

4-Way Commercial Final Drainage Report

El Paso County, Colorado

June 2026

Completed By:

Brett Louk, P.E.

Eric Maxwell, I.E.

PCD No. PPR2347



620 North Tejon, Suite 201
Colorado Springs, Colorado 80903
719-465-2145

blouk@smhconsultants.com

TABLE OF CONTENTS

TABLE OF CONTENTS	1
STATEMENT SHEET	2
1. GENERAL LOCATION AND DESCRIPTION.....	3
2. DRAINAGE BASINS AND SUB-BASINS	4
3. DRAINAGE DESIGN CRITERIA.....	12
4. DRAINAGE FACILITY DESIGN.....	13
5. FOUR STEP PROCESS	19
6. FLOODPLAIN STATEMENT.....	21
7. DRAINAGE BASIN FEES	22
8. COST ESTIMATE.....	22
9. SUMMARY	22

APPENDIX

- VICINITY MAP
- FEMA FLOODMAP
- SOILS REPORT
- GEOTECHNICAL REPORT
- HYDROLOGIC CALCULATIONS
- HYDRAULIC CALCULATIONS
- DETENTION / CONTROL MEASURE CALCULATIONS
 - EXTENDED DETENTION BASIN A
- PREVIOUS DRAINAGE STUDIES
- DRAINAGE MAPS

STATEMENT SHEET

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 preparing this report.

Brett Louk, P.E. # _____

Date

Developer's Statement:

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

Kevin O'Neil, Managing Member

Date

Owner: KO1515 LLC

Address: PO Box 1385

Colorado Springs, CO 80903

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

Date

Conditions:

1. GENERAL LOCATION AND DESCRIPTION

a. Purpose

KO1515, LLC has asked SMH Consultants, Inc. (SMH) to conduct a stormwater drainage analysis for the proposed 4-Way Commercial development to satisfy the El Paso County drainage criteria manual requirements. This analysis will determine potential impacts resulting from development of a commercial storage facility.

b. Development Location

The property is located in the NW $\frac{1}{4}$ of Section 33 and SW $\frac{1}{4}$ of Section 28, Township 12 South, Range 64 West in El Paso County, Colorado.

The site is accessed via the public road Stapleton Drive. A vicinity map of the site has been included in the appendix of this report.

The 4-Way property is 67.1 acres in size and contains two tracts that are bisected by Stapleton Drive. The tract north of Stapleton Drive is approximately 15.5 acres in size, while the tract to the south of Stapleton Drive is approximately 51.6 acres in size. No improvements to the northern tract of the property have been proposed as part of this project. The southern parcel of the property is bordered by residential property (4-Way Ranch Filing No. 1). The property is bordered by HWY 24 to the east, and unplatted agricultural and vacant property to the north.

A portion of the southern tract will be developed with a 46,000 sq. ft. mini-storage warehouse building, accessory storage buildings, and a parking lot and road to serve the development. The parking lot and road will be comprised of both asphalt pavement and asphalt millings. Approximately 4 additional acres within the southern tract will be graded and designated for future commercial use. The proposed improvements shown in the drainage plan will be located in the southern area of the property, and is referred to as 'the site' herein. The remaining area of the property will remain undeveloped.

Construction of the proposed development will be implemented in two (2) phases, Phase I and Phase II. All of the proposed improvements from both Phase I and II have been accounted for in the designs presented in this report. Additionally, the designs presented in this report account for any future commercial development to be located in the southeast region of the site.

c. Description of Property

The property consists of two separate tracts, a northern and southern tract. The northern tract of the property consists of open space and a large natural drainageway, further referenced as Drainageway B. The southern tract on the existing site consists of primarily open-space, with an existing pump house, dirt roads, and gravel roads to provide access to the pump house. The site contains an existing waterline and overhead electric that serve the existing pump house.

There are no existing irrigation facilities onsite. Several existing drainageways on site convey runoff between existing ponds that provide stormwater quality and detention for the adjacent Stapleton Road. The southern tract of the site is bound to the west by a large drainageway running along the property line, further referenced as Drainageway A. Existing vegetative cover consists of light grasses, shrubs, and some trees. With this commercial development, approximately 14.00 acres will be disturbed. All area disturbed for construction of the commercial development will be within the southern tract.

Based on a Custom Soil Resource Report, obtained from the USDA NRCS Web Soil Survey (accessed February 25th, 2025) for the site, the native soils consist of *Columbine gravelly sandy loam* and *Stapleton sandy loam*, with slopes ranging from 1-9 percent. *Columbine gravelly sandy loam* belongs to Hydrologic Soil Group A. Group A soils are typically classified as a well-drained soil, with a low runoff class. *Stapleton sandy loam* belongs to Hydrologic Soil Group B. Group B soils are typically classified as well-drained or moderately well-drained soil, with a moderately low runoff class. The Custom Soil Report has been included in the appendix of this report.

The site is located in the Geick Ranch drainage basin. Black Squirrel Creek is the nearest tributary drainageway to the site.

2. DRAINAGE BASINS AND SUB-BASINS

a. Major Basin Descriptions

The subject property is entirely in the Geick Ranch drainage basin. The Geick Ranch drainage basin is approximately 22.05 sq. mi. in size and located in El Paso County. The entire drainage basin is tributary to Black Squirrel Creek. Flows within this creek travel south to eventually combine with the Arkansas River near Pueblo, CO. The majority of the basin is undeveloped, with residential, industrial, agricultural, and commercial developments planned for the future. Geick Ranch drainage basin was studied in the “Geick Ranch Drainage Basin Planning Study” (2008). Development of the 4-Way property will be in line with the results from the DBPS.

The subject site is located within the “Haegler Diversion” of the Geick Ranch drainage basin. The Haegler Ranch drainage basin was studied in the “Haegler Ranch Drainage Basin Planning Study” (referenced further as Haegler DBPS), by URS, approved 2009.

This portion of the Geick Ranch Basin was studied as part of the “MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Dr to US HWY 24” (referenced further as the Stapleton MDDP), by JR Engineering, approved November 2009 and revised May 2010. The Stapleton MDDP was created for the Stapleton Drive construction from Highway 24 to Bandanero Drive. This section of Stapleton Drive runs between the northern and southern tracts of the 4-Way property. The Stapleton MDDP proposed construction of five (5) ponds on site to be used for temporary erosion control, water quality, interim detention, and full-spectrum detention. Existing Pond #1 acts as a sedimentation basin and is located within drainageway A. Since then, Existing Pond #1 has

been converted to an extended detention basin, with a 4'x4' outlet structure. Existing Pond #1 treats 40.4 acres of adjacent residential development and will remain undisturbed. Existing Ponds #2-4, located in the central region of the site, were constructed as temporary sediment basins for Stapleton Road. Existing Ponds #2-4 are not equipped with formal outlet structures, and are designed to detain runoff until they “overtop”, and spill runoff through defined drainageways throughout the site. Existing Pond #5 is located in the eastern corner of the site. Existing Pond #5 is equipped with two (2) outlets, a 24” RCP and 15” steel overflow pipes direct flow underneath the adjacent trail and HWY 24. Existing Pond #5 provides 0.380 ac-ft of storage volume. Existing Pond #5 is located partially within El Paso County ROW. An agreement with El Paso County was discussed in both the Stapleton and Commercial MDDP’s, which allows for drainage improvements to encroach into the county right of way. All five ponds are still present on the property. This report assigned all maintenance responsibilities to the 4-Way Ranch Metropolitan District 1. Maintenance responsibilities of the existing ponds will be transferred from the 4-Way Ranch Metropolitan District 1 to the 4-Way Commercial Metropolitan District.

Ponds #2-4 are sedimentation basins which were built in 2007 for the construction of Stapleton Road. These ponds are not up to county standards for detention ponds, as they do not have formal outlet structures or emergency spillways. Since the construction of Stapleton Road, these ponds have remained in place on the property, but do not provide any permanent water quality treatment. Pond #5 does contain outlet pipes, and was constructed to provide water quality treatment and detention for Stapleton Road, with the expectation that it would be improved to provide detention for the site once it had been developed. After analysis of Existing Pond #5, it became apparent that it would be difficult to bring to county standards. The elevations of the pond inlet and outlet pipes would need to be modified, and would require major disturbance to Rock Island Trail and US HWY 24 to do so. Per conversations with EPC, it was determined that some flow can enter this pond but it will not be considered treated since the pond is not up to county standards. In lieu of reconstruction and redesign of Existing Pond #5, SMH has decided to leave Existing Pond #5 undisturbed, and provide permanent water quality treatment and detention for the site in a different location (Extended Detention Basin A).

The 4-Way Commercial site was also previously studied in the “MDDP Amendment/Preliminary Drainage Report for 4-Way Ranch Commercial” (referenced further as Commercial MDDP), by JR Engineering, approved September 2009 and revised February 2010. The Commercial MDDP was created to plan preliminary drainage infrastructure for future developments within the 4-Way Commercial property. The Commercial MDDP provided preliminary drainage planning for the construction of Dumont Drive, however Dumont Drive has not yet been constructed. This report also provided discussion of the five (5) existing ponds on the property. Improvements/expansion were proposed to Existing Pond #5, which was to be constructed to treat additional runoff from Dumont Drive. Since Dumont Drive was not constructed, no improvements to Existing Pond #5 have been made and the pond has remained unchanged since the Stapleton MDDP. Existing Ponds #2-4 have also remained unchanged since this study. The Commercial MDDP stated that these ponds will eventually be improved to meet current criteria and provide detention for future development within the property. This report restated all drainage facilities will be maintained by 4-Way

Ranch Metropolitan District 1. As stated above, maintenance responsibilities of the existing ponds will be transferred from the 4-Way Ranch Metropolitan District 1 to the 4-Way Commercial Metropolitan District.

As identified in the Stapleton MDDP and Commercial MDDP, the 4-Way Commercial property receives offsite runoff from Meridian Ranch and 4-Way Filing No. 1 developments. This offsite runoff enters the site at the northwest corner of the southern parcel, where flow passes under Stapleton Road and travels southeast through Drainageway A. As identified in the Stapleton MDDP, historic basins H8, H9, and H10 all travel onsite through Drainageway A. Previous studies have found the 5-year and 100-year offsite flow from these developments to be 86 cfs and 469 cfs, respectively. Drainageway A is located in a 100-year floodplain (Zone A), and will remain undisturbed. Offsite runoff in Drainageway A travels to historic design point HG2, where two (2) 36" CMP culverts intercept runoff and direct flow towards a 4' x 4' RCB culvert underneath US HWY 24. Additionally, the 4' x 4' RCB is equipped with an impact stilling basin at the outfall, as identified in the Stapleton MDDP. In its existing state, the drainage infrastructure underneath US HWY 24 is not adequately sized to handle the runoff that is currently flowing to it. Since this is an existing problem, and the development is not increasing flows to this infrastructure, no downstream improvements are being recommended as part of this development.

Design point HG2 has been included in existing and proposed hydrologic calculations for comparison of ultimate flow leaving the site at this crossing. All relevant offsite runoff calculations can be seen in the appendix of the report.

b. Offsite Sub-Basin Descriptions

Offsite Drainage Area OS-1 (sub-basin X-2 in the Stapleton MDDP) is approximately 0.52 acres located northwest of the site along Stapleton Road. Stormwater runoff flows east at slopes ranging from 1-2 percent towards drainageway A at Design Point 1. OS-1 consists of both native vegetation and paved roads, but was modeled in the Stapleton MDDP as entirely pavement. This sub-basin has existing 5-year and 100-year flows of 2.42 cfs and 4.33 cfs, respectively.

Offsite Drainage Area OS-2 (sub-basin Y-2 in the Stapleton MDDP) is approximately 0.72 acres located northwest of the site along Stapleton Road. Stormwater runoff flows east at slopes ranging from 1-2 percent towards an existing area inlet at Design Point 2. Runoff is then discharged towards Drainageway A through an existing 24" RCP storm sewer. OS-2 consists of both native vegetation and paved roads, but was modeled in the Stapleton MDDP as entirely pavement. This sub-basin has existing 5-year and 100-year flows of 3.35 cfs and 6.00 cfs, respectively.

Offsite Drainage Area OS-3 (sub-basin X-1 in the Stapleton MDDP) is approximately 0.83 acres located northwest of the site along Stapleton Road. Stormwater runoff flows west at slopes ranging from 1-2 percent towards drainageway A at Design Point 1. OS-3 consists of both native vegetation and paved roads, but was modeled in the Stapleton MDDP as entirely

pavement. This sub-basin has existing 5-year and 100-year flows of 3.69 cfs and 6.61 cfs, respectively.

Offsite Drainage Area OS-4 (sub-basin Y-1 in the Stapleton MDDP) is approximately 0.77 acres located northwest of the site along Stapleton Road. Stormwater runoff flows west at slopes ranging from 1-2 percent towards an existing area inlet at Design Point 2. Runoff is then discharged towards Drainageway A through an existing 24" RCP storm sewer. OS-4 consists of both native vegetation and paved roads, but was modeled in the Stapleton MDDP as entirely pavement. This sub-basin has existing 5-year and 100-year flows of 3.22 cfs and 5.77 cfs, respectively.

Offsite Drainage Area OS-5 (sub-basin J in the Stapleton MDDP) is approximately 1.35 acres located north of the site along Stapleton Road ROW. Stormwater runoff flows east at slopes ranging from 1-3 percent towards an existing curb inlet. Runoff is then conveyed from a 24" RCP that outfalls to Existing Pond #2 at Design Point 8. OS-5 consists of native vegetation, but was modeled in the Stapleton MDDP as entirely pavement. This sub-basin has existing 5-year and 100-year flows of 5.11 cfs and 9.14 cfs, respectively.

Offsite Drainage Area OS-6 (sub-basin K in the Stapleton MDDP) is approximately 1.61 acres located north of the site along Stapleton Road. Stormwater runoff flows east at slopes ranging from 1-3 percent towards an existing curb inlet. Runoff is then conveyed from a 24" RCP that outfalls to Existing Pond #2 at Design Point 8. OS-6 consists of both native vegetation and paved roads, but was modeled in the Stapleton MDDP as entirely pavement. This sub-basin has existing 5-year and 100-year flows of 6.54 cfs and 11.71 cfs, respectively.

Offsite Drainage Area OS-7 (sub-basin L in the Stapleton MDDP) is approximately 0.47 acres located north of the site along Stapleton Road ROW. Stormwater runoff flows east at slopes ranging from 1-3 percent towards an existing curb inlet. Runoff is then conveyed from a 24" RCP that outfalls to Existing Pond #3 at Design Point 9. OS-7 consists of native vegetation, but was modeled in the Stapleton MDDP as entirely pavement. This sub-basin has existing 5-year and 100-year flows of 2.19 cfs and 3.92 cfs, respectively.

Offsite Drainage Area OS-8 (sub-basin M in the Stapleton MDDP) is approximately 0.71 acres located north of the site along Stapleton Road. Stormwater runoff flows east at slopes ranging from 1-3 percent towards an existing curb inlet. Runoff is then conveyed from a 24" RCP that outfalls to Existing Pond #3 at Design Point 9. OS-8 consists of both native vegetation and paved roads, but was modeled in the Stapleton MDDP as entirely pavement. This sub-basin has existing 5-year and 100-year flows of 3.30 cfs and 5.92 cfs, respectively.

Offsite Drainage Area OS-9 (sub-basin P in the Stapleton MDDP) is approximately 0.22 acres located north of the site along Stapleton Road. Stormwater runoff flows south at slopes ranging from 1-5 percent towards sub-basin EX-5, where runoff eventually leaves the site at Design Point 11. OS-9 consists of both native vegetation and paved roads, but was modeled in the Stapleton MDDP as entirely pavement. This sub-basin has existing 5-year and 100-year flows of 1.02 cfs and 1.83 cfs, respectively.

Offsite Drainage Area OS-10 (sub-basin Q in the Stapleton MDDP) is approximately 0.30 acres located north of the site along Stapleton Road. Stormwater runoff flows southeast at slopes ranging from 1-5 percent towards sub-basin EX-6, where runoff travels to Design Point 7 at Existing Pond #5. OS-10 consists of both native vegetation and paved roads, but was modeled in the Stapleton MDDP as entirely pavement. This sub-basin has existing 5-year and 100-year flows of 1.40 cfs and 2.50 cfs, respectively.

Offsite Drainage Area OS-11 (sub-basin S in the Stapleton MDDP) is approximately 1.24 acres located northeast of the site along Stapleton Road and US HWY 24. Stormwater runoff flows southeast at slopes ranging from 2-3 percent towards an existing curb inlet. Runoff is then conveyed from a 24" RCP that outfalls to Existing Pond #5 at Design Point 6. OS-11 consists of both native vegetation and paved roads, but was modeled in the Stapleton MDDP as entirely pavement. This sub-basin has existing 5-year and 100-year flows of 5.54 cfs and 9.93 cfs, respectively.

Offsite Drainage Area OS-12 (sub-basin R in the Stapleton MDDP) is approximately 1.55 acres located northeast of the site along Stapleton Road ROW and US HWY 24. Stormwater runoff flows southeast at slopes ranging from 2-3 percent towards an existing curb inlet. Runoff is then conveyed from a 24" RCP that outfalls to Existing Pond #5 at Design Point 6. OS-12 consists of both native vegetation and paved roads, but was modeled in the Stapleton MDDP as entirely pavement. This sub-basin has existing 5-year and 100-year flows of 6.99 cfs and 12.53 cfs, respectively.

c. Existing Sub-Basin Descriptions

Drainage Area EX-1 (sub-basin A in the Stapleton MDDP) is approximately 8.40 acres located along the western boundary of the site. Stormwater runoff flows southeast along Drainageway A at slopes ranging from 1-7 percent towards Design Point 4. This sub-basin receives offsite flow from Design Point 3. EX-1 consists entirely of native vegetation, and contains Existing Pond #1. Existing Pond #1 is an extended detention basin, equipped with a 4'x4' multi-stage outlet structure. Existing Pond #1 treats offsite flow from the adjacent Waterbury Filing No. 1 (SF237). This sub-basin has existing 5-year and 100-year flows of 2.31 cfs and 16.98 cfs, respectively.

Drainage Area EX-2 (sub-basin B in the Stapleton MDDP) is approximately 10.54 acres located along the southwestern boundary of the site. Stormwater runoff flows southeast along Drainageway A at slopes ranging from 1-8 percent towards Design Point 5. This sub-basin receives runoff from Design Point 4. EX-2 consists entirely of native vegetation. This sub-basin has existing 5-year and 100-year flows of 2.73 cfs and 20.02 cfs, respectively.

Drainage Area EX-3 (sub-basin C in the Stapleton MDDP) is approximately 13.15 acres located along the northern boundary of the site. Stormwater runoff flows south/southwest at slopes ranging from 1-8 percent towards Design Point 10. This sub-basin receives offsite flow from Design Points 8 and 9. EX-3 consists entirely of native vegetation, and contains Existing Ponds #2, #3, and #4. These ponds provide water quality treatment and interim

detention for Stapleton Road. This sub-basin has existing 5-year and 100-year flows of 3.61 cfs and 26.53 cfs, respectively.

Drainage Area EX-4 (sub-basin D in the Stapleton MDDP) is approximately 16.83 acres located in the central region of the site. Stormwater runoff flows southeast at slopes ranging from 1-6 percent towards Design Point 12. This sub-basin receives runoff from Design Point 10. EX-4 consists of native vegetation, a dirt access road, and an existing pump house. This sub-basin also contains a culvert crossing at the dirt access road. Two (2) 15" HDPE culverts convey flow through this basin, both of which are undersized and proposed to be removed. This sub-basin has existing 5-year and 100-year flows of 4.26 cfs and 31.26 cfs, respectively.

Drainage Area EX-5 is approximately 7.04 acres located in the central/western region of the site. Stormwater runoff flows south at slopes ranging from 1-7 percent towards Design Point 11. From here, runoff travels southwest along HWY 24 until it reaches Design Point 13. This sub-basin receives runoff from OS-9. EX-5 consists of native vegetation and a dirt access road. This sub-basin has existing 5-year and 100-year flows of 1.82 cfs and 13.37 cfs, respectively.

Drainage Area EX-6 is approximately 5.08 acres located in the eastern region of the site. Stormwater runoff flows south at slopes ranging from 1-6 percent towards Design Point 7, at Existing Pond #5. This sub-basin receives offsite flow from OS-10 and Design Point 6. EX-6 consists of native vegetation, paved roads, and Existing Pond #5. Existing Pond #5 provides full spectrum detention for the adjacent Stapleton Road. All inflows to this pond are represented by Design Point 7, while all outflow is represented by Design Point 14. This sub-basin has existing 5-year and 100-year flows of 1.52 cfs and 10.78 cfs, respectively.

Drainage Area EX-7 is approximately 2.67 acres located in the central/southern region of the site. Stormwater runoff flows south at slopes ranging from 1-4 percent towards Design Point 13. EX-7 consists entirely of native vegetation. This sub-basin has existing 5-year and 100-year flows of 0.77 cfs and 5.64 cfs, respectively.

d. Existing Drainage Characteristics

Existing runoff patterns follow the same historic flow paths established in the Stapleton MDDP. Stormwater runoff travels south/southeast from Stapleton Road through the 4-Way Commercial property. Within the property, runoff is largely conveyed through existing drainageways towards two separate site outfalls. One site outfall (Ex-Design Point 14), is located near the intersection of Stapleton Road and US HWY 24, at the outfall of Existing Pond #5. Existing Pond #5 provides detention and water quality treatment for Stapleton Road, and is equipped with a 24" RCP and 15" steel overflow pipe. Discharge from the pond travels southeast through an existing 24" CMP culvert under US HWY 24, where site runoff will continue to follow historic drainage paths. The other site outfall (HG2) is located approximately 300 feet south of the property, at the invert of two (2) 36" CMP culverts. A majority of all offsite drainage areas and site sub-basins drain to this area, including offsite flows from the Meridian Ranch and 4-Way Filing No. 1 developments. Runoff is directed through the property to the south to twin 36" CMP culverts. The twin culverts discharge flow

southeast to an existing 4’x4’ RCB culvert, which passes flow underneath US HWY 24. Previous analysis of the site outfall at HG2, conducted in the “Waterbury Filing. No 1” Terra Nova Engineering (2025), show that the twin 36” CMP culverts, as well as the 4’x4’ RCB culvert are undersized to handle existing runoff. These findings are consistent with the analyses conducted in this drainage study.

Several of the existing sub-basins from this report have remained unchanged from the Stapleton MDDP. All offsite sub-basins as well as EX-1, EX-2, EX-3, and EX-4 will have the same areas and land cover designations as identified in the Stapleton MDDP. Even though the existing sub-basins have the same area and land cover from the Stapleton MDDP, the existing runoff rates will vary slightly due to the change in rational runoff coefficients.

At the time of the Stapleton MDDP stormwater analysis, the El Paso County Drainage Criteria Manual Volume 1 had 5-year and 100-year rational runoff coefficients for pasture/meadow land cover (HSG A/B) of 0.02 and 0.24, respectively. Per the Volume 1 update, these values are now 0.08 and 0.35, respectively. The updated 5-year rational runoff coefficient for pasture/meadow has increased by 300%, while the updated 100-year rational runoff coefficient for pasture/meadow has increased by approximately 46%. A majority of the site is modeled with this land cover, and therefore most existing sub-basins in this report will have higher predevelopment runoff rates than that of the Stapleton MDDP. Of the total 74.8 acres analyzed for the 4-Way Commercial development, approximately 64.2 acres consisted of pasture/meadow land cover.

Table 1 below compares existing and Stapleton MDDP design points at all site outfalls.

Design Point (Stapleton MDDP Equivalent Design Point)	Q ₅ (Stapleton MDDP Q ₅)	Q ₁₀₀ (Stapleton MDDP Q ₁₀₀)	Description
HG2 (HG2)	102.65 cfs (94.3 cfs)	541.99 cfs (511.6 cfs)	Total flow to twin 36” CMPs and 4’X4’ RCB crossing underneath HWY 24
EX-DP-14 (DP-13)	1.95 cfs (3.40 cfs)	8.73 cfs (13.2 cfs)	Outflow from Existing Pond #5 to 24” CMP crossing underneath HWY 24

Table 1. Existing and Stapleton MDDP Ultimate Design Point Summary

The proposed site conditions will ensure that runoff leaving the site at all outfalls will be less than or equal to the updated existing runoff values. (541.99 cfs at Design Point HG2 and 8.73 cfs at Ex. Design Point 14)

e. Existing Drainage Infrastructure

Both the Stapleton MDDP and Commercial MDDP had proposed five (5) ponds on the 4-Way Ranch property to provide water quality treatment, erosion control, interim detention, and full-spectrum detention for Stapleton Road. All of these ponds still exist on the property. Existing Pond #1 provides detention storage for offsite property. Existing Ponds #2-4 only provide water quality and erosion control for offsite flows. Existing Ponds #1-4 will remain on the property undisturbed. No soil disturbance, or proposed improvements, are planned upstream of these facilities. Therefore, they will remain sized as they were in the Stapleton MDDP.

Existing Pond #5 is located near the intersection of Stapleton Road and US HWY 24. The pond lies within both the site and El Paso County ROW. Existing Pond #5 is the only pond on the property that provides water quality treatment and detention, up to the 100-year event. The pond receives offsite and onsite flow, and discharges stored water offsite through a 24" RCP and 15" steel overflow pipe. The pond receives flow from onsite sub-basin EX-6, an area which is slated for overlot grading and future commercial development. Development and overlot grading of the proposed development will reduce the total inflow to Existing Pond #5. Existing Pond #5 has a tributary area of 8.17 acres in the existing condition, and will have only 4.79 acres of tributary area in the proposed condition. Apart from the decrease in tributary area, the proposed developments will not disturb Existing Pond #5. Proposed outflows from this pond will be less than existing outflows. All calculations and relevant excerpts for Existing Pond #5 can be seen in the appendix of this report.

Near the northwest region of the site, Drainageway A crosses underneath Stapleton Drive. This crossing is located right at the property limits, and contains all offsite flow from Meridian Ranch and 4-Way Filing No. 1 ($Q_5=86$ cfs, $Q_{100}=469$ cfs). In the Stapleton MDDP, two (2) 8' x 4' RCB culverts were proposed to pass flows underneath Stapleton Drive. These culverts exist today and have approximately 505.49 cfs of capacity, providing adequate conveyance of offsite flows underneath Stapleton Drive. No improvements to these culverts or any other upstream drainage infrastructure are proposed as part of this project.

There exists a culvert crossing near the central region of the site. Along the existing dirt access road are two (2) 15" HDPE culverts. These culverts convey all flow from Design Point 10 ($Q_5 = 14.16$ cfs, $Q_{100} = 42.65$ cfs). Hydraulic calculations of these culverts show they are undersized, with a combined capacity for both culverts of approximately 24.35 cfs. Hydraulic calculations of the existing culverts can be seen in the appendix below.

The dirt road near the culvert crossing provides access to the pump house from the east and west sides of the property. The proposed site developments will encroach onto the eastern portion of the dirt road. Due to this, it is proposed that the dirt road embankment and twin 15" HDPE culverts west of the pump house be removed. The disturbed drainageway will be regraded and stabilized to convey runoff along historic flow paths.

The existing site outfall at HWY 24 (HG2) was also analyzed as part of this report. This site outfall is located approximately 350 feet south of the site, at HWY 24. At this location, there

are two (2) 36" CMP culverts that convey flow underneath Rock Island Trail. After this crossing, flow is conveyed under HWY 24 through a 4'x4' RCB culvert, where it then continues southeast through historic flow paths. Analysis of existing runoff generated from the property and all offsite basins shows this site outfall receives approximately 102.65 cfs and 541.99 cfs in the 5-year and 100-year events, respectively.

Hydraulic analysis of the dual 36" CMP culverts show that they can pass approximately 84.83 cfs of flow before Rock Island Trail is overtopped. Analyses show that in the 100-year event, the depth of flow overtopping Rock Island Trail will be approximately 1.8 ft. Analysis of the 4'x4' RCB culvert underneath HWY 24 shows that the crossing has a capacity of approximately 191.29 cfs before flow overtops HWY 24. In the 100-year event, the depth of flow overtopping HWY 24 is approximately 0.8 ft.

The site outfall was previously studied in the recently approved "Final Drainage Report for Waterbury Filing No. 1" by Terra Nova Engineering, approved March 2025 (SF237). This report provided HEC-RAS analysis of these crossings and found that they were undersized in the 100-year event. In this report, the 100-year flow analyzed was 290.5 cfs, and found that HWY 24 will be overtopped by approximately 0.22' of runoff. The report also found that Rock Island Trail will be overtopped in the 100-year event. This report proposed no improvements to the existing site outfall at HG2.

Findings from this study as well as the previously mentioned "Final Drainage Report for Waterbury Filing No. 1" show that the existing downstream drainage infrastructure at site outfall HG2 is currently undersized. It should be noted these findings are in contradiction to previously approved reports. The Commercial MDDP (PCD No. PUD07013) stated the downstream drainage infrastructure was adequately sized for a historic 100-year runoff rate of 521 cfs, but did not provide any further analysis of overall capacity. Similarly, the Stapleton MDDP stated the drainage infrastructure at HG2 has the capacity to convey a 100-year event of 521 cfs, without additional analysis.

3. DRAINAGE DESIGN CRITERIA

a. Development Criteria Reference

Pre- and post-development drainage characteristics were reviewed, studied, and analyzed using the *El Paso County Drainage Criteria Manual Volumes 1 and 2*, Federal Emergency Management Agency's Flood Insurance Rate Map and USDA NRCS Web Soil Survey.

b. Hydrologic Criteria

Hydrology calculations in this report were performed following the methodologies outlined in the *El Paso County Engineering Criteria Manual* and the *El Paso County Drainage Criteria Manual (DCM) Volumes 1 and 2*. Drainage characteristics were delineated based on existing topographic information from survey data and USGS topographical maps. The existing and proposed drainage maps have been included in the appendix of this report.

Since the watershed area encompassing the development site is less than 100 acres, the Rational Method was used to determine peak flows for the 5-year and 100-year storm events. Weighted C values were determined for each drainage area within the proposed site based on the amount of impervious and pervious areas. A runoff coefficient (C) was chosen from Table 6-6 of the *El Paso County Drainage Criteria Manual, Volume 1 update*. As mentioned earlier, the site consists of Hydrological Soil Group A. The Weighted C values are shown in the appendix of this report.

The time of concentration was calculated for each drainage area based off methods found in Chapter 6, Section 3.2 of the *El Paso County Drainage Criteria Manual, Volume 1 update*. The first 100 feet of unconcentrated overland flow time was calculated and added to the subsequent channelized flow times. Channelized flow times were calculated using channel flow time equation. All onsite and offsite sub-basins were analyzed under developed flow conditions. All times of concentration for the existing and proposed sub-basins have been included in the appendix of this report.

Rainfall intensity was calculated for each drainage area based off methods found in Chapter 6, Section 3.3 of the *El Paso County Drainage Criteria Manual, Volume 1 update*. The intensity value for each basin was determined using the equations from Figure 6-5. Each drainage area's time of concentration was used to determine the respective intensity. All rainfall intensity calculations for existing and proposed sub-basins have been included in the appendix of this report.

4. DRAINAGE FACILITY DESIGN

a. General Concept

Proposed improvements to the site include the construction of the southern portion of Dumont Drive, a 46,000 sq. ft. mini-storage warehouse building, accessory storage buildings, asphalt/asphalt millings parking lot, and overlot grading for future commercial development. All areas designated for future commercial development have been hydrologically modeled as fully developed commercial space.

The proposed access drive to the site is designated to become a non-residential collector, Dumont Drive, with an ultimate paved width of 48 feet, and 5' detached sidewalks on each side of the road. At the time of this development, only the southern half of the road and proposed right of way improvements will be constructed to serve the site. However, Dumont Drive has been hydrologically modeled at the ultimate condition in this study.

The proposed improvements are expected to add 7.00 acres of impervious area, with an additional 3.71 acres graded for future commercial development. The existing pump house on the property will remain, however, the dirt access road and culvert crossing east of the pump house will be removed from the property. An extended detention basin (further referenced as Extended Detention Basin A) is proposed to provide water quality and detention storage for the proposed improvements and future commercial development.

Much of the existing site, including the northern tract, all offsite basins, and all areas within the 100-year floodplain, will remain undisturbed. All offsite flow will be allowed to enter the site as it currently does. The runoff values for the site will increase in some areas due to the addition of impervious area. The 5-year and 100-year runoff calculations for the proposed site can be seen in the appendix below.

b. Proposed Sub-Basin Descriptions

Drainage Area P-1 (sub-basin A in the Stapleton MDDP) is approximately 8.40 acres located along the western boundary of the site. Stormwater runoff flows southeast along Drainageway A at slopes ranging from 1-7 percent towards Design Point 4. This sub-basin receives offsite flow from Design Point 3. P-1 consists entirely of native vegetation, and contains Existing Pond #1. Existing Pond #1 functions as a stock pond and sedimentation basin for Stapleton Road and Drainageway A. Water quality treatment is not provided for this sub-basin as it will remain undisturbed. This sub-basin has proposed 5-year and 100-year flows of 2.31 cfs and 16.98 cfs, respectively.

Drainage Area P-2 (sub-basin B in the Stapleton MDDP) is approximately 10.54 acres located along the southwestern boundary of the site. Stormwater runoff flows southeast along Drainageway A at slopes ranging from 1-8 percent towards Design Point 5. This sub-basin receives runoff from Design Point 4. P-2 consists entirely of native vegetation. Water quality treatment is not provided for this sub-basin as it will remain undisturbed. This sub-basin has proposed 5-year and 100-year flows of 2.73 cfs and 20.02 cfs, respectively.

Drainage Area P-3 is approximately 13.15 acres located along the northern boundary of the site. Stormwater runoff flows south/southwest at slopes ranging from 1-8 percent towards Design Point 10. This sub-basin receives offsite flow from Design Points 8 and 9. P-3 consists entirely of native vegetation, and contains Existing Ponds #2, #3, and #4. These ponds provide water quality treatment and interim detention for Stapleton Road. None of the existing ponds within this sub-basin will be disturbed. Water quality treatment is not provided for this sub-basin as it will remain undisturbed. This sub-basin has proposed 5-year and 100-year flows of 3.61 cfs and 26.53 cfs, respectively.

Drainage Area P-4 is approximately 15.14 acres located in the central region of the site. Stormwater runoff flows southeast at slopes ranging from 1-6 percent towards Design Point 14. This sub-basin receives runoff from Design Point 10. P-4 consists of native vegetation, a dirt access road, and an existing pump house. This sub-basin also contains a culvert crossing at the dirt access road. Proposed improvements to this sub-basin include grading for the future full-width Dumont Drive. Approximately 0.86 acres will be disturbed within this sub-basin, and are entirely pervious. The disturbances in this sub-basin are considered “self-treating” separate pervious area. This sub-basin has proposed 5-year and 100-year flows of 4.82 cfs and 29.37 cfs, respectively.

Drainage Area P-5 is approximately 4.51 acres located in the central region of the site. Stormwater runoff flows south/southwest at slopes ranging from 1-4 percent towards Extended Detention Basin A at Design Point 11. Proposed improvements to this sub-basin

include construction of the southern half of Dumont Drive, asphalt and asphalt millings parking lot, mini-storage warehouse, and three (3) accessory buildings. Water quality treatment is provided in this sub-basin by Extended Detention Basin A. This sub-basin has proposed 5-year and 100-year flows of 14.26 cfs and 26.55 cfs, respectively.

Drainage Area P-6 is approximately 4.15 acres located in the eastern region of the site. Stormwater runoff flows south/southeast at slopes ranging from 1-3 percent towards a 36" storm sewer (SD-3). Runoff is piped through the 36" storm sewer to Extended Detention Basin A at Design Point 12. All storm sewer capacity calculations can be seen in the appendix. Proposed improvements to this sub-basin include overlot grading for future commercial development, resulting in approximately 4 acres of buildable area. This sub-basin has been analyzed in the developed condition for the purposes of this report. The proposed 36" storm sewer has been sized to accept runoff from the entirety of the future commercial area. Water quality treatment is provided in this sub-basin by Extended Detention Basin A. This sub-basin has proposed 5-year and 100-year flows of 11.26 cfs and 20.95 cfs, respectively.

Drainage Area P-7 is approximately 1.85 acres located in the southeastern region of the site. Stormwater runoff flows south/southwest at slopes ranging from 1-4 percent towards proposed area inlet AI-B2 (SD-4), and are then discharged to Extended Detention Basin A at Design Point 11. Proposed improvements to this sub-basin include construction of an asphalt and asphalt millings parking lot, mini-storage warehouse, and six (6) accessory buildings. The accessory buildings proposed within this basin are classified as Phase 2 improvements and area subject to change. To be conservative, all accessory buildings within this sub-basin are modeled with a pavement land cover. Water quality treatment is provided in this sub-basin by Extended Detention Basin A. This sub-basin has proposed 5-year and 100-year flows of 6.49 cfs and 11.82 cfs, respectively.

Drainage Area P-8 is approximately 0.24 acres located in the eastern region of the site. Stormwater runoff flows south/southeast at slopes ranging from 1-3 percent towards area inlet AI-C1 (SD-2). Runoff is piped from an 18" HDPE pipe to the 36" storm sewer and eventually to Extended Detention Basin A at Design Point 11. All storm sewer capacity calculations can be seen in the appendix. Proposed improvements to this sub-basin include construction of an asphalt and asphalt millings parking lot and drive aisle. Water quality treatment is provided in this sub-basin by Extended Detention Basin A. This sub-basin has proposed 5-year and 100-year flows of 1.08 cfs and 1.96 cfs, respectively.

Drainage Area P-9 is approximately 1.71 acres located in the south-central region of the site. Stormwater runoff flows south/southwest at slopes ranging from 1-3 percent towards the proposed trickle channel (Design Point 11). Proposed improvements to this sub-basin include grading for Extended Detention Basin A, including a concrete forebay and maintenance access road. Water quality treatment is provided in this sub-basin by Extended Detention Basin A. This sub-basin has proposed 5-year and 100-year flows of 0.64 cfs and 3.98 cfs, respectively.

Drainage Area P-10 is approximately 1.52 acres located in the southern region of the site and south of the site. Stormwater runoff flows south/southwest at slopes ranging from 1-3 percent towards Design Point 15. Proposed improvements to this sub-basin include minor grading. Approximately 0.08 acres will be disturbed within this sub-basin, and are entirely pervious. The disturbances in this sub-basin are considered “self-treating” separate pervious area. This sub-basin has proposed 5-year and 100-year flows of 0.47 cfs and 3.47 cfs, respectively.

Drainage Area P-11 is approximately 1.99 acres located in the northeast region of the site, and northeast of the site. Stormwater runoff flows south/southeast at slopes ranging from 1-7 percent along Dumont Drive and Stapleton Road towards the existing curb inlet at Design Point 6. Proposed improvements to this sub-basin include construction of the Dumont Drive entrance, and some minor grading. Approximately 0.17 acres will be disturbed within this sub-basin. Approximately 0.13 acres of disturbance within this sub-basin will be untreated. The remaining 0.04 acres of disturbance in this sub-basin are to pervious area, and are considered “self-treating” separate pervious area. This sub-basin has proposed 5-year and 100-year flows of 4.85 cfs and 9.89 cfs, respectively.

Drainage Area P-12 is approximately 1.25 acres located in the eastern region of the site, and southeast of the site. Stormwater runoff flows at slopes ranging from 1-4 percent to Existing Pond #5 at Design Point 7. Due to the fact that Existing Pond #5 was constructed prior to detention and water quality standards, at the time Stapleton Road was constructed, and due to complexities with trying to modify the existing pond to current El Paso County Standards, the disturbance upstream of this pond is considered “self-treating” separate pervious area and will not utilize the pond for treatment. Proposed improvements to this sub-basin include minor grading. Approximately 0.16 acres will be disturbed within this sub-basin, and are entirely pervious. The disturbances within this sub-basin are considered “self-treating” separate pervious area. This sub-basin has proposed 5-year and 100-year flows of 0.48 cfs and 3.14 cfs, respectively.

Drainage Area P-13 is approximately 0.94 acres located in the southeastern region of the site and southeast of the site. Stormwater runoff flows south/southeast at slopes ranging from 1-5 percent towards Design Point 14. Past Design Point 14, runoff travels southwest along an existing roadside ditch on the north side of HWY 24 until it converges with the drainageway at Design Point 15. See section 2.e – Existing Drainage Infrastructure for analysis of flow conveyance beyond Design Point 15. Proposed improvements to this sub-basin include minor grading. Approximately 0.18 acres will be disturbed within this sub-basin, and are entirely pervious. The disturbances within this sub-basin are considered “self-treating” separate pervious area. This sub-basin has proposed 5-year and 100-year flows of 0.33 cfs and 2.44 cfs, respectively.

Drainage Area P-14 is approximately 0.09 acres located in the northeastern region of the site. Stormwater runoff flows southeast along Dumont Drive at slopes ranging from 1-2 percent to a proposed curb inlet. The proposed curb inlet, CI-D5 (SD-5), is a 5' CDOT Type R inlet, and discharges flow to the future commercial area through a 12" HDPE outlet. Runoff in this region is eventually conveyed to Extended Detention Basin A, at Design Point 11. Proposed improvements to this sub-basin include grading for Dumont Drive, and the construction of

new pavement for Dumont Drive. Water quality in this sub-basin is provided by Extended Detention Basin A. This sub-basin has proposed 5-year and 100-year flows of 0.38 cfs and 0.70 cfs, respectively.

c. Site Detention Design

To address the increase in runoff from the site, a full-spectrum detention basin, Extended Detention Basin A (further referenced as EDB A), has been designed to provide water quality treatment and detention up to the 100-year storm. EDB A has been designed utilizing the Mile High Flood District's MHFD-Detention Software, version 4.06, released July 2022. The pond will be owned and maintained by 4-Way Commercial Metropolitan District.

EDB A will be approximately 1.51 acres in size, and 5.33 feet in depth, with the top of the proposed micropool surface at an elevation at 6887.17' (Stage: 0') and a top of embankment elevation of 6892.50' (Stage: 5.33'). EDB A has approximately 4.00 ac-ft of storage to the top of the embankment. All embankment for EDB A is graded at a 3H:1V slope. Overland runoff will travel to the pond through a slotted curb level spreader, to protect side slopes from erosion. A concrete forebay has been proposed to protect the pond against concentrated inflows. Detained runoff will be conveyed to the proposed outlet structure by a 3-foot wide concrete trickle channel. EDB A will be equipped with a three-stage outlet structure, sized to release the Water Quality Control Volume (WQCV) over a minimum 40 hours and Excess Urban Runoff Volume (EURV) over a maximum 72 hours.

EDB A will have a WQCV volume of 0.330 ac-ft. The proposed outlet structure will control the release of the WQCV through an orifice plate. The plate will have three (3) circular orifices, all of which are 1-3/16" in diameter. The orifices will have centers located at 6887.17', 6887.97', and 6888.77'. The proposed WQCV water surface will be at an elevation of 6889.44' (Stage: 2.27').

EDB A will have an EURV volume of 1.178 ac-ft. The proposed outlet structure will control the release of the EURV through a rectangular orifice in the orifice plate mentioned above. The rectangular orifice will be 1"x10" in size, and will have its invert located at an elevation of 6889.44'. The proposed EURV water surface will be at an elevation of 6890.44' (Stage: 3.27').

EDB A will have an approximate 100-year event volume of 2.154 ac-ft. The proposed outlet structure will control the release of the 100-year event through an overflow grate and outflow pipe with restrictor plate. The front edge of the overflow grate will be at an elevation of 6890.45' and will have grate dimensions of 5'x10'. An 18" HDPE outlet pipe and restrictor plate are proposed to control the discharges from EDB A. The outlet pipe invert will be at an elevation of 6887.04', and the bottom of the restrictor plate will be located 6 inches above the invert of the outlet pipe (Elev: 6887.54). The proposed 100-year event water surface will be at an elevation of 6890.90' (Stage: 3.73'). EDB A will discharge the 5-year and 100-year events at rates of 0.40 cfs and 4.70 cfs, respectively.

Baseflows captured by EDB A will be carried to the outlet structure through a 3' wide concrete trickle channel. The proposed trickle channel will be a rectangular section, with a bottom width of 2' and a total height of 0.50'. The trickle channel has been sized to carry at least 2% of the 100-year event. The proposed 100-year flow (Design Point 11) tributary to the trickle channel is 61.08 cfs, and the channel must carry at least 1.22 cfs. The trickle channel, when flowing full, has a capacity of approximately 3.47 cfs.

A Type L riprap emergency spillway has been provided at an elevation of 6890.92' (Stage: 3.75'). Per the requirements of El Paso County Drainage Criteria Manual Vol 2, the emergency spillway is sized to pass the 100-year event and provide at least 1 foot of freeboard. The emergency spillway is 40 feet long with side slopes at 3H:1V, and a design flow depth of 0.56 feet (Elev: 6891.48). EDB A will provide approximately 1.02 feet of freeboard between the emergency spillway design flow and top of pond embankment (Elev: 6892.50). All relevant calculations for design of EDB A can be seen in the appendix.

Concerns were previously raised regarding possible shallow groundwater existing in areas where EDB A is proposed. Per the Colorado Department of Public Health & Environment's (CDPHE) guidelines, "Low Risk Discharge Guidance – Discharges of Uncontaminated Groundwater to Land", discharging groundwater to a detention pond is prohibited unless permitted by CDPHE. Additional guidelines specific to extended detention basins is provided in the Mile High Flood District (MHFD) USDCM Volumes 2 and 3. These manuals specify that groundwater depth must be at least two (2) or more feet from the bottom of the basin.

To ensure that the existing groundwater levels were sufficient for EDB A, Entech Engineering, Inc. was hired to perform soils borings for groundwater elevations. Three (3) soil borings were performed to a depth of 20 feet on March 12, 2025. The borings were performed from existing grade, ranging from approximately 6889-6892 feet of elevation. In all borings, groundwater was encountered at depths ranging from 7-9 feet from existing grade (highest groundwater encountered at approximately 6882 feet of elevation). The bottom of EDB A is at an elevation of 6887.50', and is at minimum 5 feet above the measured groundwater elevation. The referenced geotechnical report can be seen in the appendix of this report.

d. Proposed Drainage Characteristics

Runoff within the proposed site will largely follow historic flow paths, and all offsite basins, as well as sub-basins P-1 and P-2 will remain undisturbed. Within the proposed Storage Facility, runoff will be conducted via underground storm sewer and overland flow to Extended Detention Basin A. All area designated for future commercial development will also be detained and released by Extended Detention Basin A.

The proposed site will discharge runoff at the same two points identified in the Stapleton MDDP. All proposed site outfalls will be less than or equal to the existing outfalls, per the El Paso County Drainage Criteria Manual, Volumes 1 and 2.

The outfalls of the site are in a stable condition to continue receiving existing and proposed flows. The channel running through the center of the site and the southernmost adjacent property has stable vegetation and side slopes, and sufficient capacity to convey the flow to outfall HG2. Further discussion of the existing channel and flow analysis can be found in the Step 3: Stabilize Drainageways section of the Four Step Process. The existing channel conveys flow to the existing twin 36” culverts under Rock Island Trail, and to the 4’x4’ RCB culvert under US HWY 24. It should be noted that both of these culvert crossings are undersized for existing flows, and that all proposed flows to these crossings will be less than existing flows.

Table 2 below compares existing and proposed design points at all site outfalls.

Design Point	Exist. Q ₅	Prop. Q ₅	Exist. Q ₁₀₀	Prop. Q ₁₀₀	Description
HG2	102.65 cfs	102.16 cfs	541.99 cfs	538.42 cfs	Total flow to twin 36” CMPs and 4’X4’ RCB crossing underneath HWY 24
EX:DP-14 PR:DP-16	1.95 cfs	1.20 cfs	8.73 cfs	3.69 cfs	Outflow from Existing Pond #5 to 24” CMP crossing underneath HWY 24

Table 2. Existing and Proposed Ultimate Design Point Summary

See section 2.e – Existing Drainage Infrastructure for analysis of the existing stormwater infrastructure at both site outfalls. Hydraulic calculations for all existing drainage infrastructure can be seen in the appendix of the report.

5. FOUR STEP PROCESS

El Paso County requires a four-step process for stormwater quality management: reducing runoff volumes, treating the water quality capture volume, stabilizing streams, and implementing long-term source controls. These steps are further outlined in Volumes 1 and 2 of the County’s Drainage Criteria Manual.

Step 1: Employ Runoff Reduction Practices. The site has been designed so that overland runoff captured by the concrete valley gutters flows over vegetated areas prior to entering Extended Detention Basin A and eventually leaving the site. This will minimize directly connected impervious areas within the site. Overland inflows to EDB A will also pass through a slotted curb prior to the rundown into the pond. This ensures that only sheet flows will enter the pond, which promotes infiltration and reduces erosion. The northern portion of Extended Detention Basin A will infiltrate some inflows as they travel to the concrete trickle channel. The site is also designed with separate pervious areas around the extents of the development. These separate pervious areas will promote infiltration, and are considered “self-treating”.

Step 2: Implement BMPs that Provide Water Quality Capture Volume (WQCV) with Slow Release. Extended Detention Basin A has been designed for the site to provide water quality

capture volume and detention volume. Extended Detention Basin A provides full-spectrum detention for proposed sub-basins P-5, P-6, P-7, P-8, P-9 and P-14. These basins have a combined WQCV of 0.330 ac-ft. Per the El Paso County Drainage Criteria Manual Volumes 1 and 2, the WQCV must be drained in a minimum of 40 hours for extended detention basins. EDB A detains the WQCV for 40 hours. The WQCV water surface is at an elevation of 6889.44’.

