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Joyful View Subdivision
Final Drainage Report

May 2023

HR Green Project No: 2202179

PCD File No. SF2231

Prepared For:

The O'Neil Group

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Colorado Springs, CO 80901-1385

Prepared By:

HR Green Development, LLC

Contact: Colleen Monahan, PE, LEED AP

Cmonahan@hrgreen.com

(719) 394-2433

Engineer's Statement

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

Stamp/signature/date req

Colleen Monahan, PE, LEED AP Date

State of Colorado No.

For and on behalf of HR Green Development, LLC

Developer's Statement

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

Authorized Signature Date

Kevin O'Neil PO Box 1385, Colorado Springs, CO 80901

Printed Name Address

El Paso County Certification

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

Joshua Palmer, P.E. Date

County Engineer/ECM Administrator

Conditions:

Table of Contents

Add section to specifically address drainageway conditions, stability and any improvements needed for subdivision

Appendices

I. General Purpose, Location and Description

a. Purpose

The purpose of this Final Drainage Report (FDR) for Joyful View Subdivision is to describe the onsite and offsite drainage patterns and impacts on downstream facilities. This report is based on the guidelines and criteria presented in El Paso County Drainage Criteria Manual and is intended to fulfill the requirements for a Final Drainage Report in support of the Final Plat process for this property.

b. Location

Joyful View Subdivision, referred to as 'the site' herein, is a proposed 9-lot rural single-family residential subdivision located in El Paso County, Colorado. The site lies within a portion of the southern half of Section 33, Township 13 South, Range 63 West of the 6th Principal meridian in El Paso County, Colorado. The site is approximately 70.18 acres located approximately 600 feet east of North Peyton Hwy and approximately 2.0 miles north of SH94. The parcel #'s are 3300000466 and 3300000467 and they are currently platted as Grand View Subdivision, Tracts 2 and 3. A vicinity map is presented in Appendix A.

c. Description of Property

The site is currently undeveloped land with existing vegetation consisting of native grasses. The property is zoned RR-5 (rural residential), allowing for 5-acre minimum lot sizes, and the proposed subdivision is fully in conformance with the existing zoning for the site. The development will plat 9 single family residential lots with access to the lots off of a proposed private local gravel cul-de-sac (Ellas Way) extending from a proposed private local gravel road connection (Joyful View Road) to North Peyton Hwy within an existing 30-ft access easement. North Peyton Hwy is an improved, asphalt paved public road located approximately 600 feet west of the proposed cul-de-sac road entrance. The site is bordered by other RR-5 zoned rural residential properties on all sides.

The site is located in the Haegler Ranch Drainage Basin. Flows from the site generally sheet flow southeasterly into unnamed tributary that traverses the south part of the site and then drain into the Haegler Channel which is tributary to the West Fork of Black Squirrel Creek. The onsite elevations range from 6270' – 6243' with slopes ranging 1-2%, and up to 10% at the unnamed tributary.

There is an above-ground electric line that runs along the northern property line of the site. Water for the site will be from individual wells. Wastewater service will be provided by On Site Wastewater Treatment (OSWT).

Per a NRCS soil survey, the site's soil is comprised of Blakeland Loamy Sand (8) which has a Hydrologic Soil Group A, and Blendon Sandy Loams (10) with a Hydrologic Soil Group B. The NRCS soil survey is presented in Appendix A.

d. Floodplain Statement

A portion of the south side of the site is located within a designated FEMA 100-year floodplain Zone AE according to the information published in the Federal Emergency Management Agency Flood Plan Map No. 08041C0805G, dated December 7, 2018 and LOMR #20-08-0369P-080059 dated February 16, 2021. Base flood elevations are provided. See Firmette exhibit in Appendix A.

Portions of Lots 4 and 5 lie within the floodplain. Subdivision development will be restricted to outside of the floodplain limit by a No Build Area as shown on the Plat and Proposed Drainage Map (DR-2) in Appendix D.

Include section on existing floodplain area and channel. Provide status of the channel condition and stability and if any improvement or stabilizations are needed.

Unresolved - dotschoenheit
07/31/2023 6:11:21 PM

Per DCMV1 Ch1.4.2:
DEVELOPERS IN AND ALONG A DRAINAGEWAY ARE REQUIRED TO IMPLEMENT THE PROPER MEASURES TO MAINTAIN OR CREATE STABLE CHARACTERISTICS OF THE DRAINAGEWAY. THE PRINCIPAL OBJECTIVE IS TO LIMIT EXCESSIVE EROSION IN AND ALONG THE CHANNEL. HISTORICAL CHANNEL RELOCATIONS/REALIGNMENTS SHALL NOT BE ALLOWED UNLESS ENGINEERING DESIGNS FOR STABLE SYSTEMS UNDER FLOOD FLOW CONDITIONS ARE ACHIEVED AND APPROVED.

No improvements will occur within the existing floodplain. No significant subdivision development impact is anticipated for the floodplain.

II. Drainage Basins and Subbasins

a. Major Basin Description

The site is located within the Haegler Ranch Drainage Basin. Drainage from this site flows to existing natural drainage channels draining southeasterly. There is an existing Drainage Basin Planning Study (DBPS) on file for this drainage basin that studied the site's drainage characteristics:

1. "Haegler Ranch Drainage Basin Planning Study" prepared by URS, May 2009, File No. MP091.

Haegler Ranch Drainage Basin is a 16.6 square mile watershed located in El Paso County. The basin is tributary to Black Squirrel Creek and is generally located north of the Town of Falcon, and bound by just past Eastonville Road to the west, McDaniels Road to the East.

The DBPS identified no improvements needed in the project site area. No significant subdivision development impact is anticipated within the Haegler Ranch Drainage Basin.

b. Subbasin Description

3

The existing 70.18-acre site is currently undeveloped. An existing gravel drive is located off of N. Peyton Hwy within the westerly adjacent Tract 1 area to service an existing home within that Tract. A 30-foot access easement is located along the north property line, but currently no road exists within Tracts 2 and 3. The existing drainage basins lying in and around the proposed development are on the existing Drainage Map in Appendix D. The property has been delineated as four on-site developed drainage basins (EX1-EX3) flowing to existing drainage channels along the southeast side of the property

, south

The site is impacted by off-site drainage areas on the west and north sides of the property (OS1-OS3). OS1 flows affect a culvert under the proposed Joyful View Road at the intersection of N. Peyton Highway. OS2 affects a culvert that will also be under proposed Joyful View Road near the intersection of proposed Ellas Way to access the 9 lots.

Developed runoff in this subdivision will generally continue to follow historic paths.

III. Drainage Design Criteria

a. Drainage Criteria

Hydrologic data and calculations were performed using Drainage Criteria Manual Volume 1 of El Paso County (EPCDCM), with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs Drainage Criteria Manual (CCSDCM), May 2014 revised January 2021.

Onsite drainage improvements are designed for the 5-year storm (minor event) and 100-year storm (major event) using rainfall values from EPCDCM Table 6-2 below. Runoff was calculated per CCSDCM Section 6.3.0 - Rational Method.

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

5-year and 100-year runoff coefficients are as follows (source: Table 6-6: Runoff Coefficients for Rational Method, UDFCD 2001).

Undeveloped, Pasture/Meadow Areas: C5: 0.08 C100: 0.35

Spreadsheets in appendix have 0.09 & 0.36. Please update text

Developed, Proposed Building/Pavement areas: C5: 0.90 C100: 0.96

Refer to composite runoff coefficient calculations in Appendix B.

Hydrologic calculations can be found in Appendix B, and peak design flows are identified on the drainage plan drawings.

Culverts were sized per the methods described in EPCDCM Volume 1 Section III Chapter 9- Culvert Design. Swales were sized per Chapter 10- Open Channels and Structures. Culvert and swale calculations can be found in Appendix C.

IV. Drainage Planning Four Step Process

El Paso County Drainage Criteria require drainage planning to include a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls. As stated in DCM Volume 2, the Four Step Process is applicable to all new and re- development projects with construction activities that disturb 1 acre or greater or that disturb less than 1 acre but are part of a larger common plan of development. The Four Step Process has been implemented as follows in the planning of this project.

Step 1: Employ Runoff Reduction Practices

Minimize Impacts: The proposed minor rural residential subdivision is an inherently low impact development. The proposed 5-acre minimum lot sizes will significantly minimize drainage impacts in comparison to higher density development alternatives.

Step 2: Stabilize Drainageways

Portions of Lots 4 and 5 lie within the floodplain that lies around the drainageway through the southern part of the site. Subdivision development will be restricted to outside of the floodplain limit by a No Build Area as shown on the Plat and Proposed Drainage Map (DR-2) in Appendix D. No improvements will occur within the existing floodplain and drainageway. No significant subdivision development impact is anticipated for the drainageway.

Grass swales will carry the flow from the proposed gravel roads to downstream drainage channels.

Drainage basin fees will be paid at the time of recording of the subdivision plat, and these fees provide the applicable cost contribution towards regional drainage improvements.

This does not pertain to the 4 step

Please revise as WQ treatment is required because per clarification from CDPHE, this large lot exclusion only pertains to the lots and does not include roadways, hence RR is needed.

Step 3: Provide Water Quality Capture Volume (WQCV)

Water quality detention is not required based on the rural residential development proposed (5-acre minimum lot sizes). According to ECM Appendix I Section I.7.1.b.5, single-family residential lots greater than or equal to 2.5 acres in size per dwelling and having a total lot impervious area of less than 10 percent are excluded from permanent WQ control measures. As detailed in Appendix B, the total assumed impervious area for the new lots is approximately 4-7 %, which meets the criteria for exclusion from water quality requirements.

Water quality mitigation for the private roadway improvements (Joyful View Road and Ellas Way) will be provided by utilizing gravel roads to minimize impervious area and grass-lined roadside ditches for Runoff Reduction.

Step 4: Consider Need for Industrial and Commercial BMPs

No industrial or commercial land uses are proposed as part of this development.

V. General Drainage Recommendations

Discuss required sizing of culverts needs to cross the drainage easement on lots #8 & #9

The developed drainage plan for the site is to provide and maintain positive drai s and conform to the established drainage patterns for the overall site. It is recomm nage be established and maintained away from all structures within the site in conform ding codes and geotechnical engineering recommendations.

Individual lot grading is the sole responsibility of the individual builders and property owners. Final grading of each home site should establish proper protective slopes and positive drainage in accordance with HUD guidelines and building codes. In general, main floor elevations for each home should be established a minimum of 2 feet above the top of curb of the adjoining street, and a minimum of 1 foot above the BFE of the FEMA floodplain.

Roads are private gravel with no curb. Revise statement.

In general, it is recommended that a minimum of 6 inches clearance from the top of concrete foundation walls to adjacent finished site grades be established. Positive drainage slopes should be maintained away from all structures, with a minimum recommended slope of 5 percent for the first 10 feet away from buildings in landscaped areas, a minimum recommended slope of 2 percent for the first 10 feet away from buildings in paved areas, and a minimum slope of 1 percent for paved areas beyond buildings.

VI. Drainage Facility Design

Note all drainage calculations for roads and required RR will need to be redone for the larger road cross section.

a. General Concept

The general concept for management of developed storm runoff is to establish site grading to provide positive drainage away from the building pads and divert runoff to drainage swales following historic drainage patterns.

b. Existing Drainage Conditions

Historic drainage conditions are depicted on Figure DR-1 (Appendix D). The property is currently undeveloped. There are no existing drainage facilities within the property; however there are 2 existing

map shows several swales through the site. Revise statement to indicate that.

culverts that are impacted by the proposed entrance roadway Joyful View Road. There are no existing irrigation facilities, major utilities, or significant encumbrances impacting the site.

