FINAL DRAINAGE REPORT
FOR
THE VILLAS AT CLAREMONT RANCH

July 2022
Revised April 2023

Prepared for:

Phi Real Estate Services, LLC
200 W. City Center Dr. Ste 200
Pueblo, CO 81003

Prepared By:

CATAMOUNT
ENGINEERING
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PCD NO. SF-22-028

FINAL DRAINAGE REPORT
THE VILLAS AT CLAREMONT RANCH

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 the criteria established 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.

COLORADO LICENSED
DAVID L. MIJARES
40510
PROFESSIONAL ENGINEER

David L. Mijares, Colorado PE #40510   Date 12/14/22
For and on behalf of Catamount Engineering

Developer's Statement:

Premiere Homes Inc. the developer has read and will comply with all of the requirements specified in this drainage report and plan.

Phi Real Estate Services, LLC
Business Name

By: ____________________

Title: MANAGER

Address: 200 W. City Center Dr. Ste 200

Pueblo, CO 81003

El Paso County:

Filed in accordance with the requirements of the El Paso County land Development Code and the Drainage Criteria manual Volumes 1 and 2, and the El Paso County Engineering Criteria Manual, latest revision.

Josh Palmer, PE   Date
County Engineer/ECM Administrator

Conditions:

FINAL DRAINAGE REPORT for
THE VILLAS AT CLAREMONT RANCH

PURPOSE

The purpose of this drainage report is to identify existing drainage patterns, quantify developed storm water runoff, and establish outfall scenarios from the proposed development. Additionally, this analysis will establish compliance with previous drainage studies and provide for water quality and detention of developed runoff.

GENERAL LOCATION AND DESCRIPTION

The subject 10.17 acres is proposed to be platted into 83 residential townhome lots and is located within the southwest ¼ of Section 4, Township 14 South, Range 65 West of the 6th principal meridian El Paso County, Colorado. The parcel was previously platted as tracts G and A, Claremont Ranch Filing No. 7

The parcel is bounded on the north by the East Fork of Sand Creek, on the east by the Claremont Ranch Filing No. 7 single family residential development, on the south by Meadowbrook Parkway and undeveloped tract F, and on the west by Tract I and Marksheffel Road.

The site has been previously stripped and contains little volunteer vegetation besides erosion control cover. The existing terrain generally slopes to the west at a 2% grade. A swale has been formed adjacent to the Marksheffel embankment conveying undeveloped flow overland to the east Fork of Sand Creek. The site lies within the Sand Creek Drainage Basin.

Soils in the development parcel consist predominantly of Blendon sandy loam (Hydrologic Group 'B' soils) and also contains Blakeland loamy sand and Ellicott loamy coarse sand (Hydrologic Group 'A' soils) as determined by the Natural Resources Conservation Service Web Soil Survey. Hydrologic Group B soils were used in analysis.

No portion of the development lies within an F.E.M.A. designated floodplain per FIRM 08041C0756 G, effective 12/07/2018. The revised F.E.M.A. Flood Insurance Rate Map has been provided in the appendix.

EXISTING DRAINAGE CONDITIONS

The site was previously studied in the Final Drainage Report for Claremont Ranch Filing No. 7. Development of Filing No. 7 required analysis and implementation of improvements within the adjacent Lower East Fork of Sand Creek. Improvements were implemented per the Sand Creek Drainage Basin Planning Study and Preliminary Design Report; City of Colorado Springs, El Paso County, Colorado (DBPS), prepared by Kiowa Engineering Corp., revised March 1996. As upstream detention proposed in the DBPS has not been implemented the more conservative FEMA 100-YR Flow was utilized in channel evaluation and improvement. The FEMA analysis assumes a 100-YR flow of 4,500 cfs through the adjacent reach, while the DBPS estimates a flow of 3,310 cfs with upstream detention. The adjacent Lower East Fork Sand Creek improvements are detailed in the Final Drainage Report for Claremont Ranch Filing no. 7.

The Villas at Claremont Ranch were platted as Tracts 'G' and 'A' with development of Claremont Ranch Filing No. 7 and was identified as 12.21 acre commercial development (basin 7) in the final drainage report. Anticipated runoff from Basin 7 was Q_5=9.5 cfs, Q_{100}=24.4 in the interim condition and Q_5=56.0 cfs, Q_{100}=96.7 in the fully developed condition. The Villas at Claremont Ranch lies entirely with the Sand Creek Drainage Basin Planning Study area.

Basin 6 Claremont Ranch Filing No. 7 consists of undeveloped tract F south of Meadowbrook Parkway. The 11.18 acre basin (10.17 acres within the proposed Villas at Claremont Ranch) is proposed for commercial use and generates anticipated runoff of was Q_5=10.1 cfs, Q_{100}=25.8 in the interim condition and Q_5=60.4 cfs, Q_{100}=90.5 in the fully developed condition. A permanent public 24" culvert crossing was installed with development of Meadowbrook Parkway to convey flows north to Sand Creek. Interim flows will be conveyed in existing swale section developed with Filing No. 7 improvements within the 70' utility and drainage easement located along the west side of the proposed Villas at Claremont Ranch Development. Developed flows will not be accepted onto the Villas at Claremont Ranch and any development scenarios for Tract F will require water quality implementation and full spectrum detention prior to site release across Meadowbrook Parkway. Interim flows defined in the Final Drainage Report for Filing No. 7 will be accepted.

DEVELOPED DRAINAGE BASINS

Developed basins proposed to receive an increase in impervious areas will be routed to an on-site extended detention basin providing full spectrum detention prior to release to the East Fork of Sand Creek. Basins routed through the proposed EDB will be collected in proposed private roadway sections and collected in a private inlet system. Collected runoff will be conveyed in a private storm system to the EDB. A summary of peak developed runoff for the basins and design points are depicted in the Developed Drainage Plan in the appendix.

Basin 1 consists of perimeter landscape areas directly tributary to the East Fork of Sand Creek and will not be collected in the proposed extended detention basin. Basin 1 contains 2.25 acres and generates runoff of (Q_2=0.2 cfs, Q_5=0.6 cfs, Q_{10}=1.2 cfs, Q_{25}=2.0 cfs, Q_{50}=2.6 cfs, and Q_{100}=3.3 cfs). Runoff from Basin 1 will either sheet flow directly to the reach of Sand Creek or be combined with interim condition runoff from Basin 6 (Claremont Ranch Filing No. 7) of Q_5=10.1 cfs, Q_{100}=25.8 to the existing riprap rundown to Sand Creek. The swale and rundown installed with filing 7 improvements was developed to convey interim flows from both Basin 6 (tract F, Claremont Ranch Filing No. 7) and Basin 7 (tracts G and A, Claremont Ranch Filing No. 7) with a combined flow of Q_5=19.6 cfs, Q_{100}=50.2. Overlot grading and limited sidewalk improvements are proposed within Basin 1. The minimal improvements proposed in Basin 1 have been shaded to delineate limits on the proposed drainage map. The Basin 1 shaded area (0.67 acres) will utilize the applicable water quality exclusion ECM APP I.7.1.C.1 (County based exclusion of up to 20% or 1 acre).

The unshaded portion of Basin 1 (1.58 acres) will utilize the applicable WQ exclusion ECM APP I.7.1.B.7 - Sites with land disturbance to undeveloped land (land with no human-made structures such as buildings or pavement) that will remain undeveloped after the site.

Runoff from pervious area of Basin 1 will be conveyed across pervious surfaces in an unimproved trapezoidal grass swale with a 40' bottom width at a depth of 0.40' to outfall directly to Sand Creek. *See Appendix for channel section A-A calculation.*

Sub-Basin 1.1 (0.76 Acres, Q_2=0.2 cfs, Q_5=0.5 cfs, Q_{10}=0.8 cfs, Q_{25}=1.3 cfs, Q_{50}=1.7 cfs, and Q_{100}=2.1 cfs) will be collected into a grass lined flat bottom swale with 4:1 side slopes, conveying the flows South to Design Point 10. At Design Point 10 (Q_5=10.6 cfs, Q_{10}=27.9 cfs) flows are combined with offsite interim flows identified in the final drainage report for filing no. 7 basin 6 of Q_5=10.1 cfs, Q_{10}=25.8 cfs and conveyed in a trapezoidal channel section to outfall in Sand Creek. Runoff from pervious area of Basin 1 will be conveyed across pervious surfaces in an unimproved trapezoidal grass swale with a 40' bottom width at a depth of 0.40' to outfall directly to Sand Creek. Discussion of water quality exclusions for all of Basin 1 (including sub-basin 1.1), is addressed in previous paragraphs.

Basin 10 consists of rear yards of the residential portion of Filing No. 7 tributary to the Villas at Claremont development. Runoff from these perimeter landscape areas directly tributary to the East Fork of Sand Creek, will be conveyed by a proposed grass lined swale offsite, and will not be collected in the proposed extended detention basin. Basin 10 contains 0.54 acres and generates runoff of (Q_2=0.1 cfs, Q_5=0.3 cfs, Q_{10}=0.5 cfs, Q_{25}=0.8 cfs, Q_{50}=1.1 cfs, and Q_{100}=1.4 cfs). No improvements are proposed within Basin 10 affecting existing off-site facilities. Runoff from pervious area of Basin 10 will be conveyed across pervious surfaces in an unimproved trapezoidal grass swale.

Basin 10 (0.54 acres) will utilize the applicable water quality exclusion ECM APP I.7.1.B.7 - Sites with land disturbance to undeveloped land (land with no human-made structures such as buildings or pavement) that will remain undeveloped after the site.

BASINS TRIBUTARY TO EDB

Basins 2 through 8 consist of the landscape areas, residential townhome lots, and private street improvements tributary to the proposed extended detention basin. Basin 9 consists of rear lots developed within the residential portion of Filing No. 7 tributary to the extended detention basin.

Basin 2 (1.92 Acres, Q_2=1.3 cfs, Q_5=1.9 cfs, Q_{10}=2.7 cfs, Q_{25}=3.8 cfs, Q_{50}=4.6 cfs, and Q_{100}=5.6 cfs) consists of lots and landscape area along the north and east of the development. Flows from basin 2 will be conveyed in a grass swale along the northeast of the development to outfall directly to the proposed detention pond. Swale sizing calculations have been presented in the appendix.

Basin 3 (0.76 Acres, Q_2=1.1 cfs, Q_5=1.5 cfs, Q_{10}=2.0 cfs, Q_{25}=2.5 cfs, Q_{50}=2.9 cfs, and Q_{100}=3.4 cfs) consists of townhome lots and roadway improvements tributary to the proposed private 10' type R sump inlet at Design Point 2. Calculations for Carrside Grove street capacity and inlet analysis are provided in the appendix.

Basin 4 (1.00 Acres, Q_2=1.2 cfs, Q_5=1.7 cfs, Q_{10}=2.2 cfs, Q_{25}=2.7 cfs, Q_{50}=3.2 cfs, and Q_{100}=3.7 cfs) consists of townhome lots, landscape corridors, and roadway improvements tributary to the proposed private 10' type R sump inlet at Design Point 3. Calculations for Carrside Grove street capacity and inlet analysis are provided in the appendix.

Basin 5 (0.80 Acres, Q_2=1.2 cfs, Q_5=1.7 cfs, Q_{10}=2.2 cfs, Q_{25}=2.7 cfs, Q_{50}=3.2 cfs, and Q_{100}=3.7 cfs) consists of townhome lots, landscape corridors, and roadway improvements tributary to the proposed private 10' type R sump inlet at Design Point 4. Calculations for Fieldside Way street capacity and inlet analysis are provided in the appendix.

Basin 6 (1.95 Acres, Q_2=2.1 cfs, Q_5=3.0 cfs, Q_{10}=3.9 cfs, Q_{25}=5.0 cfs, Q_{50}=6.0 cfs, and Q_{100}=7.0 cfs) consists of townhome lots, landscape corridors, and roadway improvements tributary to the proposed private 10' type R sump inlet at Design Point 5. Calculations for Fieldside Way street capacity and inlet analysis are provided in the appendix.

Basin 7 (0.65 Acres, Q_2=1.0 cfs, Q_5=1.4 cfs, Q_{10}=1.7 cfs, Q_{25}=2.2 cfs, Q_{50}=2.6 cfs, and Q_{100}=3.0 cfs) consists of townhome lots, landscape corridors, and roadway improvements tributary to the proposed private 5' type R sump inlet at Design Point 7. Calculations for Greengate Way street capacity and inlet analysis are provided in the appendix.

Basin 8 (0.62 Acres, Q_2=1.2 cfs, Q_5=1.6 cfs, Q_{10}=2.0 cfs, Q_{25}=2.4 cfs, Q_{50}=2.9 cfs, and Q_{100}=3.3 cfs) consists of a small landscape area and private roadway improvements tributary to the proposed private 5' type R sump inlet at Design Point 6. Calculations for Greengate Way street capacity and inlet analysis are provided in the appendix.

Basin 9 (0.13 Acres, Q_2=0.0 cfs, Q_5=0.1 cfs, Q_{10}=0.1 cfs, Q_{25}=0.2 cfs, Q_{50}=0.2 cfs, and Q_{100}=0.3 cfs) consists of a northern portion of rear yards of the residential portion of Filing No. 7 tributary to the Villas at Claremont development. Runoff from this area will sheet flow across the proposed landscape tract and be conveyed in a vegetated swale to the proposed EDB. Swale sizing calculations are included in the appendix.

CONVEYANCE

Internal landscape and residential corridor areas, located within Basins 4 and 6 will utilize 2-foot-wide sidewalk chases to convey landscaped area stormwater swale flows into the adjacent street curb flow lines. A separate hydrologic analysis has been performed for the designated internal areas (Sub-Basin 1.1, 2.1, 4.1 and 6.1, respectively), and has been included in the Appendix.

Sub-Basin 1.1 (0.76 Acres, Q_2=0.2 cfs, Q_5=0.5 cfs, Q_{10}=0.8 cfs, Q_{25}=1.3 cfs, Q_{50}=1.7 cfs, and Q_{100}=2.1 cfs) will be collected into a grass lined (V ditch) swale with 4:1 side slopes, conveying the flows south to Design Point 10.

Sub-Basin 2.1 (0.19 Acres, Q_2=0.6 cfs, Q_5=0.7 cfs, Q_{10}=0.9 cfs, Q_{25}=1.1 cfs, Q_{50}=1.2 cfs, and Q_{100}=1.4 cfs) will be collected into a (dual) curb cuts 2' wide x 5.5' long sidewalk and outfall to 2.0' x 2.0' D50=6" dual drainage pads (outfall calculations provided in appendix).

Sub-Basin 4.1 (0.32 Acres, Q_2=0.4 cfs, Q_5=0.5 cfs, Q_{10}=0.7 cfs, Q_{25}=0.9 cfs, Q_{50}=1.0 cfs, and Q_{100}=1.2 cfs) will be collected into a 2' wide x 5.5' long sidewalk curb chase and outfall north into Carside Grove curb flow lines and be conveyed to a low point near a proposed private 10' storm inlet located at Design Point 3.

Sub-Basin 6.1 (0.45 Acres, Q_2=0.4 cfs, Q_5=0.6 cfs, Q_{10}=0.8 cfs, Q_{25}=1.1 cfs, Q_{50}=1.3 cfs, and Q_{100}=1.6 cfs) will be collected into a 2' wide x 5.5' long sidewalk curb chase and outfall north into Fieldside View curb flow lines and be conveyed to a low point near a proposed private 10' storm inlet located at Design Point 5.

Flows at DP-7 will be collected in a 5' Type R inlet and outfall in an 18" RCP at 0.50% to the inlet at DP-6. Combined flows at DP-A of Q_5=3.0 cfs, Q_{100}=6.4 will be conveyed north in an 18" RCP at 0.61% to the proposed manhole at DP-B.

Flows from DP-5 will be collected in a 10' Type R inlet and outfall in an 18" RCP at 0.50% to the inlet at DP-4. Flows from DP-4 will be collected in a 5' Type R inlet. Combined flows from DP-4 and DP-5 will be conveyed in an 18" RCP at 0.50% to the manhole at DP-B (Q_5=6.8 cfs, Q_{100}=15.3)

Combined outflow from the manhole at DP-B will be conveyed in a 30" RCP storm sewer at 0.50% to the manhole at DP-C and combined with flows intercepted in the 10' Type R inlet at DP-3. Combined flows from DP-C of Q_5=8.6 cfs, Q_{100}=19.0 cfs will be conveyed in a 30" RCP at 0.50% to the 10' Type R inlet at DP-D. Combined flows at DP-D of Q_5=9.9 cfs, Q_{100}=21.9 will be conveyed in a 30" RCP at 0.50% to pond outfall within the proposed EDB.

Swale calculations are provided in the appendix. All swales indicate velocities below 5.0 ft/second and maintain a minimum of 1.0' freeboard. Calculations were performed utilizing hydraflow extension for AutoCAD Civil 3D.

Opposing inlet pairs are proposed for Design Points 2 and 3; 4 and 5; and 6 and 7. Inlet pairs are designed to allow flow equalization for the major storm event when flow could overtop the crown of the street. No ponding is proposed beyond the back of curb elevation.

EXTENDED DETENTION BASIN

Proposed EDB 'B will require a WQCV of 0.139 acre-feet, an EURV Volume of 0.314 acre-feet and a total storage volume of 0.760 acre-ft. The pond provides 0.761 acre-ft of storage below the emergency outfall. The EDB will be designed to meet current Urban Drainage design criteria for forebay, outfall structure, and micropool *(See Calculations in Appendix).* Proposed EDB 'B will outfall through an 18" RCP storm sewer directly to the East Branch of Sand Creek. The Basin outfalls developed runoff of (Q_5=1.2 cfs, Q_{100}=4.2 cfs) to Design Point E. The emergency spillway will consist of a 20' wide trapezoidal weir constructed of soil riprap conveying the undetained 100-YR flow from Design Point 1 of 25.0 cfs at a maximum depth of 0.34'. Emergency overflow will be conveyed directly to the East Branch of Sand Creek. See Appendix for calculations. The CENTRAL MARKSHEFFEL METROPOLITAN DISTRICT will maintain the private pond facility.

The improved trail adjacent to Sand Creek has not been installed adjacent to the pond. The area will be graded to represent anticipated trail installation but will be constructed from pond overflow through channel toe with soil riprap with seeded topsoil cover. Future installation of trail segment is anticipated to be concrete trail along top of channel embankment. Spillway is intended only for emergency outflow path to adjacent channel. Major storm event is conveyed through outlet structure and conveyed through pipe system to channel bottom.

The pond maintenance access is provided from proposed parking located north of the intersection of Belton Heights and Carrside Grove. The southerly portion of access above all proposed water surface elevations is combined with required sanitary sewer access and will be constructed to Utility District Standards which exceed county requirements. The portion of the pond within the pond will be constructed of an all-weather stable surface of roadbase, gravel, or rock and maintains a maximum 10% grade per ECM 3.3.3.K.

Calculations in the Mile High Flood District UD-detention spreadsheet indicate that developed outflow during intermediate storm events exceed historic intermediate storm event release in order to comply with time constrained release of 97% of 5-YR event. The adjacent reach of Sand Creek is designed to accommodate 100-YR event conveyance and will not be negatively impacted by intermediate release rates. DBPS recommended improvements were installed for the adjacent reach and have been included in the appendix.

Trickle Channel calculations have been provided in the appendix.

The area of the development tributary to proposed EDB ‘B’ includes the following:

Tract/Use	Area	% Impervious
Lots	5.12	65%
Hardscape	0.80	89%
Landscape	1.91	0%
Total Area	7.83	52.7% Avg % Impervious

DRAINAGE METHODOLOGY

This drainage report was prepared in accordance to the criteria established in the El Paso County CDM Vol 1 and 2 with Vol 1 updates.

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

Mile High Flood District methodology was utilized for determination of street capacity and inlet sizing. Calculations are shown in the appendix of this report. Hydraulic Grade Line Calculations have been provided within this report.

The analysis, presented in the appendix, provides more detailed calculations for the system in accordance with the requirements of the El Paso County DCM criteria. The storm sewer plan and profile drawings have been submitted concurrently with this analysis.

WATER QUALITY/4-STEP PROCESS

4-STEP PROCESS

STEP 1: EMPLOY RUNOFF REDUCTION PRACTICES

The development addresses Low Impact Development strategies primarily through the utilization of landscape swales within rear lots directing runoff from rooflines and patios through swales with minimal longitudinal grade prior to outfall to the private street system.

STEP 2: STABILIZE DRAINAGEWAYS

The ultimate recipient of runoff from the site is the East Branch of Sand Creek. The adjacent reach of Sand Creek was improved to ultimate DBPW recommendations with the development of Filing No. 7.

STEP 3: PROVIDE WATER QUALITY CAPTURE VOLUME

On-site flow is directed to a proposed extended detention basin providing water quality capture volume and attenuated release rates prior to release off-site. Release from the extended detention basin is less than assumed in the Final Drainage Report for Filing No. 7 as development was assumed to be commercial in nature and no detention scenario was initially proposed.

STEP 4: CONSIDER NEED FOR INDUSTRIAL AND COMMERCIAL BMP'S

A Grading, Erosion Control, and Stormwater Quality Plan and narrative have been submitted concurrently for the development and will be subject to county approval prior to any soil disturbance. The erosion control plan included specific source control BMP's as well defined overall site management practices for the construction period. No industrial or commercial uses are proposed with the Villas at Claremont Ranch development. No temporary batch plant operations are proposed with residential development.

