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Final

Preliminary Drainage Report
4-Way Commercial
El Paso County, Colorado

September 2023

HR Green Project No: 2202654

Prepared For:

KO1515 Developments, LLC.

PO Box 1385

Colorado Springs, CO 80901

Prepared By:

HR Green Development, LLC

Contact: Colleen Monahan, PE

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PCD File No. TBD

PPR2347

ENGINEERING REVIEW COMMENTS IN BLUE BOXES WITH BLUE TEXT

Note: additional comments will be provided on additional information needed with the next review

Engineer's Statement

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable 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.

_____

Colleen Monahan, PE Date

State of Colorado No.

For and on behalf of HR Green Development, LLC

Owner/Developer's Statement

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

By: _____ _____

Authorized Signature Date

Address: KO1515, LLC
PO Box 1385
Colorado Springs, CO 80903

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:

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APPENDICES

I. General Purpose, Location and Description

a. Purpose

The purpose of this Preliminary Drainage Report (PDR) for 4-Way Commercial is to describe onsite and offsite drainage patterns, size drainage and temporary erosion control measures to safely capture and convey stormwater runoff to temporary sediment basins during the initial phase of grading of designated areas of the site, size preliminary stormwater infrastructure and permanent control measures, and to safely route treated stormwater to adequate outfalls.

b. Location

The site lies within a part of the Southwest Quarter of Section 28 and the Northwest Quarter of Section 33, Township 12 South, Range 64 West of the 6th P.M., El Paso County, Colorado. The site is bound to the north by undeveloped unplatted land, to the east by State Highway 24 and land zoned A-35, to the west by 2.5-acre single-family properties that are part of 4-Way Ranch Filing No. 1, and to the south by land zoned A-35. A vicinity map is presented in Appendix A.

delete "preliminary"

The overall 4-Way 67.1-acre property contains two tracts that are bisected by Stapleton Drive, with approximately 15.5 acres located north of Stapleton Drive and 51.6 acres south of Stapleton Drive. All of the property to the north (15.5 acres) and approximately 16.5 acres of the southern property will be portioned off for Overlot grading, with the southernmost part of the southern tract being developed with 2 warehouses, storage containers, and parking for trailer (approximately 32 acres total). The proposed improvements shown in the preliminary drainage plan (approximately 16.5 acres disturbed area) are on the southern area of the property, are referred to as 'the site' herein. The remaining area of the property will remain undeveloped.

c. Description of Property

The site that is being portioned off for Overlot grading contains 32 acres within two tracts that are bisected by Stapleton Drive. Both are currently undeveloped and unplatted with Commercial zoning. Stapleton Drive has its own storm sewer and stormwater detention ponds that are located on the overall 4-way property. One detention pond is located partially within 'the site' in the southwest corner of Stapleton Drive and Highway 24. Part of the site also drains into this detention pond.

except for the drainageway?

All of the property to the north (15.5 acres) and about 16.5 acres of the southern property will be portioned off for Overlot grading with the southernmost part of the southern tract being developed with 2 warehouses, storage containers, and parking for trailer (approximately 32 acres total) and are included in this project, referred to as 'the site' herein. The remaining 35.6 acres of the south tract will remain undeveloped. A total of 32 acres are expected to be disturbed during the Overlot grading phase, and 8 acres for the commercial development on the property.

The site lies within the Geick Ranch drainage basin and is tributary to Black Squirrel Creek. An unnamed tributary runs north-south through the southern tract and forms the west boundary of 'the site'. The portion of the site located east of this tributary drains southerly and easterly partially into this tributary, partially into a detention pond that provides treatment for Stapleton Drive, and partially into a swale that runs along the west side of Highway 24. The flows combine just south of the site where they flow easterly under Highway 24.

A second unnamed tributary traverses the northern boundary of the northern tract, and all initial grading will occur south of this tributary. Stormwater in this tract generally drains from west to east into the tributary or into the easterly adjacent property zoned A-35.

clarify and describe facilities under HWY 24

address capacities, adequacy of the existing culverts

There is existing stormwater infrastructure on the site from Stapleton Drive storm sewer. There are existing culverts for stormwater crossings under an existing dirt road that leads to an existing 1-story wood frame building and water well site that is located on the remaining undeveloped part of the 4-Way property. There is an existing overhead electric line that crosses the southern part of the property.

Existing vegetation and soils were determined from in-person field site visits and existing aerial inspection from Google Earth and the United States Department of Agriculture Natural Resources Conservation Service (NRCS) Web Soil Survey. The site currently contains vegetation consisting primarily of native grasses and weeds. Existing vegetation is estimated at 25% density by visual inspection during the in-person field site visit.

Per a NRCS web soil survey, the site's soil is comprised of Type A soils: Blakeland loamy sand and Columbine gravelly sandy loam, Type B soil Stapleton sandy loam. A NRCS soil survey is presented in Appendix A.

Existing topography within the site ranges from about 3% up to 10%.

d. Floodplain Statement

The westerly portion of the overall 4-Way property lies within a designated FEMA floodplain as determined by the flood insurance map panel '08041C0552G' effective date December 7, 2018. This part of the overall 4-Way property will remain undeveloped. The remainder of the overall 4-Way property including 'the site' for overlot grading is located outside of the floodplain, in Zone X, as shown on flood insurance map panels '08041C0552G' '08041C0556G' and '08041C0558G' effective date December 7, 2018. Zone X are areas determined to be outside the 0.2% annual chance flood. The Refer to Appendix A for Firmette.

Add a statement that the calculated 100-year floodplain for the drainageway within the north parcel is shown on all development plans

II. Drainage Design Criteria

a. Drainage Criteria

Hydrologic data and calculations were performed using the El Paso County Drainage Criteria Manual Volume 1 & 2 (EPCDCM), with current revisions.

Onsite drainage improvements are designed for the 5-year storm (minor event) and 100-year storm (major event) using rainfall values from the NOAA Atlas 14 Point Precipitation Frequency Data Server. Runoff was calculated per CCSDCM Section 6.3.0 - Rational Method. Full spectrum pond design is to be completed in a future Final Drainage Report (FDR) for the fully developed proposed conditions using the latest version of Mile High Flood District's (MHFD) UD-Detention per CCSDCM Section 13.3.2.1. The detention pond allowable release rate will be limited to less than historic rates. Proposed private storm sewer calculations will be provided with the FDR and will be calculated in accordance with County criteria.

Rainfall Depths per NOAA Atlas 14		
Return Period (yr)	5	100
1-hr Rainfall Depth (in)	1.22	2.51

please provide EDARP File #'s for all references (if/when applicable) so that they can be more easily referenced.

III. Drainage Basins and Subbasins

a. Previous Drainage Studies

The site lies within the Geick Ranch drainage basin and is tributary to Black Squirrel Creek. The site's drainage characteristics were previously studied in the following reports:

1. "Final Drainage Report for 4 Way Ranch- Filing No. 1" prepared by JR Engineering, revised March 2006.

2. "Master Development Drainage Plan for 4-Way Ranch Phase 1" prepared by Associated Design Professionals, Inc, January 2012.

3. "MDDP Amendment/Preliminary Drainage Report for 4-Way Ranch Commercial" prepared by JR Engineering, revised February 2010.

4. "MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Drive to US Hwy 24' prepared by JR Engineering, revised May 2010.

6. Gieck Ranch Drainage Basin Planning Study (DBPS), 2008.

b. Major Basin Description

Gieck Ranch Drainage Basin is a 22.05 square mile watershed located in El Paso County, Colorado. Gieck Ranch Drainage Basin begins approximately five miles northeast of the Town of Falcon and travels approximately 15 miles to the southeast. It is tributary to Black Squirrel Creek which drains to the Arkansas River near the city of Pueblo, Colorado. The majority of the basin is undeveloped and is rolling range land typical of Colorado's semi-arid climates. Anticipated land use for the basin includes residential, industrial, agricultural, and commercial development.

c. Existing Subbasin Description

The existing conditions hydrology is shown on an Existing Conditions Drainage Map within Appendix D. The map and supporting calculations quantify the stormwater runoff per historical conditions prior to overlot grading permit disturbance. The existing conditions were analyzed in the MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Drive to US Hwy 24 prepared by JR Engineering, revised May 2010. This report described the improvements for the construction of Stapleton Drive which has since been completed.

South Tract:

Runoff within the south tract flows generally from a northwest to southeast direction where flows will eventually combine and pass underneath Highway 24 at one of its existing major crossings. As stated in the approved MDDP referenced above, these crossings are adequately sized for the existing Stapleton Drive and drainage improvements that were put in place as part of that construction. With future on-site drainage improvements releasing at or below the 100-year historic flow rate, these crossings will remain satisfactory.

Basin D is 16.83 acres of undeveloped area on-site. This basin generally drains from the northwest to the southeast via sheet flow to (2) existing public 26" CMP culverts under US HWY 24 at DP1 (DBPS 4 per the MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Drive to US Hwy

see drainage plan comments.
Sub-basins will be reviewed with the additional information on the next review

24). The calculated stormwater runoff generated from this basin is Q_5 = 4.3 cfs Q_{100} = 31.3cfs in the minor and major storms. The calculated runoff flows in this report are higher than those in the "MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Drive to US Hwy 24' prepared by JR Engineering, revised May 2010" due to higher curve numbers for lawn areas specified in current criteria.

pasture/meadow?

Basin E is 9.64 acres of undeveloped area on-site. This basin generally drains from the north to the south via sheet flow to (2) existing public 26" CMP culverts under US HWY 24 at DP1 (DBPS 4 per the MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Drive to US Hwy 24). The calculated stormwater runoff generated from this basin is Q_5 = 2.5 cfs Q_{100} = 18.2 cfs in the minor and major storms. The calculated runoff flows in this report are higher than those in the "MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Drive to US Hwy 24' prepared by JR Engineering, revised May 2010" due to higher curve numbers for lawn areas specified in current criteria.

Discuss in greater detail in this Section or in Final Grading Conditions below.

Basin F is 5.83 acres of undeveloped area on-site. This basin generally drains from the northwest to the southeast via sheet flow to an existing temporary sediment and detention basin on the northwest side of US HWY 24. The calculated stormwater runoff generated from this basin is Q_5 = 2.6 cfs Q_{100} = 13.5 cfs in the minor and major storms. The calculated runoff flows in this report are higher than those in the "MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Drive to US Hwy 24' prepared by JR Engineering, revised May 2010" due to higher curve numbers for lawn areas specified in current criteria

North Tract:

Runoff within the north tract generally flows from west to east to the unnamed tributary bordering the north of this tract or into the adjacent lot to the east.

Basin NT1 is 1.45 acres of undeveloped area on the north edge of the north tract. This basin generally drains from the southwest to the northeast via sheet flow to an unnamed drainage channel on the north edge of the site. The unnamed channel drains to a public box culvert under US HWY 24 at DP2 (DBPS 5 per the MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Drive to US Hwy 24). The calculated stormwater runoff generated from this basin is Q_5 = 0.5 cfs Q_{100} = 3.4 cfs in the minor and major storms.

Basin NT2 is 10.65 acres of undeveloped area on the north tract. This basin generally drains from the west to the east via sheet flow/channelized flow to the east edge of the north tract area. Ultimately draining to the public box culvert under US HWY 24 at DP2 (DBPS 5 per the MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Drive to US Hwy 24). The calculated stormwater runoff generated from this basin is Q_5 = 2.8 cfs Q_{100} = 20.8 cfs in the minor and major storms.

Basin NT3 is 0.87 acres of undeveloped area on the south edge of the north tract. This basin generally drains from the northwest to the southeast via sheet flow onto the north side of Stapleton Drive. Ultimately draining to a public curb inlet near the intersection of Stapleton Dr and US HWY 24. Surface runoff captured by the public curb inlet drains through a series of public 24" RCP storm sewer pipes into an existing temporary sediment and detention basin on the northwest side of US HWY 24. The calculated stormwater runoff generated from this basin is Q_5 = 0.3 cfs Q_{100} = 2.3 cfs in the minor and major storms.

d. Final Grading Conditions

Within each basin paragraph, discuss how WQ treatment is achieved (or excluded if applicable) for each basin and/or parts of each basin.

Revise drainage map to match this. Drainage map shows all ponds as TSBs.

The final grading conditions hydrology is shown on the Final Drainage Map within the Appendix. The map and supporting calculations quantify the stormwater runoff per final grading conditions which includes disturbance of particular areas of the site for paved roadway corridors, paved parking areas, the construction of two warehouses, a future commercial development area, and full spectrum detention pond.

During final grading operations, runoff from the developed area of the site will be captured in sump inlets and conveyed into full spectrum detention Pond B. Runoff in the northern tract will remain as proposed in the overlot grading conditions and drain to a temporary sediment basin. The remaining area of the southern tract will remain undisturbed and will flow offsite based on historic drainage patterns.

The GEC Plan states that it will have 1 column of 2 orifices at 3/4" dia. Revise to remove discrepancy.

North Tract

Basin TSA is the northern portion of the site that is 11.46 acres in total with 11.46 acres disturbed as a part of overlot grading. This basin drains generally from the northeast to the southwest to Temporary Sediment Basin A (TSB A) at DP4. TSB A is designed to treat a tributary area of 11.46 acres with a disturbed area of 11.46 acres. The required volume of TSB A is 0.47 ac-ft below the spillway crest elevation. TSB A exceeds this with a provided volume of 1.27 ac-ft. TSB A is designed to drain its entire volume within 40 hours via a temporary outlet structure. This temporary outlet structure was designed as a singular column with five 1” dia holes allowing for water to drain. Outflows from TSB 1 will be restricted to 20.7 cfs in order to limit flows to its ultimate design point (DP2) at or less than historic values. Sediment basin design is per Table SB-1 SWENT Drawing No. 900-TSB-2. The sediment basin is owned and maintained by the Owner/Developer and is to remain in place until interim and final phases construct permanent full spectrum detention Pond A. The calculated stormwater runoff generated from this basin is Q_5 = 3.1 cfs Q_{100} = 13.5 cfs in the minor and major storms

Basin PNT1 is 0.13 acres of undeveloped area on-site and a small disturbed area from the proposed overlot grading improvements in the north tract. This subbasin represents the existing subbasin “NT1” under the proposed overlot grading conditions. There is no additional proposed impervious area proposed in this basin at the time of this report. This basin will maintain existing drainage patterns, while reducing the total peak flow drainage from existing conditions to its outfall location. This basin generally drains from the southwest to the northeast via sheet flow to an unnamed drainage channel on the north edge of the site. The unnamed channel drains to a public box culvert under US HWY 24 at DP2 (DBPS 5 per the MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Drive to US Hwy 24). The calculated stormwater runoff generated from this basin is Q_5 = 0.04 cfs Q_{100} = 0.3 cfs in the minor and major storms.

Basin PNT2 is 0.87 acres of undeveloped area on-site and a small disturbed area from the proposed overlot grading improvements in the north tract. This subbasin represents the existing subbasin “NT2” under the proposed overlot grading conditions. There is no additional proposed impervious area proposed in this basin at the time of this report. This basin will maintain existing drainage patterns, while reducing the total peak flow drainage from existing conditions to its outfall location. This basin generally drains from the west to the east via sheet flow/channelized flow to the east edge of the north tract area. Ultimately draining to the public box culvert under US HWY 24 at DP2 (DBPS 5 per the MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Drive to US Hwy 24). The calculated stormwater runoff generated from this basin is Q_5 = 0.2 cfs Q_{100} = 1.7 cfs in the minor and major storms.

Basin PNT3 is 0.56 acres of undeveloped area on-site and a small disturbed area from the proposed overlot grading improvements in the north tract. This subbasin represents the existing subbasin “NT3” under the

proposed overlot grading conditions. There is no additional proposed impervious area proposed in this basin at the time of this report. This basin will maintain existing drainage patterns, while reducing the total peak flow drainage from existing conditions to its outfall location. This basin generally drains from the northwest to the southeast via sheet flow onto the north side of Stapleton Drive. Ultimately draining to a public curb inlet near the intersection of Stapleton Dr and US HWY 24. Surface runoff captured by the public curb inlet drains through a series of public 24" RCP storm sewer pipes into an existing temporary sediment and detention basin on the northwest side of US HWY 24. The calculated stormwater runoff generated from this basin is Q_5 = 0.2 cfs Q_{100} = 1.4 cfs in the minor and major storms.

South Tract

Basin P1.1 is 0.78 acres of paved roadway. Stormwater (Q_5 = 3.1 cfs Q_{100} = 5.6 cfs) is captured at DP3.1 in a private 3' Type C sump inlet and is conveyed through a private 15" HDPE to DP3.2

Basin P1.2 is 0.26 acres of paved roadway. Stormwater (Q_5 = 1.1 cfs Q_{100} = 2.0 cfs) is captured at DP3.2 in a private 5' Type R sump inlet and is conveyed through a private 18" HDPE to DP3.3

Basin P1.3 is 0.4 acres of paved area and 0.19 acres of lawn area. Stormwater (Q_5 = 1.9 cfs Q_{100} = 3.9 cfs) is captured at DP3.3 in a private 5' Type R sump inlet and is conveyed through a private 18" HDPE to DP3.4

Basin P1.4 is 0.95 acres of paved area and 0.28 acres of roof area. Stormwater (Q_5 = 5.5 cfs Q_{100} = 9.9 cfs) is captured at DP3.4 in a private 5' Type R sump inlet and is conveyed through a private 24" HDPE to DP3.5

Basin P1.5 is 0.64 acres of paved area. Stormwater (Q_5 = 3.0 cfs Q_{100} = 5.3 cfs) is captured at DP3.1 in a private 5' Type R sump inlet and is conveyed through a private 24" HDPE to Pond B at DP3.12.

Basin P1.6A is 2.72 acres of undeveloped area. This area is designated to be a commercial site at a future date. Stormwater (Interim Q_5 = 0.8 cfs Interim Q_{100} = 5.9 cfs) is captured in a private stormsewer system to be connected to a private 30" HDPE stub at the western edge of the future development area. Flows are then conveyed to DP3.6. The stormwater flows from this basin after the build out of the future commercial site would be Q_5 = 10.2 cfs and Q_{100} = 17.1 cfs.

Basin P1.6B is 0.45 acres of paved area and 0.28 acres of roof area. Stormwater (Q_5 = 3.1 cfs Q_{100} = 5.7 cfs) is captured at DP3.6 in a private 5' Type R sump inlet and is conveyed through a private 30" HDPE to DP3.8

Basin P1.7A is 1.72 acres of undeveloped area. This area is designated to be a commercial site at a future date. Stormwater (Interim Q_5 = 0.5 cfs Interim Q_{100} = 3.9 cfs) is captured in a private 24" HDPE to be connected to a future stormwater system. Flows are then conveyed to DP3.7. The stormwater flows from this basin after the build out of the future commercial site would be Q_5 = 6.3 cfs and Q_{100} = 10.6 cfs.

Basin P1.7B is 0.31 acres of paved area and 0.28 acres of roof area. Stormwater (Q_5 = 3.1 cfs Q_{100} = 5.7 cfs) is captured at DP3.6 in a private 5' Type R sump inlet and is conveyed through a private 24" HDPE to DP3.9

Basin P1.8 is 0.76 acres of paved area. Stormwater (Q_5 = 3.2 cfs Q_{100} = 5.7 cfs) is captured at DP3.10 in a private 5' Type R sump inlet and is conveyed through a private 18" HDPE to DP3.11

Basin P1.9 is 0.20 acres of paved area. Stormwater (Q_5 = 0.9 cfs Q_{100} = 1.7 cfs) is captured at DP3.8 in a private a Duraslott XL trench drain and is conveyed to DP3.9

Basin P1.10 is 0.85 acres of paved area, 1.28 acres of lawn area, and 0.28 acres of roof area. Stormwater (Q_5 = 5.5 cfs Q_{100} = 12.8 cfs) is conveyed through sheet flow to Pond B at DP3.12

Basin PD is 14.99 acres of undeveloped area on-site and a small disturbed area from the proposed overlot grading improvements. Basin PD will not be disturbed past overlot grading conditions and will follow historic drainage patterns.

Basin PE is 2.56 acres of undeveloped area on-site and a small disturbed area from the proposed overlot grading improvements. Basin PE will not be disturbed past overlot grading conditions and will follow historic drainage patterns.

Basin PF is 2.73 acres of undeveloped area on-site and a small disturbed area from the proposed overlot grading improvements. Basin PF will not be disturbed past overlot grading conditions and will follow historic drainage patterns.

See my comment on the Proposed Drainage Map about summarizing WQ treatment more thoroughly. Adding to these tables would be acceptable.

See Table 1 below for proposed TSB parameters.

Table 1: TSB Summary

Tributary Sub-Basin	Sediment Basin Name	Tributary Acres	Required Detention Volume below spillway crest (ac-ft)	Provided Volume up to spillway crest (ac-ft)	Total Provided Volume (ac-ft)
TSA	TSB A	11.46	0.47	0.95	1.27
TSB	TSB B	12.48	0.52	3.58	5.22

See Table 2 below for proposed full spectrum detention pond parameters.

