MASTER DEVELOPMENT DRAINAGE PLAN

FOR

ENCLAVES AT MOUNTAIN VISTA EAST

December 2022

Prepared for:

Challenger Building
8605 Explorer Drive, Ste #250
Colorado Springs, CO 80920

Prepared by:

212 N Wahsatch Ave, Ste 305
Colorado Springs, CO 80903
(719) 955-5485

Project #29-010

MASTER DEVELOPMENT DRAINAGE PLAN FOR ENCLAVES AT MOUNTAIN VISTA EAST

DRAINAGE REPORT STATEMENTS

ENGINEER'S STATEMENT

This report and plan for the drainage design of Enclaves at Mountain Vista East was prepared under my supervision and is correct to the best of my knowledge and belief. Said drainage report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

COLORADO REGISTERED VIRGIL A. SANCHEZ 37160 12/07/22 PROFESSIONAL ENGINEER

Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc

DEVELOPER'S STATEMENT

Challenger Building hereby certifies that the drainage facilities for Enclaves at Mountain Vista East, shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to Section 7.7.906 of the City Code; and cannot, on behalf of the Enclaves at Mountain Vista East, guarantee that final drainage design review will absolve Challenger Building and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

BY: _____ DATE: 9/23/22

TITLE: Developer

ADDRESS: Challenger Building
8605 Explorer Drive, Ste 250
Colorado Springs, CO 80920

CITY OF COLORADO SPRINGS

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs} 2001, as amended,

BY: _____ DATE: _____

For the City Engineer

CONDITIONS:

MASTER DEVELOPMENT DRAINAGE PLAN FOR ENCLAVES AT MOUNTAIN VISTA EAST

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MASTER DEVELOPMENT DRAINAGE PLAN FOR ENCLAVES AT MOUNTAIN VISTA EAST

PURPOSE

This document is intended to serve as the Master Development Drainage Plan for Enclaves at Mountain Vista East. The parcel is currently zoned by El Paso County as PUD PK SS AO, PUD R5/CR R1-6 SS AO, and R5/CP PBC/CR R1-6 PU with plans to rezone to mixed-use PUD. Upon rezone, the proposed principal uses for the site is anticipated to be commercial, multi-density residential, and parks and open space. The primary purpose of this report at this time is provide ample information to support the master plan and concept plan amendment and to establish concept drainage infrastructure ensure that post development runoff can be routed through the site safely and in a manner that satisfies the requirements set forth by the El Paso County and City of Colorado Springs Drainage Criteria Manual. Preliminary and final drainage reports shall be required with a submittal of the final plat and an amendment to this document is likely upon determination of a site specific development plan.

It is important to note that at the time of the writing of this report, the preliminary design for Marksheffel Roadway and the offsite parcels to the north of the site were being evaluated by other consultants. Discussions with the City of Colorado Springs and the adjacent property owners and their consultants regarding the proposed drainage patterns, infrastructure, outfall(s) and water quality treatment and detention storage for these areas are ongoing and may be furthered by this report with its subsequent resubmittal. Final Drainage Reports will be required for the development of each portion of this project.

GENERAL LOCATION AND DESCRIPTION

Enclaves at Mountain Vista East is located east of the intersection of Marksheffel Road and Barnes Road, that is located in the south half (S 1/2) of Section 21, the southwest quarter of the southwest quarter (SW 1/4, SW 1/4) of Section 22, the northwest quarter of the northwest quarter (NW 1/4, NW 1/4) of section 27, and the north half of the northeast quarter (N 1/2, NE 1/4) of Section 28, Township 13 South, Range 65 West of the 6th Principal Meridian, Colorado Springs, El Paso County, Colorado.

The site is bound on the north by unplatted land owned by the City of Colorado Springs – Rec. No. 96020361 and by unplatted land owned by BLH No. 2 LLC (Rec. Nos. 214104176, 214104176, 211026733), to the east by unplatted land owned by BLH No. 1 LLC (Rec. Nos. 2214104174, to the south by unplatted land owned by BLH No. 1 LLC (Rec. No. 215057836) and BLH No. 2 LLC (Rec. No. 214101175) as well as portions of Enclaves at Mountain Vista Ranch Filing No. 6 (Rec No. 220714553) and unplatted Land owned by the Falcon Trucking Company (Rec No. 96020361) and the City of Colorado Springs. The site is bound to the west by the East Fork Sand Creek sub-tributary whose revised limits are currently being dedicated to the City of Colorado Springs from Challenger Communities with the recordation of Enclaves at Mountain Vista Filing No.7 subdivision.

The parcel is located within the Sand Creek Drainage Basin. Drainage flows from this site are tributary East Fork Sand Creek Sub-tributary (EFSCST) which discharges into Sand Creek.

Enclaves at Mountain Vista East consist of 184.292 acres and is presently undeveloped. Vegetation is sparse, consisting of native grasses. Existing site terrain generally slopes from north to south with existing slopes generally vary between 1 and 10%. A portion of the site, east of the existing channel was

utilized as a dirt "borrow" site to provide earthen material for the construction of the existing Enclaves developments located to the west of the channel.

There are existing large overhead electric lines which parallel the west leg of the site and also run north and south along the east bank of the existing channel. An 18" sanitary sewer line runs parallels to the EFSCST. Existing gas, water and fiber optic water lines run along the west side of the site adjacent to existing Marksheffel Road. Existing sanitary sewer and water lines run under existing graphite drive along the west boundary of the site. Existing sanitary and waterline stubs are provided within the street terminus of the adjacent Enclaves at Mountain Vista Ranch Filings No. 6 and a waterline stub also crosses the existing channel along the southern boundary of the site from Enclaves at Mountain Vista Ranch Filing No. 7 subdivision.

There are no known irrigation facilities on site.

The proposed development for the site include paved streets, sidewalks, single-family homes, Townhomes, commercial buildings, full spectrum detention ponds, and wet/dry utilities as normally constructed for those land uses. A total of Seven (7) full spectrum detention ponds are anticipated to be necessary to provide water quality treatment and detention for the proposed development.

The portion of the development immediately adjacent to the East Fork Sand Creek Sub-tributary is within the Streamside Overly Zone, thus poses possible impacts on streamside vegetation filtration, stream canopy cover, and soil erosion. To remain in compliance and maintain normal water conditions for the stream, several measures will be taken. Swales consisting of landscape vegetation will be used throughout the site for the purpose of runoff water filtration. Slope conditions and residual ground cover will remain similar to that under normal conditions. In addition, water released from the site to the stream, will be released at a rate similar to that under normal conditions in order to minimize soil erosion. Canopy cover and shade conditions for the stream will not be altered by site development.

WETLANDS

There are no apparent wetlands within the boundary of this project, as it is mostly outside of the existing 100-year floodplain. The design of the channel improvements for the EFSCST that proceed this report confirmed that no wetlands were present within the existing floodplain area. (See Appendix)

CHANNEL IMPROVEMENTS

The proposed project is adjacent to the East Fork Sand Creek Sub-tributary (EFSCST) drainageway. In accordance with the Sand Creek Drainage Basin Planning Study (DBPS) channel improvements are required as a part of the overall development. (Refer to Proposed Drainage Characteristics Section of this report for additional discussion). The construction of the channel improvements have been completed south of Barnes Road and are in the process of City inspection. The construction plans and design report for the box culvert (at the Barnes Road crossing) and transitions upstream and downstream of the box culvert and coordination with FEMA are ongoing at the time of writing this report (December 2022).

SOILS

Soils in the study area where delineated using "Web Soil Survey", a web-based soil database provided by the U.S. Department of Agriculture (USDA)'s, Natural Resources Conservation Service. Soils for this

project are delineated by the map in the appendix as Blakeland Loamy Sand (8), Blendon Sandy Loam (10), Bresser Sandy Loam (12), and Truckton Sandy Loam (97). The soil types have been characterized as Hydrologic Soil Types "A" and "B". An exhibit within the appendix has been provided which illustrates these descriptions and classifications.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Urban Storm Drainage Criteria Manual. The Rational Method was used to estimate storm water runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the City of Colorado Springs Storm Drainage Design Criteria manual. The relevant data sheets are included in the Appendix of this report. Detailed hydraulic calculations, including HGLs, inlet sizing, and swale calculations will be included in subsequent Final Drainage Report(s).

FLOODPLAIN STATEMENT

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0543 G, effective date December 7, 2018, the site DOES lie within a flood zone. An annotated FIRM Panel is included in the Appendix with an outline of the project site.

In 2021-2022 channel improvements along the lines of those recommended by the Sand Creek Drainage Basin Planning Study (SCDBPS), were required as a portion of the development of Enclaves at Mountain Vista Filing No.7 which functioned to alter the existing floodplain.

As a portion of the project a FEMA Conditional Letter of Map Revision (CLOMR) application (FEMA Case Number 21-08-0133R) was submitted to FEMA and approved on July 14th of 2021 to allow for the installation of approximately 3200' of constructed natural channel that bounds the subject site.

The construction of proposed Barnes Road, proposed box culvert and associated transitions will once again alter the existing floodplain. As such, an additional CLOMR will be required for channel improvements associated with the road crossing. The 100 year effective and proposed floodplains have been provided on the Proposed Conditions Drainage Map, which is provided in the appendix of this report

This analysis completed by Wilson &Company, Inc. set the FEMA effective 100 year flow rate of 1,150 cfs for the subject reach.

DRAINAGE CRITERIA

This drainage analysis has been prepared in accordance with the current City of Colorado Springs Drainage Criteria Manual (last revised January 2021). Calculations were performed to determine runoff quantities for the 5-year and 100-year frequency storms for developed conditions using the Rational Method as required for basins having areas less than 100 acres. See Appendix for calculations.

EXISTING DRAINAGE CONDITIONS

The existing undeveloped parcel consists of sparsely vegetated native grassland consistent with common agricultural grazing land. Refer to the "Existing Conditions Drainage Map" in the "Drainage Maps" Appendix. The site is bisected by an existing channel for the purposes of this report will function to separate the subject site into and eastern and western halves. The western half of the site is impacted by offsite undeveloped watershed located to the north of future Barnes roads. Grades to the west/southwest range between 2 and 10%. A very small segment of the existing property drains to the Marksheffel corridor as sheet flow which enters the falcon trucking site. While the remainder of the west side of the site is split between minor flows entering the east half of the "Falcon Trucking" property (Southeast Corner of Barnes and Marksheffel Road) and EMV Filing No.6, while the larger segment of future roadway and residential development is diverted by an earthen swale which directs much of the offsite flows to the adjacent channel via the Enclaves Filing No.7 storm sewer improvements and full spectrum detention facility.

The eastern segment of the property is divided by a ridgeline which separates runoff that drains directly to the EFSCST from runoff which is conveyed south overland. Grades on the embankment slopes range between 2 and 20%, while atop the embankment slopes, the grade flattens somewhat typically ranging between 0.5 and 10%. Runoff developed on the plateau are conveyed to south boundary where discharge at three natural swales. Flows leaving the site eventually tie back into with flows conveyed to the EFSCST due to an existing railroad embankment. There are no formal drainage improvements in these undeveloped areas.

The existing EFSCST channel within the project reach drains north to south. In May of 2021, the City of Colorado Springs approved Wilson & Company's design for the Enclaves at Mountain Vista Sand Creek East Fork Sub-tributary Channel Project which functioned to flatten approximately 3180 feet of EFSCST by flattening the channel profile from its existing 1.2% to the design gradient of 0.2% by constructing seven (7) grouted boulder drop structures. The typical section of channel between the drop structures included a low flow bottom, 25 foot wide and 1.5 foot deep with 4:1 low flow side slopes and 25 foot overbank widths on either side of the low flow section of the channel. The overbanks sloped to the center of the channel at 50:1. The channel outer banks were sloped at 4:1. Construction of these improvements had been completed in early summer of 2022; a LOMR for the improvements is anticipated to be approved in early 2023.

Existing Conditions Detailed Drainage Discussion

Design Point 1

Offsite 14.85-acre **Basin E1** (Q5=3.3 cfs, Q100=24.4 cfs) and onsite 20.23-acre **Basin E2** (Q5=4.7 cfs, Q100=34.2 cfs) are native grassed, undeveloped, west-facing hillside lands and floodplain fringe located just to the east of the EFSCST. The combined runoff from the two basins is conveyed via an earthen swale to **DP1 (**Q5=6.0 cfs, Q100=44.2 cfs) where flows reach the channel via the embankment of a grouted boulder drop structure.

Design Point 2

Basin E3 consists of approximately 5.71 acres of native grassed, undeveloped, west-facing hillside lands and floodplain fringe located just to the east of the EFSCST. Sheet flow runoff from the basin (Q5=1.6

cfs, Q100=11.9 cfs) is conveyed via an earthen swale to **DP2 (**Q5=1.6 cfs, Q100=11.9 cfs) where flows reach the channel via the embankment of a grouted boulder drop structure.

Design Point 3

Basin E4 consists of approximately 3.78 acres of native grassed, undeveloped, west-facing hillside lands and floodplain fringe located just to the east of the EFSCST. Sheet flow runoff from the basin (Q5=1.0 cfs, Q100=7.7 cfs) is conveyed via an earthen swale to **DP3 (**Q5=1.0 cfs, Q100=7.7 cfs) where flows reach the channel via the embankment of a grouted boulder drop structure.

Design Point 4

Basin E5 consists of approximately 10.47 acres of native grassed, undeveloped, west-facing hillside lands and floodplain fringe located just to the east of the EFSCST. Sheet flow runoff from the basin (Q5=2.6 cfs, Q100=19.3 cfs) is conveyed via an earthen swale to **DP4 (**Q5=2.6 cfs, Q100=19.3 cfs) where flows reach the channel via the embankment of a grouted boulder drop structure.

Design Point 5

Basin E6 consists of approximately 4.99 acres of native grassed, undeveloped, west-facing hillside lands and floodplain fringe located just to the east of the EFSCST. Sheet flow runoff from the basin (Q5=1.3 cfs, Q100=9.7 cfs) is conveyed via an earthen swale to **DP5 (**Q5=1.3 cfs, Q100=9.7 cfs) where flows reach the channel via the embankment of a grouted boulder drop structure.

Design Point 6

Basin E7 consists of approximately 5.94 acres of native grassed, undeveloped, west-facing hillside lands and floodplain fringe located just to the east of the EFSCST. Runoff from the basin (Q5=1.5 cfs, Q100=11.0 cfs) sheet flows to the existing channel **DP6 (**Q5=1.5 cfs, Q100=11.0 cfs).

Basins E1-E7 are all partially bisected by an 18" CSU sanitary sewer line and accompanying 75' utility easement, a maintenance and access road, and a high voltage overhead electric line and 100' utility easement that generally parallel the channel.

Design Point 7

Offsite 33.82-acre **Basin E8** (Q5=6.3 cfs, Q100=46.5 cfs) and onsite 39.03-acre **Basin E9** (Q5=5.1 cfs, Q100=37.1 cfs) are native grassed, watersheds located in central portion of the eastern side of the site. The combined runoff from the two basins is conveyed via a naturally occurring wide earthen swale to **DP7 (**Q5=7.4 cfs, Q100=54.2 cfs) at the southern boundary of the site. Runoff continues offsite, where it's redirected to the east by a railroad embankment before returning to the EFSCST.

Design Point 8

Offsite 20.28-acre **Basin E10** (Q5=4.2 cfs, Q100=31.1 cfs) and 8.43-acre onsite **Basin E11** (Q5=2.0 cfs, Q100=14.6 cfs) are native grassed, watersheds located in eastern side of the site. The combined runoff from the two basins is conveyed via a naturally occurring wide earthen swale to **DP8 (**Q5=2.1 cfs, Q100=39.9 cfs).

Design Point 9

Basin E12 consists of approximately 39.47 acres of native grassed, undeveloped land located within the south-central portion of the site. Runoff from the basin (Q5=9.5 cfs, Q100=48.9 cfs) combines with flows from **DP8** within a naturally occurring wide earthen swale that conveys flows to the southern

boundary at **DP9 (**Q5=9.1 cfs, Q100=66.5 cfs). Runoff continues offsite, where it's redirected to the east by a railroad embankment before returning to the EFSCST.

Design Point 10

Offsite 4.42-acre **Basin E13** (Q5=1.2 cfs, Q100=7.0 cfs) and 1.40-acre onsite **Basin E14** (Q5=0.3 cfs, Q100=2.3 cfs) are native grassed, watersheds located along the eastern side of the site. The combined runoff from the two basins is conveyed to the eastern boundary and discharged offsite via a naturally occurring wide earthen swale to **DP10 (**Q5=1.1 cfs, Q100=8.3 cfs). Runoff continues offsite, where it's eventually redirected back to the east by a railroad embankment and returned to the EFSCST.

Design Point 11

Onsite 1.48-acre **Basin E15** (Q5=0.4 cfs, Q100=2.8 cfs) and onsite 24.51-acre **Basin E16** (Q5=4.9 cfs, Q100=36.2 cfs) are native grassed, watersheds located along the eastern side of the site. The combined runoff from the two basins is conveyed via a naturally occurring wide earthen swale to **DP11 (**Q5=4.6 cfs, Q100=33.4 cfs) at the southern boundary of the site. Runoff continues offsite, where it's redirected to the east by a railroad embankment before returning to the EFSCST.

Design Point 12

Offsite 0.56-acre **Basin W1** (Q5=0.1 cfs, Q100=1.1 cfs) and onsite 1.53-acre **Basin W2** (Q5=0.4 cfs, Q100=3.3 cfs) are native grassed, undeveloped lands located east of Marksheffel along the west end of the site. The combined runoff from the two basins is discharged as sheet flow at **DP12 (**Q5=0.5 cfs, Q100=3.9 cfs).

Design Point 13

Onsite 0.87-acre **Basin W3** (Q5=0.3 cfs, Q100=2.1 cfs) is native grassed, undeveloped lands located north of the unplatted Falcon Trucking Filing No.1 parcel along the west end of the site. Flows discharge as sheet flow are collected by an existing temporary swale located along the west edge of the Enclaves Filing No. 5 and 6 Filings at **DP13 (**Q5=0.3 cfs, Q100=2.1 cfs).

Design Point 14

Onsite 1.00-acre **Basin W4** (Q5=0.3 cfs, Q100=2.4 cfs) is native grassed, undeveloped lands located north of the Enclaves at Mountain Vista Filing No. 6 parcel along the west end of the site. Flows discharge as sheet flow to a tract of land north of Filing 6 at **DP14 (**Q5=0.3 cfs, Q100=2.4 cfs).

Design Point 15

Offsite 19.36-acre **Basin W5** (Q5=4.5 cfs, Q100=32.8 cfs) and 4.51-acre onsite **Basin W6** (Q5=0.9 cfs, Q100=6.5 cfs) are native grassed watersheds located up-gradient and along the central portion of the side of the site. The combined runoff at **DP15 (**Q5=5.2 cfs, Q100=38.0 cfs) from the two basins is conveyed via a temporary earthen swale constructed during the construction of EMV Filing 6.

Design Point 16

Offsite **Basin W7** (Q5=5.1 cfs, Q100=37.5 cfs) consists of approximately 24.49 acres of native grassed, undeveloped land located north of the subject site and west of the EFSCST. Onsite **Basin W8** (Q5=9.2 cfs, Q100=36.2 cfs) consists of approximately 18.66 acres that consists of developed lots located within the northern portion of Enclaves at Mountain Vista Filing No. 6 and pastureland located north of the development. The combined runoff from **Basins W7, W8** and **DP 15** (Q5=5.2 cfs, Q100=38.0 cfs) culminate at **DP16**, an existing full spectrum detention pond (Pond 401). Flows released from the existing

full spectrum pond to the EFSCST thru the existing 24" RCP are approximated at Q5=13.3 cfs, Q100=76.8 cfs.

Design Point 17

Offsite 1.68-acre **Basin W9** (Q5=0.4 cfs, Q100=2.9 cfs) and 3.47-acre onsite **Basin W10** (Q5=0.7 cfs, Q100=5.1 cfs) are native grassed, watersheds located along the eastern side of the site. Runoff from **DP17** (Q5=1.0 cfs, Q100=7.5 cfs) is conveyed via an earthen swale to **DP5 (**Q5=1.3 cfs, Q100=9.7 cfs) where flows reach the channel via the embankment of a grouted boulder drop structure.

FOUR STEP PROCESS

The following steps shall be utilized with the proposed developments within the Master Plan of Enclaves at Mountain Vista Ranch East. All future Final Drainage (FDR) reports will be required to meet all current City of Colorado Springs Criteria associated with the Four Step Process at the time of writing of each FDR.

Step 1 Employ Runoff Reduction Practices. Whenever possible roof drains will be directed to vegetated landscaping buffer areas and islands prior to release to streets aiding in minimizing direct connection of impervious surfaces. Runoff Reduction (UD-BMP v.3.07, or most current) worksheets for determining the effective impervious area and water quality reduction values will be required within subsequent drainage reports.

Step 2 Implement Control Measures (CM) that provide a water quality capture volume with slow release. – Several Full Spectrum Detention basins are being proposed across the site to collect and treated developed runoff. This facility will restrict discharge rates to predevelopment rates and slowly release the Water Quality volume over 40 hours and the EURV storm event over 72 hours. Future Final Drainage Reports will be required to meet all current City Criteria associated with the Four Step Process at the time the writing of those individual reports.

Step 3 Stabilize streams. The proposed project is anticipated to construct improvements to the East Fork Sand Creek Sub-tributary which are to include the installation of a concrete box culvert; soil riprap lined embankments and grouted boulder drop structures at the future crossing of Barnes Road. These improvements will function to protect the roadway and limit erosion.

The developer of Enclaves East, at the time of the writing of this report, has constructed channel improvements south of Future Barnes in accordance with the Sand Creek DBPS (which includes channel lining and drop structures) that protect the west boundary of Enclaves East development. Refer to Enclaves at Mountain Vista Sand Creek East Fork Subtributary Channel Project – Channel Design Report and Plans by Wilson & Company dated December 2020 for additional details.

It should be noted that the minor increases to the amount of frequent discharge to the downstream tributaries, provided by the subject site and adjacent developments should be of benefit by providing water to existing vegetation which provides habitat and functions to stabilize the existing channel banks and channel bed.

Step 4 Implement site specific and other source control CM. – The proposed development will implement a Stormwater Management Plan including property housekeeping practices and spill containment procedures. Material storage (such as backfill stockpiles or landscape materials), during construction are to be located away from drainage facilities. Designated Fueling areas and trash enclosures are to be placed in locations where they can be easily source.

PROPOSED DRAINAGE CHARACTERISTICS

General Concept Drainage Discussion

The proposed drainage plan evaluates proposed flow patterns and recommends infrastructure and facility sizing for the project based upon conceptual grading for commercial, multi-family and single-family residential development. The development planned for the site is anticipated to include asphalt and curb and guttered roadways, parking lots, retaining walls, and building structures consistent with single and multifamily residential and commercial development. In addition to open space and landscaping seven full spectrum detention and water quality ponds are anticipated to be constructed.

The proposed site will continue to mimic existing general drainage patterns with proposed drainage being directed to the south and when applicable to the adjacent improved channel. Conceptual storm sewer main lines have been extended to areas for collection of runoff and directed to the FSD ponds. The construction of a concrete box culvert and riprap protection will be constructed to convey runoff underneath proposed Barnes Road. Facilities at the far west end of the project are anticipated to be completed by others (City improvements to Marksheffel Road and Barnes Road intersection) and discussion is ongoing at the time of the writing of this report. Refer to the "Proposed Conditions Drainage Map" in the "Drainage Map" Appendix.

Proposed Conditions Detailed Drainage Discussion

Design Point 1

Offsite 33.82-acre **Basin E1** (Q5=6.4 cfs, Q100=47.2 cfs) consists of undeveloped pastureland covered with sparse native grasses which is located to the north of proposed Barnes Road east of the high voltage overhead power lines and easement. A proposed 36" storm drain (**PR1**) is recommended to be extended under the roadway to collect flows from the offsite watershed at **DP1** (Q5=6.4 cfs, Q100=47.2 cfs). An easement from the adjacent property owner may be necessary to construct the improvement should it need to extend outside the rights of way. Future development of the offsite area will require a detention facility to restrict flows to the predevelopment levels.

Design Point 2

Offsite 24.70-acre **Basin E2** (Q5=4.3 cfs, Q100=31.3 cfs) consists of undeveloped pastureland covered with sparse native grasses which is located to the north of proposed Barnes Road and the northeast corner of the subject site. Runoff from the watershed is recommended to be collected and conveyed by a berm/swale to a localized low point along the northern embankment of proposed Barnes Road. A proposed 30" storm drain (**PR2**) is recommended to be extended under the roadway to collect flows from the offsite watershed at **DP2** (Q5=4.3 cfs, Q100=31.3 cfs). A public proposed 42" sewer (**PR3**) will collect the combined runoff carried within **Pipes Runs 1** and **2** (Q5=10.1 cfs, Q100=74.2 cfs). An easement from the adjacent property owner may be necessary to construct the improvement should it need to extend outside the rights of way. Future development of the offsite area will require a detention facility to restrict flows to the predevelopment levels.

Design Point 3

Basin E3 (Q5=26.7 cfs, Q100=50.0 cfs) consists of 8.34 acres of proposed Barnes Road right-of-way. A proposed 36" storm drain (**PR4**) Q5=26.7, Q100=50.0, is recommended to be extended under the roadway to collect flows reaching the low point.

Design Point 4

Basin E4 (Q5=40.6 cfs, Q100=74.0 cfs) a 10.41-acre parcel which is to be developed into commercial property or detached multi-family residential use. Runoff from this basin shall be conveyed to a proposed full spectrum detention pond where it combines with the flows conveyed within **PR4**. The total peak runoff anticipated to reach **FSD Pond 1** at **DP4** is Q5 =61.2 cfs, Q100 =112.9 cfs. The private full spectrum detention pond will discharge runoff at predevelopment flow rates and drain the water quality volume and excess urban runoff volume over 40 hours and 72 hours respectively. A proposed 24" storm drain will convey the peak flows released from the pond (**PR5**) of 0.8 cfs and 21.6 cfs in the 5-year and 100-year events respectively. Flows discharged from the pond and **PR3** continue south underground via a 42" storm drain (**PR6**) at Q5 =8.5 cfs and Q100 =84.1 cfs. Refer to the drainage facility design section of the report for additional information regarding the facility.

Design Point 5

Basin E5 (Q5=33.7 cfs, Q100=75.4 cfs) consists of approximately 20.10 acres of future single family residential property and roadways planned for southeastern side of the subject site. Runoff produced by the basin will be directed to a proposed full spectrum detention pond located just up-gradient to the southern boundary. The total peak runoff anticipated to reach **FSD Pond 2 at DP5** is Q5 = 33.7 cfs, Q100 = 75.4 cfs. The private full spectrum detention pond will discharge to predevelopment flow rates and drain the water quality volume and excess urban runoff volume over 40 hours and 72 hours respectively. Refer to drainage facility design section of the report for additional information regarding the proposed facility.

Design Point 6

A proposed 18" storm drain will convey the flows released from the **FSD Pond 1** (**PR7**) at peak rates of 0.6 cfs and 11.6 cfs in the 5-year and 100-year events respectively. Existing condition flow rates at this location were determined to be 4.6 cfs and 33.4 cfs in the 5 and 100-year events respectively.

Design Point 7

Basin E6 (Q5=35.0 cfs, Q100=78.3 cfs) consists of approximately 22.41 acres of future single family residential property and roadways planned for southeastern side of the subject site. Runoff produced by the basin will be directed to a proposed full spectrum detention pond located just up-gradient to the southern boundary. The total peak runoff anticipated to reach **FSD Pond 3 at DP7** is Q5 = 35.0 cfs, Q100 = 78.3 cfs. The private full spectrum detention pond will discharge runoff at predevelopment flow rates and drain the water quality volume and excess urban runoff volume over 40 hours and 72 hours respectively. Refer to drainage facility design section of the report for additional information regarding the proposed facility.

Design Point 8

A proposed 18" storm drain will convey flows released from the **FSD Pond 3** (**PR8**) at peak rates of 0.8 cfs and 16.7 cfs, where they will combine with flows conveyed in **PR6** (Q5=8.5 cfs, Q100=84.1 cfs) from **Pond 1**. The total combined flow to be released at the southern boundary through **PR9,** at **DP8,** has been estimated at 8.3 cfs and 92.3 cfs in the 5-year and 100-year events respectively. Existing condition release at this location was determined to be 9.1 cfs and 66.5 cfs in the 5-year and 100-year events respectively. It should be noted that the installation of the planned offsite detention facilities, located to the north of Barnes, could likely further reduce flows reaching this location especially in the minor storm events.

When directly added this brings the total flow discharged at the southern property line in the existing condition (**DP 7, 9** and **11**) from 21.1 cfs and 154.1 cfs, down to 8.9 cfs and 103.9 cfs in the developed condition (**DP 6** and **8**) in the 5 and 100-year events respectively (net change of negative -12.2/-50.2).

Discussion with the property owner to the south of the site will be necessary to understand the timing for constructing the storm sewer outfalls, drainage and grading easement acquisition.

Design Point 9

Basin E7 (Q5=25.5 cfs, Q100=57.2 cfs) consists of approximately 15.63 acres of future single family residential property and roadways planned along the northern boundary of the subject site. A proposed 36" storm sewer main (**PR10**) has been extended into the area to collect the flow at **DP9** (Q5=25.5 cfs, Q100=57.2 cfs).

Design Point 10

Basin E8 (Q5=24.5 cfs, Q100=54.8 cfs) consists of approximately 15.79 acres of future single family residential property and roadways planned along the northern boundary of the subject site. A proposed 36" storm sewer main (**PR11**) has been extended into the area to collect the flow at **DP10** (Q5=24.5 cfs, Q100=54.8 cfs). A proposed 48" sewer (**PR12**) will collect the combined runoff carried within **Pipes Runs 10** and **11** at peak flow rates of Q5 =48.4 cfs, Q100 =108.4 cfs.

Design Point 11

Basin E9 (Q5=59.0 cfs, Q100=132.0 cfs) consists of approximately 39.03 acres of future single family residential property and roadways planned within the central portion of the subject site. A proposed 48" storm sewer main (**PR13**) has been extended into the area to collect the flow at **DP11** (Q5=59.0 cfs, Q100=132.0 cfs). A proposed 60" sewer (**PR14**) will collect the combined runoff carried within **Pipe Runs 12** and **13** at peak flow rates of Q5 =105.7 cfs, Q100 =236.5 cfs.

Design Point 12

Basin E10 (Q5=36.3 cfs, Q100=83.5 cfs) consists of approximately 23.15 acres of future single family residential property and roadways planned for southwest side of the subject site on the east side of the channel. This basin houses an existing overhead power line and utility easement. Runoff produced by the basin will be directed to a proposed full spectrum detention pond located just up-gradient to the southern boundary, where combines with runoff conveyed by **PR14.** The total peak runoff anticipated to reach **FSD Pond 4 at DP12** is Q5 =150.9 cfs, Q100 =340.0 cfs. The private full spectrum detention pond will discharge runoff at predevelopment flow rates and drain the water quality volume and excess urban runoff volume over 40 hours and 72 hours respectively. Refer to drainage facility design section of the report for additional information regarding the proposed facility.

Design Point 13

Basin E11 (Q5=0.3 cfs, Q100=2.2 cfs) consists of approximately 1.17 acres of native grassed, undeveloped, west-facing hillside lands and floodplain fringe located just to the east of the EFSCST. Sheet flow runoff from the basin combines with the flows discharged from the **FSD Pond 4** (**PR15**) within a 42" storm drain (Q5=2.0 cfs, Q100=87.0 cfs). The combined flows reaching the EFSCST at **DP13** total Q5=2.1 cfs, Q100=87.9 cfs. A concrete headwall with riprap protection will likely be required to be provided at the discharge point.

Design Point 14

Basin E12 (Q5=0.4 cfs, Q100=3.2 cfs) consists of approximately 1.47 acres of native grassed,

undeveloped, west-facing hillside lands and floodplain fringe located just to the east of the EFSCST. Runoff from the basin sheet flows to the existing channel **DP14 (**Q5=0.4 cfs, Q100=3.2 cfs).

Design Point 15

Basin E13 (Q5=0.4 cfs, Q100=3.1 cfs) consists of approximately 1.16 acres of native grassed, undeveloped, west-facing hillside lands and floodplain fringe located just to the east of the EFSCST. Runoff from the basin sheet flows to the existing channel from **DP15 (**Q5=0.4 cfs, Q100=3.1 cfs).

Design Point 16

Basin E14 (Q5=0.5 cfs, Q100=3.4 cfs) consists of approximately 1.33 acres of native grassed, undeveloped, west-facing hillside lands and floodplain fringe located just to the east of the EFSCST. Runoff from the basin sheet flows to the existing channel from **DP16 (**Q5=0.5 cfs, Q100=3.4 cfs).

It should be noted that **Basins E11-E14** are all partially bisected by an 18" CSU sanitary sewer line and accompanying 75' utility easement.

Design Point 17

Offsite 5.30-acre **Basin W1** (Q5=1.1 cfs, Q100=8.3 cfs) consists of native grassed, undeveloped lands located north of Barnes Road and east of Marksheffel at the west end of the site. Runoff from the basin is recommended to be conveyed by a temporary earthen swale to **DP17 (**Q5=1.1 cfs, Q100=8.3 cfs).

Design Point 18

Basin W2 (Q5=10.1 cfs, Q100=18.9 cfs) consists of 2.57 acres of proposed Barnes Road right-of-way. A proposed 24" storm drain (**PR16**), Q5=10.1cfs, Q100=18.9cfs, is recommended to be extended under the roadway to collect flows prior to reaching Marksheffel Road. Existing condition flow rates at this location were determined to be 0.5 cfs and 3.9 cfs in the 5 and 100-year events respectively.

At the time of the writing of this report M&S Civil is coordinating with the City of Colorado Springs and its consultants to determine the planned outfalls and water quality treatment and detention locations that are a portion of the Marksheffel Road Improvement Project so that flows in and around the west end of Barnes Road can be accounted for and safely routed in a manner that works with both projects. For the purposes of this submittal the large-scale facilities at this end of the project are at this time to be considered to be constructed by others.

Design Point 19

Onsite 0.67-acre **Basin W3** (Q5=0.3 cfs, Q100=2.0 cfs) is native grassed, undeveloped lands located north of the west half of the unplatted Falcon Trucking Filing No.1 parcel at the west end of the site. Flows discharge as sheet flow are collected by an existing temporary swale located along the west edge of the Enclaves Filing No. 5 and 6 Filings at **DP19 (**Q5=0.3 cfs, Q100=2.0 cfs). Existing condition flow rates at this location were determined to be 0.3 cfs and 2.1 cfs in the 5 and 100-year events respectively.

Design Point 20

Onsite 1.28-acre **Basin W4** (Q5=0.5 cfs, Q100=3.6 cfs) is native grassed, undeveloped lands located north of the Enclaves at Mountain Vista Filing No. 6 parcel along the west end of the site. Flows discharge as sheet flow to a tract of land north of Filing 6 at **DP20 (**Q5=0.5 cfs, Q100=3.6 cfs). Existing condition flow rates at this location were determined to be 0.3 cfs and 2.4 cfs in the 5 and 100-year events respectively.

Design Point 21

Offsite 40.96-acre **Basin W5** (Q5=7.8 cfs, Q100=57.0 cfs) and consists of an undeveloped native grassed watershed located up-gradient and along the central western portion of the site. Runoff from the basin is recommended to be collected and conveyed within a berm/swale located along the north side of proposed Barnes Road. Runoff collected by the temporary conveyance would direct runoff to the western embankment of the EFSCST. Future development of the offsite area will require a detention facility to restrict flows to the predevelopment levels.

Design Point 22

Basin W6 (Q5=12.7 cfs, Q100=23.8 cfs) consists of 3.87 acres of proposed Barnes Road right-of-way. A proposed 30" storm drain (**PR17**), Q5=12.7cfs. Q100=23.8cfs, is recommended to be extended under the roadway to collect flows prior to reaching the intersection of Shale Drive at **DP22** (Q5=12.7 cfs, Q100=23.8 cfs).

Design Point 23

Basin W7 (Q5=17.8 cfs, Q100=33.4 cfs) consists of 5.73 acres of proposed Barnes Road right-of-way. A proposed 30" storm drain (**PR18**) is recommended to be extended under the roadway to collect flows prior to reaching the intersection of Shale Drive. A proposed 36" sewer (**PR19**) will collect the combined runoff carried within **Pipes Runs 17** and **18** at peak flow rates of Q5 =29.9 cfs, Q100 =56.0. The proposed storm sewer is intended to be conveyed overtop the proposed box culvert within the ~10 foot of fill.

Design Point 24

Basin E17 (Q5=14.4 cfs, Q100=27.0 cfs) consists of 3.55 acres of proposed Barnes Road right-of-way. A proposed 30" storm drain (**PR20**) is recommended to be extended under the roadway to collect flows prior to reaching the intersection of a proposed collector roadway at **DP24** (Q5=14.4 cfs, Q100=27.0 cfs).

Design Point 25

Basin E16 (Q5=11.8 cfs, Q100=33.9 cfs) consists of approximately 9.29 acres of future open space, park land, and roadway planned along the east side of the EFSCST along the northern boundary of the subject site. A proposed 30" storm sewer main (**PR21**) has been extended into the area to collect the flow at **DP25** (Q5=11.8 cfs, Q100=33.4 cfs).

Design Point 26

Basin E18 (Q5=2.0 cfs, Q100=10.9 cfs) consists of approximately 3.24 acres of open space that will house a full spectrum detention pond. Runoff conveyed within **Pipe Runs 19**, **20** and **21** combined within runoff developed within **Basin E18**. The total peak runoff anticipated to reach **FSD Pond 6 at DP26** is Q5 = 53.2 cfs, Q100 = 128.6 cfs. The private full spectrum detention pond will discharge to predevelopment flow rates and drain the water quality volume and excess urban runoff volume over 40 hours and 72 hours respectively. Refer to drainage facility design section of the report for additional information regarding the proposed facility.

Design Point 27

Basin E15 (Q5=21.8 cfs, Q100=39.7 cfs) consists of approximately 5.52 acres of future commercial development located to the southeast of the intersection of the proposed collector roadway and Barnes Road. Runoff produced by the basin will be directed to a proposed full spectrum detention pond located at the southwest corner of the site. The total peak runoff anticipated to reach **FSD Pond 5 at DP27** is Q5 = 21.8 cfs, Q100 = 39.7 cfs. The private full spectrum detention pond will discharge runoff at

predevelopment flow rates and drain the water quality volume and excess urban runoff volume over 40 hours and 72 hours respectively. Refer to drainage facility design section of the report for additional information regarding the proposed facility.

Design Point 28

A proposed 18" storm drain will convey the flows released from the **FSD Pond 5** (**PR23**) at peak rates of 0.2 cfs and 4.0 cfs in the 5-year and 100-year events respectively. A proposed 30" storm drain will convey the flows release from the **FSD Pond 6** (**PR22**) at peak rates of 0.8 cfs and 32.3 cfs in the 5-year and 100-year events respectively. Flows within **PR22** and **PR23** will combine within a proposed 30" storm drain (**PR24**) at peak flow rates of 2.0 and 36.2 cfs in the minor and major storm events respectively. Sheet flow runoff from the, 1.76 acres, **Basin E19** (Q5=0.5 cfs, Q100=3.8 cfs) is conveyed via an earthen swale to **DP28 (**Q5=1.3 cfs, Q100=37.5 cfs) where flows reach the channel via the embankment of a grouted boulder drop structure and combines with the discharge from **PR24**. The combined flow at **DP28** totals Q5=1.3 cfs, Q100=37.5 cfs.

Design Point 29

Basin W8 (Q5=22.0 cfs, Q100=56.4 cfs) consists of approximately 18.17 acres of future single family residential property and roadways planned along the northern boundary of the subject site west of the channel. Runoff produced by the basin will be directed to an existing full spectrum detention pond located within Enclaves at Mountain Vista Filing No. 7. The total peak runoff anticipated to reach **FSD Pond 7 (aka Pond 401) at DP29** is Q5 = 22.0 cfs, Q100 = 56.4 cfs. The private full spectrum detention pond will discharge runoff at predevelopment flow rates and drain the water quality volume and excess urban runoff volume over 40 hours and 72 hours respectively. Refer to drainage facility design section of the report for additional information regarding the proposed facility.

Design Point 30

A proposed 24" storm drain (**PR25**) will convey the flows released from the **FSD Pond 7** (**aka Pond 401**) at peak rates of 2.5 cfs and 19.1 cfs in the 5-year and 100-year events, respectively, to **DP30** where these flows reach the channel via the embankment of a grouted boulder drop structure.

Design Point 31

Basin E20 (Q5=3.4 cfs, Q100=25.2 cfs) consists of approximately 14.85 acres of future single family residential property and roadways planned along the southern boundary of the subject site east of the channel. Runoff produced by the basin will be directed west by a proposed earthen swale to **DP31** and continue west to the East Fork Sand Creek Sub-Tributary channel. The total peak runoff anticipated to reach the channel is Q5 = 3.4 cfs, Q100 = 25.2 cfs.

When directly added this brings the total flow discharged at the channel in the existing condition (**DP 1-6, 17** and **Ex Pond 7 release)** from 15.0 cfs and 211.5 cfs, up slightly to 18.4 cfs and 236.4 cfs in the developed condition (**DP 13-16, 21, 28, 30** and **31**) in the 5 and 100-year events respectively (net change of +3.4/+24.9). A net increase in runoff to the channel of plus +3.4cfs/24.9cfs, and a net decrease in flow to the southern boundary in flow of minus -12.2cfs/-50.2cfs (in the minor and major storm events respectively) results than a less than historic release condition for the overall development. Based upon the FEMA flow rate of 1,150 cfs within the channel, the 24.9 cfs increase results within a negligible increase of 2.6%, which is likely within the error of the presented calculations. As such a concept design of similar density and grading patterns to the one shown within this MDDP does not negatively affect the existing downstream storm sewer facilities.

DRAINAGE FACILITY DESIGN

Based upon a master/concept plan layout a minimum of six new and one existing Full Spectrum Detention (FSD) will be required and utilized in order to reduce the fully developed flows from the site to pre-development levels and address water quality (DCM Volume 2). The ponds have been sized utilizing MHFD v4.04 from Urban Drainage and Flood Control District (UDFCD). Refer to the "Pond Calculations" Appendix in this document.

The conceptual ponds are being modeled with an outlet control structure which limits the release rate of the pond through the use of orifices, weirs, and restrictor plates placed before a proposed outlet pipes to store the WQCV, EURV, and the flood control volumes for the 2, 5, 10, 25, 50, and 100 year storm events. The WQCV will be slowly released over 40 hours. The 100 year will drain in less than 120 hours. Ownership and maintenance of the proposed private ponds (Ponds 2-5) is to be conducted by the Mountain Vista Ranch Metropolitan District. Ownership and maintenance of the proposed public ponds (Ponds 1 & 6) is to be conducted by the City of Colorado Springs. A Final Drainage Report will be required for the construction of each pond.

A public Full Spectrum Detention Extended Detention Basin (**FSD Pond 1**) is being proposed within the northeast portion of the site to address water quality from 18.75 acres at 94.0% imperviousness. **FSD Pond 1** is being constructed with an outlet control structure and a proposed 24" outlet pipe. An overflow emergency weir is proposed along the southwest embankment to safely convey flows to Barnes Road. **Basins E3 and E4** are the tributary basins contributing to this pond.

FSD Pond 1	**WQCV**	**EURV**	**5 Year**	**100 Year**
Maximum Volume Stored (acre-ft)	0.686	2.219	1.982	2.558
Maximum WS Elevation	6669.96	6673.49	6673.03	6674.12
Peak Inflow (cfs) (calc)*			61.2	112.9
Peak Outflow (cfs)	0.4	0.8	0.8	21.6

A private Full Spectrum Detention Extended Detention Basin (**FSD Pond 2**) is being proposed for the southeast corner of the site to address water quality from 20.10 acres at 65.0% imperviousness. **FSD Pond 2** is being constructed with an outlet control structure and a proposed 18" outlet pipe. An overflow emergency weir is proposed along the southern embankment to safely convey flows to the natural drainageway in the event of outlet clogging. The 0.0' height (lowest orifice) stage was based upon an elevation of 6634.67. Flows from **Basin E5** drain into this pond.

FSD Pond 2	**WQCV**	**EURV**	**5 Year**	**100 Year**
Maximum Volume Stored (acre-ft)	0.430	1.622	1.449	2.319
Maximum WS Elevation	6636.66	6639.24	6638.92	6640.48
Peak Inflow (cfs) (calc)*			33.7	75.4
Peak Outflow (cfs)	0.2	0.7	0.6	11.6

A private Full Spectrum Detention Extended Detention Basin (**FSD Pond 3**) is being proposed for the east half of the site to address water quality from 22.40 acres at 65.0% imperviousness. **FSD Pond 3** is being constructed with an outlet control structure and a proposed 18" outlet pipe. An overflow emergency weir is proposed along the southern embankment to safely convey flows to safely convey flows to the natural drainageway in the event of outlet clogging. The 0.0' height (lowest orifice) stage was based upon an elevation of 6638.67. Flows from **Basin E6** drain into this pond.

FSD Pond 3	**WQCV**	**EURV**	**5 Year**	**100 Year**
Maximum Volume Stored (acre-ft)	0.478	1.729	1.638	2.697
Maximum WS Elevation	6640.78	6643.44	6643.27	6645.09
Peak Inflow (cfs) (calc)			35.0	78.3
Peak Outflow (cfs)	0.2	0.9	0.8	16.7

A private Full Spectrum Detention Extended Detention Basin (**FSD Pond 4**) is being proposed for the western half of the eastern portion of the site to address water quality from 93.61 acres at 64.0% imperviousness. **FSD Pond 4** is being constructed with an outlet control structure and a proposed 42" outlet pipe. An overflow emergency weir is proposed along the western embankment to safely convey flows to the EFSCST in the event of outlet clogging. The 0.0' height (lowest orifice) stage was based upon an elevation of 6606.67. **Basins E7, E8, E9, and E10** provide flows that drain to this pond.

FSD Pond 4	**WQCV**	**EURV**	**5 Year**	**100 Year**
Maximum Volume Stored (acre-ft)	1.956	7.129	6.949	10.428
Maximum WS Elevation	6609.61	6612.42	6611.01	6614.02
Peak Inflow (cfs)(calc)*			131.8	293.1
Peak Outflow (cfs)	1.0	2.7	2.7	87.0

A private Full Spectrum Detention Extended Detention Basin (**FSD Pond 5**) is being proposed for the east half of the site to address water quality from 5.50 acres at 95.0% imperviousness. **FSD Pond 5** is being constructed with an outlet control structure and a proposed 18" outlet pipe. An overflow emergency weir is proposed along the western embankment to safely convey flows to the proposed local collector corridor in the event of outlet clogging. The 0.0' height (lowest orifice) stage was based upon an elevation of 6642.67. Flows from **Basin E15** drain into this pond.

FSD Pond 5	**WQCV**	**EURV**	**5 Year**	**100 Year**
Maximum Volume Stored (acre-ft)	0.206	0.716	0.581	0.812
Maximum WS Elevation	6645.60	6648.43	6647.83	6648.83
Peak Inflow (cfs)(calc)*			21.8	39.7
Peak Outflow (cfs)	0.1	0.2	0.2	4.0

A public six Full Spectrum Detention Extended Detention Basin (**FSD Pond 6**) is being proposed for the east half of the site to address water quality from 25.68 acres at 61.0% imperviousness. **FSD Pond 6** is being constructed with an outlet control structure and a proposed 30" RCP outlet pipe. An overflow emergency weir is proposed along the southern embankment to safely convey flows to Graphite Drive corridor in the event of outlet clogging. The 0.0' height (lowest orifice) stage was based upon an elevation of 6620.67. **Basins E16, E17, E18, W6, and W7** provide flows that drain to this pond.

FSD Pond 6	**WQCV**	**EURV**	**5 Year**	**100 Year**
Maximum Volume Stored (acre-ft)	0.515	1.860	1.708	2.435
Maximum WS Elevation	6622.97	6624.98	6624.80	6625.66
Peak Inflow (cfs)(calc)*			53.2	128.6
Peak Outflow (cfs)	0.3	0.9	0.8	32.3

A private Full Spectrum Detention Extended Detention Basin (**FSD Pond 7**) makes use of an existing facility that was sized with the construction of Enclaves at Mountain Vista Filing No. 7 to accommodate the planned area as shown by this master development plan 7 (Pond 401). This facility is planned to address water quality from 18.17 acres at 48.0% imperviousness. **FSD Pond 7** was constructed with an outlet control structure and a proposed 24" RCP outlet pipe. An overflow emergency weir was constructed along the eastern embankment to safely convey flows to the EFSCST in the event of outlet clogging. The 0.0' height (lowest orifice) stage was based upon an elevation of 6622.00. Flows from **Basin W8** drain into this pond.

FSD Pond 7	**WQCV**	**EURV**	**5 Year**	**100 Year**
Maximum Volume Stored (acre-ft)	0.306	0.945	1.029	1.569
Maximum WS Elevation	6624.67	6626.09	6626.24	6627.13
Peak Inflow (cfs)(calc)			22.0	56.4
Peak Outflow (cfs)	0.1	0.4	2.5	19.1

As the required release rates will very given the final residential layouts, it can be anticipated that the existing outlet structure and/or inlet structures may need to be modified. This may or may not include items such as raising the outlet box elevation, resizing and replacement of the trash screen and orifice plates.

It should be noted that for all basins that are not directed to one of the seven ponds, shown in this MDDP, those areas are to remain fully pervious, therefore, water quality treatment will not be required. These basins are as follows: **E19, E14, E13, E12, and E11**. At the time the individual Final Drainage Reports are written, the basins not routed to a pond, if developed, will be required Final Drainage reports and will be required to meet all current City Criteria, including updates based on the now effective MS4 Permit.

EAST FORK SAND CREEK SUB-TRIBUTARY PROPOSED CONCEPT CHANNEL IMPROVEMENTS

The development of Enclaves at Mountain Vista Ranch Filing No.7 provided the construction of the Enclaves at Mountain Vista Sand Creek East Fork Sub-tributary Channel Project (EMVC Project) which flattened approximately 3180 feet of SCEFST, adjacent to EMV Filing No. 7 and Enclaves East, into a constructed natural channel.

With the extension of Barnes Road, as a portion of this development, the construction of a concrete box culvert which occurs at the exiting riprap drop structure and transition to the existing channel will be necessary. A channel report and plan shall be submitted for these improvements, including a HEC-RAS model to analyze the proposed channel improvements. These improvements shall be in compliance with the DBPS. Building permits for any of the developments associated with this site cannot be released until channel improvement assurances have been posted or channel improvements have been installed and accepted, with the exception of Enclaves at Mountain Vista Ranch Filing No. 8 as the required improvements are not necessary to its development. Below is a summary of the required improvements as taken from the Enclaves at Mountain Vista Barnes Road Culvert and Sand Creek East Fork Sub-tributary Channel Design Report (60%) by Wilson and Company dated November 2021.

Barnes Road Culvert Design

The proposed culvert is designed with a longitudinal slope of 0.40%, having an entrance invert of 6631.58 and an entrance low chord of 6639.58. The HEC-RAS model indicates a 100-year water surface elevation at the entrance of the culvert of 6636.26. The 100-year water surface elevation is estimated to be 6638.77 at the immediately upstream cross section located at the toe of the lower drop, located 4 feet upstream from the culvert. The hydraulics are in accordance with the D.C.M.'s allowable headwater criteria which specifies a maximum of 1.5:1.

Pedestrian rail is proposed to be mounted along the top of the headwalls and wingwalls to protect pedestrians from the vertical dropoff.

S.C.E.F.S. Upstream of Barnes Road

The project's constructed section of channel will begin approximately 280 feet north (upstream) of the proposed Barnes Road culvert. The upstream channel transition will include flattening the channel bottom and gradually narrowing the width via a grass-lined trapezoidal segment of channel with a longitudinal slope of 1.0%. The banks will contain a 1 foot thick layer of buried Type "VL" Soil Riprap as shown in the plans.

The grass-lined segment of channel will connect into a two-tiered drop structure. The upper drop will be lined with a 4 foot thick layer of Type "VH" Riprap, will be sloped at 19.68% and is proposed to be 4.52' high with a net drop of 3.52'. At the upstream termini of the riprap will be a 6 foot deep seepage cutoff wall. The toe of the riprap drop will connect to a 36" grouted boulder lined stilling basin. The stilling basin is to be 1-foot deep and 12 foot long and will contain a cutoff wall at its upstream termini.

The grouted boulder drop is downstream of the stilling basin, will be sloped at 25.00% and will be

4.0 foot high and will contain a series of weep drains. A 4 foot wide bench transitions the drop structure into the culvert. The grouted boulders were sized following methods provided in the MHFDCM.

The DBPS identifies the existing channel section within the project extents as "Type 3 – Unimproved, with existing or future problems expected during peak flows". The DBPS lists the future channel section for the upstream channel to be a Natural Engineered Channel with a slope of 0.2%, top width of 144 feet and maximum depth of 5 feet.

The transition section being constructed with this project is designed to give a stable channel section which allows for efficiently transitioning the existing channel section into the drop structures at the culvert. If future development occurs upstream of the drop structure to be constructed with this project, it is likely the channel will need to be deepened. To deepen the channel it is anticipated that the grouted boulder structures to be constructed with this project could likely remain in place and the riprap portion of the structure could be removed as needed.

The DBPS doesn't appear to mention of the Barnes Road culvert crossing of SCEFS.

S.C.E.F.S. Downstream of Barnes Road

The downstream limits of the constructed section of channel with this project will begin approximately 46 feet south (downstream) of the proposed Barnes Road culvert. This section of channel will consist of a trapezoidal section lined with 36 inch grouted boulders. The boulders were sized following methods provided in the D.C.M. Calculations are included in Appendix E.

The downstream-most edge of this section of channel will abut up to the grouted boulder drop structure #7 to be constructed with the EMVC Project.

Refer to the Enclaves at Mountain Vista Channel Design Report and Construction Plans prepared by Wilson & Company, Inc for details regarding the design. At the time of the writing of this report the construction plans and report has been submitted and reviewed by the City of Colorado Springs. It should be noted that any channel work required as a portion of Enclaves East is subject to review and approval by the Army Corp of Engineers.

EROSION CONTROL

It is the policy of the City of Colorado Springs that we submit an erosion control plan with the drainage report. At this time we respectfully request that the erosion control plan be submitted in conjunction with the final grading plan. Proposed straw bale check dams, silt fence, inlet protection, sediment basin, vehicle traffic control, and reseeding are proposed as erosion control measures. The Grading and Erosion Control Plan will be submitted to the Stormwater Enterprise for review and approval prior to construction.

DRAINAGE, BRIDGE, AND POND FEES

The project is located within the Sand Creek Drainage Basin. The "2022 Drainage, Bridge, and Pond Fees-City of Colorado Springs", approved December 14, 2021; table identifies the following fees associated

with the basin. These fees have been applied and summarized here for the 184.292 acre site. However, the 184.292 acre development will be platted in phases and the appropriate fees will be paid based upon the current fees for that year.

Basin Fees 2022	Total area (acres)	Basin Fee (per acre)	Total Cost Basin Fee
Drainage Fee	184.292	$20,160	$3,715,326.72
Total			**$3,715,326.72**

CONSTRUCTION COST ESTIMATE

Construction cost will be finalized with the Final Drainage Reports and Construction Drawings for each platted area. Below is a general estimate for the entire 184.292 acres. These costs are Non-Reimbursable.

NON-REIMBURSABLE

(Enclaves East MDDP Public Storm Sewer System, Non-Reimbursable)
(Private Facilities to be maintained by the Mountain Vista Ranch Metropolitan District)

Item	Description	Quantity	Unit Cost	Cost
1.	18" RCP Storm Drain	815 LF	$90/LF	$ 73,350.00
2.	24" RCP Storm Drain	725 LF	$125/LF	$ 90,625.00
3.	30" RCP Storm Drain	2614 LF	$165/LF	$ 431,310.00
4.	36" RCP Storm Drain	2611 LF	$200/LF	$ 522,200.00
5.	42" RCP Storm Drain	2700 LF	$275/LF	$ 742,500.00
6.	48" RCP Storm Drain	1100 LF	$350/LF	$ 385,000.00
7.	Pond 2	2.32 AC-FT	$30,000/AF	$ 69,690.00
8.	Pond 3	2.70 AC-FT	$30,000/AF	$ 81,000.00
9.	Pond 4	10.45 AC-FT	$25,000/AF	$ 261,250.00
10.	Pond 5	0.81 AC-FT	$40,000/AF	$ 32,400.00
11.	Pond 7 modifications	1 LS	$10,000/LS	$ 10,000.00
			Subtotal	$2,699,325.00
			Contingency (25%)	$ 674,831.25
			Total =	**$3,374,156.25**

PUBLIC REIMBURSABLE FACILITIES

(Enclaves East MDDP Public, Detention Storage, Reimbursable)
Pond 1 and 6, treat and detain a significant portion of Barnes Road.
(Public Facility to be owned and maintained by the City of Colorado Springs)

Item	Description	Quantity	Unit Cost	Cost
1.	Pond 1	2.56 AC-FT	$30,000/AF	$ 76,800.00
2.	Pond 6	3.91 AC-FT	$27,500/AF	$ 87,725.00

Subtotal (Ponds 1& 6)		$ 164,525.00
Contingency (15%)		$ 24,678.75
Total	**=**	**$ 189,203.75**

2021 Sand Creek Drainage Basin Planning Study

The following items are listed in the SCDBPS and are relative to the proposed development, however, the design and quantity is unknown at this time for future improvements. The specifics will be determined with the future phases of development and covered in the final drainage reports for each particular development phase. The unit costs shown below are established from the 2021 SCDBPS. These items are listed in the SCDBPS as reimbursable facilities.

2021 DBPS REIMBURSABLE PUBLIC DRAINAGE FACILITIES

Item	Description	Quantity	Unit Cost	Cost
1.	60" RCP Storm Drain	TBD	$450/LF	Potential Future Cost
2.	Channel Improvements	TBD	$700/LF	See below
3.	Box Culvert	TBD	$1400LF	See below
			Subtotal	$ TBD

As an example, the unit cost of improvements increased by factor of 1.07 for inflation to 2022 Dollars, based upon City of Colorado Springs Basin Fees Increases 2021 to 2022. The estimated reimbursable unit costs can be increased based upon inflation from the 2021 values. The estimated costs is dependent on annual inflation per year from 2021.

