FINAL DRAINAGE REPORT

for

SILVERADO RANCH FILING NO. 2

Prepared for:

Silverado Ranch, Inc.
18911 Cherry Springs Ranch Dr.
Monument, CO 80132

January 31, 2024

Prepared by:

JPS ENGINEERING

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SF246

JPS Project No. 080603
SF-24-___

SILVERADO RANCH FILING NO. 2 – FINAL DRAINAGE REPORT

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APPENDICES

DRAINAGE STATEMENT

Engineer's Statement:

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

John P. Schwab, P.E. #29891

Developer's Statement:

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

By:

Printed Name: Stan Searle, President Date
Silverado Ranch, Inc., 18911 Cherry Springs Ranch Drive, Monument, CO 80132

El Paso County's Statement

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

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

Conditions:

I. GENERAL LOCATION AND DESCRIPTION

A. Background

Silverado Ranch is a rural residential subdivision located in the Ellicott Valley area of eastern El Paso County, Colorado. The development is located at the southeast corner of Drennan Road and Peyton Highway. The Silverado Ranch project will ultimately consist of 64 rural residential lots (2.5-acre minimum) on the 320-acre property. The gross density of the project is 5 acres per residential lot. The El Paso County Board of County Commissioners approved the PUD and Preliminary Plan for Silverado Ranch on August 28, 2008.

The developer, Silverado Ranch, Inc., completed recording of the initial phase of development (Filing No. 1) in 2018. The existing Silverado Ranch Filing No. 1 consists of 10 lots on 106.4 acres in the northwest area of the property.

Silverado Ranch Filing No. 1A was approved by the County in October, 2023 as an Amendment to the Filing No. 1 plat, allowing for the subdivision streets to be constructed as private roads.

The current proposal for Silverado Ranch Filing No. 2 is the second phase of this subdivision development, and this filing consists of 15 lots on 48.9 acres in the northeast part of the property.

B. Scope

This report is intended to fulfill the El Paso County requirements for a Final Drainage Report (FDR) in support of the final plat submittal for Filing No. 2. The report will provide a summary of site drainage issues impacting the proposed development, including analysis of impacts from upstream drainage areas, site-specific developed drainage patterns, and impacts on downstream facilities. This report was prepared based on the guidelines and criteria presented in the El Paso County Drainage Criteria Manual.

Please add ECM to the criteria.

C. Site Location and Description

The Silverado Ranch property is described as the north half of Section 16, Township 15 South, Range 63 West of the 6th Principal Meridian. The Silverado Ranch Filing No. 2 site is a part of the unplatted balance of the Silverado Ranch property (El Paso County Assessor's Parcel Number 35000-00-082). The undeveloped balance of the Silverado Ranch property is currently vacant ranch land. Peyton Highway borders the subdivision property to the west, and Drennan Road borders the property to the north. Unplatted properties zoned RR3 (rural residential – 5-acre lots) border this parcel on all sides.

Ground elevations within the property range from a high point of approximately 5,880 feet above mean sea level at the west boundary of the site, to a low point of 5,780 at the southeast corner of the property.

In accordance with the approved PUD, the overall Silverado Ranch development will ultimately include 64 rural residential lots, maintaining a gross density of 5 units per acre. Subdivision infrastructure improvements will include gravel paving and utility installation along the roads within the site. Subdivision streets will be classified as private rural residential roads.

Filing No. 1 included construction of Drover Canyon View, providing subdivision access to Drennan Road along the north boundary of the subdivision. Filing No. 1 also included construction of the initial segment of Silverado Hill View, which will ultimately serve as a loop road within the subdivision.

Silverado Hill Loop per F1 plat

Filing No. 2 will include construction of Silverado Hill View extending easterly as a private road from the existing street termination at the east end of Filing No. 1. Silverado Hill View will provide direct access to the 15 residential lots within Filing No. 2.

A future phase of subdivision development will include construction of Mill Iron View at the western site boundary, providing a subdivision access connection to Peyton Highway.

The natural drainage channels throughout this area flow to tributaries of Upper Dry Squirrel Creek, which outfalls into Black Squirrel Creek southeast of this site. The site is located entirely within the Drennan Drainage Basin (CHDS0400).

The terrain is generally flat with gentle northwest to southeast slopes ranging from one to three percent. Historic drainage flows from the site are conveyed overland towards the southerly boundary of the site. Existing vegetation within the site consists of native prairie grasses.

D. General Soil Conditions

According to the Soil Survey of El Paso County prepared by the Soil Conservation Service, on-site soils are comprised of the following soil types (see Appendix A):

- Type 5 - "Bijou loamy sand": rapid permeability, slow surface runoff, severe erosion hazard, Hydrologic Group B (approximately 65% of site, encompassing central and eastern areas of parcel)
- Type 6 – "Bijou sandy loam": rapid permeability, slow surface runoff, moderate erosion hazard, Hydrologic Group B (small area near easterly site boundary)
- Type 106 – "Wigton loamy sand": rapid permeability, slow surface runoff, moderate to high erosion hazard, Hydrologic Group A (approximately 35% of site, encompassing western area of parcel)

The soils within this parcel are classified as hydrologic soils group A/B.

Please remove the first, and second references.

E. References

City of Colorado Springs & El Paso County "Drainage Criteria Manual, Volumes 1 and 2," revised

City of Colorado Springs & El Paso County "Drainage Criteria Manual," revised October 31, 2018.

City of Colorado Springs "Drainage Criteria Manual, Volumes 1 and 2," revised October 31, 2018.

El Paso County "Engineering Criteria Manual," revised December 13, 2016.

FEMA, Flood Insurance Rate Map (FIRM) Number 08041C1025G, December 7,

JPS Engineering, Inc., "Final Drainage Report for Silverado Ranch Filing No. 1," June 18, 2018 (approved by El Paso County 8/8/18; EDARP Project No. SF-18-011).

JPS Engineering, Inc., "Master Development Drainage Plan and Preliminary Drainage Report for Silverado Ranch," June 24, 2008 (approved by El Paso County 8/18/08).

USDA/NRCS, "Soil Survey of El Paso County Area, Colorado," June, 1981.

ECM was revised on Oct. 14, 2020

It appears that the soil survey was on August 13, 2009

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

The major drainage basins lying in and around the proposed development are depicted in Figure EX1. The proposed development lies completely within the Drennan Drainage Basin (CHDS0400) as classified by El Paso County. The Drennan Basin comprises a total drainage area in excess of 16 square miles. As such, the 320-acre Silverado Ranch development represents less than three percent of the total basin area, which is primarily agricultural land.

No drainage planning study has been completed for this drainage basin or any adjacent drainage basins. The Silverado Ranch parcel is impacted by several large off-site basins to the northwest of the site, which combine with on-site basins flowing southeasterly towards Dry Squirrel Creek.

B. Floodplain Impacts

This site is not impacted by any delineated 100-year floodplains, as studied by the Federal Emergency Management Agency (FEMA). The 100-year floodplain limits in the vicinity of the site are shown in Flood Insurance Rate Map (FIRM) Numbers 08041C0815G and 08041C1025G, dated December 7, 2018, and depicted in the Firmette Exhibit in Appendix E.

C. Sub-Basin Description

The developed drainage basins lying within the proposed development are depicted in Figure D1 (Appendix E). The interior site layout has been divided into several sub-basins (A1-A6, B1-B7, C, D) based on the proposed road layout and grading concept within the site. The natural drainage patterns will be impacted through development by site grading and concentration of runoff in subdivision roadside ditches and channels. The majority of sub-basins drain to the southeast, collecting in the interior roads and drainage channels. On-site flows will be diverted to natural swales draining towards the southerly site boundary, following historic drainage paths.

As shown in Figure D1, Filing No. 2 lies within parts of Drainage Basins B4, B6, B7, and D. There will be no developed drainage impact to Basins A and C with development of Filing No. 2.

III. DRAINAGE DESIGN CRITERIA

A. Development Criteria Reference

The Drennan Drainage Basin has not had a Drainage Basin Planning Study performed for the basin. The majority of areas within the basin are comprised of agricultural lands and rural residential uses.

B. Hydrologic Criteria

SCS procedures were utilized for analysis of major basin flows impacting the site. In accordance with El Paso County drainage criteria, SCS hydrologic calculations were based on the following assumptions:

- Design storm (minor) — 5-year
- Design storm (major) — 100-year
- 100-year, 24-hour rainfall — 4.4 inches per hour (NOAA isopluvial map)
- 5-year, 24-hour rainfall — 2.6 inches per hour (NOAA isopluvial map)
- Hydrologic soil type — B
- SCS curve number - undeveloped conditions — 61 (pasture / range)
- SCS curve number - undeveloped conditions — 50 (pasture / range with upstream retention)
- SCS curve number - developed 5-acre lots — 63.59

In accordance with the previously approved subdivision drainage reports, historic flows have been calculated using an SCS Curve Number of 50 for the off-site basins recognizing the existence of upstream (off-site) retention pond areas.

Rational method procedures were utilized for calculation of peak flows within the on-site drainage basins. Rational method hydrologic calculations were based on the following assumptions:

• Design storm (minor)	5-year	
• Design storm (major)	100-year	
• Rainfall Intensities	El Paso County I-D-F Curve	
• Hydrologic soil type	B	
	C5	C100
• Runoff Coefficients - undeveloped:		
Existing pasture/range areas	0.08	0.35
• Runoff Coefficients - developed:		
Proposed lot areas (5-acre average lots)	0.137	0.393

Composite runoff coefficients (C-values) have been calculated based on the proposed rural residential lot sizes. Hydrologic calculations are enclosed in Appendix B, and peak design flows are identified on the drainage basin drawings.

IV. DRAINAGE PLANNING FOUR STEP PROCESS

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

Step 1: Employ Runoff Reduction Practices

- Minimize Impacts: The proposed rural residential subdivision is an inherently low impact development. The proposed gross density of 5-acres per lot will significantly minimize drainage impacts in comparison to higher density development alternatives.

Step 2: Stabilize Drainageways

- There are no major drainageways within the site. Vegetated buffer strips will be maintained between developed areas of the site and downstream drainage channels.

Step 3: Provide Water Quality Capture Volume (WQCV)

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

Clarify that this statement and exclusion only apply to the lots and not the roadway. Otherwise this statement contradicts the next bullet on the next page.

Unless official Runoff Reduction calcs are provided to prove it, the grass ditches cannot count as providing water quality treatment. Please re-word this accordingly. I believe that the intent is for the PLDs to provide the WQ treatment for the roadway improvements.

Retention Ponds have permanent pools. Ponds A & B are actually full-infiltration PLD facilities.

- Water quality mitigation for the roadway improvements will be provided by grass-lined roadside ditches flowing to the existing grass-lined Retention Ponds within the subdivision.

Step 4: Consider Need for Industrial and Commercial BMPs

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

V. GENERAL DRAINAGE RECOMMENDATIONS

The developed drainage plan for the site is to provide and maintain positive drainage away from structures and conform to the established drainage patterns for the overall subdivision. JPS Engineering recommends that positive drainage be established and maintained away from all structures within the site in conformance with applicable building codes and geotechnical engineering recommendations.

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

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

VI. DRAINAGE FACILITY DESIGN

A. General Concept

Development of Silverado Ranch Filing No. 2 will include site grading and roadway construction, resulting in additional impervious areas across the site. The general drainage pattern will consist of grading away from home sites to swales and roadside ditches along the internal roads within the subdivision, conveying runoff flows through the site. Runoff from the site will flow by roadside ditches to cross culverts at low points in the road profiles, and grass-lined channels connecting to existing natural swales at the site boundaries.

The stormwater management concept for Silverado Ranch Filing No. 2 will be to provide roadside ditches and natural swales as required to convey developed drainage through the site to existing natural drainage channel outfalls. Individual lot grading will provide positive drainage away from building sites, and direct developed flows into the system of roadside ditches and drainage swales running through the subdivision.

Clarify whether or not the previous 2008 & 2018 plans accounted for the proposed road in their WQ & Detention calcs. And discuss whether or not the pond need to be upgraded at all.

PLD

Two existing retention ponds within the overall Silverado Ranch site will be maintained to mitigate the impact of developed flows and ensure that historic flows are maintained downstream of the proposed subdivision. One retention pond ("Pond A") is located at the northwest corner of the property (west of Filing No. 1), and overflows from Pond A would drain southeasterly to the larger pond ("Pond B") located on the southeast side of Filing No. 2.

B. Specific Details

1. Existing Drainage Conditions

Drainage planning for the Silverado Ranch Subdivision has been studied in several previously approved drainage reports. The most recent report on file is the "“Final Drainage Report for Silverado Ranch Filing No. 1" by JPS Engineering, Inc. dated June 18, 2018 (approved by El Paso County 8/8/18; EDARP Project No. SF-18-011).

Historic drainage conditions are depicted in Figures EX1 and EX2. There are no existing drainage facilities within the Filing No. 2 area, with the exception of an existing culvert crossing Drennan Road at the north boundary of the property, and the existing stock pond areas. The "Major Basin / Historic Drainage Plan" (Sh. EX1, Appendix E) has been updated in this report utilizing El Paso County GIS mapping to more accurately model the upstream drainage basin areas (in comparison to the USGS mapping used in the previous drainage reports for this subdivision).

PLD

The overall Silverado Ranch property is characterized by two large drainage retention areas as depicted on Sheet EX2. Based on the substantial upstream drainage areas, major storm flows would be expected to overtop the existing retention ponds within the site and overflow towards the southern boundary of the site. Historic overflows from this site would drain to existing grass-lined drainage swales downstream.

Off-site flows from Basin OA1 drain across Drennan Road into the existing depression within Basin A1 at the northwest corner of the parcel. Off-site Basin OA1 discharges historic peak flows of Q_5 = 20.6 cfs and Q_{100} = 150.7 cfs (SCS Method). An existing 18-inch CMP culvert conveys flows from Basin OA1 across the low point in Drennan Road. This undersized culvert would be expected to overtop during major storm events.

Off-site Basin OA2 consists of a tributary area at the southwest corner of Drennan Road and Peyton Highway, which discharges historic peak flows of Q_5 = 0.9 cfs and Q_{100} = 5.9 cfs (SCS Method), entering the northwest corner of the Silverado Ranch property. There is currently no culvert crossing the south side of Drennan Road at Peyton Highway. Historic flows from Basin OA2 would be expected to overtop Peyton Highway at this location.

In the existing condition, please discuss on how the existing runoff interacts with the existing channels A1, OB1, OB2, and overflow swales.

Please also discuss the current condition of these channels.

Revise to "PLD." Typical comment, all instances related to the two Silverado PLDs

The existing northwest retention area (Retention Pond A) has a storage volume of approximately 36.5 acre-feet between the 5845 and 5857 contours. Overflows from Retention Pond A would drain southeasterly through Basin A1 towards Pond B in the southeastern part of the property. Off-site flows from Basins OA1 and OA2 combine with on-site flows from Basin A, with calculated historic peak flows (SCS Method) of Q_5 = 22.7 cfs and Q_{100} = 159.1 cfs at Design Point #A1.

Off-site drainage from the large northwesterly Basin OB1 crosses Drennan Road at an existing 18-inch CMP culvert crossing, which would be expected to overtop during large storm events. Off-site Basin OB1 discharges historic peak flows of Q_5 = 13.8 cfs and Q_{100} = 100.6 cfs (SCS Method), flowing southeasterly into Basin B.

There is currently no culvert crossing where drainage from off-site Basin OB2 crosses an existing low point in Drennan Road at the north boundary of the site. Based on the topography, overflows from Basin OB2 would overtop Drennan Road and flow south into Basin B. Off-site Basin OB2 contributes historic peak flows of Q_5 = 2.0 cfs and Q_{100} = 13.3 cfs (SCS Method), entering the north boundary of the Silverado Ranch property.

The easterly retention area (Retention Pond B) within the Silverado Ranch site has a storage volume of approximately 74.3 acre-feet between the 5790 and 5796 contours. In the event the existing retention pond was completely full, overflows from this retention area would drain towards the southeast corner of the site. Flows from Basins OA1, OA2, A1, OB1, OB2, and B combine at Design Point #2, with calculated historic peak flows (SCS Method) of Q_5 = 44.2 cfs and Q_{100} = 284.1 cfs.

Basin A2 (not a part of Filing No. 2) comprises the drainage area in the southwest corner of the property, which flows towards Design Point #1 at the southern boundary of the site, with calculated historic peak flows (Rational Method) of Q_5 = 6.4 cfs and Q_{100} = 47.2 cfs.

Basin C comprises the area in the southeasterly part of the overall Silverado site (not a part of Filing No. 2), which flows towards Design Point #3 at the southeast corner of the site, with calculated historic peak flows (Rational Method) of Q_5 = 2.0 cfs and Q_{100} = 14.4 cfs.

Basin D comprises the area in the northeast corner of the overall Silverado site, which flows towards Design Point #4 near the northeast corner of the site, with calculated historic peak flows (Rational Method) of Q_5 = 2.6 cfs and Q_{100} = 19.1 cfs.

2. Developed Drainage Conditions

The developed drainage basins and projected flows are shown in the Developed Drainage Plan (Figure D1, Appendix E). Off-site flows from Basins OA1 and OA2 will continue to flow into the existing Retention Pond A within Basin A1 at the northwest corner of the subdivision.

Developed peak flows at Design Point #A1 are calculated as Q_5 = 23.6 cfs and Q_{100} = 159.0 cfs (SCS Method). Overflows from Retention Pond A will flow southeasterly across the subdivision to Retention Pond B.

The proposed Filing No. 2 development impacts parts of Basins B1.1, B4, B6, B7, and D.

Basin B1.1 comprises the proposed drainage channel area exten[illegible] existing Culvert OB1 which crosses Drennan Road northwest of th[illegible] site flows from Basin OB1 combine with Basin B1.1 at Design Poi[illegible] peak flows calculated as Q_5 = 12.7 cfs and Q_{100} = 93.0 cfs (SCS M[illegible] be conveyed across the Silverado Hill View roadway through Culv[illegible] Channel B1.1 will extend south and then easterly along the south sid[illegible] flowing into Retention Pond B.

Please discuss how erosion can be prevented between proposed channel B1.1, and B4.1 and existing pond B. Directing concentrated runoff flow directly into the pond is discouraged due to the erosion.

The majority of proposed Filing No. 2 lots on the north side of Silve[illegible] Basin B4, which flows to a proposed culvert crossing at a low poi[illegible] between Lots 4 and 12. Off-site flows from Basin OB2 combine [illegible] Point #B4.1, with developed peak flows calculated as Q_5 = 4.6 cfs and Q_{100} = 30.4 cfs (SCS Method). These flows will be conveyed across the roadway through Culvert B4.1 (24" RCP), and Channel B4.1 will extend southeasterly across Lot 12 into Retention Pond B.

The proposed Filing No. 2 lots on the south side of Silverado Hill View lie within Basin B6, which sheet flows southeasterly into Retention Pond B. Developed peak flows for Basin B6 are calculated as Q_5 = 21.5 cfs and Q_{100} = 103.6 cfs (Rational Method). Drainage easements have been provided on the subdivision plat restricting building areas to elevations above the adjoining retention pond overflow elevation.

This phase of development has a minor impact in Basin B7, consisting only of the proposed Lot 8 at the east edge of Filing No. 2. Basin B7 flows southeasterly towards the south boundary of the subdivision, with ultimate developed peak flows calculated as Q_5 = 8.8 cfs and Q_{100} = 42.5 cfs (Rational Method). Filing No. 2 impacts from the single lot within Basin B7 will be negligible.

State what flow increases are at each location.

This phase of development also has a minor impact within Basin D, consisting only of the proposed Lot 9 at the northeast corner of Filing No. 2. Basin D flows southeasterly towards the east boundary of the subdivision, with ultimate developed peak flows at Design Point #4 calculated as Q_5 = 4.6 cfs and Q_{100} = 22.0 cfs (Rational Method). Filing No. 2 impacts from the single lot within Basin D will be negligible.

Flows from Basins OA1-OA2, A1, A5, A6, OB1, and OB2 will continue to combine with on-site flows from Basins B1-B7 at Design Point #2, with developed peak flows of Q_5 = 65.6 cfs and Q_{100} = 285.6 cfs (SCS Method). Based on the small on-site area in comparison to the large off-site drainage basins, the developed flow impact at Design Point #2 is negligible.

Clarify here and/or in Step 3 of the 4-Step Process above whether or not the ponds were originally designed to provide WQ for the proposed Filing 2 roads. Excerpts from previous report(s) would be acceptable.

In the proposed condition, please discuss on how the proposed runoff interacts with the existing channels, proposed channels and overflow swales.

Silverado Ranch Filing No. 2 will not have any developed drainage impact within Basins A or C.

C. Comparison of Developed to Historic Discharges

Based on the hydrologic calculations in Appendix B, the proposed development will result in a negligible increase in developed flows based on the large size of the off-site tributary drainage areas relative to the on-site development area. The comparison of developed to historic discharges at key design points is summarized as follows:

Design Point	Historic Flow			Developed Flow			Comparison of Developed to Historic Flow (Q_{100})
	Area (ac)	Q_5 (cfs)	Q_{100} (cfs)	Area (ac)	Q_5 (cfs)	Q_{100} (cfs)	
2	2473	44.2	284.1	2481	65.6	285.6	+1.5 cfs (0.5% increase)

Based on the large size of the off-site basins impacting this site in comparison to the rural nature of the proposed development, developed flow impacts from the project will be minimal. The developed drainage impacts will be attenuated through preservation of the existing on-site stormwater retention ponds.

D. Retention Ponds

Developed runoff impacts from the project will be mitigated [...] within the site. Stormwater reten[...] [...]proved 2018 "Final Drainage Repo[...] [...] will not have any significant impac[...]

Please discuss water rights if runoffs from this project are discharged to the existing retention ponds

Please provide excerpts that include text, calculations, and a map showing that this site accounts for the two existing retention ponds. Also, please show that two ponds are functioning and meet the current design criteria. Please highlight the relevant information.

[...] continue to be privately maintai[...] [...] pond maintenance agreement was filed with El Paso County during the platting of Filing No. 1. Provisions for maintenance of the retention ponds are included in the Operation and Maintenance (O&M) manual on file with the subdivision documents.

Discuss infiltration rate of ponds and how it complies with criteria. Excerpts from previous report(s) would be acceptable.

E. On-Site Drainage Facility Design

Developed sub-basins and proposed drainage improvements are depicted in the enclosed Drainage Plan (Sheet D1). In accordance with El Paso County standards, the interior roads on this relatively flat parcel will be graded with a minimum longitudinal slope of 1.0 percent.

On-site drainage facilities will consist of roadside ditches, grass-lined channels, and culverts. Hydraulic calculations for sizing of on-site drainage facilities are enclosed in Appendix D, and design criteria are summarized as follows:

Please run updating calculations for these ponds using the UD-BMP spreadsheet for PLDs. The Retention Pond calcs in the previous FDRs would have over estimated the volume requirements compared with the PLD calcs. And then explain in this report the discrepancy in naming PLD vs retention in this report vs the previous reports.