COST ESTIMATE

Private Improvements Non-reimbursable

5' TYPE R INLET	2 EA	@$	6,138/EA	$	12,276
10' TYPE R INLET	4 EA	@$	8,447/EA	$	33,788
TYPE I MH	3 EA	@$	7,082/EA	$	21,246
18"RCP	497 LF	@$	70/LF	$	34,790
30" RCP	392 LF	@$	104/LF	$	40,768
18"RCP FES	1 EA	@$	420/EA	$	420
D_{50}=6" RipRap	58 Tons	@$	89.00/Ton	$	5,162
Detention Outlet Structure	1 EA	@$	9,000/LS	$	9,000
Pond Grading	1500 CY	@$	6.00/EA	$	9,000
Extended Detention Basin	1 LS	@$	35,000/LS	$	35,000

SUBTOTAL	**$**	**201,450**
15% CONTINGENCY	*$*	*30,218*
TOTAL	**$**	**231,668**

DRAINAGE FEE CALCULATION

Drainage Fees were accounted for with the original platting of the parcel as tracts G and A of Claremont Ranch Filing No. 7 (see appendix).

DRAINAGE METHODOLOGY

This drainage report was prepared in accordance to the criteria established in the City of Colorado Springs/El Paso County Drainage Criteria Manual Volumes 1 and 2, as revised May 2015.

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

SUMMARY

The Villas at Claremont Ranch Development exhibits drainage patterns consistent with those anticipated in the Final Drainage Report for Filing No. 7. Volume of water released from the site anticipated in the Filing 7 Final Drainage Report has been significantly reduced due to the parcel developing as residential rather commercial and implementation of on-site water quality and full spectrum detention facilities as required by current criteria. Private Storm system is designed to intercept the full 100-year runoff event and convey to existing east branch of sand creek. Development of the parcel is in conformance of current El Paso County criteria and will not adversely affect downstream properties or facilities.

REFERENCES:

El Paso County, Colorado Engineering Division Drainage Criteria Manual Volume 1, (1990), revised Oct 2018

El Paso County, Colorado Engineering Division Drainage Criteria Manual Volume 2, November 2002

El Paso County, Colorado Engineering Division Drainage Criteria Manual Update, (2015)

El Paso County Engineering Criteria Manual, (2004), revised Oct 2020

"Claremont Ranch Subdivision Filing No. 7 Preliminary and Final Drainage Report", prepared by Engineering and Surveying, Inc., dated May 2004.

"Final Master Development Drainage Plan and Preliminary Drainage Plan for the Claremont Ranch", prepared by Matrix Design Group, Inc., revised July 2002.

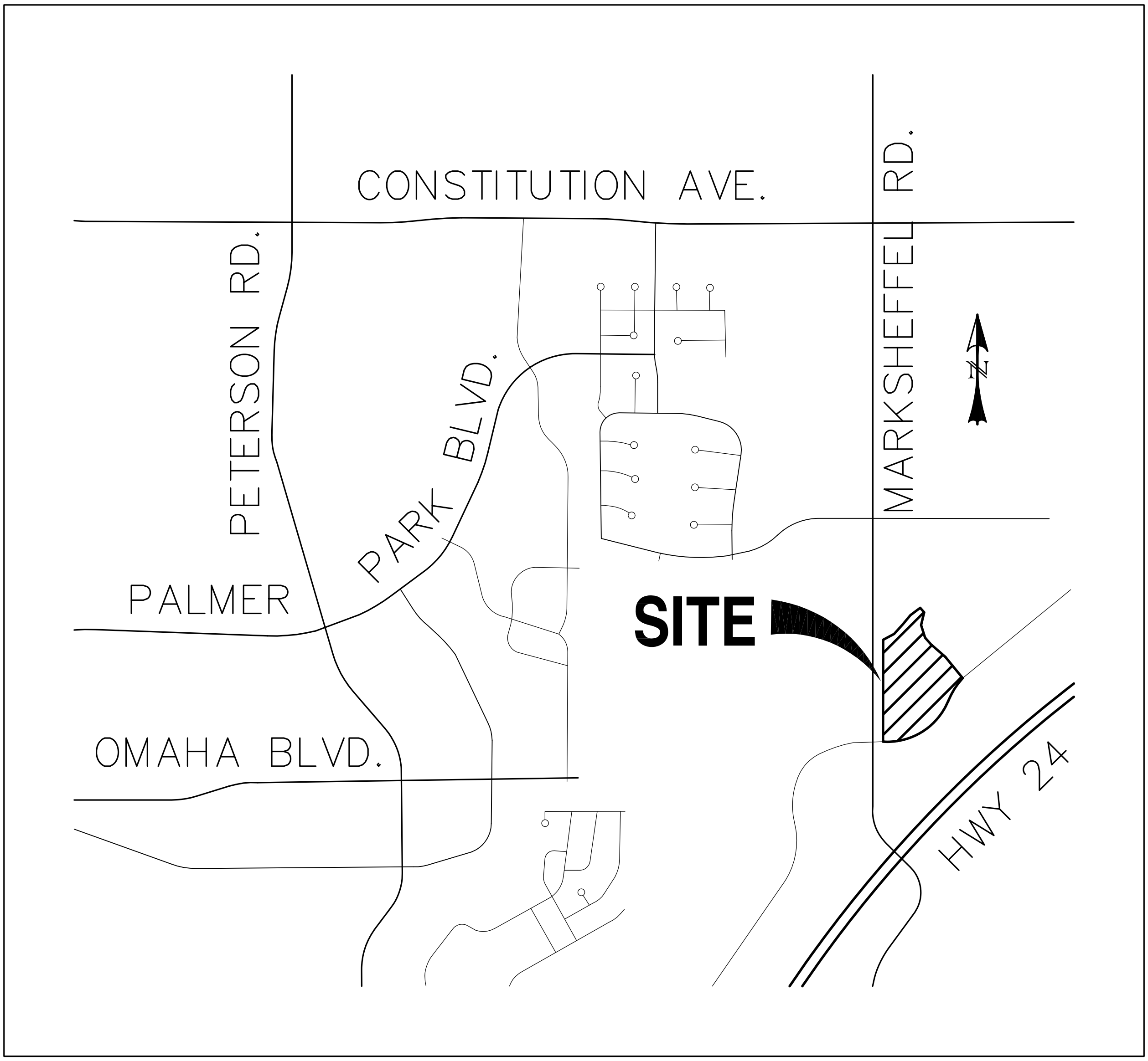
"Sand Creek Drainage Basin Planning Study Preliminary Drainage Report", prepared by Kiowa Engineering Corporation, revised March 21996.

Preliminary and Final Drainage Report for International Bible Society Filing No. 1" prepared by URS Consultants, dated August, 1988.

Flood Insurance rate map 08041C0756 F, as revised to reflect LOMR Case No. 08-08-0630P

Natural Resources Conservation Service Web Soil Survey

APPENDIX



VICINITY MAP

SCALE: N.T.S.

National Flood Hazard Layer FIRMette

FEMA

104°41'12"W 38°51'31"N

104°40'35"W 38°51'3"N

Feet

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

1:6,000

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/17/2020 at 2:43 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.


104° 40' 59" W
104° 40' 46" W
38° 51' 30" N
38° 51' 17" N
527510
527550
527590
527630
527670
527710
527750
527790
4301090
4301050
4301010
4300970
4300930
4300890
4300850
4300810
4300770
4300730
East Fork Sand Creek
Marksheffel
N Marksheffel Rd
28
10
8
Soil Map may not be valid at this scale.
Map Scale: 1:1,920 if printed on A portrait (8.5" x 11") sheet.
Meters
0
25
50
100
150
Feet
0
50
100
200
300
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

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

Date(s) aerial images were photographed: Apr 15, 2011—Mar 9, 2017

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	1.6	16.2%
10	Blendon sandy loam, 0 to 3 percent slopes	B	7.1	74.2%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	0.9	9.6%
Totals for Area of Interest			**9.6**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

CLAREMONT RANCH SUBDIVISION
FILING NO. 7
PRELIMINARY & FINAL DRAINAGE REPORT

May 2004

Prepared for:

SWAT X, LLC.
20 Boulder Crescent, 2nd Floor
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(719) 471-1742

Prepared by:

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Project #01-006

DRAINAGE AND BRIDGE FEES

The Claremont Ranch Subdivision, Filing No. 7, site is located entirely within the Sand Creek Drainage Basin. The 2004 Drainage and Bridge Fees per El Paso County for this site are listed below.

Drainage Fee: $ 15,000/Impervious acre

Bridge Fee: $ 1,336/Impervious acre

The impervious area for this subdivision was calculated from the site plan since this is a residential project.

The total platted acreage for the site is 17.79 acres consisting of 16.61 residential acres with an impervious rating of 44% and 1.18 open space acres at 7% impervious. Therefore, the calculated impervious area is 7.38 acres (42%).

Drainage Fee: $ 15,000/Impervious acre x 42% Impervious = $ 6,222/ac.

Bridge Fee: $ 1,336/Impervious acre x 42% Impervious = $ 554/ac.

Total fees due per platted acreage = $ 6,776/ac.

The total fee obligation for Claremont Ranch Subdivision Filing No. 7 is summarized as follows:

Drainage fees for subdivision: $ 6,222/ac x 17.79 ac = $ 110,689.38

Bridge fees for subdivision: $ 554/ac x 17.79 ac = $ 9,855.66

Total fees for subdivision: $ 6,776/ac x 17.79 ac = $ 120,545.04

Bridge Fees in the amount of $9,855.66 are due with final platting of Filing No. 7.

Claremont Ranch Filings #1-7 – Overall Drainage Fee Calculations:

Filing #	Required Drainage Fees	Sand Creek & Sub-tributary Improvement Construction Costs
1	$316,744.50	$376,000.00
2	$197,274.00	$355,850.00
3	$200,700.00	$0.00
4	$293,100.00	$433,250.00
5	$140,285.00	$517,145.00
6	$283,228.50	$0.00
7	**$110,689.38**	**$282,000.00**
Total	**$1,542,011.38**	**$1,964,245.00**

The developer can use the difference between reimbursable construction costs and required drainage fees as credits to be applied toward future Sand Creek Basin Drainage Fees or the developer can apply to the County for reimbursement from the Basin.

Claremont Ranch will have a drainage credit of $422,233.62 based on the above table, therefore there are no Drainage Fees are due for Claremont Ranch Filing No. 7.

SUMMARY

The Claremont Ranch Subdivision Filing No. 7 site contains 52.7 acres within the Sand Creek Drainage Basin. 17.8 acres of this Filing will be developed as single-family dwelling units, 20.2 acres as commercial development and the remaining 14.7 acres as high density single-family units. The development of the site will require drainage facilities to accommodate developed flows and meet El Paso County drainage criteria. Proposed drainage facilities will adequately convey developed runoff from the site to the East Fork of Sand Creek. All drainage facilities described herein and shown on the included drainage plan are subject to change due to final design considerations.

The drainage analysis has been prepared in accordance with the current City of Colorado Springs/El Paso County Drainage Criteria Manual. The site will continue to maintain historic drainage patterns. No on-site detention will be required due to the fact that regional detention will be provided as outlined in the DBPS prepared by Kiowa Engineering.

Supporting information is included in the Appendix.

DRAINAGE BASIN HYDROLOGY

RATIONAL METHOD

CLAREMONT RANCH #7

BASIN:	7
AREA(ac.):	12.21
SOIL TYPE:	A

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA (ft²)	AREA (ac)	C_5	C_{100}	% AREA
Commercial	531685.18	12.21	0.90	0.90	100.0%
		12.21			**100%**

COMPOSITE: C_5= **0.90**
C_{100}= **0.90**

TIME OF CONCENTRATION: Tc in Minutes:

Travel Type	*L(ft)*	*h(ft)*	*s (%)*	*v_5 (fps)*	*Tc (5 year)*	*v_{100} (fps)*	*Tc (100 year)*
Overland	300	16	5.3		3.73		3.73
Swale	350	8	2.3	3	1.94	3.5	1.67
Tc Total:					**5.67**		**5.40**

Intensity, i (inches/hr) from Fig 5-1

i_5	i_{100}
5.1 in/hr	8.8 in/hr

PEAK FLOW: Q=CiA in cfs

Q_5	Q_{100}
56.0 cfs	**96.7** cfs

DRAINAGE BASIN HYDROLOGY

RATIONAL METHOD

CLAREMONT RANCH #7

Interim Flows - assumes grading & re-vegetation but no development.

BASIN:	6a
AREA(ac.):	11.18
SOIL TYPE:	A

RUNOFF COEFFICIENT, C

ZONE/DEVELOPMENT TYPE	AREA (ft²)	AREA (ac)	C_5	C_{100}	% AREA
Pasture/Meadow	486879.86	11.18	0.25	0.35	100.0%
		11.18			**100%**

COMPOSITE: C_5= **0.25**

C_{100}= **0.35**

TIME OF CONCENTRATION: Tc in Minutes:

Travel Type	L(ft)	h (ft)	s (%)	v_5 (fps)	Tc (5 year)	v_{100} (fps)	Tc (100 year)
Overland	200	26	13.0		9.64		8.51
Swale	600	20	3.3	3	3.33	3.5	2.86
Tc Total:					**12.98**		**11.36**

Intensity, i (inches/hr) from Fig 5-1

i_5 3.6 in/hr

i_{100} 6.6 in/hr

PEAK FLOW: Q=CiA in cfs

Q_5 **10.1** cfs

Q_{100} **25.8** cfs

PROPOSED BASINS

PROPOSED DRAINAGE BASINS

											CONVEYANCE TC						TT	INTENSITY						TOTAL FLOWS					
BASIN	**AREA TOTAL (Acres)**	**C_2**	**C_5**	**C_{10}**	**C_{25}**	**C_{50}**	**C_{100}**	**Length (ft)**	**Height (ft)**	**TI (min)**	**Length (ft)**	**Height (ft)**	**C_V**	**Slope (%)**	**Velocity (fps)**	**TC (min)**	**TOTAL (min)**	**I_2 (in/hr)**	**I_5 (in/hr)**	**I_{10} (in/hr)**	**I_{25} (in/hr)**	**I_{50} (in/hr)**	**I_{100} (in/hr)**	**Q_2 (c.f.s.)**	**Q_5 (c.f.s.)**	**Q_{10} (c.f.s.)**	**Q_{25} (c.f.s.)**	**Q_{50} (c.f.s.)**	**Q_{100} (c.f.s.)**
1	2.25	**0.05**	**0.12**	**0.20**	**0.30**	**0.34**	**0.39**	100	4	12.0	1030	12	7	1.2%	0.8	22.7	34.7	1.8	2.3	2.6	3.0	3.4	3.8	**0.2**	**0.6**	**1.2**	**2.0**	**2.6**	**3.3**
LANDSCAPED	2.25	0.05	0.12	0.20	0.30	0.34	0.39																						
2	1.92	**0.25**	**0.30**	**0.37**	**0.45**	**0.48**	**0.52**	100	4	9.8	451	10	7	2.2%	1.0	7.2	17.0	2.7	3.3	3.9	4.4	5.0	5.6	**1.3**	**1.9**	**2.7**	**3.8**	**4.6**	**5.6**
HARDSCAPE	0.51	0.79	0.81	0.83	0.85	0.87	0.88																						
LANDSCAPED	1.41	0.05	0.12	0.20	0.30	0.34	0.39																						
3	0.76	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	46	2.5	4.8	440	7	20	1.6%	2.5	2.9	7.7	3.6	4.5	5.3	6.0	6.8	7.6	**1.1**	**1.5**	**2.0**	**2.5**	**2.9**	**3.4**
LOTS	0.76	0.41	0.45	0.49	0.54	0.57	0.59																						
4	1.00	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	49	2	5.5	197	3	7	1.5%	0.9	3.8	10.2	3.3	4.1	4.8	5.5	6.1	6.9	**1.3**	**1.8**	**2.3**	**2.9**	**3.5**	**4.1**
LOTS	1.00	0.41	0.45	0.49	0.54	0.57	0.59				*138*	*2*	*20*	1.4%	2.4	1.0													
5	0.80	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	51	2	5.7	176	2.5	20	1.4%	2.4	1.2	6.9	3.7	4.7	5.5	6.2	7.0	7.9	**1.2**	**1.7**	**2.1**	**2.7**	**3.2**	**3.7**
LOTS	0.80	0.41	0.45	0.49	0.54	0.57	0.59																						
6	1.95	**0.36**	**0.40**	**0.45**	**0.50**	**0.54**	**0.56**	91	2	9.9	441	10	20	2.3%	3.0	2.4	12.3	3.0	3.8	4.5	5.1	5.7	6.4	**2.1**	**3.0**	**3.9**	**5.0**	**6.0**	**7.0**
LOTS	1.66	0.41	0.45	0.49	0.54	0.57	0.59																						
LANDSCAPED	0.29	0.05	0.12	0.20	0.30	0.34	0.39																						
7	0.65	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	54	2	5.9	136	2	20	1.5%	2.4	0.9	6.9	3.7	4.7	5.5	6.3	7.0	7.9	**1.0**	**1.4**	**1.7**	**2.2**	**2.6**	**3.0**
LOTS	0.65	0.41	0.45	0.49	0.54	0.57	0.59																						
8	0.62	**0.54**	**0.58**	**0.61**	**0.65**	**0.68**	**0.70**	100	4	6.4	230	5	20	2.2%	2.9	1.3	7.7	3.6	4.5	5.3	6.0	6.8	7.6	**1.2**	**1.6**	**2.0**	**2.4**	**2.9**	**3.3**
HARDSCAPE	0.29	0.79	0.81	0.83	0.85	0.87	0.88																						
LANDSCAPED	0.08	0.05	0.12	0.20	0.30	0.34	0.39																						
LOTS	0.25	0.41	0.45	0.49	0.54	0.57	0.59																						
9	0.13	**0.05**	**0.12**	**0.20**	**0.30**	**0.34**	**0.39**	87	3	11.8	451	10	15	2.2%	2.2	3.4	15.1	2.8	3.5	4.1	4.7	5.3	5.9	**0.0**	**0.1**	**0.1**	**0.2**	**0.2**	**0.3**
ONSITE																													
REAR YARD	0.13	0.05	0.12	0.20	0.30	0.34	0.39																						
10	0.54	**0.05**	**0.12**	**0.20**	**0.30**	**0.34**	**0.39**	64	4	8.3	456	9	15	2.0%	2.1	3.6	11.9	3.1	3.9	4.5	5.2	5.8	6.5	**0.1**	**0.3**	**0.5**	**0.8**	**1.1**	**1.4**
OFFSITE																													
OFFSITE	0.54	0.05	0.12	0.20	0.30	0.34	0.39																						

Calculated by: DLM

Date: 10/1/2017

PROPOSED DESIGN POINTS

		WEIGHTED						TT	INTENSITY						TOTAL FLOWS					
DESIGN POINT	AREA TOTAL (Acres)	C_2	C_5	C_{10}	C_{25}	C_{50}	C_{100}	TOTAL (min)	I_2 (in/hr)	I_5 (in/hr)	I_{10} (in/hr)	I_{25} (in/hr)	I_{50} (in/hr)	I_{100} (in/hr)	Q_2 (c.f.s.)	Q_5 (c.f.s.)	Q_{10} (c.f.s.)	Q_{25} (c.f.s.)	Q_{50} (c.f.s.)	Q_{100} (c.f.s.)
7 BASIN 7	**0.65**	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	6.9	3.7	4.7	5.5	6.3	7.0	7.9	**1.0**	**1.4**	**1.7**	**2.2**	**2.6**	**3.0**
6 BASIN 8	**0.62**	**0.54**	**0.58**	**0.61**	**0.65**	**0.68**	**0.70**	7.7	3.6	4.5	5.3	6.0	6.8	7.6	**1.2**	**1.6**	**2.0**	**2.4**	**2.9**	**3.3**
5 BASIN 6	**1.95**	**0.36**	**0.40**	**0.45**	**0.50**	**0.54**	**0.56**	12.3	3.0	3.8	4.5	5.1	5.7	6.4	**2.1**	**3.0**	**3.9**	**5.0**	**6.0**	**7.0**
4 BASIN 5	**0.80**	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	6.9	3.7	4.7	5.5	6.2	7.0	7.9	**1.2**	**1.7**	**2.1**	**2.7**	**3.2**	**3.7**
3 BASIN 4	**1.00**	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	10.2	3.3	4.1	4.8	5.5	6.1	6.9	**1.3**	**1.8**	**2.3**	**2.9**	**3.5**	**4.1**
2 BASIN 3	**0.76**	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	7.7	3.6	4.5	5.3	6.0	6.8	7.6	**1.1**	**1.5**	**2.0**	**2.5**	**2.9**	**3.4**
1 BASIN 2 BASIN 9 DP-D	**7.83** 1.92 0.13 5.78	**0.36** 0.25 0.05 0.41	**0.41** 0.30 0.12 0.45	**0.45** 0.37 0.20 0.49	**0.51** 0.45 0.30 0.54	**0.54** 0.48 0.34 0.57	**0.57** 0.52 0.39 0.59	17.0	2.7	3.3	3.9	4.4	5.0	5.6	**7.5**	**10.6**	**13.8**	**17.9**	**21.3**	**25.0**
8	**0.32**	**0.40**	**0.42**	**0.43**	**0.45**	**0.47**	**0.48**	5.7	4.0	5.0	5.8	6.6	7.4	8.3	**0.5**	**0.7**	**0.8**	**1.0**	**1.1**	**1.3**
9 BASIN 9 DP-8	**0.45** 0.13 0.32	**0.30** 0.05 0.40	**0.33** 0.12 0.42	**0.37** 0.20 0.43	**0.41** 0.30 0.45	**0.43** 0.34 0.47	**0.45** 0.39 0.48	15.1 15.1 5.7	2.8	3.5	4.1	4.7	5.3	5.9	**0.4**	**0.5**	**0.7**	**0.9**	**1.0**	**1.2**
E Pond Outfall																**1.2**				**4.2**

