.60	39.76	53.93	66.18	84.74	99.93	151.27
	0:35:00	0.00	0.00	27.11	38.34	51.89	83.66	105.87	130.41	191.79
	0:40:00	0.00	0.00	24.67	34.37	46.19	83.29	104.57	129.43	189.13
	0:45:00	0.00	0.00	21.68	30.41	40.86	76.04	95.30	120.35	175.45
	0:50:00	0.00	0.00	18.96	27.07	35.83	68.85	86.24	109.26	159.36
	0:55:00	0.00	0.00	16.60	23.68	31.35	60.21	75.59	97.37	142.07
	1:00:00	0.00	0.00	14.67	20.72	27.60	51.77	65.14	86.37	126.06
	1:05:00	0.00	0.00	13.38	18.83	25.23	44.83	56.57	77.12	113.01
	1:10:00	0.00	0.00	12.02	17.47	23.57	39.08	49.33	66.24	97.62
	1:15:00	0.00	0.00	10.71	15.90	22.01	34.23	43.12	56.26	83.44
	1:20:00	0.00	0.00	9.54	14.11	19.74	29.37	36.92	46.61	69.09
	1:25:00	0.00	0.00	8.41	12.36	16.85	24.75	31.05	37.84	55.93
	1:30:00	0.00	0.00	7.33	10.80	14.20	20.35	25.40	30.25	44.58
	1:35:00	0.00	0.00	6.48	9.58	12.12	16.33	20.23	23.58	34.70
	1:40:00	0.00	0.00	6.00	8.50	10.91	13.14	16.19	18.34	27.18
	1:45:00	0.00	0.00	5.78	7.68	10.20	11.32	13.89	15.32	22.76
	1:50:00	0.00	0.00	5.65	7.11	9.70	10.17	12.40	13.35	19.85
	1:55:00	0.00	0.00	5.11	6.69	9.21	9.42	11.43	11.99	17.83
	2:00:00	0.00	0.00	4.53	6.23	8.48	8.90	10.73	11.01	16.35
	2:05:00	0.00	0.00	3.64	5.02	6.81	7.19	8.65	8.68	12.87
	2:10:00	0.00	0.00	2.79	3.83	5.18	5.42	6.50	6.39	9.46
	2:15:00	0.00	0.00	2.14	2.92	3.93	4.10	4.90	4.75	7.02
	2:20:00	0.00	0.00	1.63	2.21	2.95	3.09	3.68	3.58	5.27
	2:25:00	0.00	0.00	1.23	1.65	2.19	2.31	2.75	2.68	3.94
	2:30:00	0.00	0.00	0.92	1.21	1.61	1.70	2.02	1.99	2.92
	2:35:00	0.00	0.00	0.67	0.87	1.19	1.24	1.47	1.46	2.14
	2:40:00	0.00	0.00	0.48	0.63	0.87	0.92	1.10	1.09	1.59
	2:45:00	0.00	0.00	0.33	0.44	0.61	0.66	0.78	0.77	1.13
	2:50:00	0.00	0.00	0.21	0.29	0.39	0.43	0.51	0.51	0.74
	2:55:00	0.00	0.00	0.11	0.17	0.22	0.26	0.30	0.30	0.43
	3:00:00	0.00	0.00	0.05	0.08	0.10	0.13	0.15	0.14	0.21
	3:05:00	0.00	0.00	0.02	0.03	0.03	0.04	0.05	0.04	0.06
	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).

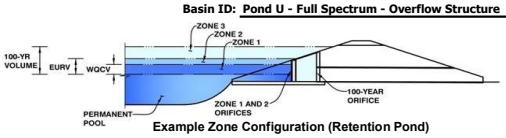
EMERGENCY OVERFLOW STRUCTURE DESIGN SHEET

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Harmony Phase 6 - Filing 16

Basin ID: Pond U - Full Spectrum - Overflow Structure



Example Zone Configuration (Retention Pond)

Stage 0 = 5582.50

Qemer (cfs) = 130.40

Emergency Overflwo Ponding WSEL = 5588.73

Top of Embankment = 5591.00

Depth Increment = ft

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	50.77	acres
Watershed Length =	2,287	ft
Watershed Length to Centroid =	1,057	ft
Watershed Slope =	0.010	ft/ft
Watershed Imperviousness =	60.70%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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) =	1.009	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	3.346	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 0.85 in.) =	2.005	acre-feet	0.85 inches
5-yr Runoff Volume (P1 = 1.14 in.) =	2.869	acre-feet	1.14 inches
10-yr Runoff Volume (P1 = 1.4 in.) =	3.852	acre-feet	1.40 inches
25-yr Runoff Volume (P1 = 1.79 in.) =	5.674	acre-feet	1.79 inches
50-yr Runoff Volume (P1 = 2.13 in.) =	7.130	acre-feet	2.13 inches
100-yr Runoff Volume (P1 = 2.48 in.) =	8.803	acre-feet	2.48 inches
500-yr Runoff Volume (P1 = 3.43 in.) =	13.039	acre-feet	3.43 inches
Approximate 2-yr Detention Volume =	1.846	acre-feet	
Approximate 5-yr Detention Volume =	2.640	acre-feet	
Approximate 10-yr Detention Volume =	3.576	acre-feet	
Approximate 25-yr Detention Volume =	4.324	acre-feet	
Approximate 50-yr Detention Volume =	4.767	acre-feet	
Approximate 100-yr Detention Volume =	5.402	acre-feet	

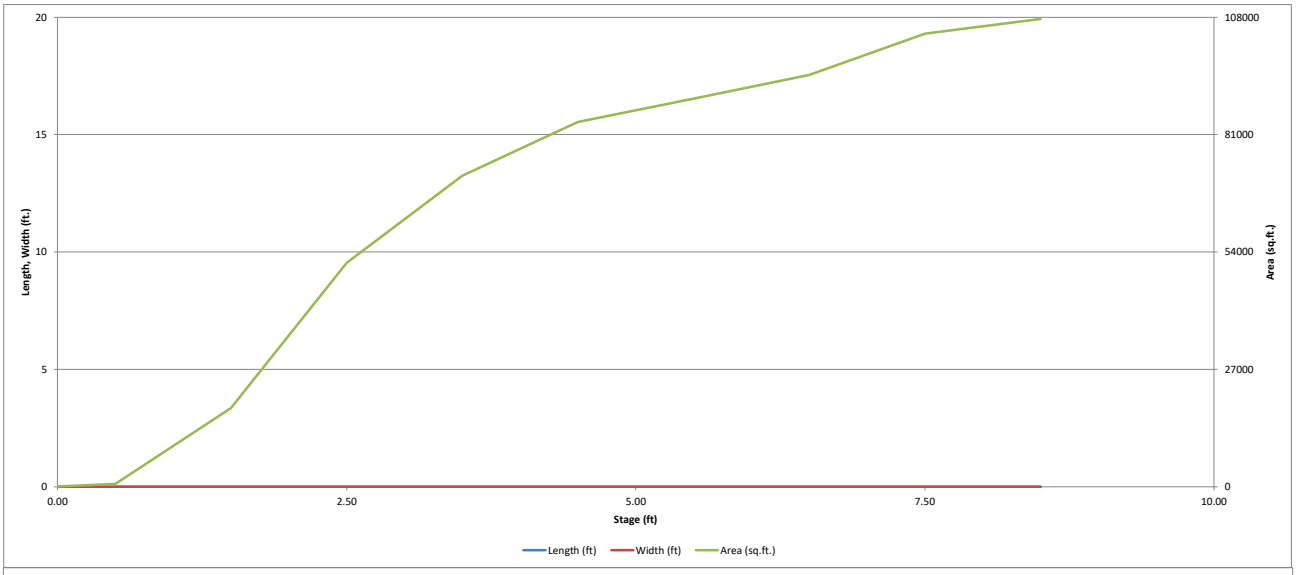
Define Zones and Basin Geometry

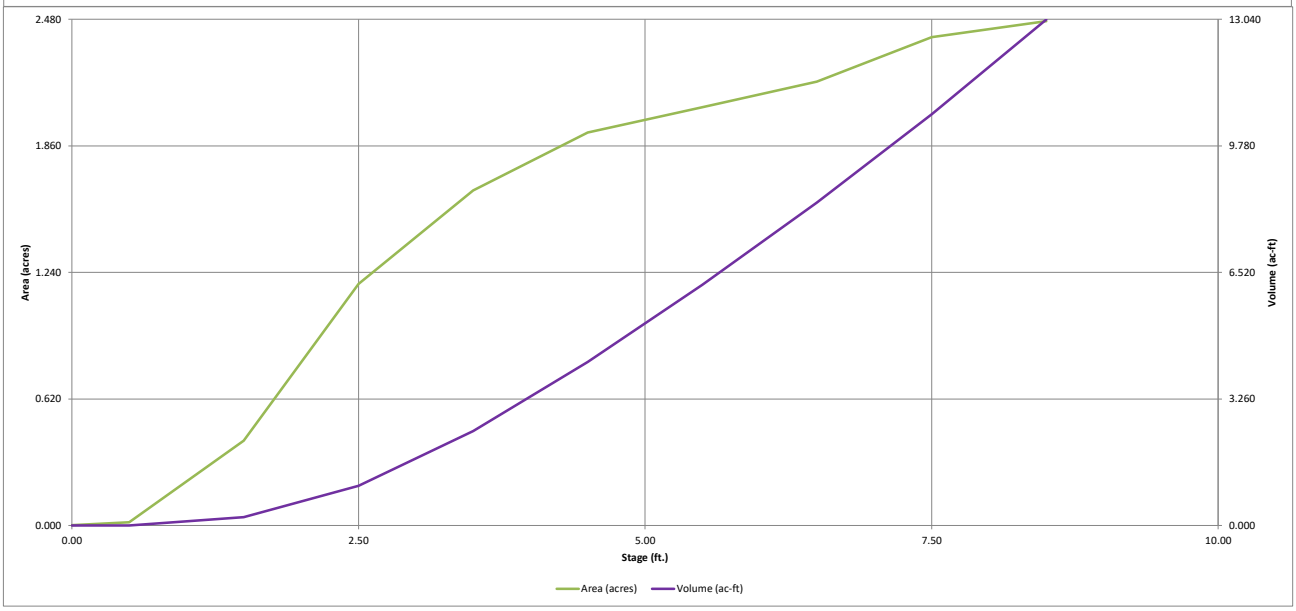
Zone 1 Volume (WQCV) =	1.009	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.337	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.056	acre-feet
Total Detention Basin Volume =	5.402	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

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		
5583	--	0.50	--	--	--	672	0.015	180	0.004
5584	--	1.50	--	--	--	18,112	0.416	9,572	0.220
5585	--	2.50	--	--	--	51,556	1.184	44,406	1.019
5586	--	3.50	--	--	--	71,546	1.642	105,957	2.432
5587	--	4.50	--	--	--	83,910	1.926	183,685	4.217
5588	--	5.50	--	--	--	89,293	2.050	270,287	6.205
5589	--	6.50	--	--	--	94,725	2.175	362,296	8.317
5590	--	7.50	--	--	--	104,237	2.393	461,777	10.601
5591	--	8.50	--	--	--	107,634	2.471	567,712	13.033

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)





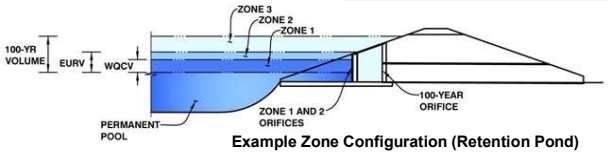
FOR THE EMERGENCY SCENARIO, WE WILL ASSUME THE OUTLET STRUCTURE IS COMPLETELY CLOGGED AND NOT FUNCTIONING. THE ORIFICE PLATE THAT CONTROLS THE WQCV & EURV AND THE 100 YEAR WEIR ARE NOT UTILIZED ON THIS SHEET TO SIMULATE A 100% CLOGGED OUTLET STRUCTURE. ZONE 3 WILL BE SET TO THE EMERGENCY OVERFLOW STRUCTURE INVERT WHICH IS JUST ABOVE THE 100 YEAR WSEL. THIS WILL ALLOW US TO DESIGN THE OVERFLOW STRUCTURE FOR AN EMERGENCY EVENT. Q(EMER) = 100 YEAR DEVELOPED INFLOW.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Harmony Phase 6 - Filing 16**

Basin ID: **Pond U - Full Spectrum - Overflow Structure**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.50	1.009	[redacted]
Zone 2 (EURV)	4.04	2.337	
Zone 3 (100-year)	5.11	2.056	Weir&Pipe (Restrict)
Total (all zones)		5.402	

THIS SECTION WILL BE USED TO DESIGN OVERFLOW STRUCTURE

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

			Calculated Parameters for Underdrain		
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

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)

			Calculated Parameters for Plate		
Centroid of Lowest Orifice =	[redacted]	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 =		ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =		inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =		sq. inches	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)								
Orifice Area (sq. inches)								

	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		Calculated Parameters for Vertical Orifice	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				

POND U 100 YEAR PONDING DEPTH IS 5.04' (SEE PREVIOUS POND U UD DETENTION SHEET). OVERFLOW INVERT SET TO 5.10' TO ENSURE OVERFLOW IS CAPTURED FOR ANY PONDING ABOVE 100 YEAR WSEL.

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		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.10	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.10	N/A	feet
Overflow Weir Front Edge Length =	16.00	N/A	feet	Overflow Weir Slope Length =	8.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	8.06	N/A	
Horiz. Length of Weir Sides =	8.00	N/A	feet	Overflow Grate Open Area w/o Debris =	101.25	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	50.62	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

50% CLOGGING FATCOR APPLIED TO GRATE.

