#### FINAL DRAINAGE REPORT FOR SADDLEHORN RANCH – FILING 2 EARLY GRADING

Prepared For: ROI Property Group, LLC 2495 Rigdon Street Napa, CA 94558 (707) 365-6891

> May 18, 2022 Project No. 25142.04

Prepared By: JR Engineering, LLC 5475 Tech Center Drive Colorado Springs, CO 80919 719-593-2593

El Paso County PCD File No.: EGP221 Final Drainage Report Filing 2 - Saddlehorn Ranch Early Grading

#### **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 El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

25043

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

#### **DEVELOPER'S STATEMENT:**

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

**Business Name:** 

ROI Property Group, LLC

By:

Title: Address:

2495 Rigdon Street Napa, CA 94558

#### **El Paso County:**

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

Jennifer Irvine, P.E. County Engineer/ ECM Administrator Date

5/24/22

Date

Conditions:



# CONTENTS

PURPOSE	.1
GENERAL LOCATION AND DESCRIPTION	.1
LOCATION DESCRIPTION OF PROPERTY FLOODPLAIN STATEMENT	.1
DRAINAGE BASINS AND SUB-BASINS	.2
Existing Major Basin Descriptions Existing Sub-basin Drainage Proposed Sub-basin Drainage Early Grading Drainage	.5 .5
DRAINAGE DESIGN CRITERIA	.7
Development Criteria Reference Hydrologic Criteria Hydraulic Criteria	.7
DRAINAGE FACILITY DESIGN	.8
GENERAL CONCEPT SPECIFIC DETAILS Four Step Process to Minimize Adverse Impacts of Urbanization	.8
Water Quality Erosion Control Plan	.9 .9
Operation & Maintenance Drainage and Bridge Fees	
SUMMARY	.9
REFERENCES:1	11

#### **APPENDICES**

- A. Figures and Exhibits
- B. Hydrologic Calculations
- C. Hydraulic Calculations
- D. Detention and Water Quality Calculations
- E. Reference Materials
- F. Drainage Maps

#### LIST OF TABLES:

- 1. Major Drainageway Naming Convention
- 2. Major Drainageway Ex. 100 Year Flow Comparison
- 3. Pond Summary



# Purpose

This document is the Final Drainage report for Filing 2 of Saddlehorn Ranch Early Grading. The purpose of this report is to:

- 1. Identify on-site and off-site drainage patterns.
- 2. Recommend necessary storm water facilities to collect and convey storm runoff from the proposed development during early grading operations to appropriate discharge and/or detention locations.
- 3. Recommend water quality and detention facilities to control discharge release rates to below historic.
- 4. Demonstrate compliance with surrounding major drainage basin planning studies, master development drainage plans and flood insurance studies.

# GENERAL LOCATION AND DESCRIPTION

## Location

The proposed Saddlehorn Ranch Filing 2, known as "Filing 2" from herein, is a parcel of land located in Section 3 and 10, Township 13 South, Range 65 West of the 6<sup>th</sup> Principal Meridian in El Paso County, Colorado. Saddlehorn Ranch is an 824 acre, rural, single family-development. Filing 2 is 176 acres and is comprised of 42 lots of the overall Saddlehorn Ranch development. Saddlehorn Ranch is bound by Judge Orr Road to the North and Curtis Road to the West. To the East, Saddlehorn Ranch is bound by undeveloped land owned by Brent Houser Enterprises, LLC. To the south, Saddlehorn Ranch is bound by undeveloped properties owned by Carolyn Gudzunas and Faye Reynolds. Filing 2 is bound by future filings to the North and East while it is bound by Curtis Road to the West and to the South by Saddlehorn Filing 1. A vicinity map is presented in Appendix A.

Currently, there are two major Drainageway that will receive flows from Filing 2: Haegler Ranch Tributary 6 (T-6) and Haegler Ranch Main Stem 6 (MS-06). These Drainageways were analyzed, both hydrologically and hydraulically, in the following reports:

- Haegler Ranch Basin Drainage Basin Planning Study (DBPS), May 2009.
- Santa Fe Springs Haegler Ranch Drainage Basin Letter of Map Revision, June 2004.
- Master Development Drainage Plan and Preliminary Drainage Report for Saddlehorn Ranch, May 2020.

The impact of these Drainageways and planning studies on the proposed development will be discussed later in the report.

## **Description of Property**

Filing 2 is currently unoccupied and undeveloped. The existing ground cover is sparse vegetation and open space, typical of a Colorado rolling range land condition. In general, Filing 2 slopes from northwest to southeast and the existing drainageways follows this topography.

Per a NRCS web soil survey of the area, Filing 2 is made up of Type A and D soils. Type A soils cover roughly 79% of Filing 2 while Type D soils cover 21% of Filing 2. Group A soils have a high infiltration rate when thoroughly wet. Type D soils have a very slow infiltration when thoroughly wet. A NRCS soil survey map has been presented in Appendix A.

## Floodplain Statement

Based on the FEMA FIRM Map number 08041C0558G, dated December 7, 2018, Filing 2 lies within Zone AE and Zone X. Zone AE is defined as area subject to inundation by the 1-percent-annual-chance flood event. Zone X is defined as area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. All proposed residential development within Filing 2 will occur in Zone X. The FIRM Map has been presented in Appendix A.

# DRAINAGE BASINS AND SUB-BASINS

## Existing Major Basin Descriptions

Filing 2 lies within Haegler Ranch Drainage Basin based on the "*Haegler Ranch Drainage Basin Planning Study*" prepared by URS Corporation in May 2009.

The Haegler Ranch Drainage Basin covers approximately 16.6 square miles in unincorporated El Paso County, CO. The Haegler Ranch Drainage Basin is tributary to Black Squirrel Creek. In its existing condition, the basin is comprised of rolling rangeland with poor vegetative cover associated with Colorado's semi-arid climate. The natural Drainageways within the basin are typically shallow and wide with poorly defined flow paths in most areas. Anticipated land use for the basin includes residential and commercial development. Residential developments will range from 0.125 - 5 acre lots with a mix of low, medium and high density developments.

As part of its drainage research, JR Engineering reviewed the following drainage studies, reports and LOMRs:

- Haegler Ranch Drainage Basin Planning Study prepared by URS Corporation in May 2009
- Santa Fe Springs Haegler Ranch Drainage Basin Letter of Map Revision prepared by Tri-Core Engineering in June 2004.
- Master Development Drainage Plan and Preliminary Drainage Report for Saddlehorn Ranch, prepared by JR Engineering, May 2020.

The "*Haegler Ranch Drainage Basin Planning Study*" was used to establish a stormwater management plan for the existing and future stormwater infrastructure needs within the Haegler Ranch Drainage Basin. Based on provided drainage maps and analysis, in the existing condition Haegler Ranch contributes a total of 710 cfs onto the site. Of the 710 cfs, 590 cfs crosses Curtis Road in an existing 24" CMP onto the site. Major Drainageway MS-06 conveys the stormwater through the site and to its off-site confluence with Major Drainageway MS-05. The remaining 120 cfs crosses Curtis Road in an existing 36" CMP onto the site. Major Drainageway T-6 conveys the stormwater through the site and to its off-site confluence with

#### Final Drainage Report Filing 2 - Saddlehorn Ranch Early Grading

Major Drainageway MS-05. Both Curtis Road culverts are undersized for existing and future flows and overtopping occurs locally near the culvert crossings. Overtopping at the intersection of Curtis Road and T-6 is contained within the 100-year floodplain and will not affect proposed lots. The overtopping at the intersection of MS-06 and Curtis Road is not contained within the 100-year floodplain limits. Therefore, at time of Final Drainage Report for Saddlehorn Filing 3, berming will be provided that will protect proposed lots from overtopping flows.

The *Haegler Ranch DBPS* evaluated two detention alternatives for the drainage basin: region and sub regional. In the regional approach, it is recommended the existing 36" CMP be upsized to a 60" RCP. In the sub-regional approach, this culvert is recommended to be left in its existing condition.

The existing 36" CMP culvert will not be upsized within the context of this report and development. The culvert is owned by El Paso County and timing of improvements, if any, will be controlled by the County.

Furthermore, the *Haegler Ranch DBPS* recommends channel improvements within drainageways MS-06 and T-6. Per the Haegler Ranch DBPS, all recommended channel sections are trapezoidal with side slopes of 4:1 and a maximum depth of five feet. Within the limits of the site, three (3) channel bottom widths are recommended for MS-06. The first reach, from station 0+00-31+34, is proposed with a 15' bottom width, the second reach from 31+34 to 74+61, MS-06 is proposed with a 30' bottom width, and the last reach from station 74+61 - 103+62 is proposed with a 20' channel bottom. All MS-06 channel improvements will be proposed with the Filing 3 improvements. Per the Haegler Ranch DBPS sub-regional detention alternative, channel and culvert improvements are only proposed through proposed developments, or where the existing conditions are undersized. For the Filing 2 development, no existing conditions are undersized for the development and the proposed Pond F prevents any negative impacts to the drainageway. Discussions with the county during the preliminary planning phase also determined that the proposed MS-06 improvements would be constructed with the San Isidro culvert crossing improvements, and with the Saddlehorn Filing 3 and Filing 5 developments. All Drainageway T-6 improvements have been proposed with the Filing 1 improvements. See recommended channel improvement sheets from the Haegler Ranch DBPS presented in Appendix E.

Based on flood impacts, stream stability and cost effectiveness, this study recommended a sub-regional detention approach. This allows future development anywhere in the basin with the construction of an associated sub-regional pond. However, based on the *Master Development Drainage Plan and Preliminary Drainage Report for Saddlehorn Ranch*, Filing 2 will utilize an on-site full spectrum water quality and detention pond instead. This full spectrum detention pond will limit developed discharge into the MS-06 Drainageway to less than historic rates.

*The Santa Fe Springs – Haegler Ranch Drainage Basin LOMR* was executed on Haegler Ranch Tributary 2, 3, and 4. The LOMR revised the onsite effective flood zone from Zone A to Zone AE. See FIRM Map Panel 08041C0558G for limits of LOMR study and revised flood zones, presented in Appendix E.

#### Final Drainage Report Filing 2 - Saddlehorn Ranch Early Grading

Of the three drainageways that were evaluated in the LOMR, Haegler Ranch Tributary 3 and 4 run adjacent to Filing 2. Within the boundary of the proposed development, Haegler Ranch Tributary 3 is synonymous with MS-06 and Haegler Ranch Tributary 4 is synonymous with T-6 from the *Haegler Ranch DBPS*. The purpose of the LOMR was to revise the flood hazard depicted in the current Flood Insurance Study. Per the LOMR, an existing 100-year flow of 130 cfs crosses onto Filing 1 in Haegler Ranch Tributary 4. The off-site flow of 130 cfs carried within Tributary 4 was used to design the 84" RCP culvert and associated channel improvements outlined in the Filing 1 report. The off-site flow of 505 cfs carried with Tributary 3 through the site will be used to design the culvert crossing at San Isidro Trail with Filing 3.

See Table 2 for comparison of Drainageway identification and the naming convention used within the context of this report. See Table 3 for a comparison of 100-year flows as calculated in the aforementioned DBPS and LOMR. An existing conditions drainage map is presented in Appendix E. Table 1: Major Drainageway Naming Convention

Major Drainageway Naming Conventions											
Saddlehorn Ranch MDDP/PDR:	Per Haegler Ranch DBPS:	Per Geick Ranch DBPS:	Per Sante Fe Springs LOMR:								
MS-06	Main Stem (MS- 06)	N/A*	Haegler Ranch Tributary 3								
T-6	Tributary 6 (T-6)	N/A*	Haegler Ranch Tributary 4								

Table 2: Major Drainageway – Ex. 100-Year Flow Comparison

Major Drainageways: 100-Year Flow Comparison										
Drainageway Name	Contributing Area (sq. mi.)	Q <sub>100</sub> Per Haegler Ranch DBPS:	Q <sub>100</sub> Per Geick Ranch DBPS:	Q <sub>100</sub> Per Sante Fe Springs LOMR:						
MS-06 @ Curtis Road	1.05	590 cfs	N/A*	505 cfs						
T-6 @ Curtis Road	0.39	120 cfs	N/A*	130 cfs						

\*N/A: Flow regime outside limits of study.

The *Master Development Drainage Plan and Preliminary Drainage Report for Saddlehorn Ranch* proposed the overall drainage facility design for Saddlehorn Ranch. Within the context of this report, onsite drainage basins the associated full spectrum water quality pond were established. As it pertains to Filing 2, one full spectrum water quality pond is recommended. Roadside ditches and local street culverts will be utilized to capture and convey Filing 2's runoff to the water quality pond. The proposed water quality pond will discharge into Drainageway MS-06 at less than historic rates.

All improvements to the Drainageway T-6, were proposed with the Filing 1 improvements. These improvements included an 84" reinforced concrete pipe (RCP) culvert at the crossing of Del Cerro Trail and Drainageway T-6, in addition to channel improvements up and downstream of the culvert. These culvert and channel improvements were designed to ensure a no-rise scenario in the floodplain.

## Existing Sub-basin Drainage

On-site, existing sub-basin drainage patterns are generally from northwest to southeast by way of Drainageway T-6 and MS-06. On-site areas flow directly into these drainageways which also bypass off-site flows through the site.

On-site, existing drainage basins were established based upon existing topography and the limits of the 100-year floodplain. These existing sub-basins were analyzed in the *Master Development Drainage Plan and Preliminary Drainage Report for Saddlehorn Ranch*. An existing drainage map has been provided in Appendix E.

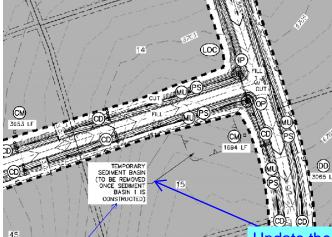
### Proposed Sub-basin Drainage

The proposed Filing 2 basin delineation is as follows;

Basin F consists of Sub-Basins F1-F10 combining for a total of 93.35 acres. In its existing condition, Basin F is rolling rangeland and runoff generally flows southeast towards Drainageway MS-06. In the proposed condition, Basin F will be rural 2.5 acre lots, paved roadway, and will include Pond F. Runoff from this basin will be collected in road side ditches and conveyed along Benito Wells Trail to Pond F. Pond F will be a full spectrum water quality and detention pond and will release at less than historic rates into Drainageway MS-06.

Basin G consists of Sub-basins G1-G2 combining for a total of 18.8 acres. In its existing condition, Basin G is rolling rangeland and runoff generally flows south and east to Drainageway MS-06. In the proposed condition, Basin G will be rural 2.5 acre lots and paved roadway. Sub-basins G1 & G2 are tributary to Pond G, which was part of the Filing 1 improvements. In the *Final Drainage Report for Saddlehorn – Filing 1*, Sub-basins G1 and G2 were referenced as F-G1 & F-G2. These were analyzed as developed basins within the context of the Filing 1 report to adequately size ditches, culverts, and water quality pond for the fully developed future condition. Runoff from this basin will be collected in road side ditches and conveyed south along El Raiceno Trail and west along Carranza Trail to Pond G. Pond G is a full spectrum water quality and detention pond and will release at less than historic rates into Drainageway T-6.

Basin UD consists of Sub-basins UD1-UD5 combining for a total of 92.13 acres. In their existing condition, these basins are rolling rangeland. Runoff from Basin UD1generally flows south and east to Drainageway T-6. Basins UD2, UD4, & UD5 generally flow south and east to Drainageway MS-06. Basin UD-3 represents Drainageway MS-06 and the runoff generated along the Filing 2 boundary. In the proposed condition, Basins UD1, UD2, UD4, and UD5 will be rural 2.5 acre lots with an Imperviousness = 6.2% and will be excluded from permanent stormwater quality management per Section I.7.1.B.5 of the ECM – Stormwater Quality Policy and Procedures.



<sup>2</sup>r a total of 2.77 acres of offsite area. In their is Road) and undeveloped area. In the proposed of pavement width and the stretch of Curtis Road une for access to Filing 2. Basin OS1-OS2 will ior to being captured in a roadside swale and eway MS-06. Basin OS3 will not be detained in section I.7.1.C.1.a of the ECM – Stormwater exceeding 1 acre, of the development site area e improvements along Curtis Road would add the exclusion present in Section I.7.1.B.2.

Update the narrative to describe. Is this proposed or existing? If proposed then provide construction details.

Basin F runoff along with runoff from S conveyed to the proposed full spectrum water quarty and detent release treated flow at less than historic rates to minimize adverse discharge into Major Drainageway MS-06. JR: This temporary sediment basin was built with the previous filing. The labels on the GEC plans have been updated to reflect that. Additionally the narrative has been update to ex-

See Table 3 beld The Pre-Development GEC plan include plain the purpose of these existing basins. Pond F Emergency Spillway that appears to be for buildout condition. If this is correct then state in the narrative as such.

Table 3: Pond S

Additionally state whether the spreader of the pond outfall is designed to buildout or temporary condition? If to buildout then final hydraulic analysis needs to be included with this report for review and construction level detail included in the GEC plan.

								~ 4 4
JR: Po	ond F's foreb	ay, outfall s	preader/ripra	ap, trickle	chanr	nel, a	nd $3.0$	011
emerg	ency spillwa	y will not be	e constructed	d with sed	liment	basir	า 1	
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Sub-Basins OS1 and OS2 will be in 1. The basin is designed to treat acres of undeveloped land. The

required volume of Temporary Sediment Basin 1 in order to treat the 95.54 acres of land is 1.66 Ac-ft. Temporary Sediment Basin 1 exceeds this with a volume of 3.011 Ac-ft. Temporary Sediment Basin 1 was designed to drain its entire volume within 40 hrs via a temporary outlet structure. This temporary outlet structure was designed as a singular column with five 2.13" dia holes allowing for water to drain.

Once the project progresses past early grading, Temporary Sediment Basin 1 will be converted to a full spectrum water quality detention pond (Pond F). A concrete forebay along with a concrete trickle channel will be installed. The temporary outlet structure will be replaced by a permanent outlet structure. The full spectrum pond will release treated flows at less than historic rates to minimize adverse impacts downstream. Pond F will discharge into Major Drainageway MS-06.

See Table 4 below for proposed Filing 2 Early Grading sediment basin parameters

Tributary Sub-Basin	Sediment Basin Name	Tributary Acres	Total Detention Volume (ac-ft)	Provided Volume (ac-ft)	Maximum Discharge (cfs)
F	Sediment Basin 1	95.54	1.66	3.011	0.251

 Table 4: Sediment Basin Summary

# DRAINAGE DESIGN CRITERIA

# Development Criteria Reference

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

# Hydrologic Criteria

All hydrologic data was obtained from the "El Paso Drainage Criteria Manual" Volumes 1 and 2, and the "Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual" Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5 year (minor) storm event and the 100-year (major) storm event. Rational Method calculations were prepared, in accordance with Section 13.3.2.1. of the CCSDCM, for the sub-basins that directly impact the sizing of ditches and local street culverts. Rational method calculations are presented in Appendix B.

Urban Drainage and Flood Control District's UD-Detention, Version 4.04 workbook was used for pond sizing. Required detention volumes and allowable release rates were designed per USDCM and CCS/EPCDCM. Pond sizing spreadsheets are presented in Appendix D.

# Hydraulic Criteria

Autodesk Inc.'s Hydraflow Express Extension (Volume 10.5) was used for roadside ditch design. Ditches were checked for velocity and capacity per the CCS/EPCDCM Section 12.3.2.2. In order to check both capacity and velocity, a cross section analysis was performed on the roadside swales using the basin's maximum runoff Q and the proposed uniform slope of the swale. The runoff quantities, street grades, and the USDCM Manual's UD-Inlet spread sheet were utilized to determine the size of storm drain inlets and street capacities. Swale cross sections have been presented in Appendix C.

Autodesk Inc.'s Hydraflow Express Extension (Volume 10.5) was used for local road crossing culvert design. Culvert size was determined based on 100-year flows and hydraulic criteria from EPCDCM Chapter 9 –Culvert Design. All local road crossing culvert design reports are presented in Appendix C.

# DRAINAGE FACILITY DESIGN

## General Concept

The proposed stormwater conveyance system was designed to convey the developed Filing 2 runoff during interim early grading to Temporary Sediment Basin 1 via roadside ditches and local street culverts. Temporary Sediment Basin 1 was designed to release at less than historic rates to minimize adverse impacts downstream during early grading via the designed temporary outlet control.

The proposed early grading improvements are over designed for the current state of the project site. The roadside swales along with the proposed culverts are designed to treat runoff for the completed subdivision. During early grading operations the site will have minimal composite impervious surfaces without the proposed roads and vacant lots. This will allow more runoff to infiltrate the ground, reducing the amount of runoff that needs to be caught by the roadside swales and Sediment Basin 1.

Once the project progresses past early grading operations, Temporary Sediment Basin 1 will be converted to a full spectrum water quality and detention pond (Pond F). The temporary outlet structure will be replaced with a permanent outlet structure. Additionally, a concrete forebay along with a concrete trickle channel will be installed. This full spectrum pond will release treated flows at less than historic rates to minimize adverse impacts downstream. Pond F will discharge into Major Drainageway MS-06. The final design for Pond F will be included in the Final Drainage report

All improvements aforementioned to Drainageway MS-06 shall be proposed with the Saddlehorn Filing 3 improvements. All improvements aforementioned to Drainageway T-6 have been proposed with the Saddlehorn Filing 1 Improvements. Outfall protection from Pond F is the only improvement to Drainageway MS-06 proposed with the Filing 2 improvements.

## Specific Details

### Four Step Process to Minimize Adverse Impacts of Urbanization

In accordance with the El Paso County Drainage Criteria Manual Volume 2, this site has implemented the four step process to minimize adverse impacts of urbanization. The four step process includes reducing runoff volumes, stabilizing drainageways, treating the water quality capture volume (WQCV), and consider the need for Industrial Commercial BMP's.

Step 1, Reducing Runoff Volumes: The development of the project site is proposed single family residential lots (2.5 ac. min.) with open spaces and lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. Roadways utilize soil riprap lined roadside ditches further disconnecting impervious areas. These practices will also allow for increased infiltration and reduce runoff volume.

Step 2, Stabilize Drainageways: Filing 2 utilizes roadside ditches with culvert crossings throughout. These roadside ditches direct the on-site development flows to the proposed detention pond within the project that releases at or below historic rates into Drainageway MS-06. Based upon the proposed

#### Final Drainage Report Filing 2 - Saddlehorn Ranch Early Grading

reduction in released flows compared to the pre-developed flows, no impact to downstream Drainageway MS-06 is anticipated.

Step 3, Provide WQCV: Runoff from this development is treated through capture and slow release of the WQCV in a full spectrum water quality and detention pond that is designed per current El Paso County drainage criteria.

Step 4 Consider the need for Industrial and Commercial BMP's: No industrial or commercial uses are proposed within this development. However, a site specific storm water quality and erosion control plan and narrative are prepared in conjunction with this report. Site specific temporary source control BMPs as well as permanent BMP's are detailed in this plan and narrative to protect receiving waters.

### Water Quality

In accordance with Section 13.3.2.1 of the CCS/EPCDCM, full spectrum water quality and detention are provided for all developed basins. Outlet structure release rates are limited to less than historic rates to minimize adverse impacts to downstream stormwater facilities. Complete pond and outlet structure designs are presented in Appendix D.

### Erosion Control Plan

The El Paso County Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate must be submitted since this project is disturbing more than 1 acre. The Early Grading Erosion Control Plan for Filing 2 is submitted concurrently with this report.

#### **Operation & Maintenance**

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. All proposed drainage structures within the any platted County ROW will be owned and maintained by El Paso County. All proposed drainage structures within easements or tracts will be owned and maintained by the 824 Acre Metropolitan No. 1. Vegetation in the natural and improved portions of Drainageway T-6 with the Filing 1 improvements is the responsibility of 824 Acre Metropolitan District No. 1. This includes all mowing, seeding and weed control activities. An Operation & Maintenance Plan will be submitted concurrently with the final drainage report that details the required maintenance activities and intervals to ensure proper function of all stormwater infrastructure in the future.

### Drainage and Bridge Fees

Drainage and Bridge Fees are not due with the early grading permit application. An estimate of basin fees for the proposed development within Haegler Ranch drainage basin will be calculated and provided with the Filing 2 Final Drainage Report.

# SUMMARY

The proposed development remains consistent with pre-development drainage conditions with the construction of the recommended drainage improvements, including ditches, culverts, detention ponds and drainage channel improvements. The proposed development will not adversely affect the offsite

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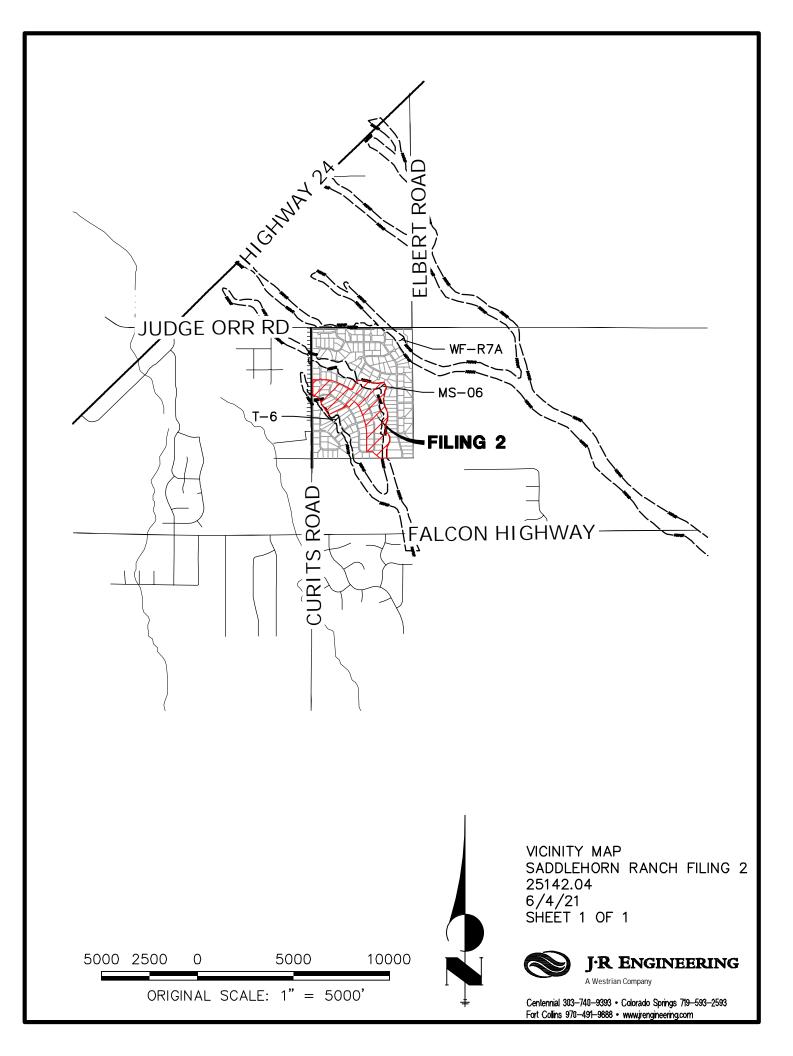
major drainageways or surrounding development. This report meets the latest El Paso County Drainage Criteria requirements for this site and is in accordance with the PDR/MDDP for Saddlehorn Ranch.

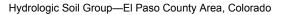
# **R**EFERENCES:

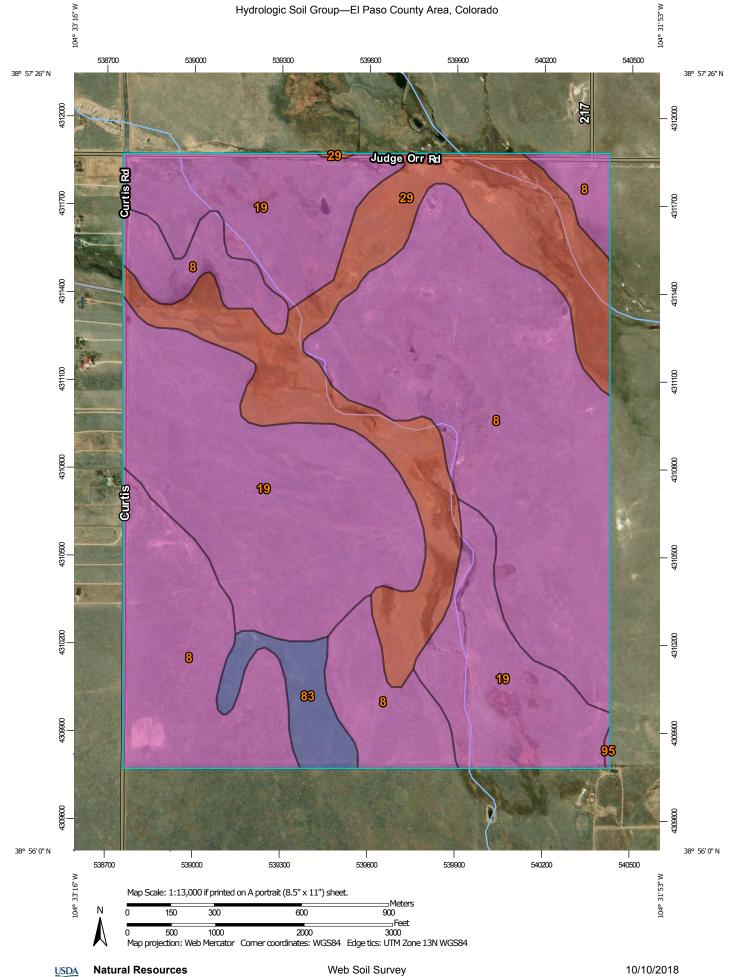
- <u>City of Colorado Springs Drainage Criteria Manual Volume 1</u>, City of Colorado Springs, CO, May 2014.
- 2. <u>Urban Storm Drainage Criteria Manual</u>, Urban Drainage and Flood Control District, Latest Revision.
- <u>Master Development Drainage Plan and Preliminary Drainage Report for Saddlehorn Ranch</u>, JR Engineering, May 2020.
- 4. <u>Haegler Ranch Drainage Basin Planning Study</u>, URS Corporation, May 2009.
- 5. <u>The Santa Fe Springs Haegler Ranch Drainage Basin LOMR</u>, Federal Emergency Management Agency, October 20, 2004.
- 6. Final Drainage Report for Saddlehorn Ranch Filing 1, JR Engineering, May 7, 2020

# APPENDIX A

# FIGURES AND EXHIBITS

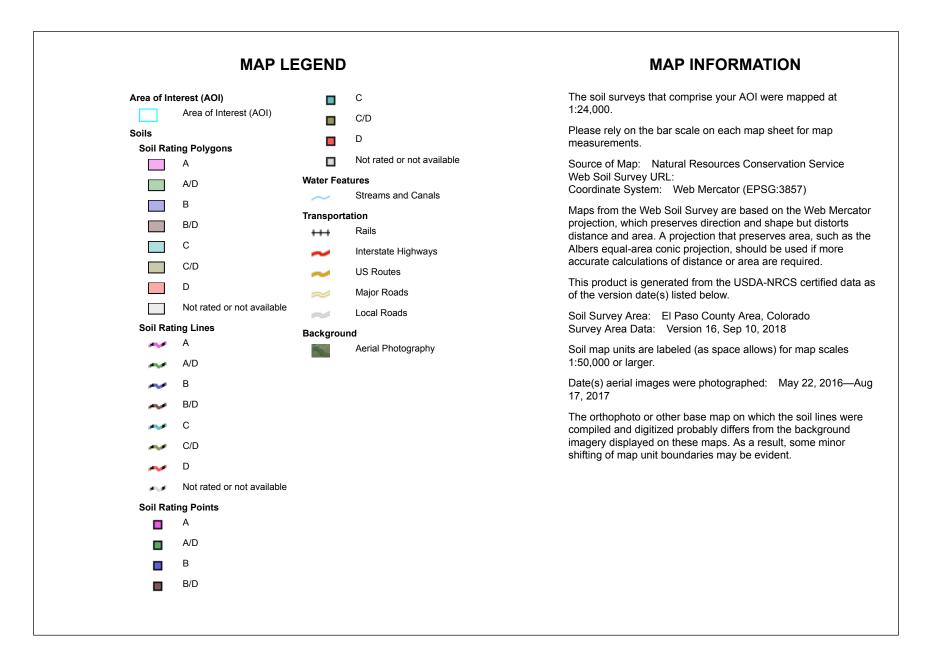






National Cooperative Soil Survey

**Conservation Service** 



# Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	388.3	44.6%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	307.3	35.3%
29	Fluvaquentic Haplaquolls, nearly level	D	150.0	17.2%
83	Stapleton sandy loam, 3 to 8 percent slopes	В	24.6	2.8%
95	Truckton loamy sand, 1 to 9 percent slopes	A	0.6	0.1%
Totals for Area of Inter	est		870.8	100.0%

# Description

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

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

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

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

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

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

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

## **Rating Options**

Aggregation Method: Dominant Condition Component Percent Cutoff: None Specified Tie-break Rule: Higher

# NOTES TO USERS

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

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

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

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

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

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

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

NGS Information Services

NOAA, N/NGS12 National Geodetic Survey SSMC-3, #9202

1315 East-West Highway Silver Spring, MD 20910-3282

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

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

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

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

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

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

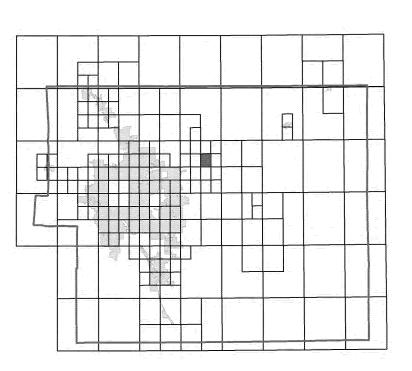
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

> El Paso County Vertical Datum Offset Table **Vertical Datum**

**Flooding Source** 

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

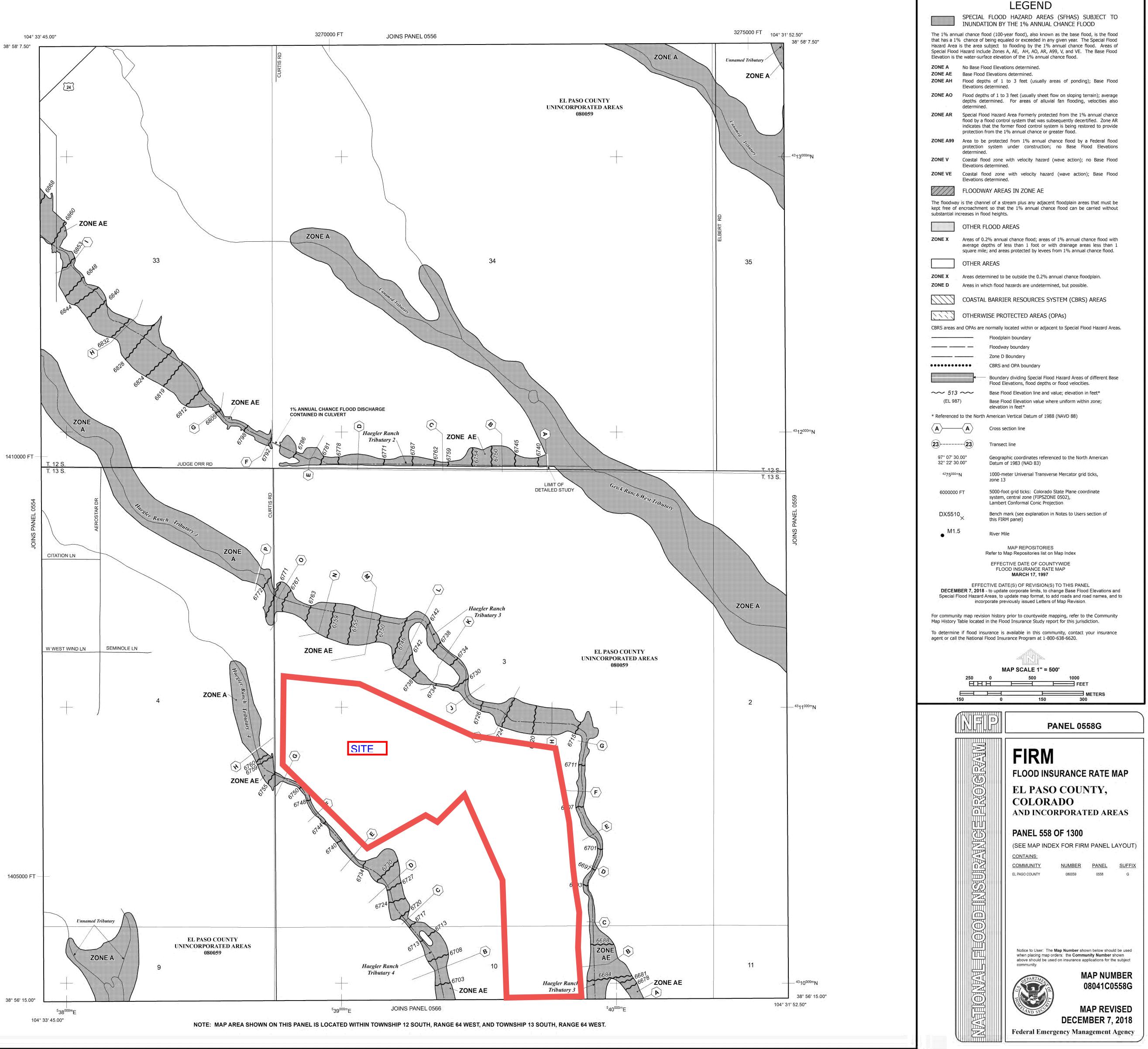
### Panel Location Map



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



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



**Remove FAE from** 

drainage report

### 2022 Financial Assurance Estimate Form (with pre-plat construction)

#### JR: Addressed

Updated: 5/12/2022

addlehorn Ranch Filing 2 Improvements Early Grading	•	ROJECT I	5/12/		•				EGP2	221
roject Name			Date			-		PCD File No.		
			Bato							
			U	Init				(with Pre	-Plat 0	Construction)
escription	Quantity	Units	c	ost			Total	% Complete		Remaining
ECTION 1 - GRADING AND EROSION CONTROL	(Construction	and Perma	nent Bl	MPs)						
* Earthwork										
less than 1,000; \$5,300 min		CY	\$	8.00	=	\$	-		\$	-
1,000-5,000; \$8,000 min		CY	\$	6.00	=	\$	-		\$	-
5,001-20,000; \$30,000 min		CY	\$	5.00	=	\$	-		\$	-
20,001-50,000; \$100,000 min		CY	\$	3.50	=	\$	-		\$	-
50,001-200,000; \$175,000 min	50,633	CY	\$	2.50	=	\$	175,000.00		\$	175,000.
greater than 200,000; \$500,000 min		CY	\$	2.00	=	\$	-		\$	-
* Permanent Seeding (inc. noxious weed mgmnt.)	6	AC	\$	828.00	=	\$	5,266.08		\$	5,266.
* Mulching	6	AC	\$	777.00	=	\$	4,662.00		\$	4,662.
* Permanent Erosion Control Blanket		SY	\$	6.00	=	\$	-		\$	-
* Permanent Pond/BMP Construction		CY	\$	-	=				\$	-
* Permanent Pond/BMP (provide engineer's estimate)		EA			=	\$	-		\$	-
*30" RCP		LF	\$	100.00	=	\$	-		\$	-
*Detention Outlet Structure		EA	\$5,	000.00	=	\$	-		\$	-
*Concrete/Riprap Forebay		EA		000.00	-	\$	-		\$	-
*Concrete Trickle Channel		CY	\$	95.00	-	\$	-		\$	-
*Detention Emergency Spillway		EA		000.00		\$	-		\$	-
*Drainageway riprap, d50 size from 6" to 24"		Tons	\$	83.00		\$	-		\$	-
*30" - Flared End Section (FES)		EA	\$	600.00	=	\$	-		\$	-
*Permanent WQ Feature (EDB)		EA	\$5,	000.00		\$	-		\$	-
*Gravel Maintenance Access Road	1,046	SY	\$	45.00		\$	47,070.00		\$	47,070.
						\$	-		\$	-
Safety Fence	8,102	LF	\$	3.00	=	\$	24,306.00		\$	24,306.
Temporary Erosion Control Blanket	3,642	SY	\$	3.00	=	\$	10,926.00		\$	10,926.
Vehicle Tracking Control	2	EA	\$ 2,	,453.00	=	\$	4,906.00		\$	4,906.
Silt Fence	11,010	LF	\$	2.60	=	\$	28,626.00		\$	28,626.
Temporary Seeding	13	AC	\$	650.00	=	\$	8,450.00		\$	8,450.
Temporary Mulch	13	AC	\$	777.00	=	\$	10,101.00		\$	10,101.0
Erosion Bales		EA	\$	26.00	=	\$	-		\$	-
Erosion Logs/Straw Waddle		LF	\$	5.00	=	\$	-		\$	-
Rock Check Dams	38	EA	\$	518.00	=	\$	19,684.00		\$	19,684.
Inlet and Outlet Protection	17	EA	\$	173.00	=	\$	2,941.00		\$	2,941.
Sediment Basin	1	EA	\$ 1,	,824.00	=	\$	1,824.00		\$	1,824.
Concrete Washout Basin		EA	\$	932.00	=	\$	-		\$	-
					=	\$	-		\$	-
[insert items not listed but part of construction plans]						\$	-		\$	-
						_				
	TENANCE (35%	6 of Constr	uction I	BMPs)	=	\$	30,610.30		\$	30,610.3
- Subject to defect warranty financial assurance. A minimum of 20% shall be tained until final acceptance (MAXIMUM OF 80% COMPLETE ALLOWED)		Sectio	n 1 Su	ubtotal	=	\$	374,372.38		\$	374,372.3
ECTION 2 - PUBLIC IMPROVEMENTS *										
OADWAY IMPROVEMENTS										
			<b>.</b>	000.00					•	
Mobilization/Construction Traffic Control Removal of Asphalt (Full Depth)		LS SY	\$ 50, \$	10.00	=	\$			\$ \$	-
						_			\$ \$	
Removal of Asphalt (Planing-4")		SY LF	\$ \$	5.00		\$ \$			\$ \$	-
Removal of Striping Removal of Fencing		LF	\$	5.00		_				
-			\$			\$ \$	-		\$ \$	-
Aggregate Base Course (135 lbs/cf)		Tons	-	29.00	=	-	-			-
Aggregate Base Course (135 lbs/cf)		CY	\$ \$	52.00		\$	-		\$	-
Asphalt Pavement (3" thick)		SY	-	14.50		\$	-		\$ \$	-
Asphalt Pavement (4" thick)		SY	\$	20.00		\$	-			-
Asphalt Pavement (6" thick)		SY	\$	30.00		\$	-		\$	-
Asphalt Pavement (147 lbs/cf)" thick		Tons	\$	91.00	=	\$	-		\$	-
		SF	\$	8.30	=	\$	-		\$	-
		EA	\$	311.00	=	\$	-		\$ \$	-
Regulatory Sign/Advisory Sign		<b>F</b> •	¢	250 20						-
Regulatory Sign/Advisory Sign Guide/Street Name Sign		EA		250.00	=	\$	-			
Regulatory Sign/Advisory Sign Guide/Street Name Sign Epoxy Pavement Marking		SF	\$	14.00	=	\$	-		\$	-
Raised Median, Paved Regulatory Sign/Advisory Sign Guide/Street Name Sign Epoxy Pavement Marking Thermoplastic Pavement Marking Barricade - Type 3	4		\$ \$							

Saddlehorn Ranch Filing 2 Improvements Early Grading			NFORMATIC 5/12/2022					EGP:	221		
Project Name	-		Date			PCD File No.					
*											
Description	Quantity	Units	Unit Cost			Total	(with Pro % Complete	e-Plat (	Construction) Remaining		
Curb and Gutter, Type A (6" Vertical)		LF	\$ 31.00	=	\$	-		\$	-		
Curb and Gutter, Type B (Median)		LF	\$ 31.00	=	\$	-		\$	-		
Curb and Gutter, Type C (Ramp)		LF	\$ 31.00	=	\$	-		\$	-		
4" Sidewalk (common areas only)		SY	\$ 50.00	=	\$	-		\$	-		
5" Sidewalk		SY	\$ 62.00	=	\$	-		\$	-		
6" Sidewalk		SY	\$ 75.00	=	\$	-		\$	-		
8" Sidewalk		SY	\$ 99.00		\$	-		\$	-		
Pedestrian Ramp		EA	\$ 1,190.00	=	\$	-		\$	-		
Cross Pan, local (8" thick, 6' wide to include return)		LF	\$ 63.00	=	\$	-		\$	-		
Cross Pan, collector (9" thick, 8' wide to include return)		LF	\$ 95.00		\$	-		\$	-		
Curb Chase		EA	\$ 1,532.00	=	\$	-		\$	-		
Guardrail Type 3 (W-Beam)		LF	\$ 51.00	=	\$	-		\$	-		
Guardrail Type 7 (Concrete)		LF	\$ 75.00	=	\$	-		\$	-		
Guardrail Impact Attenuator		EA	\$ 3,899.00	=	\$	-		\$	-		
Sound Barrier Fence (CMU block, 6' high)		LF	\$ 81.00		\$	-		\$	-		
Sound Barrier Fence (panels, 6' high)		LF	\$ 83.00	=	\$	-		\$	-		
Electrical Conduit, Size =		LF	\$ 17.00	=	\$	-		\$	-		
Traffic Signal, complete intersection		EA	\$ 439,875	=	\$	-		\$	-		
Traffic Signal, complete intersection		EA	\$ 439,875	=	\$	-		\$	-		
[insert items not listed but part of construction plans]				=	\$	-		\$	-		
TORM DRAIN IMPROVEMENTS											
Concrete Box Culvert (M Standard), Size (W x H)		LF		=	\$	-		\$	-		
18" Reinforced Concrete Pipe		LF	\$ 67.00	=	\$	-		\$	-		
24" Reinforced Concrete Pipe	123	LF	\$ 81.00	=	\$	9,963.00		\$	9,963.0		
19" x 30" Horizontal Elliptical Reinforced Concrete Pipe		LF	\$ 100.00	=	\$	-		\$	-		
54" Corrugated Steel Pipe		LF	\$ 269.00	=	\$	-		\$	-		
18" CMP	354	LF	\$ 30.00	=	\$	10,620.00		\$	10,620.0		
60" Corrugated Steel Pipe		LF	\$ 290.00	=	\$	-		\$			
66" Corrugated Steel Pipe		LF	\$ 352.00	=	\$	-		\$	-		
72" Corrugated Steel Pipe		LF	\$ 414.00	=	\$			\$	-		
18" - Flared End Section (FES)		EA	\$ 402.00		\$			\$			
18" - Flared End Section (FES)		EA	\$ 402.00		\$			\$			
24" - Flared End Section (FES)	4	EA	\$ 486.00		\$	1,944.00		\$	1,944.0		
19" x 30" - Flared End Section (FES)	4	EA	\$ 600.00		\$	1,944.00		\$ \$	1,944.0		
30" - Flared End Section (FES)		EA	\$ 600.00					⊅ \$	-		
32" Flared End Section (FES)		EA			\$	-		\$ \$	-		
Flared End Section (FES) CSP Size =		EA	\$ 650.00	=	\$	-		Э	-		
(unit cost = 6x pipe unit cost)		EA		=	\$	-		\$	-		
End Treatment- Headwall		EA		=	\$	-		\$	-		
End Treatment- Wingwall		EA		=	\$	-		\$	-		
End Treatment - Cutoff Wall		EA		=	\$	-		\$	-		
Curb Inlet (Type R) L=5', Depth < 5'		EA	\$ 5,736.00	=	\$	-		\$	-		
Curb Inlet (Type R) L=5', $5' \le \text{Depth} < 10'$		EA	\$ 7,440.00	=	\$	-		\$	-		
Curb Inlet (Type R) L =5', $10' \le \text{Depth} < 15'$		EA	\$ 8,637.00	=	\$			\$	-		
Curb Inlet (Type R) L =10', Depth < 5'		EA	\$ 7,894.00	=	\$			\$			
Curb Inlet (Type R) L =10', $5' \le \text{Depth} < 10'$		EA	\$ 8,136.00	=	\$			\$			
Curb Inlet (Type R) $L = 10'$ , $10' \le Depth < 15'$		EA	\$ 10,185.00	=	\$			\$			
Curb Inlet (Type R) L =15', Depth < 5'		EA	\$ 10,265.00	=	\$			\$			
Curb Inlet (Type R) L = 15', $5' \le \text{Depth} < 10'$		EA	\$ 10,205.00	=	\$	-		\$ \$	-		
Curb Inlet (Type R) L =15, $5 \le \text{Depth} < 10$ Curb Inlet (Type R) L =15', $10' \le \text{Depth} < 15'$		EA	\$ 11,005.00		\$			\$ \$			
		EA		=	\$	-		\$	-		
			\$ 10,940.00 \$ 12,075.00	=	\$	-			-		
		EA	\$ 12,075.00	=		-		\$	-		
Grated Inlet (Type C), Depth < 5'		EA	\$ 4,802.00	=	\$	-		\$	-		
Grated Inlet (Type D), Depth < 5'		EA	\$ 5,932.00	=	\$	-		\$	-		
Storm Sewer Manhole, Box Base		EA	\$ 12,034.00	=	\$	-		\$	-		
Storm Sewer Manhole, Slab Base		EA	\$ 6,619.00	=	\$	-		\$	-		
				=	\$	-		\$	-		
Geotextile (Erosion Control)		SY	\$ 6.20		¥			Ľ			
Rip Rap, d50 size from 6" to 24"		Tons	\$ 83.00	=	\$	-		\$	-		
Rip Rap, Grouted		Tons	\$ 98.00	=	\$	-		\$	-		
Drainage Channel Lining, Concrete		CY	\$ 590.00	=	\$	-		\$	-		
Drainage Channel Lining, Rip Rap		CY	\$ 116.00	=	\$	-		\$	-		
Drainage Channel Lining, Grass		AC	1	=	\$	-		\$	-		
Drainage Channel Lining, Other Stabilization				=	\$	-		\$	-		
<u> </u>				=	\$	-		\$	-		
[insert items not listed but part of construction plans]				=	\$	-		\$	-		
- Subject to defect warranty financial assurance. A minimum of 20% shall be	• • • • • • • • • • • • • • • • • • •				1 *			Ĺ			
tained until final acceptance (MAXIMUM OF 80% COMPLETE ALLOWED)		-	n 2 Subtotal		\$			\$	23,355.00		

SECTION 3 - COMMON DEVELOPMENT IMPROVEMENTS (Private or District and NOT Maintained by EPC)**           Source of the second					l				ROJECT I			
Begringtion         Quality         Unit         Total         Work Pro-Plat Complexe         Report Plat Complexe </th <th>GP221</th> <th></th> <th>_</th> <th>_</th> <th></th> <th>22</th> <th></th> <th></th> <th></th> <th>1</th> <th>Filing 2 Improvements Early Grading</th> <th></th>	GP221		_	_		22				1	Filing 2 Improvements Early Grading	
escription Quantity Units Cast Total % Congress Representation of the second se		PCD File No.	F				ate	D				roject Name
escription Quantity Units Cost Total % Congete Re FUTION 3 - COMMON DEVELOPMENT IMPROVEMENTS (Private or District and NOT Maintained by EPG) *** ADAVAY IMPROVEMENTS TORM DRAIN IMPROVEMENTS EXEMPTION TO A COMMON DEVELOPMENT IMPROVEMENTS (Private or District and NOT Maintained by EPG) *** ADAVAY IMPROVEMENTS TORM DRAIN IMPROVEMENTS EXEMPTION TO A COMMON DEVELOPMENT IMPROVEMENTS (Private or District and NOT Maintained by EPG) *** ATER SYSTEM IMPROVEMENTS Water Main Pipe (PVC), Size 6* ATER SYSTEM MINOPOLYMENTS Water Main Pipe (PVC), Size 12* Water Main Pipe (PVC), Size 13* Water Main Pipe (PVC), Size 14* Water Main Pipe (PVC), Size 15* Water Severe Mathole, Dater of construction plane) Water Severe IMBROVEMENTS Severe Mathole, Dater of construction plane) BADECAPTING IMPROVEMENTS Severe Mathole, Dater of con												
ECTION 3 - COMMON DEVELOPMENT IMPROVEMENTS (Private or District and NOT Maintained by EPC)**           ADAVAY IMPROVEMENTS           adaption	Vat Construction)	(with Pre-Plat C					U					
OADWAY IMPROVEMENTS	Remaining	% Complete										
TORM DRAIN IMPROVEMENTS         (Exception: Permanent PondBMP shall be limited under Section 1)         -         5         -         5           TORM DRAIN IMPROVEMENTS         -         5         -         5         -         5           ATER SYSTEM IMPROVEMENTS         -         5         -         5         -         5           Water Main Pipe (PVC), Size 8         -         5         -         5         -         5           Water Main Pipe (PVC), Size 8         -         5         -         5         -         5           Water Main Pipe (PVC), Size 8         -         -         5         -         5         -         5           Water Main Pipe (PVC), Size 8         -         -         5         -         5         -         5           Gate Valves, 6'         -         -         5         -         5         -         5         -         5         -         5         -         5         -         5         -         5         -         5         -         5         -         5         -         5         -         5         -         5         -         5         -         5         -         5         -			PC)**	ned by EP	Maintai	NO	ct a	stri	vate or Dis	VEMENTS (Priv		
Image: Solution of the second secon											<u>/EMENTS</u>	DADWAY IMPROVEMENTS
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Image: set of the set	\$	\$	-	\$	=							
Corm DRAIN MPROVEMENTS         (Exception Permanent PondBMP shall be itemized and Section 1)         =         \$         .         \$           Corm DRAIN MPROVEMENTS         (Exception Permanent PondBMP shall be itemized and Section 1)         -         \$         . <td< td=""><td>5</td><td>\$</td><td>-</td><td>\$</td><td>=</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	5	\$	-	\$	=							
CORM DRAIN MPROVEMENTS         (Exception Permanent PondBMP shall be itemized under Section 1)         Image: Construction of the image: Const	5	\$	-	\$	=							
ALTER SYSTEM IMPROVEMENTS	5	\$	-	\$	=							
Image: second					Section 1)	under	emi	be it	d/BMP shall	on: Permanent Pon	ROVEMENTS (Excepti	TORM DRAIN IMPROVEMEN
Image: Second	; .	\$	-	\$	=							
ATER SYSTEM IMPROVEMENTS         I         F         S         I         S           Water Main Ppe (PVC), Size 8°         I         I         F         S         66.00         S         .         S           Water Main Ppe (PVC), Size 8°         I         I         F         S         66.00         S         .         S           Water Main Ppe (Ductile Iron), Size 8°         I         I         F         S         .         S         .         S           Gate Valves, 8'         EA         S         1.923.00         S         .         S         .         S           Gate Valves, 12'         EA         S         1.923.00         S         .         S         .         S           Fire Hystran Assembly, wi all valves         EA         S         1.923.00         S         .         S           Fire Hystran Assembly, wi all valves         EA         S         1.920.00         S         .         S           Fire Hystran Assembly, wi all valves         EA         S         1.920.00         S         .         S           Fire Hystran Assembly, wi all valves         EA         S         1.920.00         S         .         S	; ·	\$	-	\$	=							
ATER SYSTEM IMPROVEMENTS         -         s         -         s         -         s         -         s           Water Main Pipe (PVC), Size 8°         LF         \$         66.00         -         \$         -         \$           Water Main Pipe (PVC), Size 8°         LF         \$         100.00         \$         -         \$         \$           Gate Valves, 8°         LF         \$         100.00         \$         -         \$         \$         \$           Gate Valves, 8°         LF         \$         100.00         \$         -         \$         \$         \$           Gate Valves, 12°         EA         \$         1.923.00         =         \$         -         \$         \$           Water Service Line Installation, inc. top and valves         EA         \$         6.828.00         =         \$         -         \$ <td></td> <td></td> <td>-</td> <td></td> <td>=</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>			-		=							
NATES SYSTEM IMPROVEMENTS         I <td>; ·</td> <td>\$</td> <td>-</td> <td>\$</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	; ·	\$	-	\$								
Water Main Pipe (PVC), Size 1?       LF       \$       660.0       -       \$       -       \$         Water Main Pipe (PVC), Size 1?       LF       \$       78.00       -       \$       -       \$         Gate Valves, 8'       EA       \$       1,923.00       -       \$       -       \$	\$ ·	\$	-	\$	=							
Water Main Pipe (PVC), Size 12*       I       I       I       I       F       \$       10000       \$       -       \$         Water Main Pipe (Ducille Iron), Size 8*       I       I       F       \$       78.00       =       \$       -       \$         Gate Valves, 8*       EA       \$       1,923.00       =       \$       -       \$       \$         Gate Valves, 12*       EA       \$       2,900.00       =       \$       -       \$												
Water Main Pipe (Ductile Iron), Size 8"       LF       \$ 78.00       -       \$       -       \$         Gate Valves, 8"       EA       \$ 1,923.00       -       \$       -       \$         Gate Valves, 12"       EA       \$ 2,900.00       \$       -       \$       \$         Fire Oxitant Assembly, will valves       EA       \$ 0,823.00       -       \$       \$       \$         Water Service Line Installation, inc. tap and valves       EA       \$ 0,823.00       -       \$       \$       \$         Fire Cistem Installation, complete       EA       \$ 1,370.00       -       \$       -       \$       \$         Sanitary Server Manhole, Depth < 15 feet		-	-		=			_				1 1 1
Gate Valves, 8'       EA       \$       .       \$       .       \$         Gate Valves, 12''       EA       \$        \$        \$         Gate Valves, 12''       EA       \$        \$        \$         Fire Hydrant Assembly, w/ all valves       EA       \$       6,228.00       =       \$        \$         Fire Hydrant Assembly, w/ all valves       EA       \$       6,228.00       =       \$        \$         Fire Cistern Installation, inc, tap and valves       EA       \$       6,228.00       =       \$        \$         Fire Cistern Installation, complete       EA       \$       1,370.00       =       \$        \$         Sentiary Sewer Man Pipe (PVO), Size 8'       LF       \$       66.00       =       \$        \$         Sanitary Sewer Mann Pipe (PVO, Size 8'       LF       \$       66.00       =       \$        \$         Sanitary Sewer Mann Pipe (PVO, Size 8'       LF       \$       66.00       =       \$        \$         Sanitary Sewer Lift Station, complete       EA       \$       4,454.00       =       \$	5	\$	-	\$				_			PVC), Size 12"	Water Main Pipe (PVC), Size
Gate Valves, 8'       EA       \$ 1,923.00       =       \$       .       \$         Gate Valves, 12'       EA       \$ 2,900.00       \$       .       \$       \$         The Hydrant Assembly, wi all valves       EA       \$ 2,900.00       =       \$       .       \$         Water Service Line Installation, inc. tap and valves       EA       \$ 1,370.00       =       \$       .       \$         Fire Cistem Installation, complete       EA       \$ 1,370.00       =       \$       .       \$       \$         MultarY SEWER IMPROVEMENTS       -       -       \$       .       .       \$       \$         Sanitary Sever Manhole, Depth < 15 feet			-		=	.00		\$	LF		Ductile Iron), Size 8"	Water Main Pipe (Ductile Iron)
Gate Valves, 12"       EA       \$ 2,900.00       \$       \$       .       \$         Fire Hydrant Assembly, wi all valves       EA       \$ 6,828.00       =       \$       .       \$         Fire Hydrant Assembly, wi all valves       EA       \$ 6,828.00       =       \$       .       \$         Fire Cistern Installation, inc. tap and valves       EA       \$ 1,370.00       =       \$       .       \$         Fire Cistern Installation, inc. tap and valves       EA       \$ 1,370.00       =       \$       .       \$         Sector 10 field but part of construction plans)       .       =       \$       .       \$       \$         ANTARY SEWER IMPROVEMENTS       .       .       .       .       \$       \$       \$         Sanitary Sewer Manhole, Depth < 15 feet	5	\$	-	\$								
Fire Hydrant Assembly, wf all valves       EA       \$       6.828.00       =       \$       -       \$         Water Service Line Installation, inc. tap and valves       EA       \$       1,370.00       =       \$       -       \$         Fire Cistem Installation, complete       EA       \$       1,370.00       =       \$       -       \$         Mater Service Line Installation, complete       EA       \$       1,370.00       =       \$       -       \$         Sanitary Service Line Installation, complete       EA       \$       4,540.00       =       \$       -       \$         Sanitary Service Line Installation, complete       EA       \$       4,540.00       =       \$       -       \$         Sanitary Service Line Installation, complete       EA       \$       4,540.00       =       \$       -       \$         Sanitary Service Line Installation, complete       EA       \$       1,451.00       =       \$       -       \$       \$         Sanitary Service Line Installation, complete       EA       \$       1,451.00       =       \$       -       \$       \$         Sanitary Service Line Installation, complete       EA       \$       \$       \$       \$			-		=			_	EA			
Water Service Line Installation, inc. tap and valves       EA       \$ 1,370.00       =       \$ -       \$ -       \$ -         Fire Cistern Installation, complete       EA       -       \$ -	; ·	\$	-	\$		.00	2,	\$	EA			Gate Valves, 12"
Fire Cistern Installation, complete       EA       =       \$       -       \$         Insert items not listed but part of construction plans]       =       \$       -       \$         ANTARY SEWER IMPROVEMENTS       =       \$       -       \$         Sanitary Sewer Manhole, Depth < 15 feet	; .	\$	-	\$	=	.00	6,	\$	EA		nbly, w/ all valves	Fire Hydrant Assembly, w/ all
Insert items not listed but part of construction plans]       =       \$       -       \$         Sewer Main Pipe (PVC), Size 8°       LF       \$       66.00       =       \$       -       \$         Sanitary Sewer Manhole, Depth < 16 feet	5	\$	-	\$	=	.00	1,	\$	EA		Installation, inc. tap and valves	Water Service Line Installation
Insert items not listed but part of construction plans]       =       \$       .       \$         ANTARY SEWER IMPROVEMENTS       .       .       .       .       .         Samitary Service Line Installation, complete       EA       \$ 4,540.00       =       \$       .       .         Sanitary Service Line Installation, complete       EA       \$ 1,451.00       =       \$       .       \$         Sanitary Service Line Installation, complete       EA       \$ 1,451.00       =       \$       .       \$         Sanitary Service Line Installation, complete       EA       \$ 1,451.00       =       \$       .       \$         Sanitary Service Line Installation, complete       EA       \$ 1,451.00       =       \$       .       \$         Sanitary Service Line Installation, complete       EA       =       \$       .       \$       \$         ANDSCAPING IMPROVEMENTS       (For subdivision specific condition of approval, or PUD)       .       .       \$       \$         ANDSCAPING IMPROVEMENTS       (For subdivision specific condition of approval, or PUD)       .       \$       \$       \$         ANDSCAPING IMPROVEMENTS       (For subdivision specific condition of approval, or PUD)       .       \$       \$       \$	\$ ·	\$	-	\$	=				EA		tion, complete	Fire Cistern Installation, comp
EXPLANTARY SEWER IMPROVEMENTS       LF       \$ 66.00       =       \$       -       \$         Sewer Main Pipe (PVC), Size 8'       LF       \$ 4,540.00       =       \$       -       \$         Sanitary Sewer Manhole, Depth < 15 feet			-		=							
Sewer Main Pipe (PVC), Size 8"       LF       \$       66.00       =       \$       -       \$         Sanitary Sewer Manhole, Depth < 15 feet	; .	\$	-	\$	=						ed but part of construction plans]	[insert items not listed but part
Sanitary Sewer Manhole, Depth < 15 feet											IMPROVEMENTS	ANITARY SEWER IMPROVE
Sanitary Service Line Installation, complete       EA       \$ 1,451.00       =       \$       -       \$         Sanitary Sewer Lift Station, complete       EA       EA       =       \$       -       \$         Insert items not listed but part of construction plans]       =       \$       -       \$       \$       \$         ANDSCAPING IMPROVEMENTS       (For subdivision specific condition of approval, or PUD)       =       \$       -       \$         ANDSCAPING IMPROVEMENTS       (For subdivision specific condition of approval, or PUD)       =       \$       -       \$         ANDSCAPING IMPROVEMENTS       (For subdivision specific condition of approval, or PUD)       =       \$       -       \$         ANDSCAPING IMPROVEMENTS       (For subdivision specific condition of approval, or PUD)       =       \$       -       \$         ANDSCAPING IMPROVEMENTS       (For subdivision specific condition of approval, or PUD)       =       \$       -       \$       \$         EA       =       \$       -       \$	-	\$	-	\$	=							
Sanitary Sewer Lift Station, complete   Sanitary Sewer Lift Station, complete EA = \$ - \$   [insert items not listed but part of construction plans] i<			-		=	.00	4,	\$				
[insert items not listed but part of construction plans]       (For subdivision specific condition of approval, or PUD)       =       \$       -       \$         ANDSCAPING IMPROVEMENTS       (For subdivision specific condition of approval, or PUD)       =       \$       -       \$         ANDSCAPING IMPROVEMENTS       (For subdivision specific condition of approval, or PUD)       =       \$       -       \$         EA       =       \$       -       \$       \$       \$       \$       \$         EA       =       \$       -       \$	-	\$	-		=	.00	1,	\$				
[insert items not listed but part of construction plans]			-		=				EA		Station, complete	Sanitary Sewer Lift Station, co
ANDSCAPING IMPROVEMENTS       (For subdivision specific condition of approval, or PUD)       EA       =       \$       \$         EA       =       \$       -       \$			-		-							
EA       =       \$       -       \$         - Section 3 is not subject to defect warranty requirements       Section 3 Subtotal       =       \$       -         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPS)       LS       =       \$       -       \$         (Sum of all sect	-	\$	-	\$								
EA       =       \$       .       \$         • EA       =       \$       .       \$         • Section 3 is not subject to defect warranty requirements       Section 3 Subtotal       =       \$       .         • Section 3 is not subject to defect warranty requirements       Section 3 Subtotal       =       \$       .       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       .       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       .       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       .       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       .       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       .       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       .       \$         S-BUILT PLANS (Public Improve					UD)	al, or F	app	n of		For subdivision spe	ROVEMENTS	ANDSCAPING IMPROVEMEN
EA       =       \$       -       \$         - Section 3 is not subject to defect warranty requirements       Section 3 Subtotal       =       \$       -         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$ <td></td> <td></td> <td>-</td> <td></td> <td>=</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>			-		=							
EA       =       \$       -       \$         - Section 3 is not subject to defect warranty requirements       Section 3 Subtotal       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         (Sum of all section totals leses credit for items complete plus as-builts and pond/BMP			-		-							
EA       =       \$       -       \$         - Section 3 is not subject to defect warranty requirements       Section 3 Subtotal       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       -       \$         OND/BMP CERTIFICATION (inc. elevations and volume calculations)       LS       =       \$       -       \$         Total Construction Financial Assurance (Sum of all section subtotals plus as-builts and pond/BMP certification)       \$       3       3         Total Remaining Construction Financial Assurance (with Pre-Plat Construction)       \$       3         (Sum of all section totals less credit for items complete plus as-builts and pond/BMP certification)         Total Defect Warranty Financial Assurance \$			-		=							
- Section 3 is not subject to defect warranty requirements       Section 3 Subtotal       =       \$       \$         S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$       \$         OND/BMP CERTIFICATION (inc. elevations and volume calculations)       LS       =       \$       \$         Total Construction Financial Assurance (Sum of all section subtotals plus as-builts and pond/BMP certification)       \$       3         Total Remaining Construction Financial Assurance (with Pre-Plat Construction)       \$       3         (Sum of all section totals less credit for items complete plus as-builts and pond/BMP certification)       \$       3         Total Defect Warranty Financial Assurance \$       \$       3			-		=							
S-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)       LS       =       \$         OND/BMP CERTIFICATION (inc. elevations and volume calculations)       LS       =       \$         Total Construction Financial Assurance         (Sum of all section subtotals plus as-builts and pond/BMP certification)         Total Construction Financial Assurance         (Sum of all section totals less credit for items complete plus as-builts and pond/BMP certification)         Total Defect Warranty Financial Assurance			-		=		_					
OND/BMP CERTIFICATION (inc. elevations and volume calculations)       LS       = \$       \$         Total Construction Financial Assurance (Sum of all section subtotals plus as-builts and pond/BMP certification)         Total Remaining Construction Financial Assurance (with Pre-Plat Construction)         Control Remaining Construction Financial Assurance (with Pre-Plat Construction)         Construction Financial Assurance         Construction Financial Assurance (with Pre-Plat Construction)         Construction Financial Assurance	\$-	\$	-	\$	=	otal	Su	on 3	Sectio		t to defect warranty requirements	<ul> <li>Section 3 is not subject to defect wa</li> </ul>
OND/BMP CERTIFICATION (inc. elevations and volume calculations)       LS       = \$       \$         Total Construction Financial Assurance (Sum of all section subtotals plus as-builts and pond/BMP certification)         Total Remaining Construction Financial Assurance (with Pre-Plat Construction)         Control Remaining Construction Financial Assurance (with Pre-Plat Construction)         Construction Financial Assurance         Construction Financial Assurance (with Pre-Plat Construction)         Construction Financial Assurance												
Total Construction Financial Assurance       \$       3         (Sum of all section subtotals plus as-builts and pond/BMP certification)       \$       3         Total Remaining Construction Financial Assurance (with Pre-Plat Construction)       \$       3         (Sum of all section totals less credit for items complete plus as-builts and pond/BMP certification)       \$       3         Total Defect Warranty Financial Assurance       \$       \$			-									
(Sum of all section subtotals plus as-builts and pond/BMP certification)		\$	-	\$	=				LS	lculations)	ICATION (inc. elevations and volume ca	OND/BMP CERTIFICATION (
(Sum of all section subtotals plus as-builts and pond/BMP certification)			<b></b>									
Total Remaining Construction Financial Assurance (with Pre-Plat Construction)       \$       3         (Sum of all section totals less credit for items complete plus as-builts and pond/BMP certification)       5         Total Defect Warranty Financial Assurance       \$	\$ 397,727.3											
(Sum of all section totals less credit for items complete plus as-builts and pond/BMP certification) Total Defect Warranty Financial Assurance		MP certification)	ts and pond/BMI	s plus as-builts	on subtotals	ll sect	um	(S				
(Sum of all section totals less credit for items complete plus as-builts and pond/BMP certification) Total Defect Warranty Financial Assurance							_					
Total Defect Warranty Financial Assurance	\$ 397,727.3	·		•					•			
		MP certification)	ts and pond/BMI	e plus as-builts	ns complete	for ite	s cre	s less	section totals	(Sum of all		
(20% of all items identified as (*). To be collateralized at time of preliminary acceptance)	\$ 41,656.6	al Assurance <u></u> \$	ity Financial	ect Warrant	otal Defe	-						
( , , , , , , , , , , , , , , , , , , ,		ary acceptance)	me of preliminar	teralized at tim	To be colla	as (*).	entif	ns ide	0% of all item	(20		
							_					

I hereby certify that this is an accurate and complete estimate of costs for the work as shown on the Grading and Erosion Control Plan and Construction Drawings associated with the Project.