I. Estimated Costs for Enclaves East MDDP Public, Reimbursable Barnes Road Culvert and Associated East Fork Sand Creek Sub-tributary Channel Improvements. (2023-2024) (Public Facility to be owned and maintained by the City of Colorado Springs)

ENCLAVES BARNES ROAD CULVERT & SAND CREEK EAST FORK SUBTRIBUTARY CHANNEL PROJECT
60% OPINION OF PROBABLE COST
11/11/21

ITEM	QUANTITY	UNIT	UNIT COST	COST
MOBILIZATION	1	LS	$50,000.00	$50,000.00
CONSTRUCTION SURVEYING	1	LS	$25,000.00	$25,000.00
TEMPORARY EROSION , SEDIMENT CONTROL AND WATER CONTROL	1	LS	$75,000.00	$75,000.00
CLEARING & GRUBBING*	3.1	ACRE	$1,500.00	$4,650.00
REMOVAL & DISPOSAL OF RIPRAP*	1,449	CY	$20.00	$28,980.00
REMOVAL & DISPOSAL OF 1.25'W X 6'H CONCRETE CUTOFF WALL*	135	LF	$70.00	$9,450.00
REMOVAL & DISPOSAL OF BASE COURSE MAINTENANCE ROAD*	337	SY	$10.00	$3,370.00
GROUTED BOULDERS, 36-INCH	677	SY	$360.00	$243,720.00
BURIED TYPE VL SOIL RIPRAP	57	CY	$75.00	$4,275.00
TYPE VH RIPRAP	511	CY	$100.00	$51,100.00
TYPE H RIPRAP	0	CY	$100.00	$0.00
TYPE VL SOIL RIPRAP	21	CY	$75.00	$1,575.00
GRANULAR BEDDING, TYPE II	107	CY	$80.00	$8,560.00
GEOTEXTILE FILTER FABRIC	211	SY	$5.00	$1,055.00
CHANNEL EMBANKMENT*	14,088	CY	$10.00	$140,880.00
FOUNDATION ZONE STABILIZATION (UNDER C.B.C. AND WINGWALLS)**	1	LS	$30,000.00	$30,000.00
REINFORCED STRUCTURAL CONCRETE (C.B.C., HEADWALL, C.B.C. CUTOFF WALL)	549.4	CY	$1,100.00	$604,340.00
REINFORCED STRUCTURAL CONCRETE (WALLS)	81.1	CY	$1,100.00	$89,210.00
WATERPROOFING MEMBRANE (C.B.C.)	34	SY	$20.00	$680.00
CONCRETE OR GROUT CUTOFF WALL (ON G.S.B. DROP)	37	CY	$500.00	$18,500.00
UPSTREAM TRANSITION CONCRETE CUTOFF WALL	36	CY	$600.00	$21,600.00
PEDESTRIAN RAIL	191	LF	$200.00	$38,200.00
TOPSOIL, SEEDING (NATIVE) WITH MULCH	1.7	ACRE	$11,050.00	$18,785.00
TOPSOIL, SEEDING (NATIVE) WITH TEMPORARY EROSION CONTROL BLANKET	1.4	ACRE	$20,570.00	$28,798.00
AGGREGATE BASE COURSE (12' ACCESS ROAD)	67	CY	$75.00	$5,025.00
TOTAL				**$1,502,753.00**
TOTAL WITH CONTINGENCY (10%)				**$1,653,028.30**

*ASSUMES THE EMVC PROJECT HAS FULLY BEEN CONSTRUCTED PRIOR TO THIS PROJECT BEGINNING. SEE REPORT TEXT FOR DISCUSSION.
**ASSUMED 12" THICK LAYER OF CRUSHED NO. 57 STONE OVER HIGH STRENGTH GEOTEXTILE. FUTURE SUBMITTAL TO INCLUDE GEOTECH. RECOMMENDATIONS.

Total Estimated Cost for Box Culvert and Associated Channel Imp. (2023-2024)

$1,653,028.30

II. Estimated Costs for Enclaves West MDDP Public, Reimbursable East Fork Sand Creek Sub-tributary Channel Improvements, South of Barnes Road. (2022)

Total Estimated Cost for Public Improvements (From EMVR Filing 7 Report)
$ 2,574,889.68

TOTAL ESTIMATED REIMBURSABLE IMPROVEMENTS TO DATE;
(Subject to drainage board approval)

1. **Barnes Road Box Culvert & Channel Improvements (2023-2024)**
   $ 1,653,028.30
2. **Channel Improvements (2022)**
   $ 2,574,889.68
3. **Public Ponds 1 & 6**
   $ 189,203.75
4. **Future Reimbursable Facilities**
   $ TBD

Total
+$4,417,121.73

All non-reimbursable and reimbursable fees will be finalized with each FDR and that inclusion of these values in this MDDP does not guarantee reimbursement at the time of the FDR.

Note: Previous drainage fees for platting have been credited based upon the public improvements shown above. (EMVR Filing No. 7). Reconciliation for all Final Plats & Fees will need to be provided at the time of the presentation to the El Paso County / City Drainage Board.

M & S Civil Consultants, Inc. (M & S) cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above is only an estimate of the facility cost in 2022.

SUMMARY

Development of Enclaves at Mountain Vista East will not adversely affect the surrounding development. The proposed concept drainage facilities will adequately convey, detain and route runoff from the onsite & offsite flows to existing facilities, as well as provide water quality treatment. Runoff and storm drain and appurtenances will not adversely affect the existing downstream infrastructure and surrounding developments. This MDDP is in general compliance with prior hydrologic studies affecting the site. All drainage facilities described herein and shown on the included Proposed Drainage Map (See Appendix) are subject to change being dependent upon individual lot development. However, this MDDP should be used as a guideline for release of flows offsite, and final Full Spectrum & Water Quality Detention Pond sizing. Care will be taken to accommodate overland emergency flow routes on site and temporary drainage conditions.

REFERENCES

1.) City of Colorado Springs Drainage Criteria Manual, Volumes 1 & 2, dated May 2014

2.) Urban Drainage and Flood Control District, Urban Storm Drainage Criteria Manual Volume 1 & 2 dated January 2016

3.) Web Soil Survey, USDA NRCS Soils Map https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

4.) FEMA flood Map Service Center, Federal Emergency Management Agency https://msc.fema.gov/portal/home

5.) "Master Development Drainage Plan for Enclaves at Mountain Vista", last revised May 12th, 2016, by Galloway and Company, Inc.

6.) "Sand Creek Drainage Basin Planning Study Preliminary Design Report" dated January 1993, Revised March 1996, by Kiowa Engineering Corporation.

7.) "Preliminary/Final Drainage Report for Enclaves at Mountain Vista Ranch Filing No. 7" dated June 2020 by M&S Civil Consultants, Inc.

8.) "Preliminary/Final Drainage Report for Enclaves at Mountain Vista Ranch Filing No. 6" dated June 2020 by M&S Civil Consultants, Inc.

9.) "Preliminary/Final Drainage Report for Enclaves at Mountain Vista Ranch Filing No. 5" dated October 2019 by M&S Civil Consultants, Inc.

10.) "Enclave at Mountain Vista Barnes Road Culvert and Sand Creek East Fork Sub-tributary Channel Project Channel Design Report (60%), dated November 2021, by Wilson & Company.

11.) "Sand Creek Drainage Basin Planning Study Final Report", dated 2021, by Stantec and HDR Dewberry.

12.) "Preliminary Drainage Report for Freestyle PUD Concept Plan, dated 2021, by Classic Consulting Engineers and Surveyors, Inc.

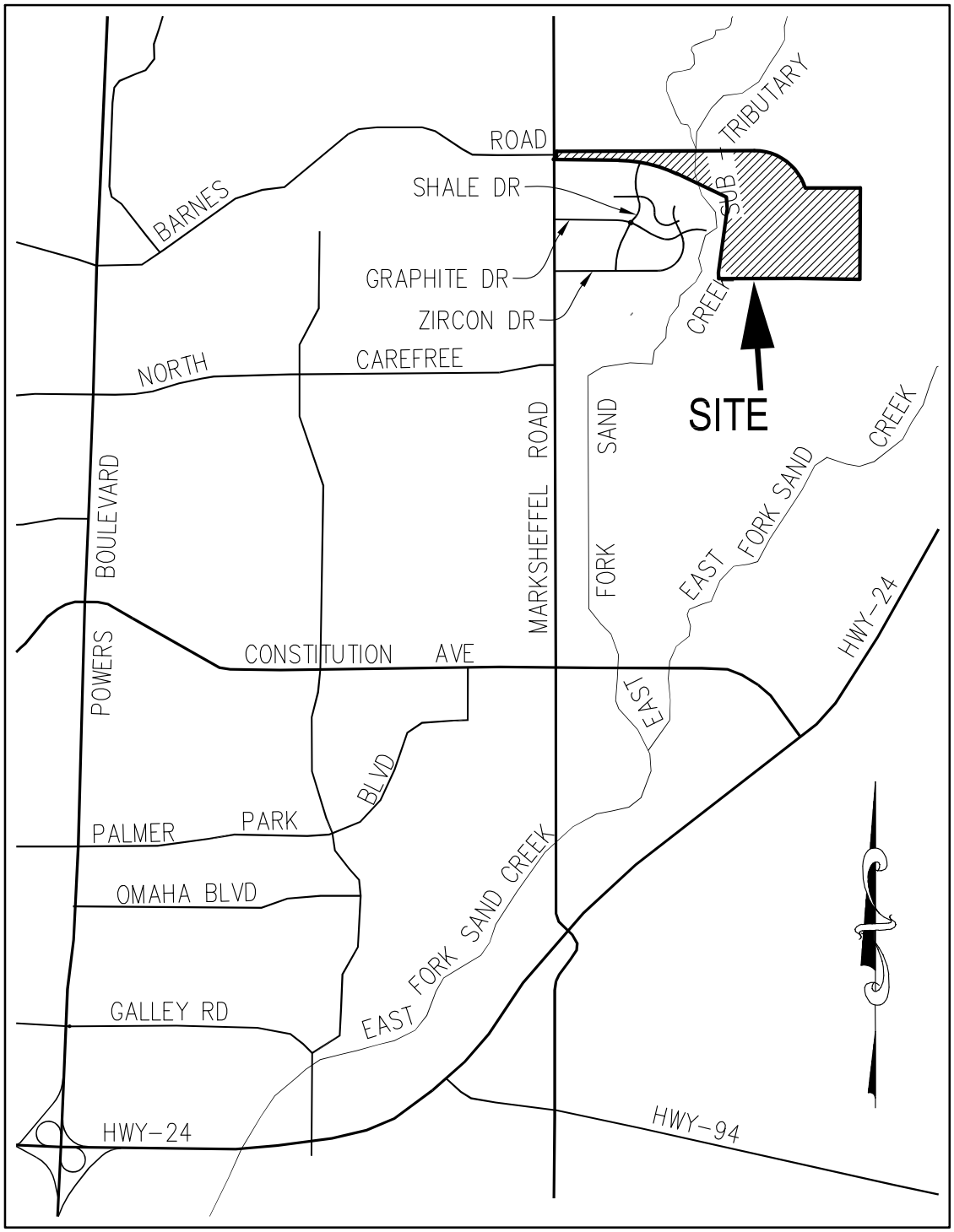
13.) "Enclave at Mountain Vista Barnes Road Culvert and Sand Creek East Fork Sub-tributary Channel Project Channel Design Report (60%)", dated November 2021, by Wilson & Company.

APPENDIX

FEE INCREASE TABLE

YEAR	CITY OF COLORADO SPRINGS BASIN FEE INCREASE (%)	CITY OF COLORADO SPRINGS BASIN FEE INCREASE (%/100)	UNIT COST OF IMPROVEMENTS INCREASED BY FACTOR
1997	4.0	0.04	1.04
1998	5.0	0.05	1.092
1999	4.0	0.04	1.13568
2000	3.0	0.03	1.1697504
2001	5.0	0.05	1.22823792
2002	3.0	0.03	1.265085058
2003	3.0	0.03	1.303037609
2004	3.0	0.03	1.342128738
2005	5.0	0.05	1.409235174
2006	4.0	0.04	1.465604581
2007	10.0	0.1	1.61216504
2008	1.0	0.01	1.62828669
2009	5.0	0.05	1.709701025
2010	0.0		1.709701025
2011	0.0		1.709701025
2012	0.0		1.709701025
2013	0.0		1.709701025
2014	4.3	0.043	1.783218169
2015	0.0		1.783218169
2016	4.8	0.048	1.868812641
2017	3.5	0.035	1.934221083
2018	5.7	0.057	2.044471685
2019	6.7	0.067	2.181451288
2020	4.0	0.04	2.268709339
2021	3.5	0.035	2.348114166
2022	7.0	0.07	2.512482158

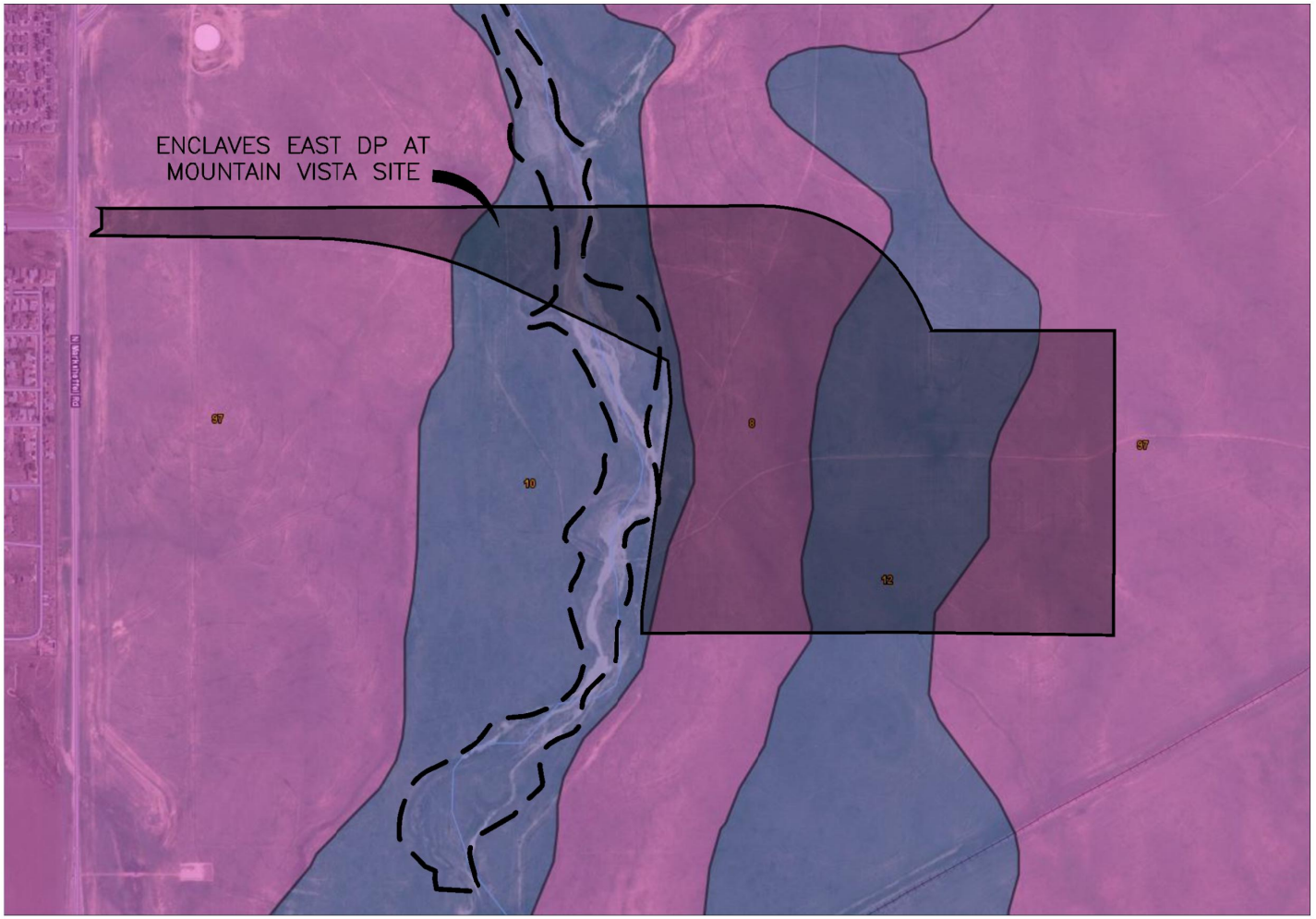
VICINITY MAP



VICINITY MAP

N.T.S.

SOILS MAP



NOT TO SCALE

Tables — Hydrologic Soil Group — Summary By Map Unit

Summary by Map Unit — El Paso County Area, Colorado (CO625)

Map unit symbol	Map unit name	Rating
8	Blakeland loamy sand, 1 to 9 percent slopes	A
10	Blendon sandy loam, 0 to 3 percent slopes	B
12	Bresser sandy loam, cool, 3 to 5 percent slopes	B
97	Truckton sandy loam, 3 to 9 percent slopes	A

ENCLAVES EAST DP AT MVR ONSITE SOILS MAP

CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

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: http://websoilsurvey.nrcs.usda.gov
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 13, Sep 22, 2015

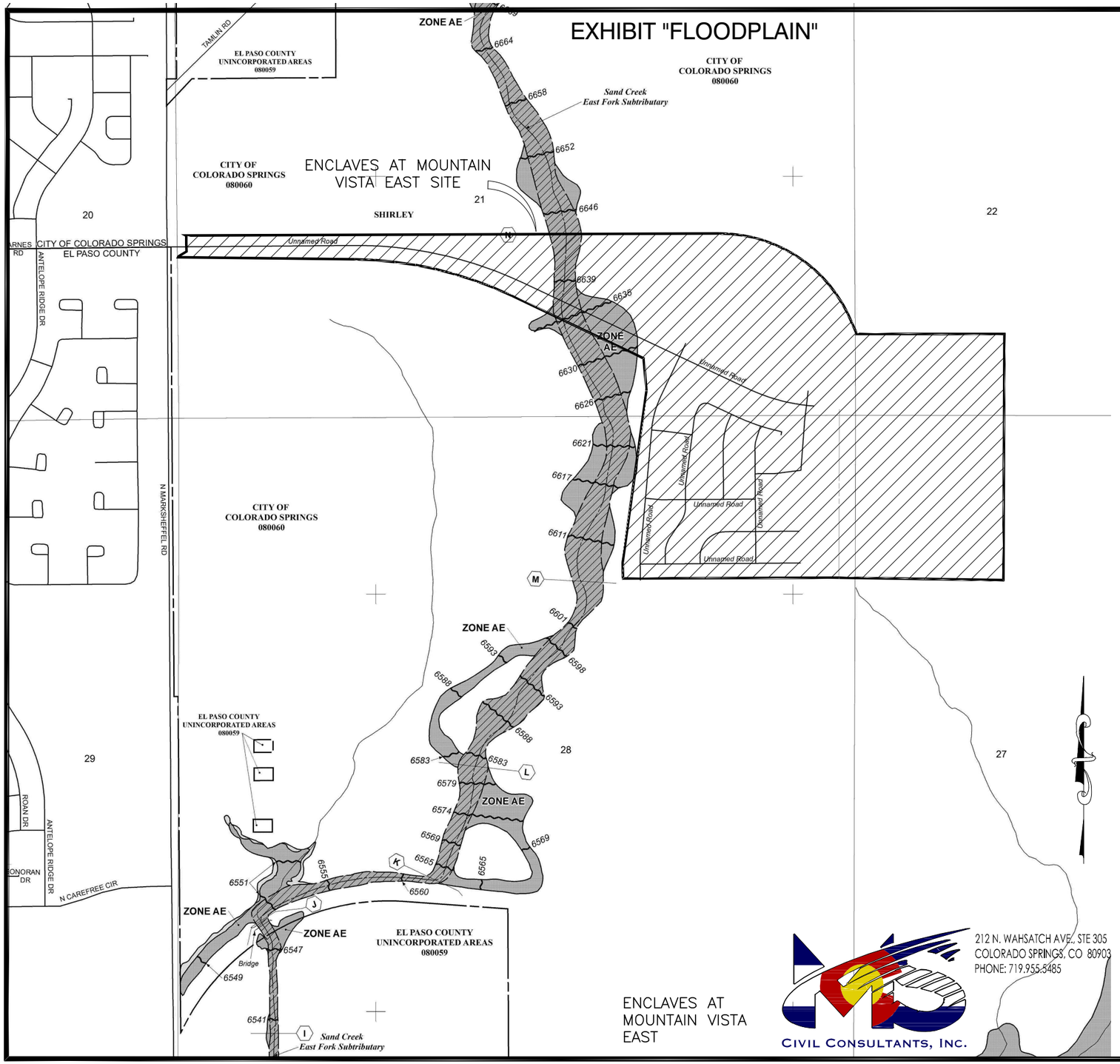
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 15, 2011—Sep 22, 2011

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.

FEMA MAP

EXHIBIT "FLOODPLAIN"



ENCLAVES AT
MOUNTAIN VISTA
EAST

CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0543G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 543 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0543	G
EL PASO COUNTY	080059	0543	G

NORTH AMERICAN DATUM OF 1988 (NAVD 88)

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

MAP NUMBER
08041C0543G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

Questions concerning the VERTCON process may be mailed to NGS

Latitude: 38.89721

Longitude: 104.6752

NGVD 29 height:

Datum shift(NAVD 88 minus NGVD 29): 1.128 meter

1.128 meters = 3.70 feet

Federal Emergency Management Agency

Washington, D.C. 20472

July 14, 2021

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 21-08-0133R

The Honorable John Suthers
Mayor, City of Colorado Springs
30 South Nevada Avenue, Suite 601
Colorado Springs, CO 80903

Community Name: City of Colorado Springs, CO
Community No.: 080060

104

Dear Mayor Suthers:

We are providing our comments with the enclosed Conditional Letter of Map Revision (CLOMR) on a proposed project within your community that, if constructed as proposed, could revise the effective Flood Insurance Study (FIS) report and Flood Insurance Rate Map (FIRM) for your community.

If you have any questions regarding the floodplain management regulations for your community, the National Flood Insurance Program (NFIP) in general, or technical questions regarding this CLOMR, please contact the Director, Mitigation Division of the Federal Emergency Management Agency (FEMA) Regional Office in Denver, at (303) 235-4830, or the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at https://www.fema.gov/flood-insurance.

Sincerely,

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Enclosure:
Conditional Letter of Map Revision Comment Document

cc: Mr. Keith Curtis, P.E., CFM
Floodplain Administrator
Pikes Peak Regional Building Department

Mr. Nathan Burns, P.E.
Engineering Manager
Wilson & Company, Inc.

Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT

COMMUNITY INFORMATION		PROPOSED PROJECT DESCRIPTION	BASIS OF CONDITIONAL REQUEST
COMMUNITY	City of Colorado Springs El Paso County Colorado	CHANNELIZATION DROP STRUCTURES FILL	1D HYDRAULIC ANALYSIS FLOODWAY UPDATED TOPOGRAPHIC DATA
	COMMUNITY NO.: 080060		
IDENTIFIER	Enclaves at Mountain Vista, Sand Creek East Fork Subtributary	APPROXIMATE LATITUDE AND LONGITUDE: 38.896, -104.670 SOURCE: OTHER DATUM: NAD 83	

AFFECTED MAP PANELS			
TYPE: FIRM*	NO.: 08041C0543G	DATE: December 7, 2018	* FIRM - Flood Insurance Rate Map
TYPE: FIRM	NO.: 08041C0545G	DATE: December 7, 2018	

FLOODING SOURCE AND REACH DESCRIPTION

Sand Creek East Fork Subtributary – From approximately 4,280 feet upstream of Industry Road to approximately 3,790 feet downstream of Tamlin Road.

PROPOSED PROJECT DESCRIPTION

Flooding Source	Proposed Project	Location of Proposed Project
Sand Creek East Fork Subtributary	Channelization	From approximately 5,830 feet upstream of Industry Road to approximately 6,720 feet downstream of Tamlin Road
	New Drop Structures	At approximately 6,460, 6,910, 7,260, 7,650, 7,980, 8,470, and 8,720 feet upstream of Industry Road
	Fill Placement	From approximately 5,830 feet upstream of Industry Road to approximately 6,720 feet downstream of Tamlin Road

SUMMARY OF IMPACTS TO FLOOD HAZARD DATA

Flooding Source	Effective Flooding	Proposed Flooding	Increases	Decreases
Sand Creek East Fork Subtributary	BFEs*	BFEs	Yes	Yes
	Floodway	Floodway	Yes	Yes
	Zone AE	Zone AE	Yes	Yes
	Zone X (unshaded)	Zone X (shaded)	Yes	Yes

* BFEs - Base (1-percent-annual-chance) Flood Elevations

COMMENT

This document provides the Federal Emergency Management Agency's (FEMA's) comment regarding a request for a CLOMR for the project described above. This document is not a final determination; it only provides our comment on the proposed project in relation to the flood hazard information shown on the effective National Flood Insurance Program (NFIP) map. We reviewed the submitted data and the data used to prepare the effective flood hazard information for your community and determined that the proposed project meets the minimum floodplain management criteria of the NFIP. Your community is responsible for approving all floodplain development and for ensuring that all permits required by Federal or State/Commonwealth law have been received. State/Commonwealth, county, and community officials, based on their knowledge of local conditions and in the interest of safety, may set higher standards for construction in the Special Flood Hazard Area (SFHA), the area subject to inundation by the base flood). If the State/Commonwealth, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional Information about the NFIP is available on the FEMA website at https://www.fema.gov/flood-insurance.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

To determine the changes in flood hazards that will be caused by the proposed project, we compared the hydraulic modeling reflecting the proposed project (referred to as the proposed conditions model) to the hydraulic modeling used to prepare the Flood Insurance Study (FIS) (referred to as the effective model). If the effective model does not provide enough detail to evaluate the effects of the proposed project, an existing conditions model must be developed to provide this detail. This existing conditions model is then compared to the effective model and the proposed conditions model to differentiate the increases or decreases in flood hazards caused by more detailed modeling from the increases or decreases in flood hazards that will be caused by the proposed project.

The table below shows the changes in the BFEs:

BFE Comparison Table

Flooding Source: Sand Creek East Fork Subtributary		BFE Change (feet)	Location of maximum change
Existing vs. Effective	Maximum increase	1.6	approximately 5,870 feet upstream of Industry Road
	Maximum decrease	1.1	approximately 4,780 feet upstream of Industry Road
Proposed vs. Existing	Maximum increase	None	N/A
	Maximum decrease	6.1	approximately 7,140 feet downstream of Tamlin Road
Proposed vs. Effective	Maximum increase	1.6	approximately 5,870 feet upstream of Industry Road
	Maximum decrease	5.7	approximately 7,140 feet downstream of Tamlin Road

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional Information about the NFIP is available on the FEMA website at https://www.fema.gov/flood-insurance.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

DATA REQUIRED FOR FOLLOW-UP LOMR

Upon completion of the project, your community must submit the data listed below and request that we make a final determination on revising the effective FIRM and FIS report. If the project is built as proposed and the data below are received, a revision to the FIRM and FIS report would be warranted.

• Detailed application and certification forms must be used for requesting final revisions to the maps. Therefore, when the map revision request for the area covered by this letter is submitted, Form 1, entitled "Overview and Concurrence Form," must be included. A copy of this form may be accessed at https://www.fema.gov/flood-maps/change-your-flood-zone/paper-application-forms/mt-2.

• The detailed application and certification forms listed below may be required if as-built conditions differ from the proposed plans. If required, please submit new forms, which may be accessed at https://www.fema.gov/flood-maps/change-your-flood-zone/paper-application forms/mt-2, or annotated copies of the previously submitted forms showing the revised information.

Form 2, entitled "Riverine Hydrology and Hydraulics Form." Hydraulic analyses for as-built conditions of the base flood , the 10-percent, 2-percent, and 0.2-percent-annual-chance floods, and the regulatory floodway, must be submitted with Form 2.

Form 3, entitled "Riverine Structures Form."

• A certified topographic work map showing the revised and effective base and 0.2-percent-annual-chance floodplain and floodway boundaries. Please ensure that the revised information ties in with the current effective information at the downstream and upstream ends of the revised reach.

• An annotated copy of the FIRM, at the scale of the effective FIRM, that shows the revised base and 0.2-percent-annual-chance floodplain and floodway boundary delineations shown on the submitted work map and how they tie-in to the base and 0.2-percent-annual-chance floodplain and floodway boundary delineations shown on the current effective FIRM at the downstream and upstream ends of the revised reach.

• As-built plans, certified by a registered Professional Engineer, of all proposed project elements.

• A copy of the public notice distributed by your community stating its intent to revise the regulatory floodway, or a signed statement by your community that it has notified all affected property owners and affected adjacent jurisdictions.

• Documentation of the individual legal notices sent to property owners who will be affected by any widening or shifting of the base floodplain and/or any BFE increases along Sand Creek East Fork Subtributary.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional Information about the NFIP is available on the FEMA website at https://www.fema.gov/flood-insurance.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

DATA REQUIRED FOR FOLLOW-UP LOMR (continued)

• FEMA's fee schedule for reviewing and processing requests for conditional and final modifications to published flood information and maps may be accessed at https://www.fema.gov/flood-maps/change-your-flood-zone/status/flood-map-related-fees. The fee at the time of the map revision submittal must be received before we can begin processing the request. Payment of this fee can be made through a check or money order, made payable in U.S. funds to the National Flood Insurance Program, or by credit card (Visa or MasterCard only). Please either forward the payment, along with the revision application, to the following address:

Colorado Water Conservation Board
Attention: Floodplain Mapping Program Manager
1313 Sherman Street, Rm 718
Denver, CO 80203

or submit the LOMR using the Online LOMC portal at: https://hazards.fema.gov/femaportal/onlinelomc/signin

After receiving appropriate documentation to show that the project has been completed, FEMA will initiate a revision to the FIRM and FIS report. Because the flood hazard information (i.e., base flood elevations, base flood depths, SFHAs, zone designations, and/or regulatory floodways) will change as a result of the project, a 90-day appeal period will be initiated for the revision, during which community officials and interested persons may appeal the revised flood hazard information based on scientific or technical data.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional Information about the NFIP is available on the FEMA website at https://www.fema.gov/flood-insurance.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

COMMUNITY REMINDERS

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Jeanine P. Petterson
Director, Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Mapping and Insurance eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional Information about the NFIP is available on the FEMA website at https://www.fema.gov/flood-insurance.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

HYDROLOGIC CALCULATIONS

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

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

3.2 Time of Concentration

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

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

ENCLAVES AT MOUNTAIN VISTA RANCH EAST
EXISTING CONDITIONS
(Area Runoff Coefficient Summary)

			UNDEVELOPED			*DEVELOPED LOTS*			*DEVELOPED LANDSCAPING*			*RUNOFF COEFFICIENT*	
BASIN		**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
E1	***646996.7***	14.85	14.85	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E2	***881283.6***	20.23	20.23	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E3	***248843.6***	5.71	5.71	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E4	***164658.9***	3.78	3.78	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E5	***455976.3***	10.47	10.47	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E6	***217282.1***	4.99	4.99	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E7	***258555.0***	5.94	5.94	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E8	***1473331.5***	33.82	33.82	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E9	***1700269.8***	39.03	39.03	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E10	***883263.5***	20.28	20.28	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E11	***367065.1***	8.43	8.43	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E12	***1719159.6***	39.47	39.47	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E13	***192648.2***	4.42	4.42	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E14	***60887.4***	1.40	1.40	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E15	***64278.3***	1.48	1.48	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E16	***1067469.2***	24.51	24.51	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W1	***24604.7***	0.56	0.56	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W2	***66844.8***	1.53	1.53	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W3	***37966.9***	0.87	0.87	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W4	***43413.4***	1.00	1.00	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W5	***843196.8***	19.36	19.36	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W6	***196648.6***	4.51	4.51	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W7	***1066820.1***	24.49	24.49	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W8	***812808.6***	18.66	11.83	0.08	0.35	5.47	0.40	0.56	1.37	0.12	0.39	***0.18***	***0.41***
W9	***73312.3***	1.68	1.68	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W10	***151339.3***	3.47	3.47	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***

ENCLAVES AT MOUNTAIN VISTA RANCH EAST
EXISTING CONDITIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY **		*TOTAL FLOWS*	
BASIN	**AREA TOTAL**	**C_5**	**C_{100}**	**C_5**	**Length**	**Height**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**CHECK**	**I_5**	**I_{100}**	**Q_5**	**Q_{100}**
	(Acres)	*From DCM Table 5-1*			*(ft)*	*(ft)*	*(min)*	*(ft)*	*(%)*	*(fps)*	*(min)*	*(min)*	*(min)*	*(in/hr)*	*(in/hr)*	*(c.f.s.)*	*(c.f.s.)*
E1	14.85	0.08	0.35	0.08	200	8	16.5	1065	5.3%	2.3	7.7	24.2	17.0	2.8	4.7	***3.3***	***24.4***
E2	20.23	0.08	0.35	0.08	200	8	16.5	850	4.7%	2.2	6.5	23.0	15.8	2.9	4.8	***4.7***	***34.2***
E3	5.71	0.08	0.35	0.08	200	16	13.1	335	11.9%	3.5	1.6	14.7	13.0	3.5	6.0	***1.6***	***11.9***
E4	3.78	0.08	0.35	0.08	200	16	13.1	390	7.2%	2.7	2.4	15.5	13.3	3.5	5.8	***1.0***	***7.7***
E5	10.47	0.08	0.35	0.08	200	12	14.4	735	6.3%	2.5	4.9	19.3	15.2	3.1	5.3	***2.6***	***19.3***
E6	4.99	0.08	0.35	0.08	200	16	13.1	600	5.7%	2.4	4.2	17.3	14.4	3.3	5.5	***1.3***	***9.7***
E7	5.94	0.08	0.35	0.08	200	9	15.9	585	8.4%	2.9	3.4	19.2	14.4	3.1	5.3	***1.5***	***11.0***
E8	33.82	0.08	0.35	0.08	200	7	17.2	1620	3.0%	1.7	15.7	32.9	20.1	2.3	3.9	***6.3***	***46.5***
E9	39.03	0.08	0.35	0.08	200	6	18.1	2400	1.3%	1.1	35.2	53.3	24.4	1.6	2.7	***5.1***	***37.1***
E10	20.28	0.08	0.35	0.08	200	10	15.3	1300	3.2%	1.8	12.2	27.5	18.3	2.6	4.4	***4.2***	***31.1***
E11	8.43	0.08	0.35	0.08	200	6	18.1	425	3.5%	1.9	3.8	21.9	13.5	3.0	5.0	***2.0***	***14.6***
E12	39.47	0.08	0.35	0.08	200	7	17.2	1780	2.0%	1.4	21.2	38.4	21.0	3.0	3.5	***9.5***	***48.9***
E13	4.42	0.08	0.35	0.08	200	6	18.1	780	2.8%	1.7	7.7	25.9	15.4	3.5	4.5	***1.2***	***7.0***
E14	1.40	0.08	0.35	0.08	200	4	20.7	235	1.7%	1.3	3.0	23.7	12.4	2.8	4.8	***0.3***	***2.3***
E15	1.48	0.08	0.35	0.08	200	6	18.1	260	2.3%	1.5	0.0	18.1	12.6	3.2	5.4	***0.4***	***2.8***
E16	24.51	0.08	0.35	0.08	200	10	15.3	1440	2.9%	1.7	14.1	29.4	19.1	2.5	4.2	***4.9***	***36.2***
W1	0.56	0.08	0.35	0.08	200	7	17.2					17.2	11.1	3.3	5.6	***0.1***	***1.1***
W2	1.53	0.08	0.35	0.08	200	13	14.0					14.0	11.1	3.6	6.1	***0.4***	***3.3***
W3	0.87	0.08	0.35	0.08	50	1	10.4					10.4	10.3	4.1	6.8	***0.3***	***2.1***
W4	1.00	0.08	0.35	0.08	50	4	6.6					6.6	10.3	4.1	6.9	***0.3***	***2.4***
W5	19.36	0.08	0.35	0.08	200	8	16.5	1000	6.6%	2.6	6.5	23.0	16.7	2.9	4.8	***4.5***	***32.8***
W6	4.51	0.08	0.35	0.08	200	8	16.5	1250	2.1%	1.4	14.4	30.9	18.1	2.4	4.1	***0.9***	***6.5***
W7	24.49	0.08	0.35	0.08	200	12	14.4	1802	5.2%	2.3	13.1	27.6	21.1	2.6	4.4	***5.1***	***37.5***
W8	18.66	0.18	0.41	0.18	100	8	8.4	1340	1.9%	1.4	16.0	24.4	18.0	2.8	4.7	***9.2***	***36.2***
W9	1.68	0.08	0.35	0.08	200	5	19.2	200	2.0%	1.4	2.4	21.6	12.2	3.0	5.0	***0.4***	***2.9***
W10	3.47	0.08	0.35	0.08	200	3	22.8	575	2.1%	1.4	6.6	29.4	14.3	2.5	4.2	***0.7***	***5.1***

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: DLM
Date: 9/14/2022
Checked by: VAS

ENCLAVES AT MOUNTAIN VISTA RANCH EAST
EXISTING CONDITIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
1	**E1, E2**	2.81	12.28				24.2	915	1.3%	1.1	13.3	37.5	2.1	3.6	***6.0***	***44.2***	Exist. Channel Drop Structure
				Basin E1 Tc Used													
2	**E3**	0.46	2.00									14.7	3.5	6.0	***1.6***	***11.9***	Exist. Channel Drop Structure
				See Area Drainage Sheet for Input													
3	**E4**	0.30	1.32									15.5	3.5	5.8	***1.0***	***7.7***	Exist. Channel Drop Structure
				See Area Drainage Sheet for Input													
4	**E5**	0.84	3.66									19.3	3.1	5.3	***2.6***	***19.3***	Exist. Channel Drop Structure
				See Area Drainage Sheet for Input													
5	**E6**	0.40	1.75									17.3	3.3	5.5	***1.3***	***9.7***	Exist. Channel Drop Structure
				See Area Drainage Sheet for Input													
6	**E7**	0.47	2.08									19.2	3.1	5.3	***1.5***	***11.0***	Exist. EFSCST Channel
				See Area Drainage Sheet for Input													
7	**E8, E9**	5.83	25.50				32.9	2680	1.7%	1.3	34.5	67.4	1.3	2.1	***7.4***	***54.2***	Southern Property Boundary Exist. Earthen swale
				Basin E8 Tc Used													
8	**E10, E11**	2.30	10.05				27.5	500	3.0%	1.7	4.8	32.3	2.4	4.0	***2.1***	***39.9***	
				Basin E10 Tc Used													
9	**DP8, E12**	5.45	23.86				32.3	1730	2.2%	1.5	19.5	51.8	1.7	2.8	***9.1***	***66.5***	Southern Property Boundary Exist. Earthen swale
				DP8 Tc Used													

ENCLAVES AT MOUNTAIN VISTA RANCH EAST
EXISTING CONDITIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
10	**E13, E14**	0.47	2.04				25.9	430	1.9%	1.4	5.3	31.1	2.4	4.1	***1.1***	***8.3***	Eastern Boundary Exist. Earthen swale
				Basin E13 Tc Used													
11	**E15, E16**	2.08	9.09				18.1	1660	2.3%	1.5	18.3	36.4	2.2	3.7	***4.6***	***33.4***	Southern Property Boundary Exist. Earthen swale
				Basin E15 Tc Used													
12	**W1, W2**	0.17	0.73				17.2	250	9.6%	3.1	1.3	18.6	3.2	5.4	***0.5***	***3.9***	Southern Property Boundary
				Basin W1 Tc Used													
13	**W3**	0.07	0.31									10.4	4.1	6.8	***0.3***	***2.1***	Falcon Trucking Exist. Earthen swale
				See Area Drainage Sheet for Input													
14	**W4**	0.08	0.35									10.3	4.1	6.9	***0.3***	***2.4***	Existing Lots EMV Filng No. 6
				See Area Drainage Sheet for Input													
15	**W5, W6**	1.91	8.36				23.0	325	3.7%	1.9	2.8	25.8	2.7	4.5	***5.2***	***38.0***	Exist. Earthen Swale
				Basin W5 Used													
16	**W7, W8, DP15**	7.17	24.66				27.6	1300	1.5%	1.2	17.9	45.5	1.9	3.1	***13.3***	***76.8***	Exist. Pond Enclaves Filing 7
				Basin W7 Used													
17	**W9, W10**	0.41	1.81				21.6	690	1.7%	1.3	8.7	30.3	2.5	4.1	***1.0***	***7.5***	Exist. Channel Drop Structure
				Basin W9 Tc Used													

ENCLAVES AT MOUNTAIN VISTA RANCH EAST
PROPOSED CONDITIONS
(Area Runoff Coefficient Summary)

			UNDEVELOPED			*DEVELOPED LOTS*			*OTHER*			*RUNOFF COEFFICIENT*	
BASIN		**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
E1	***1473331.5***	33.82	33.82	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E2	***1075906.6***	24.70	24.70	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E3	***363126.4***	8.34	0.00	0.08	0.35	7.09	0.90	0.96	1.25	0.12	0.39	***0.78***	***0.87***
E4	***453660.2***	10.41	0.00	0.08	0.35	10.41	0.81	0.88	0.00	0.12	0.39	***0.81***	***0.88***
E5	***875600.2***	20.10	0.00	0.08	0.35	20.10	0.45	0.60	0.00	0.12	0.39	***0.45***	***0.60***
E6	***976066.8***	22.41	0.00	0.08	0.35	22.41	0.45	0.60	0.00	0.12	0.39	***0.45***	***0.60***
E7	***681000.0***	15.63	0.00	0.08	0.35	15.63	0.45	0.60	0.00	0.12	0.39	***0.45***	***0.60***
E8	***687969.3***	15.79	0.00	0.08	0.35	15.79	0.45	0.60	0.00	0.12	0.39	***0.45***	***0.60***
E9	***1700269.8***	39.03	0.00	0.08	0.35	39.03	0.45	0.60	0.00	0.12	0.39	***0.45***	***0.60***
E10	***1008523.8***	23.15	3.64	0.08	0.35	17.36	0.45	0.60	2.15	0.90	0.96	***0.43***	***0.59***
E11	***50795.1***	1.17	1.17	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E12	***64032.9***	1.47	1.47	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E13	***50500.0***	1.16	1.16	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E14	***58121.2***	1.33	1.33	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E15	***240533.9***	5.52	0.00	0.08	0.35	5.52	0.81	0.88	0.00	0.12	0.39	***0.81***	***0.88***
E16	***404876.8***	9.29	0.00	0.08	0.35	2.28	0.90	0.96	7.02	0.12	0.39	***0.31***	***0.53***
E17	***154814.8***	3.55	0.00	0.08	0.35	3.02	0.90	0.96	0.53	0.12	0.39	***0.78***	***0.87***
E18	***140976.9***	3.24	0.00	0.08	0.35	0.00	0.40	0.56	3.24	0.12	0.39	***0.12***	***0.39***
E19	***76878.0***	1.76	1.76	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
E20	***646999.2***	14.85	14.85	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W1	***230874.7***	5.30	5.30	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W2	***111910.6***	2.57	0.26	0.08	0.35	2.18	0.90	0.96	0.13	0.12	0.39	***0.78***	***0.87***
W3	***29139.5***	0.67	0.67	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W4	***55852.4***	1.28	1.28	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W5	***1784156.1***	40.96	40.96	0.08	0.35	0.00	0.40	0.56	0.00	0.12	0.39	***0.08***	***0.35***
W6	***168373.8***	3.87	0.00	0.08	0.35	3.29	0.90	0.96	0.58	0.12	0.39	***0.78***	***0.87***
W7	***249691.7***	5.73	0.00	0.08	0.35	4.87	0.90	0.96	0.86	0.12	0.39	***0.78***	***0.87***
W8	***791521.3***	18.17	4.29	0.12	0.39	5.47	0.45	0.60	8.41	0.40	0.56	***0.35***	***0.53***

ENCLAVES AT MOUNTAIN VISTA RANCH EAST
PROPOSED CONDITIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY **		*TOTAL FLOWS*	
BASIN	**AREA TOTAL**	**C_5**	**C_{100}**	**C_5**	**Length**	**Height**	**T_C**	**Length**	**Slope**	**Velocity**	**T_t**	**TOTAL**	**CHECK**	**I_5**	**I_{100}**	**Q_5**	**Q_{100}**
	(Acres)	*From DCM Table 5-1*			*(ft)*	*(ft)*	*(min)*	*(ft)*	*(%)*	*(fps)*	*(min)*	*(min)*	*(min)*	*(in/hr)*	*(in/hr)*	*(c.f.s.)*	*(c.f.s.)*
E1	33.82	0.08	0.35	0.08	200	8	16.5	1620	3.0%	1.7	15.7	32.2	20.1	2.4	4.0	***6.4***	***47.2***
E2	24.70	0.08	0.35	0.08	200	8	16.5	1920	2.4%	1.5	20.7	37.2	21.8	2.2	3.6	***4.3***	***31.3***
E3	8.34	0.78	0.87	0.78	60	1.2	3.5	1380	2.9%	3.4	6.8	10.3	18.0	4.1	6.9	***26.7***	***50.0***
E4	10.41	0.81	0.88	0.81	80	2	3.5	600	3.0%	3.5	2.9	6.3	13.8	4.8	8.1	***40.6***	***74.0***
E5	20.10	0.45	0.60	0.45	100	2	9.3	900	4.0%	4.0	3.8	13.1	15.6	3.7	6.3	***33.7***	***75.4***
E6	22.41	0.45	0.60	0.45	100	2	9.3	1100	2.2%	3.0	6.2	15.5	16.7	3.5	5.8	***35.0***	***78.3***
E7	15.63	0.45	0.60	0.45	100	2	9.3	850	2.4%	3.1	4.6	14.0	15.3	3.6	6.1	***25.5***	***57.2***
E8	15.79	0.45	0.60	0.45	100	2	9.3	1230	2.5%	3.2	6.5	15.8	17.4	3.4	5.8	***24.5***	***54.8***
E9	39.03	0.45	0.60	0.45	100	2	9.3	1200	1.8%	2.7	7.4	16.7	17.2	3.4	5.6	***59.0***	***132.0***
E10	23.15	0.43	0.59	0.43	100	2	9.6	1000	3.4%	3.7	4.5	14.1	16.1	3.6	6.1	***36.3***	***83.5***
E11	1.17	0.08	0.35	0.08	200	6	18.1					18.1	11.1	3.2	5.4	***0.3***	***2.2***
E12	1.47	0.08	0.35	0.08	125	10	10.4	285	2.0%	1.4	3.4	13.7	12.3	3.8	6.1	***0.4***	***3.2***
E13	1.16	0.08	0.35	0.08	50	14	4.3	250	2.0%	1.4	2.9	7.3	11.7	3.9	7.7	***0.4***	***3.1***
E14	1.33	0.08	0.35	0.08	50	14	4.3	350	2.0%	1.4	4.1	8.5	12.2	4.4	7.4	***0.5***	***3.4***
E15	5.52	0.81	0.88	0.81	80	2	3.5	680	4.6%	4.3	2.7	6.1	14.2	4.9	8.2	***21.8***	***39.7***
E16	9.29	0.31	0.53	0.31	100	6	7.9	359	6.7%	2.6	2.3	10.2	12.6	4.1	6.9	***11.8***	***33.9***
E17	3.55	0.78	0.87	0.78	60	1	3.5	200	2.0%	2.8	1.2	5.0	11.4	5.2	8.7	***14.4***	***27.0***
E18	3.24	0.12	0.39	0.12	60	12	5.1					5.1	10.3	5.1	8.6	***2.0***	***10.9***
E19	1.76	0.08	0.35	0.08	100	10	8.6	1045	3.3%	3.6	4.8	13.4	16.4	3.7	6.2	***0.5***	***3.8***
E20	14.85	0.08	0.35	0.08	200	8	16.5	940	6.0%	2.4	6.4	22.9	16.3	2.9	4.8	***3.4***	***25.2***
W1	5.30	0.08	0.35	0.08	200	8	16.5	1325	4.7%	2.2	10.2	26.7	18.5	2.7	4.5	***1.1***	***8.3***
W2	2.57	0.78	0.87	0.78	60	1.2	3.6	525	5.3%	4.6	1.9	5.5	13.3	5.0	8.5	***10.1***	***18.9***
W3	0.67	0.08	0.35	0.08	40	8	4.3					5.0	10.2	5.2	8.7	***0.3***	***2.0***
W4	1.28	0.08	0.35	0.08	50	4	6.6					6.6	10.3	4.8	8.0	***0.5***	***3.6***
W5	40.96	0.08	0.35	0.08	200	12	14.4	2260	4.4%	2.1	17.9	32.3	23.7	2.4	4.0	***7.8***	***57.0***
W6	3.87	0.78	0.87	0.78	100	4	3.6	1070	2.2%	3.0	6.0	9.6	16.5	4.2	7.0	***12.7***	***23.8***
W7	5.73	0.78	0.87	0.78	80	2	3.8	1000	1.3%	2.3	7.3	11.1	16.0	4.0	6.7	***17.8***	***33.4***
W8	18.17	0.35	0.53	0.35	100	2	10.8	1500	7.1%	5.3	4.7	15.5	18.9	3.5	5.8	***22.0***	***56.4***

* Intensity equations assume a minimum travel time of 5 minutes.

E1, E2 are evaluted as historic watersheds and thus have a longer than 100' initial overland flow length

3

Calculated by: DLM
Date: 9/16/2022
Checked by: VAS

ENCLAVES AT MOUNTAIN VISTA RANCH EAST
PROPOSED CONDITIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
1	**E1**	2.71	11.84									32.2	2.4	4.0	***6.4***	***47.2***	Prop. 36" Storm Drain Future Detention Facility (By Others)
				See Area Drainage Sheet for Input													
2	**E2**	1.98	8.64									37.2	2.2	3.6	***4.3***	***31.3***	Prop. 30" Storm Drain Future Detention Facility (By Others)
				See Area Drainage Sheet for Input													
3	**E3**	6.53	7.29									10.3	4.1	6.9	***26.7***	***50.0***	Prop. 42" Storm Drain Low Point with Barnes
				See Area Drainage Sheet for Input													
4	**PR4, E4**	14.96	16.45				10.3					10.3	4.1	6.9	***61.2***	***112.9***	FSD Pond 1
				PR4 Tc Used													
5	**E5**	9.05	12.06									13.1	3.7	6.3	***33.7***	***75.4***	FSD Pond 2
				See Area Drainage Sheet for Input													
6	**PR7**	0.46	5.74									70.0	1.2	2.0	***0.6***	***11.6***	Proposed 18" RCP Riprap Outfall Ex. Earthen Channel
				Pond 2 Worksheet													
7	**E6**	10.08	13.44									15.5	3.5	5.8	***35.0***	***78.3***	FSD Pond 3
				See Area Drainage Sheet for Input													
8	**PR6, PR8**	5.92	39.38									61.8	1.4	2.3	***8.3***	***92.3***	Proposed 18" RCP Riprap Outfall Ex. Earthen Channel
				Avg of PR6, PR8 Tc Used													
9	**E7**	7.04	9.38									14.0	3.6	6.1	***25.5***	***57.2***	Prop. 36" Storm Drain
				See Area Drainage Sheet for Input													
10	**E8**	7.11	9.48									15.8	3.4	5.8	***24.5***	***54.8***	Prop. 36" Storm Drain
				See Area Drainage Sheet for Input													
11	**E9**	17.56	23.42									16.7	3.4	5.6	***59.0***	***132.0***	Prop. 36" Storm Drain
				See Area Drainage Sheet for Input													
12	**E10, PR14**	41.74	56.03				14.1					14.1	3.6	6.1	***150.9***	***340.0***	FSD Pond 4
				Basin W1 Tc Used													
13	**E11, PR15**	2.34	43.31									70.0	1.2	2.0	***2.8***	***87.9***	Existing EFSCST
				PR15 Tc Used													
14	**E12**	0.12	0.51									13.7	3.7	6.1	***0.4***	***3.2***	Existing Channel Drop Strcuture
				See Area Drainage Sheet for Input													
15	**E13**	0.09	0.41									7.3	4.6	7.7	***0.4***	***3.1***	Existing Channel Drop Strcuture
				See Area Drainage Sheet for Input													

ENCLAVES AT MOUNTAIN VISTA RANCH EAST
PROPOSED CONDITIONS
(Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
16	**E14**	0.11	0.47									8.5	4.4	7.4	***0.5***	***3.4***	Existing Pond Enclaves Filing 7
				See Area Drainage Sheet for Input													
17	**W1**	0.42	1.86									26.7	2.7	4.5	***1.1***	***8.3***	Prop. Temporary Earthen Swale
				See Area Drainage Sheet for Input													
18	**W2**	2.00	2.24									5.5	5.0	8.5	***10.1***	***18.9***	Prop. 24" Storm Drain
				See Area Drainage Sheet for Input													
19	**W3**	0.05	0.23									5.0	5.2	8.7	***0.3***	***2.0***	Exist. Temporary Earthen Swale
				See Area Drainage Sheet for Input													
20	**W4**	0.10	0.45									6.6	4.8	8.0	***0.5***	***3.6***	Exist. EMV Filing 6 Lots
				See Area Drainage Sheet for Input													
21	**W5**	3.28	14.34									32.3	2.4	4.0	***7.8***	***57.0***	Prop. Temporary Earthen Swale
				See Area Drainage Sheet for Input													
22	**W6**	3.03	3.38									9.6	4.2	7.0	***12.7***	***23.8***	Prop. 30" Storm Drain
				See Area Drainage Sheet for Input													
23	**W7**	4.49	5.01									11.1	4.0	6.7	***17.8***	***33.4***	Prop. 30" Storm Drain
				See Area Drainage Sheet for Input													
24	**E17**	2.78	3.11									5.0	5.2	8.7	***14.4***	***27.0***	Prop. 30" Storm Drain
				See Area Drainage Sheet for Input													
25	**E16**	2.89	4.92									10.2	4.1	6.9	***11.8***	***33.9***	Prop. 30" Storm Drain
				See Area Drainage Sheet for Input													
26	**PR19, PR20, PR21, E18**	13.58	19.53				10.2					10.2	4.1	6.9	***55.7***	***134.4***	FSD Pond 6
				PR 21 Tc Used													
27	**E15**	4.47	4.86									6.1	4.9	8.2	***21.8***	***39.7***	FSD Pond 5
				See Area Drainage Sheet for Input													
28	**PR24, E19**	1.04	18.47				70.0					70.0	1.2	2.0	***1.3***	***37.5***	Prop 30" Storm Drain Existing Channel Drop Structure
				PR 24 Tc Used													
29	**W8**	6.34	9.67									15.5	3.5	5.8	***22.0***	***56.4***	FSD Pond 7
				See Area Drainage Sheet for Input													
30	**PR25**	2.10	9.40									70.0	1.2	2.0	***2.5***	***19.1***	Exist 24" RCP
				PR 25 Tc Used													
31	**E20**	1.19	5.20									22.9	2.9	4.8	***3.4***	***25.2***	Prop. Temporary Earthen Swale
				See Area Drainage Sheet for Input													

ENCLAVES AT MOUNTAIN VISTA RANCH EAST
PROPOSED CONDITIONS
(Storm Sewer Routing Summary)

PIPE RUN	*Contributing Pipes/Design Points*	*Equivalent* CA_5	*Equivalent* CA_{100}	*Maximum* T_C	*Intensity**		*Flow*		PIPE SIZE
					I_5	I_{100}	Q_5	Q_{100}	
1	**DP1**	2.71	11.84	32.2	2.4	4.0	***6.4***	***47.2***	36" Storm Drain
2	**DP2**	1.98	8.64	37.2	2.2	3.6	***4.3***	***31.3***	30" Storm Drain
3	**PR1, PR2**	4.68	20.48	37.2	2.2	3.6	***10.1***	***74.2***	42" Storm Drain
4	**DP3**	6.53	7.29	10.3	4.1	6.9	***26.7***	***50.0***	36" Storm Drain
5	**POND 1 OUTFALL ***	0.62	10.65	70.0	1.2	2.0	***0.8***	***21.6***	24" Storm Drain
6	**PR3, PR5**	5.30	31.13	53.6	1.6	2.7	***8.5***	***84.1***	42" Storm Drain
7	**POND 2 OUTFALL****	0.46	5.74	70.0	1.2	2.0	***0.6***	***11.6***	18" Storm Drain
8	**POND 3 OUTFALL****	0.62	8.25	70.0	1.2	2.0	***0.8***	***16.7***	18" Storm Drain
9	**PR6, PR8**	5.92	39.38	61.8	1.4	2.3	***8.3***	***92.3***	36" Storm Drain
10	**DP9**	7.04	9.38	14.0	3.6	6.1	***25.5***	***57.2***	36" Storm Drain
11	**DP10**	7.11	9.48	15.8	3.4	5.8	***24.5***	***54.8***	36" Storm Drain
12	**PR10, PR11**	14.14	18.86	16.0	3.4	5.7	***48.4***	***108.4***	48" Storm Drain
13	**DP11**	17.56	23.42	16.7	3.4	5.6	***59.0***	***132.0***	48" Storm Drain
14	**PR12, PR13**	31.71	42.28	17.0	3.3	5.6	***105.7***	***236.5***	60" Storm Drain
15	**POND 4 OUTFALL****	2.25	42.90	70.0	1.2	2.0	***2.7***	***87.0***	42" Storm Drain
16	**DP18**	2.00	2.24	5.5	5.0	8.5	***10.1***	***18.9***	24" Storm Drain
17	**DP22**	3.03	3.38	9.6	4.2	7.0	***12.7***	***23.8***	30" Storm Drain
18	**DP23**	4.49	5.01	11.1	4.0	6.7	***17.8***	***33.4***	30" Storm Drain
19	**PR17, PR18**	7.51	8.39	11.1	4.0	6.7	***29.9***	***56.0***	36" Storm Drain
20	**DP24**	2.78	3.11	5.0	5.2	8.7	***14.4***	***27.0***	30" Storm Drain
21	**DP25**	2.89	4.92	10.2	4.1	6.9	***11.8***	***33.9***	30" Storm Drain
22	**POND 6 OUTFALL****	0.70	15.90	70.0	1.2	2.0	***0.8***	***32.3***	30" Storm Drain
23	**POND 5 OUTFALL****	0.20	1.95	70.0	1.2	2.0	***0.2***	***4.0***	18" Storm Drain
24	**PR22, PR23**	0.90	17.85	70.0	1.2	2.0	***2.0***	***36.2***	30" Storm Drain
25	**POND 7 OUTFALL****	2.10	9.40	70.0	1.2	2.0	***2.5***	***19.1***	24" Storm Drain

* Intensity equations assume a minimum travel time of 5 minutes.

