FINAL DRAINAGE REPORT:
MARIAH TRAIL FILING NO. 1
MAJOR SUBDIVISION

A PORITION OF THE NORTHWEST QUARTER OF
SECTION 17, TOWNSHIP 14 SOUTH, RANGE 66 WEST OF
THE 6TH P.M.
COUNTY OF EL PASO, STATE OF COLORADO

LOTS 1-6 MARIAH TRAIL FILING NO. 1
EL PASO COUNTY, COLORADO

PREPARED FOR: MR. THOMAS KIRK, JR.
19205 MARIAH TRAIL
COLORADO SPRINGS, CO
EMAIL:
PCD File No. SF-2315

LATEST REVISION DATE: August 4, 2023

PREPARED BY

CARLOS SERRANO, PE
ENGINEERING LOCAL XPERTS

PROJECT NO. 100678

2320 W. COLORADO AVENUE, STE. 122 | COLORADO SPRINGS, CO 80904 | 719.308.9146

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 city/county for drainage reports and said report is in conformity with the master 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.

SIGNATURE (Affix Seal): ____ ______________

Carlos David Serrano, Colorado P.E. No.: 52048 Date

For and on Behalf of Engineering Local Xperts

SEAL:

DEVELOPER'S STATEMENT

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

____

Name of Developer

____

Authorized Signature Date

____

Printed Name

____

Title

____

Address

EL PASO COUNTY STATEMENT:

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

APPENDICES

1) Introduction

The purpose of this report is to identify on-site and offsite drainage patterns, assess stormwater conditions per delineated project sub-basins, demonstrate adequate design standards for storm water conveyance and release into the existing storm water system (on-site or off-site), and provide a narrative for any other drainage considerations on the development. The purpose of the project is to subdivide an existing 35-acre RR-5 zoned parcel into six single-family residential lots as a Major Subdivision. A Drainage Letter is sufficient for the purposes of a final plat and "small subdivision" per County standards.

2) Existing Conditions

Location

The property of interest, henceforth referred to as the Site, addressed as 19205 Mariah Trail, is an unplatted 35-acre RR-5 zoned parcel within El Paso County with Schedule No. 5100000511. The Site within the northwest quarter of Section 7, Township 11 South, Range 65 West of the sixth P.M.. The Site is south of the County's 60-foot right-of-way of Mariah Trail, a rural local gravel roadway. The property is accessed via a private access drive within a 16-foot width common access easement (Reception No. 213070061). The adjacent properties or subdivisions are as follows:

North: El Creek Ranches Filing No. 1 (Lots 24-26)

East: 19275 Mariah Trail, Schedule No. 5100000512, Zoned RR-5, Unplatted 40.23 acre property

South: 18885 Brown Road, Schedule No. 5100000447, Zoned RR-5, Unplatted 61.55 acre property

West: Part of Section 12-11-66, Schedule No. 6100000224, Zoned RR-5, Unplatted 80 acre property

The Site is currently zoned RR-5 (Rural Residential), allowing 5-acre minimum lots with 25-foot front, rear, and side setbacks for principal structures, and a 200-foot minimum lot frontage width.

Existing Soils

The soils indicative to the site are classified as Brussett loam and Peyton-Print complex by the USDA Soil Conservation Service and are listed as NRCS (National Resources Conservation Service) Hydrologic Soil Group B. A USDA Soil Map is provided in Appendix C.

Existing Drainage Conditions

The existing topography of the Site consists of slopes between 2.0 percent and 15 percent generally draining from the west to the east. There are several local topographic high points and grasslined swales across the property. The natural landscape comes to a swale located on the eastern property boundary, central to the Site. The majority of the Site drains to this point where it continues to flow due east. The stormwater runoff to this area is via overland sheet flow and remains generally as sheet flow until the swale reduces in width downstream to channelized flow. The ultimate outfall location is East Cherry Creek approximately 1.5 miles east of the Site.

There are no major drainageways or existing facilities on the Site.

The Site lies within the East Cherry Creek Drainage Basin according to the El Paso County Drainage Basins map. There are no known non-stormwater discharges that contribute to the storm water systems on site and downstream, both private and public.

The project site does not lie within a designated floodplain according to information published in the Federal Emergency Management Agency Floodplain Map No. 08041C0305G, dated December 7, 2018. The FEMA FIRM panel is provided in Appendix B.

The existing percent imperviousness of the Site is less than 0.1% as evidence by aerial photography and site visits. The only non-vegetation land is a dirt path within a common access easement at the north of the Site. The existing vegetative cover of the Site is approximately 99.9% with sparse native grasses and weeds, also as evidence by aerial photography and site visits.

3) PROPOSED DEVELOPMENT

The proposed project scope is for a small subdivision for a total of six lots with a public 60' width right-of-way extension for the roadway of Mariah Trail. A Final Plat and Major Development Plan show Lots 1 through 6 with minimum areas of 5 acres to meet RR-5 rural residential zoning standards. A 32' width gravel surface roadway is proposed as an extension of Mariah Trail with a cul-de-sac at the termination point of the proposed right-of-way for an emergency vehicle turnaround. The typical section of the roadway follows County Standard Detail SD-2-10, a 32' width gravel section with a 4% crown with roadside swales of minimum 2' depth within the 60' right-of-way section and an additional 5' of public improvement easement on each side.

The small subdivision is to remain zoned as RR-5, allowing for single-family residences and accessory structures within the El Paso County zoning code's allowed land uses. Covenants for the Mariah Trail Filing No. 1 subdivision shall meet El Paso County land use and development standards at a minimum with the following minimum criteria per the County:

- Minimum 200' width lot frontage
- 25' front, side, and rear principal building setbacks
- 25% maximum coverage
- 7% Imperviousness (Table 3-1, Appendix L)

Proposed construction activity for the major subdivision is for the Mariah Trail right-of-way extension of the gravel roadway section and roadside ditch. Future developed lots are to connect to the gravel roadway with future driveways and 18” CMP culvert pipes within the roadside ditches. No driveway connections or culverts are proposed at this time.

The limits of disturbance and construction is to establish the roadway is approximately 5.0 acres or 11.4% of the total Site area. The interim developed condition is the initial roadway buildout of a gravel section with roadside ditches. Further interim conditions are to include driveways and culvert pipes from the roadway and lot development of single-family residences. The ultimate developed condition consists of a full build out of Lots 1 through 6 with single-family residences, driveways, hardscape, accessory structures, etc. to an assumed percent imperviousness of 7% per for the six lots per El Paso County criteria (Table 3-1, Appendix L). The total imperviousness of the Site is 8.82% for the ultimate developed condition which includes full development of all lots and the roadway.

This Drainage Letter demonstrates that Water Quality is met via the grass buffers of the large acre lots prior to exiting the Site within the concentrated swale area to the east. Runoff Reduction calculations are provided within the Appendix. While disturbance is over once acre for construction of the road, detention is not required for this rural major subdivision due to runoff reduction and infiltration within the site and a stabilized outfall exiting the site. There is no increase or decrease in flows on the site from existing to proposed. A natural drainage swale exists on the eastern boundary that conveys stormwater due east toward the East Cherry Creek. This natural swale is not a formal drainageway and is a part of the existing topography of the Site. Appendix calculations show a cross section of the existing swale with calculations for stormwater velocities during the major and minor storm events.

The construction timeline is anticipated to commence following the Subdivision Plat, Entitlements, and Construction Drawings processes with the County anticipated to be August 2023. Construction of the roadway is anticipated to take two months with final stabilization occurring in November of 2023. Erosion and sediment control measures for the Site are to be established prior to any disturbance or construction activity as required by the County and per the GEC Plan Set and Stormwater Management Report.

a) PROPOSED DRAINAGE CONDITIONS

The final drainage pattern of the ultimate buildout of the small subdivision generally follows the existing conditions by sheet flowing west to east and flowing to the concentrated swale within the central east area of the Site. The difference between existing patterns and developed is that a gravel roadway will capture upstream (west) runoff in its swale and convey it to a culvert pipe at the low point of the roadway which will flow due east to a level spreader so that the stormwater will continue due east via overland sheet flow.

Unresolved from Submittal 1: 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.
Per my comment on PDF pg 35 below, discuss the difference/increase in flows from existing to developed conditions.

Unresolved from Submittal 1 - Discuss use of Exclusion in ECM App I.7.1.B.5. Note about that exclusion:
Per direction from the State, subdivision developments that include impervious pavement roads do not qualify for Exclusion E (Large Lot Single-Family Site) on the PBMP form for soil disturbances associated with the construction of those roadway areas. Therefore, a permanent WQ facility should be designed to treat runoff from the impervious roadway area and the subsequent grading like roadside ditches (but only if the total area of soil disturbance is >1ac). A driveway that feeds and crosses multiple lots counts toward roadway impervious area. But individual driveways for individual lots counts towards the impervious area for the large single-family lot.

There is no expected increases in stormwater runoff due to impervious areas. Impervious areas are treated for water quality via grass buffers as is expected in rural settings with large areas of undeveloped land. The gravel roadway extension experiences 100% water quality runoff reduction via grass buffers as shown in the Appendix calculations (UD-BMP).

There are no stream crossings located within the construction site boundary. The lots are not within a streamside boundary and there are no preservation easements or existing no-build areas on or within the vicinity of construction/disturbance. There are no anticipated negative impacts to surrounding or downstream developments or infrastructure as a result of development of this small subdivision.

The downstream outfall location of the site is along the east property boundary where a natural grasslined swale is located per existing topography. The major storm event does not have excessive stormwater velocities that would scour the natural swale and therefore is deemed stabilized.

The proposed conditions narrative identify that there is an increase. Revise statement accordingly.

4) Drainage Basins and Sub-Basins

a) Existing Major Drainage Basin and Sub-basins

Basin E1 (1.85 ac. ; Q_5 = 0.58 cfs, Q_{100} = 4.23 cfs) is a sub-basin within the northwest corner of the Site that consists of undeveloped area with native grasses and open meadow/pasture. The drainage pattern of the sub-basin consist of overland sheet flow due northwest directed offsite to **Design Point 1**. There are no significant natural features or storm infrastructure that capture or convey the runoff and the stormwater continues due north offsite.

Basin E2 (28.42 ac. ; Q_5 = 8.84 cfs, Q_{100} = 64.91 cfs) is the sub-basin that consists of most of the undeveloped Site. The vast majority of the area consist of native grass and open meadow/pasture and the topography has natural grasslined swales that convey stormwater runoff due east toward the Site's outfall point at **Design Point 2**. There is existing fenceline and dirt trail within an existing access easement at the northeast area of the sub-basin. Most of the stormwater runoff is overland sheet flow and is concentrated within the existing natural grass swales that flow along the east property boundary. The outfall point at **Design Point 2** is not a formal channel or drainage way and continues due east until it ultimately outfalling at the East Cherry Creek.

Basin E3 (0.83 ac. ; Q_5 = 0.26 cfs, Q_{100} = 1.90 cfs) is a sub-basin within the southwest corner of the Site that consists of undeveloped area with native grasses and open meadow/pasture. The drainage pattern of the sub-basin consist of overland sheet flow due southeast directed offsite to **Design Point 3**. There are no significant natural features or storm infrastructure that capture or convey the runoff and the stormwater continues due southeast offsite toward East Cherry Creek.

Unresolved from Submittal 1-Additional Runoff Reduction notes/requirements:
- 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) and discussed in the maintenance agreement and O&M manual.
- For O&M Manual, see City's O&M for Grass Buffers / Grass Swales on their website:
https://coloradosprings.gov/stormwater-enterprise/page/operations-and-maintenance-permanent-bmps?mlid=6126
- 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 and vegetated. 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".

Basin E4 (3.90 ac. ; Q_5 = 1.21 cfs, Q_{100} = 8.91 cfs) is a sub-basin within the northeast corner of the Site that consists of undeveloped area with native grasses, open meadow/pasture, and a dirt pathway within an existing access easement. The drainage pattern of the sub-basin consist of overland sheet flow due northeast directed offsite to **Design Point 4**. There are no significant natural features or storm infrastructure that capture or convey the runoff and the stormwater continues due east offsite toward East Cherry Creek.

Basin OS1 (0.64 ac. ; Q_5 = 0.20 cfs, Q_{100} = 1.46 cfs) is a relatively small sub-basin located off-site adjacent to the west property boundary of the Site. The stormwater runoff from this sub-basin contributes to sub-basin **E2** and **Design Point 2**. There is a high point west of the Site that flows in all directions and this sub-basins drainage pattern is directed west through the Site via overland sheet flow. The area consist of native grasses and open meadow/pasture. The offsite basin is split into these two off-site sub-basins to be consistent with the developed conditions hydrology map's design points.

Basin OS2 (0.29 ac. ; Q_5 = 0.09 cfs, Q_{100} = 0.66 cfs) is a relatively small sub-basin located off-site adjacent to the west property boundary of the Site. The stormwater runoff from this sub-basin contributes to sub-basin **E2** and **Design Point 2**. There is a high point west of the Site that flows in all directions and this sub-basins drainage pattern is directed west through the Site via overland sheet flow. The area consist of native grasses and open meadow/pasture. The offsite basin is split into these two off-site sub-basins to be consistent with the developed conditions hydrology map's design points.

The total stormwater runoff for the existing conditions of the Site is 11.17 cfs for the minor (5year) storm event and 82.06 cfs for the major (100-year) storm event which includes offsite contributions.

The offsite stormwater runoff contribution to and through the Site is 0.29 cfs for the minor (5year) storm event and 2.12 cfs for the major (100-year) storm event.

The notable outfall point for the Site is **Design Point 2**, a grasslined swale that conveys stormwater runoff due east offsite toward East Cherry Creek. The existing conditions for the undeveloped Site contribute 9.13 cfs for the minor (5-year) storm event and 67.03 cfs for the major (100-year) storm event at this design point, including offsite contributions.

b) Developed Major Drainage Basin and Sub-basins

Basin D1 (1.85 ac. ; Q_5 = 0.58 cfs, Q_{100} = 4.23 cfs) is the sub-basin that corresponds to the Existing Conditions Hydrology Map's sub-basin E1. There are no changes to this sub-basin from existing undeveloped conditions because it is assumed that any Lot 1 development occurs within subbasin D2 to conservatively account for stormwater runoff to the developed roadway's ditch and culvert pipe. The sub-basin is within the northwest corner of the Site that consists of undeveloped area with native grasses and open meadow/pasture. The drainage pattern of the sub-basin consist of overland sheet flow due northwest directed offsite to **Design Point 1**. There are no significant natural features or storm infrastructure that capture or convey the runoff and the stormwater continues due north offsite.

