# 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**

**May 8, 2020**
**Project No. 25142.00**

**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**

**PPR-21-020**

**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.

Mike Bramlett, Colorado P.E. # 32314
For and On Behalf of JR Engineering, LLC

11/30/20
Date

COLORADO LICENSED MIKE BRAMLETT MB 32314 11/30/20 PROFESSIONAL ENGINEER

**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: Bill Munn FOR ROI PROPERTY GROUP, LLC

Title: AGENT/P.O.A.

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.

**APPROVED**
**Engineering Department**
*01/05/2021 7:11:43 PM*
*dsdnijkamp*
**EPC Planning & Community Development Department**

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

Conditions:

# CONTENTS

**PURPOSE** ..... **1**

**GENERAL LOCATION AND DESCRIPTION** ..... **1**

LOCATION ..... 1
DESCRIPTION OF PROPERTY ..... 1
FLOODPLAIN STATEMENT ..... 2

**DRAINAGE BASINS AND SUBBASINS** ..... **2**

MAJOR BASIN DESCRIPTIONS ..... 2
EXISTING SUB-BASIN DRAINAGE ..... 5
PROPOSED SUB-BASIN DRAINAGE ..... 8

**DRAINAGE DESIGN CRITERIA** ..... **12**

DEVELOPMENT CRITERIA REFERENCE ..... 12
HYDROLOGIC CRITERIA ..... 12
HYDRAULIC CRITERIA ..... 13

**DRAINAGE FACILITY DESIGN** ..... **13**

GENERAL CONCEPT ..... 13
SPECIFIC DETAILS ..... 14
*Four Step Process to Minimize Adverse Impacts of Urbanization* ..... *14*
*Water Quality* ..... *15*
*Erosion Control Plan* ..... *15*
*Operation & Maintenance* ..... *15*
*Drainage and Bridge Fees* ..... *15*
*Construction Cost Opinion* ..... *17*

**SUMMARY** ..... **17**

**REFERENCES:** ..... **18**

**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. Existing Drainage Basin Summary
2. Major Drainageway Naming Conventions
3. Major Drainageway Flow Comparison
4. Pond Summary
5. Site Composite Percent Imperviousness
6. Drainage & Bridge Fees

# PURPOSE

This document is the Master Development Drainage Plan (MDDP)/Preliminary Drainage Report (PDR) for the proposed Saddlehorn Ranch. The purpose of this report is to:

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

# GENERAL LOCATION AND DESCRIPTION

## Location

The proposed Saddlehorn Ranch, known as "the site" from herein, is a parcel of land located in Section 3 and 10, Township 13 South, Range 65 West of the 6$^{th}$ Principal Meridian in El Paso County, Colorado. The proposed 824 acre, rural, single family-development is bound by Judge Orr Road to the North and Curtis Road to the West. To the East, the site is bound by undeveloped land owned by Brent Houser Enterprises, LLC. To the south, the site is bound by undeveloped properties owned by 7120 Sudiev, LLC and Faye Reyonlds. A vicinity map and property owner map is presented in Appendix A.

Currently, there are three major drainageways that run through the site: Haegler Ranch Main Stem 6 (MS-06), Haegler Ranch Tributary 6 (T-6), and Gieck Ranch West Fork – Reach 7A (WF-R7A). These drainageways were analyzed, both hydrologically and hydraulically, in the following reports:

1. Geick Ranch Drainage Basin Planning Study (DBPS), October 2007
2. Haegler Ranch Basin DBPS, May 2009
3. Sante Fe Springs – Haegler Ranch Drainage Basin Letter of Map Revision (LOMR), October 2004

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

## Description of Property

The proposed development contains approximately 824 acres and will be comprised of 227 rural 2.5 – 5 acre lots. The site 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, the site slopes from northwest to southeast and the existing drainageways follow this topography.

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 T-6 conveys the stormwater through the site and to its off-site confluence with 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 sub-regional 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.

Table 1: Existing Drainage Basin Summary

| EXISTING BASIN SUMMARY TABLE | | | | |
|---|---|---|---|---|
| Tributary Sub-Basin | Area (acres) | Percent Impervious | $Q_5$ (cfs) | $Q_{100}$ (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 |

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 ¼ 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 ¾ 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.) | $Q_{100}$ Per Haegler Ranch DBPS: | $Q_{100}$ Per Geick Ranch DBPS: | $Q_{100}$ 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 $ft^2$ of Del Cerro Drive and 14,000 $ft^2$ 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 MS-06 and Ponds G, H, and I 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

| 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 |
| B | POND B | 60.4 | 0.35 | 1.46 | 2.17 | 18.9 | 21.0 |
| C | 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 |
| H | 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.

Urban Drainage and Flood Control District's UD-Detention, Version 3.07 workbook was used for preliminary 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

The Federal Highway Administration's HY-8 program (Volume 7.50) was used to analyze the proposed box culvert within Major Drainageways MS-06 and T-6. Per Section 14.3.2 of the CCS/EPCDCM, a maximum headwater-to-rise ratio of 1.5 was used for the sizing of box culverts. Furthermore, box culverts will be designed in conjunction with channel improvements to maintain the current floodplain and base flood elevations. Culvert sizing and corresponding channel improvements will be revised as roadway geometry becomes better defined. Preliminary culvert design sheets are presented in Appendix C.

Autodesk Inc.'s Hydraflow Express Extension (Volume 10.5) was used for preliminary roadside ditch design. For the purposes of this PDR/MDDP, the maximum roadside ditch size was determined based on peak 100-year flows and minimum roadway slopes within each basin. Swales were checked for velocity and Froude number per the EPC DCM Chapter 10, Section 10-7 and Table 10-4. Swale cross sections with a 100-year velocity greater than 5 ft/s or a Froude number greater than 0.9 will be lined with erosion control blanket and native grasses, or another approved method of stabilization, to limit erosive potential. Final swale designs and cross section details will be included with the Final Drainage Report. Preliminary swale design sheets are presented in Appendix C.

Autodesk Inc.'s Hydraflow Express Extension (Volume 10.5) will be used for final local road crossing culvert design with in the Final Drainage Report. All onsite, local road crossing culverts are assumed to be 18" or 24" CMP based on preliminary calculations. Culvert size was determined based on 100-year flows and hydraulic criteria from EPCDCM Chapter 9 –Culvert Design. The Final Drainage Report will provide final local road crossing culvert designs.

## DRAINAGE FACILITY DESIGN

### General Concept

The proposed stormwater conveyance system was designed to convey the developed Saddlehorn Ranch flows to full spectrum water quality and detention ponds. Water quality and detention ponds will be designed to release at less than historic rates to minimize adverse impacts downstream. All full spectrum water quality and detention ponds have been sized such that State Engineer review or approval is not required. Undeveloped basins are allowed to follow existing drainage patterns and discharge directly into major drainageways or off-site.

The undeveloped portion of developed lots will be allowed to discharge directly into Drainageways MS-06, T-6 and WF-R7A. Per the "Jurisdictional Determination Request for the 824 Acres Curtis Road subdivision Project" completed by Ecosystem System Services in October 2018, MS-06 and T-

6 are not waters of the state and WF-R7A is a water of the state however, any direct discharge into this drainageway will be historic, undeveloped flows. The direct discharge into drainageway situation occurs anywhere a lot naturally drains toward a drainageway rather than the street. It was determined for these lots that all development (i.e. house and driveway) will occur in the first 200' of the lot, measured from the street into the lot. The 200' developed region of the lot will drain towards the road and be conveyed to a full spectrum water quality pond, however; the remainder of the lot (undeveloped) will be allowed to follow historic drainage patterns and flow directly into the drainageways. Furthermore, at time of platting, a covenant will be established for the development that will limit imperviousness to 10% for areas draining directly to the drainageways in order to satisfy Section I.7.1.B.5 of the ECM Stormwater Quality Policy and Procedures.

A box culvert will be proposed within Major Drainageway MS-06 and T-6 to convey existing, off site and developed, on-site flows underneath proposed roadways and through the site, in accordance with the *Haegler Ranch DBPS*. Culverts will not be required in Major Drainageway WF-R7A to maintain the drainage patterns established in the *Gieck Ranch DBPS.*

Channel improvements will be proposed immediately up and downstream of culvert improvements in order to maintain the current floodplain. Further channel improvements may be required within the major drainageways and the need for these potential improvements will be evaluated in the Final Drainage Report for each Filing. Access roads will be provided from local roadways down into the drainageways to provide culvert and drainageway maintenance access. A proposed drainage map is presented in Appendix F showing locations of culvert improvements, approximate channel improvements and access roads.

## 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 as single family residential (2.5 ac. min.) with open spaces and lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. Roadways will utilize roadside ditches further disconnecting impervious areas. These practices will also allow for increased infiltration and reduce runoff volume.

Step 2, Stabilize Drainageways: This site will utilize roadside ditches with culvert crossings throughout the site. These roadside ditches will then direct the on-site development flows to the multiple detention ponds within the project that will be designed to release at or below historic rates in the natural channels. The natural channels will be stabilized in reaches with high velocity by the

use of drop structures incorporated at each roadway culvert crossing and isolated grade control structures where warranted. Based upon the proposed reduction in released flows compared to the pre-developed flows, no impact to downstream drainageways is anticipated.

Step 3, Provide WQCV: Runoff from this development will be treated through capture and slow release of the WQCV in multiple permanent detention basins that will be 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 will be prepared for each future Filing. Site specific temporary source control BMPs as well as permanent BMP's will be 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 will be provided for all of the development site not meeting exclusions present in the ECM - Stormwater Quality Policy and Procedures Section I.7.1.B and C. Any areas of the development site not being included in the site's permeant stormwater management are presented on the MS4 Development Site Map with their specific exclusion, presented in Appendix F. Outlet structure release rates will be limited to less than historic rates to minimize adverse impacts to downstream stormwater facilities. Complete pond and outlet structure designs will be provided with the Final Drainage Report. Preliminary pond design parameters 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 with each Final Drainage Report. We respectfully request that the Erosion Control Plan and Cost Estimate be submitted in conjunction with the grading and erosion control plans and construction assurances posted prior to obtaining a grading permit.

***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 (roadside ditches and local road culverts) will be owned and maintained by El Paso County. All proposed drainage structures within easements or tracts (full spectrum water quality ponds, drainageway culverts and drainageway improvements) will be owned and maintained by the Saddlehorn Ranch Metropolitan District No.1. Inspection access for El Paso County will be provided through a maintenance easement.

***Drainage and Bridge Fees***

An estimate of total basin fees for the proposed development within Haegler Ranch Drainage Basin is provided in Table 6. A portion of Saddlehorn Ranch (Basin J and CH1) is not within an approved

drainage basin, therefore; no drainage or bridge fees will be required for this area. Drainage and Bridge fees are for informational purposes only and do not include reductions for rural lots, permanent water quality facilities or reimbursable channel improvements. Final drainage reports for each phase of development will establish official drainage and bridge fees to be paid at time of platting.

Table 5: Site Composite Percent Imperviousness

| Total Site Composite % Impervious for Basin Fees | | | |
|---|---|---|---|
| Basin | Area (ac) | % Imperviousness | (Area) * (% Imp.) |
| A | 9.2 | 67% | 6.13 |
| B | 60.4 | 10% | 6.28 |
| C | 102.5 | 11% | 11.69 |
| D | 99.2 | 11% | 10.71 |
| E | 11.6 | 12% | 1.35 |
| F | 117.4 | 10% | 11.62 |
| G | 39.9 | 17% | 6.70 |
| H | 30.7 | 9% | 2.89 |
| I | 46.6 | 9% | 4.38 |
| J | 10.1 | 9% | 0.89 |
| UD1 | 12.4 | 2% | 0.25 |
| UD2 | 12.8 | 2% | 0.26 |
| UD2.1 | 14.8 | 2% | 0.30 |
| UD2.2 | 7.2 | 2% | 0.14 |
| UD3 | 13.4 | 2% | 0.27 |
| UD4 | 4.8 | 2% | 0.10 |
| UD5 | 36.4 | 2% | 0.73 |
| UD6 | 22.1 | 2% | 0.44 |
| UD7 | 9.3 | 2% | 0.19 |
| UD8 | 4.6 | 2% | 0.09 |
| UD8.1 | 5.3 | 2% | 0.11 |
| UD9 | 4.8 | 2% | 0.10 |
| UD9.1 | 6.4 | 2% | 0.13 |
| UD10 | 10.4 | 2% | 0.21 |
| UD11 | 6.0 | 2% | 0.12 |
| CH1 | 23.9 | 2% | 0.48 |
| CH2 | 84.2 | 2% | 1.68 |
| CH3 | 19.0 | 2% | 0.38 |
| Total | 825.4 | - | 68.59 |
| Comp. % Imp. = 68.59%*ac/825.4 ac = 8.31% | | | |

Table 6: Drainage Basin Fees

| El Paso County - Haegler Ranch Drainage Basin Fees | | | | | | |
|---|---|---|---|---|---|---|
| Area (acre) | Composite % Impervious | Total Impervious Acreage | 2019 Drainage Fee (per Impervious Acre) | 2019 Bridge Fee (per Impervious Acre) | Saddlehorn Ranch Drainage Fee | Saddlehorn Ranch Bridge Fee |
| 825.4 | 8.31% | 68.59 | $10,324 | $1,524 | $708,123 | $104,531 |

***Construction Cost Opinion***

(For Information Only / Non-Reimbursable)
Cost opinion to be provided with 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 major drainageways or surrounding development. This report meets the latest El Paso County Drainage Criteria requirements for this site.

# REFERENCES:

1. City of Colorado Springs Drainage Criteria Manual Volume 1, City of Colorado Springs, CO, May 2014.

2. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, Latest Revision.

3. Gieck Ranch Drainage Basin Planning Study, Drexel, Barrell & Co., October 2007 and revised in February 2010.

4. Haegler Ranch Drainage Basin Planning Study, URS Corporation, May 2009.

5. The Santa Fe Springs – Haegler Ranch Drainage Basin LOMR, Federal Emergency Management Agency, October 20, 2004.

# APPENDIX A

# FIGURES AND EXHIBITS

5000 2500 0 5000 10000

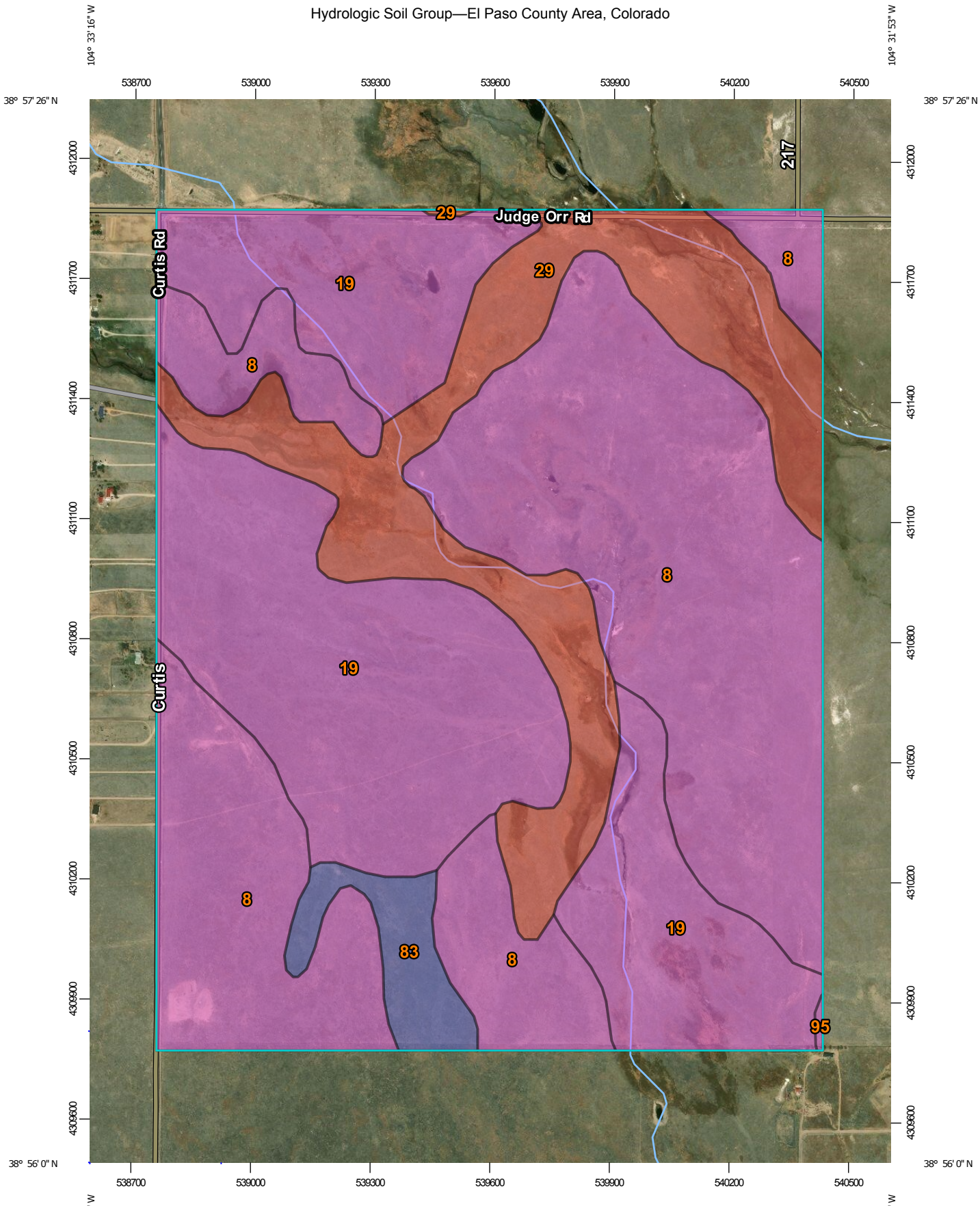
ORIGINAL SCALE: 1" = 5000'

VICINITY MAP
SADDLEHORN RANCH
25142.00
04/29/19
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303–740–9393 • Colorado Springs 719–593–2593
Fort Collins 970–491–9888 • www.jrengineering.com

X:\2510000.all\2514200\Drawings\Blocks\2514200_VIC MAP.dwg, VICINITY MAP, 4/22/2019 10:56:46 AM, CS




Map Scale: 1:13,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Soil Rating Lines**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Soil Rating Points**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

## MAP INFORMATION

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 16, Sep 10, 2018

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

Date(s) aerial images were photographed: May 22, 2016—Aug 17, 2017

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

# Hydrologic Soil Group

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 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 | B | 24.6 | 2.8% |
| 95 | Truckton loamy sand, 1 to 9 percent slopes | A | 0.6 | 0.1% |
| **Totals for Area of Interest** | | | **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 floodplain management purposes when they are higher than the elevations shown on this FIRM.

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

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

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

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

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

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

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

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

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

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

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

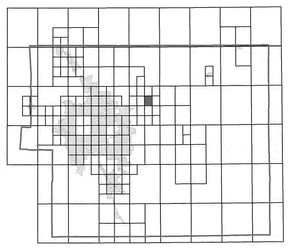
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

**El Paso County Vertical Datum Offset Table**

| Flooding Source | Vertical Datum Offset (ft) |
|---|---|

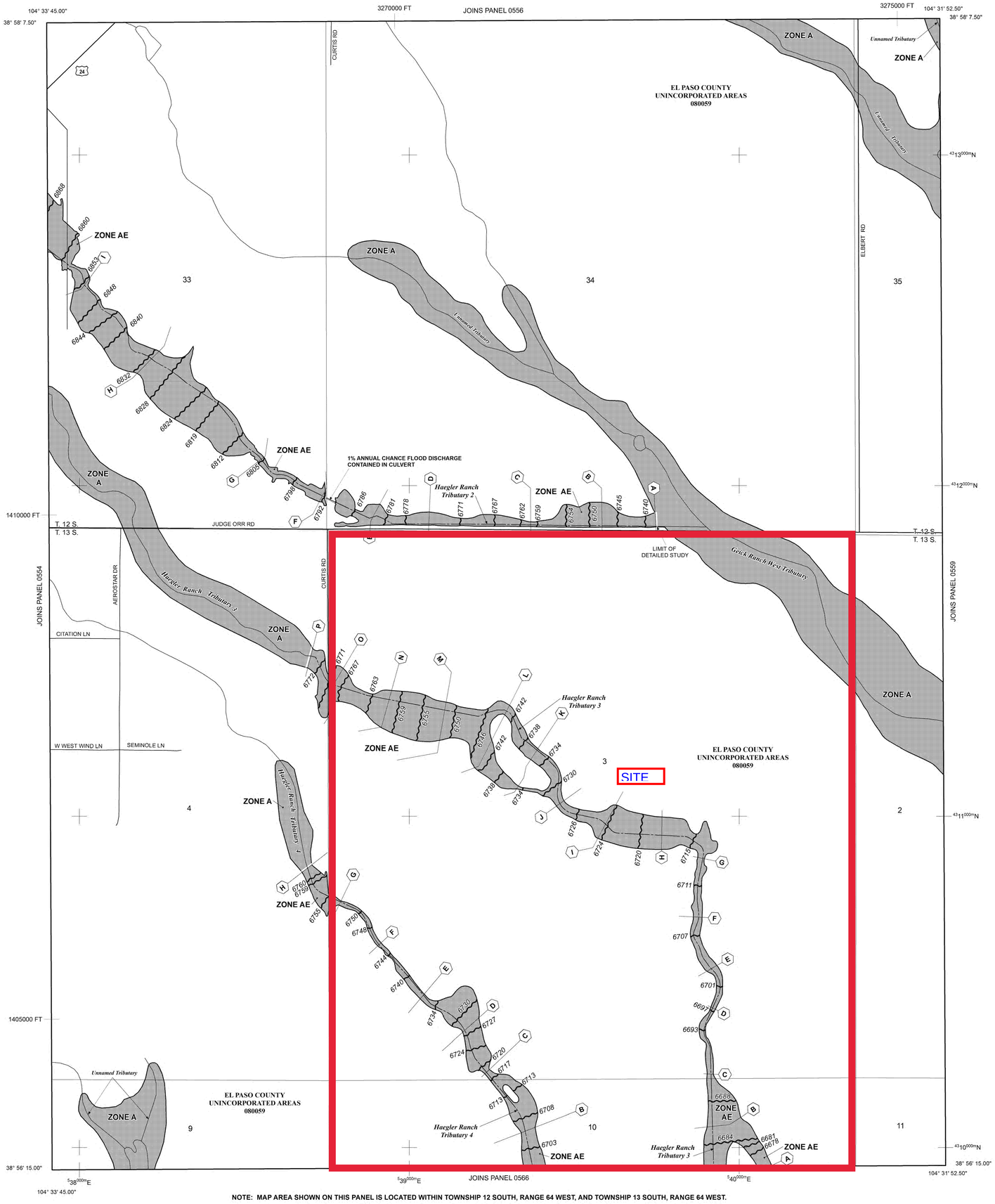
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

**Panel Location Map**



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

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




**NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 64 WEST, AND TOWNSHIP 13 SOUTH, RANGE 64 WEST.**

# LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

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

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

**MAP SCALE 1" = 500'**

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

**PANEL 0558G**

NATIONAL FLOOD INSURANCE PROGRAM

# FIRM

## FLOOD INSURANCE RATE MAP

## EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

**PANEL 558 OF 1300**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| EL PASO COUNTY | 080059 | 0558 | G |

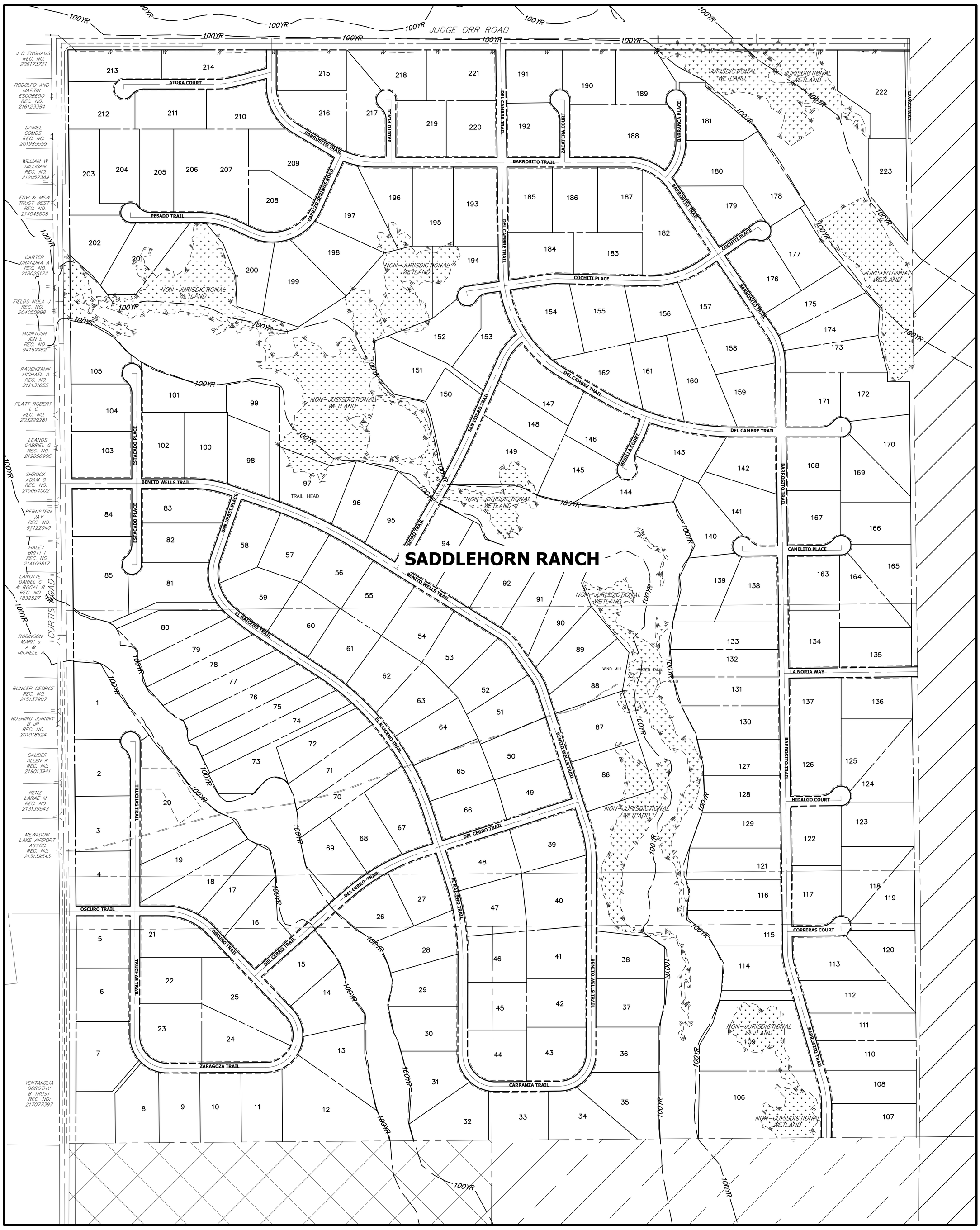
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**
**08041C0558G**

**MAP REVISED**
**DECEMBER 7, 2018**

**Federal Emergency Management Agency**

# SADDLEHORN RANCH
## PROPERTY OWNERS MAP




### OWNERSHIP LEGEND

OWNER: BRENT HOUSER ENTERPRISES, LLC
ADDRESS: N/A
MAILING ADDRESS: 11890 GARRETT ROAD
PEYTON, CO 80831

OWNER: 7120 SUDIEV LLC
ADDRESS: 7120 FALCON GRASSY HEIGHTS
MAILING ADDRESS: 7120 GRASSY HEIGHTS
PEYTON, CO 80831

OWNER: REYNOLDS, FAYE
ADDRESS: N/A (FALCON HIGHWAY)
MAILING ADDRESS: 6634 MASTERS ROAD
MANVEL, TX 77578

N

300 150 0 300 600

ORIGINAL SCALE: 1" = 300'

PROPERTY OWNERS MAP
824 CURTIS ROAD
25142.00
09/15/19
SHEET 1 OF 1


J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com



X:\25100.all\25142.00\Drawings\Sheet Dwgs_Drainage\2018-10-09_Ex.Property Owners.dwg, EX. prop owners, 9/9/2019 8:20:00 AM, CS

# APPENDIX B

# HYDROLOGIC CALCULATIONS

| BASIN SUMMARY TABLE | | | | |
|---|---|---|---|---|
| Tributary Sub-Basin | Area (acres) | Composite Percent Impervious | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
| A | 9.2 | 66.6% | 9.5 | 20.7 |
| B | 60.4 | 10.4% | 9.9 | 46.3 |
| C | 102.5 | 11.4% | 15.8 | 69.4 |
| 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 | 69.9 |
| G | 39.9 | 16.8% | 6.1 | 25.3 |
| H | 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 | 14.7 |
| UD2.2 | 7.2 | 2.0% | 0.1 | 5.5 |
| UD3 | 13.4 | 2.0% | 0.2 | 13.1 |
| UD4 | 4.8 | 2.0% | 0.03 | 3.4 |
| 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 | 4.6 | 2.0% | 0.03 | 3.3 |
| UD8.1 | 5.3 | 2.0% | 0.1 | 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 | 19.0 | 2.0% | 0.1 | 6.5 |
| Total | 825.4 | N/A | 126.7 | 627.3 |

PROPOSED CONDITIONS - COMP. & IMPERVIOUSNESS CALCULATIONS

| POND B | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Area | Streets + Drives Area | Streets + Drives I% | Lot Area | Lot I% | Roof Area | Roof I% | Composite I% |
| 60.4 | 3.39 | 1 | 55.15 | 0.02 | 1.86 | 0.9 | 10.22 |

| POND C | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Area | Streets + Drives Area | Streets + Drives I% | Lot Area | Lot I% | Roof Area | Roof I% | Composite I% |
| 102.55 | 7.27 | 1 | 92.46 | 0.02 | 2.82 | 0.9 | 11.37 |

| POND D | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Area | Streets + Drives Area | Streets + Drives I% | Lot Area | Lot I% | Roof Area | Roof I% | Composite I% |
| 99.17 | 6.63 | 1 | 89.99 | 0.02 | 2.55 | 0.9 | 10.81 |

| POND E | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Area | Streets + Drives Area | Streets + Drives I% | Lot Area | Lot I% | Roof Area | Roof I% | Composite I% |
| 11.6 | 0.44 | 1 | 10.95 | 0.02 | 0.21 | 0.9 | 7.30 |

| POND F | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Area | Streets + Drives Area | Streets + Drives I% | Lot Area | Lot I% | Roof Area | Roof I% | Composite I% |
| 117.4 | 6.78 | 1 | 107.72 | 0.02 | 2.89 | 0.9 | 9.83 |

| POND G | | | | | | |
|---|---|---|---|---|---|---|
| Total Area | Streets + Drives Area | Streets + Drives I% | Lot Area | Lot I% | Roof Area | Roof I% |
| 39.9 | 3.92 | 1 | 33.57 | 0.02 | 2.41 | 0.9 |

| POND H | | | | | | |
|---|---|---|---|---|---|---|
| Total Area | Streets + Drives Area | Streets + Drives I% | Lot Area | Lot I% | Roof Area | Roof I% |
| 30.7 | 1.86 | 1 | 28.15 | 0.02 | 0.69 | 0.9 |

| POND I | | | | | | |
|---|---|---|---|---|---|---|
| Total Area | Streets + Drives Area | Streets + Drives I% | Lot Area | Lot I% | Roof Area | Roof I% |
| 46.6 | 2.18 | 1 | 43.11 | 0.02 | 1.31 | 0.9 |

| POND A | | | | | | |
|---|---|---|---|---|---|---|
| Total Area | Streets + Drives Area | Streets + Drives I% | Lot Area | Lot I% | Roof Area | Roof I% |
| 9.24 | 1.07 | 1 | 7.83 | 0.02 | 0.34 | 0.9 |

ASSUMPTIONS: ROOF SQ. FT. = 3000, DRIVEWAYS ARE 50'X15'

| Overal Composite % Impervious Calc for Basin Fees | | | |
|---|---|---|---|
| Basin | Area (ac) | % Imperviousness | (Area)* (% Imp.) |
| A | 9.2 | 67% | 6.13 |
| B | 60.4 | 10% | 6.28 |
| C | 102.5 | 11% | 11.69 |
| D | 99.2 | 11% | 10.71 |
| E | 11.6 | 12% | 1.35 |
| F | 117.4 | 10% | 11.62 |
| G | 39.9 | 17% | 6.70 |
| H | 30.7 | 9% | 2.89 |
| I | 46.6 | 9% | 4.38 |
| J | 10.1 | 9% | 0.89 |
| UD1 | 12.4 | 2% | 0.25 |
| UD2 | 12.8 | 2% | 0.26 |
| UD2.1 | 14.8 | 2% | 0.30 |
| UD2.2 | 7.2 | 2% | 0.14 |
| UD3 | 13.4 | 2% | 0.27 |
| UD4 | 4.8 | 2% | 0.10 |
| UD5 | 36.4 | 2% | 0.73 |
| UD6 | 22.1 | 2% | 0.44 |
| UD7 | 9.3 | 2% | 0.19 |
| UD8 | 4.6 | 2% | 0.09 |
| UD8.1 | 5.3 | 2% | 0.11 |
| UD9 | 4.8 | 2% | 0.10 |
| UD9.1 | 6.4 | 2% | 0.13 |
| UD10 | 10.4 | 2% | 0.21 |
| UD11 | 6 | 2% | 0.12 |
| CH1 | 23.9 | 2% | 0.48 |
| CH2 | 84.2 | 2% | 1.68 |
| CH3 | 19.0 | 2% | 0.38 |
| Total | 825.4 | - | 68.59 |
| Comp. % Imp. = 68.59%*ac/825.4 ac = 8.31% | | | |

# Colorado Urban Hydrograph Procedure

Version 2.0.0 - Release Date: 9/9/2016

Urban Drainage and Flood Control District
Denver, Colorado
email: udfcd@udfcd.org

| | |
|---|---|
| **Purpose:** | This program produces hydrographs using the Colorado Unit Hydrograph Procedure (CUHP) |

**Functions:**

| | |
|---|---|
| Edit Raingages | Add/Remove Raingages and change names |
| Edit Subcatchments | Edit subcatchment parameters |
| Edit Multiple Run Options | Edit the Multiple Run options (Advanced User Features) |
| Import CUHP 2005 File | Import an older CUHP 2005 workbook into this updated version of CUHP |
| Check Subcatchments | Check whether subcatchment inputs conform to UDFCD guidelines |
| Check SWMM Nodes | Check whether all subcatchment target nodes are included in the SWMM .inp file |
| Run CUHP | Calculate effective precipitation and generate hydrographs for each subcatchment |

**Settings:**

Fill in the blue cells to begin:

| | |
|---|---|
| Project Title: | Saddlehorn Ranch |
| Project Comment: | Ex. Conditions Analysis |
| Time Step Between Computations: | 5 Minute(s); typically 5 or 1 (peak flow rate will differ slightly). |
| | ☐ Use Relative Path Names |
| Output Workbook Filename: | X:\2510000.all\2514200\CUHP-SWMM\Existing_CUHP_2002.xlsm.xlsx |
| CUHP/SWMM Interface Filename (Optional): | X:\2510000.all\2514200\CUHP-SWMM\Existing_CUHP_2002.xlsm.txt |
| EPA SWMM 5 Input Filename (Optional): | X:\2510000.all\2514200\CUHP-SWMM\Ex. Conditions Model.inp |
| EPA SWMM 5 Application File (Optional): | |
| SWMM Hydrograph Start Time (Optional): | |

**Acknowledgements:** Thanks to Ben Urbonas, P.E., D.WRE and James C.Y.Guo, PhD, P.E., for the development of the CUHP project.

# CUHP SUBCATCHMENTS

Columns with this color heading are for required user-input
Columns with this color heading are for optional override values
Columns with this color heading are for program-calculated values

| | | | | | | | | Maximum Depression Storage (Watershed inches) | | Horton's Infiltration Parameters | | | DCIA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subcatchment Name | EPA SWMM Target Node | Raingage | Area ($mi^2$) | Length to Centroid (mi) | Length (mi) | Slope (ft/ft) | Percent Imperviousness | Pervious | Impervious | Initial Rate (in/hr) | Decay Coefficient (1/seconds) | Final Rate (in/hr) | Level 0, 1, or 2 |
| CH1 | CH1 | EPC | 0.0373438 | 0.210994318 | 0.4289773 | 0.01 | 2 | 0.4 | 0 | 3 | 0.0018 | 0.5 | 2 |
| CH2 | CH2 | EPC | 0.1318594 | 0.930530303 | 1.4477273 | 0.015 | 2 | 0.4 | 0 | 4 | 0.0013 | 0.75 | 2 |
| CH3 | CH3 | EPC | 0.0329219 | 0.420583333 | 0.7320076 | 0.015 | 2 | 0.4 | 0 | 4.81 | 0.0011 | 0.85 | 2 |
| H1 | H1 | EPC | 0.2601406 | 0.229166666 | 0.821917 | 0.01 | 2 | 0.4 | 0 | 5 | 0.0007 | 1 | 2 |
| H2 | H2 | EPC | 0.1735781 | 0.129545454 | 0.4912879 | 0.025 | 2 | 0.4 | 0 | 5 | 0.0007 | 1 | 2 |
| H3 | H3 | EPC | 0.18325 | 0.490719697 | 0.932197 | 0.015 | 2 | 0.4 | 0 | 4.64 | 0.0009 | 0.73 | 2 |
| H4 | H4 | EPC | 0.0988906 | 0.085984848 | 0.5267045 | 0.0225 | 2 | 0.4 | 0 | 3.82 | 0.0008 | 0.74 | 2 |
| H5 | H5 | EPC | 0.0831875 | 0.236931818 | 0.7267045 | 0.02 | 2 | 0.4 | 0 | 4.93 | 0.0009 | 0.94 | 2 |
| H6 | H6 | EPC | 0.1367969 | 0.046022727 | 0.4 | 0.04 | 2 | 0.4 | 0 | 5 | 0.0007 | 1 | 2 |
| G1 | G1 | EPC | 0.01575 | 0.210606061 | 0.3015152 | 0.018 | 2 | 0.4 | 0 | 5 | 0.00007 | 1 | 2 |
| G2 | G2 | EPC | 0.1368125 | 0.235606061 | 0.6857955 | 0.02 | 2 | 0.4 | 0 | 4.32 | 0.0011 | 0.83 | 2 |

# RUN MULTIPLE CUHP AND SWMM SCENARIOS

Columns with this color heading are for required user-input
Columns with this color heading are for program-calculated values

| SWMM Run Wait Time (sec) |
|---|
| 5 |

| (Optional) SWMM Time Series Inflow "Modification Type" (LU, RP, or LU&RP) |
|---|
| |

| Subcatchment Name | Existing Landuse % Imperviousness | Future Landuse % Imperviousness |
|---|---|---|
| CH1 | 2 | 2 |
| CH2 | 2 | 2 |
| CH3 | 2 | 2 |
| H1 | 2 | 2 |
| H2 | 2 | 2 |
| H3 | 2 | 2 |
| H4 | 2 | 2 |
| H5 | 2 | 2 |
| H6 | 2 | 2 |
| G1 | 2 | 2 |
| G2 | 2 | 2 |

| Raingage | Return Period (Years) | 1 Hr Depths (in) | 6 Hr Depths (in) |
|---|---|---|---|
| EPC | WQ | 0.6 | N/A |
| | 2 | 1.19 | 2.1 |
| | 5 | 1.5 | 2.7 |
| | 10 | 1.75 | 3.2 |
| | 25 | 2 | 3.6 |
| | 50 | 2.25 | 4.2 |
| | 100 | 2.52 | 4.6 |
| | | | |

| Enter "X" to Run Scenario | Scenario ID | Land Use (E or F) | Return Period (yr) | Correction Area (Sq.Mi.) |
|---|---|---|---|---|
| X | WQ | E | WQ | 0 |
| | 2-YR | E | 2 | 1 |
| X | 5-YR | E | 5 | 1 |
| | 10-YR | E | 10 | 1 |
| | 25-YR | E | 25 | 1 |
| | 50-YR | E | 50 | 1 |
| X | 100-YR | E | 100 | 1 |

| (Optional) SWMM Time Series Inflow Table "NAME" |
|---|
| |

| | | | | | |
|---|---|---|---|---|---|
| Comment | El Paso County Rainfall Depths | | | | |
| 1Hr Depth | 2.52 | inches | 2hr Depth | 2.86 | inches |
| 6Hr Depth | 3.5 | inches | 3hr Depth | 3.11 | inches |
| Correction Area | 1 | Sq. Mi. | | | |
| Return Period | 100 | Years | | | |

NOAA Atlas 14 Point Precipitation Frequency

| Time | Adjusted Depth | Unadjusted Depth |
|---|---|---|
| 0:05 | 0.0252 | 0.0252 |
| 0:10 | 0.0756 | 0.0756 |
| 0:15 | 0.1159 | 0.1159 |
| 0:20 | 0.2016 | 0.2016 |
| 0:25 | 0.3528 | 0.3528 |
| 0:30 | 0.6300 | 0.6300 |
| 0:35 | 0.3528 | 0.3528 |
| 0:40 | 0.2016 | 0.2016 |
| 0:45 | 0.1562 | 0.1562 |
| 0:50 | 0.1260 | 0.1260 |
| 0:55 | 0.1008 | 0.1008 |
| 1:00 | 0.1008 | 0.1008 |
| 1:05 | 0.1008 | 0.1008 |
| 1:10 | 0.0504 | 0.0504 |
| 1:15 | 0.0504 | 0.0504 |
| 1:20 | 0.0302 | 0.0302 |
| 1:25 | 0.0302 | 0.0302 |
| 1:30 | 0.0302 | 0.0302 |
| 1:35 | 0.0302 | 0.0302 |
| 1:40 | 0.0302 | 0.0302 |
| 1:45 | 0.0302 | 0.0302 |
| 1:50 | 0.0302 | 0.0302 |
| 1:55 | 0.0302 | 0.0302 |
| 2:00 | 0.0302 | 0.0302 |
| 2:05 | 0.0000 | 0.0000 |
| 2:10 | 0.0000 | 0.0000 |
| 2:15 | 0.0000 | 0.0000 |
| 2:20 | 0.0000 | 0.0000 |
| 2:25 | 0.0000 | 0.0000 |
| 2:30 | 0.0000 | 0.0000 |
| 2:35 | 0.0000 | 0.0000 |
| 2:40 | 0.0000 | 0.0000 |
| 2:45 | 0.0000 | 0.0000 |
| 2:50 | 0.0000 | 0.0000 |
| 2:55 | 0.0000 | 0.0000 |
| 3:00 | 0.0000 | 0.0000 |
| 3:05 | 0.0000 | 0.0000 |
| 3:10 | 0.0000 | 0.0000 |
| 3:15 | 0.0000 | 0.0000 |
| 3:20 | 0.0000 | 0.0000 |
| 3:25 | 0.0000 | 0.0000 |
| 3:30 | 0.0000 | 0.0000 |
| 3:35 | 0.0000 | 0.0000 |
| 3:40 | 0.0000 | 0.0000 |
| 3:45 | 0.0000 | 0.0000 |
| 3:50 | 0.0000 | 0.0000 |

# SADDLEHORN RANCH - EX. 5-YEAR FLOW RESULTS

Node Inflow Summary

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Day of Maximum Inflow | Hour of Maximum Inflow | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| CH1 | JUNCTION | 5.40 | 5.40 | 0 | 00:50 | 0.232 | 0.232 | 0.000 |
| CH2 | JUNCTION | 2.58 | 2.58 | 0 | 01:00 | 0.176 | 0.176 | 0.000 |
| CH3 | JUNCTION | 0.11 | 0.11 | 0 | 00:45 | 0.00701 | 0.00701 | 0.000 |
| DP1 | JUNCTION | 0.00 | 6.79 | 0 | 00:46 | 0 | 0.268 | 0.000 |
| DP2 | JUNCTION | 0.00 | 1.46 | 0 | 00:40 | 0 | 0.0359 | 0.000 |
| DP3 | JUNCTION | 0.00 | 0.13 | 0 | 00:40 | 0 | 0.00379 | 0.000 |
| DP4 | JUNCTION | 0.00 | 0.16 | 0 | 00:35 | 0 | 0.00252 | 0.000 |
| DP5 | JUNCTION | 0.00 | 0.90 | 0 | 00:45 | 0 | 0.0334 | 0.000 |
| DP6 | JUNCTION | 0.00 | 1.35 | 0 | 00:35 | 0 | 0.0209 | 0.000 |
| DP7 | JUNCTION | 0.00 | 4.06 | 0 | 01:05 | 0 | 0.237 | 0.000 |
| DP8 | JUNCTION | 0.00 | 0.21 | 0 | 00:30 | 0 | 0.00194 | 0.000 |
| DP9 | JUNCTION | 0.00 | 0.43 | 0 | 00:40 | 0 | 0.0172 | 0.000 |
| G1 | JUNCTION | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| G2 | JUNCTION | 1.46 | 1.46 | 0 | 00:40 | 0.0359 | 0.0359 | 0.000 |
| H1 | JUNCTION | 0.13 | 0.13 | 0 | 00:40 | 0.00379 | 0.00379 | 0.000 |
| H2 | JUNCTION | 0.16 | 0.16 | 0 | 00:35 | 0.00252 | 0.00252 | 0.000 |
| H3 | JUNCTION | 0.90 | 0.90 | 0 | 00:45 | 0.0334 | 0.0334 | 0.000 |

# SADDLEHORN RANCH - EX. 5-YEAR FLOW RESULTS

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Day of Maximum Inflow | Hour of Maximum Inflow | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| H4 | JUNCTION | 1.35 | 1.35 | 0 | 00:35 | 0.0209 | 0.0209 | 0.000 |
| H5 | JUNCTION | 0.33 | 0.33 | 0 | 00:40 | 0.0102 | 0.0102 | 0.000 |
| H6 | JUNCTION | 0.21 | 0.21 | 0 | 00:30 | 0.00194 | 0.00194 | 0.000 |
| J13 | JUNCTION | 0.00 | 0.07 | 0 | 01:50 | 0 | 0.00485 | 0.000 |
| J14 | JUNCTION | 0.00 | 0.06 | 0 | 02:28 | 0 | 0.00242 | 0.000 |
| J15 | JUNCTION | 0.00 | 0.83 | 0 | 01:03 | 0 | 0.0333 | 0.000 |
| J16 | JUNCTION | 0.00 | 0.09 | 0 | 00:49 | 0 | 0.00188 | 0.000 |

# SADDLEHORN RANCH - EX. 100-YR FLOW RESULTS

Node Inflow Summary

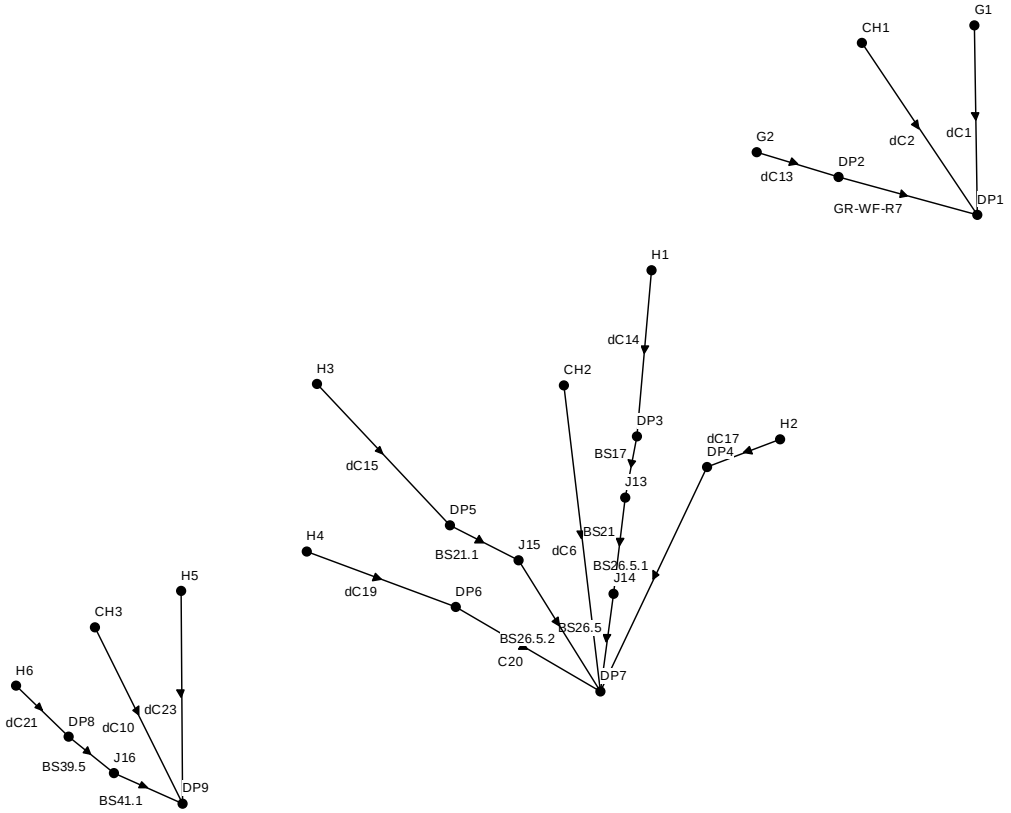
| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Day of Maximum Inflow | Hour of Maximum Inflow | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| CH1 | JUNCTION | 1038.04 | 1038.04 | 0 | 00:55 | 165 | 165 | 0.000 |
| CH2 | JUNCTION | 485.11 | 485.11 | 0 | 01:15 | 75.2 | 75.2 | 0.000 |
| CH3 | JUNCTION | 127.25 | 127.25 | 0 | 01:10 | 19.9 | 19.9 | 0.000 |
| DP1 | JUNCTION | 0.00 | 1114.02 | 0 | 00:51 | 0 | 167 | 0.000 |
| DP2 | JUNCTION | 0.00 | 76.38 | 0 | 00:50 | 0 | 2.23 | 0.000 |
| DP3 | JUNCTION | 0.00 | 80.97 | 0 | 00:45 | 0 | 2.08 | 0.000 |
| DP4 | JUNCTION | 0.00 | 91.06 | 0 | 00:40 | 0 | 1.38 | 0.000 |
| DP5 | JUNCTION | 0.00 | 64.08 | 0 | 01:00 | 0 | 2.67 | 0.000 |
| DP6 | JUNCTION | 0.00 | 73.15 | 0 | 00:40 | 0 | 1.47 | 0.000 |
| DP7 | JUNCTION | 0.00 | 704.90 | 0 | 01:08 | 0 | 83 | 0.000 |
| DP8 | JUNCTION | 0.00 | 110.05 | 0 | 00:35 | 0 | 1.06 | 0.000 |
| DP9 | JUNCTION | 0.00 | 248.10 | 0 | 00:45 | 0 | 21.9 | 0.000 |
| G1 | JUNCTION | 0.09 | 0.09 | 0 | 00:40 | 0.00364 | 0.00364 | 0.000 |
| G2 | JUNCTION | 76.38 | 76.38 | 0 | 00:50 | 2.23 | 2.23 | 0.000 |
| H1 | JUNCTION | 80.97 | 80.97 | 0 | 00:45 | 2.08 | 2.08 | 0.000 |
| H2 | JUNCTION | 91.06 | 91.06 | 0 | 00:40 | 1.38 | 1.38 | 0.000 |
| H3 | JUNCTION | 64.08 | 64.08 | 0 | 01:00 | 2.67 | 2.67 | 0.000 |
| H4 | JUNCTION | 73.15 | 73.15 | 0 | 00:40 | 1.47 | 1.47 | 0.000 |
| H5 | JUNCTION | 28.20 | 28.20 | 0 | 00:50 | 0.959 | 0.959 | 0.000 |
| H6 | JUNCTION | 110.05 | 110.05 | 0 | 00:35 | 1.06 | 1.06 | 0.000 |

# SADDLEHORN RANCH - EX. 100-YR FLOW RESULTS

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Day of Maximum Inflow | Hour of Maximum Inflow | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| J13 | JUNCTION | 0.00 | 69.43 | 0 | 01:03 | 0 | 2.18 | 0.000 |
| J14 | JUNCTION | 0.00 | 68.26 | 0 | 01:09 | 0 | 2.19 | 0.000 |
| J15 | JUNCTION | 0.00 | 63.63 | 0 | 01:07 | 0 | 2.68 | 0.000 |
| J16 | JUNCTION | 0.00 | 103.79 | 0 | 00:38 | 0 | 1.08 | 0.000 |

# SADDLEHORN RANCH - EX. CONDITIONS SWMM MODEL

**01/01/2005 00:15:00**



# Colorado Urban Hydrograph Procedure

Version 2.0.0 - Release Date: 9/9/2016

Urban Drainage and Flood Control District
Denver, Colorado
email: udfcd@udfcd.org

| | |
|---|---|
| **Purpose:** | This program produces hydrographs using the Colorado Unit Hydrograph Procedure (CUHP) |
| **Functions:** | |
| Edit Raingages | Add/Remove Raingages and change names |
| Edit Subcatchments | Edit subcatchment parameters |
| Edit Multiple Run Options | Edit the Multiple Run options (Advanced User Features) |
| Import CUHP 2005 File | Import an older CUHP 2005 workbook into this updated version of CUHP |
| Check Subcatchments | Check whether subcatchment inputs conform to UDFCD guidelines |
| Check SWMM Nodes | Check whether all subcatchment target nodes are included in the SWMM .inp file |
| Run CUHP | Calculate effective precipitation and generate hydrographs for each subcatchment |

**Settings:**

Fill in the blue cells to begin:

| | |
|---|---|
| Project Title: | Saddlehorn Ranch |
| Project Comment: | Prop. Condition Analysis |
| Time Step Between Computations: | 5 Minute(s); typically 5 or 1 (peak flow rate will differ slightly). |
| | ☐ Use Relative Path Names |
| Output Workbook Filename: | X:\2510000.all\2514200\CUHP-SWMM_Proposed\Proposed_CUHP_2002.x |
| CUHP/SWMM Interface Filename (Optional): | X:\2510000.all\2514200\CUHP-SWMM_Proposed\Proposed_CUHP_2002.x |
| EPA SWMM 5 Input Filename (Optional): | X:\2510000.all\2514200\CUHP-SWMM_Proposed\Pr. Conditions Model.in |
| EPA SWMM 5 Application File (Optional): | |
| SWMM Hydrograph Start Time (Optional): | |

**Acknowledgements:** Thanks to Ben Urbonas, P.E., D.WRE and James C.Y.Guo, PhD, P.E., for the development of the CUHP project.