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

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.20	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	12.57	N/A	ft^2
Outlet Pipe Diameter =	48.00	N/A	inches	Outlet Orifice Centroid =	2.00	N/A	feet
Restrictor Plate Height Above Pipe Invert =	48.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway	
Spillway Invert Stage=		ft (relative t	Spillway Design Flow Depth=	feet
Spillway Crest Length =		feet	Stage at Top of Freeboard =	feet
Spillway End Slopes =		H:V	Area at Top of Freeboard =	acres
Freeboard above Max Water Surface =		feet	Basin Volume at Top of Freeboard =	acre-ft

SPILLWAY IS NOT PROPOSED THEREFORE NO DESIGN IS PROVIDED

Q(EMER) = 100 YEAR DEVELOPED INFLOW FOR POND U

Routed Hydrograph Results

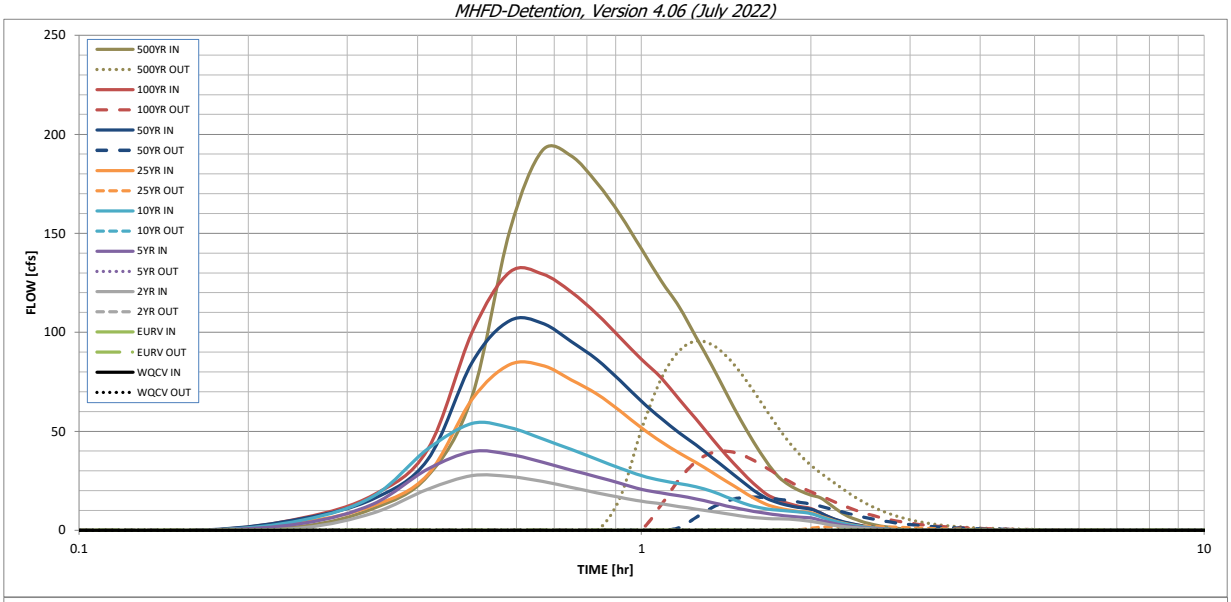
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

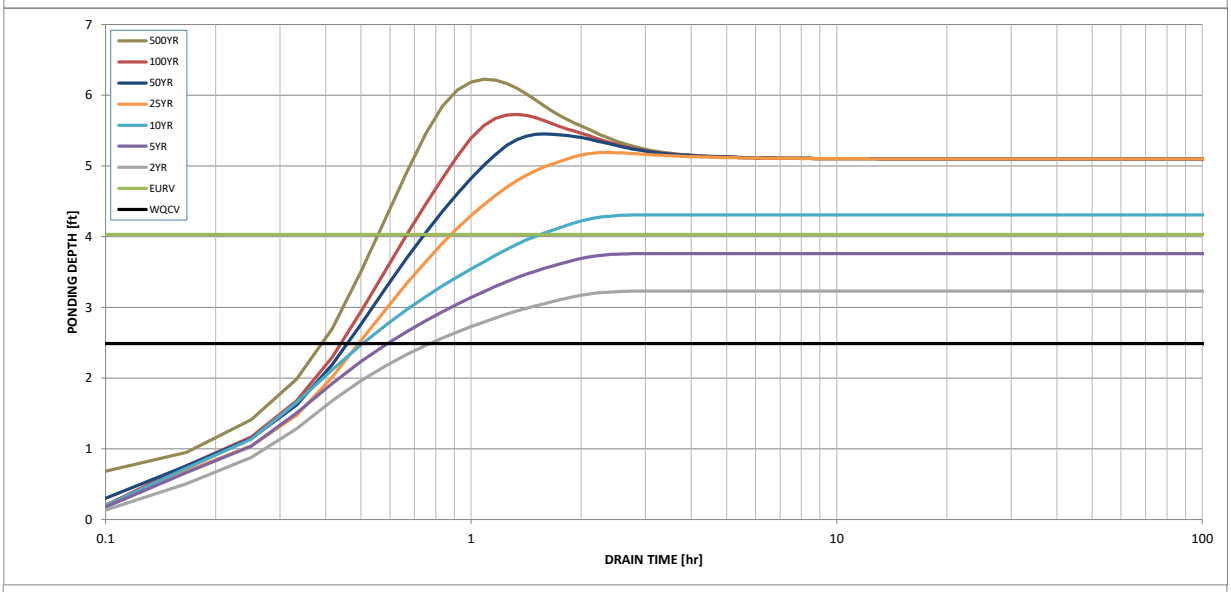
	EMERGENCY OVERFLOW
Design Storm Return Period =	[redacted]
One-Hour Rainfall Depth (in) =	3.43
CUHP Runoff Volume (acre-ft) =	13.039
Inflow Hydrograph Volume (acre-ft) =	13.039
CUHP Predevelopment Peak Q (cfs) =	89.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	130.4
Predevelopment Unit Peak Flow, q (cfs/acre) =	2.57
Peak Inflow Q (cfs) =	191.8
Peak Outflow Q (cfs) =	95.5
Ratio Peak Outflow to Predevelopment Q =	0.7
Structure Controlling Flow =	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	0.9
Max Velocity through Grate 2 (fps) =	N/A
Time to Drain 97% of Inflow Volume (hours) =	>120
Time to Drain 99% of Inflow Volume (hours) =	>120
Maximum Ponding Depth (ft) =	6.23
Area at Maximum Ponding Depth (acres) =	2.14
Maximum Volume Stored (acre-ft) =	7.713

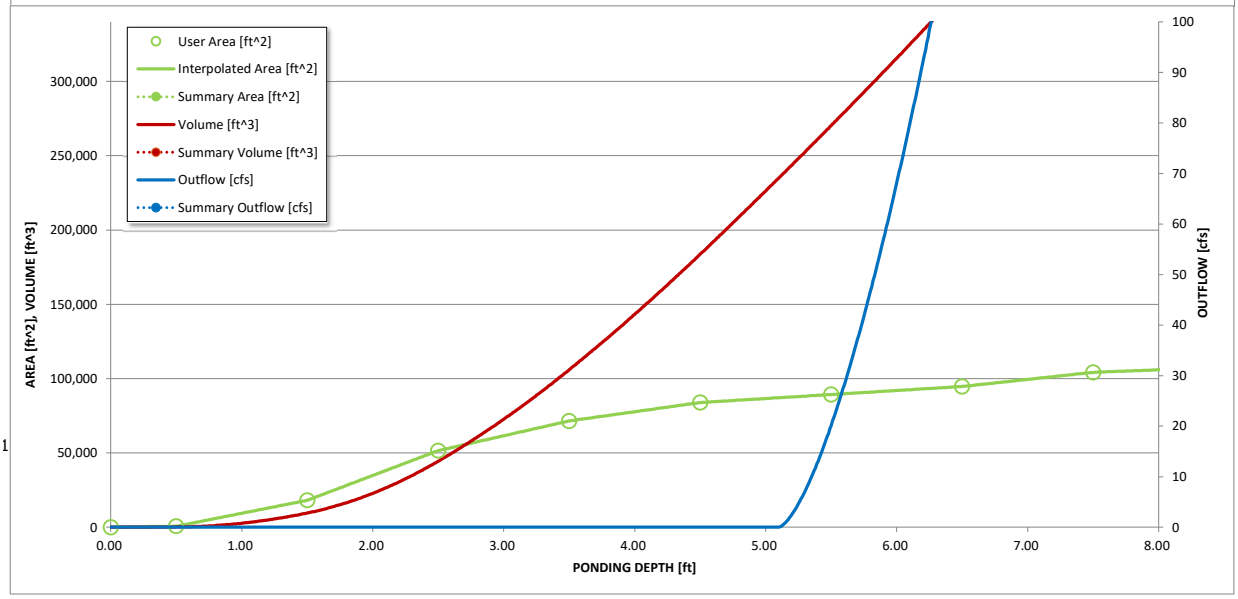
EMERGENCY PONDING DEPTH

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	0.12	0.00	2.05
	0:15:00	0.00	0.00	1.23	3.48	5.16	4.13	5.98	6.23	10.97
	0:20:00	0.00	0.00	8.71	13.33	17.16	12.41	15.92	17.79	27.30
	0:25:00	0.00	0.00	20.75	30.85	40.98	27.97	35.63	40.69	67.63
	0:30:00	0.00	0.00	27.60	39.76	53.93	66.18	84.74	99.93	151.27
	0:35:00	0.00	0.00	27.11	38.34	51.89	83.66	105.87	130.41	191.79
	0:40:00	0.00	0.00	24.67	34.37	46.19	83.29	104.57	129.43	189.13
	0:45:00	0.00	0.00	21.68	30.41	40.86	76.04	95.30	120.35	175.45
	0:50:00	0.00	0.00	18.96	27.07	35.83	68.85	86.24	109.26	159.36
	0:55:00	0.00	0.00	16.60	23.68	31.35	60.21	75.59	97.37	142.07
	1:00:00	0.00	0.00	14.67	20.72	27.60	51.77	65.14	86.37	126.06
	1:05:00	0.00	0.00	13.38	18.83	25.23	44.83	56.57	77.12	113.01
	1:10:00	0.00	0.00	12.02	17.47	23.57	39.08	49.33	66.24	97.62
	1:15:00	0.00	0.00	10.71	15.90	22.01	34.23	43.12	56.26	83.44
	1:20:00	0.00	0.00	9.54	14.11	19.74	29.37	36.92	46.61	69.09
	1:25:00	0.00	0.00	8.41	12.36	16.85	24.75	31.05	37.84	55.93
	1:30:00	0.00	0.00	7.33	10.80	14.20	20.35	25.40	30.25	44.58
	1:35:00	0.00	0.00	6.48	9.58	12.12	16.33	20.23	23.58	34.70
	1:40:00	0.00	0.00	6.00	8.50	10.91	13.14	16.19	18.34	27.18
	1:45:00	0.00	0.00	5.78	7.68	10.20	11.32	13.89	15.32	22.76
	1:50:00	0.00	0.00	5.65	7.11	9.70	10.17	12.40	13.35	19.85
	1:55:00	0.00	0.00	5.11	6.69	9.21	9.42	11.43	11.99	17.83
	2:00:00	0.00	0.00	4.53	6.23	8.48	8.90	10.73	11.01	16.35
	2:05:00	0.00	0.00	3.64	5.02	6.81	7.19	8.65	8.68	12.87
	2:10:00	0.00	0.00	2.79	3.83	5.18	5.42	6.50	6.39	9.46
	2:15:00	0.00	0.00	2.14	2.92	3.93	4.10	4.90	4.75	7.02
	2:20:00	0.00	0.00	1.63	2.21	2.95	3.09	3.68	3.58	5.27
	2:25:00	0.00	0.00	1.23	1.65	2.19	2.31	2.75	2.68	3.94
	2:30:00	0.00	0.00	0.92	1.21	1.61	1.70	2.02	1.99	2.92
	2:35:00	0.00	0.00	0.67	0.87	1.19	1.24	1.47	1.46	2.14
	2:40:00	0.00	0.00	0.48	0.63	0.87	0.92	1.10	1.09	1.59
	2:45:00	0.00	0.00	0.33	0.44	0.61	0.66	0.78	0.77	1.13
	2:50:00	0.00	0.00	0.21	0.29	0.39	0.43	0.51	0.51	0.74
	2:55:00	0.00	0.00	0.11	0.17	0.22	0.26	0.30	0.30	0.43
	3:00:00	0.00	0.00	0.05	0.08	0.10	0.13	0.15	0.14	0.21
	3:05:00	0.00	0.00	0.02	0.03	0.03	0.04	0.05	0.04	0.06
	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.

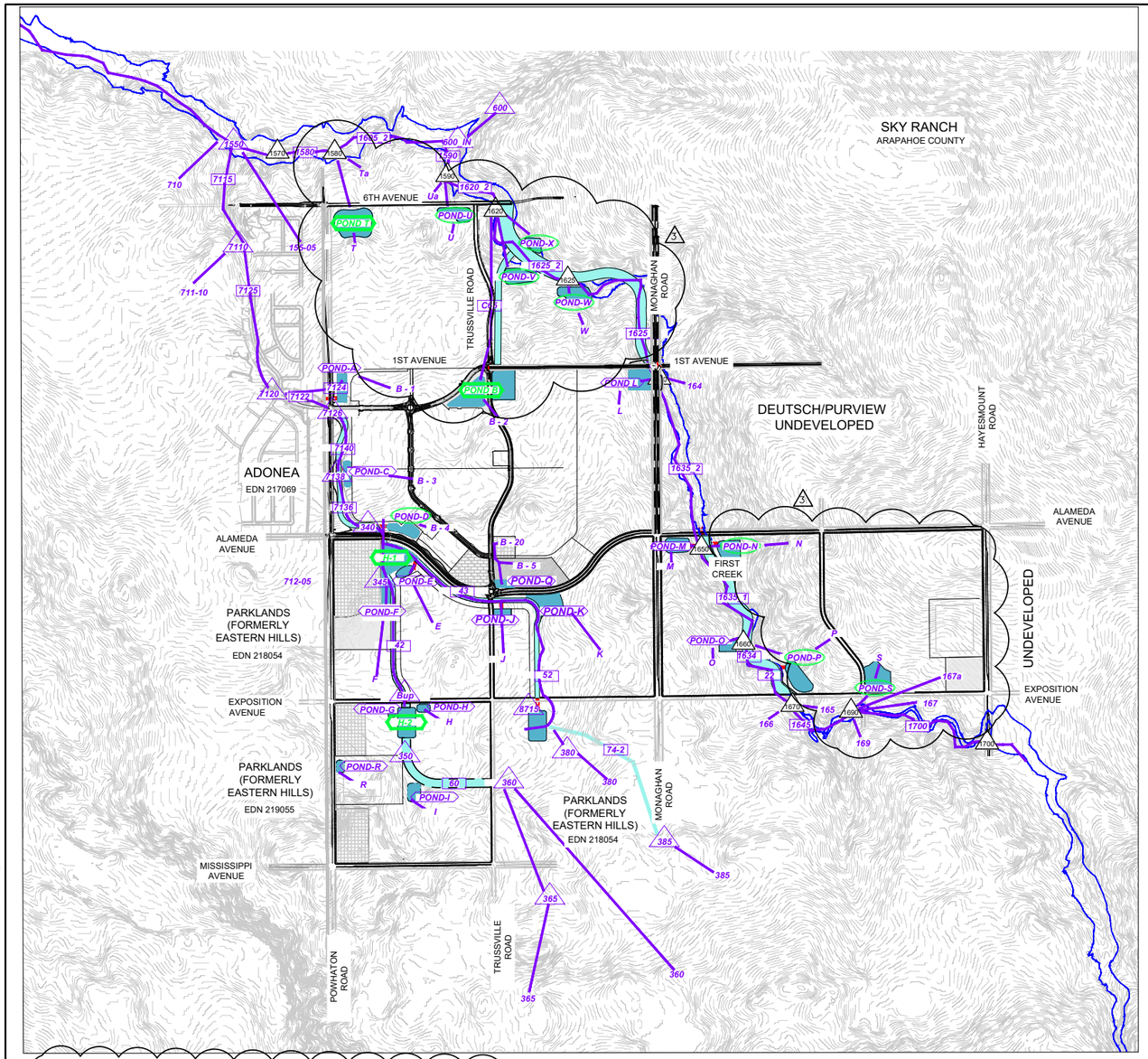
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

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).