DP - Design Point
EX - Existing Design Point
FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: DLM
Date: 9/16/2022
Checked by: VAS

HYDRAULIC CALCULATIONS

PIPE CAPACITY

DIAMETER (in)	80% FULL @ 1% SLOPE (cfs)	VELOCITY (ft/s)
8	1.2	3.9
12	3.5	5.2
15	6.3	6.0
18	10.3	6.8
24	22.1	8.2
30	40.1	9.5
36	65.2	10.8
42	98.3	11.9
48	140.4	13.0
54	192.2	14.1
60	254.5	15.1
66	328.2	16.1
72	413.9	17.1
78	486.1 @ 0.9%	17.1
84	558.5 @ 0.8%	16.9
90	627.9 @ 0.7%	16.6
96	745.8 @ 0.7%	17.3

POND CALCULATIONS

Total Weighted Percent Imperviousness (Pond 1)				
Contributing Basins	*Area (Acres)*	C_5	*Impervious % (I)*	*(Acres)*(I)*
E3	8.34	0.78	0.92	7.67
E4	10.41	0.81	0.95	9.89
Totals	***18.75***			***17.56***
Total Imperviousness	***0.94***			

Total Weighted Percent Imperviousness (Pond 2)				
Contributing Basins	*Area (Acres)*	C_5	*Impervious % (I)*	*(Acres)*(I)*
E5	20.10	0.45	0.65	13.07
Totals	***20.10***			***13.07***
Total Imperviousness	***0.65***			

Total Weighted Percent Imperviousness (Pond 3)				
Contributing Basins	*Area (Acres)*	C_5	*Impervious % (I)*	*(Acres)*(I)*
Column1	**Column2**	**Column3**	**Column4**	**Column5**
E6	22.40	0.45	0.65	14.56
Totals	***22.40***			***14.56***
Total Imperviousness	***0.65***			

Weighted Percent Imperviousness (Pond 4)				
Contributing Basins	*Area (Acres)*	C_5	*Impervious % (I)*	*(Acres)*(I)*
E7	15.63	0.45	0.65	10.16
E8	15.79	0.45	0.65	10.27
E9	39.03	0.45	0.65	25.37
E10	23.15	0.43	0.62	14.35
Totals	***93.61***			***60.15***
Total Imperviousness	***0.64***			

Total Weighted Percent Imperviousness (Pond 5)				
Contributing Basins	*Area (Acres)*	C_5	*Impervious % (I)*	*(Acres)*(I)*
E15	5.50	0.81	0.95	5.23
Totals	***5.50***			***5.23***
Total Imperviousness	***0.95***			

Weighted Percent Imperviousness (Pond 6)				
Contributing Basins	***Area (Acres)***	***C_5***	***Impervious % (I)***	***(Acres)*(I)***
E16	9.29	0.31	0.42	3.90
E17	3.55	0.78	0.87	3.09
E18	3.24	0.12	0.07	0.23
W6	3.87	0.78	0.87	3.36
W7	5.73	0.78	0.87	4.99
Totals	***25.68***			***15.57***
Total Imperviousness	***0.61***			

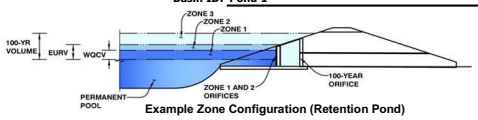
Total Weighted Percent Imperviousness (Pond 7)				
Contributing Basins	***Area (Acres)***	***C_5***	***Impervious % (I)***	***(Acres)*(I)***
W8	18.17	0.35	0.48	8.72
Totals	***18.17***			***8.72***
Total Imperviousness	***0.48***			

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves at Mountain Vista East

Basin ID: Pond 1



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	18.75	acres
Watershed Length =	925	ft
Watershed Length to Centroid =	450	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	94.00%	percent
Percentage Hydrologic Soil Group A =	53.0%	percent
Percentage Hydrologic Soil Group B =	47.0%	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) =	0.684 acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.217 acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.621 acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.088 acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.472 acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.868 acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.257 acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.689 acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	4.659 acre-feet		inches
Approximate 2-yr Detention Volume =	1.600 acre-feet		
Approximate 5-yr Detention Volume =	2.076 acre-feet		
Approximate 10-yr Detention Volume =	2.493 acre-feet		
Approximate 25-yr Detention Volume =	2.808 acre-feet		
Approximate 50-yr Detention Volume =	2.988 acre-feet		
Approximate 100-yr Detention Volume =	3.144 acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.684	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.533	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.927	acre-feet
Total Detention Basin Volume =	3.144	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

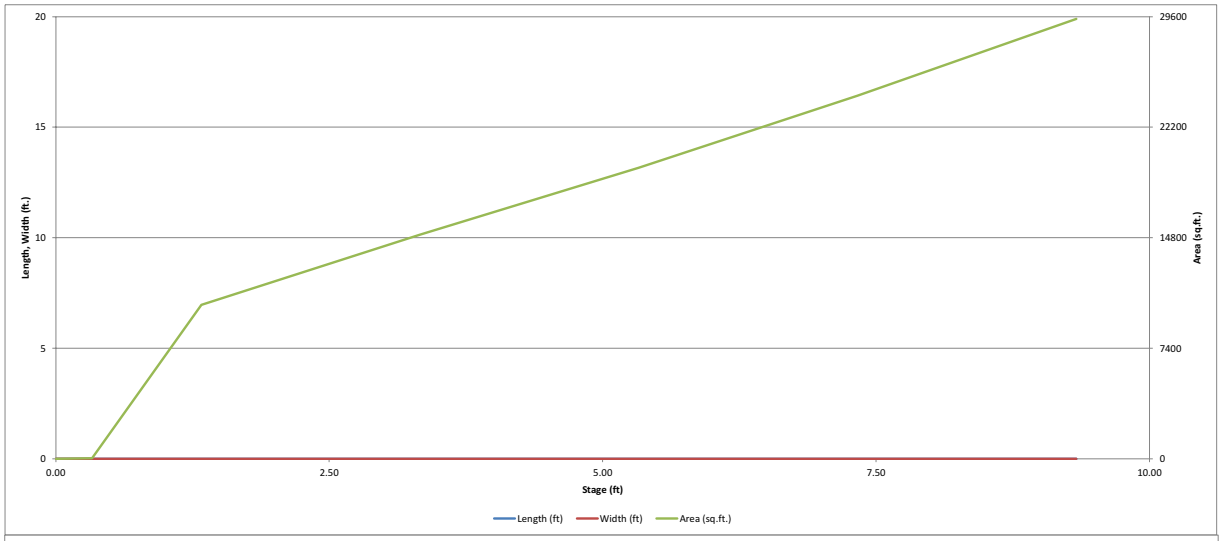
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

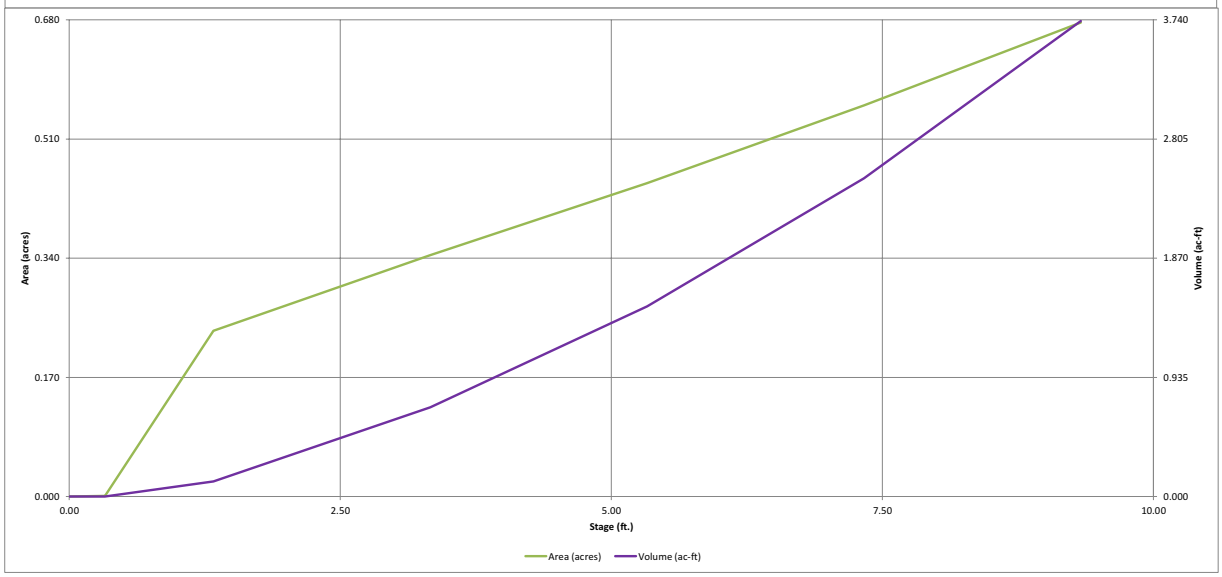
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
6666.67 **Top of Micropool**	--	0.00	--	--	--	0	0.000		
	--	0.33	--	--	--	40	0.001	7	0.000
	--	1.33	--	--	--	10,300	0.236	5,176	0.119
	--	3.33	--	--	--	15,000	0.344	30,476	0.700
	--	5.33	--	--	--	19,490	0.447	64,966	1.491
	--	7.33	--	--	--	24,300	0.558	108,756	2.497
	--	9.33	--	--	--	29,460	0.676	162,516	3.731

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



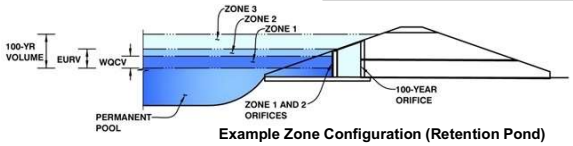


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Enclaves at Mountain Vista East**

Basin ID: **Pond 1**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.29	0.684	Orifice Plate
Zone 2 (EURV)	6.82	1.533	Orifice Plate
Zone 3 (100-year)	8.43	0.927	Weir&Pipe (Restrict)
Total (all zones)		3.144	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	2.736E-02	ft^2
Depth at top of Zone using Orifice Plate =	6.82	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	27.30	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	3.94	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.27	4.55					
Orifice Area (sq. inches)	3.94	3.94	3.94					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.82	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.82	N/A	feet
Overflow Weir Front Edge Length =	9.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	8.09	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	25.06	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	12.53	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.33	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.10	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.99	N/A	feet
Restrictor Plate Height Above Pipe Invert =	23.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.73	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.94	feet
Spillway Crest Length =	29.00	feet	Stage at Top of Freeboard =	9.44	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.68	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.73	acre-ft

Calculated Parameters for Spillway

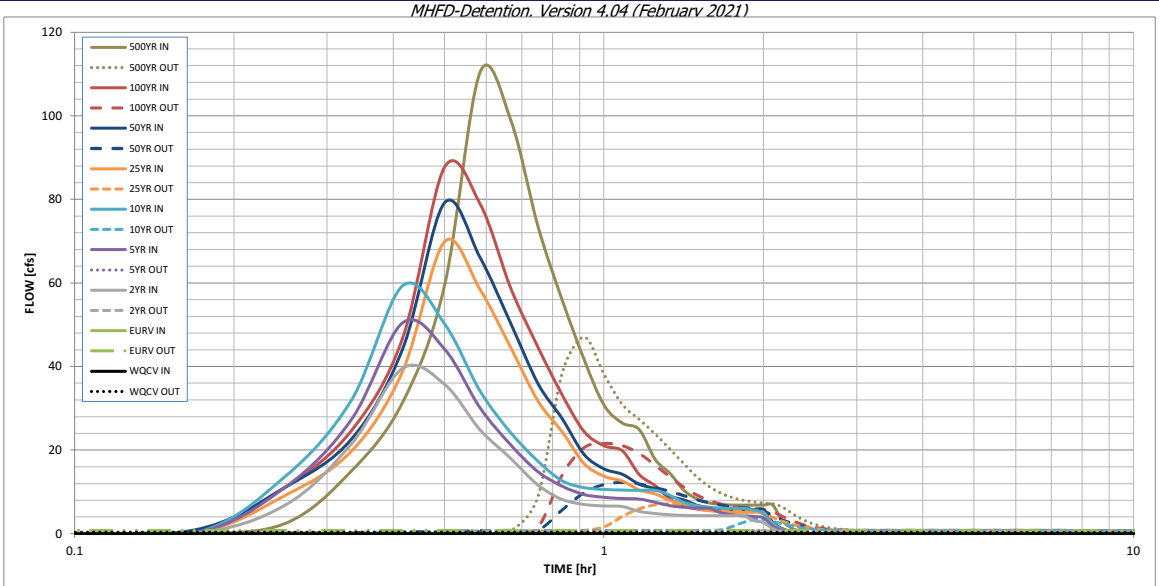
Routed Hydrograph Results

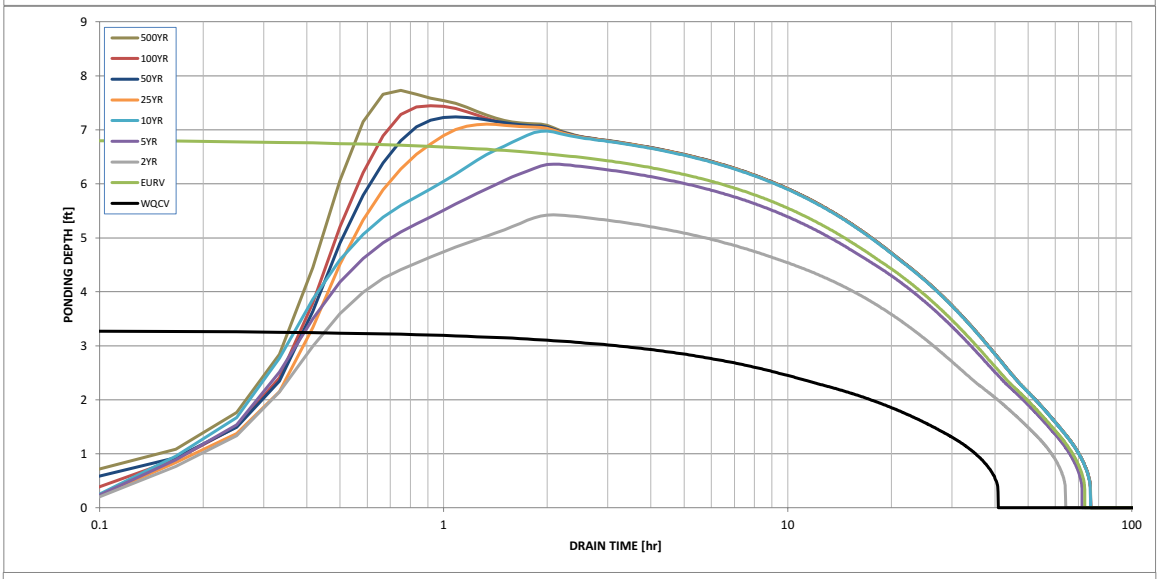
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

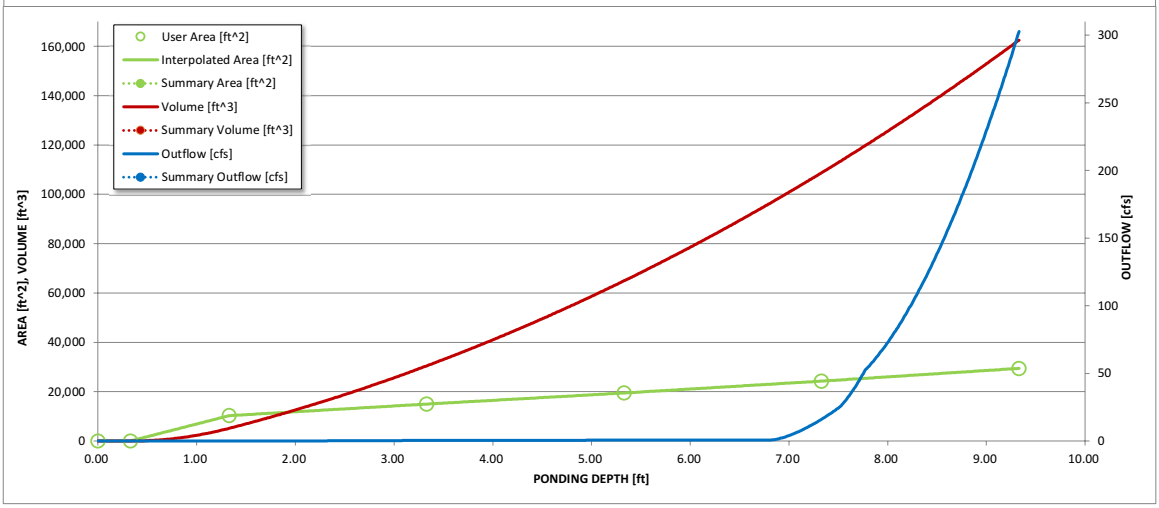
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.684	2.217	1.621	2.088	2.472	2.868	3.257	3.689	4.659
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.621	2.088	2.472	2.868	3.257	3.689	4.659
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.4	2.3	6.5	14.6	20.0	27.0	40.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.02	0.12	0.35	0.78	1.06	1.44	2.16
Peak Inflow Q (cfs) =	N/A	N/A	39.6	50.5	59.3	69.8	79.2	87.7	110.4
Peak Outflow Q (cfs) =	0.4	0.8	0.7	0.8	3.4	7.1	12.3	21.6	47.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.5	0.5	0.6	0.8	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.2	0.5	0.8	1.5
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) =	38	66	59	65	68	67	66	65	63
Time to Drain 99% of Inflow Volume (hours) =	**40**	70	62	69	73	73	72	72	71
Maximum Ponding Depth (ft) =	3.29	6.82	5.43	6.36	6.98	7.10	7.24	7.45	7.73
Area at Maximum Ponding Depth (acres) =	0.34	0.53	0.45	0.50	0.54	0.55	0.55	0.56	0.58
Maximum Volume Stored (acre-ft) =	0.686	2.219	1.532	1.982	2.299	2.370	2.447	2.558	2.719

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.08	2.45
	0:15:00	0.00	0.00	6.82	11.09	13.70	9.18	11.13	11.13	15.01
	0:20:00	0.00	0.00	21.51	27.33	31.94	19.76	22.62	24.69	31.44
	0:25:00	0.00	0.00	39.61	50.49	59.31	38.87	44.17	46.82	59.32
	0:30:00	0.00	0.00	35.78	44.17	50.22	69.83	79.19	87.70	110.36
	0:35:00	0.00	0.00	24.87	30.14	34.19	58.44	66.10	78.95	98.99
	0:40:00	0.00	0.00	18.03	21.25	24.18	44.53	50.33	58.79	73.69
	0:45:00	0.00	0.00	11.65	14.88	17.41	31.82	35.99	44.72	56.07
	0:50:00	0.00	0.00	8.25	11.41	12.67	24.43	27.62	33.32	41.79
	0:55:00	0.00	0.00	7.02	9.39	11.07	16.82	19.00	24.49	30.75
	1:00:00	0.00	0.00	6.62	8.70	10.60	13.76	15.54	21.07	26.48
	1:05:00	0.00	0.00	6.50	8.43	10.42	12.59	14.22	19.81	24.91
	1:10:00	0.00	0.00	5.37	8.32	10.38	10.49	11.85	14.12	17.74
	1:15:00	0.00	0.00	4.81	7.52	10.38	9.52	10.76	11.48	14.41
	1:20:00	0.00	0.00	4.55	6.72	9.15	7.95	8.98	8.28	10.38
	1:25:00	0.00	0.00	4.39	6.34	7.51	7.15	8.08	6.61	8.27
	1:30:00	0.00	0.00	4.34	6.13	6.72	6.02	6.79	5.88	7.36
	1:35:00	0.00	0.00	4.34	6.03	6.31	5.48	6.18	5.61	7.01
	1:40:00	0.00	0.00	4.34	5.01	6.11	5.24	5.90	5.51	6.88
	1:45:00	0.00	0.00	4.34	4.52	6.06	5.14	5.78	5.51	6.89
	1:50:00	0.00	0.00	4.34	4.29	6.06	5.10	5.74	5.51	6.89
	1:55:00	0.00	0.00	3.20	4.15	5.72	5.10	5.74	5.51	6.89
	2:00:00	0.00	0.00	2.65	3.81	4.89	5.10	5.74	5.51	6.89
	2:05:00	0.00	0.00	1.24	1.81	2.31	2.42	2.72	2.61	3.27
	2:10:00	0.00	0.00	0.54	0.84	1.05	1.12	1.26	1.21	1.51
	2:15:00	0.00	0.00	0.21	0.37	0.44	0.50	0.56	0.54	0.68
	2:20:00	0.00	0.00	0.06	0.10	0.11	0.14	0.15	0.15	0.19
	2:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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
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	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	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
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	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
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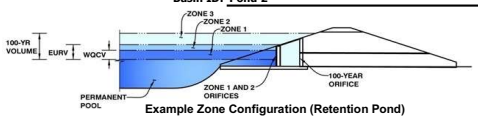
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Pond 2



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	20.10	acres
Watershed Length =	1,500	ft
Watershed Length to Centroid =	750	ft
Watershed Slope =	0.035	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	98.0%	percent
Percentage Hydrologic Soil Group B =	2.0%	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) =	0.426	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.617	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.177	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.542	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.835	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.227	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.603	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.062	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	4.067	acre-feet		inches
Approximate 2-yr Detention Volume =	1.056	acre-feet		
Approximate 5-yr Detention Volume =	1.381	acre-feet		
Approximate 10-yr Detention Volume =	1.667	acre-feet		
Approximate 25-yr Detention Volume =	2.001	acre-feet		
Approximate 50-yr Detention Volume =	2.202	acre-feet		
Approximate 100-yr Detention Volume =	2.413	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.426	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.192	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.796	acre-feet
Total Detention Basin Volume =	2.413	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

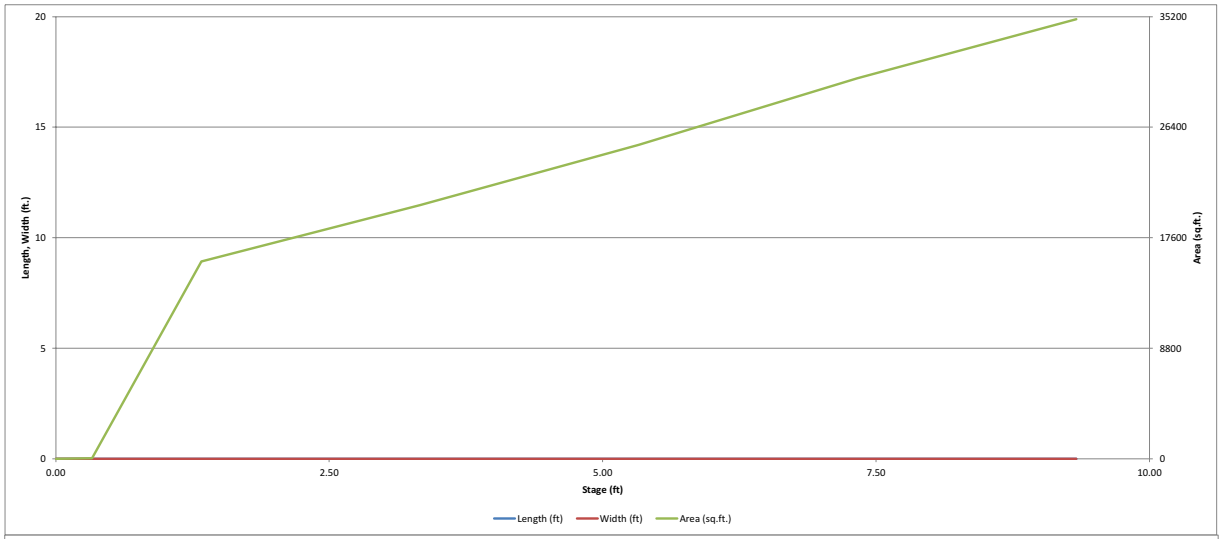
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

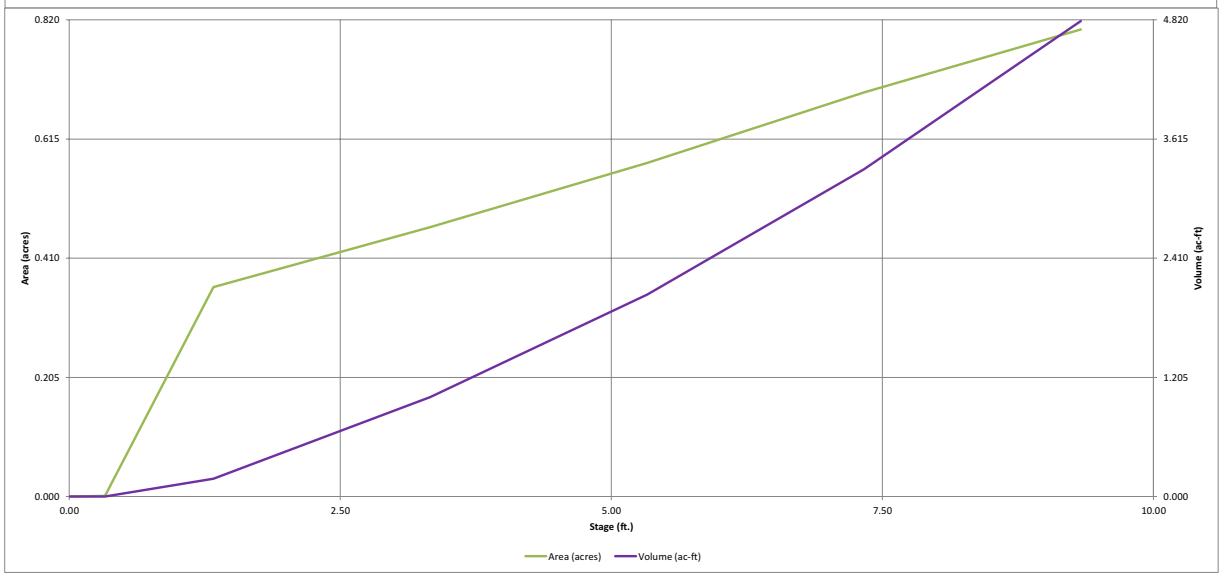
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
	--	0.33	--	--	--	40	0.001	7	0.000
	--	1.33	--	--	--	15,700	0.360	7,876	0.181
	--	3.33	--	--	--	20,190	0.463	43,766	1.005
	--	5.33	--	--	--	25,000	0.574	88,956	2.042
	--	7.33	--	--	--	30,300	0.696	144,256	3.312
	--	9.33	--	--	--	35,000	0.803	209,556	4.811

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



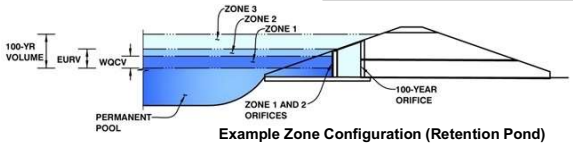


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Pond 2



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.98	0.426	Orifice Plate
Zone 2 (EURV)	4.57	1.192	Orifice Plate
Zone 3 (100-year)	5.96	0.796	Weir&Pipe (Restrict)
Total (all zones)		2.413	

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	
Depth at top of Zone using Orifice Plate =	4.57	ft (relative to basin bottom at Stage = 0 ft)	
Orifice Plate: Orifice Vertical Spacing =	18.30	inches	
Orifice Plate: Orifice Area per Row =	N/A	inches	

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.52	3.05					
Orifice Area (sq. inches)	3.06	3.06	6.80					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.00	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.06	N/A	
Overflow Grate Open Area w/o Debris =	7.12	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.56	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.33	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	10.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.01	N/A	ft^2
Outlet Orifice Centroid =	0.48	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.68	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.90	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	18.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.91	feet
Stage at Top of Freeboard =	7.81	feet
Basin Area at Top of Freeboard =	0.72	acres
Basin Volume at Top of Freeboard =	3.65	acre-ft

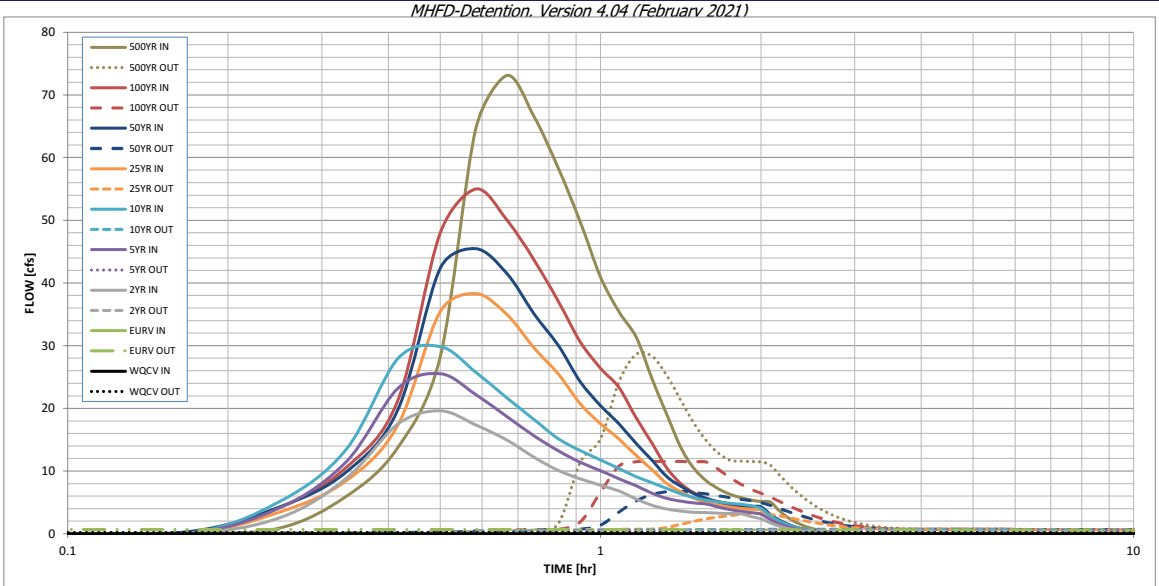
Routed Hydrograph Results

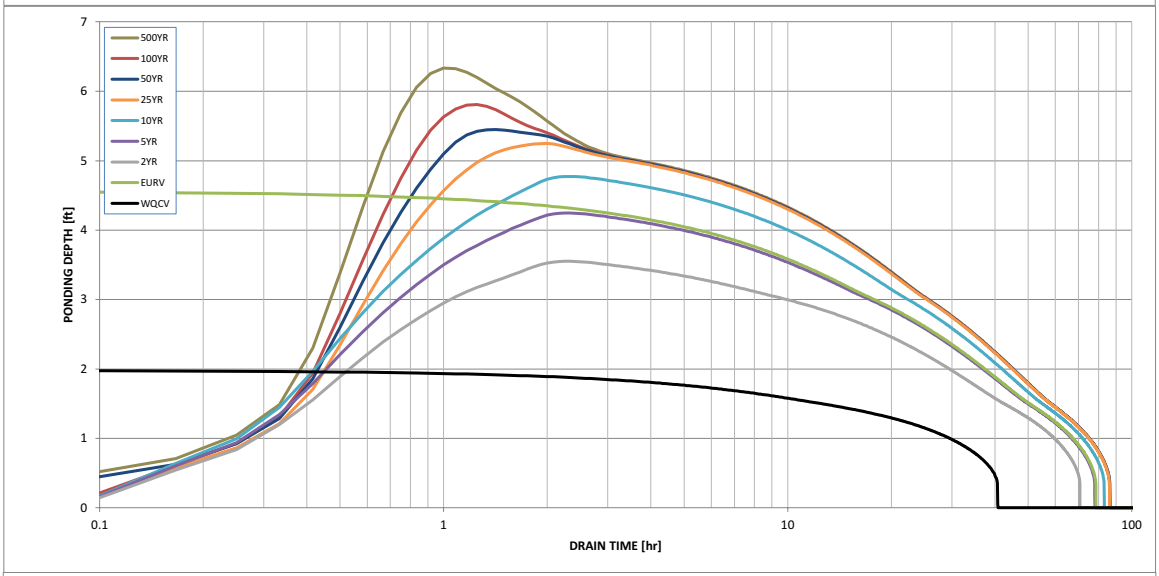
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

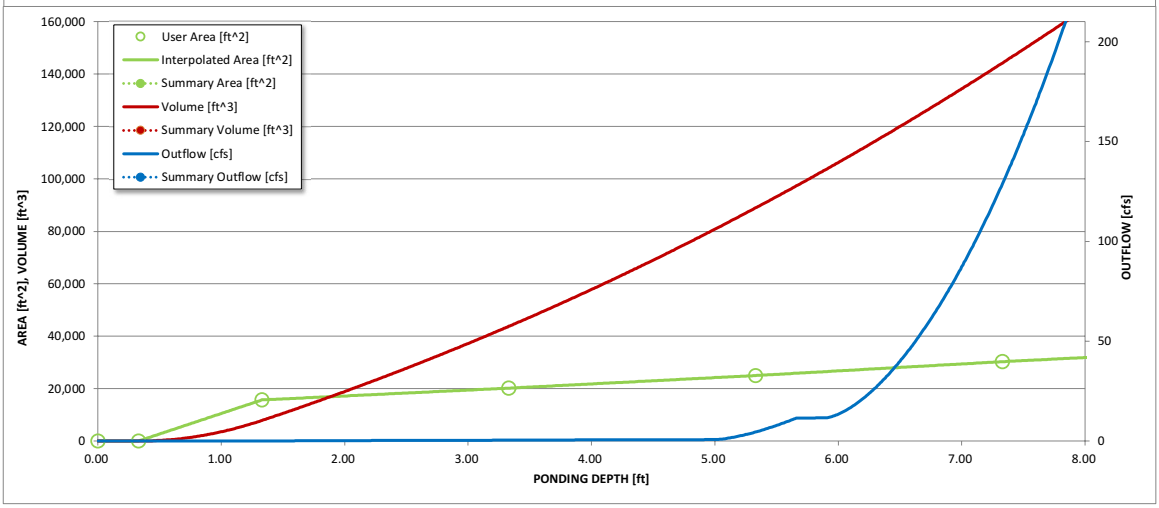
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.426	1.617	1.177	1.542	1.835	2.227	2.603	3.062	4.067
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.177	1.542	1.835	2.227	2.603	3.062	4.067
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.2	0.3	0.4	4.2	7.9	12.6	22.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.21	0.39	0.63	1.11
Peak Inflow Q (cfs) =	N/A	N/A	19.6	25.5	29.9	38.3	45.5	55.0	73.1
Peak Outflow Q (cfs) =	0.2	0.7	0.5	0.6	0.7	3.2	6.8	11.6	28.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.1	1.7	0.8	0.9	0.9	1.3
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.4	0.8	1.5	1.6
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	72	65	71	75	77	76	74	71
Time to Drain 99% of Inflow Volume (hours) =	**40**	76	69	76	80	83	82	82	80
Maximum Ponding Depth (ft) =	1.99	4.57	3.55	4.25	4.77	5.25	5.45	5.81	6.33
Area at Maximum Ponding Depth (acres) =	0.39	0.53	0.48	0.51	0.54	0.57	0.58	0.60	0.63
Maximum Volume Stored (acre-ft) =	0.430	1.622	1.108	1.449	1.729	1.991	2.106	2.319	2.646

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.03	0.93
	0:15:00	0.00	0.00	2.55	4.15	5.14	3.46	4.28	4.21	5.96
	0:20:00	0.00	0.00	8.83	11.49	13.49	8.49	9.85	10.60	13.73
	0:25:00	0.00	0.00	17.49	23.18	27.93	17.30	19.75	21.27	28.19
	0:30:00	0.00	0.00	19.59	25.53	29.87	35.42	42.33	47.96	64.58
	0:35:00	0.00	0.00	17.35	22.19	25.77	38.30	45.48	54.99	73.09
	0:40:00	0.00	0.00	14.94	18.71	21.67	35.00	41.53	50.07	66.57
	0:45:00	0.00	0.00	12.21	15.63	18.23	29.65	35.08	43.69	58.30
	0:50:00	0.00	0.00	10.10	13.22	15.15	25.49	30.02	37.08	49.69
	0:55:00	0.00	0.00	8.75	11.42	13.25	20.71	24.23	30.59	40.93
	1:00:00	0.00	0.00	7.75	10.05	11.79	17.54	20.42	26.41	35.38
	1:05:00	0.00	0.00	6.81	8.78	10.38	15.10	17.52	23.31	31.34
	1:10:00	0.00	0.00	5.54	7.63	9.11	12.46	14.39	18.45	24.61
	1:15:00	0.00	0.00	4.52	6.45	8.12	10.17	11.66	14.37	18.95
	1:20:00	0.00	0.00	3.93	5.63	7.23	7.99	9.07	10.43	13.63
	1:25:00	0.00	0.00	3.62	5.18	6.36	6.68	7.55	7.96	10.33
	1:30:00	0.00	0.00	3.44	4.91	5.76	5.64	6.36	6.49	8.35
	1:35:00	0.00	0.00	3.35	4.73	5.34	4.98	5.61	5.60	7.14
	1:40:00	0.00	0.00	3.28	4.23	5.04	4.53	5.09	4.99	6.31
	1:45:00	0.00	0.00	3.23	3.86	4.84	4.24	4.77	4.59	5.76
	1:50:00	0.00	0.00	3.19	3.59	4.70	4.04	4.54	4.30	5.37
	1:55:00	0.00	0.00	2.75	3.38	4.46	3.90	4.39	4.12	5.13
	2:00:00	0.00	0.00	2.41	3.13	4.02	3.82	4.29	4.06	5.05
	2:05:00	0.00	0.00	1.74	2.27	2.89	2.76	3.10	2.93	3.65
	2:10:00	0.00	0.00	1.22	1.59	2.02	1.94	2.17	2.07	2.57
	2:15:00	0.00	0.00	0.84	1.10	1.41	1.35	1.52	1.45	1.80
	2:20:00	0.00	0.00	0.58	0.74	0.96	0.92	1.04	0.99	1.23
	2:25:00	0.00	0.00	0.38	0.48	0.64	0.61	0.69	0.66	0.81
	2:30:00	0.00	0.00	0.24	0.32	0.42	0.42	0.46	0.44	0.55
	2:35:00	0.00	0.00	0.14	0.20	0.25	0.25	0.28	0.27	0.33
	2:40:00	0.00	0.00	0.06	0.10	0.12	0.13	0.15	0.14	0.17
	2:45:00	0.00	0.00	0.02	0.04	0.04	0.05	0.05	0.05	0.06
	2:50:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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
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	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
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	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
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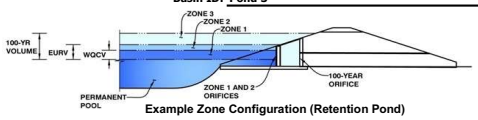
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Pond 3



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	22.40	acres
Watershed Length =	1,500	ft
Watershed Length to Centroid =	750	ft
Watershed Slope =	0.035	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	63.0%	percent
Percentage Hydrologic Soil Group B =	37.0%	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) =	0.474	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	1.726	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.343	acre-feet	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.753	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.147	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	2.667	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.106	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.671	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	4.827	acre-feet	inches
Approximate 2-yr Detention Volume =	1.197	acre-feet	
Approximate 5-yr Detention Volume =	1.580	acre-feet	
Approximate 10-yr Detention Volume =	1.946	acre-feet	
Approximate 25-yr Detention Volume =	2.244	acre-feet	
Approximate 50-yr Detention Volume =	2.421	acre-feet	
Approximate 100-yr Detention Volume =	2.641	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.474	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.252	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.915	acre-feet
Total Detention Basin Volume =	2.641	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

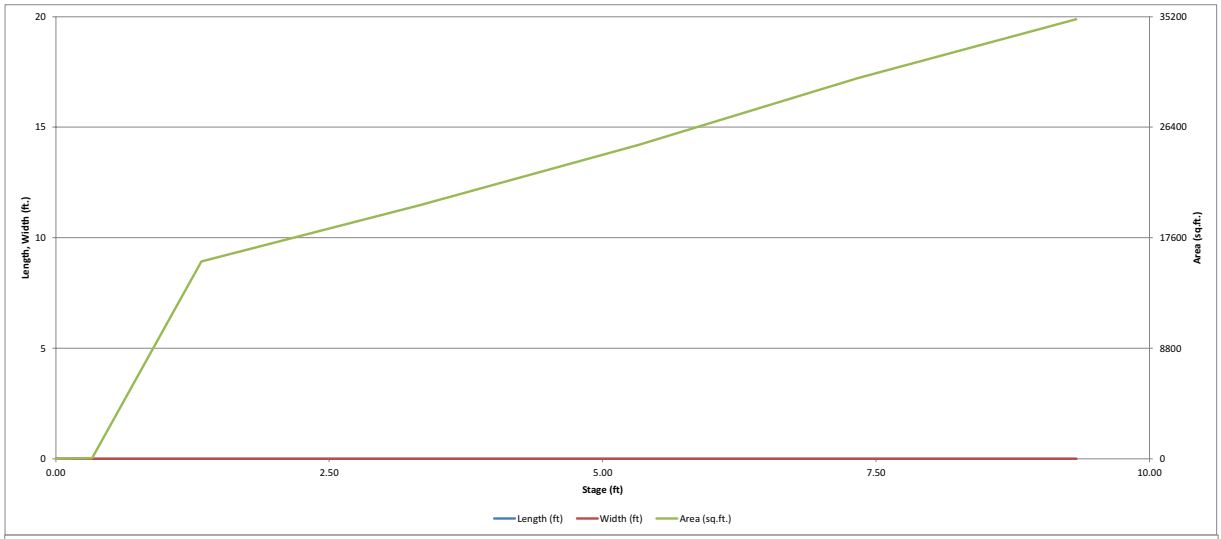
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

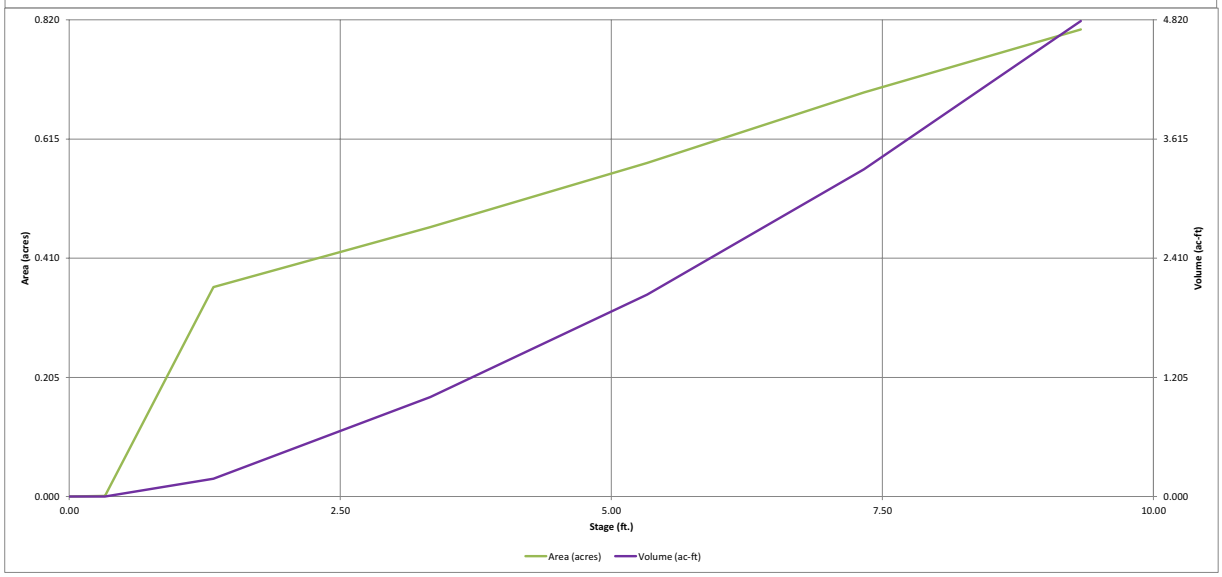
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
	--	0.33	--	--	--	40	0.001	7	0.000
	--	1.33	--	--	--	15,700	0.360	7,876	0.181
	--	3.33	--	--	--	20,190	0.463	43,766	1.005
	--	5.33	--	--	--	25,000	0.574	88,956	2.042
	--	7.33	--	--	--	30,300	0.696	144,256	3.312
	--	9.33	--	--	--	35,000	0.803	209,556	4.811

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



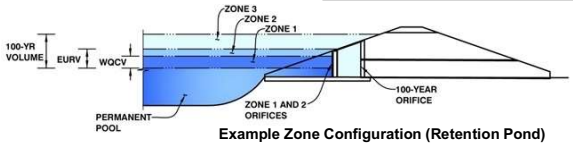


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Pond 3



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.11	0.474	Orifice Plate
Zone 2 (EURV)	4.77	1.252	Orifice Plate
Zone 3 (100-year)	6.33	0.915	Weir&Pipe (Restrict)
Total (all zones)		2.641	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.77	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	19.10	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.59	3.18					
Orifice Area (sq. inches)	3.32	3.32	10.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected				
Overflow Weir Front Edge Height, Ho =	4.77	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.77	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	4.12	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.50	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	11.48	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	5.74	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected				
Depth to Invert of Outlet Pipe =	0.33	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.77	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.75	N/A	feet
Restrictor Plate Height Above Pipe Invert =	18.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.12	feet
Spillway Crest Length =	15.00	feet	Stage at Top of Freeboard =	8.62	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.77	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	4.25	acre-ft

Calculated Parameters for Spillway

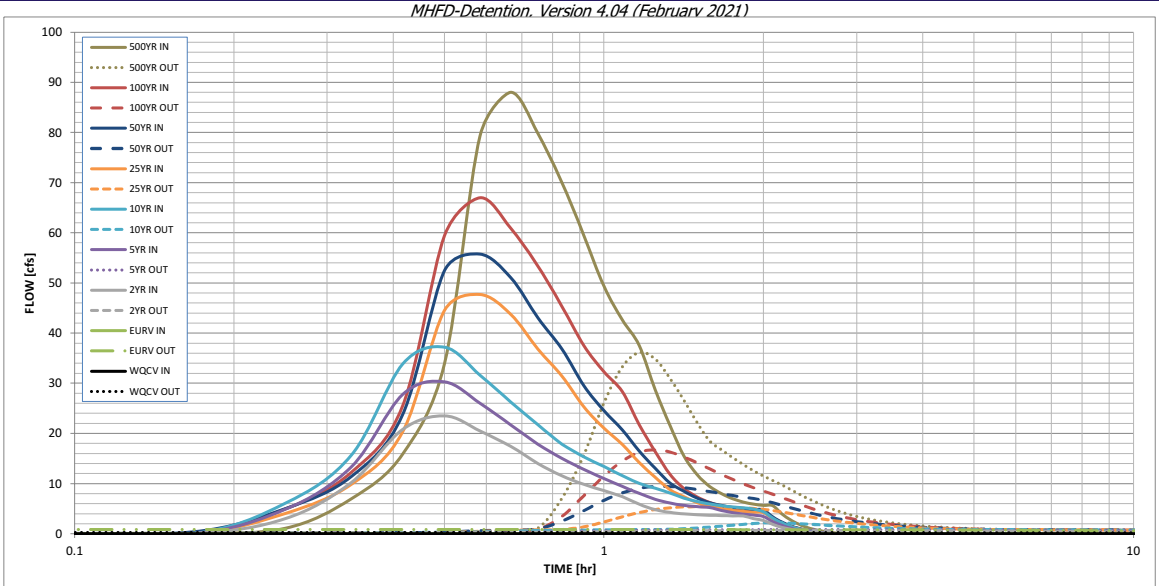
Routed Hydrograph Results

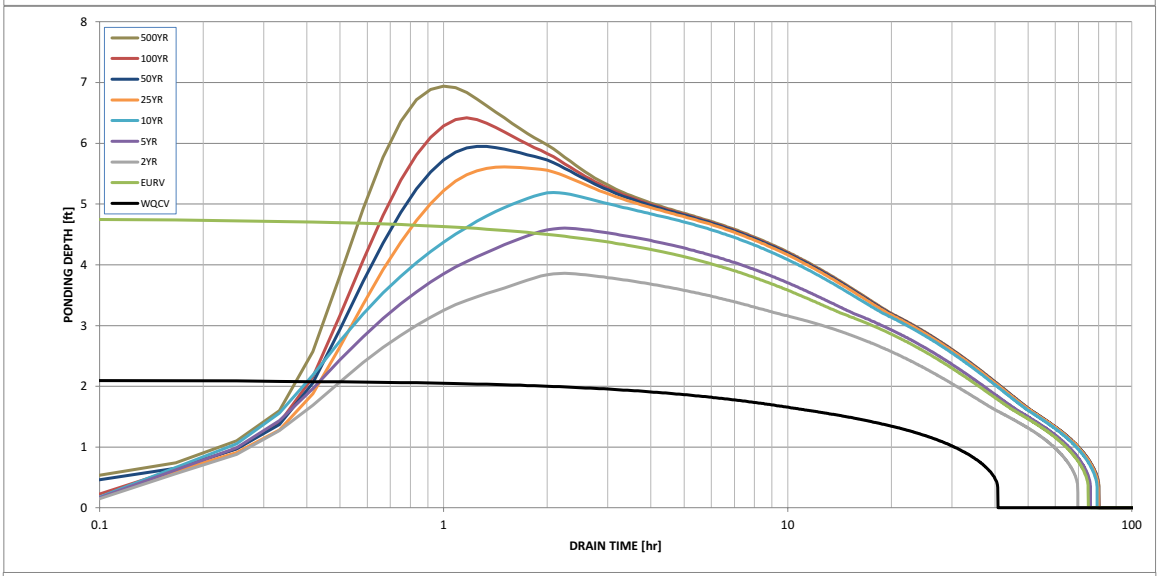
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

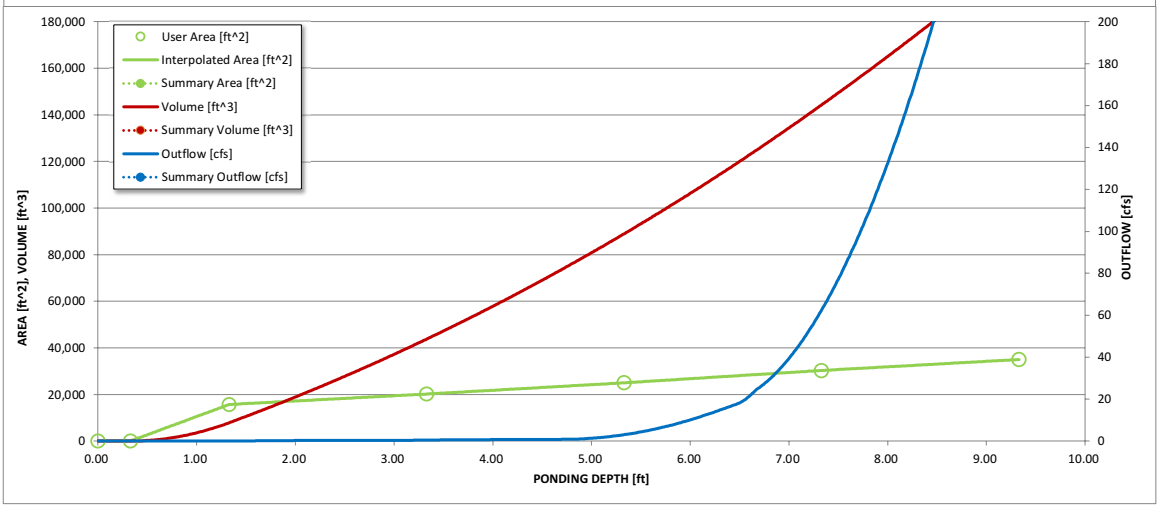
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.474	1.726	1.343	1.753	2.147	2.667	3.106	3.671	4.827
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.343	1.753	2.147	2.667	3.106	3.671	4.827
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.3	0.6	3.9	11.3	15.8	22.1	34.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.03	0.18	0.50	0.70	0.98	1.53
Peak Inflow Q (cfs) =	N/A	N/A	23.5	30.3	37.2	47.7	55.7	67.0	88.0
Peak Outflow Q (cfs) =	0.2	0.9	0.7	0.8	2.2	5.4	9.4	16.7	36.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.4	0.6	0.5	0.6	0.8	1.1
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.4	0.7	1.4	1.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	68	64	69	71	70	69	67	64
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	68	73	76	76	76	75	74
Maximum Ponding Depth (ft) =	2.11	4.77	3.86	4.60	5.19	5.61	5.95	6.42	6.94
Area at Maximum Ponding Depth (acres) =	0.40	0.54	0.49	0.53	0.57	0.59	0.61	0.64	0.67
Maximum Volume Stored (acre-ft) =	0.478	1.729	1.253	1.638	1.957	2.199	2.404	2.697	3.045

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

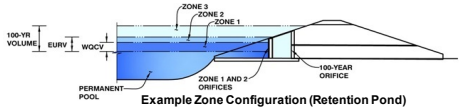
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.03	1.09
	0:15:00	0.00	0.00	2.99	4.88	6.05	4.06	5.02	4.94	6.96
	0:20:00	0.00	0.00	10.25	13.37	15.66	9.84	11.40	12.28	15.88
	0:25:00	0.00	0.00	20.81	27.77	33.83	20.32	23.76	25.50	33.91
	0:30:00	0.00	0.00	23.52	30.30	37.17	44.54	52.46	59.42	79.27
	0:35:00	0.00	0.00	20.49	26.03	31.63	47.68	55.73	66.96	87.99
	0:40:00	0.00	0.00	17.40	21.71	26.27	43.77	51.07	60.90	79.82
	0:45:00	0.00	0.00	14.02	17.87	21.76	36.82	43.06	53.39	69.97
	0:50:00	0.00	0.00	11.51	15.02	17.87	31.44	36.81	45.33	59.44
	0:55:00	0.00	0.00	9.86	12.80	15.35	25.27	29.51	37.48	49.31
	1:00:00	0.00	0.00	8.57	11.02	13.38	21.05	24.53	32.29	42.63
	1:05:00	0.00	0.00	7.38	9.42	11.56	17.80	20.69	28.32	37.48
	1:10:00	0.00	0.00	5.87	8.07	10.04	14.20	16.47	21.70	28.64
	1:15:00	0.00	0.00	4.80	6.88	9.08	11.25	13.03	16.37	21.55
	1:20:00	0.00	0.00	4.25	6.11	8.12	8.78	10.12	11.83	15.50
	1:25:00	0.00	0.00	3.96	5.68	7.12	7.37	8.45	9.03	11.77
	1:30:00	0.00	0.00	3.79	5.40	6.42	6.21	7.09	7.32	9.46
	1:35:00	0.00	0.00	3.70	5.21	5.93	5.46	6.20	6.24	8.00
	1:40:00	0.00	0.00	3.62	4.65	5.59	4.97	5.62	5.51	7.00
	1:45:00	0.00	0.00	3.57	4.23	5.35	4.65	5.25	5.03	6.33
	1:50:00	0.00	0.00	3.53	3.93	5.18	4.43	4.99	4.70	5.88
	1:55:00	0.00	0.00	3.02	3.71	4.91	4.30	4.84	4.54	5.67
	2:00:00	0.00	0.00	2.64	3.44	4.41	4.21	4.74	4.49	5.59
	2:05:00	0.00	0.00	1.87	2.44	3.11	2.98	3.35	3.18	3.96
	2:10:00	0.00	0.00	1.29	1.68	2.15	2.07	2.32	2.22	2.76
	2:15:00	0.00	0.00	0.88	1.14	1.47	1.42	1.59	1.53	1.90
	2:20:00	0.00	0.00	0.58	0.74	0.98	0.95	1.06	1.02	1.26
	2:25:00	0.00	0.00	0.37	0.48	0.63	0.62	0.69	0.66	0.82
	2:30:00	0.00	0.00	0.22	0.31	0.40	0.40	0.45	0.43	0.53
	2:35:00	0.00	0.00	0.11	0.17	0.21	0.23	0.25	0.24	0.30
	2:40:00	0.00	0.00	0.05	0.08	0.09	0.10	0.11	0.11	0.13
	2:45:00	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.03
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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 STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Pond 4



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	93.61	acres
Watershed Length =	2,730	ft
Watershed Length to Centroid =	1,350	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	64.00%	percent
Percentage Hydrologic Soil Group A =	67.0%	percent
Percentage Hydrologic Soil Group B =	33.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.953	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	7.115	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	5.631	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	7.356	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	8.981	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	11.197	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	13.062	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	15.464	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	20.400	acre-feet		inches
Approximate 2-yr Detention Volume =	4.893	acre-feet		
Approximate 5-yr Detention Volume =	6.458	acre-feet		
Approximate 10-yr Detention Volume =	7.949	acre-feet		
Approximate 25-yr Detention Volume =	9.212	acre-feet		
Approximate 50-yr Detention Volume =	9.969	acre-feet		
Approximate 100-yr Detention Volume =	10.897	acre-feet		

Define Zones and Basin Geometry

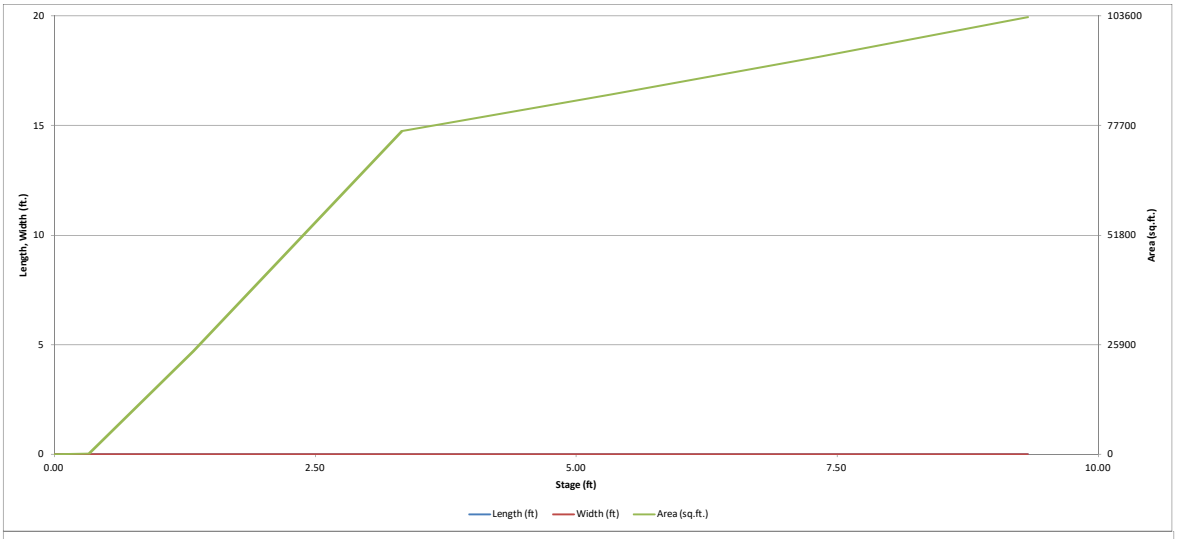
Zone 1 Volume (WQCV) =	1.953	acre-feet
Zone 2 Volume (EURV - Zone 1) =	5.162	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.782	acre-feet
Total Detention Basin Volume =	10.897	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

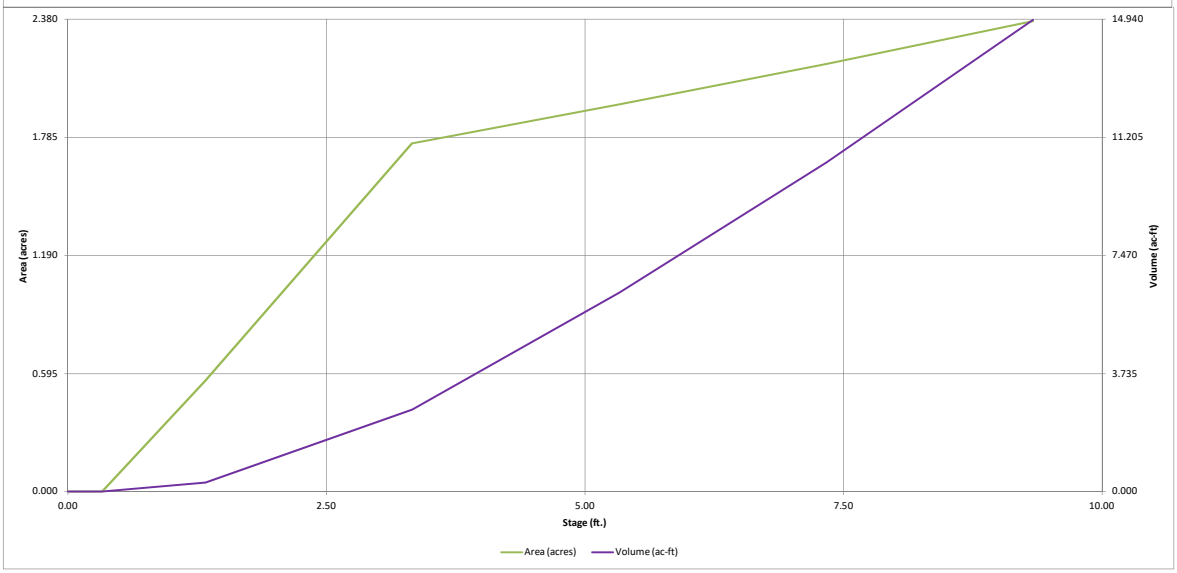
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
	--	0.33	--	--	--	40	0.001	7	0.000
	--	1.33	--	--	--	24,400	0.560	12,226	0.281
	--	3.33	--	--	--	76,400	1.754	113,026	2.595
	--	5.33	--	--	--	85,000	1.951	274,426	6.300
	--	7.33	--	--	--	93,900	2.156	453,326	10.407
	--	9.33	--	--	--	103,300	2.371	650,526	14.934