Engineer (P.E. Seal Required)	
Approved by Owner / Applicant	Date
Approved by El Paso County Engineer / ECM Administrator	Date

# APPENDIX B

# HYDROLOGIC CALCULATIONS

#### COMPOSITE % IMPERVIOUS CALCULATIONS

#### Subdivision: Saddlehorn Ranch

Location: El Paso County

Project Name: Saddlehorn Ranch

Project No.: 25142.04 Calculated By: AAM

Checked By: TBD

Date: 5/17/22

			Paved Roads	S	2.5	Acre Rural I	ots		Lawns		Basins Total
Basin ID	Total Area (ac)	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	Weighted % Imp.
F1	4.93	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	4.93	2.0%	2.0%
F2	3.77	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	3.77	2.0%	2.0%
F3	33.31	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	33.31	2.0%	2.0%
F4	14.38	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	14.38	2.0%	2.0%
F5	19.25	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	19.25	2.0%	2.0%
F6	7.67	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	7.67	2.0%	2.0%
F7	2.37	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	2.37	2.0%	2.0%
F8	2.93	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	2.93	2.0%	2.0%
F9	0.87	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	0.87	2.0%	2.0%
F10	3.87	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	3.87	2.0%	2.0%
G1	17.59	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	17.59	2.0%	2.0%
G2	1.21	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	1.21	2.0%	2.0%
UD1	16.50	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	16.50	2.0%	2.0%
UD2	23.67	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	23.67	2.0%	2.0%
UD3	44.34	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	44.34	2.0%	2.0%
UD4	1.80	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	1.80	2.0%	2.0%
UD5	5.82	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	5.82	2.0%	2.0%
OS1	1.35	100%	0.53	39.3%	6.2%	0.00	0.0%	2%	0.82	1.2%	40.5%
OS2	0.84	100%	0.42	50.0%	6.2%	0.00	0.0%	2%	0.42	1.0%	51.0%
OS3	0.58	100%	0.18	31.0%	6.2%	0.00	0.0%	2%	0.40	1.4%	32.4%
TOTAL	207.05										2.5%

Land Use or Surface	Percent						Runoff Co	oefficients	1				
Characteristics	Impervious	2-y	ear	5-1	ear	10-	year	25-	rear	50-	year	100	year
		HSG A&B	HSG C&D	HSGASS	HSG C&D	HSG A&B	HSG C&D	HSG ASB	HSG C&D	HSC A&B	HSG C&D	HSC ABB	156 (80
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	Server S			Sec	2	S						· · · · · ·	S
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				÷	2	S						S	÷
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	0.73	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		1		92 20			6			10			-
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	80.0	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				1.	3	ē							÷
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
Lawins	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

2.5 A	Acre Rural Lots - Comp.	% Impervious Calculatio	on
Total Area (ac)	Area (ac) - Roofs (90%)	Area (ac)- Drives (100%)	Area (ac) - Lawns (2%)
2.50	0.068	0.046	2.39
Comp % Imperviousness		6.20%	

Roads w/ Roadside [	Ditches - Comp. % Impe	rvious Calculation
Area* (ac)	Area - Ditch (5%)	Area - Roads (100%)
0.2124	0.1320	0.0804
Comp % Imperviousness	0.	41

\*Area based on 250 LF roadway from CL to outside edge of roadside ditch The above conservatively rounded to 45%.

### COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

#### bdivision: Saddlehorn Ranch

Location: El Paso County

Project Name: Saddlehorn Ranch

Project No.: 25142.04 Calculated By: AAM Checked By: TBD

Date: 5/17/22

		Basins Total	Hydro	ologic Soil (	Group	Hydro	ologic Soil (	Group	Mir	or Coefficie	ents	Maj	or Coefficie	ents		Basins Total
Basin ID	Total Area (ac)	Weighted % Imp.	Area A (ac)	Area B (ac)	Area C/D (ac)	% A (ac)	% B (ac)	% C/D (ac)	C <sub>5,A</sub>	C <sub>5,B</sub>	C <sub>5,C/D</sub>	C <sub>100,A</sub>	C <sub>100,B</sub>	C <sub>100,C/D</sub>	Basins Total Weighted $C_5$	Weighted C <sub>100</sub>
F1	4.93	2.0%	4.93	0.00	0.00	100%	0%	0%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13
F2	3.77	2.0%	3.77	0.00	0.00	100%	0%	0%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13
F3	33.31	2.0%	32.92	0.00	0.39	99%	0%	1%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13
F4	14.38	2.0%	14.38	0.00	0.00	100%	0%	0%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13
F5	19.25	2.0%	10.03	0.00	9.22	52%	0%	48%	0.01	0.01	0.05	0.13	0.44	0.49	0.03	0.30
F6	7.67	2.0%	7.67	0.00	0.00	100%	0%	0%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13
F7	2.37	2.0%	2.00	0.00	0.37	84%	0%	16%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.18
F8	2.93	2.0%	2.12	0.00	0.81	72%	0%	28%	0.01	0.01	0.05	0.13	0.44	0.49	0.02	0.23
F9	0.87	2.0%	0.87	0.00	0.00	100%	0%	0%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13
F10	3.87	2.0%	3.87	0.00	0.00	100%	0%	0%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13
UD1	16.50	2.0%	16.50	0.00	0.00	100%	0%	0%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13
UD2	23.67	2.0%	15.82	0.00	7.85	67%	0%	33%	0.01	0.01	0.05	0.13	0.44	0.49	0.02	0.25
UD3	44.34	2.0%	20.64	0.00	23.70	47%	0%	53%	0.01	0.01	0.05	0.13	0.44	0.49	0.03	0.32
UD4	1.80	2.0%	1.56	0.00	0.24	87%	0%	13%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.17
UD5	5.82	2.0%	5.82	0.00	0.00	100%	0%	0%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13
G1	17.59	2.0%	17.59	0.00	0.00	100%	0%	0%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13
G2	1.21	2.0%	1.21	0.00	0.00	100%	0%	0%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13

OS1	1.35	40.5%	1.35	0.00	0.00	100%	0%	0%	0.27	0.32	0.37	0.43	0.62	0.65	0.27	0.43
OS2	0.84	51.0%	0.84	0.00	0.00	100%	0%	0%	0.36	0.41	0.45	0.51	0.67	0.69	0.36	0.51
OS3	0.58	32.4%	0.58	0.00	0.00	100%	0%	0%	0.20	0.25	0.30	0.36	0.58	0.62	0.20	0.36
TOTAL	207.05	2.5%	164.47	0.00	42.58	79%	0%	21%							0.02	0.21

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS				Storm Ret	turn Period		
Soil Group	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	C <sub>A</sub> = 0.84 <i>i</i> <sup>1.302</sup>	C <sub>A</sub> = 0.86 <i>i</i> <sup>1.276</sup>	C <sub>A</sub> = 0.87 <i>i</i> <sup>1.232</sup>	$C_A =$ 0.84 <i>i</i> <sup>1.124</sup>	C <sub>A</sub> = 0.85 <i>i</i> +0.025	C <sub>A</sub> = 0.78 <i>i</i> +0.110	C <sub>A</sub> = 0.65 <i>i</i> +0.254
В	C <sub>B</sub> = 0.84 <i>i</i> <sup>1.169</sup>	C <sub>B</sub> = 0.86 <i>i</i> <sup>1.088</sup>	C <sub>B</sub> = 0.81 <i>i</i> +0.057	C <sub>B</sub> = 0.63 <i>i</i> +0.249	C <sub>B</sub> = 0.56 <i>i</i> +0.328	C <sub>B</sub> = 0.47 <i>i</i> +0.426	C <sub>B</sub> = 0.37 <i>i</i> +0.536
C/D	C <sub>C/D</sub> = 0.83 <i>i</i> <sup>1.122</sup>	C <sub>C/D</sub> = 0.82 <i>i</i> +0.035	C <sub>CD</sub> = 0.74 <i>i</i> +0.132	C <sub>C/D</sub> = 0.56 <i>i</i> +0.319	C <sub>CD</sub> = 0.49 <i>i</i> +0.393	C <sub>C/D</sub> = 0.41 <i>i</i> +0.484	C <sub>C/D</sub> = 0.32 <i>i</i> +0.588

Where:

*i* = % imperviousness (expressed as a decimal)

C<sub>4</sub> = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

 $C_B$  = Runoff coefficient for NRCS HSG B soils

 $C_{C/D}$  = Runoff coefficient for NRCS HSG C and D soils.

### STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Saddlehorn Ranch

Location: El Paso County

Project Name: Saddlehorn Ranch

Project No.: 25142.04 Calculated By: AAM

Checked By: TBD

Date: 5/17/22

		SUB-E	BASIN			INITL	AL/OVERI	LAND		Т	RAVEL TIM	E			tc CHECK		
		DA	TA				(T <sub>i</sub> )				(T <sub>t</sub> )			(L	IRBANIZED BA	(SINS)	FINAL
BASIN	D.A.	Hydrologic	Impervious	C <sub>5</sub>	C <sub>100</sub>	L	S <sub>o</sub>	t i	L <sub>t</sub>	S <sub>t</sub>	K	VEL.	t <sub>t</sub>	COMP. t <sub>c</sub>	TOTAL	Urbanized $t_c$	t <sub>c</sub>
ID	(ac)	Soils Group	(%)			(ft)	(%)	(min)	(ft)	(%)		(ft/s)	(min)	(min)	LENGTH (ft)	(min)	(min)
F1	4.93	А	2%	0.01	0.13	300	1.7%	28.5	546	0.5%	15.0	1.1	8.6	37.1	846.0	39.5	37.1
F2	3.77	А	2%	0.01	0.13	300	1.4%	30.8	249	1.0%	15.0	1.5	2.8	33.6	549.0	30.1	30.1
F3	33.31	А	2%	0.01	0.13	300	1.3%	31.7	2488	1.5%	15.0	1.8	22.5	54.2	2788.0	62.0	54.2
F4	14.38	А	2%	0.01	0.13	300	2.1%	26.8	583	1.7%	15.0	2.0	5.0	31.8	883.0	33.7	31.8
F5	19.25	А	2%	0.03	0.30	300	1.7%	28.2	1524	1.1%	15.0	1.6	16.1	44.3	1824.0	51.8	44.3
F6	7.67	А	2%	0.01	0.13	300	1.7%	28.7	690	1.0%	15.0	1.5	7.7	36.4	990.0	38.1	36.4
F7	2.37	А	2%	0.01	0.18	48	2.0%	10.8	2354	1.4%	15.0	1.8	22.1	32.9	2402.0	61.4	32.9
F8	2.93	А	2%	0.02	0.23	12	22.0%	2.4	3016	1.2%	15.0	1.6	30.6	33.0	3028.0	75.1	33.0
F9	0.87	А	2%	0.01	0.13	12	22.0%	2.5	946	1.2%	15.0	1.6	9.6	12.1	958.0	41.2	12.1
F10	3.87	А	2%	0.01	0.13	139	4.4%	14.3	489	0.5%	15.0	1.1	7.7	22.0	628.0	38.1	22.0
UD1	16.50	А	2%	0.01	0.13	118	1.8%	17.7	819	1.8%	7.0	0.9	14.5	32.2	937.0	36.6	32.2
UD2	23.67	А	2%	0.02	0.25	300	1.3%	30.9	209	1.3%	7.0	0.8	4.4	35.3	509.0	29.0	29.0
UD3	44.34	А	2%	0.03	0.32	290	1.6%	28.0	4562	1.2%	15.0	1.7	46.1	74.1	4852.0	100.1	74.1
UD4	1.80	А	2%	0.01	0.17	300	1.0%	34.0	144	1.0%	7.0	0.7	3.4	37.5	444.0	28.2	28.2
UD5	5.82	А	2%	0.01	0.13	300	4.1%	21.5	126	4.1%	7.0	1.4	1.5	23.0	426.0	26.8	23.0
G1	17.59	А	2%	0.01	0.13	300	1.5%	29.9	1399	1.1%	15.0	1.6	14.8	44.7	1699.0	49.6	44.7
G2	1.21	А	2%	0.01	0.13	12	22.0%	2.5	1378	1.1%	15.0	1.6	14.6	17.1	1390.0	49.3	17.1

### STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Saddlehorn Ranch

Location: El Paso County

Project Name: Saddlehorn Ranch

Project No.: 25142.04 Calculated By: AAM

Checked By: TBD

Date: 5/17/22

		SUB-I	BASIN			INITI	AL/OVER	LAND		Т	RAVEL TIM	E			tc CHECK		
		DA	ATA				(T <sub>i</sub> )				(T <sub>t</sub> )			(U	IRBANIZED BA	SINS)	FINAL
BASIN	D.A.	Hydrologic	Impervious	C <sub>5</sub>	C <sub>100</sub>	L	S <sub>o</sub>	t i	L <sub>t</sub>	S <sub>t</sub>	K	VEL.	t <sub>t</sub>	COMP. t <sub>c</sub>	TOTAL	Urbanized $t_c$	t <sub>c</sub>
ID	(ac)	Soils Group	(%)			(ft)	(%)	(min)	(ft)	(%)		(ft/s)	(min)	(min)	LENGTH (ft)	(min)	(min)
OS1	1.35	А	40%	0.27	0.43	55	3.4%	7.4	754	0.5%	15.0	1.1	11.8	19.3	809.0	31.2	19.3
OS2	0.84	А	51%	0.36	0.51	55	3.9%	6.3	491	0.5%	15.0	1.1	7.7	14.0	546.0	24.5	14.0
OS3	0.58	А	32%	0.20	0.36	174	3.2%	14.5	73	1.7%	7.0	0.9	1.3	15.9	247.0	21.2	15.9

#### NOTES:

$t_c = t_i + t_i$	Equation	$0.395(1.1-C_c)\sqrt{L_c}$	120 NY 120	Table 6-2. NRCS Convey	ance factors, K
$c_c = c_i + c_i$	Equation	5-2 $t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_0^{0.03}}$	Equation 6-3	Type of Land Surface	Conveyance Factor, K
Where:				Heavy meadow	2.5
$t_c$ = computed time of concentration (minutes)		Where:		Tillage/field	5
		$t_i$ = overland (initial) flow time (minutes)		Short pasture and lawns	7
$t_i$ = overland (initial) flow time (minutes)		$C_5$ = runoff coefficient for 5-year frequency (from Table 6-4) $L_i$ = length of overland flow (ft)		Nearly bare ground	10
$t_t$ = channelized flow time (minutes).		$S_o =$ average slope along the overland flow path (ft/ft).		Grassed waterway	15
L. L.		L.	122 1 15 12221	Paved areas and shallow paved swales	20
$t_{\rm r} = \frac{L_{\rm r}}{60K\sqrt{S_o}} = \frac{L_{\rm r}}{60V_{\rm r}}$	Equation 6-4	$t_{t} = (26 - 17i) + \frac{L_{t}}{60(14i + 9)\sqrt{S_{t}}}$	Equation 6-5		
/here:		Where:			
$t_t$ = channelized flow time (travel time, min) $L_t$ = waterway length (ft) $S_0$ = waterway slope (ft/ft) $V_t$ = travel time velocity (ft/sec) = K $\lor$ S <sub>0</sub> K = NRCS conveyance factor (see Table 6-2).		$t_c$ = minimum time of concentration for first design point when less $L_t$ = length of channelized flow path (ft) t = imperviousness (expressed as a decimal) $S_t$ = slope of the channelized flow path (ft/ft).	than t <sub>c</sub> from Equation 6-1	l .	

Use a minimum te value of 5 minutes for urbanized areas and a minimum te value of 10 minutes for areas

that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

Subdivisio Locatio Design Storn	n: El Pas	o Coun														Cal	Projec culate hecke	ame: t No.: d By: d By: Date:	25142 AAM TBD		Ranch		
				DIRE	CT RUN	NOFF			T	) TAL F	RUNOF	F	S	SWAL			PI	PE		TRAVE	L TIM	1E	
STREET	Design Point	3asin ID	Area (Ac)	tunoff Coeff.	; (min)	:*A (Ac)	(in/hr)	Q (cfs)	c (min)	*A (ac)	(in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	:*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	*A (ac)	Slope (%)	ipe Size (inches)	ength (ft)	Velocity (fps)	t (min)	REMARKS
	OS2	OS2	0.84	L'E	14.0	0	3.62		Ţ.	0	-	0	_	0.31		0	0	S	٩.	379	2.7	2.3	Roadside Swale Swale conveyance to DP 1.0
	1	F1	4.93				2.16							0.03						0	1.4		Roadside Swale Swale conveyance to DP 1.0
	1.0								37.1	0.34	2.16	0.7		0.34						564 0	2.4		Sum of DP OS2 and DP 1 Swale conveyance to DP 1.1 Roadside Swale
	2	F2	3.77	0.01	30.1	0.02	2.47	0.05						0.36						2922			Swale conveyance to DP 1.1 Sum of DP 1.0 and DP 2
	1.1	F3	33.31	0.01	54.2	0.22	1.59	0.4	41.0	0.36	2.01	0.7	0.4	0.22	1.5					0	2.4	0.0	Swale conveyance to DP 1.2 Roadside Swale Swale conveyance to DP 1.2
	4	F4											0.2	0.09	1.6					0	2.5	0.0	Swale conveyance to DP 1.2
	1.2								60.9	0.67	1.42	1.0		0.67						1003	2.0		Sum of DP 1.1, DP 3, and DP 4 Swale conveyance to DP 1.3 Roadside Swale
	5	F5	19.25	0.03	44.3	0.53	1.90	1.0					1.0	0.00	1.0								Swale conveyance to DP 1.3 Sum of DP 1.2 and DP 5
	1.3 OS1	OS1	1.35	0.27	19.3	0.27	3.15	1.2	69.3	1.20	1.23	1.5	1.2	0.37	1.8	1.5	1.20	0.5	24	62 379	3.2 2.7		Culvert conveyance to DP 1.6 Roadside Swale Swale conveyance to DP 1.4
	6	F6					2.19							0.05						0	2.0		Roadside Swale Swale conveyance to DP 1.4
	1.4								36.4	0.42	2.19	0.9		0.42						1672	2.4		Sum of DP OS1 and DP 6 Swale conveyance to DP 1.5 Roadside Swale
	7	F7	2.37	0.01	32.9	0.03	2.34	0.1						0.05						2987			Swale conveyance to DP 1.5 Swale conveyance to DP 1.5
	1.5 8	F8	2.93	0.02	33.0	0.05	2.34	0.1	48.2	0.45	1.77	0.8	0.1	0.05	1.3					0	2.3	0.0	Swale conveyance to DP 1.6 Swale conveyance to DP 1.6 Swale conveyance to DP 1.6
	9	F9	0.87											0.01						86	2.3		Roadside Swale Swale conveyance to DP 1.6
	1.6								69.6	1.71	1.22	2.1		1.71 0.02						489	2.4		Sum of DP 1.3, DP 1, 5, DP 8, and DP 9 Pond conveyance to DP 1.7 Proposed Pond F
	10	F10	3.87	0.01	22.0	0.02	2.95	0.1					0.1	0.02	1.0						2.0	0.0	Pond conveyance to DP 1.7 Sum of DP 1.6 and DP 10
	1.7	G1	17.59	0.01	44.7	0.11	1.88	0.2	69.6	1.73	1.22	2.1											Outlet structure release into Drainageway MS-06 Roadside Swale Swale conveyance to DP 11, Ultimately outfall into the existing Pond G
	12	G2		0.01			3.33																Smale conveyance to DP 12, Ultimately outfail into the existing Pond G

Subdivision: Location: Design Storm:	El Paso	o Coun														Pro Cal	oject N Projec Iculate Checke	lame et No ed By ed By Date	e: <u>Sado</u> 5.: <u>2514</u> 7: <u>AAN</u> 7: <u>TBD</u> 9: <u>5/17</u>	lehorr 2.04 /22	Ranc	h	
				DIRE	CT RUI	NOFF			TC	OTAL F	RUNO	F	0,	SWAL	_		Р	IPE		TRA\	'EL TII	ME	
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (Ac)	l (in/hr)	Q (cfs)	tc (min)	C*A (ac)	l (in/hr)	Q (cfs)	O <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	REMARKS
	13	UD1	16.50	0.01	32.2	0.10	2.37	0.2															Overland Flow Sheet flow into Drainageway T-6
	14		23.67				2.53																Overland Flow Sheet flow into Drainageway MS-06
	15	UD3	44.34	0.03	74.1	1.33	1.13	1.5															Overland Flow Sheet flow into Drainageway MS-06
	16	UD4					2.57																Overland Flow Sheet flow into Drainageway MS-06
	17	UD5	5.82	0.01	23.0	0.03	2.88	0.1															Overland Flow Sheet flow into Drainageway MS-06
	OS3	OS3					3.44																Overland Flow Sheet flow into Drainageway T-6

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

Project Name: Saddlehorn Ranch

Subdivision																		t No.:		2.04			
Location			ty															d By:					
Design Storm	: 100-Y	ear														C		d By: Date:		<u></u>			
																		Date.	5/1//	22			
				DIRF	CT RU	NOFF			Т	OTAL F	RUNOF	F	(	SWALE			PI	ÞF		TRAV	I TIN	1F	
		-	I	[		[	I	I	-			-						_				-	
																			ipe Size (inches)				
	Ħ			Ĥ.															nch		(s)		
STREET	oii			ğ		_	_		_	_	_		fs)	_	()	s)		()	e (i	(ft)	Ę,		REMARKS
	L L	9	(ac	ff (	(min)	(ac)	(hr)	s)	(min)	(ac)	Ĺ,	s)	t (C	(ac)	e) e	(cfs)	(ac)	6	Siz	th	ity	(min)	
	<b>Design Point</b>	Basin ID	Area (ac)	Runoff Coeff.	ш,	*A (ac)	(in/hr)	(cfs)		*A (ac)	(in/hr)	Q (cfs)	O <sub>street</sub> (cfs)	*A (ac)	Slope (%)	O <sub>pipe</sub>	C*A (ac)	Slope (%)	pe	ength (ft)-	/elocity (fps)	E)	
	ă	B	Ā	R	t c	Û	_	Ø	tc	Û	_	Ø		S			Û	S	Ρi			ţ	
													2.6	0.43	1.85					379	2.7	2.3	Roadside Swale
	OS2	OS2	0.84	0.51	14.0	0.43	6.08	2.6															Swale conveyance to DP 1.0
													2.3	0.62	0.50					0	1.4	0.0	Roadside Swale
	1	F1	4.93	0.13	37.1	0.62	3.63	2.3						4.05						5/4	0.4		Swale conveyance to DP 1.0
	1.0								37.1	1.05	2 ( 2	2.0	3.8	1.05	1.4					564	2.4	4.0	Sum of DP OS2 and DP 1
	1.0								37.1	1.05	3.63	3.8	2.0	0.40	1.0					0	2.0	0.0	Swale conveyance to DP 1.1 Roadside Swale
	2	F2	2 77	0.13	20.1	0.49	4 15	2.0					2.0	0.48	1.0					0	2.0	0.0	Roadside Swale Swale conveyance to DP 1.1
	2	12	5.77	0.15	30.1	0.40	4.13	2.0					5.2	1.53	1.5					2922	24	19.9	Sum of DP 1.0 and DP 2
	1.1								41.0	1.53	3.37	5.2	0.2	1.55	1.5					2122	2.7	17.7	Swale conveyance to DP 1.2
													11.6	4.34	1.5					0	2.4	0.0	Roadside Swale
	3	F3	33.31	0.13	54.2	4.34	2.67	11.6															Swale conveyance to DP 1.2
													7.3	1.81	1.6					0	2.5	0.0	Roadside Swale
	4	F4	14.38	0.13	31.8	1.81	4.02	7.3															Swale conveyance to DP 1.2
													18.3	7.68	1.0					1003	2.0	8.4	Sum of DP 1.1, DP 3, and DP 4
	1.2								60.9	7.68	2.38	18.3	10.5										Swale conveyance to DP 1.3
	-		10.05			5 00	0.40	40.5					18.5	5.80	1.0					0	2.0	0.0	Roadside Swale
-	5	F5	19.25	0.30	44.3	5.80	3.18	18.5															Swale conveyance to DP 1.3 Sum of DP 1.2 and DP 5
	1.3								60.2	13.48	2.05	27.7				27.7	13.48	0.5	24	62	8.8	0.1	Sum of DP 1.2 and DP 5 Culvert conveyance to DP 1.6
	1.5								07.5	13.40	2.03	21.1	3.1	0.58	1.8	21.1	13.40	0.5	24	379	2.7		Roadside Swale
	OS1	OS1	1.35	0.43	19.3	0.58	5.28	3.1					0.1	0.00						0,,,	2	2	Swale conveyance to DP 1.4
						0.00	0.00						3.6	0.97	1.0					0	2.0	0.0	Roadside Swale
	6	F6	7.67	0.13	36.4	0.97	3.68	3.6															Swale conveyance to DP 1.4
													5.7	1.55	1.4					1672	2.4	11.8	Sum of DP OS1 and DP 6
	1.4								36.4	1.55	3.68	5.7											Swale conveyance to DP 1.5
	_												1.7	0.43	1.4					0	2.4	0.0	Roadside Swale
	7	F7	2.37	0.18	32.9	0.43	3.93	1.7					5.0	4.00			-			0007		04.0	Swale conveyance to DP 1.5
	1.5								40.0	1.98	2.07	5.9	5.9	1.98	1.4					2987	2.4	21.0	Sum of DP 1.4 and DP 7
	1.5								48.Z	1.98	2.97	5.9	2.6	0.67	1.3					0	2.3	0.0	Swale conveyance to DP 1.6 Roadside Swale
	8	F8	2.93	0.23	33.0	0.67	3.92	2.6					2.0	0.07	1.5					0	2.5	0.0	Swale conveyance to DP 1.6
	Ŭ	10	2.75	0.20	55.0	0.07	3.72	2.0					0.7	0.11	1.3					86	2.3	0.6	Roadside Swale
	9	F9	0.87	0.13	12.1	0.11	6.46	0.7															Swale conveyance to DP 1.6
													33.3	16.24	1.4					489	2.4	3.4	Sum of DP 1.3, DP 1.5, DP 8, and DP 9
	1.6								69.4	16.24	2.05	33.3											Pond conveyance to DP 1.7
													2.4	0.49	1.0					0	2.0	0.0	Proposed Pond F
	10	F10	3.87	0.13	22.0	0.49	4.95	2.4															Pond conveyance to DP 1.7
	17								<i>(</i> <b>0</b> ·	1/ 70	2.05	24.0											Sum of DP 1.6 and DP 10
	1.7								69.4	16.73	2.05	34.3											Outlet structure release into Drainageway MS-06 Roadside Swale
	11	G1	17.59	0.12	417	2.22	3.16	7.0															Roadside Swale Swale conveyance to DP 11, Ultimately outfall into the existing Pond G
		01	17.37	0.13	44.7	2.22	3.10	7.0															Roadside Swale
	12	G2	1.21	0.13	17.1	0.15	5.59	0.8															Swale conveyance to DP 12, Ultimately outfall into the existing Pond G

Subdivision: Saddlehorn Ranch       Project Name:       Saddlehorn Ranch         Location: El Paso County       Project No.:       25142.04         Design Storm:       100-Year       Calculated By:       AMM         Date:       100-Year       Date:       100-Year																							
			DIRECT RUNOFF TOTAL RU							TAL RUNOFF S				SWALE			PIPE			'EL TIN	1E		
STREET	Design Point	Basin ID	Area (ac)	Runoff Coeff.	t <sub>c</sub> (min)	C*A (ac)	l (in/hr)	Q (cfs)	tc (min)	C*A (ac)	l (in/hr)	Q (cfs)	Q <sub>street</sub> (cfs)	C*A (ac)	Slope (%)	Q <sub>pipe</sub> (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t <sub>t</sub> (min)	REMARKS
	13	UD1	16.50	0.13	32.2	2.08	3.99	8.3															Overland Flow Sheet flow into Drainageway T-6
		UD2																					Overland Flow Sheet flow into Drainageway MS-06
						14.26																	Overland Flow Sheet flow into Drainageway MS-06
						0.31																	Overland Flow Sheet flow into Drainageway MS-06
		UD5																					Overland Flow Sheet flow into Drainageway MS-06
	OS3	OS3	0.58	0.36	15.9	0.21	5.77	1.2															Overland Flow Sheet flow into Drainageway T-6

Notes:

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

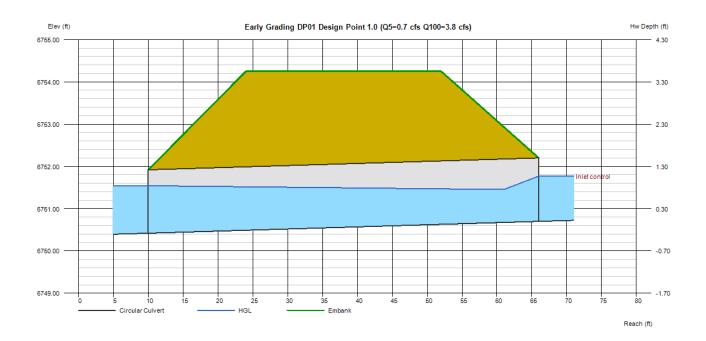
# APPENDIX C

# HYDRAULIC CALCULATIONS

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

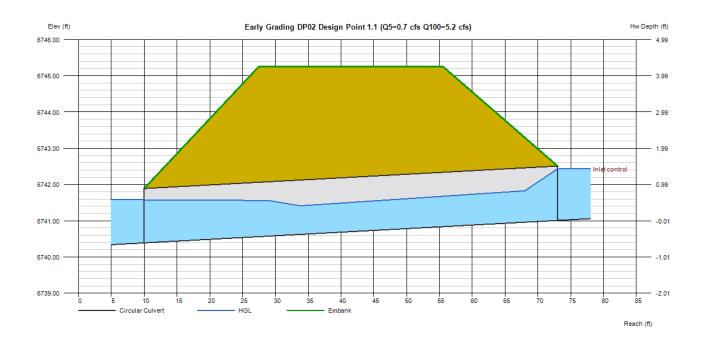
# Early Grading DP01 Design Point 1.0 (Q5=0.7 cfs Q100=3.8 cfs)

Invert Elev Dn (ft)	= 6750.42	Calculations	
Pipe Length (ft)	= 56.00	Qmin (cfs)	= 0.70
Slope (%)	= 0.50	Qmax (cfs)	= 3.80
Invert Elev Up (ft)	= 6750.70	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 18.0		
Shape	= Circular	Highlighted	
Span (in)	= 18.0	Qtotal (cfs)	= 3.80
No. Barrels	= 1	Qpipe (cfs)	= 3.80
n-Value	= 0.014	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Corrugate Metal Pipe	Veloc Dn (ft/s)	= 2.68
Culvert Entrance	= Headwall	Veloc Up (ft/s)	= 4.34
Coeff. K,M,c,Y,k	= 0.0078, 2, 0.0379, 0.69, 0.5	HGL Dn (ft)	= 6751.54
		HGL Up (ft)	= 6751.45
Embankment		Hw Elev (ft)	= 6751.77
Top Elevation (ft)	= 6754.25	Hw/D (ft)	= 0.71
Top Width (ft)	= 28.00	Flow Regime	= Inlet Control
Crest Width (ft)	= 20.00		



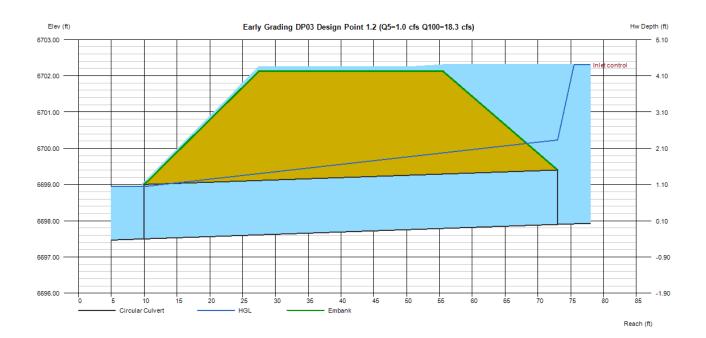
### Early Grading DP02 Design Point 1.1 (Q5=0.7 cfs Q100=5.2 cfs)

Invert Elev Dn (ft)	= 6740.39	Calculations	
Pipe Length (ft)	= 63.00	Qmin (cfs)	= 0.70
Slope (%)	= 0.98	Qmax (cfs)	= 5.20
Invert Èlev Up (ft)	= 6741.01	Tailwater Élev (ft)	= (dc+D)/2
Rise (in)	= 18.0	( )	( /
Shape	= Circular	Highlighted	
Span (in)	= 18.0	Qtotal (cfs)	= 5.20
No. Barrels	= 1	Qpipe (cfs)	= 5.20
n-Value	= 0.014	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Corrugate Metal Pipe	Veloc Dn (ft/s)	= 3.46
Culvert Entrance	= Projecting	Veloc Up (ft/s)	= 4.84
Coeff. K,M,c,Y,k	= 0.034, 1.5, 0.0553, 0.54, 0.9	HGL Dn (ft)	= 6741.58
		HGL Up (ft)	= 6741.89
Embankment		Hw Elev (ft)	= 6742.44
Top Elevation (ft)	= 6745.26	Hw/D (ft)	= 0.95
Top Width (ft)	= 28.00	Flow Regime	= Inlet Control
Crest Width (ft)	= 20.00		



### Early Grading DP03 Design Point 1.2 (Q5=1.0 cfs Q100=18.3 cfs)

Invert Elev Dn (ft) Pipe Length (ft) Slope (%) Invert Elev Up (ft) Rise (in)	= 6697.50 = 63.00 = 0.63 = 6697.90 = 18.0	<b>Calculations</b> Qmin (cfs) Qmax (cfs) Tailwater Elev (ft)	= 1.00 = 18.30 = (dc+D)/2
Shape	= Circular	Highlighted	
Span (in)	= 18.0	Qtotal (cfs)	= 18.30
No. Barrels	= 1	Qpipe (cfs)	= 14.25
n-Value	= 0.014	Qovertop (cfs)	= 4.05
Culvert Type	<ul> <li>Circular Corrugate Metal Pipe</li> </ul>	Veloc Dn (ft/s)	= 8.16
Culvert Entrance	= Projecting	Veloc Up (ft/s)	= 8.06
Coeff. K,M,c,Y,k	= 0.034, 1.5, 0.0553, 0.54, 0.9	HGL Dn (ft)	= 6698.94
		HGL Up (ft)	= 6700.23
Embankment		Hw Elev (ft)	= 6702.30
Top Elevation (ft)	= 6702.13	Hw/D (ft)	= 2.93
Top Width (ft)	= 28.00	Flow Regime	= Inlet Control
Crest Width (ft)	= 20.00	-	



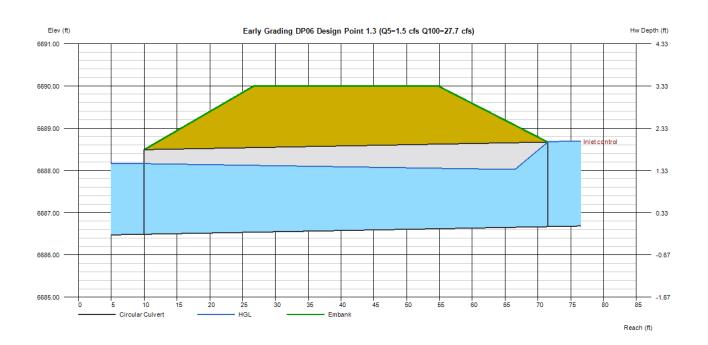
### Early Grading DP06 Design Point 1.3 (Q5=1.5 cfs Q100=27.7 cfs)

Invert Elev Dn (ft) Pipe Length (ft) Slope (%) Invert Elev Up (ft)	= 6686.49 = 61.50 = 0.29 = 6686.67	<b>Calculations</b> Qmin (cfs) Qmax (cfs) Tailwater Elev (ft)	= 1.50 = 27.70 = (dc+D)/2
Rise (in)	= 24.0		
Shape	= Circular	Highlighted	
Span (in)	= 24.0	Qtotal (cfs)	= 27.70
No. Barrels	= 2	Qpipe (cfs)	= 27.70
n-Value	= 0.013	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Concrete	Veloc Dn (ft/s)	= 4.94
Culvert Entrance	<ul> <li>Groove end projecting (C)</li> </ul>	Veloc Up (ft/s)	= 6.19
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2	HGL Dn (ft)	= 6688.16
		HGL Up (ft)	= 6688.01
Embankment		Hw Elev (ft)	= 6688.69
Top Elevation (ft)	- 6600.00		- 1 01

Top Elevation (ft) Top Width (ft) Crest Width (ft)

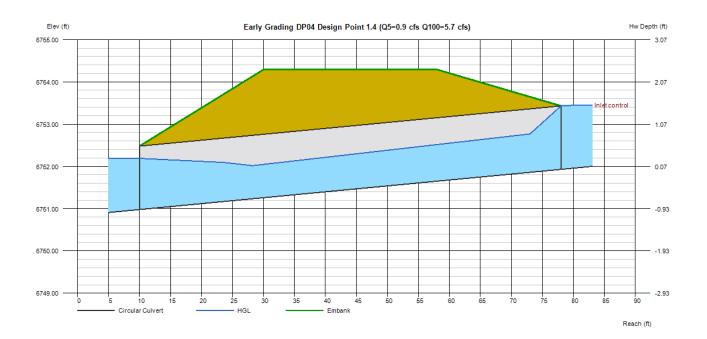
=	6690.00
=	28.00
=	20.00

inginginoa		
Qtotal (cfs)	=	27.70
Qpipe (cfs)	=	27.70
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.94
Veloc Up (ft/s)	=	6.19
HGL Dn (ft)	=	6688.16
HGL Up (ft)	=	6688.01
Hw Elev (ft)	=	6688.69
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



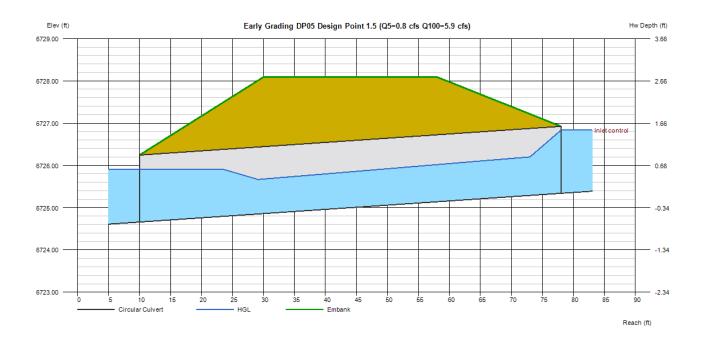
### Early Grading DP04 Design Point 1.4 (Q5=0.9 cfs Q100=5.7 cfs)

Invert Elev Dn (ft)	= 6750.98	Calculations	
Pipe Length (ft)	= 68.00	Qmin (cfs)	= 0.90
Slope (%)	= 1.40	Qmax (cfs)	= 5.70
Invert Èlev Up (ft)	= 6751.93	Tailwater Élev (ft)	= (dc+D)/2
Rise (in)	= 18.0		, , , , , , , , , , , , , , , , , , ,
Shape	= Circular	Highlighted	
Span (in)	= 18.0	Qtotal (cfs)	= 5.70
No. Barrels	= 1	Qpipe (cfs)	= 5.70
n-Value	= 0.014	Qovertop (cfs)	= 0.00
Culvert Type	<ul> <li>Circular Corrugate Metal Pipe</li> </ul>	Veloc Dn (ft/s)	= 3.73
Culvert Entrance	= Projecting	Veloc Up (ft/s)	= 5.01
Coeff. K,M,c,Y,k	= 0.034, 1.5, 0.0553, 0.54, 0.9	HGL Dn (ft)	= 6752.19
		HGL Up (ft)	= 6752.85
Embankment		Hw Elev (ft)	= 6753.45
Top Elevation (ft)	= 6754.29	Hw/D (ft)	= 1.01
Top Width (ft)	= 28.00	Flow Regime	= Inlet Control
Crest Width (ft)	= 20.00		



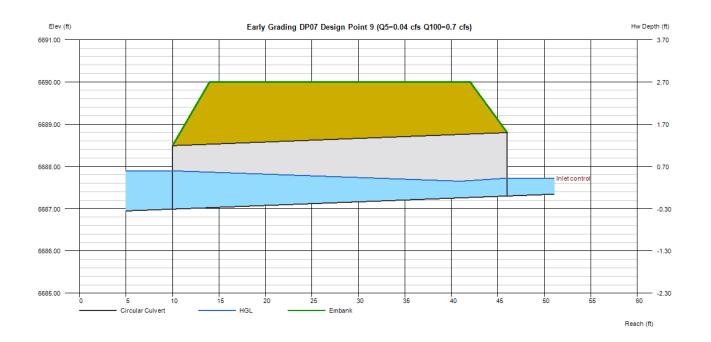
### Early Grading DP05 Design Point 1.5 (Q5=0.8 cfs Q100=5.9 cfs)

Invert Elev Dn (ft)	= 6724.66	Calculations	
Pipe Length (ft)	= 68.00	Qmin (cfs)	= 0.80
Slope (%)	= 1.00	Qmax (cfs)	= 5.90
Invert Èlev Up (ft)	= 6725.34	Tailwater Élev (ft)	= (dc+D)/2
Rise (in)	= 19.0		
Shape	= Circular	Highlighted	
Span (in)	= 19.0	Qtotal (cfs)	= 5.90
No. Barrels	= 1	Qpipe (cfs)	= 5.90
n-Value	= 0.014	Qovertop (cfs)	= 0.00
Culvert Type	<ul> <li>Circular Corrugate Metal Pipe</li> </ul>	Veloc Dn (ft/s)	= 3.53
Culvert Entrance	= Projecting	Veloc Up (ft/s)	= 4.96
Coeff. K,M,c,Y,k	= 0.034, 1.5, 0.0553, 0.54, 0.9	HGL Dn (ft)	= 6725.91
		HGL Up (ft)	= 6726.26
Embankment		Hw Elev (ft)	= 6726.83
Top Elevation (ft)	= 6728.09	Hw/D (ft)	= 0.94
Top Width (ft)	= 28.00	Flow Regime	= Inlet Control
Crest Width (ft)	= 20.00		



### Early Grading DP07 Design Point 9 (Q5=0.04 cfs Q100=0.7 cfs)

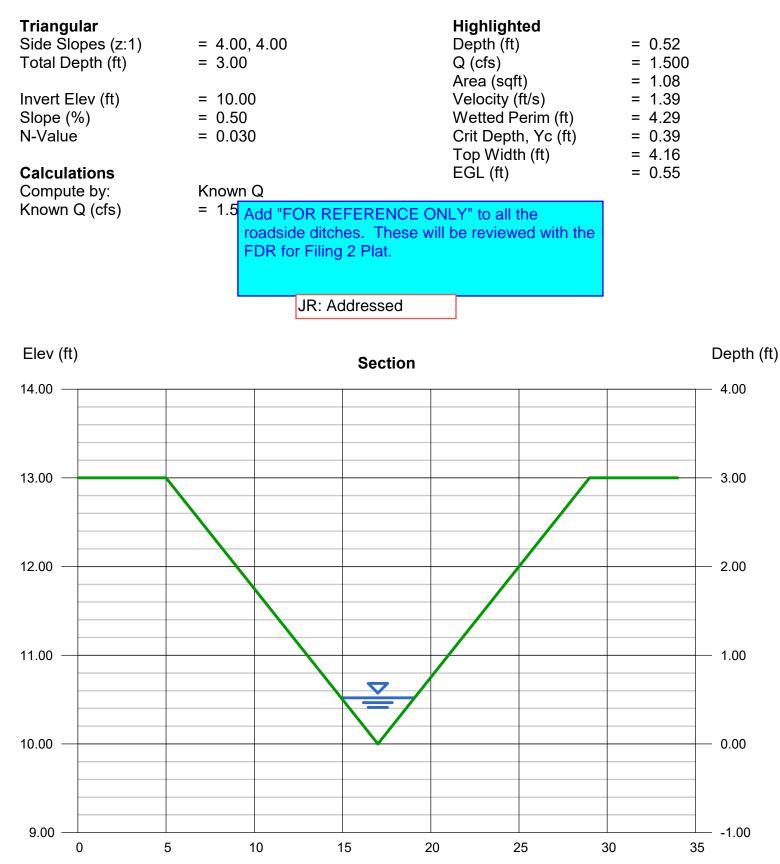
Invert Elev Dn (ft) Pipe Length (ft) Slope (%) Invert Elev Up (ft) Rise (in)	= 6686.99 = 36.00 = 0.86 = 6687.30 = 18.0	<b>Calculations</b> Qmin (cfs) Qmax (cfs) Tailwater Elev (ft)	= 0.04 = 0.70 = (dc+D)/2
Shape	= Circular	Highlighted	
Span (in)	= 18.0	Qtotal (cfs)	= 0.70
No. Barrels	= 1	Qpipe (cfs)	= 0.70
n-Value	= 0.014	Qovertop (cfs)	= 0.00
Culvert Type	= Circular Corrugate Metal Pipe	Veloc Dn (ft/s)	= 0.63
Culvert Entrance	= Projecting	Veloc Up (ft/s)	= 2.65
Coeff. K,M,c,Y,k	= 0.034, 1.5, 0.0553, 0.54, 0.9	HGL Dn (ft)	= 6687.90
		HGL Up (ft)	= 6687.61
Embankment		Hw Elev (ft)	= 6687.72
Top Elevation (ft)	= 6690.00	Hw/D (ft)	= 0.28
Top Width (ft)	= 28.00	Flow Regime	= Inlet Control
Crest Width (ft)	= 20.00		



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### DP 1.0 Swale (5-Year)



Reach (ft)

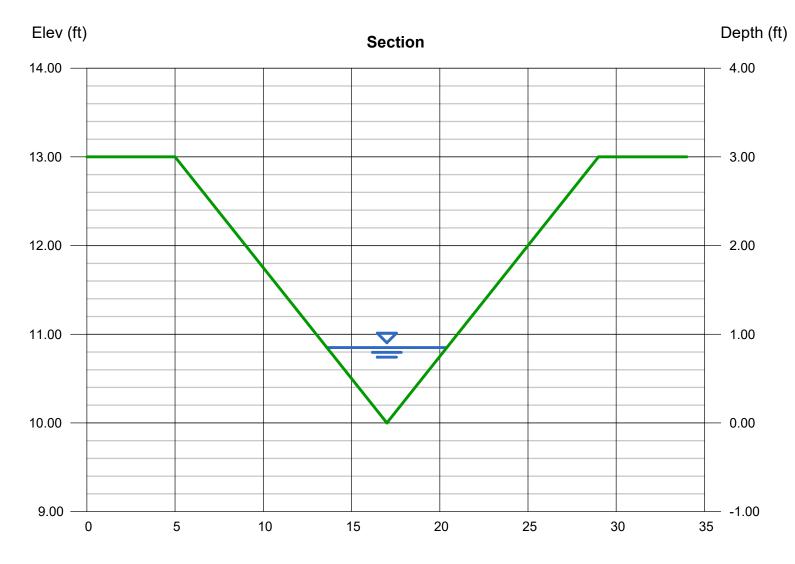
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### DP 1.0 Swale (100-Year)

#### Triangular

Triangular		Highlighted	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 0.85
Total Depth (ft)	= 3.00	Q (cfs)	= 5.600
		Area (sqft)	= 2.89
Invert Elev (ft)	= 10.00	Velocity (ft/s)	= 1.94
Slope (%)	= 0.50	Wetted Perim (ft)	= 7.01
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.66
		Top Width (ft)	= 6.80
Calculations		EGL (ft)	= 0.91
Compute by:	Known Q		
Known Q (cfs)	= 5.60		



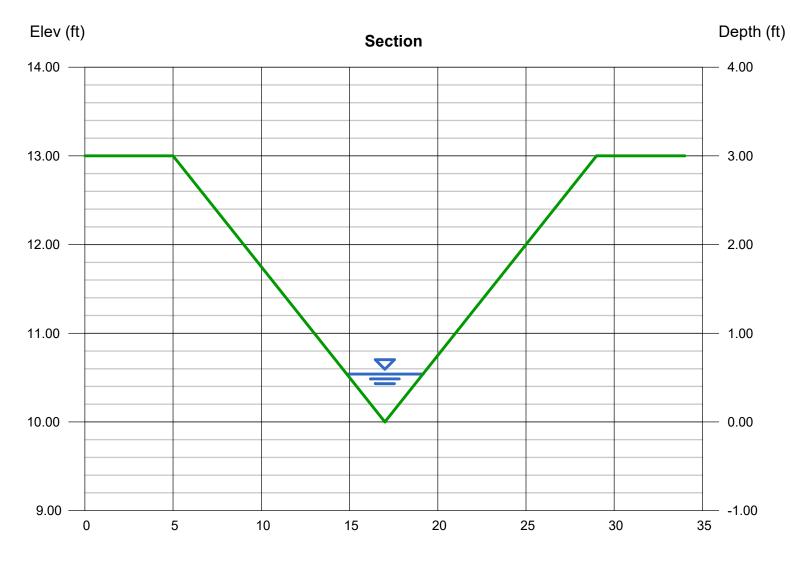
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#### DP 1.1 Swale (5-Year)

Triangular
------------

	Highlighted	
= 4.00, 4.00	Depth (ft)	= 0.54
= 3.00	Q (cfs)	= 2.300
	Area (sqft)	= 1.17
= 10.00	Velocity (ft/s)	= 1.97
= 1.00	Wetted Perim (ft)	= 4.45
= 0.030	Crit Depth, Yc (ft)	= 0.46
	Top Width (ft)	= 4.32
	EGL (ft)	= 0.60
Known Q		
= 2.30		
	= 3.00 = 10.00 = 1.00 = 0.030 Known Q	= 4.00, 4.00 Depth (ft) = 3.00 Q (cfs) Area (sqft) = 10.00 Velocity (ft/s) = 1.00 Wetted Perim (ft) = 0.030 Crit Depth, Yc (ft) Top Width (ft) EGL (ft)



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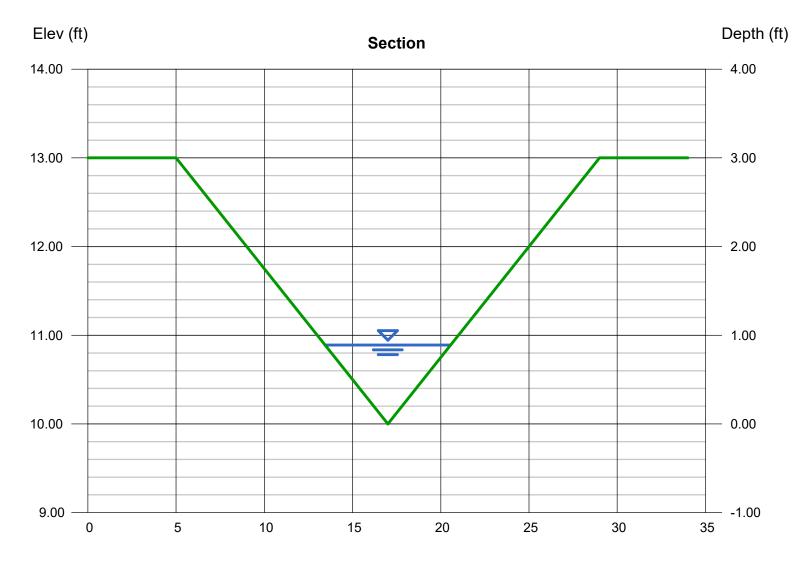
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= 0.89 = 8.800 = 3.17 = 2.78 = 7.34 = 0.79 = 7.12 = 1.01

### DP 1.1 Swale (100-Year)

Triangular
------------

	Highlighted
= 4.00, 4.00	Depth (ft)
= 3.00	Q (cfs)
	Area (sqft)
= 10.00	Velocity (ft/s)
= 1.00	Wetted Perim (ft)
= 0.030	Crit Depth, Yc (ft)
	Top Width (ft)
	EGL (ft)
Known Q	
= 8.80	
	= 3.00 = 10.00 = 1.00 = 0.030 Known Q



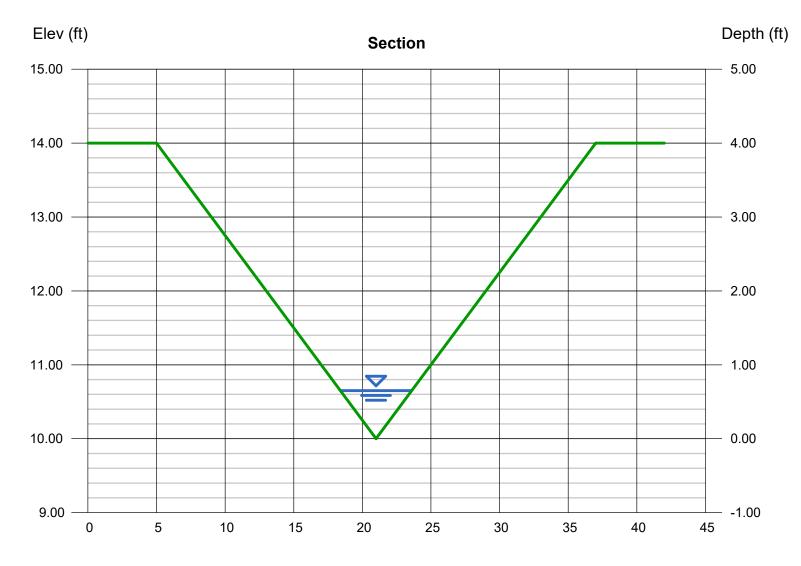
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#### DP 1.2 Swale (5-Year)

#### Triangular

Triangular		Highlighted	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 0.65
Total Depth (ft)	= 4.00	Q (cfs)	= 4.500
		Area (sqft)	= 1.69
Invert Elev (ft)	= 10.00	Velocity (ft/s)	= 2.66
Slope (%)	= 1.35	Wetted Perim (ft)	= 5.36
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.61
		Top Width (ft)	= 5.20
Calculations		EGL (ft)	= 0.76
Compute by:	Known Q		
Known Q (cfs)	= 4.50		



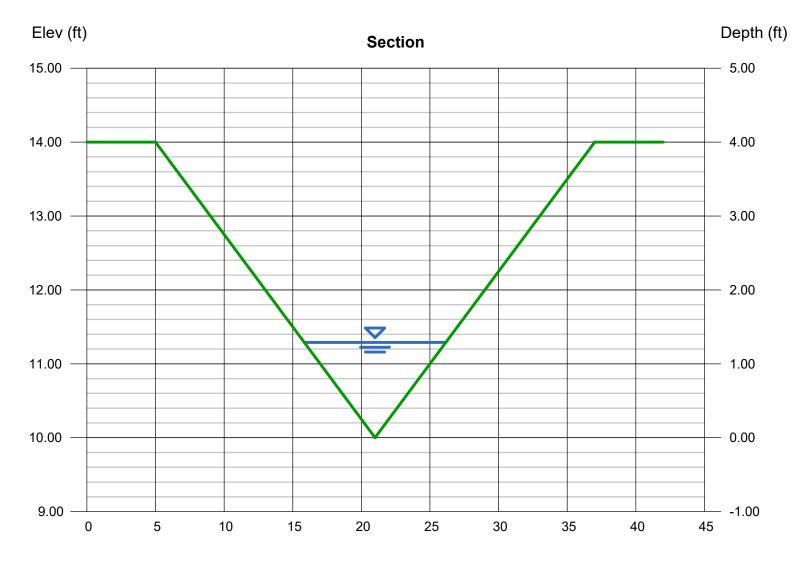
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### DP 1.2 Swale (100-Year)

#### Triangular

Triangular		Highlighted	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 1.29
Total Depth (ft)	= 4.00	Q (cfs)	= 27.90
		Area (sqft)	= 6.66
Invert Elev (ft)	= 10.00	Velocity (ft/s)	= 4.19
Slope (%)	= 1.35	Wetted Perim (ft)	= 10.64
N-Value	= 0.030	Crit Depth, Yc (ft)	= 1.25
		Top Width (ft)	= 10.32
Calculations		EGL (ft)	= 1.56
Compute by:	Known Q		
Known Q (cfs)	= 27.90		



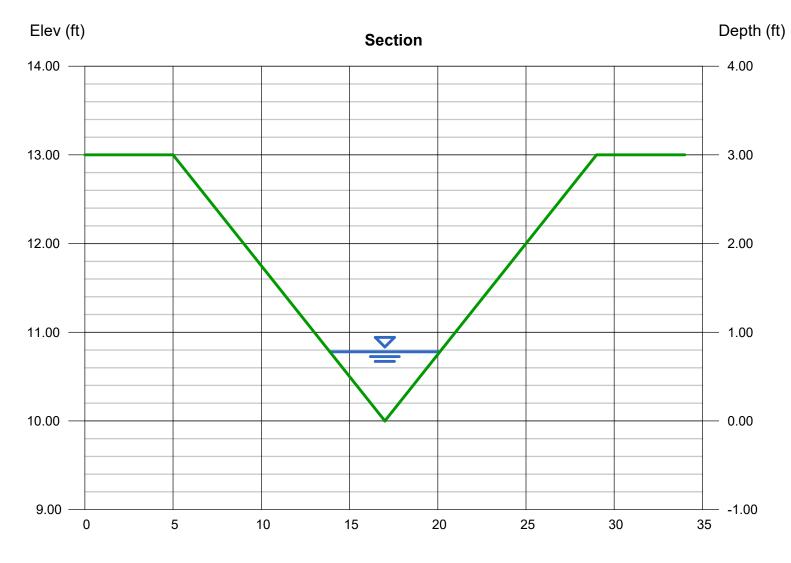
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#### DP 1.3 Swale (5-Year)

In	ana	jular	
	ang	juiui	

	Highlighted	
= 4.00, 4.00	Depth (ft)	= 0.78
= 3.00	Q (cfs)	= 6.100
	Area (sqft)	= 2.43
= 10.00	Velocity (ft/s)	= 2.51
= 1.00	Wetted Perim (ft)	= 6.43
= 0.030	Crit Depth, Yc (ft)	= 0.68
	Top Width (ft)	= 6.24
	EGL (ft)	= 0.88
Known Q		
= 6.10		
	= 3.00 = 10.00 = 1.00 = 0.030 Known Q	= 4.00, 4.00 Depth (ft) = 3.00 Q (cfs) Area (sqft) = 10.00 Velocity (ft/s) = 1.00 Wetted Perim (ft) = 0.030 Crit Depth, Yc (ft) Top Width (ft) EGL (ft)



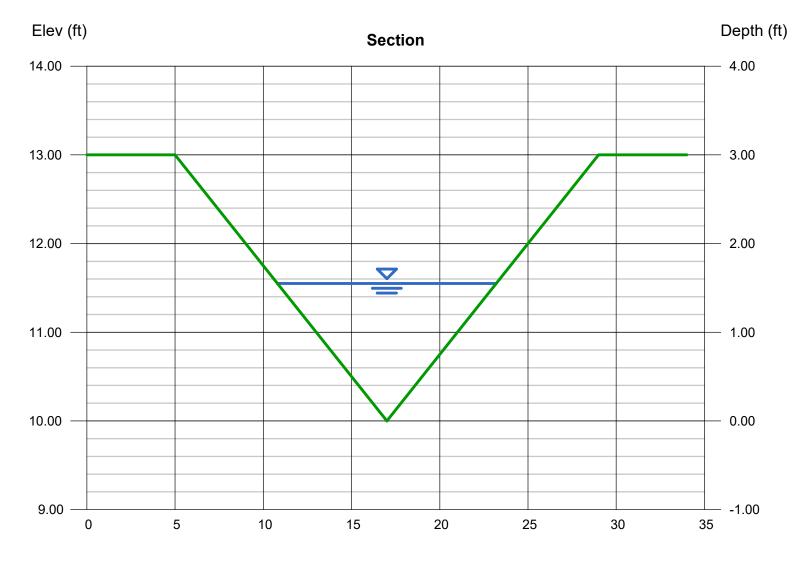
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### DP 1.3 Swale (100-Year)

#### Triangular

Triangular		Highlighted	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 1.55
Total Depth (ft)	= 3.00	Q (cfs)	= 38.70
		Area (sqft)	= 9.61
Invert Elev (ft)	= 10.00	Velocity (ft/s)	= 4.03
Slope (%)	= 1.00	Wetted Perim (ft)	= 12.78
N-Value	= 0.030	Crit Depth, Yc (ft)	= 1.43
		Top Width (ft)	= 12.40
Calculations		EGL (ft)	= 1.80
Compute by:	Known Q		
Known Q (cfs)	= 38.70		



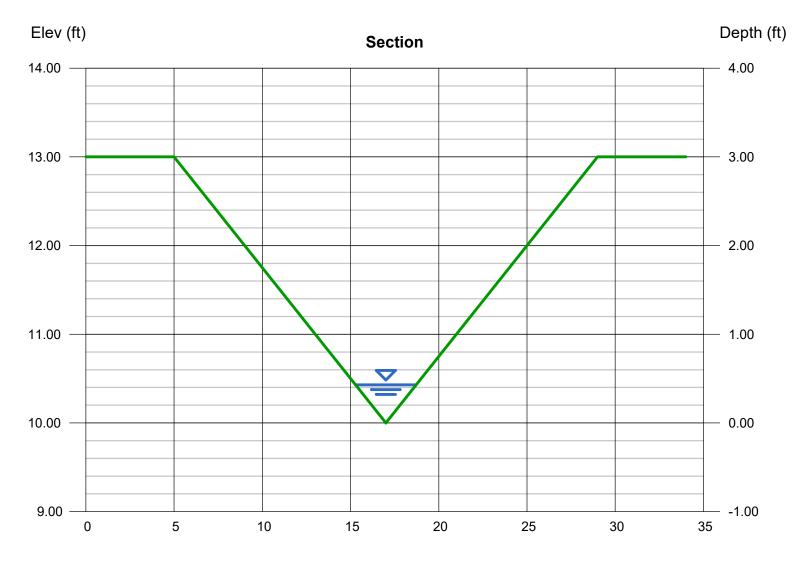
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Thursday, May 20 2021

#### DP 1.4 Swale (5-Year)

Triangular
------------

Triangular		Highlighted	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 0.43
Total Depth (ft)	= 3.00	Q (cfs)	= 1.700
		Area (sqft)	= 0.74
Invert Elev (ft)	= 10.00	Velocity (ft/s)	= 2.30
Slope (%)	= 1.87	Wetted Perim (ft)	= 3.55
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.41
		Top Width (ft)	= 3.44
Calculations		EGL (ft)	= 0.51
Compute by:	Known Q		
Known Q (cfs)	= 1.70		



