Preliminary/Final Drainage Report

Eastwood Village
El Paso County, Colorado

PCD File No.:

Prepared for:
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Prepared by:
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Project #: 096726002

Prepared: April 21, 2023

Kimley»Horn

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CERTIFICATION

ENGINEERS STATEMENT

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

SIGNATURE (Affix Seal): ____

Kevin Kofford, P.E. Colorado P.E. No. 57234 Date

DEVELOPER'S STATEMENT

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

____
Business Name

____
By:

____
Title:

____
Address:

EL PASO COUNTY STATEMENT

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

______________________________________ ______________________

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

Conditions:

GENERAL LOCATION AND DESCRIPTION

PURPOSE AND SCOPE OF STUDY

The purpose of this Final Drainage Report (FDR) is to provide the hydrologic and hydraulic calculations and to document and finalize the drainage design methodology in support of the proposed 107-unit Townhome Development, named as Eastwood Village ("the Project") for Rockwood Homes LLC. The Project is located within the jurisdictional limits of El Paso County ("the County"). Thus, the guidelines for the hydrologic and hydraulic design components were based on the criteria outlined by the County.

LOCATION

The Project is located at 1249 Meadowbrook Parkway at the northeast corner of the Meadowbrook Parkway and Marksheffel Road intersection in El Paso County, Colorado. More specifically, the Project is located at, and is a replat of the Tract F Claremont Ranch Subdivision Filing No. 7 (parcel number 5404304013) part of the southwest quarter of section 4, and a portion of the northwest quarter of section 9, Township 14 south, Range 65 West of the 6th P.M., El Paso County, CO. The site is bounded by Meadowbrook Parkway and Claremont Ranch Filing No. 7 Tract G to the North, Lots 22-28 Claremont Ranch Filing No. 7A to thew east, US Highway 24 to the south, and Marksheffel Road to the west. A vicinity map has been provided in the **Appendix** of this report.

DESCRIPTION OF PROPERTY

The Project is located on approximately 9.8 acres of undeveloped land with limited vegetation and grass cover. The site currently does not provide stormwater quality or detention and there are no known major drainage ways or irrigation facilities on the site. The site generally drains from the southeast to northwest with slopes ranging from 2% to 25% with the steeper slopes along the southeast side of the site adjacent to US Highway 24. There is an existing stormwater pond, and 36" RCP storm pipe in the northwest corner of the Site that accepts flows from the majority of the Property, conveying flow to existing stormwater infrastructure located within Meadowbrook Parkway. The Project is not adjacent to any major drainageways and does not outfall directly to any major drainageways.

PROJECT CHARACTERISTICS

The Project is a proposed townhome development that will include 107 units platted as individual lots. The project will include the construction of private streets, driveways, hardscape/landscape, and associated utility infrastructure required to serve each lot. Water quaility and detention is required for the site improvements and will be accomplished with the construction of a Full Spectrum Extended Detention Basin located in the northwest corner of the site. As part of the utility infrastructure improvements, a proposed storm sewer system will be constructed to collect runoff. Stormwater will be conveyed via overland flow across the lots, and within curb and gutter before being captured in proposed storm inlets. The storm sewer system will then convey runoff into the Full Spectrum Extended Detention Basin before being discharged.

SOILS DATA

NRCS soil data is available for the Site (See **Appendix**) and the onsite soils are 95% USCS Hydrologic Soil Group A and 5% USCS Hydrologic Soil Group B. Group A soils have higher infiltration rates compared to other soil groups and are generally made up of well drained, cohesive sands or gravelly sands. Group B soils have 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. A subsurface soil investigation performed by Entech Engineering on January 25, 2022, can be found in the **Appendix**.

EXISTING VEGETATION

The existing site is currently vacant. Ground cover consists of short prairie grasses, and some stone riprap surrounding the existing storm inlet in the northwest corner of the site. Based on visual inspection the site currently is 90% vegetated.

DRAINAGE DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

The proposed storm facilities follow the El Paso County Drainage Criteria Manual (the “CRITERIA”), El Paso Engineering Criteria Manual (the “ECM”), and the Mile High Flood District Urban Storm Drainage Criteria Manual (the “MANUAL”). Site drainage is not significantly impacted by such constraints as utilities or existing development. Further detail regarding onsite drainage patterns is provided in the Proposed Drainage Conditions Section.

HYDROLOGIC CRITERIA

The 5-year and 100-year design storm events were used in determining rainfall and runoff for the proposed drainage system per chapter 6 of the CRITERIA. Table 6-2 of the CRITERIA is the source for rainfall data for the 5-year and 100-year design storm events. Design runoff was calculated using the Rational Method for developed conditions as established in the CRITERIA and MANUAL. Runoff coefficients for the proposed development were determined using Table 6-6 of the CRITERIA by calculating weighted impervious values for each specific site basin. The detention storage requirement was calculated using Full Spectrum Detention methods as specified in the CRITERIA and MANUAL. The Full Spectrum Extended Detention Basin’s outlet structure was designed to release the Water Quality Capture Volume (WQCV) in 40 hours. Based upon this approach, the drainage design provided for the Site is in keeping with the historic drainage patterns for the Site.

HYDRAULIC CRITERIA

The proposed drainage facilities are designed in accordance with the CRITERIA and MANUAL. Floodplain identification was determined using FIRM panels by FEMA and information provided in the CRITERIA. Hydraulic calculations were computed using Storm CAD using the Standard Method. Results of the hydraulic calculations are summarized in the **Appendix**.

VARIANCES FROM CRITERIA

There are no proposed variances from the El Paso County Drainage Criteria.

FLOODPLAIN STATEMENT

The Site is located outside the 100-year floodplain and within Zone X (an area of minimal flood hazard) as noted on the FEMA FIRM Map No. 08041C0756G revised on December 7, 2018 (See **Appendix**).

MAJOR DRAINAGE BASIN

The site is located within the Sand Creek Drainage Basin Study (DBPS). It is not directly adjacent to East Fork Sand Creek, but East Fork Sand Creek is the ultimate receiving water for the discharge from this Site. No additional creek improvements are included with the development of this Project.

EXISTING DRAINAGE CONDITIONS

The existing Site has been divided into two on-site sub-basins, E1-E2 and two offsite sub-basins, O1-O2. A description of each sub-basin is listed below. Under existing conditions, the total drainage area of the site is 12.40 acres. Calculations of the existing sub-basins on the Project Site have been completed using current stormwater criteria. An Existing Conditions Drainage Map is provided in the **Appendix** of this report. The weighted imperviousness of the drainage area under existing conditions is 0.0%. Under existing conditions, flows generated from the area directly adjacent to HWY 24 are directed away from the Site and captured by an existing storm water culvert and conveyed into existing stormwater infrastructure within the HWY 24 Right of Way.

Sub-Basin E1

Sub-basin E1 is 8.65 acres and consists of central majority of the Site. This basin is undeveloped native land. The runoff developed within this sub-basin sheet flows generally from southeast to northwest overland at slopes that range approximately 3-25% with the steeper slopes located at the hill along the southern property line. Flows then travel overland towards an existing pit in the northwest corner of the site and are then accepted by an existing 36” RCP storm pipe and then conveyed into existing stormwater infrastructure within Meadowbrook Parkway. The weighted imperviousness of sub-basin E1 is 0%. The developed direct runoff from sub-basin E1 is 2.70 cfs for the 5-year event and 19.81 cfs for the 100-year event.

Sub-Basin E2

Sub-basin E2 is 1.15 acres and consists of a portion of the northern boundary of The Site. This basin is undeveloped native land. The runoff developed within this sub-basin sheet flows northwest at slopes of approximately 2-5% where it flows directly into Meadowbrook Parkway and is captured by existing curb and gutter and conveyed to an existing public 10’ storm inlet. The weighted imperviousness of sub-basin E1 is 0%. The developed direct runoff from sub-basin E2 is 0.39 cfs for the 5-year event and 2.88 cfs for the 100-year event.

Sub-Basin O1

Sub-basin O1 is 1.81 acres and consists of an offsite basin southeast of the site. This basin is undeveloped native land. The runoff developed within this sub-basin sheet flows southeast to northwest at slopes of approximately 3-10% that flows into the property at DP O1. From there flows follow the existing drainage patterns described in sub-basin E1. The weighted imperviousness of sub-basin O1 is 0%. The developed direct runoff from sub-basin O1 is 0.59 cfs for the 5-year event and 4.33 cfs for the 100-year event.

Sub-Basin O2

Sub-basin O2 is 0.78 acres and consists of an offsite basin west of the site. This basin is undeveloped native land. The runoff developed within this sub-basin sheet flows north through an existing natural swale at slopes of approximately 5-15% then flows into the property at DP O2. From there flows follow the existing drainage patterns described in sub-basin E1. The weighted imperviousness of sub-basin O1 is 0%. The developed direct runoff from sub-basin O1 is 0.29 cfs for the 5-year event and 2.12 cfs for the 100-year event.

PROPOSED DRAINAGE CONDITIONS

The Project Site is 9.80 acres in size and involves the construction of 107 townhomes, site access, pedestrian ramps, curb and gutter, private roads, retaining walls, parking, wet and dry utilities, and stormwater infrastructure. Flows generated from the drainage area's proposed conditions are captured and conveyed via proposed stormwater infrastructure to a proposed private above ground full spectrum detention pond. Flows are released from this pond from a proposed outlet structure, proposed orifice plate, and restrictor plate being released into existing stormwater pond located in the northwest corner of the site where they will be collected by the existing 36" RCP storm inlet and into the existing public stormwater infrastructure in Meadowbrook Pkwy. Flows generated from the proposed conditions with generally follow historic patterns. Under proposed conditions the entire drainage area associated with this project is 12.43 acres with a 37% weighted imperviousness and 5 and 100-yr flows of 22.12 cfs and 56.48 cfs respectively. The sub-basins tributary to the proposed stormwater facilities (P1-P10, P12, P14, O1-O4) is 10.70 acres with a 42% weighted imperviousness and 5 and 100-yr flows of 21.29 cfs and 51.26 cfs respectively. The Pond sizing, inlet capacity, and pipe sizing calculations can be found in the **Appendix.**

The developed runoff from Eastwood Village will generally be collected by means of curb and gutter, and storm inlets. These flows are conveyed via proposed stormwater infrastructure to a proposed private above ground full spectrum detention pond. The proposed site has been divided into fourteen (14) on-site sub-basins, P1-P14, and five (5) off-site sub-basins, O1-O5. Descriptions of the proposed sub-basins can be found below. A Proposed Conditions Drainage Map is provided in the **Appendix** of this report.

Sub-Basin P1

Sub-basin P1 is approximately 1.14 acres and consists of proposed townhomes, landscape, and private drives along the northeast property line adjacent to Claremont Ranch Filing No. 7A. Flows developed in this sub-basin generally travel west towards the proposed site access at grades of 2-5%. Flows are conveyed via curb and gutter to a proposed private 15' CDOT Type-R curb inlet at DP P1. Flows are then conveyed through proposed storm infrastructure to the proposed private aboveground full spectrum detention pond. Developed runoff during the 5-year and 100-year events are 2.65 cfs and 5.66 cfs respectively. The weighted imperviousness of sub-basin P1 is 59%.

Sub-Basin P2

Sub-basin P2 is approximately 1.42 acres and consists of proposed townhomes, landscape, and private drives in the southeast of the property adjacent to Claremont Ranch Filing No. 7A, and the Hwy-24 Right of Way. Flows developed in this sub-basin generally travel southwest at grades of 2-5% and up to 25% along the hill located along the southeastern property line. Flows are conveyed via curb and gutter to a proposed private 15' CDOT Type-R curb inlet at DP P2. Flows are then conveyed through proposed storm infrastructure to the proposed private aboveground full spectrum detention pond. Developed runoff during the 5-year and 100-year events are 2.77 cfs and 6.71 cfs respectively. The weighted imperviousness of sub-basin P2 is 42%.

Sub-Basin P3

Sub-basin P3 is approximately 0.56 acres and consists of proposed townhomes, landscape, and private drives along the southeast property line adjacent to the Hwy-24 Right of Way. Flows developed in this sub-basin generally travel southwest at grades of 2-5% and up to 25% along the hill located along the southeastern property line. Flows are conveyed via curb and gutter to a proposed private 10' CDOT Type-R curb inlet at DP P3. Flows are then conveyed through proposed storm infrastructure to the proposed private aboveground full spectrum detention pond. Developed runoff during the 5-year and 100-year events are 0.94 cfs and 2.35 cfs respectively. The weighted imperviousness of sub-basin P3 is 39%.

Sub-Basin P4

Sub-basin P4 is approximately 0.53 acres and consists of proposed townhomes, landscape, and private drives along the southeast property line adjacent to the Hwy-24 Right of Way. Flows developed in this sub-basin generally travel southwest at grades of 2-5% and up to 25% along the hill located along the southeastern property line. Flows are conveyed via curb and gutter to a proposed private 5' CDOT Type-R curb inlet in sump conditions at DP P4. Flows are then conveyed through proposed storm infrastructure to the proposed private aboveground full spectrum detention pond. In the event of a clogged inlet, flows will overtop the street crown and flow north into sub-basins P8, and P10. Developed runoff during the 5-year and 100-year events are 1.33 cfs and 2.98 cfs respectively. The weighted imperviousness of sub-basin P4 is 52%.

Sub-Basin P5

Sub-basin P5 is approximately 0.44 acres and consists of proposed townhomes, landscape, and private drives along the southeast property line adjacent to the Hwy-24 Right of Way. Flows developed in this sub-basin generally travel northeast at grades of 2-5% and up to 25% along the hill located along the southeastern property line. Flows are conveyed via curb and gutter to a proposed private 10' CDOT Type-R curb inlet at DP P5. Flows are then conveyed through proposed storm infrastructure to the proposed private aboveground full spectrum detention pond. Developed runoff during the 5-year and 100-year events are 0.70 cfs and 1.88 cfs respectively. The weighted imperviousness of sub-basin P5 is 33%.

Sub-Basin P6

Sub-basin P6 is approximately 0.38 acres and consists of proposed landscape area in the southern corner of the property adjacent to the Hwy-24 Right of Way. Flows developed in this sub-basin generally travel overland northeast at grades of 15-25% where it enters proposed sub-basin P5 at DP P6. Flows then follow the proposed drainage patterns described in Sub-Basin P5. Developed runoff during the 5-year and 100-year events are 0.15 cfs and 1.12 cfs respectively. The weighted imperviousness of sub-basin P6 is 0%.

Sub-Basin P7

Sub-basin P7 is approximately 1.07 acres and consists of proposed townhomes, landscape, and private drives located in the center of the property. Flows developed in this sub-basin generally travel southwest at grades of 2-5%. Flows are conveyed via curb and gutter to a proposed private 10' CDOT Type-R curb inlet in sump conditions at DP P7. Flows are then conveyed through proposed storm infrastructure to the proposed private aboveground full spectrum detention pond. In the event of a clogged inlet, flows will overtop the top back of curb and flow northwest into sub-basin P8. Developed runoff during the 5-year and 100-year events are 3.46 cfs and 6.89 cfs respectively. The weighted imperviousness of sub-basin P7 is 72%.

Sub-Basin P8

Sub-basin P8 is approximately 1.18 acres and consists of proposed townhomes, landscape, and private drives located in the center of the property. Flows developed in this sub-basin generally travel northwest at grades of 2-5%. Flows are conveyed via curb and gutter to a proposed private 10' CDOT Type-R curb inlet in sump conditions at DP P8. Flows are then conveyed through proposed storm infrastructure to the proposed private aboveground full spectrum detention pond. In the event of a clogged inlet, flows will overtop street crown and flow northwest into sub-basin P10. Developed runoff during the 5-year and 100-year events are 3.75 cfs and 7.50 cfs respectively. The weighted imperviousness of sub-basin P8 is 71%.

Sub-Basin P9

Sub-basin P9 is approximately 0.06 acres and consists of proposed landscape, and private drives along the northwest property line at the proposed site access. Flows developed in this sub-basin generally travel northwest towards the proposed site access at grades of 3%. Flows are conveyed via curb and gutter to a proposed private 5' CDOT Type-R curb inlet at DP P9. Flows are then conveyed through proposed storm infrastructure to the proposed private aboveground full spectrum detention pond. Developed runoff during the 5-year and 100-year events are 0.19 cfs and 0.38 cfs respectively. The weighted imperviousness of sub-basin P9 is 64%.

Sub-Basin P10

Sub-basin P10 is approximately 1.10 acres and consists of proposed townhomes, landscape, and private drives located in the northwest portion of the property. Flows developed in this sub-basin generally travel northeast at grades of 2-5%. Flows are conveyed via curb and gutter to a proposed private 10' CDOT Type-R curb inlet in sump conditions at DP P10. Flows are then conveyed through proposed storm infrastructure to the proposed private aboveground full spectrum detention pond. In the event of a clogged inlet, flows will overtop the proposed top of curb and flow overland directly into the proposed private aboveground full spectrum detention pond. Developed runoff during the 5-year and 100-year events are 3.87 cfs and 7.48 cfs respectively. The weighted imperviousness of sub-basin P8 is 78%.

Sub-Basin P11

Sub-basin P11 is approximately 0.39 acres and consists of proposed landscape, and a small portion of the proposed access located along the northwest portion of the site. Flows developed in this sub-basin generally travel west overland at grades of 2-5%. Flows travel directly into Meadowbrook Parkway at DP P11 and are conveyed via curb and gutter to an existing public 10' CDOT Type-R curb inlet. Flows are then conveyed through existing public storm infrastructure within the Right of Way. Developed runoff during the 5-year and 100-year events are 0.20 cfs and 1.22 cfs respectively. The weighted imperviousness of sub-basin P11 is 2%.

Sub-Basin P12

Sub-basin P12 is approximately 0.70 acres and consists of proposed townhomes, landscape, emergency access road, and the proposed private aboveground full spectrum detention pond. Sub-basin P12 is in the western corner of the site. Flows developed in this sub-basin generally travel west overland where they collect directly into the proposed private aboveground full spectrum detention pond at DP P12. Developed runoff during the 5-year and 100-year events are 0.70 cfs and 2.62 cfs respectively. The weighted imperviousness of sub-basin P12 is 15%.

Sub-Basin P13

Sub-basin P13 is approximately 0.53 acres and consists of existing landscape, riprap, and an existing stormwater inlet pipe. Flows developed in this sub-basin generally travel north at grades of 5-10%. Flows are captured by the existing stormwater pipe and DP P13 and enter the existing public storm infrastructure located in Meadowbrook Parkway. Developed runoff during the 5-year and 100-year events are 0.19 cfs and 1.41 cfs respectively. The weighted imperviousness of sub-basin P13 is 0%.