Basin OS-1 is 25.98 acres of undeveloped land. Existing stormwater (Q_5 = 4.5 cfs Q_{100} = 30.1 cfs) flows south along N. Peyton Hwy to an existing 18" culvert at DP1. Flow continues to the unnamed tributary that traverses the site and discharges offsite at DP5.

Basin OS-2 is 30.52 acres of undeveloped land north of Joyful View Road. Existing stormwater (Q_5 = 6.0 cfs Q_{100} = 40.2 cfs) flows to an existing 18" culvert at DP2. Flow then traverses the site in an existing swale and discharges offsite at DP7.

Basin OS-3 is 2.77 acres of N. Peyton Highway and roadside ditch. Existing stormwater (Q_5 = 2.3 cfs Q_{100} = 4.6 cfs) is conveyed to DP3 and to the unnamed tributary that traverses the site and discharges offsite at DP5.

offsite & onsite

Basin EX1 is 70.82 acres of undeveloped land. Existing stormwater (Q_5 = 7.9 cfs Q_{100} = 53.2 cfs) drains southeast through the unnamed tributary and discharges offsite at DP5.

Basin EX2 is 18.22 acres of undeveloped land. Existing stormwater (Q_5 = 2.8 cfs Q_{100} = 18.6 cfs) drains southeast in an existing swale and discharges offsite at DP6.

Basin EX3 is 27.31 acres of undeveloped land. Existing stormwater (Q_5 = 4.1 cfs Q_{100} = 27.8 cfs) drains southeast in an existing swale and discharges offsite at DP7.

c. Proposed Subbasin Description

The site has been divided into 7 proposed basins See below for basin descriptions:

Basin OS-1 is 25.98 acres of undeveloped land. The existing 18" culvert located at DP1 will be replaced with dual 24" RCP culverts that will convey the flow under proposed Joyful View Drive. Stormwater (Q_5 = 4.5 cfs Q_{100} = 30.1 cfs) continues to the unnamed tributary that traverses the site and discharges offsite at DP5. Basin OS-1 will remain undeveloped.

Basin OS-2 is 30.52 acres of undeveloped land. The existing 18" culvert located at DP4 will be replaced with dual 24" RCP culverts that will convey the flow under proposed Joyful View Road. Stormwater (Q_5 = 6.0 cfs Q_{100} = 40.2 cfs) continues to the unnamed tributary that traverses the site and discharges offsite at DP7. Basin OS-2 will remain undeveloped.

Basin OS-3 is 2.77 acres of undeveloped land paved roadway and existing swale. Stormwater (Q_5 = 2.3 cfs Q_{100} = 4.6 cfs) discharges at DP3, continues through Basin A, and discharges offsite at DP5. Basin OS-3 will remain as-is.

Basin A is 70.42 acres of undeveloped offsite and developed onsite area. Stormwater (Q_5 = 7.8 Q_{100} = 52.6 cfs) follows historic drainage patterns to the unnamed tributary and discharges offsite at DP5.

Basin B is 30.57 acres of undeveloped offsite and developed onsite area. Stormwater (Q_5 = 4.6 Q_{100} = 25.5 cfs) follows historic drainage patterns to proposed swale 2, and discharges offsite at DP6.

Basin C is 14.27 acres of developed onsite area. Stormwater (Q_5 = 3.5 Q_{100} = 21.8 cfs) follows historic drainage patterns to proposed swale 2, and discharges offsite at DP7. Increase in flow at DP7 is negligible compared to existing. See Table 1 for existing and proposed flow conditions.

The table shows a decrease for DP7.

Over double the flow is not negligible. Revise statement.

State how flows travel through Basin B (roadside ditch?)

Basin D is 1.10 acres of proposed gravel road and proposed swale. Stormwater (Q_5 = 0.8 cfs Q_{100} = 2.5 cfs) is conveyed in a proposed swale that discharges to a proposed 18" culvert at DP3 that will convey the flow under Joyful view Drive. Stormwater continues through Basin B and discharges at DP6. Increase in flow at DP6 is negligible compared to existing. See Table 1 for existing and proposed flow conditions.

d. Comparison of Developed to Historic Discharges

Based on the hydrologic calculations in Appendix B, the comparison of developed to historic discharges at key design points is summarized as follows:

Table 1 – Flow Comparison

DESIGN POINT	EX Q_5 (cfs)	PR Q_5 (cfs)	EX Q_{100} (cfs)	PR Q_{100} (cfs)
5	10.6	10.5	62.7	62.5
6	2.80	7.3	18.6	39.5
7	8.80	7.7	58.8	50.3

The flow increases are due to gravel roads and impervious from the lots. With proper site drainage and erosion control measures within the site, the proposed rural residential subdivision will not have any significant developed drainage impact. The drainage outfalls at design points 5, 6, and 7 have capacity and have no visual erosion degradation at this time. Rip-Rap will be used to mitigate impacts from flows at discharges of grass Swales 2 and 3.

Please backup this statement by comparing pre-development with post-development flowrates at discharge points. See comment below.

e. On-Site Drainage Facility Design

Developed drainage basins and drainage patterns are depicted on the enclosed Proposed Drainage Map (DR-2 in Appendix D). Two existing culverts that traverse under Joyful View Road will need to be upgraded as part of this project.

Based on the rural residential nature of this minor subdivision and the large lot sizes proposed, there will be no significant increase in developed flows, and there is no need for on-site flood control detention. Water quality mitigation for the public road improvements will be provided by runoff reduction utilizing gravel roads to minimize impervious areas and grass-lined roadside ditches. Rip-Rap will be used to mitigate impacts from flows at discharges from grass swales.

This table summarizes the increase in flows at DP 6. Discuss how 4.5 and 20.9 cfs are not significant.

	Q5	Q100
Existing	2.8	18.6
Proposed	7.3	39.5
Difference	4.5	20.9

f. Analysis of Existing and Proposed Downstream Facilities

The proposed subdivision area will drain easterly to existing, natural drainage swales flowing to the Haegler Ranch Drainage Basin. Development of this property as a rural residential subdivision will have no significant impact on downstream drainage facilities.

There is no evidence of erosive conditions at the outfall points, and the existing downstream grass-lined drainage channels provide a hydrologically and hydraulically adequate outfall system. Rip-rap will be used at the outfalls from the swales to further protect downstream facilities.

g. Anticipated Drainage Problems and Solutions

The drainage plan for this subdivision consists of maintaining positive drainage away from home sites and conveying surface drainage through the site in general conformance with historic drainage patterns. The

Per ECM Chap 3.2.8.B, "The proposed project or developed land use shall not change historical runoff values, cause downstream damage, or adversely impact adjacent properties." Increases from the historical flowrates are allowable (with or without full spectrum detention) if it is shown (via text and/or calcs) that the flow increase can be accommodated downstream (i.e., show that there is a suitable outfall, per ECM Chap 3.2.4). If applicable, reference the downstream facilities in a DBPS or MDDP.

primary drainage problems anticipated within this type of development consist of maintenance of proper drainage patterns and erosion control.

Care will need to be taken to implement proper erosion control measures associated with the proposed driveways, home sites, and drainage swales. Proposed drainage facilities, such as swales, will be owned and maintained by the individual lot owners unless otherwise noted.

Roadside ditches, swales will be maintained by the HOA

VII. Grading and Erosion Control Plan

Due to the project disturbance area, a separate Grading and Erosion Control plan is required. Additionally, during individual homesite construction, contractors and owners will need to implement and maintain proper Best Management Practices (BMP's) and control measures for erosion and sediment control during and after construction. Erosion control measures should include installation of silt fence at the toe of disturbed areas, straw bales protecting drainage ditches, vehicle tracking control pads at access points, riprap protection at culvert outlets, and revegetation of disturbed areas. Cut slopes will need to be stabilized during excavation as necessary and vegetation will need to be re-established as soon as possible for stabilization of graded areas.

Please revise as WQ treatment is required because per clarification from CDPHE, this large lot exclusion only pertains to the lots and does not include roadways, hence RR is needed.

VIII. Stormwater Detention and Water Quality

As previously stated, the proposed development will result in a minimal increase in developed flows based on the rural residential development plan. There is no need for on-site stormwater detention based on the minimal developed drainage impact.

Water quality facilities are not required as this site meets the exclusions listed in the revised El Paso County Engineering Criteria Manual ECM). Section I.7.1.B.5 of the ECM identifies "Large Lot Single Family Sites" as excluded sites under the following definition: "A single-family residential lot, or agricultural zoned lands, greater than or equal to 2.5 acres in size per dwelling and having a total impervious area of less than 10 percent." The proposed subdivision plat will create nine (9) lots with an estimated new impervious area of approximately 4 - 7% per Table 3-1 Typical Values of Percent Impervious in ECM Appendix L of the DCM, which is below the 10 percent threshold.

Water quality mitigation for the private roadway improvements (Joyful View Road and Ellas Way) will be provided by utilizing gravel roads to minimize impervious area and grass-lined roadside ditches for Runoff Reduction.

IX. Cost Estimate and Drainage Fees

The developer will finance all costs for the required subdivision improvements, and there are no public drainage facilities proposed as part of this minor subdivision plat.

The property is located entirely within the Haegler Ranch Drainage Basin, which has a 2022 drainage basin fee of $11,891 and $1,755 bridge fee per impervious acre. Applicable drainage basin fees are calculated as follows:

On-site Subdivision Area = 70.18 acres

Gravel roads are still 80% impervious so this doesn't do much as far as reduction. So revise this sentence to clarify

Provide runoff reduction calcs. See MHFD's calc spreadsheet "UD-BMP" and see my additional RR-related comments on pg 11 below that were submitted with Review #1.

On-Site Percent Impervious Area = 7% (per Table 3-1 Typical Values of Percent Impervious in ECM Appendix L of the DCM)

On-Site Estimated Impervious area = 4.91 ac.

Impervious Area of Off-Site Road Improvements:

New Gravel Pavement = 25,600 sf * 80% Impervious =20,480 sf

Off-Site Impervious Area = 0.47 acres

Total Calculated Impervious area = 5.38 acres

Adjusted Impervious area = (5.38 ac) * 75% = 4.04 ac.

(includes 25% reduction on drainage fees for 2.5 to 5-acre lots per ECM Appendix L Section 3.10.2a)

Drainage Basin Fee = (4.04 ac.) @ $11,891/ac. = $48,039.64

Bridge Fee = (4.04 ac.) @ $1,755/ac. = $7,090.20

Total Fee = $55,129.84

Fee is only reduced for large lots not roads or bridges. Please revise fee section

If the road cross section width is widened these calculations will need to be adjusted as well.

X. Summary

The Joyful View Subdivision is a proposed rural residential subdivision consisting of nine (9) lots on a 70.18-acre site. Development of the proposed subdivision is anticipated to result in a negligible increase in developed runoff from the site, and runoff mains consistent with pre-development drainage conditions. The proposed development will not adversely affect downstream stormwater infrastructure or surrounding developments. Erosion control best management practices will be implemented to mitigate developed drainage impacts. There are no significant adverse drainage impacts anticipated on downstream properties or drainage facilities.