# CUHP SUBCATCHMENTS

Columns with this color heading are for required user-input
Columns with this color heading are for optional override values
Columns with this color heading are for program-calculated values

| | | | | | | | | Maximum Depression Storage (Watershed inches) | | Horton's Infiltration Parameters | | | DCIA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subcatchment Name | EPA SWMM Target Node | Raingage | Area ($mi^2$) | Length to Centroid (mi) | Length (mi) | Slope (ft/ft) | Percent Imperviousness | Pervious | Impervious | Initial Rate (in/hr) | Decay Coefficient (1/seconds) | Final Rate (in/hr) | Level 0, 1, or 2 |
| A | BASIN_A | EPC | 0.014438906 | 0.111379924 | 0.2763826 | 0.0182 | 66.6 | 0.05 | 0.1 | 5 | 0.0007 | 1 | 2 |
| B | BASIN_B | EPC | 0.094375 | 0.323075 | 0.5893636 | 0.0215 | 10.4 | 0.05 | 0.1 | 5 | 0.0007 | 1 | 2 |
| C | BASIN_C | EPC | 0.16015625 | 0.368636174 | 1.0625909 | 0.014 | 11.4 | 0.05 | 0.1 | 4.92 | 0.00074 | 0.9805 | 2 |
| D | BASIN_D | EPC | 0.155 | 0.293488068 | 0.9873106 | 0.015 | 10.8 | 0.05 | 0.1 | 4.42 | 0.001 | 0.8538 | 2 |
| E | BASIN_E | EPC | 0.018057656 | 0.094991667 | 0.2315102 | 0.013 | 7.7 | 0.05 | 0.1 | 5 | 0.0007 | 1 | 2 |
| F | BASIN_F | EPC | 0.1834375 | 0.555589205 | 1.1713883 | 0.013 | 9.9 | 0.05 | 0.1 | 4.77 | 0.0008 | 0.9428 | 2 |
| G | BASIN_G | EPC | 0.06234375 | 0.39589375 | 0.5142614 | 0.015 | 16.8 | 0.05 | 0.1 | 5 | 0.0007 | 1 | 2 |
| H | BASIN_H | EPC | 0.04796875 | 0.236877841 | 0.5166667 | 0.01 | 9.4 | 0.05 | 0.1 | 5 | 0.0007 | 1 | 2 |
| I | BASIN_I | EPC | 0.0728125 | 0.151929546 | 0.3456439 | 0.038 | 9.4 | 0.05 | 0.1 | 4.966 | 0.00077432 | 0.9729729 | 2 |
| J | BASIN_J | EPC | 0.01578125 | 0.105081439 | 0.2051364 | 0.0181 | 2 | 0.05 | 0.1 | 4.604 | 0.0009178 | 0.802336 | 2 |
| UD1 | BASIN_UD1 | EPC | 0.019414688 | 0.068676326 | 0.1751894 | 0.05 | 2 | 0.35 | 0.1 | 4.645 | 0.00089516 | 0.91129 | 2 |
| UD2 | BASIN_UD2 | EPC | 0.02 | 0.085984848 | 0.2719697 | 0.026 | 2 | 0.35 | 0.1 | 5 | 0.0007 | 1 | 2 |
| UD2.1 | BASIN_UD2.1 | EPC | 0.023125 | 0.043181818 | 0.15625 | 0.023 | 2 | 0.35 | 0.1 | 5 | 0.0007 | 1 | 2 |
| UD2.2 | BASIN_UD2.2 | EPC | 0.01125 | 0.041666667 | 0.1344697 | 0.017 | 2 | 0.35 | 0.1 | 5 | 0.0007 | 1 | 2 |
| UD3 | BASIN_UD3 | EPC | 0.020937188 | 0.06155303 | 0.1486742 | 0.02 | 2 | 0.35 | 0.1 | 4.791 | 0.000814925 | 0.94776 | 2 |
| UD4 | BASIN_UD4 | EPC | 0.007533125 | 0.049242424 | 0.1003788 | 0.019 | 2 | 0.35 | 0.1 | 5 | 0.0007 | 1 | 2 |
| UD5 | BASIN_UD5 | EPC | 0.056870313 | 0.261481629 | 0.6155303 | 0.015 | 2 | 0.35 | 0.1 | 3.837 | 0.0013395 | 0.709302 | 2 |
| UD6 | BASIN_UD6 | EPC | 0.034458125 | 0.116450568 | 0.300947 | 0.016 | 2 | 0.35 | 0.1 | 5 | 0.0007 | 1 | 2 |
| UD7 | BASIN_UD7 | EPC | 0.014540938 | 0.134467424 | 0.2462121 | 0.02 | 2 | 0.35 | 0.1 | 4.731 | 0.00129139 | 0.784946 | 2 |
| UD8 | BASIN_UD8 | EPC | 0.0071875 | 0.067613636 | 0.0977273 | 0.04 | 2 | 0.35 | 0.1 | 5 | 0.0007 | 1 | 2 |
| UD8.1 | BASIN_UD8.1 | EPC | 0.00828125 | 0.022727272 | 0.1007576 | 0.03 | 2 | 0.35 | 0.1 | 5 | 0.0007 | 1 | 2 |
| UD9 | BASIN_UD9 | EPC | 0.0075 | 0.083712121 | 0.0984848 | 0.03 | 2 | 0.35 | 0.1 | 4.885 | 0.000952083 | 0.908333 | 2 |
| UD9.1 | BASIN_UD9.1 | EPC | 0.01 | 0.035984848 | 0.1268939 | 0.04 | 2 | 0.35 | 0.1 | 4.867 | 0.000992188 | 0.89375 | 2 |
| UD10 | BASIN_UD10 | EPC | 0.01625 | 0.086214205 | 0.157197 | 0.018 | 2 | 0.35 | 0.1 | 5 | 0.0007 | 1 | 2 |
| UD11 | BASIN_UD11 | EPC | 0.009375 | 0.060524621 | 0.1507576 | 0.0418 | 2 | 0.35 | 0.1 | 5 | 0.0007 | 1 | 2 |
| CH1 | BASIN_CH1 | EPC | 0.037337969 | 0.196631818 | 0.4388258 | 0.01 | 2 | 0.35 | 0.1 | 3.075 | 0.001758577 | 0.518828 | 2 |
| CH2 | BASIN_CH2 | EPC | 0.131612031 | 0.931792235 | 1.5100379 | 0.015 | 2 | 0.35 | 0.1 | 3.979 | 0.001261758 | 0.744655582 | 2 |
| CH3 | BASIN_CH3 | EPC | 0.029757969 | 0.375876326 | 0.7524621 | 0.018 | 2 | 0.35 | 0.1 | 4.805 | 0.00112842 | 1.0315789 | 2 |

# RUN MULTIPLE CUHP AND SWMM SCENARIOS

Columns with this color heading are for required user-input
Columns with this color heading are for program-calculated values

| Subcatchment Name | Existing Landuse % Imperviousness | Future Landuse % Imperviousness |
|---|---|---|
| A | 2 | 66.6 |
| B | 2 | 10.4 |
| C | 2 | 11.4 |
| D | 2 | 10.8 |
| E | 2 | 7.7 |
| F | 2 | 9.9 |
| G | 2 | 16.8 |
| H | 2 | 9.4 |
| I | 2 | 9.4 |
| J | 2 | 2 |
| UD1 | 2 | 2 |
| UD2 | 2 | 2 |
| UD2.1 | 2 | 2 |
| UD2.2 | 2 | 2 |
| UD3 | 2 | 2 |
| UD4 | 2 | 2 |
| UD5 | 2 | 2 |
| UD6 | 2 | 2 |
| UD7 | 2 | 2 |
| UD8 | 2 | 2 |
| UD8.1 | 2 | 2 |
| UD9 | 2 | 2 |
| UD9.1 | 2 | 2 |
| UD10 | 2 | 2 |
| UD11 | 2 | 2 |
| CH1 | 2 | 2 |
| CH2 | 2 | 2 |
| CH3 | 2 | 2 |

| Raingage | Return Period (Years) | 1 Hr Depths (in) | 6 Hr Depths (in) |
|---|---|---|---|
| EPC | WQ | 0.6 | N/A |
| | 2 | 1.19 | 2.1 |
| | 5 | 1.5 | 2.7 |
| | 10 | 1.75 | 3.2 |
| | 25 | 2 | 3.6 |
| | 50 | 2.25 | 4.2 |
| | 100 | 2.52 | 4.6 |

SWMM Run Wait Time (sec): 5

| Enter "X" to Run Scenario | Scenario ID | Land Use (E or F) | Return Period (yr) | Correction Area (Sq.Mi.) |
|---|---|---|---|---|
| | WQ | F | WQ | 0 |
| | 2-YR | F | 2 | 1 |
| X | 5-YR | F | 5 | 1 |
| | 10-YR | F | 10 | 1 |
| | 25-YR | F | 25 | 1 |
| | 50-YR | F | 50 | 1 |
| X | 100-YR | F | 100 | 1 |

(Optional) SWMM Time Series Inflow "Modification Type" (LU, RP, or LU&RP)

(Optional) SWMM Time Series Inflow Table "NAME"

| | | | | | |
|---|---|---|---|---|---|
| Comment | El Paso County Rainfall Depths | | | | |
| 1Hr Depth | 2.52 | inches | 2hr Depth | 2.86 | inches |
| 6Hr Depth | 3.5 | inches | 3hr Depth | 3.11 | inches |
| Correction Area | 1 | Sq. Mi. | | | |
| Return Period | 100 | Years | | | |

NOAA Atlas 14 Point Precipitation Frequency

| Time | Adjusted Depth | Unadjusted Depth |
|---|---|---|
| 0:05 | 0.0252 | 0.0252 |
| 0:10 | 0.0756 | 0.0756 |
| 0:15 | 0.1159 | 0.1159 |
| 0:20 | 0.2016 | 0.2016 |
| 0:25 | 0.3528 | 0.3528 |
| 0:30 | 0.6300 | 0.6300 |
| 0:35 | 0.3528 | 0.3528 |
| 0:40 | 0.2016 | 0.2016 |
| 0:45 | 0.1562 | 0.1562 |
| 0:50 | 0.1260 | 0.1260 |
| 0:55 | 0.1008 | 0.1008 |
| 1:00 | 0.1008 | 0.1008 |
| 1:05 | 0.1008 | 0.1008 |
| 1:10 | 0.0504 | 0.0504 |
| 1:15 | 0.0504 | 0.0504 |
| 1:20 | 0.0302 | 0.0302 |
| 1:25 | 0.0302 | 0.0302 |
| 1:30 | 0.0302 | 0.0302 |
| 1:35 | 0.0302 | 0.0302 |
| 1:40 | 0.0302 | 0.0302 |
| 1:45 | 0.0302 | 0.0302 |
| 1:50 | 0.0302 | 0.0302 |
| 1:55 | 0.0302 | 0.0302 |
| 2:00 | 0.0302 | 0.0302 |
| 2:05 | 0.0000 | 0.0000 |
| 2:10 | 0.0000 | 0.0000 |
| 2:15 | 0.0000 | 0.0000 |
| 2:20 | 0.0000 | 0.0000 |
| 2:25 | 0.0000 | 0.0000 |
| 2:30 | 0.0000 | 0.0000 |
| 2:35 | 0.0000 | 0.0000 |
| 2:40 | 0.0000 | 0.0000 |
| 2:45 | 0.0000 | 0.0000 |
| 2:50 | 0.0000 | 0.0000 |
| 2:55 | 0.0000 | 0.0000 |
| 3:00 | 0.0000 | 0.0000 |
| 3:05 | 0.0000 | 0.0000 |
| 3:10 | 0.0000 | 0.0000 |
| 3:15 | 0.0000 | 0.0000 |
| 3:20 | 0.0000 | 0.0000 |
| 3:25 | 0.0000 | 0.0000 |
| 3:30 | 0.0000 | 0.0000 |
| 3:35 | 0.0000 | 0.0000 |
| 3:40 | 0.0000 | 0.0000 |
| 3:45 | 0.0000 | 0.0000 |
| 3:50 | 0.0000 | 0.0000 |

# SADDLEHORN RANCH - PROPOSED CONDITIONS - 5-YEAR FLOW RESULTS

Node Inflow Summary

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Day of Maximum Inflow | Hour of Maximum Inflow | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| BASIN_A | JUNCTION | 9.53 | 9.53 | 0 | 00:30 | 0.201 | 0.201 | 0.000 |
| BASIN_B | JUNCTION | 9.93 | 9.93 | 0 | 00:35 | 0.303 | 0.303 | 0.000 |
| BASIN_C | JUNCTION | 15.80 | 15.80 | 0 | 00:40 | 0.591 | 0.591 | 0.000 |
| BASIN_CH1 | JUNCTION | 5.98 | 5.98 | 0 | 00:45 | 0.245 | 0.245 | 0.000 |
| BASIN_CH2 | JUNCTION | 3.85 | 3.85 | 0 | 01:00 | 0.266 | 0.266 | 0.018 |
| BASIN_CH3 | JUNCTION | 0.11 | 0.11 | 0 | 00:40 | 0.00694 | 0.00694 | 0.000 |
| BASIN_D | JUNCTION | 29.42 | 29.42 | 0 | 00:40 | 0.945 | 0.945 | 0.000 |
| BASIN_E | JUNCTION | 2.02 | 2.02 | 0 | 00:30 | 0.052 | 0.052 | 0.000 |
| BASIN_F | JUNCTION | 16.97 | 16.97 | 0 | 00:45 | 0.77 | 0.77 | -0.000 |
| BASIN_G | JUNCTION | 6.06 | 6.06 | 0 | 00:35 | 0.252 | 0.252 | 0.000 |
| BASIN_H | JUNCTION | 3.70 | 3.70 | 0 | 00:35 | 0.148 | 0.148 | 0.000 |
| BASIN_I | JUNCTION | 15.89 | 15.89 | 0 | 00:30 | 0.262 | 0.262 | 0.000 |
| BASIN_J | JUNCTION | 3.01 | 3.01 | 0 | 00:30 | 0.0749 | 0.0749 | 0.000 |
| BASIN_UD1 | JUNCTION | 0.28 | 0.28 | 0 | 00:30 | 0.00374 | 0.00374 | 0.000 |
| BASIN_UD10 | JUNCTION | 0.05 | 0.05 | 0 | 00:30 | 0.00101 | 0.00101 | 0.000 |
| BASIN_UD11 | JUNCTION | 0.04 | 0.04 | 0 | 00:30 | 0.000578 | 0.000578 | 0.000 |
| BASIN_UD2.1 | JUNCTION | 0.13 | 0.13 | 0 | 00:30 | 0.00142 | 0.00142 | 0.000 |
| BASIN_UD2.2 | JUNCTION | 0.05 | 0.05 | 0 | 00:30 | 0.000693 | 0.000693 | 0.000 |
| BASIN_UD2 | JUNCTION | 0.06 | 0.06 | 0 | 00:35 | 0.00125 | 0.00125 | 0.000 |
| BASIN_UD3 | JUNCTION | 0.21 | 0.21 | 0 | 00:30 | 0.00301 | 0.00301 | 0.000 |

# SADDLEHORN RANCH - PROPOSED CONDITIONS - 5-YEAR FLOW RESULTS

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Day of Maximum Inflow | Hour of Maximum Inflow | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| BASIN_UD4 | JUNCTION | 0.03 | 0.03 | 0 | 00:30 | 0.000464 | 0.000464 | 0.000 |
| BASIN_UD5 | JUNCTION | 4.11 | 4.11 | 0 | 00:40 | 0.157 | 0.157 | 0.000 |
| BASIN_UD6 | JUNCTION | 0.10 | 0.10 | 0 | 00:35 | 0.00215 | 0.00215 | -0.000 |
| BASIN_UD7 | JUNCTION | 0.69 | 0.69 | 0 | 00:35 | 0.0212 | 0.0212 | 0.000 |
| BASIN_UD8.1 | JUNCTION | 0.05 | 0.05 | 0 | 00:30 | 0.000496 | 0.000496 | 0.000 |
| BASIN_UD8 | JUNCTION | 0.03 | 0.03 | 0 | 00:30 | 0.000442 | 0.000442 | 0.000 |
| BASIN_UD9.1 | JUNCTION | 0.18 | 0.18 | 0 | 00:30 | 0.00212 | 0.00212 | 0.000 |
| BASIN_UD9 | JUNCTION | 0.08 | 0.08 | 0 | 00:30 | 0.00148 | 0.00148 | 0.000 |
| OUT_CH1 | OUTFALL | 0.00 | 0.08 | 0 | 04:39 | 0 | 0.00969 | 0.000 |
| OUT_CH2 | OUTFALL | 0.00 | 0.08 | 0 | 00:34 | 0 | 0.0108 | 0.000 |
| OUT_CH3 | OUTFALL | 0.00 | 0.08 | 0 | 01:50 | 0 | 0.00678 | 0.000 |
| OUT_UD10 | OUTFALL | 0.00 | 0.05 | 0 | 00:30 | 0 | 0.00101 | 0.000 |
| OUT_UD11 | OUTFALL | 0.00 | 0.02 | 0 | 01:20 | 0 | 0.000921 | 0.000 |
| OUT_UD2.1 | OUTFALL | 0.00 | 0.13 | 0 | 00:30 | 0 | 0.00142 | 0.000 |
| OUT_UD2.2 | OUTFALL | 0.00 | 0.05 | 0 | 00:30 | 0 | 0.000693 | 0.000 |
| OUT_UD2 | OUTFALL | 0.00 | 0.06 | 0 | 00:35 | 0 | 0.00125 | 0.000 |
| OUT_UD3 | OUTFALL | 0.00 | 0.21 | 0 | 00:30 | 0 | 0.00301 | 0.000 |
| OUT_UD4 | OUTFALL | 0.00 | 0.03 | 0 | 00:30 | 0 | 0.000464 | 0.000 |
| OUT_UD5 | OUTFALL | 0.00 | 4.11 | 0 | 00:40 | 0 | 0.157 | 0.000 |
| OUT_UD6 | OUTFALL | 0.00 | 0.06 | 0 | 01:14 | 0 | 0.00282 | 0.000 |
| OUT_UD7 | OUTFALL | 0.00 | 0.69 | 0 | 00:35 | 0 | 0.0212 | 0.000 |

# SADDLEHORN RANCH - PROPOSED CONDITIONS - 5-YEAR FLOW RESULTS

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Day of Maximum Inflow | Hour of Maximum Inflow | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| OUT_UD8.1 | OUTFALL | 0.00 | 0.05 | 0 | 00:30 | 0 | 0.000496 | 0.000 |
| OUT_UD8 | OUTFALL | 0.00 | 0.03 | 0 | 00:30 | 0 | 0.000442 | 0.000 |
| OUT_UD9.1 | OUTFALL | 0.00 | 0.18 | 0 | 00:30 | 0 | 0.00212 | 0.000 |
| OUT_UD9 | OUTFALL | 0.00 | 0.08 | 0 | 00:30 | 0 | 0.00148 | 0.000 |
| POND_A | STORAGE | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| POND_B | STORAGE | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| POND_C | STORAGE | 0.00 | 15.80 | 0 | 00:40 | 0 | 0.591 | 0.000 |
| POND_D | STORAGE | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| POND_E | STORAGE | 0.00 | 0.08 | 0 | 03:07 | 0 | 0.00674 | 0.003 |
| POND_F | STORAGE | 0.00 | 0.08 | 0 | 05:22 | 0 | 0.0108 | -0.000 |
| POND_G | STORAGE | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| POND_H | STORAGE | 0.00 | 0.08 | 0 | 04:41 | 0 | 0.00965 | 0.012 |
| POND_I | STORAGE | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| POND_J | STORAGE | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| WF7A(1) | OUTFALL | 0.00 | 0.28 | 0 | 00:30 | 0 | 0.00374 | 0.000 |

# SADDLEHORN RANCH - PROPOSED CONDITIONS - 100-YEAR FLOW RESULTS

Node Inflow Summary

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Day of Maximum Inflow | Hour of Maximum Inflow | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| BASIN_A | JUNCTION | 20.65 | 20.65 | 0 | 00:35 | 0.459 | 0.459 | 0.000 |
| BASIN_B | JUNCTION | 46.27 | 46.27 | 0 | 00:45 | 1.49 | 1.49 | 0.000 |
| BASIN_C | JUNCTION | 69.36 | 69.36 | 0 | 00:50 | 2.71 | 2.71 | 0.000 |
| BASIN_CH1 | JUNCTION | 1038.79 | 1038.79 | 0 | 00:55 | 165 | 165 | 0.069 |
| BASIN_CH2 | JUNCTION | 485.62 | 485.62 | 0 | 01:20 | 75.3 | 75.3 | 0.068 |
| BASIN_CH3 | JUNCTION | 136.35 | 136.35 | 0 | 01:00 | 21.4 | 21.4 | 0.068 |
| BASIN_D | JUNCTION | 95.36 | 95.36 | 0 | 00:50 | 3.47 | 3.47 | 0.000 |
| BASIN_E | JUNCTION | 9.85 | 9.85 | 0 | 00:40 | 0.273 | 0.273 | -0.000 |
| BASIN_F | JUNCTION | 69.89 | 69.89 | 0 | 00:55 | 3.32 | 3.32 | 0.000 |
| BASIN_G | JUNCTION | 25.31 | 25.31 | 0 | 00:50 | 1.09 | 1.09 | 0.000 |
| BASIN_H | JUNCTION | 17.93 | 17.93 | 0 | 00:45 | 0.746 | 0.746 | -0.000 |
| BASIN_I | JUNCTION | 63.07 | 63.07 | 0 | 00:40 | 1.23 | 1.23 | 0.000 |
| BASIN_J | JUNCTION | 10.52 | 10.52 | 0 | 00:40 | 0.315 | 0.315 | 0.000 |
| BASIN_UD1 | JUNCTION | 13.90 | 13.90 | 0 | 00:40 | 0.251 | 0.251 | 0.000 |
| BASIN_UD10 | JUNCTION | 6.67 | 6.67 | 0 | 00:40 | 0.143 | 0.143 | 0.000 |
| BASIN_UD11 | JUNCTION | 4.27 | 4.27 | 0 | 00:40 | 0.0818 | 0.0818 | 0.000 |
| BASIN_UD2.1 | JUNCTION | 14.66 | 14.66 | 0 | 00:35 | 0.2 | 0.2 | 0.000 |

# SADDLEHORN RANCH - PROPOSED CONDITIONS - 100-YEAR FLOW RESULTS

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Day of Maximum Inflow | Hour of Maximum Inflow | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| BASIN_UD2.2 | JUNCTION | 5.50 | 5.50 | 0 | 00:40 | 0.098 | 0.098 | 0.000 |
| BASIN_UD2 | JUNCTION | 7.67 | 7.67 | 0 | 00:40 | 0.177 | 0.177 | 0.000 |
| BASIN_UD3 | JUNCTION | 13.14 | 13.14 | 0 | 00:40 | 0.235 | 0.235 | 0.000 |
| BASIN_UD4 | JUNCTION | 3.44 | 3.44 | 0 | 00:40 | 0.0655 | 0.0655 | 0.000 |
| BASIN_UD5 | JUNCTION | 27.35 | 27.35 | 0 | 00:55 | 1.2 | 1.2 | 0.000 |
| BASIN_UD6 | JUNCTION | 12.42 | 12.42 | 0 | 00:40 | 0.304 | 0.304 | -0.000 |
| BASIN_UD7 | JUNCTION | 7.40 | 7.40 | 0 | 00:50 | 0.272 | 0.272 | 0.000 |
| BASIN_UD8.1 | JUNCTION | 5.63 | 5.63 | 0 | 00:35 | 0.0702 | 0.0702 | 0.000 |
| BASIN_UD8 | JUNCTION | 3.32 | 3.32 | 0 | 00:40 | 0.0624 | 0.0624 | 0.000 |
| BASIN_UD9.1 | JUNCTION | 8.08 | 8.08 | 0 | 00:35 | 0.139 | 0.139 | 0.000 |
| BASIN_UD9 | JUNCTION | 4.16 | 4.16 | 0 | 00:40 | 0.1 | 0.1 | 0.000 |
| OUT_CH1 | OUTFALL | 0.00 | 0.07 | 0 | 00:00 | 0 | 0.0118 | 0.000 |
| OUT_CH2 | OUTFALL | 0.00 | 0.07 | 0 | 00:00 | 0 | 0.0118 | 0.000 |
| OUT_CH3 | OUTFALL | 0.00 | 0.07 | 0 | 00:00 | 0 | 0.0118 | 0.000 |
| OUT_UD10 | OUTFALL | 0.00 | 6.67 | 0 | 00:40 | 0 | 0.143 | 0.000 |
| OUT_UD11 | OUTFALL | 0.00 | 0.08 | 0 | 02:28 | 0 | 0.00531 | 0.000 |
| OUT_UD2.1 | OUTFALL | 0.00 | 14.66 | 0 | 00:35 | 0 | 0.2 | 0.000 |
| OUT_UD2.2 | OUTFALL | 0.00 | 5.50 | 0 | 00:40 | 0 | 0.098 | 0.000 |

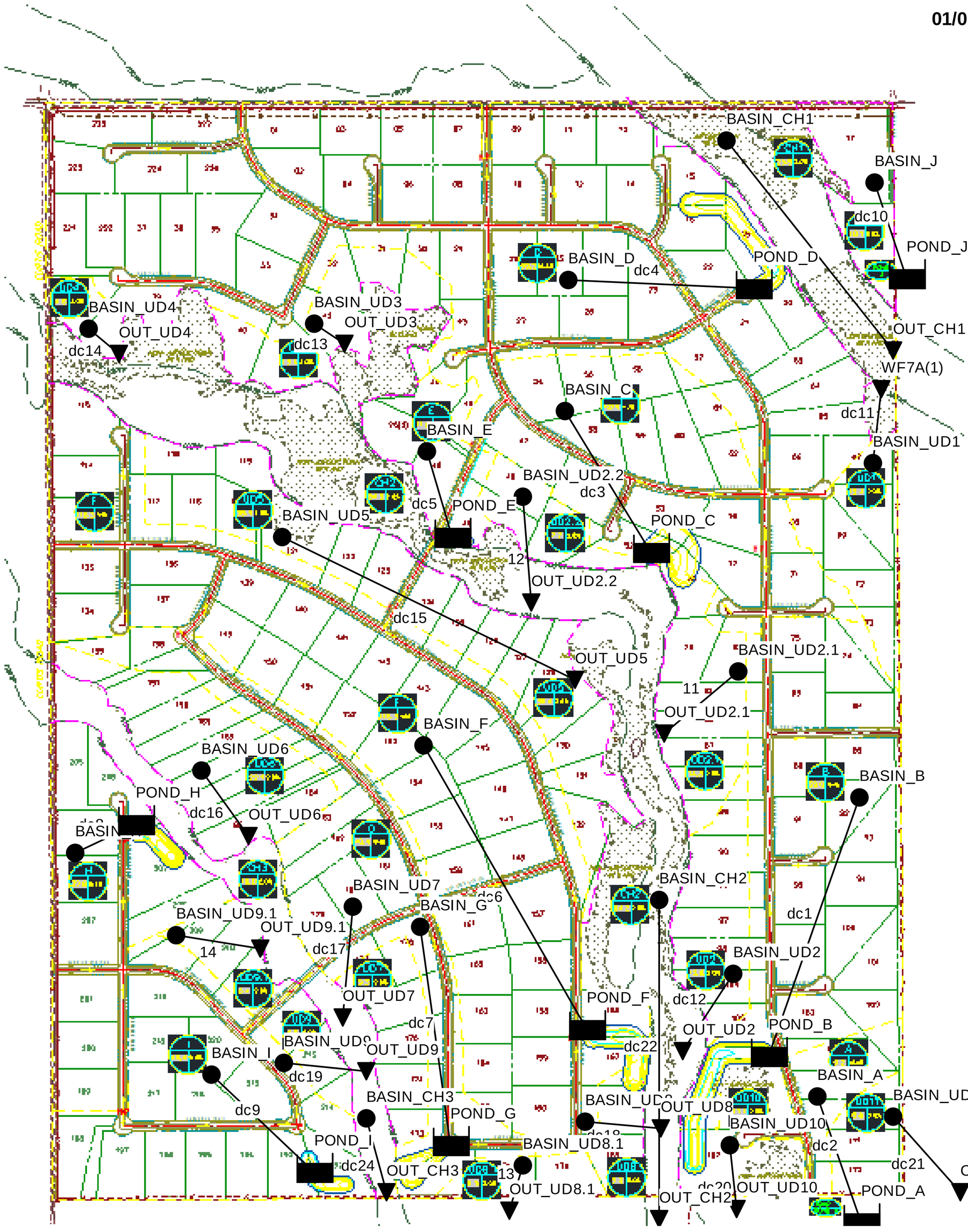
# SADDLEHORN RANCH - PROPOSED CONDITIONS - 100-YEAR FLOW RESULTS

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Day of Maximum Inflow | Hour of Maximum Inflow | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| OUT_UD2 | OUTFALL | 0.00 | 7.67 | 0 | 00:40 | 0 | 0.177 | 0.000 |
| OUT_UD3 | OUTFALL | 0.00 | 13.14 | 0 | 00:40 | 0 | 0.235 | 0.000 |
| OUT_UD4 | OUTFALL | 0.00 | 3.44 | 0 | 00:40 | 0 | 0.0655 | 0.000 |
| OUT_UD5 | OUTFALL | 0.00 | 27.35 | 0 | 00:55 | 0 | 1.2 | 0.000 |
| OUT_UD6 | OUTFALL | 0.00 | 0.08 | 0 | 03:08 | 0 | 0.00664 | 0.000 |
| OUT_UD7 | OUTFALL | 0.00 | 7.40 | 0 | 00:50 | 0 | 0.272 | 0.000 |
| OUT_UD8.1 | OUTFALL | 0.00 | 5.63 | 0 | 00:35 | 0 | 0.0702 | 0.000 |
| OUT_UD8 | OUTFALL | 0.00 | 3.32 | 0 | 00:40 | 0 | 0.0624 | 0.000 |
| OUT_UD9.1 | OUTFALL | 0.00 | 8.08 | 0 | 00:35 | 0 | 0.139 | 0.000 |
| OUT_UD9 | OUTFALL | 0.00 | 4.16 | 0 | 00:40 | 0 | 0.1 | 0.000 |
| POND_A | STORAGE | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| POND_B | STORAGE | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| POND_C | STORAGE | 0.00 | 69.36 | 0 | 00:50 | 0 | 2.71 | 0.000 |
| POND_D | STORAGE | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| POND_E | STORAGE | 0.00 | 0.08 | 0 | 03:24 | 0 | 0.00736 | 0.003 |
| POND_F | STORAGE | 0.00 | 0.08 | 0 | 05:51 | 0 | 0.0111 | -0.000 |
| POND_G | STORAGE | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| POND_H | STORAGE | 0.00 | 0.08 | 0 | 04:57 | 0 | 0.0102 | 0.018 |

# SADDLEHORN RANCH - PROPOSED CONDITIONS - 100-YEAR FLOW RESULTS

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Day of Maximum Inflow | Hour of Maximum Inflow | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|---|
| POND_I | STORAGE | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| POND_J | STORAGE | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 |
| WF7A(1) | OUTFALL | 0.00 | 13.90 | 0 | 00:40 | 0 | 0.251 | 0.000 |

01/01/2005 00:15:00

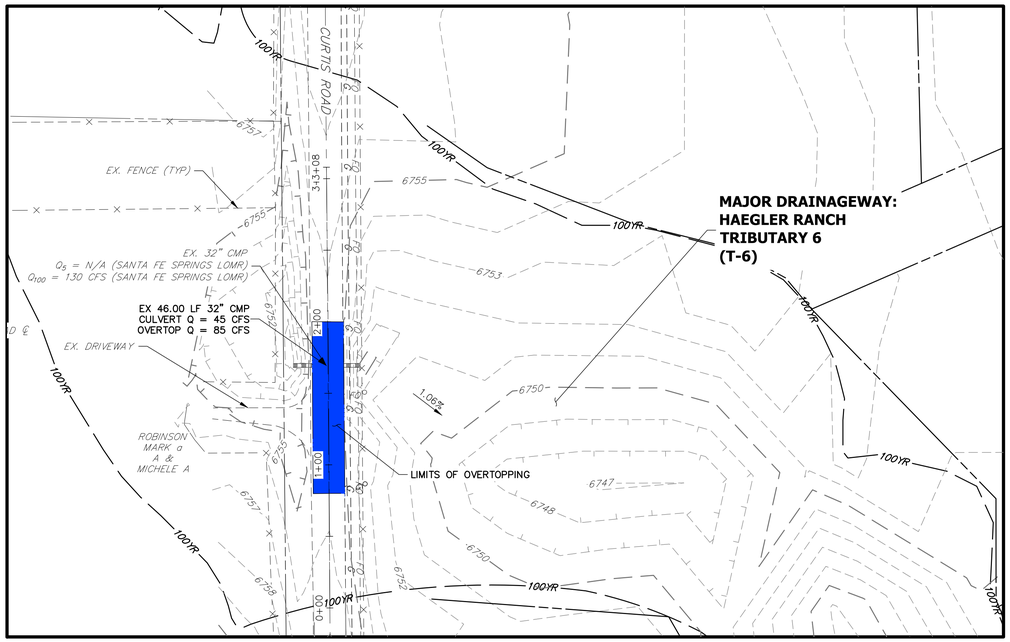


# APPENDIX C

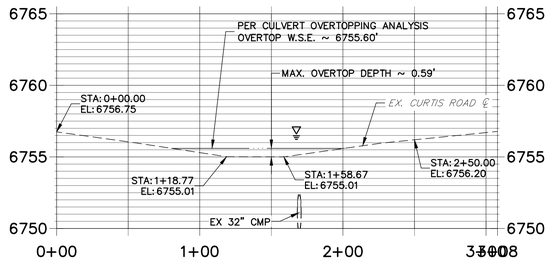
# HYDRAULIC CALCULATIONS

# SADDLEHORN RANCH

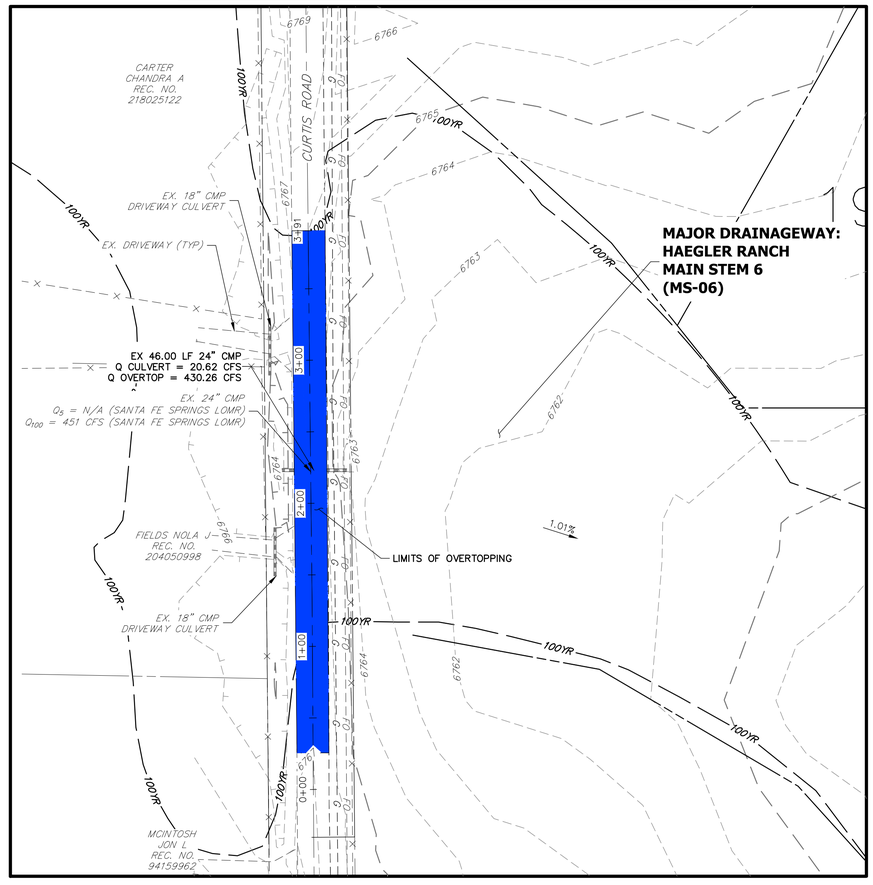
## SOUTHERNMOST CURTIS ROAD CULVERT - 36" CMP



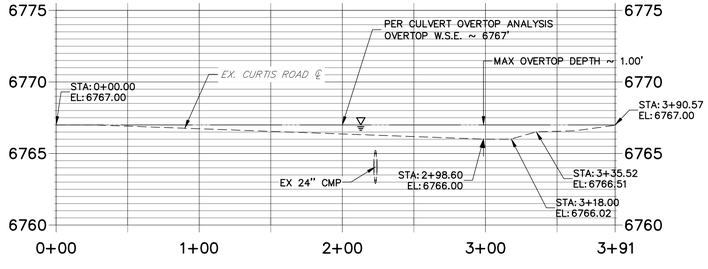

## CURTIS ROAD CL PROFILE
## STA 0+00.00 TO 3+08.03




## NORTHERNMOST CURTIS ROAD CULVERT - 24" CMP




## CURTIS ROAD NORTH CULVERT ROAD PROFILE PROFILE
## STA 0+00.00 TO 3+90.57




SADDLEHORN RANCH
EX. CULVERT OVERTOPPING
2514200
11/27/19
SHEET 1 OF 2


J·R ENGINEERING
A Westrian Company

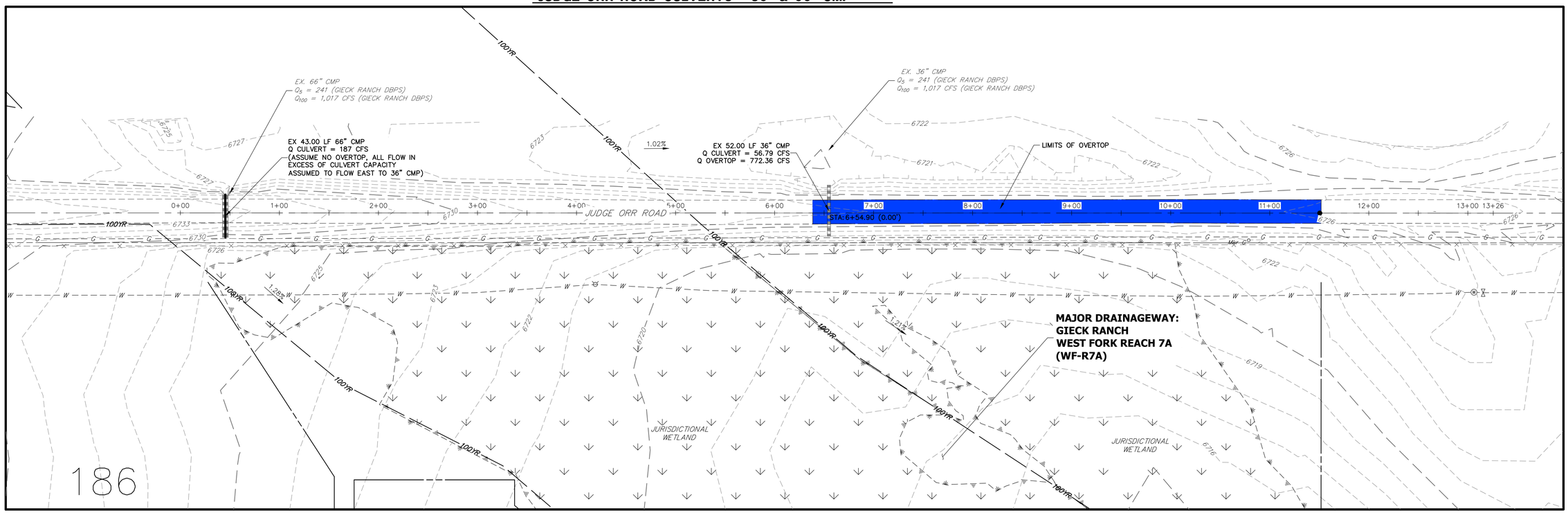
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com



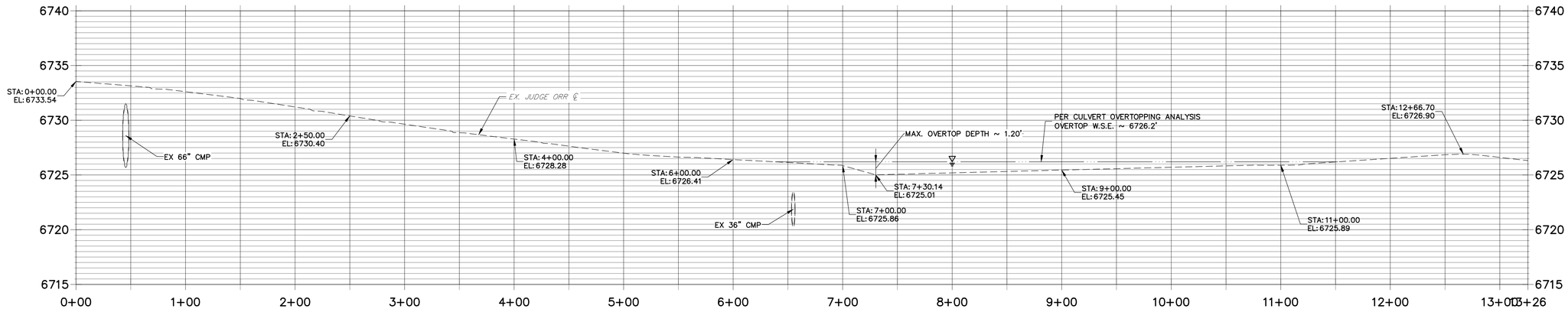
X:\2514000.all\2514200\Drawings\Sheet Dwgs_Drainage\2019-11-12_Culvert Overtop Analysis.dwg, Overtop_Curtis, 11/20/2019 1:59:08 PM, CS

# SADDLEHORN RANCH

## JUDGE ORR ROAD CULVERTS - 36" & 66" CMP




## JUDGE ORR ROAD WEST & EAST CULVERT ROAD PROFILE PROFILE
## STA 0+00.00 TO 13+25.72




SADDLEHORN RANCH
EX CULVERT OVERTOPPING
2514200
11/27/19
SHEET 2 OF 2


J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com



X:\2510000.all\2514200\Drawings\Sheet Dwgs_Drainage\2019-11-12_Culvert Overtop Analysis.dwg, Overtop_Judge Orr, 11/20/2019 1:59:19 PM, CS

JUDGE ORR ROAD - WEST CULVERT - EX 66" CMP - Q_100 = 1,017 CFS

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

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

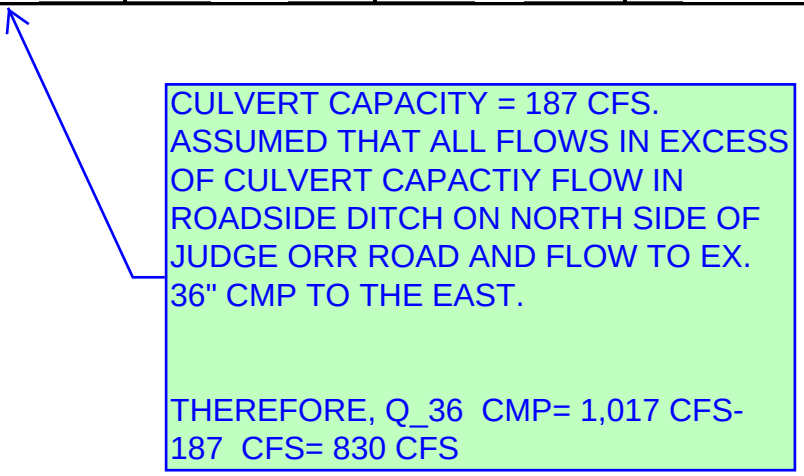
Minimum Flow: 1016 cfs

Design Flow: 1017 cfs

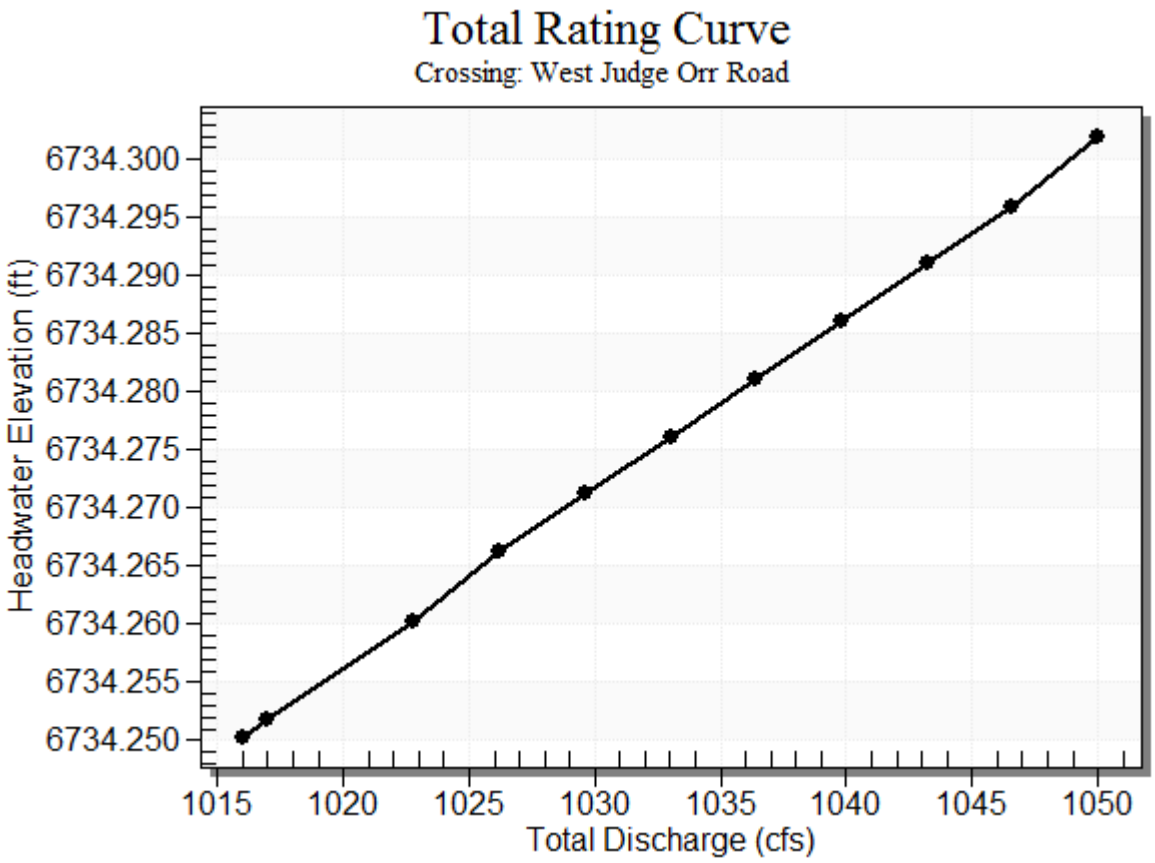
Maximum Flow: 1050 cfs

**Table 1 - Summary of Culvert Flows at Crossing: West Judge Orr Road**

| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 6734.25 | 1016.00 | 252.15 | 763.52 | 9 |
| 6734.25 | 1017.00 | 252.20 | 764.43 | 2 |
| 6734.26 | 1022.80 | 252.51 | 769.68 | 2 |
| 6734.27 | 1026.20 | 252.75 | 773.43 | 3 |
| 6734.27 | 1029.60 | 252.95 | 776.51 | 2 |
| 6734.28 | 1033.00 | 253.15 | 779.60 | 2 |
| 6734.28 | 1036.40 | 253.34 | 782.69 | 2 |
| 6734.29 | 1039.80 | 253.54 | 785.79 | 2 |
| 6734.29 | 1043.20 | 253.74 | 788.89 | 2 |
| 6734.30 | 1046.60 | 253.94 | 791.99 | 2 |
| 6734.30 | 1050.00 | 254.18 | 795.79 | 3 |
| 6732.40 | 187.39 | 187.39 | 0.00 | Overtopping |



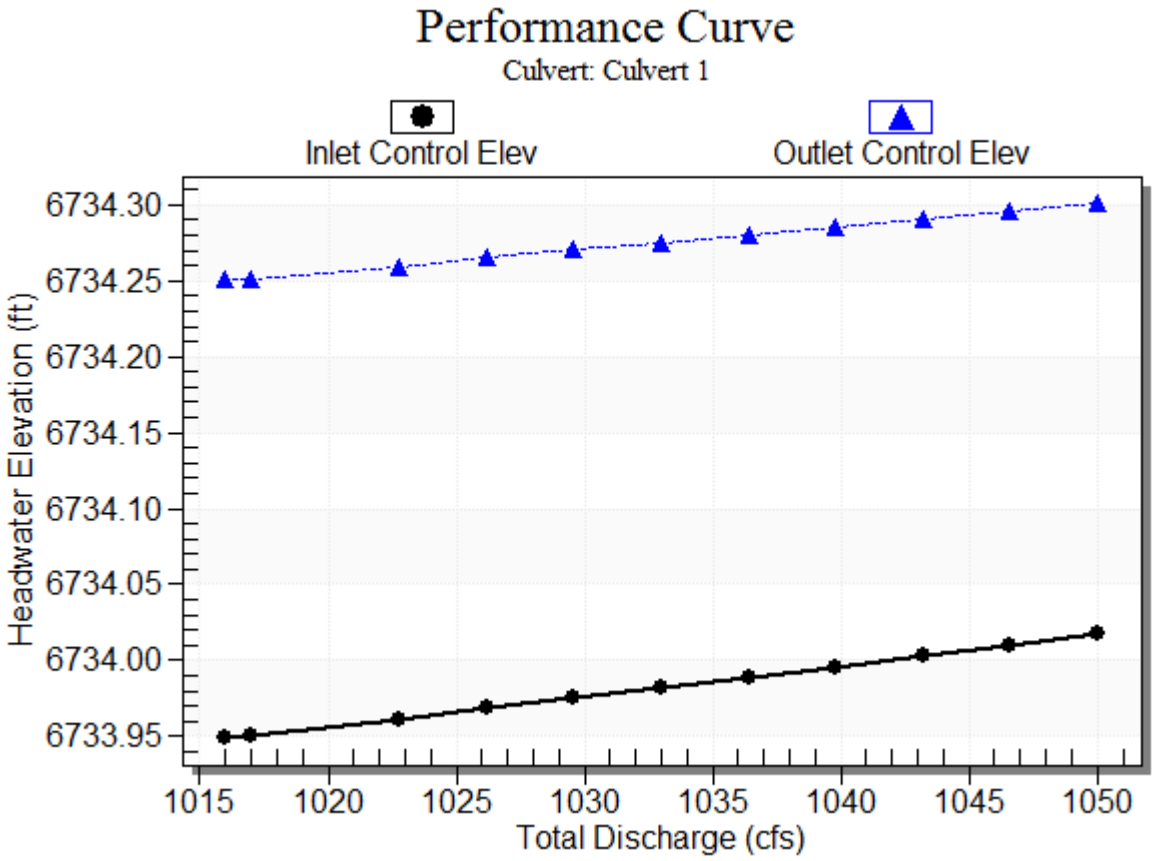
**Rating Curve Plot for Crossing: West Judge Orr Road**



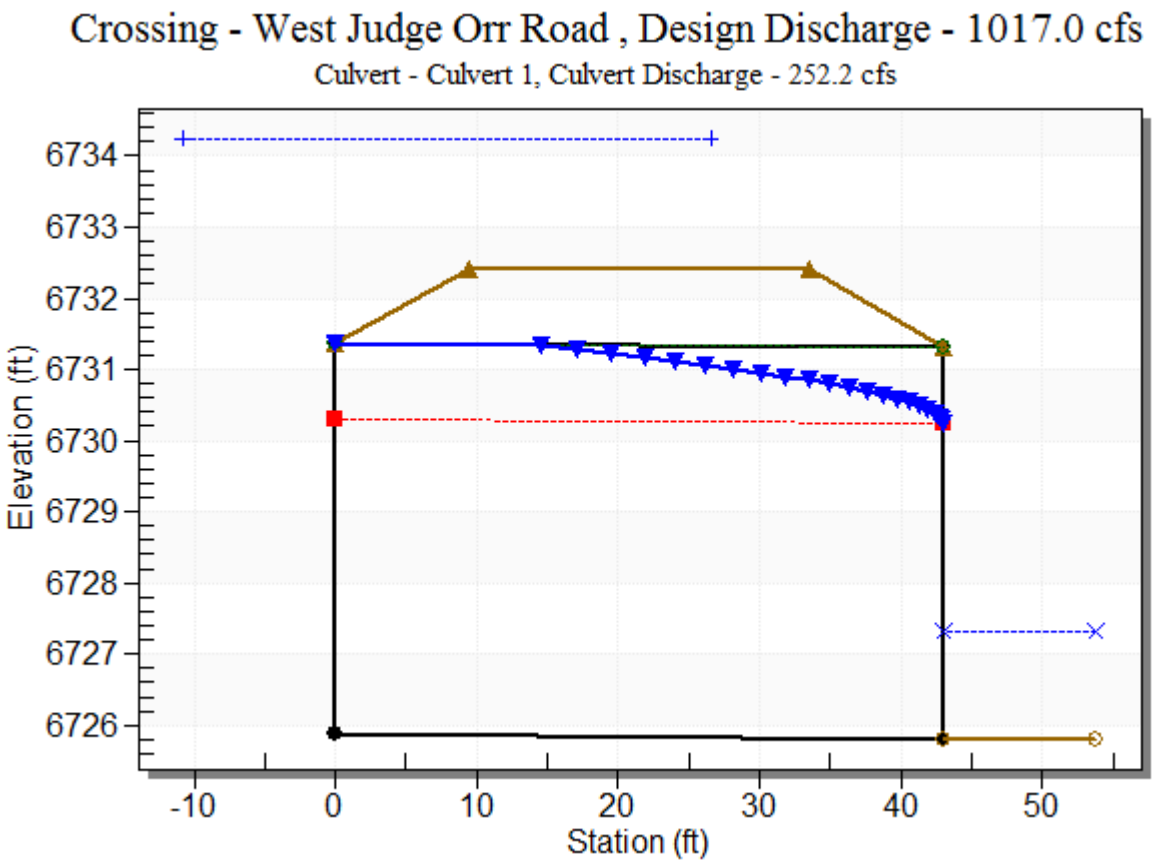
## Table 2 - Culvert Summary Table: Culvert 1

| Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1016.00 | 252.15 | 6734.25 | 8.079 | 8.380 | 7-M2c | 5.500 | 4.426 | 4.426 | 1.507 | 12.307 | 5.858 |
| 1017.00 | 252.20 | 6734.25 | 8.081 | 8.382 | 7-M2c | 5.500 | 4.426 | 4.426 | 1.508 | 12.308 | 5.860 |
| 1022.80 | 252.51 | 6734.26 | 8.091 | 8.389 | 7-M2c | 5.500 | 4.429 | 4.429 | 1.513 | 12.317 | 5.871 |
| 1026.20 | 252.75 | 6734.27 | 8.099 | 8.395 | 7-M2c | 5.500 | 4.431 | 4.431 | 1.516 | 12.324 | 5.878 |
| 1029.60 | 252.95 | 6734.27 | 8.106 | 8.400 | 7-M2c | 5.500 | 4.432 | 4.432 | 1.519 | 12.329 | 5.885 |
| 1033.00 | 253.15 | 6734.28 | 8.113 | 8.405 | 7-M2c | 5.500 | 4.434 | 4.434 | 1.522 | 12.335 | 5.891 |
| 1036.40 | 253.34 | 6734.28 | 8.119 | 8.410 | 7-M2c | 5.500 | 4.435 | 4.435 | 1.525 | 12.340 | 5.898 |
| 1039.80 | 253.54 | 6734.29 | 8.126 | 8.415 | 7-M2c | 5.500 | 4.437 | 4.437 | 1.528 | 12.346 | 5.905 |
| 1043.20 | 253.74 | 6734.29 | 8.133 | 8.420 | 7-M2c | 5.500 | 4.438 | 4.438 | 1.530 | 12.351 | 5.912 |
| 1046.60 | 253.94 | 6734.30 | 8.140 | 8.425 | 7-M2c | 5.500 | 4.440 | 4.440 | 1.533 | 12.357 | 5.918 |
| 1050.00 | 254.18 | 6734.30 | 8.148 | 8.431 | 7-M2c | 5.500 | 4.442 | 4.442 | 1.536 | 12.364 | 5.925 |

**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: 6725.87 ft

Outlet Station: 43.00 ft

Outlet Elevation: 6725.81 ft

Number of Barrels: 1

**Culvert Data Summary - Culvert 1**

Barrel Shape: Circular

Barrel Diameter: 5.50 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

JUDGE ORR ROAD - WEST CULVERT - EX 36" CMP - Q_100 = 830 CFS

## Crossing Discharge Data

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

Minimum Flow: 830 cfs

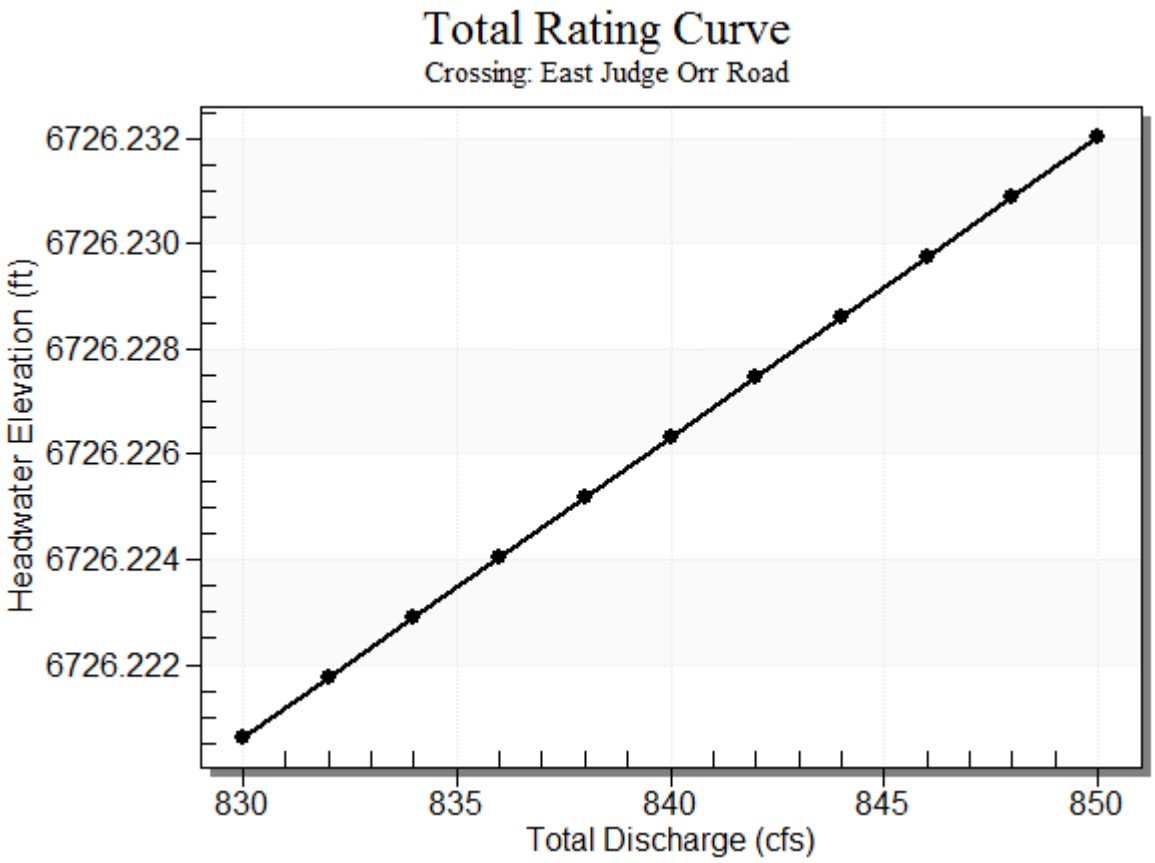
Design Flow: 840 cfs

Maximum Flow: 850 cfs

## Table 4 - Summary of Culvert Flows at Crossing: East Judge Orr Road

| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 6726.22 | 830.00 | 56.79 | 772.36 | 7 |
| 6726.22 | 832.00 | 56.80 | 774.33 | 2 |
| 6726.22 | 834.00 | 56.81 | 776.30 | 2 |
| 6726.22 | 836.00 | 56.82 | 778.27 | 2 |
| 6726.23 | 838.00 | 56.83 | 780.25 | 2 |
| 6726.23 | 840.00 | 56.84 | 782.23 | 2 |
| 6726.23 | 842.00 | 56.85 | 784.21 | 2 |
| 6726.23 | 844.00 | 56.86 | 786.19 | 2 |
| 6726.23 | 846.00 | 56.87 | 788.18 | 2 |
| 6726.23 | 848.00 | 56.88 | 790.17 | 2 |
| 6726.23 | 850.00 | 56.89 | 792.16 | 2 |
| 6725.07 | 46.85 | 46.85 | 0.00 | Overtopping |

