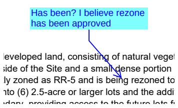
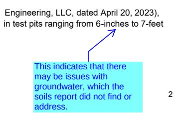
V1_Drainage Report - Final_comments.pdf Markup Summary

Callout (20)



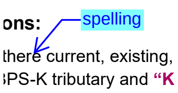
Subject: Callout
Page Label: 6
Author: CDurham
Date: 4/9/2026 11:51:19 AM
Status:
Color: ■
Layer:
Space:

Has been? I believe rezone has been approved



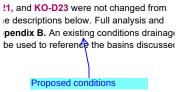
Subject: Callout
Page Label: 6
Author: CDurham
Date: 4/9/2026 11:56:53 AM
Status:
Color: ■
Layer:
Space:

This indicates that there may be issues with groundwater, which the soils report did not find or address.



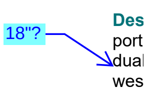
Subject: Callout
Page Label: 11
Author: CDurham
Date: 4/9/2026 12:02:19 PM
Status:
Color: ■
Layer:
Space:

spelling



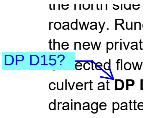
Subject: Callout
Page Label: 12
Author: CDurham
Date: 4/9/2026 12:13:11 PM
Status:
Color: ■
Layer:
Space:

Proposed conditions



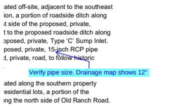
Subject: Callout
Page Label: 13
Author: CDurham
Date: 4/9/2026 12:17:39 PM
Status:
Color: ■
Layer:
Space:

18"?



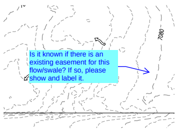
Subject: Callout
Page Label: 14
Author: CDurham
Date: 4/9/2026 12:30:52 PM
Status:
Color: ■
Layer:
Space:

DP D15?



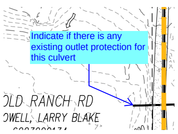
Subject: Callout
Page Label: 14
Author: CDurham
Date: 4/9/2026 12:31:23 PM
Status:
Color:
Layer:
Space:

Verify pipe size. Drainage map shows 12"



Subject: Callout
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:08:02 PM
Status:
Color:
Layer:
Space:

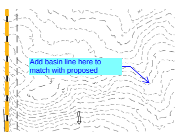
Is it known if there is an existing easement for this flow/swale? If so, please show and label it.



Subject: Callout
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:08:42 PM
Status:
Color:
Layer:
Space:

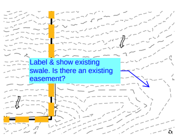
Indicate if there is any existing outlet protection for this culvert

---



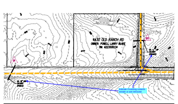
Subject: Callout
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:09:53 PM
Status:
Color:
Layer:
Space:

Add basin line here to match with proposed



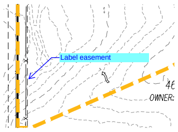
Subject: Callout
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:10:56 PM
Status:
Color:
Layer:
Space:

Label & show existing swale. Is there an existing easement?



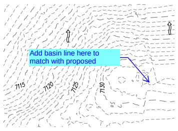
Subject: Callout
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:11:34 PM
Status:
Color:
Layer:
Space:

Indicate if existing culverts remain or are removed



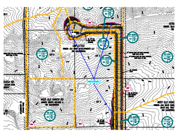
Subject: Callout
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:12:06 PM
Status:
Color: ■
Layer:
Space:

Label easement



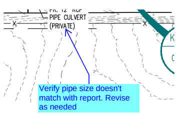
Subject: Callout
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:12:54 PM
Status:
Color: ■
Layer:
Space:

Add basin line here to match with proposed



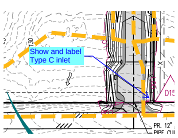
Subject: Callout
Page Label: [1] Layout1
Author: CDurham
Date: 4/9/2026 1:14:40 PM
Status:
Color: ■
Layer:
Space:

Label all slopes



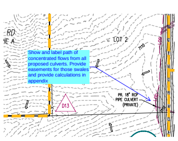
Subject: Callout
Page Label: [1] Layout1
Author: CDurham
Date: 4/9/2026 1:15:32 PM
Status:
Color: ■
Layer:
Space:

Verify pipe size doesn't match with report. Revise as needed



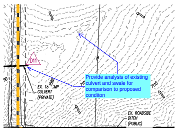
Subject: Callout
Page Label: [1] Layout1
Author: CDurham
Date: 4/9/2026 1:16:10 PM
Status:
Color: ■
Layer:
Space:

Show and label Type C inlet



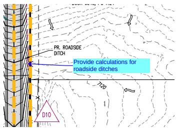
Subject: Callout
Page Label: [1] Layout1
Author: CDurham
Date: 4/9/2026 1:17:24 PM
Status:
Color: ■
Layer:
Space:

Show and label path of concentrated flows from all proposed culverts. Provide easements for those swales and provide calculations in appendix



Subject: Callout
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:18:20 PM
Status:
Color:
Layer:
Space:

Provide analysis of existing culvert and swale for comparison to proposed conditon



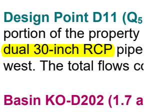
Subject: Callout
Page Label: [1] Layout1
Author: CDurham
Date: 4/9/2026 1:18:45 PM
Status:
Color:
Layer:
Space:

Provide calculations for roadside ditches

Highlight (2)

Subject: Highlight
Page Label: 11
Author: CDurham
Date: 4/9/2026 12:02:04 PM
Status:
Color:
Layer:
Space:

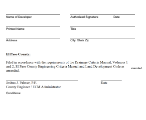
here



Subject: Highlight
Page Label: 13
Author: CDurham
Date: 4/9/2026 12:17:21 PM
Status:
Color:
Layer:
Space:

dual 30-inch RCP

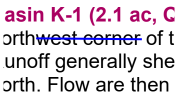
Image (1)



Subject: Image
Page Label: 4
Author: CDurham
Date: 4/9/2026 8:24:55 AM
Status:
Color:
Layer:
Space:

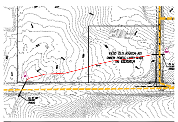
Line (2)

Subject: Line
Page Label: 1
Author: Mikayla Hartford
Date: 4/8/2026 3:25:15 PM
Status:
Color:
Layer:
Space:

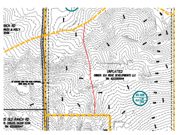


Subject: Line
Page Label: 11
Author: CDurham
Date: 4/9/2026 12:03:18 PM
Status:
Color:
Layer:
Space:

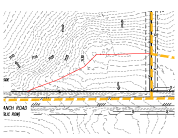
PolyLine (3)



Subject: PolyLine
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:08:18 PM
Status:
Color:
Layer:
Space:

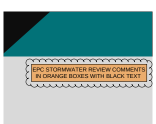


Subject: PolyLine
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:09:36 PM
Status:
Color:
Layer:
Space:



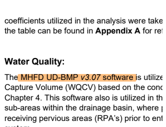
Subject: PolyLine
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:12:48 PM
Status:
Color:
Layer:
Space:

Stamp - Stormwater Comment Legend (1)



Subject: Stamp - Stormwater Comment Legend
Page Label: 1
Author: Mikayla Hartford
Date: 4/8/2026 3:25:23 PM
Status:
Color:
Layer:
Space:

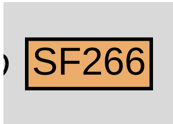
SW - Highlight (1)



Subject: SW - Highlight
Page Label: 10
Author: Mikayla Hartford
Date: 4/9/2026 1:49:31 PM
Status:
Color:
Layer:
Space:

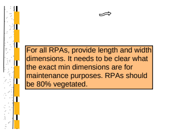
MHFD UD-BMP v3.07 software

SW - Textbox (4)



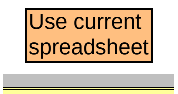
Subject: SW - Textbox
Page Label: 1
Author: Mikayla Hartford
Date: 4/8/2026 3:25:10 PM
Status:
Color: ■
Layer:
Space:

SF266



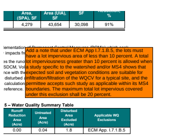
Subject: SW - Textbox
Page Label: [1] Layout1
Author: Mikayla Hartford
Date: 4/9/2026 2:57:41 PM
Status:
Color: ■
Layer:
Space:

For all RPAs, provide length and width dimensions. It needs to be clear what the exact min dimensions are for maintenance purposes. RPAs should be 80% vegetated.



Subject: SW - Textbox
Page Label: 58
Author: Mikayla Hartford
Date: 4/9/2026 2:57:57 PM
Status:
Color: ■
Layer:
Space:

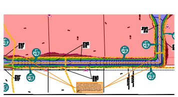
Use current spreadsheet



Subject: SW - Textbox
Page Label: 16
Author: Mikayla Hartford
Date: 4/9/2026 3:00:33 PM
Status:
Color: ■
Layer:
Space:

Add a note that under ECM App I.7.1.B.5, the lots must have a lot impervious area of less than 10 percent. A total lot imperviousness greater than 10 percent is allowed when a study specific to the watershed and/or MS4 shows that expected soil and vegetation conditions are suitable for infiltration/filtration of the WQCV for a typical site, and the permittee accepts such study as applicable within its MS4 boundaries. The maximum total lot impervious covered under this exclusion shall be 20 percent.

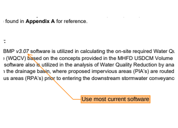
SW - Textbox with Arrow (4)



Subject: SW - Textbox with Arrow
Page Label: [1] Layout1
Author: Mikayla Hartford
Date: 4/9/2026 12:52:36 PM
Status:
Color: ■
Layer:
Space:

•For swales providing runoff reduction:
V swales – the portion of the ditch from the edge of the impervious surface (UIA) to the flowline of the RPA shall be used for runoff reduction. The backslope for v swales cannot be considered for runoff reduction. Typical comment

---



Subject: SW - Textbox with Arrow
Page Label: 10
Author: Mikayla Hartford
Date: 4/9/2026 1:49:41 PM
Status:
Color: ■
Layer:
Space:

Use most current software

Subject: SW - Textbox with Arrow
Page Label: 58
Author: Mikayla Hartford
Date: 4/9/2026 2:33:49 PM
Status:
Color:
Layer:
Space:

L/W should be between 0.0625 and 16

Subject: SW - Textbox with Arrow
Page Label: 16
Author: Mikayla Hartford
Date: 4/9/2026 2:47:01 PM
Status:
Color:
Layer:
Space:

What basin is K? Why is there untreated area listed in K if the entire area is using the large lot exclusion per the exhibit?

Text Box (28)

Subject: Text Box
Page Label: 4
Author: CDurham
Date: 4/9/2026 8:25:11 AM
Status:
Color:
Layer:
Space:

Replace with this signature block

Subject: Text Box
Page Label: 11
Author: CDurham
Date: 4/9/2026 12:05:15 PM
Status:
Color:
Layer:
Space:

Does flow remain as sheetflow, or is it released into ditch or other storm system?

Subject: Text Box
Page Label: 11
Author: CDurham
Date: 4/9/2026 12:06:36 PM
Status:
Color:
Layer:
Space:

Label & show channel on plans

Subject: Text Box
Page Label: 12
Author: CDurham
Date: 4/9/2026 12:10:04 PM
Status:
Color:
Layer:
Space:

How does this flow get to DP11 if it's in a roadside ditch along Old Ranch?

Subject: Text Box
Page Label: 12
Author: CDurham
Date: 4/9/2026 12:11:18 PM
Status:
Color:
Layer:
Space:

Label & show channel on plans

Subject: Text Box
Page Label: 13
Author: CDurham
Date: 4/9/2026 12:14:10 PM
Status:
Color:
Layer:
Space:

Does flow remain as sheetflow, or is it released into ditch or other storm system?

Subject: Text Box
Page Label: 13
Author: CDurham
Date: 4/9/2026 12:21:22 PM
Status:
Color:
Layer:
Space:

DP12?

Subject: Text Box
Page Label: 13
Author: CDurham
Date: 4/9/2026 12:22:33 PM
Status:
Color:
Layer:
Space:

D10 & Dual 30" culverts?

Subject: Text Box
Page Label: 14
Author: CDurham
Date: 4/9/2026 12:25:27 PM
Status:
Color:
Layer:
Space:

DP13?

Subject: Text Box
Page Label: 14
Author: CDurham
Date: 4/9/2026 12:25:34 PM
Status:
Color:
Layer:
Space:

DP13?

Subject: Text Box
Page Label: 14
Author: CDurham
Date: 4/9/2026 12:25:57 PM
Status:
Color:
Layer:
Space:

DP13?

Subject: Text Box
Page Label: 14
Author: CDurham
Date: 4/9/2026 12:29:29 PM
Status:
Color:
Layer:
Space:

DP17 & existing culvert?

Subject: Text Box
Page Label: 15
Author: CDurham
Date: 4/9/2026 12:32:20 PM
Status:
Color:
Layer:
Space:

DP D16?

Subject: Text Box
Page Label: 15
Author: CDurham
Date: 4/9/2026 12:33:59 PM
Status:
Color:
Layer:
Space:

Missing discussion for DP D15 and D1.

Subject: Text Box
Page Label: 15
Author: CDurham
Date: 4/9/2026 12:36:49 PM
Status:
Color:
Layer:
Space:

Need to include DP D13 or 14, DP17 and new DP at SW corner of basin KO-D206 in table.

Subject: Text Box
Page Label: 15
Author: CDurham
Date: 4/9/2026 12:36:26 PM
Status:
Color:
Layer:
Space:

Provide % increase at each design point.

Subject: Text Box
Page Label: 15
Author: CDurham
Date: 4/9/2026 12:38:48 PM
Status:
Color:
Layer:
Space:

Need to include discussion on detention. Lot size does not negate criteria for not increasing released flows.

Subject: Text Box
Page Label: 16
Author: CDurham
Date: 4/9/2026 12:39:12 PM
Status:
Color:
Layer:
Space:

Update to 2026 fees

Subject: Text Box
Page Label: 17
Author: CDurham
Date: 4/9/2026 12:39:52 PM
Status:
Color:
Layer:
Space:

Include paragraph on design of roadside ditches

Subject: Text Box
Page Label: 1
Author: CDurham
Date: 4/9/2026 12:41:15 PM
Status:
Color:
Layer:
Space:

Update to 2026 fees

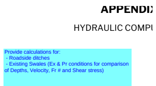
Subject: Text Box
Page Label: 33
Author: CDurham
Date: 4/9/2026 12:48:50 PM
Status:
Color:
Layer:
Space:

Include analysis of existing culvert @ DP D17, need to see how water backs up and overtops

---

Subject: Text Box
Page Label: 52
Author: CDurham
Date: 4/9/2026 12:49:25 PM
Status:
Color:
Layer:
Space:

Does not need to be in drainage report, can be removed



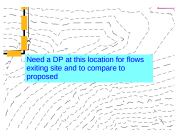
Subject: Text Box
Page Label: 32
Author: CDurham
Date: 4/9/2026 12:51:00 PM
Status:
Color:
Layer:
Space:

Provide calculations for:
 - Roadside ditches
 - Existing Swales (Ex & Pr conditions for comparison of Depths, Velocity, Fr # and Shear stress)

Subject: Text Box
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:09:20 PM
Status:
Color:
Layer:
Space:

Need a DP at this location for flows exiting site and to compare to proposed

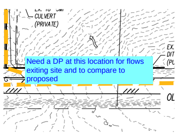
---



Subject: Text Box
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:10:08 PM
Status:
Color:
Layer:
Space:

Need a DP at this location for flows exiting site and to compare to proposed

---



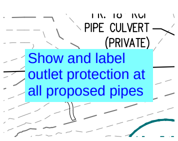
Subject: Text Box
Page Label: [1] Ex Drainage Maps-Layout1
Author: CDurham
Date: 4/9/2026 1:11:49 PM
Status:
Color:
Layer:
Space:

Need a DP at this location for flows exiting site and to compare to proposed

---

Subject: Text Box
Page Label: [1] Layout1
Author: CDurham
Date: 4/9/2026 1:14:04 PM
Status:
Color:
Layer:
Space:

Need DP here as flows exit site



Subject: Text Box
Page Label: [1] Layout1
Author: CDurham
Date: 4/9/2026 1:15:13 PM
Status:
Color:
Layer:
Space:

Show and label outlet protection at all proposed pipes

Galloway

FINAL DRAINAGE REPORT

ELK VIEW ESTATES

El Paso County, CO

EPC STORMWATER REVIEW COMMENTS IN ORANGE BOXES WITH BLACK TEXT

PREPARED FOR:
Elk Ridge Development, LLC
10548 Odin Dr.
Colorado Springs, CO 80924

PREPARED BY:
Galloway & Company, Inc.
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920

DATE:
November 21, 2025

PCD File No.: ~~TBD~~ SF266

Table of Contents

ENGINEERS CERTIFICATION STATEMENT:

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

SIGNATURE:______________________________________ (Affix Seal)

Treven Edwards

(For and on behalf of Galloway & Company)

DEVELOPERS CERTIFICATION STATEMENT:

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

Name of Developer	Authorized Signature Date
Printed Name	Title
Address	City, State Zip

El Paso County:

Replace with this signature block

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.

ımended.

_______________________________________ ____________

Joshua J. Palmer, P.E. Date

County Engineer / ECM Administrator

Conditions:

I. INTRODUCTION

Purpose:

This document is to be the Final Drainage Report (FDR) for the proposed Elk View Estates Subdivision, hereon referred to as “Site.” The purpose of this report is to identify on and offsite drainage patterns, analyze existing and proposed hydraulic improvements required by this development, and ensure there are no significant changes to existing drainage patterns in compliance with the El Paso County Land Development Code (LDC) and Drainage Criteria Manual (DCM).

Location:

The project site is located entirely within the boundaries of Parcel 6223000044 as shown in the El Paso County Assessor records. The Site is located on the north side of Old Ranch Rd., approximately 1,300-ft west from the Milam Rd./Union Blvd. intersection with Old Ranch Rd. to the southeast property corner. More specifically, the Site is located in a portion of the Southeast One-Quarter of Section 23, Township 12 South, Range 66 West of the 6th Principal Meridian, Couty of El Paso, State of Colorado.

The site is bounded by single-family residential properties on the north, east and west, and by Old Ranch Road public Right-of-Way to the south. A vicinity map is provided in **Figure 1** below for reference.

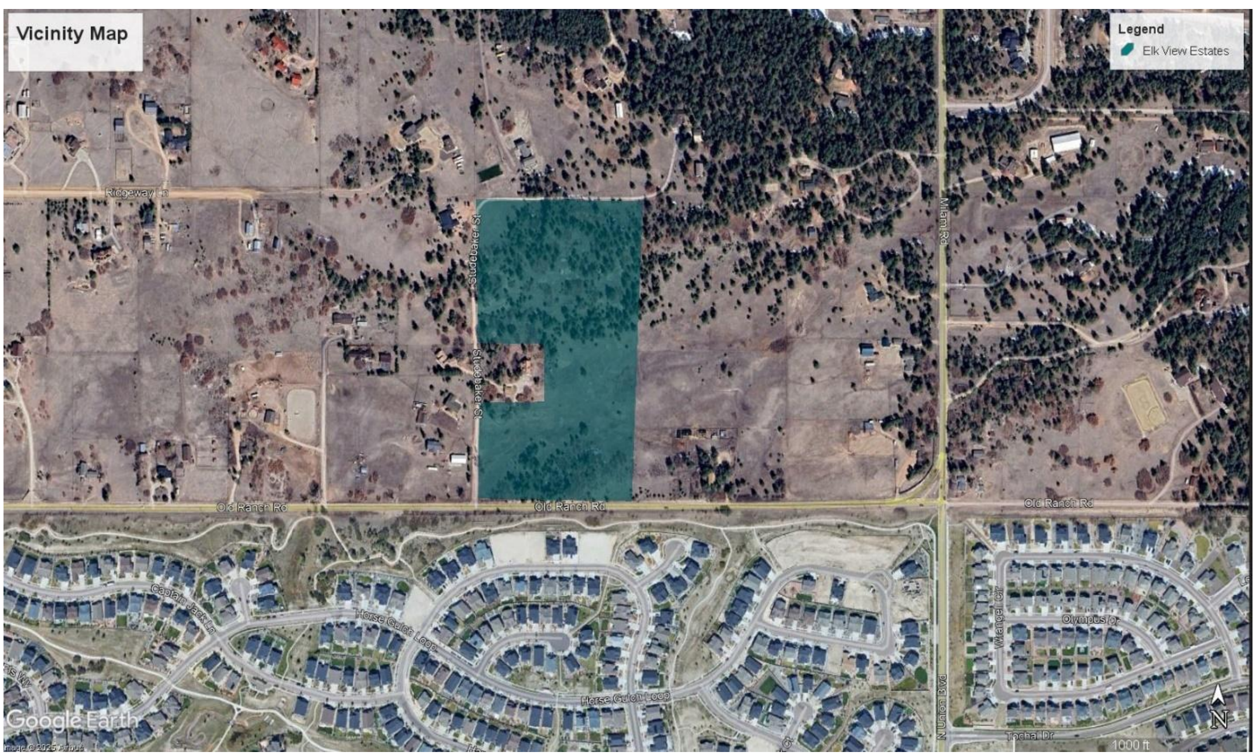


Figure 1 – Vicinity Map

Has been? I believe rezone has been approved

Description of Property:

The Site occupies approximately 17.10 acres of undeveloped land, consisting of natural vegetation and large trees, densely concentrated on the north side of the Site and a small dense portion on the south, adjacent to Old Ranch Rd. The site is currently zoned as RR-5 and is being rezoned to RR-2.5. The proposed development will be subdivided into (6) 2.5-acre or larger lots and the addition of private access road along the eastern property boundary, providing access to the future lots from Old Ranch Rd.

Description of Floodplain:

The site is located within Zone X – Areas determined to be outside of the 0.2% annual chance floodplain, according to the FEMA Flood Insurance Rate Map (FIRM) panel #08041C0526G, effective December 7, 2018. A copy of the FEMA FIRM panel can be found in **Appendix A** for reference.

Description of Soils:

Soils can be classified in four different hydrologic groups, A, B, C, or D to help predict stormwater runoff rates. Hydrologic group “A” is characterized by deep, well-drained coarse-grained soils with a rapid infiltration rate when thoroughly wet and having a low runoff potential. Group “D” typically has a clay layer at or near to the surface, or very shallow depth to impervious bedrock and has a very slow infiltration rate and a high runoff potential. According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, the project site consists of a mix of soil types and Hydrologic Soil Groups (HSGs) shown in **Table 1** below.

Table 1 – USDA NRCS Soil Data

Soil Name	HSG	Percent of Site
Kettle Fravelly Loam Sand	B	44.6%
Peyton-Pring Complex (3 to 8 % slopes)	B	11.6%
Peyton-Pring Complex (8 to 15 % Slopes)	B	43.8%

The predominant HSG for the Site is type ‘B’. A copy of the NRCS Web Soil Survey report can be found in **Appendix A** for reference.

Other Site Considerations:

- The Site is not located within a Streamside Overlay zone.
- The Site is not adjacent, nor contain, waters of the State or Federal Waters.
- An environmental study was not conducted, however, there does not appear to be any wetlands on-site that would be impacted by the Site development.
- According to the OTWS report (prepared by D&D Engineering, LLC, dated April 20, 2023), shallow seasonal ground water was encountered in test pits ranging from 6-inches to 7-feet deep.

This indicates that there may be issues with groundwater, which the soils report did not find or address.

II. DESIGN CRITERIA

Required Criteria:

The analysis and design of the drainage for the Site were prepared in accordance with the criteria set forth from the following resources:

- El Paso Drainage Criteria Manual (DCM), Volumes 1 & 2, (With latest updates); hereon referred to as DCM.
- City of Colorado Springs Drainage Criteria Manual 2014 Update: Chapter 6 and Section 3.2.1 of Chapter 13; heron referred to as COSDCM.
- Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual (USDCM), Volumes 1-3 latest updates; hereon referred to as USDCM.

HYDROLOGIC CRITERIA:

Rainfall:

The drainage analysis are based on rainfall depths for the Site as provided by Table 6-2 of the DCM as shown below in **Table 2**.

Table 2 – Rainfall Data per Table 6-2 of DCM, Vol. 1

Return Period	1-Hr. Depth (in.)	6-Hr. Depth (in.)	24-Hr. Depth (in.)
2-year	1.19	1.70	2.10
5-year	1.50	2.10	2.70
10-year	1.75	2.40	3.20
25-year	2.00	2.90	3.60
50-year	2.25	3.20	4.20
100-year	2.52	3.50	4.60
Based on elevation Z = 6,840 ft / 100			

This table is based on the City of Colorado Springs Intensity Duration Frequency (IDF) curve created from NOAA Atlas 2, Volume III, Regional 1 rainfall intensity data for an elevation of 6,840-ft.

The above rainfall methodology is not appropriate in determining the Water Quality Capture Volume (WQCV). Therefore, the MHFD USDCM methods for the WQCV are utilized, as approved by the DCM, Vol. 1, Section 2.3.

Runoff:

Because the drainage basins for the site are less than 130-acres, the Rational Method is utilized to determine the runoff peak discharges, which is calculated by the following formula from the DCM, Vol. 1, Sec. 3.0:

$$Q = C \cdot i \cdot A \qquad \textbf{(Equation 6-5)}$$

Where:

Q = maximum rate of runoff (cubic feet per second [cfs])

C = runoff coefficient (discussed below)

I = intensity of rainfall for a duration equal to the time of concentration (inches per hour [in/hr])

Runoff peak discharges where calculated for the 5-year and 100-year return periods, which are hereon referred to as the minor and major storm events, respectively.

Runoff Coefficient:

The rational method runoff coefficient 'C' is calculated for each drainage basin by using a weighted average of the land use and/or surface characteristics within the particular drainage basin, which follows the following formula from the DCM, Vol. 1, Sec. 3.0:

$$C = (C_1A_1 + C_2A_2 + C_3A_3 + \ldots C_iA_i)/A_t$$ **(Equation 6-6)**

Where:

C = Composite runoff coefficient for the drainage basin

C_i = runoff coefficient for subarea corresponding to surface type or land use

A_i = area of surface type corresponding to C_i (Acres)

A_t = total area of all subareas for which composite runoff coefficient applies (Acres)

i = number of surface types in the drainage area

The sub-area runoff coefficient is determined from Table 6-6 of the DCM which provides values based on land use/surface characteristic, percent impervious, return period, and hydrologic soil group. A copy of the table can be found in **Appendix A** for reference.

Time of Concentration:

The Time of Concentration was calculated using the equations in the DCM, Vol.1, Sec. 3.2 as follows:

$$t_c = t_i + t_t$$ **(Equation 6-7)**

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time of concentrated flow (i.e. ditch, curb/gutter, etc. [min])

The overland flow time, t_i, is calculated by the following equation:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}}$$ **(Equation 6-8)**

Where:

t_i = overland (initial) flow time (min)

C_5 = runoff coefficient for a 5-year return period

L = length of overland flow (300-ft max for non-urban, 100-ft max for urban)

S = average drainage basin slope (ft/ft)

The concentrated flow (or channelized flow) is calculated by the following equations:

$$V = C_v S_w^{0.5} \qquad \textbf{(Equation 6-9)}$$

Where:

V = velocity (feet per second [ft/s or fps])

C_v = conveyance coefficient (see **Table 3** below)

S_w = watercourse slope (ft/ft)

$$t_t = \frac{L}{60 \cdot V}$$

Where:

t_t = travel time of concentrated flow (min)

L = length of concentrated flow (feet)

V = velocity (ft/s)

Table 3 - Conveyance coefficient (C_v) from Table 6-7 of DCM

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

The final time of concentration (t_c) is then checked to according the following equation:

$$t_c = \frac{L}{180+10} \qquad \textbf{(Equation 6-10)}$$

Where:

t_c = max time of concentration at 1st design point in urban watershed (min)

L = waterway length (ft)

Where calculations result in a time less than 5-minutes, the minimum time of concentration is analyzed at 5-minutes.

HYDRAULIC CRITERIA:

Street Capacity & Inlets:

Roadside ditches were analyzed utilizing the Federal Highway Administration (FHWA) Hydraulic Toolbox *Version 5.4*. The roadside ditches were sized to convey the minor and major storm events and provide water quality reduction (discussed later in the report). Figure 8-10 (Type C Inlet Capacity Chart) from the City of Colorado Springs DCM, Volume 1 was utilized to ensure adequate inlet capacity. A copy of this chart can be found in **Appendix C**.

Roadside ditch capacity analysis within Hydraulic Toolbox uses Manning's equation, which estimates the ditch flow capacity based on the channel geometry, slope, and land characteristics based on the following equation:

$$Q = \frac{1.49}{n} \cdot A \cdot R^{0.67} \cdot S^{0.5} \qquad \textbf{(Equation 10-1)}$$

Where:

Q = Channel discharge (cfs)

n = Manning's roughness coefficient (based on channel material and/or lining)

A = cross sectional area of channel (ft^2)

R = hydraulic radius of channel = A / P (ft)

P = wetted perimeter of channel (ft)

S = slope of energy gradient (ft/ft)

The roadside ditch stability is analyzed within Hydraulic Toolbox by computing the side slope and bottom shear stresses. The channel is deemed to be stable if the computed shear stress is less than the critical shear stress for type of channel material or lining utilized.

Culverts:

Existing and proposed culverts were analyzed using the FHWA HY-8 software. Entrance loss coefficients utilized in the analysis were taken from the DCM, Vol. 1, Ch. 9, Table 9-1. A copy of the table can be found in **Appendix A** for reference.

Water Quality:

The MHFD UD-BMP *v3.07* software is utilized in calculating the on-site required Water Quality Capture Volume (WQCV) based on the concepts provided in the MHFD USDCM Volume 3, Chapter 4. This software also is utilized in the analysis of Water Quality Reduction by analyzing sub-areas within the drainage basin, where proposed impervious areas (PIA's) are routed across receiving pervious areas (RPA's) prior to entering the downstream stormwater conveyance system.

Use most current software

III. HISTORIC / EXISTING DRAINAGE

Major Drainage Basin:

The Site is within the ***"Kettle Creek Drainage Basin Planning Study"*** (DBPS-K), prepared by JR Engineering, LLC., Dated May 5, 2015 and the ***"Kettle Creek – Old Ranch Road Tributary Drainage Basin Planning Study"*** (DBPS-KO), prepared by JR Engineering, LLC., Dated April 2001. Specifically, the Site is within **sub-basin area S1** of the DBPS-K, and within **sub-basin areas D1 & D2** of the DBPS-KO.

No additional previous or on-going drainage reports were found applicable to the Site.

Overall Basin Description:

Existing topography generally slopes from the northeast to the southwest at approximately 6.0%. A defined natural channel exists on the site running across the south-central portion of the site, conveying flows to the west. The flows then are conveyed under Studebaker St. via an existing (private) pipe culvert.

Sub-Basin Descriptions:

spelling

Drainage sub-basins in there current, existing, condition have been analyzed and denoted as **"K"** for sub-basins within DBPS-K tributary and **"KO"** for sub-basin within the DBPS-KO tributary. Full analysis and results of the sub-basins hydrology can be found in **Appendix B.** An existing conditions drainage basin map has been provided in **Appendix E** and can be used to reference the basins discussed below:

Basin K-1 (2.1 ac, Q_5 = 0.7 cfs, Q_{100} = 4.8 cfs): a sub-basin defining a portion of the site in the north~~west corner~~ of the property consisting of an existing dirt roadway and undeveloped land. Runoff generally sheet flows across the sub-basin, following historic drainage patterns, to the north. Flow are then routed over the existing dirt road and off-site to the northern adjacent parcels. Does flow remain as sheetflow, or is it released into ditch or other storm system?

Basin KO-D10 (41.6 ac, Q_5 = 14.7 cfs, Q_{100} = 54.2 cfs): a sub-basin defining a large portion of offsite tributary area to the east consisting of undeveloped land, large acreage single family residences, and a portion of Milam Road. This sub-basin was created to match the portion of Basin D1 of the DBPS-KO drainage areas outside of the sites property boundaries. Runoff generally sheet flows to the west, channelizing centrally within the sub-basin. Channelized flows are then routed west, via an existing vegetated natural channel, where it then drains across **Basin KO-D20** at **DP D10.** Label & show channel on plans

Basin KO-D11 (8.4 ac, Q_5 = 1.9 cfs, Q_{100} = 12.8 cfs): a sub-basin defining a large portion of offsite tributary area to the east consisting of undeveloped land, large acreage single family residences, and a portion of Milam Road. This sub-basin was created to match the portion of Basin D1 of the DBPS-KO drainage areas outside of the sites property boundaries. Runoff generally sheet flows to the west, channelizing centrally within the sub-basin. Channelized flows are then routed west, via an existing vegetated natural channel, where it then drains across **Basin KO-D20** at **DP D10.**

Basin KO-D20 (15.3 ac, Q_5 = 3.8 cfs, Q_{100} = 25.2 cfs): a sub-basin defining the remaining portion of the site, south of **Basin K-1.** This basin consists of native vegetation and is undeveloped. Runoff generally sheet flows south before becoming channelized in the existing vegetated natural channel on the southern portion of the basin. Channelized flows are then routed west, to an existing (private) 18" CMP culvert under the private Studebaker Road at **DP D11.** Flows then discharge, via the existing pipe culvert, to **Basin KO-D23**.

Basin KO-D21 (2.5 ac, Q_5 = 2.1 cfs, Q_{100} = 7.8 cfs): a sub-basin located off-site, on the central-western side of the site. This basin consists of a large acreage, single-family, residential lot. Runoff from this basin generally sheet flows south, across **Basin KO-D20** draining to **DP D11.**

Basin KO-D22 (0.6 ac, Q_5 = 0.5 cfs, Q_{100} = 1.7 cfs): a sub-basin defining a small portion of off-site area adjacent to the southeast corner of the site. This sub-basin was created to match the portion of Basin D2 of the DBPS-KO drainage areas outside of the sites property boundaries. Runoff from this basin generally sheet flows south, before becoming channelized in roadside ditch, along the north of Old Ranch Road. Channelized flows from the roadside ditch continue into **Basin KO-D20** draining to **DP D11.** How does this flow get to DP11 if it's in a roadside ditch along Old Ranch?

Design Point D11 (Q_5 = 19.6 cfs, Q_{100} = 83.4 cfs): This desig[illegible]west portion of the site and represents the total runoff upstream to t[illegible] that crosses under the private Studebaker Road. In the existing co[illegible]ave capacity for the minor or major storm events. Therefore, exces[illegible]t side of Studebaker Road until it overtops the roadway and continue[illegible]3.

flows turn up run north to culvert. no ex culvert at driveway access

Basin KO-D23 (22.4 ac, Q_5 = 13.8 cfs, Q_{100} = 51.0 cfs): a sub-basin defining the off-site, downstream, area west of the site. This sub-basin was created to match the portion of Basin D2 of the DBPS-KO drainage areas outside of the sites property boundaries. Runoff generally sheet flows to the south, channelizing centrally within the sub-basin. Channelized flows are then routed south, via an existing vegetated natural channel, to an existing, public, 18" CMP pipe culvert under Old Ranch Road, at **DP D1.** Label & show channel on plans

IV. PROPOSED DRAINAGE

General Concept:

Elk View Estates will be developed as a single-family rural development. Runoff will primarily follow existing drainage patterns, across the proposed lots, to the southwest. Runoff from the new access roads will be collected in roadside ditches to provide a runoff reduction for water quality before being discharged to the existing natural flow paths on-site. A new, private, pipe culvert will be constructed under the new access road to allow off-site flows to the east to continue westward, following existing drainage patterns identified in the DBPS-KO.

Sub-Basin Descriptions:

Drainage sub-basins in there, proposed, future condition have been analyzed and denoted as **"K"** for sub-basins within DBPS-K tributary and **"KO"** for sub-basin within the DBPS-KO tributary. Off-site sub-basins **KO-D10, KO-D11, KO-D21,** and **KO-D23** were not changed from the existing condition and therefore are not added to the descriptions below. Full analysis and results of the sub-basins hydrology can be found in **Appendix B.** An existing conditions drainage basin map has been provided in **Appendix E** and can be used to reference the basins discussed below:

Proposed conditions

Basin K-12 (2.2 ac, Q_5 = 1.8 cfs, Q_{100} = 6.5 cfs): Located along the northern property boundary, this sub-basin consists of an existing private access road and a portion of of 2.5-acre single-family residential lots. Runoff from this basin generally sheet flows to the north / northwest, ultimately flowing off-site following historic drainage patterns. Does flow remain as sheetflow, or is it released into ditch or other storm system?

Basin KO-D201a (0.4 ac, Q_5 = 1.4 cfs, Q_{100} = 2.8 cfs): Located along the northeastern property boundary, this sub-basin consists of a portion of the east side of the north/south running private roadway. Runoff from this basin generally sheet flows east, across the private roadway, to a roadside ditch. Flows are then conveyed via the roadside ditch south, to a private, dual, 30-inch RCP pipe culvert at **DP D10.**

Design Point D10 (Q_5 = 15.2 cfs, Q_{100} = 55.1 cfs): This design point is located at the central east portion of the property boundary and represents the total flows entering the proposed, private, dual 30-inch RCP pipe culvert that conveys flows under the proposed, private, access road to the west. The total flows conveyed to this design point consist of **KO-D10** and **KO-D201a.**

Basin KO-D201b (0.2 ac, Q_5 = 0.4 cfs, Q_{100} = 0.8 cfs): Located along the southeastern property boundary, this sub-basin consists of a portion of the east side of the north/south running private roadway. Runoff from this basin generally sheet flows east, across the private roadway, to a roadside ditch. Flows are then conveyed via the roadside ditch to a private, 18-inch RCP pipe culvert at **DP D11.**

18"?

Design Point D11 (Q_5 = 2.2 cfs, Q_{100} = 13.3 cfs): This design point is located at the central east portion of the property boundary and represents the total flows entering the proposed, private, dual 30-inch RCP pipe culvert that conveys flows under the proposed, private, access road to the west. The total flows conveyed to this design point consist of **KO-D11** and **KO-D201b.**

Basin KO-D202 (1.7 ac, Q_5 = 1.4 cfs, Q_{100} = 5.2 cfs): Located at the northeast portion of the site, this sub-basin consists entirely of 2.5-acre single-family residential lots. Runoff from this basin generally sheet flows to the south, following historic drainage patterns, to a proposed, private, 18-inch RCP pipe culvert at **DP D11.** DP12?

Basin KO-D203 (0.2 ac, Q_5 = 0.9 cfs, Q_{100} = 1.6 cfs): Located along the northeastern portion of the site, this sub-basin consists of a portion of the west side of the north/south running private roadway, and the north side of the east/west running private roadway. Runoff from this basin generally sheet flows north and west, across the private roadway, to a roadside ditch. Flows are then conveyed via the roadside ditch southwest, to a private, 18-inch RCP pipe culvert at **DP D11.** D10 & Dual 30" culverts?

Design Point D12 (Q_5 = 2.1 cfs, Q_{100} = 6.5 cfs): This design point is located at the northeast portion of the property boundary and represents the total flows entering the proposed, private, 18-inch RCP pipe culvert that conveys flows under the proposed, private, access road to the south. The total flows conveyed to this design point consist of **KO-D202,** and **KO-D203.**

Basin KO-D204 (0.3 ac, Q_5 = 1.4 cfs, Q_{100} = 2.5 cfs): Located along the northeastern portion of the site, this sub-basin consists of a portion of the west side of the south side of the east/west running private roadway. Runoff from this basin generally sheet flows south, across the private roadway, over a +/- 14-ft wide, native vegetated, landscape buffer. Runoff then continues across

Basin KO-D207, following historic drainage patterns, until it reaches the existing, natural, drainage swale at **DP D12.** DP13?

Basin KO-D205a (0.4 ac, Q_5 = 1.4 cfs, Q_{100} = 2.7 cfs): Located along the central eastern portion of the site, this sub-basin consists of a portion of the west side of the north/south running private roadway. Runoff from this basin generally sheet flows west, across the private roadway, over a +/- 14-ft wide, native vegetated, landscape buffer. Runoff then continues across **Basin KO-D207**, following historic drainage patterns, until it reaches the existing, natural, drainage swale at **DP D12.** DP13?

Basin KO-D205b (0.2 ac, Q_5 = 0.9 cfs, Q_{100} = 1.6 cfs): Located along the southeastern portion of the site, this sub-basin consists of a portion of the west side of the north/south running private roadway. Runoff from this basin generally sheet flows west, across the private roadway, over a +/- 14-ft wide, native vegetated, landscape buffer. Runoff then continues across **Basin KO-D207**, following historic drainage patterns, until it reaches the existing, natural, drainage swale at **DP D12.** DP13?

Design Point D13 (Q_5 = 18.9 cfs, Q_{100} = 69.5 cfs): This design point is located at the central east portion of the site and represents the total flows entering the existing, natural, drainage swale which conveys flows west, following historic drainage patterns. The total flows conveyed to this design point consist of **DP D10, DP D11, DP D12, KO-D204, KO-D205a,** and **KO-D205b.**

Basin KO-D206 (2.3 ac, Q_5 = 1.7 cfs, Q_{100} = 6.3 cfs): Located at the northwest corner of the site, this sub-basin consists entirely of 2.5-acre single-family residential lots. Runoff from this basin generally sheet flows to the south, ultimately flowing off-site following historic drainage patterns, across **Basin KO-D21.**

Design Point D14 (Q_5 = 3.6 cfs, Q_{100} = 13.2 cfs): This design point is located at the southwest portion of the site and represents the total flows entering the existing, natural, drainage swale, from the northwest. The total flows conveyed to this design point consist of **KO-D206** and **KO-D21.**

Basin KO-D207 (8.6 ac, Q_5 = 5.7 cfs, Q_{100} = 21.1 cfs): Located to the east and south portions of the site, this sub-basin consists entirely of 2.5-acre single-family residential lots. Runoff from this basin generally sheet flow either north or south, following historic drainage patterns, to the existing, natural, drainage swale. Flows are then conveyed west, to **DP D16.** DP17 & existing culvert?

Basin KO-D221 (0.7 ac, Q_5 = 0.5 cfs, Q_{100} = 2.0 cfs): Located off-site, adjacent to the southeast property corner, this sub-basin consists of existing vegetation, a portion of roadside ditch along the north side of Old Ranch Road, and a portion of the east side of the proposed, private, roadway. Runoff from this basin generally sheet flows west to the proposed roadside ditch along the new private roadway. Flows are then conveyed to a proposed, private, Type 'C' Sump Inlet. DP D15? ected flows are then routed downstream through a proposed, private, 15-inch RCP pipe culvert at **DP D14** which conveys flows under the proposed, private, road, to follow historic drainage patterns along the north side of Old Ranch Road.