Sub-basins P-4, P-10, P-11, P-12, and P-13 are not captured by Extended Detention Basin A and will be slightly disturbed by the proposed improvements. Due to their locations, runoff from several of these basins cannot be reasonably treated without major redevelopment of existing topography on the property.

Much of the disturbed site that is not treated by Extended Detention Basin A can be identified as separate pervious area (SPA). These disturbed separate pervious areas have no tributary impervious area and are considered “self-treating”. Disturbances to separate pervious areas are considered treated. Calculations for the treatment provided in each separate pervious area was performed using the Mile High Flood District’s SCM Design Workbook. All relevant water quality calculations can be seen in the appendix of the report. Additionally, a water quality treatment map of the site has been provided in the appendix.

Approximately 0.13 acres of total disturbed area within these sub-basins will remain untreated. Per the El Paso County Engineering Criteria Manual, Appendix I, Section 7.1.C.1, 20% of disturbed area within a development, up to 1 acre, can be excluded from water quality treatment.

Table 3 below summarizes the treatment of each sub-basin on site.

Sub-Basin	Total Area	Total Proposed Disturbance	Treatment via EDB A	Self-Treating Separate Pervious Area	Untreated Area	Notes
P-1	8.40	-	-	-	-	undisturbed
P-2	10.54	-	-	-	-	undisturbed
P-3	13.15	-	-	-	-	undisturbed
P-4	15.14	0.86	-	0.86	-	
P-5	4.51	4.51	4.51	-	-	
P-6	4.15	4.15	4.15	-	-	
P-7	1.85	1.85	1.85	-	-	
P-8	0.24	0.24	0.24	-	-	
P-9	1.71	1.71	1.71	-	-	
P-10	1.52	0.08	-	0.08	-	
P-11	1.99	0.17	-	0.04	0.13	0.13 ac excluded
P-12	1.25	0.16	-	0.16	-	
P-13	0.94	0.18	-	0.18	-	
P-14	0.09	0.09	0.09	-	-	
Total	65.48	14.00	12.55	1.32	0.13	

Table 3. Proposed Sub-Basin Treatment Summary

Step 3: Stabilize Drainageways. The existing developed channels will remain in place on site. Leaving the existing vegetation will provide established vegetation to help prevent erosion. At the existing dual 15” culvert crossing, the roadway embankment and culvert crossings will be removed and restabilized to protect the existing drainageway. Check dams will be used to control erosion within drainageways during construction. The drainageway directly downstream of EDB A’s emergency spillway will be protected with Type L riprap bedding. All proposed runoff will leave the site at historic outfalls, and travel under HWY 24 through existing storm sewer infrastructure. Post-development peak runoff rates will be less than or equal to pre-development peak runoff rates within all drainageways leaving the property. Due to this, no additional drainageway stabilization efforts are anticipated.

Hydraulic calculations were performed on the existing drainageway to ensure it has sufficient capacity to convey runoff throughout the site. Several cross sections of the drainageway, located in the center of the site, were analyzed to determine the maximum drainageway capacity. Modeling of the drainageway shows that the channel’s capacity ranges from approximately 300 to 1,200 cfs. In the 100-year event, the channel is expected to convey no more than 68.82 cfs in both the existing and proposed conditions (EX-DP-12 / DP-13). Therefore, the drainageway provides sufficient capacity. All drainageway calculations can be seen in the appendix of this report.

All new and re-development projects are required to construct or participate in the funding of channel stabilization measures. Drainage basin fees paid, at the time of platting, go towards channel stabilization within the drainage basin.

Step 4: Implement Site Specific and Other Source Control BMPs. Soil erosion control measures will be implemented during improvements of the parking lot and site. Erosion control measures such as silt fence, inlet protection, temporary sediment basins, and vehicle tracking control will be utilized to reduce the disturbance of existing soil and vegetation during construction. The full soil erosion control measures to be utilized during construction of the site are shown in the grading and erosion control plans for the development.

6. FLOODPLAIN STATEMENT

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

The 100-year floodplain for Drainageway A within the southern parcel is shown on all drainage maps.

7. DRAINAGE BASIN FEES

Drainage and Bridge Fees are not due with a site development plan. Drainage basin fees for this development will be paid in the future, at the time of platting.

8. COST ESTIMATE

Extended Detention Basin A Cost Estimate				
Description	Quantity	Unit	Unit Cost	Amount
Earthwork	1	LS	\$15,000	\$15,000
Concrete Trickle Channel (3' width)	119	SY	\$90	\$10,710
Full Spectrum Outlet Structure	1	EA	\$5,000	\$5,000
Concrete Forebay	1	EA	\$5,000	\$5,000
Type L Rip-Rap (1.5' depth)	234	CY	\$70	\$16,380
Total Cost				\$52,090

**** SMH Consultants does not guarantee that the construction costs will not vary from this construction cost opinion ****

9. SUMMARY

A drainage analysis was conducted for the proposed improvements to the 67.1-acre 4-Way Commercial Property, located near the intersection of Stapleton Road and HWY 24. Proposed improvements to the property include construction of the southern half of Dumont Drive, a 46,000 sq. ft. mini-storage warehouse building, accessory storage buildings, asphalt/asphalt millings parking lot, and overlot grading for future commercial development. All improvements to the property will occur in the 51.6-acre southern tract, and no areas within the existing 100-year floodplain will be disturbed. The site is located in the "Haegler Diversion" of the Geick Ranch drainage basin. Based on the analysis, the 5-year and 100-year post-development stormwater peak flow rates would be higher than the pre-developed rates. To ensure post-development peak flow rates are less than pre-developed peak flow rates, a full spectrum extended detention basin, Extended Detention Basin A will be constructed to detain and release runoff from the proposed improvements. All proposed drainage facilities will be owned and maintained by 4-Way Commercial Metropolitan District. Runoff will leave the site through historic drainageways. Development of the site will not adversely impact surrounding or downstream properties.

References

El Paso County Assessor (2020). *El Paso County Assessor's Real Property Search*.

Retrieved from:

<https://www.elpasoco.com/search-el-paso-county/>

El Paso County Clerk and Recorder (2001-2020). *El Paso County Clerk and Recorder Web Access*. Retrieved from:

<https://publicrecordsearch.elpasoco.com/>

El Paso County, Colorado (2018). *Drainage Criteria Manual Volume 1*.

Retrieved from:

https://library.municode.com/co/el_paso_county/codes/drainage_criteria_manual?nodeId=DRCRMAVO1ELPACO

El Paso County, Colorado (2018). *Drainage Criteria Manual Volume 2*.

Retrieved from:

https://library.municode.com/co/el_paso_county/codes/drainage_criteria_manual?nodeId=DRCRMAVO2STQUPOPRBEMAPRBM

Federal Emergency Management Agency (2020). *FEMA Flood Map Service Center*.

Retrieved from:

<https://msc.fema.gov/portal/home>

JR Engineering (2010). *MDDP Amendment/Preliminary Drainage Report for 4-Way Ranch Commercial*. (EPC PCD No. PUD07013)

Retrieved From:

<https://epcdevplanreview.com/Public/ProjectDetails/11148>

JR Engineering (2010). *MDDP Amendment/Preliminary/Final Drainage Report for Stapleton Drive from Bandanero Dr to US HWY 24*.

Terra Nova Engineering (2025). *Final Drainage Report for Waterbury Filing No. 1*

Retrieved from:

<https://epcdevplanreview.com/Public/ProjectDetails/189180>

United States Department of Agriculture Natural Resources Conservation Service (2024, April 17). *Web Soil Survey*. Retrieved from:

<https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>

URS (2009). *Haegler Ranch Drainage Basin Planning Study*. (EPC PCD No. MP091)

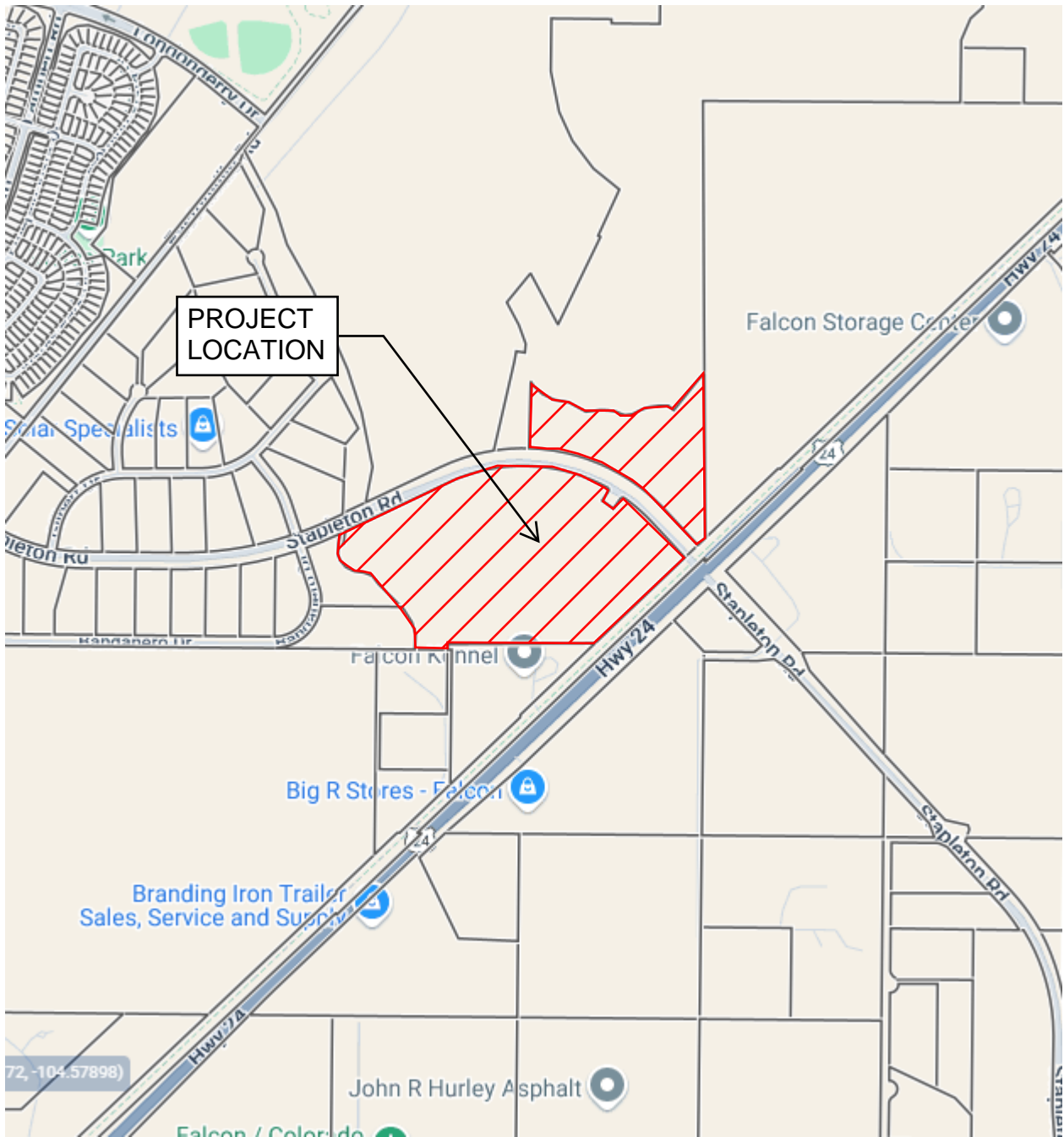
Retrieved From:

<https://epcdevplanreview.com/Public/ProjectDetails/42973>

APPENDIX

VICINITY MAP

VICINITY MAP



NOT TO SCALE

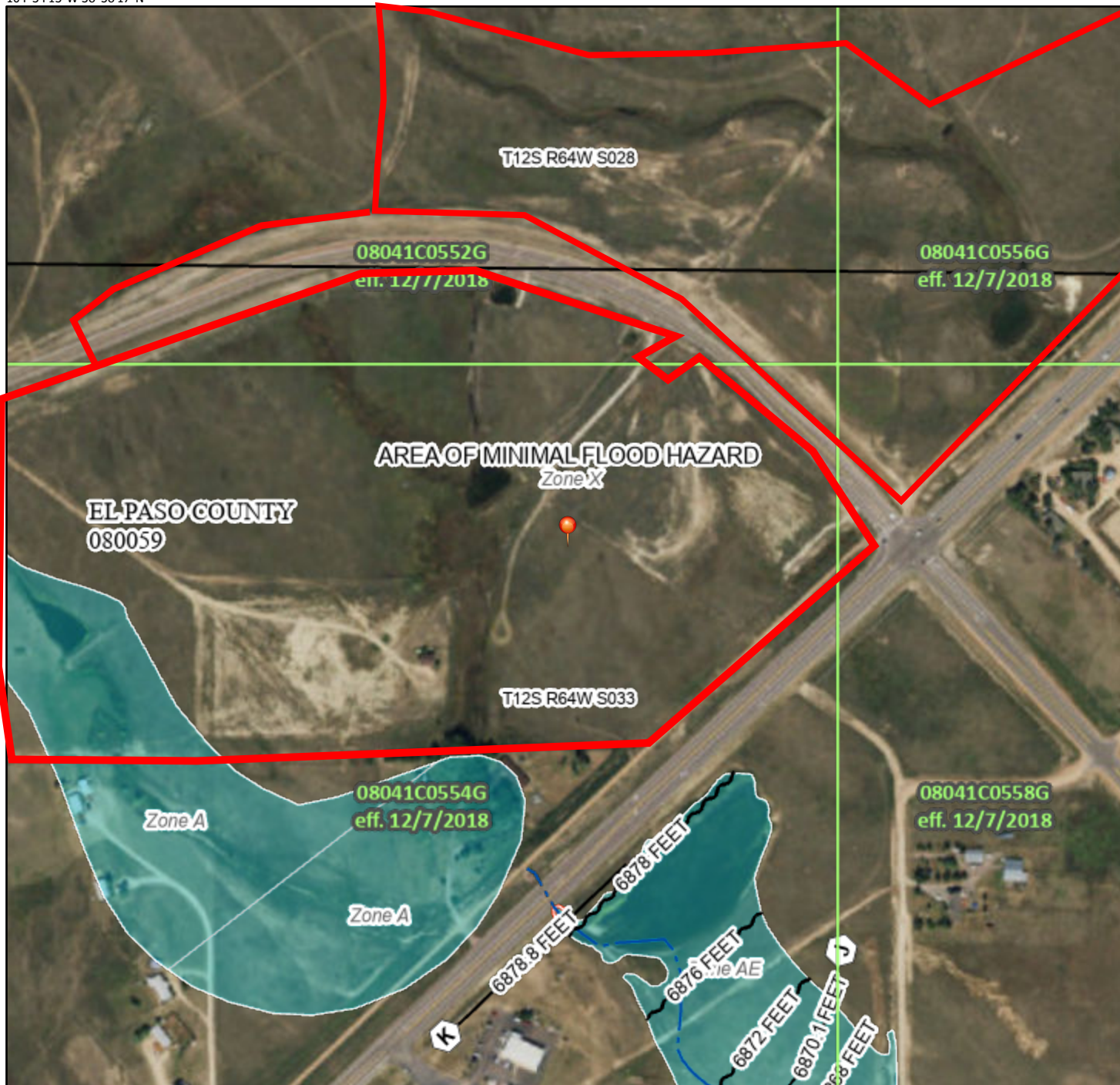


FEMA FLOODMAP

National Flood Hazard Layer FIRMette



104°34'13"W 38°58'17"N



Legend

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

- | | | |
|------------------------------------|--|--|
| SPECIAL FLOOD HAZARD AREAS | | Without Base Flood Elevation (BFE)
<i>Zone A, V, A99</i> |
| | | With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i> |
| | | 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 <i>Zone X</i> |
| | | Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i> |
| | | Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i> |
| | | Area with Flood Risk due to Levee <i>Zone D</i> |
| OTHER AREAS | | NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i> |
| | | Effective LOMRs |
| GENERAL STRUCTURES | | Area of Undetermined Flood Hazard <i>Zone D</i> |
| | | 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 |
| | | Coastal Transect Baseline |
| MAP PANELS | | 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 **11/7/2022 at 6:05 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

SOILS REPORT

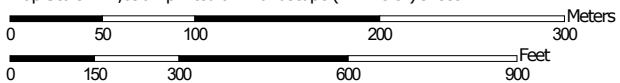
Custom Soil Resource Report for El Paso County Area, Colorado



Custom Soil Resource Report Soil Map




Map Scale: 1:4,090 if printed on A landscape (11" x 8.5") sheet.



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

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)




















Soils







 Soil Map Unit Polygons

 Soil Map Unit Lines


 Soil Map Unit Points

Special Point Features






-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features


Water Features

 Streams and Canals

Transportation

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

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 22, Sep 3, 2024

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

Date(s) aerial images were photographed: Jul 23, 2024—Aug 4, 2024

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
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	42.7	86.1%
83	Stapleton sandy loam, 3 to 8 percent slopes	6.9	13.9%
Totals for Area of Interest		49.5	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,

Custom Soil Resource Report

onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Fans, fan terraces, flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

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

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

83—Stapleton sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369z
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Stapleton and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stapleton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 11 inches: sandy loam
Bw - 11 to 17 inches: gravelly sandy loam
C - 17 to 60 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Custom Soil Resource Report

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Ecological site: R049XY214CO - Gravelly Foothill

Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent

Landform: Swales

Hydric soil rating: Yes

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

GEOTECHNICAL REPORT



March 21, 2025

The O'Neil Group
455 East Pikes Peak Avenue, Suite 101
Colorado Springs, Colorado 80903

Attn: Jordan Montoya

Re: Detention Pond Groundwater Report
4-Way Commercial, Phase 1
Stapleton Road and US Highway 24
Peyton, Colorado
Entech Job No. 241847

Dear Mr. Montoya,

Personnel of Entech Engineering, Inc. (Entech) drilled three test borings, designated TB-1 through TB-3 to a depth of 20 feet below existing ground surface (bgs), for groundwater level evaluation of the detention pond at the location referenced above on March 12, 2025. Specific findings for the investigation are present in this letter.

Site Conditions:

The test borings were drilled within the proposed detention pond area referenced above. Vegetation consisted of native grasses, weeds, and bushes.

Soil classification:

Soil types observed in the test borings consisted of loose to medium dense sand with silt to silty sand from the ground surface to depths of 13 feet bgs. Sandstone bedrock or very dense silty sand when classified as a soil was encountered underlying the native sands to the termination depths of the borings 20 feet bgs

Groundwater:

Groundwater was measured at the conclusion of, and subsequent to, drilling. At the time of drilling, groundwater was encountered in two of the test borings at 7 and 8 feet bgs. A representative of Entech visited the site on March 13, 2025 to remeasure groundwater resulting in levels ranging from 7 to 9 feet bgs in all test borings. Refer to Exhibit 1 for a table of groundwater measurements

Exhibit 1: Groundwater Measurements

Test Boring ID	Total Boring Depth (ft.)	Groundwater Depth (ft.) 3/12/2025	Groundwater Depth (ft.) 3/13/2025
TB-1	20	8	9
TB-2	20	7	8
TB-3	20	Dry	7



Remarks:

The recommendations provided in this letter are based on the observed soil conditions, anticipated construction activities, and accepted engineering procedures. During final design and/or construction, if conditions are encountered that appear different from those described in this report, Entech Engineering, Inc. requests to be notified so that the evaluation and recommendations presented herein can be reviewed and modified as appropriate.

We trust this has provided you with the information you require. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

A handwritten signature in blue ink that reads "Zachary C. Gutierrez".

Zachary C. Gutierrez, P.E.
Geotechnical Engineering Staff

Reviewed by:



Digitally signed by Joseph C Goode III
Date: 03/21/25

Joseph C. Goode III, P.E.
Sr. Engineer

ZCG:JCG/zcg



VICINITY MAP
4-WAY COMMERCIAL, P-1, DETENTION POND
THE O'NEIL GROUP

JOB NO.
241847

FIG. 1

TEST BORING 1
DATE DRILLED 3/12/2025

TEST BORING 2
DATE DRILLED 3/12/2025

REMARKS

REMARKS

WATER @ 9', 3/13/25

WATER @ 8', 3/13/25

SAND, WITH SILT to SILTY, TAN,
MEDIUM DENSE to LOOSE, DRY
to WET

SAND, WITH SILT to SILTY, TAN,
MEDIUM DENSE to LOOSE, DRY
to WET

SANDSTONE, EXTREMELY WEAK,
GRAY, HIGHLY WEATHERED
(SAND, SILTY, VERY DENSE,
MOIST)

SANDSTONE, EXTREMELY WEAK,
GRAY, HIGHLY WEATHERED
(SAND, SILTY, VERY DENSE,
MOIST)

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			18	1.8	1	5			19	1.9	1
5			11	3.0	1	5			5	2.1	1
10			8	14.2	1	10			13	13.6	1
15		50 9"	50 9"	11.8	2	15		50 9"	50	13.7	2
20		50 10"	50 10"	9.1	2	20		50 9"	50 9"	11.8	2



TEST BORING LOGS

4-WAY COMMERCIAL, P-1, DETENTION POND
THE O'NEIL GROUP

JOB NO.
241847

FIG. 3

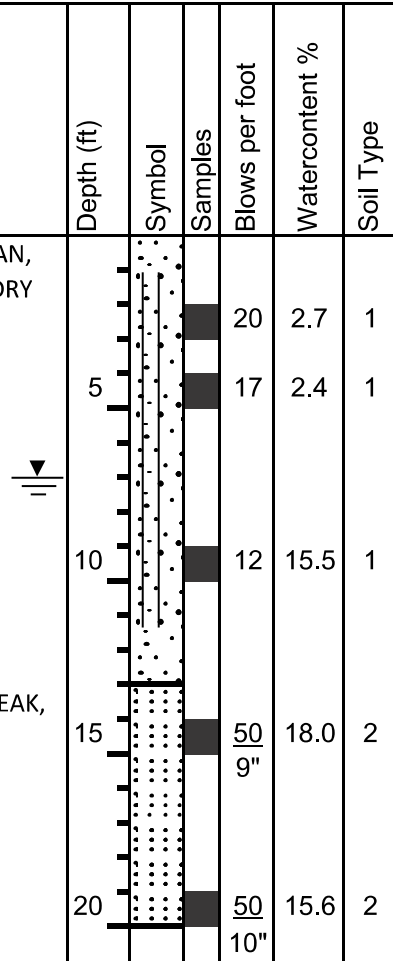
TEST BORING 3
 DATE DRILLED 3/12/2025

REMARKS

WATER @ 7', 3/13/25

SAND, WITH SILT to SILTY, TAN,
 MEDIUM DENSE to LOOSE, DRY
 to WET

SANDSTONE, EXTREMELY WEAK,
 GRAY, HIGHLY WEATHERED
 (SAND, SILTY, VERY DENSE,
 MOIST)

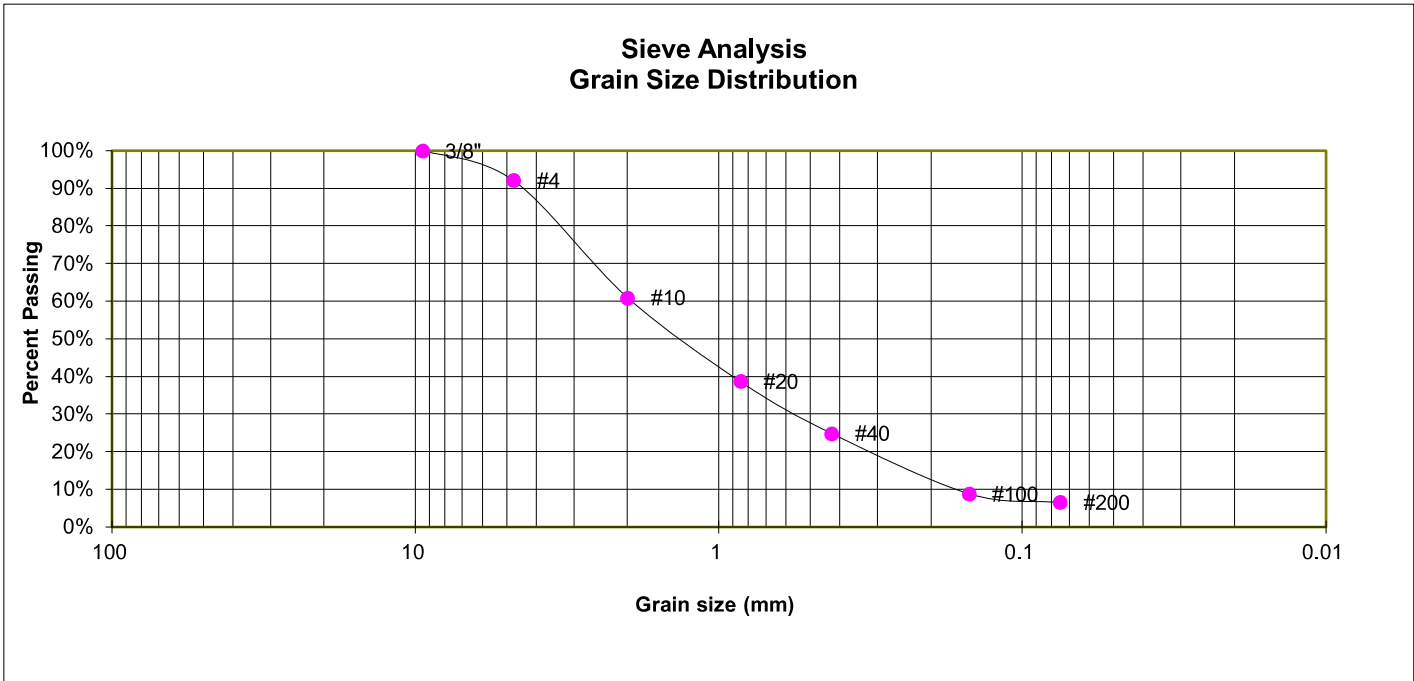


TEST BORING LOGS
 4-WAY COMMERCIAL, P-1, DETENTION POND
 THE O'NEIL GROUP

JOB NO.
 241847
FIG. 4

TEST BORING 1
 DEPTH (FT) 2-3

SOIL DESCRIPTION SAND, WITH SILT
 SOIL TYPE 1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.1%
10	60.9%
20	38.7%
40	24.9%
100	8.9%
200	6.5%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM



LABORATORY TEST RESULTS

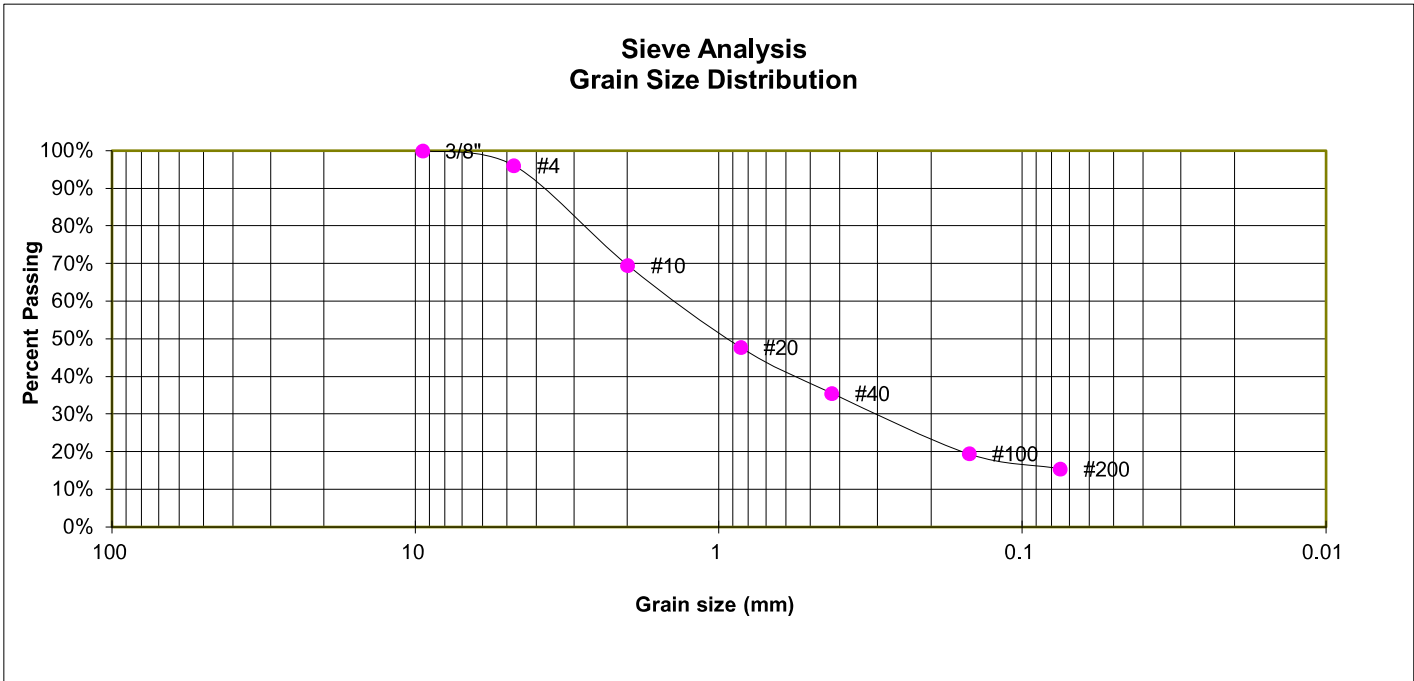
4-WAY COMMERCIAL, P-1, DETENTION POND
 THE O'NEIL GROUP

JOB NO.
 241847

FIG. 5

TEST BORING 2
 DEPTH (FT) 10

SOIL DESCRIPTION SAND, SILTY
 SOIL TYPE 1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.1%
10	69.5%
20	47.8%
40	35.6%
100	19.5%
200	15.5%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM



LABORATORY TEST RESULTS

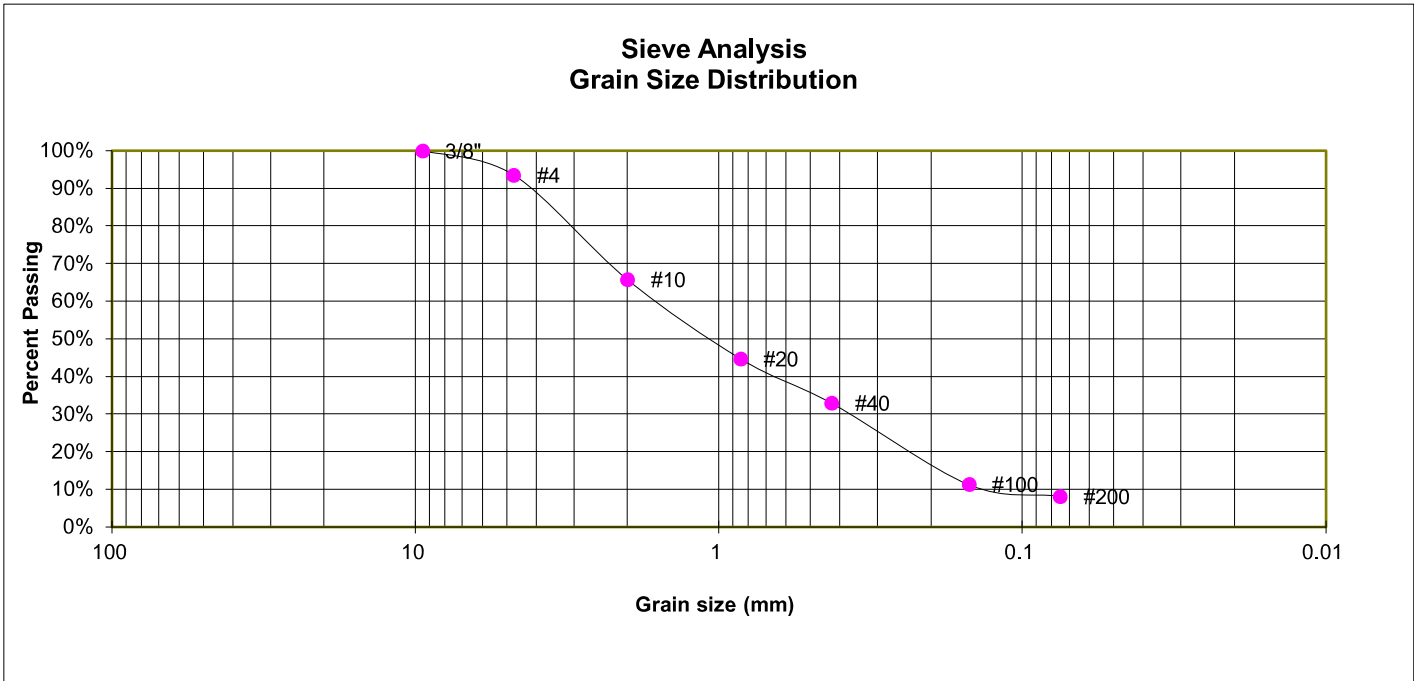
4-WAY COMMERCIAL, P-1, DETENTION POND
 THE O'NEIL GROUP

JOB NO.
 241847

FIG. 6

TEST BORING 3
 DEPTH (FT) 15

SOIL DESCRIPTION SANDSTONE (SAND, WITH SILT)
 SOIL TYPE 2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.5%
10	65.7%
20	44.7%
40	33.0%
100	11.3%
200	8.2%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION: SW-SM



LABORATORY TEST RESULTS

4-WAY COMMERCIAL, P-1, DETENTION POND
 THE O'NEIL GROUP

JOB NO.
 241847

FIG. 7

HYDROLOGIC CALCULATIONS

Existing C-Calcs (HSG:A/B)										
Sub-Basin	Land Use	Area (sf)	Area (ac)	C ₅	C ₁₀₀	C ₅ x A	C ₁₀₀ x A	Weighted C ₅	Weighted C ₁₀₀	2010 MDDP Sub-Basin
EX-1	Pavement	0	0.00	0.9	0.96	0.00	0.00	0.08	0.35	A
	Pasture/Meadow	365904	8.40	0.08	0.35	0.67	2.94			
	Total	365904	8.40			0.67	2.94			
EX-2	Pavement	0	0.00	0.9	0.96	0.00	0.00	0.08	0.35	B
	Pasture/Meadow	459122	10.54	0.08	0.35	0.84	3.69			
	Total	459122	10.54			0.84	3.69			
EX-3	Pavement	0	0.00	0.9	0.96	0.00	0.00	0.08	0.35	C
	Pasture/Meadow	572814	13.15	0.08	0.35	1.05	4.60			
	Total	572814	13.15			1.05	4.60			
EX-4	Pavement	0	0.00	0.9	0.96	0.00	0.00	0.08	0.35	D
	Pasture/Meadow	733115	16.83	0.08	0.35	1.35	5.89			
	Total	733115	16.83			1.35	5.89			
EX-5	Pavement	0	0.00	0.9	0.96	0.00	0.00	0.08	0.35	-
	Pasture/Meadow	306796	7.04	0.08	0.35	0.56	2.47			
	Total	306796	7.04			0.56	2.47			
EX-6	Pavement	871	0.02	0.9	0.96	0.02	0.02	0.08	0.35	-
	Pasture/Meadow	220382	5.06	0.08	0.35	0.40	1.77			
	Total	221253	5.08			0.42	1.79			
EX-7	Pavement	0	0.00	0.9	0.96	0.00	0.00	0.08	0.35	-
	Pasture/Meadow	116501	2.67	0.08	0.35	0.21	0.94			
	Total	116501	2.67			0.21	0.94			
OS-1	Pavement	22651	0.52	0.9	0.96	0.47	0.50	0.90	0.96	X-2
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	22651	0.52			0.47	0.50			
OS-2	Pavement	31363	0.72	0.9	0.96	0.65	0.69	0.90	0.96	Y-2
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	31363	0.72			0.65	0.69			
OS-3	Pavement	36155	0.83	0.9	0.96	0.75	0.80	0.90	0.96	X-1
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	36155	0.83			0.75	0.80			
OS-4	Pavement	33541	0.77	0.9	0.96	0.69	0.74	0.90	0.96	Y-1
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	33541	0.77			0.69	0.74			
OS-5	Pavement	58806	1.35	0.9	0.96	1.22	1.30	0.90	0.96	J
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	58806	1.35			1.22	1.30			
OS-6	Pavement	70132	1.61	0.9	0.96	1.45	1.55	0.90	0.96	K
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	70132	1.61			1.45	1.55			
OS-7	Pavement	20473	0.47	0.9	0.96	0.42	0.45	0.90	0.96	L
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	20473	0.47			0.42	0.45			
OS-8	Pavement	30928	0.71	0.9	0.96	0.64	0.68	0.90	0.96	M
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	30928	0.71			0.64	0.68			
OS-9	Pavement	9583	0.22	0.9	0.96	0.20	0.21	0.90	0.96	P
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	9583	0.22			0.20	0.21			
OS-10	Pavement	13068	0.30	0.9	0.96	0.27	0.29	0.90	0.96	Q
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	13068	0.30			0.27	0.29			
OS-11	Pavement	54014	1.24	0.9	0.96	1.12	1.19	0.90	0.96	S
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	54014	1.24			1.12	1.19			
OS-12	Pavement	67518	1.55	0.9	0.96	1.40	1.49	0.90	0.96	R
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	67518	1.55			1.40	1.49			

NOTE: SHADED SUB-BASINS HAVE THE SAME LIMITS, AREA, AND LAND COVER AS SPECIFIED IN THE "MDDP AMMENDMENT/PRELIMINARY/FINAL DRAINAGE REPORT FOR STAPLETON DRIVE FROM BANDANERO DR TO US HWY 24 EL PASO COUNTY, COLORADO" (JR ENGINEERING, REVISED MAY 2010)

Existing Time of Concentration															
Sub Basin Data			Initial/Overland Time (t _i)			Travel Time (t _t)						t _c Check			Final t _c
Sub-Basin	Area (ac)	C _s	Length (ft)	Slope (ft/ft)	t _i (min)	Length (ft)	Slope (ft/ft)	Land Type	C _v	Velocity (ft/sec)	t _t (min)	t _i + t _t (min)	Total Length (ft)	Min. t _c (10+L/180)	
EX-1	8.40	0.08	100	0.015	16.11	950	0.025	NBG	10	1.58	10.01	26.12	1050	15.83	15.8
EX-2	10.54	0.08	100	0.018	15.17	1370	0.020	NBG	10	1.41	16.15	31.31	1470	18.17	18.2
EX-3	13.15	0.08	100	0.013	16.89	960	0.023	NBG	10	1.52	10.55	27.44	1060	15.89	15.9
EX-4	16.83	0.08	100	0.015	16.11	1530	0.022	NBG	10	1.48	17.19	33.30	1630	19.06	19.1
EX-5	7.04	0.08	100	0.010	18.42	1374	0.021	NBG	10	1.45	15.80	34.22	1474	18.19	18.2
EX-6	5.08	0.08	100	0.025	13.57	685	0.044	NBG	10	2.10	5.44	19.01	785	14.36	14.4
EX-7	2.67	0.08	100	0.011	17.85	676	0.018	NBG	10	1.34	8.40	26.24	776	14.31	14.3
OS-1	0.52	0.90	18	0.020	1.22	387	0.010	PV	20	2.00	3.23	4.44	405	12.25	5.0
OS-2	0.72	0.90	20	0.020	1.28	341	0.010	PV	20	2.00	2.84	4.13	361	12.01	5.0
OS-3	0.83	0.90	17	0.020	1.18	558	0.010	PV	20	2.00	4.65	5.83	575	13.19	5.8
OS-4	0.77	0.90	20	0.020	1.28	694	0.010	PV	20	2.00	5.78	7.07	714	13.97	7.1
OS-5	1.35	0.90	20	0.020	1.28	1037	0.011	PV	20	2.10	8.24	9.52	1057	15.87	9.5
OS-6	1.61	0.90	20	0.020	1.28	949	0.015	PV	20	2.45	6.46	7.74	969	15.38	7.7
OS-7	0.47	0.90	25	0.038	1.16	391	0.021	PV	20	2.90	2.25	3.41	416	12.31	5.0
OS-8	0.71	0.90	20	0.020	1.28	431	0.015	PV	20	2.45	2.93	4.22	451	12.51	5.0
OS-9	0.22	0.90	10	0.020	0.91	40	0.024	PV	20	3.10	0.22	1.12	50	10.28	5.0
OS-10	0.30	0.90	10	0.020	0.91	125	0.027	PV	20	3.29	0.63	1.54	135	10.75	5.0
OS-11	1.24	0.90	30	0.020	1.57	771	0.024	PV	20	3.10	4.15	5.72	801	14.45	5.7
OS-12	1.55	0.90	30	0.020	1.57	783	0.027	PV	20	3.29	3.97	5.54	813	14.52	5.5

Conveyance Coefficient C _v		
Type of Land Surface	Land Type	C _v
Heavy Meadow	HM	2.5
Tillage/Fields	TF	5
Riprap (Not Buried)	RR	6.5
Short Pasture/Lawns	SP	7
Nearly Bare Ground	NBG	10
Grassed Waterway	GW	15
Paved Areas & Shallow Paved Swales	PV	20

Equations:

$$t_i (\text{overland}) = 0.395(1.1 - C_s)L^{0.5}S^{-0.333}$$

C = Runoff Coefficient

L = Length of overland flow (Max 100ft developed)

S = Slope

$$\text{Travel Time: } V = C_v S^{0.5}$$

V = Velocity (ft/s)

C_v = Conveyance Coefficient

S = Slope

$$t_c \text{ Check} = (L/180) + 10$$

L = Overall Length

NOTE: SHADED SUB-BASINS HAVE THE SAME LIMITS, AREA, AND LAND COVER AS SPECIFIED IN THE "MDDP AMMENDMENT/PRELIMINARY/FINAL DRAINAGE REPORT FOR STAPLETON DRIVE FROM BANDANERO DR TO US HWY 24 EL PASO COUNTY, COLORADO" (JR ENGINEERING, REVISED MAY 2010)

Existing Intensity and Runoff Calculations								
Sub-Basin	Area (ac)	C ₅	C ₁₀₀	D = t _c (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (cfs)	Q ₁₀₀ (cfs)
EX-1	8.40	0.08	0.35	15.8	3.44	5.77	2.31	16.98
EX-2	10.54	0.08	0.35	18.2	3.23	5.43	2.73	20.02
EX-3	13.15	0.08	0.35	15.9	3.43	5.77	3.61	26.53
EX-4	16.83	0.08	0.35	19.1	3.16	5.31	4.26	31.26
EX-5	7.04	0.08	0.35	18.2	3.23	5.42	1.82	13.37
EX-6	5.08	0.08	0.35	14.4	3.59	6.02	1.52	10.78
EX-7	2.67	0.08	0.35	14.3	3.59	6.03	0.77	5.64
OS-1	0.52	0.90	0.96	5.0	5.17	8.68	2.42	4.33
OS-2	0.72	0.90	0.96	5.0	5.17	8.68	3.35	6.00
OS-3	0.83	0.90	0.96	5.8	4.94	8.29	3.69	6.61
OS-4	0.77	0.90	0.96	7.1	4.65	7.81	3.22	5.77
OS-5	1.35	0.90	0.96	9.5	4.20	7.06	5.11	9.14
OS-6	1.61	0.90	0.96	7.7	4.51	7.58	6.54	11.71
OS-7	0.47	0.90	0.96	5.0	5.17	8.68	2.19	3.92
OS-8	0.71	0.90	0.96	5.0	5.17	8.68	3.30	5.92
OS-9	0.22	0.90	0.96	5.0	5.17	8.68	1.02	1.83
OS-10	0.30	0.90	0.96	5.0	5.17	8.68	1.40	2.50
OS-11	1.24	0.90	0.96	5.7	4.97	8.34	5.54	9.93
OS-12	1.55	0.90	0.96	5.5	5.01	8.42	6.99	12.53

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

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

(Figure 6-5 El Paso Co DCM)

Existing Design Point C Calcs									
Design Point	Contributing Basins	Land Use	Area (ac)	C ₅	C ₁₀₀	C ₅ x A	C ₁₀₀ x A	Weighted C ₅	Weighted C ₁₀₀
EX-DP-1	OS-1, OS-3	Pavement	1.35	0.9	0.96	1.22	1.30	0.90	0.96
		Pasture/Meadow	0.00	0.08	0.35	0.00	0.00		
		Total	1.35			1.22	1.30		
EX-DP-2	OS-2, OS-4	Pavement	1.49	0.9	0.96	1.34	1.43	0.90	0.96
		Pasture/Meadow	0.00	0.08	0.35	0.00	0.00		
		Total	1.49			1.34	1.43		
EX-DP-3	EX-DP-1, EX-DP-2	Pavement	2.84	0.9	0.96	2.56	2.73	0.90	0.96
		Pasture/Meadow	0.00	0.08	0.35	0.00	0.00		
		Total	2.84			2.56	2.73		
EX-DP-4	EX-1, EX-DP-3	Pavement	2.84	0.9	0.96	2.56	2.73	0.29	0.50
		Pasture/Meadow	8.40	0.08	0.35	0.67	2.94		
		Total	11.24			3.23	5.67		
EX-DP-5	EX-2, EX-DP-4	Pavement	2.84	0.9	0.96	2.56	2.73	0.19	0.43
		Pasture/Meadow	18.94	0.08	0.35	1.52	6.63		
		Total	21.78			4.07	9.36		
EX-DP-6	OS-11, OS-12	Pavement	2.79	0.9	0.96	2.51	2.68	0.90	0.96
		Pasture/Meadow	0.00	0.08	0.35	0.00	0.00		
		Total	2.79			2.51	2.68		
EX-DP-7	EX-6, OS-10, EX-DP-6	Pavement	3.11	0.9	0.96	2.80	2.99	0.39	0.58
		Pasture/Meadow	5.06	0.08	0.35	0.40	1.77		
		Total	8.17			3.20	4.76		
EX-DP-8	OS-5, OS-6	Pavement	2.96	0.9	0.96	2.66	2.84	0.90	0.96
		Pasture/Meadow	0.00	0.08	0.35	0.00	0.00		
		Total	2.96			2.66	2.84		
EX-DP-9	OS-7, OS-8	Pavement	1.18	0.9	0.96	1.06	1.13	0.90	0.96
		Pasture/Meadow	0.00	0.08	0.35	0.00	0.00		
		Total	1.18			1.06	1.13		
EX-DP-10	EX-3, EX-DP-8, EX-DP-9	Pavement	4.14	0.9	0.96	3.73	3.97	0.28	0.50
		Pasture/Meadow	13.15	0.08	0.35	1.05	4.60		
		Total	17.29			4.78	8.58		
EX-DP-11	EX-5, OS-9	Pavement	0.22	0.9	0.96	0.20	0.21	0.10	0.37
		Pasture/Meadow	7.04	0.08	0.35	0.56	2.47		
		Total	7.26			0.76	2.68		
EX-DP-12	EX-4, EX-DP-10	Pavement	4.14	0.9	0.96	3.73	3.97	0.18	0.42
		Pasture/Meadow	29.98	0.08	0.35	2.40	10.49		
		Total	34.12			6.12	14.47		
EX-DP-13	EX-7, EX-DP-5, EX-DP-11, EX-DP-12	Pavement	7.20	0.9	0.96	6.48	6.91	0.17	0.42
		Pasture/Meadow	58.64	0.08	0.35	4.69	20.52		
		Total	65.84			11.17	27.44		
EX-DP-14	EX-DP-7	Pavement	3.11	0.9	0.96	2.80	2.99	0.39	0.58
		Pasture/Meadow	5.06	0.08	0.35	0.40	1.77		
		Total	8.17			3.20	4.76		

Existing Design Point Time of Concentration																						
Design Point Data				Initial/Overland Time (t _i)			Travel Time (t _t)						Travel Time (t _t)						t _c Check			Final t _c
Design Point	Contributing Basins	Area (ac)	C _s	Length (ft)	Slope (ft/ft)	t _i (min)	Length (ft)	Slope (ft/ft)	Land Type	C _v	Velocity (ft/sec)	t _t (min)	Length (ft)	Slope (ft/ft)	Land Type	C _v	Velocity (ft/sec)	t _t (min)	t _i + t _t (min)	Total Length (ft)	Min. t _c (10+L/180)	
EX-DP-1	OS-1, OS-3	1.35	0.90	17	0.020	1.18	558	0.010	PV	20	2.00	4.65							5.83	575	13.19	5.8
EX-DP-2	OS-2, OS-4	1.49	0.90	20	0.020	1.28	694	0.010	PV	20	2.00	5.78							7.07	714	13.97	7.1
EX-DP-3	EX-DP-1, EX-DP-2	2.84	0.90	20	0.020	1.28	734	0.010	PV	20	2.00	6.12							7.40	754	14.19	7.4
EX-DP-4	EX-1, EX-DP-3	11.24	0.29	20	0.020	5.22	734	0.010	PV	20	2.00	6.12	1050	0.025	NBG	10	1.58	11.07	22.41	1804	20.02	20.0
EX-DP-5	EX-2, EX-DP-4	21.78	0.19	20	0.020	5.87	734	0.010	PV	20	2.00	6.12	1950	0.022	NBG	10	1.48	21.91	33.89	2704	25.02	25.0
EX-DP-6	OS-11, OS-12	2.79	0.90	30	0.020	1.57	771	0.024	PV	20	3.10	4.15							5.72	801	14.45	5.7
EX-DP-7	EX-6, OS-10, EX-DP-6	8.17	0.39	100	0.025	9.45	685	0.044	NBG	10	2.10	5.44							14.89	785	14.36	14.4
EX-DP-8	OS-5, OS-6	2.96	0.90	20	0.020	1.28	1037	0.011	PV	20	2.10	8.24							9.52	1057	15.87	9.5
EX-DP-9	OS-7, OS-8	1.18	0.90	25	0.038	1.16	391	0.021	PV	20	2.90	2.25							3.41	416	12.31	5.0
EX-DP-10	EX-3, EX-DP-8, EX-DP-9	17.29	0.28	20	0.020	5.29	1037	0.011	PV	20	2.10	8.24	1060	0.023	NBG	10	1.52	11.65	25.18	2117	21.76	21.8
EX-DP-11	EX-5, OS-9	7.26	0.10	10	0.020	4.52	40	0.024	PV	20	3.10	0.22	1474	0.021	NBG	10	1.45	16.95	21.69	1524	18.47	18.5
EX-DP-12	EX-4, EX-DP-10	34.12	0.18	20	0.020	5.91	1037	0.011	PV	20	2.10	8.24	1760	0.022	NBG	10	1.48	19.78	33.93	2817	25.65	25.7
EX-DP-13	EX-7, EX-DP-5, EX-DP-11, EX-DP-12	65.84	0.17	20	0.020	5.98	1037	0.011	PV	20	2.10	8.24	1950	0.022	NBG	10	1.48	21.91	36.13	3007	26.71	26.7
EX-DP-14	EX-DP-7	8.17	0.39	100	0.025	9.45	685	0.044	NBG	10	2.10	5.44							14.89	785	14.36	14.4

Conveyance Coefficient C _v		
Type of Land Surface	Land Type	C _v
Heavy Meadow	HM	2.5
Tillage/Fields	TF	5
Riprap (Not Buried)	RR	6.5
Short Pasture/Lawns	SP	7
Nearly Bare Ground	NBG	10
Grassed Waterway	GW	15
Paved Areas & Shallow Paved Swales	PV	20

Equations:

$$t_i (\text{overland}) = 0.395(1.1 - C_s)L^{0.5}S^{-0.333}$$

C = Runoff Coefficient

L = Length of overland flow (Max 100ft developed)

S = Slope

$$\text{Travel Time: } V = C_v S^{0.5}$$

V = Velocity (ft/s)

C_v = Conveyance Coefficient

S = Slope

$$t_c \text{ Check} = (L/180) + 10$$

L = Overall Length

Existing Intensity and Runoff Calculations									
Design Point	Contributing Basins	Area (ac)	C ₅	C ₁₀₀	D = t _c (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (cfs)	Q ₁₀₀ (cfs)
EX-DP-1	OS-1, OS-3	1.35	0.90	0.96	5.8	4.94	8.29	6.00	10.74
EX-DP-2	OS-2, OS-4	1.49	0.90	0.96	7.1	4.65	7.81	6.24	11.17
EX-DP-3	EX-DP-1, EX-DP-2	2.84	0.90	0.96	7.4	4.58	7.69	11.71	20.97
EX-DP-4	EX-1, EX-DP-3	11.24	0.29	0.50	20.0	3.09	5.18	9.97	29.37
EX-DP-5	EX-2, EX-DP-4	21.78	0.19	0.43	25.0	2.75	4.62	11.21	43.23
EX-DP-6	OS-11, OS-12	2.79	0.90	0.96	5.7	4.97	8.34	12.47	22.34
EX-DP-7	EX-6, OS-10, EX-DP-6	8.17	0.39	0.58	14.4	3.59	6.02	11.49	28.64
EX-DP-8	OS-5, OS-6	2.96	0.90	0.96	9.5	4.20	7.06	11.19	20.05
EX-DP-9	OS-7, OS-8	1.18	0.90	0.96	5.0	5.17	8.68	5.49	9.83
EX-DP-10	EX-3, EX-DP-8, EX-DP-9	17.29	0.28	0.50	21.8	2.96	4.97	14.16	42.65
EX-DP-11	EX-5, OS-9	7.26	0.10	0.37	18.5	3.21	5.39	2.44	14.42
EX-DP-12	EX-4, EX-DP-10	34.12	0.18	0.42	25.7	2.72	4.56	16.64	65.95
EX-DP-13	EX-7, EX-DP-5, EX-DP-11, EX-DP-12	65.84	0.17	0.42	26.7	2.66	4.46	29.67	122.28
*EX-DP-14	EX-DP-7	8.17	-	-	-	-	-	1.95	8.73

*EX-DP-14 runoff calculated from existing pond #5 outflow hydrograph

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

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

(Figure 6-5 El Paso Co DCM)

Existing Offsite Flow Calculations at HG2										
Design Point	Area (ac)	C ₅	C ₁₀₀	C ₅ X A	C ₁₀₀ X A	T _c (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (cfs)	Q ₁₀₀ (cfs)
EX-DP-13	65.84	0.17	0.42	11.17	27.44	26.71	2.66	4.46	29.67	122.28
Offsite Flows*	-	-	-	57.72	176.32	65.49	1.49	2.66	86.00 ¹	469.00 ¹
Total (HG2)	-	-	-	68.89	203.76	65.49	1.49	2.66	102.65	541.99

From Previous Calculations¹

* All values used for offsite flows are the same as was calculated in 2010 Stapleton MDDP (JR Engineering). This offsite flow represents all flows from Meridian Ranch and 4-Way Filing No. 1 through drainageway A.