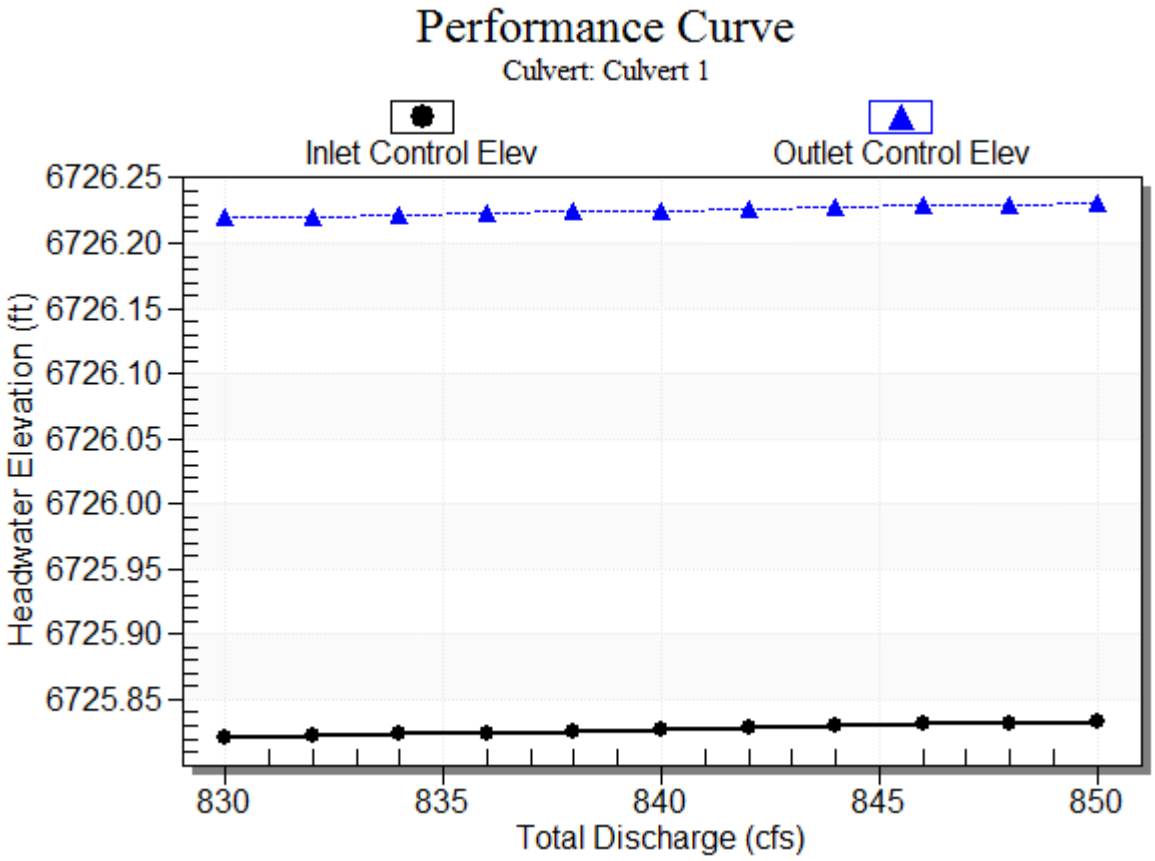
**Rating Curve Plot for Crossing: East Judge Orr Road**



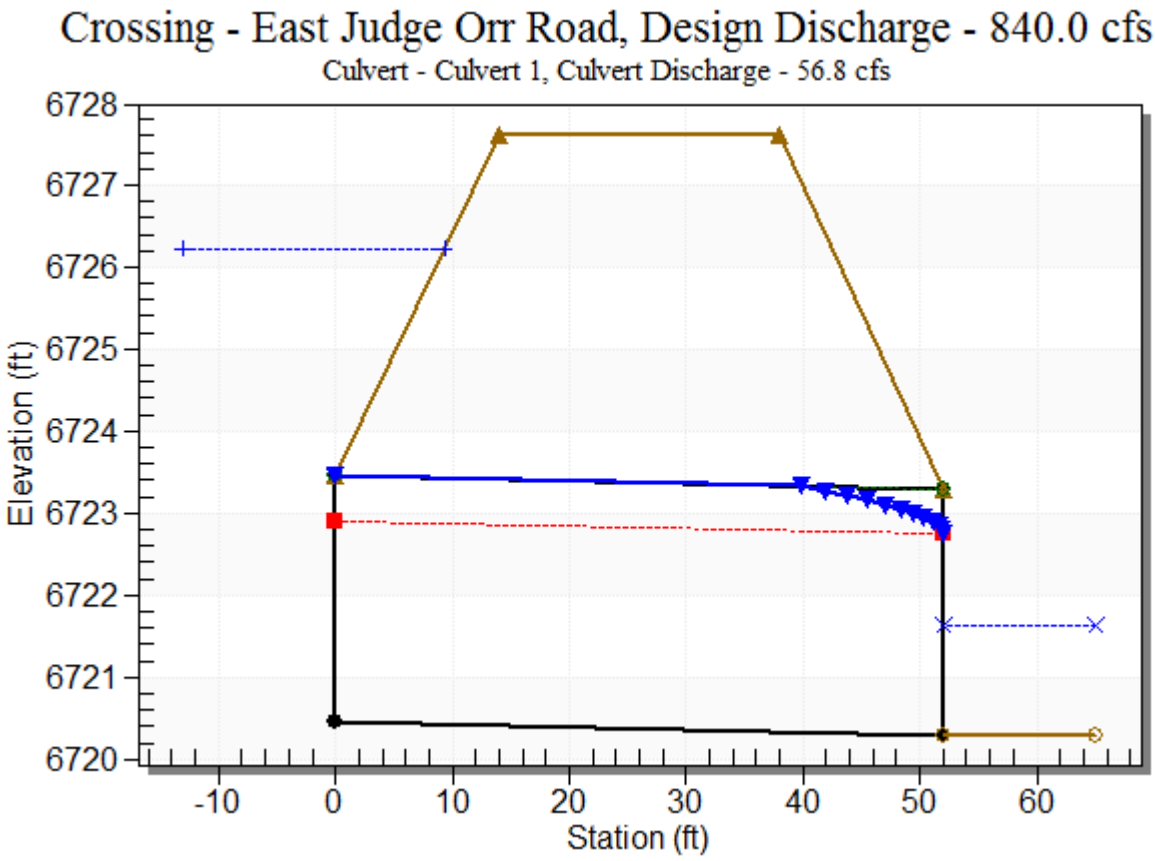
## Table 5 - Culvert Summary Table: Culvert 1

| Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 830.00 | 56.79 | 6726.22 | 5.371 | 5.770 | 7-M2c | 3.000 | 2.440 | 2.440 | 1.327 | 9.225 | 4.945 |
| 832.00 | 56.80 | 6726.22 | 5.372 | 5.771 | 7-M2c | 3.000 | 2.440 | 2.440 | 1.328 | 9.226 | 4.948 |
| 834.00 | 56.81 | 6726.22 | 5.373 | 5.772 | 7-M2c | 3.000 | 2.440 | 2.440 | 1.330 | 9.227 | 4.952 |
| 836.00 | 56.82 | 6726.22 | 5.374 | 5.773 | 7-M2c | 3.000 | 2.440 | 2.440 | 1.332 | 9.228 | 4.956 |
| 838.00 | 56.83 | 6726.23 | 5.376 | 5.774 | 7-M2c | 3.000 | 2.440 | 2.440 | 1.334 | 9.229 | 4.960 |
| 840.00 | 56.84 | 6726.23 | 5.377 | 5.775 | 7-M2c | 3.000 | 2.441 | 2.441 | 1.336 | 9.230 | 4.964 |
| 842.00 | 56.85 | 6726.23 | 5.378 | 5.776 | 7-M2c | 3.000 | 2.441 | 2.441 | 1.337 | 9.231 | 4.968 |
| 844.00 | 56.86 | 6726.23 | 5.380 | 5.778 | 7-M2c | 3.000 | 2.441 | 2.441 | 1.339 | 9.232 | 4.971 |
| 846.00 | 56.87 | 6726.23 | 5.381 | 5.779 | 7-M2c | 3.000 | 2.441 | 2.441 | 1.341 | 9.233 | 4.975 |
| 848.00 | 56.88 | 6726.23 | 5.382 | 5.780 | 7-M2c | 3.000 | 2.441 | 2.441 | 1.343 | 9.234 | 4.979 |
| 850.00 | 56.89 | 6726.23 | 5.383 | 5.781 | 7-M2c | 3.000 | 2.442 | 2.442 | 1.344 | 9.235 | 4.982 |

**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: 6720.45 ft

Outlet Station: 52.00 ft

Outlet Elevation: 6720.30 ft

Number of Barrels: 1

**Culvert Data Summary - Culvert 1**

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

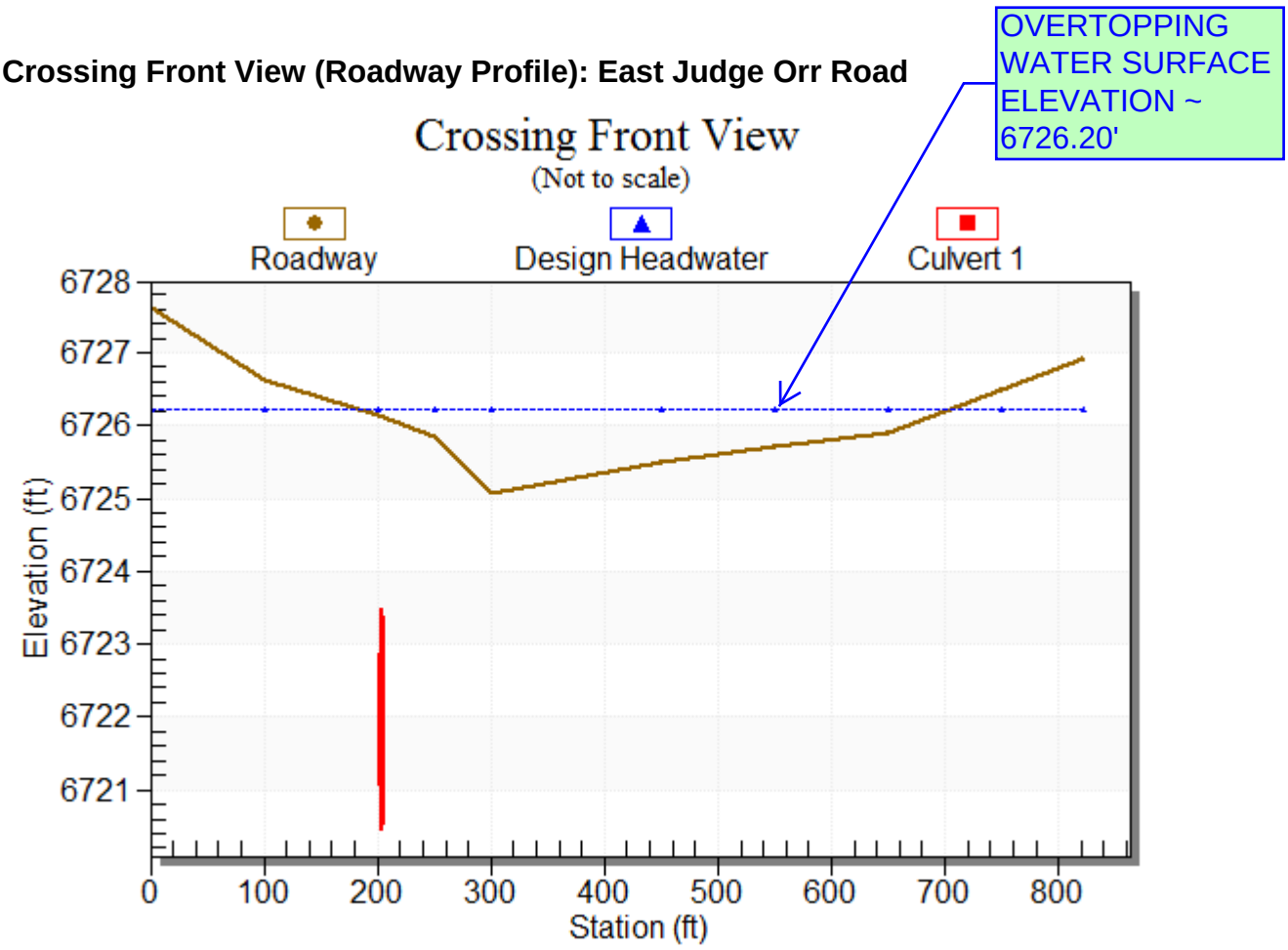
Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

**Crossing Front View (Roadway Profile): East Judge Orr Road**



CURTIS ROAD - SOUTH CULVERT - EX 32" CMP - Q_100 = 130 CFS

## Crossing Discharge Data

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

Minimum Flow: 100 cfs

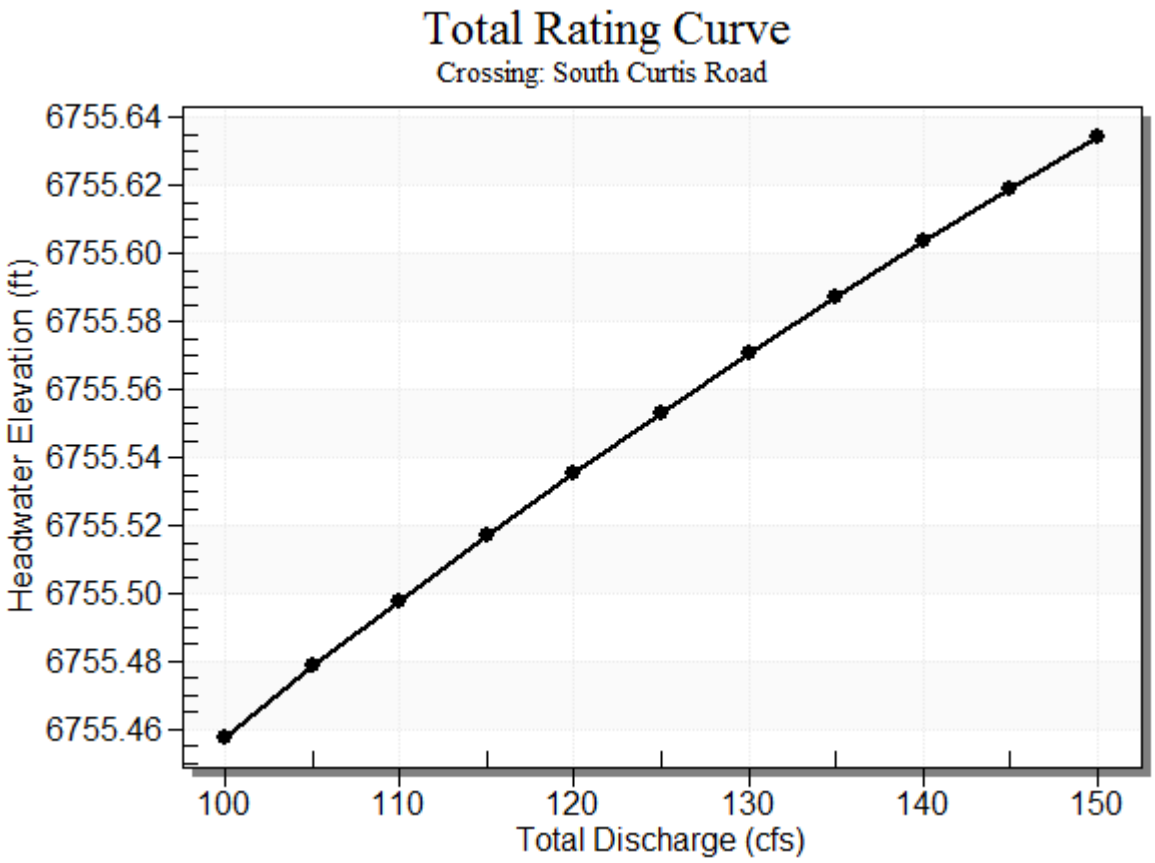
Design Flow: 130 cfs

Maximum Flow: 150 cfs

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

| 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 |

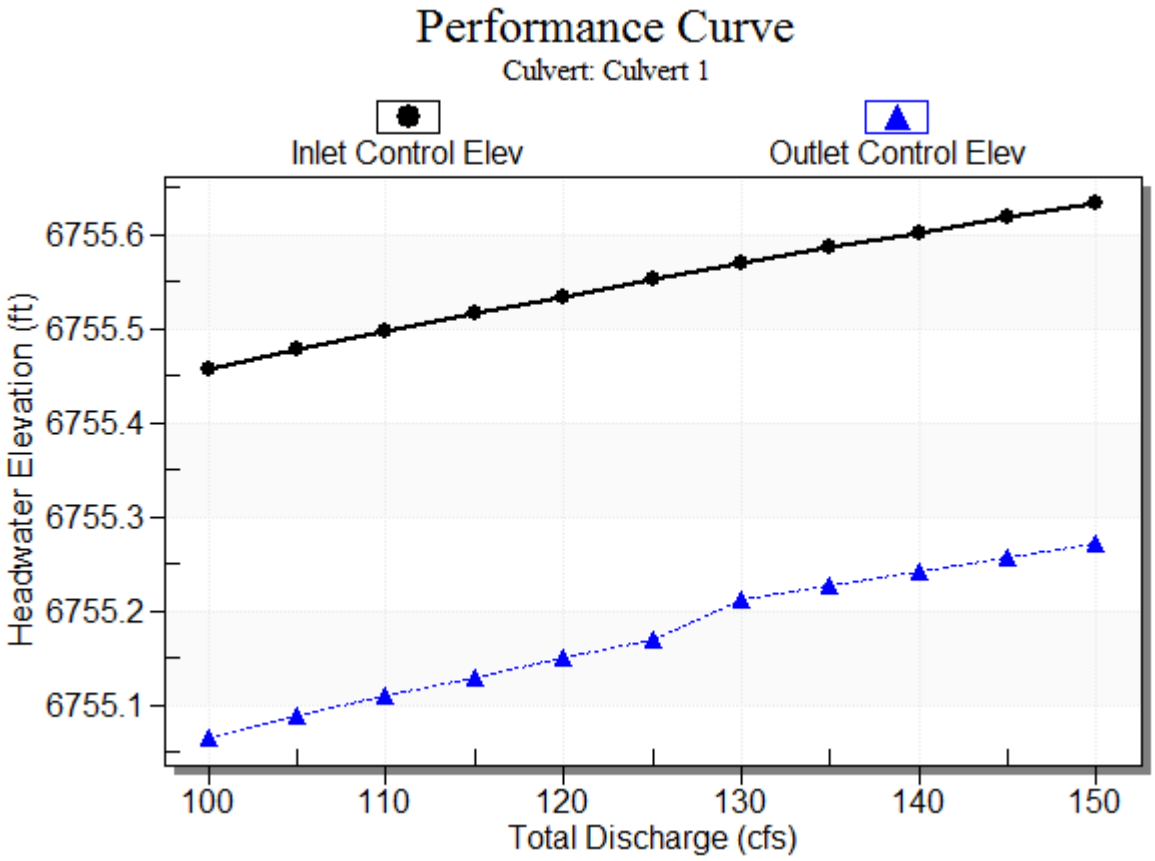
**Rating Curve Plot for Crossing: South Curtis Road**



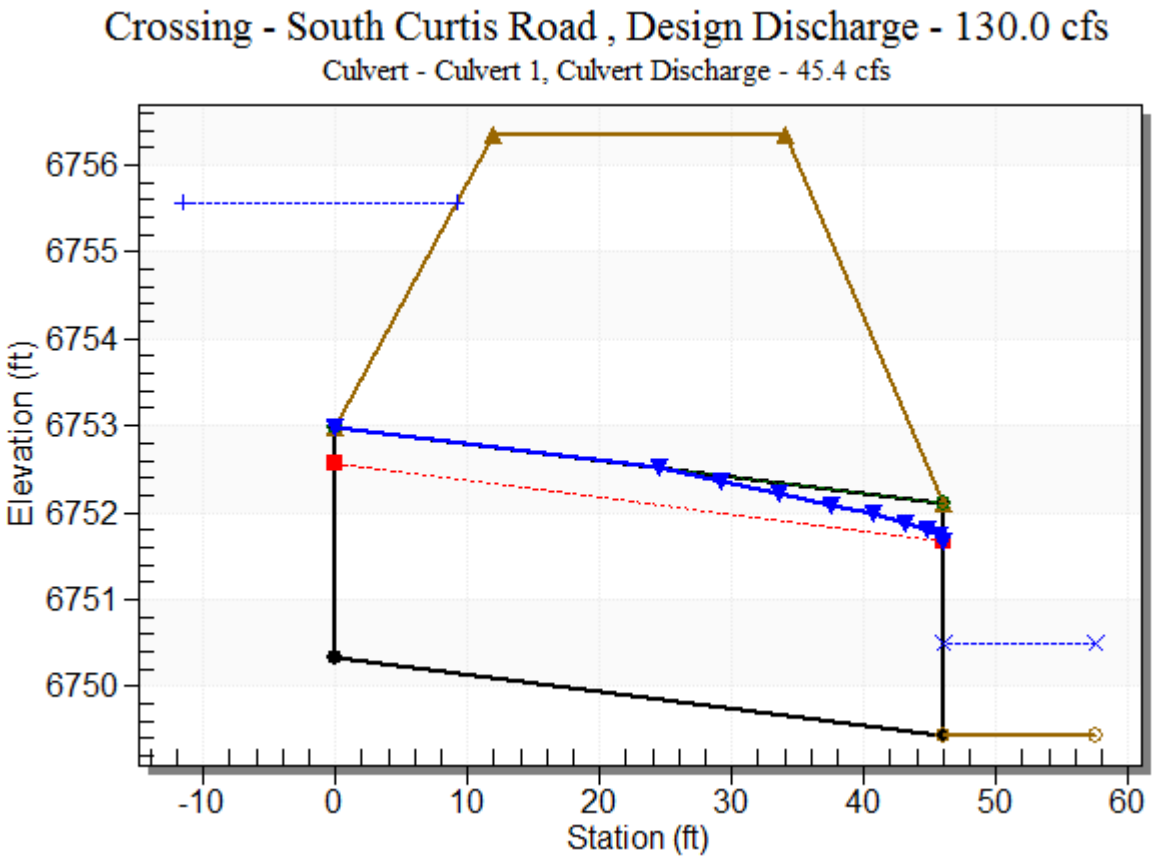
## Table 8 - Culvert Summary Table: Culvert 1

| Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

**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

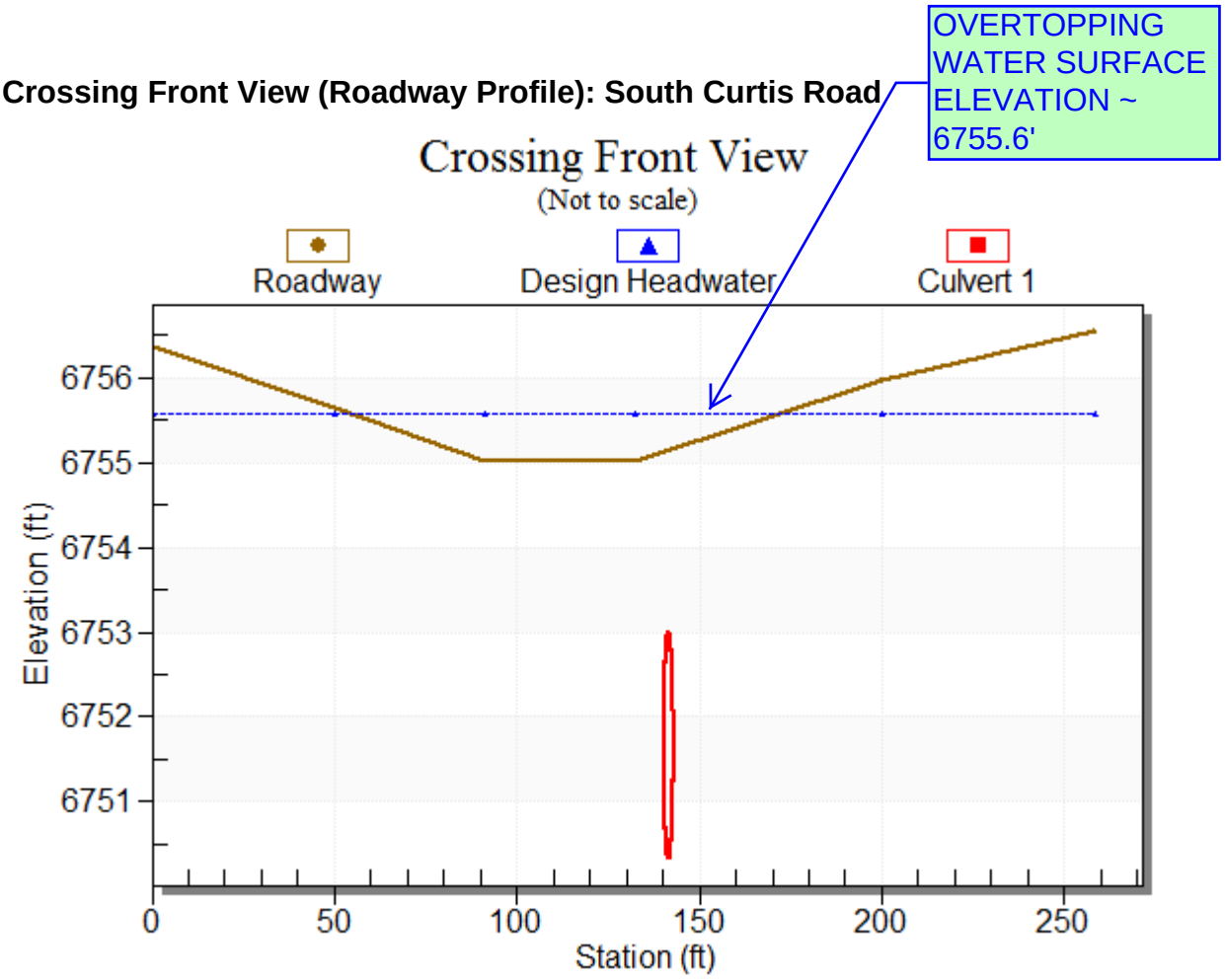
Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

**Crossing Front View (Roadway Profile): South Curtis Road**



CURTIS ROAD - NORTH CULVERT - EX 24" CMP - Q_100 = 451 CFS

## Crossing Discharge Data

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

Minimum Flow: 400 cfs

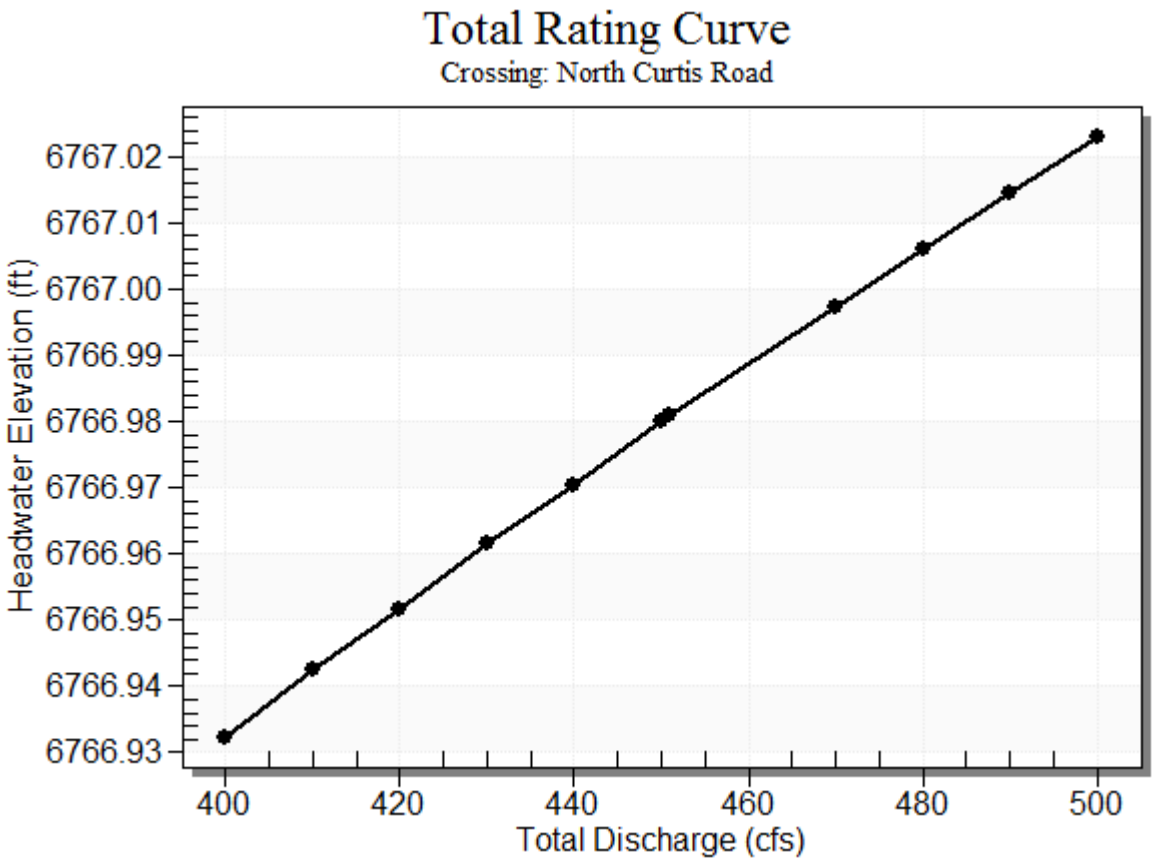
Design Flow: 451 cfs

Maximum Flow: 500 cfs

## Table 10 - Summary of Culvert Flows at Crossing: North Curtis Road

| Headwater Elevation (ft) | Total Discharge (cfs) | Culvert 1 Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 6766.93 | 400.00 | 20.40 | 379.08 | 7 |
| 6766.94 | 410.00 | 20.45 | 389.44 | 3 |
| 6766.95 | 420.00 | 20.49 | 398.64 | 2 |
| 6766.96 | 430.00 | 20.54 | 409.36 | 3 |
| 6766.97 | 440.00 | 20.58 | 418.71 | 2 |
| 6766.98 | 450.00 | 20.62 | 429.31 | 3 |
| 6766.98 | 451.00 | 20.62 | 430.26 | 2 |
| 6767.00 | 470.00 | 20.70 | 448.42 | 2 |
| 6767.01 | 480.00 | 20.74 | 458.27 | 2 |
| 6767.01 | 490.00 | 20.78 | 468.29 | 2 |
| 6767.02 | 500.00 | 20.81 | 478.44 | 2 |
| 6766.00 | 14.84 | 14.84 | 0.00 | Overtopping |

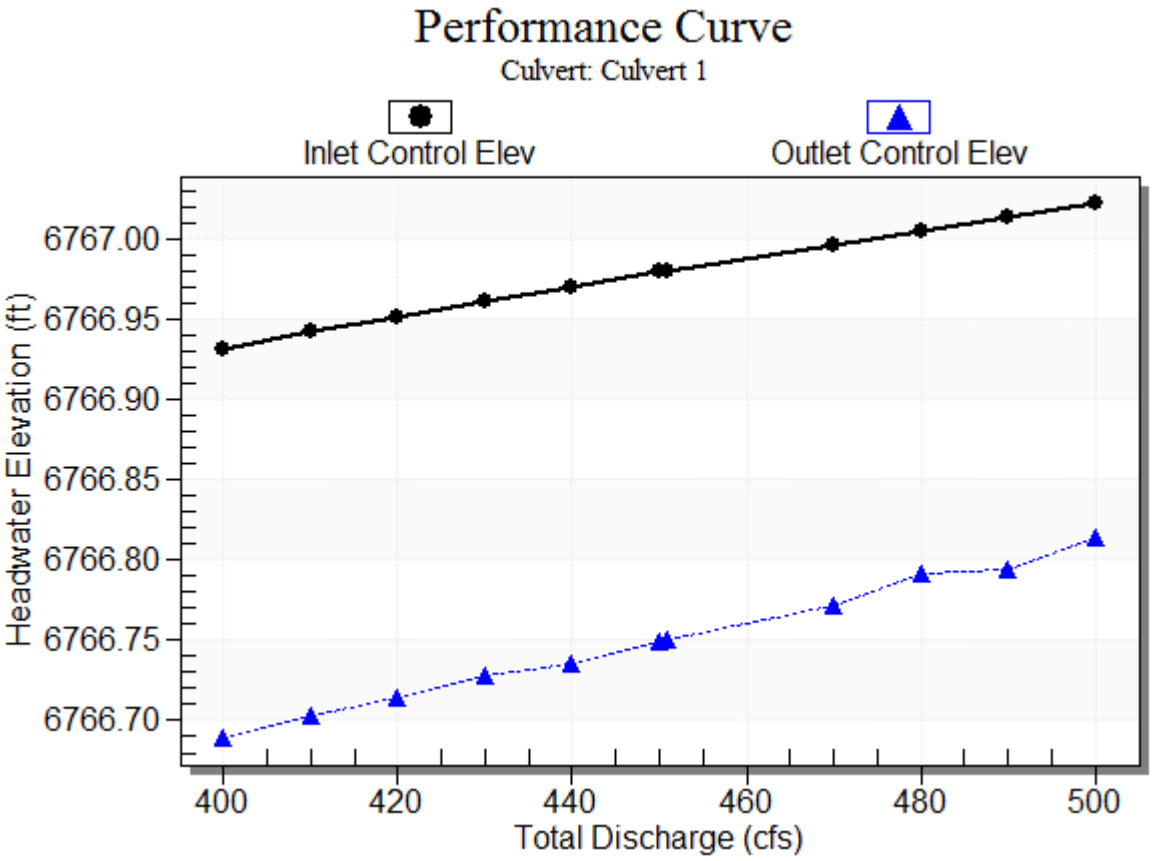
**Rating Curve Plot for Crossing: North Curtis Road**



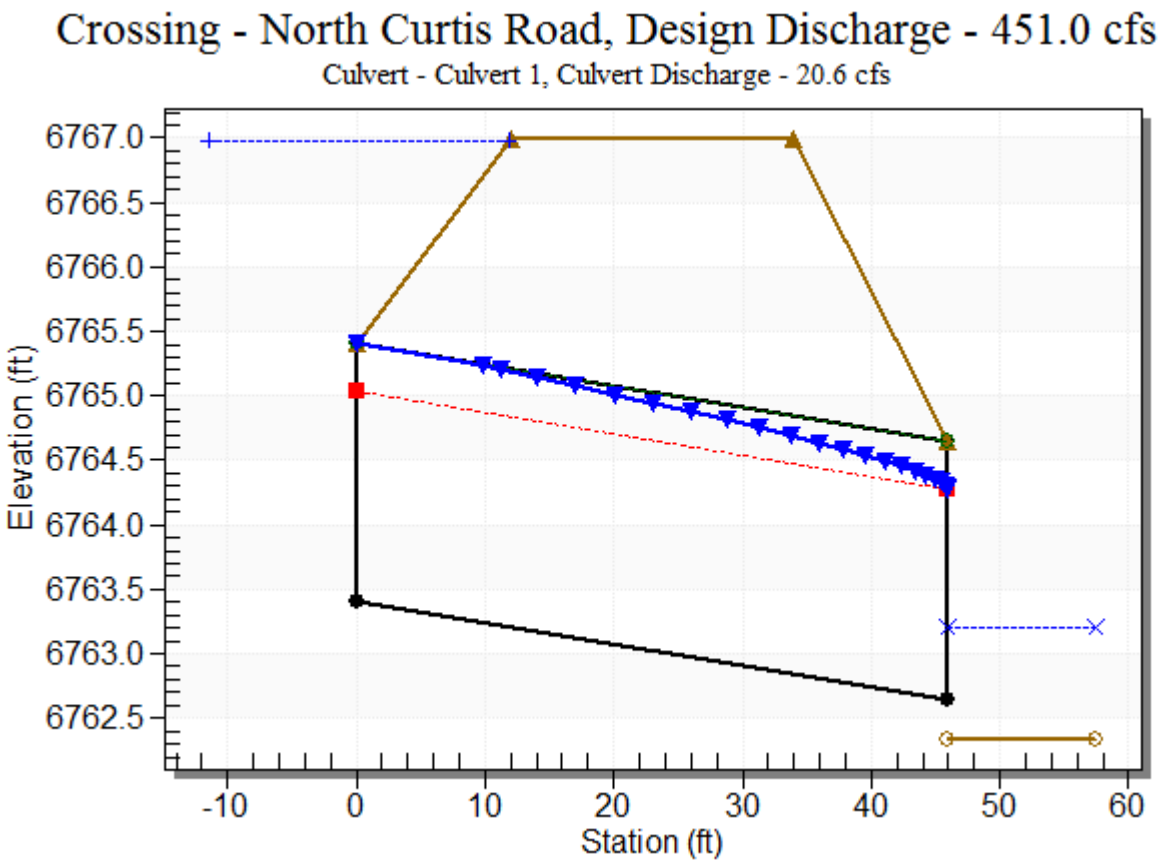
## Table 11 - Culvert Summary Table: Culvert 1

| Total Discharge (cfs) | Culvert Discharge (cfs) | Headwater Elevation (ft) | Inlet Control Depth (ft) | Outlet Control Depth (ft) | Flow Type | Normal Depth (ft) | Critical Depth (ft) | Outlet Depth (ft) | Tailwater Depth (ft) | Outlet Velocity (ft/s) | Tailwater Velocity (ft/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 400.00 | 20.40 | 6766.93 | 3.521 | 3.279 | 7-M2c | 2.000 | 1.619 | 1.619 | 0.818 | 7.488 | 2.820 |
| 410.00 | 20.45 | 6766.94 | 3.532 | 3.293 | 7-M2c | 2.000 | 1.621 | 1.621 | 0.827 | 7.498 | 2.843 |
| 420.00 | 20.49 | 6766.95 | 3.540 | 3.305 | 7-M2c | 2.000 | 1.622 | 1.622 | 0.836 | 7.507 | 2.866 |
| 430.00 | 20.54 | 6766.96 | 3.551 | 3.318 | 7-M2c | 2.000 | 1.624 | 1.624 | 0.845 | 7.517 | 2.888 |
| 440.00 | 20.58 | 6766.97 | 3.559 | 3.326 | 7-M2c | 2.000 | 1.625 | 1.625 | 0.853 | 7.525 | 2.910 |
| 450.00 | 20.62 | 6766.98 | 3.569 | 3.339 | 7-M2c | 2.000 | 1.627 | 1.627 | 0.862 | 7.535 | 2.932 |
| 451.00 | 20.62 | 6766.98 | 3.570 | 3.340 | 7-M2c | 2.000 | 1.627 | 1.627 | 0.863 | 7.536 | 2.934 |
| 470.00 | 20.70 | 6767.00 | 3.586 | 3.362 | 7-M2c | 2.000 | 1.630 | 1.630 | 0.879 | 7.551 | 2.974 |
| 480.00 | 20.74 | 6767.01 | 3.595 | 3.382 | 7-M2c | 2.000 | 1.631 | 1.631 | 0.887 | 7.560 | 2.995 |
| 490.00 | 20.78 | 6767.01 | 3.604 | 3.384 | 7-M2c | 2.000 | 1.632 | 1.632 | 0.895 | 7.568 | 3.015 |
| 500.00 | 20.81 | 6767.02 | 3.612 | 3.404 | 7-M2c | 2.000 | 1.634 | 1.634 | 0.904 | 7.576 | 3.035 |

**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: 6763.41 ft

Outlet Station: 46.00 ft

Outlet Elevation: 6762.64 ft

Number of Barrels: 1

**Culvert Data Summary - Culvert 1**

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

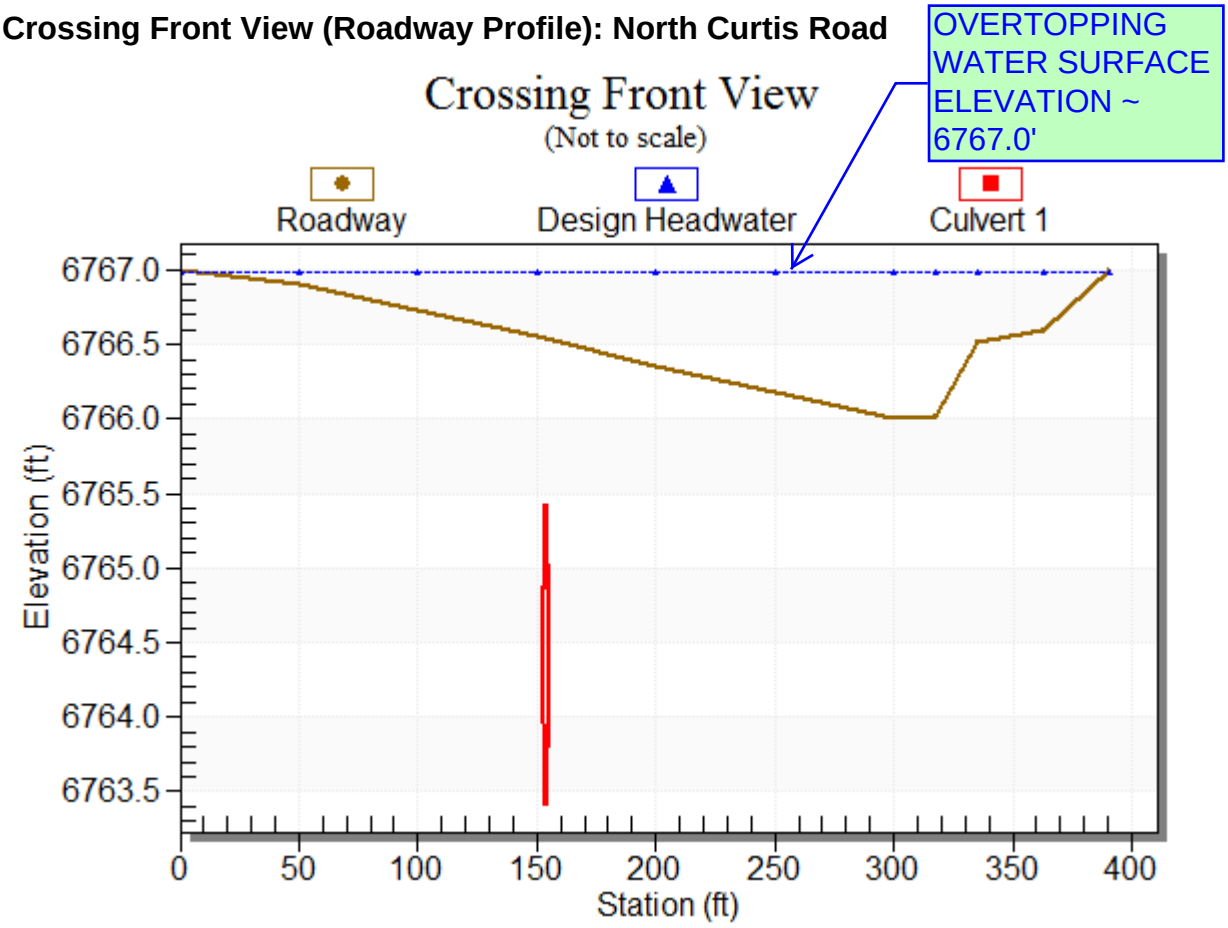
Barrel Manning's n: 0.0220

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

**Crossing Front View (Roadway Profile): North Curtis Road**



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

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

Minimum Flow: 100 cfs

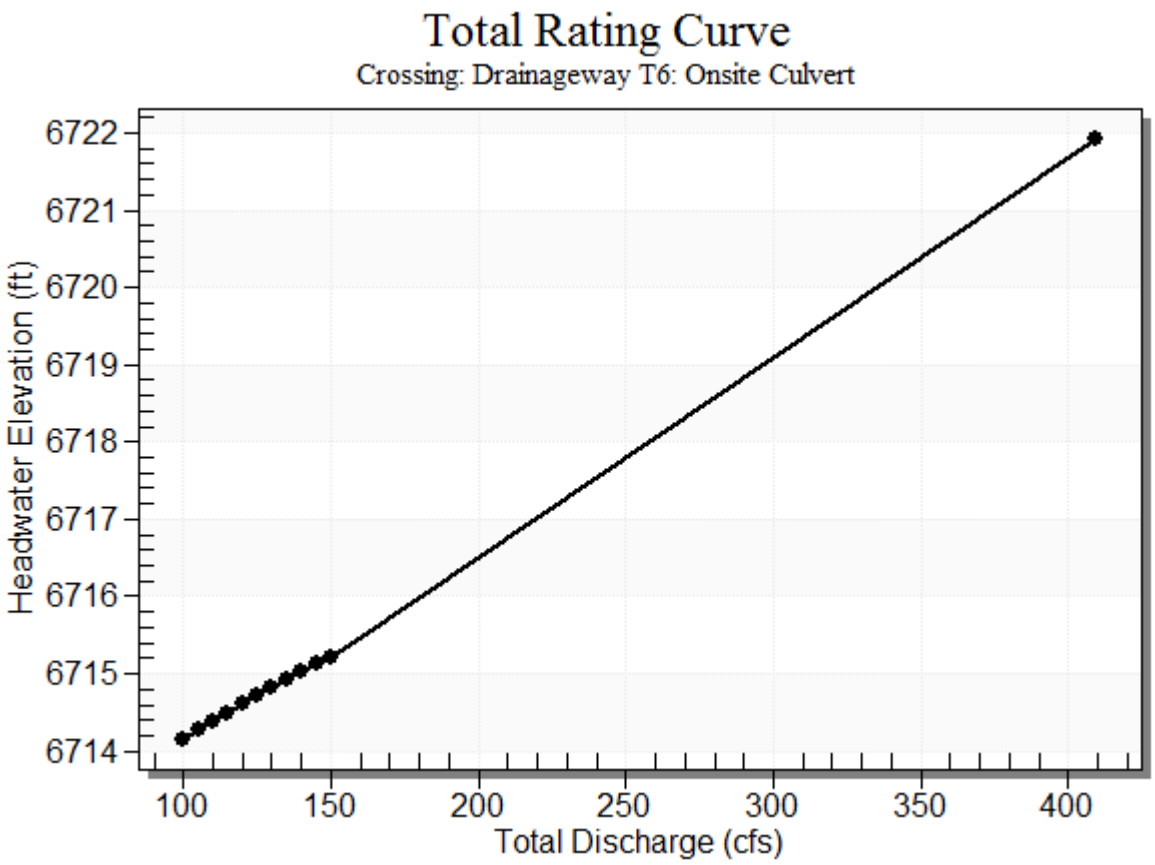
Design Flow: 130 cfs

Maximum Flow: 150 cfs

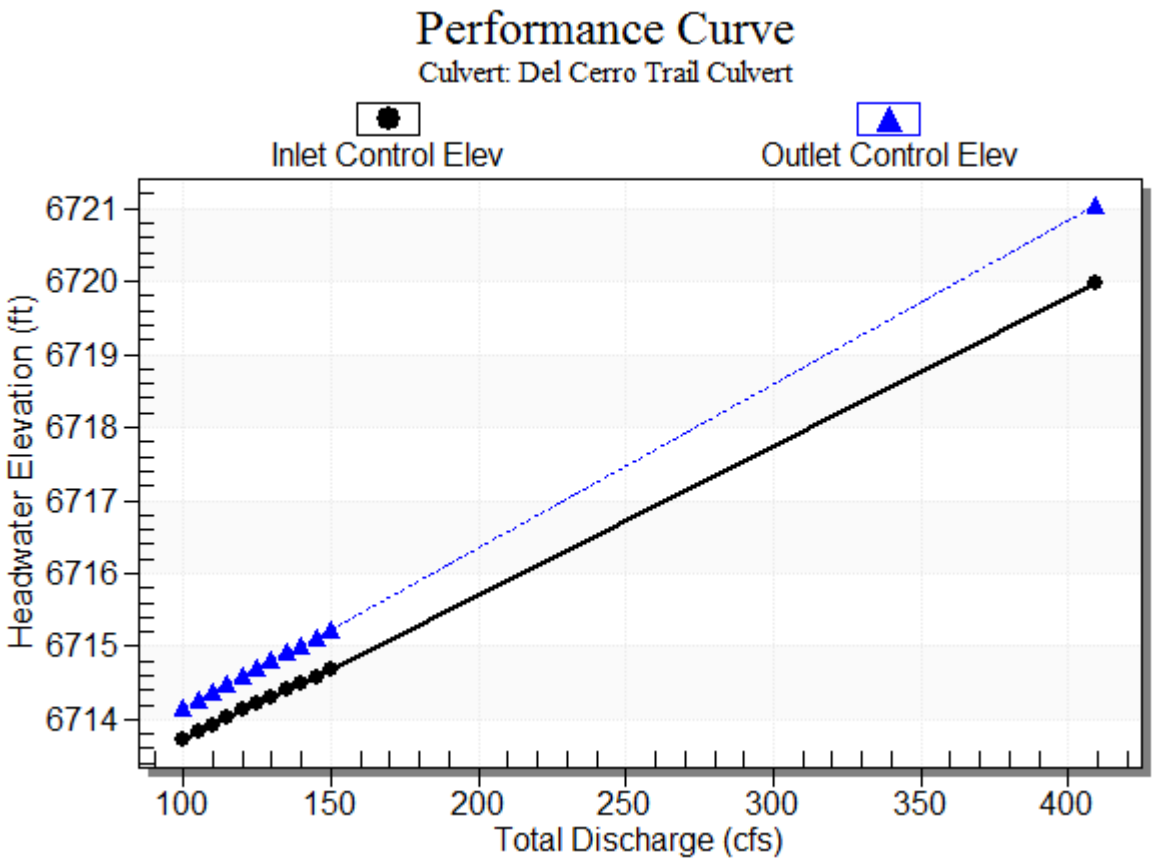
**Table 1 - Summary of Culvert Flows at Crossing: Drainageway T6: Onsite Culvert**

| Headwater Elevation (ft) | Total Discharge (cfs) | Del Cerro Trail Culvert Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 6714.16 | 100.00 | 100.00 | 0.00 | 1 |
| 6714.27 | 105.00 | 105.00 | 0.00 | 1 |
| 6714.38 | 110.00 | 110.00 | 0.00 | 1 |
| 6714.49 | 115.00 | 115.00 | 0.00 | 1 |
| 6714.60 | 120.00 | 120.00 | 0.00 | 1 |
| 6714.71 | 125.00 | 125.00 | 0.00 | 1 |
| 6714.81 | 130.00 | 130.00 | 0.00 | 1 |
| 6714.92 | 135.00 | 135.00 | 0.00 | 1 |
| 6715.02 | 140.00 | 140.00 | 0.00 | 1 |
| 6715.12 | 145.00 | 145.00 | 0.00 | 1 |
| 6715.22 | 150.00 | 150.00 | 0.00 | 1 |
| 6721.06 | 409.08 | 409.08 | 0.00 | Overtopping |

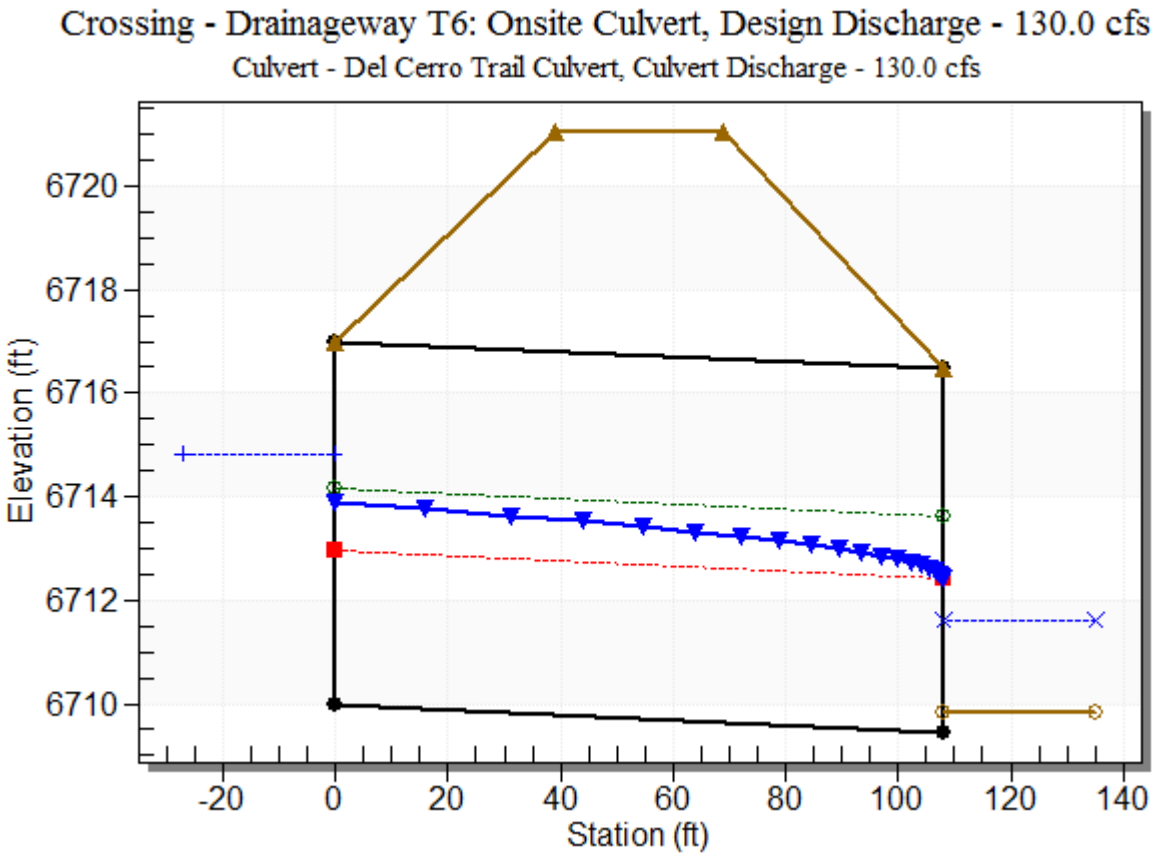
**Rating Curve Plot for Crossing: Drainageway T6: Onsite Culvert**