Calculated by: DLM

Date:

PROPOSED DESIGN POINTS

		WEIGHTED						TT	INTENSITY						TOTAL FLOWS					
DESIGN POINT	AREA TOTAL (Acres)	C_2	C_5	C_{10}	C_{25}	C_{50}	C_{100}	TOTAL (min)	I_2 (in/hr)	I_5 (in/hr)	I_{10} (in/hr)	I_{25} (in/hr)	I_{50} (in/hr)	I_{100} (in/hr)	Q_2 (c.f.s.)	Q_5 (c.f.s.)	Q_{10} (c.f.s.)	Q_{25} (c.f.s.)	Q_{50} (c.f.s.)	Q_{100} (c.f.s.)
A	**1.27**	**0.47**	**0.51**	**0.55**	**0.60**	**0.62**	**0.64**	6.9	3.7	4.7	5.5	6.3	7.0	7.9	**2.3**	**3.0**	**3.8**	**4.7**	**5.6**	**6.4**
DP-6	0.62	0.54	0.58	0.61	0.65	0.68	0.70													
DP-7	0.65	0.41	0.45	0.49	0.54	0.57	0.59													
B	4.02	**0.40**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	12.3	3.0	3.8	4.5	5.1	5.7	6.4	**5.0**	**6.8**	**8.7**	**11.1**	**13.1**	**15.3**
DP-5	1.95	0.36	0.40	0.45	0.50	0.54	0.56													
DP-4	0.80	0.41	0.45	0.49	0.54	0.57	0.59													
DP-A	1.27	0.47	0.51	0.55	0.60	0.62	0.64													
C	**5.02**	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	12.3	3.0	3.8	4.5	5.1	5.7	6.4	**6.2**	**8.6**	**10.9**	**13.8**	**16.4**	**19.0**
DP3	1.00	0.41	0.45	0.49	0.54	0.57	0.59													
DP-B	4.02	0.40	0.45	0.49	0.54	0.57	0.59													
D	**5.78**	**0.41**	**0.45**	**0.49**	**0.54**	**0.57**	**0.59**	12.3	3.0	3.8	4.5	5.1	5.7	6.4	**7.2**	**9.9**	**12.6**	**15.9**	**18.9**	**21.9**
DP-2	0.76	0.41	0.45	0.49	0.54	0.57	0.59													
DP-C	5.02	0.41	0.45	0.49	0.54	0.57	0.59													

Calculated by: DLM

Date: 10/1/2017

SUB BASIN CALCULATIONS

											CONVEYANCE TC						TT	INTENSITY						TOTAL FLOWS					
BASIN	AREA TOTAL (Acres)	C_2	C_5	C_{10}	C_{25}	C_{50}	C_{100}	Length (ft)	Height (ft)	TI (min)	Length (ft)	Height (ft)	C_V	Slope (%)	Velocity (fps)	TC (min)	TOTAL (min)	I_2 (in/hr)	I_5 (in/hr)	I_{10} (in/hr)	I_{25} (in/hr)	I_{50} (in/hr)	I_{100} (in/hr)	Q_2 (c.f.s.)	Q_5 (c.f.s.)	Q_{10} (c.f.s.)	Q_{25} (c.f.s.)	Q_{50} (c.f.s.)	Q_{100} (c.f.s.)
1.1	0.76	**0.09**	**0.16**	**0.23**	**0.33**	**0.37**	**0.42**	36	2	6.2	332	10	7	3.0%	1.2	4.6	10.8	3.2	4.0	4.7	5.4	6.0	6.7	**0.2**	**0.5**	**0.8**	**1.3**	**1.7**	**2.1**
HARDSCAPE	0.04	0.79	0.81	0.83	0.85	0.87	0.88																						
LANDSCAPED	0.72	0.05	0.12	0.20	0.30	0.34	0.39																						
2.1	0.19	**0.67**	**0.70**	**0.73**	**0.76**	**0.79**	**0.80**	38	2	2.7	102	4	7	3.9%	1.4	1.2	4.0	4.4	5.5	6.4	7.4	8.3	9.3	**0.6**	**0.7**	**0.9**	**1.1**	**1.2**	**1.4**
HARDSCAPE	0.16	0.79	0.81	0.83	0.85	0.87	0.88																						
LANDSCAPED	0.03	0.05	0.12	0.20	0.30	0.34	0.39																						
4.1	0.32	**0.33**	**0.38**	**0.43**	**0.49**	**0.52**	**0.55**	47	2	5.9	190	3	7	1.6%	0.9	3.6	9.5	3.4	4.2	4.9	5.6	6.3	7.1	**0.4**	**0.5**	**0.7**	**0.9**	**1.0**	**1.2**
LOTS	0.25	0.41	0.45	0.49	0.54	0.57	0.59																						
LANDSCAPED	0.07	0.05	0.12	0.20	0.30	0.34	0.39																						
6.1	0.45	**0.33**	**0.38**	**0.43**	**0.49**	**0.52**	**0.55**	89	2	10.0	136	2	7	1.5%	0.8	2.7	12.7	3.0	3.8	4.4	5.0	5.7	6.3	**0.4**	**0.6**	**0.8**	**1.1**	**1.3**	**1.6**
LOTS	0.35	0.41	0.45	0.49	0.54	0.57	0.59																						
LANDSCAPED	0.10	0.05	0.12	0.20	0.30	0.34	0.39																						

Calculated by: SLP

Date: 12/13/2022

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	BASIN 2	DP-3	DP-4
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
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)	1.5	1.8	1.7
Major Q_{Known} (cfs)	3.4	4.1	3.8

Bypass (Carry-Over) Flow from Upstream

Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

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

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.5**	**1.8**	**1.7**
Major Total Design Peak Flow, Q (cfs)	**3.4**	**4.1**	**3.8**
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

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP-5	DP-6	DP-7
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
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)	3.0	1.6	1.4
Major Q_{Known} (cfs)	7.0	3.3	3.0

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)			

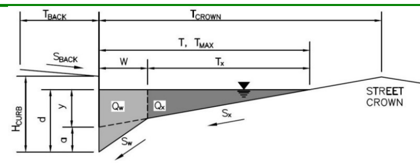
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**3.0**	**1.6**	**1.4**
Major Total Design Peak Flow, Q (cfs)	**7.0**	**3.3**	**3.0**
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

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

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

Project: THE VILLAS AT CLAREMONT RANCH
Inlet ID: BASIN 2

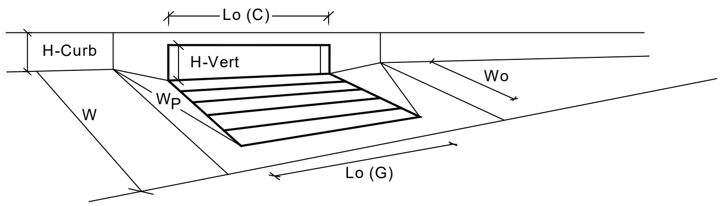


Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.015		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	13.2		ft
Gutter Width	W =	1.17		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	13.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



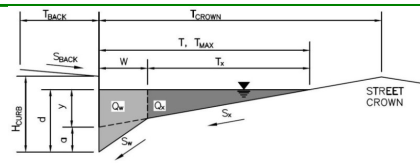
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	6.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.17	1.17	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.24	0.40	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**2.6**	**5.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.5	3.4	cfs

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

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

Project: THE VILLAS AT CLAREMONT RANCH

Inlet ID: DP-3



Gutter Geometry:

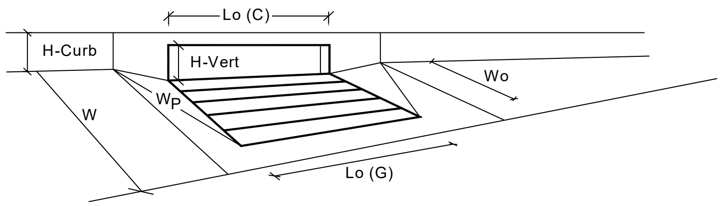
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.015	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	13.2	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	13.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)

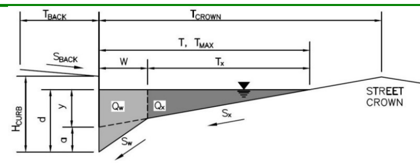


Design Information (Input) CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	6.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.17	1.17	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	**Q_{Grate} =**	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.06	0.06	
Curb Capacity as a Weir (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	4.0	10.4	cfs
Interception with Clogging	Q_{wa} =	3.7	9.8	cfs
Curb Capacity as an Orifice (based on MHFD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	16.1	19.5	cfs
Interception with Clogging	Q_{oa} =	15.1	18.3	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	7.4	13.3	cfs
Interception with Clogging	Q_{ma} =	7.0	12.4	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	**Q_{Curb} =**	**3.7**	**9.8**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	13.0	21.3	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	1.9	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.24	0.40	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.93	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.7**	**9.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.8	4.1	cfs

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

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

Project: THE VILLAS AT CLAREMONT RANCH
Inlet ID: DP-4



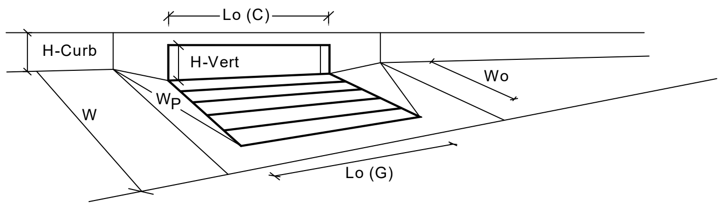
Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.015		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	13.2		ft
Gutter Width	W =	1.17		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	13.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
CDOT Type R Curb Opening				
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	6.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.17	1.17	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.24	0.40	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	

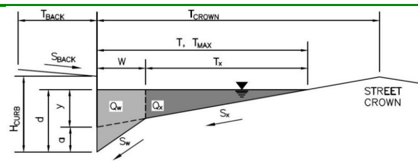
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.6**	**5.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.7	3.8	cfs

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

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

Project: THE VILLAS AT CLAREMONT RANCH

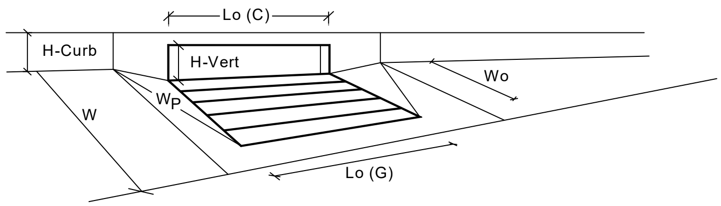
Inlet ID: DP-5



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.015		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	13.2		ft
Gutter Width	W =	1.17		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	13.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



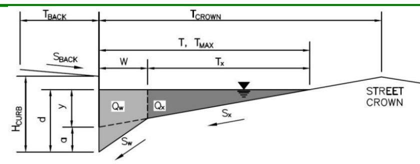
		MINOR	MAJOR	
Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	6.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.17	1.17	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.24	0.40	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.93	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.7**	**9.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.0	7.0	cfs

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

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

Project: **THE VILLAS AT CLAREMONT RANCH**

Inlet ID: **DP-6**

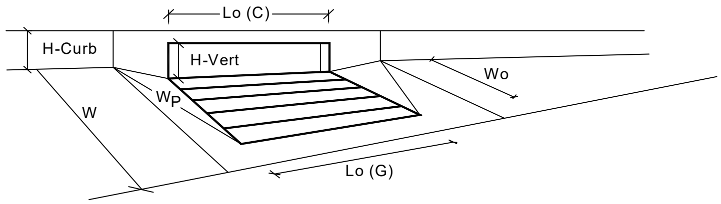


Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.015		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	13.2		ft
Gutter Width	W =	1.17		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	13.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
MINOR STORM Allowable Capacity is not applicable to Sump Condition		Minor Storm	Major Storm	
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	6.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.17	1.17	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.24	0.40	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	

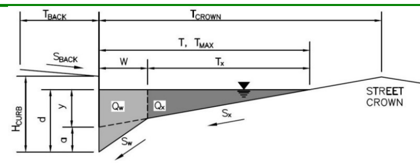
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.6**	**5.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.6	3.3	cfs

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

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

Project: THE VILLAS AT CLAREMONT RANCH

Inlet ID: DP-7



Gutter Geometry:

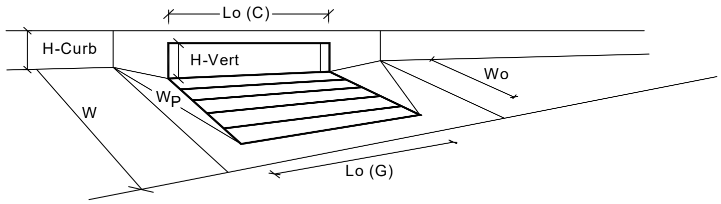
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.015	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	13.2	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.015	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	13.0	13.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

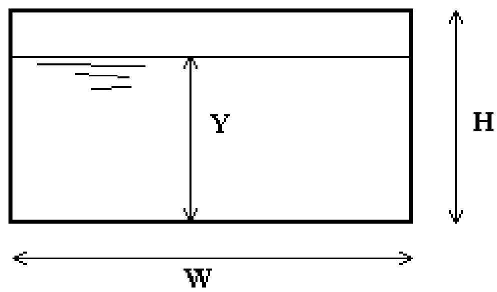
MHFD-Inlet, Version 5.02 (August 2022)



		MINOR	MAJOR	
Design Information (Input) — CDOT Type R Curb Opening				
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.0	6.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.17	1.17	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.24	0.40	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.6**	**5.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.4	3.0	cfs

BOX CONDUIT FLOW (Normal & Critical Depth Computation)

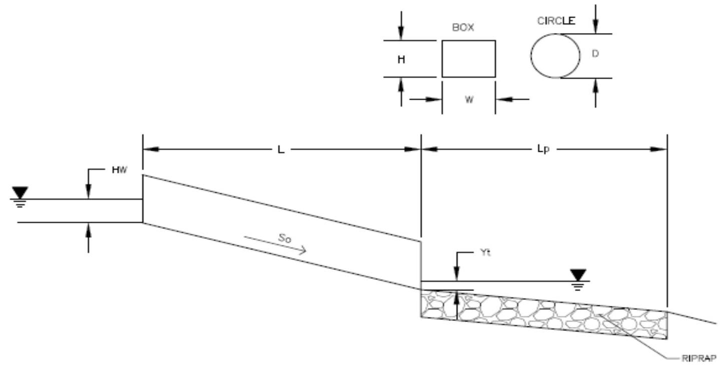
Project: Villas at Claremont Ranch
Box ID: Sub Basin 2.1-Curb Cut



Design Information (Input)			
Box conduit invert slope	So =	0.0200	ft/ft
Box Manning's n-value	n =	0.0130	
Box Width	W =	1.00	ft
Box Height	H =	0.50	ft
Design discharge	**Q =**	**1.30**	**cfs**
Full-flow capacity (Calculated)			
Full-flow area	Af =	0.50	sq ft
Full-flow wetted perimeter	Pf =	3.00	ft
Full-flow capacity	Qf =	2.45	cfs
Calculations of Normal Flow Condition			
Normal flow depth (<H)	Yn =	0.26	ft
Flow area	An =	0.26	sq ft
Wetted perimeter	Pn =	1.52	ft
Flow velocity	Vn =	5.00	fps
Discharge	Qn =	1.30	cfs
Percent Full	Flow =	53.1%	of full flow
Normal Depth Froude Number	Fr_n =	1.73	supercritical
Calculation of Critical Flow Condition			
Critical flow depth	Yc =	0.37	ft
Critical flow area	Ac =	0.37	sq ft
Critical flow velocity	Vc =	3.47	fps
Critical Depth Froude Number	Fr_c =	1.00	

Determination of Culvert Headwater and Outlet Protection

Project: Villas at Claremont Ranch
Basin ID: Outlet from curb chase SubBasin 2.1



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Ha to calculate protection type.

Design Information (Input):

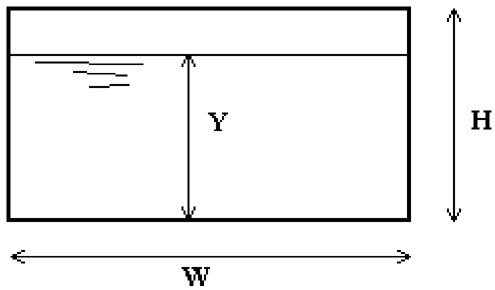
Design Discharge	Q =	1.3	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =		inches
Inlet Edge Type (Choose from pull-down list)	Square End Projection		
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =	0.5	ft
Barrel Width (Span) in Feet	Width (Span) =	1	ft
Inlet Edge Type (Choose from pull-down list)	1 : 1 Bevel w/ Headwall		
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	0.2	ft
Outlet Elevation **OR** Slope	So =	0.02	ft/ft
Culvert Length	L =	1	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Required Protection (Output):

Tailwater Surface Height	Y_t =	0.20	ft
Flow Area at Max Channel Velocity	A_t =	0.26	ft^2
Culvert Cross Sectional Area Available	A =	0.50	ft^2
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	0.07	
Sum of All Losses Coefficients	k_s =	1.27	ft
Culvert Normal Depth	Y_n =	0.25	ft
Culvert Critical Depth	Y_c =	0.37	ft
Tailwater Depth for Design	d =	0.44	ft
Adjusted Diameter **OR** Adjusted Rise	H_a =	0.37	ft
Expansion Factor	1/(2*tan(Θ)) =	5.22	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/WH^1.5 =	3.68	$ft^{0.5}/s$
Froude Number	Fr =	1.88	Supercritical!
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/H =	0.54	
Inlet Control Headwater	HW_I =	0.60	ft
Outlet Control Headwater	HW_O =	0.55	
Design Headwater Elevation	**HW =**	**0.80**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/H =**	**1.20**	
Minimum Theoretical Riprap Size	d_{50} =	1	in
Nominal Riprap Size	d_{50} =	6	in
UDFCD Riprap Type	**Type =**	**VL**	
Length of Protection	**L_p =**	**2**	**ft**
Width of Protection	**T =**	**2**	**ft**

BOX CONDUIT FLOW (Normal & Critical Depth Computation)

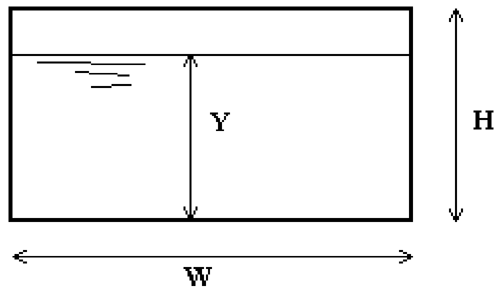
Project: **Villas at Claremont Ranch**
Box ID: **Sub Basin 4.1**



Design Information (Input)			
Box conduit invert slope	So =	0.0200	ft/ft
Box Manning's n-value	n =	0.0130	
Box Width	W =	2.00	ft
Box Height	H =	0.50	ft
Design discharge	**Q =**	**1.90**	**cfs**
Full-flow capacity (Calculated)			
Full-flow area	Af =	1.00	sq ft
Full-flow wetted perimeter	Pf =	5.00	ft
Full-flow capacity	Qf =	5.54	cfs
Calculations of Normal Flow Condition			
Normal flow depth (<H)	Yn =	0.20	ft
Flow area	An =	0.39	sq ft
Wetted perimeter	Pn =	2.39	ft
Flow velocity	Vn =	4.85	fps
Discharge	Qn =	1.90	cfs
Percent Full	Flow =	34.3%	of full flow
Normal Depth Froude Number	Fr_n =	1.93	supercritical
Calculation of Critical Flow Condition			
Critical flow depth	Yc =	0.30	ft
Critical flow area	Ac =	0.61	sq ft
Critical flow velocity	Vc =	3.13	fps
Critical Depth Froude Number	Fr_c =	1.00	

BOX CONDUIT FLOW (Normal & Critical Depth Computation)

Project: **Villas at Claremont Ranch**
Box ID: **Sub Basin 6.1**



Design Information (Input)			
Box conduit invert slope	So =	0.0200	ft/ft
Box Manning's n-value	n =	0.0130	
Box Width	W =	2.00	ft
Box Height	H =	0.50	ft
Design discharge	**Q =**	**2.50**	**cfs**
Full-flow capacity (Calculated)			
Full-flow area	Af =	1.00	sq ft
Full-flow wetted perimeter	Pf =	5.00	ft
Full-flow capacity	Qf =	5.54	cfs
Calculations of Normal Flow Condition			
Normal flow depth (<H)	Yn =	0.23	ft
Flow area	An =	0.47	sq ft
Wetted perimeter	Pn =	2.47	ft
Flow velocity	Vn =	5.35	fps
Discharge	Qn =	2.50	cfs
Percent Full	Flow =	45.1%	of full flow
Normal Depth Froude Number	Fr_n =	1.95	supercritical
Calculation of Critical Flow Condition			
Critical flow depth	Yc =	0.36	ft
Critical flow area	Ac =	0.73	sq ft
Critical flow velocity	Vc =	3.43	fps
Critical Depth Froude Number	Fr_c =	1.00	

2.3.2 Swale Capacity

Where curb and gutter are not used to contain flow, swales are frequently used to convey runoff and disconnect impervious areas. It is very important that swale depths and side slopes be shallow for safety and maintenance reasons. Street-side drainage swales are not the same as roadside ditches. Street-side drainage swales provide mild side slopes and are frequently designed to provide water quality enhancement. For purposes of disconnecting impervious area and reducing the overall volume of runoff, swales should be considered as collectors of initial runoff for transport to other larger means of conveyance. To be effective, they need to be limited to the velocity, depth, and cross-slope geometries considered acceptable.