Verify pipe size. Drainage map shows 12"

Basin KO-D222 (0.8 ac, Q_5 = 0.6 cfs, Q_{100} = 2.4 cfs): Located along the southern property boundary, this sub-basin consist of 2.5-acre single-family residential lots, a portion of the proposed, private, road, and a portion of roadside ditch along the north side of Old Ranch Road.

Runoff form this basin generally sheet flows south, to the existing roadside ditch along Old Ranch Road. Flows are then conveyed west, to **DP D15.** DP D16?

Design Point D16 (Q_5 = 1.2 cfs, Q_{100} = 4.3 cfs): This design point is located at the southwest portion of the site and represents the total flows entering the existing, natural, drainage swale, from the southeast. The total flows conveyed to this design point consist of **KO-D221** and **KO-D222.**

Design Point D17 (Q_5 = 24.2 cfs, Q_{100} = 88.9 cfs): This design point is located at the southwest portion of the site and represents the total flow at the existing, private, 18" CMP pipe culvert that conveys flows under the private Studebaker Road. The total flows conveyed to this design point consist of **D13, D14, D16,** and **KO-D207.** Flows at this design point will continue west, following historic drainage patterns. In both the historic and proposed conditions, the existing, private, 18" CMP does not have capacity for the major storm event. Therefore, flows will pond on the east side of Studebaker Road, until it overtops the roadway, and continues west to **DP D1** (following historic drainage patterns).

Missing discussion for DP D15 and D1.

The proposed and existing condition flows at similar design points downstream are compared in the summary table below to show the change in flow.

Need to include DP D13 or 14, DP17 and new DP at SW corner of basin KO-D206 in table.

Flows Leaving Site Comparison

	Existing				Proposed		
Design Point	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)	Design Point	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
D10	50.6	16.3	63.9	D10, D11, D15	51.1	17.9	70.4
D11	68.4	19.6	83.4	D17	68.2	24.2	88.9
D1	90.8	27.5	112.6	D1	90.6	32.1	118.1

Provide % increase at each design point.

Need to include discussion on detention. Lot size does not negate criteria for not increasing released flows.

Based on the comparison shown above, the ultimate flows at Design Point D1 (which is associated with the existing 18" pipe culvert crossing at Old Ranch Road from the DBPS-KO) maintains the same drainage area but has a minor increase in flow. This is likely due largely to the DBPS-KO assuming that the proposed site imperviousness would be 5% for >1 ac/du, which with the new criteria, is at 11% for 2.5-acre Single-Family Residential.

4-Step Process:

1. Volume Reduction Practices

Step 1 requires the site to evaluate Low Impact Development (LID) measures to reduce pollutants through infiltration measures, prior to entering the facilities required for Step 2. This is done by routing impervious areas across pervious areas prior to the capture and conveyance of runoff downstream to the maximum extent practicable.

Runoff Reduction Calculations: Runoff reduction has been calculated using the MHFD "UD-BMP_v3.07" software package. Print outs from this software are provided in **Appendix D.** Additionally, a water quality map showing the Upstream Impervious Areas (UIA) in translucent blue & Receiving Pervious Areas (RPA) in translucent green is provided in **Appendix E**.

Runoff Reduction Calculations are summarized below. The values shown are based only on the disturbed areas analyzed for water quality treatment and does not include the exclusion areas outlined in **Step 2**.

Table 4 – Runoff Reduction Summary

Downstream Design Point	Total Area, SF	DCIA, SF	Separate Pervious Area, (SPA), SF	Upstream Impervious Area (UIA), SF	RPA, SF	Volume Reduction, %
KO-Basins	78,031	0	4,279	43,654	30,098	91%

2. Volume Treatment

Step 2 requires the implementation of Permanent Control Measures (PCM's) which seek to address water quality impacts fr

The proposed site utilizes the runo
outlined in the MHFD USDCM, Vol
this analysis in accordance with th
below showing the total disturbed a
Additionally, supporting calculation
map in **Appendix E** for reference.

Add a note that under ECM App I.7.1.B.5, the lots must have a lot impervious area of less than 10 percent. A total lot imperviousness greater than 10 percent is allowed when a study specific to the watershed and/or MS4 shows that expected soil and vegetation conditions are suitable for infiltration/filtration of the WQCV for a typical site, and the permittee accepts such study as applicable within its MS4 boundaries. The maximum total lot impervious covered under this exclusion shall be 20 percent.

Table 5 – Water Quality Summary Table

Basin ID	Total Area (Acre)	Total Disturbed Area (Acre)	Runoff Reduction Area (Acre)	Untreated Area (Acre)	Disturbed Area Excluded (Acre)	Applicable WQ Exclusions
K	2.2	2.2	0.00	0.04	1.8	ECM App. I.7.1.B.5
KO-D20	14.3	14.3	0.65		12.3	ECM App. I.7.1.B.5
KO-D22	1.5	0.8	0.04		0.4	ECM App. I.7.1.B.5
Total	18.0	17.3	0.69	0.04	14.5	

What basin is K? Why is there untreated area listed in K if the entire area is using the large lot exclusion per the exhibit?

3. Stabilize Drainageways

Step 3 requires channel stabilization measures to protect open channels from erosion resulting from increases in frequency, duration rate, and volume of runoff associated with development.

The Site is not adjacent to Kettle Creek or any of the tributaries identified in the DBPS. Additionally, the site is being subdivided and is therefore required to participate in the drainage basin fee program. **Table 4** below reflects the El Paso County drainage basin fees for 2025. Drainage basin fees are paid at the time of recording of the plat.

Update to 2026 fees

Table 6 – Drainage Basin Fee

Drainage Basin	2025 Drainage Fee (per impervious acre)	2025 Bridge Fee (per impervious acre)	Impervious Area (acres)	Total Drainage Fees
Kettle Creek	$14,416	$0	3.335	$48,077.36

A copy of the 2025 El Paso County Drainage Basin Fees schedule has been included in **Appendix A** for reference. A total imperviousness summary for the basins within the property boundaries is included in **Appendix B** for reference.

4. Source Controls

Step 4 requires targeted source control measures based on site specific needs. Source control can include material storage, secondary containment, good housekeeping practices, and other source control measures.

Source control measures will be implemented during construction and adhere to County and State requirements. A Grading & Erosion Control Plan (GEC) and associated Stormwater Management Plan (SWMP) will be provided for the Site to show that source control measures during construction are met.

There are no plans for outdoor stockpiling of materials, or chemical and/or pollutant storage, onsite after construction has been completed, therefore, no other source control measures are anticipated at this time.

PROPOSED INFRASTRUCTURE

Culverts:

The Site is graded to maintain as much of the existing drainage patterns as possible; therefore, pipe culverts are proposed to allow existing drainage ways cross the proposed roads where they intersect. The proposed culverts are designed to adhere to the ECM for culvert sizing; an existing, private, 18-inch CMP pipe culvert at **Design Point D17** conveys flows under Studebaker St. was analyzed to compare capacity in both the existing and proposed conditions. Calculations and results can be found in **Appendix C.**

Include paragraph on design of roadside ditches

Ownership & Maintenance:

All proposed internal roadways & stormwater infrastructure are to be privately owned and maintained by the developer and its successors.

VARIANCES

There are no proposed stormwater variances required by this study.

V. CONCLUSION

This Final Drainage Report for Elk View Estates was prepared using the methods and procedures described, and in conformance with, the El Paso County Drainage Criteria Manual (DCM) & Engineering Criteria Manual (ECM). Additionally, it was prepared in accordance with the applicable chapters of the Mile High Flood District (MHFD) Urban Stormwater Drainage Criteria Manual (USDCM), Volumes 1-3; and in accordance with the applicable chapters and sections of the City of Colorado Springs Drainage Criteria Manual (COS DCM), Volumes 1-2.

This report demonstrates that the proposed Site is in general conformance with the DBPS and does not adversely affect downstream facilities and surrounding developments.

VI. REFERENCES

1. ***Drainage Criteria Manual Volume 1 & 2***, County of El Paso, Colorado, October 31, 2018 (with current revisions).

2. ***Engineering Criteria Manual***, County of El Paso, Colorado, January 9, 2025 (with current revisions).

3. ***Drainage Criteria Manual Volume 1***, City of Colorado Springs (January 2021)

4. ***Urban Storm Drainage Criteria Manual, Vol. 1-3***, Mile High Flood District, March 2024 (with current revisions).

5. ***Kettle Creek Drainage Basin – Old Ranch Road Tributary Drainage Basin Planning Study & Master Development Drainage Plan***, JR Engineering, April 2001 (Revised October 2002).

6. ***Drainage Basin Planning Study for Kettle Creek Basin***, JR Engineering, May 5, 2015.

7. Flood Insurance Rate Map – El Paso County, Colorado and Incorporated Areas Community Panel No. 08041C0526G, Effective December 7th, 2018.

8. Soil Map – El Paso County Area, Colorado as available through the Natural Resources Conservation Service National Cooperative Soil Survey web site via Web Soil Survey 2.0.

VII. APPENDIX

APPENDIX A – REFERENCE DOCUMENTATION

APPENDIX B – HYDROLOGIC COMPUTATIONS

APPENDIX C – HYDRAULIC COMPUTATIONS

APPENDIX D – WATER QUALITY COMPUTATIONS

APPENDIX E – DRAINAGE MAPS

APPENDIX A

REFERENCE DOCUMENTATION

NOTES TO USERS

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

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

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

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

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

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

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

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

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

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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

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

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

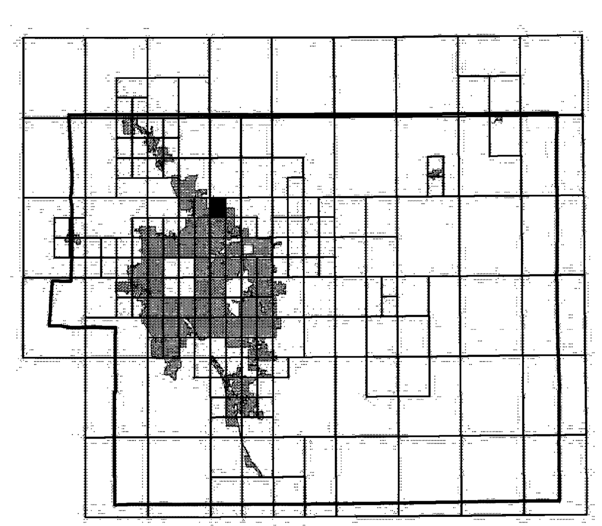
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 12 SOUTH, RANGE 66 WEST.

LEGEND

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

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

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

	Floodplain boundary
	Floodway boundary
	Zone D Boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
~~ 513 ~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

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

(A)—(A)	Cross section line
(23)- - - -(23)	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000N	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0526G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 526 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0526	G
EL PASO COUNTY	080059	0526	G

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

MAP NUMBER 08041C0526G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

United States Department of Agriculture

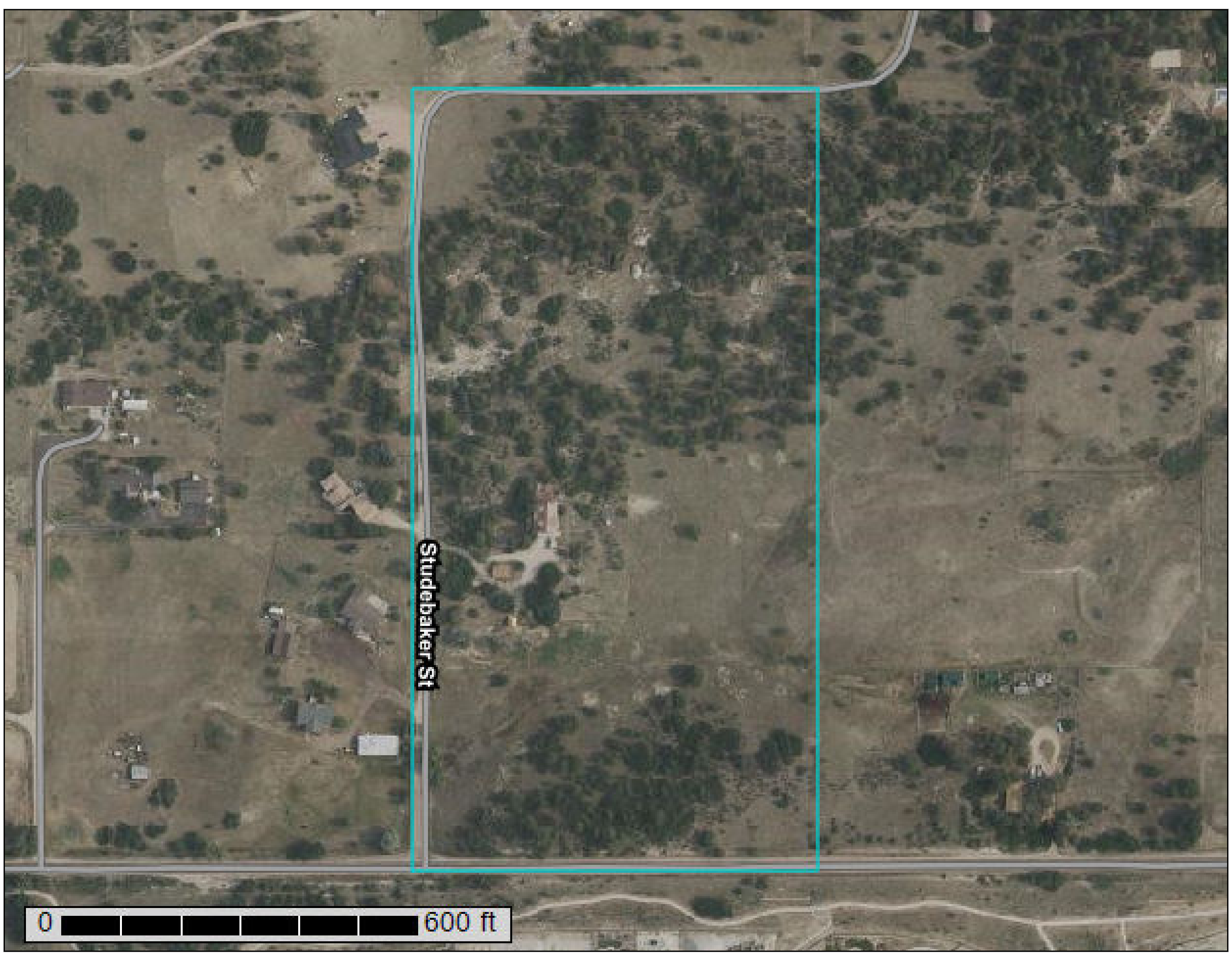
NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for

El Paso County Area, Colorado



June 6, 2025

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

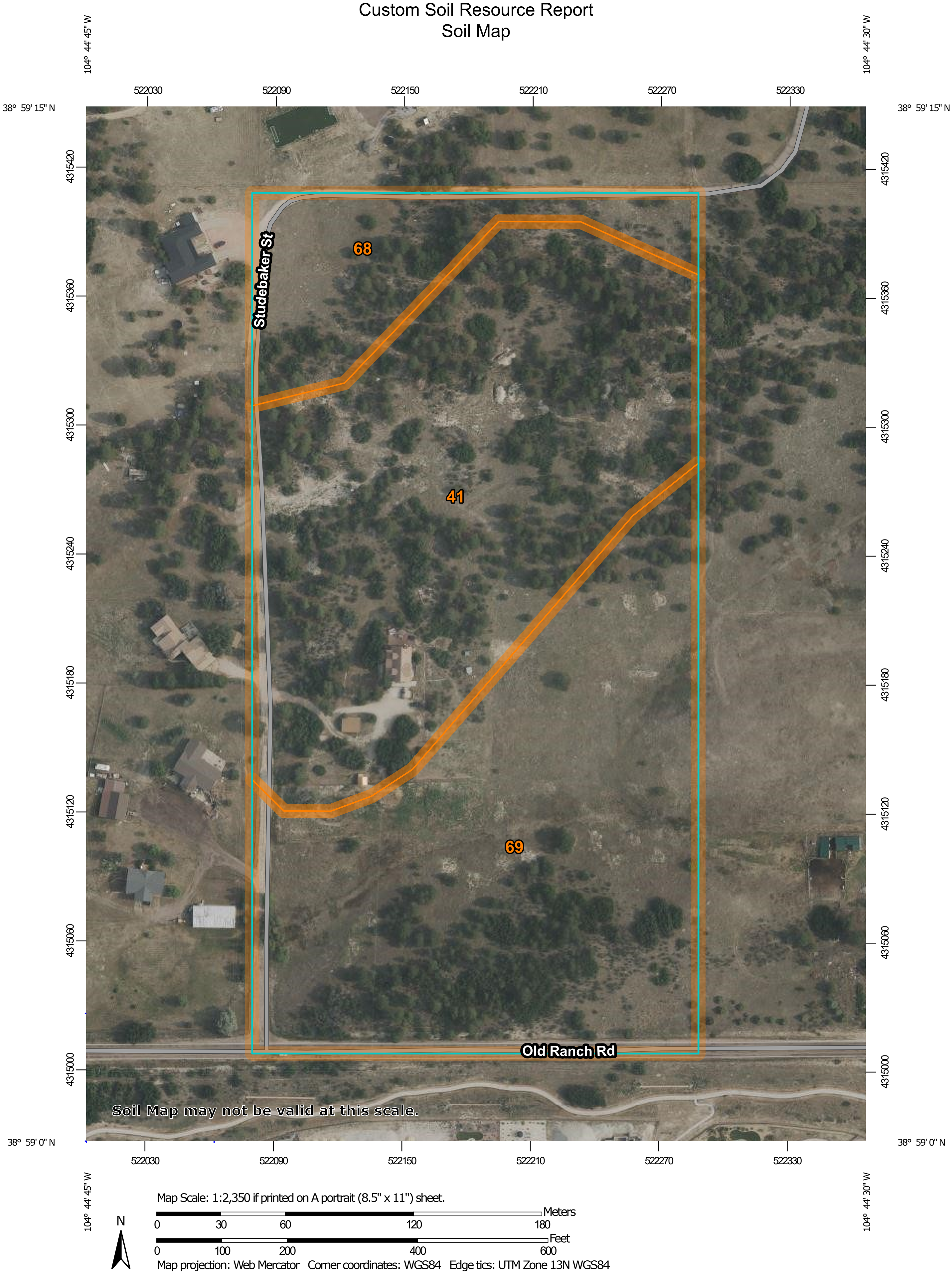
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Soil Map



Map Scale: 1:2,350 if printed on A portrait (8.5" x 11") sheet.

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

MAP LEGEND

Area of Interest (AOI)
Area of Interest (AOI)

Soils
Soil Map Unit Polygons
Soil Map Unit Lines
Soil Map Unit Points

Special Point Features
Blowout
Borrow Pit
Clay Spot
Closed Depression
Gravel Pit
Gravelly Spot
Landfill
Lava Flow
Marsh or swamp
Mine or Quarry
Miscellaneous Water
Perennial Water
Rock Outcrop
Saline Spot
Sandy Spot
Severely Eroded Spot
Sinkhole
Slide or Slip
Sodic Spot
Spoil Area
Stony Spot
Very Stony Spot
Wet Spot
Other
Special Line Features

Water Features
Streams and Canals

Transportation
Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background
Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	9.2	44.6%
68	Peyton-Pring complex, 3 to 8 percent slopes	2.4	11.6%
69	Peyton-Pring complex, 8 to 15 percent slopes	9.1	43.8%
Totals for Area of Interest		**20.7**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

41—Kettle gravelly loamy sand, 8 to 40 percent slopes

Map Unit Setting

National map unit symbol: 368h
Elevation: 7,000 to 7,700 feet
Farmland classification: Not prime farmland

Map Unit Composition

Kettle and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kettle

Setting

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

Typical profile

E - 0 to 16 inches: gravelly loamy sand
Bt - 16 to 40 inches: gravelly sandy loam
C - 40 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 8 to 40 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:

Hydric soil rating: No

68—Peyton-Pring complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369f
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 40 percent
Pring and similar soils: 30 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Description of Pring

Setting

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

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

69—Peyton-Pring complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 369g
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 40 percent
Pring and similar soils: 30 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Peyton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

Typical profile

A - 0 to 12 inches: sandy loam
Bt - 12 to 25 inches: sandy clay loam
BC - 25 to 35 inches: sandy clay loam
C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 8 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R049XY216CO - Sandy Divide
Hydric soil rating: No

Description of Pring

Setting

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

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

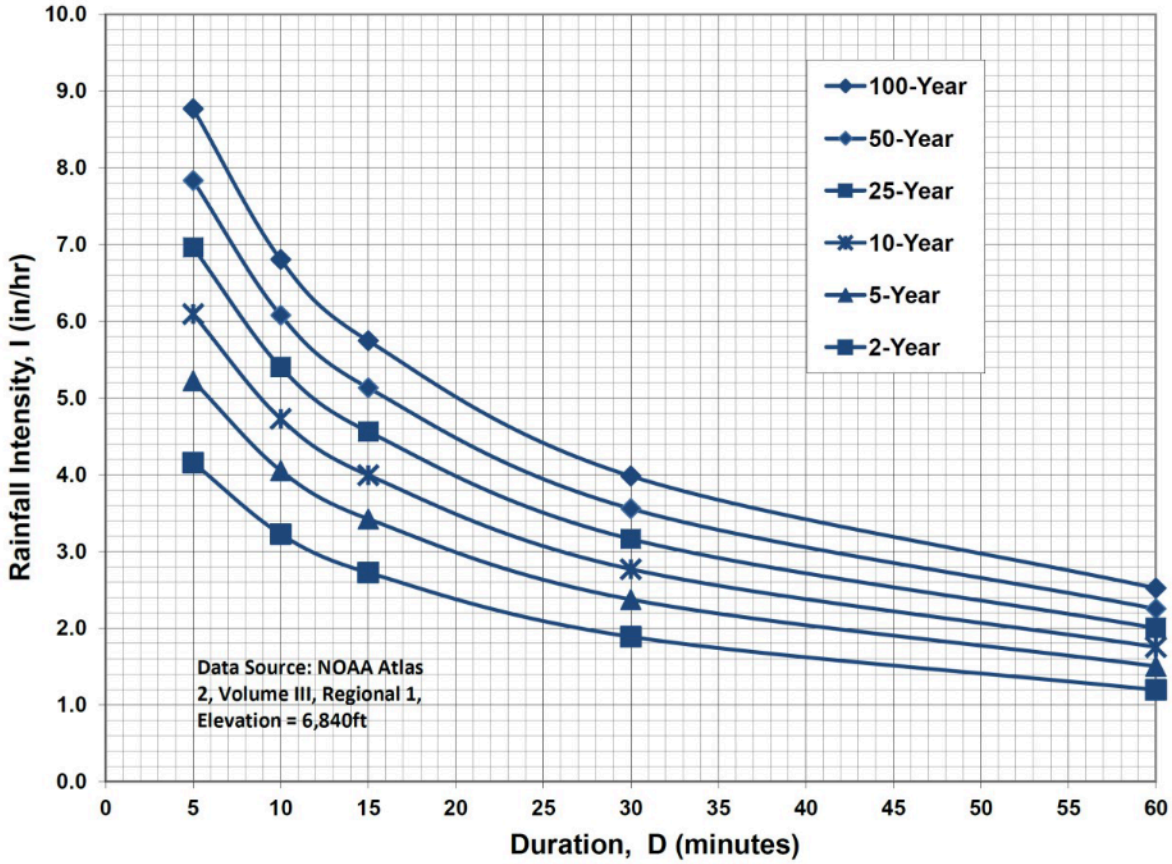
United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

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

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

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

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

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

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

$$I_{5} = -1.50 \ln(D) + 7.583$$

$$I_{2} = -1.19 \ln(D) + 6.035$$

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

Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

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

Type of Structure and Design of Entrance	Coefficient k_e
Pipe, Concrete	
Projecting from fill, socket end (groove end)	0.2
Projecting from fill, square-cut end	0.5
Headwall or headwall and wingwalls	
Socket end of pipe (groove end)	0.2
Square-edged	0.5
Rounded (radius = 1/12D)	0.2
Mitered to conform to fill slope	0.7
*End section conforming to fill slope	0.5
Beveled edges, 33.7-degree to 45-degree bevels	0.2
Side-tapered or slope-tapered inlet	0.2
Pipe, or Pipe-Arch, Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square-edge	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
*End section conforming to fill slope	0.5
Beveled edges, 33.7-degree to 45-degree bevels	0.2
Side-tapered or slope-tapered inlet	0.2

Type of Structure and Design of Entrance	Coefficient k_e
Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls) Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of 1/12 barrel dimension, or beveled edges on 3 sides	0.2
Wingwalls at 30 degrees to 75 degrees to barrel Square-edged at crown	0.4
Crown edge rounded to radius of 1/12 barrel dimension, or beveled top edge	0.2
Wingwall at 10 degrees to 25 degrees to barrel Square-edged at crown	0.5
Wingwall parallel (extension of sides) Square-edged at crown	0.7
Side-tapered or slope-tapered inlet	0.2
*Note: End sections conforming to fill slope are the sections commonly available from manufacturers. From limited hydraulic tests, they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections incorporating a closed taper in their design have a superior hydraulic performance.	
Federal Highway Administration, Hec No. 13	

El Paso County Drainage Basin Fees

Update to 2026 fees

Resolution No. 24-436

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2025 Drainage Fee (per Impervious Acre)	2025 Bridge Fee (per Impervious Acre)
Drainage Basins with DBPS's:					
CHMS0200	Chico Creek	2013	Haegler Ranch	$15,019	$2,217
CHWS1200	Chico Creek	2001	Bennett Ranch	$16,814	$6,450
CHWS1400	Chico Creek	2013	Falcon	$43,094	$5,920
FOFO2000	Fountain Creek	2001	West Fork Jimmy Camp Creek	$18,278	$5,408
FOFO2600	Fountain Creek	1991*	Big Johnson / Crews Gulch	$26,695	$3,447
FOFO2800	Fountain Creek	1988*	Widefield	$26,695	$0
FOFO2900	Fountain Creek	1988*	Security	$26,695	$0
FOFO3000	Fountain Creek	1991*	Windmill Gulch	$26,695	$400
FOFO3100 / FOFO3200	Fountain Creek	1988*	Carson Street / Little Johnson	$16,283	$0
FOFO3400	Fountain Creek	1984*	Peterson Field	$19,254	$1,460
FOFO3600	Fountain Creek	1991*	Fisher's Canyon	$26,695	$0
FOFO4000	Fountain Creek	1996	Sand Creek	$27,554	$11,270
FOFO4200	Fountain Creek	1977	Spring Creek	$13,845	$0
FOFO4600	Fountain Creek	1984*	Southwest Area	$26,695	$0
FOFO4800	Fountain Creek	1991	Bear Creek	$26,695	$1,460
FOFO5800	Fountain Creek	1964	Camp Creek	$2,958	$0
FOMO1000	Monument Creek	1981	Douglas Creek	$16,788	$371
FOMO1200	Monument Creek	1977	Templeton Gap	$17,234	$400
FOMO2000	Monument Creek	1971	Pulpit Rock	$8,852	$0
FOMO2200	Monument Creek	1994	Cottonwood Creek / S. Pine	$26,695	$1,460
FOMO2400	Monument Creek	1966	Dry Creek	$21,074	$763
FOMO3600	Monument Creek	1989*	Black Squirrel Creek	$12,120	$763
FOMO3700	Monument Creek	1987*	Middle Tributary	$22,276	$0
FOMO3800	Monument Creek	1987*	Monument Branch	$26,695	$0
FOMO4000	Monument Creek	1996	Smith Creek	$10,883	$1,460
FOMO4200	Monument Creek	1989*	Black Forest	$26,695	$727
FOMO5200	Monument Creek	1993*	Dirty Woman Creek	$26,695	$1,460
FOMO5300	Fountain Creek	1993*	Crystal Creek	$26,695	$1,460
Miscellaneous Drainage Basins: [1]					
CHBS0800	Chico Creek		Book Ranch	$25,048	$3,626
CHEC0400	Chico Creek		Upper East Chico	$13,646	$395
CHWS0200	Chico Creek		Telephone Exchange	$14,993	$351
CHWS0400	Chico Creek		Livestock Company	$24,696	$294
CHWS0600	Chico Creek		West Squirrel	$12,873	$5,342
CHWS0800	Chico Creek		Solberg Ranch	$26,695	$0
FOFO1200	Fountain Creek		Crooked Canyon	$8,059	$0
FOFO1400	Fountain Creek		Calhan Reservoir	$6,729	$392
FOFO1600	Fountain Creek		Sand Canyon	$4,862	$0
FOFO2000	Fountain Creek		Jimmy Camp Creek[3]	$26,695	$1,249
FOFO2200	Fountain Creek		Fort Carson	$21,074	$763
FOFO2700	Fountain Creek		West Little Johnson	$1,759	$0
FOFO3800	Fountain Creek		Stratton	$12,804	$573
FOFO5000	Fountain Creek		Midland	$21,074	$763
FOFO6000	Fountain Creek		Palmer Trail	$21,074	$763
FOFO6800	Fountain Creek		Black Canyon	$21,074	$763
FOMO4600	Monument Creek		Beaver Creek	$15,959	$0
FOMO3000	Monument Creek		Kettle Creek	$14,416	$0
FOMO3400	Monument Creek		Elkhorn	$2,422	$0
FOMO5000	Monument Creek		Monument Rock	$11,571	$0
FOMO5400	Monument Creek		Palmer Lake	$18,501	$0
FOMO5600	Monument Creek		Raspberry Mountain	$6,223	$0
PLPL0200	Monument Creek		Bald Mountain	$13,262	$0
Interim Drainage Basins: [2]					
FOFO1800	Fountain Creek		Little Fountain Creek	$3,413	$0
FOMO4400	Monument Creek		Jackson Creek	$10,566	$0
FOMO4800	Monument Creek		Teachout Creek	$7,337	$1,103

1. The miscellaneous drainage fee previous to September 1999 resolution was the average of all drainage fees for basins with Basin Planning Studies performed within the last 14 years.

2. Interim Drainage Fees are based upon draft Drainage Basin Planning Studies or the Drainage Basin Identification and Fee Estimation Report. (Best available information suitable for setting a fee.)

Joshua Palmer, P.E.

J·R ENGINEERING
A Subsidiary of Westrian

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
DRAINAGE BASIN PLANNING STUDY
AND
MASTER DEVELOPMENT DRAINAGE PLAN

April 2001
(Minor Text Revisions, October 2002)

Prepared For:

LP47, LLC dba
LA PLATA INVESTMENTS
2315 Briargate Parkway, Suite 100
Colorado Springs, CO 80920
(719) 260-7477

Prepared By:

JR ENGINEERING
4310 ArrowsWest Drive
Colorado Springs, CO 80907
(719) 593-2593

Job No. 8877.10

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
DRAINAGE BASIN PLANNING STUDY
AND
MASTER DEVELOPMENT DRAINAGE PLAN

JR ENGINEERING
A Subsidiary of Westrian

DRAINAGE REPORT STATEMENT

ENGINEER'S STATEMENT:
The attached drainage report was prepared under my direction and supervision and is correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City for drainage reports. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

Vancel Fossinger 3-13-03

Vancel S. Fossinger, Colorado P.E. #31972 Date
For and On Behalf of JR Engineering

COLORADO REGISTERED PROFESSIONAL ENGINEER VANCEL S FOSSINGER 31972

CITY OF COLORADO SPRINGS ONLY:
Filed in accordance with Section 15-3-906 of the Code of the City of Colorado Springs, 1980, as amended.

Tim Mitros Jr. March 18, 2003

City Engineer Date

Conditions:

4310 ArrowsWest Drive, Colorado Springs, CO 80907
719-593-2593 • Fax: 719-528-6613 • www.jrengineering.com

The proposed detention facilities are distributed throughout the watershed in order to mitigate high peak flow rates throughout the conveyance system and thus, limit the size of the required storm drains. The South Tributary will be utilized as an outfall for major flows from the area above proposed Regional Detention Facility "E", but the frequent flows from this area will be routed to Kettle Creek through a storm drain in Old Ranch Road in order to minimize impact to the natural channel of the South Tributary.

Due to concerns about preservation of downstream natural channels in their existing condition, this plan has been structured to regulate peaks release rates from the study area in the 2, 5, 10, 25, 50 and 100-year design storms. Generally accepted practice in this area has been to only regulate flows from large events. Recent regulatory actions such as the listing of the Prebles Meadow Jumping Mouse (PMJM) as a "threatened species" under the Endangered Species Act of 1973, has made it very difficult to modify or make improvements to natural channels that may contain habitat used by the Prebles Meadow Jumping Mouse. Thus, it appears to be prudent to take additional precautions in order to minimize impact to potentially sensitive areas located downstream of proposed development.

B. Fully Developed Condition Plan

1. Sub-Basins D1 through D9A

The study area begins east of future Powers Boulevard. Current land planning is very general for this area. Sub-Basins D1, D2 and D4 are assumed to remain at their current level of development. It is assumed that runoff patterns from this area will remain unchanged with the exception of the upsizing of the culverts under Old Ranch Road to pass the 100-year design storm. Sub-Basins D3 and D5 are planned for very low density residential development. The future street to be constructed along the southern boundary of these basins should be graded to provide the embankments required to detain water in the small proposed ponds labeled as Detention Facilities "A" and "B". Runoff from Sub-Basins D1 through D3 will be routed to and detained in Detention Facility "A" and runoff from Sub-Basins D4 and D5 will be routed to and detained in Detention Facility "B".

Proposed Regional Detention Facility "A" is planned to have a 100-year peak inflow of 165 cfs, a 100-year peak outflow of 65 cfs, and a 100-year storage volume requirement of 4-acre feet.

Proposed Regional Detention Facility "B" is planned to have a 100-year peak inflow of 103 cfs, a 100-year peak outflow of 57 cfs, and a 100-year storage volume requirement of 1-acre feet.

The outflow from Detention Facilities "A" and "B" will be conveyed in proposed storm drains along with runoff collected from Sub-Basins D6 and D7 to proposed Regional Detention Facility "C". Runoff from adjacent Sub-Basin D8 will also be routed to proposed Regional Detention Facility "C". Proposed Regional Detention Facility "C" is planned to have a 100-year peak inflow of 524 cfs, a 100-year peak outflow of 86 cfs, and a 100-year storage volume requirement of 21-acre feet. Outflow from proposed Regional Detention Facility "C" will be conveyed under Powers Boulevard and then to Analysis Point D4 in a proposed storm drain along with runoff from Sub-Basin D9A.

Detention Facility C will be configured such that the overflow that would occur from the 100-year flood being routed through the proposed pond (assuming the pond empty and the normal outlet is clogged at the beginning of the storm) will be routed under Powers Boulevard to Royal Pine Drive a 72" diameter culvert to be constructed with Powers Boulevard. In an overflow event, flow in excess of the capacity of the proposed storm sewer to be constructed in Royal Pine Drive will be conveyed in the street section of Royal Pine Drive to its low point, then across Basin D37 to Old Ranch Road near Chapel Hills Drive then west in Old Ranch Road to Kettle Creek. The excess stormwater will be diverted from the Royal Pine Drive storm drain via a proposed Junction 1 overflow box to be located on the storm drain between proposed Powers Boulevard and Royal Pine Drive. A concept detail of the proposed structure is contained in the appendix of this report. The proposed lots adjacent to proposed Royal Pine Drive should be graded to be a minimum of 1.5 feet above the flow line of adjacent Royal Pine Drive or have a solid wall separating them from Royal Pine modified dams. The primary development impact mitigation measures proposed in this plan is the diversion of runoff from frequent storms to a storm drain system rather than allowing it to be conveyed down this relatively steep natural channel while allowing the perennial flow that supports the vegetation growing in the channel to continue flowing. The proposed outflow structures for the proposed Regional Detention Pond "E" are planned to limit both peak flow rates and volumes that will be released to the natural channel and thus, should minimize potential impacts that development of the study area may have on the channel.

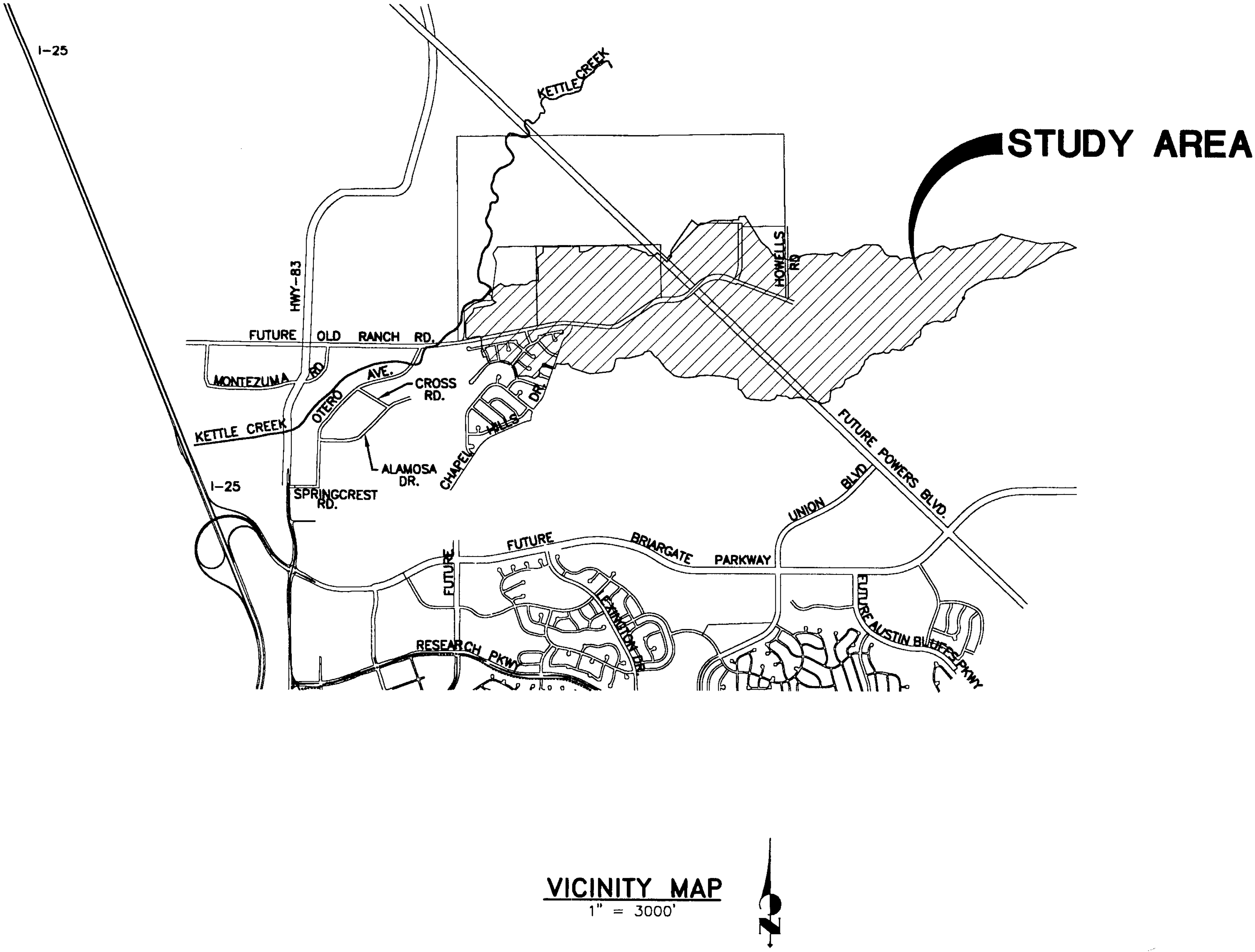
4. Proposed Constraints and Recommendations

a. The following discharge constraints are proposed for the study area:

- Free discharge of developed condition drainage from the study area will be allowed provided that the following criteria is followed.
- Adequate down stream conveyance facilities must exist or be provided in accordance with City of Colorado Springs policy and criteria.
- Runoff must be routed through the regional detention facilities as proposed in this study unless a detailed drainage study demonstrates the adequacy of alternative routing to achieve the discharge goals of this study.
- Land uses must be similar or less intensive than the land uses assumed for the purpose of this study unless a detailed drainage analysis indicates that free discharge from the more intensive land use will not have an adverse affect on the downstream drainage facilities.

b. The following recommendations are made with regard to facilities and sites that emergency overflow from detention ponds will be diverted to:

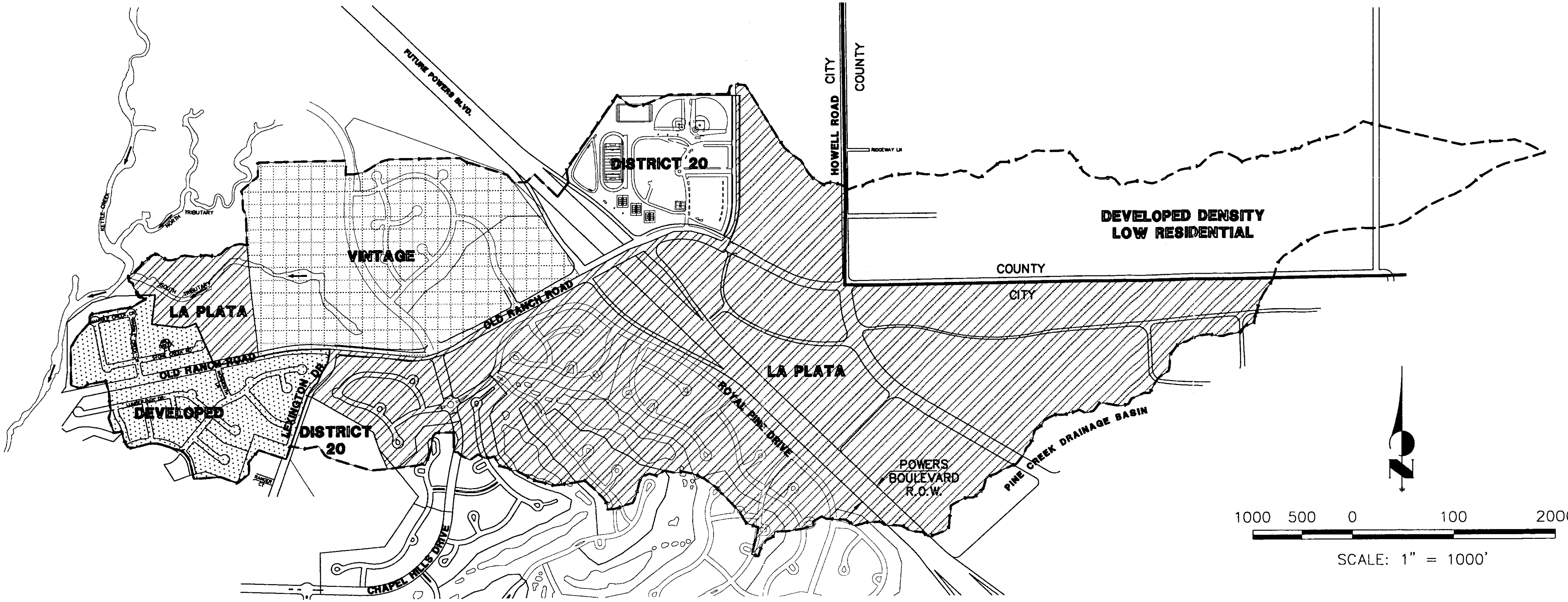
- Lots adjacent to proposed Royal Pine Drive located downstream or adjacent to the outfall from proposed Detention Facility "C" should be graded to be a minimum of 1.5 feet above the adjacent flow line of the street or be hydraulically isolated from the street by a wall or berm or combination of the two.
- An overflow route should be planned and an easement recorded for the same across Basin D37 between the low point of proposed Royal Pine Drive and