Sub-Basin P14

Sub-basin P14 is approximately 0.30 acres and consists of exisitng landscape area in the western portion of the property. Flows developed in this sub-basin generally travel overland east at grades of 15-25% where it enters proposed sub-basin P10 at DP P14. Flows then follow the proposed drainage patterns described in Sub-Basin P10. Developed runoff during the 5-year and 100-year events are 0.12 cfs and 0.91 cfs respectively. The weighted imperviousness of sub-basin P14 is 0%.

Sub-Basin O1

Offsite sub-basin O1 is approximately 0.69 acres and consists of existing landscape just southeast of the property line adjacent to Hwy 24 Right of Way. Flows in this sub-basin generally travel overland northwest towards the property line at grades of 4%. Flows enter sub-basin P2 at DP O1. Flows then follow the proposed drainage patterns described in Sub-Basin P2. Developed runoff during the 5-year and 100-year events are 0.25 cfs and 1.80 cfs respectively. The weighted imperviousness of sub-basin O1 is 0%.

Sub-Basin O2

Offsite sub-basin O2 is approximately 0.47 acres and consists of existing landscape just southeast of the property line adjacent to Hwy 24 Right of Way. Flows in this sub-basin generally travel overland northwest towards the property line at grades of 4%. Flows enter sub-basin P3 at DP O2. Flows then follow the proposed drainage patterns described in Sub-Basin P3. Developed runoff during the 5-year and 100-year events are 0.17 cfs and 1.22 cfs respectively. The weighted imperviousness of sub-basin O2 is 0%.

Sub-Basin O3

Offsite sub-basin O3 is approximately 0.26 acres and consists of existing landscape just southeast of the property line adjacent to Hwy 24 Right of Way. Flows in this sub-basin generally travel overland northwest towards the property line at grades of 4%. Flows enter sub-basin P4 at DP O3. Flows then follow the proposed drainage patterns described in Sub-Basin P4. Developed runoff during the 5-year and 100-year events are 0.09 cfs and 0.68 cfs respectively. The weighted imperviousness of sub-basin O3 is 0%.

Sub-Basin O4

Offsite sub-basin O4 is approximately 0.39 acres and consists of existing landscape just southeast of the property line adjacent to Hwy 24 Right of Way. Flows in this sub-basin generally travel overland northwest towards the property line at grades of 4%. Flows enter sub-basin P5 at DP O4. Flows then follow the proposed drainage patterns described in Sub-Basin P5. Developed runoff during the 5-year and 100-year events are 0.15 cfs and 1.07 cfs respectively. The weighted imperviousness of sub-basin O4 is 0%.

Sub-Basin O5

Offsite sub-basin O5 is approximately 0.78 acres and consists of existing landscape just west of the western property line adjacent to Marksheffel Road. Flows in this sub-basin generally travel overland northeast towards the property line at grades of 10%. Flows enter sub-basin P13 at DP O5. Flows then follow the existing drainage patterns described in Sub-Basin P13. Developed runoff during the 5-year and 100-year events are 0.32 cfs and 2.38 cfs respectively. The weighted imperviousness of sub-basin O5 is 0%.

Sub-Basin O6

Offsite sub-basin O6 is approximately 0.03 acres and consists of the proposed site access and drainage pan. Flows in this sub-basin travel southwest where it's collected in the existing curb and gutter along Meadowbrook Parkway. Flows then enter the existing public 10' storm inlet located in Meadowbrook Parkway. Developed runoff during the 5-year and 100-year events are 0.12 cfs and 0.21 cfs respectively. The weighted imperviousness of sub-basin O6 is 100%.

DRAINAGE FACILITY DESIGN

DETENTION AND WATER QUALITY

The WQCV and 100-year detention is required for this Project. This is accomplished through the proposed private Full Spectrum Extended Detention Basin on the west corner of the Site. The Extended Detention Basin was sized to provide WQ and detention for the sub-basin's tributary to the EDB (Sub-Basins P1-P10, P12, P14, O1-O4) per UDFCD criteria. The water quality and detention calculations are provided in the Appendix of this report. The proposed EDB will outfall to the existing riprap lined temporary sediment basin, created by the SDS water system project, into the existing public 36" pipe.

Four-Step Process

The four-step process per the MANUAL provides guidance and requirements for the selection of siting of structural Construction Control Measures (CCMs) for new development and significant redevelopment.

Step 1: Employ Runoff Reduction Practices
Currently the site is vacant undeveloped land with surrounding development. Development of the site will increase current runoff conditions due to increased imperviousness values. However, implementation the of landscaping throughout the site, the proposed storm sewer infrastructure, and the proposed Extended Detention Basin will help slow runoff and encourage infiltration.

Step 2: Provide Water Quality Capture Volume (WQCV)
The water quality capture volume will be detained using Full Spectrum Extended Detention Basin in the northwest corner of the Site. The outfall pipes from the water quality outlet structures will control the release of stormwater to less than historic rates.

Step 3: Stabilize Drainageways
There are no current drainageways conveyed through this property. No improvements to stabilize drainageways are a part of this Project.

Step 4: Consider need for Industrial and Commercial BMPs

Erosion control features for the final stages of the Project will be designed to reduce contamination. Source control BMPs will include the use of, inlet protection, silt fences, concrete washout areas, stockpile management, and stabilized staging areas. The Grading and Erosion Control Plans will be submitted as a separate construction document set.

Detention and Water Quality Design

The proposed private Full Spectrum Extended Detention Basin is designed with an outlet structure that is fitted with an orifice plat and restrictor plate to release the WQCV in a 40-hour time period per the MANUAL.

Calculations included in the Appendix provide details regarding the private water quality and detention basins design. The calculations include determination of the storage volumes required for full spectrum detention for the WQCV and 100 year detention and allowable release rates.

Overall, 0.165 acre-feet of WQCV is required, and 0.827 acre-feet of detention volume is required for the proposed Extended Detention Basin. The total area contributing to the Extended Detention Basin consists of 10.70 acres (42.0% imperviousness). The outlet structure and orifice releases approximately 0.2 cfs in the 5-year event and 5.8 cfs in the 100-year event. This is less than the historic flows in the 5-year and 100-year event.

Outlet Requirements

The water quality standards established by the CRITERIA are met by the proposed Full Spectrum Extended Detention Basin. The water quality outlet structure was designed per the specifications in the CRITERIA. The outlet structure for the Extended Detention Basin meets the micro-pool requirement that it be integrated into the design of the structure with an additional initial surcharge volume. The orifice plates of the structures were designed based on the CRITERIA. The orifice plates will allow the WQCV to be drained from the structure in 40 hours for the Extended Detention Basin. The calculations for the design of the outlet structure is presented in the **Appendix**.

Channel Design and Soil Erodibility

A proposed concrete lined trickle channel within the basin was designed per the MANUAL. A forebay structure is located at the upstream entrances to the Extended Detention Base. The forebay structure was designed per the MANUAL. Calculations detailing the design and dimensions forebay structure are included in the **Appendix**.

Emergency Spillway Path

The emergency overflow from the Extended Detention Basin is designed to follow historic drainage patterns and spill over the west side of the Extended Detention Basin to the existing temporary sediment basin, created by the SDS water system project, into the existing public 36" pipe.

COST OF PROPOSED DRAINAGE FACILITIES

An Engineers Opinion of Probable Construction Cost (EOPCC) is provided in the Appendix of the report. There are no public drainage facilities. All improvements with this Project will be private. The improvements are detailed in the Financial Assurance Estimate Form.

DRAINAGE AND BRIDGE FEES

The Site is located in the Sand Creek Drainage Basin. The total acreage of the parcel (5404304013) is 9.80 acres. The site imperviousness is 46%. The total drainage and bridge fees due for the Site is outlined below.

	2023 Fees ($ / Impervious acre)	Total Site Area (Acre)	X	Site Imperviousness	=	Impervious Area (Acre)	Amount Due ($)
Drainage Fee	$21,814	9.80		.46		4.5	$98,163
Bridge Fee	$8,923	9.80		.46		4.5	$40,153.50
					Total amount due:		**$138,316.50**

GRADING AND EROSION CONTROL

The GEC plans will be submitted to El Paso County Planning and Community Development Department for review and approval prior to construction. The GEC plans are consistent with this drainage report.

MAINTENANCE AND OPERATIONS

Twice per year inspections (spring and fall) of the stormwater detention and water quality structures are recommended. The owner/operator will be responsible for maintenance. A copy of this report will be provided to the owner/operator. This satisfies the EDB Operation and Maintenance (O&M) Manual.

OTHER GOVERNMENT AGENCY REQUIREMENTS

Approval from other agencies such as the FEMA, the Army Corps of Engineers, Colorado State Engineer, Colorado Water Conservation Board, and others are not needed with this Project.

SUMMARY

Ultimate outflow from the site occurs at the western corner of the site at the existing 36” RCP storm inlet pipe. Existing conditions releases 3.58 cfs during the 5-year storm and 26.27 cfs in the 100-year storm for the Site Area (Sub-basins E1, O1, O2). Under proposed conditions, these flows would be lowered to 0.81 CFS for the 5-year storm and 9.99 CFS in the 100-year storm for the Site Area (Sub-basins P1-P10, P12-P14, O1-O5). Because flows being released from the site are less than historic pre-development conditions, the existing downstream 36” RCP and associated stormwater infrastructure will be sufficient under proposed conditions.

COMPLIANCE WITH STANDARDS

The drainage design presented within this report conforms to the El Paso County Drainage Criteria Manual and the Mile High Flood District Urban Storm Drainage Criteria Manual. Additionally, the Site runoff and storm drain facilities will not adversely affect the downstream and surrounding developments. The proposed developed flows entering the Extended Detention Basin and are greater than the existing ultimate outfall of the site due to the greater imperviousness of the site, however the implementation of the drainage basins will disperse the flow over an extended period of time therefore releasing at equal to or less than the historic rate.

REFERENCES

1. City of Colorado Springs Drainage Criteria Manual, May 2014.
2. El Paso County Drainage Criteria Manual, Vol. 1 and 2, October 1994.
3. Mile High Flood District Drainage Criteria Manual (MHFDCM), Vol. 1, prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.
4. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 08041C0756G, Effective Date December 7, 2018, prepared by the Federal Emergency Management Agency (FEMA).

APPENDIX

SOILS MAP AND FEMA FIRM PANEL

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

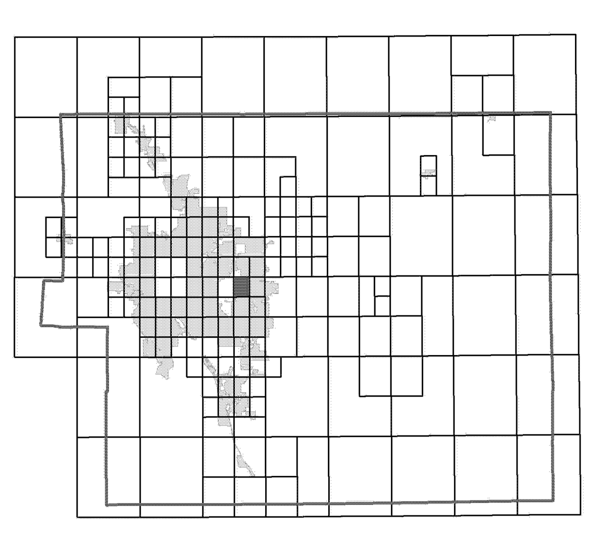
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

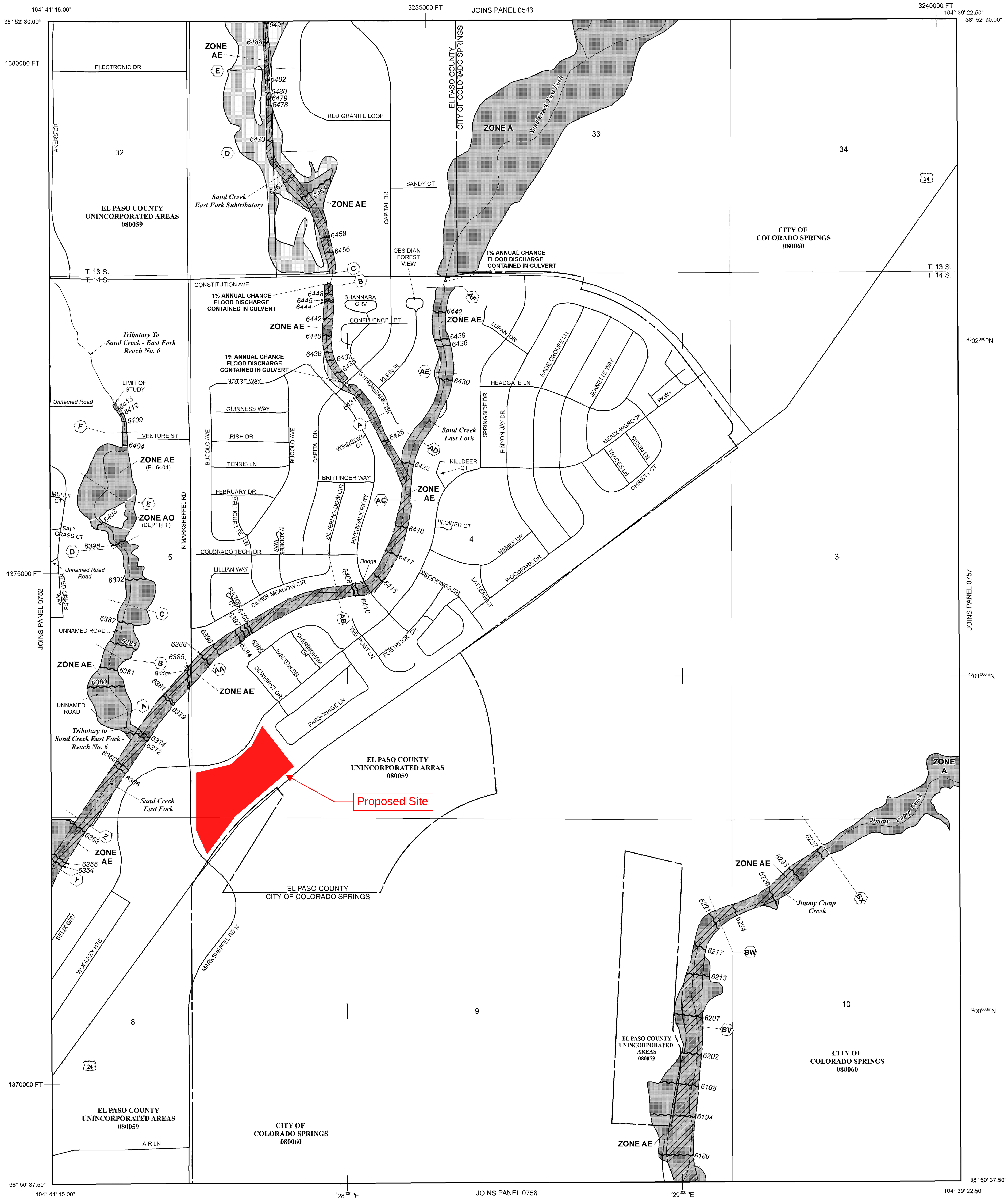
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST, AND TOWNSHIP 14 SOUTH, RANGE 65 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** No Base Flood Elevations determined.
- **ZONE AE** Base Flood Elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE AR** Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- **ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- **ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A—A Cross section line
- 23- - -23 Transect line
- 97° 07' 30.00" 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0756G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 756 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0756	G
EL PASO COUNTY	080059	0756	G

Notice: This map was reissued on 05/15/2020 to make a correction. This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0756G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for

El Paso County Area, Colorado

November 4, 2022

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Soil Map

Map Scale: 1:2,450 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 35, 70, 140, 210

Feet: 0, 100, 200, 400, 600

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 Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 20, Sep 2, 2022

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	15.2	94.7%
10	Blendon sandy loam, 0 to 3 percent slopes	0.8	5.3%
Totals for Area of Interest		**16.0**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

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

Map Unit Composition

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

Description of Blakeland

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

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

Minor Components

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

10—Blendon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3671
Elevation: 6,000 to 6,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Blendon

Setting

Landform: Alluvial fans, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 10 inches: sandy loam
Bw - 10 to 36 inches: sandy loam
C - 36 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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.

Map—Hydrologic Soil Group

Map Scale: 1:2,450 if printed on A portrait (8.5" x 11") sheet.

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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 20, Sep 2, 2022

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

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

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

Table—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	15.2	94.7%
10	Blendon sandy loam, 0 to 3 percent slopes	B	0.8	5.3%
Totals for Area of Interest			**16.0**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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HYDROLOGIC CALCULATIONS

Kimley»Horn

STANDARD FORM SF-1

RUNOFF COEFFICIENTS - IMPERVIOUS CALCULATION

EXISTING CONDITIONS

PROJECT NAME: CLAREMONT RANCH 7　　DATE: 4/19/2023
PROJECT NUMBER: 96949003
CALCULATED BY: AJL
CHECKED BY: KRK

SOIL: D

LAND USE:	PAVEMENT AREA	ROOF AREA	LANDSCAPE AREA
2-YEAR COEFF.	0.89	0.71	0.02
5-YEAR COEFF.	0.90	0.73	0.08
10-YEAR COEFF.	0.92	0.75	0.15
100-YEAR COEFF.	0.96	0.81	0.35
IMPERVIOUS %	100%	90%	0%

DESIGN BASIN	DESIGN POINT	PAVEMENT AREA (AC)	ROOF AREA (AC)	LANDSCAPE AREA (AC)	TOTAL AREA (AC)	C(2)	C(5)	C(10)	C(100)	Imp %
E1	E1	0.00	0.00	8.65	**8.65**	0.02	0.08	0.15	0.35	0%
E2	E2	0.00	0.00	1.15	**1.15**	0.02	0.08	0.15	0.35	0%
O1	O1	0.00	0.00	1.81	**1.81**	0.02	0.08	0.15	0.35	0%
O2	O2	0.00	0.00	0.78	**0.78**	0.02	0.08	0.15	0.35	0%
TOTAL - OVERALL		**0.00**	**0.00**	**12.40**	**12.40**	0.02	0.08	**0.15**	**0.35**	**0%**
		0%	**0%**	**100%**	**100%**					

Note: Land use coefficients sourced from City of Colorado Springs Drainage Criteria Manual, Volume 1, Table 6-6.