**Culvert Performance Curve Plot: Del Cerro Trail Culvert**



## Water Surface Profile Plot for Culvert: Del Cerro Trail Culvert




## Site Data - Del Cerro Trail Culvert

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6710.00 ft

Outlet Station: 108.00 ft

Outlet Elevation: 6709.46 ft

Number of Barrels: 1

## Culvert Data Summary - Del Cerro Trail Culvert

Barrel Shape: Circular

Barrel Diameter: 7.00 ft

Barrel Material: Corrugated Aluminum

Embedment: 0.00 in

Barrel Manning's n: 0.0310

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: None

## Tailwater Channel Data - Drainageway T6: Onsite Culvert

Tailwater Channel Option:  Trapezoidal Channel

Bottom Width:  10.00 ft

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

Channel Slope:  0.0100

Channel Manning's n:  0.0400

Channel Invert Elevation:  6709.83 ft

## Roadway Data for Crossing: Drainageway T6: Onsite Culvert

Roadway Profile Shape:  Constant Roadway Elevation

Crest Length:  163.00 ft

Crest Elevation:  6721.06 ft

Roadway Surface:  Paved

Roadway Top Width:  30.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

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

Minimum Flow: 450 cfs

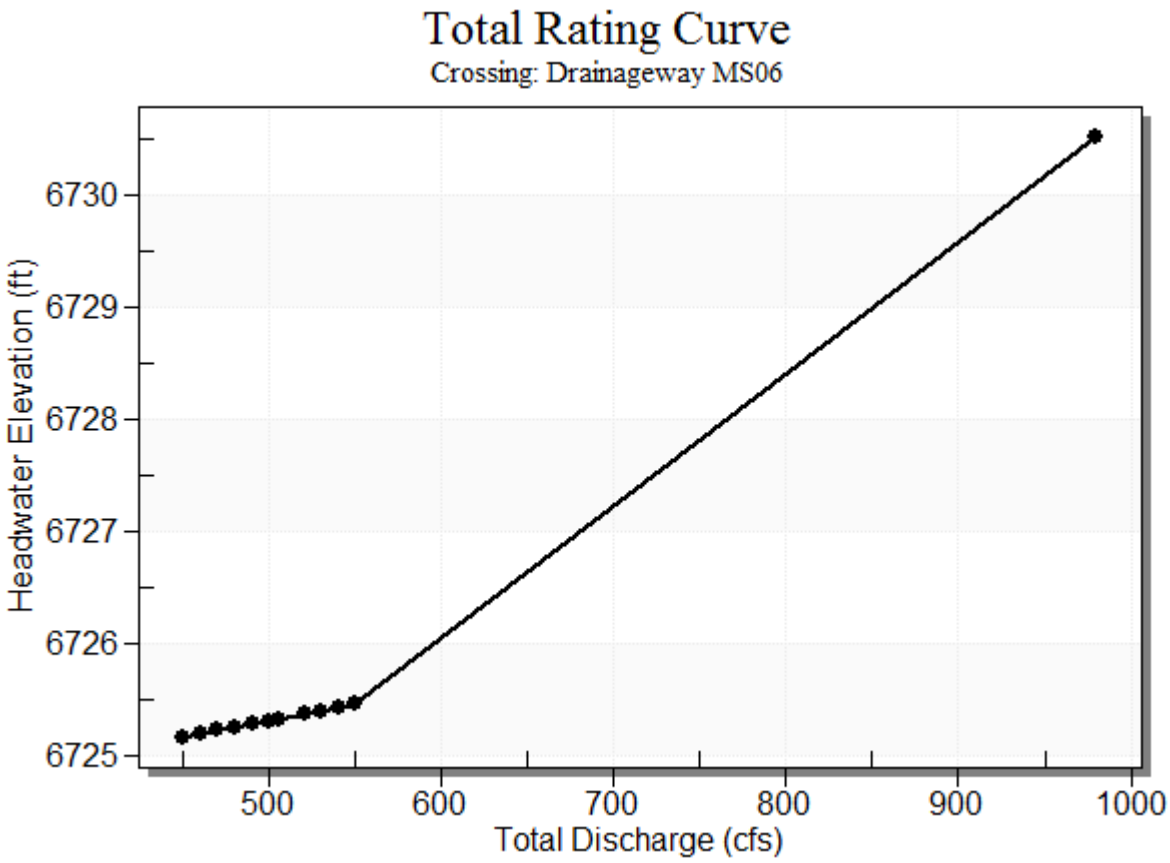
Design Flow: 505 cfs

Maximum Flow: 550 cfs

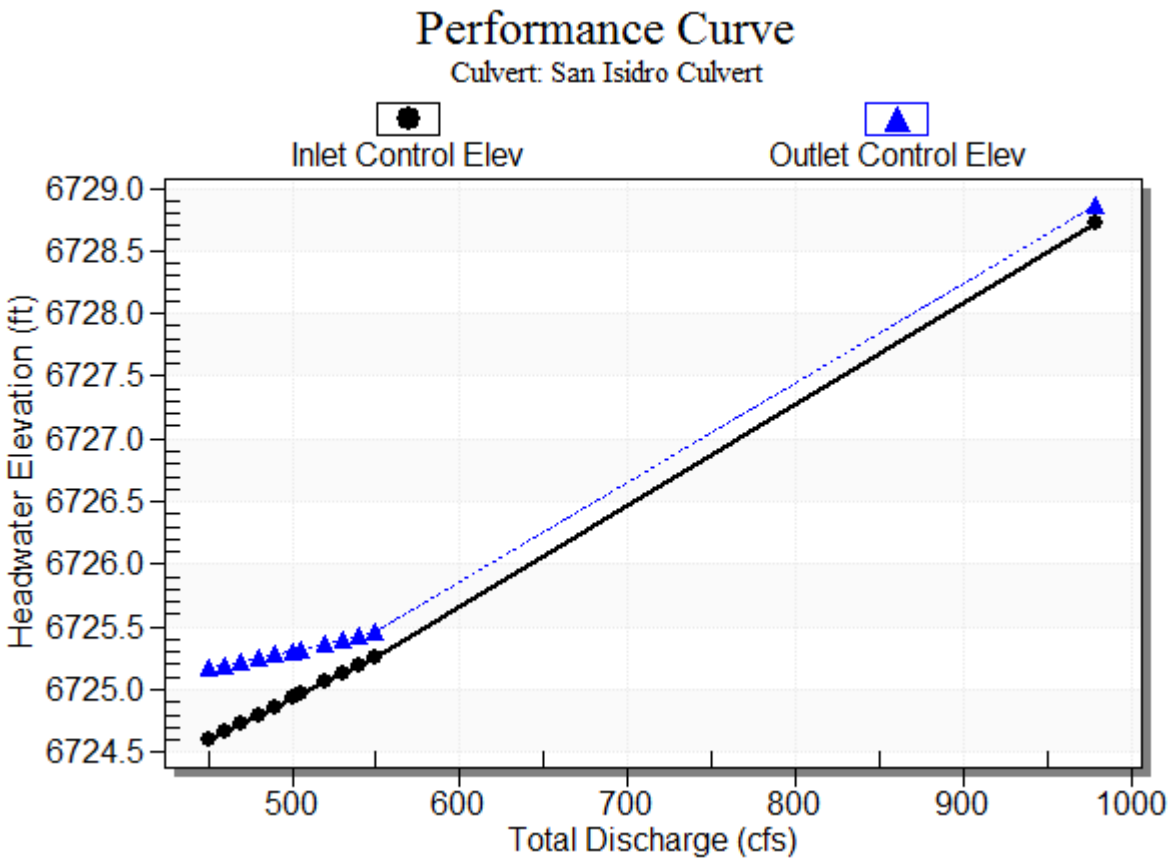
## Table 1 - Summary of Culvert Flows at Crossing: Drainageway MS06

| Headwater Elevation (ft) | Total Discharge (cfs) | San Isidro Culvert Discharge (cfs) | Roadway Discharge (cfs) | Iterations |
|---|---|---|---|---|
| 6725.17 | 450.00 | 450.00 | 0.00 | 1 |
| 6725.20 | 460.00 | 460.00 | 0.00 | 1 |
| 6725.22 | 470.00 | 470.00 | 0.00 | 1 |
| 6725.25 | 480.00 | 480.00 | 0.00 | 1 |
| 6725.28 | 490.00 | 490.00 | 0.00 | 1 |
| 6725.31 | 500.00 | 500.00 | 0.00 | 1 |
| 6725.32 | 505.00 | 505.00 | 0.00 | 1 |
| 6725.37 | 520.00 | 520.00 | 0.00 | 1 |
| 6725.40 | 530.00 | 530.00 | 0.00 | 1 |
| 6725.43 | 540.00 | 540.00 | 0.00 | 1 |
| 6725.46 | 550.00 | 550.00 | 0.00 | 1 |
| 6728.72 | 979.30 | 979.30 | 0.00 | Overtopping |

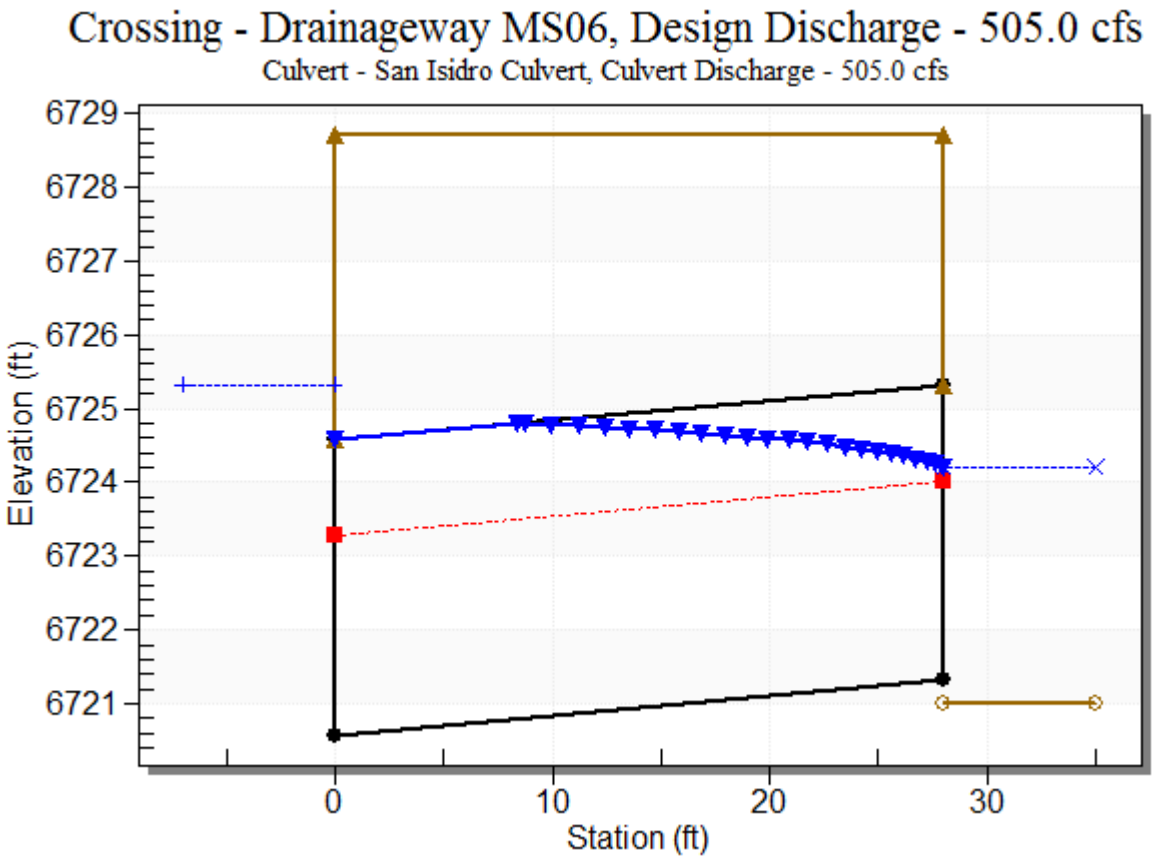
**Rating Curve Plot for Crossing: Drainageway MS06**



**Culvert Performance Curve Plot: San Isidro Culvert**



**Water Surface Profile Plot for Culvert: San Isidro Culvert**




**Site Data - San Isidro Culvert**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6721.58 ft

Outlet Station: 28.00 ft

Outlet Elevation: 6721.32 ft

Number of Barrels: 2

**Culvert Data Summary - San Isidro Culvert**

Barrel Shape: Concrete Box

Barrel Span: 10.00 ft

Barrel Rise: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: 1:1 Bevel (45º flare) Wingwall

Inlet Depression: Yes

## Tailwater Channel Data - Drainageway MS06

Tailwater Channel Option:  Trapezoidal Channel

Bottom Width:  25.00 ft

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

Channel Slope:  0.0040

Channel Manning's n:  0.0400

Channel Invert Elevation:  6721.00 ft

## Roadway Data for Crossing: Drainageway MS06

Roadway Profile Shape:  Constant Roadway Elevation

Crest Length:  100.00 ft

Crest Elevation:  6728.72 ft

Roadway Surface:  Paved

Roadway Top Width:  28.00 ft

# Channel Report



## Basin A - Roadside Ditch - Q100_Peak = 20.65 cfs

**Triangular**

| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 3.00 |
| Total Depth (ft) | = 3.00 |
| Invert Elev (ft) | = 5500.00 |
| Slope (%) | = 1.82 |
| N-Value | = 0.030 |

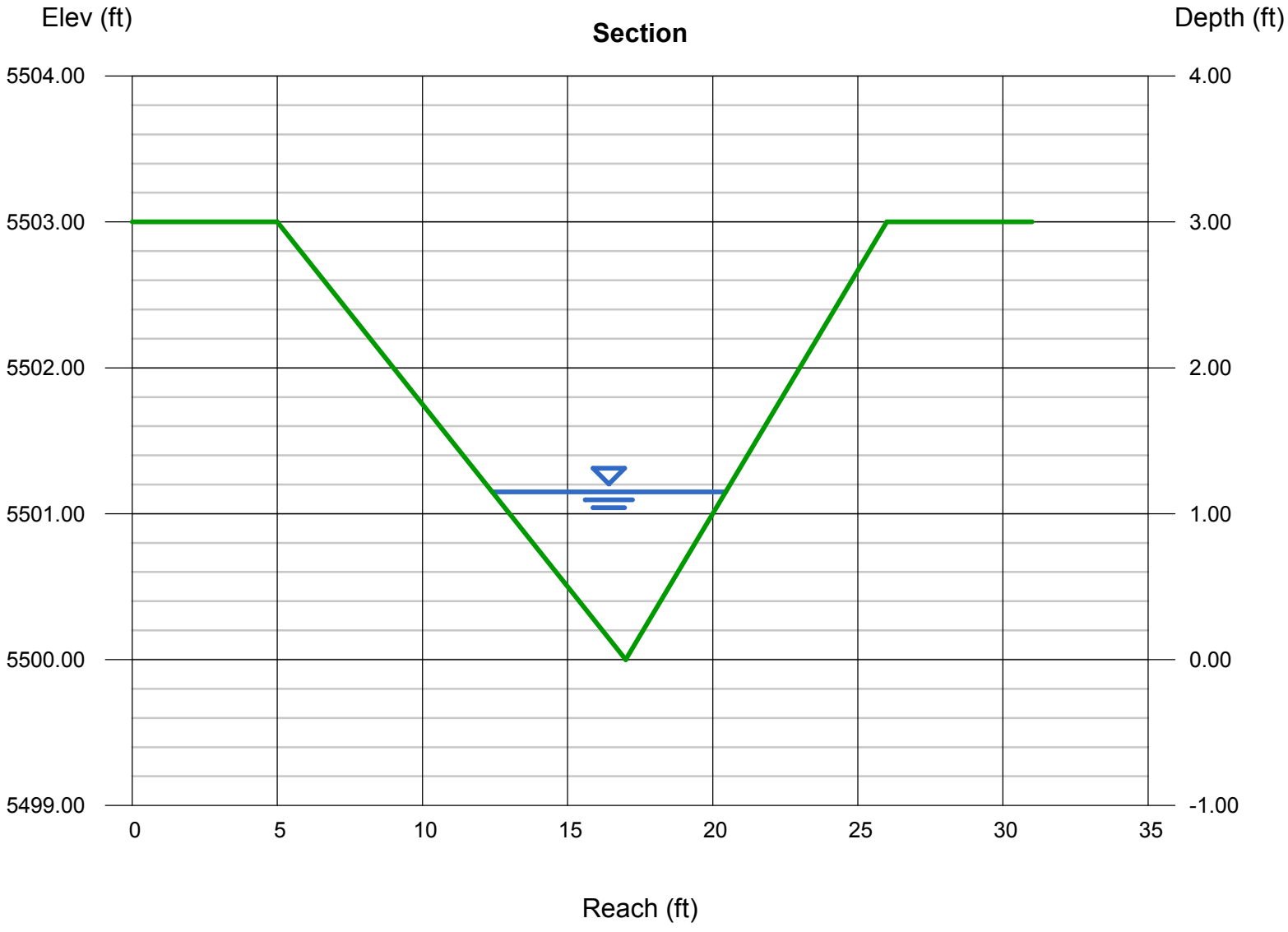
**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 20.65 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 1.15 |
| Q (cfs) | = 20.65 |
| Area (sqft) | = 4.63 |
| Velocity (ft/s) | = 4.46 |
| Wetted Perim (ft) | = 8.38 |
| Crit Depth, Yc (ft) | = 1.17 |
| Top Width (ft) | = 8.05 |
| EGL (ft) | = 1.46 |

FROUDE = 0.8 (SUBCRITICAL)



# Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Sep 9 2019

## Basin B - Roadside Swale - Q100_Peak = 46.27 cfs

**Triangular**

| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 3.00 |
| Total Depth (ft) | = 3.00 |
| Invert Elev (ft) | = 5500.00 |
| Slope (%) | = 1.00 |
| N-Value | = 0.030 |

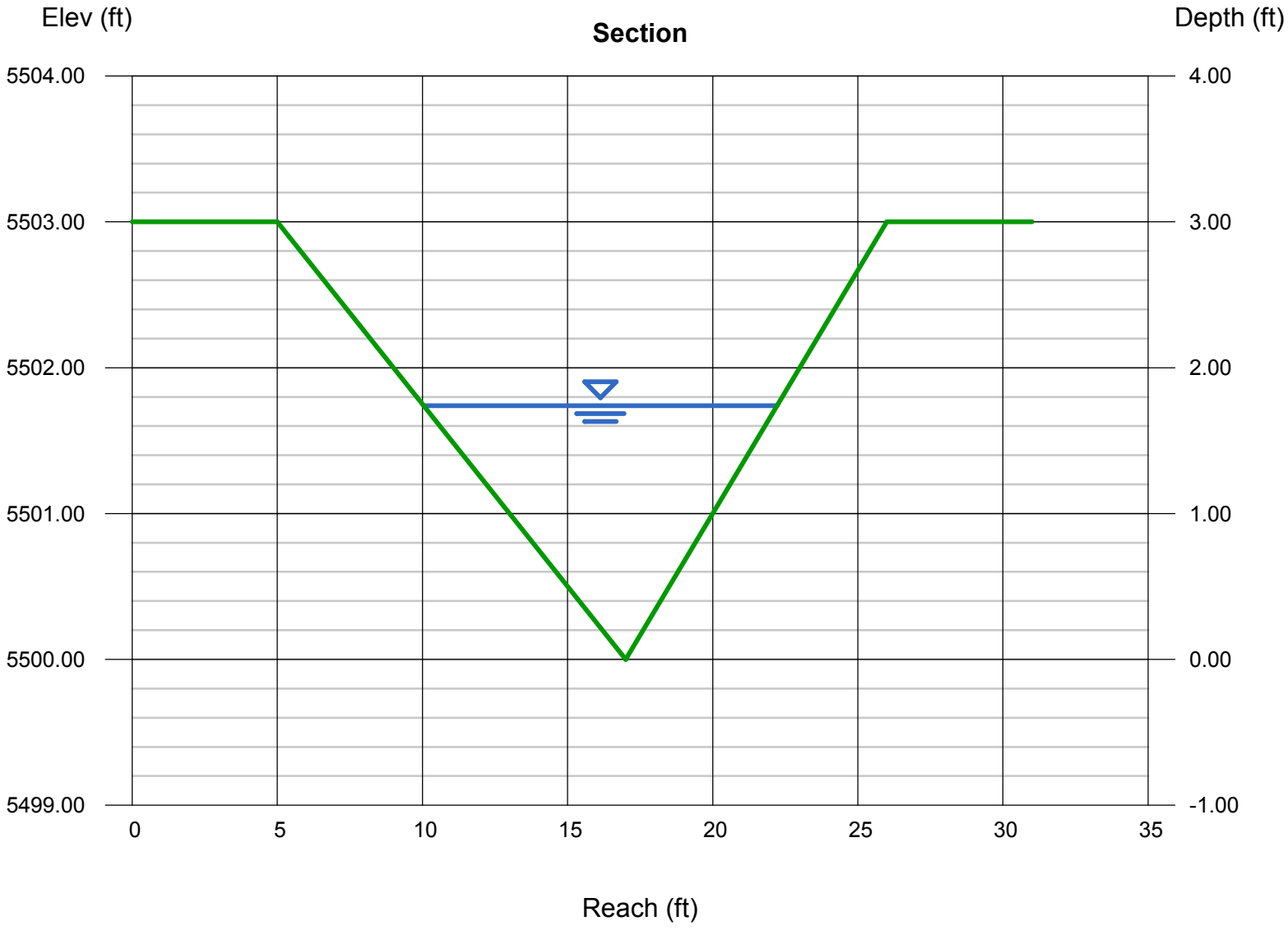
**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 46.27 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 1.74 |
| Q (cfs) | = 46.27 |
| Area (sqft) | = 10.60 |
| Velocity (ft/s) | = 4.37 |
| Wetted Perim (ft) | = 12.68 |
| Crit Depth, Yc (ft) | = 1.62 |
| Top Width (ft) | = 12.18 |
| EGL (ft) | = 2.04 |

FROUDE = 0.6 (SUBCRITICAL)



# Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Sep 9 2019

## Basin C - Roadside Ditch - Q100_Peak = 69.36 cfs

**Triangular**

| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 3.00 |
| Total Depth (ft) | = 3.00 |
| Invert Elev (ft) | = 5500.00 |
| Slope (%) | = 1.00 |
| N-Value | = 0.030 |

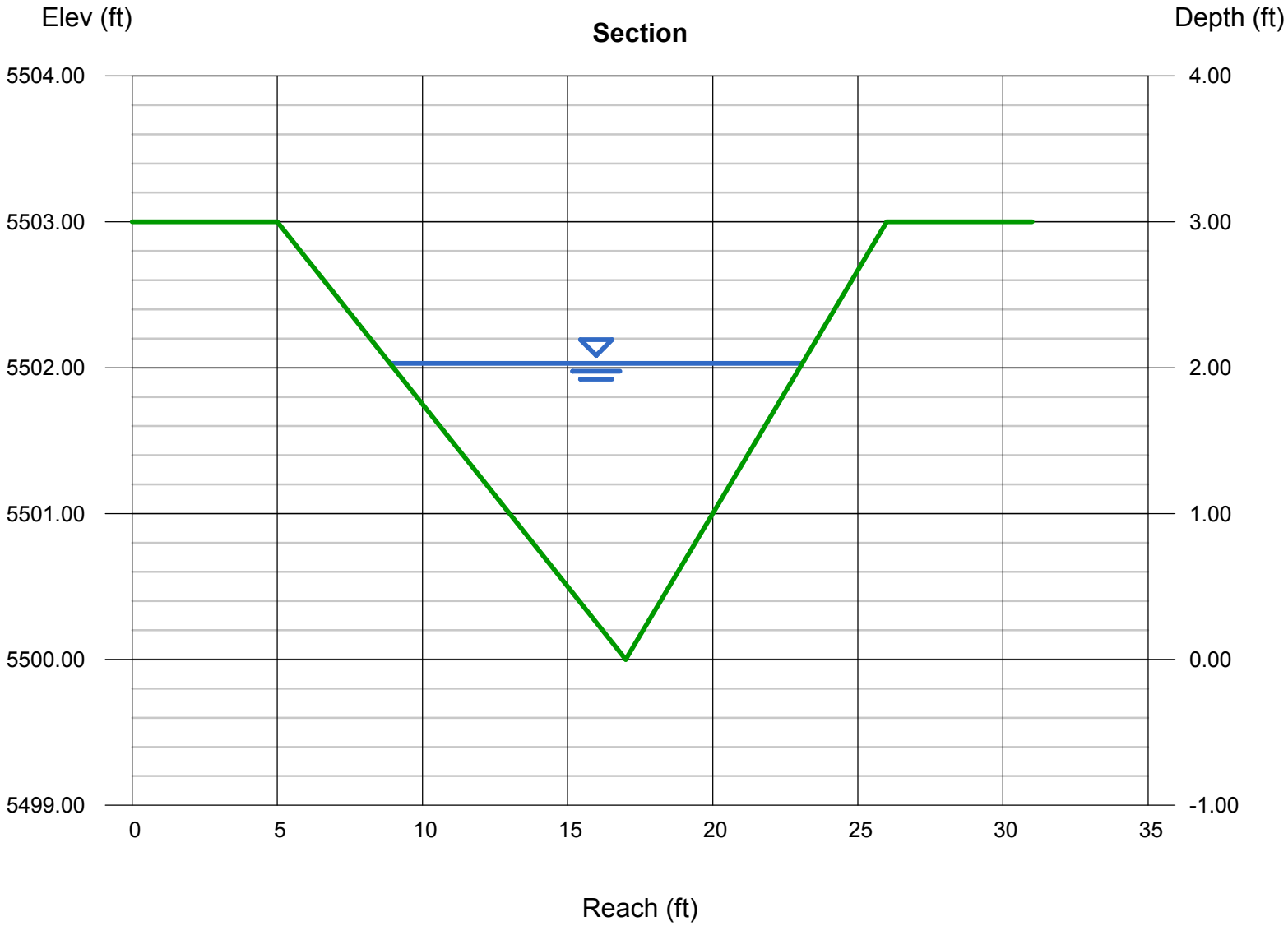
**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 69.36 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 2.03 |
| Q (cfs) | = 69.36 |
| Area (sqft) | = 14.42 |
| Velocity (ft/s) | = 4.81 |
| Wetted Perim (ft) | = 14.79 |
| Crit Depth, Yc (ft) | = 1.90 |
| Top Width (ft) | = 14.21 |
| EGL (ft) | = 2.39 |

FROUDE = 0.6 (SUBCRITICAL)



# Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Jul 15 2019

## Basin D - Roadside Ditch - Q100_Peak = 95.4 cfs

**Triangular**

| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 3.00 |
| Total Depth (ft) | = 3.00 |
| Invert Elev (ft) | = 5500.00 |
| Slope (%) | = 1.00 |
| N-Value | = 0.030 |

**Calculations**

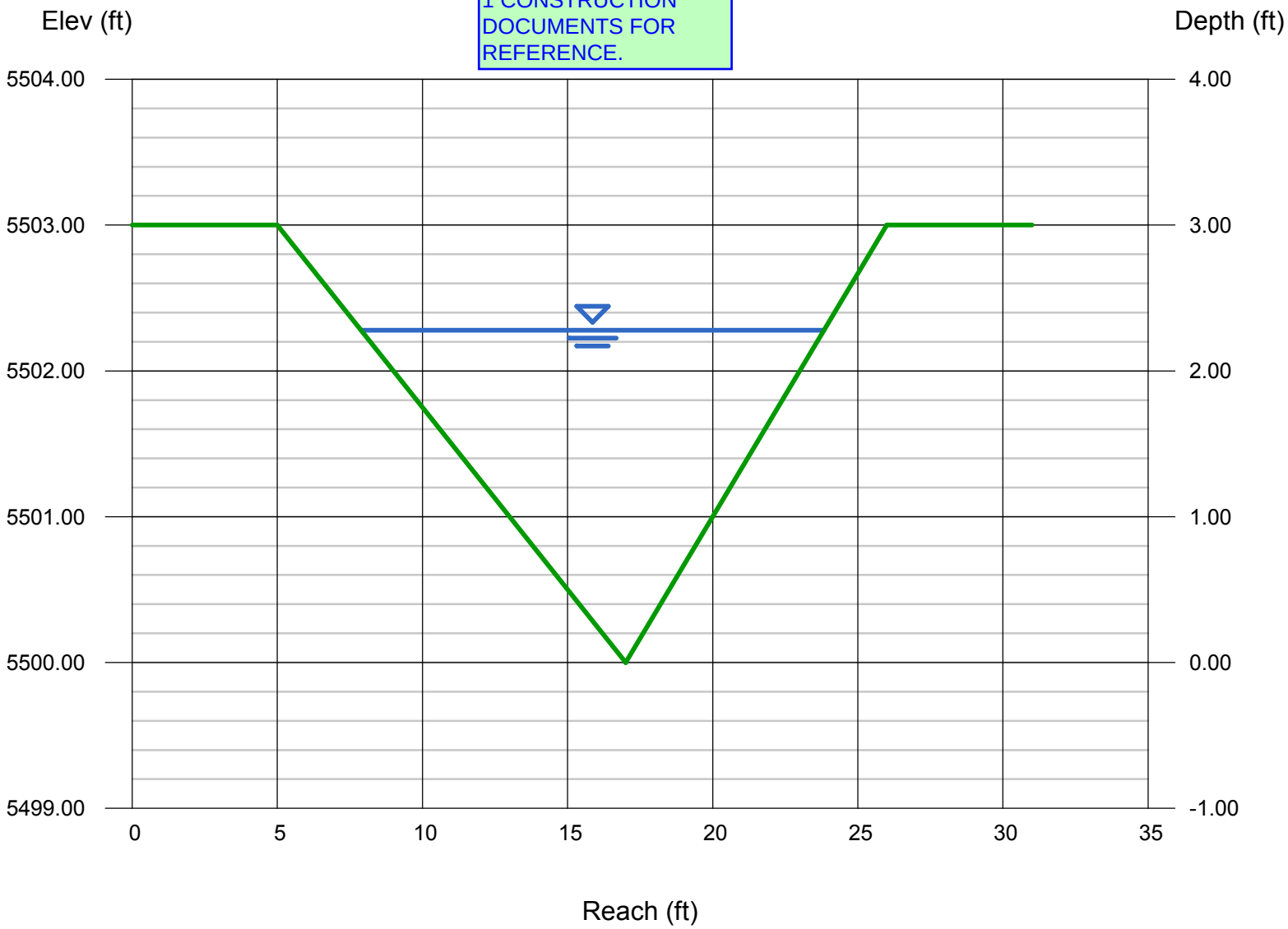
| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 95.40 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 2.28 |
| Q (cfs) | = 95.40 |
| Area (sqft) | = 18.19 |
| Velocity (ft/s) | = 5.24 |
| Wetted Perim (ft) | = 16.61 |
| Crit Depth, Yc (ft) | = 2.16 |
| Top Width (ft) | = 15.96 |
| EGL (ft) | = 2.71 |

VELOCITY >5FT/S IS A RESULT OF USING PEAK Q IN ANAYLSIS. BASIN D ROADSIDE DITCHES WILL NOT EXPERIENCE PEAK Q. THIS IS A CONSERVATIVE PDR APPROACH. EROSION CONTROL BLANKET IS PROPOSED FOR ALL DITCH CROSS SECTIONS. SEE FILING 1 CONSTRUCTION DOCUMENTS FOR REFERENCE.

FROUDE = 0.6 (SUBCRITICAL)



# Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Jul 15 2019

## Basin E - Roadside Ditch - Q100_Peak = 9.9 cfs

**Triangular**

| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 3.00 |
| Total Depth (ft) | = 3.00 |
| Invert Elev (ft) | = 5500.00 |
| Slope (%) | = 1.00 |
| N-Value | = 0.030 |

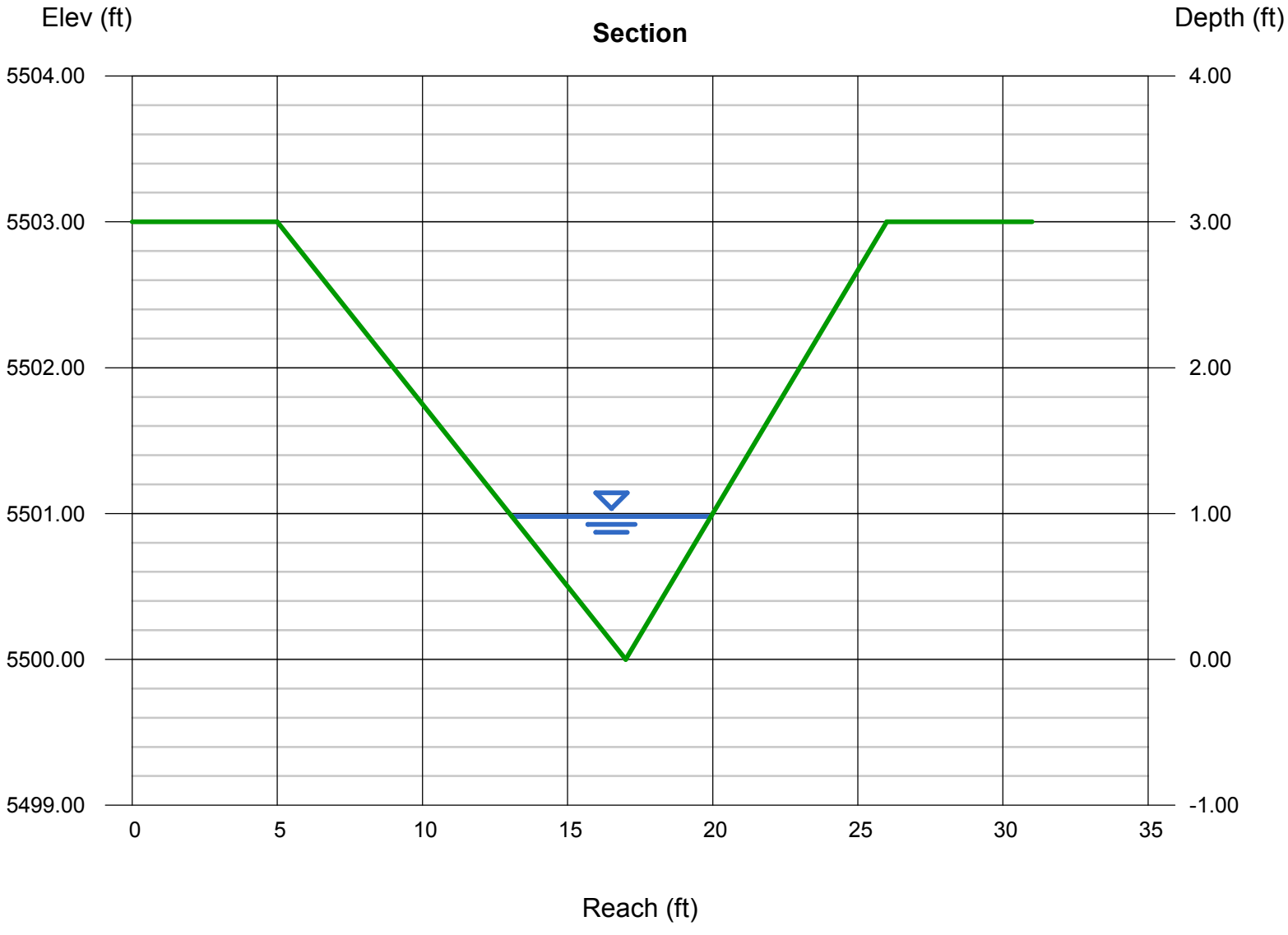
**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 9.90 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.98 |
| Q (cfs) | = 9.900 |
| Area (sqft) | = 3.36 |
| Velocity (ft/s) | = 2.95 |
| Wetted Perim (ft) | = 7.14 |
| Crit Depth, Yc (ft) | = 0.87 |
| Top Width (ft) | = 6.86 |
| EGL (ft) | = 1.11 |

FROUDE = 0.5 (SUBCRITICAL)



# Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Sep 9 2019

## Basin F - Roadside Ditch - Q100_Peak = 69.89 cfs

**Triangular**

| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 3.00 |
| Total Depth (ft) | = 3.00 |
| Invert Elev (ft) | = 5500.00 |
| Slope (%) | = 1.31 |
| N-Value | = 0.040 |

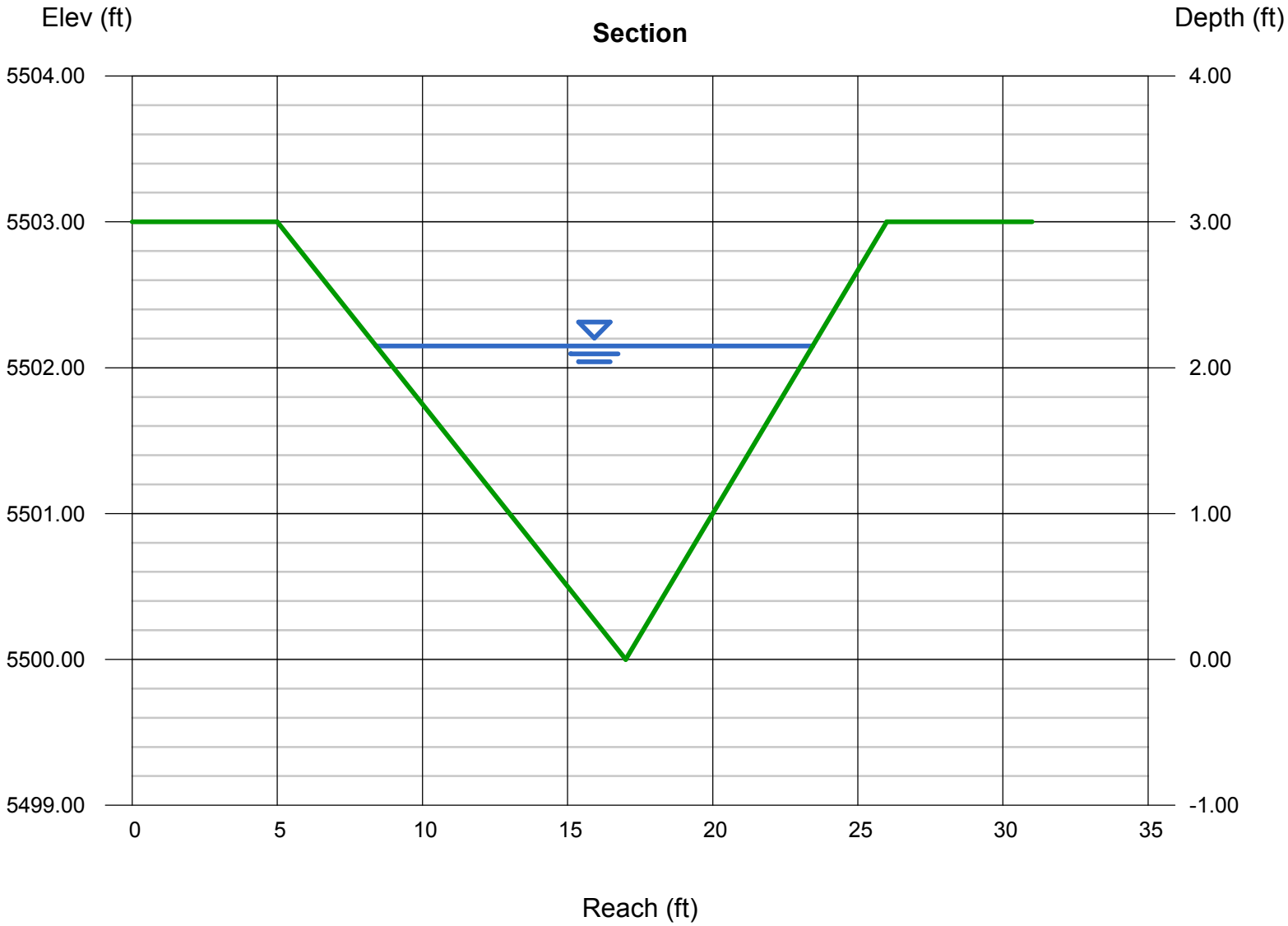
**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 69.89 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 2.15 |
| Q (cfs) | = 69.89 |
| Area (sqft) | = 16.18 |
| Velocity (ft/s) | = 4.32 |
| Wetted Perim (ft) | = 15.66 |
| Crit Depth, Yc (ft) | = 1.91 |
| Top Width (ft) | = 15.05 |
| EGL (ft) | = 2.44 |

FROUDE = 0.5 (SUBCRITICAL)



# Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Sep 9 2019

## Basin G - Roadside Ditch - Q100_Peak = 25.31 cfs

**Triangular**

| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 3.00 |
| Total Depth (ft) | = 3.00 |
| Invert Elev (ft) | = 5500.00 |
| Slope (%) | = 1.00 |
| N-Value | = 0.030 |

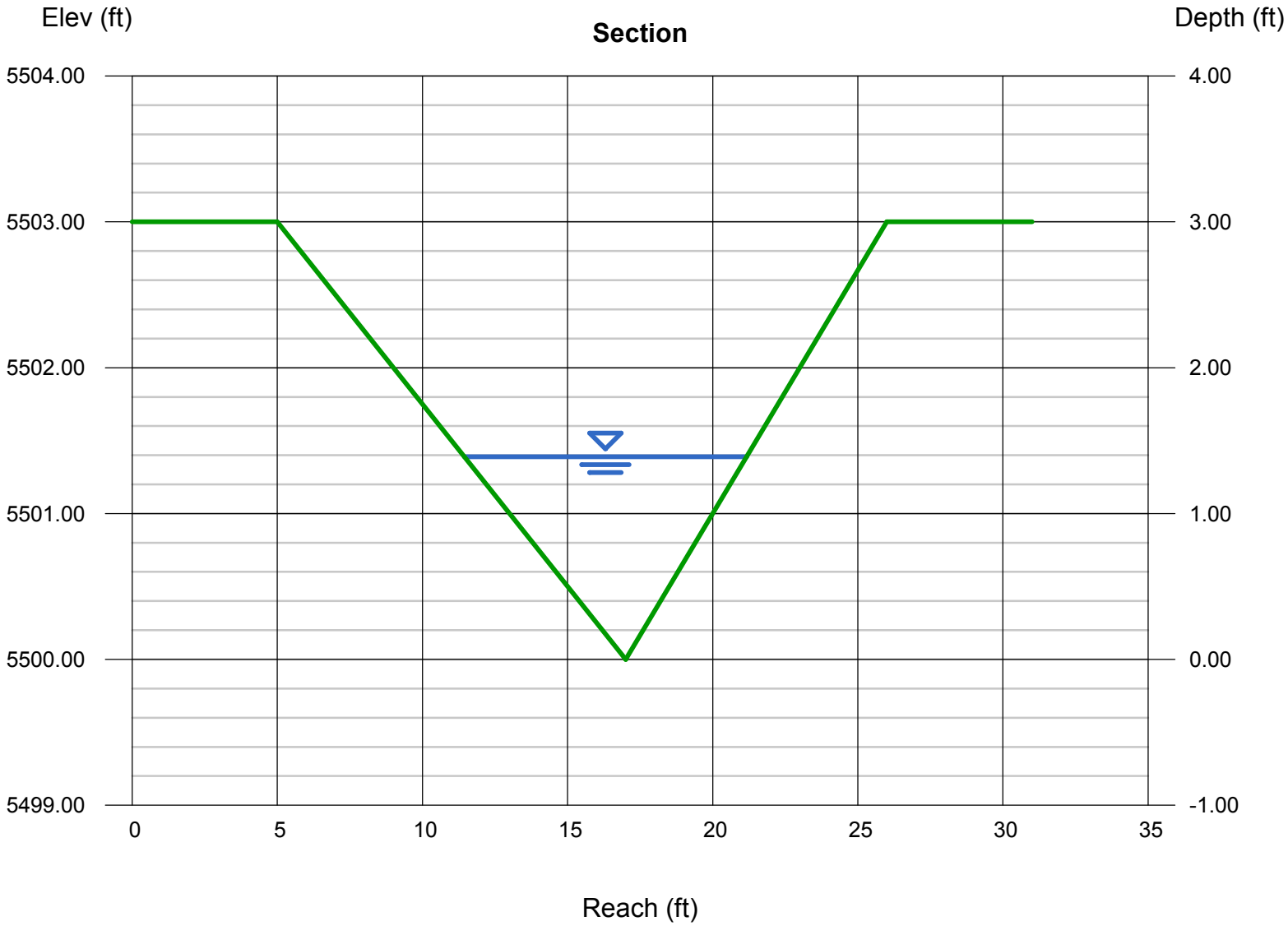
**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 25.31 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 1.39 |
| Q (cfs) | = 25.31 |
| Area (sqft) | = 6.76 |
| Velocity (ft/s) | = 3.74 |
| Wetted Perim (ft) | = 10.13 |
| Crit Depth, Yc (ft) | = 1.27 |
| Top Width (ft) | = 9.73 |
| EGL (ft) | = 1.61 |

FROUDE = 0.6 (SUBCRITICAL)



# Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Sep 9 2019

## Basin H - Roadside Ditch - Q100_Peak = 17.93 cfs

**Triangular**

| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 3.00 |
| Total Depth (ft) | = 3.00 |
| Invert Elev (ft) | = 5500.00 |
| Slope (%) | = 1.00 |
| N-Value | = 0.030 |

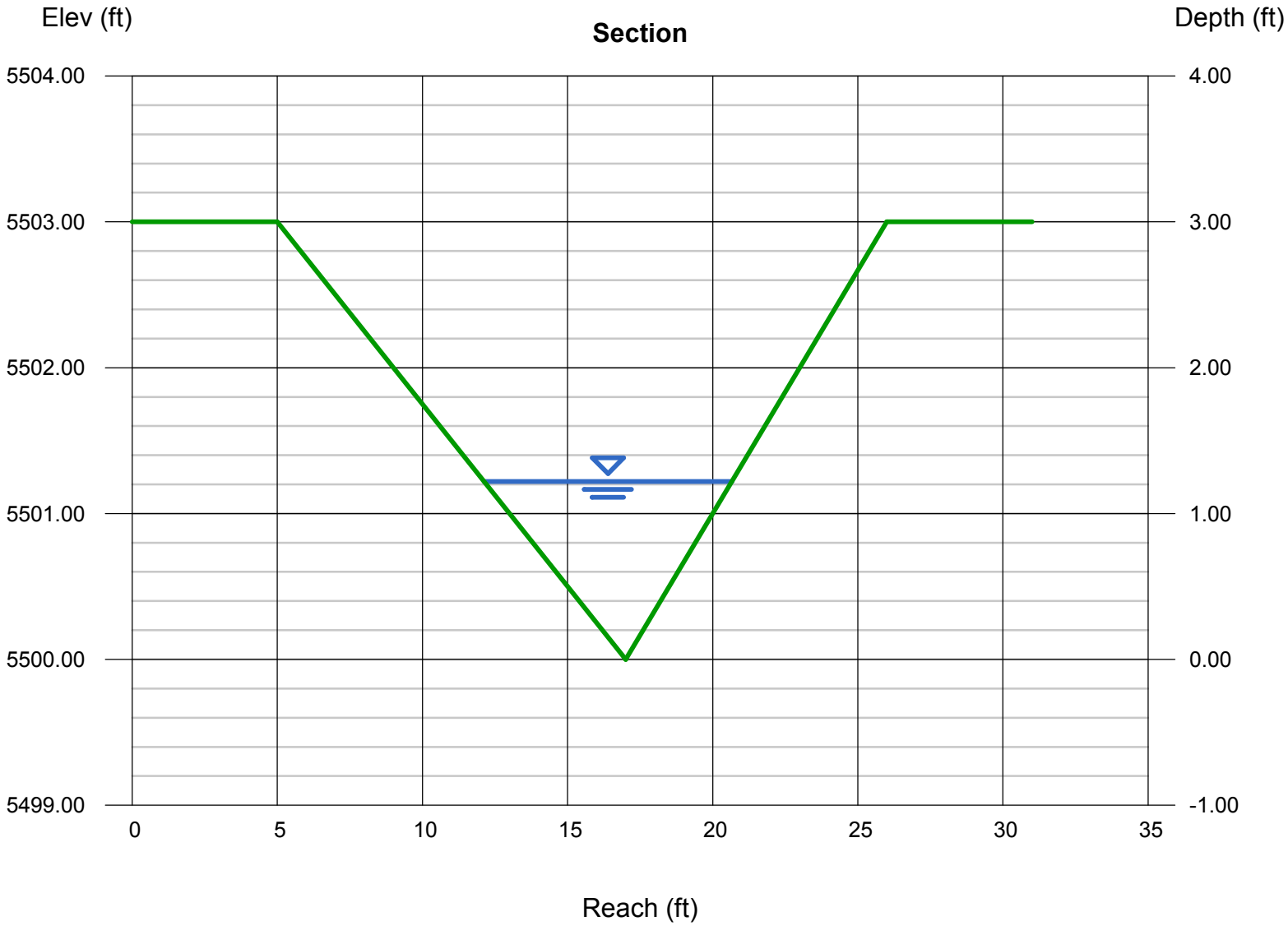
**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 17.93 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 1.22 |
| Q (cfs) | = 17.93 |
| Area (sqft) | = 5.21 |
| Velocity (ft/s) | = 3.44 |
| Wetted Perim (ft) | = 8.89 |
| Crit Depth, Yc (ft) | = 1.11 |
| Top Width (ft) | = 8.54 |
| EGL (ft) | = 1.40 |

FROUDE = 0.5 (SUBCRITICAL)



# Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Sep 9 2019

## Basin I - Roadside Ditch - Q100_Peak = 63.07 cfs

**Triangular**

| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 3.00 |
| Total Depth (ft) | = 3.00 |
| Invert Elev (ft) | = 5500.00 |
| Slope (%) | = 1.00 |
| N-Value | = 0.030 |

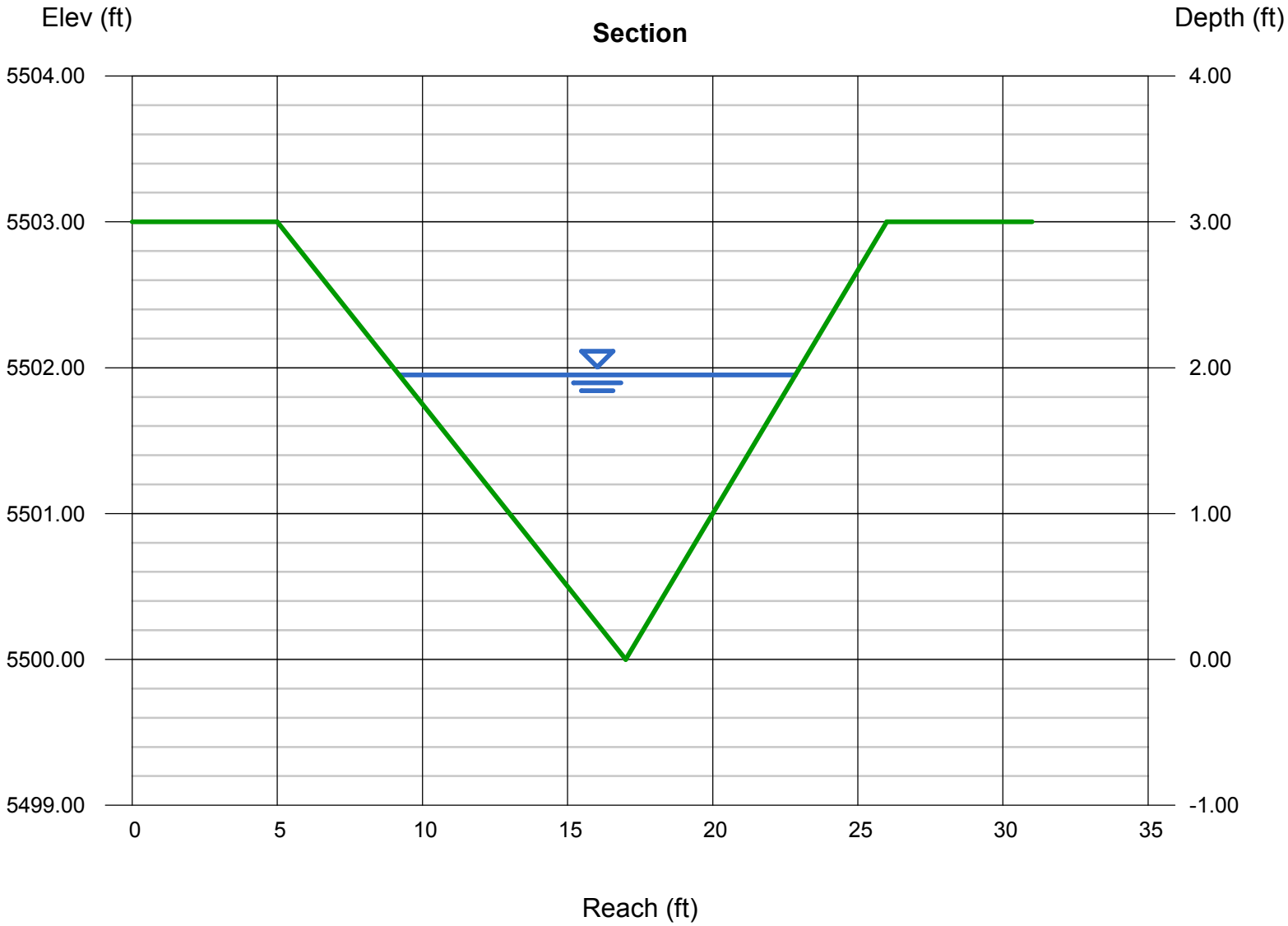
**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 63.07 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 1.95 |
| Q (cfs) | = 63.07 |
| Area (sqft) | = 13.31 |
| Velocity (ft/s) | = 4.74 |
| Wetted Perim (ft) | = 14.21 |
| Crit Depth, Yc (ft) | = 1.83 |
| Top Width (ft) | = 13.65 |
| EGL (ft) | = 2.30 |

FROUDE = 0.6 (SUBCRITICAL)



# Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Sep 9 2019

## Basin J - Roadside Ditch - Q100_Peak= 11.08 cfs

**Triangular**

| | |
|---|---|
| Side Slopes (z:1) | = 4.00, 3.00 |
| Total Depth (ft) | = 3.00 |
| Invert Elev (ft) | = 5500.00 |
| Slope (%) | = 1.52 |
| N-Value | = 0.030 |

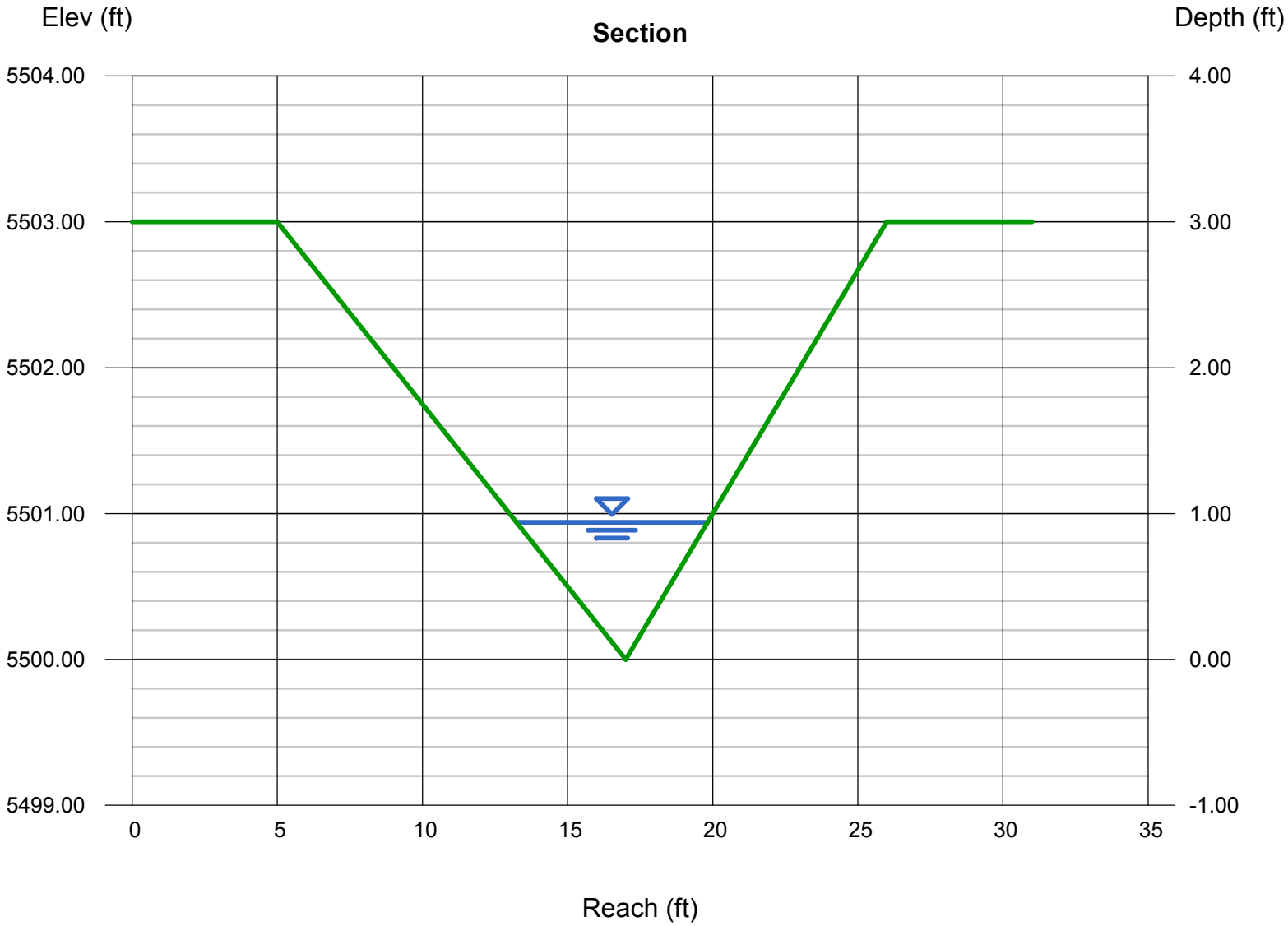
**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 11.08 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.94 |
| Q (cfs) | = 11.08 |
| Area (sqft) | = 3.09 |
| Velocity (ft/s) | = 3.58 |
| Wetted Perim (ft) | = 6.85 |
| Crit Depth, Yc (ft) | = 0.91 |
| Top Width (ft) | = 6.58 |
| EGL (ft) | = 1.14 |

FROUDE = 0.7 (SUBCRITICAL)



# APPENDIX D

# WATER QUALITY AND DETENTION CALCULATIONS

# Post Construction Stormwater Management Applicability Evaluation Form

This form is to be used by the Engineer of Record to evaluate applicable construction activities to determine if the activities are eligible for an exclusion to permanent stormwater quality management requirements. Additionally Part III of the form is used to identify and document which allowable control measure design standard is used for the structure.

| Part I. Project Information | |
|---|---|
| 1. Project Name: SADDLEHORN RANCH – PRELIMINARY PLAN | |
| 2. El Paso County Project #: SP-19-006 | 3. ESQCP #: TBD |
| 4. Project Location: SE CORNER OF JUDGE ORR ROAD AND CURTIS ROAD | Project Location in MS4 Permit Area (Y or N):N |
| 5. Project Description: AN 824 ACRE RURAL DEVELOPMENT OF 2.5+ ACRE LOTS | |
| If project is located within the El Paso County MS4 Permit Area, please provide copy of this completed form to the Stormwater Quality Coordinator for reporting purposes; and save completed form with project file. | |

Part II. Exclusion Evaluation: Determine if Post-Construction Stormwater Management exclusion criteria are met. Note: Questions A thru K directly correlate to the MS4 permit Part I.E.4.a.i (A) thru (K). If Yes, to any of the following questions, then mark Not Applicable in Part III, Question 2.

| Questions | Yes | No | Not Applicable | Notes: |
|---|---|---|---|---|
| A. Is this project a "Pavement Management Site" as defined in Permit Part I E.4.a.i.(A)? | | X | | This exclusion applies to "roadways" only. Areas used primarily for parking or access to parking are not included. |
| B. Is the project "Excluded Roadway Development"? | | | | |
| • Does the site add less than 1 acre of paved area per mile? | X | | | |
| • Does the site add 8.25 feet or less of paved width at any location to the existing roadway? | X | | | |
| C. Does the project increase the width of the existing roadway by less than 2 times the existing width? | X | | | For redevelopment of existing roadways, only the area of the existing roadway is excluded from post-construction requirements when the site does not increase the width by two times or more. *This exclusion only excludes the original roadway area it does NOT apply to entire project.* |
| D. Is the project considered an aboveground and Underground Utilities activity? | | X | | Activity can NOT permanently alter the terrain, ground cover or drainage patterns from those present prior to the activity |
| E. Is the project considered a "Large Lot Single-Family Site"? | X | | | Must be a single-residential lot or agricultural zoned land, $\geq$ 2.5 acres per dwelling and total lot impervious area < 10 percent. |

| Questions (cont'd) | Yes | No | Not Applicable | Notes |
|---|---|---|---|---|
| F. Do Non-Residential or Non-Commercial Infiltration Conditions exist?<br>Post-development surface conditions do not result in concentrated stormwater flow or surface water discharge during an 80th percentile stormwater runoff event. | | X | | Exclusion does not apply to residential or commercial sites for buildings.<br>A site specific study is required and must show: rainfall and soil conditions; allowable slopes; surface conditions; and ratios of imperviousness area to pervious area. |
| G. Is the project land disturbance to Undeveloped Land where undeveloped land remains undeveloped following the activity? | | X | | Project must be on land with no human made structures such as buildings or pavement. |
| H. Is the project a Stream Stabilization Site? | | X | | Standalone stream stabilization projects are excluded. |
| I. Is the project a bike or pedestrian trail? | | X | | Bike lanes for roadways are not included in this exclusion, but may qualify if part of larger roadway activity is excluded in A, B or C above. |
| J. Is the project Oil and Gas Exploration? | | X | | Activities and facilities associated with oil and gas exploration are excluded. |
| K. Is the project in a County Growth Area? | | | | Note, El Paso County does not apply this exclusion.<br>All Applicable Construction Activity in El Paso County must comply the Post-Construction Stormwater Management criteria. |

| Part III. Post Construction (Permanent) Stormwater Control Determination | | |
|---|---|---|
| Questions | Yes | No |
| 1. Is project an Applicable Construction Activity? | X | |
| 2. Do any of the Exclusions (A-K in Part II) apply? | X | |

If the project is an Applicable Construction Activity and no Exclusions apply then Post-Construction (Permanent) Stormwater Management is required.
Complete the applicable sections of Part IV below and then coordinate signatures for form and place in project file.
If the project is not an Applicable Construction Activity, or Exclusion(s) apply then Post-Construction (Permanent) Stormwater Management is NOT required. Coordinate signatures for form and place in project file.

| Part IV: Onsite PWQ Requirements, Documentation and Considerations | Yes | No |
|---|---|---|
| 1. Check which Design Standard(s) the project will utilize. Standards align with Control Measure Requirements identified in permit Part I.E.4.a.iv. | | |
| A. Water Quality Capture Volume (WQCV) Standard | | |
| B. Pollutant Removal/80% Total Suspended Solids Removal (TSS) | | |
| C. Runoff Reduction Standard | | |
| D. Applicable Development Site Draining to a Regional WQCV Control Measure | | |
| E. Applicable Development Site Draining to a Regional WQCV Facility | | |
| F. Constrained Redevelopment Sites Standard | | |
| G. Previous Permit Term Standard | | |
| 2. Will any of the project permanent stormwater control measure(s) be maintained by another MS4?<br>If Yes, you must obtain a structure specific maintenance agreement with the other MS4 prior to advertisement. | | |
| 3. Will any of the project permanent stormwater control measures be maintained by a private entity or quasi-governmental agency (e.g. HOA or Special District, respectively)?<br>If Yes, a Private Detention Basin/Stormwater Quality Best Management Practice Maintenance Agreement and Easement must be recorded with the El Paso County Clerk and Recorder. | | |

| Part V Notes (attach an additional sheet if you need more space) |
|---|
| |

Project design is complete to include the project design, construction plans, drainage report, specifications, and maintenance and access agreements as required. The engineering, drainage considerations and information used to complete these documents is complete, true, and accurate to the best of my belief and knowledge.