Equation 7-1 can be used to calculate the flow rate in a V-section swale (using the appropriate roughness value for the swale lining) with an adjusted cross slope found using:

$$S_x = \frac{S_{x1} S_{x2}}{S_{x1} + S_{x2}} \qquad \text{Equation 7-13}$$

Where:

S_x = adjusted side slope (ft/ft)

S_{x1} = right side slope (ft/ft)

S_{x2} = left side slope (ft/ft).

Figure 7-5 shows the geometric variables, and Examples 7.4 and 7.5 show V-shaped swale calculations.

For safety reasons, paved swales should be designed such that the product of velocity and depth is no more than six for the minor storm and eight for the major storm.

For grass swales, refer to the *Grass Swale Fact Sheet* in the Urban Storm Drainage Criteria Manual (USDCM) Volume 3. During the 2-year event, grass swales designed for water quality should have a Froude number of no more than 0.5, a velocity that does not exceed 1.0 ft/s, and a depth that does not exceed 1.0 foot.

Note that the slope of a roadside ditch or swale can be different than the adjacent street. The hydraulic characteristics of the swale can therefore change from one location to another.

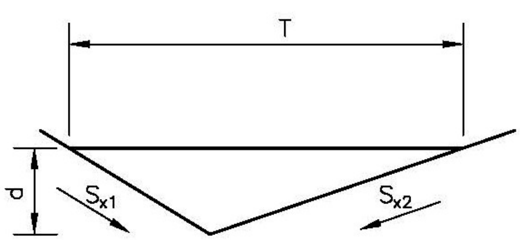


Figure 7-5. Typical v-shaped swale section

Channel Report

SECTION A-A BASIN 1

Trapezoidal

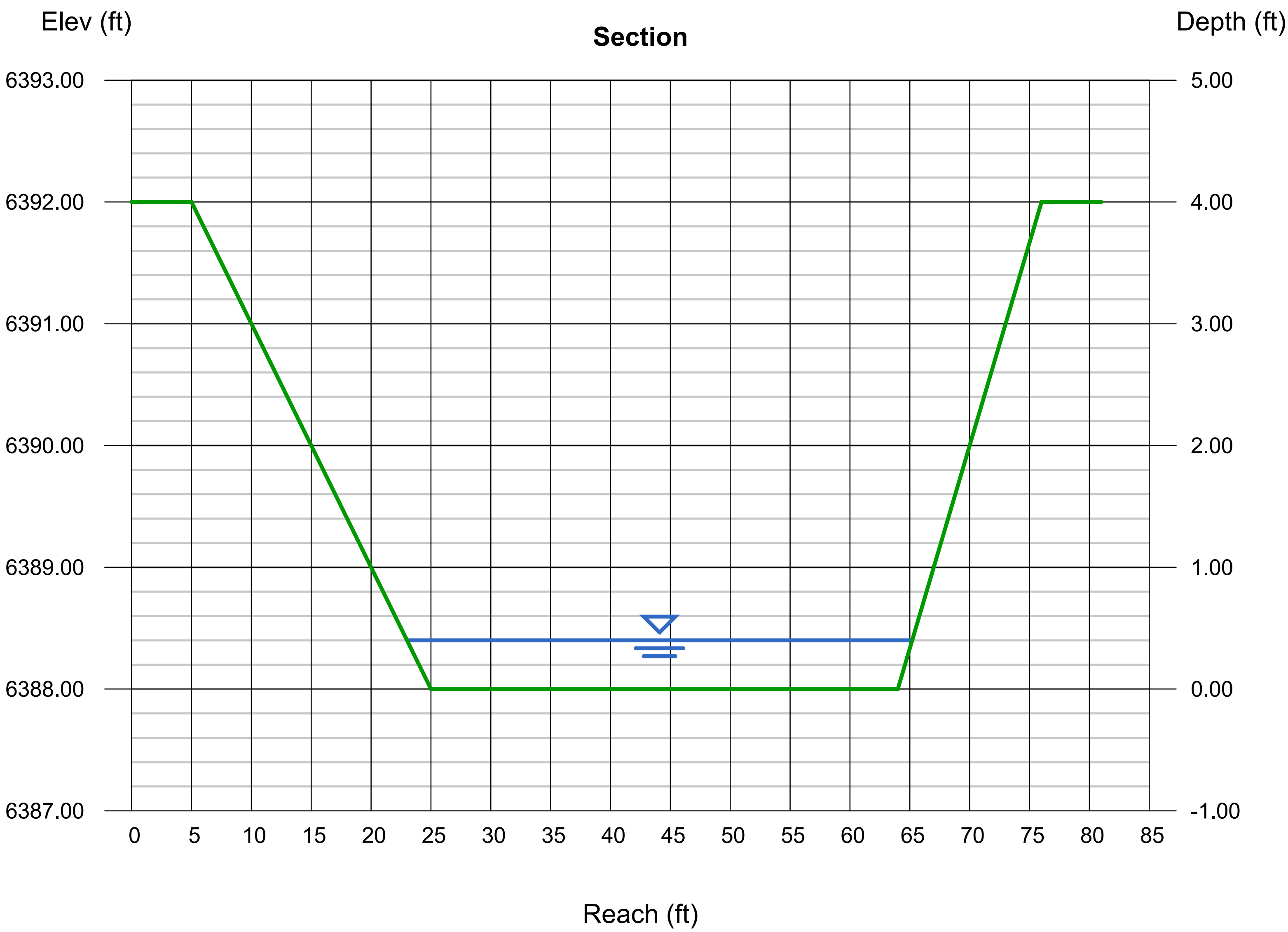
Bottom Width (ft)	=	39.00
Side Slopes (z:1)	=	5.00, 3.00
Total Depth (ft)	=	4.00
Invert Elev (ft)	=	6388.00
Slope (%)	=	0.50
N-Value	=	0.030

Calculations

Compute by:		Q vs Depth
No. Increments	=	20

Highlighted

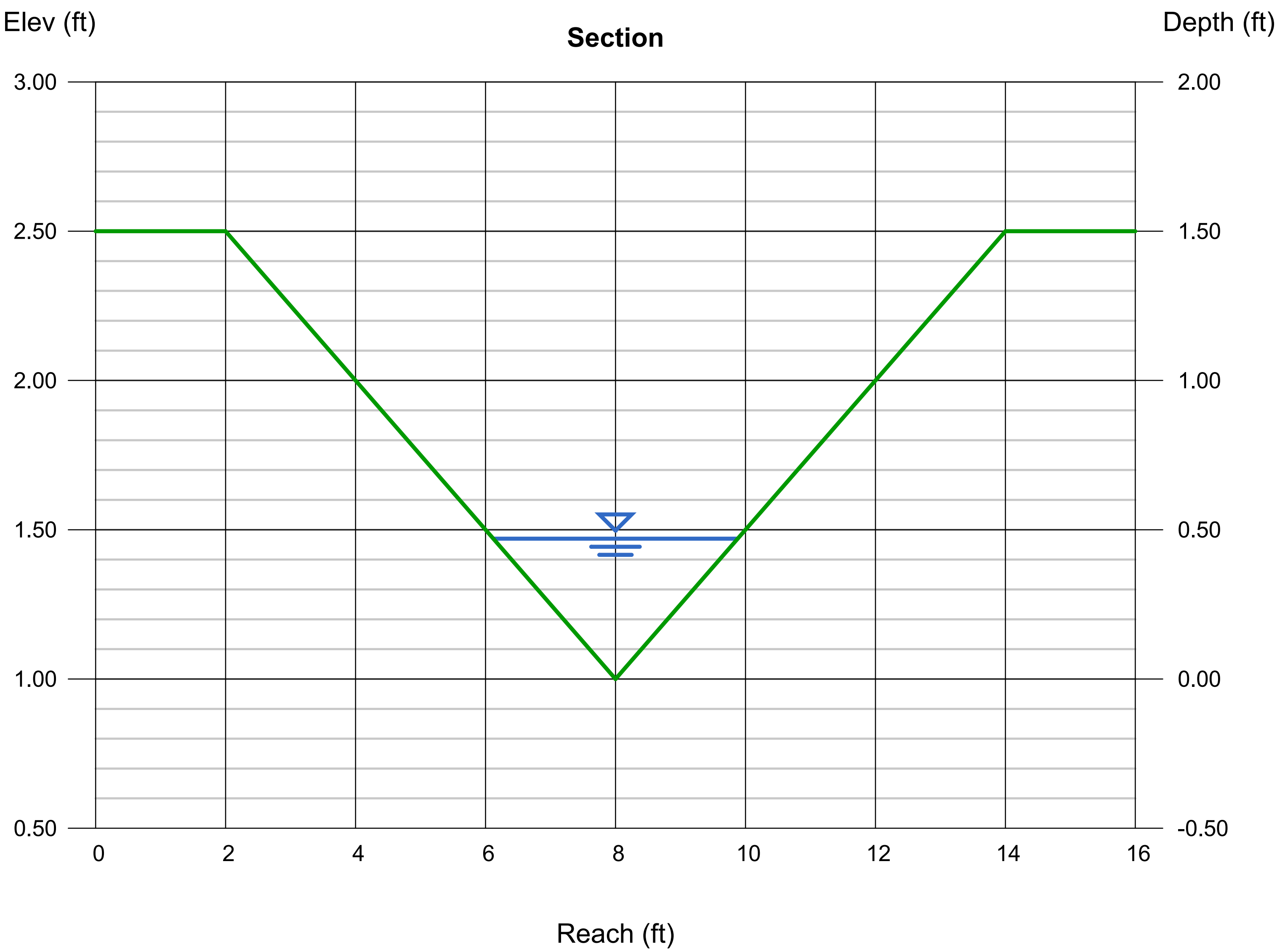
Depth (ft)	=	0.40
Q (cfs)	=	30.04
Area (sqft)	=	16.24
Velocity (ft/s)	=	1.85
Wetted Perim (ft)	=	42.30
Crit Depth, Yc (ft)	=	0.27
Top Width (ft)	=	42.20
EGL (ft)	=	0.45



Channel Report

BASIN 10
Swale

Triangular		**Highlighted**	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 0.47
Total Depth (ft)	= 1.50	Q (cfs)	= 1.400
		Area (sqft)	= 0.88
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 1.58
Slope (%)	= 0.90	Wetted Perim (ft)	= 3.88
N-Value	= 0.033	Crit Depth, Yc (ft)	= 0.38
		Top Width (ft)	= 3.76
Calculations		EGL (ft)	= 0.51
Compute by:	Known Q		
Known Q (cfs)	= 1.40		



Channel Report

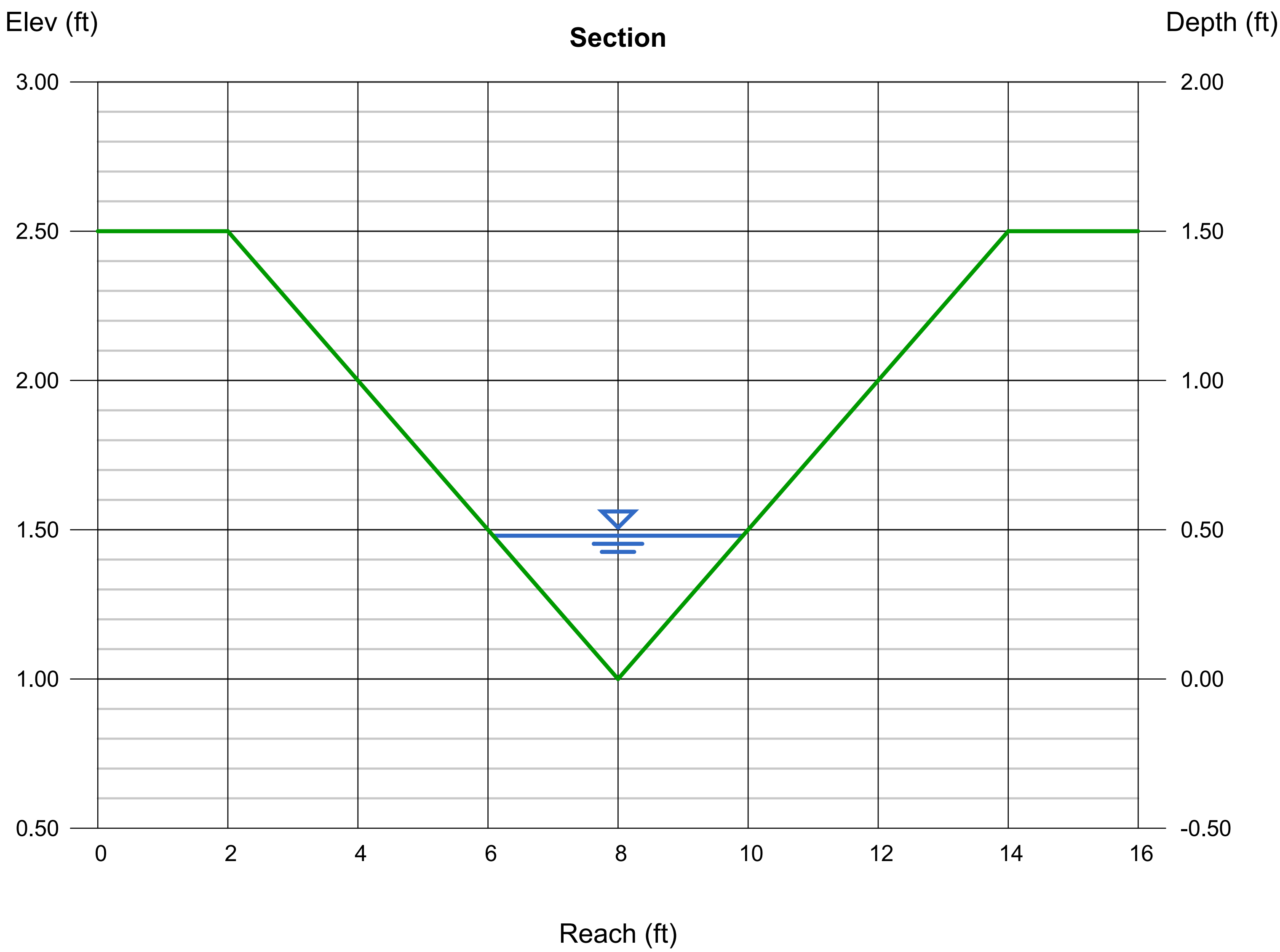
BASIN 1.1

Triangular
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 1.50

Invert Elev (ft) = 1.00
Slope (%) = 1.84
N-Value = 0.033

Calculations
Compute by: Known Q
Known Q (cfs) = 2.10

Highlighted
Depth (ft) = 0.48
Q (cfs) = 2.100
Area (sqft) = 0.92
Velocity (ft/s) = 2.28
Wetted Perim (ft) = 3.96
Crit Depth, Yc (ft) = 0.45
Top Width (ft) = 3.84
EGL (ft) = 0.56

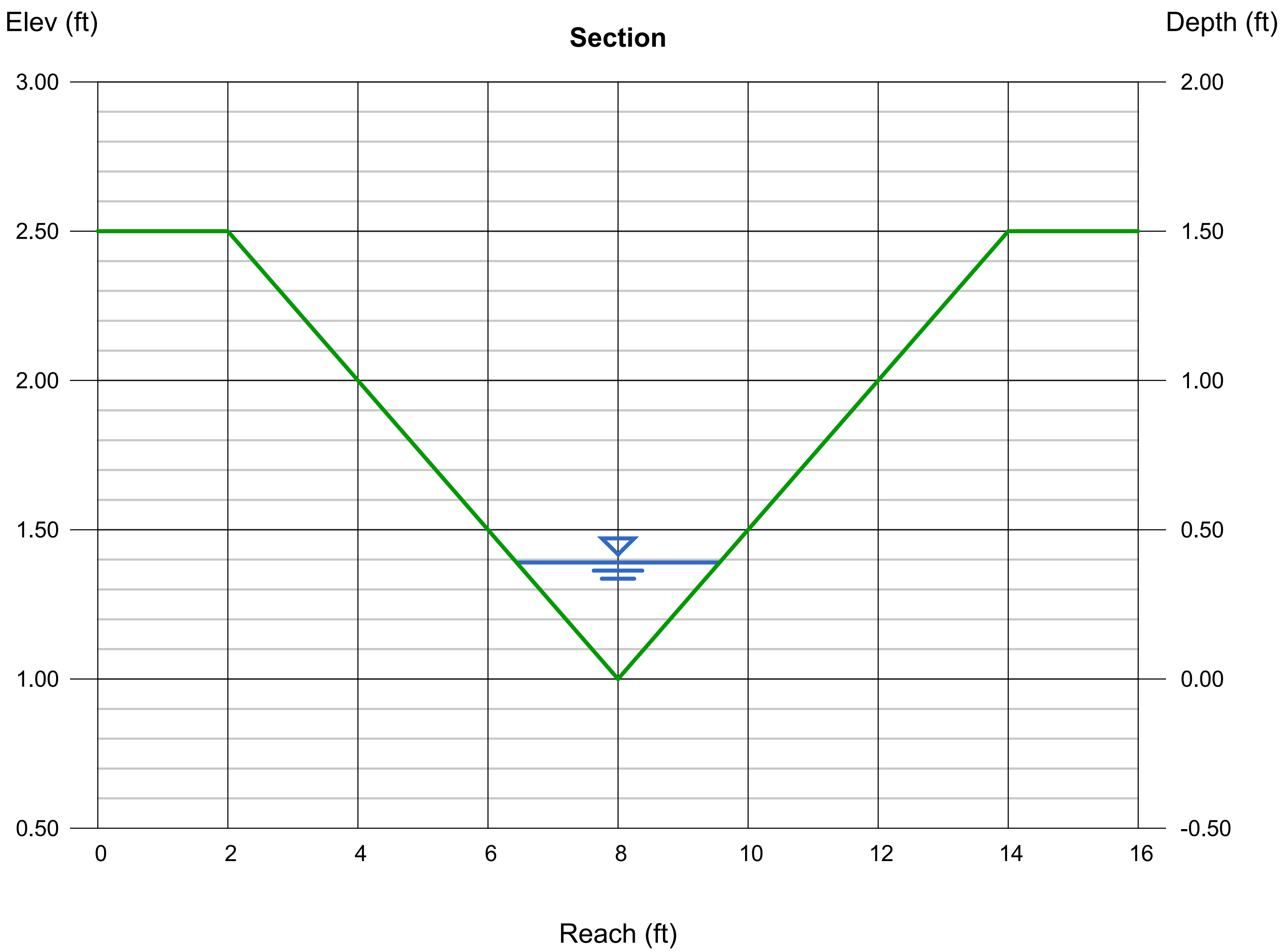


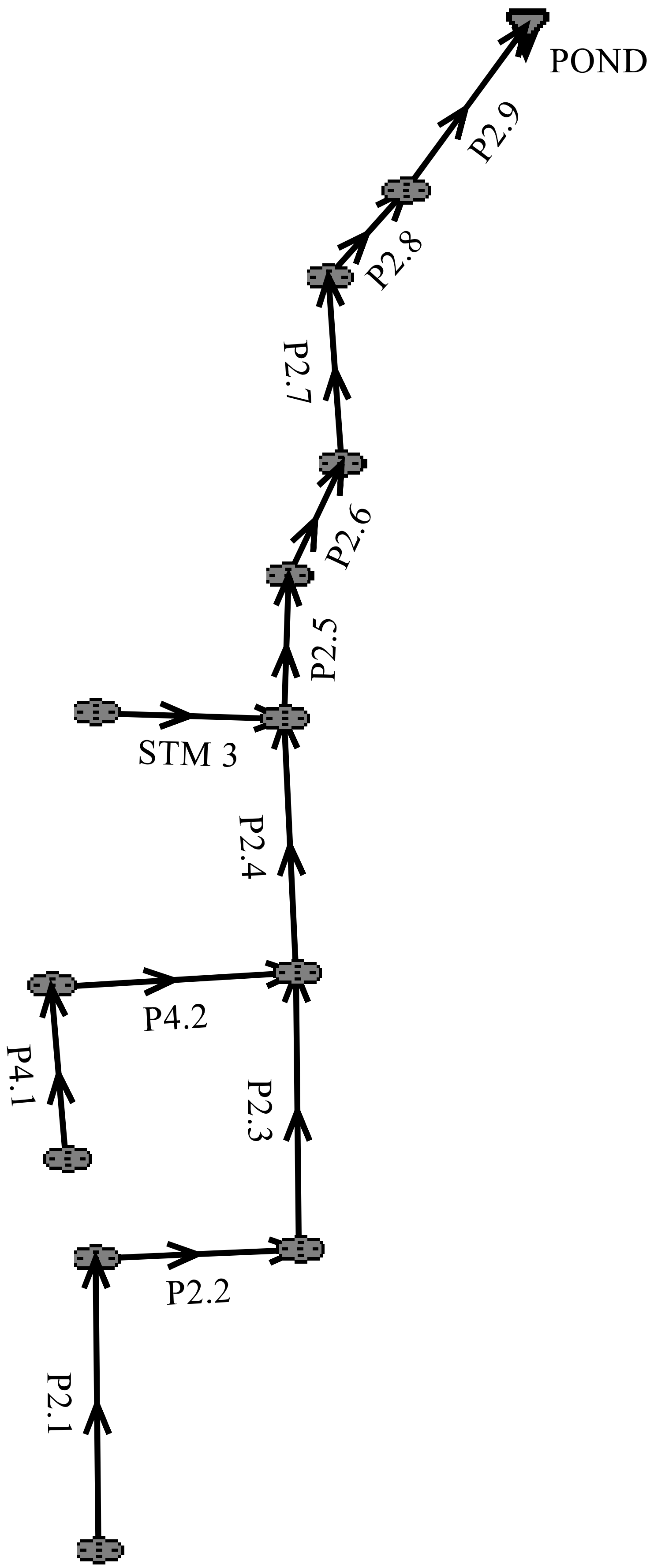
Channel Report

DP-9 Swale

Triangular	
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.033
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 1.20