VICINITY MAP

1" = 3000'

X880000.ALL8877\10DRAWINGS\VICINITYMAP.DWG DATE 6/8/99



LEGEND

BASIN BOUNDARY	- - - - - - -
DEVELOPED AREA	(dotted pattern)
DISTRICT 20 SCHOOL DISTRICT	(blank)
LP47, LLC dba La Plata Investments	(hatched pattern)
VINTAGE COMMUNITIES	(grid pattern)

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
DRAINAGE BASIN PLANNING STUDY AND
MASTER DEVELOPMENT DRAINAGE PLAN
GENERAL LAND OWNERSHIP IN STUDY AREA

JOB NO. 8877.10
04/18/01
SHEET 1 OF 1

J·R ENGINEERING
A Subsidiary of Westrian
4310 ArrowsWest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax 719-528-6613 • www.jrengineering.com

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
MASTER DEVELOPMENT DRAINAGE PLAN

DEVELOPED CONDITION
ESTIMATED CURVE NUMBERS
4/3/2001

	SUB AREA ONE				SUB AREA TWO				SUB AREA THREE				SUB AREA FOUR							
SUB-BASIN LABEL	ASSUMED LAND USE	ESTIMATED PERCENT IMPERVIOUS	ESTIMATED CN	AREA AC.	ASSUMED LAND USE	ESTIMATED PERCENT IMPERVIOUS	ESTIMATED CN	AREA AC.	ASSUMED LAND USE	ESTIMATED PERCENT IMPERVIOUS	ESTIMATED CN	AREA AC.	ASSUMED LAND USE	ESTIMATED PERCENT IMPERVIOUS	ESTIMATED CN	AREA AC.	TOTAL AREA AC.	TOTAL AREA S.M.	WEIGHTED CN	WEIGHTED INPERV.
D1	<1 DU/AC	5.0	69.0	54.2													54.2	0.085	69.0	5.0
D2	<1 DU/AC	5.0	69.0	34.3	ART. STREET	85.0	93.0	2.3									36.6	0.057	70.5	10.0
D3	2DU/AC	25.0	70.0	14.3	ART. STREET	85.0	93.0	2.3									16.6	0.026	73.2	33.3
D4	<1 DU/AC	5.0	69.0	28.9	ART. STREET	85.0	93.0	1.6									30.5	0.048	70.3	9.2
D5	2DU/AC	25.0	70.0	17.4	ART. STREET	85.0	93.0	1.7									19.1	0.030	72.0	30.3
D6	4DU/AC	40.0	76.0	18.4	SCHOOL	50.0	84.0	6.7									25.1	0.039	78.1	42.7
D7	4DU/AC	40.0	76.0	31.3	ART. STREET	85.0	93.0	8.7	2DU/AC	25.0	70.0	5.5					45.5	0.071	78.5	46.8
D8	MULT FAM	70.0	87.0	6.0	ART. STREET	85.0	93.0	3.4	LI/O	83.0	92.0	25.6	OPEN SPACE	5.0	69.0	4.5	39.5	0.062	88.7	72.3
D9*					ART. ST. PAV.	100.0	99.0	4.9	OPEN SPACE	9.0	69.0	9.0					13.9	0.022	79.6	41.1
D9A	3 DU/AC	30.0	70.0	9.2	STREET PAV.	100.0	99.0	0.8	OPEN SPACE	5.0	69.0	1.4					11.4	0.018	71.9	31.8
D10	<1 DU/AC	5.0	69.0	16.5	ART. STREET	85.0	93.0	0.7									17.2	0.027	70.0	8.3
D11	2DU/AC	25.0	70.0	30.2	ART. STREET	85.0	93.0	2.5									32.7	0.051	71.8	29.6
D12	<1DU/AC	25.0	69.0	11.2	ART. STREET	85.0	93.0	2.1									13.3	0.021	72.8	34.5
D13*	COMMERCIAL	95.0	95.0	10.0	ART. ST. PAV.	100.0	99	4	MULT FAM	70.0	87.0	24.9	OPEN SPACE	5.0	69.0	4.0	42.9	0.067	88.3	72.6
D14*	INTERCHANGE	100.0	99.0	5.0	OPEN SPACE	5.0	69.0	10.0									15.0	0.023	79.0	36.7
D15*	3 DU/AC	30.0	72.0	26.5	OPEN SPACE	5.0	69.0	0.4	ART. ST. PAV.	85.0	93.0	0.7					27.6	0.043	72.5	31.0
D16*	3 DU/AC	30.0	72.0	26.2	GOLF CRS	0.0	61.0	13.1	ART. ST. PAV.	100.0	99.0	0.5					39.8	0.062	68.7	21.0
D16A	3 DU/AC	30.0	70.0	7.5	ART. ST. PAV.	100.0	99.0	0.7									8.2	0.013	72.5	36.0
D17*					ART. ST. PAV.	100.0	99.0	1.9	OPEN SPACE	5.0	69.0	4.6					6.5	0.010	77.8	32.8
D17A*					ART. ST. PAV.	100.0	99.0	3.5	COMMERCIAL	95.0	95.0	2.0	OPEN SPACE	5.0	69.0	1.3	6.8	0.011	92.3	80.9
D18	SCHOOL	38.0	80.0	41.0													41.0	0.064	80.0	38.0
D19	INTERCHANGE	40.0	80.0	15.1													15.1	0.024	80.0	40.0
D20	COMMERCIAL	95.0	95.0	9.2	OPEN SPACE	5.0	69.0	0.7	MULTI FAM	70.0	87.0	8.2	ART. STREET	85.0	93.0	0.8	18.9	0.030	90.5	80.4
D21*	COMMERCIAL	95.0	95.0	12.5	OPEN SPACE	5.0	69.0	4.5	4DU/AC	40.0	76.0	8.0	ART. STREET	85.0	93.0	1.4	26.4	0.041	84.7	62.5
D22*	3 DU/AC	30.0	72.0	19.0					ART STREET	85.0	93.0	4.7					23.7	0.037	76.2	40.9
D23	3 DU/AC	30.0	72.0	1.8	ART. STREET	85.0	93.0	1.7									3.5	0.005	82.2	56.7
D24	3 DU/AC	30.0	72.0	13.3	OPEN SPACE	5.0	69.0	2.8									16.1	0.025	71.5	25.7
D25*	4 DU/AC	40.0	76.0	0.7	SFA 5DU/AC	70.0	87.0	1.4	SCHOOL	50.0	80.0	8.3	ART STREET	85.0	93.0	0.4	10.8	0.017	81.1	53.2
D26	3 DU/AC	30.0	72.0	20.9													20.9	0.033	72.0	30.0
D27	3 DU/AC	30.0	72.0	3.5	ART. STREET	85.0	93.0	1.5									5.0	0.008	78.3	46.5
D28	3 DU/AC	30.0	72.0	1.8	ART. STREET	85.0	93.0	1.0									2.8	0.004	79.5	49.6
D29	3 DU/AC	30.0	72.0	2.5	4 DU/AC	40.0	76.0	9.1									11.6	0.018	75.1	37.8
D30	3 DU/AC	30.0	72.0	9.0	OPEN SPACE	5.0	69.0	2.0									11.0	0.017	71.5	25.5
D31	4 DU/AC	40.0	76.0	4.5													4.5	0.007	76.0	40.0
D32	OPEN SPACE	5.0	69.0	3.7													3.7	0.006	69.0	5.0
D33*	3 DU/AC	30.0	72.0	5.0	OPEN SPACE	5.0	76.0	18.3									23.3	0.036	75.1	10.4
D34	3 DU/AC	30.0	72.0	21.8	ART. STREET	85.0	93.0	2.9									24.7	0.039	74.5	36.5
D35	4 DU/AC	40.0	76.0	24.7													24.7	0.039	76.0	40.0
D36*	3 DU/AC	30.0	72.0	6.5	ART STREET	85.0	93.0	1.2	GOLF CRS	0.0	61.0	7.5					15.2	0.024	68.2	19.5
D37*	COMMERCIAL	95.0	95.0	5.5	ART STREET	85.0	93.0	1.3									6.8	0.011	94.6	93.1
																	812.0	1.3		

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
MASTER DEVELOPMENT DRAINAGE PLAN
FULLY DEVELOPED CONDITION OUTPUT SUMMARY AND CURVE NUMBER ADJUSTMENT

3/27/2001

TYPE IIa 24HR STRM @3 MIN. TIME STEP

SUB BASIN I.D.	AREA (sq miles)	AREA (acres)	IMPERVIOUS PERCENT	COMPUTED CN	ADJUSTED CN	COMPUTED C_{100}	TC (min)	LAG (hours)	HEC1 MODEL W/ COMPUTED CN Q_{100} (cfs)	HEC1 MODEL W/ COMPUTED CN Q_{100}/ACRE (cfs)	HEC1 MODEL W/ ADJUSTED CN Q_{100} (cfs)	HEC1 MODEL W/ ADJUSTED CN Q_{100}/ACRE (cfs)	I_{100} (in/hr)	RATIONAL METHOD Q_{100} (cfs/AC)	COMPUTED HEC1 VS. RATIONAL PERCENT	ADJUSTED HEC1 VS. RATIONAL PERCENT	COMPUTED RATIONAL Q100
D1	0.085	54.2	5.0	69.0	67.5	0.38	38.34	0.383	78	1.44	72	1.33	3.49	1.33	8	0	72
D2	0.057	36.6	10.0	70.5	69.0	0.41	22.41	0.224	78	2.13	72	1.97	4.79	1.96	8	0	72
D3	0.026	16.6	33.3	73.2	75.0	0.55	26.70	0.267	37	2.23	40	2.41	4.34	2.38	-7	1	40
D4	0.048	30.5	9.2	70.3	68.2	0.41	24.46	0.245	62	2.03	56	1.84	4.56	1.85	9	-1	56
D5	0.030	19.1	30.3	72.0	74.5	0.53	23.90	0.239	42	2.20	47	2.46	4.62	2.46	-12	0	47
D6	0.039	25.1	42.7	78.1	79.2	0.61	16.43	0.164	82	3.27	86	3.43	5.63	3.41	-5	0	86
D7	0.071	45.5	46.8	78.5	79.8	0.63	17.31	0.173	149	3.27	157	3.45	5.49	3.46	-6	0	157
D8	0.062	39.5	72.3	88.7	92.2	0.78	11.12	0.111	193	4.89	208	5.27	6.76	5.30	-8	-1	209
D9*	0.022	13.9	41.1	79.6	77.0	0.60	25.09	0.251	42	3.02	37	2.66	4.49	2.68	11	-1	37
D9A*	0.018	11.4	31.8	71.9	74.5	0.54	21.27	0.213	27	2.37	30	2.63	4.92	2.66	-12	-1	30
D10	0.027	17.2	8.3	70.0	68.0	0.40	30.69	0.307	30	1.74	27	1.57	4.00	1.60	8	-2	27
D11	0.051	32.7	29.6	71.8	74.2	0.53	23.11	0.231	73	2.23	81	2.48	4.70	2.48	-11	0	81
D12	0.021	13.3	34.5	72.8	74.6	0.56	28.05	0.281	28	2.11	31	2.33	4.21	2.35	-11	-1	31
D13*	0.067	42.9	72.6	88.3	91.5	0.79	12.33	0.123	204	4.76	219	5.10	6.46	5.07	-7	1	218
D14*	0.023	15.0	36.7	79.0	78.0	0.57	15.83	0.158	51	3.40	49	3.27	5.74	3.27	4	0	49
D15*	0.043	27.6	31.0	72.5	75.0	0.54	19.99	0.200	68	2.46	75	2.72	5.09	2.73	-11	0	75
D16*	0.062	39.8	21.0	68.7	72.5	0.48	19.69	0.197	83	2.09	98	2.46	5.13	2.44	-17	1	97
D16A*	0.013	8.2	36.0	72.5	78.0	0.57	14.31	0.143	23	2.80	28	3.41	6.03	3.41	-22	0	28
D17*	0.010	6.5	32.8	77.8	76.5	0.55	11.65	0.117	22	3.38	25	3.85	6.63	3.62	-7	6	24
D17A	0.010	6.7	80.9	92.3	99.0	0.84	11.95	0.120	33	4.93	36	5.37	6.55	5.47	-11	-2	37
D18	0.064	41.0	38.0	80.0	76.3	0.58	25.24	0.252	123	3.00	106	2.59	4.48	2.59	14	0	106
D19	0.024	15.1	40.0	80.0	80.9	0.59	12.16	0.122	50	3.31	59	3.91	6.50	3.83	-16	2	58
D20	0.030	18.9	80.4	90.5	96.5	0.83	10.83	0.108	98	5.19	107	5.66	6.84	5.69	-10	-1	108
D21*	0.041	26.4	62.5	84.7	86.5	0.73	13.68	0.137	111	4.20	117	4.43	6.16	4.46	-6	-1	118
D22*	0.037	23.7	40.9	76.2	78.5	0.60	15.64	0.156	74	3.12	81	3.42	5.77	3.44	-10	-1	81
D23	0.005	3.5	56.7	82.2	88.0	0.69	11.05	0.111	13	3.71	15	4.29	6.78	4.68	-26	-9	16
D24	0.025	16.1	25.7	71.5	74.5	0.50	15.06	0.151	42	2.61	48	2.98	5.88	2.97	-14	1	48
D25	0.017	10.8	53.2	81.1	82.2	0.67	15.60	0.156	40	3.70	42	3.89	5.78	3.87	-4	1	42
D26	0.033	20.9	30.0	72.0	75.5	0.53	14.46	0.145	57	2.73	66	3.16	6.00	3.18	-17	-1	66
D27	0.008	5.0	46.5	78.3	80.0	0.63	14.35	0.144	18	3.60	19	3.80	6.02	3.79	-5	0	19
D28	0.004	2.8	49.6	79.5	84.0	0.65	13.71	0.137	9	3.21	11	3.93	6.15	3.98	-24	-1	11
D29	0.018	11.6	37.8	75.1	78.2	0.58	14.57	0.146	35	3.02	40	3.45	5.98	3.45	-14	0	40
D30	0.017	11.0	25.5	71.5	74.4	0.50	15.72	0.157	28	2.55	32	2.91	5.76	2.90	-14	0	32
D31	0.007	4.5	40.0	76.0	78.5	0.59	14.55	0.146	14	3.11	16	3.56	5.98	3.53	-13	1	16
D32	0.006	3.7	5.0	69.0	68.0	0.38	11.45	0.115	10	2.70	9	2.43	6.68	2.54	6	-4	9
D33*	0.036	23.3	10.4	75.1	70.2	0.41	13.83	0.138	72	3.09	59	2.53	6.13	2.53	18	0	59
D34	0.039	24.7	36.5	74.5	77.0	0.57	15.92	0.159	73	2.96	80	3.24	5.72	3.26	-10	-1	80
D35	0.039	24.7	40.0	76.0	78.0	0.59	16.11	0.161	77	3.12	83	3.36	5.69	3.36	-8	0	83
D36*	0.024	15.2	19.5	68.2	72.0	0.47	23.74	0.237	28	1.84	34	2.24	4.63	2.16	-17	3	33
D37	0.011	6.8	93.1	94.6	99.0	0.91	12.41	0.124	36	5.29	40	5.88	6.44	5.85	-11	1	40
TOTAL	1.258	812.000															

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
MASTER DEVELOPMENT DRAINAGE PLAN

HISTORIC (UNDEVELOPED) CONDITION LAG TIME ESTIMATE

5/6/1999

BASIN	OVERLAND FLOW				GRASS LINED SWALE				NATURAL CHANNEL					TOTAL	TOTAL	TOTAL
ID.	L (ft)	C(10YR)	S (%)	TC(min)	L (ft)	S (%)	V (fps)	TC(min)	TYPE	L (ft)	S(%)	V (fps)	TC(min)	TC(min)	LAG(min.)	LAG(hrs)
H1	500	0.25	2.2	26.37	2060	4.1	3.0	11.44	1	1260	2.9	5.0	4.20	42.02	25.21	0.420
H2	500	0.25	5.6	19.38	1350	4.6	3.2	7.03	2	1510	2.4	6.5	3.87	30.28	18.17	0.303
H3	500	0.25	5.2	19.86	550	4.7	3.2	2.86	1	2350	3.1	4.5	8.70	31.42	18.85	0.314
H4	350	0.25	8.6	14.07				0.00	1	1900	2.9	6.7	4.73	18.80	11.28	0.188
H5	500	0.25	6.2	18.74	930	4.8	3.3	4.70	1	1540	4.5	5	5.13	28.57	17.14	0.286
H6	500	0.25	4.2	21.31	3330	4.3	3.1	17.90					0.00	39.21	23.53	0.392
H7	500	0.25	3.4	22.84	2040	3.1	2.6	13.08	3				0.00	35.92	21.55	0.359
H8	500	0.25	5	20.11	760	2.9	2.6	4.87	3	2140	3	3.7	9.64	34.63	20.78	0.346
H9	500	0.25	6.4	18.54	590	5.8	3.7	2.66	3	3230	2.9	6.3	8.54	29.74	17.85	0.297
H10	500	0.25	10	16.00	320	13	5.2	1.03	2	2170	4.6	8	4.52	21.55	12.93	0.215
H11	500	0.25	2.2	26.37	800	2.4	2.4	5.56	2	3750	5.6	6.8	9.19	41.12	24.67	0.411
H12	500	0.25	4.4	20.98	3250	3.8	3.1	17.47	2	600	8.3	8	1.25	39.70	23.82	0.397

UPPER OVERLAND FLOW (TC=1.8*(1.1-C10)(*L^.5)*S^-.33)

GRASS LINED SWALE VELOCITIES BASED ON SCS TR 55 CHART
FLOW RATE

NATURAL CHANNEL VELOCITIES BASED ON MANNINGS SOLUTION FOR AN APPROXIMATE AVERAGE
SECTION CARRYING AN ESTIMATED FLOW RATE "n" VARIES FROM .040 TO .070 DEPENDING ON LOCATION

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
MASTER DEVELOPMENT DRAINAGE PLAN

DEVELOPED CONDITION LAG TIME ESTIMATE

3/8/2001

BASIN	OVERLAND FLOW				SWALE OR STREET					CHANNEL OR STORM DRAIN					TOTAL	TOTAL	TOTAL
ID.	L (ft)	C(10YR)	S (%)	TC(min)	TYPE	L (ft)	S (%)	V (fps)	TC(min)	TYPE	L (ft)	S(%)	V (fps)	TC(min)	TC(min)	LAG(min.)	LAG(hrs)
D1	500	0.25	2.2	27.40	SWALE	2100	4.1	3.2	10.94					0.00	38.34	23.00	0.383
D2	500	0.25	7.8	18.04	SWALE	970	4.9	3.7	4.37					0.00	22.41	13.45	0.224
D3	300	0.25	2.7	19.84	SWALE	1400	4.4	3.4	6.86					0.00	26.70	16.02	0.267
D4	500	0.25	8	17.89	SWALE	1260	4.1	3.2	6.56					0.00	24.46	14.67	0.245
D5	300	0.25	3.3	18.57	SWALE	400	3.5	2.7	2.47	CHAN	1030	3.7	6	2.86	23.90	14.34	0.239
D6	100	0.25	2	12.65	STREET	1550	3.8	6.8	3.79					0.00	16.43	9.86	0.164
D7	100	0.25	2	12.65	STREET	1550	2.5	5.5	4.67					0.00	17.31	10.39	0.173
D8	300	0.75	3	7.89	STREET	830	3	6.1	2.28	SD	800	3	14	0.95	11.12	6.67	0.111
D9*	400	0.25	5	18.69	STREET	1900	2	4.9	6.40					0.00	25.09	15.05	0.251
D9A	150	0.25	2	15.49	STREET	1800	2.2	5.2	5.78					0.00	21.27	12.76	0.213
D10	500	0.25	4	22.49	SWALE	1230	2.6	2.5	8.20					0.00	30.69	18.42	0.307
D11	200	0.25	2	17.88	STREET	1300	1.4	4.1	5.23					0.00	23.11	13.87	0.231
D12	500	0.25	4	22.49	SWALE	900	3.4	2.7	5.56					0.00	28.05	16.83	0.280
D13*	300	0.75	2	9.02	STREET	1000	2.7	5.8	2.90	SD	300	2	12	0.42	12.33	7.40	0.123
D14*	100	0.25	2	12.65	STREET	780	2	4.9	2.63	SD	400	2	12	0.56	15.83	9.50	0.158
D15*	120	0.25	2	13.85	STREET	2000	2.5	5.5	6.02	SD	50	1	7	0.12	19.99	12.00	0.200
D16	120	0.25	2	13.85	SWALE	2100	3	6.0	5.83					0.00	19.69	11.81	0.197
D16A	100	0.25	2	12.65	SWALE	600	3	6.0	1.67					0.00	14.31	8.59	0.143
D17	50	0.25	10	5.26	STREET	1900	2	4.9	6.40					0.00	11.65	6.99	0.117
D17A	50	0.25	2	8.94	STREET	1000	2.5	5.5	3.01					0.00	11.95	7.17	0.120
D18	300	0.25	2.0	21.90						CHAN	1200	3	6.00	3.33	25.24	15.14	0.252
D19	300	0.8	1.7	8.16	STREET	1500	3.6	6.6	3.76	SD	200	3	14	0.24	12.16	7.30	0.122
D20	300	0.75	2	9.02	STREET	600	2.5	5.5	1.81					0.00	10.83	6.50	0.108
D21	300	0.68	2	10.82	STREET	950	2.5	5.5	2.86					0.00	13.68	8.21	0.137
D22	100	0.25	2	12.65	STREET	1100	3.6	6.6	2.76	SD	200	3	14	0.24	15.64	9.39	0.156
D23	100	0.25	5	9.35	STREET	800	5	7.8	1.70					0.00	11.05	6.63	0.110
D24	100	0.25	2	12.65	STREET	950	3.5	6.5	2.42					0.00	15.06	9.04	0.151
D25*	100	0.25	2	12.65	STREET	900	3	6.1	2.47	SD	400	2.5	14	0.48	15.60	9.36	0.156

F.

HEC-1 MODEL OUTPUT
FULLY DEVELOPED CONDITION

- **100-YEAR STORM**

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             MAY   1991               *
*          VERSION 4.0.1E              *
*                                      *
* RUN DATE  10/21/2002  TIME  15:02:17 *
*                                      *
****************************************
```

```
***************************************
*                                     *
*   U.S. ARMY CORPS OF ENGINEERS      *
*   HYDROLOGIC ENGINEERING CENTER     *
*         609 SECOND STREET           *
*      DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104            *
*                                     *
***************************************
```

```
X     X  XXXXXXX   XXXXX         X
X     X  X        X     X       XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX        XXX
```

```
::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
:::                                    :::
:::  Full Microcomputer Implementation :::
:::                by                  :::
:::       Haestad Methods, Inc.        :::
:::                                    :::
::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