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= 0.76

= 2.31

= 3.42

= 6.27

= 0.76

= 6.08

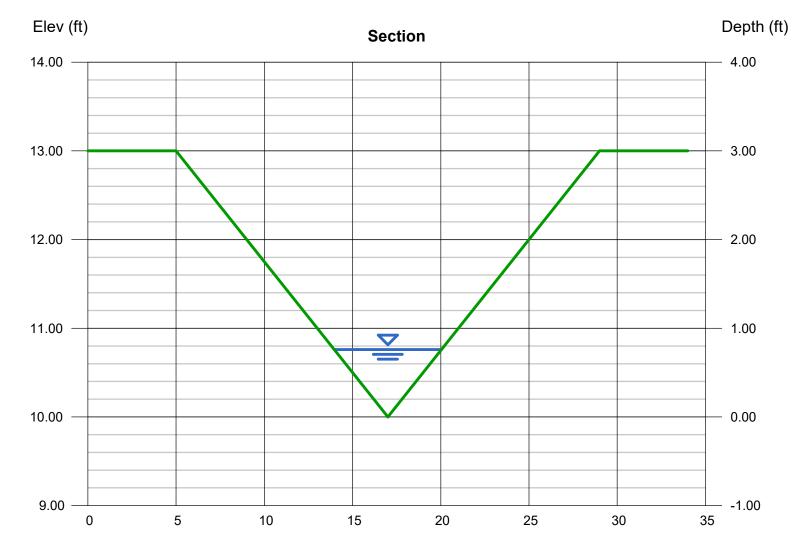
= 0.94

= 7.900

### DP 1.4 Swale (100-Year)

Triangular
------------

Triangular		Highlighted
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)
Total Depth (ft)	= 3.00	Q (cfs)
		Area (sqft)
Invert Elev (ft)	= 10.00	Velocity (ft/s)
Slope (%)	= 1.87	Wetted Perim (ft)
N-Value	= 0.030	Crit Depth, Yc (ft)
		Top Width (ft)
Calculations		EGL (ft)
Compute by:	Known Q	
Known Q (cfs)	= 7.90	



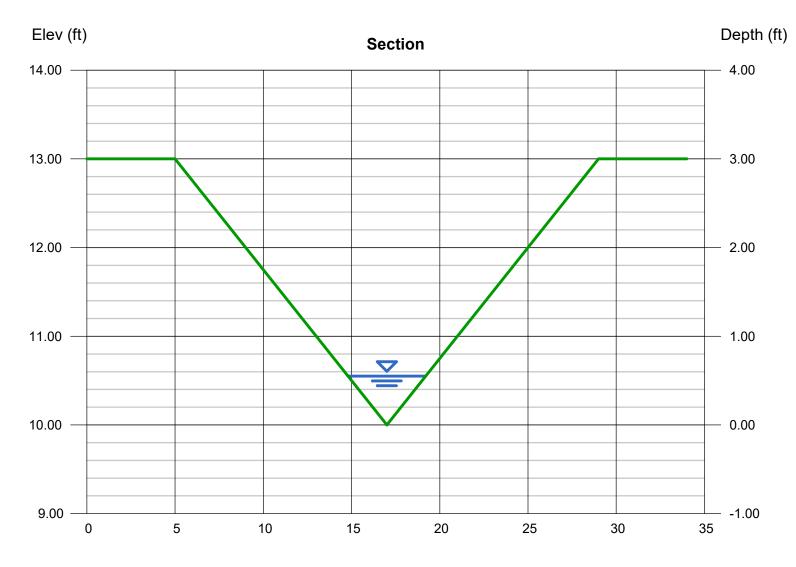
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Thursday, May 20 2021

#### DP 1.5 Swale (5-Year)

Triangular
------------

	Highlighted	
= 4.00, 4.00	Depth (ft)	= 0.55
= 3.00	Q (cfs)	= 2.800
	Area (sqft)	= 1.21
= 10.00	Velocity (ft/s)	= 2.31
= 1.40	Wetted Perim (ft)	= 4.54
= 0.030	Crit Depth, Yc (ft)	= 0.50
	Top Width (ft)	= 4.40
	EGL (ft)	= 0.63
Known Q		
= 2.80		
	= 3.00 = 10.00 = 1.40 = 0.030 Known Q	= 4.00, 4.00 Depth (ft) = 3.00 Q (cfs) Area (sqft) = 10.00 Velocity (ft/s) = 1.40 Wetted Perim (ft) = 0.030 Crit Depth, Yc (ft) Top Width (ft) EGL (ft)



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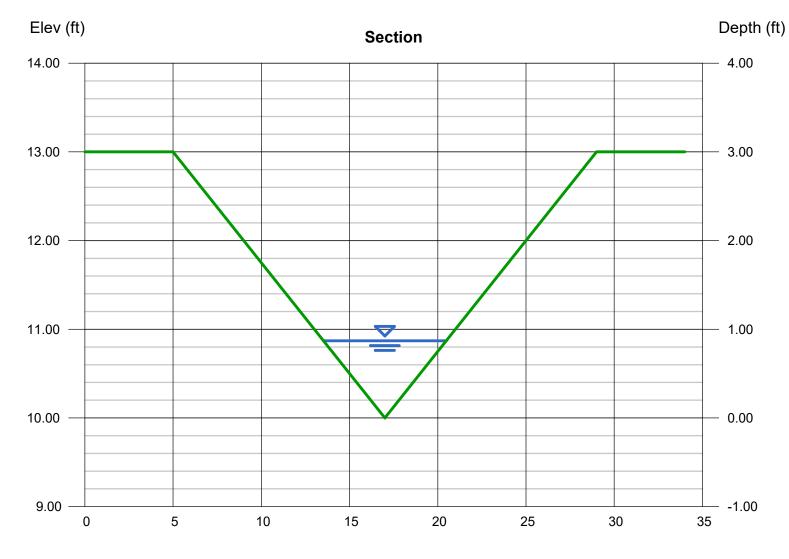
Thursday, May 20 2021

= 0.87 = 9.900 = 3.03 = 3.27 = 7.17 = 0.83 = 6.96 = 1.04

### DP 1.5 Swale (100-Year)

Triangular
------------

Triangular		Highlighted
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)
Total Depth (ft)	= 3.00	Q (cfs)
		Area (sqft)
Invert Elev (ft)	= 10.00	Velocity (ft/s)
Slope (%)	= 1.40	Wetted Perim (ft)
N-Value	= 0.030	Crit Depth, Yc (ft)
		Top Width (ft)
Calculations		EGL (ft)
Compute by:	Known Q	
Known Q (cfs)	= 9.90	



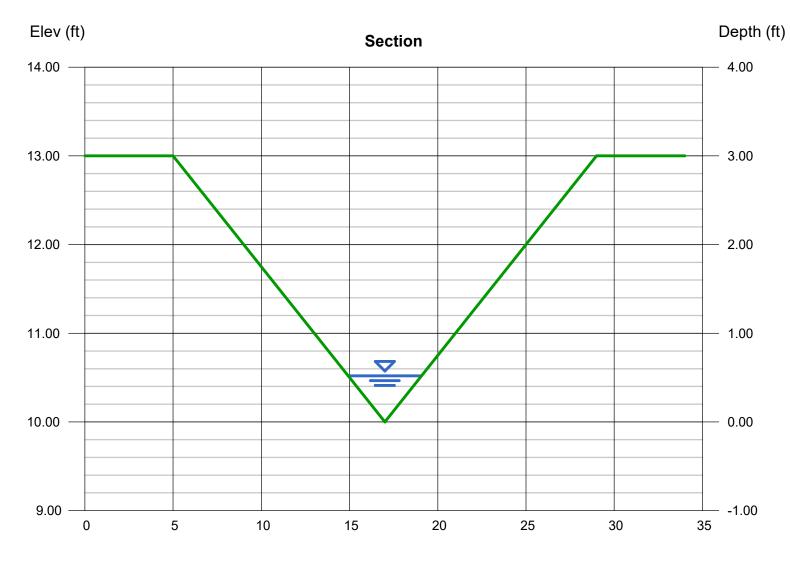
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Thursday, May 20 2021

#### DP 8 Swale (5-Year)

Triangular
------------

	Highlighted	
= 4.00, 4.00	Depth (ft)	= 0.52
= 3.00	Q (cfs)	= 2.300
	Area (sqft)	= 1.08
= 10.00	Velocity (ft/s)	= 2.13
= 1.22	Wetted Perim (ft)	= 4.29
= 0.030	Crit Depth, Yc (ft)	= 0.46
	Top Width (ft)	= 4.16
	EGL (ft)	= 0.59
Known Q		
= 2.30		
	= 3.00 = 10.00 = 1.22 = 0.030 Known Q	= 4.00, 4.00 Depth (ft) = 3.00 Q (cfs) Area (sqft) = 1.22 Velocity (ft/s) = 0.030 Crit Depth, Yc (ft) Top Width (ft) EGL (ft)



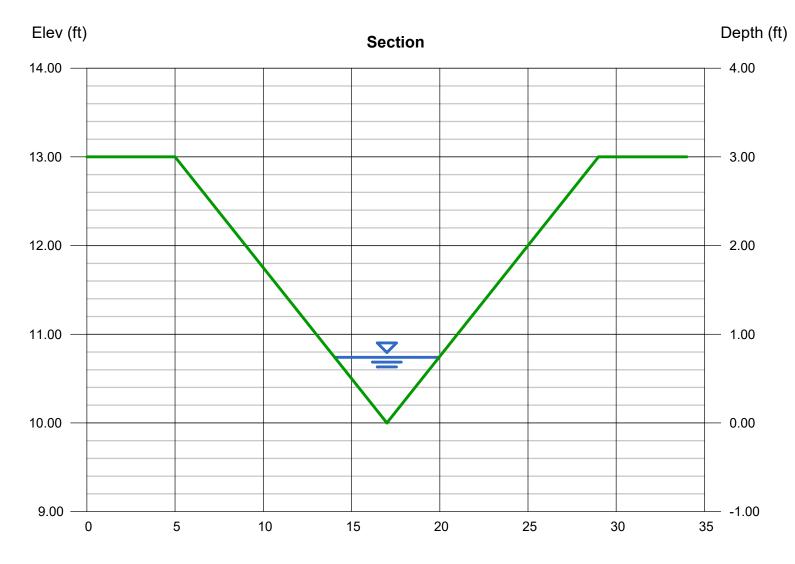
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Thursday, May 20 2021

#### DP 8 Swale (100-Year)

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			3	~	~

	Highlighted	
= 4.00, 4.00	Depth (ft)	= 0.74
= 3.00	Q (cfs)	= 6.000
	Area (sqft)	= 2.19
= 10.00	Velocity (ft/s)	= 2.74
= 1.22	Wetted Perim (ft)	= 6.10
= 0.030	Crit Depth, Yc (ft)	= 0.68
	Top Width (ft)	= 5.92
	EGL (ft)	= 0.86
Known Q		
= 6.00		
	= 3.00 = 10.00 = 1.22 = 0.030 Known Q	= 4.00, 4.00 Depth (ft) = 3.00 Q (cfs) Area (sqft) = 10.00 Velocity (ft/s) = 1.22 Wetted Perim (ft) = 0.030 Crit Depth, Yc (ft) Top Width (ft) EGL (ft)



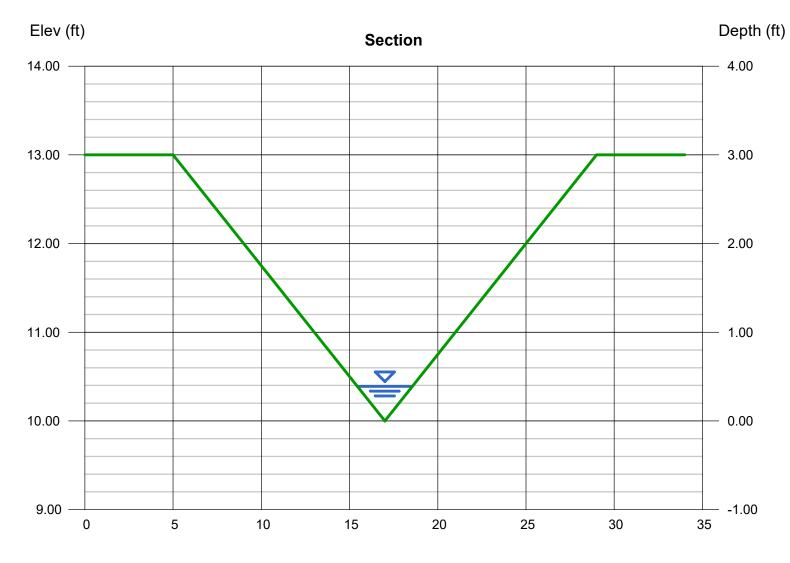
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Thursday, May 20 2021

### DP 9 Swale (5-Year)

Triang	gular
--------	-------

Triangular		Highlighted	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 0.39
Total Depth (ft)	= 3.00	Q (cfs)	= 1.100
		Area (sqft)	= 0.61
Invert Elev (ft)	= 10.00	Velocity (ft/s)	= 1.81
Slope (%)	= 1.30	Wetted Perim (ft)	= 3.22
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.35
		Top Width (ft)	= 3.12
Calculations		EGL (ft)	= 0.44
Compute by:	Known Q		
Known Q (cfs)	= 1.10		



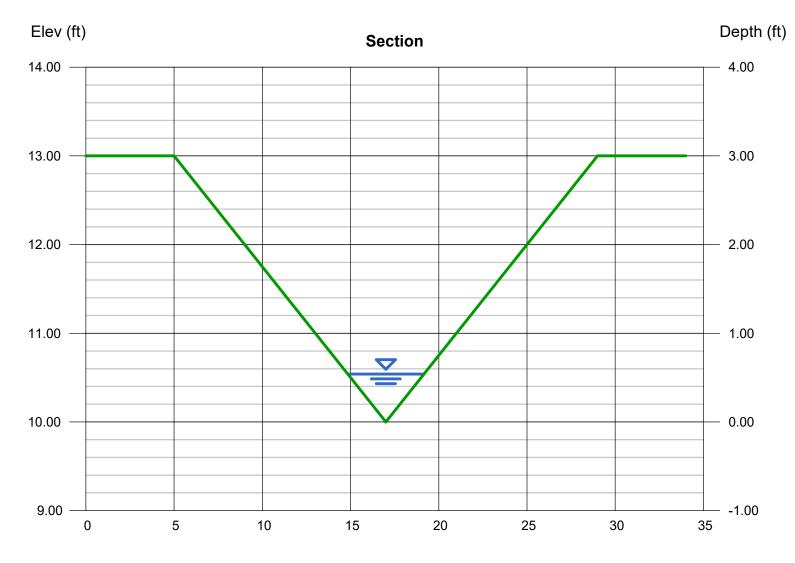
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Thursday, May 20 2021

#### DP 9 Swale (100-Year)

#### Triangular

Triangular		Highlighted	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 0.54
Total Depth (ft)	= 3.00	Q (cfs)	= 2.600
		Area (sqft)	= 1.17
Invert Elev (ft)	= 10.00	Velocity (ft/s)	= 2.23
Slope (%)	= 1.30	Wetted Perim (ft)	= 4.45
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.49
		Top Width (ft)	= 4.32
Calculations		EGL (ft)	= 0.62
Compute by:	Known Q		
Known Q (cfs)	= 2.60		



### APPENDIX D

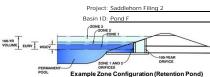
### WATER QUALITY AND DETENTION CALCULATIONS

Saddlehorn-2514204 Required Sediment Pond Volumes 5/27/2021

#### Saddlehorn (25142.04) Orifice Sizing

Solution	5 2.13	1 Column - 5 holes Inch diameter holes	
Equates to a	3.54	sq. in. hole	
Equates to a	2.125	diam. hole (in)	
	0.0502	cfs	per hole
	Assuming	5	holes
Drain Time 40 hrs	0.2511	cfs	over 40 hrs
	36155	cf	
Top 1/2	0.830	ac-ft	
Basin Total Volume:	1.660	ac-ft	
Sediment Basin #1			

#### DETENTION BASIN STAGE-STORAGE TABLE BUILDER



Watershed Information

tersned miornation		
Selected BMP Type =	EDB	
Watershed Area =	95.54	acres
Watershed Length =	5,707	ft
Watershed Length to Centroid =	2,118	ft
Watershed Slope =	0.014	ft/ft
Watershed Imperviousness =	13.50%	percent
Percentage Hydrologic Soil Group A =	89.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	11.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

the embedded bolorddo broan nyarograph needdare.				
Water Quality Capture Volume (WQCV) =	0.684	acre-feet		
Excess Urban Runoff Volume (EURV) =	1.038	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.647	acre-feet		
5-yr Runoff Volume (P1 = 1.5 in.) =	0.984	acre-feet		
10-yr Runoff Volume (P1 = 1.75 in.) =	1.358	acre-feet		
25-yr Runoff Volume (P1 = 2 in.) =	3.366	acre-feet		
50-yr Runoff Volume (P1 = 2.25 in.) =	4.729	acre-feet		
100-yr Runoff Volume (P1 = 2.52 in.) =	6.859	acre-feet		
500-yr Runoff Volume (P1 = 3.14 in.) =	11.388	acre-feet		
Approximate 2-yr Detention Volume =	0.656	acre-feet		
Approximate 5-yr Detention Volume =	0.969	acre-feet		
Approximate 10-yr Detention Volume =	1.252	acre-feet		
Approximate 25-yr Detention Volume =	1.625	acre-feet		
Approximate 50-yr Detention Volume =	1.996	acre-feet		
Approximate 100-yr Detention Volume =	2.911	acre-feet		

Define	Zones	and	Basi	n	Geome	etry
		7	one?	1	Volume	(WC

Define Zones and Basin Geometry		
Zone 1 Volume (WQCV) =	0.684	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.355	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.873	acre-feet
Total Detention Basin Volume =	2.911	acre-feet
Initial Surcharge Volume (ISV) =	user	ft <sup>3</sup>
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H <sub>total</sub> ) =	user	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	user	ft
Slope of Trickle Channel (S <sub>TC</sub> ) =	user	ft/ft
Slopes of Main Basin Sides (Smain) =	user	H:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	user	

user ft 2 user

user

user

user

user

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user

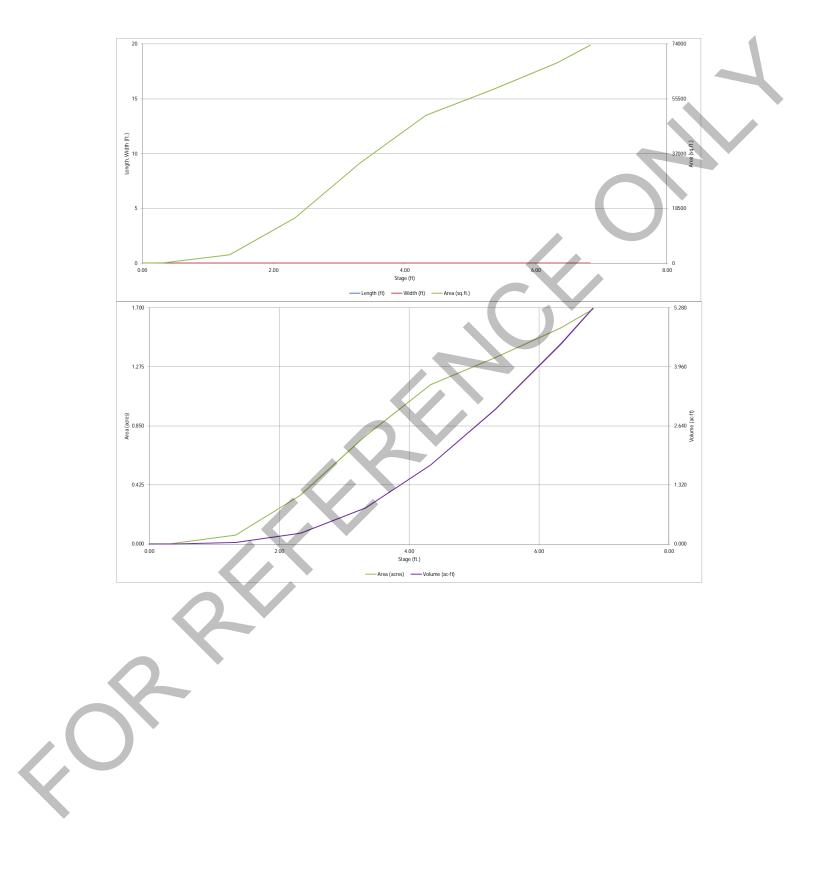
user

Initial Surcharge Area  $(A_{ISV}) =$ Surcharge Volume Length  $(L_{ISV}) =$ Surcharge Volume Width (WISV) = user Depth of Basin Floor (H<sub>FLOOR</sub>) = Length of Basin Floor (L<sub>FLOOR</sub>) Width of Basin Floor (W<sub>FLOOR</sub>) = Area of Basin Floor (A<sub>FLOOR</sub>) Volume of Basin Floor (V<sub>FLOOR</sub>) Depth of Main Basin  $(H_{MAIN})$ Length of Main Basin (L<sub>MAIN</sub>) = Width of Main Basin (W<sub>MAIN</sub>) = user user Area of Main Basin (V<sub>AMIN</sub>) = user ft <sup>2</sup> Volume of Main Basin (V<sub>AMIN</sub>) = user ft <sup>3</sup> Calculated Total Basin Volume (V<sub>total</sub>) = user acre-fee

ond)										
ond)	Depth Increment =		ft							
and)			Optional				Optional			
unu)	Stage - Storage	Stage	Override	Length	Width	Area	Override	Area (acro)	Volume	Volume
	Description	(ft)	Stage (ft)	(ft)	(ft)	(ft 2)	Area (ft 2)	(acre)	(ft 3)	(ac-ft)
	Top of Micropool		0.00				36	0.001		
	6681		0.33				50	0.001	14	0.000
	6682		1.33				2,789	0.064	1,434	0.033
	6683		2.33				15,282	0.351	10,469	0.240
	6684		3.33				33,913	0.779	35,066	0.805
	6685		4.33				49,906	1.146	76,976	1.767
	6686		5.33				58,427	1.341	131,142	3.011
	6687		6.33				67,707	1.554	194,209	4.458
	6687.5		6.83				73,617	1.690	229,540	5.270
	0007.5		0.05				73,017	1.070	227,540	3.270
	-									
al User Overrides										
acre-feet										
acre-feet										
19 inches										
								-		
50 inches										
75 inches										
00 inches										
25 inches										
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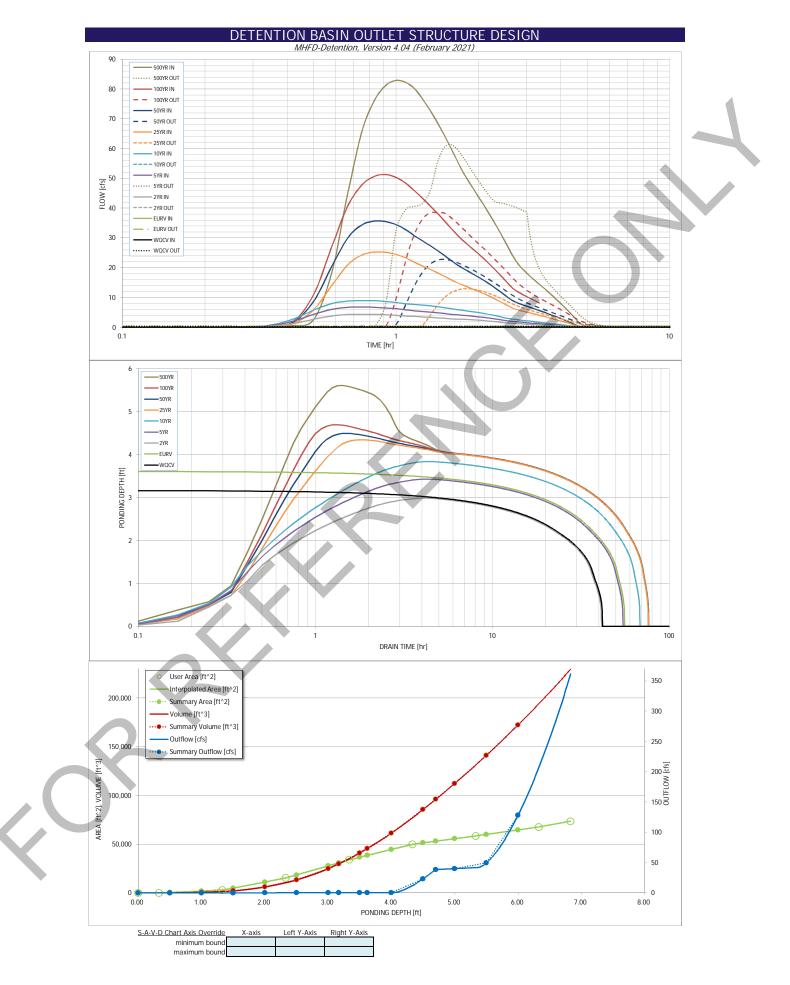
#### DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



### DETENTION BASIN OUTLET STRUCTURE DESIGN

			D-Detention, Vers	1011 4.04 (100100	y 2021)						
Project: Basin I D:	Saddlehorn Filing Pond F	2									
ZONE 3				Estimated	Estimated						
				Stage (ft)	Volume (ac-ft)	Outlet Type			4		
100-YR VOLUME EURY WOCY			Zone 1 (WQCV)	3.17	0.684	Orifice Plate					
	100-YEAR		Zone 2 (EURV)	3.62	0.355	Circular Orifice					
PERMANENT ORIFICES	ORIFICE		Zone 3 (100-year)	5.26	1.873	Weir&Pipe (Restrict)					
	Configuration (R	etention Pond)		Total (all zones)	2.911						
User Input: Orifice at Underdrain Outlet (typicall	y used to drain WQ	CV in a Filtration BN	ЛР)	rotar (all 201100)	2.711		Calculated Parame	ters for Underdrain			
Underdrain Orifice Invert Depth =	N/A		the filtration media	surface)	Underd	rain Orifice Area =	N/A	ft <sup>2</sup>			
Underdrain Orifice Diameter =	N/A	inches			Underdrain	Orifice Centroid =	N/A	feet			
User Input: Orifice Plate with one or more orific	-						Calculated Parame				
Invert of Lowest Orifice =		0.00 ft (relative to basin bottom at Stage = 0 ft) WQ Orifice Area per Row = $1.413E \cdot 02$ ft <sup>2</sup>									
Depth at top of Zone using Orifice Plate =	3.17 12.70	ft (relative to basin inches	bottom at Stage =	= 0 ft)		ptical Half-Width =	N/A N/A	feet feet			
Orifice Plate: Orifice Vertical Spacing = Orifice Plate: Orifice Area per Row =	2.03	sq. inches (diamete	r = 1.5/8 inches)			ical Slot Centroid = Iliptical Slot Area =	N/A	ft <sup>2</sup>			
office flate. Office Area per Row -	2.03	sq. menes (diamete	er = 1-570 menes)		-		IV/A	Ju -			
User Input: Stage and Total Area of Each Orifice	e Row (numbered f	rom lowest to highe	est)								
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)			
Stage of Orifice Centroid (ft)	0.00	1.06	2.11								
Orifice Area (sq. inches)	2.03	2.03	2.03								
		[]							1		
	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)			
Stage of Orifice Centroid (ft)											
Orifice Area (sq. inches)									1		
User Input: Vertical Orifice (Circular or Rectang	ulor)						Coloulated Darama	ters for Vertical Or	ifico		
ose mpat, ventea office (circular of Rectang	Zone 2 Circular	Not Selected					Zone 2 Circular	Not Selected			
Invert of Vertical Orifice =	3.17		ft (relative to basir	bottom at Stage =	0 ft) Ver	tical Orifice Area =	0.00	N/A	ft <sup>2</sup>		
Depth at top of Zone using Vertical Orifice =	3.62		-	bottom at Stage =		Orifice Centroid =	0.02	N/A	feet		
Vertical Orifice Diameter =	0.38	N/A	inches	i bottoin at otago			0102		1001		
	0.00		linoines								
User Input: Overflow Weir (Dropbox with Flat o	r Sloped Grate and	Outlet Pipe OR Rec	tangular/Trapezoid	al Weir (and No Ou	tlet Pipe)		Calculated Parame	ters for Overflow V	Veir		
	Zone 3 Weir	Not Selected					Zone 3 Weir	Not Selected			
Overflow Weir Front Edge Height, Ho =	4.03	N/A	ft (relative to basin I	bottom at Stage = 0	t) Height of Grate	e Upper Edge, $H_t =$	4.03	N/A	feet		
Overflow Weir Front Edge Length =	6.00	N/A	feet		Overflow W	eir Slope Length =	5.00	N/A	feet		
Overflow Weir Grate Slope =	0.00	N/A	H:V		ate Open Area / 10	-	4.96	N/A			
Horiz. Length of Weir Sides =	5.00	N/A	feet		erflow Grate Open		20.88	N/A	ft <sup>2</sup>		
Overflow Grate Type =	Type C Grate	N/A		C	verflow Grate Oper	n Area w/ Debris =	20.88	N/A	ft <sup>2</sup>		
Debris Clogging % =	0%	N/A	%								
User Input: Outlet Pipe w/ Flow Restriction Plate	(Circular Orifica D	actrictor Diato, or D	actorization (Drifico)		Ca	laulated Daramater	for Outlat Dipa w/	Flow Destriction D	ato		
Oser Input. Outlet Pipe w/ Flow Restriction Plate	Zone 3 Restrictor	Not Selected			<u>ua</u>	Iculated Parameters	Zone 3 Restrictor	Not Selected	ale		
Depth to Invert of Outlet Pipe =			ft (distance below b	asin bottom at Stage	– 0 ft) 0	itlet Orifice Area -	4.21	N/A	ft <sup>2</sup>		
Outlet Pipe Diameter =				asin bottom at stage		0,00 N/A ft (distance below basin bottom at Stage = 0 ft) Outlet Orifice Area =					
Restrictor Plate Height Above Pipe Invert =		30.00 N/A inches Outlet Orifice Centroid = 1.09							feet		
······	24.00	· · · · · · · · · · · · · · · · · · ·	inches	Half-Cent				N/A N/A	feet radians		
	24.00		inches	Half-Cent	Outlet ral Angle of Restric		1.09 2.21	N/A N/A	feet radians		
User Input: Emergency Spillway (Rectangular or			inches	Half-Cent				N/A			
User Input: Emergency Spillway (Rectangular or Spillway Invert Stage=			inches bottom at Stage =		ral Angle of Restric		2.21	N/A			
	<u>Trapezoidal)</u>				ral Angle of Restric Spillway D	tor Plate on Pipe =	2.21 Calculated Parame	N/A ters for Spillway			
Spillway Invert Stage=	Trapezoidal) 5.38	ft (relative to basir			ral Angle of Restric Spillway D Stage at T	tor Plate on Pipe = esign Flow Depth=	2.21 Calculated Parame 0.45	N/A ters for Spillway feet			
Spillway Invert Stage= Spillway Crest Length =	<u>Trapezoidal)</u> 5.38 55.00	ft (relative to basir feet			ral Angle of Restric Spillway D Stage at T	tor Plate on Pipe = esign Flow Depth= op of Freeboard = op of Freeboard =	2.21 Calculated Parame 0.45 6.83	N/A ters for Spillway feet feet			
Spillway Invert Stage= Spillway Crest Length = Spillway End Slopes =	<u>Trapezoidal)</u> 5.38 55.00 4.00	ft (relative to basir feet H:V			ral Angle of Restric Spillway D Stage at T Basin Area at T	tor Plate on Pipe = esign Flow Depth= op of Freeboard = op of Freeboard =	2.21 <u>Calculated Parame</u> 0.45 6.83 1.69	N/A ters for Spillway feet feet acres			
Spillway Invert Stage= Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface =	Trapezoidal)           5.38           55.00           4.00           1.00	ft (relative to basin feet H:V feet	bottom at Stage =	= 0 ft)	ral Angle of Restric Spillway D Stage at T Basin Area at T Basin Volume at T	tor Plate on Pipe = esign Flow Depth= iop of Freeboard = iop of Freeboard = iop of Freeboard =	2.21 <u>Calculated Parame</u> 0.45 6.83 1.69 5.27	N/A ters for Spillway feet feet acres acre-ft	radians		
Spillway Invert Stage= Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Routed Hydrograph Results	Trapezoidal)           5.38           55.00           4.00           1.00	ft (relative to basin feet H:V feet ride the default CUI	) bottom at Stage = HP hydrographs and	= 0 ft) d runoff volumes by	ral Angle of Restric Spillway D Stage at T Basin Area at T Basin Volume at T entering new value	tor Plate on Pipe = esign Flow Depth= op of Freeboard = op of Freeboard = iop of Freeboard =	2.21 <u>Calculated Parame</u> 0.45 6.83 1.69 5.27 drographs table (CCC	N/A ters for Spillway feet feet acres acres acre-ft	radians		
Spillway Invert Stage= Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface =	Trapezoidal)           5.38           55.00           4.00           1.00	ft (relative to basin feet H:V feet	bottom at Stage = <i>HP hydrographs ano</i> 2 Year 1.19	= 0 ft)	ral Angle of Restric Spillway D Stage at T Basin Area at T Basin Volume at T entering new value 10 Year 1.75	tor Plate on Pipe = esign Flow Depth= iop of Freeboard = iop of Freeboard = iop of Freeboard =	2.21 <u>Calculated Parame</u> 0.45 6.83 1.69 5.27	N/A ters for Spillway feet feet acres acre-ft	radians		
Spillway Invert Stage= Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = <u>Routed Hydrograph Results</u> Design Storm Return Period = One-Hour Rainfall Depth (in) = CUHP Runoff Volume (acre-ft) =	Trapezoidal)           5.38         55.00           4.00         1.00           The user can over         WQCV           WAR         0.684	ft (relative to basin feet H:V feet ride the default CUI EURV N/A 1.038	HP hydrographs and 2 Year 1.19 0.647	= 0 ft) <i>d runoff volumes by</i> <u>5 Year</u> 1.50 0.984	ral Angle of Restric Spillway D Stage at T Basin Area at T Basin Volume at T <u>entering new value</u> <u>10 Year</u> 1.75 1.358	tor Plate on Pipe = esign Flow Depth= fop of Freeboard = op of Freeboard = op of Freeboard = <u>es in the Inflow Hyp</u> 25 Year 2.00 3.366	2.21 <u>Calculated Parame</u> 0.45 6.83 1.69 5.27 drographs table (Co 50 Year 2.25 4.729	N/A ters for Spillway feet feet acres acre-ft humns W through A 100 Year 2.52 6.859	radians <i>iF).</i> <u>500 Year</u> <u>3.14</u> 11.388		
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# DETENTION BASIN OUTLET STRUCTURE DESIGN Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

	The user can o	verride the calcu	ulated inflow hy	drographs from	this workbook w	ith inflow hydro	graphs develop	ed in a separate	program.	
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00 11111	0:05:00									
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02
	0:20:00	0.00	0.00	0.03	0.39	0.46	0.30	0.37	0.37	0.53
	0:25:00	0.00	0.00	1.18	1.91	2.58	1.10	1.47	1.68	2.65
	0:30:00	0.00	0.00	2.67	4.32	5.78	5.92	8.77	11.06	18.84
	0:35:00	0.00	0.00	3.83	6.06	7.99	14.15	20.62	27.30	45.14
	0:40:00	0.00	0.00	4.28	6.69	8.78	21.04	30.08	40.81	65.73
	0:45:00	0.00	0.00	4.36	6.79	8.98	24.27	34.38	47.75	76.17
	0:50:00	0.00	0.00	4.33	6.71	8.92	25.23	35.65	50.68	81.19
	0:55:00	0.00	0.00	4.21	6.51	8.67	25.15	35.49	51.26	82.88
	1:00:00	0.00	0.00	4.02	6.20	8.29	24.46	34.47	50.28	82.22
	1:05:00	0.00	0.00	3.80	5.83	7.87	23.30	32.79	48.42	80.15
	1:10:00	0.00	0.00	3.62	5.55	7.62	21.85	30.72	45.82	76.61
	1:15:00	0.00	0.00	3.47	5.32	7.44	20.56	28.95	43.22	72.76
	1:20:00	0.00	0.00	3.32	5.08	7.22	19.41	27.33	40.71	68.67
	1:25:00	0.00	0.00	3.16	4.84	6.91	18.30	25.75	38.22	64.49
	1:30:00	0.00	0.00	3.01 2.87	4.59	6.55 6.21	17.17	24.13 22.53	35.76 33.34	60.30 56.16
	1:40:00	0.00	0.00	2.87	4.37	5.93	15.01	22.53	33.34 31.10	56.16
	1:45:00	0.00	0.00	2.76	4.19	5.68	14.16	21.06 19.86	29.24	49.20
	1:50:00	0.00	0.00	2.58	3.85	5.43	13.43	18.81	27.62	49.20
	1:55:00	0.00	0.00	2.48	3.68	5.19	12.74	17.81	26.10	43.78
	2:00:00	0.00	0.00	2.37	3.51	4.94	12.06	16.84	24.63	41.24
	2:05:00	0.00	0.00	2.24	3.32	4.67	11.36	15.85	23.16	38.73
	2:10:00	0.00	0.00	2.10	3.11	4.37	10.64	14.83	21.67	36.22
	2:15:00	0.00	0.00	1.95	2.89	4.06	9.91	13.81	20.19	33.74
	2:20:00	0.00	0.00	1.80	2.67	3.75	9.19	12.79	18.71	31.29
	2:25:00	0.00	0.00	1.66	2.45	3.44	8.46	11.77	17.25	28.85
	2:30:00 2:35:00	0.00	0.00	1.52 1.39	2.24 2.05	3.15 2.89	7.74	10.76 9.77	15.78 14.35	26.42 24.04
	2:40:00	0.00	0.00	1.39	1.91	2.89	6.42	8.93	14.35	22.02
	2:45:00	0.00	0.00	1.29	1.91	2.56	5.99	8.34	12.20	22.02
	2:50:00	0.00	0.00	1.16	1.71	2.42	5.65	7.87	11.49	19.29
	2:55:00	0.00	0.00	1.09	1.62	2.28	5.36	7.46	10.86	18.20
	3:00:00	0.00	0.00	1.03	1.53	2.15	5.08	7.07	10.29	17.19
	3:05:00	0.00	0.00	0.97	1.44	2.02	4.81	6.70	9.73	16.24
	3:10:00	0.00	0.00	0.92	1.36	1.90	4.55	6.33	9.20	15.33
	3:15:00	0.00	0.00	0.86	1.28	1.78	4.29	5.97	8.69	14.47
	3:20:00	0.00	0.00	0.81	1.20	1.67	4.04	5.62	8.19	13.64
	3:25:00 3:30:00	0.00	0.00	0.75	1.12	1.56	3.79	5.28	7.69	12.82
	3:35:00	0.00	0.00	0.70	1.04 0.96	1.45	3.54 3.30	4.93 4.59	7.20 6.70	12.00 11.18
	3:40:00	0.00	0.00	0.65	0.96	1.35	3.30	4.59	6.70	10.36
	3:45:00	0.00	0.00	0.55	0.82	1.14	2.81	3.91	5.72	9.54
	3:50:00	0.00	0.00	0.50	0.74	1.04	2.57	3.57	5.23	8.73
	3:55:00	0.00	0.00	0.46	0.67	0.94	2.33	3.23	4.74	7.92
	4:00:00	0.00	0.00	0.41	0.60	0.85	2.09	2.90	4.26	7.11
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	4:10:00	0.00	0.00	0.32 0.27	0.46	0.65	1.62 1.38	2.23	3.28 2.80	5.49 4.68
	4:15:00 4:20:00	0.00	0.00	0.27	0.39	0.56	1.38	1.89	2.80	4.68
	4:25:00	0.00	0.00	0.23	0.32	0.40	0.91	1.30	1.83	3.00
	4:30:00	0.00	0.00	0.14	0.19	0.28	0.68	0.90	1.35	2.27
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	4:50:00	0.00	0.00	0.06	0.08	0.12	0.12	0.15	0.22	0.42
	4:55:00	0.00	0.00	0.05	0.07	0.10	0.09	0.12	0.15	0.28
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	5:40:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	5:45:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
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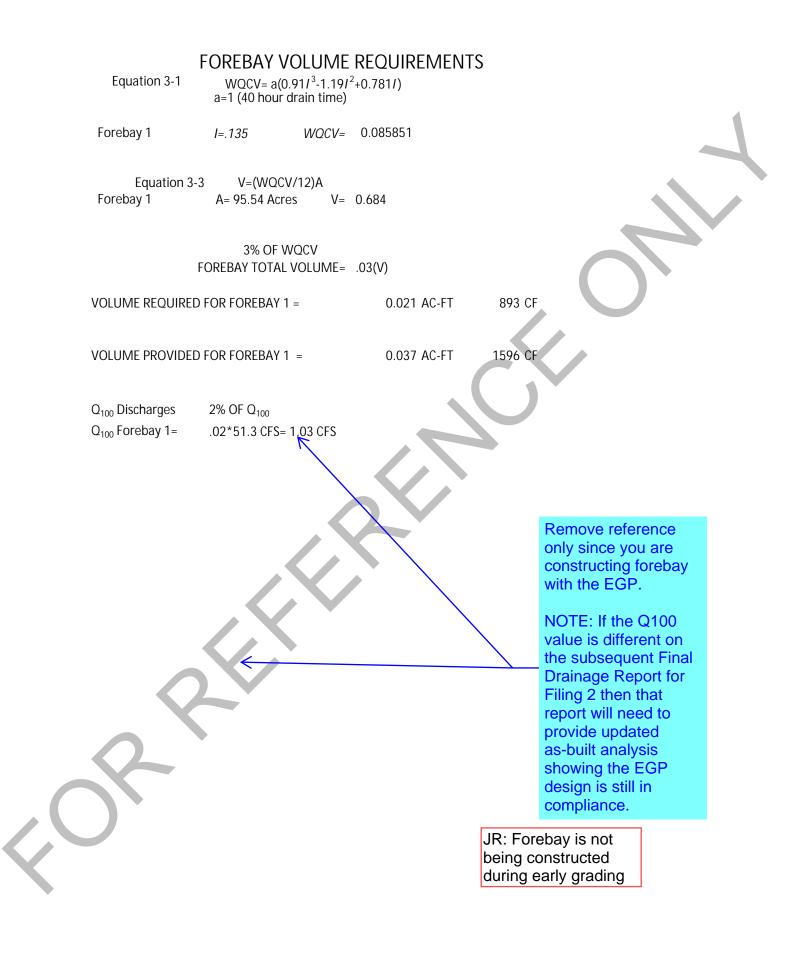


#### DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021) Summary Stage-Area-Volume-Discharge Relationships

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

Stage - Storage	Stage	Area	Area	Volume	Volume	Total Outflow	
Description	[ft]	[ft <sup>2</sup> ]	[acres]	[ft <sup>3</sup> ]	[ac-ft]	[cfs]	
		36	0.001	0	0.000	0.00	
	0.00	516	0.012	62	0.001	0.05	For best results, include the
	0.50					0.05	stages of all grade slope changes (e.g. ISV and Floor)
	1.00	1,885	0.043	662	0.015		from the S-A-V table on
	1.50	4,913	0.113	2,088	0.048	0.13	Sheet 'Basin'.
	2.00	11,159	0.256	6,106	0.140	0.16	
	2.50	18,449	0.424	13,336	0.306	0.23	Also include the inverts of all outlets (e.g. vertical orifice,
	3.00	27,765	0.637	24,890	0.571	0.28	overflow grate, and spillway,
WCQV	3.17	30,932 36,632	0.710 0.841	29,879	0.686	0.29	where applicable).
ELID) (	3.50			41,063		0.32	
EURV	3.62	38,551 44,628	0.885	45,574 61,378	1.046 1.409	0.32	
	4.00	44,828 51,355	1.179	85,583	1.409	23.22	
100 VD	4.50	53,059	1.218	96,024	2.204	38.50	
100-YR		55,615	1.277	112,326	2.204	40.07	
	5.00 5.50	60,005	1.378	141,209	3.242	49.47	
	6.00	64,645	1.484	172,371	3.957	128.37	
	0.00	04,045	1.404	172,371	3.737	120.37	
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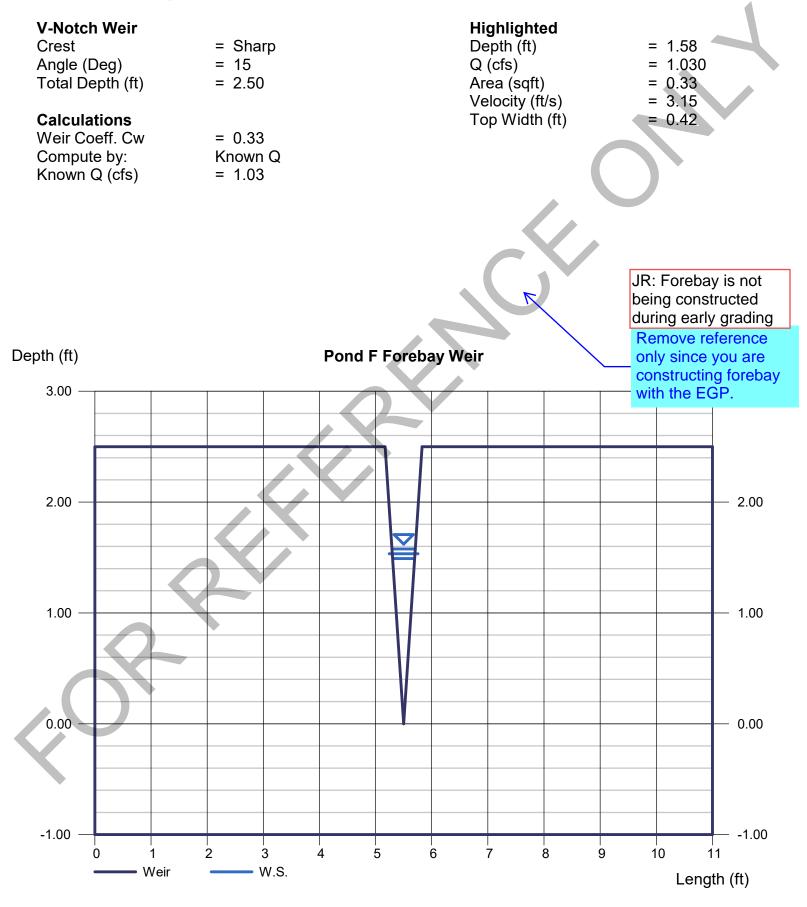


# Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Tuesday, May 25 2021

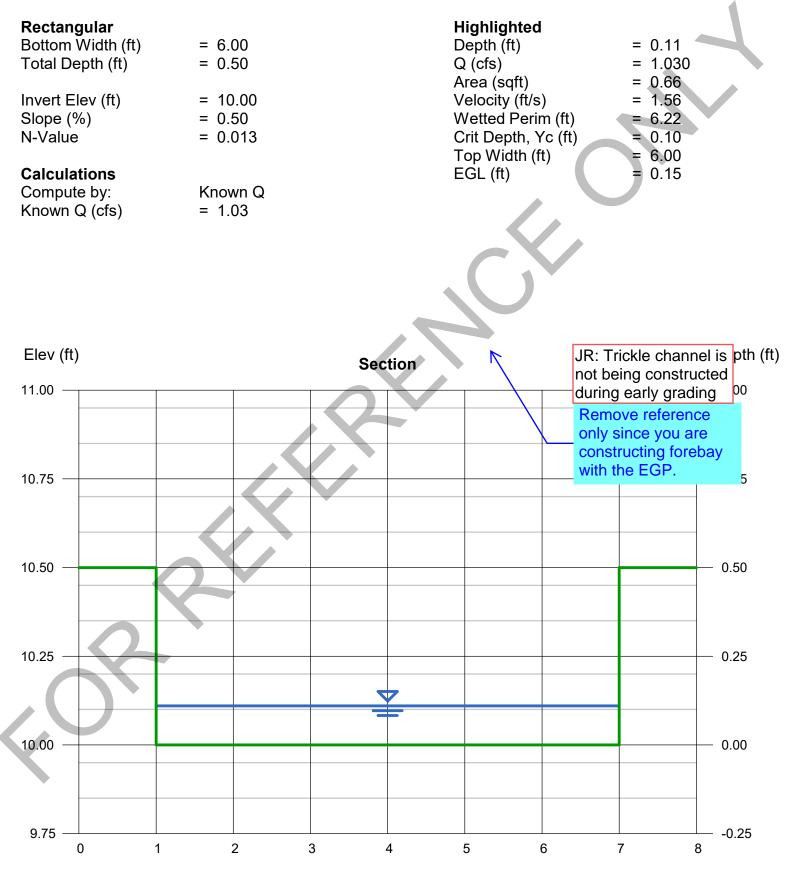
#### **Pond F Forebay Weir**



Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Thursday, May 20 2021

### Pond F Trickle Channel

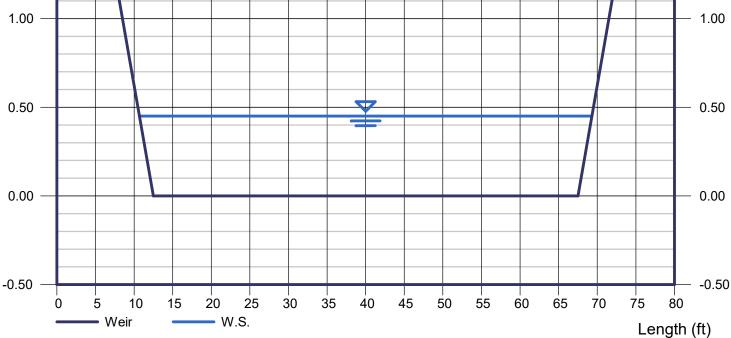


# Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

### Pond F Spillway

<b>Trapezoidal Weir</b> Crest Bottom Length (ft) Total Depth (ft) Side Slope (z:1) <b>Calculations</b> Weir Coeff. Cw Compute by: Known Q (cfs)	= Sharp = 55.00 = 1.45 = 4.00 = 3.10 Known Q = 51.30	$ \begin{array}{c} = 55.00 \\ = 1.45 \\ = 4.00 \end{array} \begin{array}{c} Q (cfs) \\ Area (sqft) \\ Velocity (ft/s) \\ Top Width (ft) \end{array} \begin{array}{c} = 51.30 \\ = 25.56 \\ = 2.01 \\ Top Width (ft) \end{array} $					
Depth (ft)	spillway is then includ	final buildout condition of being constructed with de the associated riprap in this drainage report. Pond F Spillway	the EGP sizing	Dep	th (ft)		
2.00				2.00	. ,		
1.50				1.50	)		
1.00				1.00	C		



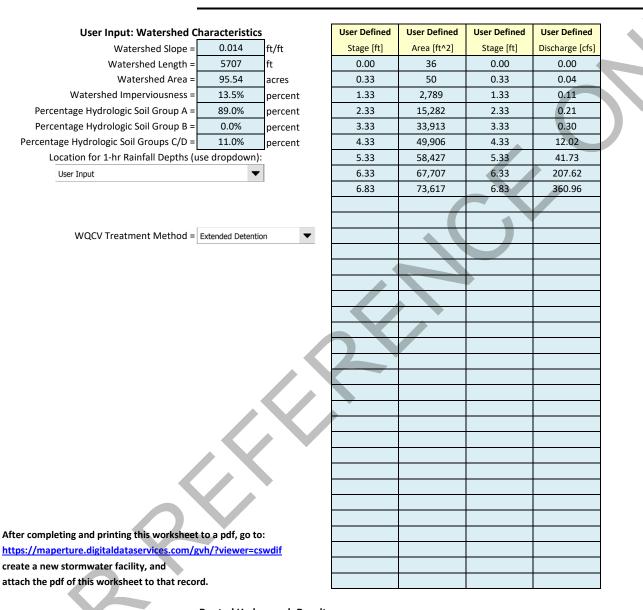
#### **Stormwater Detention and Infiltration Design Data Sheet**

Workbook Protected

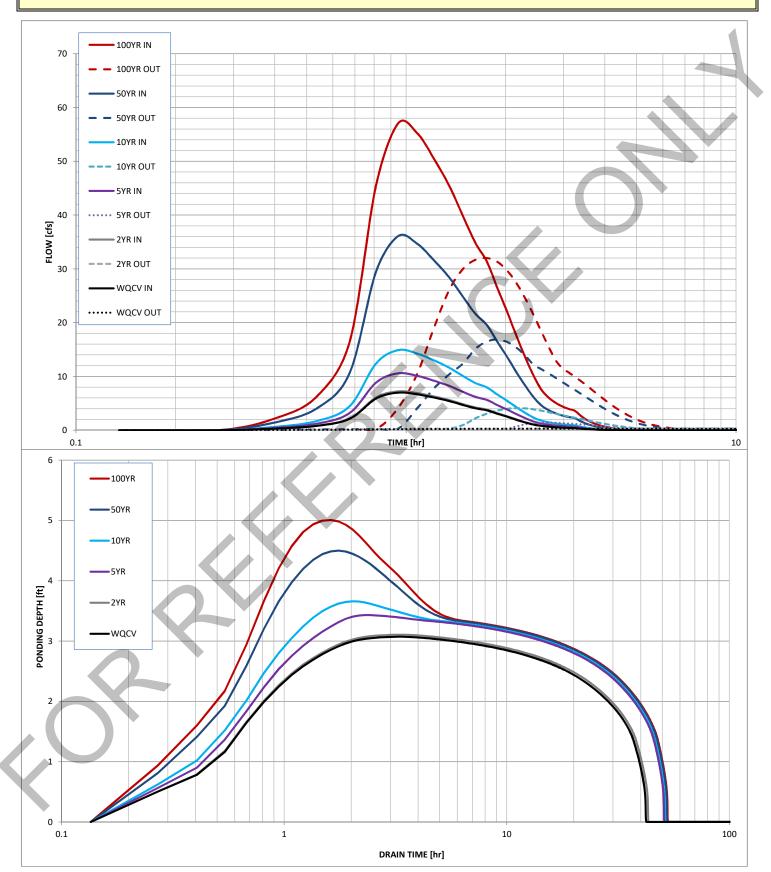
Worksheet Protected

#### Stormwater Facility Name: SADDLEHORN RANCH - FILING 2 - POND F

#### Facility Location & Jurisdiction: EL PASO COUNTY - SADDLEHORN RANCH METROPOLITAN DISTRICT



	Routed Hydro	ograph Results					_
Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	1.19	1.50	1.75	2.25	2.52	in
Calculated Runoff Volume =	0.684	0.707	1.039	1.468	3.604	5.758	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	0.683	0.706	1.038	1.468	3.604	5.752	acre-ft
Time to Drain 97% of Inflow Volume =	38.8	39.7	46.2	45.4	41.1	37.0	hours
Time to Drain 99% of Inflow Volume =	40.8	41.8	48.9	48.8	47.3	45.6	hours
Maximum Ponding Depth =	3.07	3.10	3.43	3.66	4.50	5.01	ft
Maximum Ponded Area =	0.67	0.68	0.81	0.90	1.18	1.28	acres
Maximum Volume Stored =	0.616	0.636	0.880	1.074	1.953	2.582	acre-ft



#### **Stormwater Detention and Infiltration Design Data Sheet**

#### APPENDIX E

### **REFERENCE MATERIALS**



Issue Date: OCT 2 0 2004

Federal Emergency Management Agency

Case No.: 04-08-0587P

LOMR-APP

Washington, D.C. 20472

Effective Date: FEB 1 6 2005

# LETTER OF MAP REVISION **DETERMINATION DOCUMENT (CONTINUED)**

# PUBLIC NOTIFICATION OF REVISION

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised BFEs presented in this LOMR may be changed.

A notice of changes will be published in the Federal Register. This information also will be published in your local newspaper on or about the dates listed below.

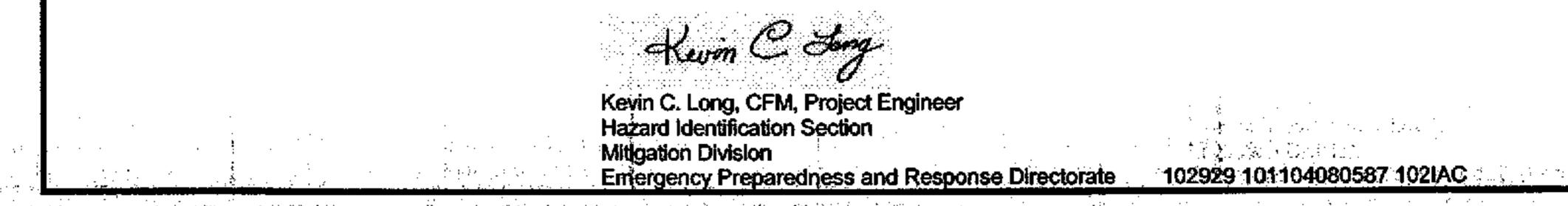
LOCAL NEWSPAPER

Page 4 of 4

Name: El Paso County News Dates: 11/10/2004 11/17/2004

	PUBLIC NOTIFICATION			
FLOODING SOURCE	LOCATION OF REFERENCED ELEVATION	BFE (FEE EFFECTIVE	REVISED	MAP PANEL NUMBER(\$)
	Approximately 310 feet upstream of confluence with Geick Ranch West Tributary	None	6,735	08041C0575 F
Haegler Ranch Tributary 2	Approximately 3,140 feet upstream of confluence with Geick Ranch West Tributary	None	6,779	08041C0575 F
Hooder Banch Tributery 2	Approximately 8,100 feet downstream of Curtis Road	None	6,672	08041C0575 F
Haegler Ranch Tributary 3	Approximately 300 feet upstream of Curtis Road	None	6,769	08041C0575 F
Haegler Ranch Tributary 4	Approximately 4,000 feet downstream of Curtis Road	None	6,688	08041C0575 F
ndeglei Nahor Tribulary 4	Approximately 300 feet upstream of Curtis Road	None	6,758	08041C0575 F
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## you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.



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# CHANGES ARE MADE IN DETERMINATIONS OF BASE FLOOD ELEVATIONS FOR THE UNINCORPORATED AREAS OF EL PASO COUNTY, COLORADO, UNDER THE NATIONAL FLOOD INSURANCE PROGRAM

On March 17, 1997, the Department of Homeland Security's Federal Emergency Management Agency identified Special Flood Hazard Areas (SFHAs) in the unincorporated areas of El Paso County, Colorado, through issuance of a Flood Insurance Rate Map (FIRM). The Mitigation Division has determined that modification of the elevations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) for certain locations in this community is appropriate. The modified Base Flood Elevations (BFEs) revise the FIRM for the community.

The changes are being made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65.

A hydraulic analysis was performed to incorporate new hydrologic, hydraulic, and topographic data for Haegler Ranch Tributary 2 from approximately 310 feet upstream to approximately 3,140 feet upstream of the confluence with Geick Ranch West Tributary; for Haegler Ranch Tributary 3 from approximately 8,100 feet downstream to approximately 400 feet upstream of Curtis Road; and for Haegler Ranch Tributary 4 from approximately 4,100 feet downstream to approximately 400 feet upstream of Curtis Road. This has resulted in increases and decreases in SFHA width and increased BFEs for the above-mentioned tributaries. The table below indicates existing and modified BFEs for selected locations along the affected lengths of the flooding source(s) cited above.

	Existing BFE	'Modified BFE
Location	(feet)*	(feet)*
Haegler Ranch Tributary 2:		
Approximately 310 feet upstream of confluence with		
Geick Ranch West Tributary	None	6,735
Approximately 3,140 feet upstream of confluence with		
Geick Ranch West Tributary	None	6,779
Haegler Ranch Tributary 3:		
Approximately 8,100 feet downstream of Curtis Road	None	6,672
Approximately 300 feet upstream of Curtis Road	None	6,769
Haegler Ranch Tributary 4:		
Approximately 4,000 feet downstream of Curtis Road	None	6,688
Approximately 300 feet upstream of Curtis Road	None	6,758

\*National Geodetic Vertical Datum, rounded to nearest whole foot

Under the above-mentioned Acts of 1968 and 1973, the Mitigation Division must develop criteria for floodplain management. To participate in the National Flood Insurance Program (NFIP), the community must use the modified BFEs to administer the floodplain management measures of the NFIP. These modified BFEs will also be used to calculate the appropriate flood insurance premium rates for new buildings and their contents and for the second layer of insurance on existing buildings and contents.

Upon the second publication of notice of these changes in this newspaper, any person has 90 days in which he or she can request, through the Chief Executive Officer of the community, that the Mitigation Division reconsider the determination. Any request for reconsideration must be based on knowledge of changed conditions or new scientific or technical data. All interested parties are on notice that until the 90-day period elapses, the Mitigation Division's determination to modify the BFEs may itself be changed.

