



Final Drainage Report

Venture on Venetucci Filing No. 1 El Paso County, Colorado

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Project #: 096302017

Prepared: November 12th, 2024

PCD File Number: **PPR2444 and**
SF2431

KH RESPONSE: ADDRESSED

Kimley»Horn

CERTIFICATION

DESIGN ENGINEER'S STATEMENT

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

Michael Hart, P.E. # 58724

Date

OWNER/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 Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

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

Date

Conditions:

KH RESPONSE: Updated County
Engineer to be Joshua Palmer

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INTRODUCTION

PURPOSE AND SCOPE OF STUDY

The purpose of this Final Drainage Report (FDR) is to provide the hydrologic and hydraulic calculations and to document and finalize the drainage design methodology in support of the Venture on Venetucci Filing No. 1 (the “Site”) for a proposed Multi-Family development (the “Project”). The Project is located within the jurisdictional limits of El Paso County (the “County”). Thus, the guidelines for the hydrologic and hydraulic design components were based on the criteria for the County and City of Colorado Springs, described below.

LOCATION

The Site is located in the South Half of Section 4, Township 15 South, Range 66 West of the 6th P.M. County of El Paso, State of Colorado, totaling 16.23-acres. The Site borders Venetucci Blvd to the West. A vicinity map has been provided in the **Appendix A** of this report.

DESCRIPTION OF PROPERTY

The Site is located on approximately 16.23 acres of land consisting of vacant land with native vegetation and is classified as “Undeveloped” per Table 6-6 of the City of Colorado Springs Drainage Criteria Manual. The Project consists of 10 multi-family buildings, 8 detached garage buildings, a fitness center, a management garage, and a clubhouse/leasing amenity space with a pool deck. The Site currently has a sediment basin located in the center of the existing Site. The existing land use is undeveloped vacant land.

The existing topography consists of slopes ranging from 1% to 40% with the majority of the property sloping to the center of the property to the existing sediment basin with the western side flowing into Fisher’s Canyon Creek.

NRCS soil data is available for this Site and it has been noted that soils onsite are generally USCS Type A. The NRCS soil data can be found in **Appendix B**.

Improvements will consist of clearing and grubbing, weed control, paved access road construction, roadway grading, a detention pond, drainage swales, and native seeding.

An updated Topographic field survey was completed for the Project by Kimley-Horn dated September 10, 2024 and is the basis for design for the drainage improvements.

DRAINAGE BASINS

MAJOR BASIN DESCRIPTIONS

The Site improvements are located in Zone X, as determined by the Flood Insurance Rate Map (FIRM) number 08041C0743G effective date, December 7, 2018 (see **Appendix A**).

please discuss the western tributary to fishers canyon on the west side of the proposed lot. Is the tributary stable, in need of improvements etc? Per DCMV1 1.4.2 developers in and along a drainageway are required to implement the proper measures to maintain or create stable characteristics.

Also, provide a brief discussion regarding the analysis and improvements that are being completed by this development at the downstream fishers canyon tributary. Be sure to discuss how the proposed outfall and spillway for the pond will tie in to the proposed channel improvements. Recommend adding excerpts of that analysis once complete into this report.

KH RESPONSE: DISCUSSION HAS BEEN ADDED TO THE REPORT.

Please include area, Q5, and Q100 with each basin description throughout the report

Sub-Basin EX-1 consists of the central from the south portion of the sub-bas basin in the middle of the site, while sediment basin at Design Point 1. This runoff will eventually outfall into Fisher's Canyon Creek. Table 1 shows the basin area, impervious value, and runoff during the 5-year and 100-year events. Refer to **Appendix D** for the Existing Conditions Drainage Map.

KH RESPONSE: THIS INFORMATION HAS BEEN ADDED TO THE BASIN DESCRIPTIONS

Sub-Basin OF-1 consists of a private onsite basin to the southwest of the Site. Drainage flows overland from north to south across native vegetation and conveys to the southern line of Sub-basin OF-1 at Design Point OF1. This runoff flows offsite to the adjacent (add street name) and is convey by curb and gutter into an existing Type R inlet and will eventually outfall into Fisher's Canyon Creek. Table 1 shows the basin area, impervious value, and runoff during the 5-year and 100-year events. Refer to **Appendix D** for the Existing Conditions Drainage Map.

add street name

KH RESPONSE: ADDED

Sub-Basin OF-2 consists of a private onsite basin in the southern central part of the Site. Drainage flows overland from north to south across native vegetation and conveys to the southern line of Sub-basin OF-2 at Design Point OF2. This runoff flows offsite to the adjacent (add street name) and is convey by curb and gutter into an existing Type R inlet and will eventually outfall into Fisher's Canyon Creek. Table 1 shows the basin area, impervious value, and runoff during the 5-year and 100-year events. Refer to **Appendix D** for the Existing Conditions Drainage Map.

KH RESPONSE: ADDED

Sub-Basin OF-3 consists of a private onsite basin to the southeast of the Site. Drainage flows overland across native vegetation from west to east and conveys to the eastern line of Sub-basin OF-3 at Design Point OF3. This runoff flows offsite to the adjacent Venetucci Blvd. and is convey by curb and gutter into an existing Type R inlet and will eventually outfall into Fisher's Canyon Creek. Table 1 shows the basin area, impervious value, and runoff during the 5-year and 100-year events. Refer to **Appendix D** for the Existing Conditions Drainage Map.

Sub-Basin OF-4 consists of a public onsite basin to the northeast of the Site. Drainage flows overland across native vegetation from west to east and conveys to the eastern line of Sub-Basin OF-4 at Design Point OF4. This runoff flows offsite to the adjacent Venetucci Blvd. and is convey by curb and gutter into an existing Type R inlet and will eventually outfall into Fisher's Canyon Creek. Table 1 shows the basin area, impervious value, and runoff during the 5-year and 100-year events. Refer to **Appendix D** for the Existing Conditions Drainage Map.

Sub-Basin OF-5 consists of a private onsite basin to the west of the Property. Drainage flows overland across native vegetation from east to west and conveys to the western line of Sub-basin OF-5 at Design Point OF5. This runoff outfalls directly into Fisher's Canyon Creek. Table 1 shows the basin area, impervious value, and runoff during the 5-year and 100-year events. Refer to **Appendix D** for the Existing Conditions Drainage Map.

Please show this sub-basin on the proposed drainage map, I don't see it. If it's already on there, you can disregard this comment.

KH RESPONSE: BASINS HAVE BEEN RENAMED FOR CLARIFICATION BETWEEN EXISTING AND PROPOSED MAPS

SUMMARY - EXISTING RUNOFF TABLE					
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	WEIGHTED I (%)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
EX1	EX-1	9.63	0.00	2.67	19.64
OF1	OF-1	0.15	0.00	0.05	0.37
OF2	OF-2	0.12	0.00	0.04	0.30
OF3	OF-3	1.10	0.00	0.35	2.62
OF4	OF-4	0.82	0.00	0.26	1.96
OF5	OF-5	4.41	0.00	1.82	13.76

Table 1. Existing Runoff

PROPOSED RATIONAL SUB-BASIN DESCRIPTIONS

Sub-Basin 01 is located in the north portion of the Project. This sub-basin encompasses the proposed private extended detention basin on the Project. The basin consists of landscaping and gravel, along with infrastructure associated with facilitating drainage in the proposed private detention basin. Additional information about the sizing and design of the detention basin can be found in Appendix C. Emergency overflow for the pond will be on the west side of the pond. Flows will overtop the spill way and flow into OF-2. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 02 consists of landscaping and pavement within the clubhouse/amenity area in the north portion of the Project. Runoff developed within this sub-basin is collected by area drains and ultimately discharges into the proposed private detention basin via proposed private storm sewer infrastructure. Emergency overflow for the basin will be routed north into sub-basin 01. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 03 consists of surface parking, sidewalk, pavement, and landscaping area in the northeast portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northeast corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed northeast into sub-basin OF-1. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 04 consists of surface parking, sidewalk, pavement, and landscaping area in the north portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the northeast corner of the basin. This runoff will continue to travel and be collected in sub-basin 03 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 03. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 05 consists of surface parking, sidewalk, pavement, and landscaping area in the north portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the northwest corner of the basin. This runoff will continue to travel and be collected in sub-basin 06 and will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 06. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 06 consists of surface parking, sidewalk, pavement, and landscaping area in the northwest portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northwest corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed northeast into sub-basin OF-2. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 07 consists of landscaping area in the eastern portion of the Project. Runoff developed within this sub-basin is conveyed via a proposed private grass swale to a proposed curb cut along the north portion of the basin. This runoff will continue to travel and be collected in sub-basin 06 and will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed north into sub-basin 03. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 08 consists of surface parking, sidewalk, pavement, and landscaping area in the northeast portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northeast corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed northeast into sub-basin 03. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 09 consists of surface parking, sidewalk, pavement, and landscaping area in the north portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northwest corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed northeast into sub-basin 06. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 10 consists of surface parking, sidewalk, pavement, and landscaping area in the northwest portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northwest corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed northeast into sub-basin OF-2. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 11 consists of landscaping area in the eastern portion of the Project. Runoff developed within this sub-basin is conveyed via a proposed private grass swale to a proposed Type C inlet in sump located in the northern portion of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed northwest into sub-basin 12. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 12 consists of surface parking, sidewalk, pavement, and landscaping area in the

central portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the northeast corner of the basin. This runoff will continue to travel and be collected in sub-basin 08 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 08. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 13 consists of surface parking, sidewalk, pavement, and landscaping area in the central portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the northwest corner of the basin. This runoff will continue to travel and be collected in sub-basin 09 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 09. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 14 consists of surface parking, sidewalk, pavement, and landscaping area in the central portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northeast corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 13. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 15 consists of surface parking, sidewalk, pavement, and landscaping area in the central portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the northeast corner of the basin. This runoff will continue to travel and be collected in sub-basin 14 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 14. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 16 consists of surface parking, sidewalk, pavement, and landscaping area in the western portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the north portion of the basin. This runoff will continue to travel and be collected in sub-basin 10 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 10. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 17 consists of surface parking and pavement in the western portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the north portion corner of the basin. This runoff will continue to travel and be collected in sub-basin 14 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 14. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 18 consists of surface parking, sidewalk, pavement, and landscaping area in the northeast portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northeast corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed north into sub-basin 12. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 19 consists of landscaping area in the central portion of the Project. Runoff developed within this sub-basin is conveyed via a proposed private grass swale to a proposed Type C inlet in sump located in the eastern portion of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed east into sub-basin 18. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 20 consists of surface parking, sidewalk, pavement, and landscaping area in the western portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northeast corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 15. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 21 consists of surface parking, sidewalk, pavement, and landscaping area in the central portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the northeast corner of the basin. This runoff will continue to travel and be collected in sub-basin 18 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 18. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 22 consists of surface parking, sidewalk, pavement, and landscaping area in the central portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the southeast corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed north into sub-basin 25. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 23 consists of surface parking, sidewalk, pavement, and landscaping area in the central portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northeast corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 22. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 24 consists of surface parking, sidewalk, pavement, and landscaping area in the central portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the northeast corner of the basin. This runoff will continue to travel and be collected in sub-basin 23 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 23. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 25 consists of surface parking, sidewalk, pavement, and landscaping area in the central portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northeast corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin OF-3. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 26 consists of surface parking, sidewalk, pavement, and landscaping area in the

central portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the southeast corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 29. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 27 consists of surface parking, sidewalk, pavement, and landscaping area in the central portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the southeast corner of the basin. This runoff will continue to travel and be collected in sub-basin 26 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 26. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 28 consists of surface parking, sidewalk, pavement, and landscaping area in the central portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northeast corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed north into sub-basin 25. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 29 consists of surface parking, sidewalk, pavement, and landscaping area in the central portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northwest corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 25. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 30 consists of surface parking, sidewalk, pavement, and landscaping area in the western portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northeast corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 41. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 31 consists of landscaping area in the south portion of the Project. Runoff developed within this sub-basin is conveyed via a proposed private grass swale to a proposed Type C inlet in sump located in the northern portion of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed north into sub-basin 27. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 32 consists of surface parking, sidewalk, pavement, and landscaping area in the southwest portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the northeast corner of the basin. This runoff will continue to travel and be collected in sub-basin 30 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 30. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 33 consists of surface parking, sidewalk, pavement, and landscaping area in the south portion of the Project. Runoff developed within this sub-basin is collected by a proposed

curb cut in the northeast corner of the basin. This runoff will continue to travel and be collected in sub-basin 28 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 28. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 34 consists of surface parking, sidewalk, pavement, and landscaping area in the south portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the northwest portion of the basin. This runoff will continue to travel and be collected in sub-basin 29 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 29. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 35 consists of surface parking, sidewalk, pavement, and landscaping area in the south portion of the Project. Runoff developed within this sub-basin is collected by a proposed private Type R inlet in sump in the northeast corner of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 34. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 36 consists of surface parking, sidewalk, pavement, and landscaping area in the south portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the northeast corner of the basin. This runoff will continue to travel and be collected in sub-basin 35 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 35. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 37 consists of surface parking, sidewalk, pavement, and landscaping area in the southwest portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the northeast corner of the basin. This runoff will continue to travel through sub-basin 36 and will be collected in sub-basin 35 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 36. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 38 consists of landscaping and pavement within the dog park area in the south portion of the Project. Runoff developed within this sub-basin is collected by a Type C inlet and ultimately discharges into the proposed private detention basin via proposed private storm sewer infrastructure. Emergency overflow for the basin will be routed south into sub-basin 39. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 39 consists of landscaping area in the south portion of the Project. Runoff developed within this sub-basin is conveyed via a proposed private grass swale to a proposed Type C inlet in sump located in the northern portion of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed south offsite. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 40 consists of landscaping area in the north portion of the Project. Runoff developed

within this sub-basin is conveyed via a proposed private grass swale to a proposed Type C inlet in sump located in the northern portion of the basin. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed north into sub-basin 06. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin 41 consists of surface parking, sidewalk, pavement, and landscaping area in the west portion of the Project. Runoff developed within this sub-basin is collected by a proposed curb cut in the southeast corner of the basin. This runoff will continue to travel through sub-basin 27 and finally be collected in sub-basin 26 where it will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Emergency overflow for the basin will be routed around the landscape island into sub-basin 27. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin OF-1 consists of an onsite basin with surface parking, sidewalk, pavement, and landscaping area in the northeast portion of the Project. Drainage flows offsite and is collected in an existing inlet in Venetucci Blvd. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin OF-2 consists of an onsite basin with landscaping area in the west portion of the Project. Drainage flows offsite and is collected in the existing Fisher's Canyon Creek. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin OF-3 consists of an onsite basin with surface parking, sidewalk, pavement, and landscaping area in the east portion of the Project. Drainage flows offsite and is collected in an existing inlet in Venetucci Blvd. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin OF-4 consists of an onsite basin with landscaping area in the southeast portion of the Project. Drainage flows offsite and is collected in an existing inlet in Venetucci Blvd. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin RW-1 consists of an offsite basin to the northeast portion of the site with landscaping and sidewalk. Drainage flows offsite and is collected in an existing inlet in Venetucci Blvd. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basin RW-2 consists of an offsite basin to the east portion of the site with pavement and sidewalk. Drainage flows offsite and is collected in an existing inlet in Venetucci Blvd. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basins R1 to R12 consist of the building roof areas. Runoff from these basins will be routed to Type R inlets or manholes and collected. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

Sub-Basins G1 to G9 consist of the garage roof areas. Runoff from these basins will be routed to Type R inlets and manholes or outlet at grade to be collected. This runoff will ultimately discharge to a proposed private detention basin via proposed private storm sewer. Table 2 shows the basin area, impervious value, and runoff during the 5-year and 100-year events.

SUMMARY - PROPOSED RUNOFF TABLE					
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	WEIGHTED I (%)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
ONSITE BASINS					
01	01	1.90	5%	1.12	6.13
02	02	0.23	80%	0.75	1.43
03	03	0.30	73%	1.27	2.97
04	04	0.07	80%	0.28	0.53
05	05	0.03	89%	0.13	0.25
06	06	0.34	79%	1.41	2.70
07	07	0.25	1%	0.10	1.39
08	08	0.19	79%	1.52	2.89
09	09	0.14	84%	1.47	2.75
10	10	0.31	85%	1.98	3.65
11	11	0.37	1%	0.13	1.09
12	12	0.21	82%	0.81	1.54
13	13	0.23	89%	0.92	1.71
14	14	0.26	79%	1.55	2.95
15	15	0.15	86%	0.59	1.10
16	16	0.13	98%	0.80	1.44
17	17	0.04	100%	0.20	0.35
18	18	0.34	76%	1.58	1.80
19	19	0.28	0%	0.96	1.35
20	20	0.29	84%	1.14	2.15
21	21	0.11	86%	0.46	0.86
22	22	0.11	76%	0.41	0.79
23	23	0.18	80%	1.59	3.01
24	24	0.25	84%	0.99	1.87
25	25	0.27	74%	0.96	1.89
26	26	0.10	78%	1.31	2.51
27	27	0.16	82%	0.94	1.81
28	28	0.20	82%	1.55	2.91
29	29	0.22	78%	1.82	3.49
30	30	0.21	81%	1.62	3.05
31	31	0.30	0%	0.87	1.28
32	32	0.20	86%	0.80	1.50
33	33	0.21	87%	0.81	1.52

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34	34	0.29	80%	1.06	2.02
35	35	0.17	71%	1.79	3.45
36	36	0.21	85%	1.19	2.27
37	37	0.10	75%	0.37	0.72
38	38	0.23	37%	0.35	0.90
39	39	0.14	0%	0.67	0.93
40	40	0.21	0%	0.79	1.12
41	41	0.10	72%	0.33	0.66
R1-A	R1-A	0.12	90%	0.44	0.82
R1-B	R1-B	0.12	90%	0.44	0.82
R2-A	R2-A	0.13	90%	0.51	0.95
R2-B	R2-B	0.13	90%	0.51	0.95
R3-A	R3-A	0.16	90%	0.61	1.13
R3-B	R3-B	0.16	90%	0.61	1.13
R4-A	R4-A	0.15	90%	0.58	1.08
R4-B	R4-B	0.15	90%	0.58	1.08
R5-A	R5-A	0.16	90%	0.61	1.13
R5-B	R5-B	0.16	90%	0.61	1.13
R6-A	R6-A	0.15	90%	0.58	1.08
R6-B	R6-B	0.15	90%	0.58	1.08
R7-A	R7-A	0.13	90%	0.51	0.95
R7-B	R7-B	0.13	90%	0.51	0.95
R8-A	R8-A	0.13	90%	0.51	0.95
R8-B	R8-B	0.13	90%	0.51	0.95
R9-A	R9-A	0.12	90%	0.44	0.82
R9-B	R9-B	0.12	90%	0.44	0.82
R10-A	R10-A	0.16	90%	0.61	1.13
R10-B	R10-B	0.16	90%	0.61	1.13
R11	R11	0.12	90%	0.45	0.84
R12	R12	0.07	90%	0.28	0.52
G1	G1	0.04	90%	0.17	0.31
G2-A	G2-A	0.04	90%	0.17	0.31
G2-B	G2-B	0.04	90%	0.17	0.31
G3-A	G3-A	0.04	90%	0.17	0.31
G3-B	G3-B	0.04	90%	0.17	0.31
G4-A	G4-A	0.04	90%	0.17	0.31
G4-B	G4-B	0.04	90%	0.17	0.31
G5-A	G5-A	0.05	90%	0.17	0.32
G5-B	G5-B	0.05	90%	0.17	0.32
G6-A	G6-A	0.04	90%	0.17	0.31

G6-B	G6-B	0.04	90%	0.17	0.31
G7-A	G7-A	0.04	90%	0.17	0.31
G7-B	G7-B	0.04	90%	0.17	0.31
G8	G8	0.04	90%	0.17	0.31
G9	G9	0.03	90%	0.13	0.23
OF-1	OF-1	0.16	17%	0.15	0.51
OF-2	OF-2	1.62	5%	0.74	4.17
OF-3	OF-3	0.21	12%	0.19	0.76
OF-4	OF-4	0.52	9%	0.41	1.76
RW-1	RW-1	0.16	31%	0.28	0.75
RW-2	RW-2	0.03	14%	0.06	0.37

Table 2. Proposed Runoff

DRAINAGE DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

The proposed storm facilities are designed to be in compliance with the City of Colorado Springs and El Paso County “Drainage Criteria Manual (DCM)” (Current Adopted Version) (“the MANUAL”), El Paso County “Engineering Criteria Manual” (“the Engineering Manual”), Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014 (“the Colorado Springs MANUAL”).

HYDROLOGIC CRITERIA

The 5-year and 100-year design storm events were used in determining rainfall and runoff for the existing and proposed drainage analysis per the MANUAL. The IDF equations from the DCM were used for the Rational Calculations. Refer to **Appendix B** for the hydrologic methods and calculations for the site.

Calculations for the runoff coefficients and percent impervious are included in the **Appendix B**. Rational method was used to determine the peak flows for the project. These flows were used to determine the size of the proposed curb cuts, inlets, and storm drain system.

The proposed impervious values in Table 6-6 of the DCM were utilized in this report for the final design. Refer to **Appendix B** of this report for Table 6-6.

The Site is proposing a private extended detention basin to maintain the historic drainage release rates with the increased impervious surface being proposed with the development. NOAA 1-hour rainfall values were used per the Colorado Springs Manual and input into the UD-Detention Spreadsheet in the Optional User Overrides. There are no additional provisions selected or deviations from the criteria in both the MANUAL and Colorado Springs MANUAL.

HYDRAULIC CRITERIA

Applicable design methods were utilized to size the proposed pond, which includes the use of the UD-Detention spreadsheet, UD-Inlet spreadsheet, rational calculations spreadsheet, StormCAD, and FlowMaster.

Proposed drainage features on-site have been analyzed and sized for the following design storm events:

- Major Storm: 100-year Storm Event

please identify who will own and maintain the pond and the private storm sewer system.

Hydraulic calculations for detention volume were computed using the High Flood District spreadsheets. Proposed underground storm sewer with the outfall set based on the tailwater condition elevation in the private full spectrum extended detention basin. The pond outlet pipe will be sized based on the proposed basin flows at the pond as shown in the StormCAD analysis provided in **Appendix C**. Headloss coefficients for the StormCAD model were based on the values provided in the StormCAD criteria.

KH RESPONSE: INFO ADDED TO REPORT

Inlet sizing, outlet structure, forebay sizing, riprap sizing, trickle channel and concrete channel capacity, and StormCAD inputs/outputs along with all other necessary calculations are provided in **Appendix C** of this report.

THE FOUR STEP PROCESS

The Project was designed in accordance with the four-step process to minimize adverse impacts of urbanization, as outlined in the County's "Four-Step Process" for selecting structural BMPs (ECM Section I.7.2 BMP Selection).

Step 1. Employ Runoff Reduction Practices- The project is proposing a multifamily development that will be designed to minimize the impact to the current existing terrain. The Site's proposed paved roadways will increase the Site's impervious area; however, a full detention pond will be used to capture stormwater and maintain flows discharging off site at or below historic levels. Landscape drainage swales are proposed around the site to reduce runoff by disconnecting some roof impervious areas.

Step 2. Stabilize Drainageways- Stabilizing proposed drainage paths with landscape or riprap will slow flow rates and is anticipated to reduce erosion. Swales will be constructed to increase the time of concentration of runoff entering the pond.

Step 3. Provide Water Quality Capture Volume (WQCV) – A permanent water quality measures and detention facility will be provided with the Project. More specifically, this project proposes the construction of an Extended Detention Basin to provide for the required water quality capture volume.

Step 4. Consider Need for Industrial and Commercial BMPs – The proposed project is proposing a multifamily development; therefore, covering of storage/handling areas and spill containment and control will not need to be provided.

DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

The proposed drainage patterns will match the historic patterns where possible. To maintain historic flows, a detention pond is being proposed and will capture and control the flows from the proposed development to release as historic levels even with the increase in imperviousness.

Provided in the **Appendix B** are hydrologic calculations utilizing the Rational method for the existing and proposed conditions. Provided in **Appendix C** are details for the proposed conditions, Flow master details, and cross section details for the proposed features. As previously mentioned, the existing drainage map can be found in **Appendix D**.

KH RESPONSE: SECTION HAS BEEN UPDATED

clarify that you wish to apply the aforementioned exclusion to these sub-basins and state the area of each.

MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4)

The Site will handle post construction stormwater by meeting the water quality capture volume design standard from the MS4. Sub-basins 01-41, R1-R12, and G1-G9 will be captured onsite and directed to the onsite extended detention basin to treat the WQCV. The design standard allows for up to 20 percent (not to exceed 1 acre) to be excluded from the capture area when not practicable to capture runoff. Sub-basins RW-1 and RW-2 are located at the access points to the Site. This runoff will flow offsite and be collected in two different inlets located in the ROW. These basins are excluded as they total under 1 acre and meet the exclusion from needing water quality per ECM Appendix I.7.1.C.1.

Basins OF-1 to OF-4 are proposed to be excluded land disturbances as they contain land disturbance to undeveloped land that will remain undeveloped. These sub-basins are excluded as they will remain undeveloped land with the proposed Site in accordance with ECM Appendix I.7.1.B.7. The basins will be stabilized after construction and are primarily made up of Type A hydrologic soil group which has low runoff potential due to high infiltration rates.

per the narrative above, OF-1 has pavement, sidewalk, parking, landscaping etc. Revise accordingly.

SPECIFIC DETAILS

Sub-basins 01 through 41 consist of landscaping, pavement/sidewalks, gravel and the detention pond. Sub-basins R1 through R12 consist of residential lots, streets, and garages. All basins have flows to the detention pond. The detention pond is located on the northwest corner of the Site to the north and east side of the Site. On site flows enter the detention pond which then discharges into a proposed 18-inch storm drain pipe at the southwest corner of the site.

KH RESPONSE: ACKNOWLEDGED, BASIN OF-1 HAS BEEN REMOVED FROM THIS EXCLUSION.

KH RESPONSE: UPDATED

northwest

Overall, the Site is reducing onsite runoff flows during the 100-year storm from 38.66 cfs to 14.05 cfs for existing to proposed conditions respectively (includes pond discharge and Basins OF-1, OF-2, OF-3, OF-4 and OF-5 which drain directly offsite). This is a 24.61 cfs reduction in onsite runoff flows and will provide stormwater flood protection for the properties located downstream of the Site. This reduction in flow will also allow portions of the Site to maintain historical drainage patterns, by allowing un-detained runoff from Sub-basins OF-1, OF-2, OF-3, OF-4, and OF-5. Refer to **Table 3** for offsite flow details for the proposed conditions.

see my comments on PDF pg 5 above.

KH RESPONSE: BASINS HAVE BEEN RENAMED FOR CLARIFICATION BETWEEN EXISTING AND PROPOSED MAPS

The hydrologic calculations, hydraulic calculations, and Drainage Maps are included in the **Appendix B, Appendix C, and Appendix D** of this report for reference.

The Site will disturb more than 1 acre and will require a Colorado Discharge Fee (CDPS) General Permit for Stormwater Discharge Associated with Construction Activities from the Colorado Department of Public Health and Environment (CDPHE).

KH RESPONSE: UPDATED

Please update to the 2024 fee schedule

The required fees for the Fisher's Canyon Drainage Basin based upon the 2023 fee schedule, are listed below. Fees will be paid prior to plat recordation.

- $\text{Drainage Fee/Impervious Acre} = \$23,078 \times 8.66 \text{ acres} = \$199,855.48$
Total = \$199,855.48

Summary of Flows Offsite					
Existing Condition					
Sub-Basin Designation	Design Points Contributing	Area (Acres)	Location Leaving Site	5-Year Runoff (CFS)	100-Year Runoff (CFS)
EX-1	EX1	9.63	Fisher's Canyon Creek	2.67	19.64
OF-1	OF1	0.15	SW Corner of Site	0.05	0.37
OF-2	OF2	0.12	SE Corner of Site	0.04	0.30
OF-3	OF3	1.10	Venetucci Blvd	0.35	2.62
OF-4	OF4	0.82	Venetucci Blvd	0.26	1.96
OF-5	OF5	4.41	Fisher's Canyon Creek	1.82	13.76
Total				5.19	38.66
Proposed Condition					
Sub-Basin Designation	Design Points Contributing	Area (Acres)	Location Leaving Site	5-Year Runoff (CFS)	100-Year Runoff (CFS)
Pond Outfall	(01-41, R1-R12, and G1-G9)	13.71	Fisher's Canyon Creek	0.22	6.85
OF-1	OF1	0.16	Venetucci Blvd	0.15	0.51
OF-2	OF2	1.62	Fisher's Canyon Creek	0.74	4.17
OF-3	OF3	0.21	Venetucci Blvd	0.19	0.76
OF-4	OF4	0.52	Venetucci Blvd	0.41	1.76
Total				1.70	14.05

Table 3. Offsite Comparison
why no OF-5 in the proposed condition?

SUMMARY

The mini... cont... proposed detention basin before out falling to an existing El Paso County Canyon Creek. The drainage design presented within this report conforms presented in both the MANUAL and the Colorado Springs MANUAL. Addi runoff and storm drain facilities will not adversely affect the downstream a developments, including Fisher's Canyon Creek.

KH RESPONSE: BASINS HAVE BEEN RENAMED FOR CLARIFICATION BETWEEN EXISTING AND PROPOSED MAPS

total flows summary should be separated into flows going to the west into fishers canyon and the east to venetucci to provide an accurate comparison between the ultimate outfalls. Revise the narrative above accordingly.

KH RESPONSE: FLOW SUMMARY SEPARATED AS REQUESTED

REFERENCES

1. City of Colorado Springs “Drainage Criteria Manual (DCM) Volume 1”, dated May, 2014, Revised January 2021.
2. El Paso County “Drainage Criteria Manual”, dated October 31, 2018
3. El Paso County “Engineering Criteria Manual” Supplement 2, dated October, 14, 2024
4. Chapter 6 and Section 3.2.1. of Chapter 13-City of Colorado Springs Drainage Criteria Manual, May 2014.
5. Mile High Flood District, Urban Storm Drainage Criteria Manual (UDFCDCM), Vol. 1, Partially Updated March 2024, Originally Published September 1969.
6. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 08041C0743G, Effective Date December 7, 2018, prepared by the Federal Emergency Management Agency (FEMA).

Include a cost estimate for each PBMP with line items for all components (ex: riprap, road base, forebay, trickle channel, outlet structure, outlet pipe, spillway, etc). Input the total value into the FAE form under “Permanent Pond/BMP (provide engineer’s estimate)” in Section 1. The total should not include grading, which is a separate line item in Section 1: “Earthwork.” The cost estimate should include labor costs (as a separate line item or added into the cost of each component).

**KH RESPONSE: POND/BMP ENGINEER'S
OPINION OF PROBABLE COST INCLUDED
AS APPENDIX E IN REPORT**

APPENDIX

APPENDIX A: VICINITY MAP, NRCS WEB SOIL SURVEY, AND FEMA FIRMETTE



VICINITY MAP

GRAPHIC SCALE IN FEET
0 1000 2000 4000





United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

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

Custom Soil Resource Report for **El Paso County Area, Colorado**



Preface

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

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

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

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

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

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

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How Soil Surveys Are Made

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

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

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

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

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

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

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

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

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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

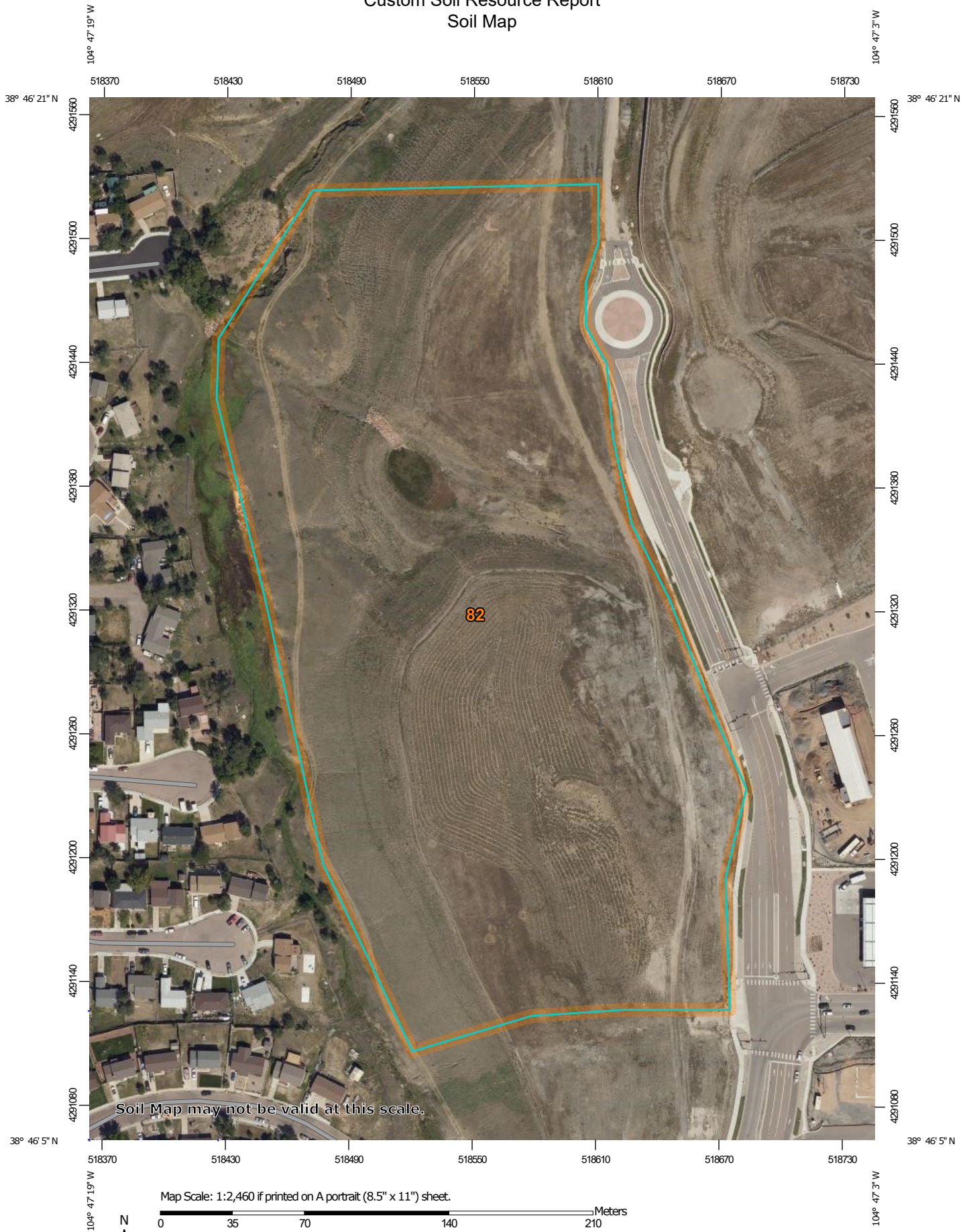
Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 21, Aug 24, 2023

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
82	Schamber-Razor complex, 8 to 50 percent slopes	18.7	100.0%
Totals for Area of Interest		18.7	100.0%

Map Unit Descriptions

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

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

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

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

Custom Soil Resource Report

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

82—Schamber-Razor complex, 8 to 50 percent slopes

Map Unit Setting

National map unit symbol: 369y
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Schamber and similar soils: 55 percent
Razor and similar soils: 43 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Schamber

Setting

Landform: Breaks
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite and/or colluvium derived from granite and/or eolian deposits derived from granite

Typical profile

A - 0 to 5 inches: gravelly loam
AC - 5 to 15 inches: very gravelly loam
C - 15 to 60 inches: very gravelly sand

Properties and qualities

Slope: 8 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R069XY064CO - Gravel Breaks
Hydric soil rating: No

Description of Razor

Setting

Landform: Breaks

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Clayey slope alluvium over residuum weathered from shale

Typical profile

A - 0 to 3 inches: clay loam

Bw - 3 to 9 inches: clay loam

Bk - 9 to 31 inches: clay

Cr - 31 to 35 inches: weathered bedrock

Properties and qualities

Slope: 8 to 15 percent

Depth to restrictive feature: 20 to 40 inches to paralithic bedrock

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 15 percent

Gypsum, maximum content: 5 percent

Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)

Sodium adsorption ratio, maximum: 15.0

Available water supply, 0 to 60 inches: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): 6e

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: D

Ecological site: R069XY047CO - Alkaline Plains

Other vegetative classification: ALKALINE PLAINS (069AY047CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent

Landform: Depressions

Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

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

Soil Qualities and Features

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

Hydrologic Soil Group

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

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

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

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

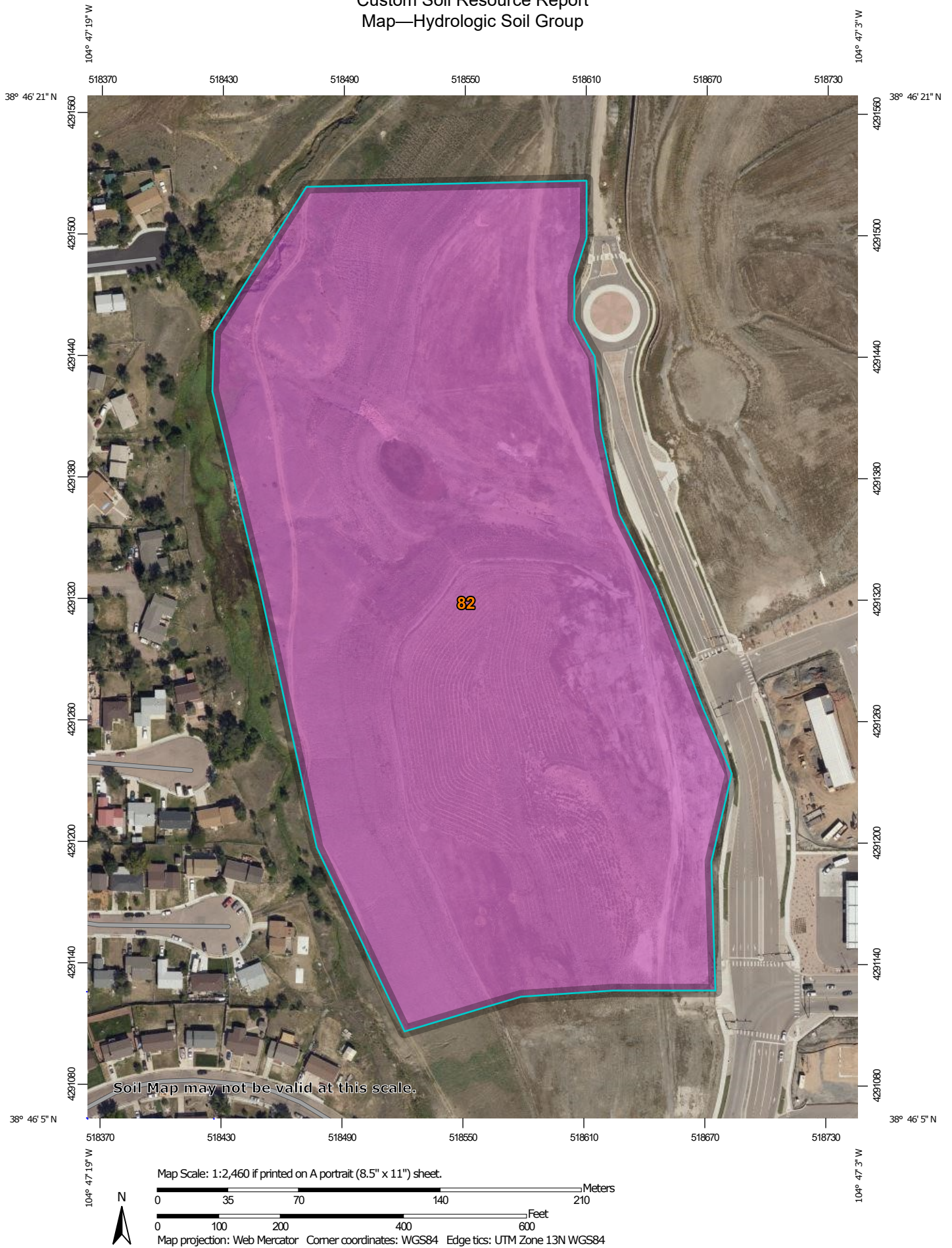
Custom Soil Resource Report

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.

