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The Cottages at Mesa Ridge
Final Drainage Report

August 2022

HR Green Project No: 200541

PCD File No. SF2214

Prepared For:

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Prepared By:

HR Green Development, LLC

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▷ ENGINEER'S STATEMENT

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

_____

Ken Huhn, PE Date

Registered Professional Engineer State of Colorado No._____

For and on behalf of HR Green Development, LLC

▷ DEVELOPER'S STATEMENT

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

_____

Name of Developer Authorized Signature Date

_____

Printed Name Title Address

▷ EL PASO COUNTY

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

_____

Jennifer Irvine, P.E.

County Engineer/ECM Administrator

HR GREEN: ADDRESSED

Please revise to Joshua Palmer

Table of Contents

Appendices

I. General Purpose, Location and Description

a. Purpose

The purpose of this Final Drainage Report (FDR) is to describe the onsite and offsite drainage patterns, existing and proposed storm infrastructure, and the planned stormwater management for The Cottages at Mesa Ridge. This report will support the development plan that is currently in review with El Paso County.

b. Location

The Cottages at Mesa Ridge, referred to as 'the site' herein, is in a portion of the northeast quarter of section 29, the southeast quarter of section 20, the southwest quarter of section 21, and the northwest quarter of section 28, township 15 south, range 65 west of the 6th P.M., County of El Paso, Colorado. The site is bound by S. Powers Boulevard to the east, multi-family residential development to the south, single-family residential development to the west and undeveloped land to the north. Surrounding platted developments include Mesa Ridge Filing 8 and 9 to the south, Sunrise Ridge to the west and the Glen at Widefield to the east. A vicinity map is presented in Appendix A.

c. Description of Property

The site is approximately 10.22 acres of undeveloped land with existing vegetation consisting of native grasses. Once developed, the site will include 122 dwelling units, a club house and open space tracts. The site will be platted as a single lot. In general, the site slopes south towards the Fountain Mutual Irrigation Co canal. Onsite elevations range from 5750' - 5795' with slopes ranging 1 – 33%. Per a NRCS soil survey, the site is made up of Type B Stoneham sandy loam and Type B Nelson-Tassel fine sand loams. The NRCS soil survey is presented in Appendix A.

There are no major drainageways or irrigation facilities that traverse the site nor does the site fall within the Streamside Overlay Zone. Onsite, existing utilities include water, sewer, fiberoptic, underground gas and underground electric/telecommunication. An existing drainage map is presented in Appendix F.

d. Floodplain Statement

Based on FEMA Firm map 08041C0956G dated December 8, 2018, the site is Zone X, which are areas determined to be outside the 0.2% annual chance flood.

II. Drainage Basins and Subbasins

a. Major Basin Description

The site is located within West Fork Jimmy Camp Creek Drainage Basin. The site's drainage characteristics were previously studied in the following reports:

1. "West Fork Jimmy Camp Creek Drainage Basin Planning Study" prepared by Kiowa Engineering Corporation, October 2003, revised.
2. "Master Development Drainage Plan Mesa Ridge Development" prepared by Kiowa Engineering Corporation, December 17, 2006. (2006 MDDP)
3. "Mesa Ridge Development Master Development Drainage Plan Update" prepared by Kiowa Engineering Corporation, January 15, 2013. (2013 MDDP)

In the 2006 MDDP, the site was identified as Basin 1040 and Basin 1030. Basin 1040 was planned to be routed to Detention Basin D (located within Mesa Ridge Subdivision Filing 8) while Basin 1030 was routed to

Detention Basin 1031 (located on the east side of S. Powers Boulevard adjacent to the site). The 2013 MDDP did not alter the planned detention scenario for the site.

b. Existing Subbasin Description

The site's existing drainage is split into five basins. An existing drainage map is presented in Appendix B. See below for existing basin descriptions:

Basin EX1 is 5.69 acres of undeveloped area and existing single family residential lots. Existing stormwater from this basin (Q_5 = 2.5 cfs Q_{100} = 13.7 cfs) is conveyed onsite to DP1.

Basin EX2 is 3.12 acres of undeveloped area and a portion of S. Powers Boulevard. Existing stormwater from this basin (Q_5 = 4.2 cfs Q_{100} = 12.4 cfs) follows historic drainage patterns to an existing roadside swale to DP2. The flow is captured in an existing area inlet at DP2 and conveyed underneath S. Powers Boulevard in a 24" RCP culvert to an existing, temporary sediment basin.

Basin EX3 is 1.46 acres of undeveloped area. Existing stormwater from this basin (Q_5 = 1.6 cfs Q_{100} = 5.1 cfs) is conveyed to the existing irrigation canal to DP3.

Basin EX4 is 0.28 acres of undeveloped area. Existing stormwater from this basin (Q_5 = 0.1 cfs Q_{100} = 0.8 cfs) is conveyed in an existing roadside swale to DP4.

Basin EX5 is 3.38 acres of undeveloped area and existing single family residential lots. Existing stormwater from this basin (Q_5 = 2.8 cfs Q_{100} = 11.9 cfs) flows offsite along the site's southern boundary at DP5.

c. Proposed Subbasin Description

The proposed site has been divided into 9 subbasins for analysis. All storm sewer and appurtenances are private. A drainage map has been presented in Appendix F. See below for basin descriptions:

Basin 1 is 3.67 acres of single-family residential lots, duplex homes, roadway and landscaping. Stormwater from this basin (Q_5 = 7.4 cfs Q_{100} = 15.3 cfs) is conveyed in curb and gutter to a 15' Type R on-grade inlet at DP5. Basin 1 stormwater is piped in proposed storm sewer along the north side of Landover Lane. From there, the flow is piped in an existing 48" culvert to the existing full spectrum detention pond (Basin D) for water quality and detention.

Basin 2 is 4.83 acres of single-family residential lots, duplex homes, roadway and landscaping. Stormwater from this basin (Q_5 = 9.7 cfs Q_{100} = 20.5 cfs) is conveyed in curb and gutter to a 15' Type R on-grade inlet at DP1. Basin 2 stormwater is piped in proposed storm sewer along the north side of Landover Lane. From there, the flow is piped in an existing 48" culvert to the existing full spectrum detention pond (Basin D) for water quality and detention.

Basin 2A is 0.13 acres of club house and patio area. Stormwater from this basin (Q_5 = 0.6 cfs Q_{100} = 1.1 cfs) is conveyed in curb and gutter to 3' Type C sump inlet at DP1A. Basin 2A stormwater is piped in proposed storm sewer along the north side of Landover Lane. From there, the flow is piped in an existing 48" culvert to the existing full spectrum detention pond (Basin D) for water quality and detention.

Basin 3 is 3.03 acres of existing roadway (S. Powers Boulevard), compacted breeze trail and undeveloped area. Stormwater from this basin (Q_5 = 3.4 cfs Q_{100} [illegible] historic drainage patterns in an existing roadside swale to an existing Type C inlet at DP2. [illegible] culvert conveys to flow to an existing, temporary sediment basin. Per Section I.7.1.B.7 and I.7.1.B.9 of the EPCDCM Appendix I – Stormwater

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Quality Policy and Procedures, Basin 3 will not be routed to a permanent stormwater control measure. The trail improvements associated with Basin 3 will not increase existing stormwater flows.

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Basin 4 is 0.48 acres of landscaping and [illegible]. Stormwater from this basin (Q_5 = 0.3 cfs Q_{100} = 1.7 cfs) follows historic drainage patterns towards the Fountain Irrigation Ditch at DP3. From there, flow is conveyed under S. Powers Blvd in an existing box culvert (size unknown) to an existing, temporary sediment basin. Per Section I.7.1.B.7 and I.7.1.B.9 of the El Paso County Appendix I – Stormwater Quality Policy and Procedures, Basin 4 will not be routed to a permanent stormwater control measure. The basin will remain mostly undeveloped with a proposed trail and retaining wall. The trail and retaining wall improvements associated with Basin 4 will not increase existing stormwater flows.

Basin 5 is 1.63 acres of landscaping and a fire access road. Stormwater from this basin (Q_5 = 2.6 cfs Q_{100} = 6.7 cfs) is captured in a grass-lined swale and captured in a Type C inlet at DP4. Basin 5 stormwater is piped in proposed storm sewer along the north side of Landover Lane. From there, the flow is piped in an existing 48" culvert to the existing full spectrum detention pond (Basin D) for water quality and detention.

Basin 6 is 0.60 acres of undeveloped area. Stormwater from this basin (Q_5 = 0.2 cfs Q_{100} = 1.2 cfs) follows historic drainage patterns to an existing roadside swale along S. Powers Boulevard at DP6 and continues south along S. Powers in a roadside ditch that outfalls into existing Detention Basin D. Basin 6 will remain undeveloped and will not increase existing stormwater flows.

Basin 7 is 0.45 acres of landscaping and existing single family residential. Stormwater from this basin (Q_5 = 0.4 cfs Q_{100} = 1.3 cfs) follows historic drainage patterns towards DP7. From there, the flow continues into Mesa Ridge Subdivision Filing 8 where it is captured and detained in Basin D. See Basin 1040 from the Mesa Ridge Filing No. 8 FDR for additional detail.

Basin 8 is 0.26 acres of roadway. Stormwater from this basin (Q_5 = 1.1 cfs Q_{100} = 2.1 cfs) is conveyed in curb and gutter down Landover Lane to a 15' Type R inlet at DP8. Basin 8 stormwater is piped in proposed storm sewer along the north side of Landover Lane. From there, the flow is piped in an existing 48" culvert to the existing full spectrum detention pond (Basin D) for water quality and detention.

Basin 9 is 0.17 acres of roadway. Stormwater from this basin (Q_5 = 0.8 cfs Q_{100} = 1.4 cfs) is conveyed in curb and gutter down Landover Lane to a 10' Type R inlet at DP9. Basin 9 stormwater is piped in proposed storm sewer along the north side of Landover Lane. From there, the flow is piped in an existing 48" culvert to the existing full spectrum detention pond (Basin D) for water quality and detention.

III. Drainage Design Criteria

a. Development Criteria Reference

Storm drainage analysis and design criteria for the project were taken from the "*Drainage Criteria Manual of EL Paso County, Colorado"* Volumes 1 and 2 (EPCDCM), current adopted version, and Chapter 6 and Section 3.2.1 of Chapter 13 of the "*Colorado Springs Drainage Criteria Manual*" (CCSDCM), dated May 2014, as adopted by El Paso County, as well as the July 2019 El Paso County Engineering Criteria Manual update.

b. Hydrologic Criteria

Hydrologic data was obtained from the "*City of Colorado Springs Drainage Criteria Manual – Chapter 6 Hydrology".* Onsite drainage improvements are designed for the 5-year storm (minor event) and 100-year storm (major event) using rainfall values from CCSDCM Table 6-2 below. Runoff was calculated per CCSDCM Section 6.3.0 - Rational Method. Full spectrum pond design was completed using the latest version

of Mile High Flood District's (MHFD) UD-Detention per CCSDCM Section 13.3.2.1 – Full Spectrum Detention in addition to CUHP v.2.0.1 and EPA-SWMM v.5.1. Detention pond allowable release rate will be limited to less than or equal to those noted in the 2013 Mesa Ridge MDDP.

Table 6-2: Rainfall Depths for Colorado Springs		
Return Period (yr)	5	100
1-hr Rainfall Depth (in)	1.50	2.52

IV. Drainage Facility Design

a. General Concept

Onsite stormwater will be conveyed via Type 5 curb and gutter to Type R inlets. Captured stormwater will be piped to and detained in an existing, full spectrum detention pond located in Mesa Ridge Filing 9 south of the site. The full spectrum detention pond will outfall at less than historic values to the east side of S. Powers Boulevard and to the site's historic outfall. See below section regarding the existing detention basin analysis and retrofit. The ultimate outfall for the site is Jimmy Camp Creek, south of Hale Reservoir.

b. Water Quality & Detention

The Cottages at Mesa Ridge will utilize the existing regional Full Spectrum Detention Basin D for water quality and detention. Detailed analysis performed with this Report indicates that in its existing condition, there is adequate 100-year volume in the Detention Basin D for development of The Cottages at Mesa Ridge site. However, there are some concerns regarding the detention pond drain times. See discussion below for details on the analysis completed on Detention Basin D.

This pond was included originally as flood control in the 2006 MDDP and was updated to provide Full Spectrum detention with the 2013 MDDP. In addition, the record drawings for the retrofit of the pond confirmed the use of an orifice plate to control the full spectrum volume. Record documents are titled: *Mesa Ridge Filings 8 & 9, Detention Basin 'D', Full Spectrum Detention Modifications, Final Design Drawings*, by Kiowa Engineering Corporation, dated October 2011. Both MDDPs show Basin 1040 routed to Full Spectrum Detention Basin D. However, the basin characteristics provided with the most recent MDDP included The Cottages at Mesa Ridge site as historic.

In order to confirm that the existing Full Spectrum Detention Basin D has capacity for development of The Cottages at Mesa Ridge, updated modeling with proposed basin 1040 characteristics is necessary and presented in Appendix D.

Hydrology and hydraulics included with the previous MDDPs utilized HEC-1 software to determine peak runoff quantities at specific design points and routing elements. These HEC-1 models were not available for use, so an effort was made to update them to the more current HEC-HMS program. However, there were too many unknown variables with the program to get it to provide reliable results.

Current CCSDCM V.1 CH.6 1.4 Selecting Methods for Estimating Design Flows notes in part that:

- For more complex drainage basins and routing requirements, the HEC-HMS model or the EPA SWMM method is better suited but requires more experience and expertise to properly apply. The EPA SWMM

method also provides hydrographs, reservoir routing, and the ability to evaluate runoff reduction practices in detail.

- If detention facilities are to be sized based on hydrograph routing, or if hydrograph information is desired for any other reason, the EPA SWMM or the NRCS method must be used.

Therefore, CUHP and EPA SWMM methodology were selected as appropriate modeling programs to confirm volumes and release rates for Full Spectrum Detention Basin D are in line with the intent of the previous MDDPs and current CCSDCM criteria.

CUHP

A new CUHP model was prepared streamlined with only the MDDP basins being updated at this time and major basins tributary to Full Spectrum Detention Basin D. This includes Basin 1040, 6001, 6005, 6010, 6011 and 6020. Basin parameters included in the CUHP as follows:

- Basin parameters for Basin 1040 were updated based on the most current design information available and correspond to the Rational Method calculations noted elsewhere in this report. The area to Basin 1040 increased from what was accounted for in the previous MDDPs.
- Basins 6001, 6005, 6010, 6011 and 6020 used area and length parameters taken directly from the HEC-1 noted above.
- Basins 6001, 6005, 6010, 6011 and 6020 utilized percent impervious estimated from existing as-constructed land uses.
- All basins used the standard depression storage and infiltration parameters for Hydrologic Soil Type B.

Rainfall data was taken from NOAA Atlas 14 Point Precipitation for a 60-minute (1-hour) recurrence interval depth, 100=2.74 in. The 1-hour point precipitation was chosen in part because the MHFD-Detention worksheet uses the 1-hour depth as an input parameter to run the CUHP program in the background. This allows a more accurate review of the existing pond by using consistent storms across both the CUHP and MHFD-Detention software.

Input parameters and results for the 100-year event are included with Appendix D.

EPA SWMM

Similar to the CUHP modeling, a simplified hydraulic routing model was prepared. In this case, the U.S. Environmental Protection Agency Stormwater Management Model (EPA SWMM) software was used for the proposed conditions with the development of The Cottages at Mesa Ridge.

The model includes a stage-storage curve for Pond D extracted directly from the pond grading shown on the 2011 Full Spectrum Detention Modifications Plan noted above. The proposed Pond D stage-release curve was developed through an iterative process, described more in depth below.

The other separate existing pond (Detention Basin 6002) which is tributary to Pond D provides storage for Basin 6001. Parameters for modeling Detention Basin 6002 were taken directly from the 2013 MDDP HEC-1. Additionally, EPA SWMM element routing parameters such as channel length and size were taken directly from the previous HEC-1 model with the exception of elevations (not used in HEC-1). For this a reasonable starting (downstream) elevation was used from the Pond D plans, and slope/length parameters from HEC-1 used to set all other upstream elevations. A back-check was completed to ensure resultant upstream elevations seem reasonable given rough elevations on 2013 MDDP Exhibit.

Input parameters and results for the 100-year event are included with Appendix D.

Full Spectrum Detention Basin D

MHFD-Detention worksheets were set up using updated total watershed area and percent imperviousness for several reasons, they include:

- To confirm the updated full spectrum volume required within Pond D. Note, because an inflow hydrograph will be used for the 5-year and 100-year events only the resultant full spectrum volumes are relevant from this data.
- To review how the existing pond is functioning under the proposed condition by incorporating the as-built stage-storage and stage-release data into the workbook. Note, the release structure was surveyed to provide accurate structure parameters.
- To route the 5-year and 100-year hydrographs developed in the CUHP and EPA SWMM through the provided pond volume and as-built release structure.

MHFD-Detention (as-built) results from routing the proposed 100-year hydrograph through the as-built pond volume and release structure indicate that there is adequate 100-year volume in the existing pond for development of The Cottages at Mesa Ridge site. However, results also indicate that the existing pond is exceeding drain time limitations noted in current MHFD criteria and Colorado Revised Statute 37-92-602(8).

To rectify the drain times discrepancy a separate MHFD-Detention (proposed) worksheet was set up matching the previously noted stage-storage curve and input hydrograph but altering the release structure (and corresponding stage-release curve). The drain times were revised by enlarging the orifice areas and updating the detention stages to correlate with the new Full Spectrum volume. Once the 100-year peak release rate was confirmed to be at or below the threshold established with the 2013 MDDP (233 cfs) the resultant stage-release curve was transferred back to the prepared SWMM and re-run to confirm the same results as found with the MHFD-Detention (proposed) analysis. Note the existing structure box size becomes the limiting element controlling release in the 100-year event, not the restrictor plate.

Key pond parameters from the 2011 Full Spectrum Detention Modifications Plan along with the values determined with this Final Drainage Report are summarized below.

Full Spectrum Detention Basin D Summary

	2011 Full Spectrum Modifications	As-Built Pond D without Modifications	As-Built Pond D with Proposed Modifications
Tributary Area (acres)	not provided	98.8	98.9
% Impervious (%)	not provided	48.8	49.1
Full Spectrum Volume (acre-ft)	4.2	5.1	5.2
Full Spectrum WSEL (ft)	5686.8	5687.2	5687.3
Full Spectrum Drain Time (hrs)	not provided	> 120	71
100-yr volume (acre-ft)	8.3	11.6	14.3
Release Rate (cfs)	219	252	230
100-yr WSEL (ft)	5690.2	5691.2	5692.7
100-yr Drain Time (hrs)	not provided	> 120	70

Conclusions from the analysis presented with this Report are that Full Spectrum Detention Basin D will function as intended in the proposed conditions taking into consideration the Basin 1040 changes (including increase in basin area) that will occur with development of The Cottages at Mesa Ridge. No modifications to the as-built volume are anticipated at this time. Modifications are required to the release structure to bring the existing pond in conformance with current drain time and stage-storage requirements. The detailed extent of modifications to the existing structure have been presented in Appendix E.

c. Operation and Maintenance

An Operation and Maintenance (O&M) manual was previously approved for Detention Basin D. The pond is privately maintained by Mesa Ridge Metropolitan District No. 1. The manual will be provided once made available. The manual specifies maintenance intervals and required actions to maintain the function of the extended detention basin and appurtenances.

d. Grading and Erosion Control Plan

Due to the project disturbance area, a separate Grading and Erosion Control plan will be required. The Grading and Erosion Control Plan has been submitted to El Paso County and City of Fountain in conjunction with the Final Drainage Report and Construction Drawings.

e. Four Step Method to Minimize Adverse Impacts of Urbanization

Step 1 – Reducing Runoff Volumes: Roof drains will route across landscape areas and grass lined swales are used for stormwater conveyance, whenever possible to promote infiltration.

Step 2 – Treat and slowly release the WQCV: An existing, regional full spectrum detention pond provides water quality for the site. The WQCV is released over a period of 41 hours.

Step 3 – Stabilize stream channels: Drainage swales will be lined with non-erosive soils and permanently seeded to provide stabilization. If required due to erosive velocities, additional protection will be provided in the form of riprap lining and drop structures to reduce stormwater velocities and provide stabilization.

Step 4 – Consider the need for source controls: No industrial or commercial uses are proposed within this development and therefore no source controls are proposed.

f. Drainage and Bridge Fees

Cottages at Mesa Ridge is located within the West Fork Jimmy Camp Creek drainage basin. See below for drainage fees associated with The Cottages at Mesa Ridge development. Fees are due at time of platting.

2022 Drainage & Bridge Fees						
Site Acreage (ac)	Site Impervious (%)	Impervious Area (ac)	Drainage Fee/ Impervious Acre	Drainage Fee	Bridge Fee/ Impervious Acre	Bridge Fee
10.22	55	5.62	$14,470	**$81,336**	$4,281	**$24,060**

V. Summary

The Cottages at Mesa Ridge development remains consistent with pre-development drainage conditions with the construction of the recommended drainage improvements. The proposed development will not adversely affect downstream stormwater infrastructure or surrounding developments. This report meets the latest El Paso County Drainage criteria and is in accordance with the Mesa Ridge MDDP.

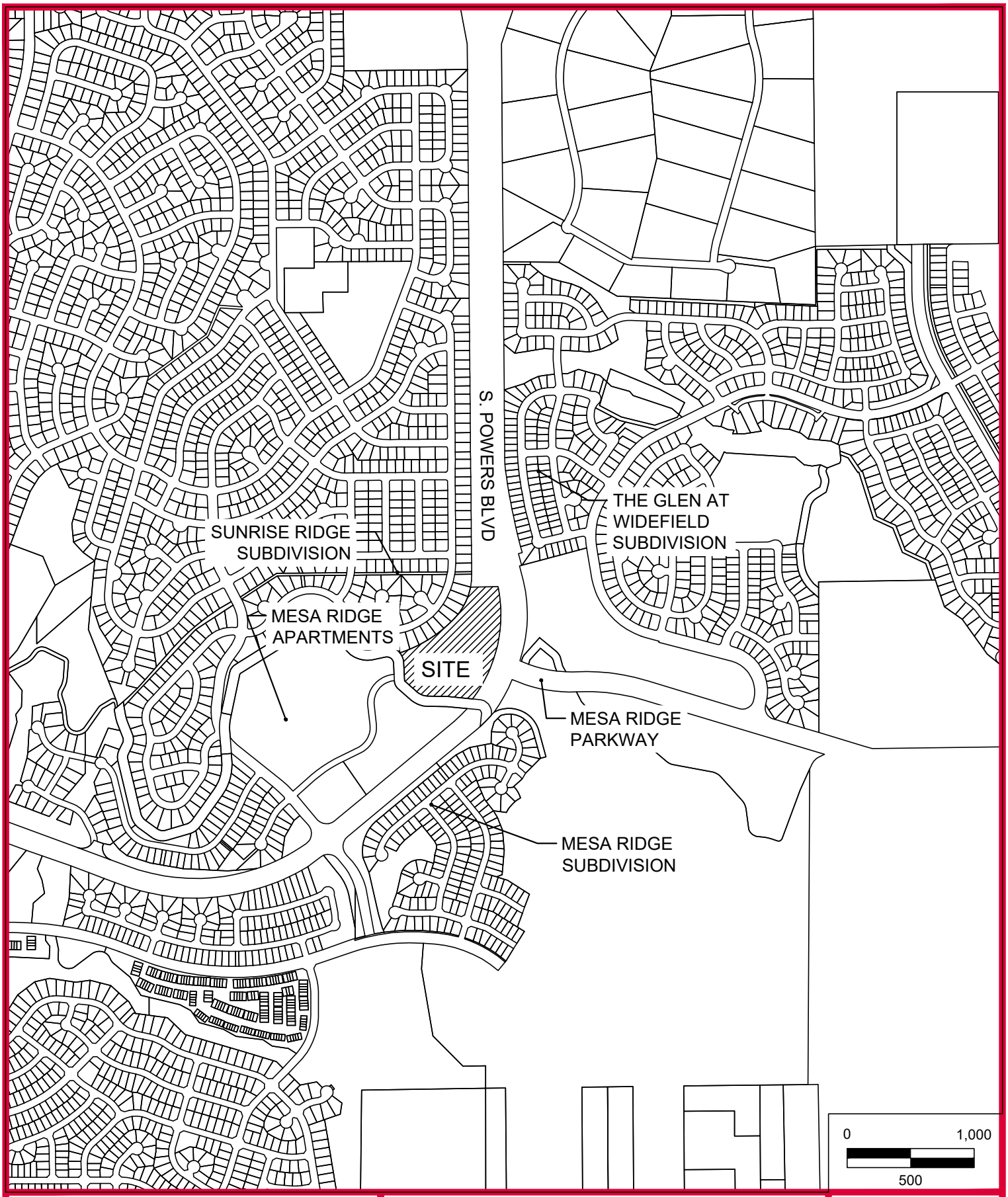
VI. Drawings

Please refer to the Appendix F for existing and proposed drainage maps.

VII. References

1. City of Colorado Springs – Drainage Criteria Manual, May 2014, Revised January 2021.
2. Urban Storm Drainage Criteria Manual, Mile High Flood District, January 2018.
3. *Master Development Drainage Plan Mesa Ridge Development*, Kiowa Engineering Corporation, December 17, 2006.
4. *Mesa Ridge Development Master Development Drainage Plan Update*, Kiowa Engineering Corporation, January 15, 2013.
5. *Mesa Ridge Filings 8 & 9, Detention Basin 'D', Full Spectrum Detention Modifications, Final Design Drawings*, by Kiowa Engineering Corporation, October 2011.
6. Colorado Unit Hydrograph Procedure (CUHP), Version 2.0.1, October 2019.
7. Environmental Protection Agency Stormwater Management Model (EPA SWMM), Version 5.1, 2020.
8. Mile High Flood District Detention Basin Design Workbook (MHFD-Detention), Version 4.04, February 2021.

APPENDIX A – VICINITY MAP, SOIL MAP, FEMA MAP



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NORTH

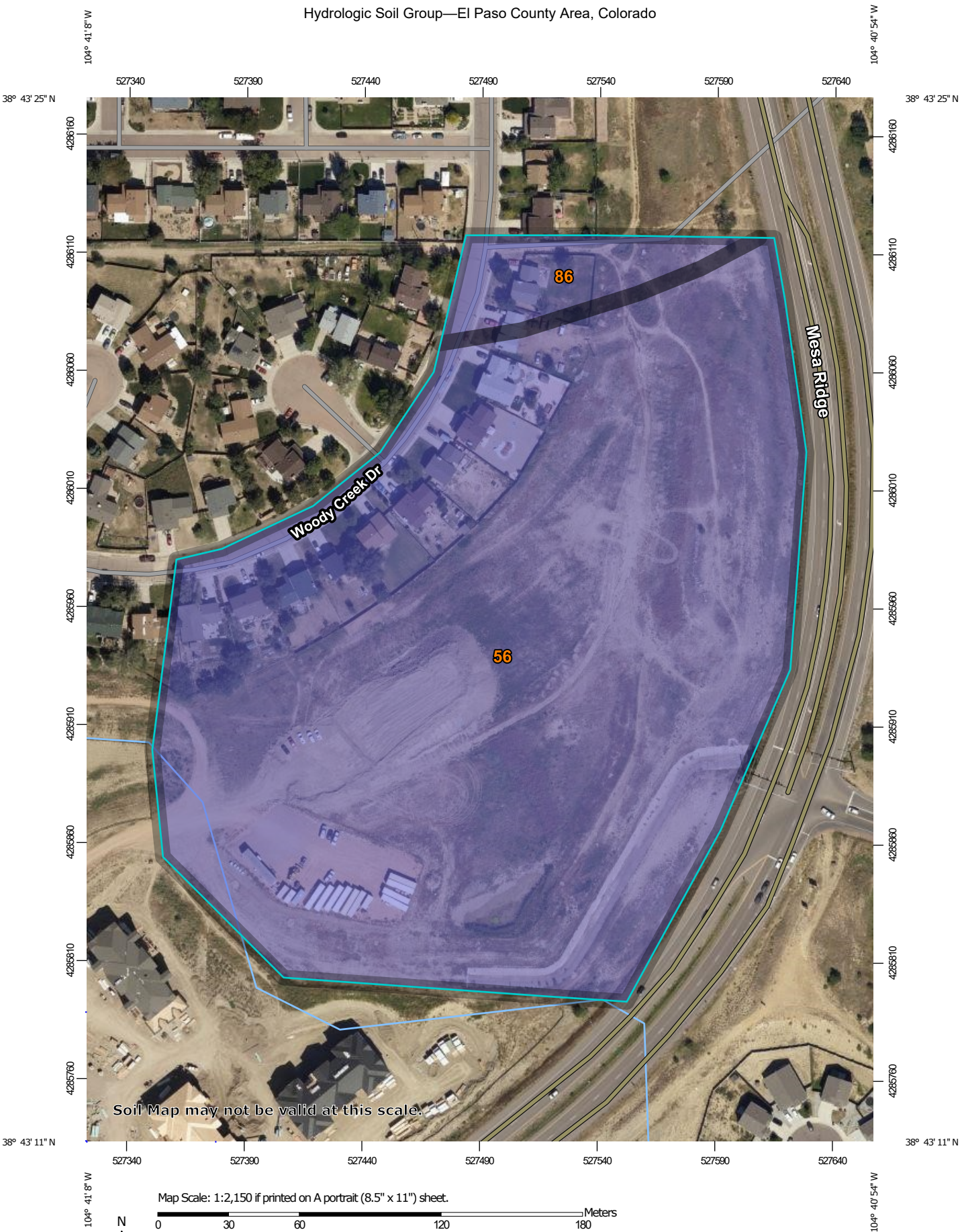
SHEET

VICINITY MAP

SCALE: 1"=1,000'

DATE: 03/29/2021

Xrefs: 8.5x11_Titleblock



Map Scale: 1:2,150 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Aug 14, 2018—Sep 23, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	B	15.6	94.7%
86	Stoneham sandy loam, 3 to 8 percent slopes	B	0.9	5.3%
Totals for Area of Interest			**16.5**	**100.0%**

Description

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

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

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

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

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

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

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

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 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/.

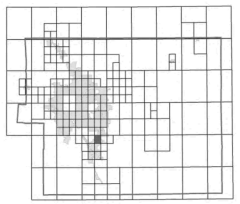
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

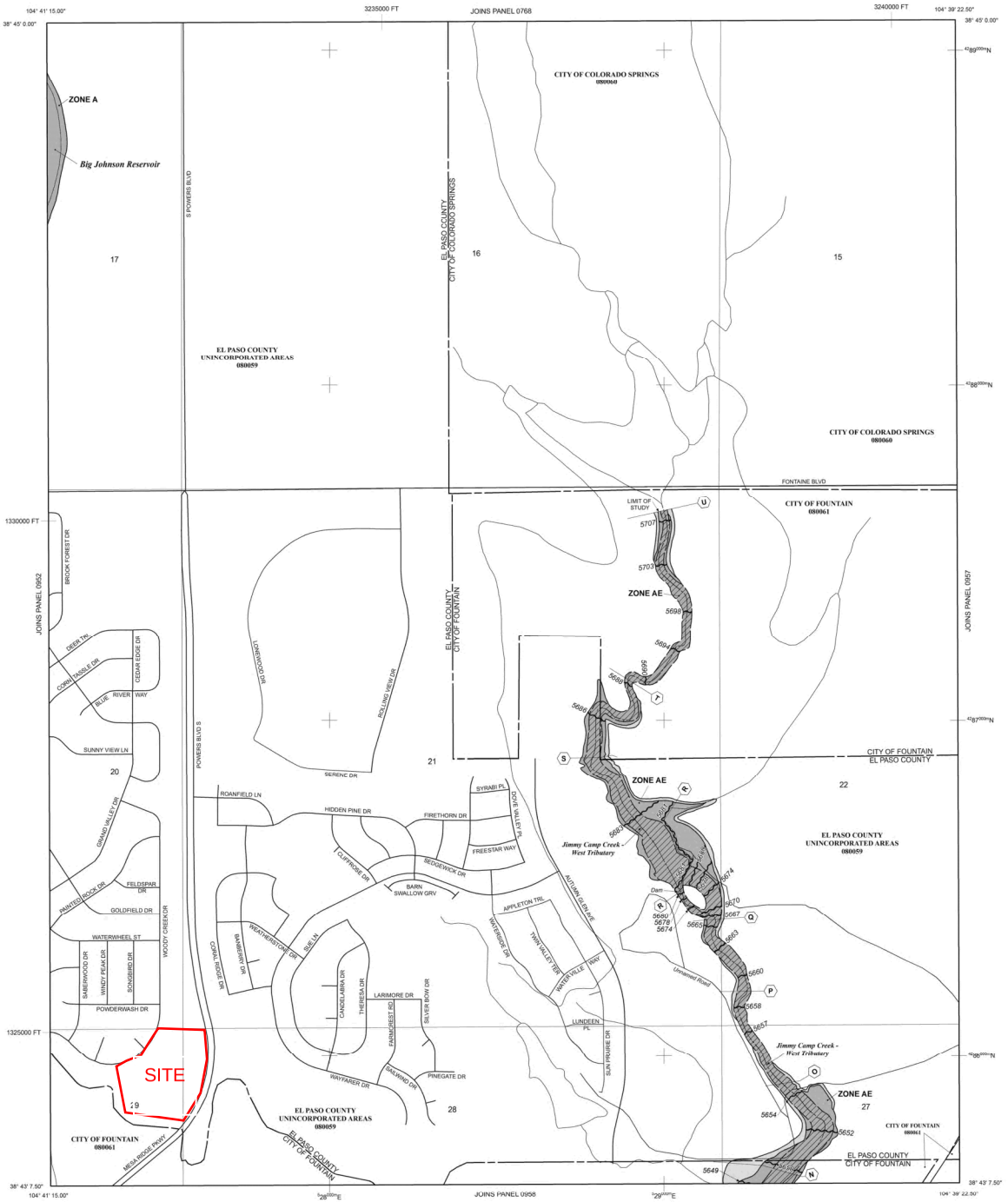
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

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 15 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 encroachments 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)
4279000mN — 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

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0956G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS
PANEL 956 OF 1300
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0956	G
EL PASO COUNTY	080059	0956	G
FOUNTAIN, CITY OF	080061	0956	G

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
08041C0956G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

NOAA Atlas 14, Volume 8, Version 2
Location name: Widefield, Colorado, USA*
Latitude: 38.7212°, Longitude: -104.684°
Elevation: 5774.67 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.253** (0.208-0.313)	**0.304** (0.250-0.377)	**0.395** (0.323-0.491)	**0.478** (0.388-0.596)	**0.603** (0.476-0.792)	**0.707** (0.541-0.940)	**0.819** (0.603-1.12)	**0.940** (0.659-1.32)	**1.11** (0.746-1.61)	**1.25** (0.811-1.83)
10-min	**0.371** (0.305-0.459)	**0.446** (0.366-0.552)	**0.579** (0.473-0.719)	**0.700** (0.569-0.873)	**0.883** (0.696-1.16)	**1.04** (0.793-1.38)	**1.20** (0.882-1.64)	**1.38** (0.965-1.93)	**1.63** (1.09-2.35)	**1.83** (1.19-2.67)
15-min	**0.452** (0.372-0.559)	**0.544** (0.446-0.673)	**0.706** (0.577-0.877)	**0.854** (0.694-1.07)	**1.08** (0.849-1.42)	**1.26** (0.967-1.68)	**1.46** (1.08-2.00)	**1.68** (1.18-2.36)	**1.99** (1.33-2.87)	**2.23** (1.45-3.26)
30-min	**0.655** (0.538-0.810)	**0.785** (0.645-0.972)	**1.02** (0.833-1.26)	**1.23** (1.00-1.54)	**1.55** (1.22-2.04)	**1.82** (1.39-2.42)	**2.11** (1.55-2.88)	**2.42** (1.70-3.40)	**2.87** (1.92-4.14)	**3.23** (2.09-4.71)
60-min	**0.851** (0.699-1.05)	**0.998** (0.819-1.24)	**1.28** (1.04-1.59)	**1.55** (1.25-1.93)	**1.97** (1.56-2.61)	**2.34** (1.80-3.13)	**2.74** (2.02-3.77)	**3.19** (2.25-4.51)	**3.84** (2.58-5.58)	**4.38** (2.84-6.39)
2-hr	**1.05** (0.865-1.29)	**1.21** (1.00-1.49)	**1.54** (1.26-1.90)	**1.86** (1.52-2.31)	**2.38** (1.92-3.16)	**2.85** (2.21-3.81)	**3.37** (2.52-4.62)	**3.96** (2.81-5.57)	**4.82** (3.27-6.97)	**5.54** (3.62-8.03)
3-hr	**1.15** (0.955-1.41)	**1.31** (1.09-1.61)	**1.65** (1.36-2.02)	**2.00** (1.64-2.46)	**2.58** (2.09-3.43)	**3.11** (2.43-4.16)	**3.71** (2.79-5.09)	**4.40** (3.15-6.19)	**5.42** (3.70-7.82)	**6.27** (4.12-9.06)
6-hr	**1.32** (1.10-1.60)	**1.48** (1.24-1.81)	**1.85** (1.54-2.26)	**2.24** (1.85-2.75)	**2.91** (2.38-3.87)	**3.53** (2.79-4.71)	**4.24** (3.21-5.79)	**5.05** (3.65-7.08)	**6.27** (4.33-9.00)	**7.29** (4.84-10.5)
12-hr	**1.47** (1.23-1.77)	**1.68** (1.41-2.03)	**2.11** (1.77-2.56)	**2.55** (2.12-3.11)	**3.29** (2.70-4.31)	**3.96** (3.13-5.21)	**4.71** (3.59-6.36)	**5.56** (4.04-7.71)	**6.82** (4.74-9.71)	**7.87** (5.27-11.2)
24-hr	**1.64** (1.39-1.97)	**1.91** (1.62-2.30)	**2.43** (2.05-2.93)	**2.93** (2.46-3.55)	**3.73** (3.06-4.80)	**4.42** (3.52-5.75)	**5.19** (3.97-6.91)	**6.04** (4.41-8.27)	**7.27** (5.09-10.2)	**8.29** (5.60-11.7)
2-day	**1.85** (1.57-2.20)	**2.19** (1.86-2.61)	**2.80** (2.37-3.35)	**3.36** (2.83-4.04)	**4.22** (3.47-5.35)	**4.94** (3.94-6.34)	**5.72** (4.40-7.54)	**6.57** (4.83-8.91)	**7.79** (5.48-10.9)	**8.77** (5.98-12.3)
3-day	**2.00** (1.71-2.37)	**2.35** (2.01-2.79)	**2.98** (2.54-3.56)	**3.57** (3.02-4.27)	**4.46** (3.68-5.63)	**5.21** (4.17-6.65)	**6.01** (4.64-7.89)	**6.89** (5.09-9.30)	**8.14** (5.77-11.3)	**9.16** (6.28-12.8)
4-day	**2.14** (1.83-2.53)	**2.49** (2.14-2.96)	**3.14** (2.68-3.73)	**3.74** (3.17-4.46)	**4.64** (3.84-5.85)	**5.41** (4.35-6.90)	**6.25** (4.84-8.17)	**7.15** (5.30-9.63)	**8.44** (6.00-11.7)	**9.49** (6.54-13.3)
7-day	**2.55** (2.20-3.00)	**2.93** (2.52-3.45)	**3.62** (3.10-4.28)	**4.25** (3.62-5.05)	**5.21** (4.34-6.52)	**6.03** (4.88-7.63)	**6.90** (5.38-8.97)	**7.86** (5.87-10.5)	**9.22** (6.60-12.7)	**10.3** (7.16-14.4)
10-day	**2.91** (2.51-3.41)	**3.33** (2.87-3.91)	**4.07** (3.51-4.80)	**4.75** (4.07-5.63)	**5.78** (4.82-7.17)	**6.63** (5.38-8.34)	**7.55** (5.90-9.75)	**8.53** (6.39-11.4)	**9.93** (7.14-13.6)	**11.1** (7.71-15.3)
20-day	**3.85** (3.35-4.49)	**4.42** (3.85-5.16)	**5.40** (4.68-6.32)	**6.25** (5.38-7.35)	**7.46** (6.24-9.14)	**8.44** (6.88-10.5)	**9.46** (7.44-12.1)	**10.5** (7.93-13.8)	**12.0** (8.69-16.3)	**13.2** (9.25-18.1)
30-day	**4.62** (4.04-5.36)	**5.32** (4.65-6.19)	**6.50** (5.65-7.57)	**7.48** (6.47-8.76)	**8.86** (7.41-10.7)	**9.94** (8.11-12.2)	**11.0** (8.70-14.0)	**12.1** (9.18-15.9)	**13.6** (9.92-18.4)	**14.8** (10.5-20.3)
45-day	**5.59** (4.91-6.46)	**6.46** (5.66-7.48)	**7.86** (6.87-9.13)	**9.02** (7.83-10.5)	**10.6** (8.86-12.7)	**11.8** (9.63-14.4)	**12.9** (10.2-16.3)	**14.1** (10.7-18.3)	**15.6** (11.4-20.9)	**16.8** (11.9-22.9)
60-day	**6.43** (5.66-7.41)	**7.43** (6.53-8.57)	**9.02** (7.90-10.4)	**10.3** (8.98-12.0)	**12.0** (10.1-14.4)	**13.3** (10.9-16.2)	**14.5** (11.5-18.2)	**15.7** (12.0-20.3)	**17.3** (12.6-23.0)	**18.4** (13.1-25.0)