Pond No. 1 - EX POND #5

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 6880.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	6880.00	3,061	0	0
1.00	6881.00	6,242	4,558	4,558
2.00	6882.00	8,025	7,114	11,672
3.00	6883.00	10,054	9,020	20,691
4.00	6884.00	12,134	11,077	31,768
5.00	6885.00	14,245	13,174	44,942

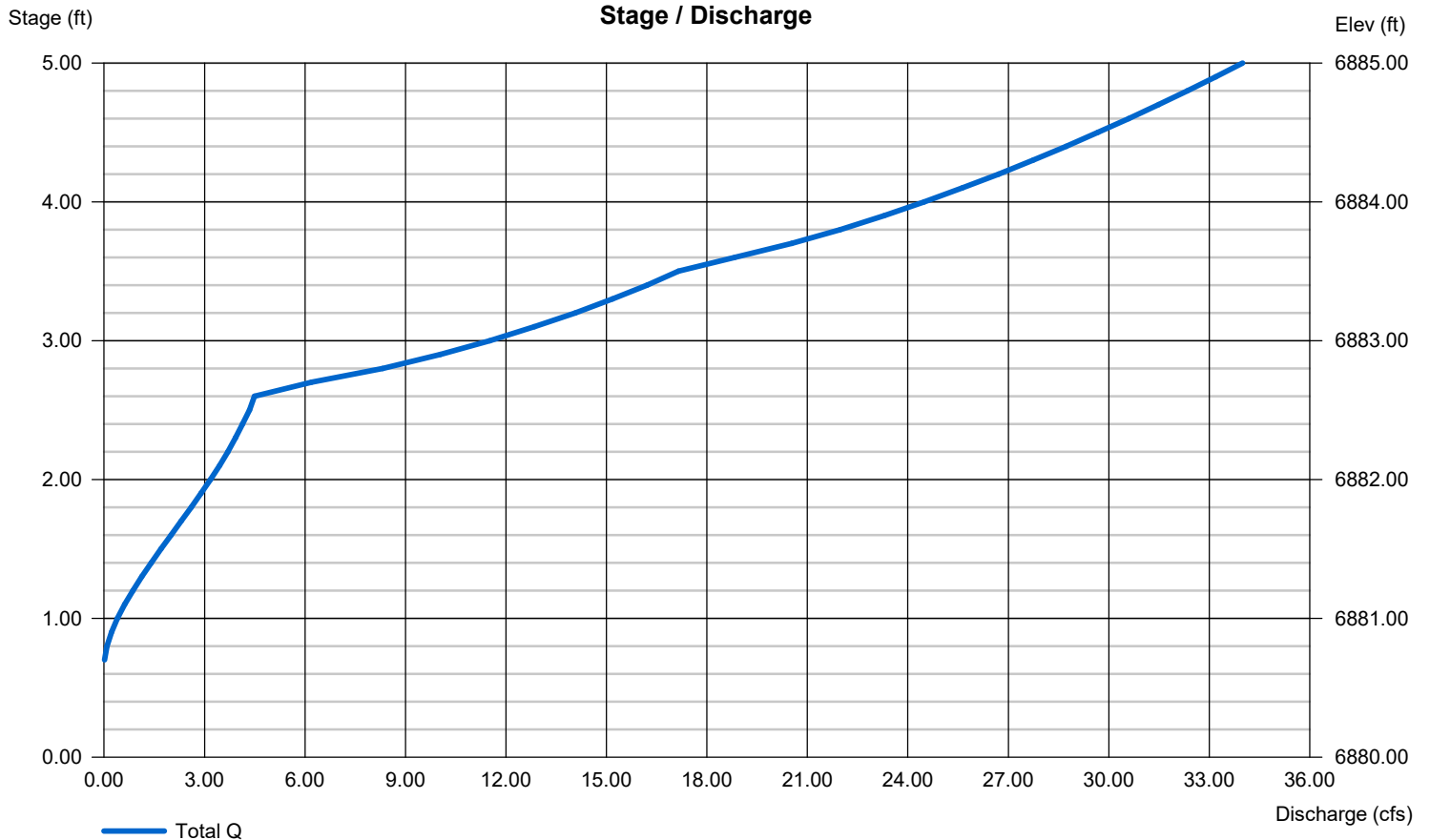
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	15.00	0.00	0.00
Span (in)	= 24.00	15.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 6880.64	6882.29	0.00	0.00
Length (ft)	= 65.00	30.00	0.00	0.00
Slope (%)	= 0.10	0.10	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Hydrograph Report

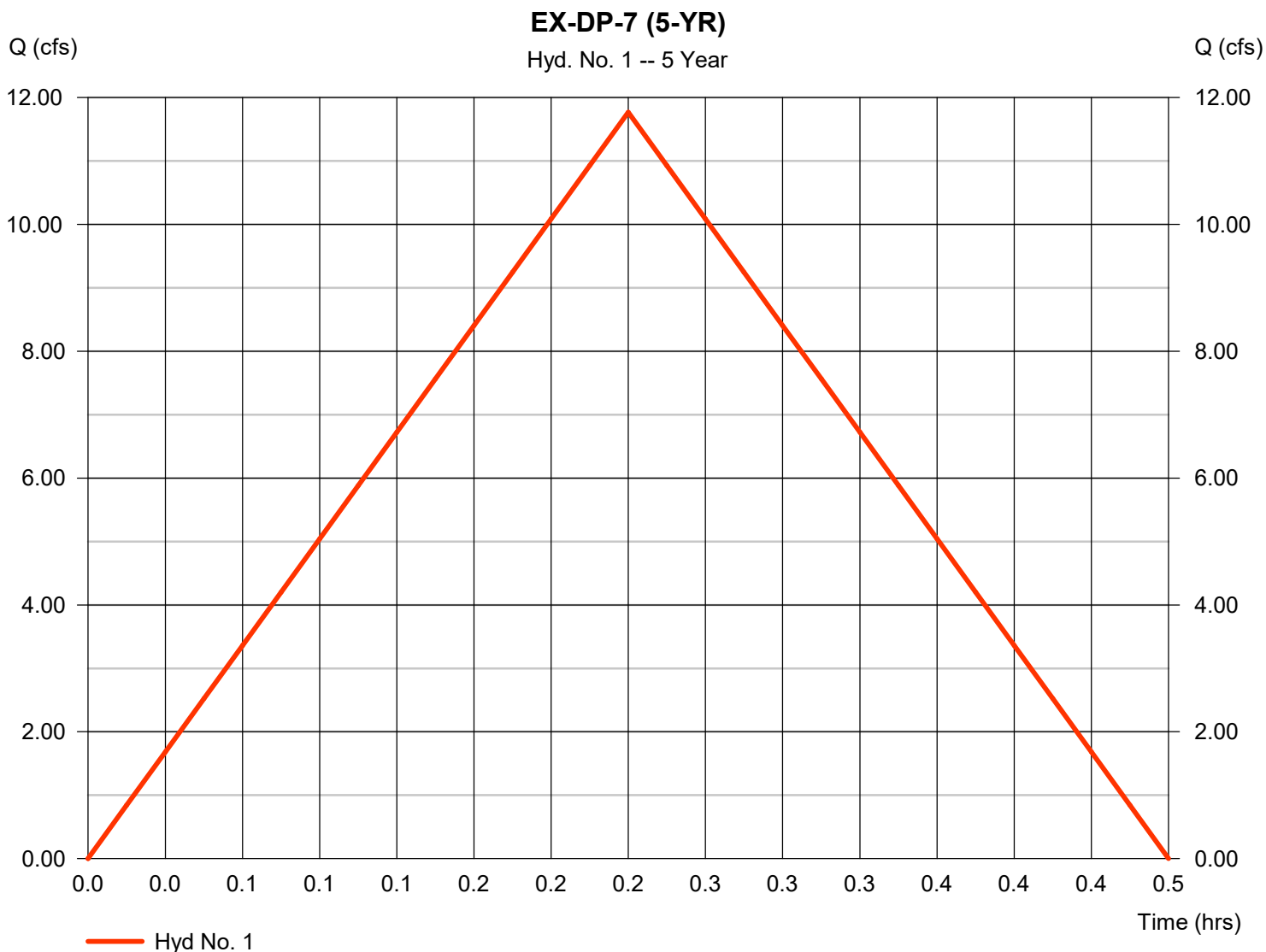
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

Wednesday, 04 / 30 / 2025

Hyd. No. 1

EX-DP-7 (5-YR)

Hydrograph type	= Rational	Peak discharge	= 11.49 cfs
Storm frequency	= 5 yrs	Time to peak	= 0.23 hrs
Time interval	= 1 min	Hyd. volume	= 9,884 cuft
Drainage area	= 8.170 ac	Runoff coeff.	= 0.39
Intensity	= 3.693 in/hr	Tc by User	= 14.00 min
IDF Curve	= Colorado Springs.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

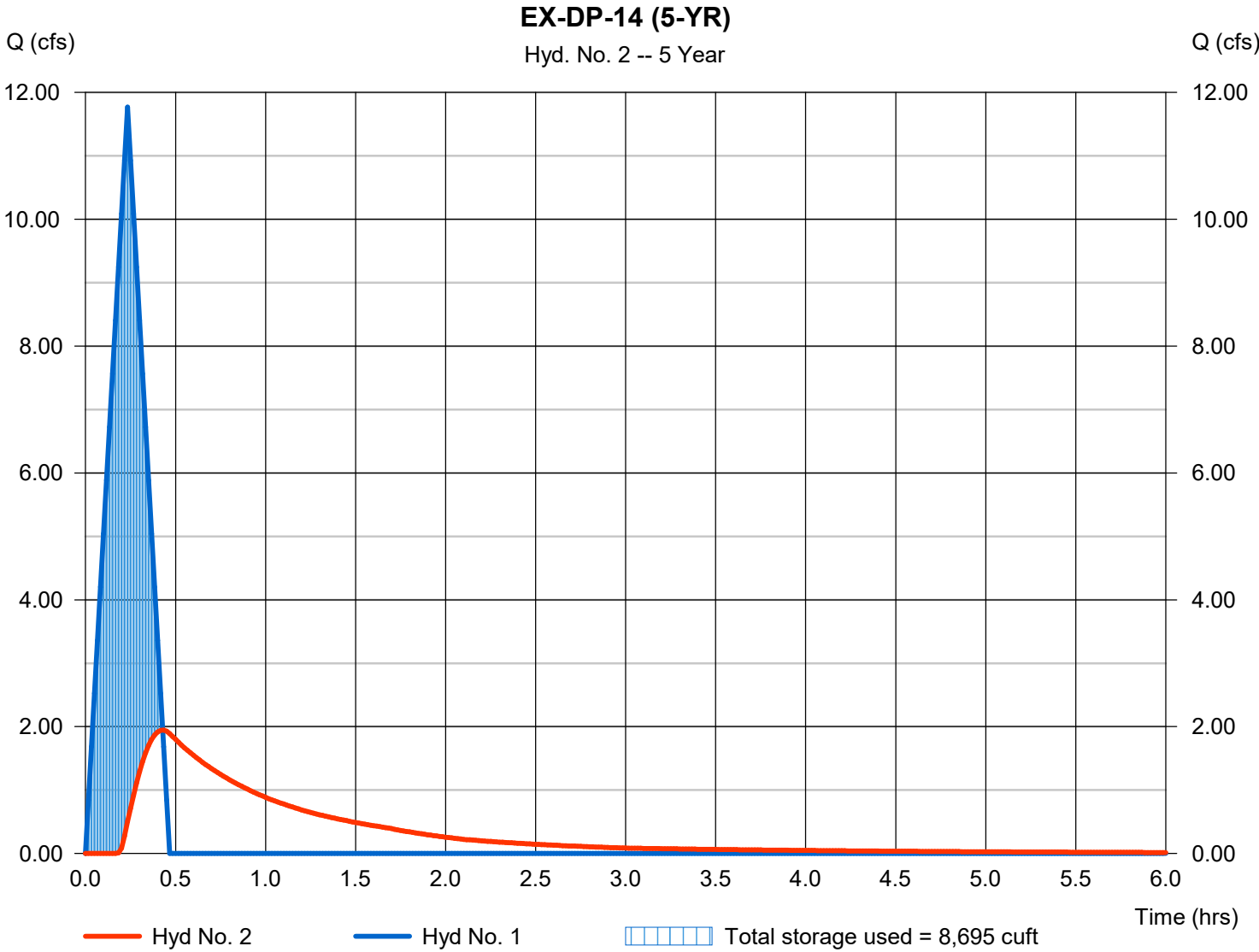
Wednesday, 04 / 30 / 2025

Hyd. No. 2

EX-DP-14 (5-YR)

Hydrograph type	= Reservoir	Peak discharge	= 1.945 cfs
Storm frequency	= 5 yrs	Time to peak	= 0.43 hrs
Time interval	= 1 min	Hyd. volume	= 7,110 cuft
Inflow hyd. No.	= 1 - EX-DP-7 (5-YR)	Max. Elevation	= 6881.58 ft
Reservoir name	= EX POND #5	Max. Storage	= 8,695 cuft

Storage Indication method used.



Hydrograph Report

Hyd. No. 1

EX-DP-7 (100-YR)

Hydrograph type	= Rational	Peak discharge	= 28.64 cfs
Storm frequency	= 100 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 24,109 cuft
Drainage area	= 8.170 ac	Runoff coeff.	= 0.58
Intensity	= 6.057 in/hr	Tc by User	= 14.00 min
IDF Curve	= Colorado Springs.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2024

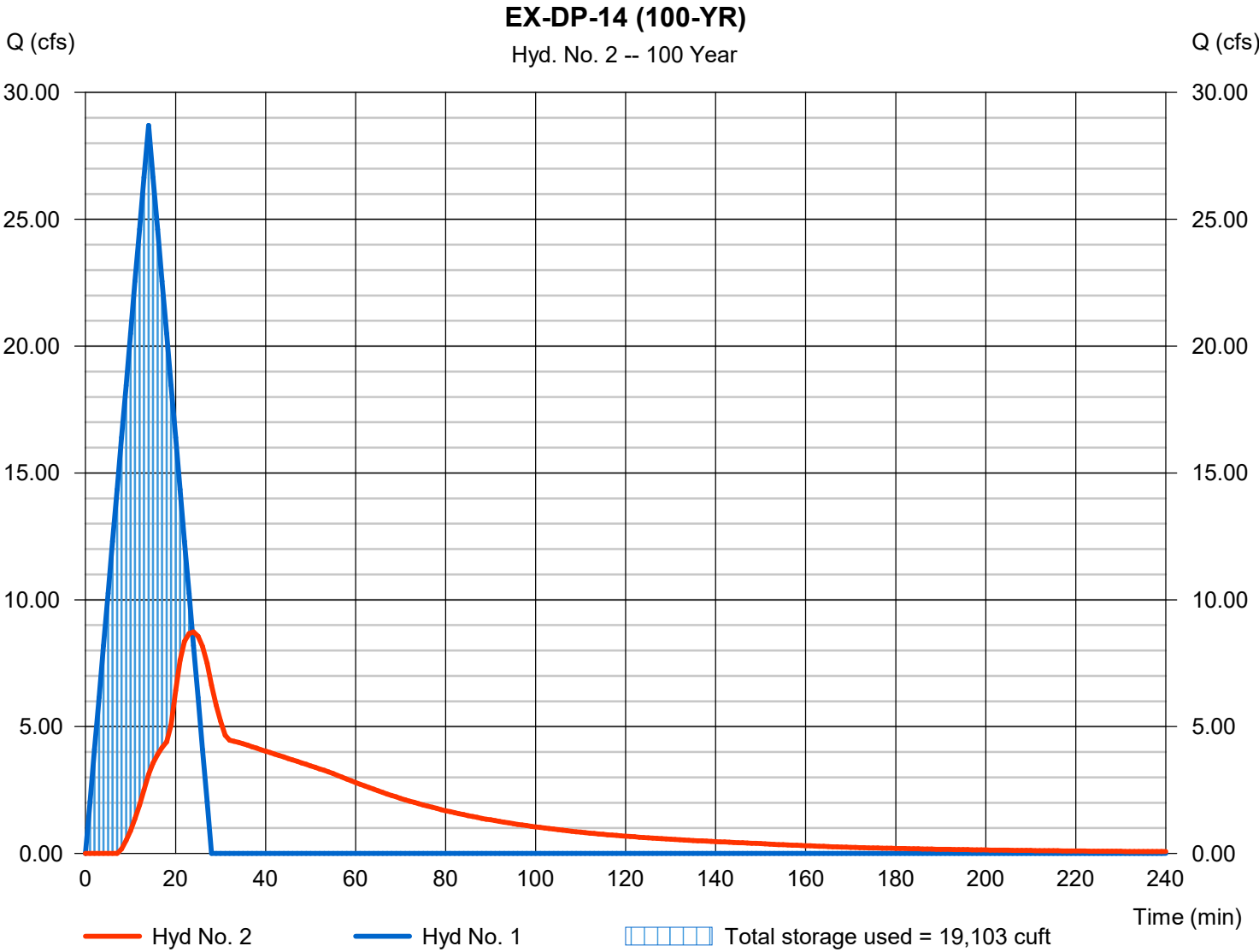
Wednesday, 04 / 30 / 2025

Hyd. No. 2

EX-DP-14 (100-YR)

Hydrograph type	= Reservoir	Peak discharge	= 8.732 cfs
Storm frequency	= 100 yrs	Time to peak	= 24 min
Time interval	= 1 min	Hyd. volume	= 21,335 cuft
Inflow hyd. No.	= 1 - EX-DP-7 (100-YR)	Max. Elevation	= 6882.82 ft
Reservoir name	= EX POND #5	Max. Storage	= 19,103 cuft

Storage Indication method used.



Proposed C-Calcs (HSG:A/B)										
Sub-Basin	Land Use	Area (sf)	Area (ac)	C ₅	C ₁₀₀	C ₅ X A	C ₁₀₀ X A	Weighted C ₅	Weighted C ₁₀₀	2010 MDDP Sub-Basin
P-1	Pavement	0	0.00	0.9	0.96	0.00	0.00	0.08	0.35	A
	Pasture/Meadow	365904	8.40	0.08	0.35	0.67	2.94			
	Total	365904	8.40			0.67	2.94			
P-2	Pavement	0	0.00	0.9	0.96	0.00	0.00	0.08	0.35	B
	Pasture/Meadow	459122	10.54	0.08	0.35	0.84	3.69			
	Total	459122	10.54			0.84	3.69			
P-3	Pavement	0	0.00	0.9	0.96	0.00	0.00	0.08	0.35	-
	Pasture/Meadow	572775	13.15	0.08	0.35	1.05	4.60			
	Total	572775	13.15			1.05	4.60			
P-4	Pavement	16713	0.38	0.9	0.96	0.35	0.37	0.10	0.37	-
	Pasture/Meadow	642811	14.76	0.08	0.35	1.18	5.16			
	Total	659524	15.14			1.53	5.53			
P-5	Pavement	118460	2.72	0.9	0.96	2.45	2.61	0.78	0.86	-
	Roof	60474	1.39	0.73	0.81	1.01	1.12			
	Pasture/Meadow	17330	0.40	0.08	0.35	0.03	0.14			
	Total	196264	4.51			3.49	3.87			
P-6	Pavement	7317	0.17	0.9	0.96	0.15	0.16	0.76	0.85	-
	Commercial	161485	3.71	0.81	0.88	3.00	3.26			
	Pasture/Meadow	12089	0.28	0.08	0.35	0.02	0.10			
	Total	180891	4.15			3.18	3.52			
P-7	Pavement	42206	0.97	0.9	0.96	0.87	0.93	0.82	0.89	-
	Roof	38204	0.88	0.73	0.81	0.64	0.71			
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	80410	1.85			1.51	1.64			
P-8	Pavement	10110	0.23	0.9	0.96	0.21	0.22	0.87	0.94	-
	Pasture/Meadow	323	0.01	0.08	0.35	0.00	0.00			
	Total	10433	0.24			0.21	0.23			
P-9	Pavement	1586	0.04	0.9	0.96	0.03	0.03	0.10	0.36	-
	Pasture/Meadow	72918	1.67	0.08	0.35	0.13	0.59			
	Total	74504	1.71			0.17	0.62			
P-10	Pavement	0	0.00	0.9	0.96	0.00	0.00	0.08	0.35	-
	Pasture/Meadow	66280	1.52	0.08	0.35	0.12	0.53			
	Total	66280	1.52			0.12	0.53			
P-11	Pavement	56632	1.30	0.9	0.96	1.17	1.25	0.62	0.75	-
	Pasture/Meadow	29987	0.69	0.08	0.35	0.06	0.24			
	Total	86619	1.99			1.23	1.49			
P-12	Pavement	871	0.02	0.9	0.96	0.02	0.02	0.09	0.36	-
	Pasture/Meadow	53625	1.23	0.08	0.35	0.10	0.43			
	Total	54496	1.25			0.12	0.45			
P-13	Pavement	0	0.00	0.9	0.96	0.00	0.00	0.08	0.35	-
	Pasture/Meadow	41036	0.94	0.08	0.35	0.08	0.33			
	Total	41036	0.94			0.08	0.33			
P-14	Pavement	3456	0.08	0.9	0.96	0.07	0.08	0.77	0.87	-
	Pasture/Meadow	630	0.01	0.08	0.35	0.00	0.01			
	Total	4086	0.09			0.07	0.08			
OS-1	Pavement	22651	0.52	0.9	0.96	0.47	0.50	0.90	0.96	X-2
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	22651	0.52			0.47	0.50			
OS-2	Pavement	31363	0.72	0.9	0.96	0.65	0.69	0.90	0.96	Y-2
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	31363	0.72			0.65	0.69			
OS-3	Pavement	36155	0.83	0.9	0.96	0.75	0.80	0.90	0.96	X-1
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	36155	0.83			0.75	0.80			
OS-4	Pavement	33541	0.77	0.9	0.96	0.69	0.74	0.90	0.96	Y-1
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	33541	0.77			0.69	0.74			
OS-5	Pavement	58806	1.35	0.9	0.96	1.22	1.30	0.90	0.96	J
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	58806	1.35			1.22	1.30			
OS-6	Pavement	70132	1.61	0.9	0.96	1.45	1.55	0.90	0.96	K
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	70132	1.61			1.45	1.55			
OS-7	Pavement	20473	0.47	0.9	0.96	0.42	0.45	0.90	0.96	L
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	20473	0.47			0.42	0.45			
OS-8	Pavement	30928	0.71	0.9	0.96	0.64	0.68	0.90	0.96	M
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	30928	0.71			0.64	0.68			
OS-9	Pavement	67518	1.55	0.9	0.96	1.40	1.49	0.90	0.96	R
	Pasture/Meadow	0	0.00	0.08	0.35	0.00	0.00			
	Total	67518	1.55			1.40	1.49			

NOTE: SHADED SUB-BASINS HAVE THE SAME LIMITS, AREA, AND LAND COVER AS SPECIFIED IN THE "MDDP AMMENDMENT/PRELIMINARY/FINAL DRAINAGE REPORT FOR STAPLETON DRIVE FROM BANDANERO DR TO US HWY 24 EL PASO COUNTY, COLORADO" (JR ENGINEERING, REVISED MAY 2010)

Proposed Time of Concentration															
Sub Basin Data			Initial/Overland Time (t _i)			Travel Time (t _t)						t _c Check			Final t _c
Sub-Basin	Area (ac)	C _s	Length (ft)	Slope (ft/ft)	t _i (min)	Length (ft)	Slope (ft/ft)	Land Type	C _v	Velocity (ft/sec)	t _t (min)	t _i + t _t (min)	Total Length (ft)	Min. t _c (10+L/180)	
P-1	8.40	0.08	100	0.015	16.11	950	0.025	NBG	10	1.58	10.01	26.12	1050	15.83	15.83
P-2	10.54	0.08	100	0.018	15.17	1370	0.02	NBG	10	1.41	16.15	31.31	1470	18.17	18.17
P-3	13.15	0.08	100	0.013	16.89	960	0.023	NBG	10	1.52	10.55	27.44	1060	15.89	15.89
P-4	15.14	0.10	100	0.015	15.78	1530	0.022	NBG	10	1.48	17.19	32.97	1630	19.06	19.06
P-5	4.51	0.78	38	0.020	2.88	937	0.011	PV	20	2.10	7.44	10.32	975	15.42	10.32
P-6	4.15	0.76	150	0.025	5.48	709	0.011	NBG	10	1.05	11.27	16.74	859	14.77	14.77
P-7	1.85	0.82	35	0.010	3.00	555	0.006	PV	20	1.55	5.97	8.97	590	13.28	8.97
P-8	0.24	0.87	30	0.010	2.23	202	0.005	PV	20	1.41	2.38	4.61	232	11.29	5.00
P-9	1.71	0.10	155	0.080	11.35	256	0.005	PV	20	1.41	3.02	14.36	411	12.28	12.28
P-10	1.52	0.08	100	0.025	13.61	230	0.025	NBG	10	1.58	2.42	16.04	330	11.83	11.83
P-11	1.99	0.62	150	0.035	7.08	720	0.021	PV	20	2.90	4.14	11.22	870	14.83	11.22
P-12	1.25	0.09	50	0.025	9.50	35	0.04	NBG	10	2.00	0.29	9.79	85	10.47	9.79
P-13	0.94	0.08	30	0.020	8.02	20	0.02	NBG	10	1.41	0.24	8.26	50	10.28	8.26
P-14	0.09	0.77	30	0.020	2.57	60	0.02	PV	20	2.83	0.35	2.92	90	10.50	5.00
OS-1	0.52	0.90	18	0.020	1.22	387	0.010	PV	20	2.00	3.23	4.44	405	12.25	5.00
OS-2	0.72	0.90	20	0.020	1.28	341	0.010	PV	20	2.00	2.84	4.13	361	12.01	5.00
OS-3	0.83	0.90	17	0.020	1.18	558	0.010	PV	20	2.00	4.65	5.83	575	13.19	5.83
OS-4	0.77	0.90	20	0.020	1.28	694	0.010	PV	20	2.00	5.78	7.07	714	13.97	7.07
OS-5	1.35	0.90	20	0.020	1.28	1037	0.011	PV	20	2.10	8.24	9.52	1057	15.87	9.52
OS-6	1.61	0.90	20	0.020	1.28	949	0.015	PV	20	2.45	6.46	7.74	969	15.38	7.74
OS-7	0.47	0.90	25	0.038	1.16	391	0.021	PV	20	2.90	2.25	3.41	416	12.31	5.00
OS-8	0.71	0.90	20	0.020	1.28	431	0.015	PV	20	2.45	2.93	4.22	451	12.51	5.00
OS-9	1.55	0.90	30	0.020	1.57	783	0.027	PV	20	3.29	3.97	5.54	813	14.52	5.54

Conveyance Coefficient C _v		
Type of Land Surface	Land Type	C _v
Heavy Meadow	HM	2.5
Tillage/Fields	TF	5
Riprap (Not Buried)	RR	6.5
Short Pasture/Lawns	SP	7
Nearly Bare Ground	NBG	10
Grassed Waterway	GW	15
Paved Areas & Shallow Paved Swales	PV	20

Equations:

$$t_i \text{ (overland)} = 0.395(1.1 - C_s)L^{0.5}S^{-0.333}$$

C = Runoff Coefficient

L = Length of overland flow (Max 100ft developed)

S = Slope

$$\text{Travel Time: } V = C_v S^{0.5}$$

V = Velocity (ft/s)

C_v = Conveyance Coefficient

S = Slope

$$t_c \text{ Check} = (L/180) + 10$$

L = Overall Length

NOTE: SHADED SUB-BASINS HAVE THE SAME LIMITS, AREA, AND LAND COVER AS SPECIFIED IN THE "MDDP AMMENDMENT/PRELIMINARY/FINAL DRAINAGE REPORT FOR STAPLETON DRIVE FROM BANDANERO DR TO US HWY 24 EL PASO COUNTY, COLORADO" (JR ENGINEERING, REVISED MAY 2010)

Proposed Intensity and Runoff Calculations								
Sub-Basin	Area (ac)	C ₅	C ₁₀₀	D = t _c (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (cfs)	Q ₁₀₀ (cfs)
P-1	8.40	0.08	0.35	15.83	3.44	5.77	2.31	16.98
P-2	10.54	0.08	0.35	18.17	3.23	5.43	2.73	20.02
P-3	13.15	0.08	0.35	15.89	3.43	5.77	3.61	26.53
P-4	15.14	0.10	0.37	19.06	3.16	5.31	4.82	29.37
P-5	4.51	0.78	0.86	10.32	4.08	6.85	14.26	26.55
P-6	4.15	0.76	0.85	14.77	3.54	5.95	11.26	20.95
P-7	1.85	0.82	0.89	8.97	4.29	7.21	6.49	11.82
P-8	0.24	0.87	0.94	5.00	5.17	8.68	1.08	1.96
P-9	1.71	0.10	0.36	12.28	3.82	6.41	0.64	3.98
P-10	1.52	0.08	0.35	11.83	3.88	6.51	0.47	3.47
P-11	1.99	0.62	0.75	11.22	3.96	6.64	4.85	9.89
P-12	1.25	0.09	0.36	9.79	4.16	6.99	0.48	3.14
P-13	0.94	0.08	0.35	8.26	4.42	7.41	0.33	2.44
P-14	0.09	0.77	0.87	5.00	5.17	8.68	0.38	0.70
OS-1	0.52	0.90	0.96	5.00	5.17	8.68	2.42	4.33
OS-2	0.72	0.90	0.96	5.00	5.17	8.68	3.35	6.00
OS-3	0.83	0.90	0.96	5.83	4.94	8.29	3.69	6.61
OS-4	0.77	0.90	0.96	7.07	4.65	7.81	3.22	5.77
OS-5	1.35	0.90	0.96	9.52	4.20	7.06	5.11	9.14
OS-6	1.61	0.90	0.96	7.74	4.51	7.58	6.54	11.71
OS-7	0.47	0.90	0.96	5.00	5.17	8.68	2.19	3.92
OS-8	0.71	0.90	0.96	5.00	5.17	8.68	3.30	5.92
OS-9	1.55	0.90	0.96	5.54	5.01	8.42	6.99	12.53

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

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

(Figure 6-5 El Paso Co DCM)

Proposed Design Point C Calcs									
Design Point	Contributing Basins	Land Use	Area (ac)	C ₅	C ₁₀₀	C ₅ x A	C ₁₀₀ x A	Weighted C ₅	Weighted C ₁₀₀
DP-1	OS-1, OS-3	Pavement	1.35	0.9	0.96	1.22	1.30	0.90	0.96
		Pasture/Meadow	0.00	0.08	0.35	0.00	0.00		
		Total	1.35			1.22	1.30		
DP-2	OS-2, OS-4	Pavement	1.49	0.9	0.96	1.34	1.43	0.90	0.96
		Pasture/Meadow	0.00	0.08	0.35	0.00	0.00		
		Total	1.49			1.34	1.43		
DP-3	DP-1, DP-2	Pavement	2.84	0.9	0.96	2.56	2.73	0.90	0.96
		Pasture/Meadow	0.00	0.08	0.35	0.00	0.00		
		Total	2.84			2.56	2.73		
DP-4	P-1, DP-3	Pavement	2.84	0.9	0.96	2.56	2.73	0.29	0.50
		Pasture/Meadow	8.40	0.08	0.35	0.67	2.94		
		Total	11.24			3.23	5.67		
DP-5	P-2, DP-4	Pavement	2.84	0.9	0.96	2.56	2.73	0.19	0.43
		Pasture/Meadow	18.94	0.08	0.35	1.52	6.63		
		Total	21.78			4.07	9.36		
DP-6	OS-9, P-11	Pavement	2.85	0.9	0.96	2.57	2.74	0.74	0.84
		Pasture/Meadow	0.69	0.08	0.35	0.06	0.24		
		Total	3.54			2.62	2.98		
DP-7	P-12, DP-6	Pavement	2.87	0.90	0.96	2.58	2.76	0.57	0.72
		Pasture/Meadow	1.92	0.08	0.35	0.15	0.67		
		Total	4.79			2.74	3.43		
DP-8	OS-5, OS-6	Pavement	2.96	0.9	0.96	2.66	2.84	0.90	0.96
		Pasture/Meadow	0.00	0.08	0.35	0.00	0.00		
		Total	2.96			2.66	2.84		
DP-9	OS-7, OS-8	Pavement	1.18	0.9	0.96	1.06	1.13	0.90	0.96
		Pasture/Meadow	0.00	0.08	0.35	0.00	0.00		
		Total	1.18			1.06	1.13		
DP-10	P-3, DP-8, DP-9	Pavement	4.14	0.9	0.96	3.73	3.97	0.28	0.50
		Pasture/Meadow	13.15	0.08	0.35	1.05	4.60		
		Total	17.29			4.78	8.58		
DP-11	P-5, P-6, P-7, P-8, P-9, P-14	Pavement	4.20	0.90	0.96	3.78	4.04	0.69	0.79
		Roof	2.27	0.73	0.81	1.65	1.83		
		Commercial	3.71	0.81	0.88	3.00	3.26		
		Pasture/Meadow	2.37	0.08	0.35	0.19	0.83		
		Total	12.55			8.63	9.96		
DP-12	DP-11 (EDB A Outfall)	Pavement	4.20	0.90	0.96	3.78	4.04	0.69	0.79
		Roof	2.27	0.73	0.81	1.65	1.83		
		Commercial	3.71	0.81	0.88	3.00	3.26		
		Pasture/Meadow	2.37	0.08	0.35	0.19	0.83		
		Total	12.55			8.63	9.96		
DP-13	P-4, DP-10, DP-12	Pavement	8.73	0.90	0.96	7.86	8.38	0.33	0.54
		Roof	2.27	0.73	0.81	1.65	1.83		
		Commercial	3.71	0.81	0.88	3.00	3.26		
		Pasture/Meadow	30.28	0.08	0.35	2.42	10.60		
		Total	44.98			14.93	24.07		
DP-14	P-13	Pavement	0.00	0.9	0.96	0.00	0.00	0.08	0.35
		Pasture/Meadow	0.94	0.08	0.35	0.08	0.33		
		Total	0.94			0.08	0.33		
DP-15	P-10, DP-5, DP-13, DP-14	Pavement	11.57	0.90	0.96	10.41	11.11	0.28	0.50
		Roof	2.27	0.73	0.81	1.65	1.83		
		Commercial	3.71	0.81	0.88	3.00	3.26		
		Pasture/Meadow	51.68	0.08	0.35	4.13	18.09		
		Total	69.22			19.20	34.29		
DP-16	DP-7 (EX Pond #5 Outfall)	Pavement	2.87	0.90	0.96	2.58	2.76	0.57	0.72
		Pasture/Meadow	1.92	0.08	0.35	0.15	0.67		
		Total	4.79			2.74	3.43		

Proposed Design Point Time of Concentration																						
Design Point Data				Initial/Overland Time (t _i)			Travel Time (t _t)						Travel Time (t _t)						t _t Check			Final t _t
Design Point	Contributing Basins	Area (ac)	C _s	Length (ft)	Slope (ft/ft)	t _i (min)	Length (ft)	Slope (ft/ft)	Land Type	C _v	Velocity (ft/sec)	t _t (min)	Length (ft)	Slope (ft/ft)	Land Type	C _v	Velocity (ft/sec)	t _t (min)	t _i + t _t (min)	Total Length (ft)	Min. t _t (10+L/180)	
DP-1	OS-1, OS-3	1.35	0.90	17	0.020	1.18	558	0.010	PV	20	2.00	4.65							5.83	575	13.19	5.8
DP-2	OS-2, OS-4	1.49	0.90	20	0.020	1.28	694	0.010	PV	20	2.00	5.78							7.07	714	13.97	7.1
DP-3	DP-1, DP-2	2.84	0.90	20	0.020	1.28	734	0.010	PV	20	2.00	6.12							7.40	754	14.19	7.4
DP-4	P-1, DP-3	11.24	0.29	20	0.020	5.22	734	0.010	PV	20	2.00	6.12	1050	0.025	NBG	10	1.58	11.07	22.41	1804	20.02	20.0
DP-5	P-2, DP-4	21.78	0.19	20	0.020	5.87	734	0.010	PV	20	2.00	6.12	1950	0.022	NBG	10	1.48	21.91	33.89	2704	25.02	25.0
DP-6	OS-9, P-11	3.54	0.74	55	0.02	3.83	873	0.021	PV	20	2.90	5.02							8.85	928	15.16	8.8
DP-7	P-12, DP-6	4.79	0.57	55	0.02	5.63	873	0.021	PV	20	2.90	5.02							10.65	928	15.16	10.7
DP-8	OS-5, OS-6	2.96	0.90	20	0.020	1.28	1037	0.011	PV	20	2.10	8.24							9.52	1057	15.87	9.5
DP-9	OS-7, OS-8	1.18	0.90	25	0.038	1.16	391	0.021	PV	20	2.90	2.25							3.41	416	12.31	5.0
DP-10	P-3, DP-8, DP-9	17.29	0.28	20	0.020	5.29	1037	0.011	PV	20	2.10	8.24	1060	0.023	NBG	10	1.52	11.65	25.18	2117	21.76	21.8
DP-11	P-5, P-6, P-7, P-8, P-9, P-14	12.55	0.69	38	0.02	3.65	937	0.011	PV	20	2.10	7.44	236	0.022	NBG	10	1.48	2.65	13.75	1211	16.73	13.7
DP-12	DP-11 (EDB A Outfall)	12.55	0.69	38	0.02	3.65	937	0.011	PV	20	2.10	7.44	236	0.022	NBG	10	1.48	2.65	13.75	1211	16.73	13.7
DP-13	P-4, DP-10, DP-12	44.98	0.33	20	0.02	4.93	1037	0.011	PV	20	2.10	8.24	1787	0.023	NBG	10	1.52	19.64	32.81	2844	25.80	25.8
DP-14	P-13	0.94	0.08	30	0.02	8.02	20	0.02	NBG	10	1.41	0.24							8.26	50	10.28	8.3
DP-15	P-10, DP-5, DP-13, DP-14	69.22	0.28	20	0.02	5.28	1037	0.011	PV	20	2.10	8.24	2077	0.021	NBG	10	1.45	23.89	37.41	3134	27.41	27.4
DP-16	DP-7 (EX Pond #5 Outfall)	4.79	0.57	55	0.02	5.63	873	0.021	PV	20	2.90	5.02							10.65	928	15.16	10.7

Conveyance Coefficient C _v		
Type of Land Surface	Land Type	C _v
Heavy Meadow	HM	2.5
Tillage/Fields	TF	5
Riprap (Not Buried)	RR	6.5
Short Pasture/Lawns	SP	7
Nearly Bare Ground	NBG	10
Grassed Waterway	GW	15
Paved Areas & Shallow Paved Swales	PV	20

Equations:

$$t_i (\text{overland}) = 0.395(1.1 - C_s)L^{0.5}S^{-0.333}$$

C = Runoff Coefficient

L = Length of overland flow (Max 100ft developed)

S = Slope

$$\text{Travel Time: } V = C_v S^{0.5}$$

V = Velocity (ft/s)

C_v = Conveyance Coefficient

S = Slope

Proposed Design Point Intensity and Runoff Calculations									
Design Point	Contributing Basins	Area (ac)	C ₅	C ₁₀₀	D = t _c (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (cfs)	Q ₁₀₀ (cfs)
DP-1	OS-1, OS-3	1.35	0.90	0.96	5.83	4.94	8.29	6.00	10.74
DP-2	OS-2, OS-4	1.49	0.90	0.96	7.07	4.65	7.81	6.24	11.17
DP-3	DP-1, DP-2	2.84	0.90	0.96	7.40	4.58	7.69	11.71	20.97
DP-4	P-1, DP-3	11.24	0.29	0.50	20.02	3.09	5.18	9.97	29.37
DP-5	P-2, DP-4	21.78	0.19	0.43	25.02	2.75	4.62	11.21	43.23
DP-6	OS-9, P-11	3.54	0.74	0.84	8.85	4.31	7.24	11.30	21.55
DP-7	P-12, DP-6	4.79	0.57	0.72	10.65	4.03	6.77	11.04	23.21
DP-8	OS-5, OS-6	2.96	0.90	0.96	9.52	4.20	7.06	11.19	20.05
DP-9	OS-7, OS-8	1.18	0.90	0.96	5.00	5.17	8.68	5.49	9.83
DP-10	P-3, DP-8, DP-9	17.29	0.28	0.50	21.76	2.96	4.97	14.16	42.65
DP-11	P-5, P-6, P-7, P-8, P-9, P-14	12.55	0.69	0.79	13.75	3.65	6.13	31.51	61.08
DP-12*	DP-11 (EDB A Outfall)	12.55	0.69	0.79	13.75	3.65	6.13	0.40	4.70
DP-13	P-4, DP-10, DP-12	44.98	0.33	0.54	25.80	2.71	4.54	17.47	68.82
DP-14	P-13	0.94	0.08	0.35	8.26	4.42	7.41	0.33	2.44
DP-15	P-10, DP-5, DP-13, DP-14	69.22	0.28	0.50	27.41	2.62	4.39	28.06	111.53
DP-16*	DP-7 (EX Pond #5 Outfall)	4.79	0.57	0.72	10.65	4.03	6.77	1.20	3.69

*DP-12 & DP-16 runoff calculated from detention calculations

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

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

(Figure 6-5 El Paso Co DCM)

Proposed Design Point and Offsite Runoff Calculations									
	Contributing Basins / Design Points	Area (ac)	C ₅	C ₁₀₀	D = t _c (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (cfs)	Q ₁₀₀ (cfs)
*DP-13	P-4, DP-10	32.43	0.19	0.44	25.80	2.71	4.54	17.07	64.12
	*DP-12 (EDB A Outfall)	12.55						0.40	4.70
	TOTAL :	44.98						17.47	68.82
*DP-15	P-4, P-10, DP-5, DP-10, DP-14	56.67	0.19	0.43	27.41	2.62	4.39	27.66	106.83
	*DP-12 (EDB A Outfall)	12.55						0.40	4.70
	TOTAL :	69.22						28.06	111.53

Proposed Offsite Flow Calculations at HG2									
		C ₅ X A	C ₁₀₀ X A	D = t _c (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (cfs)	Q ₁₀₀ (cfs)	
Total (HG2)	P-4, P-10, DP-5, DP-10, DP-14	10.57	24.33	27.41	2.62	4.39	27.66	106.83	
	Offsite Flows [^]	57.72	176.32	65.49	1.49	2.66	86.00 ¹	469.00 ¹	
	TOTAL :	68.29	200.65	65.49	1.49	2.66	101.76	533.72	
	*DP-12 (EDB A Outfall)						0.40	4.70	
TOTAL :							102.16	538.42	
From Previous Calculations ¹									
^ All values used for offsite flows are the same as was calculated in 2010 Stapleton MDDP (JR Engineering). This offsite flow represents all flows from Meridian Ranch and 4-Way Filing No. 1 through drainageway A.									