XI. Drawings

Please refer to the appendices for vicinity and drainage basin maps.

XII. References

1. City of Colorado Springs – Drainage Criteria Manual, May 2014, Revised January 2021.
2. Urban Storm Drainage Criteria Manual, Urban Drainage Flood Control District, January 2018.

Add El Paso County Engineering Criteria Manual and

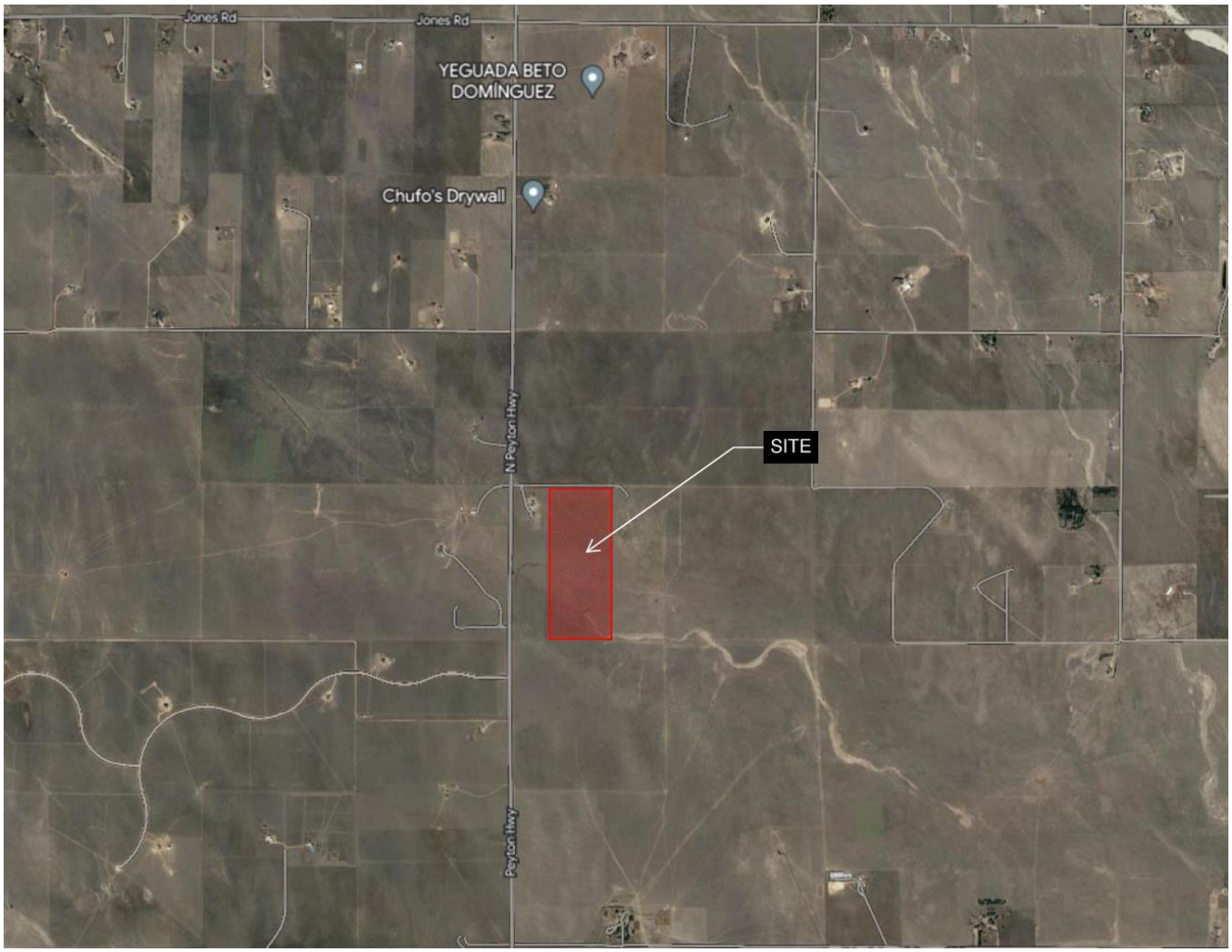
DRAINAGE CRITERIA MANUAL VOLUME 1 OF EL PASO COUNTY

Include paragraph discussing channel. Need to provide analysis that no impacts are being done to the channel, velocity, depth, Fr #, etc are still within design parameters. Has a no-rise certification been submitted to floodplain manager?

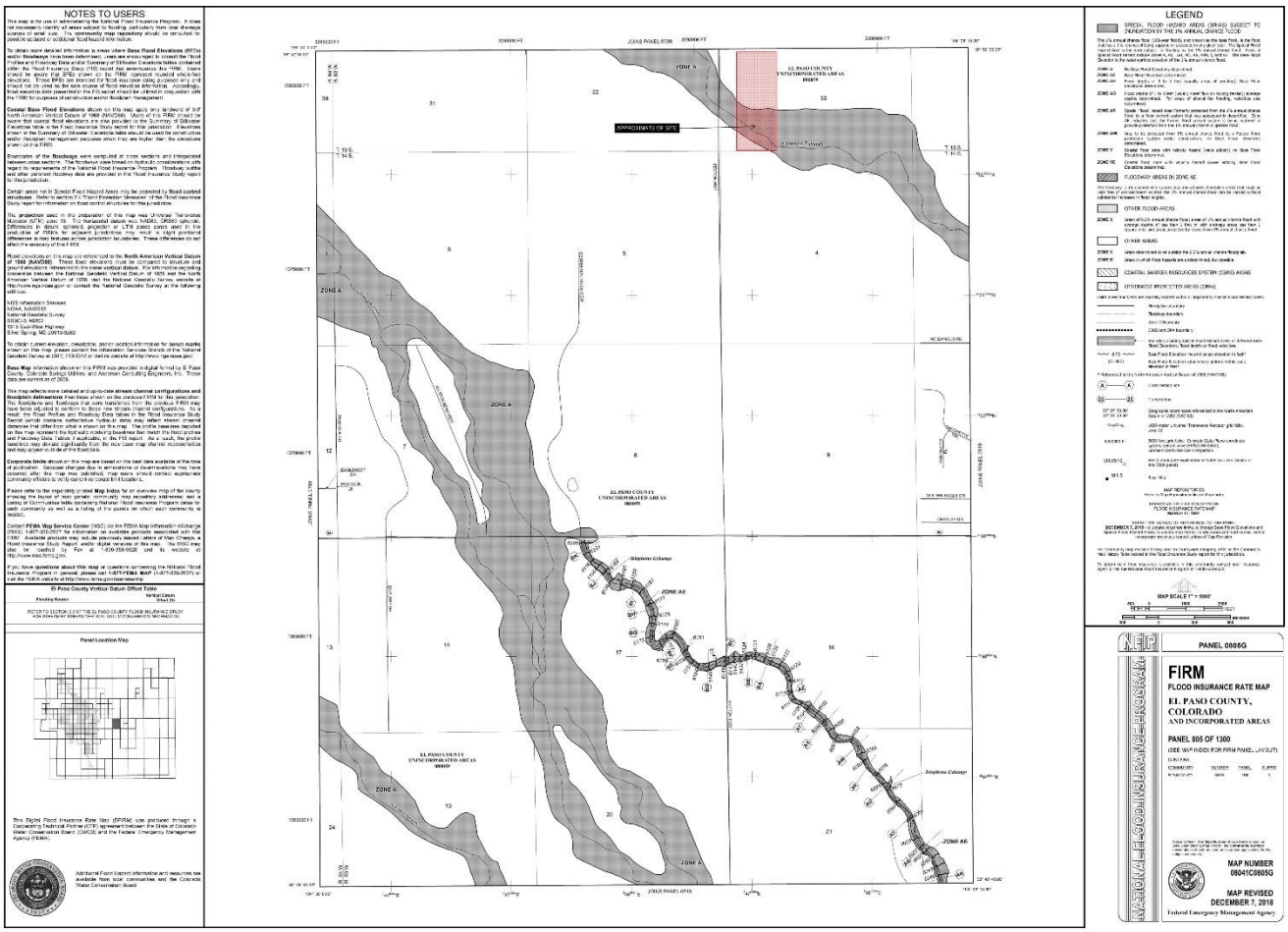
For Runoff Reduction:
- Reference MHFD Detail T-0 for guidance..
- The runoff reduction RPA is considered a WQ Facility and requires a signed Maintenance Agreement
- All RPA/SPA areas will need to be within a no build/drainage easement (or tract)
- Provide an O&M manual for the RPAs. See the City's template for grass buffers / grass swales to use as a starting point: https://coloradosprings.gov/stormwater-enterprise/page/operations-and-maintenance-permanent-bmps?mlid=6126
- Provide a figure in drainage report showing all proposed UIA, RPA and SPA areas to be utilized for runoff reduction with labels that correspond to the MHFD calcs spreadsheet.
- RPA/SPA limits must be shown on GEC Plans (not just FDR) so our SW inspectors and the QSM know that these areas are to remain pervious post-construction. Our SW inspectors do not look at drainage reports.
- Provide a detail for the UIA:RPA interface that shows the recommended vertical drop of 4".
- Wetlands are not an acceptable RPA per the MS4 Permit and MHFD guidelines.

