



Final Drainage Report

Citizen on Constitution El Paso County, Colorado

Prepared for:

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Project #: 096481004

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Kimley»Horn



CERTIFICATION

DESIGN ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparation of this report.

SIGNATURE (Affix Seal): _____
Colorado P.E. No. 53916



OWNER/DEVELOPER'S STATEMENT

I, the developer, have read and will comply with all of the requirements specified in this Drainage Report and Plan.

The Citizen on Constitution, LLC.
Name of Developer

[Signature] 10.25.22
Authorized Signature Date

W. Karl Spout
Printed Name

Director of Civil Engineering
Title

1051 Greenwood Springs Blvd Greenwood, IN 46143
Address:

EL PASO COUNTY

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

Joshua Palmer, P.E. Date
County Engineer/ ECM Administrator

Conditions:

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INTRODUCTION

PURPOSE AND SCOPE OF STUDY

The purpose of this Final Drainage Report (FDR) is to provide the hydrologic and hydraulic calculations and to document and finalize the drainage design methodology in support of the proposed Tracts M & N of Urban Collection at Palmer Village Filing No. 2 (the “Site”) for The Citizen on Constitution, LLC (the “Project”). The Project is located within the jurisdictional limits of El Paso County (the “County”). Thus, the guidelines for the hydrologic and hydraulic design components were based on the criteria for the County and City of Colorado Springs, described below.

LOCATION

The two parcels totaling 12.26-acres (TSN: 54051-04-075 & 54051-04-074) are located at the southwest corner of the Marksheffel Road and Constitution Avenue intersections. A vicinity map has been provided in the **Appendix A** of this report.

DESCRIPTION OF PROPERTY

The Project is located on approximately 12.26 acres of land consisting of vacant land with native vegetation and is classified as “Undeveloped” per Table 6-6 of the City of Colorado Springs Drainage Criteria Manual. The Project consists of 2 multi-family buildings, 3 detached garage buildings, and a clubhouse amenity space with a pool deck. The Site does not currently provide water quality or detention for the Project area. The existing land use is undeveloped vacant land.

The existing topography consists of slopes ranging from 1% to 35% and generally slopes from North to South.

NRCS soil data is available for this Site and it has been noted that soils onsite are generally USCS Type A/B. The NRCS soil data can be found in **Appendix B**. There is an existing twin 12-foot by 6-foot concrete box culvert which flows from the north side of Constitution Avenue (Hannah Ridge) to the south side where it transitions to a twin 10-foot by 6-foot box culvert before crossing the project site and discharging into an existing gulch near the southwest corner of the Site which contributes to East Fork Sand Creek.

Improvements will consist of mowing, clearing and grubbing, weed control, paved access road construction, roadway grading, a detention pond, culverts, drainage swales, and native seeding.

An updated Topographic field survey was completed for the Project by Barren Land, LLC. dated October 11, 2021 and is the basis for design for the drainage improvements.

DRAINAGE BASINS

MAJOR BASIN DESCRIPTIONS

The Site improvements are located in Zone X, as determined by the Flood Insurance Rate Map (FIRM) number 08041C0756G effective date, December 7, 2018 (see **Appendix A**).

The Project is located within El Paso County's Sand Creek Drainage Basin.

EXISTING SUB-BASIN DESCRIPTIONS

Site runoff flows from north to south via sheet flow over vacant land to adjacent southern property owners and eventually to the gulch to the southwest that eventually contributes to the East Fork Sand Creek. Below is a description of the existing onsite sub-basin.

Sub-Basin EX1

Sub-Basin EX1 consists of the western half of the multi-family development. Drainage flows overland from north to south and conveys along the southern boundary to the west at Design Point EX1. Runoff during the 5-year and 100-year events are 1.38 cfs and 9.24 cfs, respectively. Cumulative flows from this basin, including the flows from Sub-Basin OS1 and OS2, are 5.35 and 16.90 cfs, respectively. Runoff from this basin is currently directed to design point EX1 where it will drain into the existing gulch to the southwest that runs to the south eventually contributing to the East Fork Sand Creek. This sub-basin has an area of 4.05 acres. The impervious value for this basin is 2%. Refer to **Appendix D** for the Existing Conditions Drainage Map.

Sub-Basin EX2

Sub-Basin EX2 consists of the eastern half of the multi-family development. Drainage flows overland from north to south and sheet flows off the site near Design Point EX2. Runoff during the 5-year and 100-year events are 2.80 cfs and 18.81 cfs, respectively. Cumulative flows from this basin, including the flows from Sub-Basin OS3 are 2.80 cfs and 18.81 cfs, respectively. Runoff from this basin is currently directed to design point EX2 where it will sheet flow to the southern adjacent properties currently owned by El Paso County Board of County Commissioners and Waste Connections of Colorado, Inc. This sub-basin has an area of 7.67 acres. The impervious value for this basin is 2%. Refer to **Appendix D** for the Existing Conditions Drainage Map.

Sub-Basin OS1

Sub-Basin OS1 consists of an offsite basin to the northwest of the Property. Drainage flows overland from north to south and conveys to the northern line of Sub-basin EX1 at Design Point OS1. Direct runoff during the 5-year and 100-year events are 0.09 cfs and 0.60 cfs, respectively. Runoff from this basin is currently directed to design point OS1 where it will drain into the Sub-basin EX1, which is on-site. This sub-basin has an area of 0.20 acres. The impervious value for this basin is 2%. Refer to **Appendix D** for the Existing Conditions Drainage Map.

Sub-Basin OS2

Sub-Basin OS2 consists of an offsite basin within Constitution Avenue north of the project site. Drainage is collected in a curb and gutter system and enters the site at the driveway cut to the site at Design Point OS2. Direct runoff during the 5-year and 100-year events are 3.89 cfs and 7.05 cfs, respectively. Runoff from this basin is currently directed to design point OS2 where it will drain into the Sub-basin OS1 and then Sub-basin EX1. This sub-basin has an area of 1.21 acres. The impervious value for this basin is 95%. Refer to **Appendix D** for the Existing

Conditions Drainage Map.

Sub-Basin OS3

Sub-Basin OS3 consists of an offsite basin to the northeast of the Property. Drainage flows overland from north to south and conveys to the northern line of Sub-basin EX2 at Design Point OS3. Direct runoff during the 5-year and 100-year events are 0.20 cfs and 1.33 cfs, respectively. Runoff from this basin is currently directed to design point OS3 where it will drain into the Sub-basin EX2, which is on-site. This sub-basin has an area of 0.46 acres. The impervious value for this basin is 2%. Refer to **Appendix D** for the Existing Conditions Drainage Map.

PROPOSED RATIONAL SUB-BASIN DESCRIPTIONS

Sub-Basin A1 consists of landscaping and a gravel emergency access road and is the westmost portion of the site which will have minimal grading to tie into the rest of the multi-family development on site. Runoff from this basin will be directed to design point A1 and will follow the historical drainage pattern by sheet flowing from north to south and eventually flowing to the existing gulch. This sub-basin has an area of 0.87 acres. The impervious value for this basin is 2%. The basin will generate runoff of 0.26 cfs and 1.92 cfs in the minor and major storm event. Cumulative flows from this basin, including the flows from Sub-Basins OA1 and OA2, are 0.75 and 2.15 cfs, respectively. Please see below discussion in the Municipal Separate Storm Sewer System (MS4) discussion for additional information on how stormwater quality is being addressed for basins that run offsite.

Sub-Basin A2 consists of a portion of landscaping and the existing gulch on the south side of the site. Runoff from this basin will follow the historical drainage pattern by sheet flowing to adjacent southern property and eventually flowing to the gulch. This sub-basin has an area of 0.41 acres. The impervious value for this basin is 42%. The basin will generate runoff of 0.89 cfs and 2.15 cfs in the minor and major storm event. Please see below discussion in the Municipal Separate Storm Sewer System (MS4) discussion for additional information on how stormwater quality is being addressed for basins that run offsite.

Sub-Basin B1 consists of a portion of landscaping, roadway, and sidewalk. Runoff from this basin will be directed into design point B1 where it will be captured by inlet B1 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet B1 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.13 acres. The impervious value for this basin is 83%. The basin will generate runoff of 0.51 cfs and 0.97 cfs in the minor and major storm event. Cumulative flows from this basin, including the flows from Sub-Basin OB1, are 0.86 and 1.60 cfs, respectively.

Sub-Basin B2 consists of a portion of landscaping, roadway, and sidewalk. Runoff from this basin will be directed into design point B2 where it will be captured by inlet B2 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet B2 has been sized to accept the 5-year flow completely and will allow approximately 0.2 cfs to bypass onto inlet D1a in the 100-year event. This sub-basin has an area of 0.17 acres. The impervious value for this basin is 79%. The basin will generate runoff of 0.62 cfs and 1.20 cfs in the minor and major storm event. Cumulative flows from this basin, including the flows from Sub-Basin OB2, are 0.96 and 1.82 cfs, respectively.

Sub-Basin B3 consists of a portion of landscaping, roadway, and sidewalk. Runoff from this basin will be directed into design point B3 where it will be captured by inlet B3 and directly discharged to the existing gulch located in sub-basin A2 via storm drain system. Inlet B3 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.35 acres. The impervious value for this basin is 84%. The basin will generate runoff of 1.36 cfs and 2.57 cfs in the minor and major storm event. Please see below discussion in the Municipal Separate Storm Sewer System (MS4) discussion for additional information on how stormwater quality is being addressed for basins that run offsite.

Sub-Basin B4 consists of a portion of landscaping, roadway, and sidewalk. Runoff from this basin will be directed into design point B4 where it will be captured by inlet B4 and directly discharged to the existing gulch located in sub-basin A2 via storm drain system. Inlet B3 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.18 acres. The impervious value for this basin is 84%. The basin will generate runoff of 0.72 cfs and 1.36 cfs in the minor and major storm event. Please see below discussion in the Municipal Separate Storm Sewer System (MS4) discussion for additional information on how stormwater quality is being addressed for basins that run offsite.

Sub-Basin B5 consists of a portion of landscaping, roadway, and sidewalk. Runoff from this basin will be directed to design point B5 and will follow the historical drainage pattern by sheet flowing from north to south and eventually flowing to the existing gulch. This sub-basin has an area of 0.03 acres. The impervious value for this basin is 75%. The basin will generate runoff of 0.11 cfs and 0.21 cfs in the minor and major storm event. Please see below discussion in the Municipal Separate Storm Sewer System (MS4) discussion for additional information on how stormwater quality is being addressed for basins that run offsite.

Sub-Basin C1 consists of the on-site detention pond or the “West Pond” and a portion of landscaping. Runoff from this basin will be directed into the West Pond. This sub-basin has an area of 0.84 acres. The impervious value for this basin is 4%. The basin will generate runoff of 0.43 cfs and 2.64 cfs in the minor and major storm event. Cumulative flows from this basin, including the flows from Sub-Basin OC1, are 0.60 and 3.07 cfs, respectively.

Sub-Basin C2 consists of a portion of landscaping, parking lot, sidewalk, and roof area. Runoff from this basin will be directed into design point C2 where it will be directed through a curb cut to the West Pond located in sub-basin C1. The curb cut has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.26 acres. The impervious value for this basin is 73%. The basin will generate runoff of 0.89 cfs and 1.76 cfs in the minor and major storm event. Cumulative flows from this basin, including the flows from Sub-Basin OC2, are 0.89 and 1.76 cfs, respectively. Cumulative flows from this basin, including the flows from Sub-Basin OC2, are 0.97 and 2.01 cfs, respectively.

Sub-Basin C3 consists of a portion of landscaping, parking lot, sidewalk, and roof area. Runoff from this basin will be directed into design point C3 where it will be directed through a curb cut to the West Pond located in sub-basin C1. The curb cut has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.62 acres. The impervious value for this basin is 92%. The basin will generate runoff of 2.61 cfs and 4.79 cfs in the minor and major storm event.

Sub-Basin D1 consists of a portion of landscaping, roadway, parking lot, and sidewalk. Runoff from this basin will be directed into design point D1 where it will be captured by inlet D1 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet D1 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.58 acres. The impervious value for this basin is 97%. The basin will generate runoff of 2.61 cfs and 4.72 cfs in the minor and major storm event.

Sub-Basin D1a consists of a portion of landscaping, roadway, and sidewalk. Runoff from this basin will be directed into design point D1a where it will be captured by inlet D1a and directed to the West Pond located in sub-basin C1 via storm drain system. In the 100-year event Inlet D1a will receive 0.2cfs of bypass flow from inlet B2. Inlet D1a has been adequately sized to convey anticipated onsite flows from this sub-basin and the bypass flow. This sub-basin has an area of 0.18 acres. The impervious value for this basin is 87%. The basin will generate runoff of 0.73 cfs and 1.37 cfs in the minor and major storm event.

Sub-Basin D2 consists of a portion of landscaping, roadway, parking lot, sidewalk, and roof area. Runoff from this basin will be captured by inlet D2 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet D2 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 1.08 acres. The impervious value for this basin is 90%. The basin will generate runoff of 4.42 cfs and 8.17 cfs in the minor and major storm event.

Sub-Basin D3 consists of a portion of landscaping, sidewalk, and roof area. Runoff from this basin will be captured by inlet D3 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet D3 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.30 acres. The impervious value for this basin is 55%. The basin will generate runoff of 0.72 cfs and 1.59 cfs in the minor and major storm event.

Sub-Basin D4 consists of a portion of landscaping, sidewalk, and roof area. Runoff from this basin will be captured by inlet D4 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet D4 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.30 acres. The impervious value for this basin is 55%. The basin will generate runoff of 0.73 cfs and 1.63 cfs in the minor and major storm event.

Sub-Basin D5 consists of a portion of landscaping, roadway, parking lot, sidewalk, and roof area. Runoff from this basin will be captured by inlet D5 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet D5 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.51 acres. The impervious value for this basin is 90%. The basin will generate runoff of 2.08 cfs and 3.85 cfs in the minor and major storm event.

Sub-Basin D6 consists of a portion of landscaping, roadway, parking lot, sidewalk, and roof area. Runoff from this basin will be captured by inlet D6 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet D6 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.81 acres. The impervious value for this basin is 91%. The basin will generate runoff of 3.32 cfs and 6.11 cfs in the minor and major storm event.

Sub-Basin D7 consists of a portion of landscaping, roadway, parking lot, sidewalk, and roof area. Runoff from this basin will be captured by inlet D7 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet D7 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.39 acres. The impervious value for this basin is 85%. The basin will generate runoff of 1.53 cfs and 2.88 cfs in the minor and major storm event.

Sub-Basin D8 consists of a portion of landscaping, roadway, parking lot, sidewalk, and roof area. Runoff from this basin will be captured by inlet D8 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet D8 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.54 acres. The impervious value for this basin is 84%. The basin will generate runoff of 2.07 cfs and 3.92 cfs in the minor and major storm event.

Sub-Basin D9 consists of a portion of landscaping, roadway, parking lot, sidewalk, and roof area. Runoff from this basin will be captured by inlet D9 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet D9 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.43 acres. The impervious value for this basin is 83%. The basin will generate runoff of 1.58 cfs and 3.00 cfs in the minor and major storm event.

Sub-Basin D10 consists of a portion of landscaping, roadway, parking lot, sidewalk, and roof area. Runoff from this basin will be captured by inlet D10 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet D10 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.37 acres. The impervious value for this basin is 82%. The basin will generate runoff of 1.33 cfs and 2.54 cfs in the minor and major storm event.

Sub-Basin D11 consists of a portion of landscaping, roadway, parking lot, sidewalk, and roof area. Runoff from this basin will be captured by inlet D11 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet D11 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.50 acres. The impervious value for this basin is 89%. The basin will generate runoff of 2.03 cfs and 3.78 cfs in the minor and major storm event.

Sub-Basin D12 consists of a portion of landscaping and roof area. Runoff from this basin will be captured by inlet D12 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet D12 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.66 acres. The impervious value for this basin is 30%. The basin will generate runoff of 0.99 cfs and 2.86 cfs in the minor and major storm event. Cumulative flows from this basin, including the flows from Sub-Basin OD12, are 0.99 and 2.90 cfs, respectively.

Sub-Basin E1 consists of a portion of landscaping and roof area. Runoff from this basin will be captured by inlet E1 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet E1 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.18 acres. The impervious value for this basin is 46%. The basin will generate runoff of 0.37 cfs and 0.88 cfs in the minor and major storm event. Cumulative flows from this basin, including the flows from Sub-Basin OE1, are 0.49 and 1.27 cfs, respectively.

Sub-Basin E2 consists of a portion of landscaping and roof area. Runoff from this basin will be captured by inlet E2 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet E2 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.21 acres. The impervious value for this basin is 39%. The basin will generate runoff of 0.38 cfs and 0.98 cfs in the minor and major storm event. Cumulative flows from this basin, including the flows from Sub-Basin OE2, are 0.57 and 1.56 cfs, respectively.

Sub-Basin E3 consists of a portion of landscaping and roof area. Runoff from this basin will be captured by inlet E3 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet E3 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.22 acres. The impervious value for this basin is 40%. The basin will generate runoff of 0.41 cfs and 1.04 cfs in the minor and major storm event. Cumulative flows from this basin, including the flows from Sub-Basin OE3, are 0.60 and 1.63 cfs, respectively.

Sub-Basin E4 consists of a portion of landscaping and roof area. Runoff from this basin will be captured by inlet E4 and directed to the West Pond located in sub-basin C1 via storm drain system. Inlet E4 has been adequately sized to convey anticipated onsite flows from this sub-basin. This sub-basin has an area of 0.18 acres. The impervious value for this basin is 46%. The basin will generate runoff of 0.38 cfs and 0.92 cfs in the minor and major storm event. Cumulative flows from this basin, including the flows from Sub-Basin OE4, are 0.53 and 1.34 cfs, respectively.

Sub-Basin OA1 consists of landscaping offsite to the north of the Property. Runoff from this basin will be directed into design point A1 and travels through Basin A1 to follow the historical drainage pattern by sheet flowing from north to south and eventually flowing to the existing gulch. This sub-basin has an area of 0.05 acres. The impervious value for this basin is 46%. The basin will generate runoff of 0.1 cfs and 0.24 cfs in the minor and major storm event.

Sub-Basin OA2 consists of landscaped area, sidewalks, and 1,870 square feet of asphalt roadway within Urban Collection at Palmer Village offsite to the west of the Property. Runoff from this basin will be directed to design point A1 and travels through Basin A1 to follow the historic drainage pattern by sheet flowing north to south and eventually flowing to the existing gulch. Runoff values for basin OA2 were obtained from the approved Final Drainage Report for Urban Collection at Palmer Village by JR Engineering dated April 2021. The Final Drainage Report states that basins B14, B15, and B16 total 0.45 acres and will generate runoff of 0.60 cfs and 1.90 cfs in the minor and major storm events. Design Points 28, 29, and 30 correspond to basins B14, B15, and B16 on the Final Drainage Report.

Sub-Basin OB1 consists of a portion Constitution Avenue to the north of the Property. Runoff from this basin will be directed into design point B1 and travels via curb and gutter through Basin B1 to a curb inlet at design point B1. This sub-basin has an area of 0.08 acres. The impervious value for this basin is 96%. The basin will generate runoff of 0.35 cfs and 0.63 cfs in the minor and major storm event.

Sub-Basin OB2 consists of a portion of Constitution Avenue to the north of the Property. Runoff from this basin will be directed into design point B2 and travels via curb and gutter through Basin B2 to a curb inlet at design point B2. This sub-basin has an area of 0.08 acres. The impervious value for this basin is 90%. The basin will generate runoff of 0.34 cfs and 0.62 cfs in the minor and major storm event.

Sub-Basin OC1 consists of a portion of landscaping and sidewalk offsite to the north of the Property. Runoff from this basin will be directed into design point C1 and overland flows directly into the West Pond, sub-basin C1. This sub-basin has an area of 0.08 acres. The impervious value for this basin is 41%. The basin will generate runoff of 0.17 cfs and 0.42 cfs in the minor and major storm event.

Sub-Basin OC2 consists of a portion of landscaping and sidewalk offsite to the north of the Property. Runoff from this basin will be directed into design point C2 and travels through Basin C2 where it will be directed through a curb cut to the West Pond located in sub-basin C1. This sub-basin has an area of 0.06 acres. The impervious value for this basin is 25%. The basin will generate runoff of 0.08 cfs and 0.25 cfs in the minor and major storm event.

Sub-Basin OD12 consists of landscaping offsite to the northeast of the Property. Runoff from this basin will travel through Basin D12 to be captured by inlet D12 and directed to the West Pond located in sub-basin C1 via storm drain system. This sub-basin has an area of 0.01 acres. The impervious value for this basin is 2%. The basin will generate runoff of 0.01 cfs and 0.04 cfs in the minor and major storm event.

Sub-Basin OE1 consists of sidewalk and landscaping offsite to the north of the Property. Runoff from this basin will travel through Basin E1 to be captured by inlet E1 and directed to the West Pond located in sub-basin C1 via storm drain system. This sub-basin has an area of 0.09 acres. The impervious value for this basin is 25%. The basin will generate runoff of 0.13 cfs and 0.39 cfs in the minor and major storm event.

Sub-Basin OE2 consists of sidewalk and landscaping offsite to the north of the Property. Runoff from this basin will travel through Basin E2 to be captured by inlet E2 and directed to the West Pond located in sub-basin C1 via storm drain system. This sub-basin has an area of 0.14 acres. The impervious value for this basin is 25%. The basin will generate runoff of 0.19 cfs and 0.58 cfs in the minor and major storm event.

Sub-Basin OE3 consists of sidewalk and landscaping offsite to the north of the Property. Runoff from this basin will travel through Basin E3 to be captured by inlet E3 and directed to the West Pond located in sub-basin C1 via storm drain system. This sub-basin has an area of 0.14 acres. The impervious value for this basin is 25%. The basin will generate runoff of 0.19 cfs and 0.59 cfs in the minor and major storm event.

Sub-Basin OE4 consists of sidewalk and landscaping offsite to the north of the Property. Runoff from this basin will travel through Basin E4 to be captured by inlet E4 and directed to the West Pond located in sub-basin C1 via storm drain system. This sub-basin has an area of 0.09 acres. The impervious value for this basin is 28%. The basin will generate runoff of 0.14 cfs and 0.41 cfs in the minor and major storm event.

Sub-Basin OF1 consists of an offsite basin within Constitution Avenue north of the project site. Drainage is collected in a curb and gutter system and routed to a proposed curb inlet at the entrance to the site. This sub-basin has an area of 1.12 acres. The impervious value for this basin is 100%. The basin will generate runoff of 3.56 cfs and 6.36 cfs in the minor and major storm event.

Sub-Basin OF2 consists of the southern-most portion of the Site that drains to the south off-site and consists of entirely landscaping. This sub-basin has an area of 0.42 acres. The impervious

value for this basin is 2%. The basin will generate runoff of 0.15 cfs and 1.09 cfs in the minor and major storm event.

Sub-Basin OS1 consists of an offsite basin to the northwest of the site within Constitution Avenue and the adjacent landscaping. Drainage is collected in a curb and gutter system and routed to an existing curb inlet to the west in Constitution Ave, following its historical flow pattern. This sub-basin has an area of 0.25 acres. The impervious value for this basin is 83%. The basin will generate runoff of 0.99 cfs and 1.87 cfs in the minor and major storm event.

Design point UO represents the ultimate outfall for the site into the existing drainageway. The flows at this point include the detained flow release from the detention pond as well as the flows from sub-basins A1, A2, B2, B3, and B4. This design point is utilized to show that the combined flows entering the gulch from the site are less than the historical flows entering the gulch from the Site.

DRAINAGE DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

The proposed storm facilities are designed to be in compliance with the City of Colorado Springs and El Paso County “Drainage Criteria Manual (DCM)” (Current Adopted Version) (“the MANUAL”), El Paso County “Engineering Criteria Manual” (“the Engineering Manual”), Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014 (“the Colorado Springs MANUAL”).

HYDROLOGIC CRITERIA

The 5-year and 100-year design storm events were used in determining rainfall and runoff for the existing and proposed drainage analysis per the MANUAL. The rainfall depths for site were determined from equation 6-1, equation 6-2 utilizing Figures 6-6, 6-11, 6-12, and 6 -17 from the DCM. Refer to **Table 1** below for the rainfall depths utilized for the site and **Appendix B** for the hydrologic calculations for the site.

Table 1: Rainfall Depths

| | Duration (HRS) |
|--------------------|-----------------------|
| Storm Event | 1 HR |
| 2 Year | 1.19 |
| 5 Year | 1.52 |
| 10 Year | 1.75 |
| 100 Year | 2.55 |

Calculations for the runoff coefficients and percent impervious are included in the **Appendix B**. Rational method was used to determine the peak flows for the project. These flows were used to determine the size of the proposed curb cuts, inlets, and storm drain system.

The proposed impervious values in Table 6-6 of the DCM were utilized in this report for the final design. Refer to **Appendix B** of this report for Table 6-6.

The Site is providing one full spectrum detention pond. The Site is maintaining the historic drainage patterns as much as possible. The site is reducing onsite runoff flows during the 100-year storm from 16.9 cfs to 14.01 cfs for existing to proposed conditions respectively. This is a 2.92 cfs reduction in onsite runoff flows at design point EX1.

There are no additional provisions selected or deviations from the criteria in both the MANUAL and Colorado Springs MANUAL.

HYDRAULIC CRITERIA

Applicable design methods were utilized to size the proposed pond, which includes the use of the UD-Detention spreadsheet, UD-Inlet spreadsheet, rational calculations spreadsheet, StormCAD, and FlowMaster.

Proposed drainage features on-site have been analyzed and sized for the following design storm events:

- Major Storm: 100-year Storm Event

One full spectrum on-site detention pond is proposed in order to maintain historic flows and water quality. The detention pond is on the west side of the Site and is referred to as “West Pond” in this report, with a required volume of 1.466 ac-ft and a proposed volume of 1.481 ac-ft (at the 100-year water surface elevation) and designed for the 100-year storm event. With a discharge rate of 4.4 cfs, water from the West Pond is discharged into an existing gulch located at the southwest corner of the site and ultimately out falling to Sand Creek (Sand Creek’s East Fork). West Pond calculations are provided in the **Appendix C**.

The ultimate outfall for the Site is into an existing gulch that runs through the site within a concrete box culvert. The detention pond will outlet into an existing riprap channel at the end of the concrete box culvert to dissipate energy and reduce erosion. The existing riprap has been observed and no signs of erosion have been identified. This reach of Sand Creek’s East Fork was determined to be a suitable outfall and is shown to have approximately 1076 cfs in the 100-year event, per the Hydrology Analysis for East Fork Sand Creek Tributary 6. The 100-year storm contribution from the site will be reduced by 3.12 cfs from the existing and the Site will not have an adverse effect on the existing gulch.

Curb cuts, inlets, and storm drain pipes are designed to carry flows to the West Pond. The curb cuts, inlets, swales, and storm drain pipes calculations are provided in the **Appendix C** and the design points are provided in the Proposed Drainage Map located in **Appendix D**. The West Pond is designed to release the 100-year flow at 4.4 cfs, which in combination with undetained flows totals to 13.78 cfs, 3.12 cfs below the pre-development flow rate.

Emergency overflows will be routed through the overflow weir located within the outlet structure of the West Pond. It will follow existing drainage conditions and flow to the gulch to the southwest that eventually contributes to the East Fork Sand Creek to the South.

THE FOUR STEP PROCESS

The Project was designed in accordance with the four-step process to minimize adverse impacts of urbanization, as outlined in the County's "Four-Step Process" for selecting structural BMPs (ECM Section I.7.2 BMP Selection).

Step 1. Employ Runoff Reduction Practices- The project is proposing a residential development that will be designed to minimize the impact to the current existing terrain. The Site's proposed paved roadways will increase the Site's impervious area; however, a full spectrum detention pond will be used to capture stormwater and maintain flows discharging off site at or below historic levels.

Step 2. Stabilize Drainageways- Stabilizing proposed drainage paths with landscape will slow flow rates. Rock chutes will be constructed to reduce the velocities of runoff entering the ponds at the curb cut locations. We anticipate this will minimize erosion.

Step 3. Provide Water Quality Capture Volume (WQCV) –Permanent water quality measures and detention facilities will be provided with the Project. More specifically, this project proposes the construction of an Extended Detention Basin to provide for the required water quality capture volume.

Step 4. Consider Need for Industrial and Commercial BMPs – The proposed project is proposing a residential development; therefore, covering of storage/handling areas and spill containment and control will not need to be provided.

DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

The proposed drainage patterns will match the historic patterns. To maintain historic flows, a full spectrum detention pond is being proposed and will capture and control the flows from the proposed development to convey flows with landscape sheet flow, parking lot sheet flow, and a storm drain system.

Provided in the **Appendix B** are hydrologic calculations utilizing the Rational method for the existing and proposed conditions. Provided in **Appendix C** are the hydraulic calculations for the proposed conditions, Flowmaster details, and cross sections for the proposed drainage features. As previously mentioned, the existing drainage map and proposed drainage map can be found in **Appendix D**.

MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4)

The Site will handle post construction stormwater by meeting the water quality capture volume design standard from the MS4. Basins B1, B2, C1-C3, D1-D12, and E1-E4 will be captured onsite and directed to the onsite extended detention basin to treat the WQCV. The design standard allows for up to 20 percent (not to exceed 1 acre) to be excluded from the capture area when not practicable to capture runoff. Basins B3 and B4 which include the southern down gradient portion of Akers Drive will be captured by two Type R Inlets and discharged directly into

the existing gulch onsite. Basin B5 which includes the southern most portion of Akers drive will sheet flow to the pervious site to the south and ultimately end up in the existing gulch.

Basins A1 and A2 are proposed to be excluded sites as they are land disturbance to undeveloped land that will remain undeveloped. The Site will utilize informal runoff reduction (shown in the following section) “Best Management Practices” as separate pervious area that does not receive runoff from impervious surfaces. Runoff reduction calculations are not provided for these basins as they meet the exclusion from needing water quality per ECM Appendix I.7.1.B.7. The basins will be stabilized after construction and are primarily made up of Type A hydrologic soil group which has low runoff potential due to high infiltration rates.

SPECIFIC DETAILS

The existing conditions of the Site have flows from north to south via sheet flow over vacant land to adjacent southern property and eventually to the gulch to the southwest. Runoff conditions for the Site were developed utilizing the Rational Method described in the Hydrologic Criteria section of this report.

Sub-basins D1 through D12 consist of future multi-family buildings and associated infrastructure. Sub-basins C1 through C3 consist of a portion of landscaping, pavement, and the detention pond. All basins have flows being captured and conveyed onsite. Flows are conveyed from the north and east sides of the Site to the west side of the Site. On site flows enter the detention pond which then discharges into a proposed 24-inch storm drain pipe at the southwest corner of the site.

Overall the site is reducing onsite runoff flows during the 100-year storm from 33 cfs to 13.98 cfs for existing to proposed conditions respectively (includes pond discharge and Basins A1, A2, B3, B4, and B5 which drain directly offsite). This is a 19.02 cfs reduction in onsite runoff flows, and will provide stormwater flood protection for the properties located downstream of the Site. This reduction in flow will also allow portions of the Site to maintain historical drainage patterns, by allowing un-detained runoff from Sub-basins A1, A2, B3, B4 and B5. Furthermore, by maintaining the historical drainage patterns for the aforementioned sub-basins, imported fill for this project is minimized, allowing established vegetation to continue to provide infiltration and informal runoff reduction.

The hydrologic calculations, hydraulic calculations, and Drainage Maps are included in the **Appendix B**, **Appendix C**, and **Appendix D** of this report for reference.

The Site will disturb more than 1 acre and will require a Colorado Discharge Permit System (CDPS) General Permit for Stormwater Discharge Associated with Construction Activities from the Colorado Department of Public Health and Environment (CDPHE).

The required fees for the Sand Creek Drainage Basin based upon the 2022 fee schedule, are listed below. Fees will be paid prior to plat recordation.

| | | | | |
|---------------------------------------|----------------|----------|---------------------|---------------------|
| - Drainage Fee/Impervious Acre = | \$21,814 | x | 7.21 acres = | \$157,278.94 |
| - <u>Bridge Fee/Impervious Acre =</u> | <u>\$8,923</u> | <u>x</u> | <u>7.21 acres =</u> | <u>\$64,334.83</u> |
| | | | Total = | \$221,613.77 |

SUMMARY

The proposed drainage design is to maintain the historic drainage patterns, the overall imperviousness and release rates for the Site. Runoff from the Site will be controllably discharged through the proposed drainage system and will continue through the existing gulch to an existing El Paso County drainage basin: The Sand Creek Basin. The drainage design presented within this report conforms to the criteria presented in both the MANUAL and the Colorado Springs MANUAL. Additionally, the Site runoff and storm drain facilities will not adversely affect the downstream and surrounding developments, including Sand Creek.

REFERENCES

1. City of Colorado Springs “Drainage Criteria Manual (DCM) Volume 1”, dated May, 2014
2. El Paso County “Drainage Criteria Manual”, dated October 31, 2018
3. El Paso County “Engineering Criteria Manual” Revision 6, dated June, 23, 2020
4. Chapter 6 and Section 3.2.1. of Chapter 13-City of Colorado Springs Drainage Criteria Manual, May 2014.
5. Urban Drainage and Flood Control District Drainage Criteria Manual (UDFCDCM), Vol. 1, prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.
6. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 08041C0756G, Effective Date December 7, 2018, prepared by the Federal Emergency Management Agency (FEMA).

APPENDIX

APPENDIX A: FIGURES

Vicinity Map



National Flood Hazard Layer FIRMette



104°41'25"W 38°52'21"N



Legend

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

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

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

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

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

| OTHER FEATURES | Cross Sections with 1% Annual Chance Water Surface Elevation |
|----------------|--|
| | 20.2 17.5 |
| | Coastal Transect |
| | Base Flood Elevation Line (BFE) |

| OTHER FEATURES | Limit of Study |
|----------------|---------------------------|
| | |
| | Jurisdiction Boundary |
| | Coastal Transect Baseline |
| | Profile Baseline |
| | Hydrographic Feature |

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

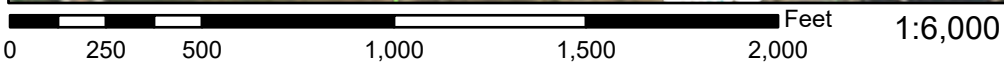
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/5/2021 at 5:09 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

USGS The National Map: Orthoimagery. Data refreshed October, 2020.



104°40'48"W 38°51'53"N

APPENDIX B: HYDROLOGY



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for El Paso County Area, Colorado



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

Custom Soil Resource Report

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

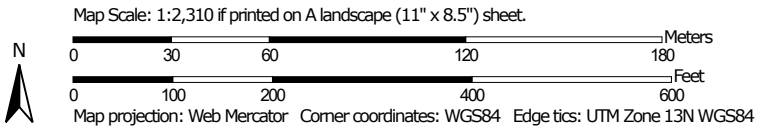
Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map


The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines


 Soil Map Unit Points

Special Point Features

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features

Water Features

 Streams and Canals

Transportation

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

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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.

Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|------------------------------------|---|--------------|----------------|
| 8 | Blakeland loamy sand, 1 to 9 percent slopes | 16.7 | 75.2% |
| 10 | Blendon sandy loam, 0 to 3 percent slopes | 5.5 | 24.8% |
| Totals for Area of Interest | | 22.2 | 100.0% |

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

Custom Soil Resource Report

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent

Landform: Depressions

Hydric soil rating: Yes

10—Blendon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3671

Elevation: 6,000 to 6,800 feet

Mean annual precipitation: 14 to 16 inches

Mean annual air temperature: 46 to 48 degrees F

Frost-free period: 125 to 145 days

Farmland classification: Not prime farmland

Map Unit Composition

Blendon and similar soils: 98 percent

Minor components: 2 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blendon

Setting

Landform: Terraces, alluvial fans

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 10 inches: sandy loam

Bw - 10 to 36 inches: sandy loam

C - 36 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 2 percent

Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Custom Soil Resource Report

Hydrologic Soil Group: B

Ecological site: R049XB210CO - Sandy Foothill

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent

Landform: Depressions

Hydric soil rating: Yes

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Custom Soil Resource Report

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The methods described in this Manual require only that the 1-hour, 6-hour and 24-hours depths be used as input. The storm return periods required for the application of methods in this Manual are the 2-, 5-, 10-, 25-, 50- and 100-year events. The 6-hour and 24-hour depths for these return periods can be read directly from Figures 6-6 through 6-17 at the end of this chapter. The 1-hour depth for return periods can be calculated for all design return periods following this procedure:

Step 1: Calculate 2-year, 1-hour rainfall based on 2-year, 6-hour and 24-hour values.

$$Y_2 = 0.218 + 0.709 \cdot (X_1 \cdot X_1 / X_2) \quad (\text{Eq. 6-1})$$

Where:

Y_2 = 2-year, 1-hour rainfall (in)

X_1 = 2-year, 6-hour rainfall (in) from Figure 6-6

X_2 = 2-year, 24-hour rainfall (in) from Figure 6-12

Step 2: Calculate 100-year, 1-hour rainfall based on 2-year 6-hour and 24-hour values

$$Y_{100} = 1.897 + 0.439 \cdot (X_3 \cdot X_3 / X_4) - 0.008 Z \quad (\text{Eq. 6-2})$$

Where

Y_{100} = 100-year, 1-hour rainfall (in)

X_3 = 100-year, 6-hour rainfall (in) from Figure 6-11

X_4 = 100-year, 24-hour rainfall (in) from Figure 6-17

Z = Elevation in hundreds of feet above sea level

Step 3: Plot the 2-year and 100-year, 1-hour values on the diagram provided in Figure 6-18 and connect the points with a straight line. The 1-hour point rainfall values for other recurrence intervals can be read directly from the straight line drawn on Figure 6-18.

Example: Determine the 10-year, 1-hour rainfall depth for downtown Colorado Springs.

Step 1: Calculate 2-year, 1-hour rainfall (Y_2) based on 2-year, 6-hour and 24-hour values. From Figure 6-6, the 2-year, 6-hour rainfall depth for downtown Colorado Springs is approximately 1.7 inches (X_1), and from Figure 6-12, the 2-year 24-hour depth is approximately 2.1 inches (X_2). The 2-year, 1-hour rainfall is calculated as follows:

$$Y_2 = 0.218 + 0.709 \cdot (1.7 \cdot 1.7 / 2.1) = 1.19 \text{ in} \quad (\text{Eq. 6-3})$$

Step 2: Calculate 100-year, 1-hour rainfall (Y_{100}) based on 100-year, 6-hour and 24-hour values. From Figure 6-11, the 100-year, 6-hour rainfall depth for downtown Colorado Springs is approximately 3.5 inches (X_3), and from Figure 6-17, the 100-year 24-hour depth is approximately 4.5 inches (X_4). Assume an elevation of 6,840 feet for Colorado Springs. The 100-year, 1-hour rainfall is calculated as follows:

$$Y_{100} = 1.897 + 0.439 \cdot (3.5 \cdot 3.5 / 4.6) - 0.008 \cdot (6,840 / 100) = 2.52 \text{ in} \quad (\text{Eq. 6-4})$$

Step 3: Plot 2-year and 100-year, 1-hour rainfall depths on Figure 6-18 and read 10-year value from straight line. This example is illustrated on Figure 6-18, with a 1-hour, 10-year rainfall depth of approximately 1.75 inches. Figure 6-18a provides the example, and Figure 6-18b provides a blank chart.

Figure 6-6. 2-Year, 6-Hour Precipitation Tenths of an Inch (NOAA Atlas 2)

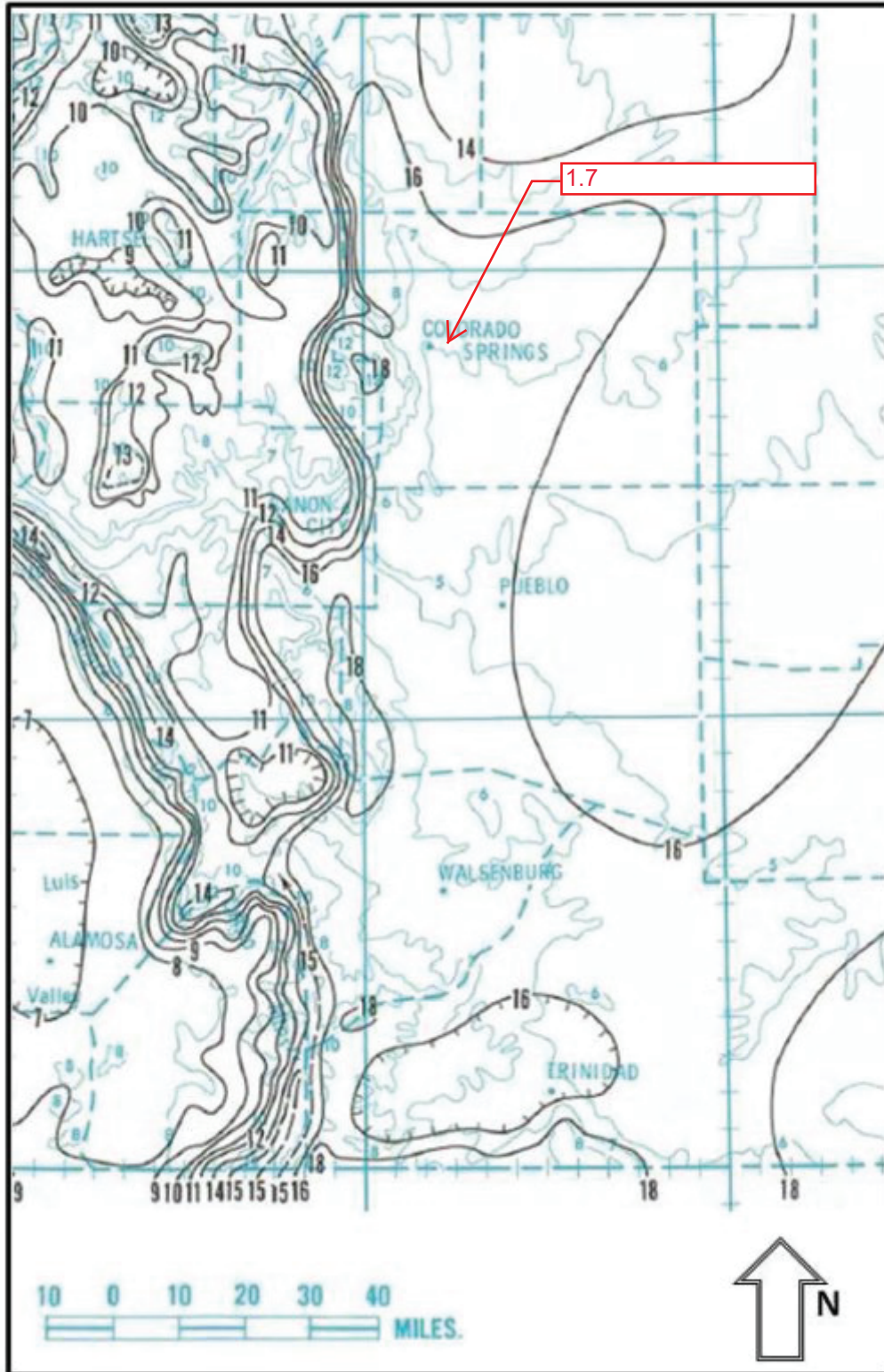


Figure 6-12. 2-Year, 24-Hour Precipitation Tenths of an Inch (NOAA Atlas 2)

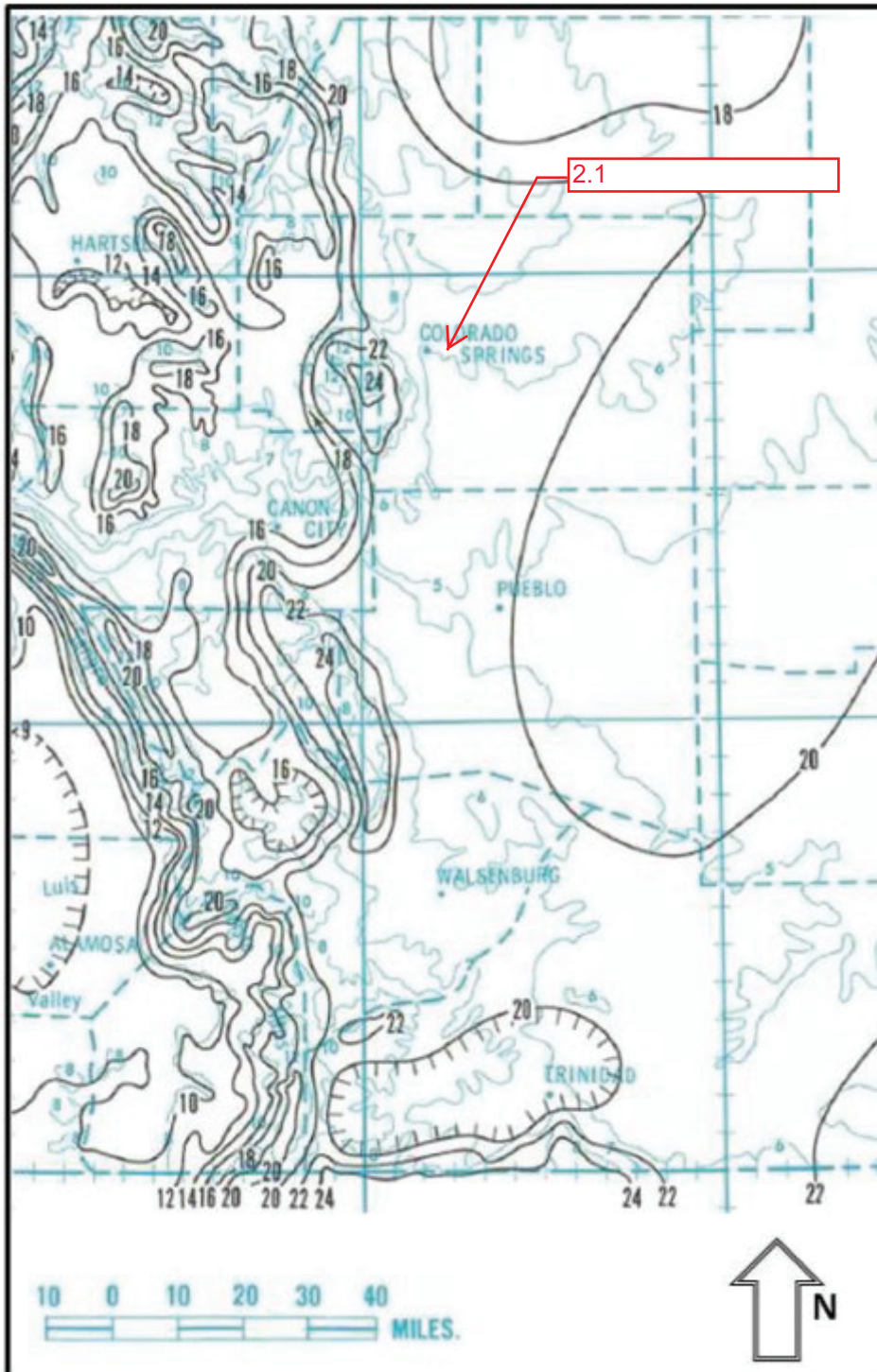


Figure 6-11. 100-Year, 6-Hour Precipitation Tenths of an Inch (NOAA Atlas 2)