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Any person having knowledge or wishing to comment on these changes should immediately notify:

The Honorable Chuck Brown Chairman, El Paso County Board of Commissioners 27 Vermijo Avenue Colorado Springs, CO 80903-2208

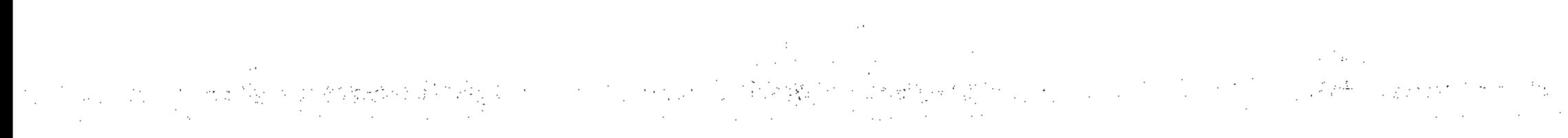
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Flooding Source and Location	Drainage Area (square miles)
Haegler Ranch Tributary 2 At the confluence with Geick	
Ranch West Tributary	1.47
Haegler Ranch Tributary 3 At approximately 2,300 feet upstream of the confluence	
with Haegler Ranch Tributary 4	1.09
Haegler Ranch Tributary 4 At approximately 3,700 feet upstream of the confluence	
with Haegler Ranch Tributary 3	0.60

1 Data Not Available

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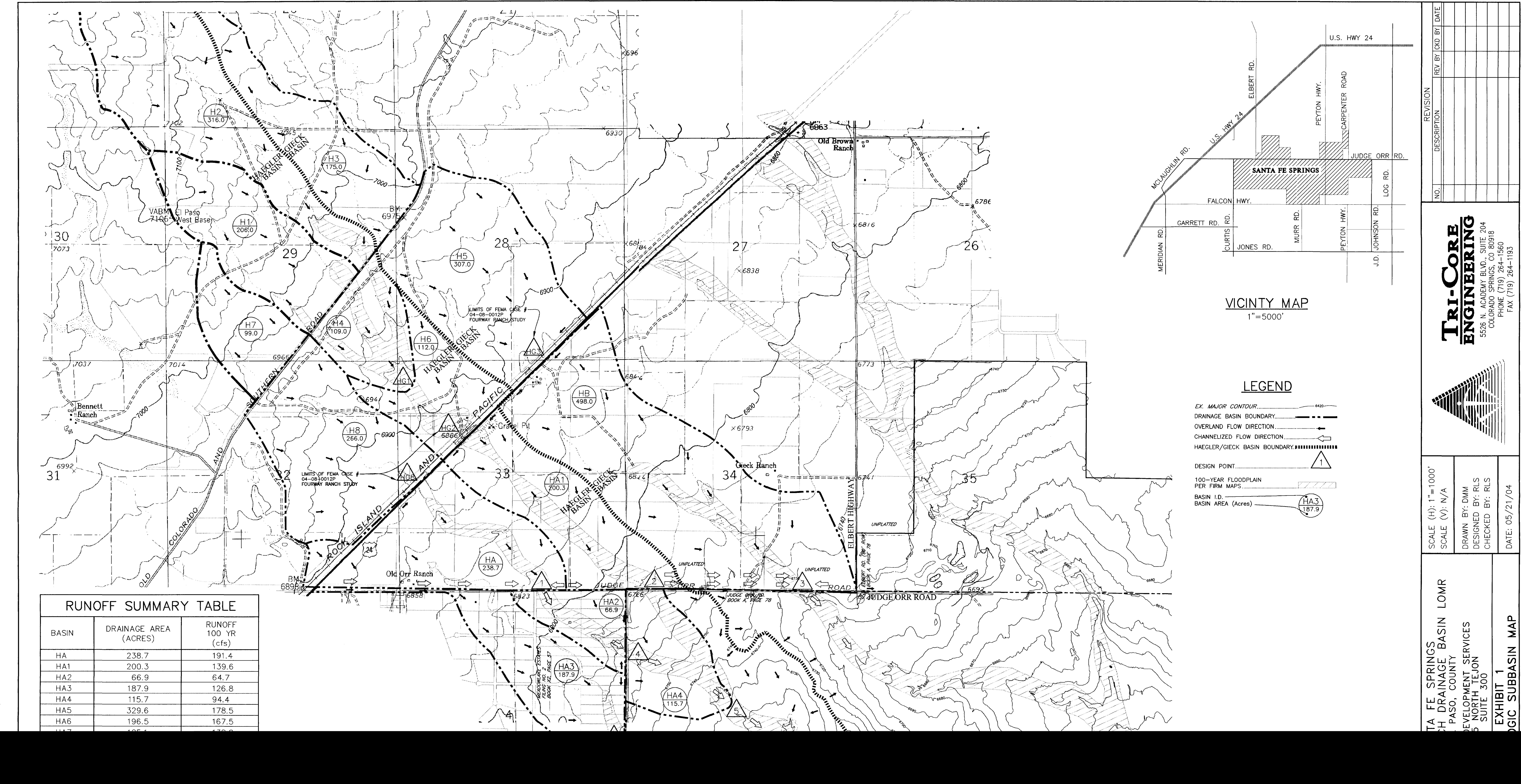
## Table 3. Summary of Discharges

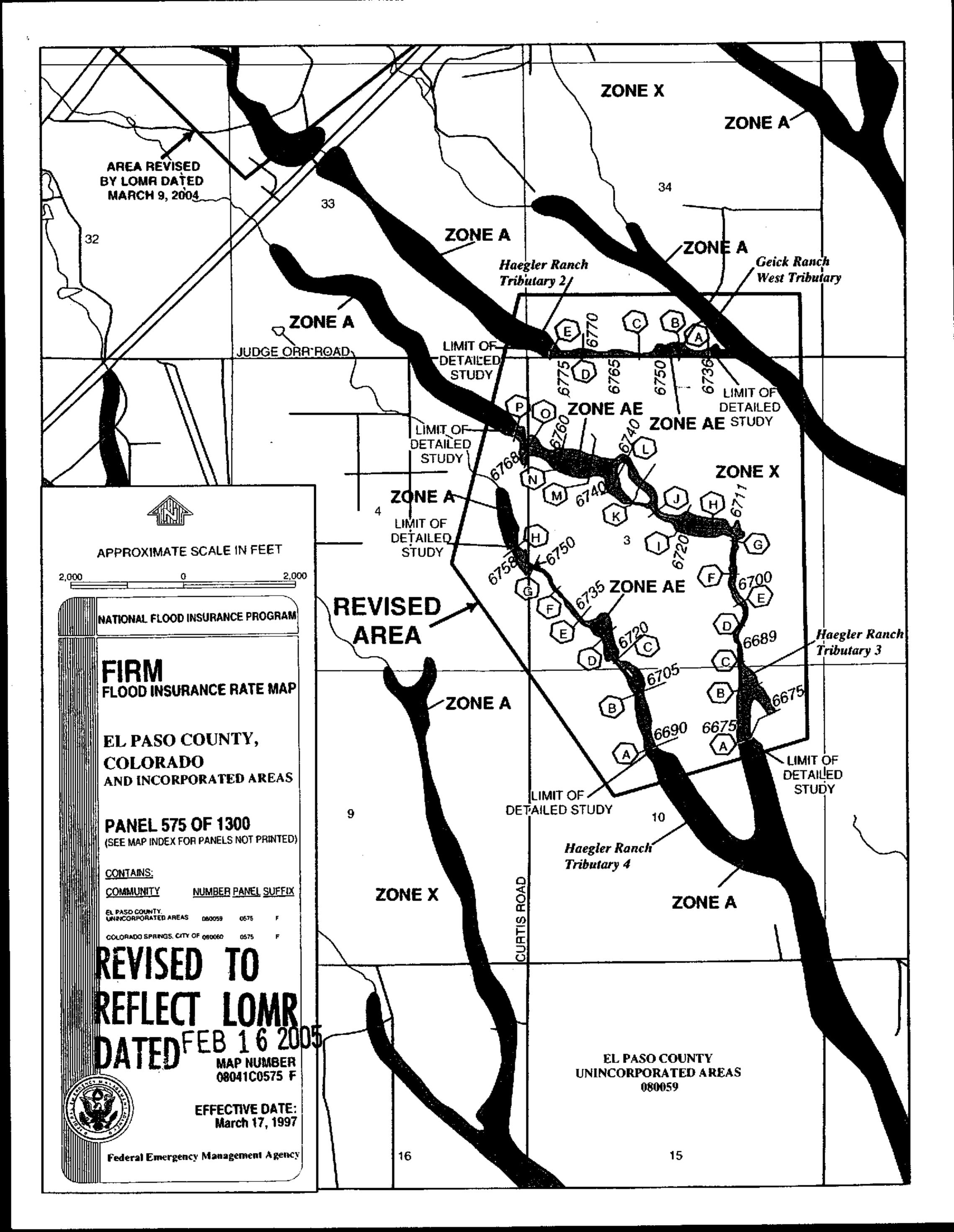
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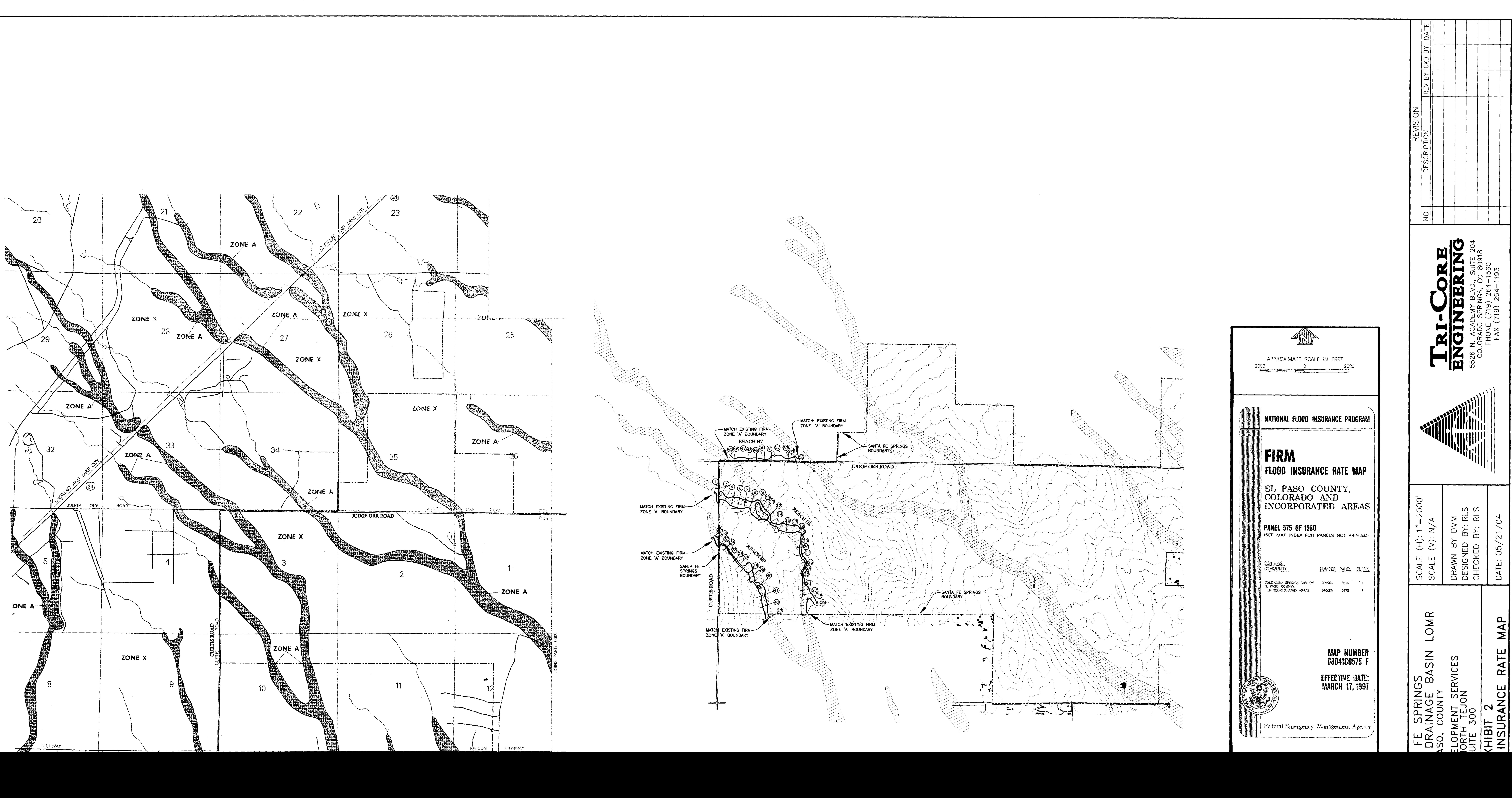
# **REVISED TO REFLECT LOMR** DATED FEB 1 6 2005

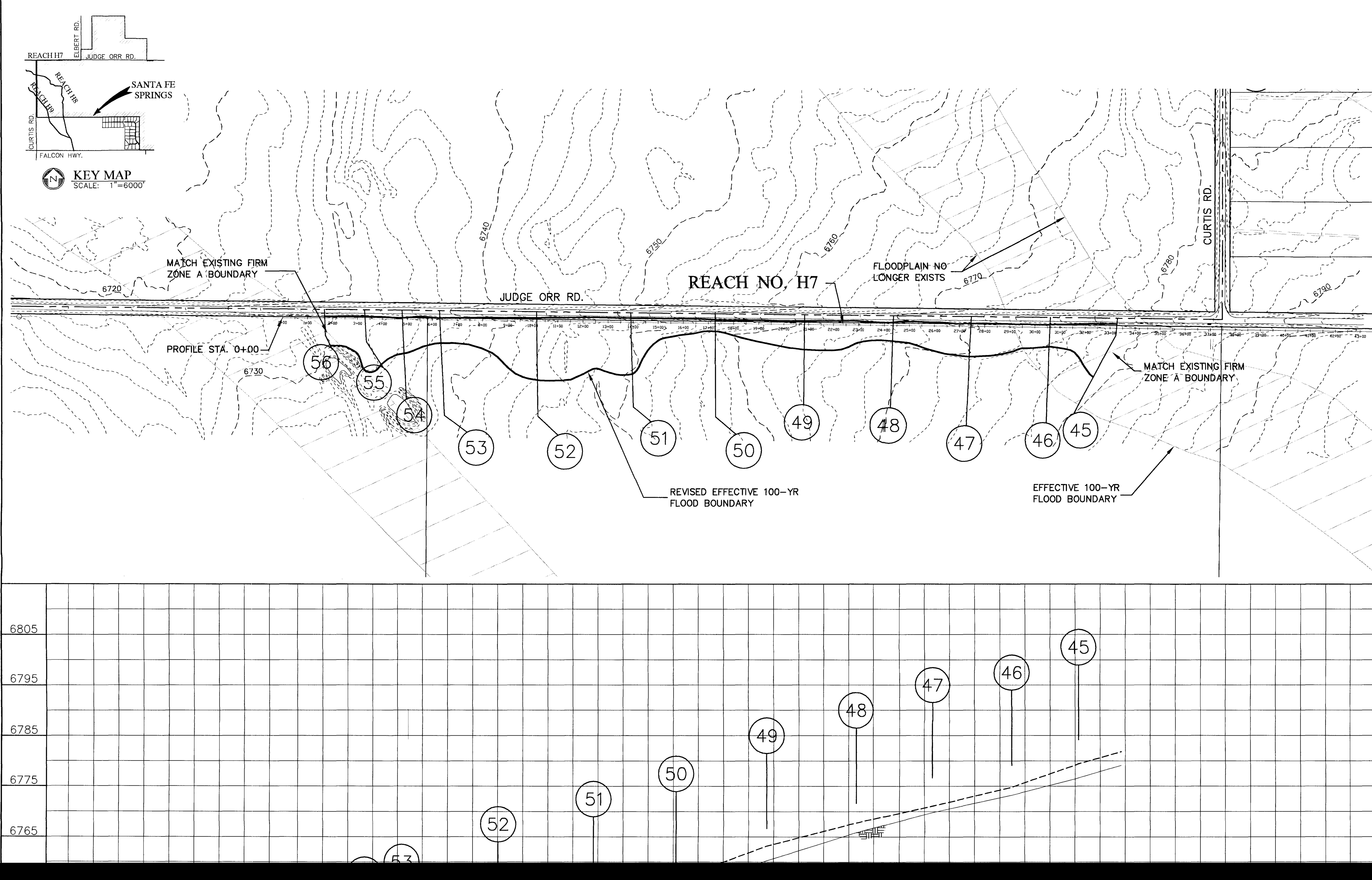
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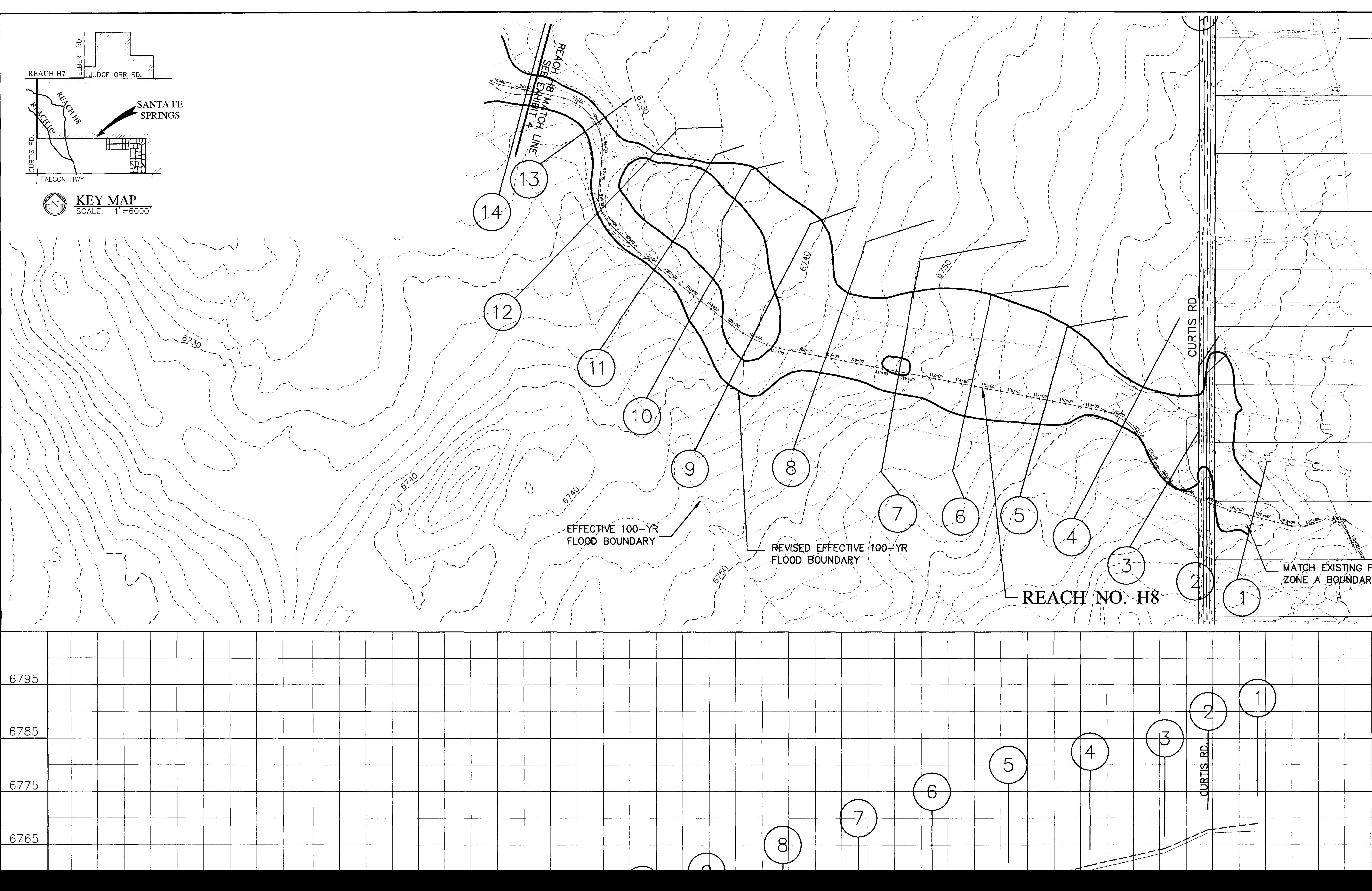




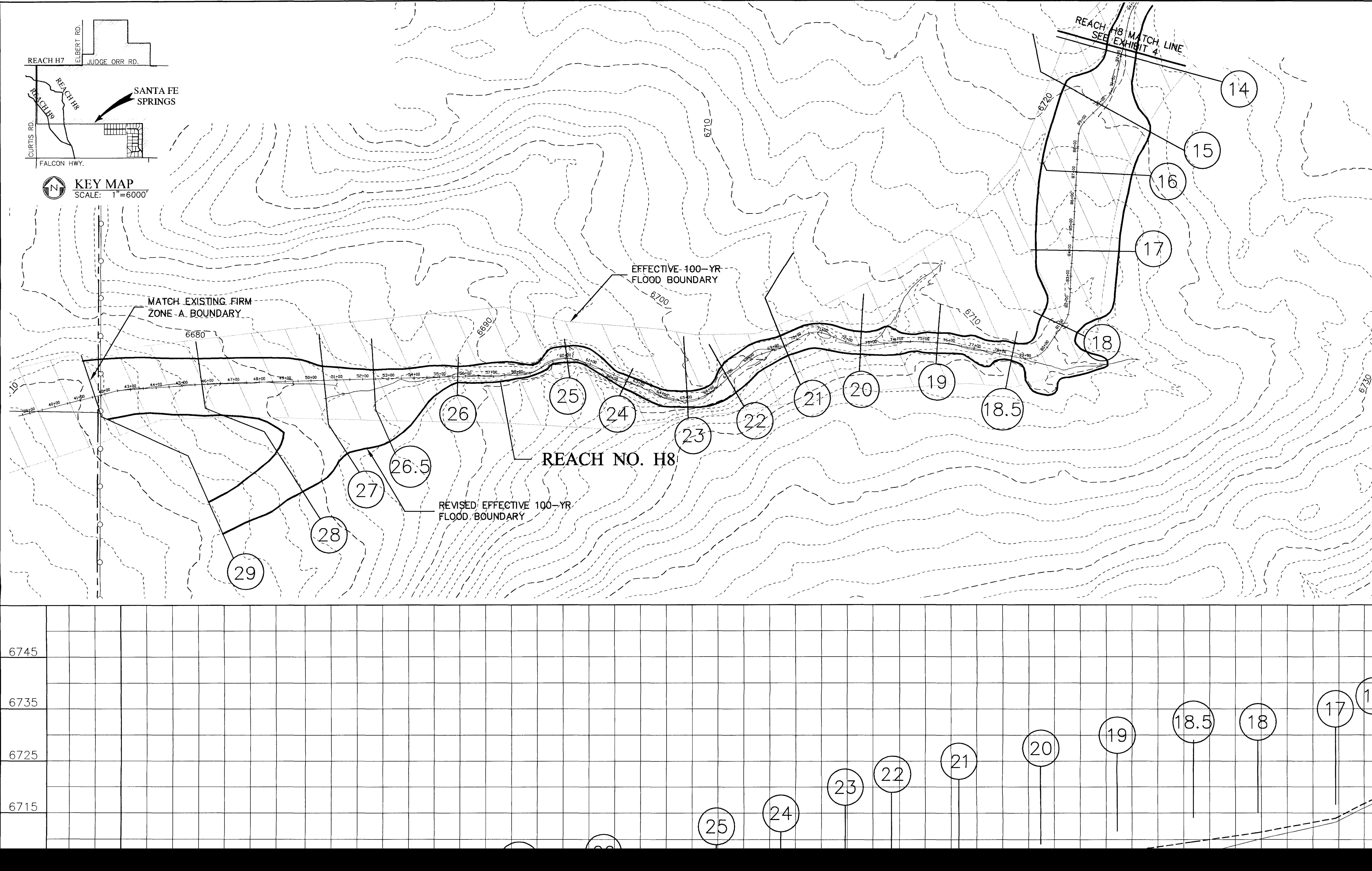




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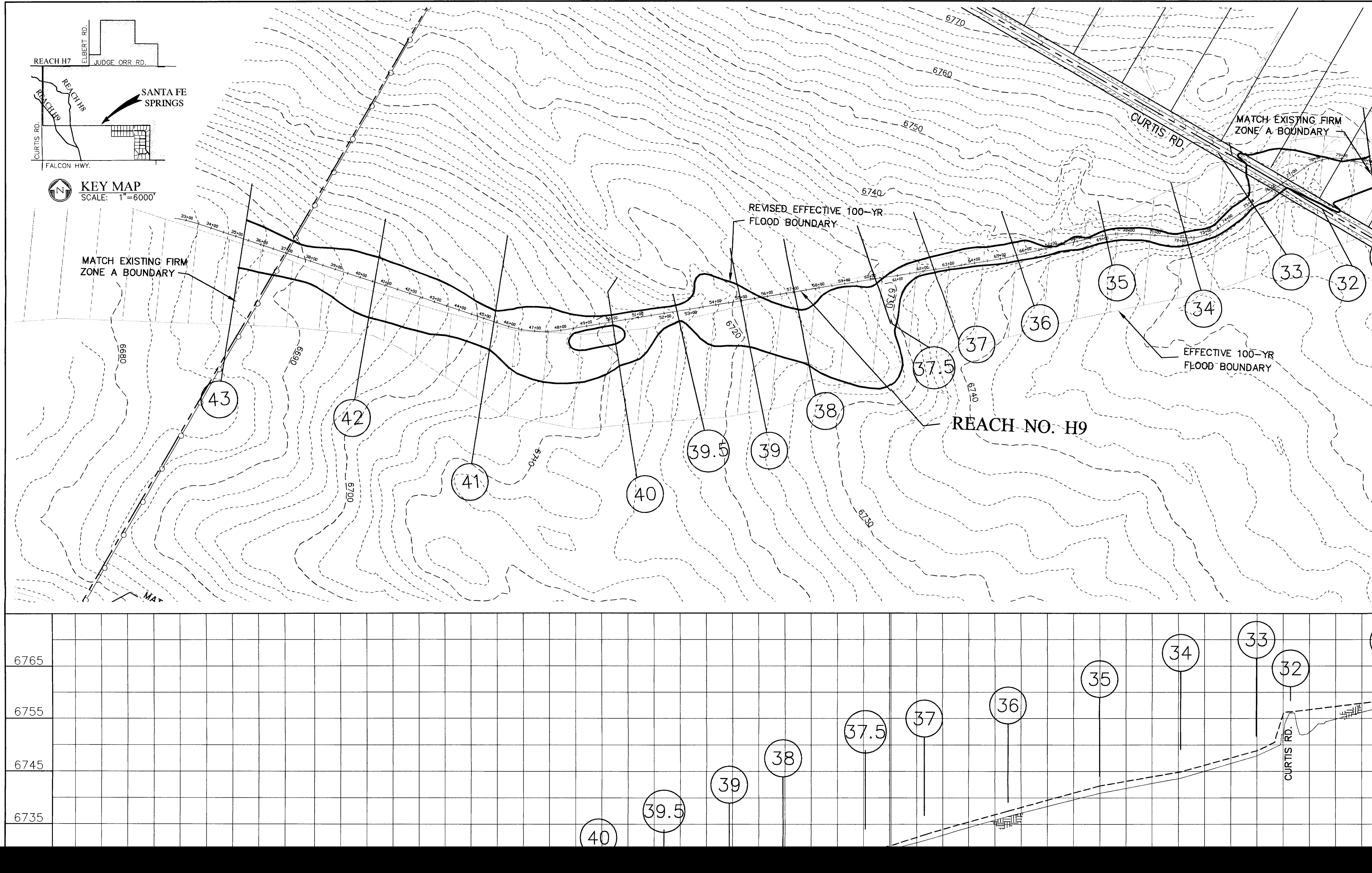


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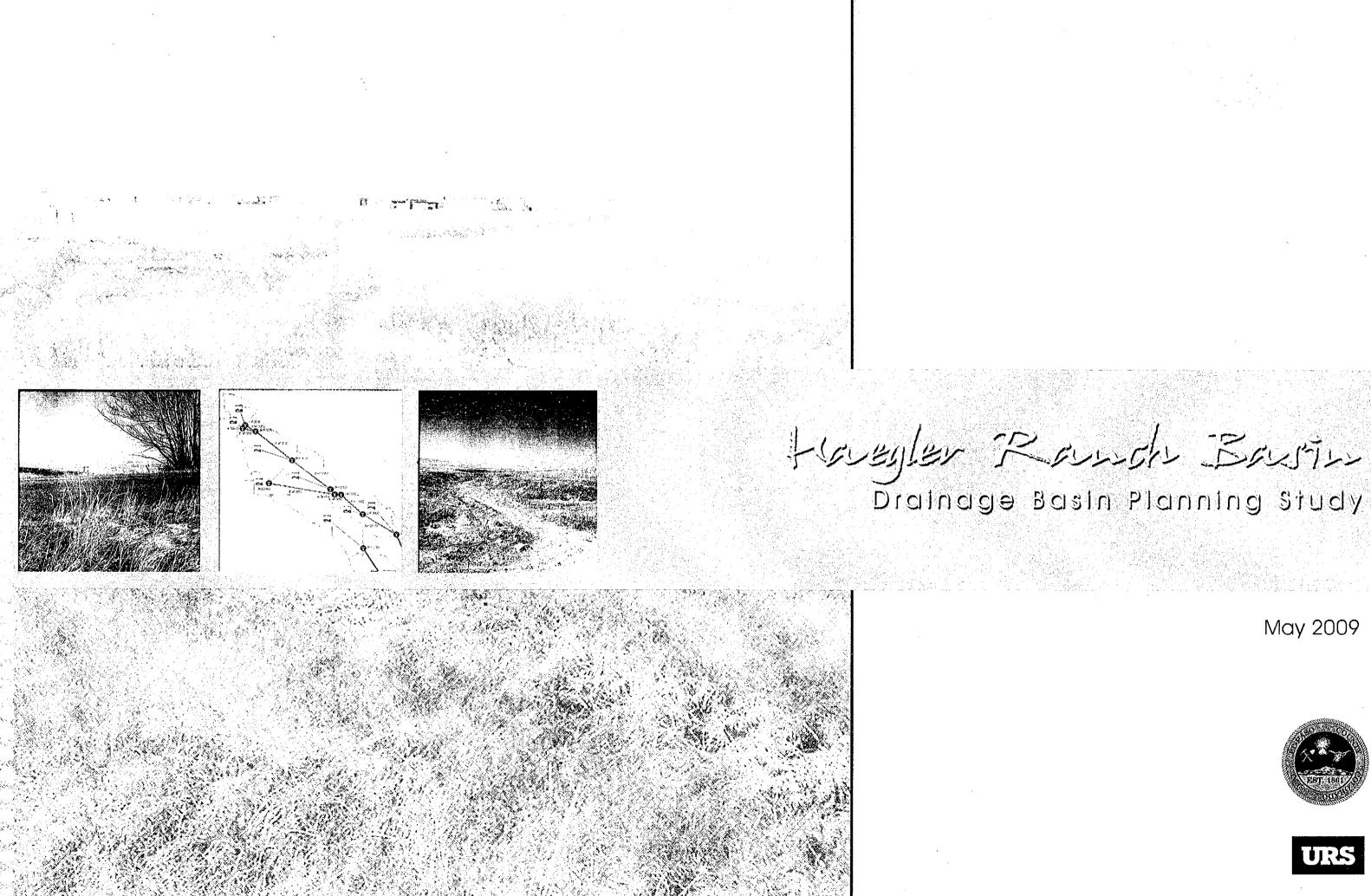


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I	REVISION         NO.       DESCRIPTION       REV BY       CKD BY       DATE         NO.       DESCRIPTION       REV BY       CKD BY       DATE
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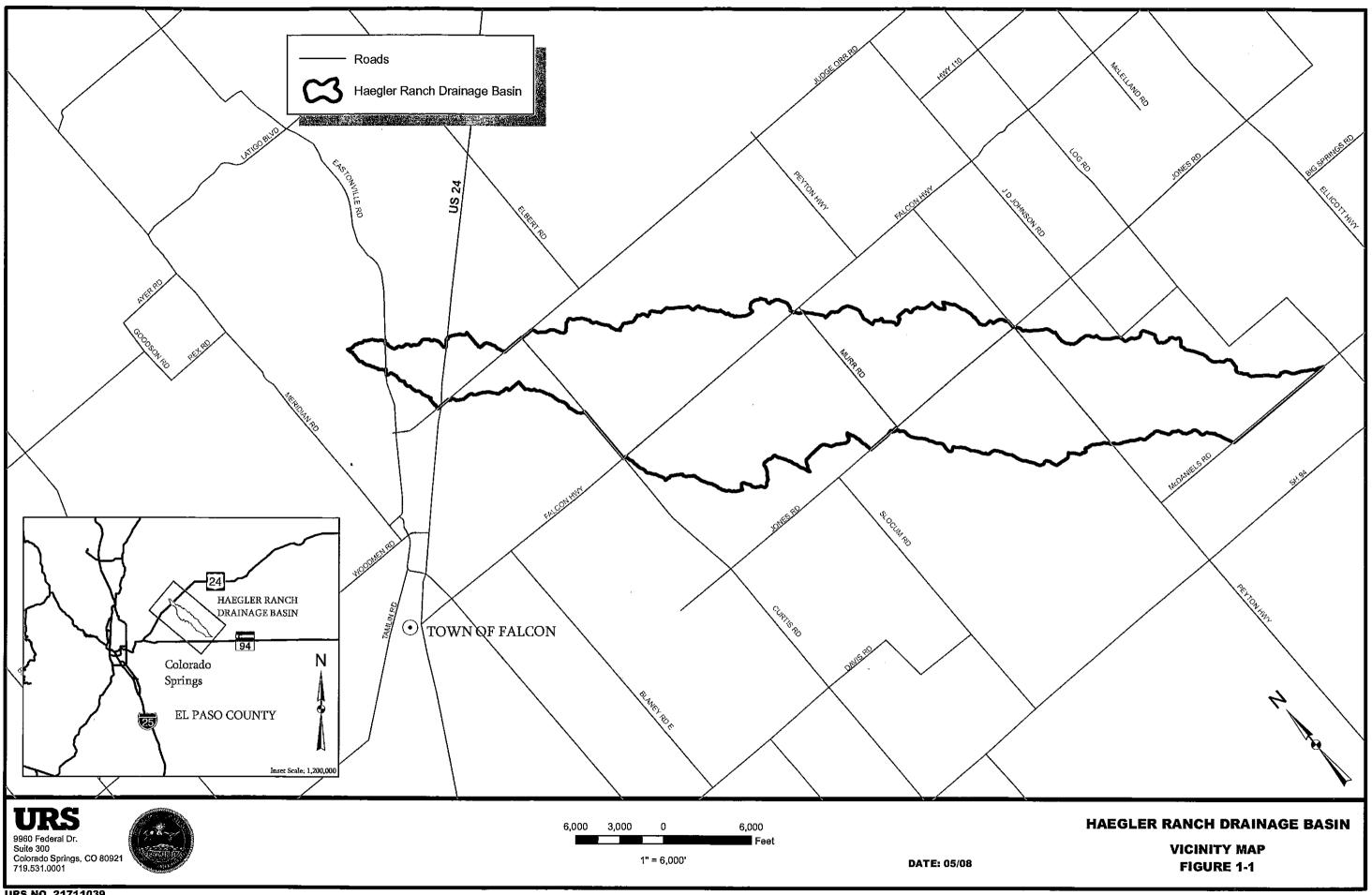
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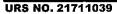


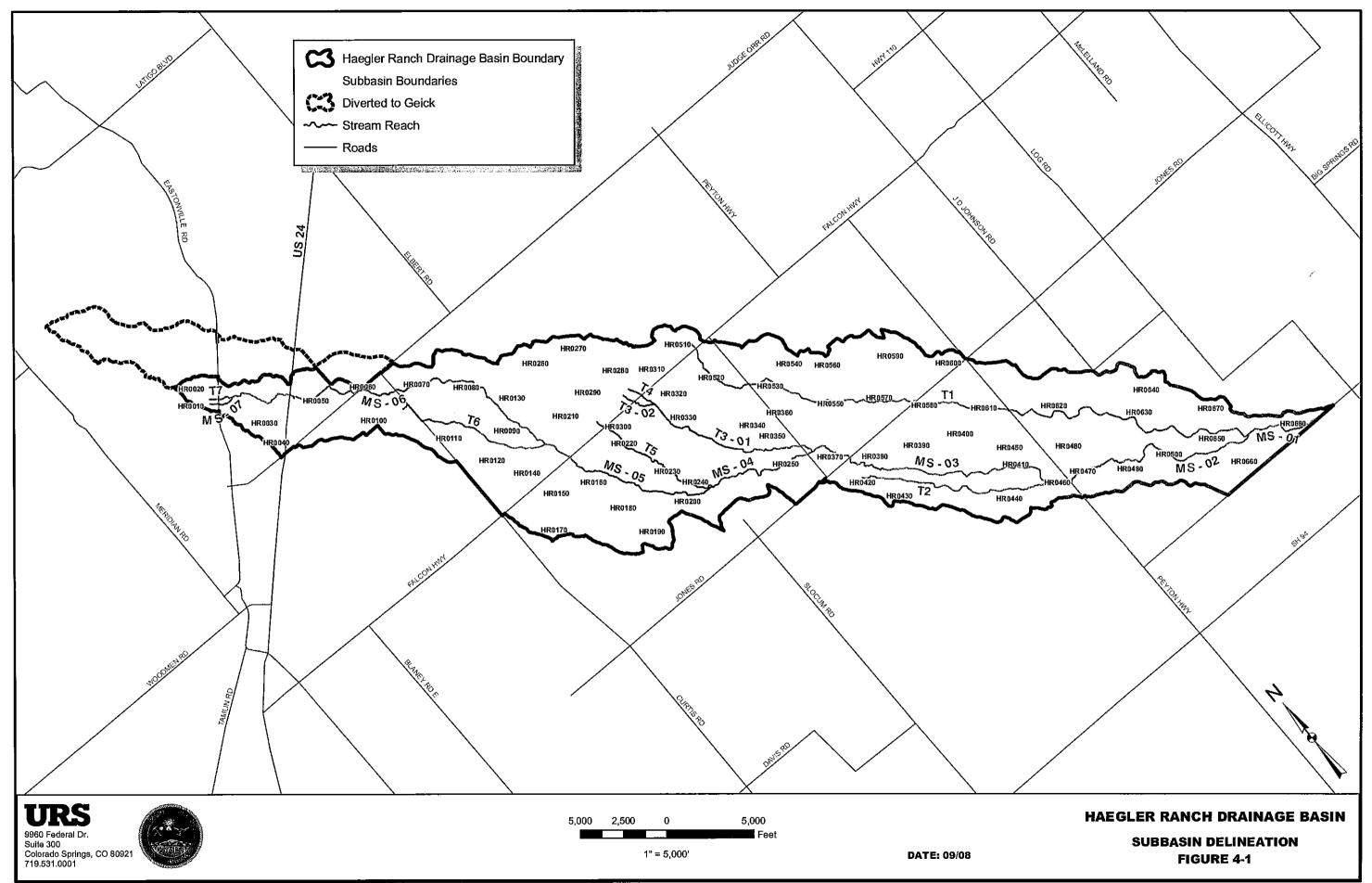
### May 2009











Facility Number	Road Crossing	Channel	Existing Size	Existing 100-yr Flow (cfs)	Deficiency
633	Sagecreek Road	N/A	24" CMP	N/A	N/A
634	Sagecreek Road	N/A	24" CMP	N/A	N/A
701	Curtis Road	N/A	18" CMP	N/A	N/A
702	Curtis Road	Tributary 6 (T6)	36" CMP	120	Overtops
703	Curtis Road	Main Stem (MS-06)	24" CMP	590	Overtops
704	Judge Orr Road	Main Stem (MS-06)	Blocked Culvert	540	Overtops
705	Judge Orr Road	N/A	18" CMP	N/A	N/A
706	US 24	N/A	20" Steel Pipe	N/A	N/A
707	US 24	N/A	24" CMP	N/A	N/A
801	Pedestrain Bridge	Main Stem (MS-06)	Bridge	350	Meets Capacity
802	US24	Main Stem (MS-06)	2-66" CMPs	350	Meets Capacity
803	Eastonville Road	Main Stem (MS-07)	27"X21" CMP	25	Overtops
804	Eastonville Road	Tributary 7 (T7)	18" CMP	99	Overtops

 Table 5-3 Existing Hydraulic Deficiencies

Note: 69 Structures were cataloged and located. N/A indicates that the structure was not analyzed because it was not on one of the main channels.

#### 5.14. Results

Hydraulic conditions from the hydraulic model results are summarized in Table 5-4. This includes channel velocity, flow depth, and top width for existing conditions at key locations. Water surface profiles for Haegler Ranch Drainage Basin for the 100-year recurrence interval flood for the existing conditions are presented in Figure 5-4 the HEC-RAS model for Haegler Ranch Drainage Basin for the existing conditions is provided in Appendix B.

The approximate 100-year floodplain as seen in Figure 5-4 varies from a contained floodplain with in a defined channel to a wide floodplain with shallow flooding. Three areas were designated as flooding: 1) the approximate 100-year floodplain as delineated by HEC-RAS, 2) split flow flooding that was estimated from HEC-RAS elevation upstream and contours, and 3) shallow areas connected to the floodplain with less than 1 foot of flooding.

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Key Location	Reach and	HEC-RAS Result	Recurrence Interva			ls
Key Location	Station	HLC-KAJ Kesut	2-yr	5-уг	10-yr	10
		Channel velocity (ft/sec)	1.1	1.63	1.98	2
Main stem at US 24	MS-06 72276	Water surface depth in channel (ft)	1.36	2.44	3.24	6
	12210	Top width (ft)	18.23	24.85	29.7	25
		Channel velocity (ft/sec)	3.33	4.09	1.76	3
Main stem at Judge Orr Road	MS-06 67666	Water surface depth in channel (ft)	0.52	1.04	1.05	1
	07000	Top width (ft)	174.53	534.34	535.52	56
		Channel velocity (ft/sec)	1.05	1.6	2.04	3
Main stem at Falcon Highway	MS-05 52353	Water surface depth in channel (ft)	1.79	3.69	4.96	5
	52355	Top width (ft)	31.42	1.42 83.76 5	556.41	59
		Channel velocity (ft/sec)	2.45	3.7	1.27	2
Main stem at Jones Road	MS-03 33189	Water surface depth in channel (ft)	3.2 5.8	5.83	9.25	1(
	55105	Top width (ft)	47.98	105.51	580.28	66
· · · · · · · · · · · · · · · · · · ·		Channel velocity (ft/sec)	0.16	0.4	0.59	1
Main stem at Peyton Highway	MS-02 18474	Water surface depth in channel (ft)	4.14	4.35	4.51	5
	10-7-	Top width (ft)	813.21	871.68	882.22	92
		Channel velocity (ft/sec)	0.62	1.02	1.47	
Southeast Tributary at Jones Road	T1 22297	Water surface depth in channel (ft)	2.45	3.52	3.59	3
		Top width (ft)	197.35	345.68	351.74	37
		Channel velocity (ft/sec)	1.67	2.25	2.65	4
Southeast Tributary at Peyton Highway	T1 16611	Water surface dcpth in channel (ft)	0.08	0.17	0.24	0
	10011	Top width (ft)	r ()		242.51	24
		Channel velocity (ft/sec)	3.44	0.11	0.18	0
Southeast Tributary at Confluencc with Main stem	T1 410	Water surface depth in channel (ft)	1.69	2.01	2.01	2
confluence with Main stem	410	Top width (ft)	31.89	1169.3	1169.3	11
· ·	L	Channel velocity (ft/sec)	2.68	3.85	19.89	1
At Confluence with Geick Basin	MS-01 82	Water surface depth in channel (ft)	1.45	2.17	1.11	2
zaom	02	Top width (ft)	75.88	255.32	60.67	2

#### Table 5-4 Existing Conditions HEC-RAS Model

100-yr
2.92 6.49
255.62
3.48
1.35 569.34
3.59
5.74
592.33
2.51
10.46
667.17
1.43 5.15
925.27
3.2
3.82
372.17
4.05
0.51 247.41
0.67
2.01
1169.3
17.33
2.36
262.84

Grass channels are designed for depths and velocities to be within the limits of allowable shear stress. Grass lined channels are limited to 1.0 psf shear stress. If calculated shear stress is above this, drop structures must be added to flatten the natural slope of the channel.

Using these criteria, several channel sections were developed to accommodate a range of future flow rates from 100 cfs to 3500 cfs, as shown in Table 6-2. The approximate channel sections were used in the alternatives to accommodate future flows as necessary,

A.			
(cfs)	Sideslope	Bottom	Depth
	(h:v)	( <b>ft</b> )	(ft)
300	4	6	5
500	4	8	5
600	4	15	5
800	4	20	5
900	4	25	5
1000	4	30	5
1500	4	50	5
2000	4	80	5
3000	4	120	5
3500	4	140	5

#### Table 6-2 Channel Dimensions based on Flow Rates

#### 6.2.2. Culvert Design

Culvert sizes for use in alternative evaluation were estimated based on full flow capacity of reinforced concrete pipe with a minimum slope of 0.50% and concrete end sections. For flows up to 300 cfs single RC pipe culverts with a maximum of 72" diameter were used. For greater flows, multiple RC pipes or 6-foot by 6-foot concrete box culverts with headwalls and flared wingwalls were used. Proposed culverts sizes based on existing flow rates are listed in Table 6-3.

Facility Number	Road Crossing	Channel	Existing Size	Existing 100-yr Flow (cfs)	Deficiency	Necessary Facility
N/A	Peyton Highway	Tributary 1 (T1)	No Culvert	500	Overtops	2-72" RCPs
N/A	Falcon Highway	Tributary 1 (T1)	No Culvert	33	Overtops	36" RCP
301	Peyton Highway	Main Stem (MS-02)	2-33"X48" CMPs	2,500	Overtops	7-6'X6' RCBs
401	Jones Road	Tributary 1 (T1)	2-24" CMPs	370	Overtops	6'X6' RCB
403	Jones Road	Main Stem (MS-03)	3-60" CMPs	2,300	Overtops	6-6'X6' RCBs

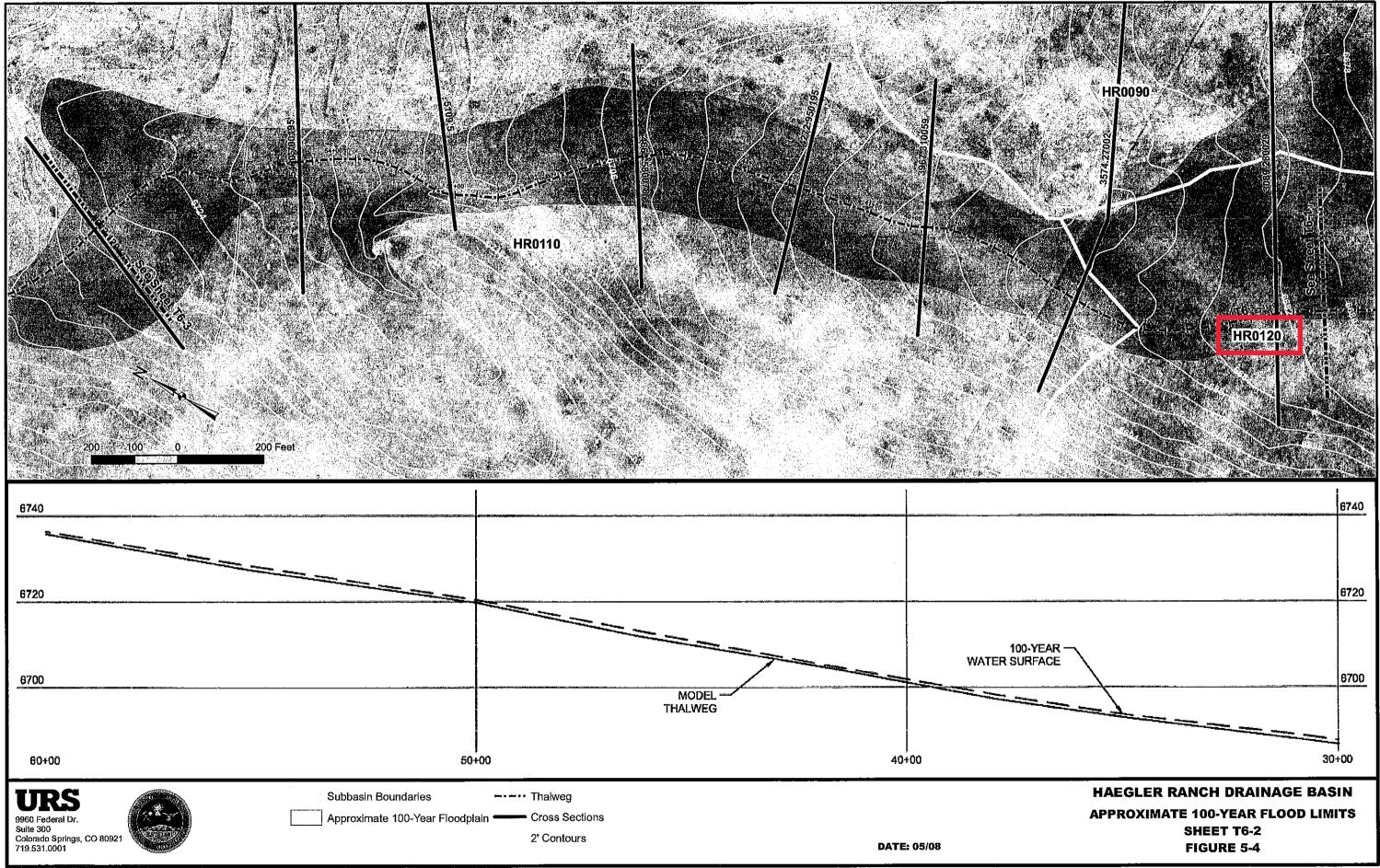
Facility Number	Road Crossing	Channel	Existing Size	Existing 100-yr Flow (cfs)	Deficiency	Necessary Facility
405	Murr Road	Main Stem Aurr Road (MS-04)		1,700	Overtops	5-6'X6' RCBs
407	Murr Road	Tributary 3 (T3-01)	66" RCP	670	Overtops	2-6'X6' RCBs
507	Peerless Farms Road	Tributary 3 (T3-01)	60'' CMP	600	Overtops	2-6'X6' RCBs
509	Murr Road	Tributary 1 (T1)	2-15" RCPs	220	Overtops	66" RCP
601	Whiting Way	Tributary 1 (T1)	24" CMP	220	Overtops	66" RCP
604	, Max Road	Tributary 1 (T1)	18" CMP	220	Overtops	66" RCP
609	Falcon Tributary 3 Highway (T3-02)		18" CMP	180	Overtops	66" RCP
610	Falcon Highway	Tributary 4 (T4)	24" CMP	200	Overtops	66" RCP
612	Falcon Highway	Tributary 5 (T5)	24" CMP	150	Overtops	60" RCP
628	Falcon Highway	Main Stem (MS-05)	2-60" CMPs	1,000	Overtops	3-6'X6' RCBs
702	Curtis Road	Tributary 6 (T6)	36" CMP	120	Overtops	54" RCP
703	Curtis Road	Main Stem (MS-06)	24" CMP	590	Overtops	2-6'X6' RCBs
704	Judge Orr Road	Main Stem (MS-06)	Blocked Culvert	540	Overtops	2-72" RCPs
801	Pedestrain Bridge	Main Stem (MS-06)	Bridge	350	Meets Capacity	Existing Bridge
802	US24	Main Stem (MS-06)	2-66'' CMPs	350	Meets Capacity	Existing Culvert
803	Eastonville Road	Eastonville Main Stem		25	Overtops	30" RCP
804	Eastonville Road	Tributary 7 (T7)	18" CMP	99	Overtops	48" RCP

#### 6.2.3. Detention Design

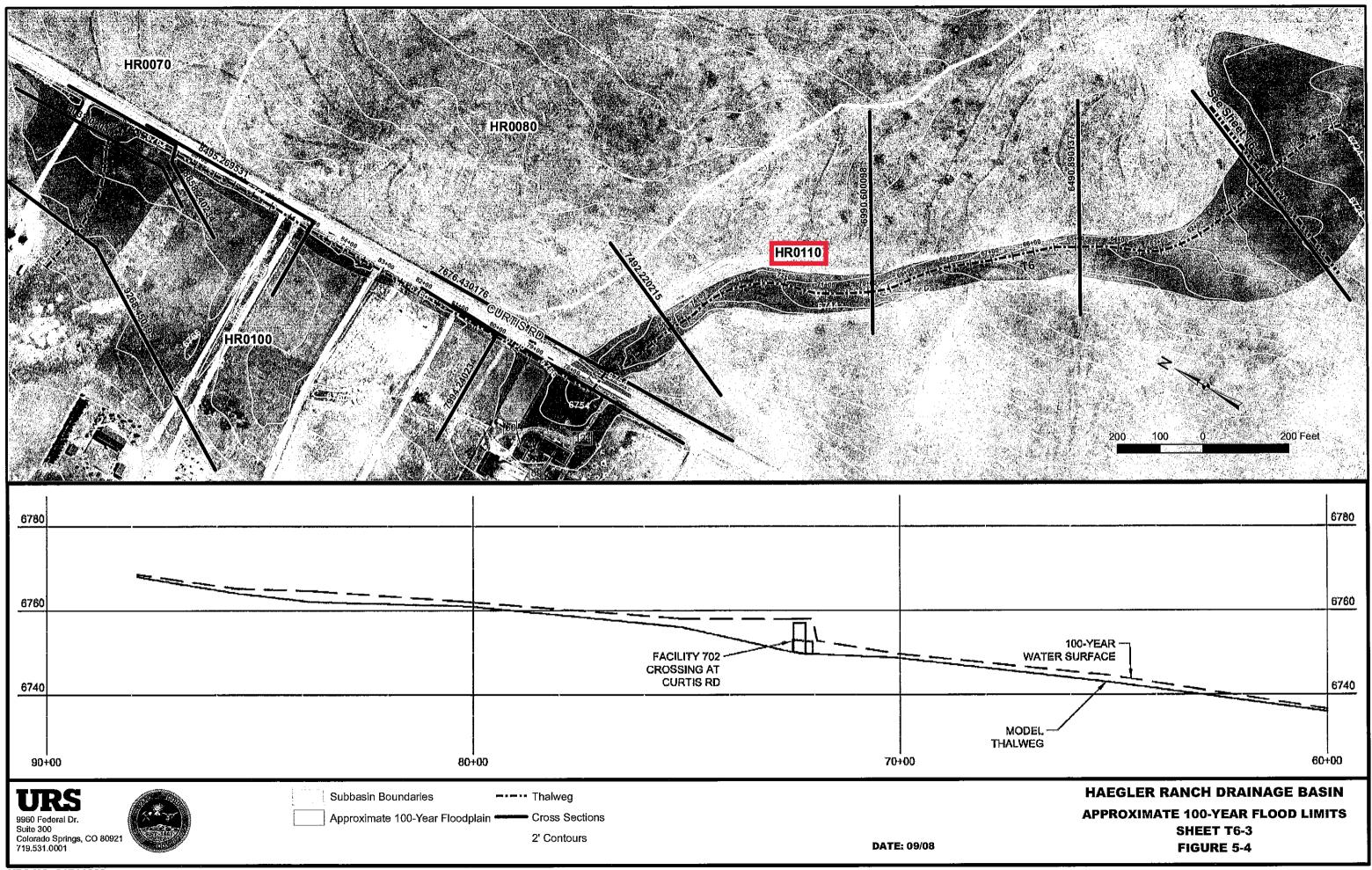
All detention pond design is based on Chapter 10, Storage, of the UDFCD SDCM. All ponds were assumed to be "full spectrum" per the SDCM. For final design to be performed later, some of the ponds may be separated into a water quality pond and an off-line major detention pond.

For the Regional Detention Alternative, either the simplified full spectrum sizing method or the hydrograph method was used to size the facility. If the contributing area is less than 160 acres and no

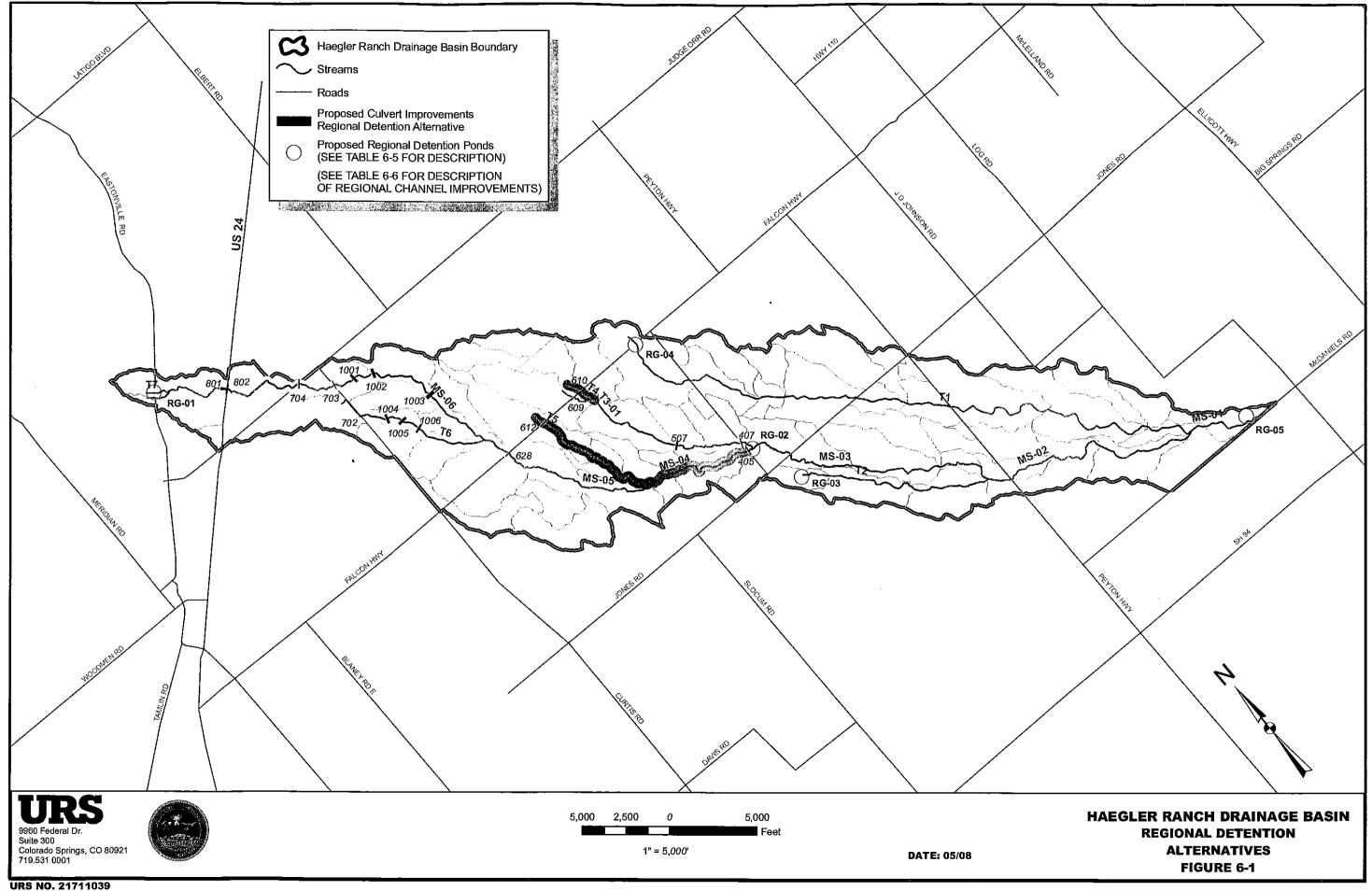
Haegler Ranch Drainage Basin Planning Study

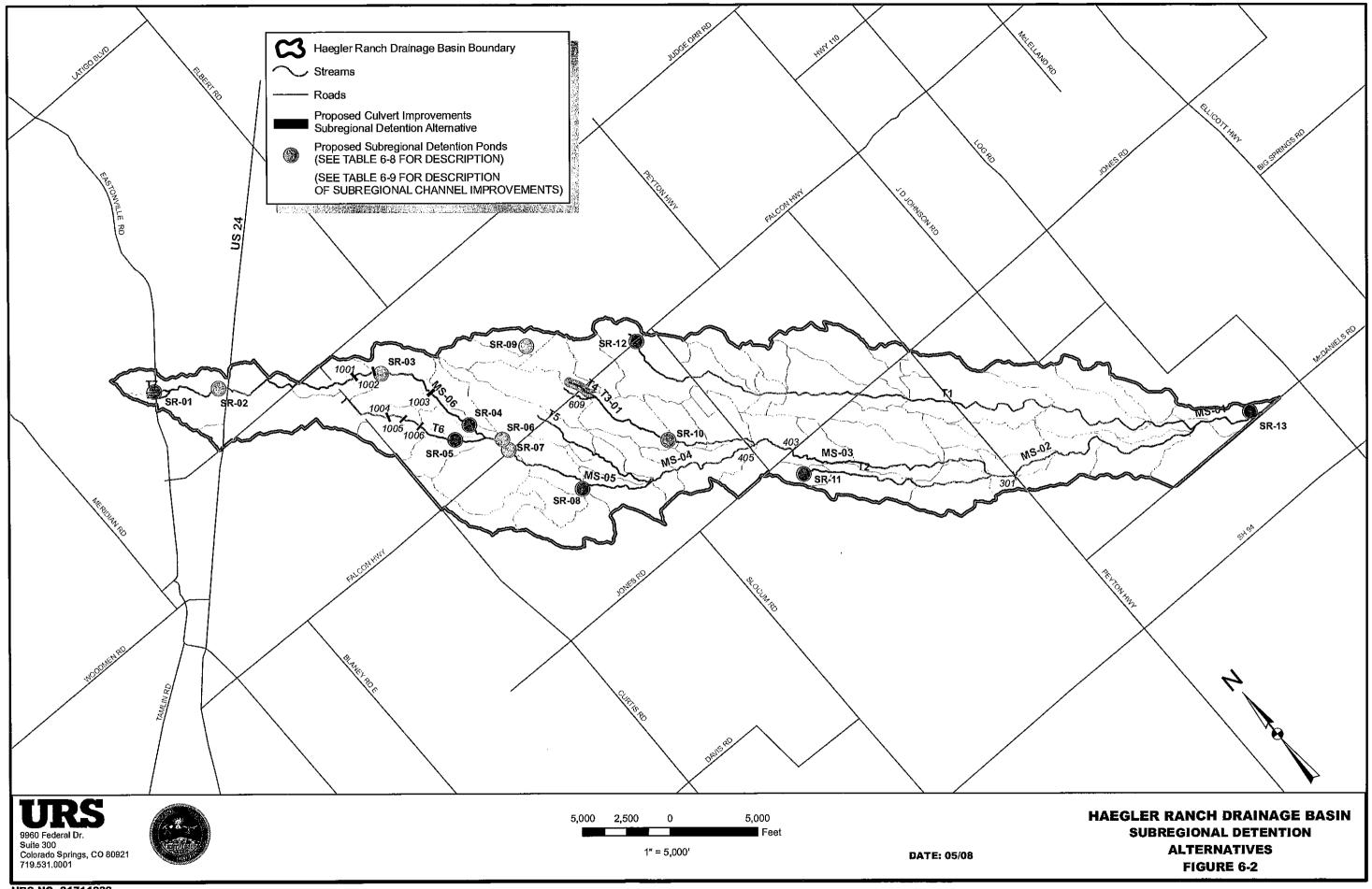


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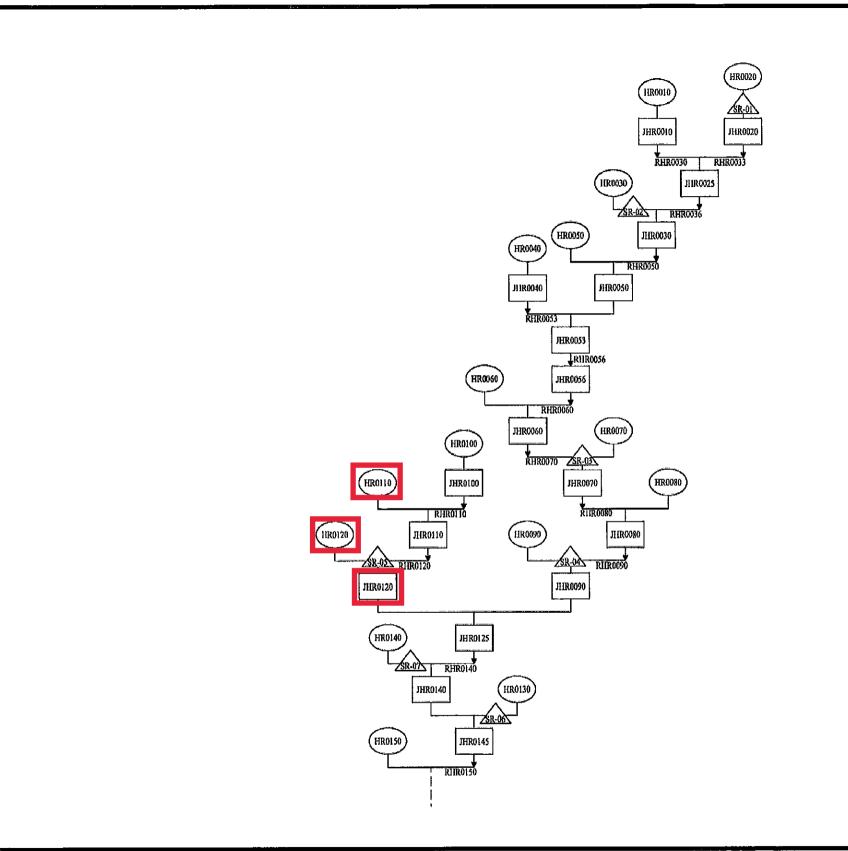


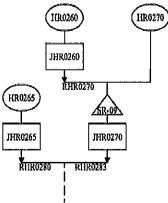
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## URS

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URS NO. 21711039

DATE: 05/08

#### HAEGLER RANCH DRAINAGE BASIN SUBREGIONAL DETENTION ALTERNATIVE SHEET 1 FIGURE 6-3

#### 6.4.1. Channel & Culvert Costs

Channel costs for each alternative are based on cubic yards of excavation, plus the cost of the channel lining and drop structures. These costs are presented in Table 6-13 and Table 6-14.

<b>Table 6-13</b>	<b>Regional Detention</b>	Alternative Channel	Cost Estimates

tructure Cost
none
2,539,000
589,000
268,000
548,000
636,000
,302,000
127,000
\$36,000
370,000
222,000
253,000
5,888,000
,066,000
,033,000
,988,000

(See Tables C6 and C7 in Appendix C for details)

#### Table 6-14 Sub-Regional Detention Alternative Channel Cost Estimates

Channel	Design Flow (cfs)	Channel Length (ft)	Total Cost	Drop Structure Cost
Main Stem (MS-05)	2,000	1,560	\$224,000	\$367,000
Main Stem (MS-06)	600	3,120	\$162,000	\$295,000
Main Stem (MS-06)	1,000	4,535	\$331,000	\$375,000
Main Stem (MS-06)	800	3,190	\$188,000	\$368,000
Tributary 3 (T3-01)	600	5,000	\$259,000	\$422,000
Tributary 3 (T3-02)	500	420	\$18,000	\$37,000
Tributary 4 (T4)	500	940	\$40.000	\$74.000
Tributary 6 (T6)	500	4,280	\$179,000	\$333,000
Tributary 6 (T6)	300	1,400	\$55,000	\$107,000
Sub-Total	Sub-Total			\$2,374,000
30% Construction Con	itingency		\$430,000	\$712,000
15% Engineering Cont	tingency		\$218,000	\$356,000
Total			\$2,111,000	\$3,442,000

Culverts costs are based on a per linear foot of pipe with two flared end sections or two wing walls, as appropriate, complete-in-place. Culvert costs for each alternative are presented in Table 6-15 and Table 6-16.

#### Table 6-15 Regional Detention Alternative Roadway Crossing Cost Estimate Sumary

Facility Number	Road Crossing	Channel	Existing Size	Proposed 100-yr Flow (cfs)	Necessary Facility for Proposed 100- year Flow	Estimated Cost
405	Murr Road	Main Stem (MS-04)	66" RCP	3,400	9-6'X6' RCBs	\$256,000
507	Peerless Farms Road	Tributary 3 (T3-01)	60" CMP	1200	4-6'X6' RCBs	\$139,000
609	Falcon Highway	Tributary 3 (T3-02)	18" CMP	460	2-66" RCPs	\$51,600
610	Falcon Highway	Tributary 4 (T4)	24" CMP	570	2-72" RCPs	\$51,000
612	Falcon Highway	Tributary 5 (T5)	24" CMP	240	72" RCP	\$26,000
628	Falcon Highway	Main Stem (MS-05)	2-60" CMPs	2,200	6-6'X6' RCBs	\$243,000
702	Curtis Road	Tributary 6 (T6)	36" CMP	140	60" RCP	\$29,000
703	Curtis Road	Main Stem (MS-06)	24" CMP	890	3-6'X6' RCBs	\$142,000
704	Judge Orr Road Future Pastura Street	Main Stem (MS-06)	Blocked Culvert	830	3-6'X6' RCBs	\$185,000
1001	Future Arroyo Hondo Blvd. N.	Main Stem (MS-06) Main Stem (MS-06)	N/A N/A	930 930	3-6'X6' RCBs	\$99,000
1003	Future Arroyo Hondo Blvd. N	Main Stem (MS-06)	N/A	1500	4-6'X6' RCBs	\$143,000
1004	Future Pastura Street	Tributary 6 (T6)	N/A	440	2-66" RCPs	\$43,000
1005	Future El Vado Road	Tributary 6 (T6)	N/A	440	2-66" RCPs	\$43,000
1006	Future Socorro Trail	Tributary 6 (T6)	N/A	440	2-66" RCPs	\$43,000
Sub-Total						\$1,591,000
30% Construction Contingency					\$477,000	
15% Engineering Contingency					\$239,000	
Total	<u></u>			· ·		\$2,307,000

(See Table C4 in Appendix C for details)

(See Tables C6 and C8 in Appendix C for details)

Facility Number	Road Crossing	Channel	Proposed 100-yr Flow (cfs)	Necessary Facility for Proposed 100-year Flow	Estimated Cost
301	Peyton Highway	Main Stem (MS-02)	3,370 .	9-6'X6' RCBs	\$402,000
403	Jones Road	Main Stem (MS-03)	2,970	8-6'X6' RCBs	\$358,000
405	Murr Road	Main Stem (MS-04)	2,870	8-6'X6' RCBs	\$283,000
609	Falcon Highway	Tributary 3 (T3-02)	460	2-6'X6' RCBs	\$106,000
N/A	Falcon Highway	Tributary 1 (T1)	110	2 - 36" RCP	\$20,000
1001	Future Pastura Street	Main Stem (MS-06)	610	2-6'X6' RCBs	\$107,000
1002	Future Arroyo Hondo Blvd. N.	Main Stem (MS-06)	610	2-6'X6' RCBs	\$87,000
1003	Future Arroyo Hondo Blvd. N.	Main Stem (MS-06)	530	2-6'X6' RCBs	\$87,000
1004	Future Pastura Street	Tributary 6 (T6)	440	2-66" RCPs	\$43,000
1005	Future El Vado Road	Tributary 6 (T6)	440	2-66" RCPs	\$43,000
1006	Future Socorro Trail	Tributary 6 (T6)	440	2-66" RCPs	\$43,000
Sub-Total				<u> </u>	\$1,582,000
30% Constru	ction Contingency				\$475,000
15% Engine	ering Contingency			· · · · · ·	\$237,000
Total					\$2,294,000

#### Table 6-16 Sub-Regional Detention Roadway Crossing Cost Estimate Summary

Table 6-18 Sub-Regional Detent Facility Storage (AF) **Including Construc** SR-01 10 SR-02 5 SR-03 16 SR-04 25 24 SR-05 SR-06 9 SR-07 5 SR-08 5 SR-09 20 23 SR-10 2 SR-11 SR-12 9 SR-13 3 Total

(See Table C1 in Appendix C for details)

#### 6.4.3. Other Costs

Design Engineering costs are also included as 15% of the construction costs. Construction contingencies (30%) include such items as utility relocations, mobilization, temporary erosion control, and construction engineering.

#### 6.4.4. Conceptual Alternative Costs

The total estimated capital costs for each alternative are based on the sum of the cost of the proposed facilities, plus costs for engineering and construction contingencies. These costs are listed in Table 6-19.

Table 6-19 Conceptual Alternative Costs						
	Regional Alternative	Subregional Alternative				
Detention Ponds	\$5,048,000	\$9,780,000				
Channel Improvements	\$10,737,000	\$2,110,000				
Drop Structures	\$9,988,000	\$3,442,000				
Roadway Crossing Culverts	\$2,307,000	\$2,294,000				
Total	\$28,080,000	\$17,627,000				

(See Tables C5 in Appendix C for details)

#### 6.4.2. Detention Pond Costs

The cost of detention ponds, both regional and subregional, is based on the cubic yards of excavation, an estimated outlet structure, and the cost of the land required for the facility. These costs are presented in Table 6-17 and Table 6-18.

Table 6-17	<b>Regional Detention Pond C</b>	Cost Summary

Facility	Storage (AF)	Total Cost Including Construction and Engineering Contingencies
RG-01 9.02	9.02	\$542,000
RG-02 64.52	64.52	\$4,053,000
RG-03 0.04	0.04	\$146,000
RG-04 1.07	1.07	\$160,000
RG-05 0.03	0.03	\$146,000
Total		\$5,048,000

(See Tables C1 in Appendix C for details)

tion Pond Cost Summary
Total Cost
ction and Engineering Contingencies
\$899,000
\$640,000
\$868,000
\$1,453,000
\$1,557,000
\$547,000
\$524,000
\$326,000
\$861,000
\$1,069,000
\$182,000
\$477,000
\$376,000
\$9,780,000

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May 2009 Page 65 impacted by site development, utility, roadway and landscape construction activities have in some cases negatively affected downstream areas.