Harmony Master Drainage Report Amendment 3

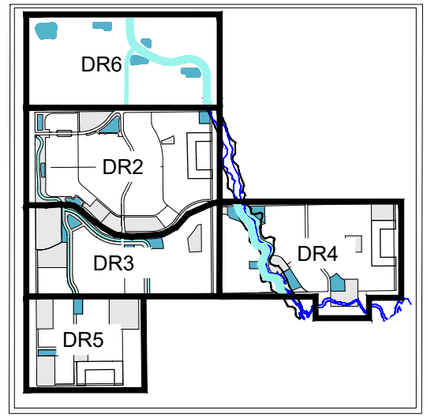


NOTE

1. CULVERT SIZES SHOWN ARE BASED ON FLOWS FROM MASTER DRAINAGE STUDY AND WILL BE CONFIRMED IN FINAL DRAINAGE REPORT.
2. "CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT."
3. TOPOGRAPHY SHOWN WAS CREATED FROM USGS DIGITAL ELEVATION MODEL DATA AND IS NGVD29 DATUM. PRELIMINARY AND FINAL DRAINAGE REPORTS WILL REQUIRE NAVD88 DATUM.
4. THE SWMM SCHEMATIC SHOWS EXISTING AND FUTURE CONDITIONS HOWEVER ANALYSIS IS DONE SEPARATELY. DETAILS ARE PROVIDED IN APPENDIX OF MASTER DRAINAGE REPORT.
5. THE FEMA FIRM PANEL NUMBERS THAT COVER THE HARMONY SITE ARE 08005C0206L, 08005C0208L, AND 08005C0209L AND THE EFFECTIVE DATE IS 2/17/2017.
6. ALL DETENTION PONDS WILL BE MAINTAINED BY THE HARMONY METRO DISTRICT EXCEPT THOSE THAT ARE MEP ELIGIBLE.

1000 500 0 1000 2000

SCALE: 1" = 1000'



KEY MAP
N.T.S.

LEGEND

1540	DESIGN POINT
1555	CONDUIT
3711-05	DETENTION POND
8154	REGIONAL POND
POND X	PERMANENT DETENTION POND
	PROPOSED BASIN LINE
5650	EXISTING INDEX CONTOURS
	EXISTING INTERMEDIATE CONTOURS

POND	TRIB. AREA (AC)	PERCENT IMPERVIOUSNESS	EURV (AC-FT)	V100 + 1/2 EURV (AC-FT)	Allowable Release Rate (CFS)	POND TYPE	COA FINAL APPROVAL NUMBER (EDN)
POND-A	48.9	42.8	2.4	7.0	45.0	Full Spectrum	217051
POND-C	24.3	40.0	1.2	3.8	25.0	Full Spectrum	217051
POND-D	38.7	44.7	1.7	4.7	33.0	Full Spectrum	217051
POND-E	46.2	61.6	3.1	NA	120.3	EURV	Future
POND-F	33.5	55.3	2.0	NA	89.7	EURV	Future
POND-G	13.5	56.6	0.8	NA	27.2	EURV	Future
POND-H	29.4	54.0	1.7	NA	65.8	EURV	Future
POND-I	62.1	48.2	3.2	NA	164.5	EURV	Future
POND-J	26.4	56.8	1.6	NA	89.8	EURV	Future
POND-K	73.5	54.4	4.3	NA	235.4	EURV	Future
POND-L	81.4	57.0	5.0	11.4	63.6	Full Spectrum	Future
POND-M	61.4	47.9	3.2	9.1	52.2	Full Spectrum	Future
POND-N	83.8	50.0	1.6	4.9	32.6	Full Spectrum	Future
POND-O	27.7	47.2	1.4	4.4	23.5	Full Spectrum	Future
POND-P	57.5	60.0	4.8	7.9	157.8	Full Spectrum	Future
POND-Q	18.3	57.0	1.1	2.6	9.8	Full Spectrum	220210
POND-R	14.2	61.2	0.9	NA	19.1	Full Spectrum	Future
POND S	74.2	65.0	4.6	10.0	79.2	Full Spectrum	Future
POND U	51.5	75.0	4.3	9.1	60.2	Full Spectrum	Future
POND V	48.5	50.0	2.6	6.1	77.0	Full Spectrum	Future
POND W	46.8	52.0	2.5	6.0	75.2	Full Spectrum	Future
POND X	71.2	68.0	5.1	11.3	97.3	Full Spectrum	Future

REGIONAL POND SUMMARY TABLE						
FIRST CREEK						
Regional Pond ID	Volume (ac-ft)		Max Inlet Rate (CFS)		Max Discharge Rate (CFS)	
	EXISTING	FUTURE	EXISTING	FUTURE	EXISTING	FUTURE
B	NA	16.04	NA	280.1	NA	54.8
T	NA	14.37	NA	240.6	NA	47.1
SOUTH POWHATON TRIBUTARY						
Regional Pond ID	Volume (ac-ft)		Max Inlet Rate (CFS)		Max Discharge Rate (CFS)	
	EXISTING	FUTURE	EXISTING	FUTURE	EXISTING	FUTURE
8715	NA	21.86	NA	529.9	NA	218.8
H-1	26.49	21.02	856.8	640.9	546.4	505.5
H-2	NA	33.14	NA	648.0	NA	258.6

FLOW AND VOLUME COMPARISON								
DESIGN POINT	EXISTING 2021 MDP INFLOW (cfs)	MODIFIED EXISTING INFLOW (cfs)	PROPOSED SITE INFLOW (cfs)	FLOW DIFFERENCE (cfs)	2021 MDP VOLUME (10^6 gal)	MODIFIED EXISTING VOLUME (10^6 gal)	PROPOSED SITE VOLUME (10^6 gal)	VOLUME DIFFERENCE (10^6 gal)
1700	1540.28	1530.41	1530.41	0.00	64.8	64.6	64.6	0
1690	1526.21	1509.61	1509.61	0.00	75.8	75.6	75.6	0
1670*	N/A	752.56	752.56	0.00	N/A	110	110	0
1660	756.30	750.51	752.80	2.29	117	114	114	0
1650*	N/A	751.14	755.28	4.14	N/A	122	122	0
1630	840.38	1015.48	1051.38	35.90	132	133	133	0
1625*	N/A	1209.80	1206.32	-3.48	N/A	162	162	0
1620	1295.96	1223.38	1273.67	50.29	170	164	171	7
1590	1614.13	1440.19	1417.49	-22.70	189	180	180	0
1580	2202.49	2088.13	2080.46	-7.67	241	231	231	0
1570	2961.38	3147.51	3136.41	-11.10	315	310	310	0
1560	3103.08	3295.07	3288.99	-6.08	326	320	320	0
1540	3260.85	3448.15	3446.15	-2.00	337	331	331	0
1520 (DOWNSTREAM POND)	3864.66	4078.71	4050.45	-28.26	397	392	392	0

* REPRESENTS NEW DESIGN POINTS CREATED FROM THE 2021 MDP SUBBASINS

APPROVED FOR ONE YEAR FROM THIS DATE

CITY ENGINEER — DATE

WATER DEPARTMENT — DATE

PREPARED UNDER THE SUPERVISION OF

BRIAN SCHAFFER
COLORADO P.E. 57673

No.	Revisions	Date	Init.	Appr.	Date
1	MDR AMENDMENT EDN 217051	02/04/21			
2	MDR AMENDMENT	09/27/21			

CVL CONSULTANTS
10333 E. Dry Creek Rd.
Suite 240
Englewood, CO 80112
Tel: (720) 482-9526
Fax: (720) 482-9546

Melcor/TC, LLC
C/O Marathon Land Company
9750 W. Cambridge Place
Littleton, CO 80127
Tel: (303) 920-9400 Fax: (303) 920-9440

HARMONY SUBDIVISION
OVERALL DRAINAGE MAP

SCALE: AS SHOWN
FILE NO: 81302149O1

DRAWN BY: AYK
CHECKED BY: MS
DATE: JAN 2016

SHEET NUMBER DR1

DR1_MDR A3.dwg

N:\PROJECTS\30\17\904.SAND CREEK\DOCS\DRAINAGE\MASTER_DRAINAGE_REPORT AND AMENDMENTS\MASTER DRAINAGE AMENDMENT 3\DRAINAGE MAPS\DR1_MDR A3.DWG, HOKADA, 9/28/22

NOTE

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3. TOPOGRAPHY SHOWN WAS CREATED FROM USGS DIGITAL ELEVATION MODEL DATA AND IS NGVD29 DATUM. PRELIMINARY AND FINAL DRAINAGE REPORTS WILL REQUIRE NAVD88 DATUM.
4. FOR HATCH PATTERNS SEE DR9.
5. EXISTING CONDITION FOR MDR A2 BASED ON PROPOSED DEVELOPMENT IN HARMONY FILINGS 1-14 AS EXISTING TO PROVIDE DESIGN INFORMATION FOR THE REGIONAL CHANNELS AND POND H-1 TO BE BUILT WITH HARMONY FILING 14 POND H-2 AND 8715 TO BE BUILT WITH FUTURE DEVELOPMENT.
6. POND H-2 WILL PROVIDE REGIONAL DETENTION FOR UPSTREAM TRIBUTARIES TO S. POWHATON TRIBUTARY. A COST SHARING AGREEMENT WILL BE NEGOTIATED BETWEEN OWNER AND CITY OF AURORA DURING PRELIMINARY DESIGN.
7. NO WORK IS ALLOWED IN THE FLOODPLAIN WITHOUT A FLOODPLAIN DEVELOPMENT PERMIT, NO WORK IS ALLOWED WITHIN THE FLOODWAY WITHOUT A CLOMR.

SEE SHEET DR6

ELLSWORTH AVENUE

POND A

2 X 10' X 6' RCBC

30" RCP
POND A OUTFALL
TO CHANNEL A

1ST AVENUE

T 111.5 60%

POND B

36" RCP
POND B OUTFALL
TO TITUS TRIBUTARY

BEGIN TITUS
TRIBUTARY

36" RCP
POND L OUTFALL
TO FIRST CREEK

POND L

3x10'x10' RCBC

B-1 48.18 42%

OS-2 18.88 34%

B-2 120.8 54%

POWHATON ROAD

S. ROBERTSDALE STREET

TRUSSVILLE ROAD

MONAGHAN ROAD

L 80.4 48%

42" RCP
POND C OUTFALL

POND C

A

A

B-3 27.80 42%

CHANNEL A

24" RCP
POND D OUTFALL
TO CHANNEL A

B-4 37.09 36%

POND D

8'X6' RCBC

DR6

DR2

DR3

DR4

DR5

KEY MAP
N.T.S.

LEGEND

B-XX (A / B)
XX = BASIN ID
A = AREA (AC)
B = % PROPOSED IMPERVIOUS

POND X — POND
CULVERTS / PIPES
CHANNEL GRADE CONTROL
PROPOSED BASIN LINE
5650 — EXISTING INDEX CONTOURS
EXISTING INTERMEDIATE CONTOURS
7124 — CONDUIT
FLOW ARROW
7170 — DESIGN POINT

Q 18.32 57%

30" RCP
POND Q OUTFALL
TO CHANNEL C

POND Q

C

C

ALAMEDA AVENUE
SEE SHEET DR3

EXPOSITION
TRIBUTARY
REACH C

TR-1
415.1 CFS

10'X6' RCBC

POND SUMMARY

ID	TYPE	POND TYPE	PROPOSED VOLUME (AC-FT)	ALLOWABLE RELEASE RATE (CFS)
POND-A	STORAGE UNIT	FULL SPECTRUM	6.4	41
POND-B	STORAGE UNIT	REGIONAL	19.5	127.7
POND-C	STORAGE UNIT	FULL SPECTRUM	3.8	23.6
POND-D	STORAGE UNIT	FULL SPECTRUM	4.1	31.5
POND-L	STORAGE UNIT	FULL SPECTRUM	14.6	93.9
POND-Q	STORAGE UNIT	FULL SPECTRUM	2.2	9.8

89' ROW
2'Freeboard
100-YEAR DEPTH
2.5'
MAINTENANCE PATH
Q100 =637 CFS
12' 8' 10' 9' 4' 15' 4' 9' 10' 8'

CHANNEL SECTION A-A

87' ROW
2'Freeboard
100-YEAR DEPTH
2.25'
MAINTENANCE PATH
Q100 =431.8 CFS
12' 8' 9' 9' 4' 15' 4' 9' 9' 8'

CHANNEL SECTION C-C

PREPARED UNDER THE SUPERVISION OF

MARK SCHEURER
COLORADO P.E. 48988

No.	Revisions	Date	Init.	Appr.	Date
2	MDR AMENDMENT	06/2021			

CVL CONSULTANTS
10333 E. Dry Creek Rd.
Suite 240
Englewood, CO 80112
Tel: (720) 482-9526
Fax: (720) 482-9546

Melcor/TC, LLC
C/O Marathon Land Company
9750 W. Cambridge Place
Littleton, CO 80127
Tel: (303) 920-9400 Fax: (303) 920-9440