Custom Soil Resource Report Map—Hydrologic Soil Group



Custom Soil Resource Report

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 21, Aug 24, 2023

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

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

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
82	Schamber-Razor complex, 8 to 50 percent slopes	A	18.7	100.0%
Totals for Area of Interest			18.7	100.0%

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

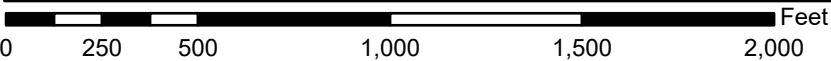
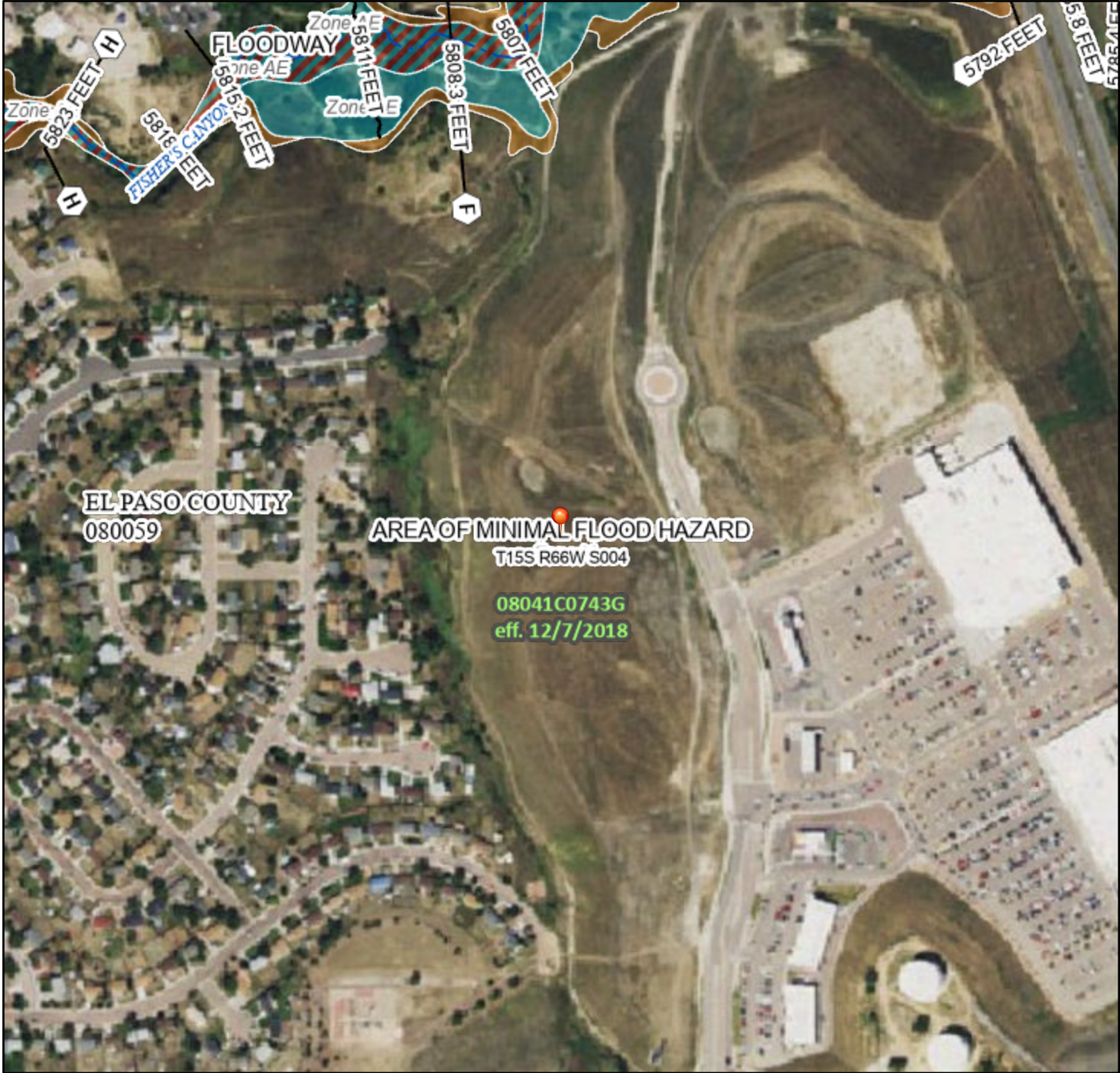
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National Flood Hazard Layer FIRMMette



104°47'30"W 38°46'28"N



1:6,000

104°46'53"W 38°46'N

Basemap Imagery Source: USGS National Map 2023

Legend

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
MAP PANELS		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Digital Data Available
		No Digital Data Available
		Unmapped



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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **10/16/2024 at 7:35 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

APPENDIX B: HYDROLOGY

IDF Equations

$$I_{100} = -2.52 \ln(D) + 12.735$$

$$I_{50} = -2.25 \ln(D) + 11.375$$

$$I_{25} = -2.00 \ln(D) + 10.111$$

$$I_{10} = -1.75 \ln(D) + 8.847$$

$$I_5 = -1.50 \ln(D) + 7.583$$

$$I_2 = -1.19 \ln(D) + 6.035$$

Note: Values calculated by
 equations may not precisely
 duplicate values read from figure.

Time Intensity Frequency Tabulation

TIME	2 YR	5 YR	10 YR	100 YR
5	4.12	5.17	6.03	8.66
10	3.29	4.13	4.82	6.91
15	2.81	3.52	4.11	5.88
30	1.99	2.48	2.89	4.13
60	1.16	1.44	1.68	2.38
120	0.34	0.40	0.47	0.62

Weighted Imperviousness Calculations - Existing Conditions

SUB-BASIN	AREA (SF)	AREA (Acres)	ROOF AREA	ROOF IMPERVIOUSNESS	ROOF				LANDSCAPE AREA (Acres)	LANDSCAPE IMPERVIOUSNESS	LANDSCAPE				PAVEMENT AREA (Acres)	PAVEMENT IMPERVIOUSNESS	PAVEMENT				WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS			
					C2	C5	C10	C100			C2	C5	C10	C100			C2	C5	C10	C100		C2	C5	C10	C100
EX-1	419,389	9.63	0	90%	0.71	0.73	0.75	0.81	9.63	0%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	0%	0.02	0.08	0.15	0.35
ONSITE FLOWING OFFSITE																									
OF-1	6,608	0.15	0	90%	0.71	0.73	0.75	0.81	0.15	0%	0.02	0.08	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0%	0.02	0.08	0.15	0.36
OF-2	5,420	0.12	0	90%	0.71	0.73	0.75	0.81	0.12	0%	0.02	0.08	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0%	0.02	0.08	0.15	0.36
OF-3	48,078	1.10	0	90%	0.71	0.73	0.75	0.81	1.10	0%	0.02	0.08	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0%	0.02	0.08	0.15	0.36
OF-4	35,561	0.82	0	90%	0.71	0.73	0.75	0.81	0.82	0%	0.02	0.08	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0%	0.02	0.08	0.15	0.36
OF-5	191,893	4.41	0	90%	0.71	0.73	0.75	0.81	4.41	0%	0.02	0.08	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0%	0.02	0.08	0.15	0.36
TOTAL	706,949	16.23	0.00	90%	0.71	0.73	0.75	0.81	16.23	0%	0.02	0.08	0.15	0.36	0	100%	0.89	0.90	0.92	0.96	0%	0.02	0.08	0.15	0.36

Venture on Venetucci Multi-Family Development
Final Drainage Report
El Paso County, CO

11/12/2024
Calculated by: CRA

Venture on Venetucci - Final Drainage Report Existing Runoff Calculations Time of Concentration Watercourse Coefficient Heavy Meadow 2.50 Short Pasture & Lawns 7.00 Grassed Waterway 15.00 Tillage/Field 5.00 Nearly Bare Ground 10.00 Paved Area & Paved Swales 20.00																
DESIGN POINT	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)				T(t) min.	T(c) CHECK (URBANIZED BASINS)			FINAL T(c) min.
	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps		COMP. T(c)	TOTAL LENGTH	L/180+10	
EX1	EX-1	419,389	9.63	0.08	300	5.8%	18.1	682	4.0%	7.00	1.4	8.1	26.2	982	15.5	15.5
OF1	OF-1	6608.22	0.15	0.08	135	3.0%	15.0					0.0	15.0	135	10.8	10.8
OF2	OF-2	5420.3	0.12	0.08	170	4.0%	15.3					0.0	15.3	170	10.9	10.9
OF3	OF-3	48077.83	1.10	0.08	255	5.5%	16.9					0.0	16.9	255	11.4	11.4
OF4	OF-4	35560.78	0.82	0.08	195	2.4%	19.5					0.0	19.5	195	11.1	11.1
OF5	OF-5	191892.6	4.41	0.08	250	24.0%	10.2					0.0	10.2	250	11.4	5.0

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L_i}}{S_o^{0.33}} \quad t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t} \quad t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Venture on Venetucci Multi-Family Development
Final Drainage Report
El Paso County, CO

11/12/2024
Calculated by: CRA

Venture on Venetucci - Final Drainage Report Existing Runoff Calculations (Rational Method Procedure) Design Storm 5 Year												
BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
EX1	EX-1	9.63	0.08	15.5	0.77	3.47	2.67				2.67	
OF1	OF-1	0.15	0.08	10.8	0.01	4.01	0.05				0.05	
OF2	OF-2	0.12	0.08	10.9	0.01	4.00	0.04				0.04	
OF3	OF-3	1.10	0.08	11.4	0.09	3.93	0.35				0.35	
OF4	OF-4	0.82	0.08	11.1	0.07	3.97	0.26				0.26	
OF5	OF-5	4.41	0.08	5.0	0.35	5.17	1.82				1.82	

Venture on Venetucci - Final Drainage Report												
Existing Runoff Calculations												
Design Storm 100 Year												
(Rational Method Procedure)												
BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
EX1	EX-1	9.63	0.35	15.5	3.37	5.83	19.64				19.64	
OF1	OF-1	0.15	0.36	10.8	0.05	6.74	0.37				0.37	
OF2	OF-2	0.12	0.36	10.9	0.04	6.72	0.30				0.30	
OF3	OF-3	1.10	0.36	11.4	0.40	6.60	2.62				2.62	
OF4	OF-4	0.82	0.36	11.1	0.29	6.67	1.96				1.96	
OF5	OF-5	4.41	0.36	5.0	1.59	8.68	13.76				13.76	

SUMMARY - EXISTING RUNOFF TABLE					
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	WEIGHTED I (%)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100- YR RUNOFF (CFS)
EX1	EX-1	9.63	0.00	2.67	19.64
OF1	OF-1	0.15	0.00	0.05	0.37
OF2	OF-2	0.12	0.00	0.04	0.30
OF3	OF-3	1.10	0.00	0.35	2.62
OF4	OF-4	0.82	0.00	0.26	1.96
OF5	OF-5	4.41	0.00	1.82	13.76

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

1

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

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IDF Equations

$$I_{100} = -2.52 \ln(D) + 12.735$$

$$I_{50} = -2.25 \ln(D) + 11.375$$

$$I_{25} = -2.00 \ln(D) + 10.111$$

$$I_{10} = -1.75 \ln(D) + 8.847$$

$$I_5 = -1.50 \ln(D) + 7.583$$

$$I_2 = -1.19 \ln(D) + 6.035$$

Note: Values calculated by
equations may not precisely
duplicate values read from figure.

Time Intensity Frequency Tabulation

TIME	2 YR	5 YR	10 YR	100 YR
5	4.12	5.17	6.03	8.66
10	3.29	4.13	4.82	6.91
15	2.81	3.52	4.11	5.88
30	1.99	2.48	2.89	4.13
60	1.16	1.44	1.68	2.38
120	0.34	0.40	0.47	0.62

Weighted Imperviousness Calculations

SUB-BASIN	AREA	AREA	ROOF	ROOF	ROOF				GRAVEL	GRAVEL	GRAVEL				LANDSCAPE	LANDSCAPE	LANDSCAPE				PAVEMENT	PAVEMENT	PAVEMENT				WEIGHTED	WEIGHTED COEFFICIENTS			
	(SF)	(AC)	AREA (AC)	IMPERVIOUSNESS	C2	C5	C10	C100	AREA (AC)	IMPERVIOUSNESS	C2	C5	C10	C100	AREA (AC)	IMPERVIOUSNESS	C2	C5	C10	C100	AREA (AC)	IMPERVIOUSNESS	C2	C5	C10	C100	IMPERVIOUSNESS	C2	C5	C10	C100
01	82554.44	1.895	0.00	90%	0.71	0.73	0.75	0.81	0.08	80%	0.57	0.59	0.63	0.70	1.78	0%	0.02	0.08	0.15	0.35	0.03	100%	0.89	0.90	0.92	0.96	5%	0.06	0.12	0.18	0.38
02	9830.71	0.226	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.05	0%	0.02	0.08	0.15	0.35	0.18	100%	0.89	0.90	0.92	0.96	80%	0.72	0.74	0.77	0.84
03	13082.50	0.300	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.08	0%	0.02	0.08	0.15	0.35	0.22	100%	0.89	0.90	0.92	0.96	73%	0.66	0.68	0.72	0.80
04	3184.87	0.073	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.01	0%	0.02	0.08	0.15	0.35	0.06	100%	0.89	0.90	0.92	0.96	80%	0.71	0.73	0.76	0.84
05	1391.86	0.032	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.00	0%	0.02	0.08	0.15	0.35	0.03	100%	0.89	0.90	0.92	0.96	89%	0.79	0.81	0.83	0.89
06	14724.32	0.338	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.07	0%	0.02	0.08	0.15	0.35	0.27	100%	0.89	0.90	0.92	0.96	79%	0.71	0.73	0.76	0.83
07	10903.25	0.250	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.25	0%	0.02	0.08	0.15	0.35	0.00	100%	0.89	0.90	0.92	0.96	1%	0.03	0.09	0.16	0.35
08	8076.80	0.185	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.04	0%	0.02	0.08	0.15	0.35	0.15	100%	0.89	0.90	0.92	0.96	79%	0.71	0.73	0.76	0.83
09	6260.32	0.144	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.02	0%	0.02	0.08	0.15	0.35	0.12	100%	0.89	0.90	0.92	0.96	84%	0.75	0.77	0.80	0.86
10	13472.93	0.309	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.05	0%	0.02	0.08	0.15	0.35	0.26	100%	0.89	0.90	0.92	0.96	85%	0.76	0.78	0.81	0.87
11	15900.76	0.365	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.36	0%	0.02	0.08	0.15	0.35	0.00	100%	0.89	0.90	0.92	0.96	1%	0.02	0.08	0.15	0.35
12	9093.58	0.209	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.04	0%	0.02	0.08	0.15	0.35	0.17	100%	0.89	0.90	0.92	0.96	82%	0.74	0.75	0.78	0.85
13	9999.48	0.230	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.03	0%	0.02	0.08	0.15	0.35	0.20	100%	0.89	0.90	0.92	0.96	89%	0.79	0.81	0.83	0.89
14	11215.56	0.257	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.06	0%	0.02	0.08	0.15	0.35	0.20	100%	0.89	0.90	0.92	0.96	79%	0.70	0.72	0.75	0.83
15	6328.38	0.145	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.02	0%	0.02	0.08	0.15	0.35	0.12	100%	0.89	0.90	0.92	0.96	86%	0.77	0.78	0.81	0.87
16	5769.99	0.132	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.00	0%	0.02	0.08	0.15	0.35	0.13	100%	0.89	0.90	0.92	0.96	98%	0.87	0.88	0.90	0.95
17	1846.41	0.042	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.00	0%	0.02	0.08	0.15	0.35	0.04	100%	0.89	0.90	0.92	0.96	100%	0.89	0.90	0.92	0.96
18	14621.66	0.336	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.08	0%	0.02	0.08	0.15	0.35	0.25	100%	0.89	0.90	0.92	0.96	76%	0.68	0.70	0.73	0.81
19	12107.43	0.278	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.28	0%	0.02	0.08	0.15	0.35	0.00	100%	0.89	0.90	0.92	0.96	0%	0.02	0.08	0.15	0.35
20	12501.18	0.287	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.05	0%	0.02	0.08	0.15	0.35	0.24	100%	0.89	0.90	0.92	0.96	84%	0.75	0.77	0.80	0.86
21	4925.14	0.113	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.02	0%	0.02	0.08	0.15	0.35	0.10	100%	0.89	0.90	0.92	0.96	86%	0.77	0.79	0.81	0.88
22	4865.98	0.112	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.03	0%	0.02	0.08	0.15	0.35	0.08	100%	0.89	0.90	0.92	0.96	76%	0.68	0.70	0.74	0.81
23	7686.10	0.176	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.03	0%	0.02	0.08	0.15	0.35	0.14	100%	0.89	0.90	0.92	0.96	80%	0.72	0.74	0.77	0.84
24	10901.02	0.250	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.04	0%	0.02	0.08	0.15	0.35	0.21	100%	0.89	0.90	0.92	0.96	84%	0.75	0.77	0.79	0.86
25	11868.69	0.272	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.07	0%	0.02	0.08	0.15	0.35	0.20	100%	0.89	0.90	0.92	0.96	74%	0.66	0.68	0.72	0.80
26	4355.60	0.100	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.02	0%	0.02	0.08	0.15	0.35	0.08	100%	0.89	0.90	0.92	0.96	78%	0.70	0.72	0.75	0.83
27	6964.98	0.160	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.03	0%	0.02	0.08	0.15	0.35	0.13	100%	0.89	0.90	0.92	0.96	82%	0.74	0.76	0.78	0.85
28	8818.61	0.202	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.04	0%	0.02	0.08	0.15	0.35	0.17	100%	0.89	0.90	0.92	0.96	82%	0.73	0.75	0.78	0.85
29	9524.15	0.219	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.05	0%	0.02	0.08	0.15	0.35	0.17	100%	0.89	0.90	0.92	0.96	78%	0.70	0.72	0.75	0.83
30	9202.82	0.211	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.04	0%	0.02	0.08	0.15	0.35	0.17	100%	0.89	0.90	0.92	0.96	81%	0.73	0.75	0.78	0.85
31	13152.14	0.302	0.00	90%	0.71	0.73	0.75	0.81	0.00	80%	0.57	0.59	0.63	0.70	0.30	0%	0.02	0.08	0.15	0.35	0.00	100%	0.89	0.90	0						

[illegible]

Venture on Venetucci
Multi-Family Development
Final Drainage Report
El Paso County, CO

11/12/2024
Calculated by: CRA

Venture on Venetucci - Final Drainage Report																
Watercourse Coefficient																
Proposed Runoff Calculations					Heavy Meadow		2.50	Short Pasture & Lawns		7.00	Grassed Waterway		15.00			
Time of Concentration					Tillage/Field		5.00	Nearly Bare Ground		10.00	Paved Area & Paved Swales		20.00			
DESIGN POINT	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)				T(c) CHECK (URBANIZED BASINS)				FINAL T(c) min.
	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	
01	01	82,554	1.90	0.12	77	30.8%	5.1	0	0.0%	7.0	0.0	0.0	5.1	77	10.4	5.1
02	02	9,831	0.23	0.74	99	0.6%	7.8	0	0.0%	20.0	0.0	0.0	7.8	99	10.5	7.8
03	03	13,083	0.30	0.68	121	1.8%	6.9	48	2.3%	20.0	3.0	0.3	7.2	169	10.9	7.2
04	04	3,185	0.07	0.73	49	2.0%	3.8	44	1.8%	20.0	2.7	0.3	5.0	94	10.5	5.0
05	05	1,392	0.03	0.81	52	2.0%	3.1	6	2.0%	20.0	2.8	0.0	5.0	58	10.3	5.0
06	06	14,724	0.34	0.73	2	2.7%	0.7	94	2.0%	20.0	2.8	0.6	5.0	96	10.5	5.0
07	07	10,903	0.25	0.09	24	6.1%	4.9	243	1.0%	15.0	1.5	2.7	7.6	266	11.5	7.6
08	08	8,077	0.19	0.73	83	3.1%	4.2	71	1.5%	20.0	2.4	0.5	5.0	154	10.9	5.0
09	09	6,260	0.14	0.77	57	3.3%	3.1	91	1.3%	20.0	2.3	0.7	5.0	148	10.8	5.0
10	10	13,473	0.31	0.78	201	3.8%	5.3	68	3.3%	20.0	3.6	0.3	5.6	269	11.5	5.6
11	11	15,901	0.37	0.08	23	3.5%	5.9	317	0.9%	15.0	1.4	3.7	9.6	341	11.9	9.6
12	12	9,094	0.21	0.75	72	3.6%	3.5	111	2.4%	20.0	3.1	0.6	5.0	183	11.0	5.0
13	13	9,999	0.23	0.81	125	1.6%	5.2	89	2.3%	20.0	3.1	0.5	5.7	213	11.2	5.7
14	14	11,216	0.26	0.72	104	4.7%	4.2	51	1.3%	20.0	2.3	0.4	5.0	154	10.9	5.0
15	15	6,328	0.15	0.78	65	1.3%	4.3	63	1.0%	20.0	2.0	0.5	5.0	128	10.7	5.0
16	16	5,770	0.13	0.88	217	2.0%	4.7	15	3.8%	20.0	3.9	0.1	5.0	233	11.3	5.0
17	17	1,846	0.04	0.90	91	2.4%	2.6	11	2.0%	20.0	2.8	0.1	5.0	103	10.6	5.0
18	18	14,622	0.34	0.70	131	3.2%	5.6	89	1.6%	20.0	2.5	0.6	6.2	220	11.2	6.2
19	19	12,107	0.28	0.08	56	2.0%	11.1	211	2.0%	15.0	2.1	1.7	12.8	267	11.5	11.5
20	20	12,501	0.29	0.77	74	3.9%	3.3	185	3.2%	20.0	3.5	0.9	5.0	259	11.4	5.0
21	21	4,925	0.11	0.79	79	3.1%	3.5	4	1.3%	20.0	2.3	0.0	5.0	83	10.5	5.0
22	22	4,866	0.11	0.70	81	2.7%	4.7	20	2.2%	20.0	3.0	0.1	5.0	101	10.6	5.0
23	23	7,686	0.18	0.74	124	2.1%	5.8	13	1.9%	20.0	2.8	0.1	5.9	137	10.8	5.9
24	24	10,901	0.25	0.77	67	4.3%	3.1	146	2.1%	20.0	2.9	0.8	5.0	214	11.2	5.0

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Venture on Venetucci - Final Drainage Report																
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Watercourse Coefficient																
Proposed Runoff Calculations																
Time of Concentration																
Heavy Meadow 2.50 Short Pasture & Lawns 7.00 Grassed Waterway 15.00																
Tillage/Field 5.00 Nearly Bare Ground 10.00 Paved Area & Paved Swales 20.00																
DESIGN	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)				T(c) CHECK (URBANIZED BASINS)				FINAL T(c)
	DRAIN	AREA	AREA	C(5)	Length	Slope	T(i)	Length	Slope	Coeff.	Velocity	T(t)	COMP.	TOTAL	L/180+10	
25	25	11,869	0.27	0.68	67	4.8%	3.7	124	3.1%	20.0	3.5	0.6	5.0	192	11.1	5.0
26	26	4,356	0.10	0.72	93	2.4%	5.0	0	0.0%	20.0	0.0	0.0	5.0	93	10.5	5.0
27	27	6,965	0.16	0.76	126	3.0%	4.9	72	2.1%	20.0	2.9	0.4	5.3	198	11.1	5.3
28	28	8,819	0.20	0.75	87	3.3%	4.0	74	2.3%	20.0	3.0	0.4	5.0	161	10.9	5.0
29	29	9,524	0.22	0.72	100	1.8%	5.7	42	1.6%	20.0	2.5	0.3	6.0	143	10.8	6.0
30	30	9,203	0.21	0.75	58	4.2%	3.0	40	2.0%	20.0	2.8	0.2	5.0	98	10.5	5.0
31	31	13,152	0.30	0.08	54	2.4%	10.3	175	2.4%	15.0	2.3	1.3	11.6	229	11.3	11.3
32	32	8,600	0.20	0.79	61	2.8%	3.2	103	2.3%	20.0	3.0	0.6	5.0	164	10.9	5.0
33	33	9,272	0.21	0.80	145	1.3%	6.2	36	2.8%	20.0	3.3	0.2	6.4	181	11.0	6.4
34	34	12,650	0.29	0.73	76	1.6%	5.0	146	2.8%	20.0	3.4	0.7	5.7	222	11.2	5.7
35	35	7,600	0.17	0.66	61	4.6%	3.8	61	1.0%	20.0	2.0	0.5	5.0	122	10.7	5.0
36	36	8,931	0.21	0.78	68	4.3%	3.0	77	1.9%	20.0	2.7	0.5	5.0	145	10.8	5.0
37	37	4,476	0.10	0.70	53	2.0%	4.2	52	2.0%	20.0	2.8	0.3	5.0	105	10.6	5.0
38	38	10,102	0.23	0.38	86	1.1%	11.9	37	1.0%	20.0	2.0	0.3	12.2	124	10.7	10.7
39	39	6,035	0.14	0.08	7	28.0%	1.6	128	1.0%	15.0	1.5	1.4	5.0	134	10.7	5.0
40	40	9,015	0.21	0.08	32	7.0%	5.5	179	1.7%	15.0	1.9	1.5	7.0	211	11.2	7.0
41	41	4,175	0.10	0.67	93	3.8%	4.8	19	1.9%	20.0	2.7	0.1	5.0	113	10.6	5.0
R1-A	R1-A	5,102	0.12	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R1-B	R1-B	5,102	0.12	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R2-A	R2-A	5,869	0.13	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R2-B	R2-B	5,869	0.13	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R3-A	R3-A	7,028	0.16	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R3-B	R3-B	7,028	0.16	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R4-A	R4-A	6,680	0.15	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R4-B	R4-B	6,680	0.15	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R5-A	R5-A	7,028	0.16	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R5-B	R5-B	7,028	0.16	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0

Venture on Venetucci
Multi-Family Development
Final Drainage Report
El Paso County, CO

11/12/2024
Calculated by: CRA

Venture on Venetucci - Final Drainage Report																
Watercourse Coefficient																
Proposed Runoff Calculations					Heavy Meadow		2.50		Short Pasture & Lawns			7.00		Grassed Waterway		15.00
Time of Concentration					Tillage/Field		5.00		Nearly Bare Ground			10.00		Paved Area & Paved Swales		20.00
DESIGN	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)				T(t)	T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
	DRAIN	AREA	AREA	C(5)	Length	Slope	T(i)	Length	Slope	Coeff.	Velocity		COMP.	TOTAL	L/180+10	
R6-A	R6-A	6,680	0.15	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R6-B	R6-B	6,680	0.15	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R7-A	R7-A	5,869	0.13	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R7-B	R7-B	5,869	0.13	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R8-A	R8-A	5,869	0.13	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R8-B	R8-B	5,869	0.13	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R9-A	R9-A	5,102	0.12	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R9-B	R9-B	5,102	0.12	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R10-A	R10-A	7,028	0.16	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R10-B	R10-B	7,028	0.16	0.73	35	2.0%	3.2	0	0.0%	20.0	0.0	0.0	5.0	35	10.2	5.0
R11	R11	5,174	0.12	0.73	30	2.0%	2.9	0	0.0%	20.0	0.0	0.0	5.0	30	10.2	5.0
R12	R12	3,221	0.07	0.73	30	2.0%	2.9	0	0.0%	20.0	0.0	0.0	5.0	30	10.2	5.0
G1	G1	1,933	0.04	0.73	20	2.0%	2.4	0	0.0%	20.0	0.0	0.0	5.0	20	10.1	5.0
G2-A	G2-A	1,911	0.04	0.73	20	2.0%	2.4	0	0.0%	20.0	0.0	0.0	5.0	20	10.1	5.0
G2-B	G2-B	1,911	0.04	0.73	20	2.0%	2.4	0	0.0%	20.0	0.0	0.0	5.0	20	10.1	5.0
G3-A	G3-A	1,911	0.04	0.73	20	2.0%	2.4	0	0.0%	20.0	0.0	0.0	5.0	20	10.1	5.0
G3-B	G3-B	1,911	0.04	0.73	20	2.0%	2.4	0	0.0%	20.0	0.0	0.0	5.0	20	10.1	5.0
G4-A	G4-A	1,911	0.04	0.73	20	2.0%	2.4	0	0.0%	20.0	0.0	0.0	5.0	20	10.1	5.0
G4-B	G4-B	1,911	0.04	0.73	20	2.0%	2.4	0	0.0%	20.0	0.0	0.0	5.0	20	10.1	5.0
G5-A	G5-A	2,002	0.05	0.73	20	2.0%	2.4	0	0.0%	20.0	0.0	0.0	5.0	20	10.1	5.0
G5-B	G5-B	2,002	0.05	0.73	20	2.0%	2.4	0	0.0%	20.0	0.0	0.0	5.0	20	10.1	5.0

Venture on Venetucci - Final Drainage Report
Proposed Runoff Calculations

Design Storm **5 Year**

(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
01	01	1.90	0.12	5.1	0.22	5.14	1.12				1.12	
02	02	0.23	0.74	7.8	0.17	4.50	0.75				0.75	
03	03	0.30	0.68	7.2	0.20	4.63	0.95	7.6	0.28	4.54	1.27	Basin 04, 07, & 03
04	04	0.07	0.73	5.0	0.05	5.17	0.28				0.28	
05	05	0.03	0.81	5.0	0.03	5.17	0.13				0.13	
06	06	0.34	0.73	5.0	0.25	5.17	1.28	5.0	0.27	5.17	1.41	Basin 05 & 06
07	07	0.25	0.09	7.6	0.02	4.54	0.10	7.6	0.2	4.54	0.10	Basin 07, R3-A, RW-1
08	08	0.19	0.73	5.0	0.14	5.17	0.70	5.0	0.29	5.17	1.52	Basin 12 & 08
09	09	0.14	0.77	5.0	0.11	5.17	0.57	5.7	0.30	4.98	1.47	Basin 13 & 09
10	10	0.31	0.78	5.6	0.24	5.00	1.20	5.6	0.40	5.00	1.98	Basin 16, 17 & 10
11	11	0.37	0.08	9.6	0.03	4.20	0.13	9.6	0.1	4.20	0.13	Basin 11, R5-A
12	12	0.21	0.75	5.0	0.16	5.17	0.81				0.81	
13	13	0.23	0.81	5.7	0.18	4.98	0.92				0.92	
14	14	0.26	0.72	5.0	0.19	5.17	0.96	5.0	0.30	5.17	1.55	Basin 14 & 15
15	15	0.15	0.78	5.0	0.11	5.17	0.59				0.59	
16	16	0.13	0.88	5.0	0.12	5.17	0.60	5.0	0.15	5.17	0.80	Basin 17 & 16
17	17	0.04	0.90	5.0	0.04	5.17	0.20				0.20	
18	18	0.34	0.70	6.2	0.24	4.85	1.14	6.2	0.32	4.85	1.58	Basin 18 & 21
19	19	0.28	0.08	11.5	0.02	3.92	0.09	11.5	0.2	3.92	0.96	Basin 19, R6-A, R4-B
20	20	0.29	0.77	5.0	0.22	5.17	1.14				1.14	
21	21	0.11	0.79	5.0	0.09	5.17	0.46				0.46	
22	22	0.11	0.70	5.0	0.08	5.17	0.41				0.41	
23	23	0.18	0.74	5.9	0.13	4.93	0.64	5.9	0.32	4.93	1.59	Basin 24 & 23
24	24	0.25	0.77	5.0	0.19	5.17	0.99				0.99	