El Paso County has enacted an erosion control ordinance to address these problems. In general, it is the responsibility of the entity conducting any land disturbance activity to properly control surface runoff, erosion and sedimentation during and after the activity. Technical criteria identifying measures which help mitigate the impacts of erosion and sedimentation are available and being used throughout the region. Minimum requirements must be developed to properly control erosion.

Erosion control is necessary to prevent environmental degradation caused by wind or water-borne soil. The following minimum criteria and standards are intended to prevent excessive erosion. El Paso County as well as other affected agencies will enforce the Clean Water Act standards if the planned erosion control measures fail to perform satisfactorily. Proper installation and maintenance is necessary to achieve the desired function of erosion control measures. By paying attention to quality, reinstallation can be avoided. General requirements for erosion control are as follows:

- 1. Any land disturbing activity shall be conducted so as to effectively reduce unacceptable erosion and resulting sedimentation.
- 2. All land disturbing activities shall be designed, constructed, and completed in such a manner that the exposure time of disturbed land shall be limited to the shortest possible period of time.
- 3. Sediment caused by accelerated soil erosion and runoff shall be intercepted by erosion control measures such as hay bales, silt fences and / or sediment ponds, and contained within the site.
- 4. Any facility designed and constructed to convey storm runoff shall be designed to be non-erosive.
- 5. Erosion control measures will be used prior to and during construction.

Temporary erosion control measures are required during construction, and permanent erosion control measures are required for all developments. Maintenance of erosion control measures is the responsibility of the property owner.

Various structures have been proposed in this plan to help control localized erosion and sedimentation problems. It is important that the erosion control plan for any land disturbing activity be strictly adhered to and maintained so that the above minimum criteria can be achieved in the Haegler Ranch Basin.

#### 7.4. Operations and Maintenance

Maintenance of drainage way facilities is essential in preventing long term degradation of the creek and overbank areas. Along the drainageway, clearing of debris and dead vegetation should be considered within the low flow area of the creek and its tributaries. On the overbanks, limited maintenance of the existing vegetative cover is recommended. Semi-annual clearing of trash and debris at roadway crossings is also recommended to increase the effectiveness of the crossings. Sediments cleared from the channel or culvert should not be left on the overbank. This disturbs the native vegetation, creates a potential water quality concern if the dredgings are subsequently washed into the drainageway by natural erosion, and reduces the capacity of the overbank. In those reaches designated to be selectively

lined and the floodplain preserved, maintenance activities should be carried out with the least disturbances to native vegetation that is practical.

Similar practices should be employed when removing sediment from detention basins. Although some channels degrade and others agrade, all detention basins will collect sediment and agrade. The use of an easily accessible concrete lined forebay in the final design of a detention facility can make the cleaning of the larger debris and trash more easily accomplished with motorized equipment. If forebays are provided, they will need clearing semi-annually and after major storm events. More frequent routine maintenance may be required depending on the type of development upstream and the access provided to the public. Plan for annual removal of sediment and debris from the detention area of a facility with a forebay.

Deposition in drainage facilities of wind-blown trash and debris, should be expected in this region. This means that regular maintenance, even without rainfall events, should be performed.

#### 7.5. Drainage and Bridge Fee Calculations

The cost estimates and basin fee calculation for the major drainageways, tributary drainageways, roadway culverts, regional detention basins, and related improvements for the Sub-Regional Detention Facilities are presented in Table 7-2. The sub-regional detention capital construction cost estimates include the cost for the construction of the embankment, water quality, and outlet structures. Bridges in the Sub-Regional Detention Alternative are presented in Table 7-3. The cost estimates include engineering and construction costs for the entire Haegler Ranch Basin as presented on the Conceptual Design Drawings in Appendix D. These estimates do not include costs for local or initial systems, and therefore no costs attributable to local or minor drainage systems have been computed in the estimation of the drainage basin fee. These systems are expected to be provided with proposed development. Costs associated with utility relocations have not been estimated but would be included in construction contingencies. A review of utility maps indicates that the majority of the potential relocations occur at the roadway crossings. Land acquisition costs for the detention facilities were not included for calculation of fees per Appendix L of the El Paso County Criteria Manual.

Unplatted acreage within Haegler Ranch was obtained from El Paso County, and is shown in Figure 7-1. A total of 8,953 acres is estimated to be currently unplatted and subject to future development. This unplatted land is projected to have an average imperviousness of approximately 15%, corresponding to approximately 1,343 unplatted impervious acres. All drainage and bridge fees are calculated per *impervious* acre. (See Appendix D for an unplatted area breakdown by subbasin and average imperviousness calculations.)

Reimbursable costs calculated for the Haegler Ranch Basin are listed in Table 7-4. These costs are based on improvements required under existing conditions. The term "reimbursable costs" used on Table 7-4 means those costs that have been used in estimation of drainage basin fees. Costs considered "non-reimbursable" are costs for the replacement of existing, undersized culverts, or costs to rehabilitate or maintain an existing lined segment of drainageway. For the most part, all of the drainageway costs for Haegler Ranch Basin are considered reimbursable.

The calculated drainage basin fee presented in Table 7-2 is \$7,633 per impervious acre, and the bridge fee is \$1,126 per impervious acre, as shown in Table 7-3.

#### Table 7-2 Drainage Basin Fec Calculations

		Channel Improvemen			
Channel	Basins	Channel Construction Cost	Drop Structure Construction Cost	Contingency Cost	Total Cost
Main Stem (MS-05)	HR0200	\$224,000	\$363,600	\$264,420	\$852,020
Main Stem (MS-06)	HR0070	\$162,000	\$295,400	\$205,830	\$633,230
Main Stem (MS-06)	HR0080	\$331,000	\$374,500	\$317,475	\$1,022,975
Main Stem (MS-06)	HR0090	\$188,000	\$368,000	\$250,200	\$806,200
Tributary 3 (T3-01)	HR0330	\$259,000	\$422,000	\$306,450	\$987,450
Tributary 3 (T3-02)	HR0300	\$18,000	\$37,000	\$24,750	\$79,750
Tributary 4 (T4)	HR0300	\$40,000	\$74,000	\$51,300	\$165,300
Tributary 6 (T6)	HR0110	\$179,000	\$333,000	\$230,400	\$742,400
Tributary 6 (T6)	HR0120	\$55,000	\$106,500	\$72,675	\$234,175
Subtotal Channel Cost	<u>s</u>				\$5,553,500
		Culvert Improvement	5		
Culvert	Road Crossing	Channel	Culvert Construction Cost	Contingency Cost	Total Cost
609	Falcon Highway	Tributary 3 (T3-02)	\$106,301	\$47,836	\$154,137
N/A	Falcon Highway	Tributary 1 (T1)	\$19,500	\$8,775	\$28,275
1001	Future Pastura Street	Main Stem (MS-06)	\$106,301	\$47,836	\$154,137
- 1002	Future Arroyo Hondo Blvd. N.	Main Stem (MS-06)	\$87,301	\$39,286	\$126,587
1003	Future Arroyo Hondo Blvd. N.	Main Stem (MS-06)	\$87,301	\$39,286	\$126,587
1004	Future Pasture Street	Tributary 6 (T6)	\$51,000	\$22,950	\$73,950
1005	Future El Vado Road	Tributary 6 (T6)	\$19,500	\$8,775	\$28,275
1006	Future Socorro Trail	Tributary 6 (T6)	\$42,800	\$19,260	\$62,060
Subtotal Culvert Costs					\$754,007
		Detention Improvemer	nts		
				Contingency	
Facility	Storage (AF)	<b>Construction Cost</b>		Cost	Total Cost
SR-01	10	\$296,701		\$133,516	\$430,217
SR-02	5	\$207,949		\$93,577	\$301,525
SR-03	16	\$186,252		\$83,814	\$270,066
SR-04	25	\$390,182		\$175,582	\$565,764
SR-05	24	\$455,235		\$204,856	\$660,091
SR-06	9	\$140,670		\$63,301	\$203,971
SR-07	5	\$162,046		\$72,921	\$234,967
SR-08	5	\$87,489		\$39,370	\$126,860
SR-09	20	\$188,250		\$84,713	\$272,963
SR-10	23	\$331,635		\$149,236	\$480,871
SR-11	2	\$56,880		\$25,596	\$82,476
SR-12	9	\$108,987		\$49,044	\$158,031
SR-13	3	\$107,812		\$48,515	\$156,327
Subtotal Detention Co.	sts		· · · · · · · · · · · · · · · · · · ·		\$3,944,129
Total Cost	<u> </u>				\$10,251,636
Total Unplatted Imp	ervious Acres		· · · · · · · · · · · · · · · · · · ·		1,343
Fee Per Impervious A					\$7,633

#### Table 7-3 Bridge Fce Calculation

301         Peyton Highway         Main Stem (MS-02)         401,710         \$180,770				\$582,480	
403 Jones Road Main Stem (MS-03) 35		358,123	\$161,155	\$519,278	
405					\$410,264
Subtotal		\$1,512,022			
Total Co		\$1,512,022			
Total Unplatted Impervious Acres					1,343
Bridge Fec Per Impervious Acre					\$1,126

\_\_\_\_

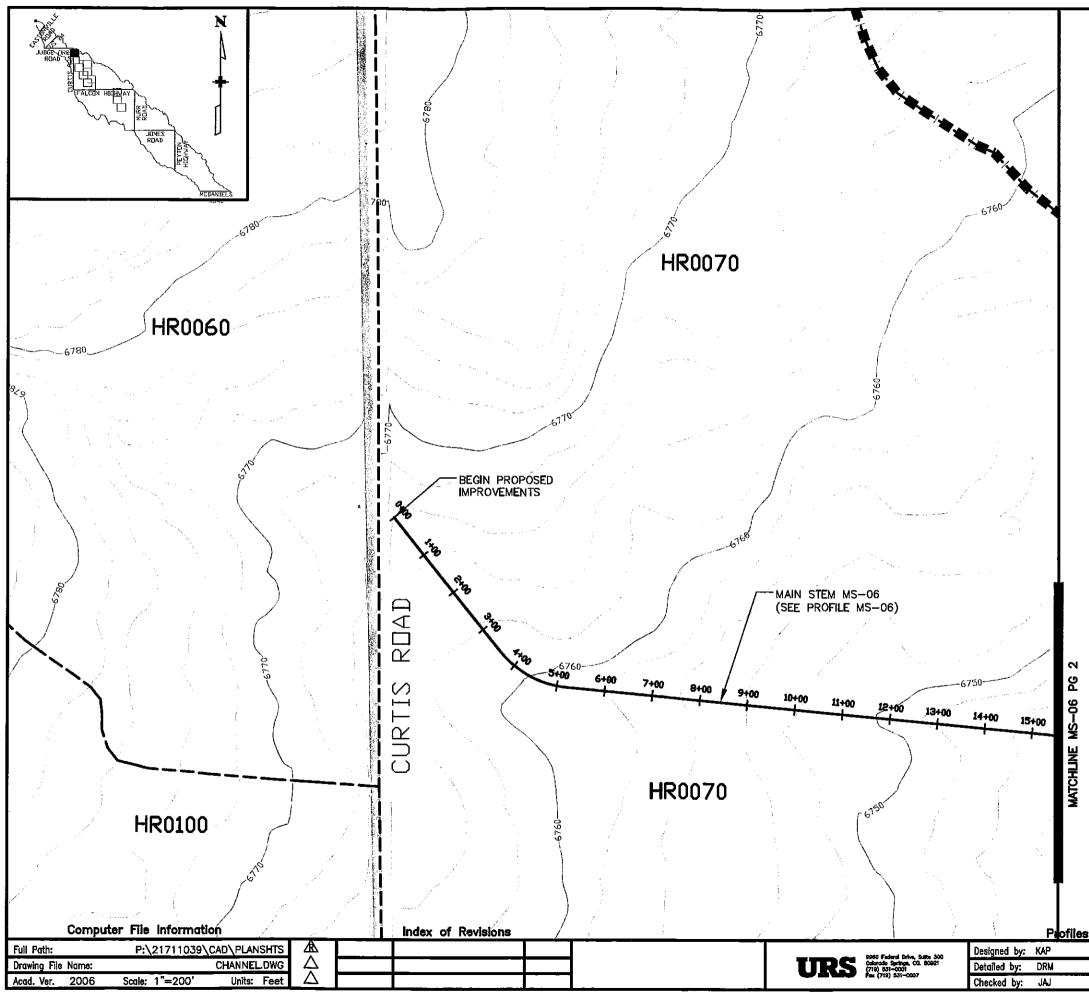
May 2009 Page 69

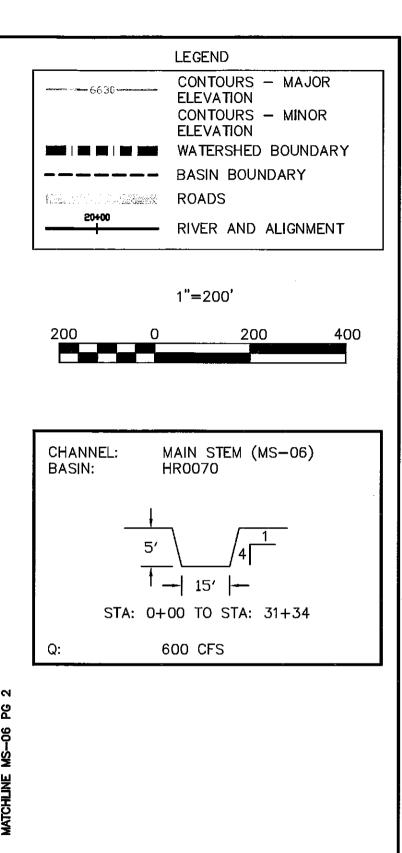
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		7-4 Reimbursable			
	Reimbi	irsable Culvert Impro	vements Culvert		
			Construction	Contingency	
Culvert	Road Crossing	Channel	Cost	Cost	Total Cost
N/A	Peyton Highway	Tributary 1 (T1)	\$51,000	\$22,950	\$73,950
N/A	Falcon Highway	Tributary 1 (T1)	\$9,7580	\$4,388	\$14,138
301	Peyton Highway	Main Stem (MS-02)	\$314,535	\$141,541	\$456,076
401	Jones Road	Tributary 1 (T1)	\$53,111	\$23,900	\$77,011
403	Jones Road	Main Stem (MS-03)	\$270,947	\$121,926	\$392,874
405	Murr Road	Main Stem (MS-04)	\$180,371	\$81,167	\$261,538
407	Murr Road	Tributary 3 (T3-01)	\$77,801	\$35,011	\$112,812
507	Peerless Farms Road	Tributary 3 (T3-01)	\$115,801	\$52,111	\$167,912
509	Murr Road	Tributary 1 (T1)	\$19,300	\$8,685	\$27,985
601	Whiting Way	Tributary 1 (T1)	\$23,500	\$10,575	\$34,075
604	Max Road	Tributary 1 (T1)	\$19,300	\$8,685	\$27,985
609	Falcon Highway	Tributary 3 (T3-02)	\$25,600	\$11,520	\$37,120
610	Falcon Highway	Tributary 4 (T4)	\$23,500	\$10,575	\$34,075
612	Falcon Highway	Tributary 5 (T5)	\$21,200	\$9,540	\$30,740
628	Falcon Highway	Main Stem (MS-05)	\$154,741	\$69,633	\$30,740 \$224,375
702	Curtis Road	Tributary 6 (T6)			a
702	Curtis Road	Main Stem (MS-06)	\$23,150	\$10,418	\$33,568
703			\$125,301	\$56,386	\$181,687
	Judge Orr Road	Main Stem (MS-06)	\$83,200	\$37,440	\$120,640
803	Eastonville Road	Main Stem (MS <sup>1</sup> 07)	\$9,680	\$4,356	\$14,036
804	Eastonville Road	Tributary 7 (T7)	\$14,980	\$6,741	\$21,721
Subtotal Channel Costs					\$2,344,315
	Reimbur	sable Detention Impr	ovements		
Facility	Storner (A D)	Construction		Contingency	<b></b>
SR-01	Storage (AF) 10	Construction Cost		Cost	Total Cost
SR-02	5	<u>\$296,701</u> \$207,949		\$133,516	\$430,217
SR-02	16	\$186,252		\$93,577 \$83,814	\$301,525 \$270,066
SR-04	25	\$390,182		\$175,582	\$565,764
SR-05	24	\$455,235		\$204,856	\$660,091
SR-06	9	\$140,670		\$63,301	\$203,971
SR-07	5	\$162,046		\$72,921	\$234,967
SR-08	5	\$87,489		\$39,370	\$126,860
SR-09	20	\$188,250		\$84,713	\$272,963
SR-10	23	\$331,635		\$149,236	\$480,871
SR-11	2	\$56,880		\$25,596	\$82,476
SR-12	9	\$108,987		\$49,044	\$158,031
CD 12					W156 707
SR-13 Subtotal Detention Cost	3	\$107,812		\$48,515	\$156,327 \$3,944,129

Table 7-4 Reimbursable Costs

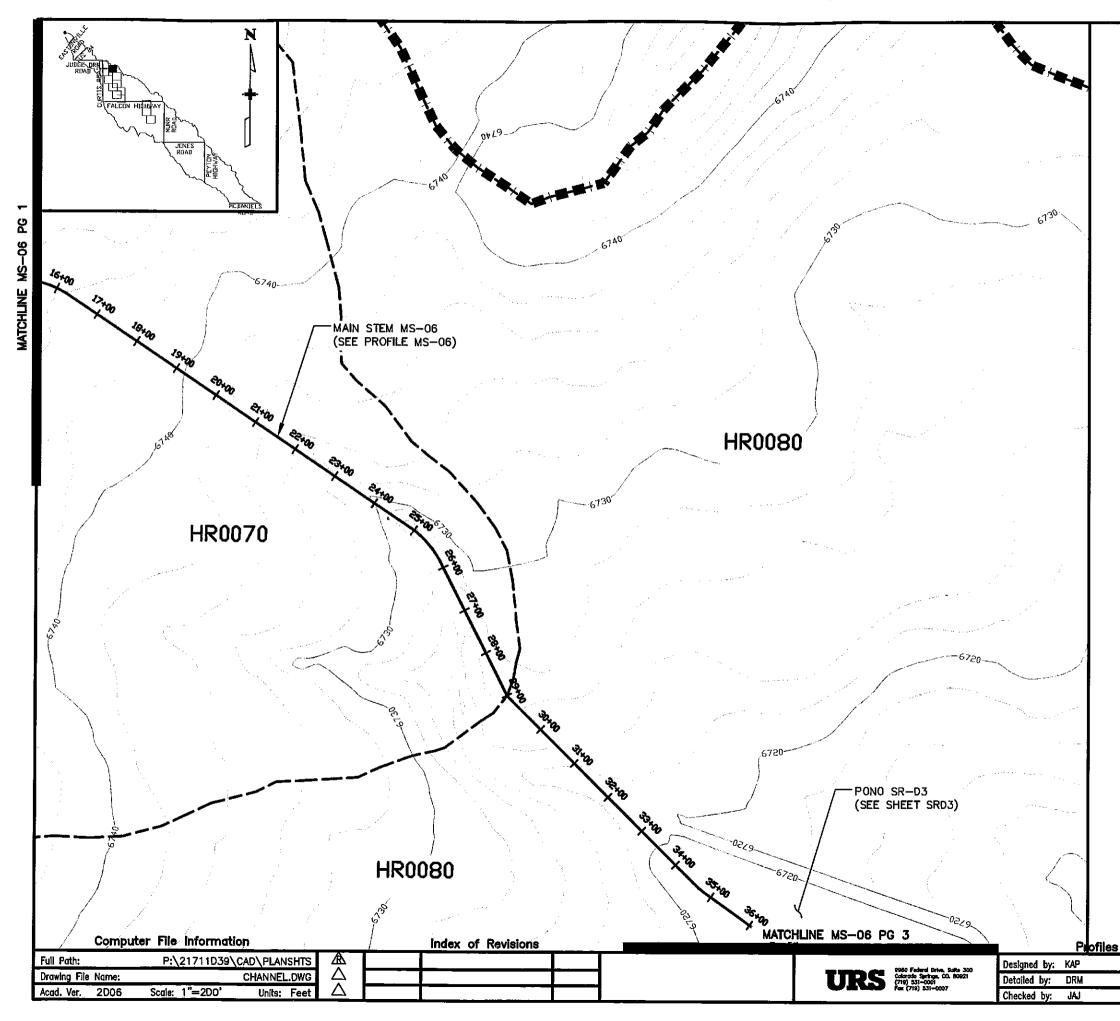
Haegler Ranch Drainage Basin Planning Study .

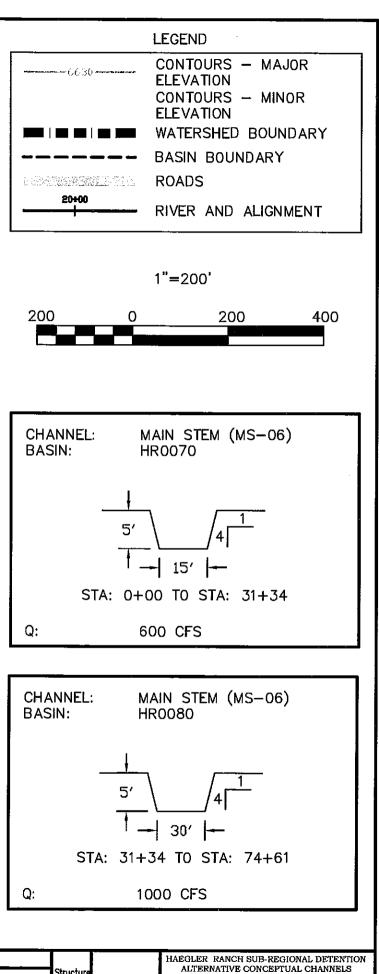




HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL CHANNELS Structur lumbe MAIN STEM PG Sheet Number

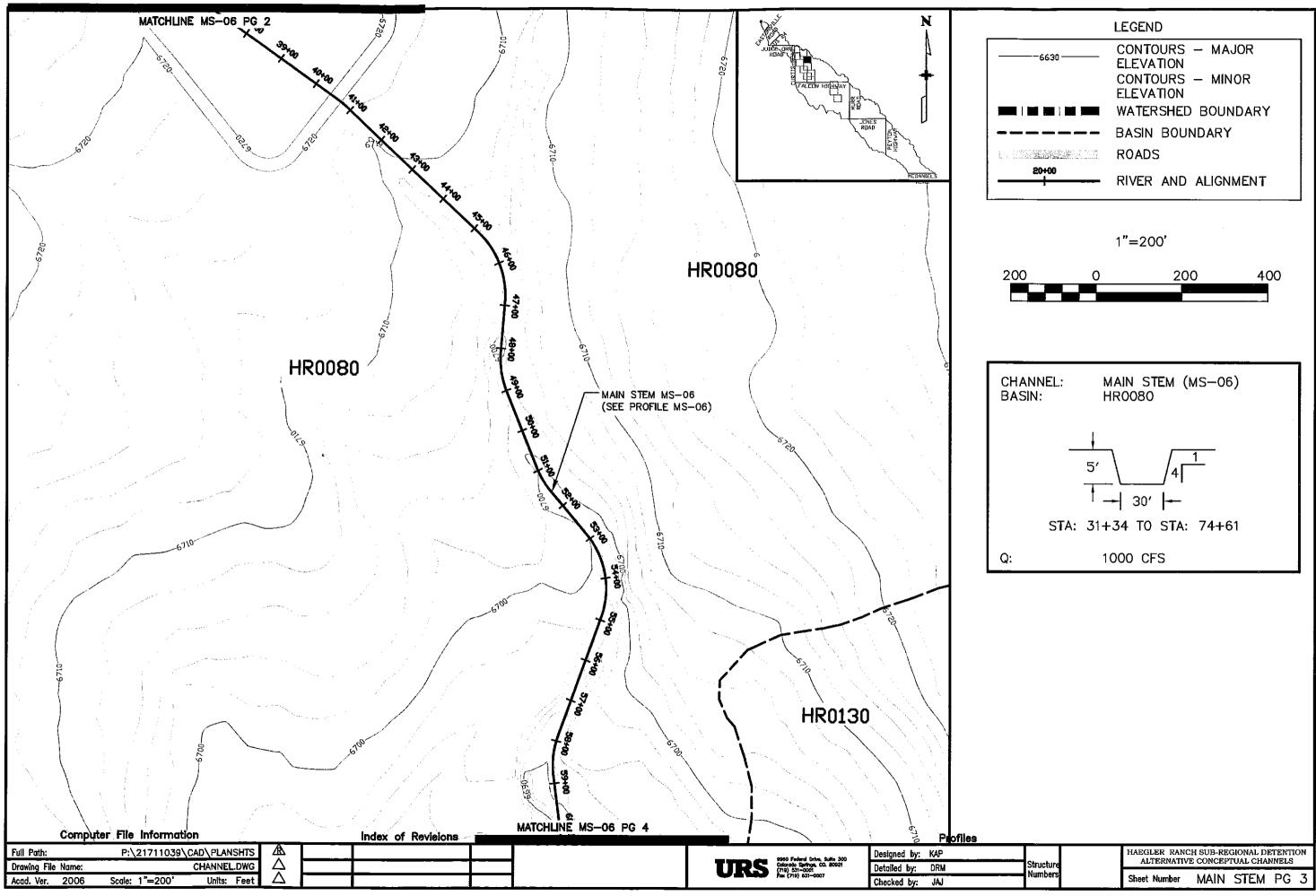
g 90 Ś MATCHLINE

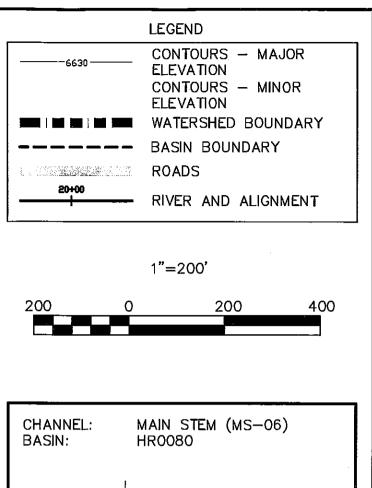


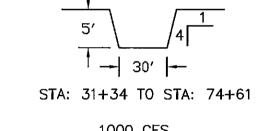


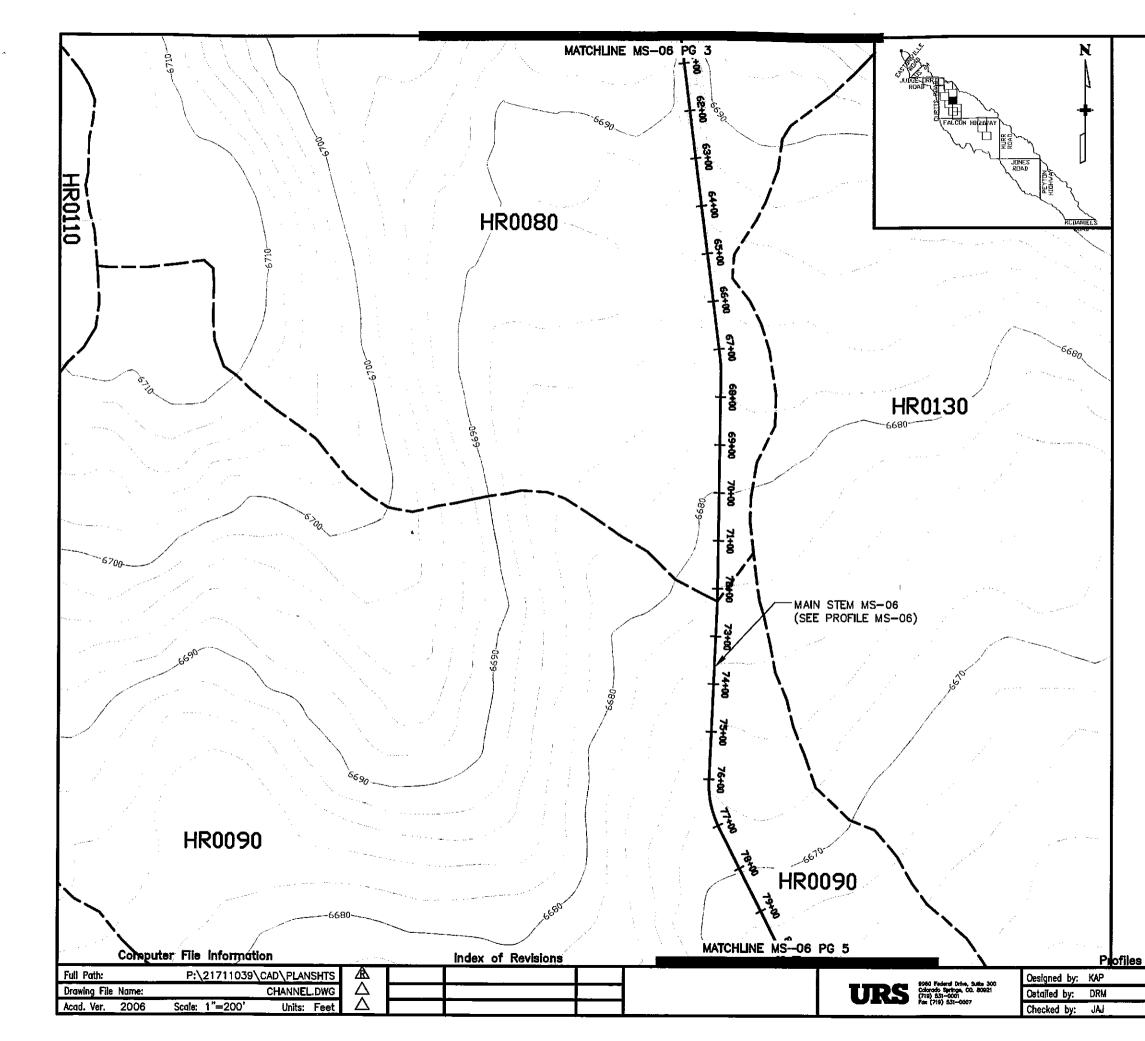
Structure ALTERNATIVE CO Numbers Sheet Number M

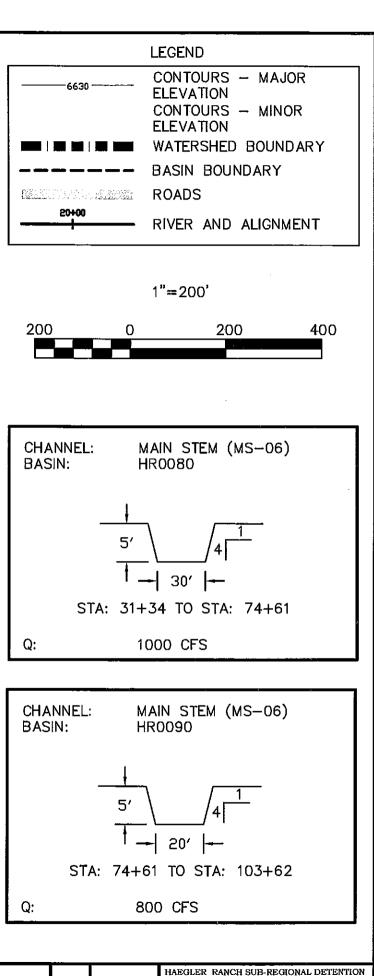
ALTERNATIVE CONCEPTUAL CHANNELS Sheet Number MAIN STEM PG 2



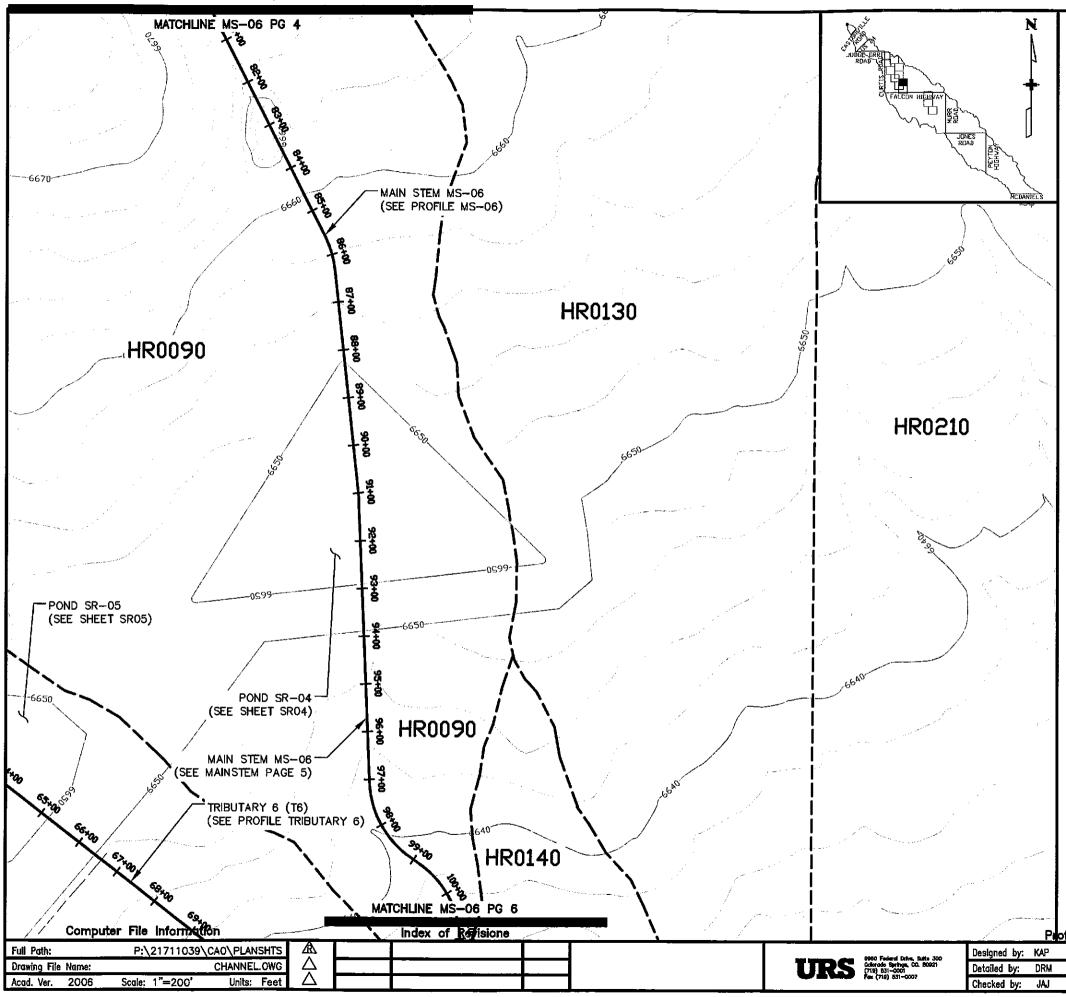


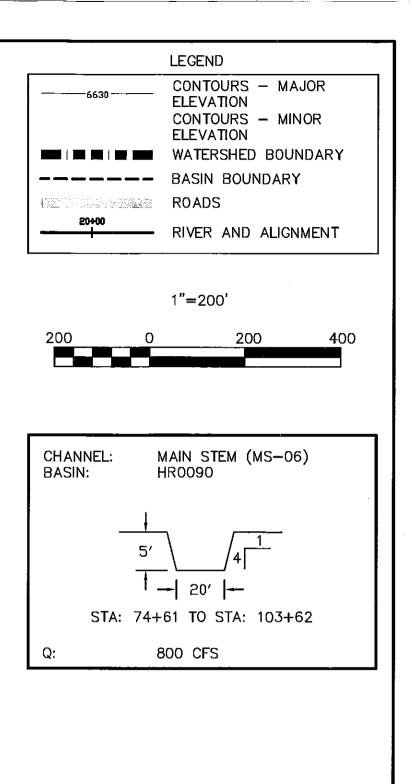




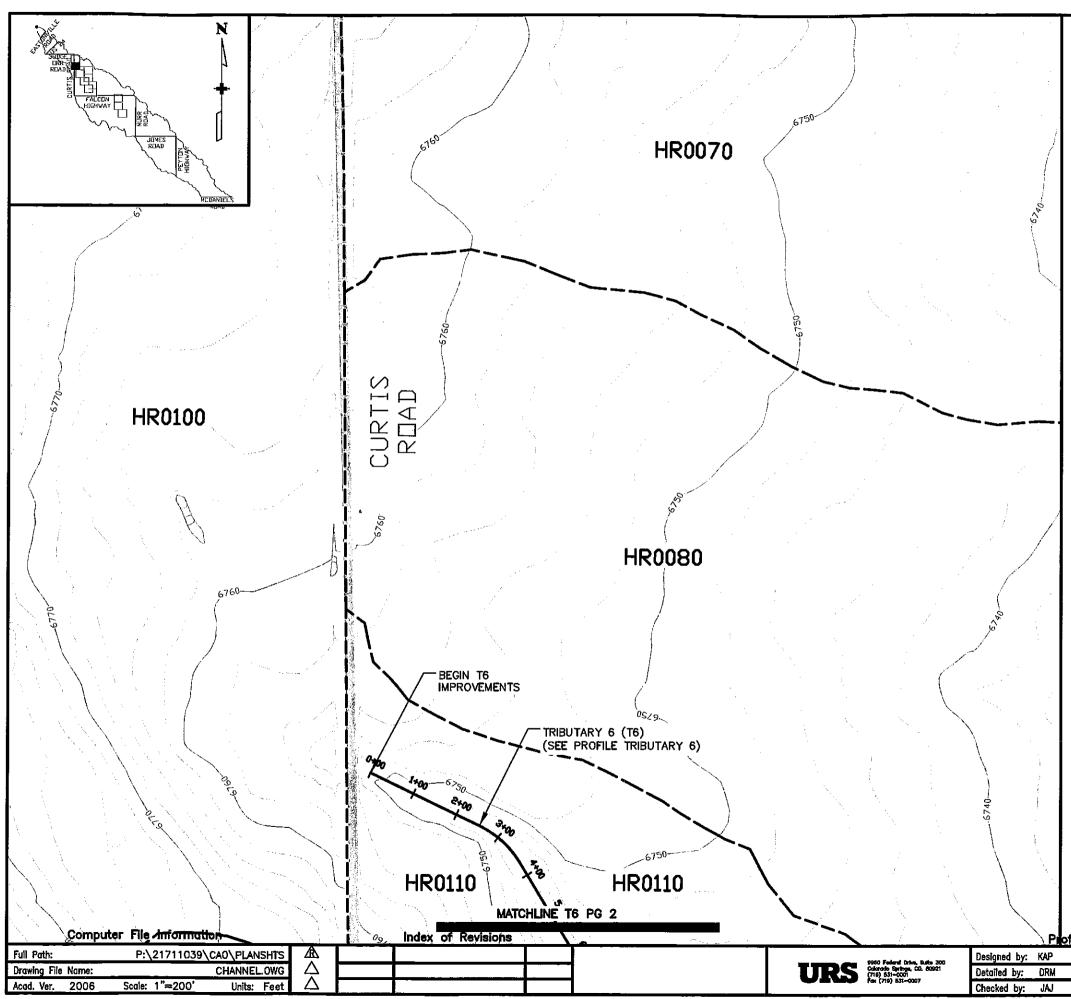


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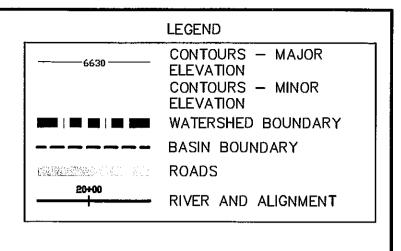




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	Structure	HAEGLER RANC				
_	Numbers	Sheet Number	MAIN	STEM	PG	5

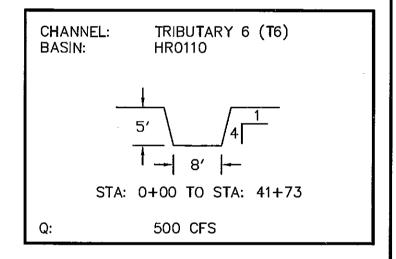




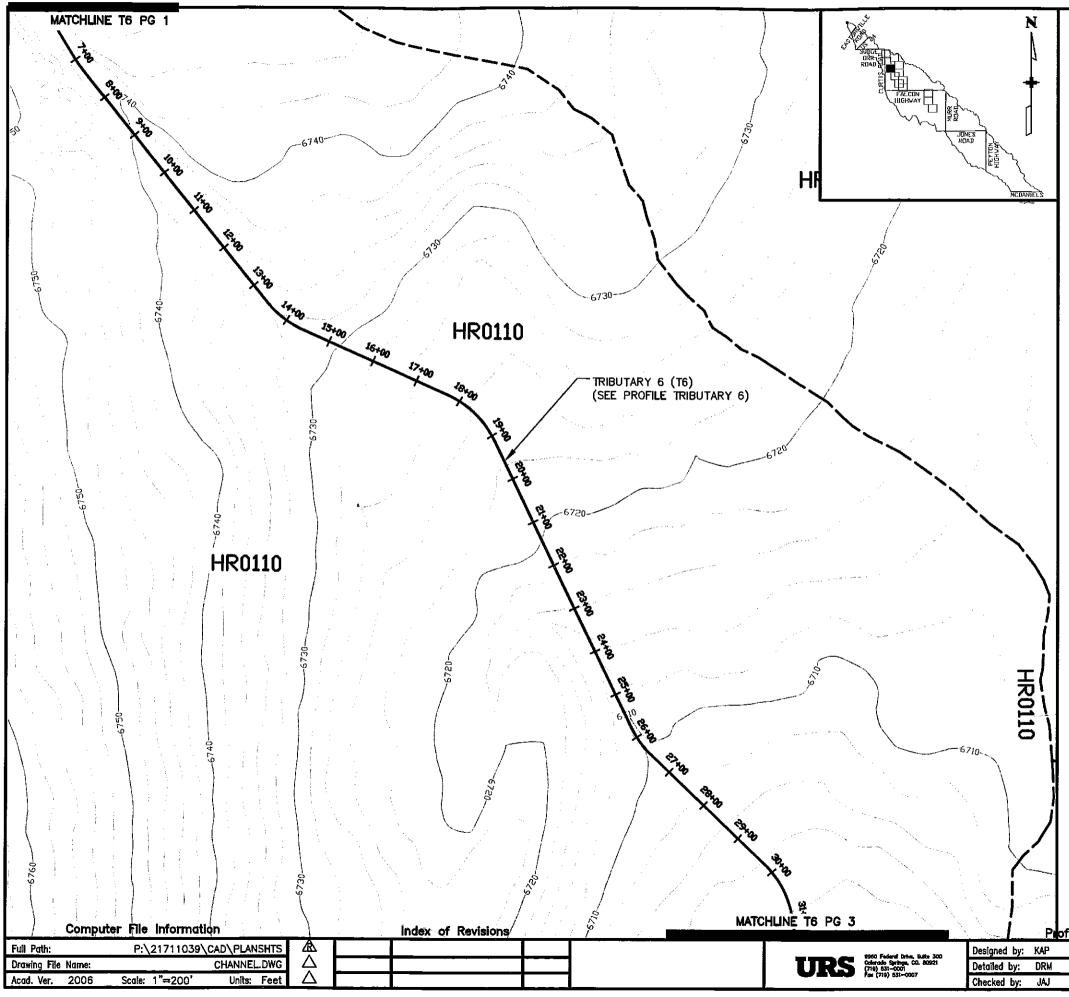


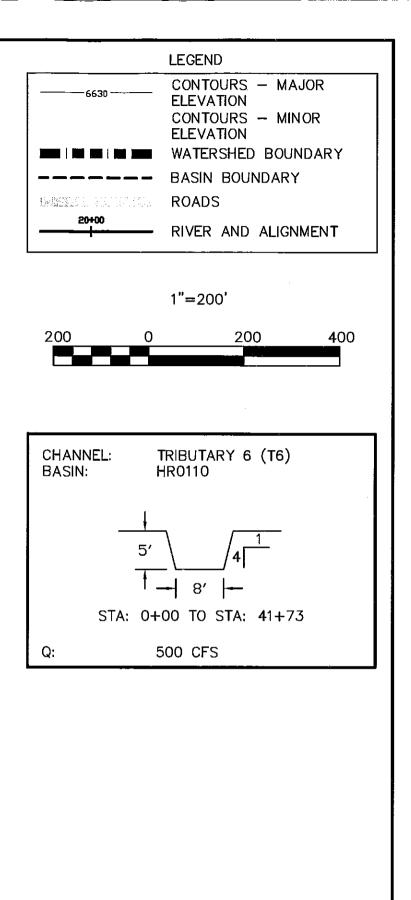
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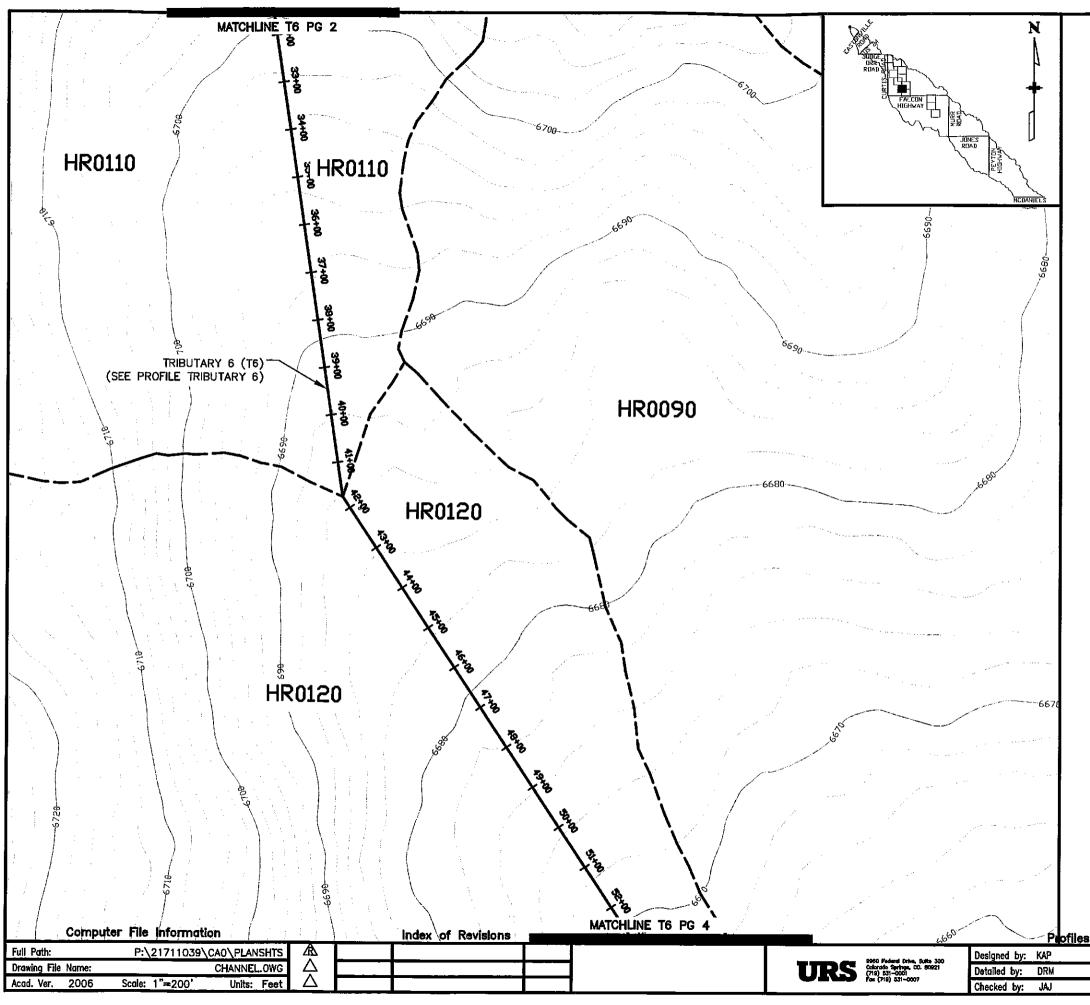


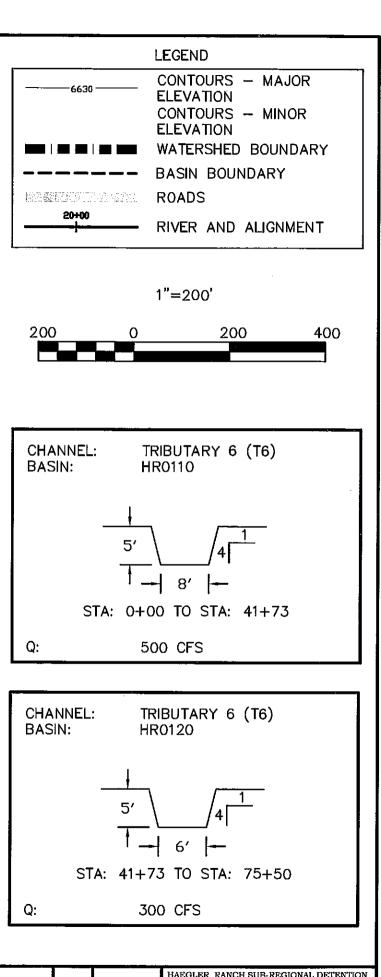
HAEGLER RANCH SUB-REGIONAL DETENTION			
ALTERNATIVE CONCEPTIONAL CULANNELS	iles		
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Numbers Sheet Number TRIBUTARY 6 PG 1		Numbers	Sheet Number TRIBUTARY 6 PG 1



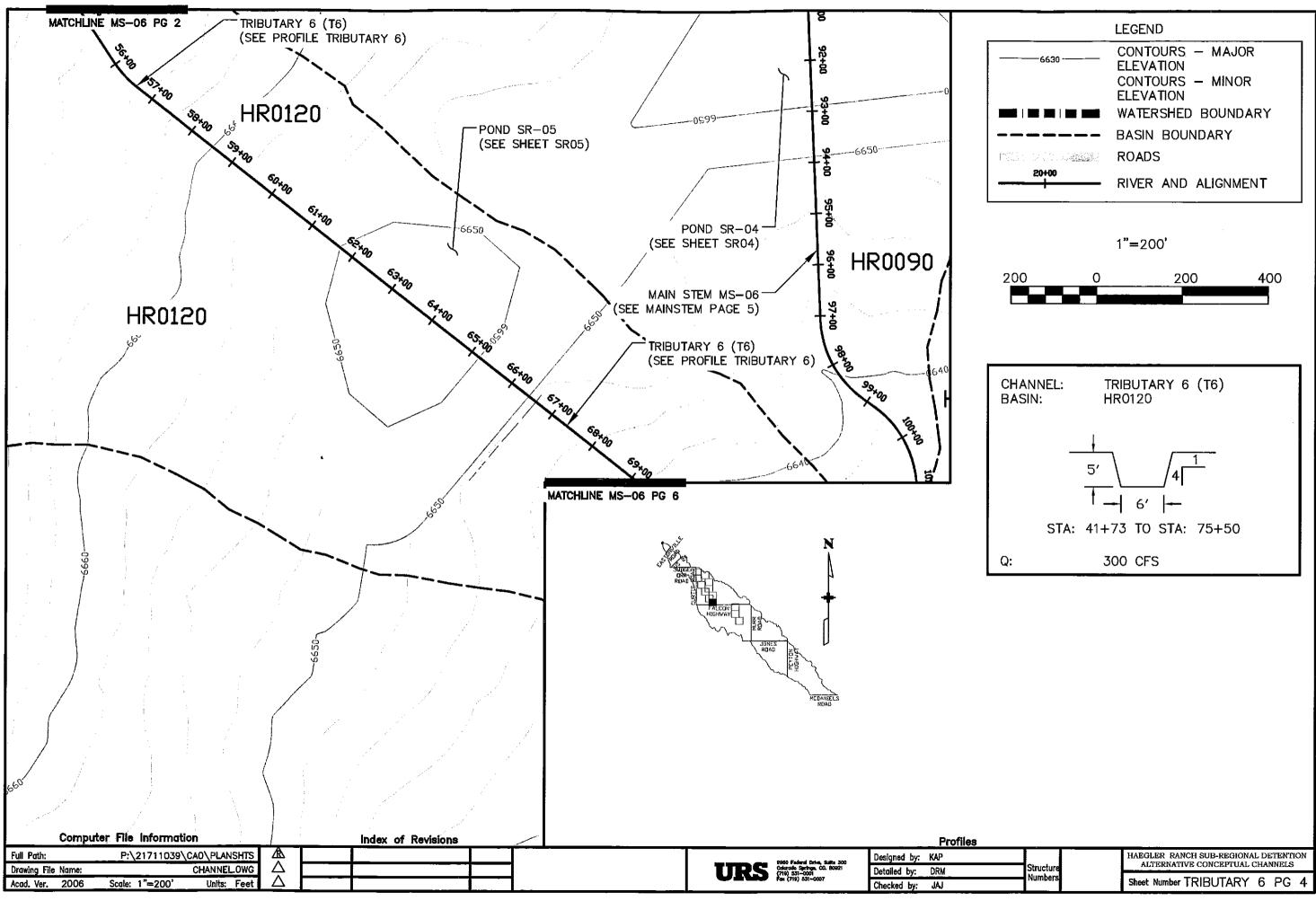


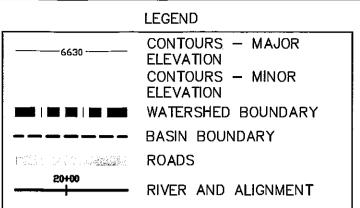
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	Numbers	Sheet Number TRIBUTARY	6	PG	2

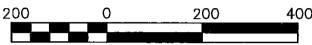


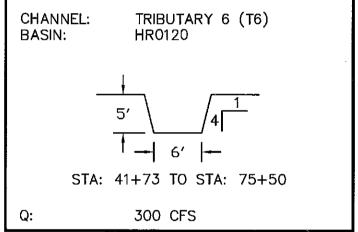


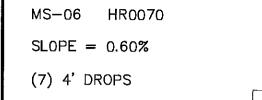
HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL CHANNELS umber sheet Number TRIBUTARY 6 PG 3







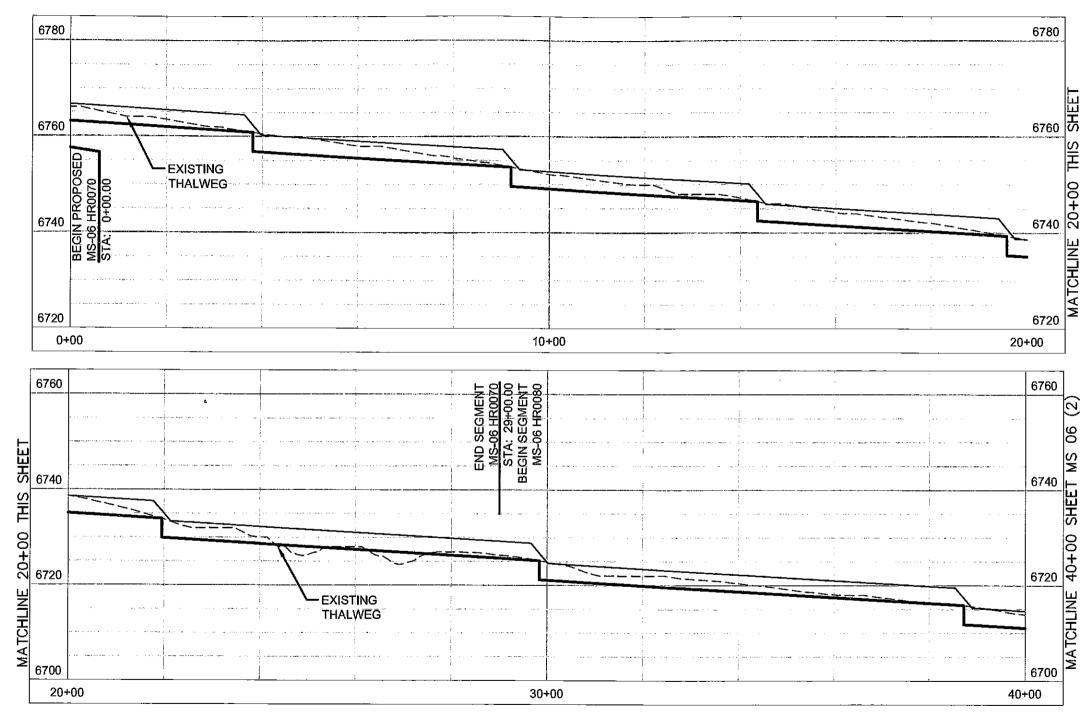




MS-06 HR0080

SLOPE = 0.60%

(7) 4' DROPS



PROFILE MAIN STEM (MS-06 & MS-05)

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Acad. Ver. 20D6 Scale: 1"=2D' Units: Feet		DEPARTMENT OF RANSPORTATION DEPARTMENT OF RANSPORTATION Created Stream C (710) 331-0001 Par (710) 331-0001	Detailed by: DRM Structure The checked by:	Sheet Number MS 06

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 PROPOSED DROP STRUCTURE		
 EXISTING THALWEG		
 HYDRAULIC GRADE LINE		



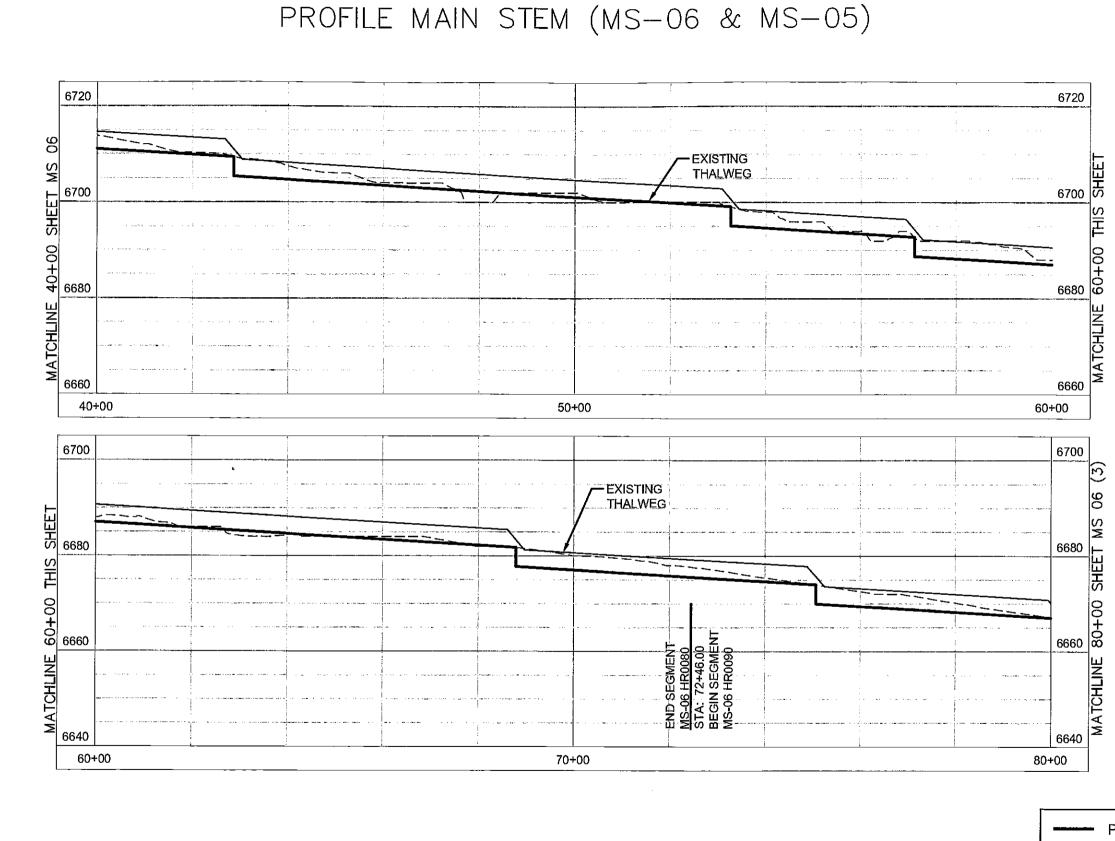
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(7) 4' DROPS

MS-06 HR0090

SLOPE = 0.60%

(8) 4' DROPS



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----- PROPOSED DROP STRUCTURE ---- EXISTING THALWEG ------ HYDRAULIC GRADE LINE



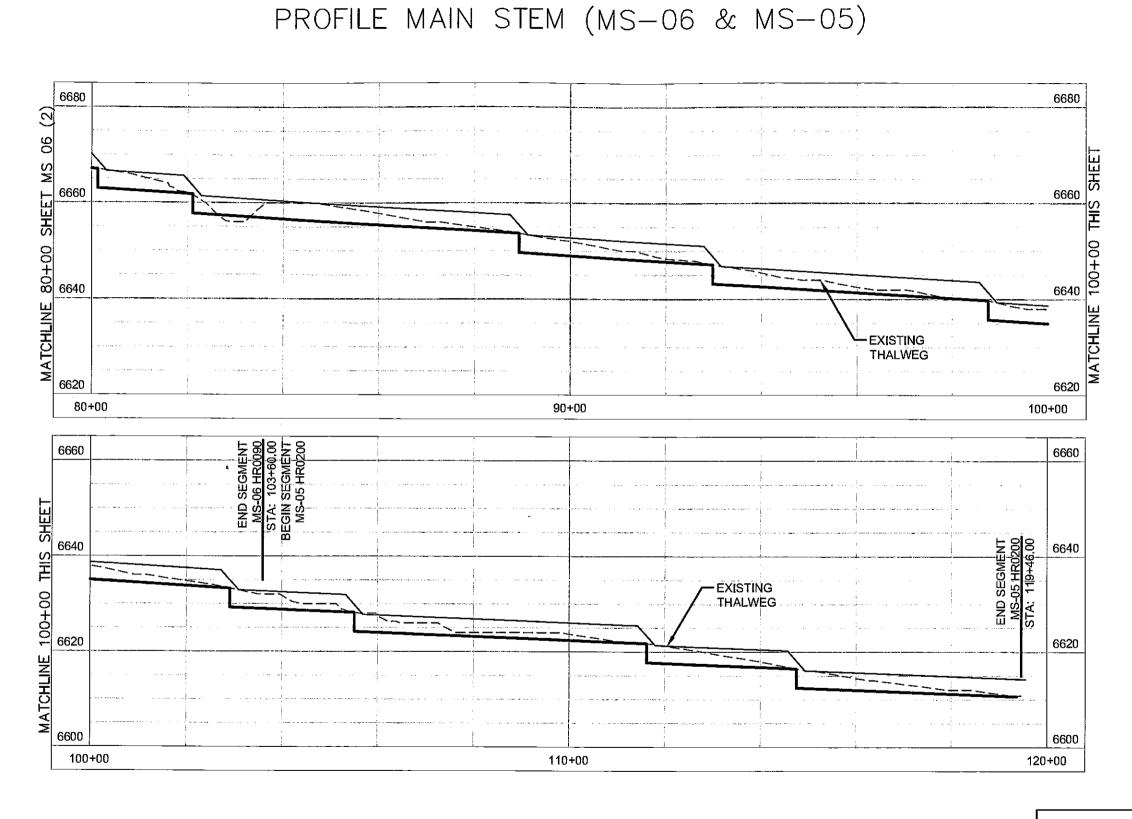
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(8) 4' DROPS

MS-05 HR0200

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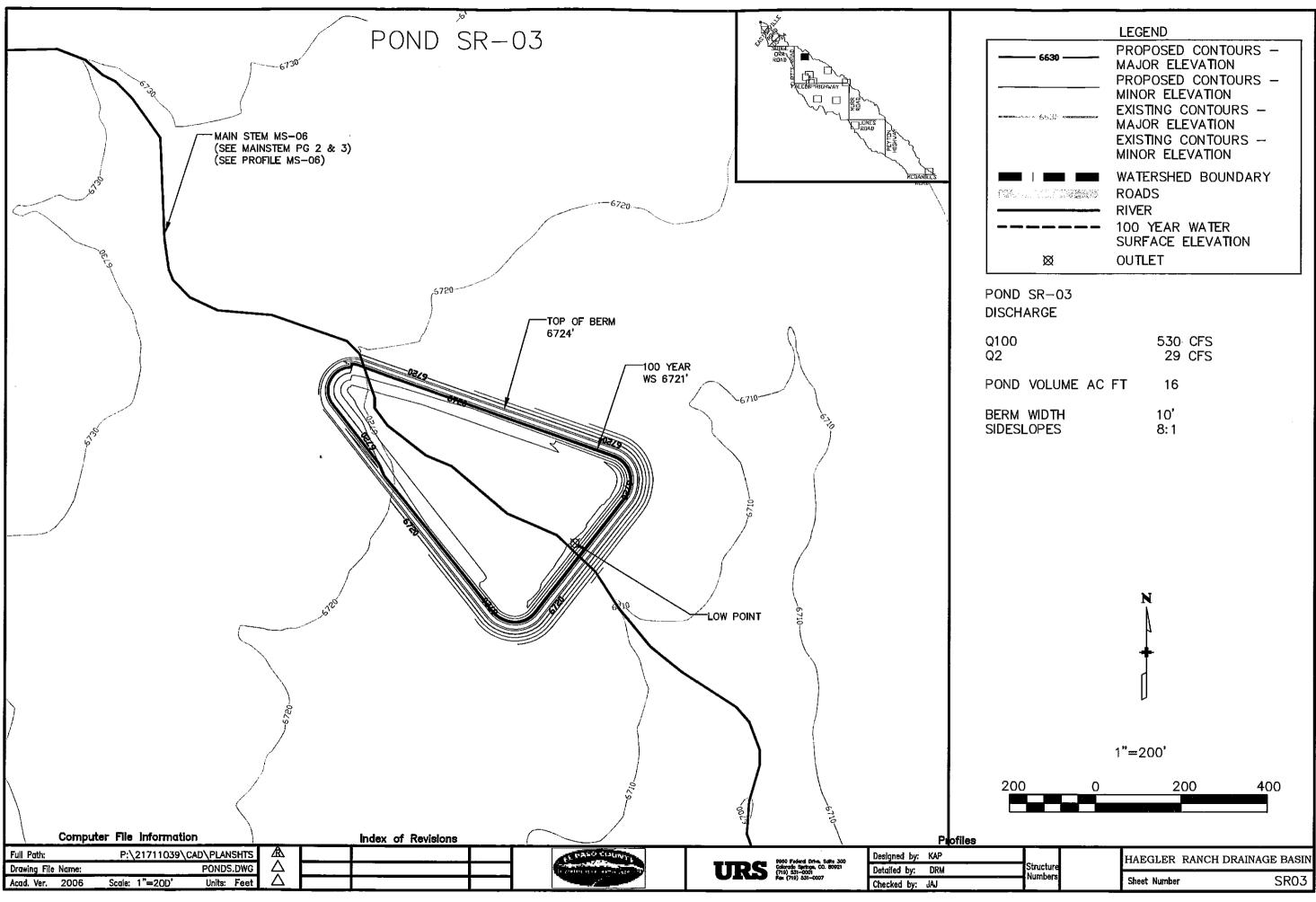
(4) 4' DROPS