Highlighted	
Depth (ft)	= 0.39
Q (cfs)	= 1.200
Area (sqft)	= 0.61
Velocity (ft/s)	= 1.97
Wetted Perim (ft)	= 3.22
Crit Depth, Yc (ft)	= 0.36
Top Width (ft)	= 3.12
EGL (ft)	= 0.45




POND
P2.9
P2.8
P2.7
P2.6
P2.5
STM 3
P2.4
P4.2
P4.1
P2.3
P2.2
P2.1

Program: UDSEWER Math Model Interface 2.1.1.4 Run Date: 3/8/2023 2:00:46 PM	UDSewer Results Summary Project Title: 16-102 CLAREMONT RANCH Project Description: Default system

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 18.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 2.0

Backwater Calculations:

Tailwater Elevation (ft): 6384.72

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
POND	6384.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P2.9	6390.00	20.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

P2.8	6392.34	20.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P2.7	6391.43	20.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P2.6	6391.38	17.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P2.5	6390.89	17.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STM 3	6391.31	4.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P2.4	6391.81	13.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P2.3	6393.65	6.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P2.2	6394.05	6.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P2.1	6394.23	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P4.2	6392.26	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P4.1	6392.44	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
POND	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Surface Water Present (Upstream)
P2.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.50	Surface Water Present (Downstream)
P2.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.50	
P2.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.50	
P2.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.60	
P2.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.60	
STM 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10	
P2.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.90	
P2.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.40	
P2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.30	
P2.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	
P4.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.70	
P4.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.60	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
P2.9	58.60	6384.72	0.5	6385.01	0.012	0.03	0.00	CIRCULAR	30.00 in	30.00 in
P2.8	9.81	6385.01	0.5	6385.06	0.012	0.05	0.00	CIRCULAR	30.00 in	30.00 in
P2.7	72.55	6385.06	0.5	6385.42	0.012	0.29	0.00	CIRCULAR	30.00 in	30.00 in

P2.6	15.91	6385.67	0.5	6385.75	0.012	0.29	0.00	CIRCULAR	30.00 in	30.00 in
P2.5	24.64	6385.76	0.5	6385.88	0.012	0.29	0.00	CIRCULAR	30.00 in	30.00 in
STM 3	16.19	6386.64	5.0	6387.45	0.012	1.32	0.00	CIRCULAR	18.00 in	18.00 in
P2.4	201.45	6386.13	0.5	6387.14	0.012	0.05	0.25	CIRCULAR	30.00 in	30.00 in
P2.3	245.18	6387.93	0.6	6389.48	0.012	1.32	0.00	CIRCULAR	18.00 in	18.00 in
P2.2	16.15	6389.98	0.6	6390.08	0.012	1.32	0.00	CIRCULAR	18.00 in	18.00 in
P2.1	38.34	6390.58	0.5	6390.77	0.012	1.32	0.00	CIRCULAR	18.00 in	18.00 in
P4.2	16.15	6387.64	3.8	6388.25	0.012	1.32	0.00	CIRCULAR	18.00 in	18.00 in
P4.1	38.34	6388.75	0.5	6388.94	0.012	1.32	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		**Critical Flow**		**Normal Flow**						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
P2.9	31.51	6.42	18.45	6.47	17.63	6.83	1.09	Supercritical	20.50	0.00	
P2.8	31.51	6.42	18.45	6.47	17.63	6.83	1.09	Supercritical	20.50	0.00	
P2.7	31.51	6.42	18.45	6.47	17.63	6.83	1.09	Supercritical	20.50	0.00	
P2.6	31.51	6.42	17.04	6.12	16.03	6.60	1.12	Supercritical	17.60	0.00	
P2.5	31.51	6.42	17.04	6.12	16.03	6.60	1.12	Supercritical	17.60	0.00	
STM 3	25.51	14.44	9.30	4.45	4.88	10.59	3.46	Supercritical	4.10	0.00	
P2.4	31.51	6.42	15.06	5.64	13.95	6.22	1.16	Supercritical	13.90	0.00	
P2.3	9.07	5.13	11.74	5.24	11.15	5.56	1.10	Supercritical	6.40	0.00	
P2.2	8.98	5.08	11.64	5.21	11.11	5.50	1.09	Supercritical	6.30	0.00	
P2.1	8.07	4.57	7.90	4.02	7.60	4.23	1.08	Supercritical	3.00	0.00	
P4.2	22.24	12.59	15.06	6.77	8.80	12.47	2.90	Supercritical Jump	10.70	0.34	
P4.1	8.07	4.57	10.95	4.98	11.03	4.93	0.99	Subcritical Surcharged	5.60	7.54	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		**Calculated**		**Used**			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
P2.9	20.50	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
P2.8	20.50	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
P2.7	20.50	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	

P2.6	17.60	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
P2.5	17.60	CIRCULAR	30.00 in	30.00 in	27.00 in	27.00 in	30.00 in	30.00 in	4.91	
STM 3	4.10	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
P2.4	13.90	CIRCULAR	30.00 in	30.00 in	24.00 in	24.00 in	30.00 in	30.00 in	4.91	
P2.3	6.40	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
P2.2	6.30	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
P2.1	3.00	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
P4.2	10.70	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	
P4.1	5.60	CIRCULAR	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6384.72

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
P2.9	6384.72	6385.01	0.00	0.00	6386.19	6386.55	6386.91	0.29	6387.20
P2.8	6385.01	6385.06	0.01	0.00	6386.65	6386.65	6387.21	0.04	6387.25
P2.7	6385.06	6385.42	0.08	0.00	6386.89	6386.96	6387.33	0.28	6387.61
P2.6	6385.67	6385.75	0.06	0.00	6387.02	6387.17	6387.68	0.07	6387.75
P2.5	6385.76	6385.88	0.06	0.00	6387.39	6387.39	6387.81	0.08	6387.89
STM 3	6386.64	6387.45	0.11	0.00	6387.50	6388.68	6388.79	0.00	6388.79
P2.4	6386.13	6387.14	0.01	0.17	6387.83	6388.39	6388.07	0.82	6388.89
P2.3	6387.93	6389.48	0.27	0.00	6388.86	6390.46	6389.34	1.54	6390.89
P2.2	6389.98	6390.08	0.26	0.00	6390.91	6391.05	6391.38	0.10	6391.47
P2.1	6390.58	6390.77	0.06	0.00	6391.13	6391.43	6391.53	0.15	6391.68
P4.2	6387.64	6388.25	0.75	0.00	6389.15	6389.51	6389.71	0.51	6390.22
P4.1	6388.75	6388.94	0.21	0.00	6390.27	6390.35	6390.42	0.09	6390.51

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

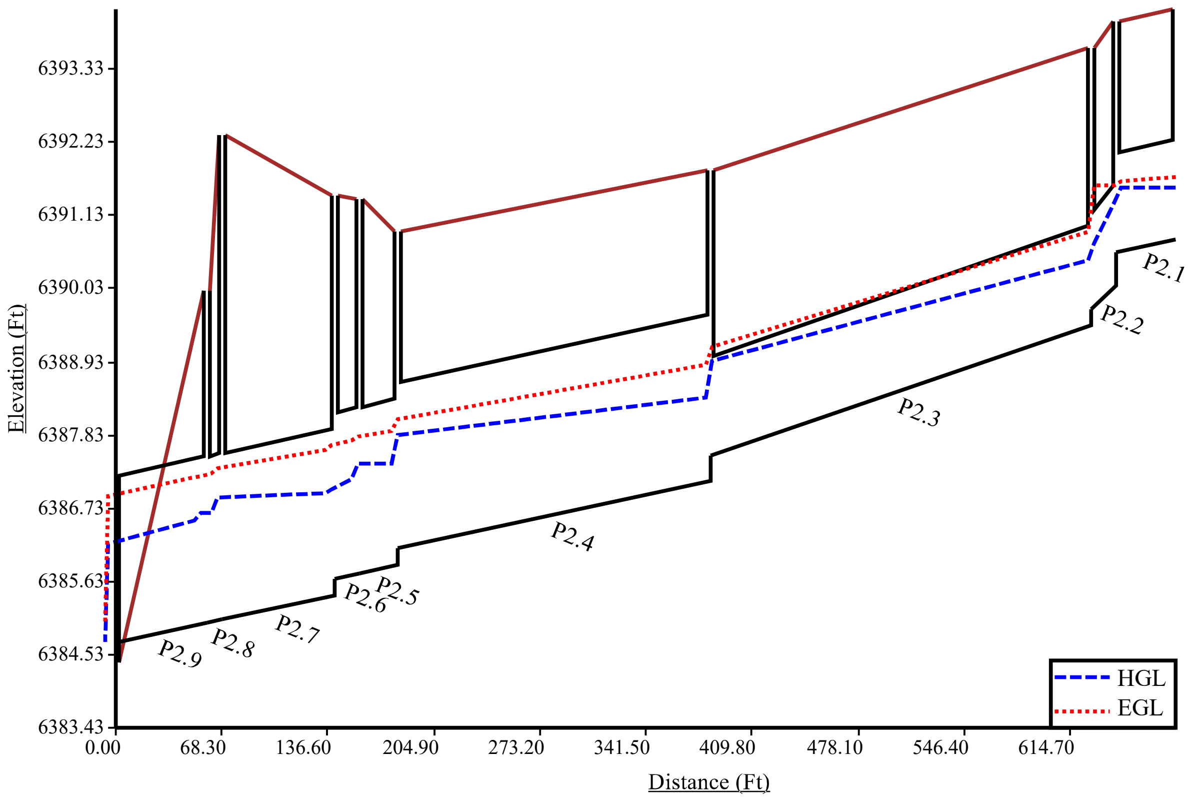
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
P2.9	58.60	3.50	6.00	6.08	0.00	0.48	0.00	8.48	5.78	2.20	42.93	Sewer Too Shallow
P2.8	9.81	3.50	6.00	6.08	8.48	5.78	2.20	13.06	8.07	4.49	17.78	
P2.7	72.55	3.50	6.00	6.08	13.07	8.07	4.49	10.52	6.80	3.22	144.57	
P2.6	15.91	3.50	6.00	6.08	10.02	6.55	2.97	9.76	6.42	2.84	25.39	
P2.5	24.64	3.50	6.00	6.08	9.75	6.41	2.83	8.52	5.80	2.22	36.12	
STM 3	16.19	2.50	4.00	4.92	8.00	4.79	2.54	7.22	4.40	2.15	14.66	
P2.4	201.45	3.50	6.00	6.08	8.01	5.55	1.97	7.84	5.46	1.88	256.23	Sewer Too Shallow
P2.3	245.18	2.50	4.00	4.92	7.26	4.42	2.17	7.84	4.71	2.46	219.81	
P2.2	16.15	2.50	4.00	4.92	6.84	4.21	1.96	7.44	4.51	2.26	13.58	Sewer Too Shallow
P2.1	38.34	2.50	4.00	4.92	6.44	4.01	1.76	6.42	4.00	1.75	28.79	Sewer Too Shallow
P4.2	16.15	2.50	4.00	4.92	7.85	4.72	2.47	7.52	4.55	2.30	14.78	
P4.1	38.34	2.50	4.00	4.92	6.52	4.05	1.80	6.50	4.04	1.79	29.16	Sewer Too Shallow

Total earth volume for sewer trenches = 844 cubic yards.

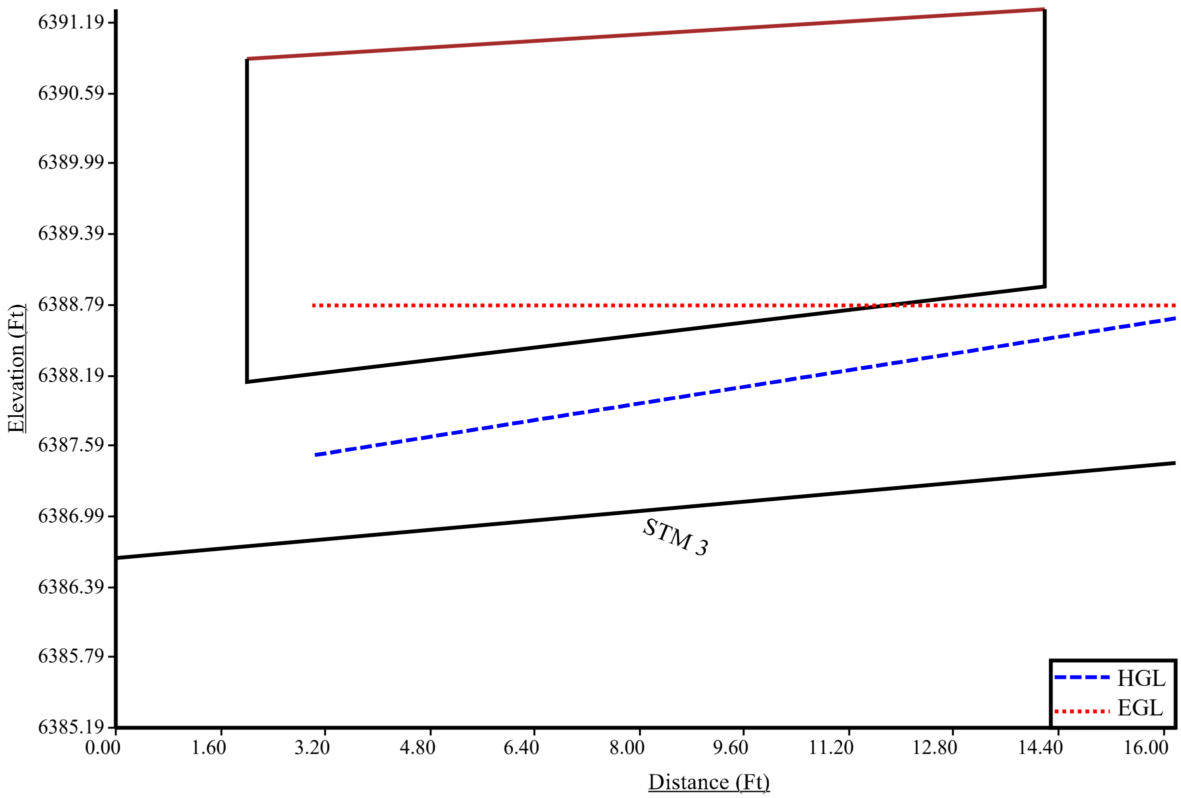
- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

100-YR MAIN



6393.33
6392.23
6391.13
6390.03
6388.93
6387.83
6386.73
6385.63
6384.53
6383.43
Elevation (Ft)
0.00
68.30
136.60
204.90
273.20
341.50
409.80
478.10
546.40
614.70
Distance (Ft)
P2.1
P2.2
P2.3
P2.4
P2.5
P2.6
P2.7
P2.8
P2.9
HGL
EGL

100-YR (STM 3)



Elevation (Ft)
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6390.59
6389.99
6389.39
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6386.99
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6385.79
6385.19
STM 3
HGL
EGL
0.00
1.60
3.20
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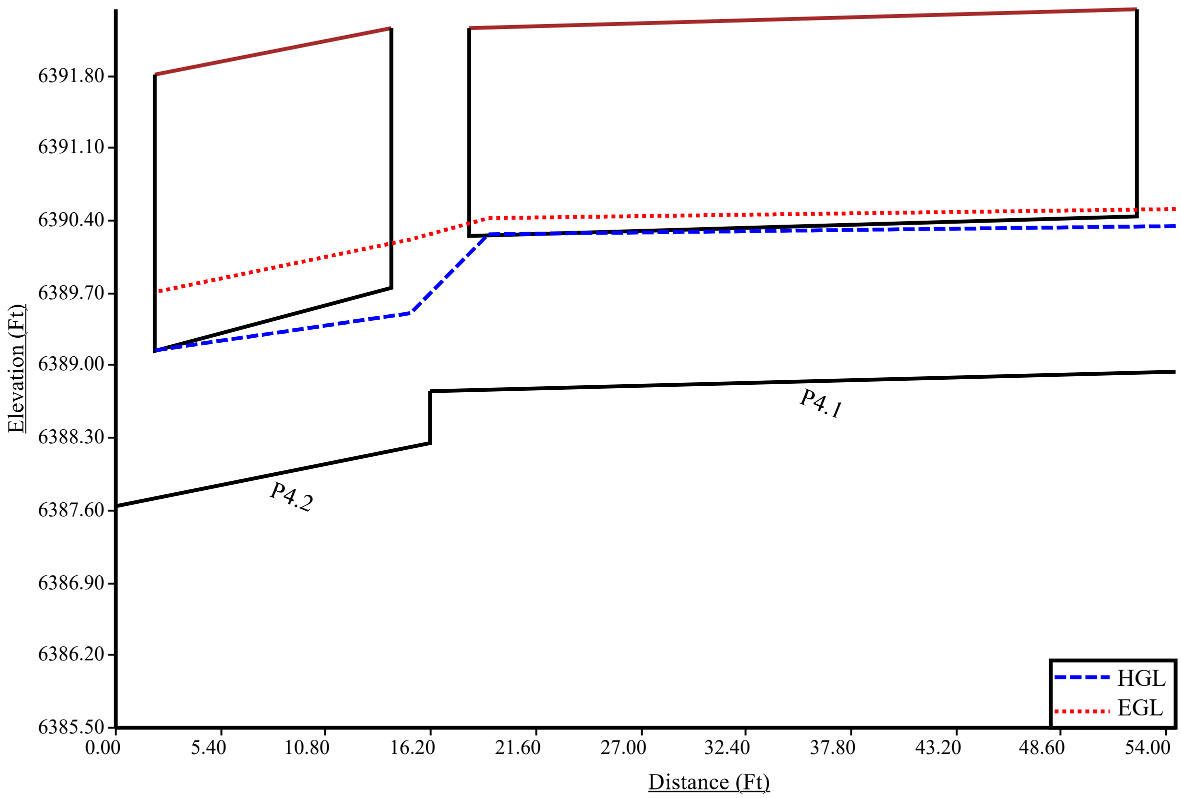
6.40
8.00
9.60
11.20
12.80
14.40
16.00
Distance (Ft)

100 YR 4



Elevation (Ft)
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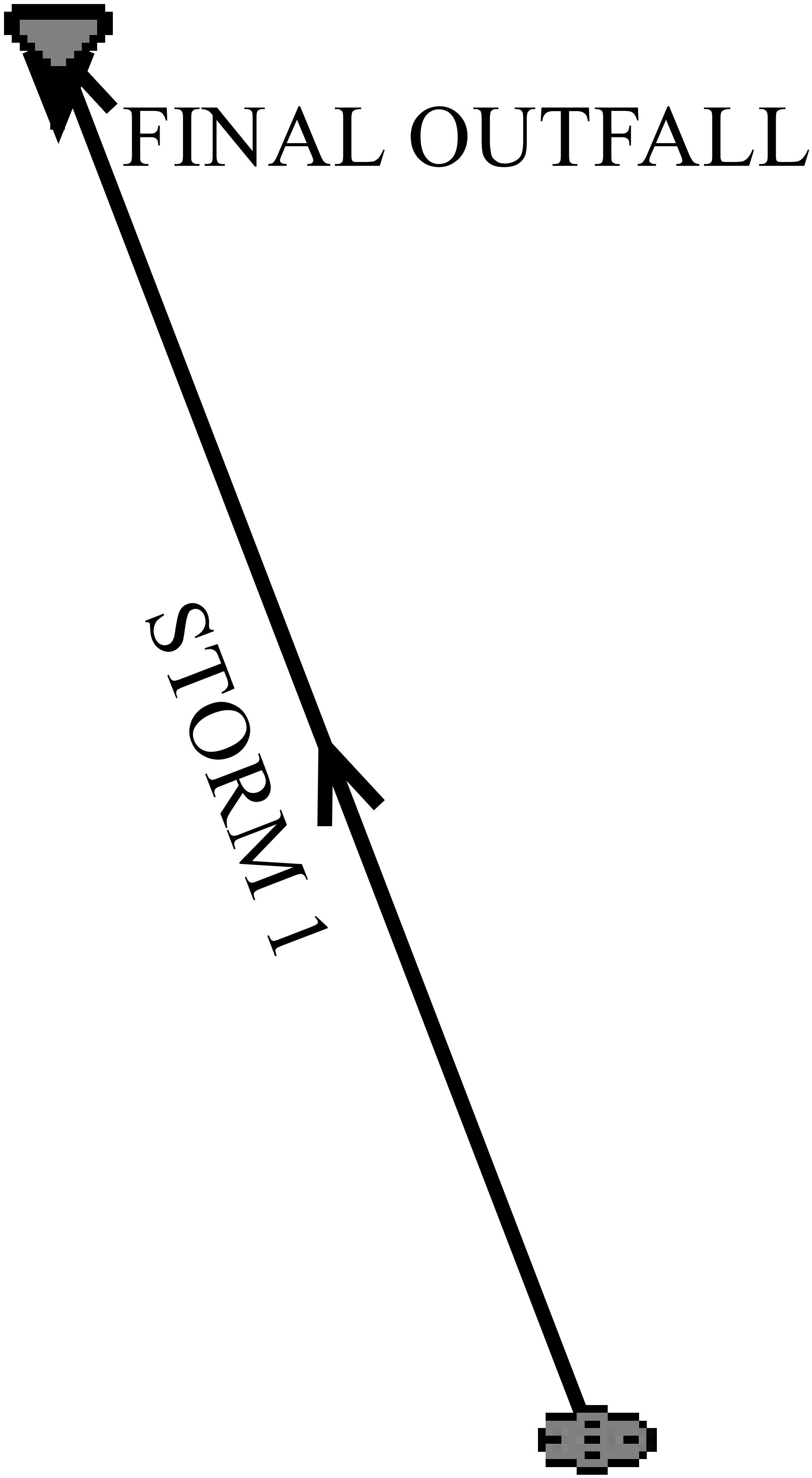
6391.10
6390.40
6389.70
6389.00
6388.30
6387.60
6386.90
6386.20
6385.50
P4.1
P4.2
HGL
EGL
0.00
5.40
10.80
16.20
21.60
27.00
32.40
37.80
43.20
48.60
54.00
Distance (Ft)