Table 2: Pond Summary

Tributary Sub-Basin	Pond Name	Tributary Acres	Required Detention Volume (ac-ft)	Provided Volume (ac-ft)	Release Rate (cfs)
Basins P1.1-1.11	Pond B	12.45	1.969	4.652	6

IV. Drainage Facility Design

See my comment about TSBs on the Drainage Map below.

a. General Concept

The drainage facilities for the overlot grading conditions will consist of the Temporary Sediment Basins (TSBs) only. The designed TSBs will be constructed in the area of future permanent detention ponds A and B which will be constructed at time of development of the commercial properties. The temporary sediment basins will not include construction of the inflow forebay, concrete trickle channel, the lower maintenance paths at the bottom of pond, and outlet structures with outlet pipes. Stormwater flows will be allowed to overtop the edge of the TSBs and flow through interim swales to historic drainage ways. Water volume in the pond will also infiltrate into the soil. The described natural release structure for each TSB will meet the minimum 40-hour drain/release time of storm water runoff from the property. Once the project progresses past this overlot grading phase, both TSB A and TSB B will be converted to full spectrum detention ponds. The final pond improvement for Pond B has been designed and will be constructed with the initial phase of

The GEC Plan and Drainage Map show the construction of two buildings and whatever the many rectangles around the buildings are (are those the storage containers?), which is more than just overlot grading. So this text does not match what is shown as proposed on those plans. Please revise as needed to remove discrepancies.

development described in this report. Further design details and improvements will be described in the FRD. Pond A will be designed at a later phase of development.

b. Water Quality & Detention

Water Quality is to be provided via future ponds A and B as a part of the interim and final phases of construction. As explained in earlier sections, Temporary Sediment Basins located at the future detention pond locations and constructed with similar basin geometry are to be implemented at the Overlot grading stage.

will be?

initial

Water quality and full spectrum detention has been provided in Pond B.

c. Inspection and Maintenance

The private full spectrum detention ponds are to be owned and maintained by a metropolitan district, to be established with the project. Maintenance access for the full spectrum detention facilities will be provided through private drainage easements and tracts. The TSB's in Tracts A and B for the overlot grading phase are owned and maintained by the Owner or its assigns until the time of the full spectrum detention ponds.

V. Four Step Method to Minimize Adverse Impacts of Urbanization

this is not consistent with the site design

Step 1 – Reducing Runoff Volumes: Low impact development (LID) practices are utilized to reduce runoff at the source. In general, stormwater discharges are routed across pervious areas prior to capture in diversion ditches constructed at the Overlot grading stage. This practice promotes infiltration and reduces peak runoff rates. LID practices will also be utilized in future phases of development through the use of grass swales, and buffers.

Step 2 – Treat and slowly release the WQCV: This step utilizes full spectrum water quality and detention to capture the WQCV and slowly release runoff from the site. Onsite full spectrum detention ponds provide water quality treatment for the site. The WQCV is released over a period of 40 hours. Proposed and future ponds will provide full spectrum detention for improvements.

Show on GEC Plans

Step 3 – Stabilize stream channels: This step establishes practices to stabilize drainageways and provide scour protection at stormwater outfalls. There are no major drainageways affected by the Overlot grading of the commercial development phase of the development. No improvements to any downstream drainageways are required or anticipated at this time. Diversion ditches and swales are utilized to convey stormwater and sediment runoff to the temporary sediment basins. These are considered stabilized control measures.

Step 4 – Consider the need for source controls: Source controls are provided for the proposed initial development phase and the commercial development phase and are discussed in the Stormwater Management Report for this project.

provide the required analysis

$50k is shown in the FAE for a PBMP. Remove from FAE or provide an itemized breakdown of that item here.

VI. Opinion of Probable Cost

An engineer's opinion of probable cost is presented will be provided with a Final Drainage Report at time of development.

VII. Erosion Control Plan

The El Paso County Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate must be submitted since this project is disturbing more than 1 acre. The Erosion Control Plan for 4-Way Commercial and for the initial phase of development have been submitted concurrently with this report.

VIII. Drainage and Bridge Fees

a site development plan

Drainage and Bridge Fees are not due with the preliminary drainage report. An estimate of basin fees for the proposed development will be calculated and provided with the FDR.

IX. Summary

delete - this is the FDR

The Preliminary Drainage Report discusses the site conditions at the time of initial overlot disturbance which includes preliminary undercut earthwork of the roadway corridors as well as the implementation of diversion ditches and temporary sediment basins as control measures for erosion and sediment control prior to interim and final construction phases. This report also discusses the preliminary development for the site and additional detail will be provided in the FDR. The proposed improvements will not adversely affect the offsite major drainageways or surrounding development.

PBMPs are required on the south side

The basins will be owned and maintained by the Owner/Developer until such time that future construction of the permanent control measures will be owned and maintained by a Metropolitan District to be established with the project. All drainage facilities were sized per the El Paso County Drainage Criteria Manuals which include standards and details from the Mile High Flood District.

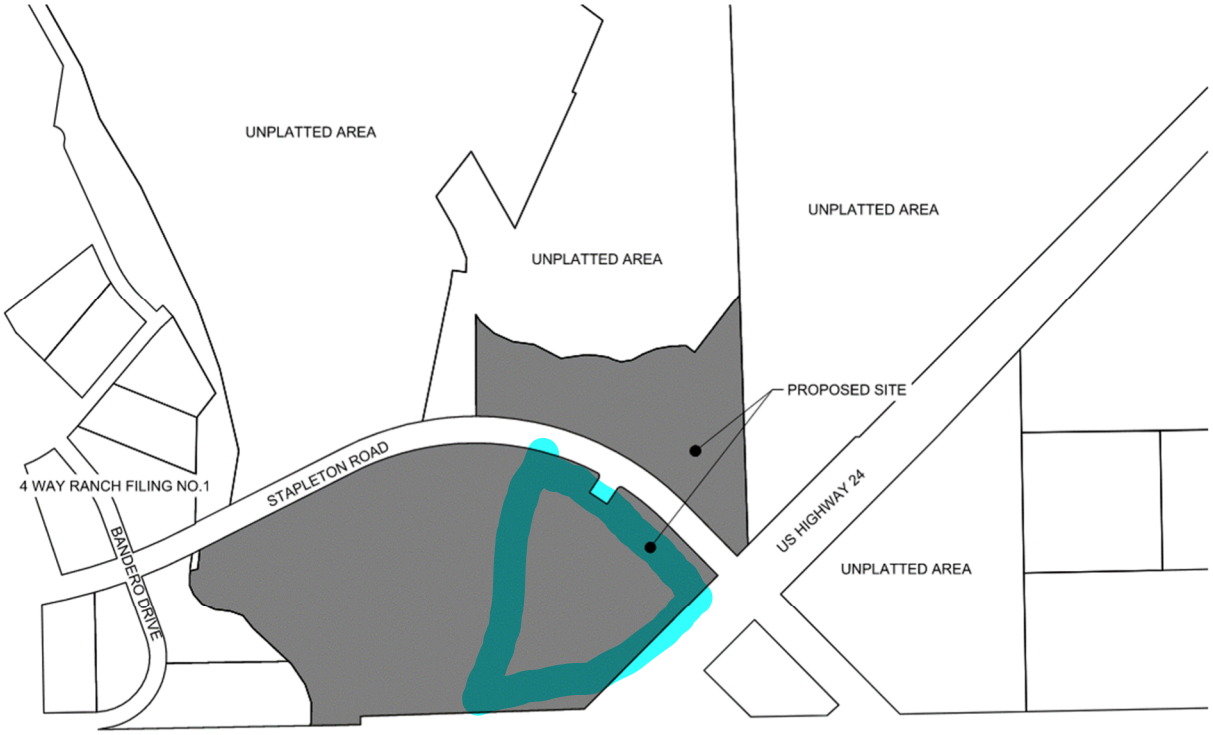
X. References

1. City of Colorado Springs – Drainage Criteria Manual, May 2014, Revised January 2021.
2. Drainage Criteria Manual of El Paso, Colorado, October 2018.
3. Urban Storm Drainage Criteria Manual, Urban Drainage Flood Control District, January 2018.

XI. Drawings

Please refer to the appendices for vicinity and drainage basin maps.

APPENDIX A – VICINITY MAP, SOIL MAP, FEMA MAP



VICINITY MAP

NORTH

0 500

250

National Flood Hazard Layer FIRMette

FEMA

104°34'13"W 38°58'17"N

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

1:6,000

104°33'35"W 38°57'49"N

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

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

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

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

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

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

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

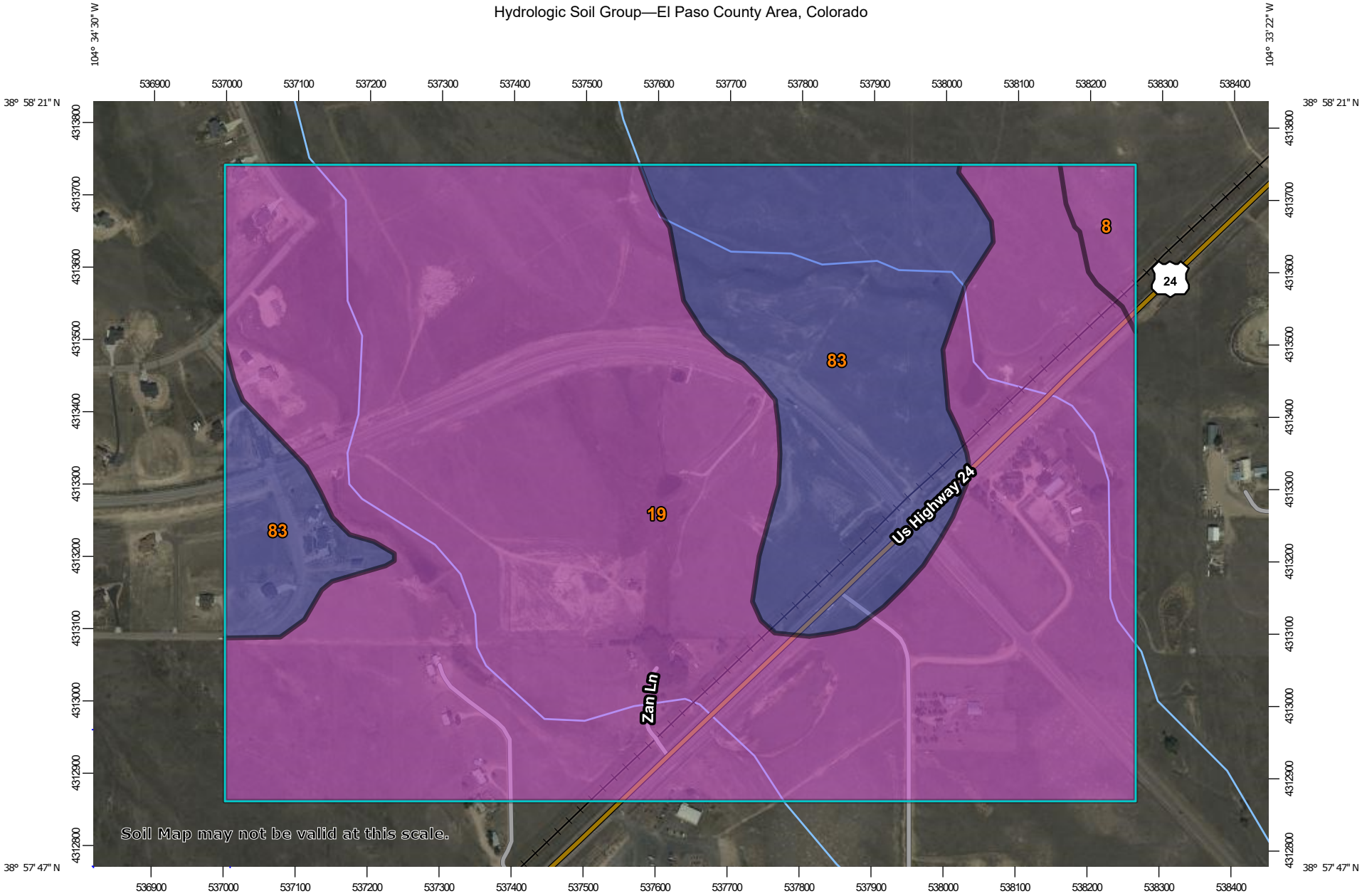
N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/7/2022 at 6:05 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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



Map Scale: 1:7,460 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

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: Sep 11, 2018—Oct 20, 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.

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	3.8	1.4%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	212.8	77.0%
83	Stapleton sandy loam, 3 to 8 percent slopes	B	59.8	21.6%
Totals for Area of Interest			**276.4**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX B – HYDROLOGIC CALCULATIONS

NOAA Atlas 14, Volume 8, Version 2
Location name: Peyton, Colorado, USA*
Latitude: 38.968°, Longitude: -104.565°
Elevation: 6900 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.239** (0.190-0.302)	**0.291** (0.232-0.368)	**0.381** (0.302-0.484)	**0.461** (0.363-0.587)	**0.577** (0.442-0.767)	**0.672** (0.502-0.903)	**0.771** (0.557-1.06)	**0.877** (0.607-1.24)	**1.02** (0.682-1.48)	**1.14** (0.738-1.67)
10-min	**0.350** (0.278-0.442)	**0.426** (0.339-0.539)	**0.559** (0.443-0.709)	**0.675** (0.532-0.860)	**0.845** (0.648-1.12)	**0.984** (0.735-1.32)	**1.13** (0.815-1.55)	**1.28** (0.889-1.81)	**1.50** (0.998-2.17)	**1.67** (1.08-2.44)
15-min	**0.426** (0.340-0.539)	**0.520** (0.414-0.658)	**0.681** (0.540-0.864)	**0.823** (0.649-1.05)	**1.03** (0.790-1.37)	**1.20** (0.897-1.61)	**1.38** (0.994-1.89)	**1.57** (1.08-2.21)	**1.83** (1.22-2.65)	**2.04** (1.32-2.98)
30-min	**0.609** (0.485-0.770)	**0.742** (0.590-0.939)	**0.971** (0.770-1.23)	**1.17** (0.924-1.49)	**1.46** (1.12-1.94)	**1.70** (1.27-2.29)	**1.95** (1.41-2.68)	**2.22** (1.54-3.13)	**2.59** (1.72-3.74)	**2.88** (1.86-4.21)
60-min	**0.779** (0.620-0.985)	**0.936** (0.745-1.18)	**1.22** (0.964-1.54)	**1.47** (1.16-1.87)	**1.85** (1.42-2.47)	**2.17** (1.62-2.92)	**2.51** (1.81-3.46)	**2.87** (1.99-4.07)	**3.39** (2.26-4.92)	**3.81** (2.47-5.57)
2-hr	**0.948** (0.761-1.19)	**1.13** (0.906-1.42)	**1.46** (1.17-1.84)	**1.77** (1.40-2.23)	**2.24** (1.74-2.97)	**2.63** (1.99-3.53)	**3.06** (2.24-4.20)	**3.53** (2.47-4.97)	**4.20** (2.83-6.06)	**4.74** (3.10-6.89)
3-hr	**1.04** (0.838-1.30)	**1.23** (0.987-1.53)	**1.57** (1.26-1.97)	**1.91** (1.52-2.40)	**2.42** (1.90-3.22)	**2.87** (2.19-3.85)	**3.37** (2.48-4.62)	**3.91** (2.76-5.50)	**4.70** (3.18-6.77)	**5.34** (3.50-7.73)
6-hr	**1.20** (0.977-1.49)	**1.40** (1.14-1.74)	**1.79** (1.45-2.22)	**2.16** (1.74-2.70)	**2.77** (2.19-3.67)	**3.30** (2.54-4.40)	**3.88** (2.88-5.30)	**4.54** (3.23-6.35)	**5.49** (3.76-7.88)	**6.28** (4.16-9.04)
12-hr	**1.39** (1.14-1.70)	**1.62** (1.32-1.98)	**2.06** (1.68-2.53)	**2.48** (2.01-3.07)	**3.16** (2.52-4.14)	**3.75** (2.91-4.96)	**4.41** (3.30-5.96)	**5.13** (3.69-7.13)	**6.19** (4.28-8.82)	**7.07** (4.72-10.1)
24-hr	**1.60** (1.32-1.94)	**1.87** (1.54-2.28)	**2.38** (1.96-2.90)	**2.86** (2.34-3.50)	**3.60** (2.89-4.66)	**4.24** (3.31-5.54)	**4.94** (3.72-6.61)	**5.71** (4.13-7.85)	**6.82** (4.74-9.62)	**7.73** (5.21-11.0)
2-day	**1.85** (1.54-2.23)	**2.18** (1.81-2.62)	**2.76** (2.28-3.34)	**3.29** (2.71-4.00)	**4.11** (3.31-5.25)	**4.79** (3.76-6.19)	**5.53** (4.20-7.32)	**6.33** (4.61-8.62)	**7.48** (5.24-10.5)	**8.40** (5.72-11.8)
3-day	**2.03** (1.70-2.43)	**2.38** (1.99-2.86)	**3.02** (2.51-3.63)	**3.59** (2.98-4.34)	**4.46** (3.61-5.66)	**5.19** (4.09-6.66)	**5.96** (4.54-7.85)	**6.80** (4.98-9.21)	**8.00** (5.63-11.1)	**8.96** (6.12-12.6)
4-day	**2.18** (1.83-2.60)	**2.55** (2.14-3.05)	**3.22** (2.69-3.86)	**3.82** (3.17-4.60)	**4.72** (3.83-5.97)	**5.48** (4.33-7.00)	**6.28** (4.80-8.24)	**7.16** (5.25-9.65)	**8.39** (5.93-11.6)	**9.38** (6.44-13.1)
7-day	**2.58** (2.18-3.06)	**2.98** (2.51-3.53)	**3.68** (3.10-4.38)	**4.32** (3.62-5.17)	**5.28** (4.32-6.62)	**6.09** (4.85-7.73)	**6.94** (5.35-9.04)	**7.87** (5.82-10.5)	**9.18** (6.54-12.7)	**10.2** (7.08-14.3)
10-day	**2.93** (2.48-3.46)	**3.36** (2.85-3.97)	**4.13** (3.48-4.89)	**4.81** (4.04-5.73)	**5.83** (4.78-7.26)	**6.67** (5.33-8.42)	**7.57** (5.85-9.81)	**8.54** (6.34-11.4)	**9.89** (7.08-13.6)	**11.0** (7.63-15.2)
20-day	**3.90** (3.34-4.57)	**4.50** (3.85-5.27)	**5.52** (4.70-6.48)	**6.38** (5.40-7.53)	**7.62** (6.26-9.33)	**8.60** (6.91-10.7)	**9.61** (7.48-12.3)	**10.7** (7.97-14.1)	**12.1** (8.72-16.4)	**13.2** (9.28-18.3)
30-day	**4.69** (4.03-5.46)	**5.43** (4.66-6.32)	**6.64** (5.68-7.75)	**7.65** (6.51-8.97)	**9.04** (7.45-11.0)	**10.1** (8.16-12.5)	**11.2** (8.74-14.2)	**12.3** (9.24-16.1)	**13.8** (9.96-18.6)	**14.9** (10.5-20.5)
45-day	**5.67** (4.89-6.56)	**6.55** (5.65-7.58)	**7.97** (6.85-9.25)	**9.12** (7.80-10.6)	**10.7** (8.81-12.8)	**11.8** (9.58-14.5)	**13.0** (10.2-16.3)	**14.1** (10.6-18.3)	**15.6** (11.3-20.9)	**16.7** (11.8-22.8)
60-day	**6.49** (5.62-7.48)	**7.47** (6.46-8.62)	**9.02** (7.78-10.4)	**10.3** (8.81-11.9)	**11.9** (9.86-14.2)	**13.1** (10.7-16.0)	**14.3** (11.2-17.9)	**15.5** (11.7-20.0)	**16.9** (12.3-22.6)	**18.0** (12.8-24.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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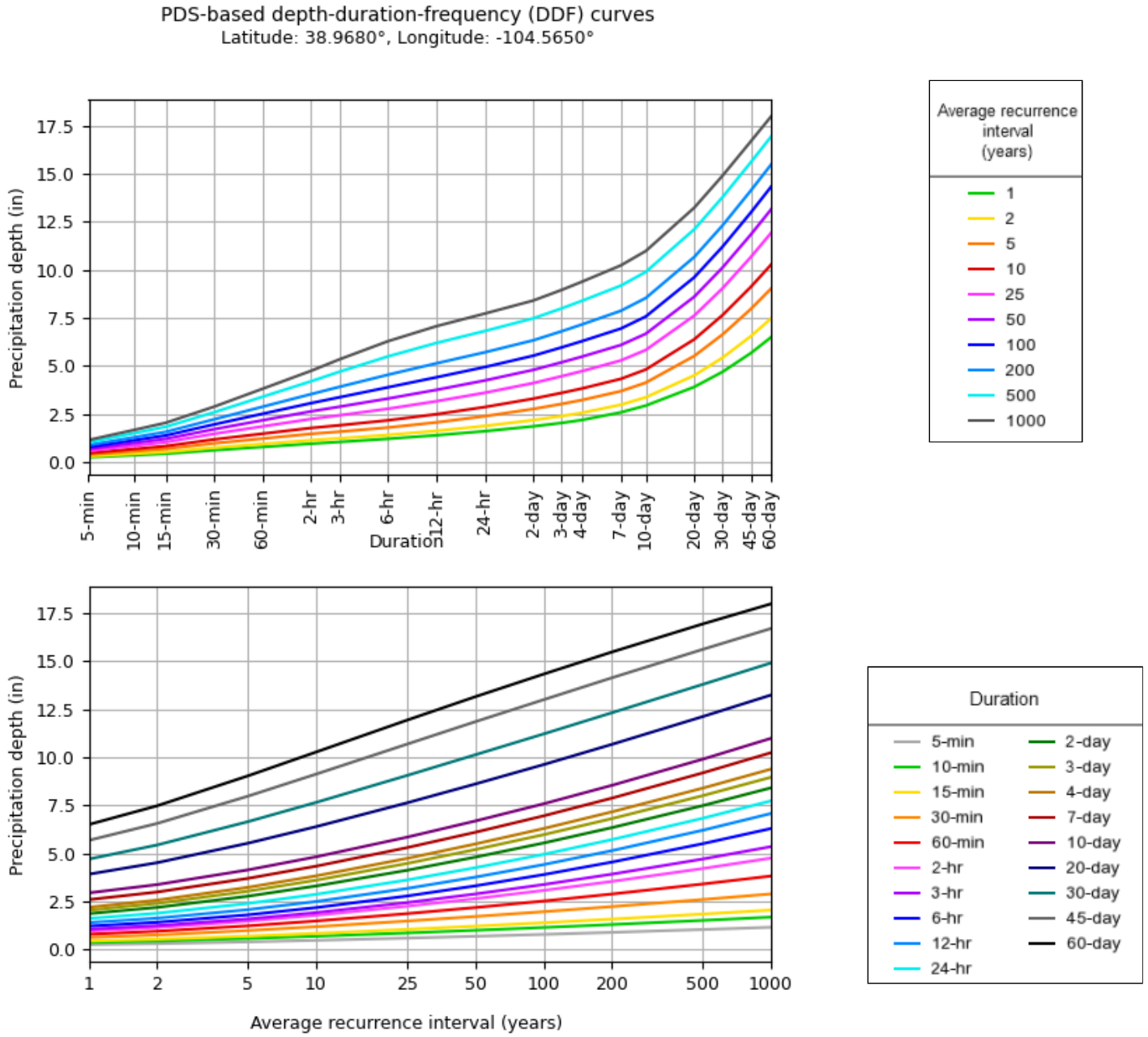
PF graphical



NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Tue Oct 10 21:03:54 2023

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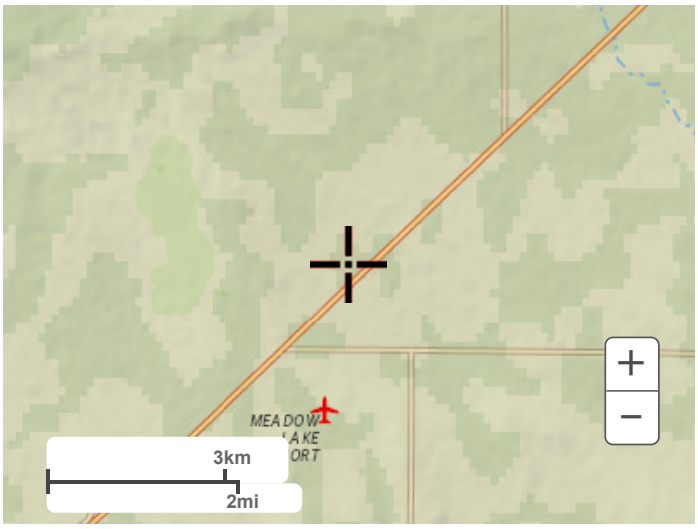
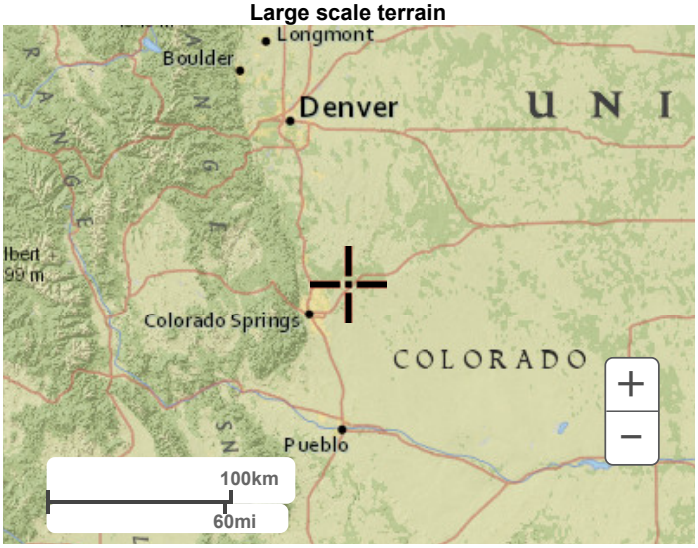
Maps & aerials

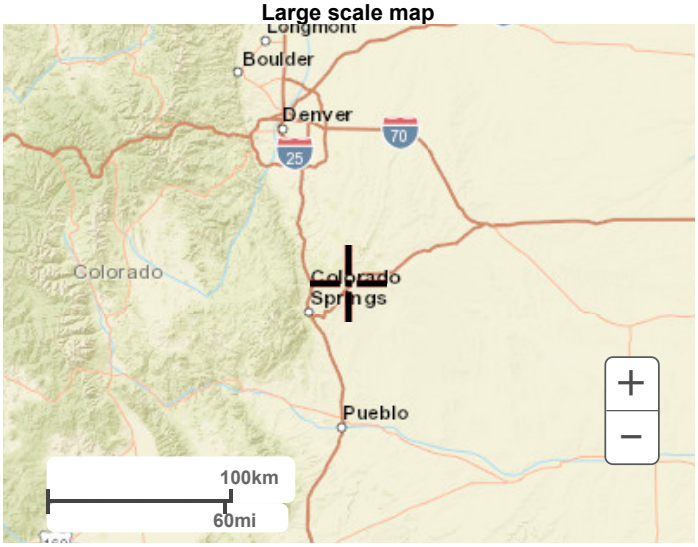
Small scale terrain



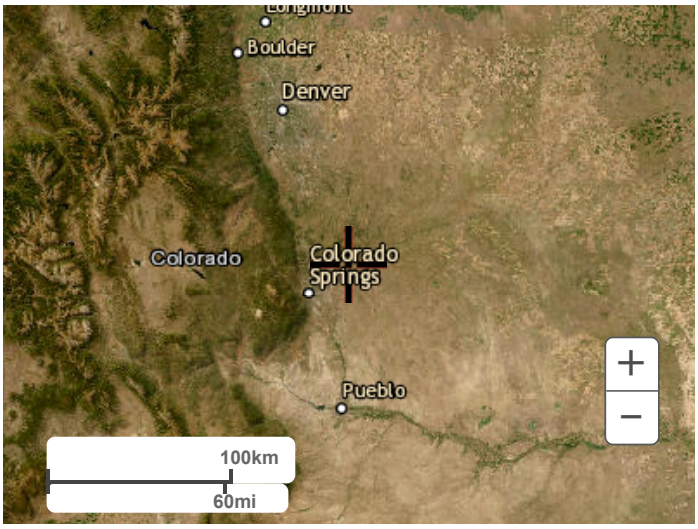
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

HRGreen	**4-WAY COMMERCIAL**	**Calc'd by:**	**SPC**
	EXISTING CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**10/12/2023**

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
NT1	1.45	0	0.5	3.4
NT2	10.65	0	2.8	20.8
NT3	0.87	0	0.3	2.3
D	16.83	0	4.3	31.3
E	9.64	0	2.5	18.2
F	5.83	5	2.6	13.5

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	D,E	6.5	47.4
2	NT1,NT2	2.8	20.7

Hydrologic calculations not checked in detail pending additional information per drainage plan redlines

HRGreen	**4-WAY COMMERCIAL**						**Calc'd by:**	**SPC**	
	EXISTING CONDITIONS						**Checked by:**	**CM**	
	EL PASO COUNTY, CO						**Date:**	**10/12/2023**	

COMPOSITE 'C' FACTORS

BASIN	UNDEVELOPED	PAVED	TOTAL	SOIL TYPE	UNDEVELOPED			PAVED			COMPOSITE IMPERVIOUSNESS & C		
	ACRES				%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}
NT1	1.45	0.00	1.45	A/B	0	0.08	0.35	100	0.90	0.96	0	0.08	0.35
NT2	10.65	0.00	10.65	A/B	0	0.08	0.35	100	0.90	0.96	0	0.08	0.35
NT3	0.87	0.00	0.87	A/B	0	0.08	0.35	100	0.90	0.96	0	0.08	0.35
D	16.83	0.00	16.83	A/B	0	0.08	0.35	100	0.90	0.96	0	0.08	0.35
E	9.64	0.00	9.64	A/B	0	0.08	0.35	100	0.90	0.96	0	0.08	0.35
F	5.51	0.32	5.83	A/B	0	0.08	0.35	100	0.90	0.96	5	0.13	0.38

HRGreen

4-WAY COMMERCIAL
EXISTING CONDITIONS
DESIGN STORM: 5-YEAR

Calc'd by:	SPC
Checked by:	CM
Date:	10/12/2023

			DIRECT RUNOFF						TOTAL RUNOFF				SURFACE			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_5*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min	
		NT1	1.45	0.08	10.6	0.12	4.05	0.5					0.5	0.12	1.1					739	1.04	11.85	
		NT2	10.65	0.08	17.1	0.85	3.33	2.8					2.8	0.85	19.4					460	4.40	1.74	
	2								22.4	0.97	2.92	2.8											Total flow to DP2 (DBPS 5 Per the MDDP Ammendment/Preliminary/Final Drainage report for Stapleton Drive From Bandero DR to US HWY 24
		NT3	0.87	0.08	8.3	0.07	4.40	0.3															
		D	16.83	0.08	19.1	1.35	3.16	4.3					4.3	1.35	2.0					125	1.41	1.47	
	1	E	9.64	0.08	18.3	0.77	3.22	2.5	20.5	2.12	3.05	6.5											Total flow to D1 (DBPS 4 Per the MDDP Ammendment/Preliminary/Final Drainage report for Stapleton Drive From Bandero DR to US HWY 24
		F	5.83	0.13	14.4	0.73	3.59	2.6															

HRGreen	**4-WAY COMMERCIAL**	**Calc'd by:**	**SPC**
	EXISTING CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**10/12/2023**

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)
NT1	0.08	1.45	100	4.2	11.6	10	0	0.0	0.0	0.0	11.6
NT2	0.08	10.65	100	2.3	14.1	10	1175	2.2	1.5	13.1	27.2
NT3	0.08	0.87	58	5.0	8.3	10	0	0.0	0.0	0.0	8.3
D	0.08	16.83	200	1.5	23.1	10	1430	2.2	1.5	16.1	39.2
E	0.08	9.64	200	2.0	21.0	10	1300	1.8	1.3	16.1	37.1
F	0.13	5.83	200	2.5	18.6	10	585	4.4	2.1	4.6	23.3

FORMULAS:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad V = C_v S_w^{0.5}$$

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

HRGreen

4-WAY COMMERCIAL
EXISTING CONDITIONS
DESIGN STORM: 100-YEAR

Calc'd by:	SPC
Checked by:	CM
Date:	10/12/2023

			DIRECT RUNOFF						TOTAL RUNOFF				SURFACE			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min	
		NT1	1.45	0.35	10.6	0.51	6.80	3.4					3.4	0.51	1.1					739	1.04	11.85	
		NT2	10.65	0.35	17.1	3.73	5.58	20.8					20.8	3.73	19.4					460	4.40	1.74	
	2								22.4	4.24	4.90	20.7											Total flow to DP2 (DBPS 5 Per the MDDP Ammendment/Preliminary/Final Drainage report for Stapleton Drive From Bandero DR to US HWY 24
		NT3	0.87	0.35	8.3	0.30	7.39	2.3															
		D	16.83	0.35	19.1	5.89	5.31	31.3					31.3	5.89	2.0					125	1.41	1.47	
		E	9.64	0.35	18.3	3.37	5.41	18.2															
	1								20.5	9.26	5.12	47.4											Total flow to D1 (DBPS 4 Per the MDDP Ammendment/Preliminary/Final Drainage report for Stapleton Drive From Bandero DR to US HWY 24
		F	5.83	0.38	14.4	2.24	6.02	13.5															

HRGreen	**4-WAY COMMERCIAL**	**Calc'd by:**	**SPC**
	PR. INTERIM GRADING CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**10/12/2023**

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
TSA	11.46	0	3.1	13.5
PNT1	0.13	0	0.0	0.3
PNT2	0.87	0	0.2	1.7
PNT3	0.56	0	0.2	1.4
PD	14.99	0	3.8	27.8
PE	2.56	0	0.7	4.8
PF	2.73	12	1.7	6.9
P1.1	0.78	100	3.1	5.6
P1.2	0.26	100	1.1	2.0
P1.3	0.59	68	1.9	3.9
P1.4	1.23	98	5.5	9.9
P1.5	0.64	100	3.0	5.3
P1.6A	2.72	0	0.8	5.9
P1.6B	0.73	96	3.1	5.7
P1.7A	1.72	0	0.5	3.9
P1.7B	0.59	95	2.5	4.6
P1.8	0.76	100	3.2	5.7
P1.9	0.20	100	0.9	1.7
P1.10	2.41	46	5.5	12.8

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	PD,PE	4.3	31.4
2	PNT1,PNT2	0.2	1.7
3.1	P1.3	3.1	5.6
3.2	P1.2,DP3.1	4.2	7.4
3.3	P1.3,DP3.2	5.8	10.8
3.4	P1.4,DP3.3	10.4	19.0
3.5	P1.5,DP1.4	8.4	15.2
3.6	P1.6A,P1.6B	4.0	5.7
3.7	P1.7A,P1.7B	3.0	8.4
3.8	P1.9,DP3.6	4.9	17.6
3.9	DP3.7,DP3.8	8.3	28.8
3.10	P1.8	3.1	5.6
3.11	DP3.9,DP3.10	10.8	23.6
3.12	DP3.5,DP3.11	27.6	53.9
4	TSA	3.1	13.5

HRGreen

4-WAY COMMERCIAL

PR. INTERIM GRADING CONDITIONS

EL PASO COUNTY, CO

Calc'd by: SPC

Checked by: CM

Date: 10/12/2023

COMPOSITE 'C' FACTORS

BASIN	UNDEVELOPED/LAWNS	Roofs	PAVED	Commercial Area	TOTAL	SOIL TYPE	UNDEVELOPED/LAWNS			Roofs			PAVED			Commercial Area			COMPOSITE IMPERVIOUSNESS & C		
							%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}
TSA	11.46	0.00	0.00	0.00	11.46	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
PNT1	0.13	0.00	0.00	0.00	0.13	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
PNT2	0.87	0.00	0.00	0.00	0.87	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
PNT3	0.56	0.00	0.00	0.00	0.56	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
P1.1	0.00	0.00	0.78	0.00	0.78	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	100	0.90	0.96
P1.2	0.00	0.00	0.26	0.00	0.26	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	100	0.90	0.96
P1.3	0.19	0.00	0.40	0.00	0.59	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	68	0.64	0.76
P1.4	0.00	0.28	0.95	0.00	1.23	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	98	0.86	0.93
P1.5	0.00	0.00	0.64	0.00	0.64	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	100	0.90	0.96
P1.6A	2.72	0.00	0.00	0.00	2.72	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
P1.6B	0.00	0.28	0.45	0.00	0.73	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	96	0.83	0.90
P1.7A	1.72	0.00	0.00	0.00	1.72	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
P1.7B	0.00	0.28	0.31	0.00	0.59	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	95	0.82	0.89
P1.8	0.00	0.00	0.76	0.00	0.76	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	100	0.90	0.96
P1.9	0.00	0.00	0.20	0.00	0.20	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	100	0.90	0.96
P1.10	1.28	0.28	0.85	0.00	2.41	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	46	0.44	0.62
PD	14.99	0.00	0.00	0.00	14.99	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
PE	2.56	0.00	0.00	0.00	2.56	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
PF	2.41	0.00	0.32	0.00	2.73	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	12	0.18	0.42
Total					14.19																

4-WAY COMMERCIAL	**Calc'd by:**	**SPC**	
PR. INTERIM GRADING CONDITIONS	**Checked by:**	**CM**	
EL PASO COUNTY, CO	**Date:**	**10/12/2023**	

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL	tc=(L/180)+10	Design tc
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)	tc max	tc design (min)
TSA	0.08	11.46	100	1.5	16.3	10	1106	2.0	1.4	12.9	29.2	16.7	16.7
PNT1	0.08	0.13	100	4.2	11.6	10	0	0.0	0.0	0.0	11.6	10.6	10.6
PNT2	0.08	0.87	100	2.3	14.1	10	1175	2.2	1.5	13.1	27.2	17.1	17.1
PNT3	0.08	0.56	58	5.0	8.3	10	0	0.0	0.0	0.0	8.3	10.3	8.3
P1.1	0.90	0.78	75	3.0	2.2	20	694	1.0	2.0	5.8	8.0	14.3	8.0
P1.2	0.90	0.26	15	2.0	1.1	20	625	1.0	2.0	5.2	6.3	13.6	6.3
P1.3	0.64	0.59	15	2.0	2.6	20	155	1.0	2.0	1.3	5.0	10.9	5.0
P1.4	0.86	1.23	81	18.5	1.5	20	217	0.5	1.4	2.6	5.0	11.7	5.0
P1.5	0.90	0.64	100	1.0	3.7	20	171	1.0	2.0	1.4	5.1	11.5	5.1
P1.6A	0.08	2.72	300	2.0	25.7	10	315	0.5	0.7	7.4	33.1	13.4	13.4
P1.6B	0.83	0.73	81	18.5	1.7	20	225	1.6	2.5	1.5	5.0	11.7	5.0
P1.7A	0.08	1.72	300	0.5	40.8	10	115	1.1	1.0	1.8	42.6	12.3	12.3
P1.7B	0.82	0.59	81	18.5	1.8	20	87	1.7	2.6	0.6	5.0	10.9	5.0
P1.8	0.90	0.76	89	1.5	3.0	20	351	0.5	1.4	4.1	7.2	12.4	7.2
P1.9	0.90	0.20	28	1.0	1.9	20	161	0.5	1.4	1.9	5.0	11.1	5.0
P1.10	0.44	2.41	81	18.5	4.1	20	233	3.2	3.6	1.1	5.2	11.7	5.2
PD	0.08	14.99	200	1.5	23.1	10	1430	2.2	1.5	16.1	39.2	19.1	19.1
PE	0.08	2.56	200	2.0	21.0	10	1300	1.8	1.3	16.1	37.1	18.3	18.3
PF	0.18	2.73	200	2.5	17.7	10	585	4.4	2.1	4.6	22.3	14.4	14.4

FORMULAS:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad V = C_v S_w^{0.5}$$

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

HRGreen

4-WAY COMMERCIAL
PR. INTERIM GRADING CONDITIONS
DESIGN STORM: 5-YEAR

Calc'd by:	SPC
Checked by:	CM
Date:	10/12/2023

			DIRECT RUNOFF						TOTAL RUNOFF				SURFACE			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_5*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min	
	4	TSA	11.46	0.08	16.7	0.92	3.36	3.1															
		PNT1	0.13	0.08	10.6	0.01	4.05	0.0					0.3	0.05	1.1	739.0				739	1.0	11.85	
	2	PNT2 (PNT1, PNT2)	0.87	0.08	17.1	0.07	3.326	0.2	22.4	0.08	2.92	0.2	1.7	0.31	19.4	460.0				460	4.4	1.74	Total flow to DP2 (DBPS 5 Per the MDDP Ammendment/Preliminary/Final Drainage report for Stapleton Drive From Bandero DR to US HWY 24
		PNT3	0.56	0.08	8.3	0.04	4.40	0.2															
		PD	14.99	0.08	19.1	1.20	3.16	3.8					3.8	1.20	2.0					125	1.4	1.47	
	1	PE (PD,PE)	2.56	0.08	18.3	0.20	3.22	0.7	20.5	1.40	3.05	4.3											Total flow to D1 (DBPS 4 Per the MDDP Ammendment/Preliminary/Final Drainage report for Stapleton Drive From Bandero DR to US HWY 24
		PF	2.73	0.18	14.4	0.48	3.59	1.7															
	3.1	P1.1	0.78	0.90	8.0	0.70	4.47	3.1								3.1	0.70	0.5	15.0	60	5.9	0.17	BASIN P1.1 FLOW, CAPTURED IN 5' TYPE C SUMP INLET @ DP3.1, PIPE FLOW TO DP3.2
	3.2	P1.2	0.26	0.90	6.3	0.23	4.81	1.1	8.2	0.94	4.44	4.2				4.2	0.94	0.5	18.0	34	7.3	0.08	BASIN P1.2 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.2, PIPE FLOW TO DP3.3
	3.3	P1.3	0.59	0.64	5.0	0.38	5.17	1.9	8.2	1.31	4.42	5.8				5.8	1.31	0.5	18.0	100	7.3	0.23	BASIN P1.3 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.3, PIPE FLOW TO DP3.7
	3.4	P1.4	1.23	0.86	5.0	1.06	5.17	5.5	8.5	2.37	4.38	10.4				10.4	2.37	0.5	24.0	225	10.2	0.37	BASIN P1.4 FLOW, CAPTURED IN 5' TYPE C INLET @ DP3.4, PIPE FLOW TO DP3.5
	3.5	P1.5	0.64	0.90	5.1	0.58	5.14	3.0	5.4	2.95	5.06	8.4				8.4	2.95	0.5	24.0	31	10.2	0.05	BASIN P1.5 FLOW, CAPTURED IN XX' INLET @ DP3.5, PIPE TO POND B
		P1.6A	2.72	0.08	13.4	0.22	3.69	0.8								0.8	0.22	0.5	30.0	10	13.2	0.01	BASIN P1.6A FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.6, PIPE FLOW TO DP3.8
	3.6	P1.6B	0.73	0.83	5.0	0.61	5.17	3.1	5.0	1.11	5.17	4.0				4.0	1.11	0.5	30.0	175	13.2	0.22	BASIN P1.6B FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.6, PIPE FLOW TO DP3.8
		P1.7A	1.72	0.08	12.3	0.14	3.82	0.5								0.5	0.14	0.5	24.0	10	10.2	0.02	BASIN P1.7A FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.7, PIPE FLOW TO DP3.9
	3.7	P1.7B	0.59	0.82	5.0	0.48	5.17	2.5	5.0	0.62	5.17	3.0				3.0	0.62	0.5	24.0	450	10.2	0.74	BASIN P1.7B FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.7, PIPE FLOW TO DP3.9
	3.8	P1.9	0.2	0.90	5.0	0.18	5.17	0.9	5.0	0.79	5.17	4.9				4.9	0.79	0.5	30.0	38	13.2	0.05	BASIN P1.9 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.8, PIPE FLOW TO DP3.9
	3.9								5.7	1.41	4.96	8.3				8.3	1.41	0.5	36.0	193	16.3	0.20	DP3.9 FLOW, PIPE TO DP3.11
	3.1	P1.8	0.76	0.90	7.2	0.68	4.63	3.2								3.2	0.68	0.5	18.0	228	7.3	0.52	BASIN P1.8 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.10, PIPE FLOW TO DP3.11
	3.11								7.7	2.09	4.52	10.8				10.8	2.09	0.5	36.0	24	16.3	0.02	DP3.9 FLOW, PIPE TO POND B
	3.12	P1.10	2.41	0.44	5.2	1.07	5.12	5.5	7.7	6.11	4.52	27.6											BASIN P1.10 SHEET FLOW TO DP3.12, POND B TOTAL FLOW