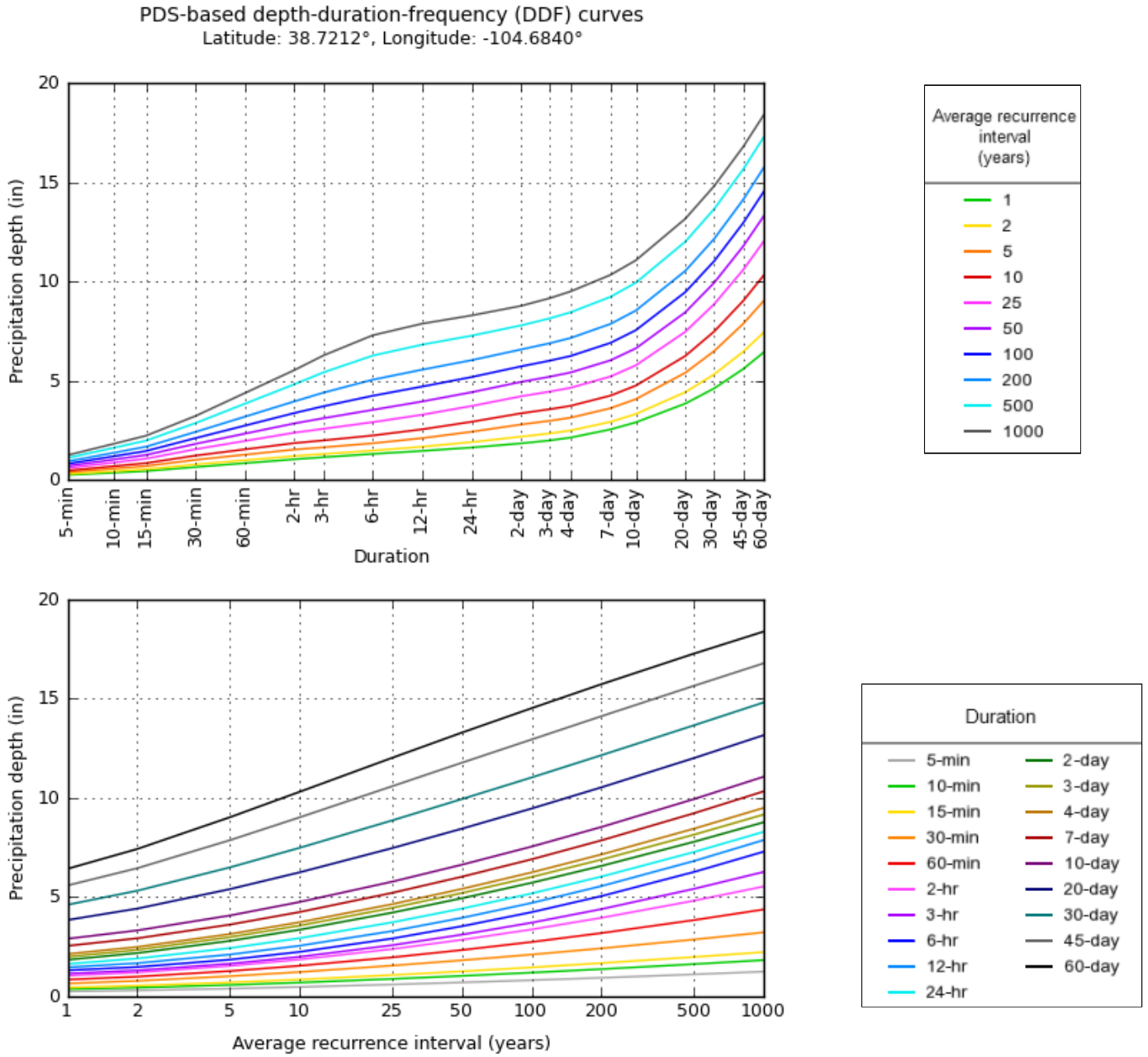
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



NOAA Atlas 14, Volume 8, Version 2

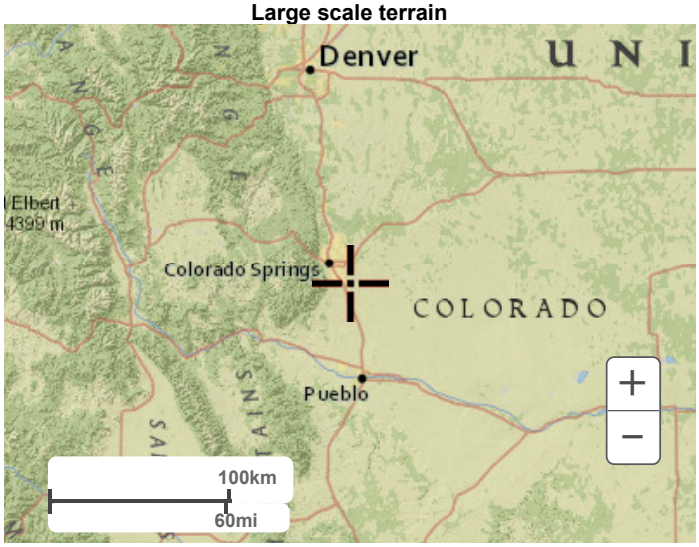
Created (GMT): Tue Jul 20 19:08:40 2021

Back to Top

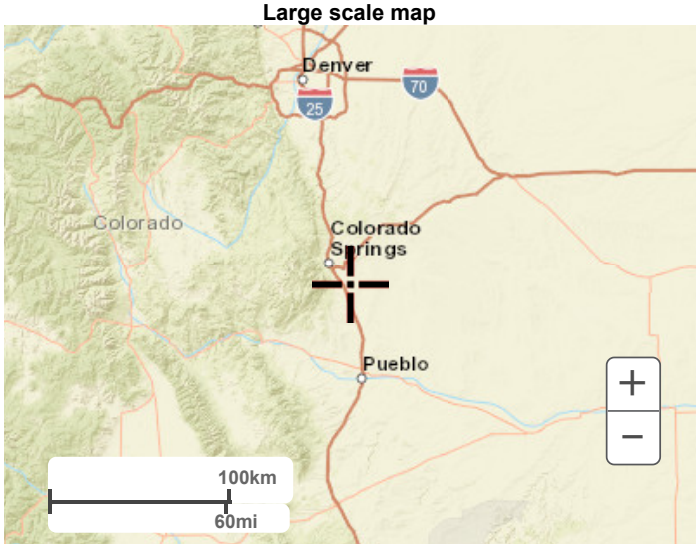
Maps & aerials

Small scale terrain

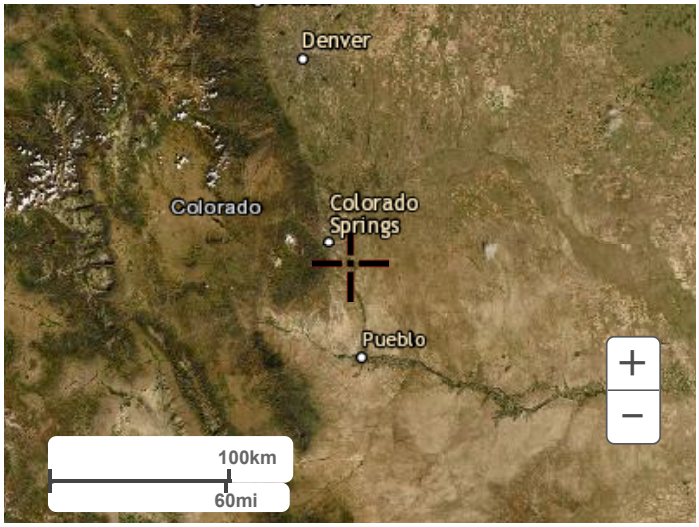
Large scale terrain



Large scale map



Large scale aerial



Back to Top

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

APPENDIX B – HYDROLOGIC CALCULATIONS

HRGreen	**COTTAGES AT MESA RIDGE**	**Calc'd by:**	**NQJ**
	EXISTING CONDITIONS	**Checked by:**	
	LOCATION: COLORADO SPRINGS, COLORADO	**Date:**	**12/6/2021**

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
EX1	5.69	7	2.5	13.4
EX2	3.12	28	3.5	10.0
EX3	1.46	24	1.4	4.1
EX4	0.28	2	0.1	0.5
EX5	3.38	15	2.1	8.7

DESIGN POINT SUMMARY TABLE

DESIGN POINT	UPSTREAM BASIN	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	EX1	2.5	13.4
2	EX2	3.5	10.0
3	EX3	1.4	4.1
4	EX4	0.1	0.5
5	EX5	2.1	8.7

HRGreen	**COTTAGES AT MESA RIDGE**	**NQJ**	**Calc'd by:**
	EXISTING CONDITIONS		**Checked by:**
	LOCATION: COLORADO SPRINGS, COLORADO	**12/6/2021**	**Date:**

COMPOSITE 'C' FACTORS

BASIN	UNDEVELOPED	PAVED	SINGLE FAMILY LOT	TOTAL	SOIL TYPE	UNDEVELOPED			PAVED			SINGLE FAMILY LOT			COMPOSITE IMPERVIOUSNESS & C		
	ACRES					%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}
EX1	5.25	0.00	0.44	5.69	B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	7	0.12	0.38
EX2	2.28	0.84	0.00	3.12	B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	28	0.31	0.52
EX3	1.13	0.33	0.00	1.46	B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	24	0.27	0.50
EX4	0.28	0.00	0.00	0.28	B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	2	0.09	0.36
EX5	2.70	0.00	0.68	3.38	B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	15	0.16	0.41
Total				13.93											15.30		

HRGreen	**COTTAGES AT MESA RIDGE**	**Calc'd by:**	**NQJ**
	EXISTING CONDITIONS	**Checked by:**	
	LOCATION: COLORADO SPRINGS, COLORADO	**Date:**	**12/6/2021**

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)
EX1	0.12	5.69	100	25.0	6.2	10	750	3.2	1.8	7.0	13.1
EX2	0.31	3.12	158	7.1	9.5	10	620	6.5	2.5	4.1	13.5
EX3	0.27	1.46	25	25.0	2.6	20	520	0.1	0.6	13.7	16.3
EX4	0.09	0.28	75	1.0	16.0	10	305	5.4	2.3	2.2	18.2
EX5	0.16	3.38	42	1.8	9.2	10	440	4.2	2.0	3.6	12.7

HRGreen

COTTAGES AT MESA RIDGE

EXISTING CONDITIONS

DESIGN STORM: 5-YEAR

Calc'd by:	NQJ
Checked by:	
Date:	12/6/2021

			DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_5*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min	
	1	EX1	5.69	0.12	13.1	0.67	3.72	2.5															
	2	EX2	3.12	0.31	13.5	0.96	3.67	3.5															
	3	EX3	1.46	0.27	16.3	0.40	3.40	1.4															
	4	EX4	0.28	0.09	18.2	0.03	3.23	0.1															
	5	EX5	3.38	0.16	12.7	0.55	3.77	2.1															

HRGreen

COTTAGES AT MESA RIDGE

EXISTING CONDITIONS

DESIGN STORM: 100-YEAR

Calc'd by:	NQJ
Checked by:	
Date:	8/10/2021

			DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min)	
	1	EX1	5.69	0.39	13.1	2.19	6.24	13.7															
	2	EX2	3.12	0.63	12.9	1.97	6.28	12.4															
	3	EX3	1.46	0.61	16.1	0.89	5.73	5.1															
	4	EX4	0.28	0.51	17.1	0.14	5.58	0.8															
	5	EX5	3.38	0.55	12.2	1.85	6.43	11.9															

HRGreen	**COTTAGES AT MESA RIDGE**	**Calc'd by:**	**NQJ**	
	PROPOSED CONDITIONS	**Checked by:**		
	LOCATION: EL PASO COUNTY, COLORADO	**Date:**	**8/19/2022**	

BASIN SUMMARY

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
1	3.67	61	7.4	15.3
2	4.83	62	9.7	20.5
3	3.03	29	3.4	9.7
4	0.48	8	0.3	1.7
5	1.63	37	2.6	6.7
6	0.60	2	0.2	1.2
7	0.45	26	0.4	1.3
8	0.26	92	1.1	2.1
9	0.17	100	0.8	1.4

DESIGN POINT SUMMARY

DESIGN POINT	UPSTREAM BASIN	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1A	2A	0.6	1.1
1	2	9.7	20.5
1.1	DP1A & DP1	8.1	14.2
2	3	3.4	9.7
3	4	0.3	1.7
4	5	2.6	6.7
4.1	DP1.1 & DP4	10.4	19.8
5	2	8.4	17.8
5.1	DP4.1 & DP5	18.0	32.7
6	6	0.2	1.2
7	7	0.4	1.3
8	8	1.5	5.8
9	9	1.5	4.4
9.1	DP6.1, DP8 & DP9	20.4	42.0

HRGreen

COTTAGES AT MESA RIDGE — Calc'd by: NQJ

PROPOSED CONDITIONS — Checked by:

LOCATION: EL PASO COUNTY, COLORADO — Date: 8/19/2022

COMPOSITE 'C' FACTORS

BASIN	LANDSCAPING	PAVED	ROOFS	SINGLE FAMILY	TOTAL	SOIL TYPE	LANDSCAPING			PAVED			ROOFS			SINGLE FAMILY			COMPOSITE IMPERVIOUSNESS & C		
	ACRES						%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}
1	1.12	1.15	0.68	0.72	3.67	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	65	0.45	0.50	61.4	0.53	0.66
2	1.60	1.75	1.21	0.27	4.83	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	61.7	0.56	0.70
2A	0.00	0.13	0.00	0.00	0.13	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	100.0	0.90	0.96
3	2.19	0.84	0.00	0.00	3.03	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	29.2	0.31	0.53
4	0.45	0.03	0.00	0.00	0.48	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	8.1	0.14	0.40
5	1.04	0.59	0.00	0.00	1.63	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	37.5	0.38	0.58
6	0.60	0.00	0.00	0.00	0.60	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	2.0	0.09	0.36
7	0.17	0.00	0.00	0.28	0.45	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	25.6	0.22	0.45
8	0.02	0.24	0.00	0.00	0.26	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	92.5	0.84	0.91
9	0.00	0.17	0.00	0.00	0.17	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	100.0	0.90	0.96
Pond					**11.74**														**55.5**		
Total					**15.25**														**48.7**		

HRGreen	**COTTAGES AT MESA RIDGE**	**Calc'd by:**	**NQJ**
	PROPOSED CONDITIONS	**Checked by:**	
	LOCATION: EL PASO COUNTY, COLORADO	**Date:**	**8/19/2022**

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)
1	0.53	3.67	100	2.0	8.3	20	900	2.9	3.4	4.4	12.7
2	0.56	4.83	100	2.0	7.9	20	1160	2.5	3.2	6.1	14.0
2A	0.90	0.13	15	2.0	1.1	20	22	2.0	2.8	0.1	5.0
3	0.31	3.03	65	2.0	9.2	10	715	6.0	2.4	4.9	14.1
4	0.14	0.48	22	25.0	2.8	20	92	9.0	6.0	0.3	5.0
5	0.38	1.63	54	25.0	3.3	10	260	0.5	0.7	6.1	9.4
6	0.09	0.60	70	1.0	15.5	10	380	5.5	2.3	2.7	18.2
7	0.22	0.45	58	2.0	9.7	10	260	3.0	1.7	2.5	12.2
8	0.84	0.26	16	2.0	1.5	20	270	9.0	6.0	0.8	5.0
9	0.90	0.17	16	2.0	1.2	20	270	9.0	6.0	0.8	5.0

HRGreen

COTTAGES AT MESA RIDGE

PROPOSED CONDITIONS

DESIGN STORM: 5-YEAR

Calc'd by: NQJ

Checked by:

Date: 8/19/2022

			DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_5*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (IN)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min	
		1	3.67	0.53	12.7	1.96	3.78	7.4															BASIN 1 FLOW @ DP5
	1A	2A	0.13	0.90	5.0	0.12	5.17	0.6								0.6	0.12	6.0	10.0	83	17.6	0.08	BASIN 2A CAPTURED IN 3' TYPE C SUMP @ DP1A, PIPE TO DP1.1
	1	2	4.83	0.56	14.0	2.68	3.62	9.7					2.0	0.56	1.0	7.7	2.13			175	2.0	1.46	BASIN 2 CAPTURED IN 15' TYPE R ONGRADE @ DP1, PIPE TO DP1.1 DP1 BYPASS FLOW, C&G FLOW TO DP5/DP9
	1.1								14.0	2.24	3.62	8.1				8.1	2.24	7.0	24	62	19.1	0.05	DP1A & DP1 COMBINED, PIPE TO DP4.1
	2	3	3.03	0.31	14.1	0.95	3.62	3.4															BASIN 3 FLOW, SWALE FLOW TO EX TYPE C INLET @ DP2
	3	4	0.48	0.14	5.0	0.07	5.17	0.3															BASIN 4 FLOW, FOLLOW HISTORIC DRAINAGE PATTERNS TO DP3
	4	5	1.63	0.38	9.4	0.62	4.22	2.6								2.6	0.62	1.0	12	432	7.2	1.00	BASIN 5 CAPTURED IN TYPE C INLET @ DP4, PIPE TO DP4.1
	4.1								14.1	2.87	3.61	10.4				10.4	2.87	1.0	18	205	7.2	0.47	COMBINED DP1.1 & DP4 FLOW @ DP4.1, PIPE TO DP5.1
	5								12.7	2.23	3.78	8.4	0.2	0.06	1.0	8.2	2.17	10.0	18	18 200	22.8 2.0	0.01 1.67	BASIN 1 & DP1 BYPASS CAPTURED IN 15' TYPE R ONGRADE @ DP5, PIPE TO DP5.1 DP5 FLOWBY, C&G FLOW TO DP8
	5.1								14.6	5.04	3.57	18.0				18.0	5.04	5.4	24	195	16.7	0.19	COMBINED DP4.1 & DP5 @ DP5.1, PIPE TO DP9.1
	6	6	0.6	0.09	18.2	0.05	3.23	0.2															BASIN 6 FLOW @ DP6, FOLLOWS HISTORIC DRAINAGE PATTERNS
	7	7	0.45	0.22	12.2	0.10	3.83	0.4															BASIN 7 FLOW @ DP7, FOLLOWS HISTORIC DRAINAGE PATTERNS
	8	8	0.26	0.84	5.0	0.22	5.17	1.1	5.0	0.28	5.17	1.5				1.5	0.28	2.0	18	16	10.2	0.03	BASIN 8 & DP5 FLOWBY CAPTURED IN 15' TYPE R ON GRADE @ DP8, PIPE TO 9.1
	9	9	0.17	0.90	5.0	0.15	5.17	0.8	15.5	0.43	3.47	1.5				1.5	0.43	2.0	18	16	10.2	0.03	BASIN 9 AND DP1 FLOWBY CAPTURED IN 10' TYPE R ONGRADE @ DP9, PIPE TO DP9.1 DP9 FLOW BY, C&G FLOW TO LANDOVER LANE SUMP INLETS
	9.1								14.8	5.75	3.55	20.4											**COMBINED DP5.1, DP8, & DP9 @ DP9.1, PIPE TO EX DETENTION POND D**

HRGreen

COTTAGES AT MESA RIDGE

PROPOSED CONDITIONS

DESIGN STORM: 100-YEAR

Calc'd by: NQJ

Checked by:

Date: 8/19/2022

			DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min)	
		1	3.67	0.66	12.7	2.42	6.34	15.3															BASIN 1 FLOW @ DP5
	1A	2A	0.13	0.96	5.0	0.12	8.68	1.1								1.1	0.12	6.0	10.0	83	17.6	0.08	BASIN 2A CAPTURED IN 3' TYPE C SUMP @ DP1A, PIPE TO DP1.1
	1	2	4.83	0.70	14.0	3.37	6.08	20.5					7.1	1.17	9.0	13.4	2.20			280	6.0	0.78	BASIN 2 CAPTURED IN 15' TYPE R ONGRADE @ DP1, PIPE TO DP1.1 DP1 BYPASS FLOW, C&G FLOW TO DP5/DP9
	1.1								14.0	2.33	6.08	14.2				14.2	2.33	7.0	2	62	19.1	0.05	DP1A & DP1 COMBINED, PIPE TO DP4.1
	2	3	3.03	0.53	14.1	1.59	6.07	9.7															BASIN 3 FLOW, SWALE FLOW TO EX TYPE C INLET @ DP2
	3	4	0.48	0.40	5.0	0.19	8.68	1.7															BASIN 4 FLOW, FOLLOW HISTORIC DRAINAGE PATTERNS TO DP3
	4	5	1.63	0.58	9.4	0.94	7.08	6.7								6.7	0.94	1.0	12	432	7.2	1.00	BASIN 5 CAPTURED IN TYPE C INLET @ DP4, PIPE TO DP4.1
	4.1								14.1	3.27	6.07	19.8				19.8	3.27	1.0	18	205	7.2	0.47	COMBINED DP1.1 & DP4 FLOW @ DP4.1, PIPE TO DP5.1
	5								14.8	3.00	5.94	17.8	4.5	0.76	9.0	13.3	2.24	10.0	18	18	22.8	0.01	BASIN 1 & DP1 BYPASS CAPTURED IN 15' TYPE R ONGRADE @ DP5, PIPE TO DP5.1
																				250	6.0	0.69	DP5 FLOWBY, C&G FLOW TO DP8
	5.1								14.8	5.51	5.94	32.7				32.7	5.51	5.4	24	195	16.7	0.19	COMBINED DP4.1 & DP5 @ DP5.1, PIPE TO DP9.1
	6	6	0.6	0.36	18.2	0.22	5.42	1.2															BASIN 6 FLOW @ DP6, FOLLOWS HISTORIC DRAINAGE PATTERNS
	7	7	0.45	0.45	12.2	0.20	6.42	1.3															BASIN 7 FLOW @ DP7, FOLLOWS HISTORIC DRAINAGE PATTERNS
	8	8	0.26	0.91	5.0	0.24	8.68	2.1	15.5	1.00	5.83	5.8				5.8	1.00	9.0	18	16	21.6	0.01	BASIN 8 & DP5 FLOWBY CAPTURED IN 15' TYPE R ON GRADE @ DP8, PIPE TO 9.1
	9	9	0.17	0.96	5.0	0.16	8.68	1.4	14.8	0.75	5.94	4.4	0.2	0.04	9.0	4.2	0.71	9.0	18	16	21.6	0.01	BASIN 9 AND DP1 FLOWBY CAPTURED IN 10' TYPE R ONGRADE @ DP9, PIPE TO DP9.1 DP9 FLOW BY, C&G FLOW TO LANDOVER LANE SUMP INLETS
	9.1								15.5	7.22	5.82	42.0											**COMBINED DP5.1, DP8, & DP9 @ DP9.1, PIPE TO EX DETENTION POND D**

APPENDIX C – HYDRAULIC CALCULATIONS

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Aug 1 2022

MINOR STORM STREET CAPACITY - APISHAPA HEIGHTS W/ BASIN 1 FLOW (Q5 = 7.4)

User-defined

Invert Elev (ft)	= 4.14
Slope (%)	= 1.00
N-Value	= 0.016

Calculations

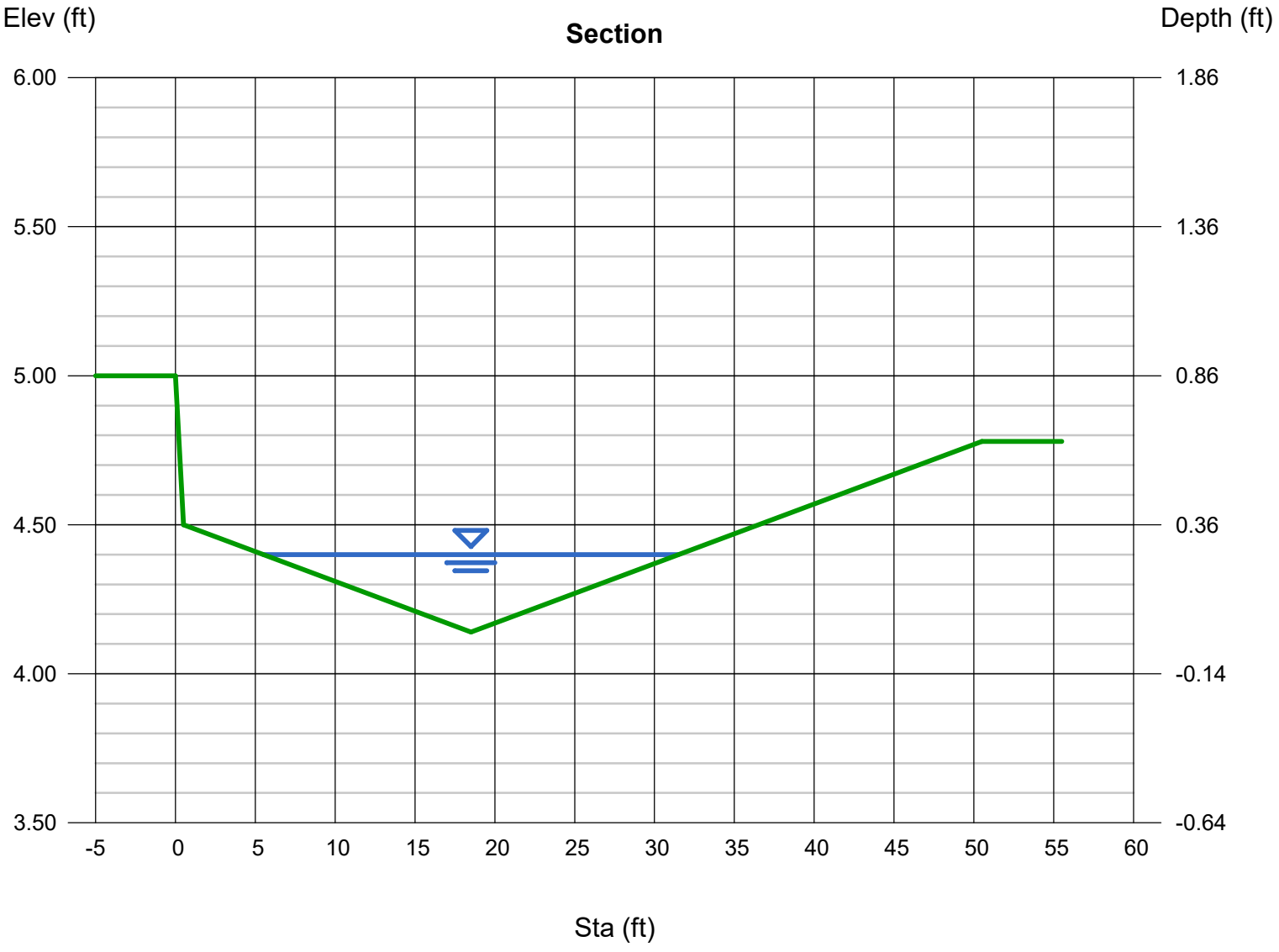
Compute by:	Known Q
Known Q (cfs)	= 7.40

Highlighted

Depth (ft)	= 0.26
Q (cfs)	= 7.400
Area (sqft)	= 3.38
Velocity (ft/s)	= 2.19
Wetted Perim (ft)	= 26.01
Crit Depth, Yc (ft)	= 0.27
Top Width (ft)	= 26.00
EGL (ft)	= 0.33

(Sta, El, n)-(Sta, El, n)...

(0.00, 5.00)-(0.50, 4.50, 0.016)-(18.50, 4.14, 0.016)-(50.50, 4.78, 0.016)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Aug 1 2022

MAJOR STORM STREET CAPACITY - APISHAPA HEIGHTS W/ BASIN 1 FLOW (Q100 = 1

User-defined

Invert Elev (ft)	= 4.14
Slope (%)	= 1.00
N-Value	= 0.016

Calculations

Compute by:	Known Q
Known Q (cfs)	= 15.30

Highlighted

Depth (ft)	= 0.34
Q (cfs)	= 15.30
Area (sqft)	= 5.78
Velocity (ft/s)	= 2.65
Wetted Perim (ft)	= 34.01
Crit Depth, Yc (ft)	= 0.36
Top Width (ft)	= 34.00
EGL (ft)	= 0.45

(Sta, El, n)-(Sta, El, n)...

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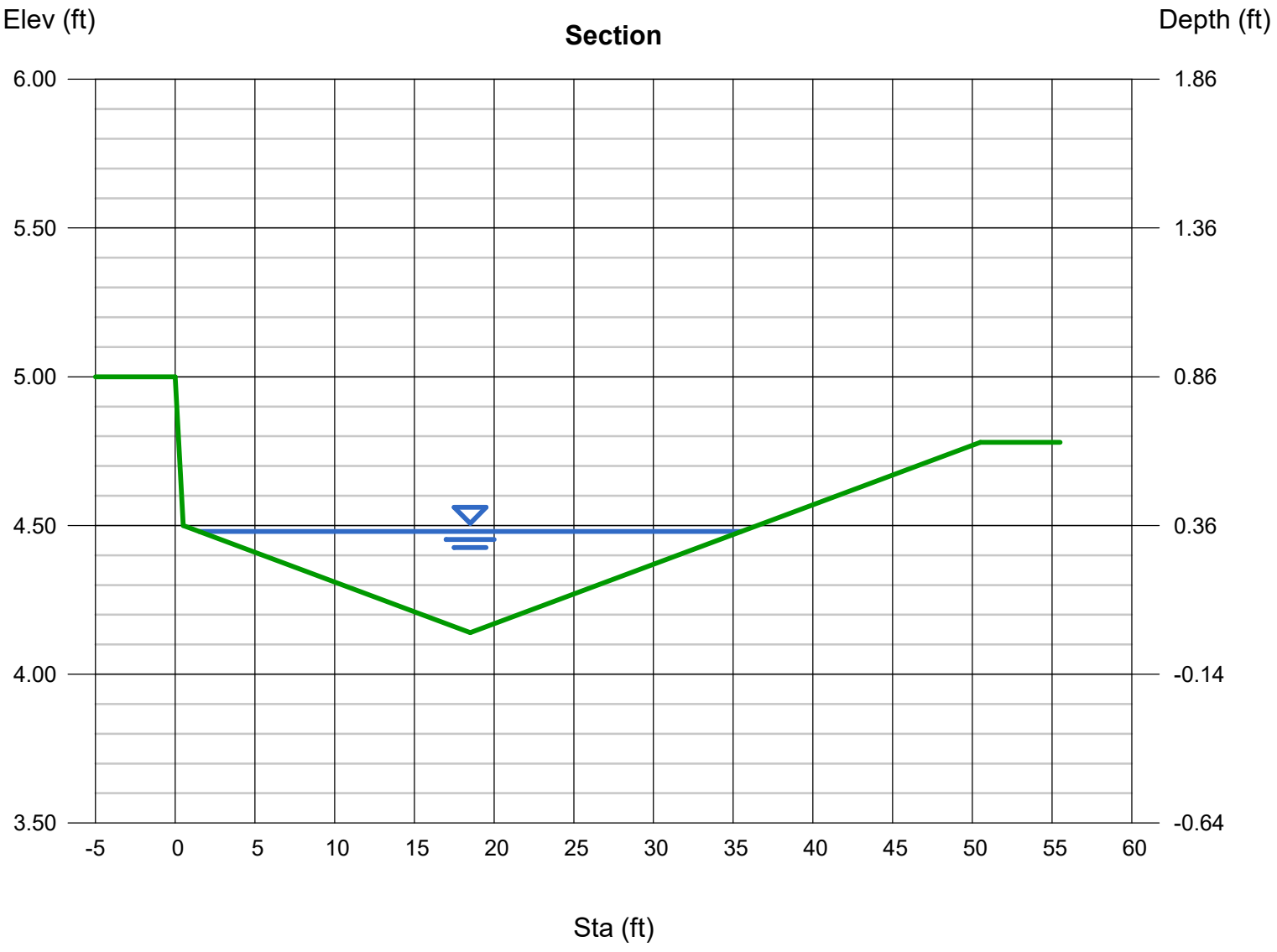


Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Aug 1 2022

MINOR STORM STREET CAPACITY - SEGUNDO GROVE W/ BASIN 2 FLOW (Q5 = 10.1)

User-defined

Invert Elev (ft)	= 9.39
Slope (%)	= 1.00
N-Value	= 0.016

Calculations

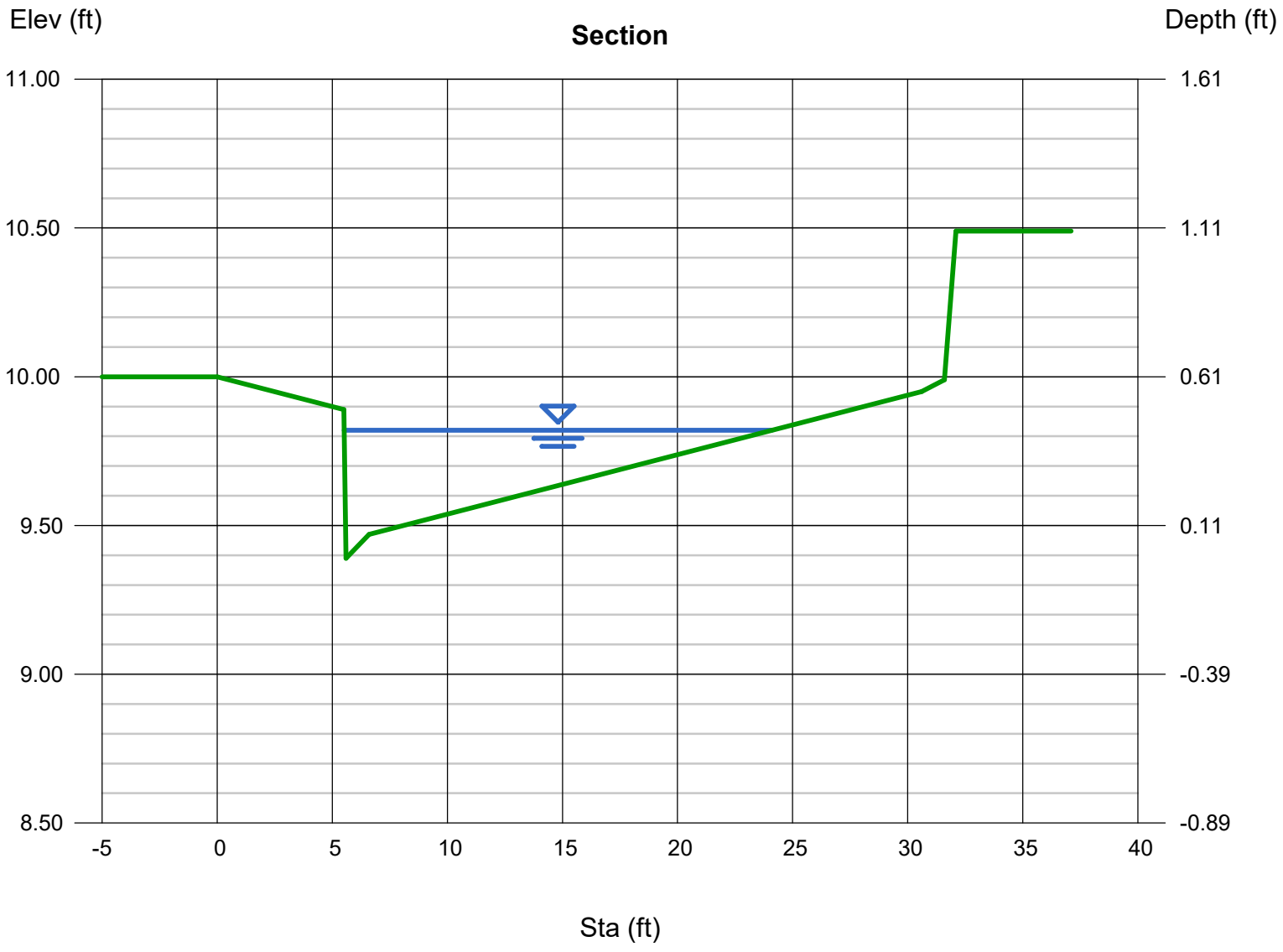
Compute by:	Known Q
Known Q (cfs)	= 10.10

Highlighted

Depth (ft)	= 0.43
Q (cfs)	= 10.10
Area (sqft)	= 3.47
Velocity (ft/s)	= 2.91
Wetted Perim (ft)	= 18.95
Crit Depth, Yc (ft)	= 0.46
Top Width (ft)	= 18.59
EGL (ft)	= 0.56

(Sta, El, n)-(Sta, El, n)...

(0.00, 10.00)-(5.50, 9.89, 0.016)-(5.60, 9.39, 0.016)-(6.60, 9.47, 0.016)-(30.60, 9.95, 0.016)-(31.60, 9.99, 0.016)-(32.10, 10.49, 0.016)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Aug 1 2022

MAJOR STORM STREET CAPACITY - SEGUNDO GROVE W/ BASIN 2 FLOW (Q100 = 21.

User-defined

Invert Elev (ft)	= 9.39
Slope (%)	= 1.00
N-Value	= 0.016

Calculations

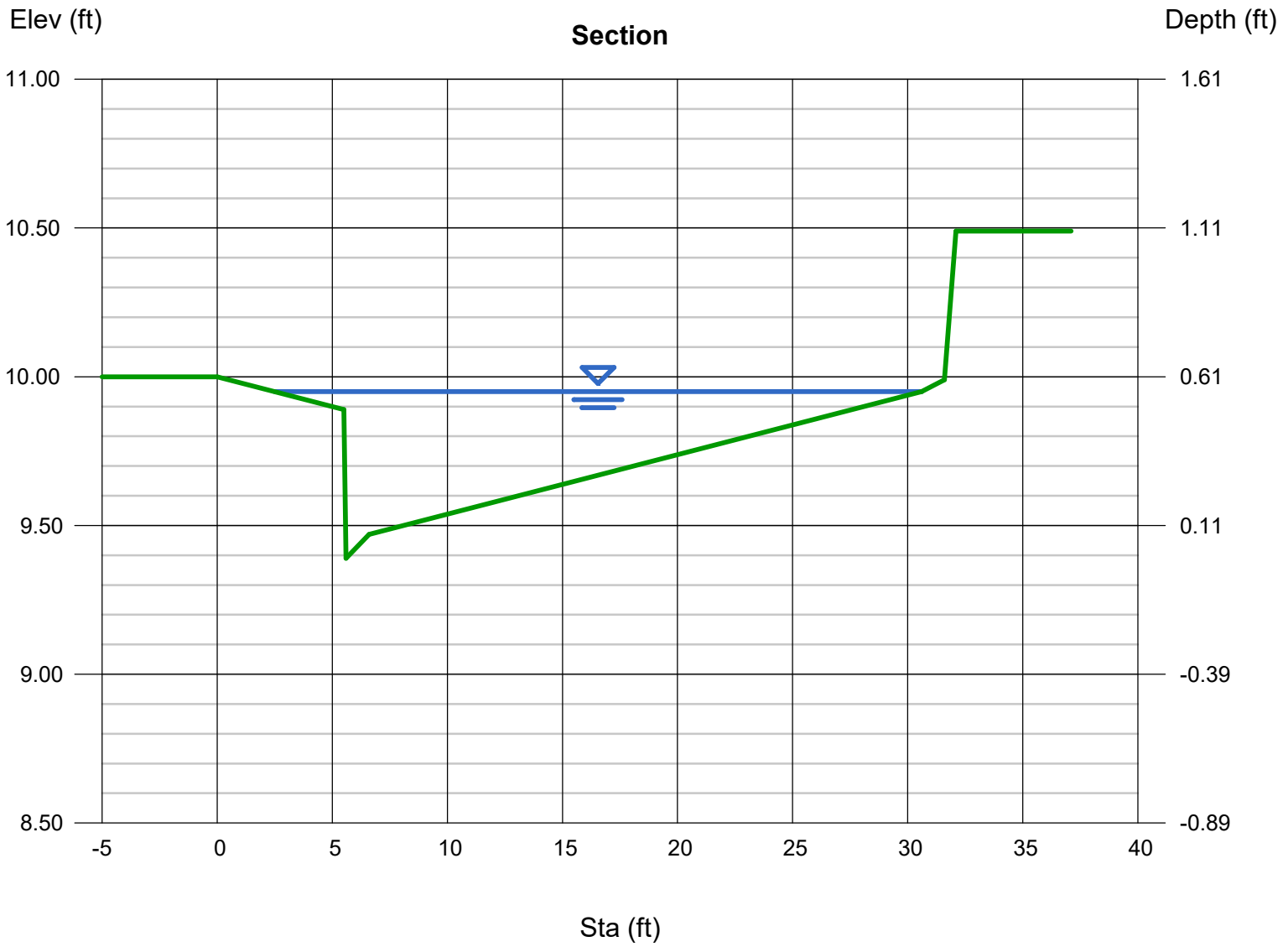
Compute by:	Known Q
Known Q (cfs)	= 21.30

Highlighted

Depth (ft)	= 0.56
Q (cfs)	= 21.30
Area (sqft)	= 6.40
Velocity (ft/s)	= 3.33
Wetted Perim (ft)	= 28.52
Crit Depth, Yc (ft)	= 0.61
Top Width (ft)	= 28.10
EGL (ft)	= 0.73

(Sta, El, n)-(Sta, El, n)...