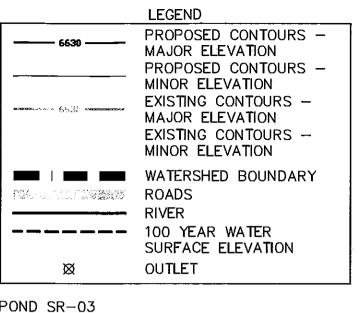


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Drawing File Name: MAINSTEM PROFILES_PROPOSED.DWG Acad. Ver. 2006 Scale: 1"=20' Units: Feet		URS (19) 331-0007 Fei (79) 331-0007	URS Colored Series, Ca. Bosti (19) 33-0007 Detailed by: DRM Numbers	Sheet Number MS06 & MS05 (3)
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#### LEGEND

PROPOSED DROP STRUCTURE
 EXISTING THALWEG
 HYDRAULIC GRADE LINE

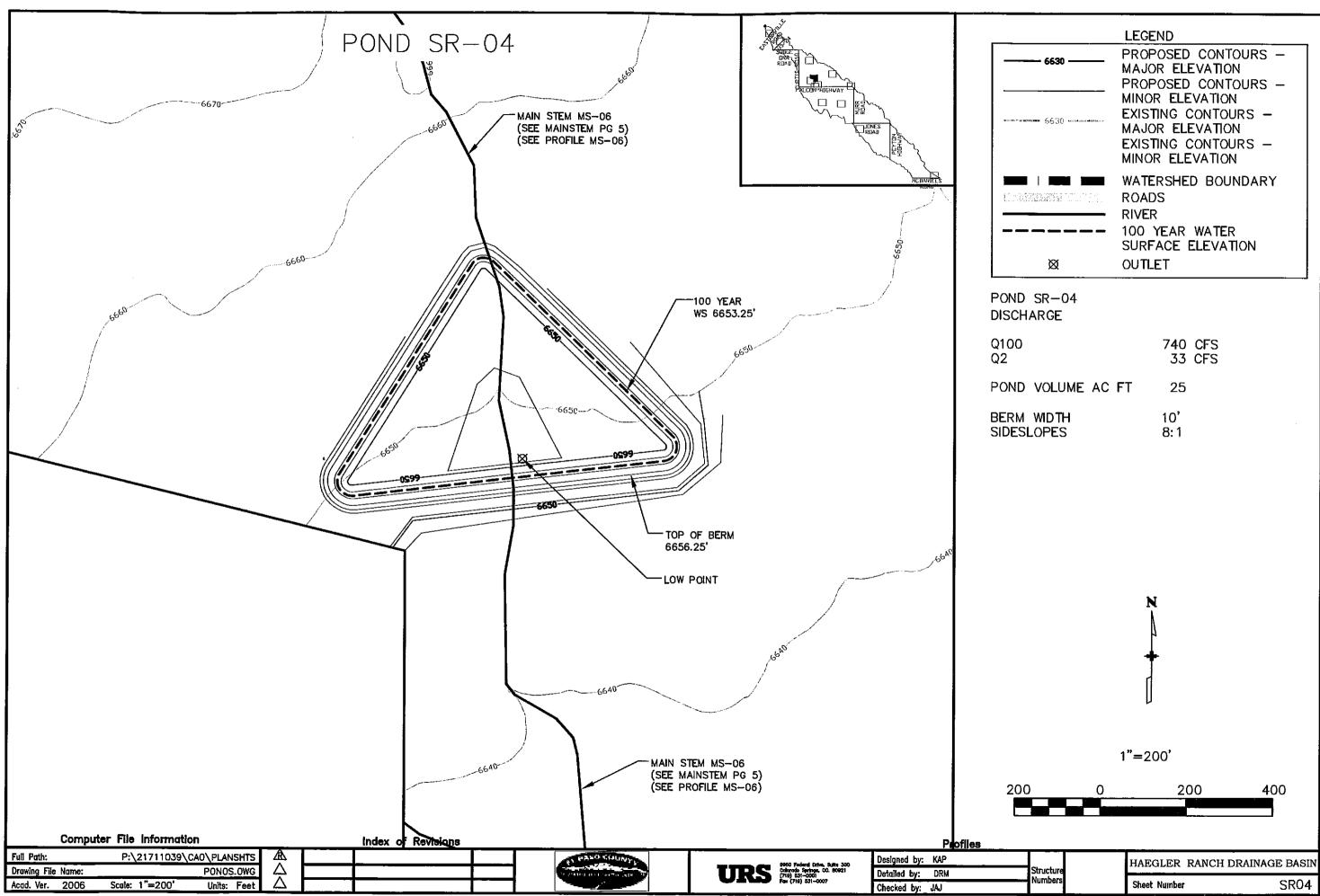


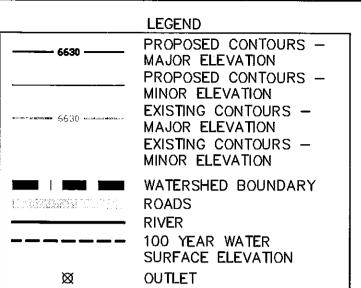


Q100	530 CFS
Q2	29 CFS
POND VOLUME AC FT	16
BERM WIDTH	10'
SIDESLOPES	8:1

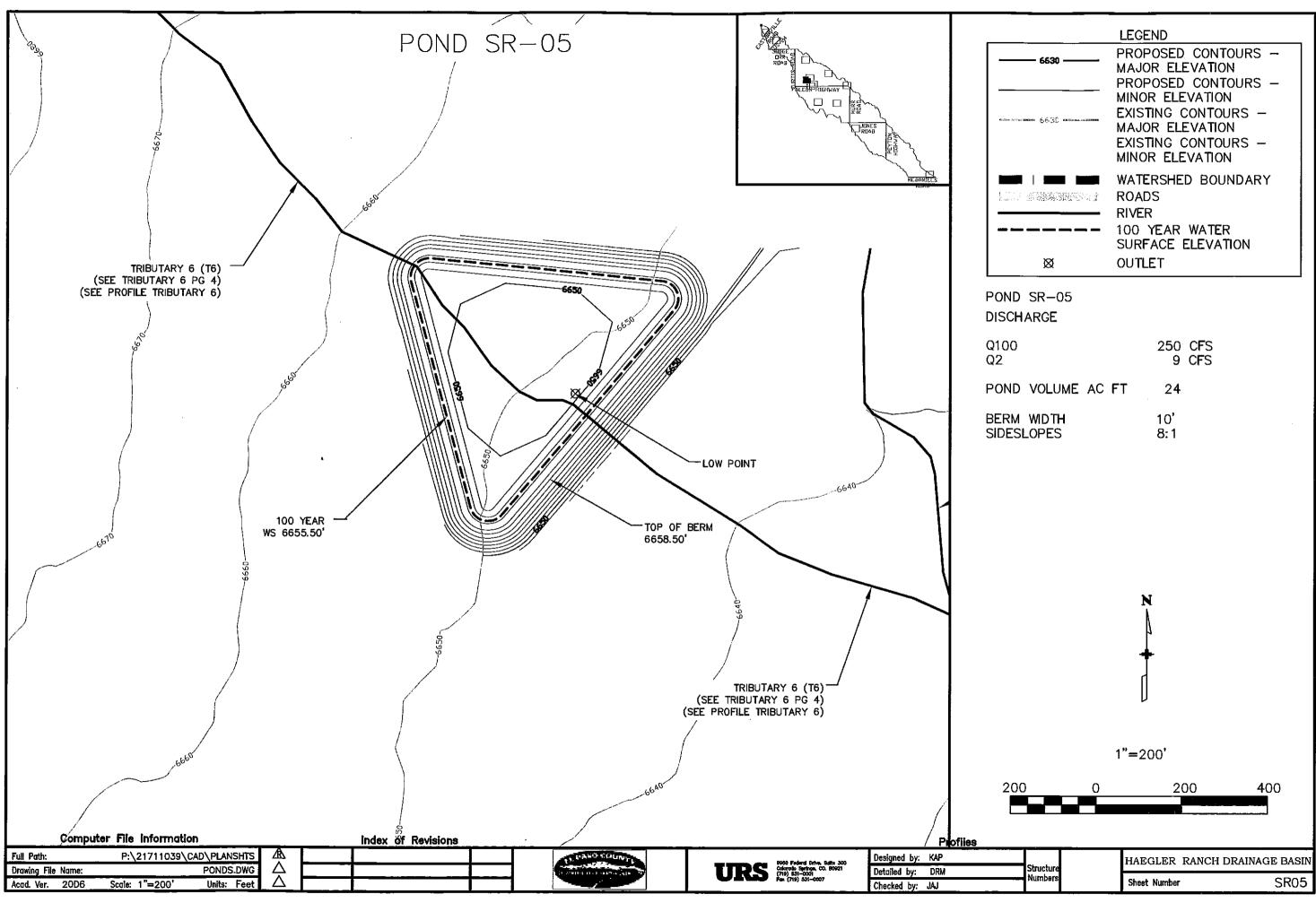


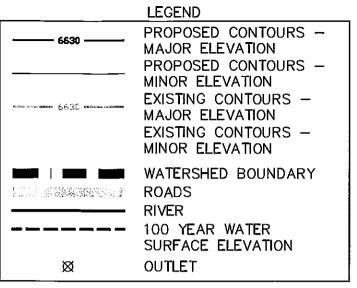






Q100	740 CFS
Q2	33 CFS
POND VOLUME AC FT	25
BERM WIDTH	10'
SIDESLOPES	8:1





Q100	250 CFS
Q2	9 CFS
POND VOLUME AC FT	24
BERM WIDTH	10'
SIDESLOPES	8:1



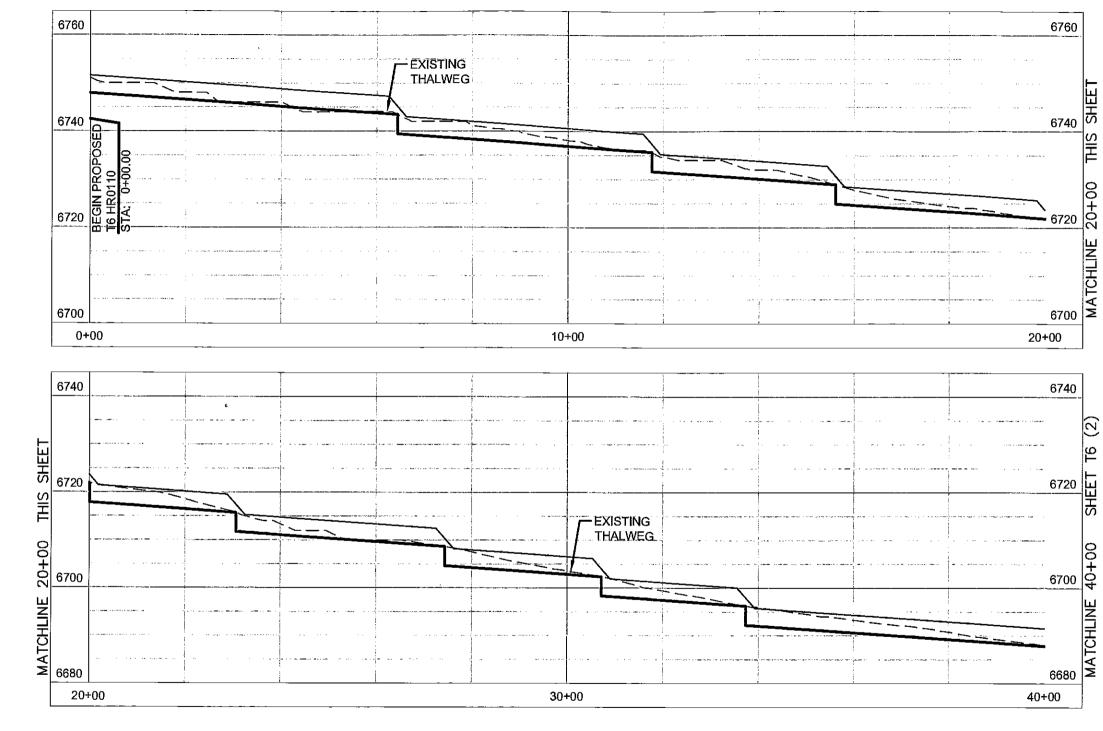


#### T6 HR0110

#### SLOPE = 0.70%

(9) 4' DROPS

# PROFILE TRIBUTARY 6 (T6)



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Drawing File Name:T PROFILE SHEETS 6_PROPOSED.0WG $\triangle$	OF PARTMENT OF TRANSPORTATION	Description of a series of a series of a series by Detailed by: DRM Structure	ALTERNATIVE CONCEPTUAL PROFILES
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## LEGEND

PROPOSED DROP STRUCTURE ---- EXISTING THALWEG HYDRAULIC GRADE LINE

#### T6 HR0110

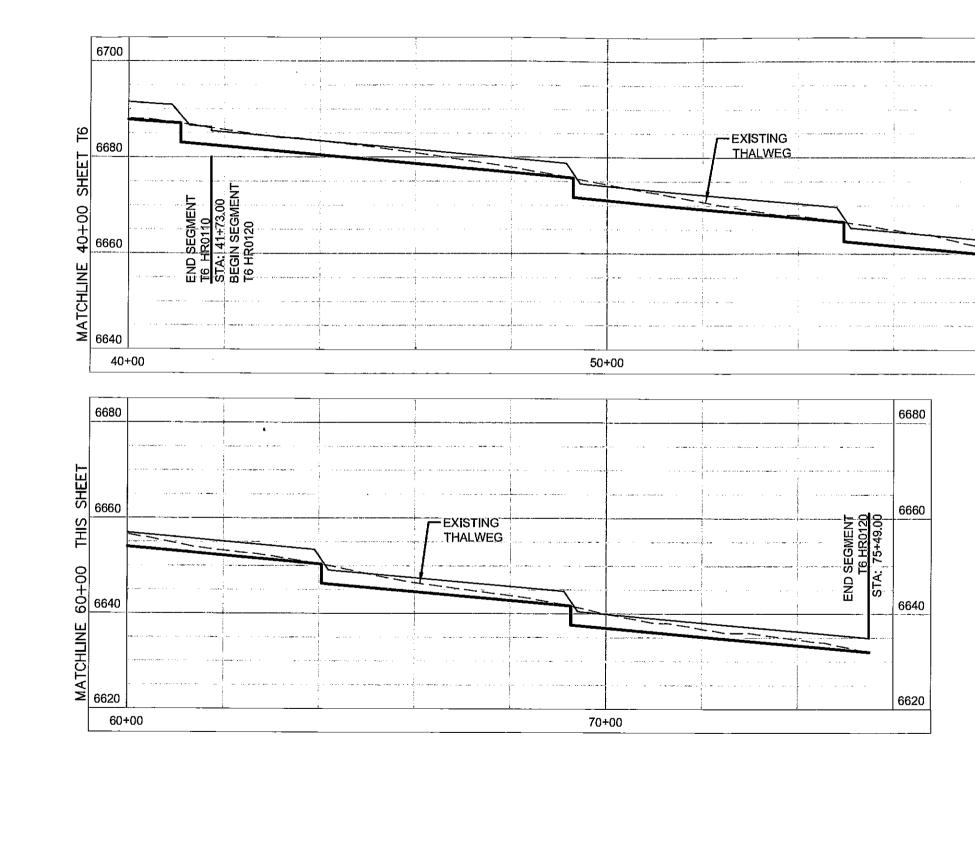
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(9) 4' OROPS

T6 HR0120

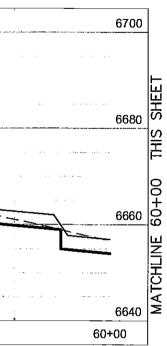
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(6) 4' DROPS

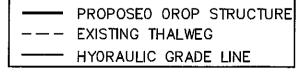


PROFILE TRIBUTARY 6 (T6)

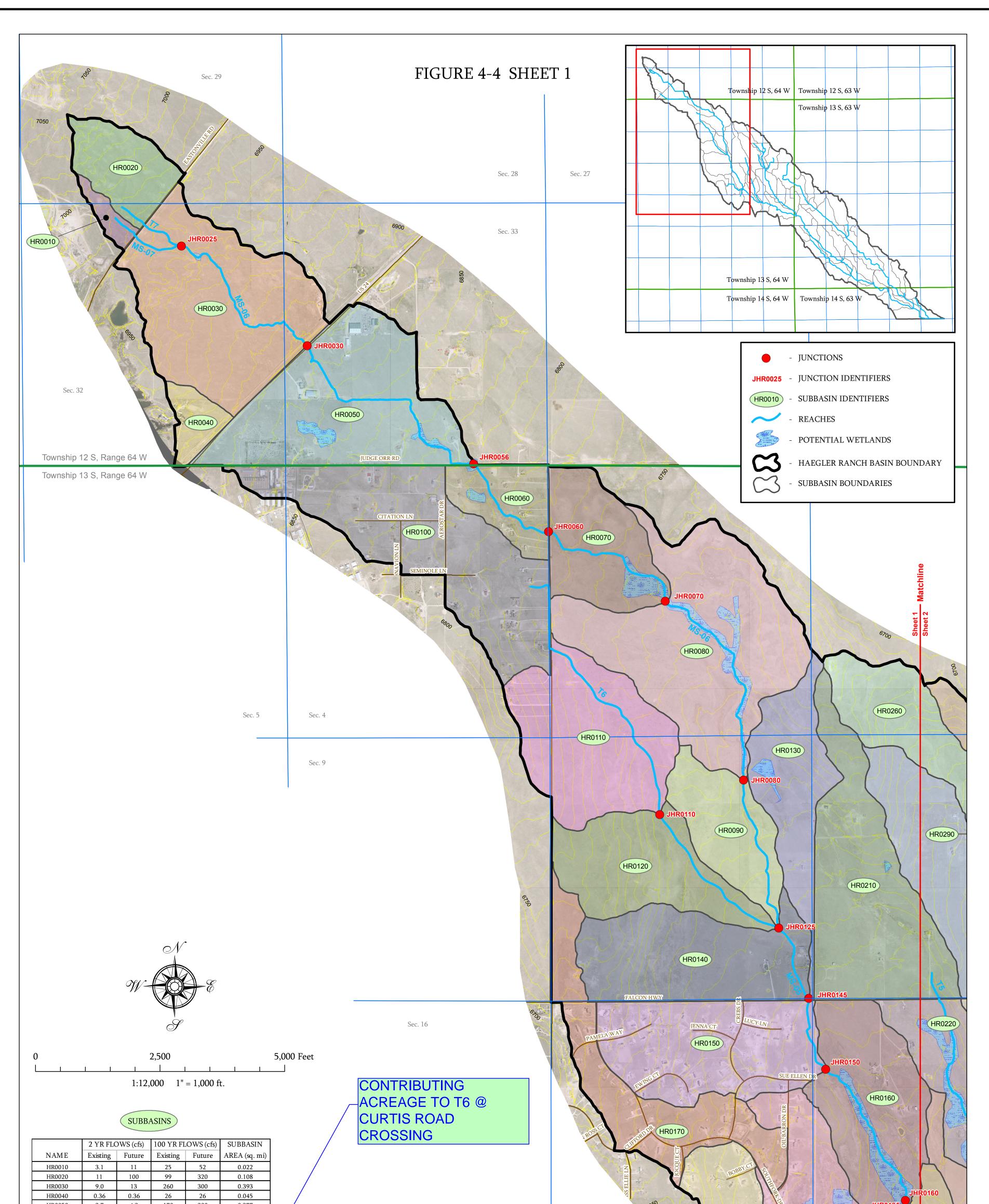
ļ	Computer File Information	Index of Revisione	Profiles
l	Full Path: P:\21711039\CAD\PLANSHTS	A EL PASO COUNTL	Designed by: KAP
	Drawing File Name: T PROFILE SHEETS 6_PROPOSED.OWG	DEPARTMENT OF TRANSPORTATION	URS Control Server to Accel (700) as1-0007
l	Acad. Ver. 2006 Scale: 1"=20' Units: Feet		For (719) 331-0007 Checked by:



## LEGEND



Structure Numbers T6 (2)

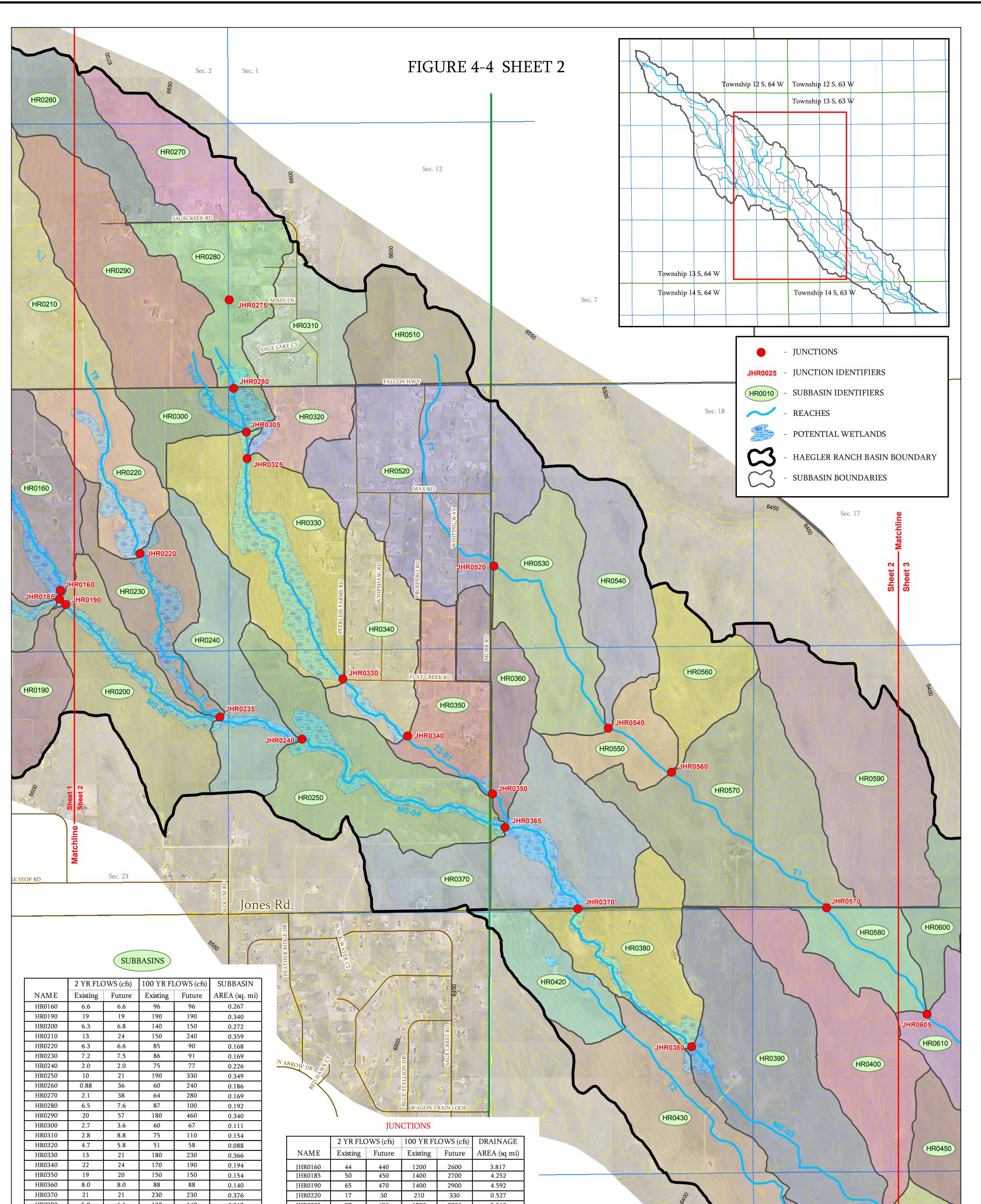


HR0050	2.7	4.3	170	200	0.377									6650	E P T	JHR0185	JHR0190
HR0060	2.0	3.5	54	66	0.101	_ /	, ,										
HR0070	5.4	210	99	580	0.180				II INI	CTIONS					HF	R0180	
HR0080	2.5	190	87	970	0.482				JUIN					Sec. 15	CALLEY CT		All and a set
HR0090	0.95	11	44	160	0.154	K		2 YR FLO	DWS (cfs)	100 YR FI	LOWS (cfs)	DRAINAGE	]				
HR0100	4.3	5.8	120	140	0.394		NAME	Existing	Future	Existing	Future	AREA (sq. mi)					
HR0110	1.9	72	84	420	0.310	I		0				-					
HR0120	2.0	4.0	73	150	0.226		JHR0025	14	110	120	370	0.130	4			$\langle \cdot \rangle$	
HR0130	0.27	15	29	180	0.185		JHR0030	21	120	350	630	0.523	1				
HR0140	3.5	6.4	110	140	0.283		JHR0056	24	120	540	830	0.945		Sec 22			
HR0150	21	21	210	210	0.290		JHR0060	25	120	590	890	1.046		CONTRIBUTING		R0190	HR0200
HR0160	6.6	6.6	96	96	0.267		JHR0070	28	210	660	930	1.226					
HR0170	15	17	130	150	0.241		JHR0080	29	340	720	1500	1.708		ACREAGE TO			
HR0180	6.4	6.4	85	85	0.194		JHR0110	6.1	72	200	440	0.704					125
HR0190	19	19	190	190	0.340		JHR0125	37	410	980	2100	2.792		MS-06 @			
HR0200	6.3	6.8	140	150	0.272		JHR0145	39	420	1100	2400	3.260		CURTIS ROAD	A A A		
HR0210	13	24	150	240	0.359		JHR0150	42	440	1100	2600	3.550					
HR0220	6.3	6.6	85	90	0.168		JHR0160	44	440	1200	2600	3.817		CROSSING	Т		$( \land ( \land \land$
HR0260	0.88	36	60	240	0.186		JHR0185	50	450	1400	2700	4.252	]				
HR0290	20	57	180	460	0.340		JHR0190	65	470	1400	2900	4.592	J				
																00	



URS NO. 21711039

DATE: 09/08

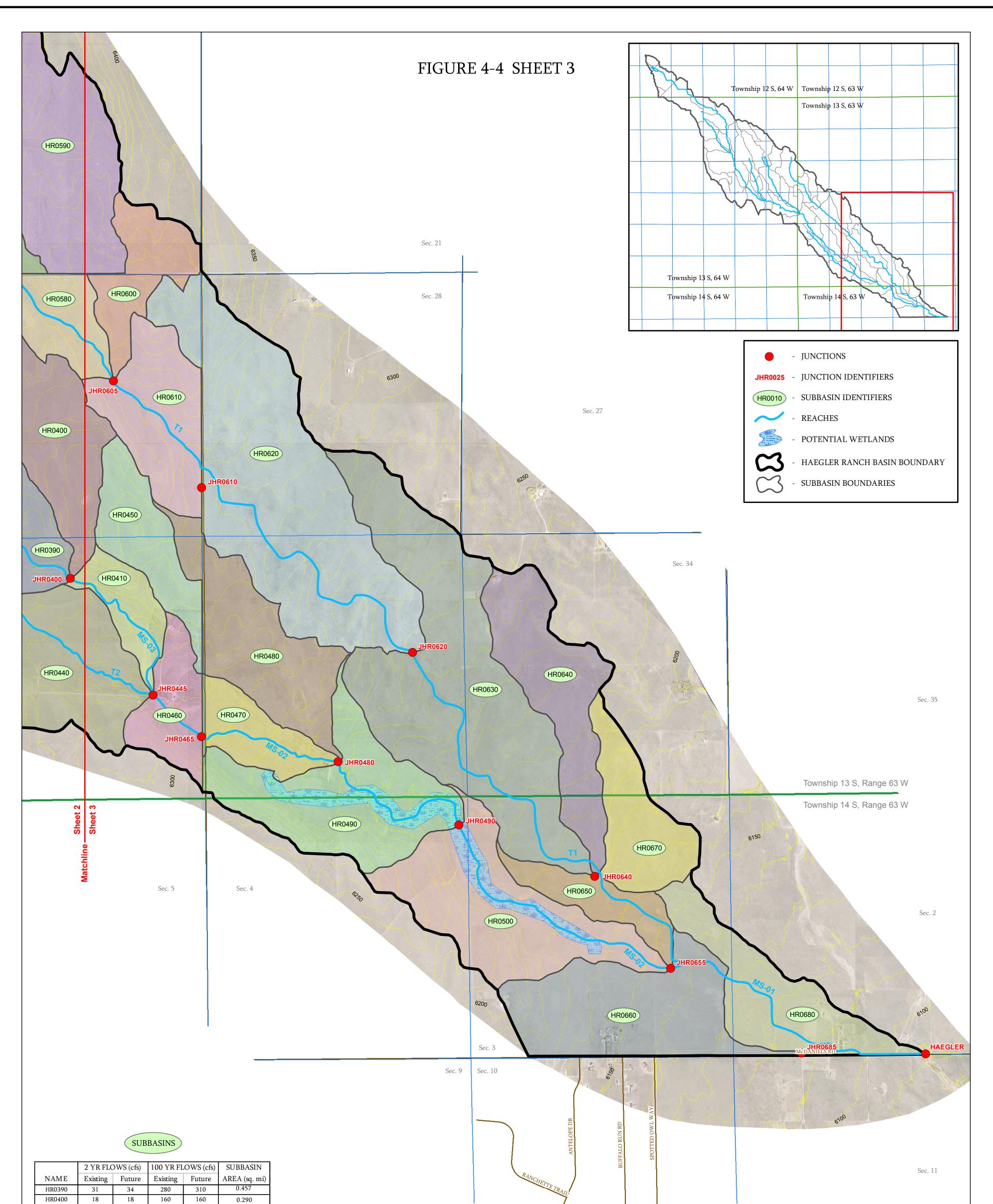


HR0380	5.9	6.1	130	140	0.212	JHR0235	87	480	1700	3300	5.560	
HR0390	31	34	280	310	0.457	JHR0240	88	470	1700	3400	5.786	JHR0430 JHR0400 H
HR0400	18	18	160	160	0.290	JHR0275	2.9	69	120	480	0.355	Sec. 31
HR0410	7.4	8.4	68	77	0.084	JHR0280	6.5	75	200	570	0.547	
HR0420	1.8	2.5	59	70	0.124	JHR0305	29	96	400	870	0.998	
HR0430	4.7	4.7	90	90	0.295	JHR0325	36	110	490	1000	1.240	
HR0440	5.5	5.5	130	130	0.357	JHR0330	44	120	600	1200	1.606	
HR0450	9.5	9.5	85	85	0.140	JHR0340	49	130	640	1300	1.800	
HR0510	0.35	19	33	140	0.157	JHR0350	52	130	670	1400	1.954	
HR0520	23	24	200	210	0.488	JHR0365	150	600	2200	4800	8.229	W E E HR0440
HR0530	1.2	1.2	76	80	0.258	JHR0370	150	600	2300	5000	8.605	
HR0540	0.30	0.30	37	37	0.206	JHR0380	150	600	2300	5000	8.817	
HR0550	0.56	0.57	50	51	0.110	JHR0400	170	600	2400	5300	9.564	
HR0560	0.22	0.22	25	25	0.150	JHR0430	5.6	6.7	150	150	0.419	La 123 La la
HR0570	8.6	8.9	170	180	0.453	JHR0520	23	43	220	350	0.645	0 2,500 5,000
HR0580	10	11	96	98	0.124	JHR0540	24	44	270	420	1.109	
HR0590	2.2	2.2	84	84	0.408	JHR0560	25	44	300	460	1.369	Feet
HR0600	1.4	1.4	41	41	0.128	JHR0570	29	48	370	520	1.822	1:12,000 1" = 1,000 ft.
HR0610	5.7	5.8	100	110	0.202	JHR0605	33	52	480	630	2.482	



URS NO. 21711039

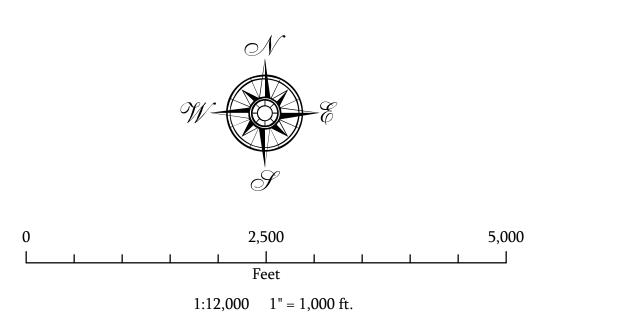
DATE: 09/08



HR0410	7.4	8.4	68	77	0.084
HR0440	5.5	5.5	130	130	0.357
HR0450	9.5	9.5	85	85	0.140
HR0460	4.0	4.0	76	76	0.109
HR0470	7.3	7.6	73	77	0.102
HR0480	0.86	0.86	34	34	0.244
HR0490	9.2	9.8	210	220	0.312
HR0500	3.3	3.4	140	150	0.326
HR0580	10	11	96	98	0.124
HR0590	2.2	2.2	84	84	0.408
HR0600	1.4	1.4	41	41	0.128
HR0610	5.7	5.8	100	110	0.202
HR0620	1.9	1.9	110	120	0.647
HR0630	2.2	2.2	86	86	0.616
HR0640	0.88	0.88	37	37	0.237
HR0650	4.2	4.3	45	46	0.092
HR0660	0.87	0.87	52	52	0.296
HR0670	0.63	0.63	31	31	0.153
HR0680	11	12	110	120	0.206

#### JUNCTIONS

	2 YR FLC	OWS (cfs)	100 YR FL	OWS (cfs)	DRAINAGE
NAME	Existing	Future	Existing	Future	AREA (sq. mi)
JHR0400	170	600	2400	5300	9.564
JHR0445	180	590	2500	5400	10.424
JHR0465	180	570	2600	5400	10.673
JHR0480	180	570	2600	5400	11.019
JHR0490	180	570	2600	5500	11.331
JHR0605	33	52	480	630	2.482
JHR0610	34	52	500	650	2.684
JHR0620	35	53	560	700	3.331
JHR0640	38	54	670	780	4.184
JHR0655	190	570	3200	5600	15.933
JHR0685	190	550	3200	5600	16.588
HAEGLER	190	550	3200	5600	16.588





URS NO. 21711039

DATE: 09/08

#### MASTER DEVELOPMENT DRAINAGE PLAN and PRELIMINARY DRAINAGE REPORT FOR SADDLEHORN RANCH

Prepared For: ROI Property Group, LLC 2495 Rigdon Street Napa, CA 94558 (707) 365-6891

Unresolved. Remove the MDDP/Prelim drainage report and only include snippets of information pertinent to the design.

May 8, 2020 Project No. 25142.00

JR: Ok to leave in per Elizabeth.

Prepared By: JR Engineering, LLC 5475 Tech Center Drive Colorado Springs, CO 80919 719-593-2593

El Paso County PCD File No. SP-19-006

 $X:\2510000.all\2514200\Word\Reports\Drainage\Saddlehorn\ Ranch\ MDDP.PDR.docx$ 

Per a NRCS web soil survey of the area, the site is made up of Type A, B and D soils. Type A soils cover roughly 80% of the site while Type B soils cover 3% and Type D cover the remaining 17% of the site. Group A soils have a high infiltration rate when thoroughly wet. Type B soils have a moderate infiltration when thoroughly wet. Type D soils have a very slow infiltration rate when thoroughly wet and have a high shrink-swell potential. A NRCS soil survey map has been presented in Appendix A.

Two existing wells are located in the southwest corner of the site. A 12" Cherokee Metropolitan District waterline runs through the site just south of the northern property line. Approximately a mile south of the Curtis Road and Judge Orr Road intersection, a two lane dirt road proceeds from Curtis Road east towards approximate center of the site. A water tank, pond and windmill are located within Major Drainageway MS-06 at the end of the dirt road.

## Floodplain Statement

Based on the FEMA FIRM Map number 08041C0558G, dated December 7, 2018, the site lies within Zone A, Zone AE, and Zone X. Zone A is defined as areas subject to inundation by the 1-percent-annual-chance flood determined using approximate methodologies because BFEs have not been established. Zone AE is defined as area subject to inundation by the 1-percent-annual-chance flood event. Zone X is defined as area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. All proposed development within the site will occur in Zone X.

In the northeast corner of the site, proposed development borders the Zone A boundary of the Geick Ranch West Tributary (WF-R7). At time of Final Drainage Report for this future phase of the development, a LOMR will be presented to establish base flood elevations (BFEs) for all lots that border the current Zone A boundary. The current FIRM Map has been presented in Appendix A.

## DRAINAGE BASINS AND SUBBASINS

## Major Basin Descriptions

The site lies within two major drainage basins: the Gieck Ranch Drainage Basin based on the "*Gieck Ranch Drainage Basin Planning Study*" (DBPS) prepared by Drexel, Barrell & Co. in October, 2007 and revised in February 2010 and the Haegler Ranch Drainage Basin based on the "*Haegler Ranch Drainage Basin Planning Study*" prepared by URS Corporation in May 2009.

The Gieck Ranch Drainage Basin covers approximately 22 square miles and begins approximately five miles northeast of the Town of Falcon and travels approximately 15 miles to the southeast. The Gieck Ranch Drainage Basin is tributary to Black Squirrel Creek which drains south to the Arkansas River near the city of Pueblo, Colorado. The majority of the area within the basin is undeveloped and is characterized as rolling range land typically associated with Colorado's semi-arid climates.

Anticipated land use for the basin includes residential, industrial, agricultural and commercial development. Residential developments will range from 0.125 - 5 acre lots with a mix of low, medium and high density developments.

The Haegler Ranch Drainage Basin covers approximately 16.6 square miles in unincorporated El Paso County, CO. The Haegler Ranch Drainage Basin is tributary to Black Squirrel Creek. In its existing condition, the basin is comprised of rolling rangeland with poor vegetative cover associated with Colorado's semi-arid climate. The natural drainageways within the basin are typically shallow and wide with poorly defined flow paths in most areas. Anticipated land use for the basin includes residential and commercial development. Residential developments will range from 0.125 - 5 acre lots with a mix of low, medium and high density developments.

As part of its drainage research, JR Engineering reviewed the following drainage studies, reports and LOMRs:

- Gieck Ranch Drainage Basin Planning Study prepared by Drexel, Barrell & Co. in October, 2007 and revised in February 2010. (Not adopted by El Paso County as of July 2019)
- Haegler Ranch Drainage Basin Planning Study prepared by URS Corporation in May 2009
- Santa Fe Springs Haegler Ranch Drainage Basin Letter of Map Revision prepared by Tri-Core Engineering in June 2004.

#### Existing Gieck Ranch Drainage Basin

The "*Gieck Ranch Drainage Basin Planning Study*" evaluated existing and future drainage conditions, identified future improvements, and established basin and bridge fees for the Gieck Ranch Drainage Basin. It should be noted that as of today the "*Gieck Ranch Drainage Basin Planning Study*" has not yet been approved and adopted by the County. All referenced information from the aforementioned report is presented for information purposes only.

Based upon provided drainage maps and analysis, Gieck Ranch discharges a total of 1,017 cfs onto the site within Major Drainageway Gieck Ranch West Fork Reach 7A (WF-R7A). An existing 66" CMP and 36" CMP convey the offsite flow across Judge Orr Road onto the site. The existing culverts at Judge Orr Road are undersized for existing and future flows resulting in localized overtopping. The DBPS recommends the culvert be upsized to four -12' x 5' box culverts. The culvert will not be upsized within the context of this report and development. The culvert is owned by El Paso County and timing of the recommended improvements will be controlled by the County. The overtopping at the intersection of WF-R7A is not contained within the 100-year floodplain. Therefore, at time of Final Drainage Report, berming will be provided that will protect proposed lots from overtopping flows. An overtopping analysis is presented in Appendix D and the limits of overtopping are presented on the existing and proposed drainage maps in Appendix F.

Based on existing channel analysis, the *Gieck Ranch DBPS* recommends WF-R7A channel improvements approximately 200' upstream and 300' downstream of the culvert crossing at Judge Orr Road (50' bottom width, 10:1 side slopes and vegetative augmentation). The recommended

channel improvements result from upsizing the culvert at Judge Orr Road, requiring the channel to be lowered. The channel improvements were not recommended due to existing channel instability. Existing velocities in the channel were found to be 2.19 ft/s, as presented in Appendix E. Per the MS4 permit requirements, the onsite reach of WF-R7A will be analyzed for channel stability with the corresponding Final Drainage Report for that phase of the development. At the time of Final Drainage Report, any necessary improvements to WF-R7A to satisfy the MS4 permit will be evaluated. It should be noted that the onsite reach of WF-R7A, where the aforementioned channel improvements were recommended, is comprised of jurisdictional wetlands which will limit the allowable improvements. Coordination with the Army Corps of Engineers will be required to grant permission to disturb the jurisdictional wetlands. Recommended channel improvements from the *Gieck Ranch DBPS* are presented in Appendix E.

#### Existing Haegler Ranch Drainage Basin

The "*Haegler Ranch Drainage Basin Planning Study*" was used to establish a stormwater management plan for the existing and future stormwater infrastructure needs within the Haegler Ranch Drainage Basin. Based on provided drainage maps and analysis, in the existing condition Haegler Ranch contributes a total of 710 cfs onto the site. Of the 710 cfs, 590 cfs crosses Curtis Road in an existing 24" CMP onto the site. Major Drainageway MS-06 conveys the stormwater through the site and to its off-site confluence with Major Drainageway MS-05. The remaining 210 cfs crosses Curtis Road in an existing 36" CMP onto the site. Major Drainageway MS-05. Both Curtis Road culverts are undersized for existing and future flows and overtopping occurs locally near the culvert crossings. Overtopping at the intersection of Curtis Road and T-6 is contained within the 100-year floodplain and will not affect proposed lots. The overtopping at the intersection of MS-06 and Curtis Road is not contained within the 100-year floodplain limits. Therefore, at time of Final Drainage Report, berming will be provided that will protect proposed lots from overtopping flows. An overtopping analysis is presented in Appendix D and the limits of overtopping are presented on the existing and proposed drainage maps in Appendix F.

The culverts are not proposed to be upsized within the context of this report and development. The culverts are owned by El Paso County and timing of the recommended improvements will be controlled by the County.

Furthermore, the *Haegler Ranch DBPS* recommends channel improvements within drainageways MS-06 and T-6. Per the *Haegler Ranch DBPS*, all recommended channel sections are trapezoidal with side slopes of 4:1 and a maximum depth of five feet. Within the limits of the site, three (3) channel bottom widths are recommended for MS-06. The first reach, from station 0+00 - 31+34, is proposed with a 15' bottom width, the second reach from 31+34 to 74+61, MS-06 is proposed with a 30' bottom width, and the last reach from station 74+61 - 103+62 is proposed with a 20' channel bottom. The *Haegler Ranch DBPS* recommends Major Drainageway T-6 be improved to a trapezoidal channel with an 8' bottom width, 4:1 side slopes and depth of 5'. Drop structures have

also been recommended within MS-06 and T-6. These improvements will not occur within the context of this report or development. However, due to the addition of culvert crossings within MS-06 and T-6, channel improvements are anticipated up and downstream of the proposed culverts. The extent of these channel improvements will be addressed with corresponding Final Drainage Reports for those phases of the development. At that time, channel stability will be evaluated and any necessary improvements will be proposed. Recommended channel improvements from the *Haegler Ranch DBPS* are presented in Appendix E.

Based on flood impacts, stream stability and cost effectiveness, this study recommended a subregional detention approach. This allows future development anywhere in the basin with the construction of an associated sub-regional pond. Within the boundary of Saddlehorn Ranch, the DBPS recommended a total of three (3) sub-regional ponds. Based on discussion with El Paso County, the site will utilize full spectrum water quality and detention ponds instead. These full spectrum detention ponds will limit developed discharge into the drainageways to less than historic rates. Future, upstream development will also require full spectrum detention in accordance with current El Paso County criteria, which is an effective alternative to the sub-regional pond approach.

*The Santa Fe Springs – Haegler Ranch Drainage Basin LOMR* was executed on Haegler Ranch Tributary 2, 3, and 4. The LOMR revised the onsite effective flood zones from Zone A to Zone AE for the three drainageways. Upstream stretches of Tributary 3 and 4 are classified Zone A but those channel reaches are off site. All stretches of Tributary 3 and 4 onsite are Zone AE. See FIRM Map Panel 080059-0575G for limits of LOMR study and revised flood zones, presented in Appendix E.

## Existing Sub-basin Drainage

On-site, existing drainage patterns are generally from northwest to southeast by way of existing, natural drainageways (MS-06, T-6, WF-R7A). On-site areas flow directly into these drainageways which also bypass off-site flows through the site. Offsite flows within the major drainageways that pass through the site will influence the on-site culvert designs and any channel improvements.

On-site, existing drainage basins were established based upon existing topography and the limits of 100-year floodplain. The site was divided into eleven existing sub-basins. See Table 1 below for summary of existing drainage sub-basins and corresponding peak flows. An existing drainage map is provided in Appendix F.

	0 0	SIN SUMN	5	ABLE
Tributary Sub-Basin	Area (acres)	Percent Impervious	Q <sub>5</sub> (cfs)	Q <sub>100</sub> (cfs)
G1	10.1	2.0%	0.00	0.1
G2	87.6	2.0%	1.5	76.4
H1	166.5	2.0%	0.1	81.0
H2	111.1	2.0%	0.2	91.1
H3	118.9	2.0%	0.9	64.1
H4	63.3	2.0%	1.4	73.2
H5	53.2	2.0%	0.3	28.2
H6	87.6	2.0%	0.2	110.1
CH1	23.9	2.0%	5.4	21.0
CH2	84.2	2.0%	2.6	33.7
CH3	19.1	2.0%	0.1	6.5
Total	825.4	N/A	12.7	585.4

Table 1: Existing Drainage Basin Summary

The existing condition of the three major drainageways are discussed below;

#### Existing Geick Ranch West Fork Reach 7A (WF-R7A)

The first major drainageway is the Gieck Ranch West Fork Reach 7A (WF-R7A), per the *Gieck Ranch DBPS*. WF-R7A crosses onto the site along Judge Orr Road, approximately <sup>1</sup>/<sub>4</sub> mile west of the intersection with Elbert Road. Discharge from the developed site into this drainageway will be limited to historic rates via a full spectrum detention pond prior to discharge. This drainageway includes jurisdictional wetlands and the entire drainageway onsite is classified Zone A. Access to the drainage way will be provided from internal roadways and along an equestrian trail will be constructed adjacent to the drainageway. The equestrian train can be utilized for maintenance equipment as well.

#### Existing Haegler Ranch Main Stem (MS-06)

The second drainageway is the Haegler Ranch Main Stem (MS-06), per the *Haegler Ranch DBPS*, which crosses onto the site along Curtis Road, approximately 1,600' south of the intersection with Judge Orr Road. MS-06 flows south towards its offsite confluence with Black Squirrel Creek. MS-06 exits the site along the southern property line. Discharge from the developed site into this drainageway will be limited to historic rates via a full spectrum detention pond prior to discharge. This drainageway includes non-jurisdiction wetlands and the entire drainageway is classified Zone AE. Access to the channel will be provided at the culvert crossing of MS-06 and San Isidro Trail via

a 15' wide maintenance and access road that will proceed from San Isidro trail to the channel bottom. From here, access through the channel is achievable with existing grades within the channel. Furthermore, an equestrian trail will be constructed adjacent to the drainageway that can be utilized for maintenance equipment as well. The road alignments are displayed on the proposed drainage map presented in Appendix F.

#### Existing Haegler Ranch Tributary 6 (T-6)

The third drainageway is the Haegler Ranch Tributary 6 (T-6), per the *Haegler Ranch DBPS*, which crosses onto the site along Curtis Road, approximately <sup>3</sup>/<sub>4</sub> mile south of the intersection with Judge Orr Road. T-6 conveys flows south through the site and towards its off-site confluence with Black Squirrel Creek. Discharge from the developed site into this drainageway will be limited to historic rates via a full spectrum detention pond prior to discharge. This drainageway is absent of any on-site wetlands and the entire drainageway is classified Zone AE. Access to the channel will be provided at the culvert crossing of T-6 and Del Cerro Trail via a 15' wide maintenance and access road that will proceed from Del Cerro Trail to the channel bottom. From here, access through the channel is achievable with existing grades within the channel. Furthermore, an equestrian trail will be constructed adjacent to the drainageway that can be utilized for maintenance equipment as well. The road alignments are displayed on the proposed drainage map presented in Appendix F.

*The Santa Fe Springs – Haegler Ranch Drainage Basin LOMR* was executed on three Haegler Ranch basin drainageways. Two of the drainageways that were evaluated pass through the proposed development. These drainageways are the: Haegler Ranch Tributary 3 & 4. Within the boundary of the proposed development, Haegler Ranch Tributary 3 and 4 are synonymous with Main Stem 6 and Tributary 6 from the *Haegler Ranch DBPS*. The purpose of the LOMR was to revise the flood hazard depicted in the current Flood Insurance Study. Additionally, the LOMR provided existing, 100-year velocities within the drainageways that will be utilized in the design of any potential channel improvements. A FIRM panel with the limits of the detailed study as well as BFEs has been presented in Appendix E.

See Table 2 for comparison of drainageway identification and the naming convention used within the context of this report. See Table 3 for a comparison of 100-year flows as calculated in the aforementioned DBPS' and LOMR. An existing conditions drainage map is presented in Appendix F.

#### Table 2: Major Drainageways

Major Drainageway Naming Conventions								
Saddlehorn Ranch MDDP/PDR:	Per Haegler Ranch DBPS:	Per Geick Ranch DBPS:	Per Sante Fe Springs LOMR:					
WF-R7A	N/A*	West Fork (Middle)/WF- R7A	N/A*					
MS-06	Main Stem (MS- 06)	N/A*	Haegler Ranch Tributary 3					
T-6	Tributary 6 (T-6)	N/A*	Haegler Ranch Tributary 4					

#### Table 3: Major Drainageways - Ex. 100-Year Flow Comparison

Major Drainageways: 100-Year Flow Comparison								
Drainageway Name	Contributing Area (sq. mi.)	Q <sub>100</sub> Per Haegler Ranch DBPS:	Q <sub>100</sub> Per Geick Ranch DBPS:	Q <sub>100</sub> Per Sante Fe Springs LOMR:				
WF-R7A @ Judge Orr Road	1.50	N/A*	1,017 cfs	N/A*				
MS-06 @ Curtis Road	1.05	451 cfs	N/A*	505 cfs				
T-6 @ Curtis Road	0.39	120 cfs	N/A*	130 cfs				

\*N/A: Flow regime outside limits of study.

## Proposed Sub-basin Drainage

The proposed basin delineation is as follows;

Basin A is approximately 9.2 acres and in its existing condition is rolling rangeland. Runoff generally flows southeast away from Drainageway MS-06. In the proposed condition, Basin A will be rural 2.5 acre lots and roadway. Runoff from this basin will be collected in road side swales and conveyed south along Barrosito Drive to Pond A. Pond A, while considered temporary in this MDDP, will need to meet Full Spectrum Detention Criteria unless deviations are approved in the Final Drainage Report for this future filing. It is anticipated that Barrosito Drive will be extended south as part of the development of the adjacent parcel to the south. The most logical place for a permanent Full Spectrum pond is located approximately 1,000 feet south at the future road crossing with MS-06. When that pond is constructed, the Saddlehorn Metropolitan District No. 1 will remove Pond A. The peak flow rate for Basin A in the 5 and 100-year storm are 9.5 cfs and 20.7 cfs, respectively. However, Pond A will discharge at less than historic rates.

Basin B is approximately 60.4 acres and in its existing condition is rolling rangeland. Runoff generally flows southwest across the basin towards Drainageway MS-06. In the proposed condition, Basin B will be rural 2.5 acre lots, paved roadway and will include Pond B. Runoff from this basin will be collected in road side swales and conveyed south along Barrosito Drive to Pond B. The peak flow rate for Basin B in the 5 and 100-year storm are 9.9 cfs and 46.3 cfs, respectively. However, Pond B will discharge at less than historic rates. A portion of Basin B is inundated by the existing 100-year floodplain, however; at time of final platting berming will be constructed to reduce the floodplain limits within the drainageway tract and a corresponding LOMR will be executed on this stretch of channel to establish the revised floodplain.

Basin C is approximately 102.5 acres and in its existing condition is rolling rangeland. Runoff generally flows southwest across the basin towards Drainageway MS-06. In the proposed condition, Basin C will be rural 2.5 acre lots, paved roadway and will include Pond C. Runoff from this basin will be collected in road side swales and conveyed south along Barrosito Drive and Del Cambre Drive to Pond C. The peak flow rate for Basin C in the 5 and 100-year storm are 15.8 cfs and 69.4 cfs, respectively. However, Pond C will discharge at less than historic rates.

Basin D is approximately 99.2 acres and in its existing condition is rolling rangeland. Runoff generally flows east across the basin towards Drainageway WF-R7A. In the proposed condition, Basin D will be rural 2.5 acre lots, paved roadway and will include Pond D. Runoff from this basin will be collected in road side swales and conveyed east along Barrosito drive to Pond D. The peak flow rate for Basin D in the 5 and 100-year storm are 29.4 cfs and 95.4 cfs, respectively. However, Pond D will discharge at less than historic rates. A portion of Basin D is inundated by the existing 100-year floodplain, however; at time of final platting berming will be constructed to reduce the floodplain limits within the drainageway tract and a corresponding LOMR will be executed on this stretch of channel to establish the base flood elevations.

Basin E is approximately 11.6 acres and in its existing condition is rolling rangeland. Runoff generally flows east across the basin towards Drainageway MS-06. In the proposed condition, Basin E will be rural 2.5 acre lots, paved roadway and will include Pond E. Runoff from this basin will be collected in road side swales and conveyed southwest along San Isidro Trail to Pond E. The peak flow rate for Basin E in the 5 and 100-year storm are 2.0 cfs and 9.9 cfs, respectively. However, Pond E will discharge at less than historic rates.

Basin F is approximately 117.4 acres and in its existing condition is rolling rangeland. Runoff generally flows southeast across the basin towards Drainageway MS-06. In the proposed condition, Basin F will be rural 2.5 acre lots, paved roadway and will include Pond F. Runoff from this basin will be collected in road side swales and conveyed southwest along Benito Wells Trail to Pond F. The peak flow rate for Basin F in the 5 and 100-year storm are 17.0 cfs and 69.9 cfs, respectively. However, Pond F will discharge at less than historic rates.

Basin G is approximately 39.9 acres and in its existing condition is rolling rangeland. Runoff generally flows south across the basin towards Drainageway T-6. In the proposed condition, Basin G will be rural 2.5 acre lots, paved roadway and will include Pond G. Runoff from this basin will be collected in road side swales and conveyed southwest along El Raiceno Trail to Pond G. The peak flow rate for Basin G in the 5 and 100-year storm are 6.1 cfs and 25.3, respectively. However, Pond G will discharge at less than historic rates.

Basin H is approximately 30.7 acres and in its existing condition is rolling rangeland. Runoff generally flows east across the basin towards Drainageway T-6. In the proposed condition, Basin H will be rural 2.5 acre lots, paved roadway and will include Pond H. Runoff from this basin will be collected in road side swales and conveyed north along Rosalia Place to Pond H. The peak flow rate for Basin H in the 5 and 100-year storm are 3.7 cfs and 17.9 cfs, respectively. However, Pond H will discharge at less than historic rates.

Basin I is approximately 46.6 acres and in its existing condition is rolling rangeland. Runoff generally flows east across the basin towards Drainageway T-6. In the proposed condition, Basin I will be rural 2.5 acre lots, paved roadway and will include Pond I. Runoff from this basin will be collected in road side swales and conveyed south down Carrizo Springs Trail and east down Zaragoza Trail to Pond I. The peak flow rate for Basin I in the 5 and 100-year storm are 15.9 cfs and 63.1 cfs, respectively. However, Pond I will discharge at less than historic rates.

Basin J is approximately 10.1 acres and in its existing condition is rolling rangeland. This basin will not be developed and will remain in its existing condition, per Section I.7.1.B.5 of the ECM Stormwater Quality Policy and Procedures this basin will not be detained in a full spectrum water quality and detention pond. Runoff generally flows east across the basin towards Drainageway T-6. In the proposed condition, Basin J will be an undeveloped tract. Undeveloped runoff from this basin will follow existing drainage patterns and sheet flow into Drainageway WF-R7A. The peak flow rate for Basin J in the 5 and 100-year storm are 3.0 cfs and 10.5 cfs, respectively.

Basins CH1, CH2 and CH3 are existing drainageway basins that will remain undeveloped in the proposed condition. There will be no development within Basin CH1-CH3, however; Basin CH2 & CH3 will require channel grading to accommodate proposed culverts. The scope of this grading will leave the channels in an undeveloped condition per Section I.7.1.B.7 and therefore will be excluded from permanent stormwater management. Basin CH1 contains jurisdictional wetlands. Basin CH2 contains non-jurisdictional wetlands. There are no wetlands located in Basin CH3. Peak flow rates for proposed undeveloped basins are presented in Appendix B.

Basins UD1-UD11 acre comprised of rural 2.5+ acre residential lots and will follow existing drainage patterns in the proposed condition. Development in these basins will be limited to a maximum of 10% impervious development via a plat covenant. Therefore, these basins can be excluded from permanent stormwater detention per Section I.7.1.B.5 of the ECM Stormwater Quality Policy and Procedures (2.5+ acre lots with imperviousness less than 10% can be excluded from

permanent stormwater management practices). Therefore, Basins UD1-UD11 will not be included in the developments permanent stormwater management facilities. A Permanent BMP applicability form is presented in Appendix D to justify these exclusions. A map detailing each development site and any exclusion is presented in Appendix F. Basin UD1 flows directly into Major Drainageway WF-R7A. Basins UD2, UD2.1, UD2.2, UD3, UD4, UD5 and UD8 flow directly into Major Drainageway MS-06. Basins UD6, UD7, UD9, and UD9.1 flow directly into Major Drainageway T-6. Basins UD8.1, UD10, and UD11 follow existing drainage patterns as well but flow directly off-site prior to being captured in major drainageways. A portion of Basin UD2.2 is inundated by the existing 100-yr floodplain. However, at time of final drainage report, lot lines will be adjusted outside floodplain limits. Furthermore, a portion of Basin UD10 is inundated by the existing 100-year floodplain, however; at time of final platting berming will be constructed to reduce the floodplain limits within the drainageway tract and a corresponding LOMR will be executed on this stretch of channel to establish the revised floodplain.

In addition to undeveloped lot areas, a small portion of Del Cerro Trail (portion of Basins UD9 & UD9.1) and San Isidro Trail (a portion of Basin UD5) will be allowed to directly discharge into Drainageway T-6 and MS-06, respectively, and excluded from the developments permanent stormwater management facilities. Per Section I.7.1.C.1, the County may exclude up to 20 percent, not to exceed 1 acre, of the applicable development site area from permanent stormwater management. Approximately, 16,240 ft<sup>2</sup> of Del Cerro Drive and 14,000 ft<sup>2</sup> square feet of San Isidro Trail, totaling 0.08% of the total development area, will be excluded from stormwater management, which is significantly less than the 20% limit.

A summary of all basin parameters has been presented in Appendix B.

Developed basin's runoff will be captured in roadside ditches and conveyed to a full spectrum water quality and detention pond per El Paso County DCM Volume 1. Each full spectrum pond will release treated flows at less than historic rates to minimize adverse impacts downstream. Pond D will discharge into Major Drainageway WF-7A, Pond B, C, E, and F will discharge into Major Drainageway T-6. Due to existing topography, Pond A will discharge into open space south of the site. Based on existing topography in the area, this flow will eventually be captured off-site by Major Drainageway MS-06.

See Table 4 for comparison of proposed pond parameters including a comparison of proposed basin discharge versus existing discharge.

Table 4: Pond Summary	1
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		POND	SUMMARY	TABLE			
Tributary Sub- Basin	Pond Name	Tributary Acres	WQ Volume (ac-ft)	100-Year Volume (ac-ft)	Provided Volume (ac-ft)	100-Year Peak Discharge (cfs)	Ex. 100- Year Peak Discharge (cfs)
А	POND A	9.2	0.20	1.14	1.14	2.5	2.8
В	POND B	60.4	0.35	1.46	2.17	18.9	21.0
С	POND C	102.5	0.64	2.69	2.77	26.0	28.9
D	POND D	99.2	0.59	2.86	2.97	47.7	53.0
E	POND E	11.6	0.05	0.23	0.39	4.7	5.2
F	POND F	117.4	0.65	3.20	3.35	50.7	56.3
G	POND G	39.9	0.34	1.36	1.62	10.1	11.2
Н	POND H	30.7	0.16	0.70	1.18	10.5	11.7
I	POND I	46.6	0.25	1.09	1.41	26.8	29.8

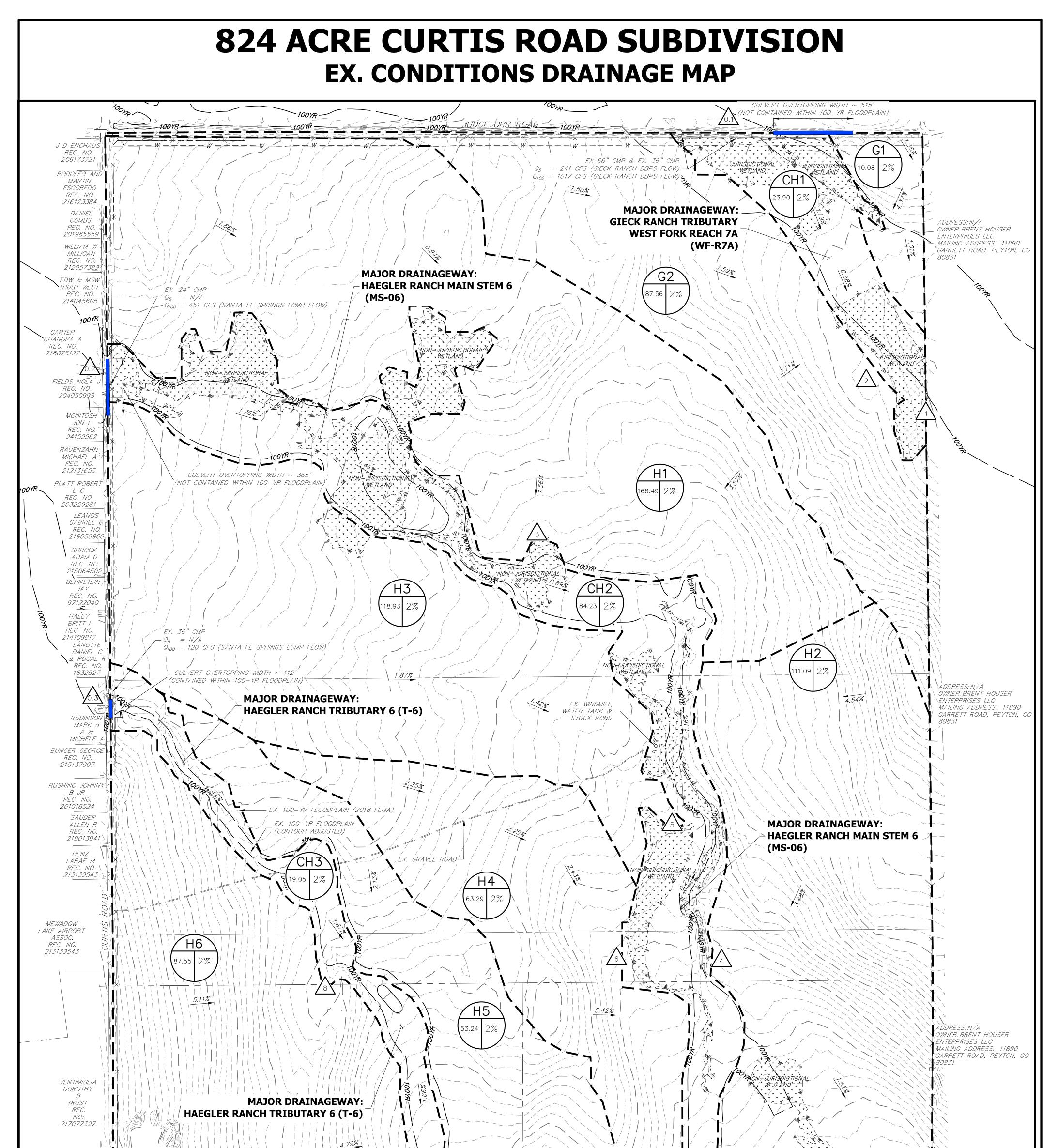
## DRAINAGE DESIGN CRITERIA

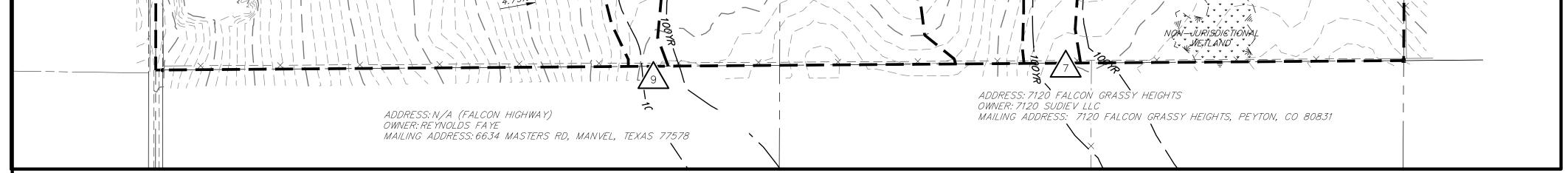
## Development Criteria Reference

Storm drainage analysis and design criteria for the project were taken from the "*City of Colorado Spring/El Paso County Drainage Criteria Manual*" Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the "*Urban Storm Drainage Criteria Manual*" Volumes 1 - 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the "Colorado Springs Drainage Criteria Manual (CCSDCM), dated May 2014, as adopted by El Paso County, as well as the July 2019 El Paso County Engineering Criteria Manual update.

## Hydrologic Criteria

All hydrologic data was obtained from the "El Paso Drainage Criteria Manual" Volumes 1 and 2, and the "Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual" Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5 year (minor) storm event and the 100-year (major) storm event. Runoff was calculated using CUHP Version 2.0.0, developed by Urban Drainage and Flood Control District. The model utilizes the raingage classified as "a design storm by temporal distribution of one-hour rain depths with area correction factors". The following Colorado Springs rainfall depths were utilized in the model: 2.52 inches for 1-hour 100-year depth and 3.5 inches for 6-hour 100-year depth. EPA SWMM 5.1 was utilized to route runoff flow rates for the sizing of stormwater storage facilities. The CUHP calculations and SWMM model are presented in Appendix B.