HRGreen

4-WAY COMMERCIAL
PR. INTERIM GRADING CONDITIONS
DESIGN STORM: 100-YEAR

Calc'd by:	SPC
Checked by:	CM
Date:	10/12/2023

			DIRECT RUNOFF						TOTAL RUNOFF				SURFACE			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min)	
	4	TSA	11.46	0.35	16.7	4.01	3.36	13.5															
		PNT1	0.13	0.35	10.6	0.05	6.80	0.3					0.3	0.05	1.1					739	1.0	11.85	
	2	PNT2 (PNT1, PNT2)	0.87	0.35	17.1	0.30	5.58298	1.7	22.4	0.35	4.90	1.7	1.7	0.30	19.4					460	4.4	1.74	Total flow to DP2 (DBPS 5 Per the MDDP Ammendment/Preliminary/Final Drainage report for Stapleton Drive From Bandero DR to US HWY 24
		PNT3	0.56	0.35	8.3	0.20	7.39	1.4															
		PD	14.99	0.35	19.1	5.25	5.31	27.8					27.8	5.25	2.0					125	1.4	1.47	
	1	PE (PD,PE)	2.56	0.35	18.3	0.90	5.40502	4.8	20.5	6.14	5.12	31.4											Total flow to D1 (DBPS 4 Per the MDDP Ammendment/Preliminary/Final Drainage report for Stapleton Drive From Bandero DR to US HWY 24
		PF	2.73	0.42	14.4	1.15	6.02	6.9															
	3.1	P1.1	0.78	0.96	8.0	0.75	7.50	5.6								5.6	0.75	0.5	15.0	60	5.9	0.17	BASIN P1.1 FLOW, CAPTURED IN 5' TYPE C SUMP INLET @ DP3.1, PIPE FLOW TO DP3.2
	3.2	P1.2	0.26	0.96	6.3	0.25	8.08	2.0	8.2	1.00	7.45	7.4				7.4	1.00	0.5	18.0	34	7.3	0.08	BASIN P1.2 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.2, PIPE FLOW TO DP3.3
	3.3	P1.3	0.59	0.76	5.0	0.45	8.68	3.9	8.2	1.45	7.42	10.8				10.8	1.45	0.5	18.0	100	7.3	0.23	BASIN P1.3 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.3, PIPE FLOW TO DP3.7
	3.4	P1.4	1.23	0.93	5.0	1.14	8.68	9.9	8.5	2.59	7.35	19.0				19.0	2.59	0.5	24.0	225	10.2	0.37	BASIN P1.4 FLOW, CAPTURED IN 5' TYPE C INLET @ DP3.4, PIPE FLOW TO DP3.5
	3.5	P1.5	0.64	0.96	5.1	0.61	8.63	5.3	5.4	3.20	8.50	15.2				15.2	3.20	0.5	24.0	31	10.2	0.05	BASIN P1.5 FLOW, CAPTURED IN XX' INLET @ DP3.5, PIPE TO POND B
		P1.6A	2.72	0.35	13.4	0.95	6.19	5.9								5.9	0.95	0.5	30.0	10	13.2	0.01	BASIN P1.6A FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.6, PIPE FLOW TO DP3.8
	3.6	P1.6B	0.73	0.90	5.0	0.66	8.68	5.7	5.0	1.61	8.68	11.6				11.6	1.61	0.5	30.0	175	13.2	0.22	BASIN P1.6B FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.6, PIPE FLOW TO DP3.8
		P1.7A	1.72	0.35	12.3	0.60	6.41	3.9								3.9	0.60	0.5	24.0	10	10.2	0.02	BASIN P1.7A FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.7, PIPE FLOW TO DP3.9
	3.7	P1.7B	0.59	0.89	5.0	0.52	8.68	4.6	5.0	1.13	8.68	8.4				8.4	1.13	0.5	24.0	450	10.2	0.74	BASIN P1.7B FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.7, PIPE FLOW TO DP3.9
	3.8	P1.9	0.2	0.96	5.0	0.19	8.68	1.7	11.8	1.80	6.51	17.6				17.6	1.80	0.5	30.0	38	13.2	0.05	BASIN P1.9 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.8, PIPE FLOW TO DP3.9
	3.9								11.9	2.93	6.50	28.8				28.8	2.93	0.5	36.0	193	16.3	0.20	DP3.9 FLOW, PIPE TO DP3.11
	3.1	P1.8	0.76	0.96	7.2	0.73	7.77	5.7								5.7	0.73	0.5	18.0	228	7.3	0.52	BASIN P1.8 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.10, PIPE FLOW TO DP3.11
	3.11								12.1	3.66	6.46	23.6				23.6	3.66	0.5	36.0	24	16.3	0.02	DP3.9 FLOW, PIPE TO POND B
	3.12	P1.10	2.41	0.62	5.2	1.49	8.59	12.8	12.1	8.35	6.45	53.9											BASIN P1.10 SHEET FLOW TO DP3.12, POND B TOTAL FLOW

HRGreen	**4-WAY COMMERCIAL**	**Calc'd by:**	**SPC**
	PR. ULTIMATE GRADING CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**10/12/2023**

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
TSA	11.46	0	3.1	13.5
PNT1	0.13	0	0.0	0.3
PNT2	0.87	0	0.2	1.7
PNT3	0.56	0	0.2	1.4
PD	14.99	0	3.8	27.8
PE	2.56	0	0.7	4.8
PF	2.73	12	1.7	6.9
P1.1	0.78	100	3.1	5.6
P1.2	0.26	100	1.1	2.0
P1.3	0.59	68	1.9	3.9
P1.4	1.23	98	5.5	9.9
P1.5	0.64	100	3.0	5.3
P1.6A	2.72	95	10.2	17.1
P1.6B	0.73	96	3.1	5.7
P1.7A	1.72	95	6.3	10.6
P1.7B	0.59	95	2.5	4.6
P1.8	0.76	100	3.2	5.7
P1.9	0.20	100	0.9	1.7
P1.10	2.41	46	5.5	12.8

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	PD,PE	4.3	31.4
2	PNT1,PNT2	0.2	1.7
3.1	P1.3	3.1	5.6
3.2	P1.2,DP3.1	4.2	7.5
3.3	P1.3,DP3.2	5.8	10.8
3.4	P1.4,DP3.3	10.4	19.3
3.5	P1.5,DP1.4	8.4	15.2
3.6	P1.6A,P1.6B	21.4	21.7
3.7	P1.7A,P1.7B	14.0	14.3
3.8	P1.9,DP3.6	3.4	23.1
3.9	DP3.7,DP3.8	21.0	36.9
3.10	P1.8	3.1	5.6
3.11	DP3.9,DP3.10	23.6	41.9
3.12	DP3.5,DP3.11	39.8	74.6
4	TSA	3.1	13.5

ULTIMATE CONDITION CALCULATIONS ACCOUNT FOR SUBBASINS P1.6A & P1.7A AS BEING FUTURE COMMERCIAL DEVELOPMENT AND DRAIN TO THE PROVIDED 30" & 24" HDPE STUBS.

HRGreen

4-WAY COMMERCIAL

PR. ULTIMATE GRADING CONDITIONS

EL PASO COUNTY, CO

Calc'd by: SPC

Checked by: CM

Date: 10/12/2023

COMPOSITE 'C' FACTORS

BASIN	UNDEVELOPED/LAWNS	Roofs	PAVED	Commercial Area	TOTAL	SOIL TYPE	UNDEVELOPED/LAWNS			Roofs			PAVED			Commercial Area			COMPOSITE IMPERVIOUSNESS & C		
							%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}
TSA	11.46	0.00	0.00	0.00	11.46	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
PNT1	0.13	0.00	0.00	0.00	0.13	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
PNT2	0.87	0.00	0.00	0.00	0.87	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
PNT3	0.56	0.00	0.00	0.00	0.56	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
P1.1	0.00	0.00	0.78	0.00	0.78	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	100	0.90	0.96
P1.2	0.00	0.00	0.26	0.00	0.26	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	100	0.90	0.96
P1.3	0.19	0.00	0.40	0.00	0.59	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	68	0.64	0.76
P1.4	0.00	0.28	0.95	0.00	1.23	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	98	0.86	0.93
P1.5	0.00	0.00	0.64	0.00	0.64	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	100	0.90	0.96
P1.6A	0.00	0.00	0.00	2.72	2.72	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	95	0.88	0.88
P1.6B	0.00	0.28	0.45	0.00	0.73	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	96	0.83	0.90
P1.7A	0.00	0.00	0.00	1.72	1.72	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	95	0.88	0.88
P1.7B	0.00	0.28	0.31	0.00	0.59	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	95	0.82	0.89
P1.8	0.00	0.00	0.76	0.00	0.76	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	100	0.90	0.96
P1.9	0.00	0.00	0.20	0.00	0.20	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	100	0.90	0.96
P1.10	1.28	0.28	0.85	0.00	2.41	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	46	0.44	0.62
PD	14.99	0.00	0.00	0.00	14.99	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
PE	2.56	0.00	0.00	0.00	2.56	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	0	0.08	0.35
PF	2.41	0.00	0.32	0.00	2.73	A/B	0	0.08	0.35	90	0.73	0.81	100	0.90	0.96	95	0.81	0.88	12	0.18	0.42
Total					14.19																

ULTIMATE CONDITION CALCULATIONS ACCOUNT FOR SUBBASINS P1.6A & P1.7A AS BEING FUTURE COMMERCIAL DEVELOPMENT AND DRAIN TO THE PROVIDED 30" & 24" HDPE STUBS.

HRGreen	**4-WAY COMMERCIAL**	**Calc'd by:**	**SPC**
	PR. ULTIMATE GRADING CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**10/12/2023**

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL	tc=(L/180)+10	Design tc
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)	tc max	tc design (min)
TSA	0.08	11.46	100	1.5	16.3	10	1106	2.0	1.4	12.9	29.2	16.7	16.7
PNT1	0.08	0.13	100	4.2	11.6	10	0	0.0	0.0	0.0	11.6	10.6	10.6
PNT2	0.08	0.87	100	2.3	14.1	10	1175	2.2	1.5	13.1	27.2	17.1	17.1
PNT3	0.08	0.56	58	5.0	8.3	10	0	0.0	0.0	0.0	8.3	10.3	8.3
P1.1	0.90	0.78	75	3.0	2.2	20	694	1.0	2.0	5.8	8.0	14.3	8.0
P1.2	0.90	0.26	15	2.0	1.1	20	625	1.0	2.0	5.2	6.3	13.6	6.3
P1.3	0.64	0.59	15	2.0	2.6	20	155	1.0	2.0	1.3	5.0	10.9	5.0
P1.4	0.86	1.23	81	18.5	1.5	20	217	0.5	1.4	2.6	5.0	11.7	5.0
P1.5	0.90	0.64	100	1.0	3.7	20	171	1.0	2.0	1.4	5.1	11.5	5.1
P1.6A	0.88	2.72	300	2.0	5.5	20	315	0.5	1.4	3.7	9.3	13.4	9.3
P1.6B	0.83	0.73	81	18.5	1.7	20	225	1.6	2.5	1.5	5.0	11.7	5.0
P1.7A	0.88	1.72	300	0.5	8.8	20	115	1.1	2.1	0.9	9.7	12.3	9.7
P1.7B	0.82	0.59	81	18.5	1.8	20	87	1.7	2.6	0.6	5.0	10.9	5.0
P1.8	0.90	0.76	89	1.5	3.0	20	351	0.5	1.4	4.1	7.2	12.4	7.2
P1.9	0.90	0.20	28	1.0	1.9	20	161	0.5	1.4	1.9	5.0	11.1	5.0
P1.10	0.44	2.41	81	18.5	4.1	20	233	3.2	3.6	1.1	5.2	11.7	5.2
PD	0.08	14.99	200	1.5	23.1	10	1430	2.2	1.5	16.1	39.2	19.1	19.1
PE	0.08	2.56	200	2.0	21.0	10	1300	1.8	1.3	16.1	37.1	18.3	18.3
PF	0.18	2.73	200	2.5	17.7	10	585	4.4	2.1	4.6	22.3	14.4	14.4

FORMULAS:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad V = C_v S_w^{0.5}$$

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

ULTIMATE CONDITION CALCULATIONS ACCOUNT FOR SUBBASINS P1.6A & P1.7A AS BEING FUTURE COMMERCIAL DEVELOPMENT AND DRAIN TO THE PROVIDED 30" & 24" HDPE STUBS.

HRGreen

4-WAY COMMERCIAL
PR. ULTIMATE GRADING CONDITIONS
DESIGN STORM: 5-YEAR

Calc'd by:	SPC
Checked by:	CM
Date:	10/12/2023

			DIRECT RUNOFF						TOTAL RUNOFF				SURFACE			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_5*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min	
	4	TSA	11.46	0.08	16.7	0.92	3.36	3.1															
		PNT1	0.13	0.08	10.6	0.01	4.05	0.0					0.3	0.05	1.1	739.0				739	1.0	11.85	
	2	PNT2 (PNT1, PNT2)	0.87	0.08	17.1	0.07	3.326	0.2	22.4	0.08	2.92	0.2	1.7	0.31	19.4	460.0				460	4.4	1.74	Total flow to DP2 (DBPS 5 Per the MDDP Ammendment/Preliminary/Final Drainage report for Stapleton Drive From Bandero DR to US HWY 24
		PNT3	0.56	0.08	8.3	0.04	4.40	0.2															
		PD	14.99	0.08	19.1	1.20	3.16	3.8					3.8	1.20	2.0					125	1.4	1.47	
	1	PE (PD,PE)	2.56	0.08	18.3	0.20	3.22	0.7	20.5	1.40	3.05	4.3											Total flow to D1 (DBPS 4 Per the MDDP Ammendment/Preliminary/Final Drainage report for Stapleton Drive From Bandero DR to US HWY 24
		PF	2.73	0.18	14.4	0.48	3.59	1.7															
	3.1	P1.1	0.78	0.90	8.0	0.70	4.47	3.1								3.1	0.70	0.5	15.0	60	5.9	0.17	BASIN P1.1 FLOW, CAPTURED IN 5' TYPE C SUMP INLET @ DP3.1, PIPE FLOW TO DP3.2
	3.2	P1.2	0.26	0.90	6.3	0.23	4.81	1.1	8.2	0.94	4.44	4.2				4.2	0.94	0.5	18.0	34	7.3	0.08	BASIN P1.2 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.2, PIPE FLOW TO DP3.3
	3.3	P1.3	0.59	0.64	5.0	0.38	5.17	1.9	8.2	1.31	4.42	5.8				5.8	1.31	0.5	18.0	100	7.3	0.23	BASIN P1.3 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.3, PIPE FLOW TO DP3.7
	3.4	P1.4	1.23	0.86	5.0	1.06	5.17	5.5	8.5	2.37	4.38	10.4				10.4	2.37	0.5	24.0	225	10.2	0.37	BASIN P1.4 FLOW, CAPTURED IN 5' TYPE C INLET @ DP3.4, PIPE FLOW TO DP3.5
	3.5	P1.5	0.64	0.90	5.1	0.58	5.14	3.0	5.4	2.95	5.06	8.4				8.4	2.95	0.5	24.0	31	10.2	0.05	BASIN P1.5 FLOW, CAPTURED IN XX' INLET @ DP3.5, PIPE TO POND B
		P1.6A	2.72	0.88	9.3	2.39	4.24	10.2								10.2	2.39	0.5	30.0	10	13.2	0.01	BASIN P1.6A FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.6, PIPE FLOW TO DP3.8
	3.6	P1.6B	0.73	0.83	5.0	0.61	5.17	3.1	9.3	3.00	7.12	21.4				21.4	3.00	0.5	30.0	175	13.2	0.22	BASIN P1.6B FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.6, PIPE FLOW TO DP3.8
		P1.7A	1.72	0.88	9.7	1.51	4.17	6.3								6.3	1.51	0.5	24.0	10	10.2	0.02	BASIN P1.7A FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.7, PIPE FLOW TO DP3.9
	3.7	P1.7B	0.59	0.82	5.0	0.48	5.17	2.5	9.7	2.00	7.00	14.0				14.0	2.00	0.5	24.0	450	10.2	0.74	BASIN P1.7B FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.7, PIPE FLOW TO DP3.9
	3.8	P1.9	0.2	0.90	5.0	0.18	5.17	0.9	9.5	3.18	4.21	3.4				3.4	3.18	0.5	30.0	38	13.2	0.05	BASIN P1.9 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.8, PIPE FLOW TO DP3.9
	3.9								10.5	5.18	4.06	21.0				21.0	5.18	0.5	36.0	193	16.3	0.20	DP3.9 FLOW, PIPE TO DP3.11
	3.10	P1.8	0.76	0.90	7.2	0.68	4.63	3.2								3.2	0.68	0.5	18.0	228	7.3	0.52	BASIN P1.8 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.10, PIPE FLOW TO DP3.11
	3.11								10.7	5.86	4.03	23.6				23.6	5.86	0.5	36.0	24	16.3	0.02	DP3.9 FLOW, PIPE TO POND B
	3.12	P1.10	2.41	0.44	5.2	1.07	5.12	5.5	10.7	9.88	4.03	39.8											BASIN P1.10 SHEET FLOW TO DP3.12, POND B TOTAL FLOW

ULTIMATE CONDITION CALCULATIONS ACCOUNT FOR SUBBASINS P1.6A & P1.7A AS BEING FUTURE COMMERCIAL DEVELOPMENT AND DRAIN TO THE PROVIDED 30" & 24" HDPE STUBS.

