EPC STORMWATER REVIEW COMMENTS
IN ORANGE BOXES WITH BLACK TEXT

FINAL DRAINAGE REPORT
FOR
LAZY Y AND ROCKING J SUBDIVISION

September 2024

Prepared For:
Scott Smith
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Project No. 25228.00

PCD Filing No: PPR-2435

J·R ENGINEERING

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 letter has been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

_____ _____

Bryan T. Law, Colorado P.E. # 25043 Date
For and On Behalf of JR Engineering, LLC

DEVELOPER'S STATEMENT:

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

Business Name: Scott Smith

By: _____

Title: _____

Address: 1172 Greenland Forest Drive
Monument, CO 80106

El Paso County:

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

_____ _____

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

Conditions:

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APPENDICES

PURPOSE

This document is the Final Drainage Report for Lazy Y and Rocking J Subdivision. The purpose of this report is to identify on-site and off-site drainage patterns, culverts, areas tributary to the site, and to safely route developed storm water to adequate outfall facilities.

GENERAL SITE DESCRIPTION

GENERAL LOCATION

Lazy Y and Rocking J Subdivision (hereby referred to as the "site") is a proposed development with a total area of approximately 34 acres. The site presently is used as a commercial equipment building. The site is located in the south half of Section 7, Township 12 South, Range 63 West of the Sixth Principal Meridian in El Paso County, State of Colorado. The site is bounded by Peyton Highway to the east, Longhorn Acres Subdivision to the south, and unplatted land to the west and north. Refer to the vicinity map in Appendix A for additional information.

DESCRIPTION OF PROPERTY

The site has a split drainage pattern with a ridge running across the site. The site generally slope(s) as follows: to the north at 1 to 9% off-site to unplatted land, to the northeast at 1 to 15% to the existing roadside ditch along Peyton Highway, and to the south at 1 to 9% off-site to Longhorn Acres Subdivision. The site is currently comprised of gravel roads, a building, a shed, concrete pads, a cell tower, dry utilities, trees and vegetation. A wire fence wraps around the perimeter of the site along the west, north, and east sides.

The proposed site development proposes asphalt and gravel drive aisles, asphalt and gravel parking spaces, tent sites, buildings, concrete sidewalks, two full-spectrum Extended Detention Basins (EDBs) and associated utility infrastructure.

Soils located on the project site are Stapleton sandy loam. These soils are classified as Hydrologic Soil Group B. Group B soils exhibit moderate infiltration rates when thoroughly wet, and consist mainly of moderately deep, moderately well drained to well drained soils. Refer to the soil survey map in Appendix A for additional information.

There are no known irrigation facilities located on the project site.

FLOODPLAIN STATEMENT

Based on the FEMA FIRM Map number 08041C0375G, dated December 7, 2018, the entire site lies within Zone X. Zone X is defined as area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. Refer to the FIRM Map in Appendix A for additional information.

EXISTING DRAINAGE CONDITIONS

MAJOR BASIN DESCRIPTIONS

Based on the map of the Drainage Basins for El Paso County, the site lies within both the Upper Bracket Creek and the La Vega Ranch Drainage Basins. Neither of these basins have been studied, and therefore no Drainage Basin Planning Studies are available. The site is split into two major basins, but the Upper Bracket Creek Basin is tributary to the La Vega Ranch Basin. The La Vega Ranch drainageway flows south about 10 miles where the Hook and Line Ranch Basin, La Vega Ranch Basin, and Baggett Basin combine just north of State Highway 94.

The site generally drains towards the north, northeast, and south from the middle of the site. Brackett Creek is located to the north and east of the site and runs from northwest to southeast. An unnamed tributary of Brackett Creek is located to the south of the site and runs from northwest to southeast. The proposed condition will send more of the site to the proposed full-spectrum extended detention basin to the north, and this will have no impact on the major basins. The additional area going to the Upper Bracket Creek basin is negligible in the overall major basin analysis.

Refer to DCM 1.2.6 regarding Basin Transfer and include the amount of flows that will be transferred from the La Vega Ranch Basin to the Upper Bracket Creek basin.

EXISTING SUB-BASIN DRAINAGE

The existing condition of the site was broken into three on-site sub-basins. The basin delineation is shown on the existing drainage map in Appendix E and is described as follows:

Basin EXA is 7.84 acres with a 2% percent impervious and is located on the northwestern portion of the site. This basin is comprised of existing vegetation and undeveloped area. Runoff from this basin (Q_5=1.8 cfs, Q_{100}=12.3 cfs) sheet flows overland northeast onto the unplatted adjacent property at design point (DP) 1. Runoff then follows historic drainage patterns off-site and eventually outfalls to Brackett Creek.

Basin EXB is 11.2 acres with a 5% percent impervious and is located on the northeastern portion of the site. This basin is comprised of part of gravel roads, buildings, shed, dry utilities, trees, existing vegetation, and undeveloped area. Runoff from this basin (Q_5=3.7 cfs, Q_{100}=21.1 cfs) sheet flows overland northeast to DP2 and along the existing Peyton Hwy roadside swale combining at DP2.1.

Basin OS1 is approximately 0.61 acres with a 42% percent impervious and is comprised of existing west half of Peyton Hwy roadway and swale. Runoff generated by this basin (Q_5=0.9 cfs, Q_{100}=2.2 cfs) flows within the existing swale to DPO1. Flows then combine within the existing Peyton Hwy swale at DP2.1 (Q_5=4.5 cfs, Q_{100}=23.0 cfs). Runoff then follows historic drainage patterns off-site and eventually outfalls to Brackett Creek.

Basin EXC is 14.9 acres with a 4% percent impervious and is located on the southern portion of the site. This basin is comprised of part of gravel roads, building, a cell tower, concrete pads, dry utilities, existing vegetation, and undeveloped area. Runoff from this basin (Q_5=3.9 cfs, Q_{100}=23.2 cfs) sheet flows overland south onto the adjacent Longhorn Acres Subdivision property at DP3. Runoff then follows historic drainage patterns off-site and eventually outfalls to the unnamed tributary of Brackett Creek.

PROPOSED DRAINAGE CONDITIONS

PROPOSED DRAINAGE CONVEYANCE

In general, developed flows are collected in proposed swales, which convey water to the proposed water quality and detention areas, Pond 1 and Pond 2. Proposed swale sections were designed to ensure they are stable and have required capacity to satisfy criteria. A swale is considered stable with a velocity of 5 ft/s of less. Erosion protection shall be provided where velocities exceed 5 ft/s. To ensure capacity, swales will have a minimum of 1 ft. of freeboard over the water surface for flows anticipated in a 100-year storm event. In addition to the swales, a proposed culvert also conveys flows under the access roadway. The culvert was sized to not overtop the roadways with flows from a 100-year storm event. Detailed swale calculations, sections, and culvert calculations are located in Appendix C.

PROPOSED SUB-BASIN DRAINAGE

The proposed basin delineation for the site as shown on the map within Appendix E is as follows:

Basin A is approximately 1.51 acres with a 21% percent impervious and is comprised of proposed gravel roadways, gravel parking areas, concrete sidewalks and RV parking spots. Runoff generated by this basin (Q_5=1.3 cfs, Q_{100}=4.3 cfs) sheet flows overland to the proposed swale at DP1. Flows enter Basin B and combine at DP2.1.

Basin B is approximately 2.51 acres with a 10% percent impervious and is comprised of proposed asphalt roadways, gravel parking areas, concrete sidewalk and RV hookup sites. Runoff generated by this basin (Q_5=1.2 cfs, Q_{100}=5.5 cfs) sheet flows overland to the proposed swale at DP2. Flows then combine with DP1 at DP2.1 (Q_5=2.3 cfs, Q_{100}=9.3 cfs) and enter into the proposed culvert. DP2.1 flows continue within a proposed swale to the combination at DP3.1.

Basin C is approximately 4.27 acres with a 20% percent impervious and is comprised of proposed gravel parking areas, concrete sidewalks and RV hookup sites. Runoff generated by this basin (Q_5=3.4 cfs, Q_{100}=11.8 cfs) sheet flows overland to the proposed swale at DP3. Flows then combine with DP2.1 at DP3.1 (Q_5=5.1 cfs, Q_{100}=18.9 cfs) and are captured by the proposed culvert at DP5.2.

Basin D is approximately 4.96 acres with a 24% percent impervious and is comprised of proposed asphalt and gravel roadways, parking areas, septic field, concrete sidewalk and RV hookup sites. Runoff generated by this basin (Q_5=3.6 cfs, Q_{100}=11.8 cfs) sheet flows overland to the proposed swale at DP4. Flows then enter into the proposed culvert and combine at DP5.1.

Basin E is approximately 2.64 acres with a 20% percent impervious and is comprised of proposed asphalt roadways, concrete sidewalk and RV hookup sites. Runoff generated by this basin (Q_5=1.9 cfs, Q_{100}=6.5 cfs) sheet flows overland to the proposed swale at DP5. Flows then combine with DP4 at DP5.1 (Q_5=4.9 cfs, Q_{100}=16.3 cfs) and are captured by the proposed culvert. DP5.1 flows then combine with DP3.1 at DP5.2 (Q_5=9.4 cfs, Q_{100}=32.9 cfs) and are captured by the proposed inflow culvert. Flows then are combined within the proposed full-spectrum EDB (Pond 1) at DP6.1.

Basin F is approximately 0.84 acres with a 16% percent impervious and is comprised of proposed Pond 1 and associated infrastructure. Runoff generated by this basin (Q_5=0.7 cfs, Q_{100}=2.5 cfs) sheet flows to Pond 1 at DP6. Flow at DP6.1 (Q_5=9.8 cfs, Q_{100}=34.6 cfs) combines the flow of DP5.2 and DP6, representing the total inflow into Pond 1. Flows will be released through the outlet structure at DP6.2 (Q_5=2.1 cfs, Q_{100}=11.9 cfs). Flows will then enter Basin H and follow the drainage patterns of the basin as described below, combining at DP8.1.

Basin OS1 is approximately 0.43 acres with a 43% percent impervious and is comprised of existing west half of Peyton Hwy roadway and swale. Runoff generated by this basin (Q_5=0.8 cfs, Q_{100}=2.0 cfs) flows within the existing swale to DPO1. Flows combine at the proposed DP7.1 culvert.

Basin G is approximately 1.57 acres with a 2% percent impervious and is comprised of existing undeveloped land to remain undeveloped. Runoff generated by this basin (Q_5=0.6 cfs, Q_{100}=4.3 cfs) sheet flows overland to the proposed swale at DP7. Flows combine at the proposed DP7.1 culvert. DP7.1 flows (Q_5=1.4 cfs, Q_{100}=6.3 cfs) enter the culvert and continue within the existing Peyton Hwy swale combining at DP8.1.

Basin OS2 is approximately 0.18 acres with a 56% percent impervious and is comprised of existing west half of Peyton Hwy roadway and swale. Runoff generated by this basin (Q_5=0.5 cfs, Q_{100}=1.0 cfs) flows within the existing swale to DPO2. Flows combine at the existing Peyton Hwy swale at DP8.1.

Basin H is approximately 0.74 acres with a 24% percent impervious and is comprised of proposed riprap, part of the access roadway and undeveloped land. Runoff generated by this basin (Q_5=0.6 cfs, Q_{100}=1.9 cfs) sheet flows overland to the existing Peyton Hwy swale at DP8. DP6.2, DP7.1, DPO2 and DP8 flows combine at the existing Peyton Hwy swale at DP8.1 (Q_5=4.1 cfs, Q_{100}=19.0 cfs). Flows continue flowing north off-site per the historic conditions and eventually outfall to Brackett Creek.

Basin I is approximately 1.00 acres with a 2% percent impervious and is comprised of existing undeveloped land to remain undeveloped. Runoff generated by this basin (Q_5=0.5 cfs, Q_{100}=3.1 cfs) sheet flows overland north following the historic drainage patterns off-site and eventually outfalls to Brackett Creek.

Basin J is approximately 2.99 acres with a 24% percent impervious and is comprised of proposed gravel roadways, gravel parking areas, building and RV hookup sites. Runoff generated by this basin (Q_5=2.6 cfs, Q_{100}=8.4 cfs) sheet flows overland to the proposed swale at DP10. Flows then enter into the proposed culvert and combine at DP11.1.

Basin K is approximately 0.78 acres with a 35% percent impervious and is comprised of proposed gravel roadway and concrete sidewalks. Runoff generated by this basin (Q_5=0.9 cfs, Q_{100}=2.5 cfs) sheet flows overland to the proposed swale at DP11. Flows then enter into the proposed culvert and combine at DP12.1.

Basin L is approximately 0.45 acres with a 40% percent impervious and is comprised of proposed gravel roadway and concrete sidewalks. Runoff generated by this basin (Q_5=0.6 cfs, Q_{100}=1.5 cfs) sheet flows overland to the proposed swale at DP12 and are captured by the proposed sump inlet. In the case where this inlet becomes clogged, the emergency overflow path would overtop the maintenance trail and flow into Pond 2. DP12 flows then combine within proposed Pond 2 at DP14.1.

Basin M is approximately 2.01 acres with a 25% percent impervious and is comprised of proposed gravel roadways, concrete sidewalk and RV hookup sites. Runoff generated by this basin (Q_5=1.5 cfs, Q_{100}=4.9 cfs) sheet flows overland to the proposed swale at DP13. Flows then enter into the proposed culvert and combine within proposed Pond 2 at DP14.1.

Basin N is approximately 2.12 acres with a 26% percent impervious is comprised of proposed gravel roadways, concrete sidewalk, RV hookup sites, Pond 2 and associated infrastructure. Runoff generated by this basin (Q_5=1.9 cfs, Q_{100}=6.1 cfs) sheet flows to Pond 2 at DP14. Flow at DP14.1 (Q_5=6.6 cfs, Q_{100}=20.6 cfs) combines the flow of DP12.1, DP13 and DP14, representing the total inflow into Pond 2. Flows will be released through the outlet structure at DP14.2 (Q_5=1.5 cfs, Q_{100}=7.8 cfs). Flows will then enter Basin O and then flow off-site to the south following historic drainage patterns off-site and eventually outfalls to the unnamed tributary of Brackett Creek.

Basin O is approximately 5.56 acres with an 8% percent impervious located within Lot 2 and is comprised of a single-family residence and private driveway. Runoff generated by this basin (Q_5=2.9 cfs, Q_{100}=14.6 cfs) sheet flows overland to the basin boundary at DP15. Flows then continue off-site to the south following historic drainage patterns off-site and eventually outfalls to the unnamed tributary of Brackett Creek.

COMPARISON OF FLOWS

There are several locations where the existing and proposed flows leave the site:

See comments on drainage maps and update flow comparisons once existing and proposed basins have been updated.

- Flows leave the northern part of the site at existing DP1 and proposed DP9. Existing DP1 flows (Q_5=1.8 cfs, Q_{100}=12.3 cfs) are greater than the proposed DP9 flows (Q_5=0.5 cfs, Q_{100}=3.1 cfs).
- Flows leave the north-eastern part of the site at existing DP2.1 and proposed DP8.1. Existing DP2.1 flows (Q_5=4.5 cfs, Q_{100}=23.0 cfs) are greater than the proposed DP8.1 flows (Q_5=4.1 cfs, Q_{100}=19.0 cfs).
- Flows leave the southern part of the site at existing DP3 and proposed DP14.2 & DP15. Existing DP3 flows (Q_5=3.9 cfs, Q_{100}=23.2 cfs) are greater in the major storm than the proposed DP14.2 flows (Q_5=1.5 cfs, Q_{100}=7.8 cfs) & DP15 (Q_5=2.9 cfs, Q_{100}=14.6 cfs) for a total proposed flow of Q_5=4.4 cfs, Q_{100}=22.4 cfs.

All proposed flows in the major storm leave the site at less than or equal to the historic flow rates. Therefore, there is no negative impact anticipated to downstream properties.

DRAINAGE DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

Storm drainage analysis and design criteria for this project were taken from the "*City of Colorado Springs/El Paso County Drainage Criteria Manual*" Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the "*Urban Storm Drainage Criteria Manual*" Volumes 1 to 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the "*Colorado Springs Drainage Criteria Manual*" (CSDCM), dated May 2014, as adopted by El Paso County.

HYDROLOGIC CRITERIA

All hydrologic data was obtained from the "*El Paso Drainage Criteria Manual*" Volumes 1 and 2, and the "*Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual*" Volumes 1, 2, and 3. On-site drainage improvements were designed based on the 5-year (minor) storm event and the 100-year (major) storm event. Runoff was calculated using the Rational Method, and rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Table 6-2 of the CSDCM. One-hour point rainfall data for the storm events is identified in the chart below. Runoff coefficients were determined based on proposed land use and from data in Table 6-6 from the CSDCM. Time of concentrations were developed using equations from CSDCM. All runoff calculations and applicable charts and graphs are included in the Appendices.

Table 1: 1-hr Point Rainfall Data

Storm	Rainfall (in.)
5-year	1.50
100-year	2.52

HYDRAULIC CRITERIA

The Rational Method and USDCM's SF-2 and SF-3 forms were used to determine the runoff from the minor and major storms on the site. Autodesk Inc.'s Hydraflow Express Extension (Volume 10.5) was used to size the roadside ditches and drainage swales per criteria. Per Section 6.4.1 of the EPCDCM, culverts were sized as to not overtop the road in the 100-year storm. The MHFD-Detention_v4.06 spreadsheet was utilized for evaluating proposed detention and water quality for the five ponds. Required detention volumes and allowable release rates were designed per USDCM and CCS/EPCDCM. See Appendix C for hydraulic calculations. The hydraulic design will be finalized with the Final Drainage Report.

DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

The proposed stormwater conveyance system was designed to convey the developed site flows to one of two full-spectrum EDBs via swales, culverts, inlets and storm sewer infrastructure. The proposed full-spectrum EDBs will be designed to release flows at less than historic to minimize adverse impacts downstream. Due to this, there are no drainage problems anticipated downstream of the site.

SPECIFIC DETAILS

All full-spectrum EDBs will have proposed forebays at inflow points, concrete trickle channels, and outlet structures. The proposed pond forebays and weir contain the required percentage of the Water Quality Capture Volume (WQCV). The forebays weir will release 1% or 2% of the undetained peak 100-year inflow (depending on impervious acres per EDB-4) into the full-spectrum EDB to the proposed concrete trickle channel. The trickle channel will direct flows into the proposed full-spectrum EDB outlet structure, which will detain water per times specified by criteria. The WQCV will be released within 40 hours and the EURV will be released within 72 hours.

Four Step Process to Minimize Adverse Impacts of Urbanization

In accordance with the El Paso County Drainage Criteria Manual Volume 2, this site has implemented the four-step process to minimize adverse impacts of urbanization. The four-step process includes reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

Step 1: Reducing Runoff Volumes - The site development consists of gravel drive aisles and parking spaces with lawn areas interspersed within the development. This layout will allow for increased infiltration and reduce runoff volume.

Step 2: Treat the WQCV - Runoff from this development is treated through capture and slow release of the WQCV in the on-site permanent full-spectrum EDBs that are designed per current El Paso County drainage criteria. The 2.5-acre (minimum) residential house on Lot 2 will be limited to a maximum of 10% imperviousness to meet the requirements of Section I.7.1.B.5 of the ECM Stormwater Quality Policy and Procedure for water quality through a plat note. Should Lot 2 exceed 10% imperviousness, a lot specific drainage report addressing the increased imperviousness must be submitted.

Step 3: Stabilize Drainageways - The site lies within the Upper Bracket Creek Drainage Basin and the La Vega Ranch Drainage Basin. Both these basins are not studied and therefore no basin and bridge fees are due. The site does not discharge directly into the open drainageway of Brackett Creek, and developed flows leaving the site are limited to below existing rates, therefore no downstream stabilization will be required with this project.

Step 4: Implementing Long Term Source Controls - A site specific stormwater quality and erosion control plan and narrative shall be prepared in conjunction with the final drainage report. Site specific temporary source control BMPs as well as permanent BMP's will be detailed in that plan and narrative to protect receiving waters.

Water Quality

In accordance with Section 13.3.2.1 of the CCS/EPCDCM, full-spectrum water quality and detention will be provided for all of the development site not meeting exclusions present in the ECM - Stormwater Quality Policy and Procedures Section I.7.1.B. As previously stated, the applicable exclusions for Basin O located within Lot 2 fall under Section I.7.1.B.5 of the ECM Stormwater Quality Policy and Procedure for areas with large single-family lots (2.5-acre min.). In addition, Basins G, H and I fall under the Section I.7.1.B.7 of the ECM Stormwater Quality Policy and Procedure for sites with land disturbance to undeveloped land that will remain undeveloped. A portion of Basins G and H are comprised of a portion of the asphalt roadway which are not able to be undetained or treated. This area is under the maximum allowable of 1.0 total acres. The remaining basins will be treated within the proposed full-spectrum EDBs (Pond 1 and Pond 2). Outlet structure release rates will be limited to less than historic rates to minimize adverse impacts to downstream stormwater facilities.

See Table 2 below for the water quality treatment summary table indicating which basins are treated and which are excluded.

Based on the below table and the maps, it seems that the roadway is entirely within H, verify and remove

Table 2 - Water quality treatment summary table.

PBMP Summary Table		
Basins	Tributary Area (acres)	PBMP
A-F	16.73	POND 1
G-I	3.18	EXCLUDED*
Part of H	0.13	EXCLUDED***
J-N	8.35	POND 2
O	5.56	EXCLUDED**
*EXCLUDED BASED ON LAND DISTURBANCE TO UNDEVELOPED LAND THAT WILL REMAIN UNDEVELOPED PER ECM APP. I.7.B.7 **EXCLUDED BASED ON LARGE LOT SINGLE FAMILY SITES PER ECM APP. I.7.B.5 ***UNTREATED/UNDETAINED AREA (< 1 TOTAL ACRE)		

Proposed Full-Spectrum EDBs

Water quality is provided for the site by two private full-spectrum detention and water quality EDBs. Table 3 below shows the basin parameters for the two ponds. Refer to Appendix C for the MHFD-Detention design sheets that include the tributary basin parameters as well as the stage-storage table and outlet structure design. The outlet structure includes an orifice plate, overflow grate, and restrictor plate to release stormwater at the appropriate rates. The WQCV will be released within 40 hours, the EURV will be released within 72 hours, and the minor and major flows will be released at or below the pre-development flow rate. Table 4 below gives the designed results for Pond 1 and 2.

Table 3 - Watershed design parameters for both EDBs.

Name	Watershed Area	Percent Impervious	Watershed Slope
Pond 1	17.0 ac	19.5%	0.030 ft/ft
Pond 2	8.5 ac	26.5%	0.030 ft/ft

Table 4- Full-spectrum EDB design for both EDBs.

Name	**Required Volume (ac-ft)**	**Provided Volume (ac-ft)**	**WQCV (ac-ft)**	**EURV (ac-ft)**	**5-year Release (cfs)**	**100-year Release (cfs)**
Pond 1	0.88	1.03	0.16	0.33	2.1	11.9
Pond 2	0.52	0.54	0.10	0.23	1.5	7.8

Calculations and pond design parameters are presented in Appendix C.

Discuss suitability of the ponds outfalls. Both ponds need suitable outfalls and it needs to be discussed/demonstrated that the discharges are not having an erosive or negative impact downstream. At Pond 2, the outfall is located at a point that previously was only sheet flow and it flows directly onto other properties. Address this change with the proposed pond and implement level spreader or other dispersement facility as needed.

- For Pond 1, a broad-crested weir lined with buried soil riprap is provided as an emergency spillway along the eastern embankment of the pond. Pond 1 emergency flows are conveyed overland to the existing Peyton Hwy roadside ditch before going off-site to the north, following the historic drainage patterns.
- For Pond 2, a broad-crested weir lined with concrete is provided as an emergency spillway along the southern embankment of the pond. Pond 2 emergency flows are conveyed overland before going off-site to the south, following the historic drainage patterns.

Driveway culverts within County ROW are maintained by the property owner and not the County.

Since riprap lining is typical, please provide an explanation and riprap calcs to show why concrete was used instead.

Erosion Control Plan

We respectfully request that the Final Erosion Control Plan and associated Cost Estimate to be submitted in conjunction with the construction drawings and plat prior to obtaining a grading permit.

Operation & Maintenance

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. All proposed drainage structures within any platted County R.O.W. (roadside ditches and local road culverts) will be owned and maintained by El Paso County. All proposed drainage structures within easements or tracts (full-spectrum water quality ponds, drainageway culverts and drainageway improvements) will be owned and maintained by the property owner unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. Inspection access for El Paso County will be provided through a maintenance easement.

Drainage and Bridge Fees

The site lies within the Upper Bracket Creek Drainage Basin and the La Vega Ranch Drainage Basin. Both these basins are not studied and therefore no basin and bridge fees are due.

Construction Cost Opinion

Please include Cost Information

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

SUMMARY

The proposed Lazy Y and Rocking J Subdivision drainage improvements were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development will not adversely affect the off-site drainageways or surrounding development. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements for this site.

REFERENCES

1. Engineering Criteria Manual, El Paso County, October 14, 2020.

2. City of Colorado Springs Drainage Criteria Manual Volume 1, City of Colorado Springs, CO, May 2014.

3. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, Latest Revision.