(0.00, 10.00)-(5.50, 9.89, 0.016)-(5.60, 9.39, 0.016)-(6.60, 9.47, 0.016)-(30.60, 9.95, 0.016)-(31.60, 9.99, 0.016)-(32.10, 10.49, 0.016)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Aug 1 2022

MINOR STORM STREET CAPACITY - WAHATOYA POINT W/ BASIN 2 FLOW (Q5 = 10.1)

User-defined

Invert Elev (ft)	= 3.90
Slope (%)	= 1.00
N-Value	= 0.016

Calculations

Compute by:	Known Q
Known Q (cfs)	= 10.10

Highlighted

Depth (ft)	= 0.29
Q (cfs)	= 10.10
Area (sqft)	= 4.20
Velocity (ft/s)	= 2.40
Wetted Perim (ft)	= 29.01
Crit Depth, Yc (ft)	= 0.31
Top Width (ft)	= 29.00
EGL (ft)	= 0.38

(Sta, El, n)-(Sta, El, n)...

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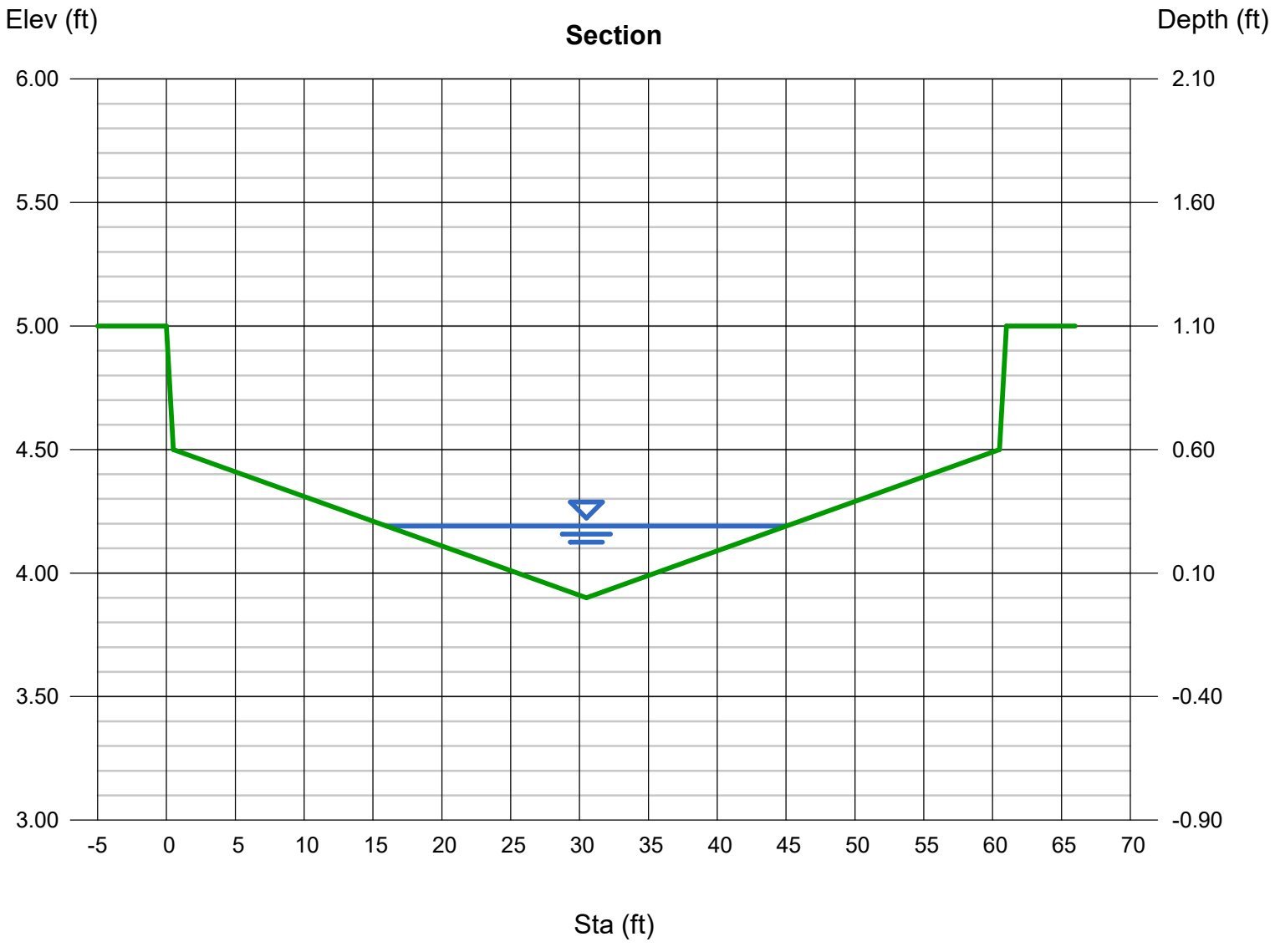


Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Aug 1 2022

MAJOR STORM STREET CAPACITY - WAHATOYA POINT W/ BASIN 2 FLOW (Q100 = 21.

User-defined

Invert Elev (ft)	= 3.90
Slope (%)	= 1.00
N-Value	= 0.016

Calculations

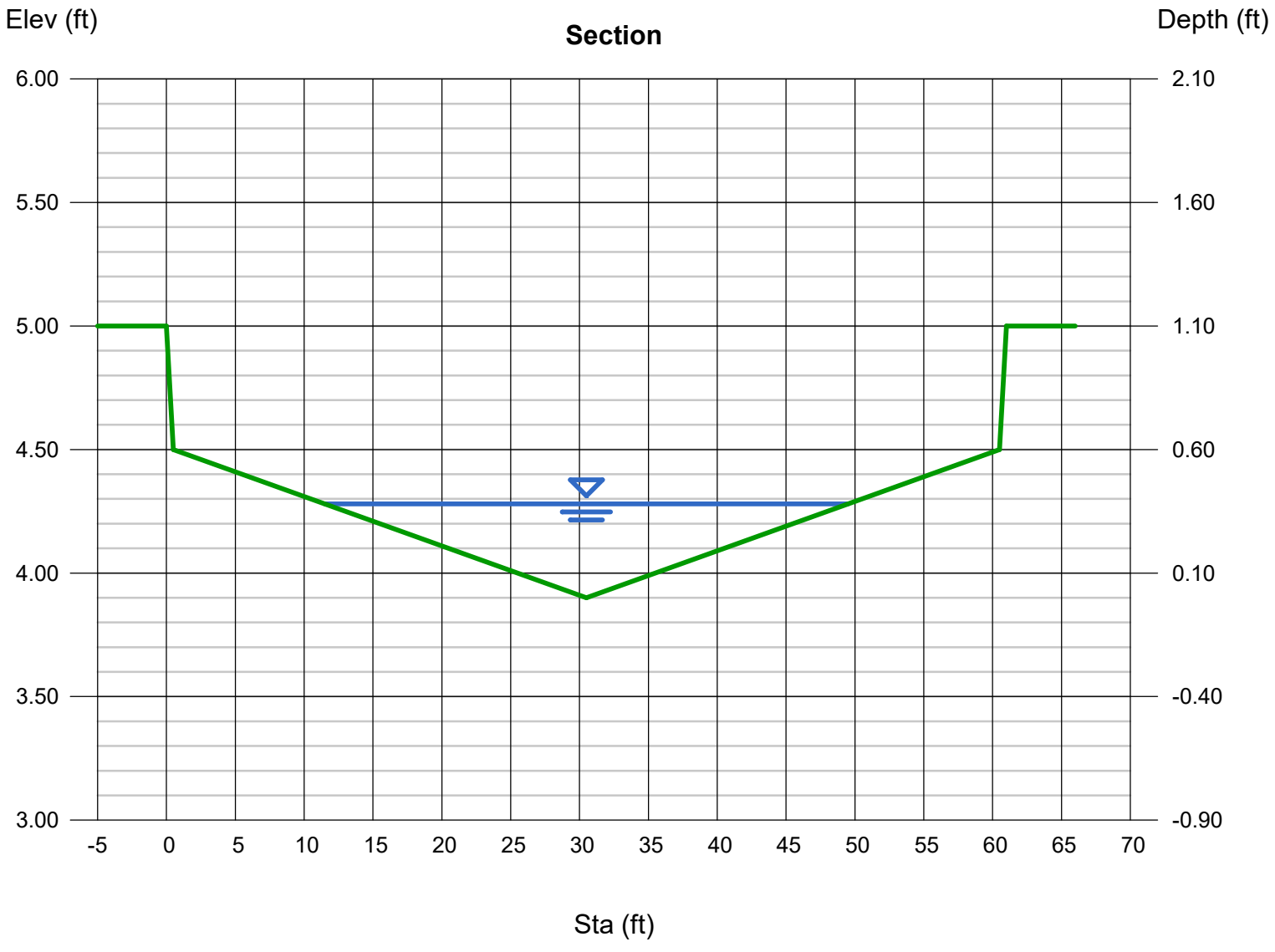
Compute by:	Known Q
Known Q (cfs)	= 21.30

Highlighted

Depth (ft)	= 0.38
Q (cfs)	= 21.30
Area (sqft)	= 7.22
Velocity (ft/s)	= 2.95
Wetted Perim (ft)	= 38.01
Crit Depth, Yc (ft)	= 0.41
Top Width (ft)	= 38.00
EGL (ft)	= 0.52

(Sta, El, n)-(Sta, El, n)...

(0.00, 5.00)-(0.50, 4.50, 0.016)-(30.50, 3.90, 0.016)-(60.50, 4.50, 0.016)-(61.00, 5.00, 0.016)



MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP1	DP5	DP8	DP9
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	9.7	8.4	1.5	1.5
Major Q_{Known} (cfs)	20.5	17.8	5.8	4.4

Bypass (Carry-Over) Flow from Upstream

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

Watershed Characteristics

Subcatchment Area (acres)				
Percent Impervious				
NRCS Soil Type				

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

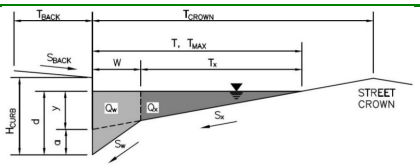
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**9.7**	**8.4**	**1.5**	**1.5**
Major Total Design Peak Flow, Q (cfs)	**20.5**	**17.8**	**5.8**	**4.4**
Minor Flow Bypassed Downstream, Q_b (cfs)	1.0	0.2	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	7.1	4.5	0.0	0.2

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

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

Project: **COTTAGES AT MESA RIDGE**
Inlet ID: **DP1**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	25.0	ft
Gutter Width	W =	1.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	25.0	25.0	ft
Warning 02 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.7	6.7	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

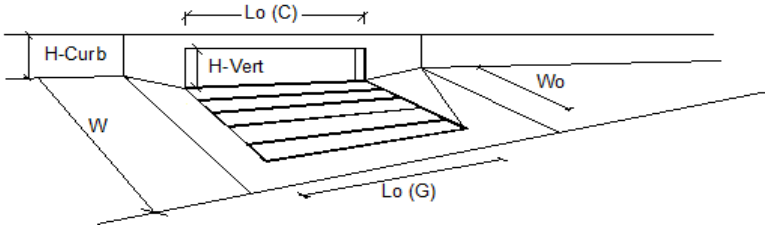
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**27.5**	**27.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

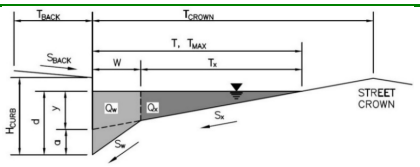


Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**8.7**	**13.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**1.0**	**7.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**90**	**65**	**%**

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

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

Project: **COTTAGES AT MESA RIDGE**
Inlet ID: **DP5**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.043	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

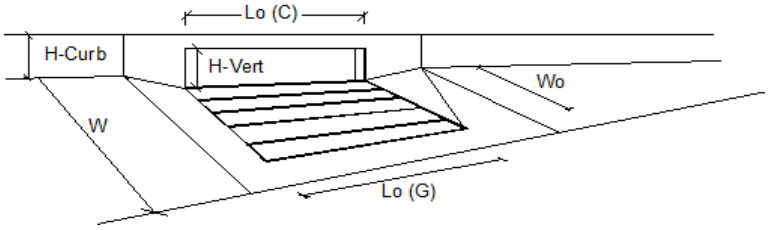
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.8	7.3	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**15.9**	**24.6**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

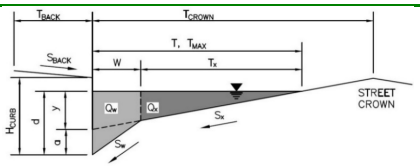


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**8.2**	**13.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.2**	**4.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**98**	**75**	**%**

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

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

Project: **COTTAGES AT MESA RIDGE**
Inlet ID: **DP8**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.090	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

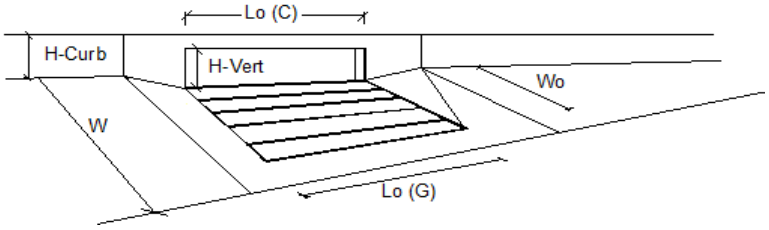
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	6.5	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**16.1**	**16.6**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input) — CDOT Type R Curb Opening

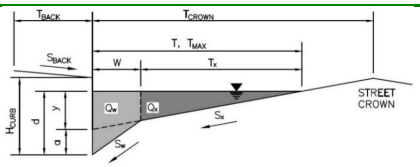
		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.5**	**5.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

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

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

Project: **COTTAGES AT MESA RIDGE**
Inlet ID: **DP9**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.063	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.046	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

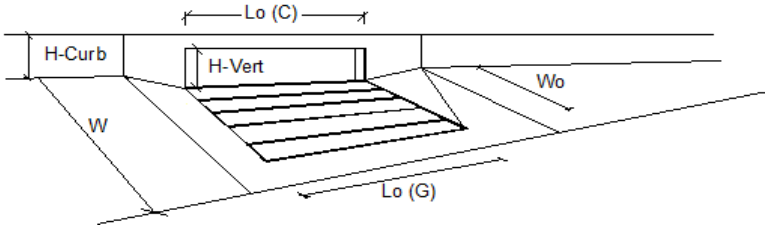
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.6	6.5	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**16.1**	**20.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.5**	**4.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**95**	**%**

STORMCAD PLAN

5-YEAR SCENARIO

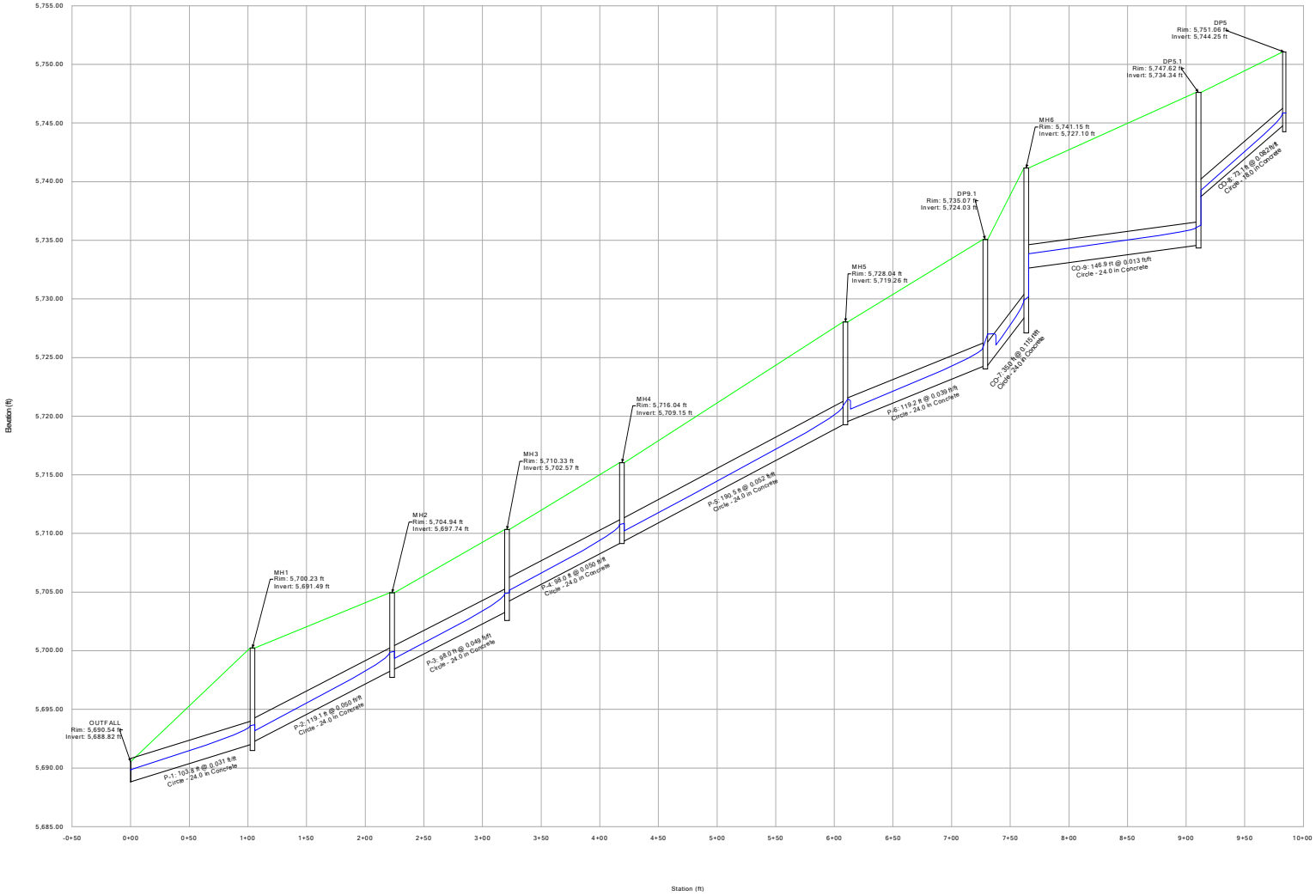
Conduit FlexTable: Combined Pipe/Node Report

Label	Upstream Structure	Diameter (in)	Length (Unified) (ft)	Flow (cfs)	Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
P-14	DP9	12.0	28.3	1.10	4.87	5,731.80	5,731.51	0.010	5,732.24	5,731.85
P-13	DP8	18.0	7.7	1.30	7.31	5,726.00	5,725.59	0.053	5,726.99	5,727.00
P-12	DP4	12.0	304.5	2.60	6.66	5,743.85	5,740.70	0.010	5,744.54	5,741.20
P-10	MH7	24.0	97.3	10.40	6.96	5,735.91	5,734.97	0.010	5,737.06	5,736.28
P-6	DP9.1	24.0	119.2	20.40	13.92	5,724.23	5,719.56	0.039	5,725.85	5,721.44
P-5	MH5	24.0	190.5	20.40	15.46	5,719.26	5,709.35	0.052	5,720.88	5,710.22
P-4	MH4	24.0	98.0	20.40	15.23	5,709.15	5,704.25	0.050	5,710.77	5,705.16
P-3	MH3	24.0	98.0	20.40	15.13	5,703.25	5,698.44	0.049	5,704.87	5,699.35
P-2	MH2	24.0	119.1	20.40	15.23	5,698.24	5,692.29	0.050	5,699.86	5,693.18
P-1	MH1	24.0	103.8	20.40	12.69	5,691.99	5,688.82	0.031	5,693.61	5,689.86
CO-10	DP1A	10.0	82.8	0.60	8.65	5,748.00	5,741.38	0.080	5,748.34	5,741.91
CO-9	DP5.1	24.0	146.9	18.00	8.89	5,734.55	5,732.63	0.013	5,736.08	5,733.86
CO-8	DP5	18.0	73.1	7.90	14.36	5,744.75	5,738.73	0.082	5,745.84	5,739.25
CO-7	MH6	24.0	35.0	18.00	19.98	5,728.37	5,724.33	0.115	5,729.90	5,727.00
CO-4	DP1.1	18.0	58.2	9.70	13.53	5,740.71	5,737.22	0.060	5,741.91	5,737.88
CO-3	BEND	18.0	117.8	2.60	8.29	5,740.20	5,737.22	0.025	5,740.81	5,738.36
CO-2	DP4.1	24.0	39.5	10.40	7.75	5,736.72	5,736.21	0.013	5,737.88	5,737.69

5-YEAR SCENARIO

Profile Report

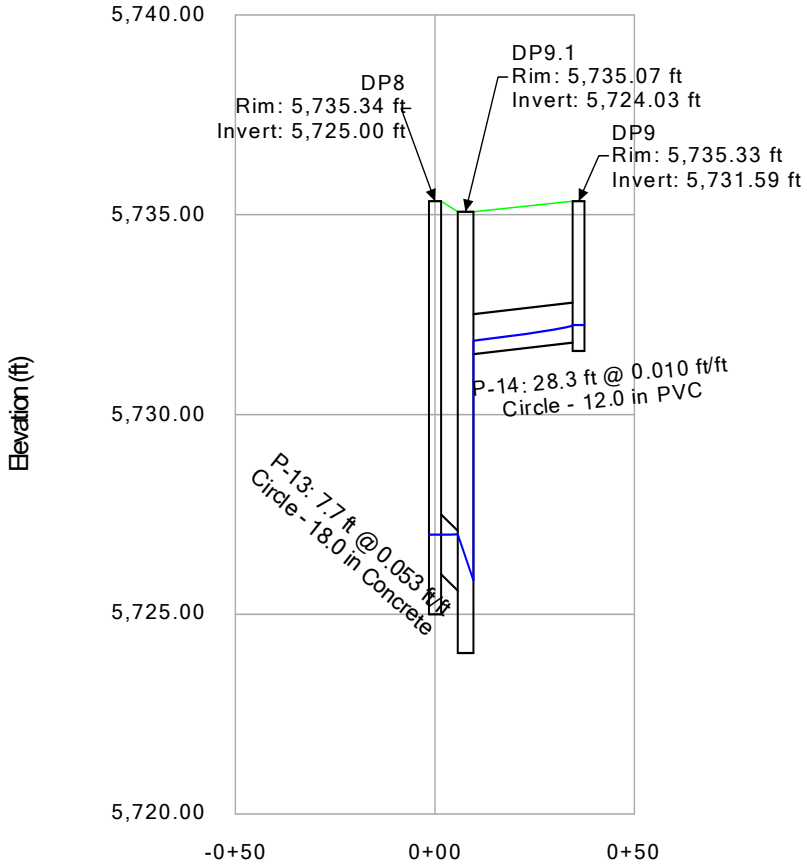
Engineering Profile - 02-Storm (Cottages_Mesa_Ridge.stsw)



5-YEAR SCENARIO

Profile Report

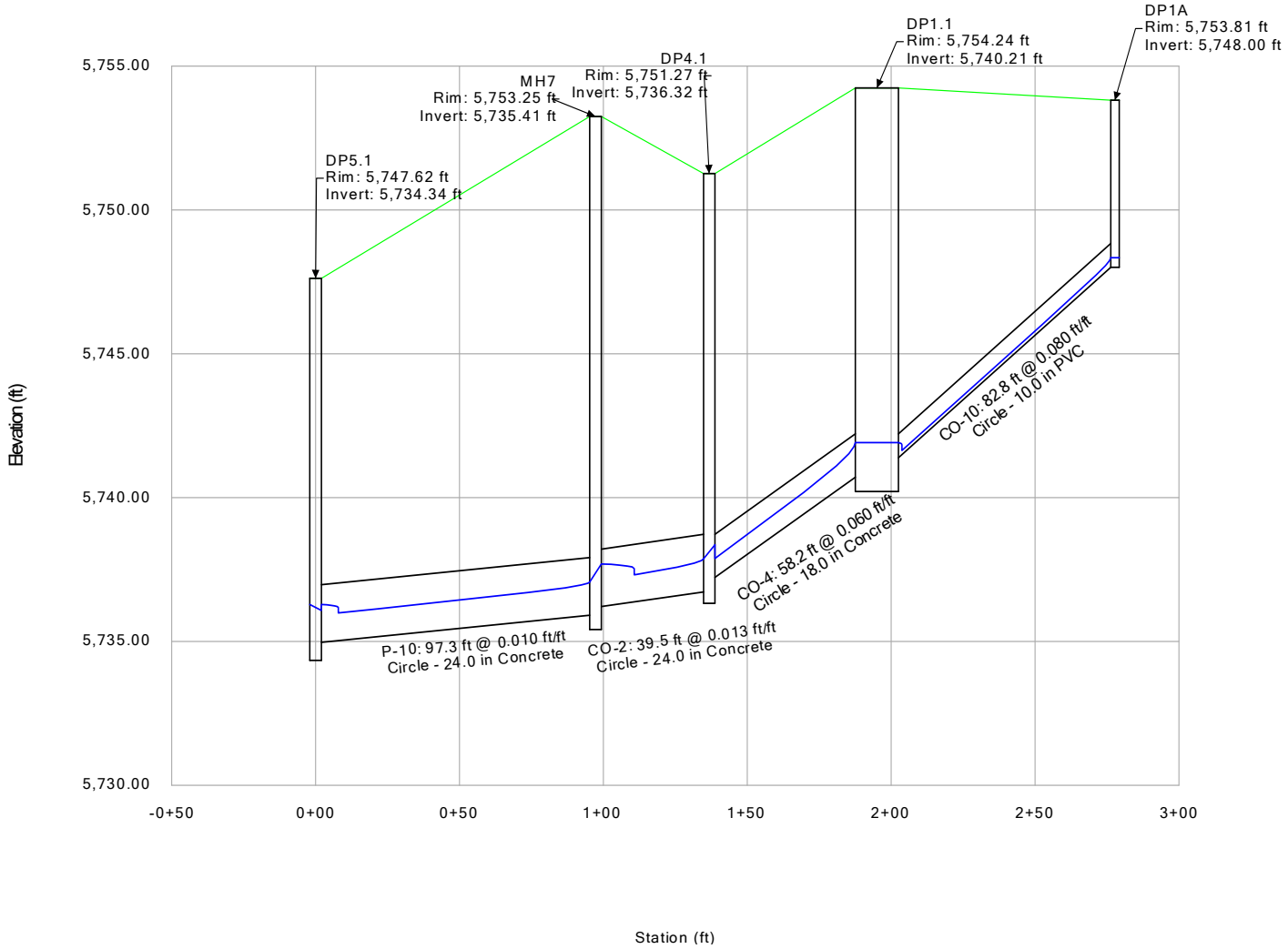
Engineering Profile - 03-Storm (Cottages_Mesa_Ridge.stsw)



5-YEAR SCENARIO

Profile Report

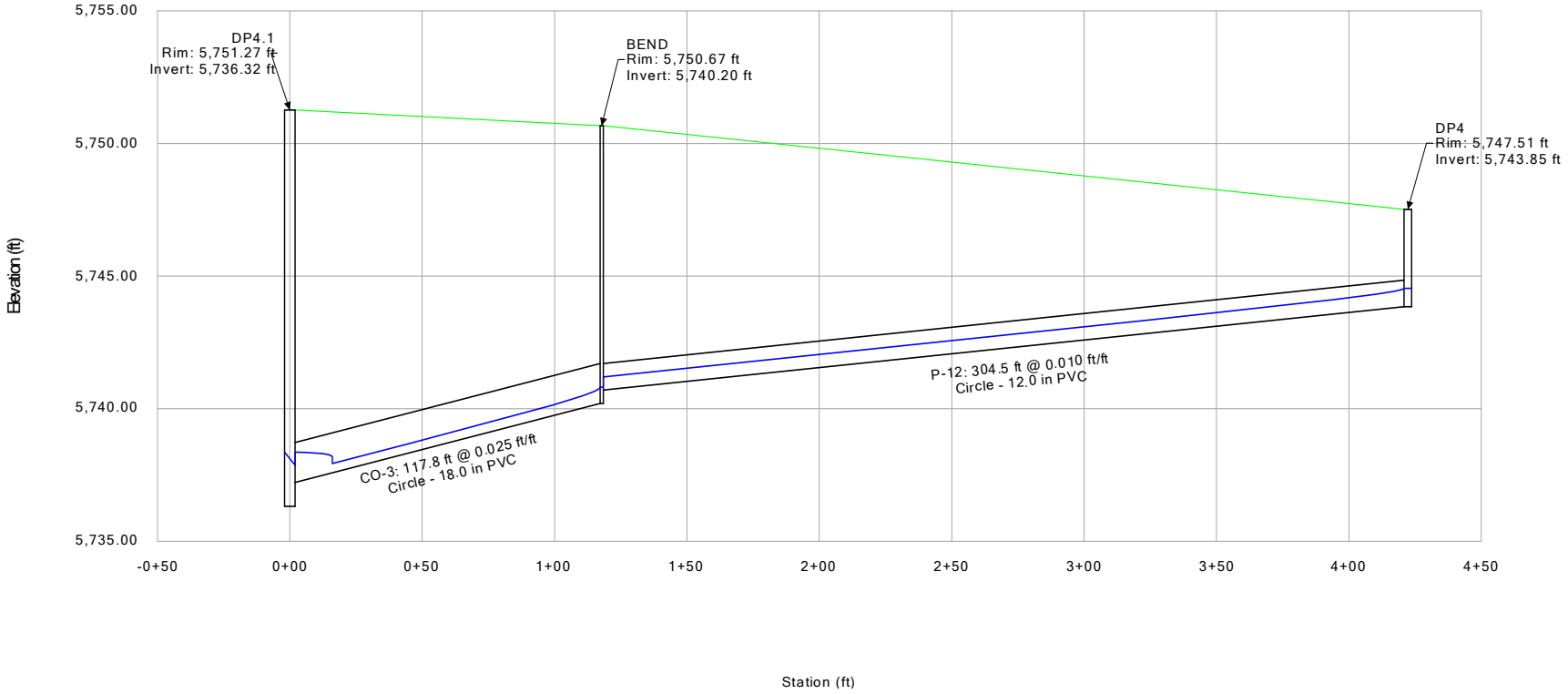
Engineering Profile - 04-Storm (Cottages_Mesa_Ridge.stsw)



5-YEAR SCENARIO

Profile Report

Engineering Profile - 05-Storm (Cottages_Mesa_Ridge.stsw)



100-YEAR SCENARIO

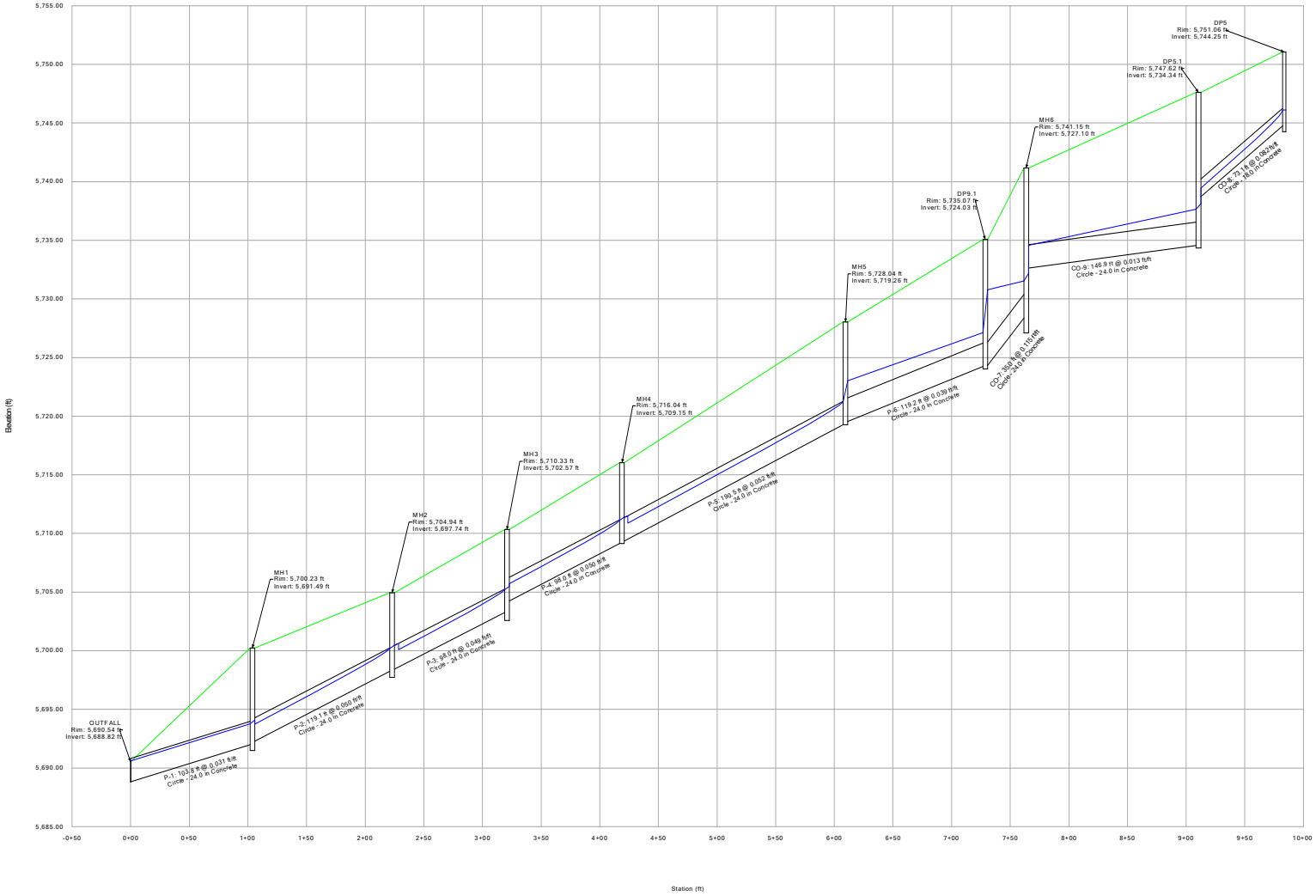
Conduit FlexTable: Combined Pipe/Node Report

Label	Upstream Structure	Diameter (in)	Length (Unified) (ft)	Flow (cfs)	Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
P-14	DP9	12.0	28.3	4.40	6.78	5,731.80	5,731.51	0.010	5,732.68	5,732.30
P-13	DP8	18.0	7.7	5.90	3.34	5,726.00	5,725.59	0.053	5,730.81	5,730.79
P-12	DP4	12.0	304.5	6.70	8.53	5,743.85	5,740.70	0.010	5,746.85	5,741.67
P-10	MH7	24.0	97.3	19.80	6.30	5,735.91	5,734.97	0.010	5,738.85	5,738.11
P-6	DP9.1	24.0	119.2	42.00	13.37	5,724.23	5,719.56	0.039	5,727.12	5,723.01
P-5	MH5	24.0	190.5	42.00	18.30	5,719.26	5,709.35	0.052	5,721.22	5,711.39
P-4	MH4	24.0	98.0	42.00	18.00	5,709.15	5,704.25	0.050	5,711.11	5,705.71
P-3	MH3	24.0	98.0	42.00	17.86	5,703.25	5,698.44	0.049	5,705.21	5,700.48
P-2	MH2	24.0	119.1	42.00	18.00	5,698.24	5,692.29	0.050	5,700.20	5,693.73
P-1	MH1	24.0	103.8	42.00	14.18	5,691.99	5,688.82	0.031	5,693.78	5,690.61
CO-10	DP1A	10.0	82.8	1.10	10.34	5,748.00	5,741.38	0.080	5,748.47	5,742.10
CO-9	DP5.1	24.0	146.9	32.70	10.41	5,734.55	5,732.63	0.013	5,737.65	5,734.53
CO-8	DP5	18.0	73.1	13.50	16.59	5,744.75	5,738.73	0.082	5,746.12	5,739.46
CO-7	MH6	24.0	35.0	32.70	10.41	5,728.37	5,724.33	0.115	5,731.52	5,730.79
CO-4	DP1.1	18.0	58.2	14.20	14.91	5,740.71	5,737.22	0.060	5,742.10	5,740.60
CO-3	BEND	18.0	117.8	6.70	10.82	5,740.20	5,737.22	0.025	5,741.20	5,740.60
CO-2	DP4.1	24.0	39.5	19.80	6.30	5,736.72	5,736.21	0.013	5,739.97	5,739.67

100-YEAR SCENARIO

Profile Report

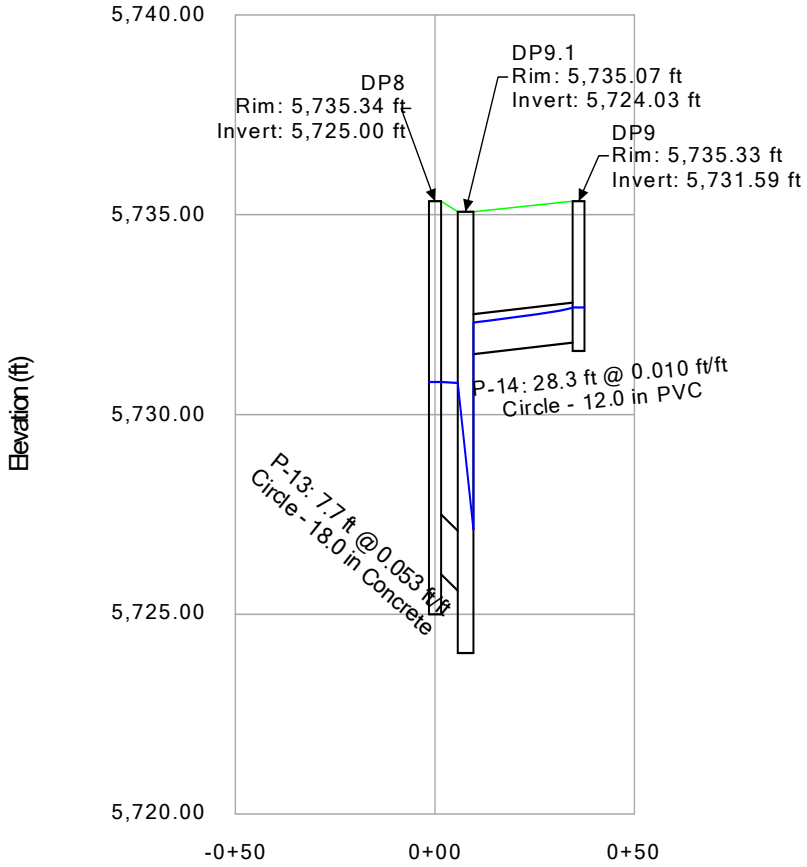
Engineering Profile - 02-Storm (Cottages_Mesa_Ridge.stsw)