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



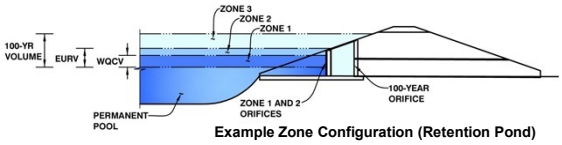


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Pond 4



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.94	1.953	Orifice Plate
Zone 2 (EURV)	5.75	5.162	Rectangular Orifice
Zone 3 (100-year)	7.56	3.782	Weir&Pipe (Restrict)
Total (all zones)		10.897	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	7.264E-02	ft^2
Depth at top of Zone using Orifice Plate =	5.75	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	23.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	10.46	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.92	3.83					
Orifice Area (sq. inches)	10.46	10.46	10.46					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected			Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.94	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.09	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	5.75	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.08	N/A	feet
Vertical Orifice Height =	2.00	N/A	inches				
Vertical Orifice Width =	6.75		inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.76	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.76	N/A	feet
Overflow Weir Front Edge Length =	8.00	N/A	feet	Overflow Weir Slope Length =	8.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.19	N/A	
Horiz. Length of Weir Sides =	8.00	N/A	feet	Overflow Grate Open Area w/o Debris =	44.54	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	22.27	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.33	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	7.19	N/A	ft^2
Outlet Pipe Diameter =	42.00	N/A	inches	Outlet Orifice Centroid =	1.37	N/A	feet
Restrictor Plate Height Above Pipe Invert =	29.40		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.98	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.40	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.97	feet
Spillway Crest Length =	98.00	feet	Stage at Top of Freeboard =	9.37	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	2.37	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	14.93	acre-ft

Calculated Parameters for Spillway

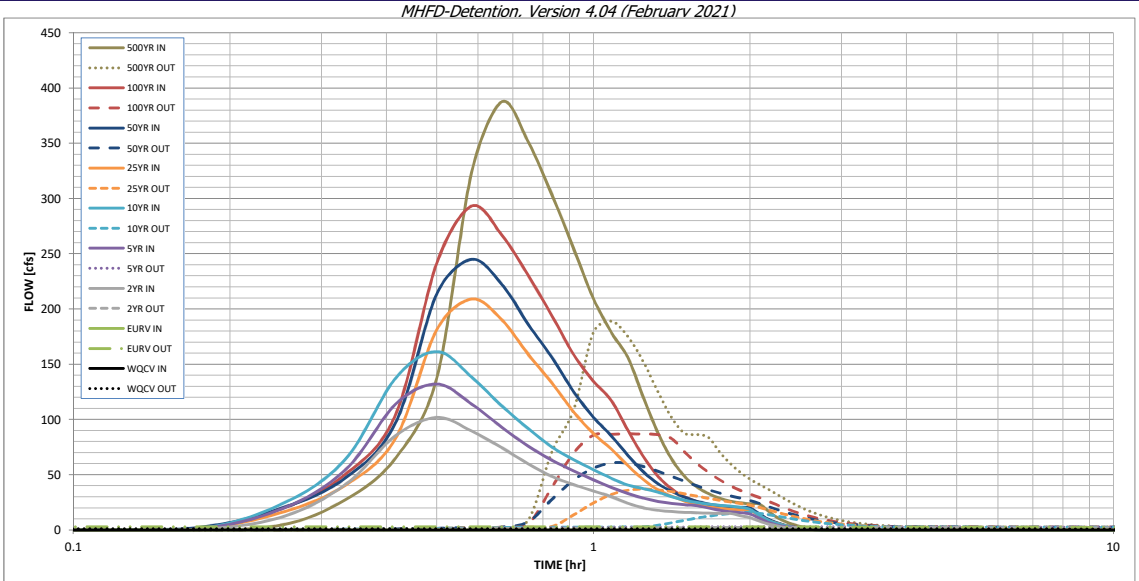
Routed Hydrograph Results

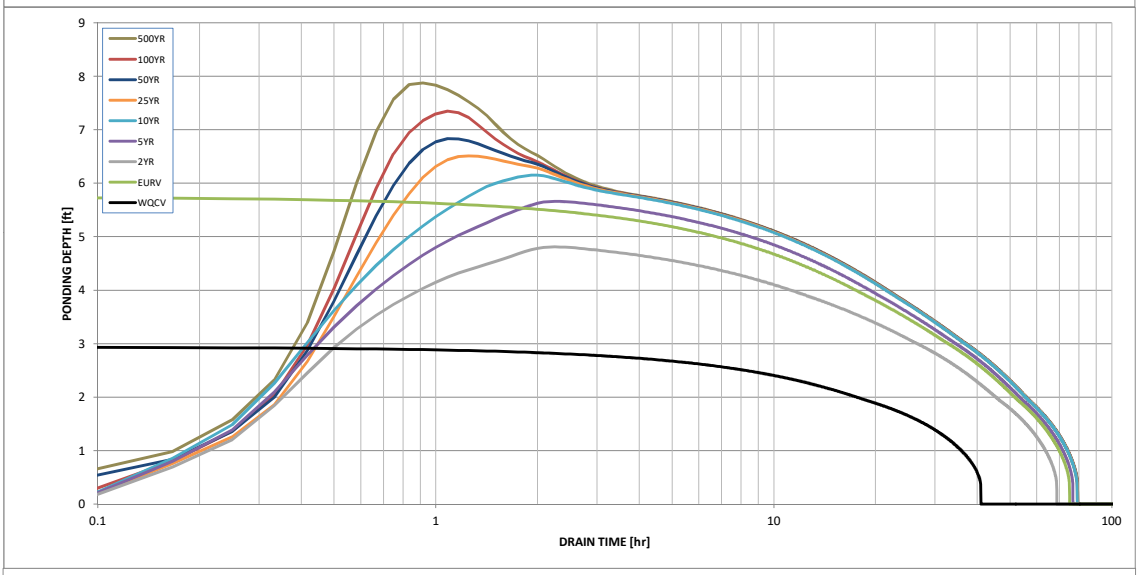
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

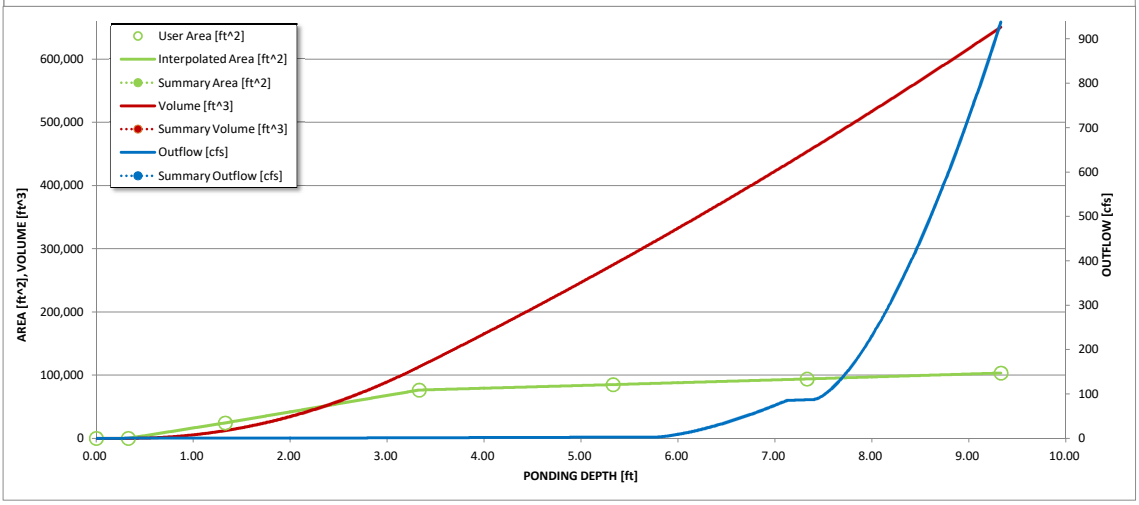
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	1.953	7.115	5.631	7.356	8.981	11.197	13.062	15.464	20.400
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	5.631	7.356	8.981	11.197	13.062	15.464	20.400
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.3	2.1	15.0	46.1	65.3	94.3	148.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.16	0.49	0.70	1.01	1.59
Peak Inflow Q (cfs) =	N/A	N/A	101.7	131.8	161.2	209.0	244.9	293.1	387.5
Peak Outflow Q (cfs) =	1.0	2.7	2.3	2.7	15.6	36.8	60.4	87.0	188.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.3	1.0	0.8	0.9	0.9	1.3
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	0.3	0.8	1.3	1.9	2.0
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	67	62	69	69	68	66	64	60
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	66	74	75	75	74	73	72
Maximum Ponding Depth (ft) =	2.94	5.75	4.81	5.66	6.15	6.51	6.83	7.35	7.88
Area at Maximum Ponding Depth (acres) =	1.52	1.99	1.90	1.99	2.04	2.07	2.10	2.16	2.21
Maximum Volume Stored (acre-ft) =	1.956	7.129	5.280	6.949	7.934	8.674	9.342	10.428	11.587

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	1.28	0.13	4.12
	0:15:00	0.00	0.00	11.26	18.44	22.85	15.35	19.25	18.73	27.17
	0:20:00	0.00	0.00	40.92	54.19	63.77	40.27	46.86	50.18	65.13
	0:25:00	0.00	0.00	85.23	113.70	137.26	82.95	96.99	104.37	137.58
	0:30:00	0.00	0.00	101.67	131.85	161.20	181.20	213.66	241.53	323.54
	0:35:00	0.00	0.00	89.45	113.74	138.19	208.96	244.92	293.07	387.55
	0:40:00	0.00	0.00	74.35	92.83	112.10	190.16	222.27	267.01	351.10
	0:45:00	0.00	0.00	59.64	75.56	91.63	158.69	185.90	230.25	302.81
	0:50:00	0.00	0.00	48.28	62.86	74.76	132.72	155.74	193.53	254.69
	0:55:00	0.00	0.00	40.95	53.29	63.43	106.68	124.96	158.72	209.63
	1:00:00	0.00	0.00	35.21	45.26	54.58	87.29	101.97	134.71	178.72
	1:05:00	0.00	0.00	30.03	38.32	46.77	72.94	84.95	116.98	155.61
	1:10:00	0.00	0.00	24.03	32.79	40.53	57.86	67.13	89.83	119.22
	1:15:00	0.00	0.00	19.80	28.58	37.35	45.14	52.22	65.90	87.14
	1:20:00	0.00	0.00	17.69	25.64	34.08	36.01	41.48	48.29	63.60
	1:25:00	0.00	0.00	16.53	23.79	29.95	30.34	34.74	36.84	48.14
	1:30:00	0.00	0.00	15.87	22.61	26.83	25.86	29.46	29.89	38.69
	1:35:00	0.00	0.00	15.48	21.82	24.77	22.66	25.69	25.57	32.74
	1:40:00	0.00	0.00	15.18	19.66	23.33	20.68	23.38	22.67	28.74
	1:45:00	0.00	0.00	14.96	17.72	22.36	19.37	21.86	20.73	26.06
	1:50:00	0.00	0.00	14.84	16.42	21.66	18.49	20.83	19.51	24.39
	1:55:00	0.00	0.00	12.93	15.51	20.59	17.98	20.23	19.02	23.73
	2:00:00	0.00	0.00	11.12	14.45	18.62	17.66	19.86	18.83	23.46
	2:05:00	0.00	0.00	8.04	10.54	13.44	13.02	14.63	13.94	17.34
	2:10:00	0.00	0.00	5.37	6.99	8.98	8.66	9.73	9.31	11.57
	2:15:00	0.00	0.00	3.58	4.64	6.02	5.83	6.55	6.27	7.79
	2:20:00	0.00	0.00	2.33	2.97	3.91	3.81	4.27	4.09	5.07
	2:25:00	0.00	0.00	1.43	1.88	2.47	2.43	2.72	2.60	3.22
	2:30:00	0.00	0.00	0.83	1.16	1.49	1.51	1.69	1.61	1.99
	2:35:00	0.00	0.00	0.40	0.62	0.76	0.81	0.91	0.86	1.06
	2:40:00	0.00	0.00	0.16	0.25	0.29	0.33	0.36	0.34	0.41
	2:45:00	0.00	0.00	0.03	0.05	0.05	0.06	0.06	0.05	0.06
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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
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	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	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
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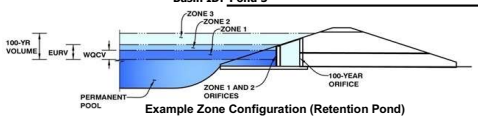
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Pond 5



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	5.50	acres
Watershed Length =	680	ft
Watershed Length to Centroid =	340	ft
Watershed Slope =	0.060	ft/ft
Watershed Imperviousness =	95.00%	percent
Percentage Hydrologic Soil Group A =	96.0%	percent
Percentage Hydrologic Soil Group B =	4.0%	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) =	0.205	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.716	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.476	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.611	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.720	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.835	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.947	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.071	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	1.353	acre-feet		inches
Approximate 2-yr Detention Volume =	0.477	acre-feet		
Approximate 5-yr Detention Volume =	0.617	acre-feet		
Approximate 10-yr Detention Volume =	0.732	acre-feet		
Approximate 25-yr Detention Volume =	0.857	acre-feet		
Approximate 50-yr Detention Volume =	0.929	acre-feet		
Approximate 100-yr Detention Volume =	0.990	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.205	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.511	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.274	acre-feet
Total Detention Basin Volume =	0.990	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

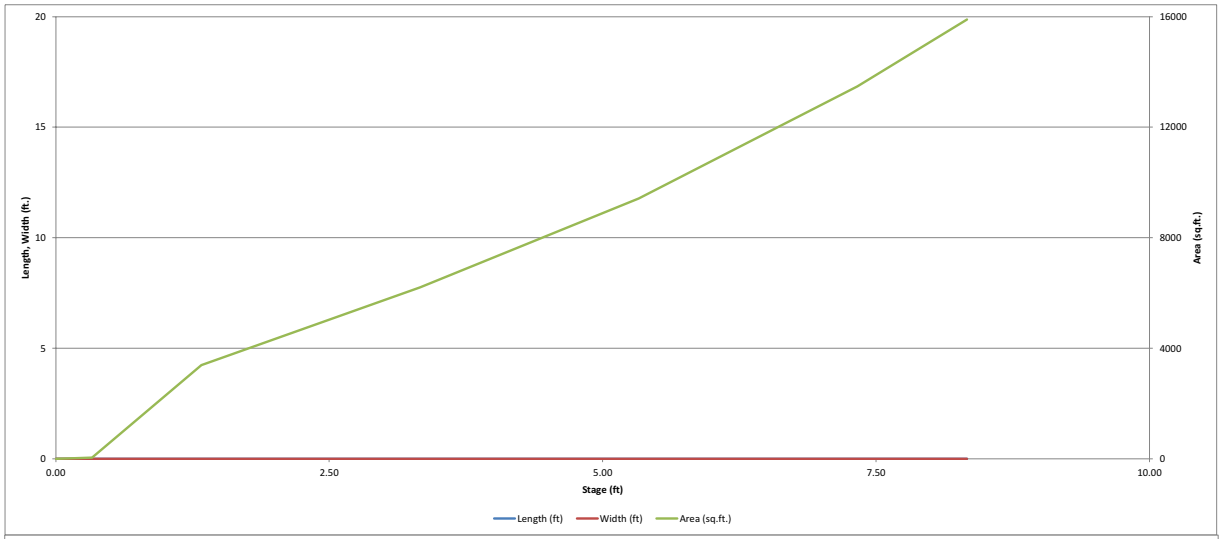
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

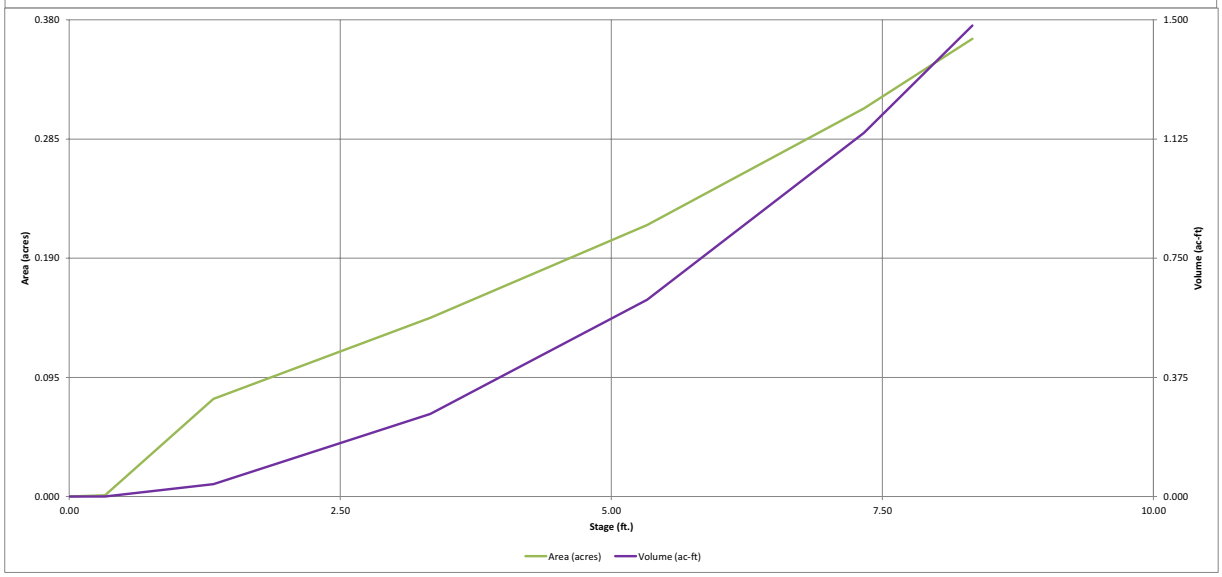
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
	--	0.33	--	--	--	40	0.001	7	0.000
	--	1.33	--	--	--	3,394	0.078	1,724	0.040
	--	3.33	--	--	--	6,210	0.143	11,328	0.260
	--	5.33	--	--	--	9,428	0.216	26,966	0.619
	--	7.33	--	--	--	13,480	0.309	49,874	1.145
	--	8.33	--	--	--	15,900	0.365	64,564	1.482

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



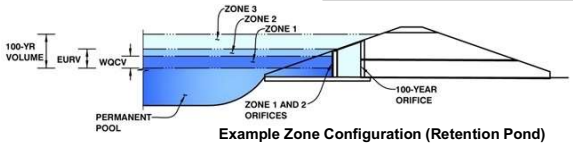


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Pond 5



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.93	0.205	Orifice Plate
Zone 2 (EURV)	5.76	0.511	Orifice Plate
Zone 3 (100-year)	6.81	0.274	Weir&Pipe (Restrict)
Total (all zones)		0.990	

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	
Depth at top of Zone using Orifice Plate =	5.76	ft (relative to basin bottom at Stage = 0 ft)	
Orifice Plate: Orifice Vertical Spacing =	23.00	inches	
Orifice Plate: Orifice Area per Row =	1.18	sq. inches (diameter = 1-3/16 inches)	

Calculated Parameters for Plate

WQ Orifice Area per Row =	8.194E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.92	3.84					
Orifice Area (sq. inches)	1.18	1.18	1.18					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.76	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.90	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 =	5.76	N/A	feet
Overflow Weir Slope Length =	2.90	N/A	feet
Grate Open Area / 100-yr Orifice Area =	24.12	N/A	
Overflow Grate Open Area w/o Debris =	8.07	N/A	ft^2
Overflow Grate Open Area w/ Debris =	4.04	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.33	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	4.40		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.33	N/A	ft^2
Outlet Orifice Centroid =	0.22	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.03	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.30	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	8.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.80	feet
Stage at Top of Freeboard =	8.10	feet
Basin Area at Top of Freeboard =	0.35	acres
Basin Volume at Top of Freeboard =	1.40	acre-ft

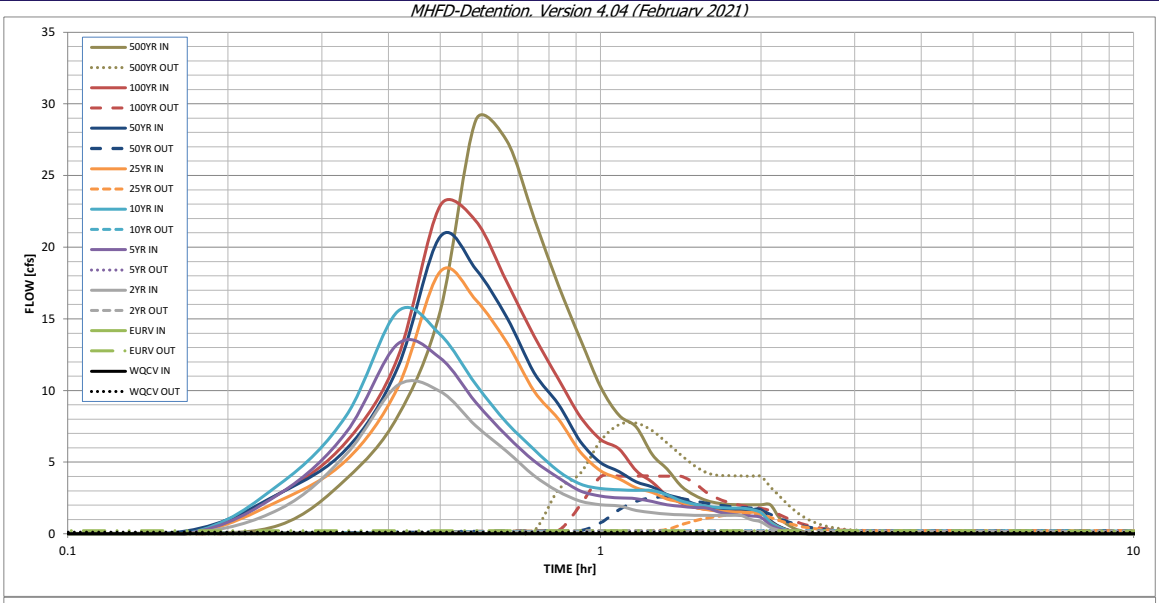
Routed Hydrograph Results

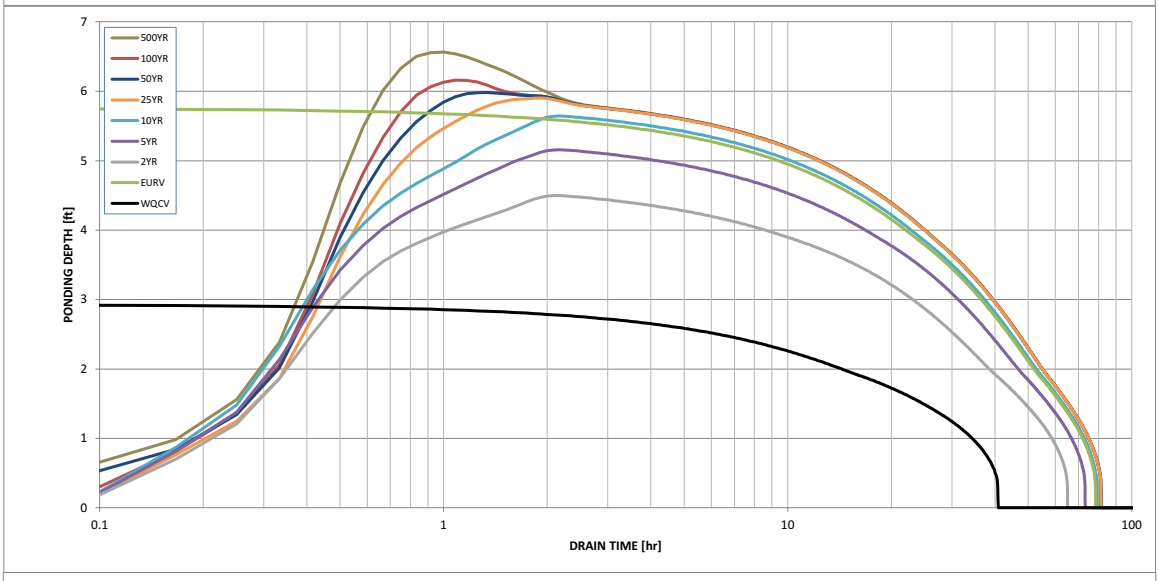
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

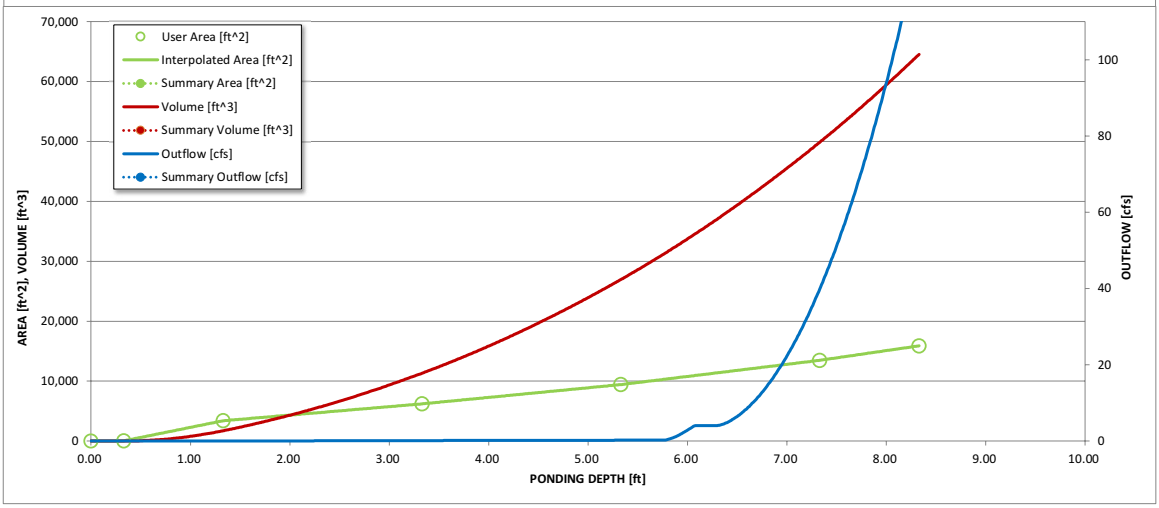
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.205	0.716	0.476	0.611	0.720	0.835	0.947	1.071	1.353
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.476	0.611	0.720	0.835	0.947	1.071	1.353
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.1	0.2	1.6	2.8	4.5	7.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.28	0.51	0.81	1.41
Peak Inflow Q (cfs) =	N/A	N/A	10.4	13.2	15.5	18.3	20.7	22.9	28.9
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.2	0.2	1.4	2.6	4.0	7.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.8	1.5	0.9	0.9	0.9	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.1	0.3	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) =	38	71	60	67	72	73	72	71	69
Time to Drain 99% of Inflow Volume (hours) =	**40**	76	63	71	76	78	78	77	77
Maximum Ponding Depth (ft) =	2.93	5.76	4.50	5.16	5.64	5.90	5.98	6.16	6.56
Area at Maximum Ponding Depth (acres) =	0.13	0.24	0.19	0.21	0.23	0.24	0.25	0.25	0.27
Maximum Volume Stored (acre-ft) =	0.206	0.716	0.450	0.581	0.688	0.750	0.770	0.812	0.920

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.02	0.62
	0:15:00	0.00	0.00	1.73	2.81	3.47	2.32	2.83	2.82	3.84
	0:20:00	0.00	0.00	5.55	7.09	8.25	5.14	5.91	6.42	8.20
	0:25:00	0.00	0.00	10.37	13.24	15.52	10.21	11.61	12.30	15.54
	0:30:00	0.00	0.00	9.94	12.26	13.91	18.29	20.74	22.90	28.86
	0:35:00	0.00	0.00	7.53	9.18	10.43	16.32	18.48	21.84	27.43
	0:40:00	0.00	0.00	5.75	6.84	7.75	13.36	15.11	17.58	22.06
	0:45:00	0.00	0.00	4.06	5.09	5.90	9.97	11.27	13.81	17.35
	0:50:00	0.00	0.00	2.95	3.92	4.37	8.01	9.05	10.81	13.59
	0:55:00	0.00	0.00	2.29	3.00	3.48	5.71	6.45	8.17	10.26
	1:00:00	0.00	0.00	2.03	2.64	3.16	4.41	4.98	6.58	8.27
	1:05:00	0.00	0.00	1.95	2.51	3.07	3.84	4.34	5.92	7.45
	1:10:00	0.00	0.00	1.63	2.46	3.03	3.21	3.63	4.40	5.53
	1:15:00	0.00	0.00	1.48	2.25	3.03	2.89	3.27	3.60	4.53
	1:20:00	0.00	0.00	1.38	2.03	2.72	2.43	2.74	2.66	3.34
	1:25:00	0.00	0.00	1.33	1.91	2.31	2.20	2.48	2.16	2.70
	1:30:00	0.00	0.00	1.29	1.84	2.07	1.86	2.10	1.85	2.31
	1:35:00	0.00	0.00	1.28	1.80	1.93	1.68	1.90	1.71	2.13
	1:40:00	0.00	0.00	1.28	1.53	1.84	1.59	1.79	1.65	2.06
	1:45:00	0.00	0.00	1.28	1.38	1.80	1.54	1.73	1.63	2.03
	1:50:00	0.00	0.00	1.28	1.30	1.79	1.52	1.71	1.63	2.03
	1:55:00	0.00	0.00	0.99	1.25	1.71	1.51	1.70	1.63	2.03
	2:00:00	0.00	0.00	0.84	1.15	1.49	1.51	1.70	1.63	2.03
	2:05:00	0.00	0.00	0.45	0.63	0.82	0.83	0.93	0.90	1.12
	2:10:00	0.00	0.00	0.24	0.35	0.45	0.46	0.52	0.50	0.62
	2:15:00	0.00	0.00	0.11	0.17	0.22	0.23	0.26	0.25	0.31
	2:20:00	0.00	0.00	0.05	0.08	0.10	0.11	0.12	0.12	0.15
	2:25:00	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.04
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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
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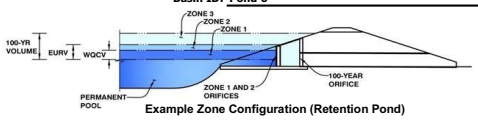
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	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 STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Pond 6



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	25.68	acres
Watershed Length =	1,200	ft
Watershed Length to Centroid =	450	ft
Watershed Slope =	0.050	ft/ft
Watershed Imperviousness =	61.00%	percent
Percentage Hydrologic Soil Group A =	73.1%	percent
Percentage Hydrologic Soil Group B =	26.9%	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) =	0.513	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.854	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.386	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.816	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.206	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.776	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.256	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.873	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	5.155	acre-feet		inches
Approximate 2-yr Detention Volume =	1.258	acre-feet		
Approximate 5-yr Detention Volume =	1.661	acre-feet		
Approximate 10-yr Detention Volume =	2.045	acre-feet		
Approximate 25-yr Detention Volume =	2.392	acre-feet		
Approximate 50-yr Detention Volume =	2.602	acre-feet		
Approximate 100-yr Detention Volume =	2.861	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.513	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.341	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.007	acre-feet
Total Detention Basin Volume =	2.861	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

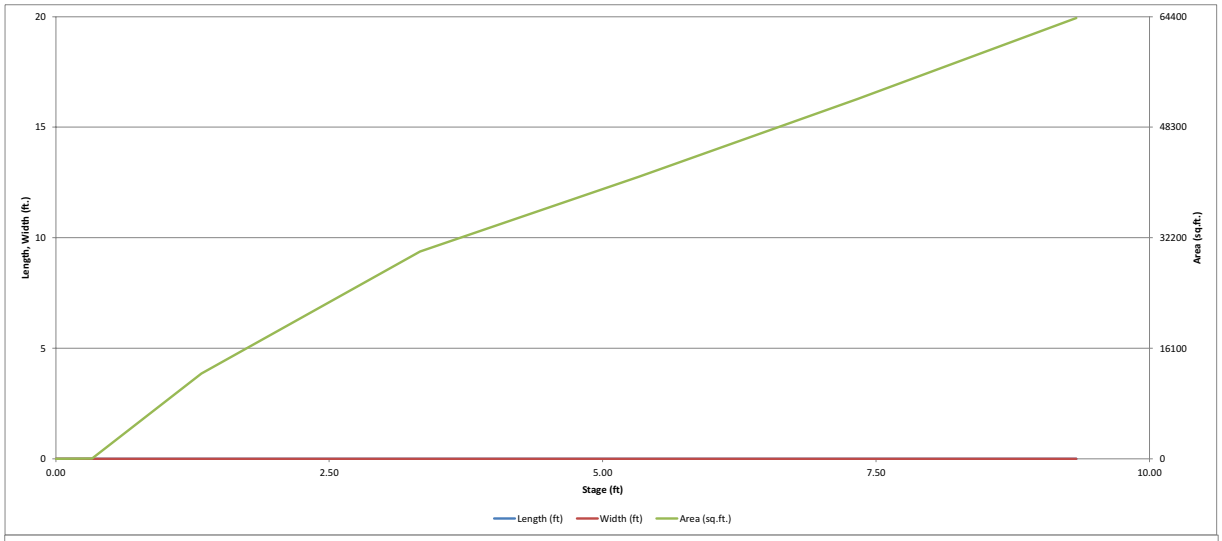
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

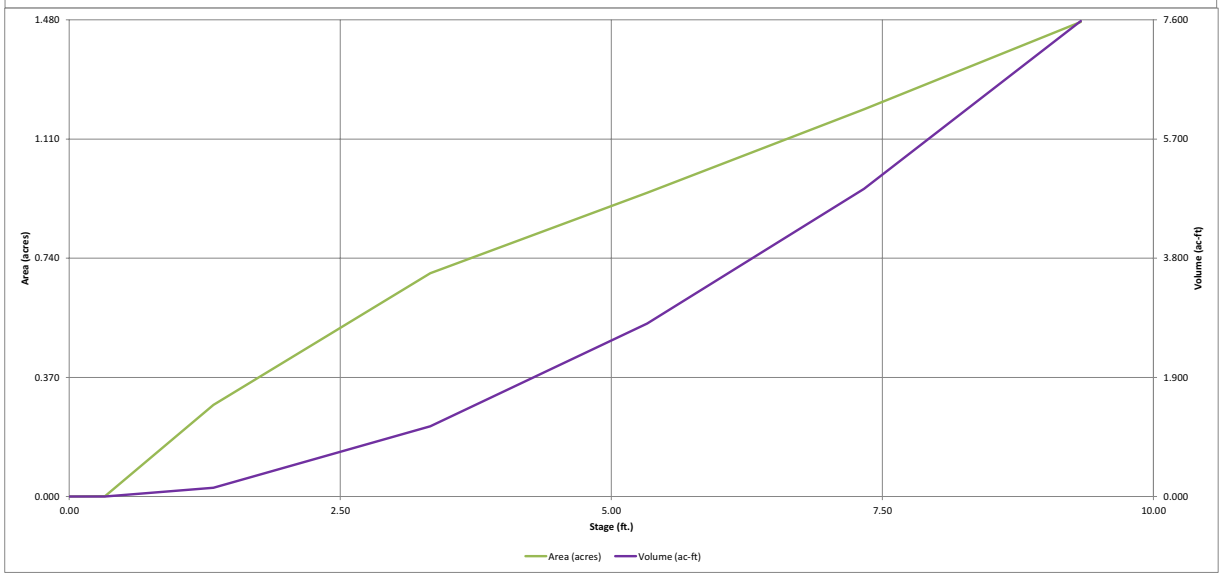
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
	--	0.33	--	--	--	40	0.001	7	0.000
	--	1.33	--	--	--	12,400	0.285	6,226	0.143
	--	3.33	--	--	--	30,200	0.693	48,826	1.121
	--	5.33	--	--	--	41,100	0.944	120,126	2.758
	--	7.33	--	--	--	52,400	1.203	213,626	4.904
	--	9.33	--	--	--	64,200	1.474	330,226	7.581

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



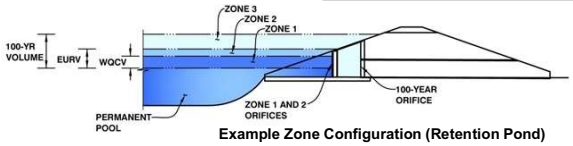


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Pond 6



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.30	0.513	Orifice Plate
Zone 2 (EURV)	4.31	1.341	Orifice Plate
Zone 3 (100-year)	5.44	1.007	Weir&Pipe (Restrict)
Total (all zones)		2.861	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	5.04	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	20.20	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.68	3.36					
Orifice Area (sq. inches)	3.31	3.35	15.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected				
Overflow Weir Front Edge Height, Ho =	4.31	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.31	N/A	feet
Overflow Weir Front Edge Length =	9.00	N/A	feet	Overflow Weir Slope Length =	9.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	17.75	N/A	
Horiz. Length of Weir Sides =	9.00	N/A	feet	Overflow Grate Open Area w/o Debris =	56.38	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	28.19	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected				
Depth to Invert of Outlet Pipe =	0.33	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.18	N/A	ft^2
Outlet Pipe Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	0.87	N/A	feet
Restrictor Plate Height Above Pipe Invert =	18.50		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.81	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.80	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.78	feet
Spillway Crest Length =	40.00	feet	Stage at Top of Freeboard =	7.58	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.24	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	5.21	acre-ft

Calculated Parameters for Spillway

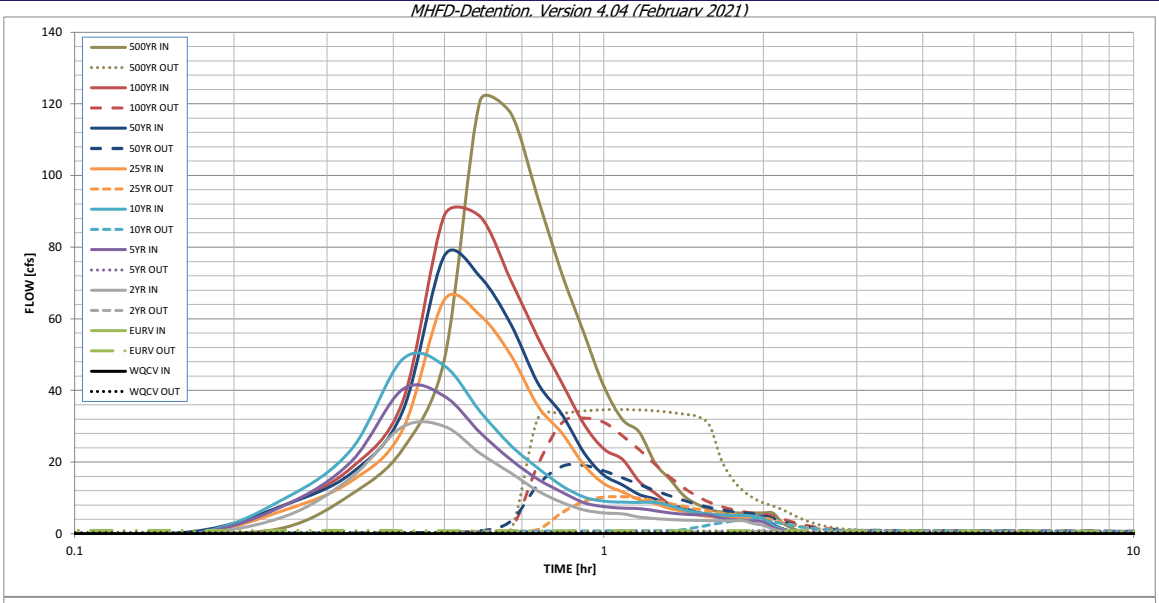
Routed Hydrograph Results

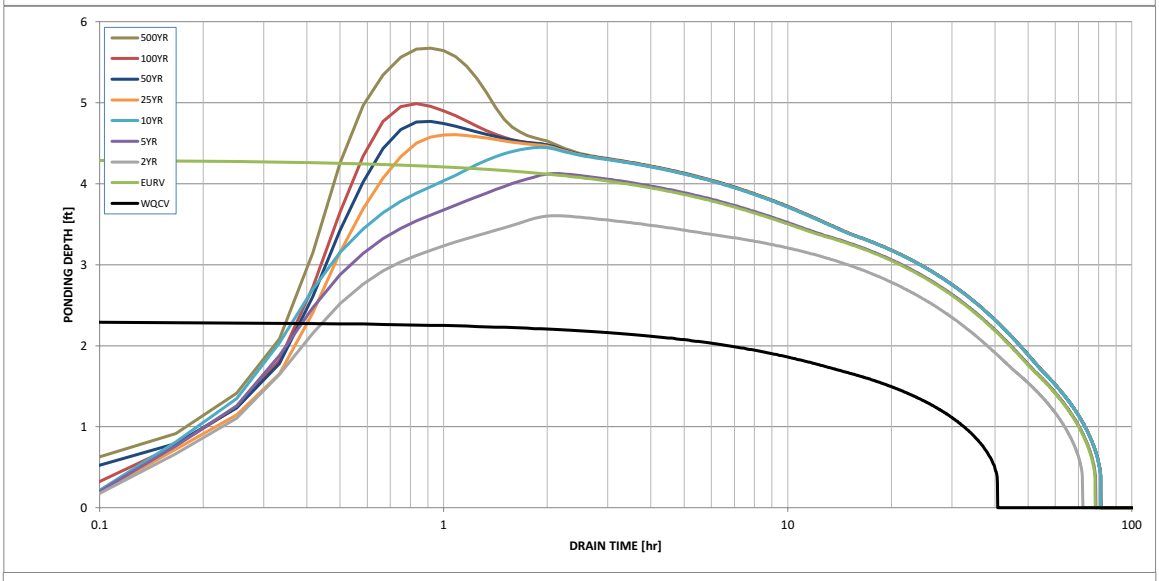
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

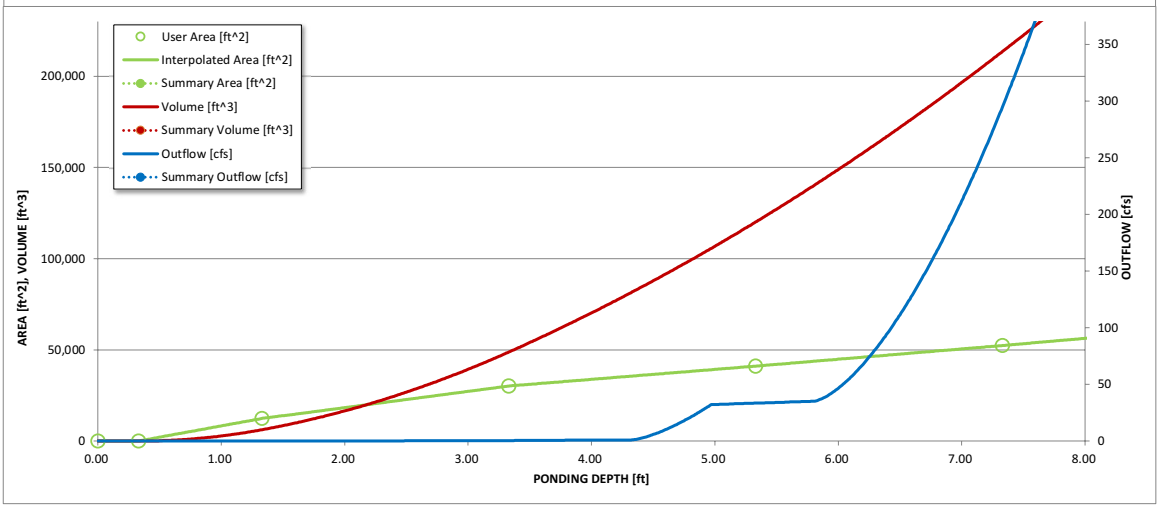
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.513	1.854	1.386	1.816	2.206	2.776	3.256	3.873	5.155
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.386	1.816	2.206	2.776	3.256	3.873	5.155
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.5	0.8	4.8	16.3	23.3	32.9	53.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.02	0.03	0.19	0.64	0.91	1.28	2.08
Peak Inflow Q (cfs) =	N/A	N/A	30.0	40.3	48.7	65.3	77.7	88.9	120.8
Peak Outflow Q (cfs) =	0.3	0.9	0.6	0.8	4.0	10.3	19.1	32.3	34.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.8	0.6	0.8	1.0	0.6
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.2	0.3	0.6	0.6
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	71	67	72	73	71	70	68	64
Time to Drain 99% of Inflow Volume (hours) =	**40**	76	70	76	78	77	77	76	75
Maximum Ponding Depth (ft) =	2.30	4.31	3.61	4.13	4.45	4.61	4.77	4.99	5.67
Area at Maximum Ponding Depth (acres) =	0.48	0.82	0.73	0.79	0.83	0.85	0.87	0.90	0.99
Maximum Volume Stored (acre-ft) =	0.515	1.860	1.313	1.708	1.976	2.102	2.240	2.435	3.086

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.06	1.78
	0:15:00	0.00	0.00	4.89	7.98	9.89	6.64	8.10	8.08	11.02
	0:20:00	0.00	0.00	15.75	20.20	23.56	14.71	16.93	18.41	23.54
	0:25:00	0.00	0.00	29.87	40.33	48.66	29.06	34.17	36.87	48.77
	0:30:00	0.00	0.00	29.98	38.37	46.88	65.31	77.66	88.87	120.76
	0:35:00	0.00	0.00	22.42	28.27	34.13	61.02	71.74	88.57	117.40
	0:40:00	0.00	0.00	16.95	20.66	24.68	49.87	58.56	70.84	93.66
	0:45:00	0.00	0.00	11.96	15.24	18.34	35.65	42.09	54.74	72.48
	0:50:00	0.00	0.00	8.72	11.63	13.37	28.06	33.29	42.07	56.01
	0:55:00	0.00	0.00	6.64	8.69	10.23	19.22	22.63	30.60	41.02
	1:00:00	0.00	0.00	5.82	7.55	9.07	13.97	16.35	23.60	31.91
	1:05:00	0.00	0.00	5.57	7.17	8.81	11.69	13.63	20.78	28.31
	1:10:00	0.00	0.00	4.67	7.02	8.75	9.49	10.95	14.53	19.63
	1:15:00	0.00	0.00	4.22	6.43	8.77	8.41	9.65	11.27	15.12
	1:20:00	0.00	0.00	3.94	5.80	7.85	6.99	7.95	8.07	10.61
	1:25:00	0.00	0.00	3.79	5.46	6.62	6.30	7.13	6.39	8.24
	1:30:00	0.00	0.00	3.70	5.26	5.92	5.32	6.00	5.35	6.77
	1:35:00	0.00	0.00	3.66	5.15	5.51	4.81	5.41	4.87	6.10
	1:40:00	0.00	0.00	3.66	4.36	5.27	4.53	5.10	4.71	5.88
	1:45:00	0.00	0.00	3.66	3.95	5.14	4.39	4.94	4.65	5.79
	1:50:00	0.00	0.00	3.66	3.71	5.11	4.33	4.87	4.65	5.79
	1:55:00	0.00	0.00	2.84	3.58	4.87	4.30	4.84	4.65	5.79
	2:00:00	0.00	0.00	2.39	3.29	4.25	4.30	4.84	4.65	5.79
	2:05:00	0.00	0.00	1.30	1.80	2.33	2.36	2.66	2.55	3.17
	2:10:00	0.00	0.00	0.70	0.99	1.27	1.30	1.46	1.40	1.74
	2:15:00	0.00	0.00	0.33	0.50	0.63	0.66	0.74	0.71	0.88
	2:20:00	0.00	0.00	0.14	0.23	0.28	0.31	0.35	0.33	0.41
	2:25:00	0.00	0.00	0.04	0.07	0.07	0.09	0.10	0.09	0.12
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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
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	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

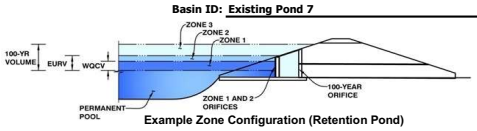
POND 401

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Existing Pond 7



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	67.02	acres
Watershed Length =	3,200	ft
Watershed Length to Centroid =	1,400	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	4.70%	percent
Percentage Hydrologic Soil Group A =	79.0%	percent
Percentage Hydrologic Soil Group B =	21.0%	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) =	0.191	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.207	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.126	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.213	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.511	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.920	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.887	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.461	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	7.667	acre-feet		inches
Approximate 2-yr Detention Volume =	0.120	acre-feet		
Approximate 5-yr Detention Volume =	0.178	acre-feet		
Approximate 10-yr Detention Volume =	0.343	acre-feet		
Approximate 25-yr Detention Volume =	0.507	acre-feet		
Approximate 50-yr Detention Volume =	0.665	acre-feet		
Approximate 100-yr Detention Volume =	1.187	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.191	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.016	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.980	acre-feet
Total Detention Basin Volume =	1.187	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

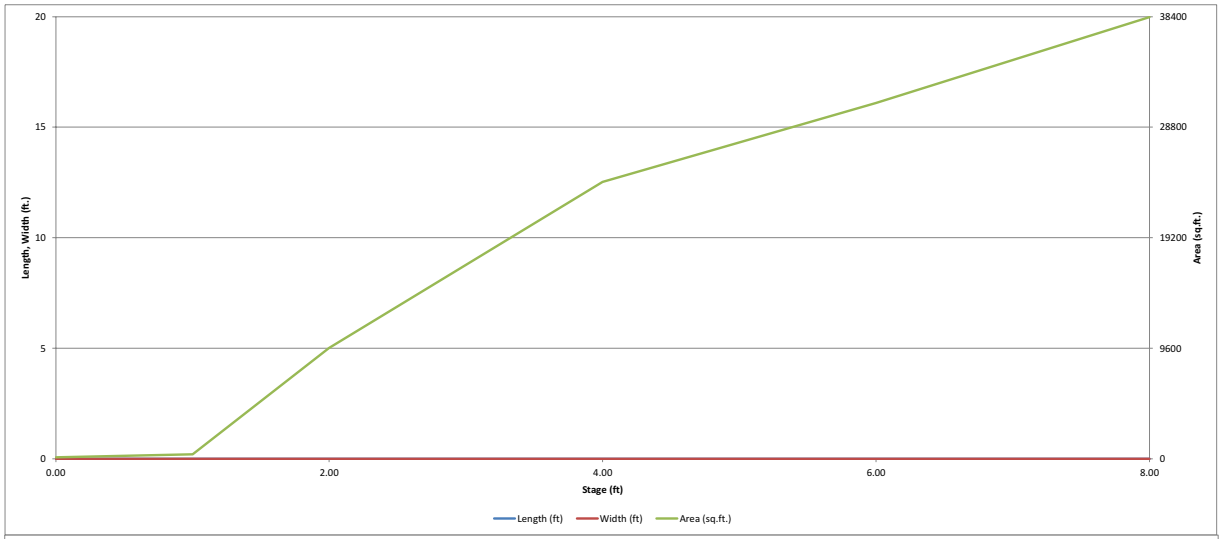
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

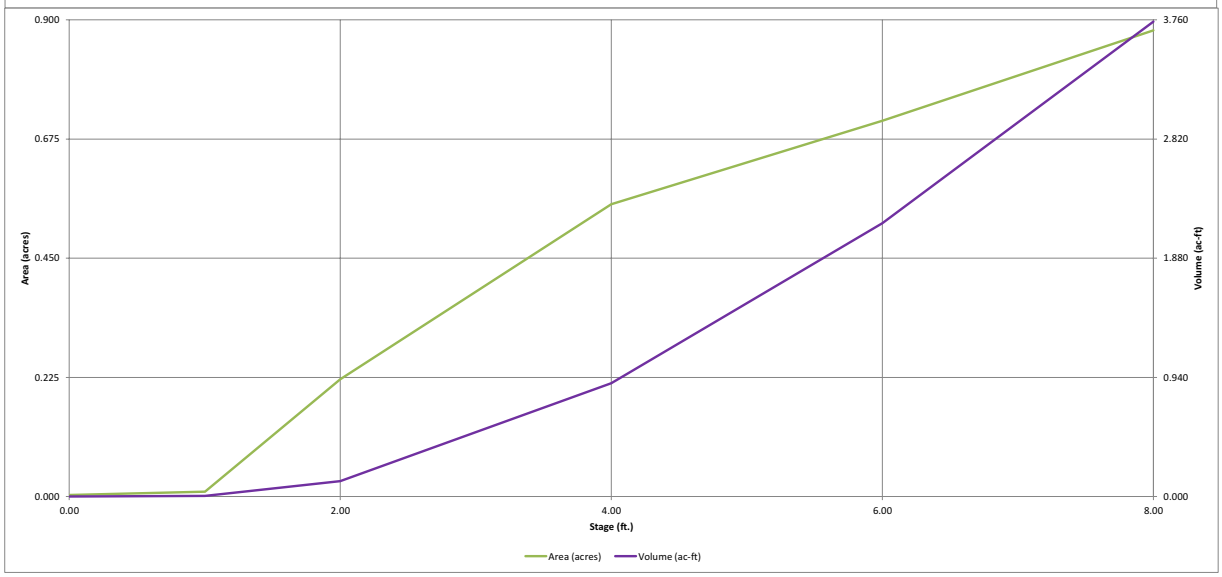
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	127	0.003		
	--	1.00	--	--	--	396	0.009	261	0.006
	--	2.00	--	--	--	9,635	0.221	5,277	0.121
	--	4.00	--	--	--	24,055	0.552	38,967	0.895
	--	6.00	--	--	--	30,917	0.710	93,939	2.157
	--	8.00	--	--	--	38,358	0.881	163,214	3.747

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



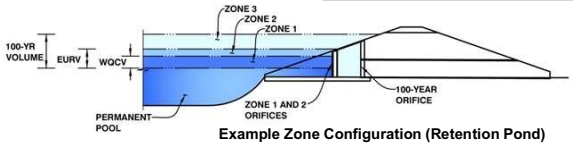


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Enclaves East**

Basin ID: **Existing Pond 7**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.29	0.191	Orifice Plate
Zone 2 (EURV)	2.35	0.016	Orifice Plate
Zone 3 (100-year)	4.52	0.980	Weir&Pipe (Restrict)
Total (all zones)		1.187	

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	
Depth at top of Zone using Orifice Plate =	4.09	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	inches	

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.35	2.70					
Orifice Area (sq. inches)	0.80	1.29	3.05					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.06	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.70	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.91	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.06	N/A	feet
Overflow Weir Slope Length =	2.91	N/A	feet
Grate Open Area / 100-yr Orifice Area =	4.04	N/A	
Overflow Grate Open Area w/o Debris =	11.54	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.77	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	20.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	2.86	N/A	ft^2
Outlet Orifice Centroid =	0.92	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.36	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	13.50	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.04	feet
Stage at Top of Freeboard =	7.54	feet
Basin Area at Top of Freeboard =	0.84	acres
Basin Volume at Top of Freeboard =	3.35	acre-ft

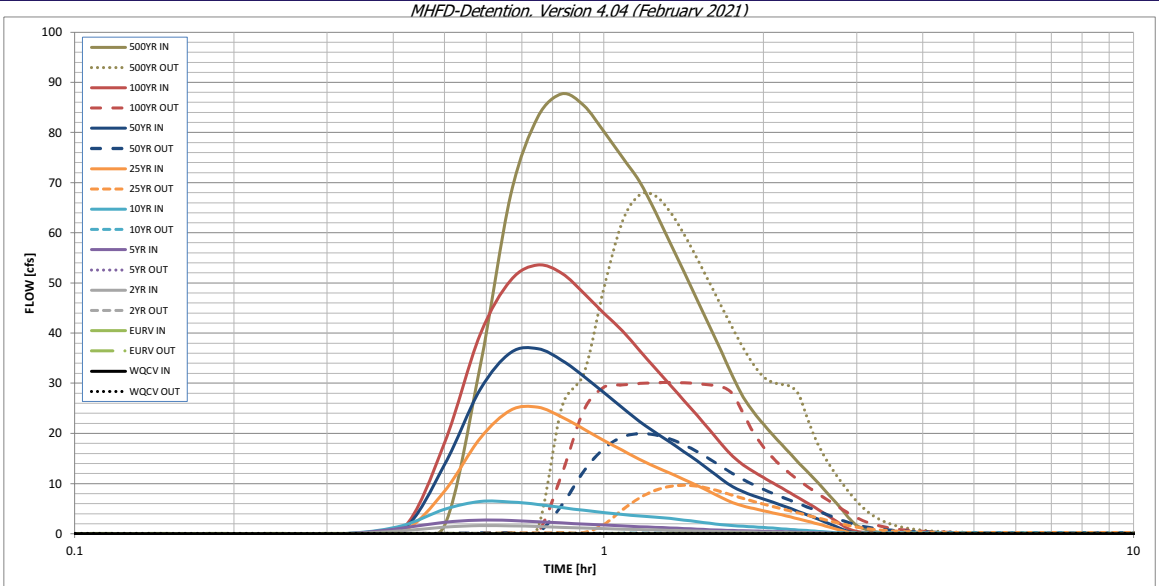
Routed Hydrograph Results

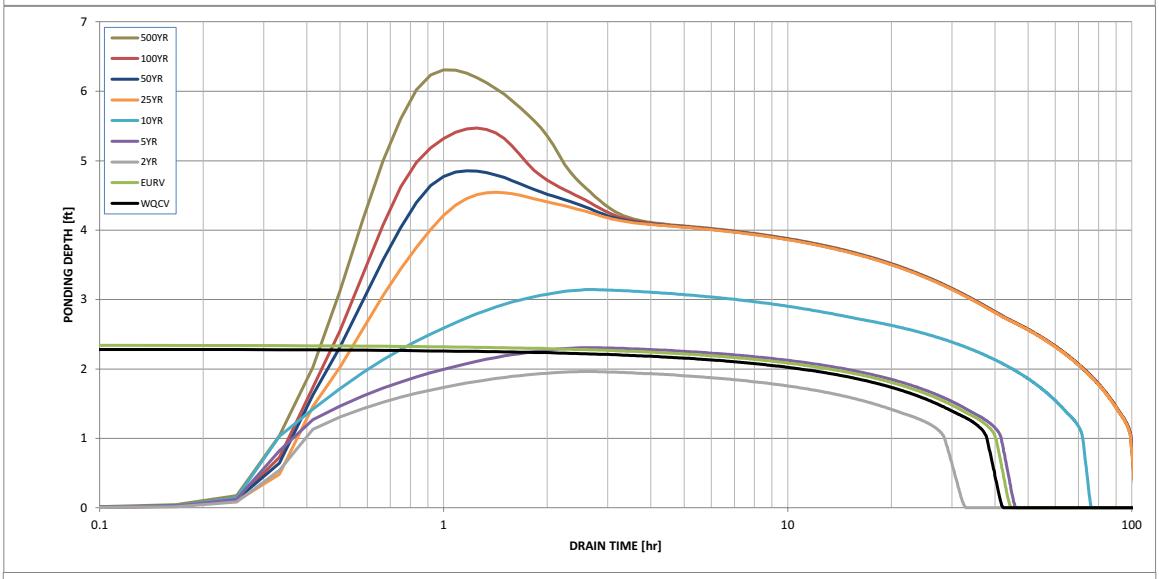
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