4. Drainage Basins: El Paso County Colorado, El Paso County, 2005.

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map

2000 1000 0 2000

ORIGINAL SCALE: 1" = 2000'

VICINITY MAP
LONGHORN ACRES RV PARK
JOB NO. 25228.00
09/01/2023
SHEET 1 OF 1

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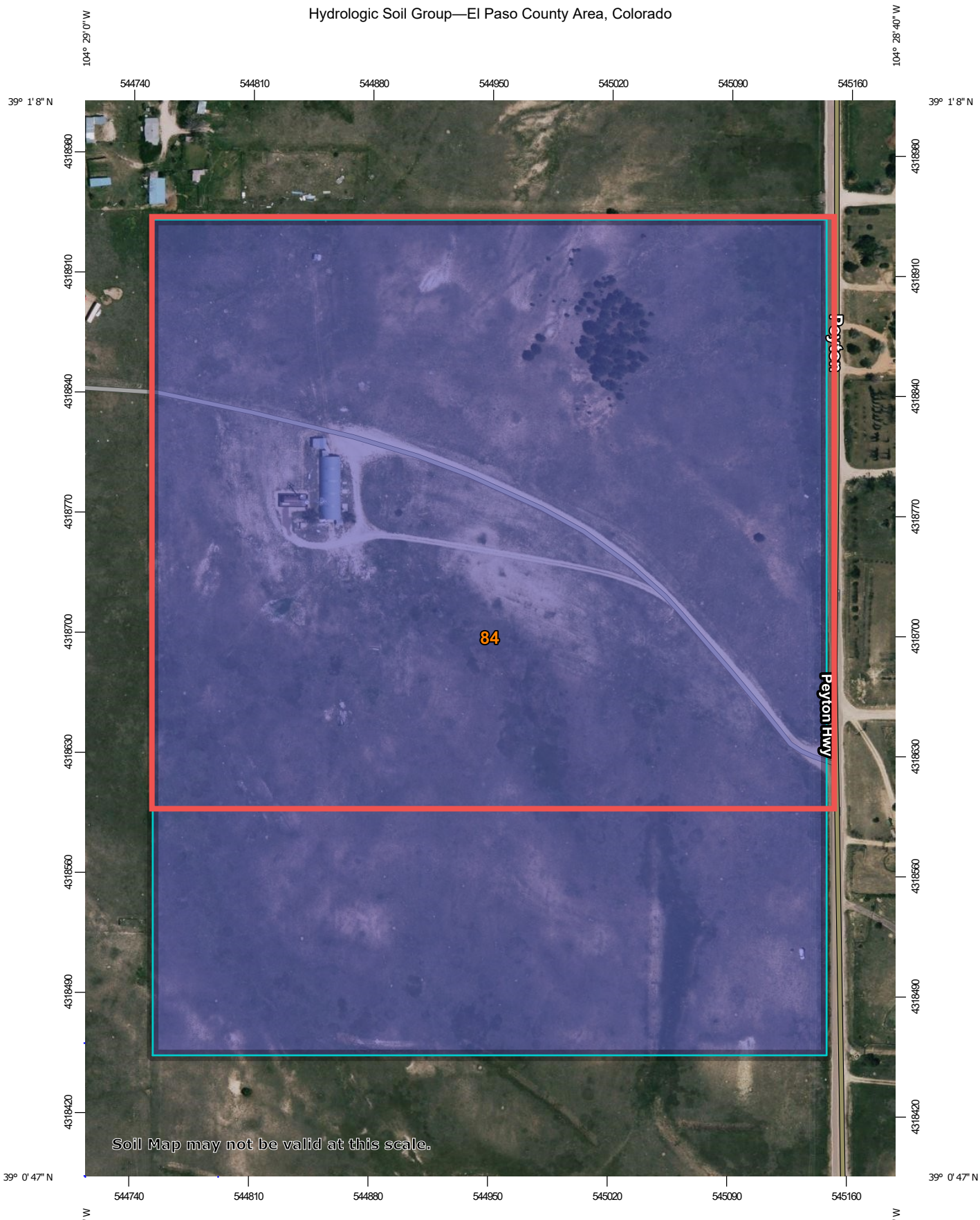


Map Scale: 1:3,060 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
84	Stapleton sandy loam, 8 to 15 percent slopes	B	47.7	100.0%
Totals for Area of Interest			**47.7**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

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

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

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

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

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

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

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

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

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

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

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

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

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

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

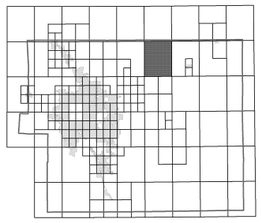
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

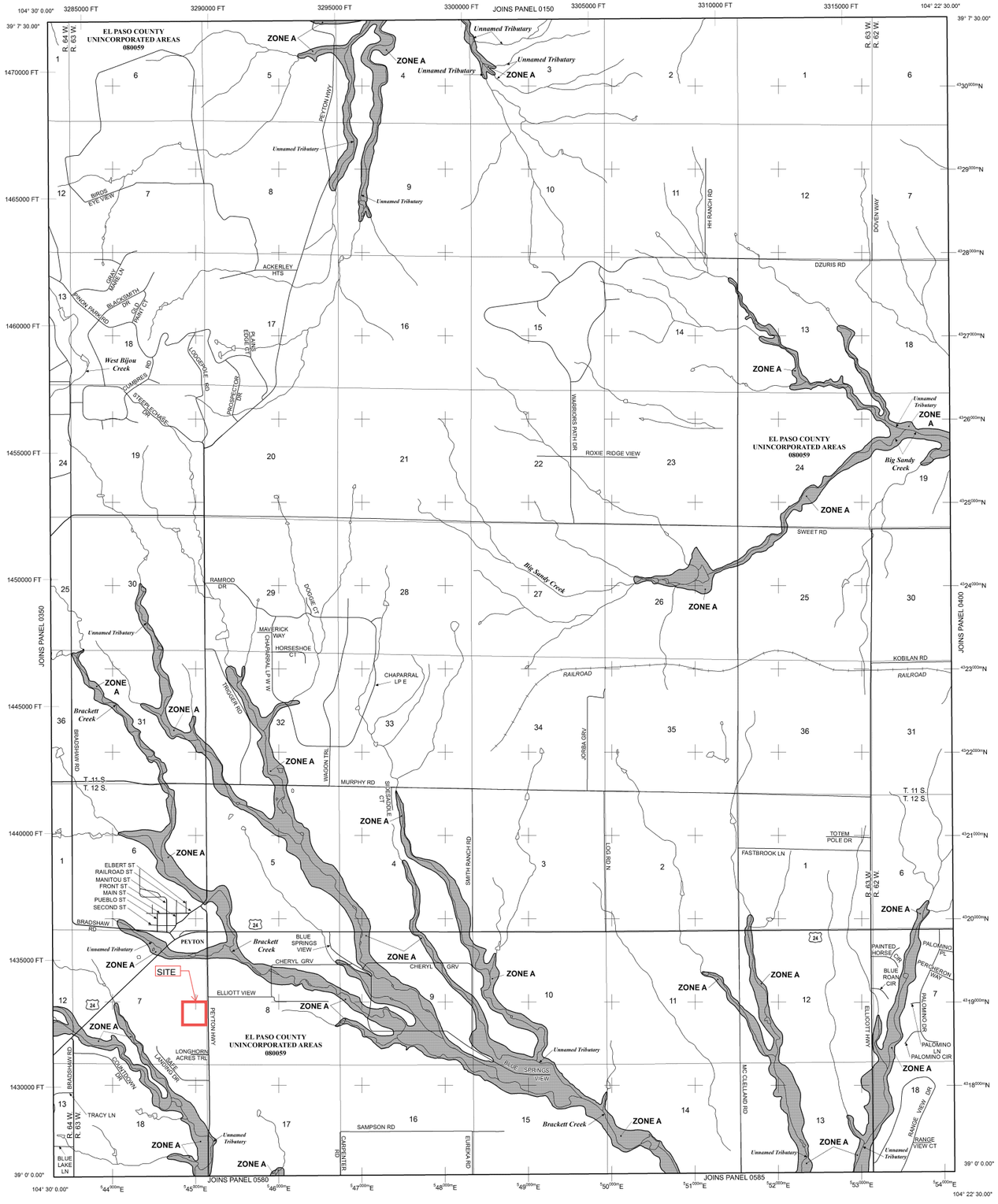
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



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

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



LEGEND

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

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

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

Floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

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

A — A — Cross section line

23 — 23 — Transect line

97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13

6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection

DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)

M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET

600 0 600 1200 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0375G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 375 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0375	G

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

MAP NUMBER
08041C0375G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

Appendix B
Hydrologic Calculations

Please include tables for rainfall data and ECM 5-1 runoff coefficients

COMPOSITE % IMPERVIOUS & COMPOSITE PRE-DEVELOPMENT RUNOFF COEFFICIENT CALCULATIONS

Subdivision:
Location: El Paso County

Project Name: Lazy Y and Rocking J Subdivision
Project No.: 25228.00
Calculated By: GAG
Checked By:
Date: 9/26/23

Basin ID	Total Area (ac)	Drives and Walks (100% Impervious)				Roofs (90% Impervious)				Streets-Gravel (80% Impervious)				Historical Analysis (2% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
EXA	7.84	0.90	0.96	0.00	0.0%	0.73	0.81	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	7.84	2.0%	0.09	0.36	2.0%
EXB	11.20	0.90	0.96	0.00	0.0%	0.73	0.81	0.05	0.4%	0.59	0.70	0.42	3.0%	0.09	0.36	10.73	1.9%	0.11	0.37	5.3%
EXC	14.90	0.90	0.96	0.01	0.1%	0.73	0.81	0.11	0.7%	0.59	0.70	0.27	1.4%	0.09	0.36	14.51	1.9%	0.10	0.37	4.1%
OS1	0.61	0.90	0.96	0.25	41.0%	0.73	0.81	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.36	1.2%	0.42	0.61	42.2%
TOTAL ON-SITE	33.94																			4.0%

PRE-DEVELOPMENT
STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision:
Location: El Paso County

Project Name: Lazy Y and Rocking J Subdivision
Project No.: 25228.00
Calculated By: GAG
Checked By:
Date: 9/26/23

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
EXA	7.84	B	2%	0.09	0.36	300	1.5%	27.6	345	8.0%	7.0	2.0	2.9	30.5	645.0	27.9	27.9
EXB	11.20	B	5%	0.11	0.37	300	8.5%	15.3	570	5.0%	7.0	1.6	6.1	21.3	870.0	29.5	21.3
EXC	14.90	B	4%	0.10	0.37	300	1.0%	31.1	420	3.0%	7.0	1.2	5.8	36.9	720.0	29.5	29.5
OS1	0.61	B	42%	0.42	0.61	25	8.0%	3.1	865	3.5%	7.0	1.3	11.0	14.1	890.0	24.0	14.1

NOTES:

$$t_c = t_i + t_t$$ Equation 6-2

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$ Equation 6-5

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

STANDARD FORM SF-3 - PRE-DEVELOPMENT

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: El Paso County
Design Storm: 5-Year

Project Name: Lazy Y and Rocking J Subdivision
Project No.: 25228.00
Calculated By: GAG
Checked By:
Date: 9/26/23

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1	EXA	7.84	0.09	27.9	0.71	2.59	1.8															Sheet flows overland to DP1 Flows off-site to the north
	2	EXB	11.20	0.11	21.3	1.25	2.99	3.7															Sheet flows overland to DP2 Combines at swale at DP2.1
	O1	OS1	0.61	0.42	14.1	0.26	3.61	0.9															Flows in ex. roadside swale Combines at swale at DP2.1
	2.1								21.3	1.51	2.99	4.5											Combines DP2 and DP-O1 Flows off-site to the north in swale
	3	EXC	14.90	0.10	29.5	1.55	2.51	3.9															Sheet flows overland to DP3 Flows off-site to the south

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

STANDARD FORM SF-3 - PRE-DEVELOPMENT

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: El Paso County
Design Storm: 100-Year

Project Name: Lazy Y and Rocking J Subdivision
Project No.: 25228.00
Calculated By: GAG
Checked By:
Date: 9/26/23

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
Description	Design Point	Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1	EXA	7.84	0.36	27.9	2.82	4.35	12.3															Sheet flows overland to DP1 Flows off-site to the north
	2	EXB	11.20	0.37	21.3	4.20	5.02	21.1															Sheet flows overland to DP2 Combines at swale at DP2.1
	O1	OS1	0.61	0.61	14.1	0.37	6.07	2.2															Flows in ex. roadside swale Combines at swale at DP2.1
	2.1								21.3	4.57	5.02	23.0											Combines DP2 and DP-O1 Flows off-site to the north in swale
	3	EXC	14.90	0.37	29.5	5.51	4.20	23.2															Sheet flows overland to DP3 Flows off-site to the south

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

COMPOSITE % IMPERVIOUS & COMPOSITE PROPOSED RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Lazy Y and Rocking J Subdivision
Location: El Paso County

Project Name: Lazy Y and Rocking J Subdivision
Project No.: 25228.00
Calculated By: GAG
Checked By:
Date: 9/4/24

Basin ID	Total Area (ac)	Streets-Paved Sidewalks (100% Impervious)				Roofs (90% Impervious)				Streets-Gravel (80% Impervious)				Historical Analysis/Lawn (2% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
A	1.51	0.90	0.96	0.07	4.6%	0.73	0.81	0.00	0.0%	0.59	0.70	0.28	14.8%	0.09	0.36	1.16	1.5%	0.22	0.45	21.0%
B	2.51	0.90	0.96	0.09	3.6%	0.73	0.81	0.00	0.0%	0.59	0.70	0.13	4.1%	0.09	0.36	2.29	1.8%	0.14	0.40	9.6%
C	4.27	0.90	0.96	0.43	10.1%	0.73	0.81	0.00	0.0%	0.59	0.70	0.42	7.9%	0.09	0.36	3.42	1.6%	0.22	0.45	19.5%
D	4.96	0.90	0.96	0.26	5.2%	0.73	0.81	0.01	0.2%	0.59	0.70	1.05	16.9%	0.09	0.36	3.64	1.5%	0.24	0.46	23.8%
E	2.64	0.90	0.96	0.19	7.2%	0.73	0.81	0.00	0.0%	0.59	0.70	0.38	11.5%	0.09	0.36	2.07	1.6%	0.22	0.45	20.3%
F	0.84	0.90	0.96	0.05	6.0%	0.73	0.81	0.00	0.0%	0.59	0.70	0.09	8.6%	0.09	0.36	0.70	1.7%	0.19	0.43	16.2%
G	1.57	0.90	0.96	0.00	0.0%	0.73	0.81	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	1.57	2.0%	0.09	0.36	2.0%
H	0.74	0.90	0.96	0.13	17.6%	0.73	0.81	0.00	0.0%	0.59	0.70	0.05	5.4%	0.09	0.36	0.56	1.5%	0.27	0.49	24.5%
I	1.00	0.90	0.96	0.00	0.0%	0.73	0.81	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	1.00	2.0%	0.09	0.36	2.0%
J	2.99	0.90	0.96	0.11	3.7%	0.73	0.81	0.11	3.3%	0.59	0.70	0.58	15.5%	0.09	0.36	2.19	1.5%	0.24	0.46	24.0%
K	0.78	0.90	0.96	0.05	6.4%	0.73	0.81	0.00	0.0%	0.59	0.70	0.27	27.7%	0.09	0.36	0.46	1.2%	0.32	0.52	35.3%
L	0.45	0.90	0.96	0.07	15.6%	0.73	0.81	0.00	0.0%	0.59	0.70	0.13	23.1%	0.09	0.36	0.25	1.1%	0.36	0.55	39.8%
M	2.01	0.90	0.96	0.07	3.5%	0.73	0.81	0.00	0.0%	0.59	0.70	0.50	19.9%	0.09	0.36	1.44	1.4%	0.24	0.47	24.8%
N	2.12	0.90	0.96	0.09	4.2%	0.73	0.81	0.00	0.0%	0.59	0.70	0.53	20.0%	0.09	0.36	1.50	1.4%	0.25	0.47	25.7%
O	5.56	0.90	0.96	0.01	0.2%	0.73	0.81	0.09	1.5%	0.59	0.70	0.29	4.2%	0.09	0.36	5.17	1.9%	0.13	0.39	7.7%
OS1	0.43	0.90	0.96	0.18	41.9%	0.73	0.81	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.25	1.2%	0.43	0.61	43.0%
OS2	0.18	0.90	0.96	0.10	55.6%	0.73	0.81	0.00	0.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.08	0.9%	0.54	0.69	56.4%
TOTAL (POND 1)	**16.73**																			**19.4%**
TOTAL (POND 2)	**8.35**																			**26.5%**

PROPOSED
STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Lazy Y and Rocking J Subdivision
Location: El Paso County

Project Name: Lazy Y and Rocking J Subdivision
Project No.: 25228.00
Calculated By: GAG
Checked By:
Date: 9/4/24

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					*tc* CHECK			FINAL
DATA						(T_i)			(T_t)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
A	1.51	A	21%	0.22	0.45	100	3.5%	10.5	310	3.0%	15.0	2.6	2.0	12.5	410.0	24.9	12.5
B	2.51	A	10%	0.14	0.40	100	2.0%	13.7	679	4.0%	15.0	3.0	3.8	17.5	779.0	29.8	17.5
C	4.27	A	20%	0.22	0.45	100	3.5%	10.5	575	3.3%	15.0	2.7	3.5	14.0	675.0	27.2	14.0
D	4.96	A	24%	0.24	0.46	100	1.5%	13.6	860	2.0%	15.0	2.1	6.8	20.3	960.0	30.2	20.3
E	2.64	A	20%	0.22	0.45	100	3.0%	11.1	750	1.5%	15.0	1.8	6.8	17.9	850.0	31.2	17.9
F	0.84	A	16%	0.19	0.43	100	15.0%	6.7	295	0.5%	20.0	1.4	3.5	10.2	395.0	29.4	10.2
G	1.57	A	2%	0.09	0.36	20	14.0%	3.4	450	3.0%	10.0	1.7	4.3	7.7	470.0	30.3	7.7
H	0.74	A	24%	0.27	0.49	100	1.5%	13.2	345	1.2%	10.0	1.1	5.2	18.4	445.0	26.1	18.4
I	1.00	A	2%	0.09	0.36	40	30.0%	3.8	0	0.0%	10.0	0.0	0.0	3.8	40.0	25.7	5.0
J	2.99	A	24%	0.24	0.46	85	3.0%	10.0	525	2.0%	15.0	2.1	4.1	14.1	610.0	26.9	14.1
K	0.78	A	35%	0.32	0.52	65	2.0%	9.1	355	1.0%	15.0	1.5	3.9	13.0	420.0	24.2	13.0
L	0.45	A	40%	0.36	0.55	100	1.5%	11.7	335	2.0%	15.0	2.1	2.6	14.3	435.0	21.9	14.3
M	2.01	A	25%	0.24	0.47	100	1.0%	15.5	455	1.2%	15.0	1.6	4.6	20.1	555.0	27.3	20.1
N	2.12	A	26%	0.25	0.47	100	3.0%	10.7	350	1.5%	15.0	1.8	3.2	13.9	450.0	25.4	13.9
O	5.56	A	8%	0.13	0.39	100	7.5%	9.0	375	6.5%	15.0	3.8	1.6	10.7	475.0	27.1	10.7
OS1	0.43	A	43%	0.43	0.61	25	8.0%	3.0	675	3.5%	15.0	2.8	4.0	7.1	700.0	22.7	7.1
OS2	0.18	A	56%	0.54	0.69	25	4.0%	3.2	270	3.5%	15.0	2.8	1.6	4.8	295.0	17.8	5.0

PROPOSED
STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Lazy Y and Rocking J Subdivision
Location: El Paso County

Project Name: Lazy Y and Rocking J Subdivision
Project No.: 25228.00
Calculated By: GAG
Checked By:
Date: 9/4/24

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					tc CHECK			FINAL
DATA						(T_i)			(T_t)					(URBANIZED BASINS)			
BASIN	D.A.	Hydrologic	Impervious	C_5	C_{100}	L	S_o	t_i	L_t	S_t	K	VEL.	t_t	COMP. t_c	TOTAL	Urbanized t_c	t_c

NOTES:

$$t_c = t_i + t_t$$ Equation 6-2

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$ Equation 6-5

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Lazy Y and Rocking J Subdivision
Location: El Paso County
Design Storm: 5-Year

Project Name: Lazy Y and Rocking J Subdivision
Project No.: 25228.00
Calculated By: GAG
Checked By:
Date: 9/4/24

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1	A	1.51	0.22	12.5	0.33	3.80	1.3					1.3	0.33	2.0					275	2.8	1.6	Sheet flows overland to DP1 swale Combines flow within swale at DP2.1
	2	B	2.51	0.14	17.5	0.36	3.29	1.2															Sheet flows overland to DP2 swale Combines flow within swale at DP2.1
	2.1								17.5	0.69	3.29	2.3	2.3	0.69	2.5					410	3.2	2.2	Combines flow of DP1 and DP2 at DP2.1 culvert Flows along in swale to DP3.1
	3	C	4.27	0.22	14.0	0.94	3.62	3.4															Sheet flows overland to DP3 at swale Combines flow within swale at DP3.1
	3.1								19.7	1.63	3.12	5.1											Combines flow of DP2.1 and DP3 Combines flow at DP5.2 inlet
	4	D	4.96	0.24	20.3	1.19	3.06	3.6					3.6	1.19	1.3					570	2.3	4.2	Sheet flows overland to DP4 culvert Combines flow within swale at DP5.1
	5	E	2.64	0.22	17.9	0.58	3.26	1.9															Sheet flows overland to DP5 swale Combines flow within swale at DP5.1
	5.1								24.5	1.77	2.78	4.9	4.9	1.77	10.0					150	6.3	0.4	Combines flow of DP4 and DP5 at culvert Flows along in swale to D5.2
	5.2								24.9	3.40	2.76	9.4											Combines flow of DP3.1 and DP5.1 at DP5.2 culvert Flows into Pond 1 forebay and combines at DP6.1
	6	F	0.84	0.19	10.2	0.16	4.10	0.7															Sheet flows overland to Pond 1 at DP6 Combines flow at Pond 1 outlet structure at DP6.1
	6.1								24.9	3.56	2.76	9.8											Combines flow of DP5.2 and DP6 Released through Pond 1 outlet pipe at DP6.2
	6.2								-	-	-	2.1											Controlled released through Pond 1 outlet pipe Combines in existing roadside swale at DP8.1
	O1	OS1	0.43	0.43	7.1	0.18	4.65	0.8															Flows along Peyton Hwy ditch to DPO1 Combines flow at DP7.1 culvert
	7	G	1.57	0.09	7.7	0.14	4.51	0.6															Sheet flows to Peyton Hwy ditch and then to DP7 Combines flow at DP7.1 culvert
	7.1								7.7	0.32	4.51	1.4	1.4	0.32	1.5					190	2.4	1.3	Combines flow of DPO1 and DP7 at culvert Continues along Peyton Hwy ditch to DP8.1
	O2	OS2	0.18	0.54	5.0	0.10	5.17	0.5															Flows along Peyton Hwy ditch to DPO2 Combines flow at DP8.1 ditch
	8	H	0.74	0.27	18.4	0.20	3.21	0.6															Sheet flows to Peyton Hwy ditch and then to DP8 Combines flow at DP8.1 ditch
	8.1								18.4	0.62	3.21	4.1											Combines flow of DP6.2, DP7.1, DPO2 and DP8 Continues along Peyton Hwy ditch off-site north

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Lazy Y and Rocking J Subdivision
Location: El Paso County
Design Storm: 5-Year

Project Name: Lazy Y and Rocking J Subdivision
Project No.: 25228.00
Calculated By: GAG
Checked By:
Date: 9/4/24

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	9	I	1.00	0.09	5.0	0.09	5.17	0.5															Sheet flows off-site to DP9 Follows historic path off-site
	10	J	2.99	0.24	14.1	0.72	3.62	2.6					2.6	0.72	1.0					40	2.0	0.3	Sheet flows overland to DP10 culvert Combines flow at DP11.1 culvert
	11	K	0.78	0.32	13.0	0.25	3.73	0.9															Sheet flows overland to DP10 culvert Combines flow at DP11.1 culvert
	11.1								14.4	0.97	3.58	3.5	3.5	0.97	2.0					190	2.8	1.1	Combines flow of DP10 and DP11 at culvert Flows along in swale to D12.1 inlet
	12	L	0.45	0.36	14.3	0.16	3.59	0.6															Sheet flows to swale at DP12 Combines flow at DP12.1 inlet
	12.1								15.5	1.13	3.47	3.9											Combines flow of DP11.1 and DP12 at inlet Flows into Pond 2 forebay and combines at DP14.1
	13	M	2.01	0.24	20.1	0.49	3.08	1.5															Sheet flows to swale at DP13 Flows into Pond 2 forebay and combines at DP14.1
	14	N	2.12	0.25	13.9	0.53	3.64	1.9															Sheet flows overland to Pond 2 at DP14 Combines flow at Pond 2 outlet structure at DP14.1
	14.1								20.1	2.15	3.08	6.6											Combines flow of DP12.1, DP13 and DP14 Released through Pond 2 outlet pipe at DP14.2
	14.2								-	-	-	1.5											Controlled released through Pond 2 outlet pipe Continues flowing off-site south
	15	O	5.56	0.13	10.7	0.71	4.03	2.9															Sheet flows overland to DP15 Continues flowing off-site south

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Lazy Y and Rocking J Subdivision
Location: El Paso County
Design Storm: 100-Year

Project Name: Lazy Y and Rocking J Subdivision
Project No.: 25228.00
Calculated By: GAG
Checked By:
Date: 9/4/24