100-YEAR SCENARIO

Profile Report

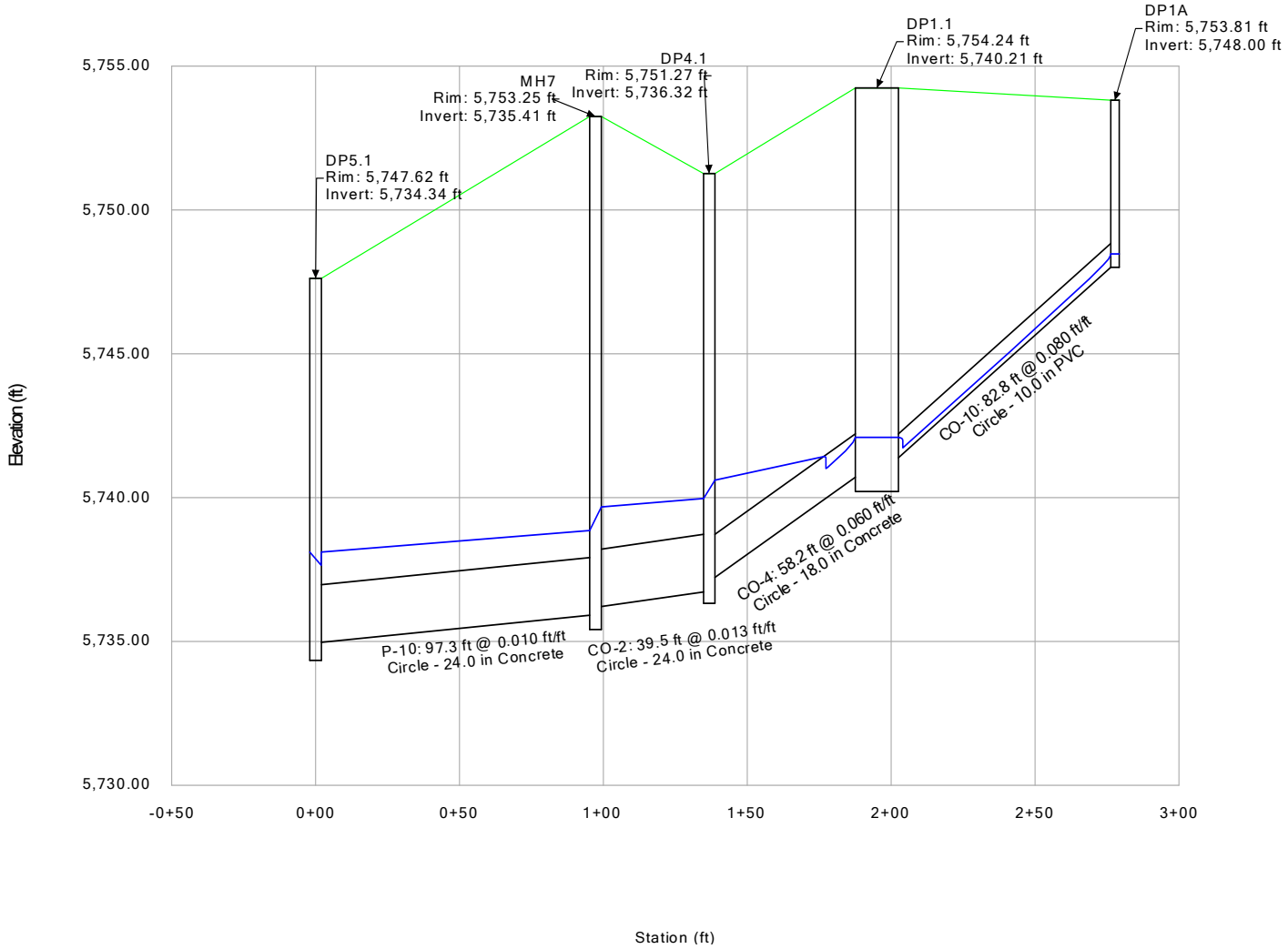
Engineering Profile - 03-Storm (Cottages_Mesa_Ridge.stsw)



100-YEAR SCENARIO

Profile Report

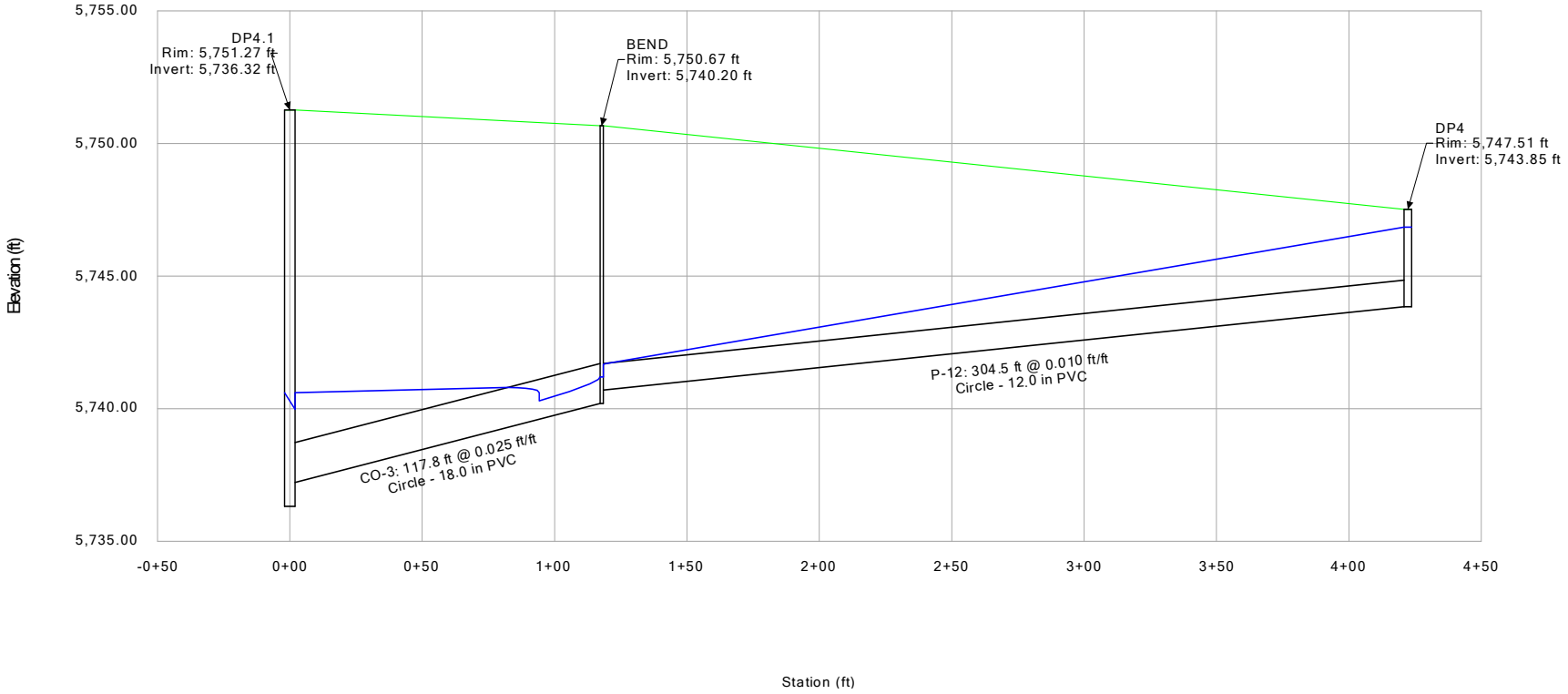
Engineering Profile - 04-Storm (Cottages_Mesa_Ridge.stsw)



100-YEAR SCENARIO

Profile Report

Engineering Profile - 05-Storm (Cottages_Mesa_Ridge.stsw)



24" RCP Outfall Riprap Sizing			
S (ft/ft)	C_f	q (cfs/ft)	D_{50} (in)
0.04	2	18.90	11.85

Type M Riprap (D_{50} = 12") will be utilized for the riprap energy dissapation protection

$$D_{50} = 5.23\ S^{0.43}\ (1.35 C_f q)^{0.56}$$ Equation 13-9

Where:

D_{50} = median rock size (in)
S = longitudinal slope (ft/ft)
C_f = concentration factor (1.0 to 3.0)
q = unit discharge (cfs/ft)

When:

η (porosity) = 0.0 (i.e., for buried soil riprap)

APPENDIX D – WATER QUALITY & DETENTION

6001
71.6 | 40.0

R6001

Pond 6002

HR GREEN: OVERALL BASIN 1040 UPDATED TO MATCH ONSITE BASIN DELINEATION. SEE FDR MAP FOR SUBBSINS. THIS MAP IS INTENDED AS AN OVERALL POND BASIN MAP.

Update the proposed storm lines so that this drawing and the drainage map are consistent with each other.

1040
11.7 | 55.6

6005
23.8 | 40.0

R6005

6010
26.1 | 50.0

R6010

R6003

R1040

6021

R6021

R6004

6020

R6020

6020
17.6 | 45.0

Pond D

R6023

6011
15.7 | 60.0

R6011

ROW DEDICATION REC NO: 1722613

WOODY CREEK DRIVE (PUBLIC RIGHT-OF-WAY)

SUNRISE RIDGE SUBDIVISION FILING NO. 2 BLOCK 1

LOT 25 LOT 24 LOT 23 LOT 22 LOT 21 LOT 20 LOT 19 LOT 18 LOT 17 LOT 16 LOT 15

EX PROPERTY LINE

30.00' UT ESMT REC NO: 98002695

EX U.G. ELEC

EX FIBEROPTIC

EX PROPERTY LINE (TYP)

WALL

EX GAS LINE

20.00' WATER & SEWER ESMT REC NO: 211107044)

30.00' PIPELINE EASEMENT (BOOK 2127 PAGE 170)

EX DETENTION POND

EX STORM INLET

EX STORM INLET

EX 66" RCP STORM SWR

15' CDOT Type-R (ON-GRADE)

EX 24" RCP STM SWR

EX BOX CULVERT

MESA RIDGE PARKWAY

MESA RIDGE SUBDIVISION FILING NO. 8

15' CDOT Type-R (ON-GRADE)

18" RCP

66" RCP (BYPASS IRRIGATION DITCH FLOWS)

PERMANENT DRAINAGE EASEMENT (REC. No. 201044126)

24" RCP

5' CDOT Type-R (ON-GRADE)

12" PVC

EX PROPERTY LINE

WATER & SEWER EASEMENT REC NO: 211707044)

FOUNTAIN MUTUAL IRRIGATION CO. (80') (BOOK 5506, PAGE 1290)

PERMANENT DRAINAGE EASEMENT (REC. No. 201044126)

3' CDOT Type-C (SUMP)

PR DRAINAGE SWALE

66" RCP (BYPASS IRRIGATION DITCH FLOWS)

20.00' FIRE ACCESS ROAD

MESA RIDGE SUBDIVISION FILING NO. 9

EX STM SWR (SIZE VARIES)

EX C&G

POWERS BOULEVARD (RIGHT-OF-WAY VARIES) (BOOK 6788 PAGE 531)

80.00' ROW

EX 5' TYPE R INLET

EX 18" STM SWR

EX 48" STM SWR

EX 5' TYPE R INLET

EX 18" RCP STM SWR

EX 24" RCP STM SWR

EX 24" RCP STM SWR

EX OUTLET STRUCTURE

EX FULL SPECTRUM DETENTION BASIN 'D' (TO BE RETROFITTED)

EX RIPRAP SPILLWAY

EX 48" RCP STM SWR

EX TYPE C INLET

SUNRISE RIDGE SUBDIVISION

LEGEND:

PROPOSED MAJOR CONTOUR	5250
PROPOSED MINOR CONTOUR	
EXISTING MAJOR CONTOUR	5250
EXISTING MINOR CONTOUR	
PROPOSED STORM DRAIN PIPE	
EXISTING STORM DRAIN PIPE	
PROPOSED DRAINAGE SWALE	
PROPERTY LINE	
PROPOSED FLOW DIRECTION	
EXISTING FLOW DIRECTION	
SUB BASIN LINE	
DESIGN POINT	A
PROPOSED BASIN LABEL	6001 (BASIN DESIGNATION); 71.6 (AREA (AC.)); 40.0 (PERCENT IMPERVIOUS (%))

NORTH

0 100

50

DRAWN BY:	NQJ	JOB DATE:	3/2/2022
APPROVED:	KMH	JOB NUMBER:	200541
CAD DATE:	6/8/2022		
CAD FILE:	J:\2020\200541\CAD\Dwgs\C\Drainage\Pr'_Drn_Map_PondD		

BAR IS ONE INCH ON OFFICIAL DRAWINGS. 0 1"

IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

HR GREEN - COLORADO SPRINGS
7222 COMMERCE CENTER DR SUITE 220
COLORADO SPRINGS CO 80919
PHONE: 719.300.4140 TOLL FREE: 800.728.7805
FAX: 844.273.1057 | HRGreen.com

THE COTTAGES AT MESA RIDGE
GOODWIN KNIGHT
EL PASO COUNTY, COLORADO

FINAL DRAINAGE REPORT

REGIONAL POND D MAP

SHEET DRN 2

CUHP SUBCATCHMENTS - PROPOSED CONDITION

Columns with this color heading are for required user-input
Columns with this color heading are for optional override values
Columns with this color heading are for program-calculated value

								Maximum Depression Storage (Watershed inches)		Horton's Infiltration Parameters			DCIA	
Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi^2)	Length to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness	Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)	Level 0, 1, or 2	Comment
6001	E6001	5-YR	0.112	0.2178	0.4356	0.012	40.0	0.35	0.1	4.5	0.0018	0.6	0	
6005	E6005	5-YR	0.0362	0.0786	0.2235	0.030	40.0	0.35	0.1	4.5	0.0018	0.6	0	
6010	E6010	5-YR	0.0433	0.1009	0.2216	0.049	50.0	0.35	0.1	4.5	0.0018	0.6	0	Updated imperviousness to include open space
6011	E6011	5-YR	0.0267	0.1621	0.3136	0.036	60.0	0.35	0.1	4.5	0.0018	0.6	0	
6020	E6020	5-YR	0.0300	0.1345	0.2083	0.050	45.0	0.35	0.1	4.5	0.0018	0.6	0	Updated to single-family imperviousness
1040	E1040	5-YR	0.0183	0.0758	0.1894	0.022	55.6	0.35	0.1	4.5	0.0018	0.6	0	Updated for new size and imperviousness

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

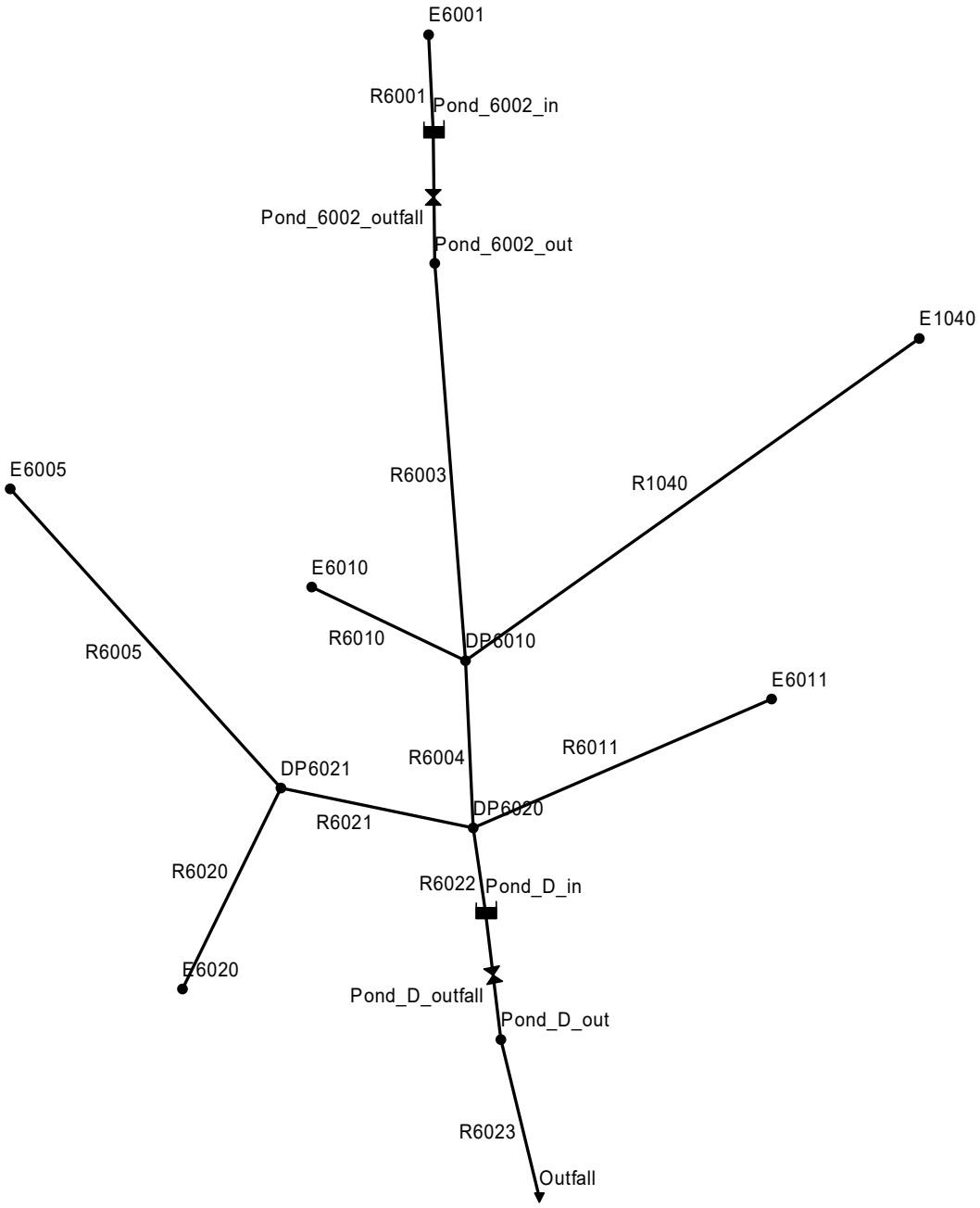
		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
6,001		0.094	0.175	23.6	3.47	12.3	2.45	5.8	142	260,198	0.56	145,367	34.0	45	145,362	0.62
6,005		0.094	0.105	14.0	1.43	7.3	1.01	2.4	77	84,100	0.56	46,985	31.0	21	46,984	0.89
6,010	Updated imperviousness to include open space	0.089	0.130	10.7	1.37	5.6	0.97	2.3	121	100,595	0.68	68,520	30.0	33	68,523	1.21
6,011		0.085	0.114	18.5	1.92	9.6	1.35	3.2	43	62,029	0.81	49,990	31.0	17	49,984	0.99
6,020	Updated to single-family imperviousness	0.092	0.104	15.2	1.52	7.9	1.07	2.5	59	69,696	0.62	43,184	31.0	17	43,176	0.91
1,040	Updated for new size and imperviousness	0.087	0.093	14.2	1.32	7.4	0.93	2.2	39	42,515	0.75	31,912	31.0	13	31,917	1.10

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

		Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
Catchment Name/ID	User Comment for Catchment	CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
6,001		0.094	0.178	23.1	3.45	12.0	2.44	5.7	146	260,198	2.09	542,819	40.0	173	542,806	2.41
6,005		0.094	0.107	13.7	1.42	7.1	1.01	2.4	79	84,100	2.09	175,447	36.0	77	175,455	3.32
6,010	Updated imperviousness to include open space	0.089	0.131	10.5	1.36	5.5	0.96	2.3	123	100,595	2.22	223,481	35.0	110	223,473	3.96
6,011		0.084	0.115	18.3	1.91	9.5	1.35	3.2	44	62,029	2.36	146,231	37.0	51	146,214	2.99
6,020	Updated to single-family imperviousness	0.091	0.105	15.0	1.51	7.8	1.07	2.5	60	69,696	2.15	150,108	36.0	62	150,075	3.21
1,040	Updated for new size and imperviousness	0.086	0.094	14.1	1.31	7.3	0.93	2.2	39	42,515	2.30	97,677	35.0	40	97,703	3.45

The Cottages at Mesa Ridge

01/01/2005 00:05:00



```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)
--------------------------------------------------------------

WARNING 04: minimum elevation drop used for Conduit R6022

**********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
**********************************************************

***************
Analysis Options
***************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ NO
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... KINWAVE
Starting Date ............ 01/01/2005 00:00:00
Ending Date .............. 01/01/2005 12:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 60.00 sec


*************************        Volume        Volume
Flow Routing Continuity        acre-feet      10^6 gal
*************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.000         0.000
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........        30.663         9.992
External Outflow .........        25.117         8.185
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         5.535         1.804
Continuity Error (%) .....         0.037


*******************************
Highest Flow Instability Indexes
*******************************
All links are stable.


************************
Routing Time Step Summary
************************
Minimum Time Step           :    60.00 sec
Average Time Step           :    60.00 sec
Maximum Time Step           :    60.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.12
Percent Not Converging      :     0.00


******************
Node Depth Summary
******************

-------------------------------------------------------------------------------
                              Average  Maximum  Maximum  Time of Max    Reported
                                Depth    Depth      HGL   Occurrence   Max Depth
Node                 Type        Feet     Feet     Feet  days hr:min        Feet
-------------------------------------------------------------------------------
E6005                JUNCTION    0.14     1.79  5715.48     0  00:37        1.76
E6010                JUNCTION    0.00     0.00  5693.19     0  00:00        0.00
E6001                JUNCTION    0.00     0.00  5750.46     0  00:00        0.00
E1040                JUNCTION    0.04     0.54  5732.81     0  00:36        0.54
E6011                JUNCTION    0.00     0.00  5688.69     0  00:00        0.00
E6020                JUNCTION    0.00     0.00  5691.39     0  00:00        0.00
```

DP6010	JUNCTION	0.48	3.15	5691.34	0	00:42	3.09
DP6021	JUNCTION	0.18	2.13	5693.32	0	00:37	2.09
DP6020	JUNCTION	0.48	3.15	5686.84	0	00:42	3.07
Pond_D_out	JUNCTION	0.19	1.04	5683.63	0	01:14	1.04
Pond_6002_out	JUNCTION	0.18	1.25	5749.71	0	00:59	1.24
Outfall	OUTFALL	0.19	1.04	5673.88	0	01:14	1.04
Pond_6002_in	STORAGE	4.90	9.61	5759.07	0	00:59	9.61
Pond_D_in	STORAGE	5.51	10.37	5694.06	0	01:14	10.37

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
E6005	JUNCTION	76.91	76.91	0 00:37	1.31	1.31	0.000
E6010	JUNCTION	109.76	109.76	0 00:36	1.67	1.67	0.000
E6001	JUNCTION	172.95	172.95	0 00:41	4.06	4.06	0.000
E1040	JUNCTION	40.35	40.35	0 00:36	0.731	0.731	0.000
E6011	JUNCTION	51.06	51.06	0 00:38	1.09	1.09	0.000
E6020	JUNCTION	61.62	61.62	0 00:37	1.12	1.12	0.000
DP6010	JUNCTION	0.00	232.79	0 00:42	0	6.28	0.000
DP6021	JUNCTION	0.00	138.54	0 00:37	0	2.43	0.000
DP6020	JUNCTION	0.00	413.44	0 00:41	0	9.8	0.000
Pond_D_out	JUNCTION	0.00	228.07	0 01:14	0	8.19	0.000
Pond_6002_out	JUNCTION	0.00	136.68	0 00:59	0	3.87	0.000
Outfall	OUTFALL	0.00	228.05	0 01:14	0	8.18	0.000
Pond_6002_in	STORAGE	0.00	172.95	0 00:41	0	4.06	0.152
Pond_D_in	STORAGE	0.00	413.44	0 00:41	0	9.8	0.048

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
Pond_6002_in	45.849	16	0	0	126.976	45	0 00:59	136.68
Pond_D_in	277.085	36	0	0	631.133	82	0 01:13	228.07

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
Outfall	98.06	25.83	228.05	8.184
System	98.06	25.83	228.05	8.184

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
R1040	CONDUIT	40.05	0 00:38	6.12	0.01	0.11
R6003	CONDUIT	136.55	0 01:01	8.00	0.06	0.25

R6004	CONDUIT	232.57	0	00:42	19.57	0.84	0.70
R6005	CONDUIT	76.92	0	00:37	17.52	0.67	0.60
R6011	DUMMY	51.06	0	00:38			
R6010	DUMMY	109.76	0	00:36			
R6021	CONDUIT	138.54	0	00:37	20.33	0.56	0.53
R6020	DUMMY	61.62	0	00:37			
R6001	DUMMY	172.95	0	00:41			
R6022	DUMMY	413.44	0	00:41			
R6023	CONDUIT	228.05	0	01:14	18.27	0.10	0.17
Pond_6002_outfall	DUMMY	136.68	0	00:59			
Pond_D_outfall	DUMMY	228.07	0	01:14			

****
Conduit Surcharge Summary
****

No conduits were surcharged.

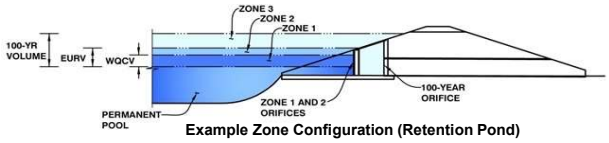
Analysis begun on: Mon Feb 28 16:14:51 2022
Analysis ended on: Mon Feb 28 16:14:51 2022
Total elapsed time: < 1 sec

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Mesa Ridge Cottages**

Basin ID: **Existing Pond D Sizing Confirmation**



Example Zone Configuration (Retention Pond)

			Elevation	Stage	Volume
5682.4	**pond bottom**	**EURV (FSV)**	**5687.18**	**4.78**	**5.14**
		5-Yr	**5687.40**	**5.00**	**5.46**
		100-YR	**5691.16**	**8.76**	**11.57**

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		
5684.00	--	1.60	--	--	--	50,745	1.165	40,595	0.932
5685.00	--	2.60	--	--	--	55,231	1.268	93,583	2.148
5686.00	--	3.60	--	--	--	58,662	1.347	150,529	3.456
5687.00	--	4.60	--	--	--	64,191	1.474	211,956	4.866
5688.00	--	5.60	--	--	--	67,213	1.543	277,658	6.374
5689.00	--	6.60	--	--	--	70,292	1.614	346,410	7.952
5690.00	--	7.60	--	--	--	73,458	1.686	418,285	9.603
5691.00	--	8.60	--	--	--	73,831	1.695	491,930	11.293
5692.00	--	9.60	--	--	--	80,094	1.839	568,892	13.060
5693.00	--	10.60	--	--	--	83,415	1.915	650,647	14.937
5694.00	--	11.60	--	--	--	87,173	2.001	735,941	16.895
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Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	98.80	acres
Watershed Length =	4,090	ft
Watershed Length to Centroid =	2,000	ft
Watershed Slope =	0.035	ft/ft
Watershed Imperviousness =	48.80%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	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) =	1.671	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	5.144	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1 in.) =	3.741	acre-feet	1.00	inches
5-yr Runoff Volume (P1 = 1.28 in.) =	5.462	acre-feet	1.28	inches
10-yr Runoff Volume (P1 = 1.55 in.) =	7.357	acre-feet	1.55	inches
25-yr Runoff Volume (P1 = 1.97 in.) =	11.295	acre-feet	1.97	inches
50-yr Runoff Volume (P1 = 2.34 in.) =	14.367	acre-feet	2.34	inches
100-yr Runoff Volume (P1 = 2.74 in.) =	18.116	acre-feet	2.74	inches
500-yr Runoff Volume (P1 = 3.84 in.) =	27.672	acre-feet	3.84	inches
Approximate 2-yr Detention Volume =	3.247	acre-feet		
Approximate 5-yr Detention Volume =	4.538	acre-feet		
Approximate 10-yr Detention Volume =	6.263	acre-feet		
Approximate 25-yr Detention Volume =	7.639	acre-feet		
Approximate 50-yr Detention Volume =	8.436	acre-feet		
Approximate 100-yr Detention Volume =	9.873	acre-feet		

Define Zones and Basin Geometry

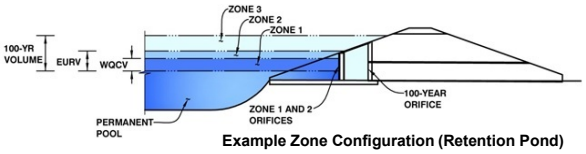
Zone 1 Volume (User Defined) =	5.14	acre-feet
Zone 2 Volume (User Defined - Zone 1) =	0.32	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	6.10	acre-feet
Total Detention Basin Volume =	11.57	acre-feet

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Mesa Ridge Cottages

Basin ID: Existing Pond D Sizing Confirmation



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (User)	4.79	5.144	Orifice Plate
Zone 2 (User)	5.01	0.318	Orifice Plate
Zone 3 (User)	8.76	6.104	Weir&Pipe (Rect.)
Total (all zones)		11.566	

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

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

Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²

Underdrain Orifice Centroid = feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	4.46	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	ft²

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)	0.85	1.19	1.52	1.85	2.19	2.52	2.85	3.19
Orifice Area (sq. inches)	3.93	3.93	3.93	3.93	3.93	3.93	3.93	3.93

	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)		0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	ft²
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 =	4.46	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.46	N/A	feet
Overflow Weir Front Edge Length =	12.00	N/A	feet	Overflow Weir Slope Length =	6.32	N/A	feet
Overflow Weir Grate Slope =	3.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	3.34	N/A	
Horiz. Length of Weir Sides =	6.00	N/A	feet	Overflow Grate Open Area w/o Debris =	60.03	N/A	ft²
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	60.03	N/A	ft²
Debris Clogging % =	0%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Rectangular	Not Selected			Zone 3 Rectangular	Not Selected	
Depth to Invert of Outlet Pipe =	1.21	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	18.00	N/A	ft²
Rectangular Orifice Width =	72.00	N/A	inches	Outlet Orifice Centroid =	1.50	N/A	feet
Rectangular Orifice Height =	36.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	11.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.59 feet
Spillway Crest Length =	185.00	feet	Stage at Top of Freeboard =	11.99 feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	2.00 acres
Freeboard above Max Water Surface =	0.40	feet	Basin Volume at Top of Freeboard =	16.89 acre-ft

Calculated Parameters for Spillway

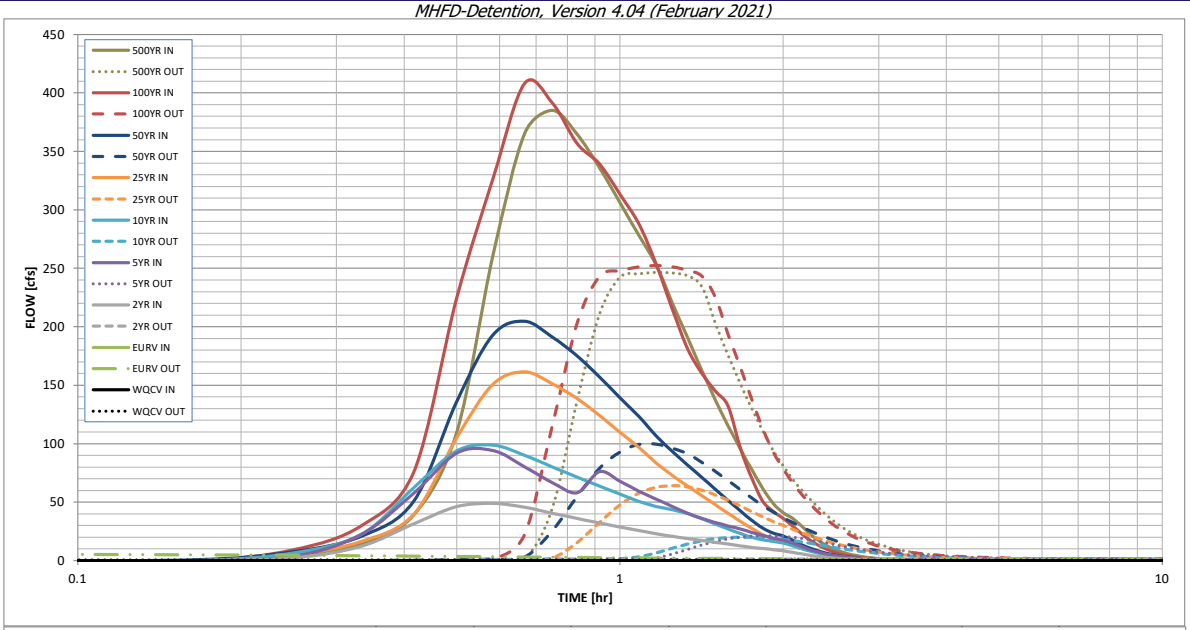
Routed Hydrograph Results

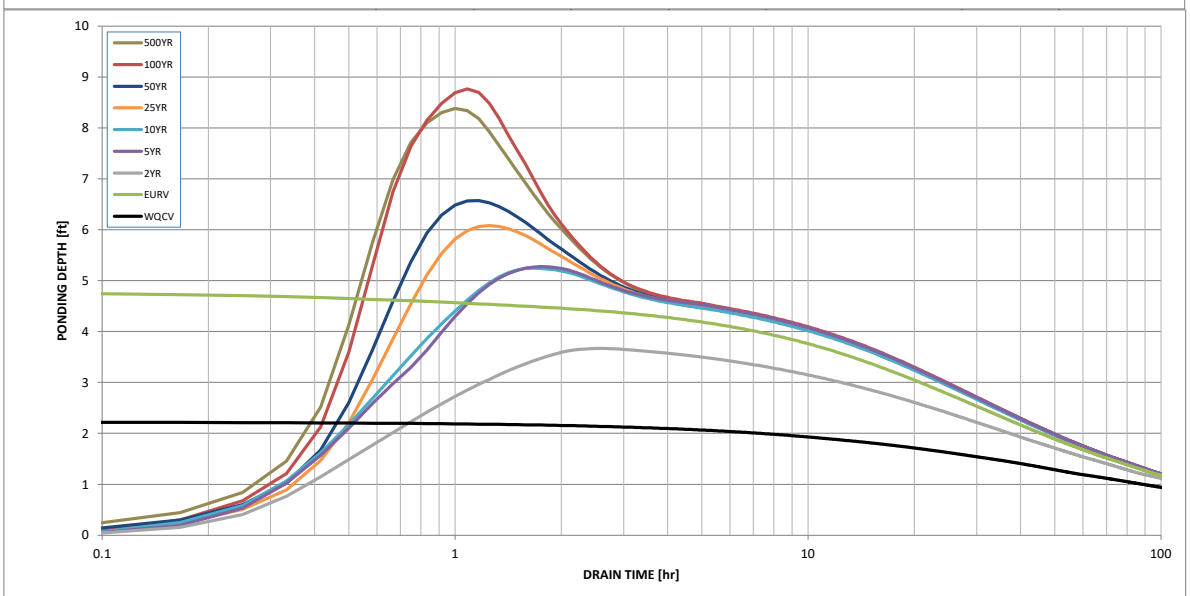
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

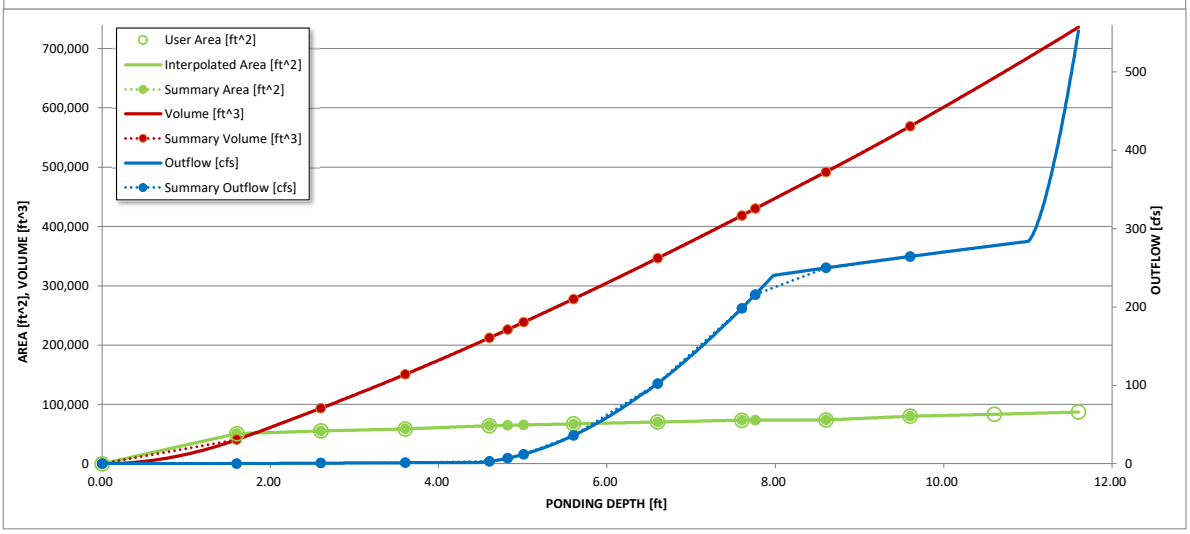
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.00	1.28	1.55	1.97	2.34	2.74	3.84
CUHP Runoff Volume (acre-ft) =	1.671	5.144	3.741	5.462	7.357	11.295	14.367	18.116	27.672
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.741	7.663	7.357	11.295	14.367	29.508	27.672
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.1	11.3	25.6	67.8	94.1	127.9	209.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.11	0.26	0.69	0.95	1.29	2.12
Peak Inflow Q (cfs) =	N/A	N/A	48.9	94.1	98.7	161.4	204.6	407.9	385.0
Peak Outflow Q (cfs) =	0.5	6.0	1.3	21.3	20.1	64.1	99.5	252.3	246.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.9	0.8	0.9	1.1	2.0	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	0.08	N/A	0.3	0.3	1.0	1.6	4.2	4.1
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) =	>120	>120	>120	>120	>120	>120	116	71	74
Time to Drain 99% of Inflow Volume (hours) =	**>120**	>120	>120	>120	>120	>120	>120	>120	>120
Maximum Ponding Depth (ft) =	2.22	4.79	3.66	5.27	5.24	6.08	6.57	8.76	8.38
Area at Maximum Ponding Depth (acres) =	1.23	1.49	1.35	1.52	1.52	1.58	1.61	1.72	1.69
Maximum Volume Stored (acre-ft) =	1.674	5.147	3.537	5.869	5.823	7.107	7.888	11.566	10.904
Equivalent Elevation (ft) =		5687.19	5686.06	5687.67	5687.64	5688.48	5688.97	5691.16	
Pond Bottom (ft) =	5682.400								

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	USER	CUHP	CUHP	CUHP	USER	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	0.70	0.00	3.09
	0:15:00	0.00	0.00	2.43	3.68	6.53	5.30	7.67	9.15	14.49
	0:20:00	0.00	0.00	12.29	22.29	22.28	16.37	20.88	29.83	38.98
	0:25:00	0.00	0.00	31.51	57.69	62.37	39.54	50.87	75.72	109.68
	0:30:00	0.00	0.00	46.16	91.81	93.76	105.05	136.02	224.60	260.83
	0:35:00	0.00	0.00	48.87	94.12	98.66	150.75	193.05	326.49	365.14
	0:40:00	0.00	0.00	45.61	80.25	90.11	161.36	204.64	407.93	385.04
	0:45:00	0.00	0.00	40.59	66.76	80.26	151.30	191.18	391.67	364.86
	0:50:00	0.00	0.00	35.99	58.09	71.47	138.64	175.05	356.83	336.13
	0:55:00	0.00	0.00	32.15	76.08	63.78	124.09	157.03	339.23	306.19
	1:00:00	0.00	0.00	28.77	67.82	56.86	109.79	139.37	313.47	278.30
	1:05:00	0.00	0.00	25.79	59.43	50.69	96.85	123.27	288.08	252.85
	1:10:00	0.00	0.00	23.01	52.50	46.30	83.54	106.61	253.54	220.13
	1:15:00	0.00	0.00	20.74	46.35	43.41	72.79	93.34	214.87	190.34
	1:20:00	0.00	0.00	18.86	40.52	40.10	63.61	81.64	180.99	162.52
	1:25:00	0.00	0.00	17.22	36.01	35.76	55.52	71.12	160.14	137.32
	1:30:00	0.00	0.00	15.66	32.65	31.27	47.74	60.92	145.01	115.32
	1:35:00	0.00	0.00	14.12	29.66	27.06	40.42	51.35	132.08	95.75
	1:40:00	0.00	0.00	12.62	27.15	23.26	33.66	42.55	96.68	77.90
	1:45:00	0.00	0.00	11.30	24.16	19.99	27.50	34.55	70.46	61.83
	1:50:00	0.00	0.00	10.40	21.51	17.80	22.22	27.75	50.89	48.98
	1:55:00	0.00	0.00	9.39	19.21	16.39	18.85	23.57	42.17	41.05
	2:00:00	0.00	0.00	8.38	17.41	15.05	16.81	20.99	36.08	35.98
	2:05:00	0.00	0.00	7.01	14.97	12.69	13.93	17.36	29.63	29.23
	2:10:00	0.00	0.00	5.61	11.89	10.11	10.84	13.48	22.74	22.26
	2:15:00	0.00	0.00	4.44	9.04	7.93	8.34	10.34	16.89	16.62
	2:20:00	0.00	0.00	3.50	7.02	6.20	6.43	7.94	12.61	12.36
	2:25:00	0.00	0.00	2.75	5.27	4.81	4.94	6.07	9.30	9.21
	2:30:00	0.00	0.00	2.14	4.09	3.67	3.78	4.62	6.83	6.99
	2:35:00	0.00	0.00	1.67	3.12	2.78	2.86	3.48	4.99	5.26
	2:40:00	0.00	0.00	1.28	2.39	2.10	2.16	2.62	3.71	4.01
	2:45:00	0.00	0.00	0.98	1.78	1.61	1.65	2.00	2.77	3.10
	2:50:00	0.00	0.00	0.72	1.41	1.20	1.25	1.51	2.08	2.33
	2:55:00	0.00	0.00	0.51	1.22	0.86	0.90	1.09	1.53	1.67
	3:00:00	0.00	0.00	0.34	1.11	0.58	0.61	0.74	1.24	1.12
	3:05:00	0.00	0.00	0.20	1.06	0.35	0.38	0.45	1.11	0.67
	3:10:00	0.00	0.00	0.10	1.03	0.18	0.20	0.24	1.05	0.34
	3:15:00	0.00	0.00	0.04	1.02	0.07	0.08	0.09	1.03	0.12
	3:20:00	0.00	0.00	0.01	1.02	0.01	0.01	0.01	1.02	0.00
	3:25:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.02	0.00
	3:30:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:35:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:40:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:45:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:50:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:55:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:00:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:05:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:10:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:15:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:20:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:25:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:30:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:35:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:40:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:45:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:50:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:55:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:00:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Summary Stage-Area-Volume-Discharge Relationships