HRGreen

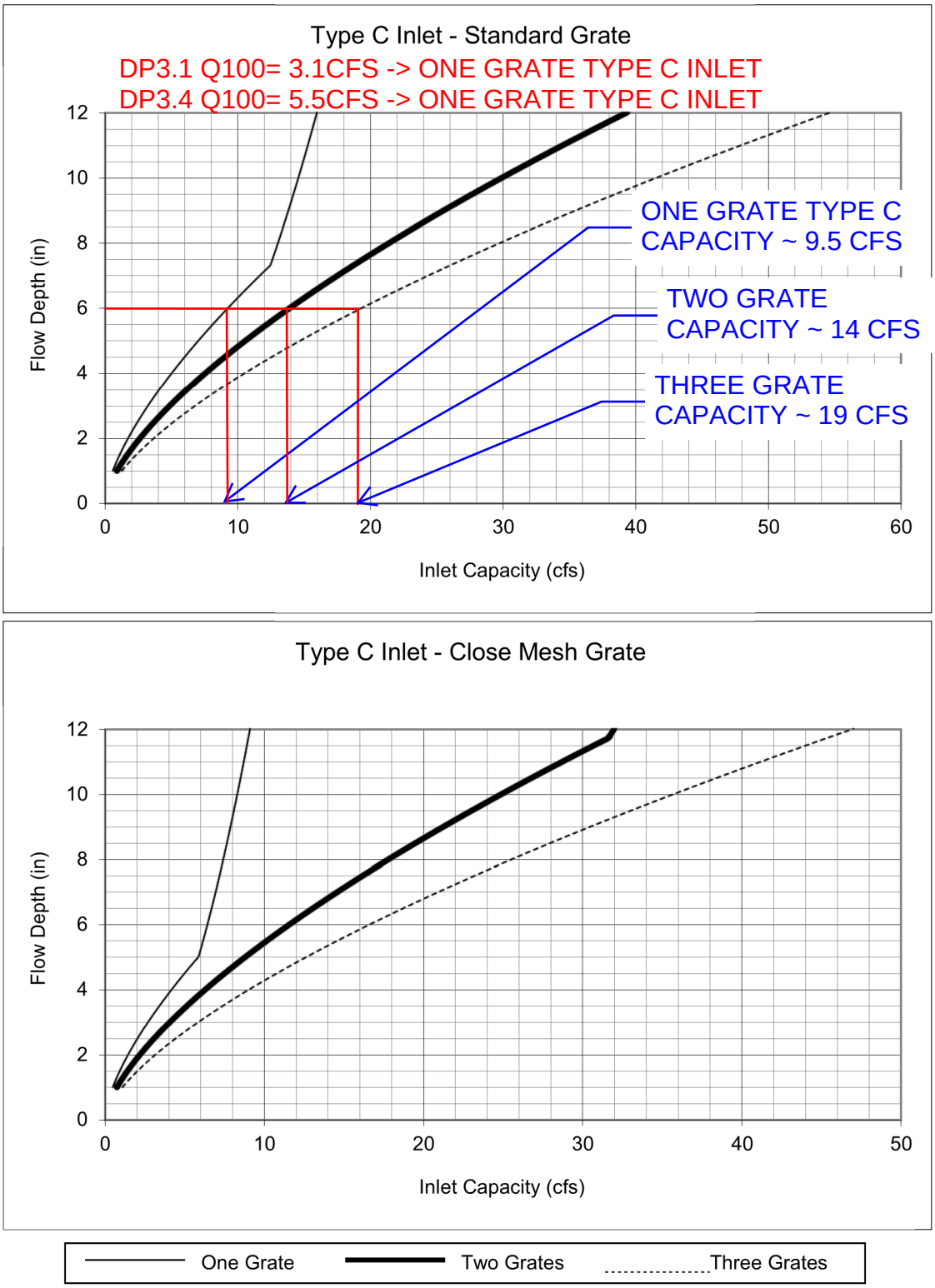
4-WAY COMMERCIAL
PR. ULTIMATE GRADING CONDITIONS
DESIGN STORM: 100-YEAR

Calc'd by:	SPC
Checked by:	CM
Date:	10/12/2023

			DIRECT RUNOFF						TOTAL RUNOFF				SURFACE			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min)	
	4	TSA	11.46	0.35	16.7	4.01	3.36	13.5															
		PNT1	0.13	0.35	10.6	0.05	6.80	0.3					0.3	0.05	1.1					739	1.0	11.85	
	2	PNT2 (PNT1, PNT2)	0.87	0.35	17.1	0.30	5.58298	1.7	22.4	0.35	4.90	1.7	1.7	0.30	19.4					460	4.4	1.74	Total flow to DP2 (DBPS 5 Per the MDDP Ammendment/Preliminary/Final Drainage report for Stapleton Drive From Bandero DR to US HWY 24
		PNT3	0.56	0.35	8.3	0.20	7.39	1.4															
		PD	14.99	0.35	19.1	5.25	5.31	27.8					27.8	5.25	2.0					125	1.4	1.47	
	1	PE (PD,PE)	2.56	0.35	18.3	0.90	5.40502	4.8	20.5	6.14	5.12	31.4											Total flow to D1 (DBPS 4 Per the MDDP Ammendment/Preliminary/Final Drainage report for Stapleton Drive From Bandero DR to US HWY 24
		PF	2.73	0.42	14.4	1.15	6.02	6.9															
	3.1	P1.1	0.78	0.96	8.0	0.75	7.50	5.6								5.6	0.75	0.5	15.0	15.0	5.9	0.04	BASIN P1.1 FLOW, CAPTURED IN 5' TYPE C SUMP INLET @ DP3.1, PIPE FLOW TO DP3.2
	3.2	P1.2	0.26	0.96	6.3	0.25	8.08	2.0	8.0	1.00	7.49	7.5				7.5	1.00	0.5	18.0	18.0	7.3	0.04	BASIN P1.2 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.2, PIPE FLOW TO DP3.3
	3.3	P1.3	0.59	0.76	5.0	0.45	8.68	3.9	8.1	1.45	7.47	10.8				10.8	1.45	0.5	18.0	18.0	7.3	0.04	BASIN P1.3 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.3, PIPE FLOW TO DP3.7
	3.4	P1.4	1.23	0.93	5.0	1.14	8.68	9.9	8.1	2.59	7.46	19.3				19.3	2.59	0.5	24.0	24.0	10.2	0.04	BASIN P1.4 FLOW, CAPTURED IN 5' TYPE C INLET @ DP3.4, PIPE FLOW TO DP3.5
	3.5	P1.5	0.64	0.96	5.1	0.61	8.63	5.3	5.1	3.20	8.63	15.2				15.2	3.20	0.5	24.0	24.0	10.2	0.04	BASIN P1.5 FLOW, CAPTURED IN XX' INLET @ DP3.5, PIPE TO POND B
		P1.6A	2.72	0.88	9.3	2.39	7.13	17.1								17.1	2.39	0.5	30.0	30.0	13.2	0.04	BASIN P1.6A FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.6, PIPE FLOW TO DP3.8
	3.6	P1.6B	0.73	0.90	5.0	0.66	8.68	5.7	9.3	3.05	7.12	21.7				21.7	3.05	0.5	30.0	30.0	13.2	0.04	BASIN P1.6B FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.6, PIPE FLOW TO DP3.8
		P1.7A	1.72	0.88	9.7	1.51	7.01	10.6								10.6	1.51	0.5	24.0	24.0	10.2	0.04	BASIN P1.7A FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.7, PIPE FLOW TO DP3.9
	3.7	P1.7B	0.59	0.89	5.0	0.52	8.68	4.6	9.8	2.04	6.99	14.3				14.3	2.04	0.5	24.0	24.0	10.2	0.04	BASIN P1.7B FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.7, PIPE FLOW TO DP3.9
	3.8	P1.9	0.2	0.96	5.0	0.19	8.68	1.7	9.3	3.24	7.11	23.1				23.1	3.24	0.5	30.0	30.0	13.2	0.04	BASIN P1.9 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.8, PIPE FLOW TO DP3.9
	3.9								9.8	5.28	6.98	36.9				36.9	5.28	0.5	36.0	36.0	16.3	0.04	DP3.9 FLOW, PIPE TO DP3.11
	3.1	P1.8	0.76	0.96	7.2	0.73	7.77	5.7								5.7	0.73	0.5	18.0	18.0	7.3	0.04	BASIN P1.8 FLOW, CAPTURED IN 5' TYPE R SUMP INLET @ DP3.10, PIPE FLOW TO DP3.11
	3.11								9.8	6.01	6.98	41.9				41.9	6.01	0.5	36.0	36.0	16.3	0.04	DP3.9 FLOW, PIPE TO POND B
	3.12	P1.10	2.41	0.62	5.2	1.49	8.59	12.8	9.9	10.70	6.97	74.6											BASIN P1.10 SHEET FLOW TO DP3.12, POND B TOTAL FLOW

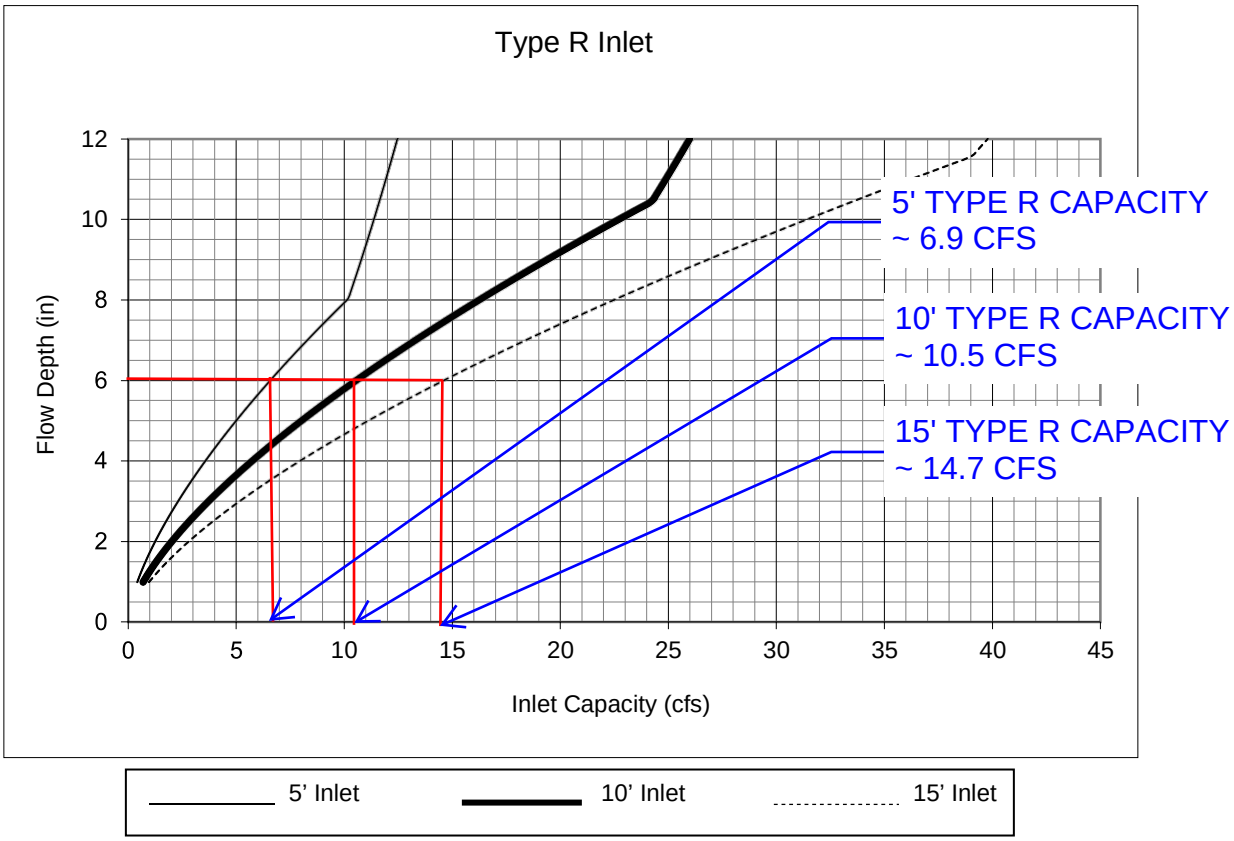
ULTIMATE CONDITION CALCULATIONS ACCOUNT FOR SUBBASINS P1.6A & P1.7A AS BEING FUTURE COMMERCIAL DEVELOPMENT AND DRAIN TO THE PROVIDED 30" & 24" HDPE STUBS.

Figure 8-10. Inlet Capacity Chart Sump Conditions, Area (Type C) Inlet



Notes:
1. The standard inlet parameters must apply to use these charts.

Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet



DP3.2 DIRECT RUNOFF Q100 = 2.0 CFS -> 5' TYPE R SUMP INLET
DP3.3 DIRECT RUNOFF Q100 = 3.9 CFS -> 5' TYPE R SUMP INLET
DP3.5 DIRECT RUNOFF Q100 = 5.3 CFS -> 5' TYPE R SUMP INLET
DP3.6 DIRECT RUNOFF Q100 = 5.7 CFS -> 5' TYPE R SUMP INLET
DP3.7 DIRECT RUNOFF Q100 = 4.6 CFS -> 5' TYPE R SUMP INLET
DP3.8 DIRECT RUNOFF Q100 = 1.7 CFS -> 5' TYPE R SUMP INLET
DP3.10 DIRECT RUNOFF Q100 = 5.7 CFS -> 5' TYPE R SUMP INLET

Notes:

1. The standard inlet parameters must apply to use this chart.

APPENDIX D – WQ & DETENTION

Why are the following pond calcs provided (presumably for Pond B) when no detail drawings were provided to compare the calcs to? If the pond design is to come under a different EDARP submittal (like an SF, for example) than just remove the calcs from this drainage report to avoid confusion.

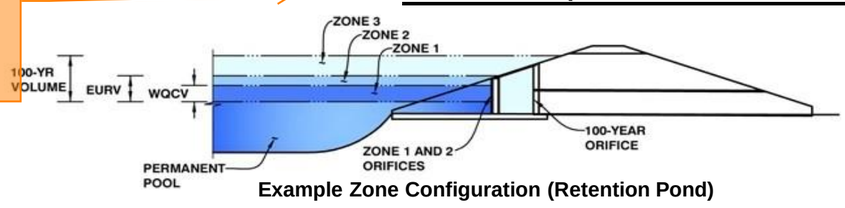
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Assign a name/number to all PBMPs and then update all submitted text and drawings accordingly with consistent labeling throughout (example: "Pond A" or "Pond 1").

Project: 4-Way Commercial

Basin ID: Southern Parcel (Interim Condition - Pre development of future commercial area tributary to pond)



Example Zone Configuration (Retention Pond)

Depth Increment = 6,889.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
6890 **Top of Micropool**	--	0.00	--	--	--	0	0.000		
6890	--	1.00	--	--	--	10,813	0.248	5,406	0.124
6891	--	2.00	--	--	--	30,589	0.702	26,107	0.599
6892	--	3.00	--	--	--	34,744	0.798	58,774	1.349
6893	--	4.00	--	--	--	38,332	0.880	95,312	2.188
6894	--	5.00	--	--	--	42,033	0.965	135,494	3.111
6895	--	6.00	--	--	--	45,847	1.053	179,434	4.119
6895.5	--	6.50	--	--	--	47,058	1.080	202,660	4.652

Should be ~9 ac, or sized to overdetain the diverted area

Verify that slope and lengths are calibrated to result in flows to approximate the Rational calculations for flows entering the pond

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	12.45	acres
Watershed Length =	1,187	ft
Watershed Length to Centroid =	660	ft
Watershed Slope =	0.015	ft/ft
Watershed Imperviousness =	50.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	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) =	0.214	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.718	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.535	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.711	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.851	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	1.074	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.291	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.566	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	2.163	acre-feet	inches
Approximate 2-yr Detention Volume =	0.462	acre-feet	
Approximate 5-yr Detention Volume =	0.608	acre-feet	
Approximate 10-yr Detention Volume =	0.741	acre-feet	
Approximate 25-yr Detention Volume =	0.907	acre-feet	
Approximate 50-yr Detention Volume =	1.012	acre-feet	
Approximate 100-yr Detention Volume =	1.141	acre-feet	

Define Zones and Basin Geometry

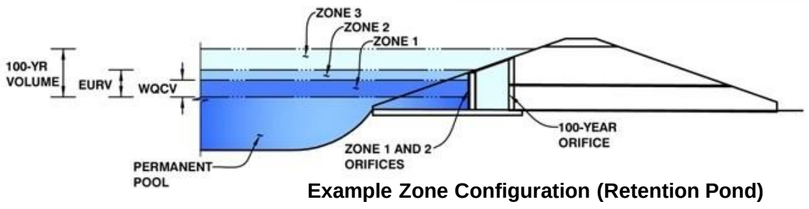
Zone 1 Volume (WQCV) =	0.214	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.504	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.423	acre-feet
Total Detention Basin Volume =	1.141	acre-feet
Initial Surcharge Volume (ISV) =	user	ft³
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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	ft²
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	ft²
Volume of Basin Floor (V_{FLOOR}) =	user	ft³
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	ft²
Volume of Main Basin (V_{MAIN}) =	user	ft³
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: 4-Way Commercial

Basin ID: Southern Parcel (Interim Condition - Pre development of future commercial area tributary to pond)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.29	0.214	Orifice Plate
Zone 2 (EURV)	2.17	0.504	Circular Orifice
Zone 3 (100-year)	2.74	0.423	Weir&Pipe (Restrict)
Total (all zones)		1.141	

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

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

Calculated Parameters for Underdrain

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

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.17	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	1.00					
Orifice Area (sq. inches)	1.45	1.45	1.45					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	1.30	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	2.17	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	1.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.01	N/A	ft^2
Vertical Orifice Centroid =	0.04	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.07	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.67	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.92	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 =	3.07	N/A	feet
Overflow Weir Slope Length =	2.92	N/A	feet
Grate Open Area / 100-yr Orifice Area =		N/A	
Overflow Grate Open Area w/o Debris =	11.52	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.76	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 =		N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =		N/A	inches
Restrictor Plate Height Above Pipe Invert =			inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

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

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	33.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	2.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.50	feet
Stage at Top of Freeboard =	6.50	feet
Basin Area at Top of Freeboard =	1.08	acres
Basin Volume at Top of Freeboard =	4.65	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).

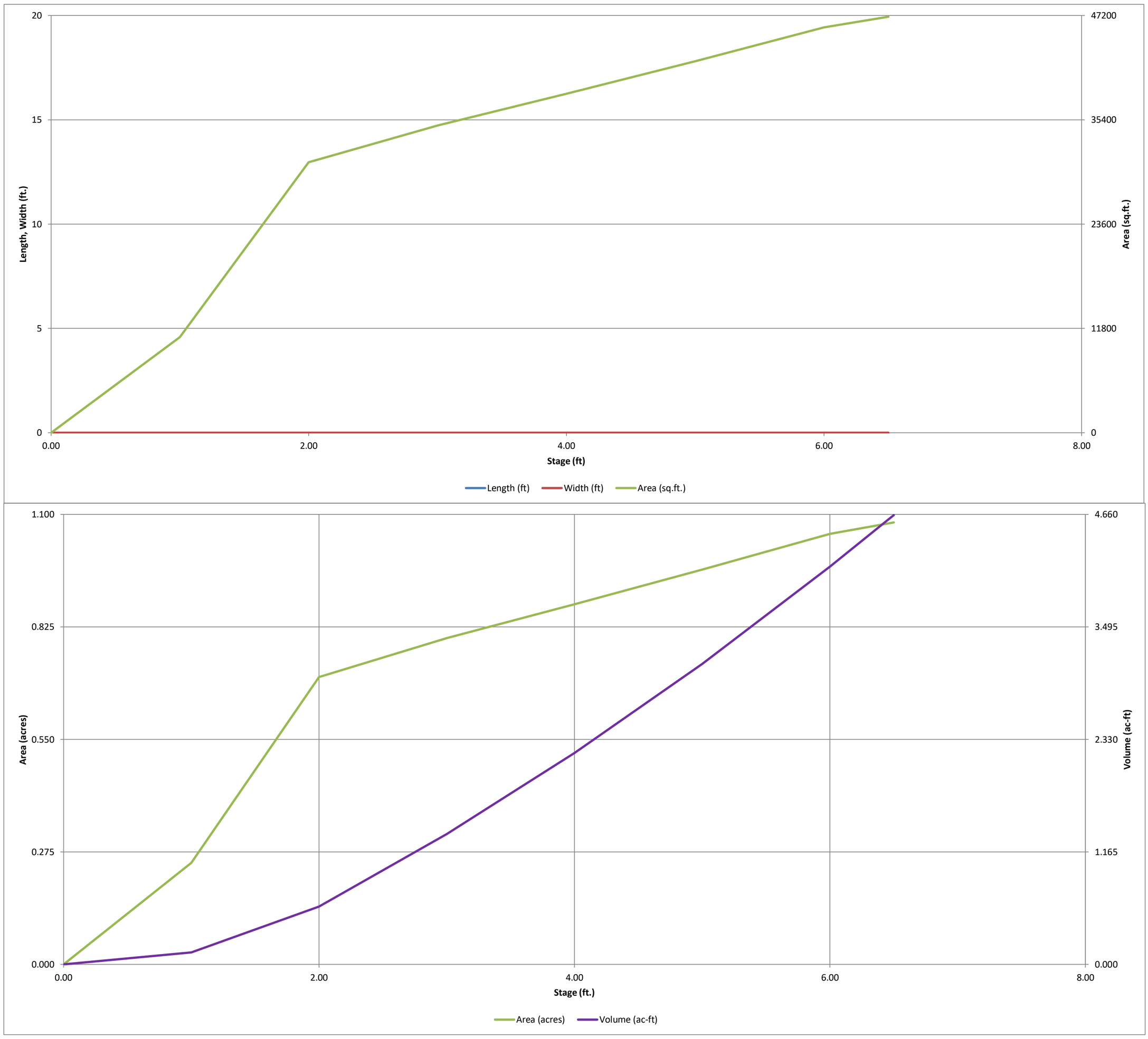
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.214	0.718	0.535	0.711	0.851	1.074	1.291	1.566	2.163
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.535	0.711	0.851	1.074	1.291	1.566	2.163
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.1	0.2	1.8	3.7	6.0	11.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.15	0.30	0.49	0.89
Peak Inflow Q (cfs) =	N/A	N/A	6.6	8.9	10.6	14.4	17.8	22.0	30.5
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.2	0.2	0.2	0.3	1.1	7.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.4	1.1	0.1	0.1	0.2	0.6
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	66	58	66	73	82	91	98	95
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	63	73	80	90	100	108	106
Maximum Ponding Depth (ft) =	1.29	2.17	1.85	2.10	2.29	2.59	2.87	3.16	3.46
Area at Maximum Ponding Depth (acres) =	0.38	0.72	0.63	0.71	0.73	0.76	0.78	0.81	0.84
Maximum Volume Stored (acre-ft) =	0.215	0.720	0.499	0.670	0.807	1.023	1.239	1.478	1.725

this is too high - revise as appropriate

see comment on Table Builder sheet. These flows should approximate the total calculated flows entering the pond. (These values are less than half)

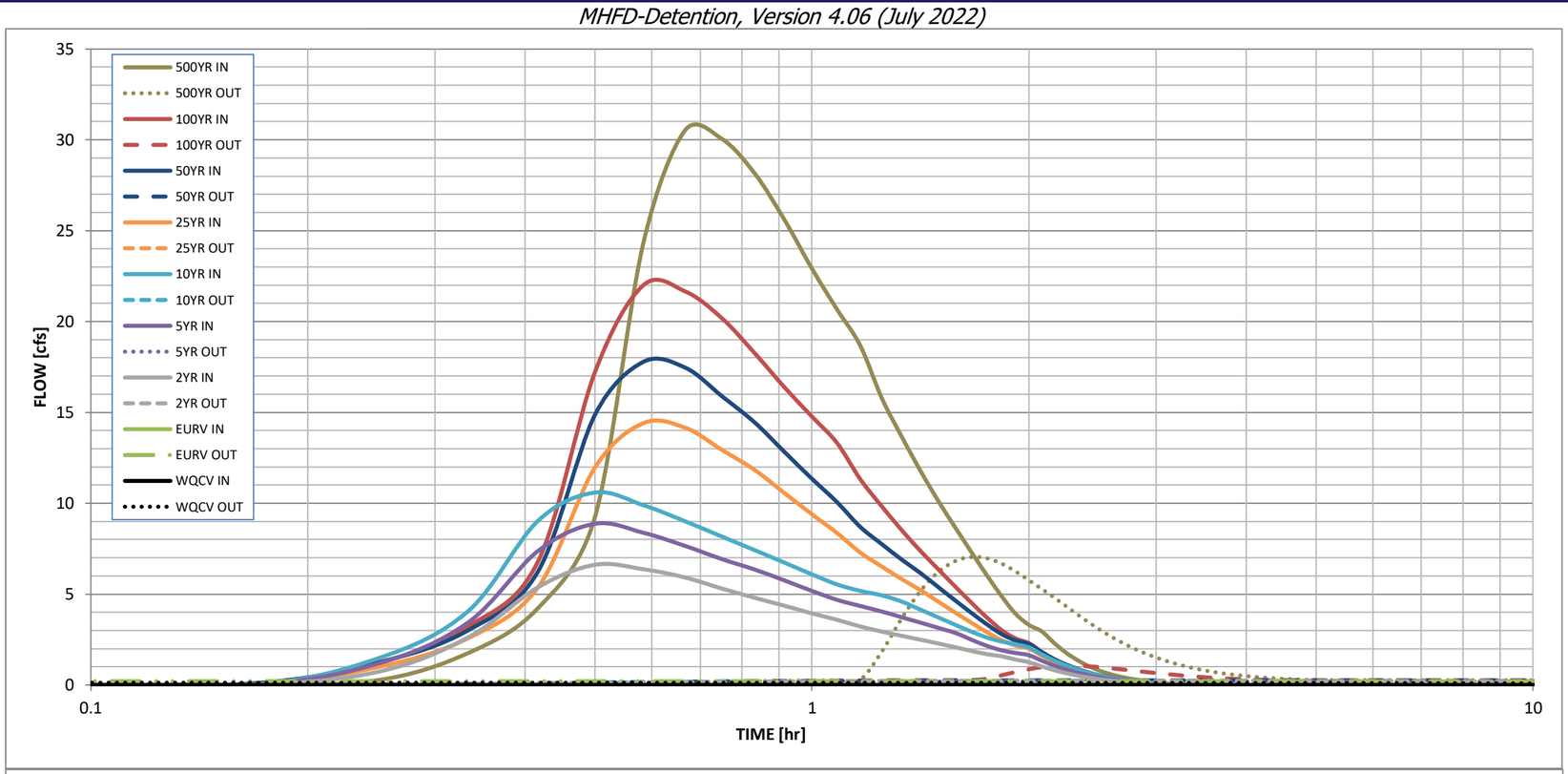
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