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
Description	Design Point	Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1	A	1.51	0.45	12.5	0.68	6.37	4.3					4.3	0.68	2.0					275	2.8	1.6	Sheet flows overland to DP1 swale Combines flow within swale at DP2.1
	2	B	2.51	0.40	17.5	1.00	5.52	5.5															Sheet flows overland to DP2 swale Combines flow within swale at DP2.1
	2.1								17.5	1.68	5.52	9.3	9.3	1.68	2.5					410	3.2	2.2	Combines flow of DP1 and DP2 at DP2.1 culvert Flows along in swale to DP3.1
	3	C	4.27	0.45	14.0	1.94	6.08	11.8															Sheet flows overland to DP3 at swale Combines flow within swale at DP3.1
	3.1								19.7	3.62	5.23	18.9											Combines flow of DP2.1 and DP3 Combines flow at DP5.2 inlet
	4	D	4.96	0.46	20.3	2.30	5.14	11.8					11.8	2.30	1.3					570	2.3	4.2	Sheet flows overland to DP4 culvert Combines flow within swale at DP5.1
	5	E	2.64	0.45	17.9	1.19	5.47	6.5															Sheet flows overland to DP5 swale Combines flow within swale at DP5.1
	5.1								24.5	3.49	4.67	16.3	16.3	3.49	10.0					150	6.3	0.4	Combines flow of DP4 and DP5 at culvert Flows along in swale to D5.2
	5.2								24.9	7.11	4.63	32.9											Combines flow of DP3.1 and DP5.1 at DP5.2 culvert Flows into Pond 1 forebay and combines at DP6.1
	6	F	0.84	0.43	10.2	0.36	6.89	2.5															Sheet flows overland to Pond 1 at DP6 Combines flow at Pond 1 outlet structure at DP6.1
	6.1								24.9	7.47	4.63	34.6											Combines flow of DP5.2 and DP6 Released through Pond 1 outlet pipe at DP6.2
	6.2								-	-	-	11.9											Controlled released through Pond 1 outlet pipe Combines in existing roadside swale at DP8.1
	O1	OS1	0.43	0.61	7.1	0.26	7.81	2.0															Flows along Peyton Hwy ditch to DPO1 Combines flow at DP7.1 culvert
	7	G	1.57	0.36	7.7	0.57	7.58	4.3															Sheet flows to Peyton Hwy ditch and then to DP7 Combines flow at DP7.1 culvert
	7.1								7.7	0.83	7.58	6.3	6.3	0.83	1.5					190	2.4	1.3	Combines flow of DPO1 and DP7 at culvert Continues along Peyton Hwy ditch to DP8.1
	O2	OS2	0.18	0.69	5.0	0.12	8.68	1.0															Flows along Peyton Hwy ditch to DPO2 Combines flow at DP8.1 ditch
	8	H	0.74	0.49	18.4	0.36	5.39	1.9															Sheet flows to Peyton Hwy ditch and then to DP8 Combines flow at DP8.1 ditch
	8.1								18.4	1.31	5.39	19.0											Combines flow of DP6.2, DP7.1, DPO2 and DP8 Continues along Peyton Hwy ditch off-site north

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Lazy Y and Rocking J Subdivision
Location: El Paso County
Design Storm: 100-Year

Project Name: Lazy Y and Rocking J Subdivision
Project No.: 25228.00
Calculated By: GAG
Checked By:
Date: 9/4/24

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
Description	Design Point	Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	9	I	1.00	0.36	5.0	0.36	8.68	3.1															Sheet flows off-site to DP9 Follows historic path off-site
	10	J	2.99	0.46	14.1	1.39	6.07	8.4					8.4	1.39	1.0					40	2.0	0.3	Sheet flows overland to DP10 culvert Combines flow at DP11.1 culvert
	11	K	0.78	0.52	13.0	0.40	6.26	2.5															Sheet flows overland to DP10 culvert Combines flow at DP11.1 culvert
	11.1								14.4	1.79	6.01	10.8	10.8	1.79	2.0					190	2.8	1.1	Combines flow of DP10 and DP11 at culvert Flows along in swale to D12.1 inlet
	12	L	0.45	0.55	14.3	0.25	6.03	1.5															Sheet flows to swale at DP12 Combines flow at DP12.1 inlet
	12.1								15.5	2.04	5.82	11.9											Combines flow of DP11.1 and DP12 at inlet Flows into Pond 2 forebay and combines at DP14.1
	13	M	2.01	0.47	20.1	0.94	5.17	4.9															Sheet flows to swale at DP13 Flows into Pond 2 forebay and combines at DP14.1
	14	N	2.12	0.47	13.9	1.00	6.11	6.1															Sheet flows overland to Pond 2 at DP14 Combines flow at Pond 2 outlet structure at DP14.1
	14.1								20.1	3.98	5.17	20.6											Combines flow of DP12.1, DP13 and DP14 Released through Pond 2 outlet pipe at DP14.2
	14.2								-	-	-	7.8											Controlled released through Pond 2 outlet pipe Continues flowing off-site south
	15	O	5.56	0.39	10.7	2.15	6.77	14.6															Sheet flows overland to DP15 Continues flowing off-site south

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

Appendix C
Hydraulic Calculations

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Aug 19 2024

Ex. DP2.1-Existing Roadside Swale

User-defined

Invert Elev (ft)	= 6798.54
Slope (%)	= 3.30
N-Value	= 0.030

Calculations

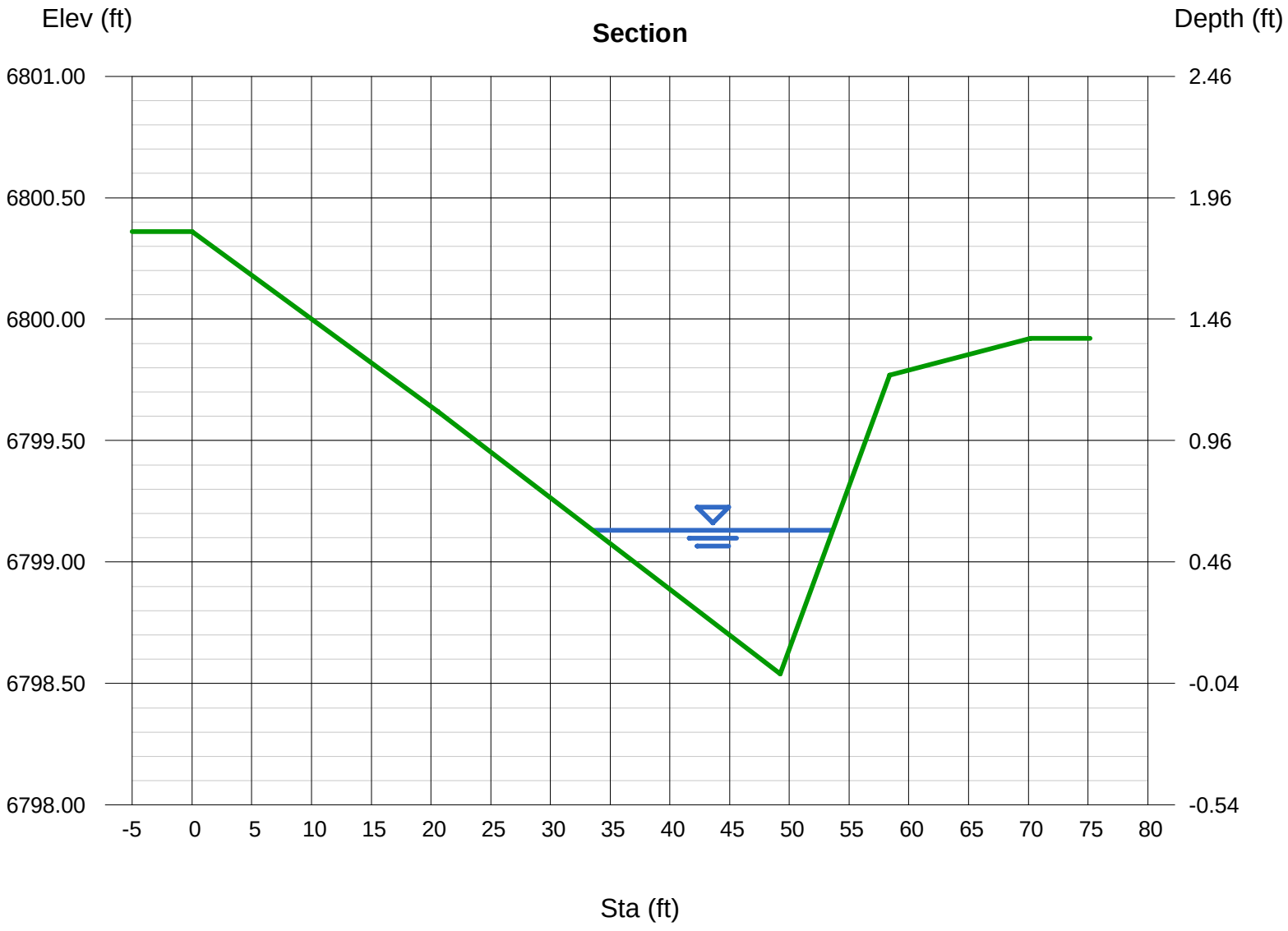
Compute by:	Known Q
Known Q (cfs)	= 23.00

Highlighted

Depth (ft)	= 0.59
Q (cfs)	= 23.00
Area (sqft)	= 5.91
Velocity (ft/s)	= 3.89
Wetted Perim (ft)	= 20.08
Crit Depth, Yc (ft)	= 0.65
Top Width (ft)	= 20.03
EGL (ft)	= 0.83

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

(0.00, 6800.36) -(20.58, 6799.62, 0.030) -(49.23, 6798.54, 0.030) -(58.38, 6799.77, 0.030) -(70.18, 6799.92, 0.030)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 12 2024

DP1 Swale

Triangular

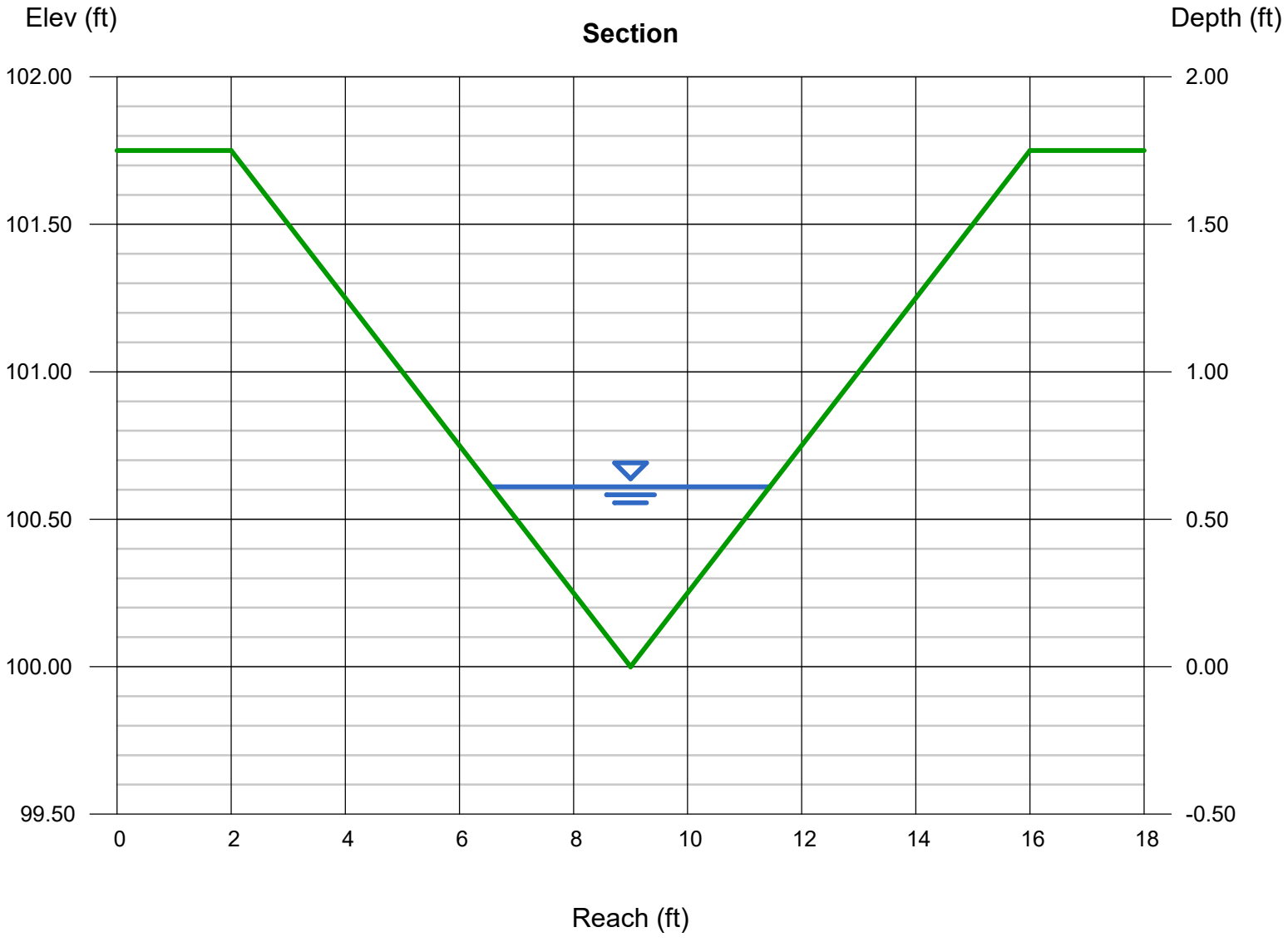
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.75
Invert Elev (ft)	= 100.00
Slope (%)	= 2.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.50

Highlighted

Depth (ft)	= 0.61
Q (cfs)	= 4.500
Area (sqft)	= 1.49
Velocity (ft/s)	= 3.02
Wetted Perim (ft)	= 5.03
Crit Depth, Yc (ft)	= 0.61
Top Width (ft)	= 4.88
EGL (ft)	= 0.75



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 12 2024

DP2.1 Swale

Triangular

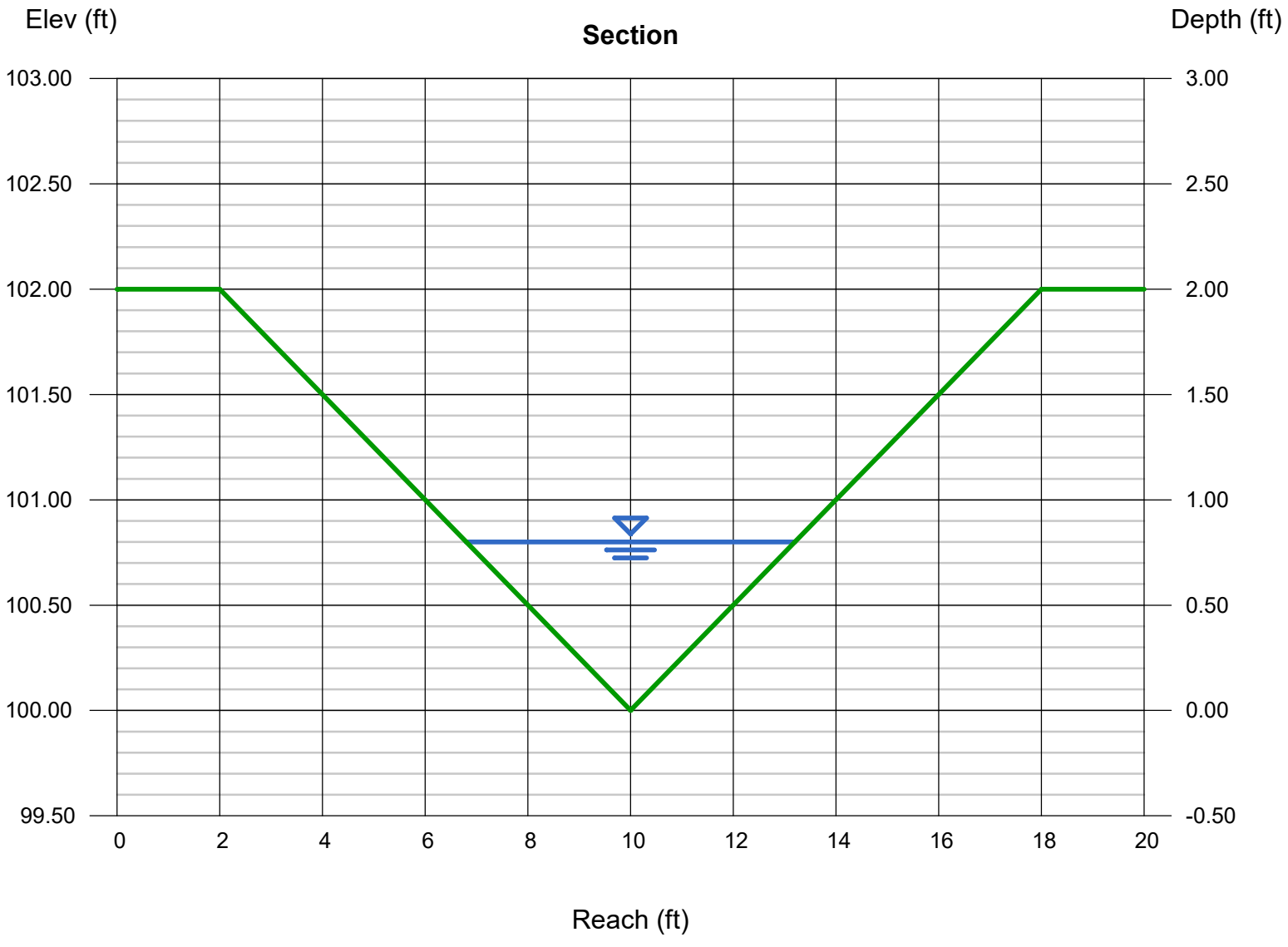
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 2.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 9.50

Highlighted

Depth (ft)	= 0.80
Q (cfs)	= 9.500
Area (sqft)	= 2.56
Velocity (ft/s)	= 3.71
Wetted Perim (ft)	= 6.60
Crit Depth, Yc (ft)	= 0.82
Top Width (ft)	= 6.40
EGL (ft)	= 1.01



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 12 2024

DP2.1 Culvert

Invert Elev Dn (ft)	=	6824.24
Pipe Length (ft)	=	32.00
Slope (%)	=	3.97
Invert Elev Up (ft)	=	6825.51
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

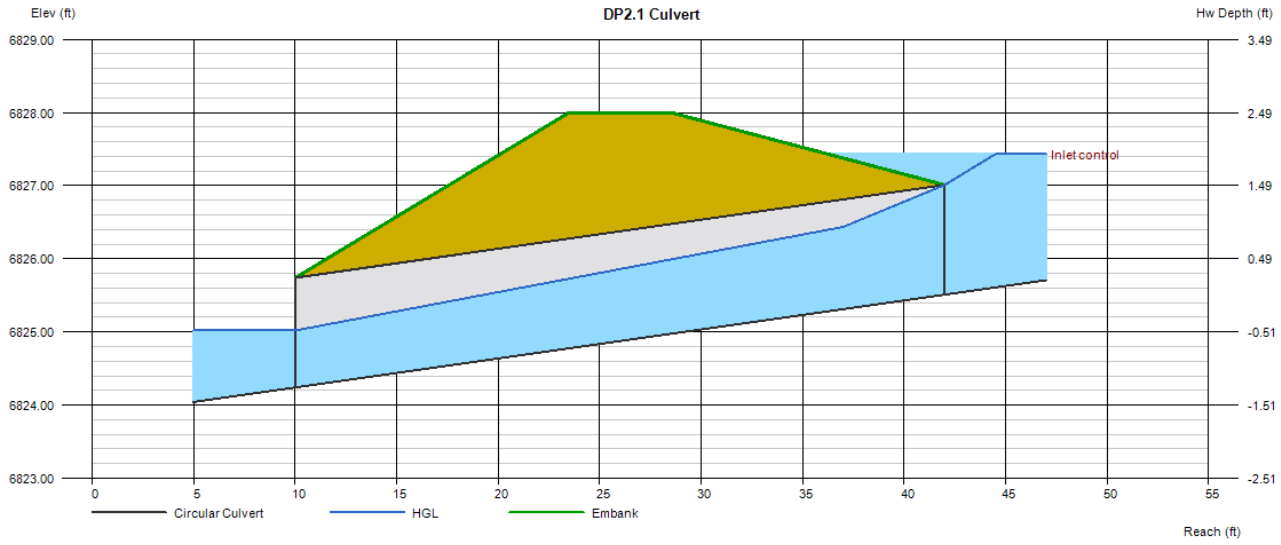
Top Elevation (ft)	=	6828.00
Top Width (ft)	=	5.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	9.50
Qmax (cfs)	=	9.50
Tailwater Elev (ft)	=	Normal

Highlighted

Qtotal (cfs)	=	9.50
Qpipe (cfs)	=	9.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	10.24
Veloc Up (ft/s)	=	6.32
HGL Dn (ft)	=	6825.02
HGL Up (ft)	=	6826.70
Hw Elev (ft)	=	6827.43
Hw/D (ft)	=	1.28
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 12 2024

DP3.1 Swale

Triangular

Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.10
Invert Elev (ft)	= 100.00
Slope (%)	= 2.65
N-Value	= 0.030

Calculations

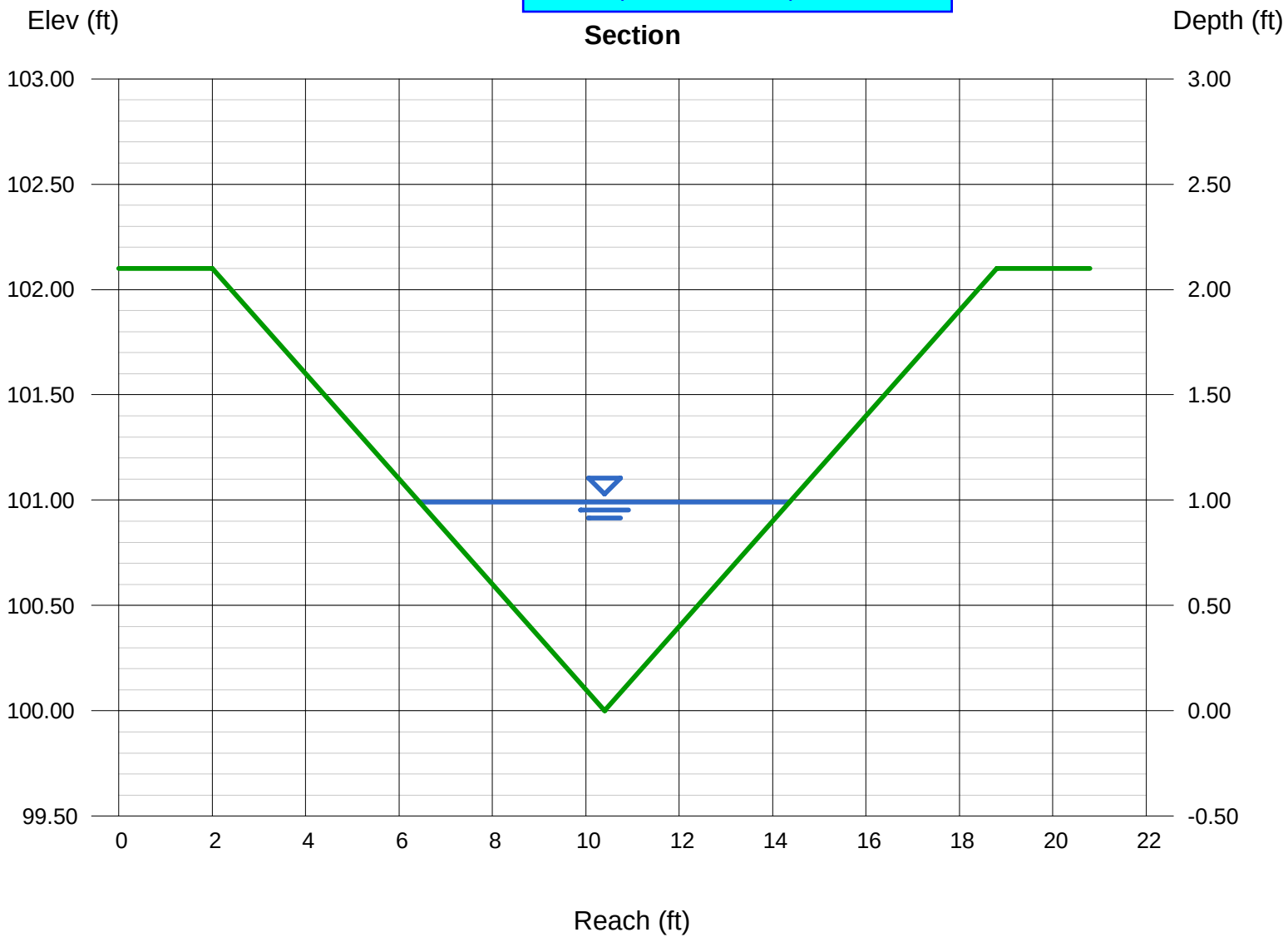
Compute by:	Known Q
Known Q (cfs)	= 19.00

Highlighted

Depth (ft)	= 0.99
Q (cfs)	= 19.00
Area (sqft)	= 3.92
Velocity (ft/s)	= 4.85
Wetted Perim (ft)	= 8.16
Crit Depth, Yc (ft)	= 1.08
Top Width (ft)	= 7.92
EGL (ft)	= 1.36

For slopes greater than 2.8% the velocities exceed 5 ft/s and erosion protection shall be provided

Please specific type of erosion protection and include calculations. This note applied to all swales where erosion protection is required.