Signature and Stamp of Engineer of Record _____ Date _____

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

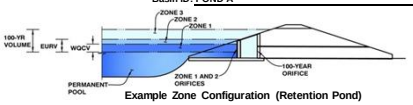
Signature of El Paso County Project Engineer _____ Date _____

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** SADDLEHORN RANCH MDDP/PDR

**Basin ID:** POND A




**Example Zone Configuration (Retention Pond)**

**Required Volume Calculation**

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 9.20 | acres |
| Watershed Length = | 1,459 | ft |
| Watershed Slope = | 0.018 | ft/ft |
| Watershed Imperviousness = | 66.60% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |
| Water Quality Capture Volume (WQCV) = | 0.200 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.766 | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.527 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.688 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.836 | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 1.010 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 1.199 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 1.421 | acre-feet |
| 500-yr Runoff Volume (P1 = 0 in.) = | 0.000 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.499 | acre-feet |
| Approximate 5-yr Detention Volume = | 0.651 | acre-feet |
| Approximate 10-yr Detention Volume = | 0.784 | acre-feet |
| Approximate 25-yr Detention Volume = | 0.942 | acre-feet |
| Approximate 50-yr Detention Volume = | 1.037 | acre-feet |
| Approximate 100-yr Detention Volume = | 1.135 | acre-feet |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| | inches |

**Stage-Storage Calculation**

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.200 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.566 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.369 | acre-feet |
| Total Detention Basin Volume = | 1.135 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | ft^2 |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | ft^2 |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | ft^3 |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | ft^2 |
| Volume of Main Basin ($V_{MAIN}$) = | user | ft^3 |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

Depth Increment = ft

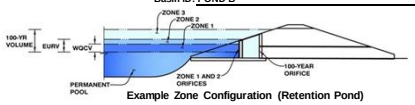
| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft^2) | Optional Override Area (ft^2) | Area (acre) | Volume (ft^3) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| **Top of Micropool** | -- | 0.00 | -- | -- | -- | 19,159 | 0.440 | | |
| | -- | 1.00 | -- | -- | -- | 21,277 | 0.488 | 20,005 | 0.459 |
| | -- | 2.00 | -- | -- | -- | 23,496 | 0.539 | 42,370 | 0.973 |
| | -- | 3.00 | -- | -- | -- | 25,816 | 0.593 | 67,260 | 1.544 |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** SADDLEHORN RANCH MDDP/PDR

**Basin ID:** POND B




**Example Zone Configuration (Retention Pond)**

### Required Volume Calculation

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 60.40 | acres |
| Watershed Length = | 3,200 | ft |
| Watershed Slope = | 0.017 | ft/ft |
| Watershed Imperviousness = | 10.41% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |
| Water Quality Capture Volume (WQCV) = | 0.349 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.467 | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.304 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.416 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.549 | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.810 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 1.460 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 2.742 | acre-feet |
| 500-yr Runoff Volume (P1 = 0 in.) = | 0.000 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.280 | acre-feet |
| Approximate 5-yr Detention Volume = | 0.384 | acre-feet |
| Approximate 10-yr Detention Volume = | 0.505 | acre-feet |
| Approximate 25-yr Detention Volume = | 0.682 | acre-feet |
| Approximate 50-yr Detention Volume = | 0.911 | acre-feet |
| Approximate 100-yr Detention Volume = | 1.461 | acre-feet |

| Optional User Override 1-hr Precipitation | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| | inches |

### Stage-Storage Calculation

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.349 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.118 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.994 | acre-feet |
| Total Detention Basin Volume = | 1.461 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | ft^2 |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | ft^2 |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | ft^3 |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | ft^2 |
| Volume of Main Basin ($V_{MAIN}$) = | user | ft^3 |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

Depth Increment = ft

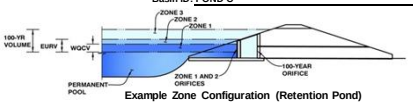
| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft^2) | Optional Override Area (ft^2) | Area (acre) | Volume (ft^3) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| **Top of Micropool** | -- | 0.00 | -- | -- | -- | 6,202 | 0.142 | | |
| | -- | 1.00 | -- | -- | -- | 14,852 | 0.341 | 10,379 | 0.238 |
| | -- | 2.00 | -- | -- | -- | 26,498 | 0.608 | 30,938 | 0.710 |
| | -- | 3.00 | -- | -- | -- | 44,365 | 1.018 | 66,633 | 1.530 |
| | -- | 3.50 | -- | -- | -- | 66,371 | 1.524 | 94,317 | 2.165 |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** SADDLEHORN RANCH MDDP/PDR

**Basin ID:** POND C




**Example Zone Configuration (Retention Pond)**

### Required Volume Calculation

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 102.55 | acres |
| Watershed Length = | 5,500 | ft |
| Watershed Slope = | 0.010 | ft/ft |
| Watershed Imperviousness = | 11.37% | percent |
| Percentage Hydrologic Soil Group A = | 96.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 4.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |
| Water Quality Capture Volume (WQCV) = | 0.638 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.892 | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.590 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.835 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 1.143 | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 1.757 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 2.960 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 5.186 | acre-feet |
| 500-yr Runoff Volume (P1 = 0 in.) = | 0.000 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.546 | acre-feet |
| Approximate 5-yr Detention Volume = | 0.775 | acre-feet |
| Approximate 10-yr Detention Volume = | 1.013 | acre-feet |
| Approximate 25-yr Detention Volume = | 1.347 | acre-feet |
| Approximate 50-yr Detention Volume = | 1.738 | acre-feet |
| Approximate 100-yr Detention Volume = | 2.688 | acre-feet |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| | inches |

### Stage-Storage Calculation

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.638 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.254 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 1.797 | acre-feet |
| Total Detention Basin Volume = | 2.688 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | ft^2 |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | ft^2 |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | ft^3 |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | ft^2 |
| Volume of Main Basin ($V_{MAIN}$) = | user | ft^3 |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

Depth Increment = ft

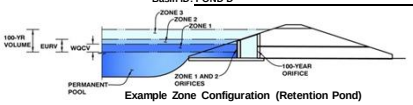
| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft^2) | Optional Override Area (ft^2) | Area (acre) | Volume (ft^3) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| **Top of Micropool** | -- | 0.00 | -- | -- | -- | 904 | 0.021 | | |
| | -- | 1.00 | -- | -- | -- | 11,766 | 0.270 | 6,218 | 0.143 |
| | -- | 2.00 | -- | -- | -- | 50,811 | 1.166 | 37,117 | 0.852 |
| | -- | 3.00 | -- | -- | -- | 75,579 | 1.735 | 100,818 | 2.314 |
| | -- | 3.25 | -- | -- | -- | 81,862 | 1.879 | 120,498 | 2.766 |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** SADDLEHORN RANCH MDDP/PDR

**Basin ID:** POND D




**Example Zone Configuration (Retention Pond)**

**Required Volume Calculation**

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 99.17 | acres |
| Watershed Length = | 4,200 | ft |
| Watershed Slope = | 0.015 | ft/ft |
| Watershed Imperviousness = | 10.81% | percent |
| Percentage Hydrologic Soil Group A = | 70.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 30.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |
| Water Quality Capture Volume (WQCV) = | 0.591 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.833 | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.601 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 1.031 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 1.696 | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 3.117 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 4.622 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 7.053 | acre-feet |
| 500-yr Runoff Volume (P1 = 0 in.) = | 0.000 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.557 | acre-feet |
| Approximate 5-yr Detention Volume = | 0.968 | acre-feet |
| Approximate 10-yr Detention Volume = | 1.271 | acre-feet |
| Approximate 25-yr Detention Volume = | 1.613 | acre-feet |
| Approximate 50-yr Detention Volume = | 1.910 | acre-feet |
| Approximate 100-yr Detention Volume = | 2.859 | acre-feet |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| | inches |

**Stage-Storage Calculation**

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.591 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.241 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 2.027 | acre-feet |
| Total Detention Basin Volume = | 2.859 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | ft^2 |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | ft^2 |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | ft^3 |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | ft^2 |
| Volume of Main Basin ($V_{MAIN}$) = | user | ft^3 |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

Depth Increment = ft

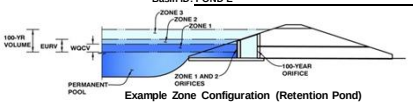
| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft^2) | Optional Override Area (ft^2) | Area (acre) | Volume (ft^3) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| **Top of Micropool** | -- | 0.00 | -- | -- | -- | 5,047 | 0.116 | | |
| | -- | 1.00 | -- | -- | -- | 21,395 | 0.491 | 13,008 | 0.299 |
| | -- | 2.00 | -- | -- | -- | 39,698 | 0.911 | 43,371 | 0.996 |
| | -- | 3.00 | -- | -- | -- | 61,991 | 1.423 | 94,612 | 2.172 |
| | -- | 3.50 | -- | -- | -- | 76,144 | 1.748 | 129,146 | 2.965 |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** SADDLEHORN RANCH MDDP/PDR

**Basin ID:** POND E




**Example Zone Configuration (Retention Pond)**

**Required Volume Calculation**

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 11.60 | acres |
| Watershed Length = | 1,000 | ft |
| Watershed Slope = | 0.015 | ft/ft |
| Watershed Imperviousness = | 7.69% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |
| Water Quality Capture Volume (WQCV) = | 0.052 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.061 | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.039 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.054 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.072 | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.110 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 0.221 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 0.465 | acre-feet |
| 500-yr Runoff Volume (P1 = 0 in.) = | 0.000 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.036 | acre-feet |
| Approximate 5-yr Detention Volume = | 0.050 | acre-feet |
| Approximate 10-yr Detention Volume = | 0.066 | acre-feet |
| Approximate 25-yr Detention Volume = | 0.091 | acre-feet |
| Approximate 50-yr Detention Volume = | 0.131 | acre-feet |
| Approximate 100-yr Detention Volume = | 0.232 | acre-feet |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| | inches |

**Stage-Storage Calculation**

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.052 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.009 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.171 | acre-feet |
| Total Detention Basin Volume = | 0.232 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | ft^2 |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | ft^2 |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | ft^3 |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | ft^2 |
| Volume of Main Basin ($V_{MAIN}$) = | user | ft^3 |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

Depth Increment = ft

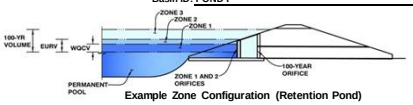
| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft^2) | Optional Override Area (ft^2) | Area (acre) | Volume (ft^3) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| **Top of Micropool** | -- | 0.00 | -- | -- | -- | 3,703 | 0.085 | | |
| | -- | 1.00 | -- | -- | -- | 4,931 | 0.113 | 4,268 | 0.098 |
| | -- | 2.00 | -- | -- | -- | 6,258 | 0.144 | 9,849 | 0.226 |
| | -- | 3.00 | -- | -- | -- | 7,684 | 0.176 | 16,882 | 0.388 |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** SADDLEHORN RANCH MDDP/PDR

**Basin ID:** POND F




**Example Zone Configuration (Retention Pond)**

**Required Volume Calculation**

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 117.40 | acres |
| Watershed Length = | 5,000 | ft |
| Watershed Slope = | 0.013 | ft/ft |
| Watershed Imperviousness = | 9.90% | percent |
| Percentage Hydrologic Soil Group A = | 71.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 29.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |
| Water Quality Capture Volume (WQCV) = | 0.650 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.885 | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.635 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 1.106 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 1.857 | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 3.476 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 5.210 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 8.074 | acre-feet |
| 500-yr Runoff Volume (P1 = 0 in.) = | 0.000 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.589 | acre-feet |
| Approximate 5-yr Detention Volume = | 1.038 | acre-feet |
| Approximate 10-yr Detention Volume = | 1.377 | acre-feet |
| Approximate 25-yr Detention Volume = | 1.752 | acre-feet |
| Approximate 50-yr Detention Volume = | 2.093 | acre-feet |
| Approximate 100-yr Detention Volume = | 3.200 | acre-feet |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| | inches |

**Stage-Storage Calculation**

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.650 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.235 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 2.315 | acre-feet |
| Total Detention Basin Volume = | 3.200 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | ft^2 |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | ft^2 |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | ft^3 |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | ft^2 |
| Volume of Main Basin ($V_{MAIN}$) = | user | ft^3 |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

Depth Increment = ft

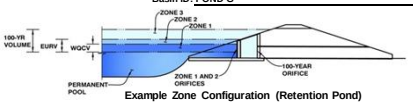
| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft^2) | Optional Override Area (ft^2) | Area (acre) | Volume (ft^3) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| **Top of Micropool** | -- | 0.00 | -- | -- | -- | 1,298 | 0.030 | | |
| | -- | 1.00 | -- | -- | -- | 12,916 | 0.297 | 6,978 | 0.160 |
| | -- | 2.00 | -- | -- | -- | 28,807 | 0.661 | 27,681 | 0.635 |
| | -- | 3.00 | -- | -- | -- | 45,533 | 1.045 | 65,138 | 1.495 |
| | -- | 4.00 | -- | -- | -- | 56,635 | 1.300 | 116,222 | 2.668 |
| | -- | 4.50 | -- | -- | -- | 62,552 | 1.436 | 146,018 | 3.352 |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** SADDLEHORN RANCH MDDP/PDR

**Basin ID:** POND G




**Example Zone Configuration (Retention Pond)**

### Required Volume Calculation

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 39.90 | acres |
| Watershed Length = | 3,700 | ft |
| Watershed Slope = | 0.015 | ft/ft |
| Watershed Imperviousness = | 16.70% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |
| Water Quality Capture Volume (WQCV) = | 0.337 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.565 | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.373 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.504 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.651 | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.914 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 1.439 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 2.298 | acre-feet |
| 500-yr Runoff Volume (P1 = 0 in.) = | 0.000 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.346 | acre-feet |
| Approximate 5-yr Detention Volume = | 0.469 | acre-feet |
| Approximate 10-yr Detention Volume = | 0.603 | acre-feet |
| Approximate 25-yr Detention Volume = | 0.790 | acre-feet |
| Approximate 50-yr Detention Volume = | 0.974 | acre-feet |
| Approximate 100-yr Detention Volume = | 1.357 | acre-feet |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| | inches |

### Stage-Storage Calculation

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.337 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.228 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.792 | acre-feet |
| Total Detention Basin Volume = | 1.357 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | ft^2 |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | ft^2 |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | ft^3 |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | ft^2 |
| Volume of Main Basin ($V_{MAIN}$) = | user | ft^3 |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

Depth Increment = ft

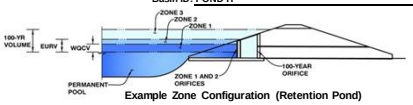
| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft^2) | Optional Override Area (ft^2) | Area (acre) | Volume (ft^3) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| **Top of Micropool** | -- | 0.00 | -- | -- | -- | 904 | 0.021 | | |
| | -- | 1.00 | -- | -- | -- | 15,257 | 0.350 | 7,928 | 0.182 |
| | -- | 2.00 | -- | -- | -- | 24,452 | 0.561 | 27,691 | 0.636 |
| | -- | 3.00 | -- | -- | -- | 29,888 | 0.686 | 55,105 | 1.265 |
| | -- | 3.50 | -- | -- | -- | 32,047 | 0.736 | 70,589 | 1.620 |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** SADDLEHORN RANCH MDDP/PDR

**Basin ID:** POND H




**Example Zone Configuration (Retention Pond)**

## Required Volume Calculation

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 30.70 | acres |
| Watershed Length = | 1,800 | ft |
| Watershed Slope = | 0.010 | ft/ft |
| Watershed Imperviousness = | 9.42% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |
| Water Quality Capture Volume (WQCV) = | 0.163 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.209 | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.135 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.186 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.246 | acre-feet |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.368 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 0.685 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 1.335 | acre-feet |
| 500-yr Runoff Volume (P1 = 0 in.) = | 0.000 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.125 | acre-feet |
| Approximate 5-yr Detention Volume = | 0.172 | acre-feet |
| Approximate 10-yr Detention Volume = | 0.227 | acre-feet |
| Approximate 25-yr Detention Volume = | 0.308 | acre-feet |
| Approximate 50-yr Detention Volume = | 0.420 | acre-feet |
| Approximate 100-yr Detention Volume = | 0.696 | acre-feet |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| | inches |

## Stage-Storage Calculation

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.163 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.046 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.487 | acre-feet |
| Total Detention Basin Volume = | 0.696 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | ft^2 |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | ft^2 |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | ft^3 |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | ft^2 |
| Volume of Main Basin ($V_{MAIN}$) = | user | ft^3 |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

Depth Increment = ft

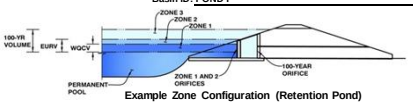
| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft^2) | Optional Override Area (ft^2) | Area (acre) | Volume (ft^3) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| 6736 **Top of Micropool** | -- | 0.00 | -- | -- | -- | 40 | 0.001 | | |
| **6737** | -- | 1.00 | -- | -- | -- | 3,419 | 0.078 | 1,695 | 0.039 |
| 6738 | -- | 2.00 | -- | -- | -- | 8,532 | 0.196 | 7,620 | 0.175 |
| 6739.00 | -- | 3.00 | -- | -- | -- | 14,546 | 0.334 | 19,244 | 0.442 |
| 6740.00 | -- | 4.00 | -- | -- | -- | 21,360 | 0.490 | 37,196 | 0.854 |
| 6741.00 | -- | | -- | -- | -- | | | | |
| 6742.00 | -- | | -- | -- | -- | | | | |

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** SADDLEHORN RANCH MDDP/PDR

**Basin ID:** POND I




**Example Zone Configuration (Retention Pond)**

## Required Volume Calculation

| | | | |
|---|---|---|---|
| Selected BMP Type = | EDB | | |
| Watershed Area = | 46.60 | acres | |
| Watershed Length = | 1,900 | ft | |
| Watershed Slope = | 0.053 | ft/ft | |
| Watershed Imperviousness = | 9.39% | percent | |
| Percentage Hydrologic Soil Group A = | 93.0% | percent | |
| Percentage Hydrologic Soil Group B = | 7.0% | percent | |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent | |
| Desired WQCV Drain Time = | 40.0 | hours | |
| Location for 1-hr Rainfall Depths = | User Input | | |
| Water Quality Capture Volume (WQCV) = | 0.247 | acre-feet | |
| Excess Urban Runoff Volume (EURV) = | 0.322 | acre-feet | |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.210 | acre-feet | |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.292 | acre-feet | |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.418 | acre-feet | |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.712 | acre-feet | |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 1.236 | acre-feet | |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 2.254 | acre-feet | |
| 500-yr Runoff Volume (P1 = 0 in.) = | 0.000 | acre-feet | |
| Approximate 2-yr Detention Volume = | 0.194 | acre-feet | |
| Approximate 5-yr Detention Volume = | 0.270 | acre-feet | |
| Approximate 10-yr Detention Volume = | 0.380 | acre-feet | |
| Approximate 25-yr Detention Volume = | 0.519 | acre-feet | |
| Approximate 50-yr Detention Volume = | 0.681 | acre-feet | |
| Approximate 100-yr Detention Volume = | 1.098 | acre-feet | |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| 1.19 | inches |
| 1.50 | inches |
| 1.75 | inches |
| 2.00 | inches |
| 2.25 | inches |
| 2.52 | inches |
| | inches |

## Stage-Storage Calculation

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.247 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.076 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.775 | acre-feet |
| Total Detention Basin Volume = | 1.098 | acre-feet |
| Initial Surcharge Volume (ISV) = | user | ft^3 |
| Initial Surcharge Depth (ISD) = | user | ft |
| Total Available Detention Depth ($H_{total}$) = | user | ft |
| Depth of Trickle Channel ($H_{TC}$) = | user | ft |
| Slope of Trickle Channel ($S_{TC}$) = | user | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | user | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | user | |
| Initial Surcharge Area ($A_{ISV}$) = | user | ft^2 |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | user | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | user | ft^2 |
| Volume of Basin Floor ($V_{FLOOR}$) = | user | ft^3 |
| Depth of Main Basin ($H_{MAIN}$) = | user | ft |
| Length of Main Basin ($L_{MAIN}$) = | user | ft |
| Width of Main Basin ($W_{MAIN}$) = | user | ft |
| Area of Main Basin ($A_{MAIN}$) = | user | ft^2 |
| Volume of Main Basin ($V_{MAIN}$) = | user | ft^3 |
| Calculated Total Basin Volume ($V_{total}$) = | user | acre-feet |

Depth Increment = ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft^2) | Optional Override Area (ft^2) | Area (acre) | Volume (ft^3) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| 6699 **Top of Micropool** | -- | 0.00 | -- | -- | -- | 0 | 0.000 | | |
| | -- | 1.00 | -- | -- | -- | 2,926 | 0.067 | 1,434 | 0.033 |
| | -- | 2.00 | -- | -- | -- | 11,781 | 0.270 | 8,699 | 0.200 |
| | -- | 3.00 | -- | -- | -- | 20,629 | 0.474 | 25,021 | 0.574 |
| | -- | 4.00 | -- | -- | -- | 26,059 | 0.598 | 48,365 | 1.110 |

# APPENDIX E

# REFERENCE MATERIALS

# Federal Emergency Management Agency

Washington, D.C. 20472

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

### PUBLIC NOTIFICATION

| FLOODING SOURCE | LOCATION OF REFERENCED ELEVATION | BFE (FEET NGVD) | | MAP PANEL NUMBER(S) |
|---|---|---|---|---|
| | | EFFECTIVE | REVISED | |
| Haegler Ranch Tributary 2 | Approximately 310 feet upstream of confluence with Geick Ranch West Tributary | None | 6,735 | 08041C0575 F |
| | Approximately 3,140 feet upstream of confluence with Geick Ranch West Tributary | None | 6,779 | 08041C0575 F |
| Haegler Ranch Tributary 3 | Approximately 8,100 feet downstream of Curtis Road | None | 6,672 | 08041C0575 F |
| | 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 |
| | Approximately 300 feet upstream of Curtis Road | None | 6,758 | 08041C0575 F |

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If 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.

Kevin C Long

Kevin C. Long, CFM, Project Engineer
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate

102929 101104080587 102IAC

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.

| Location | Existing BFE (feet)* | Modified BFE (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.

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

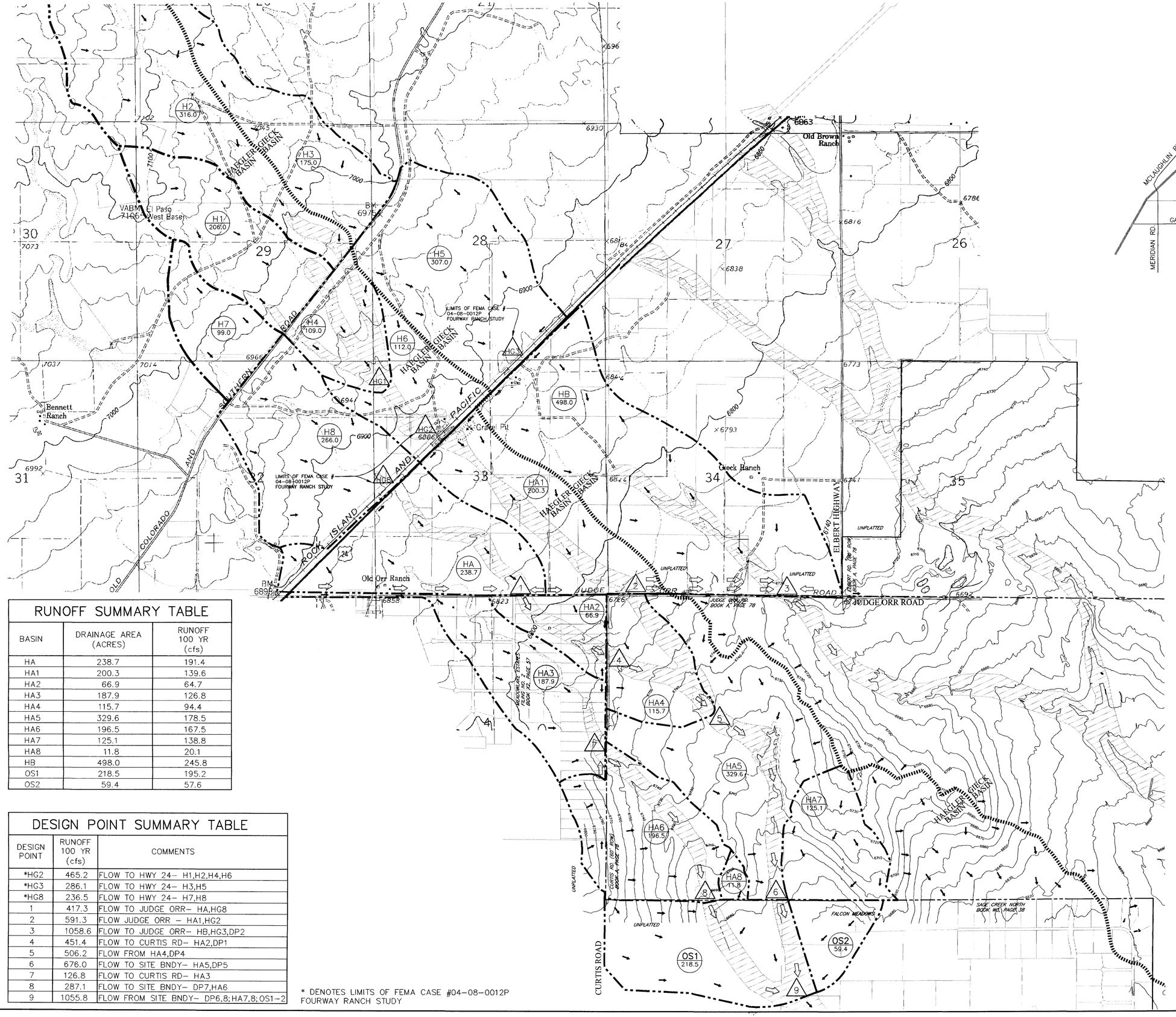
The Honorable Chuck Brown
Chairman, El Paso County
Board of Commissioners
27 Vermijo Avenue
Colorado Springs, CO 80903-2208

Table 3. Summary of Discharges

| Flooding Source and Location | Drainage Area (square miles) | Peak Discharges (cubic feet per second) 10-Year | 50-Year | 100-Year | 500-Year |
|---|---|---|---|---|---|
| Haegler Ranch Tributary 2 At the confluence with Geick Ranch West Tributary | 1.47 | __1 | __1 | 592 | __1 |
| Haegler Ranch Tributary 3 At approximately 2,300 feet upstream of the confluence with Haegler Ranch Tributary 4 | 1.09 | __1 | __1 | 505 | __1 |
| Haegler Ranch Tributary 4 At approximately 3,700 feet upstream of the confluence with Haegler Ranch Tributary 3 | 0.60 | __1 | __1 | 130 | __1 |

1 Data Not Available

REVISED TO
REFLECT LOMR
DATED FEB 16 2005



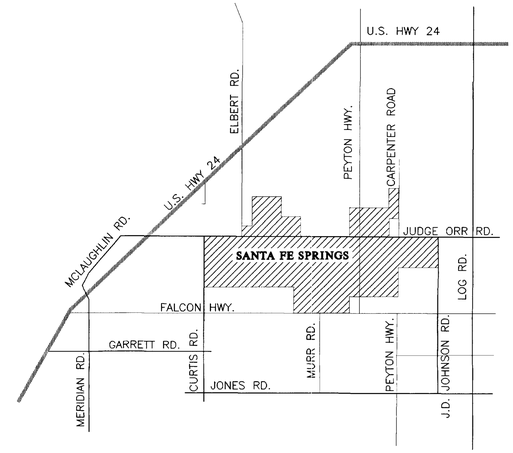

## RUNOFF SUMMARY TABLE

| BASIN | DRAINAGE AREA (ACRES) | RUNOFF 100 YR (cfs) |
|---|---|---|
| HA | 238.7 | 191.4 |
| HA1 | 200.3 | 139.6 |
| HA2 | 66.9 | 64.7 |
| HA3 | 187.9 | 126.8 |
| HA4 | 115.7 | 94.4 |
| HA5 | 329.6 | 178.5 |
| HA6 | 196.5 | 167.5 |
| HA7 | 125.1 | 138.8 |
| HA8 | 11.8 | 20.1 |
| HB | 498.0 | 245.8 |
| OS1 | 218.5 | 195.2 |
| OS2 | 59.4 | 57.6 |

## DESIGN POINT SUMMARY TABLE

| DESIGN POINT | RUNOFF 100 YR (cfs) | COMMENTS |
|---|---|---|
| *HG2 | 465.2 | FLOW TO HWY 24– H1,H2,H4,H6 |
| *HG3 | 286.1 | FLOW TO HWY 24– H3,H5 |
| *HG8 | 236.5 | FLOW TO HWY 24– H7,H8 |
| 1 | 417.3 | FLOW TO JUDGE ORR– HA,HG8 |
| 2 | 591.3 | FLOW JUDGE ORR – HA1,HG2 |
| 3 | 1058.6 | FLOW TO JUDGE ORR– HB,HG3,DP2 |
| 4 | 451.4 | FLOW TO CURTIS RD– HA2,DP1 |
| 5 | 506.2 | FLOW FROM HA4,DP4 |
| 6 | 676.0 | FLOW TO SITE BNDY– HA5,DP5 |
| 7 | 126.8 | FLOW TO CURTIS RD– HA3 |
| 8 | 287.1 | FLOW TO SITE BNDY– DP7,HA6 |
| 9 | 1055.8 | FLOW FROM SITE BNDY– DP6,8;HA7,8;OS1–2 |

* DENOTES LIMITS OF FEMA CASE #04–08–0012P FOURWAY RANCH STUDY

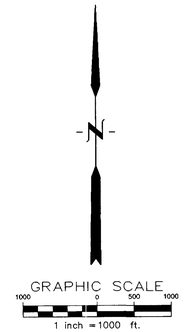



## VICINTY MAP

1"=5000'

## LEGEND

- EX. MAJOR CONTOUR ..... 6420
- DRAINAGE BASIN BOUNDARY .....
- OVERLAND FLOW DIRECTION .....
- CHANNELIZED FLOW DIRECTION .....
- HAEGLER/GIECK BASIN BOUNDARY .....
- DESIGN POINT ..... 1
- 100–YEAR FLOODPLAIN PER FIRM MAPS .....
- BASIN I.D. / BASIN AREA (Acres) — HA3 / 187.9




| NO. | DESCRIPTION | REV BY | CKD BY | DATE |
|---|---|---|---|---|
| | | | | |

REVISION

TRI-CORE ENGINEERING
5526 N. ACADEMY BLVD., SUITE 204
COLORADO SPRINGS, CO 80918
PHONE (719) 264–1560
FAX (719) 264–1193

SCALE (H): 1"=1000'
SCALE (V): N/A

DRAWN BY: DMM
DESIGNED BY: RLS
CHECKED BY: RLS

DATE: 05/21/04

SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO, COUNTY

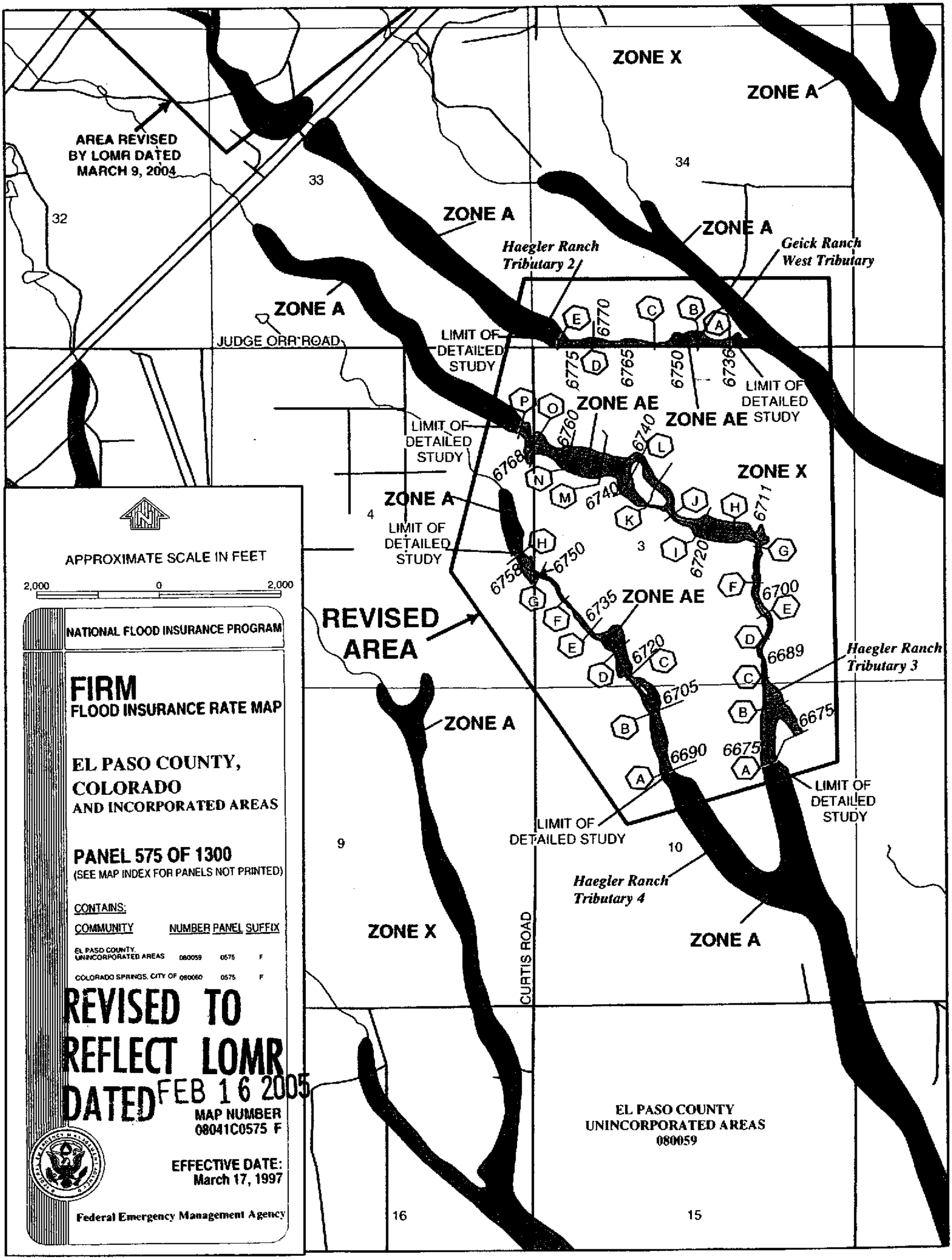
REALTY DEVELOPMENT SERVICES
25 NORTH TEJON
SUITE 300

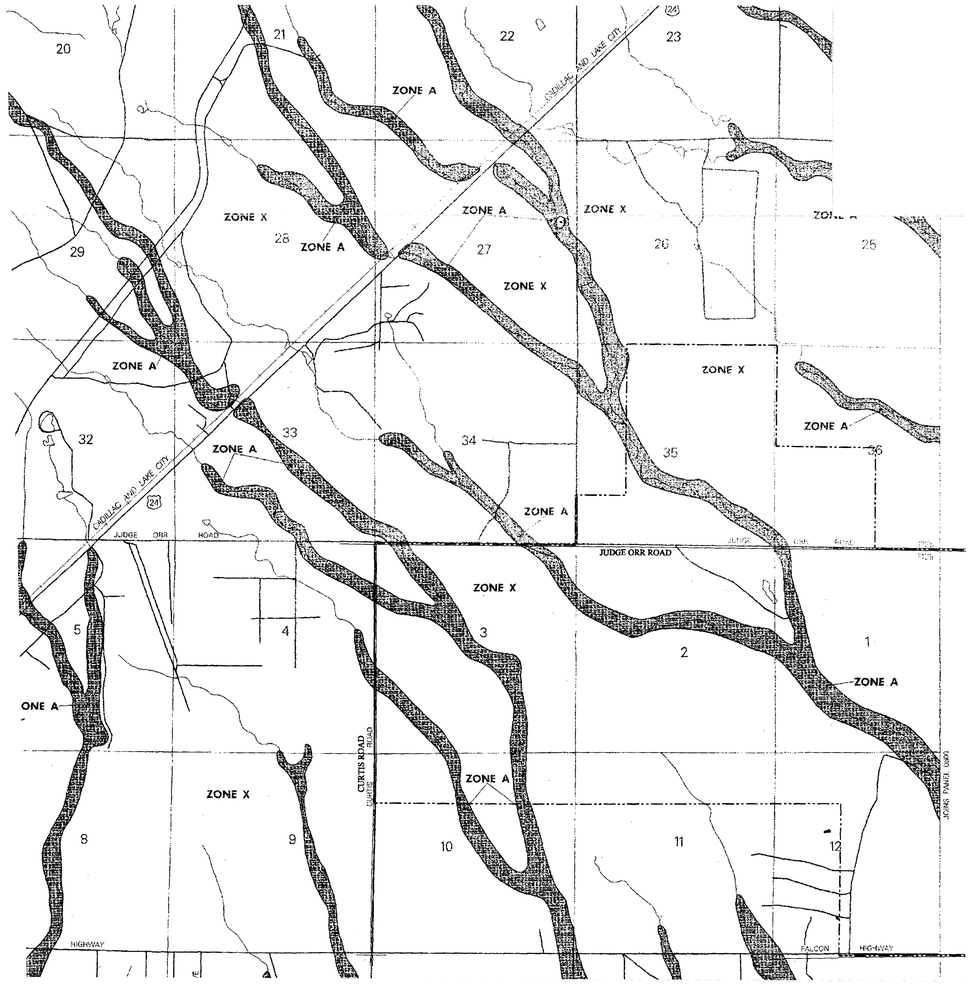
# EXHIBIT 1
# HYDROLOGIC SUBBASIN MAP

PROJECT NO.
6005–0001

FILENAME
01DR_HIST.DWG

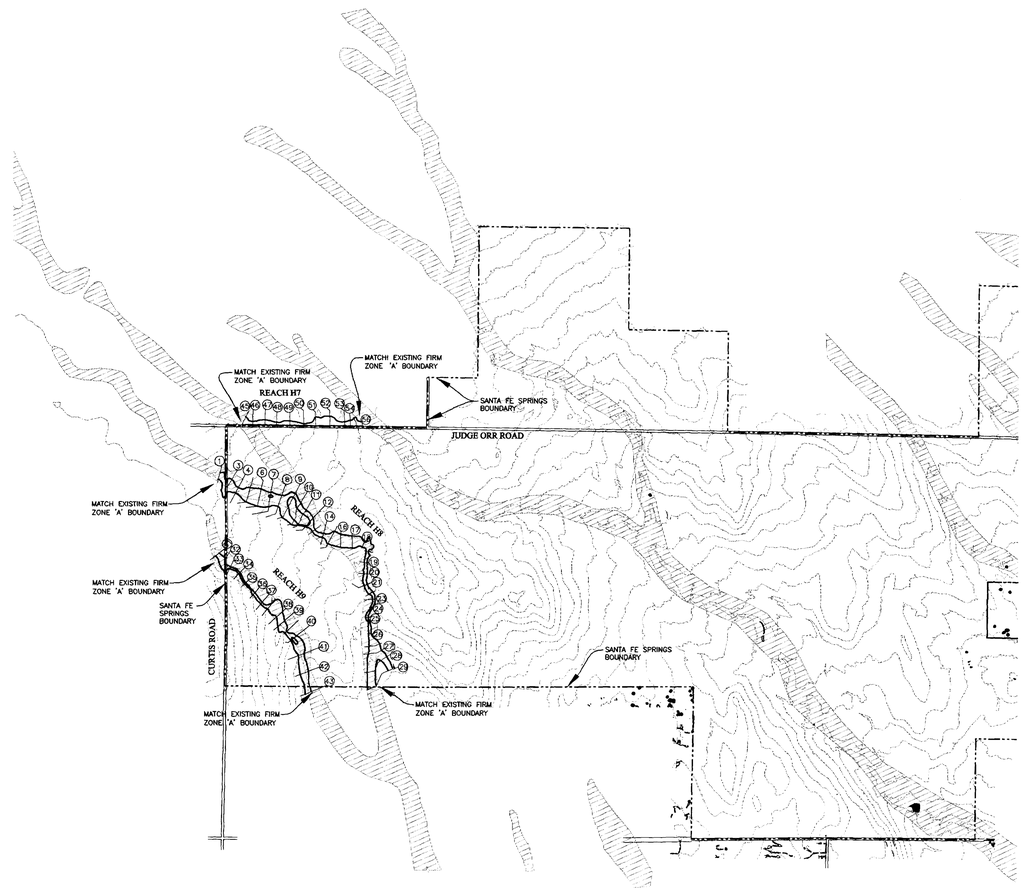
DRAWING NO.
EXH. 1


ZONE X
ZONE A
AREA REVISED BY LOMR DATED MARCH 9, 2004
33
34
32
ZONE A
ZONE A
Haegler Ranch Tributary 2
Geick Ranch West Tributary
ZONE A
JUDGE ORR ROAD
LIMIT OF DETAILED STUDY
6770
6775
6765
6750
6736
LIMIT OF DETAILED STUDY
ZONE AE
ZONE AE
LIMIT OF DETAILED STUDY
6760
6740
6768
ZONE X
6740
6711
ZONE A
4
LIMIT OF DETAILED STUDY
3
6720
6758
6750
6735 ZONE AE
6700
REVISED AREA
6720
6689
Haegler Ranch Tributary 3
6705
6675
ZONE A
6690
6675
LIMIT OF DETAILED STUDY
LIMIT OF DETAILED STUDY
9
10
Haegler Ranch Tributary 4
ZONE X
ZONE A
CURTIS ROAD
16
15
APPROXIMATE SCALE IN FEET
2,000
0
2,000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS
PANEL 575 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY
NUMBER
PANEL
SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS
080059
0575
F
COLORADO SPRINGS, CITY OF
080060
0575
F
REVISED TO REFLECT LOMR DATED FEB 16 2005
MAP NUMBER
08041C0575 F
EFFECTIVE DATE:
March 17, 1997
Federal Emergency Management Agency
EL PASO COUNTY
UNINCORPORATED AREAS
080059

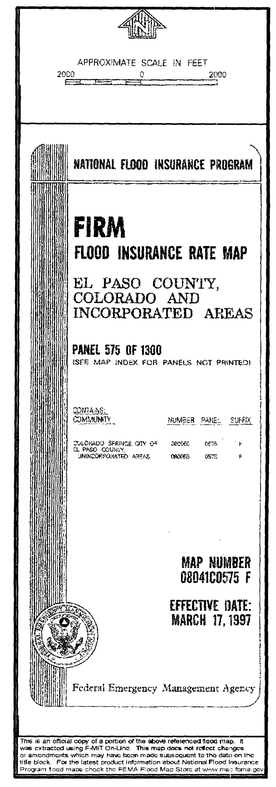


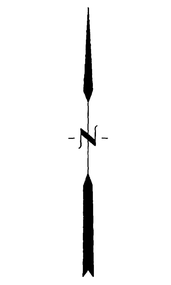

EFFECTIVE CONDITION

MAP PANEL NO. 0575F




REVISED EFFECTIVE CONDITION




| REVISION | | | | |
|---|---|---|---|---|
| NO. | DESCRIPTION | REV BY | CKD BY | DATE |

TRI-CORE ENGINEERING
5526 N. ACADEMY BLVD., SUITE 204
COLORADO SPRINGS, CO 80918
PHONE (719) 264-1560
FAX (719) 264-1193

SCALE (H): 1"=2000'
SCALE (V): N/A

DRAWN BY: DMM
DESIGNED BY: RLS
CHECKED BY: RLS

DATE: 05/21/04

SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO, COUNTY

REALTY DEVELOPMENT SERVICES
25 NORTH TEJON
SUITE 300

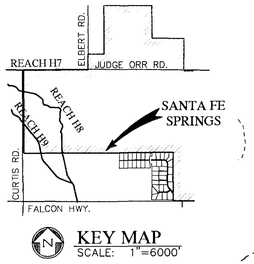
EXHIBIT 2

REVISED FLOOD INSURANCE RATE MAP

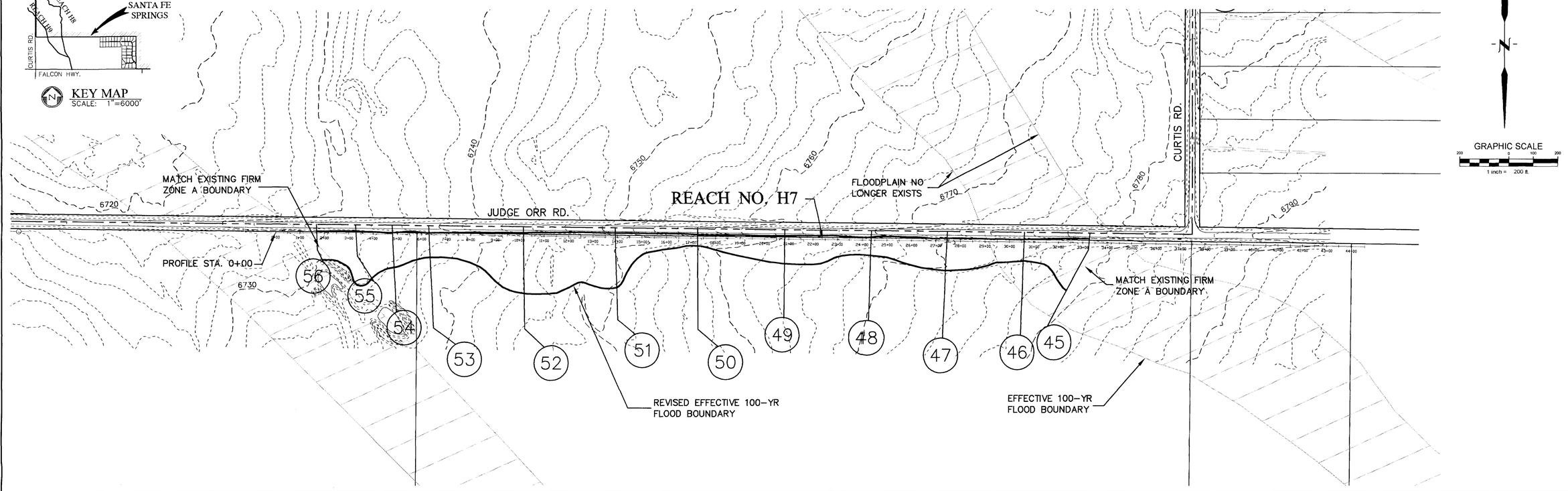
PROJECT NO.
6005-0001

FILENAME
RATE_MAP_LOMR.DWG

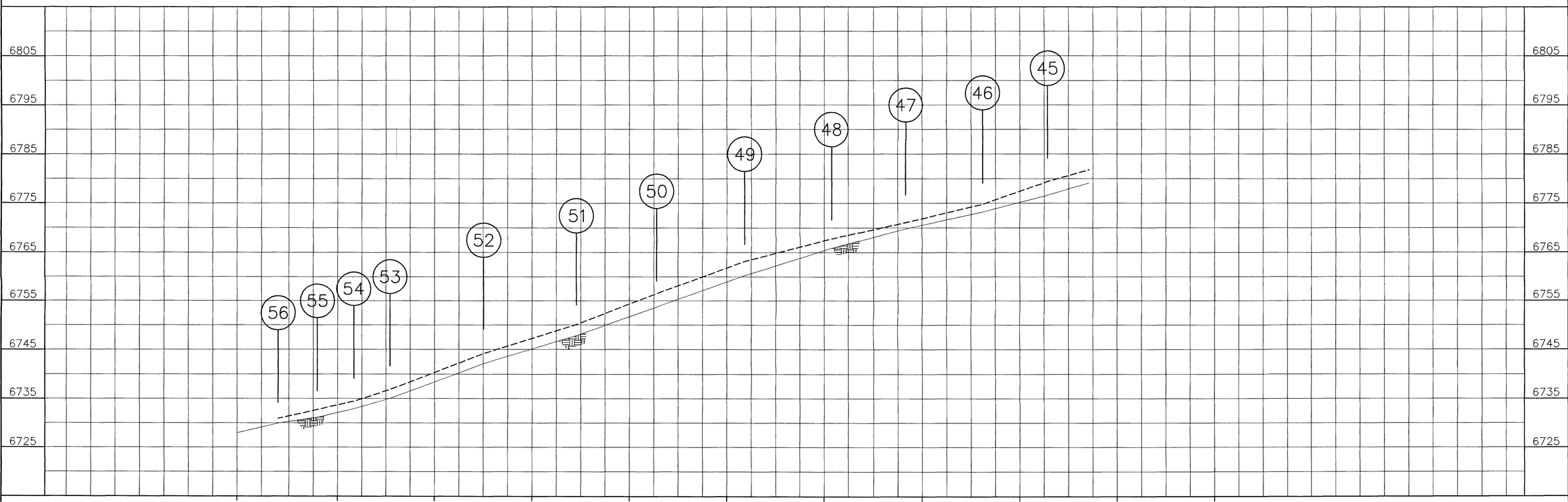
DRAWING NO.
EXH. 2




KEY MAP
SCALE: 1"=6000'




GRAPHIC SCALE
200 0 100 200
1 inch = 200 ft.




| NO. | DESCRIPTION | REV BY | CKD BY | DATE |
|---|---|---|---|---|
| | REVISION | | | |

TRI-CORE ENGINEERING
5526 N. ACADEMY BLVD., SUITE 204
COLORADO SPRINGS, CO 80918
PHONE (719) 264-1560
FAX (719) 264-1193

SCALE (H): 1"=200'
SCALE (V): 1"=10'
DRAWN BY: KMV
DESIGNED BY: RLS
CHECKED BY: RLS
DATE: 06/04/04

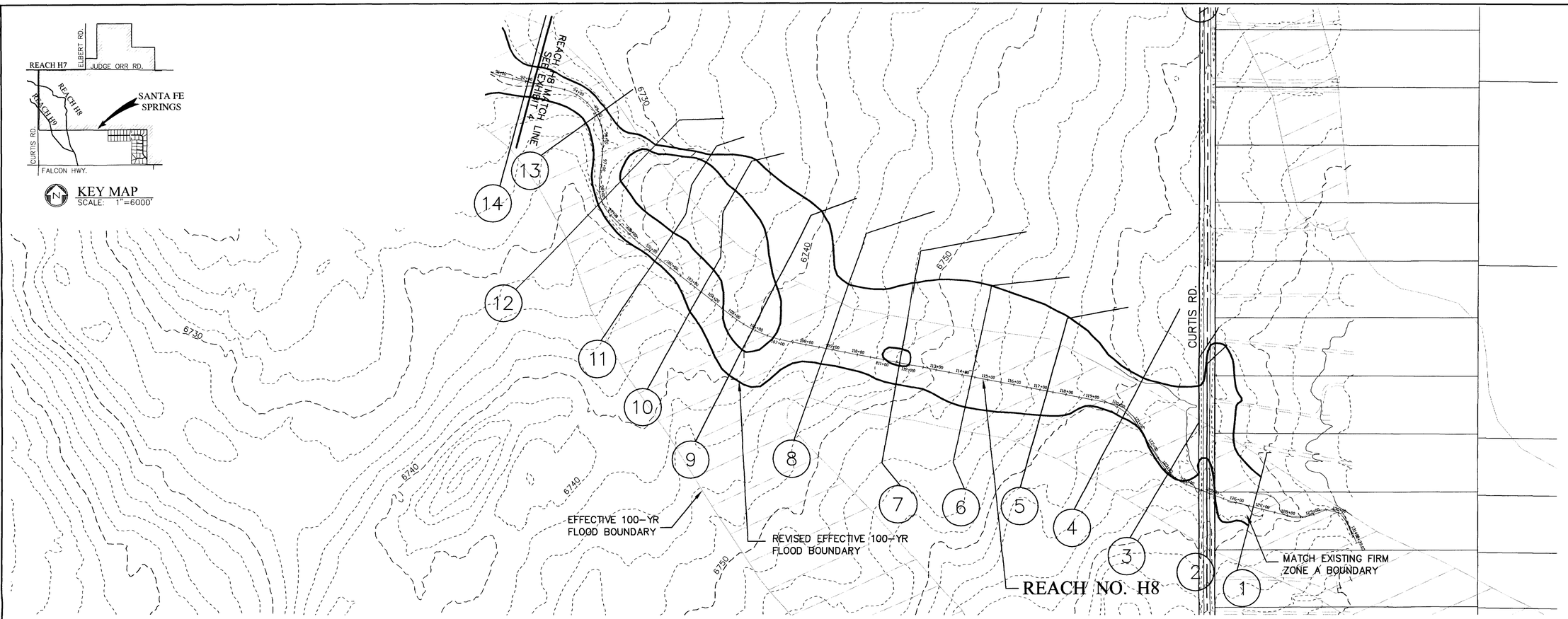
SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO COUNTY