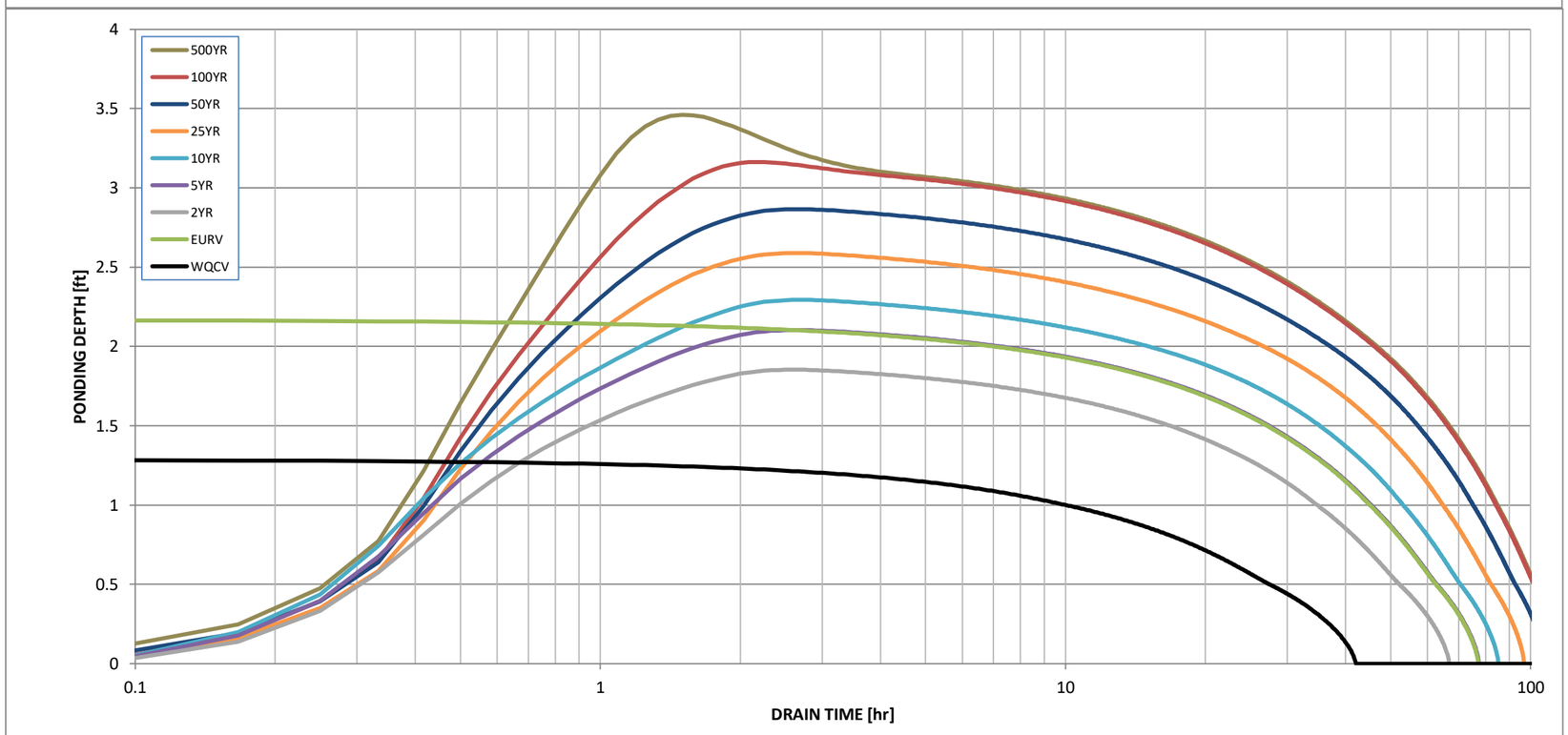
MHFD-Detention, Version 4.06 (July 2022)

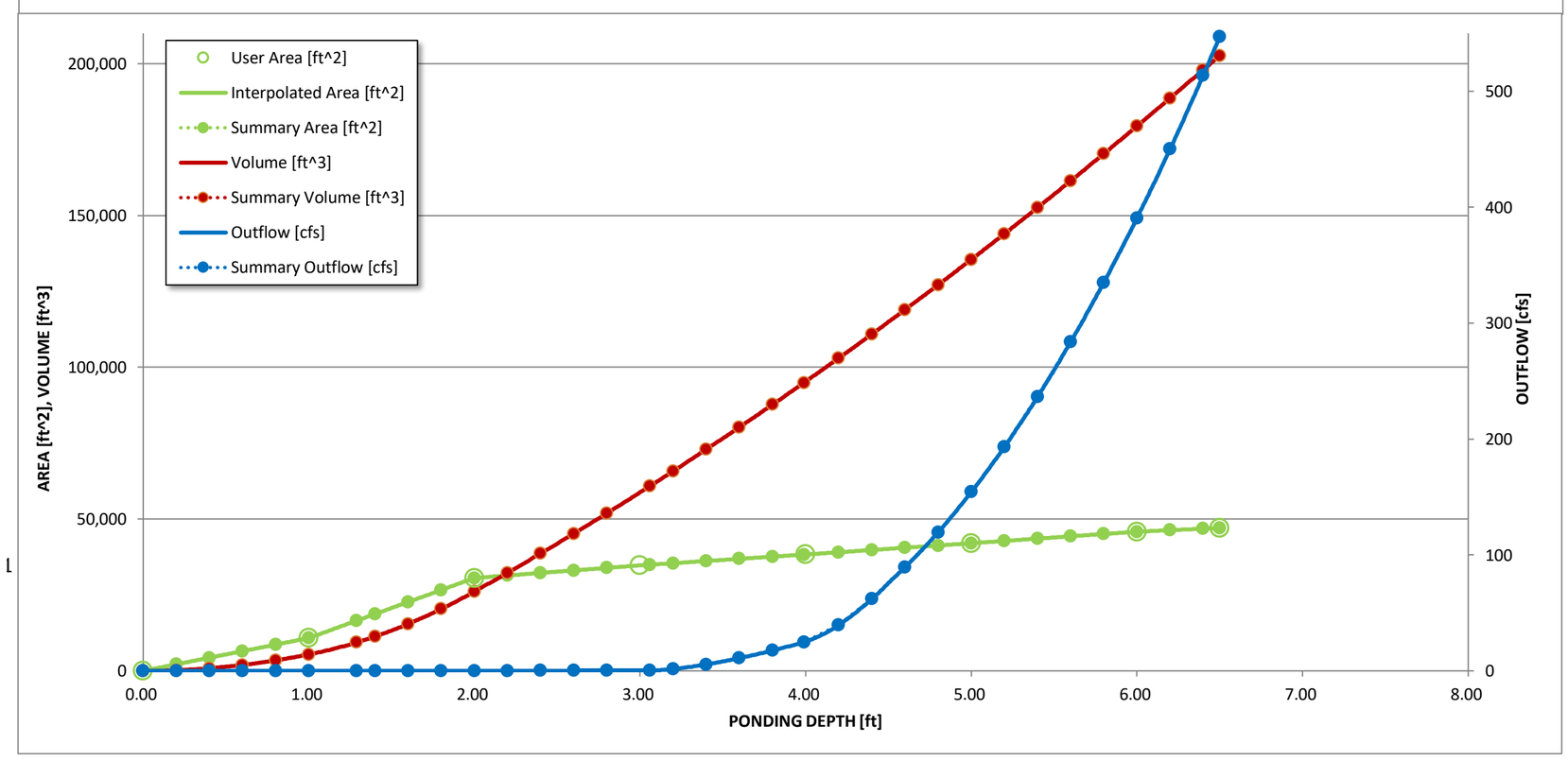


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.01	0.27
	0:15:00	0.00	0.00	0.72	1.17	1.46	0.98	1.24	1.21	1.75
	0:20:00	0.00	0.00	2.61	3.43	4.05	2.57	3.00	3.21	4.22
	0:25:00	0.00	0.00	5.37	7.36	9.02	5.35	6.22	6.76	9.22
	0:30:00	0.00	0.00	6.61	8.87	10.59	11.95	14.85	17.20	24.26
	0:35:00	0.00	0.00	6.37	8.38	9.90	14.40	17.78	21.99	30.51
	0:40:00	0.00	0.00	5.92	7.66	9.01	14.16	17.47	21.66	30.05
	0:45:00	0.00	0.00	5.31	6.93	8.17	12.94	15.89	20.18	28.14
	0:50:00	0.00	0.00	4.80	6.35	7.42	11.83	14.44	18.25	25.58
	0:55:00	0.00	0.00	4.36	5.75	6.73	10.55	12.81	16.37	22.91
	1:00:00	0.00	0.00	3.94	5.18	6.09	9.39	11.35	14.77	20.67
	1:05:00	0.00	0.00	3.59	4.68	5.53	8.37	10.06	13.32	18.68
	1:10:00	0.00	0.00	3.22	4.35	5.18	7.29	8.70	11.33	15.79
	1:15:00	0.00	0.00	2.94	4.04	4.93	6.52	7.75	9.83	13.63
	1:20:00	0.00	0.00	2.70	3.72	4.58	5.81	6.89	8.50	11.73
	1:25:00	0.00	0.00	2.49	3.42	4.13	5.20	6.14	7.34	10.07
	1:30:00	0.00	0.00	2.28	3.13	3.70	4.56	5.36	6.33	8.62
	1:35:00	0.00	0.00	2.07	2.85	3.30	3.96	4.63	5.38	7.27
	1:40:00	0.00	0.00	1.87	2.48	2.92	3.41	3.95	4.50	6.02
	1:45:00	0.00	0.00	1.70	2.15	2.61	2.90	3.33	3.70	4.87
	1:50:00	0.00	0.00	1.58	1.91	2.39	2.46	2.79	3.01	3.91
	1:55:00	0.00	0.00	1.40	1.76	2.24	2.17	2.45	2.56	3.30
	2:00:00	0.00	0.00	1.25	1.64	2.06	2.00	2.25	2.30	2.95
	2:05:00	0.00	0.00	1.02	1.34	1.69	1.61	1.81	1.82	2.32
	2:10:00	0.00	0.00	0.82	1.07	1.35	1.27	1.43	1.41	1.78
	2:15:00	0.00	0.00	0.66	0.85	1.08	1.01	1.13	1.10	1.37
	2:20:00	0.00	0.00	0.52	0.68	0.86	0.79	0.89	0.84	1.05
	2:25:00	0.00	0.00	0.41	0.54	0.67	0.62	0.70	0.65	0.80
	2:30:00	0.00	0.00	0.32	0.42	0.52	0.48	0.54	0.50	0.62
	2:35:00	0.00	0.00	0.25	0.32	0.40	0.37	0.41	0.38	0.47
	2:40:00	0.00	0.00	0.19	0.25	0.31	0.28	0.31	0.29	0.36
	2:45:00	0.00	0.00	0.15	0.19	0.24	0.22	0.24	0.23	0.28
	2:50:00	0.00	0.00	0.11	0.14	0.18	0.17	0.18	0.18	0.21
	2:55:00	0.00	0.00	0.08	0.10	0.13	0.12	0.13	0.13	0.15
	3:00:00	0.00	0.00	0.05	0.07	0.09	0.08	0.09	0.09	0.10
	3:05:00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.05	0.06
	3:10:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.03
	3:15:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	0.00	0	0.000	0	0.000	0.00
	0.20	2,163	0.050	216	0.005	0.02
	0.40	4,325	0.099	865	0.020	0.03
	0.60	6,488	0.149	1,946	0.045	0.05
	0.80	8,650	0.199	3,460	0.079	0.07
	1.00	10,813	0.248	5,406	0.124	0.08
	1.29	16,548	0.380	9,373	0.215	0.12
	1.40	18,723	0.430	11,313	0.260	0.14
	1.60	22,679	0.521	15,454	0.355	0.16
	1.80	26,634	0.611	20,385	0.468	0.18
	2.00	30,589	0.702	26,107	0.599	0.20
	2.20	31,420	0.721	32,308	0.742	0.21
	2.40	32,251	0.740	38,675	0.888	0.23
	2.60	33,082	0.759	45,208	1.038	0.24
	2.80	33,913	0.779	51,908	1.192	0.25
	3.06	34,959	0.803	60,865	1.397	0.27
	3.20	35,462	0.814	65,794	1.510	1.57
	3.40	36,179	0.831	72,958	1.675	5.53
	3.60	36,897	0.847	80,266	1.843	10.97
	3.80	37,614	0.864	87,717	2.014	17.57
	3.99	38,296	0.879	94,928	2.179	24.74
	4.20	39,072	0.897	103,052	2.366	39.60
	4.40	39,812	0.914	110,940	2.547	62.07
	4.60	40,553	0.931	118,977	2.731	89.41
	4.80	41,293	0.948	127,161	2.919	119.63
	5.00	42,033	0.965	135,494	3.111	154.31
	5.20	42,796	0.982	143,977	3.305	193.30
	5.40	43,559	1.000	152,612	3.503	236.47
	5.60	44,321	1.017	161,400	3.705	283.76
	5.80	45,084	1.035	170,341	3.910	335.14
	6.00	45,847	1.053	179,434	4.119	390.60
	6.20	46,331	1.064	188,652	4.331	450.13
	6.40	46,816	1.075	197,967	4.545	513.74
	6.50	47,058	1.080	202,660	4.652	547.08

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

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

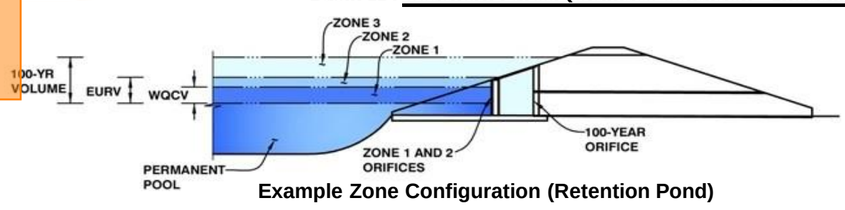
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Assign a name/number to all PBMPs and then update all submitted text and drawings accordingly with consistent labeling throughout (example: "Pond A" or "Pond 1").

Project: 4-Way Commercial

Basin ID: Southern Parcel (Ultimate Condition - Including future commercial area tributary to pond)



Example Zone Configuration (Retention Pond)

Depth Increment = 6,889.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
6890 **Top of Micropool**	--	0.00	--	--	--	0	0.000		
6890	--	1.00	--	--	--	10,813	0.248	5,406	0.124
6891	--	2.00	--	--	--	30,589	0.702	26,107	0.599
6892	--	3.00	--	--	--	34,744	0.798	58,774	1.349
6893	--	4.00	--	--	--	38,332	0.880	95,312	2.188
6894	--	5.00	--	--	--	42,033	0.965	135,494	3.111
6895	--	6.00	--	--	--	45,847	1.053	179,434	4.119
6895.5	--	6.50	--	--	--	47,058	1.080	202,660	4.652

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	12.45	acres
Watershed Length =	1,187	ft
Watershed Length to Centroid =	660	ft
Watershed Slope =	0.015	ft/ft
Watershed Imperviousness =	84.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	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	

Should be ~9 ac, or sized to overdetain the diverted area

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

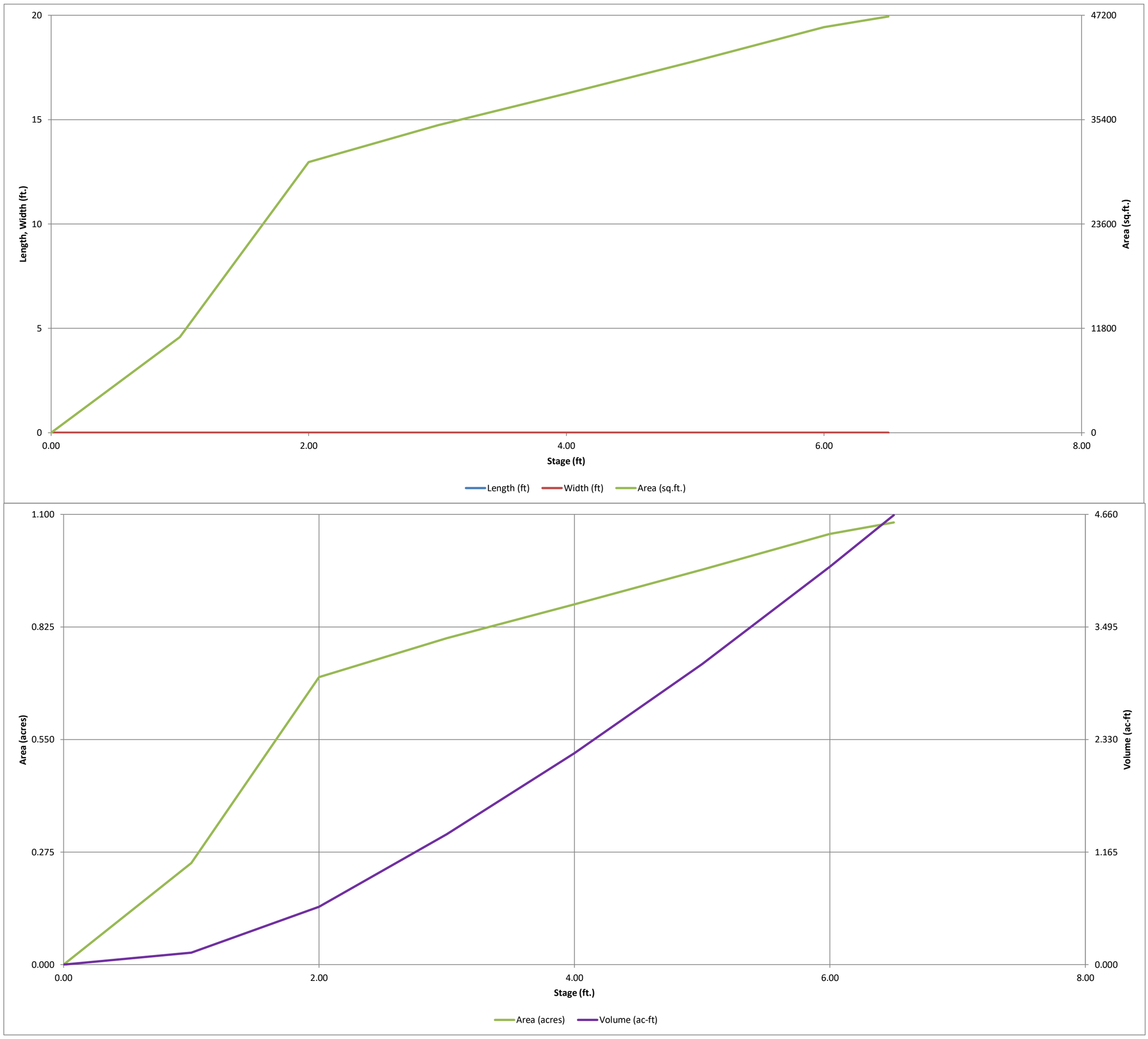
		Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.368 acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.394 acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.989 acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.279 acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.512 acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.776 acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.035 acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.331 acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	2.990 acre-feet		inches
Approximate 2-yr Detention Volume =	0.917 acre-feet		
Approximate 5-yr Detention Volume =	1.191 acre-feet		
Approximate 10-yr Detention Volume =	1.419 acre-feet		
Approximate 25-yr Detention Volume =	1.680 acre-feet		
Approximate 50-yr Detention Volume =	1.832 acre-feet		
Approximate 100-yr Detention Volume =	1.969 acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.368	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.026	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.575	acre-feet
Total Detention Basin Volume =	1.969	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

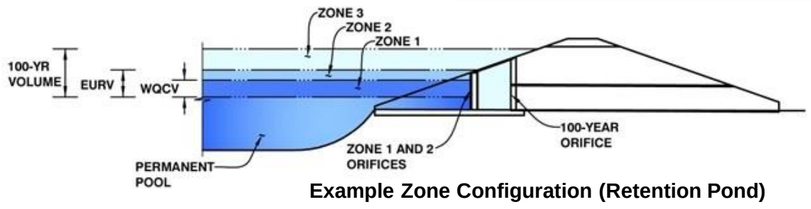


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: 4-Way Commercial

Basin ID: Southern Parcel



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.63	0.368	Orifice Plate
Zone 2 (EURV)	3.06	1.026	Circular Orifice
Zone 3 (100-year)	3.75	0.575	Weir&Pipe (Restrict)
Total (all zones)		1.969	