APPENDIX A – VICINITY MAP, SOIL MAP, FEMA MAP

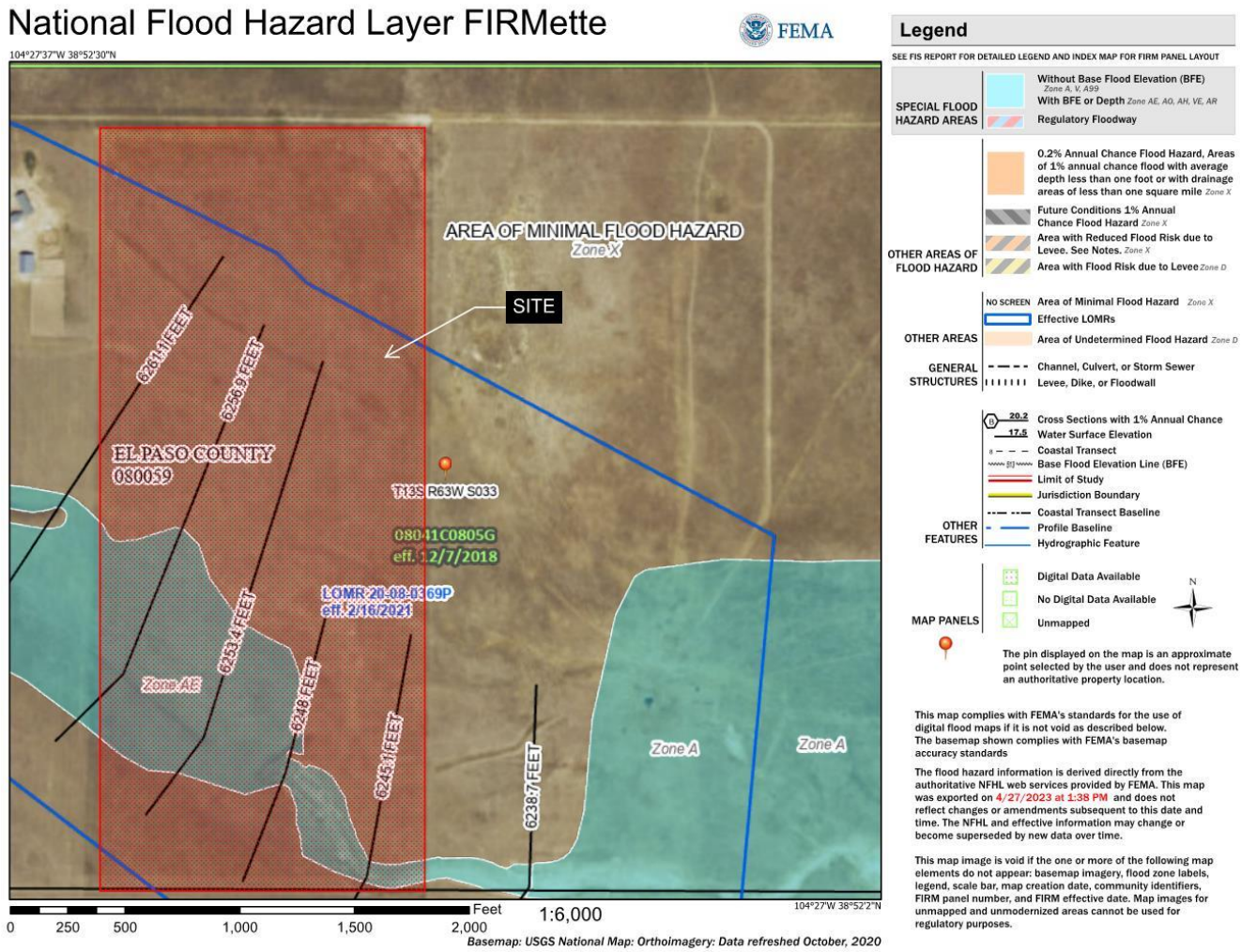
VICINITY MAP



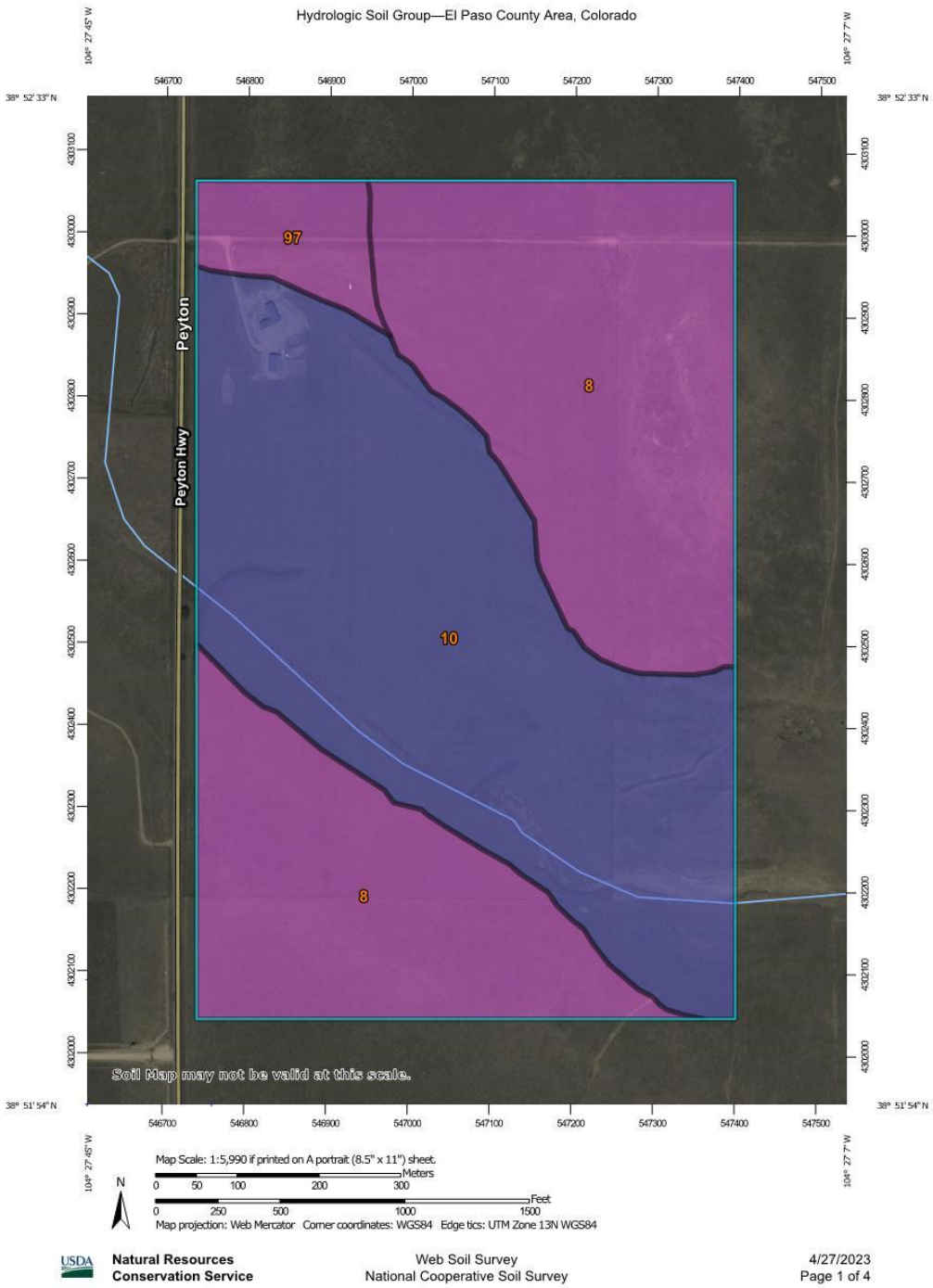
FEMA FIRM MAP



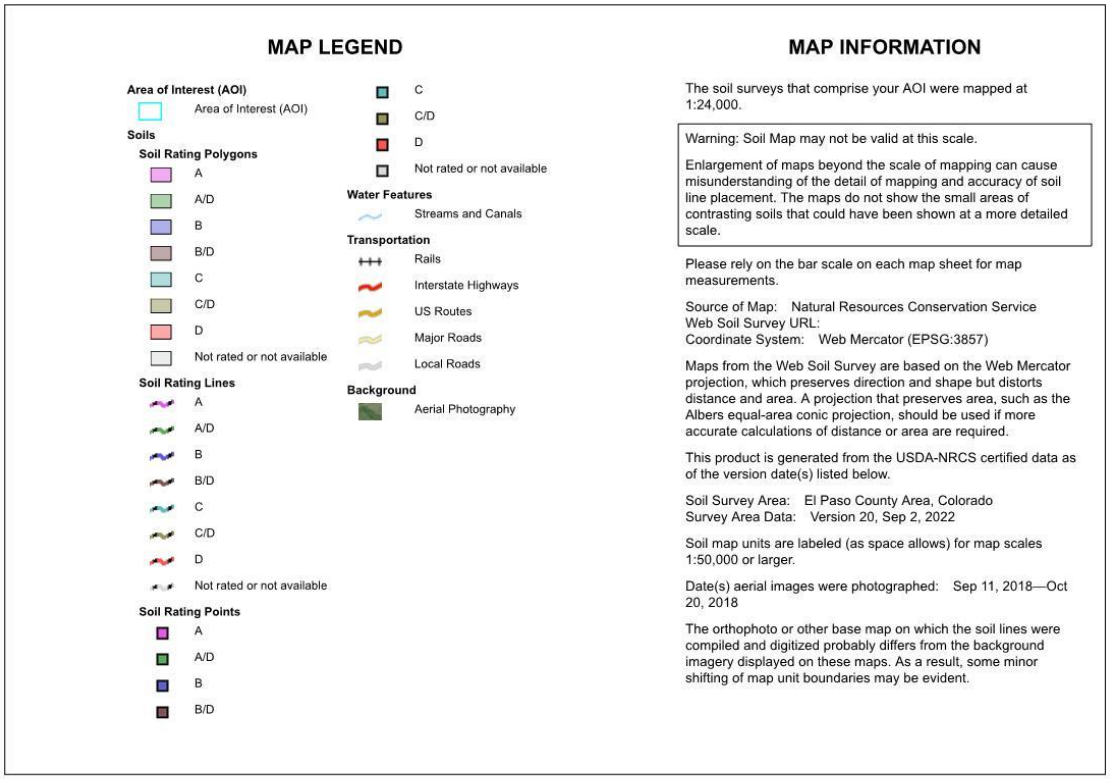
FEMA MAP


National Flood Hazard Layer FIRMette
FEMA
104°27'37"W 38°52'30"N
AREA OF MINIMAL FLOOD HAZARD
Zone X
SITE
6261.1 FEET
6256.9 FEET
EL PASO COUNTY
080059
T13S R63W S033
08041C0805G
eff. 12/7/2018
LOMR 20-08-0369P
eff. 2/16/2021
6253.4 FEET
6248 FEET
6245.1 FEET
6238.7 FEET
Zone AE
Zone A
Zone A
Feet
0 250 500 1,000 1,500 2,000
1:6,000
104°27'W 38°52'2"N
Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020
Legend
SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT
SPECIAL FLOOD HAZARD AREAS
Without Base Flood Elevation (BFE) Zone A, V, A99
With BFE or Depth Zone AE, AO, AH, VE, AR
Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD
0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
Future Conditions 1% Annual Chance Flood Hazard Zone X
Area with Reduced Flood Risk due to Levee. See Notes. Zone X
Area with Flood Risk due to Levee Zone D
OTHER AREAS
NO SCREEN Area of Minimal Flood Hazard Zone X
Effective LOMRs
Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES
Channel, Culvert, or Storm Sewer
Levee, Dike, or Floodwall
OTHER FEATURES
20.2
17.5
Cross Sections with 1% Annual Chance
Water Surface Elevation
Coastal Transect
Base Flood Elevation Line (BFE)
Limit of Study
Jurisdiction Boundary
Coastal Transect Baseline
Profile Baseline
Hydrographic Feature
MAP PANELS
Digital Data Available
No Digital Data Available
Unmapped
N
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/27/2023 at 1:38 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

SOILS MAP


Hydrologic Soil Group—El Paso County Area, Colorado
104° 27' 45" W
104° 27' 7" W
38° 52' 33" N
38° 51' 54" N
546700
546800
546900
547000
547100
547200
547300
547400
547500
4303100
4303000
4302900
4302800
4302700
4302600
4302500
4302400
4302300
4302200
4302100
4302000
Peyton
Peyton Hwy
97
8
10
8
Soil Map may not be valid at this scale.
Map Scale: 1:5,990 if printed on A portrait (8.5" x 11") sheet.
Meters
0 50 100 200 300
N
Feet
0 250 500 1000 1500
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84
USDA
Natural Resources
Conservation Service
Web Soil Survey
National Cooperative Soil Survey
4/27/2023
Page 1 of 4

Hydrologic Soil Group—El Paso County Area, Colorado



Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	83.1	49.7%
10	Blendon sandy loam, 0 to 3 percent slopes	B	76.9	46.0%
97	Truckton sandy loam, 3 to 9 percent slopes	A	7.1	4.2%
Totals for Area of Interest			**167.1**	**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.