Venture on Venetucci - Final Drainage Report
Proposed Runoff Calculations

El Paso County, CO

Design Storm 5 Year

(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN	DRAIN	AREA	RUNOFF	T(c)	C x A	I	Q	T(c)	C x A	I	Q	
25	25	0.27	0.68	5.0	0.19	5.17	0.96				0.96	
26	26	0.10	0.72	5.0	0.07	5.17	0.37	5.3	0.26	5.08	1.31	Basin 41, 27, & 26
27	27	0.16	0.76	5.3	0.12	5.08	0.61	5.3	0.19	5.08	0.94	Basin 41 & 27
28	28	0.20	0.75	5.0	0.15	5.17	0.79	6.4	0.32	4.80	1.55	Basin 33 & 28
29	29	0.22	0.72	6.0	0.16	4.90	0.77	6.0	0.37	4.90	1.82	Basin 34 & 29
30	30	0.21	0.75	5.0	0.16	5.17	0.82	5.0	0.31	5.17	1.62	Basin 32 & 30
31	31	0.30	0.08	11.3	0.02	3.95	0.10	11.3	0.2	3.95	0.87	Basin 31, R7-A, R8-B
32	32	0.20	0.79	5.0	0.16	5.17	0.80				0.80	
33	33	0.21	0.80	6.4	0.17	4.80	0.81				0.81	
34	34	0.29	0.73	5.7	0.21	4.96	1.06				1.06	
35	35	0.17	0.66	5.0	0.12	5.17	0.60	5.0	0.35	5.17	1.79	Basin 37, 36, & 35
36	36	0.21	0.78	5.0	0.16	5.17	0.82	5.0	0.23	5.17	1.19	Basin 37 & 36
37	37	0.10	0.70	5.0	0.07	5.17	0.37				0.37	
38	38	0.23	0.38	10.7	0.09	4.03	0.35				0.35	
39	39	0.14	0.08	5.0	0.01	5.17	0.06	5.0	0.1	5.17	0.67	Basin 39, R10-B
40	40	0.21	0.08	7.0	0.02	4.65	0.08	7.0	0.2	4.65	0.79	Basin 40, R12, R2-B
41	41	0.10	0.67	5.0	0.06	5.17	0.33				0.33	
R1-A	R1-A	0.12	0.73	5.0	0.09	5.17	0.44				0.44	
R1-B	R1-B	0.12	0.73	5.0	0.09	5.17	0.44				0.44	
R2-A	R2-A	0.13	0.73	5.0	0.10	5.17	0.51				0.51	
R2-B	R2-B	0.13	0.73	5.0	0.10	5.17	0.51				0.51	
R3-A	R3-A	0.16	0.73	5.0	0.12	5.17	0.61				0.61	
R3-B	R3-B	0.16	0.73	5.0	0.12	5.17	0.61				0.61	
R4-A	R4-A	0.15	0.73	5.0	0.11	5.17	0.58				0.58	
R4-B	R4-B	0.15	0.73	5.0	0.11	5.17	0.58				0.58	
R5-A	R5-A	0.16	0.73	5.0	0.12	5.17	0.61				0.61	
R5-B	R5-B	0.16	0.73	5.0	0.12	5.17	0.61				0.61	

Venture on Venetucci - Final Drainage Report

Proposed Runoff Calculations

Design Storm 5 Year

(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN	DRAIN	AREA	RUNOFF	T(c)	C x A	I	Q	T(c)	C x A	I	Q	
R6-A	R6-A	0.15	0.73	5.0	0.11	5.17	0.58				0.58	
R6-B	R6-B	0.15	0.73	5.0	0.11	5.17	0.58				0.58	
R7-A	R7-A	0.13	0.73	5.0	0.10	5.17	0.51				0.51	
R7-B	R7-B	0.13	0.73	5.0	0.10	5.17	0.51				0.51	
R8-A	R8-A	0.13	0.73	5.0	0.10	5.17	0.51				0.51	
R8-B	R8-B	0.13	0.73	5.0	0.10	5.17	0.51				0.51	
R9-A	R9-A	0.12	0.73	5.0	0.09	5.17	0.44				0.44	
R9-B	R9-B	0.12	0.73	5.0	0.09	5.17	0.44				0.44	
R10-A	R10-A	0.16	0.73	5.0	0.12	5.17	0.61				0.61	
R10-B	R10-B	0.16	0.73	5.0	0.12	5.17	0.61				0.61	
R11	R11	0.12	0.73	5.0	0.09	5.17	0.45				0.45	
R12	R12	0.07	0.73	5.0	0.05	5.17	0.28				0.28	
G1	G1	0.04	0.73	5.0	0.03	5.17	0.17				0.17	
G2-A	G2-A	0.04	0.73	5.0	0.03	5.17	0.17				0.17	
G2-B	G2-B	0.04	0.73	5.0	0.03	5.17	0.17				0.17	
G3-A	G3-A	0.04	0.73	5.0	0.03	5.17	0.17				0.17	
G3-B	G3-B	0.04	0.73	5.0	0.03	5.17	0.17				0.17	
G4-A	G4-A	0.04	0.73	5.0	0.03	5.17	0.17				0.17	
G4-B	G4-B	0.04	0.73	5.0	0.03	5.17	0.17				0.17	
G5-A	G5-A	0.05	0.73	5.0	0.03	5.17	0.17				0.17	
G5-B	G5-B	0.05	0.73	5.0	0.03	5.17	0.17				0.17	

Venture on Venetucci - Final Drainage Report Proposed Runoff Calculations Design Storm 100 Year												
(Rational Method Procedure)												
BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
01	01	1.90	0.38	5.1	0.71	8.63	6.13				6.13	
02	02	0.23	0.84	7.8	0.19	7.56	1.43				1.43	
03	03	0.30	0.80	7.2	0.24	7.77	1.86	7.6	0.4	7.62	2.97	Basin 04, 07, & 03
04	04	0.07	0.84	5.0	0.06	8.68	0.53				0.53	
05	05	0.03	0.89	5.0	0.03	8.68	0.25				0.25	
06	06	0.34	0.83	5.0	0.28	8.68	2.45	5.0	0.3	8.68	2.70	Basin 05 & 06
07	07	0.25	0.35	7.6	0.09	7.62	0.68	7.6	0.3	4.54	1.39	Basin 07, R3-A, RW-1
08	08	0.19	0.83	5.0	0.15	8.68	1.34	5.0	0.3	8.68	2.89	Basin 12 & 08
09	09	0.14	0.86	5.0	0.12	8.68	1.08	5.7	0.3	8.36	2.75	Basin 13 & 09
10	10	0.31	0.87	5.6	0.27	8.39	2.26	5.6	0.4	8.39	3.65	Basin 16, 17 & 10
11	11	0.37	0.35	9.6	0.13	7.05	0.91	9.6	0.3	4.20	1.09	Basin 11, R5-A
12	12	0.21	0.85	5.0	0.18	8.68	1.54				1.54	
13	13	0.23	0.89	5.7	0.20	8.36	1.71				1.71	
14	14	0.26	0.83	5.0	0.21	8.68	1.85	5.0	0.3	8.68	2.95	Basin 14 & 15
15	15	0.15	0.87	5.0	0.13	8.68	1.10				1.10	
16	16	0.13	0.95	5.0	0.13	8.68	1.09	5.0	0.2	8.68	1.44	Basin 17 & 16
17	17	0.04	0.96	5.0	0.04	8.68	0.35				0.35	
18	18	0.34	0.81	6.2	0.27	8.14	2.22	6.2	0.37	4.85	1.80	Basin 18 & 21
19	19	0.28	0.35	11.5	0.10	6.58	0.64	11.5	0.3	3.92	1.35	Basin 19, R6-A, R4-B
20	20	0.29	0.86	5.0	0.25	8.68	2.15				2.15	
21	21	0.11	0.88	5.0	0.10	8.68	0.86				0.86	
22	22	0.11	0.81	5.0	0.09	8.68	0.79				0.79	
23	23	0.18	0.84	5.9	0.15	8.27	1.22	5.9	0.4	8.27	3.01	Basin 24 & 23
24	24	0.25	0.86	5.0	0.22	8.68	1.87				1.87	

Venture on Venetucci - Final Drainage Report
Proposed Runoff Calculations

El Paso County, CO

Design Storm 100 Year

(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN	DRAIN	AREA	RUNOFF	T(c)	C x A	I	Q	T(c)	C x A	I	Q	
25	25	0.27	0.80	5.0	0.22	8.68	1.89				1.89	
26	26	0.10	0.83	5.0	0.08	8.68	0.72	5.3	0.3	8.52	2.51	Basin 41, 27, & 26
27	27	0.16	0.85	5.3	0.14	8.52	1.16	5.3	0.2	8.52	1.81	Basin 41 & 27
28	28	0.20	0.85	5.0	0.17	8.68	1.50	6.4	0.4	8.07	2.91	Basin 33 & 28
29	29	0.22	0.83	6.0	0.18	8.23	1.49	6.0	0.4	8.23	3.49	Basin 34 & 29
30	30	0.21	0.85	5.0	0.18	8.68	1.55	5.0	0.4	8.68	3.05	Basin 32 & 30
31	31	0.30	0.35	11.3	0.11	6.62	0.70	11.3	0.3	3.95	1.28	Basin 31, R7-A, R8-B
32	32	0.20	0.88	5.0	0.17	8.68	1.50				1.50	
33	33	0.21	0.88	6.4	0.19	8.07	1.52				1.52	
34	34	0.29	0.84	5.7	0.24	8.34	2.02				2.02	
35	35	0.17	0.78	5.0	0.14	8.68	1.19	5.0	0.4	8.68	3.45	Basin 37, 36, & 35
36	36	0.21	0.87	5.0	0.18	8.68	1.54	5.0	0.3	8.68	2.27	Basin 37 & 36
37	37	0.10	0.81	5.0	0.08	8.68	0.72				0.72	
38	38	0.23	0.57	10.7	0.13	6.76	0.90				0.90	
39	39	0.14	0.35	5.0	0.05	8.68	0.42	5.0	0.2	5.17	0.93	Basin 39, R10-B
40	40	0.21	0.35	7.0	0.07	7.81	0.57	7.0	0.2	4.65	1.12	Basin 40, R12, R2-B
41	41	0.10	0.79	5.0	0.08	8.68	0.66				0.66	
R1-A	R1-A	0.12	0.81	5.0	0.09	8.68	0.82				0.82	
R1-B	R1-B	0.12	0.81	5.0	0.09	8.68	0.82				0.82	
R2-A	R2-A	0.13	0.81	5.0	0.11	8.68	0.95				0.95	
R2-B	R2-B	0.13	0.81	5.0	0.11	8.68	0.95				0.95	
R3-A	R3-A	0.16	0.81	5.0	0.13	8.68	1.13				1.13	
R3-B	R3-B	0.16	0.81	5.0	0.13	8.68	1.13				1.13	
R4-A	R4-A	0.15	0.81	5.0	0.12	8.68	1.08				1.08	
R4-B	R4-B	0.15	0.81	5.0	0.12	8.68	1.08				1.08	
R5-A	R5-A	0.16	0.81	5.0	0.13	8.68	1.13				1.13	
R5-B	R5-B	0.16	0.81	5.0	0.13	8.68	1.13				1.13	

Venture on Venetucci - Final Drainage Report
Proposed Runoff Calculations

Design Storm 100 Year

(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN	DRAIN	AREA	RUNOFF	T(c)	C x A	I	Q	T(c)	C x A	I	Q	
R6-A	R6-A	0.15	0.81	5.0	0.12	8.68	1.08				1.08	
R6-B	R6-B	0.15	0.81	5.0	0.12	8.68	1.08				1.08	
R7-A	R7-A	0.13	0.81	5.0	0.11	8.68	0.95				0.95	
R7-B	R7-B	0.13	0.81	5.0	0.11	8.68	0.95				0.95	
R8-A	R8-A	0.13	0.81	5.0	0.11	8.68	0.95				0.95	
R8-B	R8-B	0.13	0.81	5.0	0.11	8.68	0.95				0.95	
R9-A	R9-A	0.12	0.81	5.0	0.09	8.68	0.82				0.82	
R9-B	R9-B	0.12	0.81	5.0	0.09	8.68	0.82				0.82	
R10-A	R10-A	0.16	0.81	5.0	0.13	8.68	1.13				1.13	
R10-B	R10-B	0.16	0.81	5.0	0.13	8.68	1.13				1.13	
R11	R11	0.12	0.81	5.0	0.10	8.68	0.84				0.84	
R12	R12	0.07	0.81	5.0	0.06	8.68	0.52				0.52	
G1	G1	0.04	0.81	5.0	0.04	8.68	0.31				0.31	
G2-A	G2-A	0.04	0.81	5.0	0.04	8.68	0.31				0.31	
G2-B	G2-B	0.04	0.81	5.0	0.04	8.68	0.31				0.31	
G3-A	G3-A	0.04	0.81	5.0	0.04	8.68	0.31				0.31	
G3-B	G3-B	0.04	0.81	5.0	0.04	8.68	0.31				0.31	
G4-A	G4-A	0.04	0.81	5.0	0.04	8.68	0.31				0.31	
G4-B	G4-B	0.04	0.81	5.0	0.04	8.68	0.31				0.31	
G5-A	G5-A	0.05	0.81	5.0	0.04	8.68	0.32				0.32	
G5-B	G5-B	0.05	0.81	5.0	0.04	8.68	0.32				0.32	

Venture on Venetucci - Final Drainage Report												
Proposed Runoff Calculations Design Storm 10 Year												
(Rational Method Procedure)												
BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
01	01	1.895	0.18	5.1	0.35	6.00	2.08				2.08	
02	02	0.226	0.77	7.8	0.17	5.25	0.91				0.91	
03	03	0.3	0.72	7.2	0.21	5.40	1.16	7.6	0.3	7.62	2.36	Basin 04, 07, & 03
04	04	0.073	0.76	5.0	0.06	6.03	0.34				0.34	
05	05	0.032	0.83	5.0	0.03	6.03	0.16				0.16	
06	06	0.338	0.76	5.0	0.26	6.03	1.55	5.0	0.3	8.68	2.47	Basin 05 & 06
07	07	0.25	0.16	7.6	0.04	5.29	0.21				0.21	
08	08	0.185	0.76	5.0	0.14	6.03	0.85	5.0	0.3	8.68	2.65	Basin 12 & 08
09	09	0.144	0.80	5.0	0.11	6.03	0.69	5.7	0.3	8.36	2.56	Basin 13 & 09
10	10	0.309	0.81	5.6	0.25	5.83	1.45	5.6	0.4	8.39	3.42	Basin 16, 17 & 10
11	11	0.365	0.15	9.6	0.06	4.90	0.28				0.28	
12	12	0.209	0.78	5.0	0.16	6.03	0.99				0.99	
13	13	0.23	0.83	5.7	0.19	5.81	1.11				1.11	
14	14	0.257	0.75	5.0	0.19	6.03	1.17	5.0	0.3	8.68	2.71	Basin 14 & 15
15	15	0.145	0.81	5.0	0.12	6.03	0.71				0.71	
16	16	0.132	0.90	5.0	0.12	6.03	0.72	5.0	0.2	8.68	1.38	Basin 17 & 16
17	17	0.042	0.92	5.0	0.04	6.03	0.24				0.24	
18	18	0.336	0.73	6.2	0.25	5.66	1.40	6.2	0.34	4.85	1.64	Basin 18 & 21
19	19	0.278	0.15	11.5	0.04	4.57	0.19				0.19	
20	20	0.287	0.80	5.0	0.23	6.03	1.38				1.38	
21	21	0.113	0.81	5.0	0.09	6.03	0.55				0.55	
22	22	0.112	0.74	5.0	0.08	6.03	0.50				0.50	
23	23	0.176	0.77	5.9	0.14	5.75	0.78	5.9	0.3	8.27	2.76	Basin 24 & 23
24	24	0.25	0.79	5.0	0.20	6.03	1.20				1.20	

Venture on Venetucci - Final Drainage Report												
El Paso County, CO												
Proposed Runoff Calculations												
Design Storm 10 Year												
(Rational Method Procedure)												
BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN	DRAIN	AREA	RUNOFF	T(c)	C x A	I	Q	T(c)	C x A	I	Q	
25	25	0.272	0.72	5.0	0.20	6.03	1.18				1.18	
26	26	0.1	0.75	5.0	0.08	6.03	0.45	5.3	0.3	8.52	2.29	Basin 41, 27, & 26
27	27	0.16	0.78	5.3	0.13	5.92	0.74	5.3	0.2	8.52	1.65	Basin 41 & 27
28	28	0.202	0.78	5.0	0.16	6.03	0.96	6.4	0.3	8.07	2.69	Basin 33 & 28
29	29	0.219	0.75	6.0	0.16	5.72	0.94	6.0	0.4	8.23	3.18	Basin 34 & 29
30	30	0.211	0.78	5.0	0.16	6.03	0.99	5.0	0.3	8.68	2.82	Basin 32 & 30
31	31	0.302	0.15	11.3	0.05	4.60	0.21				0.21	
32	32	0.197	0.81	5.0	0.16	6.03	0.97				0.97	
33	33	0.213	0.82	6.4	0.18	5.60	0.98				0.98	
34	34	0.29	0.76	5.7	0.22	5.79	1.28				1.28	
35	35	0.174	0.70	5.0	0.12	6.03	0.73	5.0	0.4	8.68	3.14	Basin 37, 36, & 35
36	36	0.205	0.80	5.0	0.16	6.03	0.99	5.0	0.2	8.68	2.08	Basin 37 & 36
37	37	0.103	0.73	5.0	0.07	6.03	0.45				0.45	
38	38	0.232	0.43	10.7	0.10	4.70	0.47				0.47	
39	39	0.139	0.15	5.0	0.02	6.03	0.13				0.13	
40	40	0.207	0.15	7.0	0.03	5.43	0.17				0.17	
41	41	0.096	0.71	5.0	0.07	6.03	0.41				0.41	
R1-A	R1-A	0.117	0.75	5.0	0.09	6.03	0.53				0.53	
R1-B	R1-B	0.117	0.75	5.0	0.09	6.03	0.53				0.53	
R2-A	R2-A	0.135	0.75	5.0	0.10	6.03	0.61				0.61	
R2-B	R2-B	0.135	0.75	5.0	0.10	6.03	0.61				0.61	
R3-A	R3-A	0.161	0.75	5.0	0.12	6.03	0.73				0.73	
R3-B	R3-B	0.161	0.75	5.0	0.12	6.03	0.73				0.73	
R4-A	R4-A	0.153	0.75	5.0	0.12	6.03	0.69				0.69	
R4-B	R4-B	0.153	0.75	5.0	0.12	6.03	0.69				0.69	
R5-A	R5-A	0.161	0.75	5.0	0.12	6.03	0.73				0.73	
R5-B	R5-B	0.161	0.75	5.0	0.12	6.03	0.73				0.73	

Venture on Venetucci - Final Drainage Report												
Proposed Runoff Calculations				Design Storm 10 Year								
(Rational Method Procedure)												
BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN	DRAIN	AREA	RUNOFF	T(c)	C x A	I	Q	T(c)	C x A	I	Q	
R6-A	R6-A	0.153	0.75	5.0	0.12	6.03	0.69				0.69	
R6-B	R6-B	0.153	0.75	5.0	0.12	6.03	0.69				0.69	
R7-A	R7-A	0.135	0.75	5.0	0.10	6.03	0.61				0.61	
R7-B	R7-B	0.135	0.75	5.0	0.10	6.03	0.61				0.61	
R8-A	R8-A	0.135	0.75	5.0	0.10	6.03	0.61				0.61	
R8-B	R8-B	0.135	0.75	5.0	0.10	6.03	0.61				0.61	
R9-A	R9-A	0.117	0.75	5.0	0.09	6.03	0.53				0.53	
R9-B	R9-B	0.117	0.75	5.0	0.09	6.03	0.53				0.53	
R10-A	R10-A	0.161	0.75	5.0	0.12	6.03	0.73				0.73	
R10-B	R10-B	0.161	0.75	5.0	0.12	6.03	0.73				0.73	
R11	R11	0.119	0.75	5.0	0.09	6.03	0.54				0.54	
R12	R12	0.074	0.75	5.0	0.06	6.03	0.33				0.33	
G1	G1	0.044	0.75	5.0	0.03	6.03	0.20				0.20	
G2-A	G2-A	0.044	0.75	5.0	0.03	6.03	0.20				0.20	
G2-B	G2-B	0.044	0.75	5.0	0.03	6.03	0.20				0.20	
G3-A	G3-A	0.044	0.75	5.0	0.03	6.03	0.20				0.20	
G3-B	G3-B	0.044	0.75	5.0	0.03	6.03	0.20				0.20	
G4-A	G4-A	0.044	0.75	5.0	0.03	6.03	0.20				0.20	
G4-B	G4-B	0.044	0.75	5.0	0.03	6.03	0.20				0.20	
G5-A	G5-A	0.046	0.75	5.0	0.03	6.03	0.21				0.21	
G5-B	G5-B	0.046	0.75	5.0	0.03	6.03	0.21				0.21	

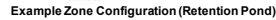
SUMMARY - PROPOSED RUNOFF TABLE					
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	WEIGHTED I (%)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
ONSITE BASINS					
01	01	1.90	5%	1.12	6.13
02	02	0.23	80%	0.75	1.43
03	03	0.30	73%	1.27	2.97
04	04	0.07	80%	0.28	0.53
05	05	0.03	89%	0.13	0.25
06	06	0.34	79%	1.41	2.70
07	07	0.25	1%	0.10	1.39
08	08	0.19	79%	1.52	2.89
09	09	0.14	84%	1.47	2.75
10	10	0.31	85%	1.98	3.65
11	11	0.37	1%	0.13	1.09
12	12	0.21	82%	0.81	1.54
13	13	0.23	89%	0.92	1.71
14	14	0.26	79%	1.55	2.95
15	15	0.15	86%	0.59	1.10
16	16	0.13	98%	0.80	1.44
17	17	0.04	100%	0.20	0.35
18	18	0.34	76%	1.58	1.80
19	19	0.28	0%	0.96	1.35
20	20	0.29	84%	1.14	2.15
21	21	0.11	86%	0.46	0.86
22	22	0.11	76%	0.41	0.79
23	23	0.18	80%	1.59	3.01
24	24	0.25	84%	0.99	1.87
25	25	0.27	74%	0.96	1.89
26	26	0.10	78%	1.31	2.51
27	27	0.16	82%	0.94	1.81
28	28	0.20	82%	1.55	2.91
29	29	0.22	78%	1.82	3.49
30	30	0.21	81%	1.62	3.05
31	31	0.30	0%	0.87	1.28
32	32	0.20	86%	0.80	1.50
33	33	0.21	87%	0.81	1.52
34	34	0.29	80%	1.06	2.02
35	35	0.17	71%	1.79	3.45
36	36	0.21	85%	1.19	2.27
37	37	0.10	75%	0.37	0.72
38	38	0.23	37%	0.35	0.90
39	39	0.14	0%	0.67	0.93
40	40	0.21	0%	0.79	1.12
41	41	0.10	72%	0.33	0.66
R1-A	R1-A	0.12	90%	0.44	0.82

R1-B	R1-B	0.12	90%	0.44	0.82
R2-A	R2-A	0.13	90%	0.51	0.95
R2-B	R2-B	0.13	90%	0.51	0.95
R3-A	R3-A	0.16	90%	0.61	1.13
R3-B	R3-B	0.16	90%	0.61	1.13
R4-A	R4-A	0.15	90%	0.58	1.08
R4-B	R4-B	0.15	90%	0.58	1.08
R5-A	R5-A	0.16	90%	0.61	1.13
R5-B	R5-B	0.16	90%	0.61	1.13
R6-A	R6-A	0.15	90%	0.58	1.08
R6-B	R6-B	0.15	90%	0.58	1.08
R7-A	R7-A	0.13	90%	0.51	0.95
R7-B	R7-B	0.13	90%	0.51	0.95
R8-A	R8-A	0.13	90%	0.51	0.95
R8-B	R8-B	0.13	90%	0.51	0.95
R9-A	R9-A	0.12	90%	0.44	0.82
R9-B	R9-B	0.12	90%	0.44	0.82
R10-A	R10-A	0.16	90%	0.61	1.13
R10-B	R10-B	0.16	90%	0.61	1.13
R11	R11	0.12	90%	0.45	0.84
R12	R12	0.07	90%	0.28	0.52
G1	G1	0.04	90%	0.17	0.31
G2-A	G2-A	0.04	90%	0.17	0.31
G2-B	G2-B	0.04	90%	0.17	0.31
G3-A	G3-A	0.04	90%	0.17	0.31
G3-B	G3-B	0.04	90%	0.17	0.31
G4-A	G4-A	0.04	90%	0.17	0.31
G4-B	G4-B	0.04	90%	0.17	0.31
G5-A	G5-A	0.05	90%	0.17	0.32
G5-B	G5-B	0.05	90%	0.17	0.32
G6-A	G6-A	0.04	90%	0.17	0.31
G6-B	G6-B	0.04	90%	0.17	0.31
G7-A	G7-A	0.04	90%	0.17	0.31
G7-B	G7-B	0.04	90%	0.17	0.31
G8	G8	0.04	90%	0.17	0.31
G9	G9	0.03	90%	0.13	0.23
OF-1	OF-1	0.16	17%	0.15	0.51
OF-2	OF-2	1.62	5%	0.74	4.17
OF-3	OF-3	0.21	12%	0.19	0.76
OF-4	OF-4	0.52	9%	0.41	1.76
RW-1	RW-1	0.16	31%	0.28	0.75
RW-2	RW-2	0.03	14%	0.06	0.37

APPENDIX C: HYDRAULICS

MHFD-Detention, Version 4.06 (July 2022)

Basin ID: Extended Detention Basin

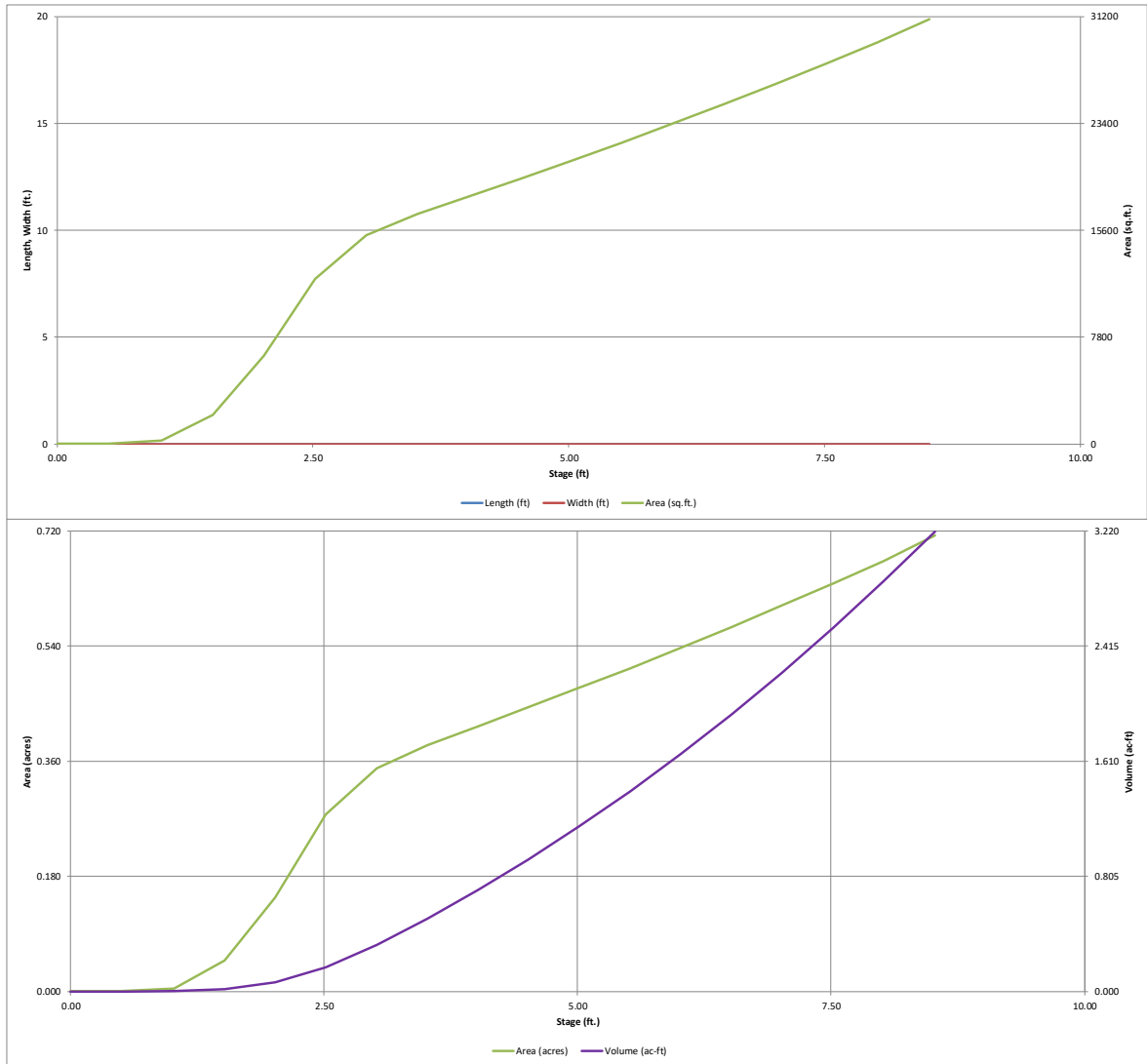


Initial Surcharge Area (A_{SV})	=	user	ft ²
Surcharge Volume Length (L_{SV})	=	user	ft
Surcharge Volume Width (W_{SV})	=	user	ft
Depth of Basin Floor (H_{FLOOR})	=	user	ft
Length of Basin Floor (L_{FLOOR})	=	user	ft
Width of Basin Floor (W_{FLOOR})	=	user	ft
Area of Basin Floor (A_{FLOOR})	=	user	ft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

[illegible]

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



- ✓ = calcs match details in plans
✗ = calcs do not match details in plans

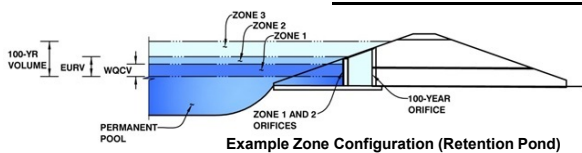
KH RESPONSE: ACKNOWLEDGED

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Venture on Venetucci

Basin ID: Extended Detention Basin



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.89	0.283	Orifice Plate
Zone 2 (EURV)	4.84	0.784	Orifice Plate
Zone 3 (100-year)	6.02	0.590	Weir&Pipe (Restrict)
Total (all zones)		1.657	

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

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

Calculated Parameters for Underdrain	
Underdrain Orifice Area =	N/A ft ²
Underdrain Orifice Centroid =	N/A feet

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.00	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	1.11	sq. inches (diameter = 1-3/16 inches)

Calculated Parameters for Plate	
WQ Orifice Area per Row =	7.708E-03 ft ²

KH RESPONSE: CDS HAVE BEEN UPDATED TO MATCH UD-DETENTION SPREADSHEET.

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.70	2.50	3.00				
Orifice Area (sq. inches)	1.11	1.11	1.11	1.11				

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice	
Vertical Orifice Area =	N/A ft ²
Vertical Orifice Centroid =	N/A feet

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

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.44	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.79	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	50%	N/A	%

KH RESPONSE: DIMENSIONS HAVE BEEN ADDED TO OUTLET STRUCTURE PLAN VIEW DETAIL

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	6.00		inches

Outlet Orifice Area =	0.52 ft ²
Outlet Orifice Centroid =	0.29 feet
Half-Central Angle of Restrictor Plate on Pipe =	1.23 radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage =	6.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	49.84	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	2.00	feet

Spillway Design Flow Depth =	0.36	feet
Stage at Top of Freeboard =	8.36	feet
Basin Area at Top of Freeboard =	0.70	acres
Basin Volume at Top of Freeboard =	3.10	acre-ft

Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period	N/A	N/A	0.97	1.24	1.50	1.89	2.24	2.61	3.62
One-Hour Rainfall Depth (in)	N/A	N/A	0.625	0.819	1.024	1.373	1.730	2.150	3.290
CUHP Runoff Volume (acre-ft)	0.283	1.067	0.625	0.819	1.024	1.373	1.730	2.150	3.290
Inflow Hydrograph Volume (acre-ft)	N/A	N/A	0.625	0.819	1.024	1.373	1.730	2.150	3.290
CUHP Predevelopment Peak Q (cfs)	N/A	N/A	0.0	0.1	0.2	1.2	4.2	7.8	17.7
OPTIONAL Override Predevelopment Peak Q (cfs)	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre)	N/A	N/A	0.00	0.01	0.01	0.09	0.31	0.57	1.29
Peak Inflow Q (cfs)	N/A	N/A	9.1	11.6	14.4	20.7	26.9	34.2	52.5
Peak Outflow Q (cfs)	0.1	0.3	0.2	0.2	0.2	2.0	5.9	6.8	30.6
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	2.5	1.6	1.7	1.4	0.9	1.7
Structure Controlling Flow	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps)	N/A	N/A	N/A	N/A	N/A	0.2	0.7	0.9	0.9
Max Velocity through Gate 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	81	62	75	80	87	85	83	78
Time to Drain 99% of Inflow Volume (hours)	41	87	65	75	85	93	93	92	89
Maximum Ponding Depth (ft)	2.89	4.84	3.73	4.19	4.64	5.19	5.42	5.90	6.29
Area at Maximum Ponding Depth (acres)	0.33	0.46	0.40	0.42	0.45	0.48	0.50	0.53	0.55
Maximum Volume Stored (acre-ft)	0.283	1.071	0.589	0.778	0.979	1.237	1.345	1.597	1.803

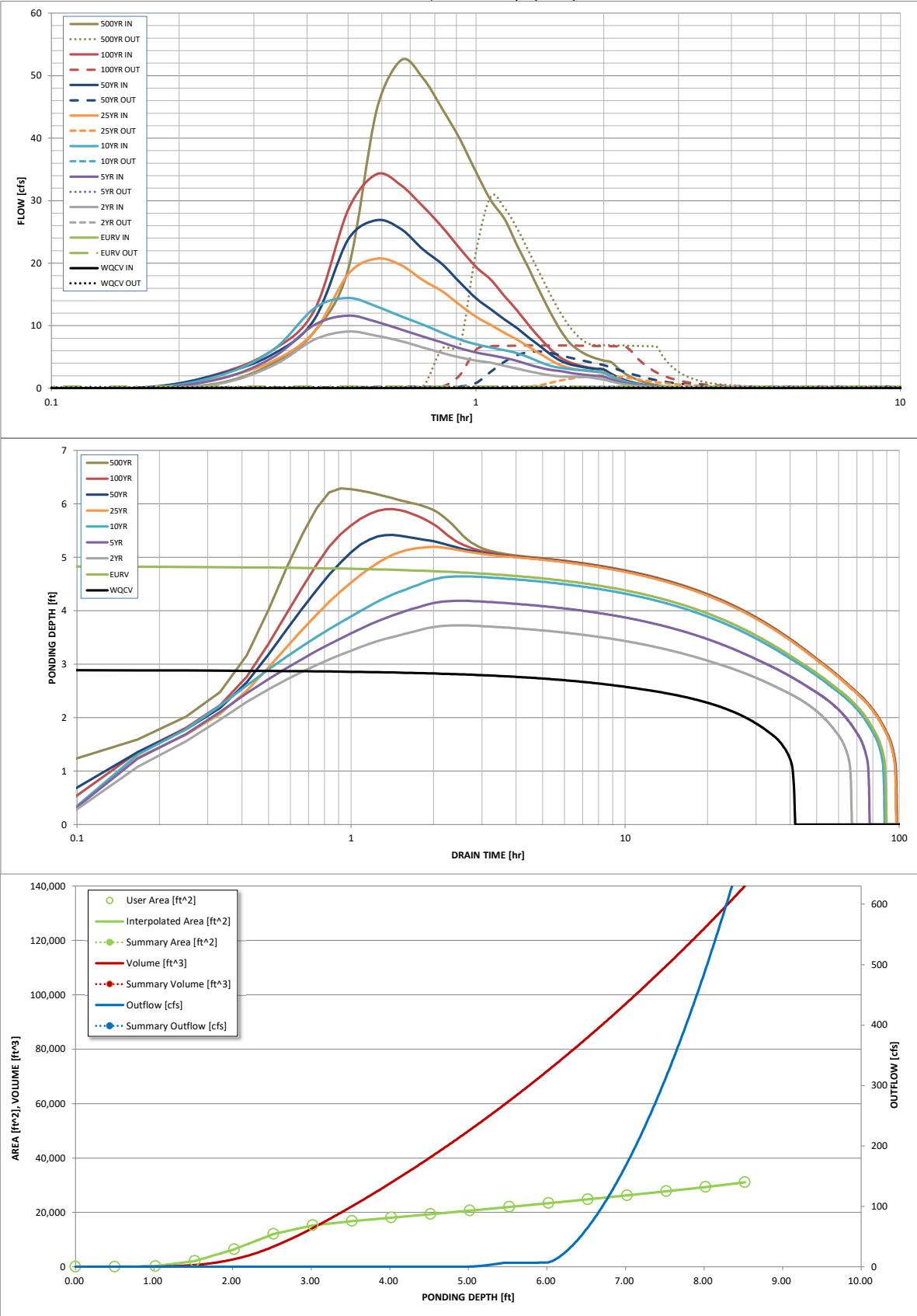
Ratio should be less than or equal to 1 for minor (5-yr) and major (100-yr) design storms. See Chapter 4.1 of DCM volume 2 (and also Chap 2 of MHFD DCM vol. 3).

But since the increase in outflow from pre-development is only 0.1cfs, just discuss this in the report text above.