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Aug 29 2024

DP4 Swale

Triangular

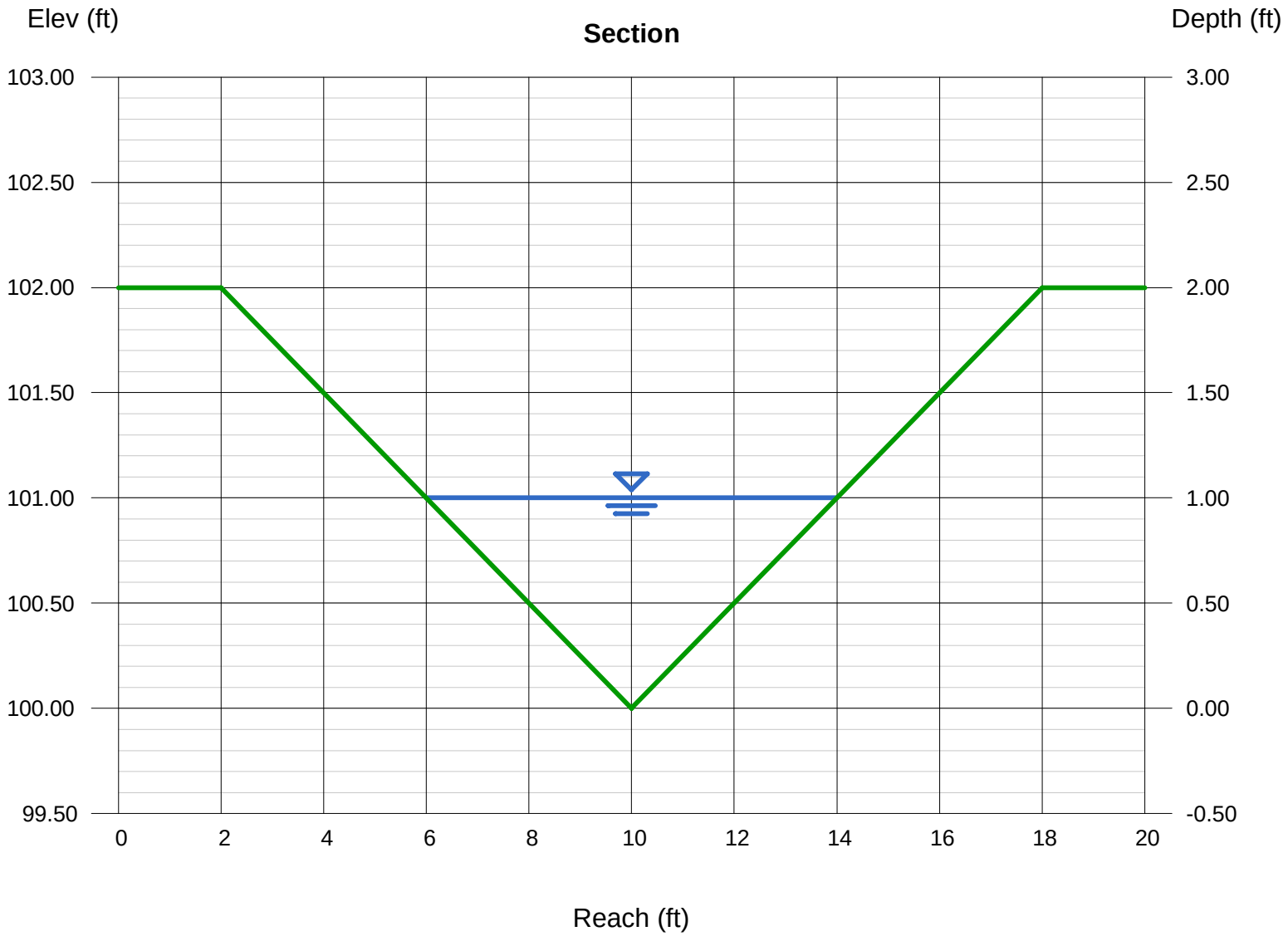
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 12.00

Highlighted

Depth (ft)	= 1.00
Q (cfs)	= 12.00
Area (sqft)	= 4.00
Velocity (ft/s)	= 3.00
Wetted Perim (ft)	= 8.25
Crit Depth, Yc (ft)	= 0.90
Top Width (ft)	= 8.00
EGL (ft)	= 1.14



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 5 2024

DP4 Culvert

Invert Elev Dn (ft)	=	6826.93
Pipe Length (ft)	=	219.20
Slope (%)	=	2.57
Invert Elev Up (ft)	=	6832.56
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

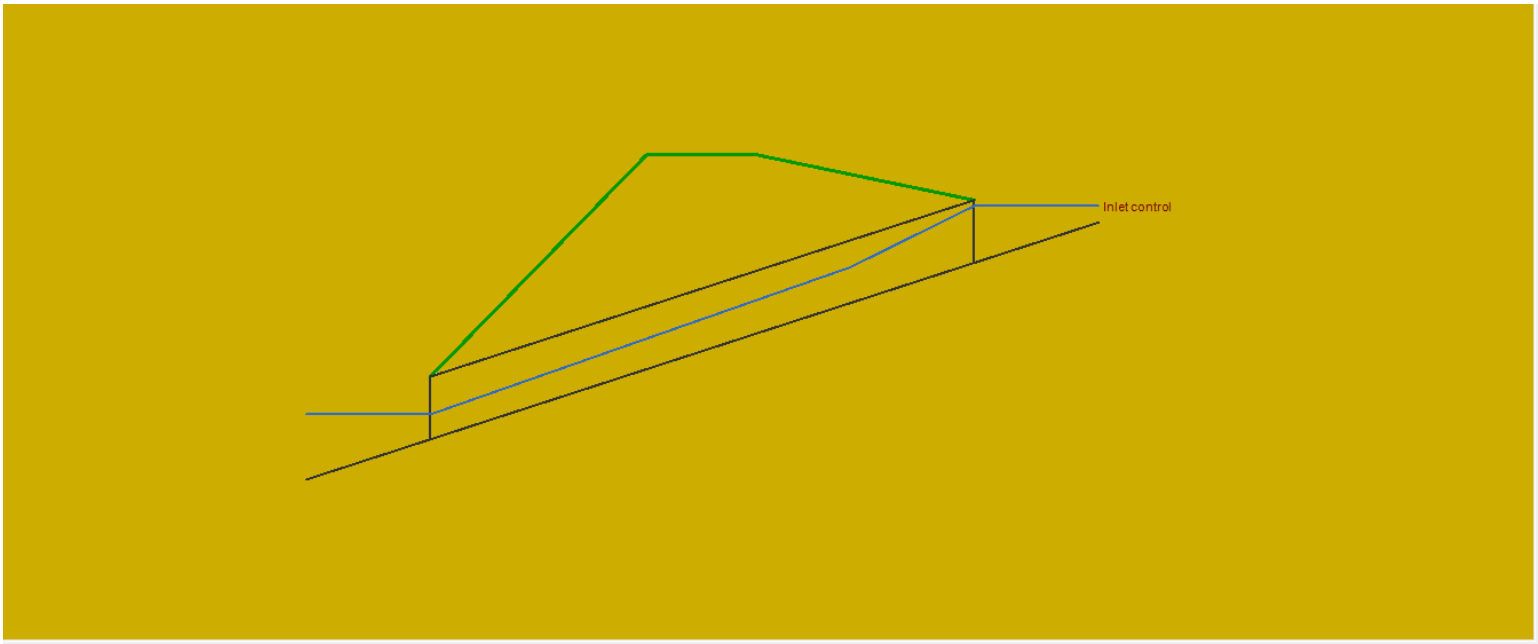
Top Elevation (ft)	=	6836.00
Top Width (ft)	=	45.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	12.00
Qmax (cfs)	=	12.00
Tailwater Elev (ft)	=	Normal

Highlighted

Qtotal (cfs)	=	12.00
Qpipe (cfs)	=	12.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	10.30
Veloc Up (ft/s)	=	5.85
HGL Dn (ft)	=	6827.73
HGL Up (ft)	=	6833.80
Hw Elev (ft)	=	6834.38
Hw/D (ft)	=	0.91
Flow Regime	=	Inlet Control



Please fix diagram

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 5 2024

DP5.1 Swale

Triangular

Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.15
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.030

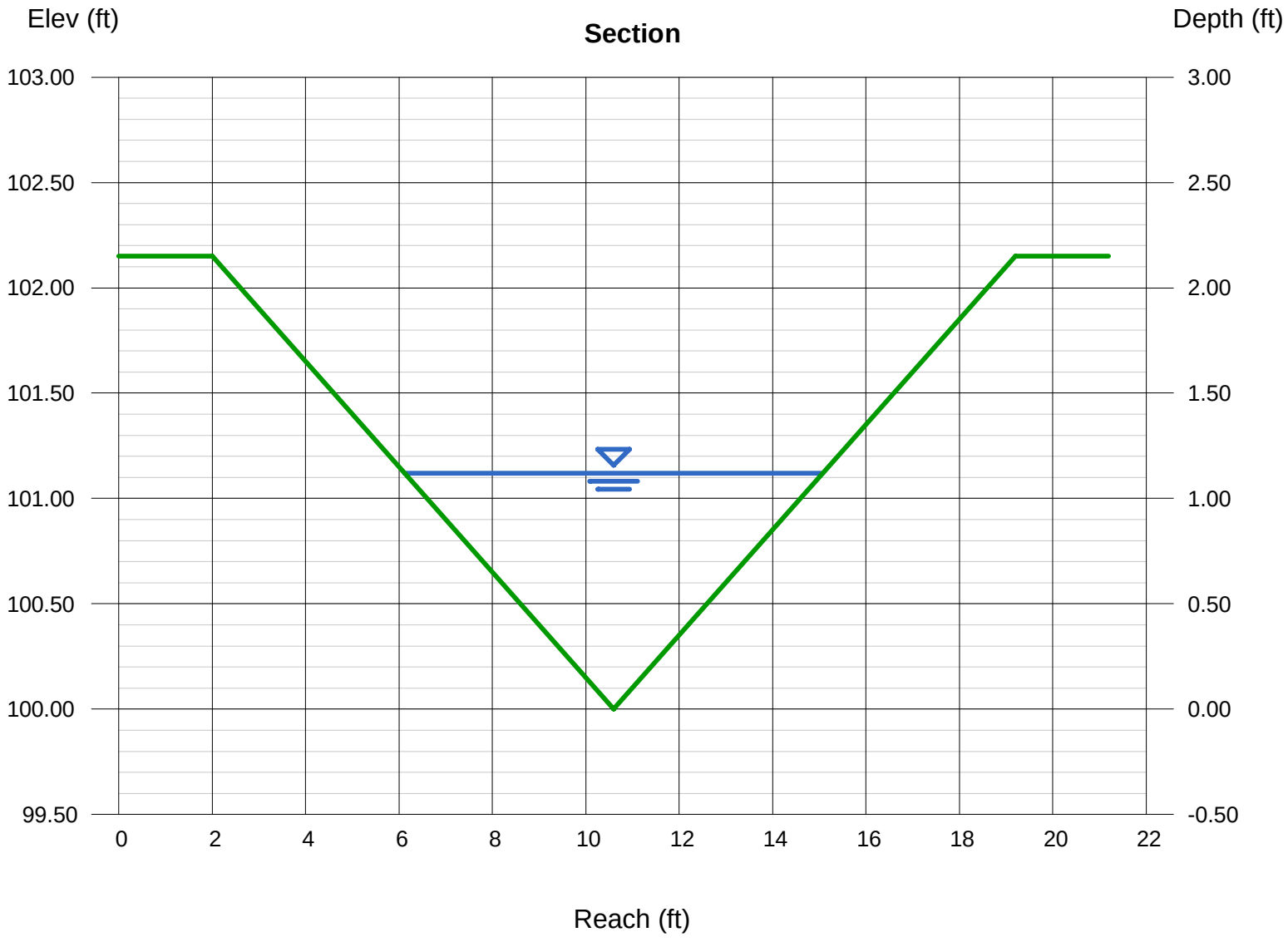
Calculations

Compute by:	Known Q
Known Q (cfs)	= 16.50

Highlighted

Depth (ft)	= 1.12
Q (cfs)	= 16.50
Area (sqft)	= 5.02
Velocity (ft/s)	= 3.29
Wetted Perim (ft)	= 9.24
Crit Depth, Yc (ft)	= 1.02
Top Width (ft)	= 8.96
EGL (ft)	= 1.29

For slopes greater than 3.1% the velocities exceed 5 ft/s and erosion protection shall be provided



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 5 2024

DP5.1 Culvert

Invert Elev Dn (ft)	=	6816.33
Pipe Length (ft)	=	48.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	6816.81
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

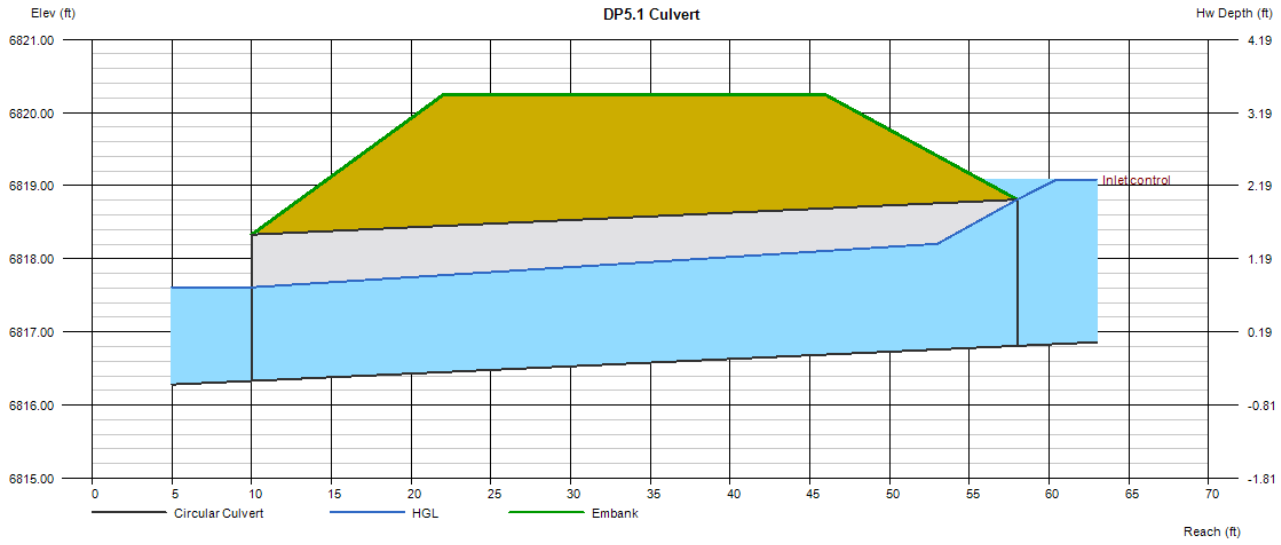
Top Elevation (ft)	=	6820.24
Top Width (ft)	=	24.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	16.50
Qmax (cfs)	=	16.50
Tailwater Elev (ft)	=	Normal

Highlighted

Qtotal (cfs)	=	16.50
Qpipe (cfs)	=	16.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.77
Veloc Up (ft/s)	=	6.70
HGL Dn (ft)	=	6817.61
HGL Up (ft)	=	6818.27
Hw Elev (ft)	=	6819.09
Hw/D (ft)	=	1.14
Flow Regime	=	Inlet Control



Culvert Report

DP5.2 Culvert - Pond 1 Inflow

Invert Elev Dn (ft)	=	6807.53
Pipe Length (ft)	=	39.30
Slope (%)	=	0.82
Invert Elev Up (ft)	=	6807.85
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

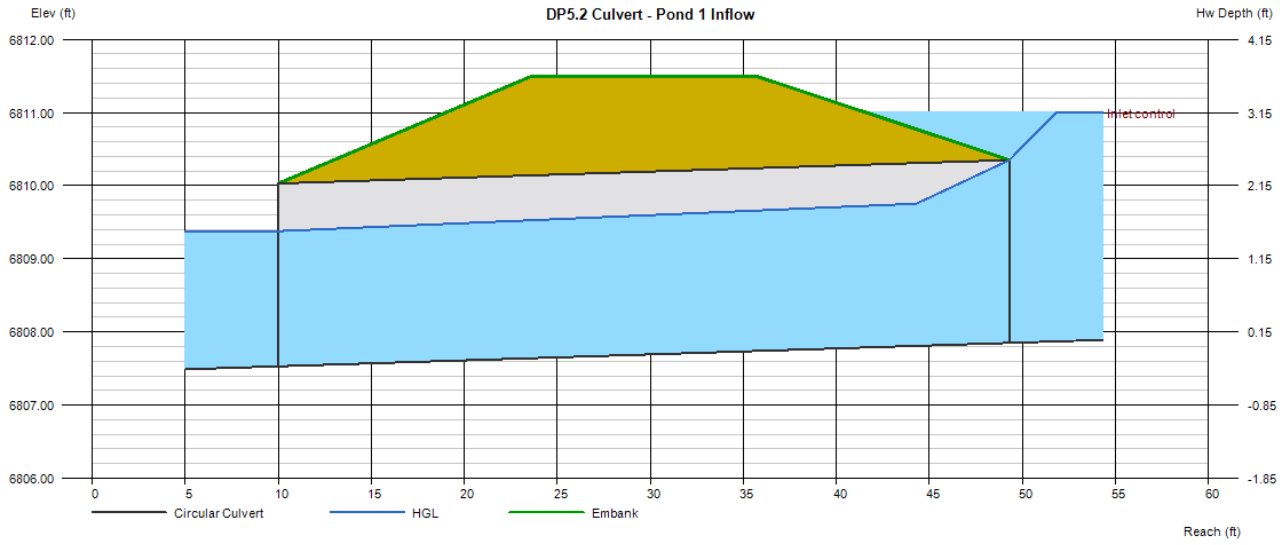
Top Elevation (ft)	=	6811.50
Top Width (ft)	=	12.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	33.00
Qmax (cfs)	=	33.00
Tailwater Elev (ft)	=	6808.99

Highlighted

Qtotal (cfs)	=	33.00
Qpipe (cfs)	=	33.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.48
Veloc Up (ft/s)	=	8.00
HGL Dn (ft)	=	6809.38
HGL Up (ft)	=	6809.81
Hw Elev (ft)	=	6811.00
Hw/D (ft)	=	1.26
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 5 2024

DP7.1 Culvert

Invert Elev Dn (ft)	=	6802.27
Pipe Length (ft)	=	48.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	6802.75
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

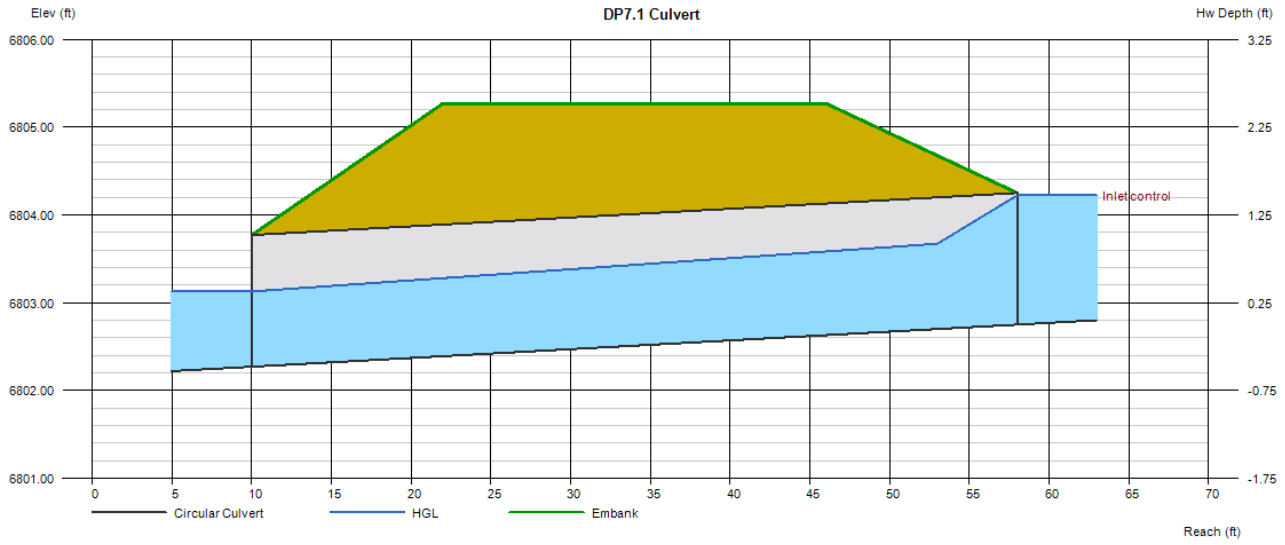
Top Elevation (ft)	=	6805.27
Top Width (ft)	=	24.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	6.50
Qmax (cfs)	=	6.50
Tailwater Elev (ft)	=	Normal

Highlighted

Qtotal (cfs)	=	6.50
Qpipe (cfs)	=	6.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.22
Veloc Up (ft/s)	=	5.28
HGL Dn (ft)	=	6803.13
HGL Up (ft)	=	6803.74
Hw Elev (ft)	=	6804.22
Hw/D (ft)	=	0.98
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 5 2024

DP8.1-Existing Roadside Swale

User-defined

Invert Elev (ft)	= 6798.54
Slope (%)	= 3.30
N-Value	= 0.030

Calculations

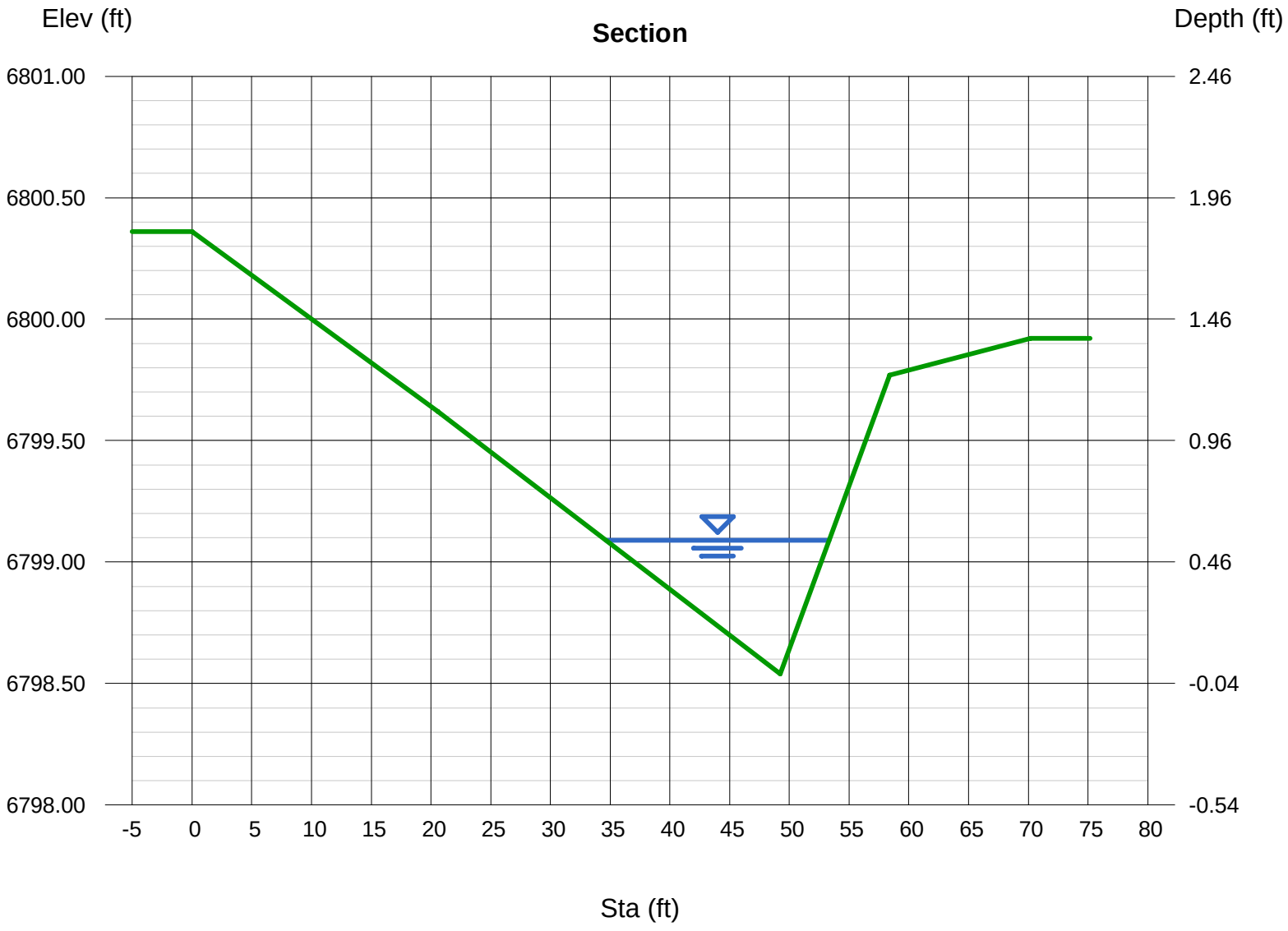
Compute by:	Known Q
Known Q (cfs)	= 19.00

Highlighted

Depth (ft)	= 0.55
Q (cfs)	= 19.00
Area (sqft)	= 5.13
Velocity (ft/s)	= 3.70
Wetted Perim (ft)	= 18.72
Crit Depth, Yc (ft)	= 0.61
Top Width (ft)	= 18.67
EGL (ft)	= 0.76

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

(0.00, 6800.36) -(20.58, 6799.62, 0.030) -(49.23, 6798.54, 0.030) -(58.38, 6799.77, 0.030) -(70.18, 6799.92, 0.030)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Aug 29 2024