Basin D2 (9.48 ac. ; Q_5 = 5.65 cfs, Q_{100} = 24.83 cfs) is a sub-basin on the west side of the developed gravel roadway, the extended Mariah Trail. The sub-basin consists of developed lots 1 and 2 with an assumed imperviousness of 7 percent. Undeveloped areas within the minimum 5-acre lots are assumed to remain meadow/pasture areas of native grasses. It also consists of the west side of the developed gravel roadway and it's roadside ditch that has a low point where a proposed 18" CMP culvert pipe is located to flow under the roadway from west to east, at **Design Point 5**. The concentrated stormwater runoff from the culvert pipe continues east to **Design Point 2**, the existing grasslined swale that conveys most of the Site's stormwater runoff due east toward East Cherry Creek.

Basin D3 (0.83 ac. ; Q_5 = 0.26 cfs, Q_{100} = 1.90 cfs) is a sub-basin that corresponds to the Existing Conditions Hydrology Map's sub-basin E3. There are no changes to this sub-basin from existing undeveloped conditions because it is assumed that any Lot 3 development occurs within subbasin E4. The sub-basin is located within the southwest corner of the Site that consists of undeveloped area with native grasses and open meadow/pasture. The drainage pattern of the sub-basin consist of overland sheet flow due southeast directed offsite to **Design Point 3**. There are no significant natural features or storm infrastructure that capture or convey the runoff and the stormwater continues due southeast offsite toward East Cherry Creek.

Basin D4 (18.02 ac. ; Q_5 = 9.66 cfs, Q_{100} = 45.97 cfs) is a sub-basin that encompasses the south and east areas of the Site with developed lots 3, 4, 5, and 6 with an assumed imperviousness of 7 percent. The sub-basin includes existing fenceline and some dirt trail within the existing access easement to the north of the Site. Undeveloped areas within the minimum 5-acre lots are assumed to remain meadow/pasture areas of native grasses. The sub-basin consists of overland sheet flow from the developed RR-5 lots toward existing natural topographic grasslined swales along the east property boundary that flow to **Design Point 2** which conveys stormwater runoff due east offsite toward East Cherry Creek.

Basin D5 (0.92 ac. ; Q_5 = 1.13 cfs, Q_{100} = 3.07 cfs) is a sub-basin that consists solely of the east side of the developed gravel roadway and roadside ditch. The sub-basin is delineated in order to model the capacity of the roadside ditch on the east side of the extended Mariah Trail roadway. The sub-basin consists of overland sheet flow from the developed gravel roadway into its east ditch where it is concentrated to a low point near the proposed 18" CMP culvert pipe outlet point where the ditch outfalls along the lot line between lots 4 and 5. The stormwater runoff continues east to **Design Point 2** which conveys stormwater runoff due east offsite toward East Cherry Creek.

Basin D6 (3.90 ac. ; Q_5 = 1.21 cfs, Q_{100} = 8.91 cfs) is the sub-basin that corresponds to Existing Conditions Hydrology Map's sub-basin E4. There are no changes to this sub-basin from existing undeveloped conditions because it is assumed that any Lot 6 development occurs within subbasin D4 to conservatively account for stormwater runoff toward **Design Point 2**. It is the subbasin within the northeast corner of the Site that consists of undeveloped area with native grasses, open meadow/pasture, and a dirt pathway within an existing access easement. The drainage pattern of the sub-basin consist of overland sheet flow due northeast directed offsite to **Design Point 4**. There are no significant natural features or storm infrastructure that capture or convey the runoff and the stormwater continues due east offsite toward East Cherry Creek.

Basin OS1 (0.64 ac. ; Q_5 = 0.20 cfs, Q_{100} = 1.46 cfs) is the sub-basin that corresponds to Existing Conditions Hydrology Map sub-basin OS1 and is unchanged from existing conditions. It is a relatively small sub-basin located off-site adjacent to the west property boundary of the Site. The stormwater runoff from this sub-basin contributes to sub-basin **D2** and **Design Point 5**. There is a high point west of the Site that flows in all directions and this sub-basins drainage pattern is directed west through the Site via overland sheet flow. The area consist of native grasses and open meadow/pasture.

Basin OS2 (0.29 ac. ; Q_5 = 0.09 cfs, Q_{100} = 0.66 cfs) is the sub-basin that corresponds to Existing Conditions Hydrology Map sub-basin OS1 and is unchanged from existing conditions. It is a relatively small sub-basin located off-site adjacent to the west property boundary of the Site. The stormwater runoff from this sub-basin contributes to sub-basin **D4** and **Design Point 2**. There is a high point west of the Site that flows in all directions and this sub-basins drainage pattern is directed west through the Site via overland sheet flow. The area consist of native grasses and open meadow/pasture.

proposed

The total stormwater runoff for the existing conditions of the Site is 18.77 cfs for the minor (5year) storm event and 91.03 cfs for the major (100-year) storm event which includes offsite contributions. This is an increase of 7.6 cfs for the minor storm event and 8.97 cfs for the major storm event compared to existing undeveloped conditions. This is considered a relatively major increase in stormwater runoff due to development for a 35 acre onsite area with 0.93 acre offsite area.

How is this major increase of 7.6 cfs and 8.97 cfs addressed?

The offsite stormwater runoff contribution to and through the Site remains 0.29 cfs for the minor (5-year) storm event and 2.12 cfs for the major (100-year) storm event.

The notable outfall point for the Site is **Design Point 2**, a grasslined swale that conveys stormwater runoff due east offsite toward East Cherry Creek. The developed conditions for the Site contribute 16.72 cfs for the minor (5-year) storm event and 76.00 cfs for the major (100year) storm event at this design point, including offsite contributions.

Another notable design point is **Design Point 5** which is the location of the proposed 18" CMP culvert pipe that conveys stormwater runoff from basins **D2 and OS1** east under the gravel roadway toward **Design Point 2**. The culvert pipe is to be sized for the major storm event which experiences 26.30 cfs. The emergency overflow condition of **Design Point 5** consists of pooling

The total site flows do increase.

within roadside ditch until overtopping the centerline of the roadway which is 2.64 feet above the culvert's inflow invert. There is no increase or decrease in flows from existing to proposed conditions located on the site. Overtopping of the roadway results in overland flow due east toward **Design Point 2**. The emergency overflow conditions does not result in any negative impacts to onsite development of the lots nor downstream developments.

Review 1 comment: See DCM 6-4 for overtopping requirements for rural roads. Update culvert analysis to include overtopping depth. Staff recommends HY-8 is used. Size culvert accordingly.
Review 2: Unresolved. Narrative indicates that the culvert is sized for the major storm. Provide analysis of the culvert for the major (100yr) storm. Please indicate in the text whether or not the over topping criteria in DCMV1 CH6 is met. Additionally, provide analysis of the protection required at the culvert outfall.

The analysis indicates that protection is required.
Please revise the narrative accordingly to reflect what is needed/proposed.

c) Downstream Storm Infrastructure Evaluation

There are no known drainage reports on file with El Paso County for this property or any nearby subdivisions that account for this property as an offsite basin. However, due to the developed conditions of the Site remaining within the typical residential land use it is anticipated that there will be no negative impacts to surrounding and downstream developments from this development. An assessment of the existing natural drainage way on the east side of the site is included in this report to demonstrate that the outfall of the major subdivision is stable and is an appropriate outfall that does not require detention or structural control measures to attenuate the stormwater runoff or provide additional energy dissipation.

Review 1 comment: Per ECM 3.2.4 a suitable outfall is required for developed flows. Flows at this outfall increase by over 10% with development. Discuss in a narrative whether detention will be required based on the increase of the flows since the are not negligible at this moment.
Provide an analysis of the outfall and determine whether any protection improvements are necessary.
Review 2: Unresolved. No additional discussion has been added to the narrative regarding how the increase of flows are mitigated. Please address the previous comment.

Step 1 – Reducing Runoff Volumes: Low impact development (LID) practices are utilized to reduce runoff at the source. In general, stormwater discharges are routed across pervious areas prior to capture in storm sewer. This practice promotes infiltration and reduces peak runoff rates. The Runoff Reduction Factor method was used and is presented in Appendix B.

Step 2 – Stabilize Drainageways: No onsite full-spectrum detention is proposed and therefore developers will employ runoff reduction measures to achieve water quality treatment.

Step 3 – Provide WQCV: Runoff from this development is treated through capture and slow release of the WQCV via detention ponds that are designed per current El Paso County DCM V2.

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

V. Summary

The hydrology calculations presented in Appendix E and F quantify stormwater runoff and the existing and developed hydrology maps presented in Appendix G visually present stormwater runoff drainage patterns for the Site and offsite areas. The developed conditions show the

Update this text to discuss the stabilization of the site.

Update Step 3 - In Step 2 and earlier in the text it is stated that WQCV treatment is achieved through runoff reduction not a pond. There is no detention pond proposed on-site.

Please revise report for consistency. Previous sections state there is no increase in runoff or there is a minor increase.

Additionally, page 7 indicates that there is a major increase.

subdivided lots and the hydrology calculations and map quantify the developed roadway and each lot's runoff contribution to their respective design points. There is no alteration to the general drainage pattern of the Site and the proposed construction to the Site yields a minor increase to the total stormwater runoff from the onsite 35 acres and offsite 0.93 acres. It is anticipated that there will be no negative impacts to surrounding and downstream developments and infrastructure.

A. COMPLIANCE WITH STANDARDS

The criteria used to design the storm water runoff volumes are formulas and figures within the El Paso County Engineering Criteria Manual, the El Paso County Drainage Criteria Manual, the City of Colorado Springs Drainage Manuals (DCM) Volumes 1 and 2. Tables 6-6 and Appendix L Table 3-1 of the EPC DCM was used for runoff coefficients for the Rational Method.

Appendix calculations show drainage way section calculations using Bentley's Flowmaster software. Water Quality Capture Volume is provided for the developed gravel roadway and developed lots via grass buffers of the naturally vegetated meadow/pasture areas of the Site, as shown in the Appendix with UD-BMP Runoff Reduction calculations. No onsite stormwater detention is required as the major subdivision consists of relatively major imperviousness resulting in a relatively small increase to the stormwater runoff from the Site which is shown to have a stable outfall with capacity for the developed condition.

B. DRAINAGE BASIN AND BRIDGE FEES

The Site is located within the East Cherry Creek drainage basin which does not have a drainage basin fee listed within the 2023 El Paso County Drainage, Bridge, and Pond Fee Schedule. All outstanding County fees are to be paid at the time of platting.

VI. REFERENCES

El Paso County Engineering Criteria Manual, latest revision October 14, 2020

El Paso County Drainage Criteria Manual, latest revision October 31, 2018

City of Colorado Springs Drainage Manual Volumes I & II (May 2014, Revised January 2021)

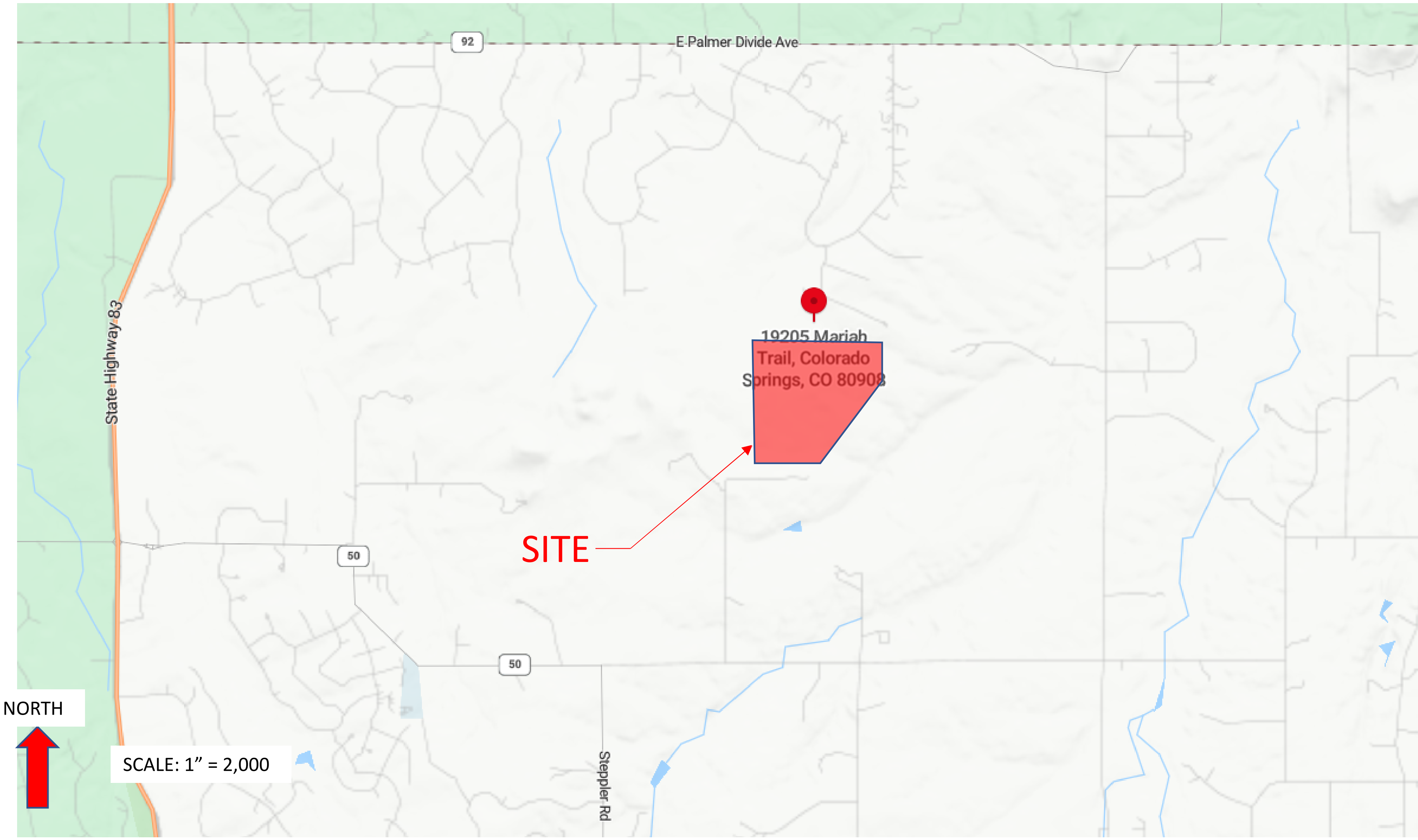
Mile High Flood District Drainage Criteria Manual, Volume I (January 2016)