KH RESPONSE: DUE TO LOW INFLOW, THE OUTFLOW CANNOT BE REDUCED ENOUGH TO MEET THE TIM TO DRAIN 97% OF THE INFLOW VOLUME WITHIN 72 HOURS.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.09	0.87
	0:15:00	0.00	0.00	0.76	1.50	2.08	1.64	2.29	2.40	4.01
	0:20:00	0.00	0.00	3.64	4.96	6.15	4.36	5.47	6.15	9.06
	0:25:00	0.00	0.00	7.78	10.15	12.81	9.12	11.05	12.52	18.95
	0:30:00	0.00	0.00	9.07	11.61	14.43	18.23	23.77	28.52	44.48
	0:35:00	0.00	0.00	8.38	10.61	13.06	20.73	26.87	34.23	52.51
	0:40:00	0.00	0.00	7.52	9.37	11.48	19.66	25.43	32.43	49.62
	0:45:00	0.00	0.00	6.52	8.27	10.17	17.28	22.21	29.09	44.68
	0:50:00	0.00	0.00	5.64	7.32	8.88	15.50	19.83	25.78	39.87
	0:55:00	0.00	0.00	4.92	6.39	7.78	13.32	16.92	22.36	34.60
	1:00:00	0.00	0.00	4.42	5.72	7.03	11.44	14.39	19.41	30.08
	1:05:00	0.00	0.00	4.07	5.26	6.52	10.12	12.64	17.39	27.12
	1:10:00	0.00	0.00	3.58	4.86	6.06	8.87	11.02	14.75	22.85
	1:15:00	0.00	0.00	3.13	4.35	5.60	7.78	9.61	12.44	19.10
	1:20:00	0.00	0.00	2.71	3.78	4.93	6.58	8.08	10.06	15.33
	1:25:00	0.00	0.00	2.33	3.28	4.17	5.52	6.73	7.99	12.06
	1:30:00	0.00	0.00	2.06	2.93	3.58	4.48	5.40	6.22	9.26
	1:35:00	0.00	0.00	1.92	2.74	3.26	3.68	4.40	4.89	7.21
	1:40:00	0.00	0.00	1.85	2.47	3.05	3.22	3.83	4.13	6.03
	1:45:00	0.00	0.00	1.80	2.25	2.90	2.93	3.48	3.67	5.29
	1:50:00	0.00	0.00	1.78	2.10	2.80	2.74	3.25	3.35	4.78
	1:55:00	0.00	0.00	1.57	1.98	2.67	2.61	3.09	3.13	4.42
	2:00:00	0.00	0.00	1.39	1.84	2.44	2.52	2.98	2.98	4.16
	2:05:00	0.00	0.00	1.07	1.41	1.88	1.94	2.30	2.26	3.14
	2:10:00	0.00	0.00	0.80	1.06	1.40	1.45	1.71	1.67	2.31
	2:15:00	0.00	0.00	0.60	0.79	1.05	1.08	1.27	1.24	1.72
	2:20:00	0.00	0.00	0.45	0.59	0.78	0.80	0.95	0.93	1.28
	2:25:00	0.00	0.00	0.33	0.43	0.57	0.59	0.69	0.68	0.94
	2:30:00	0.00	0.00	0.24	0.30	0.41	0.42	0.50	0.49	0.68
	2:35:00	0.00	0.00	0.17	0.21	0.30	0.31	0.36	0.36	0.49
	2:40:00	0.00	0.00	0.11	0.15	0.21	0.22	0.25	0.25	0.35
	2:45:00	0.00	0.00	0.07	0.10	0.13	0.14	0.17	0.16	0.22
	2:50:00	0.00	0.00	0.04	0.06	0.07	0.08	0.10	0.09	0.13
	2:55:00	0.00	0.00	0.02	0.03	0.03	0.04	0.05	0.04	0.06
	3:00:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

[illegible]

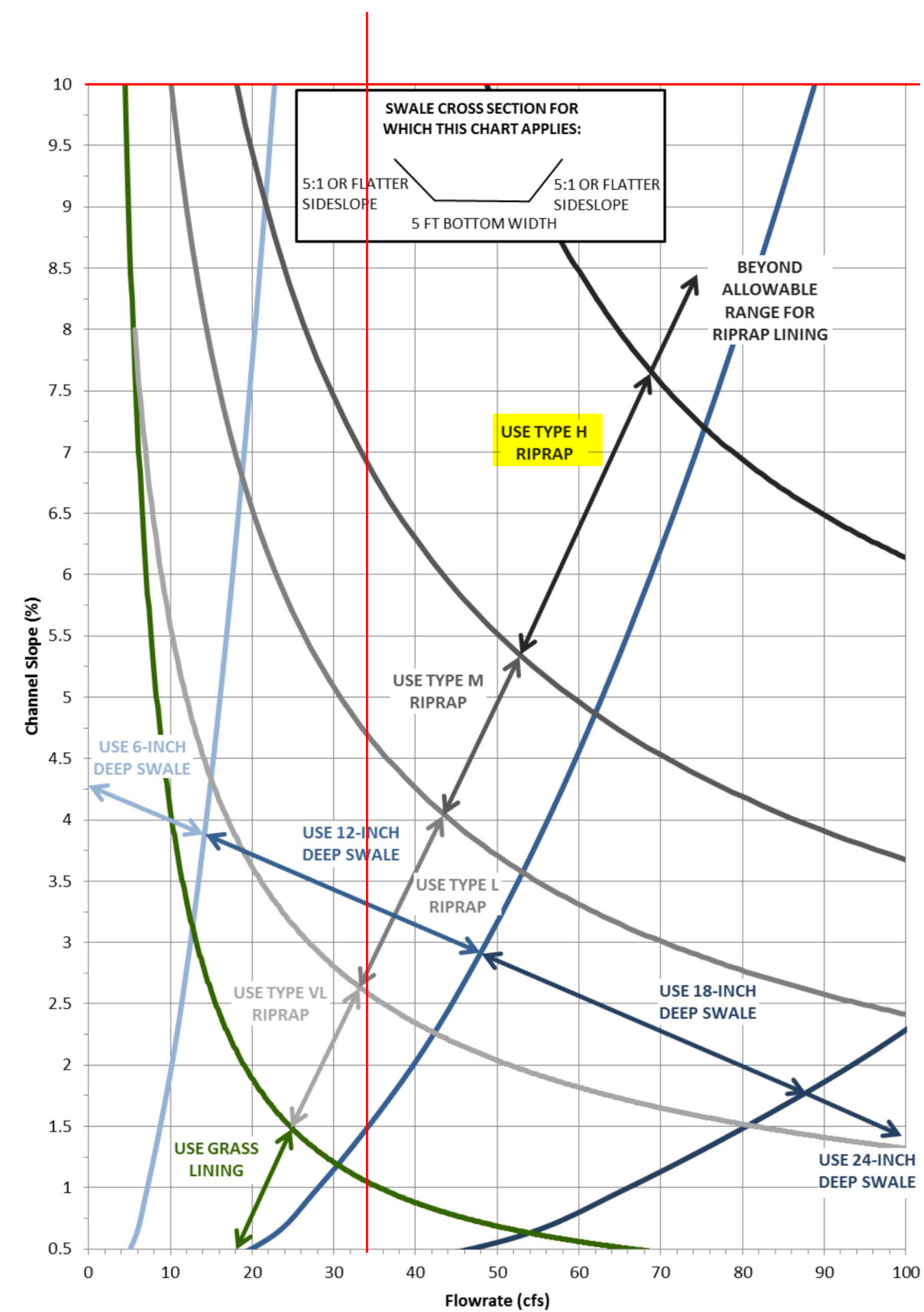
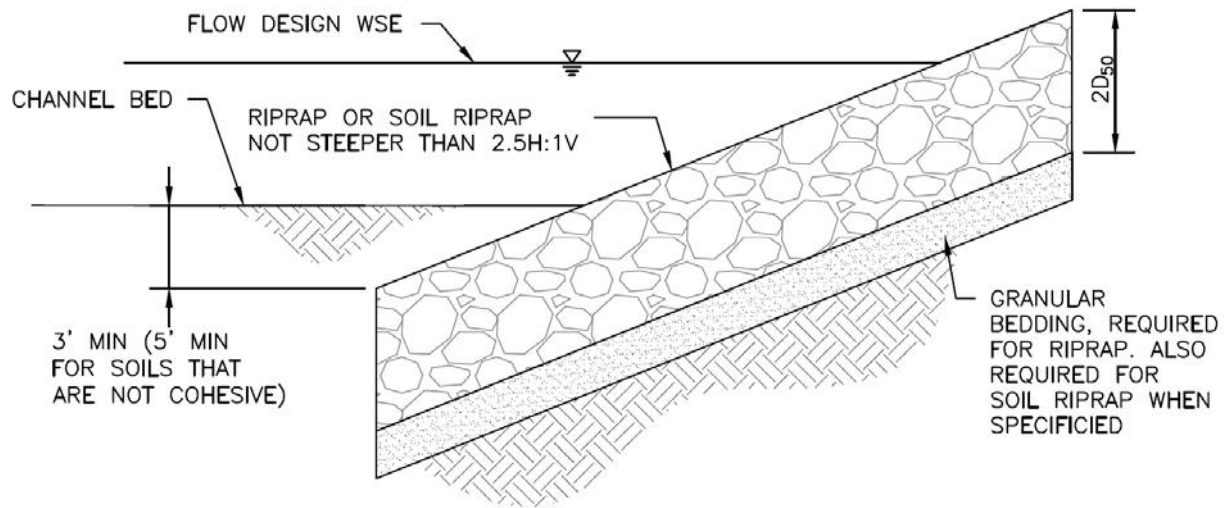


Figure 8-24. Swale stability chart: greater than 4-foot bottom width and side slopes between 5:1 and 10:1

(Note: Riprap classifications refer to gradation for riprap used in soil riprap or void-filled riprap. See Figure 8-34 for gradations.) (Source: Muller Engineering Company)



RIPRAP DESIGNATION	% SMALLER THAN GIVEN SIZE BY WEIGHT	INTERMEDIATE ROCK DIMENSION (INCHES)	D ₅₀ * (INCHES)
TYPE VL	70 – 100 50 – 70 35 – 50 2 – 10	12 9 6 2	6
TYPE L	70 – 100 50 – 70 35 – 50 2 – 10	15 12 9 3	9
TYPE M	70 – 100 50 – 70 35 – 50 2 – 10	21 18 12 4	12
TYPE H	70 – 100 50 – 70 35 – 50 2 – 10	30 24 18 6	18
*D ₅₀ = MEAN ROCK SIZE			

Figure 8-34. Riprap and soil riprap placement and gradation (part 1 of 3)

SOIL RIPRAP NOTES:

1. ELEVATION TOLERANCES FOR THE SOIL RIPRAP SHALL BE 0.10 FEET. THICKNESS OF SOIL RIPRAP SHALL BE NO LESS THAN THICKNESS SHOWN AND NO MORE THAN 2-INCHES GREATER THAN THE THICKNESS SHOWN.
2. WHERE "SOIL RIPRAP" IS DESIGNATED ON THE CONTRACT DRAWINGS, RIPRAP VOIDS ARE TO BE FILLED WITH NATIVE SOIL. THE RIPRAP SHALL BE PRE-MIXED WITH THE NATIVE SOIL AT THE FOLLOWING PROPORTIONS BY VOLUME: 65PERCENT RIPRAP AND 35 PERCENT SOIL. THE SOIL USED FOR MIXING SHALL BE NATIVE TOPSOIL AND SHALL HAVE A MINIMUM FINES CONTENT OF 15 PERCENT. THE SOIL RIPRAP SHALL BE INSTALLED IN A MANNER THAT RESULTS IN A DENSE, INTERLOCKED LAYER OF RIPRAP WITH RIPRAP VOIDS FILLED COMPLETELY WITH SOIL. SEGREGATION OF MATERIALS SHALL BE AVOIDED AND IN NO CASE SHALL THE COMBINED MATERIAL CONSIST PRIMARILY OF SOIL; THE DENSITY AND INTERLOCKING NATURE OF RIPRAP IN THE MIXED MATERIAL SHALL ESSENTIALLY BE THE SAME AS IF THE RIPRAP WAS PLACED WITHOUT SOIL.
3. WHERE SPECIFIED (TYPICALLY AS "BURIED SOIL RIPRAP"), A SURFACE LAYER OF TOPSOIL SHALL BE PLACED OVER THE SOIL RIPRAP ACCORDING TO THE THICKNESS SPECIFIED ON THE CONTRACT DRAWINGS. THE TOPSOIL SURFACE LAYER SHALL BE COMPACTED TO APPROXIMATELY 85% OF MAXIMUM DENSITY AND WITHIN TWO PERCENTAGE POINTS OF OPTIMUM MOISTURE IN ACCORDANCE WITH ASTM D698. TOPSOIL SHALL BE ADDED TO ANY AREAS THAT SETTLE.
4. ALL SOIL RIPRAP THAT IS BURIED WITH TOPSOIL SHALL BE REVIEWED AND APPROVED BY THE ENGINEER PRIOR TO ANY TOPSOIL PLACEMENT.

GRADATION FOR GRANULAR BEDDING		
U.S. STANDARD SIEVE SIZE	PERCENT PASSING BY WEIGHT	
	TYPE I CDOT SECT. 703.01	TYPE II CDOT SECT. 703.09 CLASS A
3 INCHES	—	90 — 100
1½ INCHES	—	—
¾ INCHES	—	20 — 90
⅜ INCHES	100	—
#4	95 — 100	0 — 20
#16	45 — 80	—
#50	10 — 30	—
#100	2 — 10	—
#200	0 — 2	0 — 3

RIPRAP BEDDING**Figure 8-34. Riprap and soil riprap placement and gradation (part 2 of 3)**

THICKNESS REQUIREMENTS FOR GRANULAR BEDDING			
RIPRAP DESIGNATION	MINIMUM BEDDING THICKNESS (INCHES)		
	FINE-GRAINED SOILS ¹		COARSE-GRAINED SOILS ²
	TYPE I (LOWER LAYER)	TYPE II (UPPER LAYER)	TYPE II
VL ($D_{50} = 6$ IN)	4	4	6
L ($D_{50} = 9$ IN)	4	4	6
M ($D_{50} = 12$ IN)	4	4	6
H ($D_{50} = 18$ IN)	4	6	8
VH ($D_{50} = 24$ IN)	4	6	8

NOTES:

1. MAY SUBSTITUTE ONE 12-INCH LAYER OF TYPE II BEDDING. THE SUBSTITUTION OF ONE LAYER OF TYPE II BEDDING SHALL NOT BE PERMITTED AT DROP STRUCTURES. THE USE OF A COMBINATION OF FILTER FABRIC AND TYPE II BEDDING AT DROP STRUCTURES IS ACCEPTABLE.

2. FIFTY PERCENT OR MORE BY WEIGHT RETAINED ON THE #40 SIEVE.

Figure 8-34. Riprap and soil riprap placement and gradation (part 3 of 3)



NOAA Atlas 14, Volume 8, Version 2
Location name: Colorado Springs, Colorado, USA*
Latitude: 38.7697°, Longitude: -104.786°
Elevation: 5896 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 & aerals](#)

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	0.242 (0.199-0.298)	0.291 (0.238-0.358)	0.375 (0.306-0.464)	0.451 (0.366-0.561)	0.564 (0.443-0.739)	0.658 (0.502-0.874)	0.757 (0.556-1.04)	0.864 (0.605-1.22)	1.01 (0.680-1.48)	1.13 (0.736-1.67)
10-min	0.355 (0.291-0.437)	0.425 (0.348-0.525)	0.550 (0.448-0.680)	0.661 (0.535-0.822)	0.826 (0.649-1.08)	0.963 (0.735-1.28)	1.11 (0.814-1.52)	1.26 (0.886-1.78)	1.48 (0.995-2.16)	1.66 (1.08-2.45)
15-min	0.433 (0.355-0.533)	0.519 (0.425-0.640)	0.670 (0.547-0.829)	0.806 (0.653-1.00)	1.01 (0.792-1.32)	1.18 (0.897-1.56)	1.35 (0.993-1.85)	1.54 (1.08-2.18)	1.81 (1.21-2.64)	2.02 (1.32-2.98)
30-min	0.635 (0.521-0.783)	0.764 (0.625-0.942)	0.989 (0.806-1.22)	1.19 (0.965-1.48)	1.49 (1.17-1.96)	1.74 (1.33-2.31)	2.00 (1.47-2.74)	2.29 (1.60-3.23)	2.69 (1.80-3.92)	3.01 (1.95-4.44)
60-min	0.824 (0.676-1.02)	0.970 (0.794-1.20)	1.24 (1.01-1.53)	1.50 (1.21-1.86)	1.89 (1.50-2.50)	2.24 (1.72-2.99)	2.61 (1.92-3.59)	3.02 (2.13-4.29)	3.62 (2.44-5.30)	4.11 (2.67-6.06)
2-hr	1.01 (0.835-1.24)	1.18 (0.968-1.44)	1.49 (1.22-1.83)	1.80 (1.47-2.22)	2.30 (1.84-3.04)	2.73 (2.12-3.65)	3.22 (2.40-4.42)	3.76 (2.67-5.32)	4.55 (3.09-6.64)	5.21 (3.41-7.63)
3-hr	1.11 (0.919-1.35)	1.27 (1.05-1.55)	1.59 (1.31-1.95)	1.92 (1.57-2.37)	2.47 (2.00-3.28)	2.97 (2.32-3.97)	3.53 (2.65-4.85)	4.17 (2.98-5.90)	5.11 (3.49-7.44)	5.90 (3.88-8.61)
6-hr	1.27 (1.06-1.54)	1.44 (1.19-1.74)	1.79 (1.48-2.18)	2.17 (1.78-2.65)	2.80 (2.29-3.72)	3.39 (2.67-4.52)	4.06 (3.07-5.56)	4.82 (3.48-6.80)	5.96 (4.12-8.64)	6.92 (4.60-10.0)
12-hr	1.43 (1.20-1.72)	1.64 (1.37-1.98)	2.06 (1.72-2.50)	2.50 (2.07-3.04)	3.22 (2.63-4.21)	3.86 (3.05-5.10)	4.59 (3.49-6.22)	5.42 (3.94-7.56)	6.64 (4.62-9.54)	7.66 (5.13-11.0)
24-hr	1.62 (1.36-1.93)	1.88 (1.58-2.25)	2.39 (2.01-2.87)	2.89 (2.41-3.48)	3.67 (3.01-4.74)	4.36 (3.46-5.69)	5.13 (3.92-6.87)	5.98 (4.36-8.26)	7.22 (5.05-10.3)	8.24 (5.57-11.8)
2-day	1.85 (1.57-2.20)	2.17 (1.84-2.58)	2.76 (2.33-3.29)	3.32 (2.78-3.98)	4.18 (3.43-5.32)	4.92 (3.92-6.34)	5.72 (4.40-7.58)	6.61 (4.85-9.03)	7.88 (5.55-11.1)	8.92 (6.08-12.7)
3-day	2.03 (1.72-2.40)	2.38 (2.02-2.82)	3.02 (2.56-3.59)	3.62 (3.05-4.33)	4.54 (3.74-5.76)	5.33 (4.26-6.84)	6.19 (4.77-8.16)	7.12 (5.25-9.69)	8.46 (5.99-11.9)	9.55 (6.54-13.5)
4-day	2.18 (1.86-2.57)	2.55 (2.18-3.01)	3.23 (2.74-3.82)	3.86 (3.26-4.60)	4.82 (3.98-6.08)	5.64 (4.53-7.21)	6.53 (5.05-8.59)	7.50 (5.56-10.2)	8.90 (6.32-12.4)	10.0 (6.90-14.2)
7-day	2.58 (2.21-3.02)	2.97 (2.55-3.49)	3.70 (3.16-4.36)	4.36 (3.71-5.17)	5.39 (4.47-6.75)	6.26 (5.05-7.94)	7.20 (5.60-9.40)	8.23 (6.13-11.1)	9.70 (6.94-13.5)	10.9 (7.54-15.3)
10-day	2.91 (2.50-3.40)	3.34 (2.87-3.90)	4.10 (3.51-4.82)	4.80 (4.09-5.67)	5.87 (4.88-7.30)	6.77 (5.47-8.54)	7.73 (6.04-10.0)	8.78 (6.57-11.8)	10.3 (7.38-14.2)	11.5 (8.00-16.1)
20-day	3.81 (3.30-4.43)	4.36 (3.78-5.07)	5.31 (4.58-6.20)	6.14 (5.27-7.20)	7.34 (6.12-9.00)	8.32 (6.76-10.4)	9.34 (7.33-12.0)	10.4 (7.84-13.8)	11.9 (8.61-16.3)	13.1 (9.20-18.2)
30-day	4.56 (3.96-5.27)	5.23 (4.55-6.06)	6.36 (5.50-7.38)	7.30 (6.29-8.53)	8.63 (7.19-10.5)	9.68 (7.87-11.9)	10.7 (8.44-13.7)	11.8 (8.92-15.6)	13.3 (9.65-18.1)	14.4 (10.2-20.0)
45-day	5.52 (4.82-6.36)	6.36 (5.54-7.33)	7.70 (6.69-8.91)	8.80 (7.60-10.2)	10.3 (8.58-12.4)	11.4 (9.31-14.0)	12.5 (9.88-15.8)	13.7 (10.3-17.8)	15.1 (11.0-20.4)	16.2 (11.5-22.3)
60-day	6.36 (5.57-7.31)	7.33 (6.41-8.43)	8.86 (7.72-10.2)	10.1 (8.74-11.7)	11.7 (9.78-14.0)	12.9 (10.6-15.7)	14.1 (11.1-17.7)	15.2 (11.5-19.7)	16.7 (12.1-22.3)	17.7 (12.6-24.3)

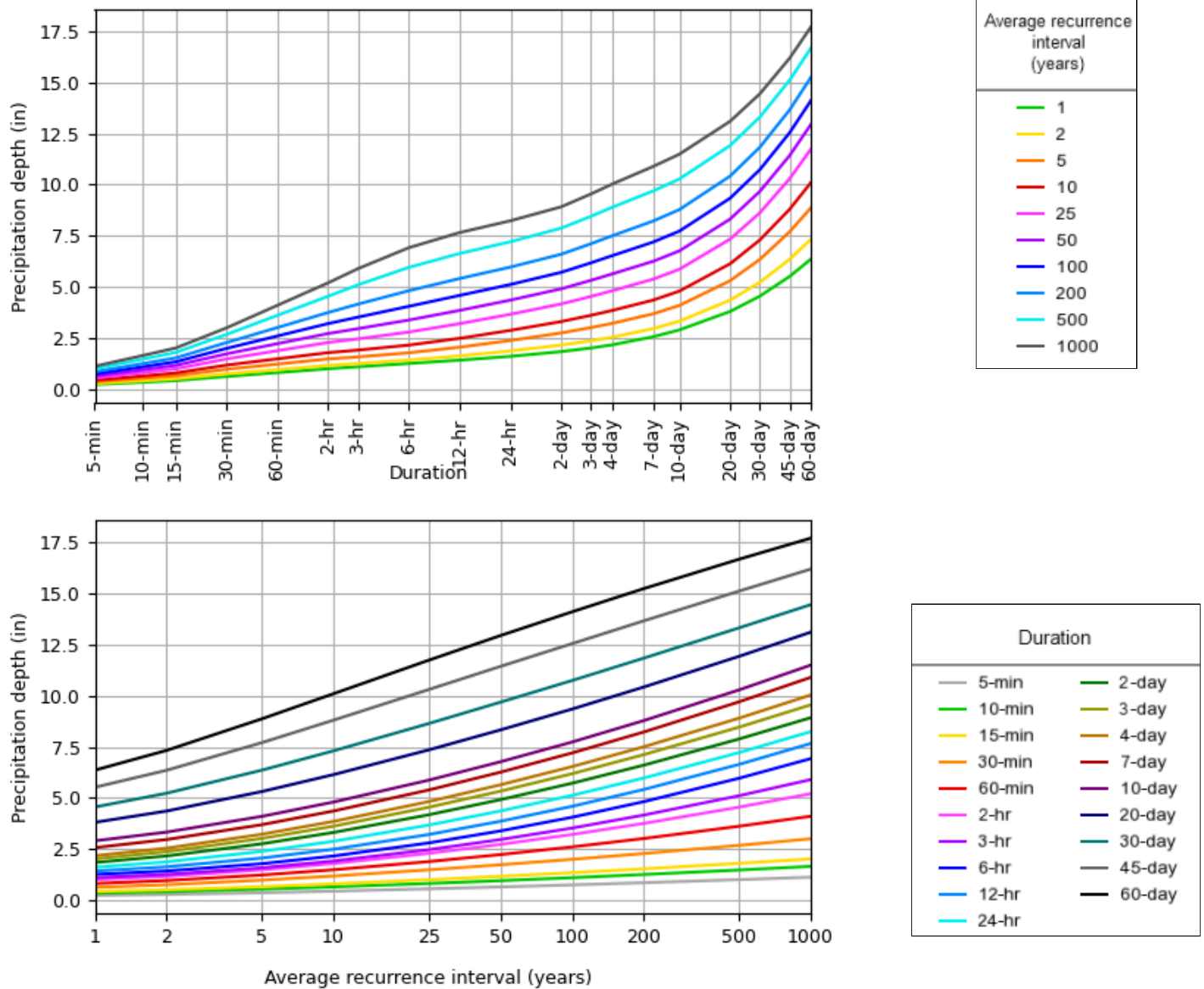
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves

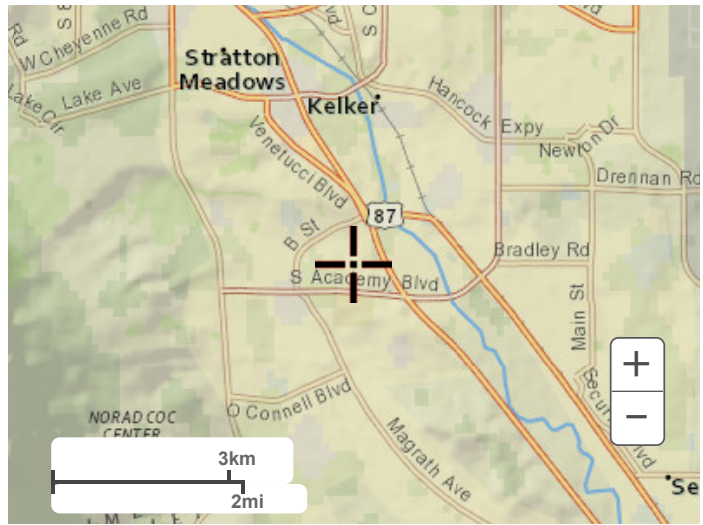
Latitude: 38.7697°, Longitude: -104.7860°



NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Tue Nov 12 00:43:38 2024

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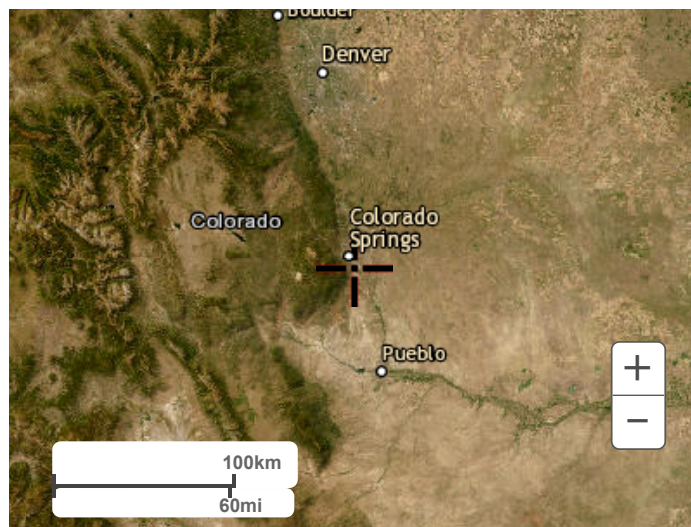
Large scale terrain



Large scale map



Large scale aerial



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1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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Worksheet for Emergency Spillway Conveyance Channel

Project Description	
Friction Method	Manning
Solve For	Formula
	Discharge
Input Data	
Roughness Coefficient	0.078
Channel Slope	0.090 ft/ft
Normal Depth	15.0 in
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	5.00 ft
Results	
Discharge	62.41 cfs
Flow Area	12.5 ft ²
Wetted Perimeter	15.3 ft
Hydraulic Radius	9.8 in
Top Width	15.00 ft
Critical Depth	14.7 in
Critical Slope	0.097 ft/ft
Velocity	4.99 ft/s
Velocity Head	0.39 ft
Specific Energy	1.64 ft
Froude Number	0.964
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	15.0 in
Critical Depth	14.7 in
Channel Slope	0.090 ft/ft
Critical Slope	0.097 ft/ft

Forebay Release and Configuration (Per MHFD Table 4-12)	Impervious Area to EDB (AC)	Required
	8.66	Size to drain in 4 to 5 minutes using equation 4-1

Minimum Forebay Volume (Per MHFD Table 4-12)	1% of the WQCV	WQCV	Criteria (Using 18" depth)	Forebay A Provided
		0.283 acre-feet	184.91	292.50

Forebay Depth (Per MHFD Table 4-12)	Required	Forebay A Provided
	15 to 18 inches	18"

Trickle Channel Capacity	See separate calculations.
--------------------------	----------------------------

Micropool	Required Area	Provided Area
	Area $\geq 10\text{ft}^2$	40 ft^2

Forebay Notch Calculations	
$w = 9.23 (A_{FB} / t) (1 / \sqrt{h_{max}})$	
Where:	
w = width of the rectangular vertical notch (inches)	
A_{FB} = surface area of the forebay (square feet)	
t = emptying time of the brim-full forebay (seconds)	
h_{max} = maximum depth of the forebay (feet)	
w_A	4.9 inches
w_B	4.9 inches
A_{FBA}	195 ft^2
A_{FBB}	195 ft^2
t_A	300 seconds
t_B	300 seconds
h_{MAXA}	1.50 feet
h_{MAXB}	1.50 feet

$$w = 9.23 (A_{FB} / t) (1 / \sqrt{h_{max}})$$

Equation 4-1

Where:

w = width of the rectangular vertical notch (inches)

A_{FB} = surface area of the forebay (square feet)

t = emptying time of the brim-full forebay (seconds)

h_{max} = maximum depth of the forebay (feet)

TABLE 4-12. FOREBAY SIZING CRITERIA

FOREBAY SIZING CRITERIA	WATERSHED IMPERVIOUS AREA (IA)				
	IA UP TO 2 ACRES	IA 2 UP TO 5 ACRES	IA 5 UP TO 10 ACRES	IA 10 UP TO 20 ACRES	IA GREATER THAN 20 ACRES
Forebay Release Rate and Configuration	Concrete sediment pad with dense grasses surrounding, concrete pad with slotted metal edge, or similar design				
Minimum Forebay Volume ¹					
Forebay Depth ¹	12 to 15 inches	15 to 18 inches	18 to 24 inches	24 to 30 inches	

¹ Appropriate volume and depth should consider maintenance and access needs. The values provided are approximate and provide a starting point for design.

Worksheet for Trickle Channel Capacity

Project Description	
Friction Method	Manning
	Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.013
Channel Slope	0.600 %
Normal Depth	6.0 in
Bottom Width	2.00 ft
Results	
Discharge	4.26 cfs
Flow Area	1.0 ft ²
Wetted Perimeter	3.0 ft
Hydraulic Radius	4.0 in
Top Width	2.00 ft
Critical Depth	6.2 in
Critical Slope	0.535 %
Velocity	4.26 ft/s
Velocity Head	0.28 ft
Specific Energy	0.78 ft
Froude Number	1.061
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	6.0 in
Critical Depth	6.2 in
Channel Slope	0.600 %
Critical Slope	0.535 %

Worksheet for Forebay Weir Flowrate for Trickle Channel Sizing

Project Description	
Solve For	Discharge
Input Data	
Headwater Elevation	1.50 ft
Crest Elevation	0.00 ft
Tailwater Elevation	0.00 ft
Weir Coefficient	$3.00 \text{ ft}^{1/2}/\text{s}$
Crest Length	0.4 ft
Number Of Contractions	1
Results	
Discharge	1.42 cfs
Headwater Height Above Crest	1.50 ft
Tailwater Height Above Crest	0.00 ft
Flow Area	0.6 ft^2
Velocity	2.32 ft/s
Wetted Perimeter	3.4 ft
Top Width	0.41 ft

PROJECT: Venetucci MF

Date:

11/6/2024

MODIFIED STILLING BASIN DESIGN PER MHFD VOL 2 CH 9

V = Flow Velocity (ft/s) 9.52 (StormCAD 100-YR Scenario)

A = Flow Area (ft^2) 1.80 (18" Diameter Pipe)

D(ft) 1.34 (See MHFD Equation Below)

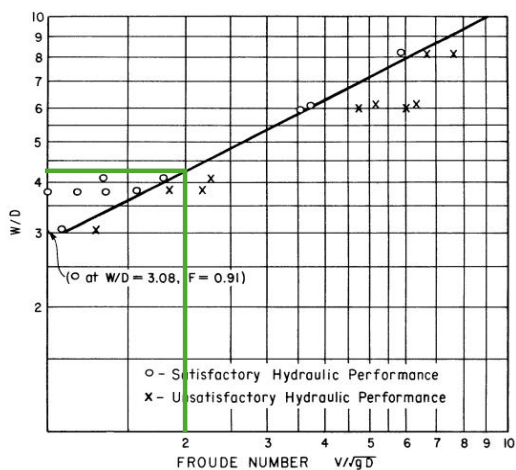
Froude Number 1.45 (See MHFD Equation Below)

W/D 4.25 (MHFD Figure 9-46)

W (ft)	5.70
H (ft)	4.28
L (ft)	13.30
a (ft)	2.85
b (ft)	2.14
c (ft)	2.85
d (ft)	0.95
e (ft)	0.48
f (ft)	0.71
t (ft)	0.48

$$\text{Froude number} = \frac{V}{(gD)^{1/2}}$$

$W = 2.94D \left[\frac{V}{(gD)^{0.5}} \right]^{0.556}$	$H = 3/4 W$	$c = 1/2 W$
$V = \text{VELOCITY, [FT/S]}$	$L = 4/3 W$	$d = 1/6 W$
$D = (A)^{0.5}$	$a = 1/2 W$	$e = 1/12 W$
$A = \text{AREA OF FLOW [SF]}$	$b = 3/8 W$	$f = 1/8 W$
	$t = 1/12 W$ (SUGGESTED MIN)	



"w" is the inside width of the basin.
 "d" represents the depth of flow entering the basin and is the square root of the flow area at the conduit outlet.
 "v" is the velocity of the incoming flow.
 The tailwater depth is uncontrolled.