APPENDIX B – HYDROLOGIC CALCULATIONS

HRGreen	**JOYFUL VIEW**	**Calc'd by:**	**AXB**
	EXISTING CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**5/24/2023**

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
EX1	70.82	2	7.9	53.2
EX2	18.22	2	2.8	18.6
EX3	27.31	2	4.1	27.8
OS1	25.98	2	4.5	30.1
OS2	30.52	2	6.0	40.2
OS3	2.77	67	2.3	4.6

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	OS1	4.5	30.1
2	OS2	6.0	40.2
3	OS3	2.3	4.6
5	OS3,EX1	8.2	46.8
6	EX2	2.8	18.6
7	EX3, OS2	8.8	58.8

HRGreen	**JOYFUL VIEW**					**Calc'd by:**	**AXB**	
	EXISTING CONDITIONS					**Checked by:**	**CM**	
	EL PASO COUNTY, CO					**Date:**	**5/24/2023**	

COMPOSITE 'C' FACTORS

BASIN	UNDEVELOPED	PAVED	TOTAL	SOIL TYPE	UNDEVELOPED			PAVED			COMPOSITE IMPERVIOUSNESS & C		
	ACRES				%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}
EX1	70.82	0.00	70.82	A/B	2	0.09	0.36	100	0.90	0.96	2	0.09	0.36
EX2	18.22	0.00	18.22	A/B	2	0.09	0.36	100	0.90	0.96	2	0.09	0.36
EX3	27.31	0.00	27.31	A/B	2	0.09	0.36	100	0.90	0.96	2	0.09	0.36
OS1	25.98	0.00	25.98	A/B	2	0.09	0.36	100	0.90	0.96	2	0.09	0.36
OS2	30.52	0.00	30.52	A/B	2	0.09	0.36	100	0.90	0.96	2	0.09	0.36
OS3	0.94	1.83	2.77	A/B	2	0.09	0.36	100	0.90	0.96	67	0.63	0.76
Total			175.62										

HRGreen	**JOYFUL VIEW**	**Calc'd by:**	**AXB**
	EXISTING CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**5/24/2023**

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)
EX1	0.09	70.82	300	4.1	20.0	10	3178	1.2	1.1	48.4	68.4
EX2	0.09	18.22	270	2.1	23.8	10	1783	1.2	1.1	27.1	50.9
EX3	0.09	27.31	244	2.0	23.0	10	1766	1.1	1.0	28.1	51.0
OS1	0.09	25.98	300	2.6	23.3	10	1898	2.4	1.5	20.4	43.7
OS2	0.09	30.52	300	2.2	24.7	10	1312	3.3	1.8	12.0	36.7
OS3	0.63	2.77	20	2.0	3.1	10	2635	0.5	0.7	62.1	65.2

FORMULAS:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad V = C_v S_w^{0.5}$$

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

HRGreen

JOYFUL VIEW
EXISTING CONDITIONS
DESIGN STORM: 5-YEAR

Calc'd by:	AXB
Checked by:	CM
Date:	5/24/2023

			DIRECT RUNOFF						TOTAL RUNOFF				SURFACE			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	Q_{Street} (cfs)	C_5*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min	
	1	OS1	25.98	0.09	43.7	2.34	1.92	4.5					4.5	2.34	0.6					1370	1.5	14.74	BASIN OS1 FLOW, CAPTURED IN 18" CUVLERT @ DP1, SWALE FLOW TO DP3
	2	OS2	30.52	0.09	36.7	2.75	2.18	6.0					6.0	2.75	1.1					1149	2.1	9.13	BASIN OS2 FLOW, CAPTURED IN 18" CUVLERT @ DP2, SWALE FLOW TO DP6
	3	OS3	2.77	0.63	65.2	1.73	1.32	2.3					2.3	1.73	1.4					2078	2.4	14.64	BASIN OS3 FLOW @ DP3, SWALE FLOW TO DP4
		EX1	70.82	0.09	68.4	6.37	1.25	7.9															BASIN EX1 SWALE FLOW @ DP4
	5								79.8	8.11	1.01	8.2											**SWALE FLOW FROM EX1 AND OS 3 @DP6, DISCHARGE OFFSITE**
	6	EX2	18.22	0.09	50.9	1.64	1.69	2.8															**BASIN EX2 SWALE FLOW @ DP5, DISCHARGE OFFSITE**
		EX3	27.31	0.09	51.0	2.46	1.68	4.1															BASIN EX 3 SWALE FLOW @ DP6
	7								51.0	5.20	1.68	8.8											**SWALE FLOW FROM EX3 AND OS 2 @DP6, DISCHARGE OFFSITE**

HRGreen

JOYFUL VIEW
EXISTING CONDITIONS
DESIGN STORM: 5-YEAR

Calc'd by:	AXB
Checked by:	CM
Date:	5/24/2023

			DIRECT RUNOFF						TOTAL RUNOFF				SURFACE			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min)	
	1	OS1	25.98	0.36	43.7	9.35	3.21	30.1					30.1	9.35	0.6					1370	1.5	14.74	BASIN OS1 FLOW, CAPTURED IN 18" CUVLERT @ DP1, SWALE FLOW TO DP3
	2	OS2	30.52	0.36	36.7	10.99	3.66	40.2					40.2	10.99	1.1					1149	2.1	9.13	BASIN OS2 FLOW, CAPTURED IN 18" CUVLERT @ DP2, SWALE FLOW TO DP6
	3	OS3	2.77	0.76	65.2	2.10	2.21	4.6					4.6	2.10	1.4					2078	2.4	14.64	BASIN OS3 FLOW @ DP3, SWALE FLOW TO DP4
		EX1	70.82	0.36	68.4	25.50	2.09	53.2															BASIN EX1 SWALE FLOW @ DP4
	5								79.8	27.59	1.70	46.8											**SWALE FLOW FROM EX1 AND OS 3 @DP6, DISCHARGE OFFSITE**
	6	EX2	18.22	0.36	50.9	6.56	2.83	18.6															**BASIN EX2 SWALE FLOW @ DP5, DISCHARGE OFFSITE**
		EX3	27.31	0.36	51.0	9.83	2.83	27.8															BASIN EX 3 SWALE FLOW @ DP6
	7								51.0	20.82	2.83	58.8											**SWALE FLOW FROM EX3 AND OS 2 @DP6, DISCHARGE OFFSITE**

HRGreen	**JOYFUL VIEW**	**Calc'd by:**	**AXB**
	PROPOSED CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**5/23/2023**

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
A	70.42	2	7.8	52.6
B	30.57	7	4.6	25.5
C	14.27	4	3.5	21.8
D	1.10	29	0.8	2.5
OS1	25.98	2	4.5	30.1
OS2	30.52	2	6.0	40.2
OS3	2.77	67	2.3	4.6

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	OS1	4.5	30.1
2	OS3	2.3	4.6
3	D	0.8	2.5
4	OS2	6.0	40.2
5	OS1,OS3,A	10.5	62.5
6	B,D	7.3	39.5
7	OS2,C	7.7	50.3

HRGreen	**JOYFUL VIEW**								**Calc'd by:**				**AXB**									
	PROPOSED CONDITIONS								**Checked by:**				**CM**									
	EL PASO COUNTY, CO								**Date:**				**5/23/2023**									

COMPOSITE 'C' FACTORS

BASIN	UNDEVELOPED	GRAVEL ROAD	ASPHALT ROAD	ROOFS	TOTAL	SOIL TYPE	UNDEVELOPED			GRAVEL ROAD			ASPHALT ROAD			ROOFS			COMPOSITE IMPERVIOUSNESS & C		
	ACRES						%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}
A	70.42	0.00	0.00	0.00	70.42	A/B	2	0.09	0.36	80	0.59	0.70	100	0.90	0.96	90	0.08	0.35	2	0.09	0.36
B	28.85	1.38	0.00	0.34	30.57	A/B	2	0.09	0.36	80	0.59	0.70	100	0.90	0.96	90	0.08	0.35	7	0.11	0.38
C	13.86	0.21	0.00	0.21	14.27	A/B	2	0.09	0.36	80	0.59	0.70	100	0.90	0.96	90	0.08	0.35	4	0.10	0.36
D	0.72	0.38	0.00	0.00	1.10	A/B	2	0.09	0.36	80	0.59	0.70	100	0.90	0.96	90	0.08	0.35	29	0.26	0.48
OS1	25.98	0.00	0.00	0.00	25.98	A/B	2	0.09	0.36	80	0.59	0.70	100	0.90	0.96	90	0.08	0.35	2	0.09	0.36
OS2	30.52	0.00	0.00	0.00	30.52	A/B	2	0.09	0.36	80	0.59	0.70	100	0.90	0.96	90	0.08	0.35	2	0.09	0.36
OS3	0.94	0.00	1.83	0.00	2.77	A/B	2	0.09	0.36	80	0.59	0.70	100	0.90	0.96	90	0.08	0.35	67	0.63	0.76
AVG HOUSE - 3000 SF WITH AVE 250 X 12 GRAVEL DRIVEWAY																					
Total					175.63																

HRGreen	**JOYFUL VIEW**	**Calc'd by:**	**AXB**
	PROPOSED CONDITIONS	**Checked by:**	**CM**
	EL PASO COUNTY, CO	**Date:**	**5/23/2023**

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)
A	0.09	70.42	300	4.1	20.0	10	3198	1.2	1.1	48.7	68.7
B	0.11	30.57	265	2.1	23.0	10	2503	1.0	1.0	41.7	64.7
C	0.10	14.27	75	1.7	13.3	10	988	1.0	1.0	16.5	29.8
D	0.26	1.10	20	2.0	5.5	10	1123	1.0	1.0	18.7	24.2
OS1	0.09	25.98	300	2.6	23.3	10	1898	2.4	1.5	20.4	43.7
OS2	0.09	30.52	300	2.2	24.7	10	1312	3.3	1.8	12.0	36.7
OS3	0.63	2.77	20	2.0	3.1	10	2635	0.5	0.7	62.1	65.2

FORMULAS:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad V = C_v S_w^{0.5}$$

25.99476

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

HRGreen

JOYFUL VIEW
PROPOSED CONDITIONS
DESIGN STORM: 5-YEAR

Calc'd by:	AXB
Checked by:	CM
Date:	5/23/2023

			DIRECT RUNOFF						TOTAL RUNOFF				SURFACE			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_5*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min)	
	1	OS1	25.98	0.09	43.7	2.34	1.92	4.5					4.5	2.34	1.0					3254	2.0	27.12	BASIN OS1 FLOW, CAPTURED IN 18" CUVLERT @ DP1, SWALE FLOW TO DP3
	2	OS3	2.77	0.63	65.2	1.73	1.32	2.3					2.3	1.73	1.4					2078	2.4	14.64	BASIN OS3 FLOW @ DP3, SWALE FLOW TO DP5
	3	D	1.1	0.26	24.2	0.29	2.80	0.8					0.8	0.29	1.0					2178	2.0	18.15	BASIN D FLOW, CAPTURED IN 18"CULVERT@ DP3, SWALE FLOW TO DP 6
	4	OS2	30.52	0.09	36.7	2.75	2.18	6.0					6.0	2.75	1.0					1069	2.0	8.91	BASIN OS2 FLOW, CAPTURED IN 18" CUVLERT @ DP4, SWALE FLOW TO DP7
		A	70.42	0.09	68.7	6.34	1.24	7.8															BASIN A SWALE FLOW @ DP5
	5								79.8	10.41	1.01	10.5											**DP1, DP2 & BASIN A FLOW @ DP5, FOLLOW HISTORIC DRAINAGE PATTERNS OFFSITE**
		B	30.57	0.11	64.7	3.44	1.33	4.6															BASIN B SWALE FLOW @ DP6
	6								42.3	3.72	1.96	7.3											**DP3 & BASIN B FLOW @ DP6, FOLLOW HISTORIC DRAINAGE PATTERNS OFFSITE**
		C	14.27	0.10	29.8	1.39	2.49	3.5															BASIN C SWALE FLOW @ DP7
	7								45.6	4.13	1.85	7.7											**DP4 & BASIN C FLOW @ DP7, FOLLOWS HISTORIC DRAINAGE PATTERNS OFFSITE**