FEMA Flood Map Service Center

United States Department of Agriculture National Resources Conservation Service

Appendix A: Vicinity Map

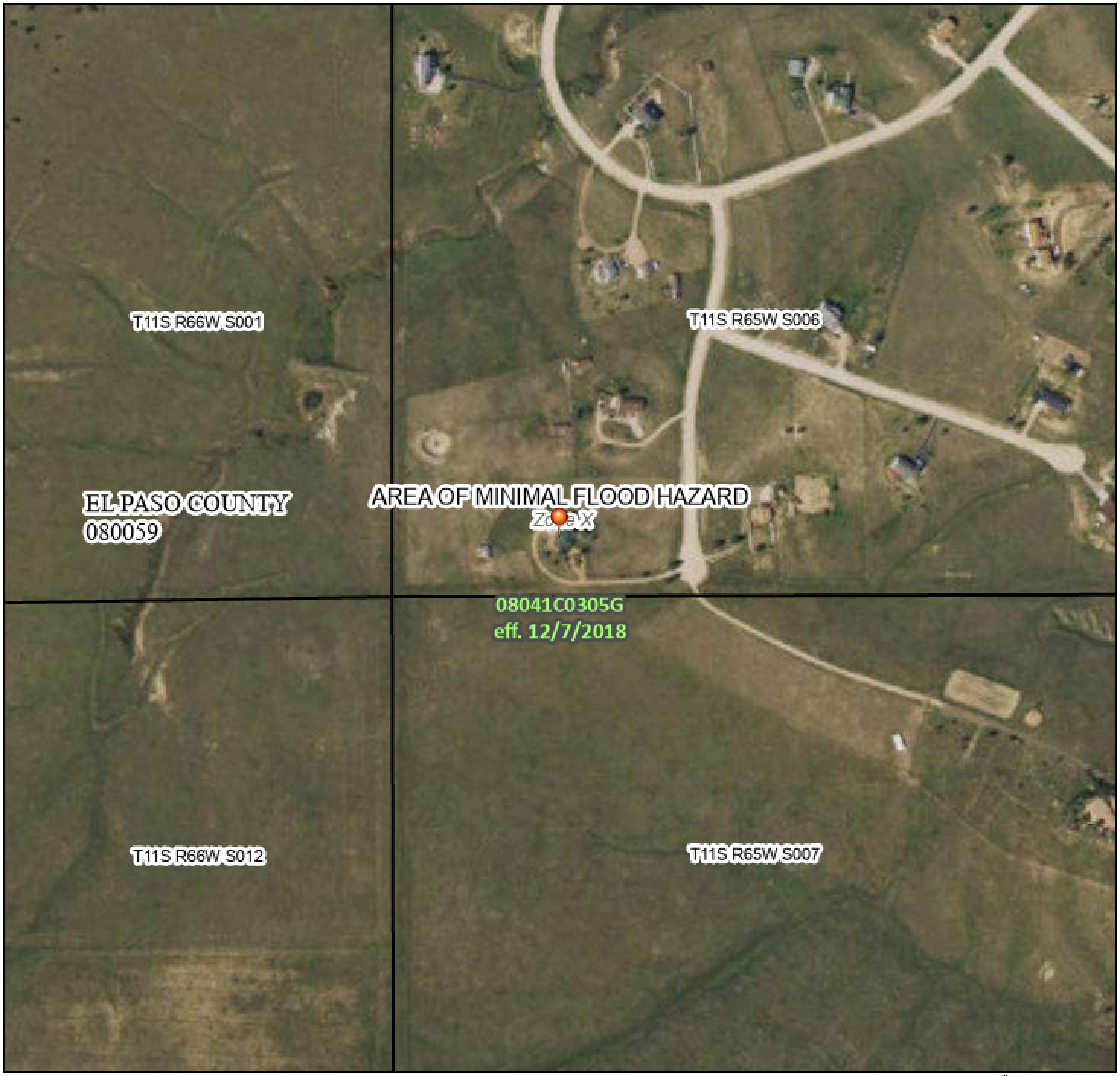
VICINITY MAP
MARIAH TRAIL FILING NO. 1
A PORTION OF THE NORTHWEST QUARTER OF
SECTION 7, TOWNSHIP 11 SOUTH, RANGE 65 WEST,
OF THE SIXTH PRINCIPAL MERIDIAN,
EL PASO COUNTY, COLORADO



Appendix B: FEMA Floodplain Map

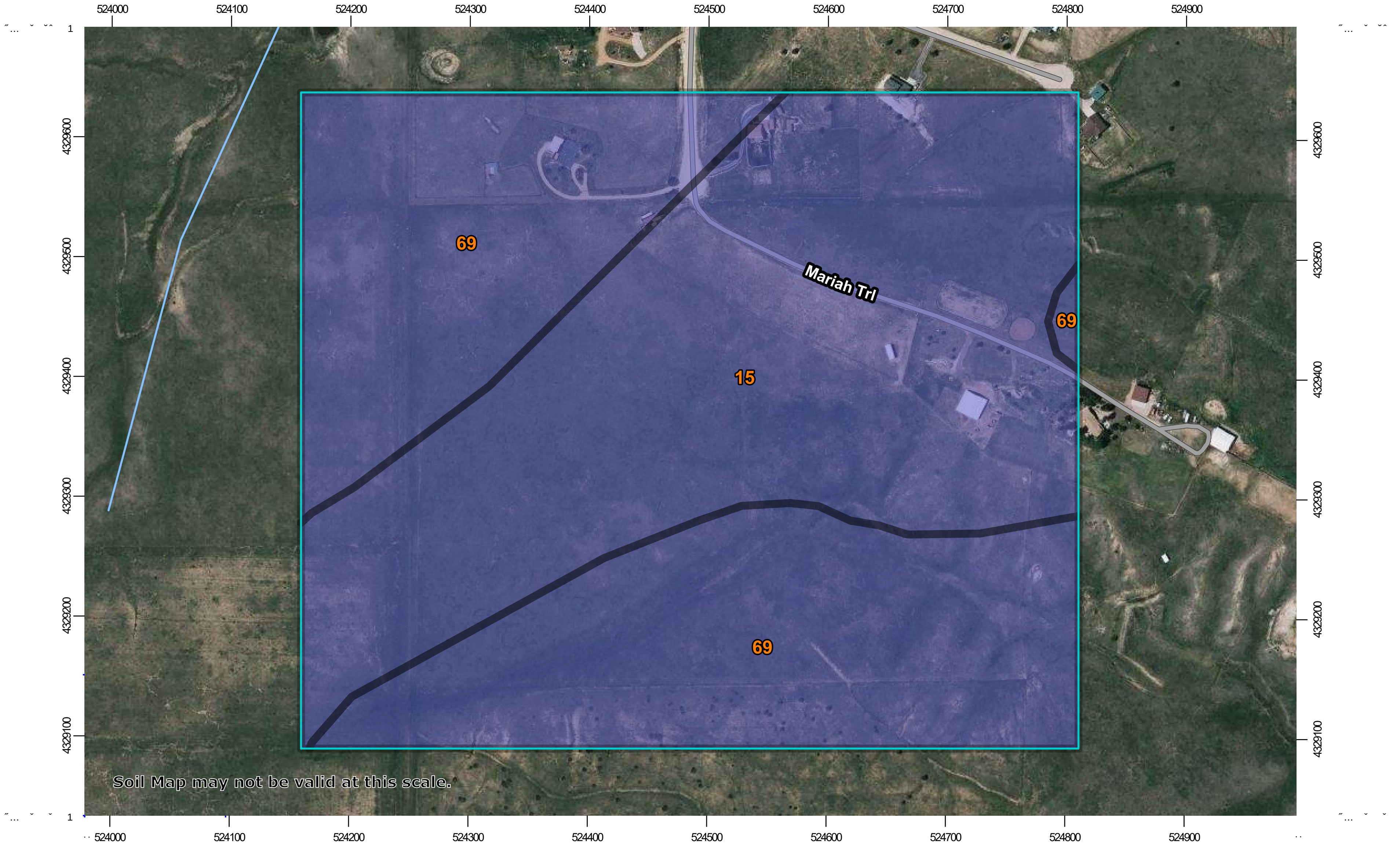
Fix heading and footer

FEMA



Appendix C: NRCS Soils Map

Hydrologic Soil Group—El Paso County Area, Colorado
(Mariah Trail Filing No. 1 - Hydrologic Soils Map)



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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
15	Brussett loam, 3 to 5 percent slopes	B	44.8	50.6%
69	Peyton-Pring complex, 8 to 15 percent slopes	B	43.7	49.4%
Totals for Area of Interest			**88.5**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix D: Hydrology Calculations

Project:	**Mariah Trail Filing No. 1**
Engineer:	**Carlos Serrano**
Date:	**3/16/2023**
Address:	**Mariah Trail El Paso County, Colorado**
CONDITION:	**EXISTING**

Lot 1 Imperviousness	2452	0.353926097	0.49890264
Lot 2 Imperviousness	3753.85	0.68115587	

Sub-Basin:	**E1**	**(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)**			
t_t Duration:	**11.75**				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
3.102718495	3.886846842	4.5348213	5.1827958	5.8307703	6.5254627

Hydrologic Soil Type:	**B**

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	-	0.000	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	**0.020**	**0.080**	**0.150**	**0.250**	**0.300**	**0.350**
Gravel Roadway	-	0.000	0.57	0.59	0.63	0.66	0.68	0.70	0.000	0.000	0.000	0.000	0.000	0.000						
Pasture/Meadow	80,586	1.850	0.02	0.08	0.15	0.25	0.30	0.35	0.037	0.148	0.278	0.463	0.555	0.648						
A_t :	80,586	1.850																		

Q Peak Flow (cfs)					
2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
0.11	**0.58**	**1.26**	**2.40**	**3.24**	**4.23**

Sub-Basin:	**E2**	**(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)**			
t_t Duration:	**17.57**				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
2.62407407	3.283513534	3.8309325	4.3783514	4.9257703	5.5118627

Hydrologic Soil Type:	**B**

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	-	0.000	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	**0.020**	**0.080**	**0.150**	**0.250**	**0.300**	**0.350**
Gravel Roadway	-	0.000	0.57	0.59	0.63	0.66	0.68	0.70	0.000	0.000	0.000	0.000	0.000	0.000						
Pasture/Meadow	1,237,975	28.420	0.02	0.08	0.15	0.25	0.30	0.35	0.568	2.274	4.263	7.105	8.526	9.947						
A_t :	1,237,975	28.420																		

Q Peak Flow (cfs)					
2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
1.76	**8.84**	**19.33**	**36.82**	**49.71**	**64.91**

Sub-Basin:	**E3**	**(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)**			
t_t Duration:	**9.31**				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
3.379920008	4.236260515	4.9424706	5.6486807	6.3548908	7.1124777

Hydrologic Soil Type:	**B**

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	-	0.000	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	**0.020**	**0.080**	**0.150**	**0.250**	**0.300**	**0.350**
Gravel Roadway	-	0.000	0.57	0.59	0.63	0.66	0.68	0.70	0.000	0.000	0.000	0.000	0.000	0.000						
Pasture/Meadow	36,155	0.830	0.02	0.08	0.15	0.25	0.30	0.35	0.017	0.066	0.125	0.208	0.249	0.291						
A_t :	36,155	0.830																		

Q Peak Flow (cfs)					
2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
0.05	**0.26**	**0.56**	**1.08**	**1.45**	**1.90**

Sub-Basin:	**E4**	**(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)**			
t_t Duration:	**10.97**				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
3.184258474	3.989628328	4.654733	5.3198378	5.9849425	6.6981356

Hydrologic Soil Type:	**B**

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	-	0.000	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	**0.020**	**0.080**	**0.150**	**0.250**	**0.300**	**0.350**
Gravel Roadway	-	0.000	0.57	0.59	0.63	0.66	0.68	0.70	0.000	0.000	0.000	0.000	0.000	0.000						
Pasture/Meadow	169,884	3.900	0.02	0.08	0.15	0.25	0.30	0.35	0.078	0.312	0.585	0.975	1.170	1.365						
A_t :	169,884	3.900																		

Q Peak Flow (cfs)					
2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
0.24	**1.21**	**2.65**	**5.05**	**6.82**	**8.91**

Sub-Basin:	**OS1**	**(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)**			
t_t Duration:	**13.19**				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
2.965055019	3.713321453	4.332375	4.9514286	5.5704822	6.23394

Hydrologic Soil Type:	**B**

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	-	0.000	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	**0.020**	**0.080**	**0.150**	**0.250**	**0.300**	**0.350**
Gravel Roadway	-	0.000	0.57	0.59	0.63	0.66	0.68	0.70	0.000	0.000	0.000	0.000	0.000	0.000						
Pasture/Meadow	27,878	0.640	0.02	0.08	0.15	0.25	0.30	0.35	0.013	0.051	0.096	0.160	0.192	0.224						
A_t :	27,878	0.640																		

Q Peak Flow (cfs)					
2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
0.04	**0.20**	**0.44**	**0.83**	**1.12**	**1.46**

Sub-Basin:	**OS2**	**(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)**			
t_t Duration:	**12.06**				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
3.071843389	3.847928642	4.4894167	5.1309049	5.772393	6.4600801

Hydrologic Soil Type:	**B**

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	-	0.000	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	**0.020**	**0.080**	**0.150**	**0.250**	**0.300**	**0.350**
Gravel Roadway	-	0.000	0.57	0.59	0.63	0.66	0.68	0.70	0.000	0.000	0.000	0.000	0.000	0.000						
Pasture/Meadow	12,632	0.290	0.02	0.08	0.15	0.25	0.30	0.35	0.006	0.023	0.044	0.073	0.087	0.102						
A_t :	12,632	0.290																		

Q Peak Flow (cfs)

2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
0.02	**0.09**	**0.20**	**0.38**	**0.51**	**0.66**

Basin Summary

Basin Summary	Design Point	Area (ac.)	Q_5	Q_{100}
E1	1	1.85	0.58	4.23
E2	2	28.42	8.84	64.91
E3	3	0.83	0.26	1.90
E4	4	3.90	1.21	8.91
OS1	2	0.64	0.20	1.46
OS2	2	0.29	0.09	0.66
TOTAL ONSITE		35.00	10.88	79.94
TOTAL OFFSITE		0.93	0.29	2.12
TOTALS		35.93	11.17	82.06

Cumulative Design Point Summary

Design Point	Basins	Area (ac.)	Q_5	Q_{100}
1	E1	1.85	9.50	69.80
2	E2, OS1, OS2	29.35	9.13	67.03
3	E3	0.83	0.26	1.90
4	E4	3.90	1.21	8.91
TOTAL ONSITE	E1-E4	35.00	10.88	79.94
TOTAL OFFSITE	OS1, OS2	0.93	0.29	2.12

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	E1	
C_5:	**0.08**	[Table 6-6. Runoff Coefficients for Rational Method]
L:	**100**	ft
S:	**0.039**	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1A_1 + C_2A_2 + C_3A_3 + ...C_iA_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	-	0.00	0.73
Gravel Roadway	-	0.00	0.59
Pasture/Meadow	80,586	1.85	0.08
At :	80,586	1.85	

$C_c = (0.08*1.85) / 1.85 =$ **0.08**

$t_i = (0.395*(1.1-C_5)*sqrt(L))/(S^0.33)$
$t_i = (0.395*(1.1-0.08)*sqrt(100))/(0.039^0.33) =$ **11.75** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)
C_v = conveyance coefficient (from Table 6-7)
S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$
$V = (20)(0.039)^{0.5} =$ **0.03** ft/s

Flow Distance: **0.00** ft

$t_t = L/V =$ 0.00 sec.
0.00 min.