Pond No. 1 - EX POND #5

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 6880.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	6880.00	3,061	0	0
1.00	6881.00	6,242	4,558	4,558
2.00	6882.00	8,025	7,114	11,672
3.00	6883.00	10,054	9,020	20,691
4.00	6884.00	12,134	11,077	31,768
5.00	6885.00	14,245	13,174	44,942

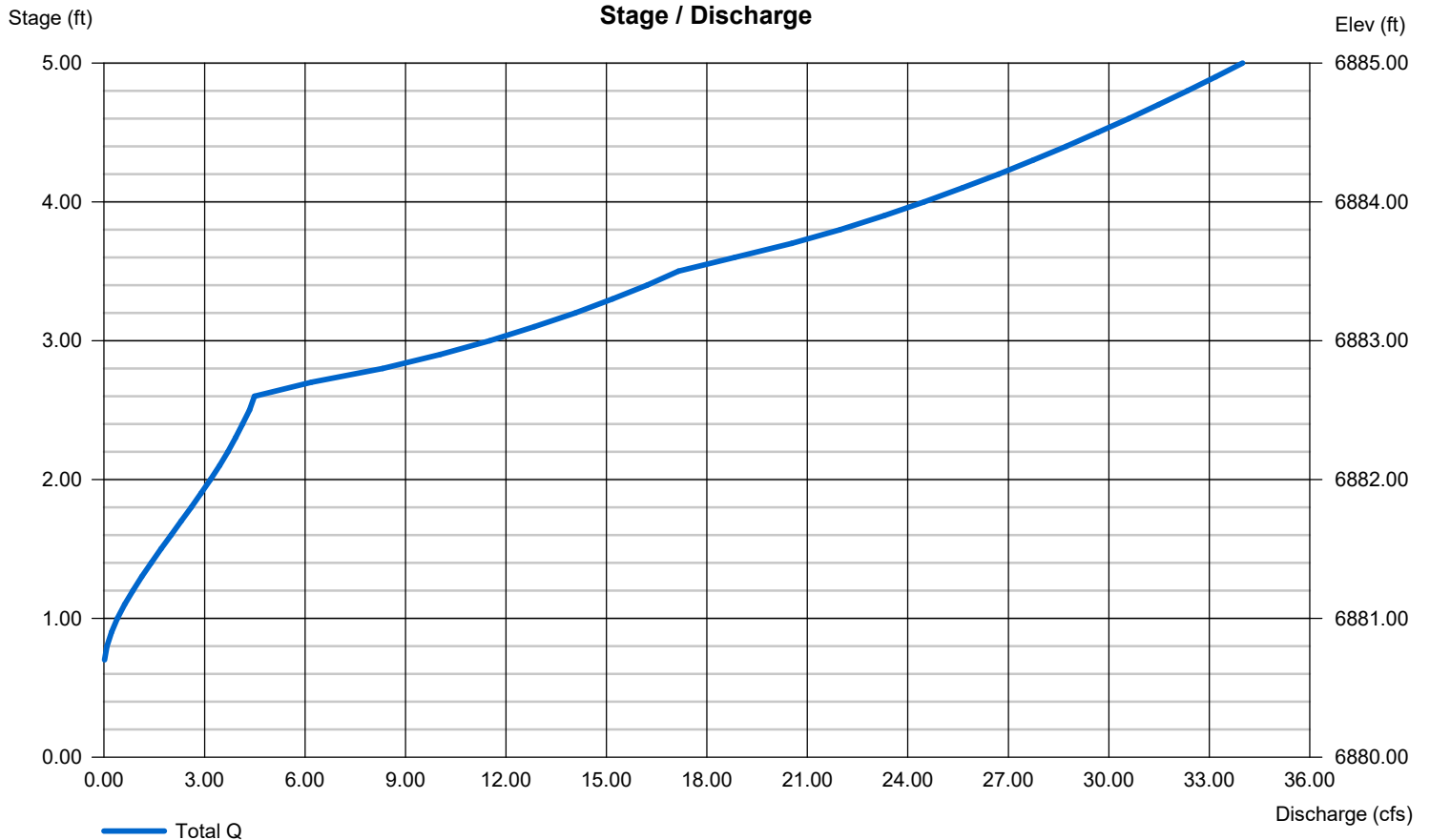
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	15.00	0.00	0.00
Span (in)	= 24.00	15.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 6880.64	6882.29	0.00	0.00
Length (ft)	= 65.00	30.00	0.00	0.00
Slope (%)	= 0.10	0.10	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Wet area)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Hydrograph Report

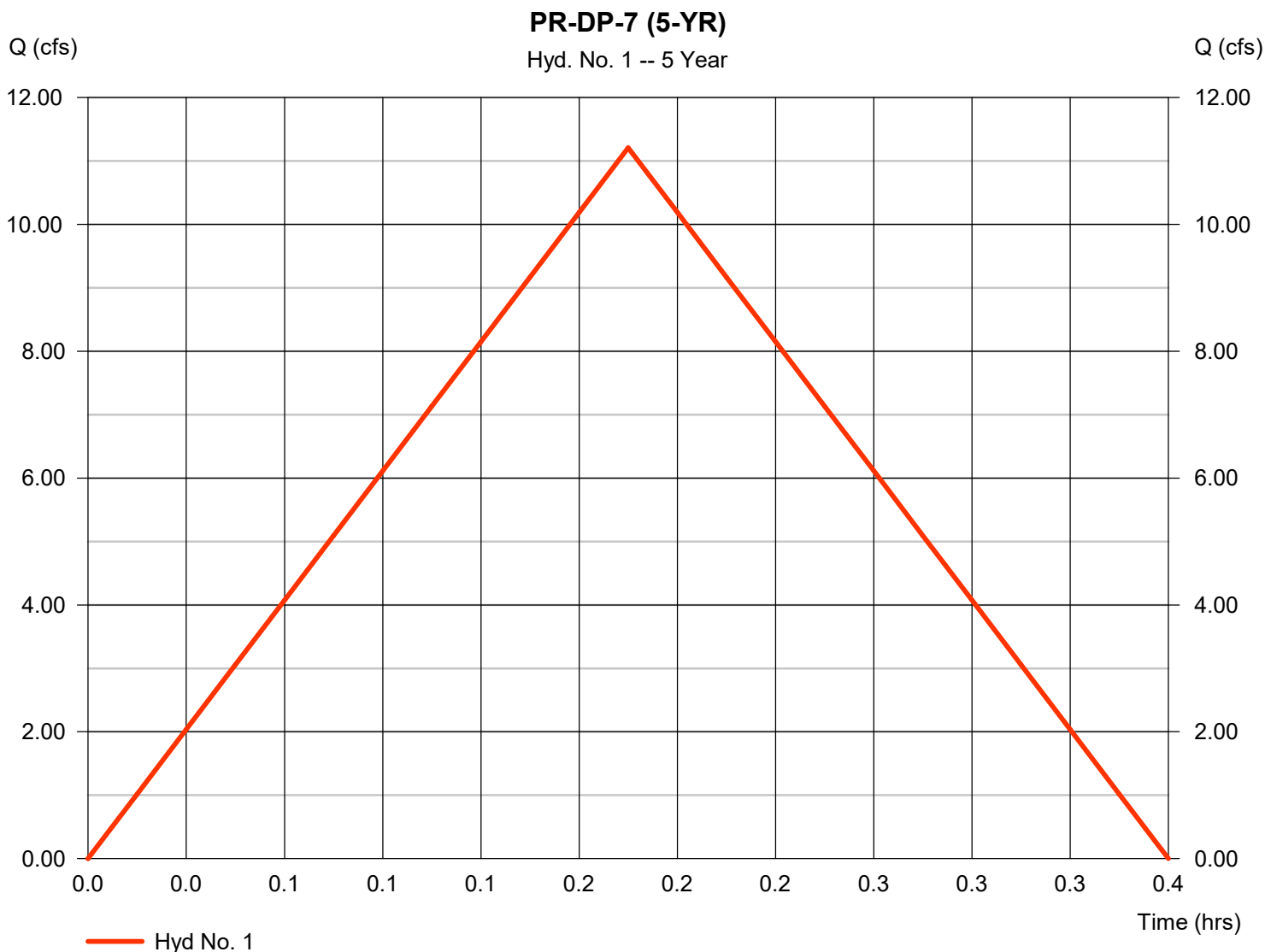
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2026

Thursday, 12 / 18 / 2025

Hyd. No. 1

PR-DP-7 (5-YR)

Hydrograph type	= Rational	Peak discharge	= 11.21 cfs
Storm frequency	= 5 yrs	Time to peak	= 0.18 hrs
Time interval	= 1 min	Hyd. volume	= 7,398 cuft
Drainage area	= 4.790 ac	Runoff coeff.	= 0.57
Intensity	= 4.105 in/hr	Tc by User	= 11.00 min
IDF Curve	= Colorado Springs.IDF	Asc/Rec limb fact	= 1/1



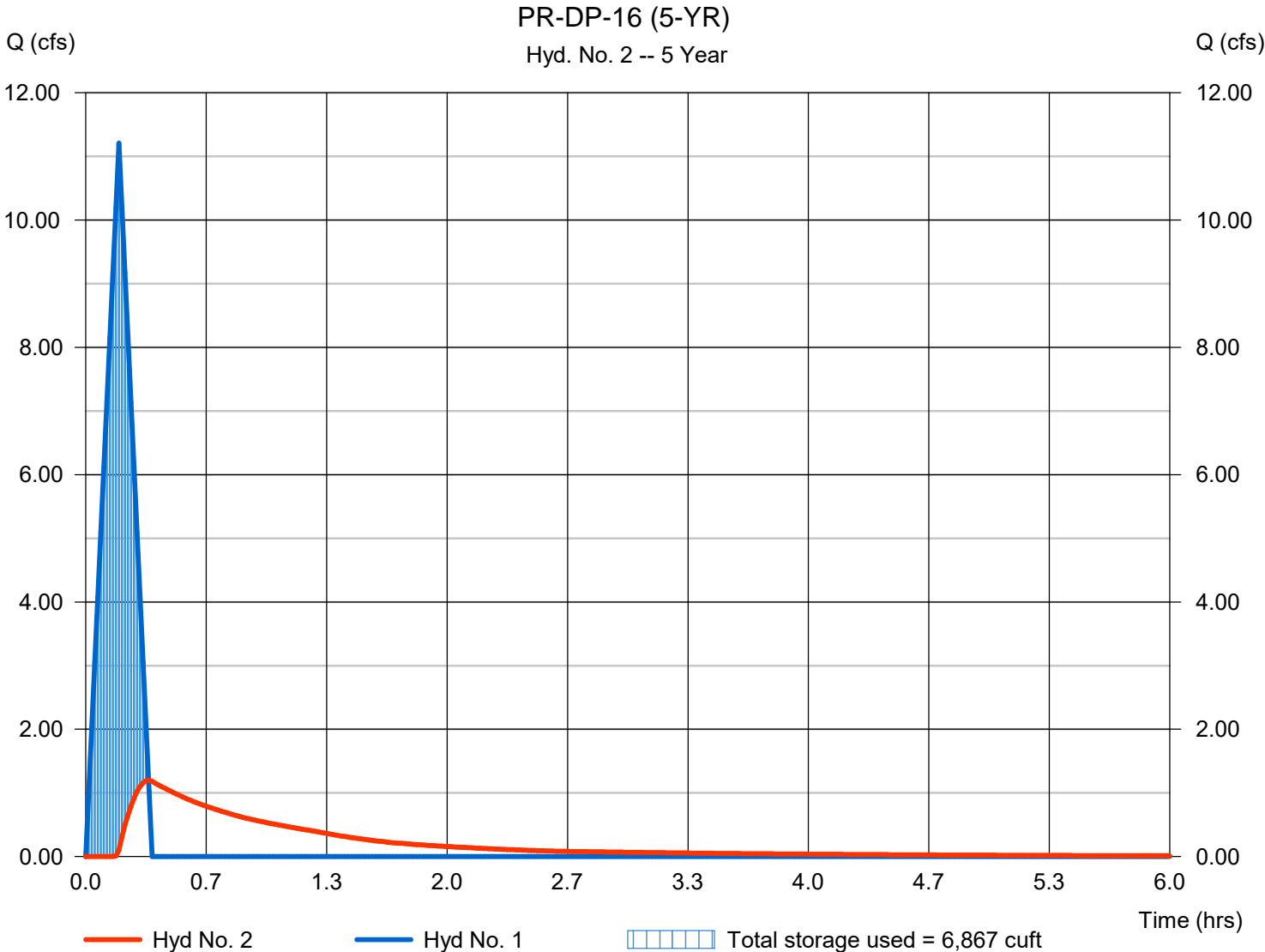
Hydrograph Report

Hyd. No. 2

PR-DP-16 (5-YR)

Hydrograph type	= Reservoir	Peak discharge	= 1.198 cfs
Storm frequency	= 5 yrs	Time to peak	= 0.35 hrs
Time interval	= 1 min	Hyd. volume	= 4,624 cuft
Inflow hyd. No.	= 1 - PR-DP-7 (5-YR)	Max. Elevation	= 6881.32 ft
Reservoir name	= EX POND #5	Max. Storage	= 6,867 cuft

Storage Indication method used.



Hydrograph Report

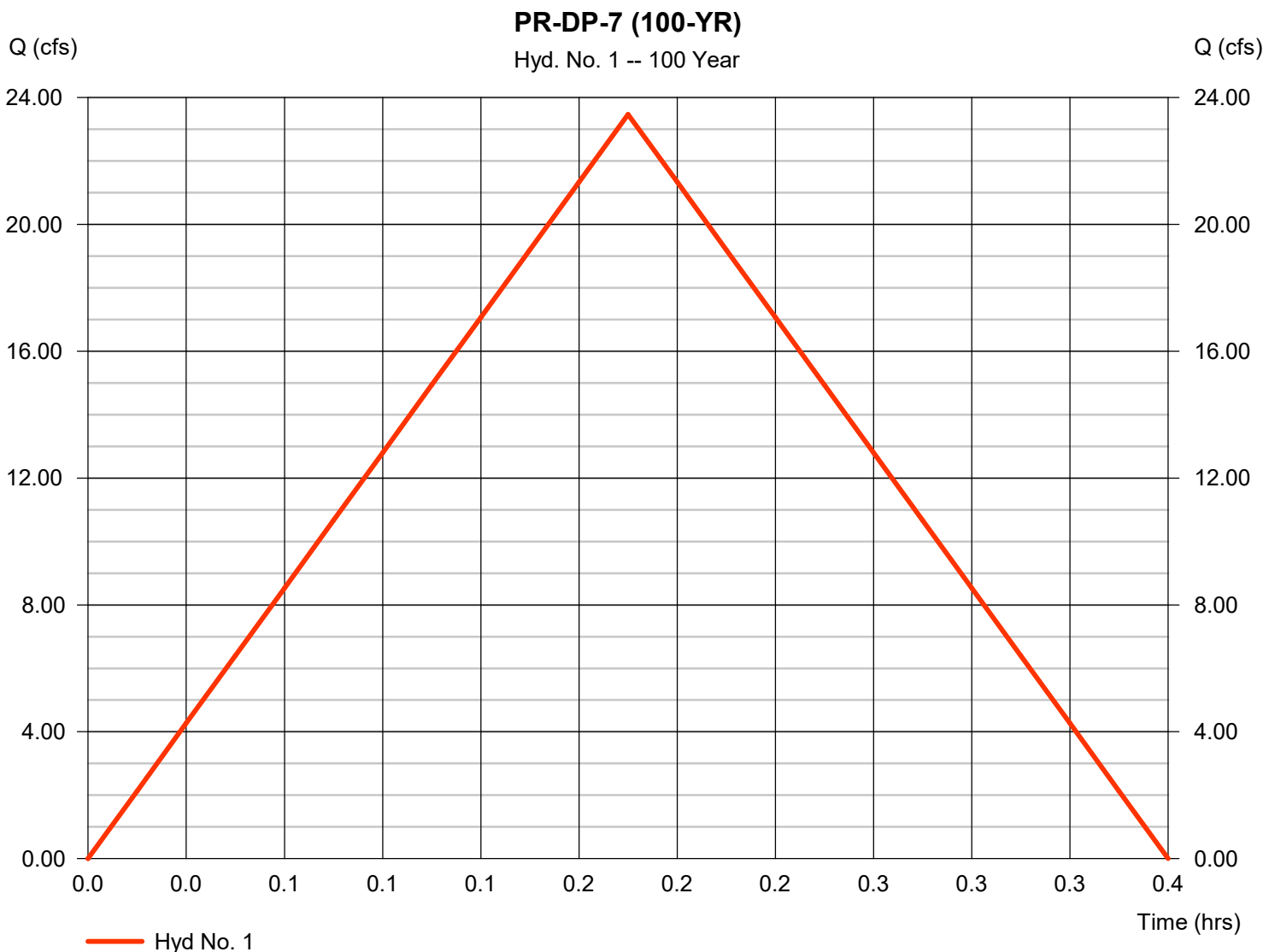
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2026

Thursday, 12 / 18 / 2025

Hyd. No. 1

PR-DP-7 (100-YR)

Hydrograph type	= Rational	Peak discharge	= 23.47 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.18 hrs
Time interval	= 1 min	Hyd. volume	= 15,491 cuft
Drainage area	= 4.790 ac	Runoff coeff.	= 0.72
Intensity	= 6.806 in/hr	Tc by User	= 11.00 min
IDF Curve	= Colorado Springs.IDF	Asc/Rec limb fact	= 1/1



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2026

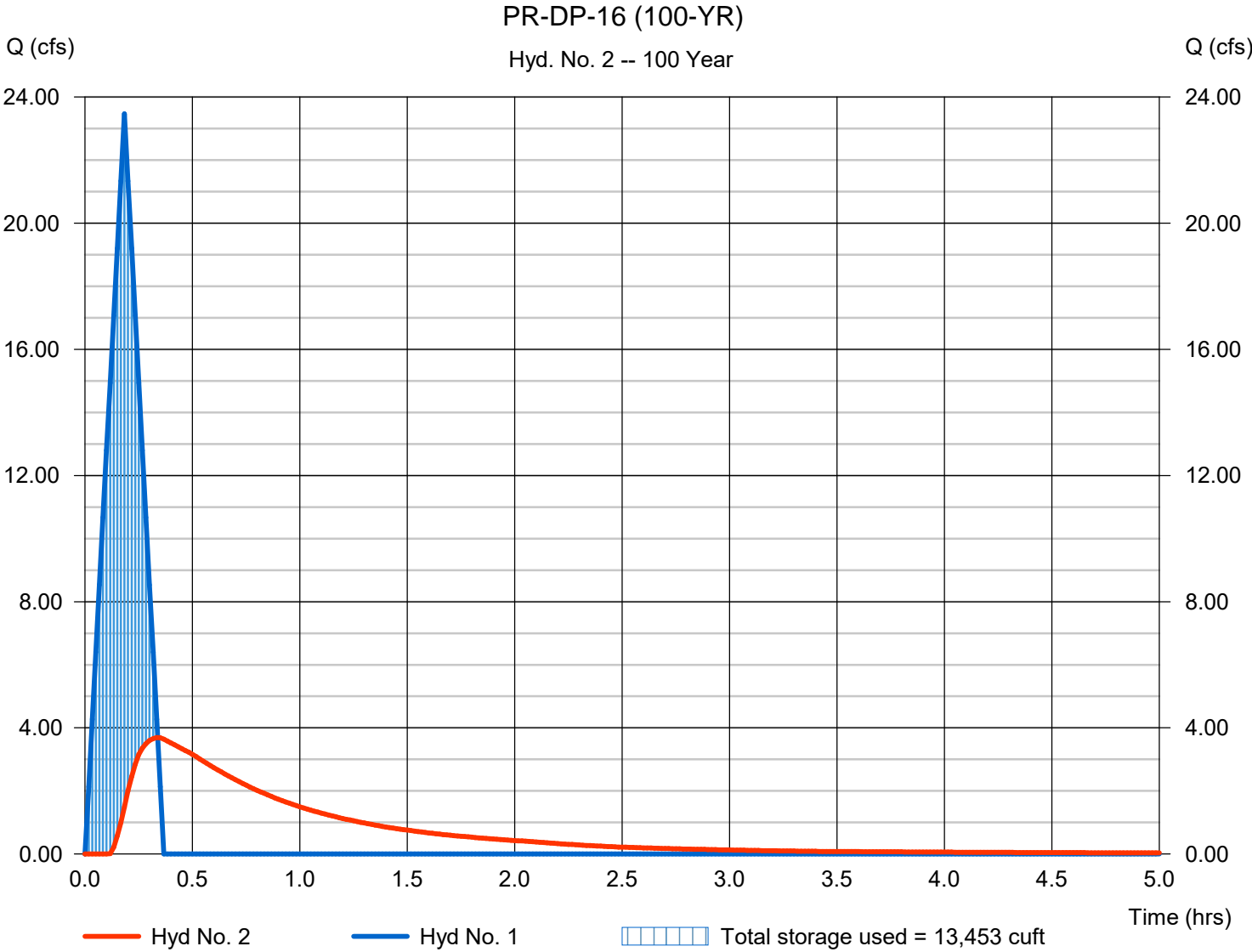
Thursday, 12 / 18 / 2025

Hyd. No. 2

PR-DP-16 (100-YR)

Hydrograph type	= Reservoir	Peak discharge	= 3.689 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.33 hrs
Time interval	= 1 min	Hyd. volume	= 12,717 cuft
Inflow hyd. No.	= 1 - PR-DP-7 (100-YR)	Max. Elevation	= 6882.20 ft
Reservoir name	= EX POND #5	Max. Storage	= 13,453 cuft

Storage Indication method used.



HYDRAULIC CALCULATIONS

Culvert Report

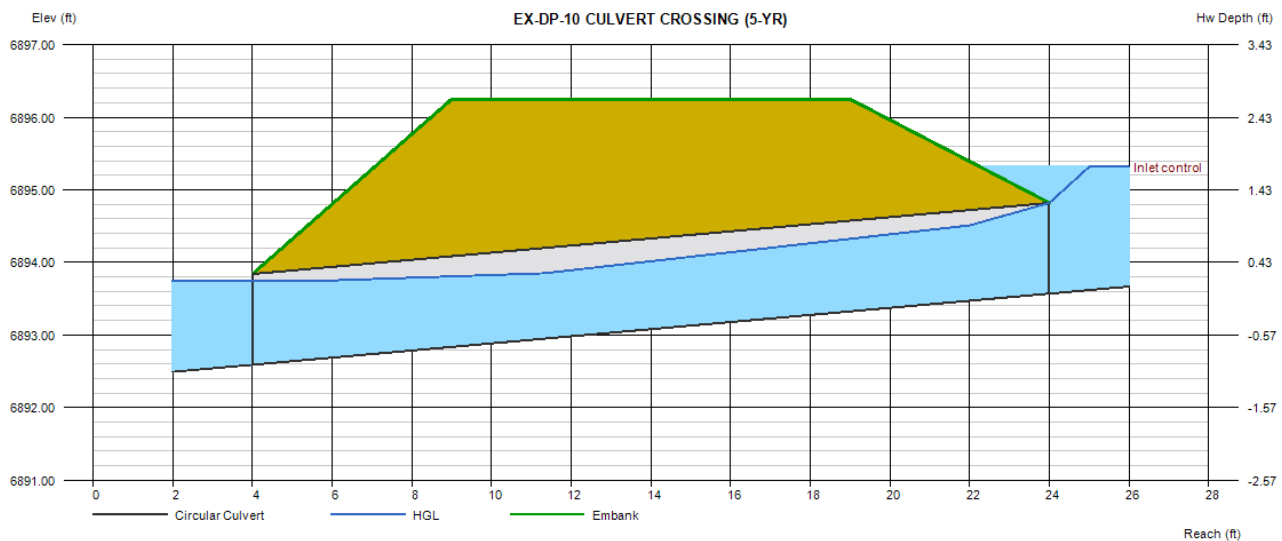
EX-DP-10 CULVERT CROSSING (5-YR)

Invert Elev Dn (ft)	=	6892.59
Pipe Length (ft)	=	20.00
Slope (%)	=	4.90
Invert Elev Up (ft)	=	6893.57
Rise (in)	=	15.0
Shape	=	Circular
Span (in)	=	15.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Culvert
Culvert Entrance	=	Smooth tapered inlet throat
Coeff. K,M,c,Y,k	=	0.534, 0.555, 0.0196, 0.9, 0.2

Embankment	
Top Elevation (ft)	= 6896.25
Top Width (ft)	= 10.00
Crest Width (ft)	= 30.00

Calculations	
Qmin (cfs)	= 0.00
Qmax (cfs)	= 14.16
Tailwater Elev (ft)	= (dc+D)/2

Highlighted	
Qtotal (cfs)	= 14.16
Qpipe (cfs)	= 14.16
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 5.97
Veloc Up (ft/s)	= 6.36
HGL Dn (ft)	= 6893.75
HGL Up (ft)	= 6894.63
Hw Elev (ft)	= 6895.32
Hw/D (ft)	= 1.40
Flow Regime	= Inlet Control



Culvert Report

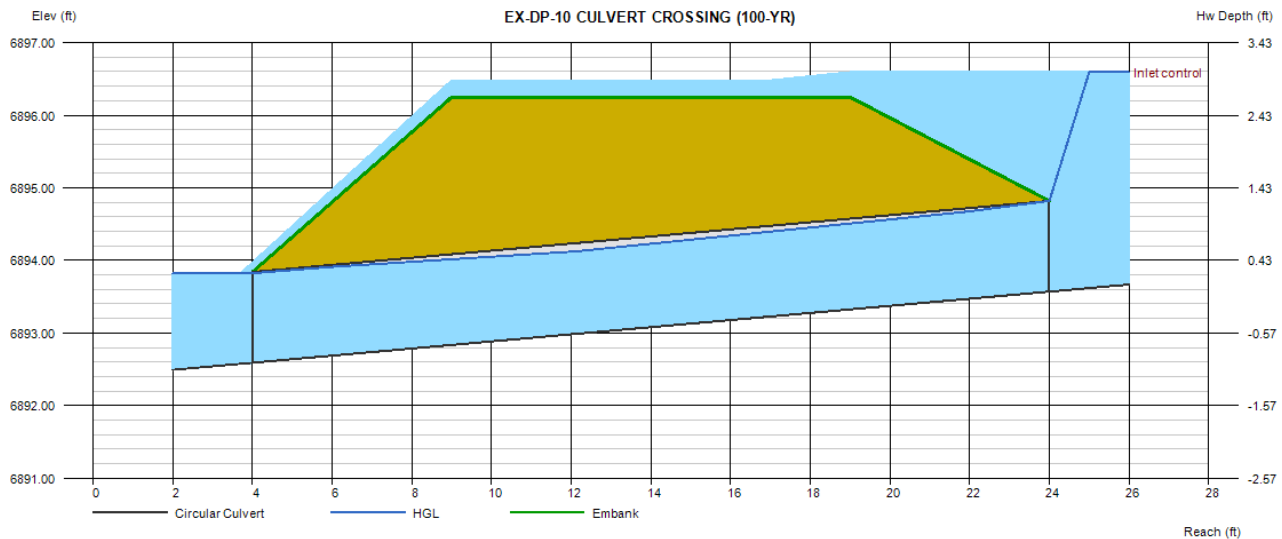
EX-DP-10 CULVERT CROSSING (100-YR)

Invert Elev Dn (ft)	= 6892.59
Pipe Length (ft)	= 20.00
Slope (%)	= 4.90
Invert Elev Up (ft)	= 6893.57
Rise (in)	= 15.0
Shape	= Circular
Span (in)	= 15.0
No. Barrels	= 2
n-Value	= 0.012
Culvert Type	= Circular Culvert
Culvert Entrance	= Smooth tapered inlet throat
Coeff. K,M,c,Y,k	= 0.534, 0.555, 0.0196, 0.9, 0.2

Embankment	
Top Elevation (ft)	= 6896.25
Top Width (ft)	= 10.00
Crest Width (ft)	= 30.00

Calculations	
Qmin (cfs)	= 0.00
Qmax (cfs)	= 42.65
Tailwater Elev (ft)	= (dc+D)/2

Highlighted	
Qtotal (cfs)	= 42.65
Qpipe (cfs)	= 24.35
Qovertop (cfs)	= 18.30
Veloc Dn (ft/s)	= 9.95
Veloc Up (ft/s)	= 9.99
HGL Dn (ft)	= 6893.82
HGL Up (ft)	= 6894.79
Hw Elev (ft)	= 6896.59
Hw/D (ft)	= 2.42
Flow Regime	= Inlet Control



Culvert Report

DUAL 36" CMP CAPACITY (HG2)

Invert Elev Dn (ft)	= 6881.14
Pipe Length (ft)	= 42.00
Slope (%)	= 2.48
Invert Elev Up (ft)	= 6882.18
Rise (in)	= 36.0
Shape	= Circular
Span (in)	= 36.0
No. Barrels	= 2
n-Value	= 0.022
Culvert Type	= Circular Corrugate Metal Pipe
Culvert Entrance	= Mitered to slope (C)
Coeff. K,M,c,Y,k	= 0.021, 1.33, 0.0463, 0.75, 0.7

Embankment

Top Elevation (ft)	= 6886.00
Top Width (ft)	= 15.00
Crest Width (ft)	= 30.00

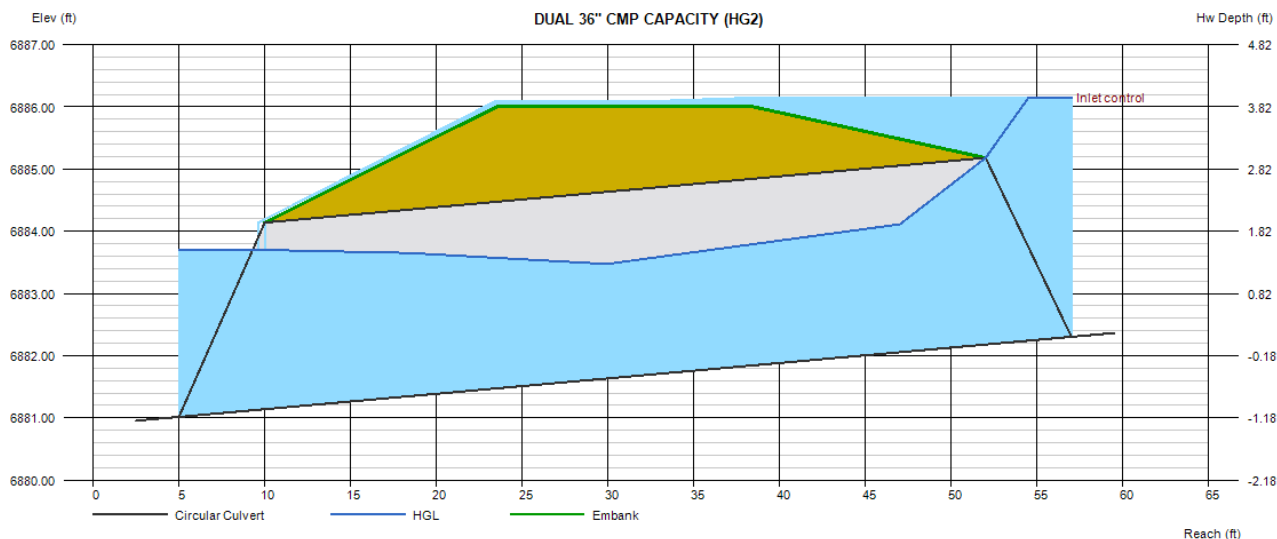
APPROXIMATE FLOW BEFORE ROCK ISLAND TRAIL IS OVERTOPPED

Calculations

Qmin (cfs)	= 0.00
Qmax (cfs)	= 90.00
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 90.00
Qpipe (cfs)	= 84.83
Qovertop (cfs)	= 5.17
Veloc Dn (ft/s)	= 6.60
Veloc Up (ft/s)	= 7.95
HGL Dn (ft)	= 6883.70
HGL Up (ft)	= 6884.30
Hw Elev (ft)	= 6886.15
Hw/D (ft)	= 1.32
Flow Regime	= Inlet Control



Culvert Report

DUAL 36" CMP Q100 (HG2)

Invert Elev Dn (ft)	= 6881.14
Pipe Length (ft)	= 42.00
Slope (%)	= 2.48
Invert Elev Up (ft)	= 6882.18
Rise (in)	= 36.0
Shape	= Circular
Span (in)	= 36.0
No. Barrels	= 2
n-Value	= 0.022
Culvert Type	= Circular Corrugate Metal Pipe
Culvert Entrance	= Mitered to slope (C)
Coeff. K,M,c,Y,k	= 0.021, 1.33, 0.0463, 0.75, 0.7

Embankment

Top Elevation (ft)	= 6886.00
Top Width (ft)	= 15.00
Crest Width (ft)	= 30.00

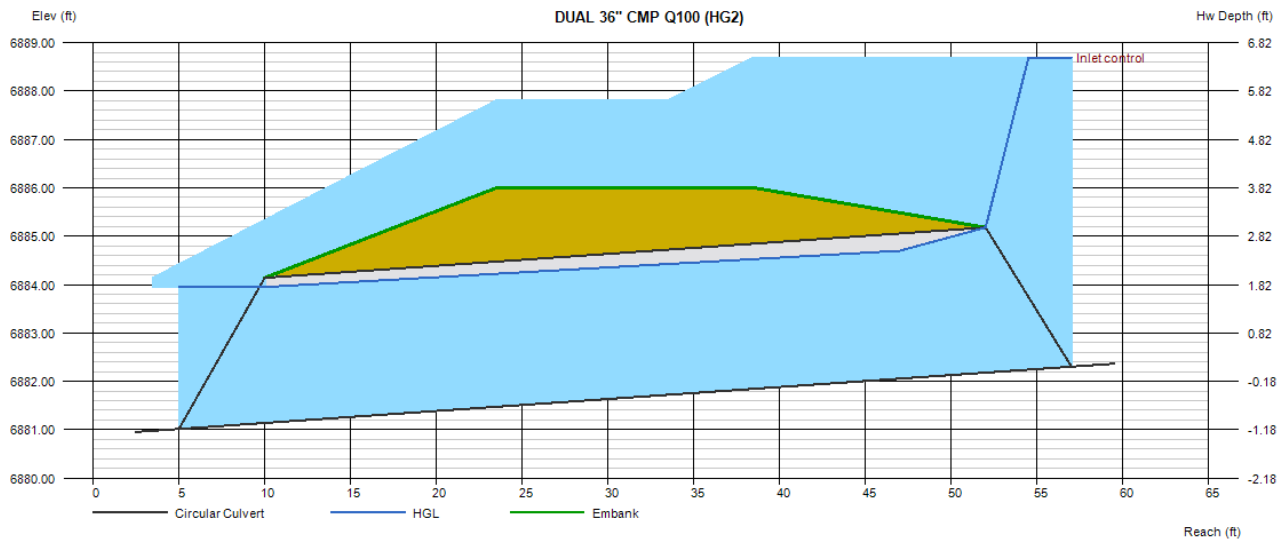
EXISTING 100-YEAR FLOW TO CROSSING (PR Q100: 538.42)

Calculations

Qmin (cfs)	= 0.00
Qmax (cfs)	= 541.99
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtotal (cfs)	= 541.99
Qpipe (cfs)	= 134.83
Qovertop (cfs)	= 407.16
Veloc Dn (ft/s)	= 9.80
Veloc Up (ft/s)	= 10.30
HGL Dn (ft)	= 6883.95
HGL Up (ft)	= 6884.80
Hw Elev (ft)	= 6888.69
Hw/D (ft)	= 2.17
Flow Regime	= Inlet Control



Culvert Report

EXISTING 4'X4' RCBC CAPACITY (HG2)

Invert Elev Dn (ft)	=	6879.30
Pipe Length (ft)	=	93.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	6880.23
Rise (in)	=	48.0
Shape	=	Box
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Rectangular Concrete
Culvert Entrance	=	Tapered inlet throat
Coeff. K,M,c,Y,k	=	0.475, 0.667, 0.0179, 0.97, 0.2

Embankment

Top Elevation (ft)	=	6886.50
Top Width (ft)	=	70.00
Crest Width (ft)	=	50.00

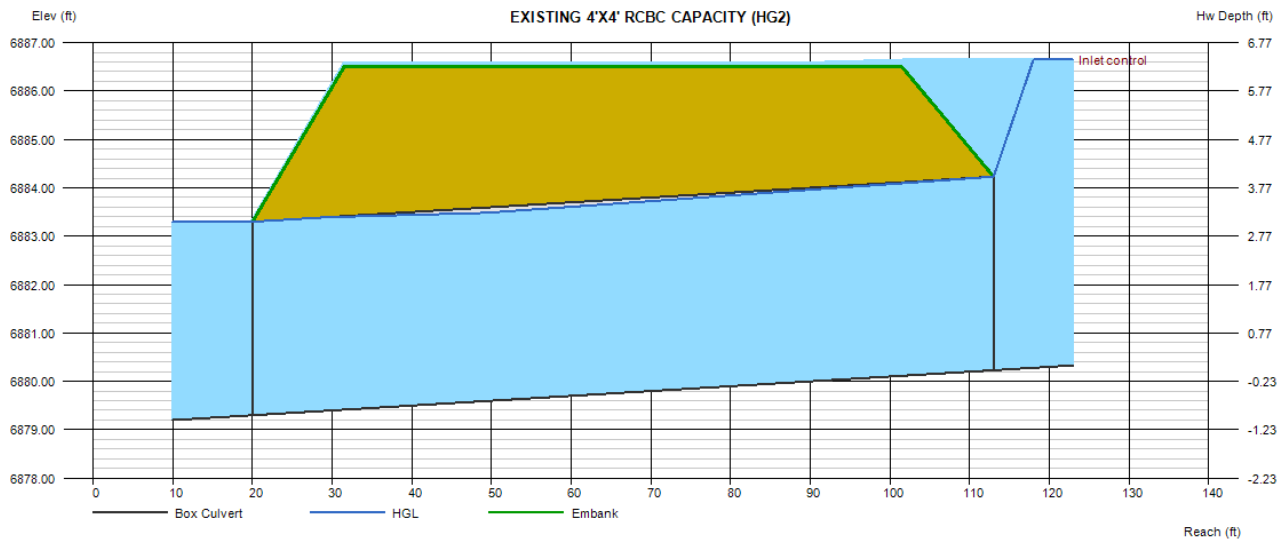
APPROXIMATE FLOW BEFORE HWY 24 IS OVERTOPPED

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	400.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	200.00
Qpipe (cfs)	=	191.29
Qovertop (cfs)	=	8.71
Veloc Dn (ft/s)	=	11.96
Veloc Up (ft/s)	=	11.96
HGL Dn (ft)	=	6883.30
HGL Up (ft)	=	6884.23
Hw Elev (ft)	=	6886.65
Hw/D (ft)	=	1.60
Flow Regime	=	Inlet Control



Culvert Report

EXISTING 4'X4' RCBC Q100 (HG2)

Invert Elev Dn (ft)	=	6879.30
Pipe Length (ft)	=	93.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	6880.23
Rise (in)	=	48.0
Shape	=	Box
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Rectangular Concrete
Culvert Entrance	=	Tapered inlet throat
Coeff. K,M,c,Y,k	=	0.475, 0.667, 0.0179, 0.97, 0.2

Embankment

Top Elevation (ft)	=	6886.50
Top Width (ft)	=	70.00
Crest Width (ft)	=	50.00

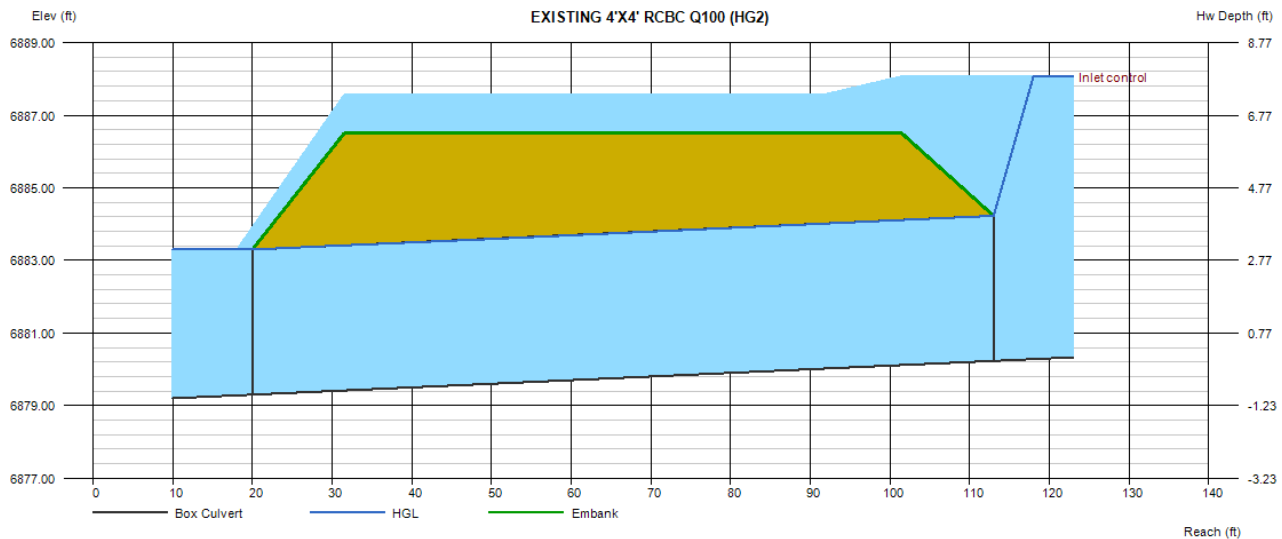
EXISTING 100-YEAR FLOW TO CROSSING (PR Q100: 538.42)

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	541.99
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	541.99
Qpipe (cfs)	=	238.64
Qovertop (cfs)	=	303.35
Veloc Dn (ft/s)	=	14.91
Veloc Up (ft/s)	=	14.91
HGL Dn (ft)	=	6883.30
HGL Up (ft)	=	6884.23
Hw Elev (ft)	=	6888.07
Hw/D (ft)	=	1.96
Flow Regime	=	Inlet Control



4-Way Commercial – Existing Drainageway Analysis

- A uniform manning's n of 0.05 was calculated for all channel sections, see EPC DCM Table 10-1 (earthen channel, minor degree of irregularity, occasionally alternating cross section, negligible effect of obstructions, medium vegetation, minor degree of meandering)

Drainageway Section A-A

Geometry – triangular section, approx. 10H:1V side slopes, min. 4.0' depth

Flow – assume channel flow approximates EX-DP-10 (Q5 = 14.16 cfs, Q100 = 42.65 cfs)

Channel Capacity – approximately 1,064 cfs (from hydraflow express calculations)

Sec A-A Capacity >> Q100 – reach is sufficient

Drainageway Section B-B

Geometry – trapezoidal section, 5.0' bottom width, approx. 9H:1V side slopes, min. 2.5' depth

Flow – assume channel flow approximates 1/2 EX-DP-10 (Q5 = 7.08 cfs, Q100 = 21.33 cfs)

Channel Capacity – approximately 308 cfs (from hydraflow express calculations)

Sec B-B Capacity >> Q100 – reach is sufficient

Drainageway Section C-C

Geometry – triangular section, approx. 13-20H:1V side slopes, min. 3.0' depth

Flow – assume channel flow approximates EX-DP-10 + 1/2 EX-4 (average between EX-DP10 & EX-DP-12) (Q5 = 15.40 cfs, Q100 = 54.30 cfs)

Channel Capacity – approximately 753 cfs (from hydraflow express calculations)

Sec C-C Capacity >> Q100 – reach is sufficient

Drainageway Section D-D

Geometry – triangular section, approx. 25H:1V side slopes, min. 3.0' depth

Flow – assume channel flow approximates EX-DP-12 (Q5 = 16.64 cfs, Q100 = 65.95 cfs)

Channel Capacity – approximately 1,175 cfs (from hydraflow express calculations)

Sec D-D Capacity >> Q100 – reach is sufficient

Channel Report

EX DRAINAGEWAY SEC A-A @ Q100

Triangular

Side Slopes (z:1) = 10.00, 10.00
Total Depth (ft) = 4.00

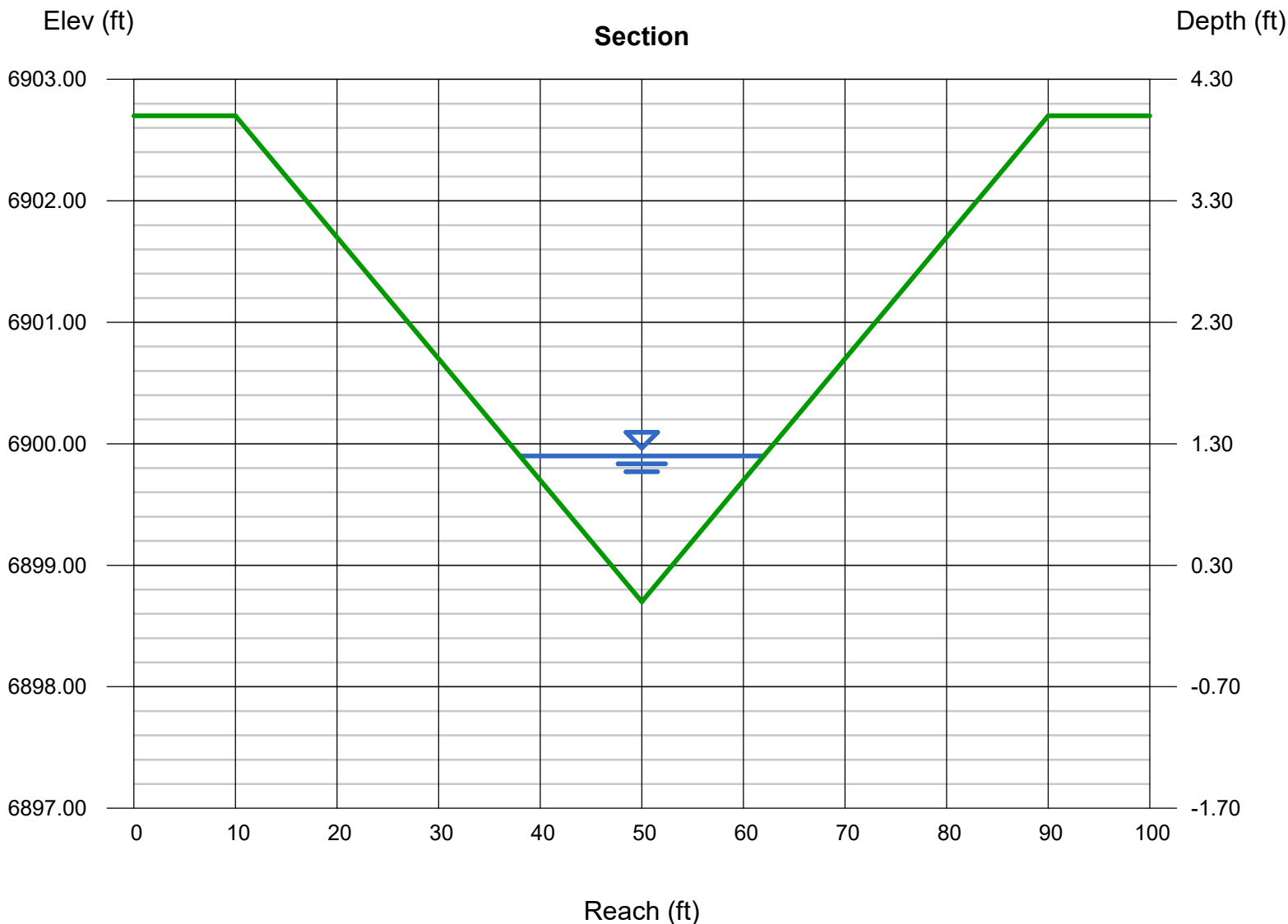
Invert Elev (ft) = 6898.70
Slope (%) = 2.00
N-Value = 0.050

Calculations

Compute by: Known Q
Known Q (cfs) = 42.65

Highlighted

Depth (ft) = 1.20
Q (cfs) = 42.65
Area (sqft) = 14.40
Velocity (ft/s) = 2.96
Wetted Perim (ft) = 24.12
Crit Depth, Yc (ft) = 1.03
Top Width (ft) = 24.00
EGL (ft) = 1.34



Channel Report

EX DRAINAGEWAY SEC A-A @ CAPACITY

Triangular

Side Slopes (z:1) = 10.00, 10.00
Total Depth (ft) = 4.00

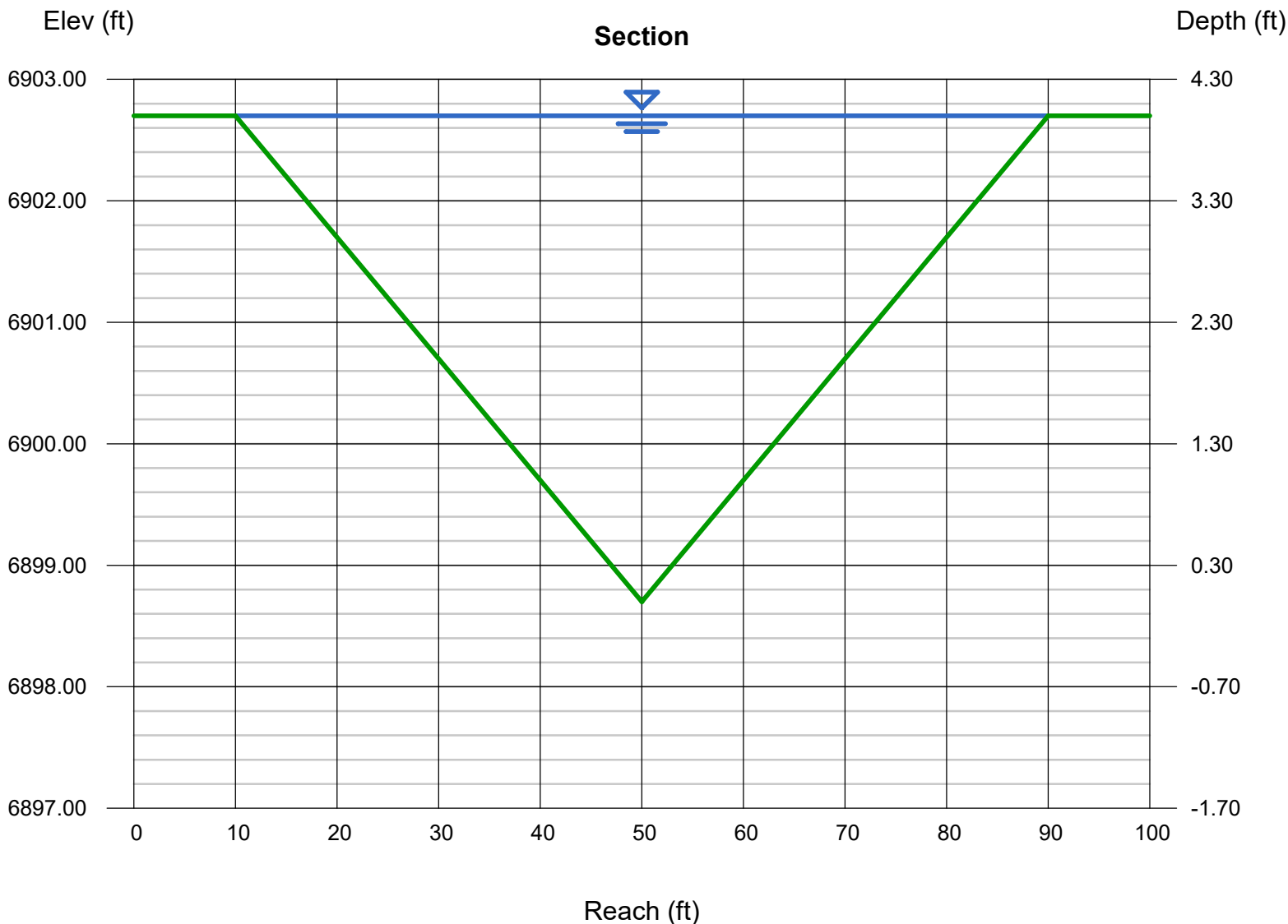
Invert Elev (ft) = 6898.70
Slope (%) = 2.00
N-Value = 0.050