HRGreen

JOYFUL VIEW
PROPOSED CONDITIONS
DESIGN STORM: 100-YEAR

Calc'd by: AXB
Checked by: CM
Date: 5/23/2023

			DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	I (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min)	
	1	OS1	25.98	0.36	43.7	9.35	3.21	30.1					30.1	9.35	1.0					3254	2.0	27.12	BASIN OS1 FLOW, CAPTURED IN 18" CUVLERT @ DP1, SWALE FLOW TO DP3
	2	OS3	2.77	0.76	65.2	2.10	2.21	4.6					4.6	2.10	1.4					2078	2.4	14.64	BASIN OS3 FLOW @ DP3, SWALE FLOW TO DP5
	3	D	1.1	0.48	24.2	0.52	4.71	2.5					2.5	0.52	1.0					2178	2.0	18.15	BASIN D FLOW, CAPTURED IN 18"CULVERT@ DP3, SWALE FLOW TO DP 6
	4	OS2	30.52	0.36	36.7	10.99	3.66	40.2					40.2	10.99	1.0					1069	2.0	8.91	BASIN OS2 FLOW, CAPTURED IN 18" CUVLERT @ DP4, SWALE FLOW TO DP7
		A	70.42	0.36	68.7	25.35	2.08	52.6															BASIN A SWALE FLOW @ DP5
	5								79.8	36.80	1.70	62.5											**DP1, DP2 & BASIN A FLOW @ DP5, FOLLOW HISTORIC DRAINAGE PATTERNS OFFSITE**
		B	30.57	0.38	64.7	11.47	2.23	25.5															BASIN B SWALE FLOW @ DP6
	6								42.3	11.99	3.30	39.5											**DP3 & BASIN B FLOW @ DP6, FOLLOW HISTORIC DRAINAGE PATTERNS OFFSITE**
		C	14.27	0.36	29.8	5.21	4.18	21.8															BASIN C SWALE FLOW @ DP7
	7								45.6	16.19	3.11	50.3											**DP4 & BASIN C FLOW @ DP7, FOLLOWS HISTORIC DRAINAGE PATTERNS OFFSITE**

APPENDIX C – HYDRAULIC CALCULATIONS

Provide calculations for outlet protection at culverts.

Provide analysis of major channel through site to ensure stability of channel (Velocity, flow depth, Fr #, etc)

Culvert Report

Culvert 1 (Q100 = 30.1 CFS - DP1)

Invert Elev Dn (ft)	=	6272.63
Pipe Length (ft)	=	46.20
Slope (%)	=	1.49
Invert Elev Up (ft)	=	6273.32
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	2
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

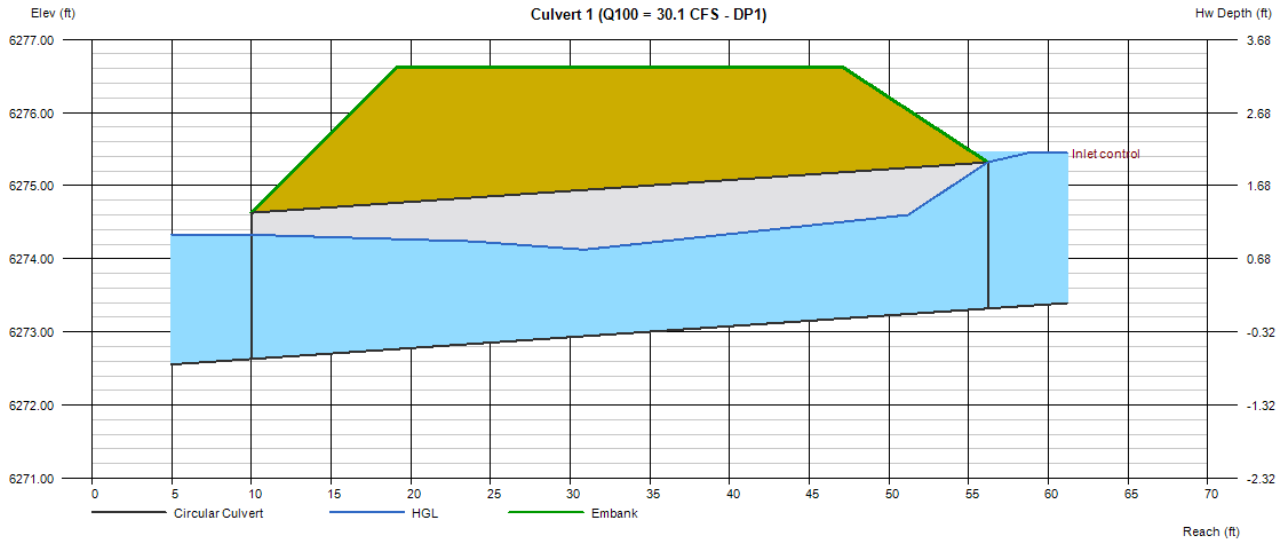
Top Elevation (ft)	=	6276.62
Top Width (ft)	=	28.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	30.10
Qmax (cfs)	=	30.10
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	30.10
Qpipe (cfs)	=	30.10
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.29
Veloc Up (ft/s)	=	6.42
HGL Dn (ft)	=	6274.33
HGL Up (ft)	=	6274.72
Hw Elev (ft)	=	6275.45
Hw/D (ft)	=	1.06
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, May 26 2023

CULVERT 2 (Q100 = 2.5 CFS - DP3)

Invert Elev Dn (ft)	=	6261.87
Pipe Length (ft)	=	58.17
Slope (%)	=	0.65
Invert Elev Up (ft)	=	6262.25
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

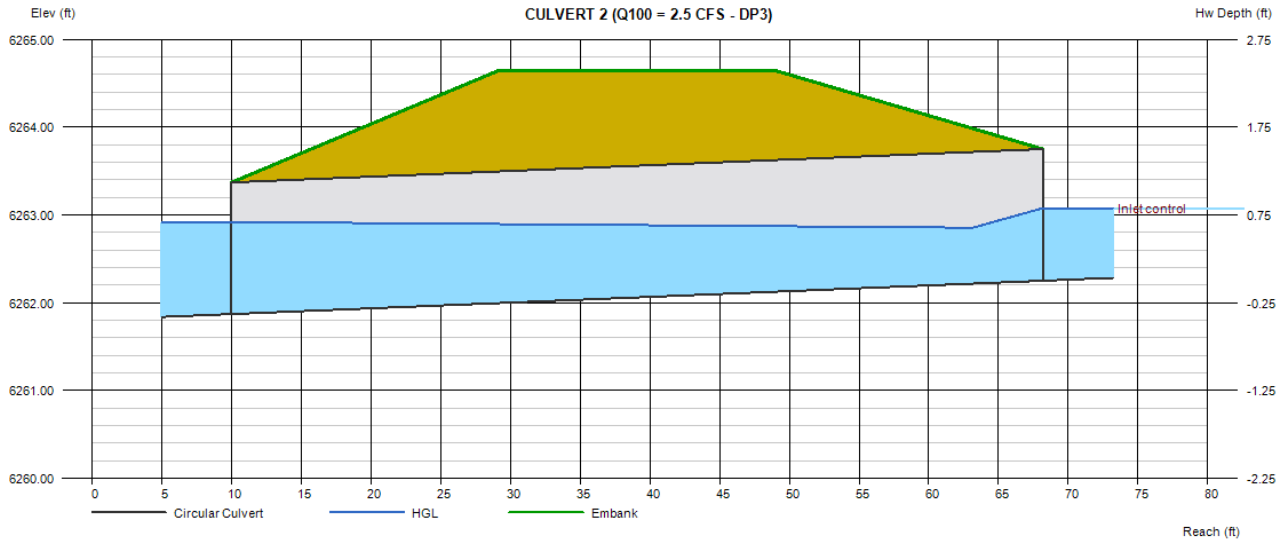
Top Elevation (ft)	=	6264.64
Top Width (ft)	=	20.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	2.50
Qmax (cfs)	=	2.50
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	2.50
Qpipe (cfs)	=	2.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.89
Veloc Up (ft/s)	=	3.80
HGL Dn (ft)	=	6262.92
HGL Up (ft)	=	6262.85
Hw Elev (ft)	=	6263.08
Hw/D (ft)	=	0.55
Flow Regime	=	Inlet Control



Culvert Report

CULVERT 3 (Q100=40.2 CFS - DP4)

Invert Elev Dn (ft)	=	6260.33
Pipe Length (ft)	=	82.89
Slope (%)	=	1.00
Invert Elev Up (ft)	=	6261.16
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	2
n-Value	=	0.012
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

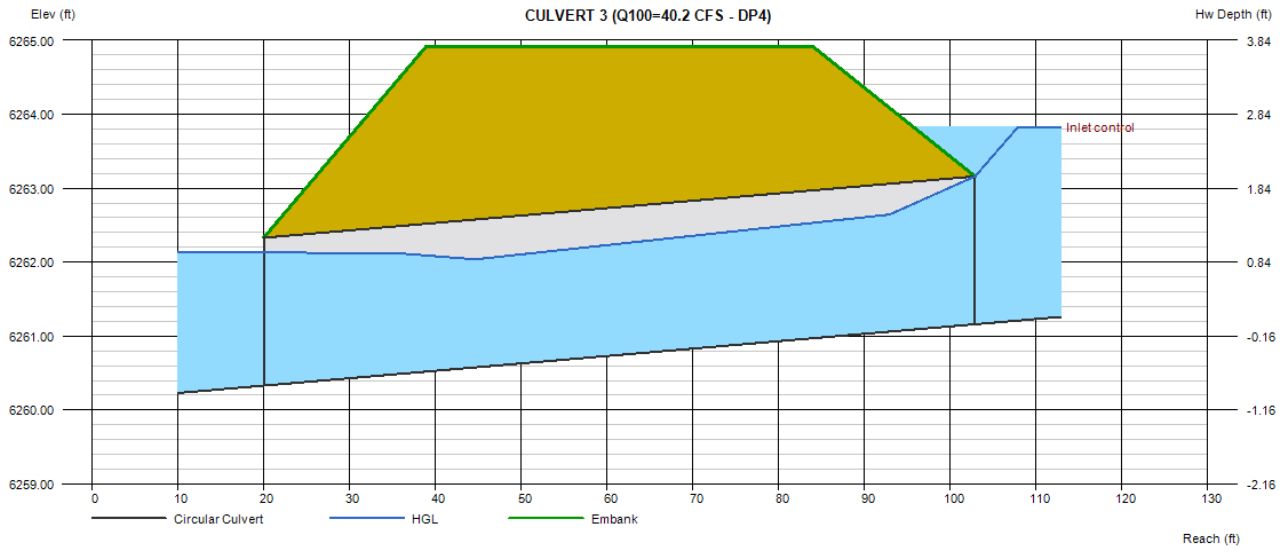
Top Elevation (ft)	=	6264.92
Top Width (ft)	=	45.00
Crest Width (ft)	=	120.00