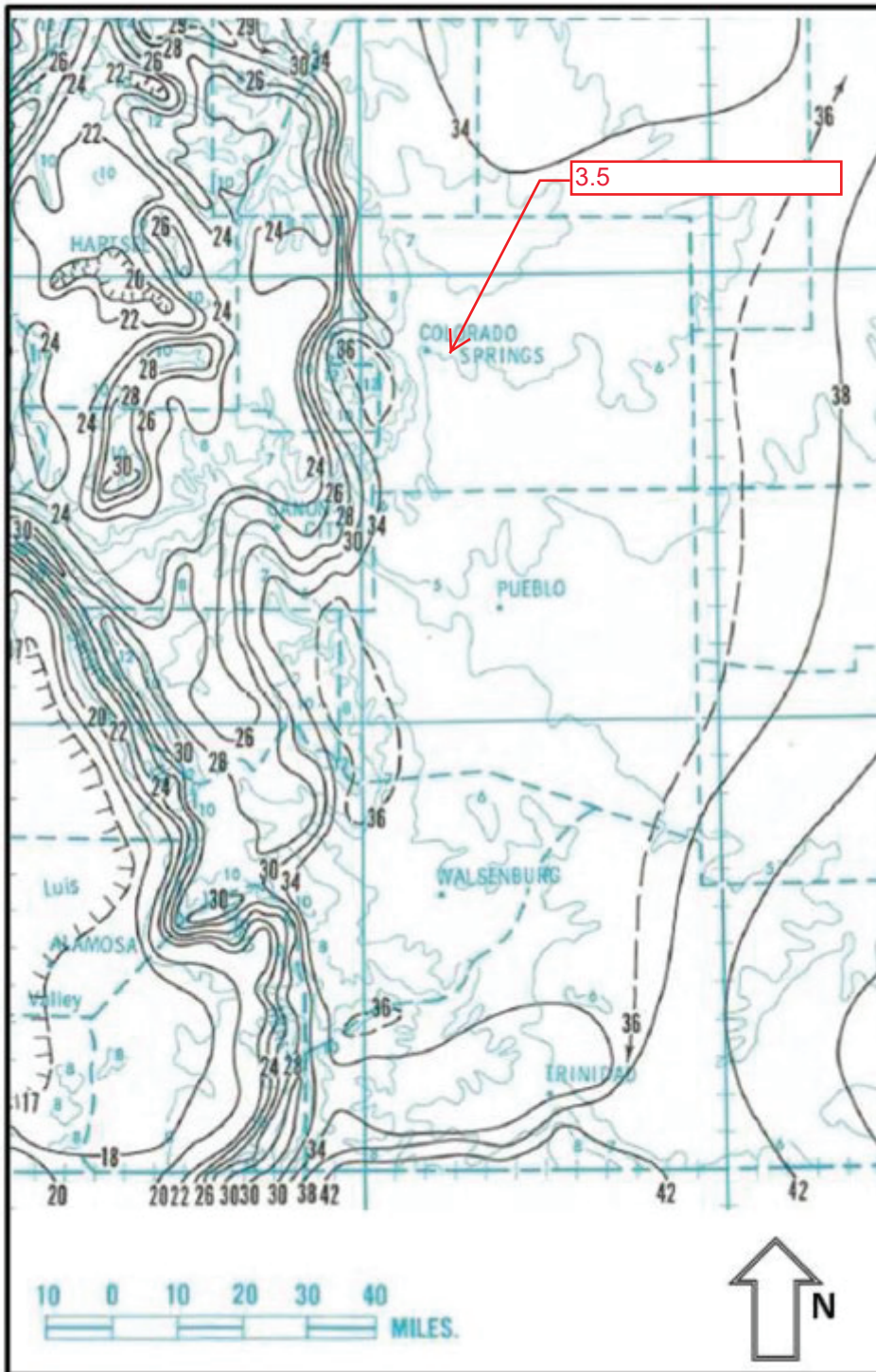
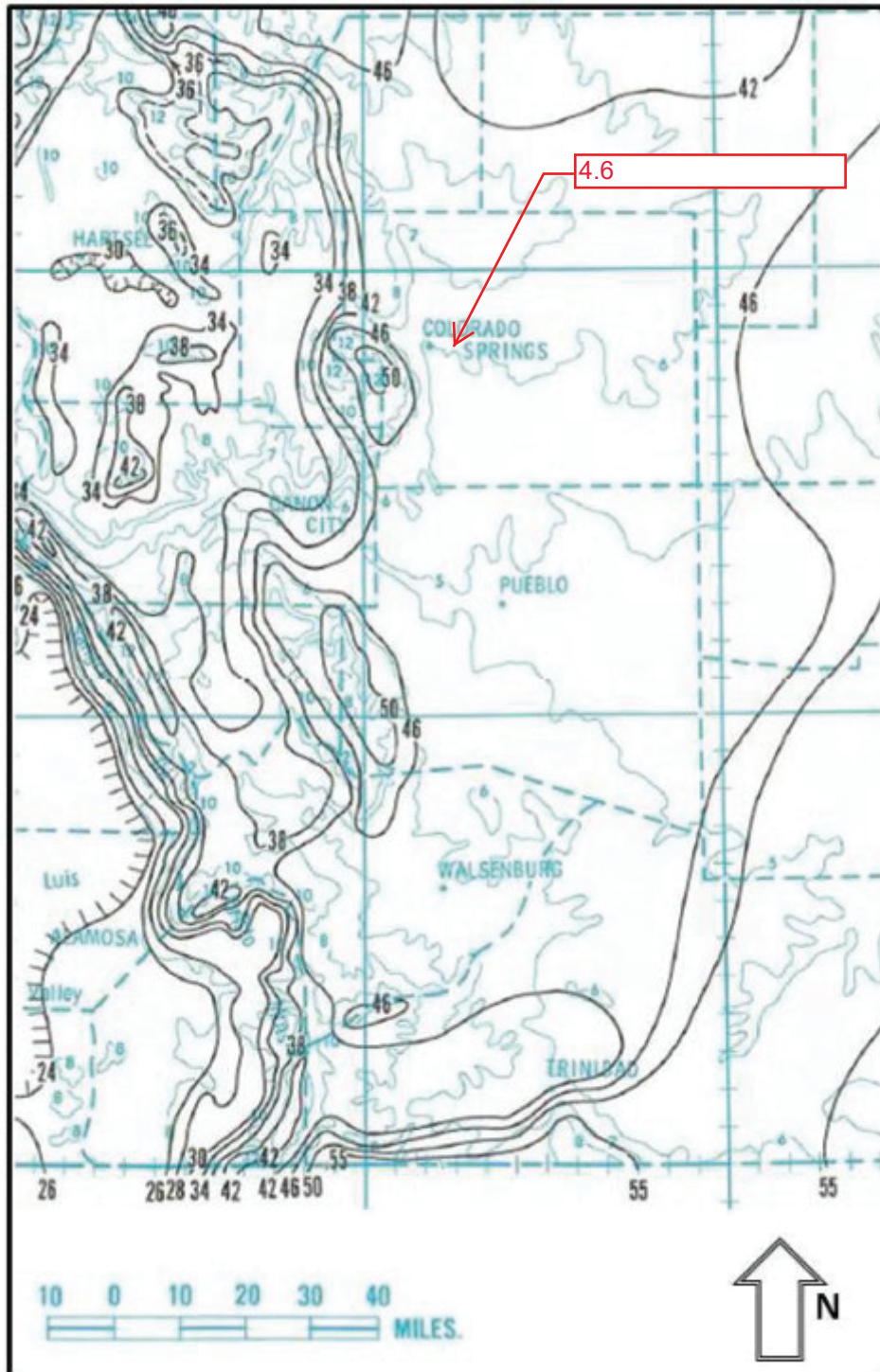
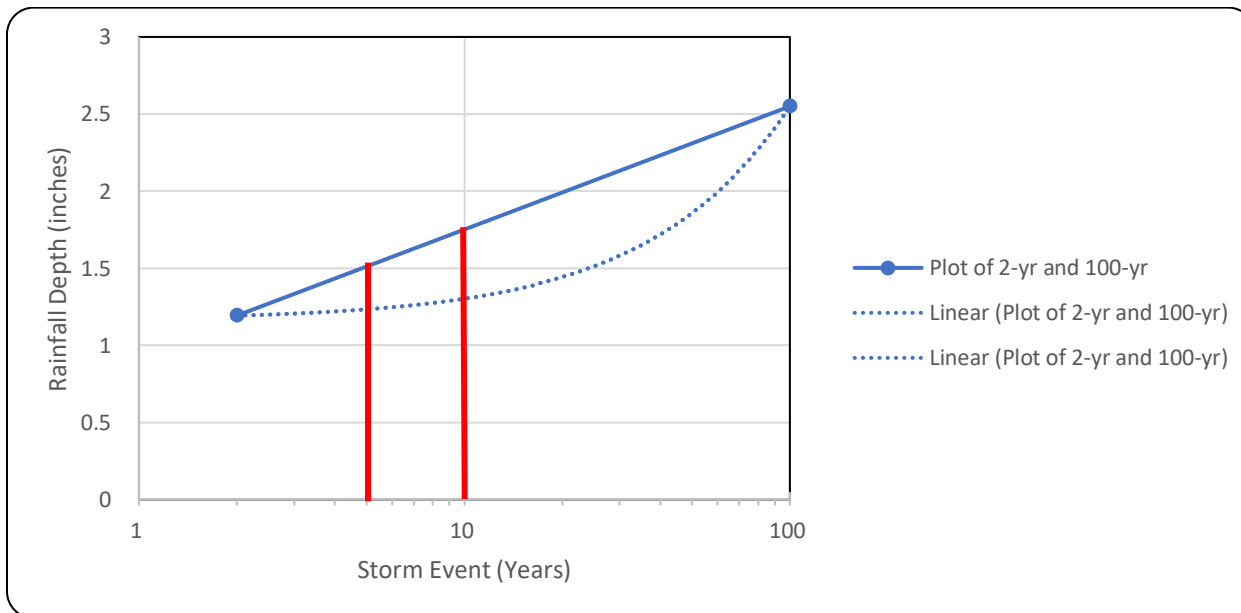


Figure 6-17. 100-Year, 24-Hour Precipitation Tenths of an Inch (NOAA Atlas 2)



| Rainfall Depths | | | |
|-------------------------------|-------------|----------|-----------------------------|
| | | | Notes |
| 2 yr, 6 hr rainfall (in) | $X_1 =$ | 1.7 | From Figure 6-6 |
| 2 yr, 24 hr rainfall (in) | $X_2 =$ | 2.1 | From Figure 6-12 |
| 100 yr, 6 hr rainfall (in) | $X_3 =$ | 3.5 | From Figure 6-11 |
| 100 yr, 24 hr rainfall (in) | $X_4 =$ | 4.6 | From Figure 6-17 |
| Elevation (hundreds of feet)] | $Z =$ | 64.5 | |
| 2 yr, 1 hr rainfall (in) | $Y_2 =$ | 1.193719 | Equation 6-1 |
| 100 yr, 1 hr rainfall (in) | $Y_{100} =$ | 2.550076 | Equation 6-2 |
| Graph | | | |
| X-axis | | Y-axis | |
| 2 | Y_2 | 1.193719 | Calculated from Eq 6-1 |
| 100 | Y_{100} | 2.550076 | Calculated from Eq 6-2 |
| | Y_5 | 1.52 | Determined From Graph below |
| | Y_{10} | 1.75 | Determined From Graph below |



$$I = \frac{28.5 P_1}{(10 + T_D)^{0.786}}$$

Where:

I = rainfall intensity (inches per hour)

P₁ = one-hour rainfall depth (inches) from Table 6-2 One-hour Point Rainfall
City of Colorado Springs Drainage Design

T_c = storm duration (minutes)

| | | | | |
|------------------|-------------|-------------|--------------|---------------|
| | <u>2-yr</u> | <u>5-yr</u> | <u>10-yr</u> | <u>100-yr</u> |
| P ₁ = | 1.19 | 1.52 | 1.75 | 2.55 |

Time Intensity Frequency Tabulation

| TIME | 2 YR | 5 YR | 10 YR | 100 YR |
|------|------|------|-------|--------|
| 5 | 4.05 | 5.16 | 5.94 | 8.65 |
| 10 | 3.23 | 4.11 | 4.73 | 6.90 |
| 15 | 2.71 | 3.45 | 3.97 | 5.79 |
| 30 | 1.87 | 2.38 | 2.75 | 4.00 |
| 60 | 1.21 | 1.54 | 1.77 | 2.58 |
| 120 | 0.74 | 0.94 | 1.09 | 1.58 |

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

| Land Use or Surface Characteristics | Percent Impervious | Runoff Coefficients | | | | | | | | | | | |
|--|--------------------|---------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|---------|
| | | 2-year | | 5-year | | 10-year | | 25-year | | 50-year | | 100-year | |
| | | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D |
| Business | | | | | | | | | | | | | |
| Commercial Areas | 95 | 0.79 | 0.80 | 0.81 | 0.82 | 0.83 | 0.84 | 0.85 | 0.87 | 0.87 | 0.88 | 0.88 | 0.89 |
| Neighborhood Areas | 70 | 0.45 | 0.49 | 0.49 | 0.53 | 0.53 | 0.57 | 0.58 | 0.62 | 0.60 | 0.65 | 0.62 | 0.68 |
| Residential | | | | | | | | | | | | | |
| 1/8 Acre or less | 65 | 0.41 | 0.45 | 0.45 | 0.49 | 0.49 | 0.54 | 0.54 | 0.59 | 0.57 | 0.62 | 0.59 | 0.65 |
| 1/4 Acre | 40 | 0.23 | 0.28 | 0.30 | 0.35 | 0.36 | 0.42 | 0.42 | 0.50 | 0.46 | 0.54 | 0.50 | 0.58 |
| 1/3 Acre | 30 | 0.18 | 0.22 | 0.25 | 0.30 | 0.32 | 0.38 | 0.39 | 0.47 | 0.43 | 0.52 | 0.47 | 0.57 |
| 1/2 Acre | 25 | 0.15 | 0.20 | 0.22 | 0.28 | 0.30 | 0.36 | 0.37 | 0.46 | 0.41 | 0.51 | 0.46 | 0.56 |
| 1 Acre | 20 | 0.12 | 0.17 | 0.20 | 0.26 | 0.27 | 0.34 | 0.35 | 0.44 | 0.40 | 0.50 | 0.44 | 0.55 |
| Industrial | | | | | | | | | | | | | |
| Light Areas | 80 | 0.57 | 0.60 | 0.59 | 0.63 | 0.63 | 0.66 | 0.66 | 0.70 | 0.68 | 0.72 | 0.70 | 0.74 |
| Heavy Areas | 90 | 0.71 | 0.73 | 0.73 | 0.75 | 0.75 | 0.77 | 0.78 | 0.80 | 0.80 | 0.82 | 0.81 | 0.83 |
| Parks and Cemeteries | 7 | 0.05 | 0.09 | 0.12 | 0.19 | 0.20 | 0.29 | 0.30 | 0.40 | 0.34 | 0.46 | 0.39 | 0.52 |
| Playgrounds | 13 | 0.07 | 0.13 | 0.16 | 0.23 | 0.24 | 0.31 | 0.32 | 0.42 | 0.37 | 0.48 | 0.41 | 0.54 |
| Railroad Yard Areas | 40 | 0.23 | 0.28 | 0.30 | 0.35 | 0.36 | 0.42 | 0.42 | 0.50 | 0.46 | 0.54 | 0.50 | 0.58 |
| Undeveloped Areas | | | | | | | | | | | | | |
| Historic Flow Analysis-- Greenbelts, Agriculture | 2 | 0.03 | 0.05 | 0.09 | 0.16 | 0.17 | 0.26 | 0.26 | 0.38 | 0.31 | 0.45 | 0.36 | 0.51 |
| Pasture/Meadow | 0 | 0.02 | 0.04 | 0.08 | 0.15 | 0.15 | 0.25 | 0.25 | 0.37 | 0.30 | 0.44 | 0.35 | 0.50 |
| Forest | 0 | 0.02 | 0.04 | 0.08 | 0.15 | 0.15 | 0.25 | 0.25 | 0.37 | 0.30 | 0.44 | 0.35 | 0.50 |
| Exposed Rock | 100 | 0.89 | 0.89 | 0.90 | 0.90 | 0.92 | 0.92 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.96 |
| Offsite Flow Analysis (when landuse is undefined) | 45 | 0.26 | 0.31 | 0.32 | 0.37 | 0.38 | 0.44 | 0.44 | 0.51 | 0.48 | 0.55 | 0.51 | 0.59 |
| Streets | | | | | | | | | | | | | |
| Paved | 100 | 0.89 | 0.89 | 0.90 | 0.90 | 0.92 | 0.92 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.96 |
| Gravel | 80 | 0.57 | 0.60 | 0.59 | 0.63 | 0.63 | 0.66 | 0.66 | 0.70 | 0.68 | 0.72 | 0.70 | 0.74 |
| Drive and Walks | 100 | 0.89 | 0.89 | 0.90 | 0.90 | 0.92 | 0.92 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.96 |
| Roots | 90 | 0.71 | 0.73 | 0.73 | 0.75 | 0.75 | 0.77 | 0.78 | 0.80 | 0.80 | 0.82 | 0.81 | 0.83 |
| Lawns | 0 | 0.02 | 0.04 | 0.08 | 0.15 | 0.15 | 0.25 | 0.25 | 0.37 | 0.30 | 0.44 | 0.35 | 0.50 |

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

Weighted Imperviousness Calculations

| SUB-BASIN | AREA (SF) | AREA (Acres) | ROOF AREA | ROOF IMPERVIOUSNESS | ROOF | | | | LANDSCAPE AREA | LANDSCAPE IMPERVIOUSNESS | LANDSCAPE | | | | PAVEMENT AREA | PAVEMENT IMPERVIOUSNESS | PAVEMENT | | | | WEIGHTED IMPERVIOUSNESS | WEIGHTED COEFFICIENTS | | | |
|-----------|-----------|--------------|-----------|---------------------|------|------|------|------|----------------|--------------------------|-----------|------|------|------|---------------|-------------------------|----------|------|------|------|-------------------------|-----------------------|------|------|------|
| | | | | | C2 | C5 | C10 | C100 | | | C2 | C5 | C10 | C100 | | | C2 | C5 | C10 | C100 | | C2 | C5 | C10 | C100 |
| EX1 | 176612 | 4.05 | 0 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 4.054449 | 2% | 0.03 | 0.09 | 0.17 | 0.36 | 0 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 2% | 0.03 | 0.09 | 0.17 | 0.36 |
| EX2 | 334022 | 7.67 | 0 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 7.668084 | 2% | 0.03 | 0.09 | 0.17 | 0.36 | 0 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 2% | 0.03 | 0.09 | 0.17 | 0.36 |
| OS1 | 8569.09 | 0.20 | 0 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.196719 | 2% | 0.03 | 0.09 | 0.17 | 0.36 | 0 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 2% | 0.03 | 0.09 | 0.17 | 0.36 |
| OS2 | 52548.9 | 1.21 | 0 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.06 | 2% | 0.03 | 0.09 | 0.17 | 0.36 | 1.15 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 95% | 0.85 | 0.86 | 0.89 | 0.93 |
| OS3 | 20104.2 | 0.46 | 0 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.461529 | 2% | 0.03 | 0.09 | 0.17 | 0.36 | 0 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 2% | 0.03 | 0.09 | 0.17 | 0.36 |
| TOTAL | 415,244 | 9.53 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 8.39 | 2% | 0.03 | 0.09 | 0.17 | 0.36 | 1.15 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 14% | 0.13 | 0.19 | 0.26 | 0.43 |

**Citizen on Constitution
Drainage Report
El Paso County, CO**

| Citizen on Constitution - Drainage Report | | | | | | | | | | | | | | | | | | | | |
|--|----------------|--------------|----------|------|-------------------------|---------|----------|------------------|---------|--------|--------------|-----------------------------|-------------------------------|--------------|----------|-----------------|--|--|-----------------------------|-------|
| Existing Runoff Calculations | | | | | | | | | | | | | | | | | | | | |
| Time of Concentration | | | | | | | | | | | | | | | | | | | | |
| Watercourse Coefficient | | | | | | | | | | | | | | | | | | | | |
| | | | | | Forest & Meadow | 2.50 | | | | | | Short Grass Pasture & Lawns | 7.00 | | | | | | Grassed Waterway | 15.00 |
| | | | | | Fallow or Cultivation | 5.00 | | | | | | Nearly Bare Ground | 10.00 | | | | | | Paved Area & Shallow Gutter | 20.00 |
| DESIGN POINT | SUB-BASIN DATA | | | | INITIAL / OVERLAND TIME | | | TRAVEL TIME T(t) | | | | | T(c) CHECK (URBANIZED BASINS) | | | FINAL T(c) min. | | | | |
| | DRAIN BASIN | AREA sq. ft. | AREA ac. | C(5) | Length ft. | Slope % | T(i) min | Length ft. | Slope % | Coeff. | Velocity fps | T(t) min. | COMP. T(c) | TOTAL LENGTH | L/180+10 | | | | | |
| 1 | EX1 | 176,612 | 4.05 | 0.09 | 141 | 1.7% | 18.4 | 275 | 2.3% | 5.00 | 0.8 | 6.1 | 24.5 | 416 | 12.3 | 12.3 | | | | |
| 2 | EX2 | 334,022 | 7.67 | 0.09 | 100 | 2.2% | 14.2 | 315 | 2.3% | 5.00 | 0.8 | 7.0 | 21.2 | 415 | 12.3 | 12.3 | | | | |
| 3 | OS1 | 8,569 | 0.20 | 0.09 | 20 | 3.5% | 5.4 | 0 | 2.0% | 5.00 | 0.7 | 0.0 | 5.4 | 20 | 10.1 | 5.4 | | | | |
| 4 | OS2 | 52,549 | 1.21 | 0.86 | 57 | 2.0% | 2.6 | 849 | 0.5% | 20.00 | 1.4 | 10.0 | 12.6 | 906 | 15.0 | 12.6 | | | | |
| 5 | OS3 | 20,104 | 0.46 | 0.09 | 20 | 2.0% | 6.6 | 0 | 0.5% | 5.00 | 0.4 | 0.0 | 6.6 | 20 | 10.1 | 6.6 | | | | |

**Citizen on Constitution
Drainage Report
El Paso County, CO**

| Citizen on Constitution - Drainage Report Existing Runoff Calculations <i>Design Storm 5 Year</i> (Rational Method Procedure) | | | | | | | | | | | | |
|--|-------------|----------|--------------|---------------|-------|---------|-------|-------------------|-------|---------|-------|------------------------------|
| BASIN INFORMATION | | | | DIRECT RUNOFF | | | | CUMULATIVE RUNOFF | | | | NOTES |
| DESIGN POINT | DRAIN BASIN | AREA ac. | RUNOFF COEFF | T(c) min | C x A | I in/hr | Q cfs | T(c) min | C x A | I in/hr | Q cfs | |
| 1 | EX1 | 4.05 | 0.09 | 12.3 | 0.36 | 3.78 | 1.38 | | | | 5.35 | Includes flow from OS1 & OS2 |
| 2 | EX2 | 7.67 | 0.09 | 12.3 | 0.69 | 3.78 | 2.61 | | | | 2.80 | Includes flow from OS3 |
| 3 | OS1 | 0.20 | 0.09 | 5.4 | 0.02 | 5.05 | 0.09 | | | | 0.09 | |
| 4 | OS2 | 1.21 | 0.86 | 12.6 | 1.04 | 3.73 | 3.89 | | | | 3.89 | |
| 5 | OS3 | 0.46 | 0.09 | 6.6 | 0.04 | 4.76 | 0.20 | | | | 0.20 | |

**Citizen on Constitution
Drainage Report
El Paso County, CO**

| Citizen on Constitution - Drainage Report Existing Runoff Calculations Design Storm 100 Year (Rational Method Procedure) | | | | | | | | | | | | |
|--|-------------|----------|--------------|---------------|-------|---------|-------|-------------------|-------|---------|-------|------------------------------|
| BASIN INFORMATION | | | | DIRECT RUNOFF | | | | CUMULATIVE RUNOFF | | | | NOTES |
| DESIGN POINT | DRAIN BASIN | AREA ac. | RUNOFF COEFF | T(c) min | C x A | I in/hr | Q cfs | T(c) min | C x A | I in/hr | Q cfs | |
| 1 | EX1 | 4.05 | 0.36 | 12.3 | 1.46 | 6.33 | 9.24 | | | | 16.90 | Includes flow from OS1 & OS2 |
| 2 | EX2 | 7.67 | 0.36 | 12.3 | 2.76 | 6.33 | 17.48 | | | | 18.81 | Includes flow from OS3 |
| 3 | OS1 | 0.20 | 0.36 | 5.4 | 0.07 | 8.47 | 0.60 | | | | 0.60 | |
| 4 | OS2 | 1.21 | 0.93 | 12.6 | 1.13 | 6.26 | 7.05 | | | | 7.05 | |
| 5 | OS3 | 0.46 | 0.36 | 6.6 | 0.17 | 7.99 | 1.33 | | | | 1.33 | |

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Drainage Report
El Paso County, CO*

| SUMMARY - EXISTING RUNOFF TABLE | | | | | | |
|--|--------------------------|---------------------------|---------------------------------|-----------------------------------|-------------------------------------|---------------------------------------|
| DESIGN POINT | BASIN DESIGNATION | BASIN AREA (ACRES) | DIRECT 5-YR RUNOFF (CFS) | DIRECT 100-YR RUNOFF (CFS) | CUMULATIVE 5-YR RUNOFF (CFS) | CUMULATIVE 100-YR RUNOFF (CFS) |
| 1 | EX1 | 4.05 | 1.38 | 9.24 | 5.35 | 16.90 |
| 2 | EX2 | 7.67 | 2.61 | 17.48 | 2.80 | 18.81 |
| 3 | OS1 | 0.20 | 0.09 | 0.60 | 3.97 | 7.65 |
| 4 | OS2 | 1.21 | 3.89 | 7.05 | 3.89 | 7.05 |
| 5 | OS3 | 0.46 | 0.20 | 1.33 | 0.20 | 1.33 |

Weighted Imperviousness Calculations

| SUB-BASIN | AREA (SF) | AREA (Acres) | ROOF AREA | ROOF IMPERVIOUSNESS | ROOF | | | | LANDSCAPE AREA | LANDSCAPE IMPERVIOUSNESS | LANDSCAPE | | | | PAVEMENT/GRAVEL AREA | PAVEMENT/GRAVEL IMPERVIOUSNESS | PAVEMENT | | | | WEIGHTED IMPERVIOUSNESS | WEIGHTED COEFFICIENTS | | | |
|-----------|-----------|--------------|-----------|---------------------|------|------|------|------|----------------|--------------------------|-----------|------|------|------|----------------------|--------------------------------|----------|------|------|------|-------------------------|-----------------------|------|------|------|
| | | | | | C2 | C5 | C10 | C100 | | | C2 | C5 | C10 | C100 | | | C2 | C5 | C10 | C100 | | C2 | C5 | C10 | C100 |
| A1* | 38032 | 0.87 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.87 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.00 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 2% | 0.02 | 0.08 | 0.15 | 0.35 |
| A2* | 18072 | 0.41 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.24 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.17 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 42% | 0.38 | 0.42 | 0.47 | 0.60 |
| B1 | 5733 | 0.13 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.02 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.11 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 83% | 0.74 | 0.76 | 0.79 | 0.85 |
| B2 | 7269 | 0.17 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.04 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.13 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 79% | 0.70 | 0.72 | 0.75 | 0.83 |
| B3* | 15035 | 0.35 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.06 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.29 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 84% | 0.75 | 0.77 | 0.79 | 0.86 |
| B4* | 7927 | 0.18 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.03 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.15 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 84% | 0.75 | 0.77 | 0.80 | 0.86 |
| B5* | 1347 | 0.03 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.01 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.02 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 75% | 0.67 | 0.69 | 0.72 | 0.80 |
| C1 | 36584 | 0.84 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.82 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.02 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 4% | 0.04 | 0.10 | 0.17 | 0.36 |
| C2 | 11364 | 0.26 | 0.04 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.07 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.15 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 73% | 0.64 | 0.66 | 0.69 | 0.78 |
| C3 | 27135 | 0.62 | 0.15 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.03 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.44 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 92% | 0.80 | 0.81 | 0.84 | 0.89 |
| D1 | 25466 | 0.58 | 0.07 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.01 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.51 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 97% | 0.85 | 0.87 | 0.89 | 0.93 |
| D1a | 7879 | 0.18 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.02 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.16 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 87% | 0.77 | 0.79 | 0.81 | 0.88 |
| D2 | 46995 | 1.08 | 0.30 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.08 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.70 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 90% | 0.78 | 0.79 | 0.82 | 0.88 |
| D3 | 12867 | 0.30 | 0.16 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.12 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.02 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 55% | 0.44 | 0.48 | 0.52 | 0.63 |
| D4 | 13087 | 0.30 | 0.16 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.12 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.02 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 55% | 0.44 | 0.48 | 0.52 | 0.63 |
| D5 | 22186 | 0.51 | 0.13 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.04 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.34 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 90% | 0.78 | 0.79 | 0.82 | 0.87 |
| D6 | 35089 | 0.81 | 0.25 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.05 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.51 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 91% | 0.78 | 0.80 | 0.82 | 0.88 |
| D7 | 17176 | 0.39 | 0.10 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.05 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.24 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 85% | 0.73 | 0.75 | 0.78 | 0.84 |
| D8 | 23507 | 0.54 | 0.11 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.08 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.35 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 84% | 0.73 | 0.75 | 0.77 | 0.84 |
| D9 | 18641 | 0.43 | 0.21 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.05 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.16 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 83% | 0.69 | 0.72 | 0.74 | 0.81 |
| D10 | 15901 | 0.37 | 0.19 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.05 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.13 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 82% | 0.68 | 0.71 | 0.73 | 0.80 |
| D11 | 21854 | 0.50 | 0.11 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.05 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.34 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 89% | 0.77 | 0.79 | 0.81 | 0.87 |
| D12 | 28925 | 0.66 | 0.21 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.45 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.00 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 30% | 0.24 | 0.29 | 0.34 | 0.50 |
| E1 | 7637 | 0.18 | 0.09 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.09 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.00 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 46% | 0.36 | 0.40 | 0.45 | 0.58 |
| E2 | 9127 | 0.21 | 0.09 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.12 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.00 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 39% | 0.31 | 0.35 | 0.40 | 0.54 |
| E3 | 9520 | 0.22 | 0.09 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.12 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.00 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 40% | 0.32 | 0.36 | 0.41 | 0.55 |
| E4 | 8040 | 0.18 | 0.09 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.09 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.00 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 46% | 0.36 | 0.40 | 0.45 | 0.58 |
| OA1* | 2118 | 0.05 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.03 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.02 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 46% | 0.41 | 0.45 | 0.50 | 0.63 |
| OA2*^ | 19602 | 0.45 | | | | | | | | | | | | | | | | | | | | | | | |
| OB1 | 3388 | 0.08 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.00 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.07 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 96% | 0.86 | 0.87 | 0.89 | 0.94 |
| OB2 | 3503 | 0.08 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.01 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.07 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 90% | 0.80 | 0.82 | 0.84 | 0.90 |
| OC1 | 3590 | 0.08 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.05 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.03 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 41% | 0.37 | 0.41 | 0.46 | 0.59 |
| OC2 | 2589 | 0.06 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.05 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.01 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 25% | 0.23 | 0.27 | 0.33 | 0.49 |
| OD12 | 653 | 0.01 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.01 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.00 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 2% | 0.02 | 0.08 | 0.15 | 0.35 |
| OE1 | 4000 | 0.09 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.07 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.02 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 25% | 0.22 | 0.27 | 0.33 | 0.49 |
| OE2 | 5897 | 0.14 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.10 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.03 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 25% | 0.22 | 0.27 | 0.33 | 0.49 |
| OE3 | 6053 | 0.14 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.11 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.03 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 25% | 0.22 | 0.27 | 0.33 | 0.49 |
| OE4 | 4075 | 0.09 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.07 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.02 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 28% | 0.25 | 0.30 | 0.35 | 0.51 |
| OF1 | 48921 | 1.12 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.00 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 1.12 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 100% | 0.89 | 0.90 | 0.92 | 0.96 |
| OF2 | 18232 | 0.42 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.42 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.00 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 2% | 0.02 | 0.08 | 0.15 | 0.35 |
| OS1* | 10993 | 0.25 | 0.00 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 0.04 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 0.21 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 83% | 0.74 | 0.76 | 0.79 | 0.85 |
| TOTAL | | 14.37 | 2.55 | 90% | 0.71 | 0.73 | 0.75 | 0.81 | 4.75 | 2% | 0.02 | 0.08 | 0.15 | 0.35 | 6.63 | 100% | 0.89 | 0.90 | 0.92 | 0.96 | 63% | 0.54 | 0.57 | 0.61 | 0.70 |

*flows from sub-basin are undetained

^sub-basin area and flows were obtained from previously approved drainage report from adjacent property

**Citizen on Constitution
Drainage Report
El Paso County, CO**

| Citizen on Constitution - Drainage Report Proposed Runoff Calculations Time of Concentration | | | | | | | | | | | | | | | | |
|---|----------------|--------------|----------|------|-------------------------|---------|----------|------------------|---------|--------|--------------|-------------------------------|------------|--------------|------------|------|
| Watercourse Coefficient Forest & Meadow 2.50 Short Grass Pasture & Lawns 7.00 Grassy Waterway 15.00 Fallow or Cultivation 5.00 Nearly Bare Ground 10.00 Paved Area & Shallow Gutter 20.00 | | | | | | | | | | | | | | | | |
| DESIGN POINT | SUB-BASIN DATA | | | | INITIAL / OVERLAND TIME | | | TRAVEL TIME T(t) | | | | T(c) CHECK (URBANIZED BASINS) | | | FINAL T(c) | |
| | DRAIN BASIN | AREA sq. ft. | AREA ac. | C(5) | Length ft. | Slope % | T(i) min | Length ft. | Slope % | Coeff. | Velocity fps | T(t) min. | COMP. T(c) | TOTAL LENGTH | /180+10 | min. |
| A1* | A1* | 38,032 | 0.87 | 0.08 | 100 | 1.6% | 16.0 | 344 | 1.6% | 7.00 | 0.9 | 6.5 | 22.5 | 444 | 12.5 | 12.5 |
| A2* | A2* | 18,072 | 0.41 | 0.42 | 40 | 33.0% | 2.5 | 0 | 15.0% | 7.00 | 2.7 | 0.0 | 5.0 | 40 | 10.2 | 5.0 |
| B1 | B1 | 5,733 | 0.13 | 0.76 | 20 | 2.0% | 2.2 | 150 | 2.0% | 20.00 | 2.8 | 0.9 | 5.0 | 170 | 10.9 | 5.0 |
| B2 | B2 | 7,269 | 0.17 | 0.72 | 20 | 2.0% | 2.4 | 150 | 2.0% | 20.00 | 2.8 | 0.9 | 5.0 | 170 | 10.9 | 5.0 |
| B3* | B3* | 15,035 | 0.35 | 0.77 | 20 | 2.0% | 2.2 | 150 | 2.0% | 20.00 | 2.8 | 0.9 | 5.0 | 170 | 10.9 | 5.0 |
| B4* | B4* | 7,927 | 0.18 | 0.77 | 20 | 2.0% | 2.1 | 150 | 2.0% | 20.00 | 2.8 | 0.9 | 5.0 | 170 | 10.9 | 5.0 |
| B5* | B5* | 1,347 | 0.03 | 0.69 | 20 | 2.0% | 2.7 | 150 | 2.0% | 20.00 | 2.8 | 0.9 | 5.0 | 170 | 10.9 | 5.0 |
| C1 | C1 | 36,584 | 0.84 | 0.10 | 60 | 33.0% | 4.4 | 0 | 2.0% | 20.00 | 2.8 | 0.0 | 5.0 | 60 | 10.3 | 5.0 |
| C2 | C2 | 11,364 | 0.26 | 0.66 | 30 | 25.0% | 1.5 | 100 | 2.0% | 20.00 | 2.8 | 0.6 | 5.0 | 130 | 10.7 | 5.0 |
| C3 | C3 | 27,135 | 0.62 | 0.81 | 20 | 3.0% | 1.6 | 80 | 2.0% | 20.00 | 2.8 | 0.5 | 5.0 | 100 | 10.6 | 5.0 |
| D1 | D1 | 25,466 | 0.58 | 0.87 | 30 | 4.0% | 1.5 | 150 | 2.0% | 20.00 | 2.8 | 0.9 | 5.0 | 180 | 11.0 | 5.0 |
| D1a | D1a | 7,879 | 0.18 | 0.79 | 20 | 5.0% | 1.5 | 50 | 2.0% | 20.00 | 2.8 | 0.3 | 5.0 | 70 | 10.4 | 5.0 |
| D2 | D2 | 46,995 | 1.08 | 0.79 | 40 | 3.0% | 2.5 | 50 | 2.0% | 20.00 | 2.8 | 0.3 | 5.0 | 90 | 10.5 | 5.0 |
| D3 | D3 | 12,867 | 0.30 | 0.48 | 40 | 3.0% | 5.0 | 40 | 2.0% | 20.00 | 2.8 | 0.2 | 5.2 | 80 | 10.4 | 5.2 |
| D4 | D4 | 13,087 | 0.30 | 0.48 | 40 | 3.0% | 5.0 | 40 | 2.0% | 20.00 | 2.8 | 0.2 | 5.2 | 80 | 10.4 | 5.2 |
| D5 | D5 | 22,186 | 0.51 | 0.79 | 40 | 3.0% | 2.5 | 15 | 2.0% | 20.00 | 2.8 | 0.1 | 5.0 | 55 | 10.3 | 5.0 |
| D6 | D6 | 35,089 | 0.81 | 0.80 | 40 | 3.0% | 2.4 | 15 | 2.0% | 20.00 | 2.8 | 0.1 | 5.0 | 55 | 10.3 | 5.0 |
| D7 | D7 | 17,176 | 0.39 | 0.75 | 40 | 3.0% | 2.8 | 15 | 2.0% | 20.00 | 2.8 | 0.1 | 5.0 | 55 | 10.3 | 5.0 |
| D8 | D8 | 23,507 | 0.54 | 0.75 | 40 | 3.0% | 2.8 | 15 | 2.0% | 20.00 | 2.8 | 0.1 | 5.0 | 55 | 10.3 | 5.0 |
| D9 | D9 | 18,641 | 0.43 | 0.72 | 40 | 3.0% | 3.1 | 15 | 2.0% | 20.00 | 2.8 | 0.1 | 5.0 | 55 | 10.3 | 5.0 |
| D10 | D10 | 15,901 | 0.37 | 0.71 | 40 | 3.0% | 3.2 | 15 | 2.0% | 20.00 | 2.8 | 0.1 | 5.0 | 55 | 10.3 | 5.0 |
| D11 | D11 | 21,854 | 0.50 | 0.79 | 40 | 3.0% | 2.5 | 15 | 2.0% | 20.00 | 2.8 | 0.1 | 5.0 | 55 | 10.3 | 5.0 |
| D12 | D12 | 28,925 | 0.66 | 0.29 | 25 | 5.0% | 4.3 | 15 | 2.0% | 20.00 | 2.8 | 0.1 | 5.0 | 40 | 10.2 | 5.0 |
| E1 | E1 | 7,637 | 0.18 | 0.40 | 30 | 25.0% | 2.4 | 0 | 2.0% | 7.00 | 1.0 | 0.0 | 5.0 | 30 | 10.2 | 5.0 |
| E2 | E2 | 9,127 | 0.21 | 0.35 | 30 | 25.0% | 2.6 | 0 | 2.0% | 7.00 | 1.0 | 0.0 | 5.0 | 30 | 10.2 | 5.0 |
| E3 | E3 | 9,520 | 0.22 | 0.36 | 30 | 25.0% | 2.5 | 0 | 2.0% | 7.00 | 1.0 | 0.0 | 5.0 | 30 | 10.2 | 5.0 |
| E4 | E4 | 8,040 | 0.18 | 0.40 | 30 | 25.0% | 2.4 | 0 | 2.0% | 7.00 | 1.0 | 0.0 | 5.0 | 30 | 10.2 | 5.0 |
| OA1* | OA1* | 2,118 | 0.05 | 0.45 | 75 | 5.0% | 6.0 | 50 | 2.0% | 7.00 | 1.0 | 0.8 | 6.8 | 125 | 10.7 | 6.8 |
| OA2*^ | OA2*^ | 19,602 | 0.45 | 0.00 | 75 | 5.0% | 10.2 | 50 | 2.0% | 7.00 | 1.0 | 0.8 | 11.0 | 125 | 10.7 | 10.7 |
| OB1 | OB1 | 3,388 | 0.08 | 0.87 | 60 | 2.0% | 2.6 | 0 | 2.0% | 7.00 | 1.0 | 0.0 | 5.0 | 60 | 10.3 | 5.0 |
| OB2 | OB2 | 3,503 | 0.08 | 0.82 | 60 | 2.0% | 3.2 | 0 | 2.0% | 7.00 | 1.0 | 0.0 | 5.0 | 60 | 10.3 | 5.0 |
| OC1 | OC1 | 3,590 | 0.08 | 0.41 | 25 | 5.0% | 3.7 | 0 | 2.0% | 7.00 | 1.0 | 0.0 | 5.0 | 25 | 10.1 | 5.0 |
| OC2 | OC2 | 2,589 | 0.06 | 0.27 | 25 | 15.0% | 3.1 | 0 | 2.0% | 7.00 | 1.0 | 0.0 | 5.0 | 25 | 10.1 | 5.0 |
| OD12 | OD12 | 653 | 0.01 | 0.08 | 25 | 5.0% | 5.5 | 0 | 2.0% | 7.00 | 1.0 | 0.0 | 5.5 | 25 | 10.1 | 5.5 |
| OE1 | OE1 | 4,000 | 0.09 | 0.27 | 0 | 25.0% | 0.2 | 70 | 2.0% | 7.00 | 1.0 | 1.2 | 5.0 | 70 | 10.4 | 5.0 |
| OE2 | OE2 | 5,897 | 0.14 | 0.27 | 0 | 25.0% | 0.2 | 70 | 2.0% | 7.00 | 1.0 | 1.2 | 5.0 | 70 | 10.4 | 5.0 |
| OE3 | OE3 | 6,053 | 0.14 | 0.27 | 0 | 25.0% | 0.2 | 70 | 2.0% | 7.00 | 1.0 | 1.2 | 5.0 | 70 | 10.4 | 5.0 |
| OE4 | OE4 | 4,075 | 0.09 | 0.30 | 0 | 25.0% | 0.2 | 70 | 2.0% | 7.00 | 1.0 | 1.2 | 5.0 | 70 | 10.4 | 5.0 |
| OF1 | OF1 | 48,921 | 1.12 | 0.90 | 50 | 2.0% | 2.1 | 750 | 2.0% | 7.00 | 1.0 | 12.6 | 14.7 | 800 | 14.4 | 14.4 |
| OF2 | OF2 | 18,232 | 0.42 | 0.08 | 30 | 2.0% | 8.1 | 0 | 2.0% | 7.00 | 1.0 | 0.0 | 8.1 | 30 | 10.2 | 8.1 |
| OS1* | OS1* | 10,993 | 0.25 | 0.76 | 50 | 2.0% | 3.5 | 75 | 5.0% | 20.00 | 4.5 | 0.3 | 5.0 | 125 | 10.7 | 5.0 |

**Citizen on Constitution
Drainage Report
El Paso County, CO**

| Citizen on Constitution - Drainage Report Proposed Runoff Calculations <i>Design Storm 5 Year</i> (Rational Method Procedure) | | | | | | | | | | | | |
|--|-------------|----------|--------------|---------------|-------|---------|-------|-------------------|-------|---------|-------|-------------------------|
| BASIN INFORMATION | | | | DIRECT RUNOFF | | | | CUMULATIVE RUNOFF | | | | NOTES |
| DESIGN POINT | DRAIN BASIN | AREA ac. | RUNOFF COEFF | T(c) min | C x A | I in/hr | Q cfs | T(c) min | C x A | I in/hr | Q cfs | |
| A1* | A1* | 0.87 | 0.08 | 12.5 | 0.07 | 3.75 | 0.26 | | | | 0.75 | A1 + OA1 + OA2 |
| A2* | A2* | 0.41 | 0.42 | 5.0 | 0.17 | 5.16 | 0.89 | | | | | |
| B1 | B1 | 0.13 | 0.76 | 5.0 | 0.10 | 5.16 | 0.51 | | | | 0.86 | B1 + OB1 |
| B2 | B2 | 0.17 | 0.72 | 5.0 | 0.12 | 5.16 | 0.62 | | | | 0.96 | B2 + OB2 |
| B3* | B3* | 0.35 | 0.77 | 5.0 | 0.26 | 5.16 | 1.36 | | | | | |
| B4* | B4* | 0.18 | 0.77 | 5.0 | 0.14 | 5.16 | 0.72 | | | | | |
| B5* | B5* | 0.03 | 0.69 | 5.0 | 0.02 | 5.16 | 0.11 | | | | | |
| C1 | C1 | 0.84 | 0.10 | 5.0 | 0.08 | 5.16 | 0.43 | | | | 0.60 | C1 + OC1 |
| C2 | C2 | 0.26 | 0.66 | 5.0 | 0.17 | 5.16 | 0.89 | | | | 0.97 | C2 + OC2 |
| C3 | C3 | 0.62 | 0.81 | 5.0 | 0.51 | 5.16 | 2.61 | | | | | |
| D1 | D1 | 0.58 | 0.87 | 5.0 | 0.51 | 5.16 | 2.61 | | | | | |
| D1a | D1a | 0.18 | 0.79 | 5.0 | 0.14 | 5.16 | 0.73 | | | | | |
| D2 | D2 | 1.08 | 0.79 | 5.0 | 0.86 | 5.16 | 4.42 | | | | | |
| D3 | D3 | 0.30 | 0.48 | 5.2 | 0.14 | 5.09 | 0.72 | | | | | |
| D4 | D4 | 0.30 | 0.48 | 5.2 | 0.14 | 5.09 | 0.73 | | | | | |
| D5 | D5 | 0.51 | 0.79 | 5.0 | 0.40 | 5.16 | 2.08 | | | | | |
| D6 | D6 | 0.81 | 0.80 | 5.0 | 0.64 | 5.16 | 3.32 | | | | | |
| D7 | D7 | 0.39 | 0.75 | 5.0 | 0.30 | 5.16 | 1.53 | | | | | |
| D8 | D8 | 0.54 | 0.75 | 5.0 | 0.40 | 5.16 | 2.07 | | | | | |
| D9 | D9 | 0.43 | 0.72 | 5.0 | 0.31 | 5.16 | 1.58 | | | | | |
| D10 | D10 | 0.37 | 0.71 | 5.0 | 0.26 | 5.16 | 1.33 | | | | | |
| D11 | D11 | 0.50 | 0.79 | 5.0 | 0.39 | 5.16 | 2.03 | | | | | |
| D12 | D12 | 0.66 | 0.29 | 5.0 | 0.19 | 5.16 | 0.99 | | | | 0.99 | D12 + OD12 |
| E1 | E1 | 0.18 | 0.40 | 5.0 | 0.07 | 5.16 | 0.37 | | | | 0.49 | E1 + OE1 |
| E2 | E2 | 0.21 | 0.35 | 5.0 | 0.07 | 5.16 | 0.38 | | | | 0.57 | E2 + OE2 |
| E3 | E3 | 0.22 | 0.36 | 5.0 | 0.08 | 5.16 | 0.41 | | | | 0.60 | E3 + OE3 |
| E4 | E4 | 0.18 | 0.40 | 5.0 | 0.07 | 5.16 | 0.38 | | | | 0.53 | E4 + OE4 |
| OA1* | OA1* | 0.05 | 0.45 | 6.8 | 0.02 | 4.71 | 0.10 | | | | | |
| OA2*^ | OA2*^ | 0.45 | 0.00 | | 0.00 | 4.00 | | | | | 0.60 | Flows from previous FDR |
| OB1 | OB1 | 0.08 | 0.87 | 5.0 | 0.07 | 5.16 | 0.35 | | | | | |
| OB2 | OB2 | 0.08 | 0.82 | 5.0 | 0.07 | 5.16 | 0.34 | | | | | |
| OC1 | OC1 | 0.08 | 0.41 | 5.0 | 0.03 | 5.16 | 0.17 | | | | | |
| OC2 | OC2 | 0.06 | 0.27 | 5.0 | 0.02 | 5.16 | 0.08 | | | | | |
| OD12 | OD12 | 0.01 | 0.08 | 5.5 | 0.00 | 5.02 | 0.01 | | | | | |
| OE1 | OE1 | 0.09 | 0.27 | 5.0 | 0.02 | 5.16 | 0.13 | | | | | |
| OE2 | OE2 | 0.14 | 0.27 | 5.0 | 0.04 | 5.16 | 0.19 | | | | | |
| OE3 | OE3 | 0.14 | 0.27 | 5.0 | 0.04 | 5.16 | 0.19 | | | | | |
| OE4 | OE4 | 0.09 | 0.30 | 5.0 | 0.03 | 5.16 | 0.14 | | | | | |
| OF1 | OF1 | 1.12 | 0.90 | 14.4 | 1.01 | 3.52 | 3.56 | | | | | |
| OF2 | OF2 | 0.42 | 0.08 | 8.1 | 0.03 | 4.45 | 0.15 | | | | | |
| OS1* | OS1* | 0.25 | 0.76 | 5.0 | 0.19 | 5.16 | 0.99 | | | | | |