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

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	0.00	0	0.000	0	0.000	0.00
	1.60	50,745	1.165	40,595	0.932	0.24
	2.60	55,231	1.268	93,583	2.148	0.70
	3.60	58,662	1.347	150,529	3.456	1.28
	4.60	64,191	1.474	211,956	4.866	2.89
EURV (FS)	4.82	64,856	1.489	226,151	5.192	7.01
5-Year	5.01	65,430	1.502	238,528	5.476	12.09
	5.60	67,213	1.543	277,658	6.374	35.96
	6.60	70,292	1.614	346,410	7.952	102.27
	7.60	73,458	1.686	418,285	9.603	198.34
100-Year	7.76	73,518	1.688	430,043	9.872	215.81
	8.60	73,831	1.695	491,930	11.293	249.84
	9.60	80,094	1.839	568,892	13.060	264.45

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

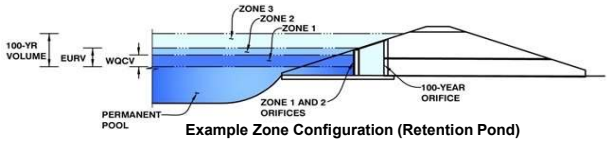
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **Mesa Ridge Cottages**

Basin ID: **Existing Pond D Sizing Confirmation - with Structure Modifications**



Example Zone Configuration (Retention Pond)

			Elevation	Stage	Volume
5682.4	**pond bottom**	**EURV (FSV)**	**5687.29**	**4.89**	**5.19**
		5-Yr	**5688.19**	**5.79**	**6.56**
		100-YR	**5692.82**	**10.42**	**14.49**

Depth Increment = ft

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	98.90	acres
Watershed Length =	4,090	ft
Watershed Length to Centroid =	2,000	ft
Watershed Slope =	0.035	ft/ft
Watershed Imperviousness =	49.08%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	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) =	1.679	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	5.181	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1 in.) =	3.768	acre-feet	1.00	inches
5-yr Runoff Volume (P1 = 1.28 in.) =	5.495	acre-feet	1.28	inches
10-yr Runoff Volume (P1 = 1.55 in.) =	7.395	acre-feet	1.55	inches
25-yr Runoff Volume (P1 = 1.97 in.) =	11.334	acre-feet	1.97	inches
50-yr Runoff Volume (P1 = 2.34 in.) =	14.409	acre-feet	2.34	inches
100-yr Runoff Volume (P1 = 2.74 in.) =	18.159	acre-feet	2.74	inches
500-yr Runoff Volume (P1 = 3.84 in.) =	27.727	acre-feet	3.84	inches
Approximate 2-yr Detention Volume =	3.272	acre-feet		
Approximate 5-yr Detention Volume =	4.571	acre-feet		
Approximate 10-yr Detention Volume =	6.303	acre-feet		
Approximate 25-yr Detention Volume =	7.685	acre-feet		
Approximate 50-yr Detention Volume =	8.485	acre-feet		
Approximate 100-yr Detention Volume =	9.924	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (User Defined) =	5.19	acre-feet
Zone 2 Volume (User Defined - Zone 1) =	1.37	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	7.93	acre-feet
Total Detention Basin Volume =	14.49	acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000		
5683.0	--	0.60	--	--	--	13,215	0.303	3,964	0.091
5684.0	--	1.60	--	--	--	50,745	1.165	35,944	0.825
5685.0	--	2.60	--	--	--	55,231	1.268	88,932	2.042
5686.0	--	3.60	--	--	--	58,662	1.347	145,878	3.349
5687.0	--	4.60	--	--	--	64,191	1.474	207,305	4.759
5688.0	--	5.60	--	--	--	67,213	1.543	273,007	6.267
5689.0	--	6.60	--	--	--	70,292	1.614	341,759	7.846
5690.0	--	7.60	--	--	--	73,458	1.686	413,634	9.496
5691.0	--	8.60	--	--	--	73,831	1.695	487,279	11.186
5692.0	--	9.60	--	--	--	80,094	1.839	564,241	12.953
5693.0	--	10.60	--	--	--	83,808	1.924	646,192	14.835
5694.0	--	11.60	--	--	--	87,413	2.007	731,803	16.800
5695.0	--	12.60	--	--	--	93,285	2.142	822,152	18.874
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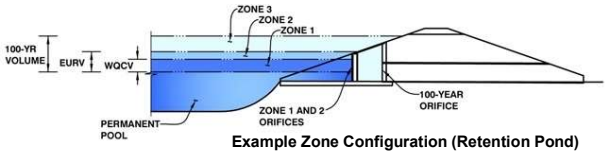
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **Mesa Ridge Cottages**

Basin ID: **Existing Pond D Sizing Confirmation - with Structure Modifications**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (User)	4.89	5.19	Orifice Plate
Zone 2 (User)	5.80	1.37	Orifice Plate
Zone 3 (User)	10.43	7.93	Weir&Pipe (Rect.)
Total (all zones)		14.49	

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	ft²
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	ft²
Depth at top of Zone using Orifice Plate =	5.80	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	ft²

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	0.81	1.14	1.47	1.80			
Orifice Area (sq. inches)	7.60	5.00	5.00	5.00	2.00			

	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 S
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at S
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

Not Selected	Not Selected	
N/A	N/A	ft²
N/A	N/A	feet

SEE CONSTRUCTION DOCUMENTS FOR MODIFICATIONS TO EX ORIFICE PLATE

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 =	5.24	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.24	N/A	feet
Overflow Weir Front Edge Length =	12.00	N/A	feet	Overflow Weir Slope Length =	6.32	N/A	feet
Overflow Weir Grate Slope =	3.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	2.93	N/A	
Horiz. Length of Weir Sides =	6.00	N/A	feet	en Area w/o Debris =	52.82	N/A	ft²
Overflow Grate Type =	Type C Grate	N/A		pen Area w/ Debris =	52.82	N/A	ft²
Debris Clogging % =	0%	N/A	%				

Calculated Parameters for Overflow Weir

SEE CONSTRUCTION DOCUMENTS FOR MODIFICATIONS TO EX OUTLET STRUCT.

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

	Zone 3 Rectangular	Not Selected			Zone 3 Rectangular	Not Selected	
Depth to Invert of Outlet Pipe =	1.21	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	18.00	N/A	ft²
Rectangular Orifice Width =	72.00	N/A	inches	Outlet Orifice Centroid =	1.50	N/A	feet
Rectangular Orifice Height =	36.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	11.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.80 feet
Spillway Crest Length =	185.00	feet	Stage at Top of Freeboard =	12.20 feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	2.09 acres
Freeboard above Max Water Surface =	0.40	feet	Basin Volume at Top of Freeboard =	18.03 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).

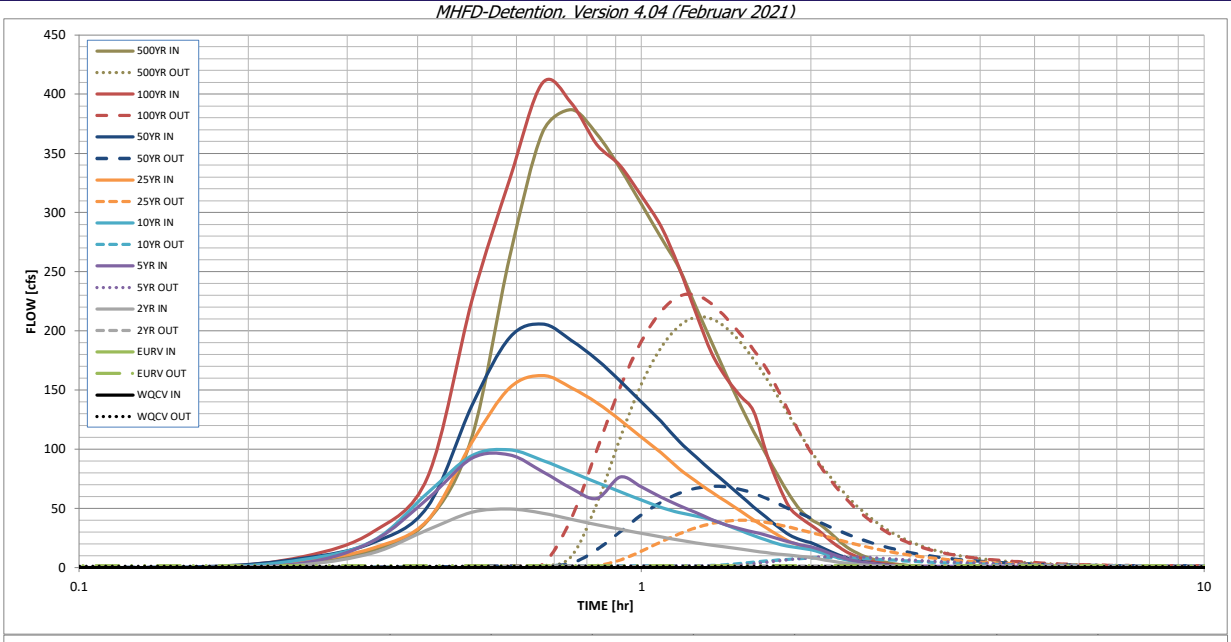
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.00	1.28	1.55	1.97	2.34	2.74	3.84
CUHP Runoff Volume (acre-ft) =	1.679	5.181	3.768	5.495	7.395	11.334	14.409	18.159	27.727
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.768	7.701	7.395	11.334	14.409	29.562	27.727
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.1	11.4	25.6	67.9	94.3	128.0	209.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						233.0	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.11	0.26	0.69	0.95	2.36	2.12
Peak Inflow Q (cfs) =	N/A	N/A	49.4	95.1	99.4	162.3	205.7	409.3	586.8
Peak Outflow Q (cfs) =	1.0	1.6	1.4	9.4	8.4	40.0	68.7	230.3	211.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.3	0.6	0.7	1.0	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.1	0.7	1.3	4.3	4.0
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) =	39	64	56	71	71	67	65	55	56
Time to Drain 99% of Inflow Volume (hours) =	**41**	71	61	79	79	77	76	70	70
Maximum Ponding Depth (ft) =	2.32	4.89	3.73	5.93	5.87	7.03	7.71	10.34	10.08
Area at Maximum Ponding Depth (acres) =	1.24	1.49	1.36	1.57	1.56	1.64	1.69	1.90	1.88
Maximum Volume Stored (acre-ft) =	1.69	5.189	3.51	6.765	6.67	8.63	9.68	14.318	13.83
Equivalent Elevation (ft) =		5687.29	5686.13	5688.33				5692.74	
Pond Bottom (ft) =	5682.400								

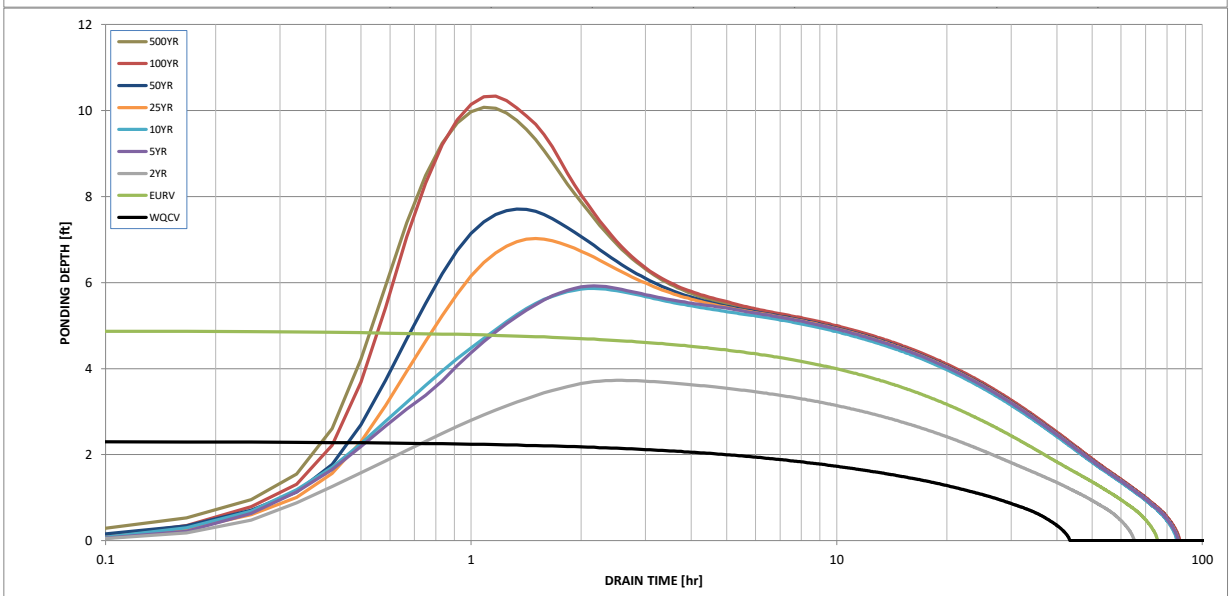
100 YR PEAK RELEASE SET BELOW VALUE PERSCRIBED IN 2013 MDDP (233 CFS)

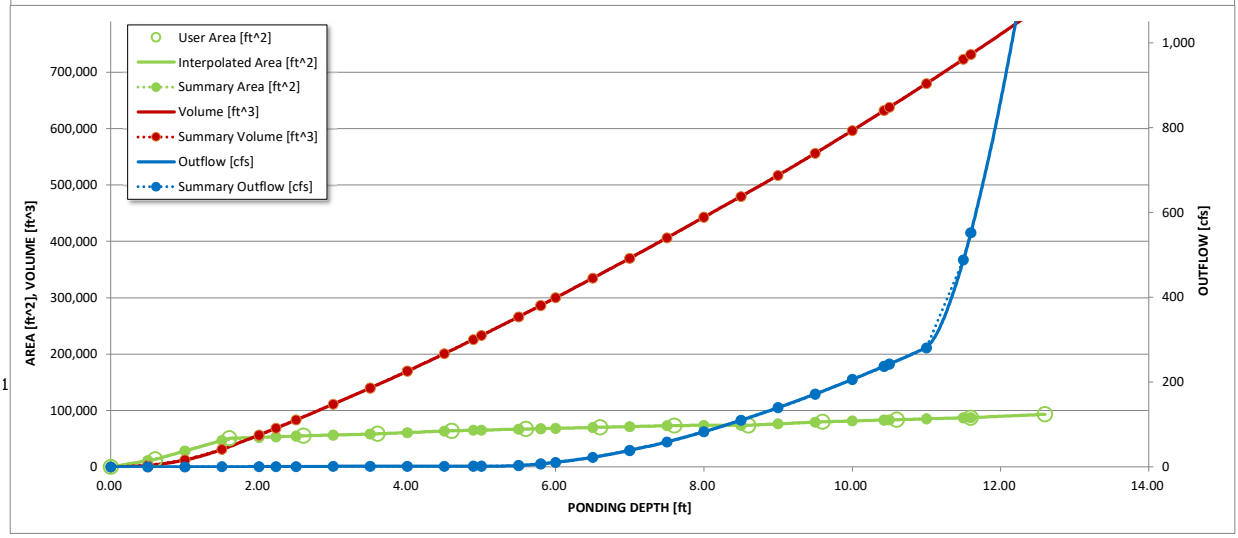
RESULTS FROM CROSSED OUT STORM EVENTS ARE NOT VALID, ONLY THE 5-YR & 100-YR HYDROGRAPHS WERE REPLACED (FROM SWMM) IN THIS WORKSHEET

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	USER	CUHP	CUHP	CUHP	USER	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	0.71	0.00	3.14
	0:15:00	0.00	0.00	2.47	3.68	6.63	5.38	7.78	9.16	14.70
	0:20:00	0.00	0.00	12.47	22.38	22.59	16.60	21.16	30.17	39.47
	0:25:00	0.00	0.00	31.93	58.18	63.06	40.04	51.48	76.34	110.68
	0:30:00	0.00	0.00	46.70	92.37	94.61	106.01	137.18	225.91	262.70
	0:35:00	0.00	0.00	49.37	95.06	99.39	151.87	194.38	328.10	367.29
	0:40:00	0.00	0.00	46.03	81.06	90.69	162.30	205.75	409.27	386.82
	0:45:00	0.00	0.00	40.94	67.14	80.71	152.06	192.06	392.65	366.24
	0:50:00	0.00	0.00	36.27	58.35	71.85	139.22	175.69	357.50	337.13
	0:55:00	0.00	0.00	32.38	76.39	64.07	124.55	157.55	339.61	306.95
	1:00:00	0.00	0.00	28.94	68.07	57.07	110.10	139.70	313.76	278.78
	1:05:00	0.00	0.00	25.93	59.52	50.84	97.03	123.44	288.18	253.04
	1:10:00	0.00	0.00	23.16	52.37	46.49	83.62	106.66	253.61	220.11
	1:15:00	0.00	0.00	20.87	46.48	43.61	72.92	93.46	214.82	190.38
	1:20:00	0.00	0.00	18.97	40.58	40.25	63.71	81.72	181.11	162.48
	1:25:00	0.00	0.00	17.30	36.06	35.86	55.57	71.14	160.14	137.12
	1:30:00	0.00	0.00	15.71	32.72	31.31	47.71	60.85	144.84	114.99
	1:35:00	0.00	0.00	14.15	30.00	27.04	40.32	51.19	132.05	95.27
	1:40:00	0.00	0.00	12.63	27.33	23.21	33.50	42.32	96.69	77.32
	1:45:00	0.00	0.00	11.31	24.24	19.93	27.30	34.26	70.46	61.23
	1:50:00	0.00	0.00	10.44	21.59	17.82	22.02	27.48	50.93	48.56
	1:55:00	0.00	0.00	9.44	19.30	16.47	18.80	23.48	42.23	40.85
	2:00:00	0.00	0.00	8.43	17.47	15.13	16.82	20.98	36.01	35.90
	2:05:00	0.00	0.00	7.05	15.04	12.75	13.95	17.37	29.84	29.18
	2:10:00	0.00	0.00	5.64	11.93	10.14	10.84	13.47	22.81	22.20
	2:15:00	0.00	0.00	4.45	9.21	7.94	8.34	10.33	16.90	16.56
	2:20:00	0.00	0.00	3.51	7.03	6.20	6.42	7.92	12.51	12.29
	2:25:00	0.00	0.00	2.75	5.27	4.80	4.93	6.05	9.31	9.17
	2:30:00	0.00	0.00	2.14	4.09	3.66	3.77	4.60	6.83	6.96
	2:35:00	0.00	0.00	1.66	3.12	2.76	2.85	3.46	5.01	5.24
	2:40:00	0.00	0.00	1.28	2.39	2.09	2.15	2.60	3.71	3.99
	2:45:00	0.00	0.00	0.97	1.78	1.60	1.64	1.98	2.77	3.08
	2:50:00	0.00	0.00	0.72	1.41	1.19	1.24	1.49	2.07	2.31
	2:55:00	0.00	0.00	0.50	1.22	0.85	0.89	1.07	1.53	1.65
	3:00:00	0.00	0.00	0.33	1.11	0.56	0.60	0.72	1.23	1.09
	3:05:00	0.00	0.00	0.19	1.06	0.34	0.37	0.44	1.10	0.65
	3:10:00	0.00	0.00	0.10	1.03	0.17	0.19	0.22	1.05	0.32
	3:15:00	0.00	0.00	0.04	1.02	0.06	0.07	0.08	1.03	0.11
	3:20:00	0.00	0.00	0.01	1.02	0.01	0.01	0.01	1.02	0.00
	3:25:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.02	0.00
	3:30:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:35:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:40:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:45:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:50:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.01	0.00
	3:55:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:00:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:05:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:10:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:15:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:20:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:25:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:30:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:35:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:40:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:45:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:50:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:55:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:00:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Summary Stage-Area-Volume-Discharge Relationships

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

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

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	0.00	0	0.000	0	0.000	0.00
	0.50	11,013	0.253	2,752	0.063	0.18
	1.00	28,227	0.648	12,252	0.281	0.33
	1.50	46,992	1.079	31,057	0.713	0.58
	2.00	52,539	1.206	56,600	1.299	0.85
WQCV	2.23	53,571	1.230	68,803	1.580	0.94
	2.50	54,782	1.258	83,431	1.915	1.04
	3.00	56,603	1.299	111,298	2.555	1.20
	3.50	58,319	1.339	140,029	3.215	1.33
	4.00	60,874	1.397	169,785	3.898	1.45
	4.50	63,638	1.461	200,913	4.612	1.57
EURV	4.89	65,067	1.494	226,047	5.189	1.65
	5.00	65,400	1.501	233,223	5.354	1.67
	5.50	66,911	1.536	266,300	6.113	3.41
5-YEAR	5.80	67,829	1.557	286,511	6.577	7.29
	6.00	68,445	1.571	300,138	6.890	10.82
	6.50	69,984	1.607	334,745	7.685	22.72
	7.00	71,558	1.643	370,129	8.497	39.06
	7.50	73,141	1.679	406,304	9.327	58.97
	8.00	73,607	1.690	443,047	10.171	83.01
	8.50	73,794	1.694	479,897	11.017	110.04
	9.00	76,336	1.752	517,312	11.876	139.71
	9.50	79,468	1.824	556,263	12.770	171.79
	10.00	81,580	1.873	596,576	13.695	206.11
100-YEAR	10.43	83,177	1.909	631,998	14.509	237.31
	10.50	83,437	1.915	637,830	14.643	242.53
	11.00	85,250	1.957	680,004	15.611	280.92
	11.50	87,052	1.998	723,079	16.600	488.10
	11.60	87,413	2.007	731,803	16.800	552.09

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

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

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: EXISTING DETENTION BASIN D W/ PROPOSED OUTLET STRUCTURE MODIFICATIONS

Facility Location & Jurisdiction: LOCATED: NW CORNER OF SNEFFLES ST & MESA RIDGE PKWY; JURISDCTION: MESA RDIGE METRO DIST, NO. 1

User Input: Watershed Characteristics

Watershed Slope =	0.035	ft/ft
Watershed Length =	4090	ft
Watershed Area =	98.90	acres
Watershed Imperviousness =	49.1%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent

Location for 1-hr Rainfall Depths (use dropdown):

User Input

WQCV Treatment Method = Extended Detention

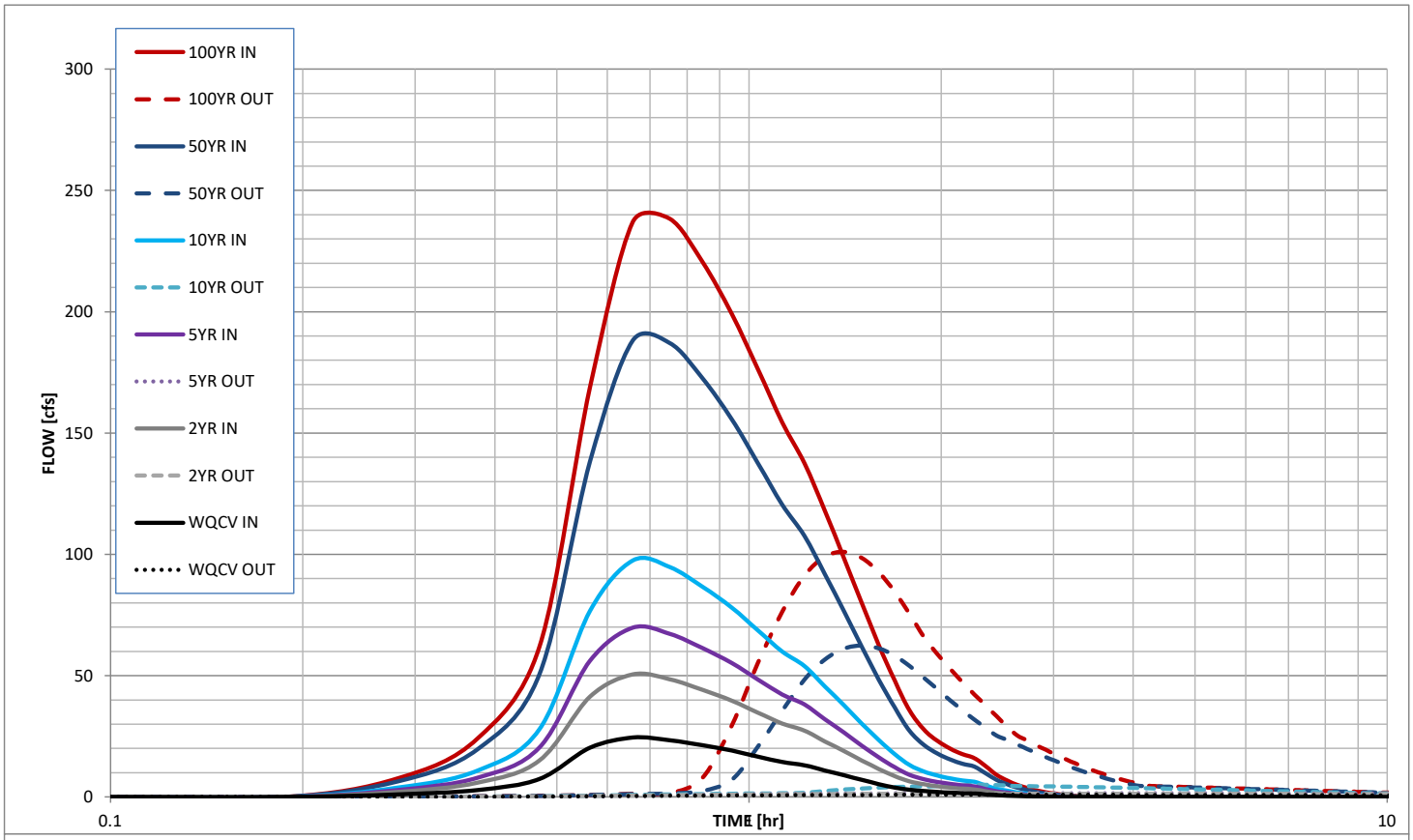
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	0	0.00	0.00
0.60	13,215	0.60	0.20
1.60	50,745	1.60	0.64
2.60	55,231	2.60	1.07
3.60	58,662	3.60	1.36
4.60	64,191	4.60	1.59
5.60	67,213	5.60	4.51
6.60	70,292	6.60	25.63
7.60	73,458	7.60	63.52
8.60	73,831	8.60	115.77
9.60	80,094	9.60	178.48
10.60	83,808	10.60	250.05
11.60	87,413	11.60	552.09
12.60	93,285	12.60	1458.41

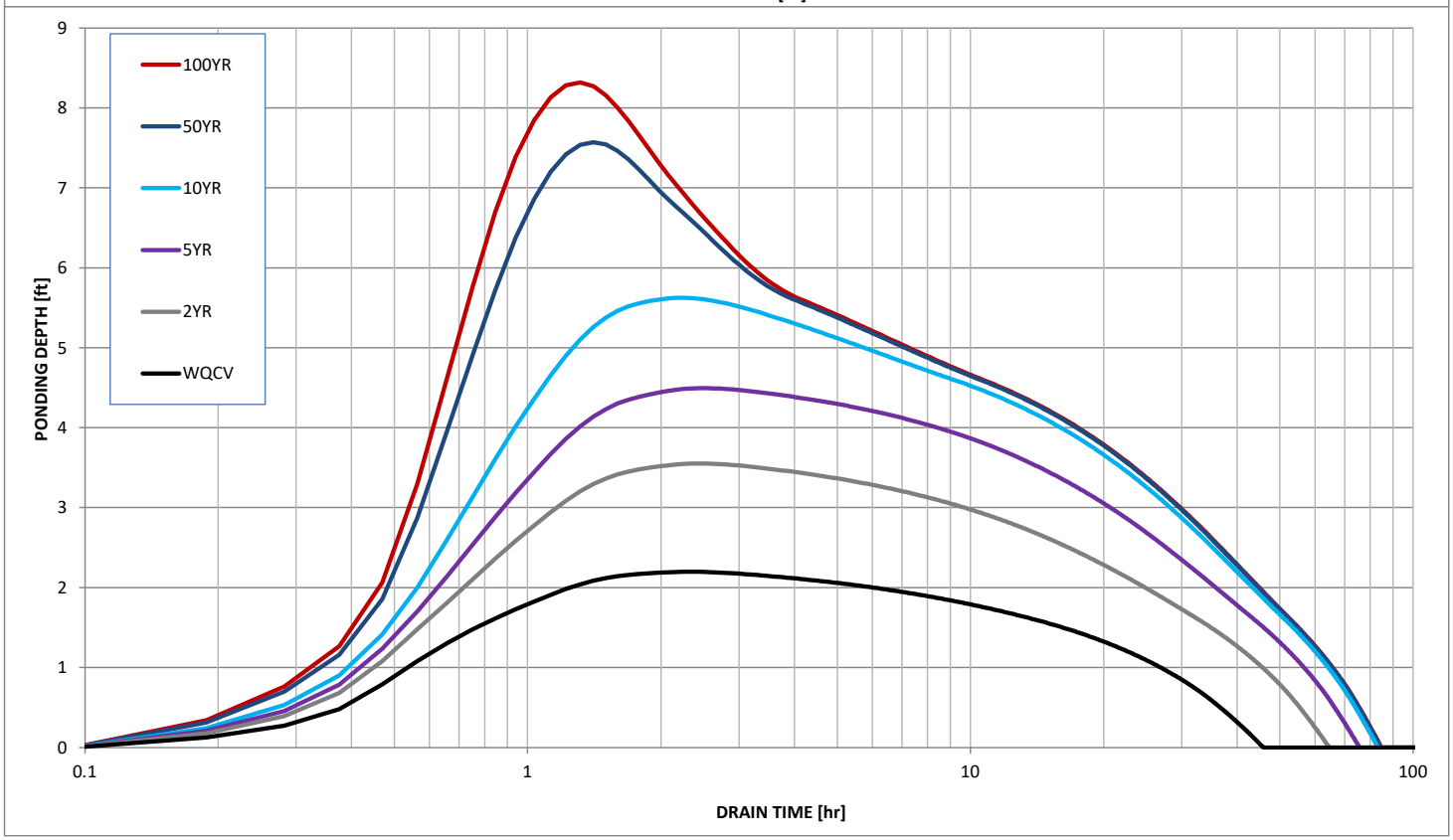
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

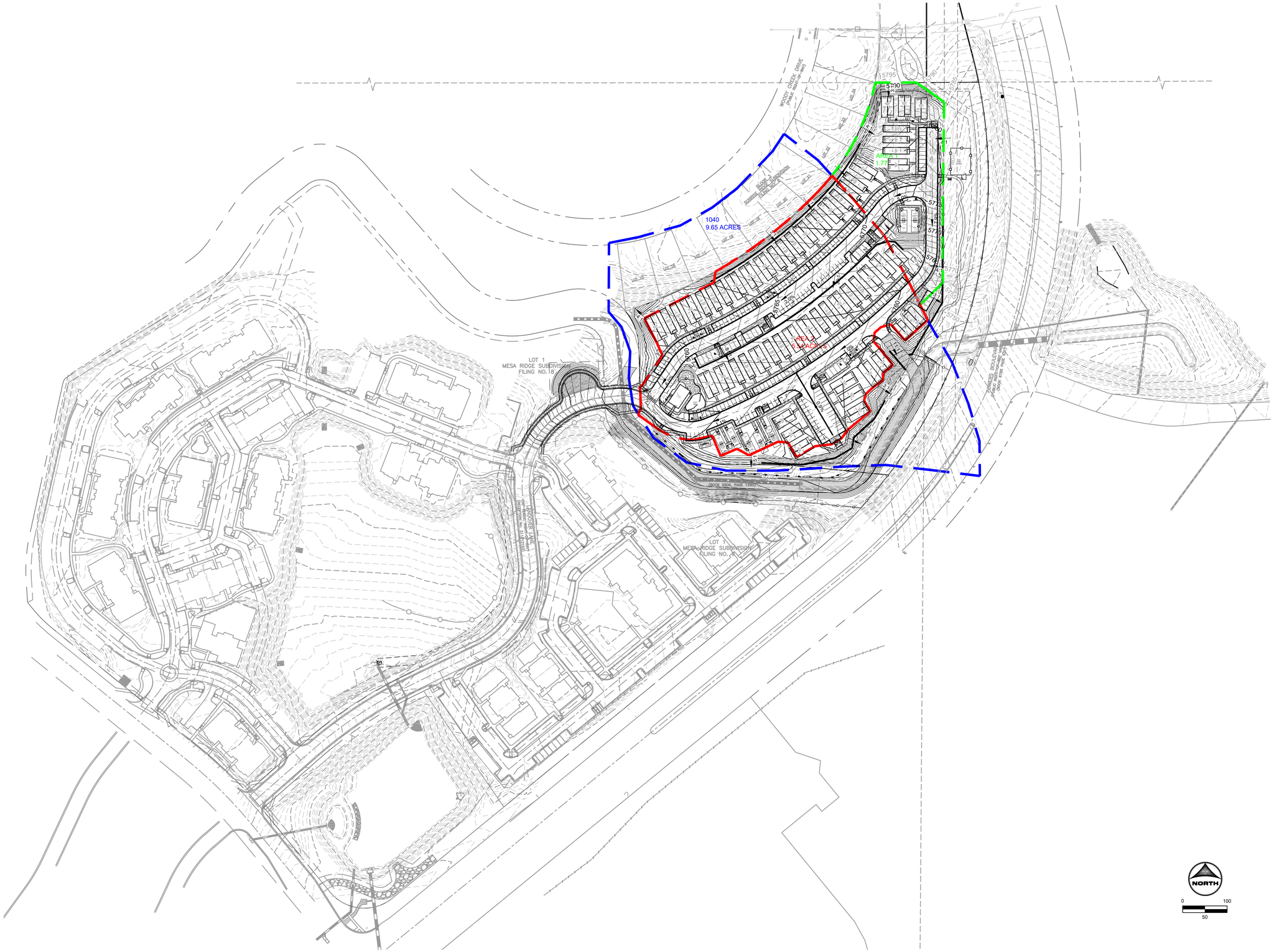
Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	1.00	1.28	1.55	2.34	2.74	in
Calculated Runoff Volume =	1.680	3.506	4.870	6.863	13.542	17.231	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	1.680	3.505	4.869	6.862	13.535	17.224	acre-ft
Time to Drain 97% of Inflow Volume =	37.7	52.8	**61.7**	66.9	62.0	59.4	hours
Time to Drain 99% of Inflow Volume =	41.2	57.8	67.6	73.7	71.2	**69.7**	hours
Maximum Ponding Depth =	2.20	3.55	4.49	5.63	7.57	8.32	ft
Maximum Ponded Area =	1.23	1.34	1.46	1.54	1.68	**1.69**	acres
Maximum Volume Stored =	1.532	3.276	4.601	6.300	9.440	10.693	acre-ft

Stormwater Detention and Infiltration Design Data Sheet







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APPROVED:	KEN	JOB NUMBER:	200541
CAD DATE:	6/8/2022		
CAD FILE:	J:\2020\200541\CAD\Dwgs\Exhibits\Site Plans\Concept_Plan		

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

NO.	DATE	BY	REVISION DESCRIPTION

HRGreen

HR GREEN - COLORADO SPRINGS

7222 COMMERCE CENTER DR SUITE 220
COLORADO SPRINGS CO 80919

PHONE: 719.300.4140 TOLL FREE: 800.728.7805
FAX: 844.273.1057 | HRGreen.com

THE COTTAGES AT MESA RIDGE
GOODWIN KNIGHT
EL PASO COUNTY, COLORADO

GOODWIN KNIGHT

FINAL DRAINAGE REPORT

SWMM WORK MAP

SHEET
DRN
1

APPENDIX E – REFERENCE MATERIAL

Mesa Ridge Development
Master Development Drainage Plan Update

Fountain, Colorado

Prepared for:
Nor'wood Development
111 South Tejon Suite 222
Colorado Springs, Colorado 80903

Prepared by:

Kiowa
Engineering Corporation

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

Kiowa Project No. 11045

January 15, 2013

SUMMARY OF PROPOSED FSD BASIN DATA (24-HOUR STORM)

PROPOSED FS DETENTION BASIN A

	Q_5	Q_{100}
IN	69 cfs	187 cfs
OUT	9 cfs	52 cfs

100 yr VOLUME= 6.8 ac-ft
EURV VOLUME= 3.1 ac-ft

PROPOSED FS DETENTION BASIN B

	Q_5	Q_{100}
IN	102 cfs	297 cfs
OUT	13 cfs	91 cfs

100 yr VOLUME= 8.4 ac-ft
EURV VOLUME= 3.1 ac-ft

PROPOSED FS DETENTION BASIN C

	Q_5	Q_{100}
IN	158 cfs	490 cfs
OUT	9 cfs	145 cfs

100 yr VOLUME= 14.8 ac-ft
EURV VOLUME= 8.3 ac-ft

AS-BUILT FS DETENTION BASIN D

	Q_5	Q_{100}
IN	109 cfs	375 cfs
OUT	24 cfs	233 cfs

100 yr VOLUME= 8.0 ac-ft
5 yr VOLUME= 4.1 ac-ft

PROPOSED FS DETENTION BASIN E

	Q_5	Q_{100}
IN	41 cfs	120 cfs
OUT	5 cfs	24 cfs

100 yr VOLUME= 3.9 ac-ft
EURV VOLUME= 1.3 ac-ft

RECONSTRUCTED DAM & RESERVOIR BASIN 'F'

	Q_5	Q_{100}
IN	540 cfs	1540 cfs
OUT	7 cfs	255 cfs

100 yr VOLUME= 95.9 ac-ft
5 yr VOLUME= 50.0 ac-ft

PROPOSED FS DETENTION BASIN G

	Q_5	Q_{100}
IN	74 cfs	216 cfs
OUT	10 cfs	51 cfs

100 yr VOLUME= 6.6 ac-ft
EURV VOLUME= 2.2 ac-ft

PROPOSED FS DETENTION BASIN H

	Q_5	Q_{100}
IN	161 cfs	323 cfs
OUT	23 cfs	56 cfs

100 yr VOLUME= 13.2 ac-ft
EURV VOLUME= 2.5 ac-ft

SUMMARY OF DESIGN POINT DISCHARGES (24-HOUR STORM WITH FSD)

DESIGN POINT	LOCATION	DRAINAGE AREA		5 Year	100 Year
DP 6010	AT LANDOVER	108.9 oc	0.18 sm	43 cfs	196 cfs
DP 6020	INFLOW TO DETENTION BASIN D	168.3 oc	0.27 sm	109 cfs	375 cfs
DB 6020	OUTFLOW FROM DETENTION BASIN D	168.3 oc	0.27 sm	24 cfs	223 cfs
DP 6040	U/S CROSS CREEK	217.0 oc	0.35 sm	74 cfs	334 cfs
DP 6050	DS CROSS CREEK AVE	233.5 oc	0.37 sm	92 cfs	358 cfs
DP 7030	AT OUTLET OF BASIN 7030	263.9 oc	0.41 sm	183 cfs	420 cfs
DP 7040	AT OUTLET OF BASIN 7040	39.6 oc	0.06 sm	30 cfs	110 cfs
DP 8010	AT OUTLET OF BASIN 8010	322.1 oc	0.50 sm	241 cfs	603 cfs
DP 8070	U/S OF HALE RESERVOIR	726.7 oc	1.15 sm	446 cfs	1259 cfs
DP 8075	INFLOW TO HALE RESERVOIR	908.8 oc	1.42 sm	540 cfs	1540 cfs
DB 8075	OUTFLOW FROM HALE RESERVOIR	908.8 oc	1.42 sm	7 cfs	255 cfs
DP 8080	C&S ROAD	928 oc	1.45 sm	13 cfs	257 cfs
DP 1031	D/S POWERS BOULEVARD	51.0 oc	0.08 sm	28 cfs	55 cfs
DP 1211	INFLOW TO DET. BASIN H	108.8 oc	0.17 sm	161 cfs	323 cfs
DB 1210	OUTLOW FROM DET. BASIN H	108.8 oc	0.17 sm	23 cfs	36 cfs
SB 1225	INFLOW TO DETENTION BASIN G	70.4 ac	0.11 sm	74 cfs	216 cfs
DP 1225	AT CROSS CREEK AVENUE	185.6 oc	0.29 sm	33 cfs	104 cfs
DP 1250	INFLOW TO DETENTION BASIN B	96.0 oc	0.15 sm	102 cfs	297 cfs
DB 1250	OUTFLOW FROM DETENTION BASIN B	96.0 oc	0.15 sm	13 cfs	91 cfs
DP 1265	INFLOW TO DETENTION BASIN A	64 ac	0.10 sm	69 cfs	187 cfs
DP 1260	AT C & S ROAD	243 oc	0.38 sm	41 cfs	156 cfs
DP 2160	DESIGN POINT 2160	448 oc	0.70 sm	188 cfs	640 cfs
DP 3110	AT MESA RIDGE PARKWAY	2163.2 oc	3.38 sm	766 cfs	3095 cfs
DP 3200	DESIGN POINT 3200	2208 oc	3.44 sm	764 cfs	3089 cfs
DP 3250	AT COLLECTOR ROAD	126.7 oc	0.20 sm	130 cfs	380 cfs
DP 3265	AT OUTLET OF BASIN 3265	40.5 oc	0.06 sm	52 cfs	135 cfs
DP 3275	INFLOW TO DET. BASIN C	172.8 oc	0.27 sm	158 cfs	490 cfs
DB 3280	OUTFLOW FROM DETENTION BASIN C	172.8 oc	0.27 sm	9 cfs	145 cfs
DP 3280	AT MARKSHEFFEL ROAD	2381.0 oc	3.72 sm	772 cfs	3215 cfs

LEGEND

- 1225 / 14.68 oc — DRAINAGE BASIN DESIGNATION / DRAINAGE BASIN AREA
- 1260 — DESIGN POINT
- DRAINAGE BASIN BOUNDARY
- FLOW DIRECTION
- 2160 — ROUTING ELEMENT

SUMMARY OF HISTORIC DISCHARGES

DESIGN POINT	LOCATION	5 Year	100 Year
3280	WF JIMMY CAMP CREEK @ MARKSHEFFEL ROAD	992 cfs	3745 cfs
1250	@ C & S ROAD	35 cfs	186 cfs
1260	@ C & S ROAD	48 cfs	340 cfs
8080 (1)	@ C & S ROAD	152 cfs	1110 cfs

(1) AREA ABOVE FOUNTAIN MUTUAL IRRIGATION CANAL ASSUMED TRIBUTARY TO THIS DESIGN POINT. FMIC CANAL ASSUMED TO CONVEY IRRIGATION FLOW ONLY.