FINAL OUTFALL
STORM 1

Program: UDSEWER Math Model Interface 2.1.1.4 **Run Date:** 12/6/2022 8:46:18 AM	# UDSewer Results Summary **Project Title:** 16-102 CLAREMONT RANCH **Project Description:** STORM SEWER

System Input Summary

Rainfall Parameters

Rainfall Return Period: 100
Rainfall Calculation Method: Formula

One Hour Depth (in):
Rainfall Constant "A": 28.5
Rainfall Constant "B": 10
Rainfall Constant "C": 0.786

Rational Method Constraints

Minimum Urban Runoff Coeff.: 0.20
Maximum Rural Overland Len. (ft): 500
Maximum Urban Overland Len. (ft): 300
Used UDFCD Tc. Maximum: Yes

Sizer Constraints

Minimum Sewer Size (in): 12.00
Maximum Depth to Rise Ratio: 0.90
Maximum Flow Velocity (fps): 18.0
Minimum Flow Velocity (fps): 3.0

Backwater Calculations:

Tailwater Elevation (ft): 6379.26

Manhole Input Summary:

		Given Flow		Sub Basin Information						
Element Name	Ground Elevation (ft)	Total Known Flow (cfs)	Local Contribution (cfs)	Drainage Area (Ac.)	Runoff Coefficient	5yr Coefficient	Overland Length (ft)	Overland Slope (%)	Gutter Length (ft)	Gutter Velocity (fps)
POND (1)	6379.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

STORM 1	6387.08	7.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Manhole Output Summary:

	Local Contribution					Total Design Flow				
Element Name	**Overland Time (min)**	**Gutter Time (min)**	**Basin Tc (min)**	**Intensity (in/hr)**	**Local Contrib (cfs)**	**Coeff. Area**	**Intensity (in/hr)**	**Manhole Tc (min)**	**Peak Flow (cfs)**	**Comment**
POND (1)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
STORM 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.80	

Sewer Input Summary:

		Elevation			Loss Coefficients			Given Dimensions		
Element Name	**Sewer Length (ft)**	**Downstream Invert (ft)**	**Slope (%)**	**Upstream Invert (ft)**	**Mannings n**	**Bend Loss**	**Lateral Loss**	**Cross Section**	**Rise (ft or in)**	**Span (ft or in)**
STORM 1	112.33	6377.76	4.9	6383.28	0.012	0.00	0.00	CIRCULAR	18.00 in	18.00 in

Sewer Flow Summary:

	Full Flow Capacity		Critical Flow		Normal Flow						
Element Name	**Flow (cfs)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Depth (in)**	**Velocity (fps)**	**Froude Number**	**Flow Condition**	**Flow (cfs)**	**Surcharged Length (ft)**	**Comment**
STORM 1	25.29	14.31	12.98	5.72	6.86	12.61	3.41	Supercritical Jump	7.80	0.00	

- A Froude number of 0 indicates that pressured flow occurs (adverse slope or undersized pipe).
- If the sewer is not pressurized, full flow represents the maximum gravity flow in the sewer.
- If the sewer is pressurized, full flow represents the pressurized flow conditions.

Sewer Sizing Summary:

			Existing		Calculated		Used			
Element Name	**Peak Flow (cfs)**	**Cross Section**	**Rise**	**Span**	**Rise**	**Span**	**Rise**	**Span**	**Area (ft^2)**	**Comment**
STORM 1	7.80	CIRCULAR	18.00 in	18.00 in	12.00 in	12.00 in	18.00 in	18.00 in	1.77	

- Calculated diameter was determined by sewer hydraulic capacity rounded up to the nearest commercially available size.
- Sewer sizes should not decrease downstream.
- All hydraulics where calculated using the 'Used' parameters.

Grade Line Summary:

Tailwater Elevation (ft): 6379.26

	Invert Elev.		Downstream Manhole Losses		HGL		EGL		
Element Name	**Downstream (ft)**	**Upstream (ft)**	**Bend Loss (ft)**	**Lateral Loss (ft)**	**Downstream (ft)**	**Upstream (ft)**	**Downstream (ft)**	**Friction Loss (ft)**	**Upstream (ft)**
STORM 1	6377.76	6383.28	0.00	0.00	6379.26	6384.36	6379.56	5.31	6384.87

- Bend and Lateral losses only apply when there is an outgoing sewer. The system outfall, sewer #0, is not considered a sewer.
- Bend loss = Bend K * V_fi ^ 2/(2*g)
- Lateral loss = V_fo ^ 2/(2*g)- Junction Loss K * V_fi ^ 2/(2*g).
- Friction loss is always Upstream EGL - Downstream EGL.

Excavation Estimate:

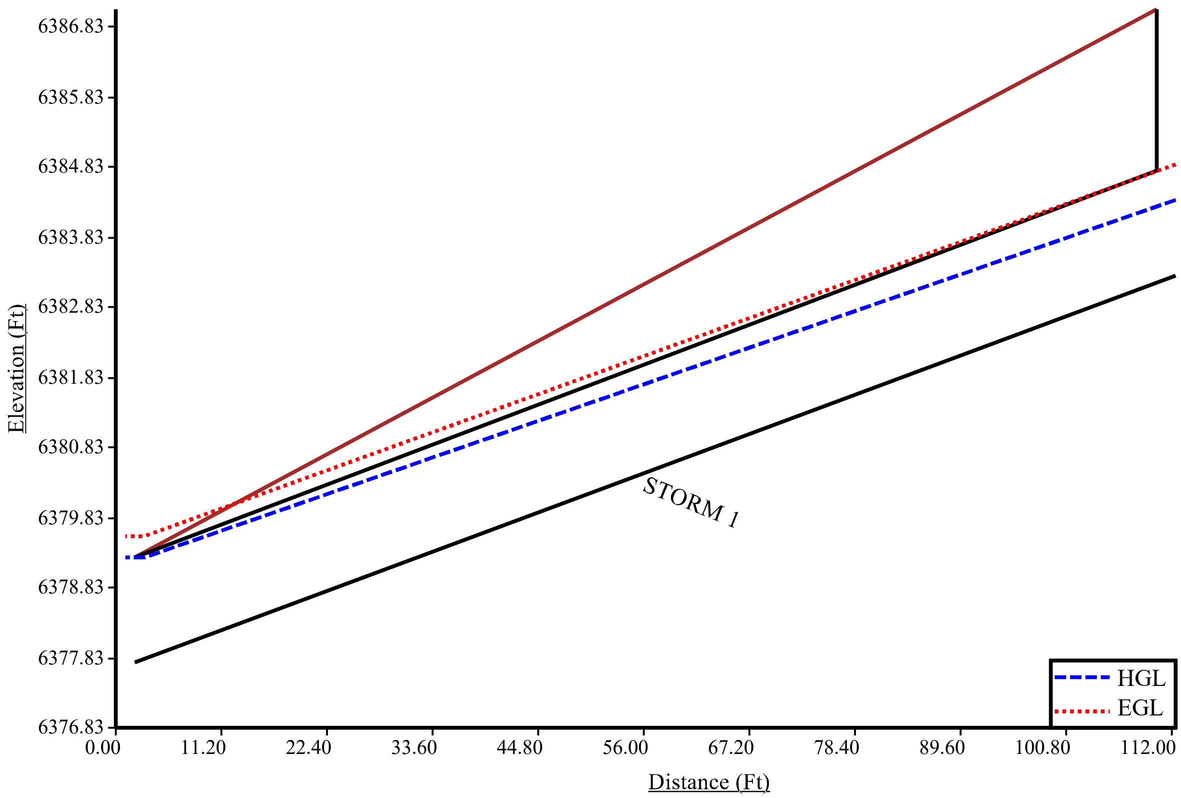
The trench side slope is 1.0 ft/ft
The minimum trench width is 2.00 ft

					Downstream			Upstream				
Element Name	**Length (ft)**	**Wall (in)**	**Bedding (in)**	**Bottom Width (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Top Width (ft)**	**Trench Depth (ft)**	**Cover (ft)**	**Volume (cu. yd)**	**Comment**
STORM 1	112.33	2.50	4.00	4.92	0.00	2.04	0.00	7.10	4.34	2.09	67.77	Sewer Too Shallow

Total earth volume for sewer trenches = 68 cubic yards.

- The trench was estimated to have a bottom width equal to the outer pipe diameter plus 36 inches.
- If the calculated width of the trench bottom is less than the minimum acceptable width, the minimum acceptable width was used.
- The sewer wall thickness is equal to: (equivalent diameter in inches/12)+1 inches
- The sewer bedding thickness is equal to:
  - Four inches for pipes less than 33 inches.
  - Six inches for pipes less than 60 inches.
  - Eight inches for all larger sizes.

100-YR SYSTEM



Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: David Mijares
Company: Catamount Engineering
Date: December 13, 2022
Project: Villas at Claremont Ranch
Location: EDB B

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 52.7 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.527

C) Contributing Watershed Area — Area = 7.830 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = ___ in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- (●) Water Quality Capture Volume (WQCV)
- ( ) Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$) — V_{DESIGN} = 0.139 ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$) — $V_{DESIGN\ OTHER}$ = ___ ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$ = ___ ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
- i) Percentage of Watershed consisting of Type A Soils — HSG_A = ___ %
- ii) Percentage of Watershed consisting of Type B Soils — HSG_B = ___ %
- iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = ___ %

J) Excess Urban Runoff Volume (EURV) Design Volume — $EURV_{DESIGN}$ = ___ ac-f t
- For HSG A: $EURV_A = 1.68 * i^{1.28}$
- For HSG B: $EURV_B = 1.36 * i^{1.08}$
- For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired) — $EURV_{DESIGN\ USER}$ = ___ ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 2.2 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 4.00 ft / ft

4. Inlet

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

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 2% of the WQCV) — V_{FMIN} = 0.003 ac-ft

B) Actual Forebay Volume — V_F = ___ ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 12.0 in

D) Forebay Discharge
- i) Undetained 100-year Peak Discharge — Q_{100} = 25.00 cfs
- ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 0.50 cfs

E) Forebay Discharge Design

Choose One
- ( ) Berm With Pipe
- (●) Wall with Rect. Notch
- ( ) Wall with V-Notch Weir

Flow too small for berm w/ pipe

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = ___ in

G) Rectangular Notch Width — Calculated W_N = 4.2 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer: David Mijares
Company: Catamount Engineering
Date: December 13, 2022
Project: Villas at Claremont Ranch
Location: EDB B

6. Trickle Channel

A) Type of Trickle Channel — Choose One: (●) Concrete ( ) Soft Bottom

F) Slope of Trickle Channel — S = 0.0100 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 20 sq ft

C) Outlet Type — Choose One: (●) Orifice Plate ( ) Other (Describe):

See UD-DETENTION FOR OUTFALL

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 0.94 inches

E) Total Outlet Area — A_{ot} = 2.82 square inches

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 4 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = cu ft

C) Initial Surcharge Provided Above Micropool — V_s= 6.7 cu ft

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = 99 square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) — *S.S. Well Screen with 60% Open Area*

Other (Y/N): N

C) Ratio of Total Open Area to Total Area (only for type 'Other') — User Ratio =

D) Total Water Quality Screen Area (based on screen type) — A_{total} = 165 sq. in.

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H= 2.06 feet

F) Height of Water Quality Screen (H_{TR}) — H_{TR}= 52.72 inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer: David Mijares
Company: Catamount Engineering
Date: December 13, 2022
Project: Villas at Claremont Ranch
Location: EDB B

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

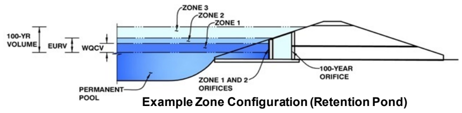
Notes:

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **VILLAS AT CLAREMONT RANCH**

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	7.83	acres		
Watershed Length =	1,300	ft		
Watershed Length to Centroid =	1,130	ft		
Watershed Slope =	0.015	ft/ft		
Watershed Imperviousness =	52.70%	percent		
Percentage Hydrologic Soil Group A =	25.8%	percent		
Percentage Hydrologic Soil Group B =	74.2%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	Denver - Capitol Building			

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.139	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.453	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.393	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.556	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.695	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.897	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.058	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.269	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	1.681	acre-feet		inches
Approximate 2-yr Detention Volume =	0.330	acre-feet		
Approximate 5-yr Detention Volume =	0.446	acre-feet		
Approximate 10-yr Detention Volume =	0.576	acre-feet		
Approximate 25-yr Detention Volume =	0.644	acre-feet		
Approximate 50-yr Detention Volume =	0.684	acre-feet		
Approximate 100-yr Detention Volume =	0.760	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.139	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.314	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.307	acre-feet
Total Detention Basin Volume =	0.760	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	16	0.000		
ISV	--	0.33	--	--	--	16	0.000	5	0.000
FLOOR-6384	--	1.00	--	--	--	3,773	0.087	1,274	0.029
6386	--	3.00	--	--	--	6,652	0.153	11,699	0.269
6388	--	5.00	--	--	--	10,299	0.236	28,650	0.658
6390	--	7.00	--	--	--	14,646	0.336	53,595	1.230
6392	--	9.00	--	--	--	19,186	0.440	87,427	2.007
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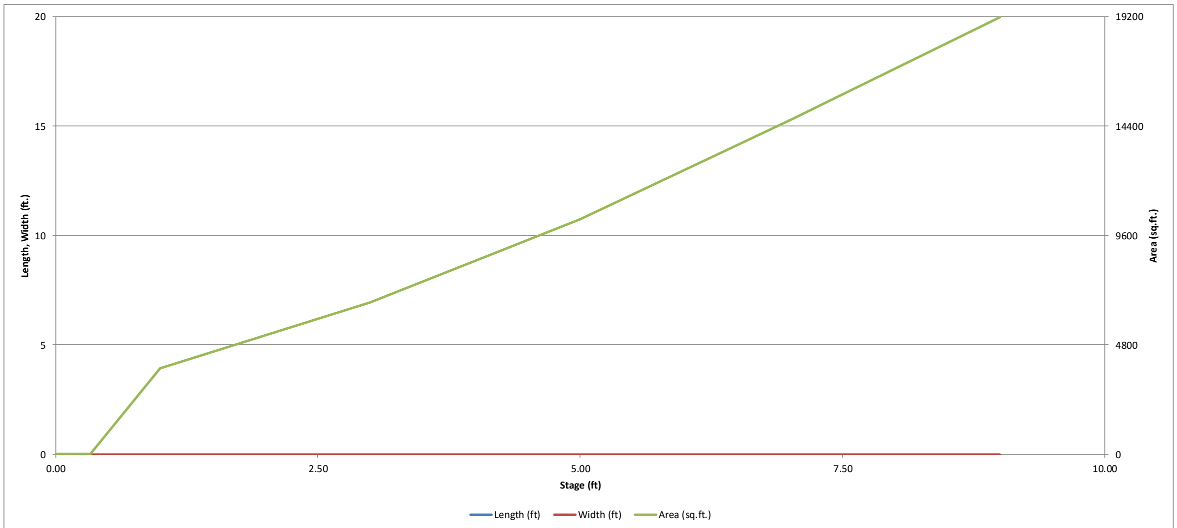
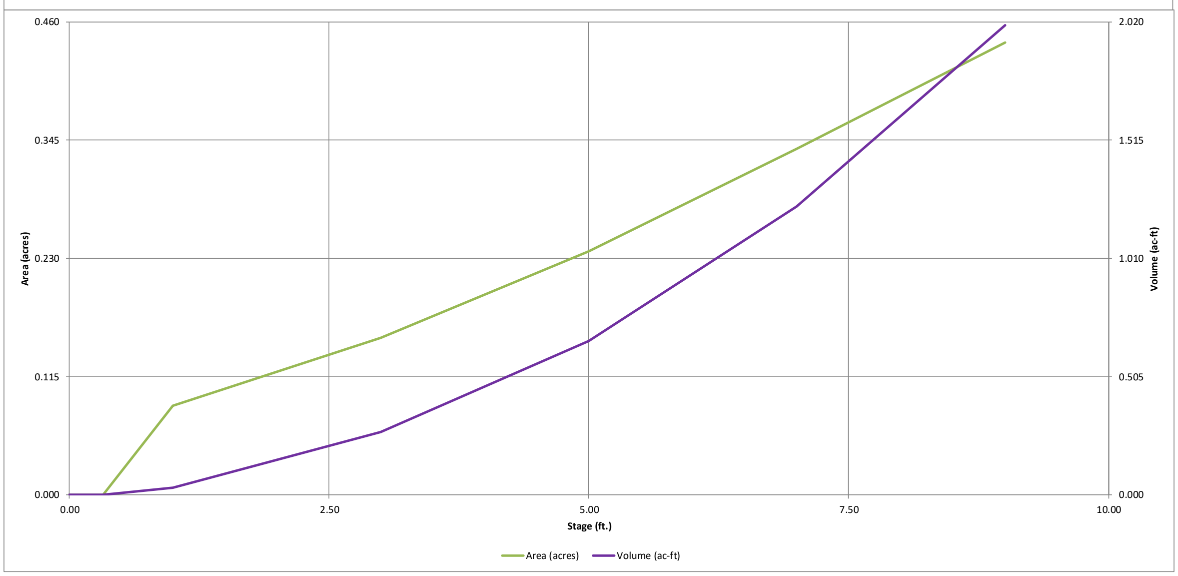
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



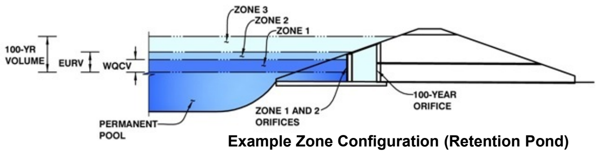


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **VILLAS AT CLAREMONT RANCH**

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.06	0.139	Orifice Plate
Zone 2 (EURV)	4.06	0.314	Orifice Plate
Zone 3 (100-year)	5.42	0.307	Weir&Pipe (Restrict)
Total (all zones)		0.760	

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 Area =		ft^2
Underdrain Orifice Diameter =		inches	Underdrain Orifice Centroid =		feet

(Calculated Parameters for Underdrain)

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

			Calculated Parameters for Plate		
Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.06	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	16.20	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.35	2.71					
Orifice Area (sq. inches)	0.94	0.94	0.94					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected		Calculated Parameters for Vertical Orifice	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

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

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.06	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.06	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	30.32	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	11.14	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	5.57	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

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

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.37	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.23	N/A	feet
Restrictor Plate Height Above Pipe Invert =	4.70		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.07	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.34	feet
Spillway Crest Length =	20.00	feet	Stage at Top of Freeboard =	7.34	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.35	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.35	acre-ft