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.

$t_c = t_i + t_t$ = **11.75** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **11.75** min.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	E2	
C_5:	0.08	[Table 6-6. Runoff Coefficients for Rational Method]
L:	300	ft
S:	0.07	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1 A_1 + C_2 A_2 + C_3 A_3 + ...C_i A_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	-	0.00	0.73
Gravel Roadway	-	0.00	0.59
Pasture/Meadow	1,237,975	28.42	0.08
At :	1,237,975	28.42	

C_c = (0.08*28.42) / 28.42 = **0.08**

t_i = (0.395*(1.1-C_5)*sqrt(L))/(S^0.33)
t_i = (0.395*(1.1-0.08)*sqrt(300))/(0.07^0.33) = **16.78** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)
C_v = conveyance coefficient (from Table 6-7)
S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$
$V = (20)(0.059)^{0.5}$ = **4.86** ft/s

Flow Distance: **230.00** ft

t_t = L/V = 47.34 sec.
0.79 min.

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.

$t_c = t_i + t_t$ = **17.57** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **17.57** min.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	E3	
C_5:	**0.08**	[Table 6-6. Runoff Coefficients for Rational Method]
L:	**100**	ft
S:	**0.079**	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1 A_1 + C_2 A_2 + C_3 A_3 + ...C_i A_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	-	0.00	0.73
Gravel Roadway	-	0.00	0.59
Pasture/Meadow	36,155	0.83	0.08
At :	36,155	0.83	

$C_c = (0.08*0.83) / 0.83 =$ **0.08**

$t_i = (0.395*(1.1-C_5)*sqrt(L))/(S\text{^}0.33)$

$t_i = (0.395*(1.1-0.08)*sqrt(100))/(0.079\text{^}0.33) =$ **9.31** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)
C_v = conveyance coefficient (from Table 6-7)
S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$

$V = (20)(0.079)^{0.5} =$ **5.62** ft/s

Flow Distance: **0.00** ft

$t_t = L/V =$ 0.00 sec.

0.00 min.

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.

$t_c = t_i + t_t =$ **9.31** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **9.31** min.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	E4	
C_5:	0.08	[Table 6-6. Runoff Coefficients for Rational Method]
L:	100	ft
S:	0.048	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1A_1 + C_2A_2 + C_3A_3 + ...C_iA_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	-	0.00	0.73
Gravel Roadway	-	0.00	0.59
Pasture/Meadow	169,884	3.90	0.08
At :	169,884	3.90	

$C_c = (0.08 * 3.90) / 3.90 =$ **0.08**

$t_i = (0.395*(1.1-C_5)*sqrt(L))/(S\text{^}0.33)$

$t_i = (0.395*(1.1-0.08)*sqrt(100))/(0.048\text{^}0.33) =$ **10.97** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)
C_v = conveyance coefficient (from Table 6-7)
S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$

$V = (20)(0.048)^{0.5} =$ **4.38** ft/s

Flow Distance: **0.00** ft

$t_t = L/V =$ 0.00 sec.
0.00 min.

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.

$t_c = t_i + t_t$ = **10.97** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **10.97** min.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	OS1	
C_5:	**0.08**	[Table 6-6. Runoff Coefficients for Rational Method]
L:	**70**	ft
S:	**0.016**	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1 A_1 + C_2 A_2 + C_3 A_3 + \ldots C_i A_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	-	0.00	0.73
Gravel Roadway	-	0.00	0.59
Pasture/Meadow	27,878	0.64	0.08
At :	27,878	0.64	

$C_c = (0.08 * 0.64) / 0.64 =$ **0.08**

$t_i = (0.395*(1.1-C_5)*sqrt(L))/(S\hat{}0.33)$

$t_i = (0.395*(1.1-0.08)*sqrt(70))/(0.016\hat{}0.33) =$ **13.19** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)
C_v = conveyance coefficient (from Table 6-7)
S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$

$V = (20)(0.016)^{0.5} =$ **2.53** ft/s

Flow Distance: **0.00** ft

$t_t = L/V =$ 0.00 sec.
0.00 min.

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.

$t_c = t_i + t_t$ = **13.19** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **13.19** min.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	OS2	
C_5:	**0.08**	[Table 6-6. Runoff Coefficients for Rational Method]
L:	**70**	ft
S:	**0.021**	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1 A_1 + C_2 A_2 + C_3 A_3 + ...C_i A_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	-	0.00	0.73
Gravel Roadway	-	0.00	0.59
Pasture/Meadow	12,632	0.29	0.08
At :	12,632	0.29	

*C_c = (0.08 * 0.29) / 0.29 =* **0.08**

t_i = (0.395(1.1-C_5)*sqrt(L))/(S^0.33)*
t_i = (0.395(1.1-0.08)*sqrt(70))/(0.021^0.33) =* **12.06** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)
C_v = conveyance coefficient (from Table 6-7)
S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$
$V = (20)(0.021)^{0.5}$ = **2.90** ft/s

Flow Distance: **0.00** ft

t_t = L/V = 0.00 sec.
0.00 min.

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.

$t_c = t_i + t_t$ = **12.06** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **12.06** min.

Project:	**Mariah Trail Filing No. 1**
Engineer:	**Carlos Serrano**
Date:	**3/16/2023**
Address:	**Mariah Trail El Paso County, Colorado**

Lot 1 Imperviousness	2452	0.353926097	0.49890264
Lot 2 Imperviousness	3753.85	0.68115587	

CONDITION: **DEVELOPED**

Sub-Basin:	**D1**	(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)			
t_t Duration:	**11.75**				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
3.102718495	3.886846842	4.5348213	5.1827958	5.8307703	6.5254627

Hydrologic Soil Type:	B

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	-	0.000	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	**0.020**	**0.080**	**0.150**	**0.250**	**0.300**	**0.350**
Gravel Roadway	-	0.000	0.57	0.59	0.63	0.66	0.68	0.70	0.000	0.000	0.000	0.000	0.000	0.000						
Pasture/Meadow	80,586	1.850	0.02	0.08	0.15	0.25	0.30	0.35	0.037	0.148	0.278	0.463	0.555	0.648						
A_t :	80,586	1.850																		

Q Peak Flow (cfs)

2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
0.11	**0.58**	**1.26**	**2.40**	**3.24**	**4.23**

Sub-Basin:	**D2**	(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)			
t_t Duration:	**14.07**				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
2.888222844	3.616474173	4.2193865	4.8222989	5.4252113	6.0712366

Hydrologic Soil Type:	B

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	32,139	0.738	0.71	0.73	0.75	0.78	0.80	0.81	0.524	0.539	0.553	0.575	0.590	0.598	**0.098**	**0.153**	**0.218**	**0.310**	**0.356**	**0.401**
Gravel Roadway	18,448	0.424	0.57	0.59	0.63	0.66	0.68	0.70	0.241	0.250	0.267	0.280	0.288	0.296						
Pasture/Meadow	362,363	8.319	0.02	0.08	0.15	0.25	0.30	0.35	0.166	0.665	1.248	2.080	2.496	2.912						
A_t :	412,949	9.480																		

Q Peak Flow (cfs)

2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
2.89	**5.65**	**9.38**	**15.21**	**19.67**	**24.83**

Sub-Basin:	**D3**	(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)			
t_t Duration:	**9.31**				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
3.379920008	4.236260515	4.9424706	5.6486807	6.3548908	7.1124777

Hydrologic Soil Type:	B

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	-	0.000	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	**0.020**	**0.080**	**0.150**	**0.250**	**0.300**	**0.350**
Gravel Roadway	-	0.000	0.57	0.59	0.63	0.66	0.68	0.70	0.000	0.000	0.000	0.000	0.000	0.000						
Pasture/Meadow	36,155	0.830	0.02	0.08	0.15	0.25	0.30	0.35	0.017	0.066	0.125	0.208	0.249	0.291						
A_t :	36,155	0.830																		

Q Peak Flow (cfs)

2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
0.05	**0.26**	**0.56**	**1.08**	**1.45**	**1.90**

Sub-Basin:	**D4**	(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)			
t_t Duration:	**12.23**				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
3.055134833	3.826867436	4.4648453	5.1028232	5.7408012	6.4246973

Hydrologic Soil Type:	B

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	69,888	1.604	0.71	0.73	0.75	0.78	0.80	0.81	1.139	1.171	1.203	1.251	1.284	1.300	**0.081**	**0.138**	**0.203**	**0.297**	**0.345**	**0.391**
Gravel Roadway	-	0.000	0.57	0.59	0.63	0.66	0.68	0.70	0.000	0.000	0.000	0.000	0.000	0.000						
Pasture/Meadow	715,064	16.416	0.02	0.08	0.15	0.25	0.30	0.35	0.328	1.313	2.462	4.104	4.925	5.745						
A_t :	784,951	18.020																		

Q Peak Flow (cfs)

2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
4.55	**9.66**	**16.62**	**27.76**	**36.20**	**45.97**

Sub-Basin:	**D5**	(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)			
t_t Duration:	**9.70**				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
3.331467321	4.175185699	4.8712166	5.5672476	6.2632785	7.009872

Hydrologic Soil Type:	B

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	-	0.000	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	**0.273**	**0.315**	**0.371**	**0.439**	**0.475**	**0.511**
Gravel Roadway	18,448	0.424	0.57	0.59	0.63	0.66	0.68	0.70	0.241	0.250	0.267	0.280	0.288	0.296						
Pasture/Meadow	21,628	0.497	0.02	0.08	0.15	0.25	0.30	0.35	0.010	0.040	0.074	0.124	0.149	0.174						
A_t :	40,075	0.920																		

Q Peak Flow (cfs)

2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
0.78	**1.13**	**1.55**	**2.09**	**2.55**	**3.07**

Sub-Basin:	D6	(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)			
t_t Duration:	10.97				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
3.184258474	3.989628328	4.654733	5.3198378	5.9849425	6.6981356

Hydrologic Soil Type:	B

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	-	0.000	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	**0.020**	**0.080**	**0.150**	**0.250**	**0.300**	**0.350**
Gravel Roadway	-	0.000	0.57	0.59	0.63	0.66	0.68	0.70	0.000	0.000	0.000	0.000	0.000	0.000						
Pasture/Meadow	169,884	3.900	0.02	0.08	0.15	0.25	0.30	0.35	0.078	0.312	0.585	0.975	1.170	1.365						
A_t:	169,884	3.900																		

Q Peak Flow (cfs)

2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
0.24	**1.21**	**2.65**	**5.05**	**6.82**	**8.91**

Sub-Basin:	OS1	(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)			
t_t Duration:	13.19				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
2.965055019	3.713321453	4.332375	4.9514286	5.5704822	6.23394

Hydrologic Soil Type:	B

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	-	0.000	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	**0.020**	**0.080**	**0.150**	**0.250**	**0.300**	**0.350**
Gravel Roadway	-	0.000	0.57	0.59	0.63	0.66	0.68	0.70	0.000	0.000	0.000	0.000	0.000	0.000						
Pasture/Meadow	27,878	0.640	0.02	0.08	0.15	0.25	0.30	0.35	0.013	0.051	0.096	0.160	0.192	0.224						
A_t:	27,878	0.640																		

Q Peak Flow (cfs)

2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
0.04	**0.20**	**0.44**	**0.83**	**1.12**	**1.46**

Sub-Basin:	OS2	(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)			
t_t Duration:	12.06				
I_2	I_5	I_{10}	I_{25}	I_{50}	I_{100}
3.071843389	3.847928642	4.4894167	5.1309049	5.772393	6.4600801

Hydrologic Soil Type:	B

Coefficient (Table 6-6)

Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient $_2$	Coefficient $_5$	Coefficient $_{10}$	Coefficient $_{25}$	Coefficient $_{50}$	Coefficient $_{100}$	2 Yr: $C_i * A_i$	5 Yr: $C_i * A_i$	10 Yr: $C_i * A_i$	25 Yr: $C_i * A_i$	50 Yr: $C_i * A_i$	100 Yr: $C_i * A_i$	2 Yr C_c	5 Yr C_c	10 Yr C_c	25 Yr C_c	50 Yr C_c	100 Yr C_c
Roof + Hardscape	-	0.000	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	**0.020**	**0.080**	**0.150**	**0.250**	**0.300**	**0.350**
Gravel Roadway	-	0.000	0.57	0.59	0.63	0.66	0.68	0.70	0.000	0.000	0.000	0.000	0.000	0.000						
Pasture/Meadow	12,632	0.290	0.02	0.08	0.15	0.25	0.30	0.35	0.006	0.023	0.044	0.073	0.087	0.102						
A_t:	12,632	0.290																		

Q Peak Flow (cfs)

2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
0.02	**0.09**	**0.20**	**0.38**	**0.51**	**0.66**

Basin Summary

Basin Summary	Design Point	Area (ac.)	Q_5	Q_{100}
D1	1	1.85	0.58	4.23
D2	5	9.48	5.65	24.83
D3	3	0.83	0.26	1.90
D4	2	18.02	9.66	45.97
D5	2	0.92	1.13	3.07
D6	4	3.90	1.21	8.91
OS1	5	0.64	0.20	1.46
OS2	2	0.29	0.09	0.66
TOTAL ONSITE		35.00	18.48	88.90
TOTAL OFFSITE		0.93	0.29	2.12
TOTALS		35.93	18.77	91.03

Cumulative Design Point Summary

Design Point	Basins	Area (ac.)	Q_5	Q_{100}
1	D1	1.85	6.32	29.72
2	DP5 + D4, D5, OS2	29.35	16.72	76.00
3	D3	0.83	0.26	1.90
4	D6	3.90	1.21	8.91
5	D2, OS1	10.12	5.85	26.30
TOTAL ONSITE	D1-D6	35.00	18.48	88.90
TOTAL OFFSITE	OS1, OS2	0.93	0.29	2.12

Unresolved from Submittal 1: Q5 = 10.88 and Q100 = 79.94cfs in the existing condition (per PDF pg 27 above). Per my comment on PDF pg 6 above, discuss this difference in the report text.