REALTY DEVELOPMENT SERVICES
25 NORTH TEJON, SUITE 300
COLORADO SPRINGS, CO 80903

# EXHIBIT 3 100-YEAR FLOODPLAIN BOUNDARY & PROFILE WORKMAP

PROJECT NO.
6005.0001
FILENAME
PP-LOMR.DWG
DRAWING NO.
EXH. 3

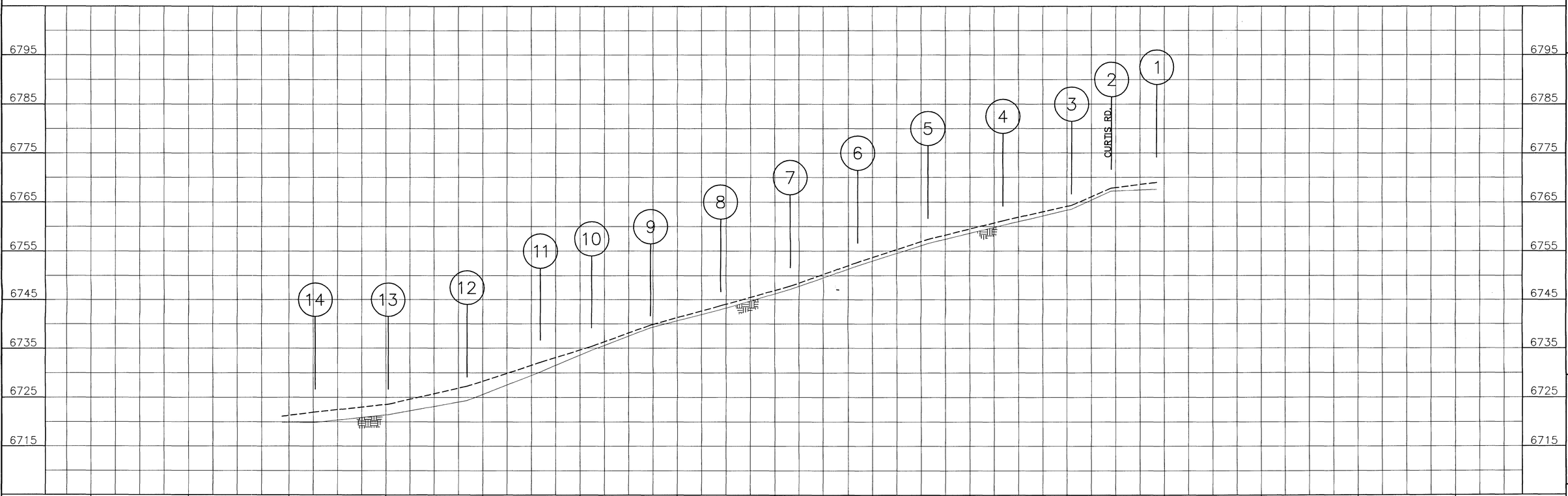
KEY MAP
SCALE: 1"=6000'




GRAPHIC SCALE
200 0 100 200
1 inch = 200 ft.

| REVISION | | | | |
|---|---|---|---|---|
| NO. | DESCRIPTION | REV BY | CKD BY | DATE |


TRI-CORE ENGINEERING
5526 N. ACADEMY BLVD., SUITE 204
COLORADO SPRINGS, CO 80918
PHONE (719) 264-1560
FAX (719) 264-1193


SCALE (H): 1"=200'
SCALE (V): 1"=10'
DRAWN BY: KMV
DESIGNED BY: RLS
CHECKED BY: RLS
DATE: 06/04/04

SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO COUNTY

REALTY DEVELOPMENT SERVICES
25 NORTH TEJON, SUITE 300
COLORADO SPRINGS, CO 80903

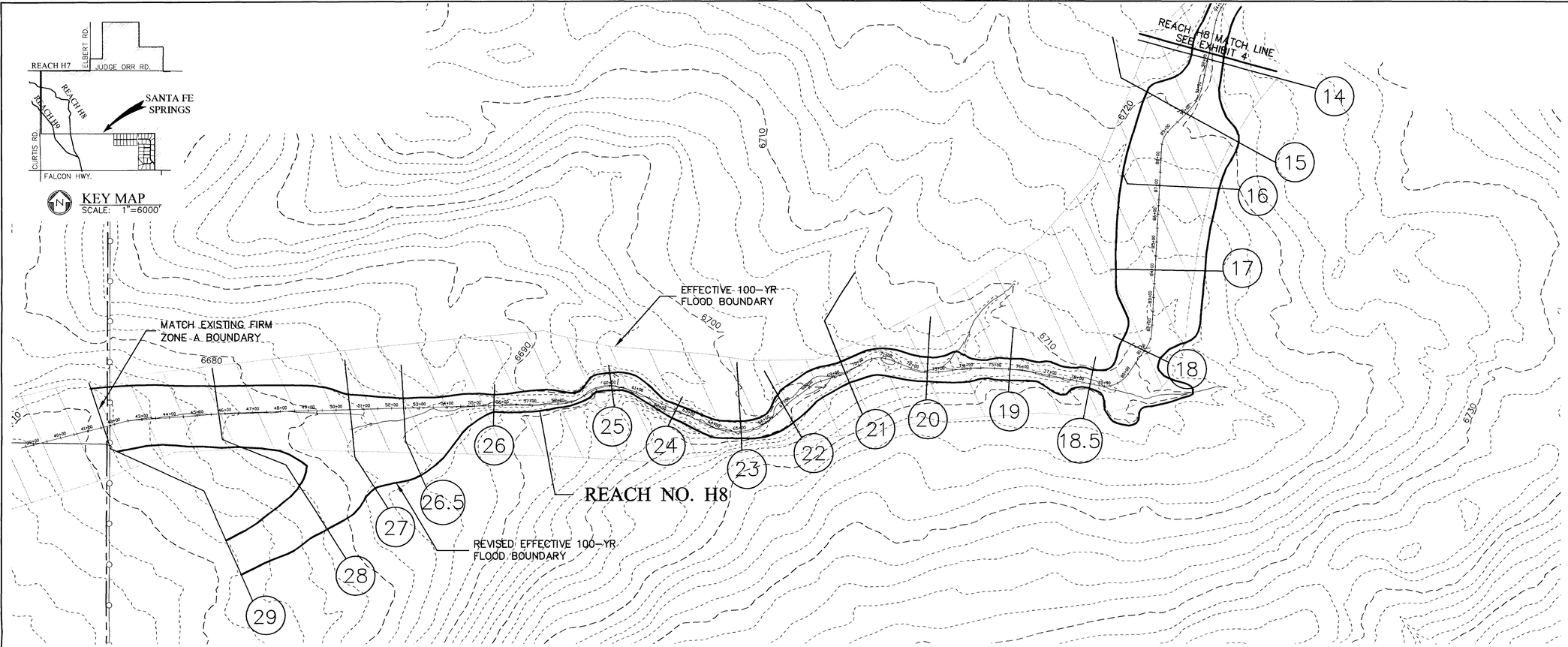
# EXHIBIT 4 100-YEAR FLOODPLAIN BOUNDARY & PROFILE WORKMAP

PROJECT NO.
6005.0001

FILENAME
PP-LOMR.DWG

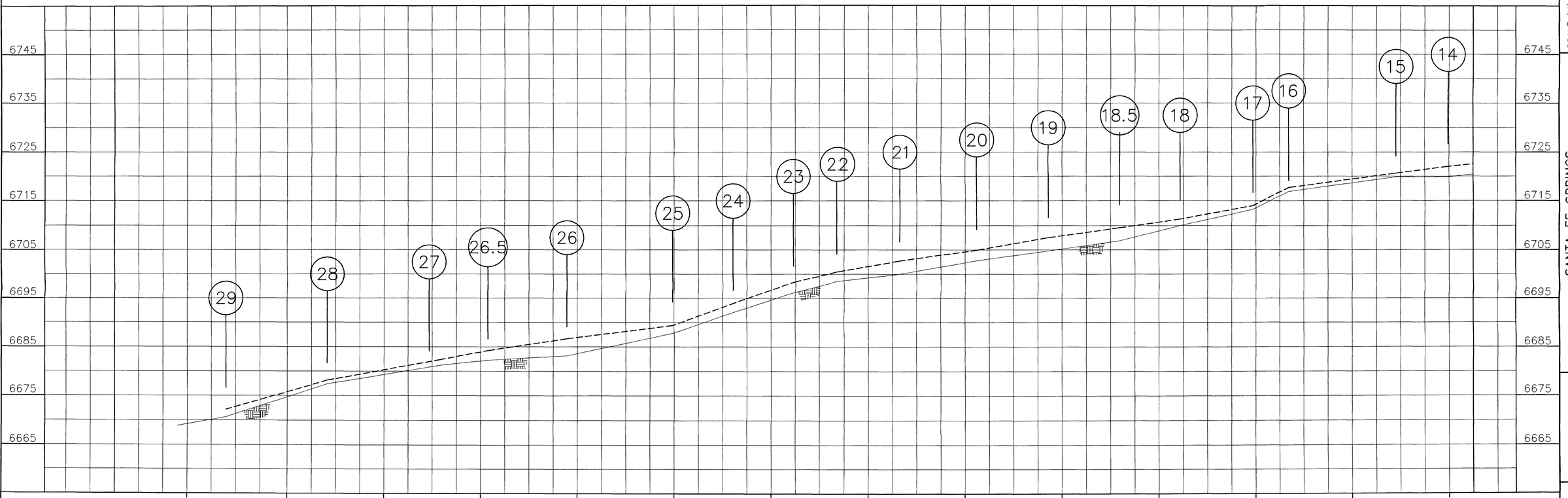
DRAWING NO.
EXH. 4

KEY MAP
SCALE: 1"=6000'




N

GRAPHIC SCALE
200 0 100 200
1 inch = 200 ft.




| NO. | DESCRIPTION | REVISION BY | CKD | DATE |
|---|---|---|---|---|

TRI-CORE ENGINEERING
5526 N. ACADEMY BLVD., SUITE 204
COLORADO SPRINGS, CO 80918
PHONE (719) 264-1560
FAX (719) 264-1193

SCALE (H): 1"=200'
SCALE (V): 1"=10'
DRAWN BY: KMV
DESIGNED BY: RLS
CHECKED BY: RLS
DATE: 06/04/04

SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO COUNTY

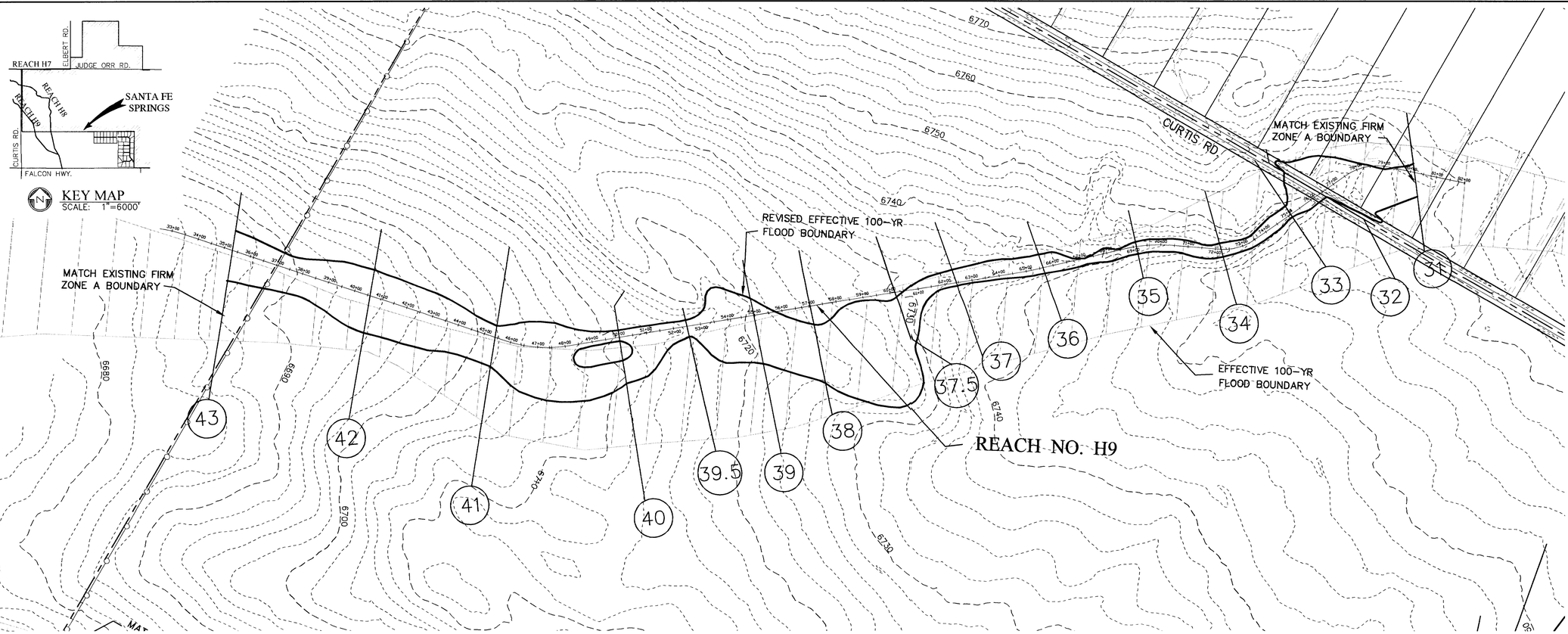
REALTY DEVELOPMENT SERVICES
25 NORTH TEJON, SUITE 300
COLORADO SPRINGS, CO 80903

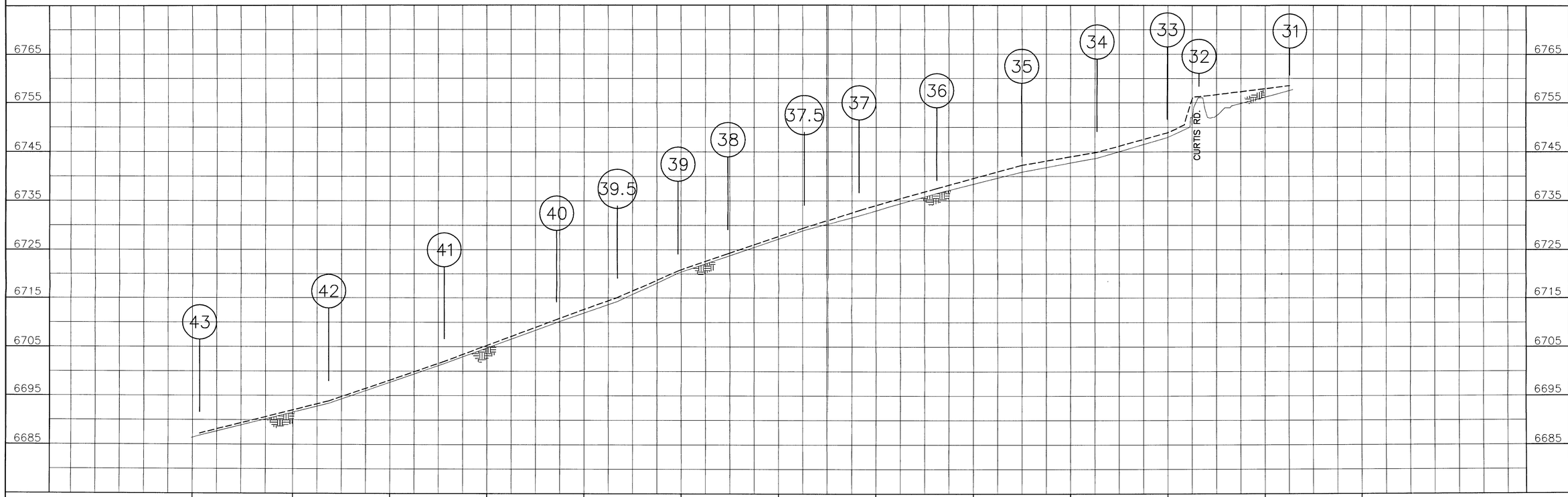
# EXHIBIT 5 100-YEAR FLOODPLAIN BOUNDARY & PROFILE WORKMAP

PROJECT NO.
6005.0001

PP-LOMR.DWG

DRAWING NO.
EXH. 5




| NO. | DESCRIPTION | REV BY | CKD BY | DATE |
|---|---|---|---|---|
| | REVISION | | | |


TRI-CORE ENGINEERING
5526 N. ACADEMY BLVD., SUITE 204
COLORADO SPRINGS, CO 80918
PHONE (719) 264-1560
FAX (719) 264-1193


SCALE (H): 1"=200'
SCALE (V): 1"=10'

DRAWN BY: KMV
DESIGNED BY: RLS
CHECKED BY: RLS

DATE: 06/04/04

SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO COUNTY

REALTY DEVELOPMENT SERVICES
25 NORTH TEJON, SUITE 300
COLORADO SPRINGS, CO 80903

# EXHIBIT 6 100-YEAR FLOODPLAIN BOUNDARY & PROFILE WORKMAP

PROJECT NO.
6005.0001

PP-LOMR.DWG

DRAWING NO.
EXH. 6

# GIECK RANCH
# DRAINAGE BASIN PLANNING STUDY
# El Paso County, Colorado

## Volume 1 – Final Report

**October 1, 2007**
**Revised: February 10, 2010**

PREPARED FOR:
975 Ford LP, LLP
118 North Tejon Street, Suite 213
Colorado Springs, CO 80903
(719) 491-4169
Contact: Neil McLeod

PREPARED BY:
**Drexel, Barrell & Co.**
3 S. 7th Street
Colorado Springs, CO 80905
(719) 260-0887
Contact: James A. Brzostowicz , P.E.
DBC Project Number: C-7706-2

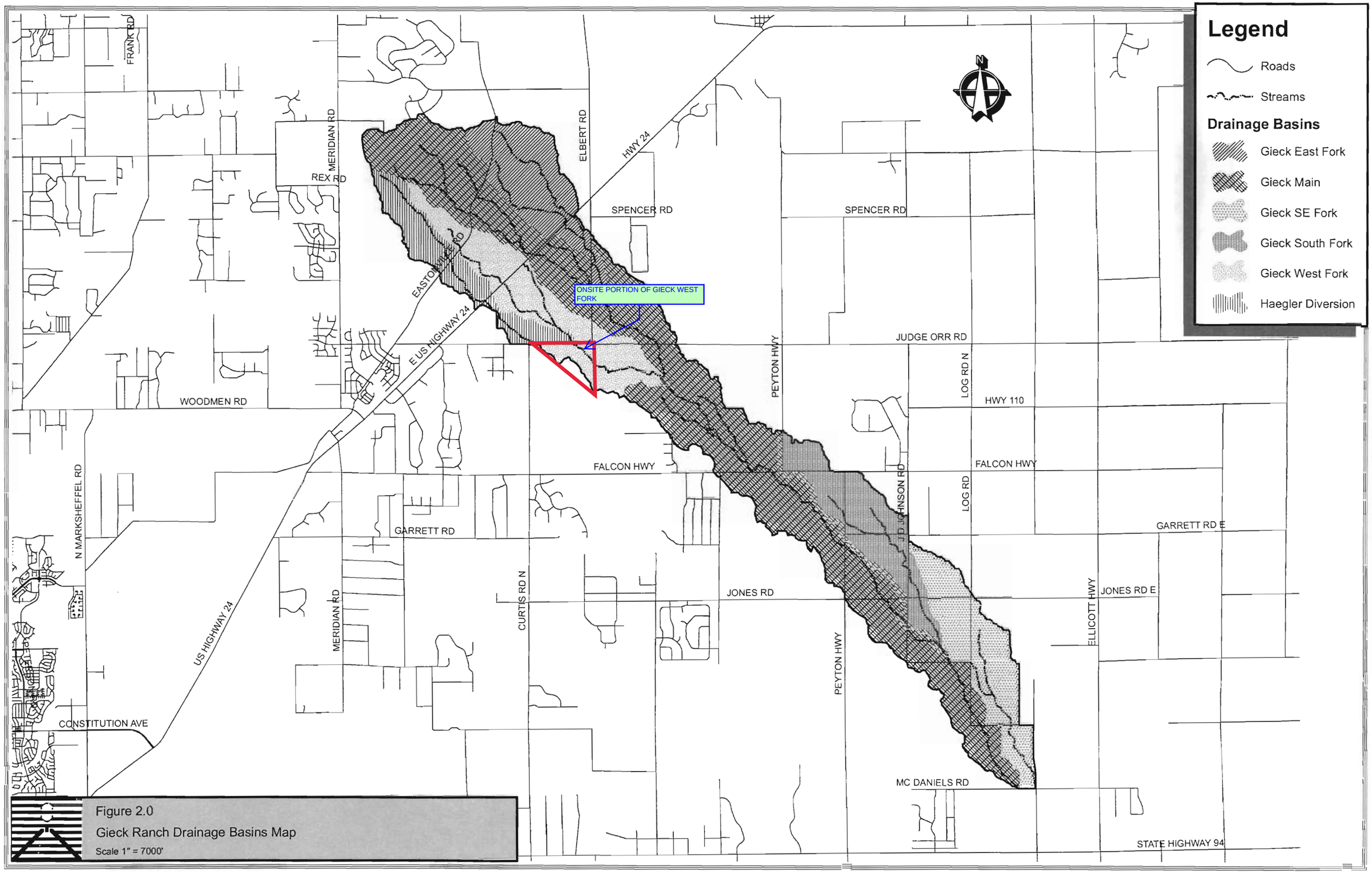



Figure 2.0
Gieck Ranch Drainage Basins Map
Scale 1" = 7000'

Table 6.4: Summary of Flows at Selected Design Points – 100-year Storm Event

| Design Point ID | Design Point Location | Hydrologic Element | Accumulative Area ($mi^2$) | Existing Peak Flow (cfs) | Future Peak Flow (cfs) | % Difference Peak Flow | Existing Volume (ac-ft) | Future Volume (ac-ft) | % Difference Volume |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Haegler Diversion at Eastonville Road | HD-J2 | 0.8 | 431 | 1060 | 146% | 77 | 96 | 25% |
| 2 | West Fork at Eastonville Road | WF-J1 | 0.3 | 146 | 389 | 166% | 29 | 39 | 33% |
| 3 | Main Channel at Eastonville Road | MS-J4 | 1.3 | 730 | 1233 | 69% | 112 | 135 | 20% |
| 4 | Haegler Diversion at Highway 24 | HD-J4 | 1.3 | 521 | 1223 | 135% | 97 | 121 | 24% |
| 5 | West Fork at Highway 24 | WF-J3 | 0.4 | 224 | 605 | 170% | 49 | 62 | 26% |
| 6 | Main Channel at Highway 24 | MS-J6 | 2.5 | 997 | 1896 | 90% | 194 | 225 | 16% |
| 7 | East Fork at Highway 24 | EF-J4 | 1.2 | 1054 | 1113 | 6% | 124 | 126 | 1% |
| 8 | Main Channel at Elbert Road | MS-J7 | 3.0 | 1010 | 1896 | 88% | 220 | 253 | 15% |
| 9 | East Fork at Elbert Road | EF-J6 | 2.1 | 1120 | 1172 | 5% | 183 | 187 | 2% |
| 10 | West Fork at Judge Orr Road | WF-J6 | 1.5 | 1017 | 2213 | 117% | 244 | 291 | 19% |
| 11 | Confluence of East Fork and Main Channel | MS-J9 | 5.7 | 1817 | 3068 | 69% | 429 | 467 | 9% |
| 12 | Main Channel at Judge Orr Road | MS-J11 | 6.7 | 1968 | 3383 | 72% | 487 | 564 | 16% |
| 13 | Confluence of West Fork and Main Channel | MS-J12 | 11.2 | 2732 | 6104 | 123% | 805 | 993 | 23% |
| 14 | Main Channel at Falcon Highway | MS-J16 | 13.4 | 3045 | 6784 | 123% | 936 | 1191 | 27% |
| 15 | Main Channel at Peyton Highway | MS-J19 | 15.1 | 3200 | 6946 | 117% | 1012 | 1269 | 25% |
| 16 | Main Channel at Jones Road | MS-J20 | 15.6 | 3250 | 7056 | 117% | 1040 | 1308 | 26% |
| 17 | South Fork at Jones Road | SF-J4 | 1.3 | 454 | 454 | 0% | 133 | 133 | 0% |
| 18 | Confluence of South Fork and Main Channel | MS-J22 | 17.9 | 3650 | 7392 | 103% | 1210 | 1489 | 23% |
| 19 | Southeast Fork at McDaniels Road | SE-J3 | 2.4 | 547 | 546 | 0% | 210 | 210 | 0% |
| 20 | Main Channel at McDaniels Road | MS-J29 | 19.6 | 3791 | 7525 | 99% | 1293 | 1597 | 23% |
| 21 | Total Combined Outfall | SE-J3 plus MS-J29 | 22.0 | 4326 | 7687 | 78% | 1503 | 1807 | 20% |

CONTRIBUTING ACREAGE TO WF-R7A @ JUDGE ORR ROAD CROSSING

The 100-year storm event future undetained peak flow is estimated to increase by 78% over the existing peak flow while the future volume of runoff is estimated to increase by 20%.

During the hydrologic analysis it was observed that the Black Squirrel Creek lies very close to the eastern boundary of the Gieck Ranch Basin from Falcon Highway downstream to Log Road. It is possible that flow from Black Squirrel Creek could spill into the Gieck Ranch Basin during extreme storm events. The flows in Black Squirrel Creek in this area are expected to be more than 5,000 cfs for the 100-year event. If the Black Squirrel Creek were to overflow its' banks and flow into the Gieck Ranch Basin it could increase the flows shown in the above tables. Possible improvements to address this potential problem include channel improvements to increase the Black Squirrel Creek conveyance in this area or constructing berms on the east bank to prevent overflow.

Table 8.0: Structure Inventory and Evaluation Summary (Cont.)

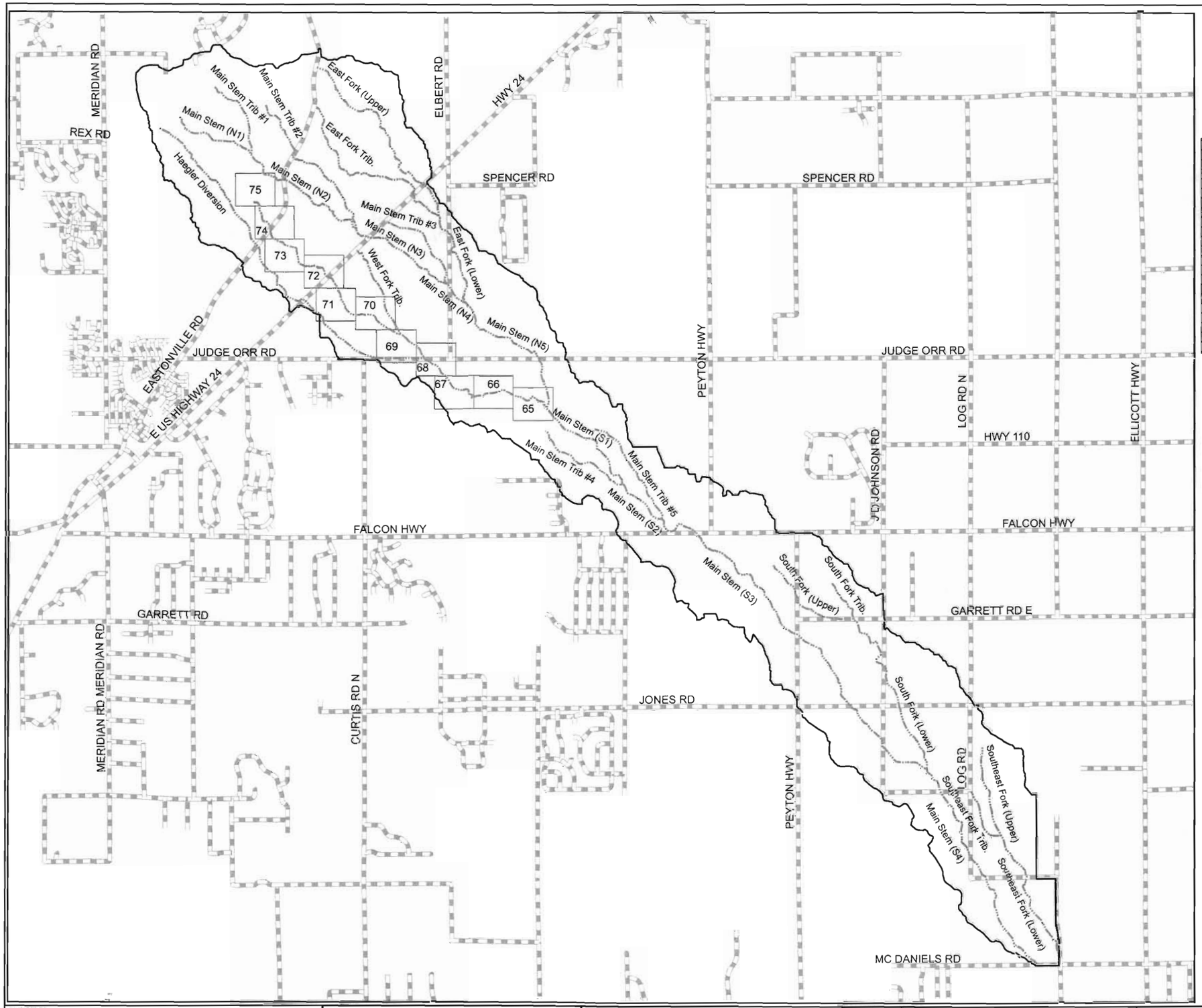
| | | | | | | |
|---|---|---|---|---|---|---|
| 35 | Elbert Road south of structure 34 | 24" CMP | Good | 100% | Y | --- |
| 36 | Elbert Road at Main Channel | 2 - 48" CMP | Good | 19% | N | 3 - 12' x 4' CBC |
| 37 | Elbert Road south of structure 36 | 24" CMP | Poor | 55% | Y | --- |
| 38 | Judge Orr Road at West Fork | 67" x 95" CMP | Good | 20% | N | 4 - 12' x 5' CBC |
| 39 | Judge Orr Road east of structure 38 | 36" CMP | Good | 100% | Y | --- |
| 40 | Judge Orr Road west of structure 41 | 24" CMP | Poor | 90% | Y | --- |
| 41 | Judge Orr Road at Main Channel | Bridge | Good | 100% | Y | --- |
| 42 | Falcon Hwy at Main Channel | Bridge | Good | 57% | N | 85' Span |
| 43 | Peyton Road at headwaters of South Fork | 24" CMP | Fair | 75% | Y | --- |
| 44 | Peyton Road at Main Channel | 4 - 24" RCP | Good | 2% | N | 5 - 12' x 7' CBC |
| 45 | Peyton Road south of structure 44 | 36" CMP | Poor | 100% | Y | --- |
| 46 | Peyton Road south of structure 45 | 24" CMP | Good | 100% | Y | --- |
| 47 | East Garrett Road west of structure 48 | 24" CMP | Poor | 100% | Y | --- |
| 48 | East Garrett Road at South Fork | 48" CMP | Good | 14% | N | 2 - 5' x 4' CBC |
| 49 | J.D. Johnson Road at South Fork | 4 - 42" RCP | Good | 63% | N | 2 - 12' x 4' CBC |
| 50 | J.D. Johnson Road south of structure 49 | 30" CMP | Fair | 56% | N | 36" CMP |
| 51 | J.D. Johnson Road south of structure 50 | 30" CMP | Fair | 100% | Y | --- |
| 52 | Jones Road at Main Channel | 60" CMP | Fair | 4% | N | 6 - 12' x 7' CBC |
| 53 | J.D. Johnson Road at Jones Road | 30" CMP | Fair | 55% | Y | --- |
| 54 | Jones Road east of J.D. Johnson Road | 30" CMP | Good | 73% | Y | --- |
| 55 | Jones Road at South Fork | 36" CMP | Good | 6% | N | 2 - 7' x 5' CBC |
| 56 | Jones Road east of structure 55 | 30" CMP | Fair | 67% | Y | --- |
| 57 | J.D. Johnson Road at Main Channel US of structure 58 | 3 - 60" RCP | Good | 14% | N | 85' Span |
| 58 | J.D. Johnson Road at Main Channel | 30" CMP | Good | 1% | N | 120' Span |
| 59 | J.D. Johnson Road and Log Road | 24" CMP | Fair | 23% | N | 2 - 6' x 3' CBC |
| 60 | Main Channel at private driveway | 48" CMP (est.) | Unknown | 2% | N.E. | --- |
| 61 | Log Road at Main Channel | Bridge | Good | 36% | N | 120' Span |
| 62 | McDaniel Road at Main Channel | 30" x 48" Oval CMP | Good | 1% | N | 120' Span |
| 63 | Log Road and McDaniels Road | 24" CMP | Good | 2% | N | 5 - 6' x 3' CBC |

* Road over-topping not included

** Allowable road over-topping included in adequacy analysis

*** Based on proposed (with selected drainage basin plan) flows

N.E. Not Evaluated, not EPCDOT responsibility




PREPARED BY:
Drexel, Barrell & Co. Engineers · Surveyors
1800 38TH STREET
3 S 7TH STREET
6513 W 4TH STREET
CONTACT: ROBERT BENNETT
BOULDER, COLORADO 80301 (303) 442-4338
COLORADO SPRINGS, COLORADO 80905 (719) 260-0887
GREELEY, COLORADO 80634 (970) 351-0645

PREPARED FOR:
REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

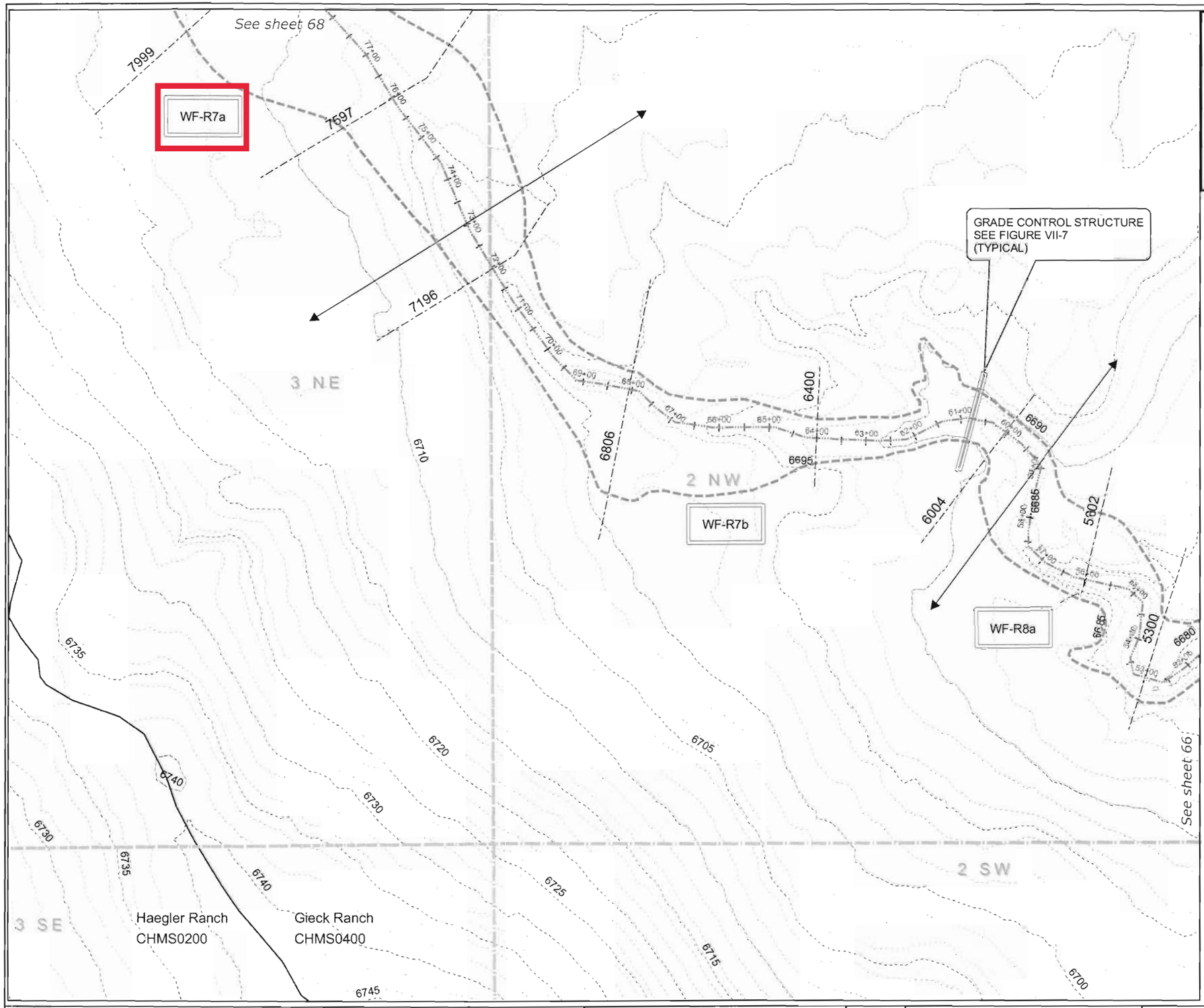
PROJECT INFO:
GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF
CHECKED BY: RJB

| REVISION DESCRIPTIONS | DATE |
|---|---|
| | |

DRAWING INFO:
GIECK RANCH
KEY MAP
WEST FORK

DATE: AUGUST 2007
JOB NO: C7706-1
SET: PL
SCALE: H: 1" = 6000' V:
DRAWING NO.: 6D 038
SHEET: K8




## Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

## Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

N

0 100 200 Feet

| Reach | Slope (%) | $Q_{100}$ (cfs) | $V_{100}$ (ft/s) |
|---|---|---|---|
| WF-R7a | 1.18 | 753 | 2.19 |
| WF-R7b | 1.14 | 753 | 4.21 |
| WF-R8a | 1.36 | 753 | 4.05 |

RECOMMENDED PLAN IMPROVEMENTS

| Reach | |
|---|---|
| WF-R7a | Vegetation Augmentation |
| WF-R7b | Vegetation Augmentation |
| WF-R8a | Selective Stabilization |

Note:
See Technical Addenda for grade control data.

THIS DRAWING IS CONCEPTUAL IN NATURE AND IS NOT TO BE USED AS THE SOLE BASIS FOR FINAL DESIGN, CONSTRUCTION, OR REMEDIAL ACTION. FURTHER STUDIES UNDER EPC DOT'S DIRECTION SHOULD BE PERFORMED PRIOR TO SUCH DECISIONS.

PREPARED BY: Drexel, Barrell & Co. Engineers · Surveyors
1800 38TH STREET, BOULDER, COLORADO 80301 (303) 442-4338
3 S 7TH STREET, COLORADO SPRINGS, COLORADO 80905 (719) 260-0887
6513 W 4TH STREET, GREELEY, COLORADO 80634 (970) 351-0645
CONTACT: ROBERT BENNETT, P.E., CFM

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF/MLM
CHECKED BY: RJB/TML

| REVISION DESCRIPTIONS | DATE |
|---|---|
| PER EPCDOT COMMENTS | FEBRUARY 2008 |
| PER EPC FINAL REVIEW | JANUARY 2010 |

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
WEST FORK #3

DATE: AUGUST 2007
SCALE: H: 1" = 200' V: NONE
JOB NO: C7706-2
DRAWING NO.: 6D 038
SET PL
SHEET 67

GRADE CONTROL STRUCTURE
SEE FIGURE VII-7
(TYPICAL)

START PROPOSED CHANNEL.
BOTTOM WIDTH = 50'
SIDE SLOPES = 10 : 1

WF-R6

POND: WF-SR1
Q100 IN = 951 CFS
Q100 OUT = 753 CFS
DETENTION STORAGE = 29 AC-FT.

34 SE

35 SW

3 NE

2 NW

ELBERT RD

JUDGE ORR RD

SEE HAEGLAR DIVERSION PLAN VIEW
SHEETS FOR CHANNEL AND DROP
STRUCTURE DETAILS

WF-R7a

STRUCTURE #39
EXISTING: 36" CMP
NOTE: EXISTING STRUCTURE TO REMAIN

END PROPOSED CHANNEL.
TIE INTO EXISTING CHANNEL.

STRUCTURE #38
EXISTING: 67" X 95" CMP
PROPOSED: 4 - 12' X 5' CBC
(CONSIDER 3-SIDED CBC PER CDOW COMMENTS)
NOTE: STREAM INVERT LOWERED TO
ACCOMMODATE LARGER STRUCTURE.

See sheet 69

See sheet 67

## Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

## Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

N

0 100 200 Feet

| Reach | Slope (%) | $Q_{100}$ (cfs) | $V_{100}$ (ft/s) |
|---|---|---|---|
| WF-R6 | 1.04 | 698 | 3.45 |
| WF-R7a | 1.18 | 753 | 2.19 |

RECOMMENDED PLAN IMPROVEMENTS

| Reach | |
|---|---|
| WF-R6 | Selective Stabilization |
| WF-R7a | Vegetation Augmentation |

THIS DRAWING IS CONCEPTUAL IN NATURE AND IS NOT TO BE USED AS THE SOLE BASIS FOR FINAL DESIGN, CONSTRUCTION, OR REMEDIAL ACTION. FURTHER STUDIES UNDER EPC DOT'S DIRECTION SHOULD BE PERFORMED PRIOR TO SUCH DECISIONS.

PREPARED BY: Drexel, Barrell & Co. Engineers · Surveyors
1800 38TH STREET, BOULDER, COLORADO 80301 (303) 442-4338
3 S 7TH STREET, COLORADO SPRINGS, COLORADO 80905 (719) 260-0887
501 3 W 4TH STREET, GREELEY, COLORADO 80634 (970) 351-0645
CONTACT: ROBERT BENNETT, P.E., CFM

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

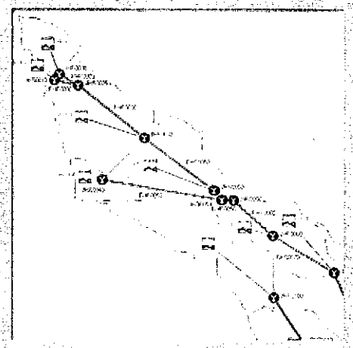
PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF/MLM
CHECKED BY: RJB/TML

| REVISION DESCRIPTIONS | DATE |
|---|---|
| PER EPCDOT COMMENTS | FEBRUARY 2008 |
| PER EPC FINAL REVIEW | JANUARY 2010 |

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
WEST FORK #4

DATE: AUGUST 2007
JOB NO: C7706-2
SET: PL
SCALE: H: 1" = 200' V: NONE
DRAWING NO.: 6D 038
SHEET: 68

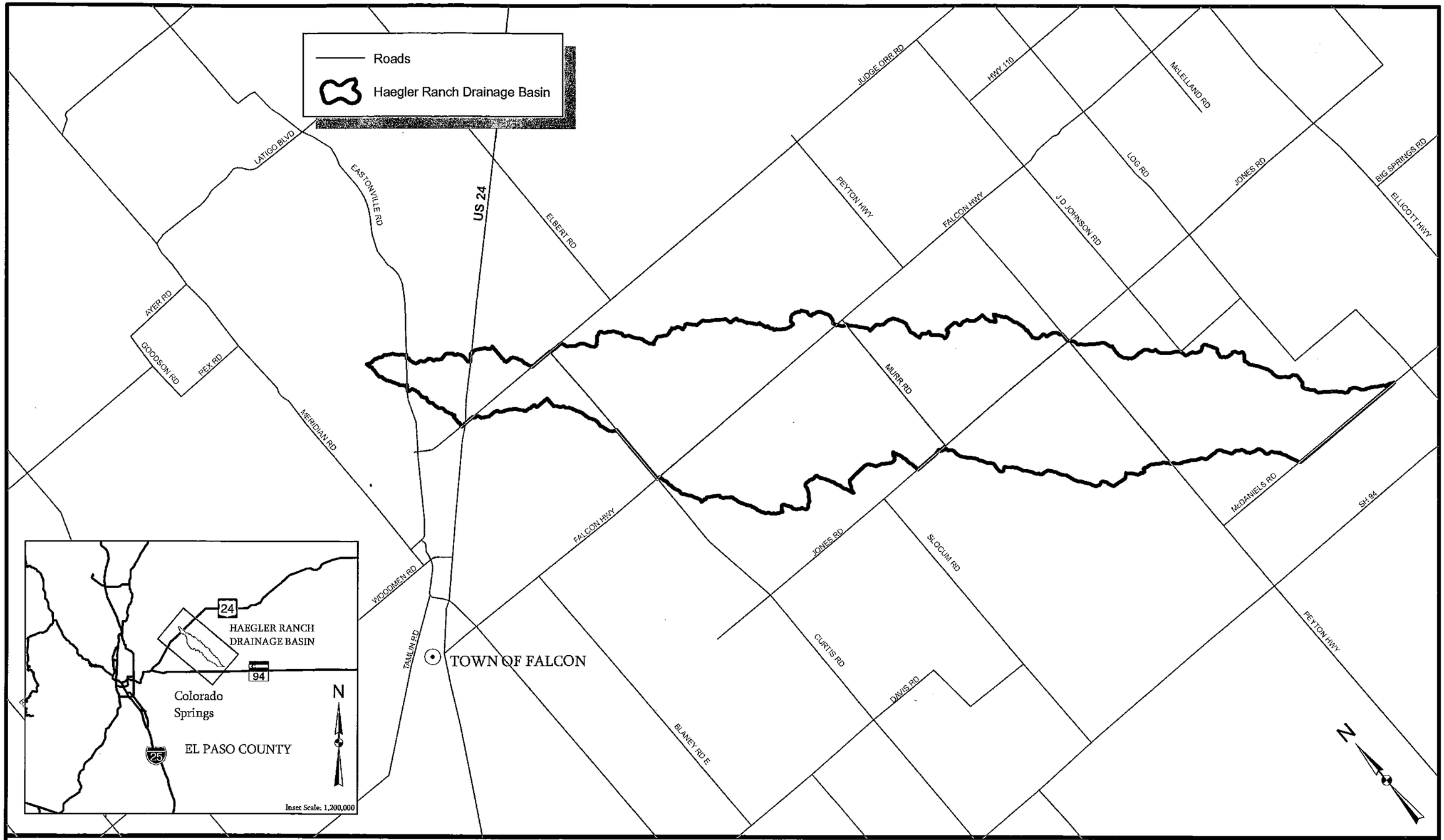


# Fountain Creek Basin

## Drainage Basin Planning Study

May 2009

URS




**URS**
9960 Federal Dr.
Suite 300
Colorado Springs, CO 80921
719.531.0001

6,000 3,000 0 6,000 Feet

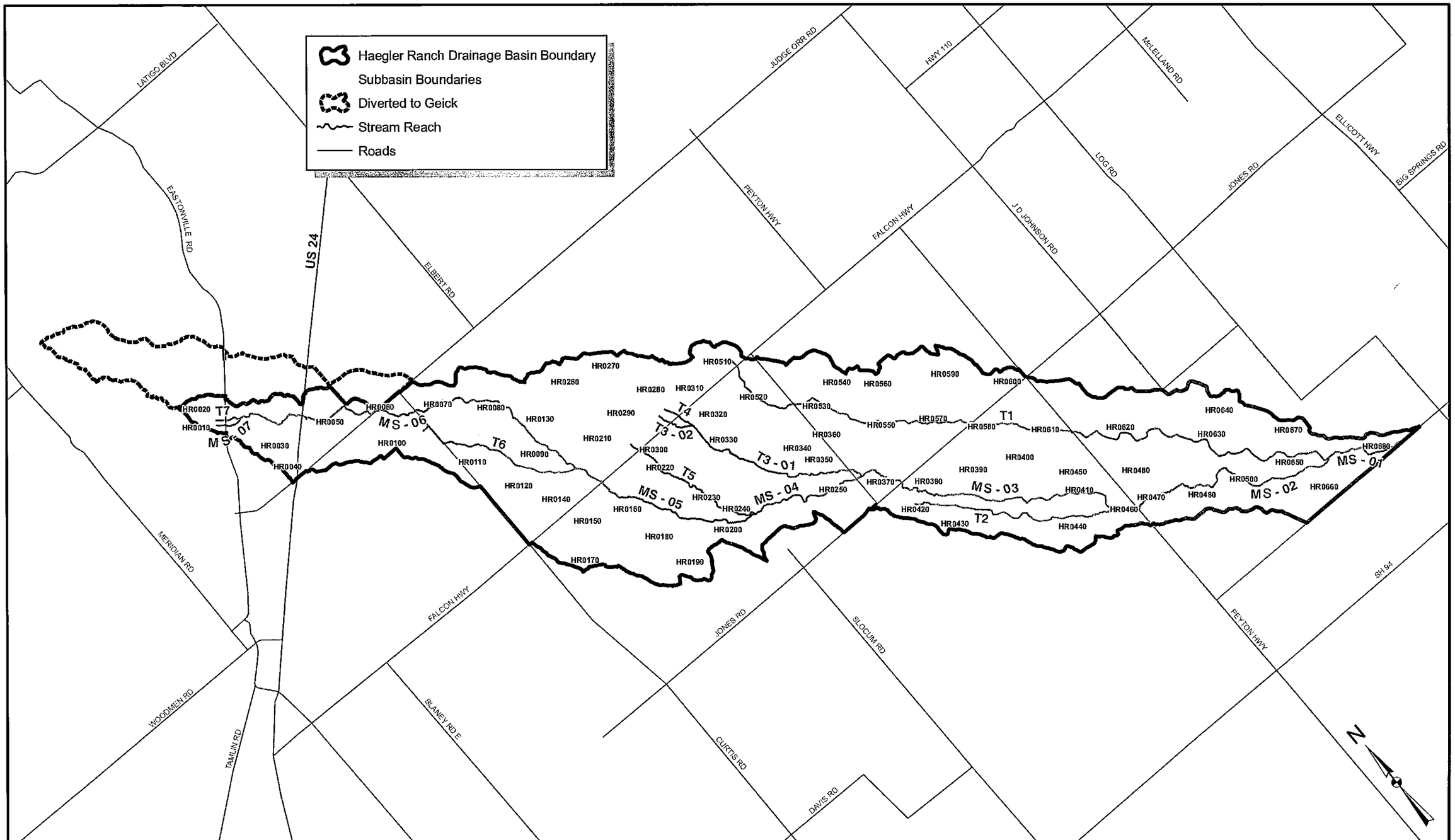
1" = 6,000'

**DATE: 05/08**

**HAEGLER RANCH DRAINAGE BASIN**

**VICINITY MAP**
**FIGURE 1-1**

**URS NO. 21711039**




**URS**
9960 Federal Dr.
Suite 300
Colorado Springs, CO 80921
719.531.0001

5,000 2,500 0 5,000 Feet

1" = 5,000'

**DATE: 09/08**

# HAEGLER RANCH DRAINAGE BASIN

## SUBBASIN DELINEATION

## FIGURE 4-1

**URS NO. 21711039**

**Table 5-3 Existing Hydraulic Deficiencies**

| 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 |

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.