HARMONY SUBDIVISION
AREA DRAINAGE MAP

SCALE: AS SHOWN
FILE NO: 8130214901
DRAWN BY: AYK
CHECKED BY: MS
DATE: 06/23/2021
SHEET NUMBER: DR2

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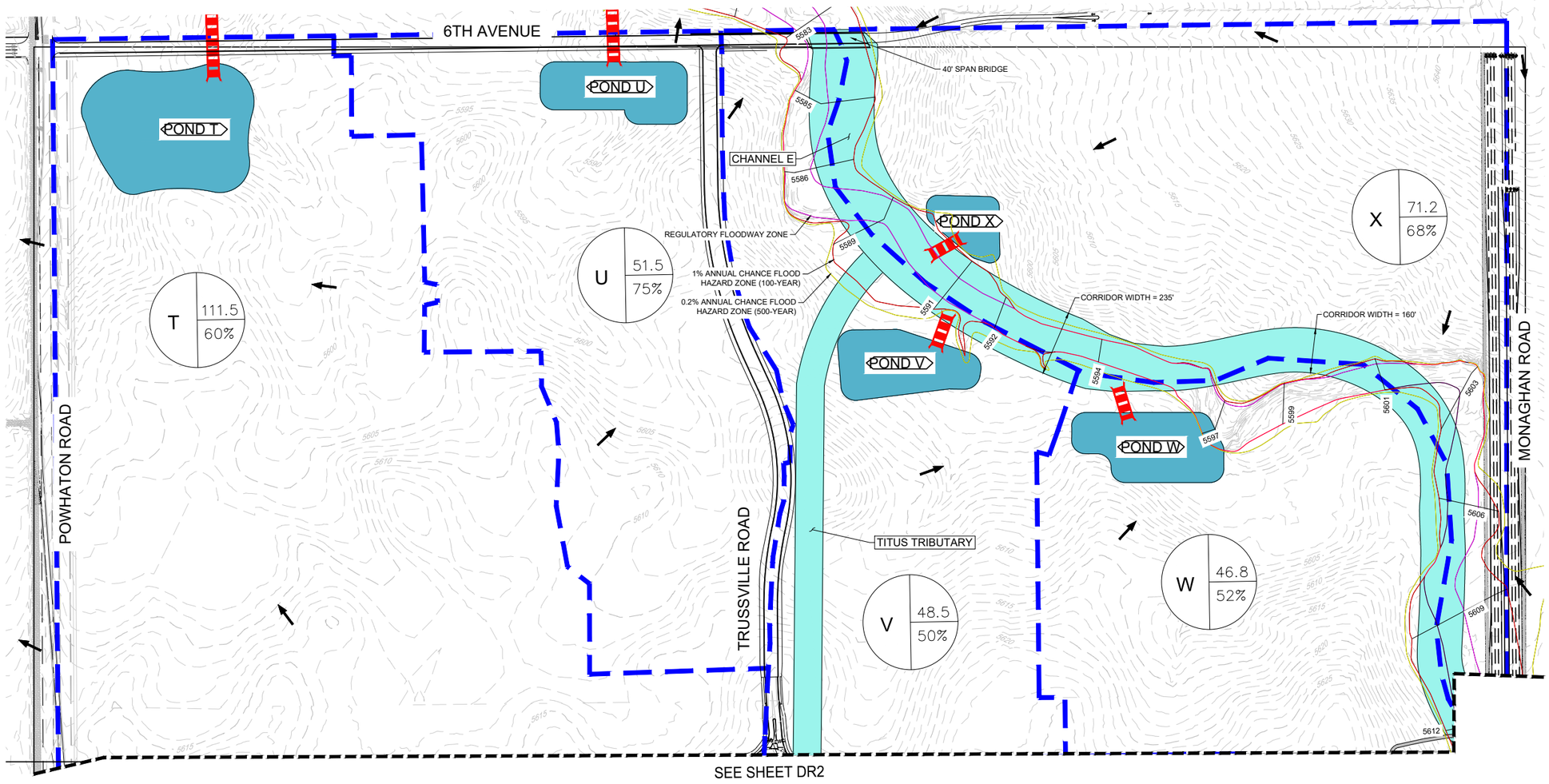
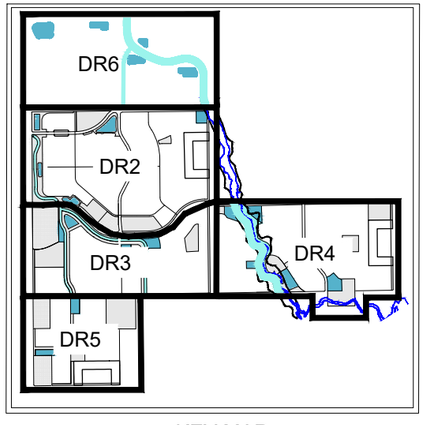
NOTE

1. CULVERT SIZES SHOWN ARE BASED ON FLOWS FROM MASTER DRAINAGE STUDY AND WILL BE CONFIRMED IN FINAL DRAINAGE REPORT.
2. "CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT."
3. TOPOGRAPHY SHOWN WAS CREATED FROM USGS DIGITAL ELEVATION MODEL DATA AND IS NGVD29 DATUM. PRELIMINARY AND FINAL DRAINAGE REPORTS WILL REQUIRE NAVD88 DATUM.
4. FOR HATCH PATTERNS SEE DR9.
5. EXISTING CONDITION FOR MDR A2 BASED ON PROPOSED DEVELOPMENT IN HARMONY FILINGS 1-14 AS EXISTING TO PROVIDE DESIGN INFORMATION FOR THE REGIONAL CHANNELS AND POND H-1 TO BE BUILT WITH HARMONY FILING 14 POND H-2 AND 8715 TO BE BUILT WITH FUTURE DEVELOPMENT.
6. POND H-2 WILL PROVIDE REGIONAL DETENTION FOR UPSTREAM TRIBUTARIES TO S. POWHATON TRIBUTARY. A COST SHARING AGREEMENT WILL BE NEGOTIATED BETWEEN OWNER AND CITY OF AURORA DURING PRELIMINARY DESIGN.





KEY MAP
N.T.S.

LEGEND

B-XX (A / B)
XX = BASIN ID
A = AREA (AC)
B = % PROPOSED IMPERVIOUS

POND X — POND
CULVERTS / PIPES
CHANNEL GRADE CONTROL
PROPOSED BASIN LINE
5650 — EXISTING INDEX CONTOURS
EXISTING INTERMEDIATE CONTOURS
7124 — CONDUIT
FLOW ARROW
7170 — DESIGN POINT

POND SUMMARY

ID	TYPE	POND TYPE	PROPOSED VOLUME (AC-FT)	ALLOWABLE RELEASE RATE (CFS)
POND-T	STORAGE UNIT	REGIONAL	15.9	102.1
POND-U	STORAGE UNIT	FULL SPECTRUM	9.1	60.2
POND-V	STORAGE UNIT	FULL SPECTRUM	6.1	77.0
POND-W	STORAGE UNIT	FULL SPECTRUM	6.0	75.2
POND-X	STORAGE UNIT	FULL SPECTRUM	11.3	97.3

PREPARED UNDER THE SUPERVISION OF

MARK SCHEURER
COLORADO P.E. 48988

No.	Revisions	Date
2	MDR AMENDMENT	06/2021

Appr. | Init. | Date

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HARMONY SUBDIVISION
AREA DRAINAGE MAP

SCALE: AS SHOWN
FILE NO: 8130214901
DRAWN BY: AYK
CHECKED BY: MS
DATE: 06/23/2021
SHEET NUMBER: DR6

N:\PROJECTS\30175804 SAND CREEK\DOCS\DRAINAGE\MASTER_DRAINAGE_REPORT AND AMENDMENTS\MASTER DRAINAGE AMENDMENT 3\DRAINAGE MAPS\DR2-DR6_MDR A3.DWG, HOWADA, 9/28/22

DR2-DR6_MDR A3.dwg

APS P-8 at Harmony Subdivision Filing No. 1 Pond Cert.

APPROVED
By Janet Bender at 11:23 am, Jul 23, 2020

219058POND1
2018-3042
07Y, 08Y

JVA, Incorporated
1512 Larimer Street
Suite 710
Denver, CO 80202
303.444.1951
info@jvajva.com

www.jvajva.com

July 16, 2020

Ms. Janet Bender, P.E., CFM
Principal Engineer
City of Aurora
15151 East Alameda Parkway
Aurora, CO 80012

RE: APS P-8 at Harmony Subdivision Filing No. 1
EDN 219058
Stormwater Pond Certificate Application
JVA Job No. 2894c

Dear Ms. Bender,

JVA, Inc. has evaluated the Topographic Survey Plat dated July 15, 2020 prepared by Falcon Surveying, Inc. for the stormwater detention facility at Aurora Public Schools Harmony P-8 new school. The subject stormwater facility is an Extended Detention Basin (EDB) with State Facility ID SWDF-20190311144827 and is described in the APS P-8 at Harmony Filing #01 Final Drainage Report, March 11, 2019 revision, Document No. 219058FD1 on file with the City of Aurora. The subject pond has been constructed in substantial conformance with the approved design drawings and will function as intended. Stage-Storage tables and critical water surface elevations for design and as-built condition are listed in the attached Pond Certification Table.

Sincerely,
JVA, INCORPORATED

By: _____
Ty Parker, P.E.
Senior Project Engineer

Enclosure(s):
Pond Certification Table
As-built Detention Worksheets
"Topographic Survey", July 15, 2020, Falcon Surveying
Sheets 6, 21, & 28, Conformed to Construction Record

COLORADO REGISTERED
KEVIN A. TONE
28699
7/16/2020
PROFESSIONAL ENGINEER

Kevin A. Tone, P.E.
Registered Professional Engineer
State of Colorado No. 28699

POND CERTIFICATION TABLE

DESCRIPTION	DESIGN	AS-BUILT (PLS)	% DIFFERENCE*
POND BOTTOM/MICROPOOL ELEVATION	5606.87	5606.57	-4.37%
1ST ORIFICE ELEV	5606.87	5606.57	-4.37%
1ST ORIFICE SIZE	7/8" Dia.	7/8" Dia.	--
2ND ORIFICE ELEV †	5607.37	n/a	--
2ND ORIFICE SIZE †	7/8" Dia.	n/a	--
3RD ORIFICE ELEV	5607.87	5607.57	-3.81%
3RD ORIFICE SIZE	7/8" Dia.	7/8" Dia.	--
4tTH ORIFICE ELEV	5608.37	5608.07	-3.58%
4tTH ORIFICE SIZE	7/8" Dia.	7/8" Dia.	--
5th ORIFICE ELEV	5608.87	5608.57	-3.38%
5th ORIFICE SIZE	7/8" Dia.	7/8" Dia.	--
VERTICAL ORIFICE ELEV	5609.37	5609.07	-3.20%
VERTICAL ORIFICE SIZE	6"x12"	6"x12"	--
EURV VOLUME (AC-FT)	0.764	0.765	0.13%
EURV WSEL	5610.10	5610.13	0.30%
TIME TO DRAIN 97% OF WQCV (HRS)	40	43	7.50%
100-YEAR VOLUME (AC-FT)	1.458	1.464	0.41%
100-YEAR WSEL	5610.94	5611.01	0.64%
100-YEAR RESTRICTOR PLATE HEIGHT	13.5"	13.5"	--
TOP OF GRATE ELEV	5610.70	5610.73	0.28%
100-YR + 1/2 EURV VOLUME (AC-FT)	1.838	1.838	0.00%
100-YR + 1/2 EURV WSEL	5611.34	5611.41	0.62%
TOP OF SPILLWAY ELEV (SPILLWAY INVERT)	5612.34	5612.39	0.41%
100-YEAR WSEL THROUGH SPILLWAY	5612.75	5612.80	0.39%
TOP OF BERM ELEV	5613.75	5613.85	0.73%
100-YEAR DISCHARGE (CFS)	17.7	18.4	3.95%

** % difference for elevations calculated relative to 5600' MSL.*

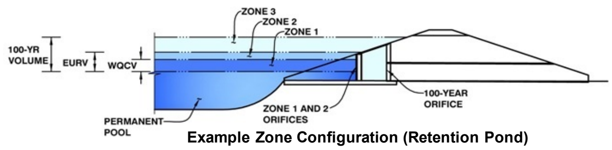
† Second orifice permenantly sealed in as-built condition to increase drain time, see plans.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **APS Harmony P8 - AS BUILT (revised July 16, 2020)**

Basin ID:



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**				
Watershed Area =	18.02	acres			
Watershed Length =	1,000	ft			
Watershed Slope =	0.020	ft/ft			
Watershed Imperviousness =	45.00%	percent			
Percentage Hydrologic Soil Group A =	0.0%	percent			
Percentage Hydrologic Soil Group B =	0.0%	percent			
Percentage Hydrologic Soil Groups C/D =	100.0%	percent			
Desired WQCV Drain Time =	40.0	hours			
Location for 1-hr Rainfall Depths =	Aurora - Municipal Center				
Water Quality Capture Volume (WQCV) =	0.290	acre-feet	Optional User Override		
Excess Urban Runoff Volume (EURV) =	0.761	acre-feet	1-hr Precipitation		
2-yr Runoff Volume (P1 = 0.87 in.) =	0.518	acre-feet		inches	
5-yr Runoff Volume (P1 = 1.14 in.) =	0.820	acre-feet		inches	
10-yr Runoff Volume (P1 = 1.39 in.) =	1.123	acre-feet		inches	
25-yr Runoff Volume (P1 = 1.76 in.) =	1.751	acre-feet		inches	
50-yr Runoff Volume (P1 = 2.08 in.) =	2.234	acre-feet		inches	
100-yr Runoff Volume (P1 = 2.42 in.) =	2.835	acre-feet		inches	
500-yr Runoff Volume (P1 = 3.3 in.) =	4.219	acre-feet		inches	
Approximate 2-yr Detention Volume =	0.485	acre-feet			
Approximate 5-yr Detention Volume =	0.773	acre-feet			
Approximate 10-yr Detention Volume =	0.922	acre-feet			
Approximate 25-yr Detention Volume =	1.113	acre-feet			
Approximate 50-yr Detention Volume =	1.214	acre-feet			
Approximate 100-yr Detention Volume =	1.458	acre-feet			

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.290	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.471	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	1.077	acre-feet
Total Detention Basin Volume =	1.838	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 = 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	--	--	--	10	0.000		
5607.00	--	0.43	--	--	--	64	0.001	16	0.000
5607.20	--	0.63	--	--	--	170	0.004	39	0.001
5607.60	--	1.03	--	--	--	509	0.012	175	0.004
5608.00	--	1.43	--	--	--	1,904	0.044	658	0.015
5608.40	--	1.83	--	--	--	5,372	0.123	2,060	0.047
5608.80	--	2.23	--	--	--	11,331	0.260	5,453	0.125
5609.20	--	2.63	--	--	--	17,070	0.392	11,134	0.256
5609.29 (WQCV)	--	2.72	--	--	--	18,380	0.422	12,729	0.292
5609.40	--	2.83	--	--	--	20,054	0.460	14,843	0.341
5609.60	--	3.03	--	--	--	22,944	0.527	19,142	0.439
5609.80	--	3.23	--	--	--	25,929	0.595	24,030	0.552
5610.00	--	3.43	--	--	--	28,634	0.657	29,486	0.677
5610.13 (EURV)	--	3.56	--	--	--	30,136	0.692	33,306	0.765
5610.40	--	3.83	--	--	--	33,003	0.758	41,830	0.960
5610.60	--	4.03	--	--	--	34,942	0.802	48,624	1.116
5610.80	--	4.23	--	--	--	36,894	0.847	55,808	1.281
5611.00	--	4.43	--	--	--	38,806	0.891	63,378	1.455
5611.20	--	4.63	--	--	--	40,628	0.933	71,321	1.637
5611.41 (100+1/2EURV)	--	4.84	--	--	--	42,684	0.980	80,069	1.838
5611.60	--	5.03	--	--	--	43,832	1.006	88,288	2.027
5611.80	--	5.23	--	--	--	45,335	1.041	97,205	2.232
5612.00	--	5.43	--	--	--	46,779	1.074	106,416	2.443
5612.20	--	5.63	--	--	--	48,238	1.107	115,918	2.661
5612.40	--	5.83	--	--	--	50,133	1.151	125,755	2.887
5612.60	--	6.03	--	--	--	51,501	1.182	135,918	3.120
5612.80	--	6.23	--	--	--	52,780	1.212	146,347	3.360
5613.00	--	6.43	--	--	--	54,102	1.242	157,035	3.605
5613.20	--	6.63	--	--	--	55,325	1.270	167,977	3.856
5613.40	--	6.83	--	--	--	56,598	1.299	179,170	4.113
5613.60	--	7.03	--	--	--	58,401	1.341	190,670	4.377
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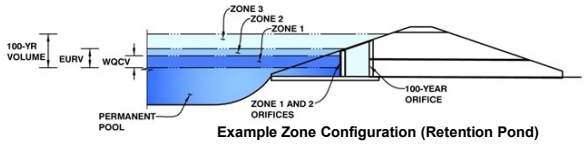
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: APS Harmony P8 - AS BUILT (revised July 16, 2020)