DP10 (Half-Flows) Swale

Triangular

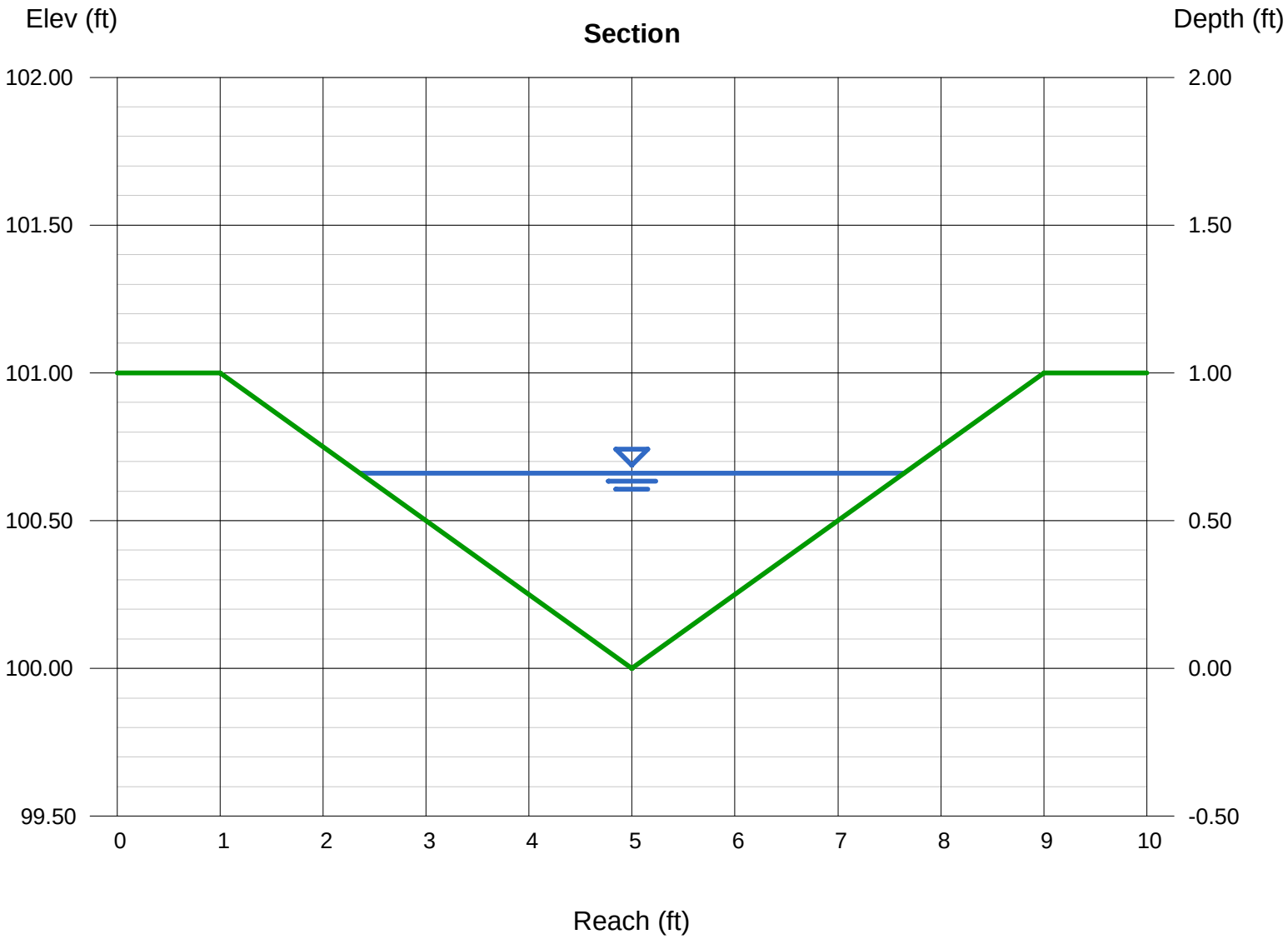
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.00

Highlighted

Depth (ft)	= 0.66
Q (cfs)	= 4.000
Area (sqft)	= 1.74
Velocity (ft/s)	= 2.30
Wetted Perim (ft)	= 5.44
Crit Depth, Yc (ft)	= 0.58
Top Width (ft)	= 5.28
EGL (ft)	= 0.74



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 5 2024

DP10 (Half-Flows) Culvert

Invert Elev Dn (ft)	=	6840.53
Pipe Length (ft)	=	48.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	6841.01
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

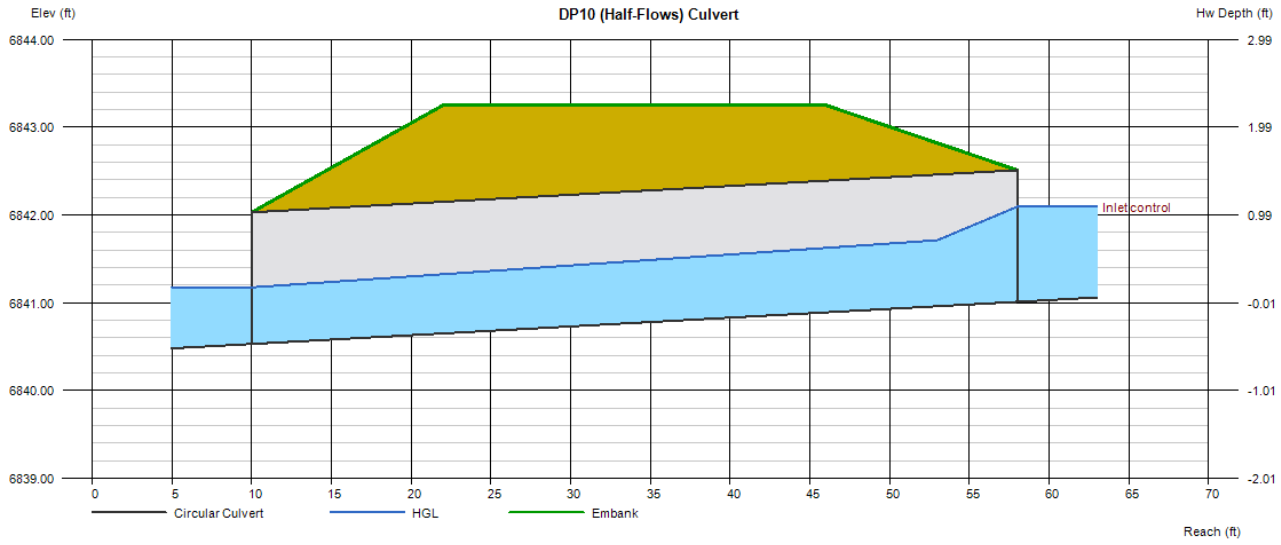
Top Elevation (ft)	=	6843.25
Top Width (ft)	=	24.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	4.00
Qmax (cfs)	=	4.00
Tailwater Elev (ft)	=	Normal

Highlighted

Qtotal (cfs)	=	4.00
Qpipe (cfs)	=	4.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.51
Veloc Up (ft/s)	=	4.42
HGL Dn (ft)	=	6841.17
HGL Up (ft)	=	6841.77
Hw Elev (ft)	=	6842.09
Hw/D (ft)	=	0.72
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Aug 29 2024

DP10 Swale

Triangular

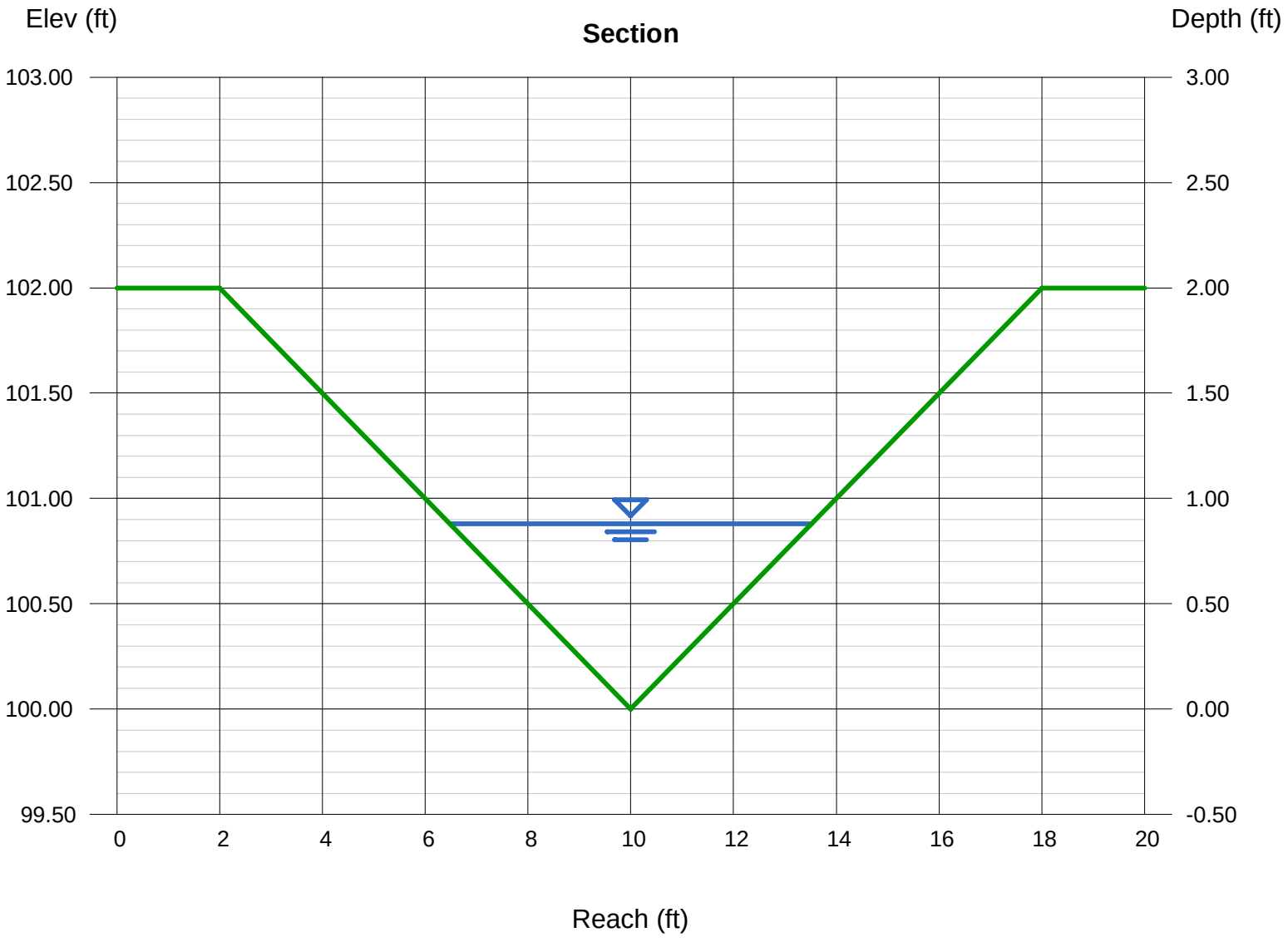
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 8.50

Highlighted

Depth (ft)	= 0.88
Q (cfs)	= 8.500
Area (sqft)	= 3.10
Velocity (ft/s)	= 2.74
Wetted Perim (ft)	= 7.26
Crit Depth, Yc (ft)	= 0.78
Top Width (ft)	= 7.04
EGL (ft)	= 1.00



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 5 2024

DP10 Culvert

Invert Elev Dn (ft)	=	6837.72
Pipe Length (ft)	=	61.50
Slope (%)	=	1.01
Invert Elev Up (ft)	=	6838.34
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

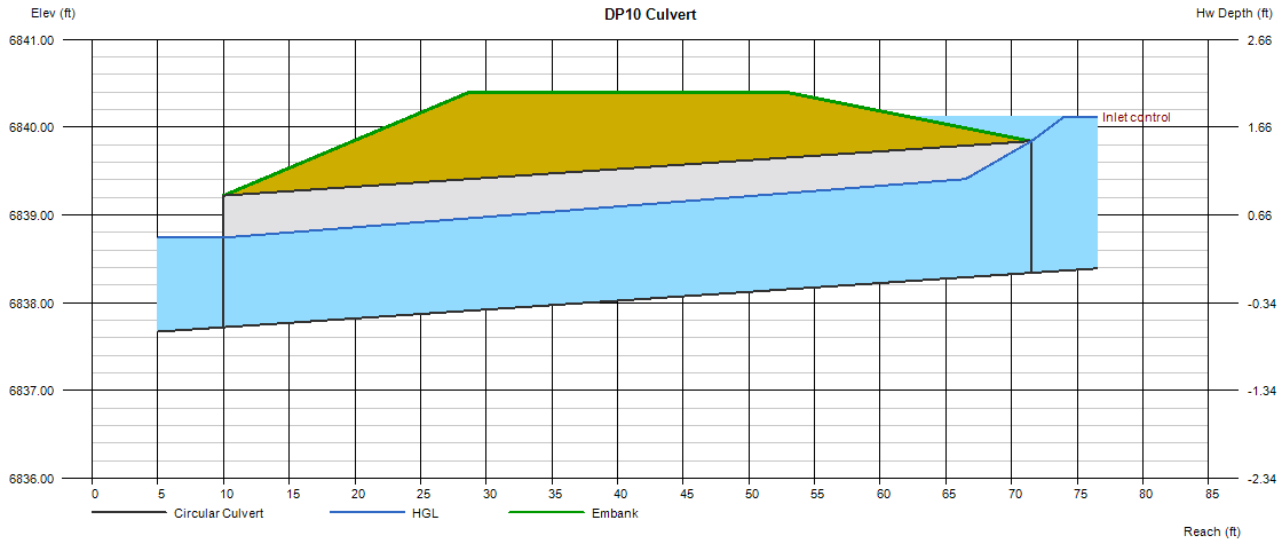
Top Elevation (ft)	=	6840.40
Top Width (ft)	=	24.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	8.50
Qmax (cfs)	=	8.50
Tailwater Elev (ft)	=	Normal

Highlighted

Qtotal (cfs)	=	8.50
Qpipe (cfs)	=	8.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.64
Veloc Up (ft/s)	=	5.96
HGL Dn (ft)	=	6838.74
HGL Up (ft)	=	6839.47
Hw Elev (ft)	=	6840.12
Hw/D (ft)	=	1.18
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Aug 29 2024

DP11 Swale

Triangular

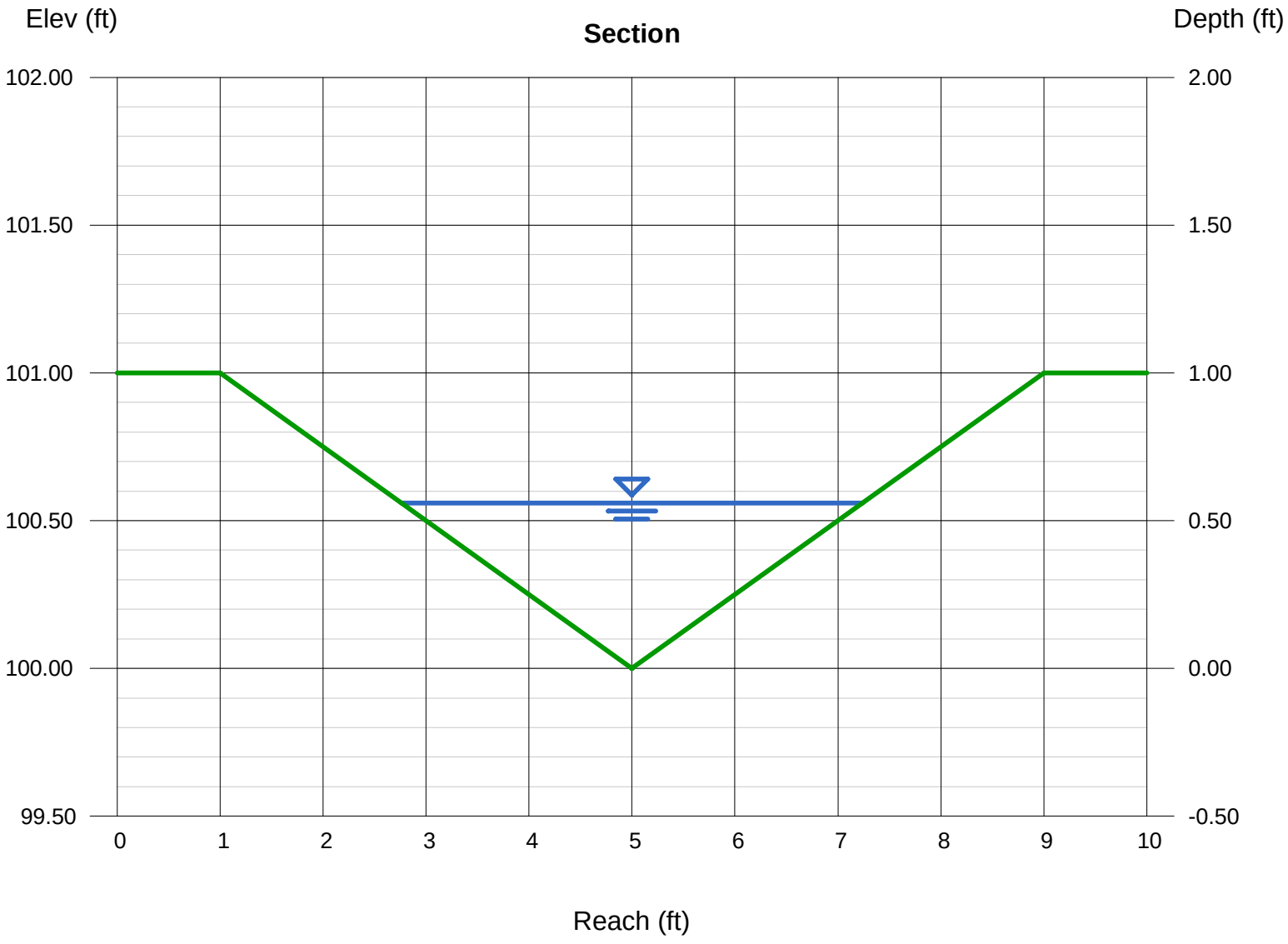
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.50

Highlighted

Depth (ft)	= 0.56
Q (cfs)	= 2.500
Area (sqft)	= 1.25
Velocity (ft/s)	= 1.99
Wetted Perim (ft)	= 4.62
Crit Depth, Yc (ft)	= 0.48
Top Width (ft)	= 4.48
EGL (ft)	= 0.62



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Aug 29 2024

DP11.1 Swale

Triangular

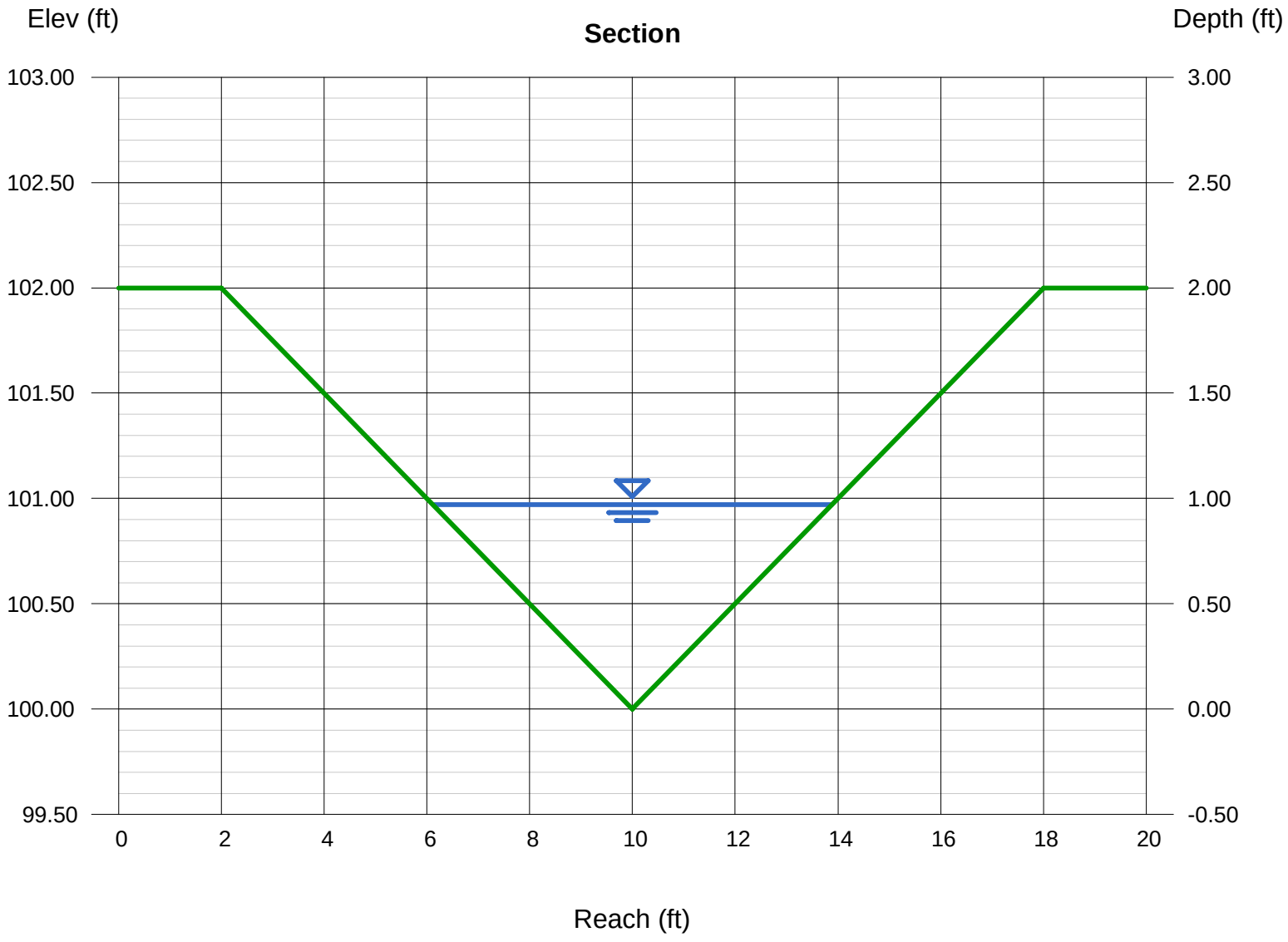
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 11.00

Highlighted

Depth (ft)	= 0.97
Q (cfs)	= 11.00
Area (sqft)	= 3.76
Velocity (ft/s)	= 2.92
Wetted Perim (ft)	= 8.00
Crit Depth, Yc (ft)	= 0.86
Top Width (ft)	= 7.76
EGL (ft)	= 1.10



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 5 2024

DP11.1 Culvert

Invert Elev Dn (ft)	=	6836.92
Pipe Length (ft)	=	43.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	6837.35
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

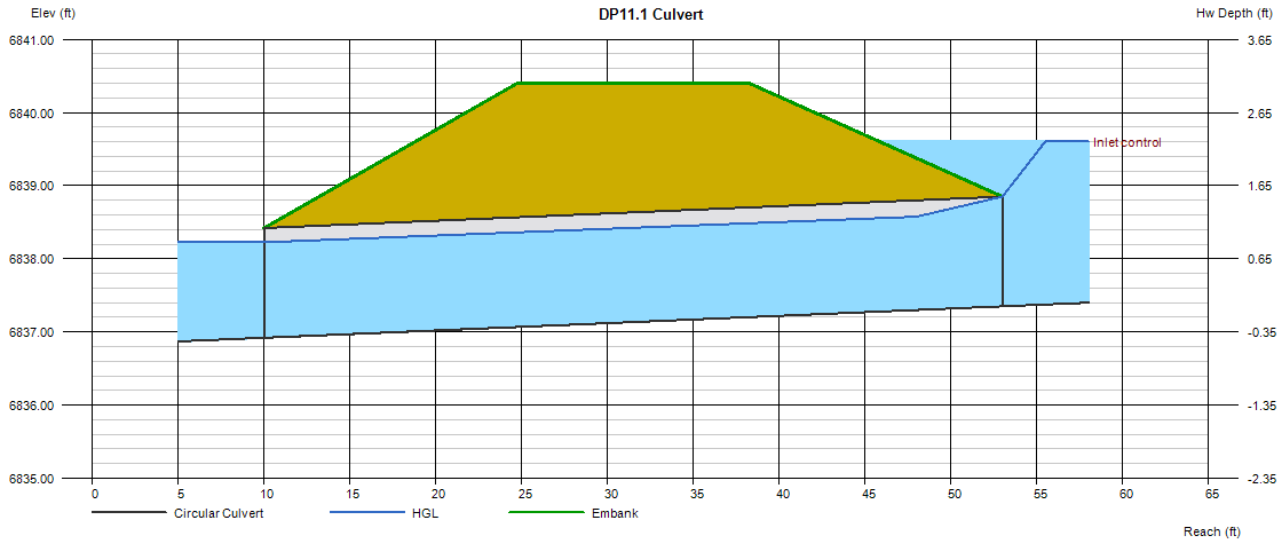
Top Elevation (ft)	=	6840.40
Top Width (ft)	=	13.50
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	11.00
Qmax (cfs)	=	11.00
Tailwater Elev (ft)	=	Normal

Highlighted

Qtotal (cfs)	=	11.00
Qpipe (cfs)	=	11.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.74
Veloc Up (ft/s)	=	6.89
HGL Dn (ft)	=	6838.23
HGL Up (ft)	=	6838.62
Hw Elev (ft)	=	6839.61
Hw/D (ft)	=	1.50
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Aug 29 2024