Figure 9-46. Basin width diagram for the USBR type VI impact stilling basin

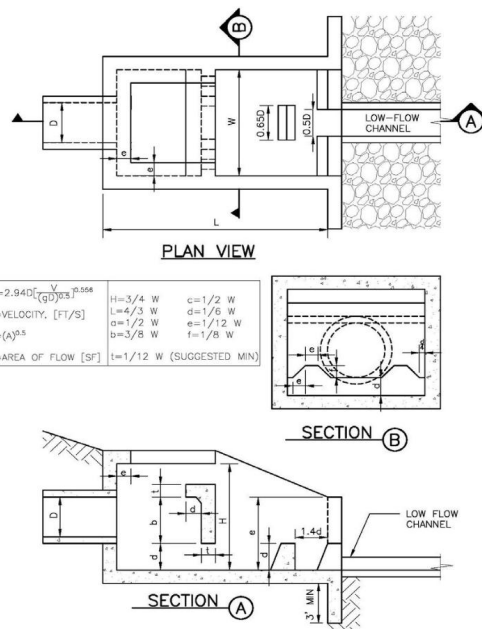


Figure 9-45. UDFCD modified USBR type VI impacts stilling basin (general design dimensions)

Figure 13-12c. Emergency Spillway Protection

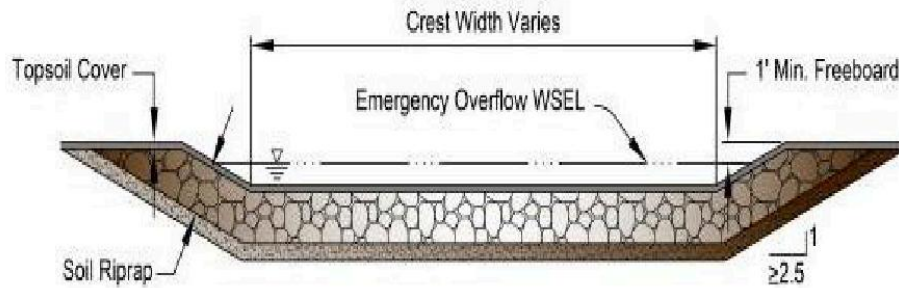
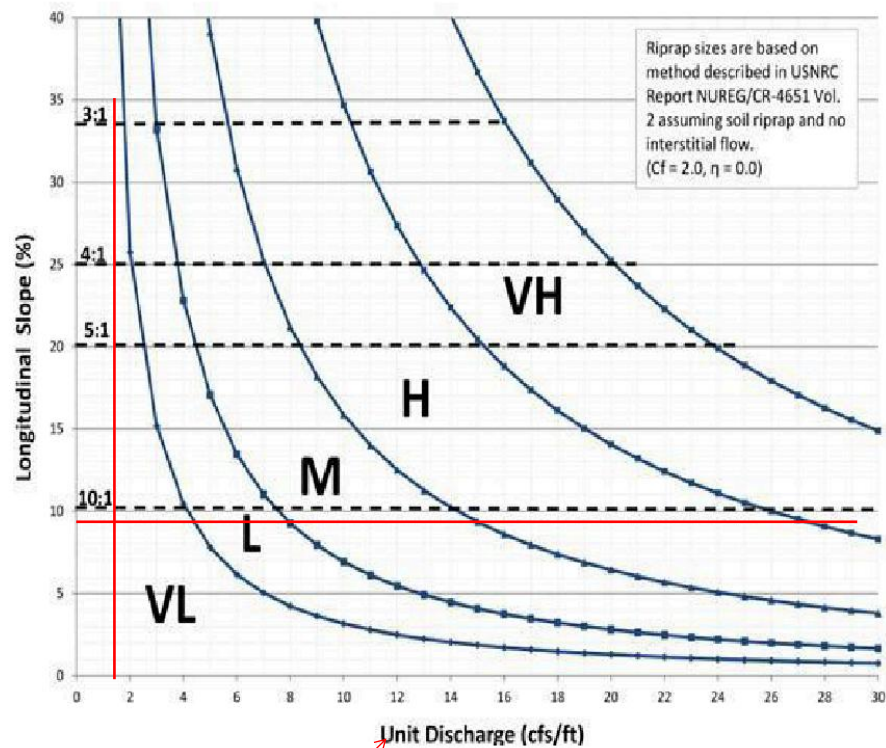


Figure 13-12d. Riprap Types for Emergency Spillway Protection



Emergency spillway designed using 100-year Peak Inflow to the Detention Pond (UD-Detention Spreadsheet)

$$34.2 \text{ cfs} / 49.84 = 0.69 \text{ cfs/ft}$$

May 2014

City of Colorado Springs
Drainage Criteria Manual, Volume 1

13-35

Outfall Protection Rip-Rap Calculation

Rip Rap Downstream of Stilling Basin

Applicable Equations:

$L_p = (1/2 \tan \theta)(A_t/Y_t - D)$	Equation 9-11 per USDCM
$A_t = Q/V$	Equation 9-12 per USDCM
$\theta = \tan^{-1}(1/(2 * \text{ExpansionFactor}))$	Equation 9-13 per USDCM
$W = 2(L_p \tan \theta) + D$	Equation 9-14 per USDCM
$T = 2D_{50}$	Equation 9-15 per USDCM

Assumptions

Maximum Major Event Velocity is 5fps for FES outletting into trickle channels

Input parameters:

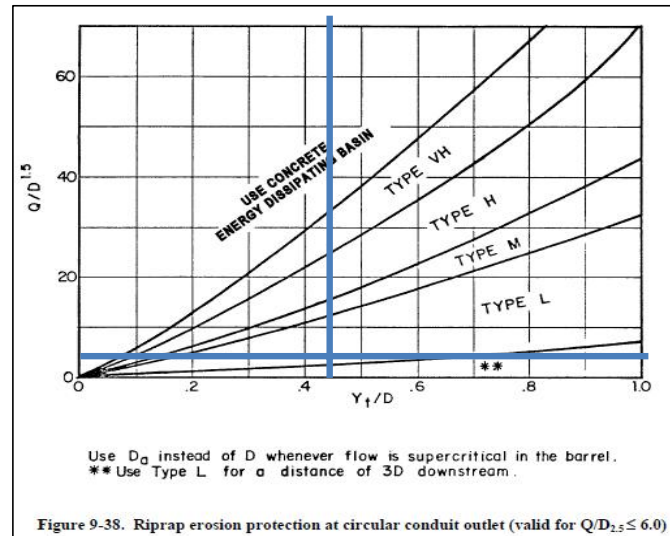
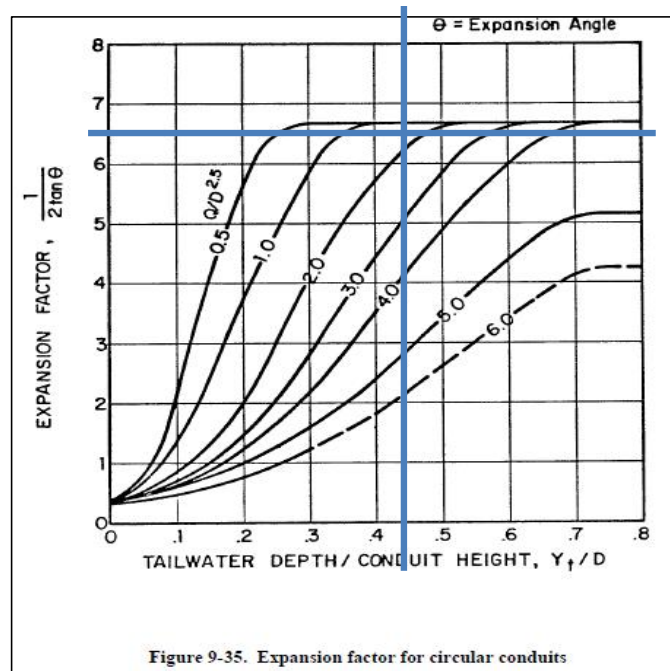
Description	Variable	Input	Unit
Width of the conduit (use diameter for circular conduits),	D:	1.50	ft
HGL Elevation		5823.64	ft
Invert Elevation		5823.00	ft
Tailwater depth (ft),	Y_t :	0.64	ft
Expansion angle of the culvert flow	θ :	0.08	radians
Design discharge (cfs) (100-YR Peak Outflow UD Det.)	Q:	6.80	cfs
Froude Number	F_r	0.85	Subcritical
Unitless Variables for Tables:			
	For Figure 9-35 $Q/D^{2.5}$	2.47	
	For Figure 9-35 Y_t/D	0.43	
	For Figure 9-38 $Q/D^{1.5}$	3.70	
	For Figure 9-38 Y_t/D	0.43	
Allowable non-eroding velocity in the downstream channel (ft/sec)	V:	5	ft/sec
Expansion Factor (Figure 9-35), $1/(2 \tan \theta)$		6.5	

Solve for:

Description	Variable	Output	Unit
1. Required area of flow at allowable velocity (ft ²)	A_t :	1.36	ft ²
2. Length of Protection	L_p :	4.06	ft
	$L_p < 3D$?	Yes	
	L_{pmin} :	4.50	ft
3. Width of downstream riprap protection	W:	2.19	ft
4. Rip Rap Type (Figure 9-38)	-	L	
5. Rip Rap Size (Figure 8-34)	D_{50} :	9	inches

Rip Rap Summary

Length	L_p	5.00	ft
Width	W	2.19	ft
Size	D_{50}	9	inches
Type	-	L	-
Thickness	T	18	inches



RIPRAP DESIGNATION	% SMALLER THAN GIVEN SIZE BY WEIGHT	INTERMEDIATE ROCK DIMENSION (INCHES)	D_{50} * (INCHES)
TYPE VL	70 - 100 50 - 70 35 - 50 2 - 10	12 9 6 2	6
TYPE L	70 - 100 50 - 70 35 - 50 2 - 10	15 12 9 3	9
TYPE M	70 - 100 50 - 70 35 - 50 2 - 10	21 18 12 4	12
TYPE H	70 - 100 50 - 70 35 - 50 2 - 10	30 24 18 6	18

* D_{50} = MEAN ROCK SIZE

Figure 8-34. Riprap and soil riprap placement and gradation (part 1 of 3)

Worksheet for Swale 07

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.030
Channel Slope	0.010 ft/ft
Left Side Slope	6.200 H:V
Right Side Slope	18.800 H:V
Discharge	1.39 cfs
Results	
Normal Depth	3.5 in
Flow Area	1.0 ft ²
Wetted Perimeter	7.2 ft
Hydraulic Radius	1.7 in
Top Width	7.19 ft
Critical Depth	2.9 in
Critical Slope	0.027 ft/ft
Velocity	1.34 ft/s
Velocity Head	0.03 ft
Specific Energy	0.32 ft
Froude Number	0.624
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	3.5 in
Critical Depth	2.9 in
Channel Slope	0.010 ft/ft
Critical Slope	0.027 ft/ft

Worksheet for Swale 11

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Roughness Coefficient	0.030
Channel Slope	0.009 ft/ft
Left Side Slope	72.500 H:V
Right Side Slope	2.870 H:V
Discharge	1.09 cfs
Results	
Normal Depth	2.1 in
Flow Area	1.2 ft ²
Wetted Perimeter	13.2 ft
Hydraulic Radius	1.0 in
Top Width	13.22 ft
Critical Depth	1.7 in
Critical Slope	0.032 ft/ft
Velocity	0.94 ft/s
Velocity Head	0.01 ft
Specific Energy	0.19 ft
Froude Number	0.560
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	2.1 in
Critical Depth	1.7 in
Channel Slope	0.009 ft/ft
Critical Slope	0.032 ft/ft

Worksheet for Swale 19

Project Description	
Friction Method	Manning
Solve For	Formula Normal Depth
Input Data	
Roughness Coefficient	0.030
Channel Slope	0.020 ft/ft
Left Side Slope	10.590 H:V
Right Side Slope	3.000 H:V
Discharge	1.35 cfs
Results	
Normal Depth	3.8 in
Flow Area	0.7 ft ²
Wetted Perimeter	4.3 ft
Hydraulic Radius	1.9 in
Top Width	4.27 ft
Critical Depth	3.6 in
Critical Slope	0.025 ft/ft
Velocity	2.02 ft/s
Velocity Head	0.06 ft
Specific Energy	0.38 ft
Froude Number	0.898
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	3.8 in
Critical Depth	3.6 in
Channel Slope	0.020 ft/ft
Critical Slope	0.025 ft/ft

Worksheet for Swale 31

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.030
Channel Slope	0.024 ft/ft
Left Side Slope	6.260 H:V
Right Side Slope	14.500 H:V
Discharge	1.28 cfs
Results	
Normal Depth	3.0 in
Flow Area	0.7 ft ²
Wetted Perimeter	5.3 ft
Hydraulic Radius	1.5 in
Top Width	5.26 ft
Critical Depth	3.0 in
Critical Slope	0.026 ft/ft
Velocity	1.92 ft/s
Velocity Head	0.06 ft
Specific Energy	0.31 ft
Froude Number	0.951
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	3.0 in
Critical Depth	3.0 in
Channel Slope	0.024 ft/ft
Critical Slope	0.026 ft/ft

Worksheet for Swale 39

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Roughness Coefficient	0.030
Channel Slope	0.010 ft/ft
Left Side Slope	8.200 H:V
Right Side Slope	3.600 H:V
Discharge	0.93 cfs
Results	
Normal Depth	3.9 in
Flow Area	0.6 ft ²
Wetted Perimeter	3.9 ft
Hydraulic Radius	1.9 in
Top Width	3.87 ft
Critical Depth	3.3 in
Critical Slope	0.026 ft/ft
Velocity	1.47 ft/s
Velocity Head	0.03 ft
Specific Energy	0.36 ft
Froude Number	0.639
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	3.9 in
Critical Depth	3.3 in
Channel Slope	0.010 ft/ft
Critical Slope	0.026 ft/ft

Worksheet for Swale 40

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.030
Channel Slope	0.017 ft/ft
Left Side Slope	6.600 H:V
Right Side Slope	3.800 H:V
Discharge	1.12 cfs
Results	
Normal Depth	4.0 in
Flow Area	0.6 ft ²
Wetted Perimeter	3.6 ft
Hydraulic Radius	2.0 in
Top Width	3.49 ft
Critical Depth	3.7 in
Critical Slope	0.025 ft/ft
Velocity	1.91 ft/s
Velocity Head	0.06 ft
Specific Energy	0.39 ft
Froude Number	0.823
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	4.0 in
Critical Depth	3.7 in
Channel Slope	0.017 ft/ft
Critical Slope	0.025 ft/ft

INLET MANAGEMENT

Worksheet Protected

INLET NAME	15-ft Inlet (Typ)	10-ft Inlet (Typ)	5-ft Inlet (Typ)
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows			
Minor Q_{known} (cfs)	2.0	1.8	1.3
Major Q_{known} (cfs)	3.7	2.5	1.5
Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.			
Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Watershed Characteristics			
Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			
Watershed Profile			
Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			
Minor Storm Rainfall Input			
Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			
Major Storm Rainfall Input			
Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

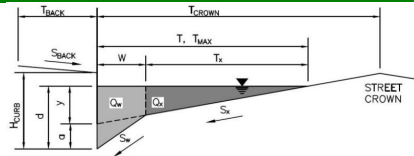
Minor Total Design Peak Flow, Q (cfs)	2.0	1.8	1.3
Major Total Design Peak Flow, Q (cfs)	3.7	2.5	1.5
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A

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

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

Project: Venetucci MF

Inlet ID: 15-ft Inlet (Typ)

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 0.0$ ft
 $S_{BACK} = 0.000$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 116.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	9.0	18.0	ft
$d_{MAX} =$	6.0	6.0	inches

☐ ☐

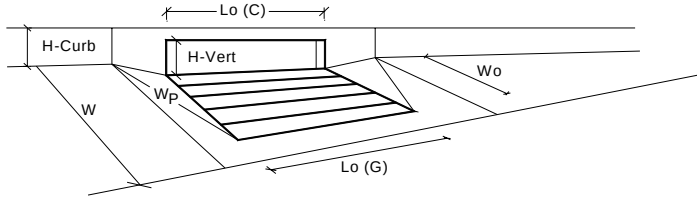
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



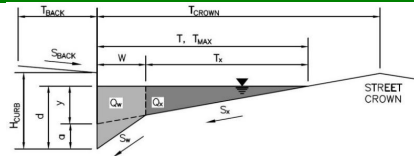
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.7	5.8	inches
<u>Grate Information</u>			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		$L_o (G)$ =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_1 (G)$ =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w (G)$ =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o (G)$ =	N/A	N/A	
<u>Curb Opening Information</u>			MINOR	MAJOR	
Length of a Unit Curb Opening		$L_o (C)$ =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_1 (C)$ =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w (C)$ =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o (C)$ =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>			MINOR	MAJOR	
Depth for Grate Midwidth		d_{grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{curb} =	0.14	0.32	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{curb} =	0.61	0.78	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q_{in} =	2.0	9.0	cfs
		$Q_{PEAK REQUIRED}$ =	2.0	3.7	cfs

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

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

Project: Venetucci MF

Inlet ID: 10-ft Inlet (Typ)

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 0.0$ ft
 $S_{BACK} = 0.000$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 116.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	9.0	18.0	ft
$d_{MAX} =$	6.0	6.0	inches

☐ ☐

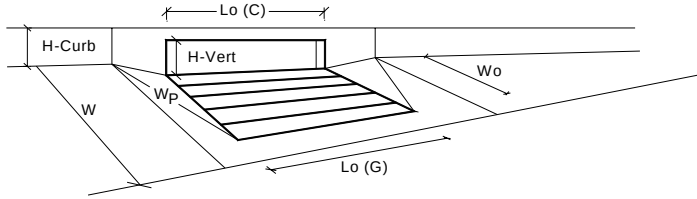
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



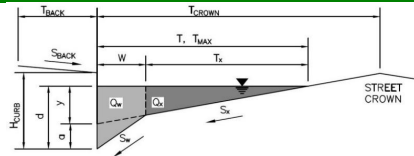
Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		a _{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.7	5.8	inches
<u>Grate Information</u>		MINOR		MAJOR	
Length of a Unit Grate		L _o (G) =	N/A	N/A	feet
Width of a Unit Grate		W _o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C ₁ (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C _w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C _o (G) =	N/A	N/A	
<u>Curb Opening Information</u>		MINOR		MAJOR	
Length of a Unit Curb Opening		L _o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches		H _{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H _{throat} =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W _p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C ₁ (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C _w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C _o (C) =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>		MINOR		MAJOR	
Depth for Grate Midwidth		d _{grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d _{curb} =	0.14	0.32	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF _{grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF _{curb} =	0.76	0.92	
Combination Inlet Performance Reduction Factor for Long Inlets		RF _{combination} =	N/A	N/A	
		MINOR		MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q _{in} =	1.8	7.7	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q _{PEAK REQUIRED} =	1.8	2.5	cfs

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

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

Project: Venetucci MF

Inlet ID: 5-ft Inlet (Typ)

**Gutter Geometry:**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

T_{BACK}	=	0.0	ft
S_{BACK}	=	0.000	ft/ft
n_{BACK}	=	0.020	

H_{CURB}	=	6.00	inches
T_{CROWN}	=	116.0	ft
W	=	2.00	ft
S_x	=	0.020	ft/ft
S_w	=	0.083	ft/ft
S_o	=	0.000	ft/ft
n_{STREET}	=	0.016	

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
T_{MAX}	9.0	18.0	ft
d_{MAX}	6.0	6.0	inches

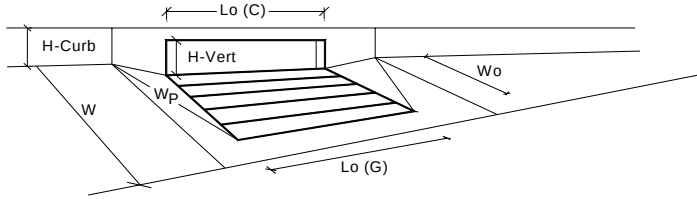
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow}	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

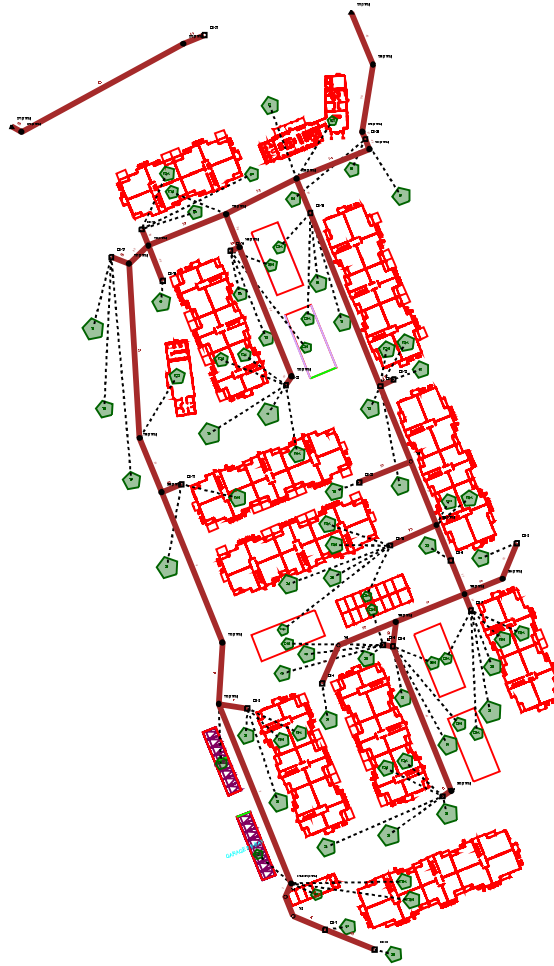


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	1	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	3.7	5.8	inches
<u>Grate Information</u>			MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate		$L_o (G)$ =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		$C_1 (G)$ =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		$C_w (G)$ =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		$C_o (G)$ =	N/A	N/A	
<u>Curb Opening Information</u>			MINOR	MAJOR	
Length of a Unit Curb Opening		$L_o (C)$ =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		$C_1 (C)$ =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		$C_w (C)$ =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		$C_o (C)$ =	0.67	0.67	
<u>Low Head Performance Reduction (Calculated)</u>			MINOR	MAJOR	
Depth for Grate Midwidth		d_{grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{curb} =	0.14	0.32	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{curb} =	1.00	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{combination}$ =	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		Q_{in} =	1.5	5.0	cfs
		$Q_{PEAK REQUIRED}$ =	1.3	1.5	cfs

Worksheet for Typical Curb Cut

Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.013
Channel Slope	0.010 ft/ft
Normal Depth	5.0 in
Bottom Width	2.00 ft
Results	
Discharge	4.21 cfs
Flow Area	0.8 ft ²
Wetted Perimeter	2.8 ft
Hydraulic Radius	3.5 in
Top Width	2.00 ft
Critical Depth	6.2 in
Critical Slope	0.005 ft/ft
Velocity	5.06 ft/s
Velocity Head	0.40 ft
Specific Energy	0.81 ft
Froude Number	1.381
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	5.0 in
Critical Depth	6.2 in
Channel Slope	0.010 ft/ft
Critical Slope	0.005 ft/ft

Scenario: Base



Venture on Venetucci

5-YEAR

Conduit Table - Time: 0.00 hours

Label	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculate d) (ft/ft)	Diameter (in)	Material	Manning's n	Flow (cfs)	Velocity (ft/s)	Hydrauli c Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
1	5,889.62	5,889.26	29.5	0.012	10.0	HDPE Pressure Pipe	0.010	0.40	3.96	5,889.89	5,889.53
2	5,889.26	5,889.00	20.8	0.013	10.0	HDPE Pressure Pipe	0.010	0.40	3.99	5,889.53	5,889.20
3	5,888.70	5,884.58	274.7	0.015	10.0	HDPE Pressure Pipe	0.010	0.80	5.20	5,889.10	5,884.85
4	5,890.19	5,889.62	48.9	0.012	10.0	HDPE Pressure Pipe	0.010	0.40	3.90	5,890.47	5,889.89
5	5,884.12	5,883.13	87.2	0.011	15.0	HDPE Pressure Pipe	0.010	2.25	6.07	5,884.72	5,883.56
6	5,881.43	5,878.68	230.0	0.012	15.0	HDPE Pressure Pipe	0.010	2.23	6.18	5,882.03	5,879.09
7	5,886.04	5,885.62	41.3	0.010	12.0	HDPE Pressure Pipe	0.010	1.82	5.55	5,886.61	5,886.07
8	5,887.67	5,887.47	14.7	0.014	15.0	HDPE Pressure Pipe	0.010	1.98	6.23	5,888.23	5,887.90
9	5,883.78	5,883.49	14.1	0.021	10.0	HDPE Pressure Pipe	0.010	1.67	7.15	5,884.36	5,883.90
10	5,882.49	5,882.07	34.9	0.012	15.0	HDPE Pressure Pipe	0.010	5.60	7.87	5,883.44	5,882.82
11	5,881.07	5,880.02	105.0	0.010	15.0	HDPE Pressure Pipe	0.010	4.49	6.96	5,881.92	5,880.67
12	5,883.82	5,882.07	87.9	0.020	10.0	HDPE Pressure Pipe	0.010	0.09	3.07	5,883.95	5,882.23
13	5,879.98	5,878.54	72.0	0.020	12.0	HDPE Pressure Pipe	0.010	2.16	7.48	5,880.61	5,878.94
14	5,881.35	5,880.80	24.6	0.022	15.0	HDPE Pressure Pipe	0.010	1.96	7.43	5,881.90	5,881.16
15	5,876.98	5,875.98	82.9	0.012	15.0	HDPE Pressure Pipe	0.010	3.12	6.77	5,877.69	5,876.48
16	5,879.13	5,878.68	30.2	0.015	12.0	HDPE Pressure Pipe	0.010	1.28	5.83	5,879.61	5,879.01
17	5,879.60	5,879.09	51.5	0.010	24.0	HDPE Pressure Pipe	0.010	6.72	7.59	5,880.52	5,879.77
18	5,879.90	5,880.57	58.2	-0.012	15.0	HDPE Pressure Pipe	0.010	0.95	4.77	5,880.96	5,880.87
19	5,878.09	5,877.54	54.5	0.010	24.0	HDPE Pressure Pipe	0.010	6.99	7.70	5,879.03	5,878.24
20	5,877.05	5,876.07	97.2	0.010	24.0	HDPE Pressure Pipe	0.010	8.82	8.22	5,878.11	5,877.43
21	5,874.38	5,873.14	247.9	0.005	15.0	HDPE Pressure Pipe	0.010	3.12	4.90	5,875.09	5,873.78
22	5,880.87	5,881.51	54.5	-0.012	10.0	HDPE Pressure Pipe	0.010	0.96	4.97	5,881.94	5,881.19
23	5,885.01	5,883.82	59.2	0.020	10.0	HDPE Pressure Pipe	0.010	0.10	3.08	5,885.14	5,883.91
24	5,873.34	5,871.37	197.5	0.010	15.0	HDPE Pressure Pipe	0.010	1.88	5.51	5,873.89	5,871.77
25	5,873.92	5,871.27	264.7	0.010	24.0	HDPE Pressure Pipe	0.010	10.31	8.54	5,875.07	5,872.09
26	5,876.07	5,874.92	115.3	0.010	24.0	HDPE Pressure Pipe	0.010	8.85	8.19	5,877.13	5,875.68
27	5,876.45	5,875.42	20.7	0.050	10.0	HDPE Pressure Pipe	0.010	0.13	4.60	5,876.60	5,875.50

Venture on Venetucci

5-YEAR

Conduit Table - Time: 0.00 hours

Label	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculate d) (ft/ft)	Diameter (in)	Material	Manning's n	Flow (cfs)	Velocity (ft/s)	Hydrauli c Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
28	5,871.51	5,871.37	13.9	0.010	15.0	HDPE Pressure Pipe	0.010	1.77	5.43	5,872.03	5,871.79
29	5,869.87	5,869.36	50.8	0.010	15.0	HDPE Pressure Pipe	0.010	3.57	6.56	5,870.63	5,869.94
30	5,870.27	5,869.75	52.6	0.010	24.0	HDPE Pressure Pipe	0.010	11.47	8.71	5,871.48	5,870.69
31	5,869.95	5,869.36	118.8	0.005	24.0	HDPE Pressure Pipe	0.010	5.57	5.61	5,870.79	5,870.07
32	5,867.86	5,867.30	111.8	0.005	30.0	HDPE Pressure Pipe	0.010	8.14	6.13	5,868.81	5,868.95
33	5,878.23	5,876.65	79.1	0.020	12.0	HDPE Pressure Pipe	0.010	0.09	2.92	5,878.35	5,877.43
34	5,867.00	5,866.44	111.3	0.005	30.0	HDPE Pressure Pipe	0.010	19.81	7.77	5,868.51	5,867.75
35	5,871.64	5,871.45	37.7	0.005	24.0	HDPE Pressure Pipe	0.010	4.48	5.27	5,872.39	5,872.10
36	5,873.54	5,873.14	26.8	0.015	12.0	HDPE Pressure Pipe	0.010	1.98	6.57	5,874.14	5,873.57
37	5,858.94	5,858.89	11.2	0.005	30.0	HDPE Pressure Pipe	0.010	20.65	7.86	5,860.49	5,860.32
38	5,854.89	5,854.40	96.6	0.005	30.0	HDPE Pressure Pipe	0.010	20.63	7.85	5,856.43	5,855.74
39	5,871.70	5,871.45	24.8	0.010	12.0	HDPE Pressure Pipe	0.010	1.49	5.26	5,872.22	5,871.86
40	5,872.27	5,871.45	54.3	0.015	10.0	HDPE Pressure Pipe	0.010	0.08	2.63	5,872.39	5,871.54
41	5,862.44	5,862.36	15.4	0.005	30.0	HDPE Pressure Pipe	0.010	19.68	7.77	5,863.95	5,863.75
42	5,850.40	5,850.00	80.5	0.005	36.0	HDPE Pressure Pipe	0.010	20.51	7.81	5,851.86	5,851.67
43	5,840.52	5,827.77	261.6	0.049	18.0	HDPE Pressure Pipe	0.010	0.00	0.00	5,840.53	5,827.78
44	5,845.48	5,844.52	32.0	0.030	18.0	HDPE Pressure Pipe	0.010	0.00	0.00	5,845.49	5,844.53
45	5,823.77	5,823.00	15.7	0.049	18.0	HDPE Pressure Pipe	0.010	0.00	0.00	5,823.78	5,823.01
46	5,886.47	5,883.49	0.0	0.014	15.0		0.013	1.97	5.16	5,887.03	5,883.92
47	5,876.09	5,875.34	0.0	0.051	12.0	HDPE Pressure Pipe	0.010	1.88	10.06	5,876.67	5,875.68
48	5,891.17	5,890.29	0.0	0.012	10.0	HDPE Pressure Pipe	0.010	0.06	2.19	5,891.27	5,890.52

Venture on Venetucci

5-YEAR

Catch Basin Table - Time: 0.00 hours

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Hydraulic Grade Line (In) (ft)	Flow (Additional Subsurface) (cfs)	Inlet Location	Headloss (ft)
CB-1	5,896.74	5,896.74	5,890.19	5,890.52	0.00	In Sag	0.05
CB-2	5,893.87	5,893.87	5,887.67	5,888.34	0.00	In Sag	0.11
CB-3	5,893.41	5,893.41	5,886.04	5,886.73	0.00	In Sag	0.12
CB-4	5,888.29	5,888.29	5,885.01	5,885.16	0.00	In Sag	0.02
CB-5	5,889.87	5,889.87	5,883.77	5,884.49	0.00	In Sag	0.13
CB-6	5,889.77	5,889.77	5,882.49	5,883.83	0.00	In Sag	0.38
CB-7	5,888.95	5,888.95	5,881.35	5,882.01	0.00	In Sag	0.11
CB-8	5,884.35	5,884.35	5,881.51	5,882.03	0.00	In Sag	0.09
CB-9	5,887.01	5,887.01	5,878.09	5,879.21	0.00	In Sag	0.18
CB-10	5,889.01	5,889.01	5,879.98	5,880.74	0.00	In Sag	0.13
CB-11	5,887.95	5,887.95	5,879.13	5,879.70	0.00	In Sag	0.09
CB-12	5,879.78	5,879.78	5,876.45	5,876.63	0.00	In Sag	0.03
CB-13	5,883.71	5,883.71	5,873.92	5,875.40	0.00	In Sag	0.33
CB-14	5,880.10	5,880.10	5,871.51	5,872.19	0.00	In Sag	0.16
CB-16	5,879.49	5,879.49	5,872.27	5,872.41	0.00	In Sag	0.02
CB-17	5,877.96	5,877.96	5,873.54	5,874.27	0.00	In Sag	0.13
CB-18	5,877.20	5,877.20	5,871.70	5,872.32	0.00	In Sag	0.10
CB-19	5,879.30	5,879.30	5,870.27	5,871.74	0.00	In Sag	0.26
CB-20	5,877.26	5,877.26	5,858.94	5,860.81	0.00	In Sag	0.33
CB-21	5,851.46	5,851.46	5,845.48	5,845.49	0.20	In Sag	0.00
CB-22	5,884.24	5,884.24	5,878.23	5,878.38	0.00	In Sag	0.02
CB-23	5,884.23	5,884.23	5,876.09	5,876.79	0.00	In Sag	0.12
CB-24	5,894.68	5,894.68	5,891.17	5,891.27	0.00	In Sag	0.00

Venture on Venetucci

5-YEAR

Outfall Table - Time: 0.00 hours

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
121 (STRM)	5,850.25	5,850.00	User Defined Tailwater	5,851.67	5,851.67	20.42
371 (STRM)	5,823.00	5,823.00	Free Outfall	0.00	5,823.01	0.00

Venture on Venetucci

5-YEAR

Manhole Table - Time: 0.00 hours

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)
STMH-01 (STRM)	5,897.94	5,897.94	5,888.70	0.80	0.40	5,889.10	5,889.19
113 (STRM)	5,894.81	5,894.81	5,881.43	2.23	0.60	5,882.03	5,882.17
112 (STRM)	5,894.25	5,894.25	5,884.12	2.25	0.60	5,884.72	5,884.91
308 (STRM)	5,893.80	5,893.80	5,886.47	1.97	0.56	5,887.03	5,887.20
156 (STRM)	5,889.59	5,889.59	5,881.07	4.49	0.86	5,881.92	5,882.23
356 (STRM)	5,888.37	5,888.37	5,876.98	3.12	0.71	5,877.69	5,877.89
155 (STRM)	5,888.02	5,888.02	5,879.60	6.72	0.92	5,880.52	5,880.87
350 (STRM)	5,887.46	5,887.46	5,877.04	8.82	1.07	5,878.11	5,878.41
116 (STRM)	5,886.53	5,886.53	5,874.38	3.12	0.71	5,875.09	5,875.27
364 (STRM)	5,886.31	5,886.31	5,880.57	0.95	0.38	5,880.96	5,881.04
123 (STRM)	5,883.83	5,883.83	5,873.34	1.88	0.54	5,873.89	5,874.01
149 (STRM)	5,879.80	5,879.80	5,869.87	3.57	0.76	5,870.63	5,870.85
119 (STRM)	5,879.21	5,879.21	5,867.86	8.14	0.95	5,868.81	5,869.06
120 (STRM)	5,878.99	5,878.99	5,867.00	19.81	1.51	5,868.51	5,868.95
117 (STRM)	5,878.35	5,878.35	5,871.64	4.48	0.74	5,872.39	5,872.60
370 (STRM)	5,877.74	5,877.74	5,854.89	20.63	1.54	5,856.43	5,856.82
118 (STRM)	5,877.57	5,877.57	5,869.95	5.57	0.83	5,870.79	5,871.10
134 (STRM)	5,876.98	5,876.98	5,862.44	19.68	1.51	5,863.95	5,864.45
135 (STRM)	5,861.66	5,861.66	5,850.40	20.51	1.45	5,851.86	5,852.20
373 (STRM)	5,852.35	5,852.35	5,840.52	0.00	0.00	5,840.53	5,840.53
372 (STRM)	5,828.33	5,828.33	5,823.77	0.00	0.00	5,823.78	5,823.78

Venture on Venetucci

5-YEAR

Catchment Table - Time: 0.00 hours

Label	Outflow Element	Area (User Defined) (acres)	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)
02	120 (STRM)	0.230	0.740	7.800	0.77
03	CB-20	0.300	0.680	7.200	0.95
04	CB-20	0.070	0.730	5.000	0.27
05	CB-18	0.030	0.810	5.000	0.13
06	CB-18	0.340	0.730	5.000	1.29
07	CB-20	0.250	0.090	7.600	0.10
08	CB-19	0.190	0.730	5.000	0.72
09	CB-14	0.140	0.770	5.000	0.56
10	CB-17	0.310	0.780	5.600	1.22
11	CB-12	0.370	0.080	9.600	0.13
12	CB-19	0.210	0.750	5.000	0.82
13	CB-14	0.230	0.810	5.700	0.93
14	CB-23	0.260	0.720	5.000	0.98
15	CB-23	0.150	0.780	5.000	0.61
16	CB-17	0.130	0.880	5.000	0.60
17	CB-17	0.040	0.900	5.000	0.19
18	CB-13	0.340	0.700	6.200	1.16
19	CB-22	0.280	0.080	11.500	0.09
20	CB-11	0.290	0.770	5.000	1.16
21	CB-13	0.110	0.790	5.000	0.45
22	CB-9	0.110	0.700	5.000	0.40
23	CB-10	0.180	0.740	5.900	0.66
24	CB-10	0.250	0.770	5.000	1.00
25	CB-8	0.270	0.680	5.000	0.96
26	CB-5	0.100	0.720	5.000	0.38
27	CB-5	0.160	0.760	5.300	0.62
28	CB-7	0.200	0.750	5.000	0.78
29	CB-6	0.220	0.720	6.000	0.78
30	CB-3	0.210	0.750	5.000	0.82