0 400' 800'

SCALE: 1"=400'

NOTE: TOPOGRAPHY USED IN THIS MDDP MAY NOT REFLECT THE EXISTING CONDITIONS FOR ALL AREAS OF THE DRAINAGE BASINS.

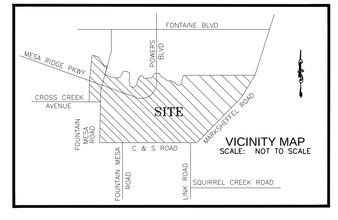
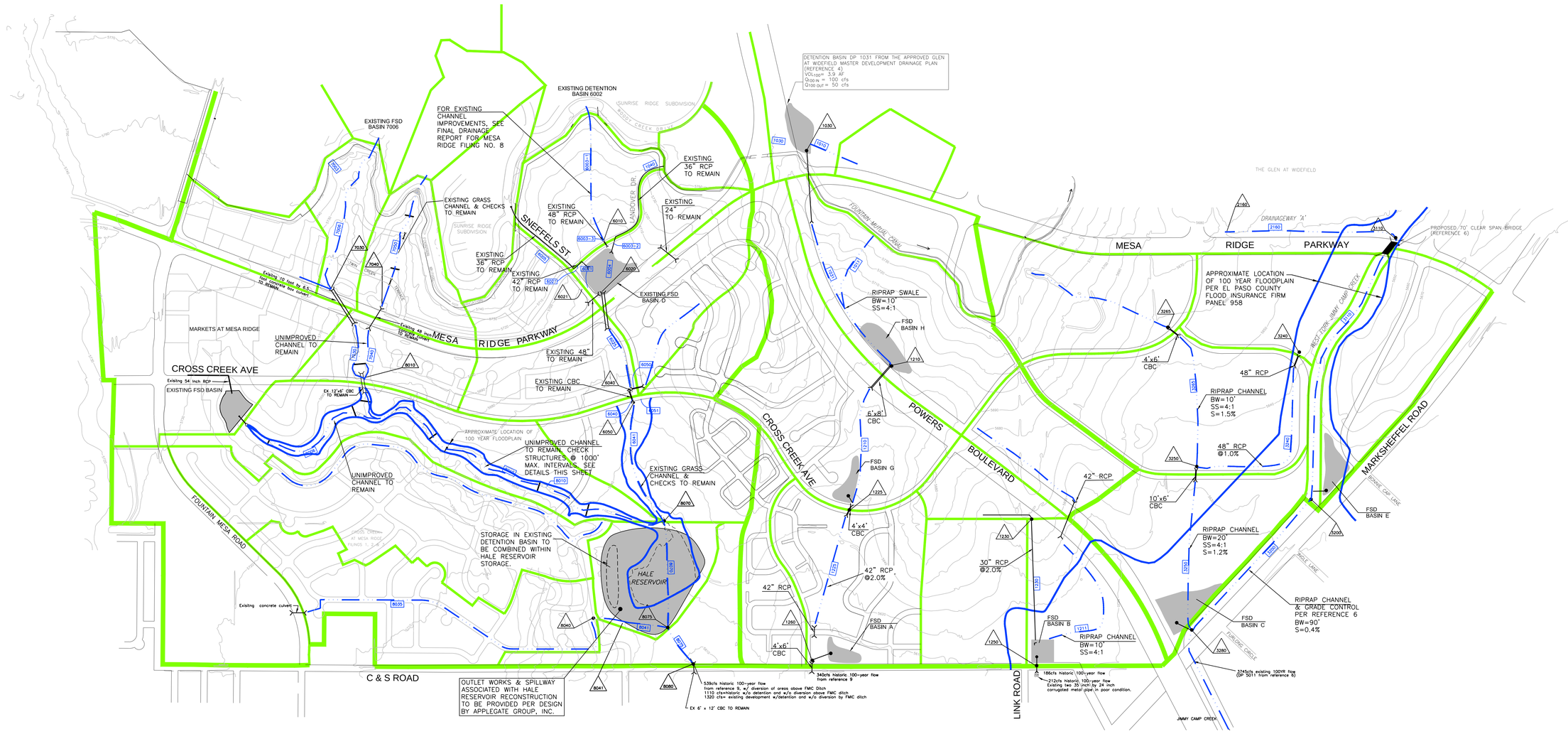


EXHIBIT 1
MESA RIDGE DEVELOPMENT
MASTER DEVELOPMENT DRAINAGE PLAN UPDATE
HYDROLOGIC SUB-BASIN MAP
DEVELOPED WITH EXISTING & PROPOSED DETENTION
FOUNTAIN, COLORADO

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



SUMMARY OF PROPOSED FSD BASIN DATA (24-HOUR STORM)

PROPOSED FS DETENTION BASIN A

	Q_5	Q_{100}
IN	69 cfs	187 cfs
OUT	9 cfs	52 cfs

100 yr VOLUME= 6.8 ac-ft
EURV VOLUME= 3.1 ac-ft

PROPOSED FS DETENTION BASIN B

	Q_5	Q_{100}
IN	102 cfs	297 cfs
OUT	13 cfs	91 cfs

100 yr VOLUME= 8.4 ac-ft
EURV VOLUME= 3.1 ac-ft

PROPOSED FS DETENTION BASIN C

	Q_5	Q_{100}
IN	158 cfs	490 cfs
OUT	9 cfs	145 cfs

100 yr VOLUME= 14.8 ac-ft
EURV VOLUME= 8.3 ac-ft

AS-BUILT FS DETENTION BASIN D

	Q_5	Q_{100}
IN	109 cfs	375 cfs
OUT	24 cfs	233 cfs

100 yr VOLUME= 8.0 ac-ft
5 yr VOLUME= 4.1 ac-ft

PROPOSED FS DETENTION BASIN E

	Q_5	Q_{100}
IN	41 cfs	120 cfs
OUT	5 cfs	24 cfs

100 yr VOLUME= 3.9 ac-ft
EURV VOLUME= 1.3 ac-ft

RECONSTRUCTED DAM & RESERVOIR BASIN 'F'

	Q_5	Q_{100}
IN	540 cfs	1540 cfs
OUT	7 cfs	255 cfs

100 yr VOLUME= 95.9 ac-ft
5 yr VOLUME= 50.0 ac-ft

PROPOSED FS DETENTION BASIN G

	Q_5	Q_{100}
IN	74 cfs	216 cfs
OUT	10 cfs	51 cfs

100 yr VOLUME= 6.6 ac-ft
EURV VOLUME= 2.2 ac-ft

PROPOSED FS DETENTION BASIN H

	Q_5	Q_{100}
IN	161 cfs	323 cfs
OUT	23 cfs	56 cfs

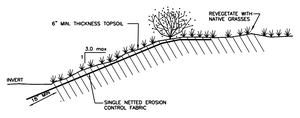
100 yr VOLUME= 13.2 ac-ft
EURV VOLUME= 2.5 ac-ft

LEGEND

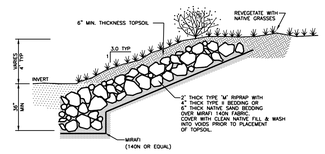
- 100-YEAR FLOODPLAIN
- 1250 — DESIGN POINT
- MAJOR DRAINAGE BASIN BOUNDARY
- FLOW DIRECTION
- DRAINAGEWAY & CHECK/DROP STRUCTURE

SUMMARY OF DESIGN POINT DISCHARGES (24-HOUR STORM WITH FSD)

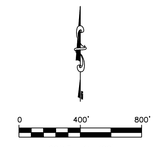
DESIGN POINT	LOCATION	DRAINAGE AREA		5 Year	100 Year
DP 6010	AT LANDOVER	108.9 ac	0.18 sm	43 cfs	196 cfs
DP 6020	INFLOW TO DETENTION BASIN D	168.3 ac	0.27 sm	109 cfs	375 cfs
DB 6020	OUTFLOW FROM DETENTION BASIN D	168.3 ac	0.27 sm	24 cfs	223 cfs
DP 6040	U/S CROSS CREEK	217.0 ac	0.35 sm	74 cfs	334 cfs
DP 6050	DS CROSS CREEK AVE	233.5 ac	0.37 sm	92 cfs	358 cfs
DP 7030	AT OUTLET OF BASIN 7030	263.9 ac	0.41 sm	183 cfs	420 cfs
DP 7040	AT OUTLET OF BASIN 7040	39.6 ac	0.06 sm	30 cfs	110 cfs
DP 8010	AT OUTLET OF BASIN 8010	322.1 ac	0.50 sm	241 cfs	603 cfs
DP 8070	U/S OF HALE RESERVOIR	726.7 ac	1.15 sm	446 cfs	1259 cfs
DP 8075	INFLOW TO HALE RESERVOIR	908.8 ac	1.42 sm	540 cfs	1540 cfs
DB 8075	OUTFLOW FROM HALE RESERVOIR	908.8 ac	1.42 sm	7 cfs	255 cfs
DP 8080	C&S ROAD	928 ac	1.45 sm	13 cfs	257 cfs
DP 1031	D/S POWERS BOULEVARD	51.0 ac	0.08 sm	28 cfs	55 cfs
DP 1211	INFLOW TO DET. BASIN H 1210, POWERS BLVD	108.8 ac	0.17 sm	161 cfs	323 cfs
DP 1210	OUTLOW FROM DET. BASIN H	108.8 ac	0.17 sm	23 cfs	36 cfs
SB 1225	INFLOW TO DETENTION BASIN G	70.4 ac	0.11 sm	74 cfs	216 cfs
DP 1225	AT CROSS CREEK AVENUE	185.6 ac	0.29 sm	33 cfs	104 cfs
DP 1250	INFLOW TO DETENTION BASIN B	96.0 ac	0.15 sm	102 cfs	297 cfs
DB 1250	OUTFLOW FROM DETENTION BASIN B	96.0 ac	0.15 sm	13 cfs	91 cfs
DP 1265	INFLOW TO DETENTION BASIN A	64 ac	0.10 sm	69 cfs	187 cfs
DP 1260	AT C & S ROAD	243 ac	0.38 sm	41 cfs	156 cfs
DP 2160	DESIGN POINT 2160	448 ac	0.70 sm	188 cfs	640 cfs
DP 3110	AT MESA RIDGE PARKWAY	2163.2 ac	3.38 sm	766 cfs	3095 cfs
DP 3200	DESIGN POINT 3200	2208 ac	3.44 sm	764 cfs	3089 cfs
DP 3250	AT COLLECTOR ROAD	126.7 ac	0.20 sm	130 cfs	380 cfs
DP 3265	AT OUTLET OF BASIN 3265	40.5 ac	0.06 sm	52 cfs	135 cfs
DP 3281	INFLOW TO DET. BASIN C	172.8 ac	0.27 sm	158 cfs	490 cfs
DB 3281	OUTFLOW FROM DETENTION BASIN C	172.8 ac	0.27 sm	9 cfs	145 cfs
DP 3280	AT MARKSHEFFEL ROAD	2381.0 ac	3.72 sm	772 cfs	3215 cfs



GRASSLINED BANK DETAIL



RIPRAP BANK LINING DETAIL
NTS



NOTE: TOPOGRAPHY USED IN THIS MDDP MAY NOT REFLECT THE EXISTING CONDITIONS FOR ALL AREAS OF THE DRAINAGE BASINS.

RIPRAP GRADATIONS

TYPE H RIPRAP

INTERMEDIATE ROCK DIMENSION IN INCHES	% SMALLER THAN GIVEN SIZE BY WEIGHT	D_{50} INCHES
30	100	18
24	50-70	
18	35-50	
6	2-10	

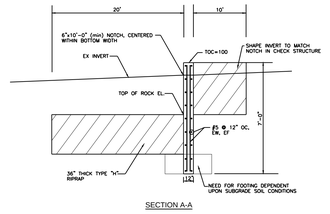
TYPE M RIPRAP

INTERMEDIATE ROCK DIMENSION IN INCHES	% SMALLER THAN GIVEN SIZE BY WEIGHT	D_{50} INCHES
21	100	12
18	50-70	
12	35-50	
4	2-10	

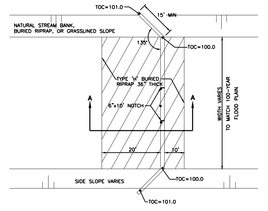
SEED MIX

AREAS DISTURBED BY THE EARTHWORK SHALL BE PERMANENTLY REVEGETATED WITH NATIVE GRASSES. NATIVE SEED MIX FOR THIS PROJECT SHALL BE AS FOLLOWS:

NATIVE SEED MIX		pls/acre
BLUE GRAMA	*Chrondrosum hirsuta*	2.0
SIDEOATS GRAMA	*Bouteloua curtipendula*	3.0
SLENDER WHEATGRASS	*Agropyron trachycaulum trachycaulum*	2.0
WESTERN WHEATGRASS	*Agropyron smithii*	4.0
		11.0 lbs



SECTION A-A



TYPICAL CHECK STRUCTURE PLAN
NO SCALE

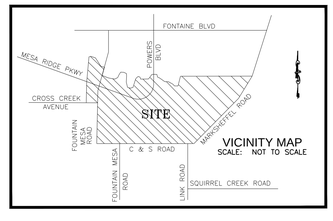


EXHIBIT 2
MESA RIDGE DEVELOPMENT
MASTER DEVELOPMENT DRAINAGE PLAN UPDATE
PROPOSED FACILITIES PLAN
DEVELOPED WITH REGIONAL DETENTION
FOUNTAIN, COLORADO

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

Master Development Drainage Plan
Mesa Ridge Development

City of Fountain, Colorado

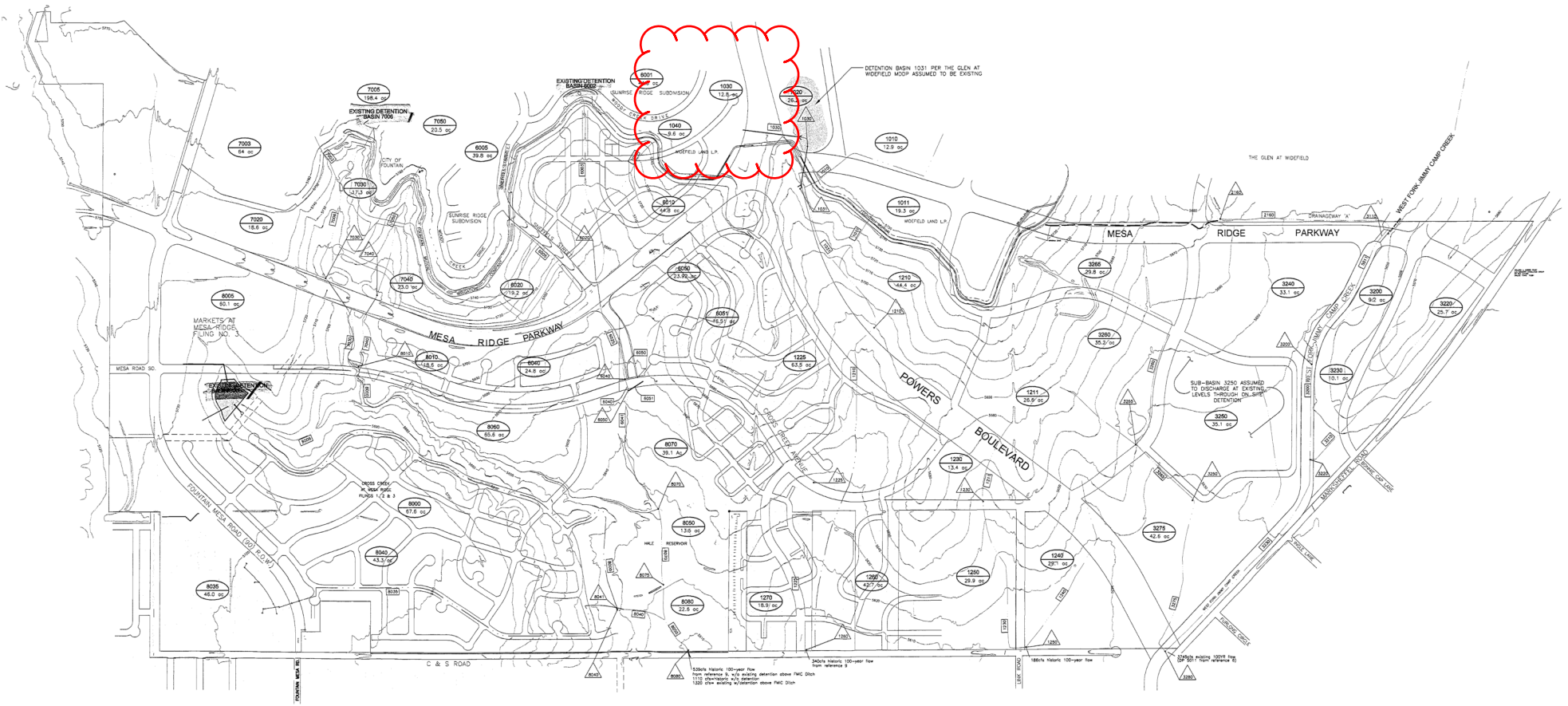
Prepared For:

Norwood Development
111 South Tejon #222
Colorado Springs, CO 80903

Prepared By:

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

Project Number 05011
December 17, 2006



6000 - 8000 BASINS

SUMMARY OF WEST DESIGN POINT DISCHARGES (24-HOUR STORM)
WITHOUT DETENTION IN CROSS CREEK DEVELOPMENT

DESIGN POINT	LOCATION	DRAINAGE AREA		DEVELOPED CONDITION 5 Year	DEVELOPED CONDITION 100 Year
DP 6020	AT OUTLET OF BASIN 6010	160.0 ac	0.25 sm	153 cfs	422 cfs
DP 6040	AT OUTLET OF BASIN 6040	211.0 ac	0.33 sm	219 cfs	590 cfs
DP 6050	DOWNSTREAM OF CROSS CREEK AVE	230.0 ac	0.36 sm	237 cfs	638 cfs
DP 7030	AT OUTLET OF BASIN 7030	300.8 ac	0.47 sm	184 cfs	453 cfs
DP 7040	AT OUTLET OF BASIN 7040	44.8 ac	0.07 sm	40 cfs	128 cfs
DP 8040	TOTAL FROM CROSS CREEK SUB.	157.0 ac	0.25 sm	118 cfs	309 cfs
DP 8075	AT HALE RESERVOIR EMBANKMENT	768.0 ac	1.20 sm	633 cfs	1665 cfs
DP 8041	AT SOUTH OUTFALL CROSS CREEK SUB.	89.3 ac	0.14 sm	86 cfs	217 cfs
DP 8010	AT CROSS CREEK AVENUE	358.0 ac	0.56 sm	252 cfs	653 cfs
DP 8070	AT OUTLET OF BASIN 8070	755.0 ac	1.18 sm	643 cfs	1658 cfs
DP 8080	AT OUTLET OF BASIN 8080	947.0 ac	1.48 sm	723 cfs	1937 cfs

1000-1200 BASINS

SUMMARY OF CENTRAL DESIGN POINT DISCHARGES (24-HOUR STORM)
WITHOUT DETENTION IN CROSS CREEK DEVELOPMENT

DESIGN POINT	LOCATION	DRAINAGE AREA		DEVELOPED CONDITION 5 Year	DEVELOPED CONDITION 100 Year
DP 1031	AT POWERS BOULEVARD	51.2 ac	0.08 sm	27 cfs	53 cfs
DP 1210	AT OUTLET OF BASIN 1210	108.3 ac	0.17 sm	162 cfs	342 cfs
DP 1225	AT OUTLET OF BASIN 1225	165.5 ac	0.29 sm	219 cfs	526 cfs
DP 1230	AT OUTLET OF BASIN 1230	32.2 ac	0.05 sm	38 cfs	104 cfs
DP 1250	AT OUTLET OF BASIN 1250	96.0 ac	0.15 sm	129 cfs	334 cfs
DP 1260	AT OUTLET OF BASIN 1260	244.0 ac	0.38 sm	272 cfs	688 cfs

WESTFORK JIMMY CAMP CREEK (3000 BASINS)

SUMMARY OF WFJCC DESIGN POINT DISCHARGES (24-HOUR STORM)
WITHOUT DETENTION IN CROSS CREEK DEVELOPMENT

DESIGN POINT	LOCATION	DRAINAGE AREA		DEVELOPED CONDITION 5 Year	DEVELOPED CONDITION 100 Year
DP 2160	DESIGN POINT 2160	448 ac	0.70 sm	186 cfs	640 cfs
DP 3110	DESIGN POINT 3110	2163.2 ac	3.38 sm	766 cfs	3095 cfs
DP 3200	DESIGN POINT 3200	2202 ac	3.44 sm	772 cfs	3085 cfs
DP 3220	AT OUTLET OF BASIN 3230	2240 ac	3.50 sm	777 cfs	3094 cfs
DP 3265	AT OUTLET OF BASIN 3260	55.0 ac	0.10 sm	65 cfs	189 cfs
DP 3250	AT OUTLET OF BASIN 3250	102.4 ac	0.16 sm	88 cfs	274 cfs
DP 3280	AT OUTLET OF BASIN 3275	2381 ac	3.72 sm	803 cfs	3159 cfs

SUMMARY OF HISTORIC DISCHARGES

DESIGN POINT	LOCATION	5 Year	100 Year
3280	WF JIMMY CAMP CREEK @ MARKS-HEFFEL ROAD	992 cfs	3745 cfs
1250	@ C & S ROAD	35 cfs	186 cfs
1260	@ C & S ROAD	48 cfs	301 cfs
8080 (1)	@ C & S ROAD	152 cfs	1110 cfs

(1) AREA ABOVE FOUNTAIN MUTUAL IRRIGATION CANAL ASSUMED TRIBUTARY TO THIS DESIGN POINT

LEGEND

- 3275 / 14.68 ac — DRAINAGE BASIN DESIGNATION / DRAINAGE BASIN AREA
- DESIGN POINT
- DRAINAGE BASIN BOUNDARY
- FLOW DIRECTION
- 2160 — CONVEYANCE ELEMENT

0 400' 800'

SCALE: 1"=400'

NOTE: TOPOGRAPHY USED IN THIS MDDP MAY NOT REFLECT THE EXISTING CONDITIONS FOR ALL AREAS OF THE DRAINAGE BASINS.

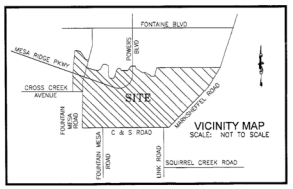
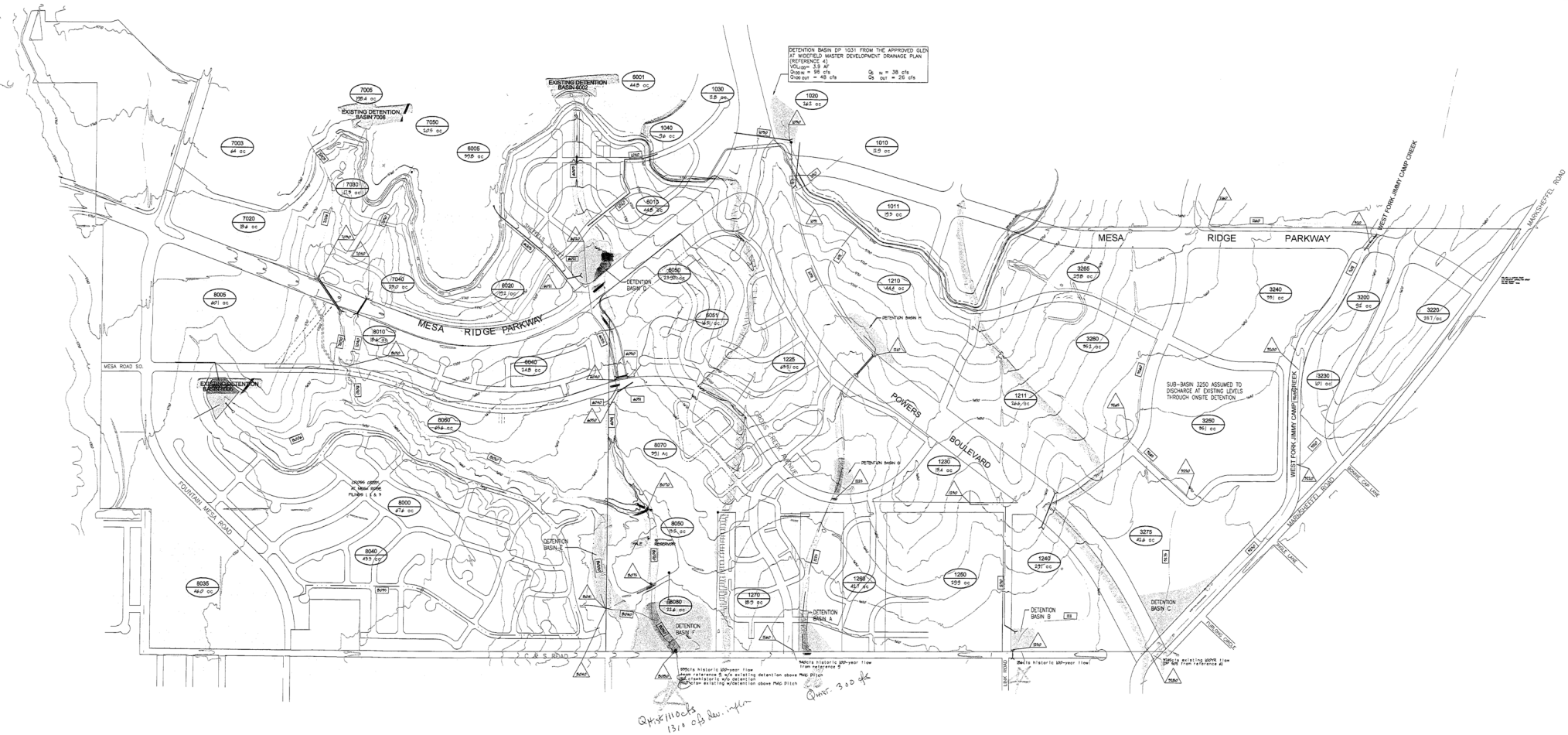


EXHIBIT 1
MESA RIDGE DEVELOPMENT
MASTER DEVELOPMENT DRAINAGE PLAN UPDATE
HYDROLOGIC SUB-BASIN MAP
DEVELOPED WITHOUT REGIONAL DETENTION
& DRAINAGEWAY IMPROVEMENTS
FOUNTAIN, COLORADO

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



SUMMARY OF DETENTION BASIN DATA (24-HOUR STORM)

PROPOSED DETENTION BASIN A

	Q_5	Q_{100}
IN	146 cfs	479 cfs
OUT	17 cfs	350 cfs

100 yr VOLUME= 17.0 ac-ft
5 yr VOLUME= 8.8 ac-ft

PROPOSED DETENTION BASIN B

	Q_5	Q_{100}
IN	125 cfs	334 cfs
OUT	47 cfs	181 cfs

100 yr VOLUME= 8.8 ac-ft
5 yr VOLUME= 1.3 ac-ft

PROPOSED DETENTION BASIN C

	Q_5	Q_{100}
IN	149 cfs	419 cfs
OUT	99 cfs	199 cfs

100 yr VOLUME= 10.5 ac-ft
5 yr VOLUME= 5.0 ac-ft

PROPOSED DETENTION BASIN D

	Q_5	Q_{100}
IN	147 cfs	414 cfs
OUT	94 cfs	186 cfs

100 yr VOLUME= 9.4 ac-ft
5 yr VOLUME= 2.0 ac-ft

PROPOSED DETENTION BASIN E

	Q_5	Q_{100}
IN	150 cfs	314 cfs
OUT	99 cfs	157 cfs

100 yr VOLUME= 14.5 ac-ft
5 yr VOLUME= 4.8 ac-ft

PROPOSED DETENTION BASIN F

	Q_5	Q_{100}
IN	373 cfs	1060 cfs
OUT	270 cfs	997 cfs

100 yr VOLUME= 15.0 ac-ft
5 yr VOLUME= 9.1 ac-ft

PROPOSED DETENTION BASIN H

	Q_5	Q_{100}
IN	160 cfs	308 cfs
OUT	102 cfs	178 cfs

100 yr VOLUME= 6.0 ac-ft
5 yr VOLUME= 2.9 ac-ft

PROPOSED DETENTION BASIN G

	Q_5	Q_{100}
IN	189 cfs	448 cfs
OUT	80 cfs	145 cfs

100 yr VOLUME= 19.8 ac-ft
5 yr VOLUME= 9.4 ac-ft

SUMMARY OF DESIGN POINT DISCHARGES (24-HOUR STORM WITH DETENTION)

DESIGN POINT	LOCATION	DRAINAGE AREA	5 Year	100 Year
DP 6010	INFLOW TO DETENTION BASIN D	1602 ac	0.25 sm	146 cfs	419 cfs
DP 6010	OUTFLOW FROM DETENTION BASIN D	1602 ac	0.25 sm	99 cfs	151 cfs
DP 6040	U/S CROSS CREEK	2110 ac	0.33 sm	176 cfs	762 cfs
DP 6090	D/S CROSS CREEK AVE	2370.0 ac	0.74 sm	148 cfs	998 cfs
DP 7090	AT OUTLET OF BASIN 7090	5005B ac	0.47 sm	154 cfs	699 cfs
DP 7040	AT OUTLET OF BASIN 7040	44B ac	0.07 sm	40 cfs	128 cfs
DP 8010	AT OUTLET OF BASIN 8010	968.4 ac	0.96 sm	291 cfs	693 cfs
DP 8070	U/S OF HALE RESERVOIR	774.0 ac	1.18 sm	979 cfs	1886 cfs
DP 8040	INFLOW TO DETENTION BASIN E	957.0 ac	0.25 sm	150 cfs	314 cfs
DP 8040	OUTFLOW FROM DETENTION BASIN E	1602 ac	0.25 sm	99 cfs	157 cfs
DP 8075	OUTFLOW FROM HALE RESERVOIR	1680 ac	1.50 sm	946 cfs	1784 cfs
DP 8080	INFLOW TO DETENTION BASIN F	1680 ac	1.50 sm	996 cfs	971 cfs
DP 8080	OUTFLOW FROM DETENTION BASIN F	5470 ac	1.48 sm	973 cfs	1060 cfs
DP 1091	D/S POWERS BOULEVARD	540 ac	0.09 sm	27 cfs	99 cfs
DP 1210	AT OUTLET OF BASIN 1210, POWERS BLVD	1088 ac	0.17 sm	102 cfs	341 cfs
DP 1225	AT OUTLET OF BASIN 1225, POWERS BLVD	1864 ac	0.33 sm	221 cfs	598 cfs
DP 1250	INFLOW TO DETENTION BASIN D	540 ac	0.15 sm	125 cfs	334 cfs
DP 1250	OUTFLOW FROM DETENTION BASIN D	540 ac	0.17 sm	47 cfs	181 cfs
DP 1240	INFLOW TO DETENTION BASIN A	244 ac	0.38 sm	140 cfs	674 cfs
DP 1240	OUTFLOW FROM DETENTION BASIN A	244 ac	0.38 sm	117 cfs	150 cfs
DP 1240	DESIGN POINT 1240	44B ac	0.70 sm	186 cfs	640 cfs
DP 9110	AT MESA RIDGE PARKWAY	3693 ac	5.76 sm	740 cfs	5079 cfs
DP 9100	DESIGN POINT 9100	2375 ac	3.44 sm	772 cfs	9286 cfs
DP 9130	AT WEST FORK JIMMY CAMP CREEK	2240 ac	3.50 sm	777 cfs	9054 cfs
DP 9245	AT OUTLET OF BASIN 9240	640 ac	0.10 sm	69 cfs	193 cfs
DP 9125	INFLOW TO DET BASIN G	1405 ac	0.22 sm	145 cfs	423 cfs
DP 9125	OUTFLOW FROM DETENTION BASIN G	1405 ac	0.22 sm	99 cfs	159 cfs
DP 9280	AT MARKSHEFFEL ROAD	17360 ac	7.73 sm	852 cfs	9221 cfs

SUMMARY OF HISTORIC DISCHARGES

DESIGN POINT	LOCATION	5 Year	100 Year
9280	WF JIMMY CAMP CREEK @ MARKSHEFFEL ROAD	955 cfs	9745 cfs
1250	@ C & S ROAD	98 cfs	184 cfs
1240	@ C & S ROAD	48 cfs	340 cfs
8080 (1)	@ C & S ROAD	152 cfs	1110 cfs

(1) AREA ABOVE FOUNTAIN MUTUAL IRRIGATION CANAL ASSUMED TRIBUTARY TO THIS DESIGN POINT

LEGEND

- 1225 / 148 ac — DRAINAGE BASIN DESIGNATION / DRAINAGE BASIN AREA
- DESIGN POINT
- DRAINAGE BASIN BOUNDARY
- FLOW DIRECTION
- 1160 — CONVEYANCE ELEMENT

0 400 800
SCALE: 1"=400'

NOTE: TOPOGRAPHY USED IN THIS MDDP MAY NOT REFLECT THE EXISTING CONDITIONS FOR ALL AREAS OF THE DRAINAGE BASINS.