The FDR from SF1811 states that the two existing ponds do not have capacity for much of the incoming flows. And so there is a lot of overflow from the ponds, which has shown to be a negligible increase in flows. However, regarding WQ treatment, once offsite flows mix with onsite flows which need to be treated, all mixed flows must then be treated. So because the runoff from the roads is mixing with the offsite flows, WQ is needed for all flows. It is common for sites like this to keep offsite flows separate and bypass them around ponds via a swale such that offsite flows don't need to be treated.

1. Culverts

The internal road system will be graded to drain roadside ditches to low points along the road profile, where cross-culverts will convey developed flows into grass-lined channels following historic drainage paths. Culvert pipes have been specified as reinforced concrete pipe (RCP) with a minimum diameter of 18-inches. Culvert sizes have been identified based on a maximum headwater-to-depth ratio (HW/D) of 1.0 for the minor (5-year) design storm. Final culvert design has been performed utilizing the FHWA HY-8 software package to perform a detailed analysis of inlet and outlet control conditions, meeting El Paso County criteria for allowable overtopping. Riprap outlet protection will be provided at all culverts. Culvert sizes are detailed in the "Culvert Sizing Table" in Appendix C.

Provide calculations in appendix for sizing of outlet protection.

2. Open Channels

Proposed drainage channels will generally be grass-lined channels designed to convey 100-year flows, with a trapezoidal cross-section, 4:1 maximum side slopes, 1-foot freeboard, and a minimum slope of 0.4 percent. The proposed drainage channels have been sized utilizing Manning's equation for open channel flow, assuming a friction factor ("n") of 0.030 for dry-land grass channels. Maximum allowable velocities have been evaluated based on El Paso County drainage criteria, typically allowing for a maximum 100-year velocity of 5 feet per second. Erosion control blanket (turf-reinforcement mat) channel lining will be provided where required based on erosive velocities.

Channel hydraulic calculations are enclosed in Appendix C, including tables summarizing design parameters for channels and roadside ditches. The proposed channels will be seeded with native grasses for erosion control. Primary drainage swales crossing proposed lots have been placed in drainage easements, with variable widths based on the required channel sections.

F. Analysis of Existing and Proposed Downstream Facilities

The proposed drainage concept is to preserve the existing on-site retention ponds to ensure that flows leaving the developed site remain consistent with historic levels. Based on the maintenance of existing on-site stormwater retention ponds, no downstream or off-site drainage improvements are proposed.

Discuss what downstream facilities are at each location where flows exit site, swale, overlot, etc. and if these facilities are adequate.

G. Anticipated Drainage Problems and Solutions

The primary drainage problems anticipated within this rural residential subdivision development will consist of maintenance of the proposed drainage channels, culverts, and retention ponds. Care will need to be taken to implement proper erosion control measures in the proposed roadside ditches and swales. Ditches have been designed to meet allowable velocity criteria. Erosion control blankets will be installed where necessary to minimize erosion concerns in ditches and channels. Maintenance of the existing retention ponds will minimize downstream drainage impacts.

VII. EROSION / SEDIMENT CONTROL

Appropriate control measures (CM's) will be implemented for erosion and sediment control during construction. Sediment control measures will include installation of silt fence at the toe of disturbed slopes and straw bales protecting drainage ditches. Cut slopes will be stabilized during excavation as necessary and vegetation will be established for stabilization of disturbed areas as soon as possible. All ditches will be designed to meet El Paso County criteria for slope and velocity. Vehicle tracking control pads will be installed at construction access points, and the existing on-site retention ponds will serve as sediment ponds during the construction period.

VIII. COST ESTIMATE AND DRAINAGE FEES

A cost estimate for proposed drainage improvements is enclosed in Appendix D, with a total estimated cost of approximately $43,974 for Filing No. 2 drainage improvements. The developer will finance all costs for proposed roadway and drainage improvements.

Private subdivision infrastructure improvements, including private roads and drainage facilities within private rights-of-way and drainage tracts, will be owned and maintained by the subdivision homeowners association (HOA). Shared private drainage facilities, including the existing retention ponds, will be owned and maintained by the subdivision HOA. Drainage swales crossing individual lots will be owned and maintained by the individual property owners.

This parcel is located entirely within the Drennan Drainage Basin (CHDS0400), which does not have a drainage or bridge fee requirement. No drainage and bridge fees will be due at time of recordation of the final plat as the subject site is not located in a fee basin.

IX. SUMMARY

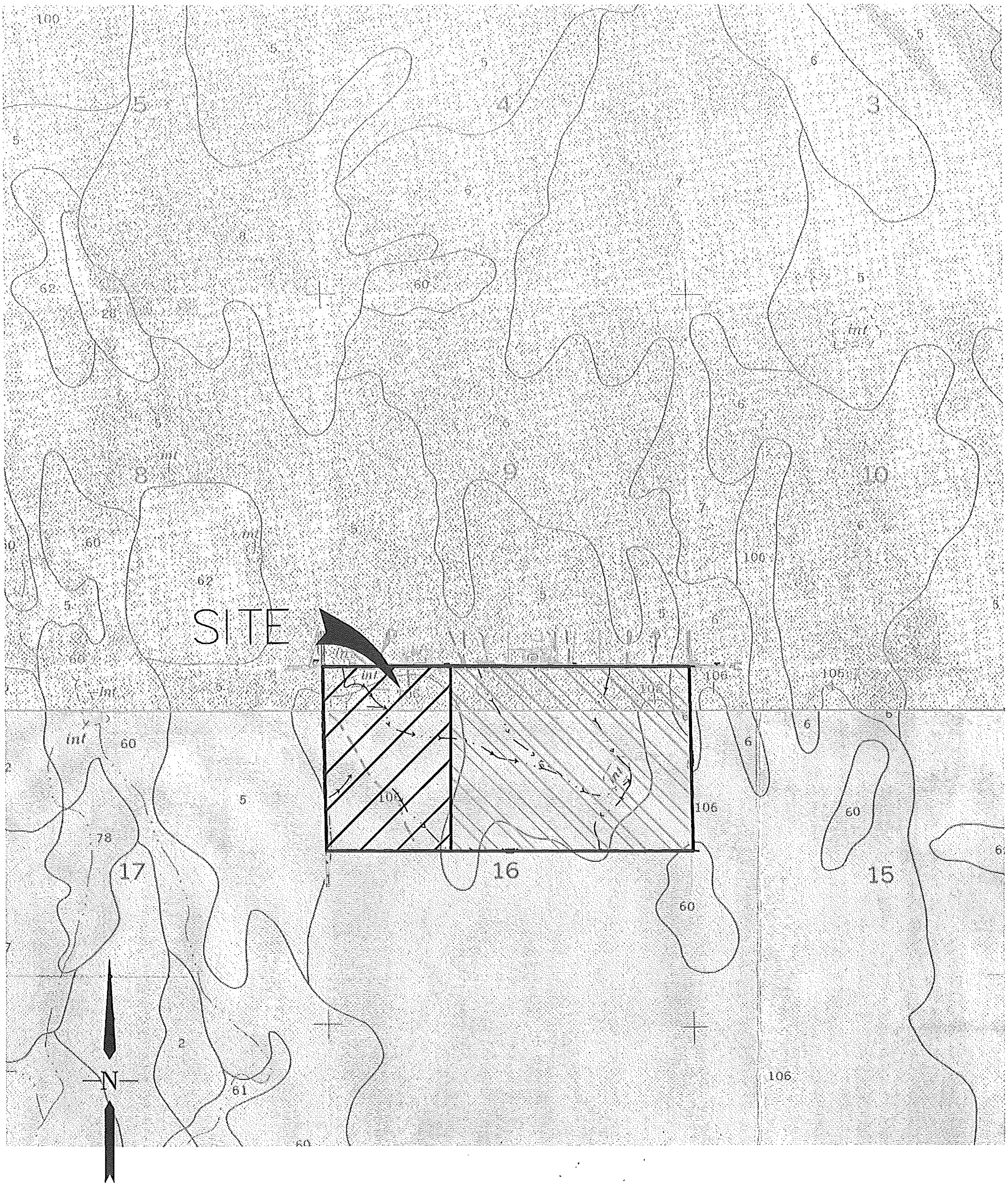
Silverado Ranch is a rural residential subdivision located southeast of Drennan Road and Peyton Highway. The Silverado Ranch project will ultimately consist of 64 rural residential units on a 320-acre parcel (2.5-acre minimum lot size; 5-acre gross density). Filing No. 2 consists of 15 lots on 48.9 acres in the northeast part of the property.

Development of the Silverado Ranch Subdivision will generate a marginal increase in developed runoff from the site, which will be mitigated through preservation and maintenance of the two existing on-site stormwater retention ponds. Based on the large size of the off-site basins impacting this site in comparison to the rural nature of the proposed development, developed flow impacts from the project will be minimal.

The proposed drainage patterns will remain consistent with historic conditions, and new drainage facilities constructed to El Paso County standards will safely convey runoff to the existing retention ponds. Preservation of the existing retention ponds and construction of the proposed on-site drainage and erosion control facilities will ensure that this subdivision has no significant adverse drainage impact on downstream or surrounding areas.

APPENDIX A

SCS SOILS INFORMATION



SCALE: 1"=2000'   (EL PASO COUNTY SCS SHEETS NO. 19 & 26)

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SCS SOILS MAP	JPS ENGINEERING	SILVERADO RANCH SUBDIVISION - FIL. #1 FIGURE B JPS PROJ NO. 080603

of Calhan; the Corral Bluffs, east of Colorado Springs; the southwestern part of the survey area on Fort Carson; and the old Golden Cycle gold ore processing mill in the western part of Colorado Springs.

Runoff is very rapid, and the hazard of erosion is high. The reaction of the tailings material is slightly acid to extremely acid. Little or no soil development has taken place. Gullying is severe in most areas of Badland.

Vegetation grows only in small patches of soil material in drainageways and in some of the less eroded areas. The sloping part of Badland is extremely gullied and lacks vegetation.

Most areas of Badland are used for wildlife habitat. In the mill tailings area in the western part of Colorado Springs, some urban development has taken place in level areas that have had a layer of topsoil applied to the surface. Capability subclass VIIIs.

5—Bijou loamy sand, 1 to 8 percent slopes. This deep, somewhat excessively drained soil is on flood plains, terraces, and uplands. It formed in sandy alluvium and eolian material derived from arkose deposits. Elevation ranges from 5,400 to 6,200 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is brown loamy sand 8 inches thick. The subsoil is grayish brown sandy loam about 20 inches thick. The substratum is pale brown loamy coarse sand.

Included with this soil in mapping are small areas of Olney sandy loam, 3 to 5 percent slopes; Valent sand, 1 to 9 percent slopes; Vona sandy loam, 3 to 9 percent slopes, and Wigton loamy sand, 1 to 8 percent slopes.

Permeability of this Bijou soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Organic matter content of the surface layer is low. Surface runoff is slow, and the hazards of erosion and soil blowing are severe.

Most areas of this soil are used for range. A small acreage is used for crops grown under sprinkler irrigation.

This soil is not suited to dryfarming, because of the soil blowing hazard. Corn, pasture, and alfalfa are the principal crops grown under irrigation. Corn and pasture require moderate to heavy applications of nitrogen. Alfalfa generally responds to phosphate fertilizer. Some zinc deficiency has been noted on corn. Crop residue management must be used at all times to control soil blowing. Crops that produce little or no residue are not suited to this soil.

Native vegetation is mainly sandreed, sand bluestem, blue grama, and needleandthread. Sand sagebrush makes up only a small part of the total ground cover.

In overgrazed areas mechanical and chemical sagebrush control may be needed. This soil is highly susceptible to soil blowing, and water erosion occurs when the plant cover is inadequate. Interseeding should be used in overgrazed areas. Proper location of livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand and low available water capacity are the principal limitations to the establishment of trees and shrubs. The soil is so loose that trees need to be planted in shallow furrows and plant cover needs to be maintained betweeen the rows. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for homesites. Shallow excavation is severely limited because cut banks cave in. This soil requires special management practices to reduce water erosion and soil blowing because it is sandy. Capability subclasses VIe, nonirrigated, and IVe, irrigated.

6—Bijou sandy loam, 1 to 3 percent slopes. This deep, well drained soil is on flood plains, terraces, and uplands. It formed in sandy alluvium and in eolian material derived from arkose deposits. Elevation ranges from 5,400 to 6,200 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is brown sandy loam about 4 inches thick. The subsoil is brown or grayish brown sandy loam about 24 inches thick. The substratum is pale brown loamy coarse sand.

Included with this soil in mapping are small areas of Olney sandy loam, 0 to 3 percent slopes; Vona sandy loam, 1 to 3 percent slopes; and Wigton loamy sand, 1 to 8 percent slopes.

Permeability of this Bijou soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Organic matter content of the surface layer is low. Surface runoff is slow, and the hazards of erosion and soil blowing are moderate.

Most areas of this soil are used for range, but some areas are used for dryland or irrigated farming.

Corn, sorghum, and wheat are the principal nonirrigated crops. Corn, alfalfa, and pasture are the main crops grown under irrigation. Irrigated crops respond to phosphate and nitrogen fertilizer. Dryfarmed corn and sorghum generally respond to nitrogen fertilizer. Management of crop residue is necessary to control soil blowing. Stripcropping helps to control soil blowing. Sprinkler irrigation is the most suitable and widely practiced method of applying water.

Native vegetation is dominantly blue grama, sand dropseed, needleandthread, side-oats grama, and buckwheat.

Seeding is advisable if the range has deteriorated. Seeding the native grasses is a good practice. If the range managing livestock grazing, and reseeding range where needed.

This soil has good potential for use as homesites. The main limitations of this soil for roads and streets are limited ability to support a load and frost action potential. Roads must be designed to overcome these limitations. This soil should be stabilized after site preparation, and as much of the existing vegetation as possible should be left on the soil. During site preparation, only small areas of this soil should be disturbed at a time. Capability subclass VIe.

106—Wigton loamy sand, 1 to 8 percent slopes. This deep, excessively drained soil formed in noncalcareous, sandy eolian material on dunelike uplands. Elevation ranges from 5,300 to 6,000 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is brown loamy sand about 8 inches thick. The next layer is brown loamy sand about 11 inches thick. The underlying material is very pale brown sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Bijou loamy sand, 1 to 8 percent slopes; Bijou sandy loam, 1 to 3 percent slopes; Bijou sandy loam, 3 to 8 percent slopes; and Valent sand, 1 to 9 percent slopes.

Permeability of this Wigton soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Surface runoff is low, the hazard of erosion is moderate to high, and the hazard of soil blowing is high.

This soil is used mostly as rangeland.

If sprinkler irrigation is used, this soil is suited to limited use as cropland and pasture if crop residue is maintained on the surface. Only a very small acreage of this soil is cultivated, and it is used for alfalfa and grasses that are harvested for hay or are grazed by livestock. Nitrogen and phosphorus fertilizer is required for satisfactory yields. The soil is unsuited to nonirrigated crops.

Rangeland vegetation on this soil is mainly sand reedgrass, and bluestem, and needleandthread. Sand sagebrush is present in the stand, but it makes up only a small part of the total ground cover.

Mechanical and chemical methods of sagebrush control may be needed in overgrazed areas. This soil is highly susceptible to soil blowing, and it is subject to water erosion when the plant cover is inadequate. Interseeding is needed in overgrazed areas. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand and low available water capacity are the main limitations for the establishment of trees and shrubs. The soil is so loose that trees need to be planted in shallow furrows and plant cover needs to be maintained between the rows. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitations of this soil for homesites are unstable cut banks during excavation and the hazard of soil blowing. Trenches for pipelines and shallow excavations must be made in such a way that cut banks remain stable, thus providing proper protection for workmen. Special practices must be used to control soil blowing. Only small areas of this soil should be disturbed at a time during construction in order to leave as much vegetation on the surface as possible. Capability subclasses VIe, nonirrigated, and IVe, irrigated.

107—Wiley silt loam, 1 to 3 percent slopes. This deep, well drained soil formed in calcareous, silty eolian material. Elevation ranges from 5,200 to 6,200 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is pale brown silt loam about 5 inches thick. The subsoil is very pale brown heavy silt loam about 18 inches thick. The substratum is very pale brown silt loam to a depth of 60 inches or more. Visible soft masses of lime are in the lower part of the subsoil and in the substratum.

Included with this soil in mapping are small areas of Fort Collins loam, 0 to 3 percent slopes; Keith silt loam, 0 to 3 percent slopes; and Satanta loam, 0 to 3 percent slopes.

Permeability of this Wiley soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, the hazard of erosion is slight to moderate, and the hazard of soil blowing is high.

Most areas of this soil are used as rangeland, but a few small areas are dryfarmed.

This soil is well suited to the production of native vegetation suitable for grazing. The native vegetation is mainly blue grama, western wheatgrass, sand dropseed, and galleta.

Fencing and properly locating livestock watering facilities help to control grazing. Deferment of grazing may be necessary to maintain a needed balance between livestock use and forage production. In areas where the plant cover has been depleted, pitting can be used to help the native vegetation recover. Chemical control practices may be needed in disturbed areas where dense stands of pricklypear occur. Ample amounts of litter and forage should be left on the soil because of the high hazard of soil blowing.

Windbreaks and environmental plantings generally are well suited to this soil. Summer fallow a year prior to

TABLE 16.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See "flooding" in Glossary for definition of terms as "rare," "brief," and "very brief." The symbol > means greater than]

Soil name and map symbol	Hydro-logic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Alamosa:							
1	C	Frequent	Brief	May-Jun	>60	---	High.
Ascalon:							
2, 3	B	None	---	---	>60	---	Moderate.
Badland:							
4	D	---	---	---	---	---	---
Bijou:							
5, 6, 7	B	None	---	---	>60	---	Low.
Blakeland:							
8	A	None	---	---	>60	---	Low.
[1]9:							
Blakeland part	A	None	---	---	>60	---	Low.
Fluvaquentic Haplaquolls part	D	Common	Very brief	Mar-Aug	>60	---	High.
Blendon:							
10	B	None	---	---	>60	---	Moderate.
Bresser:							
11, 12, 13	B	None	---	---	>60	---	Low.
Brussett:							
14, 15	B	None	---	---	>60	---	Moderate.
Chaseville:							
16, 17	A	None	---	---	>60	---	Low.
[1]18:							
Chaseville part	A	None	---	---	>60	---	Low.
Midway part	D	None	---	---	10-20	Rippable	Moderate.
Columbine:							
19	A	None to rare	---	---	>60	---	Low.
Connerton:							
[1]20:							
Connerton part	B	None	---	---	>60	---	High.
Rock outcrop part	D	---	---	---	---	---	---
Cruckton:							
21	B	None	---	---	>60	---	Moderate.
Cushman:							
22, 23	C	None	---	---	20-40	Rippable	Moderate.
[1]24:							
Cushman part	C	None	---	---	20-40	Rippable	Moderate.
Kutch part	C	None	---	---	20-40	Rippable	Moderate.
Elbeth:							
25, 26	B	None	---	---	>60	---	Moderate.
[1]27:							
Elbeth part	B	None	---	---	>60	---	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Tomah:							
[1]92, [1]93:							
Tomah part	B	None	---	---	>60	---	Moderate.
Crowfoot part	B	None	---	---	>60	---	Moderate.
Travessilla:							
[1]94:							
Travessilla part	D	None	---	---	6-20	Hard	Low.
Rock outcrop part	D	---	---	---	---	---	---
Truckton:							
95, 96, 97	B	None	---	---	>60	---	Moderate.
[1]98:							
Truckton part	B	None	---	---	>60	---	Moderate.
Blakeland part	A	None	---	---	>60	---	Low.
[1]99, [1]100:							
Truckton part	B	None	---	---	>60	---	Moderate.
Bresser part	B	None	---	---	>60	---	Low.
Ustic Torrifluvents:							
101	B	Occasional	Very brief	Mar-Aug	>60	---	Moderate.
Valent:							
102, 103	A	None	---	---	>60	---	Low.
Vona:							
104, 105	B	None	---	---	>60	---	Moderate.
Wigton:							
106	A	None	---	---	>60	---	Low.
Wiley:							
107, 108	B	None	---	---	>60	---	Low.
Yoder:							
109, 110	B	None	---	---	>60	---	Low.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior characteristics of the map unit.