HEC-1 INPUT   PAGE 1

```
        LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

           1       ID   KETTLE CREEK OLD RANCH RD. TRIBUTARY WATERSHED IN PROJECTED FULLY DEVELOPED
           2       ID   CONDITION (100 YEAR 24 HOUR RAINFALL, TYPE IIa SCS DISTRIBUTION)
           3       ID   FILE NAME:KCD500.DAT
           4       ID   3 MINUTE TIME STEP USED DUE TO SMALL SIZE OF BASINS, THIS LIMITS OUTPUT TO
           5       ID   FIRST 15 HOURS OF DESIGN STORM
           6       ID   ***************************************************************************
           7       ID   BEGIN CALCULATIONS IN THE SOUTH TRIBUTARY WATERSHED
           8       ID   ***************************************************************************
*** FREE ***
                   *DIAGRAM
           9       IT       3       0       0     300
          10       IO       5
          11       PG       2     4.4
          12       PG       1       0
          13       IN      15
          14       PC    0000   .0005   .0015   .0030   .0045   .0060   .0080   .0100   .0120   .0143
          15       PC   .0165   .0188   .0210   .0233   .0255   .0278   .0320   .0390   .0460   .0530
          16       PC   .0600   .0750   .1000   .4000   .7000   .7250   .7500   .7650   .7800   .7900
          17       PC   .8000   .8100   .8200   .8250   .8300   .8350   .8400   .8450   .8500   .8550
          18       PC   .8600   .8638   .8675   .8713   .8750   .8788   .8825   .8863   .8900   .8938
```

```
 19          PC   .8975   .9013   .9050   .9083   .9115   .9148   .9180   .9210   .9240   .9270
 20          PC   .9300   .9325   .9350   .9375   .9400   .9425   .9450   .9475   .9500   .9525
 21          PC   .9550   .9575   .9600   .9625   .9650   .9675   .9700   .9725   .9750   .9775
 22          PC   .9800   .9813   .9825   .9838   .9850   .9863   .9875   .9888   .9900   .9913
 23          PC   .9925   .9938   .9950   .9963   .9975   .9988   1.000

 24          KK   SB-D1
 25          KM   COMPUTE HYDROGRAPH FOR BASIN D1
 26          BA    .085
 27          PR       1
 28          PW       1
 29          PT       2
 30          PW       1
 31          LS       0    67.5
 32          UD    .383

 33          KK RT-SBD1
 34          KM   ROUTE THE FLOW FROM SB-D1 TO AP-D1
 35          RD    1200    .045    .029            TRAP      10      10

 36          KK   SB-D2
 37          KM   COMPUTE HYDROGRAPH FOR BASIN D2
 38          BA   0.057
 39          PR       1
 40          PW       1
 41          PT       2
 42          PW       1
 43          LS       0    69.0
 44          UD    .224
                                     HEC-1 INPUT                                        PAGE  2

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 45          KK   AP-D1
 46          KM   COMBINE THE FLOW FROM BASIN D2 WITH THE ROUTED FLOW FROM BASIN D1 AT AP-D1
 47          HC       2

 48          KK   SB-D3
 49          KM   COMPUTE HYDROGRAPH FOR BASIN D3
 50          BA   0.026
 51          PR       1
 52          PW       1
 53          PT       2
 54          PW       1
 55          LS       0      75
 56          UD    .267

 57          KK  AP-DDA
 58          KM   COMBINE THE FLOW FROM BASIN D3 WITH THE FLOW FROM AP-D1
 59          HC       2

 60          KK  RR-DFA
 61          KM   ROUTE FLOW THROUGH A PROPOSED SMALL DETENTION FACILITY
 62          KM   ASSUME A 30" DIA OUTLET WITH INVERT AT EL. 54. OUTLET Q ESTIMATED WITH
 63          KM   BUREAU OF PUBLIC ROADS NOMOGRAPH FOR INLET CONTROL OF CULVERTS. VOLUME
 64          KM   BASED ON VERY CONCEPTUAL PLAN THAT ASSUMES A ROAD EMBANKMENT WILL SERVE
 65          KM   AS A DAM AND THE GRADING BEHIND THE EMBANKMENT WILL REMAIN AS IS.
 66          KO       1       1
 67          RS       1    STOR       0
 68          SV       0     .08    0.44    1.23    2.59    4.64     7.4
 69          SE      54      56      58      60      62      64      66
 70          SQ       0      37      43      50      60      68      75

 71          KKRT-APDFA
 72          KM   ROUTE THE FLOW FROM AP-DFA TO AP-D2
 73          RD    1000     .02    .013            CIRC     2.5

 74          KK   SB-D6
 75          KM   COMPUTE HYDROGRAPH FOR BASIN D6
 76          BA   0.039
 77          PR       1
 78          PW       1
 79          PT       2
 80          PW       1
 81          LS       0    79.2
 82          UD    .164
```

```
  83          KK    AP-D2
  84          KM    COMBINE THE FLOW FROM BASIN D6 WITH THE ROUTED FLOW FROM DFA
  85          HC        2

  86          KK RT-APD2
  87          KM    ROUTE THE FLOW FROM AP-D2 TO AP-D3
  88          RD     1600      .02     .013            CIRC        4
                                    HEC-1 INPUT                                   PAGE  3

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  89          KK    SB-D7
  90          KM    COMPUTE HYDROGRAPH FOR BASIN D7
  91          BA    0.071
  92          PR        1
  93          PW        1
  94          PT        2
  95          PW        1
  96          LS        0     79.8
  97          UD     .173

  98          KK    SB-D4
  99          KM    COMPUTE HYDROGRAPH FOR BASIN D4
 100          BA    0.048
 101          PR        1
 102          PW        1
 103          PT        2
 104          PW        1
 105          LS        0     68.2
 106          UD     .245

 107          KK    SB-D5
 108          KM    COMPUTE HYDROGRAPH FOR BASIN D5
 109          BA    0.030
 110          PR        1
 111          PW        1
 112          PT        2
 113          PW        1
 114          LS        0     74.5
 115          UD     .239

 116          KK   AP-DFB
 117          KM    COMBINE THE FLOW FROM BASIN D5 WITH THE FLOW FROM BASIN D4
 118          HC        2

 119          KK   RR-DFB
 120          KM    ROUTE FLOW THROUGH A PROPOSED SMALL DETENTION FACILITY
 121          KM    ASSUME A 30" DIA OUTLET WITH INVERT AT EL.19. OUTLET Q ESTIMATED WITH
 122          KM    BUREAU OF PUBLIC ROADS NOMOGRAPH FOR INLET CONTROL OF CULVERTS. VOLUME
 123          KM    BASED ON VERY CONCEPTUAL PLAN THAT ASSUMES A ROAD EMBANKMENT WILL SERVE
 124          KM    AS A DAM AND THE GRADING BEHIND THE EMBANKMENT WILL REMAIN AS IS.
 125          KO        1        1
 126          RS        1     STOR        0
 127          SV        0      .02     0.18     0.69     1.44     3.23
 128          SE       19       20       22       24       26       28
 129          SQ        0       37       43       50       60       68

 130          KKRT-APDFB
 131          KM    ROUTE THE FLOW FROM DFB TO AP3
 132          RD      800      .02     .013            CIRC      2.5
                                    HEC-1 INPUT                                   PAGE  4

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 133          KK    AP-D3
 134          KM    COMBINE THE ROUTED FLOW FROM DF-B WITH THE ROUTED FLOW FROM AP-D2 AND
 135          KM    BASIN D7
 136          HC        3

 137          KK RT-APD3
 138          KM    ROUTE THE FLOW FROM AP-D3 TO AP-DFC
 139          RD      600      .02     .013            CIRC      5.5

 140          KK    SB-D8
```

```
 141          KM   COMPUTE HYDROGRAPH FOR BASIN D8
 142          BA   0.062
 143          PR       1
 144          PW       1
 145          PT       2
 146          PW       1
 147          LS       0     92.2
 148          UD    .111

 149          KK  AP-DFC
 150          KM   COMBINE THE ROUTED FLOW FROM AP-3 WITH THE FLOW FROM BASIN D8
 151          HC       2

 152          KK  RR-DFC
 153          KM   ROUTE FLOW THROUGH A PROPOSED REGIONAL DETENTION FACILITY ADJACENT TO POWERS
 154          KM   BLVD. ASSUME A 30" DIA OUTLET WITH INVERT AT EL. 51. OUTLET Q ESTIMATED WITH
 155          KM   BUREAU OF PUBLIC ROADS NOMOGRAPH FOR INLET CONTROL OF CULVERTS. VOLUME
 156          KM   BASED ON VERY CONCEPTUAL GRADING PLAN.
 157          KO       1       1
 158          RS       1    STOR       0
 159          SV       0      .9     2.1     3.4     6.3     9.7    13.6    17.8    22.6    27.8
 160          SE      52      54      55      56      58      60      62      64      66      68
 161          SQ       0      28      37      45      58      66      74      81      88      94

 162          KK  RT-DFC
 163          KM   ROUTE THE FLOW FROM DFC TO AP-D4
 164          RD     950    0.01   0.013            CIRC     3.5

 165          KK  SB-D9A
 166          KM   COMPUTE HYDROGRAPH FOR BASIN D9A
 167          BA   0.018
 168          PR       1
 169          PW       1
 170          PT       2
 171          PW       1
 172          LS       0     74.5
 173          UD   0.213

 174          KK   AP-D4
 175          KM   COMBINE THE FLOW FROM BASIN D9A WITH THE ROUTED FLOW FROM AP-DFC
 176          HC       2
```



```
 177          KK RT-APD4
 178          KM   ROUTE THE FLOW FROM AP-D4 TO THE DOWNSTREAM END OF BASIN D9
 179          RD     700    .027    .013            CIRC     3.5

 180          KK   SB-D9
 181          KM   COMPUTE HYDROGRAPH FOR BASIN D9
 182          BA   0.022
 183          PR       1
 184          PW       1
 185          PT       2
 186          PW       1
 187          LS       0       77
 188          UD   0.251

 189          KK  AP-D4a
 190          KM   COMBINE THE FLOW FROM BASIN D9 WITH THE ROUTED FLOW FROM AP-D4
 191          HC       2

 192          KKRT-APD4a
 193          KM   ROUTE THE FLOW FROM THE DOWNSTREAM END OF BASIN D9 TO THE DOWNSTREAM END OF
 194          KM   BASIN D15
 195          RD     500    .027    .013            CIRC     3.5

 196          KK  SB-D15
 197          KM   COMPUTE HYDROGRAPH FOR BASIN D15
 198          BA   0.043
 199          PR       1
 200          PW       1
 201          PT       2
 202          PW       1
 203          LS       0       75
```

```
UD   0.200

KK  AP-D4b
KM   COMBINE THE FLOW FROM BASIN D15 WITH THE ROUTED FLOW FROM AP4  AND BASIN D9
HC       2

KKRT-APD4b
KM   ROUTE THE FLOW FROM THE DOWNSTREAM END OF BASIN D15 TO AP7
RD      500     .027    .013                CIRC      6.0

KK  SB-D10
KM   COMPUTE HYDROGRAPH FOR BASIN D10
BA   0.027
PR       1
PW       1
PT       2
PW       1
LS       0        68
UD     .307
                                   HEC-1 INPUT                                              PAGE  6

LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KKRT-SBD10
KM   ROUTE THE FLOW FROM SB-D10 TO AP-D5 ASSUME FLOW IS ROUTED IN A RESIDENTIAL
KM   STREET SECTION  USE A ROUGH EQUIVILENT TRAPAZOIDAL SECTION TO MODEL
RD     1200      .04    .017                TRAP        0       50

KK  SB-D11
KM   COMPUTE HYDROGRAPH FOR BASIN D11
BA   0.051
PR       1
PW       1
PT       2
PW       1
LS       0     74.2
UD     .231

KK  SB-D12
KM   COMPUTE HYDROGRAPH FOR BASIN D12
BA   0.021
PR       1
PW       1
PT       2
PW       1
LS       0     74.6
UD     .281

KKRT-SBD12
KM   ROUTE THE FLOW FROM SB-D12 TO AP-D5 ASSUME FLOW IS ROUTED IN THE NORTH SIDE
KM   OF THE OLD RANCH ROAD STREET SECTION USE A ROUGH EQUIVILENT TRAPAZOIDAL
KM   SECTION TO MODEL
RD     1200     .038    .017                TRAP        0       25

KK   AP-D5
KM   COMBINE THE FLOW FROM BASIN D11 WITH THE ROUTED FLOW FROM BASINS D10 AND D12
KM   AT THE INTERSECTION OF OLD RANCH RD. AND THE STREET TO THE HIGH SCHOOL
HC       3

KK RT-APD5
KM   ROUTE THE FLOW FROM AP-D5 TO AP-D6
RD      700      .03    .013                CIRC      5.0

KK  SB-D13
KM   COMPUTE HYDROGRAPH FOR BASIN D13
BA   0.067
PR       1
PW       1
PT       2
PW       1
LS       0     91.5
UD     .123
                                   HEC-1 INPUT                                              PAGE  7

LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
```

```
KK   AP-D6
KM   COMBINE THE ROUTED FLOW FROM AP-D5 WITH THE FLOW FROM BASIN D13 AT AP-D6
HC       2

KK RT-APD6
KM    ROUTE THE FLOW FROM AP-D6 TO AP-D7
RD     1100     0.02   0.013              CIRC      6.0

KK  SB-D14
KM   COMPUTE HYDROGRAPH FOR BASIN D14
BA   0.023
PR       1
PW       1
PT       2
PW       1
LS       0       78
UD   0.158

KKRT-SBD14
KM    ROUTE THE FLOW FROM BASIN D14 TO AP-D7
RD      300     .02    .013               CIRC        2

KK   AP-D7
KM   COMBINE THE ROUTED FLOW FROM BASIN D14 WITH THE ROUTED FLOW AT AP-D7
HC       3

KK RT-APD7
KM    ROUTE THE FLOW FROM AP-D7 TO AP-D7A
RD      850     0.02   0.013              CIRC        7

KK  SB-D17
KM   COMPUTE HYDROGRAPH FOR BASIN D17
BA   0.010
PR       1
PW       1
PT       2
PW       1
LS       0     80.5
UD   0.117

KK  AP-D7A
KM   COMBINE THE FLOW FROM BASIN D17 WITH THE ROUTED FLOW AT AP-D7A
HC       2

KK SB-D16A
KM   COMPUTE HYDROGRAPH FOR BASIN D16A
BA   0.013
PR       1
PW       1
PT       2
PW       1
LS       0       78
UD   0.143
                                   HEC-1 INPUT                                   PAGE  8

LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK  AP-D7A
KM   COMBINE THE ROUTED FLOW FROM BASIN D16A WITH THE ROUTED FLOW AT AP-D7A
HC       2

KK RT-APD8
KM    ROUTE THE FLOW FROM AP-D7A TO AP-D8
RD      500    0.015   0.013              CIRC        7

KK SB-D17A
KM   COMPUTE HYDROGRAPH FOR BASIN D17A
BA   0.010
PR       1
PW       1
PT       2
PW       1
LS       0       99
UD   0.120
```

```
KK   AP-D8
KM   COMBINE THE FLOW FROM BASIN D17A WITH THE ROUTED FLOW AT AP-D8
HC       2

KK  SB-D16
KM   COMPUTE HYDROGRAPH FOR BASIN D16
BA   0.062
PR       1
PW       1
PT       2
PW       1
LS       0     72.5
UD   0.197

KKRT-SBD16
KM   ROUTE THE FLOW FROM BASIN D16 TO AP-D8
RD     400    0.02   0.013             CIRC       3

KK   AP-D8
KM   COMBINE THE ROUTED FLOW FROM BASIN D16 WITH THE ROUTED FLOW AT AP-D8
HC       2

KK RT-APD9
KM   ROUTE THE FLOW FROM AP-D8 TO AP-D9
RD     430    0.02   0.013             CIRC       7

KK  SB-D36
KM   COMPUTE HYDROGRAGH FOR BASIN D36
BA   0.024
PR       1
PW       1
PT       2
PW       1
LS       0       72
UD   0.237
```



```
LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KKRT-SBD36
KM   ROUTE THE FLOW FROM BASIN D36 TO AP-D9
RD     750    0.02   0.013             CIRC     2.5

KK   AP-D9
KM   COMBINE THE ROUTED FLOW FROM BASIN D36 WITH THE ROUTED FLOW AT AP-D9
HC       2

KK  SB-D37
KM   COMPUTE HYDROGRAGH FOR BASIN D37
BA   0.011
PR       1
PW       1
PT       2
PW       1
LS       0       99
UD   0.124

KKRT-SBD37
KM   ROUTE THE FLOW FROM BASIN D37 TO AP-D9
RD     200    0.02   0.013             CIRC     2.5

KK   AP-D9
KM   COMBINE THE ROUTED FLOW FROM BASIN D37 WITH THE ROUTED FLOW AT AP-D9
HC       2

KKRT-APDFE
KM   ROUTE THE FLOW FROM AP-D9 TO DFE, ASSUME 96"PIPE
RD     350    0.01    .013             CIRC       8

KK  SB-D18
KM   COMPUTE HYDROGRAPH FOR BASIN D18
BA   0.064
PR       1
PW       1
PT       2
PW       1
```

```
 384          LS       0     76.3
 385          UD    .252

 386          KKRR-DFPCHS
 387          KM   ROUTE FLOW THROUGH THE EXISTING PINE CREEK HIGH SCHOOL DETENTION POND
 388          KM   STORAGE IS BASED ON A TAKEOFF MADE FROM THE GRADING PLAN FOR THE SITE
 389          KM   OUTLET DISCHARGE IS ESTIMATED BASED ON ON A VERY CRUDE FIELD SURVEY
 390          KM   OF THE POND OUTLET STRUCTURE
 391          KO       1       1
 392          RS       1    STOR       0
 393          SV       0      .2     .44     .92    1.47    2.17    3.73
 394          SE      16      18      19      20      21      22      24
 395          SQ       0       0       0       0     7.9      30      40
                                         HEC-1 INPUT                                            PAGE 10

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 396          KKRT-RRDFPCHS
 397          KM   ROUTE THE FLOW FROM DFPCHS IN A STORM DRAIN TO AP-D10
 398          RD     400     .04    .013            CIRC     2.0

 399          KK  SB-D19
 400          KM   COMPUTE HYDROGRAPH FOR BASIN D19
 401          BA   0.024
 402          PR       1
 403          PW       1
 404          PT       2
 405          PW       1
 406          LS       0    80.9
 407          UD    .122

 408          KK  AP-D10
 409          KM   COMBINE THE ROUTED FLOW FROM THE HIGH SCHOOL DETENTION POND  WITH THE FLOW
 410          KM   FROM SB-D10
 411          HC       2

 412          KKRT-APD10
 413          KM   ROUTE THE FLOW FROM AP-D10 TO AP-D11
 414          RD     800     .02    .013            CIRC     3.0

 415          KK  SB-D20
 416          KM   COMPUTE HYDROGRAPH FOR BASIN D20
 417          BA   0.030
 418          PR       1
 419          PW       1
 420          PT       2
 421          PW       1
 422          LS       0    96.5
 423          UD    .108

 424          KK  AP-D11
 425          KM   COMBINE THE ROUTED FLOW FROM AP-D10 WITH THE FLOW FROM SB-D20
 426          HC       2

 427          KKRT-APD11
 428          KM   ROUTE THE FLOW FROM AP-D11 TO PROPOSED DETENTION FACILITY "E"
 429          RD    1300     .02    .013            CIRC     5.0

 430          KK  SB-D21
 431          KM   COMPUTE HYDROGRAPH FOR BASIN D21
 432          BA   0.041
 433          PR       1
 434          PW       1
 435          PT       2
 436          PW       1
 437          LS       0    86.5
 438          UD    .137
                                         HEC-1 INPUT                                            PAGE 11

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 439          KK  AP-DFE
 440          KM   COMBINE THE ROUTED FLOW FROM AP-D11 WITH THE FLOW FROM SB-D21 AND AP-D8A
 441          KM   THIS IS THE TOTAL FLOW TO PROPOSED
 442          KM   DETENTION FACILITY "E"
```

```
HC        3

KK  RR-DFE
KM   ROUTE FLOW THROUGH THE PROPOSED DETENTION FACILITY "E". STORAGE IS BASED ON
KM   A CONCEPTUAL GRADING PLAN DATED 11-21-00 WITH THE POND LOCATED AT THE NW
KM   CORNER OF THE INTERSECTION OF OLD RANCH RD. AND CHAPEL HILLS DRIVE. OUTLET
KM   CAPACITY IS BASED ON A 6" DIA ORIFICE OUTLET WITH INV AT EL 22.25, A 27" DIA
KM   ORIFICE OUTLET AT INVERT ELEV. 24.00.
KM   90 DEGREE V-NOTCH WEIR INVERT ELEV. 31.0,TRIMMED VERT AT 10' WIDTH ELEV. 36.0
KM   6" DIA. OUTLET ALLOWS LOW FLOW TO CONTINUE DOWN THE HISTORIC NATURAL CHANNEL
KM   90 DEGREE V-NOTCH OUTFALLS TO THE HISTORIC NATURAL CHANNEL TO DIRECT  SOME OF
KM   THE PEAK FLOW FROM LARGE STORMS TO THE NATURAL CHANNEL
KM   THE 27" DIA ORIFICE OUTLET OUTFALLS TO A PROPOSED STORM DRAIN IN OLD RANCH RO
KO       1       1
RS       1    STOR       0
SV       0    0.09     .74    2.79    5.13    7.78   10.82   12.47   14.21   16.03
SV   17.95   19.92   21.98   24.14   26.39   28.75   31.20   33.76   36.42
SE    22.5    23.0    24.0    26.0    28.0    30.0    32.0    33.0    34.0    35.0
SE      36    37.0    38.0    39.0    40.0    41.0    42.0    43.0    44.0
SQ     0.0     0.7    1.20    19.7    34.7    44.9    55.6    70.6      98     141
SQ     201     236     309     435     530     632     750     877    1016

KK  AP-DFE
KM   DIVERT OUT FLOW THAT PASSES THROUGH THE V-NOTCH AND THE 6" DIA OUTLET TO THE
KM   NATURAL CHANNEL
KO       1       1
DT  AP-D12
DI     0.0     0.7    1.20    19.7    34.7    44.9    55.6    70.6      98     141
DI     201     236     309     435     530     632     750     877    1016
DQ       0     0.7     1.2     1.8     2.2     2.6     5.4    16.9      41    80.5
DQ   137.7   169.6   240.7   363.8     456     556     671     796   932.4

KKRT-APD13
KM   ROUTE THE FLOW FROM THE 24" DIA OUTLET IN DETENTION FACILITY "E" DOWN TO
KM   AP-D13 IN THE PROPOSED OLD RANCH ROAD STORM DRAIN
RD     580     .02    .013            CIRC     3.5

KK  SB-D22
KM   COMPUTE HYDROGRAPH FOR BASIN D22
BA   0.037
PR       1
PW       1
PT       2
PW       1
LS       0    78.5
UD   0.156
                           HEC-1 INPUT                                              PAGE 12

LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


KK  AP-D13
KM   COMBINE FLOW FROM BASIN D22 WITH ROUTED FLOW TO AP D13
HC       2

KKRT-APD13
KM   ROUTE THE FLOW FROM AP-13 TO AP D14
RD     850     .03    .013            CIRC       4

KK  SB-D23
KM   COMPUTE HYDROGRAPH FOR BASIN D23
BA   0.005
PR       1
PW       1
PT       2
PW       1
LS       0    88.0
UD    .111

KK  AP-D14
KM   COMBINE ROUTED FLOW FROM AP-D13 WITH THE FLOW FROM BASIN D23
HC       2

KK  AP-DFF
KM   ROUTE THE FLOW FROM AP-14 TO PROPOSED DETENTION FACILITY "F"
RD     200     .03    .013            CIRC     4.5
```

```
KK  SB-D24
KM   COMPUTE HYDROGRAPH FOR BASIN D24
BA   0.025
PR        1
PW        1
PT        2
PW        1
LS        0     74.5
UD     .151

KK  AP-DFF
KM   COMBINE ROUTED FLOW FROM AP-D14 WITH THE FLOW FROM BASIN D24
HC        2

KK  RR-DFF
KM   KM ROUTE FLOW THROUGH A POND EAST OF THE EXISTING CREEKSIDE FILING 3 AREA
KM   STORAGE IS BASED ON THE CONSTRUCTION PLAN CONTOURS
KM   OUTLET CAPACITY IS BASED ON A 12" DIA OUTLET PIPE WITH INVERT AT ELEV. 58
KM   AND A SECOND OUTLET A 48" DIA STAND PIPE RIM AT ELEVATION 68
KM   THE PROPOSED OUTLET FOR THIS POND IS DESIGNED TO SIGNIFICANTLY
KM   LAG THE PEAK FLOWS TO THE DOWNSTREAM STORM DRAIN SYSTEM THUS OUTFLOW
KM   IS VERY RESTRICTED UNTIL THE POND IS NEARLY FULL
KO        1        1
RS        1     STOR        0
SV        0      0.0     0.40     1.60     3.04     4.76     6.78     9.13    11.81
SE       58     58.5       60       62       64       66       68       70       72
SQ        0      0.5      4.6      7.1      8.9     10.4     11.7     98.4      135
```



```
LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK  SB-D25
KM   COMPUTE HYDROGRAPH FOR BASIN D25
BA   0.017
PR        1
PW        1
PT        2
PW        1
LS        0     82.2
UD     .156

KKRR-SBD25
KM   ROUTE FLOW FROM SB-D25 DOWN THE EXISTING STORM DRAIN FROM THE LOW POINT IN
KM   LEXINGTON DR. TO THE LOW POINT IN MONMOUTH LANE AT AP-D16
RD      800      .05     .013              CIRC      3.0

KK  SB-D26
KM   COMPUTE HYDROGRAPH FOR BASIN D26
BA   0.033
PR        1
PW        1
PT        2
PW        1
LS        0     75.5
UD     .145

KK  AP-D16
KM   COMBINE THE ROUTED FLOW FROM BASIN D26 WITH THE ROUTED FLOW FROM BASIN D25
HC        2

KKRT-APD16
KM   ROUTE THE FLOW IN THE EXISTING STORM DRAIN FROM AP-D16 TO AP-D17 IN OLD
KM   RANCH ROAD AND MAMOUTH LANE
KO        1        1
RD      400      .05     .013              CIRC      3.5

KK  AP-D17
KM   COMBINE THE ROUTED FLOW FROM AP-D16 WITH THE ROUTED FLOW FROM DETENTION
KM   FACILITY F
KO        1        1
HC        2

KKRT-APD17
KM   ROUTE THE COMBINED FLOW AT AP-D17 DOWN THE EXISTING OLD RANCH ROAD STORM
KM   TO AP-D18
RD      500      .05     .013              CIRC      3.5
```

```
 570      KK  SB-D27
 571      KM   COMPUTE HYDROGRAPH FOR BASIN D27
 572      BA   0.008
 573      PR       1
 574      PW       1
 575      PT       2
 576      PW       1
 577      LS       0      80
                                  HEC-1 INPUT                                        PAGE 14

LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 578      UD     .144

 579      KK  AP-D18
 580      KM   COMBINE THE ROUTED FLOW FROM AP-D17 WITH THE FLOW FROM BASIN D27
 581      HC       2

 582      KKRT-APD18
 583      KM   ROUTE THE COMBINED FLOW AT AP-D18 DOWN THE EXISTING OLD RANCH ROAD STORM
 584      KM   TO AP-D20
 585      RD     500     .05    .013             CIRC     3.5

 586      KK  SB-D29
 587      KM   COMPUTE HYDROGRAPH FOR BASIN D29
 588      BA   0.018
 589      PR       1
 590      PW       1
 591      PT       2
 592      PW       1
 593      LS       0    78.2
 594      UD     .146

 595      KK  AP-D19
 596      KM   THE EXISTING STORM DRAIN THAT CONNECTS BASIN D29 TO THE EXISTING OLD RANCH
 597      KM   ROAD STORM HAS LESS CAPACITY (DUE TO INLET CONTROL) THAN THE PREDICTED 100
 598      KM   YEAR PEAK FLOW FROM BASIN D29. THE MAXIMUM CAPACITY OF THE STORM DRAIN IS
 599      KM   20 CFS. DIVERT OUT FLOW THAT EXCEEDS 20 CFS.  THE EXCESS FLOW WILL CONTINUE
 600      KM   DOWN LUMBERJACK DRIVE AND WILL NOT BE ROUTED THROUGH THE CREEKSIDE DETENTION
 601      KM   POND
 602      DT AP-D19a
 603      DI       0       5      10      15      20      25      30      35      40      45
 604      DI      50      55
 605      DQ       0       0       0       0       0       5      10      15      20      25
 606      DQ      30      35

 607      KKRT-APD19
 608      KM   ROUTE FLOW COLLECTED IN THE STORM DRAIN AT D19 DOWN THE EXISTING STORM DRAIN
 609      KM   TO AP-D20 IN OLD RANCH ROAD
 610      RD     150     .13    .013             CIRC     1.5

 611      KK  SB-D28
 612      KM   COMPUTE HYDROGRAPH FOR BASIN D28
 613      BA   0.004
 614      PR       1
 615      PW       1
 616      PT       2
 617      PW       1
 618      LS       0    84.0
 619      UD     .137

 620      KK  AP-D20
 621      KM   COMBINE THE ROUTED FLOW FROM AP-D18 AND AP-D20 WITH THE FLOW FROM BASIN D28
 622      HC       3
                                  HEC-1 INPUT                                        PAGE 15

LINE      ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 623      KKRT-APD20
 624      KM   ROUTE THE FLOW FROM AP-D20 TO AP-D21 IN THE EXISTING MARBLE CREEK STORM DRAIN
 625      RD     420    .025    .013             CIRC     4.0

 626      KK  SB-D30
 627      KM   COMPUTE HYDROGRAPH FOR BASIN D30
 628      BA   0.017
```

```
 629          PR       1
 630          PW       1
 631          PT       2
 632          PW       1
 633          LS       0     74.4
 634          UD    .157

 635          KKRT-SBD30
 636          KM    ROUTE THE FLOW FROM BASIN D30 TO AP-D21 IN THE EXISTING EASEMENT STORM DRAIN
 637          RD     330    .065    .013              CIRC      2.0

 638          KK  AP-D21
 639          KM    COMBINE THE ROUTED FLOW FROM SB-D30 WITH THE ROUTED FLOW FROM AP-D20
 640          KO       1       1
 641          HC       2

 642          KK  SB-D31
 643          KM    COMPUTE HYDROGRAPH FOR BASIN D31
 644          BA   0.007
 645          PR       1
 646          PW       1
 647          PT       2
 648          PW       1
 649          LS       0     78.5
 650          UD    .146

 651          KK  AP-D22
 652          KM    COMBINE THE ROUTED FLOW FROM SB-D31 WITH THE ROUTED FLOW FROM AP-D21
 653          HC       2

 654          KK  SB-D32
 655          KM    COMPUTE HYDROGRAPH FOR BASIN D32
 656          BA   0.006
 657          PR       1
 658          PW       1
 659          PT       2
 660          PW       1
 661          LS       0     68.0
 662          UD    .115

 663          KK AP-DFCS
 664          KM    COMBINE THE ROUTED FLOW FROM SB-D32 WITH THE ROUTED FLOW FROM AP-D22
 665          KM    THIS IS THE TOTAL FLOW INTO THE EXISTING CREEKSIDE DETENTION FACILITY
 666          KO       1       1
 667          HC       2
                                     HEC-1 INPUT                                          PAGE 16

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 668          KK RR-DFCS
 669          KM    ROUTE FLOW THROUGH THE EXISTING CREEKSIDE POND (DF"CS").  STORAGE IS BASED
 670          KM    ON THE STORAGE DATA PRESENTED IN THE FINAL DRAINAGE REPORT FOR CREEKSIDE
 671          KM    FILING No.3. OUTFLOW IS BASED ON A PROPOSED OUTLET MODIFICATION TO INCLUDE
 672          KM    A 11' LONG HORZ. WEIR AT ELEV 79 AND A 24" DIA OUTLET WITH AN INVERT
 673          KM    ELEVATION OF 72.
 674          KO       1       1
 675          RS       1    STOR       0
 676          SV       0    .050    .398   1.026   1.723   2.488   3.325   4.235   5.221   6.283
 677          SV   7.423   8.643   9.946
 678          SE      72      73      74      75      76      77      78      79      80      81
 679          SE      82      83      84
 680          SQ       0       4      15      28      32      35      38      41      78     143
 681          SQ     226     324     435

 682          KKDR-APD12
 683          KM    RETRIEVE THE FLOW THAT IS DIVERTED TO THE HISTORIC CHANNEL AT DETENTION
 684          KM    FACILITY "E"
 685          DR  AP-D12

 686          KKRT-APD12
 687          KM    ROUTE THE FLOW FROM DETENTION FACILITY "E" TO KETTLE CREEK IN THE EXISTING
 688          KM    NATURAL CHANNEL. USE GENERALIZED SECTION AND AVERAGE SLOPE
 689          RD    3700    .040    .050              TRAP       5       5

 690          KK  SB-D33
 691          KM    COMPUTE HYDROGRAPH FOR BASIN D33
```

```
 692            BA   0.036
 693            PR       1
 694            PW       1
 695            PT       2
 696            PW       1
 697            LS       0    70.2
 698            UD    .138

 699            KK  AP-D23
 700            KM   COMBINE THE ROUTED FLOW FROM SB-D33 WITH THE ROUTED FLOW FROM AP-D12
 701            HC       2

 702            KK  AP-D24
 703            KM   COMBINE THE FLOW AT AP-D23 WITH THE OUTFLOW FROM THE MODIFIED CREEKSIDE
 704            KM   DETENTION FACILITY FOR THE PURPOSE OF COMPARISON TO HISTORIC FLOW RATES
 705            KO       1       1
 706            HC       2
 707            KM    ************************************************************************
 708            KM   BEGIN CALCULATIONS IN THE NORTH TRIBUTARY WATERSHED
 709            KM    ***********************************************************************

 710            KK  SB-D34
 711            KM   COMPUTE HYDROGRAPH FOR BASIN D34
 712            BA   0.039
 713            PR       1
 714            PW       1
 715            PT       2
                                         HEC-1 INPUT                                          PAGE 17

LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 716            PW       1
 717            LS       0    77.0
 718            UD    .159

 719            KKRT-SBD34
 720            KM   ROUTE FLOW FROM BASIN D34 IN A STORM DRAIN TO PROPOSED DETENTION FACILITY "G"
 721            RD     900     .03    .013              CIRC     3.5

 722            KK  SB-D35
 723            KM   COMPUTE HYDROGRAPH FOR BASIN D35
 724            BA   0.039
 725            PR       1
 726            PW       1
 727            PT       2
 728            PW       1
 729            LS       0    78.0
 730            UD    .161

 731            KK  AP-DFG
 732            KM   COMBINE THE ROUTED FLOW FROM AP-D34  WITH THE FLOW FROM BASIN D35
 733            HC       2

 734            KK  RR-DFG
 735            KM   ROUTE FLOW THROUGH PROPOSED DETENTION FACILITY "G". STORAGE IS BASED ON A
 736            KM   PRELIMINARY GRADING PLAN AND A TWO STAGE OUTLET WITH A 6" DIA OUTLET AT
 737            KM   INVERT ELEV. 60 AND A 24" DIA STANDPIPE WITH A TOP ELEV OF 66
 738            KO       1       1
 739            RS       1    STOR       0
 740            SV       0    .081    .262    .732   1.366   2.179   3.195   4.211    5.63
 741            SE      60      61      62      64      66      68      70      72      74
 742            SQ       0     0.8     1.3     1.8     2.3    24.0    33.2    40.3    46.3
 743            ZZ

             SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   24        SB-D1
                 V
                 V
   33      RT-SBD1
                 .
                 .
   36            .        SB-D2
```

```
                .           .
                .           .
 45     AP-D1...............
                .
                .
 48             .     SB-D3
                .           .
                .           .
 57     AP-DDA..............
                V
                V
 60     RR-DFA
                V
                V
 71    RT-APDFA
                .
                .
 74             .     SB-D6
                .           .
                .           .
 83     AP-D2...............
                V
                V
 86     RT-APD2
                .
                .
 89             .     SB-D7
                .           .
                .           .
 98             .           .     SB-D4
                .           .           .
                .           .           .
107             .           .           .     SB-D5
                .           .           .           .
                .           .           .           .
116             .           .     AP-DFB...............
                .           .           V
                .           .           V
119             .           .     RR-DFB
                .           .           V
                .           .           V
130             .           .    RT-APDFB
                .           .           .
                .           .           .
133     AP-D3...........................
                V
                V
137    RT-APD3
                .
                .
140             .     SB-D8
                .           .
                .           .
149     AP-DFC..............
                V
                V
152     RR-DFC
                V
                V
162     RT-DFC
                .
                .
165             .     SB-D9A
                .           .
                .           .
174     AP-D4...............
                V
                V
177    RT-APD4
                .
                .
180             .     SB-D9
                .           .
                .           .
189     AP-D4a..............
                V
                V
```

```
   192   RT-APD4a
                .
                .
   196          .     SB-D15
                .          .
                .          .
   205     AP-D4b...........
                V
                V
   208   RT-APD4b
                .
                .
   211          .     SB-D10
                .          V
                .          V
   220          .   RT-SBD10
                .          .
                .          .
   224          .          .     SB-D11
                .          .          .
                .          .          .
   233          .          .          .     SB-D12
                .          .          .          V
                .          .          .          V
   242          .          .          .   RT-SBD12
                .          .          .          .
                .          .          .          .
   247          .      AP-D5......................
                .          V
                .          V
   251          .    RT-APD5
                .          .
                .          .
   254          .          .     SB-D13
                .          .          .
                .          .          .
   263          .      AP-D6...........
                .          V
                .          V
   266          .    RT-APD6
                .          .
                .          .
   269          .          .     SB-D14
                .          .          V
                .          .          V
   278          .          .   RT-SBD14
                .          .          .
                .          .          .
   281      AP-D7......................
                V
                V
   284    RT-APD7
                .
                .
   287          .     SB-D17
                .          .
                .          .
   296     AP-D7A...........
                .
                .
   299          .    SB-D16A
                .          .
                .          .
   308     AP-D7A...........
                V
                V
   311    RT-APD8
                .
                .
   314          .    SB-D17A
                .          .
                .          .
   323      AP-D8...........
                .
                .
   326          .     SB-D16
                .          V
```

```
                 .         V
335              .   RT-SBD16
                 .         .
                 .         .
338        AP-D8............
                 V
                 V
341      RT-APD9
                 .
                 .
344              .     SB-D36
                 .          V
                 .          V
353              .   RT-SBD36
                 .          .
                 .          .
356        AP-D9............
                 .
                 .
359              .     SB-D37
                 .          V
                 .          V
368              .   RT-SBD37
                 .          .
                 .          .
371        AP-D9............
                 V
                 V
374    RT-APDFE
                 .
                 .
377              .     SB-D18
                 .          V
                 .          V
386              .   RR-DFPCH
                 .          V
                 .          V
396              .   RT-RRDFP
                 .          .
                 .          .
399              .          .        SB-D19
                 .          .             .
                 .          .             .
408              .     AP-D10............
                 .          V
                 .          V
412              .   RT-APD10
                 .          .
                 .          .
415              .          .        SB-D20
                 .          .             .
                 .          .             .
424              :     AP-D11............
                 .          V
                 .          V
427              .   RT-APD11
                 .          .
                 .          .
430              .          .        SB-D21
                 .          .             .
                 .          .             .
439       AP-DFE.........................
                 V
                 V
444       RR-DFE
                 .
                 .
467              .------->  AP-D12
463       AP-DFE
                 V
                 V
472     RT-APD13
                 .
                 .
476              .     SB-D22
                 .          .
                 .          .
```

```
485       AP-D13............
                 V
                 V
488     RT-APD13
                 .
                 .
491              .       SB-D23
                 .            .
                 .            .
500       AP-D14............
                 V
                 V
503       AP-DFF
                 .
                 .
506              .       SB-D24
                 .            .
                 .            .
515       AP-DFF............
                 V
                 V
518       RR-DFF
                 .
                 .
531              .       SB-D25
                 .            V
                 .            V
540              .     RR-SBD25
                 .            .
                 .            .
544              .            .        SB-D26
                 .            .             .
                 .            .             .
553              .       AP-D16............
                 .            V
                 .            V
556              .     RT-APD16
                 .            .
                 .            .
561       AP-D17............
                 V
                 V
566     RT-APD17
                 .
                 .
570              .       SB-D27
                 .            .
                 .            .
579       AP-D18............
                 V
                 V
582     RT-APD18
                 .
                 .
586              .       SB-D29
                 .            .
                 .            .
602              .            .-------> AP-D19a
595              .       AP-D19
                 .            V
                 .            V
607              .     RT-APD19
                 .            .
                 .            .
611              .            .        SB-D28
                 .            .             .
                 .            .             .
620       AP-D20.......................
                 V
                 V
623     RT-APD20
                 .
                 .
626              .       SB-D30
                 .            V
                 .            V
635              .     RT-SBD30
```

```
                  .          .
                  .          .
 638    AP-D21............
                  .
                  .
 642              .      SB-D31
                  .          .
                  .          .
 651    AP-D22............
                  .
                  .
 654              .      SB-D32
                  .          .
                  .          .
 663    AP-DFCS...........
                  V
                  V
 668    RR-DFCS
                  .
                  .
 685              .          .<-------  AP-D12
 682              .     DR-APD12
                  .          V
                  .          V
 686              .     RT-APD12
                  .          .
                  .          .
 690              .          .      SB-D33
                  .          .          .
                  .          .          .
 699              .      AP-D23............
                  .          .
                  .          .
 702    AP-D24............
                  .
                  .
 710              .      SB-D34
                  .          V
                  .          V
 719              .     RT-SBD34
                  .          .
                  .          .
 722              .          .      SB-D35
                  .          .          .
                  .          .          .
 731              .      AP-DFG............
                  .          V
                  .          V
 734              .      RR-DFG

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
HEC1 S/N: 1343000062        HMVersion: 6.33    Data File: KCD100.DAT
```

```
****************************************                    ****************************************
*                                      *                    *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *    U.S. ARMY CORPS OF ENGINEERS      *
*              MAY   1991              *                    *    HYDROLOGIC ENGINEERING CENTER     *
*           VERSION 4.0.1E             *                    *         609 SECOND STREET            *
*                                      *                    *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE  10/21/2002  TIME  15:02:17 *                   *          (916) 756-1104              *
*                                      *                    *                                      *
****************************************                    ****************************************
```

```
KETTLE CREEK OLD RANCH RD. TRIBUTARY WATERSHED IN PROJECTED FULLY DEVELOPED
CONDITION (100 YEAR 24 HOUR RAINFALL, TYPE IIa SCS DISTRIBUTION)
FILE NAME:KCD500.DAT
3 MINUTE TIME STEP USED DUE TO SMALL SIZE OF BASINS, THIS LIMITS OUTPUT TO
FIRST 15 HOURS OF DESIGN STORM
**************************************************************************
BEGIN CALCULATIONS IN THE SOUTH TRIBUTARY WATERSHED
**************************************************************************
```

10 IO OUTPUT CONTROL VARIABLES
IPRNT 5 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
NMIN 3 MINUTES IN COMPUTATION INTERVAL
IDATE 1 0 STARTING DATE
ITIME 0000 STARTING TIME
NQ 300 NUMBER OF HYDROGRAPH ORDINATES
NDDATE 1 0 ENDING DATE
NDTIME 1457 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL 0.05 HOURS
TOTAL TIME BASE 14.95 HOURS

ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

*** ***

****
*   *
60 KK * RR-DFA *
*   *
****

66 KO OUTPUT CONTROL VARIABLES
IPRNT 1 PRINT CONTROL
IPLOT 1 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

HYDROGRAPH ROUTING DATA

67 RS STORAGE ROUTING
NSTPS 1 NUMBER OF SUBREACHES
ITYP STOR TYPE OF INITIAL CONDITION
RSVRIC 0.00 INITIAL CONDITION
X 0.00 WORKING R AND D COEFFICIENT

68 SV	STORAGE	0.0	0.1	0.4	1.2	2.6	4.6	7.4
69 SE	ELEVATION	54.00	56.00	58.00	60.00	62.00	64.00	66.00
70 SQ	DISCHARGE	0.	37.	43.	50.	60.	68.	75.

***

****

HYDROGRAPH AT STATION RR-DFA

****

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	*	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	0.0	54.0	*	1		0500	101	0.	0.0	54.0	*	1		1000	201	7.	0.0	54.4
1		0003	2	0.	0.0	54.0	*	1		0503	102	0.	0.0	54.0	*	1		1003	202	7.	0.0	54.4
1		0006	3	0.	0.0	54.0	*	1		0506	103	0.	0.0	54.0	*	1		1006	203	7.	0.0	54.4
1		0009	4	0.	0.0	54.0	*	1		0509	104	0.	0.0	54.0	*	1		1009	204	7.	0.0	54.4
1		0012	5	0.	0.0	54.0	*	1		0512	105	0.	0.0	54.0	*	1		1012	205	7.	0.0	54.4
1		0015	6	0.	0.0	54.0	*	1		0515	106	0.	0.0	54.0	*	1		1015	206	6.	0.0	54.3
1		0018	7	0.	0.0	54.0	*	1		0518	107	0.	0.0	54.0	*	1		1018	207	6.	0.0	54.3
1		0021	8	0.	0.0	54.0	*	1		0521	108	0.	0.0	54.0	*	1		1021	208	6.	0.0	54.3
1		0024	9	0.	0.0	54.0	*	1		0524	109	0.	0.0	54.0	*	1		1024	209	6.	0.0	54.3
1		0027	10	0.	0.0	54.0	*	1		0527	110	0.	0.0	54.0	*	1		1027	210	6.	0.0	54.3
1		0030	11	0.	0.0	54.0	*	1		0530	111	0.	0.0	54.0	*	1		1030	211	6.	0.0	54.3

1	0033	12	0.	0.0	54.0	*	1	0533	112	0.	0.0	54.0	*	1	1033	212	6.	0.0	54.3
1	0036	13	0.	0.0	54.0	*	1	0536	113	0.	0.0	54.0	*	1	1036	213	6.	0.0	54.3
1	0039	14	0.	0.0	54.0	*	1	0539	114	1.	0.0	54.0	*	1	1039	214	5.	0.0	54.3
1	0042	15	0.	0.0	54.0	*	1	0542	115	3.	0.0	54.1	*	1	1042	215	5.	0.0	54.3
1	0045	16	0.	0.0	54.0	*	1	0545	116	7.	0.0	54.4	*	1	1045	216	5.	0.0	54.3
1	0048	17	0.	0.0	54.0	*	1	0548	117	15.	0.0	54.8	*	1	1048	217	5.	0.0	54.3
1	0051	18	0.	0.0	54.0	*	1	0551	118	28.	0.1	55.5	*	1	1051	218	5.	0.0	54.3
1	0054	19	0.	0.0	54.0	*	1	0554	119	38.	0.1	56.2	*	1	1054	219	5.	0.0	54.3
1	0057	20	0.	0.0	54.0	*	1	0557	120	40.	0.2	56.9	*	1	1057	220	5.	0.0	54.3
1	0100	21	0.	0.0	54.0	*	1	0600	121	43.	0.5	58.1	*	1	1100	221	5.	0.0	54.3
1	0103	22	0.	0.0	54.0	*	1	0603	122	46.	0.8	58.9	*	1	1103	222	5.	0.0	54.3
1	0106	23	0.	0.0	54.0	*	1	0606	123	50.	1.2	59.9	*	1	1106	223	5.	0.0	54.3
1	0109	24	0.	0.0	54.0	*	1	0609	124	53.	1.6	60.6	*	1	1109	224	5.	0.0	54.3
1	0112	25	0.	0.0	54.0	*	1	0612	125	56.	2.1	61.3	*	1	1112	225	5.	0.0	54.3
1	0115	26	0.	0.0	54.0	*	1	0615	126	59.	2.5	61.9	*	1	1115	226	5.	0.0	54.3
1	0118	27	0.	0.0	54.0	*	1	0618	127	61.	2.9	62.3	*	1	1118	227	5.	0.0	54.3
1	0121	28	0.	0.0	54.0	*	1	0621	128	62.	3.2	62.6	*	1	1121	228	5.	0.0	54.3
1	0124	29	0.	0.0	54.0	*	1	0624	129	63.	3.4	62.8	*	1	1124	229	5.	0.0	54.3
1	0127	30	0.	0.0	54.0	*	1	0627	130	64.	3.6	63.0	*	1	1127	230	5.	0.0	54.3
1	0130	31	0.	0.0	54.0	*	1	0630	131	64.	3.7	63.1	*	1	1130	231	5.	0.0	54.3
1	0133	32	0.	0.0	54.0	*	1	0633	132	65.	3.8	63.2	*	1	1133	232	5.	0.0	54.3
1	0136	33	0.	0.0	54.0	*	1	0636	133	65.	3.8	63.2	*	1	1136	233	5.	0.0	54.3
1	0139	34	0.	0.0	54.0	*	1	0639	134	65.	3.8	63.2	*	1	1139	234	5.	0.0	54.3
1	0142	35	0.	0.0	54.0	*	1	0642	135	65.	3.8	63.2	*	1	1142	235	5.	0.0	54.3
1	0145	36	0.	0.0	54.0	*	1	0645	136	65.	3.7	63.1	*	1	1145	236	5.	0.0	54.3
1	0148	37	0.	0.0	54.0	*	1	0648	137	64.	3.7	63.0	*	1	1148	237	5.	0.0	54.3
1	0151	38	0.	0.0	54.0	*	1	0651	138	64.	3.6	63.0	*	1	1151	238	5.	0.0	54.3
1	0154	39	0.	0.0	54.0	*	1	0654	139	63.	3.5	62.8	*	1	1154	239	5.	0.0	54.3
1	0157	40	0.	0.0	54.0	*	1	0657	140	63.	3.3	62.7	*	1	1157	240	5.	0.0	54.3
1	0200	41	0.	0.0	54.0	*	1	0700	141	62.	3.2	62.6	*	1	1200	241	5.	0.0	54.3
1	0203	42	0.	0.0	54.0	*	1	0703	142	62.	3.1	62.5	*	1	1203	242	5.	0.0	54.3
1	0206	43	0.	0.0	54.0	*	1	0706	143	61.	2.9	62.3	*	1	1206	243	5.	0.0	54.3
1	0209	44	0.	0.0	54.0	*	1	0709	144	61.	2.8	62.2	*	1	1209	244	5.	0.0	54.3
1	0212	45	0.	0.0	54.0	*	1	0712	145	60.	2.6	62.0	*	1	1212	245	5.	0.0	54.3
1	0215	46	0.	0.0	54.0	*	1	0715	146	59.	2.5	61.8	*	1	1215	246	5.	0.0	54.3
1	0218	47	0.	0.0	54.0	*	1	0718	147	58.	2.3	61.6	*	1	1218	247	5.	0.0	54.3
1	0221	48	0.	0.0	54.0	*	1	0721	148	57.	2.1	61.3	*	1	1221	248	5.	0.0	54.3
1	0224	49	0.	0.0	54.0	*	1	0724	149	56.	2.0	61.1	*	1	1224	249	5.	0.0	54.3
1	0227	50	0.	0.0	54.0	*	1	0727	150	54.	1.8	60.9	*	1	1227	250	5.	0.0	54.3
1	0230	51	0.	0.0	54.0	*	1	0730	151	53.	1.7	60.7	*	1	1230	251	5.	0.0	54.3
1	0233	52	0.	0.0	54.0	*	1	0733	152	52.	1.5	60.4	*	1	1233	252	5.	0.0	54.3
1	0236	53	0.	0.0	54.0	*	1	0736	153	51.	1.4	60.2	*	1	1236	253	5.	0.0	54.3
1	0239	54	0.	0.0	54.0	*	1	0739	154	50.	1.2	60.0	*	1	1239	254	5.	0.0	54.3
1	0242	55	0.	0.0	54.0	*	1	0742	155	49.	1.1	59.6	*	1	1242	255	5.	0.0	54.3
1	0245	56	0.	0.0	54.0	*	1	0745	156	47.	0.9	59.3	*	1	1245	256	5.	0.0	54.3
1	0248	57	0.	0.0	54.0	*	1	0748	157	46.	0.8	58.9	*	1	1248	257	5.	0.0	54.3
1	0251	58	0.	0.0	54.0	*	1	0751	158	45.	0.7	58.6	*	1	1251	258	5.	0.0	54.3
1	0254	59	0.	0.0	54.0	*	1	0754	159	44.	0.5	58.3	*	1	1254	259	5.	0.0	54.3
1	0257	60	0.	0.0	54.0	*	1	0757	160	43.	0.4	57.9	*	1	1257	260	5.	0.0	54.3
1	0300	61	0.	0.0	54.0	*	1	0800	161	41.	0.3	57.2	*	1	1300	261	5.	0.0	54.3
1	0303	62	0.	0.0	54.0	*	1	0803	162	39.	0.2	56.6	*	1	1303	262	5.	0.0	54.3
1	0306	63	0.	0.0	54.0	*	1	0806	163	37.	0.1	56.1	*	1	1306	263	5.	0.0	54.3
1	0309	64	0.	0.0	54.0	*	1	0809	164	16.	0.0	54.9	*	1	1309	264	5.	0.0	54.3
1	0312	65	0.	0.0	54.0	*	1	0812	165	13.	0.0	54.7	*	1	1312	265	5.	0.0	54.3
1	0315	66	0.	0.0	54.0	*	1	0815	166	12.	0.0	54.6	*	1	1315	266	5.	0.0	54.3
1	0318	67	0.	0.0	54.0	*	1	0818	167	11.	0.0	54.6	*	1	1318	267	5.	0.0	54.3
1	0321	68	0.	0.0	54.0	*	1	0821	168	11.	0.0	54.6	*	1	1321	268	5.	0.0	54.3
1	0324	69	0.	0.0	54.0	*	1	0824	169	10.	0.0	54.5	*	1	1324	269	5.	0.0	54.3
1	0327	70	0.	0.0	54.0	*	1	0827	170	10.	0.0	54.5	*	1	1327	270	5.	0.0	54.3
1	0330	71	0.	0.0	54.0	*	1	0830	171	9.	0.0	54.5	*	1	1330	271	5.	0.0	54.3
1	0333	72	0.	0.0	54.0	*	1	0833	172	9.	0.0	54.5	*	1	1333	272	5.	0.0	54.3
1	0336	73	0.	0.0	54.0	*	1	0836	173	8.	0.0	54.4	*	1	1336	273	5.	0.0	54.3
1	0339	74	0.	0.0	54.0	*	1	0839	174	8.	0.0	54.4	*	1	1339	274	5.	0.0	54.3
1	0342	75	0.	0.0	54.0	*	1	0842	175	8.	0.0	54.4	*	1	1342	275	5.	0.0	54.3
1	0345	76	0.	0.0	54.0	*	1	0845	176	7.	0.0	54.4	*	1	1345	276	5.	0.0	54.2
1	0348	77	0.	0.0	54.0	*	1	0848	177	7.	0.0	54.4	*	1	1348	277	5.	0.0	54.2
1	0351	78	0.	0.0	54.0	*	1	0851	178	7.	0.0	54.4	*	1	1351	278	5.	0.0	54.2
1	0354	79	0.	0.0	54.0	*	1	0854	179	7.	0.0	54.4	*	1	1354	279	5.	0.0	54.2
1	0357	80	0.	0.0	54.0	*	1	0857	180	7.	0.0	54.4	*	1	1357	280	5.	0.0	54.2
1	0400	81	0.	0.0	54.0	*	1	0900	181	7.	0.0	54.4	*	1	1400	281	5.	0.0	54.2
1	0403	82	0.	0.0	54.0	*	1	0903	182	7.	0.0	54.4	*	1	1403	282	5.	0.0	54.2
1	0406	83	0.	0.0	54.0	*	1	0906	183	7.	0.0	54.4	*	1	1406	283	5.	0.0	54.2
1	0409	84	0.	0.0	54.0	*	1	0909	184	7.	0.0	54.4	*	1	1409	284	5.	0.0	54.2
1	0412	85	0.	0.0	54.0	*	1	0912	185	7.	0.0	54.4	*	1	1412	285	4.	0.0	54.2
1	0415	86	0.	0.0	54.0	*	1	0915	186	7.	0.0	54.4	*	1	1415	286	4.	0.0	54.2
1	0418	87	0.	0.0	54.0	*	1	0918	187	7.	0.0	54.4	*	1	1418	287	4.	0.0	54.2
1	0421	88	0.	0.0	54.0	*	1	0921	188	7.	0.0	54.4	*	1	1421	288	4.	0.0	54.2

1	0424	89	0.	0.0	54.0 *	1	0924	189	7.	0.0	54.4 *	1	1424	289	4.	0.0	54.2
1	0427	90	0.	0.0	54.0 *	1	0927	190	7.	0.0	54.4 *	1	1427	290	4.	0.0	54.2
1	0430	91	0.	0.0	54.0 *	1	0930	191	7.	0.0	54.4 *	1	1430	291	4.	0.0	54.2
1	0433	92	0.	0.0	54.0 *	1	0933	192	7.	0.0	54.4 *	1	1433	292	4.	0.0	54.2
1	0436	93	0.	0.0	54.0 *	1	0936	193	7.	0.0	54.4 *	1	1436	293	4.	0.0	54.2
1	0439	94	0.	0.0	54.0 *	1	0939	194	7.	0.0	54.4 *	1	1439	294	4.	0.0	54.2
1	0442	95	0.	0.0	54.0 *	1	0942	195	7.	0.0	54.4 *	1	1442	295	4.	0.0	54.2
1	0445	96	0.	0.0	54.0 *	1	0945	196	7.	0.0	54.4 *	1	1445	296	4.	0.0	54.2
1	0448	97	0.	0.0	54.0 *	1	0948	197	7.	0.0	54.4 *	1	1448	297	4.	0.0	54.2
1	0451	98	0.	0.0	54.0 *	1	0951	198	7.	0.0	54.4 *	1	1451	298	4.	0.0	54.2
1	0454	99	0.	0.0	54.0 *	1	0954	199	7.	0.0	54.4 *	1	1454	299	4.	0.0	54.2
1	0457	100	0.	0.0	54.0 *	1	0957	200	7.	0.0	54.4 *	1	1457	300	4.	0.0	54.2

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	14.95-HR
		(CFS)				
65.	6.60		25.	11.	11.	11.
		(INCHES)	1.385	1.531	1.531	1.531
		(AC-FT)	12.	14.	14.	14.

PEAK STORAGE (AC-FT)	TIME (HR)	MAXIMUM AVERAGE STORAGE 6-HR	24-HR	72-HR	14.95-HR
4.	6.60	1.	0.	0.	0.

PEAK STAGE (FEET)	TIME (HR)	MAXIMUM AVERAGE STAGE 6-HR	24-HR	72-HR	14.95-HR
63.22	6.60	56.80	55.18	55.18	55.18

CUMULATIVE AREA = 0.17 SQ MI

119 KK RR-DFB

125 KO OUTPUT CONTROL VARIABLES
IPRNT 1 PRINT CONTROL
IPLOT 1 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

HYDROGRAPH ROUTING DATA

126 RS STORAGE ROUTING
NSTPS 1 NUMBER OF SUBREACHES
ITYP STOR TYPE OF INITIAL CONDITION
RSVRIC 0.00 INITIAL CONDITION
X 0.00 WORKING R AND D COEFFICIENT

127 SV	STORAGE	0.0	0.0	0.2	0.7	1.4	3.2
128 SE	ELEVATION	19.00	20.00	22.00	24.00	26.00	28.00
129 SQ	DISCHARGE	0.	37.	43.	50.	60.	68.

***

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 0. TO 37.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

HYDROGRAPH AT STATION RR-DFB

G.