DP12.1 Swale

Triangular

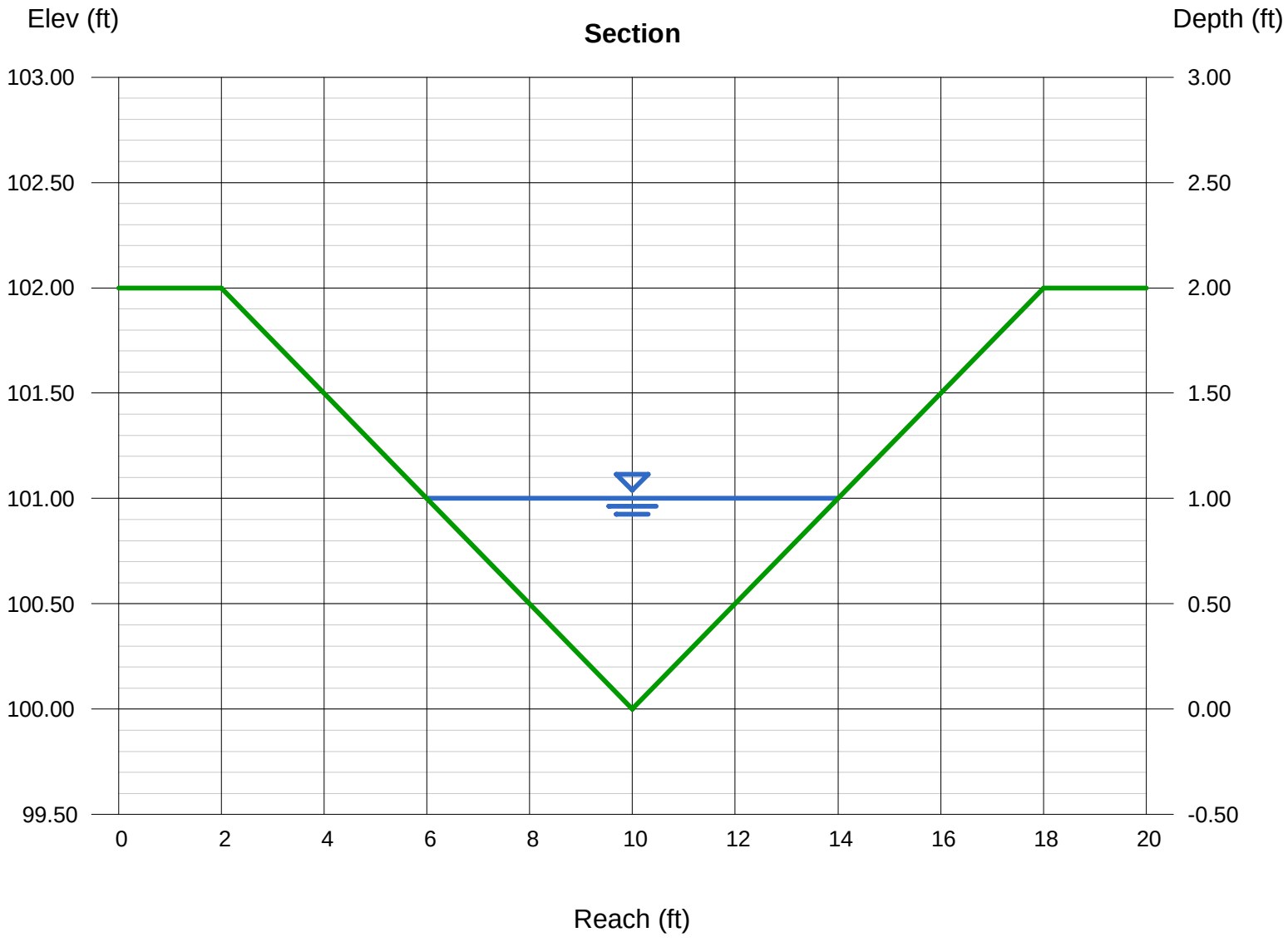
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 12.00

Highlighted

Depth (ft)	= 1.00
Q (cfs)	= 12.00
Area (sqft)	= 4.00
Velocity (ft/s)	= 3.00
Wetted Perim (ft)	= 8.25
Crit Depth, Yc (ft)	= 0.90
Top Width (ft)	= 8.00
EGL (ft)	= 1.14



Channel Report

DP12.1-Preliminary Pipe

Circular

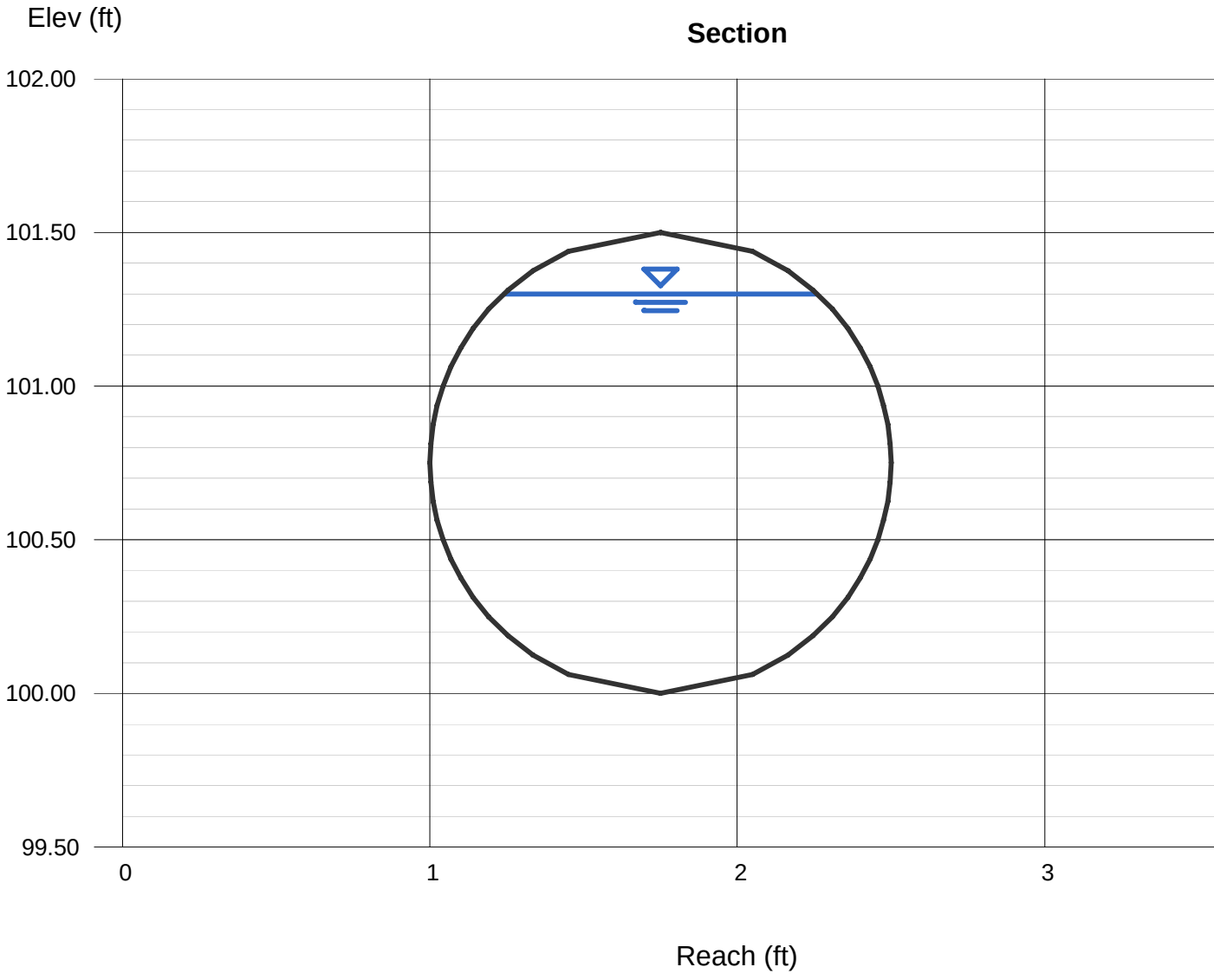
Diameter (ft)	= 1.50
Invert Elev (ft)	= 100.00
Slope (%)	= 1.20
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 12.00

Highlighted

Depth (ft)	= 1.30
Q (cfs)	= 12.00
Area (sqft)	= 1.63
Velocity (ft/s)	= 7.37
Wetted Perim (ft)	= 3.59
Crit Depth, Yc (ft)	= 1.32
Top Width (ft)	= 1.02
EGL (ft)	= 2.15



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Aug 29 2024

DP13 Swale

Triangular

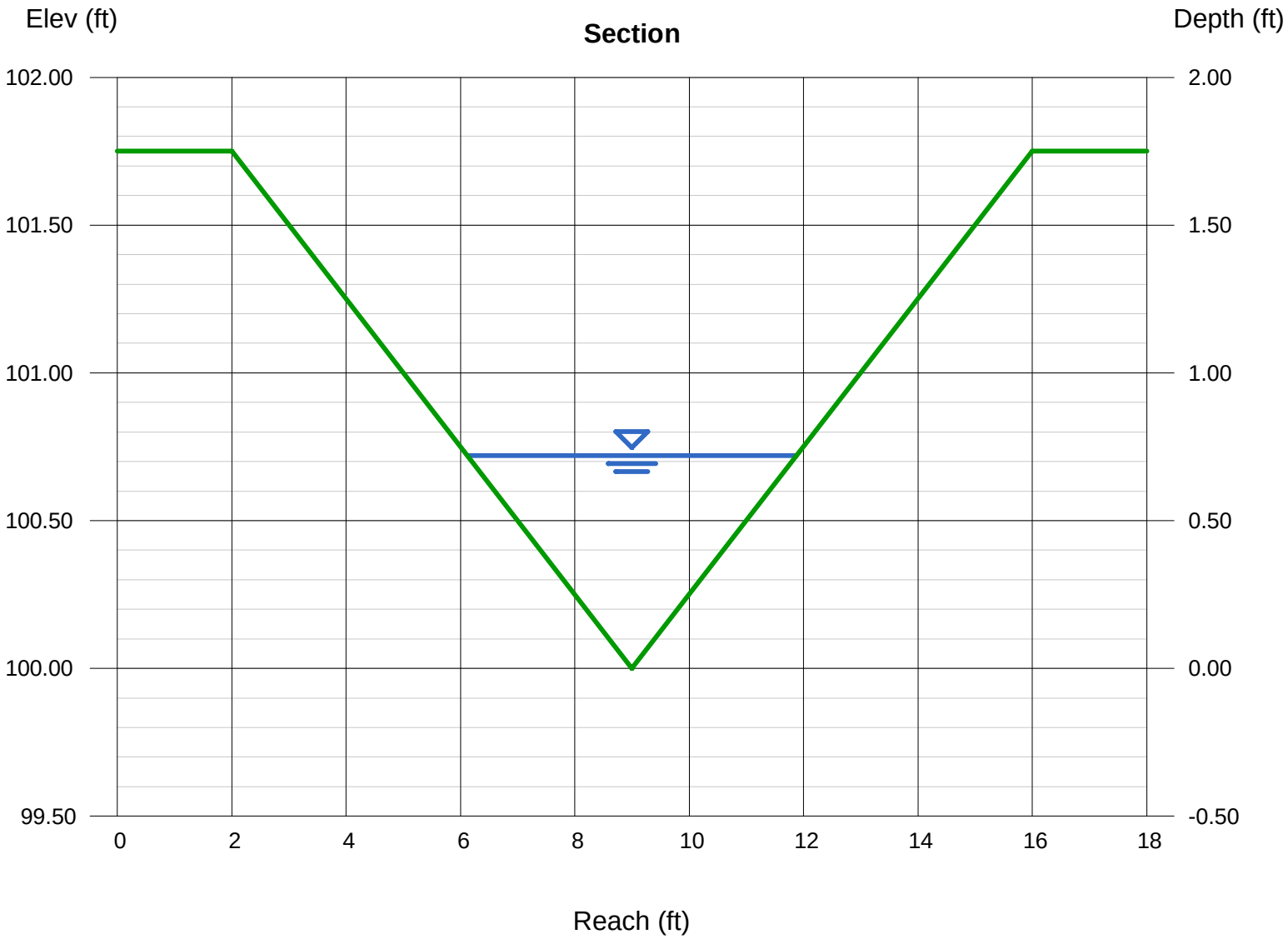
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.75
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.00

Highlighted

Depth (ft)	= 0.72
Q (cfs)	= 5.000
Area (sqft)	= 2.07
Velocity (ft/s)	= 2.41
Wetted Perim (ft)	= 5.94
Crit Depth, Yc (ft)	= 0.63
Top Width (ft)	= 5.76
EGL (ft)	= 0.81



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Sep 5 2024

DP13 Culvert

Invert Elev Dn (ft)	=	6829.09
Pipe Length (ft)	=	17.50
Slope (%)	=	3.60
Invert Elev Up (ft)	=	6829.72
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

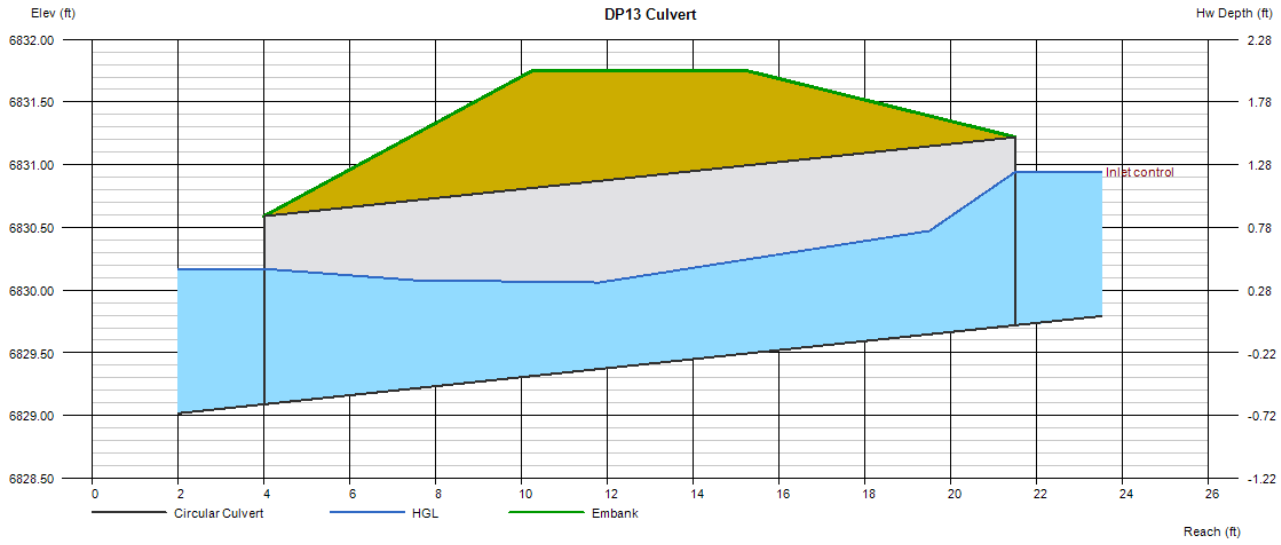
Top Elevation (ft)	=	6831.75
Top Width (ft)	=	5.00
Crest Width (ft)	=	30.00

Calculations

Qmin (cfs)	=	5.00
Qmax (cfs)	=	5.00
Tailwater Elev (ft)	=	6830.17

Highlighted

Qtotal (cfs)	=	5.00
Qpipe (cfs)	=	5.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.67
Veloc Up (ft/s)	=	4.77
HGL Dn (ft)	=	6830.17
HGL Up (ft)	=	6830.58
Hw Elev (ft)	=	6830.94
Hw/D (ft)	=	0.82
Flow Regime	=	Inlet Control



MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP12.1
Site Type (Urban or Rural)	RURAL
Inlet Application (Street or Area)	AREA
Hydraulic Condition	Swale
Inlet Type	CDOT Type C

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	4.0
Major Q_{Known} (cfs)	12.0

Bypass (Carry-Over) Flow from Upstream — Inlets must be organized from upstream (le

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

Watershed Characteristics

Subcatchment Area (acres)	
Percent Impervious	
NRCS Soil Type	

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

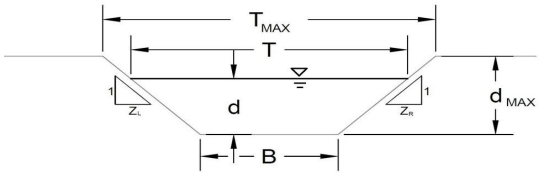
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	4.0
Major Total Design Peak Flow, Q (cfs)	12.0
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0

AREA INLET IN A SWALE

Lazy Y and Rocking J Subdivision

DP12.1



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0100	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	4.00	ft/ft
Right Side Sloe	Z2 =	4.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- (•) **Non-Cohesive**
- ( ) **Cohesive**
- ( ) **Paved**

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	8.00	8.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	2.00	2.00	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	12.3	12.3	cfs
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	1.00	1.00	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	4.0	12.0	cfs
Water Depth	d =	0.66	0.99	ft

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

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

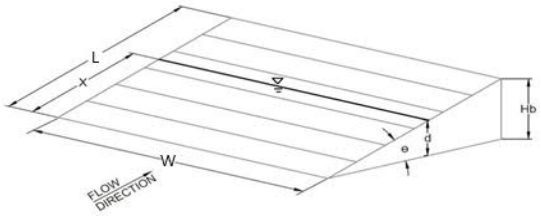
AREA INLET IN A SWALE

Lazy Y and Rocking J Subdivision

DP12.1

Inlet Design Information (Input)

Type of Inlet	CDOT Type C	Inlet Type =	CDOT Type C	
Angle of Inclined Grade (must be <= 30 degrees)		θ =	0.00	degrees
Width of Grate		W =	3.00	ft
Length of Grate		L =	3.00	ft
Open Area Ratio		A_{RATIO} =	0.70	
Height of Inclined Grate		H_B =	0.00	ft
Clogging Factor		C_f =	0.50	
Grate Discharge Coefficient		C_d =	0.96	
Orifice Coefficient		C_o =	0.64	
Weir Coefficient		C_w =	2.05	



		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.66	0.99	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	9.8	16.1	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

Warning 04: Froude No. exceeds USDCM Volume I recommendation.

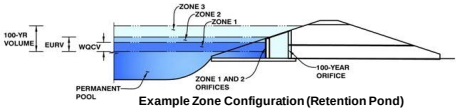
The pond spreadsheets will be reviewed once the construction details for the pond are provided.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Lazy Y and Rocking J Subdivision

Basin ID: Pond 1



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	17.00	acres
Watershed Length =	2,220	ft
Watershed Length to Centroid =	1,610	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	19.50%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.161	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.329	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.365	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.670	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.961	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	1.436	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.776	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.249	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	3.133	acre-feet	inches
Approximate 2-yr Detention Volume =	0.225	acre-feet	
Approximate 5-yr Detention Volume =	0.334	acre-feet	
Approximate 10-yr Detention Volume =	0.543	acre-feet	
Approximate 25-yr Detention Volume =	0.676	acre-feet	
Approximate 50-yr Detention Volume =	0.714	acre-feet	
Approximate 100-yr Detention Volume =	0.879	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.161	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.168	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.550	acre-feet
Total Detention Basin Volume =	0.879	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio (R_{LW}) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

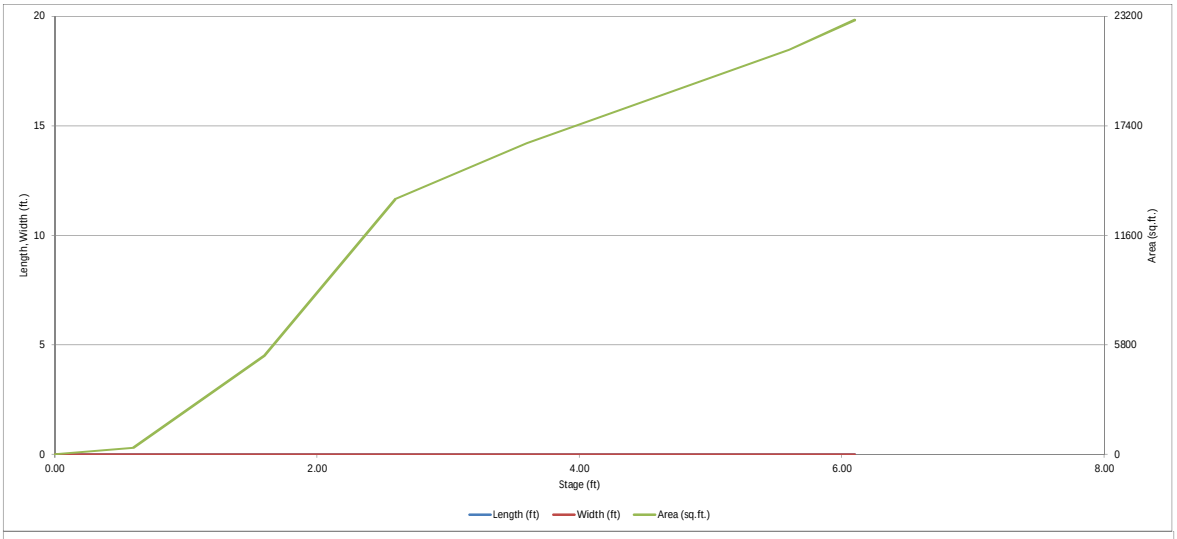
Provide calculations for forebay, forebay outlet, trickle channel, emergency spillway riprap sizing

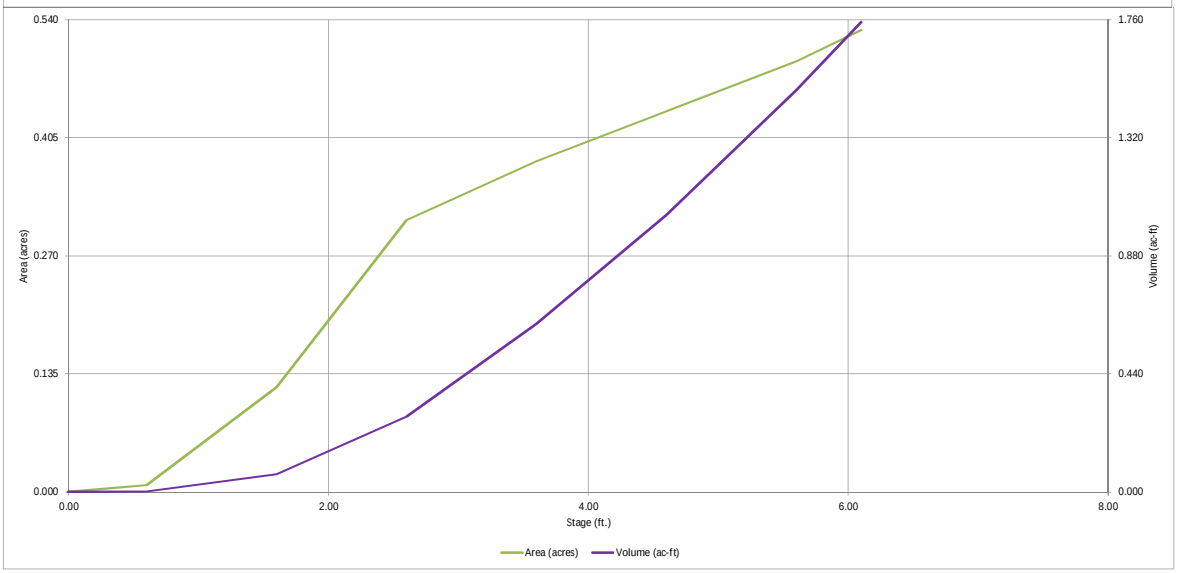
Depth Increment = 0.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
6805.4 Top of Micropool	--	0.00	--	--	--	10	0.000		
6806	--	0.60	--	--	--	335	0.008	103	0.002
6807	--	1.60	--	--	--	5,216	0.120	2,879	0.066
6808	--	2.60	--	--	--	13,531	0.311	12,252	0.281
6809	--	3.60	--	--	--	16,478	0.378	27,257	0.626
6810-Crest	--	4.60	--	--	--	18,961	0.435	44,976	1.033
6811	--	5.60	--	--	--	21,443	0.492	65,178	1.496
6811.50-Top	--	6.10	--	--	--	23,000	0.528	76,289	1.751

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



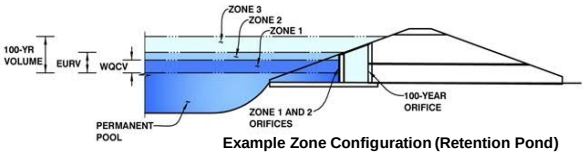


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Lazy Y and Rocking J Subdivision

Basin ID: Pond 1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.16	0.161	Orifice Plate
Zone 2 (EURV)	2.76	0.168	Orifice Plate
Zone 3 (100-year)	4.24	0.550	Weir&Pipe (Restrict)
Total (all zones)		0.879	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	3.60	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.10	1.80					
Orifice Area (sq. inches)	0.90	0.45	0.30					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.85	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	2.85	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	9.26	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	12.66	N/A	ft²
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	6.33	N/A	ft²
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.37	N/A	ft²
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.60	N/A	feet
Restrictor Plate Height Above Pipe Invert =	13.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.03	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.60	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.26	feet
Spillway Crest Length =	40.00	feet	Stage at Top of Freeboard =	5.86	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.51	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.62	acre-ft