APPENDIX B1

HYDROLOGIC CALCULATIONS (SCS METHOD)

TABLE 5-4
RUNOFF CURVE NUMBERS FOR HYDROLOGIC SOIL
COVER COMPLEXES - RURAL CONDITIONS
(Antecedent Moisture Condition II, and Ia = 0.2 S)
(From: U.S. Dept. of Agriculture,
Soil Conservation Service, 1977)

Land Use	Cover Treatment or Practice	Hydrologic Condition	Runoff Curve Number by Hydrologic Soil Group A	B	C	D
Fallow	Straight Row	----	77	86	91	94
Row Crops	Straight Row	Poor	72	81	88	91
	Straight Row	Good	67	78	85	89
	Contoured	Poor	70	79	84	88
	Contoured	Good	65	75	82	86
	Cont. & Terraced	Poor	66	74	80	82
	Cont. & Terraced	Good	62	71	78	81
Small Grain	Straight Row	Poor	65	76	84	88
	Straight Row	Good	63	75	83	87
	Contoured	Poor	63	74	82	85
	Contoured	Good	61	73	81	84
	Cont. & Terraced	Poor	61	72	79	82
	Cont. & Terraced	Good	59	70	78	81
Close-seeded legumes 1/ or rotation meadow	Straight Row	Poor	66	77	85	89
	Straight Row	Good	58	72	81	85
	Contoured	Poor	64	75	83	85
	Contoured	Good	55	69	78	83
	Cont. & Terraced	Poor	63	73	80	83
	Cont. & Terraced	Good	51	67	76	80
Pasture or range		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
	Contoured	Poor	47	67	81	88
	Contoured	Fair	25	59	75	83
	Contoured	Good	6	35	70	79
Meadow		Good	30	58	71	78
Woods		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	25	55	70	77
Farmsteads		----	59	74	82	86
Roads (dirt) 2/		----	72	82	87	89
(hard surface) 2/		----	74	84	90	92

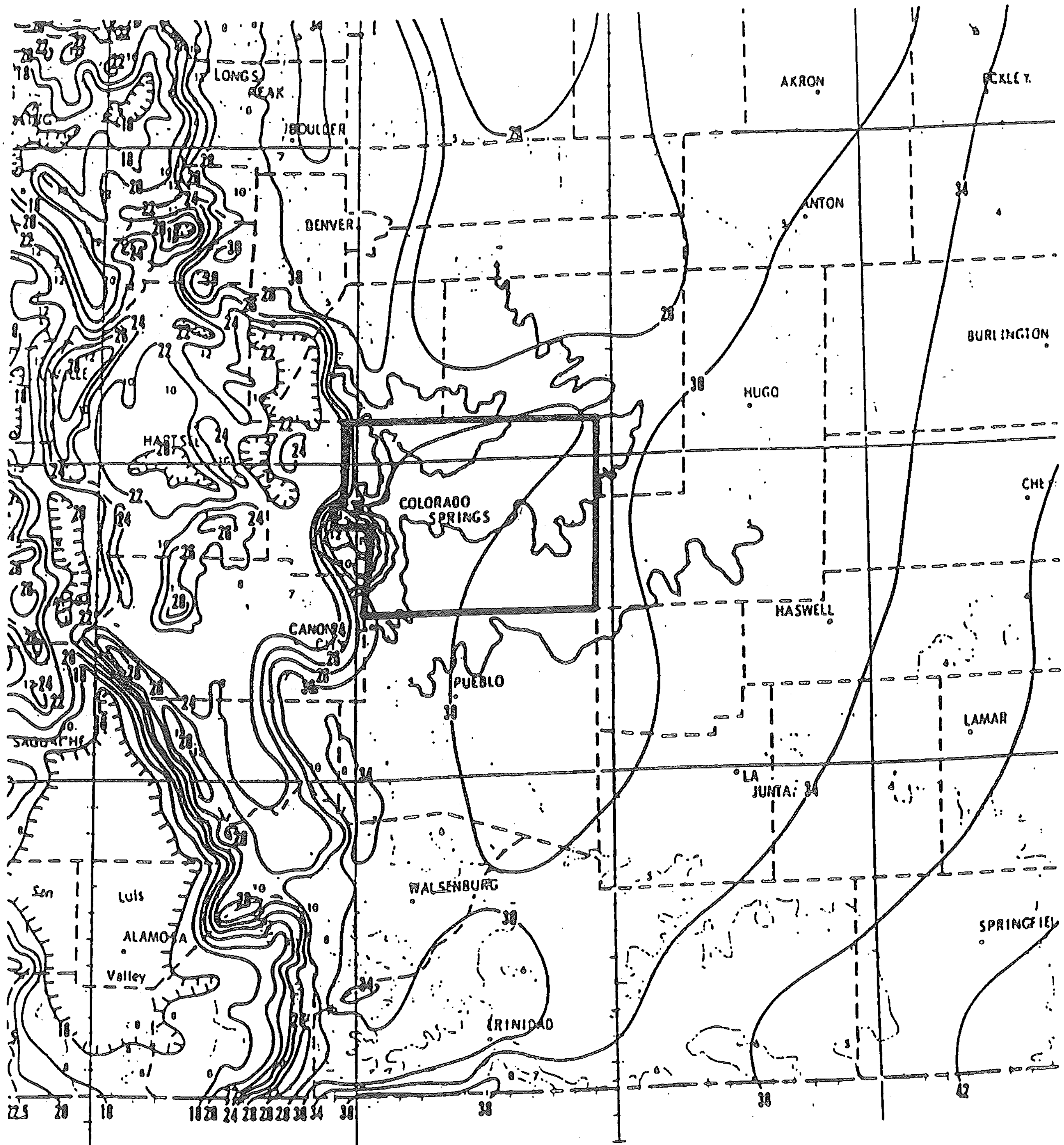
1/ Close-drilled or broadcast
2/ Including right-of-way

TABLE 5-5
RUNOFF CURVE NUMBERS FOR HYDROLOGIC SOIL COVER COMPLEXES - URBAN AND SUBURBAN CONDITIONS 1/
(Antecedent Moisture Condition II)
(From: U.S. Dept. of Agriculture, Soil Conservation Service, 1977)

Land Use		Hydrologic Soil Group A	B	C	D
Open spaces, lawns, parks, golf courses, cemeteries, etc.					
Good condition: grass cover on 75% or more of the area		39*	61	74	80
Fair condition: grass cover on 50% to 75% of the area		49*	69	79	84
Commercial and Business areas (85% Impervious)		89*	92	94	95
Industrial Districts 72% Impervious)		81*	88	91	93
Residential: 2/					
Acres per Dwelling Unit	Average % Impervious 3/				
1/8 acre or less	65	77*	85	90	92
1/4 acre	38	61*	75	83	87
1/3 acre	30	57*	72	81	86
1/2 acre	25	54*	70	80	85
1 acre	20	51*	68	79	84
Paved parking lots, roofs, driveways, etc.		98	98	98	98
Streets and Roads:					
paved with curbs and storm sewers		98	98	98	98
gravel		76*	85	89	91
dirt		72*	82	87	89

1/ For a more detailed description of agricultural land use curve numbers, refer to the National Engineering Handbook (U.S. Dept. of Agriculture, Soil Conservation Service, 1972).
2/ Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.
3/ The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

* Not to be used wherever overlot grading or filling is to occur.



NOAA ATLAS 2, Volume III
Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

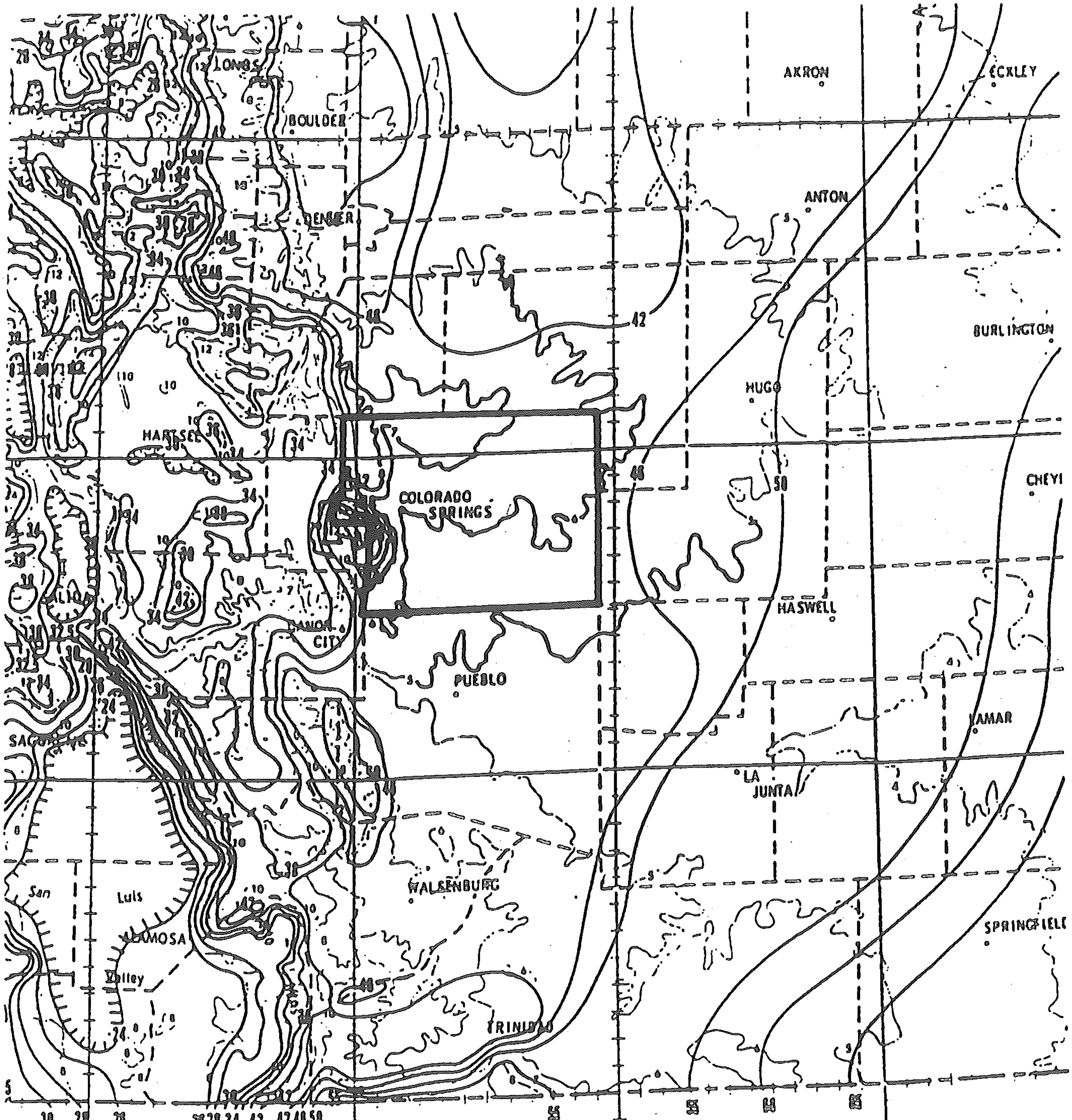
ISOPLUVIALS OF 10-YR 24-HR PRECIPITATIO
IN TENTHS OF AN INCH

HDR Infrastructure, Inc.
A Centerra Company

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

Date
OCT. 1987

Figure
A4



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ISOPLUVIALS OF 100-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

HDR Infrastructure, Inc.
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The City of Colorado Springs / El Paso County
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Date
OCT. 1987

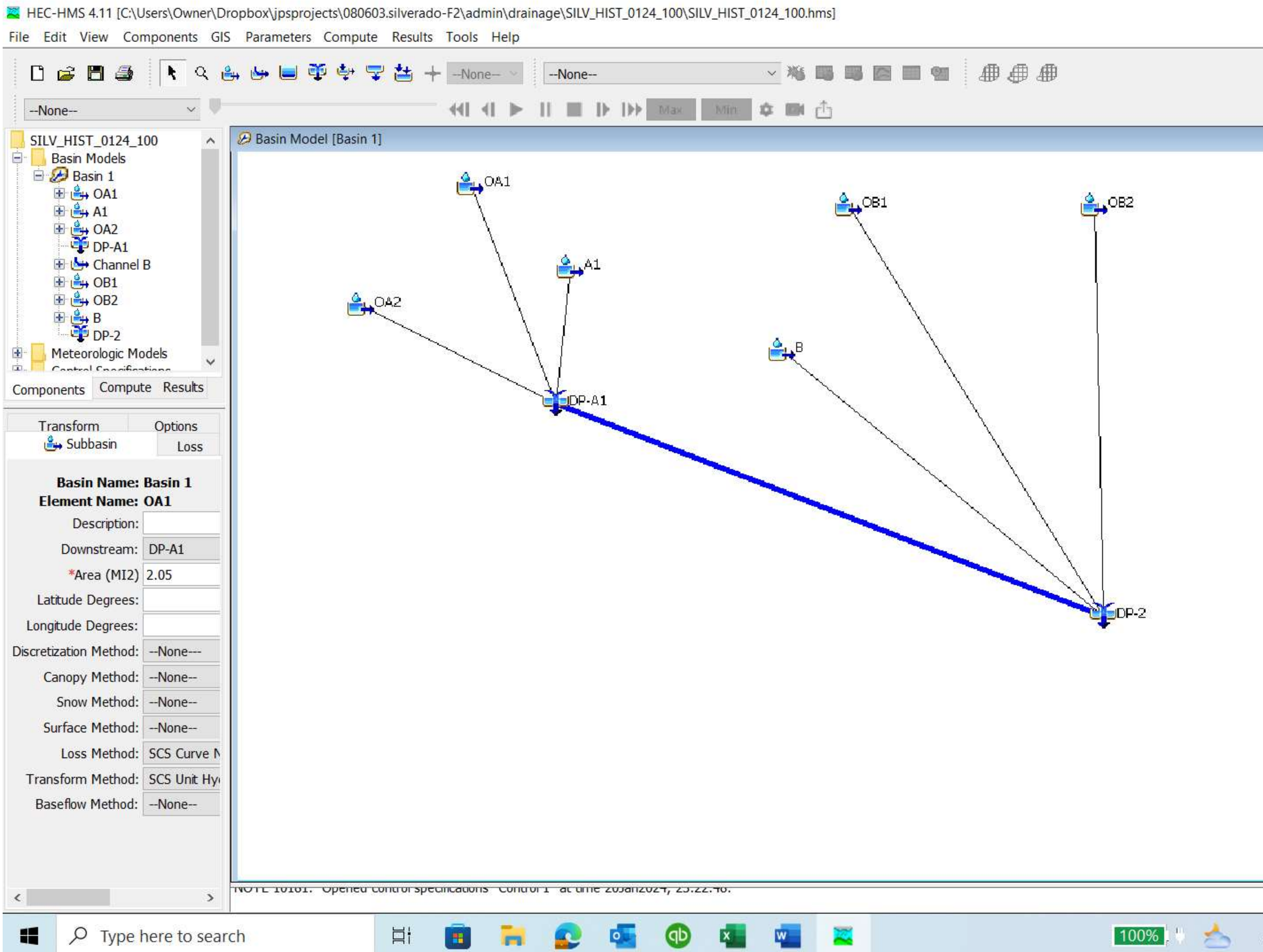
Figure
A5

SILVERADO RANCH
COMPOSITE RUNOFF COEFFICIENTS

HISTORIC CONDITIONS

SCS CN VALUES

BASIN	TOTAL AREA (AC)	SOIL TYPE	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	CN	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	CN	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	CN	WEIGHTED CN VALUE
OA1	1314.6	B	1314.6	MEADOW	50							50.00
OA2	18	B	18	MEADOW	50							50.00
A1	34.6	B	34.6	MEADOW	61							61.00
OA1,OA2,A1	1367.2	B										50.28
OB1	841.5	B	841.5	MEADOW	50							50.00
OB2	61.9	B	61.9	MEADOW	50							50.00
B	202.5	B	202.5	MEADOW	61							61.00
OA1-OB2,A1,B	2473.1	B										51.05


HEC-HMS 4.11 [C:\Users\Owner\Dropbox\jpsprojects\080603.silverado-F2\admin\drainage\SILV_HIST_0124_100\SILV_HIST_0124_100.hms]
File Edit View Components GIS Parameters Compute Results Tools Help
--None--
--None--
--None--
SILV_HIST_0124_100
Basin Models
Basin 1
OA1
A1
OA2
DP-A1
Channel B
OB1
OB2
B
DP-2
Meteorologic Models
Components Compute Results
Transform Options
Subbasin Loss
Basin Name: Basin 1
Element Name: OA1
Description:
Downstream: DP-A1
*Area (MI2) 2.05
Latitude Degrees:
Longitude Degrees:
Discretization Method: --None---
Canopy Method: --None--
Snow Method: --None--
Surface Method: --None--
Loss Method: SCS Curve N
Transform Method: SCS Unit Hy
Baseflow Method: --None--
Basin Model [Basin 1]
OA1
OB1
OB2
A1
OA2
B
DP-A1
DP-2
Type here to search
100%

Project: Silv Hist 0124 5
Simulation Run: Run 1
Simulation Start: 1 January 3000, 01:00
Simulation End: 2 January 3000, 01:30

HMS Version: 4.11
Executed: 26 January 2024, 06:10

Global Parameter Summary - Subbasin

Area (MI2)

Element Name	Area (MI2)
Oa1	2.05
A1	0.05
Oa2	0.03
Ob1	1.31
B	0.32
Ob2	0.1

Downstream

Element Name	Downstream
Oa1	DP - A1
A1	DP - A1
Oa2	DP - A1
Ob1	DP - 2
B	DP - 2
Ob2	DP - 2

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Oa1	2	50	2
A1	2	61	1.28
Oa2	2	50	2
Ob1	2	50	2
B	2	61	1.28
Ob2	2	50	2

Transform: Scs

Element Name	Lag	Unitgraph Type
Oa1	73.28	Standard
A1	38.88	Standard
Oa2	15.52	Standard
Ob1	68.38	Standard
B	16.16	Standard
Ob2	28.23	Standard

Global Parameter Summary - Reach

Downstream

Element Name	Downstream
Channel B	DP - 2

Route: Lag

Element Name	Method	Initial Variable	Lag
Channel B	Lag	Combined Inflow	16.16

Global Results Summary

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Oa1	2.05	20.55	01Jan3000, 14:05	0.08
A1	0.05	2.48	01Jan3000, 13:42	0.27
Oa2	0.03	0.85	01Jan3000, 13:08	0.09
DP - A1	2.13	22.66	01Jan3000, 14:02	0.09
Channel B	2.13	22.66	01Jan3000, 14:18	0.08
Ob1	1.31	13.82	01Jan3000, 14:00	0.08
B	0.32	26.66	01Jan3000, 13:13	0.27
Ob2	0.1	1.98	01Jan3000, 13:19	0.08
DP - 2	3.86	44.21	01Jan3000, 14:06	0.1

Project: Silv Hist 0124 100
Simulation Run: Run 1
Simulation Start: 1 January 3000, 01:00
Simulation End: 2 January 3000, 01:30

HMS Version: 4.11
Executed: 26 January 2024, 06:02

Global Parameter Summary - Subbasin

Area (MI2)

Element Name	Area (MI2)
Oa1	2.05
A1	0.05
Oa2	0.03
Ob1	1.31
B	0.32
Ob2	0.1

Downstream

Element Name	Downstream
Oa1	DP - A1
A1	DP - A1
Oa2	DP - A1
Ob1	DP - 2
B	DP - 2
Ob2	DP - 2

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Oa1	2	50	2
A1	2	61	1.28
Oa2	2	50	2
Ob1	2	50	2
B	2	61	1.28
Ob2	2	50	2

Transform: Scs

Element Name	Lag	Unitgraph Type
Oa1	73.28	Standard
A1	38.88	Standard
Oa2	15.52	Standard
Ob1	68.38	Standard
B	16.16	Standard
Ob2	28.23	Standard

Global Parameter Summary - Reach

Downstream

Element Name	Downstream
Channel B	DP - 2

Route: Lag

Element Name	Method	Initial Variable	Lag
Channel B	Lag	Combined Inflow	16.16

Global Results Summary

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Oa1	2.05	150.75	01Jan3000, 14:25	0.52
A1	0.05	15.61	01Jan3000, 13:37	1.08
Oa2	0.03	5.87	01Jan3000, 13:12	0.54
DP - A1	2.13	159.09	01Jan3000, 14:22	0.54
Channel B	2.13	159.09	01Jan3000, 14:38	0.53
Ob1	1.31	100.57	01Jan3000, 14:19	0.53
B	0.32	185.88	01Jan3000, 13:11	1.09
Ob2	0.1	13.32	01Jan3000, 13:28	0.54
DP - 2	3.86	284.15	01Jan3000, 14:30	0.58

SILVERADO RANCH
HISTORIC FLOWS

									Overland Flow			Channel flow							Time of Concentration	Total Lag Time	Total Lag Time	Peak Flow SCS	
BASIN	DESIGN POINT	AREA (AC)	AREA (SM)	RUNOFF COEFFICIENT (C5)	CURVE No. (CN)	S	Ia	PERCENT IMPERVIOUS (%)	LENGTH (FT)	SLOPE (%)	Tco [1] (MIN)	HIGH ELEV. (FT)	LOW ELEV. (FT)	H (FT)	CHANNEL LENGTH (FT)	CHANNEL LENGTH (MI)	SLOPE (%)	Tt [1] (MIN)	Tc [2] (MIN)	Tl [2] (HR)	Tl [2] (MIN)	Q5 [3] (CFS)	Q100 [3] (CFS)
OA1	OA1	1314.6	2.05	0.08	50	10.00	2.00	2	1000	3.2	39.4	6186	5860	326	21020	3.98	1.6%	82.73	122.14	1.22	73.28	20.6	150.7
OA2	OA2	18.0	0.03	0.08	50	10.00	2.00	2	450	5.3	22.4	5862	5858	4	315	0.06	1.3%	3.52	25.87	0.26	15.52	0.9	5.9
A1		34.6	0.05	0.137	61	6.39	1.28	2	1000	3.0	38.0	5858	5857	1	1150	0.22	0.1%	26.77	64.79	0.65	38.88		
OA1,OA2,A1	A1	1367.2	2.14	0.08	50.25	9.90	1.98	2											186.94	1.87	112.16	22.7	159.1
OB1	OB1	841.5	1.31	0.08	50	10.00	2.00	2	1000	1.6	49.6	6040	5830	210	14600	2.77	1.4%	64.32	113.97	1.14	68.38	13.8	100.6
OB2	OB2	61.9	0.10	0.08	50	10.00	2.00	2	1000	3.4	38.6	5820	5810	10	910	0.17	1.1%	8.42	47.05	0.47	28.23	2.0	13.3
B		202.5	0.32	0.137	61	6.39	1.28	2			0.0	5808	5802	6	940	0.18	0.6%	10.64	10.64	0.11	6.38		
CHANNEL B												5855	5795	60	4525	0.86	1.3%	26.93	26.93	0.27	16.16		
OA1-OA2,OB1-OB2,A,B	2	2473.1	3.86																213.87	2.14	128.32	44.2	284.1

1) OVERLAND FLOW Tco = (1.8*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) TRAVEL TIME, Tt = ((11.9*L^3)/H)^(0.385)
3) Tc = Tco + Tt
4) SCS LAG TIME, Tl = 0.6 * Tt
5) PEAK FLOWS CALCULATED BY HEC-HMS 4.1.1
6) 5-YR, 24-HR RAINFALL = 2.6 IN; 100-YR, 24-HR RAINFALL = 4.4 IN

Add note to see other calculations spreadsheet for Basins A2, C & D and Design Points 1, 3 & 4

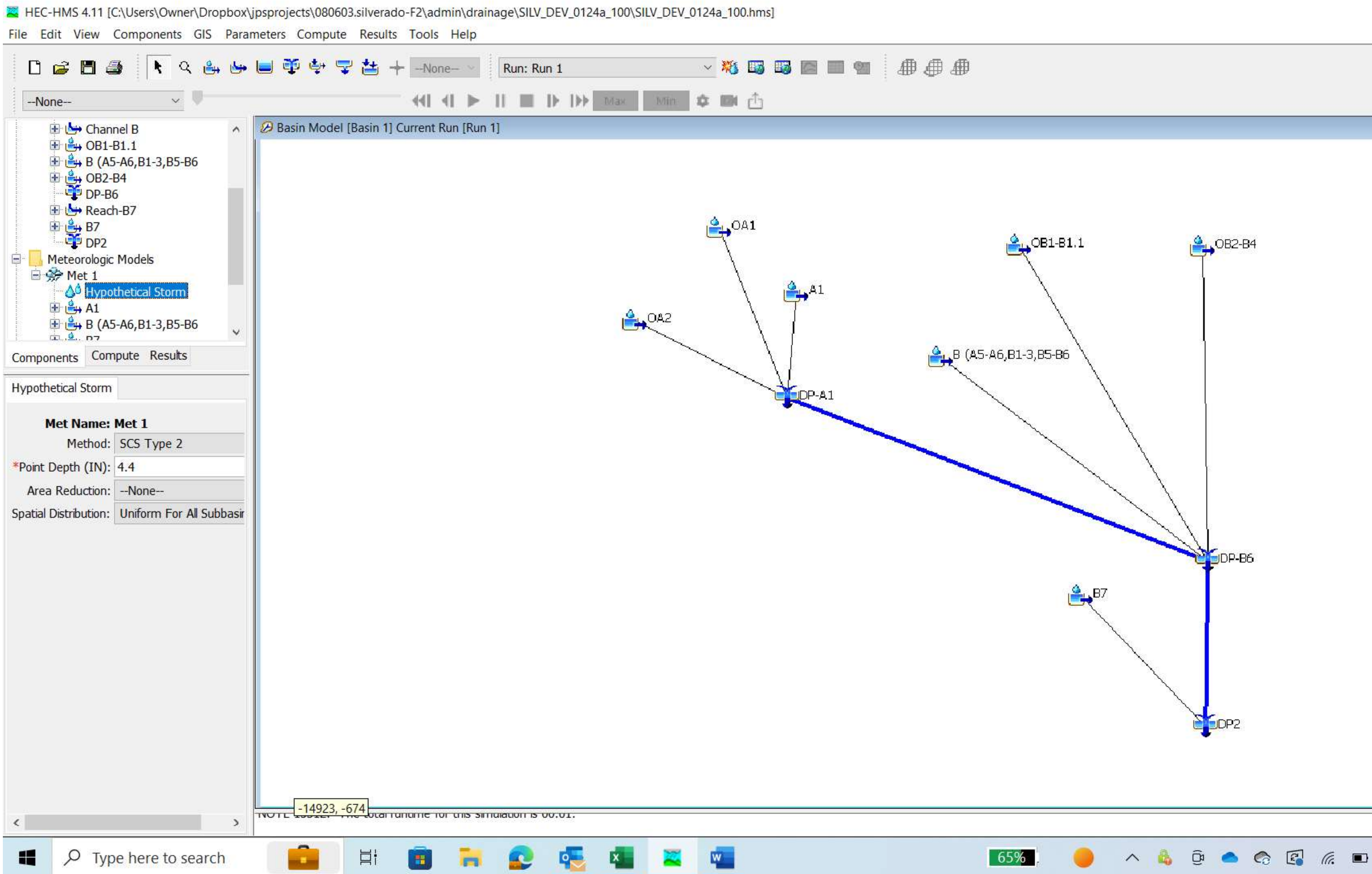
Per C/S DCM Chapter 6 Section 3.2.1, max overland length for non-urban land use is 300 ft. Please revise