On page 6 it is stated that the flows do not increase nor decrease, but the proposed condition shows an increase in flows of about 10 cfs in the 100-year condition.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	D1	
C_5:	**0.08**	[Table 6-6. Runoff Coefficients for Rational Method]
L:	**100**	ft
S:	**0.039**	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1A_1 + C_2A_2 + C_3A_3 + \ldots C_iA_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	-	0.00	0.73
Gravel Roadway	-	0.00	0.59
Pasture/Meadow	80,586	1.85	0.08
At :	80,586	1.85	

C_c = (0.08*1.85) / 1.85 = **0.08**

t_i = (0.395*(1.1-C_5)*sqrt(L))/(S^0.33)

t_i = (0.395*(1.1-0.08)*sqrt(100))/(0.039^0.33) = **11.75** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$

$V = (20)(0.039)^{0.5}$ = **0.03** ft/s

Flow Distance: **0.00** ft

t_t = L/V = 0.00 sec.
0.00 min.

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.

$t_c = t_i + t_t$ = **11.75** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **11.75** min.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	D2	
C_5:	**0.15**	[Table 6-6. Runoff Coefficients for Rational Method]
L:	**100**	ft
S:	**0.062**	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1A_1 + C_2A_2 + C_3A_3 + ...C_iA_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	32,139	0.74	0.73
Gravel Roadway	18,448	0.42	0.59
Pasture/Meadow	362,363	8.32	0.08
At :	412,949	9.48	

C_c = (0.73*0.74 + 0.59*0.42 + 0.08*8.32) / 9.48 = **0.15**

t_i = (0.395*(1.1-C_5)*sqrt(L))/(S^0.33)

t_i = (0.395*(1.1-0.17)*sqrt(100))/(0.062^0.33) = **9.36** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{\ 0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

$V = C_v S_w^{\ 0.5}$

$V = (20)(0.02)^{0.5}$ = **2.83** ft/s

Flow Distance: **800.00** ft

t_t = L/V = 282.84 sec.
4.71 min.

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.

$t_c = t_i + t_t$ = **14.07** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **14.07** min.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	D3	
C_5:	**0.08**	[Table 6-6. Runoff Coefficients for Rational Method]
L:	**100**	ft
S:	**0.079**	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1A_1 + C_2A_2 + C_3A_3 + ...C_iA_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	-	0.00	0.73
Gravel Roadway	-	0.00	0.59
Pasture/Meadow	36,155	0.83	0.08
At :	36,155	0.83	

$C_c = (0.08*0.83) / 0.83 =$ **0.08**

$t_i = (0.395*(1.1-C_5)*sqrt(L))/(S\text{^}0.33)$

$t_i = (0.395*(1.1-0.08)*sqrt(100))/(0.079\text{^}0.33) =$ **9.31** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$

$V = (20)(0.079)^{0.5} =$ **5.62** ft/s

Flow Distance: **0.00** ft

$t_t = L/V =$ 0.00 sec.

0.00 min.

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.

$t_c = t_i + t_t =$ **9.31** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **9.31** min.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	D4	
C_5:	**0.14**	[Table 6-6. Runoff Coefficients for Rational Method]
L:	**100**	ft
S:	**0.085**	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1A_1 + C_2A_2 + C_3A_3 + ...C_iA_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	69,888	1.60	0.73
Gravel Roadway	-	0.00	0.59
Pasture/Meadow	715,064	16.42	0.08
At :	784,951	18.02	

C_c = (0.73*1.60 + 0.08*16.42) / 18.02 = **0.14**

t_i = (0.395*(1.1-C_5)*sqrt(L))/(S^0.33)

t_i = (0.395*(1.1-0.14)*sqrt(100))/(0.085^0.33) = **8.57** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$

$V = (20)(0.042)^{0.5}$ = **4.10** ft/s

Flow Distance: **900.00** ft

t_t = L/V = 219.58 sec.

3.66 min.

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.

$t_c = t_i + t_t$ = **12.23** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **12.23** min.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	D5	
C_5:	**0.31**	[Table 6-6. Runoff Coefficients for Rational Method]
L:	**28**	ft
S:	**0.04**	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1 A_1 + C_2 A_2 + C_3 A_3 + ...C_i A_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	-	0.00	0.73
Gravel Roadway	18,448	0.42	0.59
Pasture/Meadow	21,628	0.50	0.08
At :	40,075	0.92	

$C_c = (0.59*0.42 + 0.08*0.50) / 0.92 =$ **0.31**

$t_i = (0.395*(1.1-C_5)*sqrt(L))/(S^0.33)$

$t_i = (0.395*(1.1-0.31)*sqrt(28))/(0.04^0.33) =$ **4.75** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$

$V = (20)(0.02)^{0.5} =$ **2.83** ft/s

Flow Distance: **840.00** ft

$t_t = L/V =$ 296.98 sec.
4.95 min.

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.

$t_c = t_i + t_t =$ **9.70** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **9.70** min.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	D6	
C_5:	**0.08**	[Table 6-6. Runoff Coefficients for Rational Method]
L:	**100**	ft
S:	**0.048**	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1 A_1 + C_2 A_2 + C_3 A_3 + ...C_i A_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	-	0.00	0.73
Gravel Roadway	-	0.00	0.59
Pasture/Meadow	169,884	3.90	0.08
At :	169,884	3.90	

C_c = (0.08 * 3.90) / 3.90 = **0.08**

t_i = (0.395*(1.1-C_5)*sqrt(L))/(S^0.33)

t_i = (0.395*(1.1-0.08)*sqrt(100))/(0.048^0.33) = **10.97** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$

$V = (20)(0.048)^{0.5}$ = **4.38** ft/s

Flow Distance: **0.00** ft

t_t = L/V = 0.00 sec.

0.00 min.

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.

$t_c = t_i + t_t$ = **10.97** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **10.97** min.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	OS1	
C_5:	**0.08**	[Table 6-6. Runoff Coefficients for Rational Method]
L:	**70**	ft
S:	**0.016**	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1 A_1 + C_2 A_2 + C_3 A_3 + ...C_i A_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	-	0.00	0.73
Gravel Roadway	-	0.00	0.59
Pasture/Meadow	27,878	0.64	0.08
At :	27,878	0.64	

C_c = (0.08 * 0.64) / 0.64 = **0.08**

t_i = (0.395*(1.1-C_5)*sqrt(L))/(S^0.33)
t_i = (0.395*(1.1-0.08)*sqrt(70))/(0.016^0.33) = **13.19** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)
C_v = conveyance coefficient (from Table 6-7)
S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$
$V = (20)(0.016)^{0.5}$ = **2.53** ft/s

Flow Distance: **0.00** ft

t_t = L/V = 0.00 sec.
0.00 min.

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.

$t_c = t_i + t_t$ = **13.19** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **13.19** min.

Time of Concentration $t_c = t_i + t_t$

3.2.1 - Overland (Initial) Flow Time

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin or DP:	OS2	
C_5:	**0.08**	[Table 6-6. Runoff Coefficients for Rational Method]
L:	**70**	ft
S:	**0.021**	ft/ft

Composite Runoff Coefficient Calculation:

$C_c = (C_1 A_1 + C_2 A_2 + C_3 A_3 + ...C_i A_i) / A_t$

Land Use or Surface Characteristic	Square Feet	Acreage	C_5
Roof + Hardscape	-	0.00	0.73
Gravel Roadway	-	0.00	0.59
Pasture/Meadow	12,632	0.29	0.08
At :	12,632	0.29	

C_c = (0.08 * 0.29) / 0.29 = **0.08**

t_i = (0.395*(1.1-C_5)*sqrt(L))/(S^0.33)

t_i = (0.395*(1.1-0.08)*sqrt(70))/(0.021^0.33) = **12.06** mins

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \qquad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

$V = C_v S_w^{0.5}$

$V = (20)(0.021)^{0.5}$ = **2.90** ft/s

Flow Distance: **0.00** ft

t_t = L/V = 0.00 sec.

0.00 min.

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.

$t_c = t_i + t_t$ = **12.06** min.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

Final t_c: **12.06** min.

Appendix E: Hydraulic Calculations

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 1

Designer:	CARLOS SERRANO, PE
Company:	ENGINEERING LOCAL XPERTS
Date:	July 31, 2023
Project:	MARIAH TRAIL FILING NO. 1
Location:	EL PASO COUNTY, COLORADO

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth	0.60	inches
Depth of Average Runoff Producing Storm, d_6 =	0.43	inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	UIA:RPA	SPA				
Area ID	LOT 1	LOT 2	LOT 3	LOT 4	LOT 5	LOT 6	R.O.W.	UNDEVELOPED				
Downstream Design Point ID	POND	POND	POND	POND	POND	POND	POND	POND				
Downstream BMP Type	EDB	EDB	EDB	EDB	EDB	EDB	EDB	EDB				
DCIA (ft^2)	--	--	--	--	--	--	--	--				
UIA (ft^2)	44,518	47,306	45,564	43,734	50,878	5,950	30,527	--				
RPA (ft^2)	30,000	32,500	30,000	15,000	20,000	55,000	40,000	--				
SPA (ft^2)	--	--	--	--	--	--	--	1,033,622				
HSG A (%)	0%	0%	0%	0%	0%	0%	0%	0%				
HSG B (%)	100%	100%	100%	100%	100%	100%	100%	100%				
HSG C/D (%)	0%	0%	0%	0%	0%	0%	0%	0%				
Average Slope of RPA (ft/ft)	0.100	0.100	0.100	0.100	0.100	0.100	0.100	--				
UIA:RPA Interface Width (ft)	200.00	200.00	200.00	100.00	400.00	600.00	800.00	--				

CALCULATED RUNOFF RESULTS

Area ID	LOT 1	LOT 2	LOT 3	LOT 4	LOT 5	LOT 6	R.O.W.	UNDEVELOPED				
UIA:RPA Area (ft^2)	74,518	79,806	75,564	58,734	70,878	60,950	70,527	--				
L / W Ratio	1.86	2.00	1.89	5.87	0.44	0.17	0.11	--				
UIA / Area	0.5974	0.5928	0.6030	0.7446	0.7178	0.0976	0.4328	--				
Runoff (in)	0.00	0.00	0.00	0.08	0.05	0.00	0.00	0.00				
Runoff (ft^3)	0	0	0	406	307	0	0	0				
Runoff Reduction (ft^3)	1855	1971	1898	1417	1813	248	1272	51681				

CALCULATED WQCV RESULTS

Area ID	LOT 1	LOT 2	LOT 3	LOT 4	LOT 5	LOT 6	R.O.W.	UNDEVELOPED				
WQCV (ft^3)	1855	1971	1898	1822	2120	248	1272	0				
WQCV Reduction (ft^3)	1855	1971	1898	1417	1813	248	1272	0				
WQCV Reduction (%)	100%	100%	100%	78%	86%	100%	100%	0%				
Untreated WQCV (ft^3)	0	0	0	406	307	0	0	0				

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	POND											
DCIA (ft^2)	0											
UIA (ft^2)	268,478											
RPA (ft^2)	222,500											
SPA (ft^2)	1,033,622											
Total Area (ft^2)	1,524,600											
Total Impervious Area (ft^2)	268,478											
WQCV (ft^3)	11,187											
WQCV Reduction (ft^3)	10,474											
WQCV Reduction (%)	94%											
Untreated WQCV (ft^3)	712											

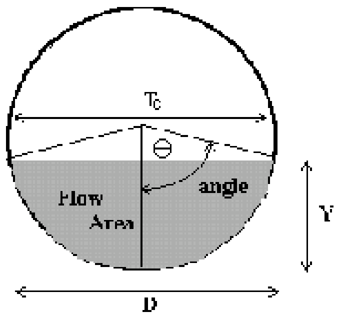
CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	1,524,600
Total Impervious Area (ft^2)	268,478
WQCV (ft^3)	11,187
WQCV Reduction (ft^3)	10,474
WQCV Reduction (%)	94%
Untreated WQCV (ft^3)	712

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: MARIAH TRAIL FILING NO. 1
Pipe ID: PIPE 1 - 18" CULVERT PIPE UNDER ROADWAY



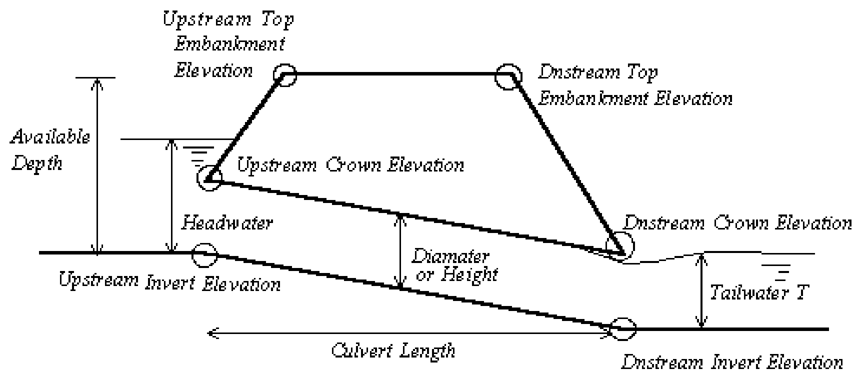
Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0200	
Pipe Diameter	D =	18.00	inches
Design discharge	Q =	5.85	cfs ← MINOR (5-YEAR STORM)
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	9.68	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.69	radians
Flow area	An =	1.02	sq ft
Top width	Tn =	1.49	ft
Wetted perimeter	Pn =	2.54	ft
Flow depth	Yn =	0.84	ft
Flow velocity	Vn =	5.74	fps
Discharge	Qn =	5.85	cfs
Percent of Full Flow	Flow =	60.4%	of full flow
Normal Depth Froude Number	Fr_n =	1.22	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.82	radians
Critical flow area	Ac =	1.16	sq ft
Critical top width	Tc =	1.45	ft
Critical flow depth	Yc =	0.93	ft
Critical flow velocity	Vc =	5.06	fps
Critical Depth Froude Number	Fr_c =	1.00	