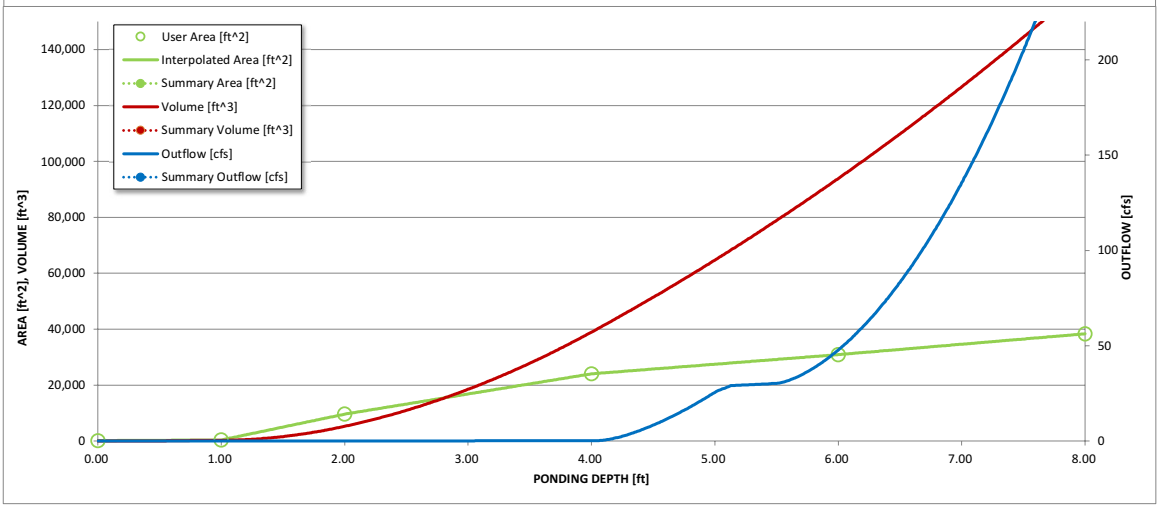
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.191	0.207	0.126	0.213	0.511	1.920	2.887	4.461	7.667
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.126	0.213	0.511	1.920	2.887	4.461	7.667
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.7	1.1	4.4	23.2	34.8	51.3	85.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.07	0.35	0.52	0.77	1.28
Peak Inflow Q (cfs) =	N/A	N/A	1.6	2.7	6.4	25.2	36.9	53.6	87.7
Peak Outflow Q (cfs) =	0.1	0.1	0.1	0.1	0.2	9.7	20.0	30.2	67.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.0	0.4	0.6	0.6	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.8	1.7	2.6	2.8
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	40	30	42	68	84	78	70	56
Time to Drain 99% of Inflow Volume (hours) =	**40**	42	31	44	73	94	91	87	81
Maximum Ponding Depth (ft) =	2.29	2.35	1.96	2.31	3.14	4.55	4.86	5.47	6.31
Area at Maximum Ponding Depth (acres) =	0.27	0.28	0.21	0.27	0.41	0.59	0.62	0.67	0.74
Maximum Volume Stored (acre-ft) =	0.192	0.209	0.112	0.195	0.481	1.204	1.392	1.791	2.373

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	0:15:00	0.00	0.00	0.01	0.02	0.03	0.02	0.03	0.02	0.04
	0:20:00	0.00	0.00	0.06	0.09	0.10	0.07	0.08	0.08	0.11
	0:25:00	0.00	0.00	0.60	1.14	1.65	0.49	0.75	0.92	1.63
	0:30:00	0.00	0.00	1.33	2.31	4.88	8.50	13.76	18.11	33.25
	0:35:00	0.00	0.00	1.61	2.70	6.41	19.00	28.70	39.67	67.59
	0:40:00	0.00	0.00	1.57	2.65	6.33	24.65	36.10	50.53	83.09
	0:45:00	0.00	0.00	1.43	2.41	5.86	25.21	36.90	53.56	87.69
	0:50:00	0.00	0.00	1.27	2.15	5.20	23.26	34.57	51.91	85.34
	0:55:00	0.00	0.00	1.14	1.93	4.67	20.83	31.37	47.93	80.16
	1:00:00	0.00	0.00	1.02	1.73	4.23	18.59	28.11	43.94	75.01
	1:05:00	0.00	0.00	0.92	1.55	3.83	16.63	25.13	40.44	70.28
	1:10:00	0.00	0.00	0.84	1.41	3.54	14.82	22.41	36.60	64.21
	1:15:00	0.00	0.00	0.76	1.29	3.32	13.34	20.20	32.98	58.04
	1:20:00	0.00	0.00	0.69	1.17	3.05	12.06	18.24	29.70	52.23
	1:25:00	0.00	0.00	0.62	1.05	2.74	10.83	16.37	26.56	46.63
	1:30:00	0.00	0.00	0.55	0.93	2.41	9.62	14.52	23.59	41.37
	1:35:00	0.00	0.00	0.48	0.81	2.09	8.41	12.70	20.71	36.31
	1:40:00	0.00	0.00	0.43	0.71	1.80	7.22	10.91	17.87	31.38
	1:45:00	0.00	0.00	0.39	0.64	1.61	6.21	9.40	15.45	27.24
	1:50:00	0.00	0.00	0.36	0.59	1.48	5.52	8.37	13.72	24.28
	1:55:00	0.00	0.00	0.34	0.55	1.36	5.03	7.60	12.38	21.86
	2:00:00	0.00	0.00	0.31	0.50	1.24	4.60	6.93	11.21	19.73
	2:05:00	0.00	0.00	0.28	0.46	1.12	4.18	6.28	10.14	17.76
	2:10:00	0.00	0.00	0.25	0.41	1.00	3.76	5.66	9.11	15.91
	2:15:00	0.00	0.00	0.22	0.36	0.87	3.35	5.04	8.11	14.15
	2:20:00	0.00	0.00	0.19	0.31	0.76	2.94	4.42	7.14	12.48
	2:25:00	0.00	0.00	0.16	0.26	0.64	2.53	3.81	6.21	10.86
	2:30:00	0.00	0.00	0.13	0.21	0.53	2.13	3.20	5.27	9.26
	2:35:00	0.00	0.00	0.10	0.16	0.42	1.72	2.60	4.34	7.65
	2:40:00	0.00	0.00	0.08	0.12	0.31	1.32	1.99	3.41	6.05
	2:45:00	0.00	0.00	0.05	0.07	0.20	0.92	1.39	2.48	4.45
	2:50:00	0.00	0.00	0.03	0.04	0.12	0.52	0.80	1.56	2.87
	2:55:00	0.00	0.00	0.02	0.03	0.07	0.23	0.37	0.86	1.71
	3:00:00	0.00	0.00	0.02	0.02	0.06	0.10	0.18	0.49	1.07
	3:05:00	0.00	0.00	0.01	0.02	0.05	0.05	0.10	0.29	0.68
	3:10:00	0.00	0.00	0.01	0.02	0.04	0.04	0.06	0.17	0.41
	3:15:00	0.00	0.00	0.01	0.01	0.03	0.03	0.04	0.10	0.24
	3:20:00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.05	0.12
	3:25:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.02	0.04
	3:30:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	3:35:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:40:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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
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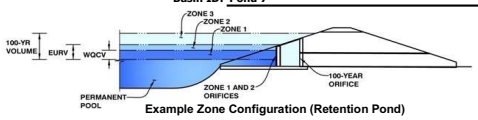
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	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 STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Pond 7



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	18.17	acres
Watershed Length =	1,500	ft
Watershed Length to Centroid =	650	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	48.00%	percent
Percentage Hydrologic Soil Group A =	16.3%	percent
Percentage Hydrologic Soil Group B =	83.7%	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) =	0.304	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.940	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.835	acre-feet	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.213	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.529	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	2.007	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.377	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.864	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	3.814	acre-feet	inches
Approximate 2-yr Detention Volume =	0.688	acre-feet	
Approximate 5-yr Detention Volume =	0.941	acre-feet	
Approximate 10-yr Detention Volume =	1.239	acre-feet	
Approximate 25-yr Detention Volume =	1.383	acre-feet	
Approximate 50-yr Detention Volume =	1.461	acre-feet	
Approximate 100-yr Detention Volume =	1.642	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.304	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.636	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.702	acre-feet
Total Detention Basin Volume =	1.642	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

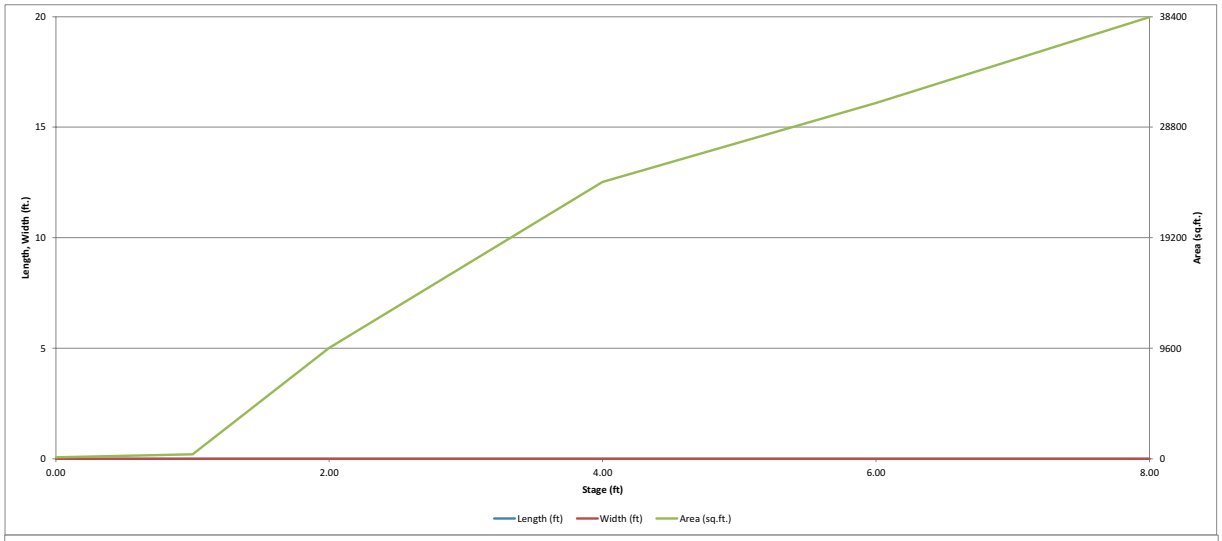
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

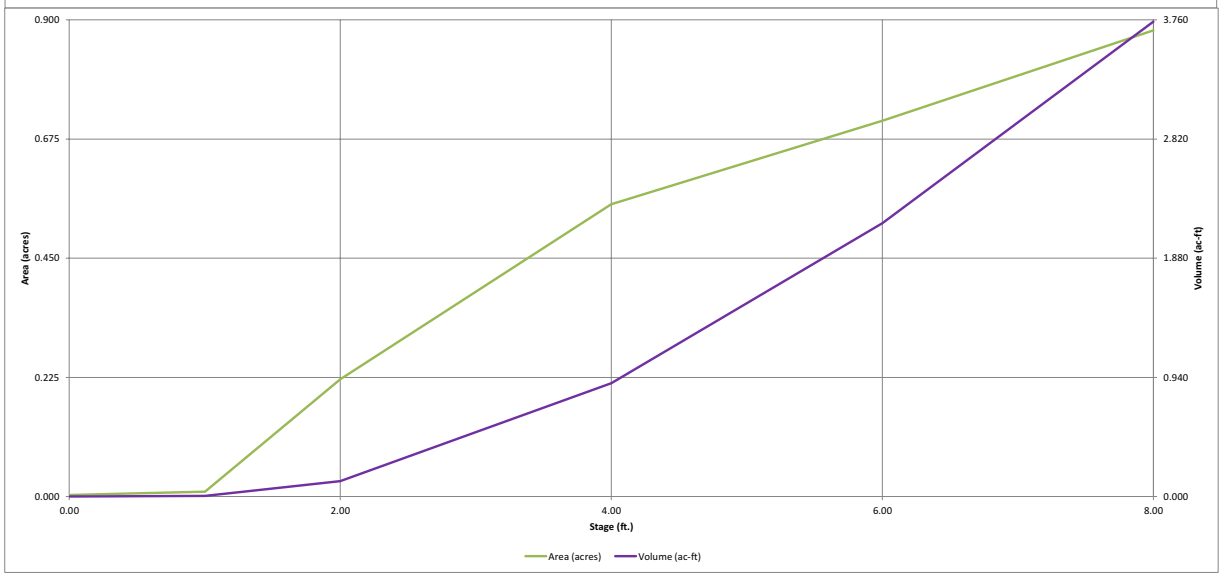
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	127	0.003		
	--	1.00	--	--	--	396	0.009	261	0.006
	--	2.00	--	--	--	9,635	0.221	5,277	0.121
	--	4.00	--	--	--	24,055	0.552	38,967	0.895
	--	6.00	--	--	--	30,917	0.710	93,939	2.157
	--	8.00	--	--	--	38,358	0.881	163,214	3.747

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



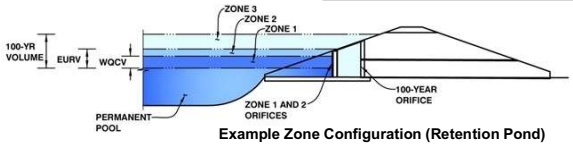


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Enclaves East

Basin ID: Pond 7



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.67	0.304	Orifice Plate
Zone 2 (EURV)	4.09	0.636	Orifice Plate
Zone 3 (100-year)	5.25	0.702	Weir&Pipe (Restrict)
Total (all zones)		1.642	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.09	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.35	2.70					
Orifice Area (sq. inches)	1.29	1.29	3.05					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.06	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.06	N/A	feet
Overflow Weir Front Edge Length =	5.70	N/A	feet	Overflow Weir Slope Length =	2.91	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.34	N/A	
Horiz. Length of Weir Sides =	2.91	N/A	feet	Overflow Grate Open Area w/o Debris =	11.54	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	5.77	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.82	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.64	N/A	feet
Restrictor Plate Height Above Pipe Invert =	13.50		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.70	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.15	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.91	feet
Spillway Crest Length =	13.50	feet	Stage at Top of Freeboard =	7.06	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.80	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	2.96	acre-ft

Calculated Parameters for Spillway

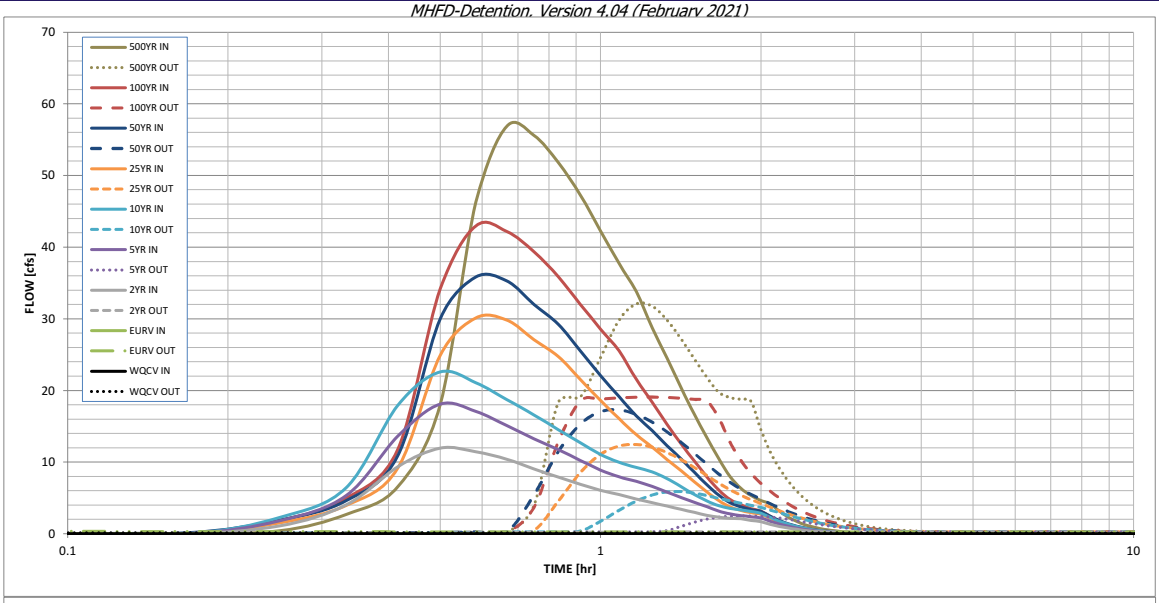
Routed Hydrograph Results

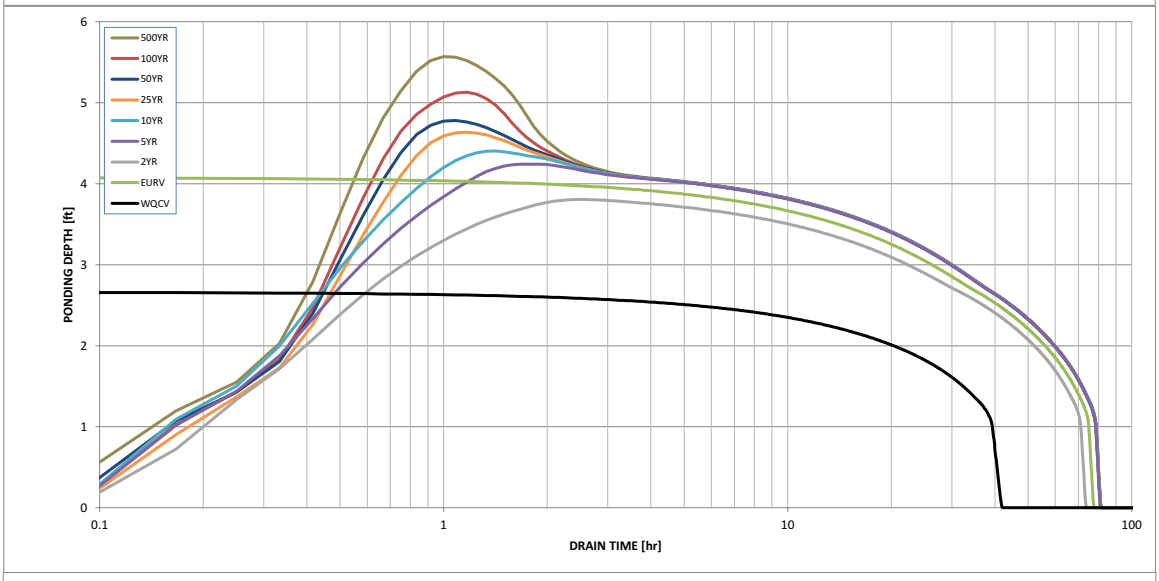
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

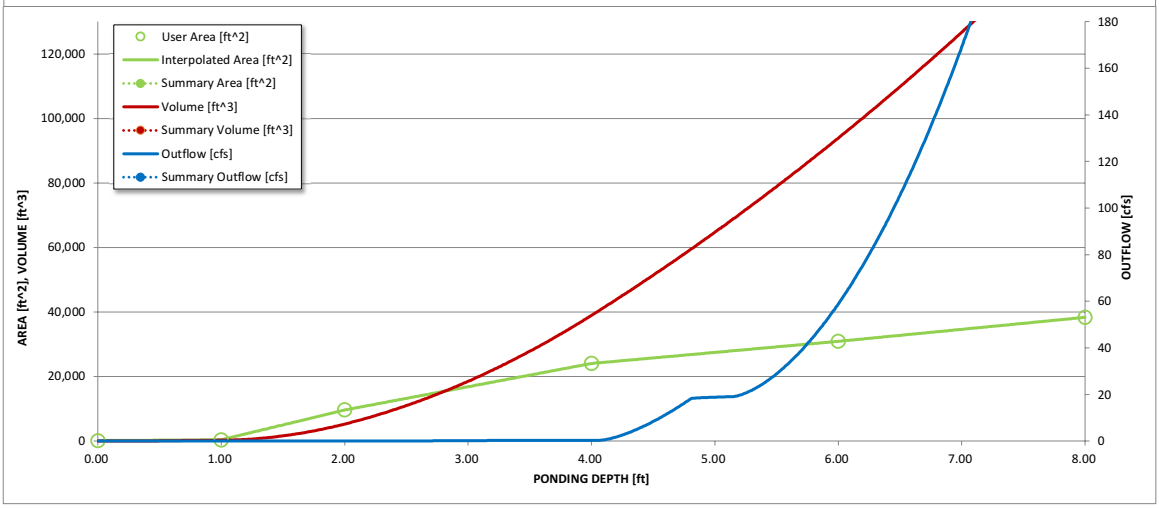
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.304	0.940	0.835	1.213	1.529	2.007	2.377	2.864	3.814
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.835	1.213	1.529	2.007	2.377	2.864	3.814
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.7	4.0	6.5	12.5	16.0	20.9	29.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.04	0.22	0.36	0.69	0.88	1.15	1.62
Peak Inflow Q (cfs) =	N/A	N/A	12.0	18.1	22.6	30.1	35.8	43.0	56.9
Peak Outflow Q (cfs) =	0.1	0.4	0.3	2.5	5.9	12.5	17.3	19.1	32.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.9	1.0	1.1	0.9	1.1
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.01	N/A	0.2	0.5	1.1	1.5	1.6	1.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	70	66	72	70	68	66	64	61
Time to Drain 99% of Inflow Volume (hours) =	**40**	74	71	77	76	75	74	73	72
Maximum Ponding Depth (ft) =	2.67	4.09	3.81	4.24	4.40	4.64	4.78	5.13	5.57
Area at Maximum Ponding Depth (acres) =	0.33	0.56	0.52	0.57	0.58	0.60	0.61	0.64	0.68
Maximum Volume Stored (acre-ft) =	0.306	0.945	0.787	1.029	1.122	1.258	1.349	1.569	1.859

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

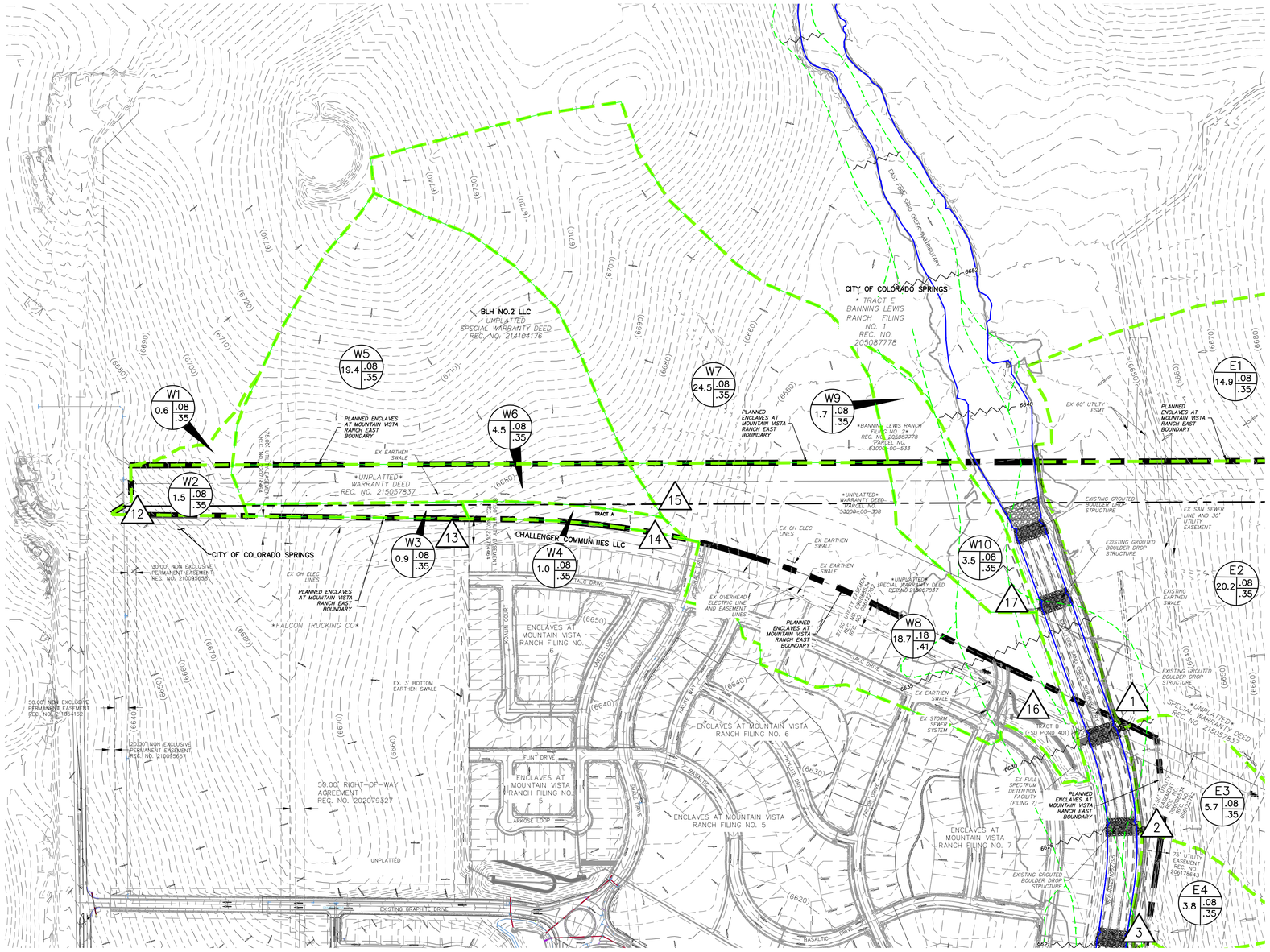
Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.01	0.41
	0:15:00	0.00	0.00	1.12	1.84	2.28	1.53	1.92	1.87	2.70
	0:20:00	0.00	0.00	4.03	5.33	6.46	3.96	4.63	4.95	6.58
	0:25:00	0.00	0.00	9.36	13.62	17.94	9.17	10.91	11.79	18.03
	0:30:00	0.00	0.00	11.96	18.11	22.58	24.91	29.99	34.17	46.26
	0:35:00	0.00	0.00	11.45	17.07	21.09	30.12	35.82	42.95	56.87
	0:40:00	0.00	0.00	10.41	15.10	18.74	29.83	35.27	42.19	55.61
	0:45:00	0.00	0.00	9.05	13.25	16.59	27.09	32.01	39.35	51.80
	0:50:00	0.00	0.00	7.90	11.75	14.52	24.73	29.23	35.85	47.25
	0:55:00	0.00	0.00	6.92	10.25	12.69	21.52	25.51	32.02	42.26
	1:00:00	0.00	0.00	6.07	8.90	11.07	18.57	22.07	28.57	37.71
	1:05:00	0.00	0.00	5.47	7.95	9.99	16.05	19.13	25.52	33.81
	1:10:00	0.00	0.00	4.86	7.31	9.26	13.82	16.47	21.57	28.72
	1:15:00	0.00	0.00	4.33	6.60	8.62	12.09	14.37	18.35	24.52
	1:20:00	0.00	0.00	3.86	5.82	7.70	10.37	12.31	15.26	20.35
	1:25:00	0.00	0.00	3.41	5.07	6.56	8.80	10.43	12.54	16.66
	1:30:00	0.00	0.00	2.98	4.38	5.49	7.26	8.57	10.15	13.42
	1:35:00	0.00	0.00	2.59	3.77	4.58	5.85	6.85	7.97	10.49
	1:40:00	0.00	0.00	2.30	3.16	3.93	4.62	5.37	6.10	8.00
	1:45:00	0.00	0.00	2.16	2.78	3.56	3.75	4.35	4.81	6.36
	1:50:00	0.00	0.00	2.09	2.55	3.34	3.25	3.75	4.03	5.33
	1:55:00	0.00	0.00	1.87	2.38	3.13	2.93	3.37	3.52	4.65
	2:00:00	0.00	0.00	1.67	2.20	2.86	2.72	3.11	3.15	4.16
	2:05:00	0.00	0.00	1.33	1.75	2.27	2.14	2.44	2.41	3.17
	2:10:00	0.00	0.00	1.03	1.35	1.75	1.63	1.85	1.78	2.33
	2:15:00	0.00	0.00	0.80	1.04	1.34	1.24	1.41	1.32	1.72
	2:20:00	0.00	0.00	0.62	0.80	1.02	0.95	1.07	0.99	1.29
	2:25:00	0.00	0.00	0.47	0.61	0.77	0.71	0.80	0.75	0.97
	2:30:00	0.00	0.00	0.36	0.45	0.57	0.53	0.60	0.56	0.73
	2:35:00	0.00	0.00	0.27	0.33	0.42	0.39	0.44	0.42	0.54
	2:40:00	0.00	0.00	0.20	0.24	0.32	0.30	0.33	0.32	0.41
	2:45:00	0.00	0.00	0.14	0.17	0.23	0.22	0.24	0.23	0.30
	2:50:00	0.00	0.00	0.09	0.12	0.16	0.15	0.17	0.16	0.21
	2:55:00	0.00	0.00	0.06	0.08	0.10	0.10	0.11	0.10	0.13
	3:00:00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.07
	3:05:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.02	0.03
	3:10:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DRAINAGE MAPS



LEGEND

BASIN DESIGNATION — O — C5 — 2.35 — .53 — .66 — ACRES — C100

- 4 — PIPE RUN REFERENCE LABEL
- 6 — SURFACE DESIGN POINT
- BASIN BOUNDARY
- (6920) — EXISTING CONTOUR
- 6920 — PROP CONTOUR
- SUBDIVISION BOUNDARY
- EX EASEMENT LINE
- STM — PROPOSED STORM SEWER PIPE
- EXISTING STORM SEWER PIPE
- EX CROSSPAN
- EX INLET
- EX MANHOLE
- EXISTING FLOW DIRECTION ARROW
- PROPOSED FLOW DIRECTION ARROW
- FLARED END SECTION
- H.P. — HIGH POINT
- L.P. — LOW POINT
- EMERGENCY OVERFLOW DIRECTION
- DIRECTION OF FUTURE ACCESS
- 100 YEAR BFE (NGVD29)
- 2022/2021 CLOMR 100 YEAR BFE (NAVD88)
- 2022/2021 CLOMR 100 YEAR FLOODPLAIN (MODELED)
- 100 YEAR EFFECTIVE FLOODPLAIN
- APPRX. EXISTING 100 YEAR FLOODPLAIN (MODELED)

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
E1	14.85	3.3	24.4
E2	20.23	4.7	34.2
E3	5.71	1.6	11.9
E4	3.78	1.0	7.7
E5	10.47	2.6	19.3
E6	4.99	1.3	9.7
E7	5.94	1.5	11.0
E8	33.82	6.3	46.5
E9	39.03	5.1	37.1
E10	20.28	4.2	31.1
E11	8.43	2.0	14.6
E12	39.47	9.5	48.9
E13	4.42	1.2	7.0
E14	1.40	0.3	2.3
E15	1.48	0.4	2.8
E16	24.51	4.9	36.2
W1	0.56	0.1	1.1
W2	1.53	0.4	3.3
W3	0.87	0.3	2.1
W4	1.00	0.3	2.4
W5	19.36	4.5	32.8
W6	4.51	0.9	6.5
W7	24.49	5.1	37.5
W8	18.66	9.2	36.2
W9	1.68	0.4	2.9
W10	3.47	0.7	5.1

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	6.0	44.2	E1, E2	EXIST CHANNEL DROP STRUCTURE
2	1.6	11.9	E3	EXIST CHANNEL DROP STRUCTURE
3	1.0	7.7	E4	EXIST CHANNEL DROP STRUCTURE
4	2.6	19.3	E5	EXIST CHANNEL DROP STRUCTURE
5	1.3	9.7	E6	EXIST CHANNEL DROP STRUCTURE
6	1.5	11.0	E7	EXIST EFSCST DROP STRUCTURE
7	7.4	54.2	E8, E9	SOUTHERN PROPERTY BOUNDARY EXIST EARTHEN SWALE
8	2.1	39.9	E10, E11	SOUTHWEST OF BASIN E11 DELINEATION
9	9.1	66.5	DP8, E12	SOUTHERN PROPERTY BOUNDARY EXIST EARTHEN SWALE
10	1.1	8.3	E13, E14	EASTERN BOUNDARY EXIST EARTHEN SWALE
11	4.6	33.4	E15, E16	SOUTHERN PROPERTY BOUNDARY EXIST EARTHEN SWALE
12	0.5	3.9	W1, W2	SOUTHERN PROPERTY BOUNDARY
13	0.3	2.1	W3	FALCON TRUCKING EXIST EARTHEN SWALE
14	0.3	2.4	W4	EXIST LOTS EMV FILING NO.6
15	5.2	38.0	W5, W6	EXIST EARTHEN SWALE
16	13.3	76.8	W7, W8, DP15	EXIST POND ENCLAVES FILING NO.7
17	1.0	7.5	W9, W10	EXIST CHANNEL DROP STRUCTURE

NOTES:

1. ALL EXISTING STORM SEWER FACILITIES WITHIN ENCLAVES FILINGS 4, 5, 6 & 7 ARE PRIVATELY OWNED AND MAINTAINED.
2. TOPOGRAPHY/CONTOURS SHOWN ARE BASED UPON THE FIMS NGVD29 DATUM

1" = 200'

0 50 100 200 400

Scale in Feet

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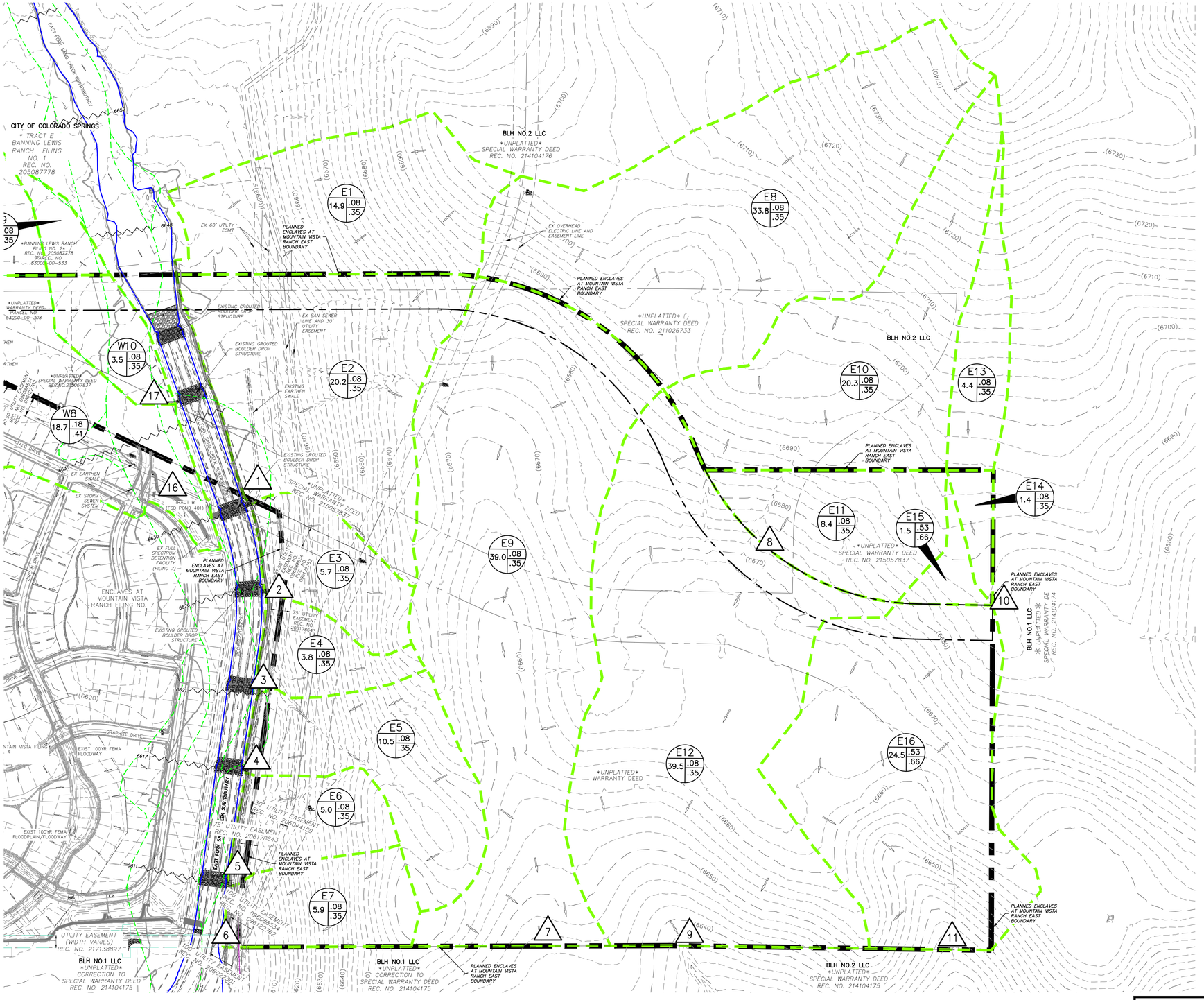
CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

ENCLAVES AT MOUNTAIN VISTA RANCH EAST

EXISTING CONDITIONS DRAINAGE MAP

PROJECT NO. 29-010
DESIGNED BY: DLM
DRAWN BY: DLM
CHECKED BY: VAS
SCALE: HORIZONTAL: 1"=200' VERTICAL: N/A
DATE: 10-27-2022
SHEET 1 OF 2
DM

File: O:\29010A-Enclaves East DP\Challenger Building\Drainage\Drainage Map\Existing Conditions Map.dwg Plotstamp: 11/11/2022 11:58 AM



BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
E1	14.85	3.3	24.4
E2	20.23	4.7	34.2
E3	5.71	1.6	11.9
E4	3.78	1.0	7.7
E5	10.47	2.6	19.3
E6	4.99	1.3	9.7
E7	5.94	1.5	11.0
E8	33.82	6.3	46.5
E9	39.03	5.1	37.1
E10	20.28	4.2	31.1
E11	8.43	2.0	14.6
E12	39.47	9.5	48.9
E13	4.42	1.2	7.0
E14	1.40	0.3	2.3
E15	1.48	0.4	2.8
E16	24.51	4.9	36.2
W1	0.56	0.1	1.1
W2	1.53	0.4	3.3
W3	0.87	0.3	2.1
W4	1.00	0.3	2.4
W5	19.36	4.5	32.8
W6	4.51	0.9	6.5
W7	24.49	5.1	37.5
W8	18.66	9.2	36.2
W9	1.68	0.4	2.9
W10	3.47	0.7	5.1

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	6.0	44.2	E1, E2	EXIST CHANNEL DROP STRUCTURE
2	1.6	11.9	E3	EXIST CHANNEL DROP STRUCTURE
3	1.0	7.7	E4	EXIST CHANNEL DROP STRUCTURE
4	2.6	19.3	E5	EXIST CHANNEL DROP STRUCTURE
5	1.3	9.7	E6	EXIST CHANNEL DROP STRUCTURE
6	1.5	11.0	E7	EXIST EFSCST DROP STRUCTURE
7	7.4	54.2	E8, E9	SOUTHERN PROPERTY BOUNDARY EXIST EARTHEN SWALE
8	2.1	39.9	E10, E11	SOUTHWEST OF BASIN E11 DELINEATION
9	9.1	66.5	DP8, E12	SOUTHERN PROPERTY BOUNDARY EXIST EARTHEN SWALE
10	1.1	8.3	E13, E14	EASTERN BOUNDARY EXIST EARTHEN SWALE
11	4.6	33.4	E15, E16	SOUTHERN PROPERTY BOUNDARY EXIST EARTHEN SWALE
12	0.5	3.9	W1, W2	SOUTHERN PROPERTY BOUNDARY
13	0.3	2.1	W3	FALCON TRUCKING EXIST EARTHEN SWALE
14	0.3	2.4	W4	EXIST LOTS EMV FILING NO.6
15	5.2	38.0	W5, W6	EXIST EARTHEN SWALE
16	13.3	76.8	W7, W8, DP15	EXIST POND ENCLAVES FILINGNO.7
17	1.0	7.5	W9, W10	EXIST CHANNEL DROP STRUCTURE

NOTES:

1. ALL EXISTING STORM SEWER FACILITIES WITHIN ENCLAVES FILINGS 4, 5, 6 & 7 ARE PRIVATELY OWNED AND MAINTAINED.
2. TOPOGRAPHY/CONTOURS SHOWN ARE BASED UPON THE FIMS NGVD29 DATUM

LEGEND

- BASIN DESIGNATION (O 2.35 .53 .66; C5; C100; ACRES)
- PIPE RUN REFERENCE LABEL (4)
- SURFACE DESIGN POINT (6)
- BASIN BOUNDARY
- EXISTING CONTOUR (6920)
- PROP CONTOUR 6920
- SUBDIVISION BOUNDARY
- EX EASEMENT LINE
- PROPOSED STORM SEWER PIPE (STM)
- EXISTING STORM SEWER PIPE
- EX CROSSPAN
- EX INLET
- EX MANHOLE
- EXISTING FLOW DIRECTION ARROW
- PROPOSED FLOW DIRECTION ARROW
- FLARED END SECTION
- H.P. HIGH POINT
- L.P. LOW POINT
- EMERGENCY OVERFLOW DIRECTION
- DIRECTION OF FUTURE ACCESS
- 100 YEAR BFE (NGVD29)
- 2022/2021 CLOMR 100 YEAR BFE (NAVD88)
- 2022/2021 CLOMR 100 YEAR FLOODPLAIN (MODELED)
- 100 YEAR EFFECTIVE FLOODPLAIN
- APPRX. EXISTING 100 YEAR FLOODPLAIN (MODELED)

1" = 200'

0 50 100 200 400

Scale in Feet

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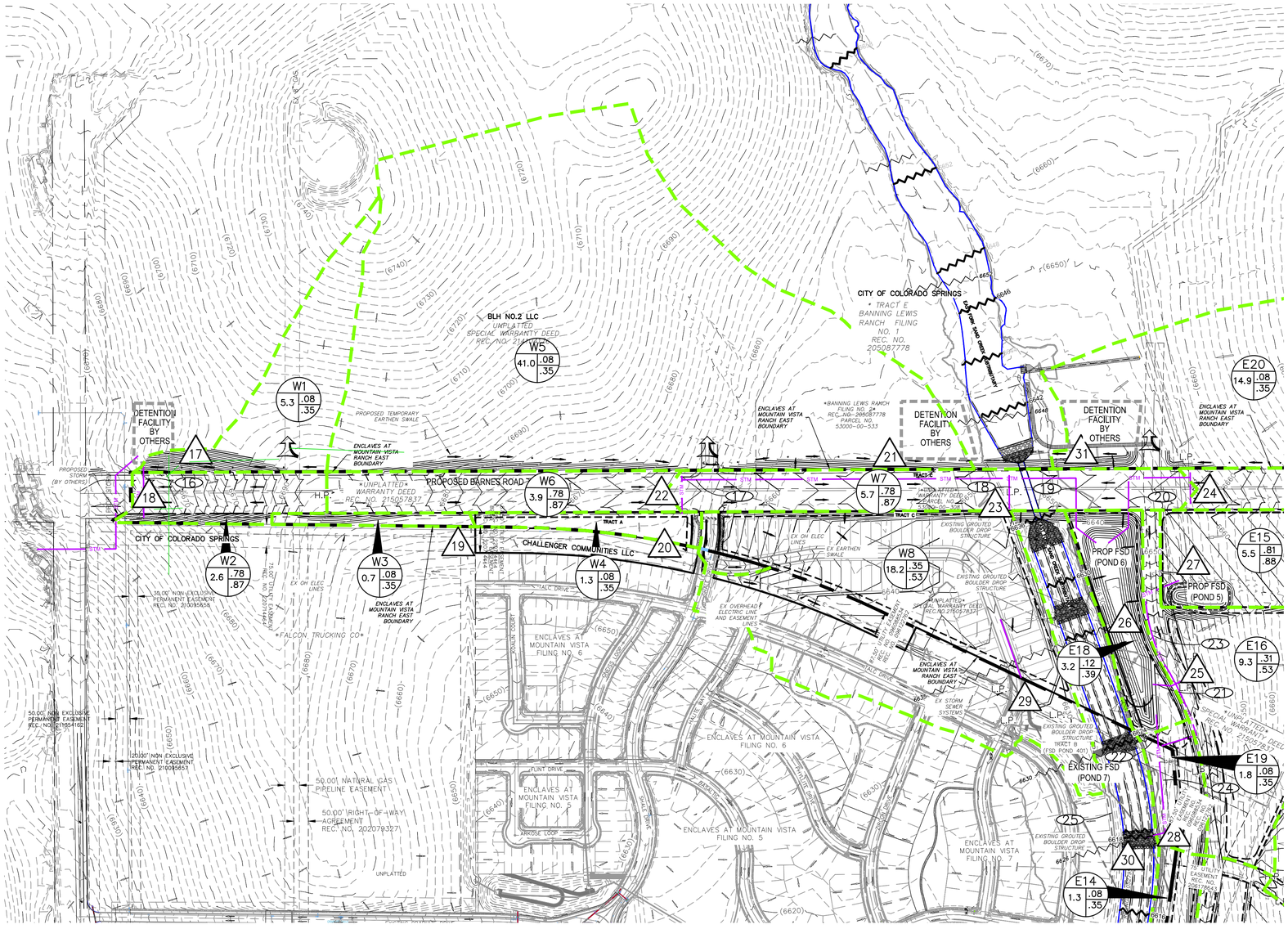
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

ENCLAVES AT MOUNTAIN VISTA RANCH EAST

EXISTING CONDITIONS DRAINAGE MAP

PROJECT NO. 29-010	SCALE: HORIZONTAL: 1"=200' VERTICAL: N/A	DATE: 10-27-2022	
DESIGNED BY: DLM		SHEET 2 OF 2	DM
DRAWN BY: DLM			
CHECKED BY: VAS			

File: O:\29010A-Enclaves East DP\Challenger Building\Drainage Map\Existing Conditions Map.dwg Plotstamp: 11/11/2022 12:14 PM



BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
E1	33.82	6.4	47.2
E2	24.70	4.3	31.3
E3	8.34	26.7	50.0
E4	10.41	40.6	74.0
E5	20.10	33.7	75.4
E6	22.41	35.0	78.3
E7	15.63	25.5	57.2
E8	15.79	24.5	54.8
E9	39.03	59.0	132.0
E10	23.15	36.3	83.5
E11	1.17	0.3	2.2
E12	1.47	0.4	3.2
E13	1.16	0.4	3.1
E14	1.33	0.5	3.4
E15	5.52	21.8	39.7
E16	9.29	11.8	33.9
E17	3.55	14.4	27.0
E18	3.24	2.0	10.9
E19	1.76	0.5	3.8
E20	14.85	3.4	25.2
W1	5.30	1.1	8.3
W2	2.57	10.1	18.9
W3	0.67	0.3	2.0
W4	1.28	0.5	3.6
W5	40.96	7.8	57.0
W6	3.87	12.7	23.8
W7	5.73	17.8	33.4
W8	18.17	22.0	56.4

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	6.4	47.2	E1	PROP 36" PIPE FUTURE DETENTION FACILITY (BY OTHERS)
2	4.3	31.3	E2	PROP 30" PIPE FUTURE DETENTION FACILITY (BY OTHERS)
3	26.7	50.0	E3	PROP 42" PIPE LOW POINT IN BARNES
4	61.2	112.9	PR4, E4	FSD POND 1
5	33.7	75.4	E5	FSD POND 2
6	0.6	11.6	PR7	PROP 18" PIPE RIPRAP OUTFALL EX EARTHEN CHANNEL
7	35.0	78.3	E6	FSD POND 3
8	8.3	92.3	PR6, PR8	PROP 18" PIPE RIPRAP OUTFALL EX EARTHEN CHANNEL
9	25.5	57.2	E7	PROP 36" PIPE
10	24.5	54.8	E8	PROP 36" PIPE
11	59.0	132.0	E9	PROP 36" PIPE
12	150.9	340.0	E10, PR14	FSD POND 4
13	2.1	87.9	E11, PR15	EXIST EFSCST
14	0.4	3.2	E12	EXIST CHANNEL DROP STRUCTURE
15	0.4	3.1	E13	EXIST CHANNEL DROP STRUCTURE
16	0.5	3.4	E14	EXIST POND ENCLAVES FILING 7
17	1.1	8.3	W1	PROP TEMPORARY EARTHEN SWALE
18	10.1	18.9	W2	PROP 24" PIPE
19	0.3	2.0	W3	EXIST TEMPORARY EARTHEN SWALE
20	0.5	3.6	W4	EXIST EMV FILING 6 LOTS
21	7.8	57.0	W5	PROP TEMPORARY EARTHEN SWALE
22	12.7	23.8	W6	PROP 30" PIPE
23	17.8	33.4	W7	PROP 30" PIPE
24	14.4	27.0	E17	PROP 30" PIPE
25	11.8	33.9	E16	PROP 30" PIPE
26	53.2	128.6	PR19, PR20, PR21, E18	FSD POND 6
27	21.8	39.7	E15	FSD POND 5
28	1.3	37.5	PR24, E19	PROP 30" PIPE EX CHANNEL DROP STRUCTURE
29	22.0	56.4	W8	EX CHANNEL DROP STRUCTURE
30	2.5	19.1	PR25	EX 24" PIPE EX CHANNEL DROP STRUCTURE
31	3.4	25.2	E20	PROP TEMPORARY EARTHEN SWALE

LEGEND

BASIN DESIGNATION: O | 2.35 | .53 | .66 (ACRES; C5; C100)

- PIPE RUN REFERENCE LABEL
- SURFACE DESIGN POINT
- BASIN BOUNDARY
- (6920) EXISTING CONTOUR
- 6920 PROP CONTOUR
- SUBDIVISION BOUNDARY
- EX EASEMENT LINE
- NES CONCEPT BUBBLES
- STM PROPOSED STORM SEWER PIPE
- EXISTING STORM SEWER PIPE
- ES CROSSPAN
- EX INLET
- EX MANHOLE
- EXISTING FLOW DIRECTION ARROW
- PROPOSED FLOW DIRECTION ARROW
- EX FLARED END SECTION
- H.P. HIGH POINT
- L.P. LOW POINT
- EMERGENCY OVERFLOW DIRECTION
- DIRECTION OF FUTURE ACCESS
- 100 YEAR BFE (NAVD88)
- 2022/2021 CLOMR 100 YEAR BFE (NGVD29)
- 2022/2021 CLOMR 100 YEAR FLOODPLAIN (MODELED)
- 100 YR AR EFFECTIVE FLOODPLAIN
- APPROX EXISTING 100 YEAR FLOODPLAIN (MODELED)

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE	PIPE MATERIAL	CONTRIBUTING PIPES/DESIGN POINTS
1	6.4	47.2	36" PIPE	RCP	DP1
2	4.3	31.3	30" PIPE	RCP	DP2
3	10.1	74.2	42" PIPE	RCP	PR1, PR2
4	26.7	50.0	36" PIPE	RCP	DP3
5	0.8	21.6	24" PIPE	RCP	POND 1 OUTFALL
6	8.5	84.1	42" PIPE	RCP	PR3, PR5
7	0.6	11.6	18" PIPE	RCP	POND 2 OUTFALL
8	0.8	16.7	18" PIPE	RCP	POND 3 OUTFALL
9	8.3	92.3	36" PIPE	RCP	PR6, PR8
10	25.5	57.2	36" PIPE	RCP	DP9
11	24.5	54.8	36" PIPE	RCP	DP10
12	48.4	108.4	48" PIPE	RCP	PR10, PR11
13	59.0	132.0	48" PIPE	RCP	DP11
14	105.7	236.5	60" PIPE	RCP	PR12, PR13
15	2.0	87.0	42" PIPE	RCP	POND 4 OUTFALL
16	10.1	18.9	24" PIPE	RCP	DP18
17	12.7	23.8	30" PIPE	RCP	DP22
18	17.8	33.4	30" PIPE	RCP	DP23
19	29.9	56.0	36" PIPE	RCP	PR17, PR18
20	14.4	27.0	30" PIPE	RCP	DP24
21	11.8	33.9	30" PIPE	RCP	DP25
22	0.8	32.3	30" PIPE	RCP	POND 6 OUTFALL
23	0.2	4.0	18" PIPE	RCP	POND 5 OUTFALL
24	2.0	36.2	30" PIPE	RCP	PR22, PR23
25	2.5	19.1	24" PIPE	RCP	POND 7 OUTFALL

1" = 200'

0 50 100 200 400

Scale in Feet

NOTES:

1. ALL EXISTING STORM SEWER FACILITIES WITHIN ENCLAVES FILINGS 4, 5, 6 & 7 ARE PRIVATELY OWNED AND MAINTAINED.
2. ALL PROPOSED STORM SEWER FACILITIES WITHIN ENCLAVES AT MOUNTAIN VISTA RANCH EAST ARE PRIVATELY OWNED AND MAINTAINED.
3. PP IS AN ACCEPTABLE ALTERNATIVE PIPE MATERIAL.
4. TOPOGRAPHY/CONTOURS SHOWN ARE BASED UPON THE FIMS NGVD29 DATUM

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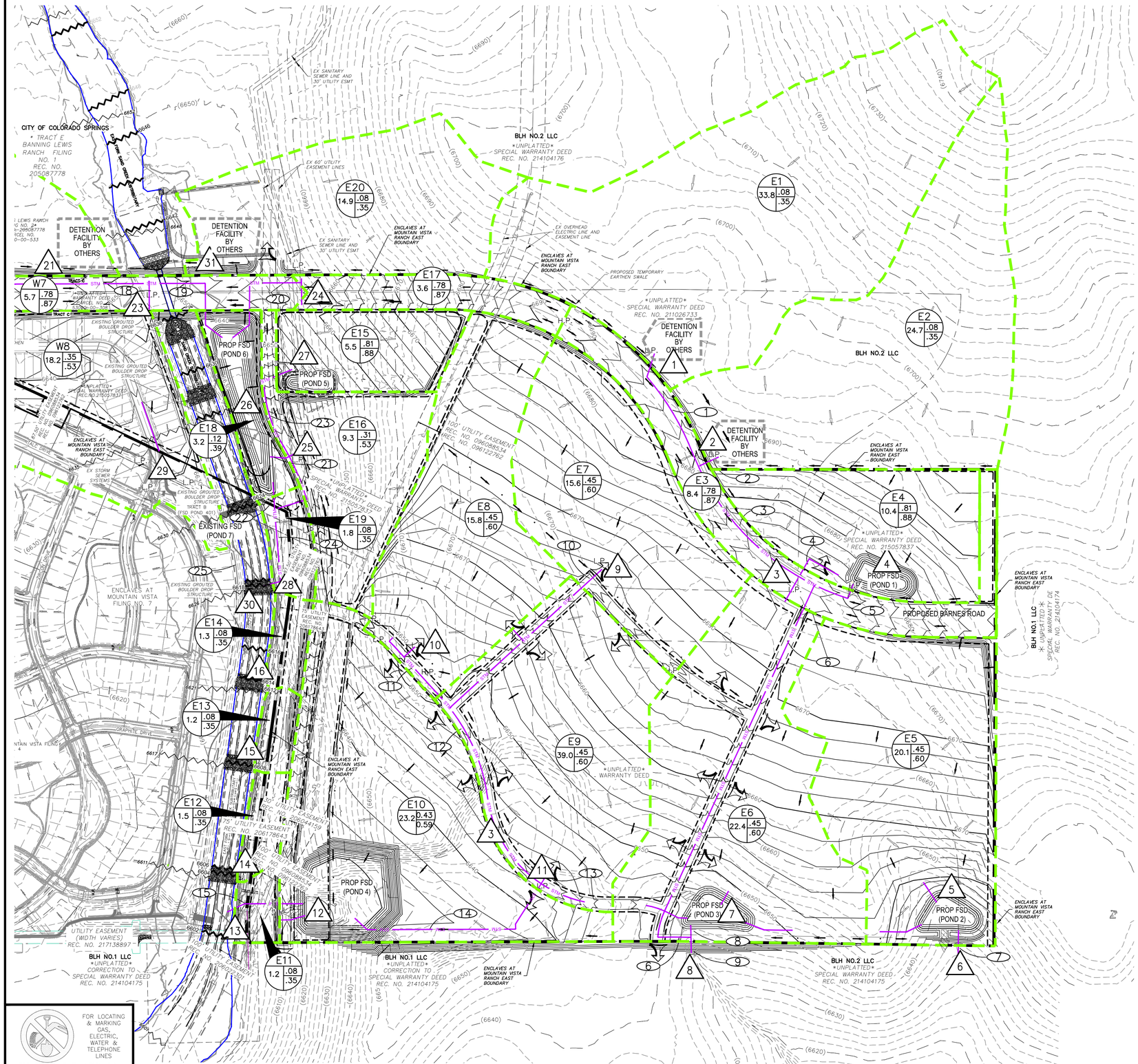
CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

ENCLAVES AT MOUNTAIN VISTA EAST

PROPOSED CONDITIONS DRAINAGE MAP

PROJECT NO. 29-010
DESIGNED BY: DLM
DRAWN BY: DLM
CHECKED BY: VAS
SCALE: HORIZONTAL: 1"=200' VERTICAL: N/A
DATE: 10-27-2022
SHEET 1 OF 2
DM

File: O:\29010A-Enclaves East 2\P\Challenger Building\Drainage\Drainage Map\Proposed Conditions Map.dwg Plotstamp: 11/10/2022 12:04 PM



BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q_{100}
E1	33.82	6.4	47.2
E2	24.70	4.3	31.3
E3	8.34	26.7	50.0
E4	10.41	40.6	74.0
E5	20.10	33.7	75.4
E6	22.41	35.0	78.3
E7	15.63	25.5	57.2
E8	15.79	24.5	54.8
E9	39.03	59.0	132.0
E10	23.15	36.3	83.5
E11	1.17	0.3	2.2
E12	1.47	0.4	3.2
E13	1.16	0.4	3.1
E14	1.33	0.5	3.4
E15	5.52	21.8	39.7
E16	9.29	11.8	33.9
E17	3.55	14.4	27.0
E18	3.24	2.0	10.9
E19	1.76	0.5	3.8
E20	14.85	3.4	25.2
W1	5.30	1.1	8.3
W2	2.57	10.1	18.9
W3	0.67	0.3	2.0
W4	1.28	0.5	3.6
W5	40.96	7.8	57.0
W6	3.87	12.7	23.8
W7	5.73	17.8	33.4
W8	18.17	22.0	56.4