Calculated Parameters for Spillway

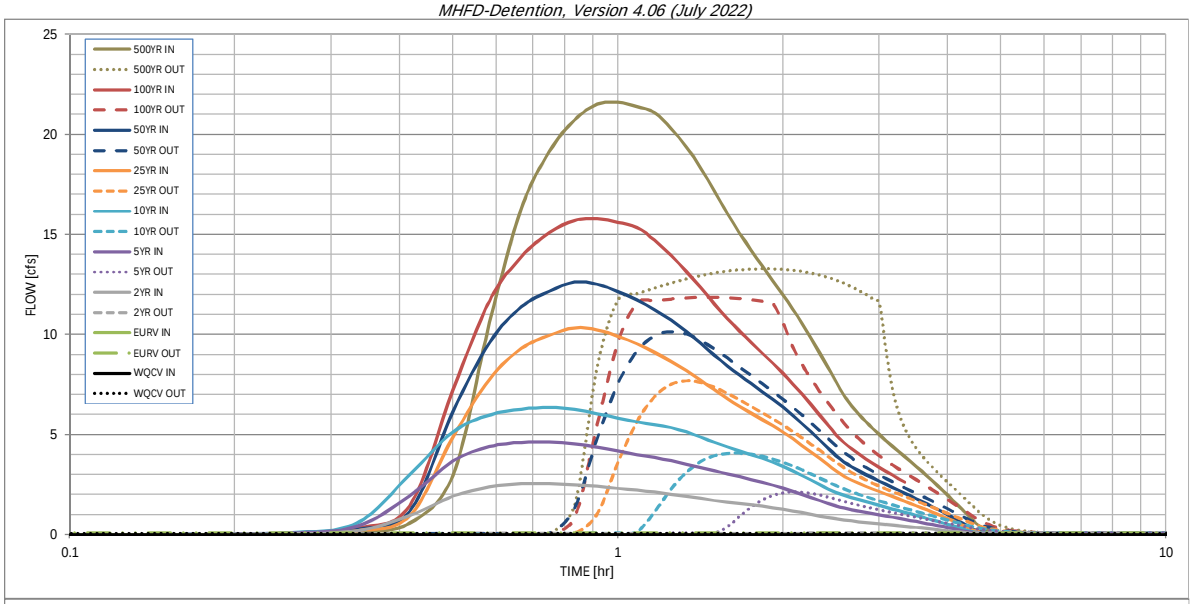
Routed Hydrograph Results

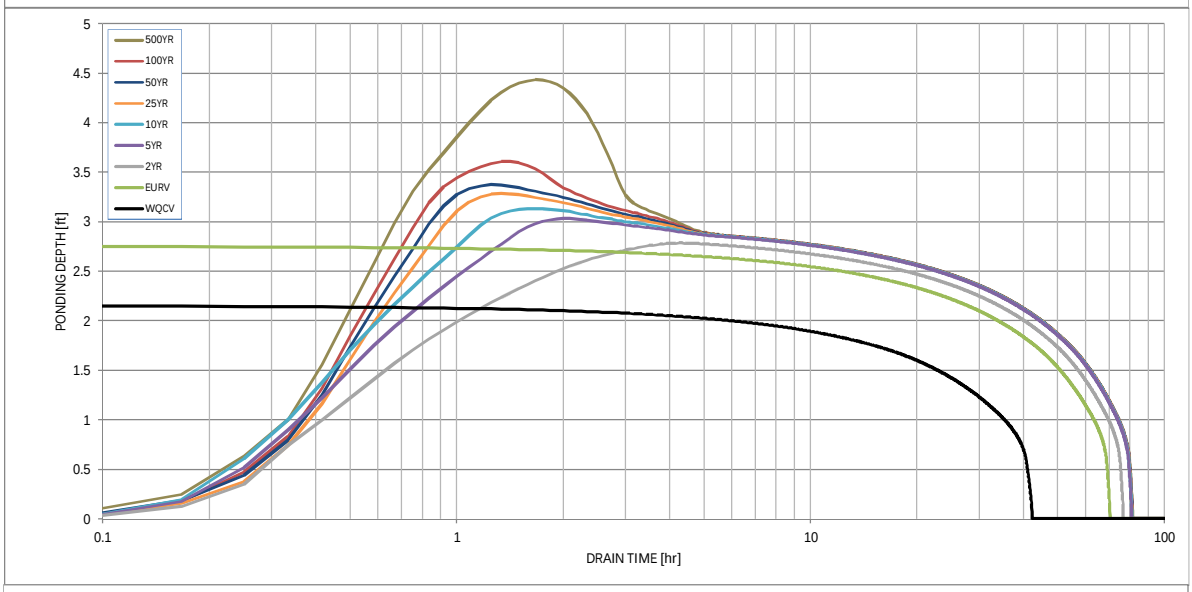
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

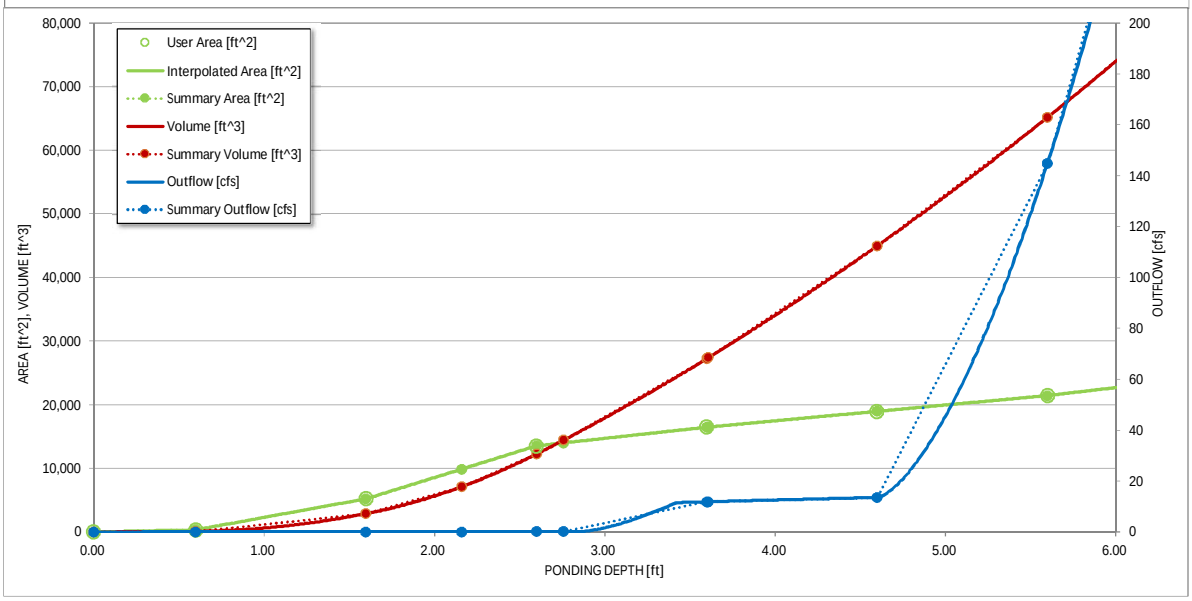
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.161	0.329	0.365	0.670	0.961	1.436	1.776	2.249	3.133
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.365	0.670	0.961	1.436	1.776	2.249	3.133
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.0	2.8	4.4	8.2	10.4	13.5	18.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.06	0.17	0.26	0.48	0.61	0.79	1.11
Peak Inflow Q (cfs) =	N/A	N/A	2.6	4.6	6.4	10.3	12.6	15.8	21.6
Peak Outflow Q (cfs) =	0.1	0.1	0.1	2.1	4.1	7.7	10.2	11.9	13.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.9	0.9	1.0	0.9	0.7
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.3	0.6	0.8	0.9	1.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	40	65	71	72	69	65	62	59	52
Time to Drain 99% of Inflow Volume (hours) =	41	68	74	77	76	74	73	71	69
Maximum Ponding Depth (ft) =	2.16	2.76	2.78	3.03	3.13	3.28	3.37	3.61	4.43
Area at Maximum Ponding Depth (acres) =	0.23	0.32	0.32	0.34	0.35	0.36	0.36	0.38	0.43
Maximum Volume Stored (acre-ft) =	0.163	0.332	0.338	0.421	0.455	0.508	0.541	0.626	0.959

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02
	0:15:00	0.00	0.00	0.05	0.08	0.10	0.07	0.09	0.08	0.12
	0:20:00	0.00	0.00	0.19	0.41	0.57	0.20	0.26	0.32	0.57
	0:25:00	0.00	0.00	0.95	1.94	2.99	0.93	1.15	1.44	2.97
	0:30:00	0.00	0.00	1.93	3.68	5.13	4.88	6.14	7.23	10.61
	0:35:00	0.00	0.00	2.39	4.40	5.98	7.78	9.61	11.70	16.32
	0:40:00	0.00	0.00	2.55	4.61	6.27	9.31	11.39	13.90	19.15
	0:45:00	0.00	0.00	2.56	4.62	6.36	9.96	12.17	15.10	20.72
	0:50:00	0.00	0.00	2.50	4.55	6.26	10.34	12.62	15.71	21.52
	0:55:00	0.00	0.00	2.42	4.38	6.05	10.24	12.52	15.80	21.62
	1:00:00	0.00	0.00	2.32	4.17	5.82	9.91	12.15	15.61	21.40
	1:05:00	0.00	0.00	2.23	4.00	5.64	9.54	11.73	15.36	21.10
	1:10:00	0.00	0.00	2.13	3.86	5.50	9.11	11.24	14.72	20.32
	1:15:00	0.00	0.00	2.02	3.70	5.35	8.66	10.72	13.96	19.39
	1:20:00	0.00	0.00	1.91	3.53	5.14	8.19	10.15	13.16	18.30
	1:25:00	0.00	0.00	1.81	3.35	4.87	7.72	9.57	12.33	17.17
	1:30:00	0.00	0.00	1.71	3.18	4.61	7.24	8.98	11.53	16.07
	1:35:00	0.00	0.00	1.62	3.05	4.40	6.80	8.43	10.80	15.08
	1:40:00	0.00	0.00	1.55	2.90	4.20	6.42	7.97	10.18	14.22
	1:45:00	0.00	0.00	1.49	2.76	4.01	6.08	7.55	9.62	13.44
	1:50:00	0.00	0.00	1.42	2.61	3.82	5.75	7.15	9.08	12.69
	1:55:00	0.00	0.00	1.35	2.47	3.63	5.44	6.76	8.57	11.98
	2:00:00	0.00	0.00	1.27	2.33	3.42	5.13	6.38	8.07	11.29
	2:05:00	0.00	0.00	1.19	2.17	3.19	4.81	5.97	7.55	10.55
	2:10:00	0.00	0.00	1.10	2.01	2.96	4.47	5.56	7.02	9.81
	2:15:00	0.00	0.00	1.02	1.86	2.73	4.14	5.15	6.51	9.08
	2:20:00	0.00	0.00	0.94	1.70	2.51	3.81	4.74	5.99	8.36
	2:25:00	0.00	0.00	0.85	1.55	2.29	3.48	4.33	5.48	7.65
	2:30:00	0.00	0.00	0.78	1.43	2.11	3.17	3.94	4.99	6.98
	2:35:00	0.00	0.00	0.73	1.33	1.98	2.92	3.64	4.61	6.46
	2:40:00	0.00	0.00	0.69	1.26	1.86	2.73	3.40	4.30	6.03
	2:45:00	0.00	0.00	0.65	1.19	1.75	2.56	3.20	4.03	5.65
	2:50:00	0.00	0.00	0.61	1.12	1.65	2.42	3.01	3.79	5.31
	2:55:00	0.00	0.00	0.58	1.06	1.55	2.28	2.84	3.56	4.99
	3:00:00	0.00	0.00	0.54	0.99	1.46	2.15	2.67	3.36	4.70
	3:05:00	0.00	0.00	0.51	0.93	1.37	2.03	2.52	3.16	4.42
	3:10:00	0.00	0.00	0.48	0.88	1.28	1.91	2.37	2.98	4.16
	3:15:00	0.00	0.00	0.45	0.82	1.20	1.79	2.23	2.80	3.91
	3:20:00	0.00	0.00	0.42	0.76	1.12	1.68	2.08	2.63	3.66
	3:25:00	0.00	0.00	0.39	0.71	1.04	1.57	1.94	2.45	3.42
	3:30:00	0.00	0.00	0.36	0.66	0.96	1.45	1.80	2.28	3.17
	3:35:00	0.00	0.00	0.33	0.60	0.89	1.34	1.67	2.10	2.93
	3:40:00	0.00	0.00	0.31	0.55	0.81	1.23	1.53	1.93	2.68
	3:45:00	0.00	0.00	0.28	0.50	0.74	1.12	1.39	1.76	2.44
	3:50:00	0.00	0.00	0.25	0.45	0.66	1.01	1.26	1.59	2.20
	3:55:00	0.00	0.00	0.22	0.40	0.59	0.91	1.12	1.42	1.97
	4:00:00	0.00	0.00	0.20	0.35	0.52	0.80	0.99	1.25	1.73
	4:05:00	0.00	0.00	0.17	0.30	0.45	0.69	0.86	1.08	1.49
	4:10:00	0.00	0.00	0.14	0.25	0.37	0.58	0.72	0.91	1.26
	4:15:00	0.00	0.00	0.12	0.20	0.30	0.48	0.59	0.74	1.02
	4:20:00	0.00	0.00	0.09	0.15	0.23	0.37	0.46	0.58	0.79
	4:25:00	0.00	0.00	0.06	0.11	0.17	0.27	0.33	0.42	0.57
	4:30:00	0.00	0.00	0.05	0.08	0.13	0.18	0.22	0.28	0.40
	4:35:00	0.00	0.00	0.03	0.06	0.11	0.13	0.16	0.20	0.29
	4:40:00	0.00	0.00	0.03	0.05	0.09	0.09	0.12	0.14	0.21
	4:45:00	0.00	0.00	0.02	0.04	0.07	0.07	0.09	0.10	0.16
	4:50:00	0.00	0.00	0.02	0.03	0.06	0.05	0.07	0.07	0.11
	4:55:00	0.00	0.00	0.02	0.03	0.05	0.04	0.05	0.05	0.08
	5:00:00	0.00	0.00	0.01	0.02	0.04	0.03	0.04	0.03	0.06
	5:05:00	0.00	0.00	0.01	0.02	0.03	0.02	0.03	0.03	0.04
	5:10:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	5:15:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.02	0.02
	5:20:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	5:25:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	5:30:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

Stage - Storage Description	Stage [ft]	Area [ft²]	Area [acres]	Volume [ft³]	Volume [ac-ft]	Total Outflow [cfs]
6805.4-Top of Micropool	0.00	10	0.000	0	0.000	0.00
6806.00	0.60	335	0.008	103	0.002	0.02
6807.00	1.60	5,216	0.120	2,879	0.066	0.05
6807.56-WQCV	2.16	9,872	0.227	7,104	0.163	0.07
6808.00	2.60	13,531	0.311	12,252	0.281	0.08
6808.16-EURV	2.76	14,003	0.321	14,455	0.332	0.08
6809.00	3.60	16,478	0.378	27,257	0.626	11.86
6809.01-100 year	3.61	16,503	0.379	27,422	0.630	11.88
6810.00-Spillway Crest	4.60	18,961	0.435	44,976	1.033	13.56
6811.00	5.60	21,443	0.492	65,178	1.496	144.67
6811.50-Top of Pond	6.10	23,000	0.528	76,289	1.751	262.68

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

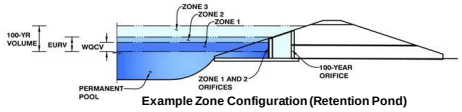
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Lazy Y and Rocking J Subdivision

Basin ID: Pond 2



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	8.50	acres
Watershed Length =	1,175	ft
Watershed Length to Centroid =	750	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	26.50%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.099	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.229	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.236	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.397	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.547	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	0.778	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.950	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.183	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	1.627	acre-feet	inches
Approximate 2-yr Detention Volume =	0.162	acre-feet	
Approximate 5-yr Detention Volume =	0.234	acre-feet	
Approximate 10-yr Detention Volume =	0.351	acre-feet	
Approximate 25-yr Detention Volume =	0.415	acre-feet	
Approximate 50-yr Detention Volume =	0.437	acre-feet	
Approximate 100-yr Detention Volume =	0.524	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.099	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.130	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.295	acre-feet
Total Detention Basin Volume =	0.524	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

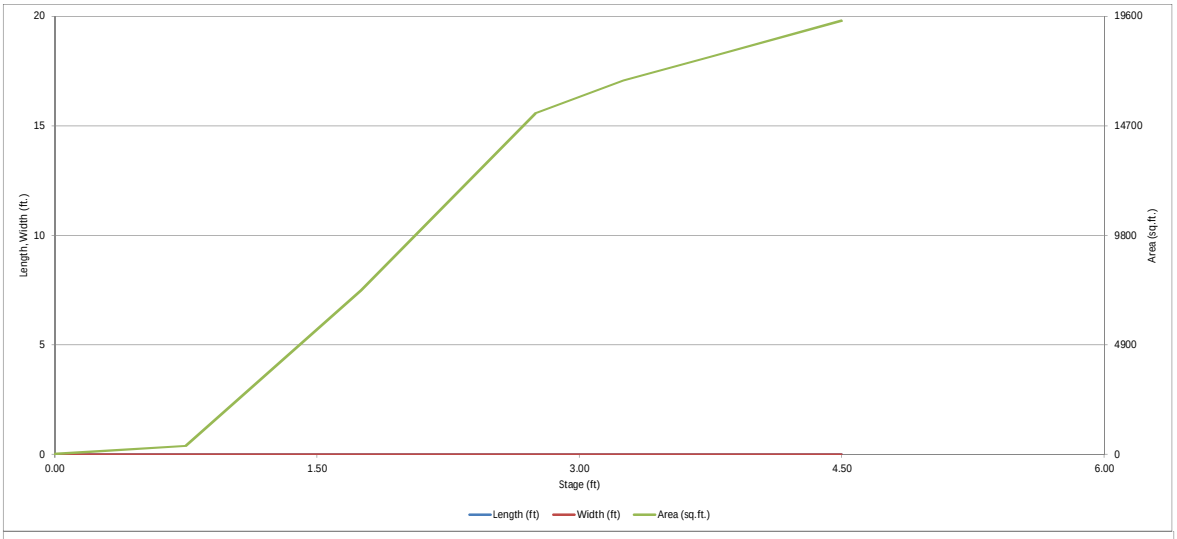
Depth Increment = 0.00 ft

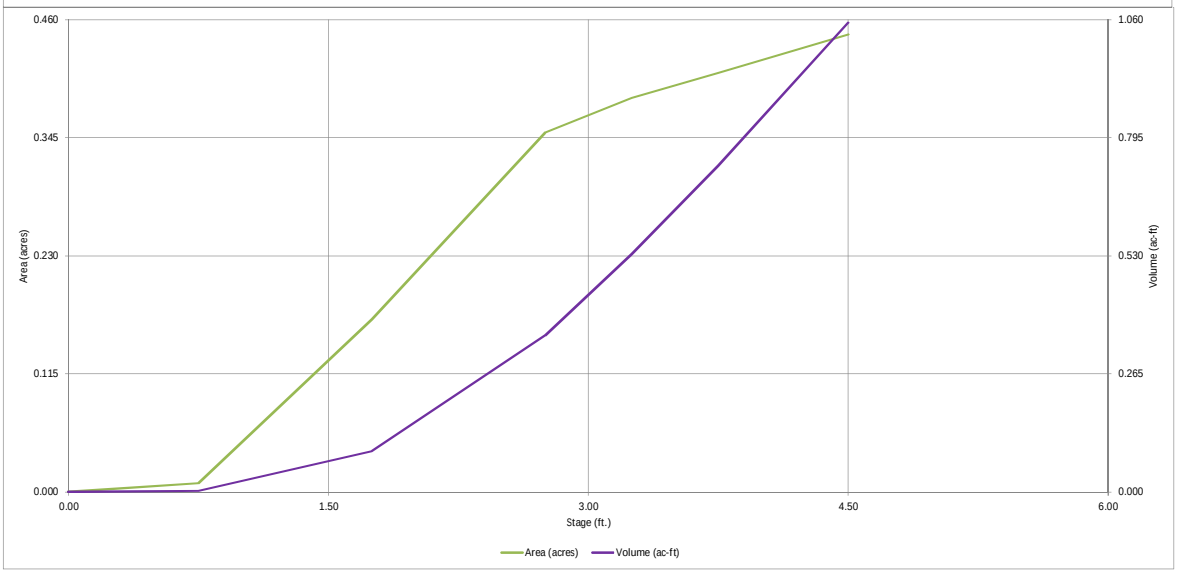
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	10	0.000		
6828	--	0.75	--	--	--	380	0.009	146	0.003
6829	--	1.75	--	--	--	7,331	0.168	4,002	0.092
6830	--	2.75	--	--	--	15,259	0.350	15,297	0.351
6830.50-Crest	--	3.25	--	--	--	16,723	0.384	23,292	0.535
6831	--	3.75	--	--	--	17,785	0.408	31,919	0.733
6831.75-Top	--	4.50	--	--	--	19,405	0.445	45,865	1.053

6827.25

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



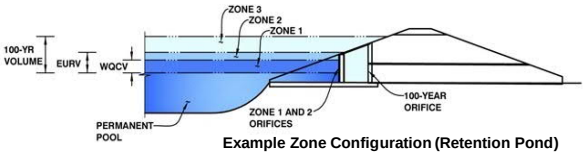


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Lazy Y and Rocking J Subdivision

Basin ID: Pond 2



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.80	0.099	Orifice Plate
Zone 2 (EURV)	2.37	0.130	Orifice Plate
Zone 3 (100-year)	3.23	0.295	Weir&Pipe (Restrict)
Total (all zones)		0.524	

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

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

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.60	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	1.40					
Orifice Area (sq. inches)	0.56	0.38	0.30					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.30	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	2.30	N/A	feet
Overflow Weir Front Edge Length =	3.00	N/A	feet	Overflow Weir Slope Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	7.24	N/A	
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	7.12	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	3.56	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.98	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.47	N/A	feet
Restrictor Plate Height Above Pipe Invert =	9.80		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.66	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.25	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.25	feet
Spillway Crest Length =	26.00	feet	Stage at Top of Freeboard =	4.50	feet
Spillway End Slopes =	20.00	H:V	Basin Area at Top of Freeboard =	0.45	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.05	acre-ft

Calculated Parameters for Spillway

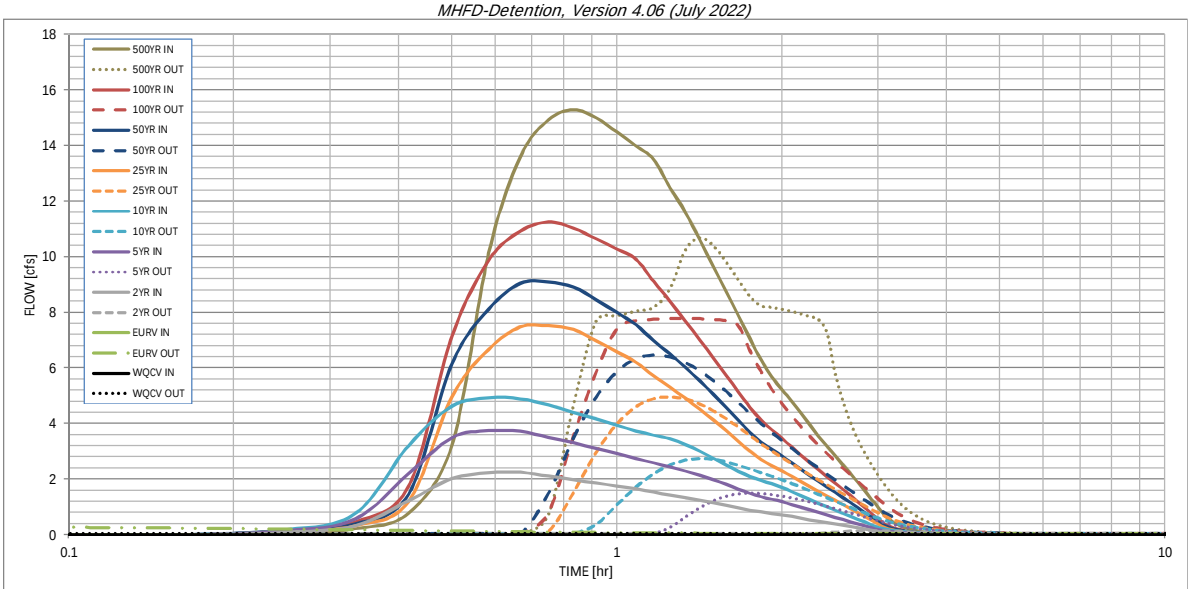
Routed Hydrograph Results

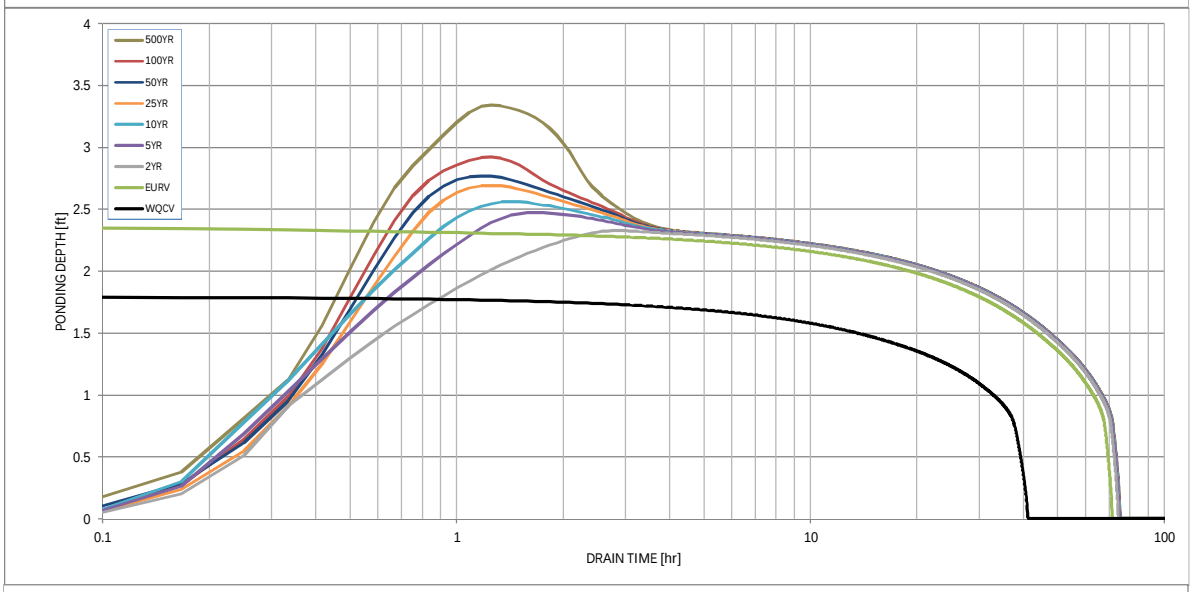
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