Venture on Venetucci

5-YEAR

Catchment Table - Time: 0.00 hours

Label	Outflow Element	Area (User Defined) (acres)	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)
31	CB-4	0.300	0.080	11.300	0.10
32	CB-3	0.200	0.790	5.000	0.82
33	CB-7	0.210	0.800	6.400	0.81
34	CB-6	0.290	0.730	5.700	1.06
35	CB-2	0.170	0.660	5.000	0.58
36	CB-2	0.210	0.780	5.000	0.85
37	CB-2	0.100	0.700	5.000	0.36
38	CB-1	0.230	0.380	10.700	0.35
39	CB-24	0.140	0.080	5.000	0.06
40	CB-16	0.210	0.080	7.000	0.08
41	CB-5	0.100	0.670	5.000	0.35
G1	112 (STRM)	0.040	0.730	5.000	0.15
G2-A	CB-19	0.040	0.730	5.000	0.15
G2-B	CB-14	0.040	0.730	5.000	0.15
G3-A	CB-19	0.040	0.730	5.000	0.15
G3-B	CB-14	0.040	0.730	5.000	0.15
G4-A	CB-10	0.040	0.730	5.000	0.15
G4-B	CB-5	0.040	0.730	5.000	0.15
G5-A	CB-10	0.050	0.730	5.000	0.19
G5-B	CB-5	0.050	0.730	5.000	0.19
G6-A	CB-7	0.040	0.730	5.000	0.15
G6-B	CB-6	0.040	0.730	5.000	0.15
G7-A	CB-7	0.040	0.730	5.000	0.15
G7-B	CB-6	0.040	0.730	5.000	0.15
G8	STMH-01 (STRM)	0.040	0.730	5.000	0.15
G9	STMH-01 (STRM)	0.030	0.730	5.000	0.11
R1-A	CB-18	0.120	0.120	5.000	0.08

Venture on Venetucci

5-YEAR

Catchment Table - Time: 0.00 hours

Label	Outflow Element	Area (User Defined) (acres)	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)
R1-B	119 (STRM)	0.120	0.120	5.000	0.08
R2-A	CB-23	0.130	0.130	5.000	0.09
R2-B	CB-23	0.130	0.130	5.000	0.09
R3-A	CB-13	0.160	0.160	5.000	0.13
R3-B	CB-13	0.160	0.160	5.000	0.13
R4-A	CB-23	0.150	0.150	5.000	0.12
R4-B	CB-11	0.150	0.150	5.000	0.12
R5-A	350 (STRM)	0.160	0.160	5.000	0.13
R5-B	350 (STRM)	0.160	0.160	5.000	0.13
R6-A	CB-10	0.150	0.150	5.000	0.12
R6-B	CB-10	0.150	0.150	5.000	0.12
R7-A	CB-3	0.130	0.130	5.000	0.09
R7-B	CB-3	0.130	0.130	5.000	0.09
R8-A	CB-2	0.130	0.130	5.000	0.09
R8-B	CB-2	0.130	0.130	5.000	0.09
R9-A	CB-7	0.120	0.120	5.000	0.08
R9-B	CB-7	0.120	0.120	5.000	0.08
R10-A	STMH-01 (STRM)	0.160	0.160	5.000	0.13
R10-B	STMH-01 (STRM)	0.160	0.160	5.000	0.13
R11	120 (STRM)	0.120	0.120	5.000	0.08
R12	116 (STRM)	0.070	0.070	5.000	0.03

Venture on Venetucci
100-YEAR
Conduit Table - Time: 0.00 hours

Label	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculate d) (ft/ft)	Diameter (in)	Material	Manning's n	Flow (cfs)	Velocity (ft/s)	Hydrauli c Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
1	5,889.62	5,889.26	29.5	0.012	10.0	HDPE Pressure Pipe	0.010	1.22	5.43	5,890.11	5,889.80
2	5,889.26	5,889.00	20.8	0.013	10.0	HDPE Pressure Pipe	0.010	1.22	5.45	5,889.80	5,889.85
3	5,888.70	5,884.58	274.7	0.015	10.0	HDPE Pressure Pipe	0.010	3.35	7.28	5,889.48	5,885.71
4	5,890.19	5,889.62	48.9	0.012	10.0	HDPE Pressure Pipe	0.010	1.23	5.34	5,890.69	5,890.11
5	5,884.12	5,883.13	87.2	0.011	15.0	HDPE Pressure Pipe	0.010	7.22	8.12	5,885.20	5,884.00
6	5,881.43	5,878.68	230.0	0.012	15.0	HDPE Pressure Pipe	0.010	7.18	8.29	5,882.50	5,880.02
7	5,886.04	5,885.62	41.3	0.010	12.0	HDPE Pressure Pipe	0.010	4.94	6.63	5,886.95	5,886.53
8	5,887.67	5,887.47	14.7	0.014	15.0	HDPE Pressure Pipe	0.010	5.31	8.12	5,888.60	5,888.23
9	5,883.78	5,883.49	14.1	0.021	10.0	HDPE Pressure Pipe	0.010	3.19	5.85	5,886.31	5,886.13
10	5,882.49	5,882.07	34.9	0.012	15.0	HDPE Pressure Pipe	0.010	12.17	9.92	5,884.91	5,884.18
11	5,881.07	5,880.02	105.0	0.010	15.0	HDPE Pressure Pipe	0.010	10.36	8.44	5,883.29	5,881.69
12	5,883.82	5,882.07	87.9	0.020	10.0	HDPE Pressure Pipe	0.010	0.70	5.54	5,884.19	5,884.18
13	5,879.98	5,878.54	72.0	0.020	12.0	HDPE Pressure Pipe	0.010	5.68	9.39	5,880.92	5,879.57
14	5,881.35	5,880.80	24.6	0.022	15.0	HDPE Pressure Pipe	0.010	4.99	9.62	5,882.25	5,881.43
15	5,876.98	5,875.98	82.9	0.012	15.0	HDPE Pressure Pipe	0.010	9.47	7.72	5,879.37	5,878.32
16	5,879.13	5,878.68	30.2	0.015	12.0	HDPE Pressure Pipe	0.010	3.24	4.13	5,880.17	5,880.02
17	5,879.60	5,879.09	51.5	0.010	24.0	HDPE Pressure Pipe	0.010	15.71	9.52	5,881.03	5,880.21
18	5,879.90	5,880.57	58.2	-0.012	15.0	HDPE Pressure Pipe	0.010	1.87	5.81	5,881.72	5,881.69
19	5,878.09	5,877.54	54.5	0.010	24.0	HDPE Pressure Pipe	0.010	16.24	9.63	5,879.54	5,879.57
20	5,877.05	5,876.07	97.2	0.010	24.0	HDPE Pressure Pipe	0.010	22.31	10.34	5,879.02	5,878.47
21	5,874.38	5,873.14	247.9	0.005	15.0	HDPE Pressure Pipe	0.010	9.78	7.97	5,877.73	5,874.32
22	5,880.87	5,881.51	54.5	-0.012	10.0	HDPE Pressure Pipe	0.010	1.89	5.91	5,882.12	5,881.74
23	5,885.01	5,883.82	59.2	0.020	10.0	HDPE Pressure Pipe	0.010	0.70	5.54	5,885.37	5,884.06
24	5,873.34	5,871.37	197.5	0.010	15.0	HDPE Pressure Pipe	0.010	5.93	7.41	5,874.33	5,872.80
25	5,873.92	5,871.27	264.7	0.010	24.0	HDPE Pressure Pipe	0.010	27.59	10.64	5,875.74	5,872.81
26	5,876.07	5,874.92	115.3	0.010	24.0	HDPE Pressure Pipe	0.010	22.83	10.34	5,877.77	5,876.66
27	5,876.45	5,875.42	20.7	0.050	10.0	HDPE Pressure Pipe	0.010	0.92	8.30	5,876.88	5,876.66

Venture on Venetucci
100-YEAR
Conduit Table - Time: 0.00 hours

Label	Invert (Start) (ft)	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculate d) (ft/ft)	Diameter (in)	Material	Manning's n	Flow (cfs)	Velocity (ft/s)	Hydrauli c Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
28	5,871.51	5,871.37	13.9	0.010	15.0	HDPE Pressure Pipe	0.010	3.28	2.67	5,872.82	5,872.80
29	5,869.87	5,869.36	50.8	0.010	15.0	HDPE Pressure Pipe	0.010	8.95	7.29	5,872.23	5,871.65
30	5,870.27	5,869.75	52.6	0.010	24.0	HDPE Pressure Pipe	0.010	29.77	10.53	5,872.13	5,871.49
31	5,869.95	5,869.36	118.8	0.005	24.0	HDPE Pressure Pipe	0.010	15.34	4.88	5,871.97	5,871.65
32	5,867.86	5,867.30	111.8	0.005	30.0	HDPE Pressure Pipe	0.010	22.42	4.57	5,871.42	5,871.22
33	5,878.23	5,876.65	79.1	0.020	12.0	HDPE Pressure Pipe	0.010	0.65	5.32	5,878.57	5,878.47
34	5,867.00	5,866.44	111.3	0.005	30.0	HDPE Pressure Pipe	0.010	52.83	10.76	5,869.96	5,868.78
35	5,871.64	5,871.45	37.7	0.005	24.0	HDPE Pressure Pipe	0.010	12.35	6.90	5,872.90	5,872.59
36	5,873.54	5,873.14	26.8	0.015	12.0	HDPE Pressure Pipe	0.010	3.65	7.67	5,874.36	5,873.77
37	5,858.94	5,858.89	11.2	0.005	30.0	HDPE Pressure Pipe	0.010	54.88	11.18	5,861.44	5,861.24
38	5,854.89	5,854.40	96.6	0.005	30.0	HDPE Pressure Pipe	0.010	54.86	11.18	5,857.86	5,856.76
39	5,871.70	5,871.45	24.8	0.010	12.0	HDPE Pressure Pipe	0.010	3.55	6.50	5,872.51	5,872.34
40	5,872.27	5,871.45	54.3	0.015	10.0	HDPE Pressure Pipe	0.010	0.58	4.73	5,872.60	5,872.34
41	5,862.44	5,862.36	15.4	0.005	30.0	HDPE Pressure Pipe	0.010	52.56	10.71	5,864.94	5,864.69
42	5,850.40	5,850.00	80.5	0.005	36.0	HDPE Pressure Pipe	0.010	54.63	7.73	5,853.70	5,853.38
43	5,840.52	5,827.77	261.6	0.049	18.0	HDPE Pressure Pipe	0.010	6.80	13.78	5,841.53	5,828.25
44	5,845.48	5,844.52	32.0	0.030	18.0	HDPE Pressure Pipe	0.010	6.80	11.56	5,846.49	5,845.16
45	5,823.77	5,823.00	15.7	0.049	18.0	HDPE Pressure Pipe	0.010	6.80	13.81	5,824.78	5,823.64
46	5,886.47	5,883.49	0.0	0.014	15.0		0.013	5.30	6.63	5,887.56	5,886.13
47	5,876.09	5,875.34	0.0	0.051	12.0	HDPE Pressure Pipe	0.010	5.94	13.71	5,877.04	5,876.03
48	5,891.17	5,890.29	0.0	0.012	10.0	HDPE Pressure Pipe	0.010	0.43	3.97	5,891.46	5,890.79

Venture on Venetucci

100-YEAR

Catch Basin Table - Time: 0.00 hours

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Hydraulic Grade Line (In) (ft)	Flow (Additional Subsurface) (cfs)	Inlet Location	Headloss (ft)
CB-1	5,896.74	5,896.74	5,890.19	5,890.79	0.00	In Sag	0.10
CB-2	5,893.87	5,893.87	5,887.67	5,888.83	0.00	In Sag	0.23
CB-3	5,893.41	5,893.41	5,886.04	5,887.29	0.00	In Sag	0.34
CB-4	5,888.29	5,888.29	5,885.01	5,885.44	0.00	In Sag	0.07
CB-5	5,889.87	5,889.87	5,883.77	5,886.57	0.00	In Sag	0.27
CB-6	5,889.77	5,889.77	5,882.49	5,886.13	0.00	In Sag	1.22
CB-7	5,888.95	5,888.95	5,881.35	5,882.46	0.00	In Sag	0.21
CB-8	5,884.35	5,884.35	5,881.51	5,882.27	0.00	In Sag	0.15
CB-9	5,887.01	5,887.01	5,878.09	5,879.89	0.00	In Sag	0.34
CB-10	5,889.01	5,889.01	5,879.98	5,881.35	0.00	In Sag	0.42
CB-11	5,887.95	5,887.95	5,879.13	5,880.30	0.00	In Sag	0.13
CB-12	5,879.78	5,879.78	5,876.45	5,876.96	0.00	In Sag	0.08
CB-13	5,883.71	5,883.71	5,873.92	5,876.66	0.00	In Sag	0.92
CB-14	5,880.10	5,880.10	5,871.51	5,872.91	0.00	In Sag	0.09
CB-16	5,879.49	5,879.49	5,872.27	5,872.66	0.00	In Sag	0.06
CB-17	5,877.96	5,877.96	5,873.54	5,874.58	0.00	In Sag	0.22
CB-18	5,877.20	5,877.20	5,871.70	5,872.72	0.00	In Sag	0.21
CB-19	5,879.30	5,879.30	5,870.27	5,872.87	0.00	In Sag	0.74
CB-20	5,877.26	5,877.26	5,858.94	5,862.41	0.00	In Sag	0.97
CB-21	5,851.46	5,851.46	5,845.48	5,846.49	6.80	In Sag	0.00
CB-22	5,884.24	5,884.24	5,878.23	5,878.63	0.00	In Sag	0.06
CB-23	5,884.23	5,884.23	5,876.09	5,877.50	0.00	In Sag	0.46
CB-24	5,894.68	5,894.68	5,891.17	5,891.46	0.00	In Sag	0.00

Venture on Venetucci

100-YEAR

Outfall Table - Time: 0.00 hours

Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)
121 (STRM)	5,850.25	5,850.00	User Defined Tailwater	5,853.38	5,853.38	54.35
371 (STRM)	5,823.00	5,823.00	Free Outfall	0.00	5,823.64	6.80

Venture on Venetucci

100-YEAR

Manhole Table - Time: 0.00 hours

Label	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)
STMH-01 (STRM)	5,897.94	5,897.94	5,888.70	3.35	0.77	5,889.48	5,889.85
113 (STRM)	5,894.81	5,894.81	5,881.43	7.18	1.07	5,882.50	5,882.89
112 (STRM)	5,894.25	5,894.25	5,884.12	7.22	1.07	5,885.20	5,885.71
308 (STRM)	5,893.80	5,893.80	5,886.47	5.30	1.09	5,887.56	5,887.83
156 (STRM)	5,889.59	5,889.59	5,881.07	10.36	2.23	5,883.29	5,884.18
356 (STRM)	5,888.37	5,888.37	5,876.98	9.47	2.40	5,879.37	5,880.02
155 (STRM)	5,888.02	5,888.02	5,879.60	15.71	1.43	5,881.03	5,881.69
350 (STRM)	5,887.46	5,887.46	5,877.04	22.31	1.98	5,879.02	5,879.57
116 (STRM)	5,886.53	5,886.53	5,874.38	9.78	3.34	5,877.73	5,878.32
364 (STRM)	5,886.31	5,886.31	5,880.57	1.87	1.15	5,881.72	5,881.74
123 (STRM)	5,883.83	5,883.83	5,873.34	5.93	0.99	5,874.33	5,874.63
149 (STRM)	5,879.80	5,879.80	5,869.87	8.95	2.36	5,872.23	5,872.80
119 (STRM)	5,879.21	5,879.21	5,867.86	22.42	3.56	5,871.42	5,871.65
120 (STRM)	5,878.99	5,878.99	5,867.00	52.83	2.96	5,869.96	5,871.22
117 (STRM)	5,878.35	5,878.35	5,871.64	12.35	1.26	5,872.90	5,873.34
370 (STRM)	5,877.74	5,877.74	5,854.89	54.86	2.98	5,857.86	5,859.03
118 (STRM)	5,877.57	5,877.57	5,869.95	15.34	2.02	5,871.97	5,872.34
134 (STRM)	5,876.98	5,876.98	5,862.44	52.56	2.50	5,864.94	5,866.36
135 (STRM)	5,861.66	5,861.66	5,850.40	54.63	3.30	5,853.70	5,854.26
373 (STRM)	5,852.35	5,852.35	5,840.52	6.80	1.01	5,841.53	5,841.53
372 (STRM)	5,828.33	5,828.33	5,823.77	6.80	1.01	5,824.78	5,824.78

Venture on Venetucci

100-YEAR

Catchment Table - Time: 0.00 hours

Label	Outflow Element	Area (User Defined) (acres)	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)
02	120 (STRM)	0.230	0.840	7.800	1.47
03	CB-20	0.300	0.800	7.200	1.88
04	CB-20	0.070	0.840	5.000	0.51
05	CB-18	0.030	0.890	5.000	0.23
06	CB-18	0.340	0.830	5.000	2.47
07	CB-20	0.250	0.350	7.600	0.67
08	CB-19	0.190	0.830	5.000	1.38
09	CB-14	0.140	0.860	5.000	1.05
10	CB-17	0.310	0.870	5.600	2.28
11	CB-12	0.370	0.350	9.600	0.92
12	CB-19	0.210	0.850	5.000	1.56
13	CB-14	0.230	0.890	5.700	1.72
14	CB-23	0.260	0.830	5.000	1.89
15	CB-23	0.150	0.870	5.000	1.14
16	CB-17	0.130	0.950	5.000	1.08
17	CB-17	0.040	0.960	5.000	0.34
18	CB-13	0.340	0.810	6.200	2.26
19	CB-22	0.280	0.350	11.500	0.65
20	CB-11	0.290	0.860	5.000	2.18
21	CB-13	0.110	0.880	5.000	0.85
22	CB-9	0.110	0.810	5.000	0.78
23	CB-10	0.180	0.840	5.900	1.26
24	CB-10	0.250	0.860	5.000	1.88
25	CB-8	0.270	0.800	5.000	1.89
26	CB-5	0.100	0.830	5.000	0.73
27	CB-5	0.160	0.850	5.300	1.17
28	CB-7	0.200	0.850	5.000	1.49
29	CB-6	0.220	0.830	6.000	1.51
30	CB-3	0.210	0.850	5.000	1.56

Venture on Venetucci

100-YEAR

Catchment Table - Time: 0.00 hours

Label	Outflow Element	Area (User Defined) (acres)	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)
31	CB-4	0.300	0.350	11.300	0.70
32	CB-3	0.200	0.880	5.000	1.54
33	CB-7	0.210	0.880	6.400	1.50
34	CB-6	0.290	0.840	5.700	2.05
35	CB-2	0.170	0.780	5.000	1.16
36	CB-2	0.210	0.870	5.000	1.60
37	CB-2	0.100	0.810	5.000	0.71
38	CB-1	0.230	0.570	10.700	0.89
39	CB-24	0.140	0.350	5.000	0.43
40	CB-16	0.210	0.350	7.000	0.58
41	CB-5	0.100	0.790	5.000	0.69
G1	112 (STRM)	0.040	0.810	5.000	0.28
G2-A	CB-19	0.040	0.810	5.000	0.28
G2-B	CB-14	0.040	0.810	5.000	0.28
G3-A	CB-19	0.040	0.810	5.000	0.28
G3-B	CB-14	0.040	0.810	5.000	0.28
G4-A	CB-10	0.040	0.810	5.000	0.28
G4-B	CB-5	0.040	0.810	5.000	0.28
G5-A	CB-10	0.050	0.810	5.000	0.35
G5-B	CB-5	0.050	0.810	5.000	0.35
G6-A	CB-7	0.040	0.810	5.000	0.28
G6-B	CB-6	0.040	0.810	5.000	0.28
G7-A	CB-7	0.040	0.810	5.000	0.28
G7-B	CB-6	0.040	0.810	5.000	0.28
G8	STMH-01 (STRM)	0.040	0.810	5.000	0.28
G9	STMH-01 (STRM)	0.030	0.810	5.000	0.21
R1-A	CB-18	0.120	0.810	5.000	0.85

Venture on Venetucci

100-YEAR

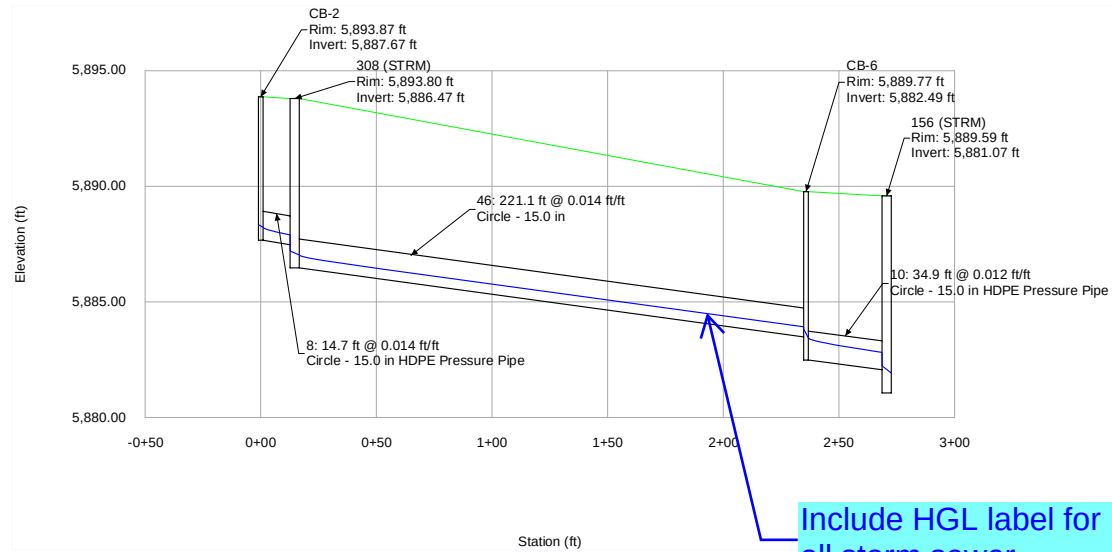
Catchment Table - Time: 0.00 hours

Label	Outflow Element	Area (User Defined) (acres)	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)
R1-B	119 (STRM)	0.120	0.810	5.000	0.85
R2-A	CB-23	0.130	0.810	5.000	0.92
R2-B	CB-23	0.130	0.810	5.000	0.92
R3-A	CB-13	0.160	0.810	5.000	1.13
R3-B	CB-13	0.160	0.810	5.000	1.13
R4-A	CB-23	0.150	0.810	5.000	1.06
R4-B	CB-11	0.150	0.810	5.000	1.06
R5-A	350 (STRM)	0.160	0.810	5.000	1.13
R5-B	350 (STRM)	0.160	0.810	5.000	1.13
R6-A	CB-10	0.150	0.810	5.000	1.06
R6-B	CB-10	0.150	0.810	5.000	1.06
R7-A	CB-3	0.130	0.810	5.000	0.92
R7-B	CB-3	0.130	0.810	5.000	0.92
R8-A	CB-2	0.130	0.810	5.000	0.92
R8-B	CB-2	0.130	0.810	5.000	0.92
R9-A	CB-7	0.120	0.810	5.000	0.85
R9-B	CB-7	0.120	0.810	5.000	0.85
R10-A	STMH-01 (STRM)	0.160	0.810	5.000	1.13
R10-B	STMH-01 (STRM)	0.160	0.810	5.000	1.13
R11	120 (STRM)	0.120	0.810	5.000	0.85
R12	116 (STRM)	0.070	0.810	5.000	0.50

Profile Report

Engineering Profile - CB 2 to 156 (STRM) (Venetucci StormCAD.stsw)

Active Scenario: 5-YEAR



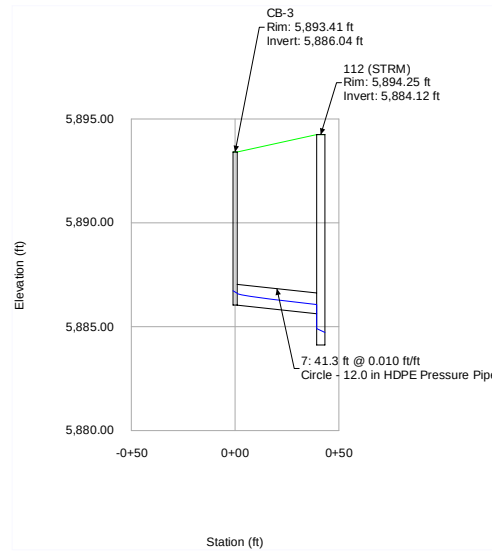
Include HGL label for
all storm sewer

**KH RESPONSE: HGL LABELS
ADDED TO PROFILES.**

Profile Report

Engineering Profile - CB 3 to 112 (STRM) (Venetucci StormCAD.stsw)

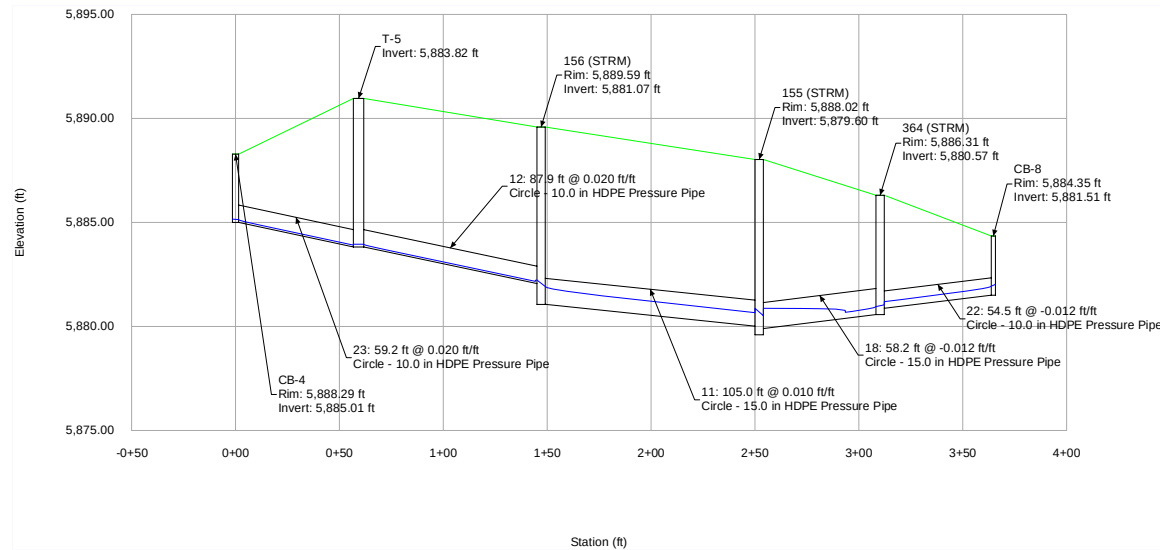
Active Scenario: 5-YEAR



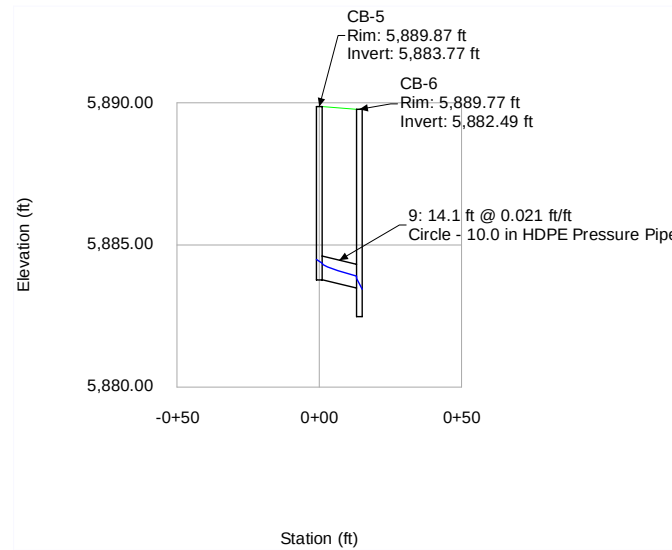
Profile Report

Engineering Profile - CB 4 to CB 8 (Venetucci StormCAD.stsw)

Active Scenario: 5-YEAR



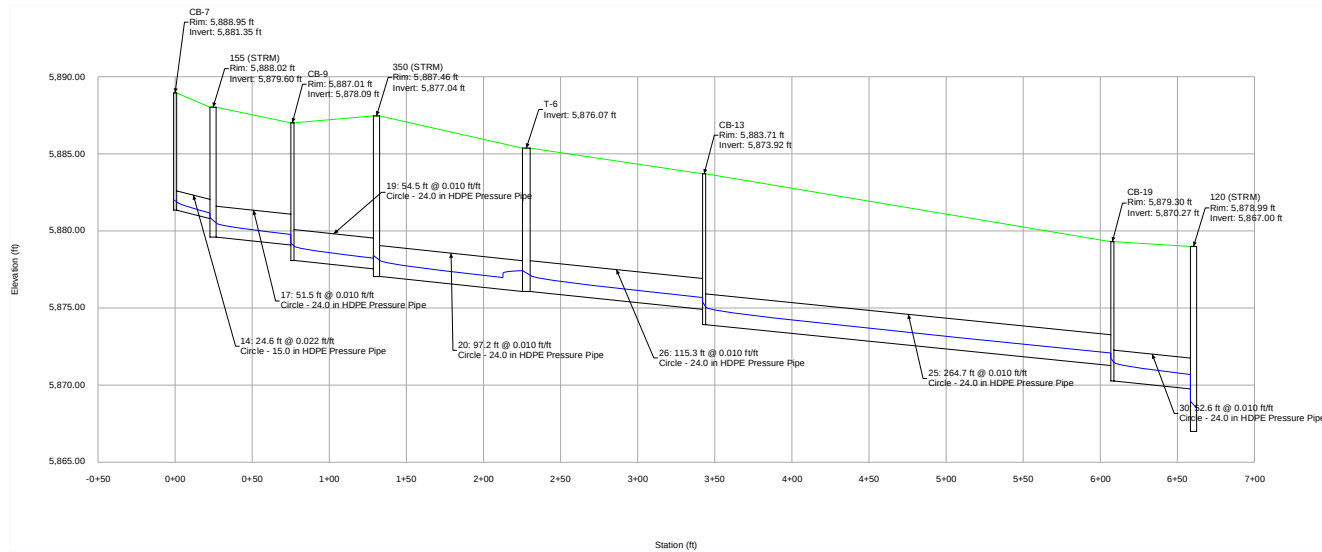
Profile Report
Engineering Profile - CB 5 to CB 6 (Venetucci StormCAD.stsw)
Active Scenario: 5-YEAR



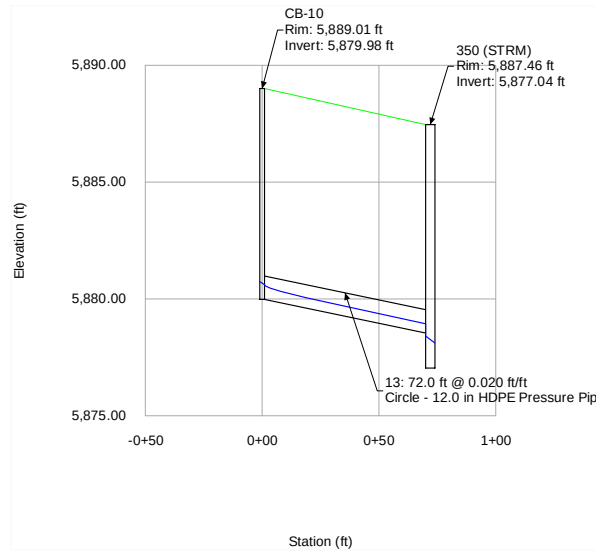
Profile Report

Engineering Profile - CB 7 to 120 (STRM) (Venetucci StormCAD.stsw)

Active Scenario: 5-YEAR



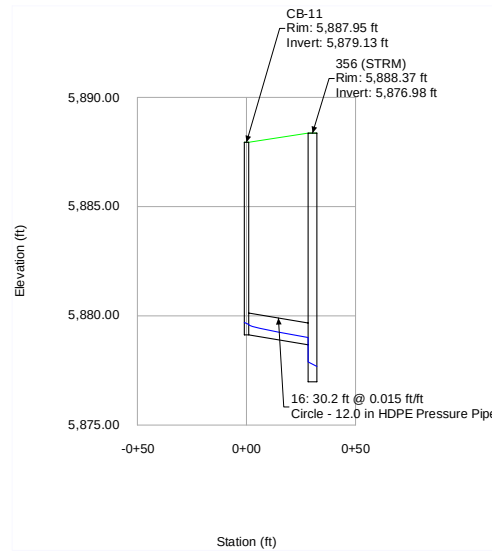
Profile Report
Engineering Profile - CB 10 to 350 (STRM) (Venetucci StormCAD.stsw)
Active Scenario: 5-YEAR



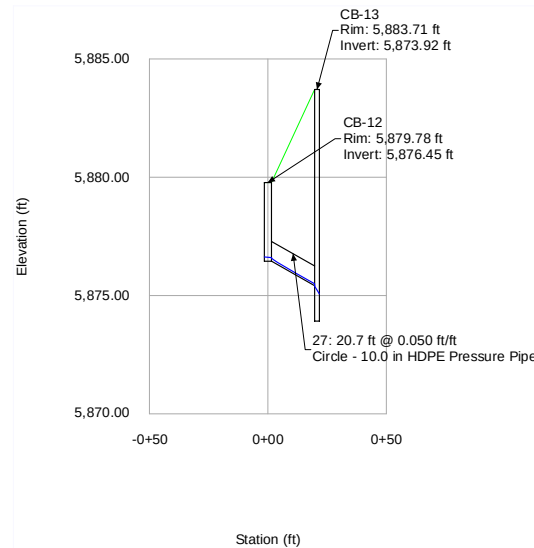
Profile Report

Engineering Profile - CB 11 to 356 (STRM) (Venetucci StormCAD.stsw)

Active Scenario: 5-YEAR



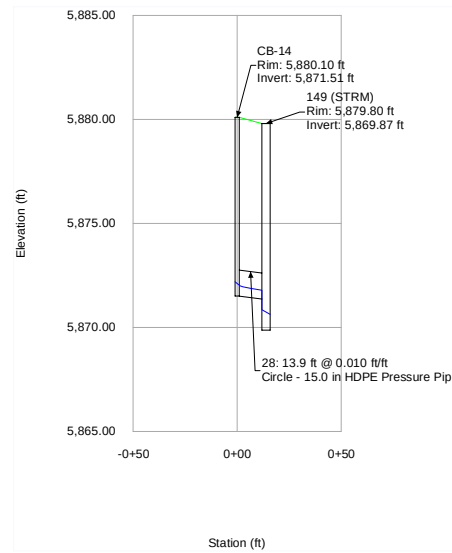
Profile Report
Engineering Profile - CB 12 to CB 13 (Venetucci StormCAD.stsw)
Active Scenario: 5-YEAR



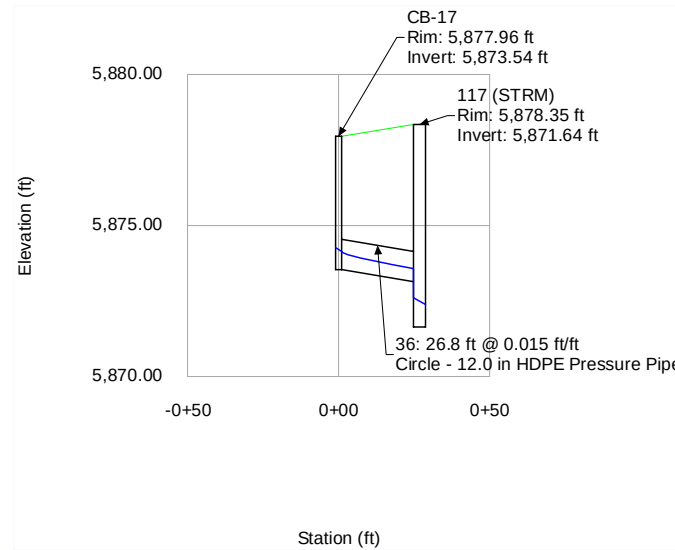
Profile Report

Engineering Profile - CB 14 to 149 (STRM) (Venetucci StormCAD.stsw)

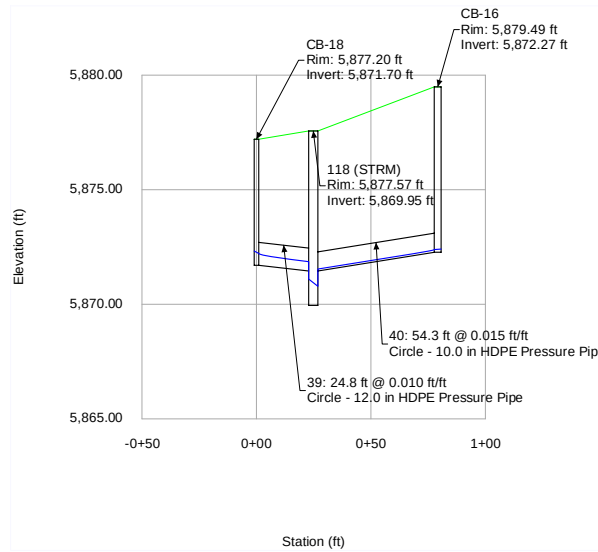
Active Scenario: 5-YEAR



Profile Report
Engineering Profile - CB 17 to 117 (STRM) (Venetucci StormCAD.stsw)
Active Scenario: 5-YEAR