DESIGN POINT SUMMARY				
DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	6.4	47.2	E1	PROP 36" PIPE FUTURE DETENTION FACILITY (BY OTHERS)
2	4.3	31.3	E2	PROP 30" PIPE FUTURE DETENTION FACILITY (BY OTHERS)
3	26.7	50.0	E3	PROP 42" PIPE LOW POINT IN BARNES
4	61.2	112.9	PR4, E4	FSD POND 1
5	33.7	75.4	E5	FSD POND 2
6	0.6	11.6	PR7	PROP 18" PIPE RIPRAP OUTFALL EX EARTHEN CHANNEL
7	35.0	78.3	E6	FSD POND 3
8	8.3	92.3	PR6, PR8	PROP 18" PIPE RIPRAP OUTFALL EX EARTHEN CHANNEL
9	25.5	57.2	E7	PROP 36" PIPE
10	24.5	54.8	E8	PROP 36" PIPE
11	59.0	132.0	E9	PROP 36" PIPE
12	150.9	340.0	E10, PR14	FSD POND 4
13	2.1	87.9	E11, PR15	EXIST EFSCST
14	0.4	3.2	E12	EXIST CHANNEL DROP STRUCTURE
15	0.4	3.1	E13	EXIST CHANNEL DROP STRUCTURE
16	0.5	3.4	E14	EXIST POND ENCLAVES FILING 7
17	1.1	8.3	W1	PROP TEMPORARY EARTHEN SWALE
18	10.1	18.9	W2	PROP 24" PIPE
19	0.3	2.0	W3	EXIST TEMPORARY EARTHEN SWALE
20	0.5	3.6	W4	EXIST EMV FILING 6 LOTS
21	7.8	57.0	W5	PROP TEMPORARY EARTHEN SWALE
22	12.7	23.8	W6	PROP 30" PIPE
23	17.8	33.4	W7	PROP 30" PIPE
24	14.4	27.0	E17	PROP 30" PIPE
25	11.8	33.9	E16	PROP 30" PIPE
26	53.2	128.6	PR19, PR20, PR21, E18	FSD POND 6
27	21.8	39.7	E15	FSD POND 5
28	1.3	37.5	PR24, E19	PROP 30" PIPE EX CHANNEL DROP STRUCTURE
29	22.0	56.4	W8	EX CHANNEL DROP STRUCTURE
30	2.5	19.1	PR25	EXIST 24" PIPE
31	3.4	25.2	E20	PROP TEMPORARY EARTHEN SWALE

LEGEND

BASIN DESIGNATION: O, 2.35 (ACRES), .53 (C5), .66 (C100)

- 4 — PIPE RUN REFERENCE LABEL
- 6 — SURFACE DESIGN POINT
- BASIN BOUNDARY
- (6920) — EXISTING CONTOUR
- 6920 — PROP CONTOUR
- SUBDIVISION BOUNDARY
- NES CONCEPT BUBBLES
- EX EASEMENT LINE
- STM — PROPOSED STORM SEWER PIPE
- EXISTING STORM SEWER PIPE
- EX CROSSPAN
- EX INLET
- EX MANHOLE
- EXISTING FLOW DIRECTION ARROW
- PROPOSED FLOW DIRECTION ARROW
- FLARED END SECTION
- H.P. — HIGH POINT
- L.P. — LOW POINT
- EMERGENCY OVERFLOW DIRECTION
- DIRECTION OF FUTURE ACCESS
- 100 YEAR BFE (NGVD29)
- 2022/2021 CLOMR 100 YEAR BFE (NAVD88)
- 2022/2021 CLOMR 100 YEAR FLOODPLAIN (MODELED)
- 100 YEAR EFFECTIVE FLOODPLAIN
- APPRX. EXISTING 100 YEAR FLOODPLAIN (MODELED)

STORM SEWER SUMMARY					
PIPE RUN	Q_5	Q_{100}	PIPE SIZE	PIPE MATERIAL	CONTRIBUTING PIPES/DESIGN POINTS
1	6.4	47.2	36" PIPE	RCP	DP1
2	4.3	31.3	30" PIPE	RCP	DP2
3	10.1	74.2	42" PIPE	RCP	PR1, PR2
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0 50 100 200 400

Scale in Feet

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PHONE: 719.955.5485

ENCLAVES AT MOUNTAIN VISTA EAST

PROPOSED CONDITIONS DRAINAGE MAP

PROJECT NO. 29-010	SCALE:	DATE: 10-27-2022	
DESIGNED BY: DLM	HORIZONTAL: 1"=200'	SHEET 2 OF 2	DM
DRAWN BY: DLM	VERTICAL: N/A		
CHECKED BY: VAS			

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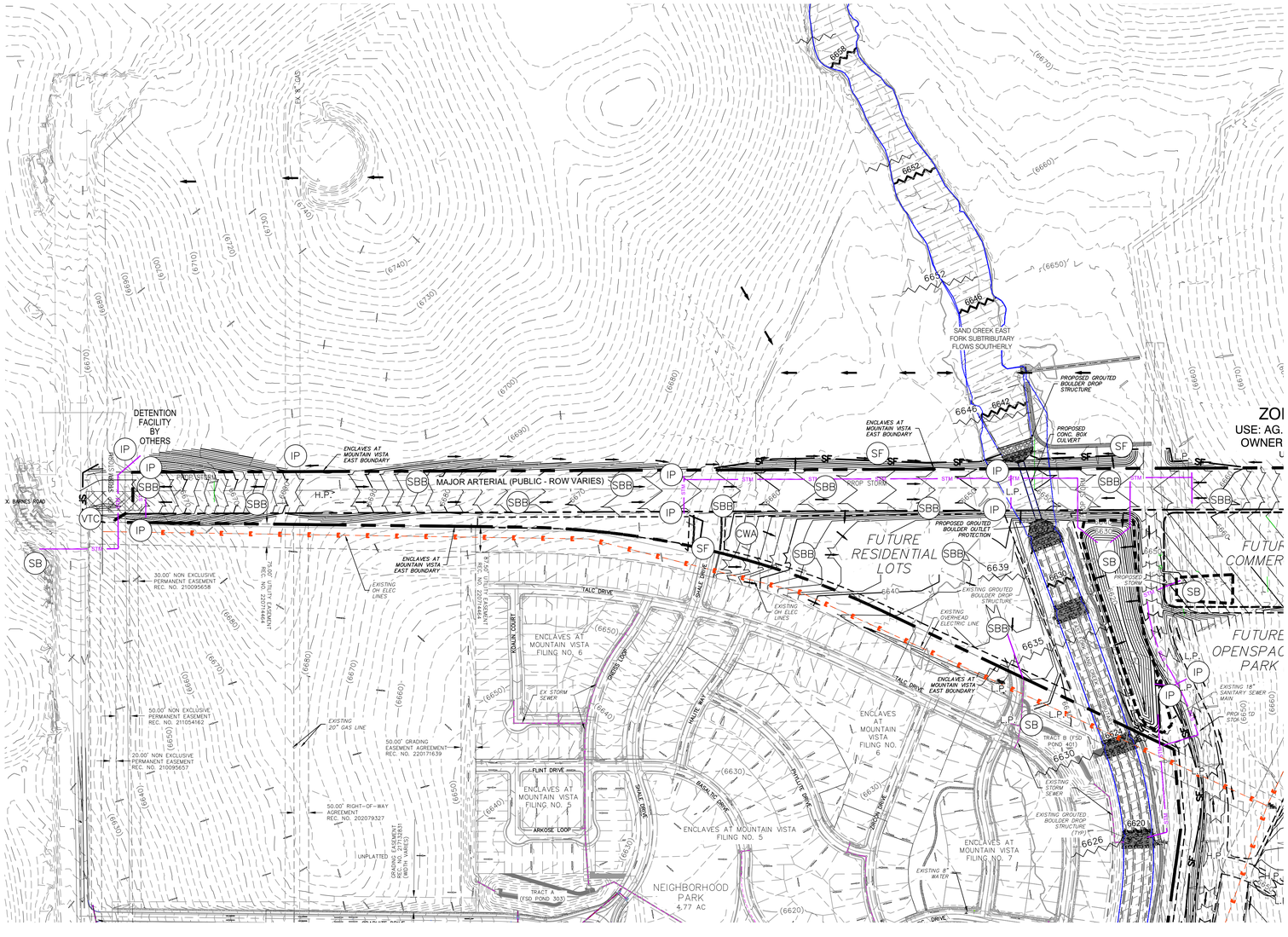
BACKGROUND

ENCLAVES AT MOUNTAIN VISTA RANCH EAST

CONCEPT PRELIMINARY GRADING PLAN
FEBRUARY 2022



1" = 200'

0 100 200 400

Scale in Feet

LEGEND

- EXISTING MAJOR CONTOUR (6920)
- EXISTING MINOR CONTOUR (6918)
- PROPOSED MAJOR CONTOUR (6920)
- PROPOSED MINOR CONTOUR (6918)
- FILING BOUNDARY LINE
- RIGHT-OF-WAY LINE
- PROPOSED PROPERTY LINE
- SF — SILT FENCE
- VEHICLE TRACKING CONTROL
- SBB — STRAW BALE DITCH CHECK
- SF — SILT FENCE
- VTC — VEHICLE TRACKING CONTROL
- L.P./H.P. — LOW POINT/HIGH POINT
- FLOW DIRECTION ARROW/ EMERGENCY OVERFLOW
- EXISTING FLOW DIRECTION ARROW
- CWA — CONCRETE WASHOUT AREA
- IP — INLET PROTECTION
- SB — TEMPORARY SEDIMENT BASIN
- 6630 — PROPOSED FEMA FLOODPLAIN ELEVATION
- 6500 — EXISTING FEMA FLOODPLAIN ELEVATION
- EMERGENCY OVERFLOW DIRECTION

STANDARD GRADING, EROSION, AND STORMWATER QUALITY CONTROL PLAN NOTES

1. ANY LAND DISTURBANCE BY ANY OWNER, DEVELOPER, BUILDER, CONTRACTOR, OR OTHER PERSON SHALL COMPLY WITH THE BASIC GRADING, EROSION, AND STORMWATER QUALITY CONTROL REQUIREMENTS AND GENERAL PROHIBITIONS NOTED IN THE DRAINAGE CRITERIA MANUAL VOLUME II.
2. NO CLEARING, GRADING, EXCAVATION, FILING, OR OTHER LAND DISTURBING ACTIVITIES SHALL BE PERMITTED UNTIL SIGNOFF AND ACCEPTANCE OF THE GRADING PLAN AND EROSION AND STORMWATER QUALITY CONTROL PLAN IS RECEIVED FROM EDRD..
3. THE INSTALLATION OF THE FIRST LEVEL OF TEMPORARY EROSION CONTROL FACILITIES AND BMP'S SHALL BE INSTALLED AND INSPECTED PRIOR TO ANY EARTH DISTURBANCE OPERATIONS TAKING PLACE. CALL CITY STORMWATER INSPECTIONS, 719-385-5980, 48 HOURS PRIOR TO CONSTRUCTION.
4. SEDIMENT (MUD AND DIRT) TRANSPORTED INTO A PUBLIC ROAD, REGARDLESS OF THE SIZE OF THE SITE, SHALL BE CLEANED IMMEDIATELY.
5. CONCRETE WASH WATER SHALL NOT BE DISCHARGED TO OR ALLOWED TO RUNOFF TO STATE WATERS, INCLUDING ANY SURFACE OR SUBSURFACE STORM DRAINAGE SYSTEM OR FACILITIES.
6. SOIL EROSION CONTROL MEASURES FOR ALL SLOPES, CHANNELS, DITCHES, OR ANY DISTURBED LAND AREA SHALL BE COMPLETED WITHIN TWENTY-ONE (21) CALENDAR DAYS AFTER FINAL GRADING OR FINAL EARTH DISTURBANCE HAS BEEN COMPLETED. DISTURBED AREAS AND STOCKPILES WHICH ARE NOT AT FINAL GRADE BUT WILL REMAIN DORMANT FOR LONGER THAN THIRTY (30) DAYS SHALL ALSO BE MULCHED WITHIN TWENTY-ONE (21) DAYS AFTER INTERIM GRADING. AN AREA THAT IS GOING TO REMAIN IN AN INTERIM STATE FOR MORE THAN SIXTY (60) DAYS SHALL ALSO BE SEEDED. ALL TEMPORARY SOIL EROSION CONTROL MEASURES AND BMP'S SHALL BE MAINTAINED UNTIL PERMANENT SOIL EROSION CONTROL MEASURES ARE IMPLEMENTED.
7. THE GRADING AND EROSION CONTROL PLAN WILL BE SUBJECT TO RE-REVIEW AND RE-ACCEPTANCE BY EDRD SHOULD ANY OF THE FOLLOWING OCCUR: GRADING DOES NOT COMMENCE WITHIN TWELVE (12) OF THE CITY ENGINEER'S ACCEPTANCE OF THE PLAN, A CHANGE IN PROPERTY OWNERSHIP,PROPOSED DEVELOPMENT CHANGES, OR PROPOSED GRADING REVISIONS.
8. THE PLAN SHALL NO SUBSTANTIALLY CHANGE THE DEPTH OF COVER, OR ACCESS EXISTING UTILITY LINES. ACCEPTANCE OF THIS PLAN DOES NOT CONSTITUTE APPROVAL TO GRADE IN ANY UTILITY EASEMENT OR RIGHT-OF-WAY. APPROVALS TO GRADE WITHIN UTILITY EASEMENTS MUST BE OBTAINED FROM THE APPROPRIATE UTILITY COMPANY. IT IS NOT PERMISSIBLE FOR ANY PERSON TO MODIFY THE GRADE OF THE EARTH ON ANY COLORADO SPRINGS UTILITY EASEMENT OR UTILITY RIGHT-OF-WAY WITHOUT THEIR WRITTEN APPROVAL. THE PLAN SHALL NOT INCREASE OR DIVERT WATER TOWARDS UTILITY FACILITIES. ANY CHANGES TO EXISTING UTILITY FACILITIES TO ACCOMMODATE THE PLAN MUST BE APPROVED BY THE AFFECTED UTILITY OWNER PRIOR TO IMPLEMENTING THE PLAN. THE COST TO RELOCATE OR PROTECT EXISTING UTILITIES OR TO PROVIDE INTERIM ACCESS IS THE APPLICANT'S EXPENSE.

EROSION CONTROL NOTES

1. AT ALL TIMES DURING THE CONSTRUCTION OF THE PROJECT, EROSION AND SEDIMENT CONTROL SYSTEMS SHALL BE MAINTAINED TO PREVENT DAMAGING FLOWS ON THE SITE AND IN THE WATERSHED BELOW THE SITE. CONTROL SYSTEMS SHALL BE INSTALLED PRIOR TO STRIPPING OF NATIVE VEGETATIVE COVER AND AS GRADING PROGRESSES. CONTROL SYSTEMS SHALL INCLUDE, AS A MINIMUM, STRAW BALE SEDIMENT TRAPS (OR EQUAL) ALONG NATURAL DRAINAGE WAYS PRIOR TO GRADING AND UTILIZATION OF DESIGNED STORM DETENTION BASINS PRIOR TO FINAL GRADING REVEGETATION. AS AN AVERAGE, SEDIMENT TRAPS WITH A CAPACITY OF 15 CUBIC YARDS SHALL BE PROVIDED FOR EACH ACRE OF DISTURBED SOIL.
2. ALL SEDIMENT TRAPS WILL BE CLEANED AND MAINTAINED TO PROVIDE ADEQUATE PROTECTION FROM SOIL LOSS UNTIL SUCH TIME AS THEY ARE NO LONGER NEEDED.
3. WHERE AREAS ARE TO BE LEFT BARE FOR EXTENDED PERIODS (TOPSOIL, STOCKPILES, EMPTY LOTS, RIGHTS-OF-WAY, HOME SITES AWAITING PURCHASE, ETC.) MECHANICAL MULCHING (STRAW CRIMP) IN ACCORDANCE WITH CDOT STANDARD SPECIFICATIONS SHALL BE APPLIED WITHIN 30 DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. SOIL STABILIZATION MEASURES SHALL BE APPLIED WITHIN 30 DAYS TO DISTURBED AREAS WHICH MAY NOT BE AT FINAL GRADE BUT WILL BE LEFT DORMANT FOR LONGER THAN 60 DAYS.
4. TOPSOIL WILL BE STOCKPILED AND USED AS A TOP DRESSING OVER CUT AND FILL AREAS TO HELP IN THE ESTABLISHMENT OF ADAPTED VEGETATION. TOPSOIL STOCKPILE WILL BE SEEDED AND/OR MULCHED AND/OR SURROUNDED BY SILT FENCE TO MINIMIZE SOIL LOSS UNTIL TOPSOIL IS USED. STOCKPILES IN EXCESS OF 8' HIGH WILL REQUIRE AN ADDITIONAL PERIMETER ROW OF SILT FENCE.
5. TEMPORARY STOCKPILES (8' MAX. HEIGHT) DUE TO UTILITY CONSTRUCTION SHALL BE KEPT MOIST BY THE CONTRACTOR TO PREVENT BLOWING SOILS.
6. AREAS LEFT OPEN FOR 30 DAYS OR MORE, OTHER THAN FOR UTILITY AND DRAINAGE CONSTRUCTION, SHALL BE SEEDED AND/OR MULCHED.
7. THE CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTING MEASURES TO PREVENT EROSION OF DISTURBED SOIL BY ABNORMAL WINDS.
8. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AT THE TIME OF CONSTRUCTION.

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PHONE: 719.955.5485

ENCLAVES AT MOUNTAIN VISTA EAST

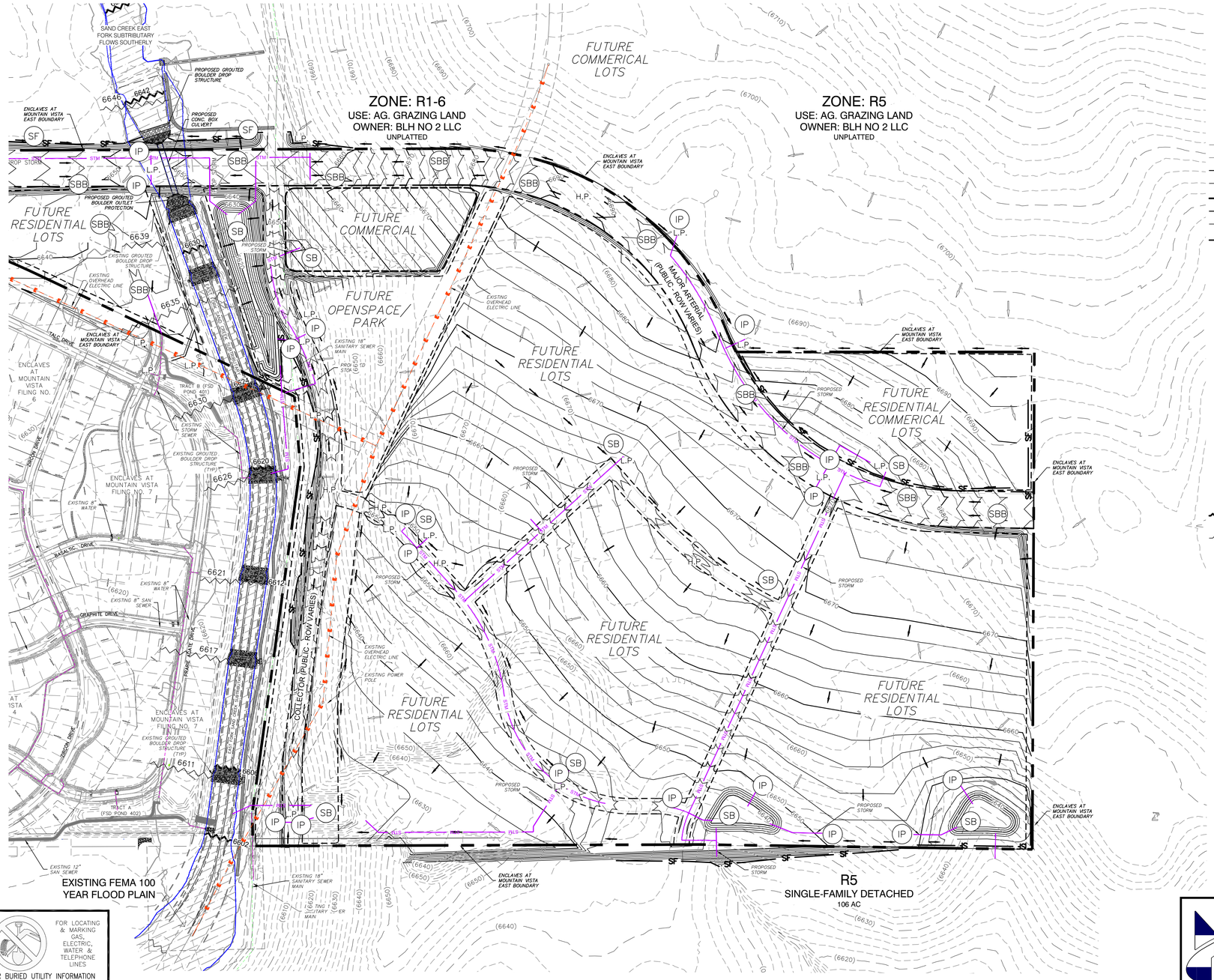
PROPOSED GRADING AND EROSION CONTROL

PROJECT NO. 29-010	SCALE: HORIZONTAL: 1"=200' VERTICAL: N/A	DATE: 02-15-2022	
DESIGNED BY: DLM		SHEET 1 OF 2	GR01
DRAWN BY: DLM			
CHECKED BY: VAS			

File: Q:\29010A-Enclaves East DP\Challenger Building\Dwg\Concept Plan\Preliminary Grading Plan.dwg Plotstamp: 2/23/2022 11:41 AM

ENCLAVES AT MOUNTAIN VISTA RANCH EAST

CONCEPT PRELIMINARY GRADING PLAN
FEBRUARY 2022



1" = 200'

0 100 200 400

Scale in Feet

LEGEND

- 6920 — EXISTING MAJOR CONTOUR
- 6918 — EXISTING MINOR CONTOUR
- 6920 — PROPOSED MAJOR CONTOUR
- 6918 — PROPOSED MINOR CONTOUR
- FILING BOUNDARY LINE
- RIGHT-OF-WAY LINE
- PROPOSED PROPERTY LINE
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1. AT ALL TIMES DURING THE CONSTRUCTION OF THE PROJECT, EROSION AND SEDIMENT CONTROL SYSTEMS SHALL BE MAINTAINED TO PREVENT DAMAGING FLOWS ON THE SITE AND IN THE WATERSHED BELOW THE SITE. CONTROL SYSTEMS SHALL BE INSTALLED PRIOR TO STRIPPING OF NATIVE VEGETATIVE COVER AND AS GRADING PROGRESSES. CONTROL SYSTEMS SHALL INCLUDE, AS A MINIMUM, STRAW BALE SEDIMENT TRAPS (OR EQUAL) ALONG NATURAL DRAINAGE WAYS PRIOR TO GRADING AND UTILIZATION OF DESIGNED STORM DETENTION BASINS PRIOR TO FINAL GRADING REVEGETATION. AS AN AVERAGE, SEDIMENT TRAPS WITH A CAPACITY OF 15 CUBIC YARDS SHALL BE PROVIDED FOR EACH ACRE OF DISTURBED SOIL.
2. ALL SEDIMENT TRAPS WILL BE CLEANED AND MAINTAINED TO PROVIDE ADEQUATE PROTECTION FROM SOIL LOSS UNTIL SUCH TIME AS THEY ARE NO LONGER NEEDED.
3. WHERE AREAS ARE TO BE LEFT BARE FOR EXTENDED PERIODS (TOPSOIL, STOCKPILES, EMPTY LOTS, RIGHTS-OF-WAY, HOME SITES AWAITING PURCHASE, ETC.) MECHANICAL MULCHING (STRAW CRIMP) IN ACCORDANCE WITH CDOT STANDARD SPECIFICATIONS SHALL BE APPLIED WITHIN 30 DAYS AFTER FINAL GRADE IS REACHED ON ANY PORTION OF THE SITE. SOIL STABILIZATION MEASURES SHALL BE APPLIED WITHIN 30 DAYS TO DISTURBED AREAS WHICH MAY NOT BE AT FINAL GRADE BUT WILL BE LEFT DORMANT FOR LONGER THAN 60 DAYS.
4. TOPSOIL WILL BE STOCKPILED AND USED AS A TOP DRESSING OVER CUT AND FILL AREAS TO HELP IN THE ESTABLISHMENT OF ADAPTED VEGETATION. TOPSOIL STOCKPILE WILL BE SEEDED AND/OR MULCHED AND/OR SURROUNDED BY SILT FENCE TO MINIMIZE SOIL LOSS UNTIL TOPSOIL IS USED. STOCKPILES IN EXCESS OF 8' HIGH WILL REQUIRE AN ADDITIONAL PERIMETER ROW OF SILT FENCE.
5. TEMPORARY STOCKPILES (8' MAX. HEIGHT) DUE TO UTILITY CONSTRUCTION SHALL BE KEPT MOIST BY THE CONTRACTOR TO PREVENT BLOWING SOILS.
6. AREAS LEFT OPEN FOR 30 DAYS OR MORE, OTHER THAN FOR UTILITY AND DRAINAGE CONSTRUCTION, SHALL BE SEEDED AND/OR MULCHED.
7. THE CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTING MEASURES TO PREVENT EROSION OF DISTURBED SOIL BY ABNORMAL WINDS.
8. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AT THE TIME OF CONSTRUCTION.

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COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

ENCLAVES AT MOUNTAIN VISTA EAST

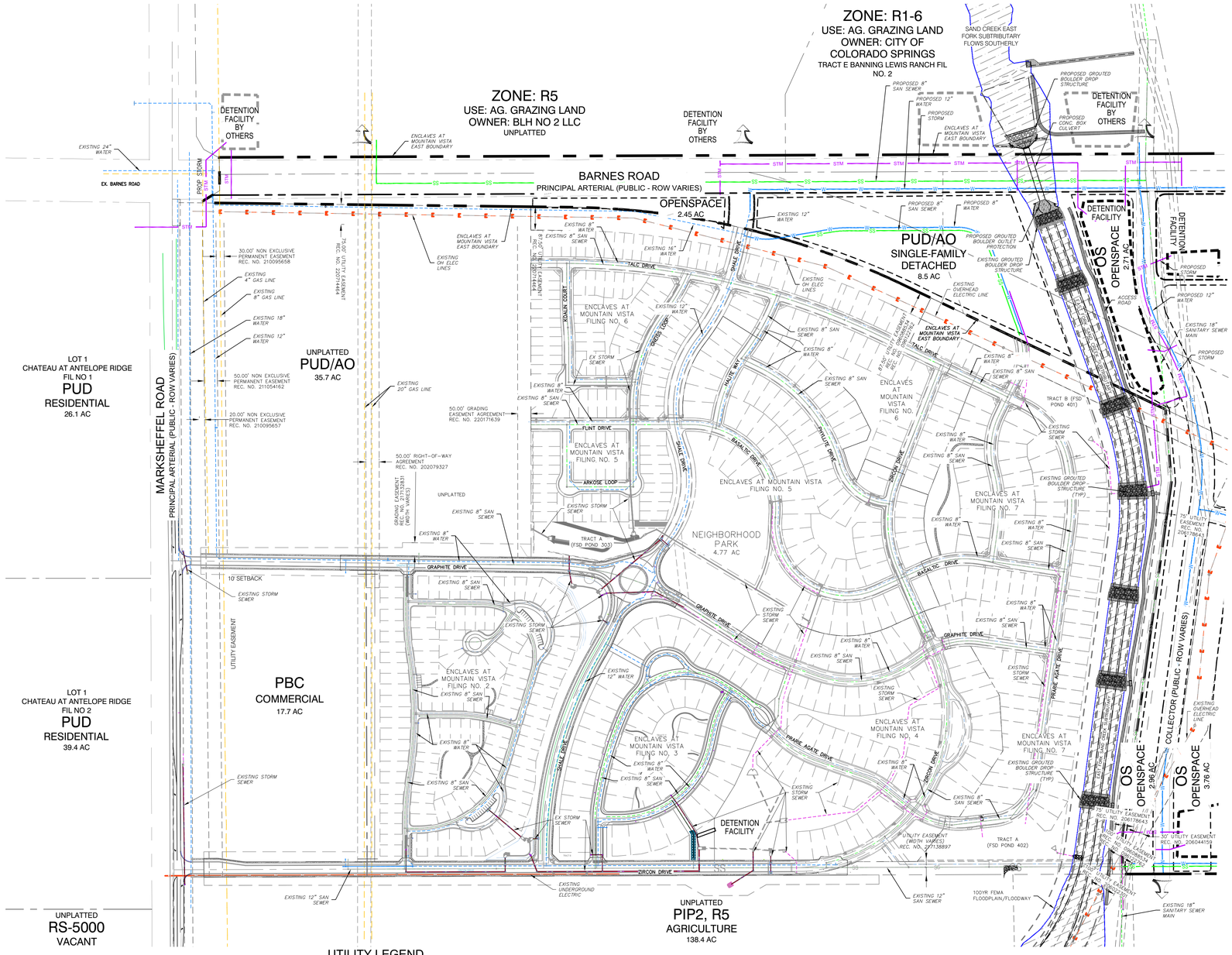
PROPOSED GRADING AND EROSION CONTROL

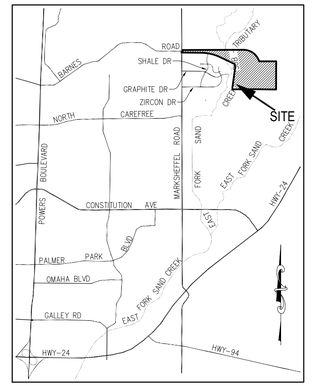
PROJECT NO. 29-010	SCALE: HORIZONTAL: 1"=200' VERTICAL: N/A	DATE: 02-15-2022	
DESIGNED BY: DLM		SHEET 2 OF 2	GR02
DRAWN BY: DLM			
CHECKED BY: VAS			

File: Q:\29010A-Enclaves East DP\Challenger Building\Dwg\Concept Plan\Preliminary Grading Plan.dwg Plotstamp: 2/23/2022 11:41 AM

ENCLAVES AT MOUNTAIN VISTA RANCH EAST

CONCEPT PRELIMINARY UTILITY AND PUBLIC FACILITIES PLAN
FEBRUARY 2022





VICINITY MAP
N.T.S.

SPECIAL NOTE:
ALL PRIVATE TO PUBLIC STORM SEWER CONNECTIONS MUST BE INSPECTED BY ENGINEERING DEVELOPMENT REVIEW INSPECTOR.

GENERAL NOTES FOR ALL PRELIMINARY UTILITY PLANS

PROPERTY OWNER(S) ACKNOWLEDGE AND AGREE TO THE FOLLOWING UPON APPROVAL OF PRELIMINARY UTILITY PLAN:

1. THIS DRAWING IS A PRELIMINARY UTILITY PLAN AND THEREFORE, COLORADO SPRINGS UTILITIES SHALL MAKE THE FINAL DETERMINATION OF THE LOCATION OF ALL WATER, WASTEWATER, ELECTRIC, AND GAS FACILITIES, WHICH MAY NOT BE THE SAME LOCATION AS SHOWN ON THIS PRELIMINARY UTILITY PLAN.
2. PROPERTY OWNER(S) ("OWNER") ACKNOWLEDGE THAT THE CONNECTION AND/OR EXTENSION OF UTILITY SERVICES TO THE PROPERTY IDENTIFIED IN THIS PRELIMINARY UTILITY PLAN ("PROPERTY") SHALL BE IN ACCORD WITH ALL APPLICABLE CODES AND REGULATIONS, SPRINGS UTILITIES' LINE EXTENSION AND SERVICE STANDARDS ("STANDARDS"), TARIFFS, RULES, REGULATIONS, AND POLICIES, CITY ORDINANCES, RESOLUTIONS, AND POLICIES, AND PIKES PEAK REGIONAL BUILDING DEPARTMENT CODES, IN EFFECT AT THE TIME OF UTILITY SERVICE CONNECTION AND/OR EXTENSION.
3. OWNER ACKNOWLEDGES RESPONSIBILITY FOR THE COSTS OF EXTENSIONS OR UTILITY SYSTEM IMPROVEMENTS THAT SPRINGS UTILITIES DETERMINES NECESSARY TO PROVIDE UTILITY SERVICES TO THE PROPERTY OR TO ENSURE TIMELY DEVELOPMENT OF INTEGRATED UTILITY SYSTEMS SERVING THE PROPERTY AND AREAS OUTSIDE THE PROPERTY (INCLUDING THE COSTS TO DESIGN AND INSTALL ALL POTABLE AND NON-POTABLE WATER SYSTEM FACILITIES AND APPURTENANCES, AND ALL WASTEWATER COLLECTION SYSTEM FACILITIES AND APPURTENANCES, AND ANY WATER OR WASTEWATER SERVICE LINES TO AND WITHIN THE PROPERTY). OWNER MAY BE ELIGIBLE FOR A COST RECOVERY AGREEMENT AS PROVIDED IN UTILITIES' RULES AND REGULATIONS.
4. SPRINGS UTILITIES' UTILITY SERVICES ARE AVAILABLE ON A "FIRST-COME, FIRST-SERVED" BASIS, AND THEREFORE NO SPECIFIC ALLOCATIONS OR AMOUNTS OF UTILITY SERVICES, FACILITIES, CAPACITIES OR SUPPLIES ARE RESERVED FOR THE OWNER, AND SPRINGS UTILITIES MAKES NO COMMITMENT AS TO THE AVAILABILITY OF ANY UTILITY SERVICE UNTIL SUCH TIME AS PERMANENT SERVICE IS INITIATED.
5. ONLY WITH THE PRIOR WRITTEN APPROVAL BY SPRINGS UTILITIES, OWNER MAY CAUSE THE RELOCATION OR ALTERATION OF ANY EXISTING UTILITY FACILITIES WITHIN THE PROPERTY AT THE OWNER'S SOLE COST AND EXPENSE. IF SPRINGS UTILITIES DETERMINES THAT OWNER'S RELOCATION OR ALTERATION REQUIRES NEW OR UPDATED EASEMENTS, OWNER SHALL CONVEY THOSE EASEMENTS PRIOR TO RELOCATING OR ALTERING THE EXISTING UTILITY FACILITIES.
6. OWNER, AT ITS SOLE COST AND EXPENSE, SHALL DEDICATE BY PLAT AND/OR CONVEY BY RECORDED DOCUMENT, ALL PROPERTY AND EASEMENTS THAT SPRINGS UTILITIES DETERMINES ARE REQUIRED FOR ALL UTILITY SYSTEM FACILITIES NECESSARY TO SERVE THE PROPERTY OR TO ENSURE DEVELOPMENT OF AN INTEGRATED UTILITY SYSTEM. ALL EASEMENTS GRANTED BY SEPARATE INSTRUMENT SHALL UTILIZE SPRINGS UTILITIES' THEN-CURRENT PERMANENT EASEMENT AGREEMENT FORM (OR EXECUTIVE AGREEMENT FORM) WITHOUT MODIFICATION UNLESS APPROVED BY SPRINGS UTILITIES.
7. THE WATER DISTRIBUTION SYSTEM FACILITIES MUST MEET SPRINGS UTILITIES' CRITERIA FOR WATER QUALITY, RELIABILITY AND PRESSURE, INCLUDING LOOPING REQUIREMENTS (SEE SECTION 4.08 OF SPRINGS UTILITIES' WATER STANDARDS).
8. OWNER RECOGNIZES THAT THE EXTENSION OF WATER SYSTEM FACILITIES MAY AFFECT THE QUALITY OF WATER IN SPRINGS UTILITIES' WATER SYSTEM. WHEN WATER QUALITY IS AFFECTED, OWNER ACKNOWLEDGE RESPONSIBILITY FOR ANY COSTS THAT SPRINGS UTILITIES DETERMINES NECESSARY TO INCUR IN ORDER TO MAINTAIN WATER QUALITY IN ITS SYSTEM AS A RESULT OF OWNER' WATER SYSTEM EXTENSIONS. (WATER-QUALITY MAINTENANCE COSTS). OWNER SHALL REIMBURSE SPRINGS UTILITIES FOR SUCH WATER-QUALITY MAINTENANCE COSTS WITHIN THIRTY (30) DAYS OF RECEIPT OF AN INVOICE FOR SUCH COSTS.
9. OWNER MUST CONTACT SPRINGS UTILITIES FIELD ENGINEERING TO SECURE APPROVAL OF GAS-SERVICE-LINE PRESSURES IN EXCESS OF SPRINGS UTILITIES' STANDARD GAS-SYSTEM PRESSURE, AND THE LOCATION OF ALL METERS AND TRANSFORMERS. (CONTACT NORTH WORK CENTER 668-4985 OR SOUTH WORK CENTER 668-5564).
10. IT SHALL NOT BE PERMISSIBLE FOR ANY PERSON TO MODIFY THE GRADE OF THE EARTH ON ANY SPRINGS UTILITIES EASEMENT OR RIGHTS OF WAY WITHOUT THE WRITTEN APPROVAL OF SPRINGS UTILITIES (CITY CODE 12.2.540).
11. SPRINGS UTILITIES' APPROVAL OF THIS PRELIMINARY UTILITY PLAN SHALL NOT BE CONSTRUED AS A LIMITATION UPON THE AUTHORITY OF SPRINGS UTILITIES TO APPLY ITS STANDARDS; AND IF THERE ARE ANY CONFLICTS BETWEEN ANY APPROVED DRAWINGS AND ANY PROVISION OF STANDARDS OR THE CITY CODE, THEN THE STANDARDS SHALL APPLY. SPRINGS UTILITIES' APPROVAL OF THIS PRELIMINARY UTILITY PLAN SHALL NOT BE CONSTRUED AS A LIMITATION UPON THE AUTHORITY OF THE CITY OR THE SPRINGS UTILITIES TO ADOPT DIFFERENT ORDINANCES, RULES, REGULATIONS, RESOLUTIONS, POLICIES OR CODES WHICH CHANGE ANY OF THE PROVISIONS OF THE STANDARDS SO LONG AS THESE APPLY TO THE CITY GENERALLY AND ARE IN ACCORD WITH THE THEN-CURRENT TARIFFS, RATES, RULES, REGULATIONS AND POLICIES OF SPRINGS UTILITIES.

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NOTES:

1. HIGH DENSITY POLYETHYLENE (HDPE) PIPE WILL BE ACCEPTABLE.

UTILITY LEGEND

- EXISTING WATER LINE
- PROPOSED WATER LINE
- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- EXISTING OVERHEAD ELECTRIC
- EXISTING UNDERGROUND UTILITIES
- EXISTING GAS (NOT VERIFIED)
- EASEMENT SET BACK
- UTILITY EASEMENT
- PROPERTY BOUNDARY
- PROPERTY LINE / PROJECT LINE
- LAND USE AREA
- RIGHT OF WAY
- FEMA FLOODPLAIN/FLOODWAY BNDRY
- SECONDARY ACCESS POINT
- RIGHT-IN RIGHT-OUT ACCESS
- PROPOSED 100 YR FLOODPLAIN

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ENCLAVES AT MOUNTAIN VISTA EAST			
PREL. UTILITIES & PUBLIC FACILITIES PLAN			
PROJECT NO. 29-010	SCALE: HORIZONTAL: 1"=200' VERTICAL: N/A	DATE: 02-14-2022	
DESIGNED BY: DLM DRAWN BY: DLM CHECKED BY: VAS		SHEET 1 OF 2	PU01

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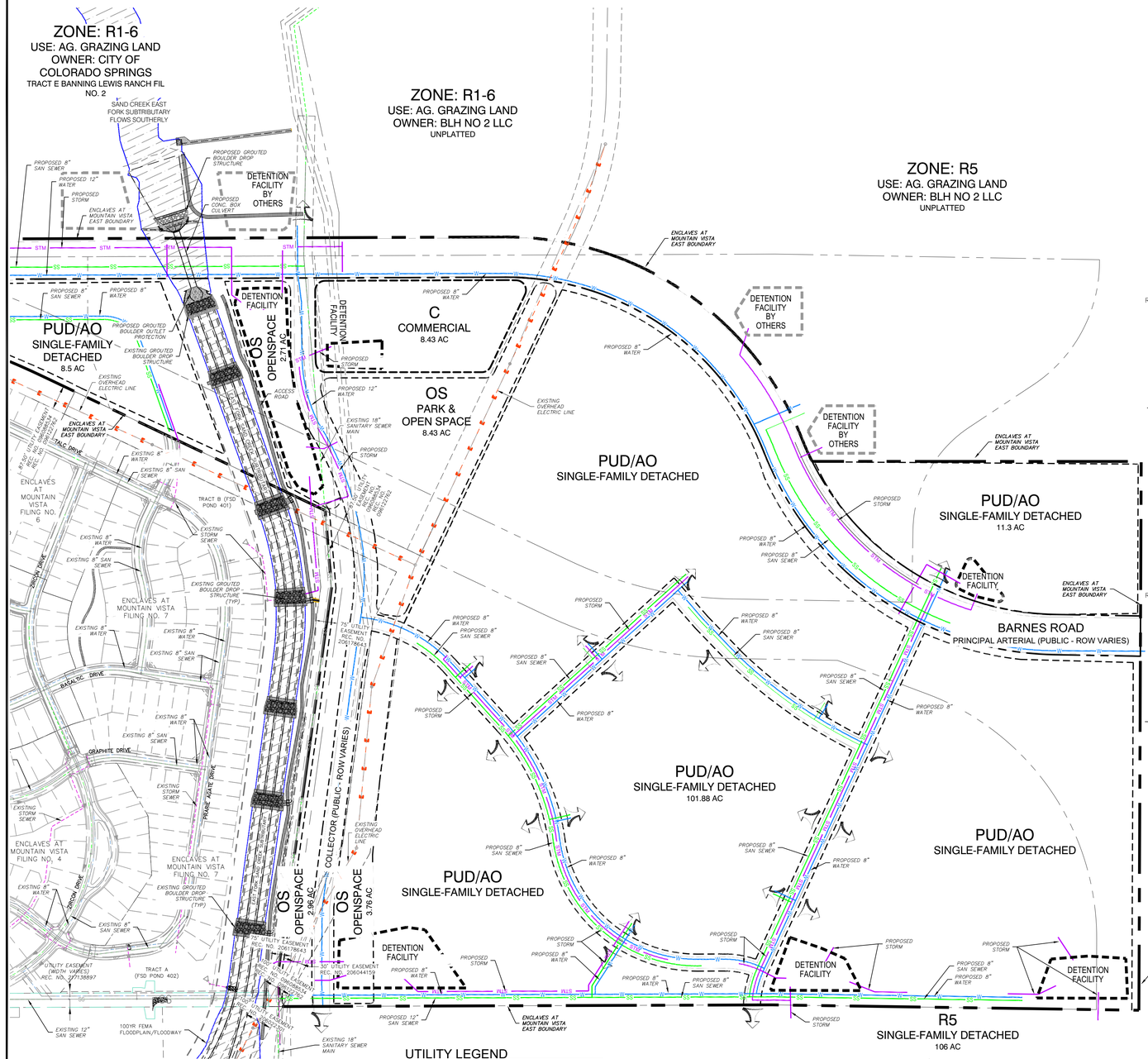
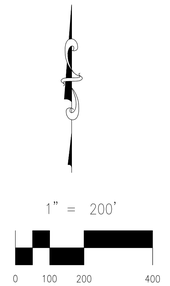
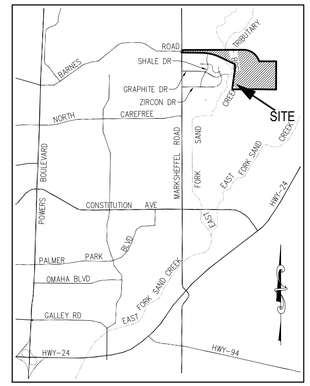
ENCLAVES AT MOUNTAIN VISTA RANCH EAST

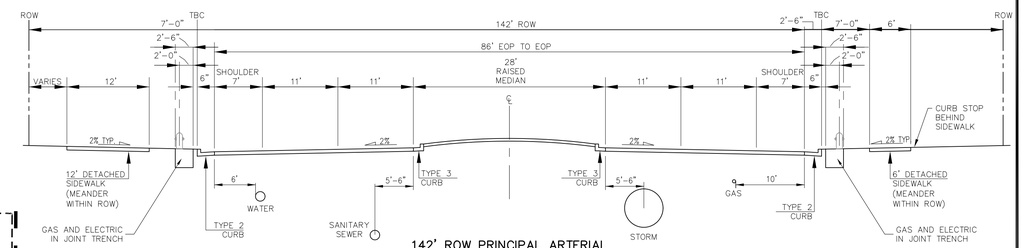
CONCEPT PRELIMINARY UTILITY AND PUBLIC FACILITIES PLAN
FEBRUARY 2022





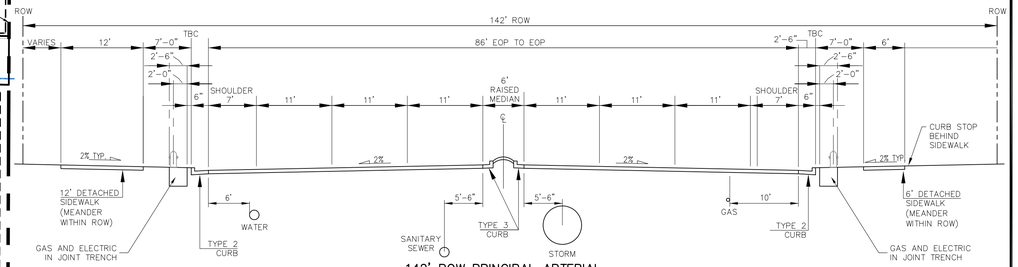


VICINITY MAP
N.T.S.



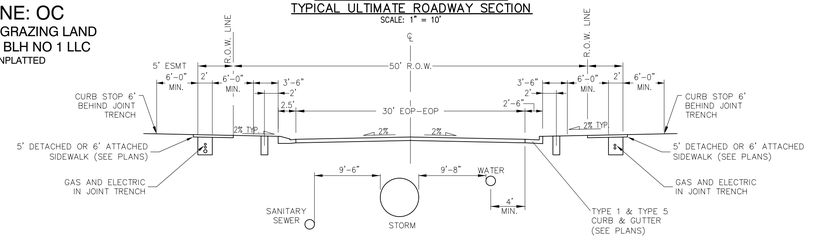
142' ROW PRINCIPAL ARTERIAL
MOUNTAIN VISTA RANCH EAST
TYPICAL INITIAL ROADWAY SECTION
SCALE: 1" = 10'

ZONE: PBC
USE: AG. GRAZING LAND
OWNER: BLH NO 1 LLC
UNPLATTED



142' ROW PRINCIPAL ARTERIAL
MOUNTAIN VISTA RANCH EAST
TYPICAL ULTIMATE ROADWAY SECTION
SCALE: 1" = 10'

ZONE: OC
USE: AG. GRAZING LAND
OWNER: BLH NO 1 LLC
UNPLATTED



TYPICAL RESIDENTIAL STREET 50' R.O.W.
SCALE: NTS

UTILITY LEGEND

- EXISTING WATER LINE
- PROPOSED WATER LINE
- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- EXISTING OVERHEAD ELECTRIC
- EXISTING UNDERGROUND UTILITIES
- EXISTING GAS (NOT VERIFIED)
- EASEMENT SET BACK
- UTILITY EASEMENT
- PROPERTY BOUNDARY
- PROPERTY LINE / PROJECT LINE
- LAND USE AREA
- RIGHT OF WAY
- FEMA FLOODPLAIN/FLOODWAY BNDRY
- SECONDARY ACCESS POINT
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- PROPOSED 100 YR FLOODPLAIN

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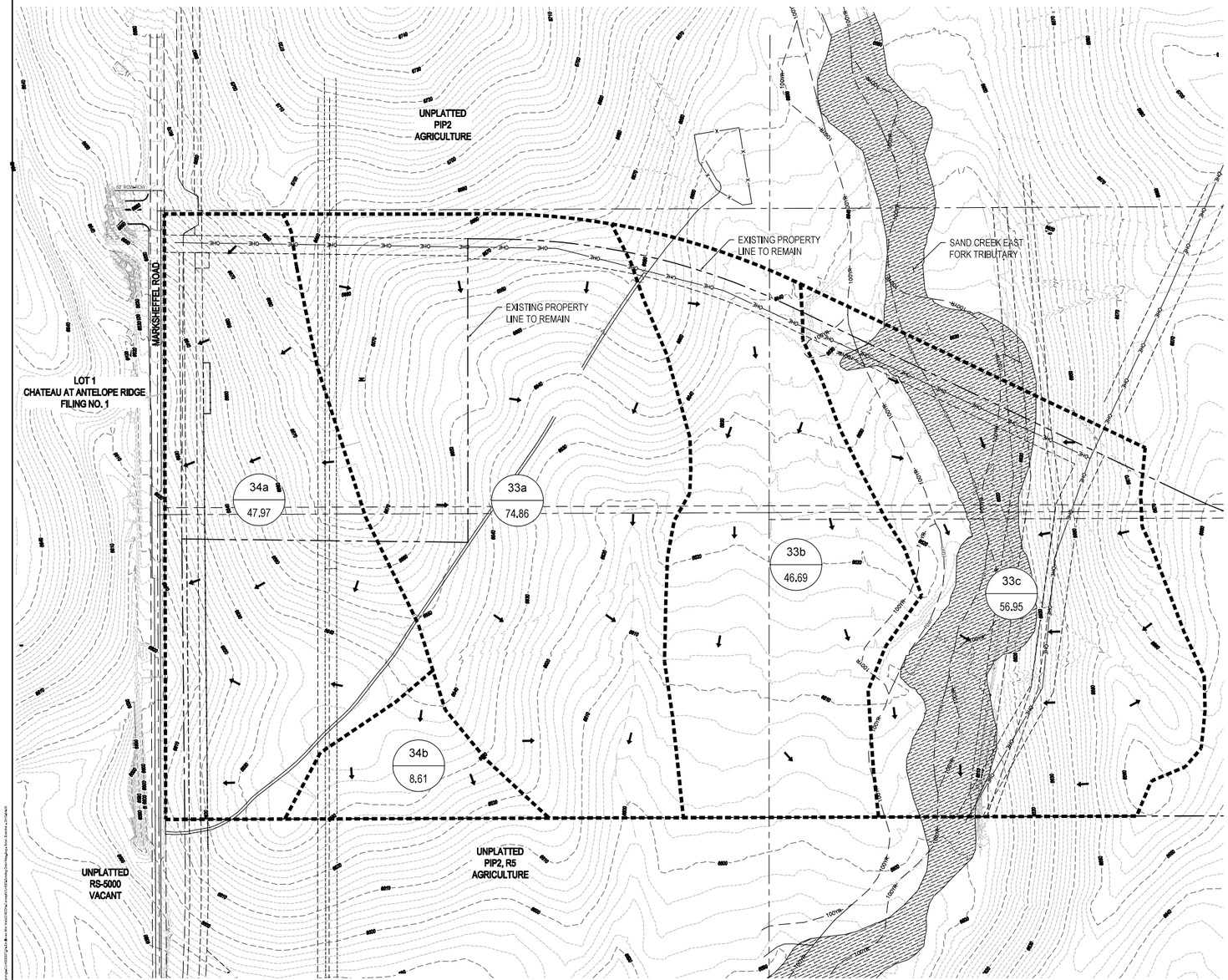
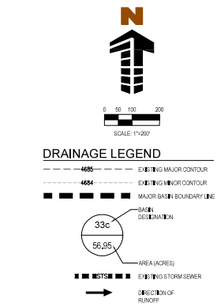
ENCLAVES AT MOUNTAIN VISTA EAST			
PREL. UTILITIES & PUBLIC FACILITIES PLAN			
PROJECT NO. 29-010	SCALE: HORIZONTAL: 1"=200' VERTICAL: N/A	DATE: 02-14-2022	
DESIGNED BY: DLM DRAWN BY: DLM CHECKED BY: VAS		SHEET 2 OF 2	PU02

File: O:\29010A-Enclaves East (PV\Challenger Building\Dwg\Concept Plan\Preliminary Utilities Map.dwg Plotstamp: 2/23/2022 11:42 AM





EXISTING CONDITIONS DRAINAGE CALCULATIONS

BASIN	AREA (ACRES)	5 YEAR EVENT	100 YEAR EVENT
33A	74.86 ACRES	7.85 CFS	18.42 CFS
33B	46.69 ACRES	4.85 CFS	10.69 CFS
33C	56.95 ACRES	5.88 CFS	12.68 CFS
34A	47.97 ACRES	5.06 CFS	9.58 CFS
34B	8.61 ACRES	0.91 CFS	1.79 CFS
TOTAL DISCHARGE	OUTFALL 33	18.58 CFS	41.79 CFS
TOTAL DISCHARGE	OUTFALL 34	5.97 CFS	11.37 CFS
	TOTAL COMBINED	24.55 CFS	53.16 CFS

HISTORIC DRAINAGE PLAN

Galloway
Planning, Architecture, Engineering
1755 Telstar Drive, Suite 107
Colorado Springs, CO 80920
719.900.7220 Office
www.gallowayUS.com

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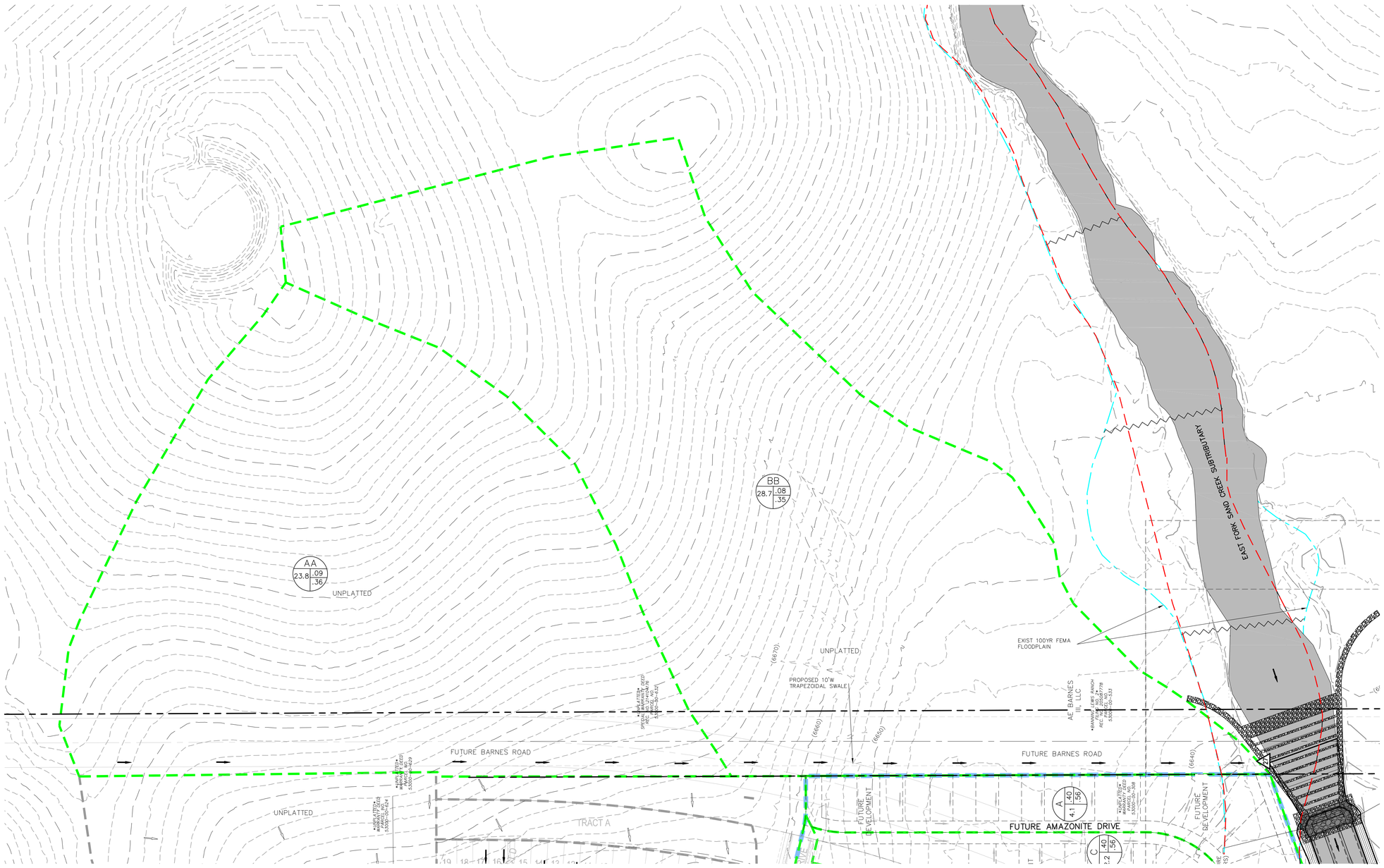
FINAL DRAINAGE PLAN
ENCLAVES AT MOUNTAIN VISTAS
COLORADO SPRINGS, CO

#	Date	Issue / Description	Init.

Project No:	CLH00007.21
Drawn By:	RAL
Checked By:	JCA
Date:	MARCH 18, 2016

HISTORIC DRAINAGE PLAN

DR-1
Sheet 1 of 4



LEGEND

- BASIN DESIGNATION (G1; 2.35 ACRES; .53 C5; .66 C100)
- 4 — PIPE RUN REFERENCE LABEL
- 6 — SURFACE DESIGN POINT
- BASIN BOUNDARY
- (6920) — EXISTING CONTOUR
- 6920 — PROP CONTOUR
- SUBDIVISION BOUNDARY
- PROPOSED STORM SEWER PIPE
- EXISTING STORM SEWER PIPE
- CROSSPAN
- INLET
- MANHOLE
- EXISTING FLOW DIRECTION ARROW
- PROPOSED FLOW DIRECTION ARROW
- FLARED END SECTION
- H.P. — HIGH POINT
- L.P. — LOW POINT
- 100 YEAR BFE (NAVD88/NGVD29)
- EFFECTIVE 100 YEAR FLOODPLAIN
- EFFECTIVE 100 YEAR FLOODWAY
- APPRX. 100 YEAR FLOODPLAIN
- REVISED 100 YEAR FLOODPLAIN PER CLOMR ANALYSIS

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q_{100}
AA	23.79	5.1	37.4
BB	30.02	5.9	43.4

DESIGN POINT SUMMARY				
DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
27	10.8	79.5	AA, BB	10'W EARTHEN DIVERSION SWALE

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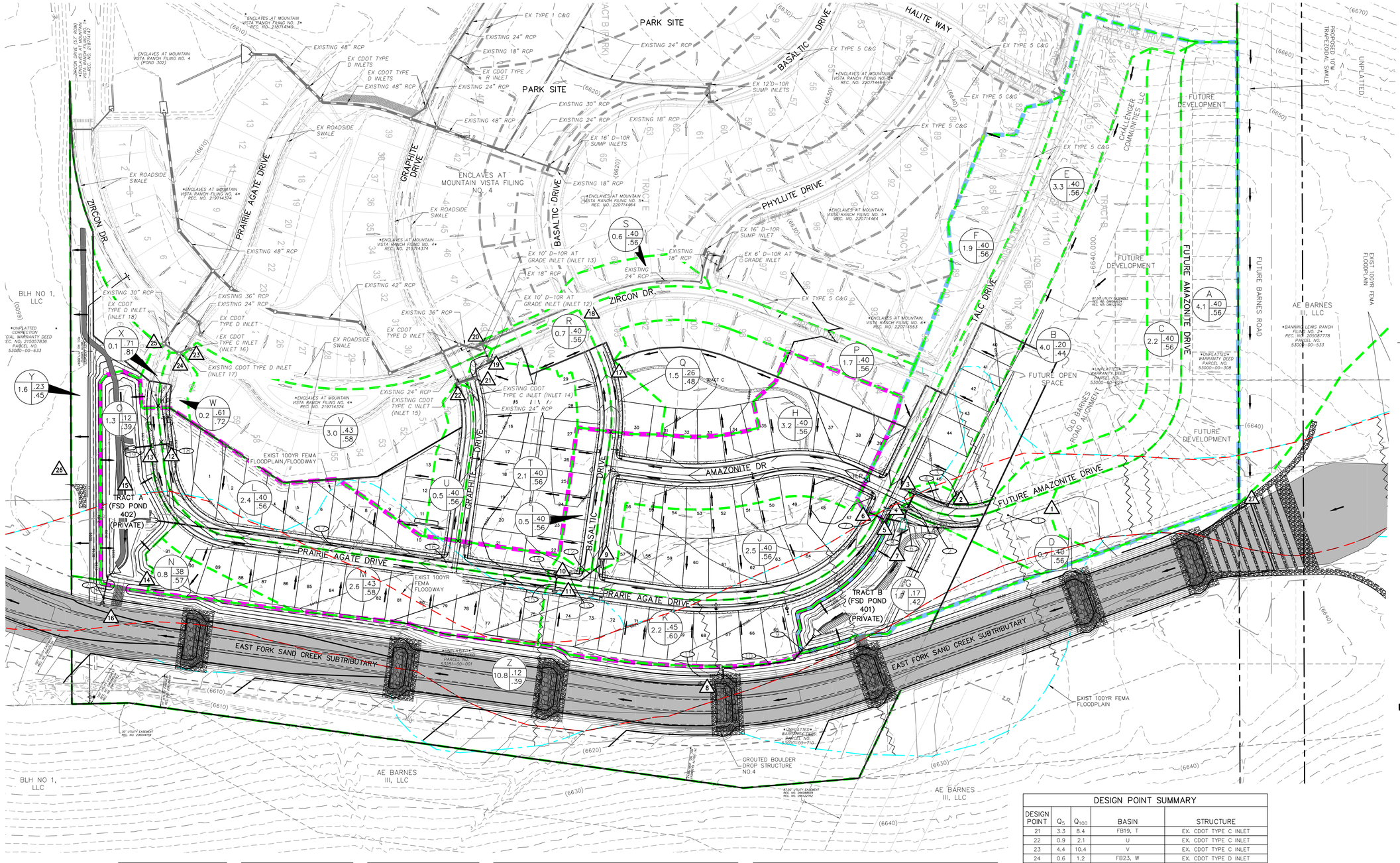
ENCLAVES AT MOUNTAIN VISTA FIL NO. 7
PROPOSED CONDITIONS DRAINAGE MAP

PROJECT NO. 29-008
DESIGNED BY: DLM
DRAWN BY: DLM
CHECKED BY: VAS
SCALE: HORIZONTAL: 1"=100' VERTICAL: N/A
DATE: 05-11-2021
SHEET 2 OF 2
DM2

File: G:\29008A - Enclaves 7\Challenger Building\dwg\Eng Exhibits\ENCLAVES 7 - PDR-FDR.dwg Plotstamp: 5/11/2021 3:57 PM



LEGEND

- BASIN DESIGNATION (G1; 2.35 ACRES; .53/.66; C5/C100)
- PIPE RUN REFERENCE LABEL (4)
- SURFACE DESIGN POINT (6)
- BASIN BOUNDARY
- (6920) EXISTING CONTOUR
- 6920 PROP CONTOUR
- SUBDIVISION BOUNDARY
- PROPOSED STORM SEWER PIPE
- EXISTING STORM SEWER PIPE
- CROSSPAN
- INLET
- MANHOLE
- EXISTING FLOW DIRECTION ARROW
- PROPOSED FLOW DIRECTION ARROW
- FLARED END SECTION
- H.P. HIGH POINT
- L.P. LOW POINT
- EMERGENCY OVERFLOW DIRECTION
- 100 YEAR BFE (NAVD88/NGVD29)
- BASIN BOUNDARY (POND 401)
- BASIN BOUNDARY (POND 402)
- EFFECTIVE 100 YEAR FLOODPLAIN
- EFFECTIVE 100 YEAR FLOODWAY
- APPRX. 100 YEAR FLOODPLAIN
- REVISED 100 YEAR FLOODPLAIN PER CLOMR ANALYSIS

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES/DESIGN POINTS
1	5.5	9.8	24" RCP*	DP1
2	5.5	9.8	24" RCP	PR2
3	2.9	10.7	18" RCP	DP2
4	2.9	10.7	18" RCP	PR3
5	6.0	16.8	30" RCP	PR4, INLET 3
6	6.4	20.0	30" RCP	PR5, INLET 4
7	2.9	6.8	18" RCP	INLET 6
8	6.9	16.8	24" RCP	PR7, INLET 5
9	2.1	20.5	24" RCP	POND OUTFALL
10	2.1	20.5	24" RCP	PR9
11	2.1	20.5	24" RCP	PR10
12	4.5	9.4	18" RCP	INLET 7
13	4.5	9.4	18" RCP	PR12
14	4.2	7.5	18" RCP	INLET 8
15	3.6	6.6	18" RCP	INLET 9
16	12.2	23.2	24" RCP	PR13, PR14, PR15
17	12.2	23.2	24" RCP	PR16
18	3.4	9.8	18" RCP	INLET 10
19	7.3	19.6	24" RCP	PR18, INLET 11
20	1.2	10.8	18" RCP	POND OUTFALL

NOTES:

1. HIGH DENSITY POLYETHYLENE (HDPE) PIPE WILL BE ACCEPTABLE.
2. ALL EXISTING STORM SEWER FACILITIES WITHIN ENCLAVES FILINGS 4, 5 & 6 ARE PUBLICLY OWNED AND MAINTAINED.
3. ALL PROPOSED STORM SEWER FACILITIES WITHIN ENCLAVES FILING 7 ARE PUBLICLY OWNED AND MAINTAINED.