SILVERADO RANCH
COMPOSITE RUNOFF COEFFICIENTS

DEVELOPED CONDITIONS

SCS CN VALUES

BASIN	TOTAL AREA (AC)	SOIL TYPE	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	CN	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	CN	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	CN	WEIGHTED CN VALUE
OA1	1314.6	B	1314.6	MEADOW	50							50.00
OA2	18	B	18	MEADOW	50							50.00
A1	24.5	B	24.5	5 AC LOTS	63.59							63.59
OA1,OA2,A1	1357.1	B										50.25
OB1	841.5	B	841.5	MEADOW	50							50.00
B1.1	2.98	B	2.98	5 AC LOTS	63.59							63.59
OB1,B1.1	844.48	B										50.05
OB2	61.9	B	61.9	MEADOW	50							50.00
B4	27.5	B	27.5	5 AC LOTS	63.59							63.59
OB2,B4	89.4	B										54.18
B (A5-A6,B1-3,B5-B6)	155.1	B	155.1	5 AC LOTS	63.59							63.59
OA1-OB2,A1,B	2446.08	B										51.17
B7	34.92	B	34.92	5 AC LOTS	63.59							63.59
OA1-OB2,A1,B	2481.0	B										51.34



HEC-HMS 4.11 [C:\Users\Owner\Dropbox\jpsprojects\080603.silverado-F2\admin\drainage\SILV_DEV_0124a_100\SILV_DEV_0124a_100.hms]
File Edit View Components GIS Parameters Compute Results Tools Help
--None--
Run: Run 1
--None--
Max
Min
Channel B
OB1-B1.1
B (A5-A6,B1-3,B5-B6
OB2-B4
DP-B6
Reach-B7
B7
DP2
Meteorologic Models
Met 1
Hypothetical Storm
A1
B (A5-A6,B1-3,B5-B6
Components
Compute
Results
Hypothetical Storm
Met Name: Met 1
Method: SCS Type 2
*Point Depth (IN): 4.4
Area Reduction: --None--
Spatial Distribution: Uniform For All Subbasir
Basin Model [Basin 1] Current Run [Run 1]
OA1
OB1-B1.1
OB2-B4
A1
OA2
B (A5-A6,B1-3,B5-B6
DP-A1
DP-B6
B7
DP2
-14923, -674
Type here to search
65%

Project: SILV_DEV_0124b_5
Simulation Run: Run 1
Simulation Start: 1 January 3000, 01:00
Simulation End: 2 January 3000, 01:30

HMS Version: 4.11
Executed: 29 January 2024, 00:32

Global Parameter Summary - Subbasin

Area (MI2)

Element Name	Area (MI2)
Oa1	2.05
A1	0.04
Oa2	0.03
OB1 - B1.1	1.32
B (A5 - A6,B1 - 3,B5 - B6	0.24
OB2 - B4	0.14
B7	0.05

Downstream

Element Name	Downstream
Oa1	DP - A1
A1	DP - A1
Oa2	DP - A1
OB1 - B1.1	DP - B6
B (A5 - A6,B1 - 3,B5 - B6	DP - B6
OB2 - B4	DP - B6
B7	Dp2

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Oa1	2	50	2
A1	7	63.59	1.15
Oa2	2	50	2
OB1 - B1.1	2.02	50.05	2
B (A5 - A6,B1 - 3,B5 - B6	7	63.59	1.15
OB2 - B4	3.54	54.18	1.69
B7	7	63.59	1.15

Transform: Scs

Element Name	Lag	Unitgraph Type
Oa1	73.28	Standard
A1	38.88	Standard
Oa2	15.52	Standard
OB1 - B1.1	78.89	Standard
B (A5 - A6,B1 - 3,B5 - B6	13.7	Standard
OB2 - B4	32.42	Standard
B7	4.7	Standard

Global Parameter Summary - Reach

Downstream

Element Name	Downstream
Channel B	DP - B6
Reach - B7	Dp2

Route: Lag

Element Name	Method	Initial Variable	Lag
Channel B	Lag	Combined Inflow	13.7
Reach - B7	Lag	Combined Inflow	4.7

Global Results Summary

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Oa1	2.05	20.55	01Jan3000, 14:05	0.08
A1	0.04	4.2	01Jan3000, 13:37	0.45
Oa2	0.03	0.85	01Jan3000, 13:08	0.09
DP - A1	2.12	23.64	01Jan3000, 13:58	0.09
Channel B	2.12	23.64	01Jan3000, 14:11	0.09
OB1 - B1.1	1.32	12.66	01Jan3000, 14:11	0.08

B (A5 - A6,B1 - 3,B5 - B6	0.24	48.9	01Jan3000, 13:09	0.45
OB2 - B4	0.14	4.63	01Jan3000, 13:25	0.18
DP - B6	3.82	61.85	01Jan3000, 13:10	0.11
Reach - B7	3.82	61.85	01Jan3000, 13:14	0.11
B7	0.05	15.8	01Jan3000, 13:00	0.45
Dp2	3.87	65.6	01Jan3000, 13:14	0.12

Project: SILV_DEV_0124a_100
Simulation Run: Run 1
Simulation Start: 1 January 3000, 01:00
Simulation End: 2 January 3000, 01:30

HMS Version: 4.11
Executed: 29 January 2024, 00:25

Global Parameter Summary - Subbasin

Area (MI2)

Element Name	Area (MI2)
Oa1	2.05
A1	0.04
Oa2	0.03
OB1 - B1.1	1.32
B (A5 - A6,B1 - 3,B5 - B6	0.24
OB2 - B4	0.14
B7	0.05

Downstream

Element Name	Downstream
Oa1	DP - A1
A1	DP - A1
Oa2	DP - A1
OB1 - B1.1	DP - B6
B (A5 - A6,B1 - 3,B5 - B6	DP - B6
OB2 - B4	DP - B6
B7	Dp2

Loss Rate: Scs

Element Name	Percent Impervious Area	Curve Number	Initial Abstraction
Oa1	2	50	2
A1	7	63.59	1.15
Oa2	2	50	2
OB1 - B1.1	2.02	50.05	2
B (A5 - A6,B1 - 3,B5 - B6	7	63.59	1.15
OB2 - B4	3.54	54.18	1.69
B7	7	63.59	1.15

Transform: Scs

Element Name	Lag	Unitgraph Type
Oa1	73.28	Standard
A1	38.88	Standard
Oa2	15.52	Standard
OB1 - B1.1	78.89	Standard
B (A5 - A6,B1 - 3,B5 - B6	13.7	Standard
OB2 - B4	32.42	Standard
B7	4.7	Standard

Global Parameter Summary - Reach

Downstream

Element Name	Downstream
Channel B	DP - B6
Reach - B7	Dp2

Route: Lag

Element Name	Method	Initial Variable	Lag
Channel B	Lag	Combined Inflow	13.7
Reach - B7	Lag	Combined Inflow	4.7

Global Results Summary

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Oa1	2.05	150.75	01Jan3000, 14:25	0.52
A1	0.04	16.83	01Jan3000, 13:35	1.39
Oa2	0.03	5.87	01Jan3000, 13:12	0.54
DP - A1	2.12	159	01Jan3000, 14:22	0.54
Channel B	2.12	159	01Jan3000, 14:35	0.54
OB1 - B1.1	1.32	93.04	01Jan3000, 14:33	0.52

B (A5 - A6,B1 - 3,B5 - B6	0.24	205.26	01Jan3000, 13:08	1.4
OB2 - B4	0.14	30.37	01Jan3000, 13:31	0.78
DP - B6	3.82	281.95	01Jan3000, 14:31	0.6
Reach - B7	3.82	281.95	01Jan3000, 14:35	0.59
B7	0.05	64.28	01Jan3000, 12:59	1.4
Dp2	3.87	285.58	01Jan3000, 14:34	0.6

SILVERADO RANCH
DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	AREA (SM)	RUNOFF COEFFICIENT (C5)	CURVE No. (CN)	S	Ia	PERCENT IMPERVIOUS (%)	Overland Flow: LENGTH (FT)	Overland Flow: SLOPE (%)	Overland Flow: Tco (1) (MIN)	Channel flow: HIGH ELEV. (FT)	Channel flow: LOW ELEV. (FT)	Channel flow: H (FT)	Channel flow: CHANNEL LENGTH (FT)	Channel flow: CHANNEL LENGTH (MI)	Channel flow: SLOPE (%)	Channel flow: Tt (1) (MIN)	Time of Concentration Tc (2) (MIN)	Total Lag Time Tl (2) (HR)	Total Lag Time Tl (2) (MIN)	Peak Flow SCS: Q5 (3) (CFS)	Peak Flow SCS: Q100 (3) (CFS)
OA1	OA1	1314.6	2.05	0.08	50	10.00	2.00	2	1000	3.2	39.4	6186	5860	326	21020	3.98	1.6%	82.73	122.14	1.22	73.28	20.6	150.7
OA2	OA2	18.0	0.03	0.08	50	10.00	2.00	2	450	5.3	22.4	5862	5858	4	315	0.06	1.3%	3.52	25.87	0.26	15.52		
A1		24.5	0.04	0.137	63.59	5.73	1.15	7	1000	3.0	38.0	5858	5857	1	1150	0.22	0.1%	26.77	64.79	0.65	38.88		
OA1,OA2,A1	A1	1357.1	2.12	0.08	50.25	9.90	1.98	2											186.94	1.87	112.16	23.6	159.0
OB1	OB1	841.5	1.31	0.08	50	10.00	2.00	2	1000	1.6	49.6	6040	5830	210	14600	2.77	1.4%	64.32	113.97	1.14	68.38		
CHANNEL B1.1												5828	5802	26	2360	0.45	1.1%	17.52	17.52	0.18	10.51		
B1.1		2.98	0.005	0.137	63.59	5.73	1.15	7	70	2.0	11.5			9.9	900	0.17	1.1%	8.34	19.86	0.20	11.92		
OB1,B1.1	B1.1	844.5	1.32	0.08	50.05	9.98	2.00	2.02											131.49	1.31	78.89	12.7	93.0
OB2	OB2	61.9	0.10	0.08	50	10.00	2.00	2	1000	3.4	38.6	5820	5810	10	910	0.17	1.1%	8.42	47.05	0.47	28.23		
B4		27.5	0.043	0.137	63.59	5.73	1.15	7			0.0			5.9	650	0.12	0.9%	6.99	6.99	0.07	4.20		
OB2,B4	B4.1	89.4	0.14	0.10	54.18	8.46	1.69	3.54											54.04	0.54	32.42	4.6	30.4
B (A5-A6,B1-B3,B5-B6)		155.1	0.24	0.137	63.59	5.73	1.15	7			0.0	5855	5790	65	4025	0.76	1.6%	22.81	22.81	0.23	13.69		
CHANNEL B												5855	5790	65	4025	0.76	1.6%	22.81	22.81	0.23	13.69		
OA1-OA2,OB1-OB2,A,B	B6	2446.1	3.82																209.75	2.10	125.85	61.8	282.0
B7		34.92	0.05	0.137	63.59	5.73	1.15	7			0.0	5796	5794	2	500	0.09	0.4%	7.83	7.83	0.08	4.70		
CHANNEL B7											0.0	5796	5794	2	500	0.09	0.4%	7.83	7.83	0.08	4.70		
OA1-OA2,OB1-OB2,A,B	2	2481.0	3.88																217.58	2.18	130.55	65.6	285.6

1) OVERLAND FLOW Tco = (1.8*(1.1-RUN[illegible] GTH^(0.5)/(SLOPE^(0.333))
2) TRAVEL TIME, Tt = ((11.9*L^3)/H)^(0.385)
3) Tc = Tco + Tt
4) SCS LAG TIME, Tl = 0.6 * Tt
5) PEAK FLOWS CALCULATED BY HEC-HMS 4.1.1 (FILE: "SILV_DEV_0124a_100.hms")
6) 5-YR, 24-HR RAINFALL = 2.6 IN; 100-YR, 24-HR RAINFALL = 4.4 IN

What is A?

Include all basins and design points as shown on drainage map.

Does this formula from Eq. 6-8, DCM, chapter 6? If so, please revise to match.

Length of overland flow for non-urban land uses cannot be greater than 300ft. Please revise. (DCM Vol1, chapter 6, Eq. 6-8)

APPENDIX B2

HYDROLOGIC CALCULATIONS (RATIONAL METHOD)

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

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

$$t_c = t_i + t_t \quad \text{(Eq. 6-7)}$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i, may be calculated using Equation 6-8.

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

Where:

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

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

3.2.2 Travel Time

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

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

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

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

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

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \qquad \text{(Eq. 6-10)}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional "calibration" of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

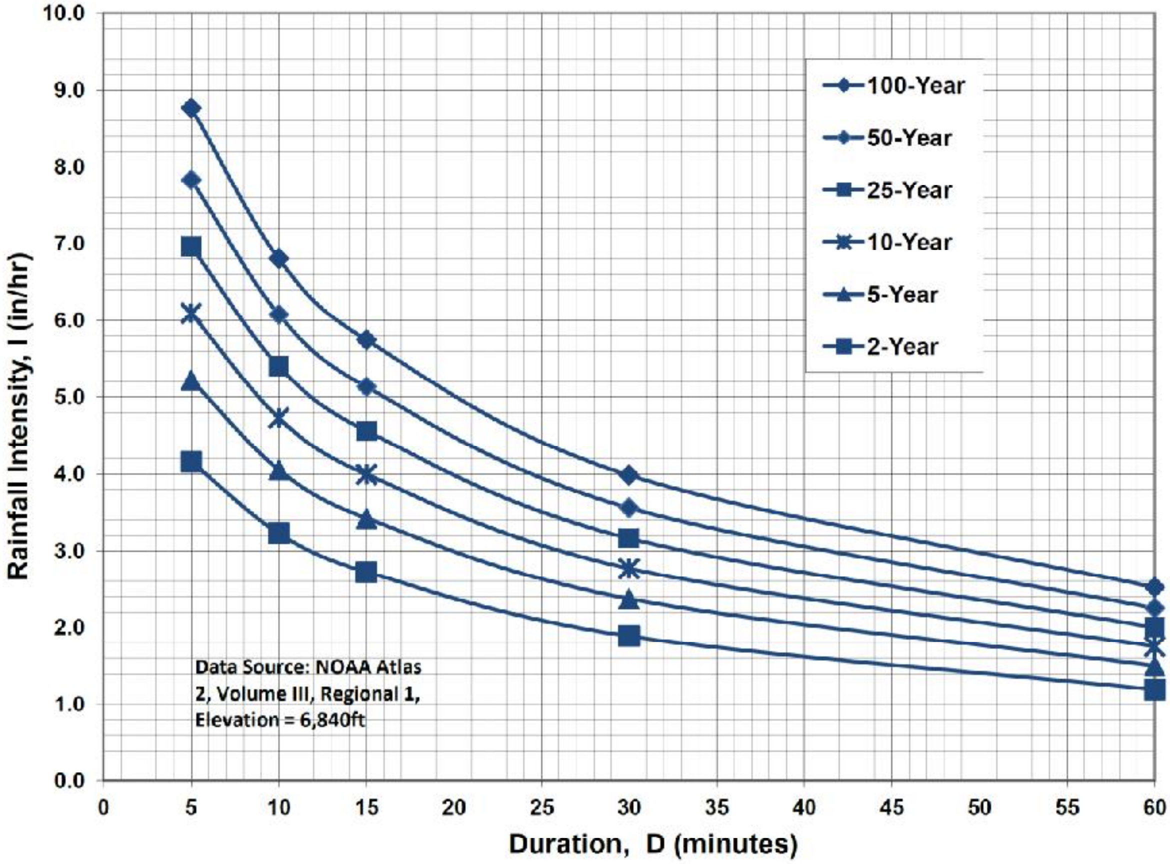
3.2.4 Minimum Time of Concentration

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

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

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.

SILVERADO RANCH FILING NO. 2
RATIONAL METHOD

HISTORIC FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR(7)	C 100-YEAR (7)	Overland Flow LENGTH (FT)	Overland Flow SLOPE (FT/FT)	Overland Flow Tco (1) (MIN)	Channel flow CHANNEL LENGTH (FT)	Channel flow CONVEYANCE COEFFICIENT C	Channel flow SLOPE (FT/FT)	Channel flow SCS (2) VELOCITY (FT/S)	Channel flow Tt (3) (MIN)	TOTAL Tc (4) (MIN)	TOTAL Tc (4) (MIN)	INTENSITY (5) 5-YR (IN/HR)	INTENSITY (5) 100-YR (IN/HR)	PEAK FLOW Q5 (6) (CFS)	PEAK FLOW Q100 (6) (CFS)
A2	1	52.17	0.080	0.350	1000	0.028	41.9	1900	15	0.022	2.23	14.2	56.1	56.1	1.54	2.59	6.44	47.22
C	3	18.12	0.080	0.350	500	0.032	28.3	2450	15	0.006	1.16	35.1	63.5	63.5	1.36	2.27	1.97	14.43
D	4	11.30	0.080	0.350	300	0.042	20.1	300	15	0.013	1.71	2.9	23.0	23.0	2.88	4.84	2.60	19.13

Length of overland flow for non-urban land uses cannot be greater than 300ft. Please revise. (DCM Vol1, chapter 6, Eq. 6-8)

1) OVERLAND FLOW Tco = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)
C = 2.5 FOR HEAVY MEADOW
C = 5 FOR TILLAGE/FIELD
C = 7 FOR SHORT PASTURE AND LAWNS
C = 10 FOR NEARLY BARE GROUND
C = 15 FOR GRASSED WATERWAY
C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES
3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MANUAL
$I_5 = -1.5 * \ln(Tc) + 7.583$
$I_{100} = -2.52 * \ln(Tc) + 12.735$
6) Q = CiA
7) WEIGHTED AVERAGE C VALUES FOR COMBINED BASINS

SILVERADO RANCH SUBDIVISION
COMPOSITE RUNOFF COEFFICIENTS - TYPICAL RURAL RESIDENTIAL LOTS

DEVELOPED CONDITIONS

5-YEAR C VALUES

BASIN	TOTAL AREA (AC)	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
5-ACRE LOTS	5.0	7.00	BUILDING / PAVEMENT	0.90	93.00	MEADOW / LS	0.08				0.137

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
5-ACRE LOTS	5.0	7.00	BUILDING / PAVEMENT	0.96	93.00	MEADOW / LS	0.35				0.393

SCS RUNOFF CURVE NUMBERS - CN-VALUES

BASIN	TOTAL AREA (AC)	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	CN	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	CN	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	CN	WEIGHTED CN- VALUE
5-ACRE LOTS	5.0	7.00	BUILDING / PAVEMENT	98	93.00	MEADOW / LS	61				63.590

IMPERVIOUS AREAS

BASIN	TOTAL AREA (AC)	AREA (%)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (%)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (%)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
5-ACRE LOTS	5.0	7.00	BUILDING / PAVEMENT	100	93.00	MEADOW / LS	0				7.000

SILVERADO RANCH FILING NO. 2
COMPOSITE RUNOFF COEFFICIENTS

DEVELOPED CONDITIONS

5-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
B1.1	2.98	2.98	5-AC LOTS	0.137							0.137
B3	45.86	45.86	5-AC LOTS	0.137							0.137
OB2	61.93	61.93	MEADOW	0.080							0.080
B4	27.47	27.47	5-AC LOTS	0.137							0.137
OB2,B4	89.40										0.098
B6	43.73	43.73	5-AC LOTS	0.137							0.137
D	11.30	11.30	5-AC LOTS	0.137							0.137

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
B1.1	2.98	2.98	5-AC LOTS	0.393							0.393
B3	45.86	45.86	5-AC LOTS	0.393							0.393
OB2	61.93	61.93	MEADOW	0.350							0.350
B4	27.47	27.47	5-AC LOTS	0.393							0.393
OB2,B4	89.40										0.363
B6	43.73	43.73	5-AC LOTS	0.393							0.393
D	11.30	11.30	5-AC LOTS	0.393							0.393

SILVERADO RANCH FILING NO. 2
RATIONAL METHOD

Remove DP Designation from this spreadsheet. Calculation here is only for drainage basin. DP is determined on SCS calculation done previously.