## LEGEND



BASIN DESIGNATION

I.D.: BASIN IDENTIFIER A: BASIN AREA B: % IMPERVIOUS

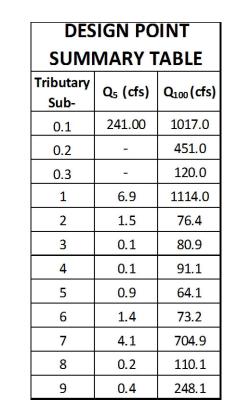


DESIGN POINT

BASIN DELINEATION

- ---6100-- EXISTING INDEX CONTOURS
- ----- EXISTING INTERMEDIATE CONTOURS
- EXISTING FLOW DIRECTION

E	BASIN S	UMMAR	<b>TABLE</b>	
Tributary Sub-Basin	Area (acres)	Percent Impervious	Q₅ (cfs)	Q <sub>100</sub> (cfs)
G1	10.1	2.0%	0.00	0.1
G2	87.6	2.0%	1.5	76.4
H1	166.5	2.0%	0.1	81.0
H2	111.1	2.0%	0.2	91.1
H3	118.9	2.0%	0.9	64.1
H4	63.3	2.0%	1.4	73.2
H5	53.2	2.0%	0.3	28.2
H6	87.6	2.0%	0.2	110.1
CH1	23.9	2.0%	5.4	21.0
CH2	84.2	2.0%	2.6	33.7
CH3	19.1	2.0%	0.1	<mark>6.5</mark>
Total	825.4	N/A	12.7	585.4



EX. DRAINAGE MAP 824 CURTIS ROAD 25142.00 5/8/20 SHEET 1 OF 1

300

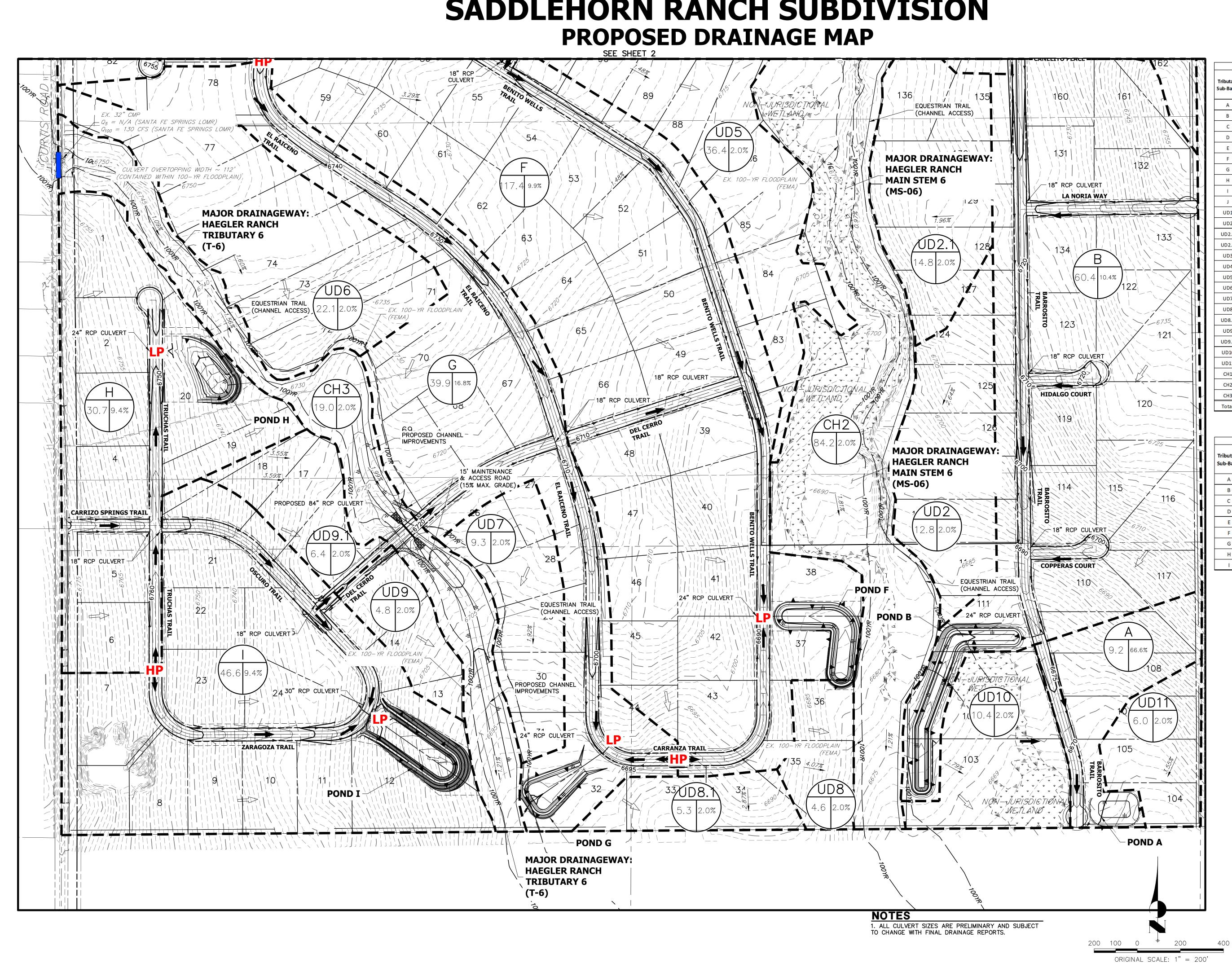
ORIGINAL SCALE: 1" = 300'

600

300 150 0



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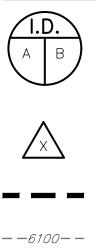


# **SADDLEHORN RANCH SUBDIVISION**

BASIN SUMMARY TABLE									
Tributary Sub-Basin	Area (acres)	Composite Percent Impervious	Q₅ (cfs)	Q <sub>100</sub> (cfs)					
Α	9.2	66.6%	9.5	20.7					
В	60.4	10.4%	9.9	<mark>46.3</mark>					
С	102.5	11.4%	15. <mark>8</mark>	69.4					
D	99.2	10.8%	29.4	<mark>95.4</mark>					
E	11.6	11.6%	2.0	9. <mark>9</mark>					
F	117.4	9.9%	17.0	69.9					
G	39.9	16.8%	6.1	25.3					
Н	30.7	9.4%	3.7	17.9					
I	46.6	9.4%	15.9	63.1					
J	10.1	2.0%	3.0	10.5					
UD1	12.4	2.0%	0.3	13.9					
UD2	12.8	2.0%	0.1	7.7					
UD2.1	14.8	2.0%	0.1	<b>14.7</b>					
UD2.2	7.2	2.0%	0.1	5.5					
UD3	13.4	2.0%	0.2	13.1					
UD4	4.8	2.0%	<mark>0.03</mark>	3.4					
UD5	<mark>36.4</mark>	2.0%	4.1	27.4					
UD6	22.1	2.0%	0.1	12. <mark>4</mark>					
UD7	9.3	2.0%	0.7	7.4					
UD8	4.6	2.0%	0.03	3.3					
UD8.1	5.3	2.0%	<mark>0.1</mark>	<mark>5.6</mark>					
UD9	4.8	2.0%	0.1	4.2					
UD9.1	6.4	2.0%	0.2	8.1					
UD10	10.4	2.0%	0.1	6.7					
UD11	6	2.0%	0.02	4.3					
CH1	23.9	2.0%	5.4	21.0					
CH2	84.2	2.0%	2.6	33.7					
CH3	19.0	2.0%	0.1	6.5					
Total	825.4	N/A	126.7	627.3					

POND SUMMARY TABLE							
Tributary Sub-Basin	Pond Name	Tributary Acres	WQ Volume (ac-ft)	100-Year Volume (ac-ft)	Provided Volume (ac-ft)	100-Year Peak Discharge (cfs)	Ex. 100- Year Peak Discharge (cfs)
A	POND A	9.2	0.20	1.14	1.14	2.5	2.8
В	POND B	<mark>60.4</mark>	0.35	1.46	2.17	18.9	21.0
С	POND C	102.5	0.64	2.69	2.77	26.0	28.9
D	POND D	99.2	0.59	2.86	2.97	47.7	53.0
E	POND E	11.6	0.05	0.23	0.39	4.7	5.2
F	POND F	117.4	0.65	3.20	3.35	50.7	56.3
G	POND G	39.9	0.34	1.36	1.62	10.1	11.2
н	POND H	30.7	0.16	0.70	1. <mark>18</mark>	10.5	11.7
I	PONDI	46.6	0.25	1.09	1.41	26.8	29.8

## LEGEND

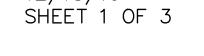


BASIN DESIGNATION I.D.:BASIN IDENTIFIER A:BASIN AREA B:COMP. % IMPERVIOUS

DESIGN POINT

BASIN DELINEATION

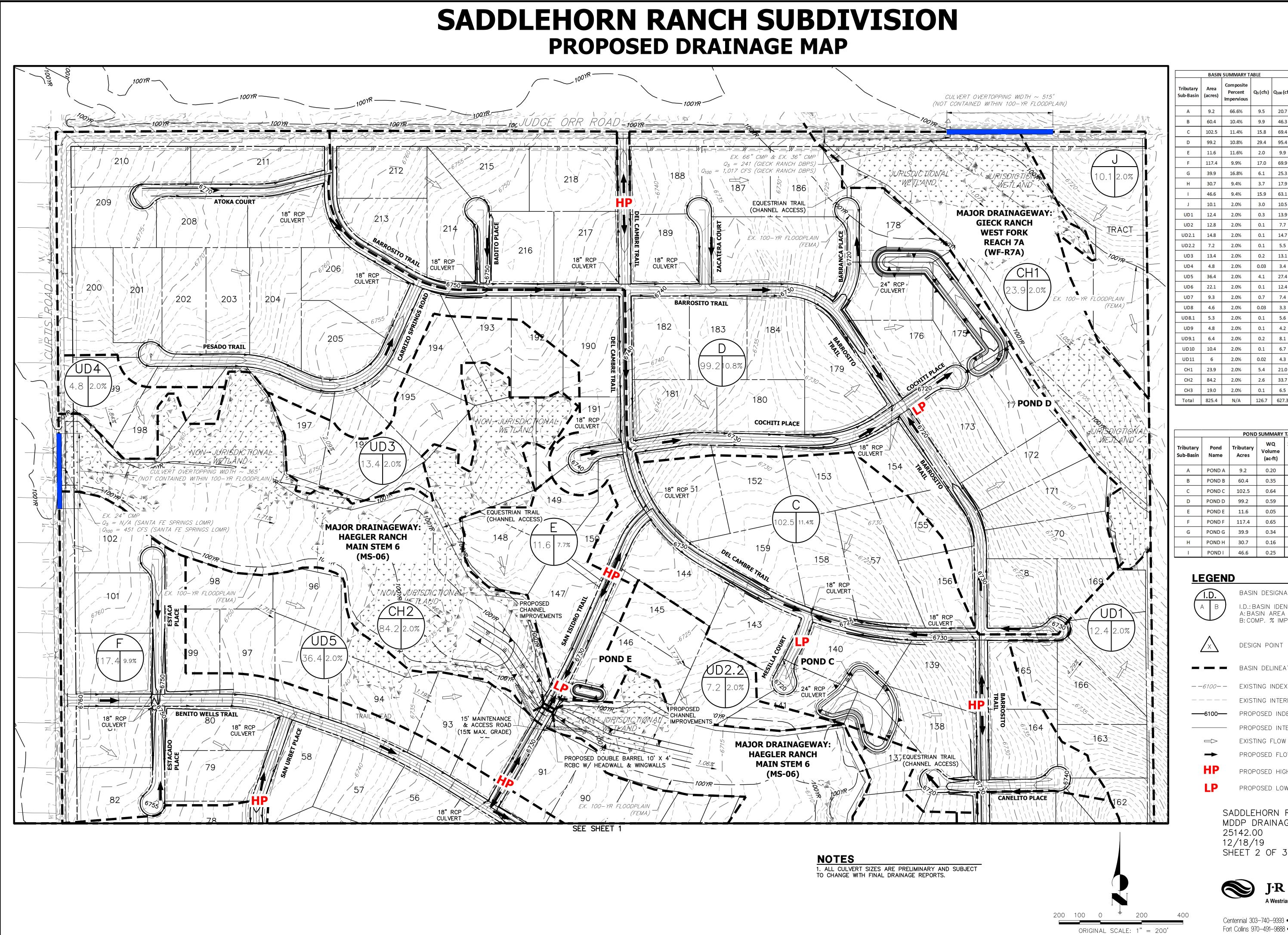
- ---6100-- EXISTING INDEX CONTOURS ---- EXISTING INTERMEDIATE CONTOURS
- - PROPOSED INTERMEDIATE CONTOURS
- EXISTING FLOW DIRECTION  $\Rightarrow$ PROPOSED FLOW DIRECTION →
- HP PROPOSED HIGH POINT
- LP PROPOSED LOW POINT
- SADDLEHORN RANCH SUBDIVISION MDDP DRAINAGE MAP 25142.00 12/18/19





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D	99.2	10.8%	29.4	95.	.4			
E	11.6	11.6%	2.0	9.	9			
F	117.4	9.9%	17.0	<mark>6</mark> 9.	.9			
G	<u>39.</u> 9	16.8%	<mark>6.1</mark>	25.	.3			
н	30.7	9.4%	3.7	17.	.9			
I	<u>46.6</u>	9.4%	15.9	63.	.1			
J	10.1	2.0%	3.0	10	.5			
UD1	12.4	2.0%	0.3	13.	.9			
UD2	12.8	2.0%	0.1	7.	7			
UD2.1	14.8	2.0%	<mark>0</mark> .1	14.	.7			
UD2.2	7.2	2.0%	<mark>0</mark> .1	5.	5			
UD3	13.4	2.0%	0.2	13.	.1			
UD4	4.8	2.0%	0.03	3.4	4			
UD5	36.4	2.0%	4.1	27.	.4			
UD6	22.1	2.0%	0.1	12.	.4			
UD7	9.3	2.0%	0.7	7.	4			
UD8	<mark>4.</mark> 6	2.0%	0.03	3.	3			
UD8.1	5.3	2.0%	<mark>0.1</mark>	5.	6			
UD9	4.8	2.0%	0.1	4.	2			
UD9.1	6.4	2.0%	0.2	8.	1			
UD10	10.4	2.0%	0.1	6.	7			
UD11	6	2.0%	0.02	4.	3			
CH1	23.9	2.0%	5.4	21.	.0			
CH2	84.2	2.0%	2.6	33.	.7			
CH3	<u>19.0</u>	2.0%	<mark>0.1</mark>	6.	5			
Total	825.4	N/A	126.7	627	.3			
	·	PO		MARY	TABLE			
			W		100-Year	Provided	100-Year	Ex. 100-
Tributary Sub-Basin	Pond Name		Volu		Volume	Volume	Peak Discharge	Year Peak Discharge
			(ac	-ft)	(ac-ft)	(ac-ft)	(cfs)	(cfs)
А	POND	A 9.2	0.2	20	1.14	1.14	2.5	2.8
В	POND	B 60.4	0.3	35	1.46	2.17	18.9	21.0
С	POND	C 102.5	0.6	64	2.69	2.77	26.0	28.9
D	POND	D 99.2	0.5	59	2.86	2.97	47.7	53.0
E	POND	E 11.6	0.0	05	0.23	0.39	4.7	5.2

56.3

11.2

11.7

50.7

10.1

10.5

**BASIN SUMMARY TABL** 

Composite

Impervious

66.6%

10.4%

9.2

Percent Q5 (cfs) Q100 (cfs

9.5 20.7

9.9 46.3

	F	G	Ε	Ν	D
_		а			v.

POND G

POND I

BASIN DESIGNATION I.D.: BASIN IDENTIFIER A: BASIN AREA B: COMP. % IMPERVIOUS

DESIGN POINT

117.4 0.65

30.7 0.16

46.6 0.25

39.9

0.34

3.20

1.36

0.70

3.35

1.62

1.18

1.09 1.41 26.8 29.8

	BASIN DELINEATION
-6100— —	EXISTING INDEX CONTOURS
	EXISTING INTERMEDIATE CONTOURS
-6100	PROPOSED INDEX CONTOURS
	PROPOSED INTERMEDIATE CONTOURS
	EXISTING FLOW DIRECTION
→	PROPOSED FLOW DIRECTION
HP	PROPOSED HIGH POINT
LP	PROPOSED LOW POINT

SADDLEHORN RANCH MDDP DRAINAGE MAP 25142.00 12/18/19 SHEET 2 OF 3



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#### FINAL DRAINAGE REPORT FOR SADDLEHORN RANCH – FILING 1

Prepared For: ROI Property Group, LLC 2495 Rigdon Street Napa, CA 94558 (707) 365-6891

Unresolved. Remove the MDDP/Prelim drainage report and only include snippets of information pertinent to the design.

JR: Ok to leave in per Elizabeth.

May 7, 2020 Project No. 25142.02

Prepared By: JR Engineering, LLC 5475 Tech Center Drive Colorado Springs, CO 80919 719-593-2593

El Paso County PCD File No.: SF-19-012 Per a NRCS web soil survey of the area, Filing 1 is made up of Type A and B soils. Type A soils cover roughly 91% of Filing 1 while Type B soils cover 9% of Filing 1. Group A soils have a high infiltration rate when thoroughly wet. Type B soils have a moderate infiltration when thoroughly wet. A NRCS soil survey map has been presented in Appendix A.

There are two existing wells in the south west corner of Filing 1.

## **Floodplain Statement**

Based on the FEMA FIRM Map number 08041C0558G, dated December 7, 2018, Filing 1 lies within Zone AE and Zone X. Zone AE is defined as area subject to inundation by the 1-percent-annual-chance flood event. Zone X is defined as area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. All proposed residential development within Filing 1 will occur in Zone X. The FIRM Map has been presented in Appendix A.

## **DRAINAGE BASINS AND SUBBASINS**

## **Existing Major Basin Descriptions**

Filing 1 lies within Haegler Ranch Drainage Basin based on the "*Haegler Ranch Drainage Basin Planning Study*" prepared by URS Corporation in May 2009.

The Haegler Ranch Drainage Basin covers approximately 16.6 square miles in unincorporated El Paso County, CO. The Haegler Ranch Drainage Basin is tributary to Black Squirrel Creek. In its existing condition, the basin is comprised of rolling rangeland with poor vegetative cover associated with Colorado's semi-arid climate. The natural Drainageways within the basin are typically shallow and wide with poorly defined flow paths in most areas. Anticipated land use for the basin includes residential and commercial development. Residential developments will range from 0.125 - 5 acre lots with a mix of low, medium and high density developments.

As part of its drainage research, JR Engineering reviewed the following drainage studies, reports and LOMRs:

- Haegler Ranch Drainage Basin Planning Study prepared by URS Corporation in May 2009
- Santa Fe Springs Haegler Ranch Drainage Basin Letter of Map Revision prepared by Tri-Core Engineering in June 2004.
- Preliminary Drainage Report/Master Development Drainage Plan for Saddlehorn Ranch, prepared by JR Engineering, April 2019.

The *Haegler Ranch Drainage Basin Planning Study* was used to establish a stormwater management plan for the existing and future stormwater infrastructure needs within the Haegler Ranch Drainage Basin. Based on provided drainage maps and analysis, in its existing condition Haegler Ranch contributes a 100year flow of 120 cfs onto Filing 1. The offsite drainage crosses Curtis Road in an existing 36" CMP onto

#### Final Drainage Report Filing 1 - Saddlehorn Ranch

Filing 1. Major Drainageway T-6 conveys the stormwater through Filing 1 and to its off-site confluence with Major Drainageway MS-05. The existing 36" CMP culvert is undersized for existing flows.

The *Haegler Ranch DBPS* evaluated two detention alternatives for the drainage basin: region and sub regional. In the regional approach, it is recommended the existing 36" CMP be upsized to a 60" RCP. In the sub-regional approach, this culvert is recommended to be left in its existing condition.

The existing 36" CMP culvert will not be upsized within the context of this report and development. The culvert is owned by El Paso County and timing of improvements, if any, will be controlled by the County.

Furthermore, the *Haegler Ranch DBPS* recommends channel improvements within Drainageway T-6. Per the *Haegler Ranch DBPS*, Drainageway T-6 should be improved to a trapezoidal channel with an 8' bottom width, 4:1 side slopes and design depth of five feet. The DBPS also recommends a total of seven (7) four-foot drops within the on-site portion of T-6 to limit erosive velocities. The recommended drop structures will not be constructed with Saddlehorn Ranch Filing 1. Proposed channel improvements will limit erosive velocities without the use of drop structures. See recommended channel improvement sheets from the *Haegler Ranch DBPS* presented in Appendix E.

Based on flood impacts, stream stability and cost effectiveness, this study recommended a sub-regional detention approach. This allows future development anywhere in the basin with the construction of an associated sub-regional pond. However, based on the *Preliminary Drainage Report/Master Development Drainage Plan for Saddlehorn Ranch*, Filing 1 will utilize on-site full spectrum water quality and detention ponds instead. These full spectrum detention ponds will limit developed discharge into the Drainageways to less than historic rates.

*The Santa Fe Springs – Haegler Ranch Drainage Basin LOMR* was executed on Haegler Ranch Tributary 2, 3, and 4. The LOMR revised the onsite effective flood zone from Zone A to Zone AE. See FIRM Map Panel 08041C0558G for limits of LOMR study and revised flood zones, presented in Appendix E.

Of the three drainageways that were evaluated in the LOMR, Haegler Ranch Tributary 4 passes through Filing 1. Within the boundary of the proposed development, Haegler Ranch Tributary 4 is synonymous with T-6 from the *Haegler Ranch DBPS*. The purpose of the LOMR was to revise the flood hazard depicted in the current Flood Insurance Study. Per the LOMR, an existing 100-year flow of 130 cfs crosses onto Filing 1 in Haegler Ranch Tributary 4. The off-site flow of 130 cfs carried within Tributary 4 was used to design the 84" RCP culvert and associated channel improvements outline in this report. Plan and profiles of the culvert and Drainageway T-6 improvements has been presented in Appendix F.

See Table 2 for comparison of Drainageway identification and the naming convention used within the context of this report. See Table 3 for a comparison of 100-year flows as calculated in the aforementioned DBPS and LOMR. An existing conditions drainage map is presented in Appendix F.

Saddlehorn Ranch Filing 1 Final Drainage Report	Per Haegler Ranch DBPS:	Per Sante Fe Springs LOMR:	
T-6	Tributary 6 (T-6)	Haegler Ranch Tributary 4	

#### Table 1: Major Drainageway Naming Convention

#### Table 2: Major Drainageway – Ex. 100-Year Flow Comparison

Drainageway	Q <sub>100</sub> Per Haegler	Q <sub>100</sub> Per Sante Fe Springs	
Name	Ranch DBPS:	LOMR:	
T-6	120 cfs	130 cfs	

The *Preliminary Drainage Report/Master Development Drainage Plan for Saddlehorn Ranch* proposed the overall drainage facility design for Saddlehorn Ranch. Within the context of this report, onsite drainage basins and associated full spectrum water quality ponds were established. As it pertains to Filing 1, three full spectrum water quality ponds are recommended. Roadside ditches and local street culverts will be utilized to capture and convey Filing 1's runoff to the water quality ponds. Water quality ponds will discharge into Drainageway T-6 at less than historic rates.

In order to maintain the function of Drainageway T-6, the PDR/MDDP recommends an 84" reinforced concrete pipe (RCP) culvert at the crossing of Del Cerro Trail and Drainageway T-6 in addition to channel improvements up and downstream of the culvert. This culvert and channel improvements are designed to ensure a no-rise scenario in the floodplain.

## **Existing Sub-basin Drainage**

On-site, existing sub-basin drainage patterns are generally from northwest to southeast by way of Drainageway T-6. On-site areas flow directly into this drainageway, which also bypasses off-site flow through Filing 1.

#### **Proposed Sub-basin Drainage**

The proposed Filing 1 basin delineation is as follows;

Filing 1 contains a 14.0 acre portion of Basin F which is comprised of Sub-basins F1-F4. The remaining area of Basin F is within the boundary of future Filings 2 and 3. In its existing condition, Basin F is rolling rangeland and runoff generally flows southeast towards Drainageway MS-06. In the Filing 1 proposed condition of Basin F, only four 2.5 acre lots will be developed and the remaining area will be undeveloped. During Filing 1, runoff from this basin will be captured in roadside ditches and conveyed to one of two temporary sediment basins. Per Section I.7.1.B.5 of the ECM – Stormwater Quality Policy and Procedures a single-family residential lots, greater than or equal to 2.5 acres, and having a total lot imperviousness no greater than 10% can be excluded from permanent stormwater quality. Sub-basins F1

and F2, Imperviousness (I) =7.0% and I=2.0% respectively, are comprised of 2.5 acre residential lots and undeveloped area, therefore; they are routed to Sediment Basin F1. In future filings of Saddlehorn Ranch, when all of Basin F will develop, a permanent, full spectrum water quality and detention pond (Pond F) will be constructed to detain and treat the developed flows from Sub-basin F1 and F2.

Per Section I.7.1.C.1 of the ECM – Stormwater Quality Policy and Procedures, the County may exclude up to 20%, not to exceed 1 acre, of the applicable development site, from the WQCV standard. Sub-basin F3 and F4 total 2.86 acres, of which 0.17 ac is asphalt roadway and 0.20 acre is gravel cul-de-sac. The combined developed area in F3 and F4 totals 0.37 acres which is approximately 0.2% of the development site. The remaining 2.49 acres are 2.5 acre residential lots with I=6.2%. Per Section I.7.1.C.1 and I.7.1.B.5, Sub-basin F3 and F4 will be excluded from permanent stormwater quality in Filing 1 and instead will be routed to Sediment Basin F2. In future filings of Saddlehorn Ranch, when all of Basin F will develop, a permanent, full spectrum water quality and detention pond (Pond F) will be constructed to detain and treat the developed flows from Sub-basin F3 and F4.

Basin G consists of Sub-basins G1-G7, F-G1 & F-G2 combining for a total of 46.5 acres. In its existing condition, Basin G is rolling rangeland and runoff generally flows south and west to Drainageway T-6. In the proposed condition, Basin G will be rural 2.5 acre lots, paved roadway and will include Pond G. Basins F-G1 & F-G2 are Basin G area outside of Filing 1, however; these basins are tributary to Filing 1 and will be fully developed in future Filing 2. Therefore, F-G1 & F-G2 were analyzed as developed basins within the context of this report to adequately size ditches, culverts and water quality pond for the fully developed future condition. Runoff from this basin will be collected in road side ditches and conveyed south along El Raiceno Trail and west along Carranza Trail to Pond G. Pond G will be a full spectrum water quality and detention pond and will release at less than historic rates into Drainageway T-6.

Basin H consists of Sub-Basins H1-H4 combining for a total of 21.2 acres. In its existing condition, Basin H is rolling rangeland and runoff generally flows southeast towards Drainageway T6. In the proposed condition, Basin H will be rural 2.5 acre lots, paved roadway and will include Pond H. Runoff from this basin will be collected in road side ditches and conveyed along Truchas Trail to Pond H. Pond H will be a full spectrum water quality and detention pond and will release at less than historic rates into Drainageway T-6.

Basin I consists of Sub-basins I1-I7 combining for a total of 37.4 acres. In its existing condition, Basin I is rolling rangeland and runoff generally flows east across the basin towards Drainageway T-6. In the proposed condition, Basin I will be rural 2.5 acre lots, paved roadway and will include Pond I. Runoff from this Basin I1-I6 will be collected in road side ditches and conveyed south down Oscuro Trail and east down Zaragoza Trail as well as Oscuro Trail to Pond I. Pond I will be a full spectrum water quality and detention pond and will release at less than historic rates into Drainageway T-6. Section I.7.1.B.5 of the ECM – Stormwater Quality Policy and Procedures single-family residential lots, greater than or equal to 2.5 acres, and having total lot imperviousness no greater than 10% can be excluded from permanent stormwater quality. Per Section I.7.1.B.5, Basin I7 (exclusively rural 2.5+ acre residential lots, I=6.2%) will be excluded from permanent stormwater management and due to existing topography it will not be routed to Pond I.

## Proposed Channel Improvements – Haegler Ranch T-6

Haegler Ranch T-6 conveys an existing 130 cfs through the site. In order to maintain the drainage patterns in the channel, an 84" RCP culvert is proposed at the crossing with Del Cerro Trail. In order to facilitate this culvert, upstream and downstream channel improvements are required. The proposed channel section includes a 50' bottom width, an 12' wide/1' deep low flow channel and 10:1 tie backs to existing grades. The channel also includes reinforced rock berms at 150' intervals to ensure the flow remains subcritical. The entire channel will be lined with erosion control blanket and seeded with Pawnee Butte Seed Inc. – Low Grow Native Mix which includes fescue and bluegrasses. Per Table 10-4 in the EPC DCM fescue and bluegrass have a permissible velocity of 5 ft/s. Based on hydraulic analysis of the proposed channel geometry and slopes, the highest velocity present in the channel is 4.71 ft/s, therefore; the selected lining and seed mix is adequate for permanent vegetation. Channel hydraulic analysis sheets are presented in Appendix C. Channel cross section is presented on the drainage map in Appendix F.

Maintenance access to the channel will be provided on the upstream and downstream ends of the Del Cerro Culvert crossing with a 15' wide maintenance and access road. The access roads begin off the edge of pavement on Del Cerro Drive and terminate alongside the channel bottom. Existing and proposed grades within the channel are such that maintenance equipment can be operated without additional roadway. Access adjacent to the channel will be provided via equestrian trails that parallel the channel along Tract B and Tract C. Access roads are shown on the drainage map presented in Appendix F. Tract B and Tract C, which contain the existing channel and proposed channel improvements, will be owned and maintained by 824 Acre Metropolitan District No. 1.

## DRAINAGE DESIGN CRITERIA

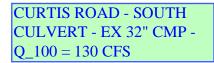
## **Development Criteria Reference**

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

## Hydrologic Criteria

All hydrologic data was obtained from the "El Paso Drainage Criteria Manual" Volumes 1 and 2, and the "Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual" Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5 year (minor) storm event and the 100-year (major) storm event. Rational Method calculations were prepared, in accordance with Section 13.3.2.1. of the CCSDCM, for the sub-basins that directly impact the sizing of ditches and local street culverts. Rational method calculations are presented in Appendix B.

Urban Drainage and Flood Control District's UD-Detention, Version 3.07 workbook was used for pond sizing. Required detention volumes and allowable release rates were designed per USDCM and CCS/EPCDCM. Pond sizing spreadsheets are presented in Appendix D.



#### **Crossing Discharge Data**

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

Minimum Flow: 100 cfs

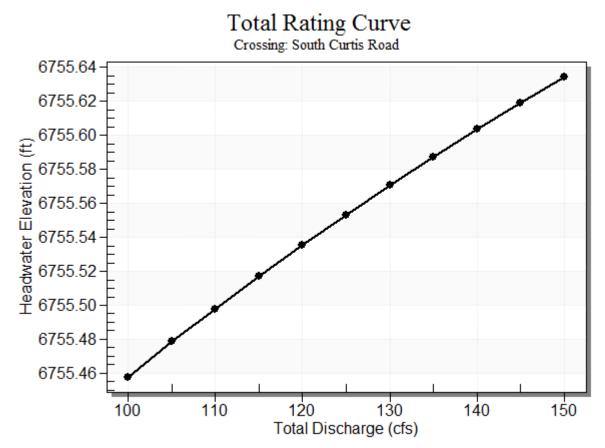
Design Flow: 130 cfs

Maximum Flow: 150 cfs

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6755.46	100.00	44.64	55.19	10
6755.48	105.00	44.78	60.13	4
6755.50	110.00	44.90	64.80	3
6755.52	115.00	45.03	69.67	3
6755.54	120.00	45.14	74.59	3
6755.55	125.00	45.26	79.52	3
6755.57	130.00	45.37	84.44	3
6755.59	135.00	45.48	89.36	3
6755.60	140.00	45.58	94.28	3
6755.62	145.00	45.68	99.20	3
6755.63	150.00	45.78	104.12	3
6755.01	41.61	41.61	0.00	Overtopping

## Table 7 - Summary of Culvert Flows at Crossing: South Curtis Road

#### Rating Curve Plot for Crossing: South Curtis Road



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)
100.00	44.64	6755.46	5.127	4.736	7-M2c	2.660	2.221	2.221	0.885	9.005	3.767
105.00	44.78	6755.48	5.148	4.759	7-M2c	2.660	2.224	2.224	0.912	9.022	3.838
110.00	44.90	6755.50	5.167	4.780	7-M2c	2.660	2.227	2.227	0.938	9.038	3.908
115.00	45.03	6755.52	5.186	4.801	7-M2c	2.660	2.229	2.229	0.964	9.053	3.975
120.00	45.14	6755.54	5.205	4.821	7-M2c	2.660	2.232	2.232	0.990	9.068	4.041
125.00	45.26	6755.55	5.223	4.840	7-M2c	2.660	2.234	2.234	1.015	9.082	4.105
130.00	45.37	6755.57	5.240	4.882	7-M2c	2.660	2.237	2.237	1.040	9.096	4.167
135.00	45.48	6755.59	5.257	4.898	7-M2c	2.660	2.239	2.239	1.064	9.110	4.228
140.00	45.58	6755.60	5.273	4.913	7-M2c	2.660	2.241	2.241	1.088	9.123	4.287
145.00	45.68	6755.62	5.289	4.928	7-M2c	2.660	2.243	2.243	1.112	9.136	4.346
150.00	45.78	6755.63	5.304	4.943	7-M2c	2.660	2.245	2.245	1.136	9.148	4.402

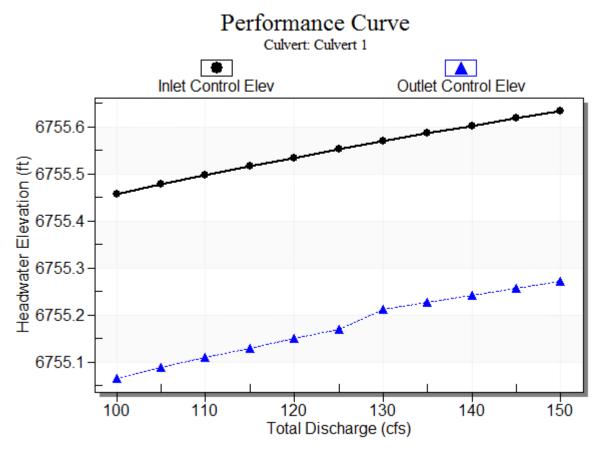
Table 8 - Culvert Summary Table: Culvert 1

#### \*\*\*\*\*\*

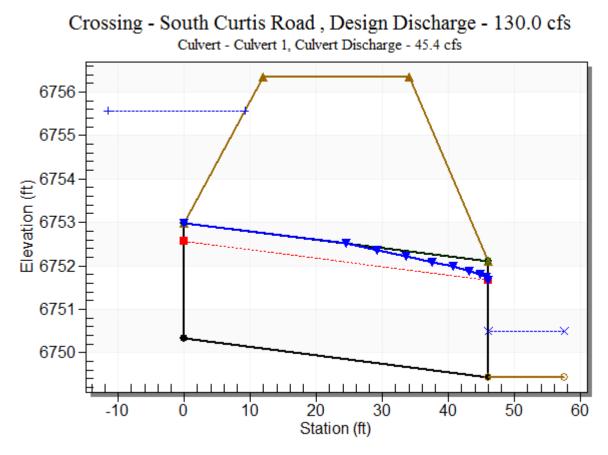
Straight Culvert

Inlet Elevation (invert): 6750.33 ft, Outlet Elevation (invert): 6749.44 ft Culvert Length: 46.01 ft, Culvert Slope: 0.0193

#### **Culvert Performance Curve Plot: Culvert 1**



#### Water Surface Profile Plot for Culvert: Culvert 1

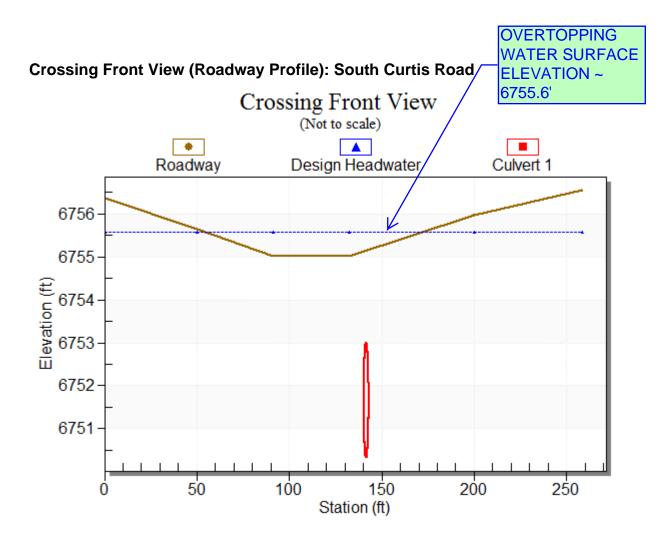


#### Site Data - Culvert 1

Site Data Option: Culvert Invert Data Inlet Station: 0.00 ft Inlet Elevation: 6750.33 ft Outlet Station: 46.00 ft Outlet Elevation: 6749.44 ft Number of Barrels: 1

#### **Culvert Data Summary - Culvert 1**

Barrel Shape: Circular Barrel Diameter: 2.66 ft Barrel Material: Corrugated Steel Embedment: 0.00 in Barrel Manning's n: 0.0240 Culvert Type: Straight Inlet Configuration: Thin Edge Projecting Inlet Depression: None



Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
100.00	6750.32	0.88	3.77	0.55	0.71
105.00	6750.35	0.91	3.84	0.57	0.71
110.00	6750.38	0.94	3.91	0.59	0.71
115.00	6750.40	0.96	3.98	0.60	0.71
120.00	6750.43	0.99	4.04	0.62	0.72
125.00	6750.46	1.02	4.11	0.63	0.72
130.00	6750.48	1.04	4.17	0.65	0.72
135.00	6750.50	1.06	4.23	0.66	0.72
140.00	6750.53	1.09	4.29	0.68	0.72
145.00	6750.55	1.11	4.35	0.69	0.73
150.00	6750.58	1.14	4.40	0.71	0.73

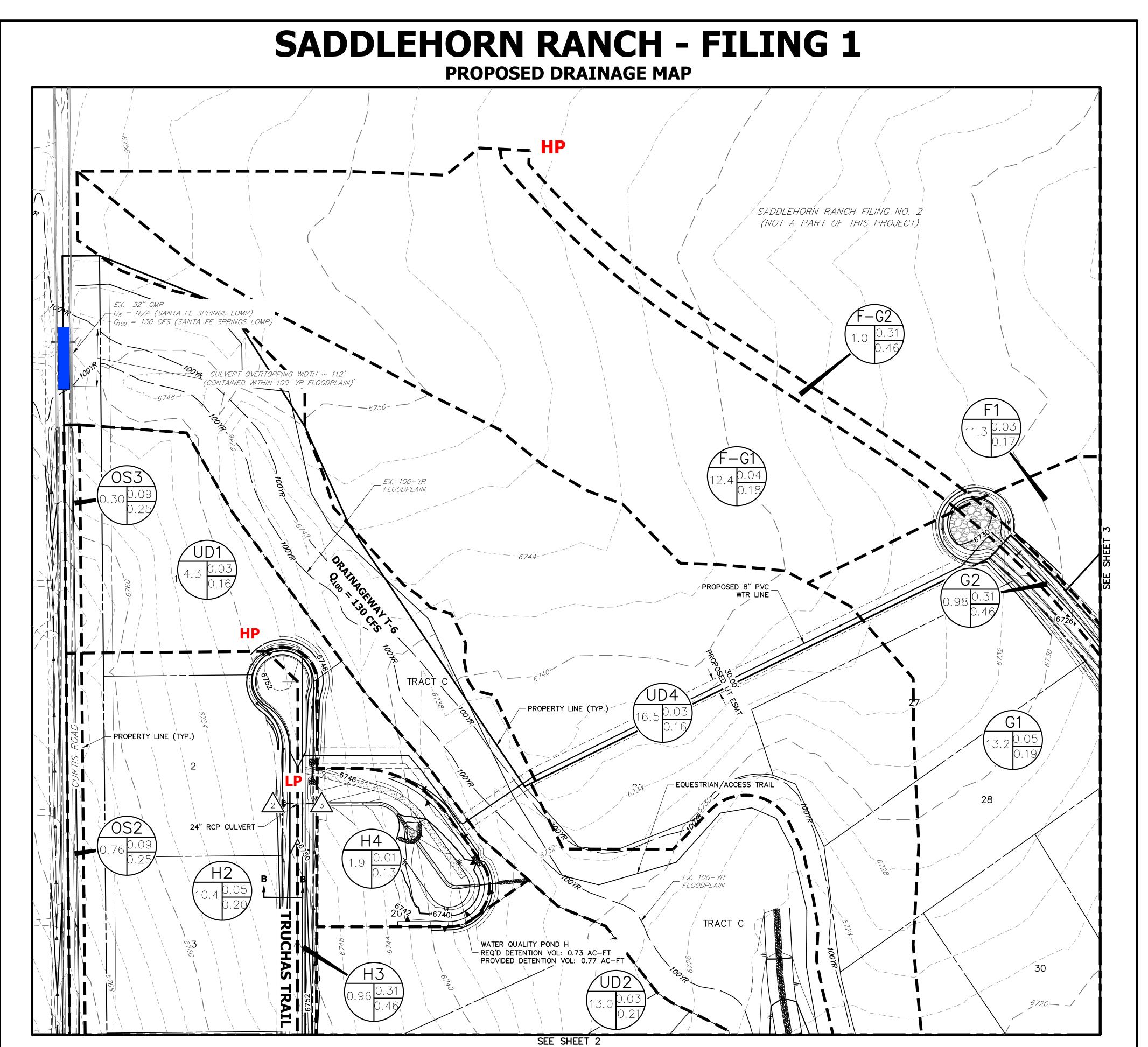
## Table 9 - Downstream Channel Rating Curve (Crossing: South Curtis Road )

#### Tailwater Channel Data - South Curtis Road

Tailwater Channel Option: Rectangular Channel Bottom Width: 30.00 ft Channel Slope: 0.0100 Channel Manning's n: 0.0350 Channel Invert Elevation: 6749.44 ft

#### Roadway Data for Crossing: South Curtis Road

Roadway Profile Shape: Irregular Roadway Shape (coordinates) Roadway Surface: Paved Roadway Top Width: 22.00 ft





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BASIN DESIGNATION I.D.: BASIN IDENTIFIER A: BASIN AREA B: C<sub>5</sub> C: C<sub>100</sub>



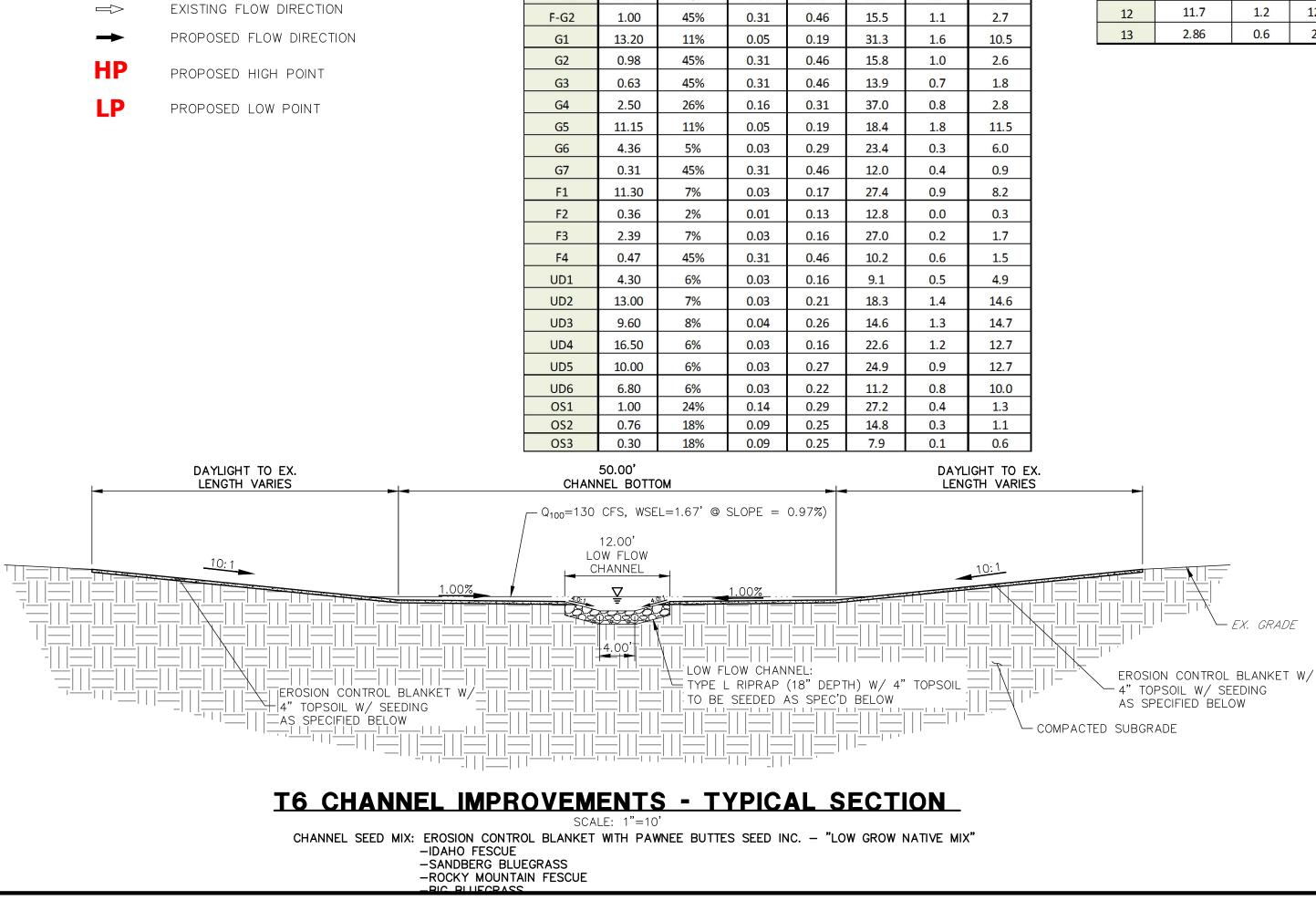
- BASIN DELINEATION
- EXISTING INDEX CONTOURS --6100--
- EXISTING INTERMEDIATE CONTOURS
- PROPOSED INDEX CONTOURS ---6100-
- PROPOSED INTERMEDIATE CONTOURS

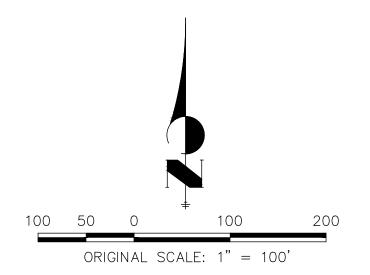
FILING 1 - SUB-BASIN SUMMARY TABLE											
Tributary	Area	Percent			t <sub>c</sub>	Q₅	<b>Q</b> 100				
Sub-basin	(acres)	Impervious	C₅	<b>C</b> <sub>100</sub>	(min)	(cfs)	(cfs)				
H1	7.90	11%	0.05	0.20	26.7	1.1	<mark>6.</mark> 9				
H2	10.40	11%	0.05	0.20	24.2	1.5	9.7				
H3	0.96	45%	0.31	0.46	14.7	1.1	2.6				
H4	1.90	2%	0.01	0.13	7.9	0.1	1.8				
11	1.10	45%	0.32	0.49	16.0	1.2	3.1				
12	0.74	45%	0.32	0.49	11.3	0.9	2.4				
13	<mark>0.61</mark>	45%	0.32	0.48	11.8	0.7	1.9				
14	14.85	7%	0.03	0.21	18.6	1.5	16.9				
15	0.82	45%	0.31	0.46	11.0	1.0	2.5				
16	19.92	8%	0.04	0.17	20.9	2.2	17.6				
17	3.91	6%	0.03	0.18	5.5	0.5	6.1				
F-G1	12.40	9%	0.04	0.18	<mark>39.3</mark>	1.1	7.9				
F-G2	1.00	45%	0.31	0.46	15.5	1.1	2.7				

FILING 1 - DESIGN POINT								
SUMMARY TABLE								
Design	Contributing	Q₅	<b>Q</b> 100					
Point	Acreage (ac)	(cfs)	(Cfs)					
1	8.9	1.4	8.2					
2	20.1	2.7	15.7					
3	22.9	3.4	18.3					
4	0.7	0.9	2.4					
5	16.8	3.4	21.8					
6	38.0	6.7	41.5					
7	25.6	2.1	14.8					
8	2.0	1.8	4.4					
9	26.2	2.5	15.6					
10	13.1	2.7	11.7					
11	46.5	4.7	25.9					
12	11.7	1.2	12.0					

2.7

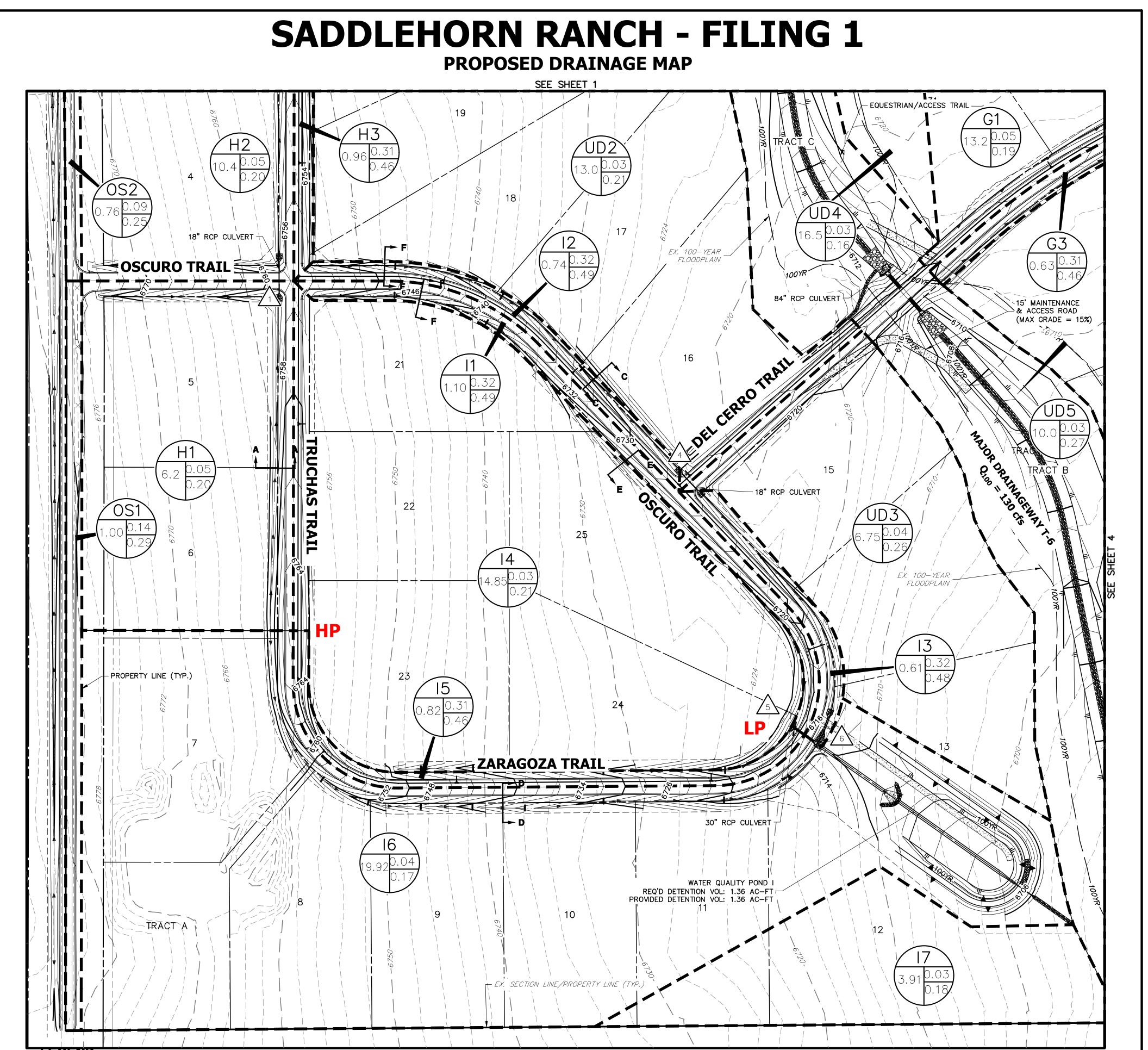
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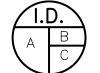




SADDLEHORN RANCH FILING 1 PROPOSED DRAINAGE MAP 2514202 11/27/19 SHEET 1 OF 4







I.D.: BASIN IDENTIFIER A: BASIN AREA B: C<sub>5</sub> C: C<sub>100</sub>



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DESIGN POINT

- BASIN DELINEATION
- EXISTING INDEX CONTOURS --6100--
- EXISTING INTERMEDIATE CONTOURS

BASIN DESIGNATION

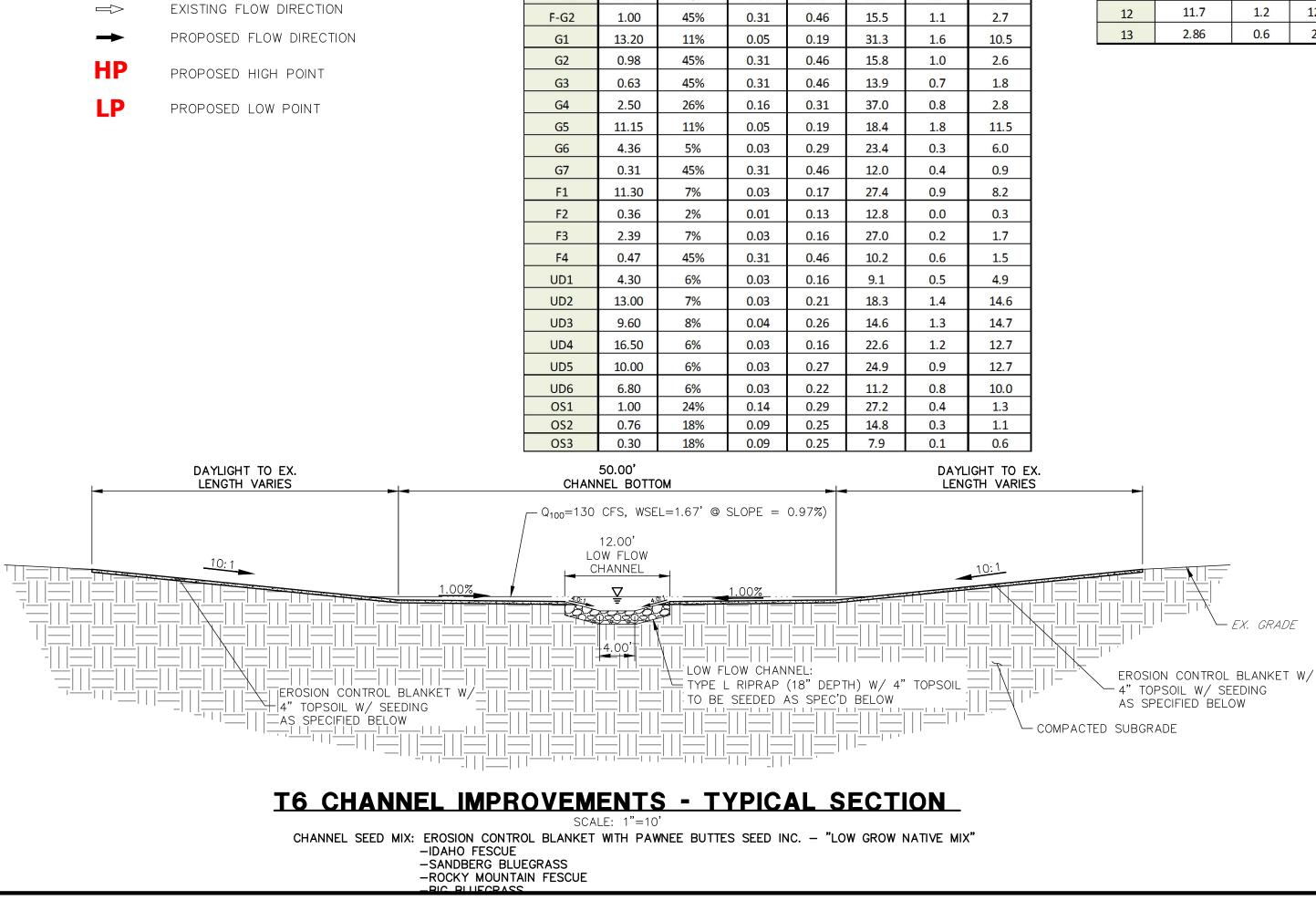
- PROPOSED INDEX CONTOURS ---6100-
- PROPOSED INTERMEDIATE CONTOURS

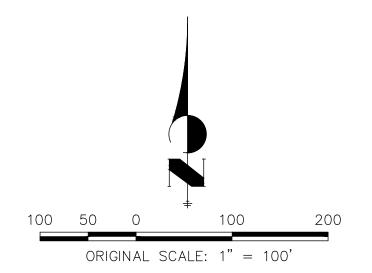
FILING 1 - SUB-BASIN SUMMARY TABLE									
Tributary	Area	Percent			t <sub>c</sub>	Q₅	<b>Q</b> <sub>100</sub>		
Sub-basin	(acres)	Impervious	C₅	<b>C</b> <sub>100</sub>	(min)	(cfs)	(cfs)		
H1	7.90	11%	0.05	0.20	26.7	1.1	<mark>6.</mark> 9		
H2	10.40	11%	0.05	0.20	24.2	1.5	9.7		
H3	0.96	45%	0.31	0.46	14.7	1.1	2.6		
H4	1.90	2%	0.01	0.13	7.9	0.1	1.8		
l1	1.10	45%	0.32	0.49	16.0	1.2	3.1		
12	0.74	45%	0.32	0.49	11.3	0.9	2.4		
13	0.61	45%	0.32	<mark>0.48</mark>	11.8	0.7	1.9		
14	14.85	7%	0.03	0.21	18.6	1.5	16.9		
15	0.82	45%	0.31	0.46	11.0	1.0	2.5		
16	19.92	8%	0.04	0.17	20.9	2.2	17.6		
17	3.91	6%	0.03	0.18	5.5	0.5	6.1		
F-G1	12.40	9%	0.04	0.18	<mark>39.3</mark>	1.1	<mark>7.</mark> 9		

FILING 1 - DESIGN POINT							
SUMMARY TABLE							
Design	Contributing	Q₅	<b>Q</b> 100				
Point	Acreage (ac)	(cfs)	(Cfs)				
1	8.9	1.4	8.2				
2	20.1	2.7	15.7				
3	22.9	3.4	18.3				
4	0.7	0.9	2.4				
5	16.8	3.4	21.8				
6	38.0	6.7	41.5				
7	25.6	2.1	14.8				
8	2.0	1.8	4.4				
9	26.2	2.5	15.6				
10	13.1	2.7	11.7				
11	46.5	4.7	25.9				
12	11.7	1.2	12.0				

2.7

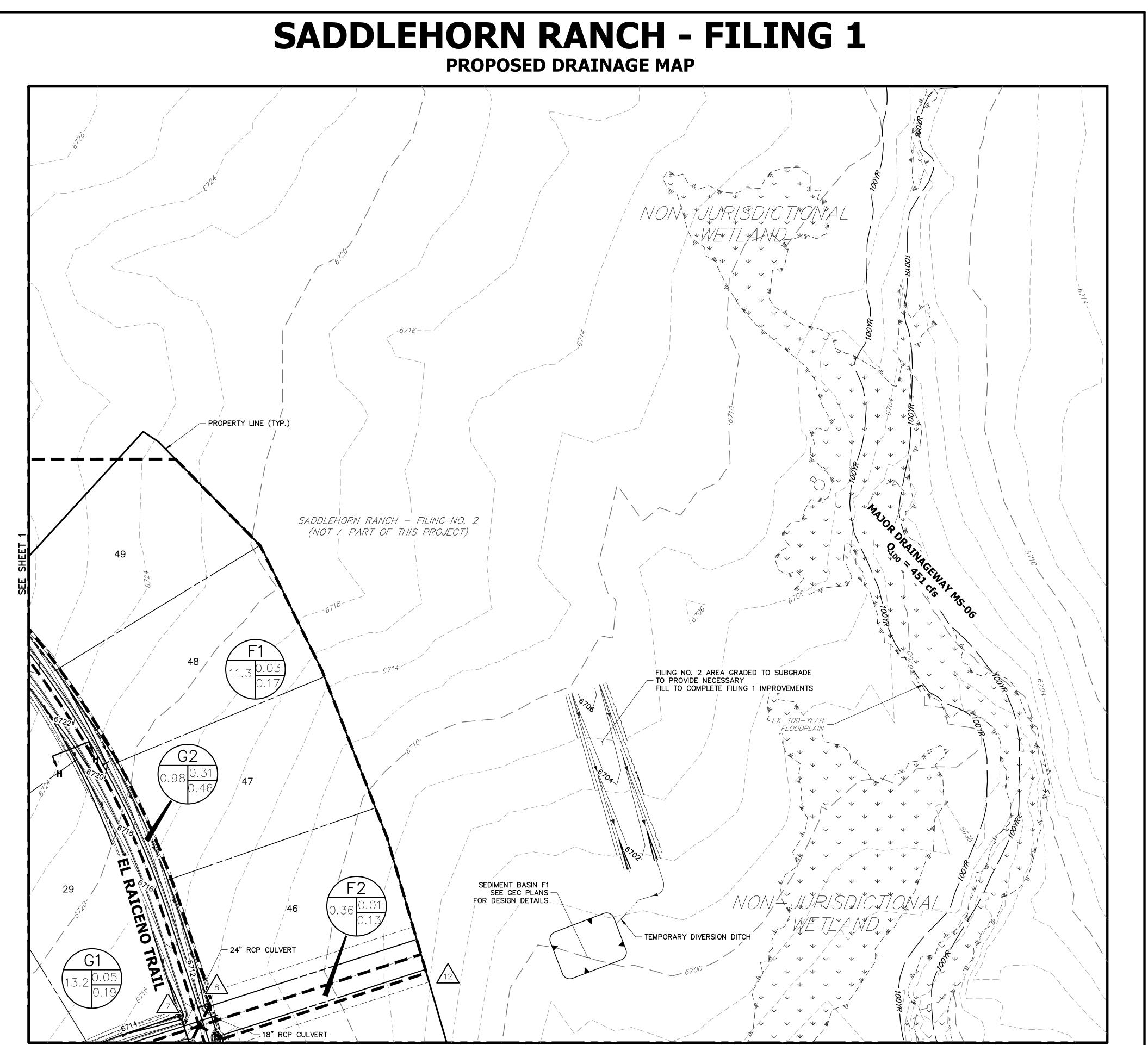
0.6





SADDLEHORN RANCH FILING 1 PROPOSED DRAINAGE MAP 2514202 11/27/19 SHEET 2 OF 4





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(1.D.	BASIN DESIGNATION
A B C	I.D.: BASIN IDENTIFIER A: BASIN AREA B: C <sub>5</sub> C: C <sub>100</sub>
$\bigwedge$	DESIGN POINT
	BASIN DELINEATION
6100	EXISTING INDEX CONTOURS
	EXISTING INTERMEDIATE CONTOURS
6100	PROPOSED INDEX CONTOURS
	PROPOSED INTERMEDIATE CONTOURS

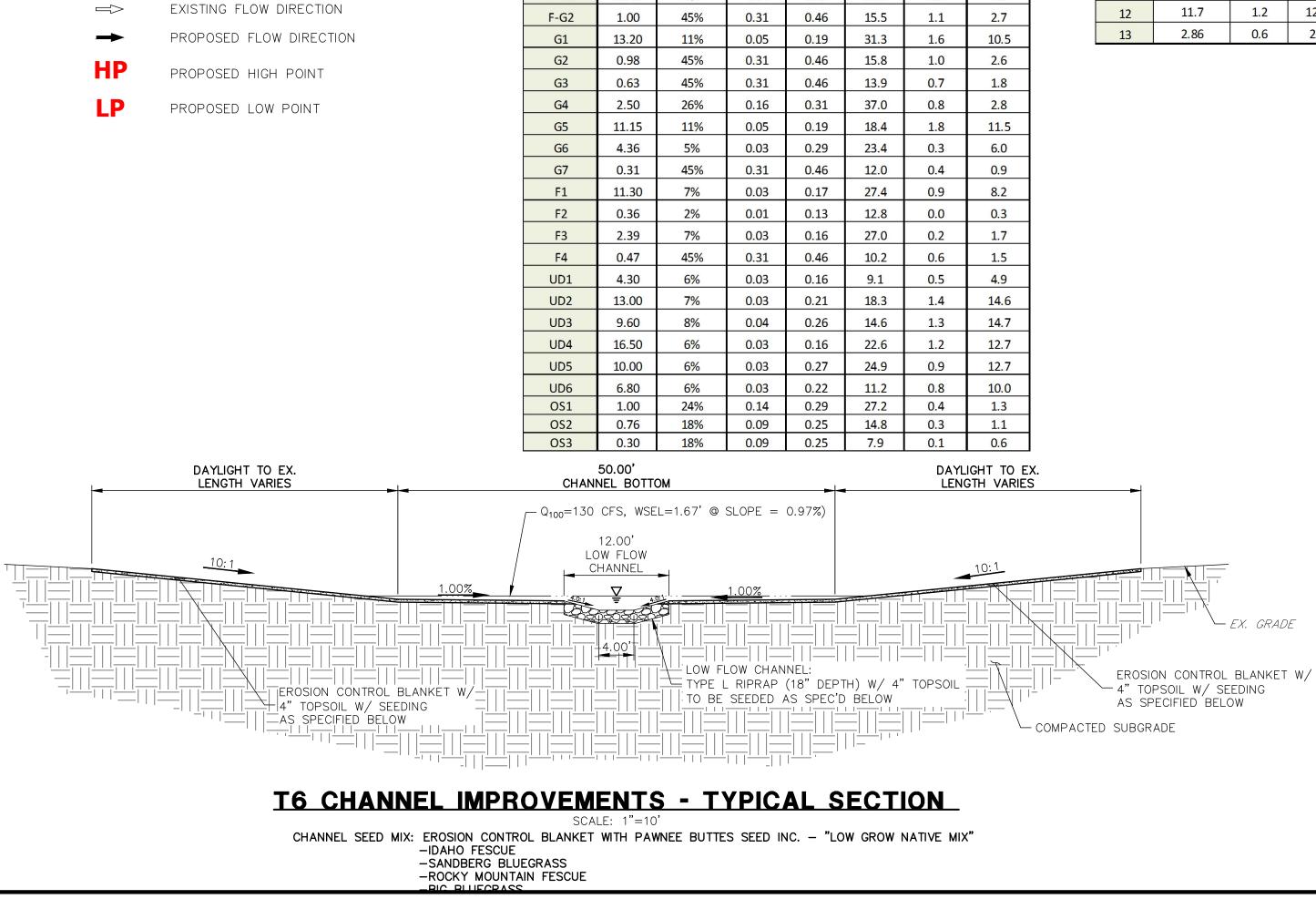
SEE SHEET 4

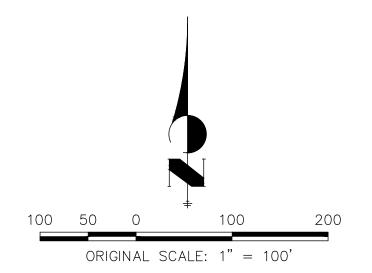
	FILING 1 - SUB-BASIN SUMMARY TABLE									
Tributary	Area	Percent			t <sub>c</sub>	Q₅	<b>Q</b> 100			
Sub-basin	(acres)	Impervious	C₅	<b>C</b> <sub>100</sub>	(min)	(cfs)	(cfs)			
H1	7.90	11%	0.05	0.20	26.7	1.1	6.9			
H2	10.40	11%	0.05	0.20	24.2	1.5	9.7			
H3	0.96	45%	0.31	0.46	14.7	1.1	2.6			
H4	1.90	2%	0.01	0.13	7.9	0.1	1.8			
11	1.10	45%	0.32	0.49	16.0	1.2	3.1			
12	0.74	<mark>45%</mark>	0.32	0.49	11.3	0.9	2.4			
13	0.61	45%	0.32	0.48	11.8	0.7	1.9			
14	14.85	7%	0.03	0.21	18.6	1.5	16.9			
15	0.82	45%	0.31	0.46	11.0	1.0	2.5			
16	19.92	8%	0.04	0.17	20.9	2.2	17.6			
17	3.91	6%	0.03	0.18	5.5	0.5	6.1			
F-G1	12.40	9%	0.04	0.18	39.3	1.1	7.9			
F-G2	1.00	45%	0.31	0.46	15 5	11	27			