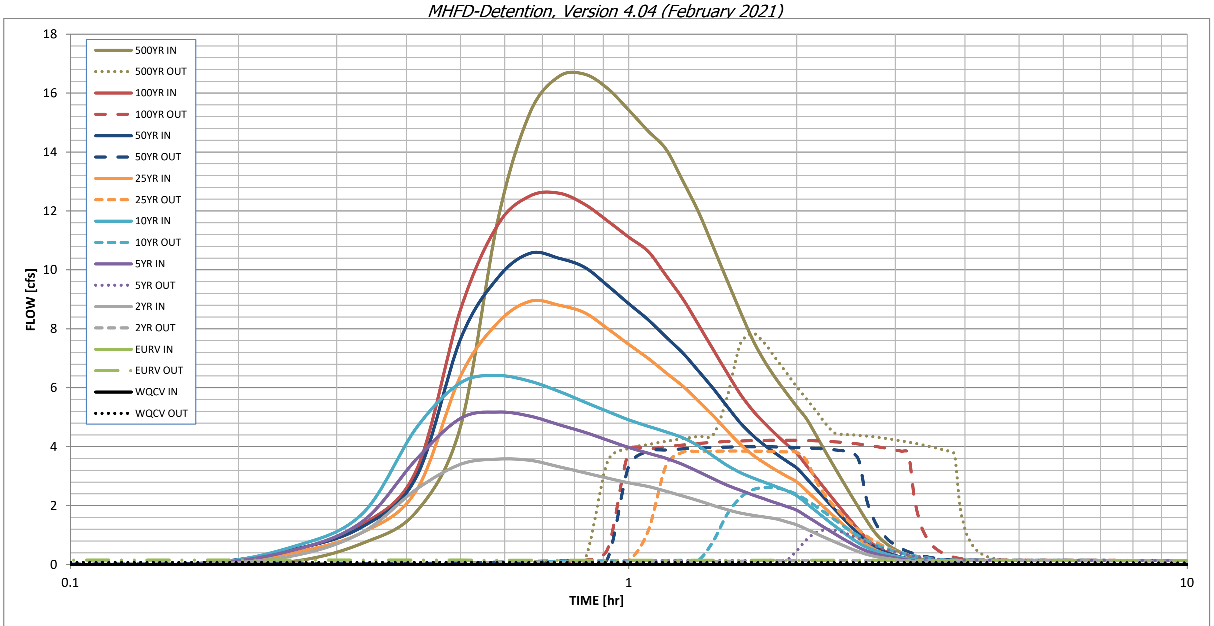
Routed Hydrograph Results

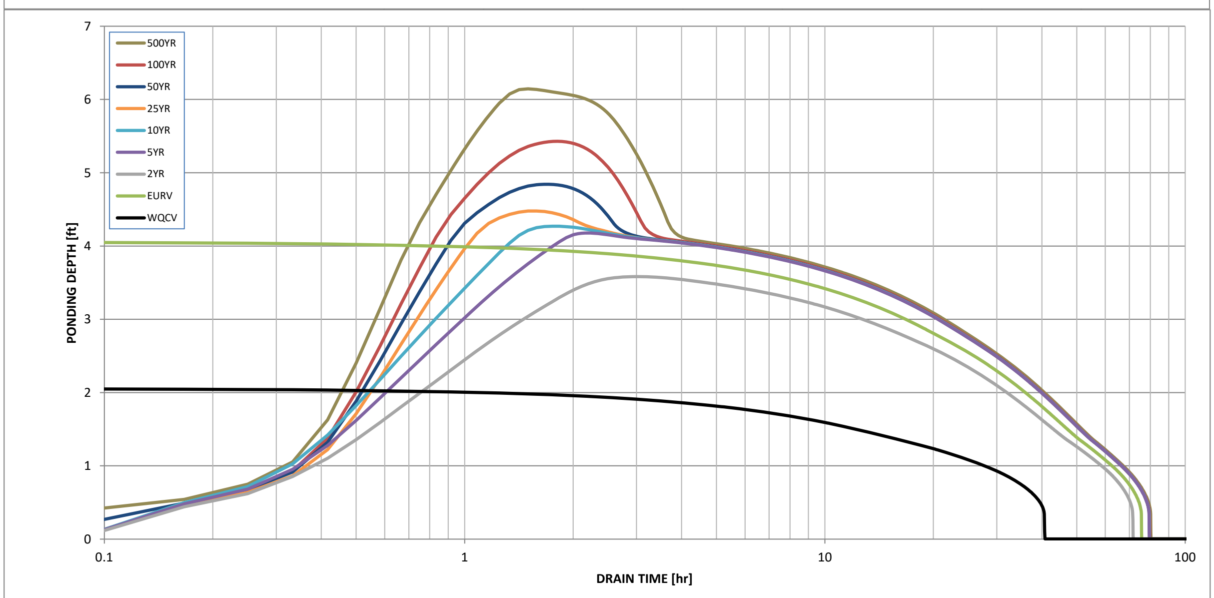
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

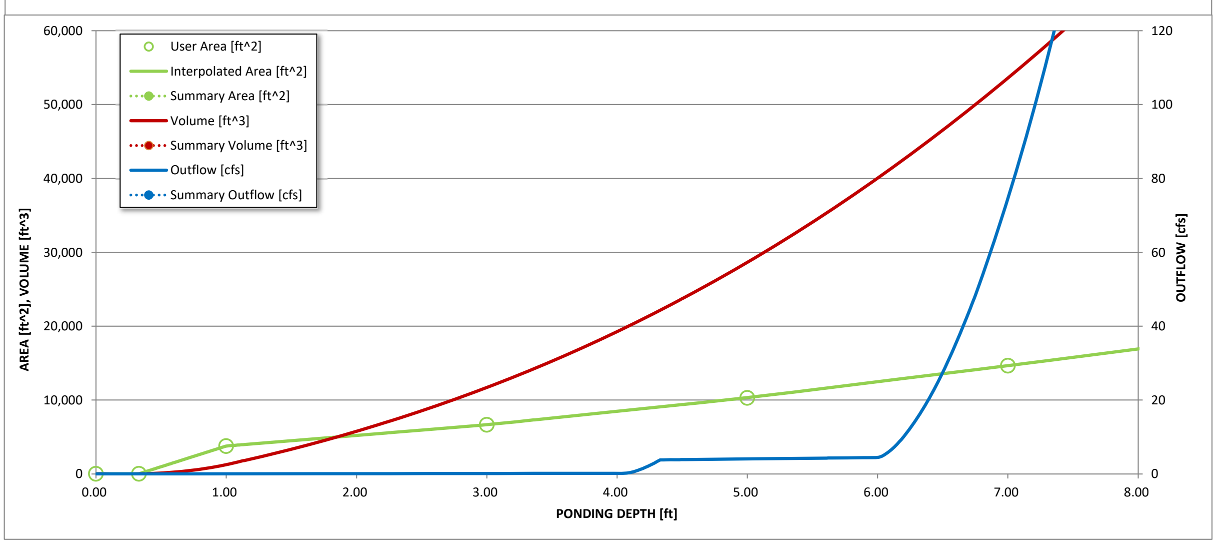
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.139	0.453	0.393	0.556	0.695	0.897	1.058	1.269	1.681
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.393	0.556	0.695	0.897	1.058	1.269	1.681
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.8	1.4	2.9	3.8	5.2	7.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.10	0.18	0.38	0.49	0.66	0.96
Peak Inflow Q (cfs) =	N/A	N/A	3.6	5.2	6.4	8.9	10.6	12.6	16.6
Peak Outflow Q (cfs) =	0.1	0.2	0.1	1.2	2.6	3.9	4.0	4.2	7.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.5	1.9	1.3	1.0	0.8	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.2	0.3	0.3	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	69	66	72	70	68	66	64	60
Time to Drain 99% of Inflow Volume (hours) =	**40**	73	70	77	76	75	74	74	72
Maximum Ponding Depth (ft) =	2.06	4.06	3.58	4.18	4.27	4.48	4.84	5.43	6.14
Area at Maximum Ponding Depth (acres) =	0.12	0.20	0.18	0.20	0.21	0.21	0.23	0.26	0.29
Maximum Volume Stored (acre-ft) =	0.140	0.454	0.364	0.476	0.494	0.538	0.620	0.761	0.960

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.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.11
	0:15:00	0.00	0.00	0.30	0.49	0.60	0.40	0.51	0.49	0.73
	0:20:00	0.00	0.00	1.10	1.46	1.73	1.09	1.28	1.36	1.80
	0:25:00	0.00	0.00	2.56	3.58	4.64	2.52	2.98	3.21	4.70
	0:30:00	0.00	0.00	3.40	4.96	6.17	6.40	7.66	8.67	11.73
	0:35:00	0.00	0.00	3.58	5.18	6.41	8.22	9.74	11.54	15.37
	0:40:00	0.00	0.00	3.53	5.03	6.22	8.94	10.57	12.51	16.57
	0:45:00	0.00	0.00	3.32	4.75	5.88	8.80	10.39	12.60	16.64
	0:50:00	0.00	0.00	3.12	4.49	5.52	8.55	10.09	12.23	16.16
	0:55:00	0.00	0.00	2.93	4.22	5.20	8.00	9.46	11.66	15.42
	1:00:00	0.00	0.00	2.77	3.97	4.91	7.47	8.85	11.11	14.71
	1:05:00	0.00	0.00	2.65	3.78	4.69	7.00	8.31	10.62	14.09
	1:10:00	0.00	0.00	2.49	3.61	4.50	6.51	7.72	9.81	13.01
	1:15:00	0.00	0.00	2.33	3.39	4.30	6.05	7.18	9.01	11.96
	1:20:00	0.00	0.00	2.16	3.15	4.02	5.54	6.57	8.13	10.78
	1:25:00	0.00	0.00	2.01	2.91	3.68	5.05	5.97	7.29	9.65
	1:30:00	0.00	0.00	1.86	2.69	3.37	4.55	5.37	6.51	8.59
	1:35:00	0.00	0.00	1.75	2.53	3.12	4.08	4.81	5.79	7.63
	1:40:00	0.00	0.00	1.67	2.37	2.94	3.72	4.39	5.23	6.90
	1:45:00	0.00	0.00	1.61	2.23	2.79	3.45	4.05	4.80	6.32
	1:50:00	0.00	0.00	1.56	2.10	2.65	3.21	3.77	4.42	5.82
	1:55:00	0.00	0.00	1.45	1.97	2.51	3.00	3.51	4.09	5.36
	2:00:00	0.00	0.00	1.35	1.84	2.34	2.80	3.27	3.77	4.94
	2:05:00	0.00	0.00	1.19	1.64	2.07	2.50	2.91	3.35	4.38
	2:10:00	0.00	0.00	1.05	1.43	1.81	2.19	2.56	2.94	3.83
	2:15:00	0.00	0.00	0.91	1.24	1.56	1.90	2.22	2.55	3.32
	2:20:00	0.00	0.00	0.78	1.05	1.32	1.63	1.89	2.18	2.83
	2:25:00	0.00	0.00	0.66	0.88	1.11	1.37	1.59	1.83	2.37
	2:30:00	0.00	0.00	0.54	0.72	0.91	1.12	1.30	1.49	1.92
	2:35:00	0.00	0.00	0.43	0.58	0.73	0.89	1.02	1.17	1.50
	2:40:00	0.00	0.00	0.35	0.46	0.59	0.68	0.78	0.88	1.12
	2:45:00	0.00	0.00	0.29	0.38	0.49	0.52	0.60	0.67	0.85
	2:50:00	0.00	0.00	0.24	0.32	0.41	0.41	0.47	0.51	0.66
	2:55:00	0.00	0.00	0.20	0.27	0.34	0.33	0.38	0.40	0.51
	3:00:00	0.00	0.00	0.17	0.22	0.28	0.27	0.31	0.31	0.40
	3:05:00	0.00	0.00	0.14	0.19	0.24	0.22	0.25	0.24	0.31
	3:10:00	0.00	0.00	0.12	0.15	0.20	0.18	0.20	0.19	0.24
	3:15:00	0.00	0.00	0.10	0.13	0.16	0.15	0.16	0.15	0.19
	3:20:00	0.00	0.00	0.08	0.10	0.13	0.12	0.13	0.12	0.15
	3:25:00	0.00	0.00	0.07	0.08	0.10	0.10	0.11	0.10	0.12
	3:30:00	0.00	0.00	0.05	0.07	0.08	0.08	0.08	0.08	0.10
	3:35:00	0.00	0.00	0.04	0.05	0.06	0.06	0.07	0.06	0.08
	3:40:00	0.00	0.00	0.03	0.04	0.05	0.05	0.05	0.05	0.06
	3:45:00	0.00	0.00	0.02	0.03	0.04	0.03	0.04	0.03	0.04
	3:50:00	0.00	0.00	0.02	0.02	0.02	0.02	0.03	0.02	0.03
	3:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02
	4:00:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

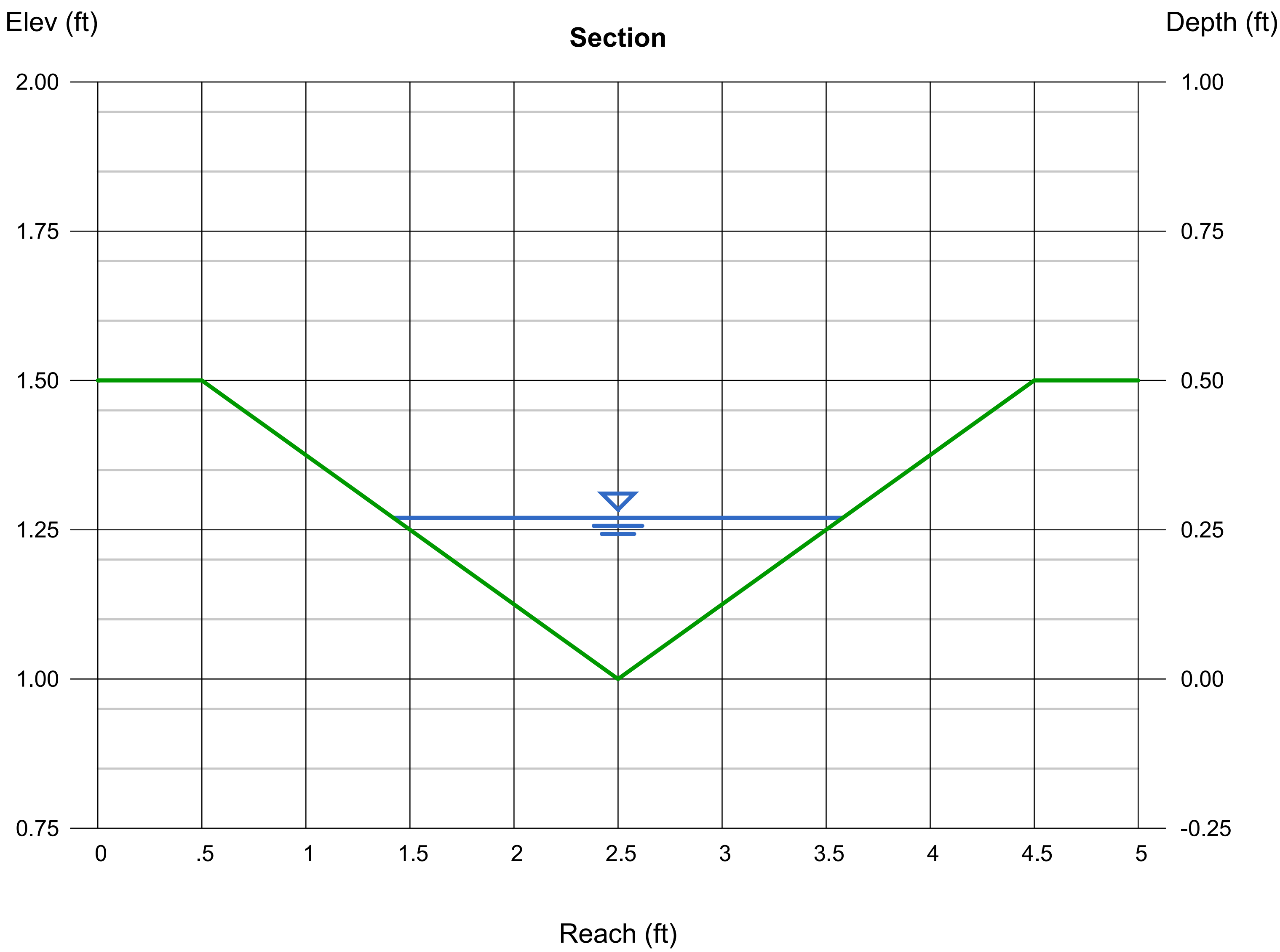
For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

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

Channel Report

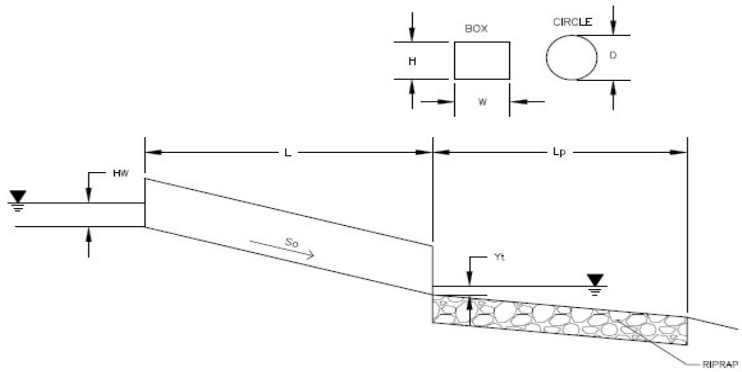
TRICKLE CHANNEL EDB-B

Triangular		**Highlighted**	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 0.27
Total Depth (ft)	= 0.50	Q (cfs)	= 0.500
		Area (sqft)	= 0.29
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 1.71
Slope (%)	= 0.50	Wetted Perim (ft)	= 2.23
N-Value	= 0.015	Crit Depth, Yc (ft)	= 0.25
		Top Width (ft)	= 2.16
Calculations		EGL (ft)	= 0.32
Compute by:	Known Q		
Known Q (cfs)	= 0.50		



Determination of Culvert Headwater and Outlet Protection

Project: Villas at Claremont
Basin ID: Pond Outlet



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Da to calculate protection type.

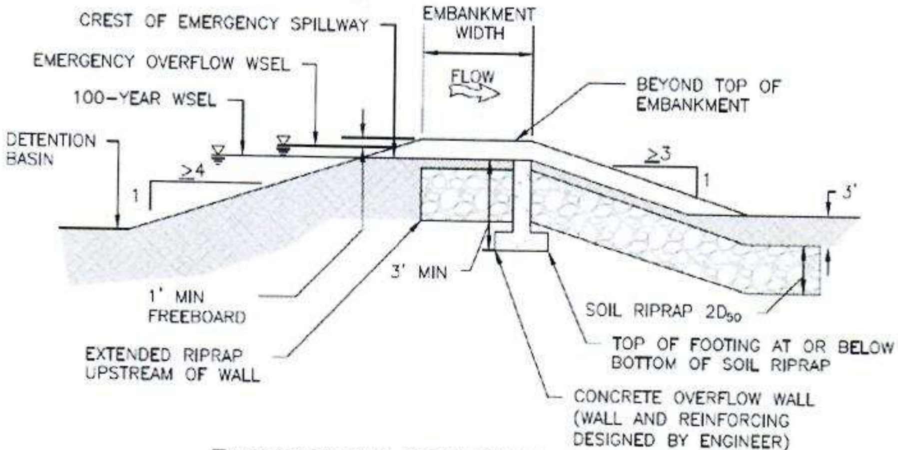
Design Information (Input):

Design Discharge	Q =	4.2	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	18	inches
Inlet Edge Type (Choose from pull-down list)	Square End Projection		
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	Height (Rise) =		ft
Barrel Width (Span) in Feet	Width (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	No =	1	
Inlet Elevation	Elev IN =	6383.28	ft
Outlet Elevation **OR** Slope	Elev OUT =	6377.76	ft
Culvert Length	L =	119.45	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	Elev Y_t =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Required Protection (Output):

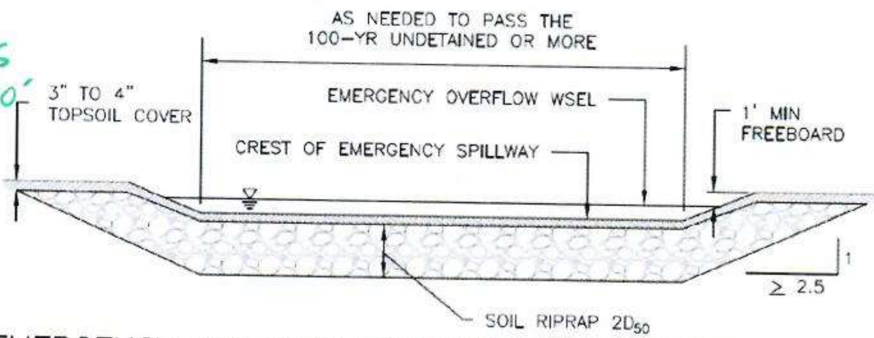
Tailwater Surface Height	Y_t =	0.60	ft
Flow Area at Max Channel Velocity	A_t =	0.84	ft^2
Culvert Cross Sectional Area Available	A =	1.77	ft^2
Entrance Loss Coefficient	k_e =	0.50	
Friction Loss Coefficient	k_f =	1.84	
Sum of All Losses Coefficients	k_s =	3.34	ft
Culvert Normal Depth	Y_n =	0.42	ft
Culvert Critical Depth	Y_c =	0.79	ft
Tailwater Depth for Design	d =	1.14	ft
Adjusted Diameter **OR** Adjusted Rise	D_a =	0.96	ft
Expansion Factor	1/(2*tan(Θ)) =	6.70	
Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	1.52	$ft^{0.5}/s$
Froude Number	Fr =	3.33	**Supercritical!**
Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.62	
Inlet Control Headwater	HW_I =	1.13	ft
Outlet Control Headwater	HW_O =	-4.08	
Design Headwater Elevation	**HW =**	**6,384.41**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**0.75**	
Minimum Theoretical Riprap Size	d_{50} =	2	in
Nominal Riprap Size	d_{50} =	6	in
UDFCD Riprap Type	**Type =**	**VL**	
Length of Protection	**L_p =**	**5**	**ft**
Width of Protection	**T =**	**3**	**ft**