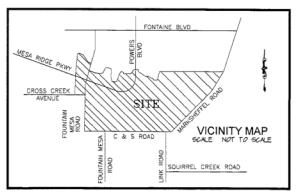
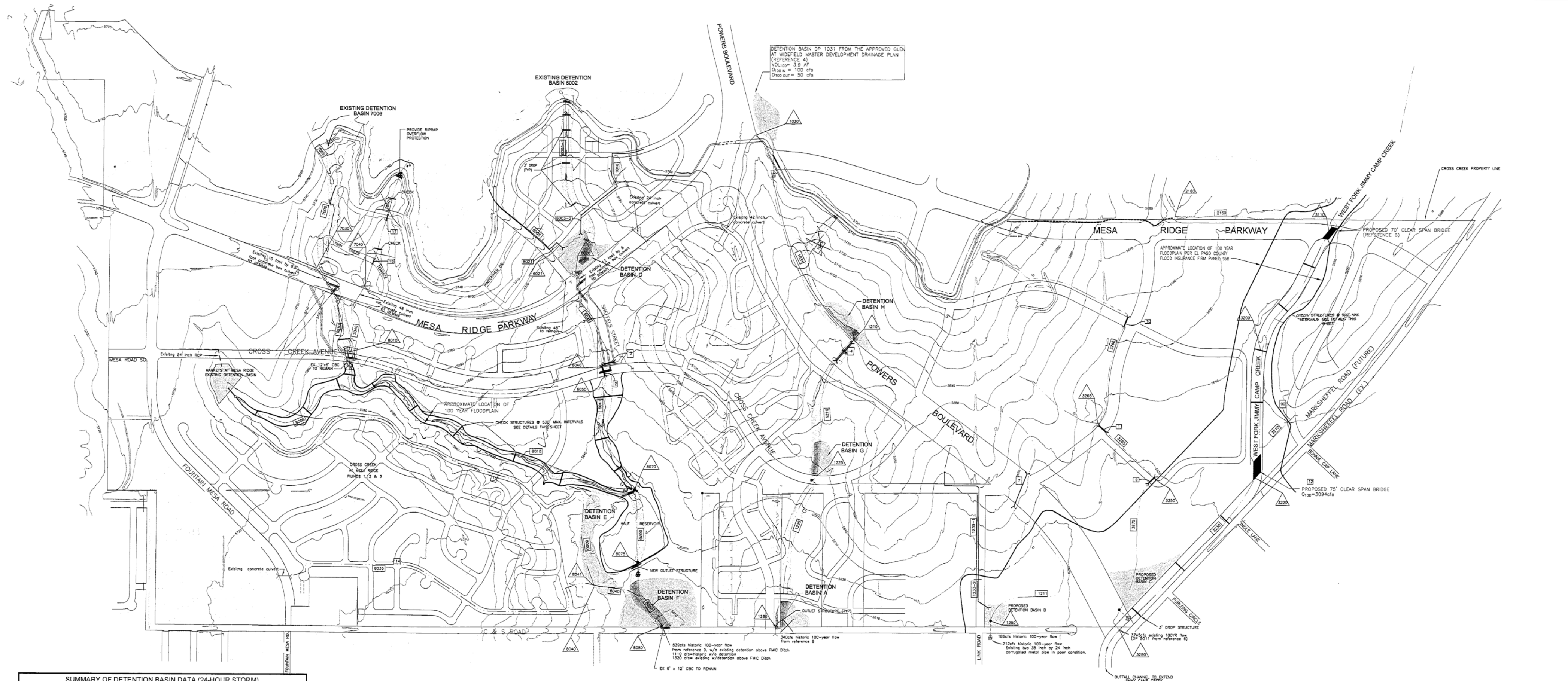


EXHIBIT 2
MESA RIDGE DEVELOPMENT
MASTER DEVELOPMENT DRAINAGE PLAN UPDAT
HYDROLOGIC SUB-BASIN MAP
DEVELOPED WITH DETENTION
FOUNTAIN, COLORADO

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



SUMMARY OF DETENTION BASIN DATA (24-HOUR STORM)

PROPOSED DETENTION BASIN A

	Q_5	Q_{100}
IN	262 cfs	676 cfs
OUT	117 cfs	290 cfs

100 yr VOLUME= 17.0 ac-ft
5 yr VOLUME= 6.8 ac-ft

PROPOSED DETENTION BASIN B

	Q_5	Q_{100}
IN	129 cfs	334 cfs
OUT	67 cfs	181 cfs

100 yr VOLUME= 6.5 ac-ft
5 yr VOLUME= 1.2 ac-ft

PROPOSED DETENTION BASIN C

	Q_5	Q_{100}
IN	145 cfs	423 cfs
OUT	55 cfs	133 cfs

100 yr VOLUME= 10.8 ac-ft
5 yr VOLUME= 5.8 ac-ft

PROPOSED DETENTION BASIN D

	Q_5	Q_{100}
IN	147 cfs	414 cfs
OUT	94 cfs	188 cfs

100 yr VOLUME= 9.4 ac-ft
5 yr VOLUME= 2.0 ac-ft

PROPOSED DETENTION BASIN E

	Q_5	Q_{100}
IN	120 cfs	314 cfs
OUT	39 cfs	127 cfs

100 yr VOLUME= 14.9 ac-ft
5 yr VOLUME= 6.8 ac-ft

PROPOSED DETENTION BASIN F

	Q_5	Q_{100}
IN	373 cfs	1060 cfs
OUT	239 cfs	537 cfs

100 yr VOLUME= 52.0 ac-ft
5 yr VOLUME= 15.2 ac-ft

PROPOSED DETENTION BASIN H

	Q_5	Q_{100}
IN	160 cfs	308 cfs
OUT	102 cfs	179 cfs

100 yr VOLUME= 6.0 ac-ft
5 yr VOLUME= 2.5 ac-ft

PROPOSED DETENTION BASIN G

	Q_5	Q_{100}
IN	189 cfs	448 cfs
OUT	80 cfs	165 cfs

100 yr VOLUME= 13.8 ac-ft
5 yr VOLUME= 5.4 ac-ft

SUMMARY OF DESIGN POINT DISCHARGES (24-HOUR STORM WITH DETENTION)

DESIGN POINT	LOCATION	DRAINAGE AREA		5 Year	100 Year
DP 6020	INFLOW TO DETENTION BASIN D	160.0 ac	0.25 sm	146 cfs	413 cfs
DP 6020	OUTFLOW FROM DETENTION BASIN D	160.0 ac	0.25 sm	115 cfs	191 cfs
DP 6040	U/S CROSS CREEK	211.0 ac	0.33 sm	151 cfs	310 cfs
DP 6050	DS CROSS CREEK AVE	230.0 ac	0.36 sm	169 cfs	358 cfs
DP 7030	AT OUTLET OF BASIN 7030	300.8 ac	0.47 sm	184 cfs	453 cfs
DP 7040	AT OUTLET OF BASIN 7040	44.8 ac	0.07 sm	40 cfs	128 cfs
DP 8010	AT OUTLET OF BASIN 8010	358.4 ac	0.56 sm	252 cfs	653 cfs
DP 8070	U/S OF HALE RESERVOIR	755.0 ac	1.18 sm	579 cfs	1385 cfs
DP 8040	INFLOW TO DETENTION BASIN E	157.0 ac	0.25 sm	120 cfs	314 cfs
DP 8040	OUTFLOW FROM DETENTION BASIN E	160.0 ac	0.25 sm	39 cfs	127 cfs
DP 8075	INFLOW TO HALE RESERVOIR	768.0 ac	1.20 sm	566 cfs	1386 cfs
DP 8075	OUTFLOW FROM HALE RESERVOIR	768.0 ac	1.20 sm	356 cfs	972 cfs
DP 8080	INFLOW TO DETENTION BASIN F	947.0 ac	1.48 sm	373 cfs	1060 cfs
DB 8080	OUTFLOW FROM DETENTION BASIN F	947.0 ac	1.48 sm	239 cfs	545 cfs
DP 1031	D/S POWERS BOULEVARD	51.0 ac	0.08 sm	27 cfs	53 cfs
DP 1210	AT OUTLET OF BASIN 1210, POWERS BLVD	108.8 ac	0.17 sm	162 cfs	342 cfs
DP 1225	AT OUTLET OF BASIN 1225, POWERS BLVD	185.6 ac	0.29 sm	222 cfs	538 cfs
DP 1250	INFLOW TO DETENTION BASIN B	96.0 ac	0.15 sm	129 cfs	334 cfs
DB 1250	OUTFLOW FROM DETENTION BASIN B	96.0 ac	0.17 sm	67 cfs	181 cfs
DP 1260	INFLOW TO DETENTION BASIN A	244 ac	0.38 sm	262 cfs	676 cfs
DB 1260	OUTFLOW FROM DETENTION BASIN A	244 ac	0.38 sm	117 cfs	290 cfs
DP 2160	DESIGN POINT 2160	448 ac	0.70 sm	188 cfs	640 cfs
DP 3110	AT MESA RIDGE PARKWAY	2163.2 ac	3.38 sm	766 cfs	3095 cfs
DP 3200	DESIGN POINT 3200	2202 ac	3.44 sm	772 cfs	3085 cfs
DP 3220	AT WEST FORK JIMMY CAMP CREEK	2240 ac	3.50 sm	777 cfs	3094 cfs
DP 3265	AT OUTLET OF BASIN 3260	65.0 ac	0.10 sm	65 cfs	189 cfs
DP 3281	INFLOW TO DET. BASIN C	140.8 ac	0.22 sm	145 cfs	423 cfs
DB 3281	OUTFLOW FROM DETENTION BASIN C	140.8 ac	0.22 sm	55 cfs	133 cfs
DP 3280	AT MARKSHEFFEL ROAD	2381.0 ac	3.72 sm	826 cfs	3221 cfs

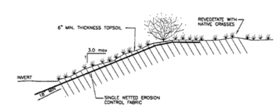
SUMMARY OF PROPOSED DRAINAGE FACILITIES (24-HOUR STORM WITH DETENTION)

CONVEYANCE NUMBER	SIZE / TYPE	CAPACITY (1)	5 Year	100 Year
1	12' X 6' CONCRETE BOX CULVERT (CROSS CREEK AVENUE) TO REMAIN	710 cfs	252 cfs	653 cfs
2	10' X 5' CONCRETE BOX CULVERT (CROSS CREEK AVENUE)	360 cfs	150 cfs	364 cfs
3	36" RCP @ 2.0%	94 cfs	29 cfs	79 cfs
4	6' X 8' CONCRETE BOX CULVERT OR 66" RCP (POWERS BLVD)	340 cfs	162 cfs	342 cfs
7	36-INCH RCP (POWERS BOULEVARD)	55 cfs	20 cfs	55 cfs
8	48" RCP	74 cfs	26 cfs	74 cfs
9	6' X 8' CBC	280 cfs	88 cfs	274 cfs
10	48" RCP	75 cfs	18 cfs	68 cfs
11	4' X 8' CONCRETE BOX CULVERT	189 cfs	65 cfs	189 cfs
12	75' CLEAR SPAN BRIDGE (FUTURE MARKSHEFFEL)	3090 cfs	777 cfs	3094 cfs
13	6' X 8' CBC (FUTURE MARKSHEFFEL)	270 cfs	83 cfs	269 cfs
14	EX. 48 INCH TO 54-INCH RCP STORM SEWER (CROSS CREEK @ MESA RIDGE, FLG. 1)	136 cfs	46 cfs	117 cfs
15	EX. 48 INCH TO 54-INCH RCP STORM SEWER (CROSS CREEK @ MESA RIDGE, FLG. 2/3)	394 cfs	161 cfs	394 cfs
16	54" RCP @ 2.0%	130 cfs	40 cfs	128 cfs
17	42" RCP @ 2.0%	70 cfs	27 cfs	70 cfs
18	54" RCP @ 2.0%			
1031	RIPRAP CHANNEL 10' BW, SS=4:1			
1040	36" RCP @ 2.0%			
1210-1	66" RCP @ 2.4%			
1210-2	60" RCP @ 2.0%			
1211	RIPRAP CHANNEL 10' BW, SS=4:1, w/3-3' DROPS			
1225	RIPRAP CHANNEL 20' BW, SS=4:1, w/2-3' DROPS			
1230-1	30" RCP @ 2.0%			
1230-2	42" RCP @ 2.0%			
3210	GRASS-LINED CHANNEL w/RIPRAP INVERT, 4' BW, SS=4:1			
3230	RIPRAP CHANNEL BANKS w/NATURAL INVERT, 40' BW, CHECKS @ 500' INTERVALS, S=0.4%			
3250	GRASS-LINED CHANNEL w/RIPRAP INVERT, 10' BW, SS=4:1			
3260	RIPRAP CHANNEL 20' BW, SS=4:1			
3265	GRASS-LINED CHANNEL w/RIPRAP INVERT, 20' BW, SS=4:1			
6003-1	RIPRAP CHANNEL 10' BW, SS=3:1, w/5-3' DROPS			
6003-2	54" RCP @ 2.0%			
6005	36" RCP @ 3.0%			
6021	24" RCP @ 3.0% MIN.			
6025	RIPRAP CHANNEL 12' BW, SS=3:1, w/4 SLOPING BOULDER DROPS			
6040	SELECTIVE RIPRAP LINING w/CHECKS @ 500' INTERVALS			
7050	NATURAL CHANNEL UNIMPROVED, 2 CHECK STRUCTURES			
7006	NATURAL CHANNEL WITH SELECTIVE RIPRAP LINING w/CHECKS @ 200' INTERVALS			
7030/7040	NATURAL CHANNEL UNIMPROVED			
8006	NATURAL CHANNEL UNIMPROVED			
8010	SELECTIVE RIPRAP LINING w/CHECKS @ 530' INTERVALS			

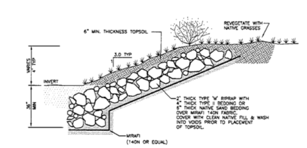
(1) CAPACITY DETERMINED ASSUMING HW/D=1.2 MAXIMUM

LEGEND

[1]	CONVEYANCE STRUCTURE NUMBER
△	DESIGN POINT
	MAJOR DRAINAGE BASIN BOUNDARY
←	FLOW DIRECTION
—|—	DRAINAGEWAY & CHECK/DROP STRUCTURE



GRASSLINED BANK DETAIL



RIPRAP BANK LINING DETAIL
NTS

RIPRAP GRADATIONS

TYPE H RIPRAP

INTERMEDIATE ROCK DIMENSION IN INCHES	% SMALLER THAN GIVEN SIZE BY WEIGHT	D_{50} INCHES
30	100	18
24	50-70	
18	35-50	
6	2-10	

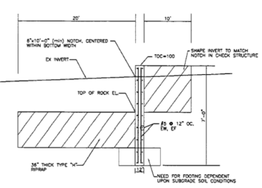
TYPE M RIPRAP

INTERMEDIATE ROCK DIMENSION IN INCHES	% SMALLER THAN GIVEN SIZE BY WEIGHT	D_{50} INCHES
21	100	12
18	50-70	
12	35-50	
4	2-10	

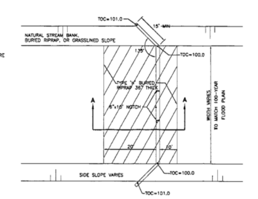
SEED MIX

AREAS DISTURBED BY THE EARTHWORK SHALL BE PERMANENTLY REVEGETATED WITH NATIVE GRASSES. NATIVE SEED MIX FOR THIS PROJECT SHALL BE AS FOLLOWS:

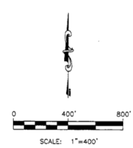
NATIVE SEED MIX		pls/acre
BLUE GRAMA	*Chrondrosum hirsuta*	2.0
SIDEOATS GRAMA	*Bouteloua curtipendula*	3.0
SLENDER WHEATGRASS	*Agropyron trachycaulum trachycaulum*	2.0
WESTERN WHEATGRASS	*Agropyron smithii*	4.0
		11.0 lbs



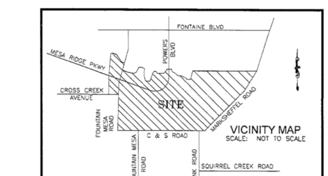
SECTION A-A



TYPICAL CHECK STRUCTURE PLAN
NO SCALE



NOTE: TOPOGRAPHY USED IN THIS MDDP MAY NOT REFLECT THE EXISTING CONDITIONS FOR ALL AREAS OF THE DRAINAGE BASINS.



VICINITY MAP
SCALE: NOT TO SCALE

EXHIBIT 3
MESA RIDGE DEVELOPMENT
MASTER DEVELOPMENT DRAINAGE PLAN UPDATE
PROPOSED FACILITIES PLAN
DEVELOPED WITH REGIONAL DETENTION
FOUNTAIN, COLORADO

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

Kiowa Records 10/25/11

MESA RIDGE FILINGS 8 & 9

DETENTION BASIN 'D'

FULL SPECTRUM DETENTION MODIFICATIONS

FINAL DESIGN DRAWINGS

FOUNTAIN, COLORADO

NOT

GENERAL NOTES

1. ALL WORK REQUIRED OF THESE PLANS SHALL BE COMPLETED IN ACCORDANCE WITH CITY OF COLORADO SPRINGS, ENGINEERING DIVISION, STANDARD SPECIFICATIONS, AND WITH THE APPLICABLE SECTIONS OF THE COLORADO DEPARTMENT OF TRANSPORTATION, STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.

2. THE CONTRACTOR IS RESPONSIBLE FOR THE FIELD VERIFICATION OF ALL PUBLIC AND PRIVATE UTILITIES PRIOR TO THE COMMENCEMENT OF WORK. THE UTILITIES SHOWN ON THESE PLANS HAVE BEEN LOCATED USING THE BEST AVAILABLE INFORMATION. SHOULD A UTILITY BE DAMAGED AS A RESULT OF THIS CONSTRUCTION, IT SHALL BE REPAIRED IMMEDIATELY BY EITHER THE CONTRACTOR OR THE AFFECTED UTILITY OWNER. THE FULL COST OF SUCH A REPAIR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

3. SURFACE AND GROUNDWATER AT THE SITE MAY CREATE A NEED FOR DEWATERING DURING THE CONSTRUCTION OF THE DRAINAGEWAY FACILITIES. CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF TEMPORARY DEWATERING STRUCTURES, AND PROVIDE FOR THE SAFE AND STABLE DISCHARGE OF WATER FROM THE CONSTRUCTION SITE. THE COST OF DEWATERING IS CONSIDERED INCIDENTAL TO THE CONSTRUCTION AND WILL NOT BE PAID FOR UNDER A SPECIFIC ITEM IN THE BID DOCUMENTS.

4. CLASS III RCP SHALL BE USED FOR ALL STORM SEWERS UNLESS OTHERWISE SPECIFIED.

5. THE CONTRACTOR SHALL NOTIFY THE CITY OF FOUNTAIN DEPARTMENT OF PUBLIC WORKS 48 HOURS PRIOR TO THE START OF CONSTRUCTION TO OUTLINE METHODS OF CONSTRUCTION, SCHEDULING, AND ISSUING OF INSPECTION PERMITS.

STRUCTURAL CONCRETE NOTES

1. ALL CONSTRUCTION INVOLVING THE PLACEMENT OF STRUCTURAL CONCRETE SHALL BE COMPLETED IN ACCORDANCE WITH SECTION 600 OF THE CITY OF COLORADO SPRINGS ENGINEERING DIVISION STANDARD SPECIFICATIONS.

2. STEEL REINFORCING SHALL BE GRADE 60 FOR ALL REINFORCING STEEL GREATER THAN #4. A TABLE SPECIFYING MINIMUM SPLICE LENGTHS HAS BEEN PROVIDED ON THE STRUCTURAL DETAIL SHEETS. ALL REINFORCING SHALL HAVE A 2-INCH MINIMUM COVER UNLESS OTHERWISE SPECIFIED. REBAR SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW PRIOR TO FABRICATION.

3. CAST-IN-PLACE CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH (F'C) OF 4,000 PSI AT 28 DAYS. ALL CONCRETE PLACED AGAINST SOIL SHALL BE TYPE II/V PORTLAND CEMENT. ALL EXPOSED CORNERS SHALL BE FORMED WITH A 3/4" CHAMFER UNLESS OTHERWISE SPECIFIED.

4. EXPANSION JOINT MATERIAL SHALL MEET AASHTO SPECIFICATION M-213.

5. BACKFILL AGAINST STRUCTURES SHALL NOT COMMENCE UNTIL ALL SUPPORTING DIAPHRAGMS ARE IN PLACE AND CONCRETE HAS OBTAINED ITS FULL SEVEN DAY STRENGTH. BACKFILL SHALL BE PLACED EQUALLY ON EACH SIDE OF CHECK STRUCTURES AND CUTOFF WALLS UNTIL THE FINAL GRADE IS REACHED.

6. FOOTING EXCAVATIONS SHALL BE EXAMINED BY THE GEOTECHNICAL ENGINEER PRIOR TO THE FORMING AND PLACING OF CONCRETE.

7. CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE ENGINEER AND GEOTECHNICAL ENGINEER WITH A 24-HOUR MINIMUM NOTIFICATION FOR REBAR OBSERVATION, SOIL AND/OR CONCRETE TESTING. PLACEMENT OF CONCRETE IN THE ABSENCE OF TESTING SHALL BE COMPLETED AT THE SOLE RISK OF THE CONTRACTOR.

8. CONCRETE:

   A. NO ADMIXTURES PERMITTED WITHOUT THE REVIEW OF ENGINEER. SUBMIT DESIGN MIX FOR ENGINEER APPROVAL.

   B. CONTRACTOR IS RESPONSIBLE FOR THE ADEQUACY OF FORMS AND SHORING AND FOR SAFE PRACTICE IN THEIR USE AND REMOVAL.

   C. COMPRESSIVE STRENGTH SHALL BE 4,000 psi, MIN.

9. REINFORCING STEEL:

   A. TO BE BILLET STEEL CONFORMING TO THE LATEST A.S.T.M/ A615 GRADE 60 SPECIFICATION, FABRICATED IN ACCORDANCE WITH MANUAL OF STANDARD PRACTICE OF THE C.R.S.I. AND PLACED IN ACCORDANCE WITH A.C.I. 315 AND A.C.I. MANUAL OF PRACTICE.

   B. MINIMUM OF CONCRETE COVER UNLESS OTHERWISE DETAILED ON DRAWINGS: FOOTINGS 3 INCHES, WALLS 3 INCHES, SLABS EXPOSED TO WEATHER 1-1/12 INCHES, SLABS ON GRADE 1-1/2 INCHES MEASURED FROM TOP OF SLAB.

   C. SLAB REINFORCEMENT: LAPPED 36 BAR DIAMETER OR MINIMUM 18 INCHES. BOTTOM BARS SPLICED ONLY AT SUPPORTS, TOP BARS SPLICED ONLY AT MID-SPAN. ALL TOP BARS HOOKED AT NON-CONTINUOUS EDGES (U.O.N.) ALL HOOKS TO BE STANDARD 90 DEGREE OR 180 DEGREE HOOKS AS REQUIRED (U.O.N.), DOWELS IN FOUNDATION TO MATCH REINFORCING ABOVE.

   D. SUBMIT SHOP DRAWINGS FOR REINFORCING PRIOR TO FABRICATION.

10. FOUNDATIONS:

    A. STRUCTURES SHALL BEAR ON SOIL HAVING A MINIMUM BEARING CAPACITY OF 2,000 P.S.F. COMPACTION FOR SUBGRADE PREPARATION SHALL BE IN ACCORDANCE WITH REQUIREMENTS OF THE SOILS REPORT. SUBGRADE PREPARATION SHALL BE MONITORED BY THE SOILS ENGINEER.

11. BACKFILL AND STABILIZATION MATERIAL:

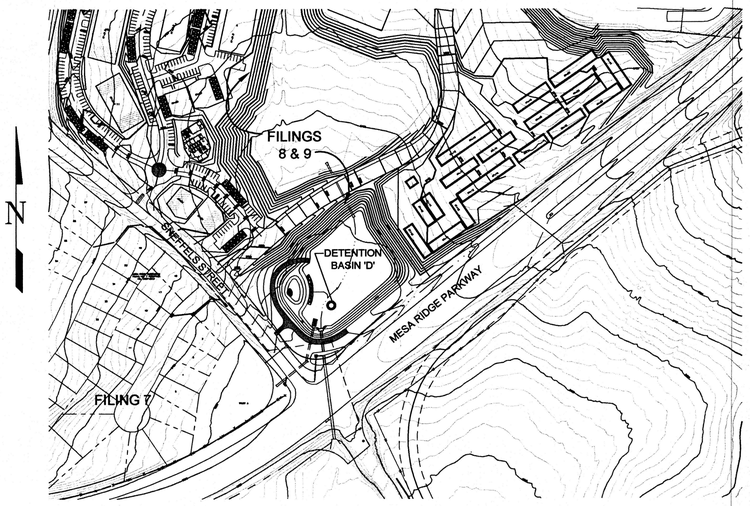
    A. BACKFILL MATERIAL CONSISTING OF SELECT, GRANULAR, NON-SWELLING MATERIAL TO BE PLACED ALONG THE SIDES OF THE VAULTS EXTENDING 3 FEET OUTSIDE THE VAULT WALLS.

    B. 3/4-INCH ROCK, 12-INCHES DEEP, TO BE PLACED UNDER ALL VAULTS.

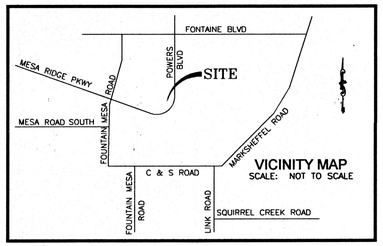
    C. 2-INCH TO 4-INCH STABILIZATION MATERIAL SHALL BE PLACED UNDER THE 3/4" ROCK IF SUBGRADE STABILIZATION IS REQUIRED.

12. ABBREVIATIONS

    E.C -- EPOXY COATED O.F. -- OUTSIDE FACE E.F. -- EACH FACE
    E.W. -- EACH WAY I.F. -- INSIDE FACE N.F. -- NEAR FACE
    T.O.C. -- TOP OF CONCRETE B.O.C. -- BOTTOM OF CONCRETE
    CONT. -- CONTINUOUS



SITE MAP
SCALE: 1"=200'



VICINITY MAP
SCALE: NOT TO SCALE

INDEX OF SHEETS

ABBREVIATIONS

ASSY = ASSEMBLY	HORIZ.= HORIZONTAL	PVC = POINT OF VERTICAL CURVATURE
BNDY = BOUNDARY	HYD = HYDRANT	PVI = POINT OF VERTICAL INTERSECTION
B.O.P. = BOTTOM OF PIPE	I.D. = INSIDE DIAMETER	PVT = POINT OF VERTICAL TANGENCY
CL = CENTERLINE	LT = LEFT	RCB = REINFORCED CONCRETE BOX
CRA = CONCRETE REVERSE ANCHOR	LF = LINEAR FEET	RCP = REINFORCED CONCRETE PIPE
CTRB = CONCRETE THRUST BLOCK	LP = LOW POINT	ROW = RIGHT OF WAY
CR = POINT OF CURB RETURN	MAX. = MAXIMUM	RT = RIGHT
DIP = DUCTILE IRON PIPE	M.H. = MANHOLE	SHT = SHEET
EL = ELEVATION	MIN. = MINIMUM	SS = SANITARY SEWER
ESMT = EASEMENT	NTS = NOT TO SCALE	STA. = STATION
EX. = EXISTING	O.D. = OUTSIDE DIAMETER	STD. = STANDARD
FC = FACE OF CURB	PC = POINT OF HORIZONTAL CURVATURE	T.O.P. = TOP OF PIPE
FES = FLARED END SECTION	PCHC = POINT OF CURVATURE ON HORIZ. CURVE	TYP. = TYPICAL
FLG = FLANGE	PP = PROPOSED	VC = VERTICAL CURVE
FL = FLOWLINE	PT = POINT OF HORIZONTAL TANGENCY	VERT. = VERTICAL
GB = GRADE BREAK	PTHC = POINT OF TANGENCY ON HORIZ. CURVE	
HP = HIGH POINT	PVC = POLY VINYL CHLORIDE PIPE	

*A.G.A./A.P.W.A. STANDARD UTILITY MARKING COLOR CODE

NATURAL GAS	YELLOW
ELECTRIC	RED
WATER	BLUE
WASTEWATER	GREEN

CALL BEFORE YOU DIG... 1-800-922-1987

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS FOR LOCATING AND MARKING GAS, ELECTRIC, WATER AND WASTEWATER

STATEMENTS

NOT

CITY OF FOUNTAIN ACCEPTANCE:

THE PLANS OR REPORT SUBMITTED APPEAR TO BE IN CONFORMANCE WITH THE CITY OF FOUNTAIN SUBMITTAL REQUIREMENTS AND STANDARD ENGINEERING PRINCIPALS AND PRACTICES APPEAR TO HAVE BEEN FOLLOWED. THE PROFESSIONAL ENGINEER SUBMITTING AND SEALING THE PLANS OR REPORT IS SOLELY RESPONSIBLE FOR THEIR ACCURACY AND VALIDITY. THIS REVIEW IS ONLY VALID FOR ONE (1) YEAR FROM THE DATE BELOW.

DUANE GREENWOOD, PUBLIC WORKS DIR./CITY ENGINEER — DATE 10/25/2011

DETAILED DRAINAGE CONSTRUCTION PLANS & SPECIFICATIONS ENGINEER'S STATEMENT:

THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID DETAILED PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE CITY FOR DETAILED DRAINAGE PLANS AND SPECIFICATIONS. SAID DETAILED DRAINAGE PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR DRAINAGE FACILITY(S) IS DESIGNED. I ACCEPT RESPONSIBILITY FOR LIABILITY CAUSED BY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARATION OF THE DETAILED DRAINAGE PLANS AND SPECIFICATIONS.

RICHARD N. WRAY P.E. #19310 — DATE 10/25/11

DEVELOPER — DATE 10/24/11

COMPANY: NOR'WOOD DEVELOPMENT

ADDRESS: PLAZA OF THE ROCKIES
11 S. TEJON STREET, SUITE 222
COLORADO SPRINGS, COLORADO 80903

PROJECT SPECIFIC GRADING AND EROSION CONTROL NOTES

1. All earthwork required of this construction shall be completed in accordance with all applicable sections of the Project Specifications and Soil Investigation Report (Geotechnical Report).
2. Rubbish including timber, concrete rubble, trees, brush, and asphalt shall not be backfilled adjacent to any of the structures or be in the placement of any unclassified fill. The Contractor shall be responsible for the removal and hauling of such materials to a suitable spoil area. Costs associated with the removal of such materials shall be paid for as documented in the Project Specifications.
3. Excess excavation shall become the property of the Contractor and shall be disposed of at the Contractor's expense. The cost of haulage and spoiling of excess excavated materials shall be paid for as documented in the Project Specifications.
4. Water shall be used as a dust palliative as required and shall be included in the cost for earthwork item(s). No separate payment will be made for dust control associated with the site construction.
5. The road grades shall be cleared of vegetation and the topsoil stockpiled for later use.
6. All grading shall be in conformance with the Geotechnical Report for the area.
7. Placement of fill for roadway embankments shall be completed in conformance with the Geotechnical Report.
8. Grading contours shown on this plan are to final grade.
9. Compaction under filled areas, including roadway and detention basin embankments, shall be 95 percent of the maximum Standard Proctor Density (ASTM D698) at two (2) percent of optimum moisture content.
10. No rubble or debris shall be placed in the backfill under any of the proposed buildings, streets, curb & gutter, sidewalk and drainage structures or within five (5) feet of a building footprint. Properly graded rubble may be used in some locations as specified and verified by the Geotechnical Engineer.
11. Contractor is responsible for reviewing the site prior to bidding to verify site conditions.
12. Contractor is responsible for providing erosion control measures as approved by the City of Fountain Dept. of Public Works Division and as may be required by the El Paso County Inspector.
13. All slopes equal to or greater than 3:1 shall require erosion control blanket, single netted fabric, American Excelsior or equal.
14. The Developer is responsible for maintaining erosion control measures until a mature stage of vegetation is established.
15. All soils used for fill must be approved by a representative of the Geotechnical Engineer.
16. All natural ground to receive fill must be properly scarified, watered and compacted prior to placing fill.
17. The Contractor is solely responsible for the design, maintenance and operation of any required dewatering system. The Contractor shall perform such independent investigation as he deems necessary to satisfy himself as to the subsurface groundwater conditions and unstable soil conditions to be encountered throughout the construction.
18. No fill shall be placed, spread or rolled while it is frozen, thawing or during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until a representative of the Geotechnical Engineer indicates that the moisture content and density of the previously placed fill are as specified. Fill surfaces may be scarified and recompacted after rainfall if necessary, to obtain proper moisture density relation.
19. Additional erosion control structures and/or grading may be required at the time of construction.
20. Sediment removal for erosion control facilities shall be performed continuously for proper function.
21. Base mapping was provided by Rockwell Consulting. The date of the survey was January 2008.
22. Proposed Construction Schedule:
    Begin Construction: OCTOBER 25, 2011
    End Construction: FEBRUARY 28, 2012
    Total Site Area = 3.6 Acres
23. Area to be disturbed = 3.6 Acres (est.)
    Existing 100-year runoff coefficient = 0.40
    Proposed 100-year runoff coefficient = 0.40
    Existing Hydrological Soil Groups: B & C
24. Site is currently undeveloped and covered with native grasses on mild slopes (2%-7%).
25. Site is located in the Jimmy Camp Creek Drainage Basin.
26. All grading and erosion control shall be completed in accordance with the City of Fountain Municipal Code Sections 12.04.160 and 12.10

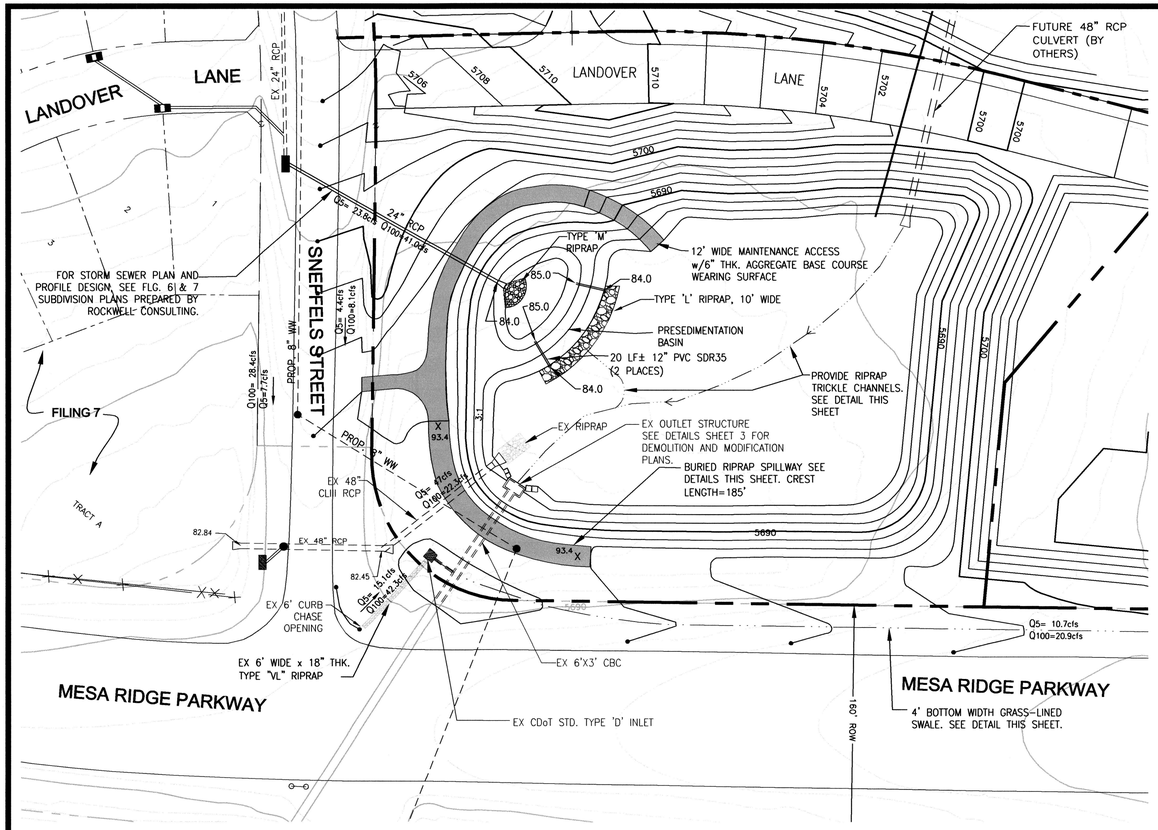
GRADING AND EROSION CONTROL NOTES

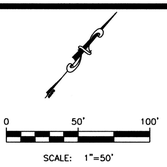
1. ALL GRADING AND EROSION CONTROL SHALL BE COMPLETED IN ACCORDANCE WITH THE CITY OF FOUNTAIN MUNICIPAL CODE SECTIONS 12.04.160 AND 12.10.
2. ALL FILL AREAS SHALL BE COMPACTED IN ACCORDANCE WITH THE GEOTECHNICAL ENGINEER'S RECOMMENDATIONS.
3. SOIL EROSION CONTROL MEASURES FOR ALL SLOPES, CHANNELS, DITCHES, OR ANY DISTURBED LAND AREA SHALL BE COMPLETED WITHIN TWENTY ONE (21) CALENDAR DAYS AFTER FINAL GRADING, OR FINAL EARTH DISTURBANCE HAS BEEN COMPLETED. AN AREA THAT IS GOING TO REMAIN IN AN INTERIM STATE FOR MORE THAN 60 DAYS SHALL ALSO BE SEEDED. ALL TEMPORARY SOIL EROSION CONTROL MEASURES AND BMPS SHALL BE MAINTAINED UNTIL PERMANENT SOIL EROSION CONTROL MEASURES ARE IMPLEMENTED.
4. EROSION CONTROL SHALL CONSIST OF SILT FENCES AND HAY BALES AS SHOWN ON THE DRAWING, AND TOPSOIL WITH GRASS SEED WHICH WILL BE WATERED UNTIL VEGETATION HAS BEEN REESTABLISHED.
5. EROSION CONTROL BALES OR SILT FENCE SHALL BE PLACED AT THE TOE AND DRAINAGE OUTFALL POINTS OF ALL SLOPES 4:1 OR STEEPER TO PREVENT SILTATION ON STREETS. REFER TO STORM WATER MANAGEMENT PLAN FOR DETAIL AND LOCATION OF EROSION CONTROL MEASURES.
6. CONTRACTOR SHALL COMPLY WITH ALL LOCAL, COUNTY AND STATE REGULATIONS PERTAINING TO GRADING, DUST AND EROSION.
7. NATURAL VEGETATION SHALL BE RETAINED AND PROTECTED WHEREVER POSSIBLE. EXPOSURE OF SOIL TO EROSION BY REMOVAL OR DISTURBANCE OF VEGETATION SHALL BE LIMITED TO THE AREA REQUIRED FOR IMMEDIATE CONSTRUCTION OPERATIONS AND FOR THE SHORTEST PRACTICAL PERIOD OF TIME.
8. TOPSOIL SHALL BE STOCKPILED TO THE EXTENT PRACTICABLE ON THE SITE FOR USE ON AREAS TO BE REVEGETATED. ANY AND ALL STOCKPILES SHALL BE LOCATED AND PROTECTED FROM EROSIVE ELEMENTS.
9. AT ALL TIMES, THE PROPERTY SHALL BE MAINTAINED AND/OR WATERED TO PREVENT WIND-CAUSED EROSION. EARTHWORK OPERATIONS SHALL BE DISCONTINUED WHEN FUGITIVE DUST SIGNIFICANTLY IMPACTS ADJACENT PROPERTY. IF EARTHWORK IS COMPLETE OR DISCONTINUED AND DUST FROM THE SITE CONTINUES TO CREATE PROBLEMS, THE OWNER/DEVELOPER SHALL IMMEDIATELY INSTITUTE MITIGATIVE MEASURES AND SHALL CORRECT DAMAGE TO ADJACENT PROPERTY.
10. ALL PERSONS ENGAGED IN EARTH DISTURBANCE SHALL IMPLEMENT AND MAINTAIN ACCEPTABLE SOIL EROSION AND SEDIMENT CONTROL MEASURES INCLUDING BMPS IN CONFORMANCE WITH THE EROSION CONTROL TECHNICAL STANDARDS OF THE MANUAL AND IN ACCORDANCE WITH THE EROSION AND STORMWATER QUALITY CONTROL PLAN APPROVED BY THE CITY OF FOUNTAIN, IF REQUIRED.
11. ALL EARTH DISTURBANCE SHALL BE CONDUCTED IN SUCH A MANNER SO AS TO EFFECTIVELY REDUCE ACCELERATED SOIL EROSION.
12. ALL EARTH DISTURBANCE SHALL BE DESIGNED, CONSTRUCTED, AND COMPLETED IN SUCH A MANNER SO THAT THE EXPOSED AREA OF ANY DISTURBED LAND SHALL BE LIMITED TO THE SHORTEST PRACTICAL PERIOD OF TIME.
13. ALL EARTH DISTURBANCE SHALL BE DONE IN A MANNER THAT MINIMIZES POLLUTION OF ANY ON-SITE OR OFF-SITE WATERS.
14. SUSPENDED SEDIMENT CAUSED BY ACCELERATED SOIL EROSION SHALL BE MINIMIZED IN RUNOFF WATER BEFORE IT LEAVES THE SITE.
15. TEMPORARY SOIL EROSION CONTROL FACILITIES SHALL BE REMOVED AND EARTH DISTURBANCE AREAS GRADED AND STABILIZED WITH PERMANENT SOIL EROSION CONTROL MEASURES PURSUANT TO THE STANDARDS AND SPECIFICATIONS PRESCRIBED IN THE MANUAL, AND IN ACCORDANCE WITH THE PERMANENT EROSION CONTROL FEATURES SHOWN ON THE EROSION AND STORMWATER CONTROL PLANS APPROVED BY THE CITY OF FOUNTAIN, IF REQUIRED.
16. ANY STREET OR DRAINAGE FACILITY WHICH HAS HAD EROSION SEDIMENT DEPOSITED IN IT DUE TO CONSTRUCTION, GRADING, OR OTHER DEVELOPMENT ACTIVITY, MUST BE CLEANED IMMEDIATELY AT THE EXPENSE OF THE CONTRACTOR, DEVELOPER, HOMEBUILDER, OR WHOEVER IS RESPONSIBLE FOR THE CONSTRUCTION, GRADING, OR LAND DEVELOPMENT ACTIVITY. IF THE FACILITY IS NOT CLEANED IMMEDIATELY OR WITHIN A RESPONSIBLE PERIOD OF TIME AFTER NOTIFICATION BY THE CITY, THE CITY MAY PERFORM THE WORK OR HAVE THE WORK DONE AND BILL THE RESPONSIBLE PARTY.
17. IT IS THE RESPONSIBILITY OF THE OWNER TO ENSURE THAT VEHICLE TRACKING CONTROL IS IN PLACE, FUNCTIONAL, AND MAINTAINED THROUGHOUT THE CONSTRUCTION PHASE OF THIS PROJECT.
18. INDIVIDUALS SHALL COMPLY WITH THE "COLORADO WATER QUALITY CONTROL ACT" (TITLE 25, ARTICLE 8, CRS), AND THE "CLEAN WATER ACT" (33USC 1344), REGULATIONS PROMULGATED, CERTIFICATIONS OR PERMITS ISSUED, IN ADDITION TO CITY OF FOUNTAIN REQUIREMENTS. IN THE EVENT OF CONFLICTS BETWEEN THESE REQUIREMENTS, THE MORE RESTRICTIVE LAWS, RULES, OR REGULATIONS SHALL APPLY.