Calculations

Compute by: Known Depth
Known Depth (ft) = 4.00

Highlighted

Depth (ft) = 4.00
Q (cfs) = 1,064
Area (sqft) = 160.00
Velocity (ft/s) = 6.65
Wetted Perim (ft) = 80.40
Crit Depth, Yc (ft) = 3.72
Top Width (ft) = 80.00
EGL (ft) = 4.69



Channel Report

EX DRAINAGEWAY SEC B-B @ Q100

Trapezoidal

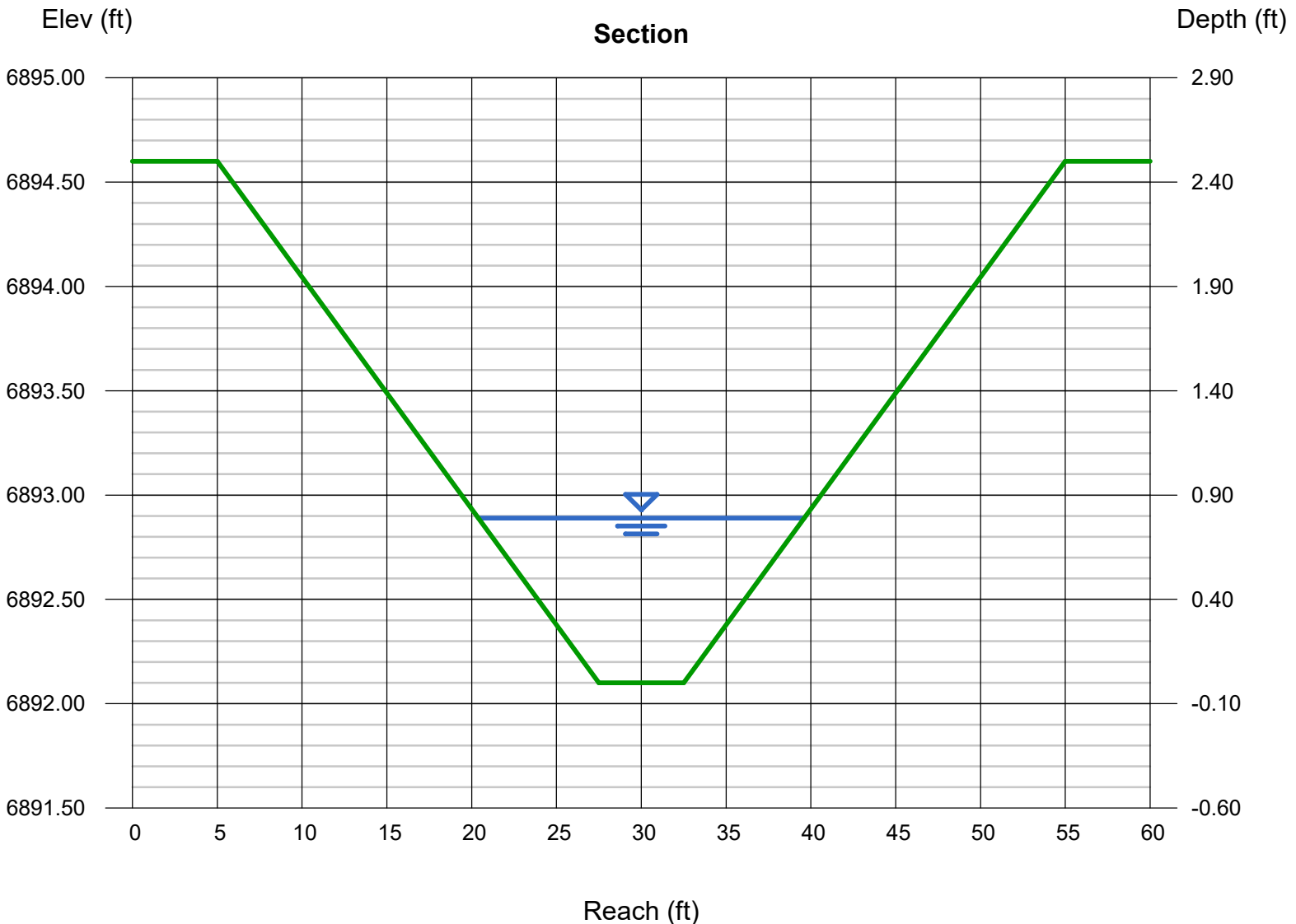
Bottom Width (ft) = 5.00
Side Slopes (z:1) = 9.00, 9.00
Total Depth (ft) = 2.50
Invert Elev (ft) = 6892.10
Slope (%) = 1.50
N-Value = 0.050

Highlighted

Depth (ft) = 0.79
Q (cfs) = 21.33
Area (sqft) = 9.57
Velocity (ft/s) = 2.23
Wetted Perim (ft) = 19.31
Crit Depth, Y_c (ft) = 0.59
Top Width (ft) = 19.22
EGL (ft) = 0.87

Calculations

Compute by: Known Q
Known Q (cfs) = 21.33



Channel Report

EX DRAINAGEWAY SEC B-B @ CAPACITY

Trapezoidal

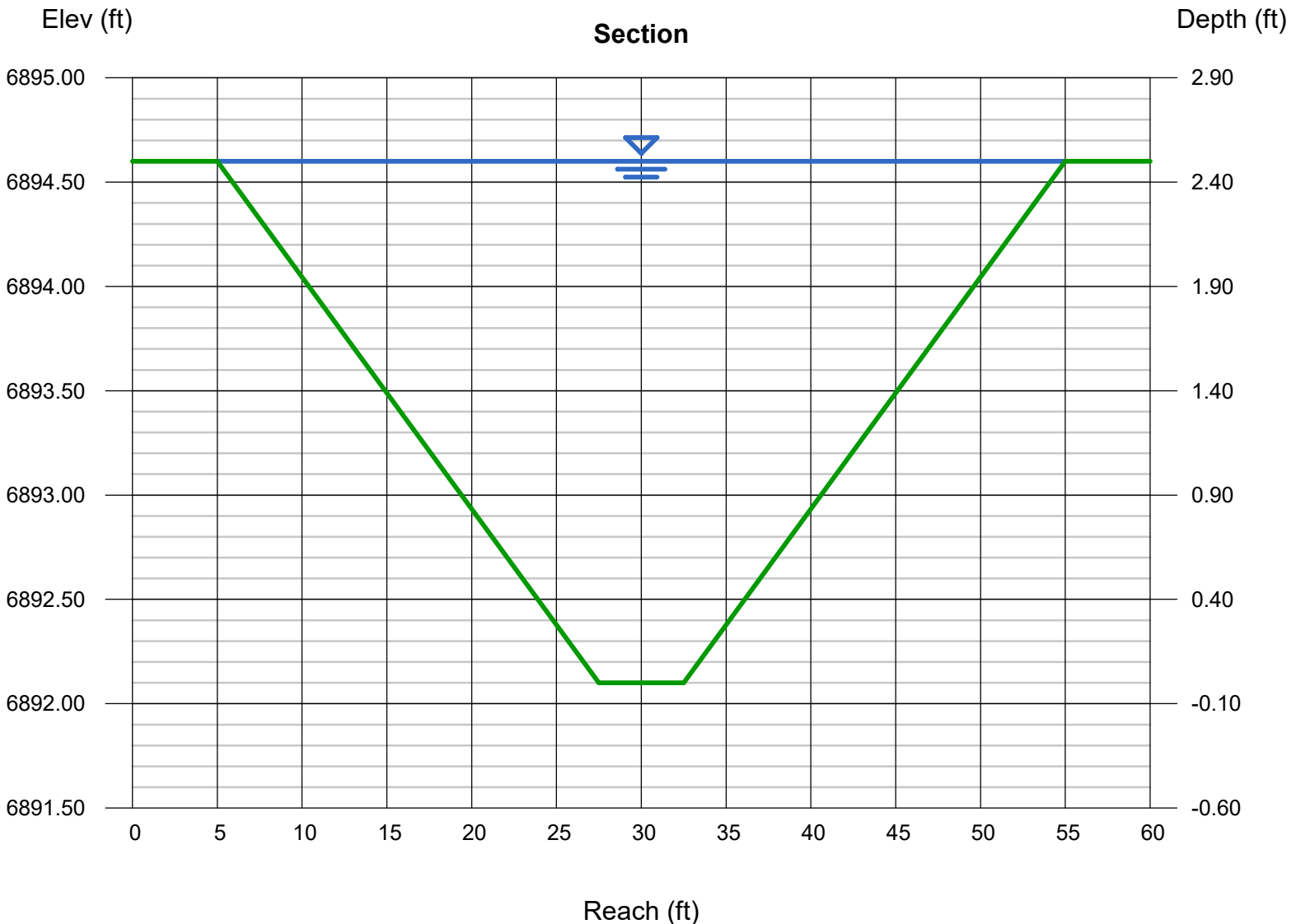
Bottom Width (ft) = 5.00
Side Slopes (z:1) = 9.00, 9.00
Total Depth (ft) = 2.50
Invert Elev (ft) = 6892.10
Slope (%) = 1.50
N-Value = 0.050

Highlighted

Depth (ft) = 2.50
Q (cfs) = 308.33
Area (sqft) = 68.75
Velocity (ft/s) = 4.48
Wetted Perim (ft) = 50.28
Crit Depth, Yc (ft) = 2.11
Top Width (ft) = 50.00
EGL (ft) = 2.81

Calculations

Compute by: Known Depth
Known Depth (ft) = 2.50



Channel Report

EX DRAINAGEWAY SEC C-C @ Q100

Triangular

Side Slopes (z:1) = 13.00, 20.00
Total Depth (ft) = 3.00

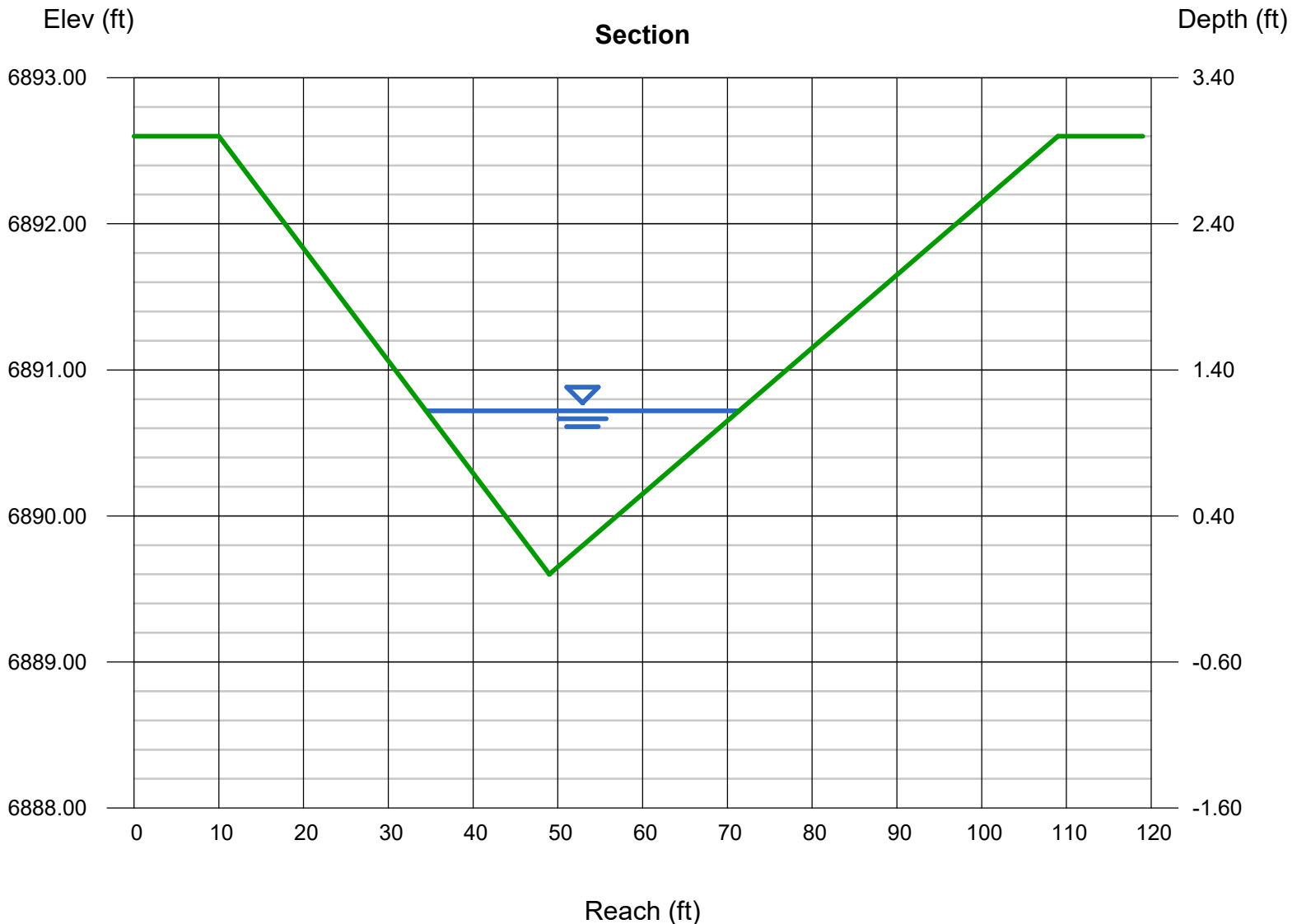
Invert Elev (ft) = 6889.60
Slope (%) = 1.70
N-Value = 0.050

Calculations

Compute by: Known Q
Known Q (cfs) = 54.30

Highlighted

Depth (ft) = 1.12
Q (cfs) = 54.30
Area (sqft) = 20.70
Velocity (ft/s) = 2.62
Wetted Perim (ft) = 37.03
Crit Depth, Yc (ft) = 0.93
Top Width (ft) = 36.96
EGL (ft) = 1.23



Channel Report

EX DRAINAGEWAY SEC C-C @ CAPACITY

Triangular

Side Slopes (z:1) = 13.00, 20.00
Total Depth (ft) = 3.00

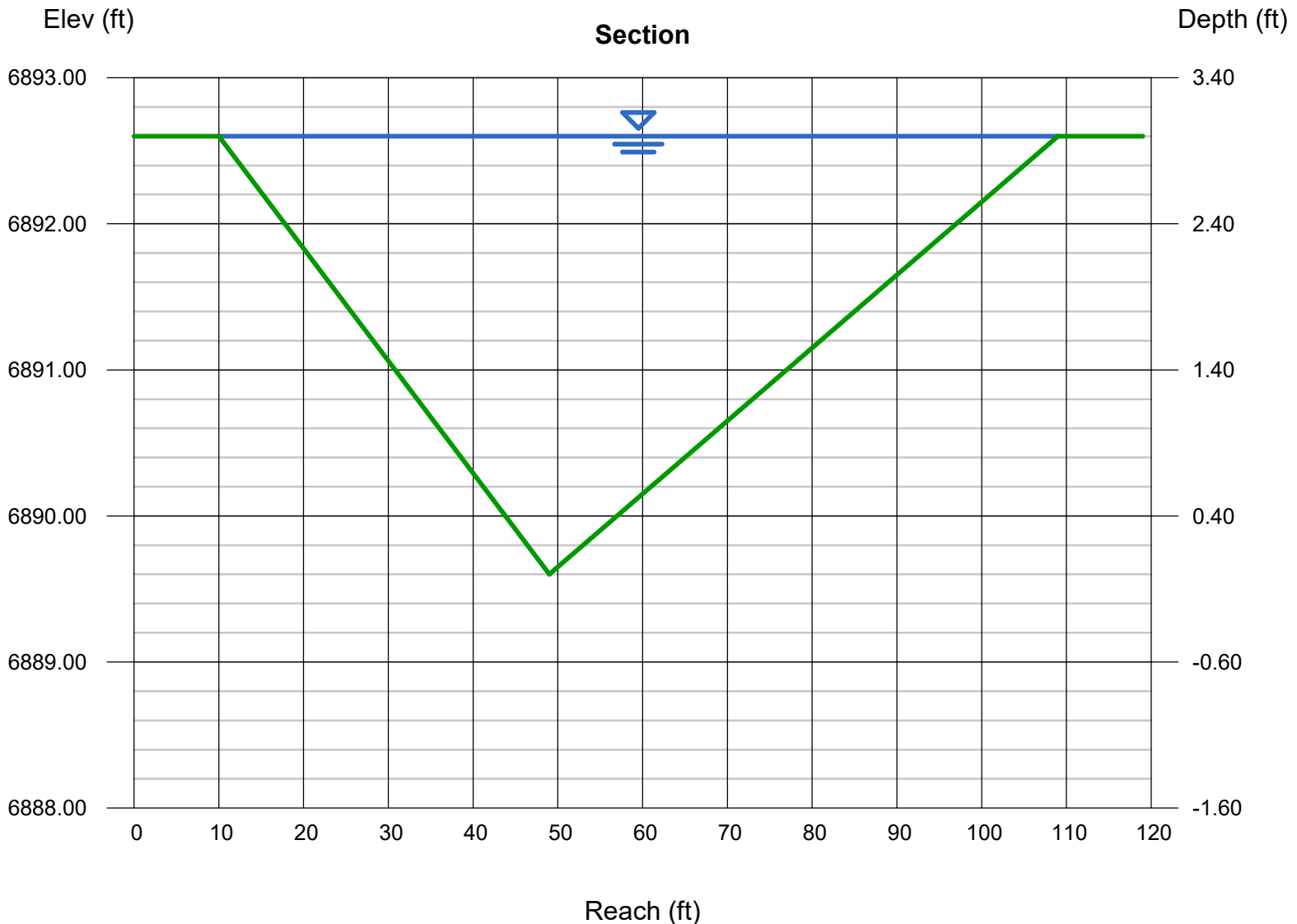
Invert Elev (ft) = 6889.60
Slope (%) = 1.70
N-Value = 0.050

Calculations

Compute by: Known Depth
Known Depth (ft) = 3.00

Highlighted

Depth (ft) = 3.00
Q (cfs) = 753.18
Area (sqft) = 148.50
Velocity (ft/s) = 5.07
Wetted Perim (ft) = 99.19
Crit Depth, Yc (ft) = 2.65
Top Width (ft) = 99.00
EGL (ft) = 3.40



Channel Report

EX DRAINAGEWAY SEC D-D @ Q100

Triangular

Side Slopes (z:1) = 25.00, 25.00
Total Depth (ft) = 3.00

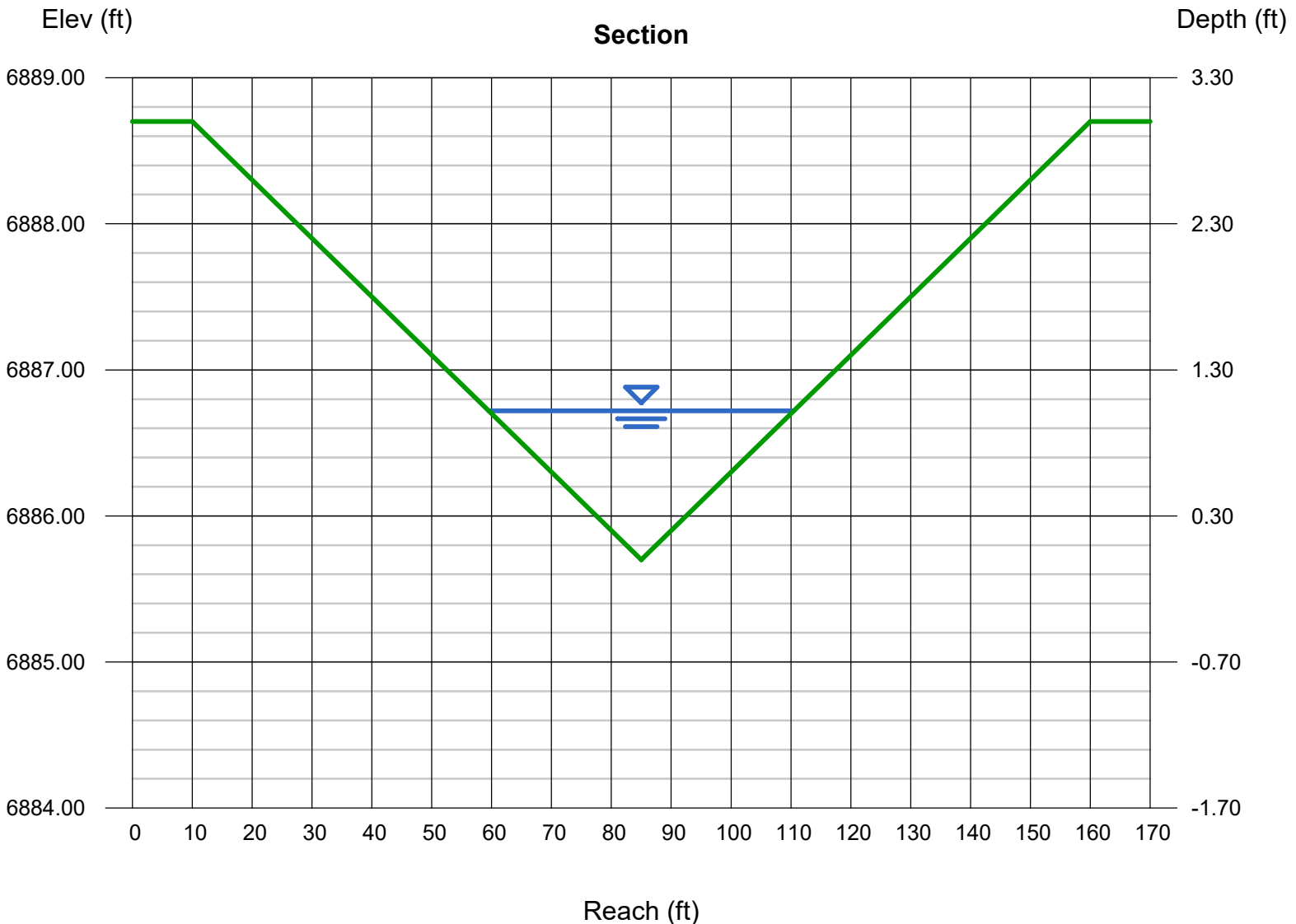
Invert Elev (ft) = 6885.70
Slope (%) = 1.80
N-Value = 0.050

Calculations

Compute by: Known Q
Known Q (cfs) = 65.95

Highlighted

Depth (ft) = 1.02
Q (cfs) = 65.95
Area (sqft) = 26.01
Velocity (ft/s) = 2.54
Wetted Perim (ft) = 51.04
Crit Depth, Yc (ft) = 0.85
Top Width (ft) = 51.00
EGL (ft) = 1.12



Channel Report

EX DRAINAGEWAY SEC D-D @ CAPACITY

Triangular

Side Slopes (z:1) = 25.00, 25.00
Total Depth (ft) = 3.00

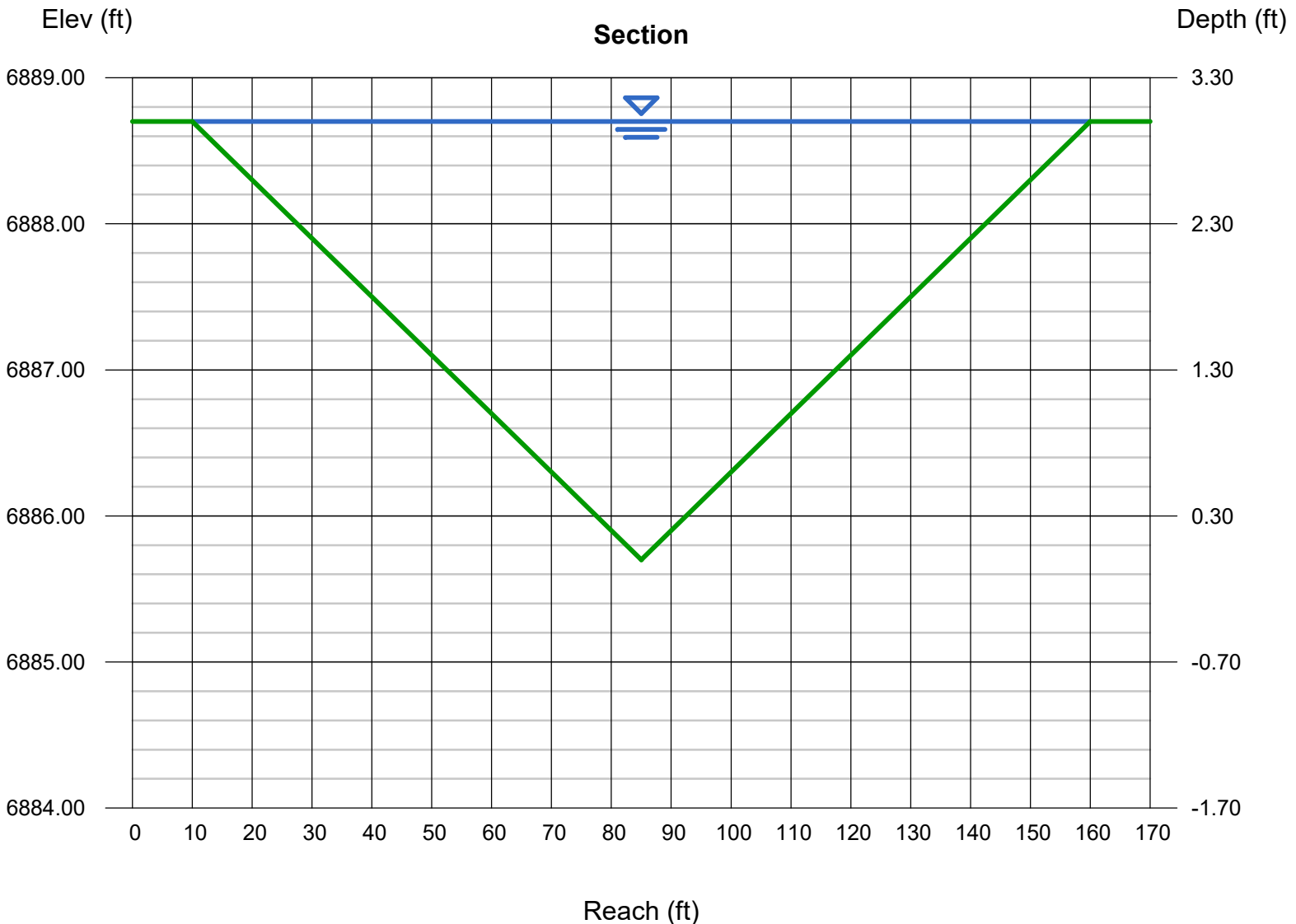
Invert Elev (ft) = 6885.70
Slope (%) = 1.80
N-Value = 0.050

Calculations

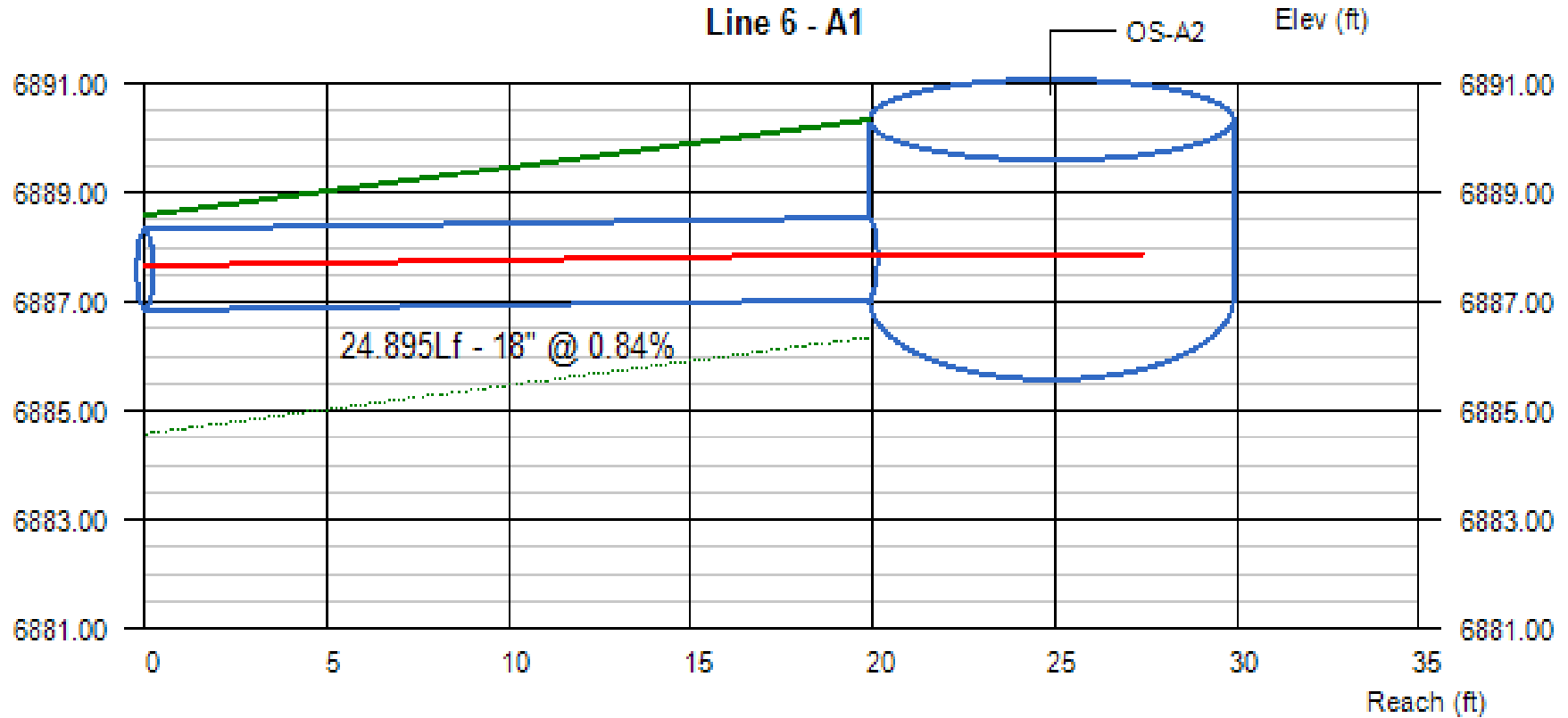
Compute by: Known Depth
Known Depth (ft) = 3.00

Highlighted

Depth (ft) = 3.00
Q (cfs) = 1,175
Area (sqft) = 225.00
Velocity (ft/s) = 5.22
Wetted Perim (ft) = 150.12
Crit Depth, Yc (ft) = 2.68
Top Width (ft) = 150.00
EGL (ft) = 3.42



EXTENDED DETENTION BASIN A
OUTFALL

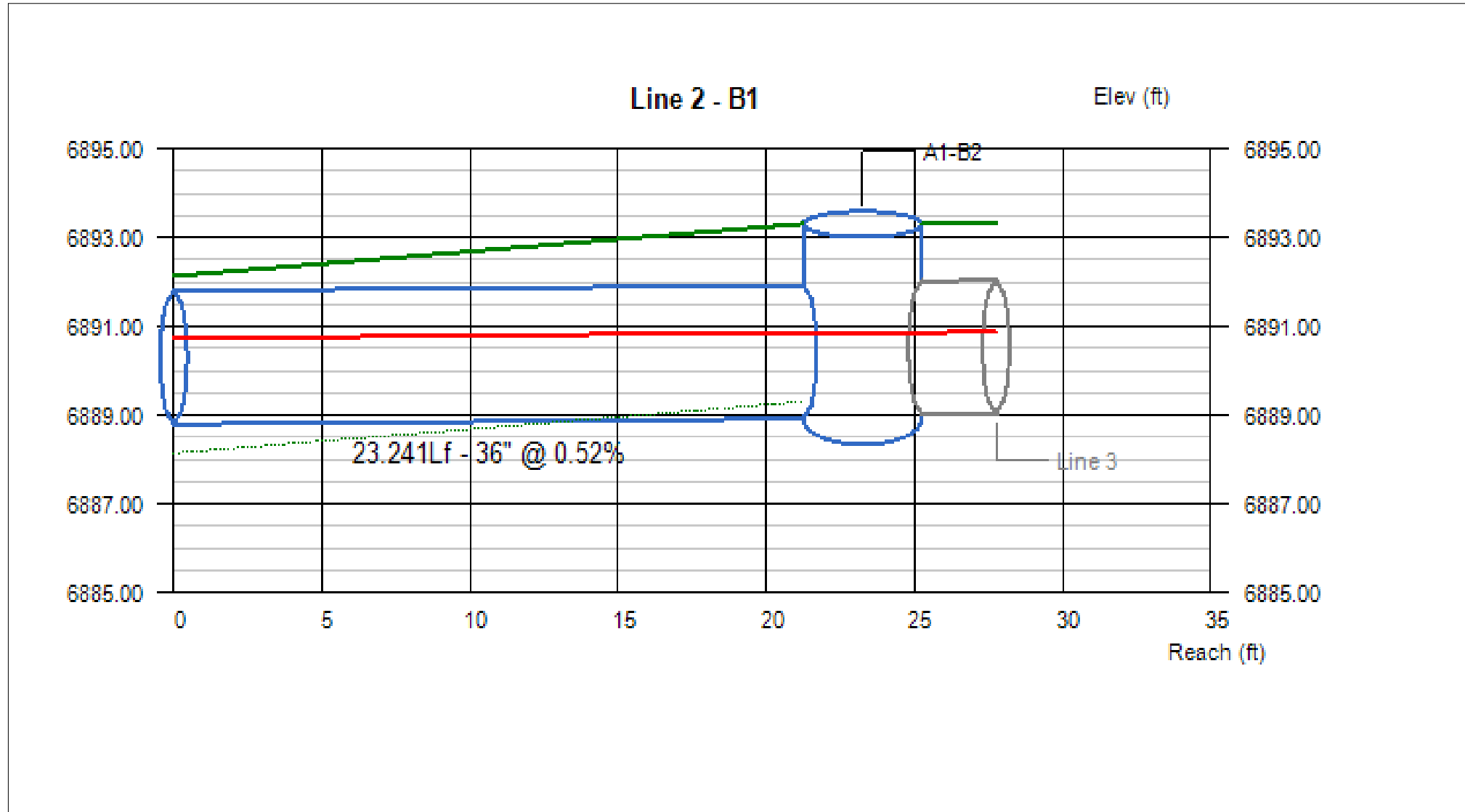


Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
6	4.70	6886.83	6887.04	0.83	0.83	0.83	6887.66	6887.87	6887.87	4.68	4.67	0.25	1.80

Project File:

No. Lines: 6

Run Date: 3/24/2026

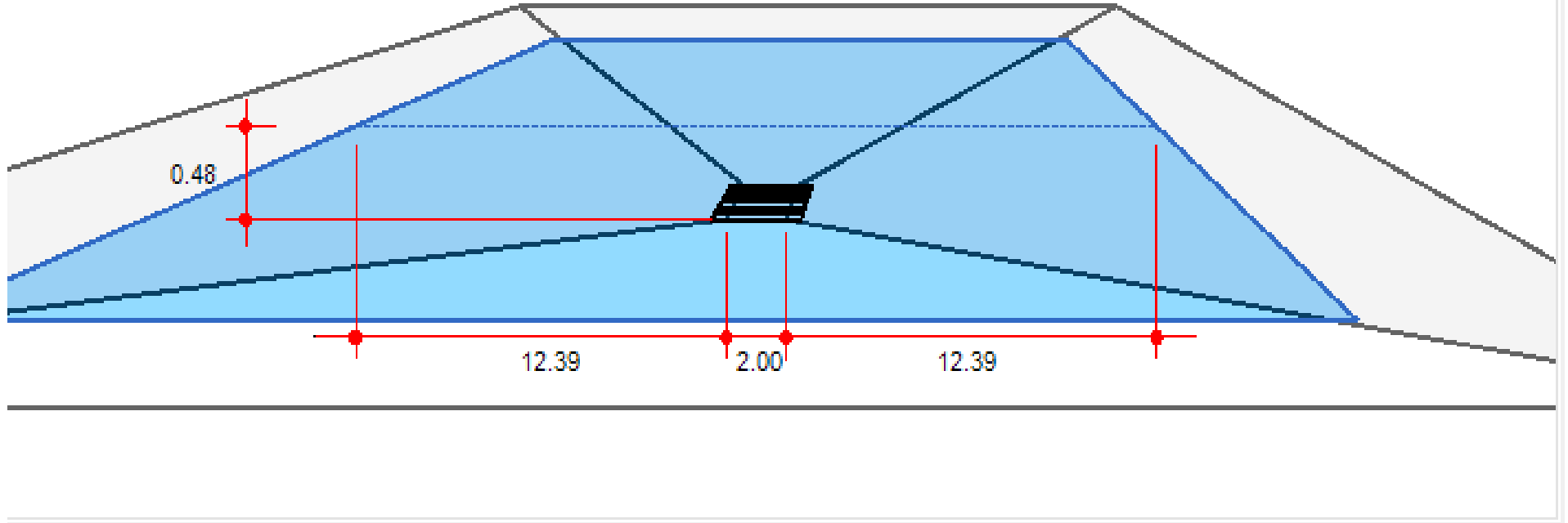


Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
2	35.43	6888.80	6888.92	1.92	1.93	1.93	6890.72	6890.85	6890.85	7.41	7.36	0.33	1.38

Project File:	No. Lines: 6	Run Date: 3/24/2026
---------------	--------------	---------------------

All dimensions in feet

Line 2 - Drop Grate Inlet in Sag - A1-B2

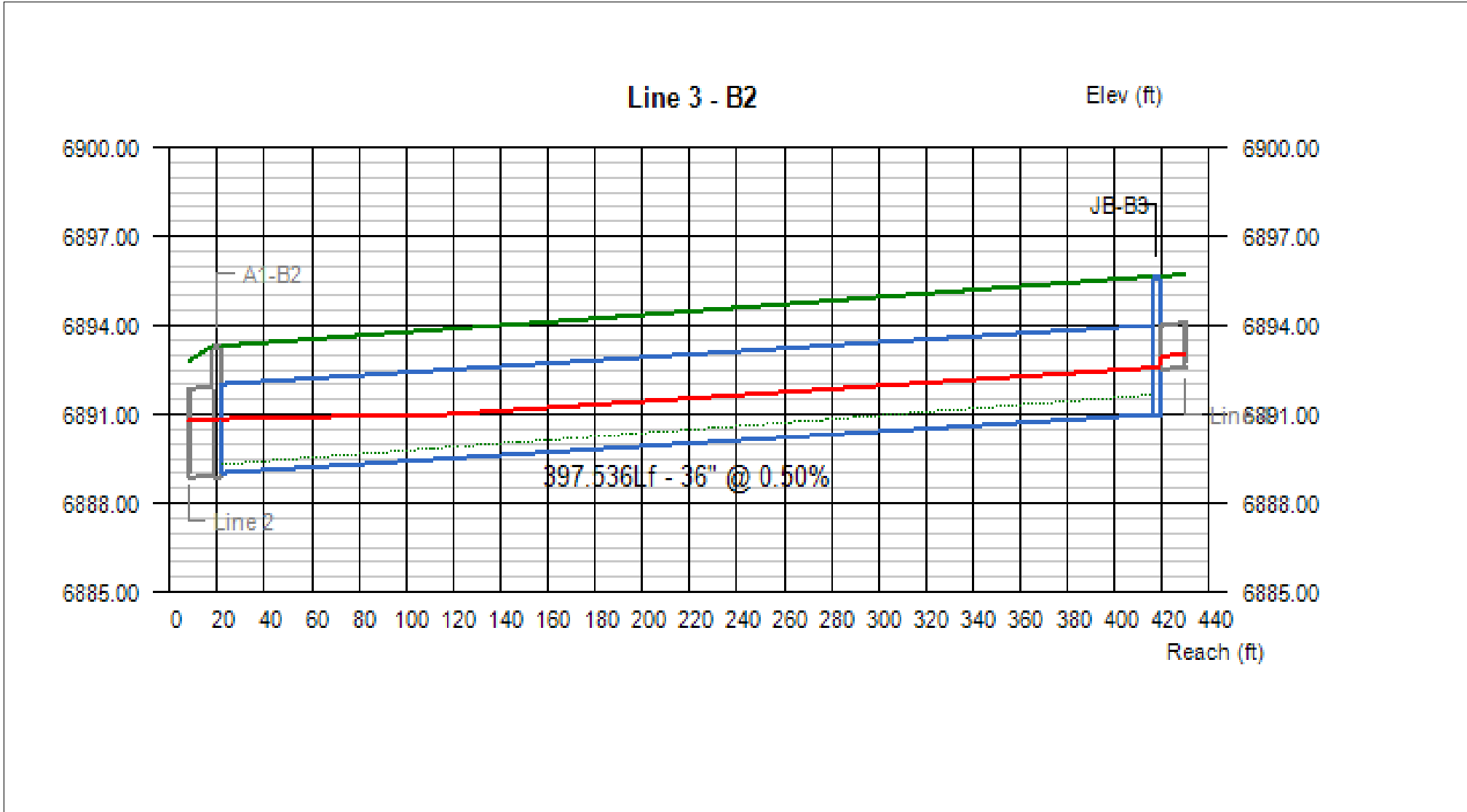


Line #	Q				Inlet			Gutter				Depth		Spread		By
	Catch (cfs)	Carry (cfs)	Capt (cfs)	Byp (cfs)	Length (ft)	Depr (in)	Area (sqft)	Width (ft)	Slope (ft/ft)	Sw (ft/ft)	Sx (ft/ft)	Gutter (ft)	Inlet (ft)	Gutter (ft)	Inlet (ft)	Line (ft)
2	11.82	0.00	11.82	0.00	3.00	4.87	2.00	Sag	0.040	0.040	0.48	26.79	n/a	n/a	Sag

Project File:

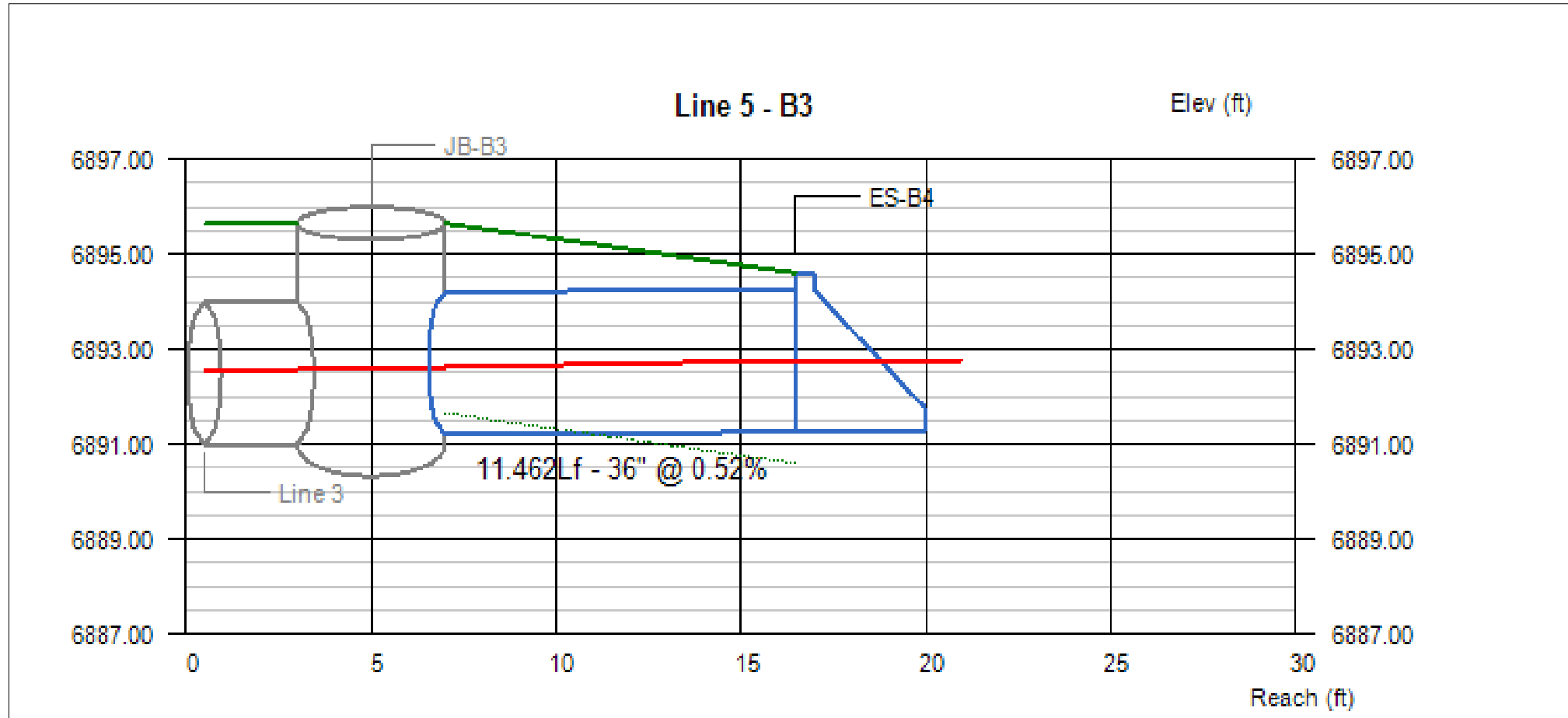
No. Lines: 6

Run Date: 3/24/2026



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
3	23.61	6889.02	6891.00	1.83	1.56	1.56	6890.85	6892.56 j	6892.56	5.22	6.34	1.28	1.65

Project File: _____ No. Lines: 6 Run Date: 3/24/2026



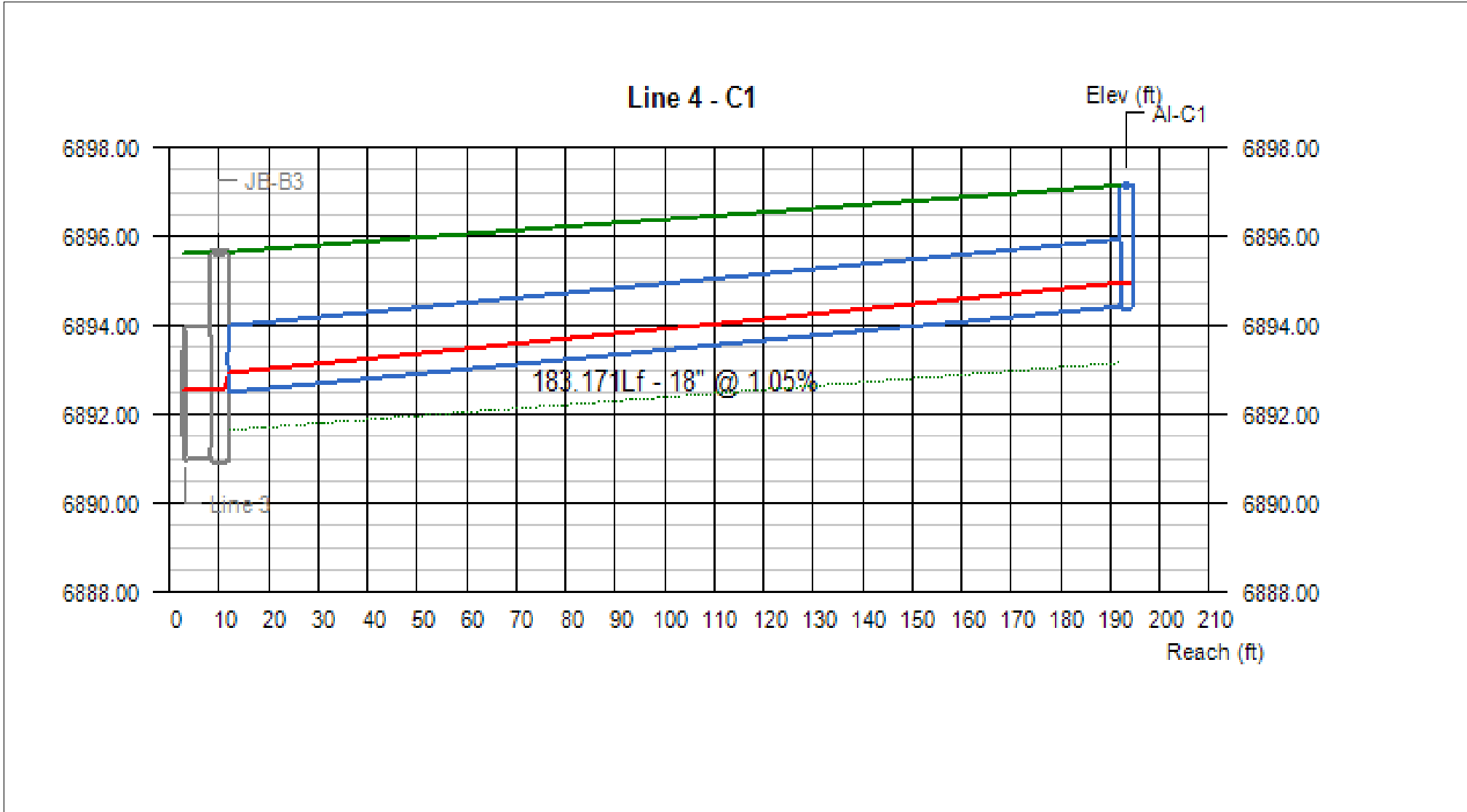
20.95 (P-6) + 0.70 (P-14)

Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
5	21.65	6891.20	6891.26	1.41	1.49	1.49	6892.61	6892.75	6892.75	6.62	6.16	1.45	0.34

Project File:

No. Lines: 6

Run Date: 3/24/2026

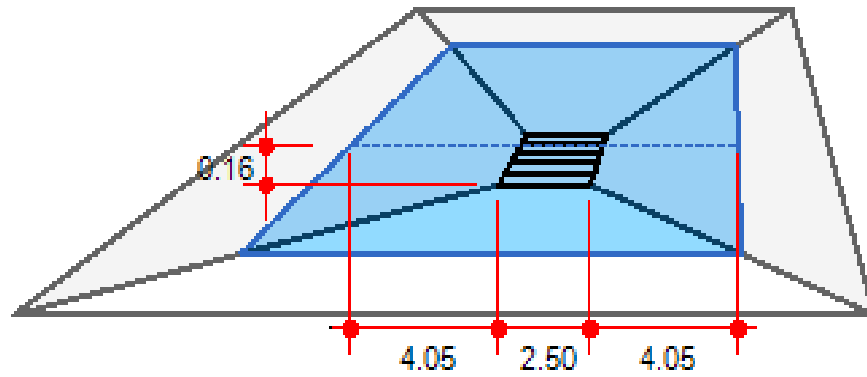


Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
4	1.96	6892.50	6894.43	0.43	0.53	0.53	6892.93	6894.96	6894.96	4.63	3.53	1.65	1.22

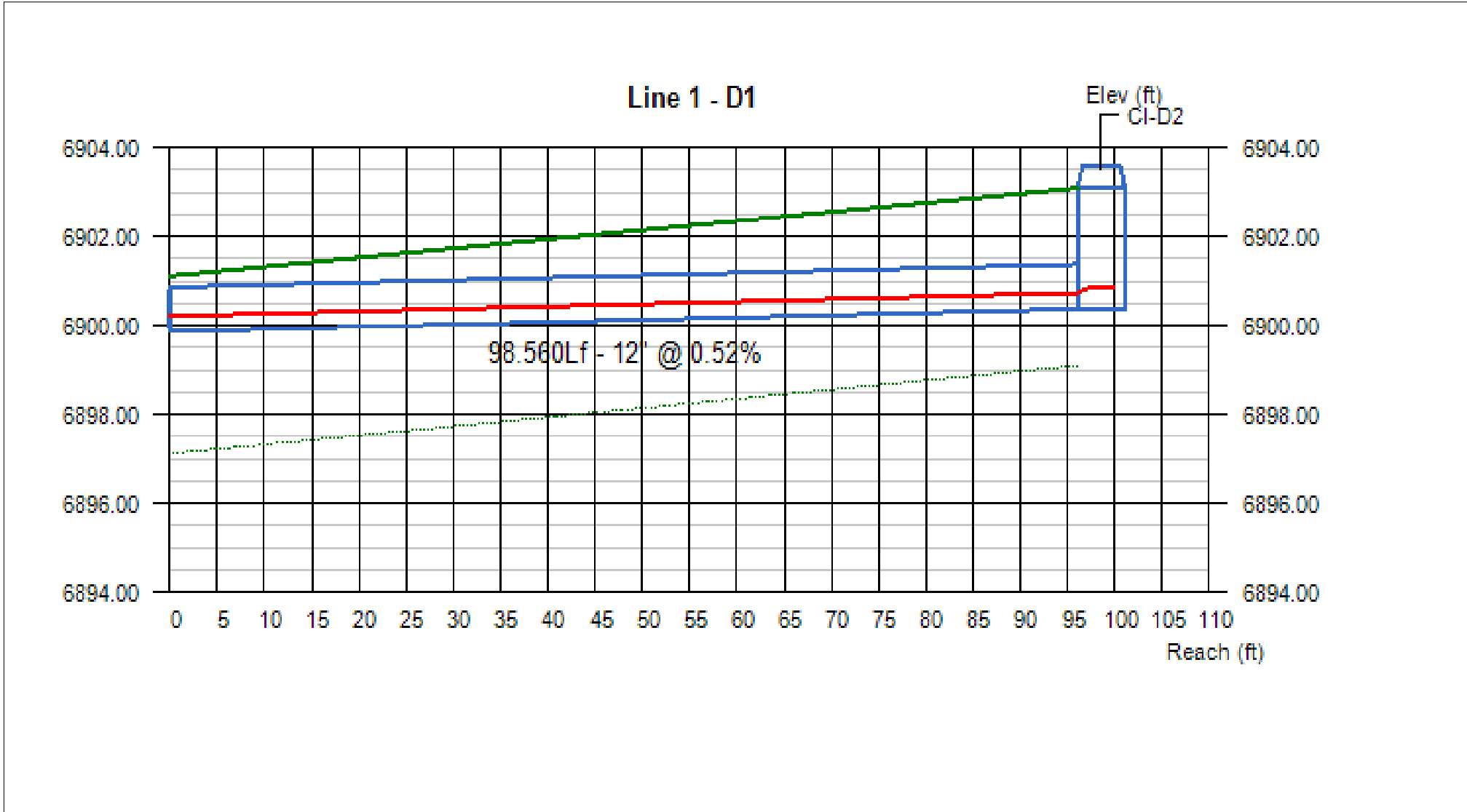
Project File: _____ No. Lines: 6 Run Date: 3/24/2026

All dimensions in feet

Line 4 - Drop Grate Inlet in Sag - AI-C1



Line #	Q				Inlet			Gutter				Depth		Spread		By
	Catch (cfs)	Carry (cfs)	Capt (cfs)	Byp (cfs)	Length (ft)	Depr (in)	Area (sqft)	Width (ft)	Slope (ft/ft)	Sw (ft/ft)	Sx (ft/ft)	Gutter (ft)	Inlet (ft)	Gutter (ft)	Inlet (ft)	Line (ft)
4	1.96	0.00	1.96	0.00	2.50	1.35	2.50	Sag	0.040	0.040	0.16	10.60	n/a	n/a	Sag
Project File:										No. Lines: 6			Run Date: 3/24/2026			

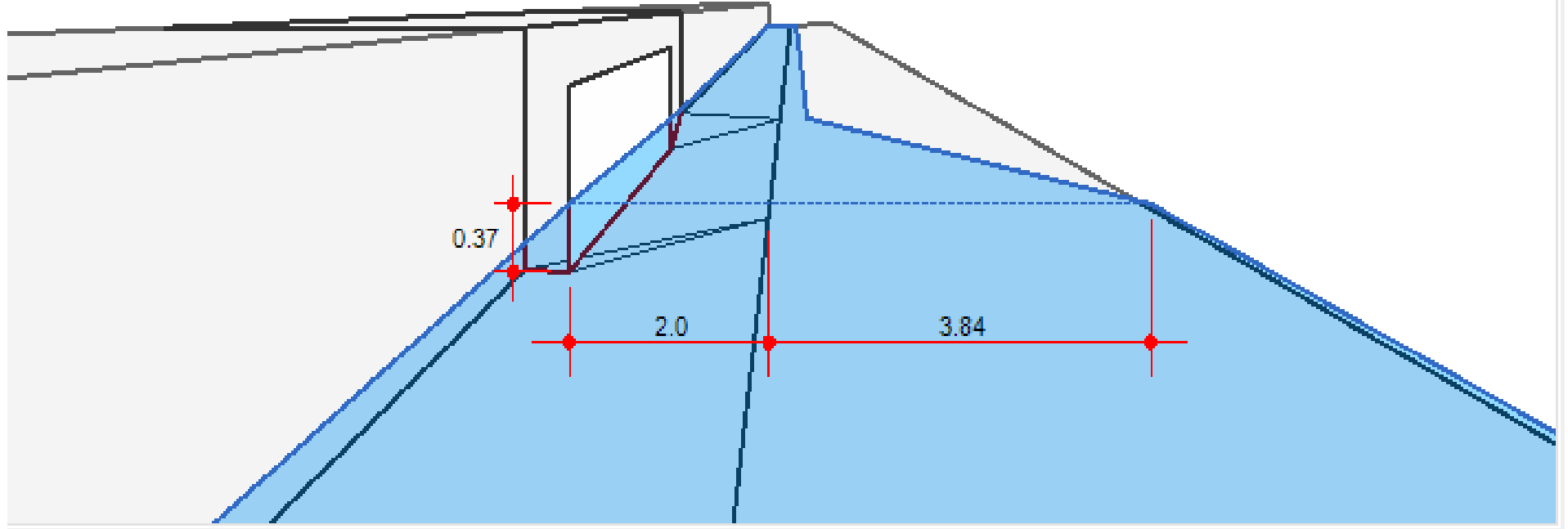


Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
1	0.70	6899.86	6900.37	0.35	0.37	0.48	6900.21	6900.74	6900.85	2.86	2.70	0.25	1.72

Project File:	No. Lines: 6	Run Date: 3/24/2026
---------------	--------------	---------------------

All dimensions in feet

Line 1 - Curb Inlet on Grade - CI-D2



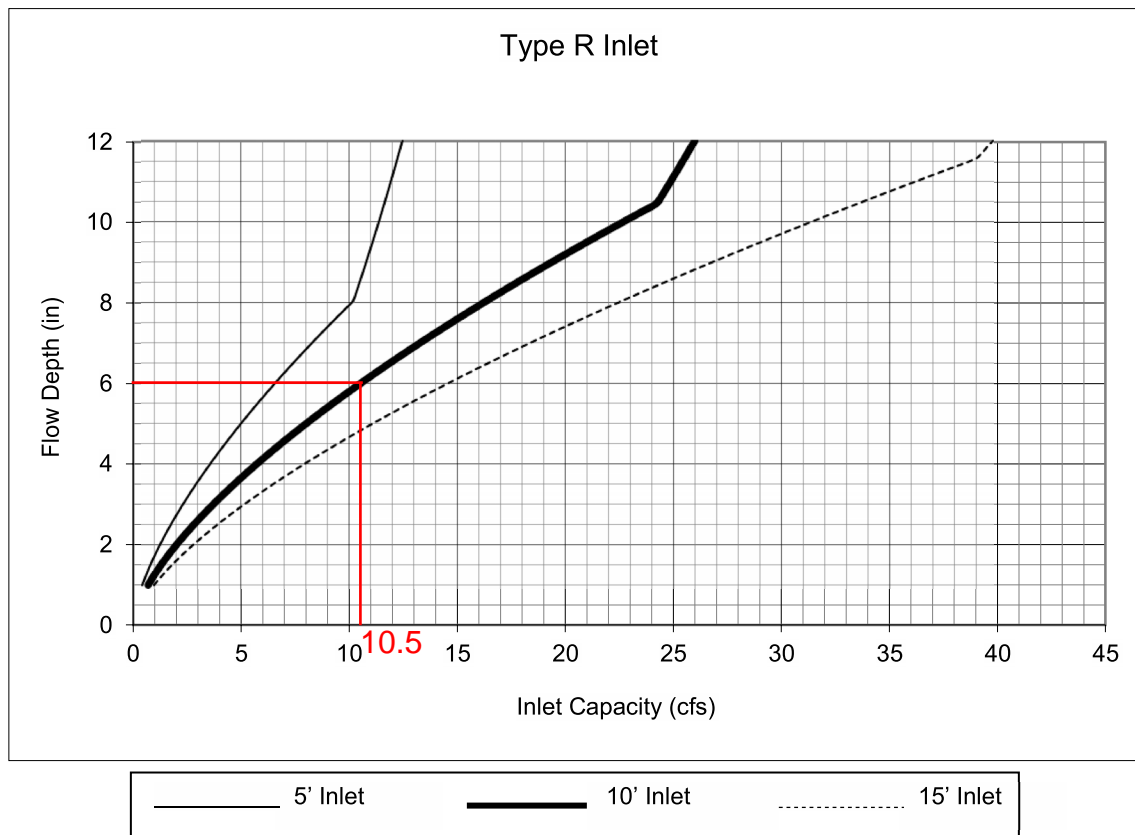
Line #	Q				Inlet			Gutter				Depth		Spread		By
	Catch (cfs)	Carry (cfs)	Capt (cfs)	Byp (cfs)	Length (ft)	Depr (in)	Throat (in)	Width (ft)	Slope (ft/ft)	Sw (ft/ft)	Sx (ft/ft)	Gutter (ft)	Inlet (ft)	Gutter (ft)	Inlet (ft)	Line (ft)
1	0.70	0.00	0.63	0.07	5.00	3.0	6.0	2.00	0.010	0.020	0.020	0.12	5.84	0.05	2.40	Offsite

Project File:

No. Lines: 6

Run Date: 3/24/2026

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



-EXISTING CURB INLET AT DP-6 IS A 10' CDOT TYPE R INLET IN SUMP CONDITION

-6" ALLOWABLE FLOW DEPTH (BEFORE OVERTOPPING CURB)

FROM CHART, APPROXIMATE INLET CAPACITY = 10.5 CFS

EXISTING SURFACE RUNOFF (FROM EX-11) = 9.93 CFS < 10.5 CFS

PROPOSED SURFACE RUNOFF (FROM P-11) = 9.89 CFS < 10.5 CFS

Notes:

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

DETENTION / CONTROL MEASURE CALCULATIONS

EXTENDED DETENTION BASIN A (EDB A)

Extended Detention Basin A

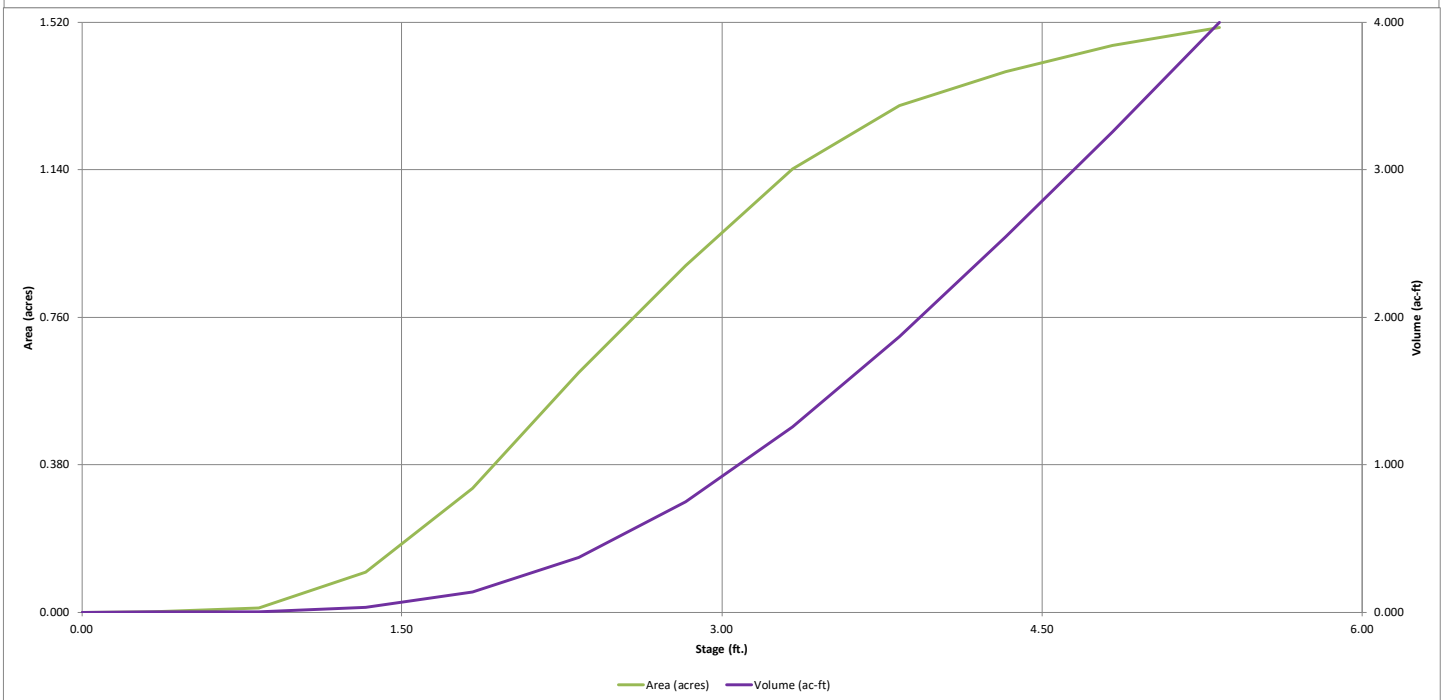
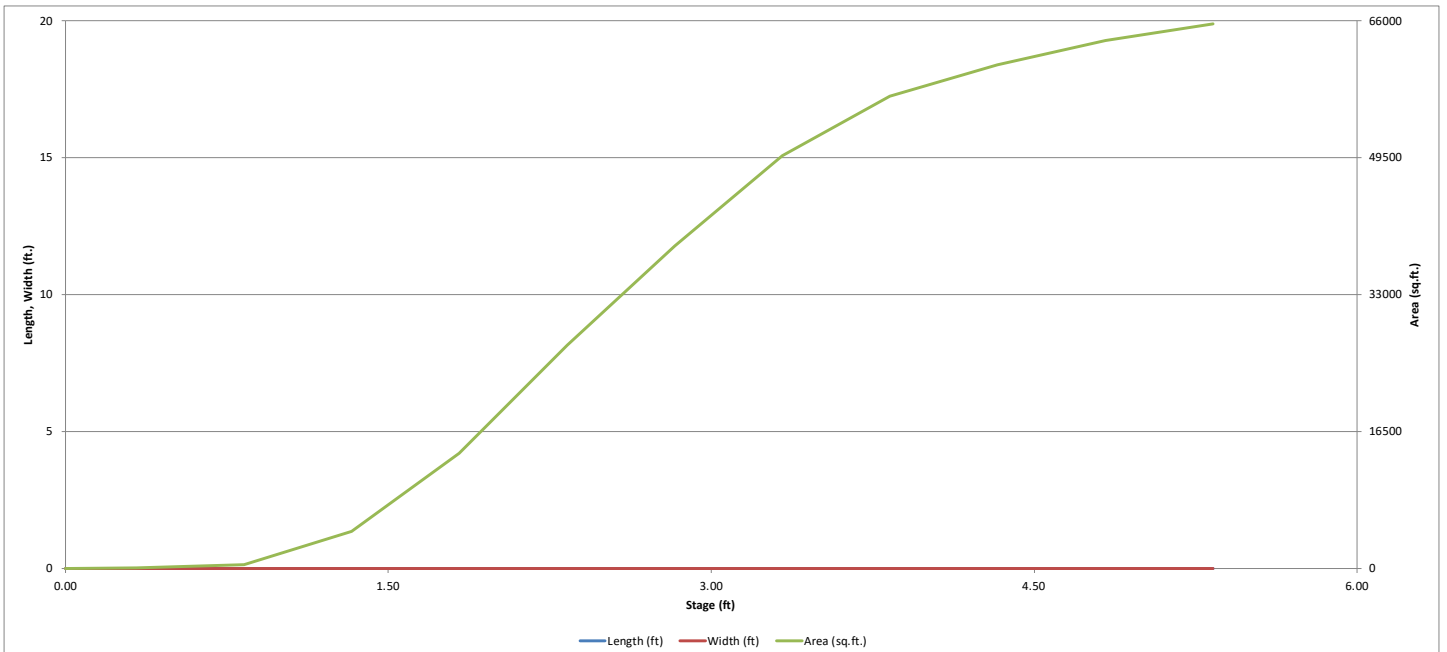
Tributary Basins: P-5, P-6, P-7, P-8, P-9, P-14

Tributary Imperviousness

Design Point	Land Use	Area (ac)	% Imp.	% Imp. X A
DP-11	Pavement	4.20	100%	4.20
	Roof	2.27	90%	2.04
	Commercial	3.71	95%	3.52
	Pasture/Meadow	2.37	0%	0.00
$A_{total} =$		12.55	$\Sigma\% \text{ Imp. X A} =$	9.76
Tributary Imperviousness = $(\Sigma\% \text{ Imp. X A})/A_{total} =$				77.8%

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

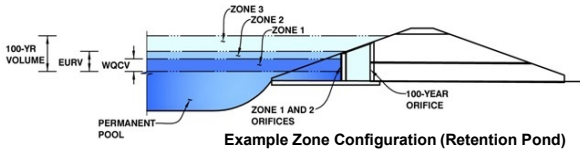


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: 4-WAY COMMERCIAL - EL PASO COUNTY, CO

Basin ID: EXTENDED DETENTION BASIN A



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.27	0.330	Orifice Plate
Zone 2 (EURV)	3.26	0.848	Rectangular Orifice
Zone 3 (100-year)	3.73	0.557	Weir&Pipe (Restrict)
Total (all zones)		1.734	

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

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

Calculated Parameters for Underdrain
 Underdrain Orifice Area = ft²
 Underdrain Orifice Centroid = feet

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

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = 2.27 ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = 9.00 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 ft²
 Elliptical Half-Width = N/A feet
 Elliptical Slot Centroid = N/A feet
 Elliptical Slot Area = N/A ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.80	1.60					
Orifice Area (sq. inches)	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)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.27	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.26	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	1.00	N/A	inches
Vertical Orifice Width =	10.00		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.07	N/A	ft ²
Vertical Orifice Centroid =	0.04	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.28	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	10.00	N/A	feet
Overflow Weir Gate Slope =	3.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Gate Type =	Close Mesh Gate	N/A	
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Gate Upper Edge, H _t =	4.95	N/A	feet
Overflow Weir Slope Length =	5.27	N/A	feet
Gate Open Area / 100-yr Orifice Area =	80.85	N/A	
Overflow Gate Open Area w/o Debris =	41.69	N/A	ft ²
Overflow Gate Open Area w/ Debris =	41.69	N/A	ft ²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.13	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	6.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

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

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	3.75	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	40.00	feet
Spillway End Slopes =	3.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =	0.56	feet
Stage at Top of Freeboard =	5.31	feet
Basin Area at Top of Freeboard =	1.50	acres
Basin Volume at Top of Freeboard =	3.97	acre-ft

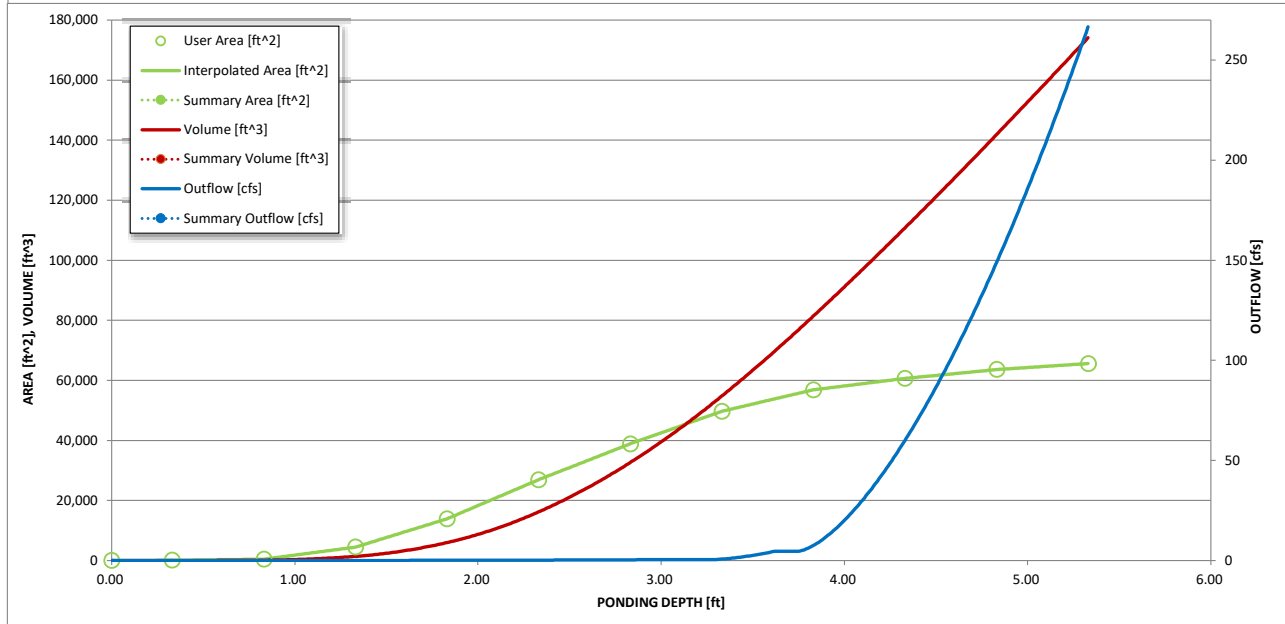
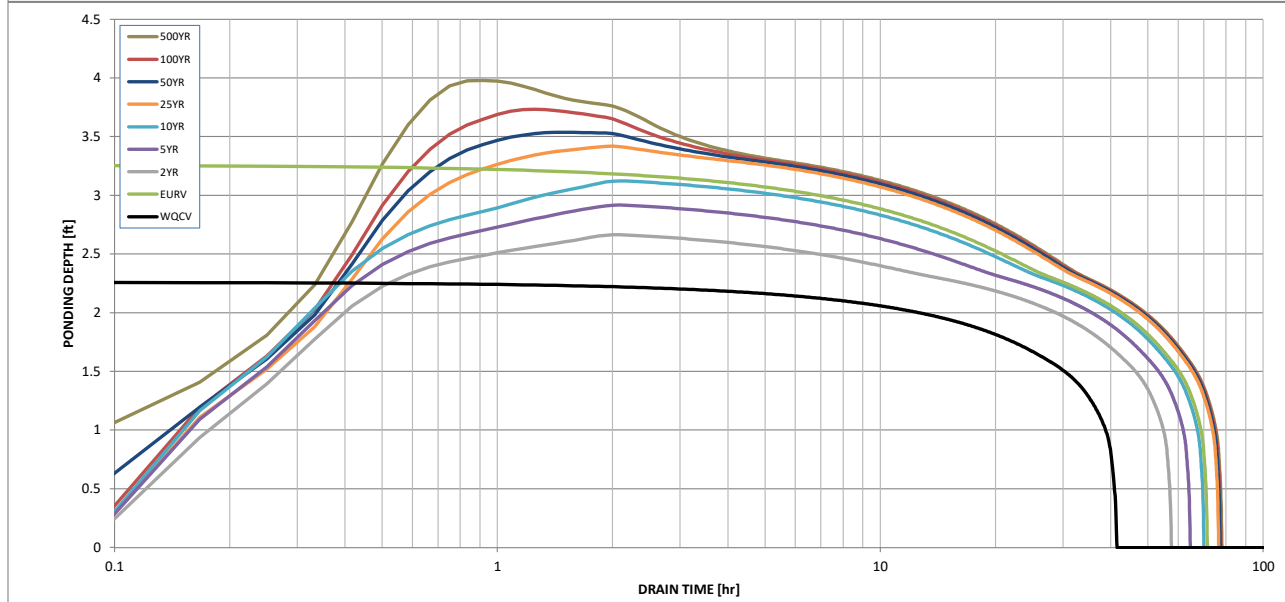
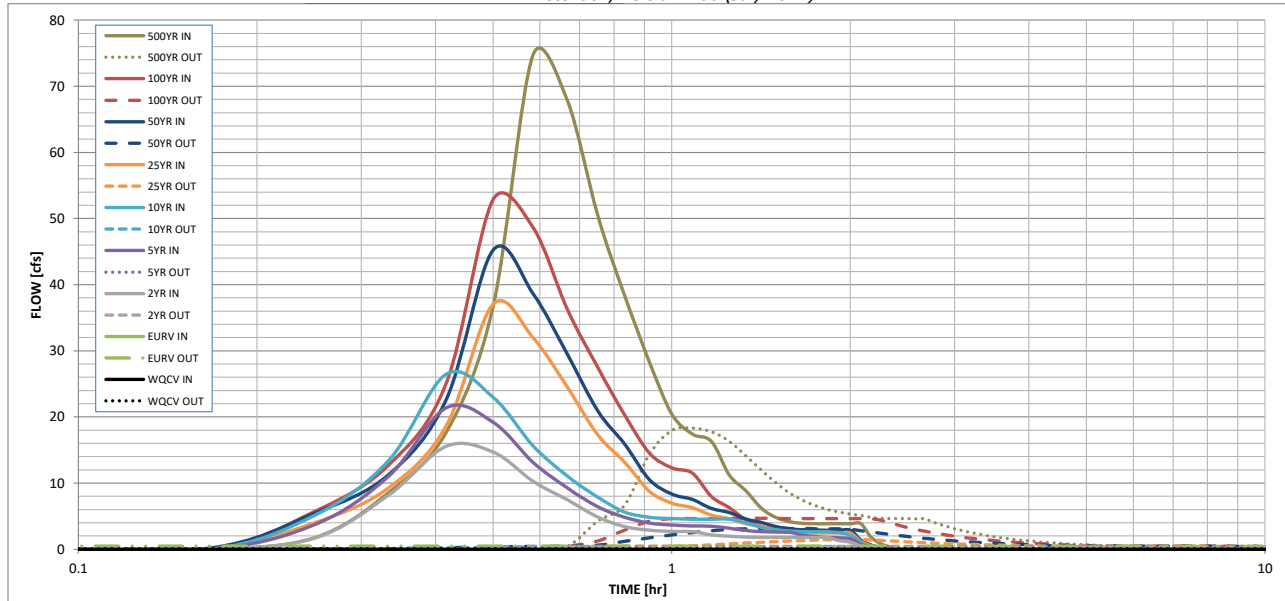
Routed Hydrograph Results

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	0.94	1.22	1.47	1.85	2.17	2.51	3.39
One-Hour Rainfall Depth (in) =	N/A	N/A	0.653	0.885	1.096	1.484	1.793	2.154	3.035
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.653	0.885	1.096	1.484	1.793	2.154	3.035
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.1	0.3	1.0	8.5	13.2	19.1	32.9
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A		2.4				14.4	
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.19	0.08	0.68	1.05	1.15	2.62
Peak Inflow Q (cfs) =	N/A	N/A	15.6	21.4	26.5	37.1	45.3	52.9	74.7
Peak Outflow Q (cfs) =	0.1	0.5	0.3	0.4	0.5	1.5	3.2	4.7	18.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.5	0.2	0.2	0.3	0.6
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	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	0.0	0.1	0.1	0.1
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) =	38	64	53	58	63	67	66	65	62
Time to Drain 99% of Inflow Volume (hours) =	40	68	55	62	67	72	72	72	71
Maximum Ponding Depth (ft) =	2.27	3.27	2.67	2.92	3.12	3.42	3.54	3.73	3.98
Area at Maximum Ponding Depth (acres) =	0.58	1.11	0.80	0.93	1.04	1.17	1.21	1.27	1.33
Maximum Volume Stored (acre-ft) =	0.335	1.189	0.605	0.821	1.028	1.349	1.491	1.739	2.066

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			

Channel Report

EDB A TRICKLE CHANNEL CAPACITY

Rectangular

Bottom Width (ft) = 2.00
Total Depth (ft) = 0.50

Invert Elev (ft) = 6887.00
Slope (%) = 0.40
N-Value = 0.013

Calculations

Compute by: Q vs Depth
No. Increments = 10

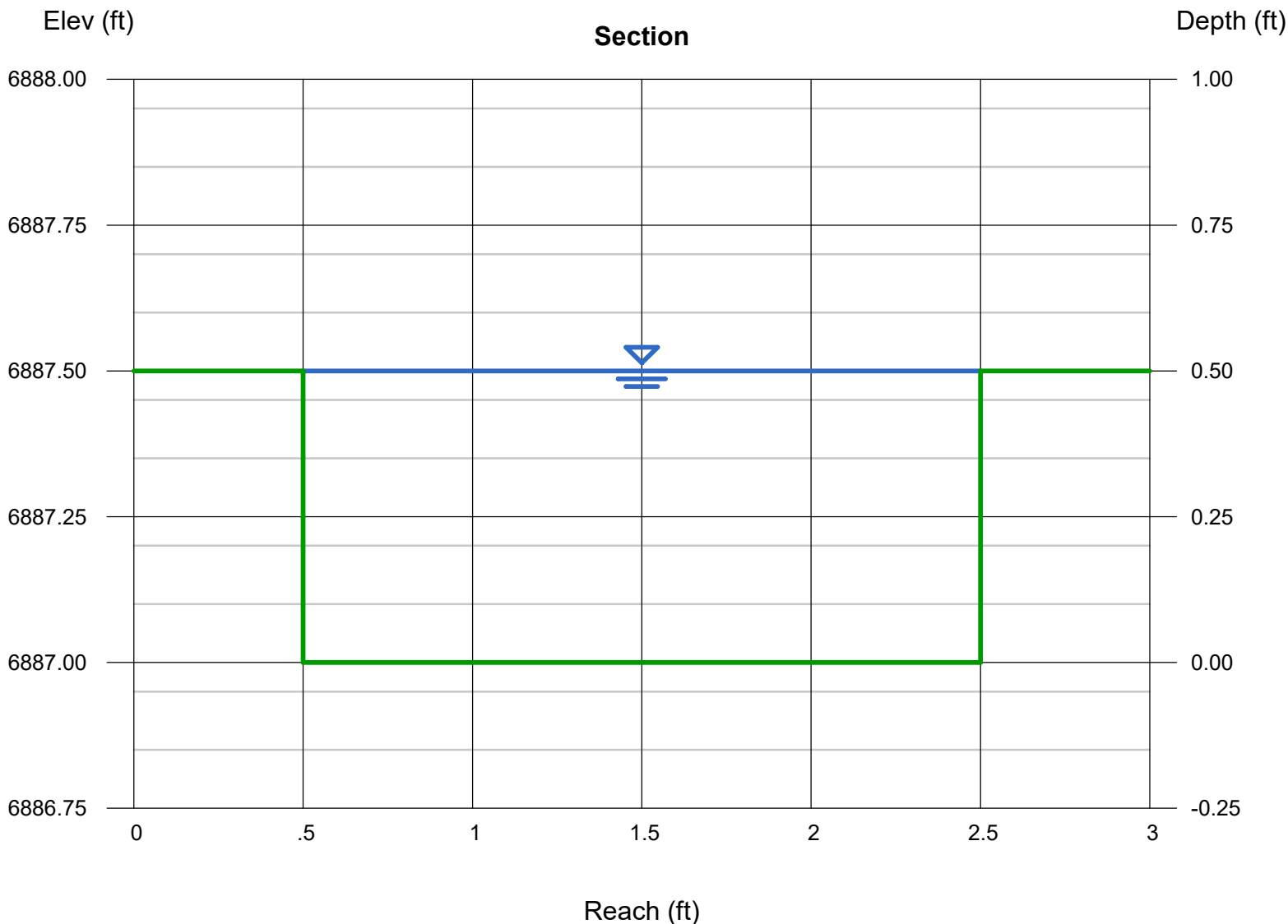
Highlighted

Depth (ft) = 0.50
Q (cfs) = 3.474
Area (sqft) = 1.00
Velocity (ft/s) = 3.47
Wetted Perim (ft) = 3.00
Crit Depth, Yc (ft) = 0.46
Top Width (ft) = 2.00
EGL (ft) = 0.69

TRICKLE CHANNEL CAPACITY = 3.47 CFS

REQUIRED CAPACITY = 2% OF Q100(DP-11) = (0.02)(61.08 CFS) = 1.22 CFS

PROVIDED CAPACITY > REQUIRED CAPACITY -----> TRICKLE CHANNEL SUFFICIENT



EMERGENCY SPILLWAY RIPRAP CALCULATIONS

CHART FROM UDFCD VOL 2:

SPILLWAY SLOPE: 16.7% (6:1)

SPILLWAY LENGTH: 40 FT

EMERGENCY OVERFLOW Q100 (PR DP-11): 61.08 CFS

UNIT DISCHARGE: 1.53 CFS/FT

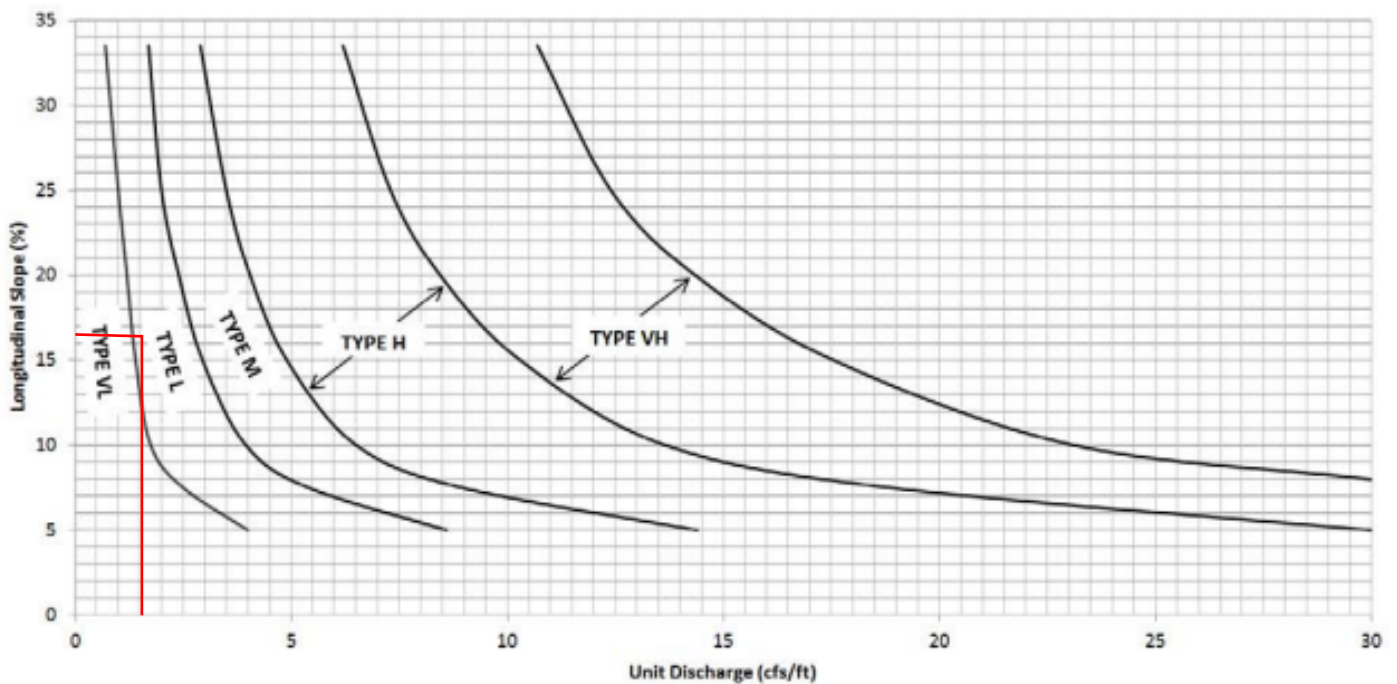


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

FROM CHART: USE TYPE L RIPRAP

TYPE X D50: 9 IN

EMERGENCY SPILLWAY RIPRAP DEPTH (2*D50) = 1.5 FT

Table 1: Riprap Gradation

Riprap Designation	% Smaller Than Given Size By Weight	Intermediate Rock Dimension (inches)	d ₅₀ * (inches)
Type VL	70 - 100	12	6**
	50 - 70	9	
	35 - 50	6	
	2 - 10	2	
Type L	70 - 100	15	9**
	50 - 70	12	
	35 - 50	9	
	2 - 10	3	
Type M	70 - 100	21	12**
	50 - 70	18	
	35 - 50	12	
	2 - 10	4	
Type H	70 - 100	30	18
	50 - 70	24	
	35 - 50	18	
	2 - 10	6	
Type VH	70 - 100	41	24
	50 - 70	33	
	35 - 50	24	
	2 - 10	9	

*d₅₀ = Mean Particle Size

**Mix VL, L and M riprap with 35% topsoil (by volume) and bury it with 4 to 6 inches of topsoil, all vibration compacted, and revegetate.

Extended Detention Basin A Forebay Design

Required Forebay Volume – 5-10% of WQCV

EDB A WQCV: 0.330 ac-ft = 14,375 ft³

Min required Forebay Volume = 0.05 x 14,375 = 719 ft³

Min required Forebay Volume = 0.10 x 14,375 = 1,438 ft³

Provided Forebay Volume = 2' sidewall height x 465 ft² area = **930 ft³**

Outlet notch to release 2% of 100-year peak discharge (DP-11 Q100: 61.08 cfs)

$Q = 0.02 \times 61.08 = 1.22 \text{ cfs}$

Outlet notch can be modeled as a broad crested weir (C = 3.0)

Notch height will be 2.0'

$Q = 1.22 = CLH^{3/2} = 3L(2.0^{3/2})$

$L = 0.143 \text{ ft} = 1.716''$

Outlet notch dimensions: **2" x 24"**



POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aerials](#)

1-HR RAINFALL DEPTHS USED FOR EDB A CALCS

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.239 (0.190-0.302)	0.291 (0.232-0.368)	0.381 (0.302-0.484)	0.461 (0.363-0.587)	0.577 (0.442-0.767)	0.672 (0.502-0.903)	0.771 (0.557-1.06)	0.877 (0.607-1.24)	1.02 (0.682-1.48)	1.14 (0.738-1.67)
10-min	0.350 (0.278-0.442)	0.426 (0.339-0.539)	0.559 (0.443-0.709)	0.675 (0.532-0.860)	0.845 (0.648-1.12)	0.984 (0.735-1.32)	1.13 (0.815-1.55)	1.28 (0.889-1.81)	1.50 (0.998-2.17)	1.67 (1.08-2.44)
15-min	0.426 (0.340-0.539)	0.520 (0.414-0.658)	0.681 (0.540-0.864)	0.823 (0.649-1.05)	1.03 (0.790-1.37)	1.20 (0.897-1.61)	1.38 (0.994-1.89)	1.57 (1.08-2.21)	1.83 (1.22-2.65)	2.04 (1.32-2.98)
30-min	0.609 (0.485-0.770)	0.742 (0.590-0.939)	0.971 (0.770-1.23)	1.17 (0.924-1.49)	1.46 (1.12-1.94)	1.70 (1.27-2.29)	1.95 (1.41-2.68)	2.22 (1.54-3.13)	2.59 (1.72-3.74)	2.88 (1.86-4.21)
60-min	0.779 (0.620-0.985)	0.936 (0.745-1.18)	1.22 (0.964-1.54)	1.47 (1.16-1.87)	1.85 (1.42-2.47)	2.17 (1.62-2.92)	2.51 (1.81-3.46)	2.87 (1.99-4.07)	3.39 (2.26-4.92)	3.81 (2.47-5.57)
2-hr	0.948 (0.761-1.19)	1.13 (0.906-1.42)	1.46 (1.17-1.84)	1.77 (1.40-2.23)	2.24 (1.74-2.97)	2.63 (1.99-3.53)	3.06 (2.24-4.20)	3.53 (2.47-4.97)	4.20 (2.83-6.06)	4.74 (3.10-6.89)
3-hr	1.04 (0.838-1.30)	1.23 (0.987-1.53)	1.57 (1.26-1.97)	1.91 (1.52-2.40)	2.42 (1.90-3.22)	2.87 (2.19-3.85)	3.37 (2.48-4.62)	3.91 (2.76-5.50)	4.70 (3.18-6.77)	5.34 (3.50-7.73)
6-hr	1.20 (0.977-1.49)	1.40 (1.14-1.74)	1.79 (1.45-2.22)	2.16 (1.74-2.70)	2.77 (2.19-3.67)	3.30 (2.54-4.40)	3.88 (2.88-5.30)	4.54 (3.23-6.35)	5.49 (3.76-7.88)	6.28 (4.16-9.04)
12-hr	1.39 (1.14-1.70)	1.62 (1.32-1.98)	2.06 (1.68-2.53)	2.48 (2.01-3.07)	3.16 (2.52-4.14)	3.75 (2.91-4.96)	4.41 (3.30-5.96)	5.13 (3.69-7.13)	6.19 (4.28-8.82)	7.07 (4.72-10.1)
24-hr	1.60 (1.32-1.94)	1.87 (1.54-2.28)	2.38 (1.96-2.90)	2.86 (2.34-3.50)	3.60 (2.89-4.66)	4.24 (3.31-5.54)	4.94 (3.72-6.61)	5.71 (4.13-7.85)	6.82 (4.74-9.62)	7.73 (5.21-11.0)
2-day	1.85 (1.54-2.23)	2.18 (1.81-2.62)	2.76 (2.28-3.34)	3.29 (2.71-4.00)	4.11 (3.31-5.25)	4.79 (3.76-6.19)	5.53 (4.20-7.32)	6.33 (4.61-8.62)	7.48 (5.24-10.5)	8.40 (5.72-11.8)
3-day	2.03 (1.70-2.43)	2.38 (1.99-2.86)	3.02 (2.51-3.63)	3.59 (2.98-4.34)	4.46 (3.61-5.66)	5.19 (4.09-6.66)	5.96 (4.54-7.85)	6.80 (4.98-9.21)	8.00 (5.63-11.1)	8.96 (6.12-12.6)
4-day	2.18 (1.83-2.60)	2.55 (2.14-3.05)	3.22 (2.69-3.86)	3.82 (3.17-4.60)	4.72 (3.83-5.97)	5.48 (4.33-7.00)	6.28 (4.80-8.24)	7.16 (5.25-9.65)	8.39 (5.93-11.6)	9.38 (6.44-13.1)
7-day	2.58 (2.18-3.06)	2.98 (2.51-3.53)	3.68 (3.10-4.38)	4.32 (3.62-5.17)	5.28 (4.32-6.62)	6.09 (4.85-7.73)	6.94 (5.35-9.04)	7.87 (5.82-10.5)	9.18 (6.54-12.7)	10.2 (7.08-14.3)
10-day	2.93 (2.48-3.46)	3.36 (2.85-3.97)	4.13 (3.48-4.89)	4.81 (4.04-5.73)	5.83 (4.78-7.26)	6.67 (5.33-8.42)	7.57 (5.85-9.81)	8.54 (6.34-11.4)	9.89 (7.08-13.6)	11.0 (7.63-15.2)
20-day	3.90 (3.34-4.57)	4.50 (3.85-5.27)	5.52 (4.70-6.48)	6.38 (5.40-7.53)	7.62 (6.26-9.33)	8.60 (6.91-10.7)	9.61 (7.48-12.3)	10.7 (7.97-14.1)	12.1 (8.72-16.4)	13.2 (9.28-18.3)
30-day	4.69 (4.03-5.46)	5.43 (4.66-6.32)	6.64 (5.68-7.75)	7.65 (6.51-8.97)	9.04 (7.45-11.0)	10.1 (8.16-12.5)	11.2 (8.74-14.2)	12.3 (9.24-16.1)	13.8 (9.96-18.6)	14.9 (10.5-20.5)
45-day	5.67 (4.89-6.56)	6.55 (5.65-7.58)	7.97 (6.85-9.25)	9.12 (7.80-10.6)	10.7 (8.81-12.8)	11.8 (9.58-14.5)	13.0 (10.2-16.3)	14.1 (10.6-18.3)	15.6 (11.3-20.9)	16.7 (11.8-22.8)
60-day	6.49 (5.62-7.48)	7.47 (6.46-8.62)	9.02 (7.78-10.4)	10.3 (8.81-11.9)	11.9 (9.86-14.2)	13.1 (10.7-16.0)	14.3 (11.2-17.9)	15.5 (11.7-20.0)	16.9 (12.3-22.6)	18.0 (12.8-24.5)

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

[Back to Top](#)

PF graphical

Site Layout

SCM Design, Version 4.02 (June 2025)

Designer: E. Maxwell

Company: SMH Consultants

Date: March 24, 2026

Project: 4-Way Commercial

Location: El Paso County, Colorado

SITE LAYOUT INFO (User Input in Blue Cells)

Water Quality Event (WQE) inches

Outfall ID	SITE	SPAs											
Total Tributary Area (ft ²)	546,678	57,493											
Total Tributary Area (ac)	12.55	1.32											
Imperviousness (%)	77.8%	0.0%											
MS4 Design Standard	WQCV	Runoff											
SCM Type	EDB	RPA											

Notes:

OUTFALL RESULTS

SCM Worksheet Name	EDB_SITE	RPA_SPAs											
Untreated Area (ft ³)	0	0											
Default WQCV (ft ³)	14,354	0											
Optional Override WQCV (ft ³)													
WQCV Reduction (ft ³)	0	0											
Remaining WQCV (ft ³)	14,354	0											
WQCV Reduction (%)	0%	0%											
Design WQCV of SCM (ft ³)	0	0											
Pollutant Removal (ft ³)	0	0											
Untreated WQCV (ft ³)	14,354	0											

TOTAL SITE RESULTS (Sums results from all Outfalls)

Total Site Area	<input type="text" value="604,171"/>	ft ²	<input type="text" value="13.87"/>	acres
Treated Area	<input type="text" value="604,171"/>	ft ²	<input type="text" value="13.87"/>	acres
Untreated Area	<input type="text" value="0"/>	ft ²	<input type="text" value="0.00"/>	acres
Total Site Imperviousness	<input type="text" value="70.4%"/>	%		
Default (or Override) WQCV	<input type="text" value="14,354"/>	ft ³	<input type="text" value="0.330"/>	acre-feet
Remaining WQCV	<input type="text" value="14,354"/>	ft ³	<input type="text" value="0.330"/>	acre-feet
WQCV Reduction	<input type="text" value="0%"/>	%		
Design WQCV	<input type="text" value="0"/>	ft ³	<input type="text" value="0.000"/>	acre-feet
Untreated WQCV	<input type="text" value="14,354"/>	ft ³	<input type="text" value="0.330"/>	acre-feet

Confirm with local jurisdiction whether design meets Runoff Reduction Standard

Receiving Pervious Areas (Including Grass Buffers and Grass Swales)

SCM Design, Version 4.02 (June 2025)

Designer: E. Maxwell
Company: SMH Consultants
Date: March 24, 2026
Project: 4-Way Commercial
Location: El Paso County, Colorado
Outfall ID: SPAs

DESIGN PROCEDURE AND CRITERIA FOR ALL RPAs (User Input in Blue Cells)

1. Apply Four-Cover Land Use Model to Site Layout

Design Point ID	SPAs	P-4	P-10	P-11	P-12	P-13				
Area Type	RPA	SPA	SPA	SPA	SPA	SPA				
Downstream Design Point ID	--									
DCIA (ft ²)	--	--	--	--	--	--				
UIA (ft ²)	--	--	--	--	--	--				
RPA (ft ²)	--	--	--	--	--	--				
SPA (ft ²)	--	37,376	3,610	1,699	6,837	7,971				

2. Protect the RPA from Traffic

RPA Protection Type	--	--	--	--	--	--				
---------------------	----	----	----	----	----	----	--	--	--	--

3. Characterize On-site Topsoil and Determine Suitability for the RPA

HSG A (%)	--	--	--	--	--	--				
HSG B (%)	--	--	--	--	--	--				
HSG C/D (%)	--	--	--	--	--	--				

4. Select Appropriate Vegetation

RPA Vegetation Type	--	--	--	--	--	--				
Irrigation Type	--	--	--	--	--	--				

Notes:

GRASS BUFFER ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Define the UIA:RPA pair, Ratio, and Interface Width

Sheet Flow Inflow Feature	--	--	--	--	--	--				
Is Concrete Edger used?	--	--	--	--	--	--				
Spacing between slots (ft)	--	--	--	--	--	--				
Slot Opening Length (in)	--	--	--	--	--	--				
Blind Swale Type	--	--	--	--	--	--				
Spreader Energy Dissipation	--	--	--	--	--	--				
Total Area of UIA:RPA (ft ²)	--	--	--	--	--	--				
UIA:RPA Ratio	--	--	--	--	--	--				
UIA:RPA Interface Width (ft)	--	--	--	--	--	--				
L / W Ratio of UIA:RPA	--	--	--	--	--	--				

2. Buffer Length

Average Buffer Length (ft)	--	--	--	--	--	--				
----------------------------	----	----	----	----	----	----	--	--	--	--

3. Buffer Slope

Average Buffer Slope (ft/ft)	--	--	--	--	--	--				
Effective Distance (ft)	--	--	--	--	--	--				
Number of Level Spreaders	--	--	--	--	--	--				

4. Provide a Vertical Drop

Vertical Drop (in)	--	--	--	--	--	--				
Mowing Strip Provided?	--	--	--	--	--	--				

5. Calculate Runoff for UIA and RPA Pair

Imperviousness (%)	--	--	--	--	--	--				
UIA:RPA Runoff (in)	--	--	--	--	--	--				
UIA:RPA Runoff (ft ³)	--	--	--	--	--	--				

6. Compare Runoff from UIA:RPA Pair to Runoff from UIA Only

UIA Runoff (ft ³)	--	--	--	--	--	--				
Runoff Reduction (ft ³)	--	--	--	--	--	--				
Runoff Reduction (%)	--	--	--	--	--	--				

Notes:

GRASS SWALE ADDITIONAL DESIGN PROCEDURE AND CRITERIA (User Input in Blue Cells)

1. Delineate Areas Tributary to Swale

Total Tributary Area (ft ²)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Imperviousness (%)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

2. Swale Inflows

Concentrated Flow Type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Blind Swale Type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Spreader Energy Dissipation	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vertical Drop (in)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gutter Depression (in)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Curb Opening Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Concrete Sediment Pad	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Min. Forebay Volume (ft ³)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Design Forebay Volume (ft ³)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Max. Forebay Depth (in)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Design Forebay Depth (in)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calculated Notch Width (in)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Design Notch Width (in)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Drain Time (minutes)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Energy Dissipation Type	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

3. Swale Cross Section

Length of Swale (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bottom Width (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bottom Area (ft ²)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Side Slopes (horiz/vert)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

4. Longitudinal Slope

Available Slope (ft/ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Design Slope (ft/ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Drop Height (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Underdrains Provided?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

5. Calculate Runoff from Tributary Area

Tributary Runoff (ft ³)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Reduced Trib. Runoff (ft ³)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

6. Calculate Runoff Reduction through Swale Bottom

Volume Infiltrated (ft ³)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Swale Discharge (ft ³)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Runoff Reduction (%)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

7. Design Discharge

2-year Discharge, Q2 (cfs)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
----------------------------	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

8. Design Velocity

Vegetal Retardance Curve	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Velocity, V2 (fps)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

9. Design Flow Depth

Flow Depth, D2 (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Flow Area, A (ft ²)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Wetted Perimeter, P (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Top Width, T (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydraulic Radius, Rh (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VR Product (ft ² /sec)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manning's n value	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydraulic Depth, Dh (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Froude Number	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

10. Swale Outflows

Outflows Considered?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
----------------------	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Notes:

DESIGN POINT RESULT (Sums results for current column and all upstream design point columns.)