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
21	3.3	8.4	FB19, T	EX. CDOT TYPE C INLET
22	0.9	2.1	U	EX. CDOT TYPE C INLET
23	4.4	10.4	V	EX. CDOT TYPE C INLET
24	0.6	1.2	FB23, W	EX. CDOT TYPE D INLET
25	0.5	0.9	X	EX. CDOT TYPE D INLET
26	1.5	5.1	Y	
27	10.8	79.5	OS1, OS2	10'W EARTHEN DIVERSION SWALE

1" = 100'

0 25 50 100 200

Scale in Feet

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
A	4.09	5.5	13.0
B	4.03	2.9	10.7
C	2.21	3.3	7.7
D	0.71	1.1	2.6
E	3.32	4.6	10.7
F	1.91	2.9	6.8
G	1.67	1.2	4.7
H	3.16	4.5	10.5
I	0.52	0.9	2.1
J	2.47	3.6	8.4

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
K	2.18	3.6	8.1
L	2.39	3.5	8.2
M	2.58	3.8	8.6
N	0.44	0.7	1.7
O	1.25	0.6	3.4
P	1.68	2.5	6.0
Q	1.54	1.6	4.8
R	0.69	1.1	2.7
S	0.61	1.0	2.4
T	2.11	3.2	7.5

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
U	0.53	0.9	2.1
V	2.97	4.3	10.1
W	0.19	0.6	1.2
X	0.13	0.5	0.9
Y	1.57	1.5	5.1
Z	10.84	5.2	28.6
AA	23.79	5.1	37.4
BB	28.66	4.9	36.1

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	5.5	13.0	A	FUTURE 12' AT-GRADE INLET
2	2.9	10.7	B	PROP. CDOT TYPE D INLET
3	3.3	7.7	C	PROP. 10' AT-GRADE INLET
4	0.9	5.2	FB1, D	PROP. 10' AT-GRADE INLET
5	4.4	11.7	FB3, FB4, E	PROP. 16' AT-GRADE INLET
6	2.9	6.8	F	PROP. 14' AT-GRADE INLET
7	19.2	49.6	PR2, PR6, PR8, G	TRACT B POND 401
8	2.1	20.5	PR11 (OUTFALL)	EFSCST CHANNEL
9	4.5	10.5	H	PROP. 14' AT-GRADE INLET
10	4.2	11.1	I, J, FB6, FB9	PROP. 14' AT-GRADE INLET

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
11	3.6	8.1	K, FB5	PROP. 10' AT-GRADE INLET
12	3.4	9.8	L, FB10	PROP. 8' SUMP INLET
13	3.9	9.8	M, FB11	PROP. 8' SUMP INLET
14	0.7	1.7	N	PROP. RIPRAP RUNDOWN
15	20.5	47.0	PR19, DP14, O	TRACT A POND 402
16	1.2	10.8	PR19	EFSCST CHANNEL
17	1.6	4.8	Q	PROP. 5' SIDEWALK CHASE
18	3.9	10.1	G2	
19	4.8	7.2	OS4, OS5	EX 10' AT-GRADE INLET
20	0.9	7.2	S	EX 10' AT-GRADE INLET

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
CALL 1-800-922-1987

CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

ENCLAVES AT MOUNTAIN VISTA FIL NO. 7

PROPOSED CONDITIONS DRAINAGE MAP

PROJECT NO. 29-006	SCALE: HORIZONTAL: 1"=100' VERTICAL: N/A	DATE: 05-12-2021	
DESIGNED BY: VAS		SHEET 1 OF 2	DM
DRAWN BY: CLP DCV			
CHECKED BY: VAS			

File: D:\29006A - Enclaves 7\Challenger Building\dwg\Eng Exhibits\ENCLAVES 7 - PDR-FDR.dwg Photostamp: 10/15/2021 3:16 PM

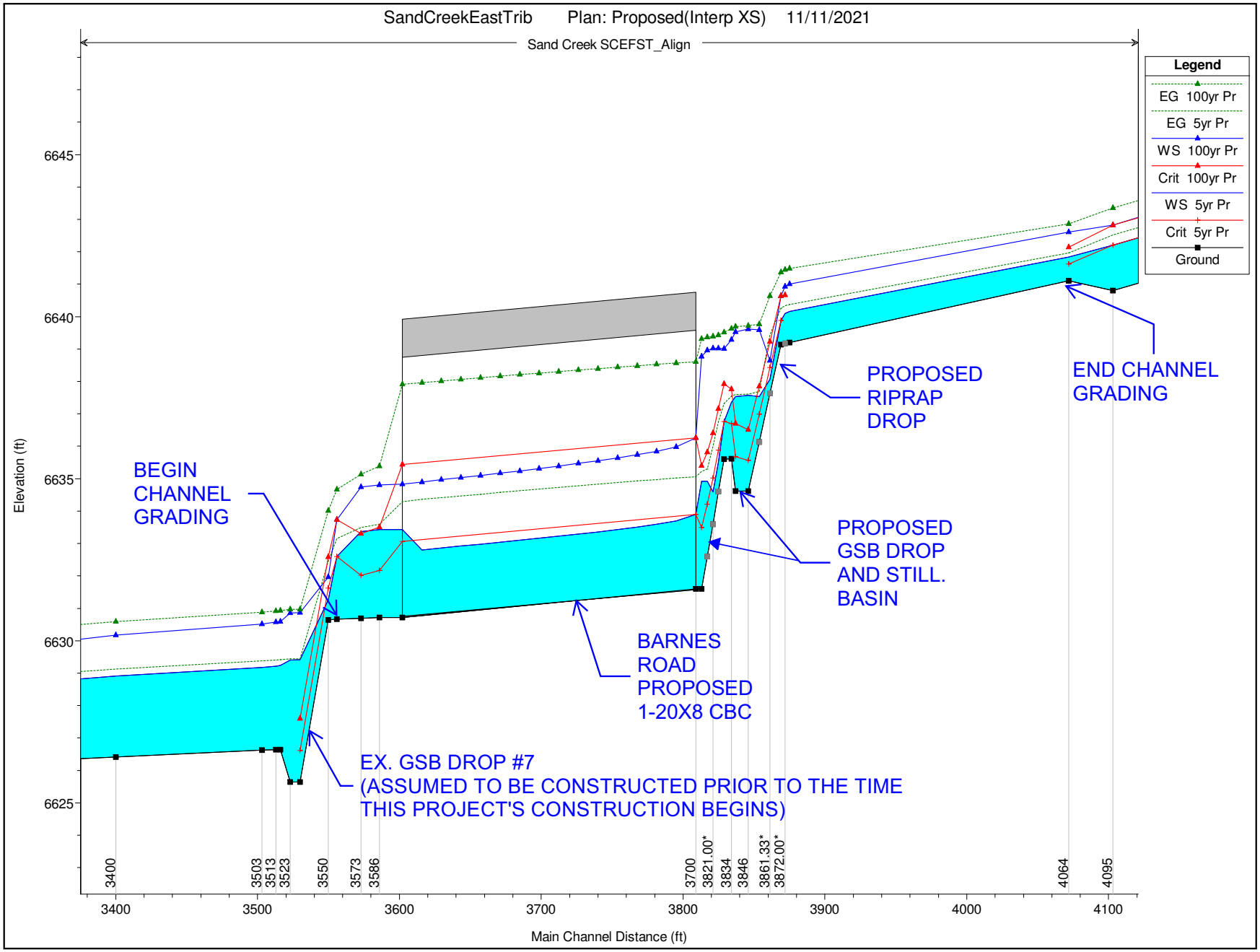
Appendix D

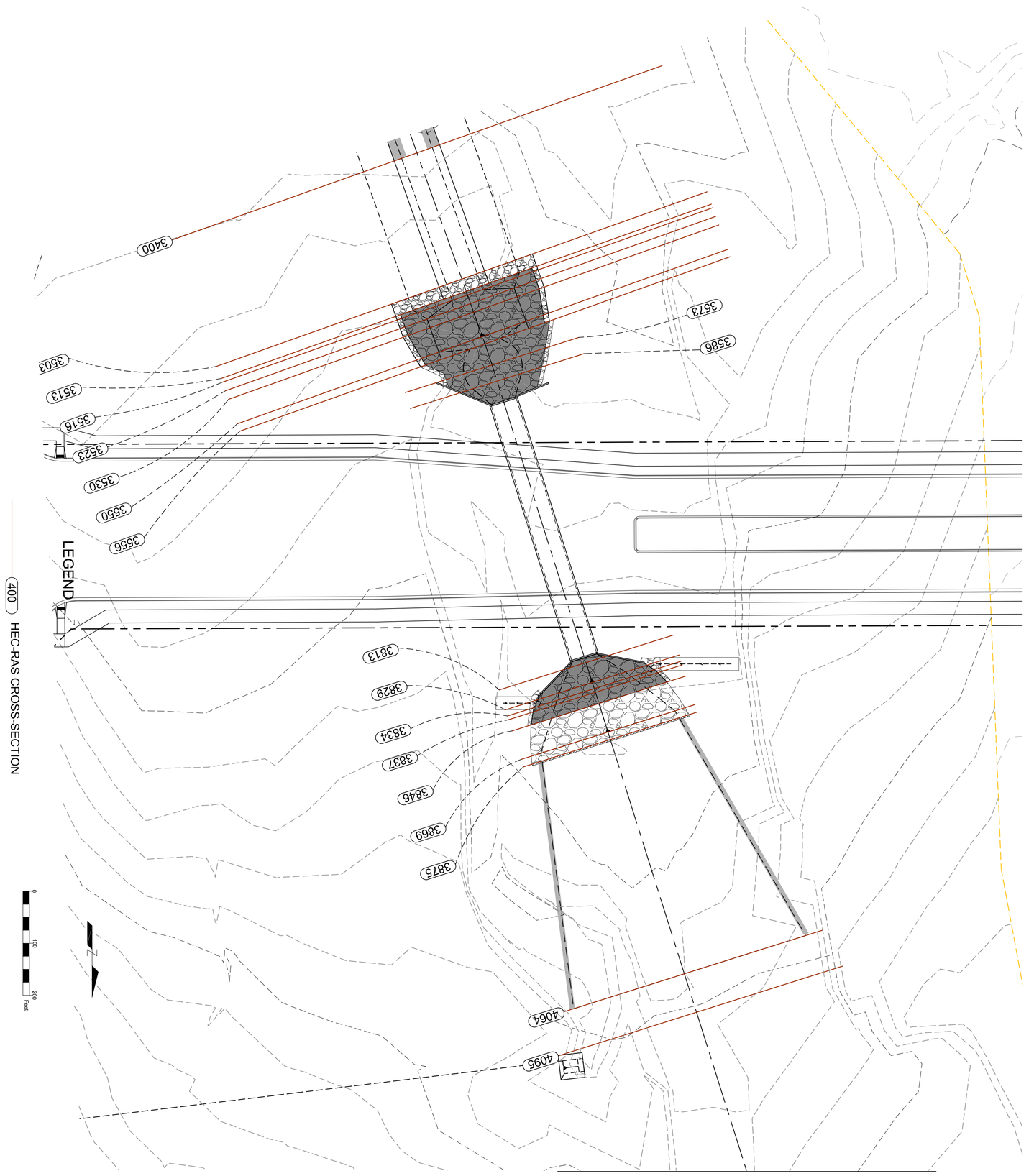
Channel Hydraulic Analysis

(HEC-RAS)

"Enclave at Mountain Vist Barnes Road Culvert
and Sand Creek East Fork Sub-tributary Channel
Project Channel Design Report", dated November 2021,
by Wilson & Company.

FOR INFORMATION PURPOSES ONLY


SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
Sand Creek SCEFST_Align
Legend
EG 100yr Pr
EG 5yr Pr
WS 100yr Pr
Crit 100yr Pr
WS 5yr Pr
Crit 5yr Pr
Ground
Elevation (ft)
6645
6640
6635
6630
6625
Main Channel Distance (ft)
3400
3500
3600
3700
3800
3900
4000
4100
3400
3503
3513
3523
3550
3573
3586
3700
3821.00*
3834
3846
3861.33*
3872.00*
4064
4095
BEGIN CHANNEL GRADING
PROPOSED RIPRAP DROP
END CHANNEL GRADING
PROPOSED GSB DROP AND STILL. BASIN
BARNES ROAD PROPOSED 1-20X8 CBC
EX. GSB DROP #7
(ASSUMED TO BE CONSTRUCTED PRIOR TO THE TIME THIS PROJECT'S CONSTRUCTION BEGINS)



HEC-RAS WORK MAP

PROJECT NAME

SAND CREEK EAST FORK TRIBUTARY CHANNEL DESIGN

ENCLAVES AT MOUNTAIN VISTA CHANNEL PROJECT

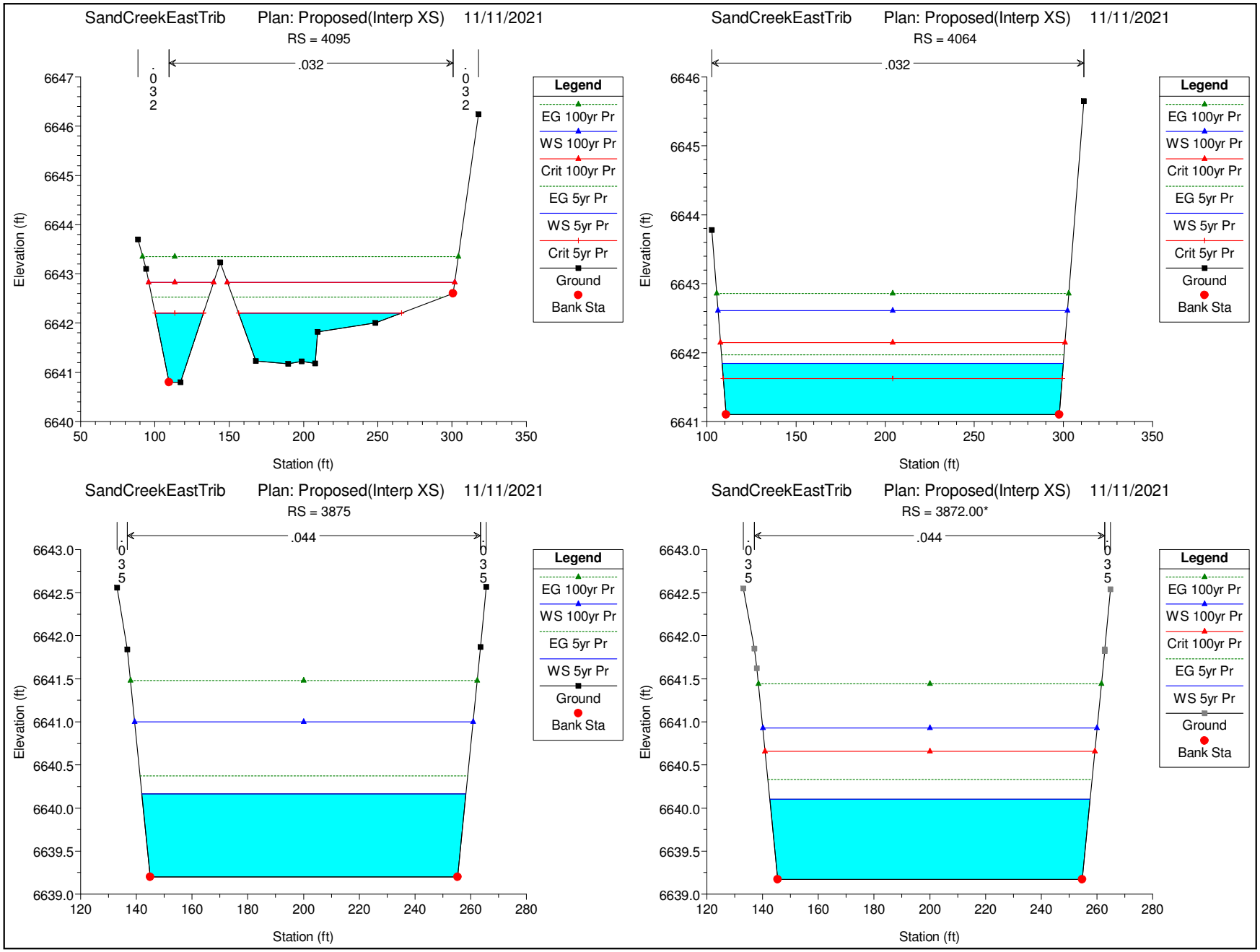
WILSON & COMPANY
5755 MARK DABLING BLVD. SUITE 220
COLORADO SPRINGS, CO 80919
PHONE: 719-520-5800
FAX: 719-520-0108
www.wilsonco.com

HEC-RAS Plan: Prp River: Sand Creek Reach: SCEFST_Align

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Vel Total	Froude # XS	Mann Wtd Chnl	Shear Total	Max Chl Dpth	Top Width
			(cfs)	(ft)	(ft)	(ft/s)			(lb/sq ft)	(ft)	(ft)
SCEFST_Align	4095	5yr Pr	400.00	6640.80	6642.20	4.54	1.02	0.032	0.70	1.40	142.18
SCEFST_Align	4095	100yr Pr	1150.00	6640.80	6642.83	5.81	1.02	0.032	0.97	2.03	196.65
SCEFST_Align	4064	5yr Pr	400.00	6641.10	6641.84	2.84	0.59	0.032	0.26	0.74	191.42
SCEFST_Align	4064	100yr Pr	1150.00	6641.10	6642.61	3.98	0.58	0.032	0.40	1.51	196.01
SCEFST_Align	3875	5yr Pr	400.00	6639.20	6640.16	3.66	0.67	0.044	0.74	0.96	116.35
SCEFST_Align	3875	100yr Pr	1150.00	6639.20	6641.00	5.50	0.75	0.044	1.34	1.80	121.51
SCEFST_Align	3872.00*	5yr Pr	400.00	6639.17	6640.10	3.83	0.71	0.044	0.82	0.93	114.92
SCEFST_Align	3872.00*	100yr Pr	1150.00	6639.17	6640.93	5.71	0.78	0.044	1.46	1.76	119.98
SCEFST_Align	3869	5yr Pr	400.00	6639.14	6639.88	4.88	1.01	0.044	1.43	0.74	112.53
SCEFST_Align	3869	100yr Pr	1150.00	6639.14	6640.64	6.83	1.01	0.044	2.21	1.50	117.13
SCEFST_Align	3861.33*	5yr Pr	400.00	6637.63	6638.06	9.38	2.54	0.044	6.35	0.43	100.19
SCEFST_Align	3861.33*	100yr Pr	1150.00	6637.63	6638.64	11.27	2.02	0.044	6.86	1.01	103.74
SCEFST_Align	3853.67*	5yr Pr	400.00	6636.13	6637.53	3.13	0.48	0.044	0.47	1.40	95.68
SCEFST_Align	3853.67*	100yr Pr	1150.00	6636.13	6639.59	3.41	0.35	0.044	0.41	3.46	108.23
SCEFST_Align	3846	5yr Pr	400.00	6634.62	6637.57	1.58	0.17	0.064	0.20	2.95	94.66
SCEFST_Align	3846	100yr Pr	1150.00	6634.62	6639.61	2.60	0.21	0.064	0.46	4.99	107.11
SCEFST_Align	3837	5yr Pr	400.00	6634.62	6637.54	1.90	0.20	0.064	0.29	2.92	84.02
SCEFST_Align	3837	100yr Pr	1150.00	6634.62	6639.53	3.19	0.26	0.064	0.70	4.91	97.39
SCEFST_Align	3834	5yr Pr	400.00	6635.62	6637.35	3.48	0.48	0.064	1.17	1.73	74.67
SCEFST_Align	3834	100yr Pr	1150.00	6635.62	6639.29	4.61	0.43	0.064	1.60	3.67	90.73
SCEFST_Align	3829	5yr Pr	400.00	6635.60	6636.77	5.95	0.99	0.064	3.89	1.17	62.82
SCEFST_Align	3829	100yr Pr	1150.00	6635.60	6639.01	5.76	0.55	0.064	2.56	3.40	80.54
SCEFST_Align	3825.00*	5yr Pr	400.00	6634.60	6635.50	8.93	1.69	0.064	9.55	0.90	53.83
SCEFST_Align	3825.00*	100yr Pr	1150.00	6634.60	6639.03	5.10	0.43	0.064	1.84	4.43	65.49
SCEFST_Align	3821.00*	5yr Pr	400.00	6633.60	6634.59	9.52	1.71	0.064	10.55	0.99	47.55
SCEFST_Align	3821.00*	100yr Pr	1150.00	6633.60	6639.02	4.92	0.37	0.064	1.60	5.42	48.72
SCEFST_Align	3817.00*	5yr Pr	400.00	6632.60	6634.92	4.90	0.57	0.064	2.11	2.32	41.07
SCEFST_Align	3817.00*	100yr Pr	1150.00	6632.60	6638.96	5.14	0.36	0.064	1.65	6.36	41.09
SCEFST_Align	3813	5yr Pr	400.00	6631.60	6634.92	4.43	0.43	0.064	1.52	3.32	33.45

HEC-RAS Plan: Prp River: Sand Creek Reach: SCEFST_Align (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Vel Total	Froude # XS	Mann Wtd Chnl	Shear Total	Max Chl Dpth	Top Width
			(cfs)	(ft)	(ft)	(ft/s)			(lb/sq ft)	(ft)	(ft)
SCEFST_Align	3813	100yr Pr	1150.00	6631.60	6638.77	5.89	0.39	0.064	2.08	7.17	33.45
SCEFST_Align	3700		Culvert								
SCEFST_Align	3586	5yr Pr	400.00	6630.72	6633.43	3.25	0.36	0.072	1.12	2.71	56.55
SCEFST_Align	3586	100yr Pr	1150.00	6630.72	6634.80	6.12	0.54	0.072	3.45	4.08	62.39
SCEFST_Align	3573	5yr Pr	400.00	6630.69	6633.37	2.79	0.34	0.072	0.79	2.67	62.73
SCEFST_Align	3573	100yr Pr	1150.00	6630.69	6634.74	4.87	0.49	0.072	2.11	4.05	73.48
SCEFST_Align	3556	5yr Pr	400.00	6630.66	6632.59	5.60	1.07	0.070	2.61	1.93	71.90
SCEFST_Align	3556	100yr Pr	1150.00	6630.66	6633.74	7.16	0.99	0.070	4.74	3.08	83.77
SCEFST_Align	3550	5yr Pr	400.00	6630.64	6631.26	8.72	1.99	0.095	22.51	0.62	75.99
SCEFST_Align	3550	100yr Pr	1150.00	6630.64	6631.97	11.31	1.81	0.095	29.16	1.33	81.66
SCEFST_Align	3530	5yr Pr	400.00	6625.64	6629.41	1.29	0.13	0.050	0.07	3.77	93.61
SCEFST_Align	3530	100yr Pr	1150.00	6625.64	6630.87	2.54	0.22	0.050	0.25	5.23	102.34
SCEFST_Align	3523	5yr Pr	400.00	6625.64	6629.41	1.29	0.13	0.050	0.07	3.77	94.91
SCEFST_Align	3523	100yr Pr	1150.00	6625.64	6630.86	2.52	0.22	0.050	0.25	5.22	104.13
SCEFST_Align	3516	5yr Pr	400.00	6626.64	6629.23	3.06	0.50	0.055	0.54	2.59	91.75
SCEFST_Align	3516	100yr Pr	1150.00	6626.64	6630.59	4.38	0.51	0.055	1.07	3.95	102.61
SCEFST_Align	3513	5yr Pr	400.00	6626.64	6629.22	3.10	0.51	0.040	0.29	2.58	91.64
SCEFST_Align	3513	100yr Pr	1150.00	6626.64	6630.57	4.41	0.52	0.040	0.57	3.93	102.47
SCEFST_Align	3503	5yr Pr	400.00	6626.62	6629.18	3.14	0.53	0.032	0.20	2.56	91.49
SCEFST_Align	3503	100yr Pr	1150.00	6626.62	6630.51	4.49	0.55	0.032	0.41	3.89	102.11
SCEFST_Align	3400	5yr Pr	400.00	6626.41	6628.91	3.27	0.57	0.032	0.21	2.50	91.02
SCEFST_Align	3400	100yr Pr	1150.00	6626.41	6630.17	4.73	0.59	0.032	0.45	3.76	101.09


SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
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Elevation (ft)
Station (ft)
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WS 100yr Pr
Crit 100yr Pr
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WS 5yr Pr
Crit 5yr Pr
Ground
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 4064
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Elevation (ft)
Station (ft)
Legend
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WS 100yr Pr
Crit 100yr Pr
EG 5yr Pr
WS 5yr Pr
Crit 5yr Pr
Ground
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3875
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Elevation (ft)
Station (ft)
Legend
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WS 100yr Pr
EG 5yr Pr
WS 5yr Pr
Ground
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3872.00*
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Station (ft)
Legend
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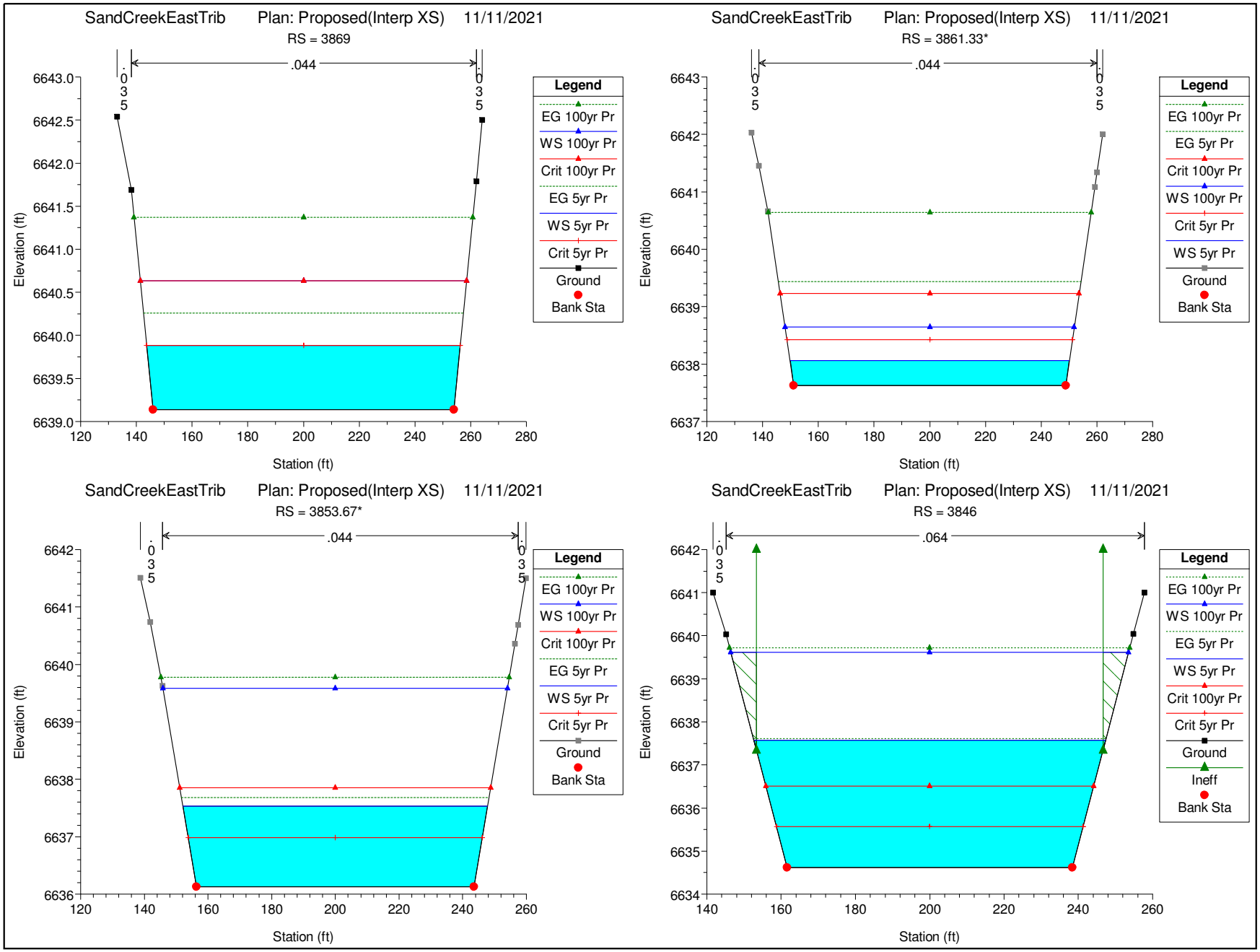
WS 100yr Pr
Crit 100yr Pr
EG 5yr Pr
WS 5yr Pr
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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WS 100yr Pr
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EG 5yr Pr
WS 5yr Pr
Crit 5yr Pr
Ground
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3861.33*
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.035
.035
Elevation (ft)
Station (ft)
Legend
EG 100yr Pr
EG 5yr Pr
Crit 100yr Pr
WS 100yr Pr
Crit 5yr Pr
WS 5yr Pr
Ground
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3853.67*
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Elevation (ft)
Station (ft)
Legend
EG 100yr Pr
WS 100yr Pr
Crit 100yr Pr
EG 5yr Pr
WS 5yr Pr
Crit 5yr Pr
Ground
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3846
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Elevation (ft)
Station (ft)
Legend
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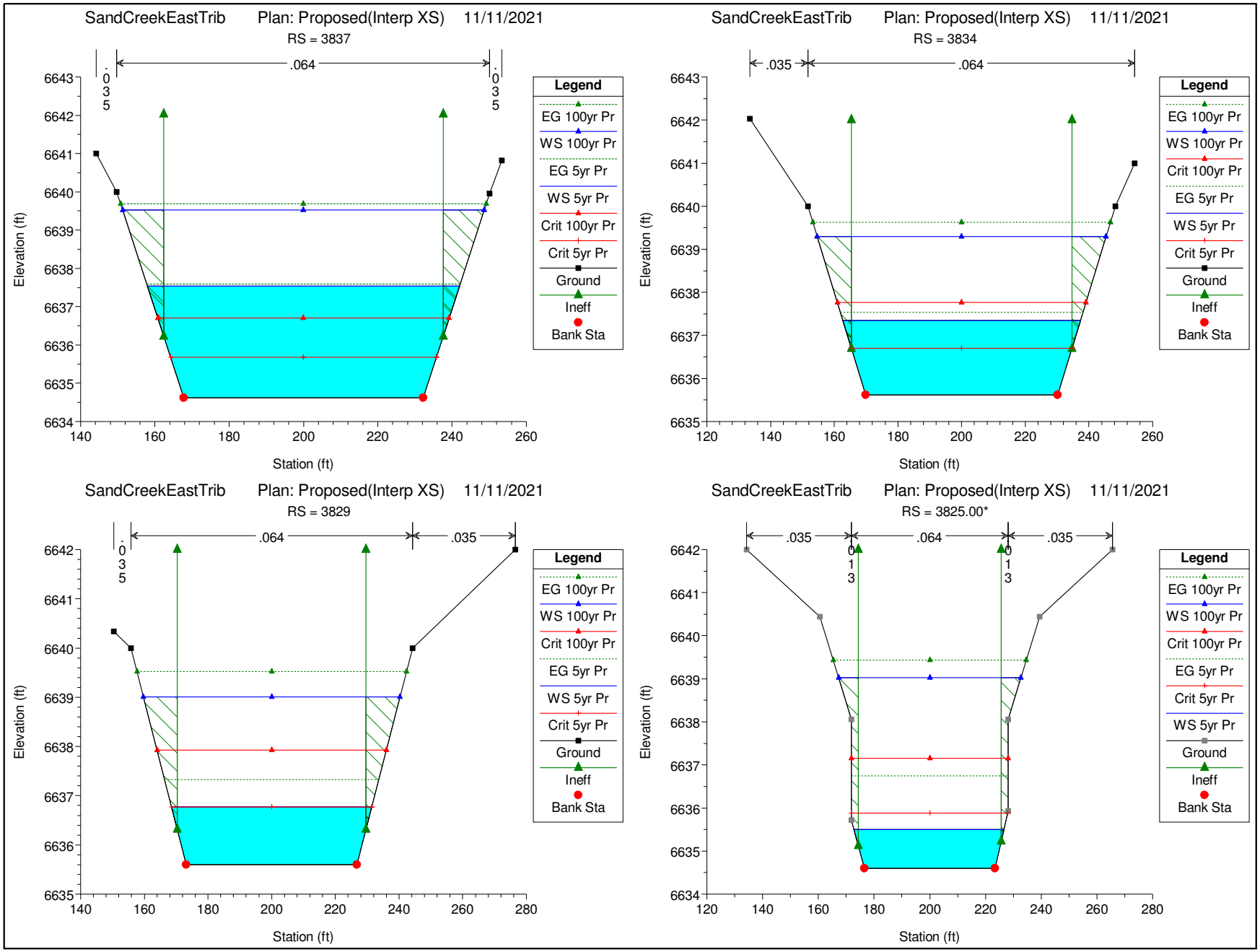
WS 100yr Pr
EG 5yr Pr
WS 5yr Pr
Crit 100yr Pr
Crit 5yr Pr
Ground
Ineff
Bank Sta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Elevation (ft)
Station (ft)
Legend
EG 100yr Pr
WS 100yr Pr
EG 5yr Pr
WS 5yr Pr
Crit 100yr Pr
Crit 5yr Pr
Ground
Ineff
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3834
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Elevation (ft)
Station (ft)
Legend
EG 100yr Pr
WS 100yr Pr
Crit 100yr Pr
EG 5yr Pr
WS 5yr Pr
Crit 5yr Pr
Ground
Ineff
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3829
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.064
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Elevation (ft)
Station (ft)
Legend
EG 100yr Pr
WS 100yr Pr
Crit 100yr Pr
EG 5yr Pr
WS 5yr Pr
Crit 5yr Pr
Ground
Ineff
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
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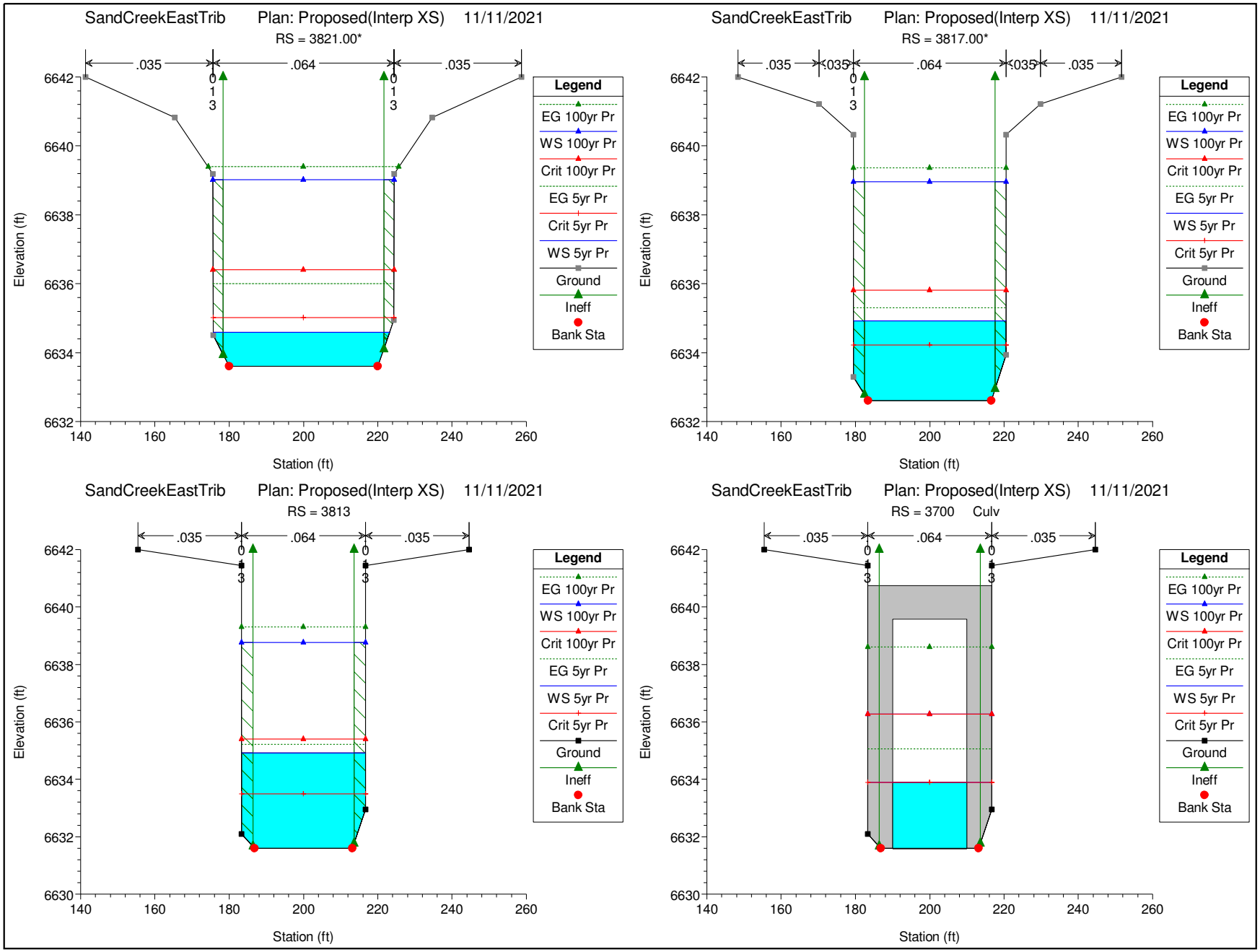
WS 5yr Pr
Crit 5yr Pr
Ground
Ineff
Bank Sta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Elevation (ft)
Station (ft)
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WS 100yr Pr
Crit 100yr Pr
EG 5yr Pr
Crit 5yr Pr
WS 5yr Pr
Ground
Ineff
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3817.00*
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SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
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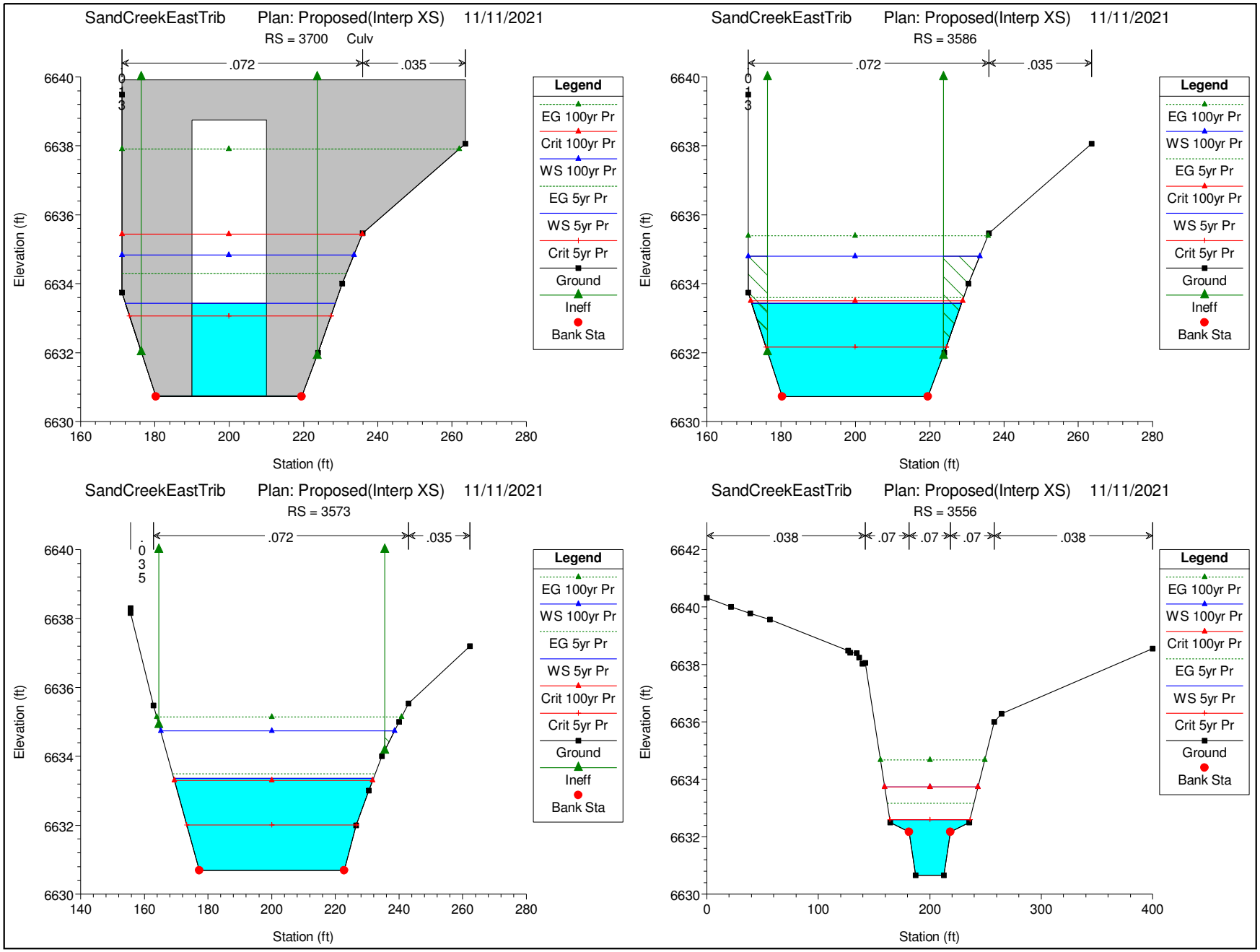
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3700 Culv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0.13
Elevation (ft)
Station (ft)
Legend
EG 100yr Pr
Crit 100yr Pr
WS 100yr Pr
EG 5yr Pr
WS 5yr Pr
Crit 5yr Pr
Ground
Ineff
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3586
.072
.035
0.13
Elevation (ft)
Station (ft)
Legend
EG 100yr Pr
WS 100yr Pr
EG 5yr Pr
Crit 100yr Pr
WS 5yr Pr
Crit 5yr Pr
Ground
Ineff
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3573
.072
.035
0.35
Elevation (ft)
Station (ft)
Legend
EG 100yr Pr
WS 100yr Pr
EG 5yr Pr
WS 5yr Pr
Crit 100yr Pr
Crit 5yr Pr
Ground
Ineff
Bank Sta
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3556
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.07
.07
.07
.038
Elevation (ft)
Station (ft)
Legend
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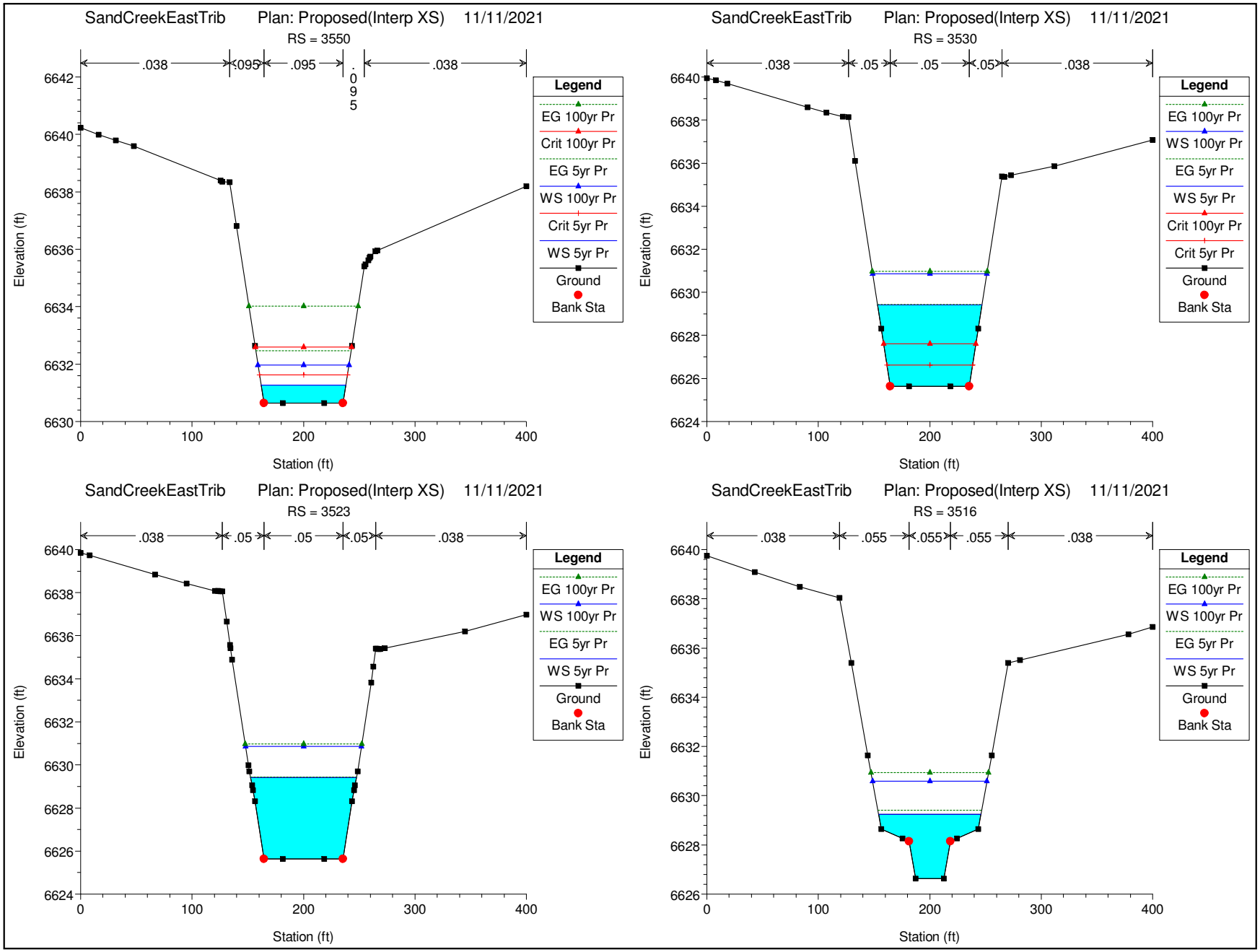
Crit 100yr Pr
EG 5yr Pr
WS 5yr Pr
Crit 5yr Pr
Ground
Bank Sta


SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3550
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.095
.095
.095
.038
Legend
EG 100yr Pr
Crit 100yr Pr
EG 5yr Pr
WS 100yr Pr
Crit 5yr Pr
WS 5yr Pr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3530
.038
.05
.05
.05
.038
Legend
EG 100yr Pr
WS 100yr Pr
EG 5yr Pr
WS 5yr Pr
Crit 100yr Pr
Crit 5yr Pr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3523
.038
.05
.05
.05
.038
Legend
EG 100yr Pr
WS 100yr Pr
EG 5yr Pr
WS 5yr Pr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3516
.038
.055
.055
.055
.038
Legend
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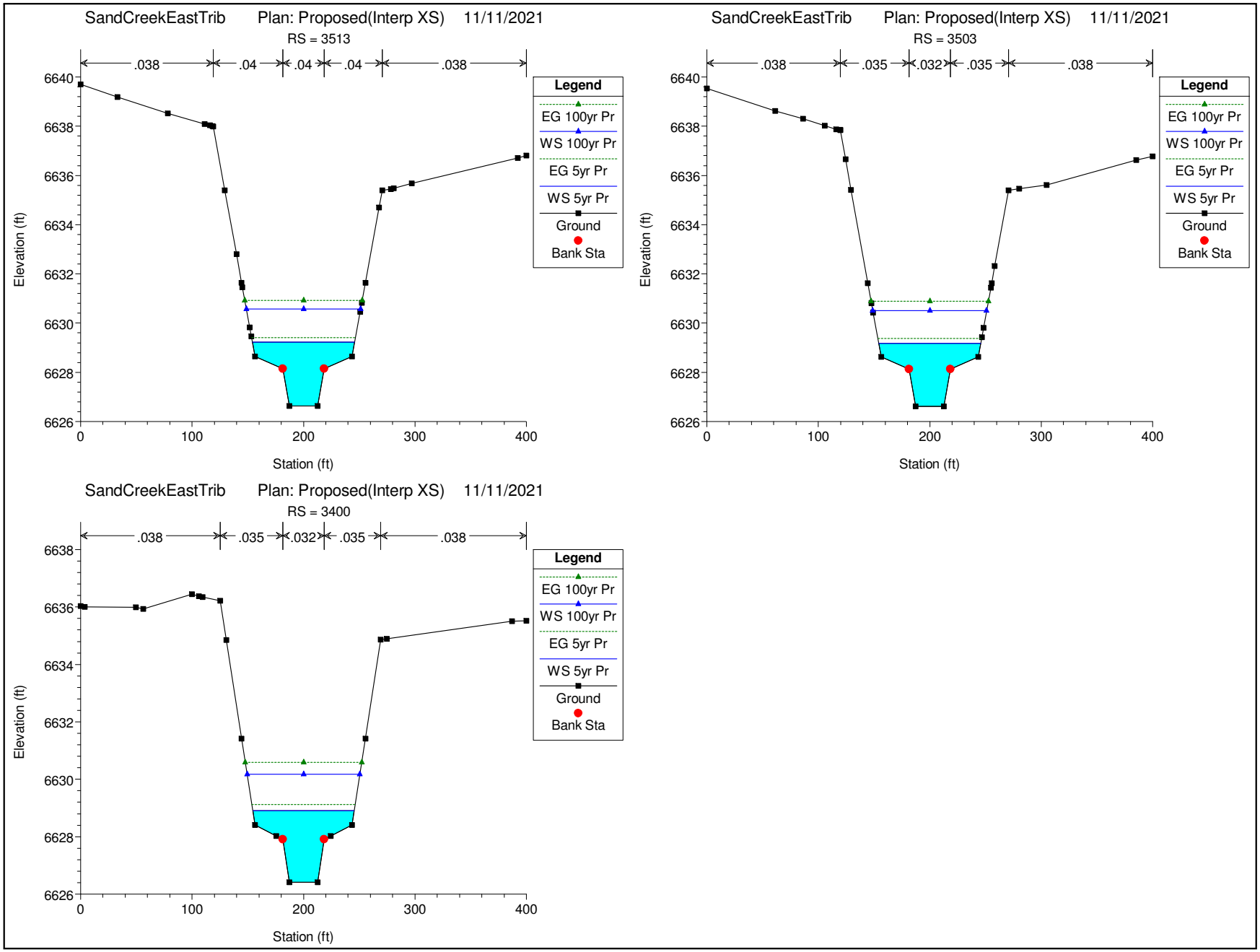
WS 100yr Pr
EG 5yr Pr
WS 5yr Pr
Ground
Bank Sta
Elevation (ft)
Station (ft)


SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3513
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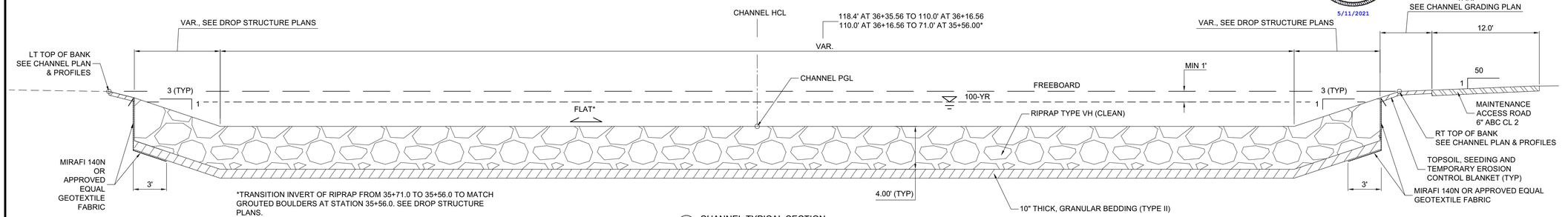
.04
.04
.04
.038
Legend
EG 100yr Pr
WS 100yr Pr
EG 5yr Pr
WS 5yr Pr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3503
.038
.035
.032
.035
.038
Legend
EG 100yr Pr
WS 100yr Pr
EG 5yr Pr
WS 5yr Pr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SandCreekEastTrib Plan: Proposed(Interp XS) 11/11/2021
RS = 3400
.038
.035
.032
.035
.038
Legend
EG 100yr Pr
WS 100yr Pr
EG 5yr Pr
WS 5yr Pr
Ground
Bank Sta
Elevation (ft)
Station (ft)

Appendix F

Partial Construction Plans from Previous Project

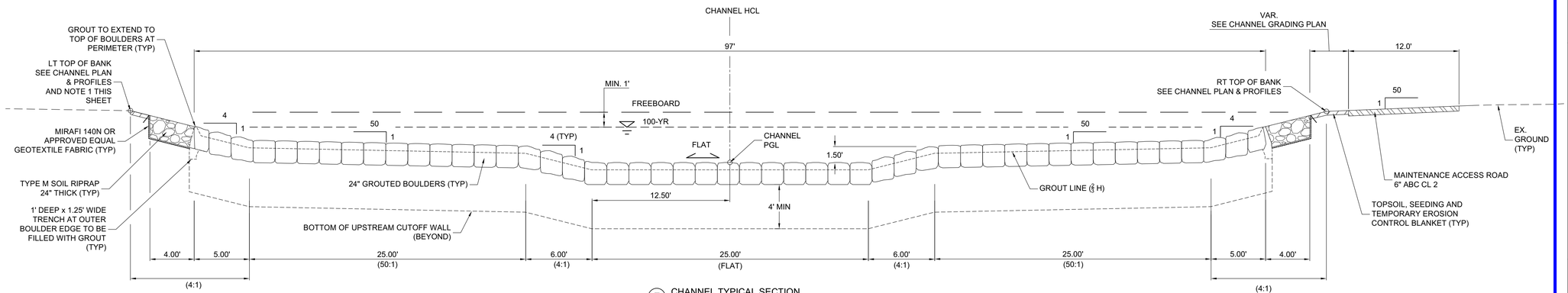
EMVC PROJECT PLANS (FOR REFERENCE ONLY)

SEE GSB DROP STRUCTURE DETAIL & SUMMARY OF TYPICAL SECTIONS SHEET FOR STATIONING. SEE CHANNEL PLAN & PROFILES FOR PGL ELEVATIONS.