Basin ID:



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.72	0.290	Orifice Plate
Zone 2 (EURV)	3.56	0.471	Rectangular Orifice
Zone 3 (User)	4.84	1.077	Weir&Pipe (Restrict)
		1.838	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.50	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	9.00	inches
Orifice Plate: Orifice Area per Row =	0.60	sq. inches (diameter = 7/8 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	4.174E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	1.50	2.00				
Orifice Area (sq. inches)	0.60	0.60	0.60	0.60				

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	6.00	N/A	inches
Vertical Orifice Width =	12.00		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.50	N/A	ft^2
Vertical Orifice Centroid =	0.25	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.16	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.16	N/A	feet
Over Flow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.59	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	12.00	N/A	ft^2
Overflow Grate Open Area w/ Debris =	6.00	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 =	0.25	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 =	13.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.82	N/A	ft^2
Outlet Orifice Centroid =	0.64	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=	5.82	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	65.30	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

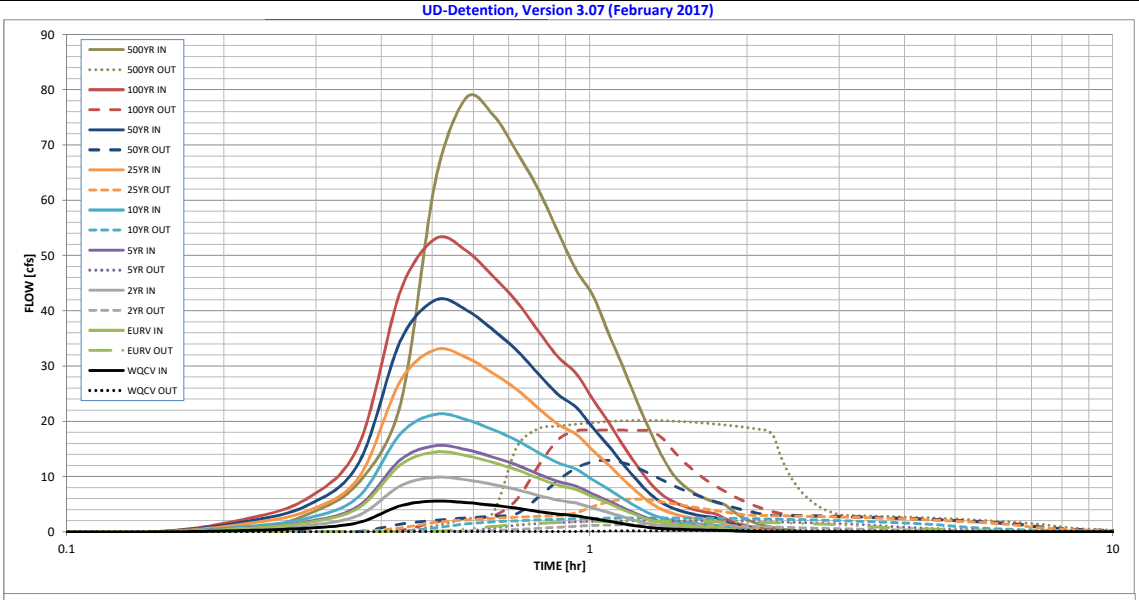
Spillway Design Flow Depth=	0.41	feet
Stage at Top of Freeboard =	7.23	feet
Basin Area at Top of Freeboard =	1.34	acres

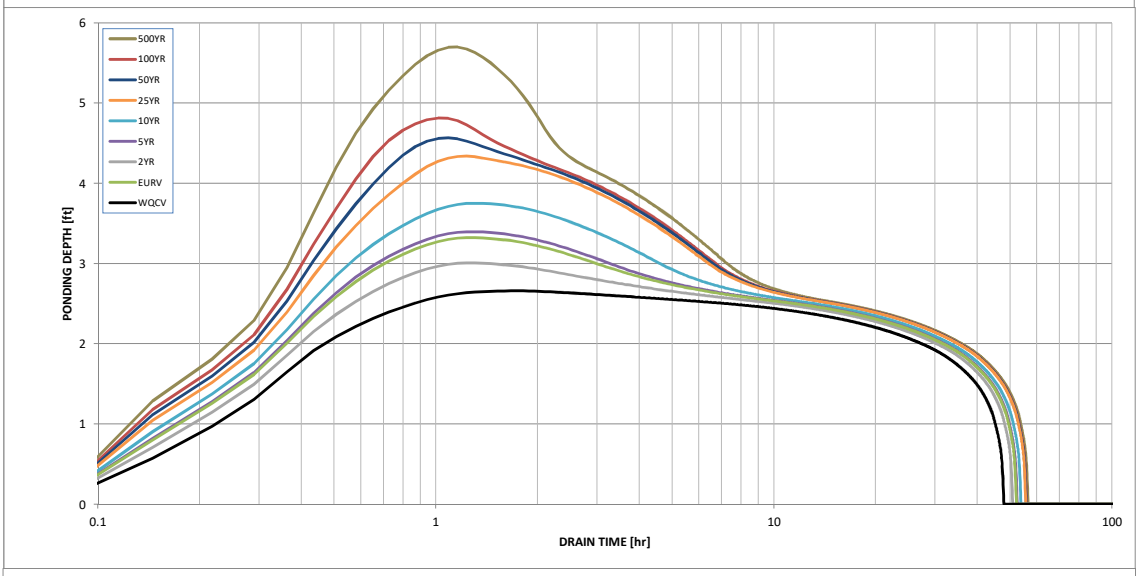
Routed Hydrograph Results

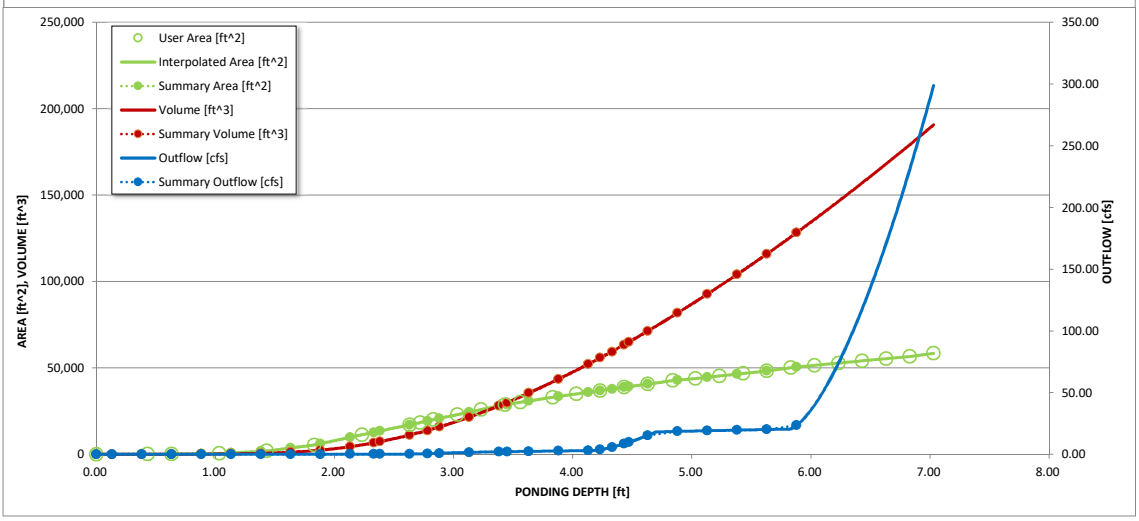
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.87	1.14	1.39	1.76	2.08	2.42	3.30
Calculated Runoff Volume (acre-ft) =	0.290	0.761	0.518	0.820	1.123	1.751	2.234	2.835	4.219
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.290	0.759	0.517	0.819	1.122	1.749	2.232	2.833	4.217
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.11	0.32	0.82	1.13	1.52	2.41
Predevelopment Peak Q (cfs) =	0.0	0.0	0.2	2.0	5.8	14.7	20.4	27.4	43.3
Peak Inflow Q (cfs) =	5.6	14.5	9.9	15.6	21.3	33.0	42.0	53.1	78.5
Peak Outflow Q (cfs) =	0.25	1.9	1.3	2.1	2.5	5.9	13.0	18.4	20.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.4	0.4	0.6	0.7	0.5
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.8	1.2	1.3
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) =	43	43	44	43	42	40	37	34	27
Time to Drain 99% of Inflow Volume (hours) =	**46**	48	48	48	48	48	47	45	43
Maximum Ponding Depth (ft) =	2.66	3.32	3.01	3.40	3.75	4.34	4.57	4.81	5.70
Area at Maximum Ponding Depth (acres) =	0.40	0.62	0.52	0.64	0.74	0.87	0.92	0.97	1.12
Maximum Volume Stored (acre-ft) =	0.263	0.606	0.424	0.651	0.900	1.367	1.573	1.809	2.728
Elev 5606.57 = 0.0 depth	5609.23	5609.89	5609.58	5609.97	5610.32	5610.91	5611.14	5611.38	5612.27

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

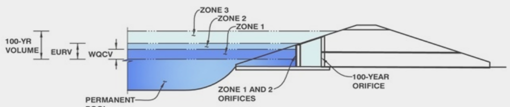
Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
4.35 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:04:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:08:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:13:03	0.25	0.64	0.44	0.69	0.93	1.42	1.80	2.25	3.25
1.149	0:17:24	0.67	1.72	1.18	1.85	2.52	3.88	4.92	6.20	9.05
	0:21:45	1.73	4.43	3.04	4.76	6.48	9.97	12.63	15.91	23.23
	0:26:06	4.75	12.16	8.36	13.09	17.79	27.38	34.67	43.65	63.69
	0:30:27	5.58	14.47	9.89	15.59	21.28	33.00	41.96	53.09	78.50
	0:34:48	5.31	13.82	9.43	14.89	20.34	31.58	40.20	50.91	75.55
	0:39:09	4.83	12.58	8.59	13.55	18.52	28.75	36.59	46.33	68.82
	0:43:30	4.30	11.24	7.66	12.12	16.58	25.80	32.87	41.67	61.99
	0:47:51	3.69	9.72	6.61	10.48	14.37	22.41	28.61	36.34	54.24
	0:52:12	3.22	8.46	5.76	9.12	12.50	19.46	24.88	31.65	47.35
	0:56:33	2.92	7.67	5.22	8.27	11.33	17.65	22.54	28.64	42.74
	1:00:54	2.39	6.34	4.29	6.84	9.40	14.70	18.81	23.93	35.83
	1:05:15	1.94	5.18	3.50	5.60	7.71	12.11	15.52	19.78	29.69
	1:09:36	1.47	4.00	2.69	4.33	5.99	9.48	12.19	15.59	23.53
	1:13:57	1.08	2.99	1.99	3.23	4.51	7.21	9.31	11.96	18.18
	1:18:18	0.79	2.16	1.45	2.34	3.27	5.28	6.87	8.87	13.58
	1:22:39	0.62	1.67	1.12	1.81	2.52	4.02	5.20	6.69	10.18
	1:27:00	0.51	1.37	0.92	1.48	2.06	3.28	4.22	5.41	8.19
	1:31:21	0.43	1.17	0.79	1.26	1.75	2.77	3.56	4.56	6.89
	1:35:42	0.38	1.02	0.69	1.10	1.53	2.42	3.11	3.98	5.99
	1:40:03	0.34	0.92	0.62	0.99	1.38	2.17	2.79	3.56	5.36
	1:44:24	0.32	0.85	0.57	0.92	1.27	2.00	2.56	3.27	4.91
	1:48:45	0.23	0.62	0.42	0.67	0.93	1.47	1.89	2.42	3.66
	1:53:06	0.17	0.46	0.31	0.49	0.68	1.07	1.38	1.76	2.65
	1:57:27	0.13	0.34	0.23	0.36	0.50	0.79	1.01	1.30	1.96
	2:01:48	0.09	0.25	0.17	0.27	0.37	0.58	0.75	0.96	1.46
	2:06:09	0.06	0.18	0.12	0.19	0.27	0.42	0.55	0.70	1.07
	2:10:30	0.05	0.13	0.08	0.14	0.19	0.30	0.39	0.50	0.77
	2:14:51	0.03	0.09	0.06	0.10	0.14	0.22	0.28	0.36	0.56
	2:19:12	0.02	0.06	0.04	0.06	0.09	0.15	0.19	0.25	0.39
	2:23:33	0.01	0.04	0.02	0.04	0.06	0.09	0.12	0.16	0.25
	2:27:54	0.01	0.02	0.01	0.02	0.03	0.05	0.07	0.09	0.14
	2:32:15	0.00	0.01	0.00	0.01	0.01	0.02	0.03	0.04	0.07
	2:36:36	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02
	2:40:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:49:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:54:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:58:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:02:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:07:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:11:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:24:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:28:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:33:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:37:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:41:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:46:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:54:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:59:15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:03:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:07:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:12:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:16:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:21:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:29:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:34:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:38:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:42:45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:47:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:51:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:04:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:08:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:13:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: APS Harmony P8

Basin ID: A1



Example Zone Configuration (Retention Pond)

Required Volume Calculation

			Optional User Override 1-hr Precipitation	
Selected BMP Type =	EDB			
Watershed Area =	18.02	acres		
Watershed Length =	1,000	ft		
Watershed Slope =	0.020	ft/ft		
Watershed Imperviousness =	45.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	100.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	Aurora - Municipal Center			
Water Quality Capture Volume (WQCV) =	0.290	acre-feet		
Excess Urban Runoff Volume (EURV) =	0.761	acre-feet		
2-yr Runoff Volume (P1 = 0.87 in.) =	0.518	acre-feet		inches
5-yr Runoff Volume (P1 = 1.14 in.) =	0.820	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	1.123	acre-feet		inches
25-yr Runoff Volume (P1 = 1.76 in.) =	1.751	acre-feet		inches
50-yr Runoff Volume (P1 = 2.08 in.) =	2.234	acre-feet		inches
100-yr Runoff Volume (P1 = 2.42 in.) =	2.835	acre-feet		inches
500-yr Runoff Volume (P1 = 3.3 in.) =	4.219	acre-feet		inches
Approximate 2-yr Detention Volume =	0.485	acre-feet		
Approximate 5-yr Detention Volume =	0.773	acre-feet		
Approximate 10-yr Detention Volume =	0.922	acre-feet		
Approximate 25-yr Detention Volume =	1.113	acre-feet		
Approximate 50-yr Detention Volume =	1.214	acre-feet		
Approximate 100-yr Detention Volume =	1.458	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.290	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.471	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	1.077	acre-feet
Total Detention Basin Volume =	1.838	acre-feet