HEC-1 MODEL OUTPUT

FULLY DEVELOPED CONDITION

SUMMARY SHEETS FOR 2, 5, 10, 25 AND 50-YEAR STORMS

2 Year, 24 Hour, Developed Condition

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
				6-HOUR	24-HOUR	72-HOUR			
HYDROGRAPH AT	SB-D1	6.	6.35	1.	1.	1.	0.09		
ROUTED TO	RT-SBD1	6.	6.45	1.	1.	1.	0.09		
HYDROGRAPH AT	SB-D2	8.	6.15	1.	1.	1.	0.06		
2 COMBINED AT	AP-D1	11.	6.25	2.	1.	1.	0.14		
HYDROGRAPH AT	SB-D3	7.	6.20	1.	0.	0.	0.03		
2 COMBINED AT	AP-DDA	17.	6.20	3.	2.	2.	0.17		
ROUTED TO	RR-DFA	17.	6.25	3.	2.	2.	0.17	54.92	6.25
ROUTED TO	RT-APDFA	17.	6.25	3.	2.	2.	0.17		
HYDROGRAPH AT	SB-D6	19.	6.10	2.	1.	1.	0.04		
2 COMBINED AT	AP-D2	30.	6.15	5.	2.	2.	0.21		
ROUTED TO	RT-APD2	29.	6.15	5.	2.	2.	0.21		
HYDROGRAPH AT	SB-D7	36.	6.10	4.	2.	2.	0.07		
HYDROGRAPH AT	SB-D4	5.	6.20	1.	0.	0.	0.05		
HYDROGRAPH AT	SB-D5	8.	6.15	1.	0.	0.	0.03		
2 COMBINED AT	AP-DFB	13.	6.15	2.	1.	1.	0.08		
ROUTED TO	RR-DFB	13.	6.20	2.	1.	1.	0.08	19.35	6.20
ROUTED TO	RT-APDFB	13.	6.20	2.	1.	1.	0.08		
3 COMBINED AT	AP-D3	73.	6.10	11.	5.	5.	0.36		
ROUTED TO	RT-APD3	73.	6.15	11.	5.	5.	0.36		
HYDROGRAPH AT	SB-D8	79.	6.00	8.	3.	3.	0.06		
2 COMBINED AT	AP-DFC	139.	6.05	19.	8.	8.	0.42		
ROUTED TO	RR-DFC	45.	6.40	18.	8.	8.	0.42	55.96	6.40

5 Year, 24 Hour, Developed Condition

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-D1	17.	6.30	3.	1.	1.	0.09		
ROUTED TO	RT-SBD1	17.	6.35	3.	1.	1.	0.09		
HYDROGRAPH AT	SB-D2	20.	6.15	2.	1.	1.	0.06		
2 COMBINED AT	AP-D1	31.	6.25	6.	3.	3.	0.14		
HYDROGRAPH AT	SB-D3	13.	6.15	2.	1.	1.	0.03		
2 COMBINED AT	AP-DDA	44.	6.20	7.	3.	3.	0.17		
ROUTED TO	RR-DFA	38.	6.35	7.	3.	3.	0.17	56.38	6.35
ROUTED TO	RT-APDFA	38.	6.35	7.	3.	3.	0.17		
HYDROGRAPH AT	SB-D6	34.	6.05	3.	2.	2.	0.04		
2 COMBINED AT	AP-D2	64.	6.15	11.	5.	5.	0.21		
ROUTED TO	RT-APD2	64.	6.15	11.	5.	5.	0.21		
HYDROGRAPH AT	SB-D7	62.	6.05	7.	3.	3.	0.07		
HYDROGRAPH AT	SB-D4	14.	6.15	2.	1.	1.	0.05		
HYDROGRAPH AT	SB-D5	16.	6.15	2.	1.	1.	0.03		
2 COMBINED AT	AP-DFB	30.	6.15	4.	2.	2.	0.08		
ROUTED TO	RR-DFB	30.	6.15	4.	2.	2.	0.08	19.82	6.15
ROUTED TO	RT-APDFB	30.	6.15	4.	2.	2.	0.08		
3 COMBINED AT	AP-D3	148.	6.10	21.	10.	10.	0.36		
ROUTED TO	RT-APD3	147.	6.15	21.	10.	10.	0.36		
HYDROGRAPH AT	SB-D8	111.	6.00	11.	5.	5.	0.06		
2 COMBINED AT	AP-DFC	237.	6.05	32.	14.	14.	0.42		
ROUTED TO	RR-DFC	60.	6.60	32.	14.	14.	0.42	58.40	6.60

10 Year, 24 Hour, Developed Condition

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
				6-HOUR	24-HOUR	72-HOUR			
HYDROGRAPH AT	SB-D1	27.	6.30	5.	2.	2.	0.09		
ROUTED TO	RT-SBD1	27.	6.35	5.	2.	2.	0.09		
HYDROGRAPH AT	SB-D2	30.	6.15	4.	2.	2.	0.06		
2 COMBINED AT	AP-D1	48.	6.20	8.	4.	4.	0.14		
HYDROGRAPH AT	SB-D3	19.	6.15	2.	1.	1.	0.03		
2 COMBINED AT	AP-DDA	66.	6.20	11.	5.	5.	0.17		
ROUTED TO	RR-DFA	45.	6.45	11.	5.	5.	0.17	58.43	6.45
ROUTED TO	RT-APDFA	44.	6.45	11.	5.	5.	0.17		
HYDROGRAPH AT	SB-D6	45.	6.05	5.	2.	2.	0.04		
2 COMBINED AT	AP-D2	81.	6.10	15.	7.	7.	0.21		
ROUTED TO	RT-APD2	80.	6.10	15.	7.	7.	0.21		
HYDROGRAPH AT	SB-D7	82.	6.05	9.	4.	4.	0.07		
HYDROGRAPH AT	SB-D4	22.	6.15	3.	1.	1.	0.05		
HYDROGRAPH AT	SB-D5	22.	6.15	3.	1.	1.	0.03		
2 COMBINED AT	AP-DFB	44.	6.15	6.	3.	3.	0.08		
ROUTED TO	RR-DFB	39.	6.25	6.	3.	3.	0.08	20.69	6.25
ROUTED TO	RT-APDFB	39.	6.25	6.	3.	3.	0.08		
3 COMBINED AT	AP-D3	198.	6.10	29.	13.	13.	0.36		
ROUTED TO	RT-APD3	196.	6.10	29.	13.	13.	0.36		
HYDROGRAPH AT	SB-D8	133.	6.00	13.	6.	6.	0.06		
2 COMBINED AT	AP-DFC	311.	6.05	43.	19.	19.	0.42		
ROUTED TO	RR-DFC	66.	6.80	42.	19.	19.	0.42	60.06	6.80

25 Year, 24 Hour, Developed Condition

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-D1	45.	6.30	8.	3.	3.	0.09		
ROUTED TO	RT-SBD1	45.	6.35	8.	3.	3.	0.09		
HYDROGRAPH AT	SB-D2	46.	6.10	6.	2.	2.	0.06		
2 COMBINED AT	AP-D1	79.	6.20	13.	6.	6.	0.14		
HYDROGRAPH AT	SB-D3	27.	6.15	3.	2.	2.	0.03		
2 COMBINED AT	AP-DDA	105.	6.20	16.	7.	7.	0.17		
ROUTED TO	RR-DFA	54.	6.55	16.	7.	7.	0.17	60.75	6.55
ROUTED TO	RT-APDFA	54.	6.55	16.	7.	7.	0.17		
HYDROGRAPH AT	SB-D6	62.	6.05	6.	3.	3.	0.04		
2 COMBINED AT	AP-D2	101.	6.10	23.	10.	10.	0.21		
ROUTED TO	RT-APD2	101.	6.10	23.	10.	10.	0.21		
HYDROGRAPH AT	SB-D7	113.	6.05	12.	5.	5.	0.07		
HYDROGRAPH AT	SB-D4	36.	6.15	4.	2.	2.	0.05		
HYDROGRAPH AT	SB-D5	32.	6.15	4.	2.	2.	0.03		
2 COMBINED AT	AP-DFB	68.	6.15	8.	4.	4.	0.08		
ROUTED TO	RR-DFB	47.	6.30	8.	4.	4.	0.08	23.03	6.30
ROUTED TO	RT-APDFB	47.	6.30	8.	4.	4.	0.08		
3 COMBINED AT	AP-D3	254.	6.10	43.	19.	19.	0.36		
ROUTED TO	RT-APD3	253.	6.10	43.	19.	19.	0.36		
HYDROGRAPH AT	SB-D8	165.	6.00	17.	7.	7.	0.06		
2 COMBINED AT	AP-DFC	405.	6.05	60.	26.	26.	0.42		
ROUTED TO	RR-DFC	75.	7.05	58.	26.	26.	0.42	62.40	7.10

50 Year, 24 Hour, Developed Condition

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-D1	58.	6.25	10.	4.	4.	0.09		
ROUTED TO	RT-SBD1	58.	6.30	10.	4.	4.	0.09		
HYDROGRAPH AT	SB-D2	59.	6.10	7.	3.	3.	0.06		
2 COMBINED AT	AP-D1	102.	6.20	16.	7.	7.	0.14		
HYDROGRAPH AT	SB-D3	33.	6.15	4.	2.	2.	0.03		
2 COMBINED AT	AP-DDA	134.	6.20	21.	9.	9.	0.17		
ROUTED TO	RR-DFA	60.	6.60	21.	9.	9.	0.17	62.11	6.60
ROUTED TO	RT-APDFA	60.	6.60	21.	9.	9.	0.17		
HYDROGRAPH AT	SB-D6	74.	6.05	8.	3.	3.	0.04		
2 COMBINED AT	AP-D2	116.	6.05	28.	12.	12.	0.21		
ROUTED TO	RT-APD2	116.	6.10	28.	12.	12.	0.21		
HYDROGRAPH AT	SB-D7	134.	6.05	14.	6.	6.	0.07		
HYDROGRAPH AT	SB-D4	45.	6.15	6.	2.	2.	0.05		
HYDROGRAPH AT	SB-D5	40.	6.10	5.	2.	2.	0.03		
2 COMBINED AT	AP-DFB	85.	6.15	10.	5.	5.	0.08		
ROUTED TO	RR-DFB	52.	6.30	10.	5.	5.	0.08	24.31	6.30
ROUTED TO	RT-APDFB	52.	6.35	10.	5.	5.	0.08		
3 COMBINED AT	AP-D3	291.	6.10	53.	23.	23.	0.36		
ROUTED TO	RT-APD3	291.	6.10	53.	23.	23.	0.36		
HYDROGRAPH AT	SB-D8	186.	6.00	19.	8.	8.	0.06		
2 COMBINED AT	AP-DFC	465.	6.05	72.	32.	32.	0.42		
ROUTED TO	RR-DFC	81.	7.20	67.	31.	31.	0.42	64.02	7.20

H.

HEC-1 MODEL OUTPUT

HISTORIC (UNDEVELOPED) CONDITION

- **100-YEAR STORM**

HEC1 S/N: 1343000062   HMVersion: 6.33   Data File: x:\880000.all\887710\hec1\mddp\kcu100.dat