VILLAS AT CLAREMONT RANCH
EDB-B EMERGENCY SPILLWAY



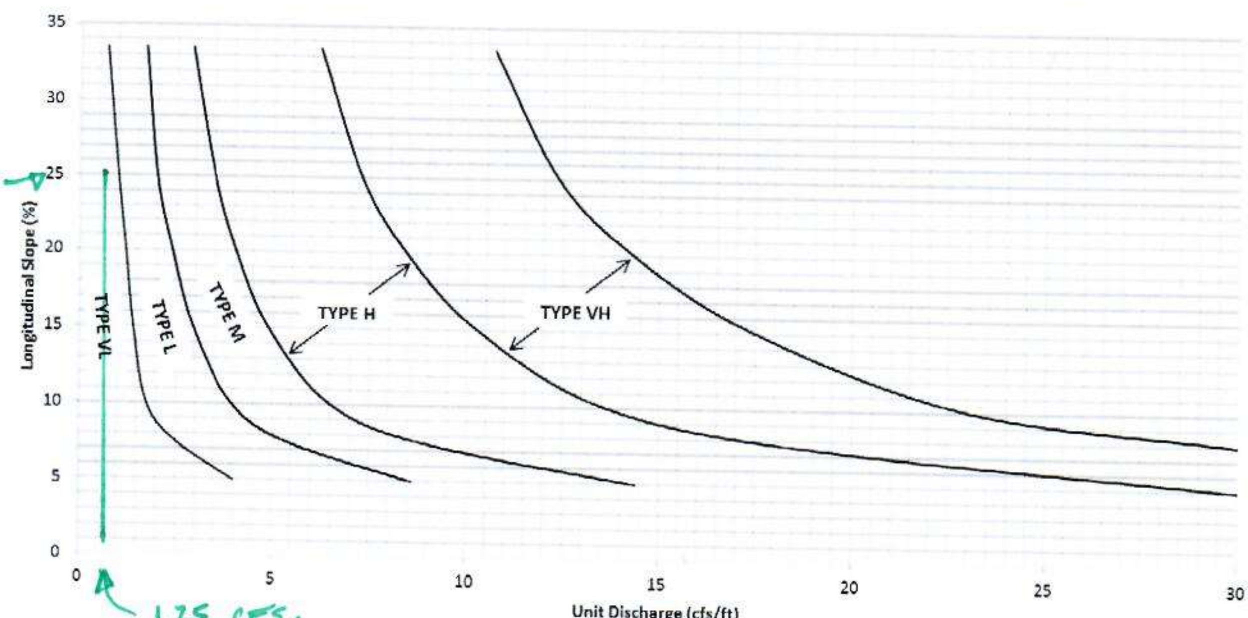
EMERGENCY SPILLWAY PROFILE

Q_{100} = 25 CFS
WIER LENGTH = 20'
∴ 1.25 CFS/FT



EMERGENCY SPILLWAY SECTION AND SPILLWAY CHANNEL

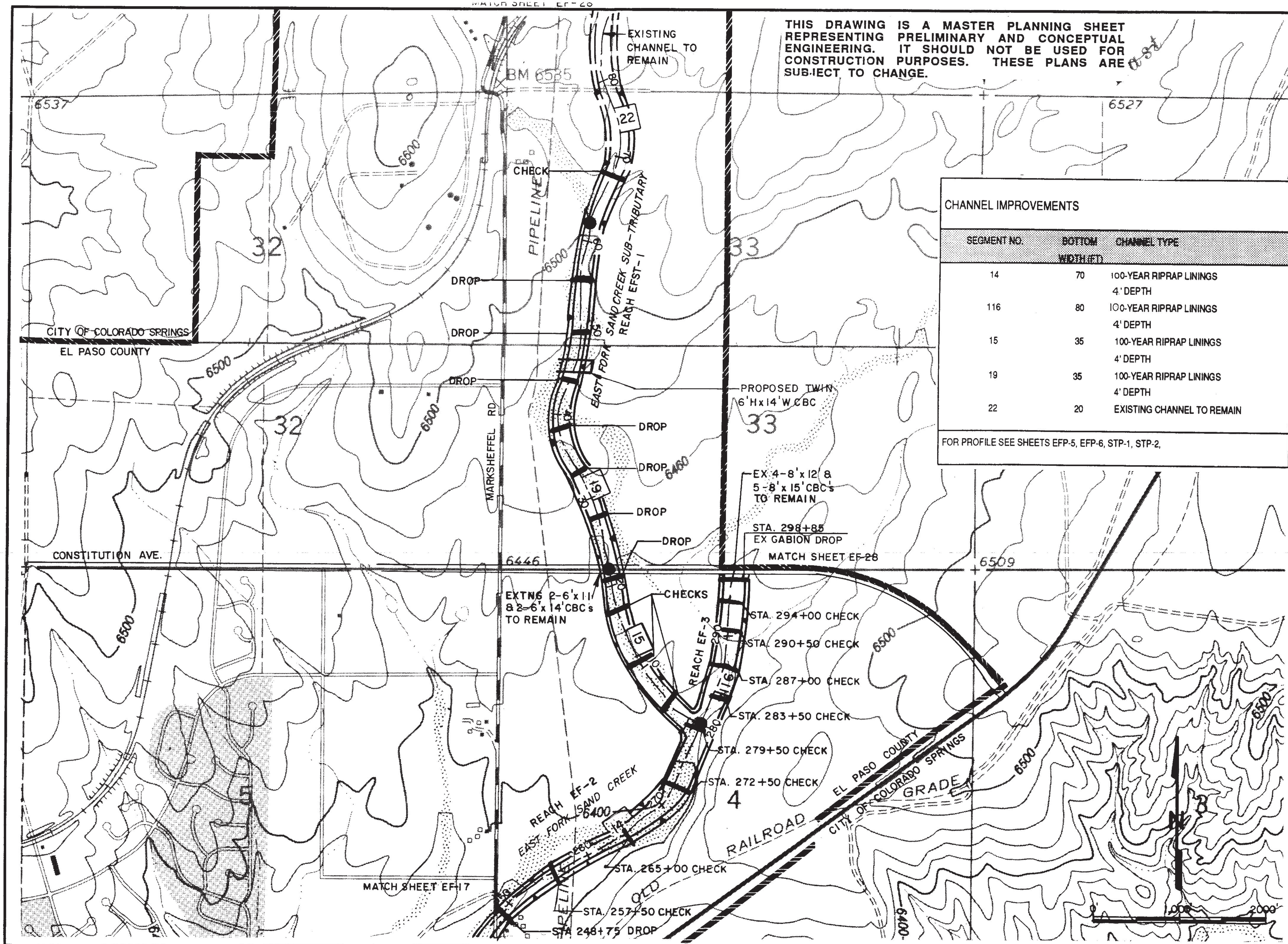
4:1 SLOPE



1.25 CFS/FT

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

DRAINAGE MAPS



THIS DRAWING IS A MASTER PLANNING SHEET REPRESENTING PRELIMINARY AND CONCEPTUAL ENGINEERING. IT SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES. THESE PLANS ARE SUBJECT TO CHANGE.

CHANNEL IMPROVEMENTS

SEGMENT NO.	BOTTOM WIDTH (FT)	CHANNEL TYPE
14	70	100-YEAR RIPRAP LININGS 4' DEPTH
116	80	100-YEAR RIPRAP LININGS 4' DEPTH
15	35	100-YEAR RIPRAP LININGS 4' DEPTH
19	35	100-YEAR RIPRAP LININGS 4' DEPTH
22	20	EXISTING CHANNEL TO REMAIN

FOR PROFILE SEE SHEETS EFP-5, EFP-6, STP-1, STP-2,

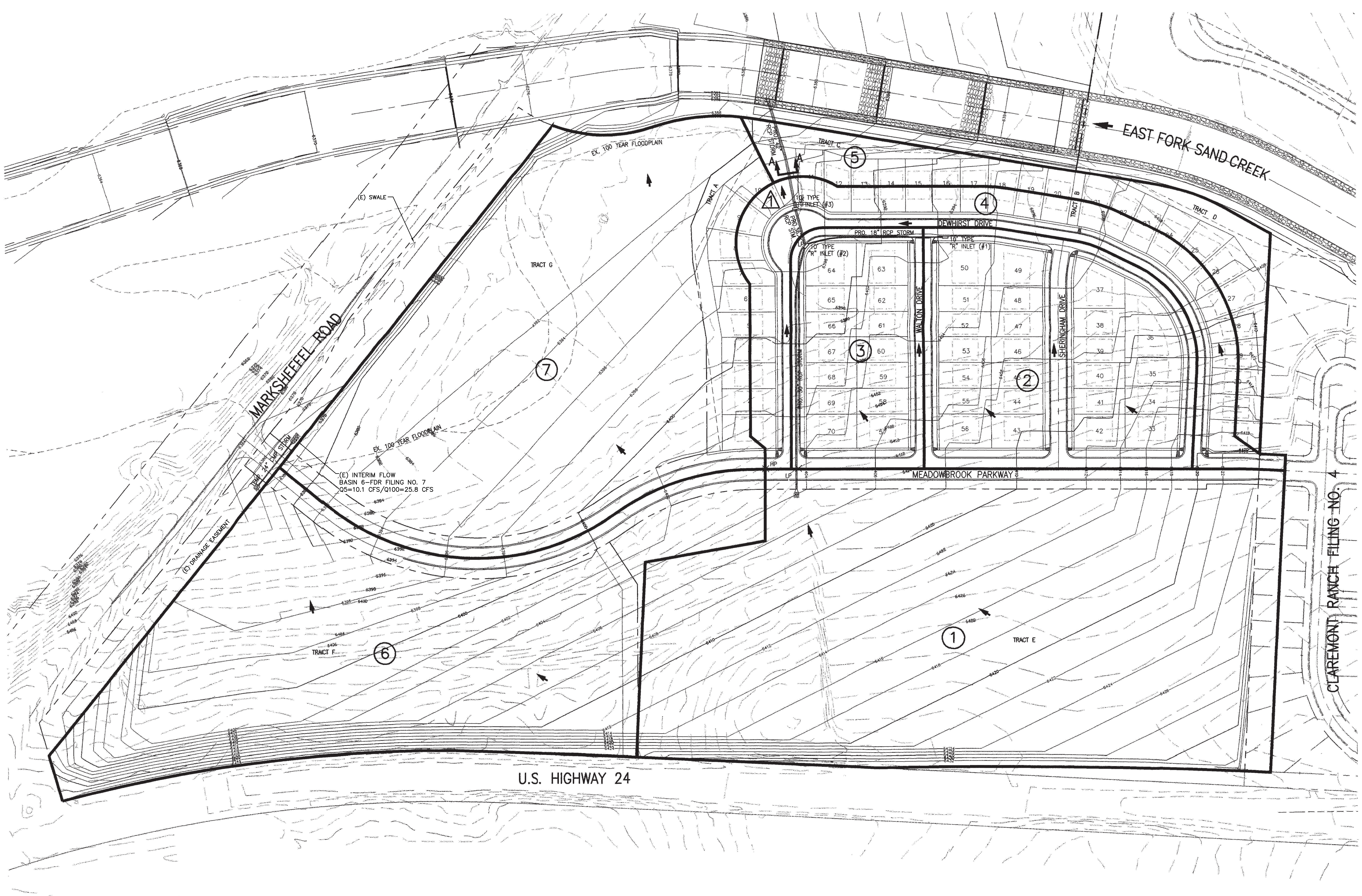
Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN PLANS

Project No
Date:
Design:
Drawn:
Check.
Revisions:

EF-27



1" = 100'

0 50 100 200
Scale in Feet

LEGEND

EXISTING CONTOURS-MNR (2')
EXISTING CONTOURS-MJR (10')
PROPOSED CONTOURS-MNR (2')
PROPOSED CONTOURS-MJR (10')
BASIN BOUNDARY

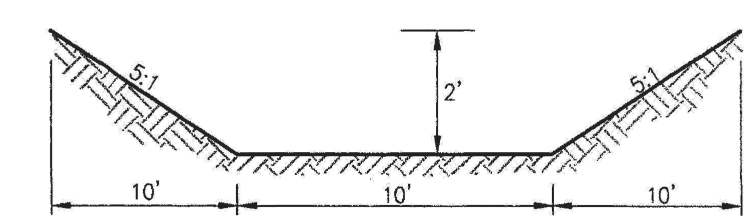
BASIN DESIGNATOR 1

DESIGN POINT DESIGNATOR 1

DIRECTION OF FLOW

HIGH POINT × HP

LOW POINT × LP



TEMPORARY OVERFLOW
SECTION A-A
NTS

BASIN TABLE

#	AC	Q_5 (cfs)	Q_{100} (cfs)
1	15.60	35.6	77.5
2	5.15	11.1	24.9
3	2.77	6.5	14.6
4	3.36	7.9	18.1
5	2.43	5.8	13.1
6	11.18	60.4	90.5
7	12.21	56.0	96.7

DESIGN POINT TABLE

#	AC	Q_5 (cfs)	Q_{100} (cfs)
1	26.88	58.1	128.0

REVISIONS:

NO.	DATE:	BY:	DESCRIPTION:	APPROVED BY:	DATE:

TIM D. McCONNELL, COLORADO P.E. NO. 33797

FOR AND ON BEHALF OF ENGINEERING AND SURVEYING INC. (ESI)

ESI
ENGINEERING AND SURVEYING INC.
20 BOULDER CRESCENT, 2nd FLOOR
COLORADO SPRINGS, CO 80903
(719) 955-5485, FAX (719) 471-4812

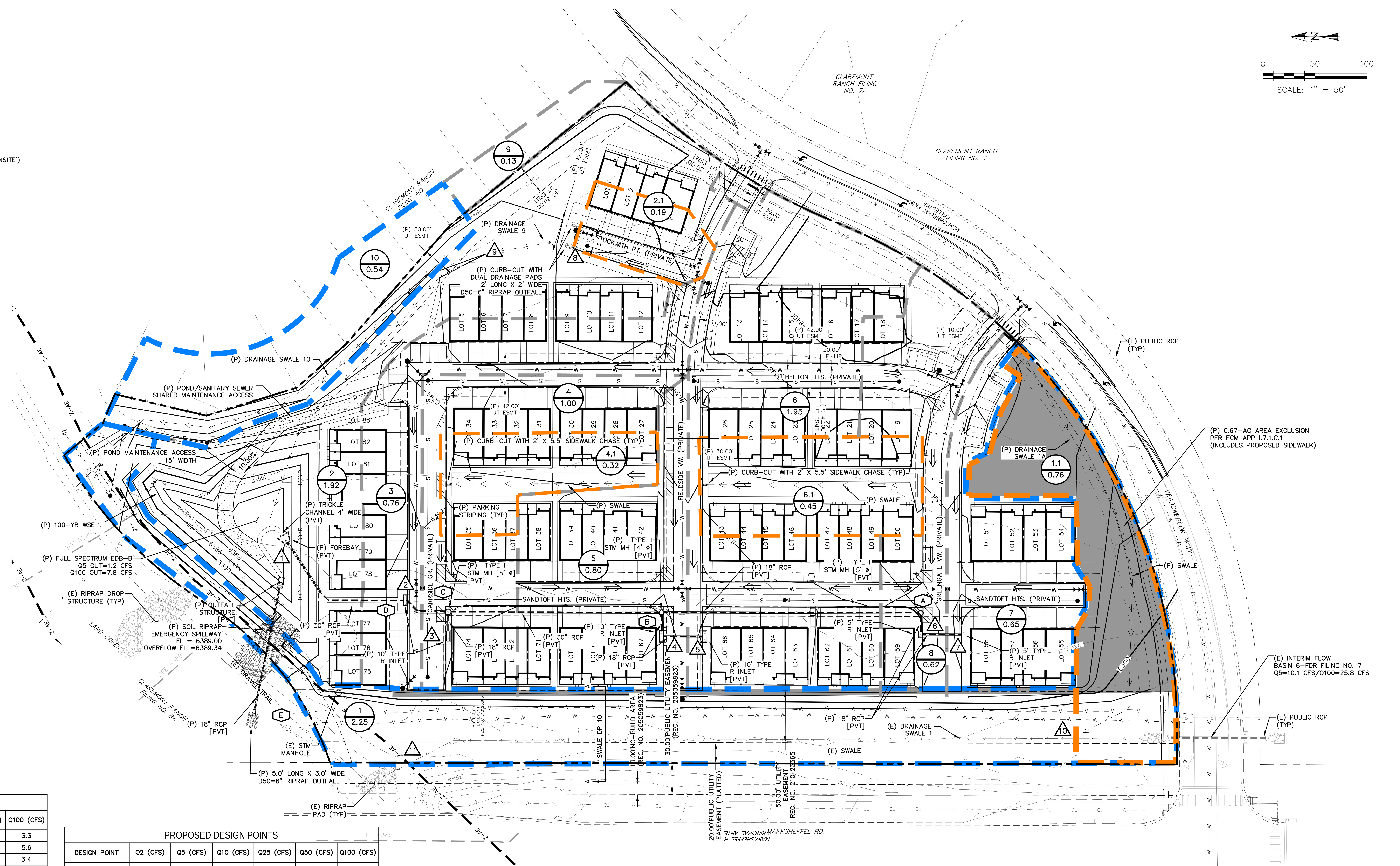
CLAREMONT RANCH FILING NO. 7

DRAINAGE PLAN

PROJECT NO. 01-006 | FILE: Claremont #7\dwg\D1-drainage.dwg
DESIGNED BY: TDM | SCALE | DATE: 05/17/04
DRAWN BY: KGV | HORIZ: 1"=100'
CHECKED BY: TDM | VERT: N/A | SHEET 1 OF 1 | D1

DRAINAGE LEGEND

(P) LIMITS OF DISTURBANCE	
(EX) BASE FLOOD ELEVATIONS	
BASIN IDENTIFIER / BASIN AREA [AC]	F / 0.36
DESIGN POINT IDENTIFIERS	3
STORM SEWER DESIGN POINT IDENTIFIERS	P5
DRAINAGE BASIN BOUNDARY	(ONSITE OR 'FLOWS TO ONSITE') / (FLOWS TO OFFSITE)
DRAINAGE SUB-BASIN BOUNDARY	
SURFACE FLOW DIRECTION	
EXISTING MAJOR CONTOUR (10')	6900
EXISTING MINOR CONTOUR (2')	
PROPOSED MAJOR CONTOUR (10')	6900
EXISTING / PROPOSED MINOR CONTOUR (2')	
FUTURE	(E)
PROPOSED	(P)
	(F)
SLOPE/DIRECTION	1.00%
(E) STORM SEWER	
(P) STORM SEWER, INLET, OUTFALL	
(E) DRAINAGE SWALE	
(P) DRAINAGE SWALE	
(P) STREET PAINT STRIPING	



WATER QUALITY SUMMARY TABLE			
BASIN	TRIBUTARY AREA TO POND EDB-B (ACRES)	TRIBUTARY AREA UNTREATED (ACRES)	APPLICABLE EXCLUSION
1 UNSHADED AREA	0.00	1.58 AC	ECM APP I.7.1.B.7
1 SHADED AREA	0.00	0.67	ECM APP I.7.1.C.1
2	1.92		
3	0.76		
4	1.00		
5	0.80		
6	1.95		
7	0.65		
8	0.62		
9	0.13		
10	0.00	0.54	ECM APP I.7.1.B.7

POND DESIGN		
STORM EVENT	ELEVATION	VOLUME (A-FT)
WQCV	6385.06	0.14
EURV	6387.06	0.45
10-YR	6387.27	0.49
100-YR	6388.43	0.76
EM. OVERFLOW	6389.00	
MIN TOP OF BERM	6390.34	

PROPOSED DRAINAGE BASINS							
BASIN	AREA (ACRES)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
1	2.25	0.2	0.6	1.2	2.0	2.6	3.3
2	1.92	1.3	1.9	2.7	3.8	4.6	5.6
3	0.76	1.1	1.5	2.0	2.5	2.9	3.4
4	1.00	1.3	1.8	2.3	2.9	3.5	4.1
5	0.80	1.2	1.7	2.2	2.7	3.2	3.7
6	1.95	2.1	3.0	3.9	5.0	6.0	7.0
7	0.65	1.0	1.4	1.7	2.2	2.6	3.0
8	0.62	1.2	1.6	2.0	2.4	2.9	3.3
9	0.13	0.0	0.1	0.1	0.2	0.2	0.3
10	0.54	0.1	0.3	0.5	0.8	1.1	1.4

PROPOSED DRAINAGE SUB-BASINS (BASIN AREAS INCLUDED IN TABLE ABOVE)							
BASIN	AREA (ACRES)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
1.1	0.76	0.2	0.5	0.8	1.3	1.7	2.1
2.1	0.19	0.6	0.7	0.9	1.1	1.2	1.4
4.1	0.32	0.4	0.5	0.7	0.9	1.0	1.2
6.1	0.45	0.4	0.6	0.8	1.1	1.3	1.6

PROPOSED DESIGN POINTS						
DESIGN POINT	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
1	7.5	10.6	13.8	17.9	21.3	25.0
2	1.1	1.5	2.0	2.5	2.9	3.4
3	1.3	1.8	2.3	2.9	3.5	4.1
4	1.2	1.7	2.1	2.7	3.2	3.7
5	2.1	3.0	3.9	5.0	6.0	7.0
6	1.2	1.6	2.0	2.4	2.9	3.3
7	1.0	1.4	1.7	2.2	2.6	3.0
8	0.5	0.7	0.8	1.0	1.1	1.3
9	0.4	0.5	0.7	0.9	1.0	1.2
10		10.6				27.9
11		11.2				31.2
A	2.3	3.0	3.8	4.7	5.6	6.4
B	5.0	6.8	8.7	11.1	13.1	15.3
C	6.2	8.6	10.9	13.8	16.4	19.0
D	7.2	9.9	12.6	15.9	18.9	21.9
E (POND OUT)		1.2				4.2

REV.	DESCRIPTION	DATE

PREPARED FOR:

PHI REAL ESTATE SERVICES, LLC
200 W. CITY CENTER DR. STE 200
PUEBLO, CO 81003

CATAMOUNT ENGINEERING
PO BOX 692 DIVIDE, CO 80814 (719)426-2124

THE VILLAS AT CLAREMONT RANCH

PROPOSED DRAINAGE MAP

DESIGNED BY: DLM	DRAWN BY: MGP
SCALE: 1"=50'	DATE: 06/13/17
JOB NUMBER	SHEET
16-102	__ OF __