Depth Increment = 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	--	--	--	10	0.000		
5607.5	--	0.63	--	--	--	295	0.007	96	0.002
5608	--	1.13	--	--	--	1,850	0.042	627	0.014
5608.5	--	1.63	--	--	--	6,670	0.153	2,741	0.063
5609	--	2.13	--	--	--	14,100	0.324	7,910	0.182
5609.5	--	2.63	--	--	--	22,710	0.521	17,084	0.392
5610	--	3.13	--	--	--	30,000	0.689	30,238	0.694
5610.5	--	3.63	--	--	--	36,000	0.826	46,719	1.073
5611	--	4.13	--	--	--	40,900	0.939	65,928	1.513
5611.5	--	4.63	--	--	--	45,200	1.038	87,439	2.007
5612	--	5.13	--	--	--	48,900	1.123	110,952	2.547
5612.5	--	5.63	--	--	--	51,800	1.189	136,118	3.125
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-Predominant Soil Group: **C** (see soil map, Appendix A)

-Allowable Release Rate: **18 cfs** (1 cfs/acre for HSG C&D)

-EURV WSE: **5609.93**

-100-yr + 1/2 EURV WSE: **5611.34**

-Emergency spillway crest elevation: **5612.34** (1' freeboard provided above 100-yr + 1/2 EURV WSE)

-Emergency spillway 100-yr undetained WSE: **5612.75,** (see attached FlowMaster weir calculation, 100-yr undetained depth of flow = 0.41 feet)

-Top of berm: **5613.75** (1' freeboard provided above emergency spillway 100-yr undertained WSE)

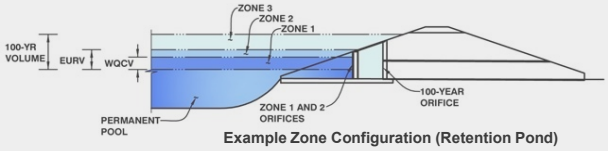
Design

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: APS Harmony P8

Basin ID: A1



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.42	0.290	Orifice Plate
Zone 2 (EURV)	3.23	0.471	Rectangular Orifice
Zone 3 (User)	4.47	1.077	Weir&Pipe (Restrict)
		1.838	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.42	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	9.00	inches
Orifice Plate: Orifice Area per Row =	0.60	sq. inches (diameter = 7/8 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	4.174E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	1.00	1.50	2.00			
Orifice Area (sq. inches)	0.60	0.60	0.60	0.60	0.89			

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.83	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	6.50	N/A	inches
Vertical Orifice Width =	12.00		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.54	N/A	ft^2
Vertical Orifice Centroid =	0.27	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.83	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.83	N/A	feet
Over Flow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.59	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	12.00	N/A	ft^2
Overflow Grate Open Area w/ Debris =	6.00	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 =	0.25	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 =	13.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.82	N/A	ft^2
Outlet Orifice Centroid =	0.64	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=	5.47	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	65.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

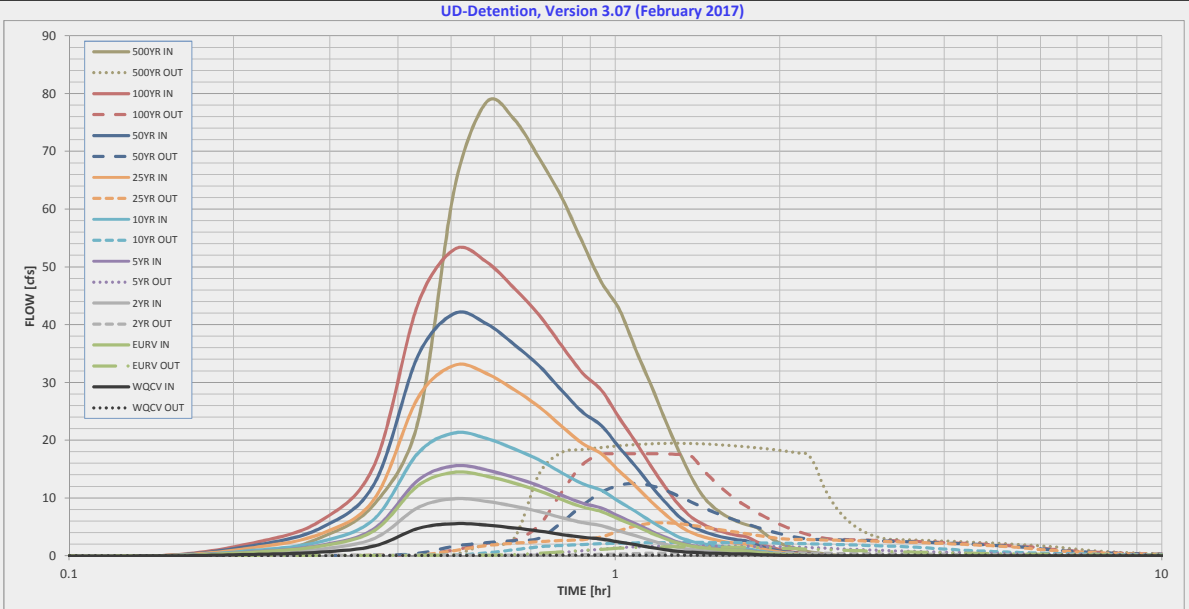
Spillway Design Flow Depth=	0.41	feet
Stage at Top of Freeboard =	6.88	feet
Basin Area at Top of Freeboard =	1.17	acres

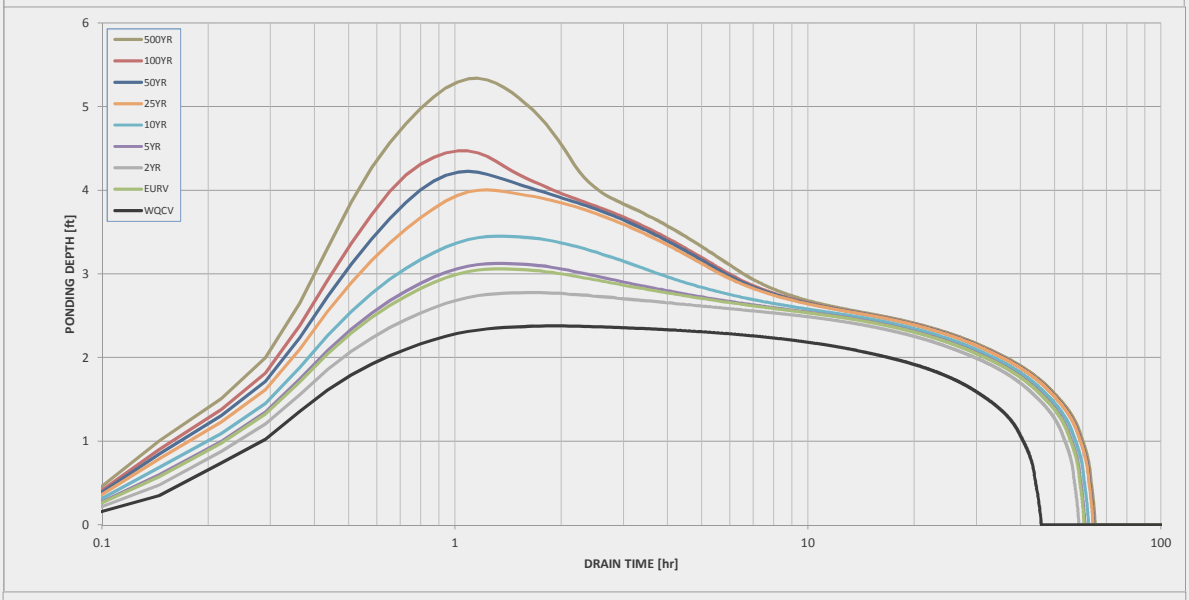
Routed Hydrograph Results

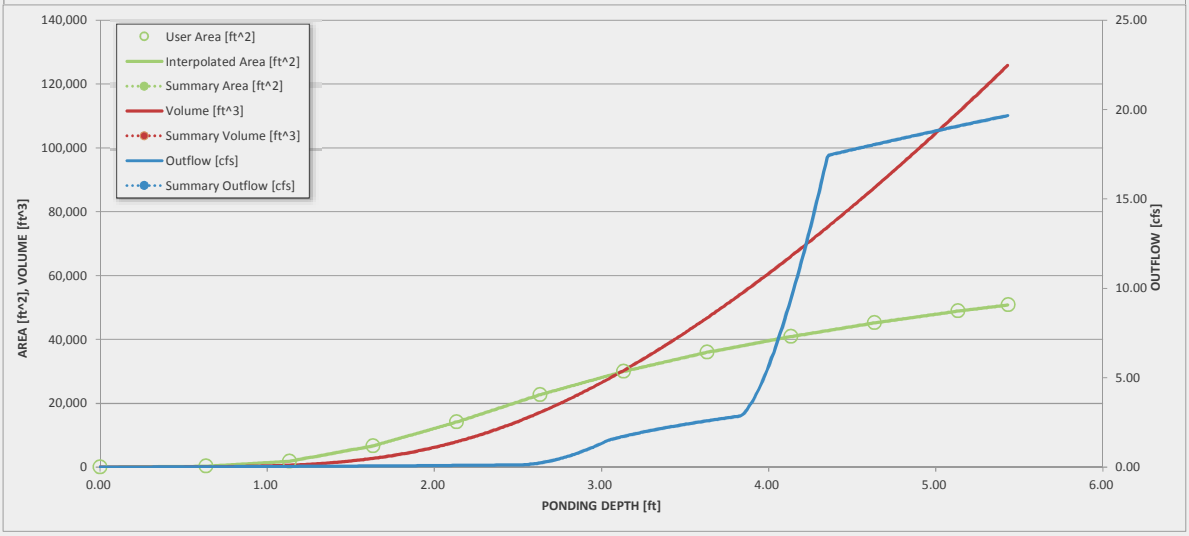
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.87	1.14	1.39	1.76	2.08	2.42	3.30
Calculated Runoff Volume (acre-ft) =	0.290	0.761	0.518	0.820	1.123	1.751	2.234	2.835	4.219
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.290	0.759	0.517	0.819	1.122	1.749	2.232	2.833	4.217
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.11	0.32	0.82	1.13	1.52	2.41
Predevelopment Peak Q (cfs) =	0.0	0.0	0.2	2.0	5.8	14.7	20.4	27.4	43.3
Peak Inflow Q (cfs) =	5.6	14.5	9.9	15.6	21.3	33.0	42.0	53.1	78.5
Peak Outflow Q (cfs) =	0.12	1.6	0.5	1.7	2.3	5.7	12.5	17.7	19.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.4	0.4	0.6	0.6	0.4
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.8	1.2	1.3
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) =	41	52	52	52	51	49	47	44	39
Time to Drain 99% of Inflow Volume (hours) =	**43**	56	55	56	57	57	56	55	52
Maximum Ponding Depth (ft) =	2.38	3.06	2.78	3.13	3.45	4.00	4.23	4.47	5.34
Area at Maximum Ponding Depth (acres) =	0.42	0.66	0.57	0.68	0.78	0.91	0.96	1.01	1.15
Maximum Volume Stored (acre-ft) =	0.270	0.640	0.468	0.687	0.928	1.393	1.599	1.844	2.774
Elev 5606.87 = 0.0 depth	5609.25	5609.93	5609.65	5610.00	5610.32	5610.87	5611.10	5611.34	5612.21

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

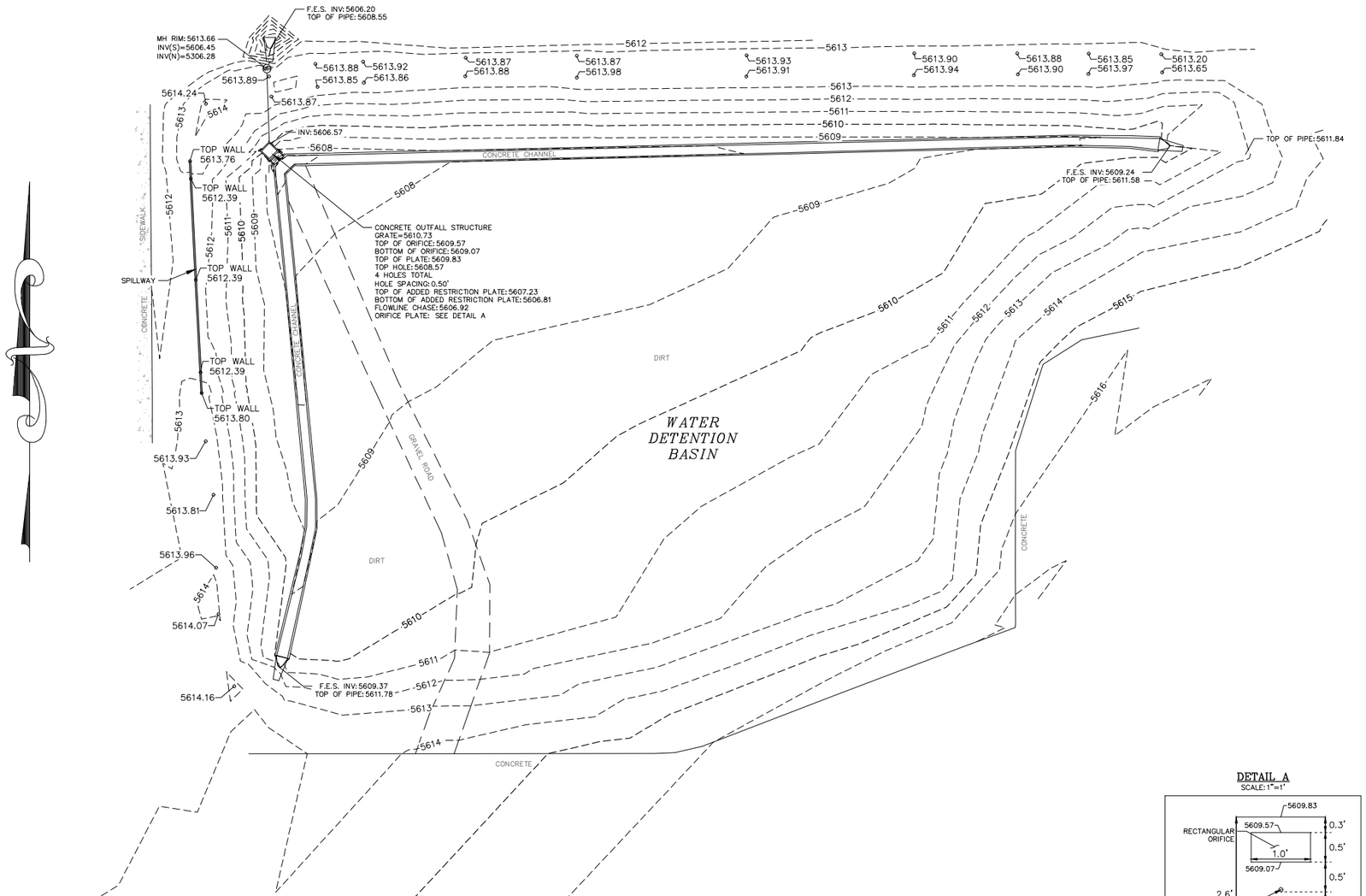






TOPOGRAPHIC SURVEY

A PARCEL OF LAND SITUATED IN THE SOUTHWEST 1/4 OF SECTION 9,
TOWNSHIP 4 SOUTH, RANGE 65 WEST OF THE 6TH P.M.,
COUNTY OF ARAPAHOE, STATE OF COLORADO

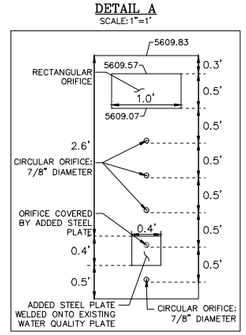


GRAPHIC SCALE

20 0 10 20 40 80

(IN US SURVEY FEET)
1 inch = 20 ft.