			C		Overland Flow			Channel flow							INTENSITY (5)		PEAK FLOW	
BASIN	DESIGN POINT	AREA (AC)	5-YEAR (7)	100-YEAR (7)	LENGTH (FT)	SLOPE (FT/FT)	Tco (1) (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS (2) VELOCITY (FT/S)	Tt (3) (MIN)	TOTAL Tc (4) (MIN)	TOTAL Tc (4) (MIN)	5-YR (IN/HR)	100-YR (IN/HR)	Q5 (6) (CFS)	Q100 (6) (CFS)
A2-A4	1	47.43	0.137	0.393	100	0.060	9.7	2600	15	0.023	2.27	19.0	28.8	28.8	2.54	4.27	16.54	79.61
B1.1		2.98	0.137	0.393	70	0.020	11.7	900	15	0.011	1.57	9.5	21.2	21.2	3.00	5.03	1.22	5.90
B3	B3	39.38	0.137	0.393			0.0	1800	15	0.012	1.66	18.1	18.1	18.1	3.24	5.44	17.47	84.13
FILING NO. 2 BASINS:																		
B4		27.47	0.137	0.393			0.0	650	15	0.009	1.42	7.6	7.6	7.6	4.54	7.62	17.08	82.26
B6	B6	50.20	0.137	0.393	100	0.020	14.0	900	15	0.033	2.72	5.5	19.5	19.5	3.13	5.25	21.51	103.57
B7	B7	34.92	0.137	0.393	100	0.020	14.0	2720	15	0.009	1.42	31.9	45.9	45.9	1.84	3.09	8.83	42.47
C	3	18.12	0.137	0.393	500	0.032	26.8	2450	15	0.006	1.16	35.1	61.9	61.9	1.39	2.34	3.46	16.65
D	4	11.30	0.137	0.393	300	0.042	18.9	300	15	0.013	1.71	2.9	21.9	21.9	2.96	4.96	4.58	22.04

1) OVERLAND FLOW Tco = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)
C = 2.5 FOR HEAVY MEADOW
C = 5 FOR TILLAGE/FIELD
C = 7 FOR SHORT PASTURE AND LAWNS
C = 10 FOR NEARLY BARE GROUND
C = 15 FOR GRASSED WATERWAY
C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES
3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MAN

$I_5 = -1.5 * \ln(Tc) + 7.583$

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

6) Q = CiA
7) WEIGHTED AVERAGE C VALUES FOR COMBINED BASINS

Length of overland flow for non-urban land uses cannot be greater than 300ft. Please revise. (DCM Vol1, chapter 6, Eq. 6-8)

Include these design points in summary table on drainage map.

APPENDIX C

HYDRAULIC CALCULATIONS

TABLE 10-2 (Continued)

TYPICAL ROUGHNESS COEFFICIENTS FOR OPEN CHANNELS

Type of Channel and Description	Minimum	Normal	Maximum
c. Concrete bottom float finished with sides of			
1. Dressed stone in mortar	0.015	0.017	0.020
2. Random stone in mortar	0.017	0.020	0.024
3. Cement rubble masonry, plastered	0.016	0.020	0.024
4. Cement rubble masonry	0.020	0.025	0.030
5. Dry rubble or riprap	0.020	0.030	0.035
d. Gravel bottom with sides of			
1. Formed concrete	0.017	0.020	0.025
2. Random stone in mortar	0.020	0.023	0.026
3. Dry rubble or riprap	0.023	0.033	0.036
e. Asphalt			
1. Smooth		0.013	
2. Rough		0.016	
f. Grassed	0.030	0.040	0.050

TABLE 10-3

MAXIMUM PERMISSIBLE DESIGN
OPEN CHANNEL FLOW VELOCITIES IN EARTH*

Soil Types	Permissible Mean Channel Velocity (ft/sec)
Fine Sand (noncolloidal)	2.0
Coarse Sand (noncolloidal)	4.0
Sandy Loam (noncolloidal)	2.5
Silt Loam (noncolloidal)	3.0
Ordinary Firm Loam	3.5
Silty Clay	3.5
Fine Gravel	5.0
Stiff Clay (very colloidal)	5.0
Graded, Loam to Cobbles (noncolloidal)	5.0
Graded, Silt to Cobbles (colloidal)	5.5
Alluvial Silts (noncolloidal)	3.5
Alluvial Silts (colloidal)	5.0
Coarse Gravel (noncolloidal)	6.0
Cobbles and Shingles	5.5
Hard Shales and Hard Pans	6.0
Soft Shales	3.5
Soft Sandstone	8.0
Sound rock (usu. igneous or hard metamorphic)	20.0

* These velocities shall be used in conjunction with scour calculations and as approved by City/County.

TABLE 10-2

TYPICAL ROUGHNESS COEFFICIENTS FOR OPEN CHANNELS
(Reference: Chow, Ven Te, 1959; Open-Channel Hydraulics)

Type of Channel and Description	Minimum	Normal	Maximum
EXCAVATED OR DREDGED			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	0.022	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same, highest stage of flow	0.045	0.070	0.110
4. Dense brush, high stage	0.080	0.100	0.140

TABLE 10-4

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

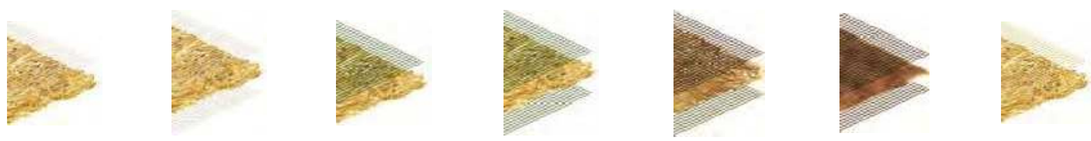
Channel Slope	Lining	Permissible Mean Channel Velocity * (ft/sec)
0 - 5%	Sodded grass	7
	Bermudagrass	6
	Reed canarygrass	5
	Tall fescue	5
	Kentucky bluegrass	5
	Grass-legume mixture	4
	Red fescue	2.5
	Redtop	2.5
	Sericea lespedeza	2.5
	Annual lespedeza	2.5
	Small grains (temporary)	2.5
5 - 10%	Sodded grass	6
	Bermudagrass	5
	Reed canarygrass	4
	Tall fescue	4
	Kentucky bluegrass	4
	Grass-legume mixture	3
Greater than 10%	Sodded grass	5
	Bermudagrass	4
	Reed canarygrass	3
	Tall fescue	3
	Kentucky bluegrass	3

* For highly erodible soils, decrease permissible velocities by 25%.

* Grass lined channels are dependent upon assurances of continuous growth and maintenance of grass.

The complete line of RollMax™ products offers a variety of options for both short-term and permanent erosion control needs. Reference the RollMax Products Chart below to find the right solution for your next project.

RollMax Product Selection Chart



	TEMPORARY						
	ERONET						BIONET
	DS75	DS150	S75	S150	SC150	C125	S75BN
Longevity	45 days	60 days	12 mo.	12 mo.	24 mo.	36 mo.	12 mo.
Applications	Low Flow Channels 4:1-3:1 Slopes	Moderate Flow Channels 3:1-2:1 Slopes	Low Flow Channels 4:1-3:1 Slopes	Moderate Flow Channels 3:1-2:1 Slopes	Medium Flow Channels 2:1-1:1 Slopes	High-Flow Channels 1:1 and Greater Slopes	Low Flow Channels 4:1-3:1 Slopes
Design Permissible Shear Stress lbs/ft² (Pa)	Unvegetated 1.55 (74)	Unvegetated 1.75 (84)	Unvegetated 1.55 (74)	Unvegetated 1.75 (84)	Unvegetated 2.00 (96)	Unvegetated 2.25 (108)	Unvegetated 1.60 (76)
Design Permissible Velocity ft/s (m/s)	Unvegetated 5.00 (1.52)	Unvegetated 6.00 (1.52)	Unvegetated 5.00 (1.2)	Unvegetated 6.00 (1.83)	Unvegetated 8.00 (2.44)	Unvegetated 10.00 (3.05)	Unvegetated 5.00 (1.52)
Top Net	Lightweight accelerated photodegradable polypropylene 1.50 lbs/1000 ft² (0.73 kg/100 m²) approx wt	Lightweight accelerated photodegradable polypropylene 1.50 lbs/1000 ft² (0.73 kg/100 m²) approx wt	Lightweight photodegradable polypropylene 1.50 lbs/1000 ft² (0.73 kg/100 m²) approx wt	Lightweight photodegradable polypropylene 1.50 lbs/1000 ft² (0.73 kg/100 m²) approx wt	Heavyweight UV-stabilized polypropylene 2.9 lbs/1000 ft² (1.47 kg/100 m²) approx wt	Heavyweight UV-stabilized polypropylene 2.9 lbs/1000 ft² (1.47 kg/100 m²) approx wt	Leno woven. 100% biodegradable jute fiber 9.30 lbs/1000 ft² (4.53 kg/100 m²) approx wt
Center Net	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fiber Matrix	Straw fiber 0.50 lbs/yd² (0.27 kg/m²)	Straw fiber 0.50 lbs/yd² (0.27 kg/m²)	Straw fiber 0.50 lbs/yd² (0.27 kg/m²)	Straw fiber 0.50 lbs/yd² (0.27 kg/m²)	Straw/coconut matrix 70% Straw 0.35 lbs/yd² (0.19 kg/m²) 30% Coconut 0.15 lbs/yd² (0.08 kg/m²)	Coconut fiber 0.50 lbs/yd² (0.27 kg/m²)	Straw fiber 0.50 lbs/yd² (0.27 kg/m²)
Bottom Net	N/A	Lightweight accelerated photodegradable polypropylene 1.50 lbs/1000 ft² (0.73 kg/100 m²) approx wt	N/A	Lightweight photodegradable polypropylene 1.50 lbs/1000 ft² (0.73 kg/100 m²) approx wt	Lightweight photodegradable polypropylene 1.50 lbs/1000 ft² (0.73 kg/100 m²) approx wt	Heavyweight UV-stabilized polypropylene 2.9 lbs/1000 ft² (1.47 kg/100 m²) approx wt	N/A
Thread	Accelerated degradable	Accelerated degradable	Degradable	Degradable	Degradable	UV-stabilized polypropylene	Biodegradable

SILVERADO RANCH FILING NO. 2
DITCH CALCULATION SUMMARY

PROPOSED ROADSIDE DITCHES

ROADWAY	SHEET	FROM STA	TO STA	SIDE	PROPOSED SLOPE (%)	SIDE SLOPE (Z)	CHANNEL DEPTH (FT)	FRICTION FACTOR (n)	ROW WIDTH (ft)	BASIN	Q100 FLOW (CFS)	DITCH FLOW % OF BASIN	DITCH FLOW (CFS)	Q100 DEPTH (FT)	Q100 VELOCITY (FT/S)	DITCH LINING
SILVERADO HILL VIEW - N	PP4	40+00	46+00	N	1.00	4:1/3:1	2.5	0.030	60	B4	82.3	20	16.5	1.2	3.4	GRASS
SILVERADO HILL VIEW - N	PP4	40+00	46+00	S	1.00	4:1/3:1	2.5	0.030	60	B6	103.6	5	5.2	0.8	2.5	GRASS
SILVERADO HILL VIEW - N	PP4	46+00	52+25	N	3.00	4:1/3:1	2.5	0.030	60	B4	82.3	40	32.9	1.2	6.1	**GRASS / TRM**
SILVERADO HILL VIEW - N	PP4	46+00	52+25	S	3.00	4:1/3:1	2.5	0.030	60	B6	103.6	10	10.4	0.8	4.6	GRASS
SILVERADO HILL VIEW - N	PP5	52+25	58+25	N	1.00	4:1/3:1	2.5	0.030	60	B4	82.3	20	16.5	1.2	3.4	GRASS
SILVERADO HILL VIEW - N	PP5	52+25	58+25	S	1.00	4:1/3:1	2.5	0.030	60	B6	103.6	5	5.2	0.8	2.5	GRASS
SILVERADO HILL VIEW - N	PP5	58+25	61+25	N	1.00	4:1/3:1	2.5	0.030	60	B7	42.5	10	4.3	0.7	2.4	GRASS
SILVERADO HILL VIEW - N	PP5	58+25	61+25	S	1.00	4:1/3:1	2.5	0.030	60	B6	103.6	5	5.2	0.8	2.5	GRASS

1) Channel flow calculations based on Manning's Equation
2) n = 0.03 for grass-lined non-irrigated channels (minimum)
3) n = 0.035 for riprap-lined channels
4) Vmax = 5.0 fps for 100-year flows w/ grass-lined channels
5) Vmax = 8.0 fps for 100-year flows w/ Turf Reinforcement Mat Lining (NAG C350 or equal)

Hydraulic Analysis Report

Project Data

Project Title: Project - Silverado Ranch Flg. 2 - Roadside Ditches

Designer: JPS

Project Date: Tuesday, January 30, 2024

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis-Ditch-4000-4600-N

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0300

Flow: 16.5000 cfs

Result Parameters

Depth: 1.1791 ft

Area of Flow: 4.8657 ft^2

Wetted Perimeter: 8.5900 ft

Hydraulic Radius: 0.5664 ft

Average Velocity: 3.3911 ft/s

Top Width: 8.2535 ft

Froude Number: 0.7783

Critical Depth: 1.0710 ft

Critical Velocity: 4.1099 ft/s

Critical Slope: 0.0167 ft/ft

Critical Top Width: 7.65 ft

Calculated Max Shear Stress: 0.7357 lb/ft^2

Calculated Avg Shear Stress: 0.3535 lb/ft^2

Channel Analysis: Channel Analysis-Ditch-4000-4600-S

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0300

Flow: 5.2000 cfs

Result Parameters

Depth: 0.7647 ft

Area of Flow: 2.0466 ft^2

Wetted Perimeter: 5.5711 ft

Hydraulic Radius: 0.3674 ft

Average Velocity: 2.5408 ft/s

Top Width: 5.3528 ft

Froude Number: 0.7241

Critical Depth: 0.6748 ft

Critical Velocity: 3.2624 ft/s

Critical Slope: 0.0195 ft/ft

Critical Top Width: 4.82 ft

Calculated Max Shear Stress: 0.4772 lb/ft^2

Calculated Avg Shear Stress: 0.2292 lb/ft^2

Channel Analysis: Channel Analysis-Ditch-4600-5225-N

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Longitudinal Slope: 0.0300 ft/ft

Manning's n: 0.0300

Flow: 32.9000 cfs

Result Parameters

Depth: 1.2430 ft

Area of Flow: 5.4077 ft^2

Wetted Perimeter: 9.0558 ft

Hydraulic Radius: 0.5972 ft

Average Velocity: 6.0839 ft/s USE TRM DITCH LINING

Top Width: 8.7010 ft

Froude Number: 1.3600

Critical Depth: 1.4115 ft

Critical Velocity: 4.7182 ft/s

Critical Slope: 0.0152 ft/ft

Critical Top Width: 10.09 ft

Calculated Max Shear Stress: 2.3269 lb/ft^2

Calculated Avg Shear Stress: 1.1179 lb/ft^2

Channel Analysis: Channel Analysis-Ditch-4600-5225-S

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Longitudinal Slope: 0.0300 ft/ft

Manning's n: 0.0300

Flow: 10.4000 cfs

Result Parameters

Depth: 0.8071 ft

Area of Flow: 2.2798 ft^2

Wetted Perimeter: 5.8798 ft

Hydraulic Radius: 0.3877 ft

Average Velocity: 4.5619 ft/s

Top Width: 5.6495 ft

Froude Number: 1.2655

Critical Depth: 0.8905 ft

Critical Velocity: 3.7475 ft/s

Critical Slope: 0.0178 ft/ft

Critical Top Width: 6.36 ft

Calculated Max Shear Stress: 1.5108 lb/ft^2

Calculated Avg Shear Stress: 0.7258 lb/ft^2

Channel Analysis: Channel Analysis-Ditch-5225-5825-N

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0300

Flow: 16.5000 cfs

Result Parameters

Depth: 1.1791 ft

Area of Flow: 4.8657 ft^2

Wetted Perimeter: 8.5900 ft

Hydraulic Radius: 0.5664 ft

Average Velocity: 3.3911 ft/s

Top Width: 8.2535 ft

Froude Number: 0.7783

Critical Depth: 1.0710 ft

Critical Velocity: 4.1099 ft/s

Critical Slope: 0.0167 ft/ft

Critical Top Width: 7.65 ft

Calculated Max Shear Stress: 0.7357 lb/ft^2

Calculated Avg Shear Stress: 0.3535 lb/ft^2

Channel Analysis: Channel Analysis-Ditch-5225-2825-S

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0300

Flow: 5.2000 cfs

Result Parameters

Depth: 0.7647 ft

Area of Flow: 2.0466 ft^2

Wetted Perimeter: 5.5711 ft

Hydraulic Radius: 0.3674 ft

Average Velocity: 2.5408 ft/s

Top Width: 5.3528 ft

Froude Number: 0.7241

Critical Depth: 0.6748 ft

Critical Velocity: 3.2624 ft/s

Critical Slope: 0.0195 ft/ft

Critical Top Width: 4.82 ft

Calculated Max Shear Stress: 0.4772 lb/ft^2

Calculated Avg Shear Stress: 0.2292 lb/ft^2

Channel Analysis: Channel Analysis-Ditch-5825-6125-N

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0300

Flow: 4.3000 cfs

Result Parameters

Depth: 0.7121 ft

Area of Flow: 1.7748 ft^2

Wetted Perimeter: 5.1878 ft

Hydraulic Radius: 0.3421 ft

Average Velocity: 2.4229 ft/s

Top Width: 4.9846 ft

Froude Number: 0.7156

Critical Depth: 0.6254 ft

Critical Velocity: 3.1407 ft/s

Critical Slope: 0.0200 ft/ft

Critical Top Width: 4.47 ft

Calculated Max Shear Stress: 0.4443 lb/ft^2

Calculated Avg Shear Stress: 0.2135 lb/ft^2

Channel Analysis: Channel Analysis-Ditch-5825-6125-S

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 3.0000 ft/ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0300

Flow: 5.2000 cfs

Result Parameters

Depth: 0.7647 ft

Area of Flow: 2.0466 ft^2

Wetted Perimeter: 5.5711 ft

Hydraulic Radius: 0.3674 ft

Average Velocity: 2.5408 ft/s

Top Width: 5.3528 ft

Froude Number: 0.7241

Critical Depth: 0.6748 ft

Critical Velocity: 3.2624 ft/s

Critical Slope: 0.0195 ft/ft

Critical Top Width: 4.82 ft

Calculated Max Shear Stress: 0.4772 lb/ft^2

Calculated Avg Shear Stress: 0.2292 lb/ft^2

Please show cross-sections of all proposed channels with 1ft minimum freeboard.

SILVERADO RANCH - FILING NO. 2
CHANNEL CALCULATIONS
DEVELOPED FLOWS

Per grading on drainage map, depth of channel appears to be 2 feet deep or less. Min depth based on flow depth and freeboard is 2.5'. Please verify grading

PROPOSED CHANNELS

CHANNEL	DESIGN POINT	PROPOSED SLOPE (%)	BOTTOM WIDTH (B, FT)	SIDE SLOPE (Z)	CHANNEL DEPTH (FT)	FRICTION FACTOR (n)	Q100 FLOW (CFS)	Q100 DEPTH (FT)	Q100 VELOCITY (FT/S)	CHANNEL LINING
B1.1	B1.1	0.40	12	4:1	3.0	0.030	93.0	1.5	3.4	GRASS
B4.1	B4.1	0.45	0	4:1	2.0	0.030	30.4	1.6	2.8	GRASS

1) Channel flow calculations based on Manning's Equation
2) Channel depth includes 1' minimum freeboard
3) n = 0.03 for grass-lined non-irrigated channels (minimum)
4) n = 0.035 for riprap-lined channels
5) Vmax = 5.0 fps per El Paso County criteria (p. 10-13) for fescue (dry land grass) for 100-year flows
6) Vmax = 8.0 fps with Erosion Control Blankets (NAG C350 or equal)

Hydraulic Analysis Report

Project Data

Project Title: Project - Silverado Ranch Flg. 2 - Channels

Designer: JPS

Project Date: Tuesday, January 30, 2024

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis-B1.1

Notes:

Input Parameters

Channel Type: Trapezoidal

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Channel Width: 12.0000 ft

Longitudinal Slope: 0.0040 ft/ft

Manning's n: 0.0300

Flow: 93.0000 cfs

Result Parameters

Depth: 1.5212 ft

Area of Flow: 27.5109 ft^2

Wetted Perimeter: 24.5442 ft

Hydraulic Radius: 1.1209 ft

Average Velocity: 3.3805 ft/s

Top Width: 24.1697 ft

Froude Number: 0.5584

Critical Depth: 1.0840 ft

Critical Velocity: 5.2519 ft/s

Critical Slope: 0.0141 ft/ft

Critical Top Width: 20.67 ft

Calculated Max Shear Stress: 0.3797 lb/ft^2

Calculated Avg Shear Stress: 0.2798 lb/ft^2

Channel Analysis: Channel Analysis-B4.1

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 4.0000 ft/ft

Side Slope 2 (Z2): 4.0000 ft/ft

Longitudinal Slope: 0.0045 ft/ft

Manning's n: 0.0300

Flow: 30.4000 cfs

Result Parameters

Depth: 1.6341 ft

Area of Flow: 10.6817 ft^2

Wetted Perimeter: 13.4755 ft

Hydraulic Radius: 0.7927 ft

Average Velocity: 2.8460 ft/s

Top Width: 13.0731 ft

Froude Number: 0.5549

Critical Depth: 1.2911 ft

Critical Velocity: 4.5592 ft/s

Critical Slope: 0.0158 ft/ft

Critical Top Width: 10.33 ft

Calculated Max Shear Stress: 0.4589 lb/ft^2

Calculated Avg Shear Stress: 0.2226 lb/ft^2

SILVERADO RANCH FILING NO. 2
CULVERT DESIGN SUMMARY

BASIN	DESIGN POINT	RD CL ELEV	INV IN ELEV	INV OUT ELEV	PIPE LENGTH (FT)	N0. OF PIPES	PIPE DIA (FT)	TOTAL Q_5 (CFS)	PER PIPE Q_5 (CFS)	Q_5 MAX ALLOWABLE HEADWATER [1]	CALC Q_5 HW ELEV	TOTAL Q_{100} (CFS)	PER PIPE Q_{100} (CFS)	Q_{100} MAX ALLOWABLE HEADWATER [2]	CALC Q_{100} HW ELEV
SILVERADO HILL VIEW:															
B1.1	B1.1	5822.16	5816.90	5816.50	70.0	1	**3.0**	12.7	12.7	5819.9	5818.4	93.0	93.0	5822.34	5822.34
B4.1	B4.1	5801.03	5797.53	5797.13	70.0	1	**2.0**	9.1	9.1	5799.5	5799.1	30.4	30.4	5801.21	5801.10

[1] Q_5 MAX. ALLOWABLE HEADWATER, HW/D = 1.0

[2] Q_{100} MAX. ALLOWABLE HEADWATER = 6" DEPTH AT SHOULDER (PER DCM TABLE 6-1)