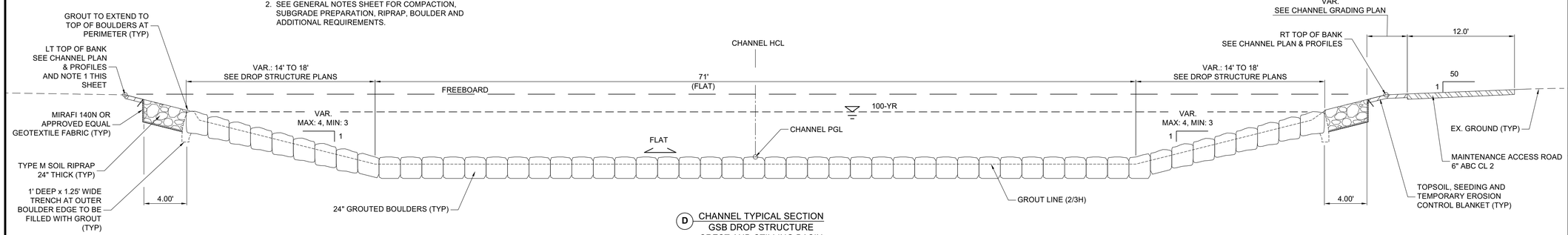
*TRANSITION INVERT OF RIPRAP FROM 35+71.0 TO 35+56.0 TO MATCH GROUTED BOULDERS AT STATION 35+56.0. SEE DROP STRUCTURE PLANS.

F CHANNEL TYPICAL SECTION
CLEAN RIPRAP
DROP STRUCTURE
N.T.S.



E CHANNEL TYPICAL SECTION
GSB DROP STRUCTURE
UPSTREAM TERMINI
N.T.S.

NOTES:
1. LT TOP OF BANK (LTOB) HAS ALTERNATE END CONDITION WHICH INCLUDES EXTENSION OF FILL SLOPE ABOVE LTOB ELEVATIONS TO ACCOMODATE SUBDIVISION GRADING. LEFT TOP OF BANK ELEVATIONS SHOWN IN CHANNEL PLAN AND PROFILES ARE THE MINIMUM ELEVATIONS TO BE CONSTRUCTED WITH CHANNEL CONSTRUCTION.
2. SEE GENERAL NOTES SHEET FOR COMPACTION, SUBGRADE PREPARATION, RIPRAP, BOULDER AND ADDITIONAL REQUIREMENTS.



D CHANNEL TYPICAL SECTION
GSB DROP STRUCTURE
CREST AND STILLING BASIN
N.T.S.

COLORADO LICENSED
NATHAN ALLEN BURAN
48791
PROFESSIONAL ENGINEER
5/11/2021

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COLORADO SPRINGS, CO 80919
PHONE: 719-520-5800
FAX: 719-520-0108
www.wilsonco.com

CLIENT
CHALLENGER HOMES

PROJECT NAME
ENCLAVES AT MOUNTAIN VISTA
SAND CREEK EAST FORK SUBTRIBUTARY
CHANNEL PROJECT
CHALLENGER COMMUNITIES, LLC
8605 EXPLORER DRIVE, SUITE 250
COLORADO SPRINGS, CO 80920

BY	DESCRIPTION	DATE	REV.

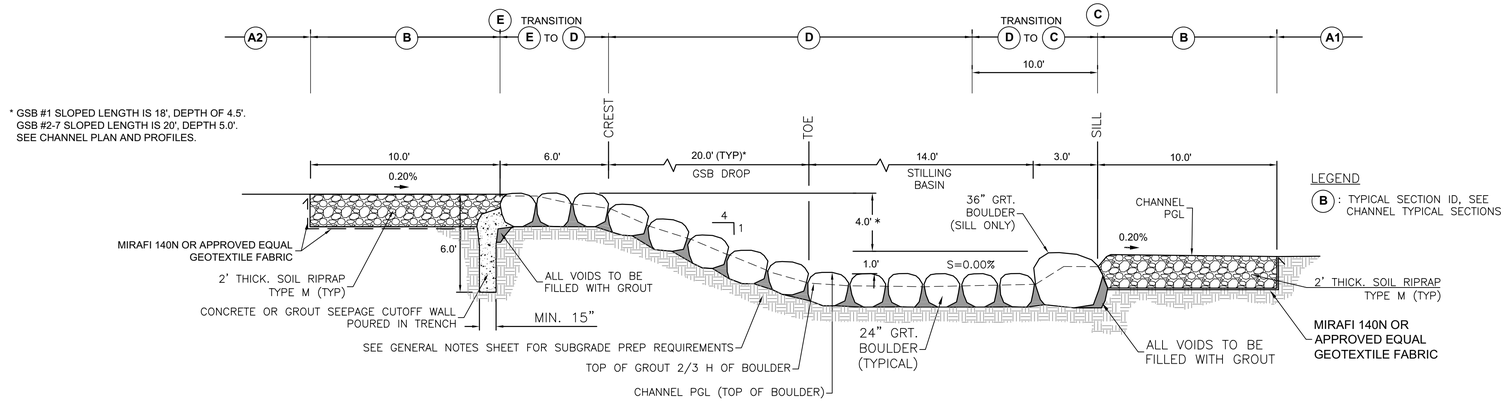
PROJECT NO:	
DESIGNED BY:	NAB
DRAWN BY:	HKB
CHECKED BY:	NAB
DATE:	5/10/21

SHEET TITLE
CHANNEL TYPICAL SECTIONS - 02

SHEET NO:
6

5/10/2021 M:\MSD\19-600-039-002_Disciplines\Drainage_or_Sitework\Sheets\Drainage_Details.dwg

EMVC PROJECT PLANS (FOR REFERENCE ONLY)



TYPICAL GROUTED BOULDER DROP STRUCTURE
PROFILE SECTION
N.T.S.

	CHANNEL TYPICAL SECTION ID	BEGIN		END
	SECTION A1*	6+50.00	to	10+00.00
	SECTION A1	10+00.00	to	12+45.00
	SECTION B	12+45.00	to	12+55.00
GSB DROP 1	SECTION C	12+55.00		
	TRANSITION C TO D	12+55.00	to	12+65.00
	SECTION D	12+65.00	to	12+90.00
	TRANSITION D TO E	12+90.00	to	12+96.00
	SECTION E	12+96.00		
	SECTION B	12+96.00	to	13+06.00
	SECTION A2	13+06.00	to	14+06.00
	SECTION A1	14+06.00	to	17+03.00
	SECTION B	17+03.00	to	17+13.00
GSB DROP 2	SECTION C	17+13.00		
	TRANSITION C TO D	17+13.00	to	17+23.00
	SECTION D	17+23.00	to	17+50.00
	TRANSITION D TO E	17+50.00	to	17+56.00
	SECTION E	17+56.00		
	SECTION B	17+56.00	to	17+66.00
	SECTION A2	17+66.00	to	18+66.00
	SECTION A1	18+66.00	to	20+33.00
	SECTION B	20+33.00	to	20+43.00
GSB DROP 3	SECTION C	20+43.00		
	TRANSITION C TO D	20+43.00	to	20+53.00
	SECTION D	20+53.00	to	20+80.00
	TRANSITION D TO E	20+80.00	to	20+86.00
	SECTION E	20+86.00		
	SECTION B	20+86.00	to	20+96.00
	SECTION A2	20+96.00	to	21+96.00
	SECTION A1	21+96.00	to	24+23.00
	SECTION B	24+23.00	to	24+33.00
GSB DROP 4	SECTION C	24+33.00		
	TRANSITION C TO D	24+33.00	to	24+43.00
	SECTION D	24+43.00	to	24+70.00
	TRANSITION D TO E	24+70.00	to	24+76.00
	SECTION E	24+76.00		

	CHANNEL TYPICAL SECTION ID	BEGIN		END
	SECTION B	24+76.00	to	24+86.00
	SECTION A2	24+86.00	to	25+86.00
	SECTION A1	25+86.00	to	27+53.00
	SECTION B	27+53.00	to	27+63.00
GSB DROP 5	SECTION C	27+63.00		
	TRANSITION C TO D	27+63.00	to	27+73.00
	SECTION D	27+73.00	to	28+00.00
	TRANSITION D TO E	28+00.00	to	28+06.00
	SECTION E	28+06.00		
	SECTION B	28+06.00	to	28+16.00
	SECTION A2	28+16.00	to	29+00.00
	SECTION A1	29+00.00	to	32+43.00
	SECTION B	32+43.00	to	32+53.00
GSB DROP 6	SECTION C	32+53.00		
	TRANSITION C TO D	32+53.00	to	32+63.00
	SECTION D	32+63.00	to	32+90.00
	TRANSITION D TO E	32+90.00	to	32+96.00
	SECTION E	32+96.00		
	SECTION B	32+96.00	to	33+06.00
	SECTION A2	33+06.00	to	34+00.00
	SECTION A1	34+00.00	to	35+03.00
	SECTION B	35+03.00	to	35+13.00
GSB DROP 7	SECTION C	35+13.00		
	TRANSITION C TO D	35+13.00	to	35+23.00
	SECTION D	35+23.00	to	35+50.00
	TRANSITION D TO E	35+50.00	to	35+56.00
	SECTION E	35+56.00		
	SECTION F	35+56.00	to	36+35.56
	SECTION G	36+35.56	to	36+36.81
	SECTION H**	36+36.81	to	38+33.80

* SEE CHANNEL GRADING PLANS FOR LAYOUT OF DOWNSTREAM CHANNEL TRANSITION.
** CHANNEL BANKS ARE SKEWED TO ALIGNMENT AT UPSTREAM CHANNEL TRANSITION. SEE DROP STRUCTURE PLANS FOR LAYOUT.

CHANNEL TYPICAL SECTION SUMMARY

COLORADO LICENSED NATHAN ALLEN BURNAM 48791 PROFESSIONAL ENGINEER
5/11/2021

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CHALLENGER HOMES

PROJECT NAME
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SAND CREEK EAST FORK SUBTRIBUTARY
CHANNEL PROJECT

CHALLENGER COMMUNITIES, LLC
8605 EXPLORER DRIVE, SUITE 250
COLORADO SPRINGS, CO 80920

BY	DESCRIPTION	DATE	REV.

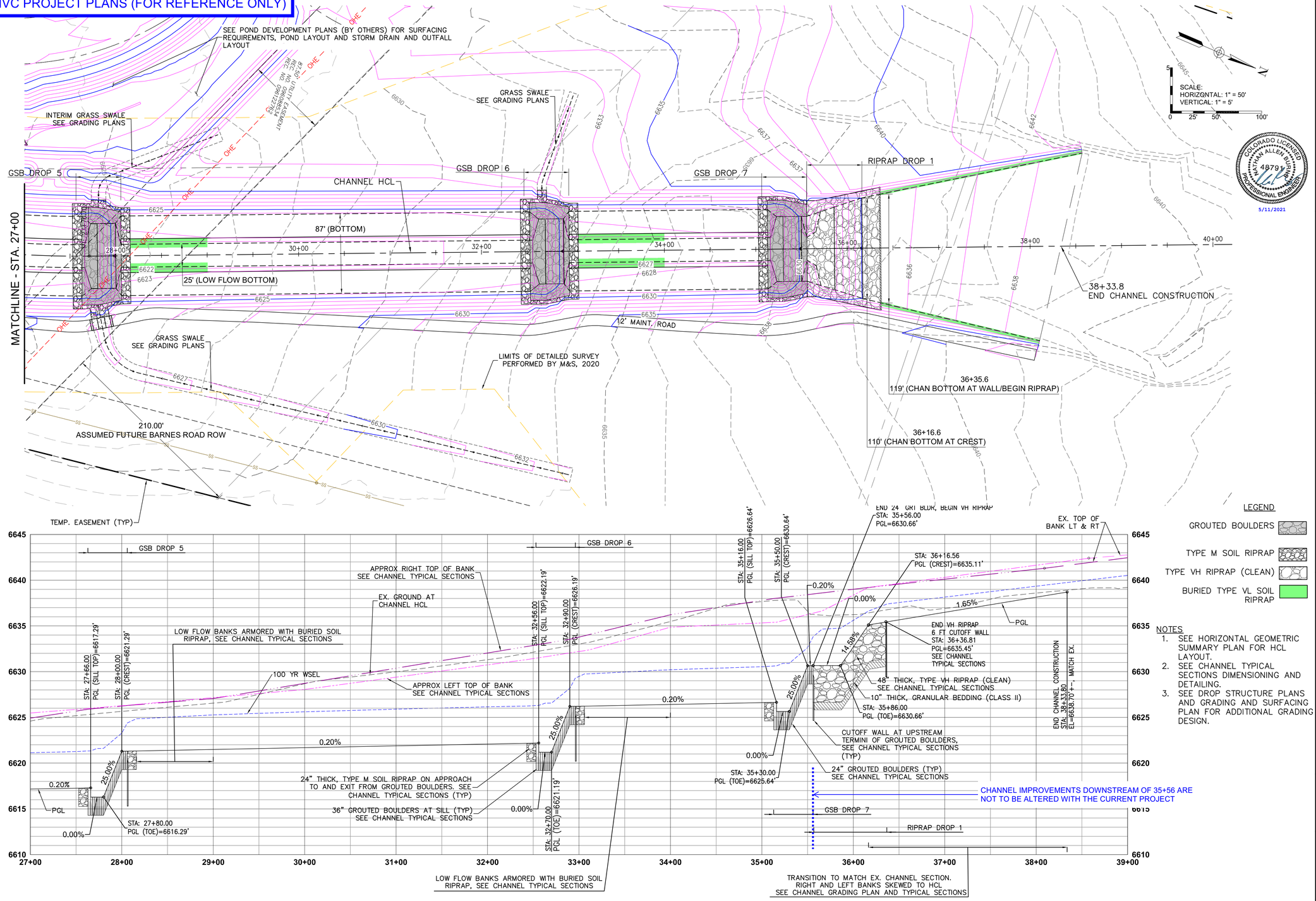
PROJECT NO:	
DESIGNED BY:	NAB
DRAWN BY:	HKB
CHECKED BY:	NAB
DATE:	4/8/21

SHEET TITLE
GSB DROP STRUCTURE DETAIL & SUMMARY OF TYPICAL SECTIONS

SHEET NO:
8

4/12/2021 M:\MSD\19-600-039-00\2_Disciplines\Drainage_or_Sitework\Sheets\Drainage_Details.dwg

EMVC PROJECT PLANS (FOR REFERENCE ONLY)



LEGEND

- GROUTED BOULDERS
- TYPE M SOIL RIPRAP
- TYPE VH RIPRAP (CLEAN)
- BURIED TYPE VL SOIL RIPRAP

NOTES

1. SEE HORIZONTAL GEOMETRIC SUMMARY PLAN FOR HCL LAYOUT.
2. SEE CHANNEL TYPICAL SECTIONS DIMENSIONING AND DETAILING.
3. SEE DROP STRUCTURE PLANS AND GRADING AND SURFACING PLAN FOR ADDITIONAL GRADING DESIGN.

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5755 MARK DABLING BLVD, SUITE 220
COLORADO SPRINGS, CO 80919
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COLORADO LICENSED
NATHAN ALLEN BURNETT
48791
PROFESSIONAL ENGINEER
5/11/2021

CLIENT
CHALLENGER HOMES

PROJECT NAME
ENCLAVES AT MOUNTAIN VISTA
SAND CREEK EAST FORK SUBTRIBUTARY CHANNEL PROJECT
CHALLENGER COMMUNITIES, LLC
8605 EXPLORER DRIVE, SUITE 250
COLORADO SPRINGS, CO 80920

REV.	DATE	DESCRIPTION	BY

PROJECT NO:
DESIGNED BY: NAB
DRAWN BY: HKB
CHECKED BY: NAB
DATE: 5/10/21

SHEET TITLE
CHANNEL PLAN & PROFILE
27+00-40+00

SHEET NO:
11

5/11/2021 M:\MSD\19-600-039-002_Disciplines\Drainage_or_Sitework\Sheets\Channel P&P.dwg

Appendix G

FIRM & FIS Excerpts

NOTES TO USERS

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

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

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

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

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

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

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

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

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

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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

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

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

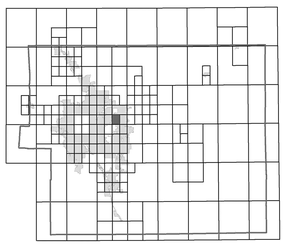
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

El Paso County Vertical Datum Offset Table

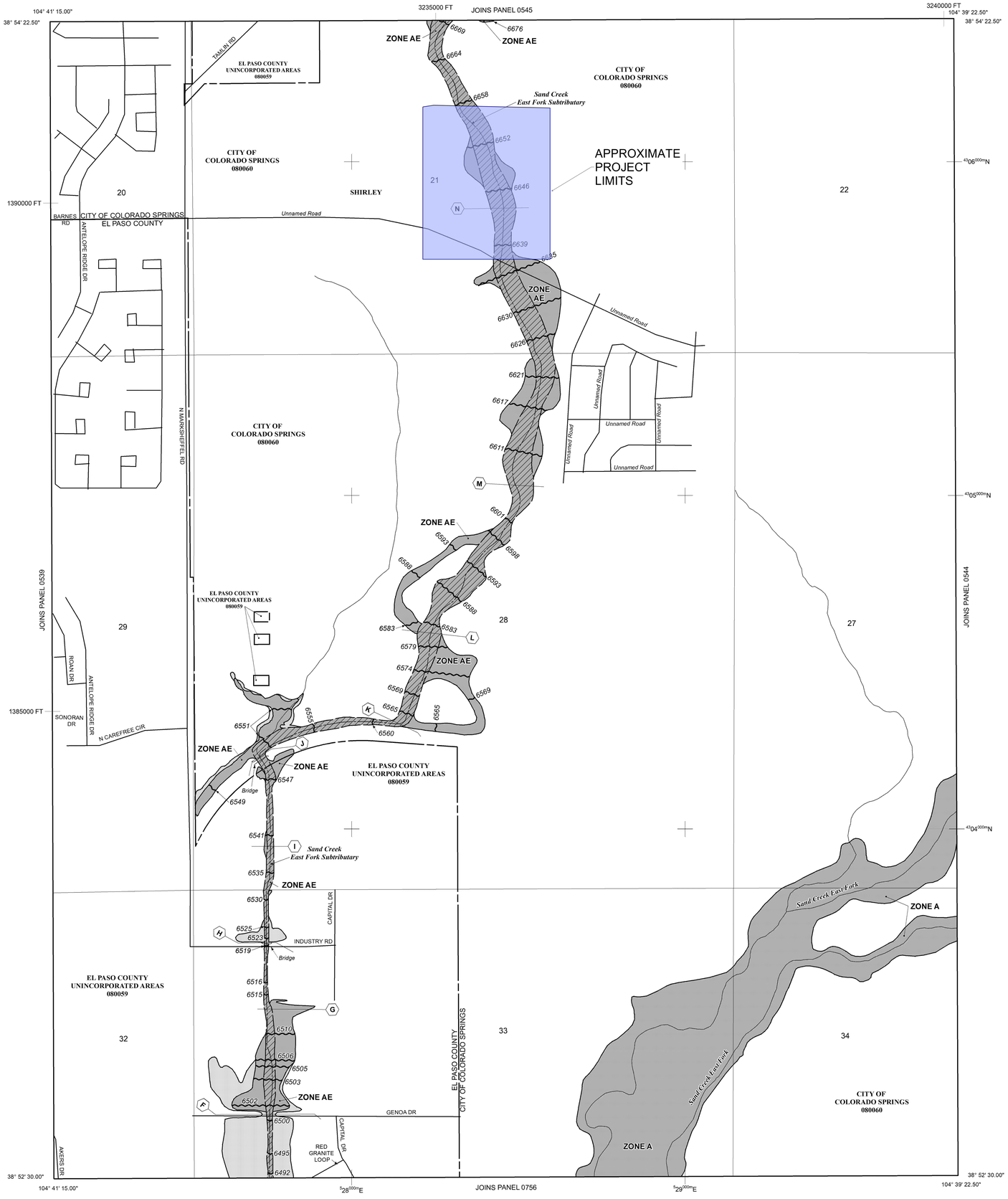
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



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

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

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

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

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

NFIP

PANEL 0543G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 543 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0543	G
EL PASO COUNTY	080059	0543	G

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

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

MAP NUMBER
08041C0543G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Sand Creek East Fork Subtributary								
A	650	63	194	10.5	6427.4	6427.4	6427.4	0.0
B	2,120	77	208	9.7	6450.1	6450.1	6450.1	0.0
C	2,270	90	388	5.4	6453.3	6453.3	6453.3	0.0
D	3,567	58	191	10.3	6471.4	6471.4	6471.4	0.0
E	4,408	56	185	10.6	6483.7	6483.7	6483.7	0.0
F	5,507	65	198	9.9	6500.9	6500.9	6501.0	0.1
G	6,547	78	211	9.2	6513.8	6513.8	6514.0	0.2
H	7,197	44	257	7.5	6519.9	6519.9	6520.9	1.0
I	8,147	64	192	9.9	6538.8	6538.8	6538.8	0.0
J	9,057	100	403	4.3	6548.7	6548.7	6549.7	1.0
K	10,537	80	195	8.9	6561.2	6561.2	6561.6	0.4
L	11,340	231	202	5.5	6580.8	6580.8	6580.8	0.0
M	13,100	214	201	5.5	6605.5	6605.5	6605.5	0.0
N	15,970	219	209	5.3	6642.7	6642.7	6642.7	0.0
O	18,710	60	96	7.2	6677.8	6677.8	6677.8	0.0
P	20,450	90	110	6.3	6701.4	6701.4	6701.4	0.0
Q	22,700	100	112	6.1	6732.8	6732.8	6732.9	0.1

Q (M)=1110 CFS

[1]Feet Above Confluence with Sand Creek East Fork.

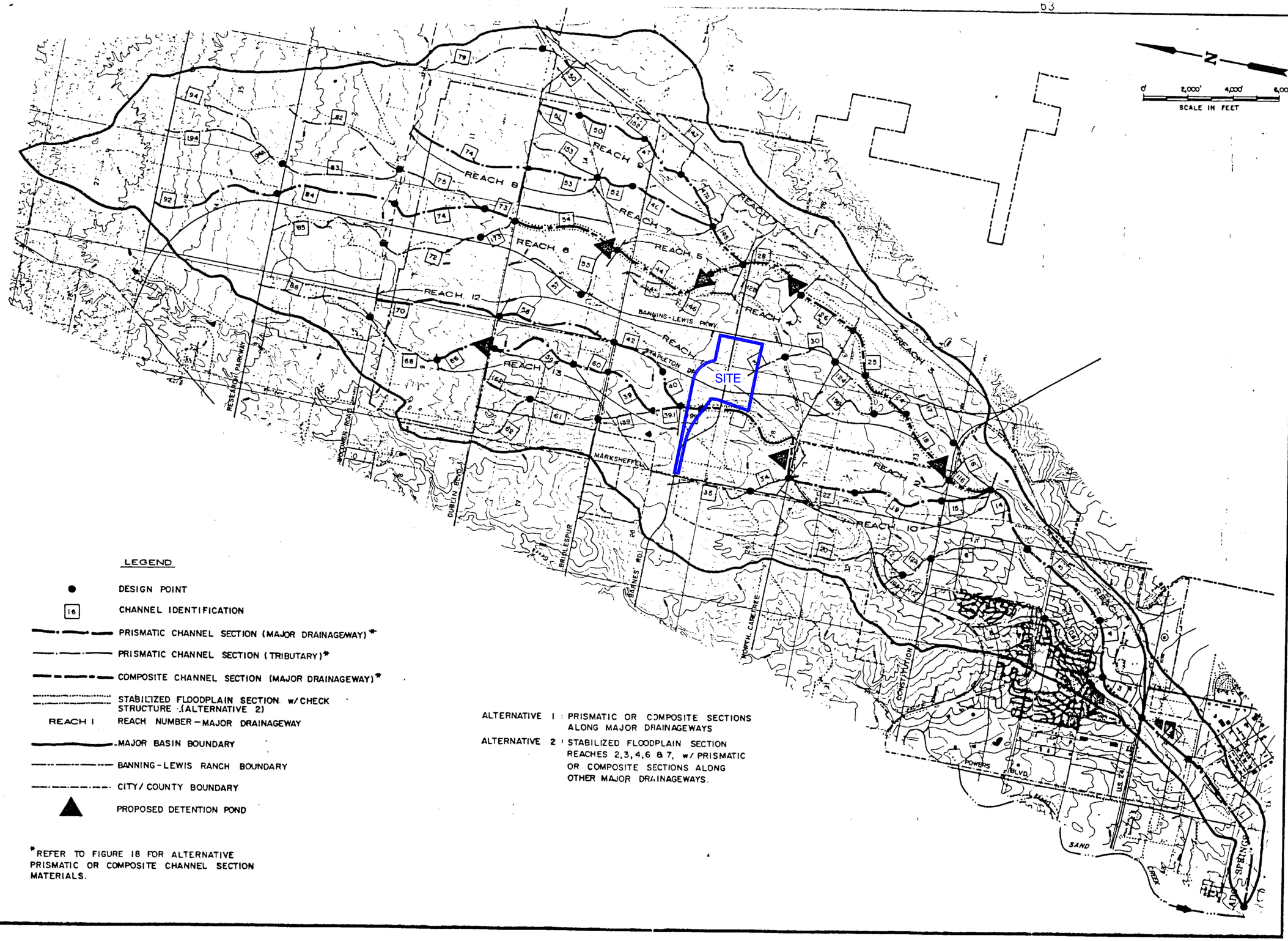
TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

SAND CREEK EAST FORK SUBTRIBUTARY



LEGEND

- DESIGN POINT
- [16] CHANNEL IDENTIFICATION
- PRISMATIC CHANNEL SECTION (MAJOR DRAINAGEWAY)*
- PRISMATIC CHANNEL SECTION (TRIBUTARY)*
- COMPOSITE CHANNEL SECTION (MAJOR DRAINAGEWAY)*
- STABILIZED FLOODPLAIN SECTION w/ CHECK STRUCTURE (ALTERNATIVE 2)
- REACH 1 — REACH NUMBER — MAJOR DRAINAGEWAY
- MAJOR BASIN BOUNDARY
- BANNING-LEWIS RANCH BOUNDARY
- CITY/COUNTY BOUNDARY
- PROPOSED DETENTION POND

*REFER TO FIGURE 18 FOR ALTERNATIVE PRISMATIC OR COMPOSITE CHANNEL SECTION MATERIALS.

ALTERNATIVE 1 : PRISMATIC OR COMPOSITE SECTIONS ALONG MAJOR DRAINAGEWAYS

ALTERNATIVE 2 : STABILIZED FLOODPLAIN SECTION REACHES 2,3,4,6 & 7, w/ PRISMATIC OR COMPOSITE SECTIONS ALONG OTHER MAJOR DRAINAGEWAYS.

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

EAST FORK SAND CREEK
DRAINAGE BASIN PLANNING STUDY

ALTERNATIVE CHANNELIZATION PLANS

Project No.	88.11.23
Date:	4-89
Design:	JYC
Drawn:	EAK
Check:	
Revisions:	

50

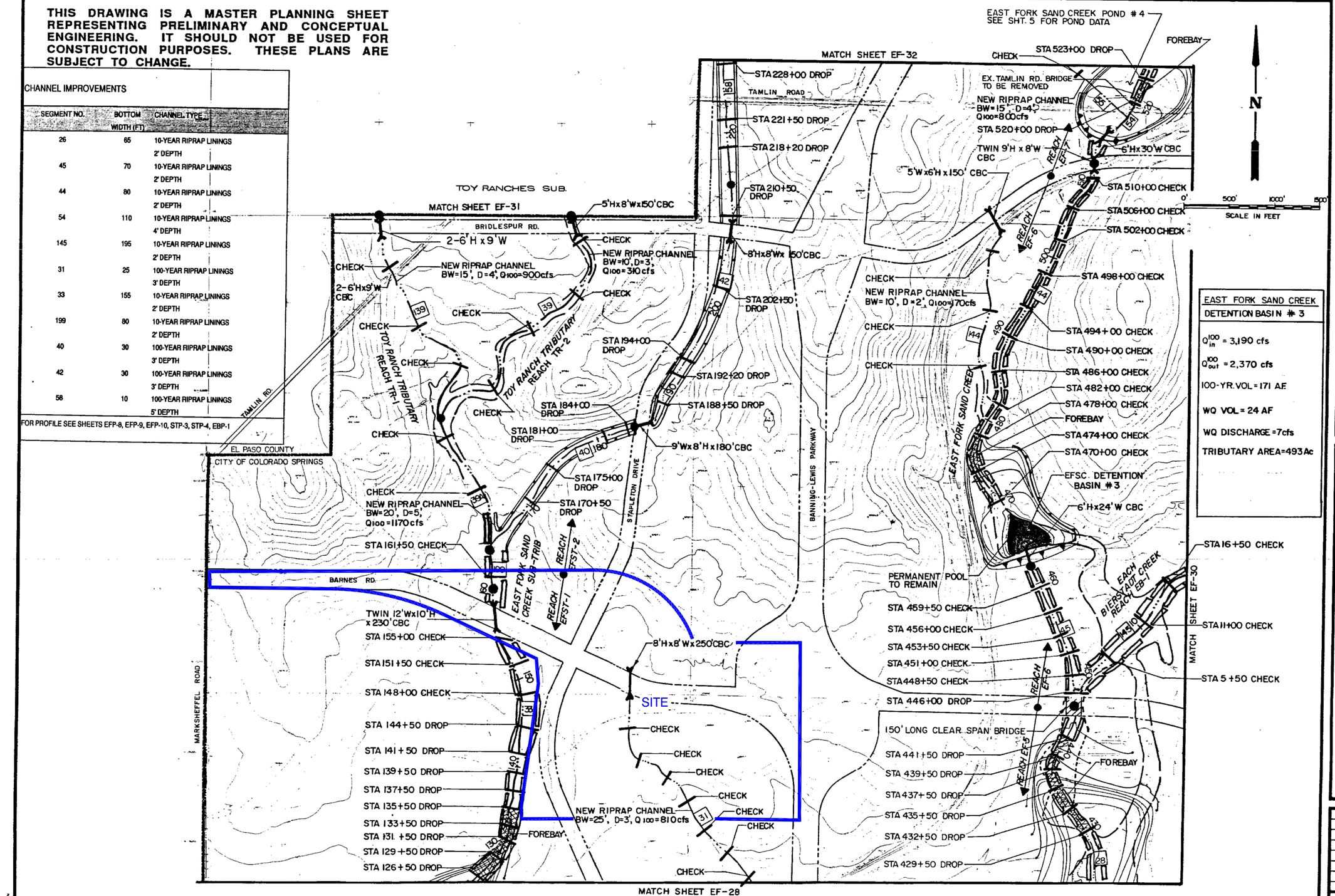
FIGURE VI-1

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

CHANNEL IMPROVEMENTS

SEGMENT NO.	BOTTOM WIDTH (FT)	CHANNEL TYPE
26	65	10-YEAR RIPRAP LININGS 2' DEPTH
45	70	10-YEAR RIPRAP LININGS 2' DEPTH
44	80	10-YEAR RIPRAP LININGS 2' DEPTH
54	110	10-YEAR RIPRAP LININGS 4' DEPTH
145	195	10-YEAR RIPRAP LININGS 2' DEPTH
31	25	100-YEAR RIPRAP LININGS 3' DEPTH
33	155	10-YEAR RIPRAP LININGS 2' DEPTH
199	80	10-YEAR RIPRAP LININGS 2' DEPTH
40	30	100-YEAR RIPRAP LININGS 3' DEPTH
42	30	100-YEAR RIPRAP LININGS 3' DEPTH
58	10	100-YEAR RIPRAP LININGS 5' DEPTH

FOR PROFILE SEE SHEETS EFP-8, EFP-9, EFP-10, STP-3, STP-4, EBP-1



EAST FORK SAND CREEK DETENTION BASIN # 3
Q_{in}^{100} = 3,190 cfs
Q_{out}^{100} = 2,370 cfs
100-YR. VOL = 171 A.F.
WQ VOL = 24 AF
WQ DISCHARGE = 7cfs
TRIBUTARY AREA = 493 Ac

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

EAST FORK SAND CREEK DRAINAGE BASIN PLANNING STUDY
PRELIMINARY PLANS

Project No.	88.11.23
Date:	6/89
Design:	JYC
Drawn:	EAK
Check:	
Revisions:	

EF-29

TABLE VIII-2: SAND CREEK DRAINAGE BASIN PLANNING STUDY
CONT'D DRAINAGEWAY CONVEYANCE COST ESTIMATE
EAST FORK SUB-TRIBUTARY WITH DETENTION

SEGMENT NUMBER	REACH NUMBER	SEGMENT LENGTH (FT)	IMPROVEMENT TYPE	IMPROVEMENT LENGTH (FT)	UNIT COST ($/LF)	NUMBER OF GRADE CONTROLS	LENGTH OF GRADE CONTROL (FT)	TOTAL REIMBURSABLE COSTS	TOTAL COST
15	EFST-1	2200	100-YR RIPRAP	2150	234	4	240	$546,300	$546,300
19	"	4000	"	3840	234	4	420	$974,160	$974,160
22	"	3000	"	550	234	7	100	$146,700	$146,700
33A	"	2050	"	1900	268	2	40	$516,400	$516,400
33	"	4750	10-YEAR RIPRAP	3120	185	1	1920	$922,800	$922,800
199	"	500	"	500	185	12	180	$124,900	$124,900
40	EFST-2	1950	"	1950	205	2	200	$435,750	$435,750
42	"	2900	"	2570	205	4	160	$555,650	$555,650
58	"	5200	"	5050	268	6	180	$1,385,800	$1,385,800
70	"	2600	"	2600	234	1	60	$619,200	$619,200
TOTAL EAST FORK SUB-TRIBUTARY DRAINAGEWAY								$6,227,660	$6,227,660

Table VIII-7:
CONT'D

SAND CREEK DRAINAGE BASIN PLANNING STUDY
BRIDGE CROSSING COST ESTIMATE
EAST FORK SAND CREEK DRAINAGE BASINS

ROADWAY	REACH NUMBER	DRAINAGEWAY SEGMENT	CROSSING TYPE	JURISIDICTION CITY	JURISIDICTION COUNTY	SIZE	UNIT	UNIT COST	TOTAL COST COUNTY	TOTAL COST CITY
		EAST FORK SAND CREEK								
UN-NAMED ROADWAY	EFSC-2	1	140' TWO-SPAN BRIDGE			4200	SF	$80	$0	$0
PETERSON ROAD	EFSC-2	4	3- 9'Hx16'W CBC		X	80	LF	$1,800	$144,000	$0
OMAHA BLVD	EFSC-2	5	3- 9'Hx16'W CBC		X	80	LF	$1,800	$144,000	$0
MARKSHEFFEL ROAD	EFSC-2	5	120' TWO-SPAN BRIDGE		X	8400	SF	$80	$672,000	$0
STAPLETON DRIVE	EFSC-4	24	2-10'Hx10'W CBC	X		200	LF	$1,050	$0	$210,000
BANNING-LEWIS PRKWY	EFSC-4	25	2-10'Hx14'W CBC	X		300	LF	$1,250	$0	$375,000
NORTH CAREFREE CIR	EFSC-4	26	2-10'Hx14'W CBC	X		150	LF	$1,250	$0	$187,500
BARNES ROAD	EFSC-5	28	150' TWO-SPAN BRIDGE	X		9000	SF	$80	$0	$720,000
BRIDLESPUR ROAD	EFSC-6	44	2-8'Hx9'W CBC	X		150	LF	$725	$0	$108,750
DUBLIN ROAD	EFSC-7	73	150' TWO-SPAN BRIDGE	X		9000	SF	$80	$0	$720,000
		EAST FORK SUB-TRIB.								
GENOA DRIVE	EFST-1	19	2-6'Hx14'W CBC		X	80	LF	$1,050	$84,000	$0
BARNES ROAD	EFST-1	33	2-10'Hx12'W CBC	X		230	LF	$1,100	$0	$253,000
N. CAREFRE CIR	EFST-1	33A	2-8'Hx10'W CBC	X		150	LF	$950	$0	$142,500
		EAST BIERSTADT CREEK								
UN-NAMED ROADWAY	EB-2	47A	2-10'Hx14'W CBC	X		250	LF	$1,250	$0	$312,500
		WEST BIERSTADT CREEK								
UN-NAMED ROADWAY	WB-1	46	2-10'Hx12'W CBC	X		180	LF	$1,100	$0	$198,000
TOTAL BRIDGE CONSTRUCTION COSTS, EAST FORK SAND CREEK									$1,044,000	$3,227,250

Table VIII-9: SAND CREEK DRAINAGE BASIN PLANNING STUDY
CITY BRIDGE FEE CALCULATION

ROADWAY	CROSSING TYPE	TOTAL COST	TOTAL CITY COST (1)	TOTAL REIMBURSABLE COST
SAND CREEK				
CHELTON ROAD	210' TWO-SPAN BRIDGE	$1,344,000	$201,600	$1,142,400
STETSON HILLS	3- 8'Hx10'W CBC	$222,000	$84,360	$137,640
JEDEDIAH SMITH RD.	3- 8'Hx10'W BOX CULVERT	$66,600	$9,990	$56,610
PETERSON ROAD	80' CLEAR SPAN BRIDGE	$512,000	$194,560	$317,440
DUBLIN BOULEVARD	80' CLEAR SPAN BRIDGE	$512,000	$194,560	$317,440
WEST FORK SAND CREEK				
GALLEY ROAD	54' CLEAR SPAN BRIDGE	$410,400	$410,400	$0
PALMER PARK BLVD.	54' CLEAR SPAN BRIDGE	$410,400	$410,400	$0
CONSTITUTION AVE.	40' CLEAR SPAN BRIDGE	$256,000	$256,000	$0
MAIZELAND ROAD	30' CLEAR SPAN BRIDGE	$192,000	$192,000	$0
SOUTH CAREFREE CIRCLE	2- 8'Hx15'W CBC	$96,000	$96,000	$0
EAST FORK SAND CREEK				
STAPLETON PARKWAY	2-10'H x 10'W CBC	$210,000	$138,600	$71,400
BANNING LEWIS PARKWAY	2-10'H x 14'W CBC	$375,000	$288,750	$86,250
NORTH CAREFREE CIRCLE	2-10'H x 14'W CBC	$187,500	$103,125	$84,375
BARNES ROAD	150' TWO SPAN BRIDGE	$720,000	$475,200	$244,800
BRIDLESPUR ROAD	2-8'H x 9'W CBC	$108,750	$59,813	$48,937
DUBLIN ROAD	150' TWO SPAN BRIDGE	$720,000	$396,000	$324,000
EAST FORK SUB-TRIBUTARY				
BARNES ROADWAY	2- 10'H x 12'W CBC	$253,000	$166,980	$86,020
NORTH CAREFREE CIRCLE	2- 8'H x 10'W CBC	$142,500	$78,375	$64,125
EAST BIERSTADT CREEK				
UN-NAMED ROADWAY	2- 10'H x 14'W CBC	$312,500	$193,750	$118,750
WEST BIERSTADT CREEK				
UN-NAMED ROADWAY	2- 10'H x 12'W CBC	$198,000	$122,760	$75,240
TOTAL ROADWAY CONSTRUCTION COSTS		$7,248,650	$4,073,223	$3,175,428
10% ENGINEERING		$724,865	$407,322	$317,543
5% CONTINGENCY		$362,433	$203,661	$158,771
TOTALS		$8,335,948	$4,684,206	$3,651,742
TOTAL UNPLATTED ACREAGE IN CITY				11312
CITY BRIDGE FEE ($/ACRE)				$323

(1) FEES HAVE BEEN CALCULATED PER CITY ORDINANCE 15-3-1001, ARTERIAL ROADWAY BRIDGES.
CITY IS RESPONSIBLE FOR COST OF BRIDGE IN EXCESS OF 68-FEET AS MEASURED PERPENDICULARLY TO THE ROADWAY CENTERLINE UP TO AND NOT EXCEEDING THE ROAD RIGHT-OF-WAY WIDTH.

Table VIII-10: SAND CREEK DRAINAGE BASIN PLANNING STUDY
COUNTY BRIDGE FEE CALCULATION

ROADWAY	CROSSING TYPE	TOTAL COST	TOTAL COUNTY COST	TOTAL REIMBURSABLE COST
SAND CREEK				
MARKSHEFFEL ROAD	3- 10'Hx10'W CBC	$100,800	$0	$100,800
RESEARCH PARKWAY	4-8'Hx10'W CBC	$124,800	$0	$124,800
BANNING-LEWIS PARKWAY	4-8'Hx10'W CBC	$124,800	$0	$124,800
CENTER TRIBUTARY SAND CREEK				
W. FRONTAGE US 24 (1)	3-6'Hx16'W CBC	$106,200	$0	$0
US 24 (POWERS) (1)	3-6'Hx14'W CBC	$211,500	$0	$0
E. FRONTAGE US 24 (1)	3-6'Hx14'W CBC	$84,600	$0	$0
BIJOU STREET (1)	3-6'Hx14'W CBC	$84,600	$0	$0
PLATTE AVENUE (1)	3-6'Hx14'W CBC	$169,200	$0	$0
GALLEY ROAD	3-5'Hx8'W CBC	$90,000	$56,700	$33,300
EAST FORK SAND CREEK				
UN-NAMED ROAD, PETERSON AFB	140' TWO SPAN BRIDGE	$336,000	$0	$0
PETERSON ROAD	3-9'H X 16'W CBC	$144,000	$0	$144,000
OMAHA BLVD EXTENDED	3-9'H X 16'W CBC	$144,000	$0	$144,000
MARKSHEFFEL ROAD	120' TWO SPAN BRIDGE	$672,000	$0	$672,000
EAST FORK SUBTRIBUTARY				
GENOA DRIVE	2-6'H X 14'W CBC	$84,000	$0	$84,000
TOTAL ROADWAY CONSTRUCTION COSTS		$2,476,500	$56,700	$1,427,700
10% ENGINEERING		$247,650	$5,670	$142,770
5% CONTINGENCY		$123,825	$2,835	$71,385
COUNTY BRIDGE OUTSTANDING CLAIMS				$1,083,133
TOTALS		$2,847,975	$65,205	$2,724,988
TOTAL UNPLATTED ACREAGE IN COUNTY				7497
COUNTY BRIDGE FEE ($/ACRE)				$363

(1) BRIDGES ON CENTER TRIBUTARY FUNDED THROUGH US 24 BYPASS PHASE II PROJECT.

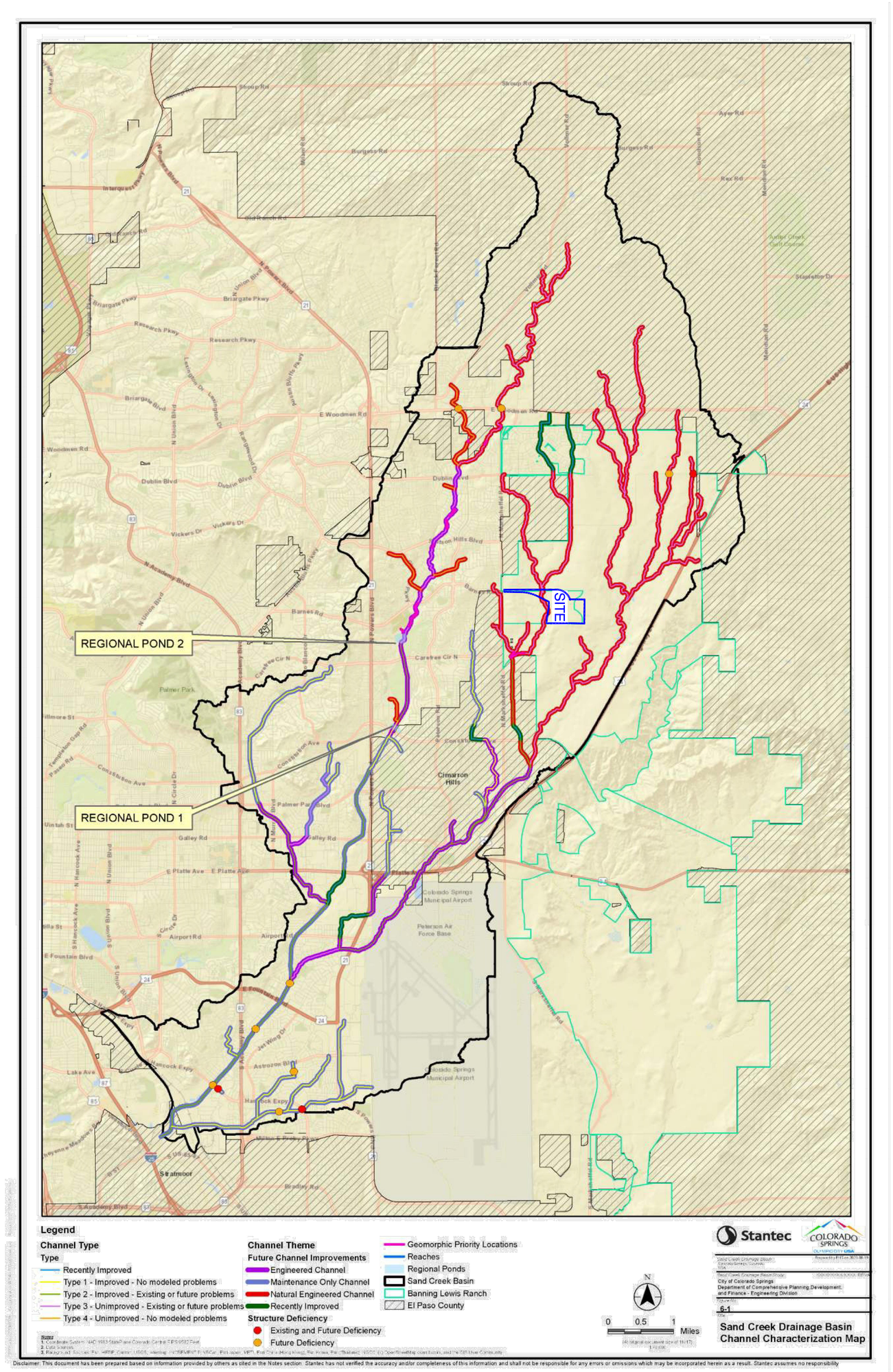


Figure 6-1. Sand Creek Drainage Basin Deficiency Map

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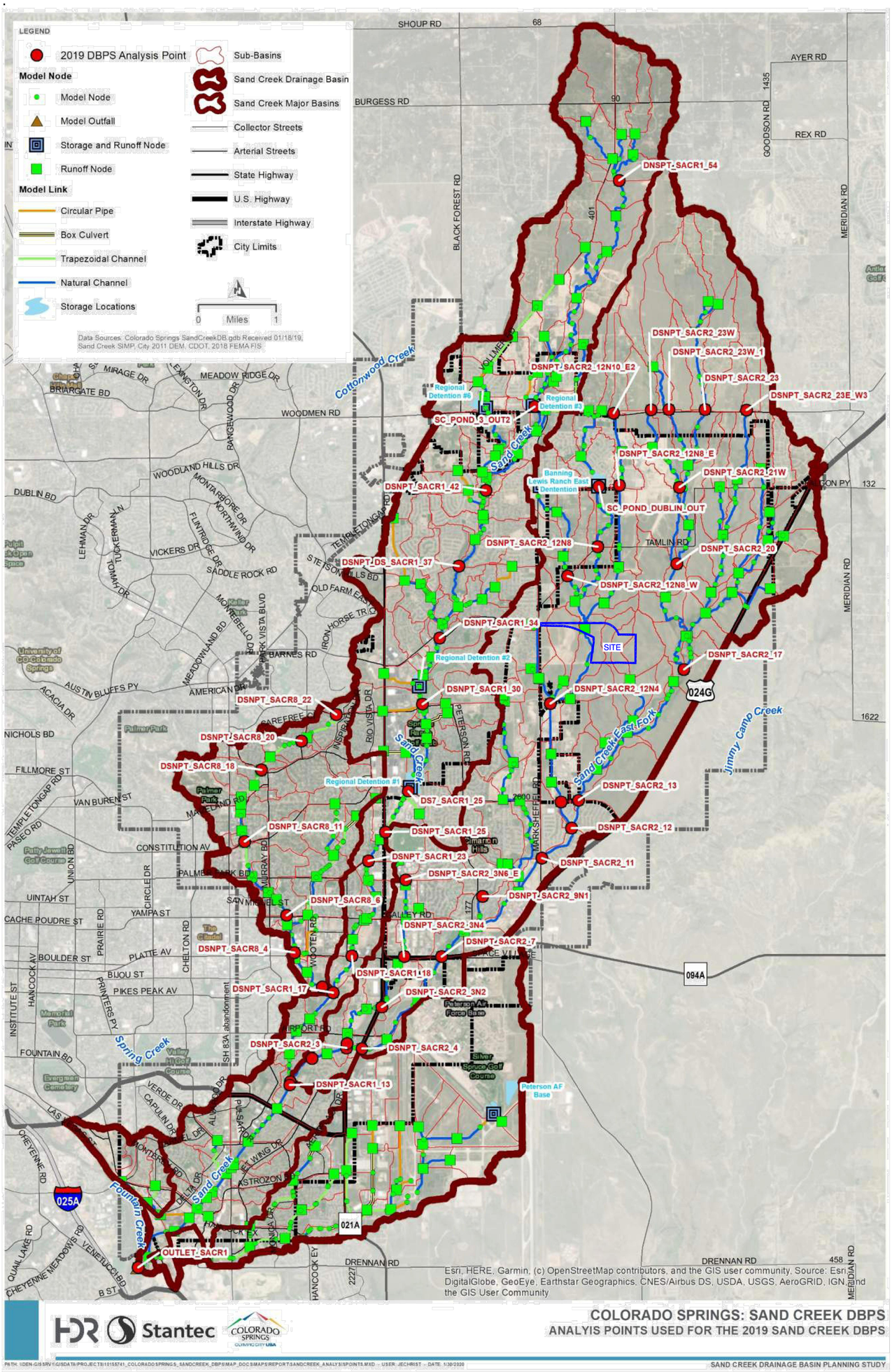

Figure 3-7. Analysis Points used in the Sand Creek DBS for the Presentation of Peak Flow Rates

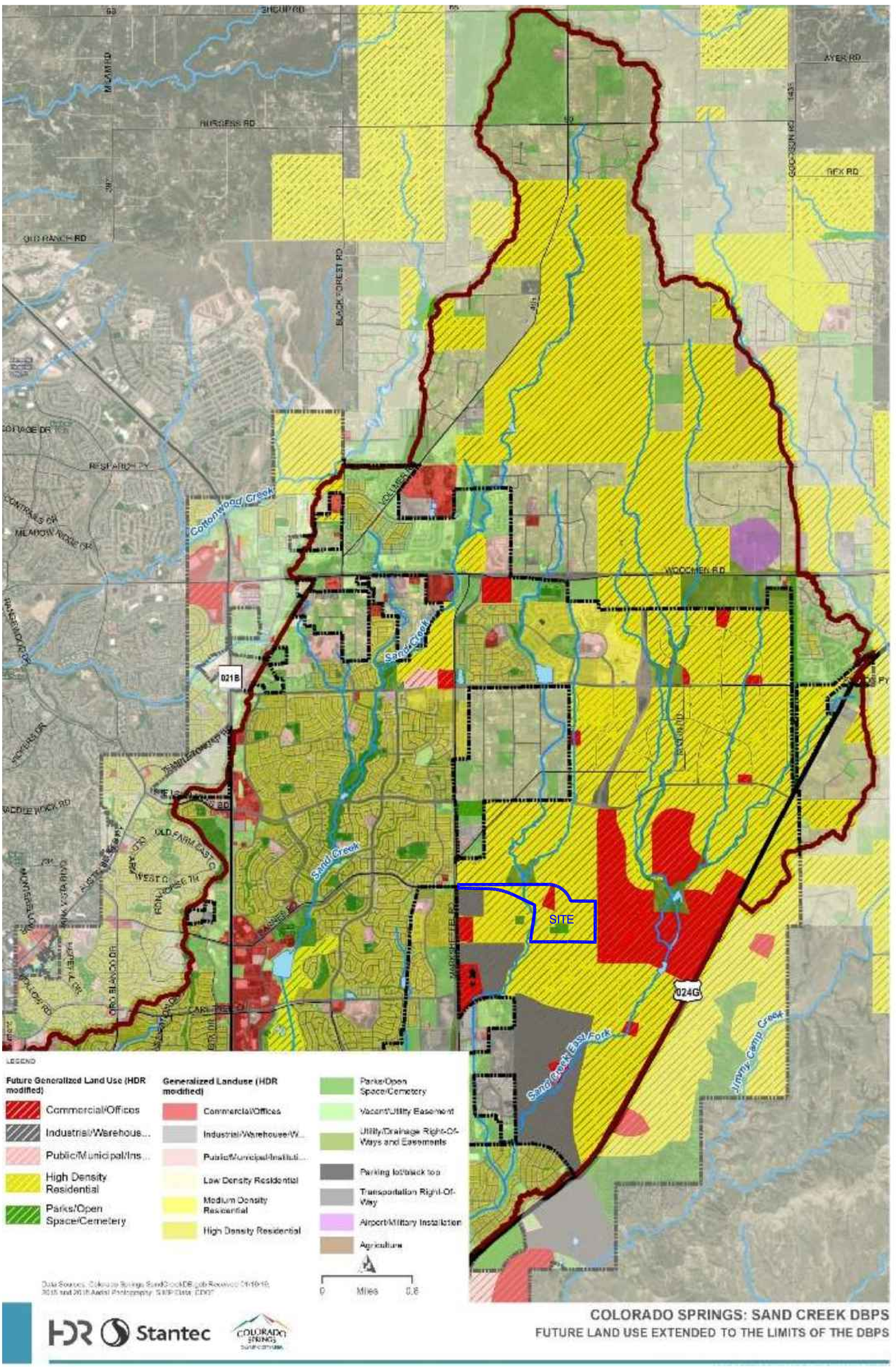

Figure 3-15. Future Land Use MapFuture Condition Model Results

8.0 FEE DEVELOPMENT

This section describes the basis of estimating capital costs and the drainage fee per acre for the recommended DBPS stormwater improvements.

Stormwater improvements identified for Sand Creek consist of spot channel improvements (e.g., eroding streambanks), reach channel improvements (including channel grading and grade control structures), new storm drain systems, and improvements to Sand Creek Regional Ponds 1 and 2. These improvements are broken down by reach to identify the improvements required in each subbasin. Engineering design costs have been estimated to be 10% of the overall construction cost. No allowances have been provided for utility relocations, habitat mitigation, or ROW acquisition.

During implementation, the recommended stormwater improvements may have to be modified to fit specific site conditions. The number of drop structures within a particular reach has been estimated based on allowable slope within the channel reach. The assumed size and locations may be moved to minimize disturbance and to fit site conditions.

The drainage fee for Sand Creek has been established to determine an equitable cost of drainage improvements that will be shared across all remaining developable land within the basin. Currently, platted land is not required to pay for additional stormwater improvements within the basin. The drainage fee is the cost of reimbursable stormwater improvements within the City's future developable area that have been identified in this DBPS divided by the remaining unplatted land within the basin.

8.1 UNIT COSTS

Improvements to Regional Ponds 1 and 2 consist of constructing new outlet structures and low flow channels through the storage areas. Costs of these improvements were calculated based on the specific proposed improvements at each location, using typical unit costs for concrete work, earthwork, and other requirements.

The costs of new storm drain systems were based on a unit cost per linear foot for the required pipe diameter. The unit cost includes the pipe, excavation, transitions, and all appurtenances.

The costs of roadway crossing improvements were also based on a unit cost per linear foot for the required culvert size. The unit cost includes excavation and embankment as well as required headwalls and wingwalls and other appurtenances necessary for construction.

The costs of reach channel improvements were estimated as a linear foot cost based on recent channel projects completed in Sand Creek and surrounding basins. Reach channel Improvements include channel grading, bank stabilization, drop structures, revegetation, and all other construction elements needed along each channel segment. Only road crossings are included in separate cost items.

The costs of spot channel improvements such as localized erosion control and stabilization measures were estimated as a lump sum based on recent projects in the basin. Each spot improvement assumes a project length of 250 LF. In order to account for variations in stream width, three types of spot improvements are identified. Small improvements correspond to upstream locations with top widths less than 90'. Medium improvements correspond to locations with top widths between 90' and 150' while large improvements correspond to locations where spot improvements are required on channels greater than 150' in top width.

A summary of the unit costs is provided in Table 8-1 and Table 8-2.

Table 8-1. Unit Costs for Sand Creek DBPS Cost Estimates

Facility	Unit	Unit Cost	Notes
Engineered Channel ID 1 (TW = 92')	LF	$600	Based on CCS CIP Channel Costs
Engineered Channel ID 2 (TW = 120')	LF	$800	Based on CCS CIP Channel Costs
Engineered Channel ID 3 (TW = 168')	LF	$1,200	Based on CCS CIP Channel Costs
Engineered Channel ID 4 (TW = 200')	LF	$2,400	Based on CCS CIP Channel Costs
Natural Channel ID 5 (TW = 84')	LF	$400	Based on CCS CIP Channel Costs
Natural Channel ID 6 (TW = 144')	LF	$700	Based on CCS CIP Channel Costs
Natural Channel ID 7 (TW = 188')	LF	$1,000	Based on CCS CIP Channel Costs
Natural Channel ID 8 (TW = 284')	LF	$2,000	Based on CCS CIP Channel Costs
Small Spot Channel Improvement	EA	$250,000	Estimated Improvement Length of 250'
Medium Spot Channel Improvement	EA	$350,000	Estimated Improvement Length of 250'
Large Spot Channel Improvement	EA	$550,000	Estimated Improvement Length of 250'
Concrete Channel Improvement	LF	$1,000	Based on CDOT Cost Data Book 2019
48" RCP	LF	$350	Based on CDOT Cost Data Book 2019
60" RCP	LF	$450	Based on CDOT Cost Data Book 2019
72" RCP	LF	$550	Based on CDOT Cost Data Book 2019
84" RCP	LF	$650	Based on CDOT Cost Data Book 2019
Box Culvert < 50 SF	LF	$1,000	Based on MHFD Bid Item Pricing v8.0.
Box Culvert 50 < 74 SF	LF	$1,400	Based on MHFD Bid Item Pricing v8.0.
Box Culvert 75 < 99 SF	LF	$1,700	Based on MHFD Bid Item Pricing v8.0.
Box Culvert 100 < 150 SF	LF	$2,000	Based on MHFD Bid Item Pricing v8.0.
Box Culvert > 150 SF	LF	$2,500	Based on MHFD Bid Item Pricing v8.0.
Sand Creek DBPS Report	EA	$500,000	City Cost