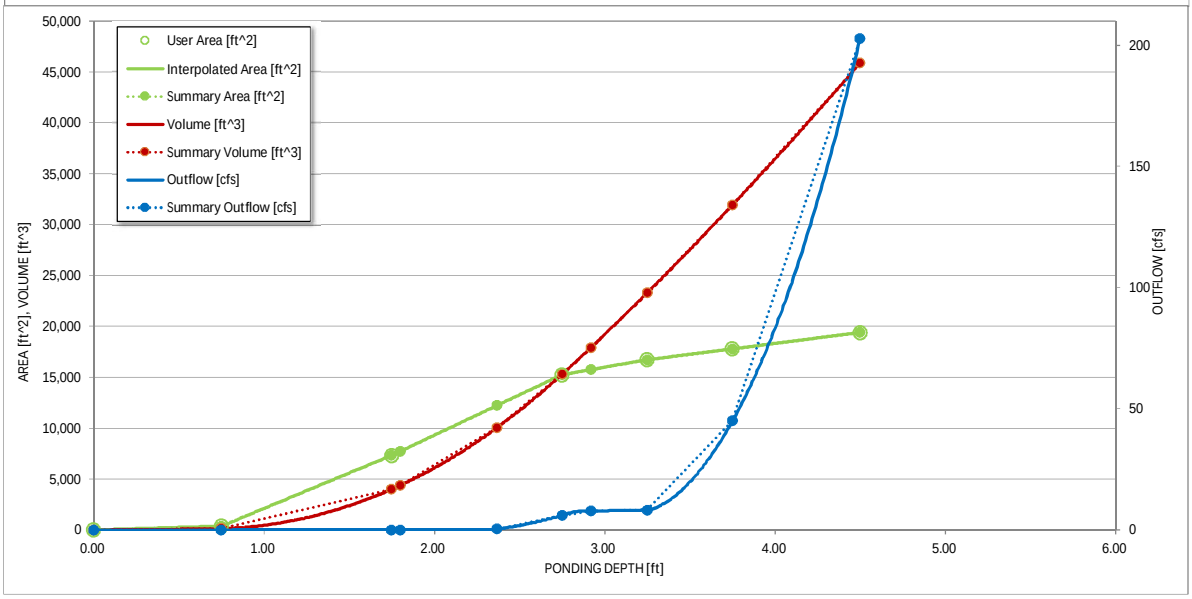
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.099	0.229	0.236	0.397	0.547	0.778	0.950	1.183	1.627
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.236	0.397	0.547	0.778	0.950	1.183	1.627
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.7	2.0	3.0	5.5	6.9	8.9	12.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.08	0.23	0.36	0.65	0.81	1.04	1.46
Peak Inflow Q (cfs) =	N/A	N/A	2.2	3.7	4.9	7.5	9.1	11.3	15.3
Peak Outflow Q (cfs) =	0.0	0.3	0.1	1.5	2.7	5.0	6.5	7.8	10.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.9	0.9	0.9	0.9	0.9
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.05	0.01	0.2	0.4	0.7	0.9	1.1	1.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	66	68	66	63	60	58	55	50
Time to Drain 99% of Inflow Volume (hours) =	40	69	72	71	70	68	67	66	64
Maximum Ponding Depth (ft) =	1.80	2.37	2.33	2.47	2.56	2.69	2.77	2.92	3.34
Area at Maximum Ponding Depth (acres) =	0.18	0.28	0.27	0.30	0.32	0.34	0.35	0.36	0.39
Maximum Volume Stored (acre-ft) =	0.101	0.231	0.217	0.260	0.288	0.330	0.355	0.412	0.569

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.03
	0:15:00	0.00	0.00	0.09	0.15	0.18	0.12	0.15	0.15	0.22
	0:20:00	0.00	0.00	0.33	0.57	0.77	0.32	0.39	0.46	0.78
	0:25:00	0.00	0.00	1.22	2.20	3.21	1.20	1.46	1.74	3.22
	0:30:00	0.00	0.00	2.02	3.49	4.63	4.96	6.15	7.14	10.13
	0:35:00	0.00	0.00	2.22	3.75	4.93	6.67	8.12	9.87	13.61
	0:40:00	0.00	0.00	2.25	3.72	4.89	7.48	9.04	10.93	14.93
	0:45:00	0.00	0.00	2.11	3.51	4.67	7.52	9.08	11.25	15.29
	0:50:00	0.00	0.00	1.98	3.31	4.40	7.39	8.92	11.04	15.00
	0:55:00	0.00	0.00	1.86	3.11	4.17	6.98	8.45	10.65	14.49
	1:00:00	0.00	0.00	1.76	2.92	3.94	6.59	8.00	10.28	14.00
	1:05:00	0.00	0.00	1.66	2.74	3.73	6.20	7.56	9.91	13.51
	1:10:00	0.00	0.00	1.54	2.59	3.58	5.71	6.98	9.11	12.49
	1:15:00	0.00	0.00	1.43	2.45	3.45	5.32	6.52	8.41	11.60
	1:20:00	0.00	0.00	1.34	2.29	3.25	4.91	6.02	7.69	10.60
	1:25:00	0.00	0.00	1.24	2.13	3.00	4.52	5.54	7.00	9.65
	1:30:00	0.00	0.00	1.15	1.98	2.75	4.12	5.05	6.36	8.75
	1:35:00	0.00	0.00	1.05	1.82	2.51	3.74	4.58	5.74	7.88
	1:40:00	0.00	0.00	0.96	1.64	2.28	3.36	4.12	5.15	7.05
	1:45:00	0.00	0.00	0.88	1.49	2.09	3.00	3.68	4.58	6.28
	1:50:00	0.00	0.00	0.83	1.37	1.96	2.71	3.33	4.13	5.69
	1:55:00	0.00	0.00	0.77	1.28	1.84	2.49	3.06	3.78	5.22
	2:00:00	0.00	0.00	0.72	1.19	1.71	2.30	2.84	3.48	4.81
	2:05:00	0.00	0.00	0.66	1.09	1.55	2.10	2.59	3.16	4.37
	2:10:00	0.00	0.00	0.60	0.99	1.41	1.91	2.35	2.86	3.95
	2:15:00	0.00	0.00	0.54	0.89	1.27	1.73	2.13	2.59	3.56
	2:20:00	0.00	0.00	0.48	0.80	1.13	1.56	1.92	2.33	3.19
	2:25:00	0.00	0.00	0.43	0.71	1.01	1.40	1.72	2.09	2.85
	2:30:00	0.00	0.00	0.38	0.63	0.89	1.24	1.52	1.86	2.52
	2:35:00	0.00	0.00	0.34	0.55	0.77	1.09	1.34	1.63	2.20
	2:40:00	0.00	0.00	0.29	0.47	0.67	0.94	1.15	1.41	1.89
	2:45:00	0.00	0.00	0.24	0.39	0.56	0.80	0.98	1.19	1.58
	2:50:00	0.00	0.00	0.20	0.32	0.45	0.65	0.80	0.97	1.27
	2:55:00	0.00	0.00	0.16	0.24	0.35	0.51	0.63	0.76	0.97
	3:00:00	0.00	0.00	0.12	0.18	0.26	0.38	0.46	0.56	0.70
	3:05:00	0.00	0.00	0.09	0.14	0.21	0.26	0.32	0.39	0.51
	3:10:00	0.00	0.00	0.07	0.11	0.17	0.19	0.24	0.28	0.37
	3:15:00	0.00	0.00	0.06	0.09	0.14	0.14	0.18	0.21	0.28
	3:20:00	0.00	0.00	0.05	0.08	0.12	0.11	0.14	0.15	0.21
	3:25:00	0.00	0.00	0.04	0.06	0.10	0.08	0.11	0.11	0.16
	3:30:00	0.00	0.00	0.03	0.05	0.08	0.07	0.09	0.08	0.11
	3:35:00	0.00	0.00	0.03	0.04	0.06	0.05	0.07	0.06	0.08
	3:40:00	0.00	0.00	0.02	0.03	0.05	0.04	0.05	0.04	0.06
	3:45:00	0.00	0.00	0.02	0.03	0.04	0.03	0.04	0.04	0.05
	3:50:00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.03	0.04
	3:55:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	4:00:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.02
	4:05:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	4:10:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	4:15:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

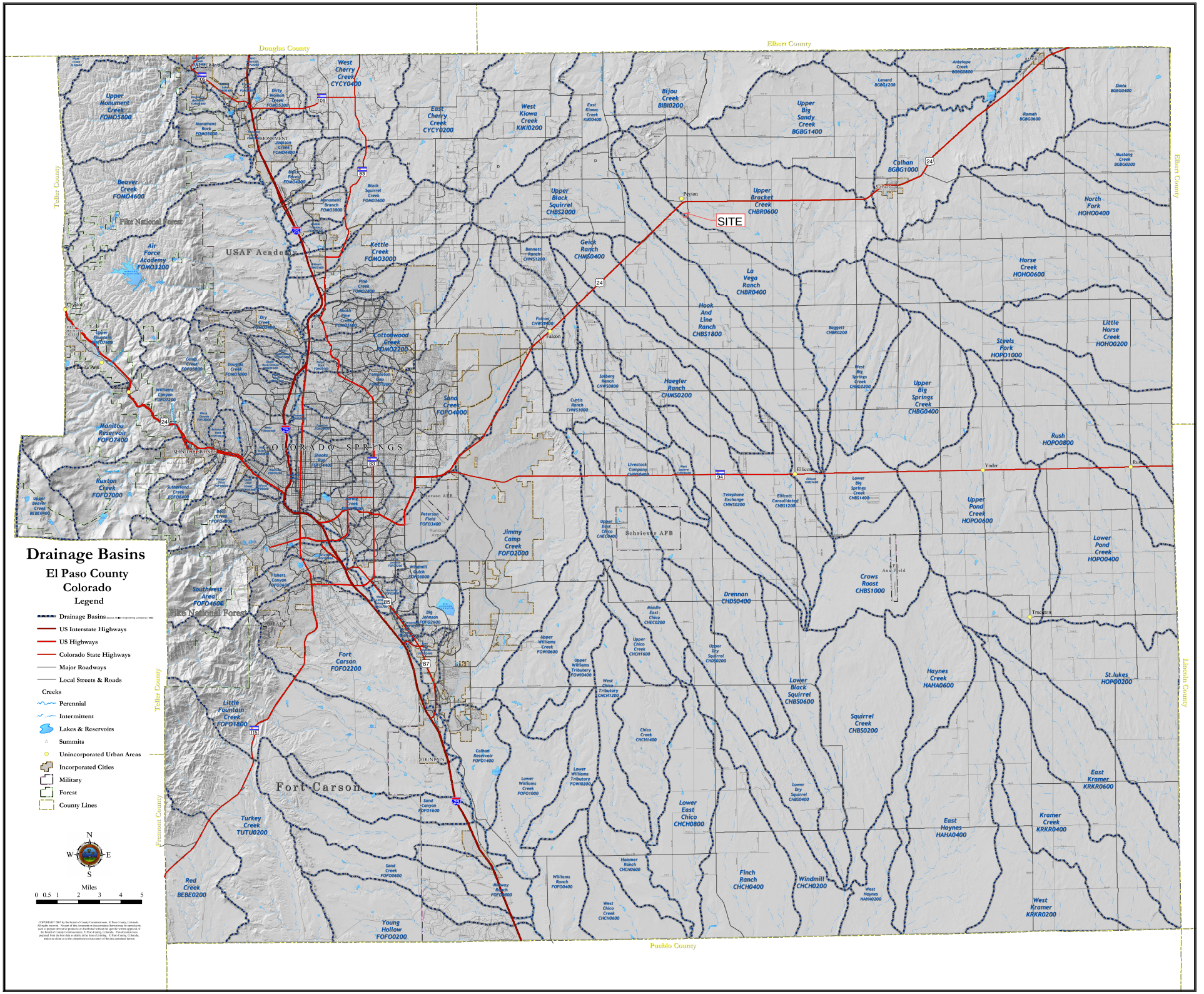
The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft²]	Area [acres]	Volume [ft³]	Volume [ac-ft]	Total Outflow [cfs]
6827.25-Top of Micropool	0.00	10	0.000	0	0.000	0.00
6828.00	0.75	380	0.009	146	0.003	0.02
6829.00	1.75	7,331	0.168	4,002	0.092	0.04
6829.05-WQCV	1.80	7,727	0.177	4,378	0.101	0.04
6829.62-EURV	2.37	12,246	0.281	10,071	0.231	0.42
6830.00	2.75	15,259	0.350	15,297	0.351	6.08
6830.17 - 100 year	2.92	15,757	0.362	17,933	0.412	7.78
6830.50-Spillway Crest	3.25	16,723	0.384	23,292	0.535	8.25
6831.00	3.75	17,785	0.408	31,919	0.733	44.96
6831.75-Top of Pond	4.50	19,405	0.445	45,865	1.053	202.66

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

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

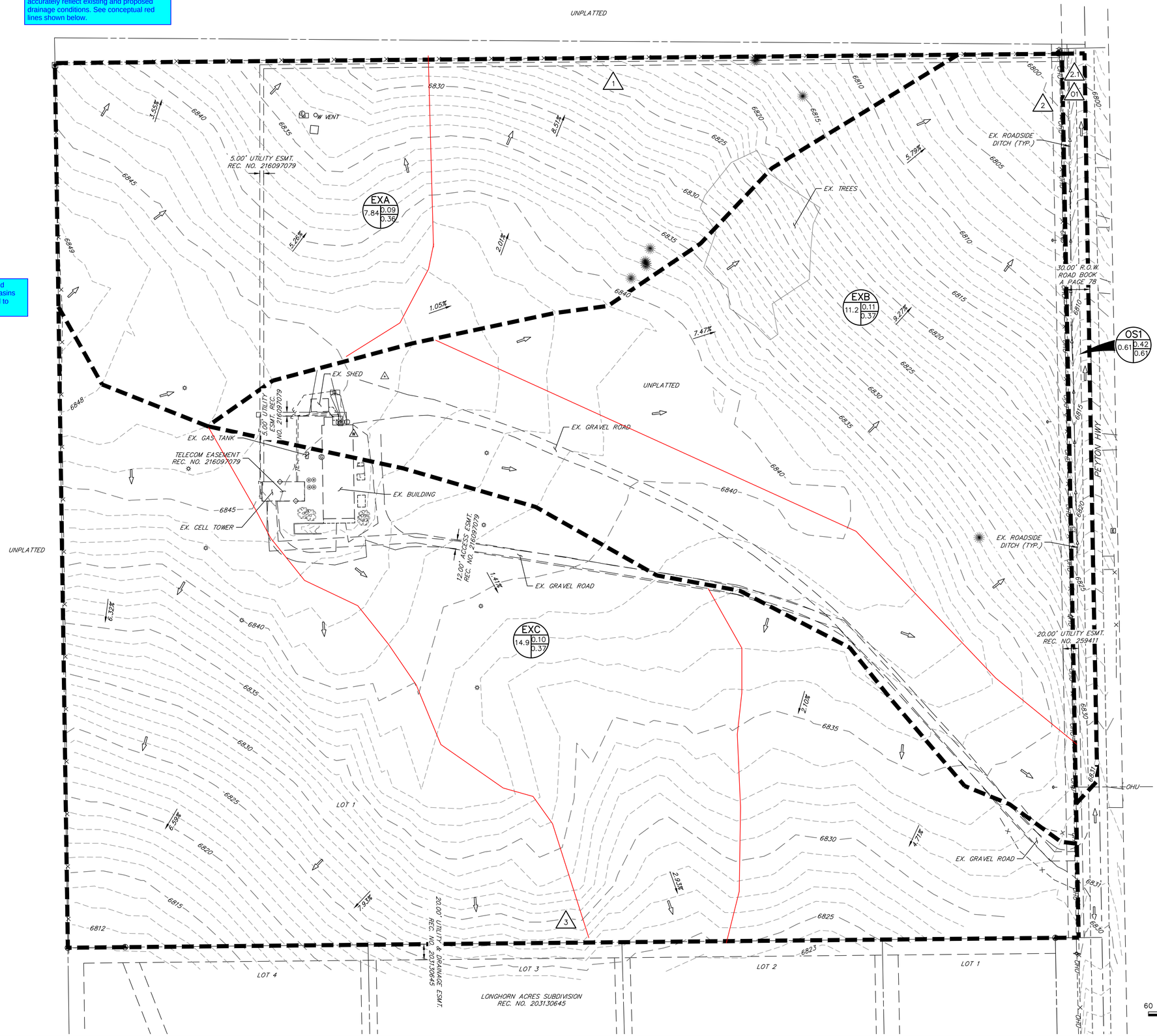
Appendix D
Reference Materials



Appendix E
Drainage Maps

More sub basin divisions are needed to accurately reflect existing and proposed drainage conditions. See conceptual red lines shown below.

Clearly label Las Vega Ranch and Upper Bracket Creek drainage basins and use an obvious color like red to show the basin boundaries.



LEGEND

	EXISTING	PROPOSED
SECTION LINE		
BOUNDARY LINE		
PROPERTY LINE		
EASEMENT LINE		
RIGHT OF WAY		
CENTERLINE		
STORM SEWER		
SWALE/WATERWAY FLOWLINE		
INDEX CONTOUR	6100	6100
INTERMEDIATE CONTOUR		

BASIN ID (ID / AC / DS / C100) — DESIGN POINT DESIGNATION (1)

FLOW DIRECTION

SUB-BASIN DRAINAGE AREA

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EXA	7.84	2%	0.09	0.36	27.9	1.8	12.3
EXB	11.20	5%	0.11	0.37	21.3	3.7	21.1
EXC	14.90	4%	0.10	0.37	29.5	3.9	23.2
OS1	0.61	42%	0.42	0.61	14.1	0.9	2.2

DESIGN POINT

DP	Q_5 Total	Q_{100} Total
1	1.8	12.3
2	3.7	21.1
O1	0.9	2.2
2.1	4.5	23.0
3	3.9	23.2

60 30 0 60 120

ORIGINAL SCALE: 1" = 60'

EXISTING DRAINAGE MAP
LAZY Y AND ROCKING J SUBDIVISION
JOB NO. 25228.00
09/26/2023
SHEET 1 OF 1

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Add a swale to transfer concentrated flows to the ditch.

Clearly label Las Vega Ranch and Upper Bracket Creek drainage basins and use an obvious color like red to show the basin boundaries.

Provide calculations in appendix for all culvert riprap sizing and dimensions

More sub basin divisions are needed to accurately reflect existing and proposed drainage conditions.

Culvert needs to extend under the driveway.

This outlet needs to be a suitable outfall. Discuss in the text.

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A	1.51	21%	0.22	0.45	12.5	1.3	4.3
B	2.51	10%	0.14	0.40	17.5	1.2	5.5
C	4.27	20%	0.22	0.45	14.0	3.4	11.8
D	4.96	24%	0.24	0.46	20.3	3.6	11.8
E	2.64	20%	0.22	0.45	17.9	1.9	6.5
F	0.84	16%	0.19	0.43	10.2	0.7	2.5
G	1.57	2%	0.09	0.36	7.7	0.6	4.3
H	0.74	24%	0.27	0.49	18.4	0.6	1.9
I	1.00	2%	0.09	0.36	5.0	0.5	3.1
J	2.99	24%	0.24	0.46	14.1	2.6	8.4
K	0.78	35%	0.32	0.52	13.0	0.9	2.5
L	0.45	40%	0.36	0.55	14.3	0.6	1.5
M	2.01	25%	0.24	0.47	20.1	1.5	4.9
N	2.12	26%	0.25	0.47	13.9	1.9	6.1
O	5.56	8%	0.13	0.39	10.7	2.9	14.6
OS1	0.43	43%	0.43	0.61	7.1	0.8	2.0
OS2	0.18	56%	0.54	0.69	5.0	0.5	1.0

DESIGN POINT

DP	Q_5 Total	Q_{100} Total
1	1.3	4.3
2	1.2	5.5
2.1	2.3	9.3
3	3.4	11.8
3.1	5.1	18.9
4	3.6	11.8
5	1.9	6.5
5.1	4.9	16.3
5.2	9.4	32.9
6	0.7	2.5
6.1	9.8	34.6
6.2	2.1	11.9
O1	0.8	2.0
7	0.6	4.3
7.1	1.4	6.3
O2	0.5	1.0
8	0.6	1.9
8.1	4.1	19.0
9	0.5	3.1
10	2.6	8.4
11	0.9	2.5
11.1	3.5	10.8
12	0.6	1.5
12.1	3.9	11.9
13	1.5	4.9
14	1.9	6.1
14.1	6.6	20.6
14.2	1.5	7.8
15	2.9	14.6

LEGEND

	EXISTING	PROPOSED
SECTION LINE		
BOUNDARY LINE		
PROPERTY LINE		
EASEMENT LINE		
RIGHT OF WAY		
CENTERLINE		
STORM SEWER		
SWALE/WATERWAY FLOWLINE		
INDEX CONTOUR	6100	6100
INTERMEDIATE CONTOUR		

BASIN ID (AC / DS / 2100) — DESIGN POINT DESIGNATION

FLOW DIRECTION — SUB-BASIN DRAINAGE AREA

PROPOSED DRAINAGE MAP
LAZY Y AND ROCKING J SUBDIVISION
JOB NO. 25228.00
09/12/2024
SHEET 1 OF 1

60 30 0 60 120
ORIGINAL SCALE: 1" = 60'

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UNPLATTED

TRACT A

10.00' PUBLIC UTILITY & DRAINAGE EASEMENT

20.00' RESERVATION OF RIGHT-OF-WAY

EX. ROADSIDE DITCH (TYP.)

A 1.51

B 2.51

C 4.27

D 4.96

E 2.64

F 0.84

G 1.57

H 0.74

I 1.00

J 2.99

K 0.78

L 0.45

M 2.01

N 2.12

O 5.56

5.00' UTILITY ESMT. REC. NO. 216097079

PROPOSED GRAVEL ROADWAY (TYP.)

PROPOSED GRAVEL PARKING (TYP.)

PROPOSED 5' SIDEWALK (TYP.)

PROP. FULL-SPECTRUM EDB: POND 1

BASIN H UNCAPTURED/ UNTREATED AREA: 0.13 AC

PROPOSED ASPHALT ROADWAY (TYP.)

30.00' R.O.W. ROAD BOOK A PAGE 78

PEYTON HWY

20.00' PUBLIC UTILITY & DRAINAGE EASEMENT

LOT 1

PROPOSED ASPHALT PARKING (TYP.)

PROPOSED SEPTIC FIELDS

PROPOSED SINGLE-FAMILY RESIDENCE

LOT 2

PROP. FULL-SPECTRUM EDB: POND 2

PROPOSED ACCESS DRIVE

20.00' UTILITY ESMT. REC. NO. 259411

10.00' PUBLIC UTILITY & DRAINAGE EASEMENT

20.00' PUBLIC UTILITY & DRAINAGE EASEMENT

20.00' UTILITY & DRAINAGE ESMT. REC. NO. 203130645

LOT 4

LOT 3

LOT 2

LOT 1

LONGHORN ACRES SUBDIVISION REC. NO. 203130645

OHU

LAYER LINETYPE LEGEND

	EXISTING	PROPOSED
BOUNDARY LINE		
PROPERTY LINE		
EASEMENT LINE		
RIGHT OF WAY		
CENTERLINE		
STORM SEWER		
SWALE/WATERWAY FLOWLINE		
INDEX CONTOUR	6100	6100
INTERMEDIATE CONTOUR		
CURB & GUTTER		
SUB-BASIN DRAINAGE AREA		
FLOW DIRECTION	FLOW DIRECTION (EXISTING)	FLOW DIRECTION (PROPOSED)
FEMA FLOODPLAIN	100YR	100YR

- DETAINED AND TREATED AREAS WITHIN PROPOSED EDB'S
- APPROXIMATE EDB FOR DETENTION AND WATER QUALITY
- LARGE-LOT SINGLE FAMILY DEVELOPMENT UNDETAINED AREA
- LAND DISTURBANCE TO UNDEVELOPED LAND THAT WILL REMAIN UNDEVELOPED
- UNTREATED DEVELOPED AREA (TO NOT EXCEED 1 ACRE TOTAL)

PBMP Summary Table

Basins	Tributary Area (acres)	PBMP
A-F	16.73	POND 1
G-I	3.18	EXCLUDED*
Part of H	0.13	EXCLUDED***
J-N	8.35	POND 2
O	5.56	EXCLUDED**

*EXCLUDED BASED ON LAND DISTURBANCE TO UNDEVELOPED LAND THAT WILL REMAIN UNDEVELOPED PER ECM APP. I.7.B.7
**EXCLUDED BASED ON LARGE LOT SINGLE FAMILY SITES PER ECM APP. I.7.B.5
***UNTREATED/UNDETAINED AREA (< 1 TOTAL ACRE)

N

60 30 0 60 120

ORIGINAL SCALE: 1" = 60'

PROPOSED WATER QUALITY MAP
LAZY Y AND ROCKING J SUBDIVISION
JOB NO. 25228.00
09/12/2024
SHEET 1 OF 1

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