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

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

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

			Calculated Parameters for Plate		
Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.319E-02	ft^2
Depth at top of Zone using Orifice Plate =	1.63	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.90	sq. inches (diameter = 1-9/16 inches)	Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	1.00					
Orifice Area (sq. inches)	1.90	1.90	1.90					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected		Calculated Parameters for Vertical Orifice	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	1.64	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.03	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	3.06	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.10	N/A	feet
Vertical Orifice Diameter =	2.33	N/A	inches				

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

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.07	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.07	N/A	feet
Overflow Weir Front Edge Length =	5.67	N/A	feet	Overflow Weir Slope Length =	2.92	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	17.14	N/A	
Horiz. Length of Weir Sides =	2.92	N/A	feet	Overflow Grate Open Area w/o Debris =	11.52	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	5.76	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

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

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.67	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.35	N/A	feet
Restrictor Plate Height Above Pipe Invert =	7.30		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.38	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	4.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.50	feet
Spillway Crest Length =	33.00	feet	Stage at Top of Freeboard =	6.50	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.08	acres
Freeboard above Max Water Surface =	2.00	feet	Basin Volume at Top of Freeboard =	4.65	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).*

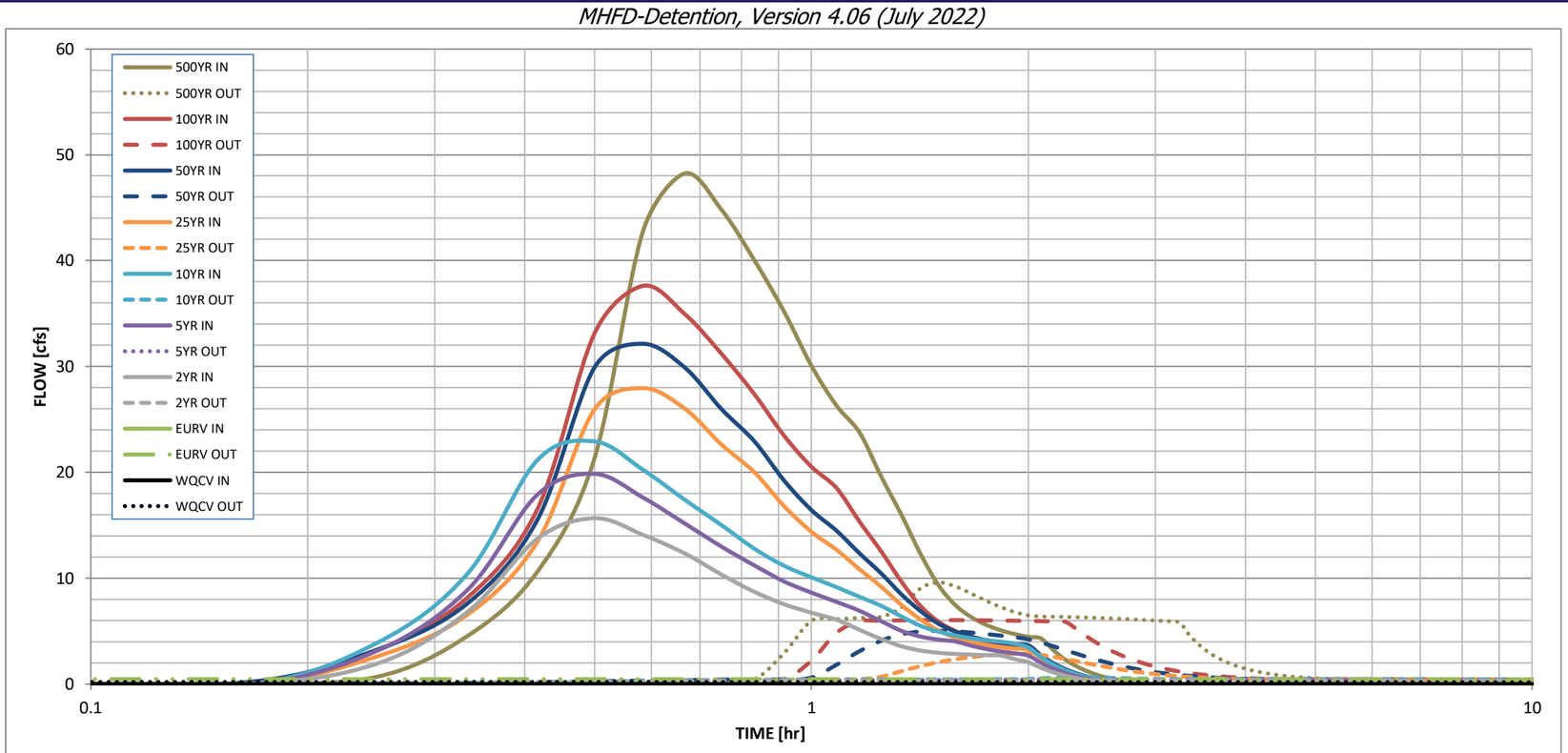
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.368	1.394	0.989	1.279	1.512	1.776	2.035	2.331	2.990
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.989	1.279	1.512	1.776	2.035	2.331	2.990
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.1	0.2	1.8	3.7	6.0	11.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.15	0.30	0.49	0.89
Peak Inflow Q (cfs) =	N/A	N/A	15.7	19.9	22.9	28.0	32.1	37.6	48.2
Peak Outflow Q (cfs) =	0.2	0.5	0.4	0.4	0.6	2.9	5.0	6.0	9.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.1	3.2	1.6	1.4	1.0	0.9
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.2	0.4	0.5	0.5
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) =	37	65	57	63	68	67	66	65	64
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	63	70	75	75	75	74	73
Maximum Ponding Depth (ft) =	1.63	3.06	2.46	2.82	3.10	3.26	3.37	3.59	4.10
Area at Maximum Ponding Depth (acres) =	0.53	0.80	0.75	0.78	0.81	0.82	0.83	0.85	0.89
Maximum Volume Stored (acre-ft) =	0.371	1.397	0.925	1.207	1.429	1.559	1.642	1.826	2.268

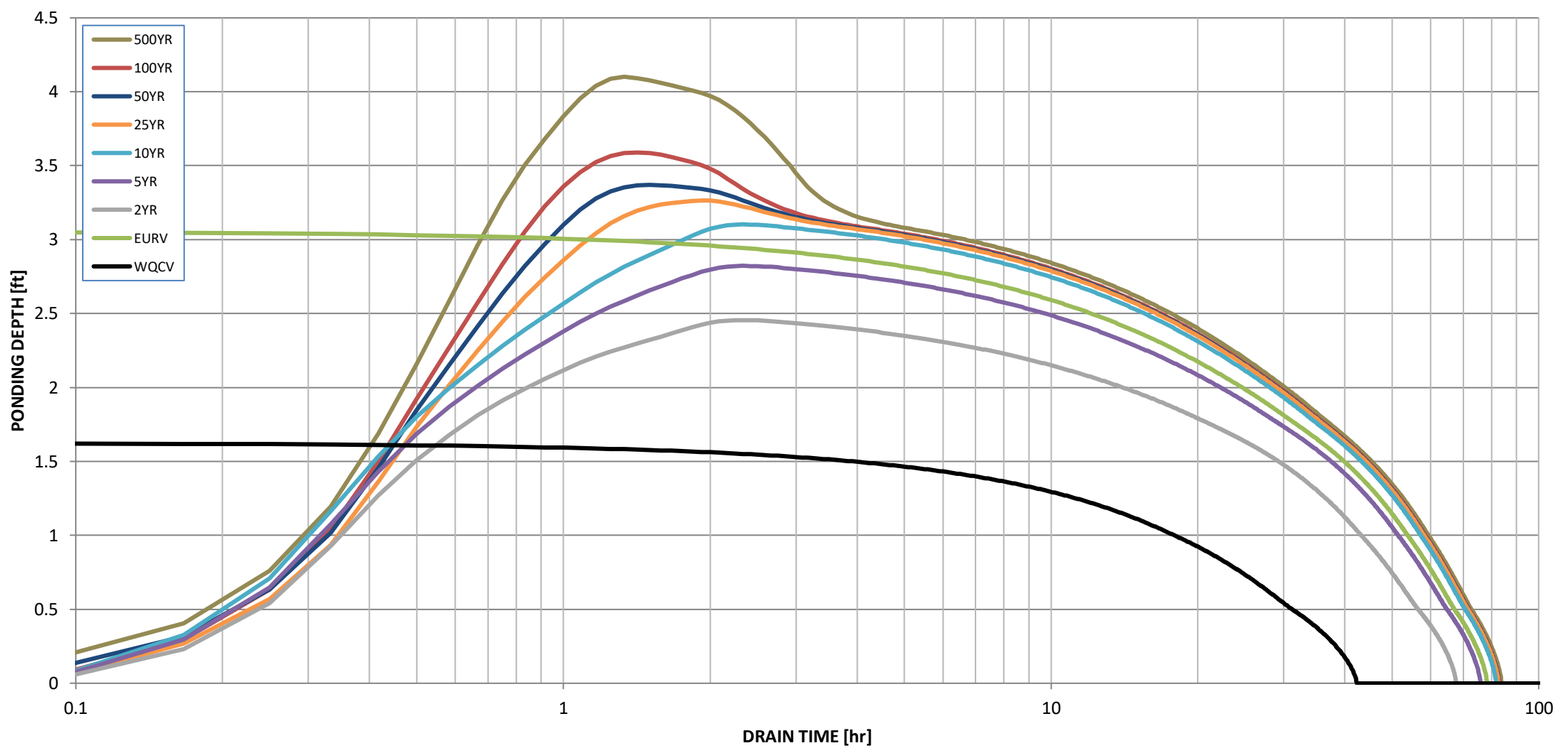
Revise grading to include only historic tributary area or acquire downstream drainage easements and address stable conveyance

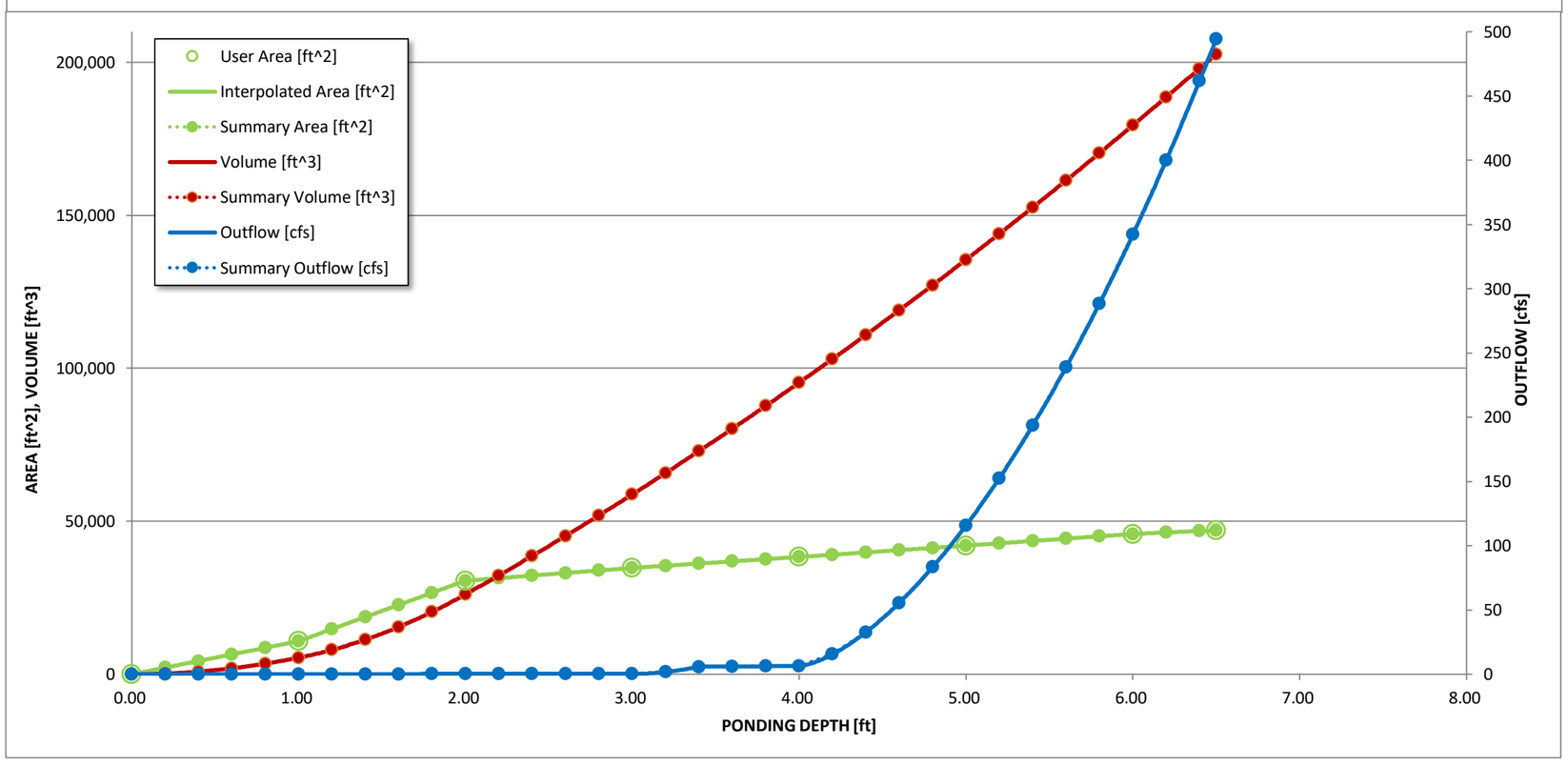
the highlighted cells are too high - revise as appropriate

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	0.22	0.02	0.70
	0:15:00	0.00	0.00	1.95	3.17	3.92	2.63	3.27	3.20	4.55
	0:20:00	0.00	0.00	6.82	8.91	10.44	6.57	7.63	8.18	10.61
	0:25:00	0.00	0.00	13.74	17.90	21.16	13.46	15.52	16.54	21.33
	0:30:00	0.00	0.00	15.67	19.86	22.93	25.94	29.91	33.12	42.70
	0:35:00	0.00	0.00	14.11	17.63	20.26	27.96	32.14	37.61	48.23
	0:40:00	0.00	0.00	12.35	15.18	17.42	26.04	29.92	34.98	44.82
	0:45:00	0.00	0.00	10.35	12.99	15.03	22.64	25.98	31.21	40.04
	0:50:00	0.00	0.00	8.71	11.21	12.79	20.01	22.93	27.39	35.17
	0:55:00	0.00	0.00	7.54	9.69	11.17	16.80	19.21	23.45	30.07
	1:00:00	0.00	0.00	6.74	8.64	10.09	14.38	16.44	20.53	26.31
	1:05:00	0.00	0.00	6.08	7.76	9.16	12.69	14.49	18.52	23.74
	1:10:00	0.00	0.00	5.12	6.92	8.23	10.83	12.34	15.32	19.59
	1:15:00	0.00	0.00	4.25	5.93	7.39	9.19	10.45	12.53	15.99
	1:20:00	0.00	0.00	3.57	5.03	6.39	7.47	8.47	9.68	12.31
	1:25:00	0.00	0.00	3.17	4.49	5.50	6.11	6.90	7.39	9.37
	1:30:00	0.00	0.00	2.96	4.21	4.95	5.06	5.71	5.91	7.47
	1:35:00	0.00	0.00	2.85	4.03	4.59	4.40	4.96	5.02	6.33
	1:40:00	0.00	0.00	2.78	3.62	4.32	3.97	4.48	4.44	5.58
	1:45:00	0.00	0.00	2.73	3.31	4.13	3.68	4.14	4.05	5.07
	1:50:00	0.00	0.00	2.70	3.08	4.00	3.48	3.92	3.77	4.72
	1:55:00	0.00	0.00	2.35	2.90	3.80	3.35	3.77	3.58	4.46
	2:00:00	0.00	0.00	2.06	2.69	3.45	3.25	3.66	3.45	4.30
	2:05:00	0.00	0.00	1.53	2.00	2.55	2.42	2.73	2.57	3.20
	2:10:00	0.00	0.00	1.12	1.45	1.84	1.75	1.97	1.86	2.31
	2:15:00	0.00	0.00	0.80	1.04	1.32	1.26	1.42	1.35	1.68
	2:20:00	0.00	0.00	0.57	0.73	0.94	0.90	1.01	0.97	1.20
	2:25:00	0.00	0.00	0.39	0.50	0.66	0.63	0.70	0.68	0.84
	2:30:00	0.00	0.00	0.27	0.34	0.45	0.44	0.49	0.47	0.58
	2:35:00	0.00	0.00	0.17	0.23	0.30	0.30	0.33	0.32	0.39
	2:40:00	0.00	0.00	0.10	0.14	0.18	0.18	0.21	0.20	0.24
	2:45:00	0.00	0.00	0.05	0.07	0.09	0.10	0.11	0.10	0.13
	2:50:00	0.00	0.00	0.02	0.03	0.03	0.04	0.04	0.04	0.05
	2:55:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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]
	0.00	0	0.000	0	0.000	0.00
	0.20	2,163	0.050	216	0.005	0.03
	0.40	4,325	0.099	865	0.020	0.04
	0.60	6,488	0.149	1,946	0.045	0.07
	0.80	8,650	0.199	3,460	0.079	0.09
	1.00	10,813	0.248	5,406	0.124	0.11
	1.20	14,768	0.339	7,964	0.183	0.15
	1.40	18,723	0.430	11,313	0.260	0.18
	1.60	22,679	0.521	15,454	0.355	0.20
	1.80	26,634	0.611	20,385	0.468	0.25
	2.00	30,589	0.702	26,107	0.599	0.30
	2.20	31,420	0.721	32,308	0.742	0.34
	2.40	32,251	0.740	38,675	0.888	0.38
	2.60	33,082	0.759	45,208	1.038	0.41
	2.80	33,913	0.779	51,908	1.192	0.43
	3.00	34,744	0.798	58,774	1.349	0.46
	3.20	35,462	0.814	65,794	1.510	1.78
	3.40	36,179	0.831	72,958	1.675	5.75
	3.60	36,897	0.847	80,266	1.843	6.05
	3.80	37,614	0.864	87,717	2.014	6.22
	4.00	38,332	0.880	95,312	2.188	6.39
	4.20	39,072	0.897	103,052	2.366	15.58
	4.40	39,812	0.914	110,940	2.547	32.73
	4.60	40,553	0.931	118,977	2.731	55.55
	4.80	41,293	0.948	127,161	2.919	83.35
	5.00	42,033	0.965	135,494	3.111	115.76
	5.20	42,796	0.982	143,977	3.305	152.59
	5.40	43,559	1.000	152,612	3.503	193.71
	5.60	44,321	1.017	161,400	3.705	239.04
	5.80	45,084	1.035	170,341	3.910	288.54
	6.00	45,847	1.053	179,434	4.119	342.18
	6.20	46,331	1.064	188,652	4.331	399.96
	6.40	46,816	1.075	197,967	4.545	461.88
	6.50	47,058	1.080	202,660	4.652	494.39

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).

Provide all calculations and analyses for culverts, swales, offsite conveyances, TSB spillways, etc.