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              MAY   1991               *
*            VERSION 4.0.1E             *
*                                       *
*  RUN DATE  05/06/1999  TIME  19:40:18 *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*   U.S. ARMY CORPS OF ENGINEERS        *
*   HYDROLOGIC ENGINEERING CENTER       *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*            (916) 756-1104             *
*                                       *
*****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

```
::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::
:::                                  :::
:::  Full Microcomputer Implementation :::
:::                by                :::
:::       Haestad Methods, Inc.      :::
:::                                  :::
::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   1          ID   KETTLE CREEK DRAINAGE BASIN - 24HR, HISTORIC CONDITION (TYPE IIa100 YEAR)
   2          ID   WATERSHED IN PREDEVELOPMENT CONDITION WITH NO CONSERVATION TREATMENT
   3          ID   FILE:KCU100.DAT
   4          ID   UNDEVELOPED CONDITION MODEL
   5          ID   ****************************************************************************
   6          ID   BEGIN CALCULATIONS IN THE SOUTH TRIBUTARY WATERSHED
   7          ID   ****************************************************************************
*** FREE ***
              *DIAGRAM
   8          IT       3       0       0     300
   9          IO       5

  10          KK   SB-H1
  11          KM   COMPUTE HYDROGRAPH FOR BASIN H1
  12          BA   .1347
  13          IN      15
  14          PB     4.4     4.0
  15          PC    0000   .0005   .0015   .0030   .0045   .0060   .0080   .0100   .0120   .0143
  16          PC   .0165   .0188   .0210   .0233   .0255   .0278   .0320   .0390   .0460   .0530
  17          PC   .0600   .0750   .1000   .4000   .7000   .7250   .7500   .7650   .7800   .7900
  18          PC   .8000   .8100   .8200   .8250   .8300   .8350   .8400   .8450   .8500   .8550
  19          PC   .8600   .8638   .8675   .8713   .8750   .8788   .8825   .8863   .8900   .8938
  20          PC   .8975   .9013   .9050   .9083   .9115   .9148   .9180   .9210   .9240   .9270
  21          PC   .9300   .9325   .9350   .9375   .9400   .9425   .9450   .9475   .9500   .9525
  22          PC   .9550   .9575   .9600   .9625   .9650   .9675   .9700   .9725   .9750   .9775
  23          PC   .9800   .9813   .9825   .9838   .9850   .9863   .9875   .9888   .9900   .9913
  24          PC   .9925   .9938   .9950   .9963   .9975   .9988   1.000
  25          LS       0      66
  26          UD    .420

  27          KK RT-SBH1
  28          KM   ROUTE THE RUNOFF FROM SB-H1 THROUGH SB-H2 TO AP-H1
  29          RD    3500    .027    .035            TRAP      15      10

  30          KK   SB-H2
  31          KM   COMPUTE HYDROGRAPH FOR BASIN H2
  32          BA  0.1288
  33          LS       0      66
  34          UD    .303

  35          KK   AP-H1
  36          KM   COMBINE THE FLOW FROM BASIN H2 TO THE ROUTED FLOW FROM BASIN H1 AT AP-H1
  37          HC       2

  38          KK RT-APH1
  39          KM   ROUTE THE RUNOFF FROM AP1 TO AP-H2
  40          RD     590    .015    .035            TRAP      30       5

  41          KK   SB-H3
  42          KM   COMPUTE HYDROGRAPH FOR BASIN H3
  43          BA  0.0853
  44          LS       0      66
  45          UD    .314
```

```
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  10        SB-H1
                V
                V
  27      RT-SBH1
                .
                .
  30            .       SB-H2
                .           .
                .           .
  35        AP-H1............
                V
                V
  38      RT-APH1
                .
                .
  41            .       SB-H3
                .           V
                .           V
  46            .       RT-H3
                .           .
                .           .
  49        AP-H2............
                V
                V
  52      RT-AP2
                .
                .
  55            .       SB-H4
                .           .
                .           .
  60            .           .       SB-H5
                .           .           .
                .           .           .
  65        AP-H3........................
                V
                V
  68      RT-APH3
                .
                .
  71            .       SB-H6
                .           .
                .           .
  76        AP-H4............
                V
                V
  79      RT-APH4
                V
                V
  82      RT-APH5
                V
                V
  85      RT-APH6
                .
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-H1	99.	6.30	17.	8.	8.	0.13		
ROUTED TO	RT-SBH1	98.	6.45	17.	8.	8.	0.13		
HYDROGRAPH AT	SB-H2	118.	6.20	16.	7.	7.	0.13		
2 COMBINED AT	AP-H1	179.	6.30	33.	15.	15.	0.26		
ROUTED TO	RT-APH1	178.	6.35	33.	15.	15.	0.26		
HYDROGRAPH AT	SB-H3	76.	6.20	11.	5.	5.	0.09		
ROUTED TO	RT-H3	75.	6.25	11.	5.	5.	0.09		
2 COMBINED AT	AP-H2	247.	6.30	44.	20.	20.	0.35		
ROUTED TO	RT-AP2	245.	6.35	44.	20.	20.	0.35		
HYDROGRAPH AT	SB-H4	51.	6.10	5.	2.	2.	0.04		
HYDROGRAPH AT	SB-H5	72.	6.20	10.	4.	4.	0.08		
3 COMBINED AT	AP-H3	317.	6.30	59.	26.	26.	0.47		
ROUTED TO	RT-APH3	314.	6.35	59.	26.	26.	0.47		
HYDROGRAPH AT	SB-H6	62.	6.30	10.	5.	5.	0.08		
2 COMBINED AT	AP-H4	376.	6.30	69.	31.	31.	0.55		
ROUTED TO	RT-APH4	376.	6.35	69.	31.	31.	0.55		
ROUTED TO	RT-APH5	376.	6.40	69.	31.	31.	0.55		
ROUTED TO	RT-APH6	374.	6.40	69.	31.	31.	0.55		
HYDROGRAPH AT	SB-H7	48.	6.25	8.	3.	3.	0.06		
ROUTED TO	RT-SBH7	48.	6.45	8.	3.	3.	0.06		
HYDROGRAPH AT	SB-H8	67.	6.25	10.	5.	5.	0.08		
2 COMBINED AT	AP-H7	103.	6.35	18.	8.	8.	0.14		
ROUTED TO	RT-APH7	102.	6.40	18.	8.	8.	0.14		
2 COMBINED AT	AP-H8	477.	6.40	87.	39.	39.	0.69		
ROUTED TO	RT-APH8	474.	6.40	87.	39.	39.	0.69		
HYDROGRAPH AT	SB-H9	130.	6.20	18.	8.	8.	0.14		

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	PEAK	TIME TO PEAK	VOLUME
						INTERPOLATED TO COMPUTATION INTERVAL			
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
RT-SBH1	MANE	2.25	98.35	387.00	1.30	3.00	98.35	387.00	1.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9429E+01 EXCESS=0.0000E+00 OUTFLOW=0.9338E+01 BASIN STORAGE=0.1320E+00 PERCENT ERROR= -0.4

RT-APH1	MANE	1.79	178.47	381.10	1.31	3.00	178.46	381.00	1.31

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1840E+02 EXCESS=0.0000E+00 OUTFLOW=0.1836E+02 BASIN STORAGE=0.5273E-01 PERCENT ERROR= -0.1

RT-H3	MANE	1.95	75.64	374.40	1.32	3.00	75.26	375.00	1.31

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5996E+01 EXCESS=0.0000E+00 OUTFLOW=0.5985E+01 BASIN STORAGE=0.1681E-01 PERCENT ERROR= -0.1

RT-AP2	MANE	2.40	245.53	381.60	1.30	3.00	244.54	381.00	1.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2434E+02 EXCESS=0.0000E+00 OUTFLOW=0.2423E+02 BASIN STORAGE=0.1467E+00 PERCENT ERROR= -0.1

RT-APH3	MANE	1.00	316.88	379.09	1.31	3.00	314.46	381.00	1.31

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3266E+02 EXCESS=0.0000E+00 OUTFLOW=0.3263E+02 BASIN STORAGE=0.5039E-01 PERCENT ERROR= 0.0

RT-APH4	MANE	1.51	376.34	381.05	1.30	3.00	376.31	381.00	1.30

ONTINUITY SUMMARY (AC-FT) - INFLOW=0.3833E+02 EXCESS=0.0000E+00 OUTFLOW=0.3827E+02 BASIN STORAGE=0.8959E-01 PERCENT ERROR= -0.1

RT-APH5	MANE	3.00	376.45	384.00	1.30	3.00	376.45	384.00	1.30

ONTINUITY SUMMARY (AC-FT) - INFLOW=0.3830E+02 EXCESS=0.0000E+00 OUTFLOW=0.3818E+02 BASIN STORAGE=0.1874E+00 PERCENT ERROR= -0.2

RT-APH6	MANE	1.09	375.92	385.14	1.30	3.00	374.36	384.00	1.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3815E+02 EXCESS=0.0000E+00 OUTFLOW=0.3811E+02 BASIN STORAGE=0.5767E-01 PERCENT ERROR= 0.0

RT-SBH7	MANE	2.10	48.07	386.40	1.30	3.00	47.88	387.00	1.30

HEC-1 MODEL OUTPUT

HISTORIC (UNDEVELOPED) CONDITION

SUMMARY SHEETS FOR 2, 5, 10, 25, AND 50 YEAR STORMS

2 YEAR 24 HOUR STORM

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-H1	7.	6.40	2.	1.	1.	0.13		
ROUTED TO	RT-SBH1	7.	6.65	2.	1.	1.	0.13		
HYDROGRAPH AT	SB-H2	8.	6.25	2.	1.	1.	0.13		
2 COMBINED AT	AP-H1	11.	6.65	3.	2.	2.	0.26		
ROUTED TO	RT-APH1	11.	6.75	3.	2.	2.	0.26		
HYDROGRAPH AT	SB-H3	5.	6.30	1.	1.	1.	0.09		
ROUTED TO	RT-H3	5.	6.35	1.	1.	1.	0.09		
2 COMBINED AT	AP-H2	14.	6.75	5.	2.	2.	0.35		
ROUTED TO	RT-AP2	14.	6.85	5.	2.	2.	0.35		
HYDROGRAPH AT	SB-H4	4.	6.15	1.	0.	0.	0.04		
HYDROGRAPH AT	SB-H5	5.	6.25	1.	1.	1.	0.08		
3 COMBINED AT	AP-H3	18.	6.45	6.	3.	3.	0.47		
ROUTED TO	RT-APH3	18.	6.50	6.	3.	3.	0.47		
HYDROGRAPH AT	SB-H6	4.	6.40	1.	1.	1.	0.08		
2 COMBINED AT	AP-H4	22.	6.50	7.	3.	3.	0.55		
ROUTED TO	RT-APH4	22.	6.50	7.	3.	3.	0.55		
ROUTED TO	RT-APH5	23.	6.65	7.	3.	3.	0.55		
ROUTED TO	RT-APH6	22.	6.70	7.	3.	3.	0.55		
HYDROGRAPH AT	SB-H7	3.	6.35	1.	0.	0.	0.06		
ROUTED TO	RT-SBH7	4.	6.65	1.	0.	0.	0.06		
HYDROGRAPH AT	SB-H8	5.	6.30	1.	1.	1.	0.08		
2 COMBINED AT	AP-H7	7.	6.65	2.	1.	1.	0.14		
ROUTED TO	RT-APH7	6.	6.75	2.	1.	1.	0.14		
2 COMBINED AT	AP-H8	27.	6.75	9.	4.	4.	0.69		
ROUTED TO	RT-APH8	27.	6.75	9.	4.	4.	0.69		
HYDROGRAPH AT	SB-H9	9.	6.25	2.	1.	1.	0.14		

5 YEAR 24 HOUR STORM
RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-H1	22.	6.35	5.	2.	2.	0.13		
ROUTED TO	RT-SBH1	22.	6.55	4.	2.	2.	0.13		
HYDROGRAPH AT	SB-H2	26.	6.25	4.	2.	2.	0.13		
2 COMBINED AT	AP-H1	36.	6.40	9.	4.	4.	0.26		
ROUTED TO	RT-APH1	35.	6.50	9.	4.	4.	0.26		
HYDROGRAPH AT	SB-H3	17.	6.25	3.	1.	1.	0.09		
ROUTED TO	RT-H3	17.	6.30	3.	1.	1.	0.09		
2 COMBINED AT	AP-H2	48.	6.45	12.	5.	5.	0.35		
ROUTED TO	RT-AP2	47.	6.60	12.	5.	5.	0.35		
HYDROGRAPH AT	SB-H4	12.	6.10	1.	1.	1.	0.04		
HYDROGRAPH AT	SB-H5	16.	6.20	3.	1.	1.	0.08		
3 COMBINED AT	AP-H3	60.	6.35	15.	7.	7.	0.47		
ROUTED TO	RT-APH3	59.	6.35	15.	7.	7.	0.47		
HYDROGRAPH AT	SB-H6	14.	6.35	3.	1.	1.	0.08		
2 COMBINED AT	AP-H4	73.	6.35	18.	8.	8.	0.55		
ROUTED TO	RT-APH4	73.	6.40	18.	8.	8.	0.55		
ROUTED TO	RT-APH5	72.	6.50	18.	8.	8.	0.55		
ROUTED TO	RT-APH6	73.	6.50	18.	8.	8.	0.55		
HYDROGRAPH AT	SB-H7	11.	6.30	2.	1.	1.	0.06		
ROUTED TO	RT-SBH7	11.	6.55	2.	1.	1.	0.06		
HYDROGRAPH AT	SB-H8	15.	6.30	3.	1.	1.	0.08		
2 COMBINED AT	AP-H7	23.	6.45	5.	2.	2.	0.14		
ROUTED TO	RT-APH7	22.	6.55	5.	2.	2.	0.14		
2 COMBINED AT	AP-H8	94.	6.55	23.	10.	10.	0.69		
ROUTED TO	RT-APH8	93.	6.55	23.	10.	10.	0.69		
HYDROGRAPH AT	SB-H9	29.	6.25	5.	2.	2.	0.14		

10 YEAR 24 HOUR STORM

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-H1	35.	6.35	7.	3.	3.	0.13		
ROUTED TO	RT-SBH1	35.	6.55	7.	3.	3.	0.13		
HYDROGRAPH AT	SB-H2	43.	6.20	7.	3.	3.	0.13		
2 COMBINED AT	AP-H1	60.	6.40	13.	6.	6.	0.26		
ROUTED TO	RT-APH1	60.	6.45	13.	6.	6.	0.26		
HYDROGRAPH AT	SB-H3	27.	6.25	4.	2.	2.	0.09		
ROUTED TO	RT-H3	27.	6.25	4.	2.	2.	0.09		
2 COMBINED AT	AP-H2	81.	6.40	18.	8.	8.	0.35		
ROUTED TO	RT-AP2	81.	6.50	18.	8.	8.	0.35		
HYDROGRAPH AT	SB-H4	19.	6.10	2.	1.	1.	0.04		
HYDROGRAPH AT	SB-H5	27.	6.20	4.	2.	2.	0.08		
3 COMBINED AT	AP-H3	99.	6.30	23.	11.	11.	0.47		
ROUTED TO	RT-APH3	99.	6.35	23.	11.	11.	0.47		
HYDROGRAPH AT	SB-H6	22.	6.30	4.	2.	2.	0.08		
2 COMBINED AT	AP-H4	121.	6.35	28.	13.	13.	0.55		
ROUTED TO	RT-APH4	121.	6.35	28.	13.	13.	0.55		
ROUTED TO	RT-APH5	121.	6.45	28.	12.	12.	0.55		
ROUTED TO	RT-APH6	120.	6.50	27.	12.	12.	0.55		
HYDROGRAPH AT	SB-H7	17.	6.30	3.	1.	1.	0.06		
ROUTED TO	RT-SBH7	17.	6.55	3.	1.	1.	0.06		
HYDROGRAPH AT	SB-H8	24.	6.25	4.	2.	2.	0.08		
2 COMBINED AT	AP-H7	35.	6.40	7.	3.	3.	0.14		
ROUTED TO	RT-APH7	35.	6.50	7.	3.	3.	0.14		
2 COMBINED AT	AP-H8	155.	6.50	34.	16.	16.	0.69		
ROUTED TO	RT-APH8	154.	6.50	34.	16.	16.	0.69		
HYDROGRAPH AT	SB-H9	47.	6.20	7.	3.	3.	0.14		

25 YEAR 24 HOUR STORM
RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-H1	59.	6.35	11.	5.	5.	0.13		
ROUTED TO	RT-SBH1	60.	6.50	11.	5.	5.	0.13		
HYDROGRAPH AT	SB-H2	72.	6.20	10.	5.	5.	0.13		
2 COMBINED AT	AP-H1	105.	6.35	21.	10.	10.	0.26		
ROUTED TO	RT-APH1	105.	6.40	21.	10.	10.	0.26		
HYDROGRAPH AT	SB-H3	46.	6.20	7.	3.	3.	0.09		
ROUTED TO	RT-H3	46.	6.25	7.	3.	3.	0.09		
2 COMBINED AT	AP-H2	144.	6.35	28.	13.	13.	0.35		
ROUTED TO	RT-AP2	143.	6.40	28.	13.	13.	0.35		
HYDROGRAPH AT	SB-H4	32.	6.10	3.	2.	2.	0.04		
HYDROGRAPH AT	SB-H5	45.	6.20	6.	3.	3.	0.08		
3 COMBINED AT	AP-H3	181.	6.35	37.	17.	17.	0.47		
ROUTED TO	RT-APH3	180.	6.40	37.	17.	17.	0.47		
HYDROGRAPH AT	SB-H6	38.	6.30	7.	3.	3.	0.08		
2 COMBINED AT	AP-H4	217.	6.35	44.	20.	20.	0.55		
ROUTED TO	RT-APH4	216.	6.40	44.	20.	20.	0.55		
ROUTED TO	RT-APH5	216.	6.45	44.	20.	20.	0.55		
ROUTED TO	RT-APH6	215.	6.45	44.	20.	20.	0.55		
HYDROGRAPH AT	SB-H7	29.	6.25	5.	2.	2.	0.06		
ROUTED TO	RT-SBH7	29.	6.45	5.	2.	2.	0.06		
HYDROGRAPH AT	SB-H8	41.	6.25	6.	3.	3.	0.08		
2 COMBINED AT	AP-H7	60.	6.40	11.	5.	5.	0.14		
ROUTED TO	RT-APH7	60.	6.40	11.	5.	5.	0.14		
2 COMBINED AT	AP-H8	274.	6.45	55.	25.	25.	0.69		
ROUTED TO	RT-APH8	274.	6.45	55.	25.	25.	0.69		
HYDROGRAPH AT	SB-H9	80.	6.20	11.	5.	5.	0.14		

50 YEAR 24 HOUR STORM
RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-H1	78.	6.30	14.	6.	6.	0.13		
ROUTED TO	RT-SBH1	78.	6.45	14.	6.	6.	0.13		
HYDROGRAPH AT	SB-H2	94.	6.20	13.	6.	6.	0.13		
2 COMBINED AT	AP-H1	140.	6.35	27.	12.	12.	0.26		
ROUTED TO	RT-APH1	139.	6.35	27.	12.	12.	0.26		
HYDROGRAPH AT	SB-H3	61.	6.20	9.	4.	4.	0.09		
ROUTED TO	RT-H3	60.	6.25	9.	4.	4.	0.09		
2 COMBINED AT	AP-H2	193.	6.30	36.	16.	16.	0.35		
ROUTED TO	RT-AP2	192.	6.40	36.	16.	16.	0.35		
HYDROGRAPH AT	SB-H4	41.	6.10	4.	2.	2.	0.04		
HYDROGRAPH AT	SB-H5	58.	6.20	8.	4.	4.	0.08		
3 COMBINED AT	AP-H3	246.	6.35	48.	22.	22.	0.47		
ROUTED TO	RT-APH3	246.	6.35	48.	21.	21.	0.47		
HYDROGRAPH AT	SB-H6	50.	6.30	8.	4.	4.	0.08		
2 COMBINED AT	AP-H4	294.	6.35	56.	25.	25.	0.55		
ROUTED TO	RT-APH4	292.	6.35	56.	25.	25.	0.55		
ROUTED TO	RT-APH5	291.	6.40	56.	25.	25.	0.55		
ROUTED TO	RT-APH6	291.	6.45	56.	25.	25.	0.55		
HYDROGRAPH AT	SB-H7	38.	6.25	6.	3.	3.	0.06		
ROUTED TO	RT-SBH7	38.	6.45	6.	3.	3.	0.06		
HYDROGRAPH AT	SB-H8	54.	6.25	8.	4.	4.	0.08		
2 COMBINED AT	AP-H7	81.	6.35	14.	6.	6.	0.14		
ROUTED TO	RT-APH7	81.	6.45	14.	6.	6.	0.14		
2 COMBINED AT	AP-H8	371.	6.45	70.	31.	31.	0.69		
ROUTED TO	RT-APH8	370.	6.45	70.	31.	31.	0.69		
HYDROGRAPH AT	SB-H9	104.	6.20	15.	7.	7.	0.14		

I.

HEC-1 MODEL OUTPUT

HISTORIC (UNDEVELOPED) CONDITION

SUMMARY SHEETS FOR 2, 5, 10, 25, AND 50-YEAR STORMS

2 YEAR 24 HOUR STORM
RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-D1	6.	6.35	1.	1.	1.	0.09		
ROUTED TO	RT-SBD1	6.	6.45	1.	1.	1.	0.09		
HYDROGRAPH AT	SB-D2	8.	6.15	1.	1.	1.	0.06		
2 COMBINED AT	AP-D1	11.	6.25	2.	1.	1.	0.14		
HYDROGRAPH AT	SB-D3	7.	6.20	1.	0.	0.	0.03		
2 COMBINED AT	AP-DDA	17.	6.20	3.	2.	2.	0.17		
ROUTED TO	RR-DFA	17.	6.25	3.	2.	2.	0.17	54.92	6.25
ROUTED TO	RT-APDFA	17.	6.25	3.	2.	2.	0.17		
HYDROGRAPH AT	SB-D6	19.	6.10	2.	1.	1.	0.04		
2 COMBINED AT	AP-D2	30.	6.15	5.	2.	2.	0.21		
ROUTED TO	RT-APD2	29.	6.15	5.	2.	2.	0.21		
HYDROGRAPH AT	SB-D7	36.	6.10	4.	2.	2.	0.07		
HYDROGRAPH AT	SB-D4	5.	6.20	1.	0.	0.	0.05		
HYDROGRAPH AT	SB-D5	8.	6.15	1.	0.	0.	0.03		
2 COMBINED AT	AP-DFB	13.	6.15	2.	1.	1.	0.08		
ROUTED TO	RR-DFB	13.	6.20	2.	1.	1.	0.08	19.35	6.20
ROUTED TO	RT-APDFB	13.	6.20	2.	1.	1.	0.08		
3 COMBINED AT	AP-D3	73.	6.10	11.	5.	5.	0.36		
ROUTED TO	RT-APD3	73.	6.15	11.	5.	5.	0.36		
HYDROGRAPH AT	SB-D8	79.	6.00	8.	3.	3.	0.06		
2 COMBINED AT	AP-DFC	139.	6.05	19.	8.	8.	0.42		
ROUTED TO	RR-DFC	45.	6.40	18.	8.	8.	0.42	55.96	6.40
ROUTED TO	RT-RRDFC	45.	6.45	18.	8.	8.	0.42		
HYDROGRAPH AT	SB-D9	41.	6.05	4.	2.	2.	0.06		
2 COMBINED AT	AP-D4	78.	6.10	23.	10.	10.	0.47		
ROUTED TO	RT-APD4	78.	6.10	23.	10.	10.	0.47		

5 YEAR 24 HOUR STORM

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-D1	17.	6.30	3.	1.	1.	0.09		
ROUTED TO	RT-SBD1	17.	6.35	3.	1.	1.	0.09		
HYDROGRAPH AT	SB-D2	20.	6.15	2.	1.	1.	0.06		
2 COMBINED AT	AP-D1	31.	6.25	6.	3.	3.	0.14		
HYDROGRAPH AT	SB-D3	13.	6.15	2.	1.	1.	0.03		
2 COMBINED AT	AP-DDA	44.	6.20	7.	3.	3.	0.17		
ROUTED TO	RR-DFA	38.	6.35	7.	3.	3.	0.17	56.38	6.35
ROUTED TO	RT-APDFA	38.	6.35	7.	3.	3.	0.17		
HYDROGRAPH AT	SB-D6	34.	6.05	3.	2.	2.	0.04		
2 COMBINED AT	AP-D2	64.	6.15	11.	5.	5.	0.21		
ROUTED TO	RT-APD2	64.	6.15	11.	5.	5.	0.21		
HYDROGRAPH AT	SB-D7	62.	6.05	7.	3.	3.	0.07		
HYDROGRAPH AT	SB-D4	14.	6.15	2.	1.	1.	0.05		
HYDROGRAPH AT	SB-D5	16.	6.15	2.	1.	1.	0.03		
2 COMBINED AT	AP-DFB	30.	6.15	4.	2.	2.	0.08		
ROUTED TO	RR-DFB	30.	6.15	4.	2.	2.	0.08	19.82	6.15
ROUTED TO	RT-APDFB	30.	6.15	4.	2.	2.	0.08		
3 COMBINED AT	AP-D3	148.	6.10	21.	10.	10.	0.36		
ROUTED TO	RT-APD3	147.	6.15	21.	10.	10.	0.36		
HYDROGRAPH AT	SB-D8	111.	6.00	11.	5.	5.	0.06		
2 COMBINED AT	AP-DFC	237.	6.05	32.	14.	14.	0.42		
ROUTED TO	RR-DFC	60.	6.60	32.	14.	14.	0.42	58.40	6.60
ROUTED TO	RT-RRDFC	60.	6.60	32.	14.	14.	0.42		
HYDROGRAPH AT	SB-D9	66.	6.05	7.	3.	3.	0.06		
2 COMBINED AT	AP-D4	112.	6.10	39.	17.	17.	0.47		
ROUTED TO	RT-APD4	112.	6.10	39.	17.	17.	0.47		

10YEAR 24 HOUR STORM

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-D1	27.	6.30	5.	2.	2.	0.09		
ROUTED TO	RT-SBD1	27.	6.35	5.	2.	2.	0.09		
HYDROGRAPH AT	SB-D2	30.	6.15	4.	2.	2.	0.06		
2 COMBINED AT	AP-D1	48.	6.20	8.	4.	4.	0.14		
HYDROGRAPH AT	SB-D3	19.	6.15	2.	1.	1.	0.03		
2 COMBINED AT	AP-DDA	66.	6.20	11.	5.	5.	0.17		
ROUTED TO	RR-DFA	45.	6.45	11.	5.	5.	0.17	58.43	6.45
ROUTED TO	RT-APDFA	44.	6.45	11.	5.	5.	0.17		
HYDROGRAPH AT	SB-D6	45.	6.05	5.	2.	2.	0.04		
2 COMBINED AT	AP-D2	81.	6.10	15.	7.	7.	0.21		
ROUTED TO	RT-APD2	80.	6.10	15.	7.	7.	0.21		
HYDROGRAPH AT	SB-D7	82.	6.05	9.	4.	4.	0.07		
HYDROGRAPH AT	SB-D4	22.	6.15	3.	1.	1.	0.05		
HYDROGRAPH AT	SB-D5	22.	6.15	3.	1.	1.	0.03		
2 COMBINED AT	AP-DFB	44.	6.15	6.	3.	3.	0.08		
ROUTED TO	RR-DFB	39.	6.25	6.	3.	3.	0.08	20.69	6.25
ROUTED TO	RT-APDFB	39.	6.25	6.	3.	3.	0.08		
3 COMBINED AT	AP-D3	198.	6.10	29.	13.	13.	0.36		
ROUTED TO	RT-APD3	196.	6.10	29.	13.	13.	0.36		
HYDROGRAPH AT	SB-D8	133.	6.00	13.	6.	6.	0.06		
2 COMBINED AT	AP-DFC	311.	6.05	43.	19.	19.	0.42		
ROUTED TO	RR-DFC	66.	6.80	42.	19.	19.	0.42	60.06	6.80
ROUTED TO	RT-RRDFC	66.	6.85	42.	19.	19.	0.42		
HYDROGRAPH AT	SB-D9	83.	6.05	9.	4.	4.	0.06		
2 COMBINED AT	AP-D4	135.	6.10	51.	23.	23.	0.47		
ROUTED TO	RT-APD4	135.	6.10	51.	23.	23.	0.47		

25 YEAR 24 HOUR STORM

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-D1	45.	6.30	8.	3.	3.	0.09		
ROUTED TO	RT-SBD1	45.	6.35	8.	3.	3.	0.09		
HYDROGRAPH AT	SB-D2	46.	6.10	6.	2.	2.	0.06		
2 COMBINED AT	AP-D1	79.	6.20	13.	6.	6.	0.14		
HYDROGRAPH AT	SB-D3	27.	6.15	3.	2.	2.	0.03		
2 COMBINED AT	AP-DDA	105.	6.20	16.	7.	7.	0.17		
ROUTED TO	RR-DFA	54.	6.55	16.	7.	7.	0.17	60.75	6.55
ROUTED TO	RT-APDFA	54.	6.55	16.	7.	7.	0.17		
HYDROGRAPH AT	SB-D6	62.	6.05	6.	3.	3.	0.04		
2 COMBINED AT	AP-D2	101.	6.10	23.	10.	10.	0.21		
ROUTED TO	RT-APD2	101.	6.10	23.	10.	10.	0.21		
HYDROGRAPH AT	SB-D7	113.	6.05	12.	5.	5.	0.07		
HYDROGRAPH AT	SB-D4	36.	6.15	4.	2.	2.	0.05		
HYDROGRAPH AT	SB-D5	32.	6.15	4.	2.	2.	0.03		
2 COMBINED AT	AP-DFB	68.	6.15	8.	4.	4.	0.08		
ROUTED TO	RR-DFB	47.	6.30	8.	4.	4.	0.08	23.03	6.30
ROUTED TO	RT-APDFB	47.	6.30	8.	4.	4.	0.08		
3 COMBINED AT	AP-D3	254.	6.10	43.	19.	19.	0.36		
ROUTED TO	RT-APD3	253.	6.10	43.	19.	19.	0.36		
HYDROGRAPH AT	SB-D8	165.	6.00	17.	7.	7.	0.06		
2 COMBINED AT	AP-DFC	405.	6.05	60.	26.	26.	0.42		
ROUTED TO	RR-DFC	75.	7.05	58.	26.	26.	0.42	62.40	7.10
ROUTED TO	RT-RRDFC	75.	7.10	58.	26.	26.	0.42		
HYDROGRAPH AT	SB-D9	109.	6.05	12.	5.	5.	0.06		
2 COMBINED AT	AP-D4	168.	6.05	70.	31.	31.	0.47		
ROUTED TO	RT-APD4	167.	6.10	70.	31.	31.	0.47		

50 YEAR 24 HOUR STORM

RUNOFF SUMMARY

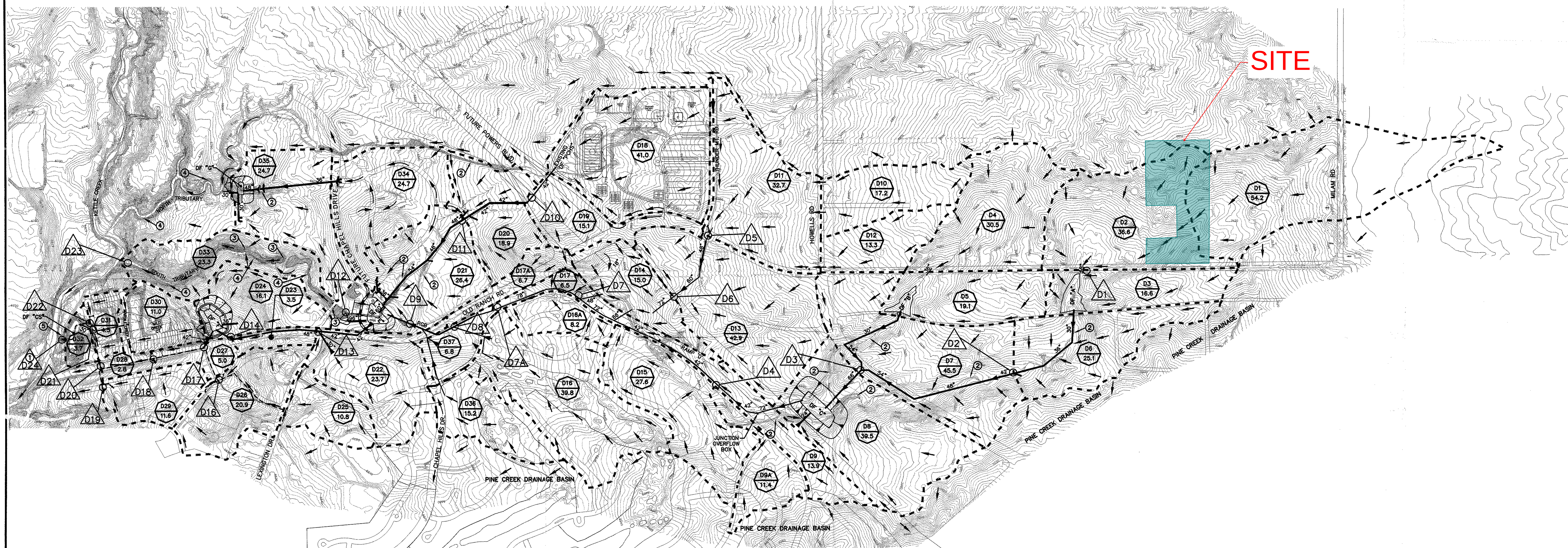
FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	SB-D1	58.	6.25	10.	4.	4.	0.09		
ROUTED TO	RT-SBD1	58.	6.30	10.	4.	4.	0.09		
HYDROGRAPH AT	SB-D2	59.	6.10	7.	3.	3.	0.06		
2 COMBINED AT	AP-D1	102.	6.20	16.	7.	7.	0.14		
HYDROGRAPH AT	SB-D3	33.	6.15	4.	2.	2.	0.03		
2 COMBINED AT	AP-DDA	134.	6.20	21.	9.	9.	0.17		
ROUTED TO	RR-DFA	60.	6.60	21.	9.	9.	0.17	62.11	6.60
ROUTED TO	RT-APDFA	60.	6.60	21.	9.	9.	0.17		
HYDROGRAPH AT	SB-D6	74.	6.05	8.	3.	3.	0.04		
2 COMBINED AT	AP-D2	116.	6.05	28.	12.	12.	0.21		
ROUTED TO	RT-APD2	116.	6.10	28.	12.	12.	0.21		
HYDROGRAPH AT	SB-D7	134.	6.05	14.	6.	6.	0.07		
HYDROGRAPH AT	SB-D4	45.	6.15	6.	2.	2.	0.05		
HYDROGRAPH AT	SB-D5	40.	6.10	5.	2.	2.	0.03		
2 COMBINED AT	AP-DFB	85.	6.15	10.	5.	5.	0.08		
ROUTED TO	RR-DFB	52.	6.30	10.	5.	5.	0.08	24.31	6.30
ROUTED TO	RT-APDFB	52.	6.35	10.	5.	5.	0.08		
3 COMBINED AT	AP-D3	291.	6.10	53.	23.	23.	0.36		
ROUTED TO	RT-APD3	291.	6.10	53.	23.	23.	0.36		
HYDROGRAPH AT	SB-D8	186.	6.00	19.	8.	8.	0.06		
2 COMBINED AT	AP-DFC	465.	6.05	72.	32.	32.	0.42		
ROUTED TO	RR-DFC	81.	7.20	67.	31.	31.	0.42	64.02	7.20
ROUTED TO	RT-RRDFC	81.	7.20	67.	31.	31.	0.42		
HYDROGRAPH AT	SB-D9	127.	6.05	14.	6.	6.	0.06		
2 COMBINED AT	AP-D4	190.	6.05	80.	37.	37.	0.47		
ROUTED TO	RT-APD4	188.	6.05	80.	37.	37.	0.47		

North

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
MASTER DEVELOPMENT DRAINAGE PLAN
FULLY DEVELOPED CONDITION BASIN MAP AND MASTER PLAN



KEYED NOTES

① ANALYSIS POINT D24 REPRESENTS A DIRECT ADDITION OF THE HYDROGRAPHS AT ANALYSIS POINT D23 AND THE OUTLET HYDROGRAPH FROM THE CREEKSIDE ESTATES REGIONAL DETENTION FACILITY. IT DOES NOT REFLECT ANY OTHER FLOW IN KETTLE CREEK.

② NATURAL CHANNEL IS PROPOSED TO BE ELIMINATED IN THIS AREA. STORM WATER TO BE CONVEYED IN A PROPOSED STORM DRAIN.

③ REMOVE EXISTING EMBANKMENT DOWN TO LEVEL OF PERMANENT POOL. PROTECT REMAINING EMBANKMENT IF PRUDENT TO DO SO IN ORDER TO PROTECT AGAINST EXCESSIVE EROSION.

④ NATURAL CHANNEL PROPOSED TO REMAIN UNIMPROVED IN THIS AREA.

⑤ DETENTION FACILITY OUTLET AND SPILLWAY ARE PROPOSED TO BE REVISED.

GENERAL NOTES:

1. PROPOSED STORM DRAINS SHOWN ON THIS PLAN ARE ONLY INTENDED TO INDICATE GENERAL LOCATIONS AND APPROXIMATE SIZES OF FUTURE FACILITIES. ACTUAL STORM DRAIN SIZES AND LOCATIONS SHALL BE DETERMINED WITH MORE DETAILED ANALYSIS AT THE TIME OF DETAILED DESIGN OF THE FACILITIES. IT IS LIKELY THAT ADDITIONAL FACILITIES NOT SHOWN ON THIS PLAN WILL BE REQUIRED.
2. PROPOSED DETENTION FACILITIES SHOWN ON THIS PLAN ARE ONLY INTENDED TO INDICATE GENERAL LOCATIONS AND LAND AREA REQUIRED FOR THESE FACILITIES. ACTUAL LOCATIONS AND LAND AREA REQUIRED SHALL BE DETERMINED AT THE TIME OF DETAILED DESIGN OF THE FACILITIES.
3. EXCEPT AS OTHERWISE NOTED, THIS PLAN SHALL NOT MODIFY THE REQUIREMENTS OF PREVIOUSLY APPROVED MASTER DEVELOPMENT DRAINAGE PLANS AND FINAL DRAINAGE REPORTS.

SUB-BASIN DATA SUMMARY FULLY DEVELOPED CONDITION

SUB BASIN I.D.	AREA (sq miles)	AREA (acres)	PERCENT IMPERVIOUS	CN	LAG (hours)	Q5 (cfs)	Q100 (cfs)
D1	0.085	54.2	5.0	67.5	0.383	17	72
D2	0.057	36.6	10.0	69.0	0.224	20	72
D3	0.026	16.6	33.3	75.0	0.267	13	40
D4	0.048	30.5	9.2	68.2	0.245	14	56
D5	0.030	19.1	30.3	74.5	0.239	16	47
D6	0.039	25.1	42.7	79.2	0.164	34	86
D7	0.071	45.5	46.8	79.8	0.173	62	157
D8	0.062	39.5	72.3	92.2	0.111	111	208
D9	0.022	13.9	41.1	77.0	0.251	14	37
D9A	0.018	11.4	31.8	74.5	0.213	10	30
D10	0.027	17.2	8.3	68.0	0.307	7	27
D11	0.051	32.7	29.6	74.2	0.231	27	81
D12	0.021	13.3	34.5	74.6	0.280	10	31
D13	0.067	42.9	72.6	91.5	0.123	115	219
D14	0.023	15.0	36.7	78.0	0.158	19	49
D15	0.043	27.6	31.0	75.0	0.200	26	75
D16	0.062	39.8	21.0	72.5	0.197	31	98
D16A	0.013	8.2	36.0	78.0	0.143	11	28
D17	0.010	6.5	32.8	76.5	0.117	10	25
D17A	0.011	6.7	80.9	99.0	0.120	21	36
D18	0.064	41.0	38.0	76.3	0.252	38	106
D19	0.024	15.1	40.0	80.9	0.122	25	59
D20	0.030	18.9	80.4	96.5	0.108	62	107
D21	0.041	26.4	62.5	86.5	0.137	56	117
D22	0.037	23.7	40.9	78.5	0.156	31	81
D23	0.005	3.5	56.7	88.0	0.110	8	15
D24	0.025	16.1	25.7	74.5	0.151	16	48
D25	0.017	10.8	53.2	82.2	0.156	18	42
D26	0.033	20.9	30.0	75.5	0.145	24	66
D27	0.008	5.0	46.5	80.0	0.143	8	19
D28	0.004	2.8	49.6	84.0	0.137	5	11
D29	0.018	11.6	37.8	78.2	0.146	15	40
D30	0.017	11.0	25.5	74.4	0.157	11	32
D31	0.007	4.5	40.0	78.5	0.146	6	16
D32	0.006	3.7	5.0	68.0	0.114	3	9
D33	0.036	23.3	10.4	70.2	0.138	18	59
D34	0.039	24.7	36.5	77.0	0.159	30	80
D35	0.039	24.7	40.0	78.0	0.161	32	83
D36	0.024	15.2	19.5	72.0	0.237	10	34
D37	0.011	6.8	93.1	99.0	0.124	23	40
TOTAL	1.269	812.0					

ANALYSIS POINT DATA SUMMARY FULLY DEVELOPED CONDITION

ANALYSIS POINT	WATERSHED AREA (acres)	WATERSHED AREA (sm)	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q25 (cfs)	Q50 (cfs)	Q100 (cfs)	POINT DESCRIPTION
D1	90.8	0.14	11	31	48	79	102	127	TOTAL FLOW
DFA	107.4	0.17	17	44	66	105	134	165	TOTAL POND INFLOW
D2	132.5	0.21	30	64	81	101	116	131	TOTAL FLOW
DFB	49.6	0.08	13	30	44	68	85	103	TOTAL POND INFLOW
D3	227.6	0.36	73	148	198	254	291	330	TOTAL FLOW
DFC	267.1	0.42	139	237	311	405	465	524	TOTAL POND INFLOW
D4	278.5	0.44	47	64	73	85	93	102	TOTAL FLOW
D5	63.2	0.10	19	40	58	88	110	133	TOTAL FLOW
D6	106.1	0.17	90	141	178	238	280	323	TOTAL FLOW
D7	441.1	0.69	153	244	311	418	492	567	TOTAL FLOW
D7A	447.6	0.70	164	263	335	451	532	614	TOTAL FLOW
D8	502.3	0.78	191	310	398	538	637	739	TOTAL FLOW
D9	524.3	0.82	208	337	433	585	692	803	TOTAL FLOW
D10	56.1	0.09	15	25	32	44	54	65	TOTAL FLOW
D11	75.0	0.12	60	85	103	129	147	167	TOTAL FLOW
DFE	625.7	0.98	299	470	596	796	935	1079	TOTAL POND INFLOW
D12	**	0.98	9	77	148	297	417	525	OUTFLOW TO NAT. CHANNEL
D13	* 649.4	1.02	55	79	95	118	132	148	TOTAL FLOW
D14	* 652.9	1.02	58	84	101	127	144	161	TOTAL FLOW
DFF	* 669.0	1.05	66	100	123	159	184	208	TOTAL POND INFLOW
D16	* 31.7	0.05	23	41	55	77	92	108	TOTAL FLOW
D17	* 700.7	1.10	48	59	64	85	101	117	TOTAL FLOW
D18	* 705.7	1.10	49	59	72	98	116	135	TOTAL FLOW
D19	* 11.6	0.02	9	15	20	20	20	20	INTERCEPTED FLOW
D20	* 720.1	1.13	49	74	97	125	145	165	TOTAL FLOW
D21	* 731.1	1.14	49	84	111	146	171	196	TOTAL FLOW IN STORM DRAIN
D22	* 735.6	1.15	52	90	119	158	184	211	TOTAL FLOW
DFCS	* 739.3	1.16	53	93	123	164	192	221	TOTAL POND INFLOW
D23	**	0.04	9	80	153	307	440	544	TOTAL FLOW
D24	762.6	1.19	40	111	188	348	501	630	TOTAL FLOW FROM "DFCS" & D23
DFG	49.4	0.08	33	60	81	115	138	162	TOTAL POND INFLOW

* WATERSHED AREAS DO NOT REFLECT THE TRIBUTARY AREA REDUCTION DUE TO THE DIVERSION OF FLOW Q's ARE COMPUTED BASED ON THE ACTUAL BASIN AREAS.

** PEAK FLOW DIVERTED TO NATURAL CHANNEL DURING INFREQUENT RUNOFF EVENTS.

LEGEND

- 5660 — EXISTING CONTOUR 10'
- EXISTING CONTOUR 2'
- DEVELOPED BASIN BOUNDARY
- EXISTING STORM DRAIN
- 48" — ESTIMATED STORM DRAIN SIZE PROPOSED STORM DRAIN
- RBC — PROPOSED REINFORCED BOX CULVERT
- DRAINAGE DIRECTION
- D8 — BASIN IDENTIFIER; 39.5 — BASIN AREA (ACRES)
- D4 — ANALYSIS POINT
- ① — KEYED NOTE REFERENCE

DETENTION FACILITY DATA SUMMARY

DETENTION FACILITY I.D.	PEAK INFLOW (CFS) Q2	Q5	Q10	Q25	Q50	Q100	PEAK OUTFLOW (CFS) Q2	Q5	Q10	Q25	Q50	Q100	ESTIMATED PEAK STORAGE (ACRE-FEET) V2	V5	V10	V25	V50	V100
A	17	44	66	105	134	165	17	38	45	54	60	65	0	0.1	1	2	3	4
B	13	30	44	68	85	103	13	30	39	47	52	57	0	0.0	0.1	0.4	1	1
C	139	237	311	405	465	524	45	60	66	75	81	86	3	7	10	14	18	21
E	299	470	596	796	935	1079	60	137	213	366	489	600	11	16	19	23	25	28
F	66	100	123	159	184	208	48	57	61	66	71	76	8	8	8	8	8	9
G	33	60	81	115	138	162	2	11	23	31	36	41	1	2	2	3	4	4
CREEKSIDE	53	93	123	164	192	221	37	55	61	73	79	90	3	5	5	5	5	5
P.C. HIGH SCHOOL	19	38	51	74	90	106	1	6	14	29	33	36	1	1	2	2	3	3

PREPARED FOR

J·R ENGINEERING
A Subsidiary of Westrian
4310 ArrowsWest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax 719-528-6613
www.jrengineering.com

No.	REVISION	BY	DATE
1	REVISED ROYAL PINE DRIVE STORM SEWER AT POWERS RAMP 'D'	VSF	10/2002

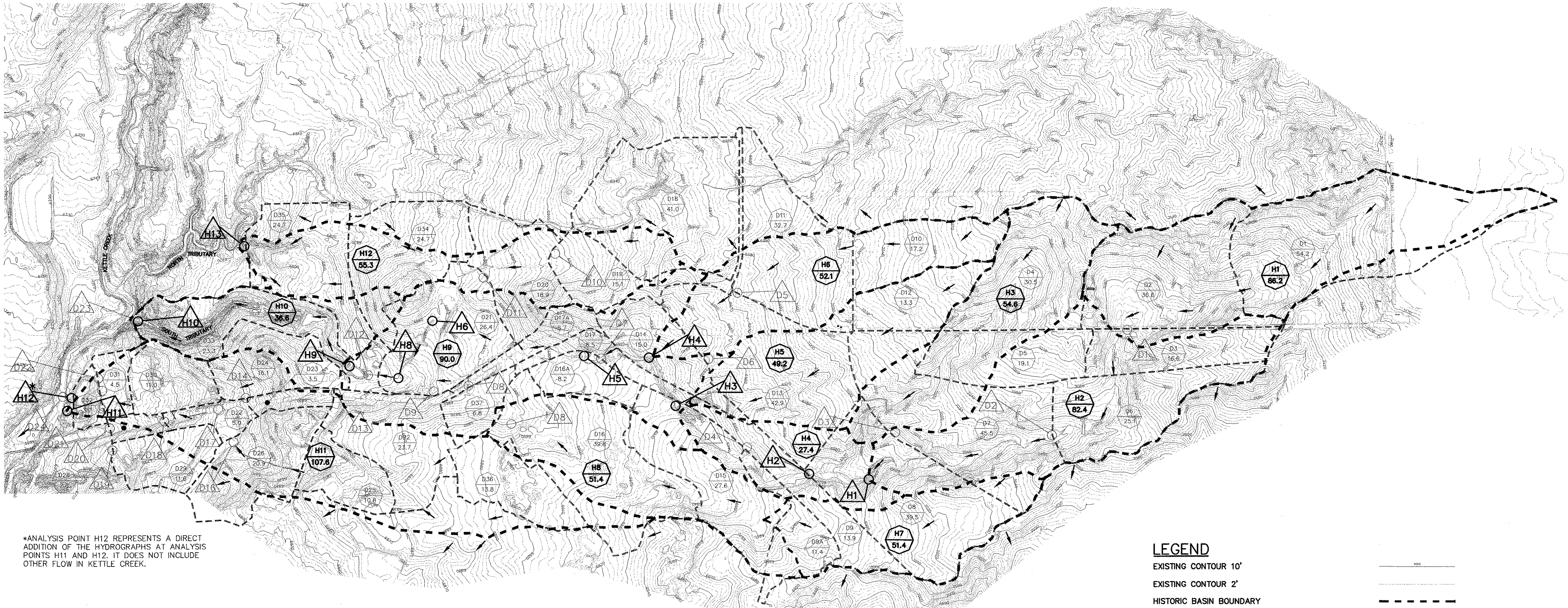
H-SCALE	1"=400'
V-SCALE	N/A
DATE	03/28/01
DESIGNED BY	VSF
DRAWN BY	ELY
CHECKED BY	VSF

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
MASTER DEVELOPMENT DRAINAGE PLAN
FULLY DEVELOPED CONDITION BASIN MAP AND MASTER PLAN

SHEET 1 OF 1

JOB NO. 28877.10

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
DRAINAGE BASIN PLANNING STUDY AND MASTER DEVELOPMENT DRAINAGE PLAN
HISTORIC CONDITION DRAINAGE BASIN MAP



*ANALYSIS POINT H12 REPRESENTS A DIRECT ADDITION OF THE HYDROGRAPHS AT ANALYSIS POINTS H11 AND H12. IT DOES NOT INCLUDE OTHER FLOW IN KETTLE CREEK.

LEGEND

- EXISTING CONTOUR 10'
- EXISTING CONTOUR 2'
- HISTORIC BASIN BOUNDARY
- DEVELOPED BASIN BOUNDARY
- DRAINAGE FLOW ARROW
- DEVELOPED BASIN IDENTIFIER / AREA IN ACRES (D15 / 33.2)
- HISTORIC BASIN IDENTIFIER / AREA IN ACRES (H4 / 27.4)
- HISTORIC ANALYSIS POINT (H2)
- DEVELOPED ANALYSIS POINT (H2)

500 250 0 500 1000

SCALE: 1" = 500'

(HISTORIC) UNDEVELOPED CONDITION
BASIN DATA AND FLOW RATE SUMMARY

SUBBASIN ID ⊖	AREA (acres)	AREA (sq mi)	CN	LAG (hrs)	Q10 (cfs)	q10 (cfs/ac)	Q100 (cfs)	q100 (cfs/ac)
H1	86.2	0.135	66	0.420	35	0.4	99	1.1
H2	82.4	0.129	66	0.303	43	0.5	118	1.4
H3	54.6	0.085	66	0.314	27	0.5	76	1.4
H4	27.4	0.043	66	0.188	19	0.7	51	1.9
H5	49.2	0.077	66	0.286	27	0.5	72	1.5
H6	52.1	0.081	66	0.392	22	0.4	62	1.2
H7	37.8	0.059	66	0.359	17	0.4	48	1.3
H8	51.4	0.080	66	0.346	24	0.5	67	1.3
H9	90.0	0.141	66	0.359	47	0.5	130	1.4
H10	36.6	0.057	66	0.215	24	0.7	63	1.7
H11	107.6	0.168	66	0.411	45	0.4	125	1.2
H12	55.3	0.086	66	0.397	23	0.4	65	1.2

(HISTORIC) UNDEVELOPED CONDITION
ANLYSIS POINT WATERSHED AREA AND FLOW RATE SUMMARY