DETAIL A
SCALE: 1"=1'



CLIENT INFORMATION

THIS SURVEY WAS PREPARED FOR JHL CONSTRUCTION ON JULY 15, 2020.

NOTES

1) FALCON SURVEYING, INC. RECOMMENDS THE PROPERTY OWNER OBTAIN A TITLE COMMITMENT TO MORE THOROUGHLY RESEARCH EASEMENTS.

2) ANY PERSON WHO KNOWINGLY REMOVES, ALTERS OR DEFACES ANY PUBLIC LAND SURVEY MONUMENT OR LAND MONUMENT OR ACCESSORY, COMMITS A CLASS TWO (2) MISDEMEANOR PURSUANT TO STATE STATUTE 18-4-508, C.R.S.

3) NOTICE: ACCORDING TO COLORADO LAW YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS SURVEY WITHIN THREE YEARS AFTER YOU FIRST DISCOVER SUCH DEFECT. IN NO EVENT, MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF CERTIFICATION SHOWN HEREON. (C.R.S. 13-80-105(3)(A))

4) FALCON SURVEYING, INC. RECOMMENDS ALL INTERESTED PARTIES RETAIN THE SERVICES OF A COMPETENT INDIVIDUAL TO CONSULT PERTINENT DOCUMENTS FOR SPECIFIC DEVELOPMENT RESTRICTIONS AND CRITERIA WHICH MIGHT APPLY TO SUBJECT PARCEL. FALCON SURVEYING, INC. AND THE SURVEYOR OF RECORD ASSUME NO RESPONSIBILITY FOR THE ZONING RESTRICTIONS UPON THE SUBJECT PROPERTY.

5) BURIED UTILITIES AND/OR PIPE LINES ARE SHOWN PER VISIBLE SURFACE EVIDENCE AND UTILITY PLANS. ADDITIONAL UTILITIES, IN USE OR ABANDONED, MIGHT EXIST ON, NEAR OR CROSSING THE SUBJECT PROPERTY. LACKING EXCAVATION, THE EXACT LOCATION OF UNDERGROUND FEATURES CANNOT BE ACCURATELY, COMPLETELY AND RELIABLY DEPICTED. WHERE ADDITIONAL OR MORE DETAILED INFORMATION IS REQUIRED, THE CLIENT IS ADVISED THAT EXCAVATION MAY BE NECESSARY. WITHOUT EXPRESSING A LEGAL OPINION AS TO THE OWNERSHIP OR NATURE OF THE POTENTIAL OVERHANGS. THE DIMENSIONS OF ALL UTILITY POLE CROSSMEMBERS AND/OR OVERHANGS SHOWN HEREON ARE LOCATED TO THE BEST OF OUR ABILITY AND ARE APPROXIMATE. FALCON SURVEYING, INC. AND THE SURVEYOR OF RECORD SHALL NOT BE LIABLE FOR THE LOCATION OF OR THE FAILURE TO NOTE THE LOCATION OF NON-VISIBLE UTILITIES.

6) ALL DISTANCES IN U.S. SURVEY FEET.

7) BENCHMARK: CITY OF AURORA BENCHMARK KNOWN AS 4S6508SE001(OLD REFERENCE NAME 23-045), BEING A 3" DIAMETER BRASS CAP STAMPED "C.O.A., BM, 23-45" ATOP THE NORTHEAST CONCRETE BASE OF THE TOWER FOR THE OVERHEAD TRANSMISSION LINES LOCATED ON THE WEST SIDE OF POWHATON ROAD IN THE VICINITY OF THE EAST-WEST CENTERLINE OF SECTION 8, TOWNSHIP 4 SOUTH, RANGE 65 WEST HAVING A PUBLISHED ELEVATION OF 5612.875' NAVD 88 DATUM.

SURVEYOR'S CERTIFICATE

I, JEFFREY J. MACKENNA, A REGISTERED LAND SURVEYOR IN THE STATE OF COLORADO, DO HEREBY CERTIFY THAT THE SURVEY SHOWN HEREON WAS MADE UNDER MY DIRECT SUPERVISION AND THAT IT IS BASED ON MY KNOWLEDGE, INFORMATION AND BELIEF. THIS SURVEY IS IN ACCORDANCE WITH APPLICABLE STANDARDS OF PRACTICE BUT IS NOT A GUARANTY OR WARRANTY, EITHER EXPRESSED OR IMPLIED.

JEFFREY J. MACKENNA 07/15/2020
PLS 34183

FALCON SURVEYING INC.
9940 WEST 25TH AVENUE
LAKEWOOD, CO 80215
303-202-1560
WWW.FALCONSURVEYING.COM

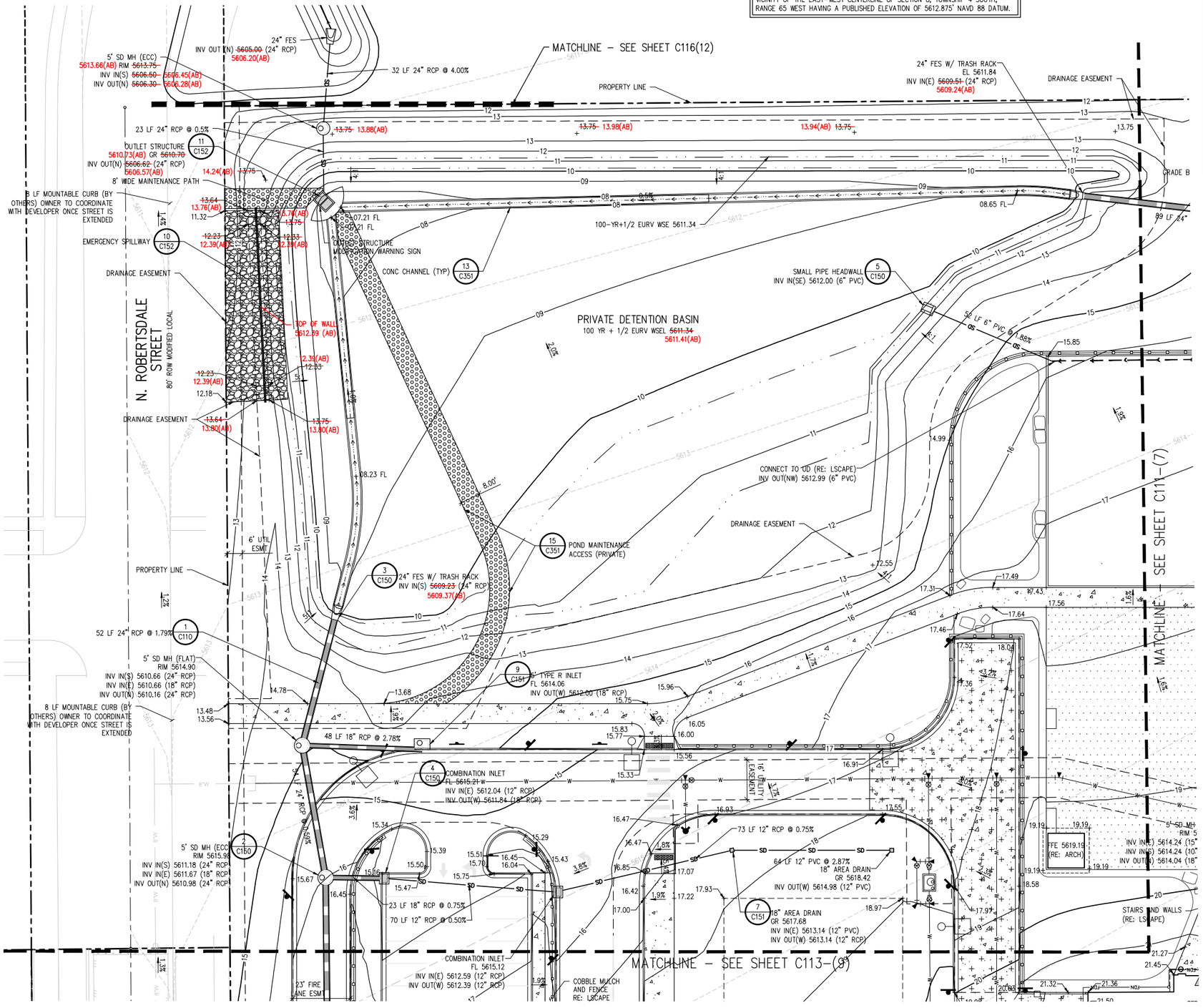
DATE: 07/15/2020	REVA:		
REVB:	REVC:		
DRAWN BY: CT	CHK'D BY: JJM	JOB NO. 181215	
DATE OF FIELD SURVEY: 07/XX/2020	181215-TOPO-V2.DWG		

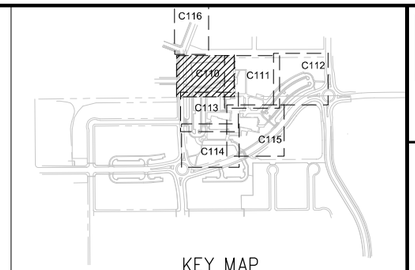
S:\JOBS\2018\181215\DWG\PDF_2020-07-15\181215-TOPO-V2.dwg

219058

BENCHMARK

CITY OF AURORA BENCHMARK KNOWN AS 4S650BSE001 (OLD REFERENCE NAME 23-045), BEING A 3" DIAMETER BRASS CAP STAMPED "C.O.A., BM, 23-45" ATOP THE NORTHEAST CONCRETE BASE OF THE TOWER FOR THE OVERHEAD TRANSMISSION LINES LOCATED ON THE WEST SIDE OF POWHATON ROAD IN THE VICINITY OF THE EAST-WEST CENTERLINE OF SECTION 8, TOWNSHIP 4 SOUTH, RANGE 65 WEST HAVING A PUBLISHED ELEVATION OF 5612.875' NAVD 88 DATUM.





KEY MAP

GRADING AND DRAINAGE NOTES:

1. CONTRACTOR TO FIELD VERIFY ALL EXISTING UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION. REFER TO GENERAL NOTES FOR UTILITY LOCATION AND PROTECTION.
2. REFER TO HORIZONTAL CONTROL PLAN FOR FURTHER INFORMATION PERTAINING TO CURB & GUTTER, CHASES, AND DRAINAGE PANS.
3. CONTRACTOR IS RESPONSIBLE FOR RESTORING ALL DISTURBED AREAS TO THEIR ORIGINAL CONDITIONS.
4. ALL SPOT ELEVATIONS ARE TO FINISHED GRADE OR FLOWLINE UNLESS OTHERWISE SPECIFIED.
5. IF WALL IS SHOWN, TW DENOTES THE FINISHED GRADE ADJACENT TO THE HIGH SIDE OF THE WALL. BW DENOTES THE FINISHED GRADE ADJACENT TO THE LOW SIDE OF THE WALL. REFER TO ARCH PLANS/DETAILS FOR WALL ELEVATIONS BEYOND THE ADJACENT FINISHED GRADES (EXPOSED WALL CAP/FOOTER, ETC.)
6. UNLESS LABELED AS "PUBLIC", ALL STORM INFRASTRUCTURE IS PRIVATE AND WILL BE MAINTAINED BY OWNER UNDER AURORA PUBLIC SCHOOLS MS4.
7. ADD 5600.00 TO ALL ELEVATIONS SHOWN AS TWO DIGITS LEFT OF DECIMAL.

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Glenwood Springs • Denver

NO.	DATE	DES'D	DWN
2	7/16/20	WTP	WTP
1	11/11/19	WTP	WTP

CONSTRUCTION RECORD
REVISION #1
REVISION DESCRIPTION

DESIGNED BY:	AMF/SW
DRAWN BY:	AMF/SW
CHECKED BY:	WTP
JOB #:	2894c
DATE:	3/11/2019

JVA, INC.