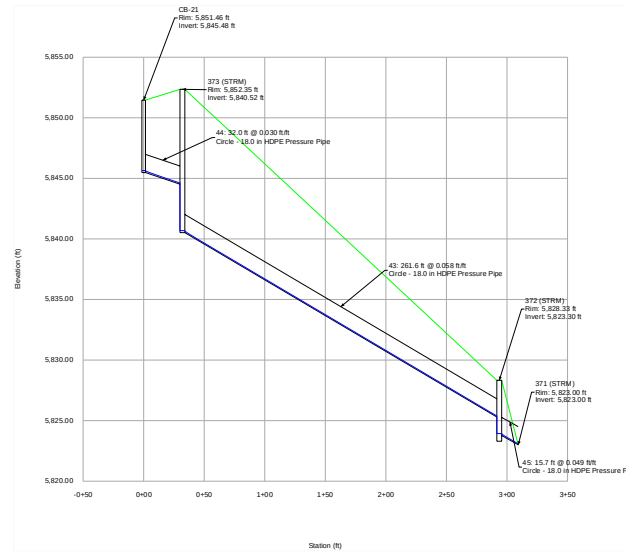
Profile Report
Engineering Profile - CB 18 to CB 16 (Venetucci StormCAD.stsw)
Active Scenario: 5-YEAR



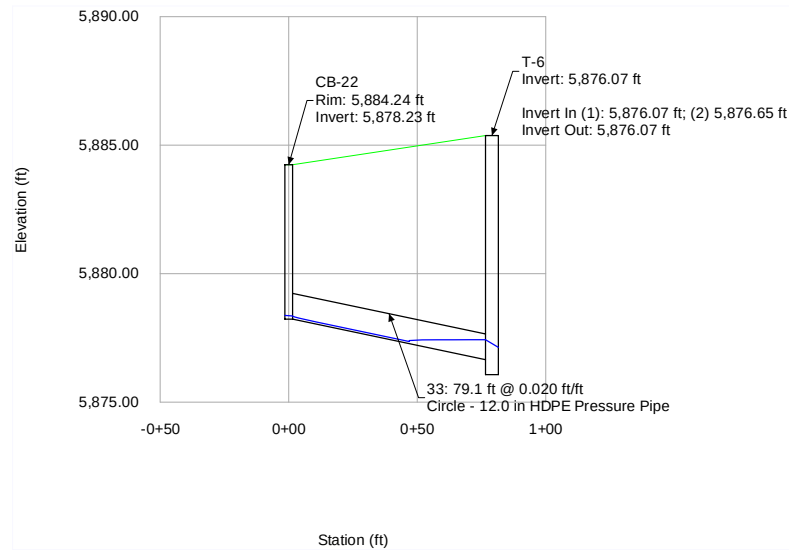
Profile Report

Engineering Profile - CB 21 to Creek Outfall (Venetucci StormCAD.stsw)

Active Scenario: 5-YEAR



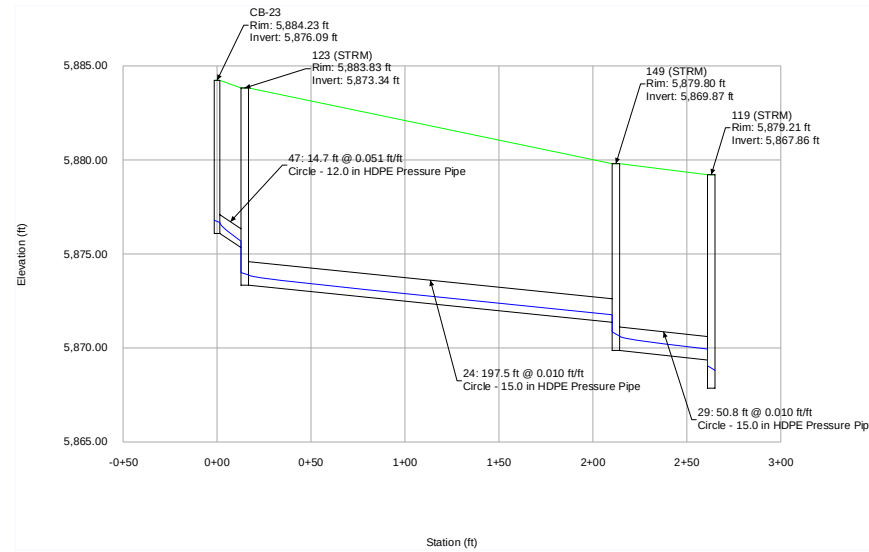
Profile Report
Engineering Profile - CB 22 to T 6 (Venetucci StormCAD.stsw)
Active Scenario: 5-YEAR



Profile Report

Engineering Profile - CB 23 to 119 (STRM) (Venetucci StormCAD.stsw)

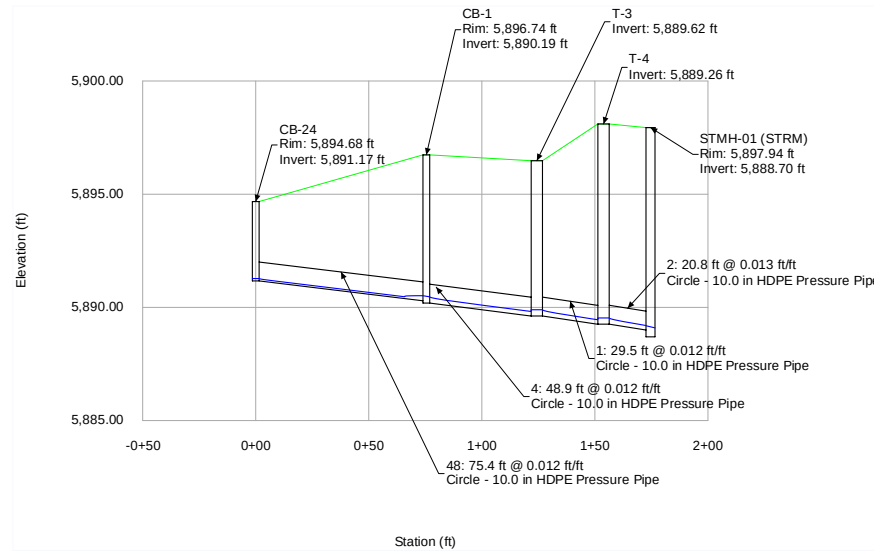
Active Scenario: 5-YEAR



Profile Report

Engineering Profile - CB 24 to STMH 01 (Venetucci StormCAD.stsw)

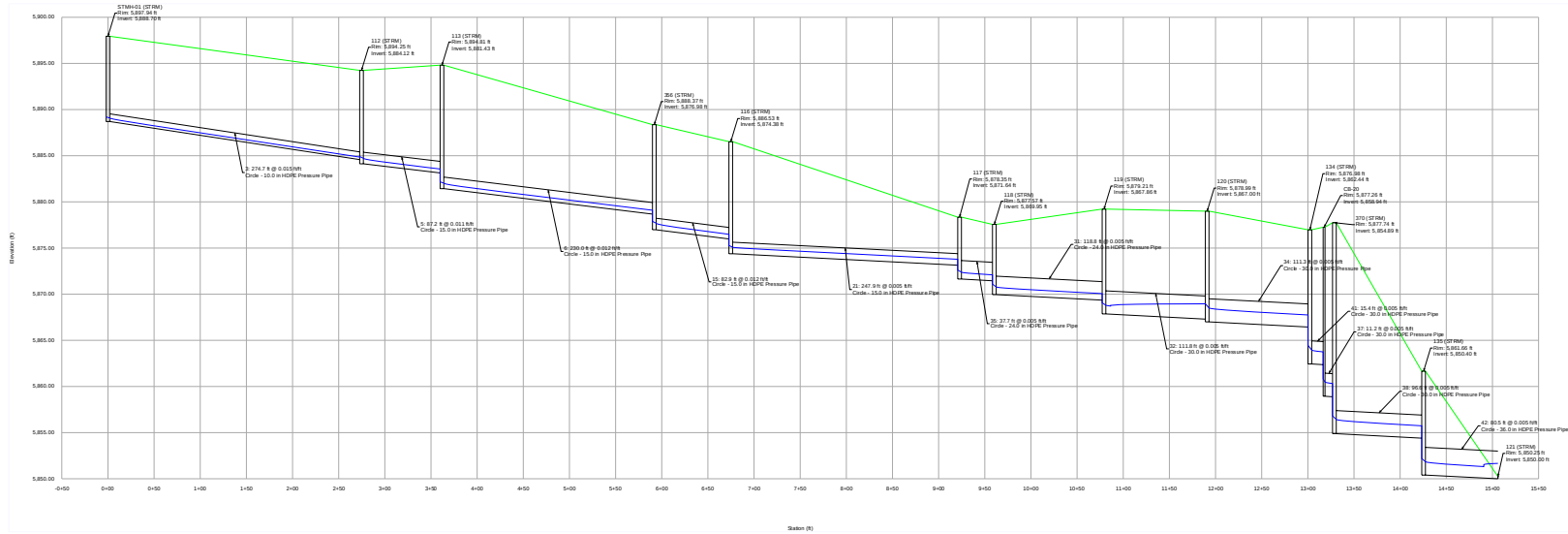
Active Scenario: 5-YEAR



Profile Report

Engineering Profile - STMH 01 to Pond Outfall (Venetucci StormCAD.stsw)

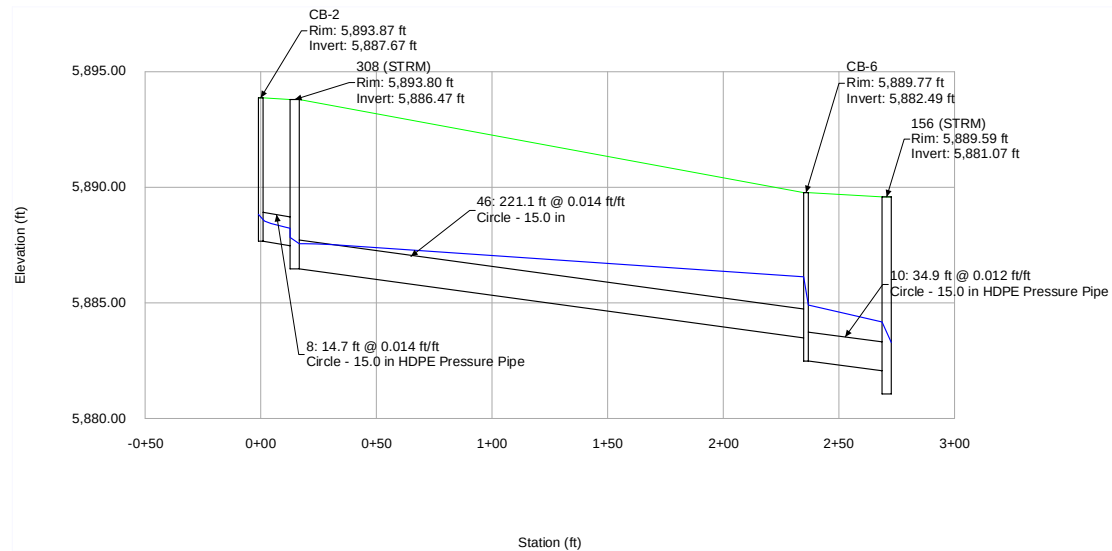
Active Scenario: 5-YEAR



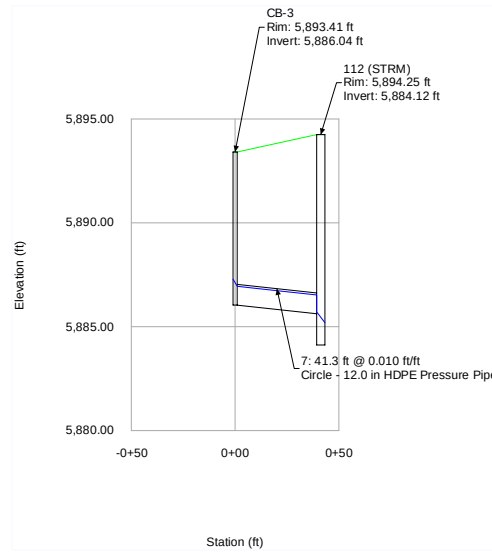
Profile Report

Engineering Profile - CB 2 to 156 (STRM) (Venetucci StormCAD.stsw)

Active Scenario: 100-YEAR



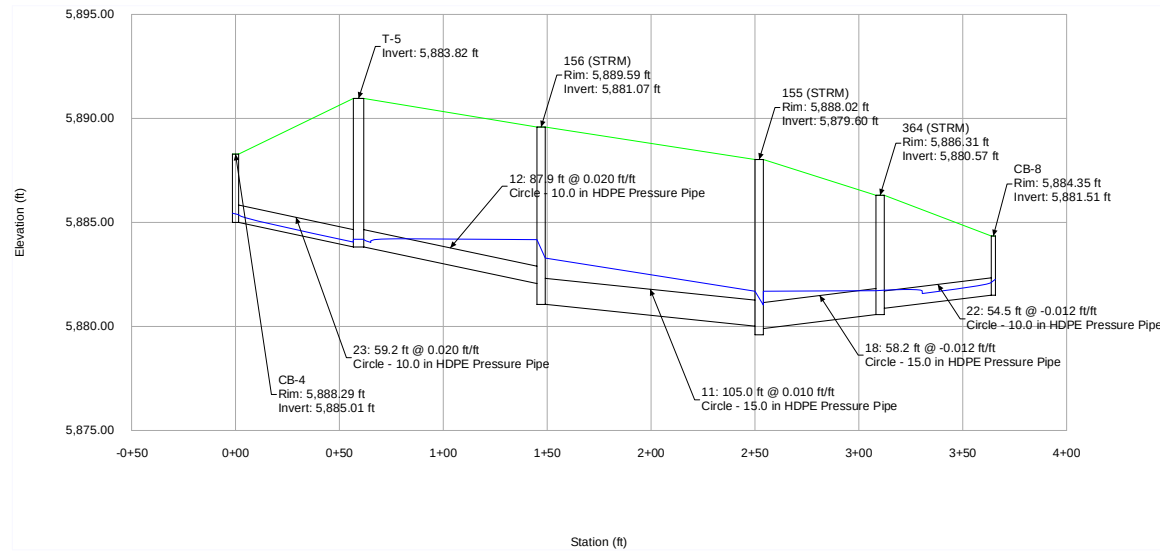
Profile Report
Engineering Profile - CB 3 to 112 (STRM) (Venetucci StormCAD.stsw)
Active Scenario: 100-YEAR



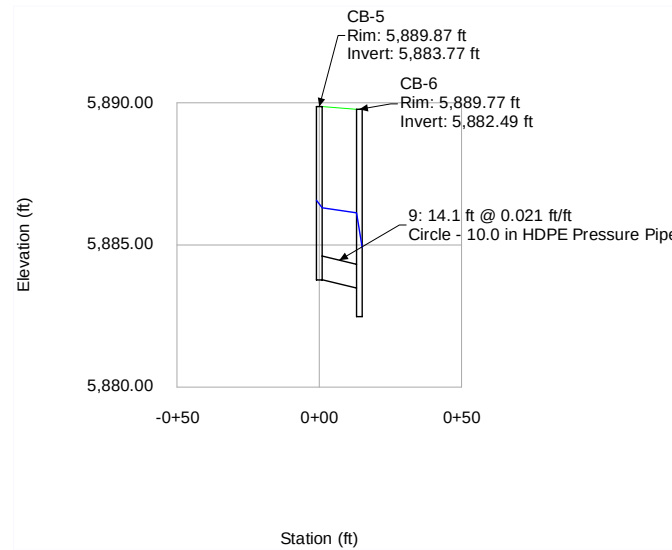
Profile Report

Engineering Profile - CB 4 to CB 8 (Venetucci StormCAD.stsw)

Active Scenario: 100-YEAR



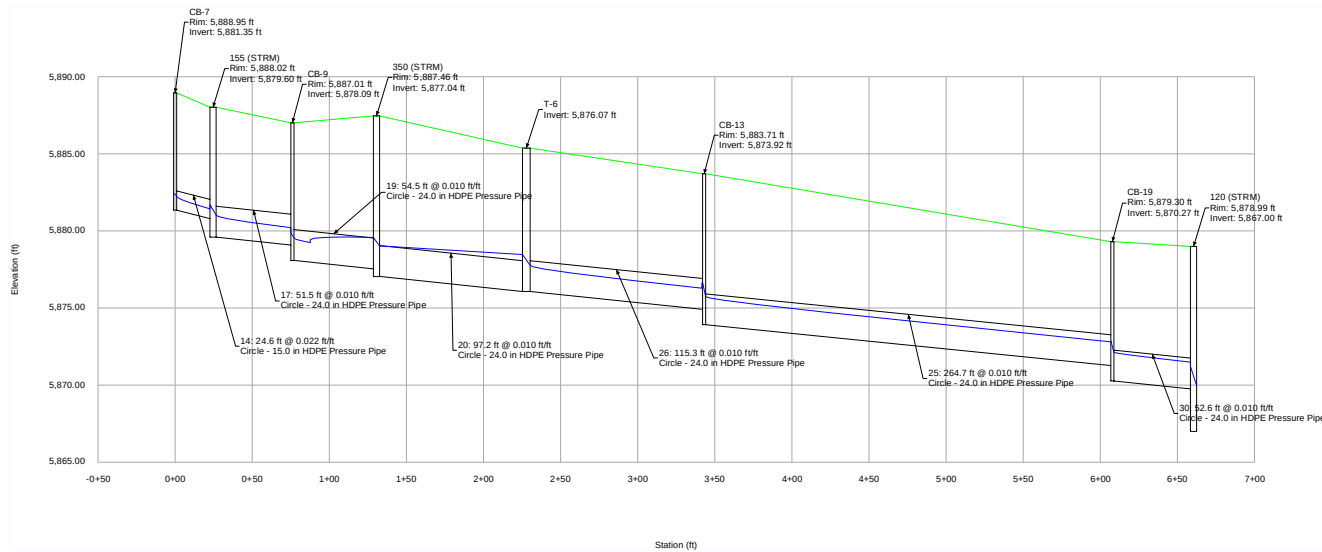
Profile Report
Engineering Profile - CB 5 to CB 6 (Venetucci StormCAD.stsw)
Active Scenario: 100-YEAR



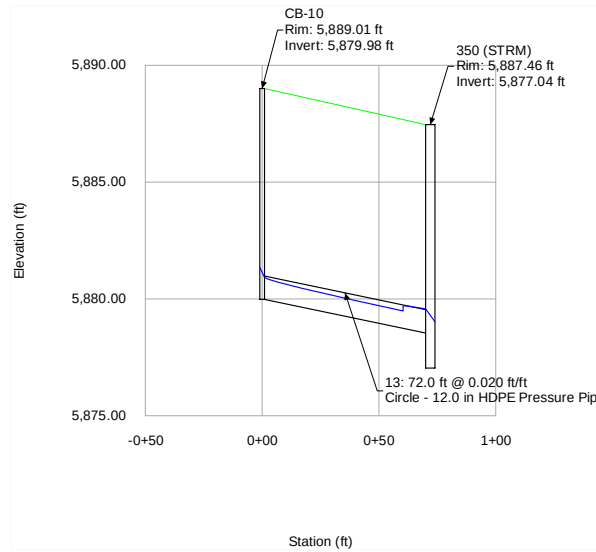
Profile Report

Engineering Profile - CB 7 to 120 (STRM) (Venetucci StormCAD.stsw)

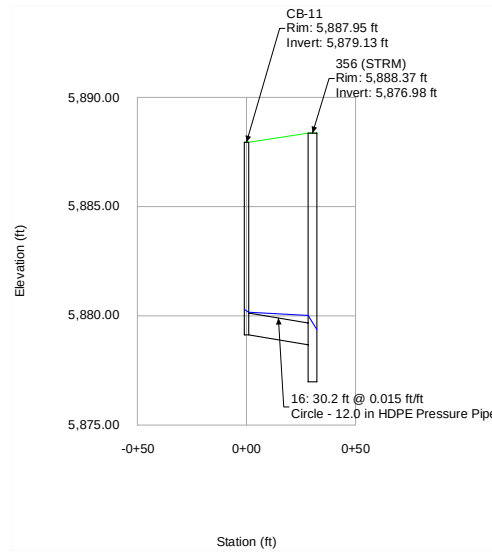
Active Scenario: 100-YEAR



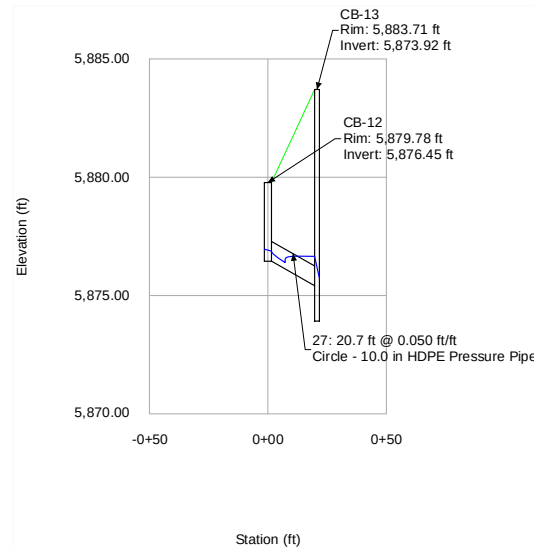
Profile Report
Engineering Profile - CB 10 to 350 (STRM) (Venetucci StormCAD.stsw)
Active Scenario: 100-YEAR



Profile Report
Engineering Profile - CB 11 to 356 (STRM) (Venetucci StormCAD.stsw)
Active Scenario: 100-YEAR



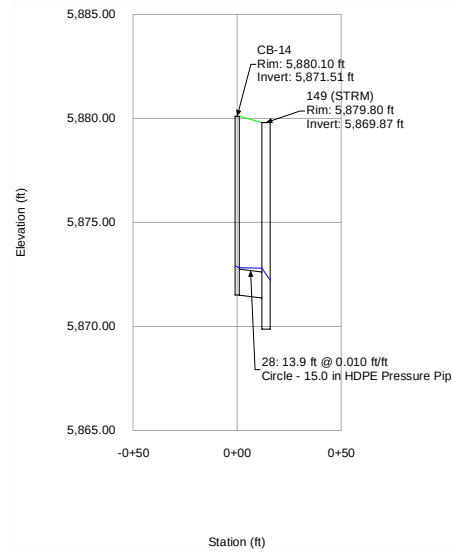
Profile Report
Engineering Profile - CB 12 to CB 13 (Venetucci StormCAD.stsw)
Active Scenario: 100-YEAR



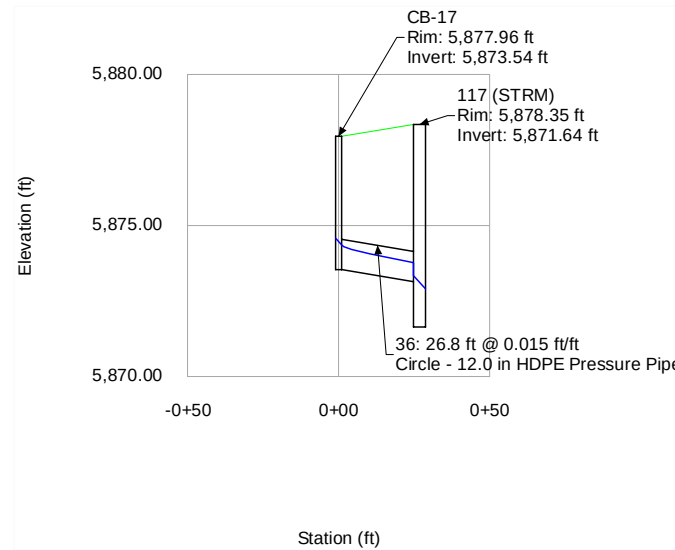
Profile Report

Engineering Profile - CB 14 to 149 (STRM) (Venetucci StormCAD.stsw)

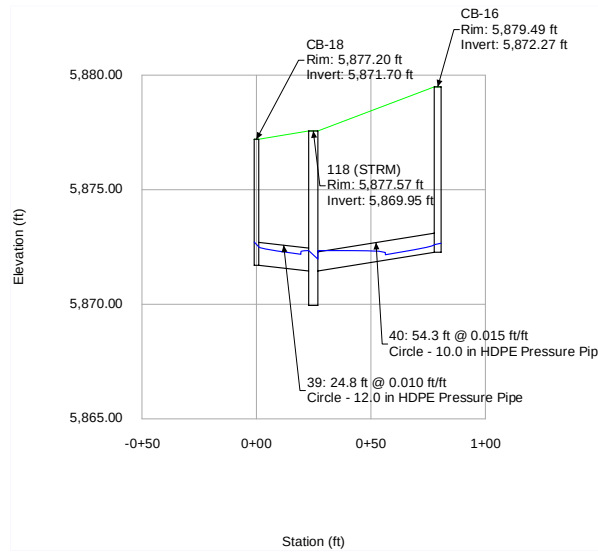
Active Scenario: 100-YEAR



Profile Report
Engineering Profile - CB 17 to 117 (STRM) (Venetucci StormCAD.stsw)
Active Scenario: 100-YEAR



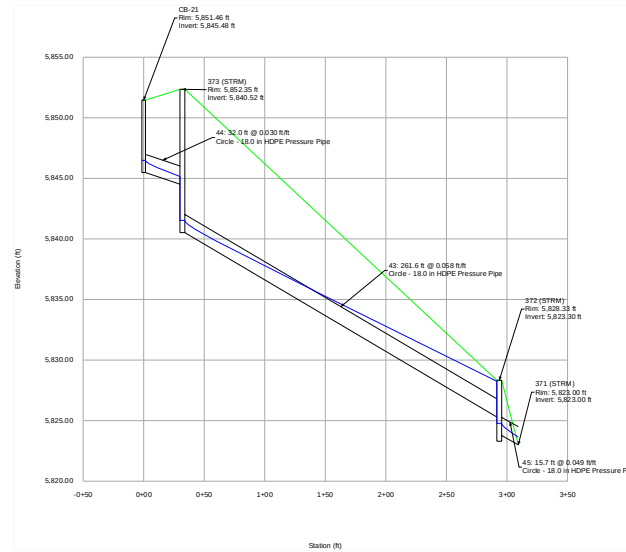
Profile Report Engineering Profile - CB 18 to CB 16 (Venetucci StormCAD.stsw) Active Scenario: 100-YEAR



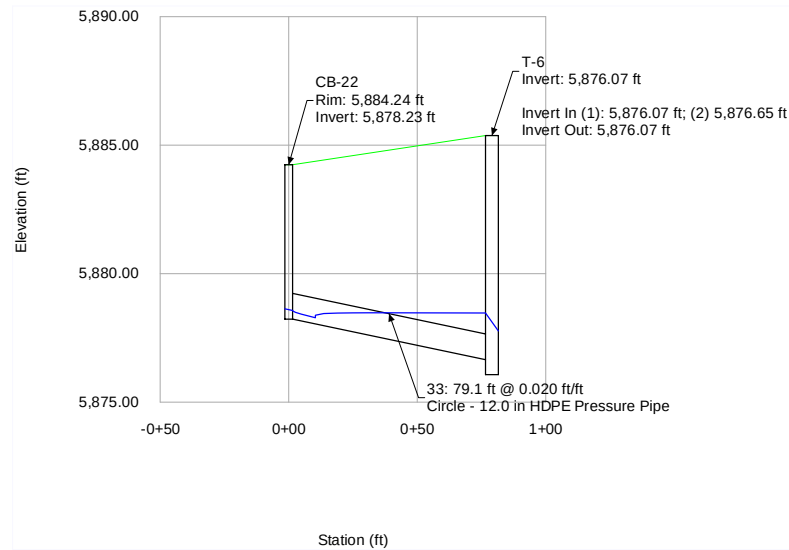
Profile Report

Engineering Profile - CB 21 to Creek Outfall (Venetucci StormCAD.stsw)

Active Scenario: 100-YEAR



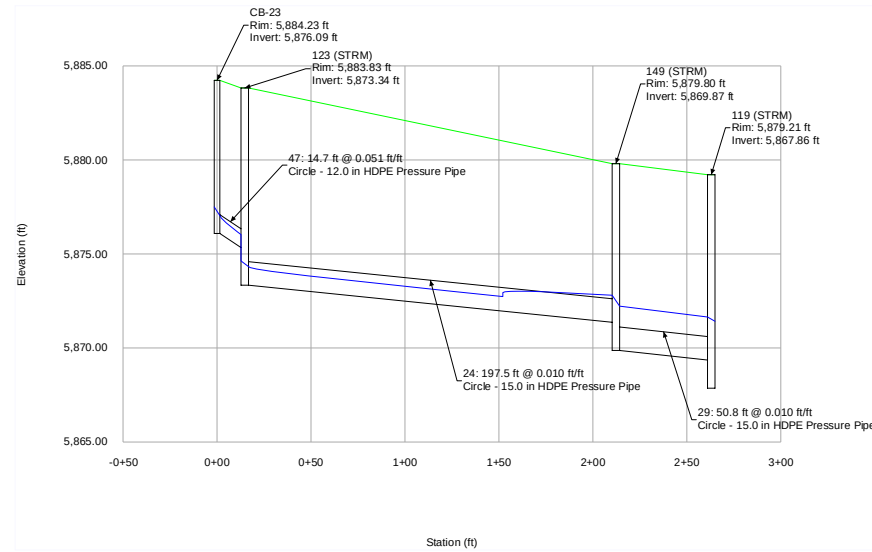
Profile Report Engineering Profile - CB 22 to T 6 (Venetucci StormCAD.stsw) Active Scenario: 100-YEAR



Profile Report

Engineering Profile - CB 23 to 119 (STRM) (Venetucci StormCAD.stsw)

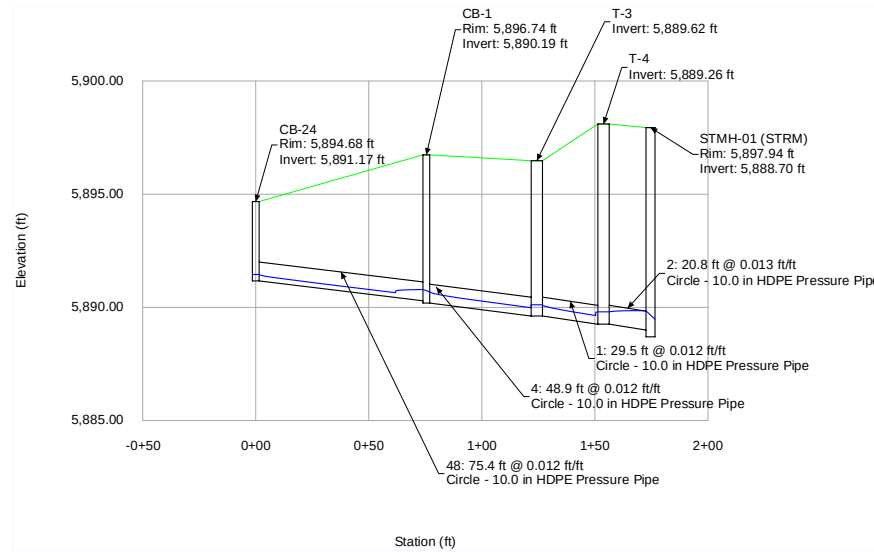
Active Scenario: 100-YEAR



Profile Report

Engineering Profile - CB 24 to STMH 01 (Venetucci StormCAD.stsw)

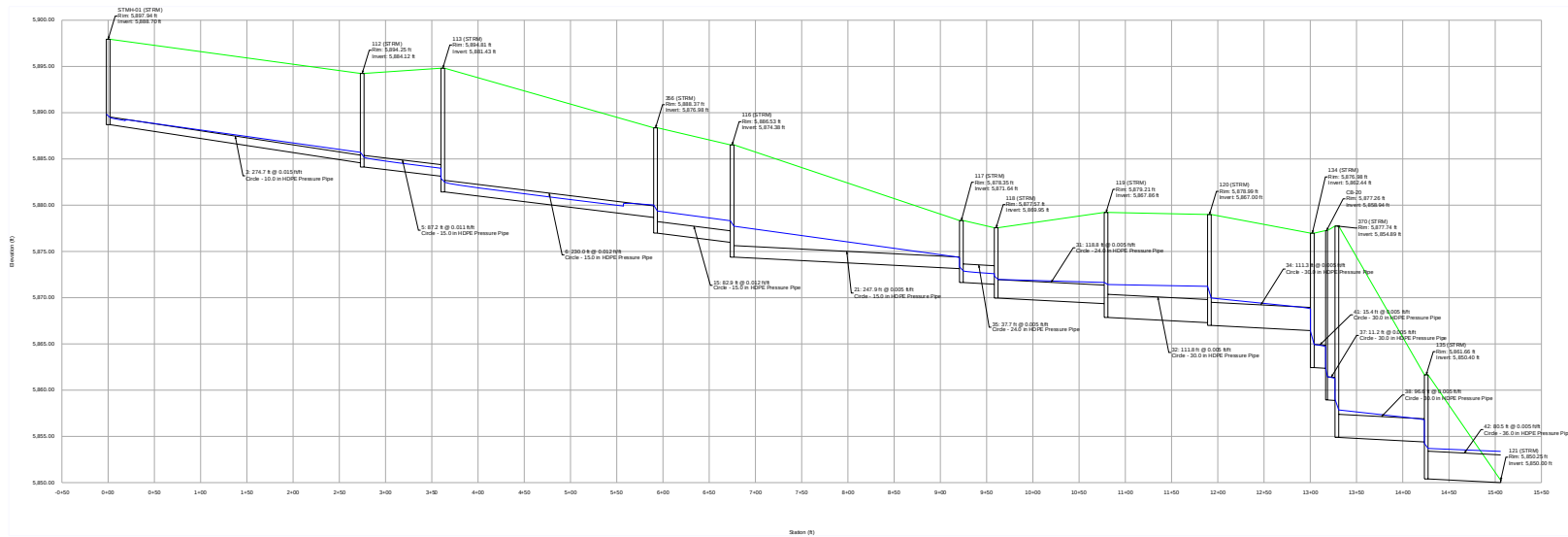
Active Scenario: 100-YEAR



Profile Report

Engineering Profile - STMH 01 to Pond Outfall (Venetucci StormCAD.stsw)

Active Scenario: 100-YEAR

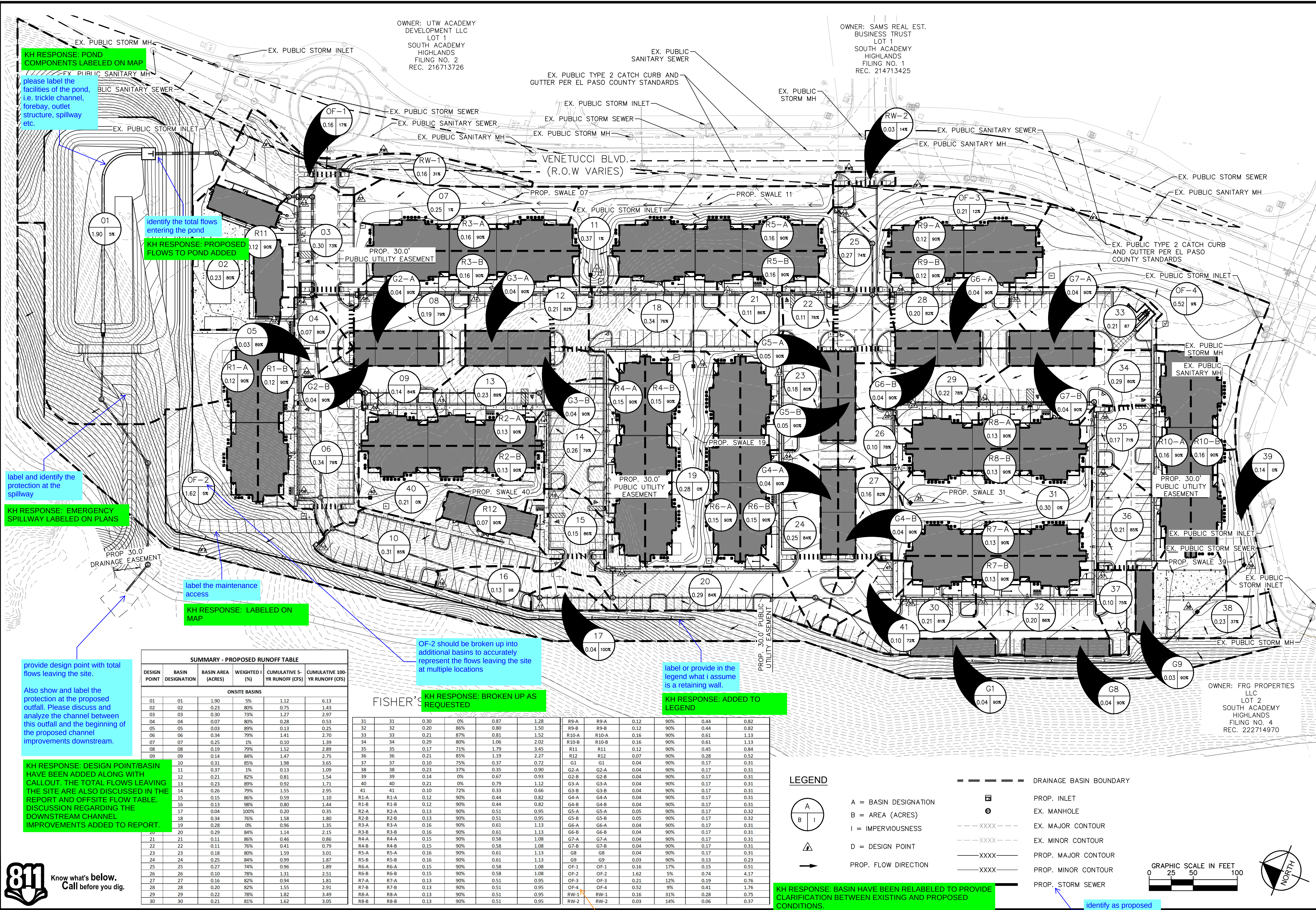


APPENDIX D: DRAINAGE MAPS

Please move
this to the end
of the report

KH RESPONSE: DRAINAGE
MAPS MOVED TO END OF
REPORT.