VERTICAL PROFILE FOR THE CULVERT

MHFD-Culvert, Version 4.00 (May 2020)

Project = MARIAH TRAIL FILING NO.1

ID = PIPE 1 - 18" CULVERT PIPE UNDER ROADWAY



Culvert Information (Input)

Barrel Diameter or Height	D or H =	18.00	inches
Barrel Length	L =	100.00	ft
Barrel Invert Slope	So =	0.02	ft/ft
Downstream Invert Elevation	EDI =	7450.92	ft
Downstream Top Embankment Elevation	EDT =	7455.01	ft
Upstream Top Embankment Elevation	EUT =	7455.05	ft
Design Headwater Depth (not elev.)	Hw =	1.50	ft
Tailwater Depth (not elev.)	Yt =	1.50	ft

Culvert Hydraulics (Calculated)

Available Headwater Depth	HW-a =	1.71	ft
Design Hw/D ratio	Hw/D =	1.00	

Culvert Vertical Profile

Upstream Invert Elevation	EUI =	7453.34	ft
Upstream Crown Elevation	EUC =	7454.84	ft
Upstream Soil Cover Depth	Upsoil =	0.21	ft
Downstream Crown Elevation	EDC =	7452.42	ft
Downstream Soil Cover Depth	Dnsoil =	2.59	ft

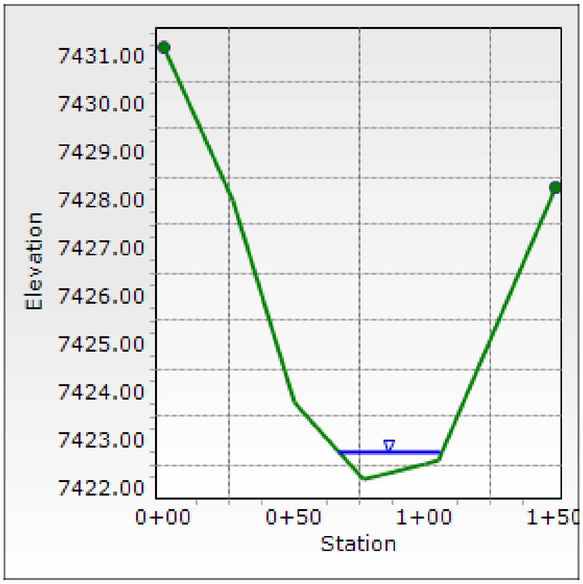
Section A-A

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.047 ft/ft
Normal Depth	7.3 in
Discharge	50.00 cfs



Please input data of the channel sections such as bottom width, side slopes, n value used etc.

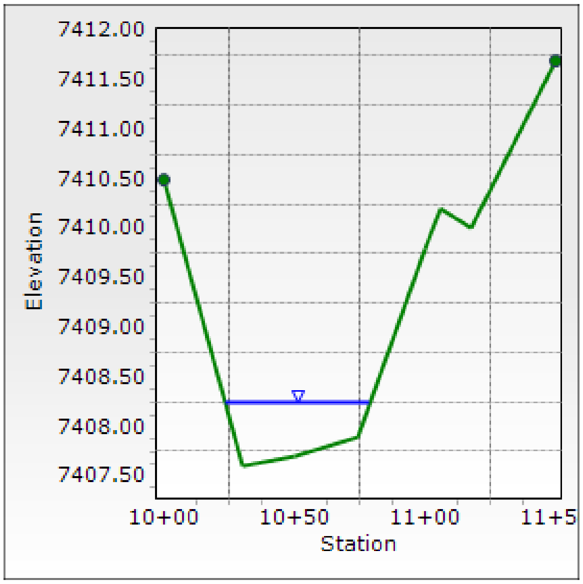
Section B-B

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.023 ft/ft
Normal Depth	7.9 in
Discharge	75.99 cfs



Please verify the ditch calculations (left & right)as the velocities shown would require protection.

$$\textbf{\textit{Open Channel Flow}}$$

$$\textbf{\textit{Left Side Ditch}}$$

$$V = \frac{1}{n} R^{\frac{2}{3}} s^{\frac{1}{2}}$$

$$V = Velocity\ or\ water\ mass\ flow\ rate$$

$$n = Manning's\ roughness\ coefficient, 0.025\ for\ grass$$

$$R = Hydraulic\ Radius, 0.35183$$

$$s = Slope\ of\ channel's\ bottom\ surface$$

$$V = \frac{1}{0.025} (0.35183)^{\frac{2}{3}} (2.5)^{\frac{1}{2}}$$

$$V = 31.52\ ft/s$$

$$Q = V * A$$

$$Q = Volumetric\ Flow\ Rate$$

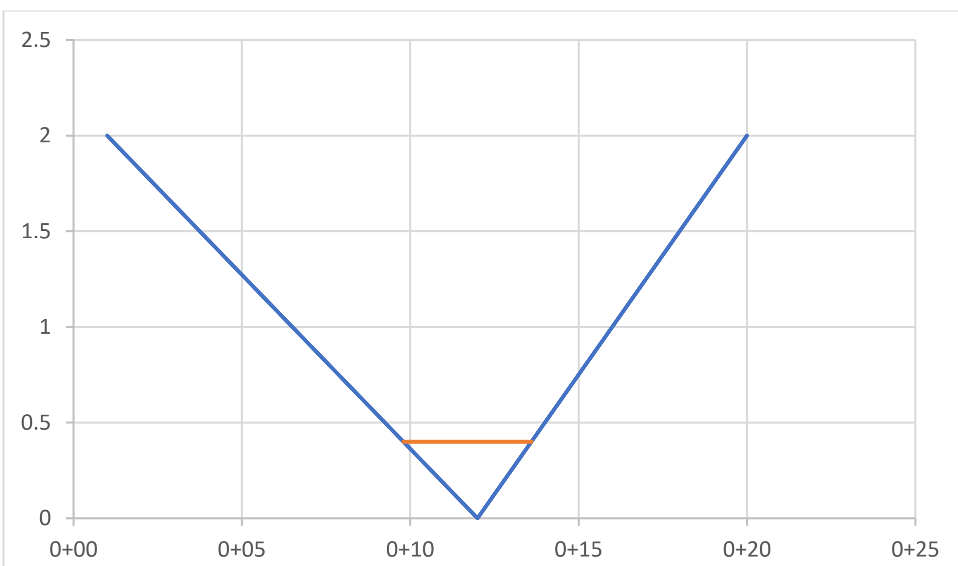
$$V = Calculated\ Mass\ Flow\ Rate$$

$$A = Cross - sectional\ area\ of\ the\ water\ flow$$

$$Q = 31.52 * 0.79$$

$$Q = 24.83\ cf/s$$

$$Water\ Depth = 0.4\ ft$$



Right Side Ditch

$$V = \frac{1}{n} R^{\frac{2}{3}} s^{\frac{1}{2}}$$

$$V = Velocity\ or\ water\ mass\ flow\ rate$$

$$n = Manning's\ roughness\ coefficient, 0.025\ for\ grass$$

$$R = Hydraulic\ Radius, 0.16053$$

$$s = Slope\ of\ channel's\ bottom\ surface$$

$$V = \frac{1}{0.025}(0.16053)^{\frac{2}{3}}(2.5)^{\frac{1}{2}}$$

$$V = 18.6811\ ft/s$$

$$Q = V * A$$

$$Q = Volumetric\ Flow\ Rate$$

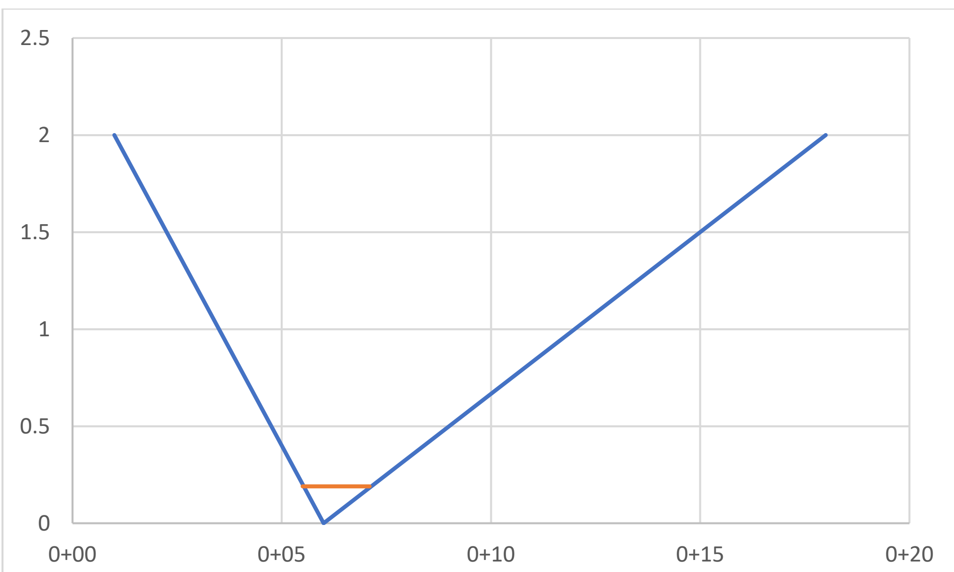
$$V = Calculated\ Mass\ Flow\ Rate$$

$$A = Cross - sectional\ area\ of\ the\ water\ flow$$

$$Q = 18.6811 * 0.16$$

$$Q = 3.07\ cf/s$$

$$Water\ Depth = 0.19\ ft$$



Per DCM Vol. 1 Section 3 Chapter 10.10 Riprap please provide calculations showing the type, width, and thickness of riprap required. Please reference Tables 10-6 through Table 10-7 for criteria. Fabric filter is required.

FROUDE NUMBER CALCULATIONS			CALCULATED BY:	ARP	DATE:	8/2/2023
PROJECT: MARIAH TRAIL			CHECKED BY:	RL		
Froude Number Calculations: 100-YR						
Section	Velocity	Gravitational Constant	Hydraulic depth	Xsectional Area	top Width	Froude #
-	ft/s	ft/s^2	ft	ft^2	ft	N/A
A-A	5.74	32.17	0.61	23.28	38.27	1.30
B-B	5.74	32.17	0.66	37.24	56.56	1.25

Per the El Paso County DCM Vol. 1 Section 3 Chapter 10.7 Supercritical Flow channels should have a froude number of 0.9 or less to avoid supercritical flow.

Per El Paso County DCM Vol. 1 Section 3 Chapter 10 Table 10-3 velocities exceed maximum permissible velocities for earth channels. Lining is required. Per Table 10-4 for a channel with a slope of 0-5% Bermuda Grass or Sodded Grass are the linings identified for flows higher than 5 ft/s. Please discuss the type of lining for the channel.

TABLE 10-4

MAXIMUM PERMISSIBLE VELOCITIES FOR EARTH CHANNELS WITH VARIED GRASS LININGS AND SLOPES

EXPAND

Channel Slope	Lining	Permissible Mean Channel Velocity* (ft/sec)
0 - 5%	Sodded grass	7
	Bermudagrass	6
	Reed canarygrass	5
	Tall fescue	5
	Kentucky bluegrass	5
	Grass-legume mixture	4

SHEAR STRESS & CHANNEL LININGS		CALCULATED BY:	ARP	DATE:	8/2/2023
PROJECT: MARIAH TRAIL		CHECKED BY:	RL		

Shear Stress Calculations: 100-YR				
Section	unit weight of water	Depth of flow	Slope	Shear Stress
-	lb/ft^3	ft	ft/ft	lb/ft^2
A-A	62.43	0.77	0.05	2.48
B-B	62.43	0.55	0.05	1.77

Channel Lining Determination					
Calculated Values			P300 Max Values		
Section	Shear Stress	Velocity	Shear Stress	Velocity	Lining Required
A-A	2.48	5.74	3	9	P300
B-B	1.77	5.74	3	9	P300

Provide spec sheets of any proposed lining

Appendix F: Drainage Maps

MAJOR SUBDIVISION FINAL DRAINAGE REPORT
EXISTING CONDITIONS HYDROLOGY MAP
MARIAH TRAIL FILING NO. 1

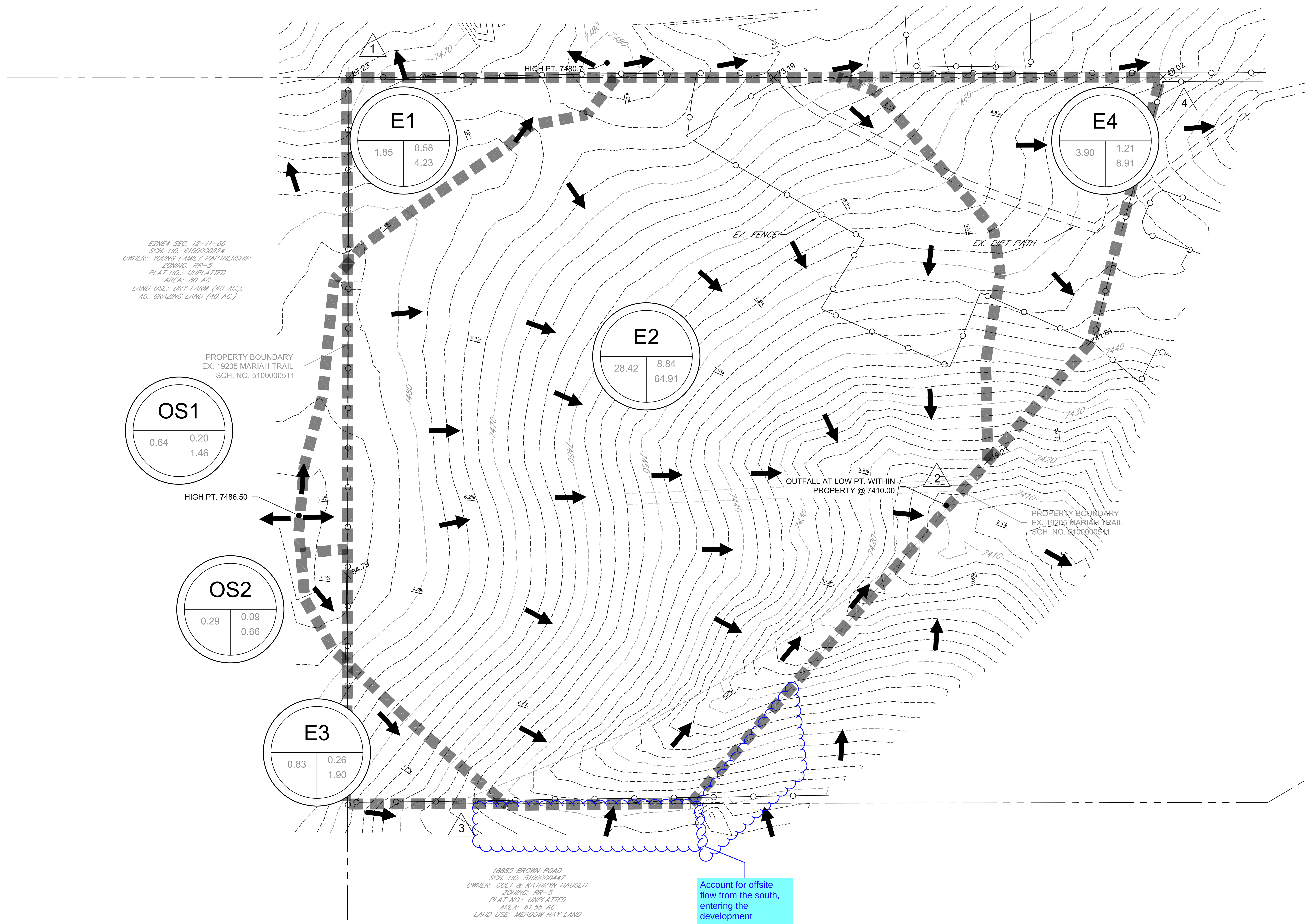
A PORTION OF THE NORTHWEST QUARTER OF SECTION 7,
TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPAL MERIDIAN,
PASO COUNTY, COLORADO.