Calculations

Qmin (cfs)	=	40.20
Qmax (cfs)	=	40.20
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	40.20
Qpipe (cfs)	=	40.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.74
Veloc Up (ft/s)	=	7.42
HGL Dn (ft)	=	6262.13
HGL Up (ft)	=	6262.77
Hw Elev (ft)	=	6263.83
Hw/D (ft)	=	1.33
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, May 26 2023

SWALE 1 - JOYFUL VIEW ROAD

Triangular

Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.60
Invert Elev (ft)	= 1.00
Slope (%)	= 0.90
N-Value	= 0.035

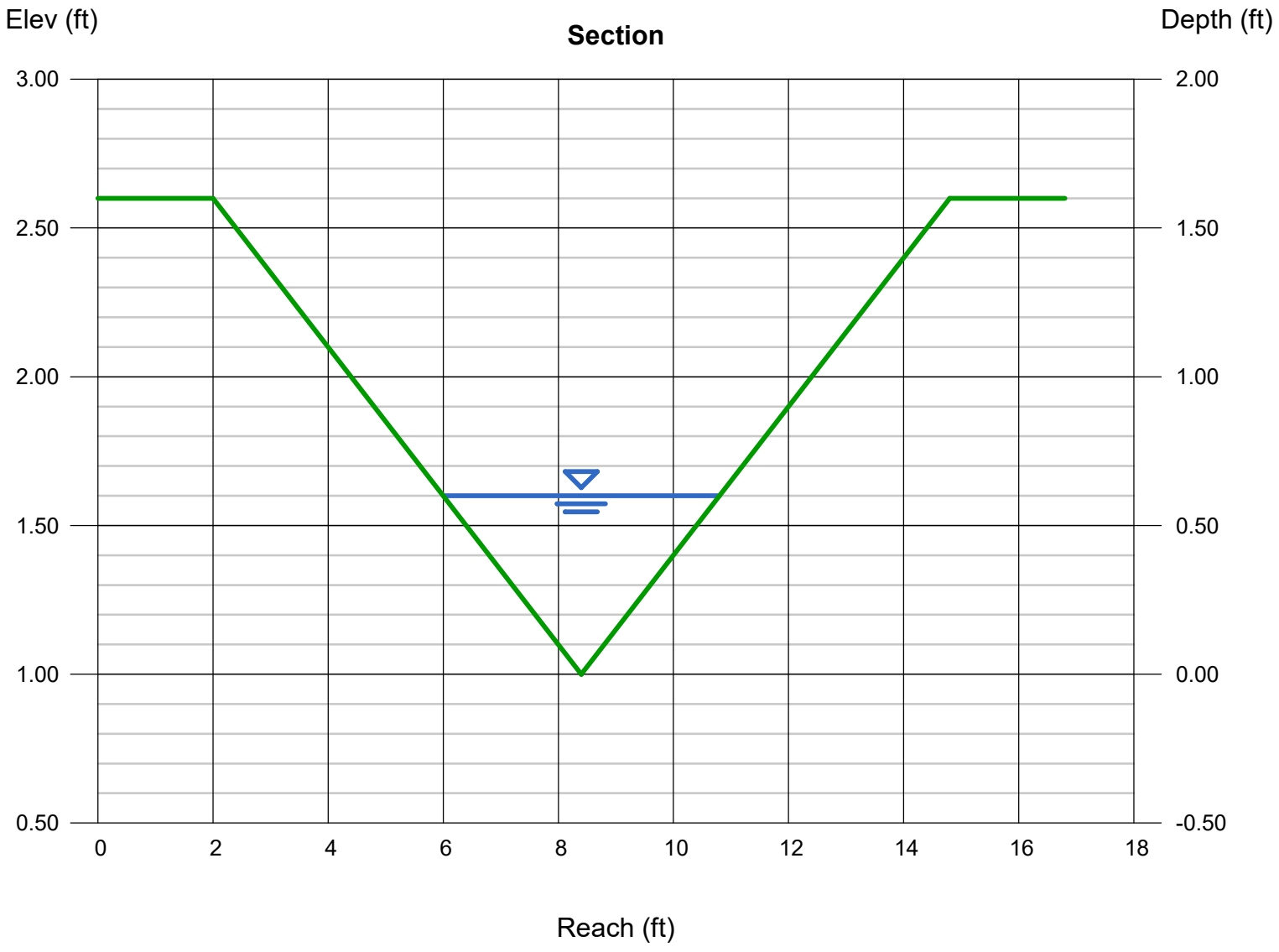
Calculations

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

Highlighted

Depth (ft)	= 0.60
Q (cfs)	= 2.500
Area (sqft)	= 1.44
Velocity (ft/s)	= 1.74
Wetted Perim (ft)	= 4.95
Crit Depth, Yc (ft)	= 0.48
Top Width (ft)	= 4.80
EGL (ft)	= 0.65

Fr = 3.1/(sqrt(32.17 *0.6))=0.70 < 0.9



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, May 24 2023

SWALE 2 - ELLAS WAY

Triangular

Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.70
Invert Elev (ft)	= 1.00
Slope (%)	= 0.74
N-Value	= 0.035

Calculations

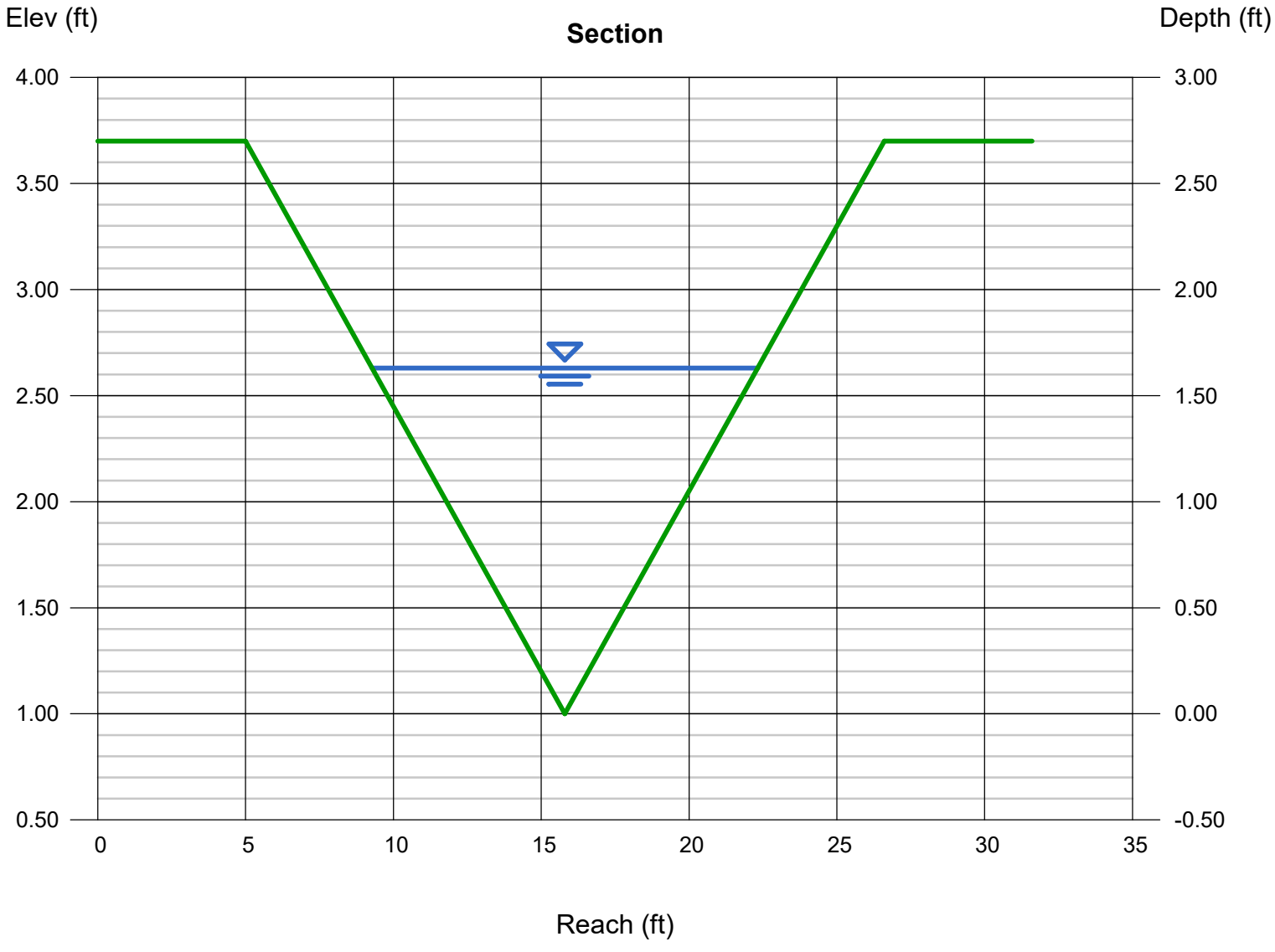
Compute by:	Known Q
Known Q (cfs)	= 32.90

Highlighted

Depth (ft)	= 1.63
Q (cfs)	= 32.90
Area (sqft)	= 10.63
Velocity (ft/s)	= 3.10
Wetted Perim (ft)	= 13.44
Crit Depth, Yc (ft)	= 1.34
Top Width (ft)	= 13.04
EGL (ft)	= 1.78

Fr = 3.1/(sqrt(32.17*1.63))=0.43 < 0.9

Where did this flow come from? It does not match with any basin or DP flows.



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, May 26 2023

SWALE 3 - LOTS 8 & 9

Triangular

Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.90
Invert Elev (ft)	= 1.00
Slope (%)	= 0.90
N-Value	= 0.035