ANALYSIS POINT △	AREA (acres)	AREA (sq mi)	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q25 (cfs)	Q50 (cfs)	Q100 (cfs)
H1	166	0.26	11	36	60	105	140	179
H2	224	0.35	14	48	81	144	193	247
H3	301	0.47	18	60	99	181	246	317
H4	352	0.55	22	73	121	217	294	376
H5	352	0.55	22	72	121	216	291	376
H6	352	0.55	22	73	120	215	291	374
H7	90	0.14	7	23	35	60	81	103
H8	442	0.69	27	94	155	274	371	477
H9	531	0.83	31	107	178	320	432	557
H10	570	0.89	32	110	184	331	448	577
H11	109	0.17	9	28	45	76	99	125
H12	678	1.06	37	129	219	398	535	693
H13	58	0.09	5	14	23	40	52	65

NOTES:

1. PEAK FLOW RATES WERE ESTIMATED WITH HEC-1 COMPUTER MODEL USING THE SCS UNIT HYDROGRAPH METHOD.
2. HISTORIC FLOW RATES WERE ESTIMATED BASED ON AN ASSUMED CONDITION PRIOR TO ANY DEVELOPMENT IN THE WATERSHED. TOPO SHOWN ON THIS MAP REFLECTS SOME CHANGES CAUSED BY DEVELOPMENT. HOWEVER, FLOW PATHS UTILIZED IN THIS ANALYSIS WERE ESTIMATED BASED ON PRE-DEVELOPMENT CONDITIONS TO THE EXTENT POSSIBLE.

PREPARED FOR

J·R ENGINEERING
A Subsidiary of Westrian
4310 ArrowsWest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax 719-528-6613
www.jrengineering.com

BY	DATE	No.	REVISION

H-SCALE	1"=500'
V-SCALE	N/A
DATE	04/18/01
DESIGNED BY	VSF
DRAWN BY	SDG
CHECKED BY	[signature]

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY

DRAINAGE BASIN PLANNING STUDY AND MASTER DEVELOPMENT DRAINAGE PLAN

HISTORIC DRAINAGE BASIN MAP

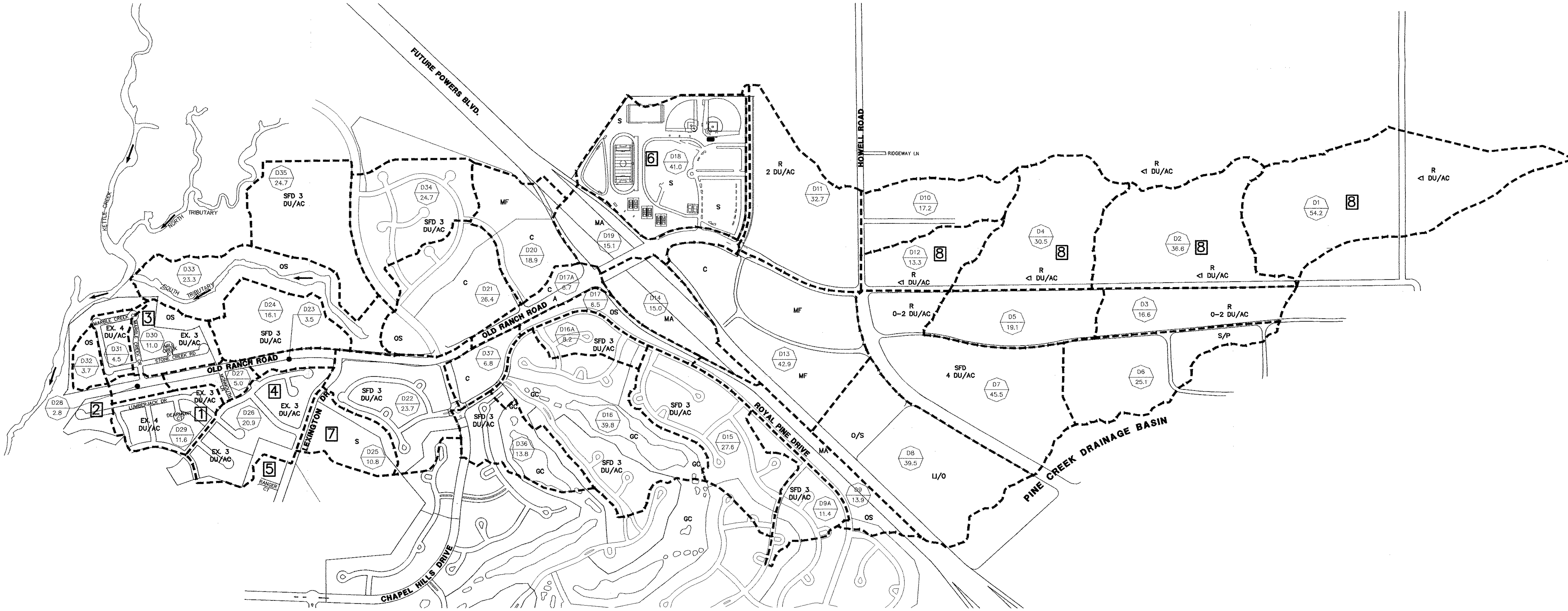
SHEET 1 OF 1

JOB NO. 8877.10

DRAINAGE BASIN PLANNING STUDY AND MASTER DEVELOPMENT DRAINAGE PLAN

PLATTED SUBDIVISION I.D. AND LAND USE MAP

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY



SUBDIVISION INDEX	☐
CREEKSIDE ESTATES FILING NO. 1	1
CREEKSIDE ESTATES FILING NO. 2	2
CREEKSIDE ESTATES FILING NO. 3	3
CREEKSIDE ESTATES FILING NO. 4	4
KITTY HAWK VILLAGE IN CHAPEL HILLS	5
ACADEMY HIGHSCHOOL FILING NO. 5	6
PINE CREEK FILING NO. 10	7
MISCELLANEOUS 4 ACRE TO 20 ACRE LOTS	8

LAND USE LEGEND

DESCRIPTION	SYMBOL
COMMERCIAL	C
LIGHT INDUSTRIAL/OFFICE	LI/O
OPEN SPACE	OS
RURAL RESIDENTIAL	R
GOLF COURSE	GC
MAJOR ARTERIAL ROADWAY	MA
MULTI FAMILY RESIDENTIAL	MF
SINGLE FAMILY DETACHED	SFD
SCHOOL	S
SCHOOL/PARK	S/P
SINGLE FAMMILY ATTACHED	SFA
DWELLING UNITS PER ACRE	XX DU/AC
EXISTING DEVELOPMENT	EX

NOTE:

THE LAND USES SHOWN ON THIS MAP ARE THE LAND USES ASSUMED FOR THE PUPOSE OF PREPARING THIS MDDP AND ASSOCIATED DRAINAGE ANALYSIS. THESE LAND USES ARE PATTERNED AFTER THE MAY 1998 BRIARGATE MASTER PLAN AND MORE SPECIFIC NEIGHBORHOOD PLANS WHERE AVAILABLE.

LEGEND

SUB-BASIN ID / SUB-BASIN AREA (ACRES) — (BASIN / ACRE)

SUB-BASIN BOUNDARY - - - - - - -

500 250 0 500 1000

SCALE: 1" = 500'

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
DRAINAGE BASIN PLANNING STUDY AND
MASTER DEVELOPMENT DRAINAGE PLAN
PLATTED SUBDIVISION I.D. AND LAND USE MAP
JOB NO. 8877.10
04/18/01
SHEET 1 OF 1

J·R ENGINEERING
A Subsidiary of Westrian
4310 ArrowsWest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax: 719-528-6613 • www.jrengineering.com

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
DRAINAGE BASIN PLANNING STUDY AND MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING STORM DRAIN FACILITY MAP

STORM DRAIN PIPE DATA TABLE				
I.D. NUMBER	LENGTH	DIAMETER	TYPE	SLOPE
SD1	81'	24"	RCP	1.00%
SD2	26'	48"	RCP	2.20%
SD3	11'	48"	RCP	2.50%
SD4	56'	48"	RCP	2.50%
SD5	30'	24"	RCP	2.00%
SD6	85'	24"	RCP	2.00%
SD7	208'	24"	RCP	9.60%
SD8	364'	48"	RCP	2.50%
SD9	31'	48"	RCP	2.25%
SD10	148'	18"	RCP	13.20%
SD11	27'	42"	RCP	5.14%
SD12	494'	42"	RCP	5.14%
SD13	440'	42"	RCP	5.00%
SD14	114'	42"	RCP	4.00%
SD15	71'	30"	RCP	3.64%
SD16	33'	42"	RCP	4.00%
SD17	336'	42"	RCP	4.00%
SD18	36'	36"	RCP	2.00%
SD19	103'	36"	RCP	2.20%
SD20	21'	36"	RCP	2.20%
SD21	10'	36"	RCP	2.50%
SD22	168'	36"	RCP	4.80%
SD23	296'	30"	RCP	9.60%
SD24	181'	30"	RCP	2.80%
SD25	24'	30"	RCP	2.80%
SD26	8'	30"	RCP	1.20%
SD27	81'	30"	CMP	3.60%
SD28	63'	48"	RCP	1.00%
SD29	92'	48"	RCP	1.00%
SD30	81'	24"	RCP	1.00%

DRAINAGE INLET DATA TABLE				
I.D. NUMBER	LENGTH	TYPE	DEPTH	CONNECTOR STORM DRAIN
DI1	6'	D-10-R	4.5'	37', 18" RCP @ 2.00%
DI2	4'	D-10-R	5.0'	54', 24" RCP @ 2.00%
DI3	4'	D-10-R	5.0'	N/A
DI4	10'	D-10-R	4.5'	37', 24" RCP @ 2.00%
DI5	20'	D-10-R	6.0'	N/A
DI6	20'	D-10-R	4.0'	29', 30" RCP @ 2.00%
DI7	14'	D-10-R	3.7'	N/A
DI8	20'	D-10-R	3.0'	37', 18" RCP @ 1.00%
DI9	20'	D-10-R	3.5'	48', 18" RCP @ 4.00%
DI10	20'	D-10-R	3.0'	54', 18" RCP @ 4.00%
DI11	20'	D-10-R	4.0'	52', 24" RCP @ 5.00%
DI12	20'	D-10-R	5.0'	14', 18" RCP @ 5.00%
DI13	10'	D-10-R	3.0'	45', 18" RCP @ 8.80%
DI14	10'	D-10-R	4.5'	180', 18" RCP @ 1.50%
DI15	18'	D-10-R	8.0'	5', 36" RCP @ 1.00%
DI16	10'	D-10-R	8.0'	N/A
DI17	16'	D-10-R	9.0'	N/A
DI18	15'	D-10-R	4.0'	50', 24" RCP @ 1.00%
DI19	10'	D-10-R	6.0'	20', 24" RCP @ 20.00%

MANHOLE DATA TABLE		
I.D. NUMBER	TYPE	DEPTH (FT)
MH1	TYPE 1	9.5'
MH2	TYPE 1	6.0'
MH3	TYPE 1	7.8'
MH4	TYPE 1	11.9'
MH5	TYPE 1	8.7'
MH6	TYPE 1	11.0'

NOTE:

THE INFORMATION CONTAINED ON THIS MAP WAS OBTAINED IN THE REVIEW OF DRAINAGE PLANS AND CONSTRUCTION PLANS. THE INFORMATION IS INTENDED TO DEMONSTRATE THE GENERAL EXTENT OF EXISTING DRAINAGE FACILITIES AND IS NOT INTENDED OR WARRANTED FOR ANY OTHER USE.

LEGEND

SUB-BASIN ID
SUB-BASIN AREA (ACRES)
SUB-BASIN BOUNDARY
EXISTING STORM DRAIN
EXISTING STORM MANHOLE
EXISTING STORM DRAIN INLET

400 200 0 400 800
SCALE: 1" = 400'

KETTLE CREEK DRAINAGE BASIN
OLD RANCH ROAD TRIBUTARY
DRAINAGE BASIN PLANNING STUDY AND MASTER DEVELOPMENT DRAINAGE PLAN
EXISTING STORM DRAIN FACILITY MAP
JOB NO.JOB NO. 8877.10
04/18/01
SHEET 1 OF 1

J·R ENGINEERING
A Subsidiary of Westrian
4310 ArrowsWest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax 719-528-6613 • www.jrengineering.com

APPENDIX B

HYDROLOGIC COMPUTATIONS

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: Elk View Estates
Location: CO, Colorado Springs

Project Name: Elk View Estates
Project No.: ERD01.20
Calculated By: EBB
Checked By: TJE
Date: 11/21/25

Basin ID	Total Area (ac)	<1 DU/AC *			Undeveloped / Historic			Single-Family (2.5 Acre Lots)			Paved Streets			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
EXISTING CONDITIONS														
K-1	2.1	5		0.0	2	2.1	2.0	11		0.0	100		0.00	2.0
KO-D10	41.6	5	27.1	3.3	2	14.5	0.7	11		0.0	100		0.00	4.0
KO-D11	8.4	5	8.4	5.0	2		0.0	11		0.0	100		0.00	5.0
KO-D20	15.3	5		0.0	2	15.3	2.0	11		0.0	100		0.00	2.0
KO-D21	2.5	5	2.5	5.0	2		0.0	11		0.0	100		0.00	5.0
KO-D22	0.6	5	0.6	5.0	2		0.0	11		0.0	100		0.00	5.0
KO-D23	22.4	5	22.4	5.0	2		0.0	11		0.0	100		0.00	5.0
PROPOSED CONDITIONS														
K-12	2.2	5		0.0	2		0.0	11	2.2	11.0	100		0.00	11.0
KO-D201a	0.4	5		0.0	2	0.10	0.5	11		0.0	100	0.3	75.00	75.5
KO-D201b	0.2	5		0.0	2		0.0	11		0.0	100	0.1	50.00	50.0
KO-D202	1.7	5		0.0	2		0.0	11	1.7	11.0	100		0.00	11.0
KO-D203	0.2	5		0.0	2		0.0	11		0.0	100	0.2	100.00	100.0
KO-D204	0.3	5		0.0	2		0.0	11		0.0	100	0.3	100.00	100.0
KO-D205a	0.4	5		0.0	2	0.10	0.5	11		0.0	100	0.3	75.00	75.5
KO-D205b	0.2	5		0.0	2		0.0	11		0.0	100	0.2	100.00	100.0
KO-D206	2.3	5		0.0	2		0.0	11	2.3	11.0	100		0.00	11.0
KO-D207	8.6	5		0.0	2		0.0	11	8.6	11.0	100		0.00	11.0
KO-D21	2.5	5		0.0	2		0.0	11		0.0	100		0.00	0.0
KO-D221	0.7	5	0.70	5.0	2		0.0	11		0.0	100		0.00	5.0
KO-D222	0.8	5		0.0	2		0.0	11	0.8	11.0	100		0.00	11.0

* percent impervious taken from the Kettel Creek - Old Ranch Rd. Tributary DBPS for off-site basins adjacent to site to be consistent

Galloway

TOTAL SITE IMPERVIOUSNESS SUMMARY

Subdivision: Elk View Estates
Location: CO, Colorado Springs

Project Name: Elk View Estates
Project No.: ERD01.20
Calculated By: EBB
Checked By: TJE
Date: 11/21/25

Basin	Area	% Imp
K-12	2.2	11.0
KO-D201a	0.4	75.5
KO-D201b	0.2	50.0
KO-D202	1.7	11.0
KO-D203	0.2	100.0
KO-D204	0.3	100.0
KO-D205a	0.4	75.5
KO-D205b	0.2	100.0
KO-D206	2.3	11.0
KO-D207	8.6	11.0
KO-D221	0.7	5.0
Total	**17.2**	**17.8**

Galloway

COMPOSITE C VALUE CALCULATIONS

Subdivision: Elk View Estates
Location: CO, Colorado Springs

Project Name: Elk View Estates
Project No.: ERD01.20
Calculated By: EBB
Checked By: TJE
Date: 11/21/25

Basin ID	Total Area (ac)	Soil Type	<1 DU/AC *			Undeveloped / Historic			Single-Family (2.5 Acre Lots) **			Paved Streets			Composite C_5	Composite C_{100}
			C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)		
EXISTING CONDITIONS																
K-1	2.1	B	0.20	0.44	0.0	0.09	0.36	2.1	0.20	0.44	0.0	0.90	0.96	0.0	0.09	0.36
KO-D10	41.6	B	0.20	0.44	27.1	0.09	0.36	14.5	0.20	0.44	0.0	0.90	0.96	0.0	0.16	0.41
KO-D11	8.4	B	0.20	0.44	8.4	0.09	0.36	0.0	0.20	0.44	0.0	0.90	0.96	0.0	0.20	0.44
KO-D20	15.3	B	0.20	0.44	0.0	0.09	0.36	15.3	0.20	0.44	0.0	0.90	0.96	0.0	0.09	0.36
KO-D21	2.5	B	0.20	0.44	2.5	0.09	0.36	0.0	0.20	0.44	0.0	0.90	0.96	0.0	0.20	0.44
KO-D22	0.6	B	0.20	0.44	0.6	0.09	0.36	0.0	0.20	0.44	0.0	0.90	0.96	0.0	0.20	0.44
KO-D23	22.4	B	0.20	0.44	22.4	0.09	0.36	0.0	0.20	0.44	0.0	0.90	0.96	0.0	0.20	0.44
PROPOSED CONDITIONS																
K-12	2.2	B	0.20	0.44	0.00	0.09	0.36	0.00	0.20	0.44	2.20	0.90	0.96	0.00	0.20	0.44
KO-D201a	0.4	B	0.20	0.44	0.00	0.09	0.36	0.10	0.20	0.44	0.00	0.90	0.96	0.30	0.70	0.81
KO-D201b	0.2	B	0.20	0.44	0.00	0.09	0.36	0.00	0.20	0.44	0.00	0.90	0.96	0.10	0.45	0.48
KO-D202	1.7	B	0.20	0.44	0.00	0.09	0.36	0.00	0.20	0.44	1.70	0.90	0.96	0.00	0.20	0.44
KO-D203	0.2	B	0.20	0.44	0.00	0.09	0.36	0.00	0.20	0.44	0.00	0.90	0.96	0.20	0.90	0.96
KO-D204	0.3	B	0.20	0.44	0.00	0.09	0.36	0.00	0.20	0.44	0.00	0.90	0.96	0.30	0.90	0.96
KO-D205a	0.4	B	0.20	0.44	0.00	0.09	0.36	0.10	0.20	0.44	0.00	0.90	0.96	0.30	0.70	0.81
KO-D205b	0.2	B	0.20	0.44	0.00	0.09	0.36	0.00	0.20	0.44	0.00	0.90	0.96	0.20	0.90	0.96
KO-D206	2.3	B	0.20	0.44	0.00	0.09	0.36	0.00	0.20	0.44	2.30	0.90	0.96	0.00	0.20	0.44
KO-D207	8.6	B	0.20	0.44	0.00	0.09	0.36	0.00	0.20	0.44	8.60	0.90	0.96	0.00	0.20	0.44
KO-D21	2.5	B	0.20	0.44	0.00	0.09	0.36	0.00	0.20	0.44	0.00	0.90	0.96	0.00	0.00	0.00
KO-D221	0.7	B	0.20	0.44	0.70	0.09	0.36	0.00	0.20	0.44	0.00	0.90	0.96	0.00	0.20	0.44
KO-D222	0.8	B	0.20	0.44	0.00	0.09	0.36	0.00	0.20	0.44	0.80	0.90	0.96	0.00	0.20	0.44

* Curve Number was utilized in DBPS - Runoff coefficients are based on 1-acre Residential per Table 6-6 of ECM

Galloway

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Elk View Estates
Location: CO, Colorado Springs

Project Name: Elk View Estates
Project No.: ERD01.20
Calculated By: EBB
Checked By: TJE
Date: 11/21/25

SUB-BASIN DATA						INITIAL/OVERLAND (Sheet Flow) (T_i)			Shallow Concentrated Flows (T_t)					Tc CHECK		FINAL
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C_{100}	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	Cv	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	Regional T_c (MIN)	T_c (MIN)
EXISTING CONDITIONS																
K-1	2.10	B	2.0	0.36	0.09	120	7.2	10.5	171	4.2	7.0	1.4	2.0	12.5	27.2	12.5
KO-D10	41.60	B	4.0	0.44	0.20	300	6.8	15.1	2893	4.3	7.0	1.5	33.2	48.3	49.7	48.3
KO-D11	8.40	B	5.0	0.36	0.09	162	5.3	13.5	1352	4.3	7.0	1.5	15.5	29.0	36.4	29.0
KO-D20	15.30	B	2.0	0.36	0.09	200	9.2	12.5	1237	5.2	7.0	1.6	12.9	25.4	35.4	25.4
KO-D21	2.50	B	5.0	0.44	0.20	54	3.8	7.8	288	10.7	10.0	3.3	1.5	9.2	26.7	9.2
KO-D22	0.60	B	5.0	0.44	0.20	123	6.1	10.0	174	3.7	10.0	1.9	1.5	11.5	26.7	11.5
KO-D23	22.40	B	5.0	0.44	0.20	300	9.6	13.4	970	5.9	10.0	2.4	6.7	20.1	32.0	20.1
PROPOSED CONDITIONS																
K-12	2.20	B	11.0	0.44	0.20	120	7.2	9.4	171	4.2	10.0	2.0	1.4	10.7	25.4	10.7
KO-D201a	0.40	B	75.5	0.81	0.70	25	2.0	2.9	485	8.0	15.0	4.2	1.9	4.8	14.6	5.0
KO-D201b	0.20	B	50.0	0.48	0.45	25	2.0	4.7	334	4.0	15.0	3.0	1.9	6.6	19.2	6.6
KO-D202	1.70	B	11.0	0.44	0.20	100	6.5	8.8	160	4.2	10.0	2.0	1.3	10.1	25.4	10.1
KO-D203	0.20	B	100.0	0.96	0.90	25	2.0	1.5	421	6.5	15.0	3.8	1.8	3.3	10.2	5.0
KO-D204	0.30	B	100.0	0.96	0.90	100	2.0	2.9	116	2.0	15.0	2.1	0.9	3.8	9.6	5.0
KO-D205a	0.40	B	75.5	0.81	0.70	25	2.0	2.9	425	4.0	15.0	3.0	2.4	5.3	15.0	5.3
KO-D205b	0.20	B	100.0	0.96	0.90	25	2.0	1.5	322	4.0	15.0	3.0	1.8	3.2	10.2	5.0
KO-D206	2.30	B	11.0	0.44	0.20	100	5.4	9.4	525	5.4	10.0	2.3	3.8	13.2	27.7	13.2
KO-D207	8.60	B	11.0	0.44	0.20	200	9.2	11.1	1237	5.2	15.0	3.4	6.0	17.2	32.7	17.2
KO-D21	2.50	B	0.0	0.00	0.00	54	3.8	9.5	288	10.7	10.0	3.3	1.5	11.0	27.6	11.0
KO-D221	0.70	B	5.0	0.44	0.20	123	6.1	10.0	174	3.7	10.0	1.9	1.5	11.5	26.7	11.5
KO-D222	0.80	B	11.0	0.44	0.20	25	2.0	6.5	663	3.4	15.0	2.8	4.0	10.5	29.8	10.5

NOTES:

T_i = (0.395*(1.1 - C_5)*(L)^0.5)/((S)^0.33), S in ft/ft

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

Velocity V=Cv*S^0.5, S in ft/ft

Tc Regional = (26-17i)+(L/(60(14i+9)S^0.5)), S in ft/ft, i= Imperviousness expressed as decimal

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Elk View Estates
Location: CO, Colorado Springs
Design Storm: 5-Year

Project Name: Elk View Estates
Project No.: ERD01.20
Calculated By: EBB
Checked By: TJE
Date: 11/21/25

STREET		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
EXISTING CONDITIONS																					
		K-1	2.1	0.09	12.5	0.19	3.80	0.7													PORTION OF SITE IN KETTLE CREEK TRIB.
		KO-D10	41.6	0.20	48.3	8.32	1.77	14.7													OFFSITE BASIN - EAST
		KO-D11	8.4	0.09	29.0	0.76	2.53	1.9													OFFSITE BASIN - SOUTHEAST
		KO-D22	0.6	0.20	11.5	0.12	3.92	0.5													OFFSITE BASIN - SOUTHEAST
	D10		50.6						48.3	9.20	1.77	16.3									KO-D10 + KO-D11 + KO-D22
		KO-D20	15.3	0.09	25.4	1.38	2.73	3.8													PORTION OF SITE IN KETTLE CREEK - ORR TRIB.
		KO-D21	2.5	0.20	9.2	0.50	4.25	2.1													OFFSITE BASIN - CENTRAL / WEST
	D11		68.4						48.3	11.08	1.77	19.6									DP D10 + KO-D20 + KO-D21 EXISTING 18" CMP CULVERT UNDER STUDEBAKER ST.
		KO-D23	22.4	0.20	20.1	4.48	3.08	13.8													OFFSITE BASIN - WEST
	D1		90.8						48.3	15.56	1.77	27.5									DP D11 + KO-D23 EXISTING 18" CMP CULVERT UNDER ORR

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Elk View Estates
Location: CO, Colorado Springs
Design Storm: 5-Year

Project Name: Elk View Estates
Project No.: ERD01.20
Calculated By: EBB
Checked By: TJE
Date: 11/21/25

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
PROPOSED CONDITIONS																					
		K-12	2.2	0.20	10.7	0.44	4.02	1.8													PORTION OF SITE IN KETTLE CREEK TRIB.
	K1								10.7	0.44	4.02	1.8									TOTAL RUNOFF FROM K-11 & K-12
		KO-D10	41.6	0.20	48.3	8.32	1.77	14.7													OFFSITE BASIN - EAST
		KO-D201a	0.4	0.70	5.0	0.28	5.17	1.4													NORTHEAST SIDE OF PROP. PRIVATE ACCESS ROAD
	D10		42.0						48.3	8.60	1.77	15.2									KO-D10 + KO-D201a PR. (2) 30" RCP CULVERT
		KO-D11	8.4	0.09	29.0	0.76	2.53	1.9													OFFSITE BASIN - EAST
		KO-D201b	0.2	0.45	6.6	0.09	4.76	0.4													NORTHEAST SIDE OF PROP. PRIVATE ACCESS ROAD
	D11		8.6						29.0	0.85	2.53	2.2									KO-D11 + KO-D201b PR. 18" RCP CULVERT
		KO-D202	1.7	0.20	10.1	0.34	4.11	1.4													PROP. NORTHEAST SUB-BASIN
		KO-D203	0.2	0.90	5.0	0.18	5.17	0.9													PROP. NORTHEAST SUB-BASIN
	D12		1.9						10.1	0.52	4.11	2.1									KO-D202 + KO-D203 PR. 18" RCP CULVERT
		KO-D204	0.3	0.90	5.0	0.27	5.17	1.4													PROP. NORTHEAST SUB-BASIN
		KO-D205a	0.4	0.70	5.3	0.28	5.09	1.4													NORTHWEST SIDE OF PROP. PRIVATE ACCESS ROAD
		KO-D205b	0.2	0.90	5.0	0.18	5.17	0.9													SOUTHWEST SIDE OF PROP. PRIVATE ACCESS ROAD
	D13		53.4						48.3	10.70	1.77	18.9									DP D10 + DP D11 + DP D12 + KO-D204 + KO-D205a + KO-D205b
		KO-D206	2.3	0.20	13.2	0.46	3.72	1.7													PROP. NORTHWEST SUB-BASIN
		KO-D21	2.5	0.20	9.2	0.50	4.25	2.1													OFFSITE BASIN - CENTRAL / WEST
	D14		4.8						13.2	0.96	3.72	3.6									KO-D206 + KO-D21

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Elk View Estates
Location: CO, Colorado Springs
Design Storm: 5-Year

Project Name: Elk View Estates
Project No.: ERD01.20
Calculated By: EBB
Checked By: TJE
Date: 11/21/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
		KO-D221	0.7	0.20	11.5	0.14	3.92	0.5													OFF-SITE BASIN - SOUTHEAST
	D15		0.7						11.5	0.14	3.92	0.5									PR. 18" RCP CULVERT
		KO-D222	0.8	0.20	10.5	0.16	4.05	0.6													PROP. SOUTHEAST BASIN
	D16		1.5						11.5	0.30	3.92	1.2									DP14 + KO-D222
		KO-D207	8.6	0.20	17.2	1.72	3.32	5.7													PROP. MAIN SUB-BASIN
	D17		68.3						48.3	13.68	1.77	24.2									DP D13 + DP D14 + DP D16 + KO-D207 EXISTING 18" CMP CULVERT UNDER STUDEBAKER ST.
		KO-D23	22.4	0.20	20.1	4.48	3.08	13.8													OFFSITE BASIN - WEST
	D1		90.7						48.3	18.16	1.77	32.1									DP D17 + KO-D23 EXISTING 18" CMP CULVERT UNDER ORR

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Elk View Estates
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Elk View Estates
Project No.: ERD01.20
Calculated By: EBB
Checked By: TJE
Date: 11/21/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
EXISTING CONDITIONS																					
		K-1	2.1	0.36	12.5	0.76	6.37	4.8													PORTION OF SITE IN KETTLE CREEK TRIB.
		KO-D10	41.6	0.44	48.3	18.30	2.96	54.2													OFFSITE BASIN - EAST
		KO-D11	8.4	0.36	29.0	3.02	4.25	12.8													OFFSITE BASIN - SOUTHEAST
		KO-D22	0.6	0.44	11.5	0.26	6.58	1.7													OFFSITE BASIN - SOUTHEAST
	D10		50.6						48.3	21.58	2.96	63.9									KO-D10 + KO-D11 + KO-D22
		KO-D20	15.3	0.36	25.4	5.51	4.58	25.2													PORTION OF SITE IN KETTLE CREEK - ORR TRIB.
		KO-D21	2.5	0.44	9.2	1.10	7.13	7.8													OFFSITE BASIN - CENTRAL / WEST
	D11		17.8						48.3	28.19	2.96	83.4									DP D10 + KO-D20 + KO-D21 EXISTING 18" CMP CULVERT UNDER STUDEBAKER ST.
		KO-D23	22.4	0.44	20.1	9.86	5.17	51.0													OFFSITE BASIN - WEST
	D1		22.4						48.3	38.05	2.96	112.6									DP D11 + KO-D23 EXISTING 18" CMP CULVERT UNDER ORR

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Elk View Estates
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Elk View Estates
Project No.: ERD01.20
Calculated By: EBB
Checked By: TJE
Date: 11/21/25

STREET		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
PROPOSED CONDITIONS																					
		K-12	2.2	0.44	10.7	0.97	6.75	6.5													PORTION OF SITE IN KETTLE CREEK TRIB.
	K1								10.7	0.97	6.75	6.5									TOTAL RUNOFF FROM K-11 & K-12
		KO-D10	41.6	0.44	48.3	18.30	2.96	54.2													OFFSITE BASIN - EAST
		KO-D201a	0.4	0.81	5.0	0.32	8.68	2.8													NORTHEAST SIDE OF PROP. PRIVATE ACCESS ROAD
	D10		42.0						48.3	18.62	2.96	55.1									KO-D10 + KO-D201a PR. (2) 30" RCP CULVERT
		KO-D11	8.4	0.36	29.0	3.02	4.25	12.8													OFFSITE BASIN - EAST
		KO-D201b	0.2	0.48	6.6	0.10	7.99	0.8													NORTHEAST SIDE OF PROP. PRIVATE ACCESS ROAD
	D11		8.6						29.0	3.12	4.25	13.3									KO-D11 + KO-D201b PR. 18" RCP CULVERT
		KO-D202	1.7	0.44	10.1	0.75	6.90	5.2													PROP. NORTHEAST SUB-BASIN
		KO-D203	0.2	0.96	5.0	0.19	8.68	1.6													PROP. NORTHEAST SUB-BASIN
	D12		1.9						10.1	0.94	6.90	6.5									KO-D202 + KO-D203 PR. 18" RCP CULVERT
		KO-D204	0.3	0.96	5.0	0.29	8.68	2.5													PROP. NORTHEAST SUB-BASIN
		KO-D205a	0.4	0.81	5.3	0.32	8.54	2.7													NORTHWEST SIDE OF PROP. PRIVATE ACCESS ROAD
		KO-D205b	0.2	0.96	5.0	0.19	8.68	1.6													SOUTHWEST SIDE OF PROP. PRIVATE ACCESS ROAD
	D13		53.4						48.3	23.48	2.96	69.5									DP D10 + DP D11 + DP D12 + KO-D204 + KO-D205a + KO-D205b
		KO-D206	2.3	0.44	13.2	1.01	6.24	6.3													PROP. NORTHWEST SUB-BASIN
		KO-D21	2.5	0.44	9.2	1.10	7.13	7.8													OFFSITE BASIN - CENTRAL / WEST
	D14		4.8						13.2	2.11	6.24	13.2									KO-D206 + KO-D21

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Elk View Estates
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Elk View Estates
Project No.: ERD01.20
Calculated By: EBB
Checked By: TJE
Date: 11/21/25

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
		KO-D221	0.7	0.44	11.5	0.31	6.58	2.0													OFF-SITE BASIN - SOUTHEAST
	D15								11.5	0.31	6.58	2.0									PR. 18" RCP CULVERT
		KO-D222	0.8	0.44	10.5	0.35	6.80	2.4													PROP. SOUTHEAST BASIN
	D16		1.5						11.5	0.66	6.58	4.3									DP14 + KO-D222
		KO-D207	8.6	0.44	17.2	3.78	5.57	21.1													PROP. MAIN SUB-BASIN
	D17		68.3						48.3	30.03	2.96	88.9									DP D13 + DP D14 + DP D16 + KO-D207 EXISTING 18" CMP CULVERT UNDER STUDEBAKER ST.
		KO-D23	22.4	0.44	20.1	9.86	5.17	51.0													OFFSITE BASIN - WEST
	D1		90.7						48.3	39.89	2.96	118.1									DP D17 + KO-D23 EXISTING 18" CMP CULVERT UNDER ORR

Galloway

APPENDIX C

HYDRAULIC COMPUTATIONS

Provide calculations for:
- Roadside ditches
- Existing Swales (Ex & Pr conditions for comparison of Depths, Velocity, Fr # and Shear stress)

HY-8 Culvert Analysis Report

Table 1 - Project Headwater Table

Crossing Name	Culvert Name	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	HW / D (ft)	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Outlet Velocity (ft/s)
DP D10	DP D10	55.10	55.10	7117.94	3.18	0.0*	1.27	0.95	1.79	1.03	14.40
DP D11	DP D11	13.30	13.30	7118.01	3.83	0.0*	2.55	0.74	1.36	0.76	14.74
DP D12	DP D12	6.50	6.50	7145.30	1.64	0.0*	1.09	0.53	0.99	0.54	11.24
DP D15	DP D15	2.00	2.00	7123.68	0.83	0.375	0.66	0.55	0.56	0.55	3.80

* Full Flow Headwater elevation is below inlet invert.

Include analysis of existing culvert @ DP D17, need to see how water backs up and overtops

Crossing Input: DP D10

Parameter	Value	Units
DISCHARGE DATA		
Discharge Method	Minimum, Design, and Maximum	
Minimum Flow	15.200	cfs
Design Flow	55.100	cfs
Maximum Flow	55.100	cfs
TAILWATER DATA		
Channel Type	Enter Constant Tailwater Elevation	
Channel Invert Elevation	7111.410	ft
Constant Tailwater Elevation	7111.410	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	1000.000	ft
Crest Length	50.000	ft
Crest Elevation	7119.620	ft
Roadway Surface	Paved	
Top Width	36.000	ft

Culvert Input: DP D10

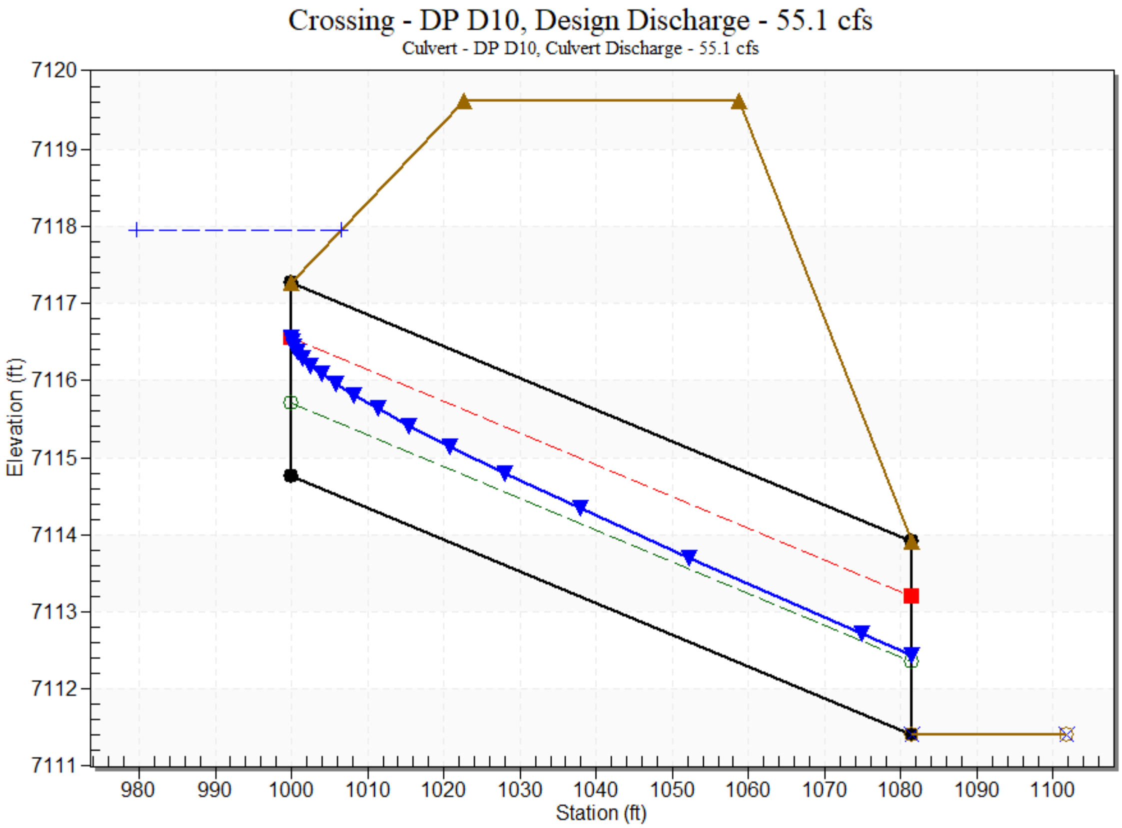
Parameter	Value	Units
CULVERT DATA		
Name	DP D10	
Shape	Circular	
Material	Concrete	
Diameter	2.500	ft
Embedment Depth	0.000	in
Manning's n	0.012	
Culvert Type	Straight	
Inlet Configuration	Mitered to Conform to Slope (Ke=0.7)	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	1000.000	ft
Inlet Elevation	7114.760	ft
Outlet Station	1081.430	ft
Outlet Elevation	7111.410	ft
Number of Barrels	2	
Computed Culvert Slope	0.041140	ft/ft

Table 2 - Culvert Summary Table: DP D10

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	HW / D (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
15.20	15.20	7116.15	1.39	0.0*	0.56	1-S2n	0.49	0.92	0.49	0.00	11.20	0.00
19.19	19.19	7116.34	1.58	0.0*	0.63	1-S2n	0.55	1.03	0.58	0.00	11.12	0.00
23.18	23.18	7116.50	1.74	0.0*	0.70	1-S2n	0.60	1.14	0.64	0.00	11.77	0.00
27.17	27.17	7116.66	1.90	0.0*	0.76	1-S2n	0.65	1.24	0.69	0.00	12.36	0.00
31.16	31.16	7116.82	2.06	0.0*	0.82	1-S2n	0.70	1.33	0.74	0.00	12.82	0.00
35.15	35.15	7116.98	2.22	0.0*	0.89	1-S2n	0.75	1.42	0.80	0.00	13.05	0.00
39.14	39.14	7117.14	2.38	0.0*	0.95	1-S2n	0.79	1.50	0.84	0.00	13.41	0.00
43.13	43.13	7117.32	2.56	0.0*	1.02	5-S2n	0.83	1.58	0.89	0.00	13.69	0.00
47.12	47.12	7117.51	2.75	0.0*	1.10	5-S2n	0.87	1.65	0.94	0.00	13.93	0.00
51.11	51.11	7117.72	2.96	0.0*	1.18	5-S2n	0.91	1.72	0.99	0.00	14.18	0.00
55.10	55.10	7117.94	3.18	0.0*	1.27	5-S2n	0.95	1.79	1.03	0.00	14.40	0.00
85.15	80.03	7119.73	4.97	1.376	1.99	5-S2n	1.17	2.13	1.30	0.00	15.54	0.00

* Full Flow Headwater elevation is below inlet invert.

Water Surface Profile Plot for Culvert: DP D10



Crossing Input: DP D11

Parameter	Value	Units
DISCHARGE DATA		
Discharge Method	Minimum, Design, and Maximum	
Minimum Flow	2.200	cfs
Design Flow	13.300	cfs
Maximum Flow	13.300	cfs
TAILWATER DATA		
Channel Type	Enter Constant Tailwater Elevation	
Channel Invert Elevation	7109.060	ft
Constant Tailwater Elevation	7109.060	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	1000.000	ft
Crest Length	50.000	ft
Crest Elevation	7120.330	ft
Roadway Surface	Paved	
Top Width	36.000	ft

Culvert Input: DP D11

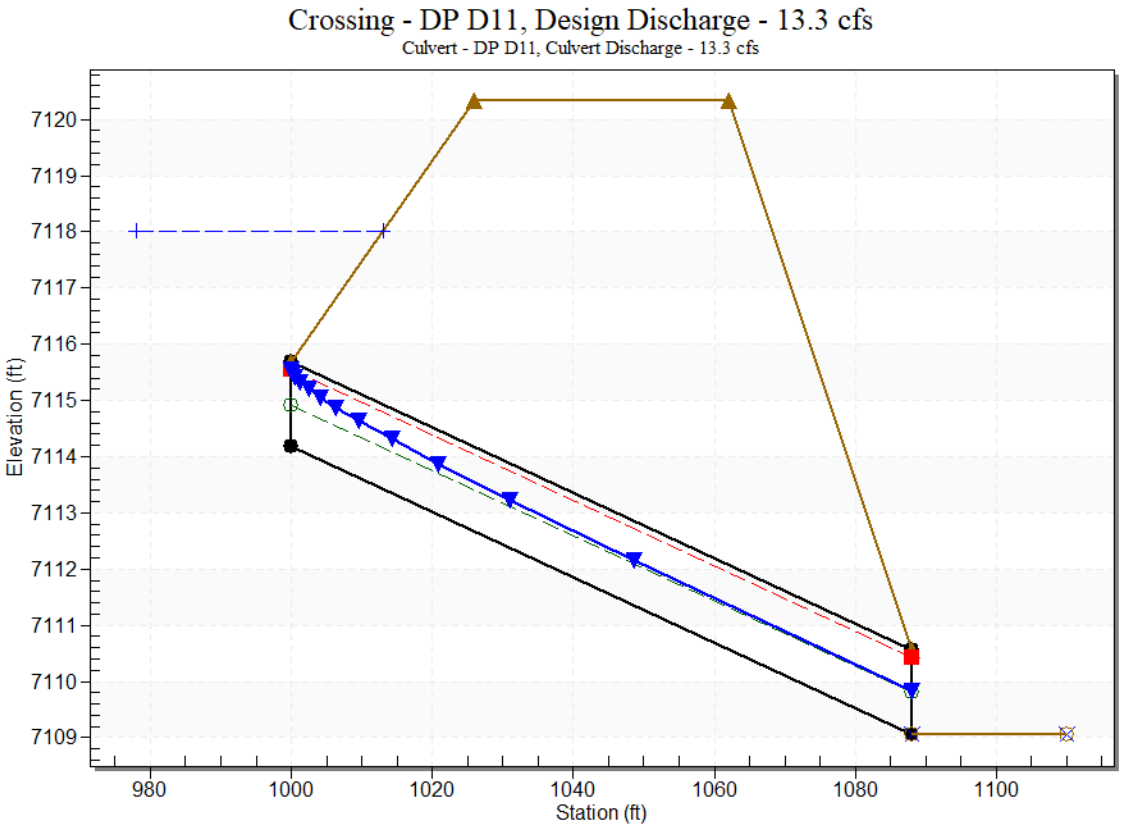
Parameter	Value	Units
CULVERT DATA		
Name	DP D11	
Shape	Circular	
Material	Concrete	
Diameter	1.500	ft
Embedment Depth	0.000	in
Manning's n	0.012	
Culvert Type	Straight	
Inlet Configuration	Mitered to Conform to Slope (Ke=0.7)	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	1000.000	ft
Inlet Elevation	7114.180	ft
Outlet Station	1088.040	ft
Outlet Elevation	7109.060	ft
Number of Barrels	1	
Computed Culvert Slope	0.058155	ft/ft

Table 3 - Culvert Summary Table: DP D11

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	HW / D (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2.20	2.20	7115.05	0.87	0.0*	0.58	1-S2n	0.29	0.56	0.29	0.00	9.34	0.00
3.31	3.31	7115.26	1.08	0.0*	0.72	1-S2n	0.35	0.69	0.35	0.00	10.51	0.00
4.42	4.42	7115.45	1.27	0.0*	0.84	1-S2n	0.41	0.81	0.41	0.00	11.43	0.00
5.53	5.53	7115.64	1.46	0.0*	0.97	1-S2n	0.46	0.91	0.46	0.00	12.17	0.00
6.64	6.64	7115.86	1.68	0.0*	1.12	5-S2n	0.50	1.00	0.52	0.00	12.33	0.00
7.75	7.75	7116.12	1.94	0.0*	1.29	5-S2n	0.54	1.08	0.57	0.00	12.52	0.00
8.86	8.86	7116.42	2.24	0.0*	1.50	5-S2n	0.59	1.15	0.59	0.00	13.87	0.00
9.97	9.97	7116.77	2.59	0.0*	1.73	5-S2n	0.62	1.22	0.65	0.00	13.48	0.00
11.08	11.08	7117.15	2.97	0.0*	1.98	5-S2n	0.66	1.27	0.69	0.00	14.05	0.00
12.19	12.19	7117.56	3.38	0.0*	2.26	5-S2n	0.70	1.32	0.72	0.00	14.49	0.00
13.30	13.30	7118.01	3.83	0.0*	2.55	5-S2n	0.74	1.36	0.76	0.00	14.74	0.00
19.35	17.96	7120.37	6.19	1.247	4.13	5-S2n	0.88	1.41	0.93	0.00	15.58	0.00

* Full Flow Headwater elevation is below inlet invert.

Water Surface Profile Plot for Culvert: DP D11



Crossing Input: DP D12

Parameter	Value	Units
DISCHARGE DATA		
Discharge Method	Minimum, Design, and Maximum	
Minimum Flow	2.100	cfs
Design Flow	6.500	cfs
Maximum Flow	6.500	cfs
TAILWATER DATA		
Channel Type	Enter Constant Tailwater Elevation	
Channel Invert Elevation	7140.430	ft
Constant Tailwater Elevation	7140.430	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	1036.580	ft
Crest Length	50.000	ft
Crest Elevation	7146.630	ft
Roadway Surface	Paved	
Top Width	36.000	ft

Culvert Input: DP D12

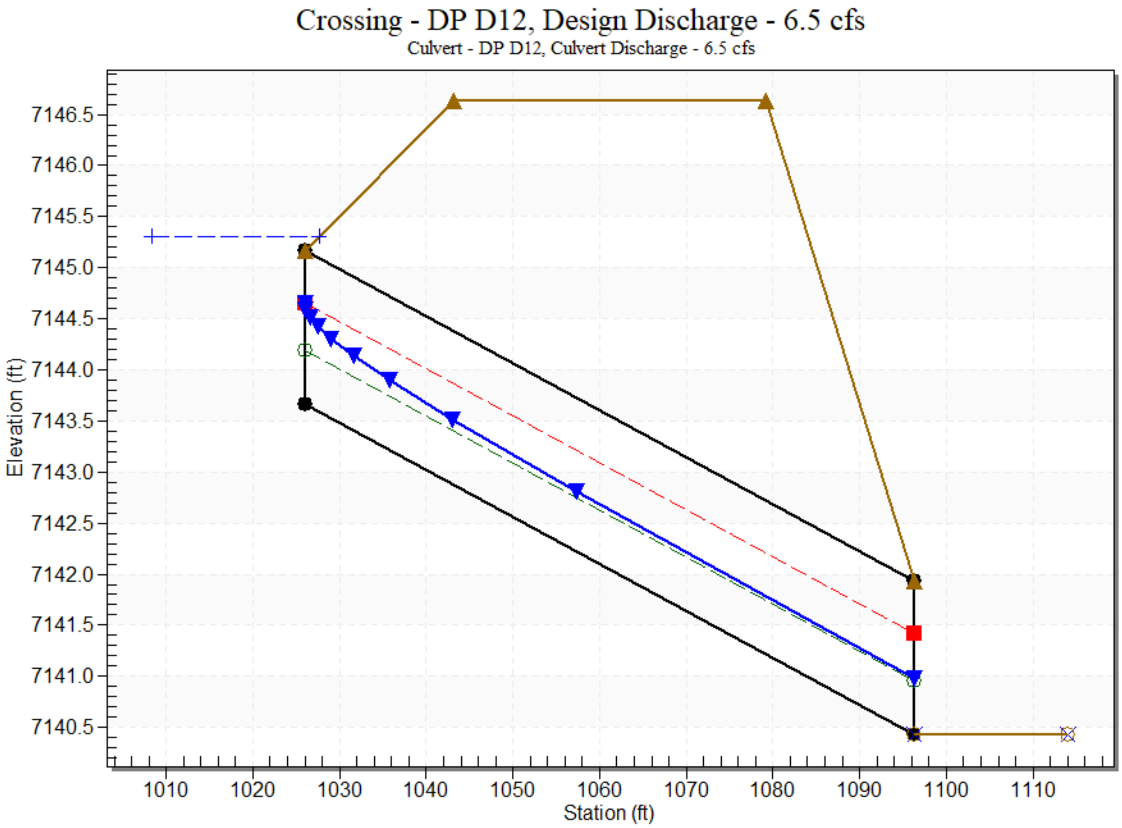
Parameter	Value	Units
CULVERT DATA		
Name	DP D12	
Shape	Circular	
Material	Concrete	
Diameter	1.500	ft
Embedment Depth	0.000	in
Manning's n	0.012	
Culvert Type	Straight	
Inlet Configuration	Mitered to Conform to Slope (Ke=0.7)	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	1025.990	ft
Inlet Elevation	7143.660	ft
Outlet Station	1096.400	ft
Outlet Elevation	7140.430	ft
Number of Barrels	1	
Computed Culvert Slope	0.045874	ft/ft

Table 4 - Culvert Summary Table: DP D12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	HW / D (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
2.10	2.10	7144.49	0.83	0.0*	0.56	1-S2n	0.30	0.55	0.30	0.00	8.47	0.00
2.54	2.54	7144.58	0.92	0.0*	0.62	1-S2n	0.33	0.60	0.33	0.00	8.95	0.00
2.98	2.98	7144.67	1.01	0.0*	0.67	1-S2n	0.35	0.66	0.35	0.00	9.37	0.00
3.42	3.42	7144.74	1.08	0.0*	0.72	1-S2n	0.38	0.71	0.38	0.00	9.75	0.00
3.86	3.86	7144.82	1.16	0.0*	0.77	1-S2n	0.40	0.75	0.41	0.00	9.77	0.00
4.30	4.30	7144.89	1.23	0.0*	0.82	1-S2n	0.43	0.79	0.43	0.00	10.41	0.00
4.74	4.74	7144.97	1.31	0.0*	0.87	1-S2n	0.45	0.84	0.46	0.00	10.34	0.00
5.18	5.18	7145.05	1.39	0.0*	0.92	1-S2n	0.47	0.88	0.47	0.00	10.97	0.00
5.62	5.62	7145.13	1.47	0.0*	0.98	1-S2n	0.49	0.91	0.49	0.00	11.23	0.00
6.06	6.06	7145.21	1.55	0.0*	1.03	5-S2n	0.51	0.95	0.53	0.00	10.72	0.00
6.50	6.50	7145.30	1.64	0.0*	1.09	5-S2n	0.53	0.99	0.54	0.00	11.24	0.00
11.82	11.19	7146.66	3.00	0.0*	2.00	5-S2n	0.71	1.28	0.75	0.00	12.56	0.00

* Full Flow Headwater elevation is below inlet invert.

Water Surface Profile Plot for Culvert: DP D12



Crossing Input: DP D15

Parameter	Value	Units
DISCHARGE DATA		
Discharge Method	Minimum, Design, and Maximum	
Minimum Flow	0.500	cfs
Design Flow	2.000	cfs
Maximum Flow	2.000	cfs
TAILWATER DATA		
Channel Type	Enter Constant Tailwater Elevation	
Channel Invert Elevation	7122.540	ft
Constant Tailwater Elevation	7122.540	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	1000.000	ft
Crest Length	50.000	ft
Crest Elevation	7126.630	ft
Roadway Surface	Paved	
Top Width	36.000	ft

Culvert Input: DP D15

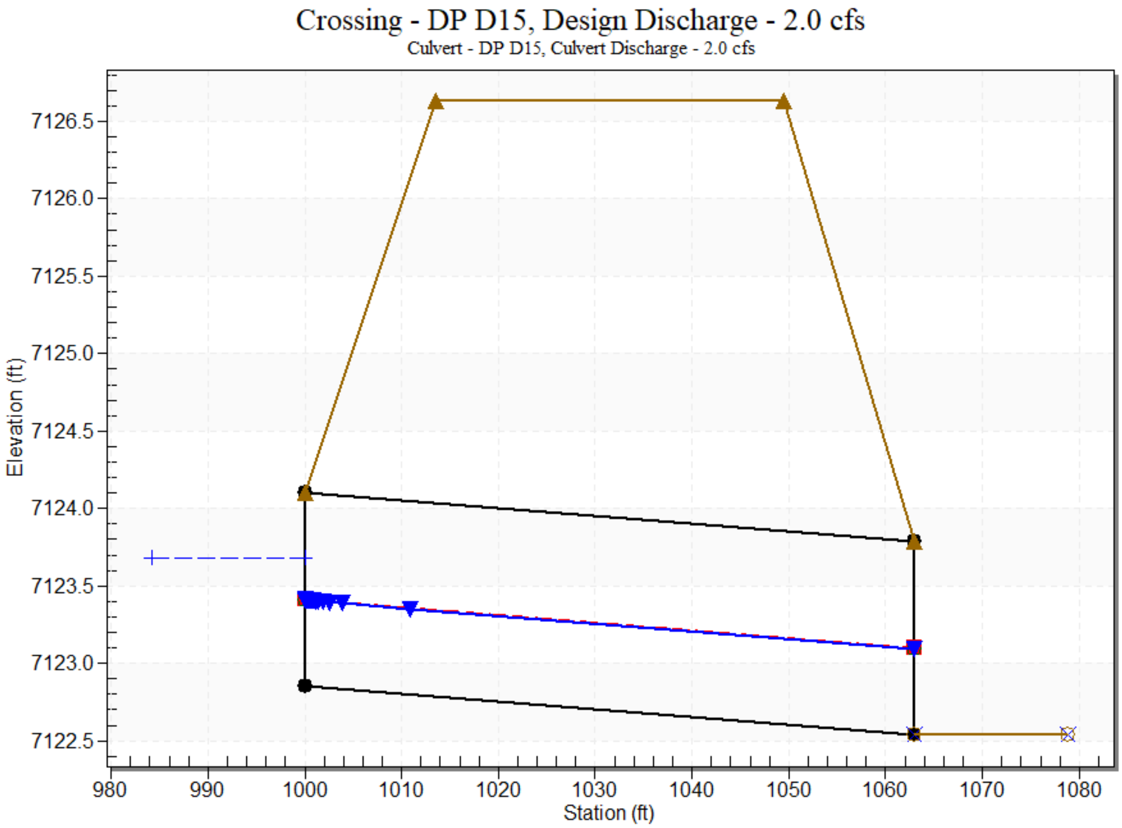
Parameter	Value	Units
CULVERT DATA		
Name	DP D15	
Shape	Circular	
Material	Concrete	
Diameter	1.250	ft
Embedment Depth	0.000	in
Manning's n	0.012	
Culvert Type	Straight	
Inlet Configuration	Mitered to Conform to Slope (Ke=0.7)	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	1000.000	ft
Inlet Elevation	7122.850	ft
Outlet Station	1063.040	ft
Outlet Elevation	7122.540	ft
Number of Barrels	1	
Computed Culvert Slope	0.004918	ft/ft

Table 5 - Culvert Summary Table: DP D15

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	HW / D (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.50	0.50	7123.24	0.39	0.0*	0.31	1-S2n	0.27	0.28	0.27	0.00	2.58	0.00
0.65	0.65	7123.30	0.45	0.018	0.36	1-S2n	0.31	0.31	0.31	0.00	2.78	0.00
0.80	0.80	7123.35	0.50	0.060	0.40	1-S2n	0.34	0.35	0.34	0.00	2.95	0.00
0.95	0.95	7123.40	0.55	0.100	0.44	1-S2n	0.37	0.38	0.37	0.00	3.10	0.00
1.10	1.10	7123.44	0.59	0.139	0.47	1-S2n	0.40	0.41	0.40	0.00	3.23	0.00
1.25	1.25	7123.49	0.64	0.178	0.51	1-S2n	0.43	0.44	0.43	0.00	3.35	0.00
1.40	1.40	7123.53	0.68	0.217	0.54	1-S2n	0.46	0.47	0.46	0.00	3.45	0.00
1.55	1.55	7123.57	0.72	0.256	0.58	1-S2n	0.48	0.49	0.48	0.00	3.55	0.00