**Citizen on Constitution
Drainage Report
El Paso County, CO**

| Citizen on Constitution - Drainage Report Proposed Runoff Calculations <i>Design Storm 100 Year</i> (Rational Method Procedure) | | | | | | | | | | | | |
|--|-------------|----------|--------------|---------------|-------|---------|-------|-------------------|-------|---------|-------|-------------------------|
| BASIN INFORMATION | | | | DIRECT RUNOFF | | | | CUMULATIVE RUNOFF | | | | NOTES |
| DESIGN POINT | DRAIN BASIN | AREA ac. | RUNOFF COEFF | T(c) min | C x A | I in/hr | Q cfs | T(c) min | C x A | I in/hr | Q cfs | |
| A1* | A1* | 0.87 | 0.35 | 12.5 | 0.31 | 6.29 | 1.92 | | | | 3.09 | A1 + OA1 + OA2 |
| A2* | A2* | 0.41 | 0.60 | 5.0 | 0.25 | 8.65 | 2.15 | | | | | |
| B1 | B1 | 0.13 | 0.85 | 5.0 | 0.11 | 8.65 | 0.97 | | | | 1.60 | B1 + OB1 |
| B2 | B2 | 0.17 | 0.83 | 5.0 | 0.14 | 8.65 | 1.20 | | | | 1.82 | B2 + OB2 |
| B3* | B3* | 0.35 | 0.86 | 5.0 | 0.30 | 8.65 | 2.57 | | | | | |
| B4* | B4* | 0.18 | 0.86 | 5.0 | 0.16 | 8.65 | 1.36 | | | | | |
| B5* | B5* | 0.03 | 0.80 | 5.0 | 0.02 | 8.65 | 0.21 | | | | | |
| C1 | C1 | 0.84 | 0.36 | 5.0 | 0.31 | 8.65 | 2.64 | | | | 3.07 | C1 + OC1 |
| C2 | C2 | 0.26 | 0.78 | 5.0 | 0.20 | 8.65 | 1.76 | | | | 2.01 | C2 + OC2 |
| C3 | C3 | 0.62 | 0.89 | 5.0 | 0.55 | 8.65 | 4.79 | | | | | |
| D1 | D1 | 0.58 | 0.93 | 5.0 | 0.55 | 8.65 | 4.72 | | | | | |
| D1a | D1a | 0.18 | 0.88 | 5.0 | 0.16 | 8.65 | 1.37 | | | | | |
| D2 | D2 | 1.08 | 0.88 | 5.0 | 0.94 | 8.65 | 8.17 | | | | | |
| D3 | D3 | 0.30 | 0.63 | 5.2 | 0.19 | 8.54 | 1.59 | | | | | |
| D4 | D4 | 0.30 | 0.63 | 5.2 | 0.19 | 8.54 | 1.63 | | | | | |
| D5 | D5 | 0.51 | 0.87 | 5.0 | 0.45 | 8.65 | 3.85 | | | | | |
| D6 | D6 | 0.81 | 0.88 | 5.0 | 0.71 | 8.65 | 6.11 | | | | | |
| D7 | D7 | 0.39 | 0.84 | 5.0 | 0.33 | 8.65 | 2.88 | | | | | |
| D8 | D8 | 0.54 | 0.84 | 5.0 | 0.45 | 8.65 | 3.92 | | | | | |
| D9 | D9 | 0.43 | 0.81 | 5.0 | 0.35 | 8.65 | 3.00 | | | | | |
| D10 | D10 | 0.37 | 0.80 | 5.0 | 0.29 | 8.65 | 2.54 | | | | | |
| D11 | D11 | 0.50 | 0.87 | 5.0 | 0.44 | 8.65 | 3.78 | | | | | |
| D12 | D12 | 0.66 | 0.50 | 5.0 | 0.33 | 8.65 | 2.86 | | | | 2.90 | D12 + OD12 |
| E1 | E1 | 0.18 | 0.58 | 5.0 | 0.10 | 8.65 | 0.88 | | | | 1.27 | E1 + OE1 |
| E2 | E2 | 0.21 | 0.54 | 5.0 | 0.11 | 8.65 | 0.98 | | | | 1.56 | E2 + OE2 |
| E3 | E3 | 0.22 | 0.55 | 5.0 | 0.12 | 8.65 | 1.04 | | | | 1.63 | E3 + OE3 |
| E4 | E4 | 0.18 | 0.58 | 5.0 | 0.11 | 8.65 | 0.92 | | | | 1.34 | E4 + OE4 |
| OA1* | OA1* | 0.05 | 0.63 | 6.8 | 0.03 | 7.90 | 0.24 | | | | | |
| OA2*^ | OA2*^ | 0.45 | 0.00 | 10.7 | 0.00 | 6.71 | | | | | 1.90 | Flows from previous FDR |
| OB1 | OB1 | 0.08 | 0.94 | 5.0 | 0.07 | 8.65 | 0.63 | | | | | |
| OB2 | OB2 | 0.08 | 0.90 | 5.0 | 0.07 | 8.65 | 0.62 | | | | | |
| OC1 | OC1 | 0.08 | 0.59 | 5.0 | 0.05 | 8.65 | 0.42 | | | | | |
| OC2 | OC2 | 0.06 | 0.49 | 5.0 | 0.03 | 8.65 | 0.25 | | | | | |
| OD12 | OD12 | 0.01 | 0.35 | 5.5 | 0.01 | 8.43 | 0.04 | | | | | |
| OE1 | OE1 | 0.09 | 0.49 | 5.0 | 0.05 | 8.65 | 0.39 | | | | | |
| OE2 | OE2 | 0.14 | 0.49 | 5.0 | 0.07 | 8.65 | 0.58 | | | | | |
| OE3 | OE3 | 0.14 | 0.49 | 5.0 | 0.07 | 8.65 | 0.59 | | | | | |
| OE4 | OE4 | 0.09 | 0.51 | 5.0 | 0.05 | 8.65 | 0.41 | | | | | |
| OF1 | OF1 | 1.12 | 0.96 | 14.4 | 1.08 | 5.90 | 6.36 | | | | | |
| OF2 | OF2 | 0.42 | 0.35 | 8.1 | 0.15 | 7.46 | 1.09 | | | | | |
| OS1* | OS1* | 0.25 | 0.85 | 5.0 | 0.22 | 8.65 | 1.87 | | | | | |

| SUMMARY - PROPOSED RUNOFF TABLE | | | | | | |
|--|--------------------------|---------------------------|---------------------------------|-----------------------------------|-------------------------------------|---------------------------------------|
| DESIGN POINT | BASIN DESIGNATION | BASIN AREA (ACRES) | DIRECT 5-YR RUNOFF (CFS) | DIRECT 100-YR RUNOFF (CFS) | CUMULATIVE 5-YR RUNOFF (CFS) | CUMULATIVE 100-YR RUNOFF (CFS) |
| A1* | A1* | 0.87 | 0.26 | 1.92 | 0.75 | 3.09 |
| A2* | A2* | 0.41 | 0.89 | 2.15 | 0.89 | 2.15 |
| B1 | B1 | 0.13 | 0.51 | 0.97 | 0.86 | 1.60 |
| B2 | B2 | 0.17 | 0.62 | 1.20 | 0.96 | 1.82 |
| B3* | B3* | 0.35 | 1.36 | 2.57 | 1.36 | 2.57 |
| B4* | B4* | 0.18 | 0.72 | 1.36 | 0.72 | 1.36 |
| B5* | B5* | 0.03 | 0.11 | 0.21 | 0.11 | 0.21 |
| C1 | C1 | 0.84 | 0.43 | 2.64 | 0.60 | 3.07 |
| C2 | C2 | 0.26 | 0.89 | 1.76 | 0.97 | 2.01 |
| C3 | C3 | 0.62 | 2.61 | 4.79 | 2.61 | 4.79 |
| D1 | D1 | 0.58 | 2.61 | 4.72 | 2.61 | 4.72 |
| D1a | D1a | 0.18 | 0.73 | 1.37 | 0.73 | 1.37 |
| D2 | D2 | 1.08 | 4.42 | 8.17 | 4.42 | 8.17 |
| D3 | D3 | 0.30 | 0.72 | 1.59 | 0.72 | 1.59 |
| D4 | D4 | 0.30 | 0.73 | 1.63 | 0.73 | 1.63 |
| D5 | D5 | 0.51 | 2.08 | 3.85 | 2.08 | 3.85 |
| D6 | D6 | 0.81 | 3.32 | 6.11 | 3.32 | 6.11 |
| D7 | D7 | 0.39 | 1.53 | 2.88 | 1.53 | 2.88 |
| D8 | D8 | 0.54 | 2.07 | 3.92 | 2.07 | 3.92 |
| D9 | D9 | 0.43 | 1.58 | 3.00 | 1.58 | 3.00 |
| D10 | D10 | 0.37 | 1.33 | 2.54 | 1.33 | 2.54 |
| D11 | D11 | 0.50 | 2.03 | 3.78 | 2.03 | 3.78 |
| D12 | D12 | 0.66 | 0.99 | 2.86 | 0.99 | 2.90 |
| E1 | E1 | 0.18 | 0.37 | 0.88 | 0.49 | 1.27 |
| E2 | E2 | 0.21 | 0.38 | 0.98 | 0.57 | 1.56 |
| E3 | E3 | 0.22 | 0.41 | 1.04 | 0.60 | 1.63 |
| E4 | E4 | 0.18 | 0.38 | 0.92 | 0.53 | 1.34 |
| OA1* | OA1* | 0.05 | 0.10 | 0.24 | 0.10 | 0.24 |
| OA2*^ | OA2*^ | 0.45 | 0.00 | 0.00 | 0.60 | 1.90 |
| OB1 | OB1 | 0.08 | 0.35 | 0.63 | 0.35 | 0.63 |
| OB2 | OB2 | 0.08 | 0.34 | 0.62 | 0.34 | 0.62 |
| OC1 | OC1 | 0.08 | 0.17 | 0.42 | 0.17 | 0.42 |
| OC2 | OC2 | 0.06 | 0.08 | 0.25 | 0.08 | 0.25 |
| OD12 | OD12 | 0.01 | 0.01 | 0.04 | 0.01 | 0.04 |
| OE1 | OE1 | 0.09 | 0.13 | 0.39 | 0.13 | 0.39 |
| OE2 | OE2 | 0.14 | 0.19 | 0.58 | 0.19 | 0.58 |
| OE3 | OE3 | 0.14 | 0.19 | 0.59 | 0.19 | 0.59 |
| OE4 | OE4 | 0.09 | 0.14 | 0.41 | 0.14 | 0.41 |
| OF1 | OF1 | 1.12 | 3.56 | 6.36 | 3.56 | 6.36 |
| OF2 | OF2 | 0.42 | 0.15 | 1.09 | 0.15 | 1.09 |
| OS1* | OS1* | 0.25 | 0.99 | 1.87 | 0.99 | 1.87 |

*flows from sub-basin are undetained

^sub-basin area and flows were obtained from previously approved drainage report from adjacent property

APPENDIX C: HYDRAULICS

Worksheet for Curb Cut Analysis (Largest Proposed Discharge)

| Project Description | |
|-----------------------|---------------------|
| Friction Method | Manning Formula |
| Solve For | Normal Depth |
| Input Data | |
| Roughness Coefficient | 0.013 |
| Channel Slope | 0.020 ft/ft |
| Bottom Width | 3.00 ft |
| Discharge | 4.79 cfs |
| Results | |
| Normal Depth | 3.2 in |
| Flow Area | 0.8 ft ² |
| Wetted Perimeter | 3.5 ft |
| Hydraulic Radius | 2.7 in |
| Top Width | 3.00 ft |
| Critical Depth | 5.2 in |
| Critical Slope | 0.005 ft/ft |
| Velocity | 6.00 ft/s |
| Velocity Head | 0.56 ft |
| Specific Energy | 0.83 ft |
| Froude Number | 2.050 |
| Flow Type | Supercritical |
| GVF Input Data | |
| Downstream Depth | 0.0 in |
| Length | 0.0 ft |
| Number Of Steps | 0 |
| GVF Output Data | |
| Upstream Depth | 0.0 in |
| Profile Description | N/A |
| Profile Headloss | 0.00 ft |
| Downstream Velocity | Infinity ft/s |
| Upstream Velocity | Infinity ft/s |
| Normal Depth | 3.2 in |
| Critical Depth | 5.2 in |
| Channel Slope | 0.020 ft/ft |
| Critical Slope | 0.005 ft/ft |

INLET MANAGEMENT

Worksheet Protected

| INLET NAME | B1 | B2 | B3 |
|------------------------------------|--------------------------|--------------------------|--------------------------|
| Site Type (Urban or Rural) | | | |
| Inlet Application (Street or Area) | STREET | STREET | STREET |
| Hydraulic Condition | On Grade | On Grade | On Grade |
| Inlet Type | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening |

USER-DEFINED INPUT

User-Defined Design Flows

| | | | |
|-------------------------|-----|-----|-----|
| Minor Q_{Known} (cfs) | 0.9 | 1.0 | 1.4 |
| Major Q_{Known} (cfs) | 1.6 | 1.8 | 2.6 |

Bypass (Carry-Over) Flow from Upstream

| | | | |
|---|-------------------------|-----|-----|
| Receive Bypass Flow from: | No Bypass Flow Received | OF1 | B1 |
| Minor Bypass Flow Received, Q_b (cfs) | 0.0 | 0.0 | 0.0 |
| Major Bypass Flow Received, Q_b (cfs) | 0.0 | 0.0 | 0.1 |

Watershed Characteristics

| | | | |
|---------------------------|--|--|--|
| Subcatchment Area (acres) | | | |
| Percent Impervious | | | |
| NRCS Soil Type | | | |

Watershed Profile

| | | | |
|------------------------|--|--|--|
| Overland Slope (ft/ft) | | | |
| Overland Length (ft) | | | |
| Channel Slope (ft/ft) | | | |
| Channel Length (ft) | | | |

Minor Storm Rainfall Input

| | | | |
|---|--|--|--|
| Design Storm Return Period, T_r (years) | | | |
| One-Hour Precipitation, P_1 (inches) | | | |

Major Storm Rainfall Input

| | | | |
|---|--|--|--|
| Design Storm Return Period, T_r (years) | | | |
| One-Hour Precipitation, P_1 (inches) | | | |

CALCULATED OUTPUT

| | | | |
|---|------------|------------|------------|
| Minor Total Design Peak Flow, Q (cfs) | 0.9 | 1.0 | 1.4 |
| Major Total Design Peak Flow, Q (cfs) | 1.6 | 1.8 | 2.7 |
| Minor Flow Bypassed Downstream, Q_b (cfs) | 0.0 | 0.0 | 0.0 |
| Major Flow Bypassed Downstream, Q_b (cfs) | 0.1 | 0.2 | 0.6 |

INLET MANAGEMENT

Worksheet Protected

| INLET NAME | B4 | D1 | D2 |
|------------------------------------|--------------------------|--------------------------|--------------------------|
| Site Type (Urban or Rural) | | | |
| Inlet Application (Street or Area) | STREET | STREET | STREET |
| Hydraulic Condition | On Grade | In Sump | In Sump |
| Inlet Type | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening |

USER-DEFINED INPUT

User-Defined Design Flows

| | | | |
|-------------------------|-----|-----|-----|
| Minor Q_{known} (cfs) | 0.7 | 2.6 | 4.4 |
| Major Q_{known} (cfs) | 0.4 | 4.7 | 8.2 |

Bypass (Carry-Over) Flow from Upstream

| | | | |
|---|-------------------------|-----|-------------------------|
| Receive Bypass Flow from: | No Bypass Flow Received | D1a | No Bypass Flow Received |
| Minor Bypass Flow Received, Q_b (cfs) | 0.0 | 0.0 | 0.0 |
| Major Bypass Flow Received, Q_b (cfs) | 0.0 | 0.1 | 0.0 |

Watershed Characteristics

| | | | |
|---------------------------|--|--|--|
| Subcatchment Area (acres) | | | |
| Percent Impervious | | | |
| NRCS Soil Type | | | |

Watershed Profile

| | | | |
|------------------------|--|--|--|
| Overland Slope (ft/ft) | | | |
| Overland Length (ft) | | | |
| Channel Slope (ft/ft) | | | |
| Channel Length (ft) | | | |

Minor Storm Rainfall Input

| | | | |
|---|--|--|--|
| Design Storm Return Period, T_r (years) | | | |
| One-Hour Precipitation, P_1 (inches) | | | |

Major Storm Rainfall Input

| | | | |
|---|--|--|--|
| Design Storm Return Period, T_r (years) | | | |
| One-Hour Precipitation, P_1 (inches) | | | |

CALCULATED OUTPUT

| | | | |
|---|------------|------------|------------|
| Minor Total Design Peak Flow, Q (cfs) | 0.7 | 2.6 | 4.4 |
| Major Total Design Peak Flow, Q (cfs) | 0.4 | 4.8 | 8.2 |
| Minor Flow Bypassed Downstream, Q_b (cfs) | 0.0 | N/A | N/A |
| Major Flow Bypassed Downstream, Q_b (cfs) | 0.0 | N/A | N/A |

INLET MANAGEMENT

Worksheet Protected

| INLET NAME | D5 | D6 | D7 |
|------------------------------------|--------------------------|--------------------------|--------------------------|
| Site Type (Urban or Rural) | | | |
| Inlet Application (Street or Area) | STREET | STREET | STREET |
| Hydraulic Condition | In Sump | In Sump | In Sump |
| Inlet Type | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening |

USER-DEFINED INPUT

User-Defined Design Flows

| | | | |
|-------------------------|-----|-----|-----|
| Minor Q_{Known} (cfs) | 2.1 | 3.3 | 1.5 |
| Major Q_{Known} (cfs) | 3.9 | 6.1 | 2.9 |

Bypass (Carry-Over) Flow from Upstream

| | | | |
|---|-------------------------|-------------------------|-------------------------|
| Receive Bypass Flow from: | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received |
| Minor Bypass Flow Received, Q_b (cfs) | 0.0 | 0.0 | 0.0 |
| Major Bypass Flow Received, Q_b (cfs) | 0.0 | 0.0 | 0.0 |

Watershed Characteristics

| | | | |
|---------------------------|--|--|--|
| Subcatchment Area (acres) | | | |
| Percent Impervious | | | |
| NRCS Soil Type | | | |

Watershed Profile

| | | | |
|------------------------|--|--|--|
| Overland Slope (ft/ft) | | | |
| Overland Length (ft) | | | |
| Channel Slope (ft/ft) | | | |
| Channel Length (ft) | | | |

Minor Storm Rainfall Input

| | | | |
|---|--|--|--|
| Design Storm Return Period, T_r (years) | | | |
| One-Hour Precipitation, P_1 (inches) | | | |

Major Storm Rainfall Input

| | | | |
|---|--|--|--|
| Design Storm Return Period, T_r (years) | | | |
| One-Hour Precipitation, P_1 (inches) | | | |

CALCULATED OUTPUT

| | | | |
|---|------------|------------|------------|
| Minor Total Design Peak Flow, Q (cfs) | 2.1 | 3.3 | 1.5 |
| Major Total Design Peak Flow, Q (cfs) | 3.9 | 6.1 | 2.9 |
| Minor Flow Bypassed Downstream, Q_b (cfs) | N/A | N/A | N/A |
| Major Flow Bypassed Downstream, Q_b (cfs) | N/A | N/A | N/A |

INLET MANAGEMENT

Worksheet Protected

| INLET NAME | D8 | D9 | D10 |
|------------------------------------|--------------------------|--------------------------|--------------------------|
| Site Type (Urban or Rural) | | | |
| Inlet Application (Street or Area) | STREET | STREET | STREET |
| Hydraulic Condition | In Sump | In Sump | In Sump |
| Inlet Type | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening |

USER-DEFINED INPUT

User-Defined Design Flows

| | | | |
|-------------------------|-----|-----|-----|
| Minor Q_{Known} (cfs) | 2.1 | 1.6 | 1.3 |
| Major Q_{Known} (cfs) | 3.9 | 3.0 | 2.5 |

Bypass (Carry-Over) Flow from Upstream

| | | | |
|---|-------------------------|-------------------------|-------------------------|
| Receive Bypass Flow from: | No Bypass Flow Received | No Bypass Flow Received | No Bypass Flow Received |
| Minor Bypass Flow Received, Q_b (cfs) | 0.0 | 0.0 | 0.0 |
| Major Bypass Flow Received, Q_b (cfs) | 0.0 | 0.0 | 0.0 |

Watershed Characteristics

| | | | |
|---------------------------|--|--|--|
| Subcatchment Area (acres) | | | |
| Percent Impervious | | | |
| NRCS Soil Type | | | |

Watershed Profile

| | | | |
|------------------------|--|--|--|
| Overland Slope (ft/ft) | | | |
| Overland Length (ft) | | | |
| Channel Slope (ft/ft) | | | |
| Channel Length (ft) | | | |

Minor Storm Rainfall Input

| | | | |
|---|--|--|--|
| Design Storm Return Period, T_r (years) | | | |
| One-Hour Precipitation, P_1 (inches) | | | |

Major Storm Rainfall Input

| | | | |
|---|--|--|--|
| Design Storm Return Period, T_r (years) | | | |
| One-Hour Precipitation, P_1 (inches) | | | |

CALCULATED OUTPUT

| | | | |
|---|------------|------------|------------|
| Minor Total Design Peak Flow, Q (cfs) | 2.1 | 1.6 | 1.3 |
| Major Total Design Peak Flow, Q (cfs) | 3.9 | 3.0 | 2.5 |
| Minor Flow Bypassed Downstream, Q_b (cfs) | N/A | N/A | N/A |
| Major Flow Bypassed Downstream, Q_b (cfs) | N/A | N/A | N/A |

INLET MANAGEMENT

Worksheet Protected

| | | | |
|------------------------------------|--------------------------|--------------------------|--------------------------|
| INLET NAME | D11 | OF1 | D1a |
| Site Type (Urban or Rural) | URBAN | URBAN | URBAN |
| Inlet Application (Street or Area) | STREET | STREET | STREET |
| Hydraulic Condition | In Sump | On Grade | On Grade |
| Inlet Type | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening |

USER-DEFINED INPUT

User-Defined Design Flows

| | | | |
|-------------------------|-----|-----|-----|
| Minor Q_{known} (cfs) | 2.0 | 3.6 | 0.7 |
| Major Q_{known} (cfs) | 3.8 | 6.4 | 1.4 |

Bypass (Carry-Over) Flow from Upstream

| | | | |
|---|-------------------------|-------------------------|-----|
| Receive Bypass Flow from: | No Bypass Flow Received | No Bypass Flow Received | B2 |
| Minor Bypass Flow Received, Q_b (cfs) | 0.0 | 0.0 | 0.0 |
| Major Bypass Flow Received, Q_b (cfs) | 0.0 | 0.0 | 0.2 |

Watershed Characteristics

| | | | |
|---------------------------|--|--|--|
| Subcatchment Area (acres) | | | |
| Percent Impervious | | | |
| NRCS Soil Type | | | |

Watershed Profile

| | | | |
|------------------------|--|--|--|
| Overland Slope (ft/ft) | | | |
| Overland Length (ft) | | | |
| Channel Slope (ft/ft) | | | |
| Channel Length (ft) | | | |

Minor Storm Rainfall Input

| | | | |
|---|--|--|--|
| Design Storm Return Period, T_r (years) | | | |
| One-Hour Precipitation, P_1 (inches) | | | |

Major Storm Rainfall Input

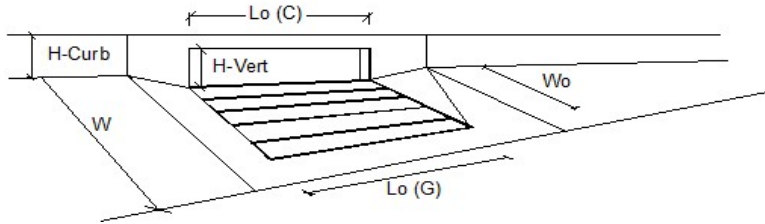
| | | | |
|---|--|--|--|
| Design Storm Return Period, T_r (years) | | | |
| One-Hour Precipitation, P_1 (inches) | | | |

CALCULATED OUTPUT

| | | | |
|---|------------|------------|------------|
| Minor Total Design Peak Flow, Q (cfs) | 2.0 | 3.6 | 0.7 |
| Major Total Design Peak Flow, Q (cfs) | 3.8 | 6.4 | 1.6 |
| Minor Flow Bypassed Downstream, Q_b (cfs) | N/A | 0.0 | 0.0 |
| Major Flow Bypassed Downstream, Q_b (cfs) | N/A | 0.0 | 0.1 |

INLET ON A CONTINUOUS GRADE

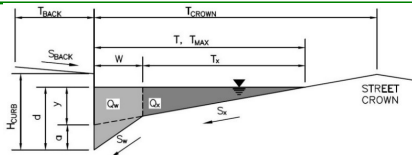
MHFD-Inlet, Version 5.01 (April 2021)



| Design Information (Input) | MINOR | MAJOR | |
|---|--------------------------|----------------------|--------|
| Type of Inlet | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | 0.10 | 0.10 | |
| Street Hydraulics: OK - Q < Allowable Street Capacity | | | |
| Total Inlet Interception Capacity | Q = 0.9 | Q = 1.5 | cfs |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | Q _b = 0.0 | Q _b = 0.1 | cfs |
| Capture Percentage = Q _i /Q _a = | C% = 100 | C% = 93 | % |

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Citizen On Constitution
 Inlet ID: B2



Gutter Geometry:

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

$T_{BACK} = 0.0$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 2.00$ ft
 $S_X = 0.020$ ft/ft
 $S_G = 0.083$ ft/ft
 $S_O = 0.020$ ft/ft
 $n_{STREET} = 0.016$

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

| | Minor Storm | Major Storm | |
|-------------|--------------------------|--------------------------|--------|
| $T_{MAX} =$ | 9.0 | 18.0 | ft |
| $d_{MAX} =$ | 3.0 | 6.0 | inches |
| | <input type="checkbox"/> | <input type="checkbox"/> | |

MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

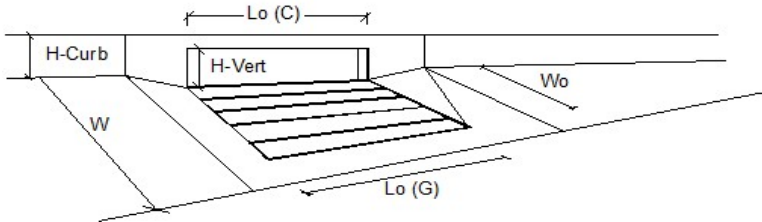
$Q_{allow} =$

| Minor Storm | Major Storm | |
|-------------|-------------|-----|
| 1.7 | 16.3 | 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'

INLET ON A CONTINUOUS GRADE

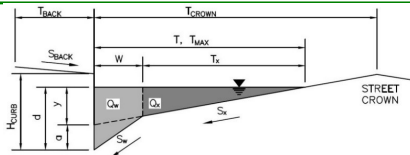
MHFD-Inlet, Version 5.01 (April 2021)



| Design Information (Input) | MINOR | MAJOR | |
|---|--------------------------|-------|--------|
| Type of Inlet | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | 0.10 | 0.10 | |
| Street Hydraulics: OK - Q < Allowable Street Capacity | | | |
| Total Inlet Interception Capacity | 1.0 | 1.6 | cfs |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | 0.0 | 0.2 | cfs |
| Capture Percentage = Q_i/Q_o = | 100 | 90 | % |

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Citizen On Constitution
 Inlet ID: B3



Gutter Geometry:

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

$T_{BACK} = 0.0$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 20.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.020$ ft/ft
 $n_{STREET} = 0.016$

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

| | | | |
|-------------|--------------------------|--------------------------|--------|
| | Minor Storm | Major Storm | |
| $T_{MAX} =$ | 10.0 | 10.0 | ft |
| $d_{MAX} =$ | 3.0 | 6.0 | inches |
| | <input type="checkbox"/> | <input type="checkbox"/> | |

MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Spread Criterion

$Q_{allow} =$

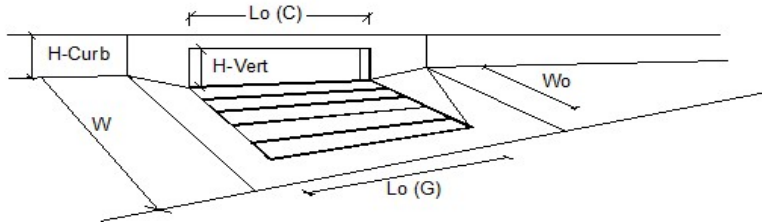
| | |
|-------------|-------------|
| Minor Storm | Major Storm |
| 1.7 | 4.4 |

 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'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

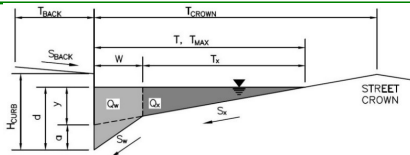


| Design Information (Input) | MINOR | MAJOR | |
|---|--------------------------|-------|--------|
| Type of Inlet | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | 0.10 | 0.10 | |
| Street Hydraulics: OK - Q < Allowable Street Capacity | | | |
| Total Inlet Interception Capacity | 1.3 | 2.1 | cfs |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | 0.0 | 0.6 | cfs |
| Capture Percentage = Q_i/Q_o = | 97 | 77 | % |

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

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

Project: Citizen On Constitution
Inlet ID: B4



Gutter Geometry:

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

| | | |
|-----------------------|-------|--------|
| T _{BACK} = | 20.0 | ft |
| S _{BACK} = | | ft/ft |
| n _{BACK} = | 0.020 | |
| H _{CURB} = | 6.00 | inches |
| T _{CROWN} = | 20.0 | ft |
| W = | 2.00 | ft |
| S _X = | 0.020 | ft/ft |
| S _G = | 0.083 | ft/ft |
| S _O = | 0.020 | ft/ft |
| n _{STREET} = | 0.016 | |

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

| | | | |
|--------------------|--------------------------|--------------------------|--------|
| | Minor Storm | Major Storm | |
| T _{MAX} = | 10.0 | 20.0 | ft |
| d _{MAX} = | 3.0 | 6.0 | inches |
| | <input type="checkbox"/> | <input type="checkbox"/> | |

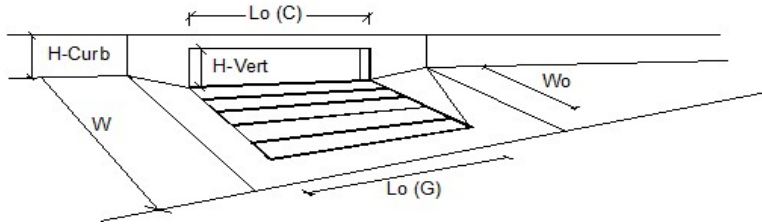
[MINOR STORM Allowable Capacity is based on Depth Criterion](#)
[MAJOR STORM Allowable Capacity is based on Depth Criterion](#)

| | | | |
|----------------------|-------------|-------------|-----|
| | Minor Storm | Major Storm | |
| Q _{allow} = | 1.7 | 16.3 | 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'

INLET ON A CONTINUOUS GRADE

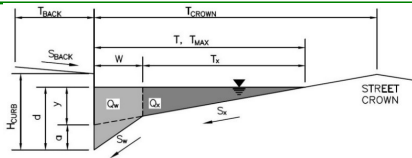
MHFD-Inlet, Version 5.01 (April 2021)



| Design Information (Input) Type of Inlet: CDOT Type R Curb Opening Local Depression (additional to continuous gutter depression 'a') Total Number of Units in the Inlet (Grate or Curb Opening) Length of a Single Unit Inlet (Grate or Curb Opening) Width of a Unit Grate (cannot be greater than W, Gutter Width) Clogging Factor for a Single Unit Grate (typical min. value = 0.5) Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">MINOR</th> <th style="text-align: center;">MAJOR</th> <th></th> </tr> </thead> <tbody> <tr> <td>Type =</td> <td colspan="2" style="text-align: center;">CDOT Type R Curb Opening</td> <td></td> </tr> <tr> <td>a_{LOCAL} =</td> <td style="text-align: center;">3.0</td> <td style="text-align: center;">3.0</td> <td>inches</td> </tr> <tr> <td>No =</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td></td> </tr> <tr> <td>L_o =</td> <td style="text-align: center;">5.00</td> <td style="text-align: center;">5.00</td> <td>ft</td> </tr> <tr> <td>W_o =</td> <td style="text-align: center;">N/A</td> <td style="text-align: center;">N/A</td> <td>ft</td> </tr> <tr> <td>C_{r-G} =</td> <td style="text-align: center;">N/A</td> <td style="text-align: center;">N/A</td> <td></td> </tr> <tr> <td>C_{r-C} =</td> <td style="text-align: center;">0.10</td> <td style="text-align: center;">0.10</td> <td></td> </tr> </tbody> </table> | | MINOR | MAJOR | | Type = | CDOT Type R Curb Opening | | | a _{LOCAL} = | 3.0 | 3.0 | inches | No = | 1 | 1 | | L _o = | 5.00 | 5.00 | ft | W _o = | N/A | N/A | ft | C _{r-G} = | N/A | N/A | | C _{r-C} = | 0.10 | 0.10 | |
|---|--|-------|--------|-------|--|--------|--------------------------|-----|-----|----------------------|-----|-----|--------|------|-----|-----|---|------------------|------|------|----|------------------|-----|-----|----|--------------------|-----|-----|--|--------------------|------|------|--|
| | MINOR | MAJOR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Type = | CDOT Type R Curb Opening | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| a _{LOCAL} = | 3.0 | 3.0 | inches | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| No = | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| L _o = | 5.00 | 5.00 | ft | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| W _o = | N/A | N/A | ft | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C _{r-G} = | N/A | N/A | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C _{r-C} = | 0.10 | 0.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Street Hydraulics: OK - Q < Allowable Street Capacity | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Total Inlet Interception Capacity Total Inlet Carry-Over Flow (flow bypassing inlet) Capture Percentage = Q _i /Q _s = | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">MINOR</th> <th style="text-align: center;">MAJOR</th> <th></th> </tr> </thead> <tbody> <tr> <td>Q =</td> <td style="text-align: center;">0.7</td> <td style="text-align: center;">0.4</td> <td>cfs</td> </tr> <tr> <td>Q_b =</td> <td style="text-align: center;">0.0</td> <td style="text-align: center;">0.0</td> <td>cfs</td> </tr> <tr> <td>C% =</td> <td style="text-align: center;">100</td> <td style="text-align: center;">100</td> <td>%</td> </tr> </tbody> </table> | | MINOR | MAJOR | | Q = | 0.7 | 0.4 | cfs | Q _b = | 0.0 | 0.0 | cfs | C% = | 100 | 100 | % | | | | | | | | | | | | | | | | |
| | MINOR | MAJOR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Q = | 0.7 | 0.4 | cfs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Q _b = | 0.0 | 0.0 | cfs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C% = | 100 | 100 | % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Citizen On Constitution**
 Inlet ID: **D1**



Gutter Geometry:

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

$T_{BACK} = 0.0$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.00$ ft
 $S_X = 0.040$ ft/ft
 $S_W = 0.083$ ft/ft
 $S_O = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

| | Minor Storm | Major Storm | |
|-------------|--------------------------|--------------------------|--------|
| $T_{MAX} =$ | 18.0 | 18.0 | ft |
| $d_{MAX} =$ | 6.0 | 6.0 | inches |
| | <input type="checkbox"/> | <input type="checkbox"/> | |

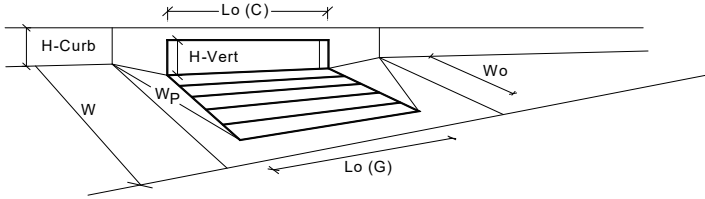
MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

| Minor Storm | Major Storm | |
|-------------|-------------|-----|
| SUMP | SUMP | cfs |

INLET IN A SUMP OR SAG LOCATION

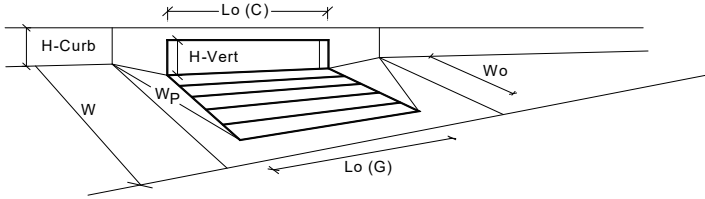
MHFD-Inlet, Version 5.01 (April 2021)



| Design Information (Input) | MINOR | MAJOR | |
|--|--------------------------|------------|------------|
| Type of Inlet | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | 6.0 | 6.0 | inches |
| Grate Information | | | |
| Length of a Unit Grate | N/A | N/A | feet |
| Width of a Unit Grate | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | N/A | N/A | |
| Curb Opening Information | | | |
| Length of a Unit Curb Opening | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | 1.00 | 1.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | 0.67 | 0.67 | |
| Low Head Performance Reduction (Calculated) | | | |
| Depth for Grate Midwidth | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | 0.42 | 0.42 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | 0.77 | 0.77 | |
| Curb Opening Performance Reduction Factor for Long Inlets | 1.00 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | N/A | N/A | |
| Total Inlet Interception Capacity (assumes clogged condition) | | | |
| Inlet Capacity IS GOOD for Minor and Major Storms(>0 PEAK) | 5.9 | 5.9 | cfs |
| Q PEAK REQUIRED = | 2.6 | 4.8 | cfs |

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)

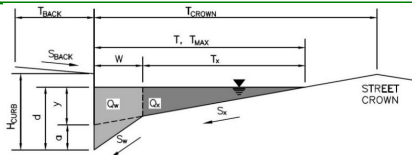


| Design Information (Input) | MINOR MAJOR | |
|--|--------------------------|-------|
| Type of Inlet | CDOT Type R Curb Opening | |
| Local Depression (additional to continuous gutter depression 'a' from above) | 3.00 | 3.00 |
| Number of Unit Inlets (Grate or Curb Opening) | 1 | 1 |
| Water Depth at Flowline (outside of local depression) | 5.1 | 6.0 |
| Grate Information | MINOR | MAJOR |
| Length of a Unit Grate | N/A | N/A |
| Width of a Unit Grate | N/A | N/A |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | N/A | N/A |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | N/A | N/A |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | N/A | N/A |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | N/A | N/A |
| Curb Opening Information | MINOR | MAJOR |
| Length of a Unit Curb Opening | 10.00 | 10.00 |
| Height of Vertical Curb Opening in Inches | 6.00 | 6.00 |
| Height of Curb Orifice Throat in Inches | 6.00 | 6.00 |
| Angle of Throat (see USDCM Figure ST-5) | 63.40 | 63.40 |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | 1.00 | 1.00 |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | 0.10 | 0.10 |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | 3.60 | 3.60 |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | 0.67 | 0.67 |
| Low Head Performance Reduction (Calculated) | MINOR | MAJOR |
| Depth for Grate Midwidth | N/A | N/A |
| Depth for Curb Opening Weir Equation | 0.34 | 0.42 |
| Combination Inlet Performance Reduction Factor for Long Inlets | 0.48 | 0.57 |
| Curb Opening Performance Reduction Factor for Long Inlets | 0.88 | 0.94 |
| Grated Inlet Performance Reduction Factor for Long Inlets | N/A | N/A |
| Total Inlet Interception Capacity (assumes clogged condition) | 6.9 | 10.2 |
| Inlet Capacity IS GOOD for Minor and Major Storms(>0 PEAK) | 4.4 | 8.2 |

Warning 5: The width of unit is greater than the gutter width.