HY-8 Culvert Analysis Report - Culvert B1.1

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

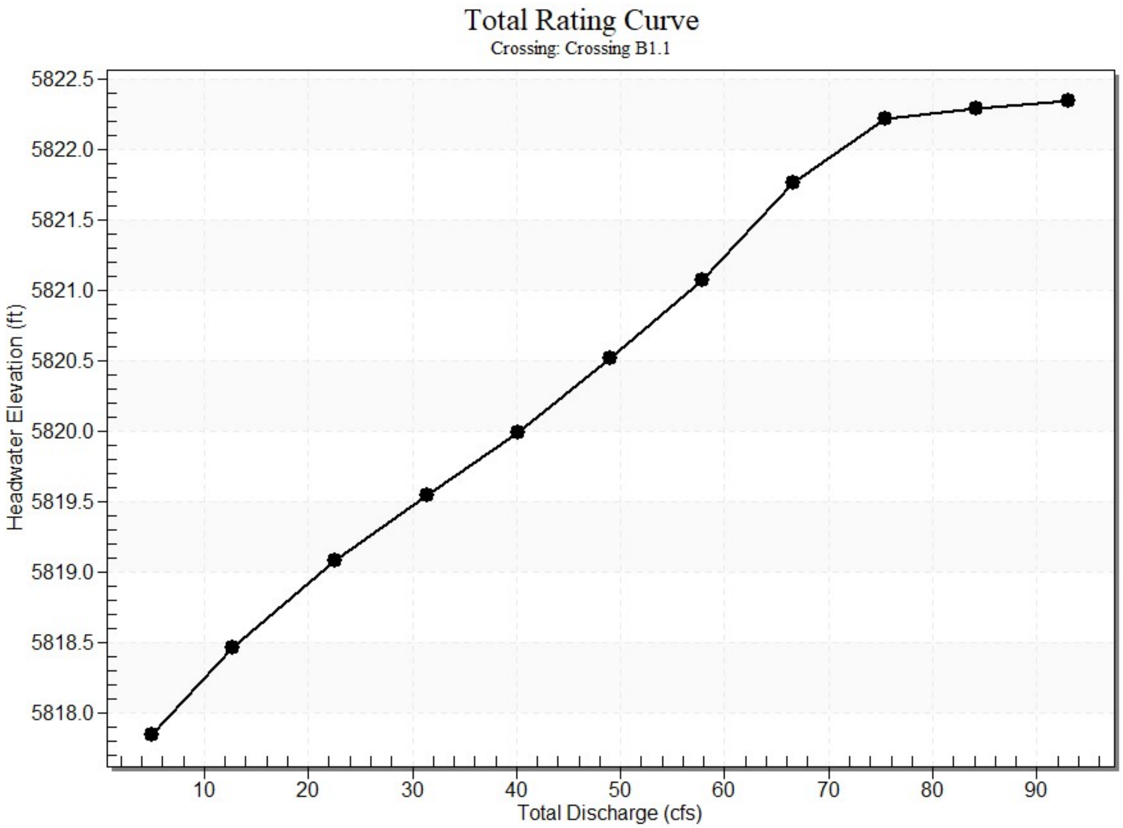
Design Flow: 12.70 cfs

Maximum Flow: 93.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Crossing B1.1

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert B1.1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
5817.85	5.00	5.00	0.00	1
5818.46	12.70	12.70	0.00	1
5819.08	22.60	22.60	0.00	1
5819.54	31.40	31.40	0.00	1
5819.99	40.20	40.20	0.00	1
5820.52	49.00	49.00	0.00	1
5821.07	57.80	57.80	0.00	1
5821.76	66.60	66.60	0.00	1
5822.22	75.40	71.73	3.47	16
5822.29	84.20	72.48	11.50	5
5822.34	93.00	73.05	19.73	4
5822.16	71.11	71.11	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing B1.1



Culvert Data: Culvert B1.1

Table 1 - Culvert Summary Table: Culvert B1.1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	5.00 cfs	5817.85	0.95	0.313	1-S2n	0.64	0.70	0.64	0.51	4.56	1.63
12.70 cfs	12.70 cfs	5818.46	1.56	0.818	1-S2n	1.02	1.13	1.03	0.82	5.93	2.12
22.60 cfs	22.60 cfs	5819.08	2.18	1.400	1-S2n	1.41	1.53	1.41	1.09	6.91	2.48
31.40 cfs	31.40 cfs	5819.54	2.64	1.939	1-S2n	1.71	1.82	1.72	1.28	7.51	2.70
40.20 cfs	40.20 cfs	5819.99	3.09	2.520	5-S2n	2.02	2.06	2.02	1.43	7.93	2.88
49.00 cfs	49.00 cfs	5820.52	3.59	3.618	7-M2c	2.38	2.28	2.28	1.57	8.51	3.03
57.80 cfs	57.80 cfs	5821.07	4.17	4.104	7-M2c	3.00	2.46	2.46	1.69	9.31	3.17
66.60 cfs	66.60 cfs	5821.76	4.86	4.747	7-M2c	3.00	2.61	2.61	1.81	10.20	3.28
75.40 cfs	71.73 cfs	5822.22	5.32	5.181	7-M2c	3.00	2.68	2.68	1.91	10.76	3.39
84.20 cfs	72.48 cfs	5822.29	5.39	5.244	7-M2c	3.00	2.69	2.69	2.01	10.85	3.49
93.00 cfs	73.05 cfs	5822.34	5.44	5.292	7-M2c	3.00	2.70	2.70	2.10	10.91	3.58

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

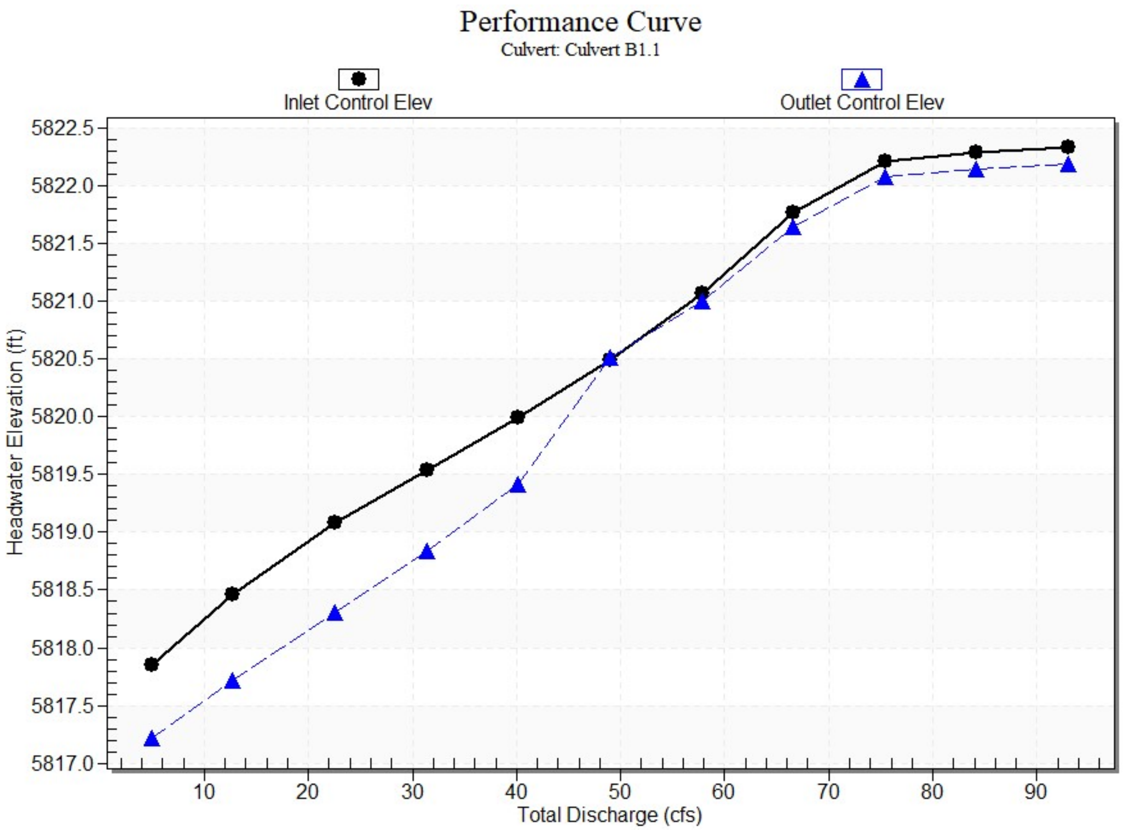
Inlet Elevation (invert): 5816.90 ft,

Outlet Elevation (invert): 5816.50 ft

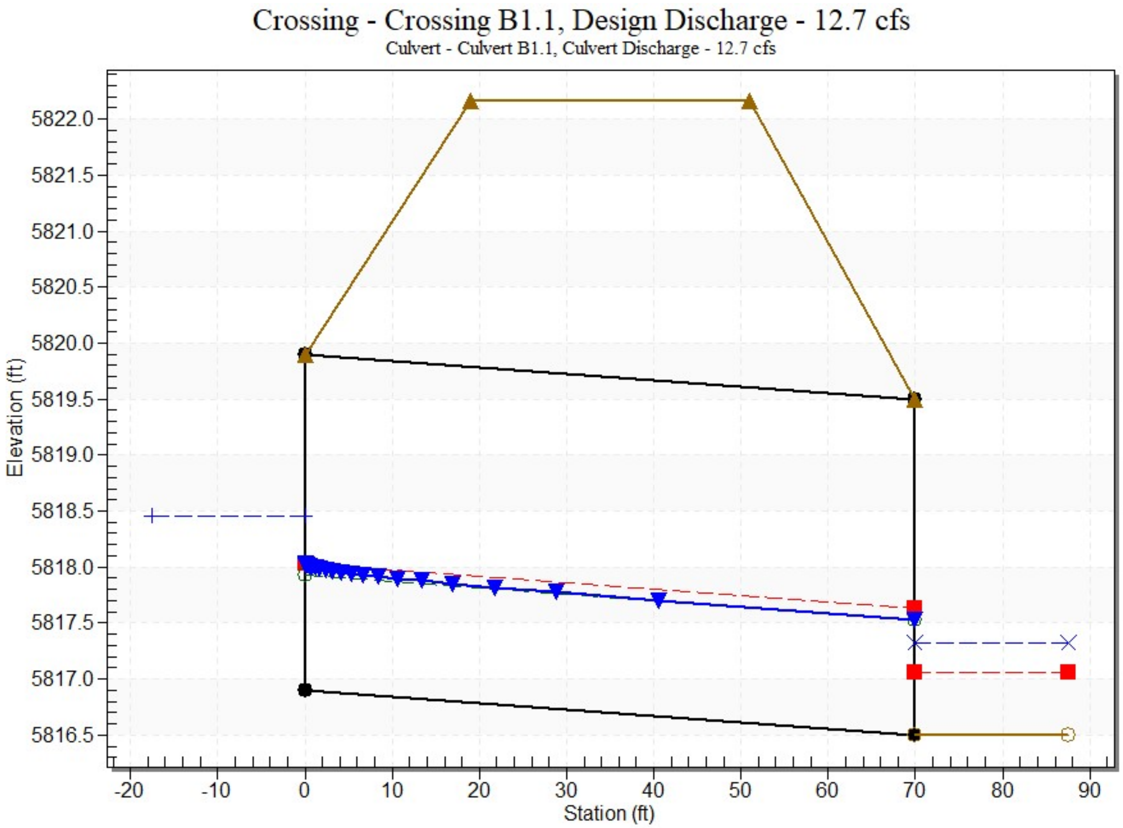
Culvert Length: 70.00 ft,

Culvert Slope: 0.0057

Culvert Performance Curve Plot: Culvert B1.1



Water Surface Profile Plot for Culvert: Culvert B1.1



Site Data - Culvert B1.1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 5816.90 ft

Outlet Station: 70.00 ft

Outlet Elevation: 5816.50 ft

Number of Barrels: 1

Culvert Data Summary - Culvert B1.1

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting (Ke=0.2)

Inlet Depression: None

Tailwater Data for Crossing: Crossing B1.1

Table 2 - Downstream Channel Rating Curve (Crossing: Crossing B1.1)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	5817.01	0.51	1.63	0.13	0.47
12.70	5817.32	0.82	2.12	0.21	0.50
22.60	5817.59	1.09	2.48	0.27	0.52
31.40	5817.78	1.28	2.70	0.32	0.53

40.20	5817.93	1.43	2.88	0.36	0.53
49.00	5818.07	1.57	3.03	0.39	0.54
57.80	5818.19	1.69	3.17	0.42	0.55
66.60	5818.31	1.81	3.28	0.45	0.55
75.40	5818.41	1.91	3.39	0.48	0.56
84.20	5818.51	2.01	3.49	0.50	0.56
93.00	5818.60	2.10	3.58	0.52	0.56

Tailwater Channel Data - Crossing B1.1

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0040

Channel Manning's n: 0.0300

Channel Invert Elevation: 5816.50 ft

Roadway Data for Crossing: Crossing B1.1

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 5822.16 ft

Roadway Surface: Gravel

Roadway Top Width: 32.00 ft

HY-8 Culvert Analysis Report - Culvert B4.1

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.00 cfs

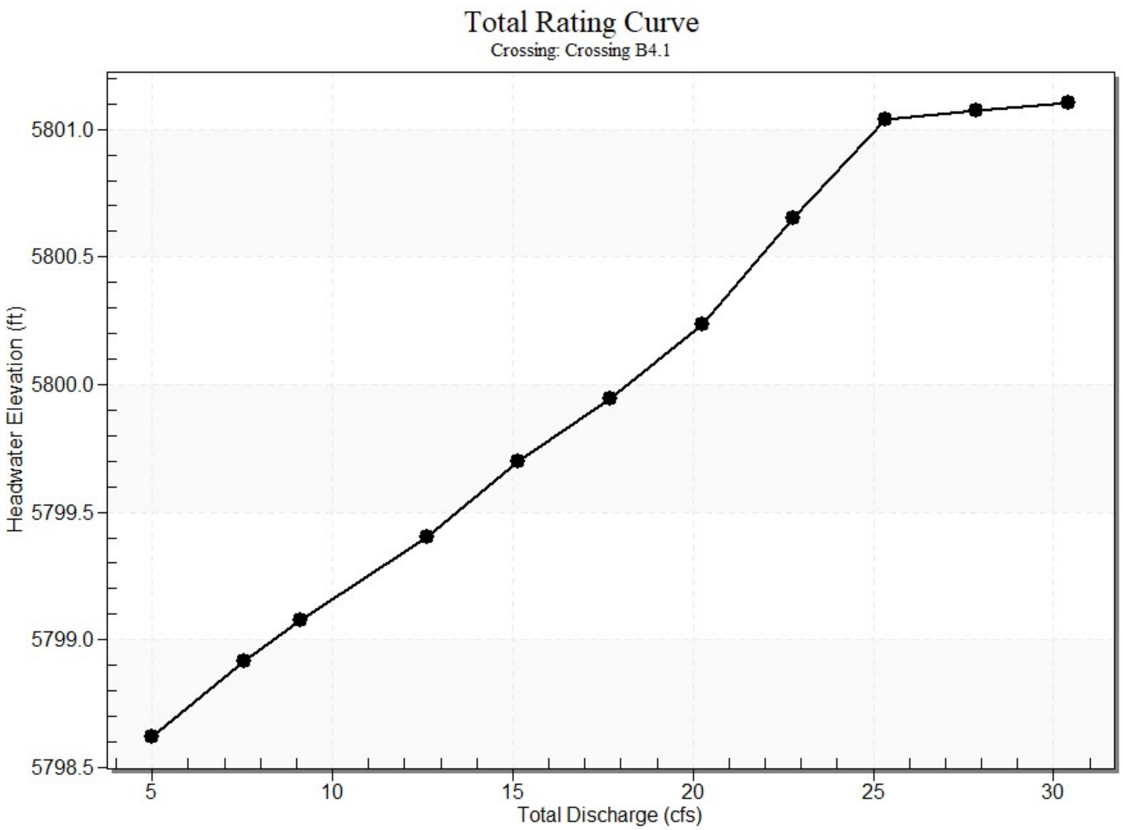
Design Flow: 9.10 cfs

Maximum Flow: 30.40 cfs

Table 3 - Summary of Culvert Flows at Crossing: Crossing B4.1

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert B4.1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
5798.62	5.00	5.00	0.00	1
5798.92	7.54	7.54	0.00	1
5799.08	9.10	9.10	0.00	1
5799.40	12.62	12.62	0.00	1
5799.70	15.16	15.16	0.00	1
5799.95	17.70	17.70	0.00	1
5800.24	20.24	20.24	0.00	1
5800.65	22.78	22.78	0.00	1
5801.04	25.32	24.96	0.25	34
5801.08	27.86	25.16	2.56	5
5801.10	30.40	25.31	4.98	4
5801.03	24.91	24.91	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing B4.1



Culvert Data: Culvert B4.1

Table 2 - Culvert Summary Table: Culvert B4.1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00 cfs	5.00 cfs	5798.62	1.09	0.512	1-S2n	0.74	0.79	0.74	0.83	4.73	1.81
7.54 cfs	7.54 cfs	5798.92	1.39	0.761	1-S2n	0.93	0.98	0.93	0.97	5.28	2.01
9.10 cfs	9.10 cfs	5799.08	1.55	0.946	1-S2n	1.04	1.08	1.04	1.04	5.54	2.11
12.62 cfs	12.62 cfs	5799.40	1.87	1.395	1-S2n	1.28	1.28	1.28	1.18	5.96	2.28
15.16 cfs	15.16 cfs	5799.70	2.12	2.170	7-M2c	1.46	1.40	1.40	1.26	6.44	2.39
17.70 cfs	17.70 cfs	5799.95	2.38	2.415	7-M2c	1.71	1.52	1.52	1.33	6.93	2.49
20.24 cfs	20.24 cfs	5800.24	2.69	2.706	7-M2c	2.00	1.61	1.61	1.40	7.45	2.57
22.78 cfs	22.78 cfs	5800.65	3.03	3.124	7-M2c	2.00	1.70	1.70	1.47	8.01	2.65
25.32 cfs	24.96 cfs	5801.04	3.37	3.510	7-M2c	2.00	1.76	1.76	1.53	8.52	2.72
27.86 cfs	25.16 cfs	5801.08	3.40	3.545	7-M2c	2.00	1.77	1.77	1.58	8.57	2.78
30.40 cfs	25.31 cfs	5801.10	3.43	3.573	7-M2c	2.00	1.77	1.77	1.63	8.61	2.85

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

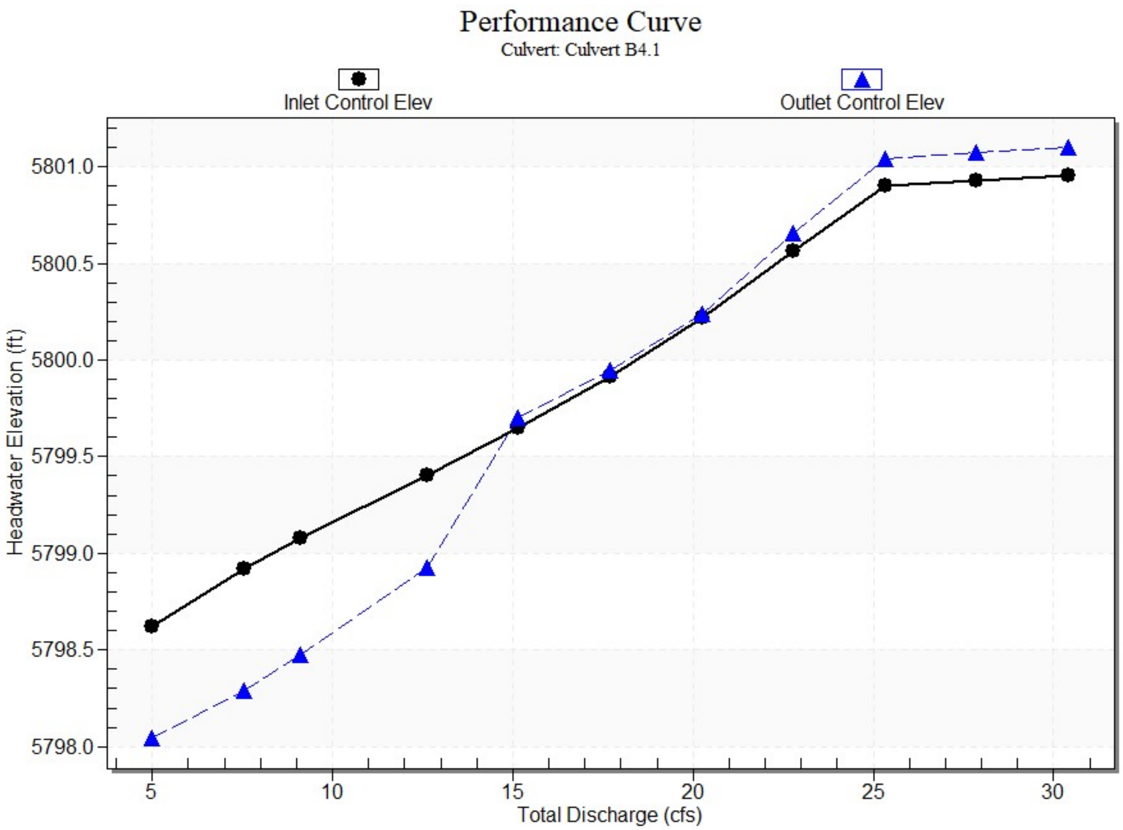
Inlet Elevation (invert): 5797.53 ft,

Outlet Elevation (invert): 5797.13 ft

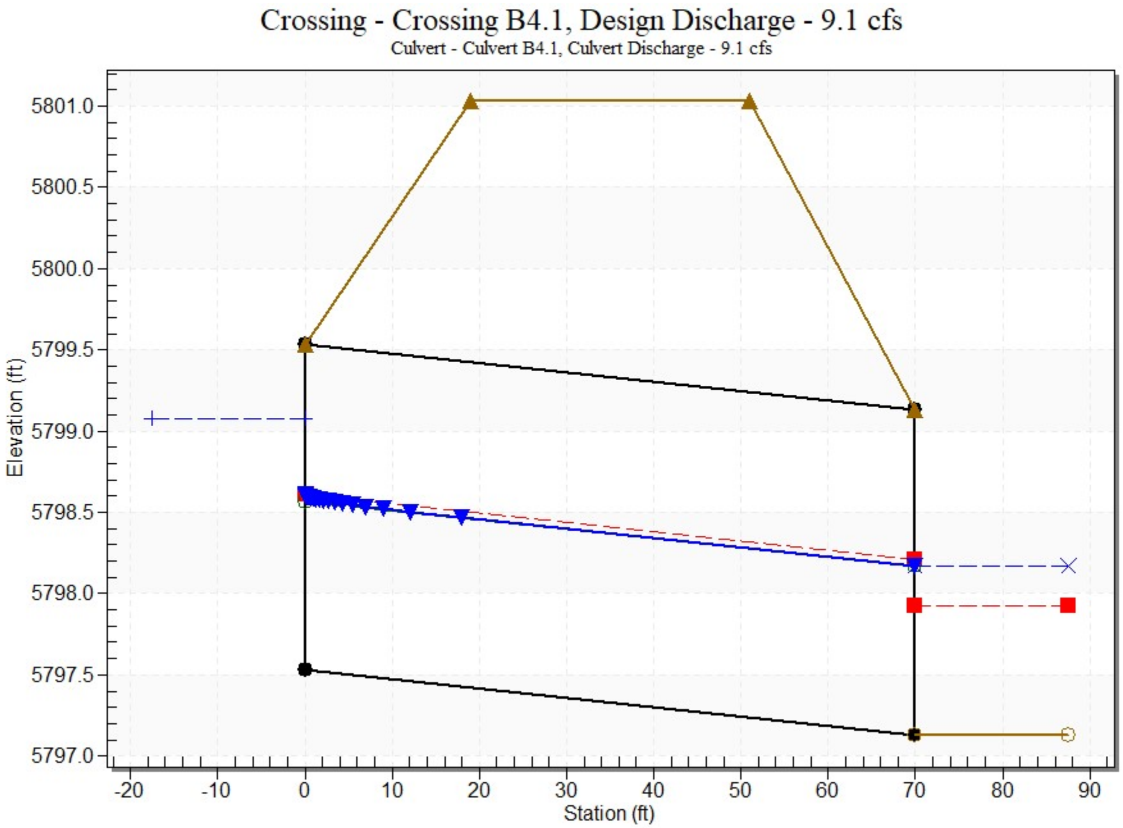
Culvert Length: 70.00 ft,

Culvert Slope: 0.0057

Culvert Performance Curve Plot: Culvert B4.1



Water Surface Profile Plot for Culvert: Culvert B4.1



Site Data - Culvert B4.1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 5797.53 ft