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

| Key Location | Reach and Station | HEC-RAS Result | Recurrence Intervals | | | |
|---|---|---|---|---|---|---|
| | | | 2-yr | 5-yr | 10-yr | 100-yr |
| Main stem at US 24 | MS-06 72276 | Channel velocity (ft/sec) | 1.1 | 1.63 | 1.98 | 2.92 |
| | | Water surface depth in channel (ft) | 1.36 | 2.44 | 3.24 | 6.49 |
| | | Top width (ft) | 18.23 | 24.85 | 29.7 | 255.62 |
| Main stem at Judge Orr Road | MS-06 67666 | Channel velocity (ft/sec) | 3.33 | 4.09 | 1.76 | 3.48 |
| | | Water surface depth in channel (ft) | 0.52 | 1.04 | 1.05 | 1.35 |
| | | Top width (ft) | 174.53 | 534.34 | 535.52 | 569.34 |
| Main stem at Falcon Highway | MS-05 52353 | Channel velocity (ft/sec) | 1.05 | 1.6 | 2.04 | 3.59 |
| | | Water surface depth in channel (ft) | 1.79 | 3.69 | 4.96 | 5.74 |
| | | Top width (ft) | 31.42 | 83.76 | 556.41 | 592.33 |
| Main stem at Jones Road | MS-03 33189 | Channel velocity (ft/sec) | 2.45 | 3.7 | 1.27 | 2.51 |
| | | Water surface depth in channel (ft) | 3.2 | 5.83 | 9.25 | 10.46 |
| | | Top width (ft) | 47.98 | 105.51 | 580.28 | 667.17 |
| Main stem at Peyton Highway | MS-02 18474 | Channel velocity (ft/sec) | 0.16 | 0.4 | 0.59 | 1.43 |
| | | Water surface depth in channel (ft) | 4.14 | 4.35 | 4.51 | 5.15 |
| | | Top width (ft) | 813.21 | 871.68 | 882.22 | 925.27 |
| Southeast Tributary at Jones Road | T1 22297 | Channel velocity (ft/sec) | 0.62 | 1.02 | 1.47 | 3.2 |
| | | Water surface depth in channel (ft) | 2.45 | 3.52 | 3.59 | 3.82 |
| | | Top width (ft) | 197.35 | 345.68 | 351.74 | 372.17 |
| Southeast Tributary at Peyton Highway | T1 16611 | Channel velocity (ft/sec) | 1.67 | 2.25 | 2.65 | 4.05 |
| | | Water surface depth in channel (ft) | 0.08 | 0.17 | 0.24 | 0.51 |
| | | Top width (ft) | 239.82 | 241.36 | 242.51 | 247.41 |
| Southeast Tributary at Confluence with Main stem | T1 410 | Channel velocity (ft/sec) | 3.44 | 0.11 | 0.18 | 0.67 |
| | | Water surface depth in channel (ft) | 1.69 | 2.01 | 2.01 | 2.01 |
| | | Top width (ft) | 31.89 | 1169.3 | 1169.3 | 1169.3 |
| At Confluence with Geick Basin | MS-01 82 | Channel velocity (ft/sec) | 2.68 | 3.85 | 19.89 | 17.33 |
| | | Water surface depth in channel (ft) | 1.45 | 2.17 | 1.11 | 2.36 |
| | | Top width (ft) | 75.88 | 255.32 | 60.67 | 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,

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

| Q (cfs) | Grass | | |
|---|---|---|---|
| | Sideslope (h:v) | Bottom (ft) | Depth (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 |

### 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.

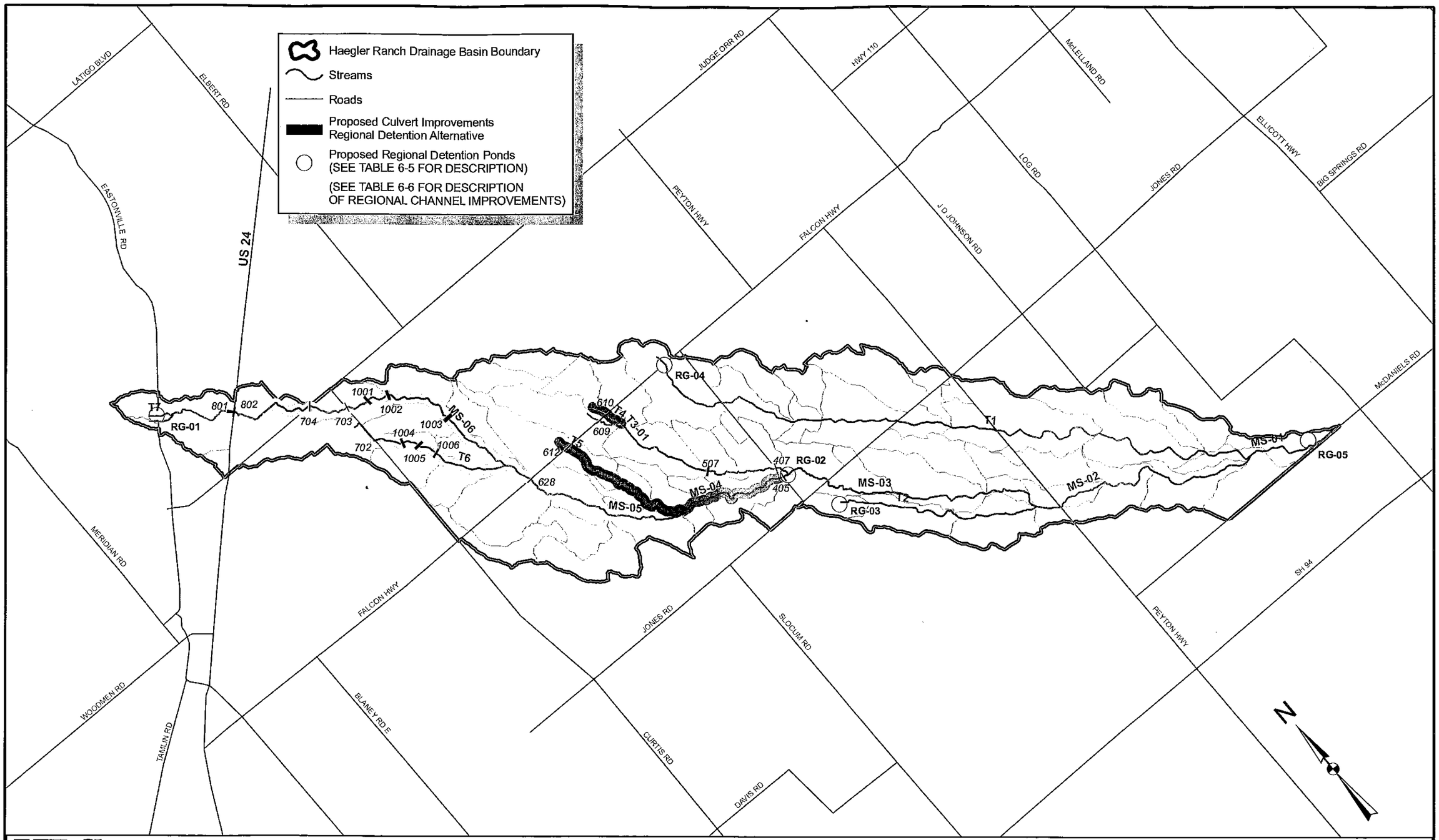
**Table 6-3 Existing Conditions Culvert Design**

| 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 |
| 405 | Murr Road | Main Stem (MS-04) | 66" RCP | 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 Highway | Tributary 3 (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 | Main Stem (MS-07) | 27"X21" CMP | 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




URS
9960 Federal Dr.
Suite 300
Colorado Springs, CO 80921
719.531.0001

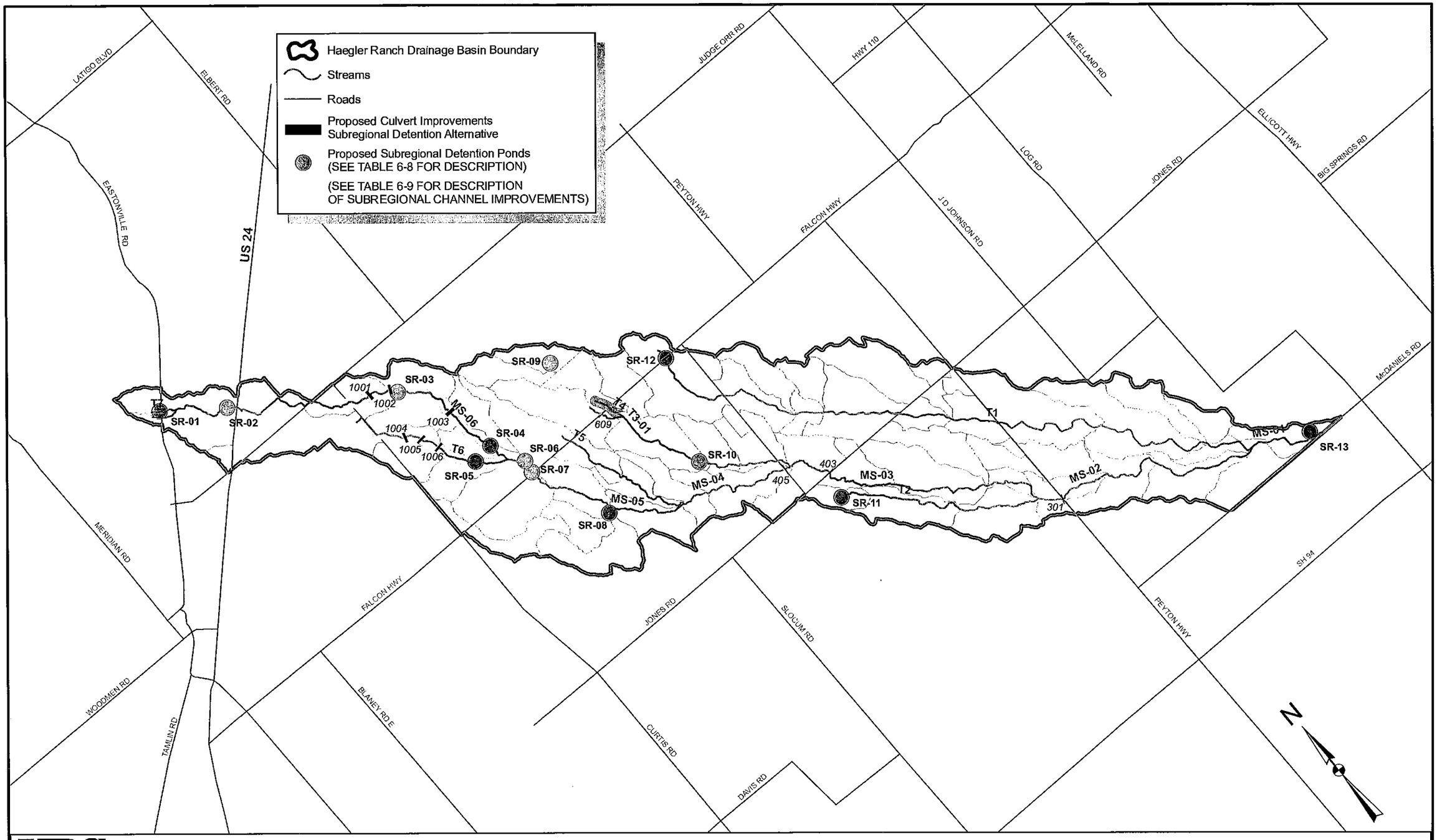
5,000 2,500 0 5,000 Feet

1" = 5,000'

DATE: 05/08

**HAEGLER RANCH DRAINAGE BASIN**
**REGIONAL DETENTION**
**ALTERNATIVES**
**FIGURE 6-1**

URS NO. 21711039




URS
9960 Federal Dr.
Suite 300
Colorado Springs, CO 80921
719.531.0001

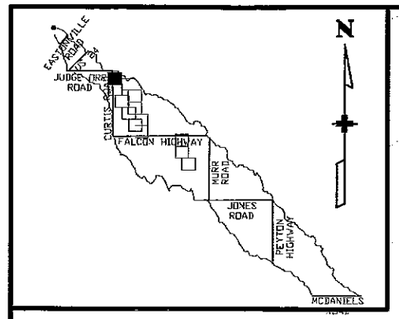
5,000 2,500 0 5,000 Feet

1" = 5,000'

DATE: 05/08

**HAEGLER RANCH DRAINAGE BASIN**
**SUBREGIONAL DETENTION ALTERNATIVES**
**FIGURE 6-2**

URS NO. 21711039




HR0060

HR0070

HR0100

HR0070

CURTIS ROAD

BEGIN PROPOSED IMPROVEMENTS

0+00 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00 15+00

MAIN STEM MS-06 (SEE PROFILE MS-06)

6780 6770 6760 6750

MATCHLINE MS-06 PG 2

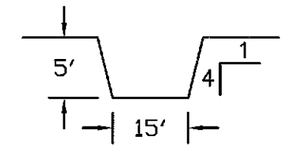
LEGEND

| | |
|---|---|
| 6630 | CONTOURS – MAJOR ELEVATION |
| | CONTOURS – MINOR ELEVATION |
| | WATERSHED BOUNDARY |
| | BASIN BOUNDARY |
| | ROADS |
| 20+00 | RIVER AND ALIGNMENT |

1"=200'

200 0 200 400

CHANNEL: MAIN STEM (MS-06)
BASIN: HR0070




STA: 0+00 TO STA: 31+34

Q: 600 CFS

**Computer File Information**

Full Path: P:\21711039\CAD\PLANSHTS
Drawing File Name: CHANNEL.DWG
Acad. Ver. 2006 Scale: 1"=200' Units: Feet

**Index of Revisions**

| | | | |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |

URS
9960 Federal Drive, Suite 300
Colorado Springs, CO. 80921
(719) 531-0001
Fax (719) 531-0007

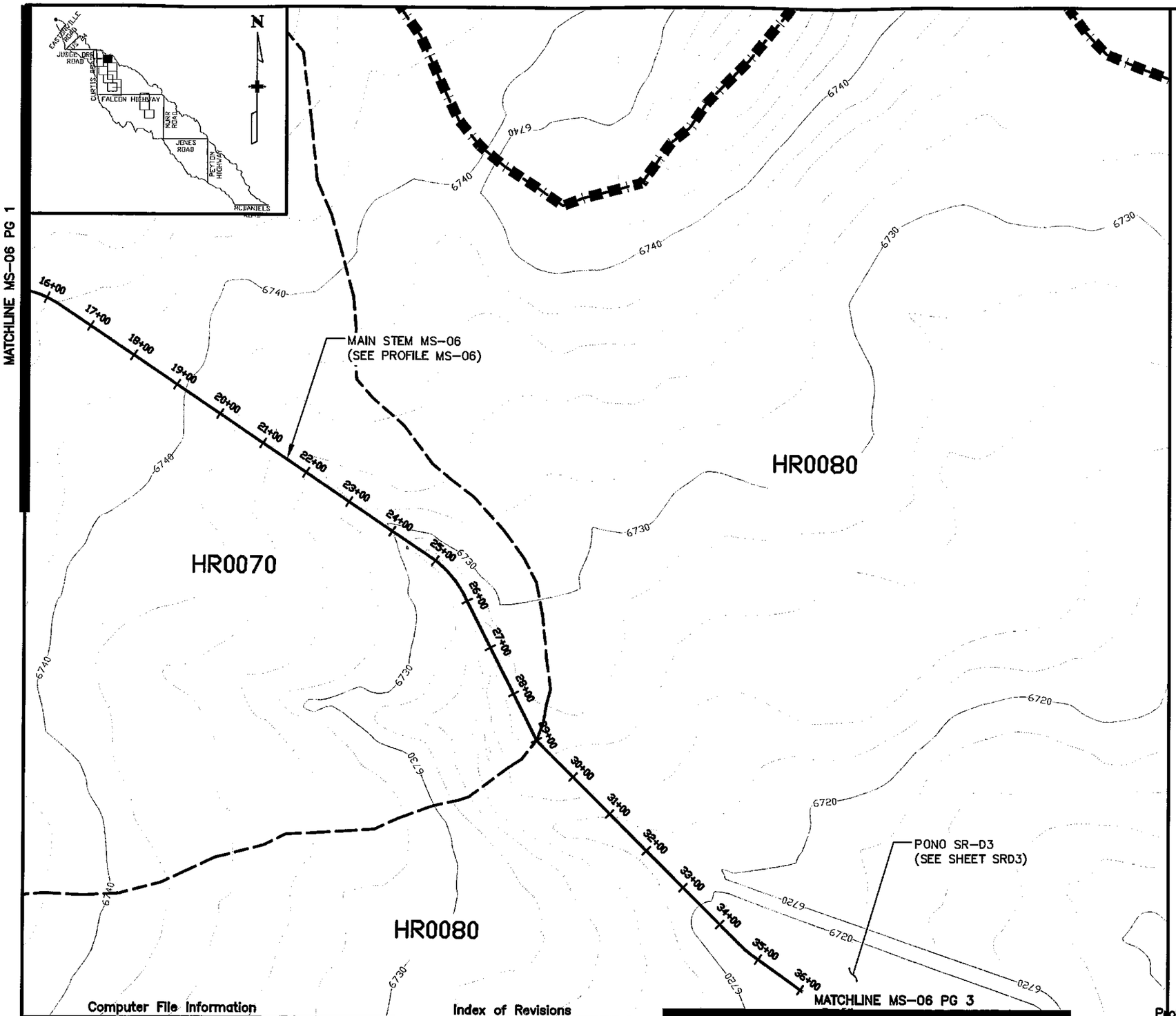
Designed by: KAP
Detailed by: DRM
Checked by: JAJ

Structure Numbers

**Profiles**

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 1



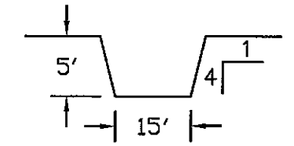

LEGEND

- CONTOURS – MAJOR ELEVATION
- CONTOURS – MINOR ELEVATION
- WATERSHED BOUNDARY
- BASIN BOUNDARY
- ROADS
- 20+00 RIVER AND ALIGNMENT

1"=200'

200 0 200 400

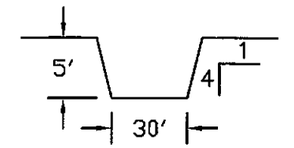
CHANNEL: MAIN STEM (MS–06)
BASIN: HR0070




STA: 0+00 TO STA: 31+34

Q: 600 CFS

CHANNEL: MAIN STEM (MS–06)
BASIN: HR0080




STA: 31+34 TO STA: 74+61

Q: 1000 CFS

**Computer File Information**

| | |
|---|---|
| Full Path: | P:\21711D39\CAD\PLANSHTS |
| Drawing File Name: | CHANNEL.DWG |
| Acad. Ver. 2D06 | Scale: 1"=2D0' Units: Feet |

**Index of Revisions**

**Profiles**

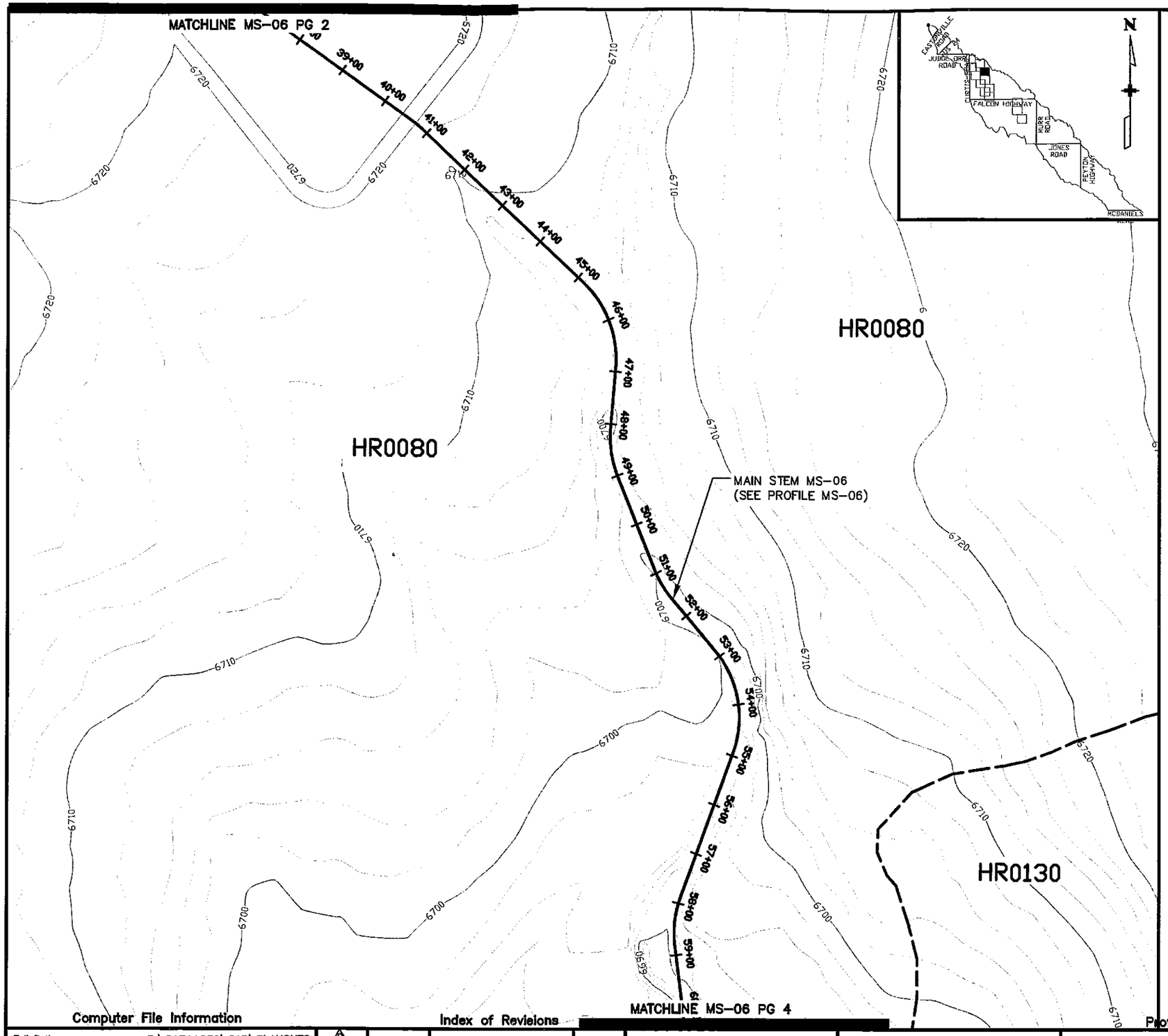
URS 9960 Federal Drive, Suite 300 Colorado Springs, CO. 80921 (719) 531-0001 Fax (719) 531-0007

| | |
|---|---|
| Designed by: | KAP |
| Detailed by: | DRM |
| Checked by: | JAJ |

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 2



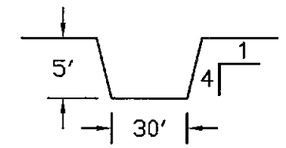

LEGEND

- 6630 — CONTOURS – MAJOR ELEVATION
- CONTOURS – MINOR ELEVATION
- WATERSHED BOUNDARY
- BASIN BOUNDARY
- ROADS
- 20+00 — RIVER AND ALIGNMENT

1"=200'

200 0 200 400

CHANNEL: MAIN STEM (MS-06)
BASIN: HR0080




STA: 31+34 TO STA: 74+61

Q: 1000 CFS

Computer File Information

Full Path: P:\21711039\CAD\PLANSHTS
Drawing File Name: CHANNEL.DWG
Acad. Ver. 2006 Scale: 1"=200' Units: Feet

Index of Revisions

| | | | |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |

URS 8900 Federal Drive, Suite 300 Colorado Springs, CO. 80921 (719) 531-0001 Fax (719) 531-0007

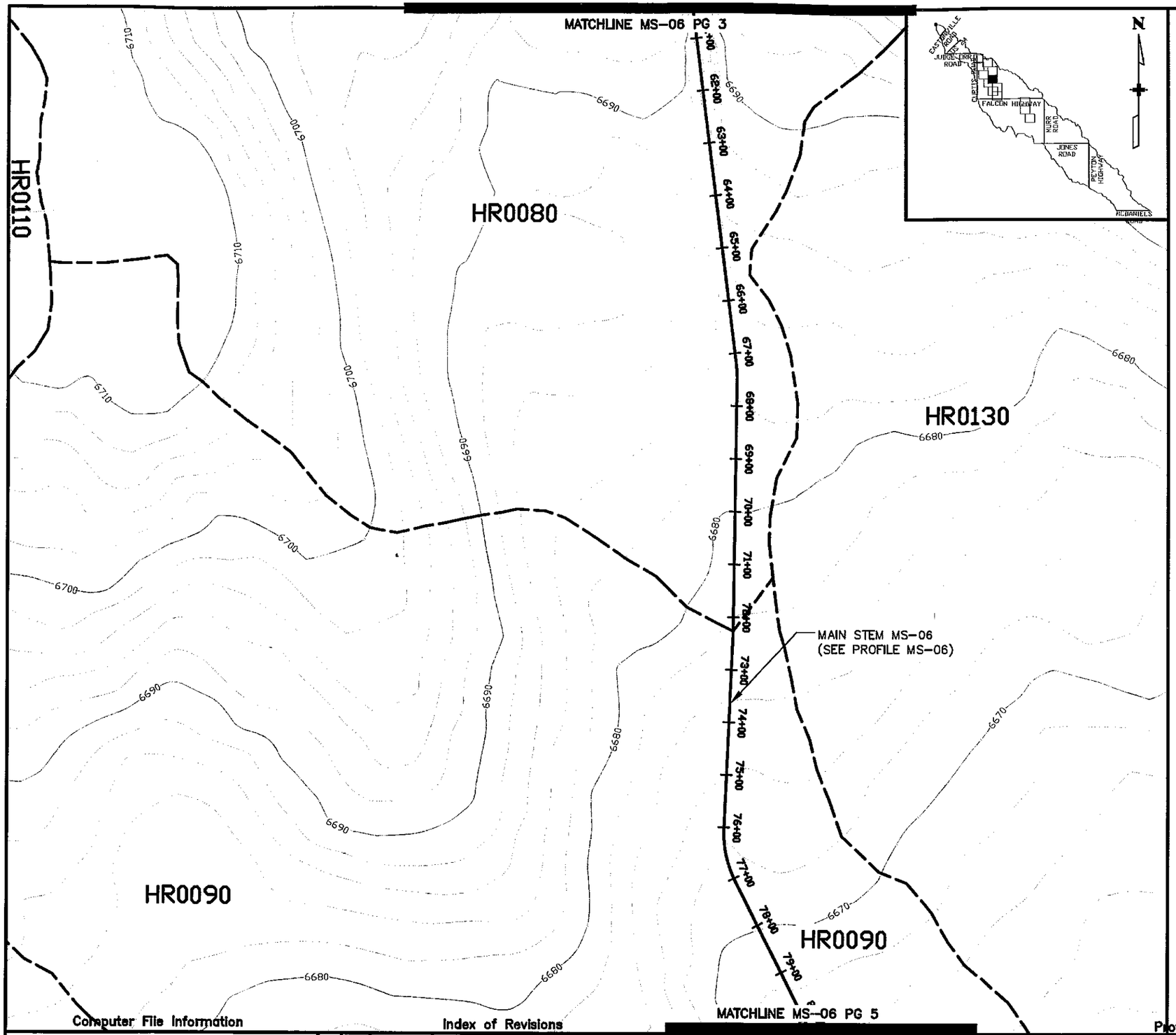
Designed by: KAP
Detailed by: DRM
Checked by: JAJ

Structure Numbers

Profiles

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 3



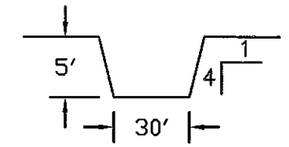

LEGEND

| | |
|---|---|
| 6630 | CONTOURS – MAJOR ELEVATION |
| | CONTOURS – MINOR ELEVATION |
| | WATERSHED BOUNDARY |
| | BASIN BOUNDARY |
| | ROADS |
| 20+00 | RIVER AND ALIGNMENT |

1"=200'

200 0 200 400

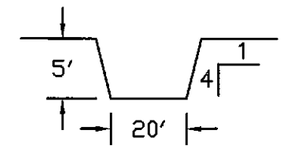
CHANNEL: MAIN STEM (MS-06)
BASIN: HR0080




STA: 31+34 TO STA: 74+61

Q: 1000 CFS

CHANNEL: MAIN STEM (MS-06)
BASIN: HR0090




STA: 74+61 TO STA: 103+62

Q: 800 CFS

**Computer File Information**

Full Path: P:\21711039\CAD\PLANSHTS
Drawing File Name: CHANNEL.DWG
Acad. Ver. 2006 Scale: 1"=200' Units: Feet

**Index of Revisions**

| | | | |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |

**Profiles**

URS
9200 Federal Drive, Suite 300
Colorado Springs, CO. 80921
(719) 531-0001
Fax (719) 531-0007

Designed by: KAP
Detailed by: DRM
Checked by: JAJ

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 4

MATCHLINE MS-06 PG 4

MAIN STEM MS-06
(SEE PROFILE MS-06)

HR0090

HR0130

HR0210

HR0140

POND SR-05
(SEE SHEET SR05)

POND SR-04
(SEE SHEET SR04)

MAIN STEM MS-06
(SEE MAINSTEM PAGE 5)

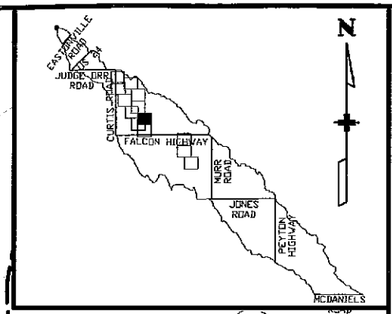
TRIBUTARY 6 (T6)
(SEE PROFILE TRIBUTARY 6)

MATCHLINE MS-06 PG 6

Index of Revisions

Computer File Information

Profiles



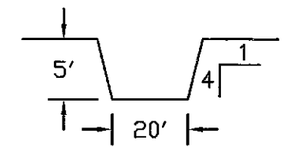

LEGEND

- 6630 — CONTOURS – MAJOR ELEVATION
- CONTOURS – MINOR ELEVATION
- WATERSHED BOUNDARY
- BASIN BOUNDARY
- ROADS
- 20+00 — RIVER AND ALIGNMENT

1"=200'

200 0 200 400

CHANNEL: MAIN STEM (MS-06)
BASIN: HR0090




STA: 74+61 TO STA: 103+62

Q: 800 CFS

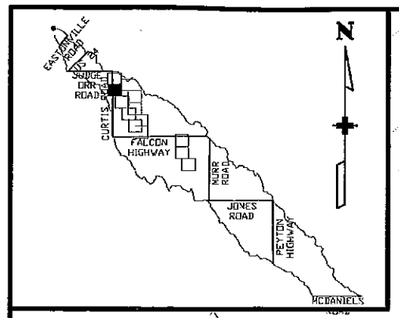
| | | | |
|---|---|---|---|
| Full Path: | P:\21711039\CAD\PLANSHTS | Designed by: | KAP |
| Drawing File Name: | CHANNEL.DWG | Detailed by: | DRM |
| Acad. Ver. 2006 | Scale: 1"=200' Units: Feet | Checked by: | JAJ |

URS 9960 Federal Drive, Suite 300 Colorado Springs, CO. 80921 (719) 531-0001 Fax (719) 531-0007

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 5




HR0070

HR0100

HR0080

HR0110

HR0110

CURTIS ROAD

6760
6750
6740
6770
6760
6750
6740
6760
6750
6770
6760
6750
6740

BEGIN T6 IMPROVEMENTS

TRIBUTARY 6 (T6) (SEE PROFILE TRIBUTARY 6)

0+00
1+00
2+00
3+00
4+00

MATCHLINE T6 PG 2

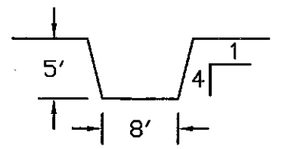
LEGEND

| | |
|---|---|
| 6630 | CONTOURS – MAJOR ELEVATION |
| | CONTOURS – MINOR ELEVATION |
| | WATERSHED BOUNDARY |
| | BASIN BOUNDARY |
| | ROADS |
| 20+00 | RIVER AND ALIGNMENT |

1"=200'

200 0 200 400

CHANNEL: TRIBUTARY 6 (T6)
BASIN: HR0110




STA: 0+00 TO STA: 41+73

Q: 500 CFS

Computer File Information

Full Path: P:\21711039\CAD\PLANSHTS
Drawing File Name: CHANNEL.DWG
Acad. Ver. 2006 Scale: 1"=200' Units: Feet

Index of Revisions

Profiles

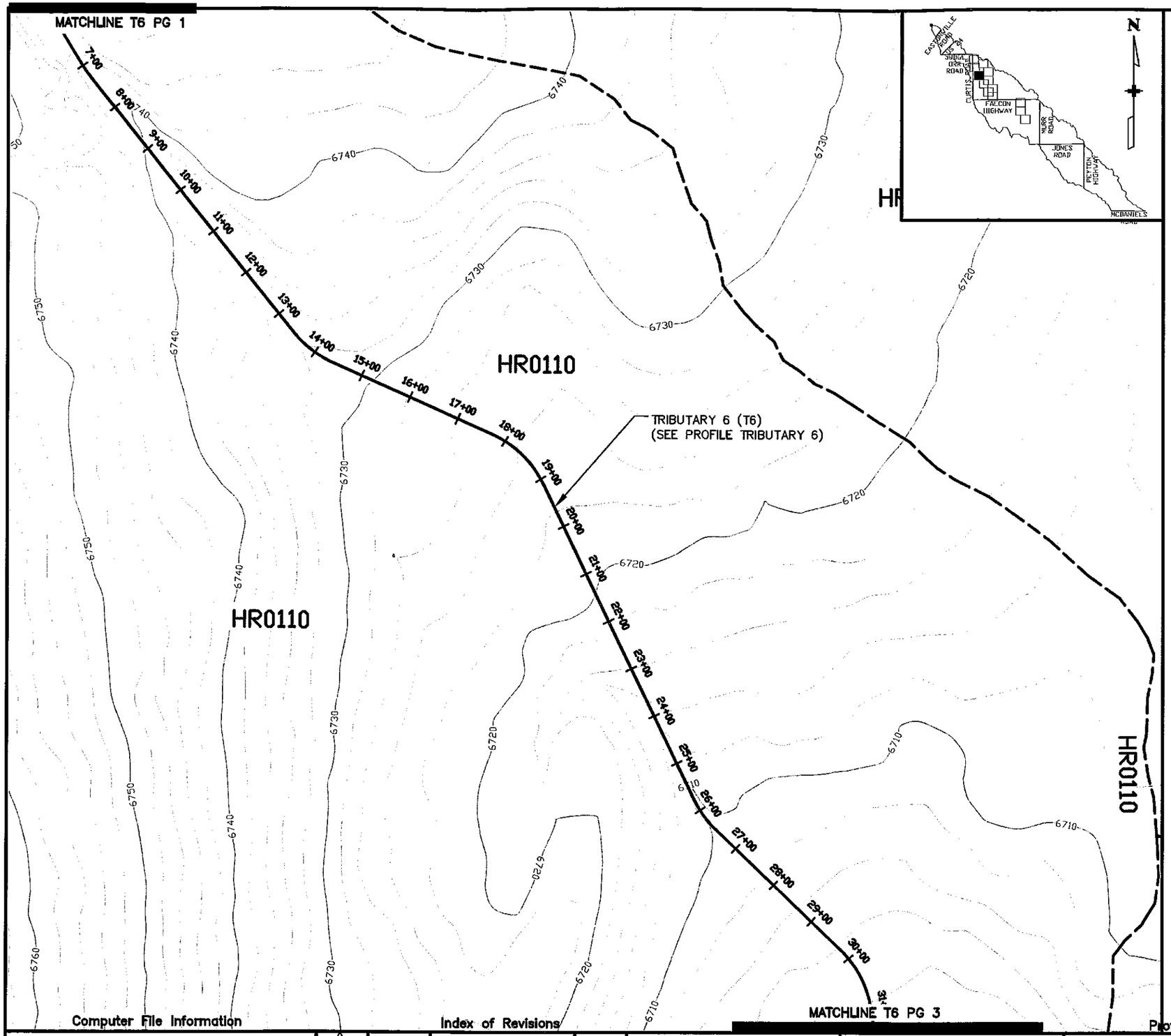
URS 9960 Federal Drive, Suite 200 Colorado Springs, CO. 80921 (719) 531-0001 Fax (719) 531-0007

Designed by: KAP
Detailed by: DRM
Checked by: JAJ

Structure Numbers:

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number TRIBUTARY 6 PG 1







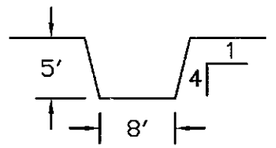
LEGEND

- 6630 — CONTOURS – MAJOR ELEVATION
- CONTOURS – MINOR ELEVATION
- WATERSHED BOUNDARY
- BASIN BOUNDARY
- ROADS
- 20+00 — RIVER AND ALIGNMENT

1"=200'

200 0 200 400

CHANNEL: TRIBUTARY 6 (T6)
BASIN: HR0110




STA: 0+00 TO STA: 41+73

Q: 500 CFS

Computer File Information

Full Path: P:\21711039\CAD\PLANSHTS
Drawing File Name: CHANNEL.DWG
Acad. Ver. 2006 Scale: 1"=200' Units: Feet

Index of Revisions

| | | | |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |

Profiles

URS 8960 Federal Drive, Suite 300 Colorado Springs, CO. 80921 (719) 531-0001 Fax (719) 531-0007

Designed by: KAP
Detailed by: DRM
Checked by: JAJ

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number TRIBUTARY 6 PG 2

MATCHLINE T6 PG 2

HR0110

HR0110

HR0090

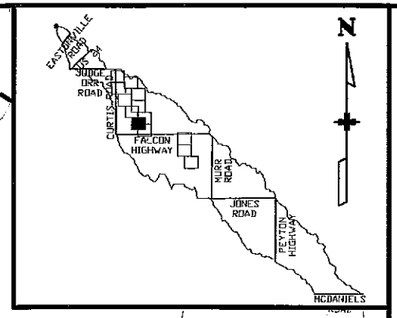
HR0120

HR0120

TRIBUTARY 6 (T6)
(SEE PROFILE TRIBUTARY 6)

0+00
33+00
34+00
35+00
36+00
37+00
38+00
39+00
40+00
41+00
42+00
43+00
44+00
45+00
46+00
47+00
48+00
49+00
50+00
51+00
52+00

6700
6690
6680
6670
6660
6718
6708
6699
6729



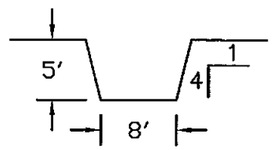

LEGEND

| | |
|---|---|
| 6630 | CONTOURS – MAJOR ELEVATION |
| | CONTOURS – MINOR ELEVATION |
| | WATERSHED BOUNDARY |
| | BASIN BOUNDARY |
| | ROADS |
| 20+00 | RIVER AND ALIGNMENT |

1"=200'

200 0 200 400

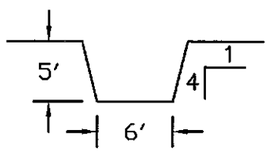
CHANNEL: TRIBUTARY 6 (T6)
BASIN: HR0110




STA: 0+00 TO STA: 41+73

Q: 500 CFS

CHANNEL: TRIBUTARY 6 (T6)
BASIN: HR0120




STA: 41+73 TO STA: 75+50

Q: 300 CFS

MATCHLINE T6 PG 4

Computer File Information

| | |
|---|---|
| Full Path: | P:\21711039\CAD\PLANSHTS |
| Drawing File Name: | CHANNEL.DWG |
| Acad. Ver. 2006 | Scale: 1"=200' Units: Feet |

Index of Revisions

| | | |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |

Profiles

URS
9200 Federal Drive, Suite 300
Colorado Springs, CO. 80921
(719) 531-0001
Fax (719) 531-0007

| | |
|---|---|
| Designed by: | KAP |
| Detailed by: | DRM |
| Checked by: | JAJ |

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number TRIBUTARY 6 PG 3

MATCHLINE MS-06 PG 2

TRIBUTARY 6 (T6)
(SEE PROFILE TRIBUTARY 6)

HR0120

POND SR-05
(SEE SHEET SR05)

POND SR-04
(SEE SHEET SR04)

HR0090

MAIN STEM MS-06
(SEE MAINSTEM PAGE 5)

TRIBUTARY 6 (T6)
(SEE PROFILE TRIBUTARY 6)

HR0120

MATCHLINE MS-06 PG 6

LEGEND

| | |
|---|---|
| 6630 | CONTOURS – MAJOR ELEVATION |
| | CONTOURS – MINOR ELEVATION |
| | WATERSHED BOUNDARY |
| | BASIN BOUNDARY |
| | ROADS |
| 20+00 | RIVER AND ALIGNMENT |

1"=200'

200 0 200 400

CHANNEL: TRIBUTARY 6 (T6)
BASIN: HR0120

5' 1 4 6'

STA: 41+73 TO STA: 75+50

Q: 300 CFS

N

EASTONVILLE ROAD
SUDER ORR ROAD
CURTIS ROAD
FALCON HIGHWAY
MARK ROAD
JONES ROAD
PEYTON HIGHWAY
MCDANIELS ROAD

**Computer File Information**

| | |
|---|---|
| Full Path: | P:\21711039\CAD\PLANSHTS |
| Drawing File Name: | CHANNEL.DWG |
| Acad. Ver. 2006 | Scale: 1"=200' Units: Feet |

**Index of Revisions**

| | | | |
|---|---|---|---|
| 2 | | | |
| 1 | | | |
| | | | |

**Profiles**

URS
9960 Federal Drive, Suite 300
Colorado Springs, CO. 80921
(719) 531-0001
Fax (719) 531-0007

| | |
|---|---|
| Designed by: | KAP |
| Detailed by: | DRM |
| Checked by: | JAJ |

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number TRIBUTARY 6 PG 4

MS–06 HR0070

SLOPE = 0.60%

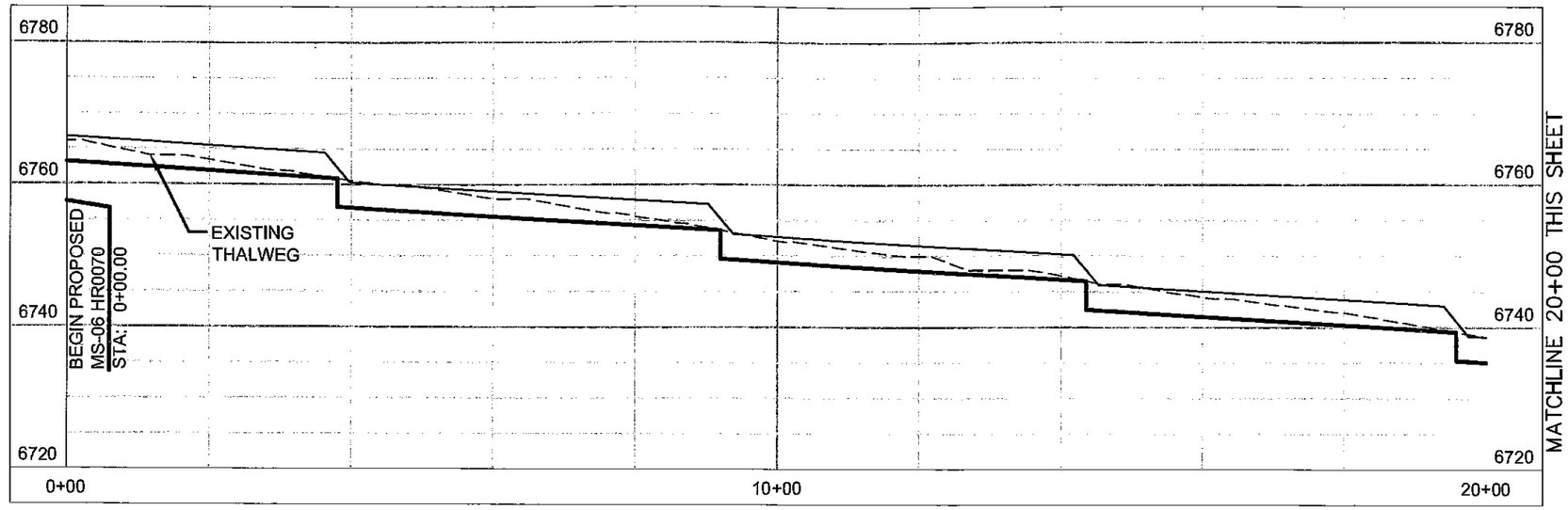
(7) 4' DROPS

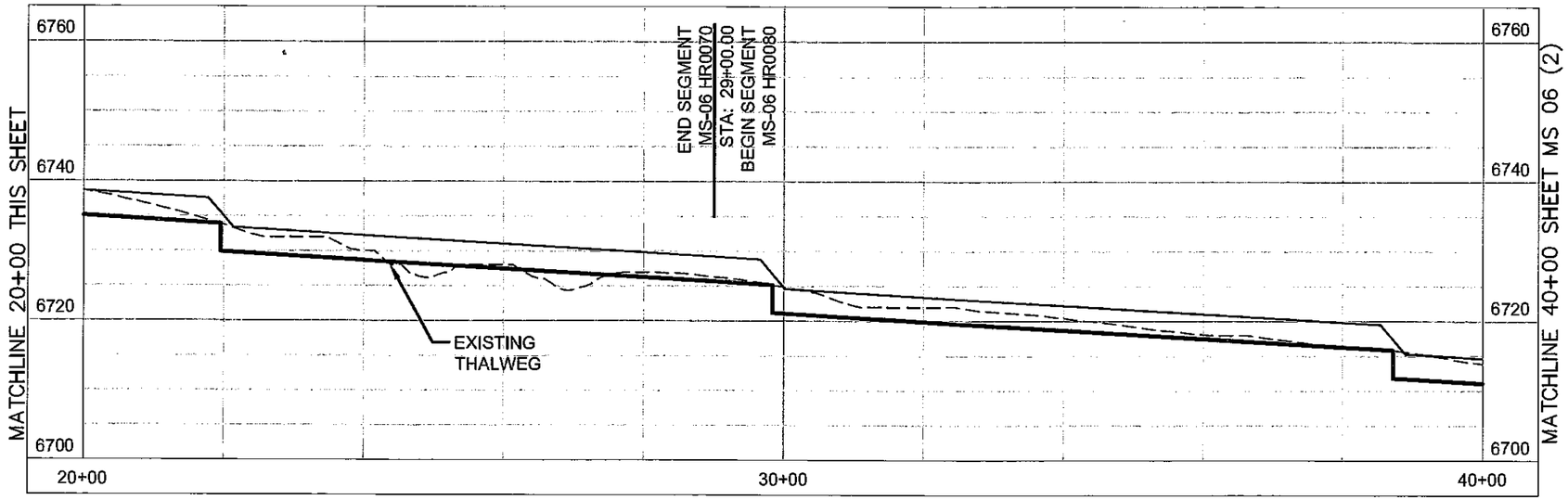
MS–06 HR0080

SLOPE = 0.60%

(7) 4' DROPS

# PROFILE MAIN STEM (MS–06 & MS–05)




LEGEND

- PROPOSED DROP STRUCTURE
- EXISTING THALWEG
- HYDRAULIC GRADE LINE

**Computer File Information**

Full Path: P:\21711039\CAD\PLANSHTS

Drawing File Name: MAINSTEM PROFILES_PRDPOSED.DWG

Acad. Ver. 2006 Scale: 1"=2' Units: Feet

**Index of Revisions**

| | | | |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

URS 9950 Federal Drive, Suite 300 Colorado Springs, CO. 80921 (719) 531-0001 Fax (719) 531-0007

**Profiles**

Designed by: KAP

Detailed by: DRM

Checked by:

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL PROFILES

Sheet Number MS 06

MS–06 HR0080

SLOPE = 0.60%

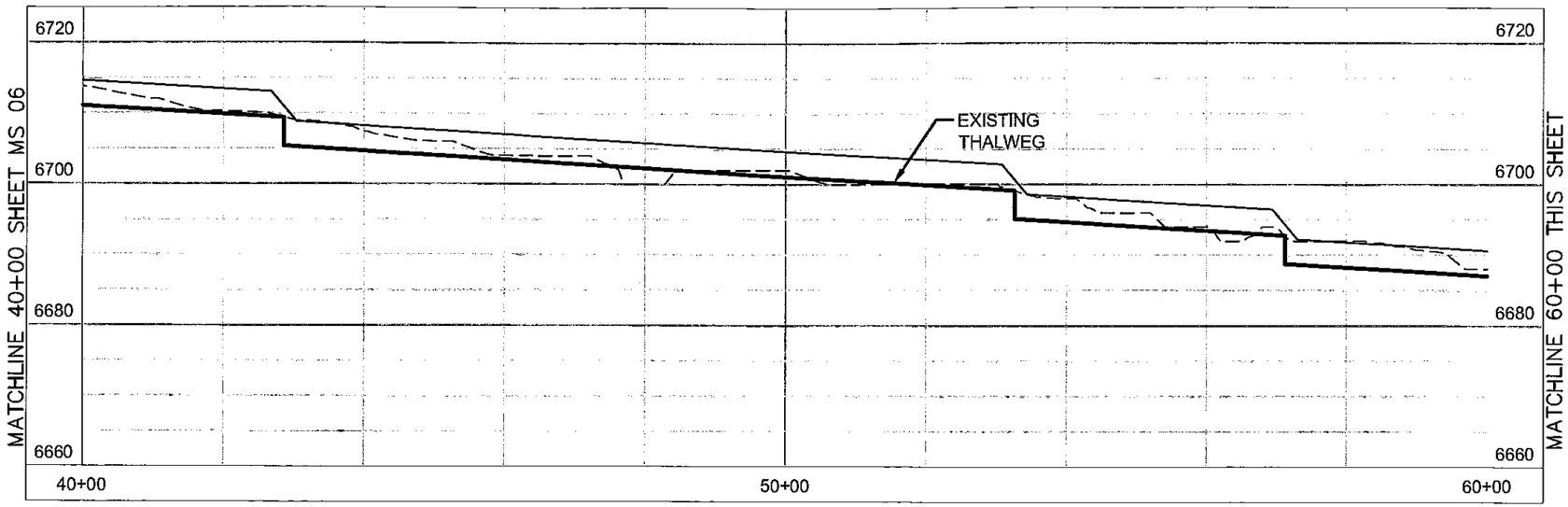
(7) 4' DROPS

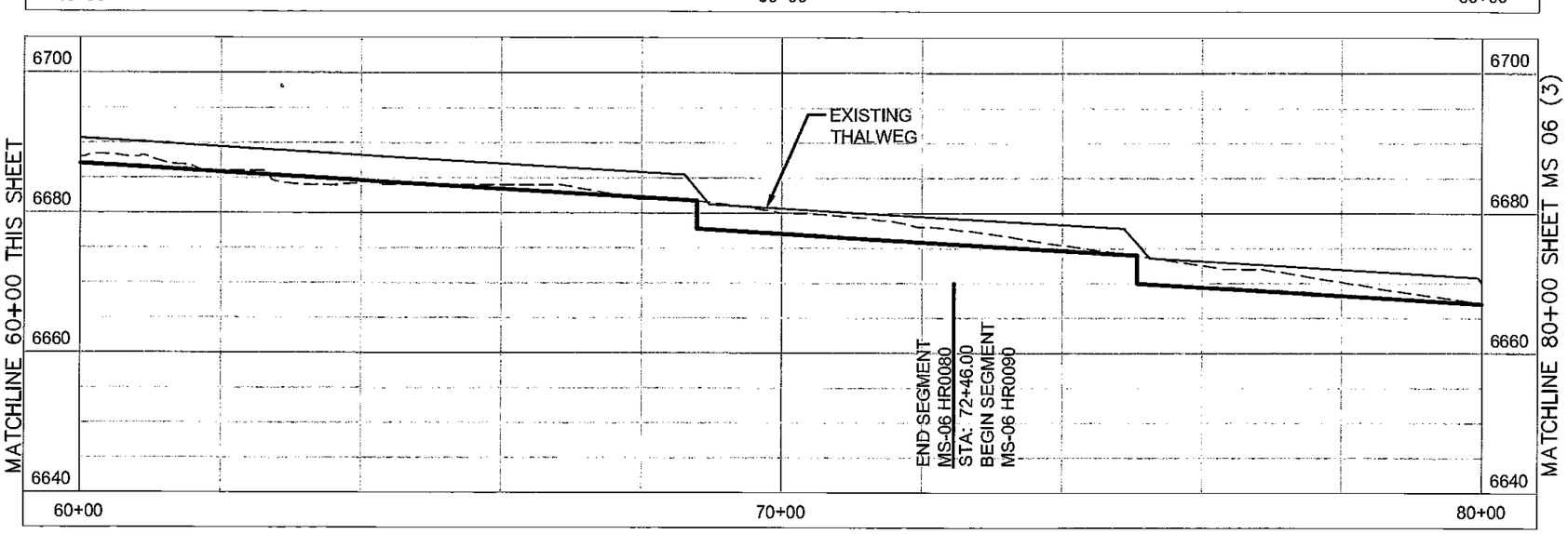
MS–06 HR0090

SLOPE = 0.60%

(8) 4' DROPS

# PROFILE MAIN STEM (MS–06 & MS–05)




LEGEND

- PROPOSED DROP STRUCTURE
- EXISTING THALWEG
- HYDRAULIC GRADE LINE

**Computer File Information**

Full Path: P:\21711039\CAD\PLANSHTS

Drawing File Name: MAINSTEM PROFILES_PROPOSED.DWG

Acad. Ver. 2006 Scale: 1"=20' Units: Feet

**Index of Revisions**

| | | | |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

URS 9960 Federal Drive, Suite 300 Colorado Springs, CO. 80921 (719) 531-0001 Fax (719) 531-0007

**Profiles**

Designed by: KAP

Detailed by: DRM

Checked by:

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL PROFILES

Sheet Number MS06 (2)

MS–06 HR0090

SLOPE = 0.60%

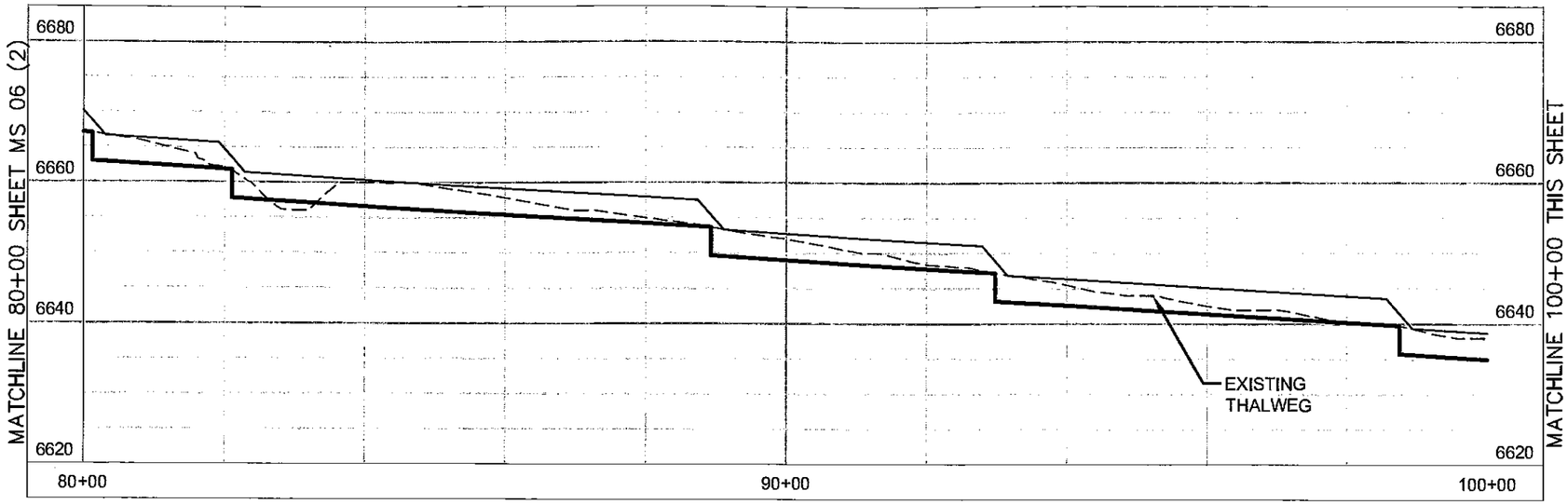
(8) 4' DROPS

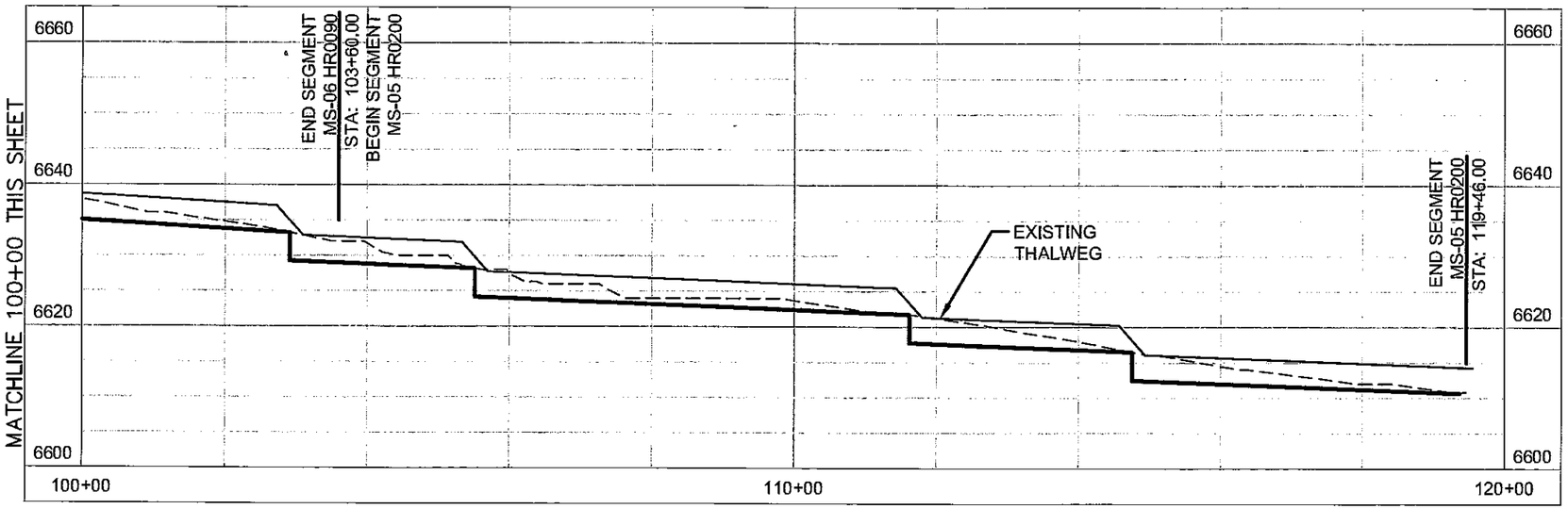
MS–05 HR0200

SLOPE = 0.40%

(4) 4' DROPS

# PROFILE MAIN STEM (MS–06 & MS–05)




LEGEND

- PROPOSED DROP STRUCTURE
- EXISTING THALWEG
- HYDRAULIC GRADE LINE

**Computer File Information**

Full Path: P:\21711039\CAD\PLANSHTS

Drawing File Name: MAINSTEM PROFILES_PROPOSED.DWG

Acad. Ver. 2006 Scale: 1"=20' Units: Feet

**Index of Revisions**

| | | | |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

URS 6960 Federal Drive, Suite 300 Colorado Springs, CO. 80921 (719) 531-0001 Fax (719) 531-0007

**Profiles**

Designed by: KAP

Detailed by: DRM

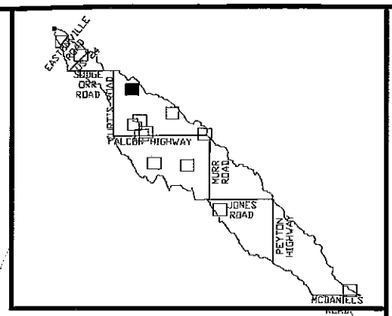
Checked by:

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL PROFILES

Sheet Number MS06 & MS05 (3)

# POND SR-03




MAIN STEM MS-06
(SEE MAINSTEM PG 2 & 3)
(SEE PROFILE MS-06)

TOP OF BERM
6724'

100 YEAR
WS 6721'

LOW POINT

6730
6720
6710
6700

## LEGEND

- 6630 — PROPOSED CONTOURS – MAJOR ELEVATION
- PROPOSED CONTOURS – MINOR ELEVATION
- 6630 — EXISTING CONTOURS – MAJOR ELEVATION
- EXISTING CONTOURS – MINOR ELEVATION
- WATERSHED BOUNDARY
- ROADS
- RIVER
- 100 YEAR WATER SURFACE ELEVATION
- ⊠ OUTLET

POND SR-03
DISCHARGE

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

N

1"=200'

200 0 200 400

**Computer File Information**

| | |
|---|---|
| Full Path: | P:\21711039\CAD\PLANSHTS |
| Drawing File Name: | PONDS.DWG |
| Acad. Ver. 2006 | Scale: 1"=20D' Units: Feet |

**Index of Revisions**

| | | | |
|---|---|---|---|
| 3 | | | |
| 2 | | | |
| 1 | | | |

**Profiles**


URS
9960 Federal Drive, Suite 300
Colorado Springs, CO. 80921
(719) 531-0001
Fax (719) 531-0007

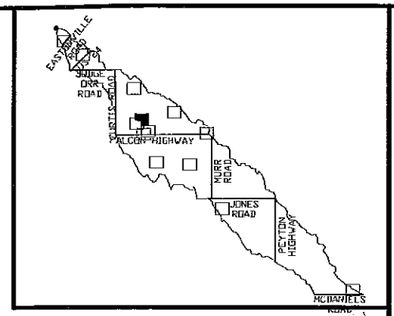

| | |
|---|---|
| Designed by: | KAP |
| Detailed by: | DRM |
| Checked by: | JAJ |

Structure Numbers

HAEGLER RANCH DRAINAGE BASIN

Sheet Number SR03

# POND SR-04




MAIN STEM MS-06
(SEE MAINSTEM PG 5)
(SEE PROFILE MS-06)

100 YEAR
WS 6653.25'

TOP OF BERM
6656.25'

LOW POINT

MAIN STEM MS-06
(SEE MAINSTEM PG 5)
(SEE PROFILE MS-06)

6670 6660 6650 6640

LEGEND

- 6630 — PROPOSED CONTOURS - MAJOR ELEVATION
- PROPOSED CONTOURS - MINOR ELEVATION
- 6630 — EXISTING CONTOURS - MAJOR ELEVATION
- EXISTING CONTOURS - MINOR ELEVATION
- WATERSHED BOUNDARY
- ROADS
- RIVER
- 100 YEAR WATER SURFACE ELEVATION
- ⊠ OUTLET

POND SR-04
DISCHARGE

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

N

1"=200'

200 0 200 400

**Computer File Information**

| | |
|---|---|
| Full Path: | P:\21711039\CAD\PLANSHTS |
| Drawing File Name: | PONDS.DWG |
| Acad. Ver. 2006 | Scale: 1"=200' Units: Feet |

**Index of Revisions**

| | | | |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |

**Profiles**

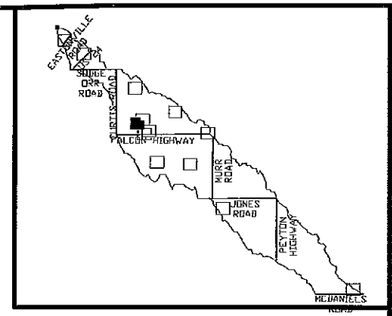
URS 9950 Federal Drive, Suite 300 Colorado Springs, CO. 80921 (719) 531-0001 Fax (719) 531-0007

| | |
|---|---|
| Designed by: | KAP |
| Detailed by: | DRM |
| Checked by: | JAJ |
| Structure Numbers | |

HAEGLER RANCH DRAINAGE BASIN

Sheet Number SR04

# POND SR-05




TRIBUTARY 6 (T6)
(SEE TRIBUTARY 6 PG 4)
(SEE PROFILE TRIBUTARY 6)

LOW POINT

100 YEAR
WS 6655.50'

TOP OF BERM
6658.50'

TRIBUTARY 6 (T6)
(SEE TRIBUTARY 6 PG 4)
(SEE PROFILE TRIBUTARY 6)