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Citizen On Constitution
 Inlet ID: D5



Gutter Geometry:

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

$T_{BACK} = 0.0$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.00$ ft
 $S_X = 0.030$ ft/ft
 $S_W = 0.083$ ft/ft
 $S_O = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

| | Minor Storm | Major Storm | |
|-------------|--------------------------|--------------------------|--------|
| $T_{MAX} =$ | 18.0 | 18.0 | ft |
| $d_{MAX} =$ | 6.0 | 6.0 | inches |
| | <input type="checkbox"/> | <input type="checkbox"/> | |

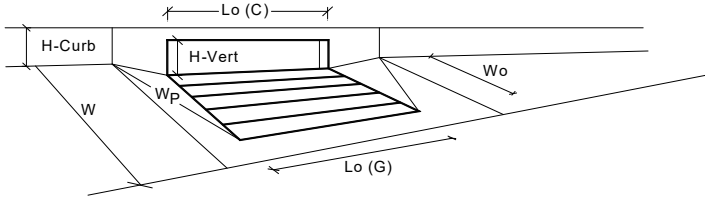
MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

| Minor Storm | Major Storm | |
|-------------|-------------|-----|
| SUMP | SUMP | cfs |

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)

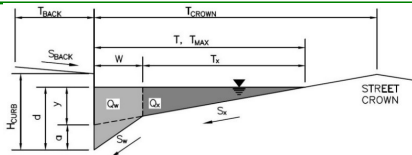


| | | | |
|--|--------------------------|--------------------------|--|
| Design Information (Input) | | CDOT Type R Curb Opening | |
| Type of Inlet | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | | | |
| Number of Unit Inlets (Grate or Curb Opening) | | | |
| Water Depth at Flowline (outside of local depression) | | | |
| Grate Information | | | |
| Length of a Unit Grate | | | |
| Width of a Unit Grate | | | |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | | | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | | | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | | | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | | | |
| Curb Opening Information | | | |
| Length of a Unit Curb Opening | | | |
| Height of Vertical Curb Opening in Inches | | | |
| Height of Curb Orifice Throat in Inches | | | |
| Angle of Throat (see USDCM Figure ST-5) | | | |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | | | |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | | | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | | | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | | | |
| Low Head Performance Reduction (Calculated) | | | |
| Depth for Grate Midwidth | | | |
| Depth for Curb Opening Weir Equation | | | |
| Combination Inlet Performance Reduction Factor for Long Inlets | | | |
| Curb Opening Performance Reduction Factor for Long Inlets | | | |
| Grated Inlet Performance Reduction Factor for Long Inlets | | | |
| Total Inlet Interception Capacity (assumes clogged condition) | | | |
| Inlet Capacity IS GOOD for Minor and Major Storms(>0 PEAK) | | | |

| | MINOR | MAJOR | |
|------------------------------|--------------------------|-------|--|
| Type = | CDOT Type R Curb Opening | | |
| a _{local} = | 3.00 | 3.00 | inches |
| No = | 1 | 1 | |
| Ponding Depth = | 6.0 | 6.0 | inches |
| | MINOR | MAJOR | <input type="checkbox"/> Override Depths |
| L _o (G) = | N/A | N/A | feet |
| W _o = | N/A | N/A | feet |
| A _{ratio} = | N/A | N/A | |
| C _f (G) = | N/A | N/A | |
| C _w (G) = | N/A | N/A | |
| C _o (G) = | N/A | N/A | |
| | MINOR | MAJOR | |
| L _o (C) = | 5.00 | 5.00 | feet |
| H _{vert} = | 6.00 | 6.00 | inches |
| H _{throat} = | 6.00 | 6.00 | inches |
| Theta = | 63.40 | 63.40 | degrees |
| W _p = | 1.00 | 1.00 | feet |
| C _f (C) = | 0.10 | 0.10 | |
| C _w (C) = | 3.60 | 3.60 | |
| C _o (C) = | 0.67 | 0.67 | |
| | MINOR | MAJOR | |
| d _{Grate} = | N/A | N/A | ft |
| d _{Curb} = | 0.42 | 0.42 | ft |
| RF _{Combination} = | 0.77 | 0.77 | |
| RF _{Curb} = | 1.00 | 1.00 | |
| RF _{Grate} = | N/A | N/A | |
| | MINOR | MAJOR | |
| Q _s = | 5.9 | 5.9 | cfs |
| Q _{PEAK REQUIRED} = | 2.1 | 3.9 | cfs |

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Citizen On Constitution
 Inlet ID: D6



Gutter Geometry:

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

$T_{BACK} = 0.0$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.00$ ft
 $S_x = 0.030$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

| | Minor Storm | Major Storm | |
|-------------|--------------------------|--------------------------|--------|
| $T_{MAX} =$ | 18.0 | 18.0 | ft |
| $d_{MAX} =$ | 6.0 | 8.0 | inches |
| | <input type="checkbox"/> | <input type="checkbox"/> | |

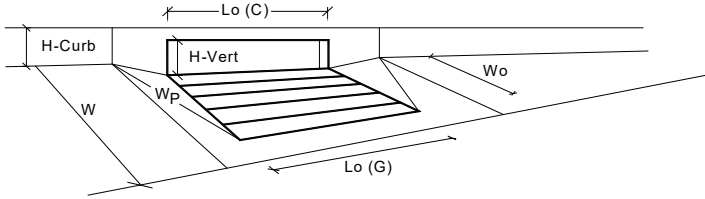
MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

| Minor Storm | Major Storm | |
|-------------|-------------|-----|
| SUMP | SUMP | cfs |

INLET IN A SUMP OR SAG LOCATION

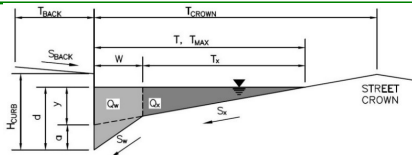
MHFD-Inlet, Version 5.01 (April 2021)



| Design Information (Input) | MINOR | MAJOR | |
|--|--------------------------|------------|--|
| Type of Inlet | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | 6.0 | 7.1 | inches |
| Grate Information | MINOR | MAJOR | <input type="checkbox"/> Override Depths |
| Length of a Unit Grate | N/A | N/A | feet |
| Width of a Unit Grate | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | N/A | N/A | |
| Curb Opening Information | MINOR | MAJOR | |
| Length of a Unit Curb Opening | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | 1.00 | 1.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | 0.67 | 0.67 | |
| Low Head Performance Reduction (Calculated) | MINOR | MAJOR | |
| Depth for Grate Midwidth | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | 0.42 | 0.51 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | 0.77 | 0.91 | |
| Curb Opening Performance Reduction Factor for Long Inlets | 1.00 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | N/A | N/A | |
| Total Inlet Interception Capacity (assumes clogged condition) | 5.9 | 8.0 | cfs |
| Inlet Capacity IS GOOD for Minor and Major Storms(>0 PEAK) | 3.3 | 6.1 | cfs |

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Citizen On Constitution
 Inlet ID: D7



Gutter Geometry:

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

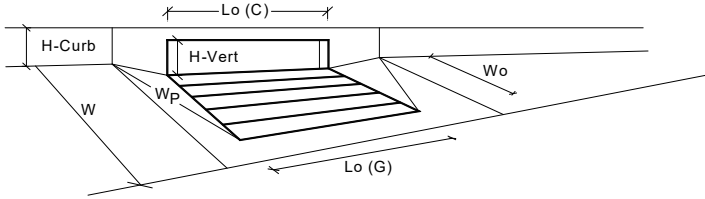
| | | | | | | | | | | | | | | | | | | |
|---|--------------------------|--------------------------|--------|-------------|-------------|--|----------------------|------|------|-----|--------------------|-----|-----|--------|--|--------------------------|--------------------------|--|
| T _{BACK} = | 0.0 | ft | | | | | | | | | | | | | | | | |
| S _{BACK} = | | ft/ft | | | | | | | | | | | | | | | | |
| n _{BACK} = | 0.020 | | | | | | | | | | | | | | | | | |
| H _{CURB} = | 6.00 | inches | | | | | | | | | | | | | | | | |
| T _{CROWN} = | 18.0 | ft | | | | | | | | | | | | | | | | |
| W = | 1.00 | ft | | | | | | | | | | | | | | | | |
| S _x = | 0.030 | ft/ft | | | | | | | | | | | | | | | | |
| S _w = | 0.083 | ft/ft | | | | | | | | | | | | | | | | |
| S _o = | 0.000 | ft/ft | | | | | | | | | | | | | | | | |
| n _{STREET} = | 0.016 | | | | | | | | | | | | | | | | | |
| <table border="1"> <tr> <td></td> <td>Minor Storm</td> <td>Major Storm</td> <td></td> </tr> <tr> <td>T_{MAX} =</td> <td>18.0</td> <td>18.0</td> <td>ft</td> </tr> <tr> <td>d_{MAX} =</td> <td>6.0</td> <td>6.0</td> <td>inches</td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td></td> </tr> </table> | | | | Minor Storm | Major Storm | | T _{MAX} = | 18.0 | 18.0 | ft | d _{MAX} = | 6.0 | 6.0 | inches | | <input type="checkbox"/> | <input type="checkbox"/> | |
| | Minor Storm | Major Storm | | | | | | | | | | | | | | | | |
| T _{MAX} = | 18.0 | 18.0 | ft | | | | | | | | | | | | | | | |
| d _{MAX} = | 6.0 | 6.0 | inches | | | | | | | | | | | | | | | |
| | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | | | | | | | | | | | |
| <table border="1"> <tr> <td></td> <td>Minor Storm</td> <td>Major Storm</td> <td></td> </tr> <tr> <td>Q_{allow} =</td> <td>SUMP</td> <td>SUMP</td> <td>cfs</td> </tr> </table> | | | | Minor Storm | Major Storm | | Q _{allow} = | SUMP | SUMP | cfs | | | | | | | | |
| | Minor Storm | Major Storm | | | | | | | | | | | | | | | | |
| Q _{allow} = | SUMP | SUMP | cfs | | | | | | | | | | | | | | | |

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)

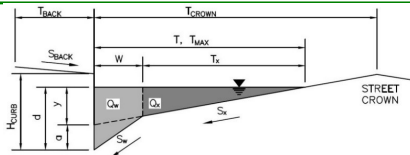


| Design Information (Input) | CDOT Type R Curb Opening | |
|--|--------------------------|--|
| Type of Inlet | CDOT Type R Curb Opening | |
| Local Depression (additional to continuous gutter depression 'a' from above) | | |
| Number of Unit Inlets (Grate or Curb Opening) | | |
| Water Depth at Flowline (outside of local depression) | | |
| Grate Information | | |
| Length of a Unit Grate | | |
| Width of a Unit Grate | | |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | | |
| Curb Opening Information | | |
| Length of a Unit Curb Opening | | |
| Height of Vertical Curb Opening in Inches | | |
| Height of Curb Orifice Throat in Inches | | |
| Angle of Throat (see USDCM Figure ST-5) | | |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | | |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | | |
| Low Head Performance Reduction (Calculated) | | |
| Depth for Grate Midwidth | | |
| Depth for Curb Opening Weir Equation | | |
| Combination Inlet Performance Reduction Factor for Long Inlets | | |
| Curb Opening Performance Reduction Factor for Long Inlets | | |
| Grated Inlet Performance Reduction Factor for Long Inlets | | |
| Total Inlet Interception Capacity (assumes clogged condition) | | |
| Inlet Capacity IS GOOD for Minor and Major Storms(>0 PEAK) | | |

| | MINOR | MAJOR | |
|------------------------------|--------------------------|-------|--|
| Type = | CDOT Type R Curb Opening | | |
| a _{local} = | 3.00 | 3.00 | inches |
| No = | 1 | 1 | |
| Ponding Depth = | 6.0 | 6.0 | inches |
| | MINOR | MAJOR | <input type="checkbox"/> Override Depths |
| L _o (G) = | N/A | N/A | feet |
| W _o = | N/A | N/A | feet |
| A _{ratio} = | N/A | N/A | |
| C _f (G) = | N/A | N/A | |
| C _w (G) = | N/A | N/A | |
| C _o (G) = | N/A | N/A | |
| | MINOR | MAJOR | |
| L _o (C) = | 5.00 | 5.00 | feet |
| H _{vert} = | 6.00 | 6.00 | inches |
| H _{throat} = | 6.00 | 6.00 | inches |
| Theta = | 63.40 | 63.40 | degrees |
| W _p = | 1.00 | 1.00 | feet |
| C _f (C) = | 0.10 | 0.10 | |
| C _w (C) = | 3.60 | 3.60 | |
| C _o (C) = | 0.67 | 0.67 | |
| | MINOR | MAJOR | |
| d _{Grate} = | N/A | N/A | ft |
| d _{Curb} = | 0.42 | 0.42 | ft |
| RF _{Combination} = | 0.77 | 0.77 | |
| RF _{Curb} = | 1.00 | 1.00 | |
| RF _{Grate} = | N/A | N/A | |
| | MINOR | MAJOR | |
| Q _s = | 5.9 | 5.9 | cfs |
| Q _{PEAK REQUIRED} = | 1.5 | 2.9 | cfs |

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Citizen On Constitution**
 Inlet ID: **D8**



Gutter Geometry:

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

| | | |
|-----------------------|-------|--------|
| T _{BACK} = | 0.0 | ft |
| S _{BACK} = | | ft/ft |
| n _{BACK} = | 0.020 | |
| H _{CURB} = | 6.00 | inches |
| T _{CROWN} = | 18.0 | ft |
| W = | 1.00 | ft |
| S _x = | 0.030 | ft/ft |
| S _w = | 0.083 | ft/ft |
| S _o = | 0.000 | ft/ft |
| n _{STREET} = | 0.016 | |

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

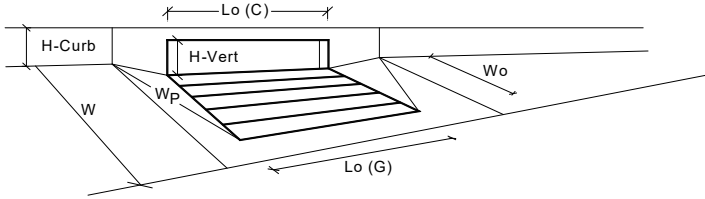
| | | | |
|--------------------|--------------------------|--------------------------|--------|
| | Minor Storm | Major Storm | |
| T _{MAX} = | 18.0 | 18.0 | ft |
| d _{MAX} = | 6.0 | 6.0 | inches |
| | <input type="checkbox"/> | <input type="checkbox"/> | |

MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

| | | | |
|----------------------|-------------|-------------|-----|
| | Minor Storm | Major Storm | |
| Q _{allow} = | SUMP | SUMP | cfs |

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)

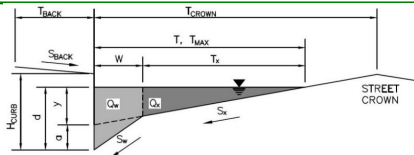


| Design Information (Input) | CDOT Type R Curb Opening | |
|--|--------------------------|--|
| Type of Inlet | CDOT Type R Curb Opening | |
| Local Depression (additional to continuous gutter depression 'a' from above) | | |
| Number of Unit Inlets (Grate or Curb Opening) | | |
| Water Depth at Flowline (outside of local depression) | | |
| Grate Information | | |
| Length of a Unit Grate | | |
| Width of a Unit Grate | | |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | | |
| Curb Opening Information | | |
| Length of a Unit Curb Opening | | |
| Height of Vertical Curb Opening in Inches | | |
| Height of Curb Orifice Throat in Inches | | |
| Angle of Throat (see USDCM Figure ST-5) | | |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | | |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | | |
| Low Head Performance Reduction (Calculated) | | |
| Depth for Grate Midwidth | | |
| Depth for Curb Opening Weir Equation | | |
| Combination Inlet Performance Reduction Factor for Long Inlets | | |
| Curb Opening Performance Reduction Factor for Long Inlets | | |
| Grated Inlet Performance Reduction Factor for Long Inlets | | |
| Total Inlet Interception Capacity (assumes clogged condition) | | |
| Inlet Capacity IS GOOD for Minor and Major Storms(>0 PEAK) | | |

| | MINOR | MAJOR | |
|--|--------------------------|------------|---------|
| Type = | CDOT Type R Curb Opening | | |
| a _{local} = | 3.00 | 3.00 | inches |
| No = | 1 | 1 | |
| Ponding Depth = | 6.0 | 6.0 | inches |
| <input type="checkbox"/> Override Depths | | | |
| L _o (G) = | N/A | N/A | feet |
| W _o = | N/A | N/A | feet |
| A _{ratio} = | N/A | N/A | |
| C _f (G) = | N/A | N/A | |
| C _w (G) = | N/A | N/A | |
| C _o (G) = | N/A | N/A | |
| MINOR MAJOR | | | |
| L _o (C) = | 5.00 | 5.00 | feet |
| H _{vert} = | 6.00 | 6.00 | inches |
| H _{throat} = | 6.00 | 6.00 | inches |
| Theta = | 63.40 | 63.40 | degrees |
| W _o = | 1.00 | 1.00 | feet |
| C _f (C) = | 0.10 | 0.10 | |
| C _w (C) = | 3.60 | 3.60 | |
| C _o (C) = | 0.67 | 0.67 | |
| MINOR MAJOR | | | |
| d _{Grate} = | N/A | N/A | ft |
| d _{Curb} = | 0.42 | 0.42 | ft |
| RF _{Combination} = | 0.77 | 0.77 | |
| RF _{Curb} = | 1.00 | 1.00 | |
| RF _{Grate} = | N/A | N/A | |
| MINOR MAJOR | | | |
| Q _s = | 5.9 | 5.9 | cfs |
| Q _{PEAK REQUIRED} = | 2.1 | 3.9 | cfs |

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Citizen On Constitution
 Inlet ID: D9



Gutter Geometry:

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

$T_{BACK} = 0.0$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.00$ ft
 $S_X = 0.030$ ft/ft
 $S_W = 0.083$ ft/ft
 $S_O = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

| | Minor Storm | Major Storm | |
|-----------|--------------------------|--------------------------|--------|
| T_{MAX} | 18.0 | 18.0 | ft |
| d_{MAX} | 6.0 | 6.0 | inches |
| | <input type="checkbox"/> | <input type="checkbox"/> | |

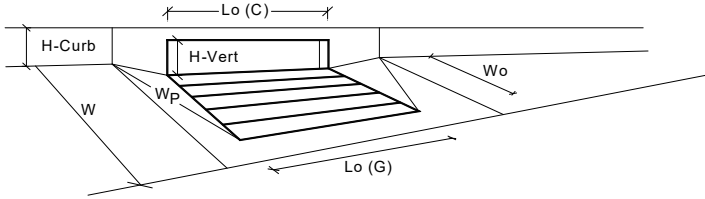
MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

| Minor Storm | Major Storm | |
|-------------|-------------|-----|
| SUMP | SUMP | cfs |

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)

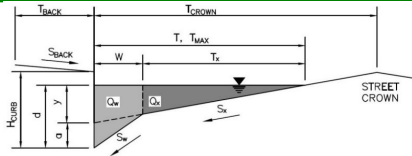


| | | | |
|--|--------------------------|--------------------------|--|
| Design Information (Input) | | CDOT Type R Curb Opening | |
| Type of Inlet | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | | | |
| Number of Unit Inlets (Grate or Curb Opening) | | | |
| Water Depth at Flowline (outside of local depression) | | | |
| Grate Information | | | |
| Length of a Unit Grate | | | |
| Width of a Unit Grate | | | |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | | | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | | | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | | | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | | | |
| Curb Opening Information | | | |
| Length of a Unit Curb Opening | | | |
| Height of Vertical Curb Opening in Inches | | | |
| Height of Curb Orifice Throat in Inches | | | |
| Angle of Throat (see USDCM Figure ST-5) | | | |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | | | |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | | | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | | | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | | | |
| Low Head Performance Reduction (Calculated) | | | |
| Depth for Grate Midwidth | | | |
| Depth for Curb Opening Weir Equation | | | |
| Combination Inlet Performance Reduction Factor for Long Inlets | | | |
| Curb Opening Performance Reduction Factor for Long Inlets | | | |
| Grated Inlet Performance Reduction Factor for Long Inlets | | | |
| Total Inlet Interception Capacity (assumes clogged condition) | | | |
| Inlet Capacity IS GOOD for Minor and Major Storms(>0 PEAK) | | | |

| | MINOR | MAJOR | |
|------------------------------|--------------------------|-------|--|
| Type = | CDOT Type R Curb Opening | | |
| a _{local} = | 3.00 | 3.00 | inches |
| No = | 1 | 1 | |
| Ponding Depth = | 6.0 | 6.0 | inches |
| | MINOR | MAJOR | <input type="checkbox"/> Override Depths |
| L _o (G) = | N/A | N/A | feet |
| W _o = | N/A | N/A | feet |
| A _{ratio} = | N/A | N/A | |
| C _f (G) = | N/A | N/A | |
| C _w (G) = | N/A | N/A | |
| C _o (G) = | N/A | N/A | |
| | MINOR | MAJOR | |
| L _o (C) = | 5.00 | 5.00 | feet |
| H _{vert} = | 6.00 | 6.00 | inches |
| H _{throat} = | 6.00 | 6.00 | inches |
| Theta = | 63.40 | 63.40 | degrees |
| W _p = | 1.00 | 1.00 | feet |
| C _f (C) = | 0.10 | 0.10 | |
| C _w (C) = | 3.60 | 3.60 | |
| C _o (C) = | 0.67 | 0.67 | |
| | MINOR | MAJOR | |
| d _{Grate} = | N/A | N/A | ft |
| d _{Curb} = | 0.42 | 0.42 | ft |
| RF _{Combination} = | 0.77 | 0.77 | |
| RF _{Curb} = | 1.00 | 1.00 | |
| RF _{Grate} = | N/A | N/A | |
| | MINOR | MAJOR | |
| Q _s = | 5.9 | 5.9 | cfs |
| Q _{PEAK REQUIRED} = | 1.6 | 3.0 | cfs |

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Citizen On Constitution
 Inlet ID: D10



Gutter Geometry:

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

$T_{BACK} = 0.0$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.00$ ft
 $S_X = 0.030$ ft/ft
 $S_W = 0.083$ ft/ft
 $S_O = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

| | Minor Storm | Major Storm | |
|-------------|--------------------------|--------------------------|--------|
| $T_{MAX} =$ | 18.0 | 18.0 | ft |
| $d_{MAX} =$ | 6.0 | 6.0 | inches |
| | <input type="checkbox"/> | <input type="checkbox"/> | |

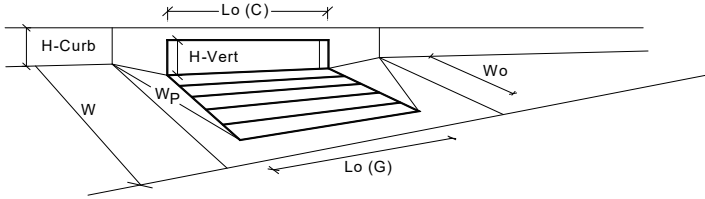
MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

| Minor Storm | Major Storm | |
|-------------|-------------|-----|
| SUMP | SUMP | cfs |

INLET IN A SUMP OR SAG LOCATION

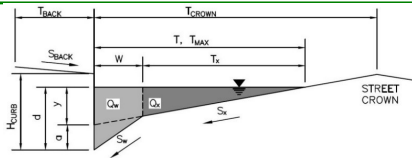
MHFD-Inlet, Version 5.01 (April 2021)



| Design Information (Input) | MINOR | MAJOR | |
|--|--------------------------|------------|------------|
| Type of Inlet | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | 6.0 | 6.0 | inches |
| Grate Information | | | |
| Length of a Unit Grate | N/A | N/A | feet |
| Width of a Unit Grate | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | N/A | N/A | |
| Curb Opening Information | | | |
| Length of a Unit Curb Opening | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | 1.00 | 1.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | 0.67 | 0.67 | |
| Low Head Performance Reduction (Calculated) | | | |
| Depth for Grate Midwidth | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | 0.42 | 0.42 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | 0.77 | 0.77 | |
| Curb Opening Performance Reduction Factor for Long Inlets | 1.00 | 1.00 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | N/A | N/A | |
| Total Inlet Interception Capacity (assumes clogged condition) | | | |
| Inlet Capacity IS GOOD for Minor and Major Storms(>0 PEAK) | 5.9 | 5.9 | cfs |
| Q PEAK REQUIRED = | 1.3 | 2.5 | cfs |

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Citizen On Constitution**
 Inlet ID: **D11**



Gutter Geometry:

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

$T_{BACK} = 0.0$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

| | Minor Storm | Major Storm | |
|-------------|--------------------------|--------------------------|--------|
| $T_{MAX} =$ | 18.0 | 18.0 | ft |
| $d_{MAX} =$ | 6.0 | 6.0 | inches |
| | <input type="checkbox"/> | <input type="checkbox"/> | |

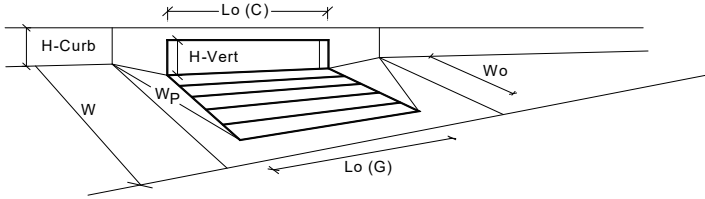
MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

| Minor Storm | Major Storm | |
|-------------|-------------|-----|
| SUMP | SUMP | cfs |

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



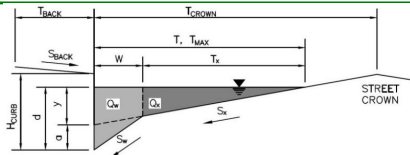
| Design Information (Input) | CDOT Type R Curb Opening | |
|--|--------------------------|--|
| Type of Inlet | CDOT Type R Curb Opening | |
| Local Depression (additional to continuous gutter depression 'a' from above) | | |
| Number of Unit Inlets (Grate or Curb Opening) | | |
| Water Depth at Flowline (outside of local depression) | | |
| Grate Information | | |
| Length of a Unit Grate | | |
| Width of a Unit Grate | | |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | | |
| Curb Opening Information | | |
| Length of a Unit Curb Opening | | |
| Height of Vertical Curb Opening in Inches | | |
| Height of Curb Orifice Throat in Inches | | |
| Angle of Throat (see USDCM Figure ST-5) | | |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | | |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | | |
| Low Head Performance Reduction (Calculated) | | |
| Depth for Grate Midwidth | | |
| Depth for Curb Opening Weir Equation | | |
| Combination Inlet Performance Reduction Factor for Long Inlets | | |
| Curb Opening Performance Reduction Factor for Long Inlets | | |
| Grated Inlet Performance Reduction Factor for Long Inlets | | |
| Total Inlet Interception Capacity (assumes clogged condition) | | |
| Inlet Capacity IS GOOD for Minor and Major Storms(>0 PEAK) | | |

| | MINOR | MAJOR | |
|--|--------------------------|------------|---------|
| Type = | CDOT Type R Curb Opening | | |
| a _{local} = | 3.00 | 3.00 | inches |
| No = | 1 | 1 | |
| Ponding Depth = | 5.1 | 5.1 | inches |
| <input type="checkbox"/> Override Depths | | | |
| L _o (G) = | N/A | N/A | feet |
| W _o = | N/A | N/A | feet |
| A _{ratio} = | N/A | N/A | |
| C _f (G) = | N/A | N/A | |
| C _w (G) = | N/A | N/A | |
| C _o (G) = | N/A | N/A | |
| MINOR MAJOR | | | |
| L _o (C) = | 5.00 | 5.00 | feet |
| H _{vert} = | 6.00 | 6.00 | inches |
| H _{throat} = | 6.00 | 6.00 | inches |
| Theta = | 63.40 | 63.40 | degrees |
| W _o = | 1.00 | 1.00 | feet |
| C _f (C) = | 0.10 | 0.10 | |
| C _w (C) = | 3.60 | 3.60 | |
| C _o (C) = | 0.67 | 0.67 | |
| MINOR MAJOR | | | |
| d _{Grate} = | N/A | N/A | ft |
| d _{Curb} = | 0.34 | 0.34 | ft |
| RF _{Combination} = | 0.65 | 0.65 | |
| RF _{Curb} = | 1.00 | 1.00 | |
| RF _{Grate} = | N/A | N/A | |
| MINOR MAJOR | | | |
| Q _s = | 4.4 | 4.4 | cfs |
| Q _{PEAK REQUIRED} = | 2.0 | 3.8 | cfs |

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

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

Project: Citizen On Constitution
Inlet ID: OF1



Gutter Geometry:

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

| | | |
|------------------------------|--------------------------|--------------------------|
| T _{BACK} = | 0.0 | ft |
| S _{BACK} = | 0.060 | ft/ft |
| n _{BACK} = | 0.020 | |
| H _{CURB} = | 6.00 | inches |
| T _{CROWN} = | 30.0 | ft |
| W = | 2.00 | ft |
| S _X = | 0.020 | ft/ft |
| S _W = | 0.083 | ft/ft |
| S ₀ = | 0.005 | ft/ft |
| n _{STREET} = | 0.016 | |
| Minor Storm Major Storm | | |
| T _{MAX} = | 15.0 | 30.0 |
| d _{MAX} = | 5.0 | 6.0 |
| | <input type="checkbox"/> | <input type="checkbox"/> |

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

Maximum Capacity for 1/2 Street based On Allowable Spread

Water Depth without Gutter Depression (Eq. ST-2)
 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")
 Gutter Depression ($d_c - (W * S_x * 12)$)
 Water Depth at Gutter Flowline
 Allowable Spread for Discharge outside the Gutter Section W (T - W)
 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
 Discharge outside the Gutter Section W, carried in Section T_X
 Discharge within the Gutter Section W (Q_T - Q_X)
 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
 Maximum Flow Based On Allowable Spread
 Flow Velocity within the Gutter Section
 V*d Product: Flow Velocity times Gutter Flowline Depth

| | | | |
|---------------------|-------------|-------------|--------|
| | Minor Storm | Major Storm | |
| y = | 3.60 | 7.20 | inches |
| d _c = | 2.0 | 2.0 | inches |
| a = | 1.51 | 1.51 | inches |
| d = | 5.11 | 8.71 | inches |
| T _X = | 13.0 | 28.0 | ft |
| E ₀ = | 0.397 | 0.194 | |
| Q _X = | 3.4 | 26.4 | cfs |
| Q _W = | 2.2 | 6.3 | cfs |
| Q _{BACK} = | 0.0 | 0.0 | cfs |
| Q _T = | 5.7 | 32.7 | cfs |
| V = | 3.3 | 4.9 | fps |
| V*d = | 1.4 | 3.6 | |

Maximum Capacity for 1/2 Street based on Allowable Depth

Theoretical Water Spread
 Theoretical Spread for Discharge outside the Gutter Section W (T - W)
 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)
 Theoretical Discharge outside the Gutter Section W, carried in Section T_{X TH}
 Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})
 Discharge within the Gutter Section W (Q_d - Q_X)
 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)
 Total Discharge for Major & Minor Storm (Pre-Safety Factor)
 Average Flow Velocity Within the Gutter Section
 V*d Product: Flow Velocity Times Gutter Flowline Depth
 Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm
 Max Flow Based on Allowable Depth (Safety Factor Applied)
 Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)
 Resultant Flow Depth at Street Crown (Safety Factor Applied)

| | | | |
|----------------------|-------------|-------------|--------|
| | Minor Storm | Major Storm | |
| T _{TH} = | 14.5 | 18.7 | ft |
| T _{X TH} = | 12.5 | 16.7 | ft |
| E ₀ = | 0.409 | 0.318 | |
| Q _{X TH} = | 3.1 | 6.6 | cfs |
| Q _X = | 3.1 | 6.6 | cfs |
| Q _W = | 2.1 | 3.1 | cfs |
| Q _{BACK} = | 0.0 | 0.0 | cfs |
| Q _d = | 5.2 | 9.7 | cfs |
| V = | 3.2 | 3.7 | fps |
| V*d = | 1.3 | 1.9 | |
| R = | 1.00 | 1.00 | |
| Q _d = | 5.2 | 9.7 | cfs |
| d = | 5.00 | 6.00 | inches |
| d _{CROWN} = | 0.00 | 0.00 | inches |

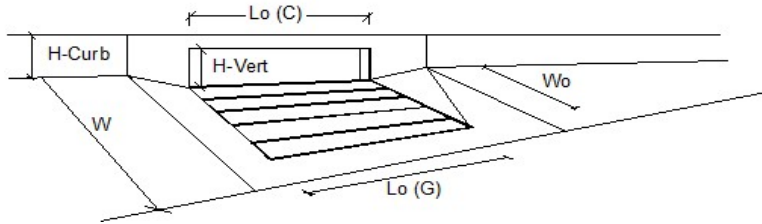
MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

| | | | |
|----------------------|-------------|-------------|-----|
| | Minor Storm | Major Storm | |
| Q _{allow} = | 5.2 | 9.7 | 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'

INLET ON A CONTINUOUS GRADE

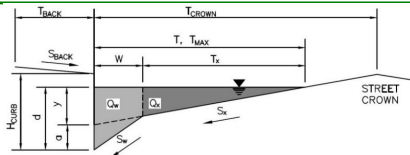
MHFD-Inlet, Version 5.01 (April 2021)



| Design Information (Input) | MINOR | | MAJOR | |
|---|--------------------------|-------|--------|-----|
| Type of Inlet | CDOT Type R Curb Opening | | | |
| Local Depression (additional to continuous gutter depression 'a') | 3.0 | 3.0 | inches | |
| Total Number of Units in the Inlet (Grate or Curb Opening) | 1 | 1 | | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | 15.00 | 15.00 | ft | |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | N/A | N/A | ft | |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | N/A | N/A | | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | 0.10 | 0.10 | | |
| Street Hydraulics: OK - Q < Allowable Street Capacity | | | | |
| Total Inlet Interception Capacity | Q = | 3.6 | 6.4 | cfs |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | Q _b = | 0.0 | 0.0 | cfs |
| Capture Percentage = Q _i /Q _a = | C% = | 100 | 100 | % |

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Citizen On Constitution
 Inlet ID: D1a



Gutter Geometry:

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

$T_{BACK} = 0.0$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 15.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.020$ ft/ft
 $n_{STREET} = 0.016$

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

| | Minor Storm | Major Storm | |
|-------------|--------------------------|--------------------------|--------|
| $T_{MAX} =$ | 15.0 | 15.0 | ft |
| $d_{MAX} =$ | 3.0 | 6.0 | inches |
| | <input type="checkbox"/> | <input type="checkbox"/> | |

MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Spread Criterion

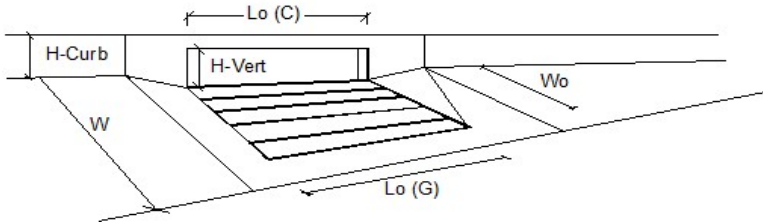
$Q_{allow} =$

| | Minor Storm | Major Storm | |
|--|-------------|-------------|-----|
| | 1.7 | 11.3 | 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'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



| Design Information (Input) | MINOR | MAJOR | |
|---|--------------------------|-------|--------|
| Type of Inlet | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | 1 | 1 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | 0.10 | 0.10 | |
| Street Hydraulics: OK - Q < Allowable Street Capacity | | | |
| Total Inlet Interception Capacity | 0.7 | 1.5 | cfs |
| Total Inlet Carry-Over Flow (flow bypassing inlet) | 0.0 | 0.1 | cfs |
| Capture Percentage = Q_i/Q_o = | 100 | 94 | % |

Worksheet for D3 & D4 Inlet Analysis

| Project Description | |
|--------------------------|---------------------|
| Solve For | Spread |
| Input Data | |
| Discharge | 3.22 cfs |
| Left Side Slope | 0.050 H:V |
| Right Side Slope | 0.050 H:V |
| Bottom Width | 0.00 ft |
| Grate Width | 1.91 ft |
| Grate Length | 3.3 ft |
| Local Depression | 0.0 in |
| Local Depression Width | 24.0 in |
| Grate Type | Curved Vaned |
| Clogging | 75.0 % |
| Results | |
| Spread | 0.1 ft |
| Depth | 14.2 in |
| Wetted Perimeter | 2.4 ft |
| Top Width | 0.12 ft |
| Open Grate Area | 0.6 ft ² |
| Active Grate Weir Length | 7.6 ft |

Worksheet for D12 Inlet Analysis

| Project Description | |
|--------------------------|---------------------|
| Solve For | Spread |
| Input Data | |
| Discharge | 2.90 cfs |
| Left Side Slope | 5.000 H:V |
| Right Side Slope | 5.000 H:V |
| Bottom Width | 0.00 ft |
| Grate Width | 1.91 ft |
| Grate Length | 3.3 ft |
| Local Depression | 0.0 in |
| Local Depression Width | 24.0 in |
| Grate Type | Curved Vaned |
| Clogging | 75.0 % |
| Results | |
| Spread | 9.6 ft |
| Depth | 11.5 in |
| Wetted Perimeter | 9.8 ft |
| Top Width | 9.57 ft |
| Open Grate Area | 0.6 ft ² |
| Active Grate Weir Length | 7.6 ft |

Worksheet for E1 E2 E3 & E4 Inlet Analysis

| Project Description | |
|--------------------------|---------------------|
| Solve For | Spread |
| Input Data | |
| Discharge | 1.63 cfs |
| Left Side Slope | 4.000 H:V |
| Right Side Slope | 6.000 H:V |
| Bottom Width | 0.00 ft |
| Grate Width | 1.91 ft |
| Grate Length | 3.3 ft |
| Local Depression | 0.0 in |
| Local Depression Width | 24.0 in |
| Grate Type | Curved Vaned |
| Clogging | 75.0 % |
| Results | |
| Spread | 3.0 ft |
| Depth | 3.6 in |
| Wetted Perimeter | 3.1 ft |
| Top Width | 3.02 ft |
| Open Grate Area | 0.6 ft ² |
| Active Grate Weir Length | 7.6 ft |

FlexTable: Catch Basin Table

Active Scenario: 5 YR

| Label | Elevation (Rim) (ft) | Elevation (Invert) (ft) | Headloss Method | Headloss (ft) | Flow (Additional Subsurface) (cfs) | Flow (Total Out) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|-------|----------------------|-------------------------|-----------------|---------------|------------------------------------|------------------------|--------------------------------|---------------------------------|
| E1 | 6,435.50 | 6,431.13 | Standard | 0.09 | 0.00 | 0.62 | 6,431.55 | 6,431.47 |
| E2 | 6,436.03 | 6,432.13 | Standard | 0.10 | 0.00 | 0.76 | 6,432.60 | 6,432.50 |
| E3 | 6,437.31 | 6,433.41 | Standard | 0.10 | 0.00 | 0.79 | 6,433.90 | 6,433.80 |
| E4 | 6,437.81 | 6,434.51 | Standard | 0.09 | 0.00 | 0.67 | 6,434.96 | 6,434.87 |
| B2 | 6,436.08 | 6,432.33 | Standard | 0.12 | 0.00 | 1.30 | 6,432.88 | 6,432.75 |
| B1 | 6,436.64 | 6,433.10 | Standard | 0.12 | 0.00 | 1.21 | 6,433.63 | 6,433.51 |
| B4 | 6,431.98 | 6,422.13 | Standard | 0.09 | 0.00 | 0.72 | 6,422.53 | 6,422.45 |
| B3 | 6,431.71 | 6,426.71 | Standard | 0.13 | 0.00 | 1.36 | 6,427.28 | 6,427.15 |
| POND | 6,430.88 | 6,423.72 | Standard | 0.14 | 0.00 | 2.01 | 6,424.35 | 6,424.21 |
| D1 | 6,432.34 | 6,428.49 | Standard | 0.18 | 0.00 | 2.61 | 6,429.29 | 6,429.10 |
| D2 | 6,435.00 | 6,430.61 | Standard | 0.26 | 0.00 | 4.42 | 6,431.68 | 6,431.42 |
| D4 | 6,437.96 | 6,433.07 | Standard | 0.10 | 0.00 | 0.73 | 6,433.53 | 6,433.42 |
| D5 | 6,436.11 | 6,430.16 | Standard | 0.05 | 0.00 | 2.08 | 6,431.04 | 6,430.99 |
| D6 | 6,436.48 | 6,430.78 | Standard | 0.21 | 0.00 | 3.32 | 6,431.69 | 6,431.48 |
| D7 | 6,435.86 | 6,431.75 | Standard | 0.13 | 0.00 | 1.53 | 6,432.35 | 6,432.21 |
| D8 | 6,437.70 | 6,433.37 | Standard | 0.16 | 0.00 | 2.07 | 6,434.07 | 6,433.91 |
| D9 | 6,438.88 | 6,434.85 | Standard | 0.14 | 0.00 | 1.58 | 6,435.45 | 6,435.32 |
| D10 | 6,439.09 | 6,435.37 | Standard | 0.12 | 0.00 | 1.33 | 6,435.92 | 6,435.80 |
| D11 | 6,437.27 | 6,432.02 | Standard | 0.16 | 0.00 | 2.03 | 6,432.71 | 6,432.56 |
| D12 | 6,436.95 | 6,433.73 | Standard | 0.11 | 0.00 | 0.99 | 6,434.21 | 6,434.10 |
| L1 | 6,440.93 | 6,432.84 | Standard | 0.22 | 0.00 | 3.56 | 6,433.79 | 6,433.56 |
| D1a | 6,433.43 | 6,429.43 | Standard | 0.09 | 0.00 | 0.73 | 6,429.84 | 6,429.75 |

FlexTable: Conduit Table

Active Scenario: 5 YR

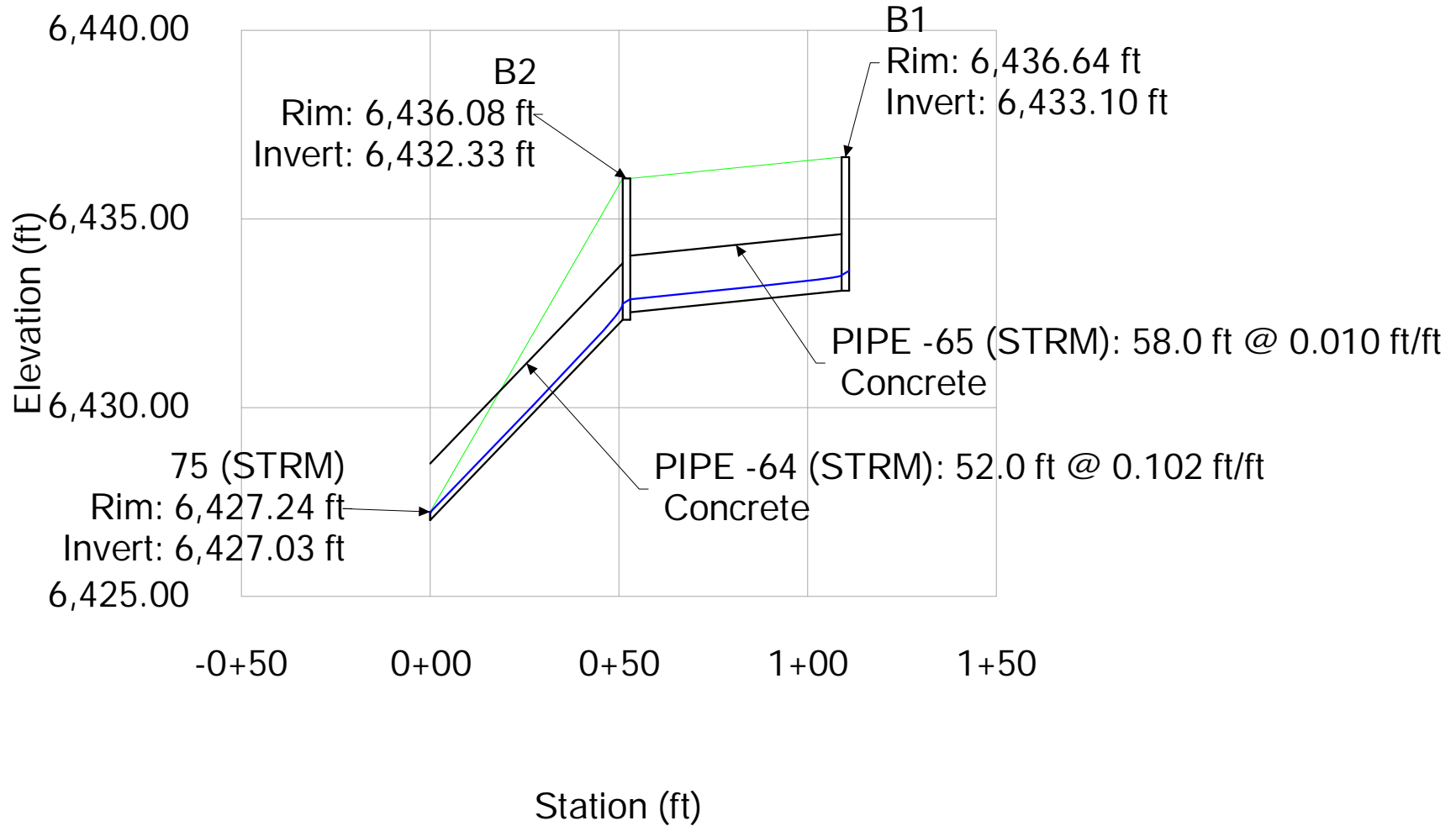
| Start Node | Stop Node | Invert (Start) (ft) | Invert (Stop) (ft) | Length (ft) | Slope (Calculated) (ft/ft) | Diameter (in) | Flow (cfs) | Velocity (ft/s) | Capacity (Design) (cfs) | Flow / Capacity (Design) (%) | Manning's n | Headloss (ft) | Froude Number (Normal) |
|------------|------------|---------------------|--------------------|-------------|----------------------------|---------------|------------|-----------------|-------------------------|------------------------------|-------------|---------------|------------------------|
| D12 | 34 (STRM) | 6,433.73 | 6,432.95 | 155.7 | 0.005 | 18.0 | 0.99 | 2.92 | 7.44 | 13.3 | 0.013 | 0.78 | 1.008 |
| 34 (STRM) | D11 | 6,432.85 | 6,432.22 | 126.1 | 0.005 | 18.0 | 0.99 | 2.92 | 7.43 | 13.3 | 0.013 | 0.51 | 1.007 |
| D10 | D9 | 6,435.37 | 6,434.95 | 42.2 | 0.010 | 18.0 | 1.33 | 4.07 | 10.50 | 12.7 | 0.013 | 0.35 | 1.421 |
| D9 | D8 | 6,434.85 | 6,433.47 | 137.7 | 0.010 | 18.0 | 1.58 | 4.28 | 10.51 | 15.0 | 0.013 | 1.24 | 1.426 |
| E1 | 67 (STRM) | 6,431.13 | 6,430.15 | 196.1 | 0.005 | 12.0 | 0.62 | 2.65 | 2.52 | 24.6 | 0.013 | 0.99 | 0.941 |
| 67 (STRM) | 68 (STRM) | 6,427.49 | 6,427.15 | 33.5 | 0.010 | 18.0 | 4.18 | 5.60 | 10.50 | 39.8 | 0.013 | 0.45 | 1.396 |
| D11 | 36 (STRM) | 6,432.02 | 6,431.71 | 62.4 | 0.005 | 18.0 | 2.03 | 3.58 | 7.43 | 27.3 | 0.013 | 0.31 | 1.005 |
| 36 (STRM) | 37 (STRM) | 6,431.21 | 6,430.04 | 232.7 | 0.005 | 24.0 | 4.10 | 4.26 | 16.00 | 25.6 | 0.013 | 0.93 | 1.057 |
| D8 | 36 (STRM) | 6,433.37 | 6,433.15 | 22.2 | 0.010 | 18.0 | 2.07 | 4.60 | 10.45 | 19.8 | 0.013 | 0.31 | 1.421 |
| E4 | E3 | 6,434.51 | 6,433.51 | 200.0 | 0.005 | 12.0 | 0.67 | 2.71 | 2.52 | 26.6 | 0.013 | 0.97 | 0.940 |
| E3 | E2 | 6,433.41 | 6,432.23 | 237.2 | 0.005 | 12.0 | 0.79 | 2.84 | 2.52 | 31.4 | 0.013 | 1.20 | 0.934 |
| D4 | 45 (STRM) | 6,433.07 | 6,431.94 | 113.0 | 0.010 | 12.0 | 0.73 | 3.57 | 3.57 | 20.5 | 0.013 | 1.18 | 1.337 |
| 45 (STRM) | D2 | 6,431.74 | 6,431.13 | 59.3 | 0.010 | 12.0 | 0.73 | 3.60 | 3.61 | 20.2 | 0.013 | 0.41 | 1.352 |
| 37 (STRM) | 38 (STRM) | 6,429.84 | 6,429.03 | 159.6 | 0.005 | 24.0 | 6.18 | 4.79 | 16.10 | 38.4 | 0.013 | 0.33 | 1.045 |
| D5 | 37 (STRM) | 6,430.16 | 6,430.04 | 22.2 | 0.005 | 18.0 | 2.08 | 3.65 | 7.56 | 27.5 | 0.013 | 0.00 | 1.023 |
| B1 | B2 | 6,433.10 | 6,432.53 | 58.0 | 0.010 | 18.0 | 1.21 | 3.94 | 10.43 | 11.6 | 0.013 | 0.64 | 1.409 |
| B2 | 75 (STRM) | 6,432.33 | 6,427.03 | 52.0 | 0.102 | 18.0 | 1.30 | 9.17 | 33.54 | 3.9 | 0.013 | 5.53 | 4.344 |
| D6 | D5 | 6,430.78 | 6,430.26 | 105.1 | 0.005 | 18.0 | 3.32 | 4.08 | 7.43 | 44.7 | 0.013 | 0.44 | 0.977 |
| 38 (STRM) | 39 (STRM) | 6,428.83 | 6,427.64 | 240.5 | 0.005 | 24.0 | 10.60 | 5.42 | 15.93 | 66.6 | 0.013 | 1.22 | 0.958 |
| D2 | 38 (STRM) | 6,430.61 | 6,430.36 | 12.8 | 0.020 | 18.0 | 4.42 | 7.33 | 14.84 | 29.8 | 0.013 | 0.44 | 2.005 |
| E2 | E1 | 6,432.13 | 6,431.23 | 179.7 | 0.005 | 12.0 | 0.76 | 2.81 | 2.52 | 30.2 | 0.013 | 0.91 | 0.937 |
| D7 | D6 | 6,431.75 | 6,430.88 | 174.0 | 0.005 | 18.0 | 1.53 | 3.31 | 7.43 | 20.6 | 0.013 | 0.52 | 1.010 |
| 39 (STRM) | 40 (STRM) | 6,426.66 | 6,426.13 | 101.1 | 0.005 | 30.0 | 13.21 | 5.89 | 29.84 | 44.3 | 0.013 | 0.35 | 1.096 |
| 40 (STRM) | 41 (STRM) | 6,425.93 | 6,425.68 | 49.3 | 0.005 | 30.0 | 13.21 | 5.78 | 29.03 | 45.5 | 0.013 | 0.29 | 1.064 |
| D1 | 39 (STRM) | 6,428.49 | 6,427.63 | 79.8 | 0.011 | 18.0 | 2.61 | 5.06 | 10.89 | 24.0 | 0.013 | 0.84 | 1.477 |
| B3 | B4 | 6,426.71 | 6,422.33 | 52.0 | 0.084 | 18.0 | 1.36 | 8.69 | 30.49 | 4.5 | 0.013 | 4.60 | 3.975 |
| B4 | 129 (STRM) | 6,422.13 | 6,421.17 | 58.0 | 0.017 | 18.0 | 0.72 | 4.06 | 13.52 | 5.3 | 0.013 | 1.04 | 1.777 |
| POND | 32 (STRM) | 6,423.72 | 6,423.00 | 102.0 | 0.007 | 24.0 | 2.01 | 4.73 | 24.71 | 8.1 | 0.010 | 0.83 | 1.609 |
| L1 | 67 (STRM) | 6,432.84 | 6,427.69 | 52.0 | 0.099 | 18.0 | 3.56 | 12.23 | 33.07 | 10.8 | 0.013 | 5.04 | 4.460 |
| D1a | D1 | 6,429.43 | 6,428.69 | 67.7 | 0.011 | 18.0 | 0.73 | 4.24 | 14.27 | 5.1 | 0.010 | 0.46 | 1.872 |