Outlet Station: 70.00 ft

Outlet Elevation: 5797.13 ft

Number of Barrels: 1

Culvert Data Summary - Culvert B4.1

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material:

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting (Ke=0.2)

Inlet Depression: None

Tailwater Data for Crossing: Crossing B4.1

Table 4 - Downstream Channel Rating Curve (Crossing: Crossing B4.1)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
5.00	5797.96	0.83	1.81	0.23	0.50
7.54	5798.10	0.97	2.01	0.27	0.51
9.10	5798.17	1.04	2.11	0.29	0.51
12.62	5798.31	1.18	2.28	0.33	0.53

15.16	5798.39	1.26	2.39	0.35	0.53
17.70	5798.46	1.33	2.49	0.37	0.54
20.24	5798.53	1.40	2.57	0.39	0.54
22.78	5798.60	1.47	2.65	0.41	0.54
25.32	5798.66	1.53	2.72	0.43	0.55
27.86	5798.71	1.58	2.78	0.44	0.55
30.40	5798.76	1.63	2.85	0.46	0.55

Tailwater Channel Data - Crossing B4.1

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 4.00 (_:1)

Channel Slope: 0.0045

Channel Manning's n: 0.0300

Channel Invert Elevation: 5797.13 ft

Roadway Data for Crossing: Crossing B4.1

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 5801.03 ft

Roadway Surface: Gravel

Roadway Top Width: 32.00 ft

APPENDIX D

DRAINAGE COST ESTIMATE

SILVERADO RANCH - FILING NO. 2
DRAINAGE IMPROVEMENTS COST ESTIMATE

Item No.	Description	Quantity	Unit	Unit Cost ($$$)	Total Cost ($$$)
	DRAINAGE IMPROVEMENTS				
203	Grass-Lined Drainage Channels	2940	LF	$5	$14,700
506	Riprap Culvert Aprons (d_{50} = 12")	30	TN	$104	$3,120
603	24" RCP Culvert w/ FES	82	LF	$98	$8,036
603	36" RCP Culvert w/ FES	82	LF	$151	$12,382
	SUBTOTAL				**$38,238**
	Contingency @ 15%				**$5,736**
	TOTAL				**$43,974**

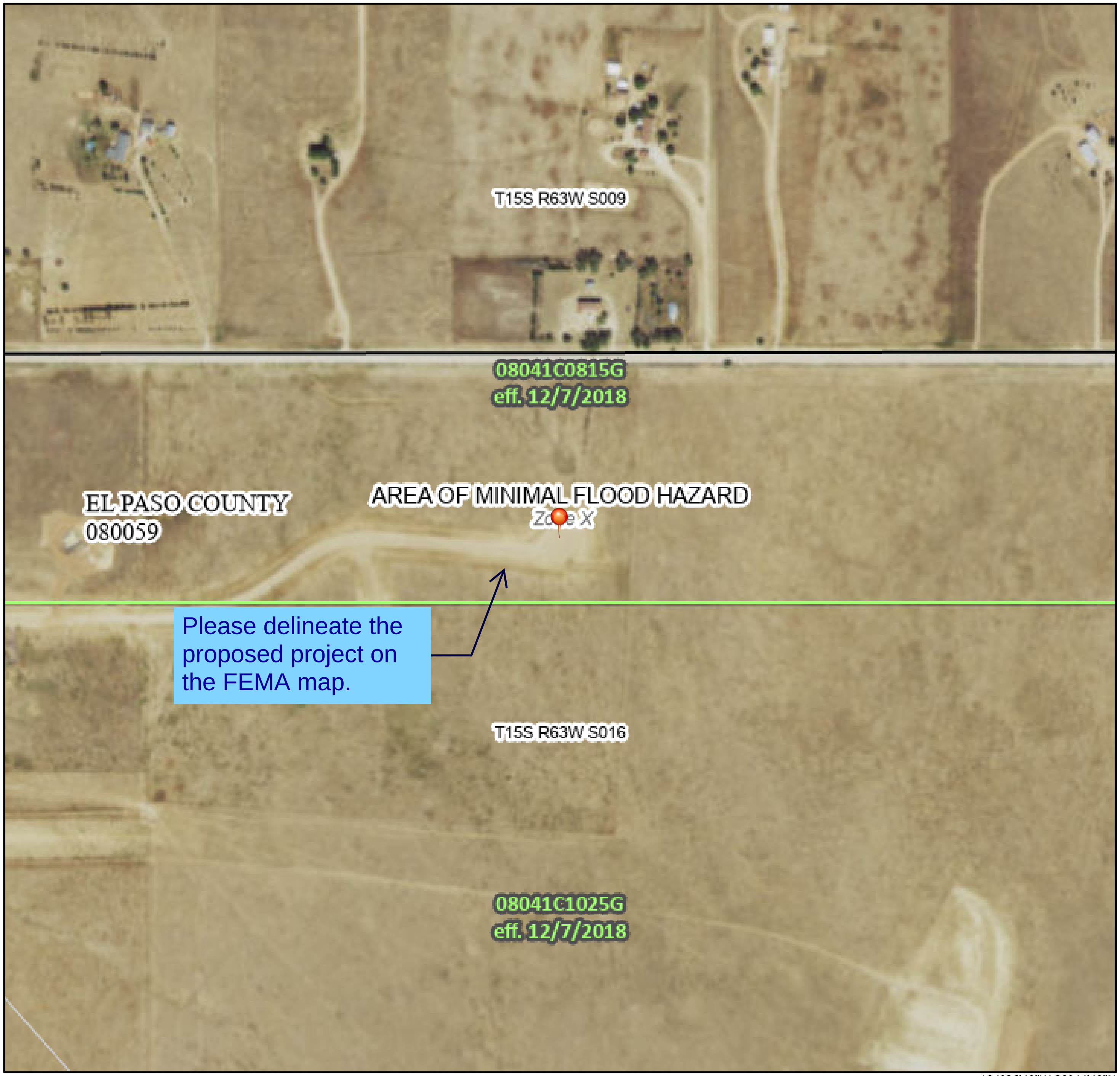
APPENDIX E

FIGURES

National Flood Hazard Layer FIRMette

FEMA

104°27'17"W 38°45'16"N



104°26'40"W 38°44'48"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

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

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

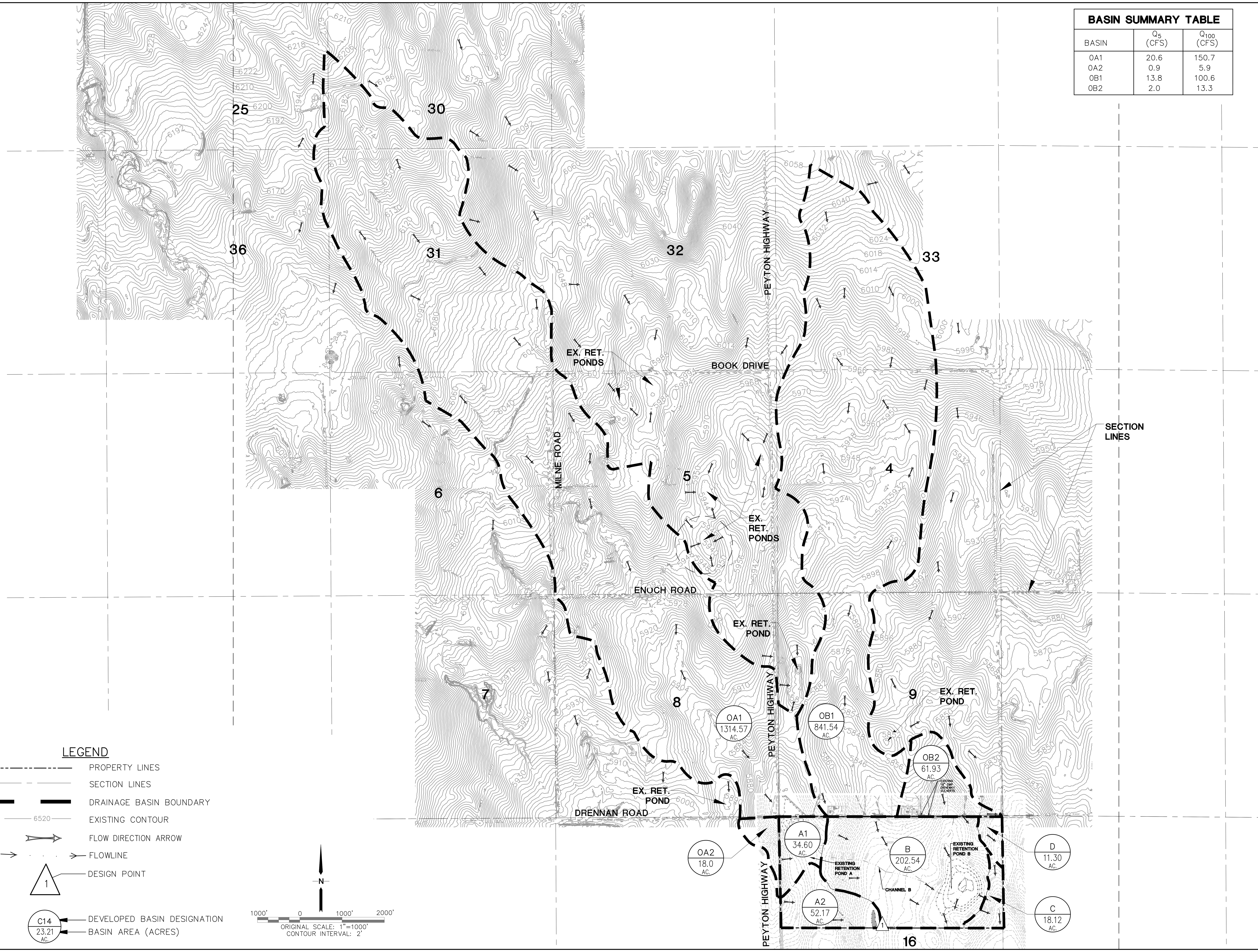
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/31/2024 at 10:16 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

BASIN SUMMARY TABLE		
BASIN	Q_5 (CFS)	Q_{100} (CFS)
0A1	20.6	150.7
0A2	0.9	5.9
0B1	13.8	100.6
0B2	2.0	13.3



LEGEND

- PROPERTY LINES
- SECTION LINES
- DRAINAGE BASIN BOUNDARY
- 6520 EXISTING CONTOUR
- FLOW DIRECTION ARROW
- FLOWLINE
- 1 DESIGN POINT
- C14 DEVELOPED BASIN DESIGNATION
- 23.21 AC. BASIN AREA (ACRES)

1000' 0 1000' 2000'
ORIGINAL SCALE: 1"=1000'
CONTOUR INTERVAL: 2'

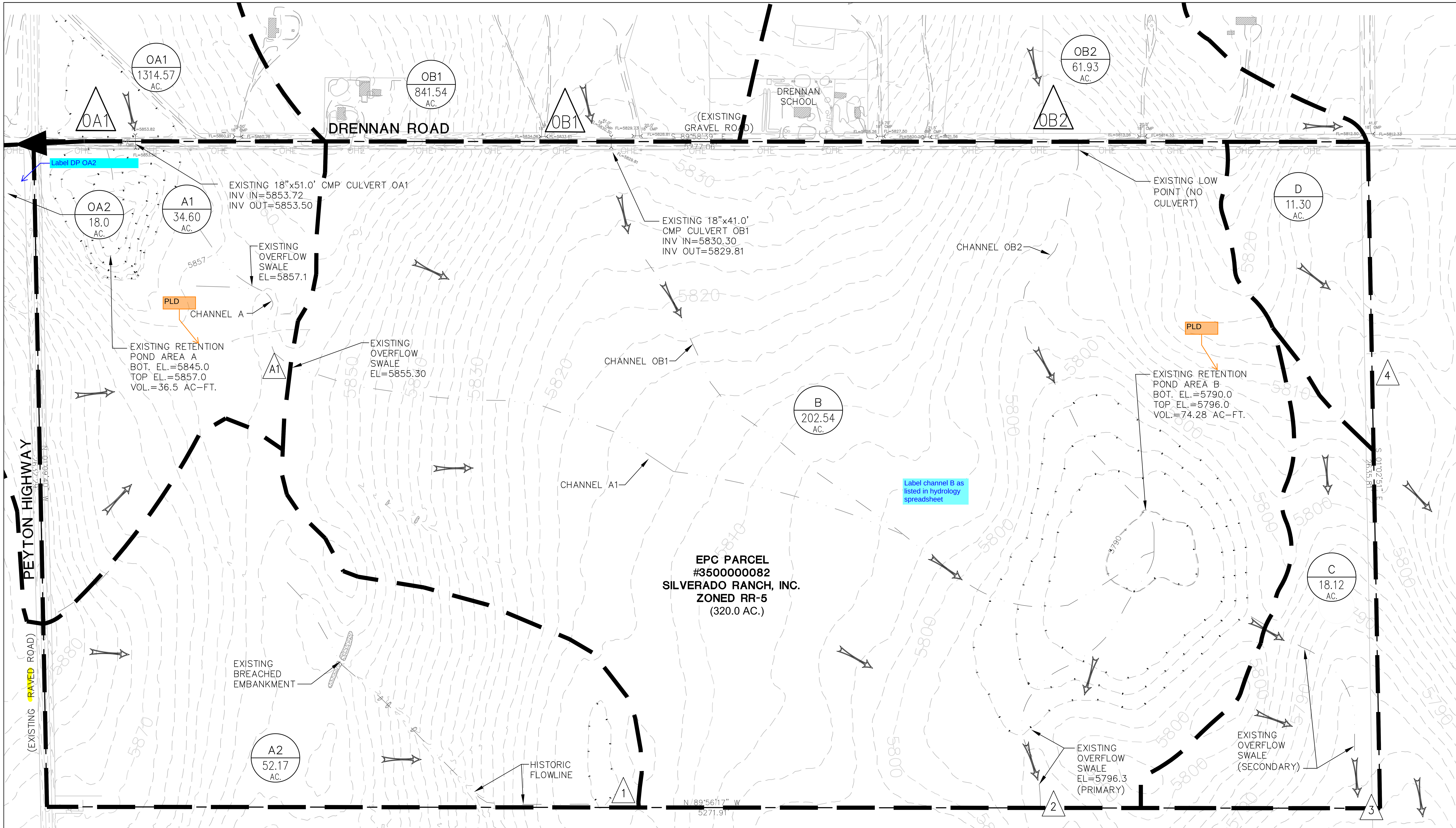
JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766

SILVERADO RANCH FILING NO. 2

MAJOR BASIN/ HISTORIC DRAINAGE PLAN

No.	REVISION	BY	DATE

HORZ. SCALE: 1"=1000'	DRAWN: RMD
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: LWA/GIS	CHECKED: JPS
CREATED: 8/28/06	LAST MODIFIED: 02/01/24
PROJECT NO: 080603	MODIFIED BY: PV
SHEET:	EX1



LEGEND

- PROPERTY LINES
- DRAINAGE BASIN BOUNDARY
- 6520 EXISTING CONTOUR
- FLOW DIRECTION ARROW
- FLOWLINE
- DESIGN POINT
- XX DEVELOPED BASIN DESIGNATION
- XXXX AC. BASIN AREA (ACRES)

EPC PARCEL
#3500000017
STATE OF COLORADO
ZONED RR-5
(320.0 AC.)

Include adjacent property owner information

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q_5 (CFS)	Q_{100} (CFS)
OA1	20.6	150.7
OA2	0.9	5.9
OB1	13.8	100.6
OB2	2.0	13.3
A1	22.7	159.1
1	6.4	47.2
2	44.2	284.1
3	2.0	14.4
4	2.6	19.1

N
200' 0 200' 400'
SCALE: 1"=200'
CONTOUR INTERVAL = 2'

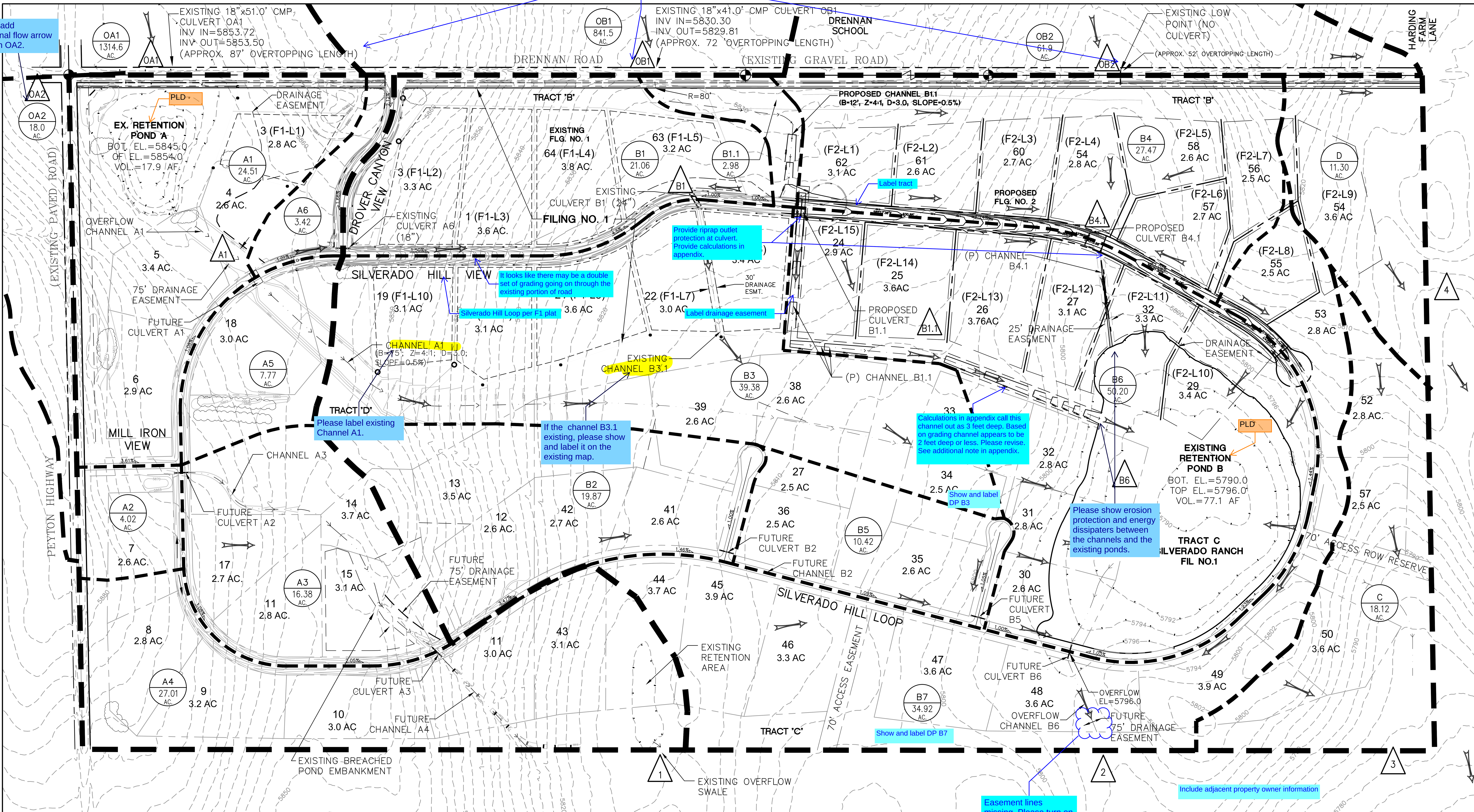
JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766

SILVERADO RANCH FILING NO. 2

HISTORIC DRAINAGE PLAN

No.	REVISION	BY	DATE

HORZ. SCALE: 1"=200'		DRAWN:	RMD
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	LWA	CHECKED:	JPS
CREATED:	8/28/06	LAST MODIFIED:	02/01/24
PROJECT NO:	080603	MODIFIED BY:	PV
SHEET:	EX2		



Include adjacent property owner information

Include all basins and design points on the hydrology calculation spreadsheets which are shown on drainage maps.

Turn off future improvements. If you want this information left in the report, refer to it as an "ultimate condition" map. Need to have proposed drainage map showing only existing and proposed conditions. Revise any drainage basins and routing as needed for this condition.

List all storm facilities/structures as public or private

Provide cross sections for drainage channels B1.1 & B4.1

LEGEND

- PROPERTY LINES
- MAJOR DRAINAGE BASIN BOUNDARY
- MINOR DRAINAGE BASIN BOUNDARY
- 6520 EXISTING CONTOUR
- FLOW DIRECTION ARROW
- FLOWLINE
- DESIGN POINT (3)
- DEVELOPED BASIN DESIGNATION (C14)
- BASIN AREA (ACRES) (23.21 AC.)

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
1	16.5	79.6
OA1	20.6	150.7
A1	23.6	159.0
OB1	13.8	100.6
B1.1	12.7	93.0
B4.1	4.6	30.4
B6	61.8	282.0
2	65.6	285.6
3	3.5	16.7
4	4.6	22.0

DP's OA2, OB2, B3 and B7 missing from summary table

BASIN SUMMARY TABLE

BASIN	Q5 (CFS)	Q100 (CFS)
B4	17.1	82.3
B6	21.5	103.6
B7	8.8	42.5
C	3.5	16.7
D	4.6	22.0

N

200' 0 200' 400'

ORIGINAL SCALE: 1"=200'
CONTOUR INTERVAL = 2'

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

No.	REVISION	BY	DATE
1	COUNTY SUBMITTAL	JPS	02/01/24

SILVERADO RANCH

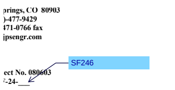
DEVELOPED DRAINAGE PLAN

HORZ. SCALE: 1"=200'		DRAWN:	PV
VERT. SCALE: N/A		DESIGNED:	JPS
SURVEYED: LWA		CHECKED:	JPS
CREATED: 8/28/06		LAST MODIFIED:	02/01/24
PROJECT NO: 080603		MODIFIED BY:	PV

SHEET: D1

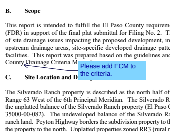
V1_Drainage Report - Final.pdf Markup Summary

Callout (35)



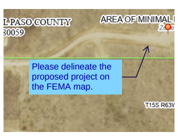
Subject: Callout
Page Label: 1
Author: HaoVo
Date: 3/15/2024 11:44:44 AM
Status:
Color: ■
Layer:
Space:

SF246



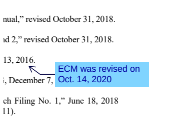
Subject: Callout
Page Label: 4
Author: HaoVo
Date: 3/15/2024 11:52:15 AM
Status:
Color: ■
Layer:
Space:

Please add ECM to the criteria.