STANDARD FORM SF-2
Time of Concentration

PROJECT NAME: CLAREMONT RANCH 7
PROJECT NUMBER: 96949003
CALCULATED BY: AJL
CHECKED BY: KRK

EXISTING CONDITIONS

DATE: 4/19/2023

Watercourse Coefficient

Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00	Grassed Waterway	15.00
Fallow or Cultivation	5.00	Nearly Bare Ground	10.00	Paved Area & Shallow Gutter	20.00

SUB-BASIN DATA			INITIAL TIME (T_i)			TRAVEL TIME (T_t)					Tc CHECK (URBANIZED BASINS)					FINAL Tc
DESIGN BASIN (1)	AREA Ac (2)	C5 (3)	LENGTH Ft (4)	SLOPE % (5)	T_i Min. (6)	LENGTH Ft. (7)	SLOPE % (8)	C_v (9)	VEL fps (11)	T_t Min. (12)	COMP. tc (13)	TOTAL LENGTH (14)	TOTAL SLOPE (15)	TOTAL IMP. (16)	Tc Min. (17)	Min.
E1	8.65	0.08	100	7.0%	9.8	200	1.8%	7.0	0.9	3.5	13.3	300	3.5%		11.7	11.7
E2	1.15	0.08	50	3.0%	9.2			7.0			9.2	50	3.0%		10.3	9.2
O1	1.81	0.08	80	2.0%	13.3			7.0			13.3	80	2.0%		10.4	10.4
O2	0.78	0.08	60	8.0%	7.2			7.0			7.2	60	8.0%		10.3	7.2

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_0^{0.33}}$$

$$t_c = \frac{L}{180} + 10$$

$$V = C_v S_w^{0.5}$$

Note: Conveyance coefficient from Table 6-7 of DCM

Kimley»Horn

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 5 YEAR EVENT

PROJECT NAME: CLAREMONT RANCH 7 | EXISTING CONDITIONS | DATE: 4/19/2023

PROJECT NUMBER: 96949003
CALCULATED BY: AJL
CHECKED BY: KRK

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
STORM LINE	DESIGN POINT	DESIGN BASIN	AREA (AC)	RUNOFF COEFF	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCIT Y	tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	E1	E1	8.65	0.08	11.67	0.69	3.90	2.70													
	E2	E2	1.15	0.08	9.17	0.09	4.26	0.39													
	O1	O1	1.81	0.08	10.44	0.15	4.06	0.59													
	O2	O2	0.78	0.08	7.24	0.06	4.61	0.29													

$$I_5 = -1.50 \ln(t_{c,min}) + 7.583$$

Note: Rainfall intensity from Figure 6-5 IDF Equations

Kimley»Horn

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 100 YEAR EVENT

PROJECT NAME: CLAREMONT RANCH 7
EXISTING CONDITIONS
DATE: 4/19/2023
PROJECT NUMBER: 96949003
CALCULATED BY: AJL
CHECKED BY: KRK

STORM LINE		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			DESIGN BASIN	AREA (AC)	RUNOFF COEFF	t_c (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCIT Y	tt (min)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
		E1	E1	8.65	0.35	11.67	3.03	6.54	19.81													
		E2	E2	1.15	0.35	9.17	0.40	7.15	2.88													
		O1	O1	1.81	0.35	10.44	0.63	6.82	4.33													
		O2	O2	0.78	0.35	7.24	0.27	7.75	2.12													

$$I_{100} = -2.52 \ln(t_{c,min}) + 12.735$$

Note: Rainfall intensity from Figure 6-5 IDF Equations

Kimley»Horn 4/19/2023

PROJECT NAME: CLAREMONT RANCH 7
PROJECT NUMBER 96949003
CALCULATED BY: AJL
CHECKED BY: KRK

EXISTING CONDITIONS RATIONAL CALCULATIONS SUMMARY							
DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	CFS				% IMPERVIOUS
			Q2	Q5	Q10	Q100	
FDR Basins							
E1	E1	8.65	0.54	2.70	5.90	19.81	0%
E2	E2	1.15	0.08	0.39	0.86	2.88	0%
O1	O1	1.81	0.12	0.59	1.29	4.33	0%
O2	O2	0.78	0.06	0.29	0.63	2.12	0%
TOTAL		**12.40**	**0.79**	**3.97**	**8.68**	**29.15**	**0%**

STANDARD FORM SF-1
RUNOFF COEFFICIENTS - IMPERVIOUS CALCULATION

PROPOSED CONDITIONS

PROJECT NAME: CLAREMONT RANCH FILING NO. 7 DATE: 4/19/2023
PROJECT NUMBER: 96726002
CALCULATED BY: AJL
CHECKED BY: KFK

SOIL: A & B

LAND USE:	PAVEMENT AREA	ROOF AREA	LANDSCAPE AREA
2-YEAR COEFF.	0.89	0.71	0.02
5-YEAR COEFF.	0.90	0.73	0.08
10-YEAR COEFF.	0.92	0.75	0.15
100-YEAR COEFF.	0.96	0.81	0.35
IMPERVIOUS %	100%	90%	0%

DESIGN BASIN	DESIGN POINT	PAVEMENT AREA (AC)	ROOF AREA (AC)	LANDSCAPE AREA (AC)	TOTAL AREA (AC)	C(2)	C(5)	C(10)	C(100)	Imp %
P1	P1	0.44	0.26	0.44	**1.14**	0.51	0.54	0.58	0.69	59%
P2	P2	0.34	0.29	0.79	**1.42**	0.37	0.41	0.46	0.59	42%
P3	P3	0.12	0.10	0.33	**0.56**	0.34	0.38	0.43	0.57	39%
P4	P4	0.15	0.14	0.24	**0.53**	0.45	0.49	0.53	0.65	52%
P5	P5	0.08	0.07	0.29	**0.44**	0.29	0.33	0.39	0.53	33%
P6	P6	0.00	0.00	0.38	**0.38**	0.02	0.08	0.15	0.35	0%
P7	P7	0.47	0.33	0.27	**1.07**	0.61	0.64	0.67	0.76	72%
P8	P8	0.54	0.33	0.31	**1.18**	0.61	0.64	0.67	0.76	71%
P9	P9	0.04	0.00	0.02	**0.06**	0.58	0.61	0.65	0.74	64%
P10	P10	0.67	0.21	0.22	**1.10**	0.68	0.70	0.73	0.81	78%
P11	P11	0.01	0.00	0.38	**0.39**	0.04	0.10	0.17	0.36	2%
P12	P12	0.00	0.12	0.58	**0.70**	0.14	0.19	0.25	0.43	15%
P13	P13	0.00	0.00	0.53	**0.53**	0.02	0.08	0.15	0.35	0%
P14	P14	0.00	0.00	0.30	**0.30**	0.02	0.08	0.15	0.35	0%
O1	O1	0.00	0.00	0.69	**0.69**	0.02	0.08	0.15	0.35	0%
O2	O2	0.00	0.00	0.47	**0.47**	0.02	0.08	0.15	0.35	0%
O3	O3	0.00	0.00	0.26	**0.26**	0.02	0.08	0.15	0.35	0%
O4	O4	0.00	0.00	0.39	**0.39**	0.02	0.08	0.15	0.35	0%
O5	O5	0.00	0.00	0.78	**0.78**	0.02	0.08	0.15	0.35	0%
O6	O6	0.03	0.00	0.00	**0.03**	0.89	0.90	0.92	0.96	100%
TOTAL - OVERALL		**2.89**	**1.84**	**7.69**	**12.43**	**0.32**	**0.37**	**0.42**	**0.56**	**37%**
		23%	**15%**	**62%**	**100%**					

Note: Land use coefficients sourced from City of Colorado Springs Drainage Criteria Manual, Volume 1, Table 6-6.

Kimley»Horn

STANDARD FORM SF-2
Time of Concentration

PROJECT NAME: **CLAREMONT RANCH FILING NO. 7**
PROJECT NUMBER: **96726002**
CALCULATED BY: **AJL**
CHECKED BY: **KFK**

PROPOSED CONDITIONS

DATE: 4/19/2023

Watercourse Coefficient

Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00	Grassed Waterway	15.00
Fallow or Cultivation	5.00	Nearly Bare Ground	10.00	Paved Area & Shallow Gutter	20.00

SUB-BASIN DATA			INITIAL TIME (T_i)			TRAVEL TIME (T_t)					Tc CHECK (URBANIZED BASINS)					FINAL Tc
DESIGN BASIN (1)	AREA Ac (2)	C5 (3)	LENGTH Ft (4)	SLOPE % (5)	T_i Min. (6)	LENGTH Ft. (7)	SLOPE % (8)	C_v (9)	VEL fps (11)	T_t Min. (12)	COMP. tc (13)	TOTAL LENGTH (14)	TOTAL SLOPE (15)	TOTAL IMP. (16)	Tc Min. (17)	Min.
P1	1.14	0.54	100	3.0%	7.1	130	2.5%	20.0	3.2	0.7	7.8	230	2.7%	59%	11.3	7.8
P2	1.42	0.41	75	10.0%	5.1	175	1.1%	7.0	0.7	4.0	9.1	250	3.8%	42%	11.4	9.1
P3	0.56	0.38	91	15.0%	5.1	145	1.0%	7.0	0.7	3.5	8.5	236	6.4%	39%	11.3	8.5
P4	0.53	0.49	55	15.0%	3.4	55	1.2%	7.0	0.8	1.2	4.6	110	8.1%	52%	10.6	5.0
P5	0.44	0.33	100	17.0%	5.5	55	1.8%	7.0	0.9	1.0	6.4	155	11.6%	33%	10.9	6.4
P6	0.38	0.08	50	15.0%	5.4			7.0			5.4	50	15.0%		10.3	5.4
P7	1.07	0.64	50	5.0%	3.5	80	1.0%	20.0	2.0	0.7	4.2	130	2.5%	72%	10.7	5.0
P8	1.18	0.64	50	4.0%	3.8	75	1.0%	20.0	2.0	0.6	4.4	125	2.2%	71%	10.7	5.0
P9	0.06	0.61	25	1.0%	4.5	50	1.3%	20.0	2.2	0.4	4.9	75	1.2%	64%	10.4	5.0
P10	1.10	0.70	50	2.2%	4.0	85	1.7%	20.0	2.6	0.5	4.5	135	1.9%	78%	10.8	5.0
P11	0.39	0.10	35	10.0%	5.0			7.0			5.0	35	10.0%	2%	10.2	5.0
P12	0.70	0.19	60	20.0%	4.8			7.0			4.8	60	20.0%	15%	10.3	5.0
P13	0.53	0.08	80	10.0%	7.8			7.0			7.8	80	10.0%		10.4	7.8
P14	0.30	0.08	50	15.0%	5.4			7.0			5.4	50	15.0%		10.3	5.4
O1	0.69	0.08	40	3.0%	8.2			7.0			8.2	40	3.0%		10.2	8.2
O2	0.47	0.08	40	3.0%	8.2			7.0			8.2	40	3.0%		10.2	8.2
O3	0.26	0.08	40	3.0%	8.2			7.0			8.2	40	3.0%		10.2	8.2
O4	0.39	0.08	40	5.0%	6.9			7.0			6.9	40	5.0%		10.2	6.9
O5	0.78	0.08	30	15.0%	4.2			7.0			4.2	30	15.0%		10.2	5.0
O6	0.03	0.90	5	2.0%	0.7	10	4.0%	20.0	4.0	0.0	0.7	15	3.3%	100%	10.1	5.0

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_0^{0.33}} \qquad t_c = \frac{L}{180} + 10 \qquad V = C_v S_w^{0.5}$$

Note: Conveyance coefficient from Table 6-7 of DCM

Kimley»Horn

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 5 YEAR EVENT

PROJECT NAME: CLAREMONT RANCH FILING NO. 7 **PROPOSED CONDITIONS** DATE: 4/19/2023
PROJECT NUMBER: 96726002
CALCULATED BY: AJL
CHECKED BY: KFK

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
STORM LINE	DESIGN POINT	DESIGN BASIN	AREA (AC)	RUNOFF COEFF	tc (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCIT Y	tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	P1	P1	1.14	0.54	7.77	0.62	4.51	2.79													
	P2	P2	1.42	0.41	9.07	0.58	4.28	2.48													
	P3	P3	0.56	0.38	8.55	0.21	4.36	0.94													
	P4	P4	0.53	0.49	5.00	0.26	5.17	1.33													
	P5	P5	0.44	0.33	6.45	0.15	4.79	0.70													
	P6	P6	0.38	0.08	5.36	0.03	5.06	0.15													
	P7	P7	1.07	0.64	5.00	0.68	5.17	3.54													
	P8	P8	1.18	0.64	5.00	0.75	5.17	3.87													
	P9	P9	0.06	0.61	5.00	0.04	5.17	0.19													
	P10	P10	1.10	0.70	5.00	0.77	5.17	3.98													
	P11	P11	0.39	0.10	5.04	0.04	5.16	0.20													
	P12	P12	0.70	0.19	5.00	0.13	5.17	0.70													
	P13	P13	0.53	0.08	7.76	0.04	4.51	0.19													
	P14	P14	0.30	0.08	5.36	0.02	5.06	0.12													
	O1	O1	0.69	0.08	8.20	0.06	4.43	0.25													
	O2	O2	0.47	0.08	8.20	0.04	4.43	0.17													
	O3	O3	0.26	0.08	8.20	0.02	4.43	0.09													
	O4	O4	0.39	0.08	6.92	0.03	4.68	0.15													
	O5	O5	0.78	0.08	5.00	0.06	5.17	0.32													
	O6	O6	0.03	0.90	5.00	0.02	5.17	0.12													

$$I_{10} = -1.50 \ln(t_{c,min}) + 7.583$$

Note: Rainfall intensity from Figure 6-5 IDF Equations

Kimley»Horn

STANDARD FORM SF-3
STORM DRAINAGE DESIGN - RATIONAL METHOD 100 YEAR EVENT

PROJECT NAME: CLAREMONT RANCH FILING NO. 7

PROPOSED CONDITIONS

DATE: 4/19/2023

PROJECT NUMBER: 96726002
CALCULATED BY: AJL
CHECKED BY: KFK

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
STORM LINE	DESIGN POINT	DESIGN BASIN	AREA (AC)	RUNOFF COEFF	tc (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCIT Y	tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	P1	P1	1.14	0.69	7.77	0.79	7.57	5.96													
	P2	P2	1.42	0.59	9.07	0.84	7.18	6.01													
	P3	P3	0.56	0.57	8.55	0.32	7.33	2.35													
	P4	P4	0.53	0.65	5.00	0.34	8.68	2.98													
	P5	P5	0.44	0.53	6.45	0.23	8.04	1.88													
	P6	P6	0.38	0.35	5.36	0.13	8.50	1.12													
	P7	P7	1.07	0.76	5.00	0.81	8.68	7.04													
	P8	P8	1.18	0.76	5.00	0.89	8.68	7.74													
	P9	P9	0.06	0.74	5.00	0.05	8.68	0.40													
	P10	P10	1.10	0.81	5.00	0.89	8.68	7.70													
	P11	P11	0.39	0.36	5.04	0.14	8.66	1.22													
	P12	P12	0.70	0.43	5.00	0.30	8.68	2.62													
	P13	P13	0.53	0.35	7.76	0.19	7.57	1.41													
	P14	P14	0.30	0.35	5.36	0.11	8.50	0.91													
	O1	O1	0.69	0.35	8.20	0.24	7.43	1.80													
	O2	O2	0.47	0.35	8.20	0.16	7.43	1.22													
	O3	O3	0.26	0.35	8.20	0.09	7.43	0.68													
	O4	O4	0.39	0.35	6.92	0.14	7.86	1.07													
	O5	O5	0.78	0.35	5.00	0.27	8.68	2.38													
	O6	O6	0.03	0.96	5.00	0.02	8.68	0.21													

$$I_{100} = -2.52 \ln(t_{c,min}) + 12.735$$

Note: Rainfall intensity from Figure 6-5 IDF Equations

Kimley»Horn 4/19/2023

PROJECT NAME: CLAREMONT RANCH FILING NO. 7
PROJECT NUMBER: 96726002
CALCULATED BY: AJL
CHECKED BY: KFK

PROPOSED CONDITIONS RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	CFS				% IMPERVIOUS
			Q2	Q5	Q10	Q100	
FDR Basins							
P1	P1	1.14	2.10	2.79	3.50	5.96	59%
P2	P2	1.42	1.79	2.48	3.23	6.01	42%
P3	P3	0.56	0.67	0.94	1.23	2.35	39%
P4	P4	0.53	0.99	1.33	1.69	2.98	52%
P5	P5	0.44	0.48	0.70	0.94	1.88	33%
P6	P6	0.38	0.03	0.15	0.33	1.12	0%
P7	P7	1.07	2.71	3.54	4.34	7.04	72%
P8	P8	1.18	2.96	3.87	4.75	7.74	71%
P9	P9	0.06	0.15	0.19	0.24	0.40	64%
P10	P10	1.10	3.08	3.98	4.85	7.70	78%
P11	P11	0.39	0.06	0.20	0.39	1.22	2%
P12	P12	0.70	0.40	0.70	1.07	2.62	15%
P13	P13	0.53	0.04	0.19	0.42	1.41	0%
P14	P14	0.30	0.02	0.12	0.27	0.91	0%
O1	O1	0.69	0.05	0.25	0.54	1.80	0%
O2	O2	0.47	0.03	0.17	0.36	1.22	0%
O3	O3	0.26	0.02	0.09	0.20	0.68	0%
O4	O4	0.39	0.03	0.15	0.32	1.07	0%
O5	O5	0.78	0.06	0.32	0.71	2.38	0%
O6	O6	0.03	0.09	0.12	0.14	0.21	100%
TOTAL		**12.43**	**15.75**	**22.28**	**29.54**	**56.70**	**37%**

HYDRAULIC CALCULATIONS

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	P1	P2	P3	P4	P5	P7	P8	P9	P10
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	In Sump	On Grade	In Sump	In Sump	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	2.7	3.2	1.1	1.4	1.0	3.5	3.6	0.2	4.0
Major Q_{Known} (cfs)	5.7	8.5	3.6	3.4	4.1	6.9	7.1	0.4	8.4

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	P2	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	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	0.0	0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)									
Percent Impervious									
NRCS Soil Type									

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

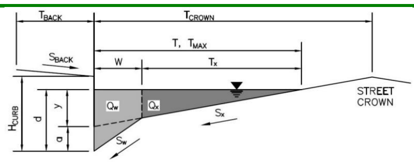
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	2.7	3.2	1.1	1.4	1.0	3.5	3.6	0.2	4.0
Major Total Design Peak Flow, Q (cfs)	5.7	8.5	3.7	3.4	4.1	6.9	7.1	0.4	8.4
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0	N/A	0.0	N/A	N/A	0.0	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	0.2	0.0	N/A	0.0	N/A	N/A	0.0	N/A