1.70	1.70	7123.61	0.76	0.295	0.61	1-S2n	0.51	0.52	0.51	0.00	3.64	0.00
1.85	1.85	7123.64	0.79	0.335	0.64	1-S2n	0.53	0.54	0.53	0.00	3.72	0.00
2.00	2.00	7123.68	0.83	0.375	0.66	1-S2n	0.55	0.56	0.55	0.00	3.80	0.00
9.82	9.60	7126.64	3.79	3.703	3.03	7-M2c	1.25	1.17	1.17	0.00	8.02	0.00

* Full Flow Headwater elevation is below inlet invert.

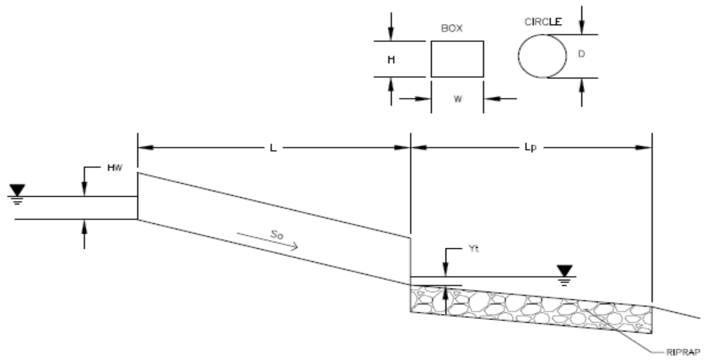
Water Surface Profile Plot for Culvert: DP D15



DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.01 (April 2025)

Project: **Elk View Estates**
ID: **DP D10 Culvert**



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

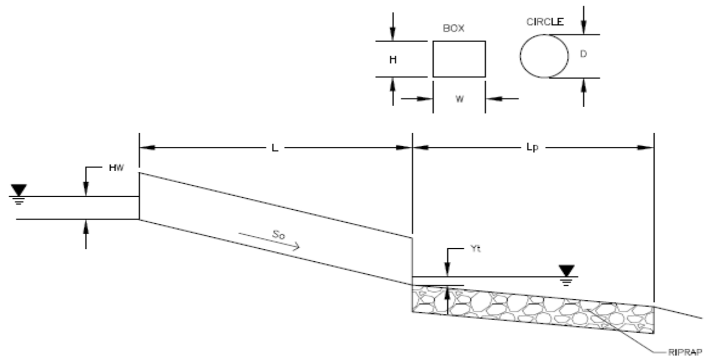
Design Information:			
Design Discharge	Q =	55.1	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	30	inches
Inlet Edge Type (Choose from pull-down list)		Square Edge Projecting	
OR:			
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	2	
Inlet Elevation	Elev IN =	7114.76	ft
Outlet Elevation **OR** Slope	Elev OUT =	7111.41	ft
Culvert Length	L =	81.5	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Calculated Results:			
Culvert Cross Sectional Area Available	A =	4.91	ft^2
Culvert Normal Depth	Y_n =	0.95	ft
Culvert Critical Depth	Y_c =	1.79	ft
Froude Number	Fr =	3.36	**Supercritical!**
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	0.64	
Sum of All Loss Coefficients	k_s =	1.84	ft
Headwater:			
Inlet Control Headwater	HW_I =	2.93	ft
Outlet Control Headwater	HW_O =	N/A	ft
Design Headwater Elevation	**HW =**	**7117.69**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.17**	
Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required			
Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	2.79	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	1.00	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	4.67	
Flow Area at Max Channel Velocity	A_t =	11.02	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	5.00	ft
Length of Riprap Protection	**L_p =**	**25**	**ft**
Width of Riprap Protection at Downstream End	**T =**	**11**	**ft**
Adjusted Diameter for Supercritical Flow	Da =	1.73	ft
Minimum Theoretical Riprap Size	d_{50} min=	6	in
Nominal Riprap Size	d_{50} nominal=	9	in
MHFD Riprap Type	**Type =**	**L**	

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.01 (April 2025)

Project: Elk View Estates
ID: DP D11 Culvert



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge	Q =	13.3	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	18	inches
Inlet Edge Type (Choose from pull-down list)		Square Edge Projecting	
OR:			
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	1	
Inlet Elevation	Elev IN =	7114.18	ft
Outlet Elevation **OR** Slope	Elev OUT =	7109.06	ft
Culvert Length	L =	88.1	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t, Elevation}$ =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Calculated Results:

Culvert Cross Sectional Area Available	A =	1.77	ft^2
Culvert Normal Depth	Y_n =	0.80	ft
Culvert Critical Depth	Y_c =	1.36	ft
Froude Number	Fr =	3.07	**Supercritical!**
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	1.36	
Sum of All Loss Coefficients	k_s =	2.56	ft
Headwater:			
Inlet Control Headwater	HW_I =	3.25	ft
Outlet Control Headwater	HW_O =	N/A	ft
Design Headwater Elevation	**HW =**	**7117.43**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**2.17**	

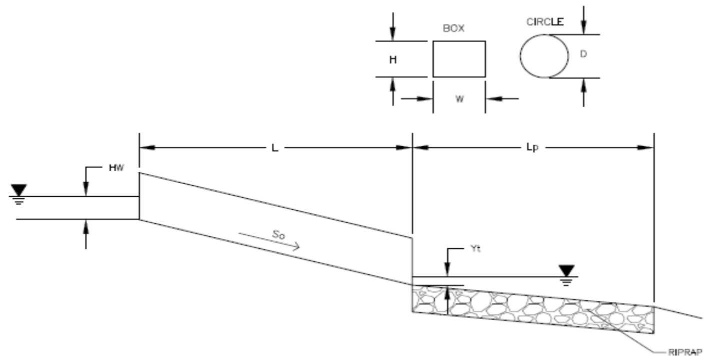
Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	4.83	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	0.60	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	2.60	
Flow Area at Max Channel Velocity	A_t =	2.66	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
Length of Riprap Protection	**L_p =**	**8**	**ft**
Width of Riprap Protection at Downstream End	**T =**	**5**	**ft**
Adjusted Diameter for Supercritical Flow	Da =	1.15	ft
Minimum Theoretical Riprap Size	d_{50} min=	6	in
Nominal Riprap Size	d_{50} nominal=	9	in
MHFD Riprap Type	**Type =**	**L**	

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.01 (April 2025)

Project: Elk View Estates
ID: DP D12 Culvert



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge	Q =	6.5	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	18	inches
Inlet Edge Type (Choose from pull-down list)		Square Edge Projecting	
OR:			
Box Culvert:		**OR**	
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	1	
Inlet Elevation	Elev IN =	7143.66	ft
Outlet Elevation **OR** Slope	So =	0.0459	ft/ft
Culvert Length	L =	70.4	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
Max Allowable Channel Velocity	V =	5	ft/s

Calculated Results:

Culvert Cross Sectional Area Available	A =	1.77	ft^2
Culvert Normal Depth	Y_n =	0.53	ft
Culvert Critical Depth	Y_c =	0.99	ft
Froude Number	Fr =	3.31	**Supercritical!**
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	1.09	
Sum of All Loss Coefficients	k_s =	2.29	ft
Headwater:			
Inlet Control Headwater	HW_I =	1.53	ft
Outlet Control Headwater	HW_O =	N/A	ft
Design Headwater Elevation	**HW =**	**7145.19**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.02**	

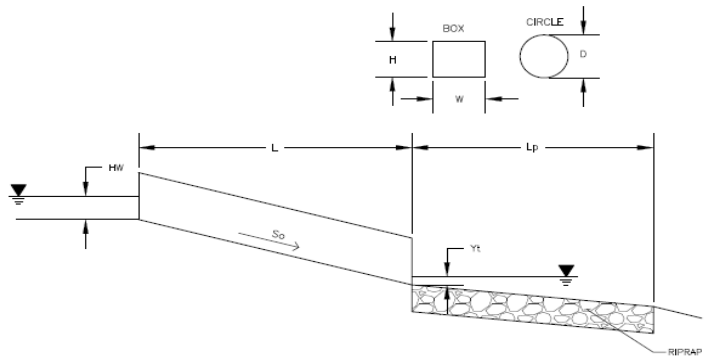
Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	2.36	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	0.60	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	5.25	
Flow Area at Max Channel Velocity	A_t =	1.30	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
Length of Riprap Protection	**L_p =**	**5**	**ft**
Width of Riprap Protection at Downstream End	**T =**	**3**	**ft**
Adjusted Diameter for Supercritical Flow	Da =	1.01	ft
Minimum Theoretical Riprap Size	d_{50} min=	3	in
Nominal Riprap Size	d_{50} nominal=	6	in
MHFD Riprap Type	**Type =**	**VL**	

DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.01 (April 2025)

Project: Elk View Estates
ID: DP D15 Culvert



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Adjusted Diameter to calculate protection type.

Design Information:

Design Discharge	Q =	2	cfs
Circular Culvert:			
Barrel Diameter in Inches	D =	15	inches
Inlet Edge Type (Choose from pull-down list)	Square Edge Projecting		
OR:			
Box Culvert:		OR	
Barrel Height (Rise) in Feet	H (Rise) =		ft
Barrel Width (Span) in Feet	W (Span) =		ft
Inlet Edge Type (Choose from pull-down list)			
Number of Barrels	# Barrels =	1	
Inlet Elevation	Elev IN =	7122.85	ft
Outlet Elevation **OR** Slope	Elev OUT =	7122.54	ft
Culvert Length	L =	63	ft
Manning's Roughness	n =	0.012	
Bend Loss Coefficient	k_b =	0	
Exit Loss Coefficient	k_x =	1	
Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
Max Allowable Channel Velocity	V =	5	ft/s

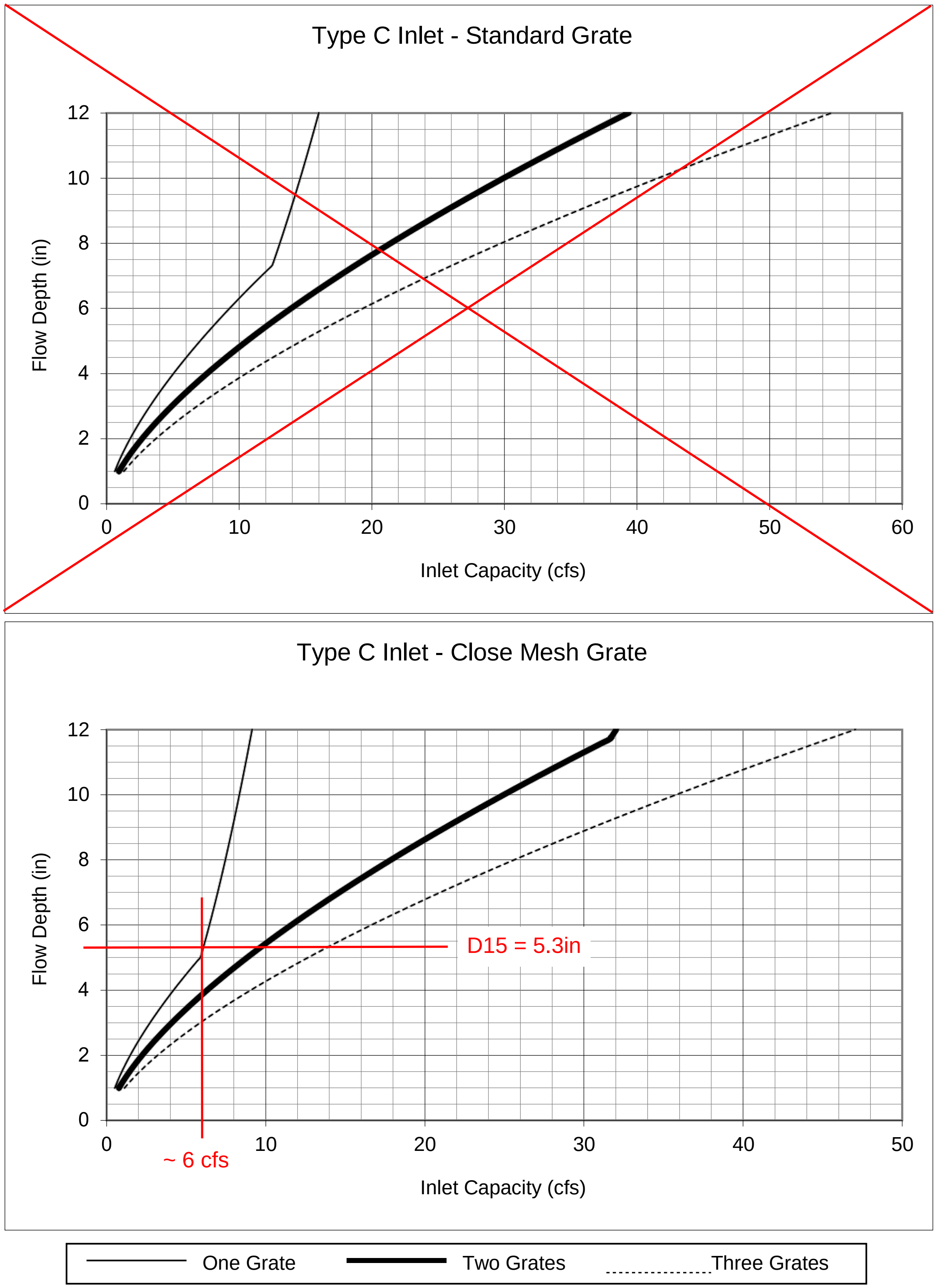
Calculated Results:

Culvert Cross Sectional Area Available	A =	1.23	ft^2
Culvert Normal Depth	Y_n =	0.30	ft
Culvert Critical Depth	Y_c =	0.49	ft
Froude Number	Fr =	2.68	**Supercritical!**
Entrance Loss Coefficient	k_e =	0.20	
Friction Loss Coefficient	k_f =	1.24	
Sum of All Loss Coefficients	k_s =	2.44	ft
Headwater:			
Inlet Control Headwater	HW_I =	0.67	ft
Outlet Control Headwater	HW_O =	N/A	ft
Design Headwater Elevation	**HW =**	**N/A**	**ft**
Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**N/A**	

Outlet Control Headwater Approximation Method Inaccurate for Low Flow - Backwater Calculations Required

Outlet Protection:			
Flow/(Diameter^2.5)	Q/D^2.5 =	1.14	$ft^{0.5}/s$
Tailwater Surface Height	Y_t =	0.50	ft
Tailwater/Diameter	Yt/D =	0.40	
Expansion Factor	1/(2*tan(Θ)) =	6.56	
Flow Area at Max Channel Velocity	A_t =	0.40	ft^2
Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
Length of Riprap Protection	**L_p =**	**5**	**ft**
Width of Riprap Protection at Downstream End	**T =**	**3**	**ft**
Adjusted Diameter for Supercritical Flow	Da =	0.77	ft
Minimum Theoretical Riprap Size	d_{50} min=	1	in
Nominal Riprap Size	d_{50} nominal=	6	in
MHFD Riprap Type	**Type =**	**VL**	

Figure 8-10. Inlet Capacity Chart Sump Conditions, Area (Type C) Inlet



Notes:
1. The standard inlet parameters must apply to use these charts.

APPENDIX D

WATER QUALITY COMPUTATIONS

2880 International Circle, Suite 110
Colorado Springs, CO 80910
Phone: 719-520-6300
Email: Stormwater@elpasoco.com
publicworks.elpasoco.com/stormwater/

Does not need to be in drainage report, can be removed

EL PASO COUNTY
PCM APPLICABILITY FORM

EPC Project Number: ______________

This form is to be used by the Engineer of Record to determine if the proposed construction activities are eligible for an exclusion to stormwater quality permanent control measure (PCM) requirements. All "applicable construction activity" within El Paso County (EPC) must comply with the post-construction stormwater management criteria. Reference ECM Appendix I for information about PCMs.

Note that this form only addresses stormwater quality for the site. Even if the site is fully excluded from needing a stormwater quality PCM, the site may still need to address stormwater detention (per DCMv1 Chap 1.5 and ECM Chap 3.2.8.B). However, if the site requires stormwater detention, then it must also address stormwater quality (per DCMv2 Chap 4.1 and ECM Appendix I.7.3). Refer to the Reference Information pages below for more guidance.

Part I. Project Summary			
Project Name:	Elk View Estates Subdivision		
Is Stormwater Detention Required?	☐ Yes ☒ No	**Is Water Quality Treatment Required? (i.e.: non-excluded disturbance >1ac)**	☒ Yes ☐ No
Is an ESQCP Required? If "No," Check Applicable Reason	☒ Yes ☐ No	☐ Not an Applicable Construction Activity ☐ Oil & Gas ☐ R-Factor	
Engineer of Record Email Address:	TrevenEdwards@GallowayUS.com		

Part II. PCM Exclusions

Note: Questions A through K directly correlate to Part I.E.4.a.i (A) to (K) on page 27 of the 2016 CDPS Statewide Standard MS4 General Permit COR090000 (i.e.: the MS4 Permit), as amended. Document exclusions that apply to the whole project or parts of it.

Questions	Excluded Acreage	Yes	No	Notes
A. Is this project a "Pavement Management Site?"			✘	This exclusion applies to the maintenance, rehabilitation, and reconstruction of pavement on existing roads, bridges, bike lanes, and parking along roads. Areas used primarily for parking (i.e.: separate lots not along roadway) or access to parking are not included. No increase in impervious area is allowable.
B. Review two options below to see if project is an "Excluded Roadway Development."				Does not include sidewalks. Does include curb & gutter.
• Does the project include improvements to an existing roadway that adds < 1 acre of paved or gravel area per mile of roadway?			✘	If selected, list the proposed additional acreage per mile in Part IV Notes below.
• Does the project include improvements to an existing roadway that adds ≤ 8.25 ft of paved width at any location?			✘	If selected, list the proposed additional width in Part IV Notes below.

2880 International Circle, Suite 110
Colorado Springs, CO 80910
Phone: 719-520-6300
Email: Stormwater@elpasoco.com
publicworks.elpasoco.com/stormwater/

EL PASO COUNTY
PCM APPLICABILITY FORM

EPC Project Number: ______________

Part II. PCM Exclusions (continued)

Questions	Excluded Acreage	Yes	No	Notes
C. Does the project include "Excluded Existing Roadway Areas?"			X	For redevelopment of existing roadways. This exclusion only excludes the original roadway area, it does NOT apply to the entire project. This exclusion applies only when the proposed project will expand the existing roadway width by <2x on average. If selected, list the proposed expanded width in Part IV Notes below.
D. Is the project considered an Aboveground or Underground Utilities activity?			X	Activity can not permanently alter the terrain, ground cover, or drainage patterns from existing conditions.
E. Is the project considered a "Large Lot Single-Family Site"? *This exclusion only pertains to the lots and does not include roadways.*		X		Must be a single-family residential lot or agricultural zoned land with $\geq$ 2.5 acres per dwelling and total lot impervious area < 10%. If "Yes," notate the percent impervious below in Part IV: Notes.
F. Do Non-Residential or Non-Commercial Infiltration Conditions exist? *Post-development surface conditions do not result in concentrated stormwater flow or surface water discharge during an 80th percentile stormwater runoff event, and the 80th percentile event must be infiltrated.*			X	Exclusion does not apply to residential or commercial sites for buildings. A site-specific study is required and must show rainfall and soil conditions, allowable slopes, surface conditions, and ratios of imperviousness area to pervious area.
G. Is the project land disturbance to Undeveloped Land where undeveloped land remains undeveloped following the activity?			X	Project must be on land with no human made structures such as buildings or pavement. The proposed development must return the disturbed area to its historical condition. See CDPHE's "Standard MS4 Permit FAQ" for more detail on how this exclusion applies.
H. Is the project a Stream Stabilization Site?			X	
I. Is the project a Bike or Pedestrian Trail?			X	Bike lanes for roadways are not included in this exclusion but may qualify if attached to a larger roadway activity that is excluded in A, B or C above. Pedestrian trails (e.g. sidewalks) that are attached to a roadway do not apply.
J. Is the project Oil and Gas Exploration?			X	Activities and facilities associated with oil and gas exploration are excluded.
K. Is the project in a County Growth Area?				El Paso County does not apply this exclusion.

If any exclusions above apply (via a "Yes" for any row), runoff from those areas is excluded from stormwater quality treatment requirements. All runoff from remaining non-excluded disturbed areas will need to be treated by a stormwater quality PCM, unless remaining area is <1ac. If remaining area is >1ac, select at least one Design Standard on the next page.

2880 International Circle, Suite 110
Colorado Springs, CO 80910
Phone: 719-520-6300
Email: Stormwater@elpasoco.com
publicworks.elpasoco.com/stormwater/

EL PASO COUNTY
PCM APPLICABILITY FORM

EPC Project Number: ______________

Part III: PCM Information		
Questions	**Yes**	**No**
1. Which of the following Design Standard(s) will the project utilize? *(If a PCM is required, you must select at least one. See Control Measure Requirements identified in MS4 Permit Part I.E.4.a.iv on page 29.)*		
A. Water Quality Capture Volume (WQCV) Standard		✘
B. Pollutant Removal Standard - 80% Total Suspended Solids Removal (TSS) *(must treat runoff to <30mg/L of TSS)*		✘
C. Runoff Reduction Standard	✘	
D. Applicable Development Site Draining to a Regional WQCV Control Measure *(no conveyance via "Waters of the State")*		✘
E. Applicable Development Site Draining to a Regional WQCV Facility *(conveyance allowable via "Waters of the State," if the 8 conditions in the MS4 permit are met and documented in the drainage report)*		✘
F. Constrained Redevelopment Sites Standard *(must be pre-approved by ECM Administrator)*		✘
G. Previous Permit Term Standard		✘
2. Will any of the PCMs be located within any other jurisdiction besides EPC?		✘

Part IV: Notes

Provide info regarding all applicable PCM(s) and PCM Exclusion(s) including location, PCM name(s)/number(s), and additional relevant filings or reports or maintenance agreements, etc. Attach an additional sheet if you need more space. Attaching a detailed summary table would replace the need for any notes here.

The proposed development plan is to subdivide the existing undeveloped parcel of land into (6) 2.5-acre single-family residential lots. (2) proposed, private, roadways are proposed within this subdivision. In conformance with the County MS4, the proposed residential lots will be excluded from the stormwater quality requirements per the ECM, Appendix I.7.1.B.5.

The proposed roadway is not included in this exclusion. The proposed road has been analyzed to meet the County runoff reduction requirement to provide water quality treatment. The impervious areas are routed across pervious landscape buffers, adjacent to the roadway, still within the private roadway easement.

2880 International Circle, Suite 110
Colorado Springs, CO 80910
Phone: 719-520-6300
Email: Stormwater@elpasoco.com
publicworks.elpasoco.com/stormwater/

EL PASO COUNTY
PCM APPLICABILITY FORM

EPC Project Number: _______________

Part V: Signatures
Applicant: This PCM Applicability Form was prepared under my direction and supervision and is correct to the best of my knowledge and belief. It was prepared along with the project design, construction plans, drainage report, specifications, and maintenance and access agreements as required. And it has been reviewed for compliance with the Post Construction Stormwater Management criteria and MS4 Permit requirements.

____ ____________________

Signature and Stamp of Engineer of Record — Date

(If the project is not an Applicable Construction Activity, this line can be signed by the Applicant or their rep, they do not have to be an engineer)

____

El Paso County: This PCM Applicability Form has been reviewed and the project design, construction plans, drainage report, specifications, and maintenance and access agreements as required, have been reviewed for compliance with the Post Construction Stormwater Management process and MS4 Permit requirements.

____ ____________________

Signature of El Paso County Project Engineer — Date

Reference Information:

If a PCM is required, then these additional documents will also need to be submitted:

- PCM Maintenance Agreement
- PCM O&M Manual
- MHFD Detention Basin Design Workbook*
- Proof of Submittal of: Notice of Intent to Construct a Non-Jurisdictional Water Impoundment Structure*

*Not required for all PCMs, check ECM Appendix I for requirements

The following are screenshots of example Water Quality Treatment Summary Tables. The Excel versions can be found at the EPC DPW Stormwater website linked below. These are optional tables that can be used to summarize water quality treatment and applicable exclusions. Select the table that best suits the project based on the number of basins, PCMs, and/or exclusions. A PDF of the selected table(s) can be attached to this form and/or to the Drainage Report. It is helpful to also include a basic overview map with color shading or hatch patterns that shows areas tributary to each type of PCM (pond, runoff reduction, etc.) and those areas that are not captured by a PCM, with the applicable exclusion(s) labeled.

https://publicworks.elpasoco.com/stormwater/

Water Quality Treatment Summary Table

Basin ID(s)	PCM Tributary Area (ac)	PCM ID
A1 - A5	4	Pond 1
B1 - B3	3.25	Pond 2
C, D	5.5	Runoff Reduction
E	10	Excluded*

* Excluded based on ECM App I.7.1.B.5

Water Quality Treatment Summary Table

Basin ID	Total Area (ac)	Total Proposed Disturbed Area (ac)	Area Trib to Pond A (ac)	Disturbed Area Treated via Runoff Reduction (ac)	Disturbed Area Excluded from WQ per ECM App I.7.1.C.1 (ac)	Disturbed Area Excluded from WQ per ECM App I.7.1.B.# (ac)	Applicable WQ Exclusions (App I.7.1.B.#)
A	4.50	4.50	4.50				
B	1.25	1.25		1.25			
C	6.00	4.00				4.00	ECM App I.7.1.B.5
D	2.50	2.50	1.00		0.50	1.00	ECM App I.7.1.B.7
E	3.00		3.00				
F	8.25						
Total	25.50	12.25	8.50	1.25	0.50	5.00	

Min Required Area to Receive WQ Treatment	Total Proposed Disturbed Area (ac)	Total Proposed Treated Area (ac)	Total Proposed Disturbed Area Excluded from WQ (ac)	Net Treatment (ac)
6.75	12.25	9.75	5.50	3.00

Design Standard D, definition of "Waters of the State of Colorado" per MS4 Permit:

"Any and all surface waters and subsurface waters which are contained in or flow in or through this state, but does not include waters in sewage systems, waters in treatment works of disposal systems, waters in potable water distribution systems, and all water withdrawn for use until use and treatment have been completed. This definition can include water courses that are usually dry."

The following website shows Waters of the State of Colorado:

https://cdphe.maps.arcgis.com/apps/Viewer/index.html?appid=f1541d2f21834642ba1551c674fd4a79

Design Standard E, additional info from the MS4 Permit:

Before discharging to a water of the state, at least 20 percent of the upstream imperviousness of the applicable development site must be disconnected from the storm drainage system and drain through a receiving pervious area control measure comprising a footprint of at least 10 percent of the upstream disconnected impervious area of the applicable development site. The control measure must be designed in accordance with a design manual identified by the permittee. In addition, the stream channel between the discharge point of the applicable development site and the regional WQCV facility must be stabilized.

Below are the 8 conditions that must be met:

1) The regional WQCV facility must be implemented, functional, and maintained following good engineering, hydrologic and pollution control practices.

2) The regional WQCV facility must be designed and maintained for 100% WQCV for its entire drainage area.

3) The regional WQCV facility must have capacity to accommodate the drainage from the applicable development site.

4) The regional WQCV facility be designed and built to comply with all assumptions for the development activities planned by the permittee within its drainage area, including the imperviousness of its drainage area and the applicable development site.

5) Evaluation of the minimum drain time shall be based on the pollutant removal mechanism and functionality of the facility. Consideration of drain time shall include maintaining vegetation necessary for operation of the facility (e.g., wetland vegetation).

6) The permittee shall meet the requirements in Parts I.E.4.a.v. and vii. and Part I.E.4.b. for the regional WQCV facility consistent with requirements and actions for control measures.

7) The regional WQCV facility must be subject to the permittee's authority consistent with requirements and actions for a Control Measure in accordance with Part I.E.4.a.iv.

8) Regional Facilities must be designed and implemented with flood control or water quality as the primary use. Recreational ponds and reservoirs may not be considered Regional Facilities. Water bodies listed by name in surface water quality classifications and standards regulations (5 CCR 1002-32 through 5 CCR 1002-38) may not be considered regional facilities.

Use current spreadsheet

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Designer: TJE
Company: Galloway & Company
Date: November 21, 2025
Project: Elk View Estates - KO SUB-BASINS
Location: El Paso County, CO

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	SPA	UIA:RPA	SPA	UIA:RPA	UIA:RPA		UIA:RPA	SPA	UIA:RPA	SPA	
Area ID	D201	D201_SPA	D203	D203_SPA	D204	D205		D221	D221_SPA	D222	D222_SPA	
Downstream Design Point ID	D10/D11	D10/D11	D12	D12	D13	D13		D15	D15	D16	D16	
Downstream BMP Type	None	None	None	None	None	None		None	None	None	None	
DCIA (ft^2)	--	--	--	--	--	--		--	--	--	--	
UIA (ft^2)	15,291	--	6,216	--	3,673	14,258		525	--	3,691	--	
RPA (ft^2)	9,657	--	2,008	--	4,556	12,260		711	--	906	--	
SPA (ft^2)	--	1,017	--	1,571	--	--		--	959	--	732	
HSG A (%)	0%	0%	0%	0%	0%	0%		0%	0%	0%	0%	
HSG B (%)	100%	100%	100%	100%	100%	100%		100%	100%	100%	100%	
HSG C/D (%)	0%	0%	0%	0%	0%	0%		0%	0%	0%	0%	
Average Slope of RPA (ft/ft)	0.250	--	0.250	--	0.250	0.250		0.250	--	0.250	--	
UIA:RPA Interface Width (ft)	945.00	--	230.00	--	400.00	890.00		130.00	--	104.00	--	

L/W should be between 0.0625 and 16

CALCULATED RUNOFF RESULTS

Area ID	D201	D201_SPA	D203	D203_SPA	D204	D205		D221	D221_SPA	D222	D222_SPA	
UIA:RPA Area (ft^2)	24,948	--	8,224	--	8,229	26,518		1,236	--	4,597	--	
L / W Ratio	0.06	--	0.16	--	0.06	0.06		0.07	--	0.43	--	
UIA / Area	0.6129	--	0.7558	--	0.4463	0.5377		0.4248	--	0.8029	--	
Runoff (in)	0.00	0.00	0.13	0.00	0.00	0.00		0.00	0.00	0.19	0.00	
Runoff (ft^3)	0	0	87	0	0	0		0	0	74	0	
Runoff Reduction (ft^3)	637	51	172	79	153	594		22	48	79	37	

CALCULATED WQCV RESULTS

Area ID	D201	D201_SPA	D203	D203_SPA	D204	D205		D221	D221_SPA	D222	D222_SPA	
WQCV (ft^3)	637	0	259	0	153	594		22	0	154	0	
WQCV Reduction (ft^3)	637	0	172	0	153	594		22	0	79	0	
WQCV Reduction (%)	100%	0%	67%	0%	100%	100%		100%	0%	52%	0%	
Untreated WQCV (ft^3)	0	0	87	0	0	0		0	0	74	0	

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

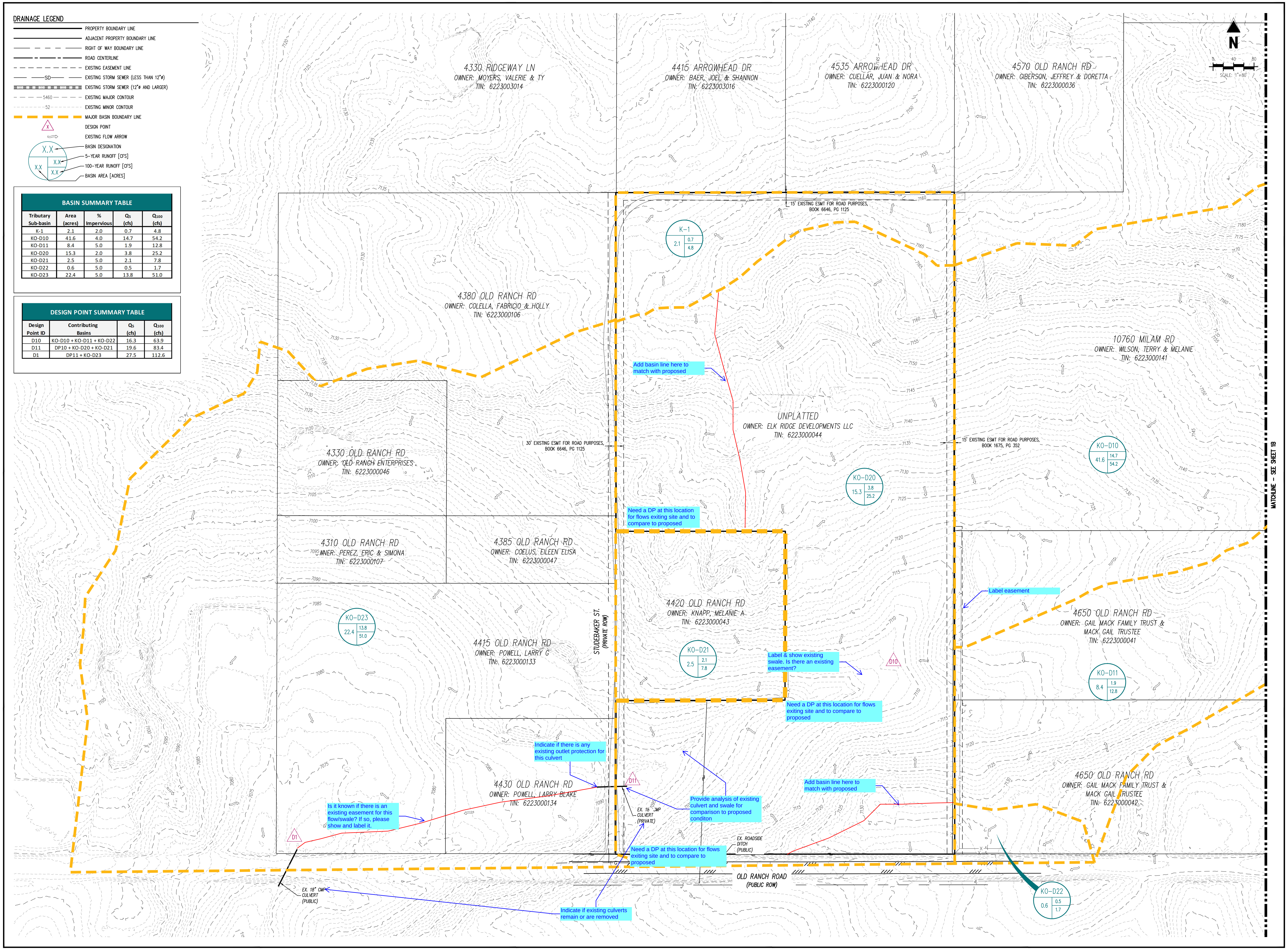
Downstream Design Point ID	D10/D11	D12	D13	D15	D16							
DCIA (ft^2)	0	0	0	0	0							
UIA (ft^2)	15,291	6,216	17,931	525	3,691							
RPA (ft^2)	9,657	2,008	16,816	711	906							
SPA (ft^2)	1,017	1,571	0	959	732							
Total Area (ft^2)	25,965	9,795	34,747	2,195	5,329							
Total Impervious Area (ft^2)	15,291	6,216	17,931	525	3,691							
WQCV (ft^3)	637	259	747	22	154							
WQCV Reduction (ft^3)	637	172	747	22	79							
WQCV Reduction (%)	100%	67%	100%	100%	52%							
Untreated WQCV (ft^3)	0	87	0	0	74							

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

Total Area (ft^2)	78,031
Total Impervious Area (ft^2)	43,654
WQCV (ft^3)	1,819
WQCV Reduction (ft^3)	1,658
WQCV Reduction (%)	91%
Untreated WQCV (ft^3)	161

APPENDIX E

DRAINAGE MAPS



BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	% Impervious	Q_5 (cfs)	Q_{100} (cfs)
K-1	2.1	2.0	0.7	4.8
KO-D10	41.6	4.0	14.7	54.2
KO-D11	8.4	5.0	1.9	12.8
KO-D20	15.3	2.0	3.8	25.2
KO-D21	2.5	5.0	2.1	7.8
KO-D22	0.6	5.0	0.5	1.7
KO-D23	22.4	5.0	13.8	51.0

DESIGN POINT SUMMARY TABLE

Design Point ID	Contributing Basins	Q_5 (cfs)	Q_{100} (cfs)
D10	KO-D10 + KO-D11 + KO-D22	16.3	63.9
D11	DP10 + KO-D20 + KO-D21	19.6	83.4
D1	DP11 + KO-D23	27.5	112.6

Galloway
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

NOT FOR CONSTRUCTION

ELK VIEW ESTATES
CONSTRUCTION DRAWINGS

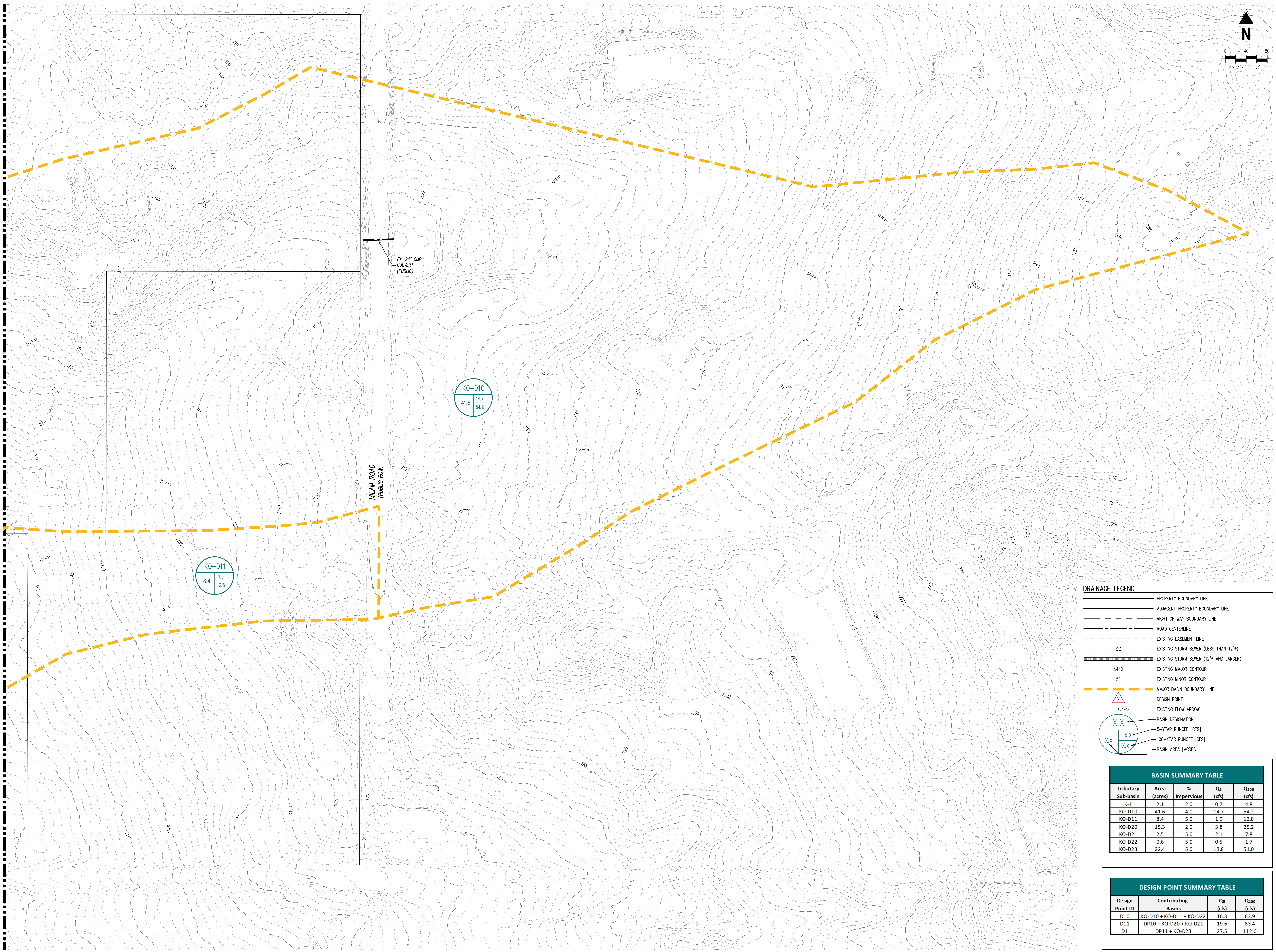
OLD RANCH ROAD
EL PASO COUNTY, CO

#	Date	Issue / Description	Init.
1	06/20/2025	1ST COUNTY SUBMITTAL	ELB

Project No:	ERD01
Drawn By:	ELB
Checked By:	TJE
Date:	06/20/2025

EXISTING CONDITIONS DRAINAGE MAP

1A



DRAINAGE LEGEND

- PROPERTY BOUNDARY LINE
- ADJACENT PROPERTY BOUNDARY LINE
- RIGHT OF WAY BOUNDARY LINE
- ROAD CENTERLINE
- EXISTING EASEMENT LINE
- EXISTING STORM SEWER (LESS THAN 12"⌀)
- EXISTING STORM SEWER (12"⌀ AND LARGER)
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- MAJOR BASIN BOUNDARY LINE
- DESIGN POINT
- EXISTING FLOW ARROW
- BASIN DESIGNATION
- 5-YEAR RUNOFF [CFS]
- 100-YEAR RUNOFF [CFS]
- BASIN AREA [ACRES]

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	% Impervious	Q_5 (cfs)	Q_{100} (cfs)
K-1	2.1	2.0	0.7	4.8
KO-D10	41.6	4.0	14.7	54.2
KO-D11	8.4	5.0	1.9	12.8
KO-D20	15.3	2.0	3.8	25.2
KO-D21	2.5	5.0	2.1	7.8
KO-D22	0.6	5.0	0.5	1.7
KO-D23	22.4	5.0	13.8	51.0

DESIGN POINT SUMMARY TABLE

Design Point ID	Contributing Basins	Q_5 (cfs)	Q_{100} (cfs)
D10	KO-D10 + KO-D11 + KO-D22	16.3	63.9
D11	DP10 + KO-D20 + KO-D21	19.6	83.4
D1	DP11 + KO-D23	27.5	112.6

Galloway
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

NOT FOR CONSTRUCTION

ELK VIEW ESTATES
CONSTRUCTION DRAWINGS

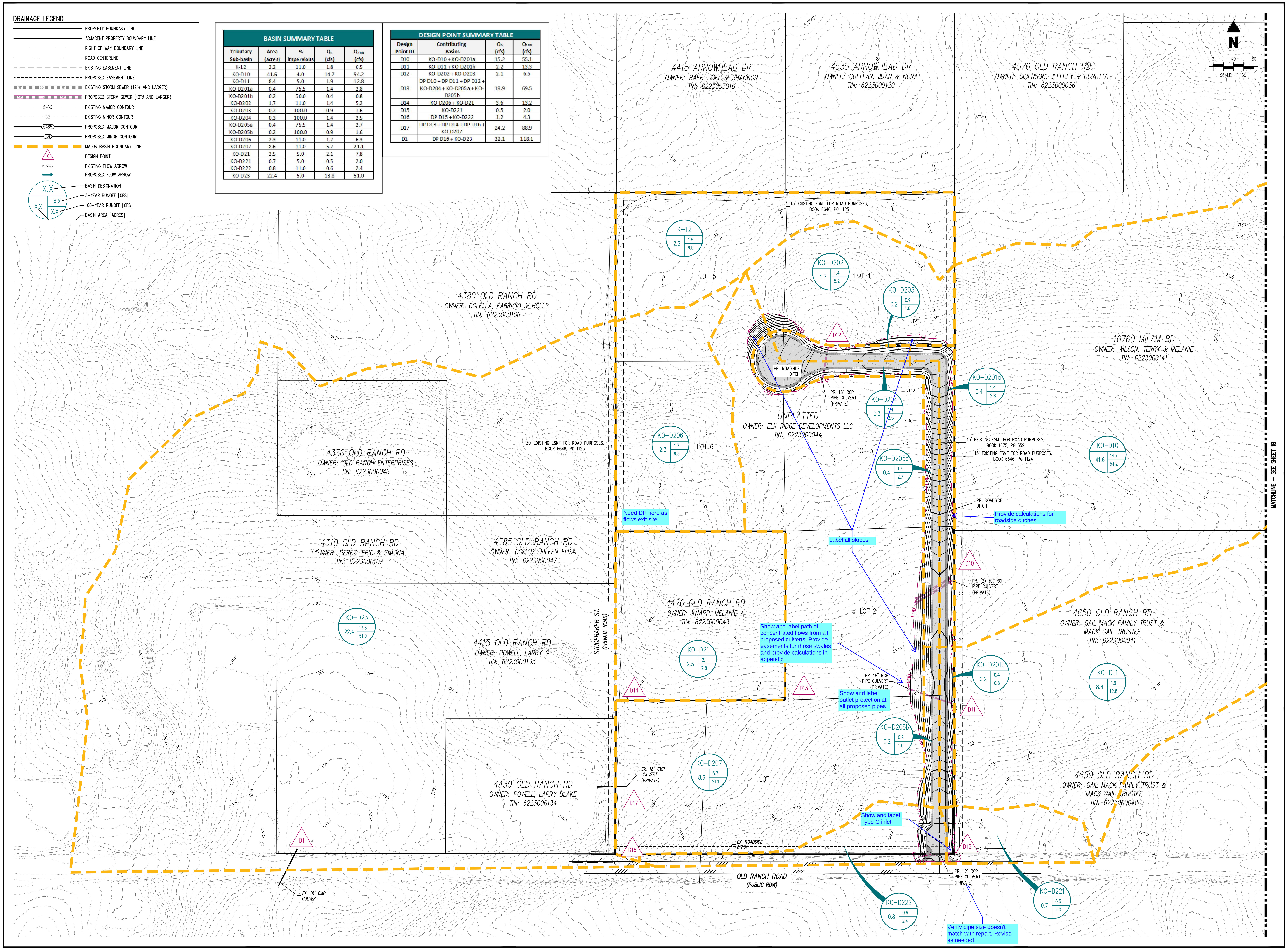
OLD RANCH ROAD
EL PASO COUNTY, CO

#	Date	Issue / Description	Init.
1	06/20/2025	1ST COUNTY SUBMITTAL	ELB

Project No: ERD01
Drawn By: ELB
Checked By: TJE
Date: 06/19/2025

EXISTING CONDITIONS DRAINAGE MAP

1B



BASIN SUMMARY TABLE				
Tributary Sub-basin	Area (acres)	% Impervious	Q_5 (cfs)	Q_{100} (cfs)
K-12	2.2	11.0	1.8	6.5
KO-D10	41.6	4.0	14.7	54.2
KO-D11	8.4	5.0	1.9	12.8
KO-D201a	0.4	75.5	1.4	2.8
KO-D201b	0.2	50.0	0.4	0.8
KO-D202	1.7	11.0	1.4	5.2
KO-D203	0.2	100.0	0.9	1.6
KO-D204	0.3	100.0	1.4	2.5
KO-D205a	0.4	75.5	1.4	2.7
KO-D205b	0.2	100.0	0.9	1.6
KO-D206	2.3	11.0	1.7	6.3
KO-D207	8.6	11.0	5.7	21.1
KO-D21	2.5	5.0	2.1	7.8
KO-D221	0.7	5.0	0.5	2.0
KO-D222	0.8	11.0	0.6	2.4
KO-D23	22.4	5.0	13.8	51.0

DESIGN POINT SUMMARY TABLE			
Design Point ID	Contributing Basins	Q_5 (cfs)	Q_{100} (cfs)
D10	KO-D10 + KO-D201a	15.2	55.1
D11	KO-D11 + KO-D201b	2.2	13.3
D12	KO-D202 + KO-D203	2.1	6.5
D13	DP D10 + DP D11 + DP D12 + KO-D204 + KO-D205a + KO-D205b	18.9	69.5
D14	KO-D206 + KO-D21	3.6	13.2
D15	KO-D221	0.5	2.0
D16	DP D15 + KO-D222	1.2	4.3
D17	DP D13 + DP D14 + DP D16 + KO-D207	24.2	88.9
D1	DP D16 + KO-D23	32.1	118.1

Galloway
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

NOT FOR CONSTRUCTION

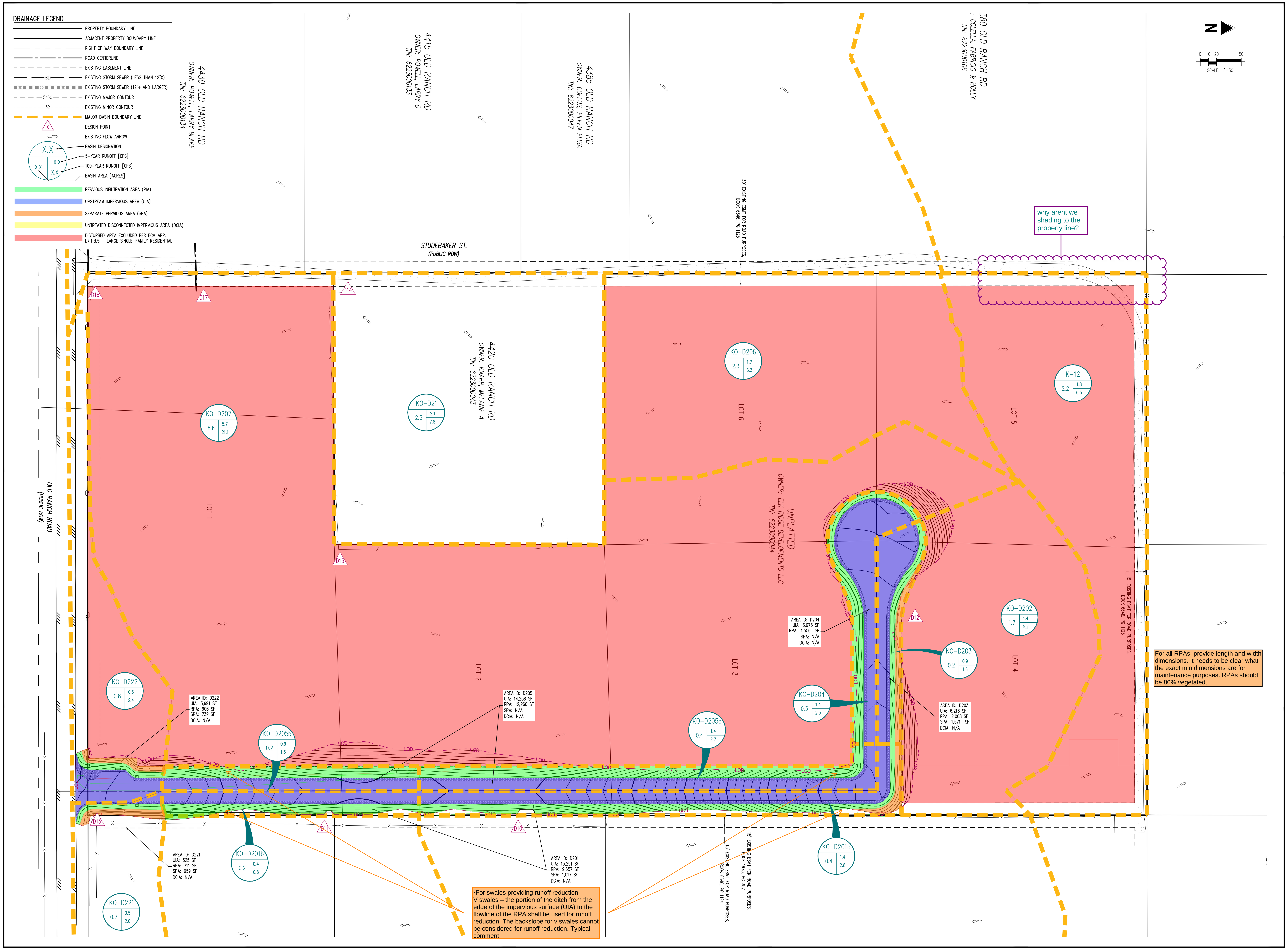
ELK VIEW ESTATES
CONSTRUCTION DRAWINGS

OLD RANCH ROAD
EL PASO COUNTY, CO

#	Date	Issue / Description	Init.
1	06/27/2025	1ST COUNTY SUBMITTAL	ELB

Project No:	ERD01
Drawn By:	ELB
Checked By:	TJE
Date:	06/19/2025

PROPOSED CONDITIONS DRAINAGE MAP



Galloway

1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

NOT FOR CONSTRUCTION

ELK VIEW ESTATES
CONSTRUCTION DRAWINGS

OLD RANCH ROAD
EL PASO COUNTY, CO

#	Date	Issue / Description	Init.
1	06/27/2025	1ST COUNTY SUBMITTAL	ELB

Project No: ERD01
Drawn By: ELB
Checked By: TJE
Date: 06/19/2025

WATER QUALITY & RUNOFF REDUCTION DRAINAGE MAP