Basin Summary

Basin Summary	Design Point	Area (ac.)	Q_5	Q_{100}
E1	1	1.85	0.58	4.23
E2	2	28.42	8.84	64.91
E3	3	0.83	0.26	1.90
E4	4	3.90	1.21	8.91
OS1	2	0.64	0.20	1.46
OS2	2	0.29	0.09	0.66
TOTAL ONSITE		35.00	10.88	79.94
TOTAL OFFSITE		0.93	0.29	2.12
TOTALS		35.93	11.17	82.06

Cumulative Design Point Summary

Design Point	Basins	Area (ac.)	Q_5	Q_{100}
1	E1	1.85	9.50	69.80
2	E2, OS1, OS2	29.35	9.13	67.03
3	E3	0.83	0.26	1.90
4	E4	3.90	1.21	8.91
TOTAL ONSITE	E1-E4	35.00	10.88	79.94
TOTAL OFFSITE	OS1, OS2	0.93	0.29	2.12



(IN FEET)
1 inch = 100 ft.

EXISTING LEGAL DESCRIPTION:
UNPLATTED

A TR OF LAND BEING IN A PORTION OF LOT 1 SEC 7-11-65...

REPLATTED LEGAL DESCRIPTION:
LOTS 1-6 MARIAH TRAIL FILING NO. 1

PARCEL SCHEDULE NO.:
5100000511

PROJECT DESCRIPTION:
SMALL SUBDIVISION OF 6 LOTS FROM EX. 35-ACRE RR-5 ZONED PACEL

FLOODPLAIN STATEMENT:
THE SUBJECT PROPERTY IS NOT LOCATED IN A DESIGNATED FLOODPLAIN AS SHOWN ON THE FEMA FLOOD INSURANCE RATE MAP 08041C0305G, EFFECTIVE DATE DECEMBER 7, 2018.

CONSTRUCTION ACTIVITIES:

THE SCOPE OF WORK INVOLVES DISTURBANCE AND CONSTRUCTION ACTIVITY FOR THE APPROXIMATE 1,050 FT. EXTENSION OF COUNTY RIGHT-OF-WAY INCLUDING THE EXTENSION OF THE GRAVEL ROADWAY OF MARIAH TRAIL.

ULTIMATE BUILDOUT OF THE SMALL SUBDIVISION IS FOR FIVE (LOTS 1-5) SINGLE-FAMILY RESIDENTS AT AN ASSUMED MAXIMUM COVERAGE FOR RR-5 ZONED LOTS (25%) WITH ALLOWABLE LAND USES.

TOTAL AREA TO BE CLEARED, EXCAVATED, OR GRADED:
FOR ROADWAY: 1.54 ACRES
INCLUDING EROSION AND SEDIMENT CONTROL MEASURES

-THIS MAP SHOWS EXISTING CONDITIONS, NO DISTURBANCE HAS TAKEN PLACE-

RECEIVING WATERS: EAST CHERRY CREEK, LOCATED APPROXIMATELY 1.5 MILES EAST OF THE PROPERTY OF INTEREST

SOIL TYPE: BRUSSETT LOAM AND PEYTON-PRINT COMPLEX - HYDROLOGIC SOIL GROUP B

LEGEND

- PROPERTY BOUNDARY
- EXITING LOT LINE
- PROPOSED LOT LINE
- RIGHT-OF-WAY LINE
- EXISTING CURB & GUTTER
- EXISTING CONTOURS
- BASIN ID (BASIN, AREA, 5_YR, 100_YR)
- DESIGN POINT ID
- BASIN BOUNDARY
- DRAINAGE FLOW ARROW
- EXISTING BUILDING
- PROPOSED BUILDING
- EXISTING ASPHALT
- PROPOSED ASPHALT
- EXISTING CONCRETE

NOTE:

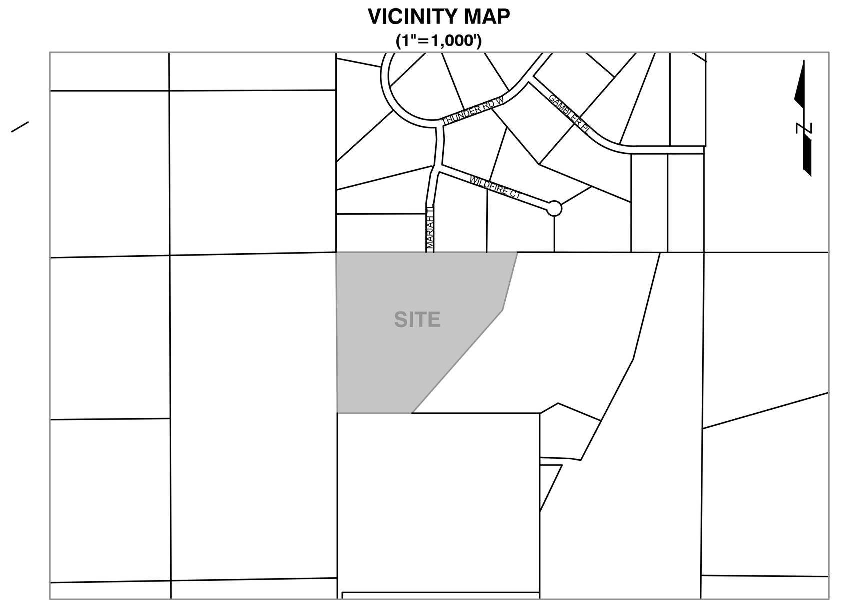
THE PROPERTY INFORMATION AND LINEWORK SHOWN IS CONSIDERED APPROXIMATE AND BASED ON THE PRELIMINARY AND FINAL PLAT DOCUMENTS PREPARED BY MARR LAND SURVEYING DATED OCTOBER OF 2022.

THERE IS NO PUBLIC OR PRIVATE STORMWATER INFRASTRUCTURE WITHIN THE VICINITY OF THE PROPERTY OF INTEREST TO DISPLAY ON THIS HYDROLOGY MAP.

THE PROPERTY OF INTEREST IS NOT WITHIN A STREAMSIDE ZONE, PRESERVATION AREA, OR NO-BUILD AREA.

THE PROPERTY OF INTEREST IS NOT WITHIN A FEMA FLOODPLAIN.

VICINITY MAP
(1"=1,000')



ELX
Phone: 719.308.9146
www.elxsoco.com
Hablamos Español

PROJECT NAME:
MARIAH TRAIL FILING NO. 1

PROJECT LOCATION:
LOTS 1-6, MARIAH TRAIL SUBDIVISION FILING NO. 1
EL PASO COUNTY, COLORADO

CLIENT:
MR. THOMAS KIRK

CONTACT INFO:
THOMAS KIRK
19205 MARIAH TRAIL
COLORADO SPRINGS, CO 80908-1123

PROFESSIONAL SEAL:

DATE:	DESCRIPTION:
05/01/23	SUBMITTAL 1
08/04/23	SUBMITTAL 2

JOB #: 100678

DRAWN BY: CDS
REVIEWED BY: CDS
PROJ. MNGR.: CDS

PLAN SET:
MAJOR SUBDIVISION CONSTRUCTION DRAWINGS

SHEET TITLE:
EXISTING CONDITIONS HYDROLOGY MAP

SHEET NO.:
C.01

PCD FIL. NO.: SF-2315

MAJOR SUBDIVISION FINAL DRAINAGE REPORT
DEVELOPED CONDITIONS HYDROLOGY MAP
MARIAH TRAIL FILING NO. 1

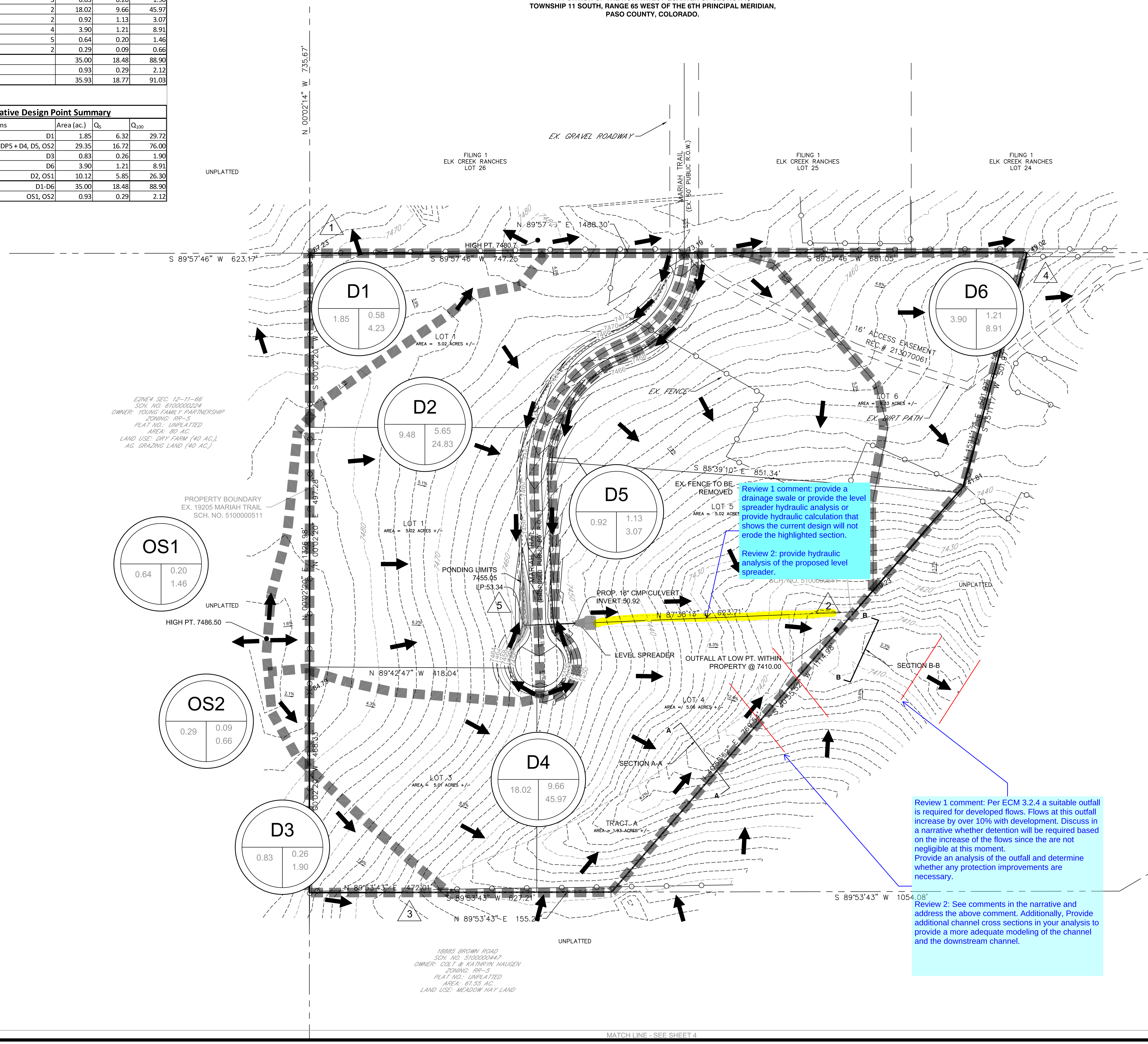
A PORTION OF THE NORTHWEST QUARTER OF SECTION 7,
TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPAL MERIDIAN,
PASO COUNTY, COLORADO.

Basin Summary

Basin Summary	Design Point	Area (ac.)	Q_5	Q_{100}
D1	1	1.85	0.58	4.23
D2	5	9.48	5.65	24.83
D3	3	0.83	0.26	1.90
D4	2	18.02	9.66	45.97
D5	2	0.92	1.13	3.07
D6	4	3.90	1.21	8.91
OS1	5	0.64	0.20	1.46
OS2	2	0.29	0.09	0.66
TOTAL ONSITE		35.00	18.48	88.90
TOTAL OFFSITE		0.93	0.29	2.12
TOTALS		35.93	18.77	91.03

Cumulative Design Point Summary

Design Point	Basins	Area (ac.)	Q_5	Q_{100}
1	D1	1.85	6.32	29.72
2	DP5 + D4, D5, OS2	29.35	16.72	76.00
3	D3	0.83	0.26	1.90
4	D6	3.90	1.21	8.91
5	D2, OS1	10.12	5.85	26.30
TOTAL ONSITE	D1-D6	35.00	18.48	88.90
TOTAL OFFSITE	OS1, OS2	0.93	0.29	2.12



MATCH LINE - SEE SHEET 4

(IN FEET)
1 inch = 100 ft.

EXISTING LEGAL DESCRIPTION:
UNPLATTED

A TR OF LAND BEING IN A PORTION OF LOT 1 SEC 7-11-65...