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

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

Project:
Inlet ID: P1



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	25.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.100	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.030	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 =	0.035	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

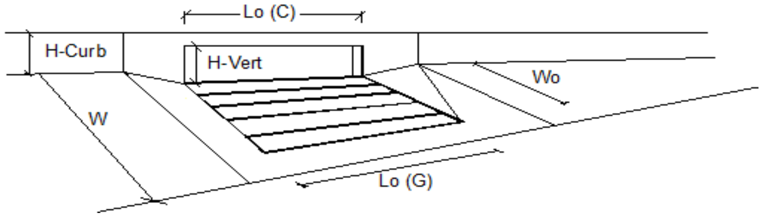
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	13.1	23.4	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.65 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.66 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

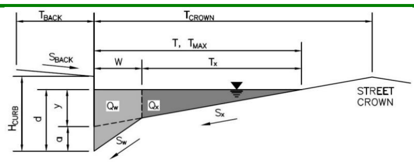


Design Information (Input)	CDOT Type R Curb Openi		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	2.7	5.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_b =	0.0	0.0	cfs
Capture Percentage = Q_a/Q_o		C% =	100	100	%

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

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

Project:
Inlet ID: P2



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	25.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.050	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.030	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

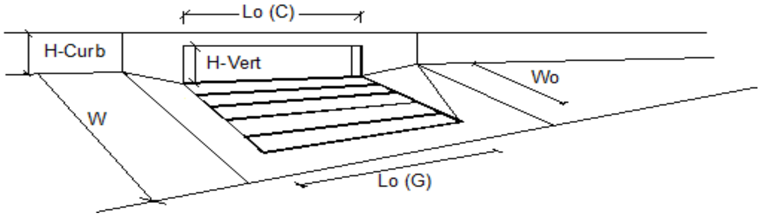
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	10.6	12.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.20 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 8.50 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)	CDOT Type R Curb Openii		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	

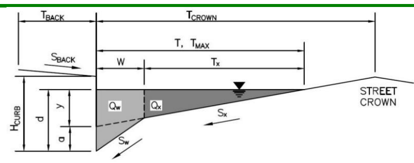
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	3.2	8.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	0.2	cfs
Capture Percentage = Q_a/Q_o	C% =	100	98	%

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

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

Project:

Inlet ID: P3



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	25.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.050	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.030	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

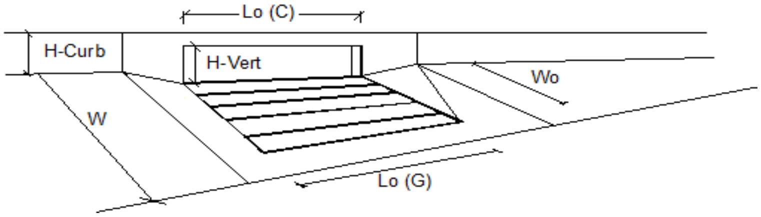
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	10.6	12.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.11 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.72 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

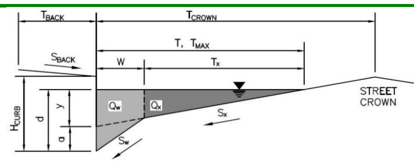


Design Information (Input)	CDOT Type R Curb Openi		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	1.1	3.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_b =	0.0	0.0	cfs
Capture Percentage = Q_a/Q_o		C% =	100	100	%

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

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

Project:
Inlet ID: P4



Gutter Geometry:

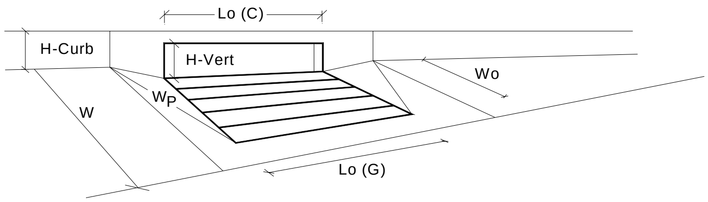
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	25.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.050	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.030	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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)

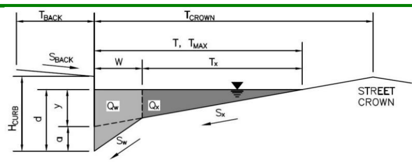


			MINOR	MAJOR	
Design Information (Input)	CDOT Type R Curb Openi				
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.3	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 =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
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} =	0.33	0.36	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 =	5.4	6.0	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_{PEAK\ REQUIRED}$ =	1.4	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:
Inlet ID: P5



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	25.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.050	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.030	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.018	

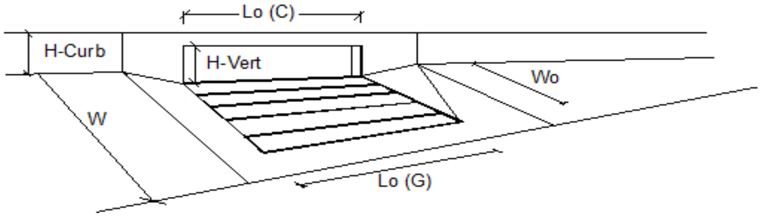
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	13.4	15.7	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.00 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.07 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

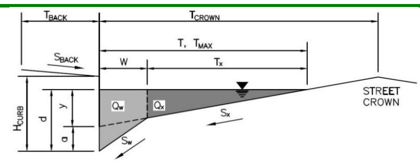


Design Information (Input)	CDOT Type R Curb Openi		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	1.0	4.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_b =	0.0	0.0	cfs
Capture Percentage = Q_a/Q_o		C% =	100	100	%

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

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

Project:
Inlet ID: P7



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} =	0.010	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	32.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.025	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

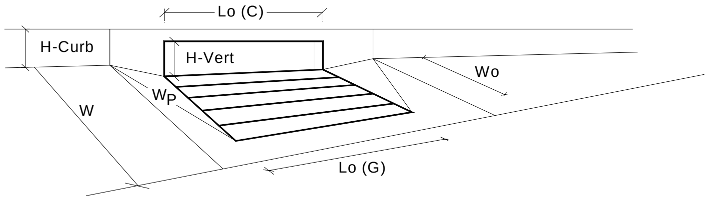
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	32.0	32.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
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 Openi)	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 =	6.0	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 =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

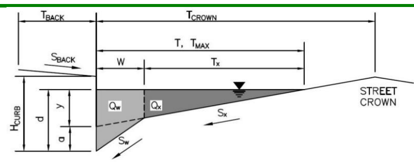
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	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 =	8.3	8.3	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.5	6.9	cfs

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

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

Project:
Inlet ID: P8



Gutter Geometry:

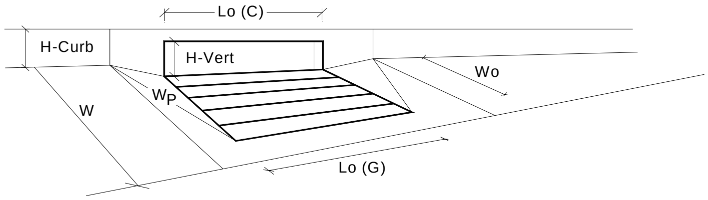
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	25.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.050	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.030	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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 Openi				
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 =	6.0	6.3	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 =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

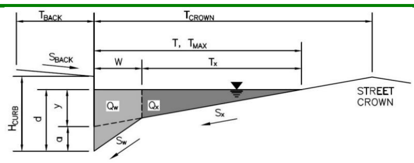
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.36	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	0.95	
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 =	8.3	9.4	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.6	7.1	cfs

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

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

Project:
Inlet ID: P9



Gutter Geometry:

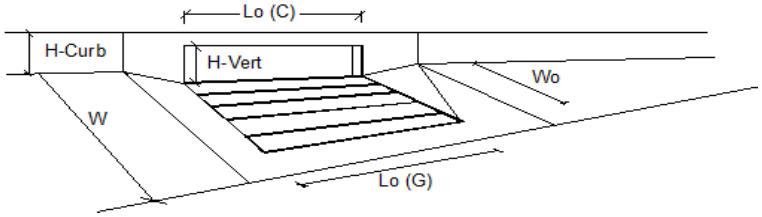
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.050		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.030		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	13.7	21.6	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.19 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 0.38 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)

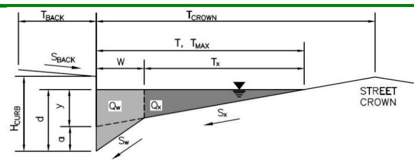


Design Information (Input)	CDOT Type R Curb Openi		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	0.2	0.4	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_b =	0.0	0.0	cfs
Capture Percentage = Q_a/Q_o		C% =	100	100	%

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

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

Project:
Inlet ID: P10



Gutter Geometry:

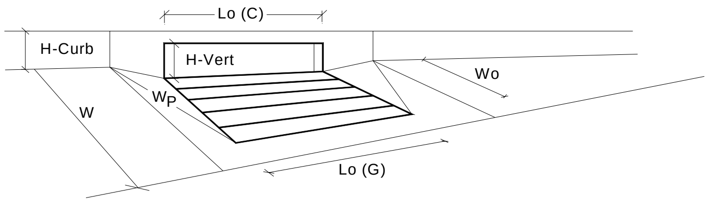
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	25.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.030	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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 Openi		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 =	6.0	6.3	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 =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
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} =	0.33	0.36	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} =	0.93	0.95	
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 =	8.3	9.4	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	4.0	8.4	cfs

MILE HIGH FLOOD DISTRICT

DETENTION BASIN DESIGN WORKBOOK

MHFD-Detention, Version 4.06 (July 2022)
Mile High Flood District
Denver, Colorado
www.mhfd.org

Purpose: This workbook aids in the estimation of stormwater detention basin sizing and outlet routing based on the modified puls routing method for urban watersheds. Several different BMP types and various outlet configurations can be sized.

Function:

1. Approximates the stage-area-volume relationship for a detention basin based on watershed parameters and basin geometry parameters. Also evaluates existing user-defined basin stage-area relationships.

2. Sizes filtration media orifice, outlet orifices, elliptical slots, weirs, trash racks, and develops stage-discharge relationships. Uses the Modified Puls method to route a series of hydrographs (i.e., 2-, 5-, 10-, 25-, 50-, 100- and 500-year) and calibrates the peak discharge out of the basin to match the pre-development peak discharges for the watershed.

Content: This workbook consists of the following sheets:

Basin	Tabulates stage-area-volume relationship estimates based on watershed parameters
Outlet Structure	Tabulates a stage-discharge relationship for the user-defined outlet structure (inlet control).
Reference	Provides reference equations and figures.
User Tips and Tools	Provides instructions and video links to assist in using this workbook. Includes a stage-area calculator.
BMP Zone Images	Provides images of typical BMP zone confirgurations corresponding with Zone pulldown selections.

Acknowledgements: *Spreadsheet Development Team:*
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Mile High Flood District

Derek N. Rapp, P.E.
Peak Stormwater Engineering, LLC

Dr. James C.Y. Guo, Ph.D., P.E.
Professor, Department of Civil Engineering, University of Colorado at Denver

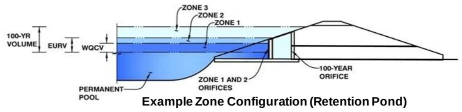
Comments? Direct all comments regarding this spreadsheet workbook to: MHFD E-Mail
Revisions? Check for revised versions of this or any other workbook at: Downloads

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Eastwood Village (Tract F Claremont Ranch Filing No. 7)

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	10.70	acres
Watershed Length =	1,000	ft
Watershed Length to Centroid =	500	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	42.00%	percent
Percentage Hydrologic Soil Group A =	95.0%	percent
Percentage Hydrologic Soil Group B =	5.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.165	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.492	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.372	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.498	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.599	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.801	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.979	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.215	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	1.726	acre-feet		inches
Approximate 2-yr Detention Volume =	0.317	acre-feet		
Approximate 5-yr Detention Volume =	0.420	acre-feet		
Approximate 10-yr Detention Volume =	0.520	acre-feet		
Approximate 25-yr Detention Volume =	0.639	acre-feet		
Approximate 50-yr Detention Volume =	0.718	acre-feet		
Approximate 100-yr Detention Volume =	0.827	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.165	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.327	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.334	acre-feet
Total Detention Basin Volume =	0.827	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		
6391.40	--	0.20	--	--	--	23	0.001	4	0.000
6391.60	--	0.40	--	--	--	23	0.001	9	0.000
6391.80	--	0.60	--	--	--	66	0.002	17	0.000
6392.00	--	0.80	--	--	--	161	0.004	40	0.001
6392.20	--	1.00	--	--	--	499	0.011	106	0.002
6392.40	--	1.20	--	--	--	1,060	0.024	262	0.006
6392.60	--	1.40	--	--	--	1,896	0.044	558	0.013
6392.80	--	1.60	--	--	--	2,904	0.067	1,038	0.024
6393.00	--	1.80	--	--	--	3,886	0.089	1,716	0.039
6393.20	--	2.00	--	--	--	4,746	0.109	2,580	0.059
6393.40	--	2.20	--	--	--	5,531	0.127	3,607	0.083
6393.60	--	2.40	--	--	--	6,190	0.142	4,779	0.110
6393.80	--	2.60	--	--	--	6,831	0.157	6,081	0.140
6394.00	--	2.80	--	--	--	7,405	0.170	7,505	0.172
6394.20	--	3.00	--	--	--	7,753	0.178	9,021	0.207
6394.40	--	3.20	--	--	--	8,101	0.186	10,606	0.243
6394.60	--	3.40	--	--	--	8,450	0.194	12,261	0.281
6394.80	--	3.60	--	--	--	8,801	0.202	13,986	0.321
6395.00	--	3.80	--	--	--	9,155	0.210	15,782	0.362
6395.20	--	4.00	--	--	--	9,512	0.218	17,649	0.405
6395.40	--	4.20	--	--	--	9,874	0.227	19,587	0.450
6395.60	--	4.40	--	--	--	10,239	0.235	21,599	0.496
6395.80	--	4.60	--	--	--	10,607	0.244	23,683	0.544
6396.00	--	4.80	--	--	--	10,983	0.252	25,842	0.593
6396.20	--	5.00	--	--	--	11,371	0.261	28,078	0.645
6396.40	--	5.20	--	--	--	11,754	0.270	30,390	0.698
6396.60	--	5.40	--	--	--	12,139	0.279	32,779	0.753
6396.80	--	5.60	--	--	--	12,526	0.288	35,246	0.809
6397.00	--	5.80	--	--	--	13,063	0.300	37,805	0.868
6397.20	--	6.00	--	--	--	13,310	0.306	40,442	0.928
6397.40	--	6.20	--	--	--	13,713	0.315	43,144	0.990
6397.60	--	6.40	--	--	--	14,125	0.324	45,928	1.054
6397.80	--	6.60	--	--	--	14,553	0.334	48,796	1.120
6398.00	--	6.80	--	--	--	14,997	0.344	51,751	1.188
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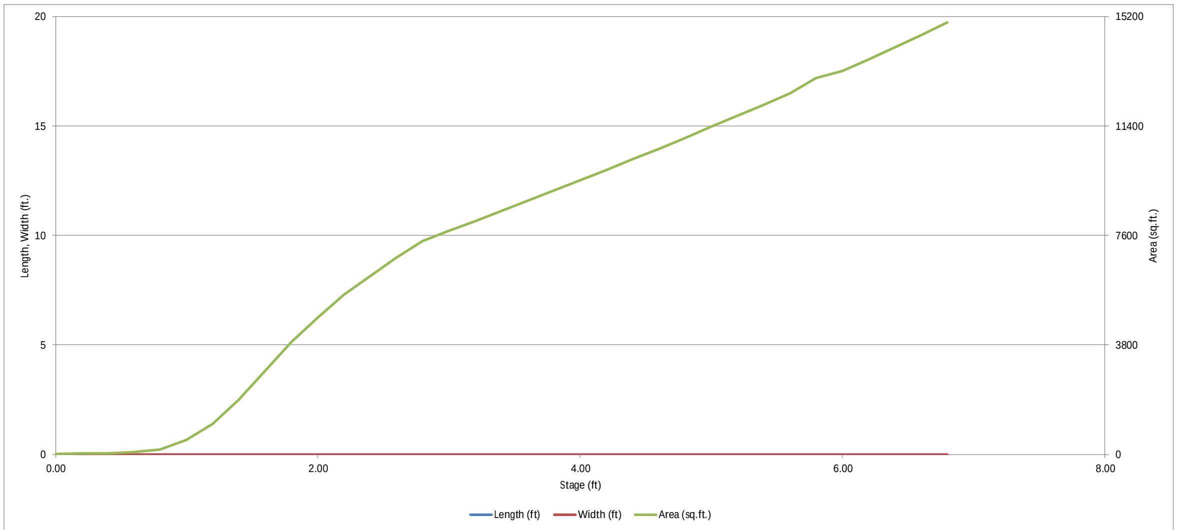
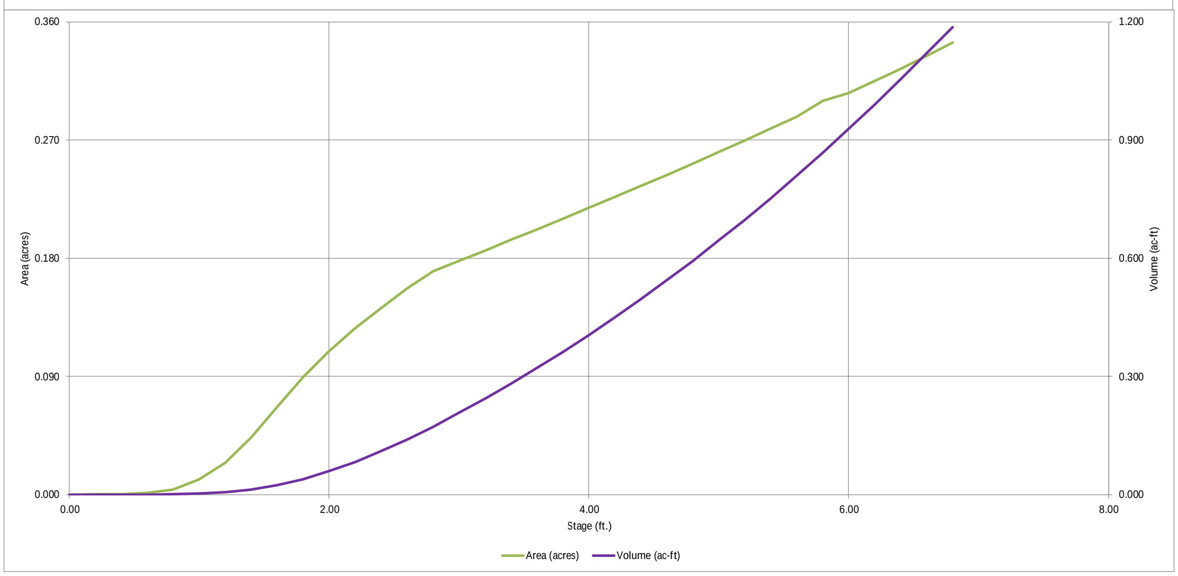

Length, Width (ft.)
Area (sq.ft.)
Stage (ft)
0
5
10
15
20
0
3800
7600
11400
15200
0.00
2.00
4.00
6.00
8.00
Length (ft)
Width (ft)
Area (sq.ft.)