FlexTable: Manhole Table

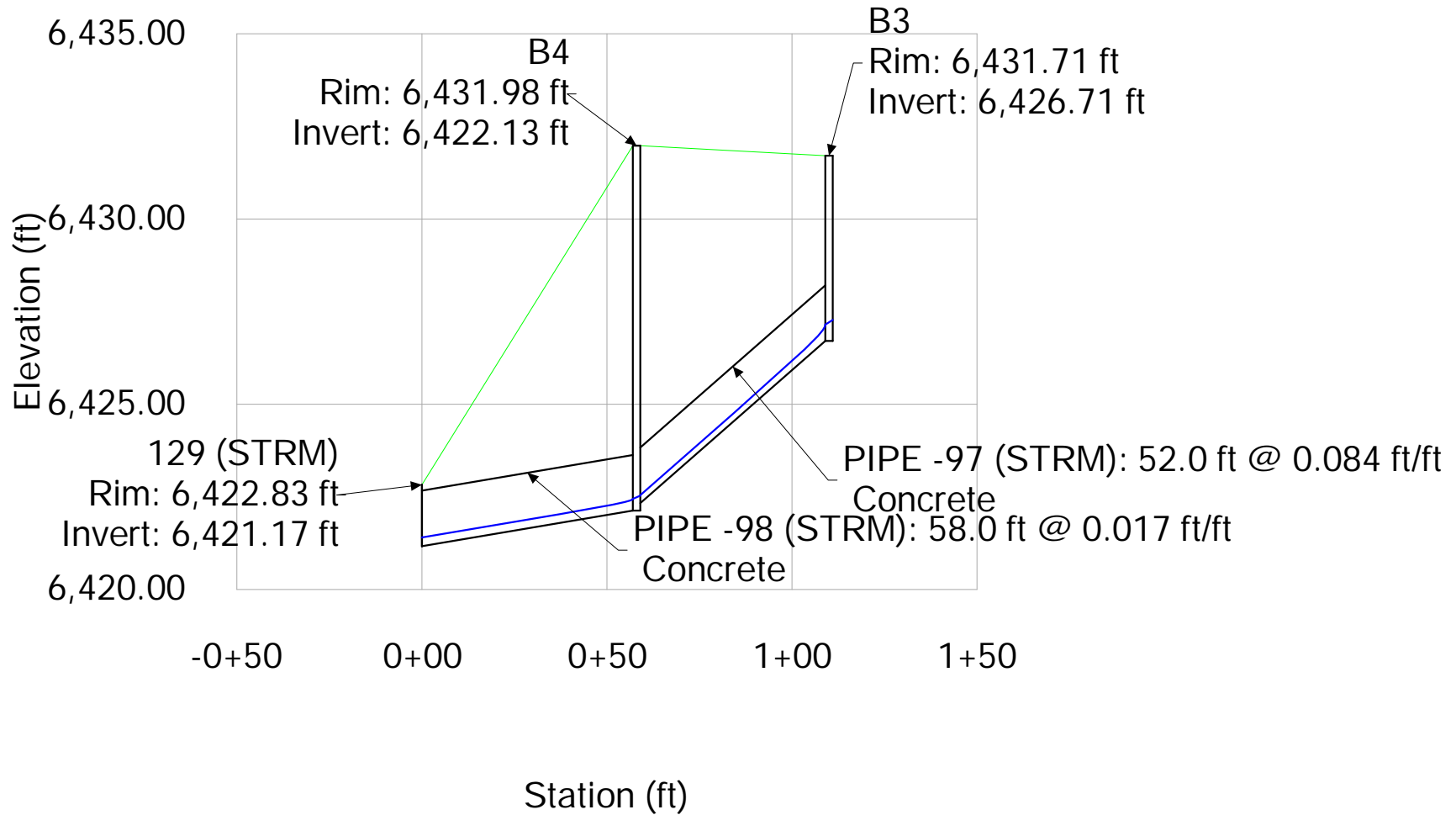
Active Scenario: 5 YR

| Label | Elevation (Rim) (ft) | Elevation (Invert) (ft) | Headloss Method | Headloss Coefficient (Standard) | Headloss (ft) | Flow (Total Out) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|-----------|----------------------------|-------------------------------|--------------------|---------------------------------------|------------------|------------------------------|---|--|
| 34 (STRM) | 6,439.98 | 6,432.85 | Standard | 0.800 | 0.11 | 0.99 | 6,433.33 | 6,433.22 |
| 67 (STRM) | 6,437.03 | 6,427.49 | Standard | 0.800 | 0.25 | 4.18 | 6,428.52 | 6,428.27 |
| 36 (STRM) | 6,438.00 | 6,431.21 | Standard | 0.800 | 0.21 | 4.10 | 6,432.13 | 6,431.92 |
| 45 (STRM) | 6,436.59 | 6,431.74 | Standard | 0.800 | 0.10 | 0.73 | 6,432.20 | 6,432.09 |
| 37 (STRM) | 6,436.84 | 6,429.84 | Standard | 0.800 | 0.27 | 6.18 | 6,430.99 | 6,430.72 |
| 38 (STRM) | 6,436.12 | 6,428.83 | Standard | 0.800 | 0.37 | 10.60 | 6,430.39 | 6,430.03 |
| 40 (STRM) | 6,434.09 | 6,425.93 | Standard | 0.800 | 0.38 | 13.21 | 6,427.53 | 6,427.15 |
| 39 (STRM) | 6,433.75 | 6,426.66 | Standard | 0.800 | 0.38 | 13.21 | 6,428.27 | 6,427.88 |

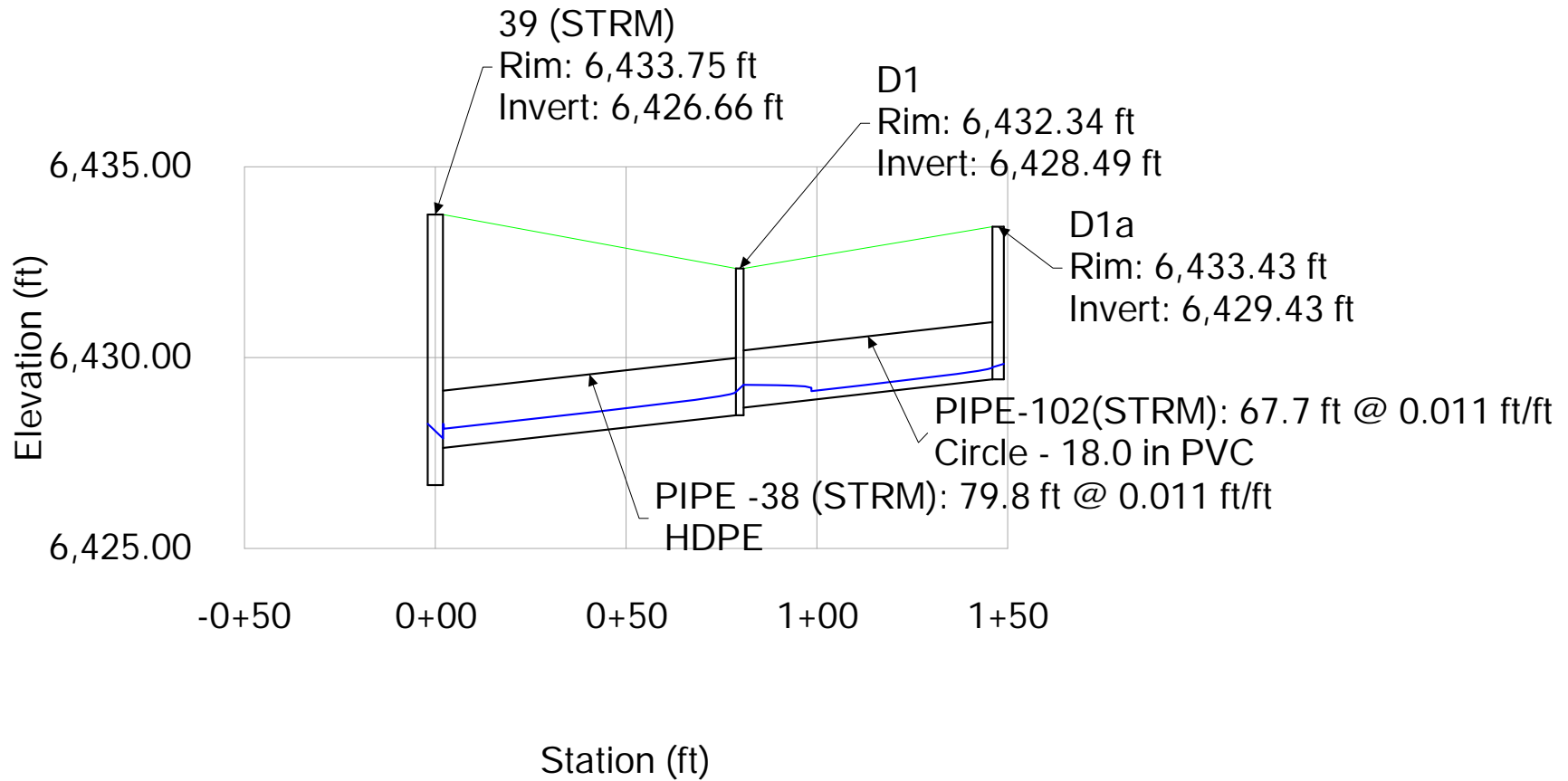
Profile Report
 Engineering Profile - B1 (Untitled1.stsw)
 Active Scenario: 5 YR



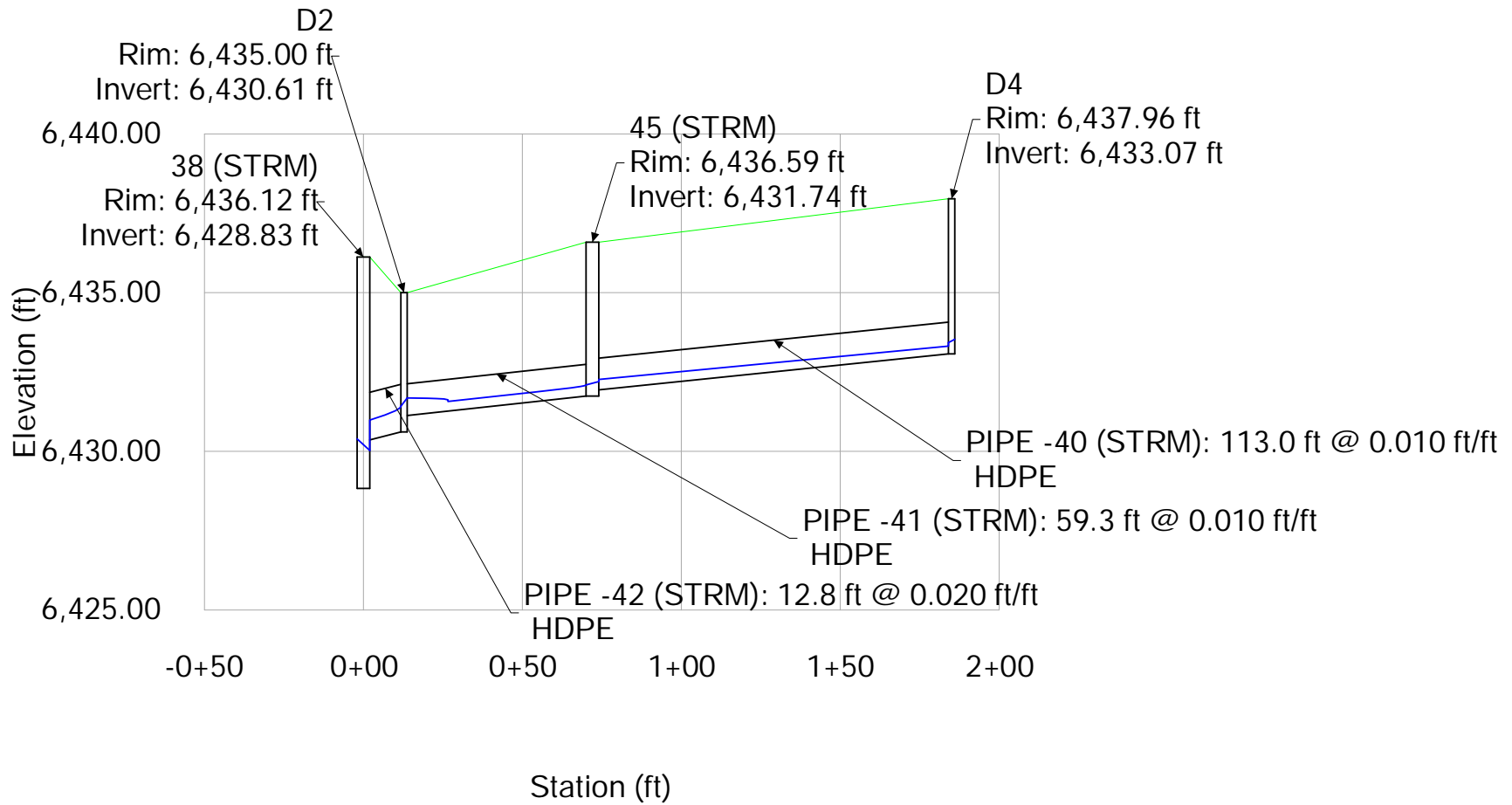
Profile Report
 Engineering Profile - B3 (Untitled1.stsw)
 Active Scenario: 5 YR



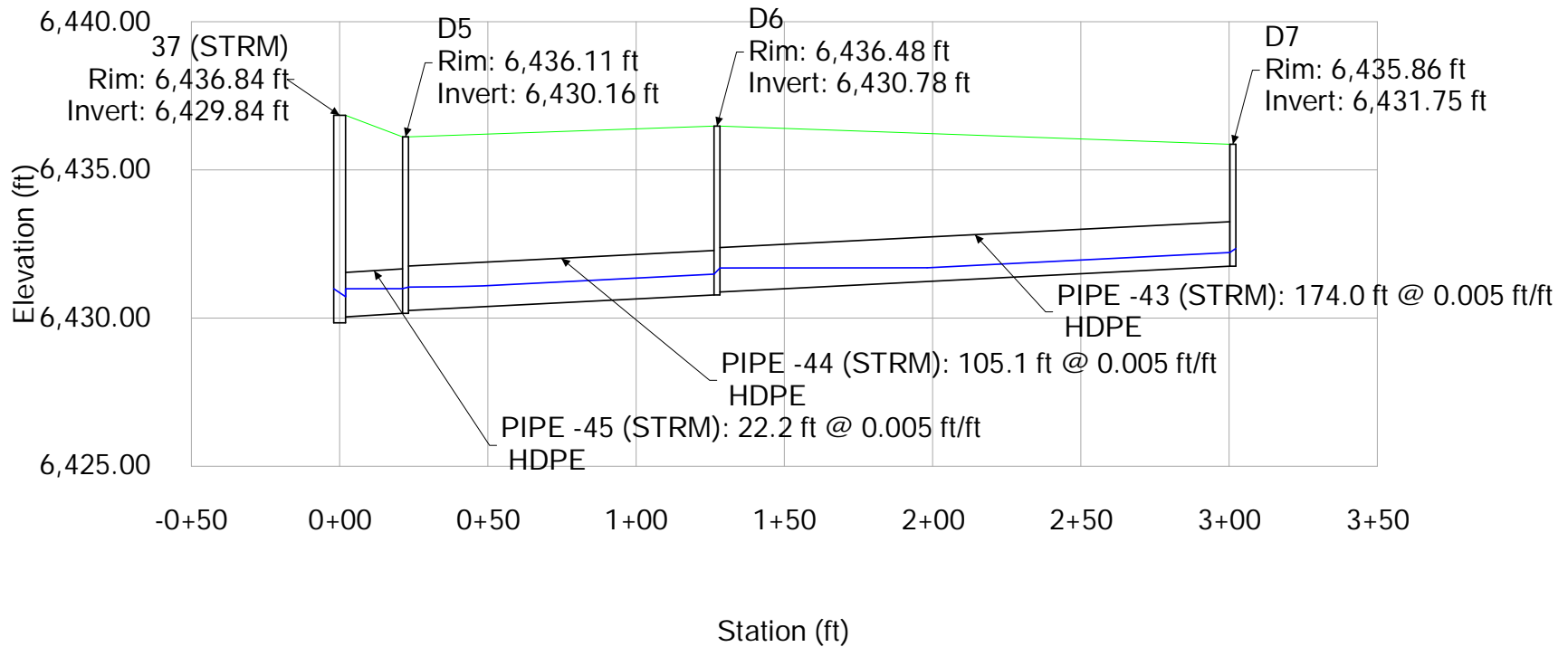
Profile Report
 Engineering Profile - D1 (Untitled1.stsw)
 Active Scenario: 5 YR



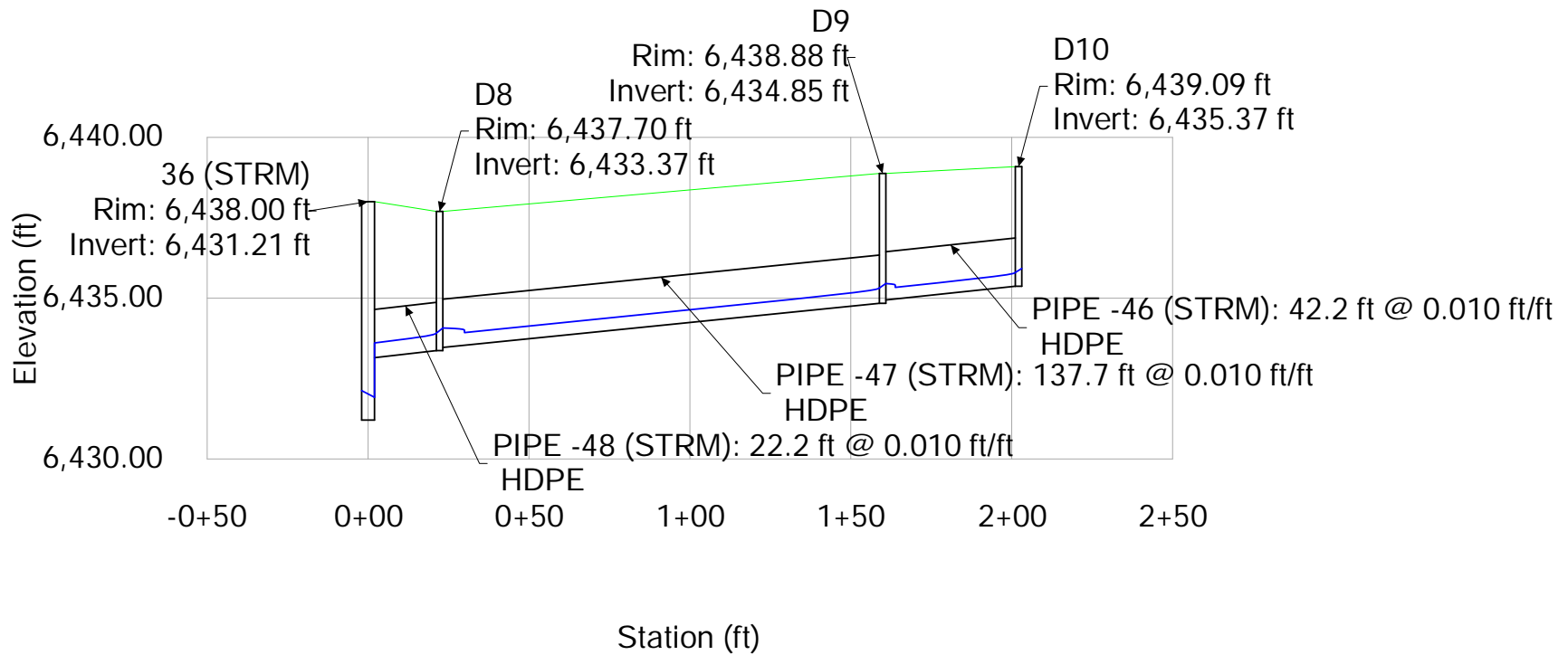
Profile Report
 Engineering Profile - D3 (Untitled1.stsw)
 Active Scenario: 5 YR



Profile Report
 Engineering Profile - D7 (Untitled1.stsw)
 Active Scenario: 5 YR



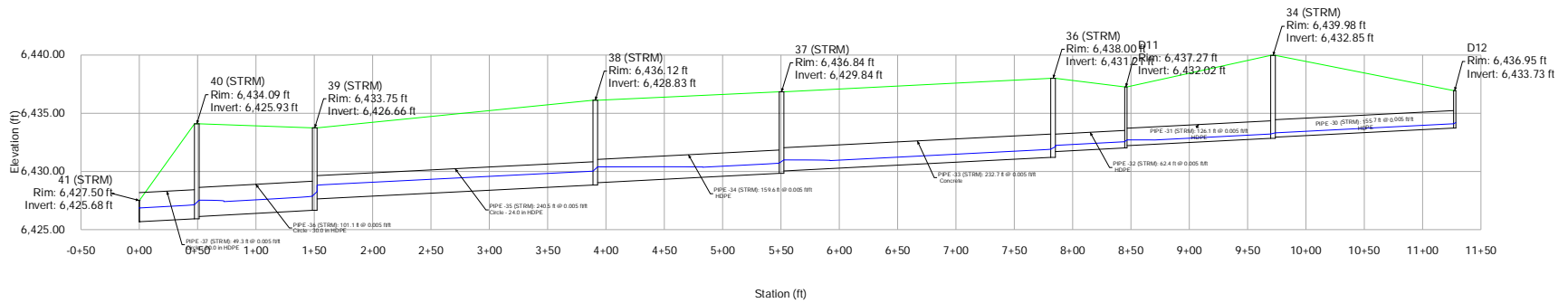
Profile Report
 Engineering Profile - D10 (Untitled1.stsw)
 Active Scenario: 5 YR



Profile Report

Engineering Profile - D12 (Untitled1.stsw)

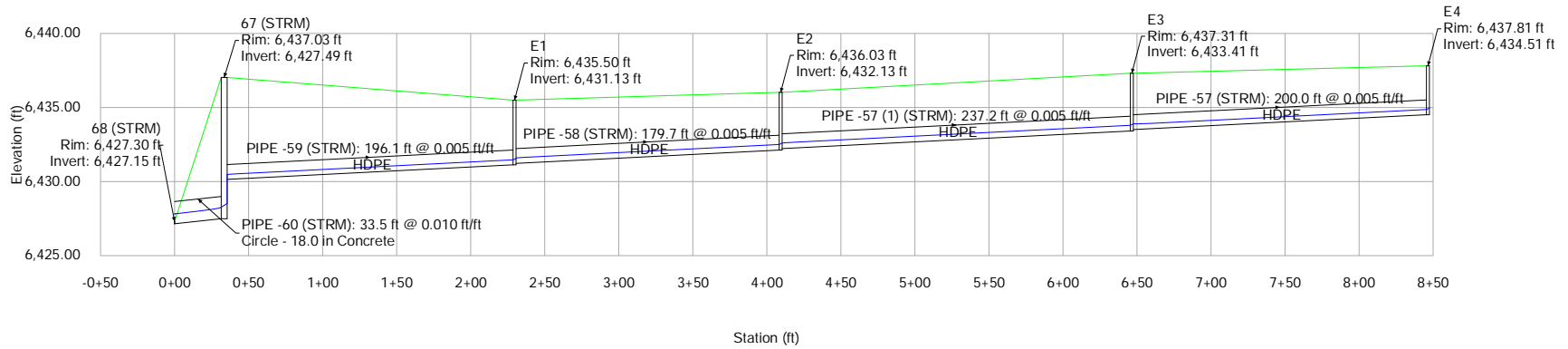
Active Scenario: 5 YR



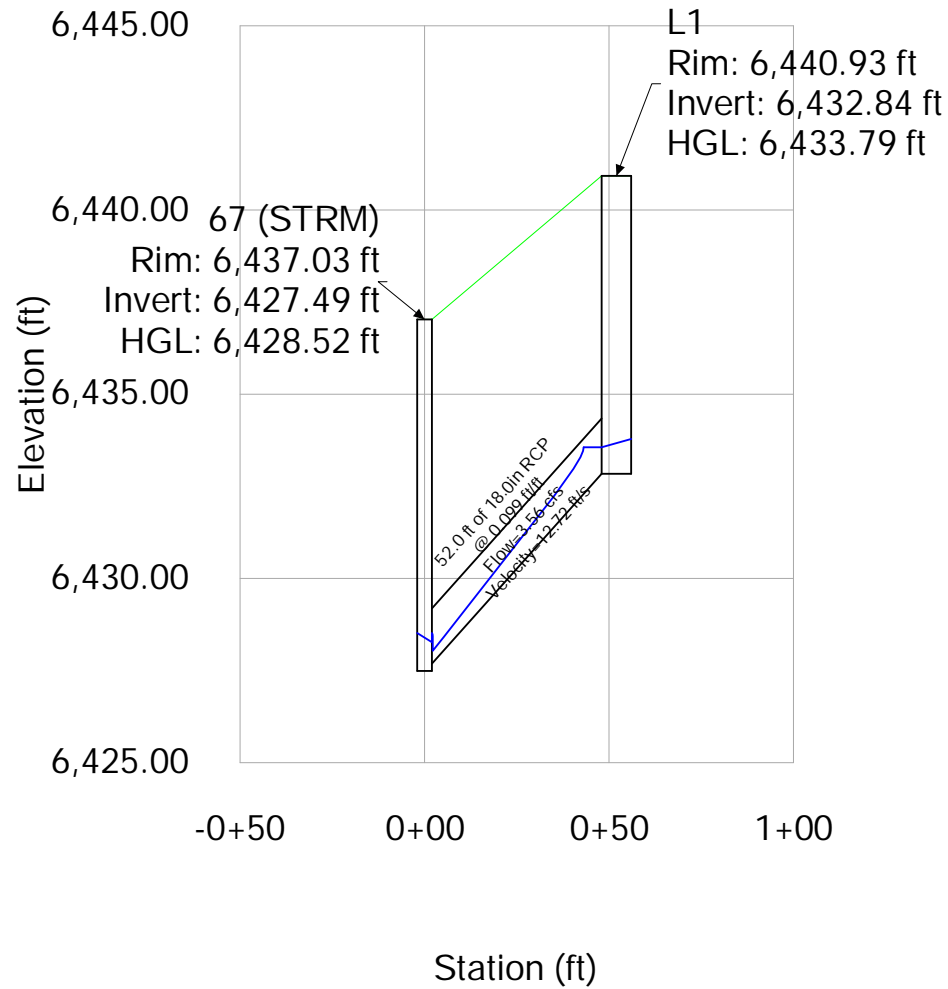
Profile Report

Engineering Profile - E (Untitled1.stsw)

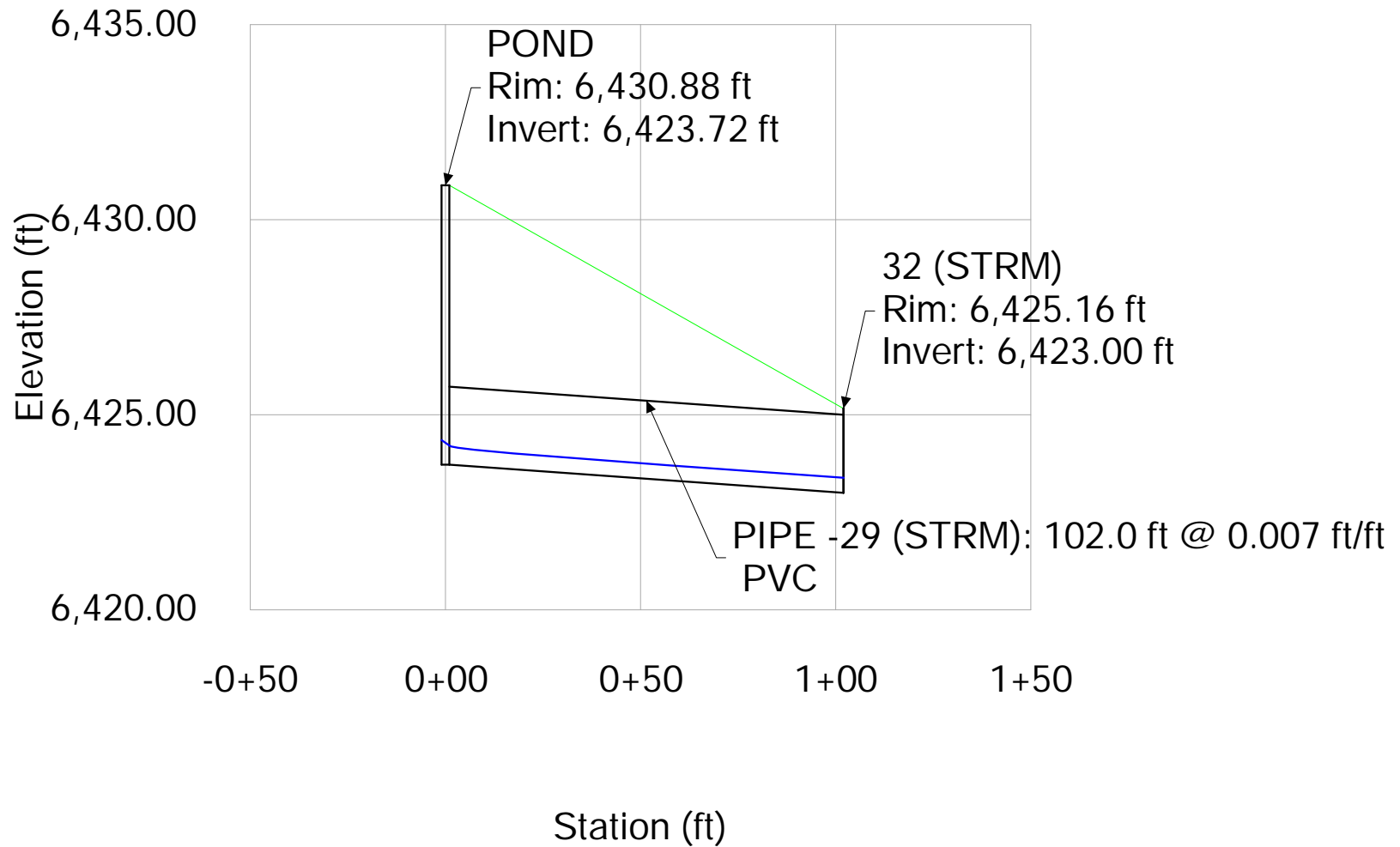
Active Scenario: 5 YR



Profile Report
 Engineering Profile - L (Untitled1.stsw)
 Active Scenario: 5 YR



Profile Report
Engineering Profile - POND (Untitled1.stsw)
Active Scenario: 5 YR



FlexTable: Catch Basin Table

Active Scenario: 100 YR

| Label | Elevation (Rim) (ft) | Elevation (Invert) (ft) | Headloss Method | Headloss (ft) | Flow (Additional Subsurface) (cfs) | Flow (Total Out) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|-------|----------------------|-------------------------|-----------------|---------------|------------------------------------|------------------------|--------------------------------|---------------------------------|
| E1 | 6,435.50 | 6,431.13 | Standard | 0.15 | 0.00 | 1.66 | 6,431.87 | 6,431.72 |
| E2 | 6,436.03 | 6,432.13 | Standard | 0.16 | 0.00 | 2.14 | 6,433.00 | 6,432.83 |
| E3 | 6,437.31 | 6,433.41 | Standard | 0.16 | 0.00 | 2.22 | 6,434.30 | 6,434.14 |
| E4 | 6,437.81 | 6,434.51 | Standard | 0.15 | 0.00 | 1.75 | 6,435.28 | 6,435.13 |
| B2 | 6,436.08 | 6,432.33 | Standard | 0.18 | 0.00 | 2.44 | 6,433.10 | 6,432.92 |
| B1 | 6,436.64 | 6,433.10 | Standard | 0.17 | 0.00 | 2.23 | 6,433.83 | 6,433.66 |
| B4 | 6,431.98 | 6,422.13 | Standard | 0.13 | 0.00 | 1.36 | 6,422.69 | 6,422.57 |
| B3 | 6,431.71 | 6,426.71 | Standard | 0.18 | 0.00 | 2.57 | 6,427.50 | 6,427.32 |
| POND | 6,430.88 | 6,423.72 | Standard | 0.19 | 0.00 | 7.82 | 6,425.13 | 6,424.95 |
| D1 | 6,432.34 | 6,428.49 | Standard | 0.27 | 0.00 | 4.72 | 6,429.60 | 6,429.32 |
| D2 | 6,435.00 | 6,430.61 | Standard | 0.42 | 0.00 | 8.17 | 6,432.15 | 6,431.72 |
| D4 | 6,437.96 | 6,433.07 | Standard | 0.17 | 0.00 | 1.63 | 6,433.78 | 6,433.61 |
| D5 | 6,436.11 | 6,430.16 | Standard | 0.06 | 0.00 | 3.85 | 6,432.39 | 6,432.33 |
| D6 | 6,436.48 | 6,430.78 | Standard | 0.15 | 0.00 | 6.11 | 6,432.89 | 6,432.74 |
| D7 | 6,435.86 | 6,431.75 | Standard | 0.04 | 0.00 | 2.88 | 6,433.05 | 6,433.01 |
| D8 | 6,437.70 | 6,433.37 | Standard | 0.24 | 0.00 | 3.92 | 6,434.37 | 6,434.13 |
| D9 | 6,438.88 | 6,434.85 | Standard | 0.20 | 0.00 | 3.00 | 6,435.70 | 6,435.50 |
| D10 | 6,439.09 | 6,435.37 | Standard | 0.18 | 0.00 | 2.54 | 6,436.15 | 6,435.97 |
| D11 | 6,437.27 | 6,432.02 | Standard | 0.22 | 0.00 | 3.78 | 6,433.00 | 6,432.78 |
| D12 | 6,436.95 | 6,433.73 | Standard | 0.19 | 0.00 | 2.90 | 6,434.57 | 6,434.38 |
| L1 | 6,440.93 | 6,432.84 | Standard | 0.34 | 0.00 | 6.36 | 6,434.16 | 6,433.82 |
| D1a | 6,433.43 | 6,429.43 | Standard | 0.13 | 0.00 | 1.37 | 6,429.99 | 6,429.87 |

FlexTable: Conduit Table

Active Scenario: 100 YR

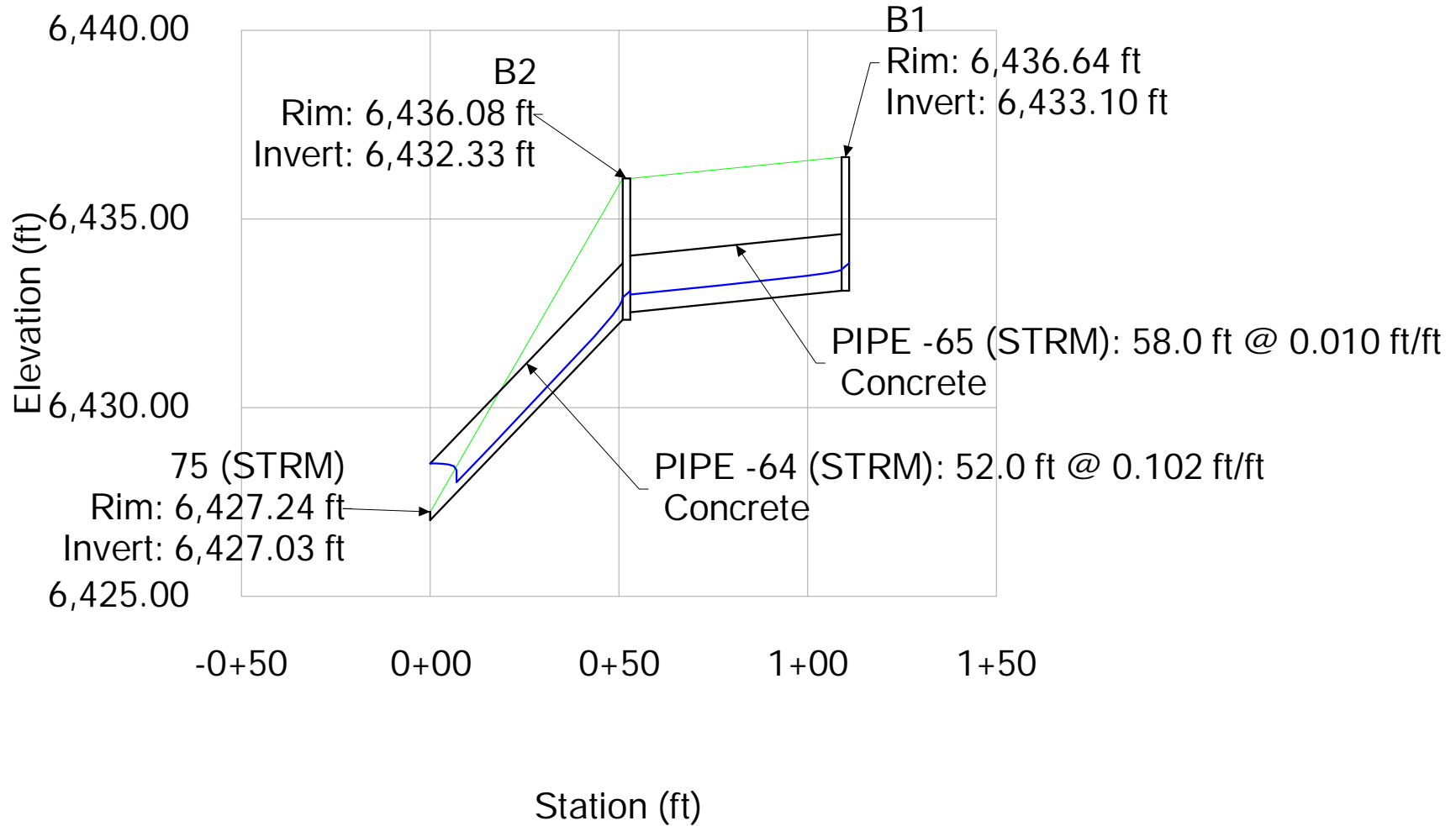
| Start Node | Stop Node | Invert (Start) (ft) | Invert (Stop) (ft) | Length (ft) | Slope (Calculated) (ft/ft) | Diameter (in) | Flow (cfs) | Velocity (ft/s) | Capacity (Design) (cfs) | Flow / Capacity (Design) (%) | Manning's n | Headloss (ft) | Froude Number (Normal) |
|------------|------------|---------------------|--------------------|-------------|----------------------------|---------------|------------|-----------------|-------------------------|------------------------------|-------------|---------------|------------------------|
| D12 | 34 (STRM) | 6,433.73 | 6,432.95 | 155.7 | 0.005 | 18.0 | 2.90 | 3.95 | 7.44 | 39.0 | 0.013 | 0.69 | 0.990 |
| 34 (STRM) | D11 | 6,432.85 | 6,432.22 | 126.1 | 0.005 | 18.0 | 2.90 | 3.94 | 7.43 | 39.0 | 0.013 | 0.50 | 0.988 |
| D10 | D9 | 6,435.37 | 6,434.95 | 42.2 | 0.010 | 18.0 | 2.54 | 4.89 | 10.50 | 24.2 | 0.013 | 0.27 | 1.424 |
| D9 | D8 | 6,434.85 | 6,433.47 | 137.7 | 0.010 | 18.0 | 3.00 | 5.13 | 10.51 | 28.6 | 0.013 | 1.14 | 1.420 |
| E1 | 67 (STRM) | 6,431.13 | 6,430.15 | 196.1 | 0.005 | 12.0 | 1.66 | 3.42 | 2.52 | 65.9 | 0.013 | 1.03 | 0.860 |
| 67 (STRM) | 68 (STRM) | 6,427.49 | 6,427.15 | 33.5 | 0.010 | 18.0 | 8.02 | 6.55 | 10.50 | 76.4 | 0.013 | 0.11 | 1.245 |
| D11 | 36 (STRM) | 6,432.02 | 6,431.71 | 62.4 | 0.005 | 18.0 | 3.78 | 4.22 | 7.43 | 50.9 | 0.013 | 0.13 | 0.963 |
| 36 (STRM) | 37 (STRM) | 6,431.21 | 6,430.04 | 232.7 | 0.005 | 24.0 | 7.70 | 5.04 | 16.00 | 48.1 | 0.013 | 0.18 | 1.017 |
| D8 | 36 (STRM) | 6,433.37 | 6,433.15 | 22.2 | 0.010 | 18.0 | 3.92 | 5.49 | 10.45 | 37.5 | 0.013 | 0.33 | 1.395 |
| E4 | E3 | 6,434.51 | 6,433.51 | 200.0 | 0.005 | 12.0 | 1.75 | 3.46 | 2.52 | 69.5 | 0.013 | 0.82 | 0.848 |
| E3 | E2 | 6,433.41 | 6,432.23 | 237.2 | 0.005 | 12.0 | 2.22 | 3.62 | 2.52 | 88.1 | 0.013 | 1.15 | 0.768 |
| D4 | 45 (STRM) | 6,433.07 | 6,431.94 | 113.0 | 0.010 | 12.0 | 1.63 | 4.44 | 3.57 | 45.7 | 0.013 | 1.20 | 1.291 |
| 45 (STRM) | D2 | 6,431.74 | 6,431.13 | 59.3 | 0.010 | 12.0 | 1.63 | 4.48 | 3.61 | 45.2 | 0.013 | 0.13 | 1.308 |
| 37 (STRM) | 38 (STRM) | 6,429.84 | 6,429.03 | 159.6 | 0.005 | 24.0 | 11.55 | 3.68 | 16.10 | 71.7 | 0.013 | 0.42 | 0.950 |
| D5 | 37 (STRM) | 6,430.16 | 6,430.04 | 22.2 | 0.005 | 18.0 | 3.85 | 2.18 | 7.56 | 51.0 | 0.013 | 0.03 | 0.980 |
| B1 | B2 | 6,433.10 | 6,432.53 | 58.0 | 0.010 | 18.0 | 2.23 | 4.70 | 10.43 | 21.4 | 0.013 | 0.57 | 1.418 |
| B2 | 75 (STRM) | 6,432.33 | 6,427.03 | 52.0 | 0.102 | 18.0 | 2.44 | 11.06 | 33.54 | 7.3 | 0.013 | 4.39 | 4.466 |
| D6 | D5 | 6,430.78 | 6,430.26 | 105.1 | 0.005 | 18.0 | 6.11 | 3.46 | 7.43 | 82.3 | 0.013 | 0.36 | 0.854 |
| 38 (STRM) | 39 (STRM) | 6,428.83 | 6,427.64 | 240.5 | 0.005 | 24.0 | 19.72 | 6.28 | 15.93 | 123.8 | 0.013 | 1.94 | 0.783 |
| D2 | 38 (STRM) | 6,430.61 | 6,430.36 | 12.8 | 0.020 | 18.0 | 8.17 | 8.60 | 14.84 | 55.0 | 0.013 | 0.01 | 1.904 |
| E2 | E1 | 6,432.13 | 6,431.23 | 179.7 | 0.005 | 12.0 | 2.14 | 3.60 | 2.52 | 84.9 | 0.013 | 0.97 | 0.785 |
| D7 | D6 | 6,431.75 | 6,430.88 | 174.0 | 0.005 | 18.0 | 2.88 | 3.93 | 7.43 | 38.8 | 0.013 | 0.12 | 0.989 |
| 39 (STRM) | 40 (STRM) | 6,426.66 | 6,426.13 | 101.1 | 0.005 | 30.0 | 24.44 | 6.78 | 29.84 | 81.9 | 0.013 | 0.30 | 0.958 |
| 40 (STRM) | 41 (STRM) | 6,425.93 | 6,425.68 | 49.3 | 0.005 | 30.0 | 24.44 | 6.63 | 29.03 | 84.2 | 0.013 | 0.15 | 0.920 |
| D1 | 39 (STRM) | 6,428.49 | 6,427.63 | 79.8 | 0.011 | 18.0 | 4.72 | 5.94 | 10.89 | 43.4 | 0.013 | 0.04 | 1.438 |
| B3 | B4 | 6,426.71 | 6,422.33 | 52.0 | 0.084 | 18.0 | 2.57 | 10.49 | 30.49 | 8.4 | 0.013 | 4.70 | 4.081 |
| B4 | 129 (STRM) | 6,422.13 | 6,421.17 | 58.0 | 0.017 | 18.0 | 1.36 | 4.90 | 13.52 | 10.1 | 0.013 | -0.10 | 1.820 |
| POND | 32 (STRM) | 6,423.72 | 6,423.00 | 102.0 | 0.007 | 24.0 | 7.82 | 6.98 | 24.71 | 31.7 | 0.010 | -0.05 | 1.621 |
| L1 | 67 (STRM) | 6,432.84 | 6,427.69 | 52.0 | 0.099 | 18.0 | 6.36 | 14.45 | 33.07 | 19.2 | 0.013 | 4.75 | 4.496 |
| D1a | D1 | 6,429.43 | 6,428.69 | 67.7 | 0.011 | 18.0 | 1.37 | 5.10 | 14.27 | 9.6 | 0.010 | 0.27 | 1.918 |