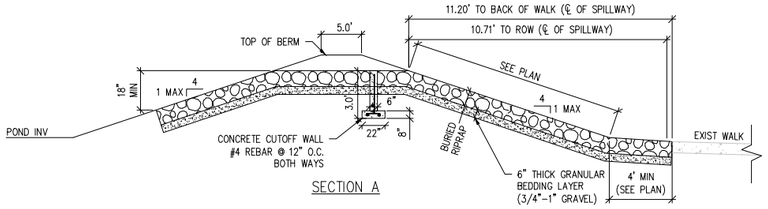
APS P-8 AT HARMONY FILING #1

DETAILED GRADING AND DRAINAGE PLAN

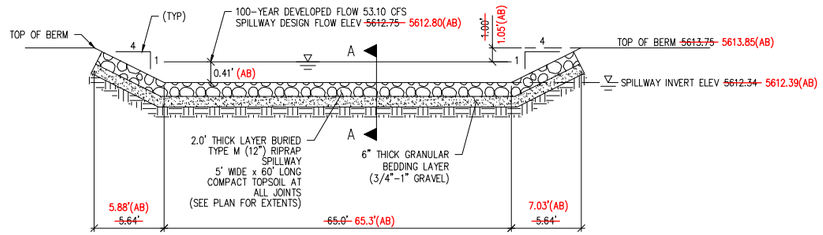
SHEET NO.
C110-(6)

20 0 20 40
SCALE IN FEET

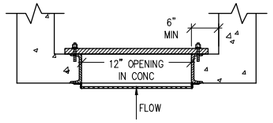
219058



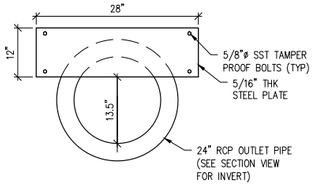
SECTION A



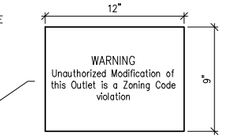
EMERGENCY SPILLWAY DETAIL (10 / C110)
NTS



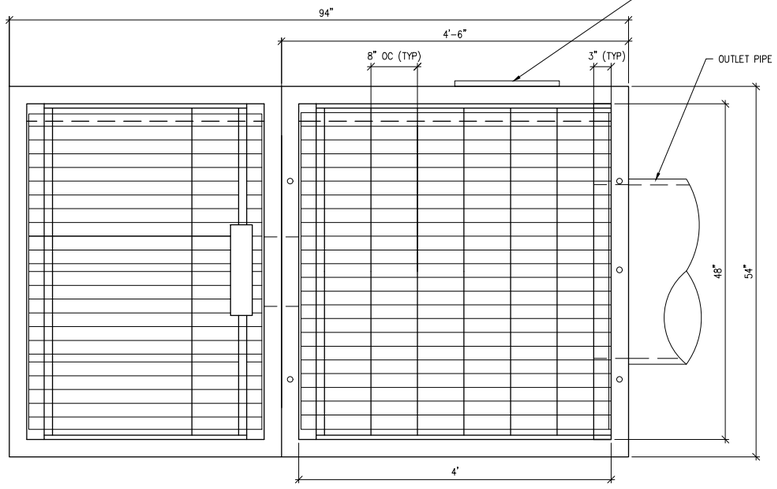
SECTION B-B – PLAN VIEW



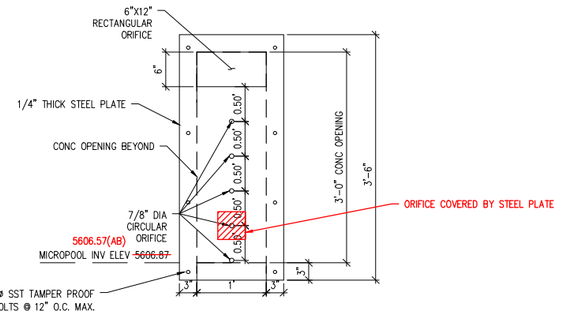
100-YR PLATE DETAIL



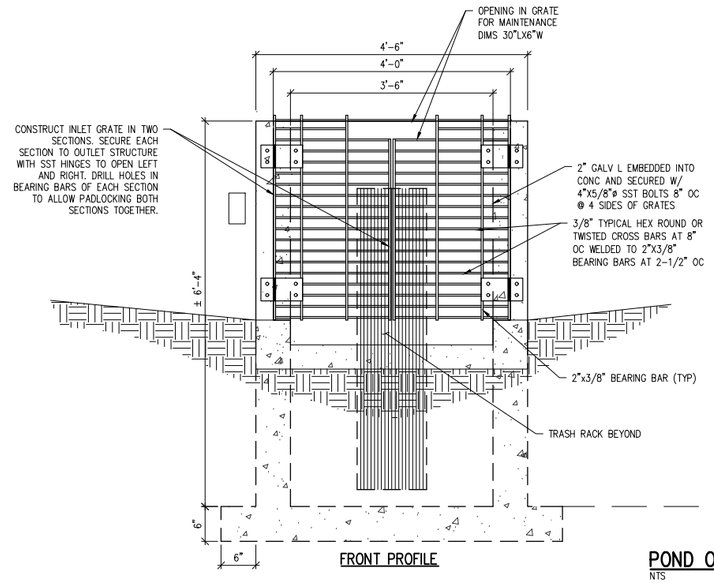
OUTLET STRUCTURE WARNING SIGN



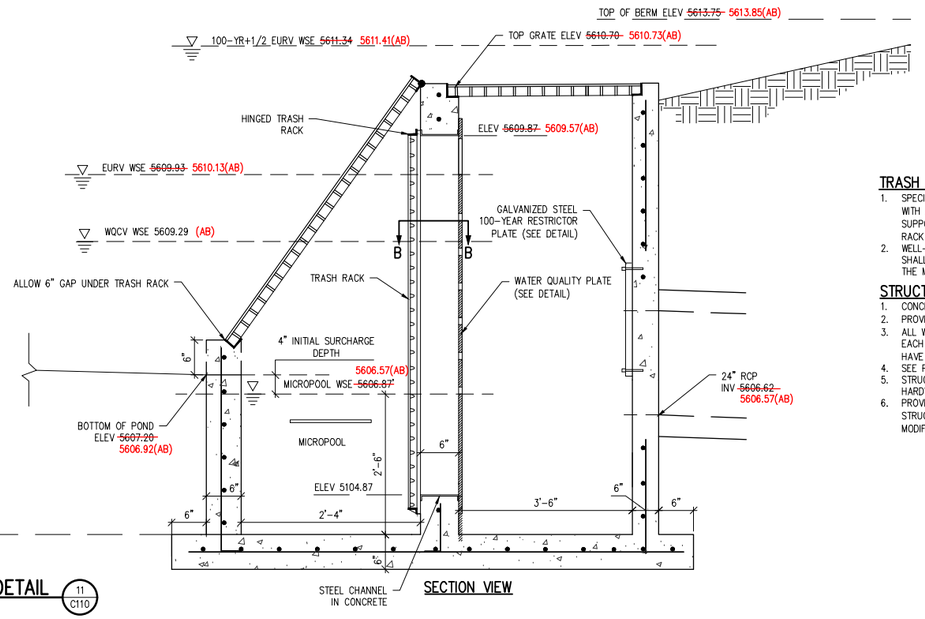
PLAN



WATER QUALITY PLATE DETAIL



FRONT PROFILE



SECTION VIEW

POND OUTLET STRUCTURE DETAIL (11 / C110)
NTS

TRASH RACK NOTES:

1. SPECIFIED TRASH RACK: US FILTER STAINLESS STEEL WELL-SCREEN WITH #93 VEE WIRE, 0.139" OPENINGS BETWEEN WIRES, #156 SUPPORT RODS ON 3/4" SPACING, VERTICAL ORIENTATION. TOTAL RACK THICKNESS OF 0.31" AND 3/8" X 1.0" FLAT BAR FRAME.
2. WELL-SCREEN TRASH RACKS SHALL BE STAINLESS STEEL AND SHALL BE ATTACHED BY INTERMITTENT WELDS ALONG THE EDGE OF THE MOUNTING FRAME

STRUCTURAL NOTES:

1. CONCRETE SHALL BE CDOT CLASS B AND CAST-IN PLACE.
2. PROVIDE STEPS AT 15" OC IN BOTH BOXES.
3. ALL WALLS AND BASE SHALL BE REINFORCED WITH #4'S @ 8" OC EACH WAY. REINFORCING BARS SHALL BE DEFORMED AND SHALL HAVE A 2" MINIMUM CLEARANCE.
4. SEE PLAN DETAILS FOR LOCATION AND SIZE OF PIPE.
5. STRUCTURAL STEEL FOR GRATES AND GRATE INSTALLATION HARDWARE SHALL BE GALVANIZED.
6. PROVIDE THE FOLLOWING WARNING SIGN ON THE OUTLET STRUCTURE: "KEEP SCREEN AND GRATE CLEAN. UNAUTHORIZED MODIFICATION OF THIS OUTLET IS A CODE VIOLATION."

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NO.	DATE	DES'D	DWN	REVISION DESCRIPTION
2	7/16/20	WTP	WTP	CONSTRUCTION RECORD
1	11/11/19	WTP	WTP	REVISION #1

DESIGNED BY:	AMF/SW
DRAWN BY:	AMF/SW
CHECKED BY:	WTP
JOB #:	2894c
DATE:	3/11/2019

JVA, INC.

APS P-8 AT HARMONY FILING #1

PRIVATE DRAINAGE DETAILS

SHEET NO.
C152-(21)

219058

TIE TO EXIST GRADE
N68913.70
E2232916.61

0.4%

1080 LF DRAINAGE SWALE @ 0.4%
TO BE MAINTAINED BY SUBDIVISION PROPERTY OWNER

5606.20(AB) 24" FES
INV OUT (N) ~~5605.00~~ (24" RCP)
TO BE MAINTAINED BY SCHOOL DISTRICT

05.00 FL

32 LF 24" RCP @ 4.00%
TO BE MAINTAINED BY SCHOOL DISTRICT
(SEE PROFILE, THIS SHEET)

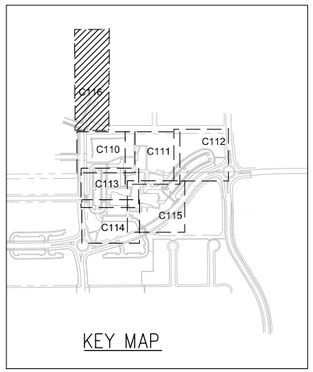
MATCHLINE – SEE SHEET C100-(5)

MATCHLINE – SEE SHEET C111-(7)

⚠1

OFF-SITE DRAINAGE NOTES:

1. DRAINAGE SWALE SHOWN IS LOCATED ON ADJACENT PROPERTY OWNED BY OTHERS.
2. CONTRACTOR TO FIELD VERIFY ALL EXISTING UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION. REFER TO GENERAL NOTES FOR UTILITY LOCATION AND PROTECTION.
3. CONTRACTOR TO INSTALL AND MAINTAIN EROSION CONTROL WITHIN AND ADJACENT TO DRAINAGE SWALE AS NECESSARY FOR COMPLIANCE WITH CONTRACTOR'S STATE STORMWATER PERMIT.
4. PROPERTY OWNER SHALL OWN AND MAINTAIN DRAINAGE SWALE AT ALL TIMES. AURORA PUBLIC SCHOOLS IS NOT RESPONSIBLE FOR MAINTENANCE OF OFF-SITE DRAINAGE SYSTEMS, OFF-SITE EROSION AND SEDIMENT CONTROL, AND DOWNSTREAM FACILITIES.
5. CONTRACTOR IS RESPONSIBLE FOR RESTORING ALL AREAS DISTURBED BY CONSTRUCTION ACTIVITIES TO THEIR ORIGINAL CONDITIONS.



KEY MAP

BENCHMARK

CITY OF AURORA BENCHMARK KNOWN AS 4S6508SE001 (OLD REFERENCE NAME 23-045), BEING A 3" DIAMETER BRASS CAP STAMPED "C.O.A., BM, 23-45" ATOP THE NORTHEAST CONCRETE BASE OF THE TOWER FOR THE OVERHEAD TRANSMISSION LINES LOCATED ON THE WEST SIDE OF POWHATON ROAD IN THE VICINITY OF THE EAST-WEST CENTERLINE OF SECTION 8, TOWNSHIP 4 SOUTH, RANGE 65 WEST HAVING A PUBLISHED ELEVATION OF 5612.875' NAVD 88 DATUM.

N

50 0 50 100
SCALE IN FEET

CONFORMED TO CONSTRUCTION RECORD

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⚠2	7/16/20	WTP	WTP
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CONSTRUCTION RECORD
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DESIGNED BY:	AMF/SW
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CHECKED BY:	WTP
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DATE:	3/11/2019

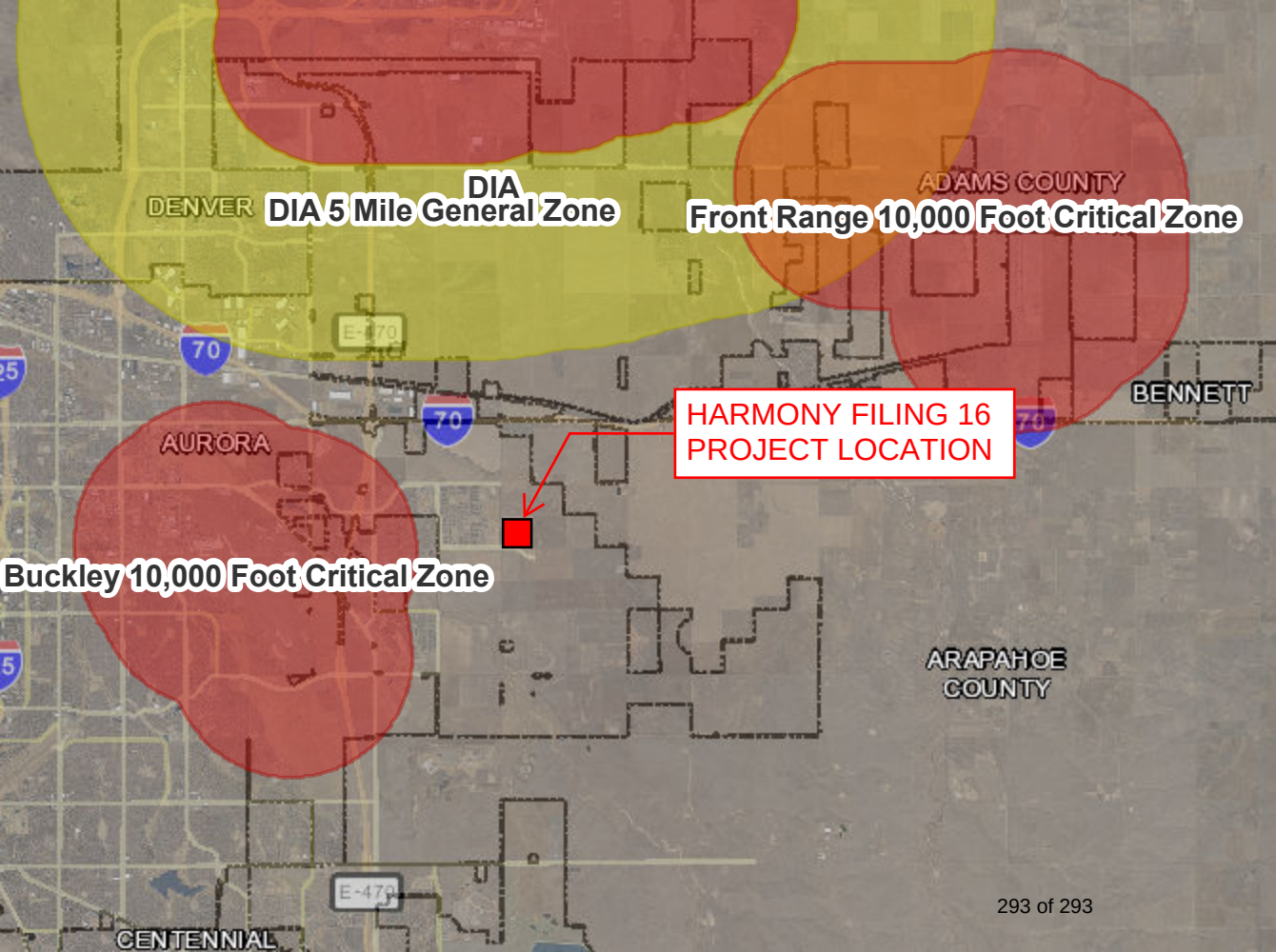
JVA, INC.

APS P-8 AT HARMONY FILING #1

OFFSITE GRADING AND DRAINAGE PLAN

SHEET NO.
C400-(28)

Airport Influence Map


DIA
DENVER
DIA 5 Mile General Zone
ADAMS COUNTY
Front Range 10,000 Foot Critical Zone
70
E-470
BENNETT
HARMONY FILING 16
PROJECT LOCATION
AURORA
Buckley 10,000 Foot Critical Zone
ARAPAHOE
COUNTY
E-470
CENTENNIAL