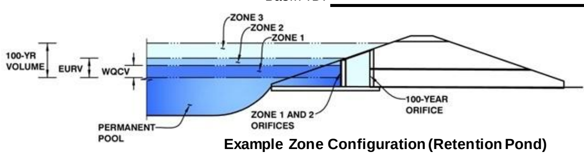

Area (acres)
Volume (ac-ft)
Stage (ft.)
0.000
0.090
0.180
0.270
0.360
0.000
0.300
0.600
0.900
1.200
0.00
2.00
4.00
6.00
8.00
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Eastwood Village (Tract F Claremont Ranch Filing No. 7)

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.76	0.165	Orifice Plate
Zone 2 (EURV)	4.39	0.327	Orifice Plate
Zone 3 (100-year)	5.67	0.334	Weir&Pipe (Restrict)
Total (all zones)		0.827	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.39	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.40	2.80					
Orifice Area (sq. inches)	0.60	0.80	1.77					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.39	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.39	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	12.15	N/A	
Overflow Grate Open Area w/o Debris =	6.26	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.13	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	6.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.52	N/A	ft^2
Outlet Orifice Centroid =	0.29	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.23	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.45	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	30.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.34	feet
Stage at Top of Freeboard =	6.79	feet
Basin Area at Top of Freeboard =	0.34	acres
Basin Volume at Top of Freeboard =	1.18	acre-ft

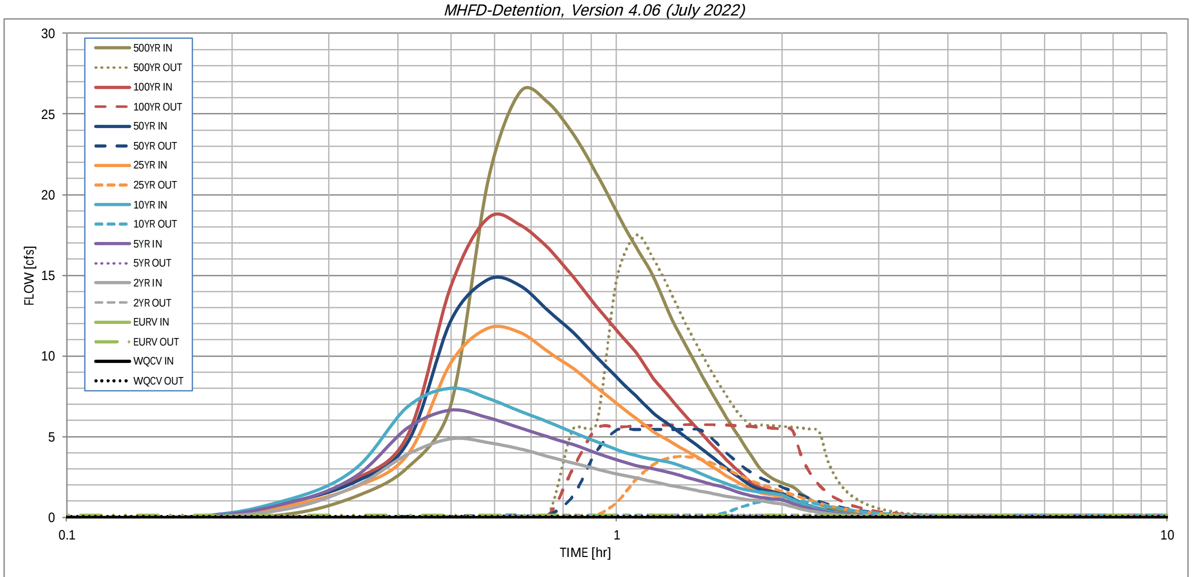
Routed Hydrograph Results

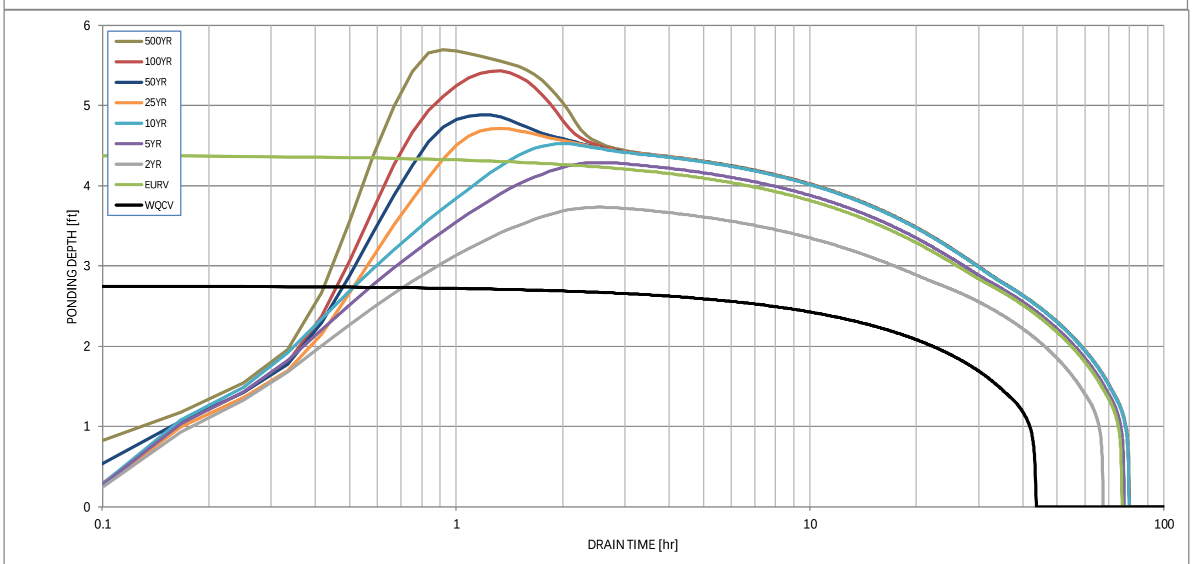
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

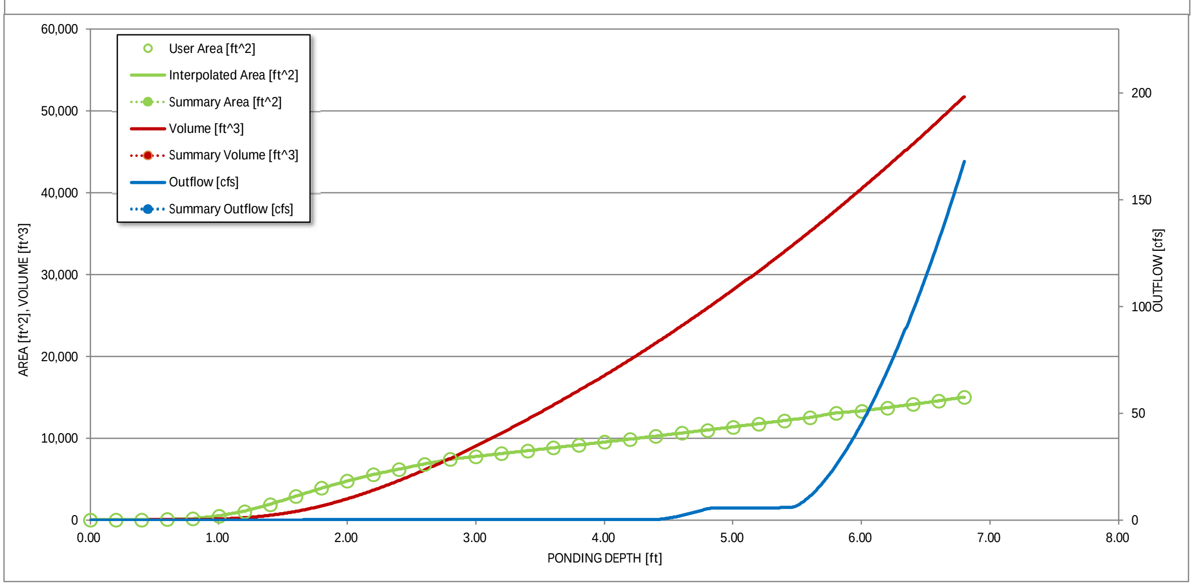
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.165	0.492	0.372	0.498	0.599	0.801	0.979	1.215	1.726
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.372	0.498	0.599	0.801	0.979	1.215	1.726
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.2	2.5	4.4	6.9	12.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.02	0.23	0.41	0.64	1.12
Peak Inflow Q (cfs) =	N/A	N/A	4.9	6.7	8.0	11.7	14.7	18.6	26.4
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.2	1.2	3.8	5.5	5.8	17.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	5.2	1.5	1.2	0.8	1.5
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.2	0.6	0.8	0.9	0.9
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) =	40	68	61	69	70	68	67	65	61
Time to Drain 99% of Inflow Volume (hours) =	42	73	65	74	76	75	74	73	71
Maximum Ponding Depth (ft) =	2.76	4.39	3.73	4.29	4.53	4.72	4.89	5.43	5.70
Area at Maximum Ponding Depth (acres) =	0.17	0.23	0.21	0.23	0.24	0.25	0.26	0.28	0.29
Maximum Volume Stored (acre-ft) =	0.166	0.493	0.348	0.468	0.524	0.571	0.614	0.761	0.838

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.01	0.20
	0:15:00	0.00	0.00	0.53	0.86	1.08	0.73	0.91	0.89	1.29
	0:20:00	0.00	0.00	1.90	2.50	2.96	1.88	2.20	2.36	3.09
	0:25:00	0.00	0.00	3.93	5.54	6.87	3.90	4.64	5.09	7.04
	0:30:00	0.00	0.00	4.90	6.66	8.02	9.61	12.23	14.38	20.92
	0:35:00	0.00	0.00	4.65	6.18	7.37	11.74	14.75	18.59	26.39
	0:40:00	0.00	0.00	4.26	5.57	6.61	11.46	14.39	18.15	25.70
	0:45:00	0.00	0.00	3.78	4.99	5.92	10.27	12.82	16.69	23.75
	0:50:00	0.00	0.00	3.38	4.51	5.29	9.26	11.48	14.91	21.41
	0:55:00	0.00	0.00	3.02	4.02	4.72	8.10	10.00	13.13	18.91
	1:00:00	0.00	0.00	2.71	3.57	4.22	7.06	8.68	11.60	16.77
	1:05:00	0.00	0.00	2.46	3.23	3.84	6.16	7.53	10.23	14.91
	1:10:00	0.00	0.00	2.21	3.01	3.60	5.32	6.48	8.63	12.54
	1:15:00	0.00	0.00	2.00	2.78	3.40	4.73	5.71	7.42	10.71
	1:20:00	0.00	0.00	1.82	2.52	3.11	4.16	5.00	6.30	9.02
	1:25:00	0.00	0.00	1.65	2.28	2.75	3.64	4.35	5.31	7.54
	1:30:00	0.00	0.00	1.48	2.05	2.40	3.10	3.68	4.42	6.21
	1:35:00	0.00	0.00	1.32	1.83	2.09	2.60	3.05	3.60	4.99
	1:40:00	0.00	0.00	1.18	1.56	1.83	2.15	2.49	2.85	3.88
	1:45:00	0.00	0.00	1.09	1.37	1.67	1.77	2.01	2.21	2.96
	1:50:00	0.00	0.00	1.04	1.25	1.58	1.53	1.73	1.83	2.44
	1:55:00	0.00	0.00	0.93	1.17	1.50	1.39	1.57	1.62	2.13
	2:00:00	0.00	0.00	0.84	1.09	1.38	1.31	1.48	1.49	1.92
	2:05:00	0.00	0.00	0.67	0.88	1.11	1.05	1.18	1.16	1.49
	2:10:00	0.00	0.00	0.53	0.69	0.87	0.82	0.92	0.89	1.12
	2:15:00	0.00	0.00	0.42	0.54	0.69	0.64	0.71	0.67	0.84
	2:20:00	0.00	0.00	0.33	0.43	0.53	0.49	0.55	0.51	0.63
	2:25:00	0.00	0.00	0.25	0.33	0.41	0.38	0.42	0.39	0.49
	2:30:00	0.00	0.00	0.20	0.25	0.31	0.29	0.32	0.30	0.37
	2:35:00	0.00	0.00	0.15	0.19	0.24	0.22	0.24	0.23	0.28
	2:40:00	0.00	0.00	0.11	0.14	0.18	0.16	0.18	0.17	0.21
	2:45:00	0.00	0.00	0.08	0.11	0.13	0.12	0.14	0.13	0.16
	2:50:00	0.00	0.00	0.06	0.08	0.10	0.09	0.10	0.09	0.11
	2:55:00	0.00	0.00	0.04	0.05	0.06	0.06	0.07	0.06	0.07
	3:00:00	0.00	0.00	0.02	0.03	0.04	0.04	0.04	0.04	0.04
	3:05:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.02
	3:10:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

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

Kimley»Horn

Date	4/5/2023
Prepared By	AJL
Checked By	KRK

Forebay Sizing Calculations- Detention Basin Forebay

Contributing Sub-Basins: P1-P10, P12, P14, O1-O4

	Required	Forebay B Flow: Q_{100} = (cfs)	Release Rate
Forebay Release and Configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch or berm/pipe configuration	51.26	1.03

			Required (CF)	Provided (CF)
Minimum Forebay Volume Required	2% of the WQCV	40hr drain time a = 1 I = 0.803 A = 4.48 AC	143.79	145.03

	Required	Provided	
Maximum Forebay Depth	18" Max	18"	Concrete Forebay Structure

Forebay Notch Calculations			
$Q = C_o A_o (2gH_o)^{0.5}$			
Q_a	1.03	cfs	2% of Peak 100 YR Discharge for contributing Sub-Basins
C_o	0.6		
H_o	0.5	ft	
g	32.2	ft/s^2	
A_a	0.30	ft^2	
L_a	0.20	ft	
	2.41	**in**	3" Minimum per Criteria

$$WQCV = a(0.91I^3 - 1.19I^2 + 0.78I) \quad \text{Equation 3-1}$$

Where:

WQCV = Water Quality Capture Volume (watershed inches)

a = Coefficient corresponding to WQCV drain time (Table 3-2)

I = Imperviousness (%/100) (see Figures 3-3 through 3-5 [single family land use] and /or the *Runoff* chapter of Volume 1[other typical land uses])