FlexTable: Manhole Table

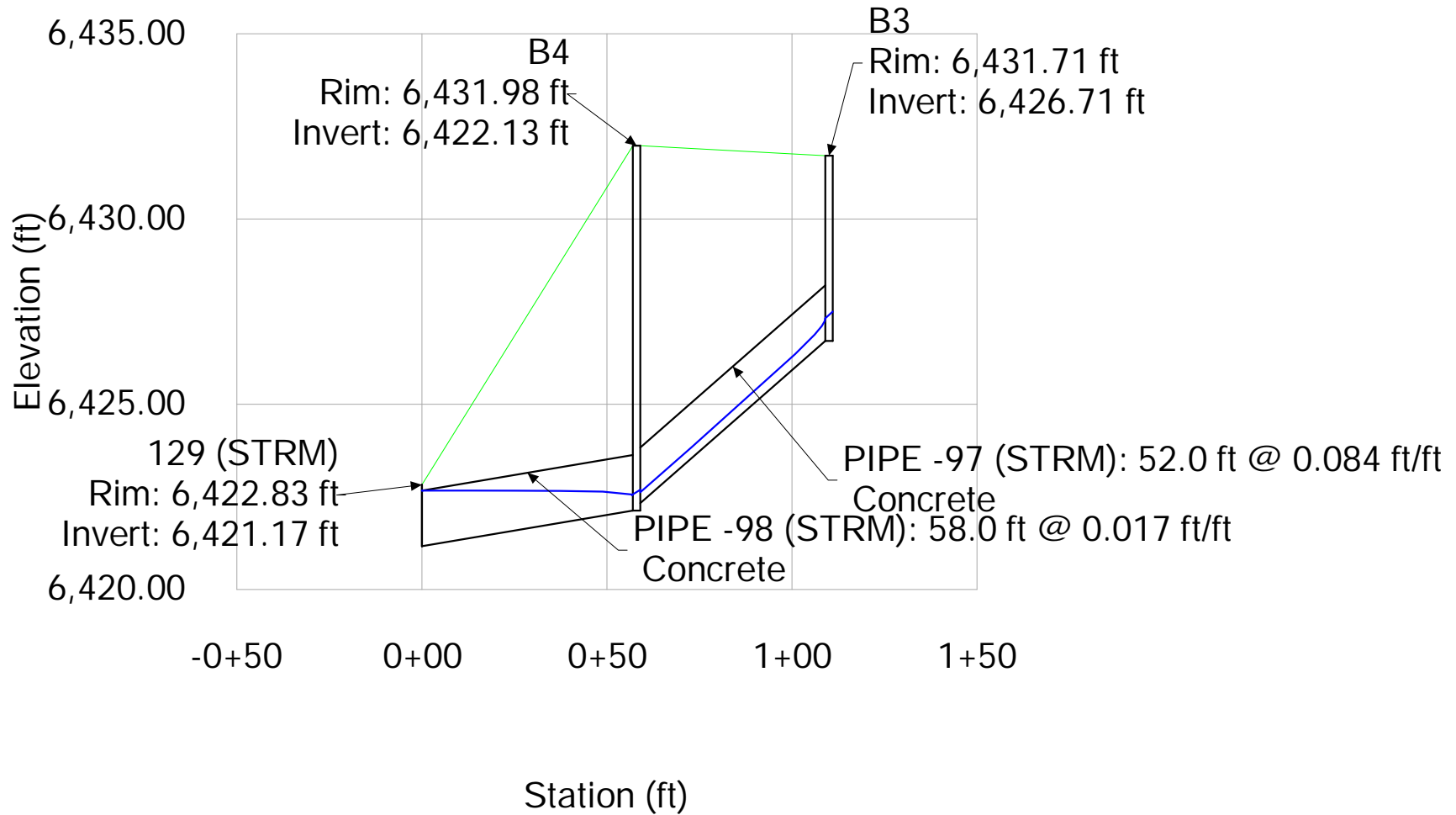
Active Scenario: 100 YR

| Label | Elevation (Rim) (ft) | Elevation (Invert) (ft) | Headloss Method | Headloss Coefficient (Standard) | Headloss (ft) | Flow (Total Out) (cfs) | Hydraulic Grade Line (In) (ft) | Hydraulic Grade Line (Out) (ft) |
|-----------|----------------------------|-------------------------------|--------------------|---------------------------------------|------------------|------------------------------|---|--|
| 34 (STRM) | 6,439.98 | 6,432.85 | Standard | 0.800 | 0.19 | 2.90 | 6,433.69 | 6,433.50 |
| 67 (STRM) | 6,437.03 | 6,427.49 | Standard | 0.800 | 0.31 | 8.02 | 6,429.07 | 6,428.76 |
| 36 (STRM) | 6,438.00 | 6,431.21 | Standard | 0.800 | 0.17 | 7.70 | 6,432.65 | 6,432.48 |
| 45 (STRM) | 6,436.59 | 6,431.74 | Standard | 0.800 | 0.17 | 1.63 | 6,432.45 | 6,432.28 |
| 37 (STRM) | 6,436.84 | 6,429.84 | Standard | 0.800 | 0.17 | 11.55 | 6,432.30 | 6,432.13 |
| 38 (STRM) | 6,436.12 | 6,428.83 | Standard | 0.800 | 0.49 | 19.72 | 6,431.71 | 6,431.22 |
| 40 (STRM) | 6,434.09 | 6,425.93 | Standard | 0.800 | 0.32 | 24.44 | 6,428.65 | 6,428.34 |
| 39 (STRM) | 6,433.75 | 6,426.66 | Standard | 0.800 | 0.33 | 24.44 | 6,429.29 | 6,428.95 |

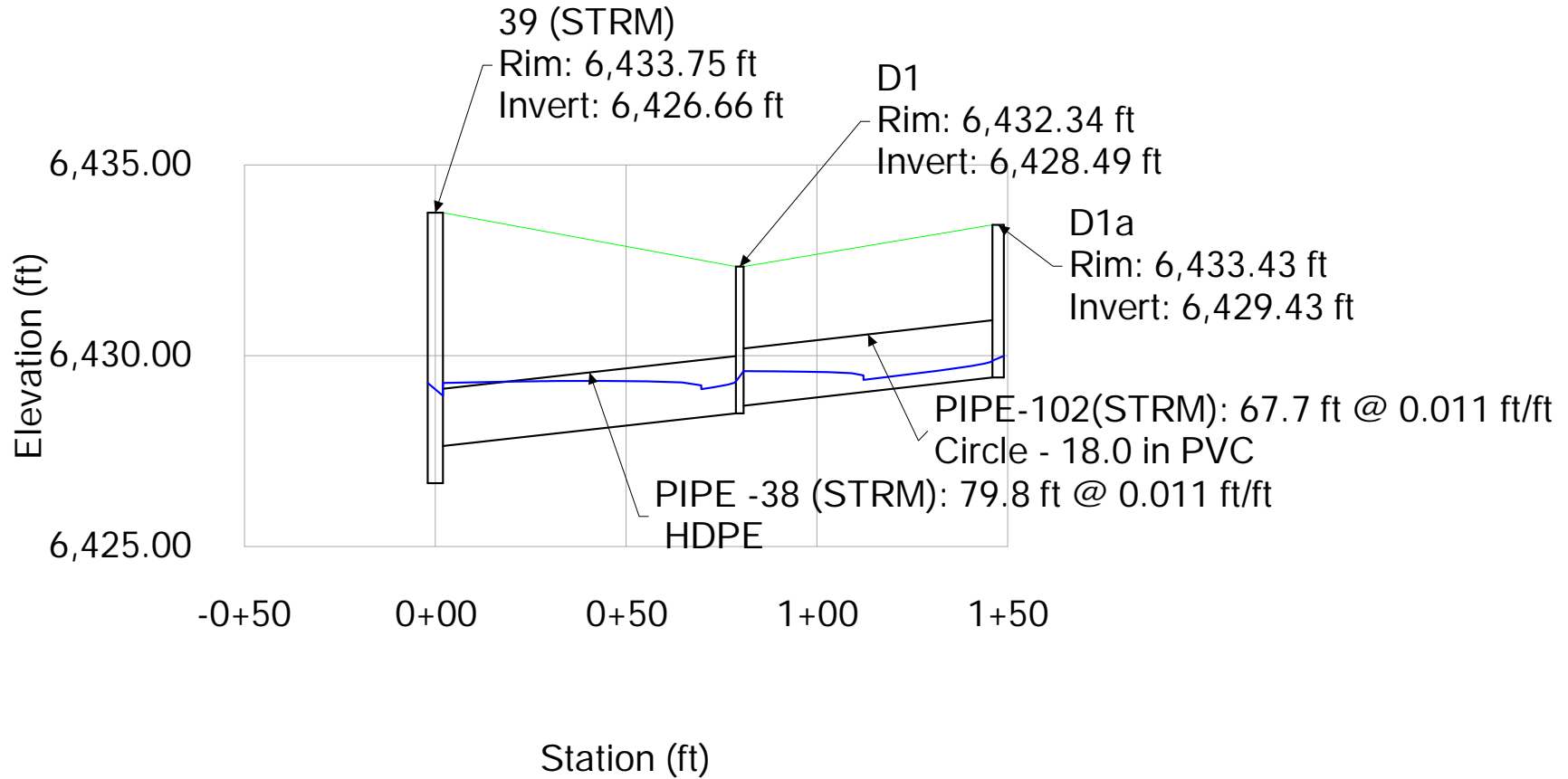
Profile Report
 Engineering Profile - B1 (Untitled1.stsw)
 Active Scenario: 100 YR



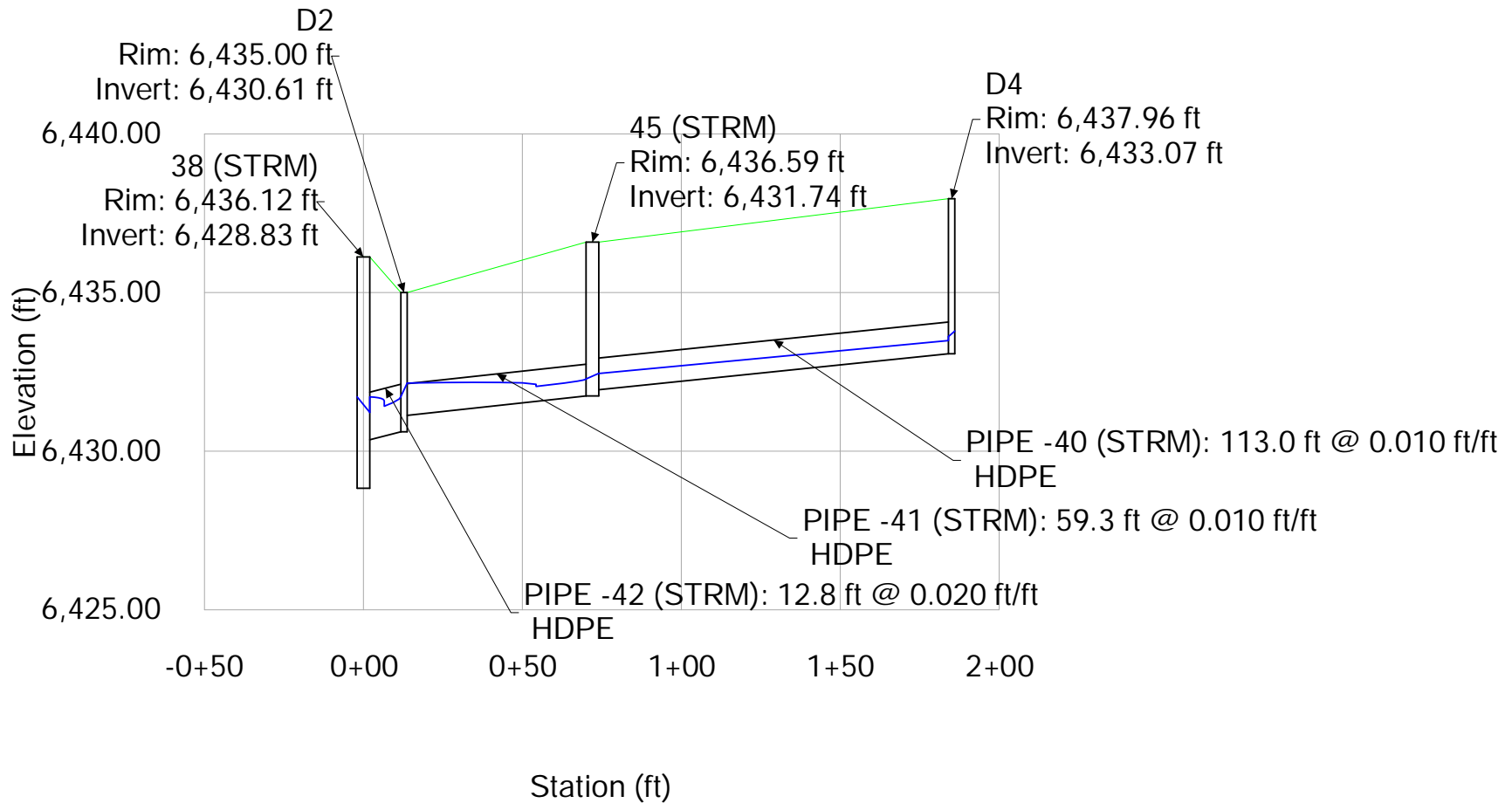
Profile Report
 Engineering Profile - B3 (Untitled1.stsw)
 Active Scenario: 100 YR



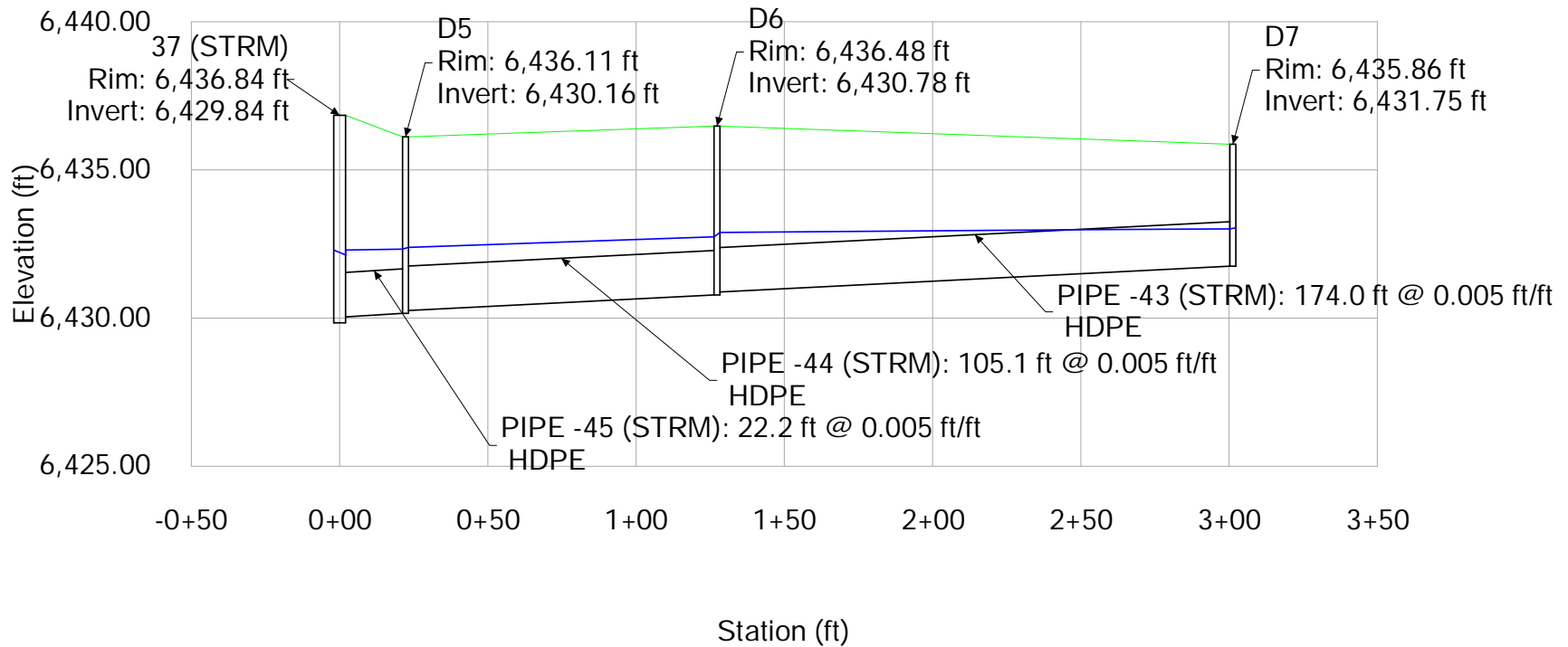
Profile Report
 Engineering Profile - D1 (Untitled1.stsw)
 Active Scenario: 100 YR



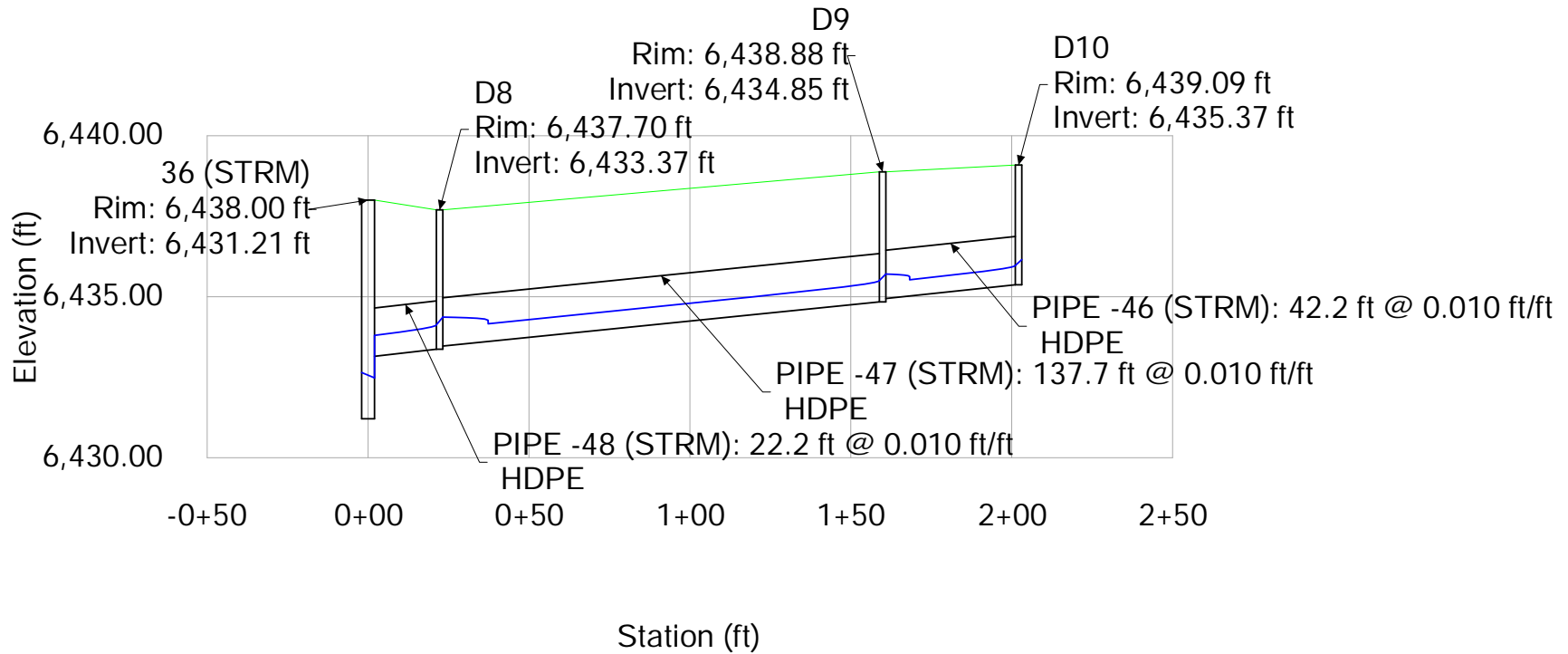
Profile Report
 Engineering Profile - D3 (Untitled1.stsw)
 Active Scenario: 100 YR



Profile Report
 Engineering Profile - D7 (Untitled1.stsw)
 Active Scenario: 100 YR



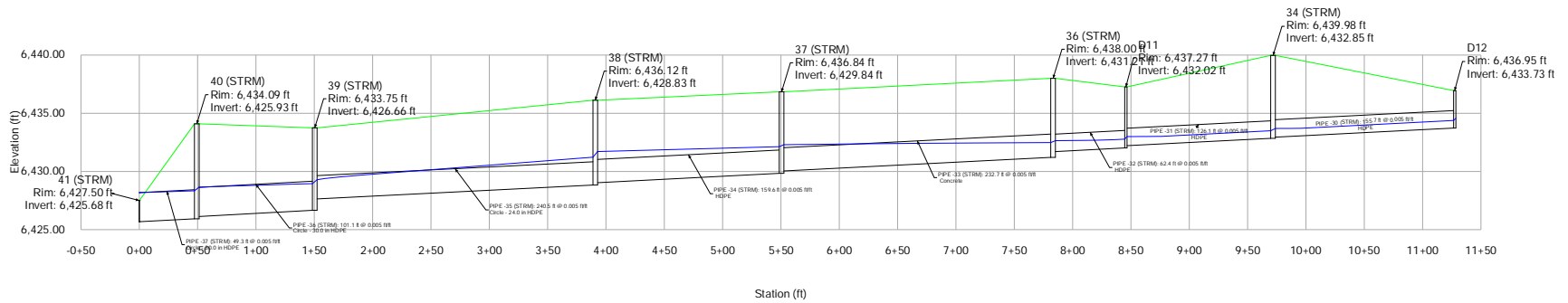
Profile Report
 Engineering Profile - D10 (Untitled1.stsw)
 Active Scenario: 100 YR



Profile Report

Engineering Profile - D12 (Untitled1.stsw)

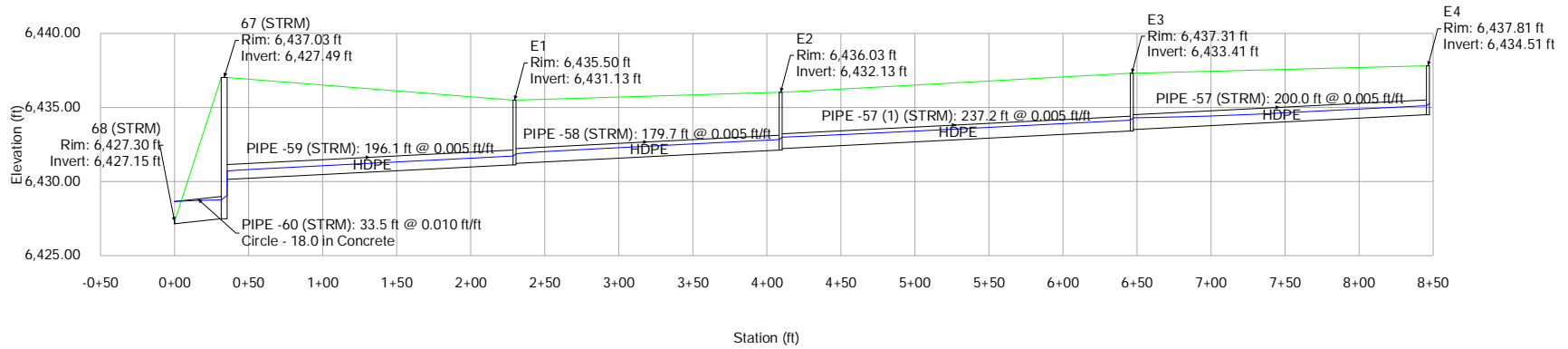
Active Scenario: 100 YR



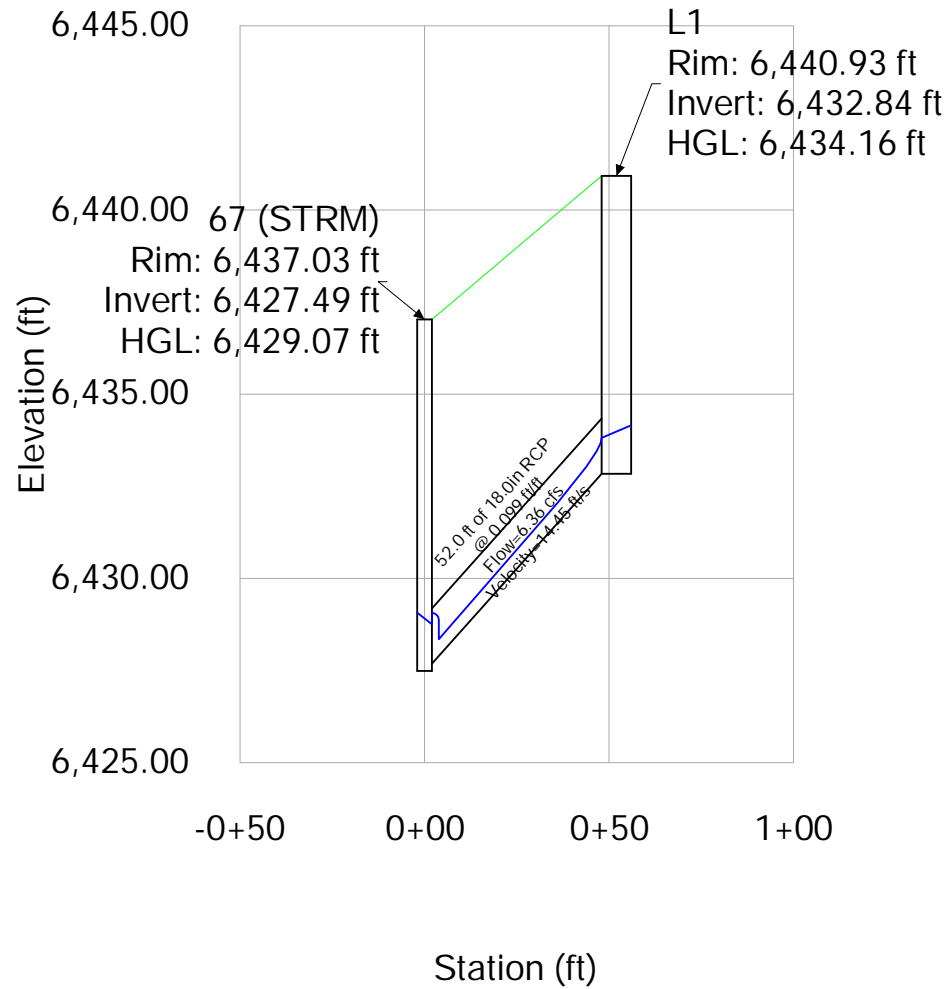
Profile Report

Engineering Profile - E (Untitled1.stsw)

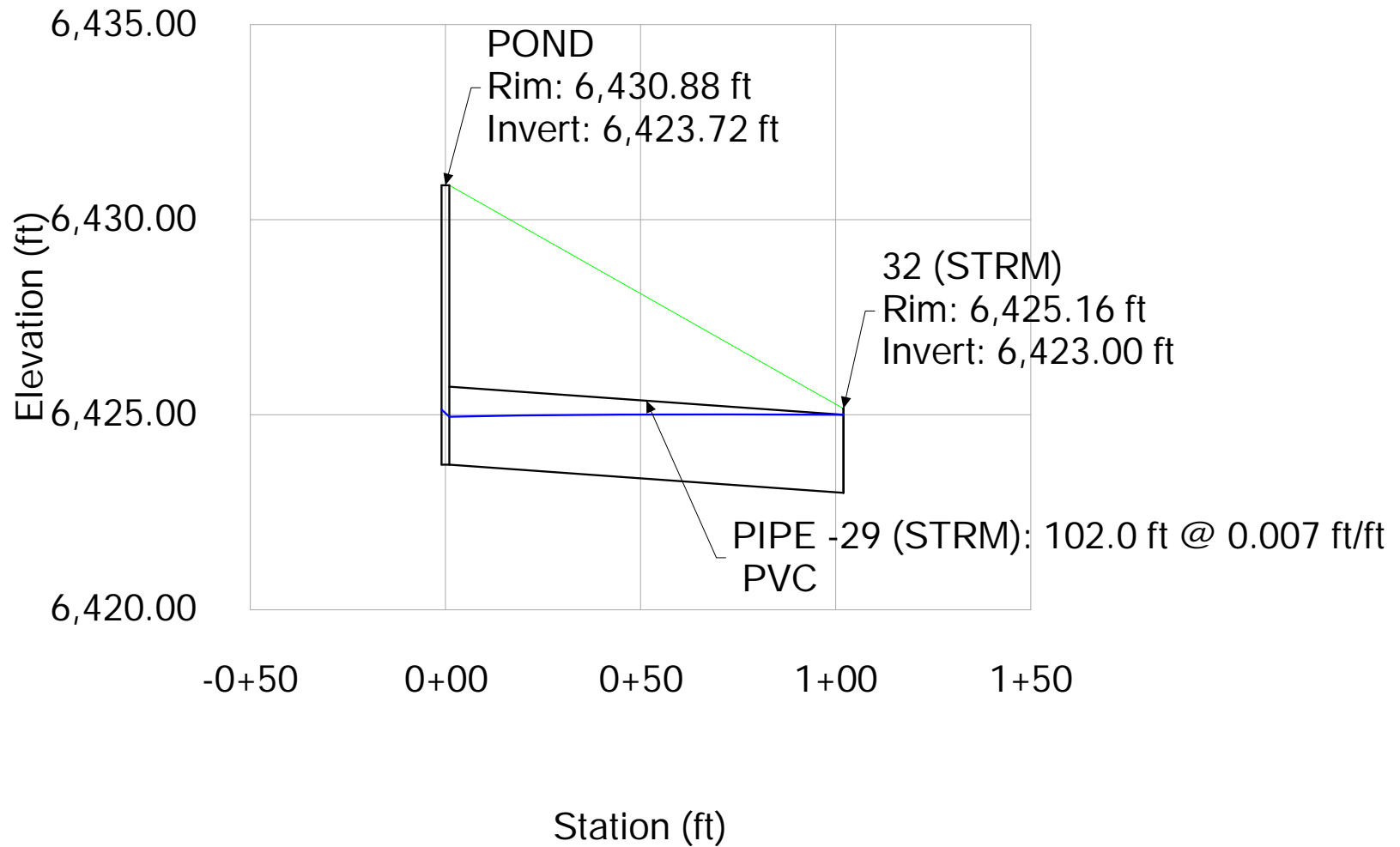
Active Scenario: 100 YR



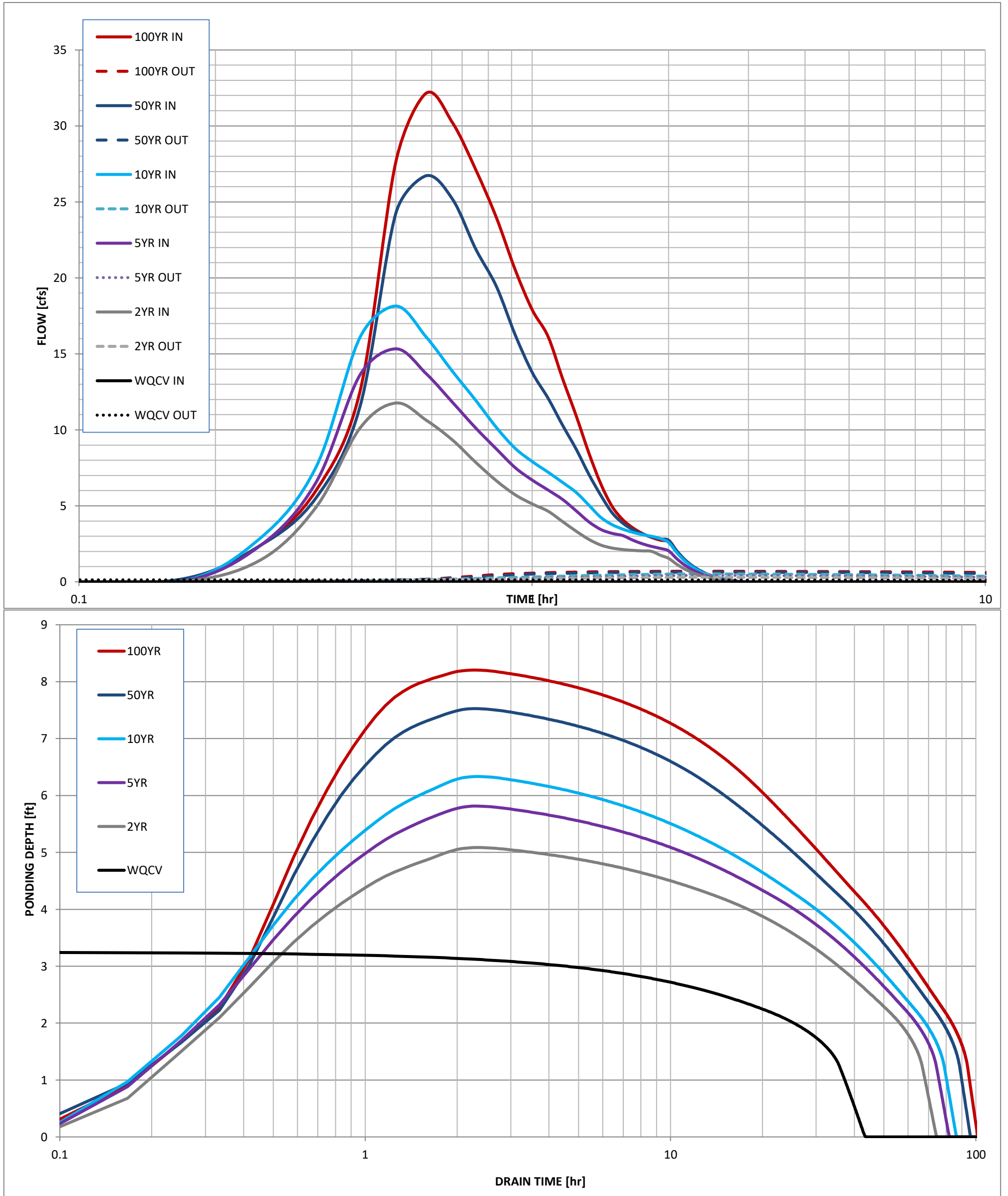
Profile Report
 Engineering Profile - L (Untitled1.stsw)
 Active Scenario: 100 YR



Profile Report
Engineering Profile - POND (Untitled1.stsw)
Active Scenario: 100 YR



Stormwater Detention and Infiltration Design Data Sheet

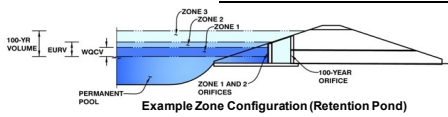


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **Citizen On Constitution (El Paso)**

Basin ID: **Extended Detention Basin**



Watershed Information

| | |
|---|----------------|
| Selected BMP Type = | EDB |
| Watershed Area = | 11.25 acres |
| Watershed Length = | 1,200 ft |
| Watershed Length to Centroid = | 600 ft |
| Watershed Slope = | 0.020 ft/ft |
| Watershed Imperviousness = | 71.00% percent |
| Percentage Hydrologic Soil Group A = | 66.5% percent |
| Percentage Hydrologic Soil Group B = | 33.5% percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% percent |
| Target WQC 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.

| | |
|--|-----------------|
| Water Quality Capture Volume (WQCV) = | 0.262 acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.970 acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.746 acre-feet |
| 5-yr Runoff Volume (P1 = 1.52 in.) = | 0.986 acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 1.177 acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 1.437 acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 1.663 acre-feet |
| 100-yr Runoff Volume (P1 = 2.55 in.) = | 1.974 acre-feet |
| 500-yr Runoff Volume (P1 = 3.14 in.) = | 2.537 acre-feet |
| Approximate 2-yr Detention Volume = | 0.671 acre-feet |
| Approximate 5-yr Detention Volume = | 0.894 acre-feet |
| Approximate 10-yr Detention Volume = | 1.077 acre-feet |
| Approximate 25-yr Detention Volume = | 1.241 acre-feet |
| Approximate 50-yr Detention Volume = | 1.339 acre-feet |
| Approximate 100-yr Detention Volume = | 1.466 acre-feet |

Optional User Overrides

| | |
|-----------|-----------|
| acre-feet | acre-feet |
| acre-feet | acre-feet |
| inches | inches |
| inches | inches |
| inches | inches |
| inches | inches |
| inches | inches |
| inches | inches |
| inches | inches |

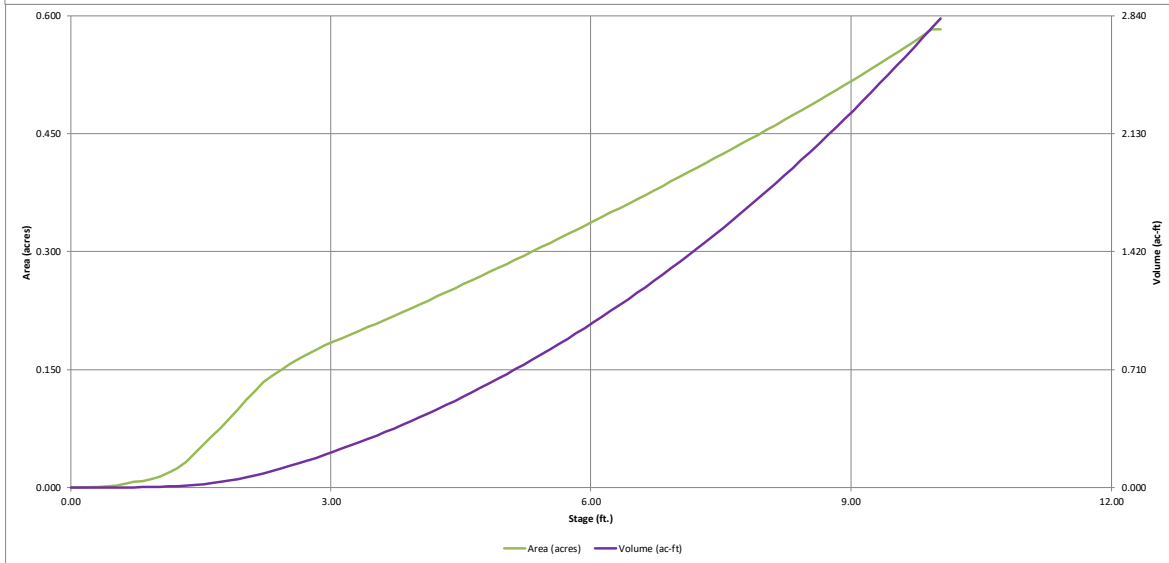
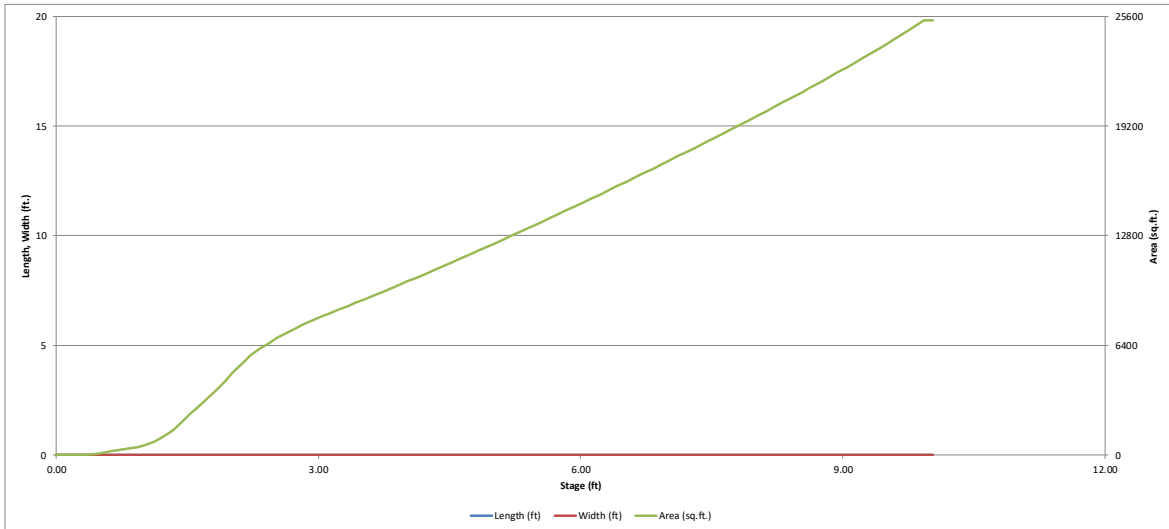
Define Zones and Basin Geometry

| | |
|---|----------------------|
| Zone 1 Volume (WQCV) = | 0.262 acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.708 acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.496 acre-feet |
| Total Detention Basin Volume = | 1.466 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 _{SV}) = | user ft |
| Surcharge Volume Width (W _{SV}) = | 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 _{MAN}) = | user ft |
| Length of Main Basin (L _{MAN}) = | user ft |
| Width of Main Basin (W _{MAN}) = | user ft |
| Area of Main Basin (A _{MAN}) = | user ft ² |
| Volume of Main Basin (V _{MAN}) = | 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 | -- | -- | -- | 10 | 0.000 | | |
| 6425.4 | -- | 0.33 | -- | -- | -- | 14 | 0.000 | 4 | 0.000 |
| 6425.5 | -- | 0.43 | -- | -- | -- | 51 | 0.001 | 7 | 0.000 |
| 6425.6 | -- | 0.53 | -- | -- | -- | 105 | 0.002 | 15 | 0.000 |
| 6425.7 | -- | 0.63 | -- | -- | -- | 216 | 0.005 | 31 | 0.001 |
| 6425.8 | -- | 0.73 | -- | -- | -- | 306 | 0.007 | 57 | 0.001 |
| 6425.9 | -- | 0.83 | -- | -- | -- | 366 | 0.008 | 91 | 0.002 |
| 6426 | -- | 0.93 | -- | -- | -- | 443 | 0.010 | 131 | 0.003 |
| 6426.1 | -- | 1.03 | -- | -- | -- | 581 | 0.013 | 183 | 0.004 |
| 6426.2 | -- | 1.13 | -- | -- | -- | 794 | 0.018 | 251 | 0.006 |
| 6426.3 | -- | 1.23 | -- | -- | -- | 1,075 | 0.025 | 345 | 0.008 |
| 6426.4 | -- | 1.33 | -- | -- | -- | 1,409 | 0.032 | 469 | 0.011 |
| 6426.5 | -- | 1.43 | -- | -- | -- | 1,874 | 0.043 | 633 | 0.015 |
| 6426.6 | -- | 1.53 | -- | -- | -- | 2,385 | 0.055 | 846 | 0.019 |
| 6426.7 | -- | 1.63 | -- | -- | -- | 2,845 | 0.065 | 1,107 | 0.025 |
| 6426.8 | -- | 1.73 | -- | -- | -- | 3,303 | 0.076 | 1,415 | 0.032 |
| 6426.9 | -- | 1.83 | -- | -- | -- | 3,778 | 0.087 | 1,769 | 0.041 |
| 6427 | -- | 1.93 | -- | -- | -- | 4,309 | 0.099 | 2,173 | 0.050 |
| 6427.1 | -- | 2.03 | -- | -- | -- | 4,843 | 0.111 | 2,631 | 0.060 |
| 6427.2 | -- | 2.13 | -- | -- | -- | 5,343 | 0.123 | 3,140 | 0.072 |
| 6427.3 | -- | 2.23 | -- | -- | -- | 5,842 | 0.134 | 3,699 | 0.085 |
| 6427.4 | -- | 2.33 | -- | -- | -- | 6,190 | 0.142 | 4,301 | 0.099 |
| 6427.5 | -- | 2.43 | -- | -- | -- | 6,514 | 0.150 | 4,936 | 0.113 |
| 6427.6 | -- | 2.53 | -- | -- | -- | 6,828 | 0.157 | 5,603 | 0.129 |
| 6427.7 | -- | 2.63 | -- | -- | -- | 7,114 | 0.163 | 6,300 | 0.145 |
| 6427.8 | -- | 2.73 | -- | -- | -- | 7,380 | 0.169 | 7,025 | 0.161 |
| 6427.9 | -- | 2.83 | -- | -- | -- | 7,628 | 0.175 | 7,775 | 0.179 |
| 6428 | -- | 2.93 | -- | -- | -- | 7,861 | 0.180 | 8,550 | 0.196 |
| 6428.1 | -- | 3.03 | -- | -- | -- | 8,064 | 0.185 | 9,346 | 0.215 |
| 6428.2 | -- | 3.13 | -- | -- | -- | 8,268 | 0.190 | 10,163 | 0.233 |
| 6428.3 | -- | 3.23 | -- | -- | -- | 8,472 | 0.194 | 11,000 | 0.253 |
| 6428.4 | -- | 3.33 | -- | -- | -- | 8,677 | 0.199 | 11,857 | 0.272 |
| 6428.5 | -- | 3.43 | -- | -- | -- | 8,883 | 0.204 | 12,735 | 0.292 |
| 6428.6 | -- | 3.53 | -- | -- | -- | 9,090 | 0.209 | 13,634 | 0.313 |
| 6428.7 | -- | 3.63 | -- | -- | -- | 9,298 | 0.213 | 14,553 | 0.334 |
| 6428.8 | -- | 3.73 | -- | -- | -- | 9,507 | 0.218 | 15,493 | 0.356 |
| 6428.9 | -- | 3.83 | -- | -- | -- | 9,720 | 0.223 | 16,455 | 0.378 |
| 6429 | -- | 3.93 | -- | -- | -- | 9,934 | 0.228 | 17,437 | 0.400 |
| 6429.1 | -- | 4.03 | -- | -- | -- | 10,149 | 0.233 | 18,442 | 0.423 |
| 6429.2 | -- | 4.13 | -- | -- | -- | 10,364 | 0.238 | 19,467 | 0.447 |
| 6429.3 | -- | 4.23 | -- | -- | -- | 10,582 | 0.243 | 20,514 | 0.471 |
| 6429.4 | -- | 4.33 | -- | -- | -- | 10,812 | 0.248 | 21,584 | 0.496 |
| 6429.5 | -- | 4.43 | -- | -- | -- | 11,033 | 0.253 | 22,676 | 0.521 |
| 6429.6 | -- | 4.53 | -- | -- | -- | 11,255 | 0.258 | 23,791 | 0.546 |
| 6429.7 | -- | 4.63 | -- | -- | -- | 11,478 | 0.264 | 24,927 | 0.572 |
| 6429.8 | -- | 4.73 | -- | -- | -- | 11,703 | 0.269 | 26,086 | 0.599 |
| 6429.9 | -- | 4.83 | -- | -- | -- | 11,928 | 0.274 | 27,268 | 0.626 |
| 6430 | -- | 4.93 | -- | -- | -- | 12,155 | 0.279 | 28,472 | 0.654 |
| 6430.1 | -- | 5.03 | -- | -- | -- | 12,382 | 0.284 | 29,699 | 0.682 |
| 6430.2 | -- | 5.13 | -- | -- | -- | 12,610 | 0.289 | 30,949 | 0.710 |
| 6430.3 | -- | 5.23 | -- | -- | -- | 12,841 | 0.295 | 32,221 | 0.740 |
| 6430.4 | -- | 5.33 | -- | -- | -- | 13,075 | 0.300 | 33,517 | 0.769 |
| 6430.5 | -- | 5.43 | -- | -- | -- | 13,309 | 0.306 | 34,836 | 0.800 |
| 6430.6 | -- | 5.53 | -- | -- | -- | 13,545 | 0.311 | 36,179 | 0.831 |
| 6430.7 | -- | 5.63 | -- | -- | -- | 13,781 | 0.316 | 37,545 | 0.862 |
| 6430.8 | -- | 5.73 | -- | -- | -- | 14,019 | 0.322 | 38,935 | 0.894 |
| 6430.9 | -- | 5.83 | -- | -- | -- | 14,258 | 0.327 | 40,349 | 0.926 |
| 6431 | -- | 5.93 | -- | -- | -- | 14,497 | 0.333 | 41,787 | 0.959 |
| 6431.1 (EURV) | -- | 6.03 | -- | -- | -- | 14,739 | 0.338 | 43,249 | 0.993 |
| 6431.2 | -- | 6.13 | -- | -- | -- | 14,981 | 0.344 | 44,735 | 1.027 |
| 6431.3 | -- | 6.23 | -- | -- | -- | 15,225 | 0.350 | 46,245 | 1.062 |
| 6431.4 | -- | 6.33 | -- | -- | -- | 15,470 | 0.355 | 47,780 | 1.097 |
| 6431.5 | -- | 6.43 | -- | -- | -- | 15,716 | 0.361 | 49,339 | 1.133 |
| 6431.6 | -- | 6.53 | -- | -- | -- | 15,963 | 0.366 | 50,923 | 1.169 |
| 6431.7 | -- | 6.63 | -- | -- | -- | 16,212 | 0.372 | 52,532 | 1.206 |
| 6431.8 | -- | 6.73 | -- | -- | -- | 16,461 | 0.378 | 54,165 | 1.243 |
| 6431.9 | -- | 6.83 | -- | -- | -- | 16,712 | 0.384 | 55,824 | 1.282 |
| 6432 | -- | 6.93 | -- | -- | -- | 16,964 | 0.389 | 57,508 | 1.320 |
| 6432.1 | -- | 7.03 | -- | -- | -- | 17,219 | 0.395 | 59,217 | 1.359 |
| 6432.2 | -- | 7.13 | -- | -- | -- | 17,474 | 0.401 | 60,952 | 1.399 |
| 6432.3 | -- | 7.23 | -- | -- | -- | 17,729 | 0.407 | 62,712 | 1.440 |
| 6432.4 | -- | 7.33 | -- | -- | -- | 17,985 | 0.413 | 64,497 | 1.481 |
| 6432.5 (100-YR) | -- | 7.43 | -- | -- | -- | 18,242 | 0.419 | 66,309 | 1.522 |
| 6432.6 | -- | 7.53 | -- | -- | -- | 18,499 | 0.425 | 68,146 | 1.564 |
| 6432.7 | -- | 7.63 | -- | -- | -- | 18,757 | 0.431 | 70,009 | 1.607 |
| 6432.8 | -- | 7.73 | -- | -- | -- | 19,018 | 0.437 | 71,897 | 1.651 |
| 6432.9 | -- | 7.83 | -- | -- | -- | 19,281 | 0.443 | 73,812 | 1.694 |
| 6433 | -- | 7.93 | -- | -- | -- | 19,545 | 0.449 | 75,754 | 1.739 |
| 6433.1 | -- | 8.03 | -- | -- | -- | 19,811 | 0.455 | 77,721 | 1.784 |
| 6433.2 | -- | 8.13 | -- | -- | -- | 20,079 | 0.461 | 79,716 | 1.830 |
| 6433.3 | -- | 8.23 | -- | -- | -- | 20,348 | 0.467 | 81,737 | 1.876 |
| 6433.4 | -- | 8.33 | -- | -- | -- | 20,618 | 0.473 | 83,786 | 1.923 |
| 6433.5 | -- | 8.43 | -- | -- | -- | 20,892 | 0.480 | 85,861 | 1.971 |
| 6433.6 | -- | 8.53 | -- | -- | -- | 21,167 | 0.486 | 87,964 | 2.019 |
| 6433.7 | -- | 8.63 | -- | -- | -- | 21,446 | 0.492 | 90,095 | 2.068 |
| 6433.8 | -- | 8.73 | -- | -- | -- | 21,727 | 0.499 | 92,253 | 2.118 |
| 6433.9 | -- | 8.83 | -- | -- | -- | 22,010 | 0.505 | 94,440 | 2.168 |
| 6434 | -- | 8.93 | -- | -- | -- | 22,296 | 0.512 | 96,656 | 2.219 |
| 6434.1 | -- | 9.03 | -- | -- | -- | 22,584 | 0.518 | 98,899 | 2.270 |
| 6434.2 | -- | 9.13 | -- | -- | -- | 22,876 | 0.525 | 101,172 | 2.323 |
| 6434.3 | -- | 9.23 | -- | -- | -- | 23,172 | 0.532 | 103,476 | 2.375 |
| 6434.4 | -- | 9.33 | -- | -- | -- | 23,472 | 0.539 | 105,807 | 2.429 |
| 6434.5 | -- | 9.43 | -- | -- | -- | 23,775 | 0.546 | 108,169 | 2.483 |
| 6434.6 | -- | 9.53 | -- | -- | -- | 24,082 | 0.553 | 110,562 | 2.538 |
| 6434.7 | -- | 9.63 | -- | -- | -- | 24,396 | 0.560 | 112,986 | 2.594 |
| 6434.8 | -- | 9.73 | -- | -- | -- | 24,716 | 0.567 | 115,442 | 2.650 |
| 6434.9 | -- | 9.83 | -- | -- | -- | 25,044 | 0.575 | 117,930 | 2.707 |
| 6435 | -- | 9.93 | -- | -- | -- | 25,384 | 0.583 | 120,451 | 2.765 |
| 6435.1 | -- | 10.03 | -- | -- | -- | 25,734 | 0.583 | 122,990 | 2.823 |