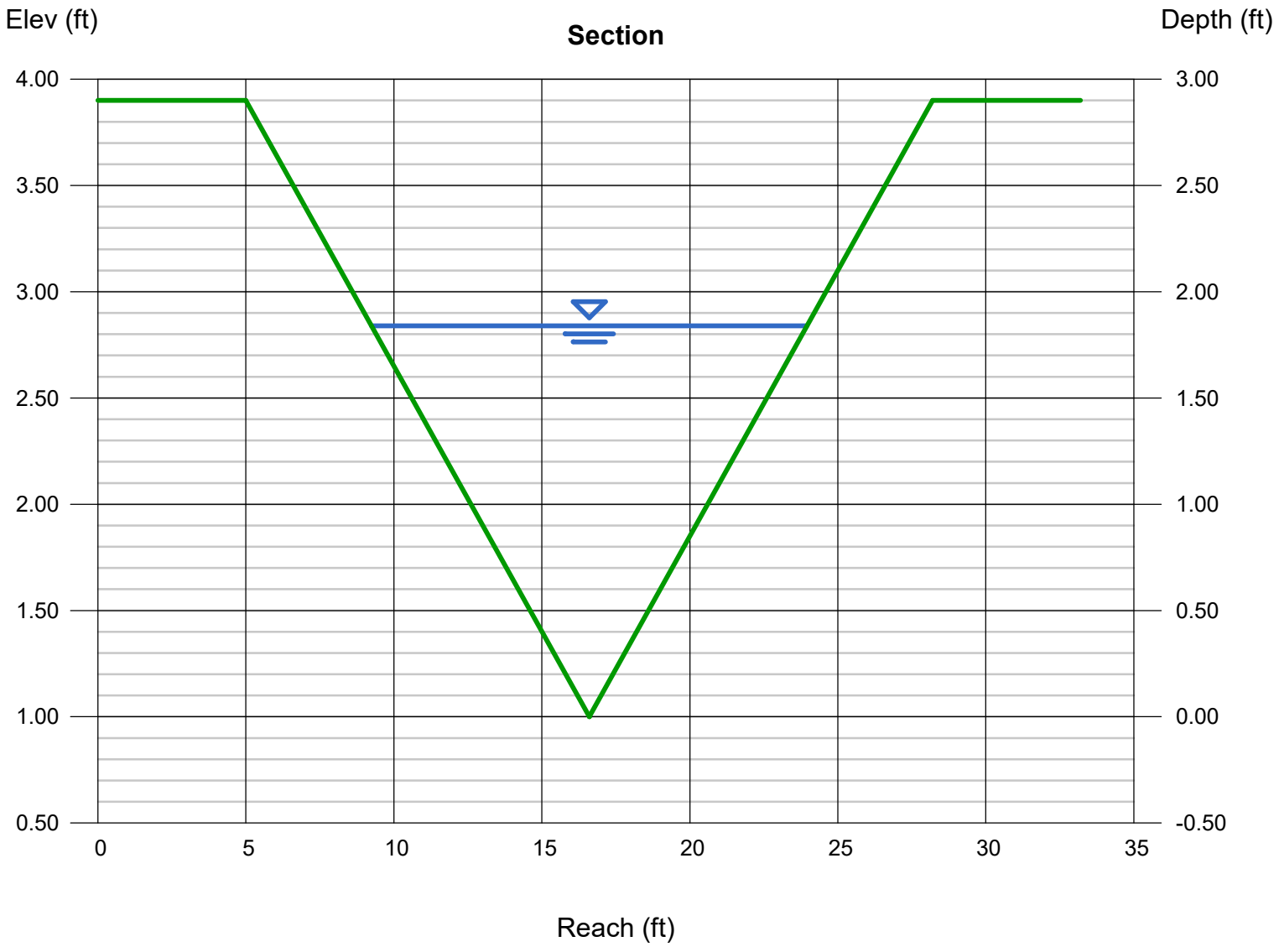
Calculations

Compute by:	Known Q
Known Q (cfs)	= 50.30

Highlighted

Depth (ft)	= 1.84
Q (cfs)	= 50.30
Area (sqft)	= 13.54
Velocity (ft/s)	= 3.71
Wetted Perim (ft)	= 15.17
Crit Depth, Yc (ft)	= 1.58
Top Width (ft)	= 14.72
EGL (ft)	= 2.05

Fr = 3.1/(sqrt(32.17 *1.84))=0.40 < 0.9



APPENDIX D – DRAINAGE MAPS

State what FEMA flows are at this location and size of storm facility crossing road (both maps)

Proposed map calls out an existing swale. Please show and label on this map or remove from other map.

N. PEYTON HIGHWAY
PUBLIC ROADWAY

EXIST. 18" CULVERT
FL 6274.09

EXIST. 18" CULVERT
FL 6274.82

OS3
2.77

OS1
25.98

EX SWALE

6261.1 FEET

OWNER INFO NOT FOUND
SCH. NO. 3300000465

EX PROPERTY LINE

EX OVERHEAD ELECTRIC

EX1
70.82

EX2
18.22

6258.9 FEET

EX 100 YR
FLOODPLAIN
ZONE AE

OS2
30.52

OGC RE2 LLC
SCH. NO. 3300000466

6253.4 FEET

Fix cut off text

BERTO & NATHALIEB
ZEPEDA
CH. NO. 3400000467

EX PROPERTY LINE

EX3
27.31

EXIST. 18" CULVERT
FL 6262.32

EXIST. 18" CULVERT
FL 6262.5

CLASSIC MEDIA
MONEY PURCHASE
PLAN & TRUST
SCH. NO. 3300000458

EX PROPERTY LINE

6248 FEET

EX SWALE

OGC RE2 LLC
SCH. NO. 330000067

EX SWALE

6245.1 FEET

Update channel slope

EX PROPERTY LINE

GARRETT & ELIZABETH J GIBSON
SCH. NO. 3300000468

Label all easements and ROW.

2.4%

2.6%

2.2%

NORTH

0 150

75

LEGEND:

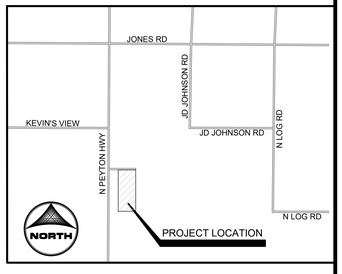
PROPOSED MAJOR CONTOUR	5250
PROPOSED MINOR CONTOUR	
EXISTING MAJOR CONTOUR	5250
EXISTING MINOR CONTOUR	
EXISTING DRAINAGE SWALE	
PROPOSED DRAINAGE SWALE	
PROJECT SITE BOUNDARY	
FLOW DIRECTION	
EXISTING DRAINAGE BASIN	
PROPOSED DRAINAGE BASIN	
EXISTING STORM CULVERT	
PROPOSED STORM CULVERT	
DESIGN POINT	X
PROPOSED BASIN LABEL	11 / 1.25 — BASIN DESIGNATION / AREA (AC.)

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
EX1	70.82	2	7.9	53.2
EX2	18.22	2	2.8	18.6
EX3	27.31	2	4.1	27.8
OS1	25.98	2	4.5	30.1
OS2	30.52	2	6.0	40.2
OS3	2.77	67	2.3	4.6

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	OS1	4.5	30.1
2	OS2	6.0	40.2
3	OS3	2.3	4.6
5	OS3,EX1,OS1	10.6	62.7
6	EX2	2.8	18.6
7	EX3, OS2	8.8	58.8



VICINITY MAP
(NOT TO SCALE)

PCD FILING NO. SF2231

DRAWN BY: AXB
APPROVED: CM
CAD DATE: 5/24/2023
CAD FILE: J:\2022\2202179\CAD\Dwgs\C\Drainage\Ex_Drainage
JOB DATE: 5/24/2023
JOB NUMBER: 2202179

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

NO.	DATE	BY	REVISION DESCRIPTION

HRGreen
HR GREEN - COLORADO SPRINGS
1975 RESEARCH PARKWAY SUITE 230
COLORADO SPRINGS, CO 80920
PHONE: 719.394.2440
FAX: 713.965.0044

JOYFUL VIEW SUBDIVISION
OGC RE2, LLC.
EL PASO COUNTY, CO

DRAINAGE MAPS
EXISTING DRAINAGE

SHEET
DR
1

N. PEYTON HIGHWAY (PUBLIC-60' ROW)

EX SWALE

OS3 2.77

Call out offsite easements

PR CULVERT 1

OS1 25.98

Update direction of swale in this area

Add culvert pipe sizes to drainage map with design details or put a roll up table with details.

Include outlet protection size and public/private

Please explain why the BFE lines go out so far from floodplain or correct linework

A 70.42

Label swale 1

D 1.10

POINT OF BEGINING TRACT 2

6281.1 FEET

NO PARCEL INFO FOUND ON EL PASO COUNTY ASSESSOR GIS

60.00' U.E (REC. NO. 205900168) & D.E

60.00' U.E (REC. NO. 205900168) & D.E

delete "road"

6256.5 FEET

ROBERTO & NATHALIEB ZEPEDA SCH. NO. 3400000467

LOT 4 812,674 SQ.FT. 18.66 +/- AC. ( )

LOT 3 231,588 SQ.FT. 5.32 +/- AC. ( )

LOT 2 233,710 SQ.FT. 5.37 +/- AC. ( )

LOT 1 250,578 SQ.FT. 5.75 +/- AC. ( )

OS2 30.52

30.00' RECORDED AT BOOK A, PAGE 78 AND BOOK 571, PAGE 55

EX 100 YR FLOODPLAIN ZONE AE

6243.4 FEET

edge of floodplain based on BFEs? Verify.

B 30.57

10.00' U.E & D.E (TYP.)

JOYFUL VIEW ROAD (PRIVATE-LOCAL)

PR CULVERT 3

PR CULVERT 2

CLASSIC MEDIA MONEY PURCHASE PLAN & TRUST SCH. NO. 3300000458

Label this a BFE

10.00' U.E & D.E (TYP.)

15.00' T.E

50.00'

15.00' T.E

ELLAS WAY (PRIVATE-LOCAL)

Call out offsite easements

ADDITIONAL TRAVEL EASEMENT FOR HAMMERHEAD

100.00'

PR SWALE 2

POINT OF BEGINNING TRACT 3

6248.1 FEET

C 14.27

LOT 8 233,731 SQ.FT. 5.37 +/- AC. ( )

10.00' U.E & D.E (TYP.)

LOT 5 589,304 SQ.FT. 13.53 +/- AC. ( )

LOT 6 223,301 SQ.FT. 5.13 +/- AC. ( )

LOT 7 231,584 SQ.FT. 5.32 +/- AC. ( )

LOT 9 250,584 SQ.FT. 5.75 +/- AC. ( )

PR SWALE 3

PR 30.00' DRAINAGE ESMT

show turnaround

Discuss culvert size required to cross DE in narrative.

6245.1 FEET

Provide a detail showing how grading will tie in and stabilization

Add linetype to Legend

GARRETT & ELIZABETH J GIBSON SCH. NO. 3300000468

NORTH

0 150

1" = 75

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- EXISTING DRAINAGE SWALE
- PROPOSED DRAINAGE SWALE
- PROJECT SITE BOUNDARY
- FLOW DIRECTION
- EXISTING DRAINAGE BASIN
- PROPOSED DRAINAGE BASIN
- EXISTING STORM CULVERT
- PROPOSED STORM CULVERT
- DESIGN POINT
- PROPOSED BASIN LABEL — 11 / 1.25 — BASIN DESIGNATION / AREA (AC.)

D.E. Drainage Easement
U.E. Utility Easement
T.E. Travel Easement

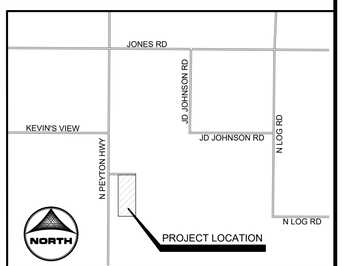
- Utility & Drainage Easement Hatch
- Travel Easement Hatch
- Utility & Travel Easement Hatch
- Floodplain / No Build Area

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
A	70.42	2	7.8	52.6
B	30.57	7	4.6	25.5
C	14.27	4	3.5	21.8
D	1.10	29	0.8	2.5
OS1	25.98	2	4.5	30.1
OS2	30.52	2	6.0	40.2
OS3	2.77	67	2.3	4.6

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	OS1	4.5	30.1
2	OS3	2.3	4.6
3	D	0.8	2.5
4	OS2	6.0	40.2
5	OS1,OS3,A	10.5	62.5
6	B,D	7.3	39.5
7	OS2,C	7.7	50.3



VICINITY MAP
(NOT TO SCALE)

PCD FILING NO. SF2231

DRAWN BY: AXB JOB DATE: 5/24/2023
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CAD DATE: 5/25/2023
CAD FILE: J:\2022\2202179\CAD\Dwgs\C\Drainage\Pr_Drainage

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FAX: 713.965.0044

JOYFUL VIEW SUBDIVISION
OGC RE2, LLC.
EL PASO COUNTY, CO

DRAINAGE MAPS
PROPOSED DRAINAGE

SHEET DR 2