Table 3-2. Drain Time Coefficients for WQCV Calculations

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

Figure 13-12c. Emergency Spillway Protection

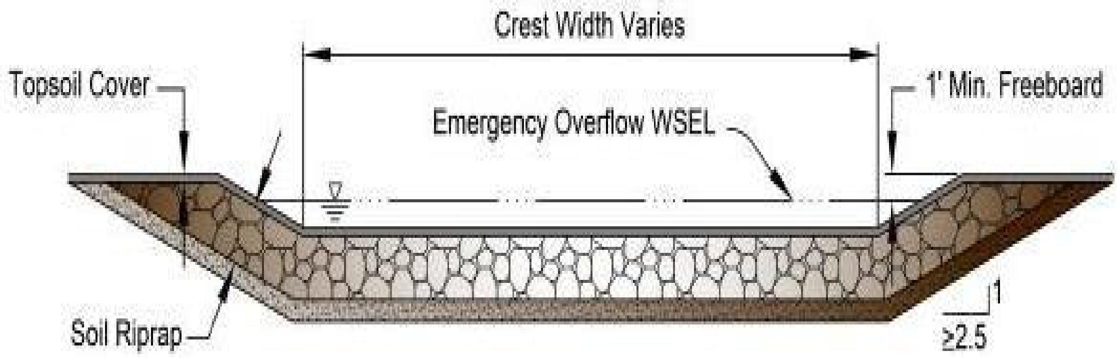
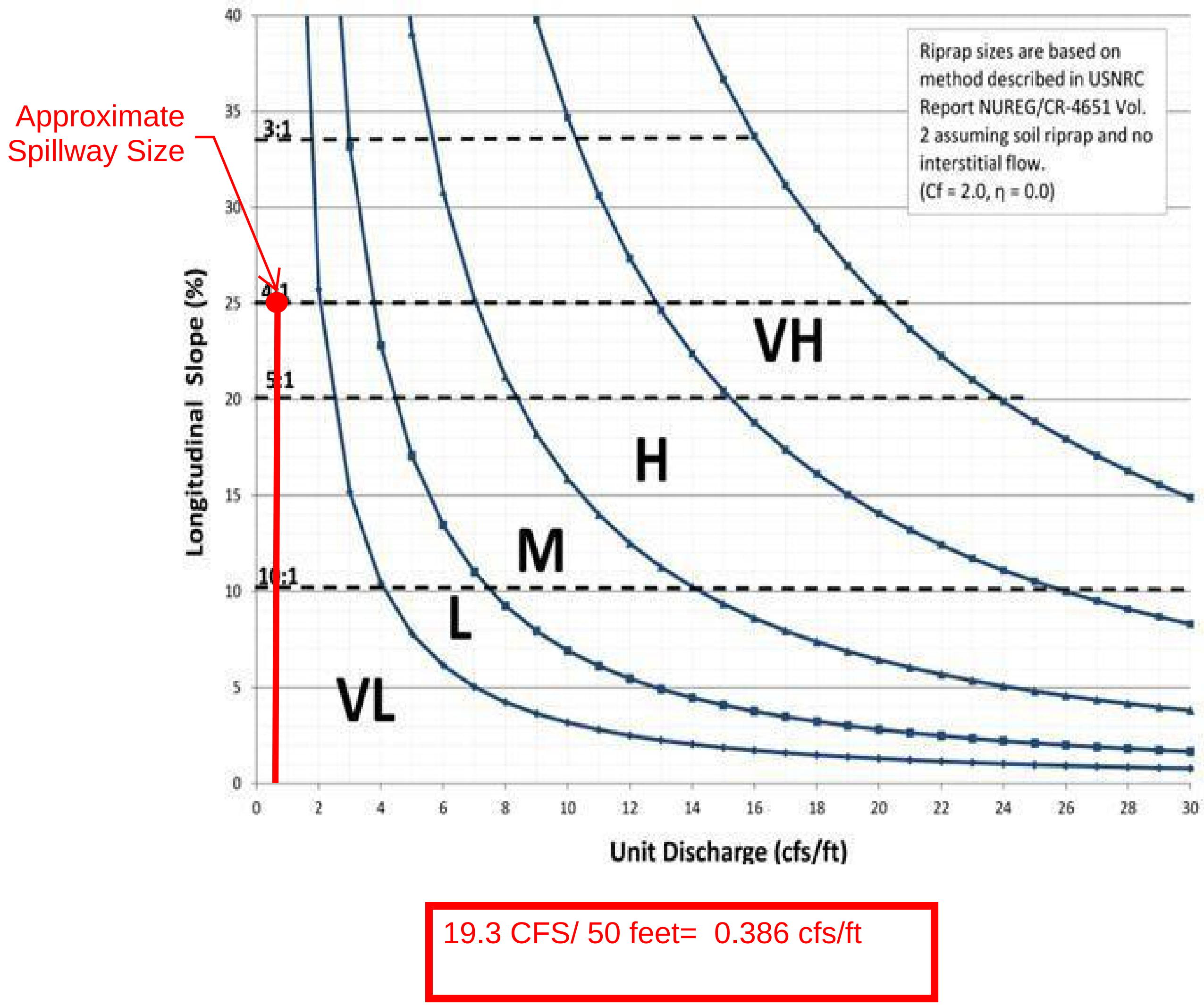
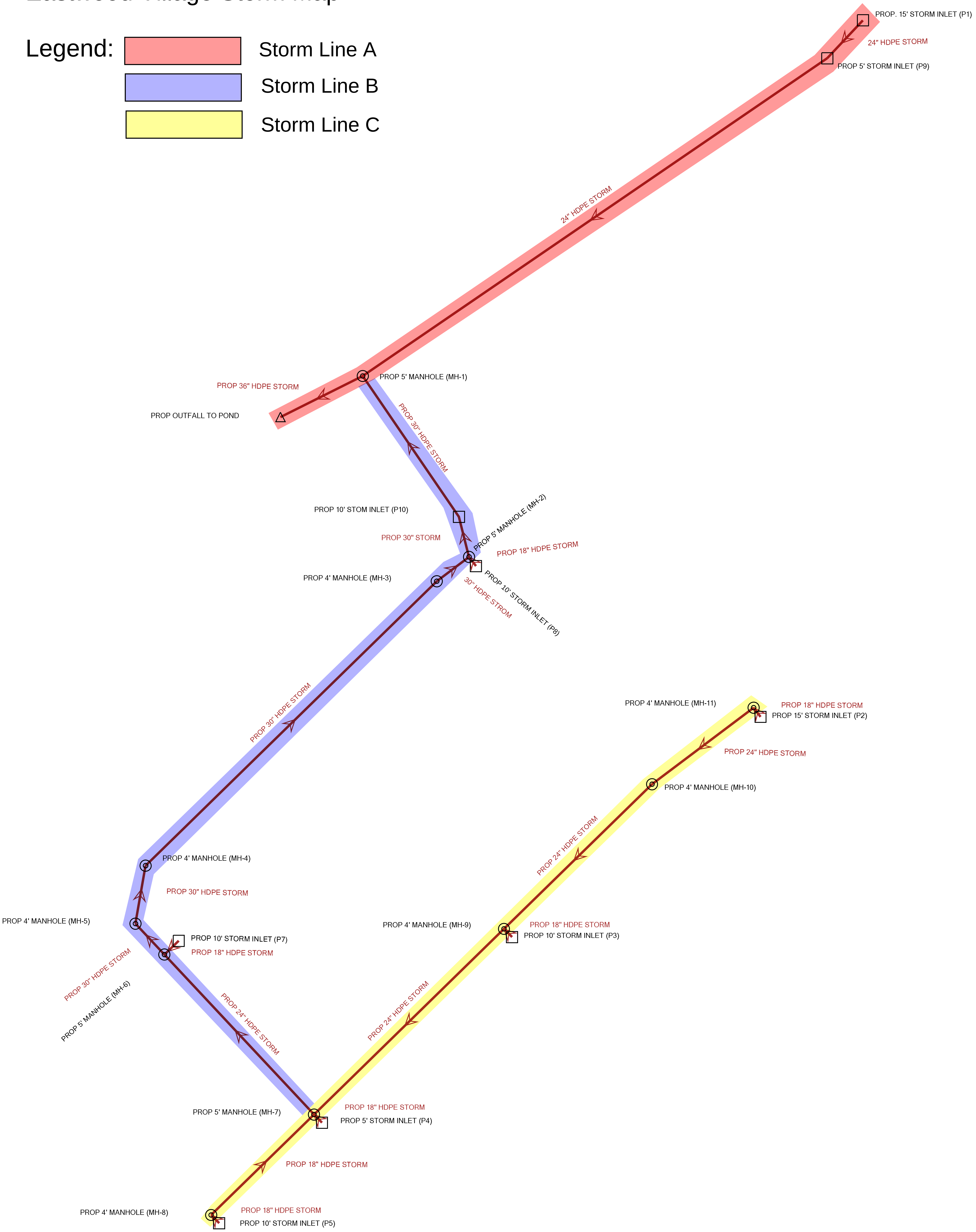


Figure 13-12d. Riprap Types for Emergency Spillway Protection



Eastwood Village Storm Map



Claremont Ranch Filing No. 7

Active Scenario: 5-YR

FlexTable: Manhole Table

Label	Flow (Total Out) (cfs)	Velocity (Out) (ft/s)	Diameter (in)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Coefficient (Standard)
PROP 4' MANHOLE (MH-11)	3.20	3.82	48.0	0.62	6,402.81	6,402.58	1.020
PROP 4' MANHOLE (MH-10)	3.20	3.82	48.0	0.62	6,401.76	6,401.75	0.050
PROP 4' MANHOLE (MH-9)	4.30	4.16	48.0	0.73	6,400.83	6,400.56	1.020
PROP 4' MANHOLE (MH-8)	1.00	2.92	48.0	0.37	6,399.45	6,399.44	0.050
PROP 5' MANHOLE (MH-7)	6.70	4.76	48.0	0.92	6,399.38	6,398.92	1.320
PROP 5' MANHOLE (MH-6)	10.20	5.10	60.0	1.07	6,398.12	6,397.71	1.020
PROP 4' MANHOLE (MH-5)	10.20	5.10	48.0	1.07	6,397.24	6,397.20	0.100
PROP 4' MANHOLE (MH-4)	10.20	5.10	48.0	1.07	6,396.61	6,396.61	0.000
PROP 4' MANHOLE (MH-3)	10.20	5.10	48.0	1.07	6,394.36	6,394.34	0.050
PROP 5' MANHOLE (MH-2)	13.80	5.62	60.0	1.25	6,394.53	6,394.03	1.020
PROP 5' MANHOLE (MH-1)	20.70	6.06	60.0	1.46	6,392.99	6,392.41	1.020

Claremont Ranch Filing No. 7

Active Scenario: 5-YR

FlexTable: Conduit Table

Label	Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Flow (cfs)	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
PROP 18" HDPE STORM	PROP 4' MANHOLE (MH-11)	PROP 15' STORM INLET (P2)	6,402.45	6,402.48	6.2	-0.005	24.0	3.20	4.75	6,403.10	6,403.02
PROP 24" HDPE STORM	PROP 4' MANHOLE (MH-10)	PROP 4' MANHOLE (MH-11)	6,401.22	6,401.95	68.3	-0.011	24.0	3.20	6.28	6,402.58	6,401.66
PROP 24" HDPE STORM	PROP 4' MANHOLE (MH-9)	PROP 4' MANHOLE (MH-10)	6,399.93	6,401.12	111.2	-0.011	24.0	3.20	6.28	6,401.75	6,400.83
PROP 18" HDPE STORM	PROP 4' MANHOLE (MH-9)	PROP 10' STORM INLET (P3)	6,400.33	6,400.36	6.2	-0.005	18.0	1.10	3.59	6,400.82	6,400.83
PROP 18" HDPE STORM	PROP 4' MANHOLE (MH-8)	PROP 10' STORM INLET (P5)	6,399.57	6,399.60	6.2	-0.005	18.0	1.00	3.50	6,399.97	6,399.91
PROP 24" HDPE STORM	PROP 5' MANHOLE (MH-7)	PROP 4' MANHOLE (MH-9)	6,398.30	6,399.83	142.8	-0.011	24.0	4.30	6.85	6,400.56	6,399.38
PROP 18" HDPE STORM	PROP 5' MANHOLE (MH-7)	PROP 4' MANHOLE (MH-8)	6,398.30	6,399.07	77.3	-0.010	18.0	1.00	4.50	6,399.44	6,399.38
PROP 18" HDPE STORM	PROP 5' MANHOLE (MH-7)	PROP 5' STORM INLET (P4)	6,398.50	6,398.53	6.2	-0.005	24.0	1.40	3.73	6,399.38	6,399.38
24" HDPE STORM	PROP. 15' STORM INLET (P1)	PROP 5' STORM INLET (P9)	6,397.45	6,396.99	28.0	0.016	24.0	2.70	6.96	6,398.02	6,397.38
PROP 24" HDPE STORM	PROP 5' MANHOLE (MH-6)	PROP 5' MANHOLE (MH-7)	6,397.14	6,398.00	117.7	-0.007	24.0	6.70	6.78	6,398.92	6,398.12
24" HDPE STORM	PROP 5' MANHOLE (MH-1)	PROP 5' STORM INLET (P9)	6,391.95	6,396.89	302.4	-0.016	24.0	2.90	7.09	6,397.49	6,392.99
PROP 18" HDPE STORM	PROP 5' MANHOLE (MH-6)	PROP 10' STORM INLET (P7)	6,397.64	6,397.69	10.7	-0.005	18.0	3.50	5.02	6,398.40	6,398.29
PROP 30" HDPE STORM	PROP 4' MANHOLE (MH-5)	PROP 5' MANHOLE (MH-6)	6,396.43	6,396.64	22.7	-0.009	30.0	10.20	8.07	6,397.71	6,397.30
PROP 30" HDPE STORM	PROP 4' MANHOLE (MH-4)	PROP 4' MANHOLE (MH-5)	6,395.75	6,396.13	31.6	-0.012	30.0	10.20	8.99	6,397.20	6,396.55
PROP 30" HDPE STORM	PROP 4' MANHOLE (MH-3)	PROP 4' MANHOLE (MH-4)	6,393.57	6,395.55	218.7	-0.009	30.0	10.20	8.07	6,396.61	6,394.33
PROP 18" HDPE STORM	PROP 5' MANHOLE (MH-2)	PROP 10' STORM INLET (P8)	6,393.78	6,394.23	6.6	-0.069	18.0	3.60	12.98	6,394.95	6,394.53
30" HDPE STROM	PROP 5' MANHOLE (MH-2)	PROP 4' MANHOLE (MH-3)	6,393.08	6,393.27	21.7	-0.009	30.0	10.20	8.08	6,394.34	6,394.53
PROP 30" HDPE STORM	PROP 5' MANHOLE (MH-1)	PROP 10' STOM INLET (P10)	6,391.45	6,392.28	91.6	-0.009	30.0	17.80	9.41	6,393.71	6,392.99
PROP 30" STORM	PROP 10' STOM INLET (P10)	PROP 5' MANHOLE (MH-2)	6,392.38	6,392.78	22.2	-0.018	30.0	13.80	11.26	6,394.03	6,393.73
PROP 36" HDPE STORM	PROP OUTFALL TO POND	PROP 5' MANHOLE (MH-1)	6,387.00	6,390.95	49.5	-0.080	36.0	20.70	21.08	6,392.41	6,387.70

Claremont Ranch Filing No. 7

Active Scenario: 5-YR

FlexTable: Catch Basin Table

Label	Elevation (Invert) (ft)	Flow (Local In) (cfs)	Flow (Total Out) (cfs)	Headloss Coefficient (Standard)
PROP. 15' STORM INLET (P1)	6,397.45	2.70	2.70	0.050
PROP 5' STORM INLET (P9)	6,396.89	0.20	2.90	0.050
PROP 10' STORM INLET (P8)	6,394.23	3.60	3.60	0.000
PROP 10' STORM INLET (P7)	6,397.69	3.50	3.50	0.050
PROP 10' STORM INLET (P5)	6,399.60	1.00	1.00	0.050
PROP 5' STORM INLET (P4)	6,398.53	1.40	1.40	0.050
PROP 10' STORM INLET (P3)	6,400.36	1.10	1.10	0.050
PROP 15' STORM INLET (P2)	6,402.48	3.20	3.20	0.050
PROP 10' STOM INLET (P10)	6,392.28	4.00	17.80	0.050

Claremont Ranch Filing No. 7

Active Scenario: 100-YR

FlexTable: Manhole Table

Label	Flow (Total Out) (cfs)	Velocity (Out) (ft/s)	Diameter (in)	Depth (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Coefficient (Standard)
PROP 4' MANHOLE (MH-11)	8.50	5.15	48.0	1.04	6,403.41	6,402.99	1.020
PROP 4' MANHOLE (MH-10)	8.50	5.15	48.0	1.04	6,402.18	6,402.16	0.050
PROP 4' MANHOLE (MH-9)	12.20	5.88	48.0	1.25	6,401.63	6,401.08	1.020
PROP 4' MANHOLE (MH-8)	4.10	2.32	48.0	1.70	6,400.77	6,400.77	0.050
PROP 5' MANHOLE (MH-7)	19.70	7.33	48.0	1.60	6,400.70	6,399.60	1.320
PROP 5' MANHOLE (MH-6)	26.60	7.21	60.0	1.76	6,399.22	6,398.40	1.020
PROP 4' MANHOLE (MH-5)	26.60	7.21	48.0	1.76	6,397.97	6,397.89	0.100
PROP 4' MANHOLE (MH-4)	26.60	7.21	48.0	1.76	6,397.31	6,397.31	0.000
PROP 4' MANHOLE (MH-3)	26.60	5.42	48.0	2.58	6,395.88	6,395.85	0.050
PROP 5' MANHOLE (MH-2)	33.70	7.74	60.0	2.08	6,395.80	6,394.85	1.020
PROP 5' MANHOLE (MH-1)	48.20	8.43	60.0	2.26	6,394.34	6,393.21	1.020

Claremont Ranch Filing No. 7

Active Scenario: 100-YR

FlexTable: Conduit Table

Label	Start Node	Stop Node	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Flow (cfs)	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
PROP 18" HDPE STORM	PROP 4' MANHOLE (MH-11)	PROP 15' STORM INLET (P2)	6,402.45	6,402.48	6.2	-0.005	24.0	8.50	6.22	6,403.52	6,403.42
PROP 24" HDPE STORM	PROP 4' MANHOLE (MH-10)	PROP 4' MANHOLE (MH-11)	6,401.22	6,401.95	68.3	-0.011	24.0	8.50	8.30	6,402.99	6,401.98
PROP 24" HDPE STORM	PROP 4' MANHOLE (MH-9)	PROP 4' MANHOLE (MH-10)	6,399.93	6,401.12	111.2	-0.011	24.0	8.50	8.30	6,402.16	6,401.63
PROP 18" HDPE STORM	PROP 4' MANHOLE (MH-9)	PROP 10' STORM INLET (P3)	6,400.33	6,400.36	6.2	-0.005	18.0	3.70	5.05	6,401.63	6,401.63
PROP 18" HDPE STORM	PROP 4' MANHOLE (MH-8)	PROP 10' STORM INLET (P5)	6,399.57	6,399.60	6.2	-0.005	18.0	4.10	5.19	6,400.77	6,400.77
PROP 24" HDPE STORM	PROP 5' MANHOLE (MH-7)	PROP 4' MANHOLE (MH-9)	6,398.30	6,399.83	142.8	-0.011	24.0	12.20	9.15	6,401.08	6,400.70
PROP 18" HDPE STORM	PROP 5' MANHOLE (MH-7)	PROP 4' MANHOLE (MH-8)	6,398.30	6,399.07	77.3	-0.010	18.0	4.10	2.32	6,400.77	6,400.70
PROP 18" HDPE STORM	PROP 5' MANHOLE (MH-7)	PROP 5' STORM INLET (P4)	6,398.50	6,398.53	6.2	-0.005	24.0	3.40	1.08	6,400.70	6,400.70
24" HDPE STORM	PROP. 15' STORM INLET (P1)	PROP 5' STORM INLET (P9)	6,397.45	6,396.99	28.0	0.016	24.0	5.70	8.65	6,398.29	6,397.58
PROP 24" HDPE STORM	PROP 5' MANHOLE (MH-6)	PROP 5' MANHOLE (MH-7)	6,397.14	6,398.00	117.7	-0.007	24.0	19.70	8.87	6,399.60	6,399.22
24" HDPE STORM	PROP 5' MANHOLE (MH-1)	PROP 5' STORM INLET (P9)	6,391.95	6,396.89	302.4	-0.016	24.0	6.10	8.80	6,397.77	6,394.34
PROP 18" HDPE STORM	PROP 5' MANHOLE (MH-6)	PROP 10' STORM INLET (P7)	6,397.64	6,397.69	10.7	-0.005	18.0	6.90	3.90	6,399.25	6,399.22
PROP 30" HDPE STORM	PROP 4' MANHOLE (MH-5)	PROP 5' MANHOLE (MH-6)	6,396.43	6,396.64	22.7	-0.009	30.0	26.60	10.44	6,398.40	6,397.93
PROP 30" HDPE STORM	PROP 4' MANHOLE (MH-4)	PROP 4' MANHOLE (MH-5)	6,395.75	6,396.13	31.6	-0.012	30.0	26.60	11.69	6,397.89	6,397.15
PROP 30" HDPE STORM	PROP 4' MANHOLE (MH-3)	PROP 4' MANHOLE (MH-4)	6,393.57	6,395.55	218.7	-0.009	30.0	26.60	10.44	6,397.31	6,395.88
PROP 18" HDPE STORM	PROP 5' MANHOLE (MH-2)	PROP 10' STORM INLET (P8)	6,393.78	6,394.23	6.6	-0.069	18.0	7.10	4.02	6,395.82	6,395.80
30" HDPE STROM	PROP 5' MANHOLE (MH-2)	PROP 4' MANHOLE (MH-3)	6,393.08	6,393.27	21.7	-0.009	30.0	26.60	5.42	6,395.85	6,395.80
PROP 30" HDPE STORM	PROP 5' MANHOLE (MH-1)	PROP 10' STOM INLET (P10)	6,391.45	6,392.28	91.6	-0.009	30.0	42.10	8.58	6,394.91	6,394.34
PROP 30" STORM	PROP 10' STOM INLET (P10)	PROP 5' MANHOLE (MH-2)	6,392.38	6,392.78	22.2	-0.018	30.0	33.70	14.35	6,394.85	6,394.97
PROP 36" HDPE STORM	PROP OUTFALL TO POND	PROP 5' MANHOLE (MH-1)	6,387.00	6,390.95	49.5	-0.080	36.0	48.20	26.92	6,393.21	6,388.19