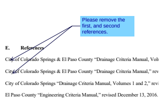
Subject: Callout
Page Label: 87
Author: HaoVo
Date: 3/15/2024 12:59:51 PM
Status:
Color: ■
Layer:
Space:

Please delineate the proposed project on the FEMA map.



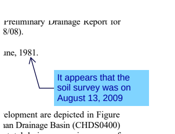
Subject: Callout
Page Label: 6
Author: HaoVo
Date: 3/15/2024 1:18:41 PM
Status:
Color: ■
Layer:
Space:

ECM was revised on Oct. 14, 2020



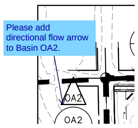
Subject: Callout
Page Label: 6
Author: HaoVo
Date: 4/2/2024 9:46:12 AM
Status:
Color: ■
Layer:
Space:

Please remove the first, and second references.



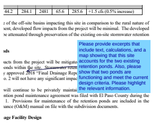
Subject: Callout
Page Label: 6
Author: HaoVo
Date: 3/15/2024 1:22:46 PM
Status:
Color: ■
Layer:
Space:

It appears that the soil survey was on August 13, 2009



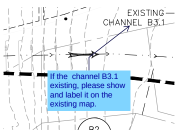
Subject: Callout
Page Label: [1] D1
Author: HaoVo
Date: 3/21/2024 3:54:04 PM
Status:
Color:
Layer:
Space:

Please add directional flow arrow to Basin OA2.



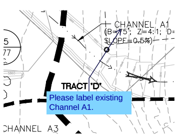
Subject: Callout
Page Label: 13
Author: HaoVo
Date: 3/28/2024 11:27:34 AM
Status:
Color:
Layer:
Space:

Please provide excerpts that include text, calculations, and a map showing that this site accounts for the two existing retention ponds. Also, please show that two ponds are functioning and meet the current design criteria. Please highlight the relevant information.



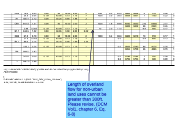
Subject: Callout
Page Label: [1] D1
Author: HaoVo
Date: 3/15/2024 2:32:30 PM
Status:
Color:
Layer:
Space:

If the channel B3.1 existing, please show and label it on the existing map.



Subject: Callout
Page Label: [1] D1
Author: HaoVo
Date: 3/15/2024 2:33:04 PM
Status:
Color:
Layer:
Space:

Please label existing Channel A1.



Subject: Callout
Page Label: 42
Author: HaoVo
Date: 3/15/2024 2:55:17 PM
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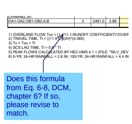
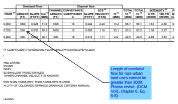
Space:

Length of overland flow for non-urban land uses cannot be greater than 300ft. Please revise. (DCM Vol1, chapter 6, Eq. 6-8)



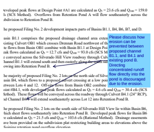
Subject: Callout
Page Label: 42
Author: HaoVo
Date: 3/15/2024 2:53:53 PM
Status:
Color:
Layer:
Space:

Does this formula from Eq. 6-8, DCM, chapter 6? If so, please revise to match.



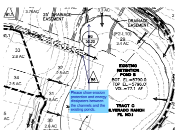
Subject: Callout
Page Label: 48
Author: HaoVo
Date: 3/15/2024 3:00:24 PM
Status:
Color:
Layer:
Space:

Length of overland flow for non-urban land uses cannot be greater than 300ft. Please revise. (DCM Vol1, chapter 6, Eq. 6-8)



Subject: Callout
Page Label: 12
Author: HaoVo
Date: 3/28/2024 11:43:21 AM
Status:
Color:
Layer:
Space:

Please discuss how erosion can be prevented between proposed channel B1.1, and B4.1 and existing pond B.
Directing concentrated runoff flow directly into the pond is discouraged due to the erosion.



Subject: Callout
Page Label: [1] D1
Author: HaoVo
Date: 4/2/2024 9:48:14 AM
Status:
Color:
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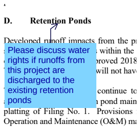
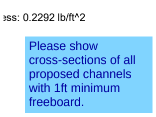
Space:

Please show erosion protection and energy dissipaters between the channels and the existing ponds.



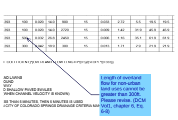
Subject: Callout
Page Label: 13
Author: HaoVo
Date: 3/28/2024 11:27:30 AM
Status:
Color:
Layer:
Space:

Please discuss water rights if runoffs from this project are discharged to the existing retention ponds



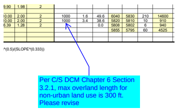
Subject: Callout
Page Label: 65
Author: HaoVo
Date: 3/22/2024 11:13:41 AM
Status:
Color:
Layer:
Space:

Please show cross-sections of all proposed channels with 1ft minimum freeboard.



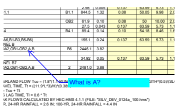
Subject: Callout
Page Label: 51
Author: HaoVo
Date: 3/28/2024 9:37:41 AM
Status:
Color:
Layer:
Space:

Length of overland flow for non-urban land uses cannot be greater than 300ft. Please revise. (DCM Vol1, chapter 6, Eq. 6-8)



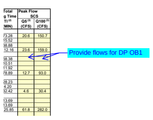
Subject: Callout
Page Label: 33
Author: CDurham
Date: 4/1/2024 3:59:52 PM
Status:
Color:
Layer:
Space:

Per C/S DCM Chapter 6 Section 3.2.1, max overland length for non-urban land use is 300 ft. Please revise



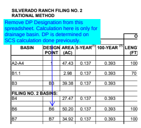
Subject: Callout
Page Label: 42
Author: CDurham
Date: 4/1/2024 4:15:41 PM
Status:
Color:
Layer:
Space:

What is A?



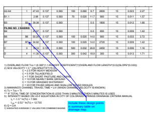
Subject: Callout
Page Label: 42
Author: CDurham
Date: 4/1/2024 4:18:31 PM
Status:
Color:
Layer:
Space:

Provide flows for DP OB1



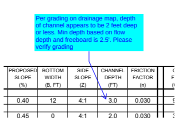
Subject: Callout
Page Label: 51
Author: CDurham
Date: 4/1/2024 4:33:56 PM
Status:
Color:
Layer:
Space:

Remove DP Designation from this spreadsheet. Calculation here is only for drainage basin. DP is determined on SCS calculation done previously.



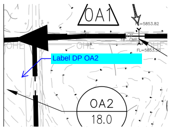
Subject: Callout
Page Label: 51
Author: CDurham
Date: 4/1/2024 4:34:04 PM
Status:
Color:
Layer:
Space:

Include these design points in summary table on drainage map.



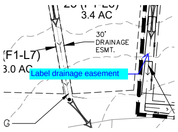
Subject: Callout
Page Label: 66
Author: CDurham
Date: 4/1/2024 5:03:44 PM
Status:
Color:
Layer:
Space:

Per grading on drainage map, depth of channel appears to be 2 feet deep or less. Min depth based on flow depth and freeboard is 2.5'. Please verify grading



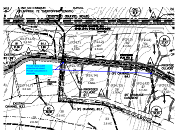
Subject: Callout
Page Label: [1] EX2
Author: CDurham
Date: 4/1/2024 5:13:25 PM
Status:
Color:
Layer:
Space:

Label DP OA2



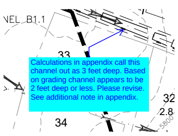
Subject: Callout
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:21:11 PM
Status:
Color:
Layer:
Space:

Label drainage easement



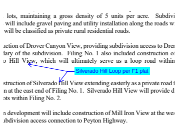
Subject: Callout
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:22:31 PM
Status:
Color:
Layer:
Space:

Provide riprap outlet protection at culvert. Provide calculations in appendix.



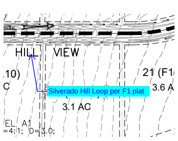
Subject: Callout
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:23:48 PM
Status:
Color:
Layer:
Space:

Calculations in appendix call this channel out as 3 feet deep. Based on grading channel appears to be 2 feet deep or less. Please revise. See additional note in appendix.



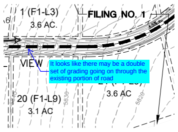
Subject: Callout
Page Label: 5
Author: CDurham
Date: 4/1/2024 5:40:54 PM
Status:
Color:
Layer:
Space:

Silverado Hill Loop per F1 plat



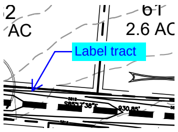
Subject: Callout
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:39:07 PM
Status:
Color:
Layer:
Space:

Silverado Hill Loop per F1 plat



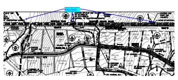
Subject: Callout
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:39:12 PM
Status:
Color:
Layer:
Space:

It looks like there may be a double set of grading going on through the existing portion of road



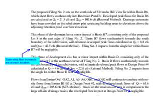
Subject: Callout
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:39:35 PM
Status:
Color:
Layer:
Space:

Label tract



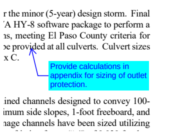
Subject: Callout
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:59:40 PM
Status:
Color:
Layer:
Space:

Provide analysis of these 3 locations, showing the overtopping conditions.



Subject: Callout
Page Label: 12
Author: CDurham
Date: 4/2/2024 7:44:51 AM
Status:
Color:
Layer:
Space:

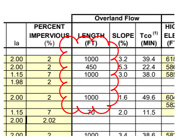
State what flow increases are at each location.



Subject: Callout
Page Label: 14
Author: CDurham
Date: 4/2/2024 7:47:16 AM
Status:
Color:
Layer:
Space:

Provide calculations in appendix for sizing of outlet protection.

Cloud (3)



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Page Label: 42
Author: HaoVo
Date: 3/15/2024 2:52:19 PM
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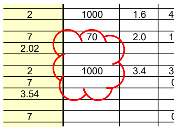

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Page Label: 42
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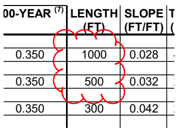
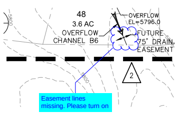


Subject: Cloud
Page Label: 48
Author: HaoVo
Date: 3/15/2024 3:00:28 PM
Status:
Color:
Layer:
Space:

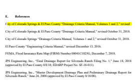
Cloud+ (1)



Subject: Cloud+
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:19:21 PM
Status:
Color:
Layer:
Space:

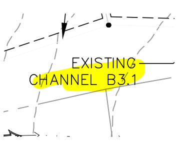
Easement lines missing. Please turn on

Highlight (7)

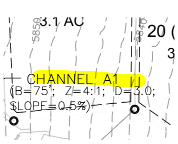


Subject: Highlight
Page Label: 6
Author: HaoVo
Date: 3/15/2024 1:19:51 PM
Status:
Color:
Layer:
Space:

ity of Colorado Springs & El Paso County “Drainage Criteria Manual, Volumes 1 and 2,” revised



Subject: Highlight
Page Label: [1] D1
Author: HaoVo
Date: 3/15/2024 2:28:38 PM
Status:
Color:
Layer:
Space:

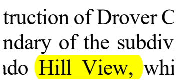


Subject: Highlight
Page Label: [1] D1
Author: HaoVo
Date: 3/15/2024 2:29:32 PM
Status:
Color:
Layer:
Space:

Subject: Highlight
Page Label: 51
Author: HaoVo
Date: 3/15/2024 3:00:53 PM
Status:
Color:
Layer:
Space:

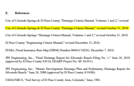
500

Subject: Highlight
Page Label: [1] EX2
Author: CDurham
Date: 4/1/2024 5:13:05 PM
Status:
Color:
Layer:
Space:



Subject: Highlight
Page Label: 5
Author: CDurham
Date: 4/1/2024 5:33:23 PM
Status:
Color:
Layer:
Space:

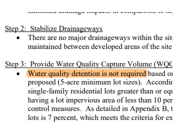
Hill View,



Subject: Highlight
Page Label: 6
Author: HaoVo
Date: 4/2/2024 8:07:01 AM
Status:
Color:
Layer:
Space:

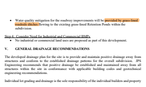
City of Colorado Springs & El Paso County “Drainage Criteria Manual,” revised October 31, 2018.

SW - Highlight (2)



Subject: SW - Highlight
Page Label: 8
Author: Glenn Reese - EPC Stormwater
Date: 3/29/2024 4:43:04 PM
Status:
Color:
Layer:
Space:

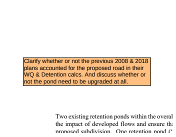
Water quality detention is not required



Subject: SW - Highlight
Page Label: 9
Author: Glenn Reese - EPC Stormwater
Date: 3/29/2024 4:46:46 PM
Status:
Color:
Layer:
Space:

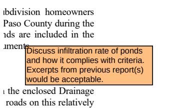
provided by grass-lined
roadside ditches

SW - Textbox (2)



Subject: SW - Textbox
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 4/1/2024 12:11:24 PM
Status:
Color: ■
Layer:
Space:

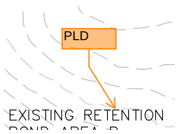
Clarify whether or not the previous 2008 & 2018 plans accounted for the proposed road in their WQ & Detention calcs. And discuss whether or not the pond need to be upgraded at all.



Subject: SW - Textbox
Page Label: 13
Author: Glenn Reese - EPC Stormwater
Date: 4/1/2024 11:28:58 AM
Status:
Color: ■
Layer:
Space:

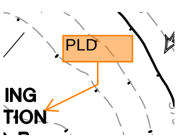
Discuss infiltration rate of ponds and how it complies with criteria. Excerpts from previous report(s) would be acceptable.

SW - Textbox with Arrow (13)



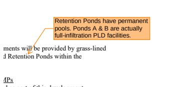
Subject: SW - Textbox with Arrow
Page Label: [1] EX2
Author: Glenn Reese - EPC Stormwater
Date: 3/29/2024 3:57:02 PM
Status:
Color: ■
Layer:
Space:

PLD



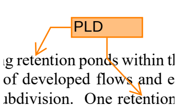
Subject: SW - Textbox with Arrow
Page Label: [1] D1
Author: Glenn Reese - EPC Stormwater
Date: 3/29/2024 3:57:10 PM
Status:
Color: ■
Layer:
Space:

PLD



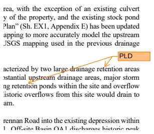
Subject: SW - Textbox with Arrow
Page Label: 9
Author: Glenn Reese - EPC Stormwater
Date: 3/29/2024 3:58:22 PM
Status:
Color: ■
Layer:
Space:

Retention Ponds have permanent pools. Ponds A & B are actually full-infiltration PLD facilities.



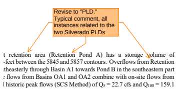
Subject: SW - Textbox with Arrow
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 3/29/2024 3:58:51 PM
Status:
Color: ■
Layer:
Space:

PLD



Subject: SW - Textbox with Arrow
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 3/29/2024 3:59:25 PM
Status:
Color: ■
Layer:
Space:

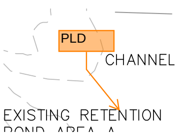
PLD



Subject: SW - Textbox with Arrow
Page Label: 11
Author: Glenn Reese - EPC Stormwater
Date: 4/1/2024 12:12:01 PM
Status:
Color: ■
Layer:
Space:

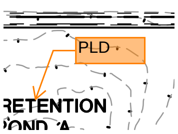
Revise to "PLD."
Typical comment, all instances related to the two Silverado PLDs

---



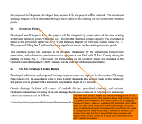
Subject: SW - Textbox with Arrow
Page Label: [1] EX2
Author: Glenn Reese - EPC Stormwater
Date: 3/29/2024 4:11:50 PM
Status:
Color: ■
Layer:
Space:

PLD



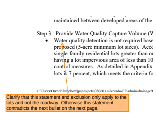
Subject: SW - Textbox with Arrow
Page Label: [1] D1
Author: Glenn Reese - EPC Stormwater
Date: 3/29/2024 4:12:07 PM
Status:
Color: ■
Layer:
Space:

PLD



Subject: SW - Textbox with Arrow
Page Label: 13
Author: Glenn Reese - EPC Stormwater
Date: 4/1/2024 11:19:02 AM
Status:
Color: ■
Layer:
Space:

The FDR from SF1811 states that the two existing ponds do not have capacity for much of the incoming flows. And so there is a lot of overflow from the ponds, which has shown to be a negligible increase in flows. However, regarding WQ treatment, once offsite flows mix with onsite flows which need to be treated, all mixed flows must then be treated. So because the runoff from the roads is mixing with the offsite flows, WQ is needed for all flows. It is common for sites like this to keep offsite flows separate and bypass them around ponds via a swale such that offsite flows don't need to be treated.



Subject: SW - Textbox with Arrow
Page Label: 8
Author: Glenn Reese - EPC Stormwater
Date: 3/29/2024 4:44:09 PM
Status:
Color: ■
Layer:
Space:

Clarify that this statement and exclusion only apply to the lots and not the roadway. Otherwise this statement contradicts the next bullet on the next page.

Subject: SW - Textbox with Arrow
Page Label: 9
Author: Glenn Reese - EPC Stormwater
Date: 3/29/2024 4:48:32 PM
Status:
Color: ■
Layer:
Space:

Unless official Runoff Reduction calcs are provided to prove it, the grass ditches cannot count as providing water quality treatment. Please re-word this accordingly. I believe that the intent is for the PLDs to provide the WQ treatment for the roadway improvements.

Subject: SW - Textbox with Arrow
Page Label: 13
Author: Glenn Reese - EPC Stormwater
Date: 4/1/2024 12:05:51 PM
Status:
Color: ■
Layer:
Space:

Clarify here and/or in Step 3 of the 4-Step Process above whether or not the ponds were originally designed to provide WQ for the proposed Filing 2 roads. Excerpts from previous report(s) would be acceptable.

Subject: SW - Textbox with Arrow
Page Label: 13
Author: Glenn Reese - EPC Stormwater
Date: 4/1/2024 11:18:55 AM
Status:
Color: ■
Layer:
Space:

Please run updating calculations for these ponds using the UD-BMP spreadsheet for PLDs. The Retention Pond calcs in the previous FDRs would have over estimated the volume requirements compared with the PLD calcs. And then explain in this report the discrepancy in naming PLD vs retention in this report vs the previous reports.

Text Box (15)

Subject: Text Box
Page Label: 10
Author: HaoVo
Date: 3/15/2024 2:27:36 PM
Status:
Color: ■
Layer:
Space:

In the existing condition, please discuss on how the existing runoff interacts with the existing channels A1, OB1, OB2, and overflow swales.

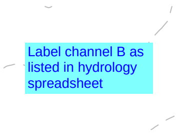
Please also discuss the current condition of these channels.

Subject: Text Box
Page Label: 13
Author: HaoVo
Date: 3/15/2024 2:34:03 PM
Status:
Color: ■
Layer:
Space:

In the proposed condition, please discuss on how the proposed runoff interacts with the existing channels, proposed channels and overflow swales.

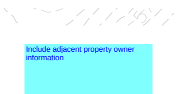
Subject: Text Box
Page Label: 42
Author: CDurham
Date: 4/1/2024 4:17:09 PM
Status:
Color: ■
Layer:
Space:

Include all basins and design points as shown on drainage map.



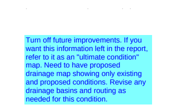
Subject: Text Box
Page Label: [1] EX2
Author: CDurham
Date: 4/1/2024 5:13:53 PM
Status:
Color: ■
Layer:
Space:

Label channel B as listed in hydrology spreadsheet



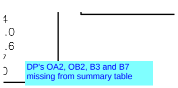
Subject: Text Box
Page Label: [1] EX2
Author: CDurham
Date: 4/1/2024 5:14:23 PM
Status:
Color: ■
Layer:
Space:

Include adjacent property owner information



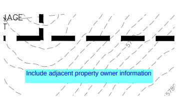
Subject: Text Box
Page Label: [1] D1
Author: CDurham
Date: 4/2/2024 7:51:49 AM
Status:
Color: ■
Layer:
Space:

Turn off future improvements. If you want this information left in the report, refer to it as an "ultimate condition" map. Need to have proposed drainage map showing only existing and proposed conditions. Revise any drainage basins and routing as needed for this condition.



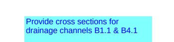
Subject: Text Box
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:17:43 PM
Status:
Color: ■
Layer:
Space:

DP's OA2, OB2, B3 and B7 missing from summary table



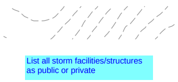
Subject: Text Box
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:18:00 PM
Status:
Color: ■
Layer:
Space:

Include adjacent property owner information



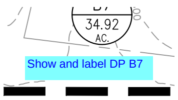
Subject: Text Box
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:18:42 PM
Status:
Color: ■
Layer:
Space:

Provide cross sections for drainage channels B1.1 & B4.1



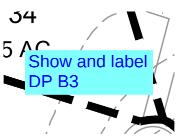
Subject: Text Box
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:19:49 PM
Status:
Color:
Layer:
Space:

List all storm facilities/structures as public or private



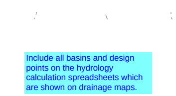
Subject: Text Box
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:20:22 PM
Status:
Color:
Layer:
Space:

Show and label DP B7



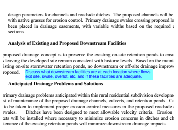
Subject: Text Box
Page Label: [1] D1
Author: CDurham
Date: 4/1/2024 5:20:43 PM
Status:
Color:
Layer:
Space:

Show and label DP B3



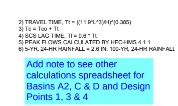
Subject: Text Box
Page Label: [1] D1
Author: CDurham
Date: 4/2/2024 7:51:37 AM
Status:
Color:
Layer:
Space:

Include all basins and design points on the hydrology calculation spreadsheets which are shown on drainage maps.



Subject: Text Box
Page Label: 14
Author: CDurham
Date: 4/2/2024 7:49:03 AM
Status:
Color:
Layer:
Space:

Discuss what downstream facilities are at each location where flows exit site, swale, overlot, etc. and if these facilities are adequate.



Subject: Text Box
Page Label: 33
Author: CDurham
Date: 4/2/2024 9:49:18 AM
Status:
Color:
Layer:
Space:

Add note to see other calculations spreadsheet for Basins A2, C & D and Design Points 1, 3 & 4