APPENDIX E – REFERENCE MATERIAL

MDDP AMMENDMENT/PRELIMINARY/FINAL
DRAINAGE REPORT
FOR
STAPLETON DRIVE FROM BANDANERO DR TO US HWY 24
EL PASO COUNTY, COLORADO

November 2009
Revised May 2010

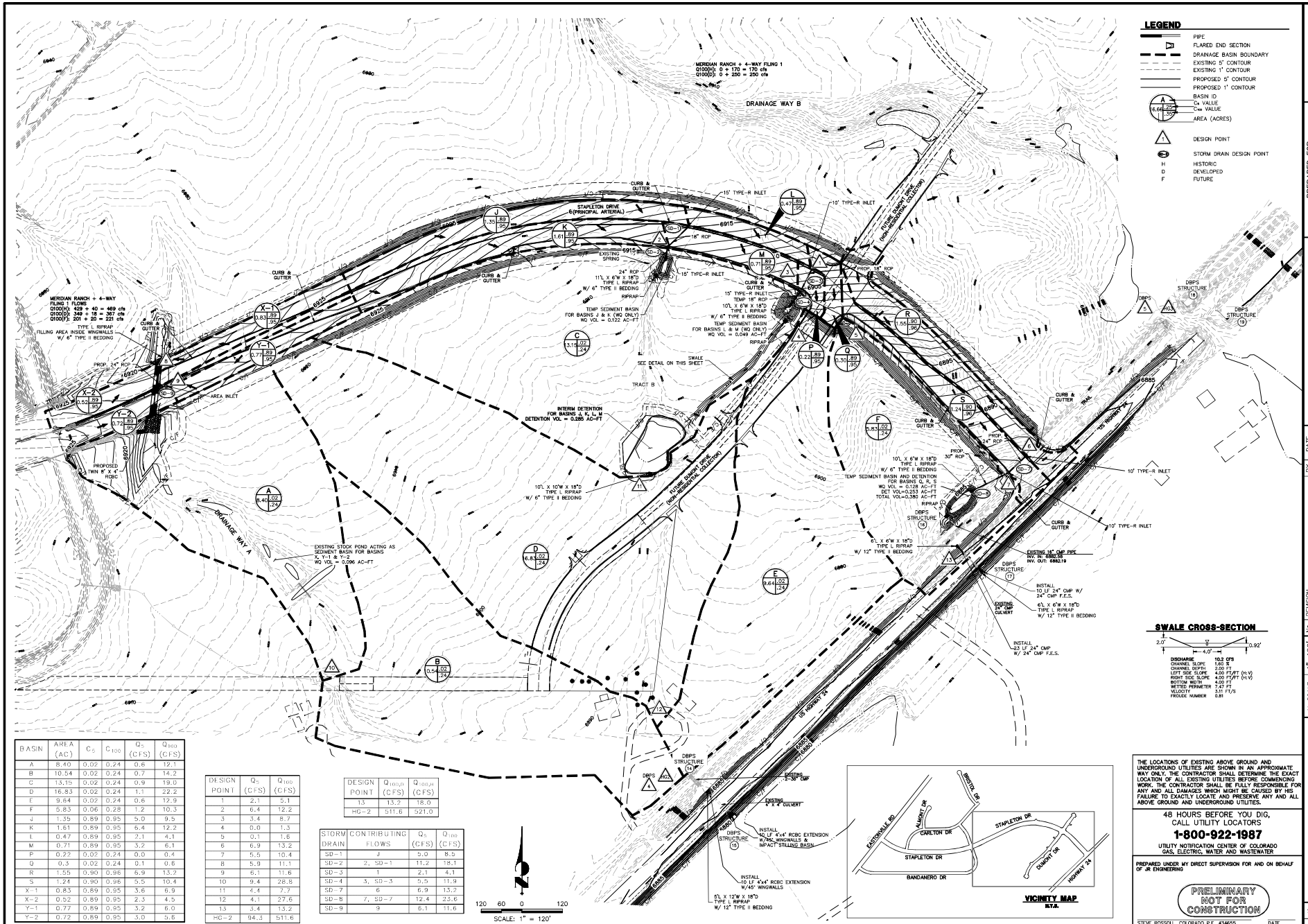
Prepared For:

935 Development, Inc.
PO Box 50223
Colorado Springs CO 80949
(719) 447-8773

Prepared By:

JR ENGINEERING
7200 S Alton Way, Suite C100
Centennial, CO 80112
(303) 740-9393

Job No. 29931.25



BASIN	AREA (AC)	C_5	C_{100}	Q_5 (CFS)	Q_{100} (CFS)
A	8.40	0.02	0.24	0.6	12.1
B	10.54	0.02	0.24	0.7	14.2
C	13.15	0.02	0.24	0.9	19.0
D	16.83	0.02	0.24	1.1	22.2
E	9.64	0.02	0.24	0.6	12.9
F	5.83	0.06	0.28	1.2	10.3
J	1.35	0.89	0.95	5.0	9.5
K	1.61	0.89	0.95	6.4	12.2
L	0.47	0.89	0.95	2.1	4.1
M	0.71	0.89	0.95	3.2	6.1
P	0.22	0.02	0.24	0.0	0.4
Q	0.3	0.02	0.24	0.1	0.6
R	1.55	0.90	0.96	6.9	13.2
S	1.24	0.90	0.96	5.5	10.4
X-1	0.83	0.89	0.95	3.6	6.9
X-2	0.52	0.89	0.95	2.3	4.5
Y-1	0.77	0.89	0.95	3.2	6.0
Y-2	0.72	0.89	0.95	3.0	5.6

DESIGN POINT	Q_5 (CFS)	Q_{100} (CFS)
1	2.1	5.1
2	6.4	12.2
3	3.4	8.7
4	0.0	1.3
5	0.1	1.6
6	6.9	13.2
7	5.5	10.4
8	5.9	11.1
9	6.1	11.6
10	9.4	28.8
11	4.4	7.7
12	4.1	27.6
13	3.4	13.2
HG-2	94.3	511.6

DESIGN POINT	$Q_{100,D}$ (CFS)	$Q_{100,H}$ (CFS)
13	13.2	18.0
HG-2	511.6	521.0

STORM DRAIN	CONTRIBUTING FLOWS	Q_5 (CFS)	Q_{100} (CFS)
SD-1	J	5.0	8.5
SD-2	2, SD-1	11.2	18.1
SD-3	1	2.1	4.1
SD-4	3, SD-3	5.5	11.9
SD-7	6	6.9	13.2
SD-8	7, SD-7	12.4	23.6
SD-9	9	6.1	11.6

THE LOCATIONS OF EXISTING ABOVE GROUND AND UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL ABOVE GROUND AND UNDERGROUND UTILITIES.

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS

1-800-922-1987

UTILITY NOTIFICATION CENTER OF COLORADO
GAS, ELECTRIC, WATER AND WASTEWATER

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

PRELIMINARY NOT FOR CONSTRUCTION

STEVE ROSSOLL, COLORADO P.E. #34655 DATE

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE FOR ANY PURPOSES OTHER THAN THOSE DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
935 DEVELOPMENT, INC.
PO BOX 50223
COLORADO SPRINGS, CO 80949
(719) 447-8773

J·R ENGINEERING
A Westrian Company
7200 S. Alton Way, Suite C100, ●Centennial, CO 80112
303-740-9393 ●Fax: 303-721-0189
www.jrengineering.com

No.	REVISION	BY	DATE
1	Per CDOT Comments	TAB	5/11/10

H-SCALE 1"=120'
V-SCALE N.T.S.
DATE 09/08/08
DESIGNED BY JMA
DRAWN BY TAB
CHECKED BY

4 WAY RANCH COMMERCIAL
STAPLETON ROAD
INTERIM
OVERALL DRAINAGE PLAN

SHEET 1 OF 1
JOB NO. 29931.24

X:\29900000.dir\29931.24\Drawings\Sheet Dwgs\Drainage Report\20100510-13 29931.24.DRP.dwg, 24x36 STAPLETON INTERIM, 5/13/2010 6:49:48 PM, Agnes

APPENDIX F – DRAINAGE MAPS

address offsite basins flowing onto the site

NOTE: ONSITE DRAINAGE BASINS UNAFFECTED BY PROPOSED EARLY GRADING ACTIVITIES WILL NOT BE ANALYZED WITH THIS REPORT.

correct the direction of the flow arrows

Label all existing conveyances and address cross-section, capacity, stability...

Please label the existing ponds shown in the MDDP Amendment (May 2010). You have currently already labeled 3 out of the 5. Also label these other 2.

Show limits of floodplain

Provide design points with all flow information

*PER THE MDDP AMENDMENT/PRELIMINARY/FINAL DRAINAGE REPORT FOR STAPLETON DRIVE FROM BANDERO DR TO US HWY 24

Overlot (standalone) grading isn't typically done with a site development plan. Clarify what this means with a note or delete "overlot".

Label all features or add linetypes to legend

provide sub-basin

Identify retention area, direction of overflow

Call out drainage facilities under HWY 24

Provide DP for flow comparison to proposed pond outfall

Is drainageway obstructed?

Provide total flows also

Provide DP

provide DP with inflows

provide DP with flows released

Add all site-level design points

NT1 1.45

NT2 10.65

NT3 0.87

D 16.83

E 9.64

F 5.83

24" RCP STORM SEWER ℄IN(N): 6911.91 ℄OUT(S): 6908.55

CURB INLET RIM: 6914.94

CURB INLET RIM: 6912.76

24" RCP STORM SEWER ℄IN(N): 6908.55 ℄OUT(S): 6908.50

24" RCP STORM SEWER ℄IN(N): 6900.41 ℄OUT(S): 6900.41

CURB INLET RIM: 6905.11

24" RCP STORM SEWER ℄IN(N): 6900.41 ℄OUT(S): 6899.27

24" RCP STORM SEWER ℄IN(N): 6882.19 ℄OUT(S): 6881.77

CURB INLET RIM: 6885.86

CURB INLET RIM: 6885.04

24" RCP STORM SEWER ℄IN(N): 6881.77 ℄OUT(S): 6881.04

DETENTION POND

15" STEEL OVERFLOW PIPE ℄ 6882.29

15" STEEL OVERFLOW PIPE ℄ 6882.15

OVERLOT PROPOSED DISTURBED AREA

EX DIRT ROAD 8' APPROXIMATE WIDTH

EX DIRT ROAD 10' APPROXIMATE WIDTH

EX GRAVEL ROAD 13' APPROXIMATE WIDTH

EX POND

EX RAVINE

EX DETENTION POND

EX OVERHEAD ELECTRIC

EX 1-STORY WOOD-FRAME BUILDING

UNKNOWN VENTS AND MANHOLES

EDGE OF WATER

EX U.G F.O LINE UNKNOWN SIZE & MATERIAL UNKNOWN OWNERSHIP

STAPLETON DR.

HWY 24

RAVINE

*PER THE MDDP AMENDMENT/PRELIMINARY/FINAL DRAINAGE REPORT FOR STAPLETON DRIVE FROM BANDERO DR TO US HWY 24

DBPS 5 PER THE MDDP AMENDMENT/PRELIMINARY/FINAL DRAINAGE REPORT FOR STAPLETON DRIVE FROM BANDERO DR TO US HWY 24

DBPS 4 PER THE MDDP AMENDMENT/PRELIMINARY/FINAL DRAINAGE REPORT FOR STAPLETON DRIVE FROM BANDERO DR TO US HWY 24

LEGEND:

PROPOSED MAJOR CONTOUR	5250
PROPOSED MINOR CONTOUR	
EXISTING MAJOR CONTOUR	5250
EXISTING MINOR CONTOUR	
PROPOSED STORM DRAIN PIPE	
EXISTING STORM DRAIN PIPE	
PROPERTY LINE	
PROPOSED ROOF	
PROPOSED FLOW DIRECTION	
EXISTING FLOW DIRECTION	
BASIN LINE	
DESIGN POINT	
PROPOSED BASIN LABEL	11 / 1.25 BASIN DESIGNATION / AREA (AC.)

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q5 (cfs)	Q100 (cfs)
NT1	1.45	0	0.5	3.4
NT2	10.65	0	2.8	20.8
NT3	0.87	0	0.3	2.3
D	16.83	0	4.3	31.3
E	9.64	0	2.5	18.2
F	5.83	5	2.6	13.5

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	SQ5 (cfs)	SQ100 (cfs)
1	D,E	6.8	50.1
2	NT1,NT2	3.1	22.6

NORTH

0 100

50

DRAWN BY: SPC JOB DATE: 5/16/2023

APPROVED: CM JOB NUMBER: 2202654

CAD DATE: 10/13/2023

CAD FILE: J:\2022\2202654\CAD\Dwgs\C\Drainage\Early Grading\Ex_Drainage_Map

BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 1" IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

HRGreen

HR GREEN - COLORADO SPRINGS
1975 RESEARCH PARKWAY SUITE 230
COLORADO SPRINGS, CO 80920
PHONE: 719.394.2440
FAX: 713.965.0044

4-WAY COMMERCIAL
KO1515, LLC
EL PASO COUNTY, CO

DRAINAGE PLANS

EXISTING DRAINAGE PLAN

SHEET DNG

1

CALLAHAN, SEAN, 10/13/2023 12:50 PM

4200000366
ACM ALF VIII JV SUB II LLC

address offsite basins flowing onto the site

PR. DRAINAGE SWALE

18" CORRUGATED METAL CULVERT
℄IN(W): 6893.21
℄OUT(E): 6892.62

TEMPORARY SED BASIN A
REFER TO GEC PLAN FOR DETAILS

Diversion of all runoff to this point discharge requires analysis of downstream conveyance.

show outfall pipe location, erosion protection, etc.

PNT1 0.13

PNT2 0.87

TSA 11.46

24" RCP STORM SEWER
℄IN(N): 6911.91
℄OUT(S): 6908.55

CURB INLET
RIM: 6914.94

EX PROPERTY LINE

CURB INLET
RIM: 6912.76

24" RCP STORM SEWER
℄IN(N): 6908.55
℄OUT(S): 6908.50

24" RCP STORM SEWER
℄IN(N): 6901.25
℄OUT(S): 6900.41

CURB INLET
RIM: 6907.25

CURB INLET
RIM: 6905.11

24" RCP STORM SEWER
℄IN(N): 6900.41
℄OUT(S): 6899.27

STAPLETON DR.

Revise, offsite drainage basins draining to site need to be included in the analysis. Revise to include flows in drainage report.

NOTE: ONSITE DRAINAGE BASINS UNAFFECTED BY PROPOSED EARLY GRADING ACTIVITIES WILL NOT BE ANALYZED WITH THIS REPORT.

RT 91 04

24" RCP CATCH BASIN
℄ 6916.22

fix flow arrows

P1.3 0.59

P1.2 0.26

P1.6A 2.72

PNT3 0.56

P1.1 0.78

PRIVATE DRIVE

P1.6B 0.73

FUTURE COMMERCIAL DEVELOPMENT

30" HDPE STUB FOR FUTURE DEVELOPMENT

P1.7A 1.72

P1.9 0.20

P1.7B 0.59

CURB INLET
RIM: 6885.86

CURB INLET
RIM: 6885.04

24" RCP STORM SEWER
℄IN(N): 6882.19
℄OUT(S): 6881.77

24" RCP STORM SEWER
℄IN(N): 6881.77
℄OUT(S): 6881.04

15" STEEL OVERFLOW PIPE
℄ 6882.29

15" STEEL OVERFLOW PIPE
℄ 6882.15

24" RCP OVERFLOW PIPE
℄ 6880.64

24" RCP OVERFLOW PIPE
℄ 6880.42

Please label the existing ponds shown in the MDDP Amendment (May 2010)

5' TYPE-R INLET (PVT)

15" ADS N-12 CULVERT
℄IN(N): 6894.05
℄OUT(S): 6893.68

18" HDPE

5' TYPE-R INLET (PVT)
LP: 6897.16

15" ADS N-12 CULVERT
℄IN(N): 6893.57
℄OUT(S): 6892.59

TYPE-C (PVT)
LP: 6897.18

15" HDPE
LP: 6897.63

LP: 6896.85

30" HDPE

5' TYPE-R INLET (PVT)

24" HDPE STUB FOR FUTURE DEVELOPMENT

LP: 6897.50

PD 14.99

P1.4 1.23

18" HDPE

P1.5 0.64

36" HDPE

24" HDPE

36" HDPE

24" HDPE

Show limits of floodplain

EDGE OF WATER

EX OVERHEAD ELECTRIC

UNKNOWN VENTS

UNKNOWN MANHOLES

18" HDPE

5' TYPE-R INLET (PVT)

P1.10 2.41

P1.8 0.76

LP: 6896.05

5' TYPE-R INLET (PVT)

18" RCP

EX FIBER OPTIC LINE

PE 2.56

TEMPORARY SED BASIN B
REFER TO GEC PLAN FOR DETAILS

Provide DP for pond outfall

Label offsite properties, improvements and easements needed

Diversion of all runoff to this point discharge requires easements and analysis of downstream conveyance to DP1. Note that downstream owner has already notified EPC about ongoing drainage issues from upstream flows.

DBPS 4 PER THE MDDP AMMENDMENT/PRELIMINARY/FINAL DRAINAGE REPORT FOR STAPLETON DRIVE FROM BANDERO DR TO US HWY 24

DBPS 5 PER THE MDDP AMMENDMENT/PRELIMINARY/FINAL DRAINAGE REPORT FOR STAPLETON DRIVE FROM BANDERO DR TO US HWY 24

show flowpath from this outfall

Add a note stating that all rooftop areas are to drain into the site and to the EDB

Show pond easement and access road

This proposed grading in Basin PF is tributary to an existing TSB. In the report text above, please discuss this fact and include analysis of flows

It's not acceptable to develop has much area as is proposed and then only have a TSB. If this partial development will just be an interim condition, build the EDB for this condition. And when doing so, have the ultimate condition in mind to make the pond more easily modifiable (ie: with minimal changes to interim concrete components).

If however, the intent is actually to only do overlot grading at this stage (as is stated in the report text above, please remove everything that is not overlot grading (ie: buildings, parking, storage, etc). And then in that case, leaving this as a TSB would be acceptable.

This EDB is going to as relatively close to the existing drainage way as test borings 3 and 4 that had shallow groundwater. Consider this in regards to the placement and design of this EDB.

Per CDPHE's "Low Risk Discharge Guidance - Discharges of Uncontaminated Groundwater to Land," discharging groundwater to a pond or other SW conveyance is prohibited unless properly permitted through CDPHE. Please review this guidance and the applicable permits. The guidance and permits can be found on CDPHE's website.

See excerpts to the left from MHFD's DCM Volume 2 and 3 for potential concerns with groundwater in an EDB and the recommended mitigation options (like a clay or geomembrane liner). Please discuss this potential shallow groundwater in the report text above. If you decide not to design for mitigation now and shallow groundwater is encountered during or after construction (or at PA/FA), proper mitigation and permitting will need to be implemented at that time

We need to know how much of the proposed area of disturbance (not just the impervious surfaces) is treated vs untreated and if there are any exclusions that apply to the untreated areas. So please create a basic overview map (or modify an existing drainage map) with color shading/hatching that shows areas tributary to each PBMP (pond, runoff reduction, etc.) and those disturbed areas that are not treated by a PBMP, with the applicable exclusion labeled (ex: 20% up to 1ac of development can be excluded per ECM App I.7.1.C.1 and exclusions listed in ECM App I.7.1.B.#). An accompanying summary table on this map would also be very helpful (example provided):

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM DRAIN PIPE
- EXISTING STORM DRAIN PIPE
- PROPERTY LINE
- PROPOSED ROOF
- PROPOSED FLOW DIRECTION
- EXISTING FLOW DIRECTION
- BASIN LINE
- DESIGN POINT
- PROPOSED BASIN LABEL — 11 / 1.25 — BASIN DESIGNATION / AREA (AC.)

PBMP SUMMARY TABLE

BASINS	PBMP TRIBUTARY AREA (AC)	PBMP
A1.1	1.43	RG-A1.1
A3.1	1.87	RG-A3.1
B1,B2	8.60	EDB-B
OA2,A2	0.95	EXCLUDED*

* EXCLUDED BASED ON < 1-ACRE OF DEVELOPED ROADWAY AREA PER ECM APP. I7.C1.a

- **Groundwater**: Shallow groundwater on a site presents challenges for BMPs that rely on infiltration and for BMPs that are intended to be dry between storm events. Shallow groundwater may limit the ability to infiltrate runoff or result in unwanted groundwater storage in areas intended for storage of the WQCV (e.g., porous sub-base of a permeable pavement system or in the bottom of an otherwise dry facility such as an extended detention basin). Conversely, for some types of BMPs such as wetland channels or constructed wetland basins, groundwater can be beneficial by providing saturation of the root zone and/or a source of baseflow. Groundwater quality protection is an issue that should be considered for infiltration-based BMPs. Infiltration BMPs may not be appropriate for land uses that involve storage or use of materials that have the potential to contaminate groundwater underlying a site (i.e., "hot spot" runoff from fueling stations, materials storage areas, etc.). If groundwater or soil contamination exists on a site and it will not be remediated or removed as a part of construction, it may be necessary to avoid infiltration-based BMPs or use a durable liner to prevent infiltration into contaminated areas.

5.12 Linings

Sometimes an impermeable clay or synthetic liner is necessary. Stormwater detention and retention facilities have the potential to raise the groundwater level in the vicinity of the basin. Where there is concern for damage to adjacent structures due to rising ground water, consider lining the basin with an impermeable liner. An impermeable liner may also be warranted for a retention pond where the designer seeks to limit seepage from the permanent pool. Note that if left uncovered, synthetic lining on side slopes creates a serious impediment to egress and a potential drowning hazard. See the Retention Pond Fact Sheet in Volume 3 of the USDCM for guidance and benefits associated with the constructing a safety wetland bench.

Site Selection

EDBs are well suited for watersheds with at least five imperviousness acres up to approximately one square mile of watershed. Smaller watersheds can result in an orifice size prone to clogging. Larger watersheds and watersheds with baseflows can complicate the design and reduce the level of treatment provided. EDBs are also well suited where flood detention is incorporated into the same basin. The depth of groundwater should be investigated. Groundwater depth should be 2 or more feet below the bottom of the basin in order to keep this area dry and maintainable.

- Design foundation drains and other groundwater drains to bypass the water quality plate directing these drains to a conveyance element downstream of the EDB. This will reduce baseflows and help preserve storage for the WQCV.

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q5 (cfs)	Q100 (cfs)
TSA	11.46	0	3.1	13.5
PNT1	0.13	0	0.0	0.3
PNT2	0.87	0	0.2	1.7
PNT3	0.56	0	0.2	1.4
PD	14.99	0	3.8	27.8
PE	2.56	0	0.7	4.8
PF	2.73	12	1.7	6.9
P1.1	0.78	100	3.1	5.6
P1.2	0.26	100	1.1	2.0
P1.3	0.59	68	1.9	3.9
P1.4	1.23	98	5.5	9.9
P1.5	0.64	100	3.0	5.3
P1.6A	2.72	0	0.8	5.9
P1.6B	0.73	96	3.1	5.7
P1.7A	1.72	0	0.5	3.9
P1.7B	0.59	95	2.5	4.6
P1.8	0.76	100	3.2	5.7
P1.9	0.20	100	0.9	1.7
P1.10	2.41	46	5.5	12.8

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	SQ5 (cfs)	SQ100 (cfs)
1	PD,PE	4.3	31.4
2	PNT1,PNT2	0.2	1.7
3.1	P1.3	3.1	5.6
3.2	P1.2,DP3.1	4.2	7.4
3.3	P1.3,DP3.2	5.8	10.8
3.4	P1.4,DP3.3	10.4	19.0
3.5	P1.5,DP1.4	8.4	15.2
3.6	P1.6A,P1.6B	4.0	5.7
3.7	P1.7A,P1.7B	3.0	8.4
3.8	P1.9,DP3.6	4.9	17.6
3.9	DP3.7,DP3.8	8.3	28.8
3.10	P1.8	3.1	5.6
3.11	DP3.9,DP3.10	10.8	23.6
3.12	DP3.5,DP3.11	27.6	53.9
4	TSA	3.1	13.5

DRAWN BY: SPC
APPROVED: CM
CAD DATE: 10/13/2023
CAD FILE: J:\2022\2202654\CAD\Dwgs\C\Drainage\Pr_Drainage_Map
JOB DATE: 5/16/2023
JOB NUMBER: 2202654

BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

HR GREEN - COLORADO SPRINGS
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COMMERCIAL

EL PASO COUNTY, CO

DRAINAGE PLANS

PROPOSED DRAINAGE PLAN

SHEET DNG 2

HR GREEN Xrefs: xc-dsgn-2564; xc-row-2564; xv-dsgn-2564; xv-row-2564; xv-utl-2564; xgr1-dh01r-2654; drain_map_legend