Claremont Ranch Filing No. 7

Active Scenario: 100-YR

FlexTable: Catch Basin Table

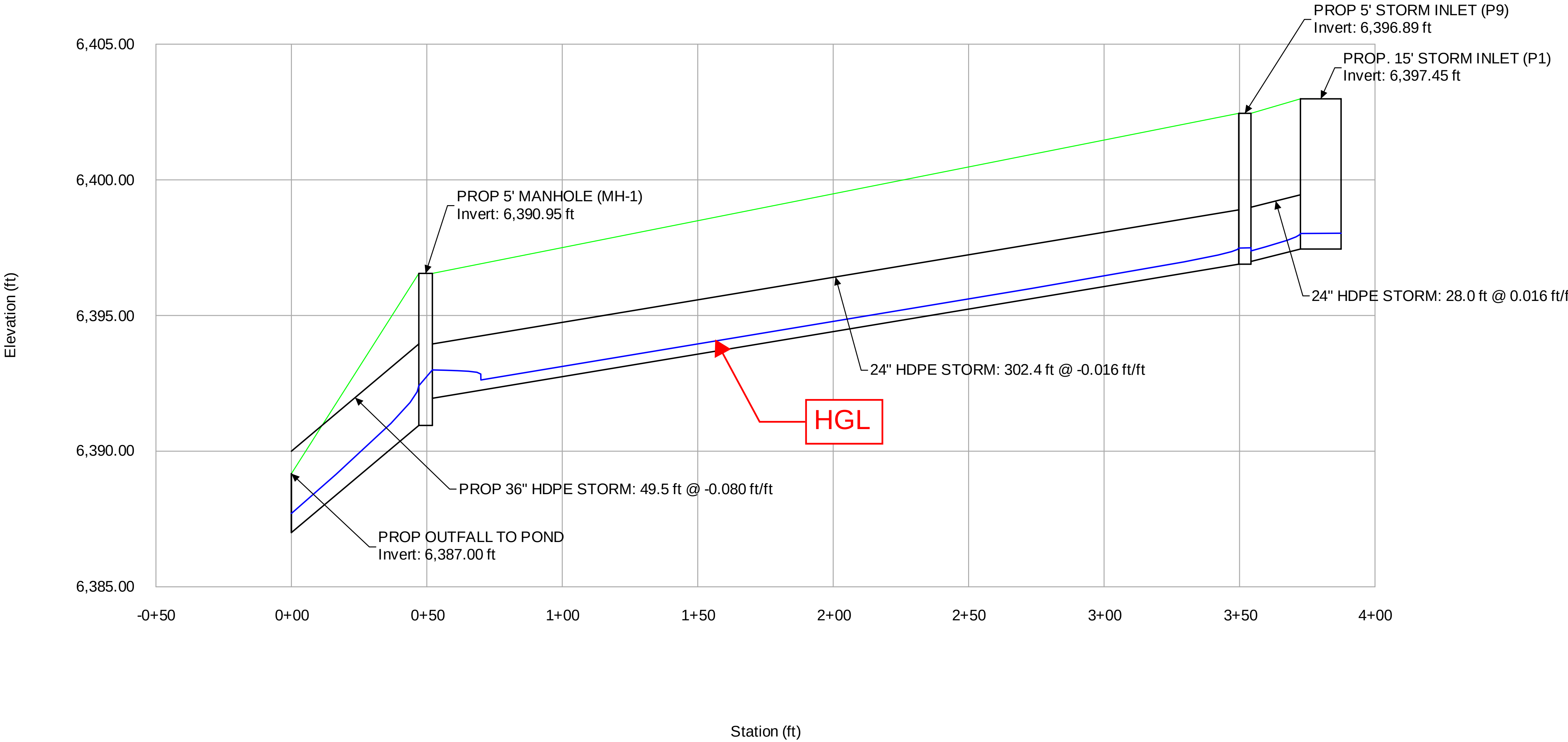
Label	Elevation (Invert) (ft)	Flow (Local In) (cfs)	Flow (Total Out) (cfs)	Headloss Coefficient (Standard)
PROP. 15' STORM INLET (P1)	6,397.45	5.70	5.70	0.050
PROP 5' STORM INLET (P9)	6,396.89	0.40	6.10	0.050
PROP 10' STORM INLET (P8)	6,394.23	7.10	7.10	0.000
PROP 10' STORM INLET (P7)	6,397.69	6.90	6.90	0.050
PROP 10' STORM INLET (P5)	6,399.60	4.10	4.10	0.050
PROP 5' STORM INLET (P4)	6,398.53	3.40	3.40	0.050
PROP 10' STORM INLET (P3)	6,400.36	3.70	3.70	0.050
PROP 15' STORM INLET (P2)	6,402.48	8.50	8.50	0.050
PROP 10' STOM INLET (P10)	6,392.28	8.40	42.10	0.050

Claremont Ranch Filing No. 7

Active Scenario: 5-YR

Profile Report

Engineering Profile - STORM A (Untitled1.stsw)

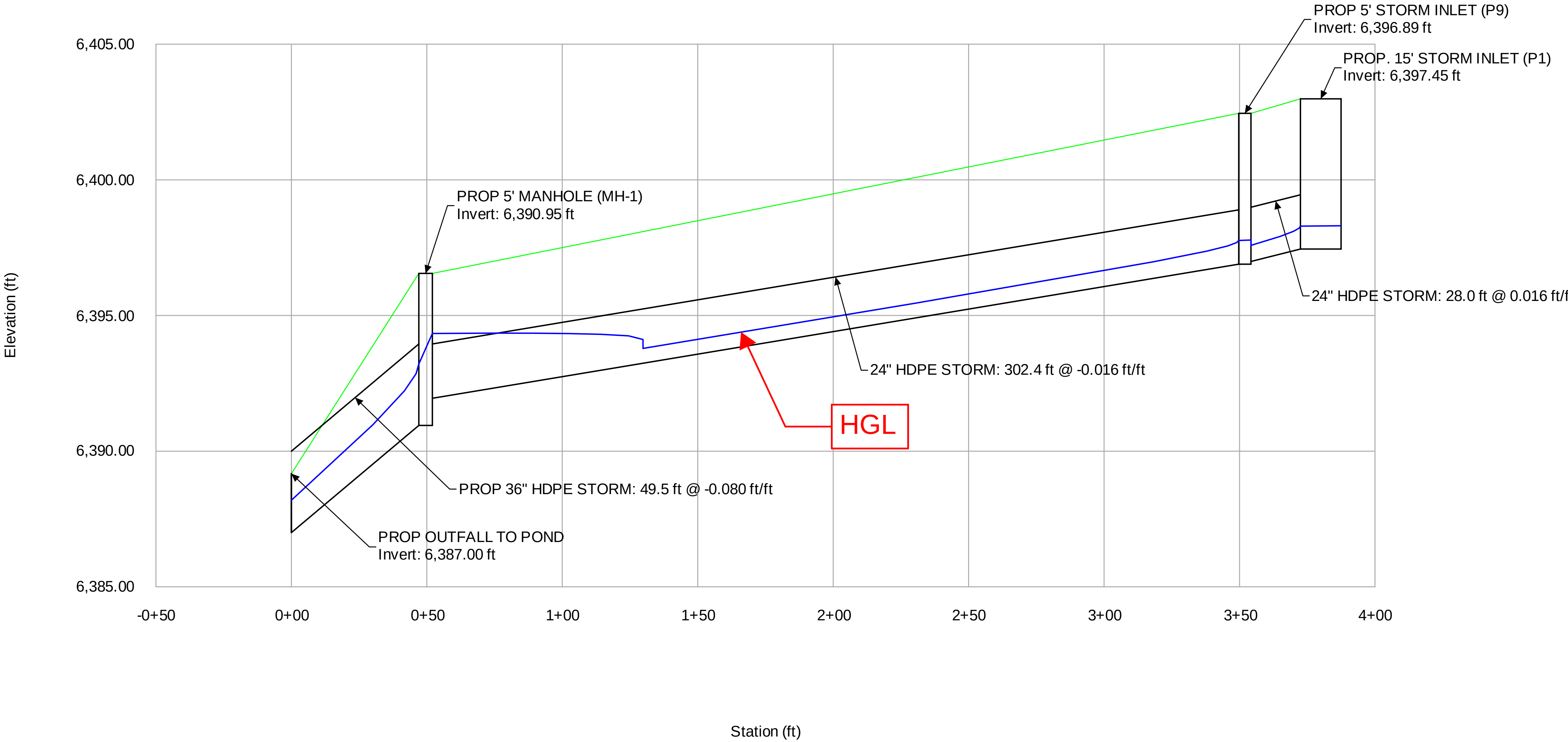


Claremont Ranch Filing No. 7

Active Scenario: 100-YR

Profile Report

Engineering Profile - STORM A (Untitled1.stsw)

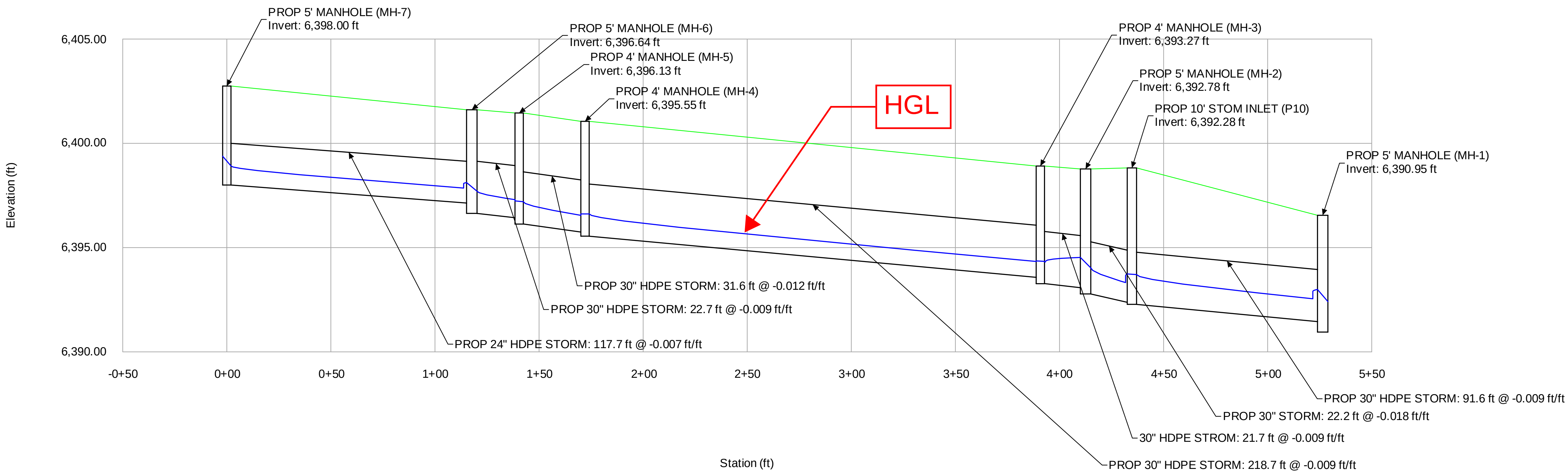


Claremont Ranch Filing No. 7

Active Scenario: 5-YR

Profile Report

Engineering Profile - STORM B (Untitled1.stsw)

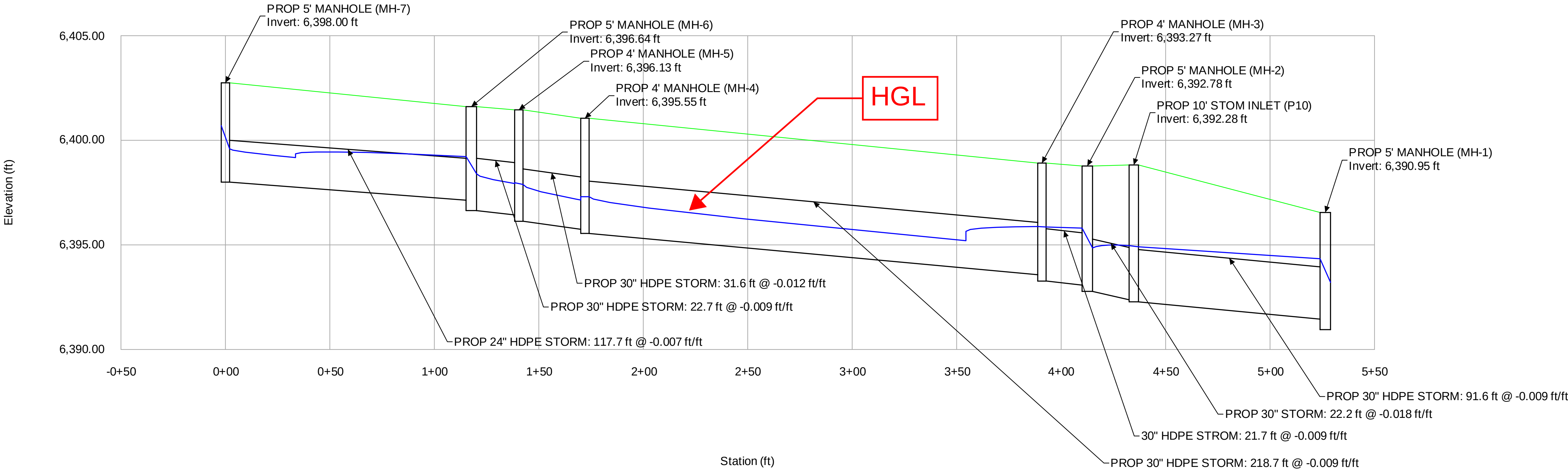


Claremont Ranch Filing No. 7

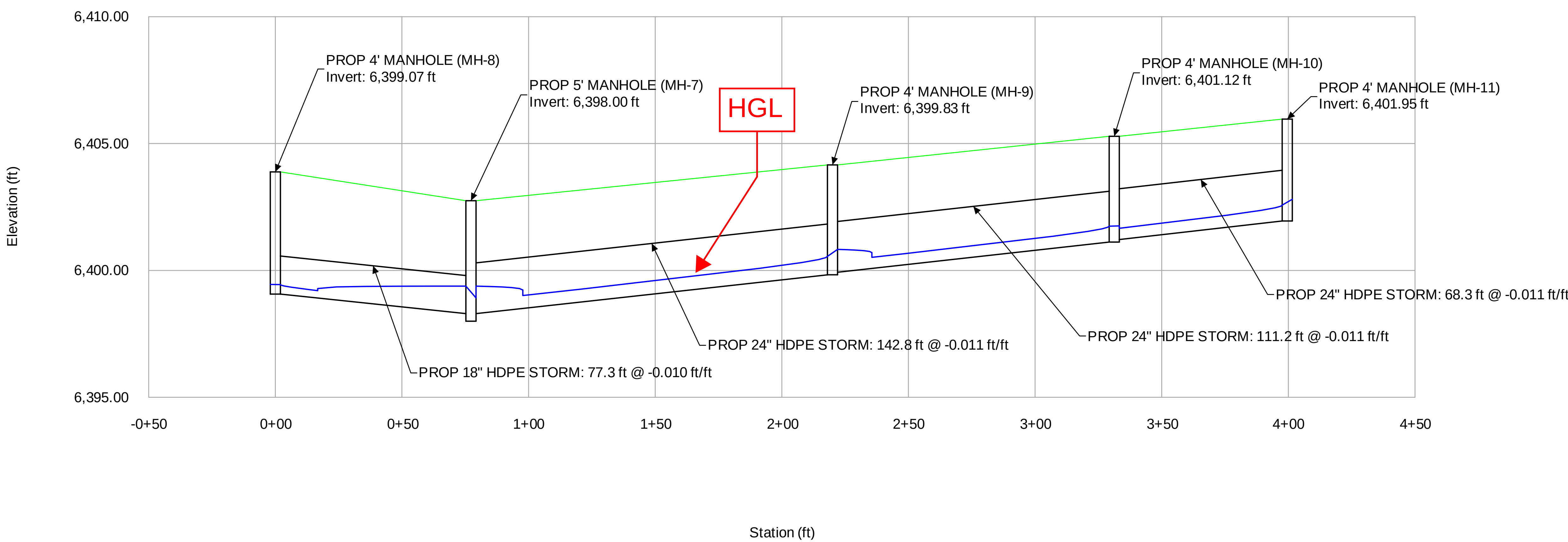
Active Scenario: 100-YR

Profile Report

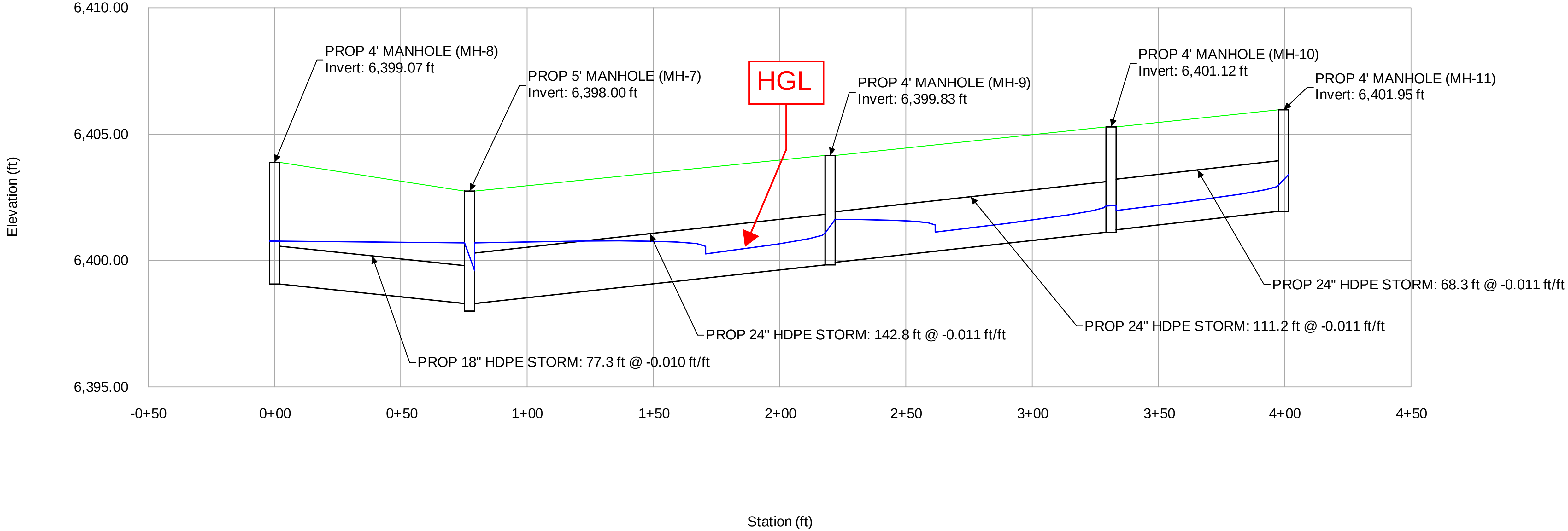
Engineering Profile - STORM B (Untitled1.stsw)