REPLATTED LEGAL DESCRIPTION:
LOTS 1-6 MARIAH TRAIL FILING NO. 1

PARCEL SCHEDULE NO.:
5100000511

PROJECT DESCRIPTION:
SMALL SUBDIVISION OF 6 LOTS FROM EX. 35-ACRE RR-5 ZONED PACEL

FLOODPLAIN STATEMENT:
THE SUBJECT PROPERTY IS NOT LOCATED IN A DESIGNATED FLOODPLAIN AS SHOWN ON THE FEMA FLOOD INSURANCE RATE MAP 08041C0305G, EFFECTIVE DATE DECEMBER 7, 2018.

CONSTRUCTION ACTIVITIES:

THE SCOPE OF WORK INVOLVES DISTURBANCE AND CONSTRUCTION ACTIVITY FOR THE APPROXIMATE 1,050 FT. EXTENSION OF COUNTY RIGHT-OF-WAY INCLUDING THE EXTENSION OF THE GRAVEL ROADWAY OF MARIAH TRAIL.

ULTIMATE BUILDOUT OF THE SMALL SUBDIVISION IS FOR FIVE (LOTS 1-5) SINGLE-FAMILY RESIDENTS AT AN ASSUMED MAXIMUM COVERAGE FOR RR-5 ZONED LOTS (25%) WITH ALLOWABLE LAND USES.

TOTAL AREA TO BE CLEARED, EXCAVATED, OR GRADED:
FOR ROADWAY: 1.54 ACRES
INCLUDING EROSION AND SEDIMENT CONTROL MEASURES

RECEIVING WATERS: EAST CHERRY CREEK, LOCATED APPROXIMATELY 1.5 MILES EAST OF THE PROPERTY OF INTEREST

SOIL TYPE: BRUSSETT LOAM AND PEYTON-PRINT COMPLEX - HYDROLOGIC SOIL GROUP B

LEGEND

- PROPERTY BOUNDARY
- EXISTING LOT LINE
- PROPOSED LOT LINE
- RIGHT-OF-WAY LINE
- EXISTING CURB & GUTTER
- EXISTING CONTOURS
- BASIN ID (BASIN, AREA, 5_YR, 100_YR)
- DESIGN POINT ID (X)
- BASIN BOUNDARY
- DRAINAGE FLOW ARROW
- EXISTING BUILDING
- PROPOSED BUILDING
- EXISTING ASPHALT
- PROPOSED ASPHALT
- EXISTING CONCRETE

NOTE:

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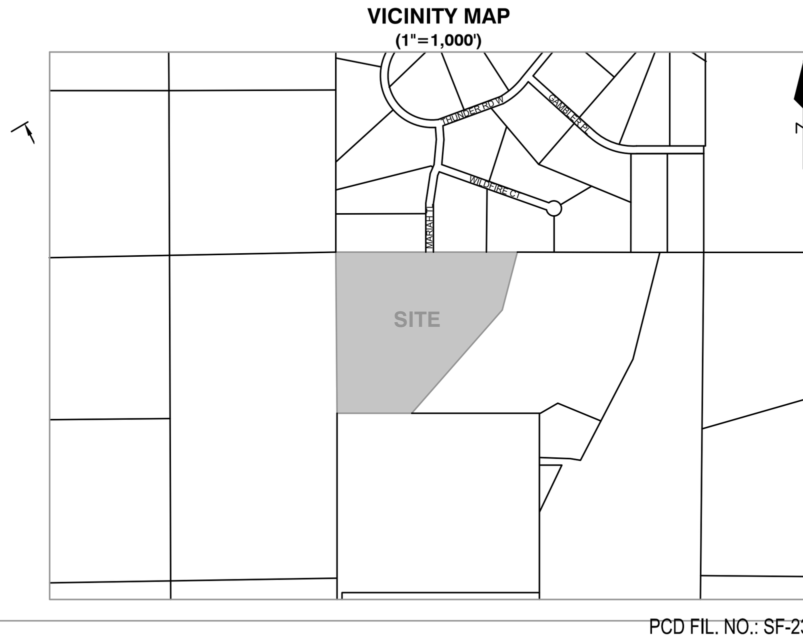
THE PROPERTY OF INTEREST IS NOT WITHIN A FEMA FLOODPLAIN.

VICINITY MAP
(1"=1,000')



PCD FIL. NO.: SF-2315

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Hablamos Español

PROJECT NAME:
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CLIENT:
MR. THOMAS KIRK

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19205 MARIAH TRAIL
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80908-1123

PROFESSIONAL SEAL:

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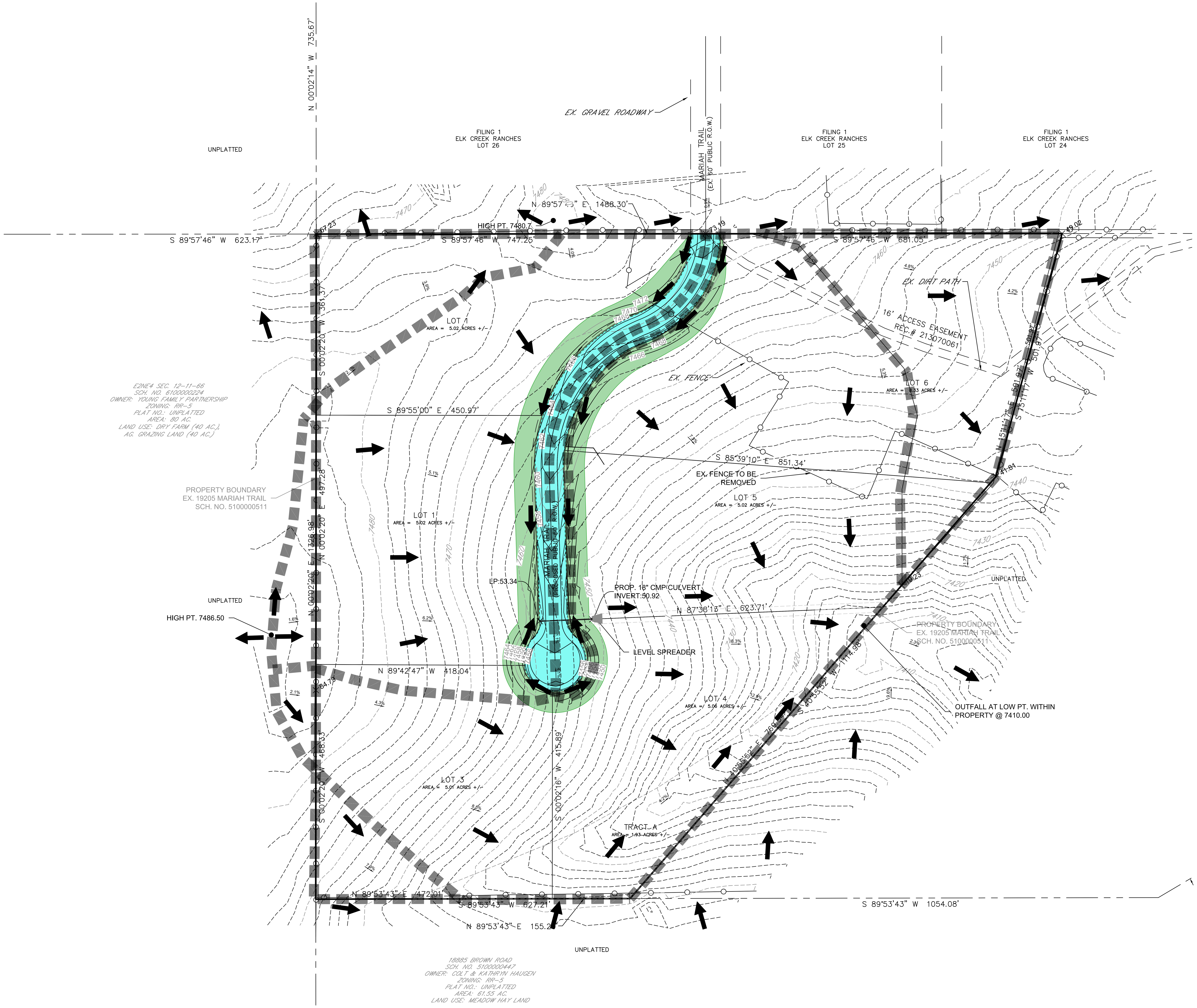
PLAN SET:
MAJOR SUBDIVISION CONSTRUCTION DRAWINGS

SHEET TITLE:
DEVELOPED CONDITIONS HYDROLOGY MAP

SHEET NO.:
C.01

MAJOR SUBDIVISION FINAL DRAINAGE REPORT
DEVELOPED CONDITIONS HYDROLOGY MAP
MARIAH TRAIL FILING NO. 1

A PORTION OF THE NORTHWEST QUARTER OF SECTION 7,
TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH PRINCIPAL MERIDIAN,
PASO COUNTY, COLORADO.



100 0 100 200
(IN FEET)
1 inch = 100 ft.

EXISTING LEGAL DESCRIPTION:
UNPLATTED

A TR OF LAND BEING IN A PORTION OF LOT 1 SEC 7-11-65...

REPLATTED LEGAL DESCRIPTION:
LOTS 1-6 MARIAH TRAIL FILING NO. 1

PARCEL SCHEDULE NO.:
5100000511

PROJECT DESCRIPTION:
SMALL SUBDIVISION OF 6 LOTS FROM EX. 35-ACRE RR-5 ZONED PACEL

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THE SCOPE OF WORK INVOLVES DISTURBANCE AND CONSTRUCTION ACTIVITY FOR THE APPROXIMATE 1,050 FT. EXTENSION OF COUNTY RIGHT-OF-WAY INCLUDING THE EXTENSION OF THE GRAVEL ROADWAY OF MARIAH TRAIL.

ULTIMATE BUILDOUT OF THE SMALL SUBDIVISION IS FOR FIVE (LOTS 1-5) SINGLE-FAMILY RESIDENTS AT AN ASSUMED MAXIMUM COVERAGE FOR RR-5 ZONED LOTS (25%) WITH ALLOWABLE LAND USES.

TOTAL AREA TO BE CLEARED, EXCAVATED, OR GRADED:
FOR ROADWAY: 1.54 ACRES
INCLUDING EROSION AND SEDIMENT CONTROL MEASURES

RECEIVING WATERS: EAST CHERRY CREEK, LOCATED APPROXIMATELY 1.5 MILES EAST OF THE PROPERTY OF INTEREST

SOIL TYPE: BRUSSETT LOAM AND PEYTON-PRINT COMPLEX - HYDROLOGIC SOIL GROUP B

LEGEND

- PROPERTY BOUNDARY
- EXITING LOT LINE
- PROPOSED LOT LINE
- RIGHT-0F-WAY LINE
- EXISTING CURB & GUTTER
- EXISTING CONTOURS
- BASIN ID
- DESIGN POINT ID
- BASIN BOUNDARY
- DRAINAGE FLOW ARROW
- EXISTING BUILDING
- PROPOSED BUILDING
- EXISTING ASPHALT
- PROPOSED ASPHALT
- EXISTING CONCRETE
- RPA
- UIA

NOTE:

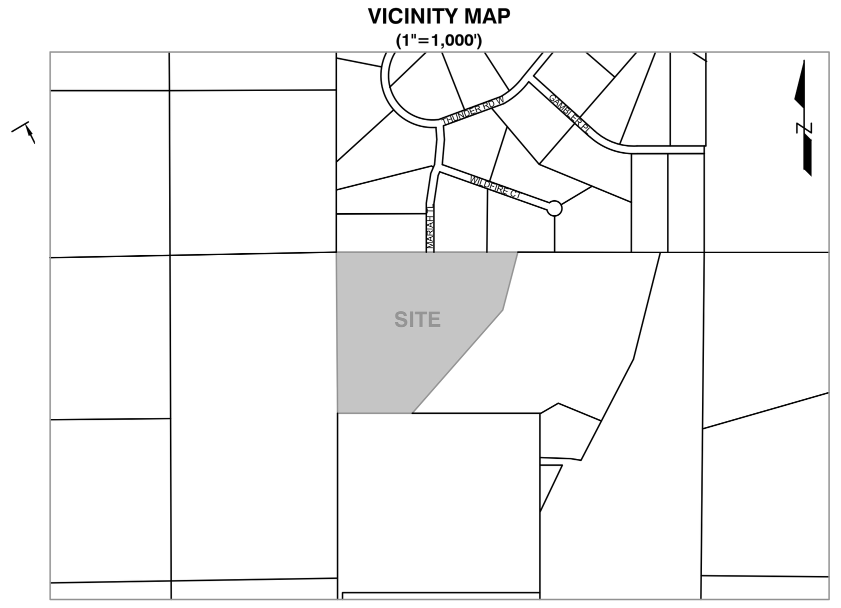
THE PROPERTY INFORMATION AND LINEWORK SHOWN IS CONSIDERED APPROXIMATE AND BASED ON THE PRELIMINARY AND FINAL PLAT DOCUMENTS PREPARED BY MARR LAND SURVEYING DATED OCTOBER OF 2022.

THERE IS NO PUBLIC OR PRIVATE STORMWATER INFRASTRUCTURE WITHIN THE VICINITY OF THE PROPERTY OF INTEREST TO DISPLAY ON THIS HYDROLOGY MAP.

THE PROPERTY OF INTEREST IS NOT WITHIN A STREAMSIDE ZONE, PRESERVATION AREA, OR NO-BUILD AREA.

THE PROPERTY OF INTEREST IS NOT WITHIN A FEMA FLOODPLAIN.

VICINITY MAP
(1"=1,000')



ELX
Phone: 719.308.9146
www.elxsoco.com
Hablamos Español

PROJECT NAME:
MARIAH TRAIL
FILING NO. 1

PROJECT LOCATION:
LOTS 1-6, MARIAH TRAIL
SUBDIVISION
FILING NO. 1

EL PASO COUNTY, COLORADO

CLIENT:
MR. THOMAS KIRK

CONTACT INFO:
THOMAS KIRK
19205 MARIAH TRAIL
COLORADO SPRINGS, CO
80908-1123

PROFESSIONAL SEAL:

DATE:	DESCRIPTION:
05/01/23	SUBMITTAL 1
08/04/23	SUBMITTAL 2

JOB #: 100678

DRAWN BY: CDS
REVIEWED BY: CDS
PROJ. MNGR.: CDS

PLAN SET:
MAJOR SUBDIVISION
CONSTRUCTION DRAWINGS

SHEET TITLE:
DEVELOPED CONDITIONS
HYDROLOGY MAP

SHEET NO.:
C.01