K:\DEN_Civil\096302017_Venettucci Multi-Family\CADD\PlanSheets\Drainage\096302017_DP-PR.dwg Ayers, Connor 11/13/2024 8:11 AM



KH RESPONSE: POND COMPONENTS LABELED ON MAP

please label the facilities of the pond, i.e. trickle channel, forebay, outlet structure, spillway etc.

Identify the total flows entering the pond

KH RESPONSE: PROPOSED FLOWS TO POND ADDED

label and identify the protection at the spillway

KH RESPONSE: EMERGENCY SPILLWAY LABELED ON PLANS

provide design point with total flows leaving the site.

Also show and label the protection at the proposed outfall. Please discuss and analyze the channel between this outfall and the beginning of the proposed channel improvements downstream.

KH RESPONSE: DESIGN POINT/BASIN HAVE BEEN ADDED ALONG WITH CALLOUT. THE TOTAL FLOWS LEAVING THE SITE ARE ALSO DISCUSSED IN THE REPORT AND OFFSITE FLOW TABLE. DISCUSSION REGARDING THE DOWNSTREAM CHANNEL IMPROVEMENTS ADDED TO REPORT.

SUMMARY - PROPOSED RUNOFF TABLE					
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	WEIGHTED I (%)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
ONSITE BASINS					
01	01	1.90	5%	1.12	6.13
02	02	0.23	80%	0.75	1.43
03	03	0.30	73%	1.27	2.97
04	04	0.07	80%	0.28	0.53
05	05	0.03	89%	0.13	0.25
06	06	0.34	79%	1.41	2.70
07	07	0.25	1%	0.10	1.39
08	08	0.19	79%	1.52	2.89
09	09	0.14	84%	1.47	2.75
10	10	0.31	85%	1.98	3.65
11	11	0.37	1%	0.13	1.09
12	12	0.21	82%	0.81	1.54
13	13	0.23	89%	0.92	1.71
14	14	0.26	79%	1.55	2.95
15	15	0.15	86%	0.59	1.10
16	16	0.13	98%	0.80	1.44
17	17	0.04	100%	0.20	0.35
18	18	0.34	76%	1.58	3.80
19	19	0.28	0%	0.96	1.35
20	20	0.29	84%	1.14	2.15
21	21	0.11	86%	0.46	0.86
22	22	0.11	76%	0.41	0.79
23	23	0.18	86%	1.59	3.01
24	24	0.25	84%	0.99	1.87
25	25	0.27	74%	0.96	1.89
26	26	0.10	78%	1.31	2.51
27	27	0.16	82%	0.94	1.81
28	28	0.20	82%	1.55	2.91
29	29	0.22	78%	1.82	3.49
30	30	0.21	93%	1.62	3.05

OWNER: UTW ACADEMY DEVELOPMENT LLC
LOT 1
SOUTH ACADEMY HIGHLANDS
FILING NO. 2
REC. 216713726

EX. PUBLIC STORM INLET
EX. PUBLIC TYPE 2 CATCH CURB AND GUTTER PER EL PASO COUNTY STANDARDS
EX. PUBLIC STORM SEWER
EX. PUBLIC SANITARY MH
EX. PUBLIC STORM MH

OWNER: SAMS REAL EST. BUSINESS TRUST
LOT 1
SOUTH ACADEMY HIGHLANDS
FILING NO. 1
REC. 214713425

VENETUCCI BLVD.
(R.O.W. VARIES)

OWNER: FRG PROPERTIES LLC
LOT 2
SOUTH ACADEMY HIGHLANDS
FILING NO. 4
REC. 222714970

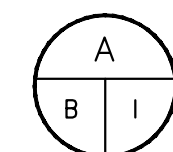
OF-2 should be broken up into additional basins to accurately represent the flows leaving the site at multiple locations

KH RESPONSE: BROKEN UP AS REQUESTED

label or provide in the legend what I assume is a retaining wall.

KH RESPONSE: ADDED TO LEGEND

LEGEND



A = BASIN DESIGNATION

B = AREA (ACRES)

I = IMPERVIOUSNESS

D = DESIGN POINT

PROP. FLOW DIRECTION

--- DRAINAGE BASIN BOUNDARY

□ PROP. INLET

○ EX. MANHOLE

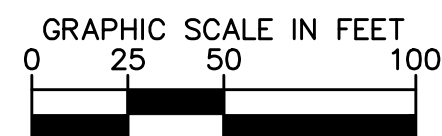
---XXXX EX. MAJOR CONTOUR

---XXXX EX. MINOR CONTOUR

---XXXX PROP. MAJOR CONTOUR

---XXXX PROP. MINOR CONTOUR

--- PROP. STORM SEWER



KH RESPONSE: BASIN HAVE BEEN RELABELLED TO PROVIDE CLARIFICATION BETWEEN EXISTING AND PROPOSED CONDITIONS.

Identify as proposed private storm sewer

KH RESPONSE: LEGEND UPDATED TO PRIVATE

where is OF-5 that is discussed in the report text?

KH RESPONSE: BASIN HAVE BEEN RELABELLED TO PROVIDE CLARIFICATION BETWEEN EXISTING AND PROPOSED CONDITIONS.

I think my confusion about the OF-5 basin is that there is "OF-5" basins in the existing and proposed condition, but they are completely unrelated. So OF-1 in the existing condition is on the other side of the site than OF-1 in the proposed condition. Recommend renaming the existing basins to EX-1 to EX-5 (or something different like that) to avoid this confusion.

Kimley»Horn

2024 KIMLEY-HORN AND ASSOCIATES, INC.
6200 South Syracuse Way, Suite 300
Greenwood Village, Colorado 80111 (303) 228-2300

DESIGNED BY: CRA
DRAWN BY: CRA
CHECKED BY: MTH
DATE: 11/12/2024

VENETUCCI MULTIFAMILY
FINAL DRAINAGE REPORT
DRAINAGE MAP
COLORADO SPRINGS, CO 80921
PROPOSED DRAINAGE MAP

PROJECT NO.
096302017

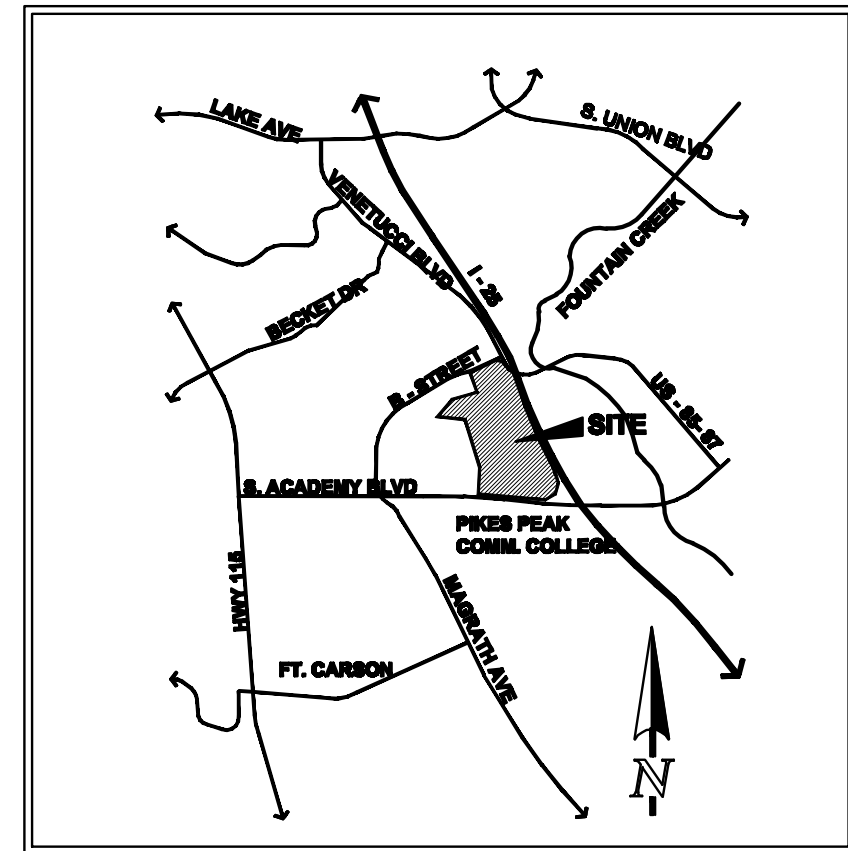
SHEET

PR-1

NO. BY DATE APPR

APPENDIX E: EXCERPTS FROM ADJACENT PROPERTY DRAINAGE REPORTS

FINAL DRAINAGE REPORT
CITY OF FOUNTAIN, COUNTY OF EL PASO, STATE OF COLORADO
SOUTH ACADEMY HIGHLANDS FILING NO. 1
EXISTING CONDITIONS
MARCH 2013



VICINITY MAP
N.T.S.

EXISTING AREA DRAINAGE		
BASIN	Q5 (CFS)	Q100 (CFS)
OS-1A	9	19
OS-1B	34	70
OS-2	24	59
OS-3	40	86
OS-4	9	20
OS-5	7	14
OS-6	22	46
OS-7	29	61
EX-A	13	34
EX-B	8	21
EX-C	6	15
EX-D	4	10
EX-E	6	15
EX-F	10	28
EX-G	11	30
EX-H	18	45
FC1	44	87
FC2	18	47
FC3	43	116
FC4	21	57
FC5	27	71
FC6	6	17
FC7	40	99
FC8	19	36

EXISTING DESIGN POINT SUMMARY

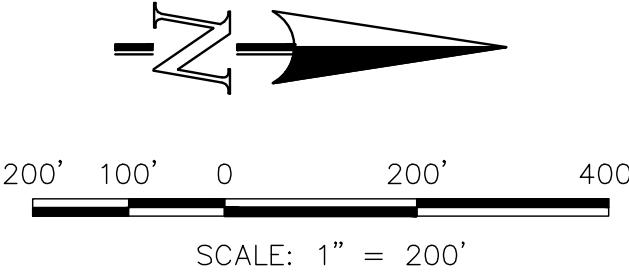
DESIGN POINT	Q5 (CFS)	Q100 (CFS)	DESCRIPTION
A	9.2	19.0	Existing 24" RCP
B	33.8	69.9	Existing 24" RCP (Direct Release)
C-1	64.0	142.4	Fisher's Canyon Tributary
C-2	104.7	232.1	Fisher's Canyon Tributary
C-3	113.8	253.4	Fisher's Canyon Tributary
C-4	119.1	265.7	Fisher's Canyon Tributary
C-5	135.3	301.1	Fisher's Canyon Tributary
C-6	162.2	361.0	Fisher's Canyon Tributary
D	154.5	346.7	Fisher's Canyon Tributary
EX1	21.5	57.2	Existing 36" RCP
EX2	26.8	71.5	Existing 24" RCP
EX3	6.4	17.0	Existing 30" RCP
EX4	39.7	99.0	Existing 36" RCP
8 - SITE	193.6	431.3	Site Runoff Into Fisher's Canyon Creek
9 - SITE	227.9	520.8	Site Runoff Into Fisher's Canyon Creek
21 - SITE	255.8	595.2	Total Outfall East of I-25

EXISTING DBPS DESIGN POINTS (PER DBPS STUDY)

DESIGN POINT	Q100 (CFS)
7	2,676
8	3,050
9	3,163

LEGEND

- EXISTING GROUND CONTOUR (5820)
PROPOSED FINISHED CONTOUR 5820
OVERALL SITE BOUNDARY
EXISTING LOT LINE
PROPOSED BASIN BOUNDARY
MDDP BASIN BOUNDARY
PROP. DIRECTION OF DRAINAGE
EXISTING DIRECTION OF DRAINAGE
BASIN IDENTIFIER
AREA IN ACRES
DESIGN POINT



48 HOURS BEFORE YOU DIG,
CALL UTILITY LOCATORS
1-800-922-1987

CITY OF COLORADO SPRINGS DEPT. OF UTILITIES
GAS, ELECTRIC, WATER AND WASTEWATER

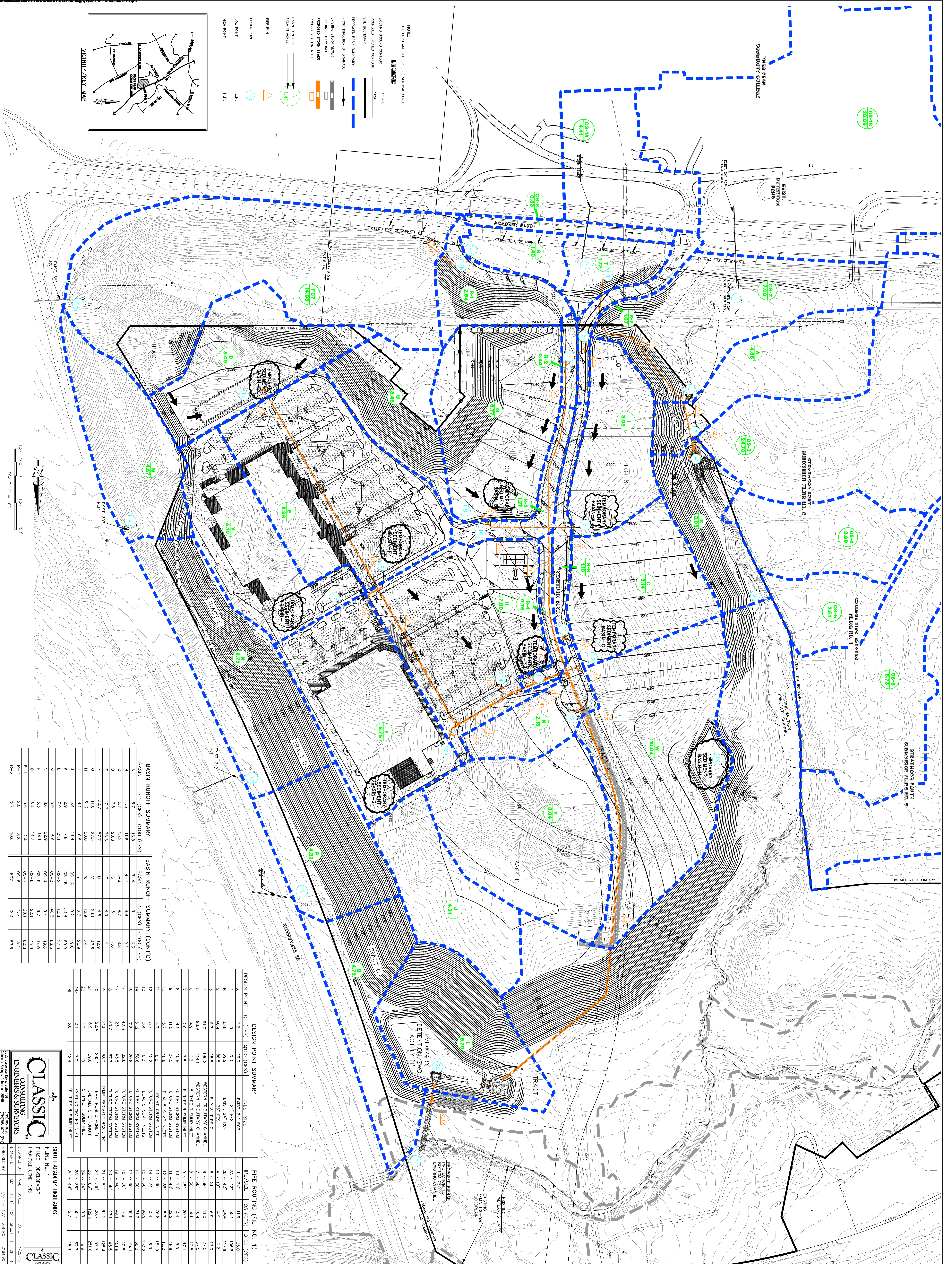
THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE
SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR
SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING
UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL
BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH
MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE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

NO.	REVISION	DATE

REVIEW:
PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF
CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC
KYLE R. CAMPBELL, COLORADO P.E. #29794 DATE

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS

FINAL DRAINAGE REPORT SOUTH ACADEMY HIGHLANDS FILING NO. 1 EXISTING CONDITIONS DRAINAGE MAP			
DESIGNED BY	MAL	SCALE	DATE 3/11/13
DRAWN BY	MAL	(H) 1" = 200'	SHEET 1 OF 1
CHECKED BY	(V) 1" = N/A	JOB NO.	2184.80



BASIN RUNOFF SUMMARY				BASIN RUNOFF SUMMARY (CONT'D)			
BASIN	Q ₅ (CFS)	Q ₁₀₀ (CFS)	Q ₁₀₀ (CFS)	BASIN	Q ₅ (CFS)	Q ₁₀₀ (CFS)	Q ₁₀₀ (CFS)
A	6.7	16.8	11.6	R-4	3.4	6.3	9.2
B	4.3	11.6	8.8	R-7	4.9	9.2	12.8
C	5.7	15.2	10.8	R-8	4.7	8.8	12.8
D	7.8	20.8	15.2	S	3.1	7.0	10.8
E	7.8	20.8	15.2	T	4.0	9.1	12.8
F	30.7	86.5	63.6	U	4.8	12.8	18.4
G	11.0	27.5	20.8	V	23.9	54.4	78.4
H	31.2	58.8	44.4	W	12.9	34.4	50.4
I	4.1	10.8	8.8	Y	9.7	25.4	36.4
J	5.4	14.4	10.8	Z	9.2	25.4	36.4
K	2.9	7.8	5.7	AA	3.8	10.8	15.2
L	7.9	21.1	15.2	AB	10.8	27.3	39.2
M	5.9	16.8	12.8	AC	40.3	86.3	124.8
N	8.6	22.9	16.8	AD	9.4	19.6	28.4
O	5.3	14.1	10.8	AE	6.7	14.0	20.8
P	5.4	14.3	10.8	AF	22.1	45.8	67.2
R-1	5.8	12.4	9.2	AG	29.1	60.8	89.2
R-2	2.0	3.8	5.7	AH	13.3	34.4	50.4
R-3	3.7	10.8	15.2	AI	22.3	53.5	78.4

DESIGN POINT SUMMARY				PIPE ROUTING (FIL. NO. 1)			
DESIGN POINT	Q ₅ (CFS)	Q ₁₀₀ (CFS)	Q ₁₀₀ (CFS)	PIPE SIZE	Q ₅ (CFS)	Q ₁₀₀ (CFS)	Q ₁₀₀ (CFS)
A	9.2	19.0	13.6	EXIST. 24" RCP	1 ~ 24"	11.9	25.0
B	11.9	25.0	17.6	EXIST. 24" RCP	2 ~ 42"	50.1	106.8
C	33.6	69.9	51.6	EXIST. 24" RCP	28 ~ 42"	54.4	117.6
D	40.4	86.5	63.6	5" X 3" TYPE C	4 ~ 18"	4.9	9.2
E	6.7	16.8	11.6	5" X 3" TYPE C	5 ~ 24"	6.9	13.0
F	91.0	196.2	144.8	WESTERN TRIBUTARY CHANNEL	6 ~ 36"	11.0	37.5
G	98.9	214.1	158.4	5" TYPE B SWAMP INLET	7 ~ 36"	18.4	37.5
H	4.9	9.2	6.3	5" TYPE B SWAMP INLET	8 ~ 30"	4.1	10.8
I	2.0	3.8	5.7	5" TYPE B SWAMP INLET	9 ~ 48"	20.7	47.1
J	4.1	10.8	8.8	5" TYPE B SWAMP INLET	10 ~ 18"	3.4	5.5
K	11.0	27.5	20.8	5" TYPE B SWAMP INLET	11 ~ 48"	22.2	48.9
L	37.2	86.5	63.6	5" TYPE B SWAMP INLET	12 ~ 36"	32.8	78.2
M	57.2	128.8	94.4	5" TYPE B SWAMP INLET	13 ~ 60"	41.6	93.2
N	57.2	128.8	94.4	5" TYPE B SWAMP INLET	14 ~ 96"	53.9	124.8
O	15.2	34.4	25.4	5" TYPE B SWAMP INLET	15 ~ 96"	53.9	124.8
P	31.2	69.9	51.6	5" TYPE B SWAMP INLET	16 ~ 36"	31.2	59.8
Q	31.2	69.9	51.6	5" TYPE B SWAMP INLET	17 ~ 36"	31.2	59.8
R	42.0	86.5	63.6	5" TYPE B SWAMP INLET	18 ~ 36"	31.2	59.8
S	23.1	43.5	31.2	5" TYPE B SWAMP INLET	19 ~ 48"	49.1	104.8
T	30.7	57.7	43.5	5" TYPE B SWAMP INLET	20 ~ 36"	23.1	43.5
U	21.6	38.2	28.4	5" TYPE B SWAMP INLET	21 ~ 54"	62.2	125.4
V	122.4	285.1	208.8	5" TYPE B SWAMP INLET	22 ~ 36"	30.7	57.7
W	6.9	15.2	10.8	5" TYPE B SWAMP INLET	23 ~ 36"	122.9	281.0
X	4.2	11.0	8.8	5" TYPE B SWAMP INLET	24 ~ 24"	9.0	18.9
Y	7.0	17.6	13.6	5" TYPE B SWAMP INLET	25 ~ 36"	30.7	57.7
Z	3.1	7.0	5.5	5" TYPE B SWAMP INLET	26 ~ 48"	2.7	48.3

CLASSIC CONSULTING ENGINEERS & SURVEYORS

1739-25-2500
Colorado Springs, Colorado 80909

South Academy Highlands

Phase 1 Development

Proposed Conditions

DESIGNED BY: W.A. SCALE: 1" = 100'

DRAWN BY: W.A. SCALE: 1" = 100'

CHECKED BY: W.A. SCALE: 1" = 100'

DATE: 7/22/13

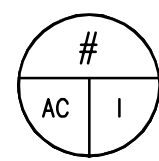
SHEET: 1 OF 1

JOB NO.: 2184.00

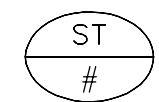
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BASIN HYDROLOGIC SUMMARY						
INLET ID	AREA (AC)	T _c (MIN)	RATIONAL "C _s "	RATIONAL "C ₁₀₀ "	Q _s (CFS)	Q ₁₀₀ (CFS)
A1a	0.6	5	0.9	0.95	2.9	5.4
A1g	1.7	5	0.9	0.95	7.7	14.5
A2a	0.1	5	0.9	0.95	0.5	1.0
A2b	0.6	5	0.9	0.95	2.7	5.1
A2c	0.9	5	0.9	0.95	4.1	7.6
A3a	0.8	5	0.9	0.95	3.8	7.0
A4	0.2	5	0.9	0.95	0.8	1.6
A5a	0.7	5	0.9	0.95	3.2	5.9
A6a	0.5	5	0.9	0.95	2.1	3.9
A7	0.1	5	0.9	0.95	0.6	1.0
A8a	0.1	5	0.9	0.95	0.3	0.6
A9a	0.1	5	0.9	0.95	0.3	0.6
A10	0.3	5	0.9	0.95	1.2	2.2
A11	0.3	5	0.9	0.95	1.3	2.5
A12	0.9	5	0.9	0.95	4.3	8.1
B1a	0.2	5	0.9	0.95	1.1	2.1
B2	0.2	5	0.9	0.95	0.8	1.5
B3	1.1	5	0.9	0.95	5.2	9.8
B5	0.8	5	0.89	0.94	3.7	7.0
B6	0.8	5	0.77	0.85	3.2	6.3
C1	0.4	5	0.9	0.95	1.8	3.3
C2	1.0	5	0.9	0.95	4.8	9.0
D1	1.8	5	0.7	0.78	6.3	12.6
D2	1.2	5	0.76	0.83	4.6	8.9
E0c	1.2	5	0.9	0.95	5.3	10.0
E1	1.2	5	0.6	0.7	3.8	7.8
E2	0.7	5	0.68	0.77	2.4	4.9
E3	1.2	5	0.66	0.77	3.4	7.1
E4	0.5	5	0.9	0.95	2.5	4.6
E5	0.7	5	0.9	0.95	3.3	6.3
E6	0.3	5	0.9	0.95	1.3	2.5
D	5.1	5	0.3	0.45	7.8	20.8
F1	0.7	5	0.9	0.95	3.4	6.4
G1	0.4	5	0.9	0.95	1.8	3.3
G2a	0.2	5	0.9	0.95	0.8	1.5
G3	0.1	5	0.9	0.95	0.3	0.6
G4a	1.0	5	0.9	0.95	1.3	2.5
G5	0.4	5	0.9	0.95	1.7	3.2
G6a	0.8	5	0.9	0.95	1.9	3.5
G7	0.1	5	0.9	0.95	0.4	0.7
G8	0.1	5	0.9	0.95	0.5	1.0
G9	0.1	5	0.9	0.95	0.5	0.9
G10	0.2	5	0.9	0.95	0.8	1.5
J1	1.8	5	0.9	0.95	8.1	15.2
J1a	0.9	5	0.9	0.95	4.0	7.5
J2	0.9	5	0.9	0.95	4.0	7.6
J2a	0.3	5	0.9	0.95	1.5	2.9
J2b	1.3	5	0.9	0.95	5.8	10.9
J3	0.6	5	0.9	0.95	2.7	5.1
J4a	0.5	5	0.9	0.95	2.1	3.9
J5	0.3	5	0.9	0.95	1.4	2.6
J7	0.3	5	0.9	0.95	1.3	2.4
K0	1.0	5	0.3	0.45	1.6	4.2
K1	0.9	5	0.9	0.95	4.2	7.9

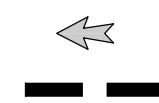
LEGEND



= BASIN DESIGNATION
AC = AREA IN ACRES
I(100) = WEIGHTED BASIN IMPERVIOUSNESS (C100)



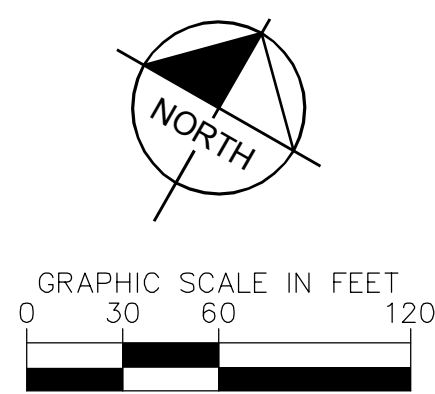
STRUCTURE NUMBER



EXISTING DRAINAGE PATTERN



EXISTING BASIN BOUNDARY



DEVELOPER PARCEL (N.A.P.)

DEVELOPER PARCEL (N.A.P.)

FUTURE DEVELOPMENT (N.A.P.)

WALMART SITE

STORE No. 8272-00
RCL-136-TR
TOTAL BUILDING AREA S.F. = ±136,634
F.F.E. = 5888.00



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and Associates, Inc.**
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990 SOUTH BROADWAY, SUITE 200, DENVER, CO 80209
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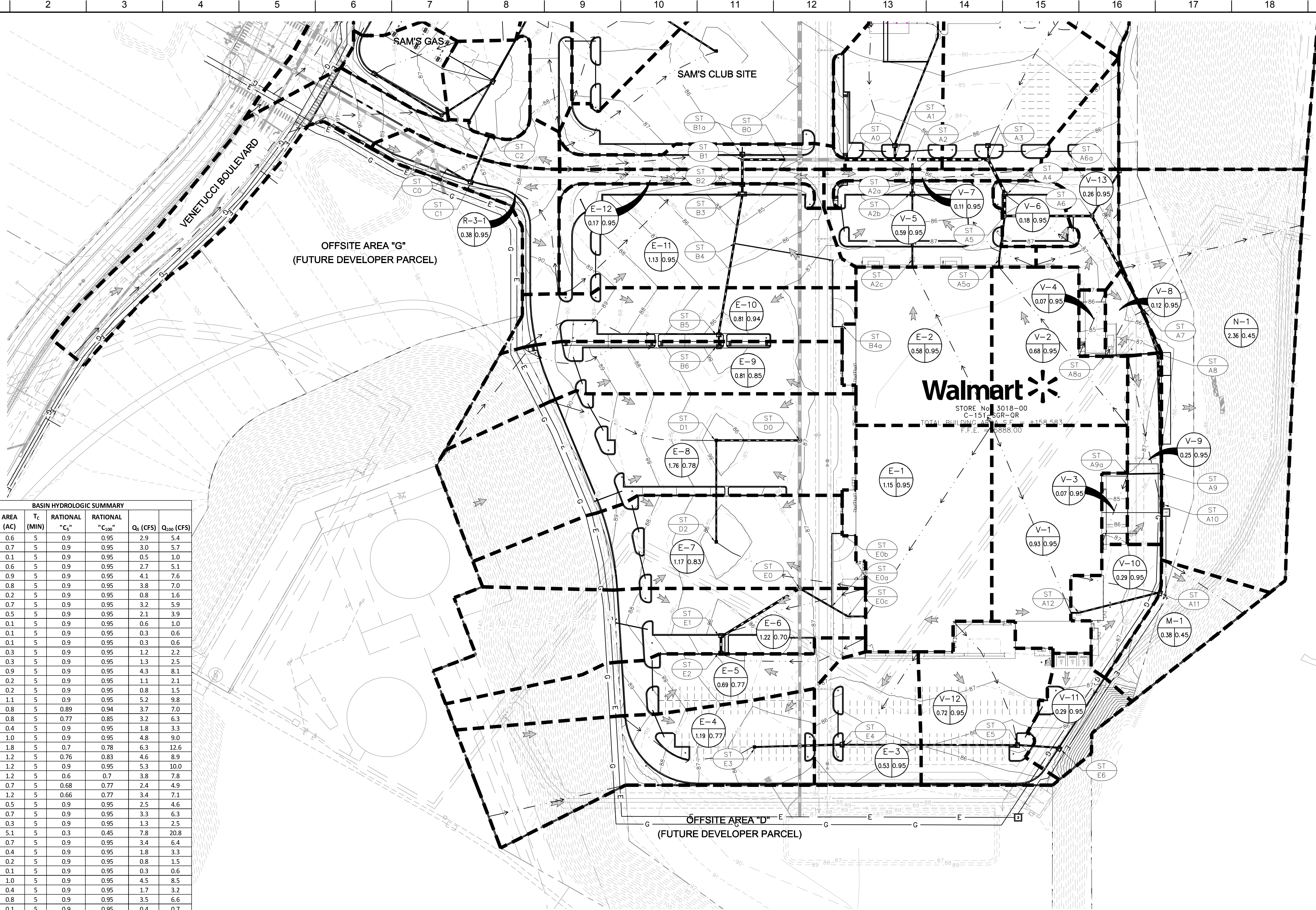
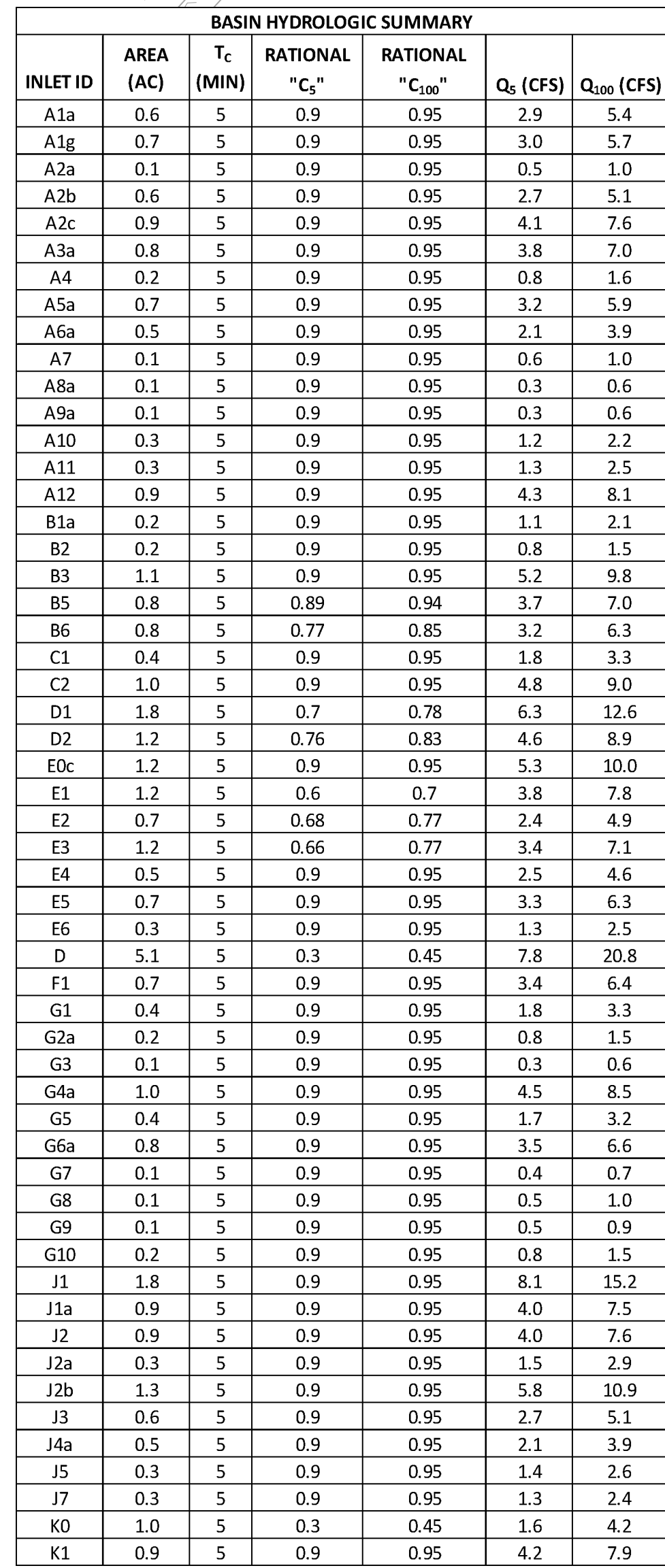
SCALE	AS NOTED
DESIGNED BY	RSC
DRAWN BY	RSC
CHECKED BY	DLS

POST-DEVELOPMENT
DA MAP: LOT 1

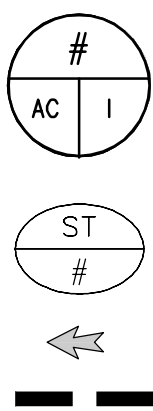
SAM'S CLUB STORE #8272-08
SOUTH ACADEMY HIGHLANDS - LOT 1
SAM'S REAL ESTATE BUSINESS TRUST
COLORADO
FOUNTAIN

DATE
3/4/2014
PROJECT NO.
067811100
SHEET NUMBER

6030



LEGEND



= BASIN DESIGNATION
AC = AREA IN ACRES
I(100) = WEIGHTED BASIN IMPERVIOUSNESS (C100)
STRUCTURE NUMBER
PROPOSED DRAINAGE PAT
PROPOSED BASIN BOUND