Claremont Ranch Filing No. 7
Active Scenario: 5-YR
Profile Report
Engineering Profile - STORM C (Untitled1.stsw)



Claremont Ranch Filing No. 7
Active Scenario: 100-YR
Profile Report
Engineering Profile - STORM C (Untitled1.stsw)



OPINION OF PROBABLE CONSTRUCTION COST

Kimley»Horn
2 North Nevada, Suite 900
Colorado Springs, Colorado 80903

Project:	Proposed Stormwater Infrastructure Eastwood Village		Prepared By:	AJL
Project Number:	96726002		Checked By:	KRK
Date:	April 21, 2023			

ALL INFRASTRUCTURE IS PRIVATE						
	Bid Item #	**Item Description**	**Unit**	**Unit Cost**	**Quantity**	**Extended Cost**
	1	18" HDPE PIPE	LF	$76.00	41	$3,116
	2	24" HDPE PIPE	LF	$91.00	844	$76,804
	3	30" HDPE PIPE	LF	$114.00	405	$46,170
	4	36" HDPE PIPE	EA	$140.00	49	$6,860
	5	5' CDOT Type-R Inlet	EA	$6,703.00	2	$13,406
	6	10' CDOT Type-R Inlet	EA	$9,224.00	5	$46,120
	7	15' CDOT Type-R Inlet	EA	$12,858.00	2	$25,716
	8	4' Type I Manhole	EA	$12,000.00	7	$84,000
	9	5' Type I Manhole	EA	$14,061.00	4	$56,244
		PROJECT CONSTRUCTION BID ITEMS COST			**B**	**$192,476**
	Contingencies (Construction Items)		(0 - 25%) of **B**		10.0%	$19,248
	Total Project Cost (Non-Reimbursable)					**$211,724**

Conceptual Opinion of Probable Construction Cost
The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

Kimley»Horn
2 North Nevada, Suite 900
Colorado Springs, Colorado 80903

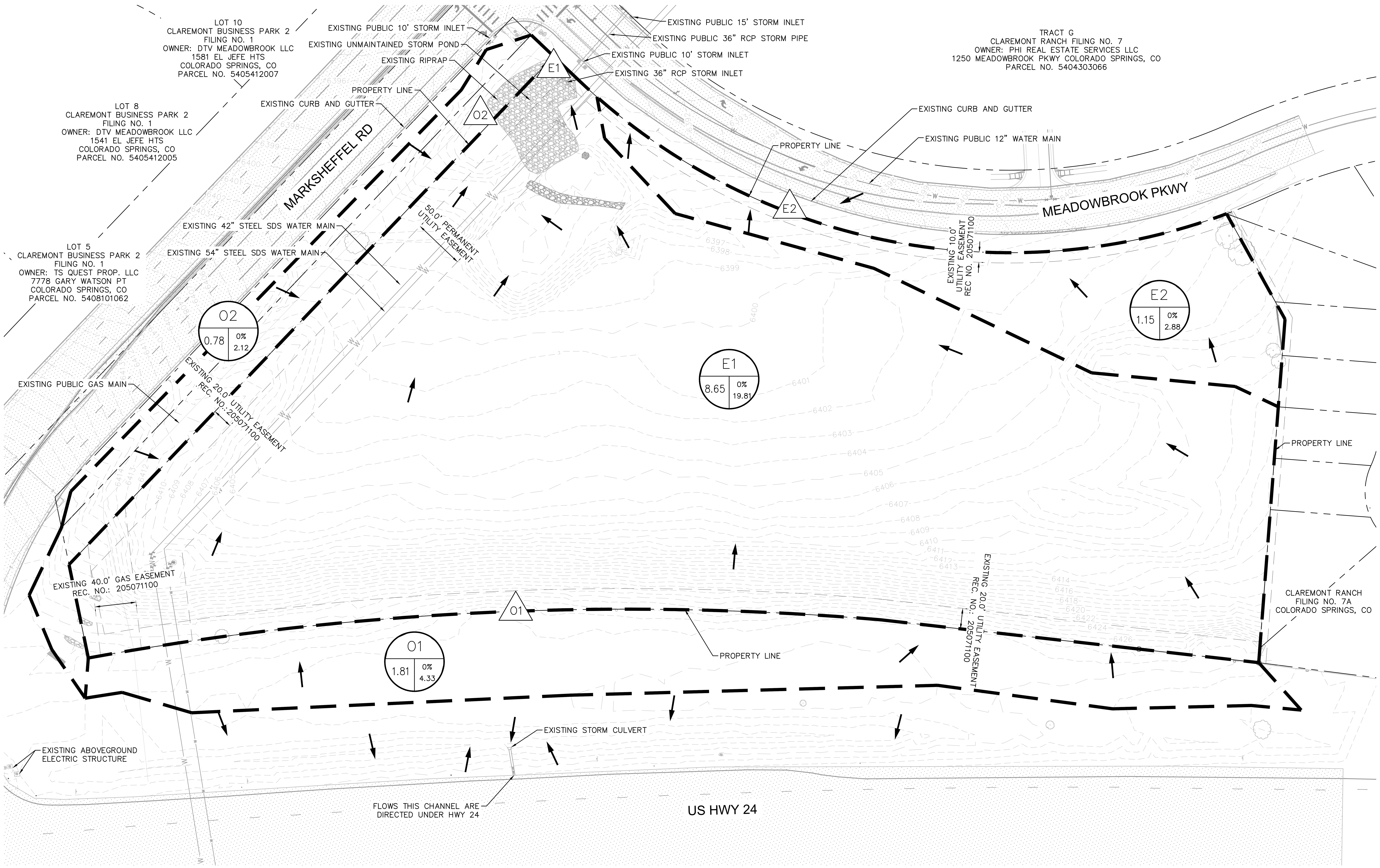
Project:	Proposed EDB Infrastructure Eastwood Village		Prepared By:	AJL
Project Number:	96726002		Checked By:	KRK
Date:	April 21, 2023			

ALL INFRASTRUCTURE IS PRIVATE

Bid Item #	Item Description	Unit	Unit Cost	Quantity	Extended Cost
1	Concrete Forebay	EA	$7,500.00	1	$7,500
2	Concrete Trickle Channel	LF	$15.00	76	$1,140
3	Emergency Overflow (Type VL Riprap)	CY	$115.00	19	$2,185
4	Maintenance Road	CY	$120.00	30	$3,600
5	Outlet Structure	EA	$8,000.00	1	$8,000
6	Micropool	EA	$8,000.00	1	$8,000
	PROJECT CONSTRUCTION BID ITEMS COST			**B**	**$30,425**
	Contingencies (Construction Items)	(0 - 25%) of **B**		10.0%	$3,043
	Total Project Cost (Non-Reimbursable)				**$33,468**

Conceptual Opinion of Probable Construction Cost
The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

EXISTING AND PROPOSED DRAINAGE MAP



LEGEND

- A = BASIN DESIGNATION
- B = AREA (ACRES)
- C = BASIN IMPERVIOUSNESS
- D = 100YR STORM RUNOFF (CFS)
- # = DESIGN POINT
- FLOW DIRECTION
- DRAINAGE BASIN BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPERTY LINE
- EXISTING WATER MAIN
- EXISTING GAS MAIN

NORTH

GRAPHIC SCALE IN FEET
0 25 50 100

EXISTING CONDITIONS RATIONAL CALCULATIONS SUMMARY							
DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	CFS				% IMPERVIOUS
			Q2	Q5	Q10	Q100	
FDR Basins							
E1	E1	8.65	0.54	2.70	5.90	19.81	0%
E2	E2	1.15	0.08	0.39	0.86	2.88	0%
O1	O1	1.81	0.12	0.59	1.29	4.33	0%
O2	O2	0.78	0.06	0.29	0.63	2.12	0%
TOTAL		**12.40**	**0.79**	**3.97**	**8.68**	**29.15**	**0%**

EASTWOOD VILLAGE
EXISTING DRAINAGE EXHIBIT
04/19/2023

Kimley»Horn

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PHONE: 719-453-0180

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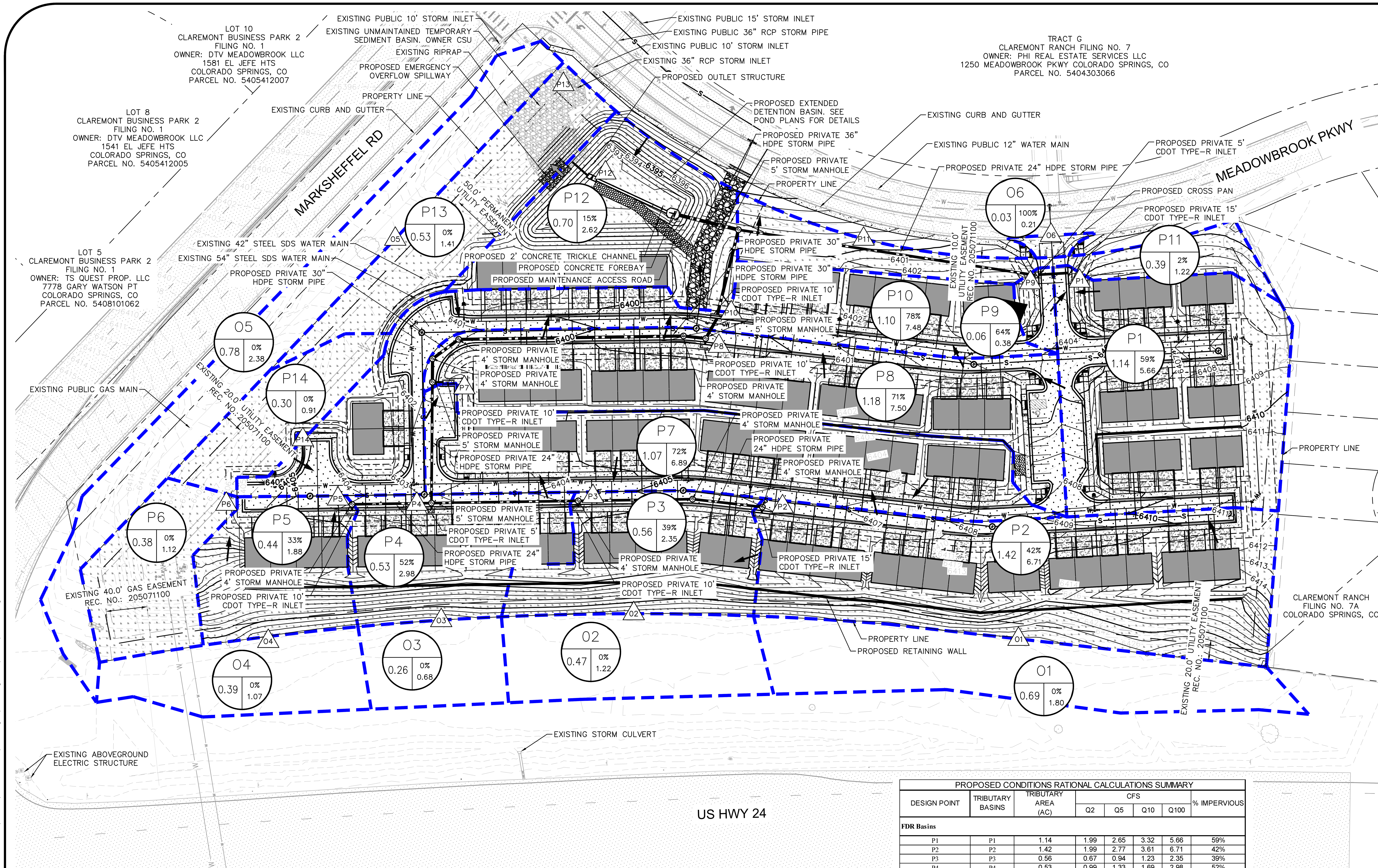
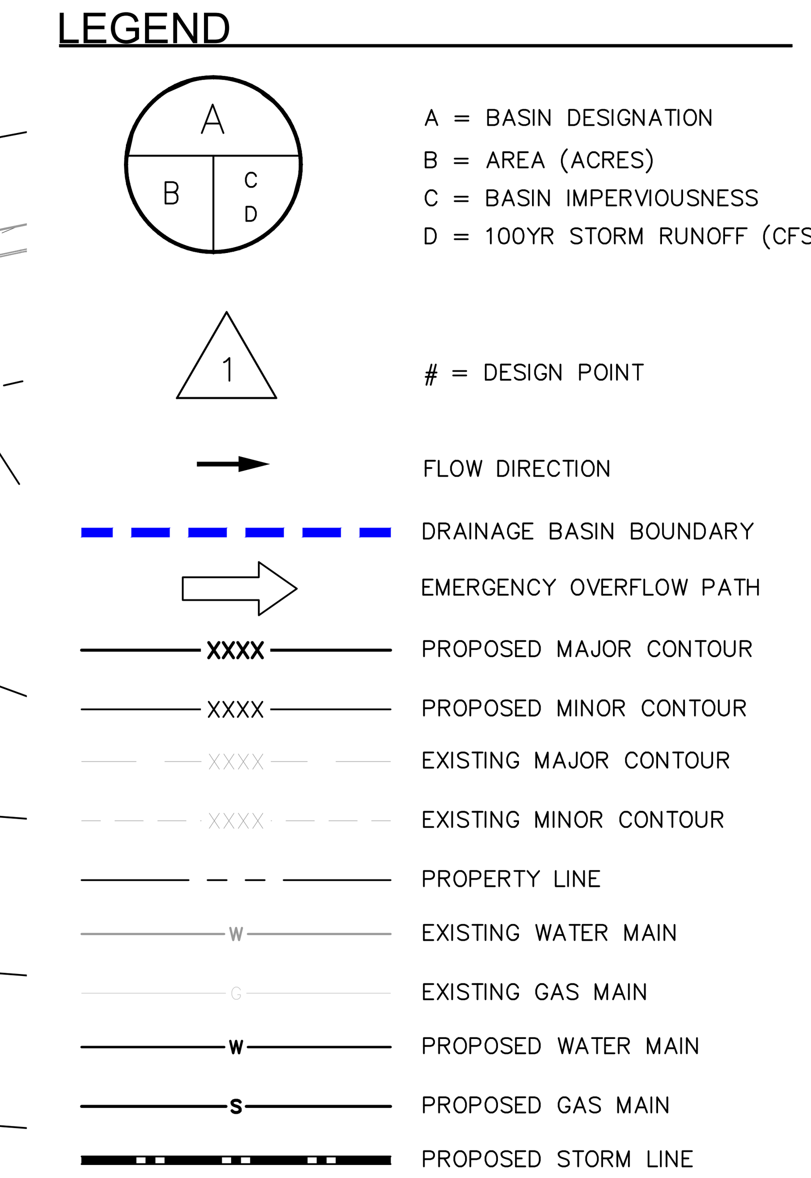
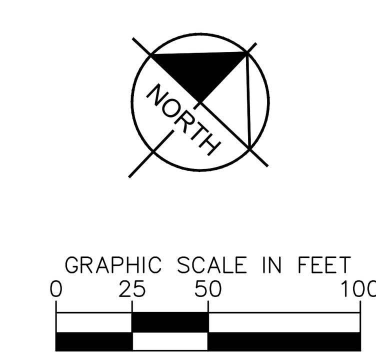




PROPOSED CONDITIONS RATIONAL CALCULATIONS SUMMARY							
DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	CFS				% IMPERVIOUS
			Q2	Q5	Q10	Q100	
FDR Basins							
P1	P1	1.14	1.99	2.65	3.32	5.66	59%
P2	P2	1.42	1.99	2.77	3.61	6.71	42%
P3	P3	0.56	0.67	0.94	1.23	2.35	39%
P4	P4	0.53	0.99	1.33	1.69	2.98	52%
P5	P5	0.44	0.48	0.70	0.94	1.88	33%
P6	P6	0.38	0.03	0.15	0.33	1.12	0%
P7	P7	1.07	2.65	3.46	4.24	6.89	72%
P8	P8	1.18	2.87	3.75	4.61	7.50	71%
P9	P9	0.06	0.14	0.19	0.23	0.38	64%
P10	P10	1.10	2.99	3.87	4.71	7.48	78%
P11	P11	0.39	0.06	0.20	0.39	1.22	2%
P12	P12	0.70	0.40	0.70	1.07	2.62	15%
P13	P13	0.53	0.04	0.19	0.42	1.41	0%
P14	P14	0.30	0.02	0.12	0.27	0.91	0%
O1	O1	0.69	0.05	0.25	0.54	1.80	0%
O2	O2	0.47	0.03	0.17	0.36	1.22	0%
O3	O3	0.26	0.02	0.09	0.20	0.68	0%
O4	O4	0.39	0.03	0.15	0.32	1.07	0%
O5	O5	0.78	0.06	0.32	0.71	2.38	0%
O6	O6	0.03	0.09	0.12	0.14	0.21	100%
TOTAL		**12.43**	**15.61**	**22.12**	**29.35**	**56.48**	**37%**



EASTWOOD VILLAGE
PROPOSED DRAINAGE EXHIBIT
04/05/2023

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PHONE: 719-453-0180

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