Kiowa Project No. 09061
October 25, 2011

DEVELOPER:
NOR'WOOD DEVELOPMENT
PLAZA OF THE ROCKIES
11 S. TEJON STREET, SUITE 222
COLORADO SPRINGS, COLORADO 80903

PREPARED BY:
Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
(719) 630-7342





DETENTION BASIN D DATA

Q_5 IN = 97 cfs		Q_{100} IN = 349 cfs	
Q_5 OUT = 13 cfs		Q_{100} OUT = 202 cfs	
VOL_5 = 4.5 AC-FT		WS_5 = 5686.8	
VOL_{100} = 8.3 AC-FT		WS_{100} = 5689.3	
VOL_{FS} = 4.2 AC-FT		WS_{FS} = 5686.6	

DETENTION BASIN TO BE INSPECTED ANNUALLY TO INSURE BASIN IS FUNCTIONING AS INTENDED. MAINTAIN FACILITY AS RECOMMENDED IN DCM VOLUME 2.

CALL BEFORE YOU DIG... 1-800-922-1987

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS FOR LOCATING and MARKING GAS, ELECTRIC, WATER and WASTEWATER

SEED MIX

AREAS DISTURBED BY THE EARTHWORK SHALL BE PERMANENTLY REVEGETATED WITH NATIVE GRASSES. NATIVE SEED MIX FOR THIS PROJECT SHALL BE AS FOLLOWS:

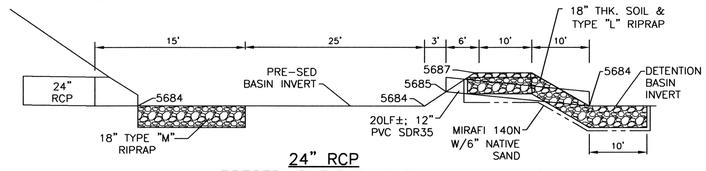
COMMON NAME	SCIENTIFIC NAME	Seeds/Lb	Lbs/PLS/Ac
SHEEP FESCUE(DURAR)	*Festuca ovina*	680,000	1.3
WESTERN WHEATGRASS (ARRIBA)	*Pascopyrum smithii*	110,000	7.9
ALKALI SACATON	*Sporobolus airoides*	1.758,000	0.5
SLENDER WHEATGRASS	*Elymus trachycaulus*	159,000	5.5
CANADIAN BLUEGRASS (RUEBENS)	*poa compressa*	2,500,000	0.3
SWITCH GRASS (PATHFINDER)	*Panicum virgatum*	389,000	1.3
			16.8

SEEDING APPLICATION: DRILL SEED 1/4" TO 1/2" INTO TOPSOIL. IN AREAS INACCESSIBLE TO A DRILL, HAND BROADCAST AT DOUBLE THE RATE AND RAKE 1/4" TO 1/2" INTO THE TOPSOIL.
MULCHING APPLICATION: 1-1/2 TONS NATIVE HAY PER ACRE, MECHANICALLY CRIMPED INTO THE TOPSOIL.

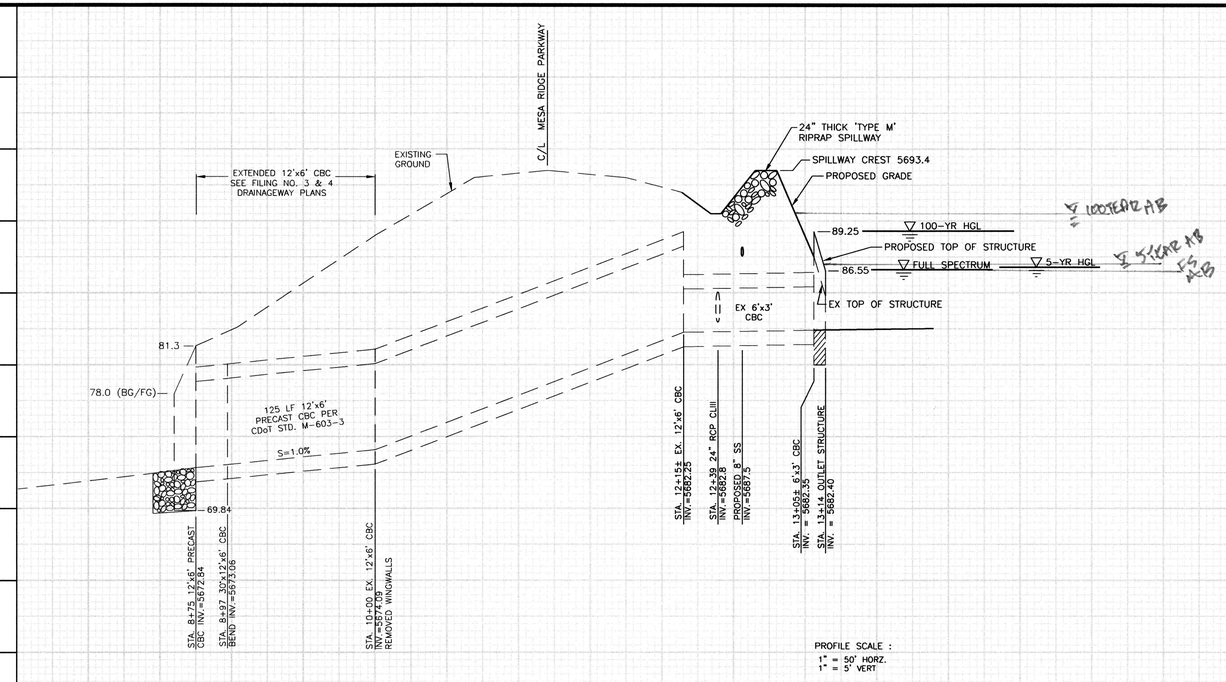
* SEED MIX SHALL BE IN CONFORMANCE WITH USDFS TRAILSTAIN AREA MIX SPECIFICATIONS.

EROSION CONTROL INSPECTION AND MAINTENANCE

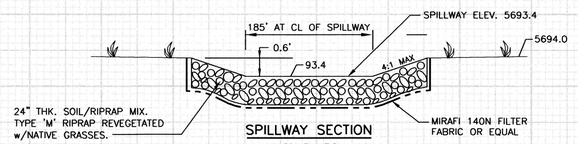
A THOROUGH INSPECTION OF THE EROSION CONTROL PLAN/STORMWATER MANAGEMENT SYSTEM SHALL BE PERFORMED EVERY 14 DAYS AS WELL AS AFTER ANY RAIN OR SNOWMELT EVENT THAT CAUSES SURFACE EROSION:
* WHEN STRAW BALE BARRIERS HAVE SILTED UP TO HALF THEIR HEIGHT, THE SILT SHALL BE REMOVED, FINAL GRADE REESTABLISHED AND SLOPES RESEEDED IF NECESSARY. ANY STRAW BALES THAT HAVE SHIFTED OR DECAYED SHALL BE REPAIRED OR REPLACED.
* ANY ACCUMULATED TRASH OR DEBRIS SHALL BE REMOVED FROM OUTLETS. AN INSPECTION AND MAINTENANCE LOG SHALL BE KEPT.



24" RCP PRESEDIMENTATION BASIN
SCALE: H: 1"=10', V: 1"=5'



PROFILE SCALE :
1" = 50' HORZ.
1" = 5' VERT



SPILLWAY SECTION
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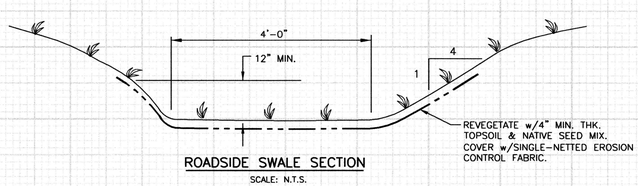

ROADSIDE SWALE SECTION
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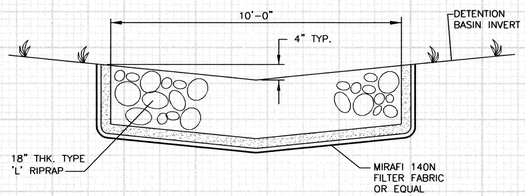


TYPICAL LOW FLOW RIPRAP TRICKLE CHANNEL
SCALE: N.T.S.

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
719) 630-7342

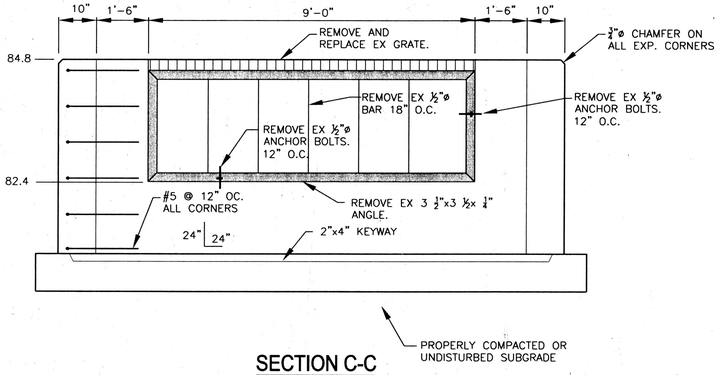
MESA RIDGE FILINGS 8 & 9 - DETENTION BASIN 'D' FULL SPECTRUM DETENTION MODIFICATIONS GRADING AND EROSION CONTROL PLAN AND STORM PROFILE

FOUNTAIN, COLORADO

Project No.:	09061
Date:	October 17, 2011
Design:	RNW
Drawn:	JGD
Check:	RNW
Revisions:	

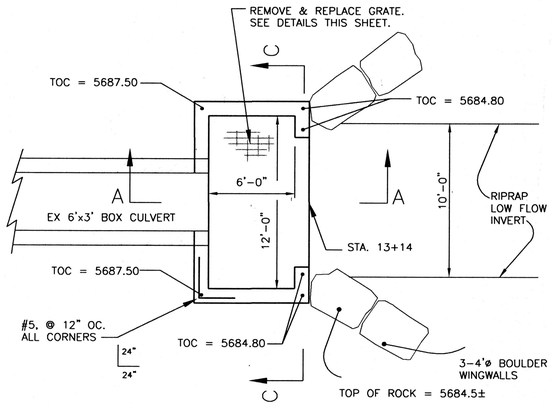
SHEET 2 OF 3 SHEETS

0906102PP.dwg/Oct 24, 2011



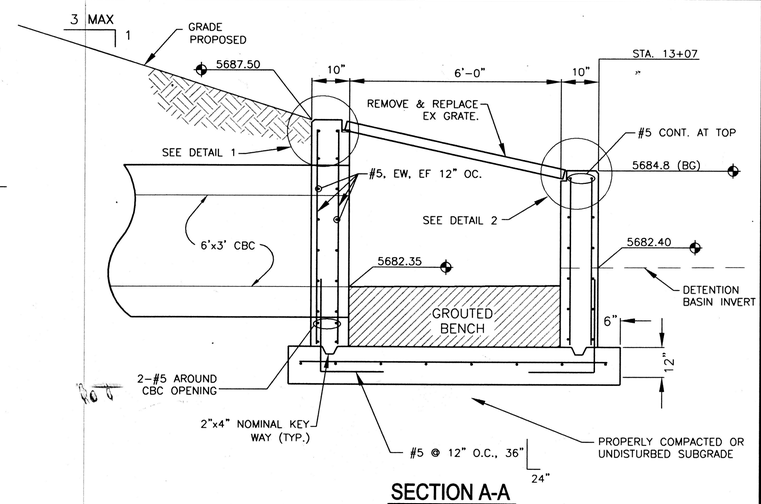
SECTION C-C

SCALE: 1"=2'



EX. OUTLET STRUCTURE PLAN

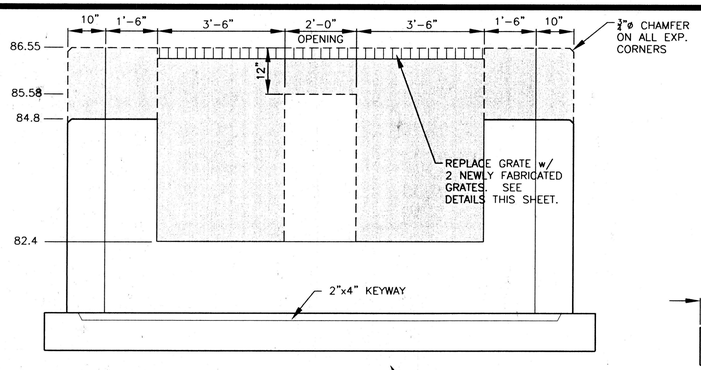
SCALE : N.T.S.



SECTION A-A

SCALE: 1"=2'

STRUCTURE DEMOLITION PLAN



SECTION C-C

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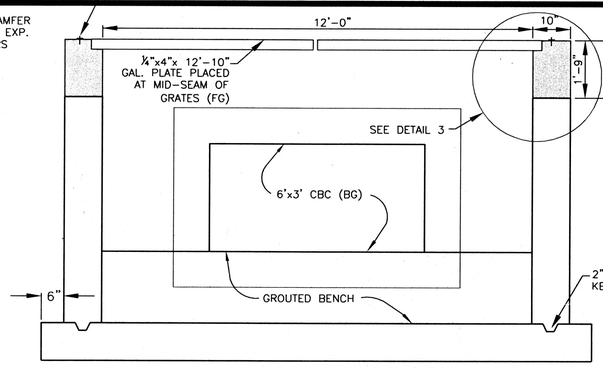
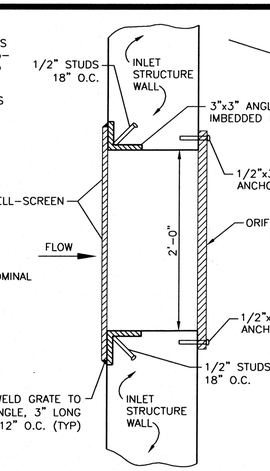


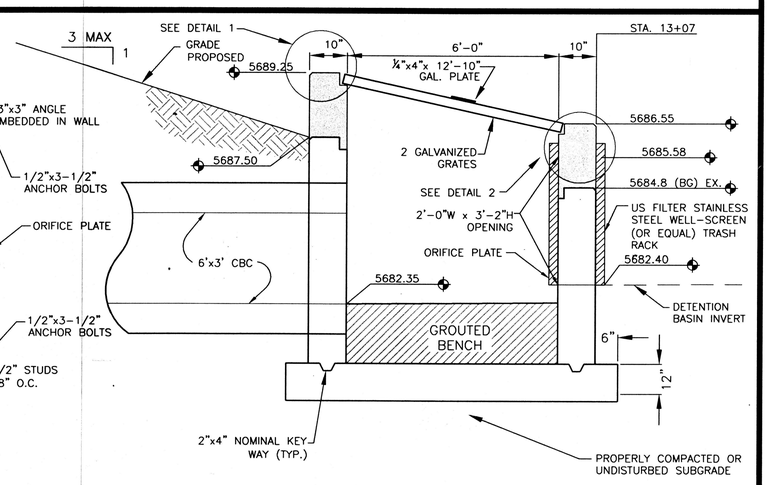
SECTION B-B

SCALE: 1"=2'



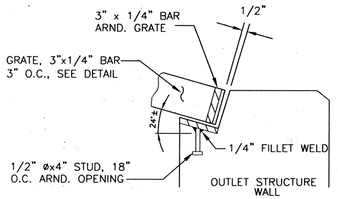
TRASH RACK DETAIL

SCALE: N.T.S.



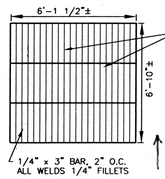
SECTION A-A

SCALE: 1"=2'



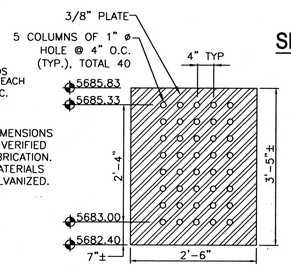
DETAIL 2

SCALE: NTS



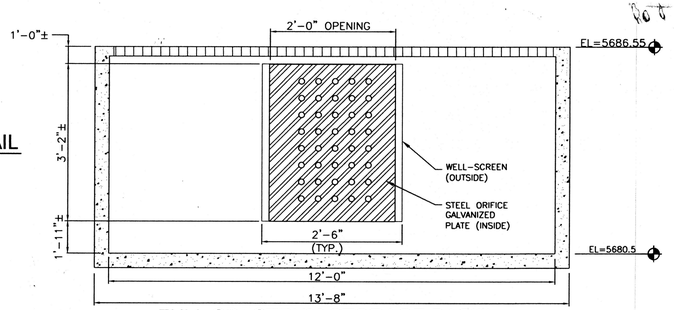
GRATE DETAIL (2)

SCALE: NTS



ORIFICE PLATE HOLE DETAIL

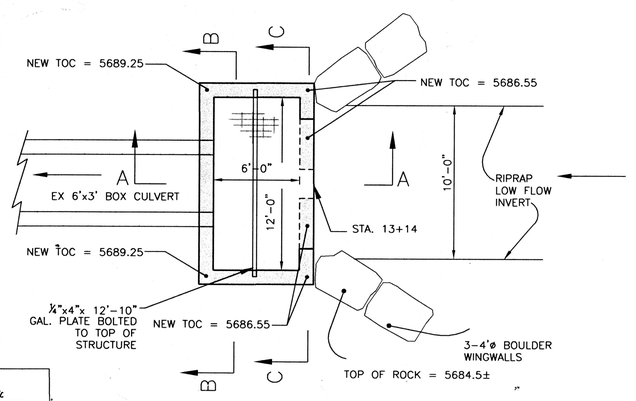
SCALE: NTS



FULL SPECTRUM STORAGE BASIN OUTLET STRUCTURE

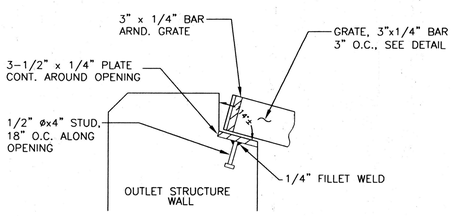
ELEVATION DETAIL

SCALE: NTS



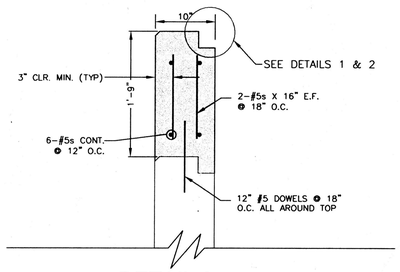
OUTLET STRUCTURE PLAN

SCALE : N.T.S.



DETAIL 1

SCALE: NTS



DETAIL 3

SCALE: 1/2"=1'-0"

NOTE:
ALL METAL PLATE & EMBEDMENTS SHALL BE GALVANIZED STEEL.
ALL BOLTS & NUTS SHALL BE STAINLESS STEEL.

STRUCTURE MODIFICATION PLAN

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
[719] 630-7342

MESA RIDGE FILINGS 8 & 9 - DETENTION BASIN 'D' FULL SPECTRUM DETENTION MODIFICATIONS

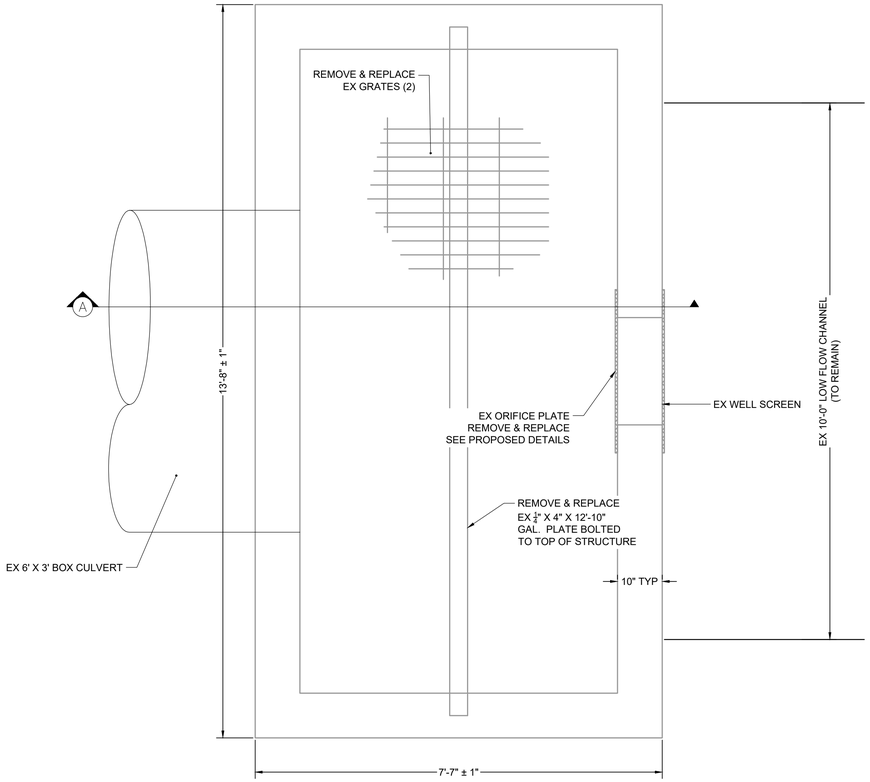
OUTLET STRUCTURE DETAILS

FOUNTAIN, COLORADO

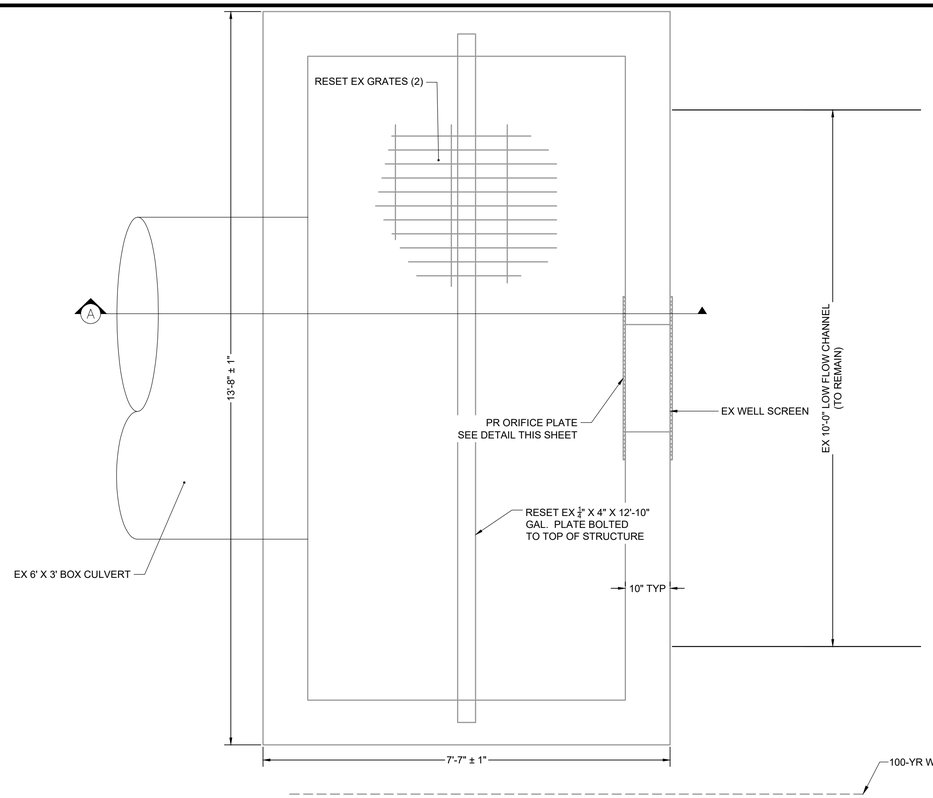
Project No.:	09061
Date:	October 24, 2011
Design:	RNW
Drawn:	JGD
Check:	RNW
Revisions:	

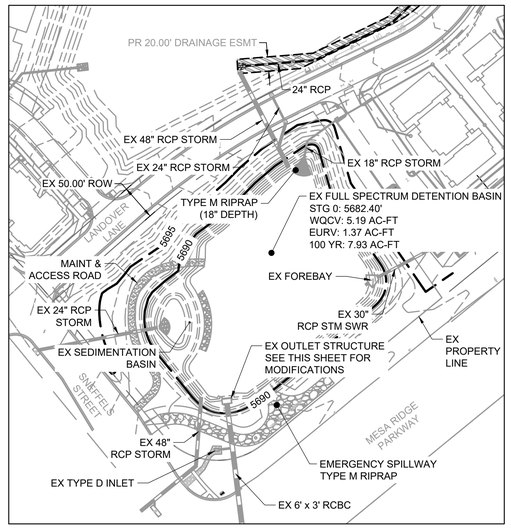
SHEET 3 OF 3 SHEETS

09061030T.dwg/Oct 24, 2011

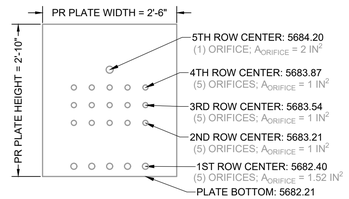


PLAN VIEW
EX POND OUTLET STRUCTURE PLAN
SCALE: 3/4" = 1'

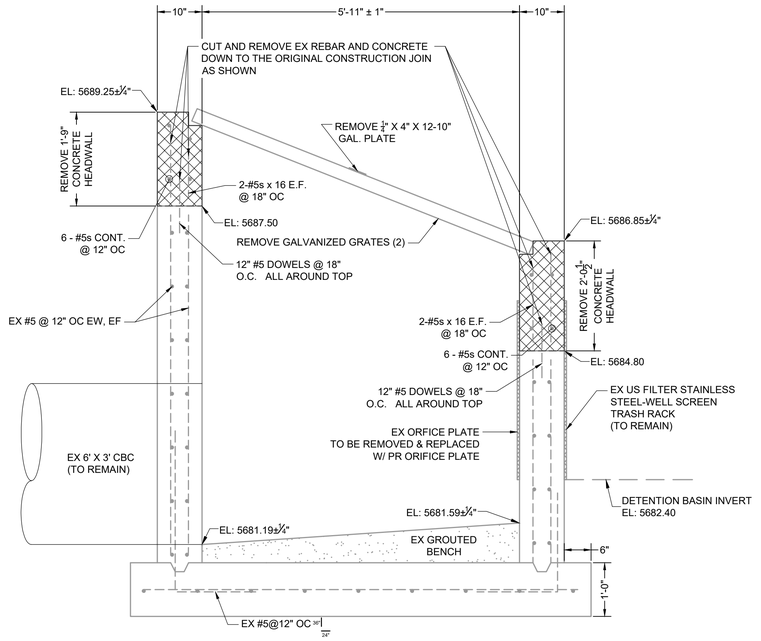




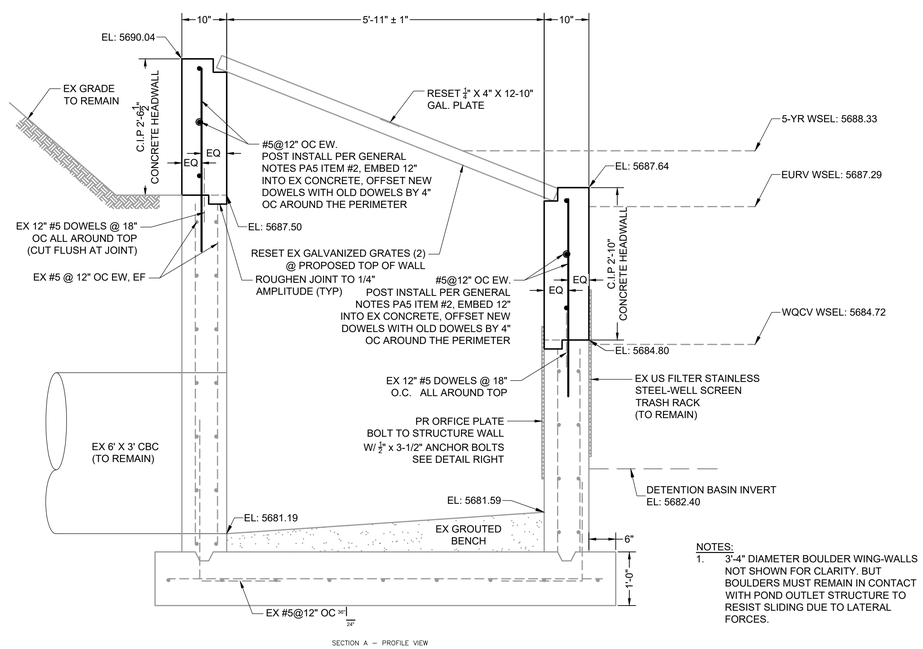
VICINITY MAP
SCALE: 1" = 100'



ELEVATION VIEW
PROPOSED ORIFICE PLATE
SCALE: 3/4" = 1'



SECTION A – PROFILE VIEW
EX POND OUTLET STRUCTURE – DEMO PLAN
SCALE: 3/4" = 1'



SECTION A – PROFILE VIEW
POND OUTLET STRUCTURE MODIFICATIONS
SCALE: 3/4" = 1'

NOTES:
1. 3'-4" DIAMETER BOULDER WING-WALLS NOT SHOWN FOR CLARITY. BUT BOULDERS MUST REMAIN IN CONTACT WITH POND OUTLET STRUCTURE TO RESIST SLIDING DUE TO LATERAL FORCES.

NOT FOR CONSTRUCTION

SCALE:
¾" = 1'

DRAWN BY:	NQJ	JOB DATE:	7/22/2022
APPROVED:	KMH	JOB NUMBER:	200541
CAD DATE:	8/19/2022		
CAD FILE:	J:\2020\200541\CAD\Dwgs\C\CD\C.O.F\Outlet_Structure_Details		

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

NO.	DATE	BY	REVISION DESCRIPTION

HRGreen

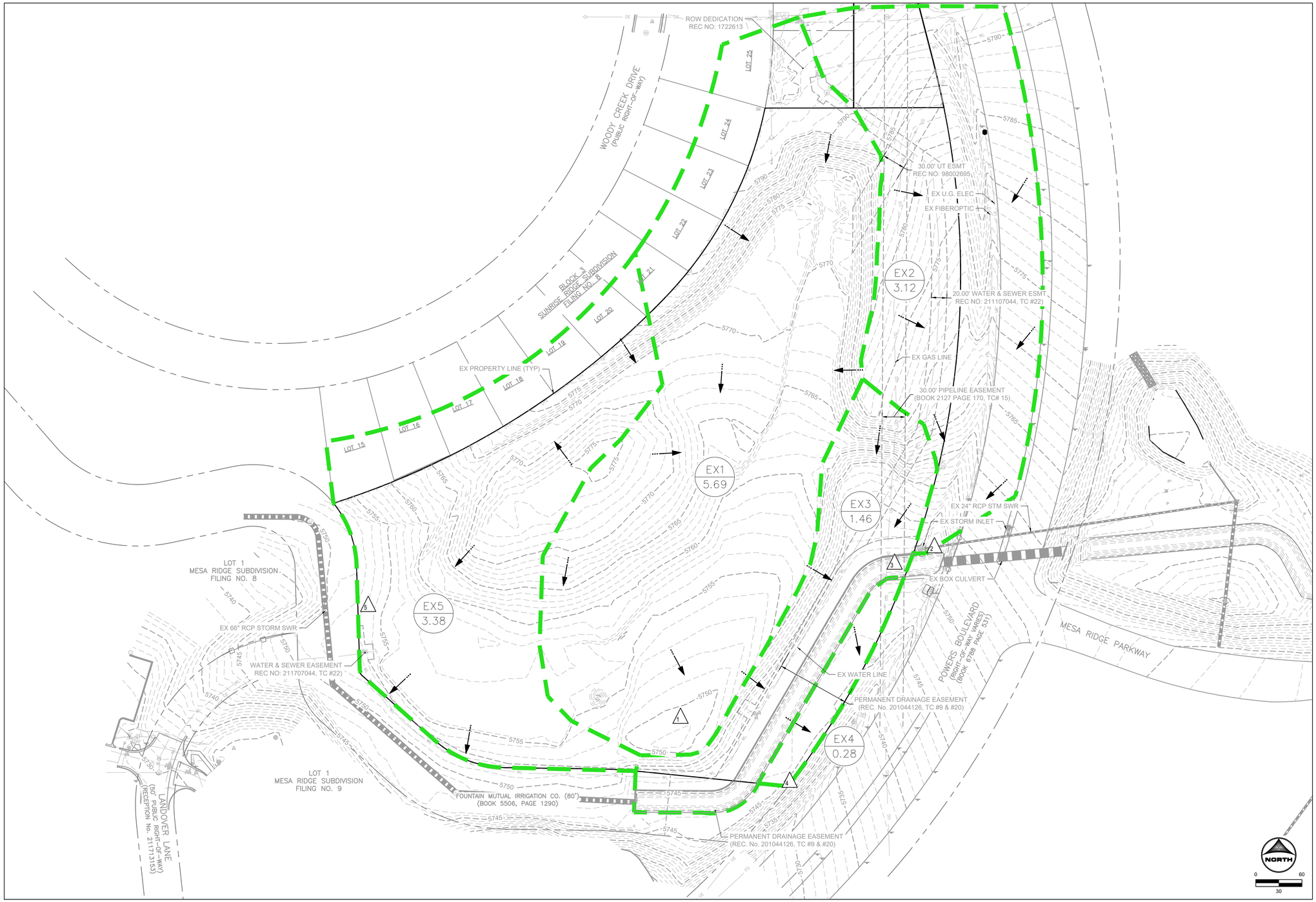
HR GREEN - COLORADO SPRINGS
7222 COMMERCE CENTER DR SUITE 220
COLORADO SPRINGS CO 80919
PHONE: 719.300.4140 TOLL FREE: 800.728.7805
FAX: 844.273.1057 | HRGreen.com

THE COTTAGES AT MESA RIDGE
GOODWIN KNIGHT
FOUNTAIN, COLORADO

CITY OF FOUNTAIN CONSTRUCTION DOCUMENTS
OUTLET STRUCTURE MODIFICATION PLAN

SHEET
DT
10

APPENDIX F – DRAINAGE MAPS



LEGEND:

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

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
EX1	5.69	7	2.5	13.4
EX2	3.12	28	3.5	10.0
EX3	1.46	24	1.4	4.1
EX4	0.28	2	0.1	0.5
EX5	3.38	15	2.1	8.7

DESIGN POINT SUMMARY TABLE

DESIGN POINT	UPSTREAM BASIN	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	EX1	2.5	13.4
2	EX2	3.5	10.0
3	EX3	1.4	4.1
4	EX4	0.1	0.5
5	EX5	2.1	8.7

DRAWN BY: YOU JOB DATE: 8/10/2021
APPROVED: KEN JOB NUMBER: 200541
CAD DATE: 12/6/2021
CAD FILE: J:\2020\200541\CAD\Dwgs\C\Drainage\Ex_Drn_Map

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

NO.	DATE	BY	REVISION DESCRIPTION

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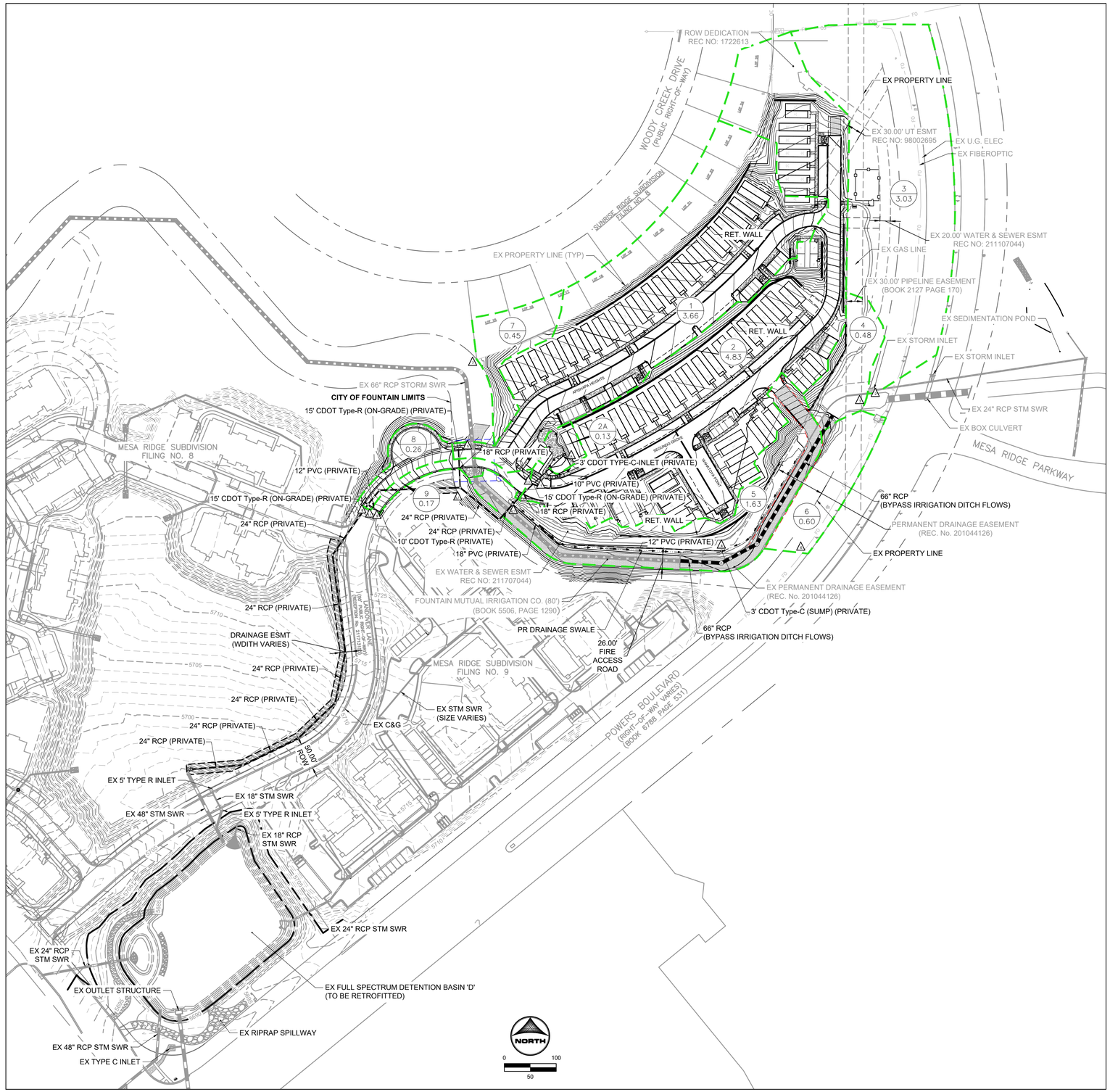
THE COTTAGES AT MESA RIDGE
GOODWIN KNIGHT
EL PASO COUNTY, COLORADO

PRELIMINARY DRAINAGE REPORT
EXISTING DRAINAGE MAP

SHEET DRN 1



LEGEND:

PROPOSED MAJOR CONTOUR	5250
PROPOSED MINOR CONTOUR	
EXISTING MAJOR CONTOUR	5250
EXISTING MINOR CONTOUR	
PROPOSED STORM DRAIN PIPE	
EXISTING STORM DRAIN PIPE	
PROPOSED DRAINAGE SWALE	
PROPERTY LINE	
PROPOSED FLOW DIRECTION	
EXISTING FLOW DIRECTION	
SUB BASIN LINE	
DESIGN POINT	1
PROPOSED BASIN LABEL	11 / 1.25 (BASIN DESIGNATION / AREA (AC.))

BASIN SUMMARY

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
1	3.67	61	7.4	15.3
2	4.83	62	9.7	20.5
2A	0.13	100	0.6	1.1
3	3.03	29	3.4	9.7
4	0.48	8	0.3	1.7
5	1.63	37	2.6	6.7
6	0.60	2	0.2	1.2
7	0.45	26	0.4	1.3
8	0.26	92	1.1	2.1
9	0.17	100	0.8	1.4

DESIGN POINT SUMMARY

DESIGN POINT	UPSTREAM BASIN	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1A	2A	0.6	1.1
1	2	9.7	20.5
1.1	DP1A & DP1	8.1	14.2
2	3	3.4	9.7
3	4	0.3	1.7
4	5	2.6	6.7
4.1	DP1.1 & DP4	10.4	19.8
5	2	8.4	17.8
5.1	DP4.1 & DP5	18.0	32.7
6	6	0.2	1.2
7	7	0.4	1.3
8	8	1.5	5.8
9	9	1.5	4.4
9.1	DP6.1, DP8 & DP9	20.4	42.0

DRAWN BY: NQJ JOB DATE: 8/19/2022
APPROVED: KMH JOB NUMBER: 200541
CAD DATE: 8/19/2022
CAD FILE: J:\2020\200541\CAD\Dwgs\C\Drainage\Pr'_Drn_Map

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NO.	DATE	BY	REVISION DESCRIPTION

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THE COTTAGES AT MESA RIDGE
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EL PASO COUNTY, COLORADO

GOODWIN KNIGHT

FINAL DRAINAGE REPORT
PROPOSED DRAINAGE MAP

SHEET DRN 1