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

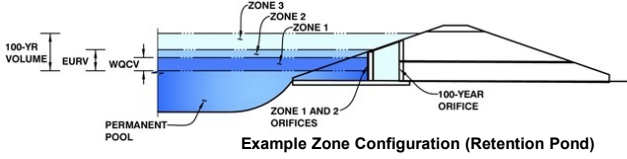
MHFD-Detention, Version 4.04 (February 2021)



DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Citizen On Constitution (El Paso)
Basin ID: Extended Detention Basin



| | Estimated Stage (ft) | Estimated Volume (ac-ft) | Outlet Type |
|-------------------|----------------------|--------------------------|----------------------|
| Zone 1 (WQCV) | 3.28 | 0.262 | Orifice Plate |
| Zone 2 (EURV) | 5.97 | 0.708 | Orifice Plate |
| Zone 3 (100-year) | 7.30 | 0.496 | Weir&Pipe (Restrict) |
| Total (all zones) | | 1.466 | |

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)

Invert 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 = inches

Calculated Parameters for Plate

WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = 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) | Row 8 (optional) |
|--------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Stage of Orifice Centroid (ft) | 0.00 | 2.85 | 4.23 | 5.23 | | | | |
| Orifice Area (sq. inches) | 1.40 | 2.00 | 3.30 | 3.30 | | | | |

| | 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)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Vertical Orifice Diameter = inches

Calculated Parameters for Vertical Orifice

Vertical Orifice Area = ft²
 Vertical Orifice Centroid = feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe))

| | Zone 3 Weir | Not Selected | |
|---|--------------|--------------|---|
| Overflow Weir Front Edge Height, H _o = | 6.03 | N/A | ft (relative to basin bottom at Stage = 0 ft) |
| Overflow Weir Front Edge Length = | 4.00 | N/A | feet |
| Overflow Weir Grate Slope = | 0.00 | N/A | H:V |
| Horiz. Length of Weir Sides = | 4.00 | N/A | feet |
| Overflow Grate Type = | Type C Grate | N/A | |
| Debris Clogging % = | 50% | N/A | % |

Calculated Parameters for Overflow Weir

| | Zone 3 Weir | Not Selected | |
|--|-------------|--------------|-----------------|
| Height of Grate Upper Edge, H _t = | 6.03 | N/A | feet |
| Overflow Weir Slope Length = | 4.00 | N/A | feet |
| Grate Open Area / 100-yr Orifice Area = | 32.36 | N/A | |
| Overflow Grate Open Area w/o Debris = | 11.14 | N/A | ft ² |
| Overflow Grate Open Area w/ Debris = | 5.57 | N/A | ft ² |

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

| | Zone 3 Restrictor | Not Selected | |
|---|-------------------|--------------|--|
| Depth to Invert of Outlet Pipe = | 1.35 | 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 = | 4.00 | | inches |

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

| | Zone 3 Restrictor | Not Selected | |
|--|-------------------|--------------|-----------------|
| Outlet Orifice Area = | 0.34 | N/A | ft ² |
| Outlet Orifice Centroid = | 0.20 | N/A | feet |
| Half-Central Angle of Restrictor Plate on Pipe = | 0.84 | N/A | radians |

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway

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

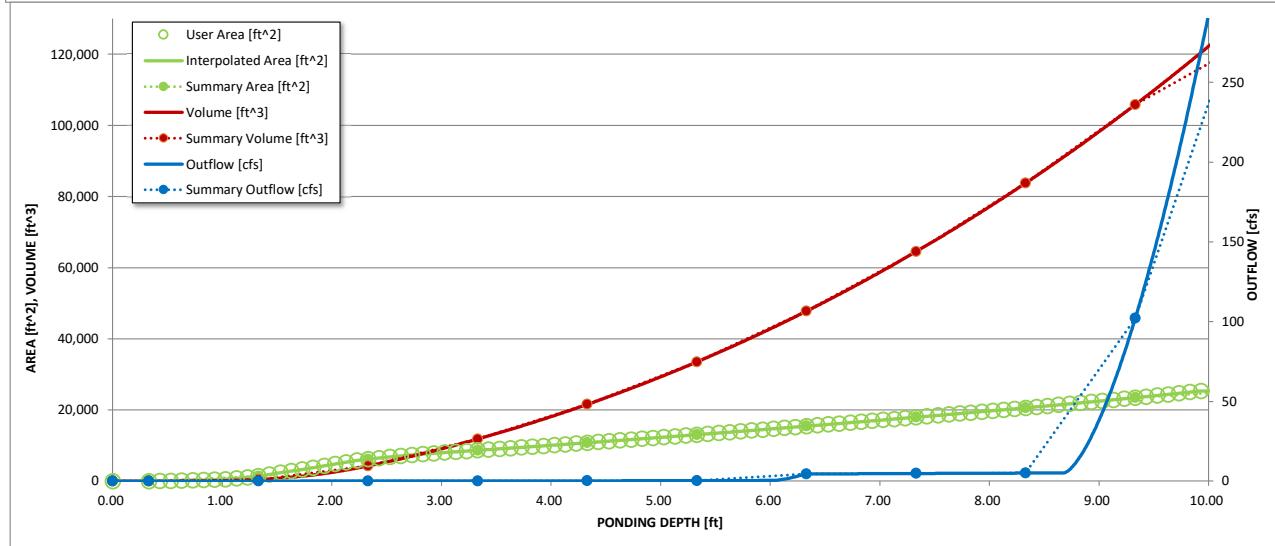
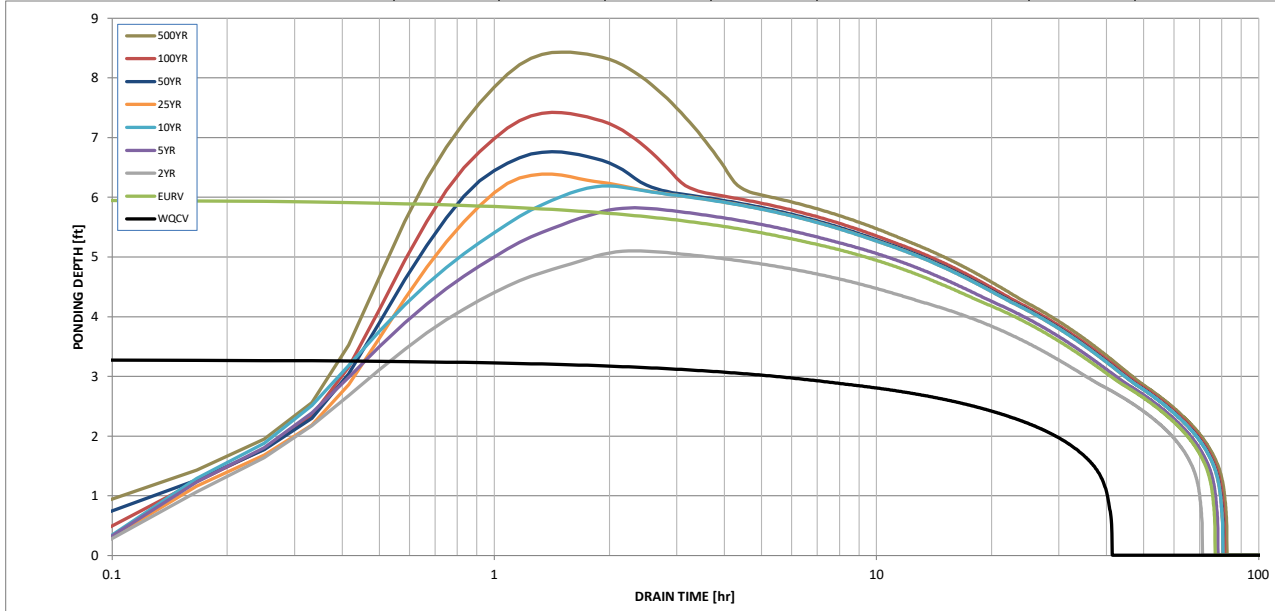
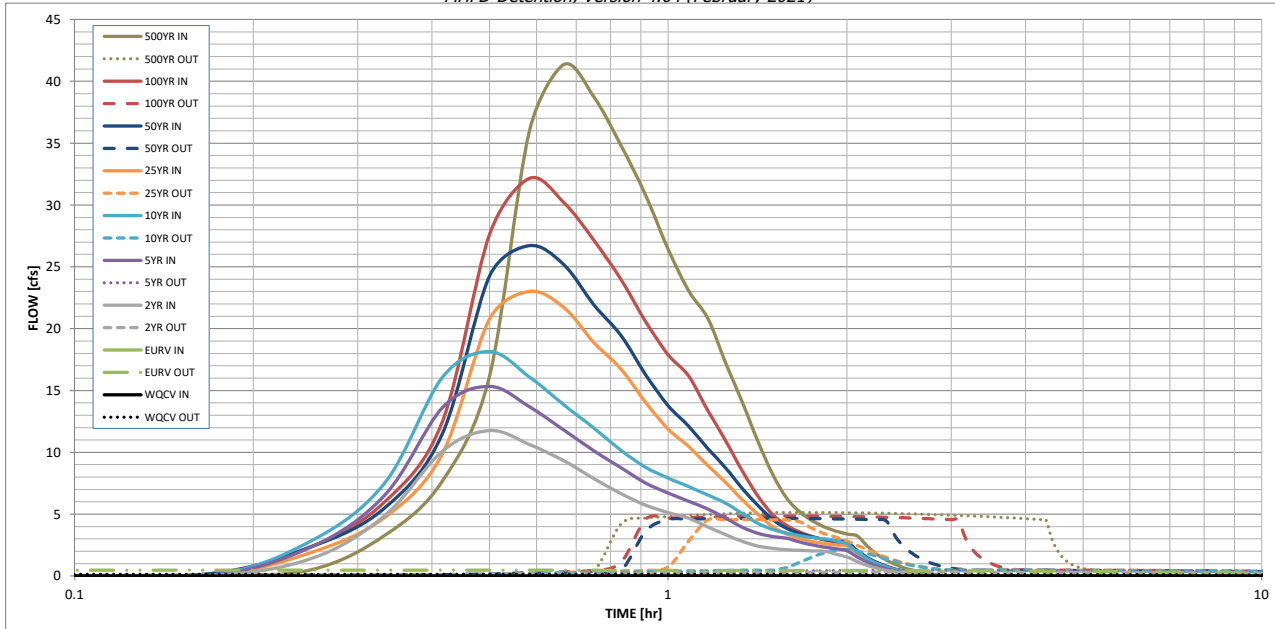
Routed Hydrograph Results

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

| | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year | 500 Year |
|---|-------|-------|--------|--------|-----------------|----------------|----------------|----------------|----------------|
| Design Storm Return Period = | | | | | | | | | |
| One-Hour Rainfall Depth (in) = | N/A | N/A | 1.19 | 1.52 | 1.75 | 2.00 | 2.25 | 2.55 | 3.14 |
| CUHP Runoff Volume (acre-ft) = | 0.262 | 0.970 | 0.746 | 0.986 | 1.177 | 1.437 | 1.663 | 1.974 | 2.537 |
| Inflow Hydrograph Volume (acre-ft) = | N/A | N/A | 0.746 | 0.986 | 1.177 | 1.437 | 1.663 | 1.974 | 2.537 |
| CUHP Predevelopment Peak Q (cfs) = | N/A | N/A | 0.1 | 0.2 | 1.4 | 4.4 | 6.2 | 9.3 | 14.2 |
| OPTIONAL Override Predevelopment Peak Q (cfs) = | N/A | N/A | | 5.4 | 7.8 | | | 16.9 | |
| Predevelopment Unit Peak Flow, q (cfs/acre) = | N/A | N/A | 0.01 | 0.48 | 0.69 | 0.39 | 0.55 | 1.50 | 1.27 |
| Peak Inflow Q (cfs) = | N/A | N/A | 11.8 | 15.3 | 18.1 | 23.0 | 26.7 | 32.2 | 41.4 |
| Peak Outflow Q (cfs) = | 0.1 | 0.5 | 0.3 | 0.5 | 2.1 | 4.5 | 4.7 | 4.9 | 5.1 |
| Ratio Peak Outflow to Predevelopment Q = | N/A | N/A | N/A | 0.1 | 0.3 | 1.0 | 0.8 | 0.3 | 0.4 |
| Structure Controlling Flow = | Plate | Plate | Plate | Plate | Overflow Weir 1 | Outlet Plate 1 | Outlet Plate 1 | Outlet Plate 1 | Outlet Plate 1 |
| Max Velocity through Grate 1 (fps) = | N/A | N/A | N/A | N/A | 0.1 | 0.4 | 0.4 | 0.4 | 0.4 |
| Max Velocity through Grate 2 (fps) = | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Time to Drain 97% of Inflow Volume (hours) = | 39 | 70 | 66 | 72 | 73 | 71 | 70 | 69 | 67 |
| Time to Drain 99% of Inflow Volume (hours) = | 41 | 75 | 69 | 76 | 78 | 77 | 77 | 77 | 77 |
| Maximum Ponding Depth (ft) = | 3.28 | 5.97 | 5.10 | 5.82 | 6.19 | 6.39 | 6.76 | 7.42 | 8.43 |
| Area at Maximum Ponding Depth (acres) = | 0.20 | 0.34 | 0.29 | 0.33 | 0.35 | 0.36 | 0.38 | 0.42 | 0.48 |
| Maximum Volume Stored (acre-ft) = | 0.262 | 0.973 | 0.699 | 0.923 | 1.044 | 1.115 | 1.255 | 1.514 | 1.966 |

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)



| 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 | 0.16 | 0.04 | 0.51 |
| | 0:15:00 | 0.00 | 0.00 | 1.40 | 2.34 | 2.83 | 1.90 | 2.36 | 2.36 | 3.29 |
| | 0:20:00 | 0.00 | 0.00 | 4.91 | 6.54 | 7.55 | 4.75 | 5.52 | 6.01 | 7.69 |
| | 0:25:00 | 0.00 | 0.00 | 10.11 | 13.61 | 16.08 | 9.90 | 11.52 | 12.51 | 16.16 |
| | 0:30:00 | 0.00 | 0.00 | 11.77 | 15.33 | 18.15 | 20.78 | 24.25 | 27.63 | 35.91 |
| | 0:35:00 | 0.00 | 0.00 | 10.64 | 13.70 | 16.11 | 23.01 | 26.72 | 32.15 | 41.35 |
| | 0:40:00 | 0.00 | 0.00 | 9.33 | 11.82 | 13.85 | 21.72 | 25.19 | 30.22 | 38.75 |
| | 0:45:00 | 0.00 | 0.00 | 7.87 | 10.13 | 11.95 | 18.88 | 21.92 | 27.14 | 34.81 |
| | 0:50:00 | 0.00 | 0.00 | 6.65 | 8.75 | 10.16 | 16.73 | 19.45 | 23.97 | 30.77 |
| | 0:55:00 | 0.00 | 0.00 | 5.73 | 7.52 | 8.79 | 14.02 | 16.27 | 20.55 | 26.42 |
| | 1:00:00 | 0.00 | 0.00 | 5.13 | 6.70 | 7.91 | 11.89 | 13.78 | 17.90 | 23.05 |
| | 1:05:00 | 0.00 | 0.00 | 4.65 | 6.04 | 7.22 | 10.46 | 12.09 | 16.16 | 20.83 |
| | 1:10:00 | 0.00 | 0.00 | 3.97 | 5.42 | 6.54 | 8.92 | 10.31 | 13.37 | 17.22 |
| | 1:15:00 | 0.00 | 0.00 | 3.33 | 4.67 | 5.89 | 7.57 | 8.74 | 10.93 | 14.07 |
| | 1:20:00 | 0.00 | 0.00 | 2.80 | 3.95 | 5.05 | 6.15 | 7.08 | 8.48 | 10.87 |
| | 1:25:00 | 0.00 | 0.00 | 2.42 | 3.45 | 4.24 | 4.98 | 5.70 | 6.45 | 8.21 |
| | 1:30:00 | 0.00 | 0.00 | 2.22 | 3.19 | 3.77 | 3.99 | 4.55 | 4.97 | 6.31 |
| | 1:35:00 | 0.00 | 0.00 | 2.13 | 3.05 | 3.47 | 3.40 | 3.87 | 4.10 | 5.18 |
| | 1:40:00 | 0.00 | 0.00 | 2.07 | 2.74 | 3.26 | 3.03 | 3.44 | 3.56 | 4.47 |
| | 1:45:00 | 0.00 | 0.00 | 2.04 | 2.51 | 3.11 | 2.79 | 3.15 | 3.18 | 3.98 |
| | 1:50:00 | 0.00 | 0.00 | 2.01 | 2.33 | 3.00 | 2.62 | 2.96 | 2.93 | 3.64 |
| | 1:55:00 | 0.00 | 0.00 | 1.75 | 2.20 | 2.85 | 2.51 | 2.83 | 2.74 | 3.40 |
| | 2:00:00 | 0.00 | 0.00 | 1.54 | 2.04 | 2.59 | 2.43 | 2.74 | 2.62 | 3.24 |
| | 2:05:00 | 0.00 | 0.00 | 1.16 | 1.53 | 1.93 | 1.82 | 2.05 | 1.95 | 2.41 |
| | 2:10:00 | 0.00 | 0.00 | 0.85 | 1.12 | 1.40 | 1.33 | 1.49 | 1.42 | 1.75 |
| | 2:15:00 | 0.00 | 0.00 | 0.62 | 0.81 | 1.02 | 0.97 | 1.09 | 1.04 | 1.28 |
| | 2:20:00 | 0.00 | 0.00 | 0.45 | 0.58 | 0.73 | 0.70 | 0.78 | 0.76 | 0.93 |
| | 2:25:00 | 0.00 | 0.00 | 0.32 | 0.40 | 0.52 | 0.49 | 0.55 | 0.54 | 0.66 |
| | 2:30:00 | 0.00 | 0.00 | 0.22 | 0.28 | 0.36 | 0.35 | 0.39 | 0.38 | 0.46 |
| | 2:35:00 | 0.00 | 0.00 | 0.14 | 0.19 | 0.25 | 0.24 | 0.27 | 0.26 | 0.32 |
| | 2:40:00 | 0.00 | 0.00 | 0.09 | 0.12 | 0.15 | 0.16 | 0.17 | 0.17 | 0.21 |
| | 2:45:00 | 0.00 | 0.00 | 0.04 | 0.07 | 0.08 | 0.09 | 0.10 | 0.10 | 0.12 |
| | 2:50:00 | 0.00 | 0.00 | 0.02 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.05 |
| | 2:55:00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| | 3:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:05:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:10:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:15:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:20:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:25:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:30:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:35:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:40:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:45:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:50:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:55:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| RUNOFF SUMMARY: EXISTING VS PROPOSED | | |
|--|---------------------------|-----------------------------|
| | 5-YEAR STORM (CFS) | 100-YEAR STORM (CFS) |
| TOTAL EXISTING ON-SITE FLOWS: | 8.17 | 33 |
| EXISTING ON-SITE FLOWS AT DP EX1: | 5.35 | 16.9 |
| EXISTING ON-SITE FLOWS AT DP EX2: | 2.8 | 18.81 |
| *PROPOSED TOTAL ON-SITE FLOWS AT DP UO: | 7.33 | 13.78 |
| NET RESULT: | 1.98 | -3.12 |

***PROPOSED FLOWS INCLUDE POND DISCHARGE AND BASINS A1, A2, B3, B4, B5**

Rock Chute Design Data

(Version WI-Nov. 2017, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Urban Collection at Palmer Village F2
Designer: SMW
Date: March 28, 2022

County: El Paso County
Checked by: _____
Date: _____

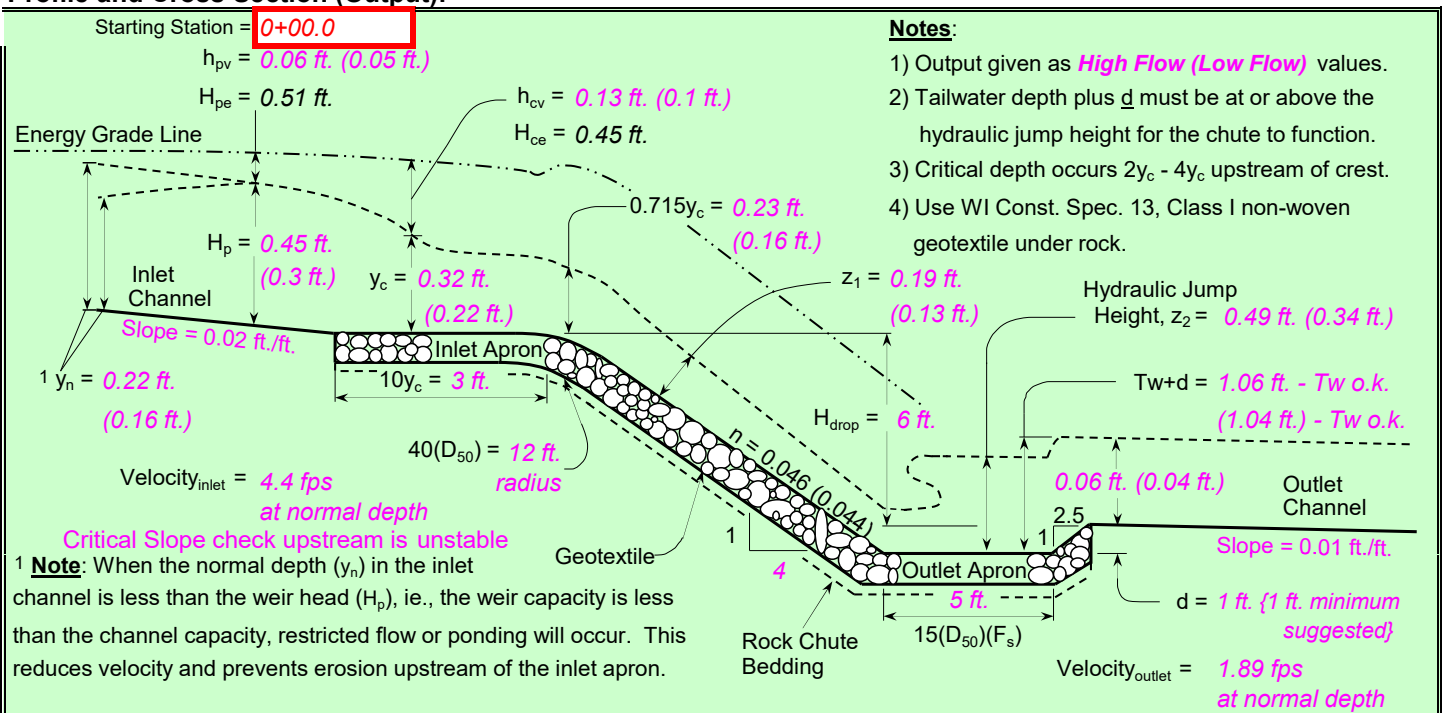
Input Geometry:

| Upstream Channel | Chute | Downstream Channel |
|---|--|----------------------------|
| Bw = 3.0 ft. | Bw = 3.0 ft. | Bw = 30.0 ft. |
| Side slopes = 2.0 (m:1) | Factor of safety = 1.20 (F_s) 1.2 Min | Side slopes = 4.0 (m:1) |
| Velocity n-value = 0.016 | Side slopes = 2.0 (m:1) → 2.0:1 max. | Velocity n-value = 0.012 |
| Bed slope = 0.0200 ft./ft. | Bed slope (4:1) = 0.250 ft./ft → 3.0:1 max. | Bed slope = 0.0100 ft./ft. |
| <i>Note: n value = a) velocity n from waterway program or b) computed manning's n for channel</i> | Freeboard = 0.5 ft. → | Base flow = 0.0 cfs |
| | Outlet apron depth, d = 1.0 ft. | |

Design Storm Data (Table 2, FOTG, WI-NRCS Grade Stabilization Structure No. 410):

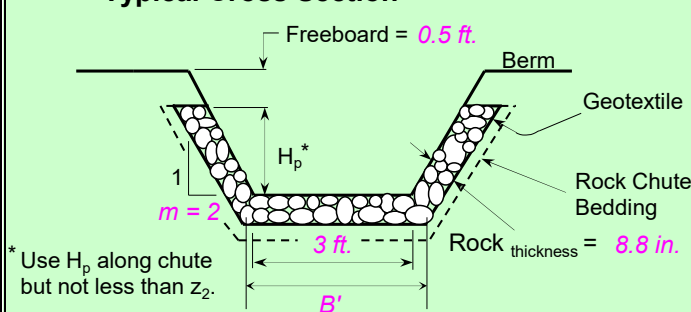
| | |
|--|---|
| Apron elev. --- Inlet = 6434.0 ft. ----- Outlet 6427.0 ft. --- ($H_{drop} = 6$ ft.) | Note: The total required capacity is routed through the chute (principal spillway) or in combination with an auxiliary spillway. |
| Q_{high} = Runoff from design storm capacity from Table 2, FOTG Standard 410 | Input tailwater (T_w): 0.25 1.20 |
| Q_5 = Runoff from a 5-year, 24-hour storm. | |
| $Q_{high} = 3.4$ cfs High flow storm through chute | → T_w (ft.) = Program |
| $Q_5 = 1.9$ cfs Low flow storm through chute | → T_w (ft.) = Program |

Profile and Cross Section (Output):



Profile Along Centerline of Chute

Typical Cross Section



| | |
|--|---------------------------------|
| $F_s = 1.20$ | Equivalent unit discharge |
| $Z_1 = 0.19$ ft. | Factor of safety (multiplier) |
| n-value = 0.046 | Normal depth in chute |
| $D_{50}(F_s) = 4.4$ in. | Manning's roughness coefficient |
| $2(D_{50})(F_s) = 8.8$ in. | Minimum Design D_{50} * |
| $T_w + d = 1.06$ ft. | Rock chute thickness |
| $Z_2 = 0.49$ ft. | Tailwater above outlet apron |
| *** The outlet will function adequately | Hydraulic jump height |

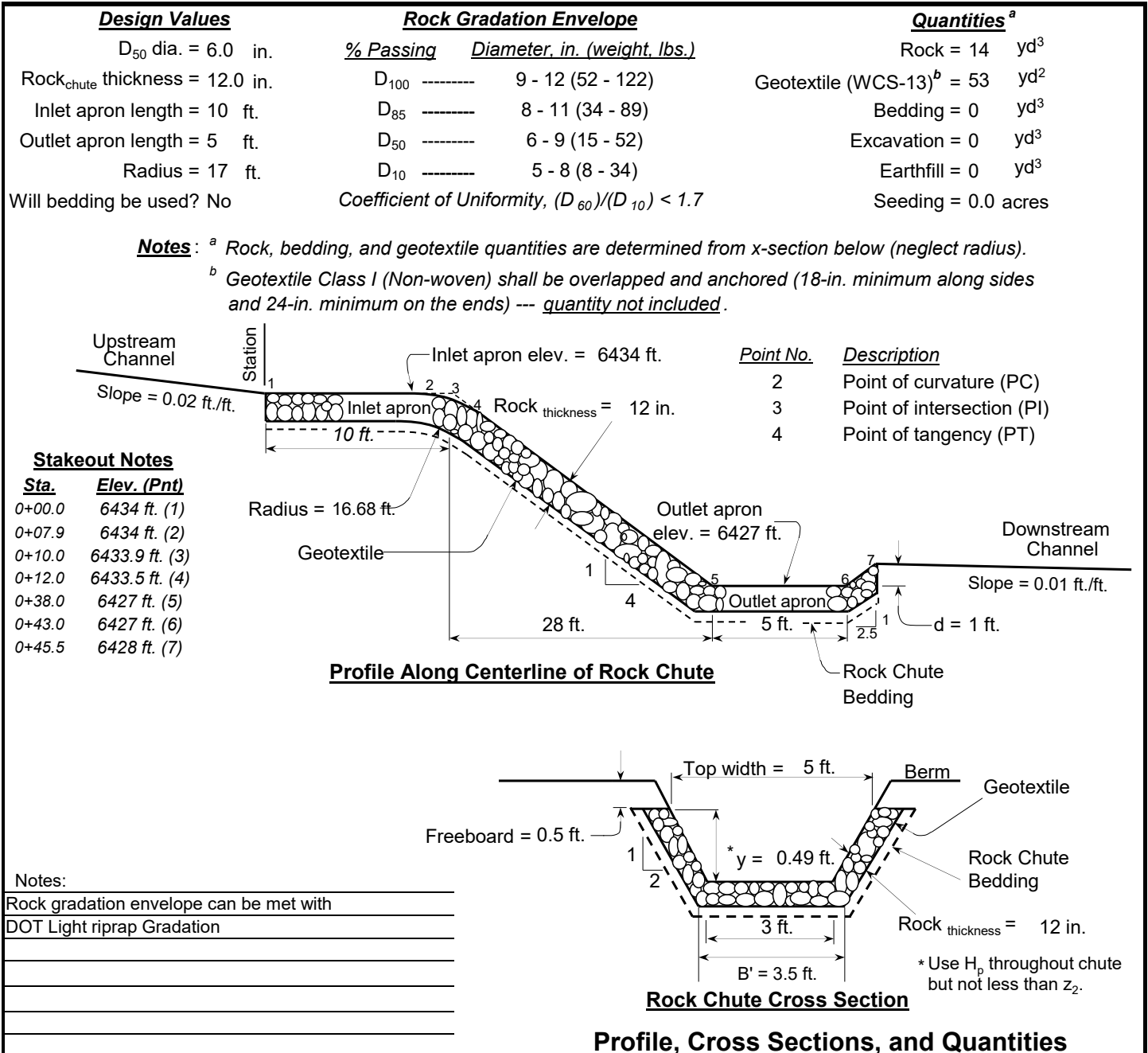
High Flow Storm Information

Rock Chute Design - Cut/Paste Plan

(Version WI-Nov. 2017, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Urban Collection at Palmer Village F2
Designer: SMW
Date: 3/28/2022

County: El Paso County
Checked by: _____
Date: _____



Notes:

| |
|---|
| Rock gradation envelope can be met with |
| DOT Light riprap Gradation |
| |
| |
| |
| |

| | | | |
|--|---------------------------------------|---------------------|------------------|
| NRCS <small>Natural Resources Conservation Service United States Department of Agriculture</small> | Urban Collection at Palmer Village F2 | Date | File Name |
| | El Paso County County | Designed <u>SMW</u> | _____ |
| | | Drawn _____ | _____ |
| | | Checked _____ | _____ |
| | | Approved _____ | _____ |
| | | _____ | Drawing Name |
| | | _____ | Sheet ___ of ___ |

Rock Chute Design Calculations

(Version WI-Nov. 2017, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Urban Collection at Palmer Village F2
Designer: SMW
Date: 3/28/2022

County: El Paso County
Checked by: _____
Date: _____

I. Calculate the normal depth in the inlet channel

| <u>High Flow</u> | <u>Low Flow</u> |
|---------------------------------|---|
| $y_n = 0.22$ ft. | $y_n = 0.16$ ft. (Normal depth) |
| Area = 0.8 ft ² | Area = 0.5 ft ² (Flow area in channel) |
| $Q_{high} = 3.4$ cfs | $Q_{low} = 1.9$ cfs (Capacity in channel) |
| Scupstreamchannel = 0.007 ft/ft | |

II. Calculate the critical depth in the chute

| <u>High Flow</u> | <u>Low Flow</u> |
|----------------------------|--|
| $y_c = 0.32$ ft. | $y_c = 0.22$ ft. (Critical depth in chute) |
| Area = 1.2 ft ² | Area = 0.8 ft ² (Flow area in channel) |
| $Q_{high} = 3.4$ cfs | $Q_{low} = 1.9$ cfs (Capacity in channel) |
| $H_{ce} = 0.45$ ft. | $H_{ce} = 0.32$ ft. (Total minimum specific energy head) |
| $h_{cv} = 0.13$ ft. | $h_{cv} = 0.10$ ft. (Velocity head corresponding to y_c) |
| $10y_c = 3.17$ ft. | --- (Required inlet apron length) |
| $0.715y_c = 0.23$ ft. | $0.715y_c = 0.16$ ft. (Depth of flow over the weir crest or brink) |

III. Calculate the tailwater depth in the outlet channel

| <u>High Flow</u> | <u>Low Flow</u> |
|----------------------------|--|
| $T_w = 0.06$ ft. | $T_w = 0.04$ ft. (Tailwater depth) |
| Area = 1.8 ft ² | Area = 1.3 ft ² (Flow area in channel) |
| $Q_{high} = 3.4$ cfs | $Q_{low} = 1.9$ cfs (Capacity in channel) |
| $H_2 = 0.00$ ft. | $H_2 = 0.00$ ft. (Downstream head above weir crest, $H_2 = 0$, if $H_2 < 0.715y_c$) |

IV. Calculate the head for a trapezoidal shaped broadcrested weir

$C_d = 1.00$ (Coefficient of discharge for broadcrested weirs)

| <u>High Flow</u> | <u>Low Flow</u> |
|----------------------------|--|
| $H_p = 0.49$ ft. | 0.45 ft. (Weir head) |
| Area = 1.9 ft ² | 1.7 ft ² (Flow area in channel) |
| $V_o = 0.00$ fps | 1.95 fps (Approach velocity) |
| $h_{pv} = 0.00$ ft. | 0.06 ft. (Velocity head corresponding to H_p) |
| $Q_{high} = 3.4$ cfs | 3.4 cfs (Capacity in channel) |

Trial and error procedure solving simultaneously for velocity and head

| <u>Low Flow</u> | <u>Low Flow</u> |
|----------------------------|--|
| $H_p = 0.34$ ft. | 0.30 ft. (Weir head) |
| Area = 1.2 ft ² | 1.1 ft ² (Flow area in channel) |
| $V_o = 0.00$ fps | 1.73 fps (Approach velocity) |
| $h_{pv} = 0.00$ ft. | 0.05 ft. (Velocity head corresponding to H_p) |
| $Q_{low} = 1.9$ cfs | 1.9 cfs (Capacity in channel) |

Trial and error procedure solving simultaneously for velocity and head

Rock Chute Design Calculations

(Version WI-Nov. 2017, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

| | |
|--|--|
| Project: <u>Urban Collection at Palmer Village F2</u> Designer: <u>SMW</u> Date: <u>3/28/2022</u> | County: <u>El Paso County</u> Checked by: _____ Date: _____ |
|--|--|

V. Calculate the rock chute parameters (w/o a factor of safety applied)

| <u>High Flow</u> | <u>Low Flow</u> |
|-------------------------------|---|
| $q_t = 0.09$ cms/m | $q_t = 0.05$ cms/m (Equivalent unit discharge) |
| $D_{50} = 92.71$ → (3.65 in.) | $D_{50} = 69.41$ mm (Median angular rock size) |
| $n = 0.046$ | $n = 0.044$ (Manning's roughness coefficient) |
| $z_1 = 0.19$ ft. | $z_1 = 0.13$ ft. (Normal depth in the chute) |
| $A_1 = 0.6$ ft ² | $A_1 = 0.4$ ft ² (Area associated with normal depth) |
| Velocity = 5.27 fps | Velocity = 4.34 fps (Velocity in chute slope) |
| $z_{mean} = 0.17$ ft. | $z_{mean} = 0.12$ ft. (Mean depth) |
| $F_1 = 2.24$ | $F_1 = 2.17$ (Froude number) |
| $L_{rock\ apron} = 4.56$ ft. | ---- (Length of rock outlet apron = 15*D ₅₀) |

VI. Calculate the height of hydraulic jump height (conjugate depth)

| <u>High Flow</u> | <u>Low Flow</u> |
|-----------------------------|--|
| $z_2 = 0.49$ ft. | $z_2 = 0.34$ ft. (Hydraulic jump height) |
| $Q_{high} = 3.4$ cfs | $Q_{high} = 1.9$ cfs (Capacity in channel) |
| $A_2 = 1.9$ ft ² | $A_2 = 1.2$ ft ² (Flow area in channel) |

VII. Calculate the energy lost through the jump (absorbed by the rock)

| <u>High Flow</u> | <u>Low Flow</u> |
|------------------|--|
| $E_1 = 0.62$ ft. | $E_1 = 0.43$ ft. (Total energy <u>before</u> the jump) |
| $E_2 = 0.53$ ft. | $E_2 = 0.37$ ft. (Total energy <u>after</u> the jump) |
| $R_E = 14.21$ % | $R_E = 12.75$ % (Relative loss of energy) |

Calculate Quantities for Rock Chute

| <u>-----Rock Riprap Volume-----</u> | |
|---|-----------------------------|
| <u>Area Calculations</u> | <u>Length @ Rock CL</u> |
| $h = 0.49$ | Inlet = 9.94 |
| $x_1 = 2.24$ | Outlet = 5.16 |
| $L = 1.10$ | Slope = 28.86 |
| $A_s = 1.10$ | 2.5:1 Lip = 2.59 |
| $x_2 = 2.00$ | Total = 46.55 ft. |
| $A_b = 5.47$ | Rock Volume |
| $A_b + 2 * A_s = 7.66$ ft² | 13.21 yd³ |

| <u>-----Bedding Volume-----</u> | |
|---|----------------------------|
| <u>Area Calculations</u> | <u>Bedding Thickness</u> |
| $h = 1.49$ | $t_1, t_2 = 0.00$ in. |
| $x_1 = 0.00$ | |
| $L = 3.33$ | |
| $A_s = 0.00$ | Length @ Bed CL |
| $x_2 = 0.00$ | Total = 46.54 ft. |
| $A_b = 0.00$ | Bedding Volume |
| $A_b + 2 * A_s = 0.00$ ft² | 0.00 yd³ |

| <u>-----Geotextile Quantity-----</u> | |
|--------------------------------------|-----------------------------|
| <u>Width</u> | <u>Length @ Bot. Rock</u> |
| 2*Slope = 6.66 | Total = 46.54 ft. |
| Bottom = 3.47 | Geotextile Area |
| Total = 10.14 ft. | 52.41 yd² |

Note: 1) The radius is not considered when calculating quantities of riprap, bedding, or geotextile.
 2) The geotextile quantity does not include over-lapping (18-in. min.) or anchoring material (18-in. min. along sides, 24-in. min. on ends).

| Forebay Release and Configuration | Required | Forebay B | |
|--|----------|--------------------------------|--------------|
| | | Flow: Q ₁₀₀ = (cfs) | Release Rate |
| Release 2% of the undetained 100-year peak discharge by way of a wall/notch or berm/pipe configuration | | 3.37 | 0.07 |

| Minimum Forebay Volume Required | | 40hr drain time a = 1 | Required (CF) | Provided (CF) |
|---------------------------------|--|-------------------------|---------------|---------------|
| 1% of the WQCV | | l = 0.79 A = 0.46 AC | 5.38 | 24.00 |

| Maximum Forebay Depth | Required | Provided | |
|-----------------------|----------|----------|----------------------------|
| | 12" Max | 12" | Concrete Forebay Structure |

| Forebay Notch Calculations | | |
|-----------------------------|------------------------|---|
| $Q = C_o A_o (2gH_o)^{0.5}$ | | |
| Q _a | 0.07 cfs | 2% of Peak 100 YR Discharge for contributing Sub-Basins |
| C _o | 0.6 | |
| H _o | 0.5 ft | |
| g | 32.2 ft/s ² | |
| A _a | 0.02 ft ² | |
| L _a | 0.01 ft | |
| | 0.16 in | 3" Minimum per Criteria |

WQCV = a(0.91l³ - 1.19l² + 0.78l) Equation 3-1

Where:

- WQCV = Water Quality Capture Volume (watershed inches)
- a = Coefficient corresponding to WQCV drain time (Table 3-2)
- l = Imperviousness (%/100) (see Figures 3-3 through 3-5 [single family land use] and /or the Runoff chapter of Volume 1[other typical land uses])

Table 3-2. Drain Time Coefficients for WQCV Calculations

| Drain Time (hrs) | Coefficient, a |
|------------------|----------------|
| 12 hours | 0.8 |
| 24 hours | 0.9 |
| 40 hours | 1.0 |

| | | Forebay A | |
|--|----------|-------------------------|--------------|
| Forebay Release and Configuration | Required | Flow: Q_{100} = (cfs) | Release Rate |
| Release 2% of the undetained 100-year peak discharge by way of a wall/notch or berm/pipe configuration | | 16.00 | 0.32 |

| Minimum Forebay Volume Required | | 40hr drain time $a = 1$ | Required (CF) | Provided (CF) |
|---------------------------------|--|-----------------------------|---------------|---------------|
| 1% of the WQCV | | $I = 0.66$ $A = 2.27$ AC | 21.26 | 24.00 |

| Maximum Forebay Depth | Required | Provided | |
|-----------------------|----------|----------|----------------------------|
| | 12" Max | 12" | Concrete Forebay Structure |

| Forebay Notch Calculations | | |
|-----------------------------|----------------|---|
| $Q = C_o A_o (2gH_o)^{0.5}$ | | |
| Q_a | 0.32 cfs | 2% of Peak 100 YR Discharge for contributing Sub-Basins |
| C_o | 0.6 | |
| H_o | 0.5 ft | |
| g | 32.2 ft/s^2 | |
| A_a | 0.09 ft^2 | |
| L_a | 0.06 ft | |
| | 0.75 in | 3" Minimum per Criteria |

$WQCV = a(0.91I^3 - 1.19I^2 + 0.78I)$ Equation 3-1

Where:

- WQCV = Water Quality Capture Volume (watershed inches)
- a = Coefficient corresponding to WQCV drain time (Table 3-2)
- I = Imperviousness (%/100) (see Figures 3-3 through 3-5 [single family land use] and /or the *Runoff* chapter of Volume 1 [other typical land uses])

Table 3-2. Drain Time Coefficients for WQCV Calculations

| Drain Time (hrs) | Coefficient, a |
|------------------|----------------|
| 12 hours | 0.8 |
| 24 hours | 0.9 |
| 40 hours | 1.0 |

| | | Forebay C | |
|--|--|-------------------------|--------------|
| | | Required | Release Rate |
| Forebay Release and Configuration | Release 2% of the undetained 100-year peak discharge by way of a wall/notch or berm/pipe configuration | Flow: $Q_{100} =$ (cfs) | |
| | | 43.57 | 1.31 |

| | | Required (CF) | Provided (CF) |
|--|--|---------------|---------------|
| Minimum Forebay Volume Required | 3% of the WQCV for contributing basins | | |
| | 40hr drain time $a = 1$ $I = 0.78$ $A = 6.31$ AC | 144.87 | 147.00 |

| Maximum Forebay Depth | Required | Provided |
|-----------------------|----------|----------|
| | 18" Max | 18" |

Concrete Forebay Structure

| Forebay Notch Calculations | | |
|-----------------------------|------------------------|---|
| $Q = C_o A_o (2gH_o)^{0.5}$ | | |
| Q_a | 1.31 cfs | 2% of Peak 100 YR Discharge for contributing Sub-Basins |
| C_o | 0.6 | |
| H_o | 0.5 ft | |
| g | 32.2 ft/s ² | |
| A_a | 0.38 ft ² | |
| L_a | 0.26 ft | |
| | 3.07 in | 3" Minimum per Criteria |

$WQCV = a(0.91I^3 - 1.19I^2 + 0.78I)$ Equation 3-1

Where:

- WQCV = Water Quality Capture Volume (watershed inches)
- a = Coefficient corresponding to WQCV drain time (Table 3-2)
- I = Imperviousness (%/100) (see Figures 3-3 through 3-5 [single family land use] and /or the *Runoff* chapter of Volume 1[other typical land uses])

Table 3-2. Drain Time Coefficients for WQCV Calculations

| Drain Time (hrs) | Coefficient, a |
|------------------|----------------|
| 12 hours | 0.8 |
| 24 hours | 0.9 |
| 40 hours | 1.0 |

APPENDIX D: SITE PHOTOS



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8

APPENDIX E: EXCEPTS FROM ADJACENT PROPERTY DRAINAGE REPORTS

**FINAL DRAINAGE REPORT
FOR
URBAN COLLECTION AT PALMER VILLAGE**

Prepared For:

**MDC Holdings – Richmond American Homes
4350 South Monaco Street
Denver, CO 80237
720-977-3827**

**PCD Filing No.:
SF-20-028**

**April 23, 2021
Project No. 25149.01**

**Prepared By:
JR Engineering, LLC
5475 Tech Center Drive, Suite 235
Colorado Springs, CO 80919
719-593-2593**

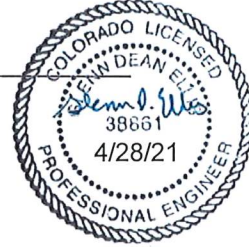
FINAL DRAINAGE REPORT FOR
URBAN COLLECTION AT PALMER VILLAGE

April 2021

ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

Glenn D. Ellis, Colorado P.E. 38861
For and On Behalf of JR Engineering, LLC



DEVELOPER'S STATEMENT:

I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: MDC Holdings – Richmond American Homes

By: 
Jason J.W. Pock


Title: VP of Land Acquisition & Entitlements

Address: 4350 South Monaco Street
Denver, CO 80237

El Paso County:

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual, Volumes 1 and 2 and Engineering Criteria Manual, as amended.