Design Point ID	SPAs	P-4	P-10	P-11	P-12	P-13															
Area Type	RPA	SPA	SPA	SPA	SPA	SPA															
Total Area (ft ²)	0	37,376	3,610	1,699	6,837	7,971															
Imperviousness (%)		0.0%	0.0%	0.0%	0.0%	0.0%															
Tributary Runoff (ft ³)		0	0	0	0	0															
Runoff Reduction (ft ³)		0	0	0	0	0															
Runoff Remaining (ft ³)		0	0	0	0	0															

Total Tributary Area entered on Site Layout Worksheet is: 57,493 square feet

PROPOSED SUB-BASIN TREATMENT SUMMARY					
SUB-BASIN	TOTAL AREA	TOTAL PROPOSED DISTURBANCE	TREATMENT VIA EDB A	TREATMENT VIA RUNOFF REDUCTION (SEPARATE PVIOUS AREA)	UNTREATED AREA
P-1	8.40	-	-	-	-
P-2	10.54	-	-	-	-
P-3	13.15	-	-	-	-
P-4	15.14	0.86	-	0.86	-
P-5	4.51	4.51	4.51	-	-
P-6	4.15	4.15	4.15	-	-
P-7	1.85	1.85	1.85	-	-
P-8	0.24	0.24	0.24	-	-
P-9	1.71	1.71	1.71	-	-
P-10	1.52	0.08	-	0.08	-
P-11	1.99	0.17	-	0.04	0.13
P-12	1.25	0.16	-	0.16	-
P-13	0.94	0.18	-	0.18	-
P-14	0.09	0.09	0.09	-	-
TOTAL	65.48	14.00	12.55	1.32	0.13

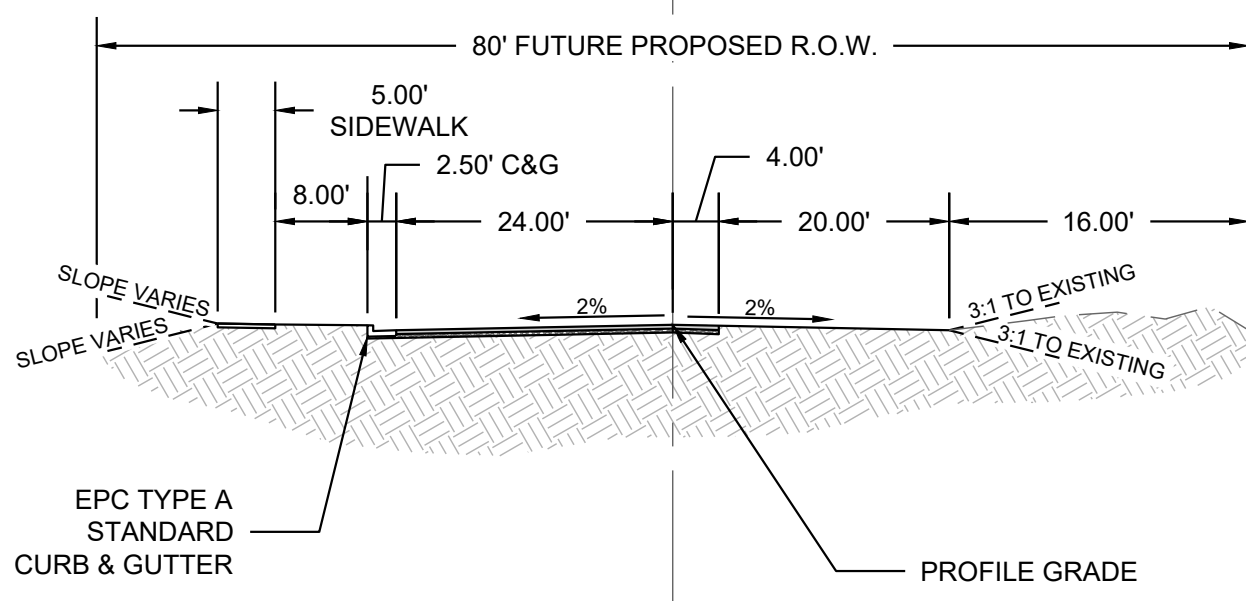
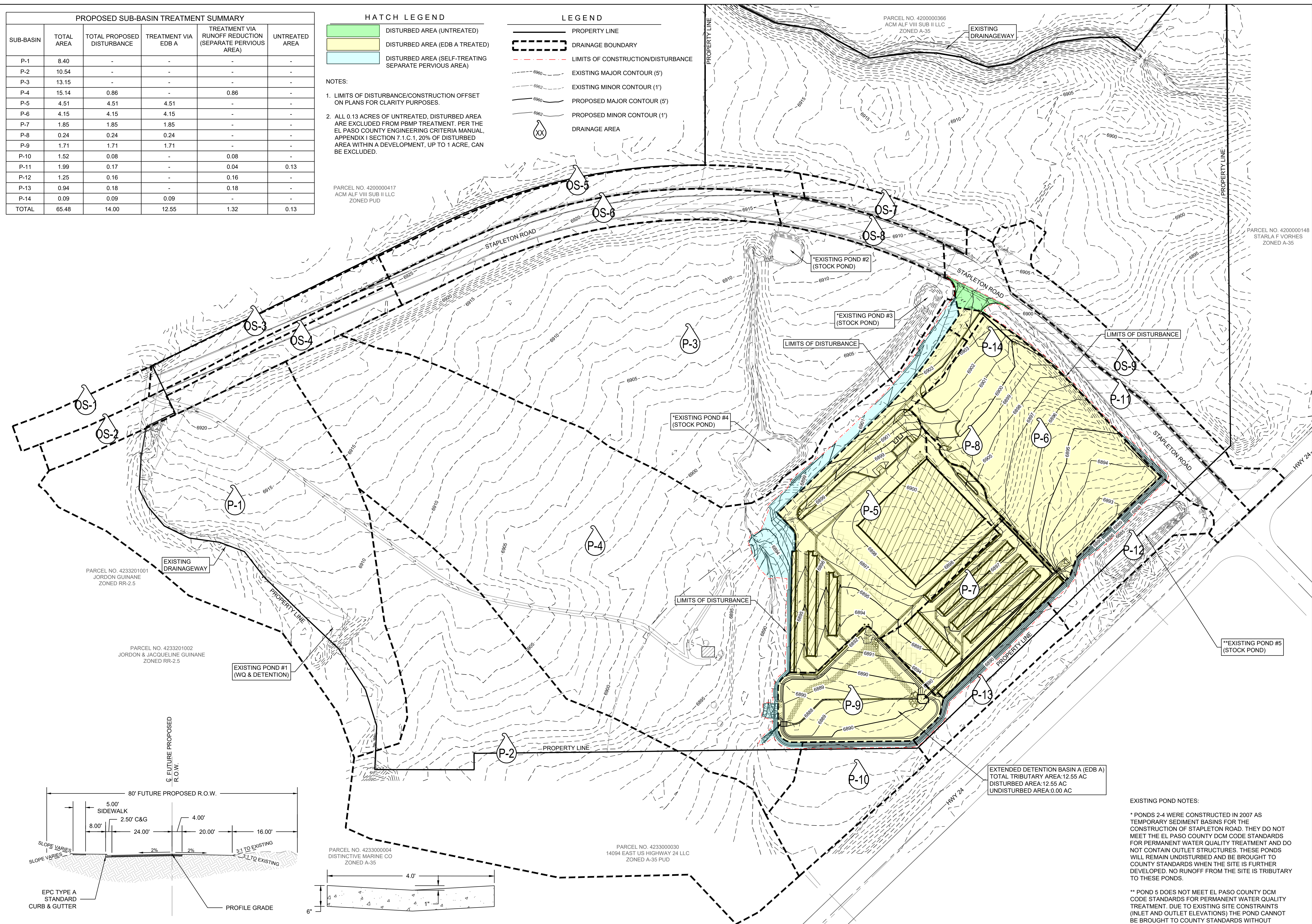
HATCH LEGEND	
	DISTURBED AREA (UNTREATED)
	DISTURBED AREA (EDB A TREATED)
	DISTURBED AREA (SELF-TREATING SEPARATE PVIOUS AREA)

NOTES:

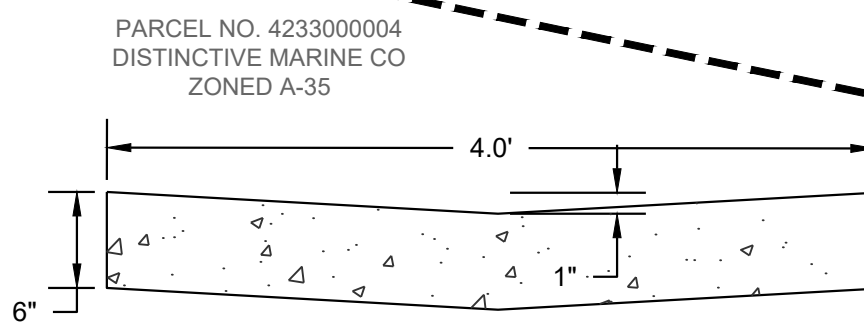
- LIMITS OF DISTURBANCE/CONSTRUCTION OFFSET ON PLANS FOR CLARITY PURPOSES.
- ALL 0.13 ACRES OF UNTREATED, DISTURBED AREA ARE EXCLUDED FROM PBMP TREATMENT. PER THE EL PASO COUNTY ENGINEERING CRITERIA MANUAL, APPENDIX I SECTION 7.1.C.1, 20% OF DISTURBED AREA WITHIN A DEVELOPMENT, UP TO 1 ACRE, CAN BE EXCLUDED.

LEGEND	
	PROPERTY LINE
	DRAINAGE BOUNDARY
	LIMITS OF CONSTRUCTION/DISTURBANCE
	EXISTING MAJOR CONTOUR (5')
	EXISTING MINOR CONTOUR (1')
	PROPOSED MAJOR CONTOUR (5')
	PROPOSED MINOR CONTOUR (1')
	DRAINAGE AREA

PARCEL NO. 4200000417
ACM ALF VIII SUB II LLC
ZONED PUD



DUMONT DRIVE INTERIM CROSS SECTION
NOT TO SCALE



CONCRETE VALLEY GUTTER DETAIL
NOT TO SCALE

EXTENDED DETENTION BASIN A (EDB A)
TOTAL TRIBUTARY AREA: 12.55 AC
DISTURBED AREA: 12.55 AC
UNDISTURBED AREA: 0.00 AC

EXISTING POND NOTES:
* PONDS 2-4 WERE CONSTRUCTED IN 2007 AS TEMPORARY SEDIMENT BASINS FOR THE CONSTRUCTION OF STAPLETON ROAD. THEY DO NOT MEET THE EL PASO COUNTY DCM CODE STANDARDS FOR PERMANENT WATER QUALITY TREATMENT AND DO NOT CONTAIN OUTLET STRUCTURES. THESE PONDS WILL REMAIN UNDISTURBED AND BE BROUGHT TO COUNTY STANDARDS WHEN THE SITE IS FURTHER DEVELOPED. NO RUNOFF FROM THE SITE IS TRIBUTARY TO THESE PONDS.
** POND 5 DOES NOT MEET EL PASO COUNTY DCM CODE STANDARDS FOR PERMANENT WATER QUALITY TREATMENT. DUE TO EXISTING SITE CONSTRAINTS (INLET AND OUTLET ELEVATIONS) THE POND CANNOT BE BROUGHT TO COUNTY STANDARDS WITHOUT DISTURBANCE TO US HWY 24 AND WILL BE LEFT UNDISTURBED. A SMALL PORTION OF SITE RUNOFF REACHES THIS POND, AND IS CONSIDERED UNTREATED.

SMH CONSULTANTS
www.smhconsultants.com
Civil Engineering • Land Surveying
Landscape Architecture
Manhattan, KS - HQ
(785) 776-0541
Dodge City, KS
(620) 255-1952
Kansas City
(913) 444-9615
Colorado Springs, CO
(719) 465-2145

4-WAY COMMERCIAL
FINAL DRAINAGE REPORT
EL PASO COUNTY, CO

REVISION DATE	REVISION DESCRIPTION (DESCRIPTION)
00/00/00	

PROJECT #: 2412-0471
CHECKED BY: BML
DRAWN BY: EDM
DATE: 04/13/2026
SHEET # **1**
TOTAL SHEETS 1

PREVIOUS DRAINAGE STUDIES

EXCERPTS FROM

"MDDP AMMENDMENT/PRELIMINARY/FINAL
DRAINAGE REPORT FOR STAPLETON DRIVE
FROM BANDANERO TO US HWY 24"

JR ENGINEERING (NOV 2009, REV. MAY 2010)

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

November 2009
Revised May 2010

Prepared For:

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

Prepared By:

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

Job No. 29931.25

report. Basin delineations can be found on the Drainage Maps located in the Map Pocket at the end of the Appendix.

HYDRAULIC CALCULATIONS

Culverts were evaluated using the Federal Highway Administration culvert hydraulics program, HY-8 Version 7.2. Pipe diameters and channel sections were evaluated using Bentley's FlowMaster v8.0, and Stormcad v8 XM software using the Manning's Formula. Pertinent data sheets are included in the Appendix of this report.

DRAINAGE FACILITY DESIGN

The detention discharge was modeled after the 100-year historic flow rates. The historic flow release rate for each pond was determined by calculating the average release per acre of historic basins H9 and H12, as taken from the MDDP. This value was then applied towards the area of each proposed basin within their respective historic basins that were tributary to a pond (see Appendix). Interim detention volumes and release rates for build-out of Stapleton Drive were calculated using the Rational Stored Rate Method. See the Appendix for all pond calculations used.

EXISTING DRAINAGE CONDITIONS

The proposed site is part of the Haegler Diversion of the Gieck Basin. Historically, the property sits in basins H9 and H12 as defined in the MDDP for 4-Way Ranch. Both basins drain in a southeasterly direction. Basin H12 contains a more well-defined natural channel occurring within it, referred to as Drainage Way B in the MDDP for 4-Way Ranch. A natural spring occurs in this area of Basin H9, and flows to the south. To the west of Basin H9 is another drainage way flowing southerly, referred to as Drainage Way A in the MDDP for 4-Way Ranch.

Meridian Ranch flows have been adjusted per recent revisions to the Meridian Ranch MDDP, completed in October 2005 by PBS&J. Flows from the Meridian Ranch site were determined from the HEC-HMS model for the Haegler Ranch Drainage Basin provided by PBS&J in 2007. Output from this model is included in the Appendix. Meridian Ranch will detain on-site for the developed condition in order to reduce developed conditions flows to approximately 80% of historic rates. Historic runoff from Design Points H8, H9, and H10 flow to Drainage Way A, and historic runoff from Design Points H13 and H14 flow to Drainage Way B. In the developed

condition, the same Design Points contribute to Drainage Way A, and only Design Point H14 contributes to Drainage Way B.

Drainage Way B flows to the east, eventually hitting a major crossing of Highway 24, defined as Design Point HG-3 in the MDDP. The historic flows at basin HG-3 are $Q_5 = 52$ cfs, $Q_{100} = 224$ cfs. Flows from Drainage Way A head toward the south where they cross Highway 24 at another major crossing defined as HG-2. The historic flows at basin HG-2 are $Q_5 = 137$ cfs, $Q_{100} = 521$ cfs. There is a portion of historic basin H9 that is located to north of the site. The vast majority of these offsite flows will be intercepted via a roadside swale along Stapleton Drive. The flows will then be routed to the west where they will be introduced into Drainage Way A. A summary of proposed flows leaving the site compared to historic flows (From Filing 1) at the same points is shown in the Appendix.

PROPOSED DRAINAGE CONDITIONS

The intent of this report is to design in preparation for construction of the interim and ultimate Stapleton Drive and associated improvements for the Highway 24 intersection. Drainage improvements presented in this report show only the items related to the proposed interim and ultimate Stapleton Drive improvements, which will occur before the 4-Way Commercial and Dumont Drive improvements. These improvements to Dumont Drive and to the commercial lots will occur at a future time and are addressed in the “MDDP Amendment/Preliminary Drainage Report for 4-Way Ranch,” by JR Engineering, dated September 2008 and revised January 2010. All drainage facilities will be maintained by 4-Way Ranch Metropolitan District 1.

Runoff from the site will be consistent with existing patterns on-site. The runoff flows will travel in a southeasterly direction where they will eventually pass underneath Highway 24 at one of its existing major crossings. As stated in the MDDP, these crossings are adequately sized for the developed condition, and with the proposed Stapleton Drive and future on-site drainage improvements releasing at or below the 100-year historic flow rate, these crossings will remain satisfactory. Extensions to the existing Highway 24 culverts are necessary, however. The existing 24” corrugated metal pipe (CMP) near the Stapleton Drive intersection will need to be extended by a total of 50 feet, and the existing 4’x4’ RCBC at Design Point HG-2 will need to be extended by a total of 33 feet. The riprap inlet protection for the 24” CMP extends into the El

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: Stapleton Drive Interim Conditions
Location: El Paso County

Project Name: 4 Way Ranch
Project No.: 29931.25
Calculated By: TAB
Checked By: _____
Date: 5/13/10

Basin ID	Total Area (ac)	Paved Roads			Lawns			Roofs			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
A	8.40	100	0.00	0.00	5	8.40	5.00	90	0.00	0.00	5.00
B	10.54	100	0.00	0.00	5	10.54	5.00	90	0.00	0.00	5.00
C	13.15	100	0.00	0.00	5	13.15	5.00	90	0.00	0.00	5.00
D	16.83	100	0.00	0.00	5	16.83	5.00	90	0.00	0.00	5.00
E	9.64	100	0.00	0.00	5	9.64	5.00	90	0.00	0.00	5.00
F	5.83	100	0.32	5.49	5	5.51	4.70	90	0.00	0.00	10.19
J	1.35	100	1.35	100.00	5	0.00	0.00	90	0.00	0.00	100.00
K	1.61	100	1.61	100.00	5	0.00	0.00	90	0.00	0.00	100.00
L	0.47	100	0.47	100.00	5	0.00	0.00	90	0.00	0.00	100.00
M	0.71	100	0.71	100.00	5	0.00	0.00	90	0.00	0.00	100.00
P	0.22	100	0.00	0.00	5	0.22	5.00	90	0.00	0.00	5.00
Q	0.30	100	0.00	0.00	5	0.30	5.00	90	0.00	0.00	5.00
R	1.55	100	1.55	100.00	5	0.00	0.00	90	0.00	0.00	100.00
S	1.24	100	1.24	100.00	5	0.00	0.00	90	0.00	0.00	100.00
X-1	0.83	100	0.83	100.00	5	0.00	0.00	90	0.00	0.00	100.00
X-2	0.52	100	0.52	100.00	5	0.00	0.00	90	0.00	0.00	100.00
Y-1	0.77	100	0.77	100.00	5	0.00	0.00	90	0.00	0.00	100.00
Y-2	0.72	100	0.72	100.00	5	0.00	0.00	90	0.00	0.00	100.00

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Stapleton Drive Interim Conditions
Location: El Paso County

Project Name: 4 Way Ranch
Project No.: 29931.25
Calculated By: TAB
Checked By: _____
Date: 5/13/10

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					Tc CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (AC)	Soils Type	Percent Impervious	C ₁₀₀	C _s	L (FT)	S (%)	T _i (MIN)	L (FT)	S (%)	C _v	VEL. (FPS)	T _t (MIN)	COMP. T _c (MIN)	TOTAL LENGTH(FT)	MIN. T _c (MIN)	
A	8.40	A	5.0	0.24	0.02	200	1.5	24.4	850	2.5	10.0	1.6	9.0	33.4	1050	15.8	15.8
B	10.54	A	5.0	0.24	0.02	200	1.75	23.2	1270	2.0	10.0	1.4	14.8	38.0	1470	18.2	18.2
C	13.15	A	5.0	0.24	0.02	200	1.25	26.0	860	2.3	10.0	1.5	9.4	35.4	1060	15.9	15.9
D	16.83	A	5.0	0.24	0.02	200	1.5	24.4	1430	2.2	10.0	1.5	16.2	40.6	1630	19.1	19.1
E	9.64	A	5.0	0.24	0.02	200	2	22.2	1300	1.8	10.0	1.4	15.9	38.1	1500	18.3	18.3
F	5.83	A	10.2	0.28	0.06	200	2.5	19.8	585	4.4	10.0	2.1	4.6	24.5	785	14.4	14.4
J	1.35	A	100.00	0.95	0.89	20	2.0	1.4	1037	1.1	20.0	2.1	8.2	9.6	1057.0	15.9	9.6
K	1.61	A	100.00	0.95	0.89	20	2.0	1.4	949	1.5	20.0	2.4	6.5	7.8	969.0	15.4	7.8
L	0.47	A	100.00	0.95	0.89	25	3.8	1.2	391	2.1	20.0	2.9	2.2	3.5	416.0	12.3	5.0
M	0.71	A	100.00	0.95	0.89	20	2.0	1.4	431	1.5	20.0	2.4	2.9	4.3	451.0	12.5	5.0
P	0.22	A	5.00	0.24	0.02	20	1.5	7.7	267	0.9	20.0	1.9	2.3	10.1	287.0	11.6	10.1
Q	0.30	A	5.00	0.24	0.02	20	1.5	7.7	250	1.0	20.0	2.0	2.1	9.8	270.0	11.5	5.0
R	1.55	B	100.00	0.96	0.90	30	2.0	1.6	783	2.7	20.0	3.3	4.0	5.6	813.0	14.5	5.6
S	1.24	B	100.00	0.96	0.90	30	2.0	1.6	771	2.4	20.0	3.1	4.1	5.7	801.0	14.5	5.7
X-1	0.83	A	100.00	0.95	0.89	17	2.0	1.3	558	1.0	20.0	2.0	4.7	5.9	575.0	13.2	5.9
X-2	0.52	A	100.00	0.95	0.89	18	2.0	1.3	387	1.0	20.0	2.0	3.2	4.5	405.0	12.3	5.0
Y-1	0.77	A	100.00	0.95	0.89	20	2.0	1.4	694	1.0	20.0	2.0	5.8	7.1	714.0	14.0	7.1
Y-2	0.72	A	100.00	0.95	0.89	20	2.0	1.4	341	1.0	20.0	2.0	2.8	4.2	361.0	12.0	5.0

NOTES:

$T_i = (0.395 * (1.1 - C_s) * (L)^{0.5}) / ((S)^{0.33})$, S in ft/ft

$T_t = L / 60V$ (Velocity From Fig. 501)

Tc Check = 10 + L/180

STANDARD FORM SF-3
OFFSITE FLOWS CALCULATION
(RATIONAL METHOD PROCEDURE)

Subdivision: Stapleton Drive Interim Conditions
Location: El Paso County
Design Storm: 5-Year

VALUES USED FOR
OFFSITE FLOW
CALCULATIONS

Project Name: 4 Way Ranch
Project No.: 29931.25
Calculated By: TAB
Checked By:
Date: 5/13/10

Analysis Points	Design Point	DIRECT RUNOFF							BASIN ROUTING				TOTAL RUNOFF	HISTORIC FLOWS
		Contributing Basins or Design Points	Area (Ac)	Runoff Coeff.	Tc (min)	Equivalent C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Q ₅ (cfs)	Q ₅ (cfs)
	13	Pond 4			13.0	0.74	3.69	2.74						
		Design Point 5			19.4	0.01	5.10	0.05						
		F	5.83	0.06	14.4	0.35	3.53	1.24	19.4	1.10	3.06	3.37	3.37	4.36
	HG-2	Offsite ¹			65.49	57.72	1.49	86.00						
		SD-4			5.00	1.09	5.10	5.55						
		Design Point 4			10.07	0.00	4.09	0.00						
		Design Point 10			15.83	2.77	3.38	28.76						
		Design Point 12			19.06	1.33	3.09	27.60						
		B	10.54	0.02	18.2	0.21	3.16	0.66						
		E	9.64	0.02	18.3	0.19	3.15	0.60	65.49	63.31	1.49	94.34	94.34	137.00

¹ Offsite Existing Flows in Drainage Way A and 4-Way Filing 1 Flows.

STANDARD FORM SF-3
OFFSITE FLOWS CALCULATION
(RATIONAL METHOD PROCEDURE)

Subdivision: Stapleton Drive Interim Conditions
Location: El Paso County
Design Storm: 100-Year

VALUES USED FOR
OFFSITE FLOW
CALCULATIONS

Project Name: 4 Way Ranch
Project No.: 29931.25
Calculated By: TAB
Checked By:
Date: 5/13/10

Analysis Points	Design Point	DIRECT RUNOFF							BASIN ROUTING				TOTAL RUNOFF	HISTORIC FLOWS
		Contributing Basins or Design Points	Area (Ac)	Runoff Coeff.	Tc (min)	Equivalent C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Q ₁₀₀ (cfs)	Q ₁₀₀ (cfs)
	13	Pond 4			13.0	0.72	6.57	4.76						
		Design Point 5			19.4	0.07	5.45	1.61						
		F	5.83	0.28	14.4	1.63	6.29	10.25	19.4	2.42	5.45	13.21	13.21	17.96
	HG-2	Offsite ¹			65.49	176.32	2.66	469.00						
		SD-4			5.00	1.31	9.09	11.86						
		Design Point 4			10.07	0.05	7.28	1.32						
		Design Point 10			15.83	4.78	6.01	28.76						
		Design Point 12			19.06	5.02	5.50	27.60						
		B	10.54	0.24	18.2	2.53	5.63	14.24						
		E	9.64	0.24	18.3	2.31	5.60	12.94	65.49	192.31	2.66	511.56	511.56	521.00

¹ Offsite Existing Flows in Drainage Way A and 4-Way Filing 1 Flows.

Hydrology Report

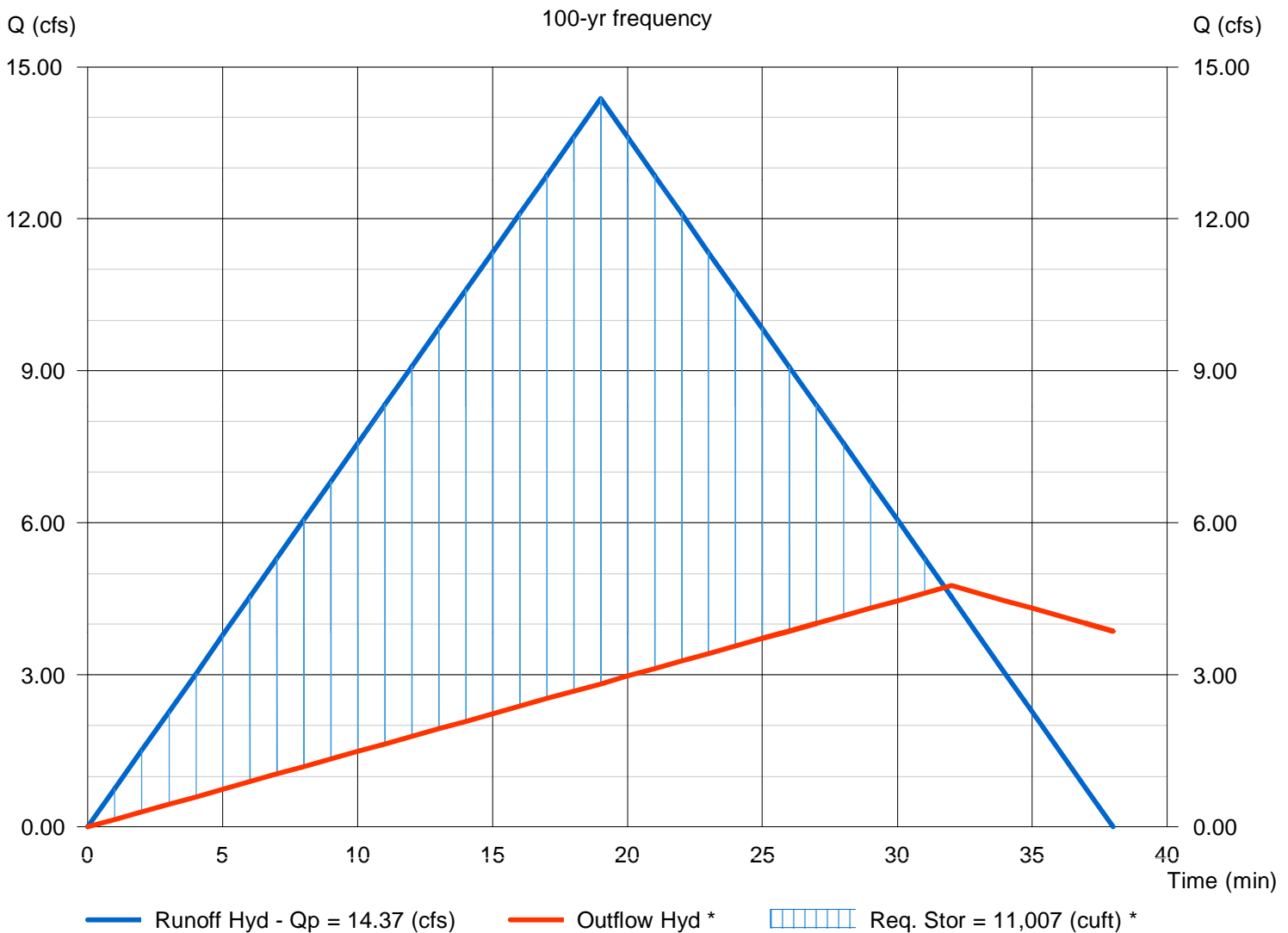
EXISTING POND #5
IN 4-WAY
COMMERCIAL FDR
(SMH 2025)

Interim Pond 4 - Basins Q, R, S

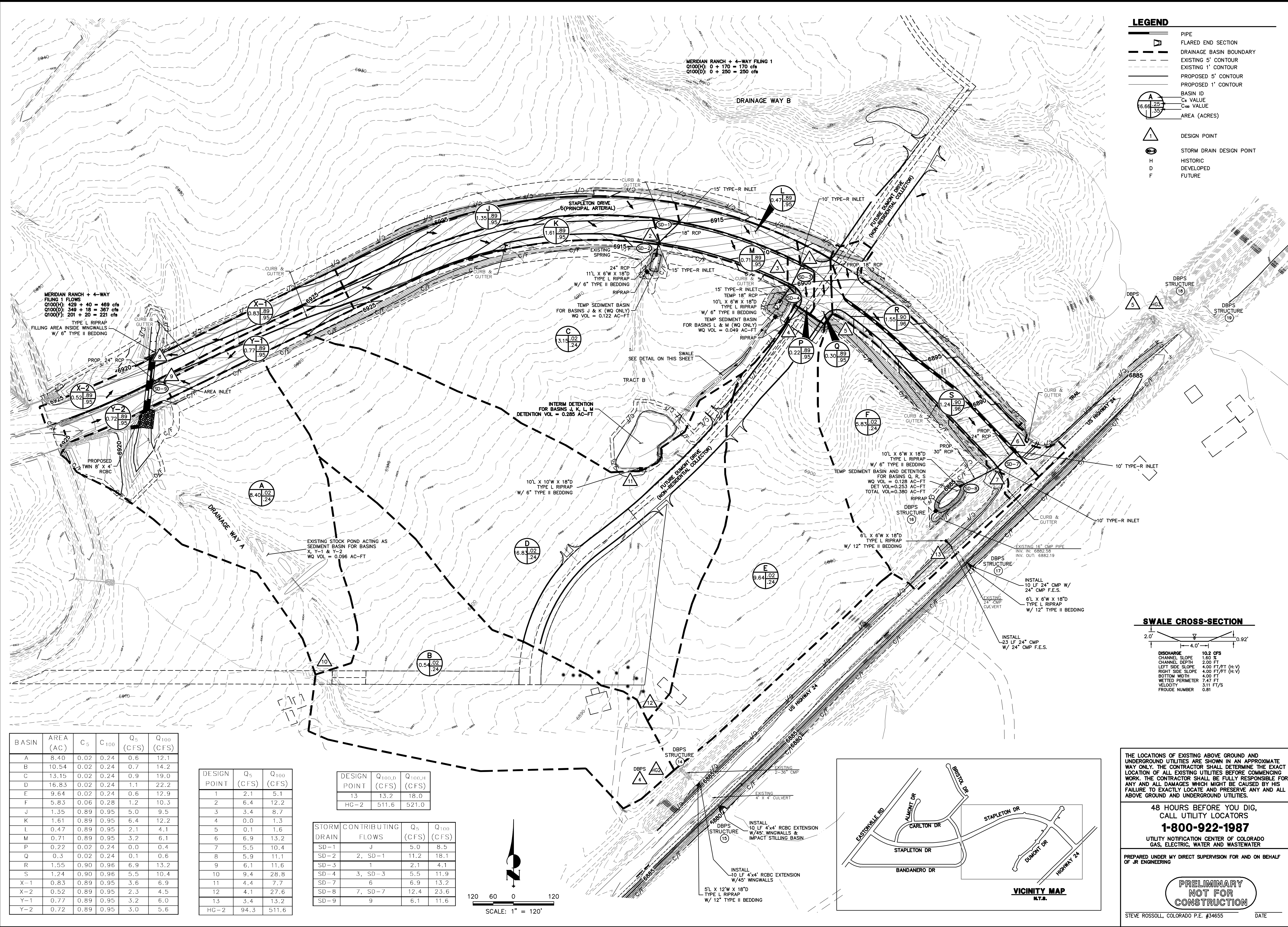
Hydrograph type	= Rational	Peak discharge (cfs)	= 14.37
Storm frequency (yrs)	= 100	Time interval (min)	= 1
Drainage area (ac)	= 3.090	Runoff coeff. (C)	= 0.87
Rainfall Inten (in/hr)	= 5.347	Tc by User (min)	= 19
IDF Curve	= DCM-TimeIntensity .IDF	Rec limb factor	= 1.00

Hydrograph Volume = 16,387 (cuft); 0.376 (acft)

Runoff Hydrograph



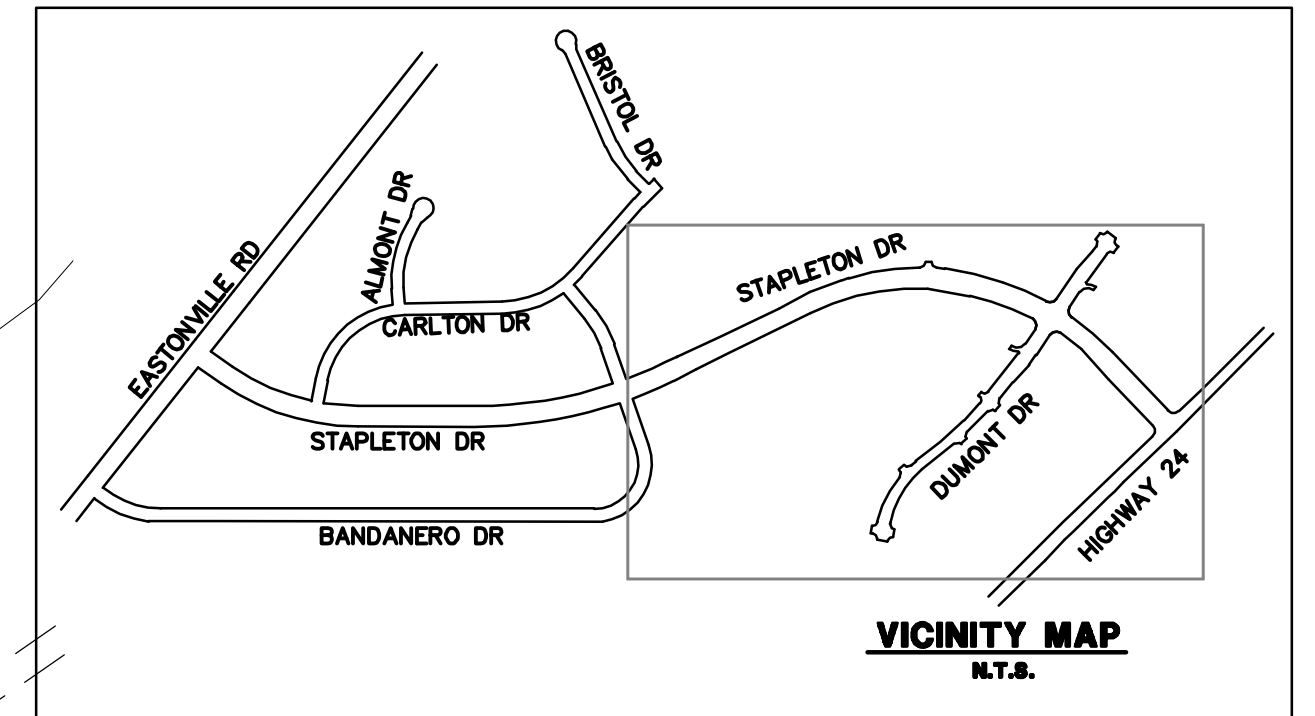
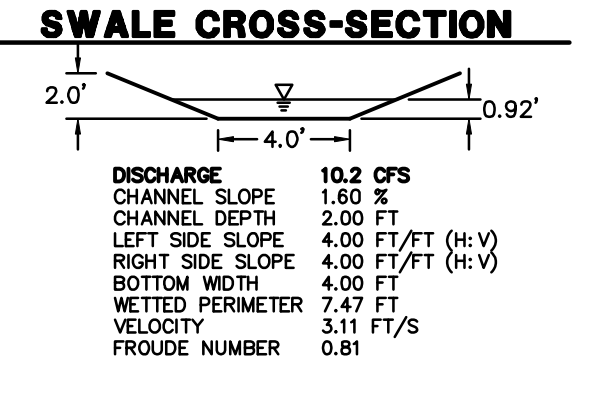
* Estimated



- LEGEND**
- PIPE
 - FLARED END SECTION
 - DRAINAGE BASIN BOUNDARY
 - EXISTING 5' CONTOUR
 - EXISTING 1' CONTOUR
 - PROPOSED 5' CONTOUR
 - PROPOSED 1' CONTOUR
 - BASIN ID
 - C_s VALUE
 - C₁₀₀ VALUE
 - AREA (ACRES)
 - DESIGN POINT
 - STORM DRAIN DESIGN POINT
 - HISTORIC
 - DEVELOPED
 - FUTURE

MERIDIAN RANCH + 4-WAY FILING 1
 Q100(H): 0 + 170 = 170 cfs
 Q100(D): 0 + 250 = 250 cfs

MERIDIAN RANCH + 4-WAY FILING 1 FLOWS
 Q100(H): 429 + 40 = 469 cfs
 Q100(D): 349 + 18 = 367 cfs
 Q100(F): 201 + 20 = 221 cfs



BASIN	AREA (AC)	C _s	C ₁₀₀	Q ₅ (CFS)	Q ₁₀₀ (CFS)
A	8.40	0.02	0.24	0.6	12.1
B	10.54	0.02	0.24	0.7	14.2
C	13.15	0.02	0.24	0.9	19.0
D	16.83	0.02	0.24	1.1	22.2
E	9.64	0.02	0.24	0.6	12.9
F	5.83	0.06	0.28	1.2	10.3
J	1.35	0.89	0.95	5.0	9.5
K	1.61	0.89	0.95	6.4	12.2
L	0.47	0.89	0.95	2.1	4.1
M	0.71	0.89	0.95	3.2	6.1
P	0.22	0.02	0.24	0.0	0.4
Q	0.3	0.02	0.24	0.1	0.6
R	1.55	0.90	0.96	6.9	13.2
S	1.24	0.90	0.96	5.5	10.4
X-1	0.83	0.89	0.95	3.6	6.9
X-2	0.52	0.89	0.95	2.3	4.5
Y-1	0.77	0.89	0.95	3.2	6.0
Y-2	0.72	0.89	0.95	3.0	5.6

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

DESIGN POINT	Q _{100,0} (CFS)	Q _{100,+1} (CFS)
13	13.2	18.0
HC-2	511.6	521.0

STORM DRAIN	CONTRIBUTING FLOWS	Q ₅ (CFS)	Q ₁₀₀ (CFS)
SD-1	J	5.0	8.5
SD-2	2, SD-1	11.2	18.1
SD-3	1	2.1	4.1
SD-4	3, SD-3	5.5	11.9
SD-7	6	6.9	13.2
SD-8	7, SD-7	12.4	23.6
SD-9	9	6.1	11.6

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE AGENCIES, JR ENGINEERING APPROVES THE BUSINESS DESIGNATED BY WRITTEN AUTHORIZATION.

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

JR ENGINEERING
 A Weisman Company
 7200 S. Alton Way, Suite C100 • Centennial, CO 80112
 303-740-9993 • Fax: 303-721-9019
 www.jrengineering.com

BY	DATE
TAB	5/11/10

No.	REVISION	Comments
1	Per CDOT	Comments

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

4 WAY RANCH COMMERCIAL STAPLETON ROAD INTERIM OVERALL DRAINAGE PLAN

SHEET 1 OF 1
 JOB NO. 29931.24

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

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
1-800-922-1987
 UTILITY NOTIFICATION CENTER OF COLORADO
 GAS, ELECTRIC, WATER AND WASTEWATER

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

PRELIMINARY NOT FOR CONSTRUCTION

STEVE ROSSOLL, COLORADO P.E. #34655 DATE

EXCERPTS FROM

"FINAL DRAINAGE REPORT FOR
WATERBURY FILING NO. 1"

TERRA NOVA ENGINEERING (MARCH 2025)

**FINAL DRAINAGE REPORT FOR
WATERBURY FILING NO. 1
EL PASO COUNTY, COLORADO**

**PCD FILE NO:
SF237**

MARCH 2025

Prepared For:

Prepared for:
ACM ALF VIII JV SUB II LLC
4100 E. MISSISSIPPI AVE., STE 500
DENVER, CO 80246
Contact: Jason Pock

Prepared By:

TERRA NOVA ENGINEERING, INC.
721 S. 23rd ST.
Colorado Springs, CO 80904
Contact: Quentin Armijo

Job No. 2356.00

47	6920.50	6919.03	1.47
48	6921.00	6919.39	1.61
49	6921.00	6919.39	1.61
75	6928.00	6924.05	3.95
88	6928.00	6924.73	3.27
89	6929.00	6926.65	2.35
90	6934.00	6932.59	1.41
91	6935.00	6933.84	1.16
92	6939.00	6937.50	1.50
113	6941.00	6939.43	1.57
131	6964.00	6962.36	1.64
132	6962.00	6959.85	2.15
133	6961.00	6957.55	3.45
134	6960.00	6957.55	2.45
135	6958.00	6956.33	1.67
136	6957.00	6953.20	3.80
137	6954.00	6951.80	2.20
150	6952.00	6949.64	2.36
151	6951.00	6948.23	2.77
152	6949.00	6945.90	3.10
153	6948.00	6942.34	5.66
154	6947.00	6942.22	4.78
155	6945.00	6942.22	2.78
156	6943.00	6939.22	3.78
157	6943.00	6939.22	3.78
158	6942.00	6939.22	2.78
159	6942.00	6937.11	4.89
160	6941.00	6936.21	4.79
161	6941.00	6936.21	4.79
162	6940.00	6934.12	5.88
163	6938.00	6934.12	3.88
164	6937.00	6932.39	4.61
165	6936.00	6932.39	3.61

WEST CHANNEL WITH POND FAILURE FOR CDOT ANALYSIS OF DOWNSTREAM

An analysis of the west channel was performed based upon the 100-year flow in the channel (216 cfs) and the runoff from the emergency spillway of Pond 1 (59.9 cfs) and outlet release (14.6 cfs) of in case of failure in the pond to check for any potential downstream impacts to Highway 24 and the CDOT drainage facilities. The flow was increased at the downstream RS x-section of the emergency

spillway at 10200 from 216 cfs to 290.5 cfs (59.9 + 14.6). The RS x-sections for this analysis were taken from the original HEC RAS analysis above and added 10000 to each one to accommodate the downstream stations. The results show the flow full through the existing 2-30” culverts at the Rock Island trail just north of Highway 24 and overtops the berm of the trail. The flow also shows the existing 4’ x 4’ concrete culvert at Highway 24 and cannot pass all of this flow and the highway 24 is overtopped by 0.22’ of runoff sheet flowing over the Highway. All this happens in the 100-year storm, with Pond 1 filling up to the 100-year capacity, releasing the 100-year allowable historic flow and also assuming that the 100-peak somehow is not detained and is released in the emergency spillway See appendix for results and RS x-section exhibit.