FILING 1 - DESIGN POINT									
	SUMMARY TABLE								
Design	Contributing	Q <sub>5</sub>							
Point			Q <sub>100</sub> (Cfs)						
Point	Acreage (ac)	(cfs)							
1	8.9	1.4	8.2						
2	20.1	2.7	15.7						
3	22.9	3.4	18.3						
4	0.7	0.9	2.4						
5	16.8	3.4	21.8						
6	38.0	6.7	41.5						
7	25.6	2.1	14.8						
8	2.0	1.8	4.4						
9	26.2	2.5	15.6						
10	13.1	2.7	11.7						
11	46.5	4.7	25.9						
12	11.7	1.2	12.0						

2.7

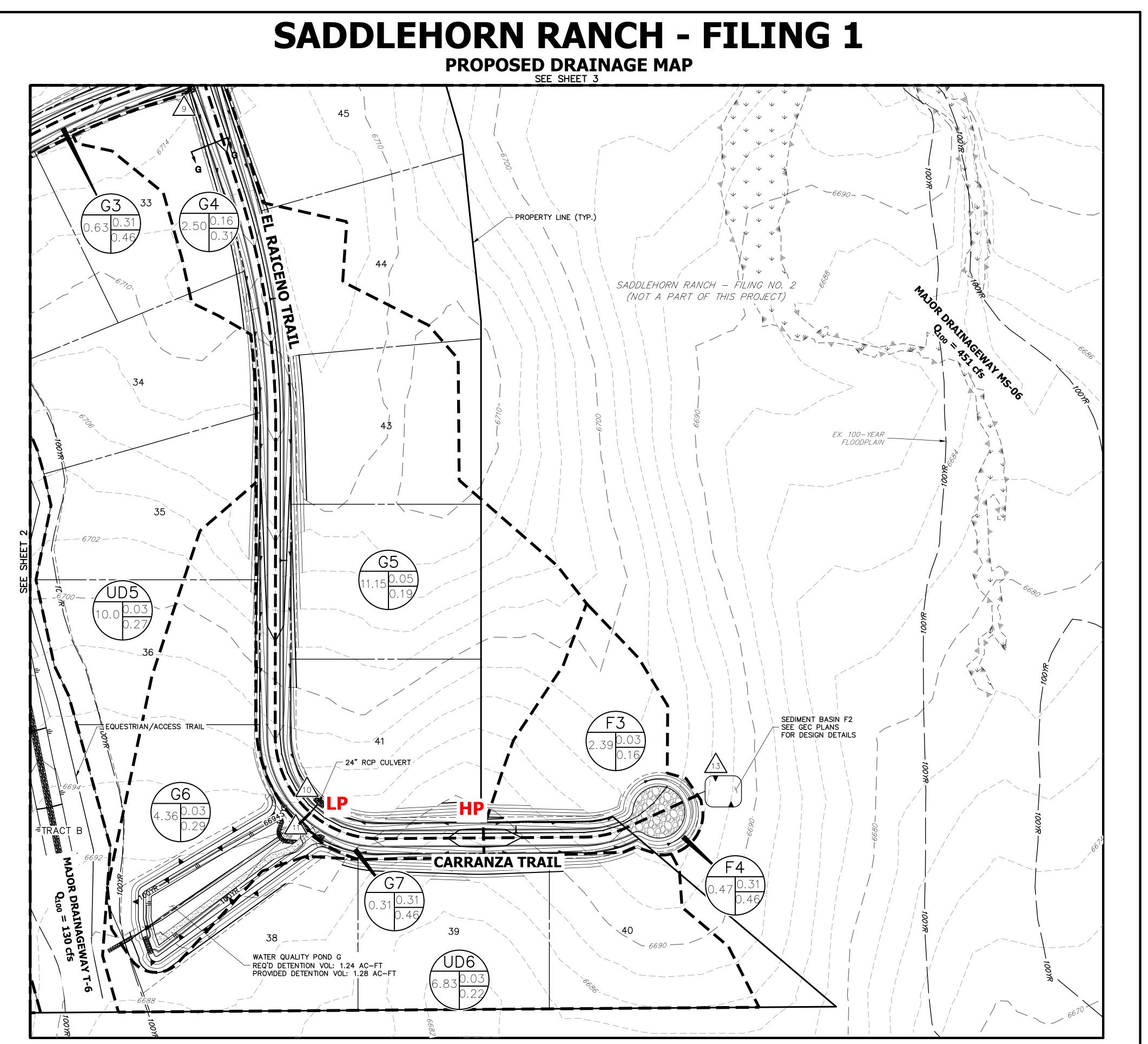
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SADDLEHORN RANCH FILING 1 PROPOSED DRAINAGE MAP 2514202 11/27/19 SHEET 3 OF 4

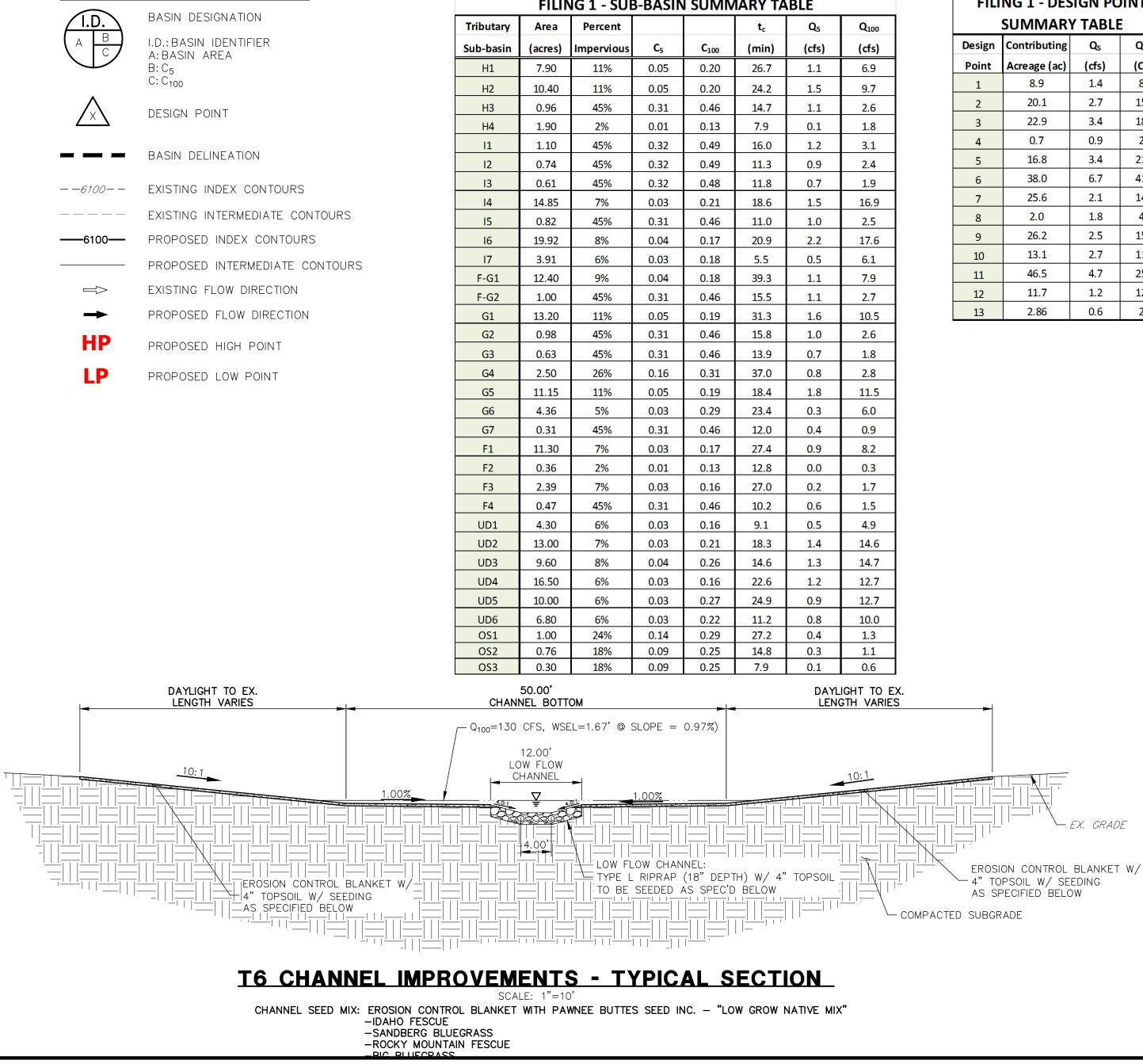




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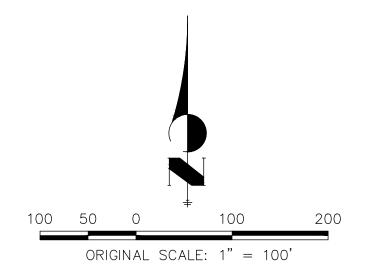


FILING 1 - SUB-BASIN SUMMARY TABLE									
Tributary	Area	Percent			t <sub>c</sub>	Q₅	<b>Q</b> 100		
Sub-basin	(acres)	Impervious	C₅	<b>C</b> <sub>100</sub>	(min)	(cfs)	(cfs)		
H1	7.90	11%	0.05	0.20	26.7	1.1	6.9		
H2	10.40	11%	0.05	0.20	24.2	1.5	9.7		
H3	0.96	45%	0.31	0.46	14.7	1.1	2.6		
H4	1.90	2%	0.01	0.13	7.9	0.1	1.8		
l1	1.10	45%	0.32	<mark>0.49</mark>	16.0	1.2	3.1		
12	0.74	45%	0.32	0.49	11.3	0.9	2.4		
13	0.61	45%	0.32	<mark>0.48</mark>	11.8	0.7	1.9		
14	14.85	7%	0.03	0.21	18.6	1.5	16.9		
15	0.82	45%	0.31	0.46	11.0	1.0	2.5		
<mark>1</mark> 6	19.92	8%	0.04	0.17	20.9	2.2	17.6		
17	3.91	6%	0.03	0.18	5.5	0.5	6.1		
F-G1	12.40	9%	0.04	0.18	<mark>39.3</mark>	1.1	7.9		
F-G2	1.00	45%	0.31	0.46	15.5	1.1	2.7		

FILING 1 - DESIGN POINT							
Design	SUMMARY TABLE           Design         Contributing         Q5         Q100						
Point	Acreage (ac)	(cfs)	(Cfs)				
1	8.9	1.4	8.2				
2	20.1	2.7	15.7				
3	22.9	3.4	18.3				
4	0.7	0.9	2.4				
5	16.8	3.4	21.8				
6	38.0	6.7	41.5				
7	25.6	2.1	14.8				
8	2.0	1.8	4.4				
9	26.2	2.5	15.6				
10	13.1	2.7	11.7				
11	46.5	4.7	25.9				
12	11.7	1.2	12.0				

2.7

0.6

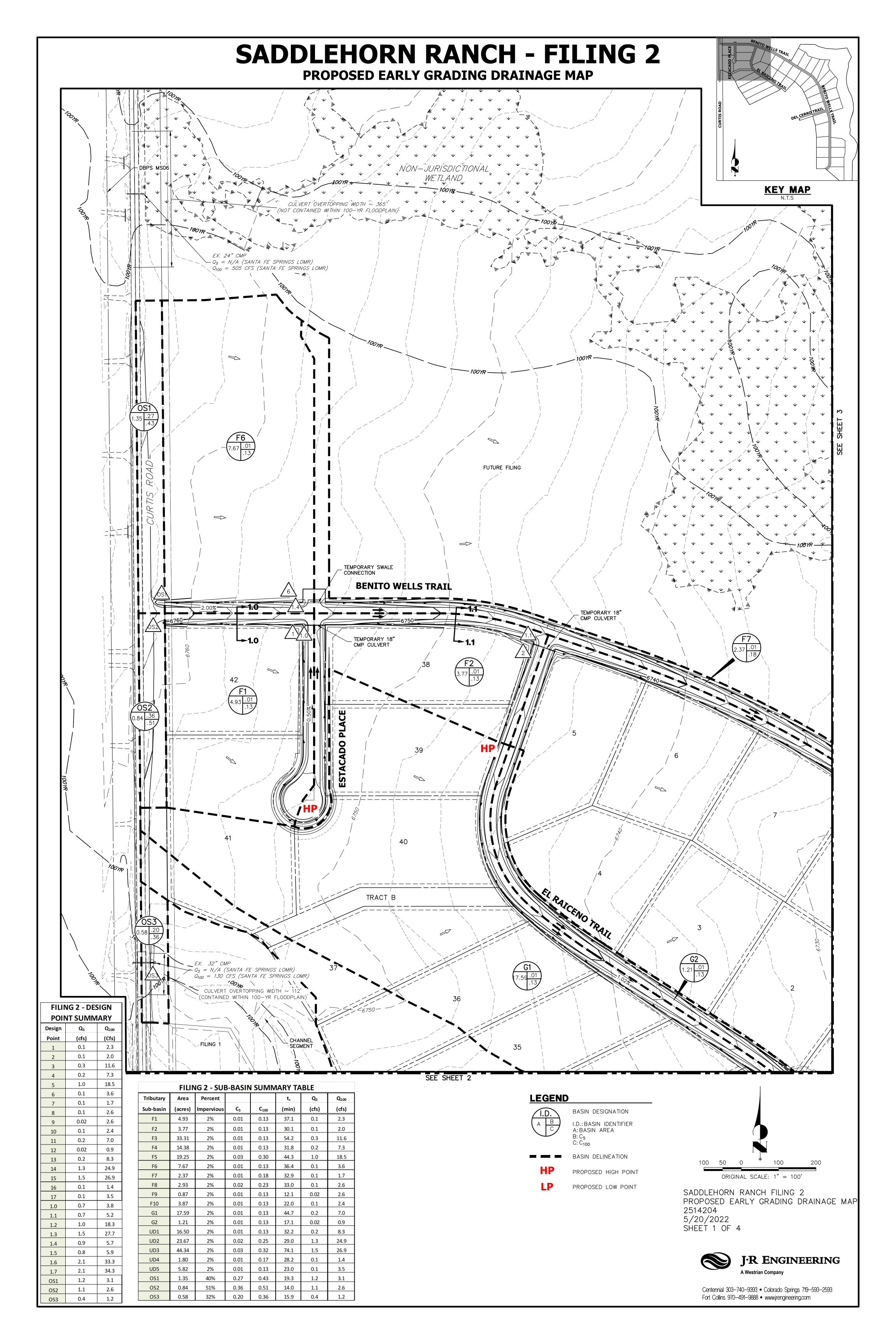


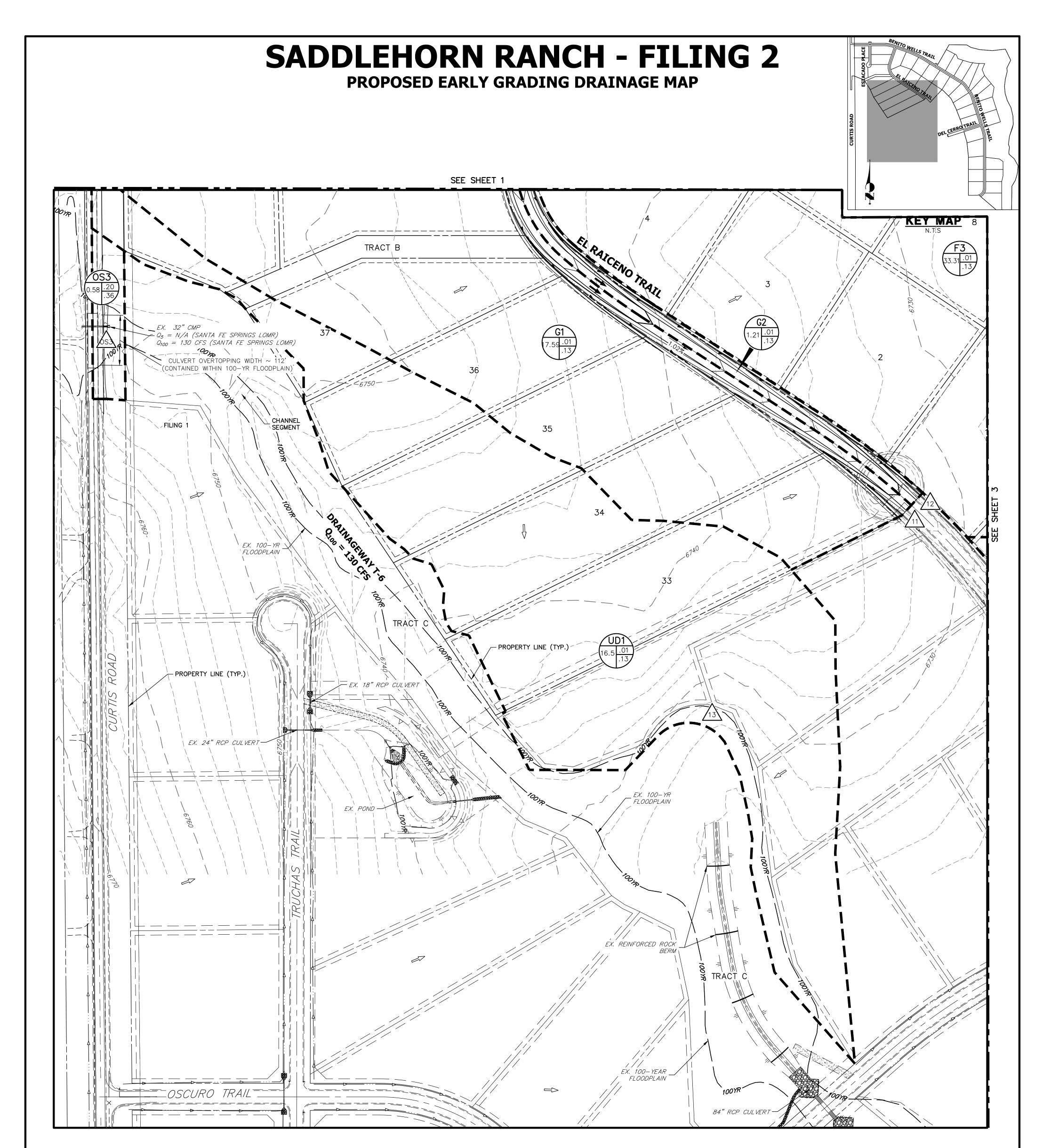
SADDLEHORN RANCH FILING 1 PROPOSED DRAINAGE MAP 2514202 11/27/19 SHEET 4 OF 4



## APPENDIX F

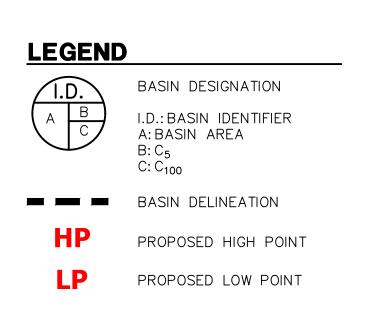
## DRAINAGE MAPS & PLANS

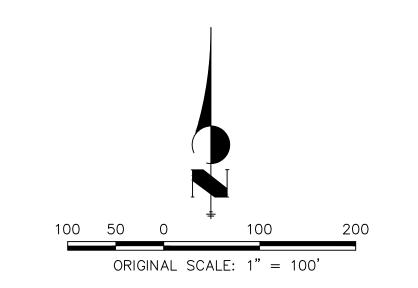




FILING 2 - DESIGN						
POINT SUMMARY						
Design	Q₅	<b>Q</b> <sub>100</sub>				
Point	(cfs)	(Cfs)				
1	0.1	2.3				
2	0.1	2.0				
3	0.3	11.6				
4	0.2	7.3				
5	1.0	18.5				
6	0.1	3.6				
7	0.1	1.7				
8	0.1	2.6				
9	0.02	2.6				
10	0.1	2.4				
11	0.2	7.0				
12	0.02	0.9				
13	0.2	8.3				
14	1.3	24.9				
15	1.5	26.9				
16	0.1	1.4				
17	0.1	3.5				
1.0	0.7	3.8				
1.1	0.7	5.2				
1.2	1.0	18.3				
1.3	1.5	27.7				
1.4	0.9	5.7				
1.5	0.8	5.9				
1.6	2.1	33.3				
1.7	2.1	34.3				
OS1	1.2	3.1				
OS2	1.1	2.6				
OS3	0.4	1.2				

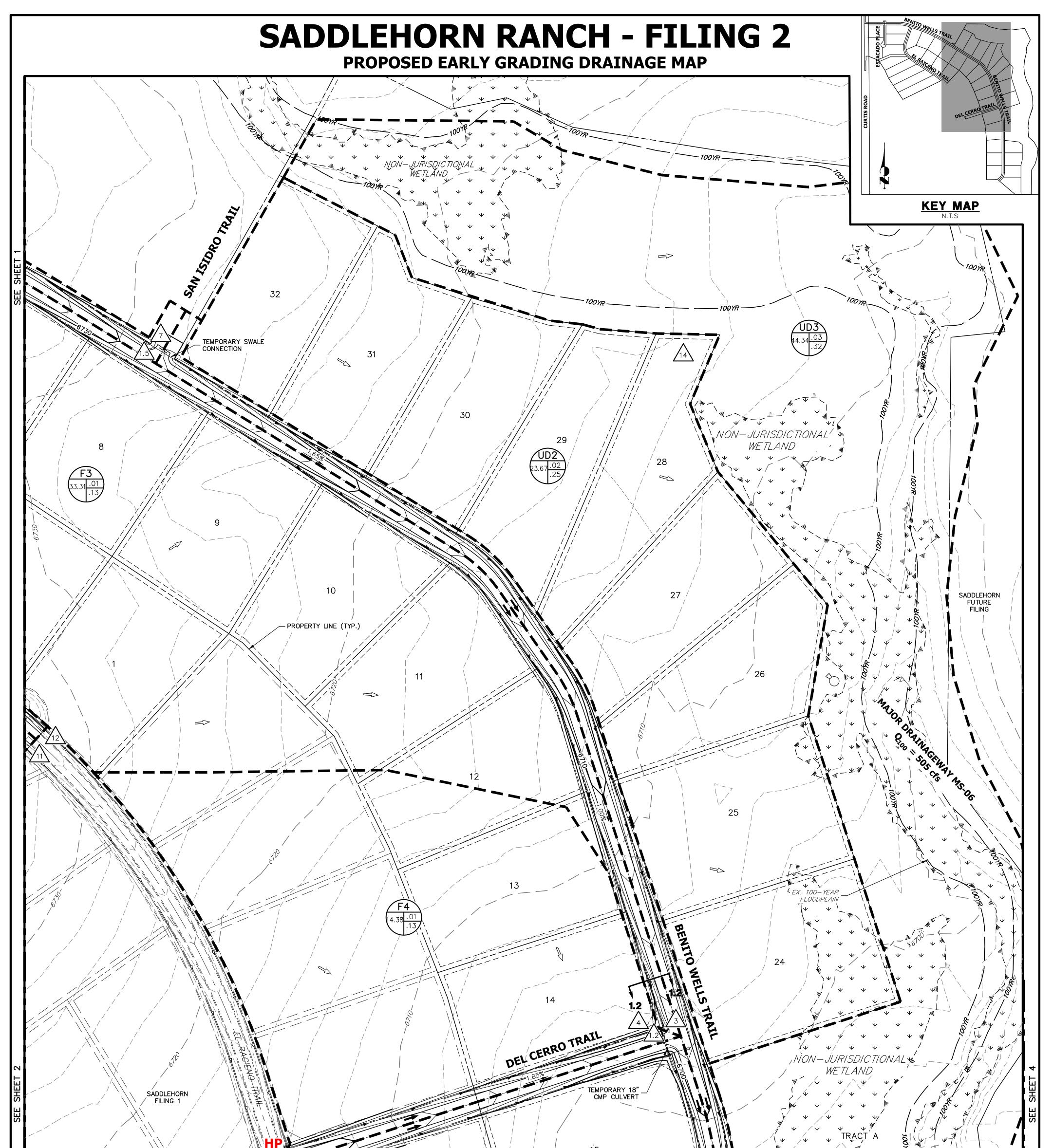
	FILING 2 - SUB-BASIN SUMMARY TABLE								
Tributary	Area	Percent			t <sub>c</sub>	Q₅	<b>Q</b> <sub>100</sub>		
Sub-basin	(acres)	Impervious	<b>C</b> <sub>5</sub>	<b>C</b> <sub>100</sub>	(min)	(cfs)	(cfs)		
F1	4.93	2%	0.01	0.13	37.1	0.1	2.3		
F2	3.77	2%	0.01	0.13	30.1	0.1	2.0		
F3	33.31	2%	0.01	0.13	54.2	0.3	11.6		
F4	14.38	2%	0.01	0.13	31.8	0.2	7.3		
F5	19.25	2%	0.03	0.30	44.3	1.0	18.5		
F6	7.67	2%	0.01	0.13	36.4	0.1	3.6		
F7	2.37	2%	0.01	0.18	32.9	0.1	1.7		
F8	2.93	2%	0.02	0.23	33.0	0.1	2.6		
F9	0.87	2%	0.01	0.13	12.1	0.02	2.6		
F10	3.87	2%	0.01	0.13	22.0	0.1	2.4		
G1	17.59	2%	0.01	0.13	44.7	0.2	7.0		
G2	1.21	2%	0.01	0.13	17.1	0.02	0.9		
UD1	16.50	2%	0.01	0.13	32.2	0.2	8.3		
UD2	23.67	2%	0.02	0.25	29.0	1.3	24.9		
UD3	44.34	2%	0.03	0.32	74.1	1.5	26.9		
UD4	1.80	2%	0.01	0.17	28.2	0.1	1.4		
UD5	5.82	2%	0.01	0.13	23.0	0.1	3.5		
OS1	1.35	40%	0.27	0.43	19.3	1.2	3.1		
OS2	0.84	51%	0.36	0.51	14.0	1.1	2.6		
OS3	0.58	32%	0.20	0.36	15.9	0.4	1.2		



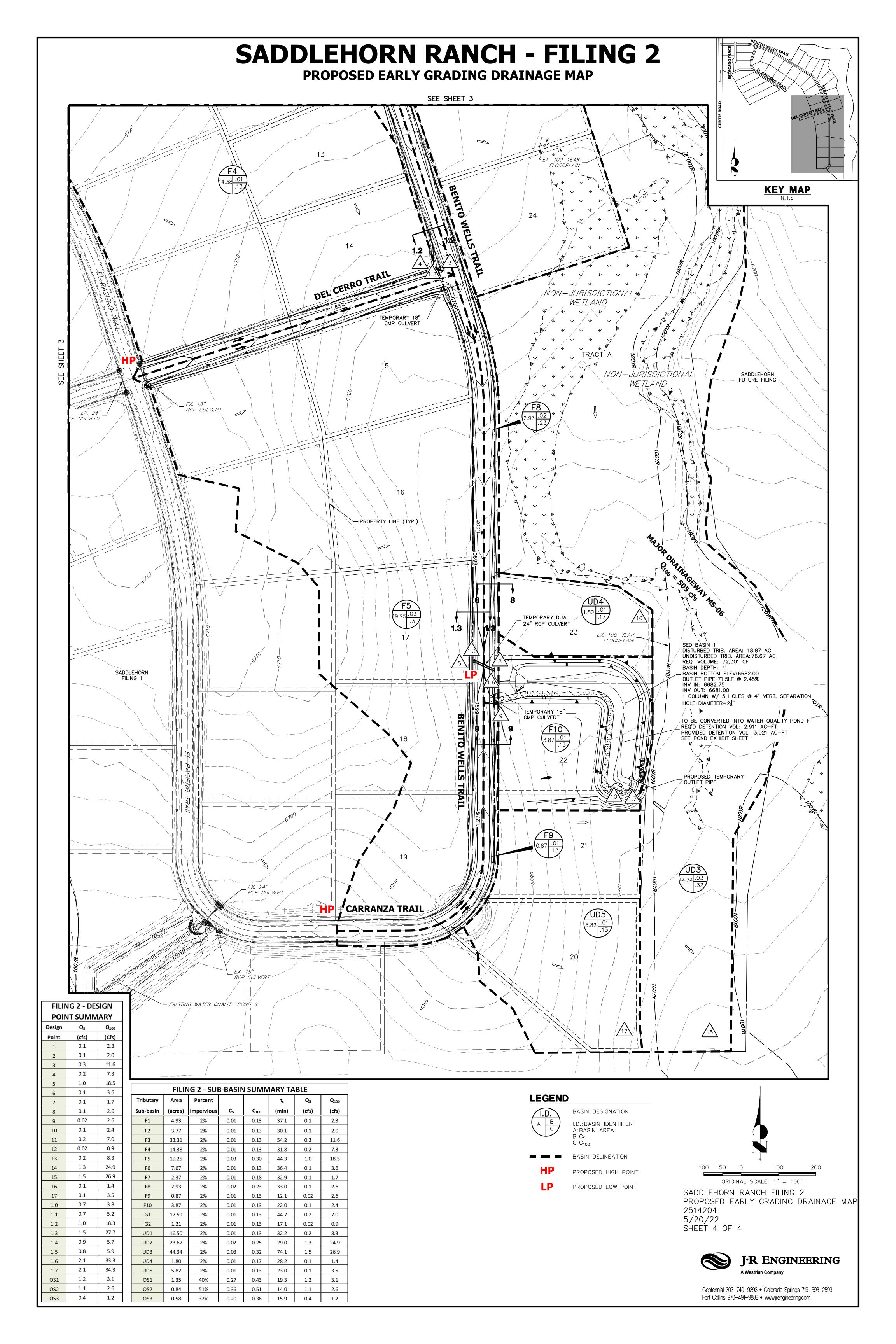


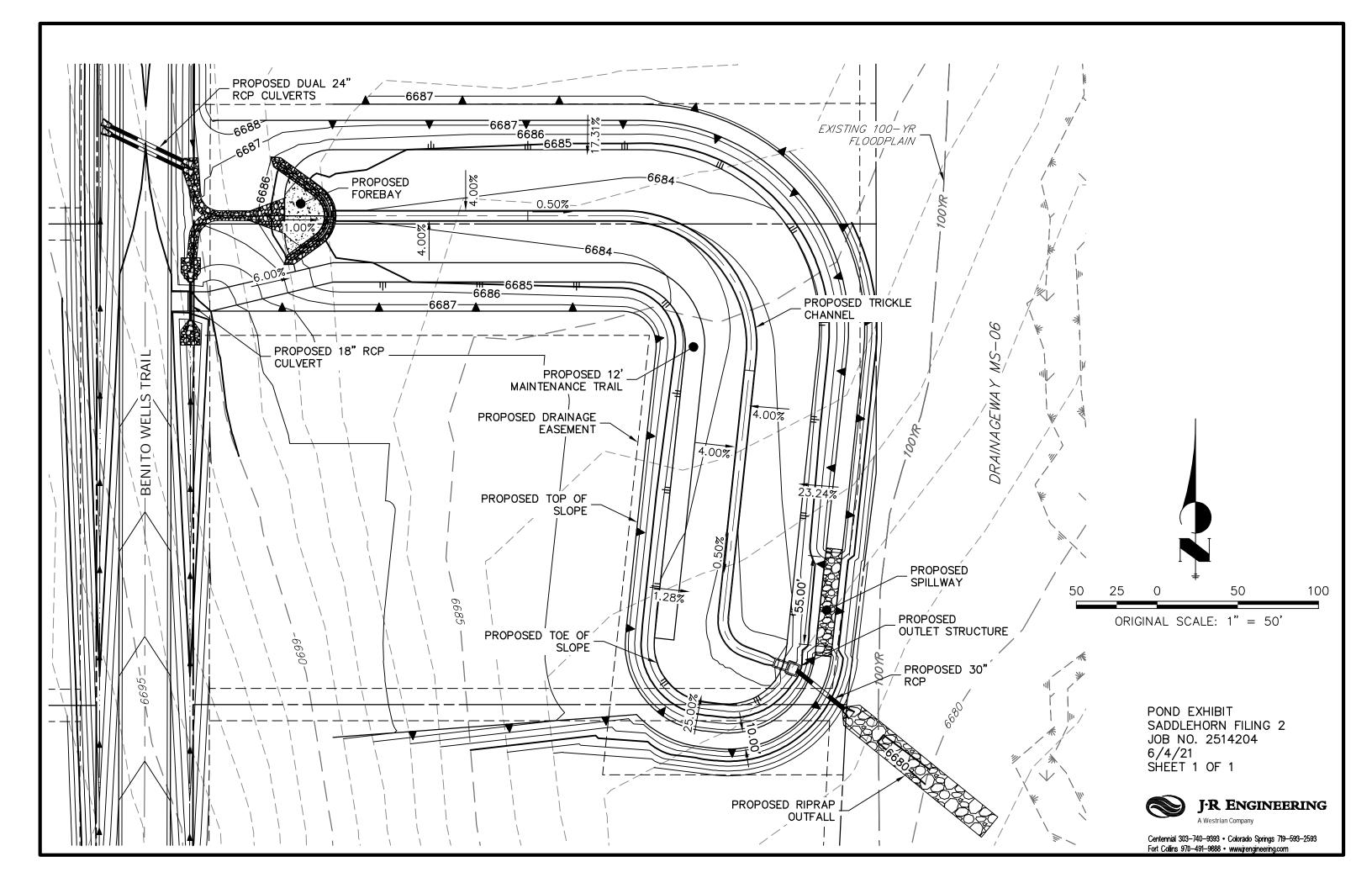
SADDLEHORN RANCH FILING 2 PROPOSED EARLY GRADING DRAINAGE MAP 2514204 5/20/2022 SHEET 2 OF 4

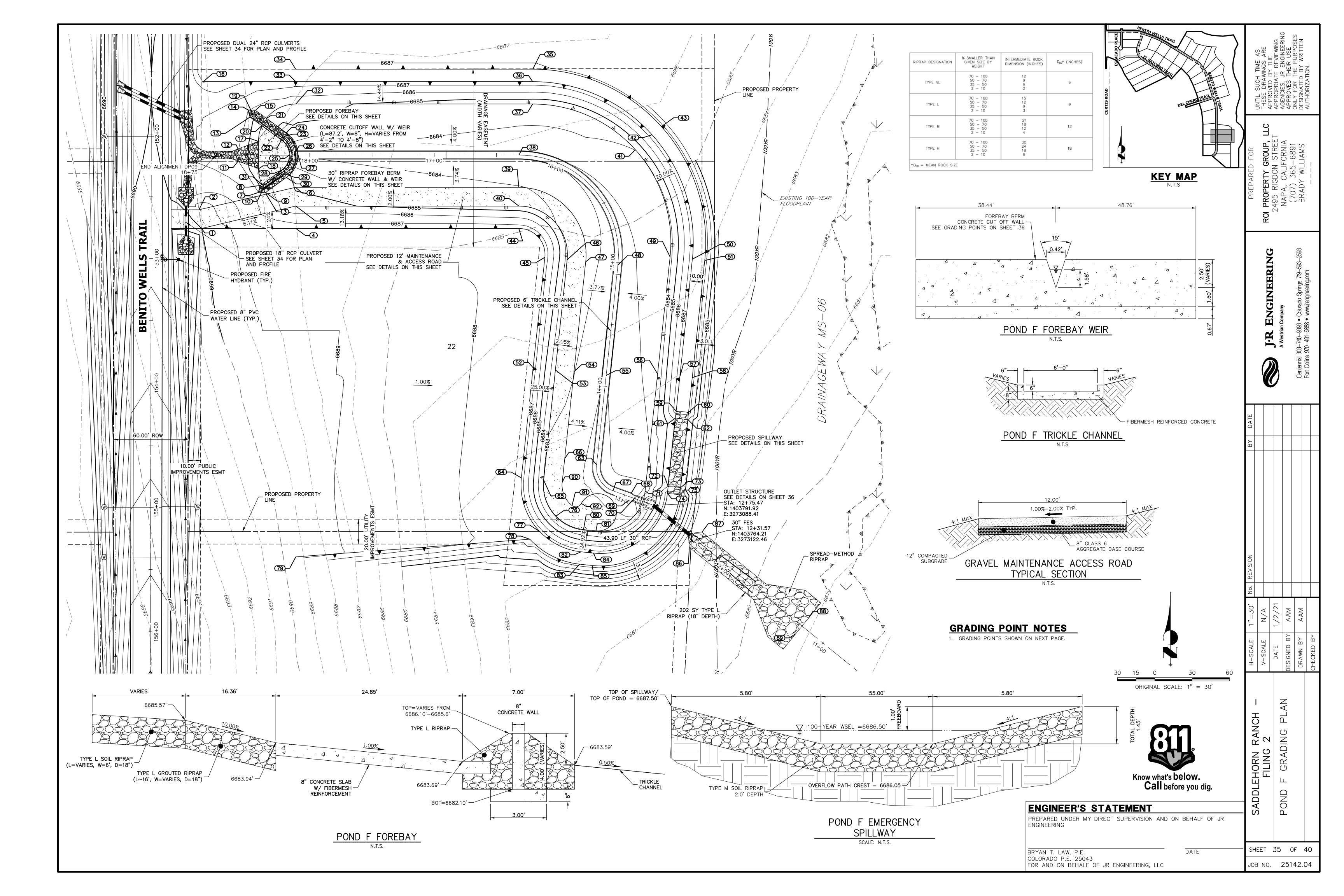


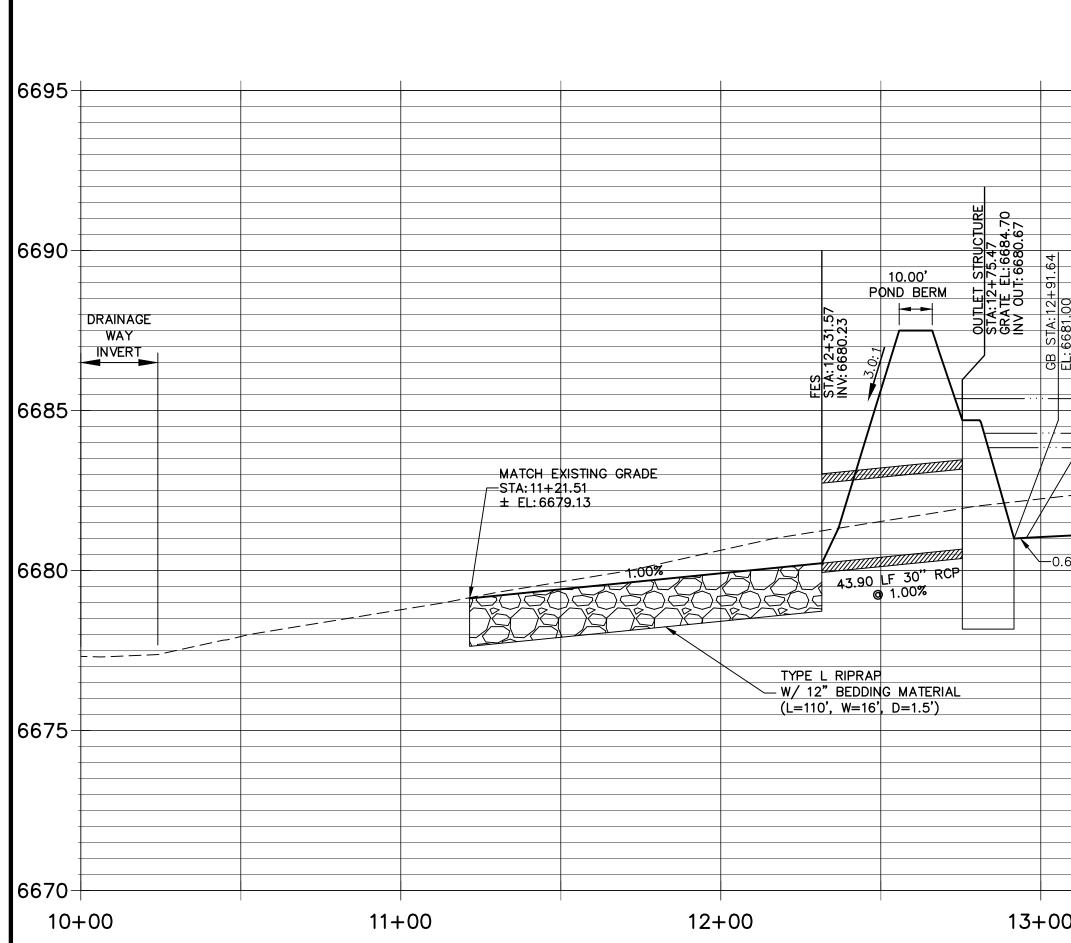


		G 2 - DES T SUMM			RC	EX. 24" CULVERT				EX. 18 RCP C	JL VERT	15 $\psi$ $\psi$ $\psi$ $\psi$ $\psi$ $\psi$ $\psi$ $\psi$ $\psi$ $\psi$
	Design	Q₅	<b>Q</b> <sub>100</sub>									
	Point	(cfs)	(Cfs)		/	_/				\		
	1	0.1	2.3					~			$\left  \right  \right $	
_	2	0.1	2.0				/				$\leq$	
	3	0.3	11.6				/					
_	4	0.2	7.3									SEE SHEET 4
	5	1.0	18.5 3.6		FILIN	IG 2 - SUE	B-BASIN		IARY TA	BLE		
	5	0.1	1.7	Tributary	Area	Percent			t	Q₅	<b>Q</b> <sub>100</sub>	LEGEND
	2	0.1	2.6	Sub-basin		Impervious	C₅	<b>C</b> <sub>100</sub>	(min)	(cfs)	(cfs)	
	9	0.02	2.6	F1	4.93	2%	0.01	0.13	37.1	0.1	2.3	
	10	0.1	2.4	F2	3.77	2%	0.01	0.13	30.1	0.1	2.0	A B I.D.: BASIN IDENTIFIER A: BASIN AREA
	11	0.2	7.0	F3	33.31	2%	0.01	0.13	54.2	0.3	11.6	B: C <sub>5</sub>
	12	0.02	0.9	F4	14.38	2%	0.01	0.13	31.8	0.2	7.3	C: C <sub>100</sub>
	13	0.2	8.3	F5	19.25	2%	0.03	0.30	44.3	1.0	18.5	BASIN DELINEATION
	14	1.3	24.9	F6	7.67	2%	0.01	0.13	36.4	0.1	3.6	HP PROPOSED HIGH POINT 100 50 0 <sup>1</sup> 100 200
	15	1.5	26.9	F7	2.37	2%	0.01	0.18	32.9	0.1	1.7	ORIGINAL SCALE: 1" = 100'
	16	0.1	1.4	F8	2.93	2%	0.02	0.23	33.0	0.1	2.6	
	17	0.1	3.5	F9	0.87	2%	0.01	0.13	12.1	0.02	2.6	SADDLEHORN RANCH FILING 2 PROPOSED EARLY GRADING DRAINAGE MAP
	1.0	0.7	3.8	F10	3.87	2%	0.01	0.13	22.0	0.1	2.4	2514204
	1.1	0.7	5.2	G1	17.59	2%	0.01	0.13	44.7	0.2	7.0	5/20/22
	1.2	1.0	18.3	G2	1.21	2%	0.01	0.13	17.1	0.02	0.9	SHEET 3 OF 4
	1.3	1.5 0.9	27.7	UD1	16.50	2%	0.01	0.13	32.2	0.2	8.3	
	1.4	0.9	5.7 5.9	UD2	23.67	2%	0.02	0.25	29.0	1.3	24.9	
	1.5 1.6	2.1	33.3	UD3 UD4	44.34 1.80	2% 2%	0.03 0.01	0.32 0.17	74.1 28.2	1.5	26.9 1.4	J·R ENGINEERING
	1.7	2.1	34.3	UD5	5.82	2% 2%	0.01	0.17	28.2	0.1	3.5	
	OS1	1.2	3.1	OS1	1.35	40%	0.01	0.13	19.3	1.2	3.1	A Westrian Company
	OS2	1.1	2.6	OS2	0.84	51%	0.36	0.51	14.0	1.1	2.6	Centennial 303–740–9393 • Colorado Springs 719–593–2593
	OS3	0.4	1.2	0\$3	0.58	32%	0.20	0.36	15.9	0.4	1.2	Fort Collins 970-491-9888 • www.jrengineering.com









ID NO.	DESCRIPTION	NORTHING/EASTING ELEVATIO			
ID NO.	DESCRIPTION	NOR THING/EASTING			
1	ACCESS ROAD/TOP	N:1404014.35 E:3272725.47	6690.00		
2	ACCESS ROAD	N: 1404029.36 E: 3272723.28	6689.74		
3	ACCESS ROAD	N: 1404041.88 E: 3272777.25	6686.36		
4	ACCESS ROAD/TOP	N:1404014.35 E: 3272801.15	6687.50		
5	ACCESS ROAD/TOE	N: 1404032.35 E: 3272801.15	6685.24		
6	ACCESS ROAD	N: 1404047.35 E: 3272800.81	6684.94		
7	RIPRAP	N:1404043.16 E: 3272770.82	6686.10		
8	TOE OF BERM	N: 1404048.93 E: 3272772.81	6684.40		
9	TOE OF BERM	N:1404043.26 E:3272776.93	6686.29		
10	END CONCRETE WALL/TOP OF BERM	N:1404046.10 E: 3272774.87	5901.89		
11	RIPRAP/CONCRETE	N: 1404068.36 E: 3272754.79	6686.08		
12	RIPRAP/CONCRETE	N:1404078.37 E: 3272754.79	6686.07		
13	RIRRAP	N:1404103.85 E: 3272764.33	6685.40		
14	RIPRAP	N:1404109.71 E:3272762.62	6686.10		
15	RIPRAP	N: 1404109.32 E: 3272768.71	6685.77		
16	ТОР	N:1404132.35 E:3272726.82	6689.11		
17	RIPRAP/CONCRETE	N: 1404084.35 E: 3272771.15	6683.99		
18	RIPRAP/CONCRETE	N:1404062.35 E: 3272771.15	6683.99		
19	START CONCRETE WALL/TOP OF BERM	N:1404106.68 E:3272766.39	6686.07		

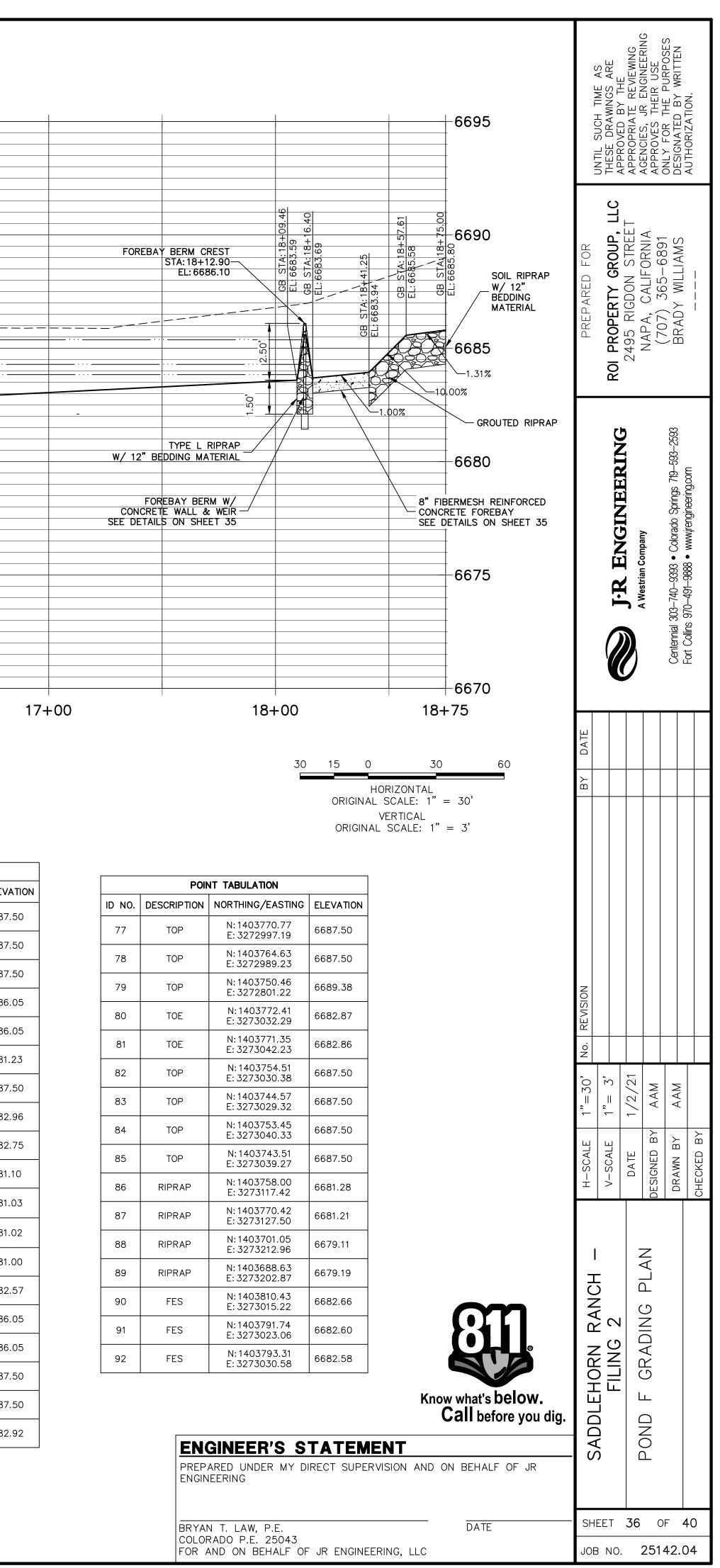
POINT TABULATION							
ID NO.	DESCRIPTION	NORTHING/EASTING	ELEVATION				
20	TOE OF BERM	N:1404096.88 E: 3272773.89	6684.06				
21	TOE OF BERM	N: 1404102.88 E: 3272777.55	6685.17				
22	TOE OF BERM	N:1404085.41 E: 3272789.65	6683.83				
23	TOP OF BERM	N: 1404088.44 E: 3272791.43	6685.78				
24	TOE OF BERM	N:1404091.30 E: 3272793.44	6684.88				
25	TOE OF BERM	N:1404073.35 E: 3272796.00	6683.69				
26	TOP OF BERM	N:1404073.35 E: 3272799.50	6685.60				
27	TRICKLE CHANNEL INV	N: 1404073.35 E: 3272802.94	6683.59				
28	TOE OF BERM	N:1404061.06 E: 3272789.53	6683.84				
29	TOP OF BERM	N: 1404058.39 E: 3272791.83	6685.82				
30	TOE OF BERM	N: 1404055.34 E: 3272793.56	6685.26				
31	TOE OF BERM	N:1404049.74 E: 3272773.93	6684.13				
32	TOE	N: 1404114.35 E: 3272801.15	6685.17				
33	ТОР	N: 1404132.35 E: 3272801.15	6687.50				
34	TOP	N:1404142.35 E:3272801.14	6687.50				
35	TOP	N:1404142.35 E: 3272991.53	6687.50				
36	TOP	N: 1404132.35 E: 3272991.53	6687.50				
37	TOP	N: 1404114.35 E: 3272991.53	6684.30				
38	TRICKLE CHANNEL INV	N:1404073.35 E: 3272980.41	6682.71				

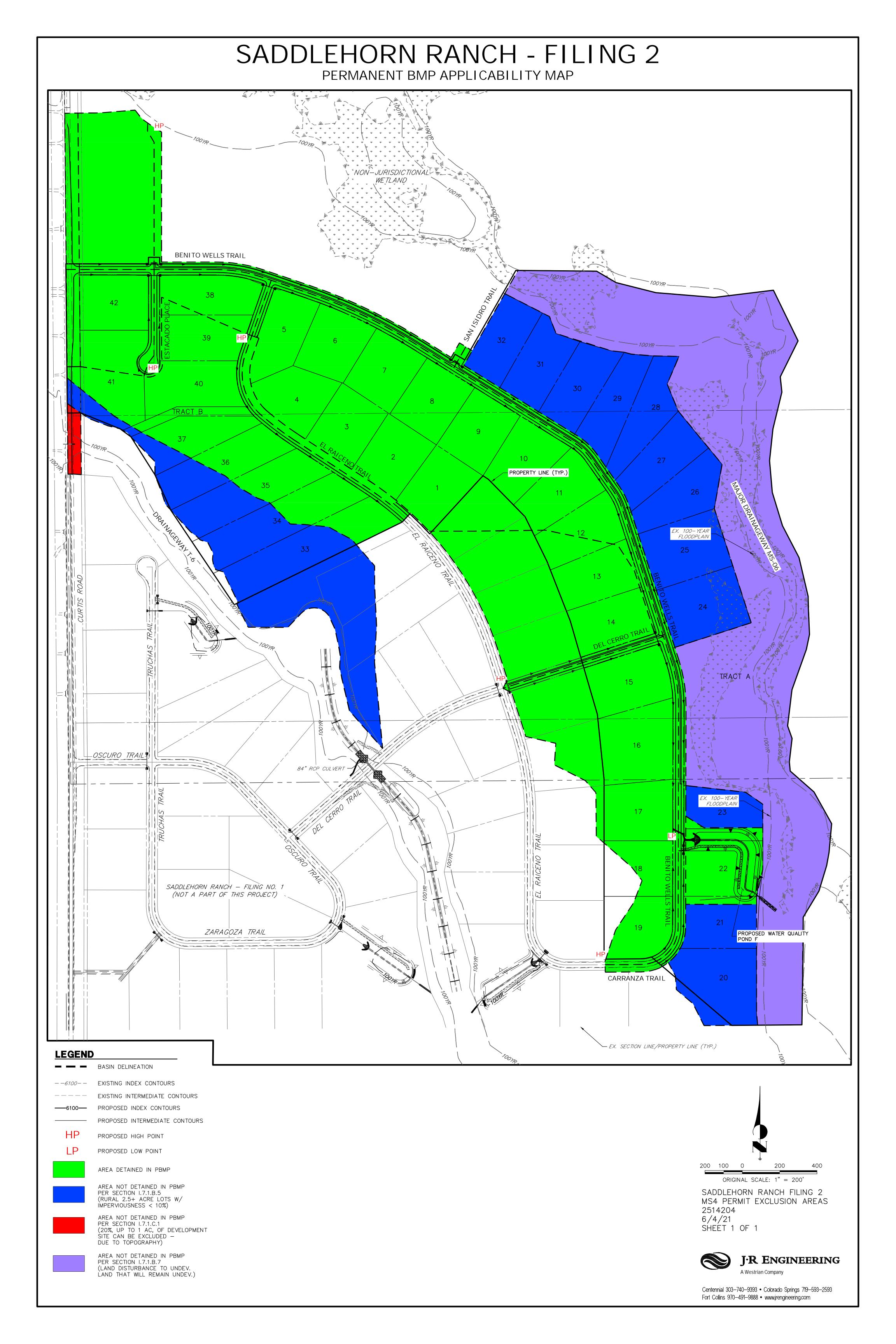
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	$\frac{\nabla \text{EURV WSEL}}{=} \frac{66}{=} \frac{\nabla \text{WQCV WSEL}}{=}$	= 6683.84				· · · · · · · ·	· · · · -
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	POINT TA	BULATION	
ID NO.	DESCRIPTION	NORTHING/EASTING	ELEVATION
39	ACCESS ROAD	N: 1404047.35 E: 3272980.41	6684.05
40	TOE	N: 1404032.35 E: 3272980.41	6684.35
41	TOE	N:1404077.57 E: 3273074.07	6684.00
42	TOP	N:1404089.60 E: 3273087.46	6687.50
43	TOP	N:1404096.29 E: 3273094.89	6687.48
44	TOP	N: 1404014.35 E: 3272980.41	6687.50
45	TOP	N:1403991.13 E: 3273001.29	6687.50
46	TOE	N: 1403989.22 E: 3273019.19	6683.68
47	ACCESS TRAIL	N: 1403987.63 E: 3273034.10	6683.38
48	TRICKLE CHANNEL INV	N:1403984.88 E: 3273059.96	6682.04
49	TOE	N: 1403991.59 E: 3273101.90	6683.71
50	TOP	N: 1403989.69 E: 3273119.80	6687.50
51	TOP	N: 1403988.63 E: 3273129.75	6687.50
52	TOP	N: 1403902.53 E: 3272991.85	6687.50
53	TOE	N:1403900.62 E: 3273009.75	6683.25
54	ACCESS TRAIL	N:1403899.35 E: 3273024.70	6683.03
55	TRICKLE CHANNEL INV	N: 1403896.28 E: 3273050.52	6681.59
56	TOE	N:1403897.46 E: 3273091.87	6683.27
57	ТОР	N:1403895.56 E:3273109.77	6687.50

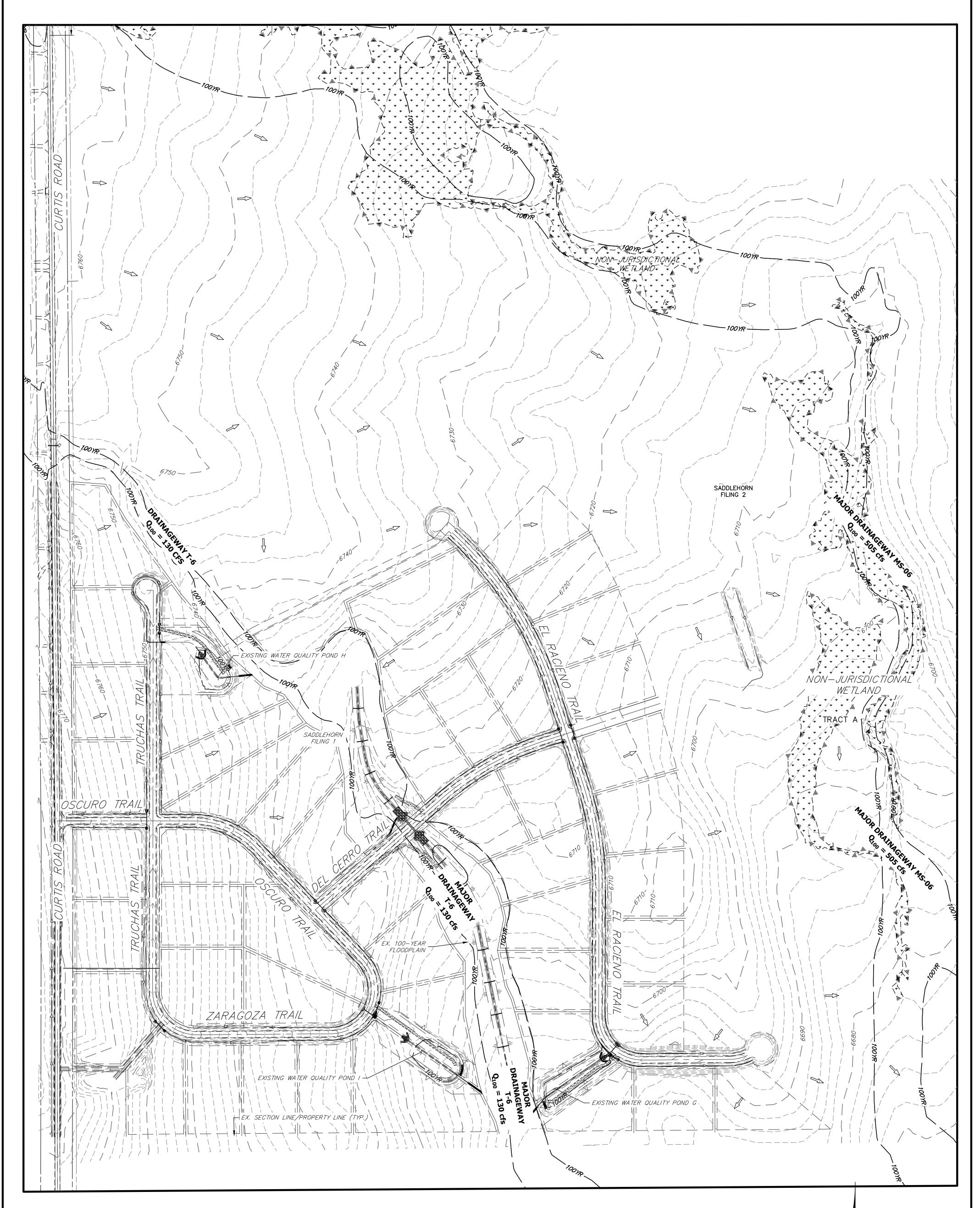
	POINT TABUL/	ATION	
ID NO.	DESCRIPTION	NORTHING/EASTING	ELEVA
58	ТОР	N:1403894.50 E: 3273119.72	6687.
59	SPILLWAY TOP	N:1403867.65 E: 3273106.80	6687.
60	SPILLWAY TOP	N:1403866.59 E: 3273116.74	6687.
61	SPILLWAY CREST	N:1403861.88 E: 3273106.19	6686.
62	SPILLWAY CREST	N: 1403860.82 E: 3273116.13	6686.
63	TRICKLE CHANNEL INV	N:1403824.51 E: 3273042.87	6681.
64	ТОР	N:1403813.93 E: 3272982.41	6687.
65	TOE	N:1403812.02 E: 3273000.31	6682.
66	ACCESS TRAIL	N:1403829.69 E: 3273017.27	6682.
67	TRICKLE CHANNEL INV	N:1403803.57 E: 3273055.99	6681.
68	BEGIN TRICKLE CHANNEL TAPER TO 4.0' TRICKLE CHANNEL	N:1403801.52 E: 3273070.58	6681.
69	BEGIN TRICKLE CHANNEL TAPER TO 4.0' TRICKLE CHANNEL	N:1403795.87 E: 3273068.55	6681.
70	OUTLET STRUCTURE	N:1403797.39 E:3273073.20	6681.
71	TOE	N: 1403803.33 E: 3273081.84	6682.
72	SPILLWAY CREST	N:1403807.19 E: 3273100.36	6686.
73	SPILLWAY CREST	N:1403806.13 E: 3273110.30	6686.
74	SPILLWAY TOP	N:1403801.42 E:3273099.74	6687.
75	SPILLWAY TOP	N:1403800.37 E: 3273109.69	6687.
76	TOE	N:1403783.25 E: 3273010.16	6682.





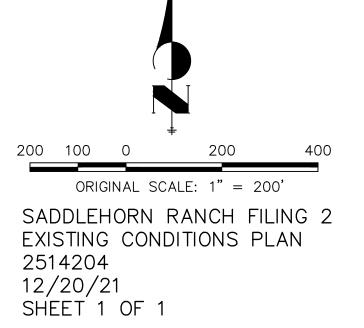
# **SADDLEHORN RANCH - FILING 2**

## **EXISTING CONDITIONS PLAN**



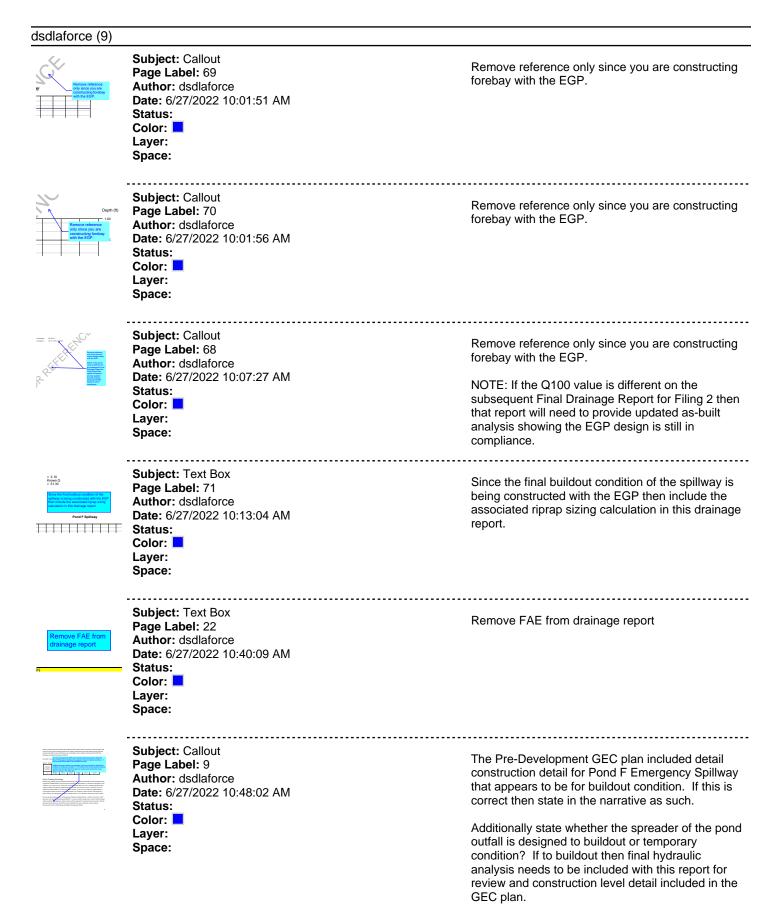
## LEGEND

--6100-- EXISTING INDEX CONTOURS
 ----- EXISTING INTERMEDIATE CONTOURS
 EXISTING FLOW DIRECTION





## Drainage Report\_v2 Redline.pdf Markup Summary



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- 5.55 Avriant - 2.55 Avriant	Subject: Text Box Page Label: 43 Author: dsdlaforce Date: 6/27/2022 11:00:14 AM Status: Color: Layer: Space:	Add "FOR REFERENCE ONLY" to all the roadside ditches. These will be reviewed with the FDR for Filing 2 Plat.
<text><text><text><text><text><text></text></text></text></text></text></text>	Subject: Callout Page Label: 9 Author: dsdlaforce Date: 6/27/2022 11:01:33 AM Status: Color: Layer: Space:	Update the narrative to describe. Is this proposed or existing? If proposed then provide construction details.
lpackman (2)		
p. LLC ref. 8 Unresolved: Remove the MDDPPretein chanage report and only include suppets of information pertinent to the design.	Subject: Text Box Page Label: 137 Author: Ipackman Date: 6/23/2022 10:31:11 AM Status: Color: Layer: Space:	Unresolved. Remove the MDDP/Prelim drainage report and only include snippets of information pertinent to the design.
555 91 Untersectived. Promove the and output include surgicipants of information performent to the design. 9 42,00	Subject: Text Box Page Label: 122 Author: Ipackman Date: 6/23/2022 10:31:36 AM Status: Color: Layer: Space:	Unresolved. Remove the MDDP/Prelim drainage report and only include snippets of information pertinent to the design.