Jennifer Irvine, P.E.
County Engineer/ ECM Administrator

| | |
|--|--|
| <p>Approved by Jeff Rice El Paso County Planning and Community Development on behalf of Elizabeth Nijkamp, Engineering Review Manager</p> | <p>Date  09/07/2021 10:32:14 AM</p> |
|--|--|

Conditions:

north to the sump Double Type 16 inlet at DP23. In the event that the inlet at DP22 becomes clogged, the flow would follow the curb flowline north to the sump Double Type 16 inlet at DP23.

The total combined flow at DP23 from Basin B7, DP20, and DP22 flow-by is $Q_5=2.6$ cfs and $Q_{100}=5.6$ cfs. All flow at DP23 is captured and combines with flow from DP18.1 at DP23.1. In the event the inlet at DP23 becomes clogged, the flow will overtop the road crown to the north and enter the sump Triple Type 16 inlet at DP24.

Total flows at DP22.1 are $Q_5=1.7$ cfs and $Q_{100}=3.5$ cfs. The flow is conveyed via 18" RCP to DP23.1, where it combines with flow from DP23.

Total flows at DP23.1 from DP18.1, DP22.1, and DP23 are $Q_5=8.2$ cfs and $Q_{100}=16.5$ cfs. The flow is conveyed via 24" RCP to DP24.1, where it combines with flow from DP19 and DP24.

Total flows at DP24.1 are $Q_5=10.2$ cfs and $Q_{100}=21.5$ cfs. The flow is conveyed via 30" RCP to Pond B at DP25, where it combines with flow from Basin B11.

Basin B11 consists of approximately 0.55 acres of walks and landscaped areas and contains Full-Spectrum Water Quality and Detention Pond B. Flow from this basin ($Q_5=0.3$ cfs and $Q_{100}=1.7$ cfs) sheet flows directly into Pond B where it combines with flow from DP24.1 at DP25. A detailed discussion of Full-Spectrum Water Quality and Detention Pond B is presented in the Water Quality section later in this report.

Total flows at DP25 are $Q_5=10.4$ cfs and $Q_{100}=22.9$ cfs. All flow at DP25 is routed through the Pond B outlet structure and proposed RCP (various sizes) before discharging into the existing double 10'x6' concrete box culvert that conveys a tributary to the East Fork Sand Creek.

Basin B12 consists of approximately 0.06 acres of landscaped areas and sidewalk. Due to topographical constraints, flow from this basin ($Q_5=0.1$ cfs and $Q_{100}=0.3$ cfs) will discharge directly into Constitution Avenue curb and gutter at DP26, which conveys the flow east to an existing Type R inlet about 670 feet east of Hannah Ridge Drive.

Basin B13 consists of approximately 0.18 acres of landscaped areas and sidewalk. Due to topographical constraints, flow from this basin ($Q_5=0.3$ cfs and $Q_{100}=0.9$ cfs) will discharge directly into Constitution Avenue curb and gutter at DP27, and will follow the same flow path as Basin B12.

Basin B14 consists of approximately 0.17 acres of landscaped areas and contains approximately 1,870 square feet of asphalt roadway. Flow from this basin ($Q_5=0.2$ cfs and $Q_{100}=0.7$ cfs) follows historic drainage patterns and sheet flows offsite at DP28, along the eastern site boundary, eventually flowing directly into the Tributary to Sand Creek – East Fork Reach No. 6.

Basin B15 consists of approximately 0.17 acres of walks and landscaped areas. Flow from this basin ($Q_5=0.2$ cfs and $Q_{100}=0.6$ cfs) follows historic drainage patterns and sheet flows easterly offsite at DP29 to Tributary to Sand Creek – East Fork Reach No. 6.

Basin B16 consists of approximately 0.11 acres of landscaped areas and will remain undeveloped. Flow from this basin ($Q_5=0.1$ cfs and $Q_{100}=0.3$ cfs) is conveyed in a grass-lined swale onsite before discharging to the east property line at DP30. From here, the flow follows historic drainage patterns to the Tributary to Sand Creek – East Fork Reach No. 6.

DRAINAGE DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

Storm drainage analysis and design criteria for this project were taken from the “*City of Colorado Springs/El Paso County Drainage Criteria Manual*” Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the “*Urban Storm Drainage Criteria Manual*” Volumes 1 to 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the “*Colorado Springs Drainage Criteria Manual*” (CSDCM), dated May 2014, as adopted by El Paso County.

HYDROLOGIC CRITERIA

All hydrologic data was obtained from the “*El Paso Drainage Criteria Manual*” Volumes 1 and 2, and the “*Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual*” Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5-year (minor) storm event and the 100-year (major) storm event. Runoff was calculated using the Rational Method, and rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Table 6-2 of the CSDCM. One hour point rainfall data for the storm events is identified in the chart below. Runoff coefficients were determined based on proposed land use and from data in Table 6-6 from the CSDCM. Time of concentrations were developed using equations from CSDCM. All runoff calculations and applicable charts and graphs are included in the Appendices.

Table 2 - 1-hr Point Rainfall Data

| Storm | Rainfall (in.) |
|--------------|-----------------------|
| 5-year | 1.50 |
| 100-year | 2.52 |

HYDRAULIC CRITERIA

The Rational Method and USDCM’s SF-2 and SF-3 forms were used to determine the runoff from the minor and major storms on the site, and the UDFCD UD-Detention v4.04 spreadsheet was utilized for evaluating proposed detention and water quality pond. Sump and on-grade inlets were sized using UDFCD UD-Inlet v4.05. Manning’s equation was used to size the proposed pipes in this report and StormCAD was used to model the proposed storm sewer system and to analyze the

PALRMER VILLAGE - PROPOSED DRAINAGE SUMMARY

| BASIN 'A' SUMMARY TABLE | | | | | | | |
|-------------------------|---------|------------|-------|-----------|-------|-------|-----------|
| Tributary | Area | Percent | | | t_c | Q_5 | Q_{100} |
| Sub-basin | (acres) | Impervious | C_5 | C_{100} | (min) | (cfs) | (cfs) |
| EX1 | 0.15 | 0% | 0.08 | 0.35 | 7.9 | 0.0 | 0.2 |
| EX2 | 0.46 | 0% | 0.08 | 0.35 | 8.1 | 0.2 | 0.7 |
| A1 | 0.78 | 75% | 0.65 | 0.77 | 5.5 | 2.6 | 5.1 |
| A2 | 0.22 | 67% | 0.63 | 0.76 | 7.8 | 0.6 | 1.3 |
| A3 | 0.11 | 63% | 0.60 | 0.74 | 6.2 | 0.3 | 0.7 |
| A4 | 0.62 | 75% | 0.65 | 0.76 | 5.2 | 2.0 | 4.0 |
| A5 | 0.83 | 55% | 0.50 | 0.65 | 7.0 | 2.0 | 4.2 |
| A6 | 0.18 | 84% | 0.74 | 0.84 | 7.9 | 0.6 | 1.1 |
| A7 | 0.46 | 67% | 0.60 | 0.73 | 5.8 | 1.3 | 2.7 |
| A8 | 0.75 | 48% | 0.44 | 0.61 | 7.8 | 1.5 | 3.5 |
| A9 | 0.57 | 72% | 0.66 | 0.77 | 6.9 | 1.8 | 3.5 |
| A10 | 0.78 | 5% | 0.12 | 0.38 | 9.4 | 0.4 | 2.1 |
| A11 | 0.16 | 40% | 0.41 | 0.60 | 9.8 | 0.3 | 0.6 |
| A12 | 0.13 | 39% | 0.40 | 0.59 | 7.8 | 0.2 | 0.6 |

| DESIGN POINT SUMMARY TABLE | | |
|----------------------------|-------------|-----------------|
| Design Point | Q_5 (cfs) | Q_{100} (cfs) |
| EX1 | 0.04 | 0.2 |
| EX2 | 0.2 | 0.7 |
| 1 | 2.3 | 4.9 |
| 2 | 2.0 | 4.7 |
| 3 | 3.0 | 6.2 |
| 4 | 2.4 | 5.7 |
| 4.1 | 4.8 | 9.4 |
| 5 | 2.0 | 4.2 |
| 5.1 | 6.7 | 13.5 |
| 6 | 1.8 | 4.8 |
| 7 | 1.5 | 3.5 |
| 8 | 2.4 | 5.9 |
| 8.1 | 8.8 | 15.0 |
| 9 | 3.4 | 9.2 |
| 9.1 | 11.9 | 23.9 |
| 10 | 12.1 | 25.7 |
| 11 | 0.3 | 0.6 |
| 12 | 0.2 | 0.6 |

| BASIN 'B' SUMMARY TABLE | | | | | | | |
|-------------------------|---------|------------|-------|-----------|-------|-------|-----------|
| Tributary | Area | Percent | | | t_c | Q_5 | Q_{100} |
| Sub-basin | (acres) | Impervious | C_5 | C_{100} | (min) | (cfs) | (cfs) |
| B1 | 0.61 | 55% | 0.50 | 0.65 | 6.3 | 1.4 | 3.2 |
| B2 | 0.08 | 100% | 0.90 | 0.96 | 5.0 | 0.4 | 0.6 |
| B3 | 0.12 | 87% | 0.79 | 0.88 | 5.0 | 0.5 | 0.9 |
| B4 | 0.76 | 75% | 0.66 | 0.77 | 5.9 | 2.5 | 4.9 |
| B5 | 0.66 | 53% | 0.49 | 0.64 | 6.2 | 1.6 | 3.5 |
| B6 | 0.08 | 84% | 0.77 | 0.87 | 5.0 | 0.3 | 0.6 |
| B7 | 0.13 | 88% | 0.80 | 0.89 | 5.0 | 0.5 | 1.0 |
| B8 | 0.72 | 68% | 0.60 | 0.72 | 5.5 | 2.2 | 4.4 |
| B9 | 0.31 | 2% | 0.10 | 0.36 | 5.6 | 0.1 | 0.9 |
| B10 | 0.55 | 65% | 0.59 | 0.72 | 6.4 | 1.6 | 3.2 |
| B11 | 0.55 | 3% | 0.10 | 0.37 | 5.6 | 0.3 | 1.7 |
| B12 | 0.06 | 36% | 0.37 | 0.57 | 5.0 | 0.1 | 0.3 |
| B13 | 0.18 | 39% | 0.40 | 0.59 | 7.0 | 0.3 | 0.9 |
| B14 | 0.17 | 21% | 0.25 | 0.48 | 5.6 | 0.2 | 0.7 |
| B15 | 0.17 | 11% | 0.17 | 0.42 | 5.0 | 0.2 | 0.6 |
| B16 | 0.11 | 0% | 0.08 | 0.35 | 5.0 | 0.1 | 0.3 |

| DESIGN POINT SUMMARY TABLE | | |
|----------------------------|-------------|-----------------|
| Design Point | Q_5 (cfs) | Q_{100} (cfs) |
| 15 | 1.4 | 3.2 |
| 16 | 2.5 | 4.9 |
| 17 | 1.7 | 3.6 |
| 18 | 2.8 | 5.4 |
| 18.1 | 4.2 | 7.8 |
| 19 | 1.9 | 4.8 |
| 20 | 2.2 | 4.4 |
| 21 | 0.1 | 0.9 |
| 22 | 1.6 | 3.2 |
| 22.1 | 1.7 | 3.5 |
| 23 | 2.6 | 5.6 |
| 23.1 | 8.2 | 16.5 |
| 24 | 1.0 | 3.2 |
| 24.1 | 10.2 | 21.5 |
| 25 | 10.4 | 22.9 |
| 26 | 0.3 | 1.7 |
| 27 | 0.1 | 0.3 |
| 28 | 0.3 | 0.9 |
| 29 | 0.2 | 0.7 |
| 30 | 0.1 | 0.3 |

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: PALMER VILLAGE
 Location: Colorado Springs

Project Name: PALMER VILLAGE
 Project No.: 2514901
 Calculated By: RPD
 Checked By: _____
 Date: 1/27/21

| Basin ID | Total Area (ac) | Drives/Walks | | | Roofs | | | Lawns | | | Basins Total Weighted % Imp. |
|------------|-----------------|--------------|-----------|-----------------|--------|-----------|-----------------|--------|-----------|-----------------|------------------------------|
| | | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | % Imp. | Area (ac) | Weighted % Imp. | |
| EX1 | 0.15 | 100% | 0.00 | 0.0% | 90% | 0.00 | 0.0% | 0% | 0.15 | 0.0% | 0.0% |
| EX2 | 0.46 | 100% | 0.00 | 0.0% | 90% | 0.00 | 0.0% | 0% | 0.46 | 0.0% | 0.0% |
| A1 | 0.78 | 100% | 0.28 | 36.2% | 90% | 0.33 | 38.3% | 0% | 0.17 | 0.0% | 74.5% |
| A2 | 0.22 | 100% | 0.15 | 67.3% | 90% | 0.00 | 0.0% | 0% | 0.07 | 0.0% | 67.3% |
| A3 | 0.11 | 100% | 0.07 | 63.3% | 90% | 0.00 | 0.0% | 0% | 0.04 | 0.0% | 63.3% |
| A4 | 0.62 | 100% | 0.16 | 26.6% | 90% | 0.33 | 48.3% | 0% | 0.12 | 0.0% | 74.8% |
| A5 | 0.83 | 100% | 0.21 | 24.8% | 90% | 0.28 | 29.9% | 0% | 0.35 | 0.0% | 54.7% |
| A6 | 0.18 | 100% | 0.11 | 59.4% | 90% | 0.05 | 24.5% | 0% | 0.02 | 0.0% | 83.9% |
| A7 | 0.46 | 100% | 0.16 | 34.5% | 90% | 0.17 | 32.7% | 0% | 0.13 | 0.0% | 67.1% |
| A8 | 0.75 | 100% | 0.16 | 20.9% | 90% | 0.22 | 26.6% | 0% | 0.37 | 0.0% | 47.5% |
| A9 | 0.57 | 100% | 0.32 | 54.9% | 90% | 0.11 | 17.4% | 0% | 0.15 | 0.0% | 72.3% |
| A10 | 0.78 | 100% | 0.04 | 5.2% | 90% | 0.00 | 0.0% | 0% | 0.74 | 0.0% | 5.2% |
| A11 | 0.16 | 100% | 0.06 | 40.5% | 90% | 0.00 | 0.0% | 0% | 0.09 | 0.0% | 40.5% |
| A12 | 0.13 | 100% | 0.05 | 38.9% | 90% | 0.00 | 0.0% | 0% | 0.08 | 0.0% | 38.9% |
| | | | | | | | | | | | |
| B1 | 0.61 | 100% | 0.13 | 21.6% | 90% | 0.22 | 33.0% | 0% | 0.25 | 0.0% | 54.6% |
| B2 | 0.08 | 100% | 0.08 | 100.0% | 90% | 0.00 | 0.0% | 0% | 0.00 | 0.0% | 100.0% |
| B3 | 0.12 | 100% | 0.10 | 87.0% | 90% | 0.00 | 0.0% | 0% | 0.02 | 0.0% | 87.0% |
| B4 | 0.76 | 100% | 0.27 | 35.8% | 90% | 0.33 | 39.2% | 0% | 0.16 | 0.0% | 75.0% |
| B5 | 0.66 | 100% | 0.15 | 23.0% | 90% | 0.22 | 30.0% | 0% | 0.29 | 0.0% | 53.0% |
| B6 | 0.08 | 100% | 0.07 | 84.4% | 90% | 0.00 | 0.0% | 0% | 0.01 | 0.0% | 84.4% |
| B7 | 0.13 | 100% | 0.11 | 87.9% | 90% | 0.00 | 0.0% | 0% | 0.02 | 0.0% | 87.9% |
| B8 | 0.72 | 100% | 0.19 | 26.4% | 90% | 0.33 | 41.6% | 0% | 0.20 | 0.0% | 68.0% |
| B9 | 0.31 | 100% | 0.01 | 2.2% | 90% | 0.00 | 0.0% | 0% | 0.30 | 0.0% | 2.2% |
| B10 | 0.55 | 100% | 0.21 | 38.0% | 90% | 0.17 | 27.0% | 0% | 0.18 | 0.0% | 65.0% |
| B11 | 0.55 | 100% | 0.02 | 2.8% | 90% | 0.00 | 0.0% | 0% | 0.54 | 0.0% | 2.8% |
| B12 | 0.06 | 100% | 0.02 | 36.0% | 90% | 0.00 | 0.0% | 0% | 0.04 | 0.0% | 36.0% |
| B13 | 0.18 | 100% | 0.07 | 39.3% | 90% | 0.00 | 0.0% | 0% | 0.11 | 0.0% | 39.3% |
| B14 | 0.17 | 100% | 0.04 | 20.7% | 90% | 0.00 | 0.0% | 0% | 0.14 | 0.0% | 20.7% |
| B15 | 0.17 | 100% | 0.02 | 11.0% | 90% | 0.00 | 0.0% | 0% | 0.15 | 0.0% | 11.0% |
| B16 | 0.11 | 100% | 0.00 | 0.0% | 90% | 0.00 | 0.0% | 0% | 0.11 | 0.0% | 0.0% |
| | | | | | | | | | | | |
| SITE TOTAL | 11.46 | | | | | | | | | SITE | 50.0% |
| WEST POND | 5.92 | | | | | | | | | WEST POND | 50.5% |
| EAST POND | 4.57 | | | | | | | | | EAST POND | 54.3% |

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: PALMER VILLAGE
 Location: Colorado Springs

Project Name: PALMER VILLAGE
 Project No.: 2514901
 Calculated By: RPD
 Checked By:
 Date: 1/27/21

| Basin ID | Total Area (ac) | Basins Total Weighted % Imp. | Hydrologic Soil Group | | | Land Use | | | Minor Coefficients | | | Major Coefficients | | | Basins Total Weighted C ₅ | Basins Total Weighted C ₁₀₀ |
|----------|-----------------|------------------------------|-----------------------|-------------|---------------|--------------------------|-----------------|-----------------|-------------------------------------|------------------------|------------------------|---------------------------------------|--------------------------|--------------------------|--------------------------------------|--|
| | | | Area A (ac) | Area B (ac) | Area C/D (ac) | Area Walks & Drives (ac) | Area Roofs (ac) | Area Lawns (ac) | C _{5,A,WALKS & DRIVES} | C _{5,A,ROOFS} | C _{5,A,LAWNS} | C _{100,A,WALKS & DRIVES} | C _{100,A,ROOFS} | C _{100,A,LAWNS} | | |
| EX1 | 0.15 | 0% | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.08 | 0.35 |
| EX2 | 0.46 | 0% | 0.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.46 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.08 | 0.35 |
| A1 | 0.78 | 75% | 0.78 | 0.00 | 0.00 | 0.28 | 0.33 | 0.17 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.65 | 0.77 |
| A2 | 0.22 | 67% | 0.22 | 0.00 | 0.00 | 0.15 | 0.00 | 0.07 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.63 | 0.76 |
| A3 | 0.11 | 63% | 0.11 | 0.00 | 0.00 | 0.07 | 0.00 | 0.04 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.60 | 0.74 |
| A4 | 0.62 | 75% | 0.62 | 0.00 | 0.00 | 0.16 | 0.33 | 0.12 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.65 | 0.76 |
| A5 | 0.83 | 55% | 0.83 | 0.00 | 0.00 | 0.21 | 0.28 | 0.35 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.50 | 0.65 |
| A6 | 0.18 | 84% | 0.18 | 0.00 | 0.00 | 0.11 | 0.05 | 0.02 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.74 | 0.84 |
| A7 | 0.46 | 67% | 0.46 | 0.00 | 0.00 | 0.16 | 0.17 | 0.13 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.60 | 0.73 |
| A8 | 0.75 | 48% | 0.75 | 0.00 | 0.00 | 0.16 | 0.22 | 0.37 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.44 | 0.61 |
| A9 | 0.57 | 72% | 0.57 | 0.00 | 0.00 | 0.32 | 0.11 | 0.15 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.66 | 0.77 |
| A10 | 0.78 | 5% | 0.78 | 0.00 | 0.00 | 0.04 | 0.00 | 0.74 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.12 | 0.38 |
| A11 | 0.16 | 40% | 0.16 | 0.00 | 0.00 | 0.06 | 0.00 | 0.09 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.41 | 0.60 |
| A12 | 0.13 | 39% | 0.13 | 0.00 | 0.00 | 0.05 | 0.00 | 0.08 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.40 | 0.59 |
| B1 | 0.61 | 55% | 0.61 | 0.00 | 0.00 | 0.13 | 0.22 | 0.25 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.50 | 0.65 |
| B2 | 0.08 | 100% | 0.08 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.90 | 0.96 |
| B3 | 0.12 | 87% | 0.12 | 0.00 | 0.00 | 0.10 | 0.00 | 0.02 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.79 | 0.88 |
| B4 | 0.76 | 75% | 0.76 | 0.00 | 0.00 | 0.27 | 0.33 | 0.16 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.66 | 0.77 |
| B5 | 0.66 | 53% | 0.66 | 0.00 | 0.00 | 0.15 | 0.22 | 0.29 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.49 | 0.64 |
| B6 | 0.08 | 84% | 0.08 | 0.00 | 0.00 | 0.07 | 0.00 | 0.01 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.77 | 0.87 |
| B7 | 0.13 | 88% | 0.13 | 0.00 | 0.00 | 0.11 | 0.00 | 0.02 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.80 | 0.89 |
| B8 | 0.72 | 68% | 0.72 | 0.00 | 0.00 | 0.19 | 0.33 | 0.20 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.60 | 0.72 |
| B9 | 0.31 | 2% | 0.31 | 0.00 | 0.00 | 0.01 | 0.00 | 0.30 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.10 | 0.36 |
| B10 | 0.55 | 65% | 0.55 | 0.00 | 0.00 | 0.21 | 0.17 | 0.18 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.59 | 0.72 |
| B11 | 0.55 | 3% | 0.55 | 0.00 | 0.00 | 0.02 | 0.00 | 0.54 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.10 | 0.37 |
| B12 | 0.06 | 36% | 0.06 | 0.00 | 0.00 | 0.02 | 0.00 | 0.04 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.37 | 0.57 |
| B13 | 0.18 | 39% | 0.18 | 0.00 | 0.00 | 0.07 | 0.00 | 0.11 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.40 | 0.59 |
| B14 | 0.17 | 21% | 0.17 | 0.00 | 0.00 | 0.04 | 0.00 | 0.14 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.25 | 0.48 |
| B15 | 0.17 | 11% | 0.17 | 0.00 | 0.00 | 0.02 | 0.00 | 0.15 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.17 | 0.42 |
| B16 | 0.11 | 0% | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.90 | 0.73 | 0.08 | 0.96 | 0.81 | 0.35 | 0.08 | 0.35 |
| TOTAL | 11.46 | 50.0% | 11.46 | 0.00 | 0.00 | 3.24 | 2.76 | 5.45 | --- | --- | --- | --- | --- | --- | 0.47 | 0.63 |

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 1/27/21

| SUB-BASIN | | | | | | INITIAL/OVERLAND | | | TRAVEL TIME | | | | | tc CHECK | | | FINAL |
|-----------|-----------|------------------------|----------------|----------------|------------------|-------------------|--------------------|----------------------|---------------------|--------------------|------|-------------|----------------------|----------------------------|-------------------|--------------------------------|----------------------|
| DATA | | | | | | (T _i) | | | (T _t) | | | | | (URBANIZED BASINS) | | | |
| BASIN ID | D.A. (ac) | Hydrologic Soils Group | Impervious (%) | C _s | C ₁₀₀ | L (ft) | S _o (%) | t _i (min) | L _t (ft) | S _t (%) | K | VEL. (ft/s) | t _t (min) | COMP. t _c (min) | TOTAL LENGTH (ft) | Urbanized t _c (min) | t _c (min) |
| EX1 | 0.15 | A | 0% | 0.08 | 0.35 | 50 | 5.0% | 7.7 | 26 | 5.0% | 10.0 | 2.2 | 0.2 | 7.9 | 76.0 | 26.2 | 7.9 |
| EX2 | 0.46 | A | 0% | 0.08 | 0.35 | 50 | 5.0% | 7.7 | 56 | 5.0% | 10.0 | 2.2 | 0.4 | 8.1 | 106.0 | 26.5 | 8.1 |
| A1 | 0.78 | A | 75% | 0.65 | 0.77 | 87 | 5.0% | 4.4 | 155 | 1.4% | 20.0 | 2.4 | 1.1 | 5.5 | 242.0 | 14.4 | 5.5 |
| A2 | 0.22 | A | 67% | 0.63 | 0.76 | 87 | 2.0% | 6.3 | 180 | 1.0% | 20.0 | 2.0 | 1.5 | 7.8 | 267.0 | 16.2 | 7.8 |
| A3 | 0.11 | A | 63% | 0.60 | 0.74 | 87 | 6.0% | 4.7 | 180 | 1.0% | 20.0 | 2.0 | 1.5 | 6.2 | 267.0 | 16.9 | 6.2 |
| A4 | 0.62 | A | 75% | 0.65 | 0.76 | 87 | 6.0% | 4.2 | 150 | 1.6% | 20.0 | 2.5 | 1.0 | 5.2 | 237.0 | 14.3 | 5.2 |
| A5 | 0.83 | A | 55% | 0.50 | 0.65 | 87 | 5.0% | 5.9 | 150 | 1.6% | 20.0 | 2.5 | 1.0 | 7.0 | 237.0 | 17.9 | 7.0 |
| A6 | 0.18 | A | 84% | 0.74 | 0.84 | 99 | 1.0% | 6.4 | 178 | 1.0% | 20.0 | 2.0 | 1.5 | 7.9 | 277.0 | 13.2 | 7.9 |
| A7 | 0.46 | A | 67% | 0.60 | 0.73 | 87 | 5.5% | 4.8 | 153 | 1.6% | 20.0 | 2.5 | 1.0 | 5.8 | 240.0 | 15.7 | 5.8 |
| A8 | 0.75 | A | 48% | 0.44 | 0.61 | 90 | 4.5% | 6.8 | 115 | 1.1% | 20.0 | 2.1 | 0.9 | 7.8 | 205.0 | 19.1 | 7.8 |
| A9 | 0.57 | A | 72% | 0.66 | 0.77 | 87 | 3.0% | 5.2 | 200 | 1.0% | 20.0 | 2.0 | 1.7 | 6.9 | 287.0 | 15.5 | 6.9 |
| A10 | 0.78 | A | 5% | 0.12 | 0.38 | 50 | 15.0% | 5.1 | 325 | 0.7% | 15.0 | 1.3 | 4.3 | 9.4 | 375.0 | 31.8 | 9.4 |
| A11 | 0.16 | A | 40% | 0.41 | 0.60 | 90 | 2.0% | 9.4 | 55 | 1.0% | 20.0 | 2.0 | 0.5 | 9.8 | 145.0 | 19.7 | 9.8 |
| A12 | 0.13 | A | 39% | 0.40 | 0.59 | 20 | 2.0% | 4.5 | 280 | 0.5% | 20.0 | 1.4 | 3.3 | 7.8 | 300.0 | 24.0 | 7.8 |
| B1 | 0.61 | A | 55% | 0.50 | 0.65 | 97 | 8.0% | 5.4 | 105 | 1.0% | 20.0 | 2.0 | 0.9 | 6.3 | 202.0 | 17.8 | 6.3 |
| B2 | 0.08 | A | 100% | 0.90 | 0.96 | 12 | 2.0% | 1.0 | 182 | 2.3% | 20.0 | 3.1 | 1.0 | 2.0 | 194.0 | 9.9 | 5.0 |
| B3 | 0.12 | A | 87% | 0.79 | 0.88 | 12 | 2.0% | 1.5 | 190 | 2.3% | 20.0 | 3.0 | 1.0 | 2.6 | 202.0 | 12.2 | 5.0 |
| B4 | 0.76 | A | 75% | 0.66 | 0.77 | 120 | 6.0% | 4.9 | 183 | 2.0% | 20.0 | 2.8 | 1.1 | 5.9 | 303.0 | 14.4 | 5.9 |
| B5 | 0.66 | A | 53% | 0.49 | 0.64 | 97 | 8.0% | 5.5 | 103 | 1.6% | 20.0 | 2.5 | 0.7 | 6.2 | 200.0 | 17.8 | 6.2 |
| B6 | 0.08 | A | 84% | 0.77 | 0.87 | 12 | 2.0% | 1.6 | 160 | 2.5% | 20.0 | 3.2 | 0.8 | 2.5 | 172.0 | 12.5 | 5.0 |
| B7 | 0.13 | A | 88% | 0.80 | 0.89 | 12 | 2.0% | 1.5 | 170 | 2.5% | 20.0 | 3.2 | 0.9 | 2.4 | 182.0 | 11.9 | 5.0 |
| B8 | 0.72 | A | 68% | 0.60 | 0.72 | 97 | 9.0% | 4.3 | 145 | 1.0% | 20.0 | 2.0 | 1.2 | 5.5 | 242.0 | 15.7 | 5.5 |
| B9 | 0.31 | A | 2% | 0.10 | 0.36 | 15 | 10.0% | 3.3 | 365 | 3.0% | 15.0 | 2.6 | 2.3 | 5.6 | 380.0 | 29.4 | 5.6 |
| B10 | 0.55 | A | 65% | 0.59 | 0.72 | 87 | 5.0% | 5.1 | 155 | 1.0% | 20.0 | 2.0 | 1.3 | 6.4 | 242.0 | 16.4 | 6.4 |
| B11 | 0.55 | A | 3% | 0.10 | 0.37 | 15 | 2.0% | 5.5 | 40 | 33.0% | 15.0 | 8.6 | 0.1 | 5.6 | 55.0 | 25.6 | 5.6 |
| B12 | 0.06 | A | 36% | 0.37 | 0.57 | 20 | 2.0% | 4.7 | 19 | 2.5% | 20.0 | 3.2 | 0.1 | 4.8 | 39.0 | 20.0 | 5.0 |
| B13 | 0.18 | A | 39% | 0.40 | 0.59 | 20 | 2.0% | 4.5 | 450 | 2.2% | 20.0 | 3.0 | 2.5 | 7.0 | 470.0 | 22.8 | 7.0 |
| B14 | 0.17 | A | 21% | 0.25 | 0.48 | 20 | 2.0% | 5.5 | 20 | 2.0% | 20.0 | 2.8 | 0.1 | 5.6 | 40.0 | 22.7 | 5.6 |
| B15 | 0.17 | A | 11% | 0.17 | 0.42 | 20 | 25.0% | 2.6 | 35 | 25.0% | 15.0 | 7.5 | 0.1 | 2.7 | 55.0 | 24.2 | 5.0 |
| B16 | 0.11 | A | 0% | 0.08 | 0.35 | 15 | 10.0% | 3.3 | 150 | 1.5% | 15.0 | 1.9 | 1.3 | 4.7 | 165.0 | 28.2 | 5.0 |

MP96001

**HYDROLOGY ANALYSIS
EAST FORK SAND CREEK
TRIBUTARY 6**

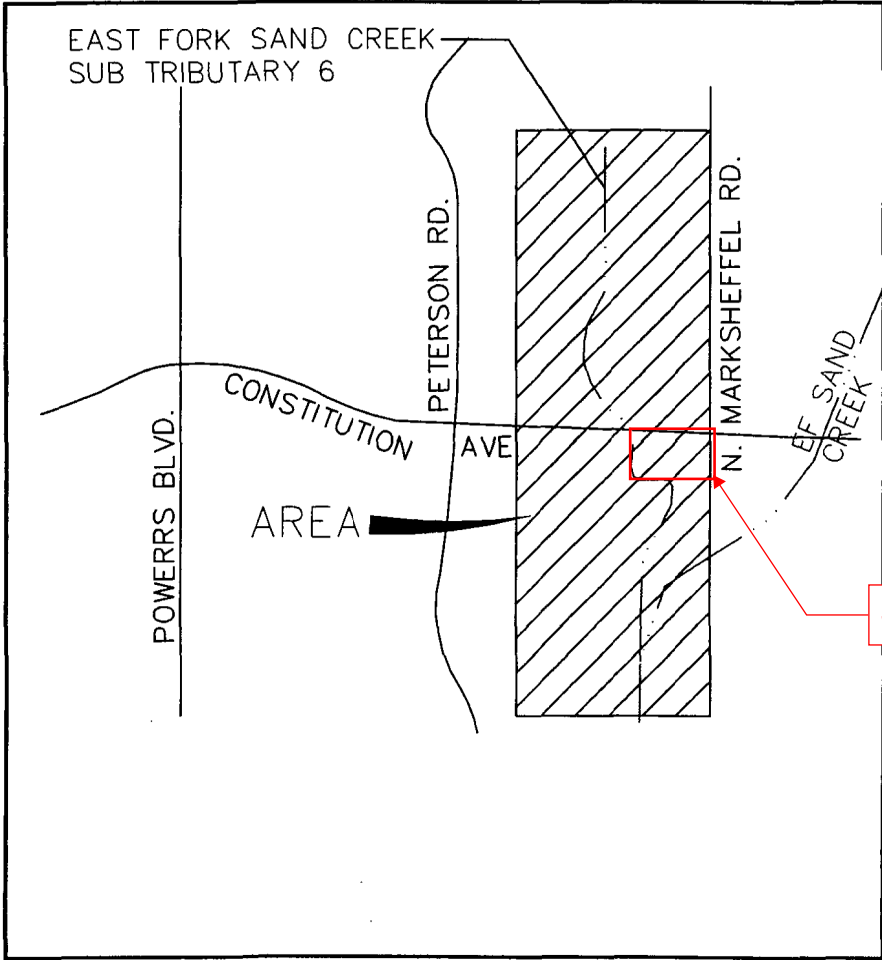
EL PASO COUNTY, COLORADO

Prepared for
Mr. Chuck Crum
MVE, Inc.
1903 Lelaray Street Suite 200
Colorado Springs, Colorado 80909

Prepared by
Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904

Project number 06040
August 31, 2006
Revised December 15, 2006
Revised January 18, 2007

RECEIVED
JAN 29 2007
EPC DEVELOPMENT SERVICES



NO SCALE

Kiowa Engineering Corporation

1604 South 21st Street
 Colorado Springs, Colorado
 80904-4208
 (719) 630-7342

SAND CREEK DBPS UPDATE
 VICINITY MAP
 COLORADO SPRINGS, COLORADO

FIGURE 1

PROJECT NO.: 06040
 DATE: 08/18/06
 DESIGN: RNW
 REVISIONS:

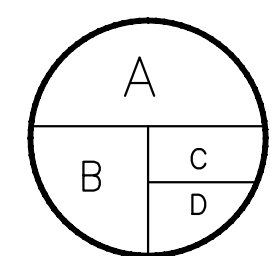
Table 1: Comparisons of Future Development Condition Peak Discharges

| Location | 1996 Sand Creek DBRS | | | | Design Point | 2006 Hydrology Update | | | |
|---|----------------------------------|----------------------|--------------|---------|--------------|----------------------------------|----------------------|--------------|---------|
| | Drainage Area (mi ²) | Peak Discharge (cfs) | | | | Drainage Area (mi ²) | Peak Discharge (cfs) | | |
| | | 100-year | 100yr cfs/ac | 10-year | | | 100-year | 100yr cfs/ac | 10-year |
| Tributary 6- East Fork Sand Creek: | | | | | | | | | |
| at Outfall East Fork Sand Creek | 1.43 | 1,671 | 1.83 | 702 | 8A | 1.91 | 2,088 | 1.71 | 925 |
| at Constitution Avenue | 1.14 | 1,581 | 2.17 | 640 | 8 | 1.07 | 1,076 | 1.57 | 457 |
| at Railroad embankment (inflow) | 0.69 | 990 | 2.24 | 490 | 14 | 0.66 | 915 | 2.17 | 374 |
| at Railroad embankment (outflow) | 0.69 | NA | NA | NA | 14 | 0.66 | 640 | 1.52 | 360 |
| at North Carefree Circle | 0.39 | 613 | 2.46 | 280 | 1 | 0.34 | 551 | 2.53 | 255 |

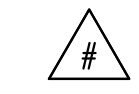
APPENDIX F: DRAINAGE MAPS

K:\DEN_Civil\096481004 - El Paso Constitution\CADD\PlanSheets\DR\096481004_EDR.dwg Menke, Joseph 8/19/2022 6:51 AM

LEGEND



A = BASIN DESIGNATION
 B = AREA (ACRES)
 C = 100-YR COMPOSITE RUNOFF COEFFICIENT
 D = 100-YR DESIGN STORM RUNOFF (CFS)



DESIGN POINT
 FLOW DIRECTION



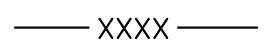
DRAINAGE BASIN BOUNDARY



PROPERTY LINE



PROPOSED MAJOR CONTOUR



PROPOSED MINOR CONTOUR



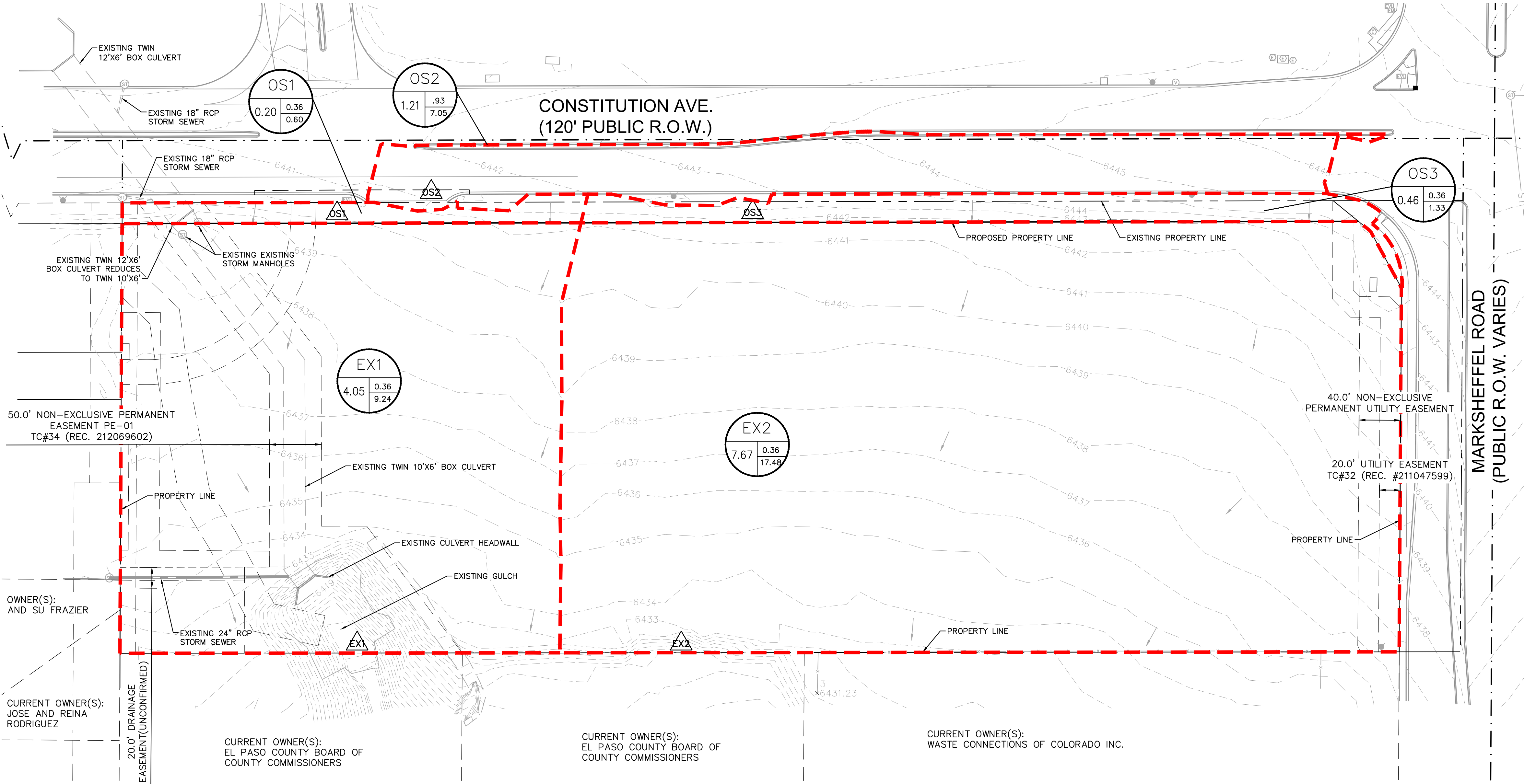
EXISTING MAJOR CONTOUR



EXISTING MINOR CONTOUR

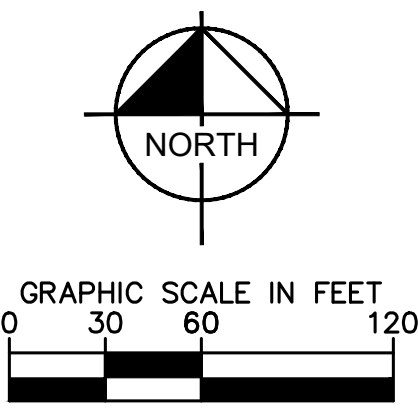
NOTES

- THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID DETAILED PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE ESTABLISHED CRITERIA FOR DETAILED DRAINAGE PLANS AND SPECIFICATIONS, AND SAID DETAILED PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH THE MASTER PLAN OF THE DRAINAGE BASIN. SAID DETAILED DRAINAGE PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR DRAINAGE FACILITY(S) IS DESIGNED. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR COMMISSIONS ON MY PART IN PREPARATION OF THE DETAILED DRAINAGE PLANS AND SPECIFICATIONS.
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| SUMMARY - EXISTING RUNOFF TABLE | | | | | | |
|---------------------------------|-------------------|--------------------|--------------------------|----------------------------|------------------------------|--------------------------------|
| DESIGN POINT | BASIN DESIGNATION | BASIN AREA (ACRES) | DIRECT 5-YR RUNOFF (CFS) | DIRECT 100-YR RUNOFF (CFS) | CUMULATIVE 5-YR RUNOFF (CFS) | CUMULATIVE 100-YR RUNOFF (CFS) |
| 1 | EX1 | 4.05 | 1.38 | 9.24 | 5.35 | 16.90 |
| 2 | EX2 | 7.67 | 2.61 | 17.48 | 2.80 | 18.81 |
| 3 | OS1 | 0.20 | 0.09 | 0.60 | 3.97 | 7.65 |
| 4 | OS2 | 1.21 | 3.89 | 7.05 | 3.89 | 7.05 |
| 5 | OS3 | 0.46 | 0.20 | 1.33 | 0.20 | 1.33 |

*ADDITIONAL FLOWS THROUGH THE SITE WITHIN EXISTING GULCH EQUAL TO APPROXIMATELY 1076 CFS IN THE 100-YEAR EVENT PER "HYDROLOGY ANALYSIS EAST FORK SAND CREEK TRIBUTARY 6 (MP96001)". THIS INCLUDES THE FLOWS ENTERING THE CULVERT FROM THE NORTH SIDE OF CONSTITUTION, NOT THE OVERLAND FLOWS ENTERING THE GULCH TO THE SOUTH OF CONSTITUTION FROM THE EXISTING SITE.



Kimley»Horn
 2022 KIMLEY-HORN AND ASSOCIATES, INC.
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THE CITIZEN ON CONSTITUTION
 EL PASO COUNTY, COLORADO
 GRADING EROSION CONTROL AND
 PUBLIC IMPROVEMENT PLAN
 EXISTING DRAINAGE MAP

PRELIMINARY
 FOR REVIEW ONLY
 NOT FOR CONSTRUCTION

PROJECT NO.
 096481004
 SHEET
C7.0

| NO. | REVISION | BY | DATE | APPR. |
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