FILING 1 CONSTRUCTION COST OPINION

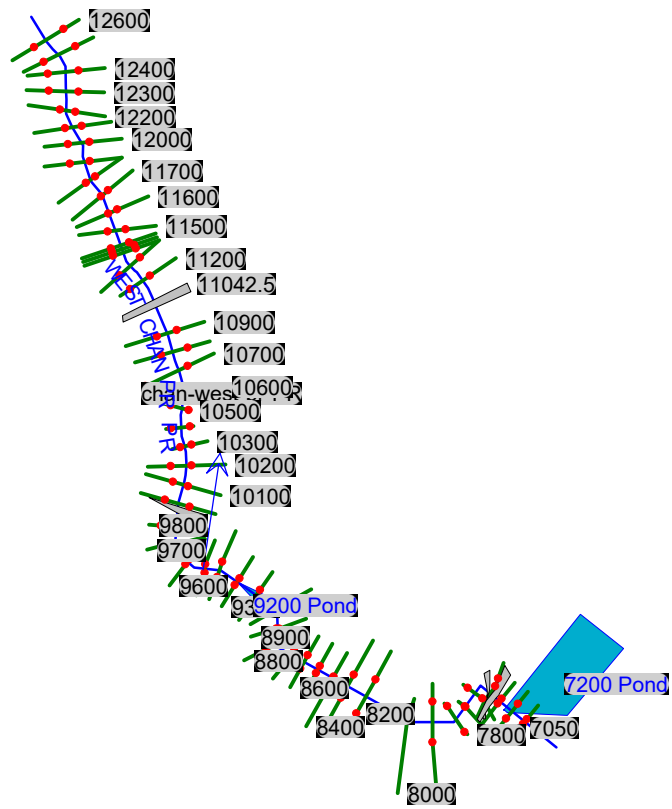
Private Drainage Facilities Improvements, Non-Reimbursable

	Item	Quantity	Unit Price	Cost
1.	12” HDPE	1126 LF	\$ 14/LF	\$ 15,769
2.	18” DIA INLET	12 EA	\$ 1500/EA	\$ 18,000
3.	18” RCP	465 LF	\$ 82/LF	\$ 38,130
4.	24” RCP	46 LF	\$ 98/LF	\$ 4,508
5.	36” RCP	210 LF	\$ 151/LF	\$ 31,745
6.	FES: 24”	2 EA	\$ 588/EA	\$ 1,176
7.	FES: 36”	1 EA	\$ 906/EA	\$ 906
7.	SWALE 4’x2’	565 LF	\$ 30/LF	\$ 16,950
8.	RIPRAP d30	0.83 TONS	\$ 104/TONS	\$ 87
9.	Drainage Channel Lining, Riprap	381 CY	\$135/CY	\$ 51,435
			Total	\$ 178,706

Public Drainage Facilities Improvements, Non-Reimbursable

	<u>Item</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Cost</u>
1.	15” RCP	66 LF	\$74/LF	\$ 4,911
2.	18” RCP	1,491 LF	\$82/LF	\$ 122,241
3.	24” RCP	795 LF	\$98/LF	\$ 77,944
4.	30” RCP	1,664 LF	\$123/LF	\$ 204,697
5.	36” RCP	2,619 LF	\$151/LF	\$ 395,418

PROPOSED WEST CHANNEL 100-Y W/ POND FAILURES



PROPOSED WEST CHANNEL 100-Y W/ POND FAILURES

HEC-RAS Plan: PR River: WEST CHAN PR PR Reach: chan-west-pr-PR Profile: PF 1

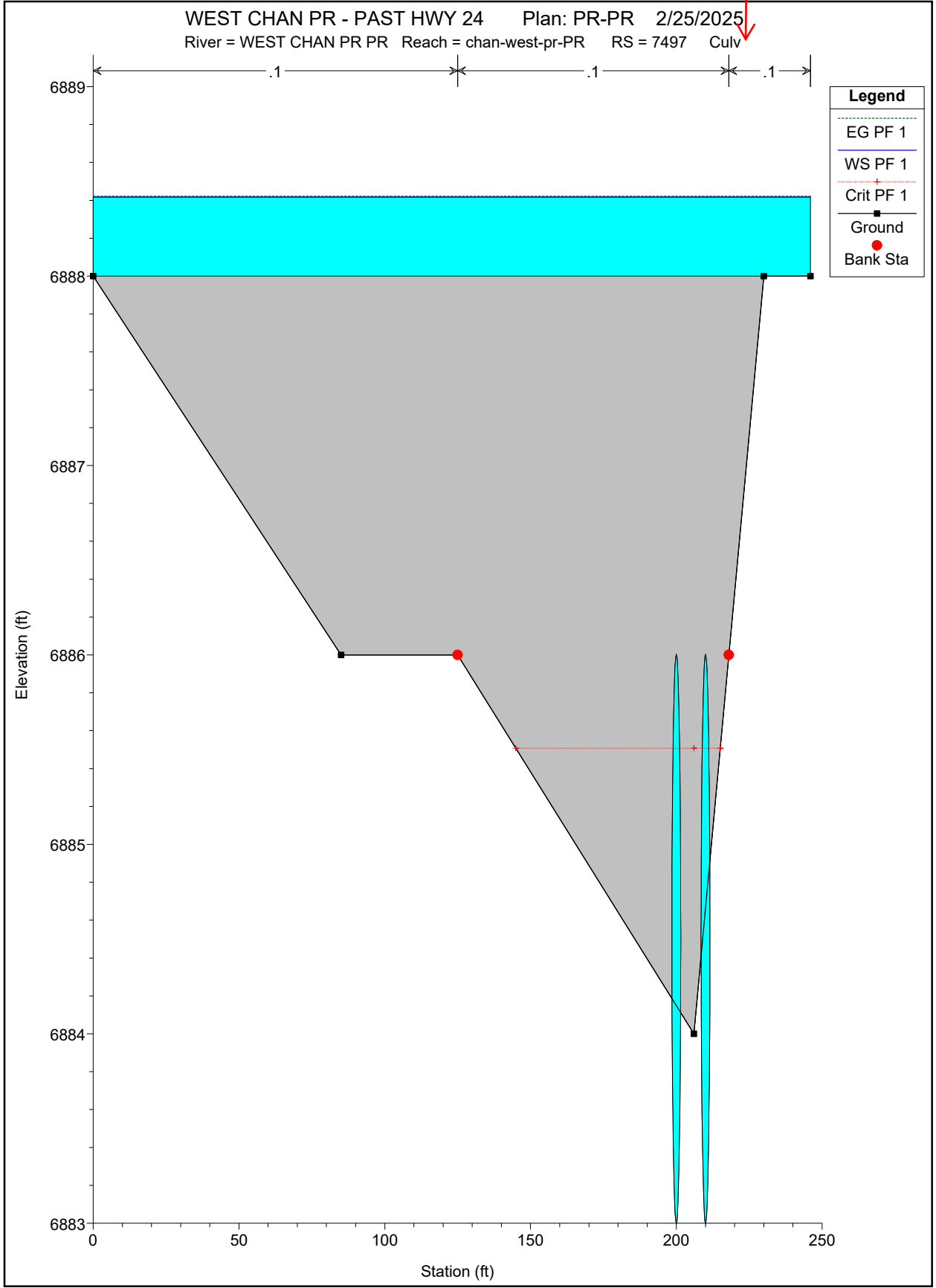
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
chan-west-pr-PR	12600	PF 1	216.00	6966.83	6967.84		6967.92	0.019298	2.35	91.77	162.15	0.55
chan-west-pr-PR	12500	PF 1	216.00	6964.90	6965.80		6965.90	0.021156	2.58	83.56	137.43	0.58
chan-west-pr-PR	12400	PF 1	216.00	6963.25	6964.29		6964.36	0.011605	2.07	104.20	152.72	0.44
chan-west-pr-PR	12300	PF 1	216.00	6961.27	6962.38		6962.52	0.033590	2.97	72.63	136.85	0.72
chan-west-pr-PR	12200	PF 1	216.00	6958.46	6959.77		6959.92	0.020750	3.12	74.33	122.34	0.61
chan-west-pr-PR	12100	PF 1	216.00	6955.98	6957.61		6957.78	0.022067	3.33	64.96	75.51	0.63
chan-west-pr-PR	12000	PF 1	216.00	6954.57	6956.24		6956.33	0.009980	2.38	90.64	95.81	0.43
chan-west-pr-PR	11900	PF 1	216.00	6952.76	6954.55	6954.40	6954.72	0.030195	3.25	66.42	100.94	0.71
chan-west-pr-PR	11800	PF 1	216.00	6949.31	6951.82		6952.04	0.023942	3.79	57.03	57.62	0.67
chan-west-pr-PR	11700	PF 1	216.00	6947.11	6949.61		6949.86	0.019906	4.02	53.71	42.97	0.63
chan-west-pr-PR	11600	PF 1	216.00	6945.84	6948.14		6948.31	0.012252	3.25	67.02	59.07	0.50
chan-west-pr-PR	11500	PF 1	216.00	6944.91	6947.09		6947.19	0.009984	2.42	89.37	92.48	0.43
chan-west-pr-PR	11420.03	PF 1	216.00	6944.06	6945.20	6945.20	6945.52	0.064325	4.54	47.55	77.24	1.02
chan-west-pr-PR	11400	PF 1	216.00	6942.00	6942.85		6942.94	0.012119	2.41	89.80	107.97	0.46
chan-west-pr-PR	11379.97	PF 1	216.00	6941.43	6942.19	6942.19	6942.44	0.068031	4.04	53.48	108.10	1.01
chan-west-pr-PR	11300	PF 1	216.00	6939.98	6942.23		6942.24	0.000425	0.83	261.06	126.04	0.10
chan-west-pr-PR	11200	PF 1	216.00	6938.82	6942.20	6939.60	6942.21	0.000209	0.71	306.22	110.15	0.07
chan-west-pr-PR	11042.5		Culvert									
chan-west-pr-PR	10900	PF 1	216.00	6934.00	6936.49		6936.53	0.010071	1.68	128.34	106.54	0.27
chan-west-pr-PR	10800	PF 1	216.00	6934.00	6935.64		6935.67	0.007563	1.38	156.86	144.60	0.23
chan-west-pr-PR	10700	PF 1	216.00	6932.83	6934.24	6933.91	6934.32	0.030748	2.32	99.53	146.12	0.45
chan-west-pr-PR	10600	PF 1	216.00	6930.96	6932.46		6932.50	0.011636	1.72	149.30	191.95	0.29
chan-west-pr-PR	10500	PF 1	216.00	6928.39	6929.68	6929.56	6929.90	0.100808	3.75	57.67	81.46	0.78
chan-west-pr-PR	10400	PF 1	216.00	6924.96	6927.33		6927.39	0.010868	1.93	112.01	80.45	0.29
chan-west-pr-PR	10300	PF 1	216.00	6923.02	6924.21	6924.21	6924.61	0.161997	5.09	42.47	54.04	1.01
chan-west-pr-PR	10200	PF 1	290.50	6919.08	6921.10		6921.16	0.011548	2.06	141.06	96.13	0.30
chan-west-pr-PR	10100	PF 1	290.50	6917.36	6920.58		6920.62	0.003103	1.48	200.17	100.06	0.17
chan-west-pr-PR	10000	PF 1	290.50	6918.00	6919.27	6919.27	6919.62	0.170378	4.76	61.00	89.13	1.01
chan-west-pr-PR	9915		Culvert									
chan-west-pr-PR	9800	PF 1	290.50	6915.00	6917.02		6917.11	0.022710	2.37	122.67	112.71	0.40
chan-west-pr-PR	9700	PF 1	290.50	6912.70	6915.42	6914.65	6915.50	0.012291	2.67	144.44	134.62	0.33
chan-west-pr-PR	9600	PF 1	290.50	6911.00	6912.57	6912.54	6912.87	0.100387	4.93	72.07	102.07	0.84
chan-west-pr-PR	9500	PF 1	290.50	6907.80	6911.13		6911.21	0.006463	2.30	136.08	71.53	0.25
chan-west-pr-PR	9400	PF 1	290.50	6907.00	6910.40		6910.46	0.008532	1.97	155.33	135.31	0.26
chan-west-pr-PR	9300	PF 1	290.50	6905.00	6907.56	6907.56	6908.21	0.138923	6.48	44.80	34.99	1.01
chan-west-pr-PR	9200	PF 1	290.50	6902.00	6905.82		6905.89	0.007939	2.15	134.93	64.52	0.26

PROPOSED WEST CHANNEL 100-Y W/ POND FAILURES

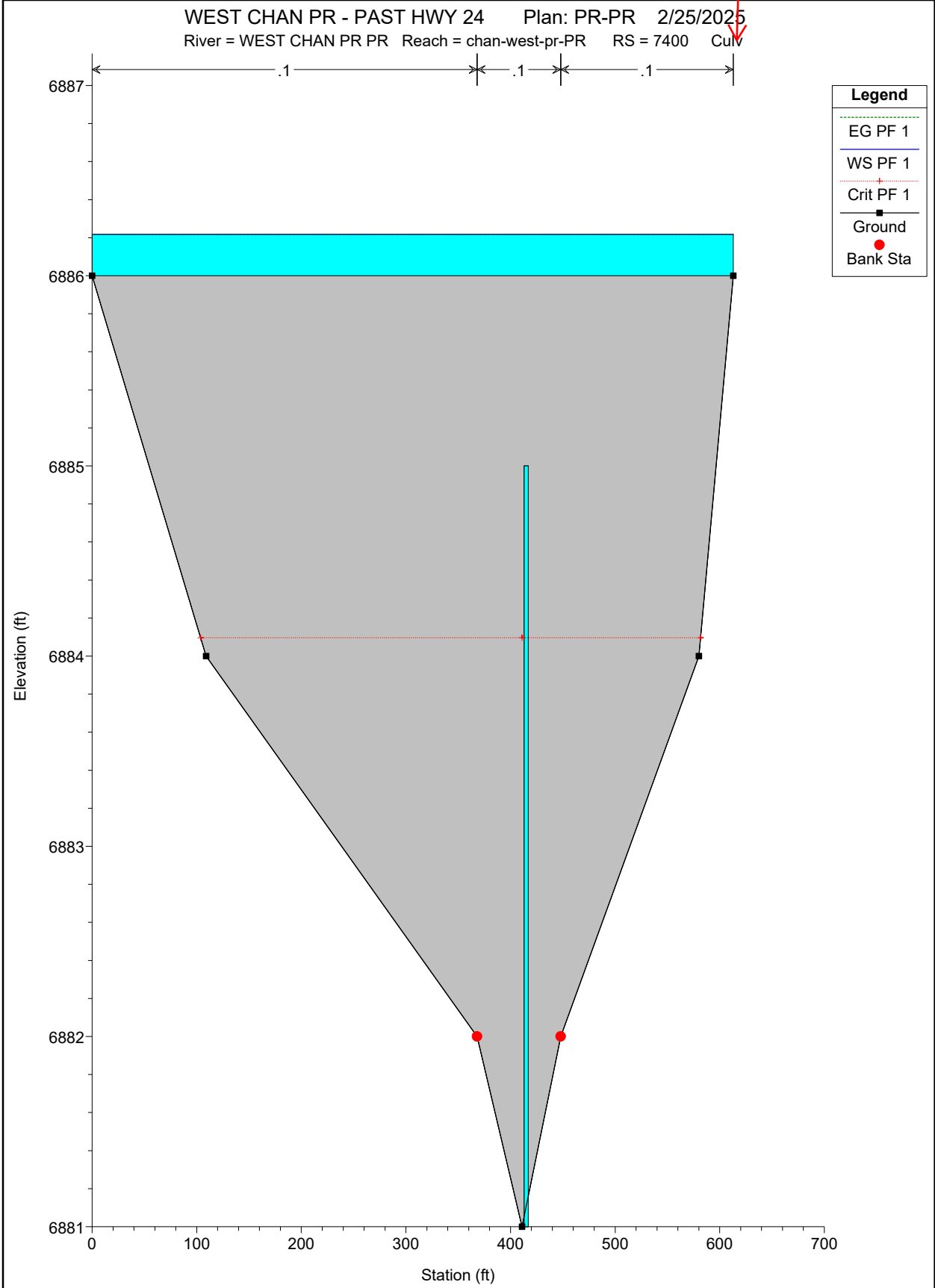
HEC-RAS Plan: PR River: WEST CHAN PR PR Reach: chan-west-pr-PR Profile: PF 1 (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
chan-west-pr-PR	9000	PF 1	290.50	6902.00	6905.07		6905.13	0.007248	2.05	178.71	172.88	0.25
chan-west-pr-PR	8900	PF 1	290.50	6901.00	6903.08	6903.08	6903.40	0.085842	5.85	76.67	117.58	0.82
chan-west-pr-PR	8800	PF 1	290.50	6898.00	6900.23		6900.29	0.011119	1.98	146.47	102.56	0.29
chan-west-pr-PR	8700	PF 1	290.50	6895.80	6899.21		6899.29	0.009019	2.31	125.98	59.71	0.28
chan-west-pr-PR	8600	PF 1	290.50	6895.00	6898.44		6898.50	0.006950	1.90	159.50	119.19	0.24
chan-west-pr-PR	8500	PF 1	290.50	6894.50	6897.53		6897.63	0.011068	2.70	128.33	103.32	0.32
chan-west-pr-PR	8400	PF 1	290.50	6893.60	6895.44		6895.62	0.045214	4.39	95.35	112.00	0.60
chan-west-pr-PR	8300	PF 1	290.50	6892.60	6893.91		6893.93	0.008398	1.43	252.49	386.92	0.24
chan-west-pr-PR	8200	PF 1	290.50	6891.50	6892.45		6892.51	0.028930	1.99	151.67	249.74	0.42
chan-west-pr-PR	8000	PF 1	290.50	6887.80	6889.52		6889.54	0.009019	1.94	243.38	316.42	0.27
chan-west-pr-PR	7900	PF 1	290.50	6887.80	6889.12		6889.13	0.002461	0.84	385.07	401.20	0.13
chan-west-pr-PR	7800	PF 1	290.50	6886.70	6888.81		6888.83	0.003590	1.15	264.13	199.00	0.17
chan-west-pr-PR	7700	PF 1	290.50	6885.80	6888.49		6888.50	0.002992	1.53	277.98	193.00	0.17
chan-west-pr-PR	7600	PF 1	290.50	6884.00	6888.42	6885.56	6888.42	0.000344	0.62	558.58	246.00	0.06
chan-west-pr-PR	7497		Culvert									
chan-west-pr-PR	7460	PF 1	290.50	6881.00	6886.22	6882.28	6886.22	0.000026	0.21	1808.20	613.00	0.02
chan-west-pr-PR	7400		Culvert									
chan-west-pr-PR	7300	PF 1	290.50	6875.80	6879.22		6879.38	0.012950	3.22	94.63	44.32	0.35
chan-west-pr-PR	7200	PF 1	290.50	6874.80	6879.24		6879.25	0.000298	0.63	543.46	213.74	0.06
chan-west-pr-PR	7050	PF 1	290.50	6877.00	6878.78	6878.78	6879.06	0.079079	4.93	81.94	138.45	0.77

100-YEAR FLOW ANALYSIS AT DUAL 36" CULVERT CROSSING AT ROCK ISLAND TRAIL



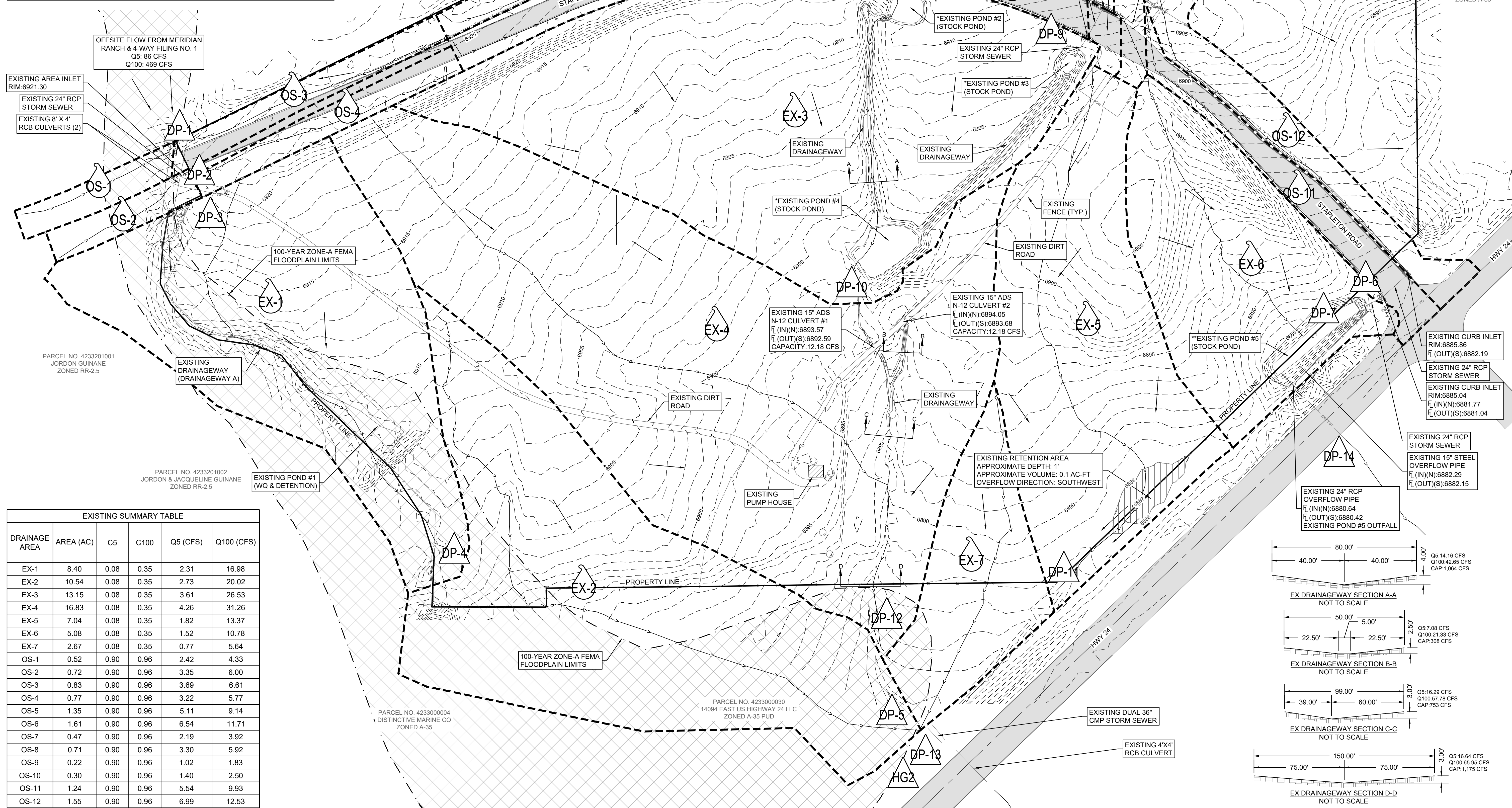
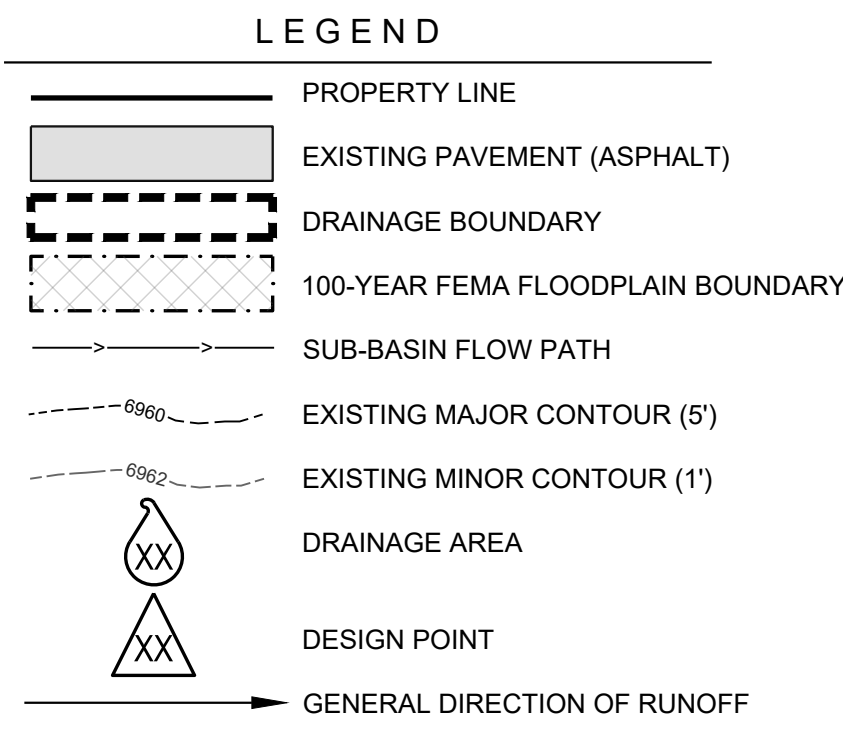
**100-YEAR FLOW ANALYSIS AT 4'X4' RCBC
CULVERT CROSSING AT HWY 24**



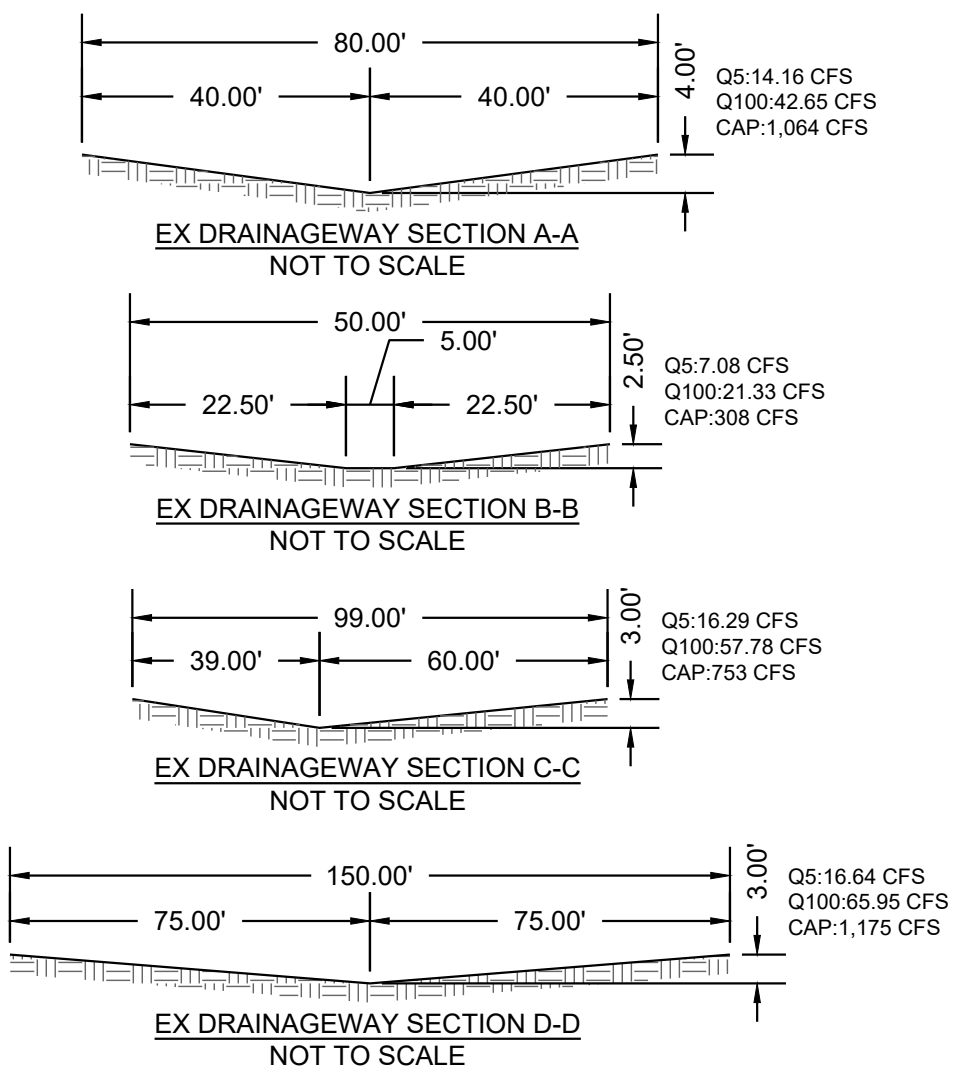
DRAINAGE MAPS

DESIGN POINT	CONTRIBUTING SUB-BASINS	AREA (AC)	C5	C100	Q5 (CFS)	Q100 (CFS)
EX-DP-1	OS-1, OS-3	1.35	0.90	0.96	6.00	10.74
EX-DP-2	OS-2, OS-4	1.49	0.90	0.96	6.24	11.17
EX-DP-3	EX-DP-1, EX-DP-2	2.84	0.90	0.96	11.71	20.97
EX-DP-4	EX-1, EX-DP-3	11.24	0.29	0.50	9.97	29.37
EX-DP-5	EX-2, EX-DP-4	21.78	0.19	0.43	11.21	43.23
EX-DP-6	OS-11, OS-12	2.79	0.90	0.96	12.47	22.34
EX-DP-7	EX-6, OS-10, EX-DP-6	8.17	0.39	0.58	11.49	28.64
EX-DP-8	OS-5, OS-6	2.96	0.90	0.96	11.19	20.05
EX-DP-9	OS-7, OS-8	1.18	0.90	0.96	5.49	9.83
EX-DP-10	EX-3, EX-DP-8, EX-DP-9	17.29	0.28	0.50	14.16	42.65
EX-DP-11	EX-5, OS-9	7.26	0.10	0.37	2.44	14.42
EX-DP-12	EX-4, EX-DP-10	34.12	0.18	0.42	16.64	65.95
EX-DP-13	EX-7, EX-DP-5, EX-DP-11, EX-DP-12	65.84	0.17	0.42	29.67	122.28
EX-DP-14	EX-DP-7	8.17	0.39	0.58	1.95	8.73
HG2	EX-DP-13, OFFSITE*	-	-	-	102.65	541.99

* INCLUDES OFFSITE FLOW FROM MERIDIAN RANCH AND 4-WAY FILING NO. 1, SEE OFFSITE CALCULATIONS



DRAINAGE AREA	AREA (AC)	C5	C100	Q5 (CFS)	Q100 (CFS)
EX-1	8.40	0.08	0.35	2.31	16.98
EX-2	10.54	0.08	0.35	2.73	20.02
EX-3	13.15	0.08	0.35	3.61	26.53
EX-4	16.83	0.08	0.35	4.26	31.26
EX-5	7.04	0.08	0.35	1.82	13.37
EX-6	5.08	0.08	0.35	1.52	10.78
EX-7	2.67	0.08	0.35	0.77	5.64
OS-1	0.52	0.90	0.96	2.42	4.33
OS-2	0.72	0.90	0.96	3.35	6.00
OS-3	0.83	0.90	0.96	3.69	6.61
OS-4	0.77	0.90	0.96	3.22	5.77
OS-5	1.35	0.90	0.96	5.11	9.14
OS-6	1.61	0.90	0.96	6.54	11.71
OS-7	0.47	0.90	0.96	2.19	3.92
OS-8	0.71	0.90	0.96	3.30	5.92
OS-9	0.22	0.90	0.96	1.02	1.83
OS-10	0.30	0.90	0.96	1.40	2.50
OS-11	1.24	0.90	0.96	5.54	9.93
OS-12	1.55	0.90	0.96	6.99	12.53



SMH CONSULTANTS
 Civil Engineering • Land Surveying
 Landscape Architecture
 Manhattan, KS - HQ
 (785) 776-0541
 Dodge City, KS
 (620) 255-1952
 Kansas City
 (913) 444-9615
 Colorado Springs, CO
 (719) 465-2145

4-WAY COMMERCIAL
 FINAL DRAINAGE REPORT
 EL PASO COUNTY, CO

REVISION DESCRIPTION (DESCRIPTION)
 0000000
 NORTH
 PROJECT #: 2412-0471
 CHECKED BY: BML
 DRAWN BY: EDM
 DATE: 06/11/2026
 SHEET # **1**
 TOTAL SHEETS 2

EXISTING POND NOTES:
 * PONDS 2-4 WERE CONSTRUCTED IN 2007 AS TEMPORARY SEDIMENT BASINS FOR THE CONSTRUCTION OF STAPLETON ROAD. THEY DO NOT MEET THE EL PASO COUNTY DCM CODE STANDARDS FOR PERMANENT WATER QUALITY TREATMENT AND DO NOT CONTAIN OUTLET STRUCTURES. THESE PONDS WILL REMAIN UNDISTURBED AND BE BROUGHT TO COUNTY STANDARDS WHEN THE SITE IS FURTHER DEVELOPED. NO RUNOFF FROM THE SITE IS TRIBUTARY TO THESE PONDS.
 ** POND 5 DOES NOT MEET EL PASO COUNTY DCM CODE STANDARDS FOR PERMANENT WATER QUALITY TREATMENT. DUE TO EXISTING SITE CONSTRAINTS (INLET AND OUTLET ELEVATIONS) THE POND CANNOT BE BROUGHT TO COUNTY STANDARDS WITHOUT DISTURBANCE TO US HWY 24 AND WILL BE LEFT UNDISTURBED. A SMALL PORTION OF SITE RUNOFF REACHES THIS POND, AND IS CONSIDERED UNTREATED.

PROPOSED DESIGN POINT SUMMARY TABLE						
DESIGN POINT	CONTRIBUTING SUB-BASINS	AREA (AC)	C5	C100	Q5 (CFS)	Q100 (CFS)
DP-1	OS-1, OS-3	1.35	0.90	0.96	6.00	10.74
DP-2	OS-2, OS-4	1.49	0.90	0.96	6.24	11.17
DP-3	DP-1, DP-2	2.84	0.90	0.96	11.71	20.97
DP-4	P-1, DP-3	11.24	0.29	0.50	9.97	29.37
DP-5	P-2, DP-4	21.78	0.19	0.43	11.21	43.23
DP-6	OS-9, P-11	3.54	0.74	0.84	11.30	21.55
DP-7	P-12, DP-6	4.79	0.57	0.72	11.04	23.21
DP-8	OS-5, OS-6	2.96	0.90	0.96	11.19	20.05
DP-9	OS-7, OS-8	1.18	0.90	0.96	5.49	9.83
DP-10	P-3, DP-8, DP-9	17.29	0.28	0.50	14.16	42.65
DP-11	P-5, P-6, P-7, P-8, P-9, P-14	12.55	0.69	0.79	31.51	61.08
DP-12	DP-12	12.55	0.69	0.79	0.40	4.70
DP-13	P-4, DP-10, DP-12	44.98	0.33	0.54	17.47	68.82
DP-14	P-13	0.94	0.08	0.35	0.33	2.44
DP-15	P-10, DP-5, DP-13, DP-14	69.22	0.28	0.50	28.06	111.53
DP-16	DP-7	4.79	0.57	0.72	1.20	3.69
HG2	DP-15, OFFSITE*	-	-	-	102.16	538.42

* INCLUDES OFFSITE FLOW FROM MERIDIAN RANCH AND 4-WAY FILING NO. 1, SEE OFFSITE CALCULATIONS

LEGEND

- PROPERTY LINE
- DRAINAGE BOUNDARY
- SUB-BASIN FLOW PATH
- EXISTING MAJOR CONTOUR (5')
- EXISTING MINOR CONTOUR (1')
- PROPOSED MAJOR CONTOUR (5')
- PROPOSED MINOR CONTOUR (1')
- DRAINAGE AREA
- DESIGN POINT
- STORM SEWER DESIGN POINT
- GENERAL DIRECTION OF RUNOFF

HATCH LEGEND

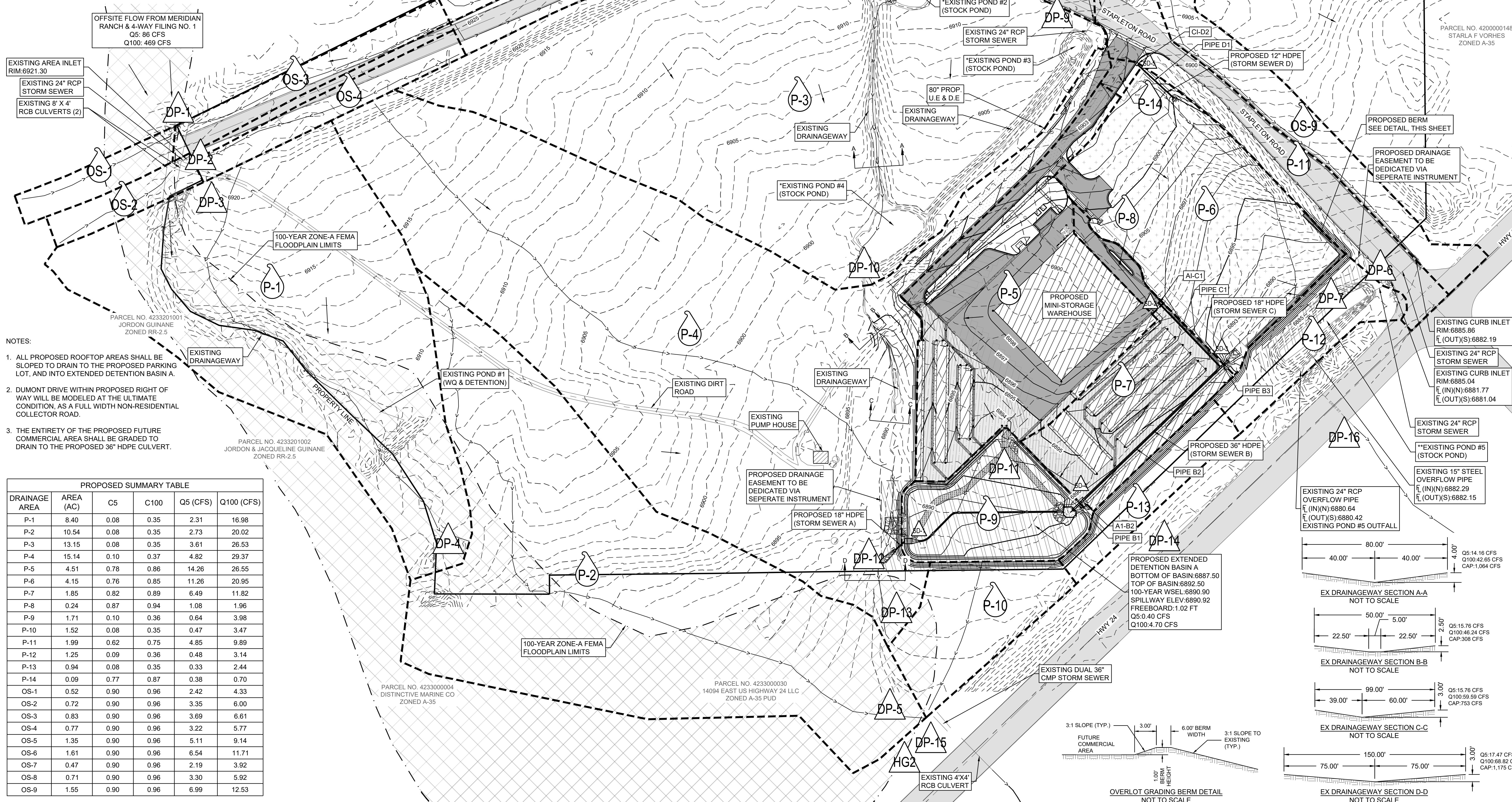
- EXISTING PAVEMENT (ASPHALT)
- PROPOSED PAVEMENT (ASPHALT)
- PROPOSED PAVEMENT (ASPH. MILLINGS)
- PROPOSED BUILDING
- PROPOSED FUTURE COMMERCIAL AREA
- 100-YEAR FEMA FLOODPLAIN BOUNDARY
- PROPOSED UTILITY & DRAINAGE EASEMENT
- PROPOSED DRAINAGE EASEMENT

PROPOSED STORM DESIGN POINT SUMMARY TABLE						
STORM DESIGN POINT	CONTRIBUTING SUB-BASINS	AREA (AC)	C5	C100	Q5 (CFS)	Q100 (CFS)
SD-1	DP-12	12.55	0.69	0.79	0.40	4.70
SD-2	P-8	0.24	0.87	0.94	1.08	1.96
SD-3	P-6, P-14	4.25	0.77	0.85	11.63	21.65
SD-4	P-6, P-7, P-8, P-14	6.33	0.78	0.86	19.20	35.43
SD-5	P-14	0.09	0.77	0.87	0.38	0.70

EXISTING POND NOTES:

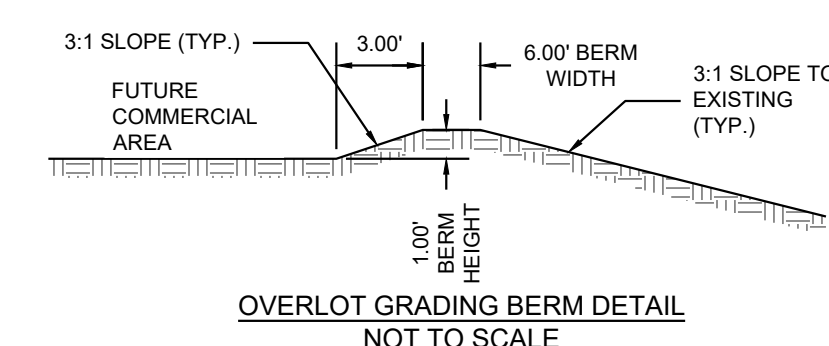
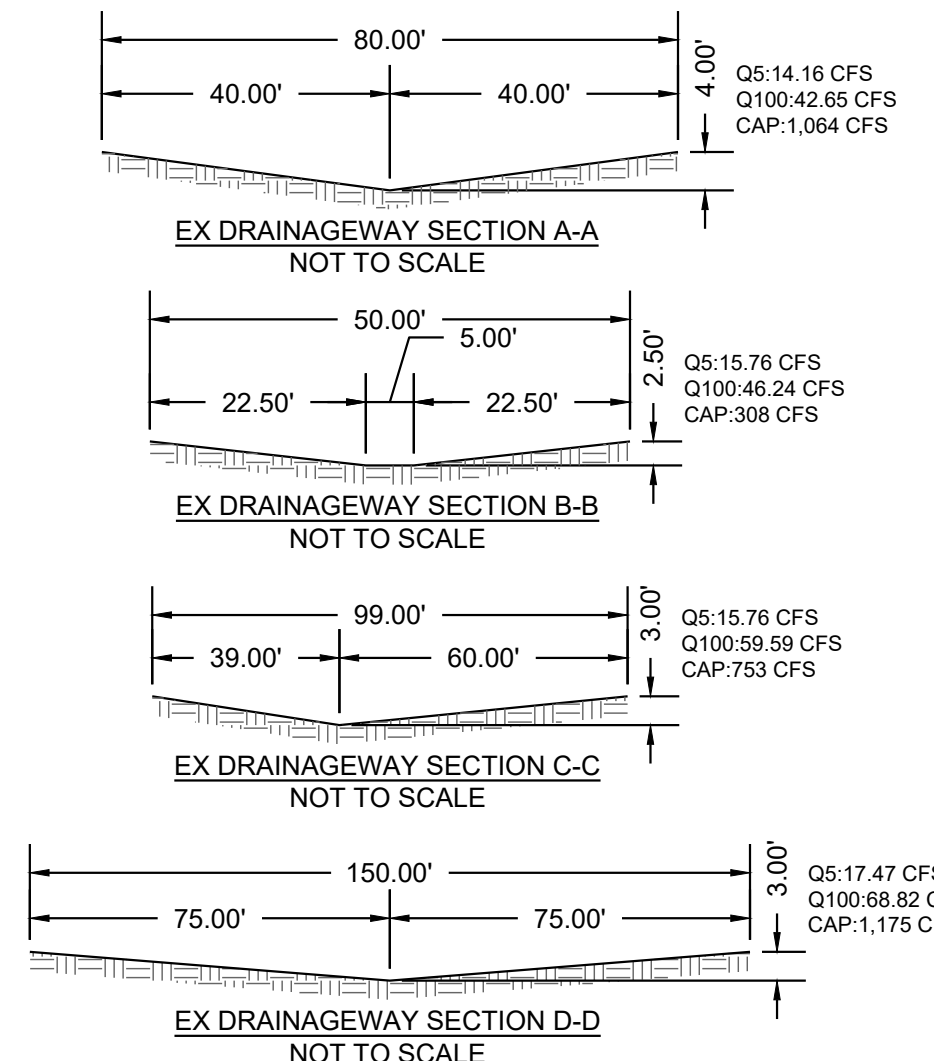
* PONDS 2-4 WERE CONSTRUCTED IN 2007 AS TEMPORARY SEDIMENT BASINS FOR THE CONSTRUCTION OF STAPLETON ROAD. THEY DO NOT MEET THE EL PASO COUNTY DCM CODE STANDARDS FOR PERMANENT WATER QUALITY TREATMENT AND DO NOT CONTAIN OUTLET STRUCTURES. THESE PONDS WILL REMAIN UNDISTURBED AND BE BROUGHT TO COUNTY STANDARDS WHEN THE SITE IS FURTHER DEVELOPED. NO RUNOFF FROM THE SITE IS TRIBUTARY TO THESE PONDS.

** POND 5 DOES NOT MEET EL PASO COUNTY DCM CODE STANDARDS FOR PERMANENT WATER QUALITY TREATMENT. DUE TO EXISTING SITE CONSTRAINTS (INLET AND OUTLET ELEVATIONS) THE POND CANNOT BE BROUGHT TO COUNTY STANDARDS WITHOUT DISTURBANCE TO US HWY 24 AND WILL BE LEFT UNDISTURBED. A SMALL PORTION OF SITE RUNOFF REACHES THIS POND, AND IS CONSIDERED UNTREATED.



- NOTES:**
- ALL PROPOSED ROOFTOP AREAS SHALL BE SLOPED TO DRAIN TO THE PROPOSED PARKING LOT, AND INTO EXTENDED DETENTION BASIN A.
 - DUMONT DRIVE WITHIN PROPOSED RIGHT OF WAY WILL BE MODELED AT THE ULTIMATE CONDITION, AS A FULL WIDTH NON-RESIDENTIAL COLLECTOR ROAD.
 - THE ENTIRETY OF THE PROPOSED FUTURE COMMERCIAL AREA SHALL BE GRADED TO DRAIN TO THE PROPOSED 36" HDPE CULVERT.

PROPOSED SUMMARY TABLE					
DRAINAGE AREA	AREA (AC)	C5	C100	Q5 (CFS)	Q100 (CFS)
P-1	8.40	0.08	0.35	2.31	16.98
P-2	10.54	0.08	0.35	2.73	20.02
P-3	13.15	0.08	0.35	3.61	26.53
P-4	15.14	0.10	0.37	4.82	29.37
P-5	4.51	0.78	0.86	14.26	26.55
P-6	4.15	0.76	0.85	11.26	20.95
P-7	1.85	0.82	0.89	6.49	11.82
P-8	0.24	0.87	0.94	1.08	1.96
P-9	1.71	0.10	0.36	0.64	3.98
P-10	1.52	0.08	0.35	0.47	3.47
P-11	1.99	0.62	0.75	4.85	9.89
P-12	1.25	0.09	0.36	0.48	3.14
P-13	0.94	0.08	0.35	0.33	2.44
P-14	0.09	0.77	0.87	0.38	0.70
OS-1	0.52	0.90	0.96	2.42	4.33
OS-2	0.72	0.90	0.96	3.35	6.00
OS-3	0.83	0.90	0.96	3.69	6.61
OS-4	0.77	0.90	0.96	3.22	5.77
OS-5	1.35	0.90	0.96	5.11	9.14
OS-6	1.61	0.90	0.96	6.54	11.71
OS-7	0.47	0.90	0.96	2.19	3.92
OS-8	0.71	0.90	0.96	3.30	5.92
OS-9	1.55	0.90	0.96	6.99	12.53



SMH CONSULTANTS
 Civil Engineering • Land Surveying
 Landscape Architecture
 Manhattan, KS • HQ (785) 776-0541
 Dodge City, KS (620) 255-1952
 Kansas City (913) 444-9615
 Colorado Springs, CO (719) 465-2145

4-WAY COMMERCIAL
 FINAL DRAINAGE REPORT
 EL PASO COUNTY, CO

PROPOSED DRAINAGE MAP

REVISION DATE (DESCRIPTION)
 000000 NORTH

PROJECT #: 2412-0471
 CHECKED BY: BML
 DRAWN BY: EDM

DATE: 06/11/2026
 SHEET # **2**

TOTAL SHEETS 2