LEGEND

| | |
|---|---|
| 6630 | PROPOSED CONTOURS – MAJOR ELEVATION |
| | PROPOSED CONTOURS – MINOR ELEVATION |
| 6630 | EXISTING CONTOURS – MAJOR ELEVATION |
| | EXISTING CONTOURS – MINOR ELEVATION |
| | WATERSHED BOUNDARY |
| | ROADS |
| | RIVER |
| | 100 YEAR WATER SURFACE ELEVATION |
| ⊠ | OUTLET |

POND SR-05
DISCHARGE

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

N

1"=200'

200 0 200 400

**Computer File Information**

| | |
|---|---|
| Full Path: | P:\21711039\CAD\PLANSHTS |
| Drawing File Name: | PONDS.DWG |
| Acad. Ver. 20D6 | Scale: 1"=200' Units: Feet |

**Index of Revisions**

| | | | |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |

**Profiles**

EL PASO COUNTY

URS 9960 Federal Drive, Suite 300 Colorado Springs, CO. 80921 (719) 531-5001 Fax (719) 531-0007

| | |
|---|---|
| Designed by: | KAP |
| Detailed by: | DRM |
| Checked by: | JAJ |

Structure Numbers

HAEGLER RANCH DRAINAGE BASIN

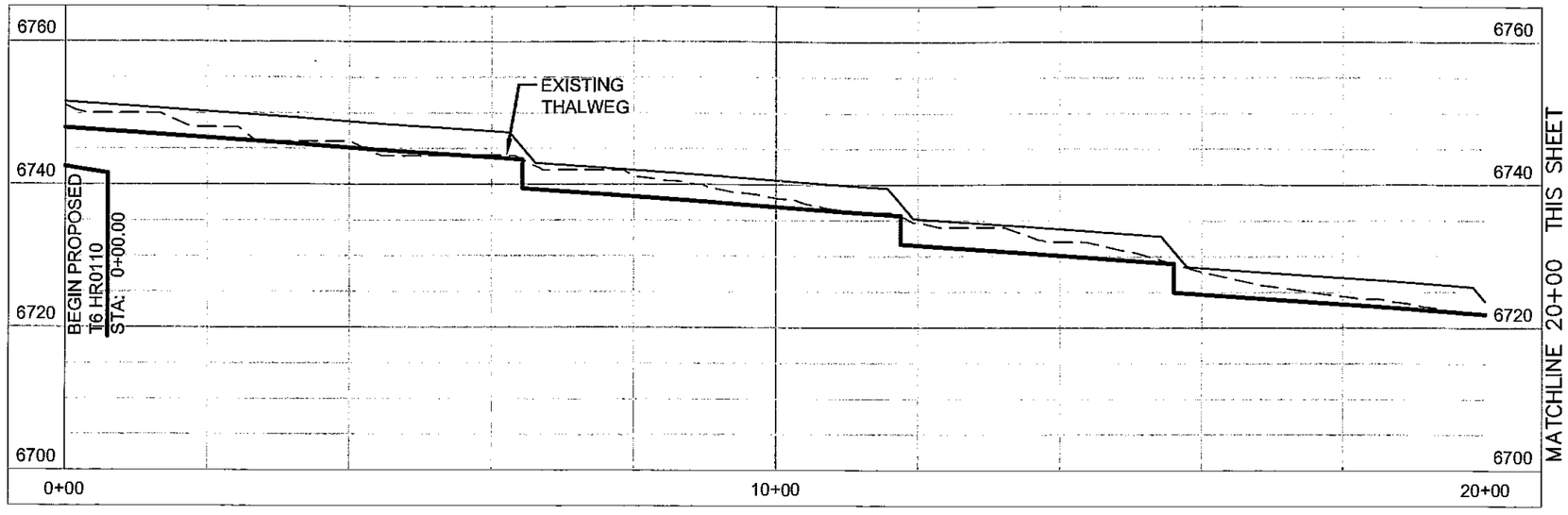
Sheet Number SR05

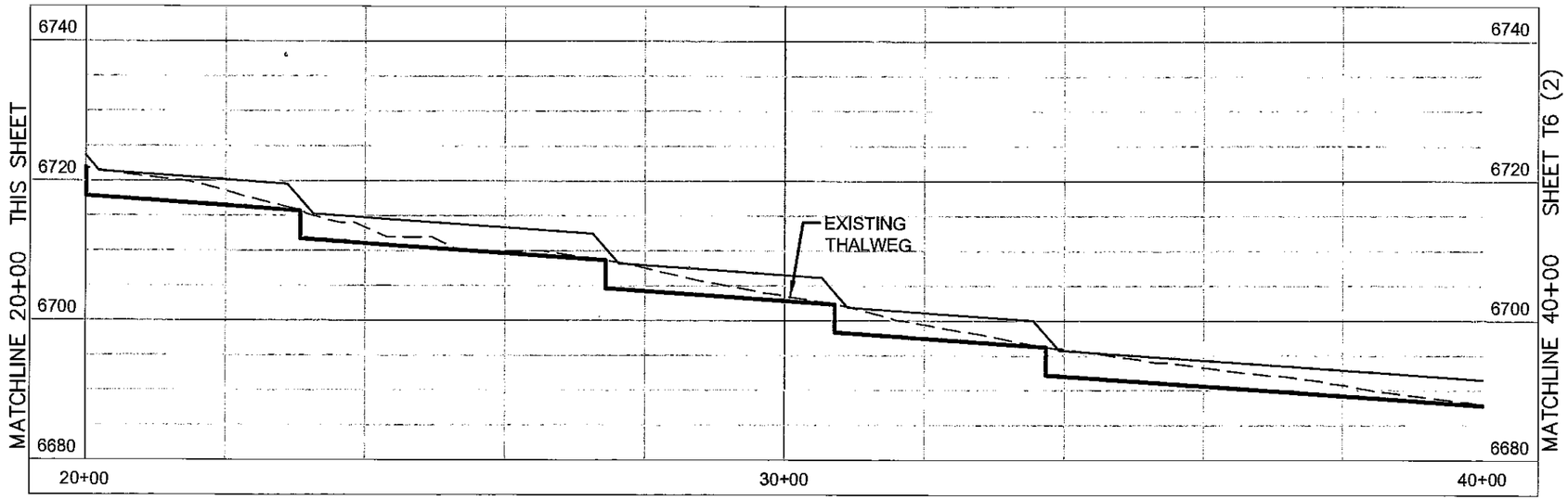
T6 HR0110

SLOPE = 0.70%

(9) 4' DROPS

# PROFILE TRIBUTARY 6 (T6)




LEGEND

- PROPOSED DROP STRUCTURE
- EXISTING THALWEG
- HYDRAULIC GRADE LINE

**Computer File information**

Full Path: P:\21711039\CAD\PLANSHTS

Drawing File Name: T_PROFILE_SHEETS 6_PROPOSED.DWG

Acad. Ver. 2006 Scale: 1"=20' Units: Feet

**Index of Revisions**

**Profiles**

Designed by: KAP

Detailed by: DRM

Checked by:

Structure Numbers


EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

URS 9950 Federal Drive, Suite 300 Colorado Springs, CO. 80921 (719) 531-0001 Fax (719) 531-0007


HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL PROFILES

Sheet Number T6

T6 HR0110

SLOPE = 0.70%

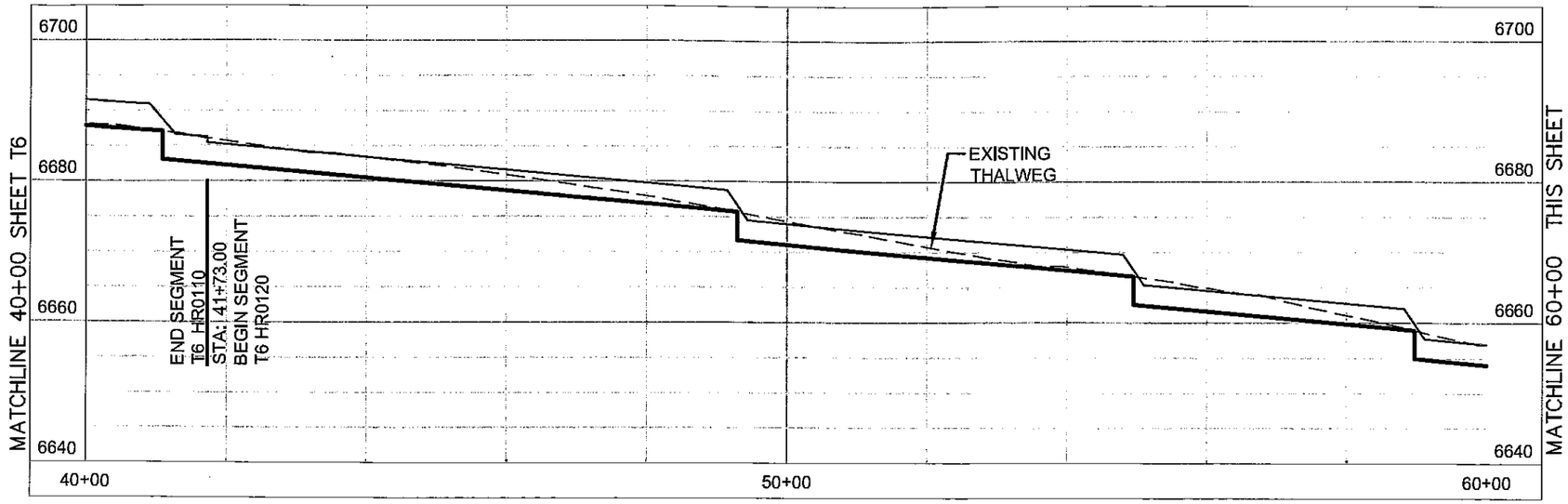
(9) 4' DROPS

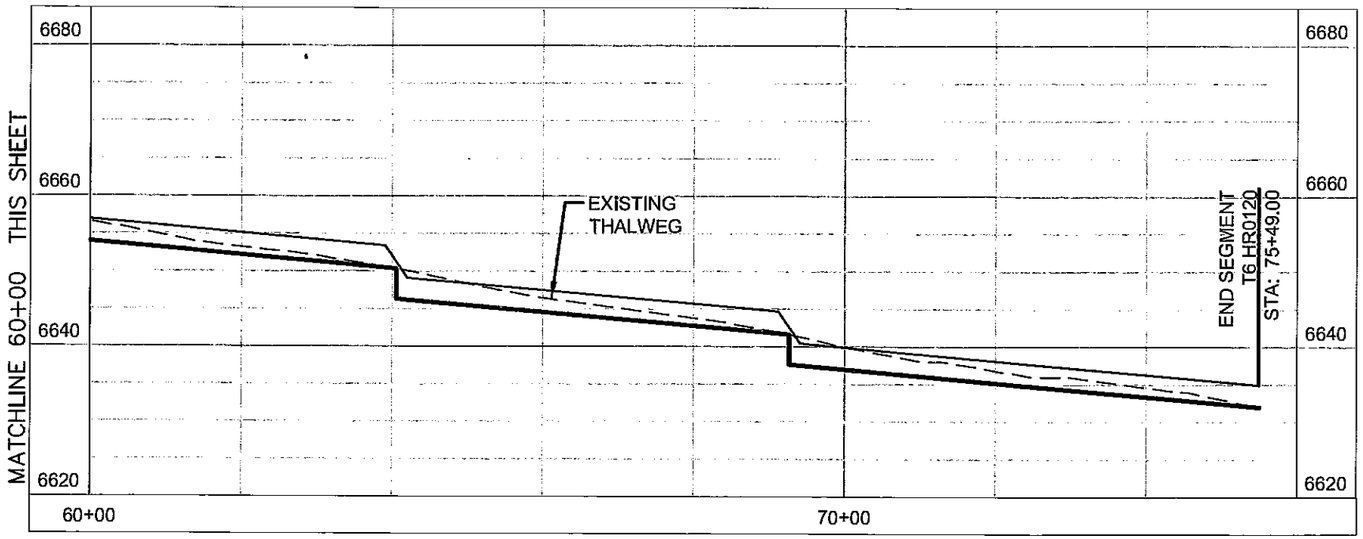
T6 HR0120

SLOPE = 0.90%

(6) 4' DROPS

# PROFILE TRIBUTARY 6 (T6)




LEGEND

- PROPOSED DROP STRUCTURE
- EXISTING THALWEG
- HYDRAULIC GRADE LINE

**Computer File Information**

Full Path: P:\21711039\CAD\PLANSHTS

Drawing File Name: T PROFILE SHEETS 6_PROPOSED.DWG

Acad. Ver. 2006 Scale: 1"=20' Units: Feet

**Index of Revisions**

**Profiles**

Designed by: KAP

Detailed by: DRM

Checked by:

Structure Numbers

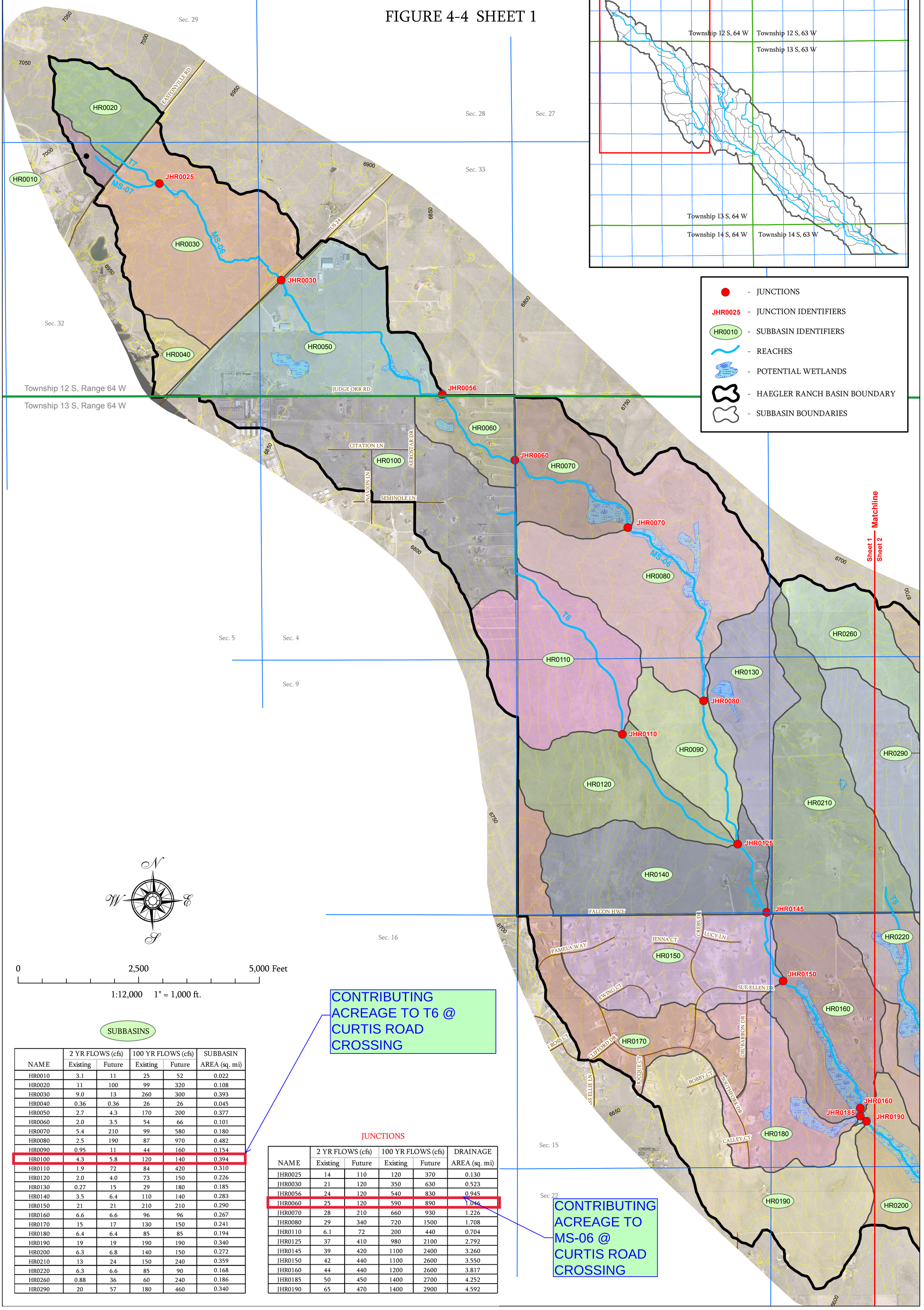
EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

URS 9950 Federal Drive, Suite 300 Colorado Springs, CO. 80921 (719) 531-0001 Fax (719) 531-0007

HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL PROFILES

Sheet Number T6 (2)

# FIGURE 4-4 SHEET 1







0 2,500 5,000 Feet

1:12,000 1" = 1,000 ft.

SUBBASINS

| NAME | 2 YR FLOWS (cfs) Existing | 2 YR FLOWS (cfs) Future | 100 YR FLOWS (cfs) Existing | 100 YR FLOWS (cfs) Future | SUBBASIN AREA (sq. mi) |
|---|---|---|---|---|---|
| HR0010 | 3.1 | 11 | 25 | 52 | 0.022 |
| HR0020 | 11 | 100 | 99 | 320 | 0.108 |
| HR0030 | 9.0 | 13 | 260 | 300 | 0.393 |
| HR0040 | 0.36 | 0.36 | 26 | 26 | 0.045 |
| HR0050 | 2.7 | 4.3 | 170 | 200 | 0.377 |
| HR0060 | 2.0 | 3.5 | 54 | 66 | 0.101 |
| HR0070 | 5.4 | 210 | 99 | 580 | 0.180 |
| HR0080 | 2.5 | 190 | 87 | 970 | 0.482 |
| HR0090 | 0.95 | 11 | 44 | 160 | 0.154 |
| HR0100 | 4.3 | 5.8 | 120 | 140 | 0.394 |
| HR0110 | 1.9 | 72 | 84 | 420 | 0.310 |
| HR0120 | 2.0 | 4.0 | 73 | 150 | 0.226 |
| HR0130 | 0.27 | 15 | 29 | 180 | 0.185 |
| HR0140 | 3.5 | 6.4 | 110 | 140 | 0.283 |
| HR0150 | 21 | 21 | 210 | 210 | 0.290 |
| HR0160 | 6.6 | 6.6 | 96 | 96 | 0.267 |
| HR0170 | 15 | 17 | 130 | 150 | 0.241 |
| HR0180 | 6.4 | 6.4 | 85 | 85 | 0.194 |
| HR0190 | 19 | 19 | 190 | 190 | 0.340 |
| HR0200 | 6.3 | 6.8 | 140 | 150 | 0.272 |
| HR0210 | 13 | 24 | 150 | 240 | 0.359 |
| HR0220 | 6.3 | 6.6 | 85 | 90 | 0.168 |
| HR0260 | 0.88 | 36 | 60 | 240 | 0.186 |
| HR0290 | 20 | 57 | 180 | 460 | 0.340 |

CONTRIBUTING ACREAGE TO T6 @ CURTIS ROAD CROSSING

JUNCTIONS

| NAME | 2 YR FLOWS (cfs) Existing | 2 YR FLOWS (cfs) Future | 100 YR FLOWS (cfs) Existing | 100 YR FLOWS (cfs) Future | DRAINAGE AREA (sq. mi) |
|---|---|---|---|---|---|
| JHR0025 | 14 | 110 | 120 | 370 | 0.130 |
| JHR0030 | 21 | 120 | 350 | 630 | 0.523 |
| JHR0056 | 24 | 120 | 540 | 830 | 0.945 |
| JHR0060 | 25 | 120 | 590 | 890 | 1.046 |
| JHR0070 | 28 | 210 | 660 | 930 | 1.226 |
| JHR0080 | 29 | 340 | 720 | 1500 | 1.708 |
| JHR0110 | 6.1 | 72 | 200 | 440 | 0.704 |
| JHR0125 | 37 | 410 | 980 | 2100 | 2.792 |
| JHR0145 | 39 | 420 | 1100 | 2400 | 3.260 |
| JHR0150 | 42 | 440 | 1100 | 2600 | 3.550 |
| JHR0160 | 44 | 440 | 1200 | 2600 | 3.817 |
| JHR0185 | 50 | 450 | 1400 | 2700 | 4.252 |
| JHR0190 | 65 | 470 | 1400 | 2900 | 4.592 |

CONTRIBUTING ACREAGE TO MS-06 @ CURTIS ROAD CROSSING

URS

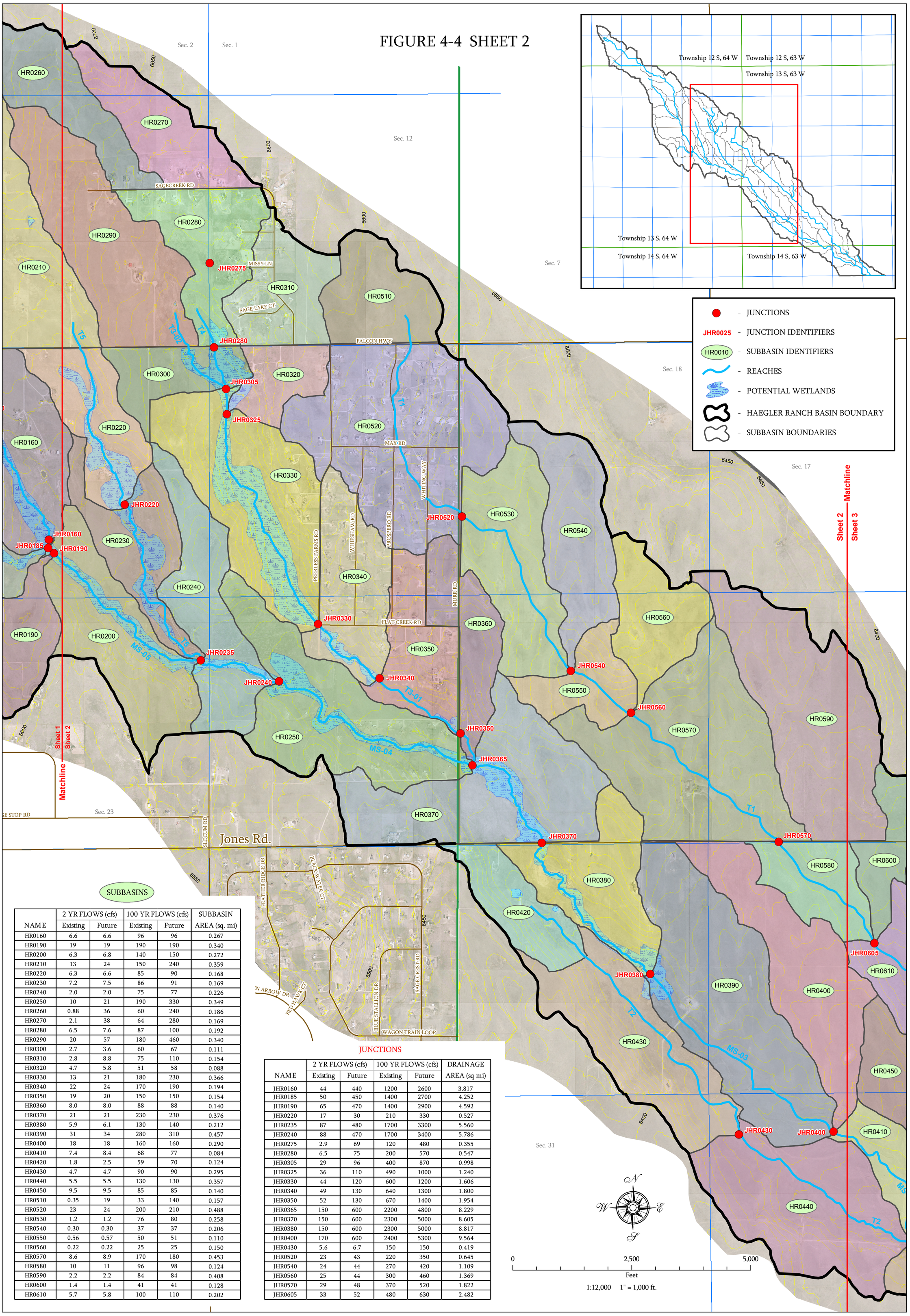
# HAEGLER RANCH DRAINAGE BASIN

## EXISTING AND FUTURE CONDITIONS HYDROLOGIC MODEL

URS NO. 21711039

DATE: 09/08

# FIGURE 4-4 SHEET 2




SUBBASINS

| NAME | 2 YR FLOWS (cfs) Existing | 2 YR FLOWS (cfs) Future | 100 YR FLOWS (cfs) Existing | 100 YR FLOWS (cfs) Future | SUBBASIN AREA (sq. mi) |
|---|---|---|---|---|---|
| HR0160 | 6.6 | 6.6 | 96 | 96 | 0.267 |
| HR0190 | 19 | 19 | 190 | 190 | 0.340 |
| HR0200 | 6.3 | 6.8 | 140 | 150 | 0.272 |
| HR0210 | 13 | 24 | 150 | 240 | 0.359 |
| HR0220 | 6.3 | 6.6 | 85 | 90 | 0.168 |
| HR0230 | 7.2 | 7.5 | 86 | 91 | 0.169 |
| HR0240 | 2.0 | 2.0 | 75 | 77 | 0.226 |
| HR0250 | 10 | 21 | 190 | 330 | 0.349 |
| HR0260 | 0.88 | 36 | 60 | 240 | 0.186 |
| HR0270 | 2.1 | 38 | 64 | 280 | 0.169 |
| HR0280 | 6.5 | 7.6 | 87 | 100 | 0.192 |
| HR0290 | 20 | 57 | 180 | 460 | 0.340 |
| HR0300 | 2.7 | 3.6 | 60 | 67 | 0.111 |
| HR0310 | 2.8 | 8.8 | 75 | 110 | 0.154 |
| HR0320 | 4.7 | 5.8 | 51 | 58 | 0.088 |
| HR0330 | 13 | 21 | 180 | 230 | 0.366 |
| HR0340 | 22 | 24 | 170 | 190 | 0.194 |
| HR0350 | 19 | 20 | 150 | 150 | 0.154 |
| HR0360 | 8.0 | 8.0 | 88 | 88 | 0.140 |
| HR0370 | 21 | 21 | 230 | 230 | 0.376 |
| HR0380 | 5.9 | 6.1 | 130 | 140 | 0.212 |
| HR0390 | 31 | 34 | 280 | 310 | 0.457 |
| HR0400 | 18 | 18 | 160 | 160 | 0.290 |
| HR0410 | 7.4 | 8.4 | 68 | 77 | 0.084 |
| HR0420 | 1.8 | 2.5 | 59 | 70 | 0.124 |
| HR0430 | 4.7 | 4.7 | 90 | 90 | 0.295 |
| HR0440 | 5.5 | 5.5 | 130 | 130 | 0.357 |
| HR0450 | 9.5 | 9.5 | 85 | 85 | 0.140 |
| HR0510 | 0.35 | 19 | 33 | 140 | 0.157 |
| HR0520 | 23 | 24 | 200 | 210 | 0.488 |
| HR0530 | 1.2 | 1.2 | 76 | 80 | 0.258 |
| HR0540 | 0.30 | 0.30 | 37 | 37 | 0.206 |
| HR0550 | 0.56 | 0.57 | 50 | 51 | 0.110 |
| HR0560 | 0.22 | 0.22 | 25 | 25 | 0.150 |
| HR0570 | 8.6 | 8.9 | 170 | 180 | 0.453 |
| 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 |

JUNCTIONS

| NAME | 2 YR FLOWS (cfs) Existing | 2 YR FLOWS (cfs) Future | 100 YR FLOWS (cfs) Existing | 100 YR FLOWS (cfs) Future | DRAINAGE AREA (sq mi) |
|---|---|---|---|---|---|
| JHR0160 | 44 | 440 | 1200 | 2600 | 3.817 |
| JHR0185 | 50 | 450 | 1400 | 2700 | 4.252 |
| JHR0190 | 65 | 470 | 1400 | 2900 | 4.592 |
| JHR0220 | 17 | 30 | 210 | 330 | 0.527 |
| JHR0235 | 87 | 480 | 1700 | 3300 | 5.560 |
| JHR0240 | 88 | 470 | 1700 | 3400 | 5.786 |
| JHR0275 | 2.9 | 69 | 120 | 480 | 0.355 |
| JHR0280 | 6.5 | 75 | 200 | 570 | 0.547 |
| JHR0305 | 29 | 96 | 400 | 870 | 0.998 |
| JHR0325 | 36 | 110 | 490 | 1000 | 1.240 |
| JHR0330 | 44 | 120 | 600 | 1200 | 1.606 |
| JHR0340 | 49 | 130 | 640 | 1300 | 1.800 |
| JHR0350 | 52 | 130 | 670 | 1400 | 1.954 |
| JHR0365 | 150 | 600 | 2200 | 4800 | 8.229 |
| JHR0370 | 150 | 600 | 2300 | 5000 | 8.605 |
| JHR0380 | 150 | 600 | 2300 | 5000 | 8.817 |
| JHR0400 | 170 | 600 | 2400 | 5300 | 9.564 |
| JHR0430 | 5.6 | 6.7 | 150 | 150 | 0.419 |
| JHR0520 | 23 | 43 | 220 | 350 | 0.645 |
| JHR0540 | 24 | 44 | 270 | 420 | 1.109 |
| JHR0560 | 25 | 44 | 300 | 460 | 1.369 |
| JHR0570 | 29 | 48 | 370 | 520 | 1.822 |
| JHR0605 | 33 | 52 | 480 | 630 | 2.482 |

URS

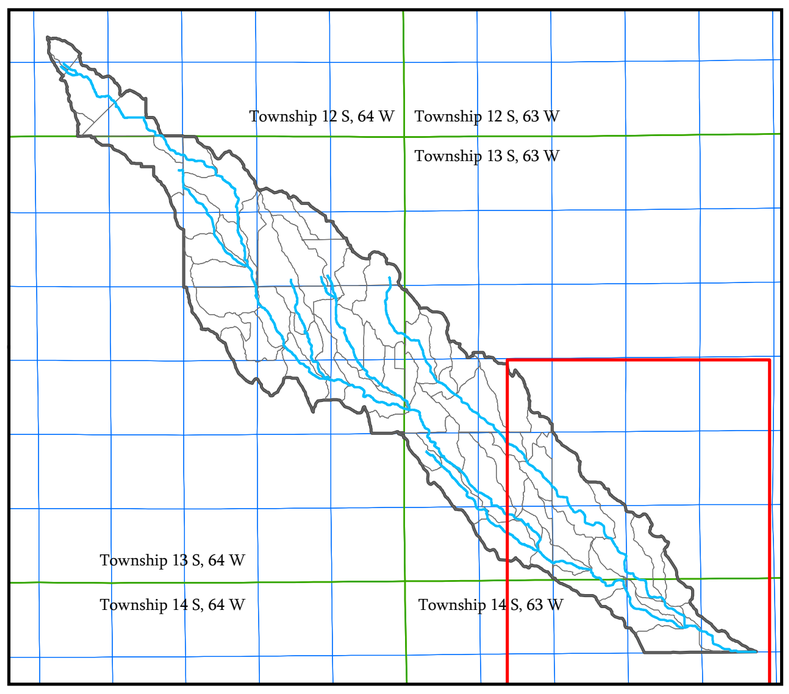
# HAEGLER RANCH DRAINAGE BASIN

## EXISTING AND FUTURE CONDITIONS HYDROLOGIC MODEL

URS NO. 21711039

DATE: 09/08

# FIGURE 4-4 SHEET 3




- JUNCTIONS
- JHR0025 - JUNCTION IDENTIFIERS
- HR0010 - SUBBASIN IDENTIFIERS
- REACHES
- POTENTIAL WETLANDS
- HAEGLER RANCH BASIN BOUNDARY
- SUBBASIN BOUNDARIES

Sheet 2 Matchline Sheet 3

Township 13 S, Range 63 W

Township 14 S, Range 63 W

SUBBASINS

| NAME | 2 YR FLOWS (cfs) Existing | 2 YR FLOWS (cfs) Future | 100 YR FLOWS (cfs) Existing | 100 YR FLOWS (cfs) Future | SUBBASIN AREA (sq. mi) |
|---|---|---|---|---|---|
| HR0390 | 31 | 34 | 280 | 310 | 0.457 |
| HR0400 | 18 | 18 | 160 | 160 | 0.290 |
| 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

| NAME | 2 YR FLOWS (cfs) Existing | 2 YR FLOWS (cfs) Future | 100 YR FLOWS (cfs) Existing | 100 YR FLOWS (cfs) Future | DRAINAGE 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 |

N W E S

0 2,500 5,000

Feet

1:12,000 1" = 1,000 ft.

URS

# HAEGLER RANCH DRAINAGE BASIN

## EXISTING AND FUTURE CONDITIONS HYDROLOGIC MODEL

URS NO. 21711039

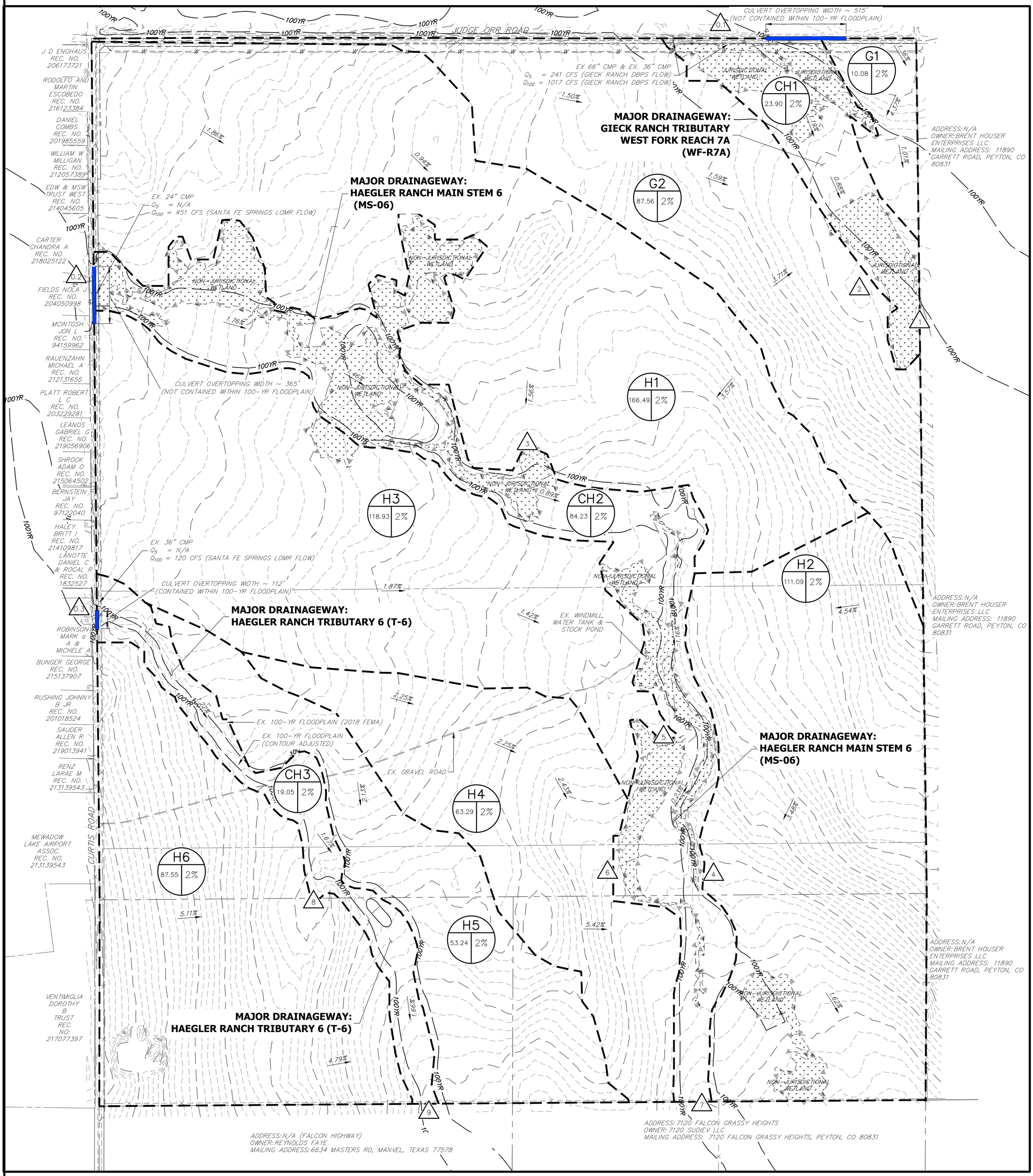
DATE: 09/08

# APPENDIX F

# DRAINAGE MAPS

# 824 ACRE CURTIS ROAD SUBDIVISION

## EX. CONDITIONS DRAINAGE MAP




## LEGEND

I.D. (A | B)

BASIN DESIGNATION

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

X — DESIGN POINT

BASIN DELINEATION

--6100-- EXISTING INDEX CONTOURS

EXISTING INTERMEDIATE CONTOURS

EXISTING FLOW DIRECTION

**BASIN SUMMARY TABLE**

| Tributary Sub-Basin | Area (acres) | Percent Impervious | $Q_5$ (cfs) | $Q_{100}$ (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 |

**DESIGN POINT SUMMARY TABLE**

| Tributary Sub- | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|
| 0.1 | 241.00 | 1017.0 |
| 0.2 | - | 451.0 |
| 0.3 | - | 120.0 |
| 1 | 6.9 | 1114.0 |
| 2 | 1.5 | 76.4 |
| 3 | 0.1 | 80.9 |
| 4 | 0.1 | 91.1 |
| 5 | 0.9 | 64.1 |
| 6 | 1.4 | 73.2 |
| 7 | 4.1 | 704.9 |
| 8 | 0.2 | 110.1 |
| 9 | 0.4 | 248.1 |

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


J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com


X:\25100.all\25142.00\Drawings\Sheet Dwgs_Drainage\2018-10-09_Ex.Drainage Map.dwg, EX. DR01, 5/8/2020 12:25:28 PM, ClarkD

# SADDLEHORN RANCH SUBDIVISION

## PROPOSED DRAINAGE MAP

SEE SHEET 2

| BASIN SUMMARY TABLE | | | | |
|---|---|---|---|---|
| Tributary Sub-Basin | Area (acres) | Composite Percent Impervious | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
| A | 9.2 | 66.6% | 9.5 | 20.7 |
| B | 60.4 | 10.4% | 9.9 | 46.3 |
| C | 102.5 | 11.4% | 15.8 | 69.4 |
| 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 | 69.9 |
| G | 39.9 | 16.8% | 6.1 | 25.3 |
| H | 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 | 14.7 |
| UD2.2 | 7.2 | 2.0% | 0.1 | 5.5 |
| UD3 | 13.4 | 2.0% | 0.2 | 13.1 |
| UD4 | 4.8 | 2.0% | 0.03 | 3.4 |
| 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 | 4.6 | 2.0% | 0.03 | 3.3 |
| UD8.1 | 5.3 | 2.0% | 0.1 | 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 | 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 |
| B | POND B | 60.4 | 0.35 | 1.46 | 2.17 | 18.9 | 21.0 |
| C | 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 |
| H | 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 |

**LEGEND**

- BASIN DESIGNATION (I.D.: A / B) — I.D.: BASIN IDENTIFIER; A: BASIN AREA; B: COMP. % IMPERVIOUS
- DESIGN POINT (X)
- 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
SUBDIVISION
MDDP DRAINAGE MAP
25142.00
12/18/19
SHEET 1 OF 3

**NOTES**

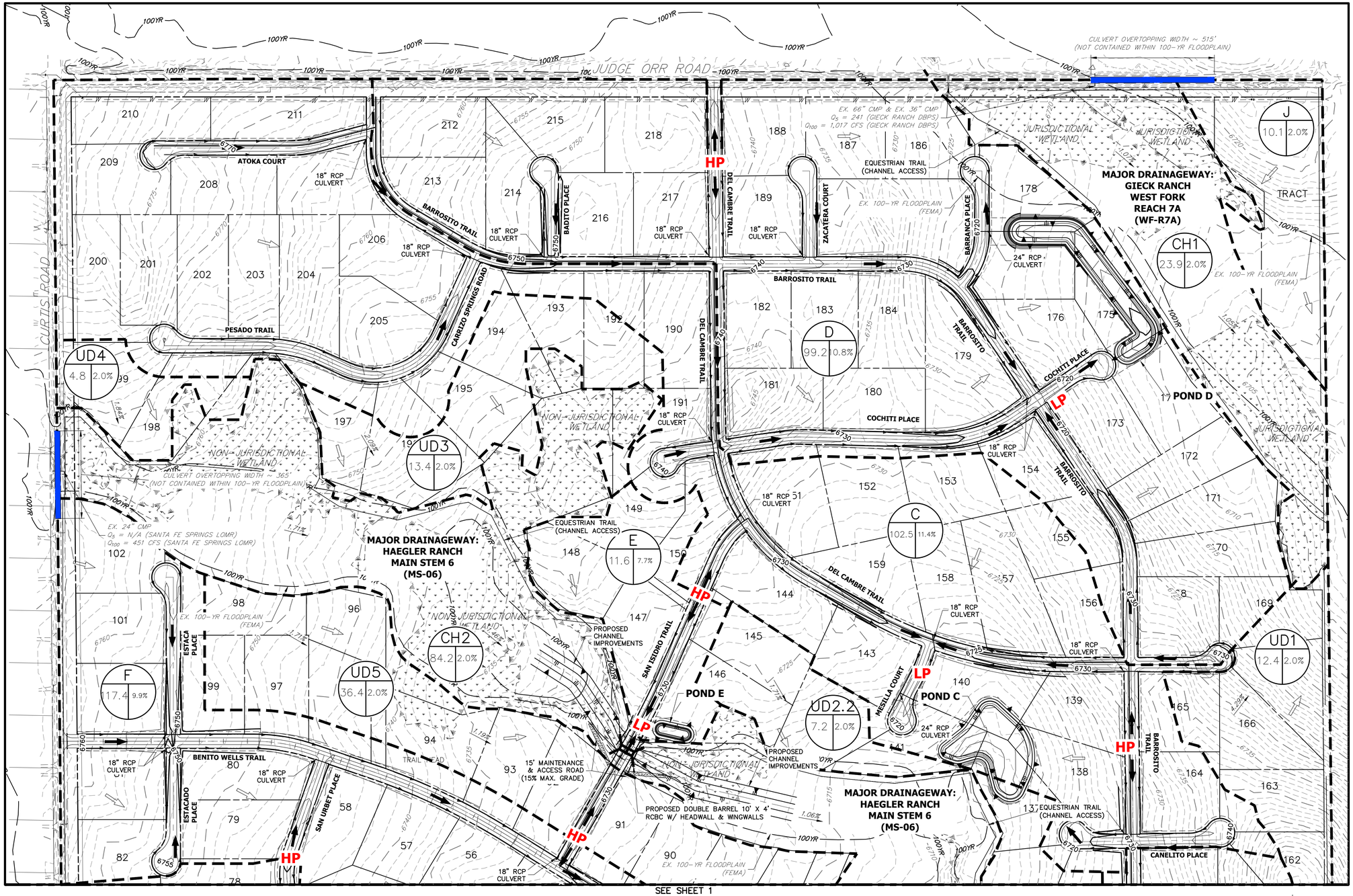
1. ALL CULVERT SIZES ARE PRELIMINARY AND SUBJECT TO CHANGE WITH FINAL DRAINAGE REPORTS.

200 100 0 200 400
ORIGINAL SCALE: 1" = 200'

J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

X:\25100\00 all\25142\00\Drawings\Sheet Dwgs\L_Drainage\Pr Drainage Map Aerg_DRB1_200_5/8/2020 12:31:16 PM, ClarkD

# SADDLEHORN RANCH SUBDIVISION
## PROPOSED DRAINAGE MAP




SEE SHEET 1

| BASIN SUMMARY TABLE | | | | |
|---|---|---|---|---|
| Tributary Sub-Basin | Area (acres) | Composite Percent Impervious | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
| A | 9.2 | 66.6% | 9.5 | 20.7 |
| B | 60.4 | 10.4% | 9.9 | 46.3 |
| C | 102.5 | 11.4% | 15.8 | 69.4 |
| 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 | 69.9 |
| G | 39.9 | 16.8% | 6.1 | 25.3 |
| H | 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 | 14.7 |
| UD2.2 | 7.2 | 2.0% | 0.1 | 5.5 |
| UD3 | 13.4 | 2.0% | 0.2 | 13.1 |
| UD4 | 4.8 | 2.0% | 0.03 | 3.4 |
| 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 | 4.6 | 2.0% | 0.03 | 3.3 |
| UD8.1 | 5.3 | 2.0% | 0.1 | 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 | 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 |
| B | POND B | 60.4 | 0.35 | 1.46 | 2.17 | 18.9 | 21.0 |
| C | 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 |
| H | 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 |

## LEGEND

- I.D. (A | B): BASIN DESIGNATION — I.D.: BASIN IDENTIFIER; A: BASIN AREA; B: COMP. % IMPERVIOUS
- X: DESIGN POINT
- 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

## NOTES

1. ALL CULVERT SIZES ARE PRELIMINARY AND SUBJECT TO CHANGE WITH FINAL DRAINAGE REPORTS.

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

200 100 0 200 400
ORIGINAL SCALE: 1" = 200'

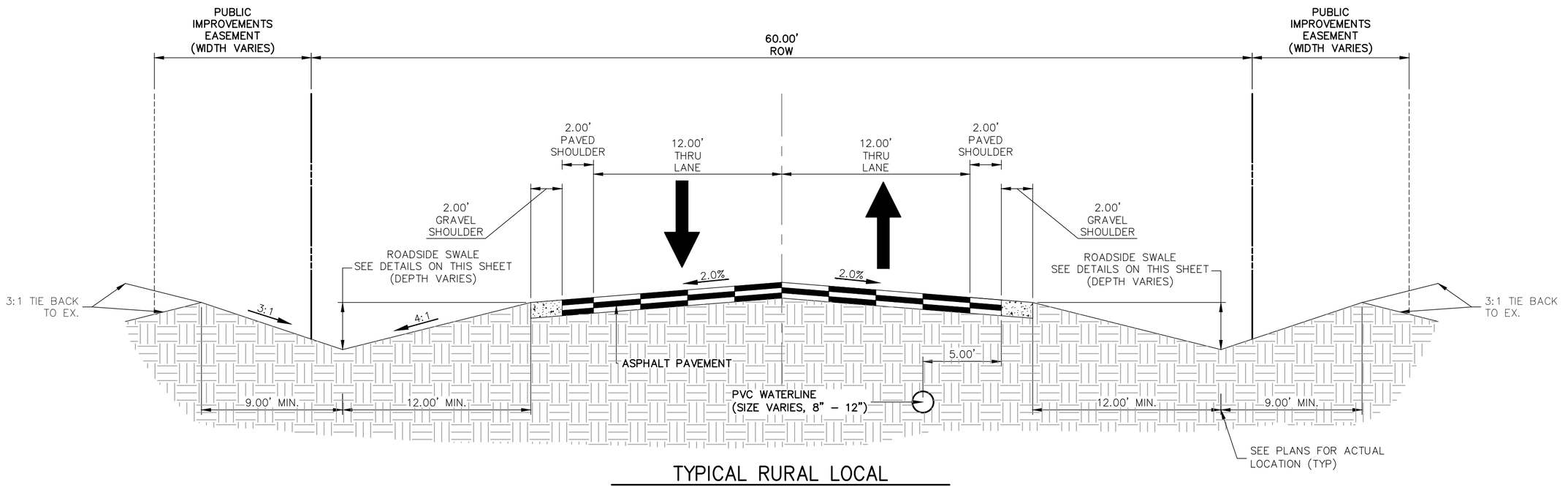

J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com



X:\25\10000-allf\25142\00\Drawings\Sheet Dwgs_Drainage\Pr Drainage Map.dwg, DR01_20X11, 5/9/2020 12:31:44 PM, ClarkD

# SADDLEHORN RANCH

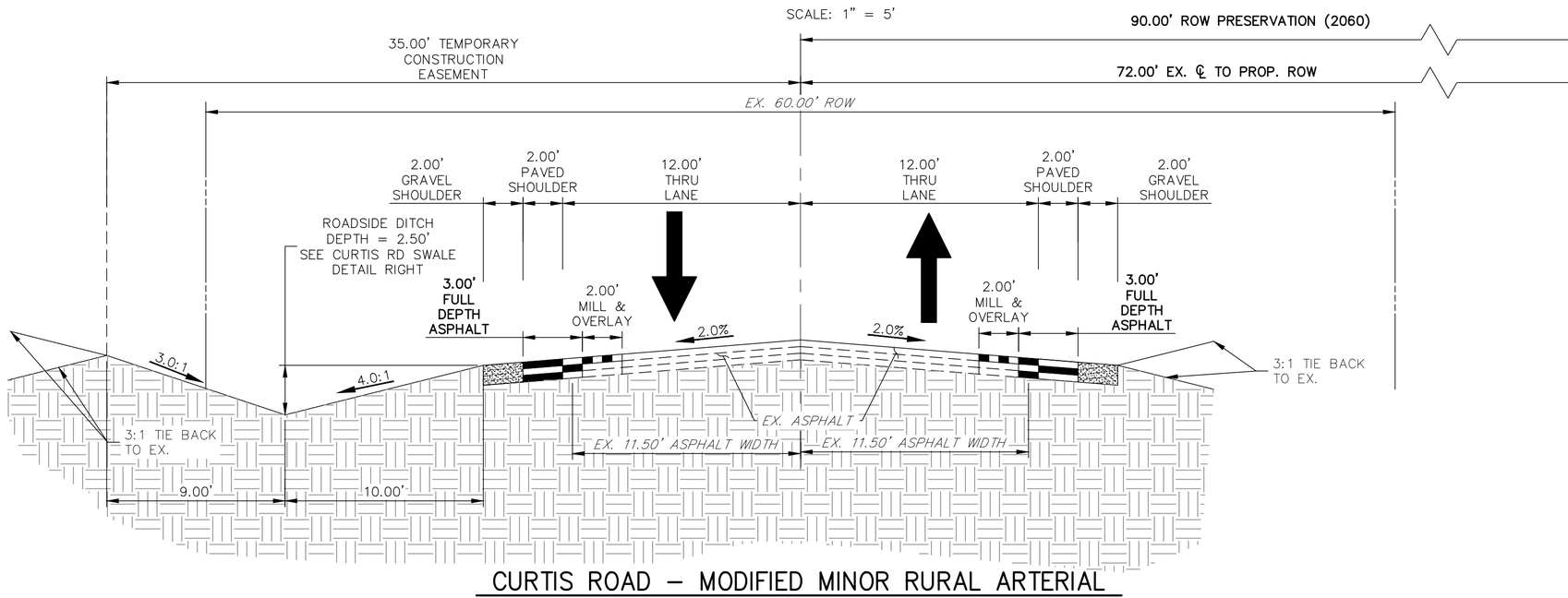
## TYPICAL ROADWAY SECTIONS




### TYPICAL RURAL LOCAL

POSTED SPEED LIMIT = 30 MPH, DESIGN SPEED LIMIT = 30 MPH

SCALE: 1" = 5'



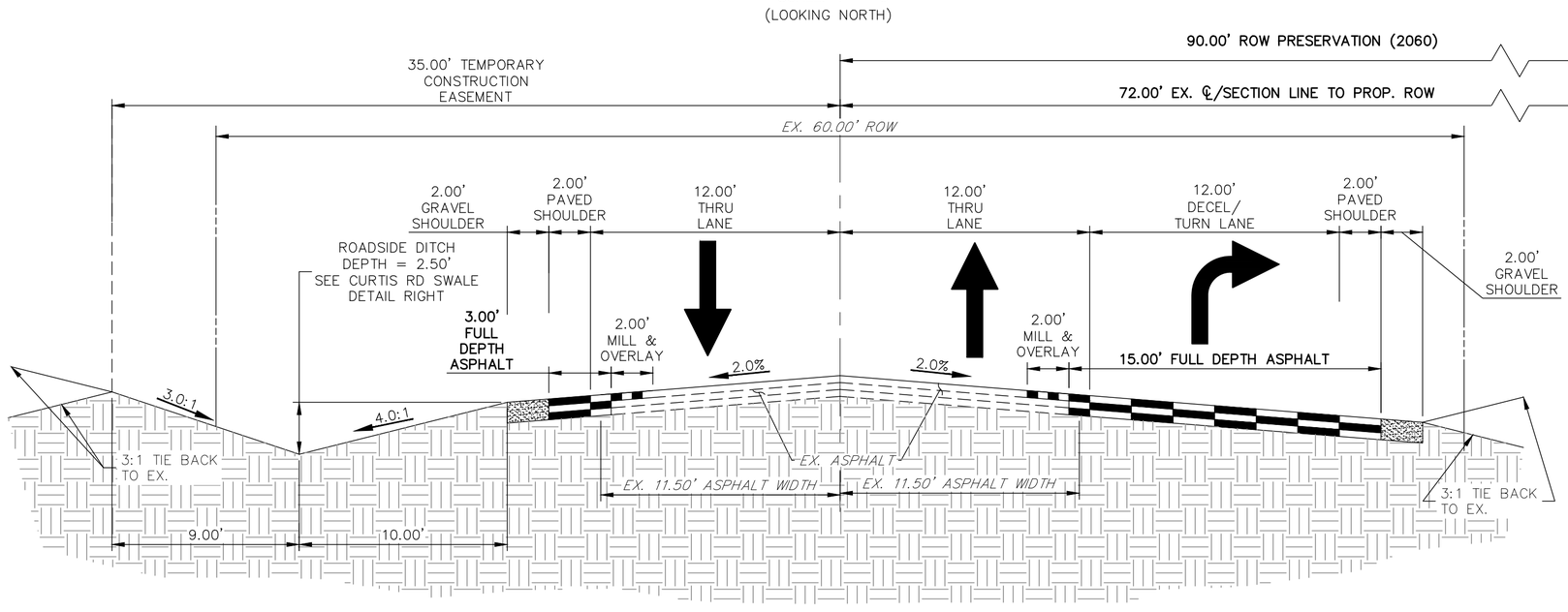

### CURTIS ROAD – MODIFIED MINOR RURAL ARTERIAL

STA: 1+05 – 10+40.09 & 15+82.58 – 30+81.13

POSTED SPEED LIMIT = 45 MPH

SCALE: 1" = 5'

(LOOKING NORTH)



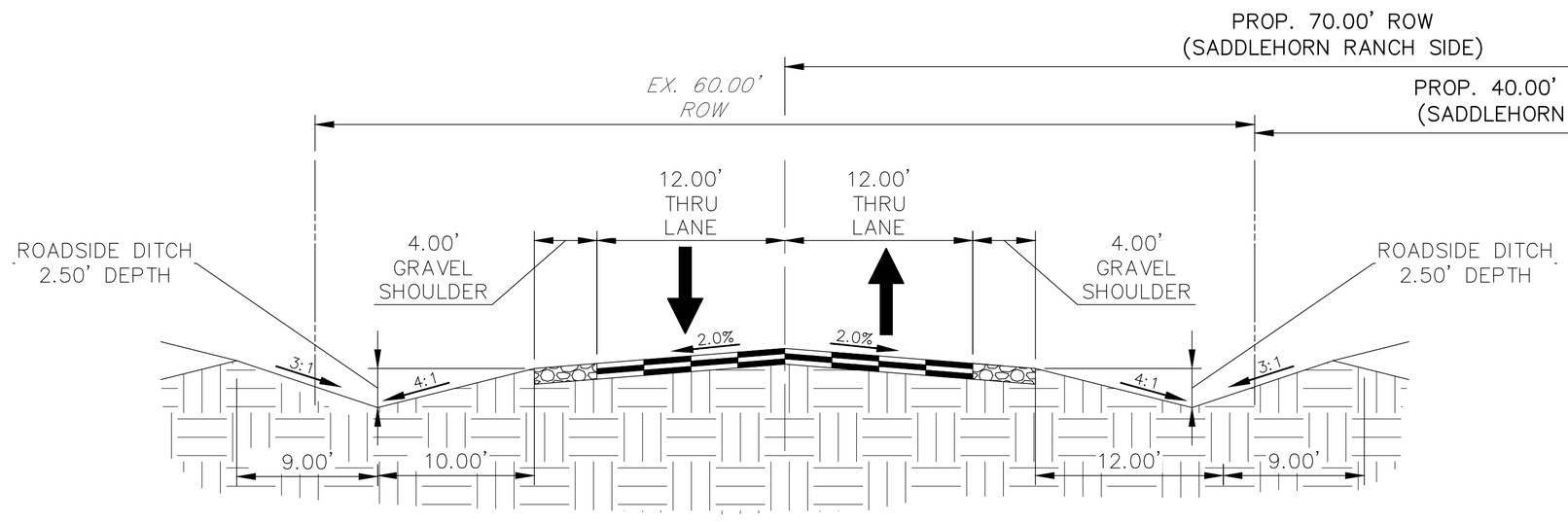

### CURTIS ROAD – MODIFIED MINOR RURAL ARTERIAL

STA: 12+42.36 – 14+94.72

POSTED SPEED LIMIT = 45 MPH

SCALE: 1" = 5'

(LOOKING NORTH)




### EX. JUDGE ORR ROAD – TYPICAL SECTION

POSTED SPEED LIMIT = 45 MPH, DESIGN SPEED LIMIT = 50 MPH

SADDLEHORN RANCH
TYPICAL ROADWAY SECTIONS
2514200
12/18/19
SHEET 3 OF 3

J·R ENGINEERING
A Westrian Company

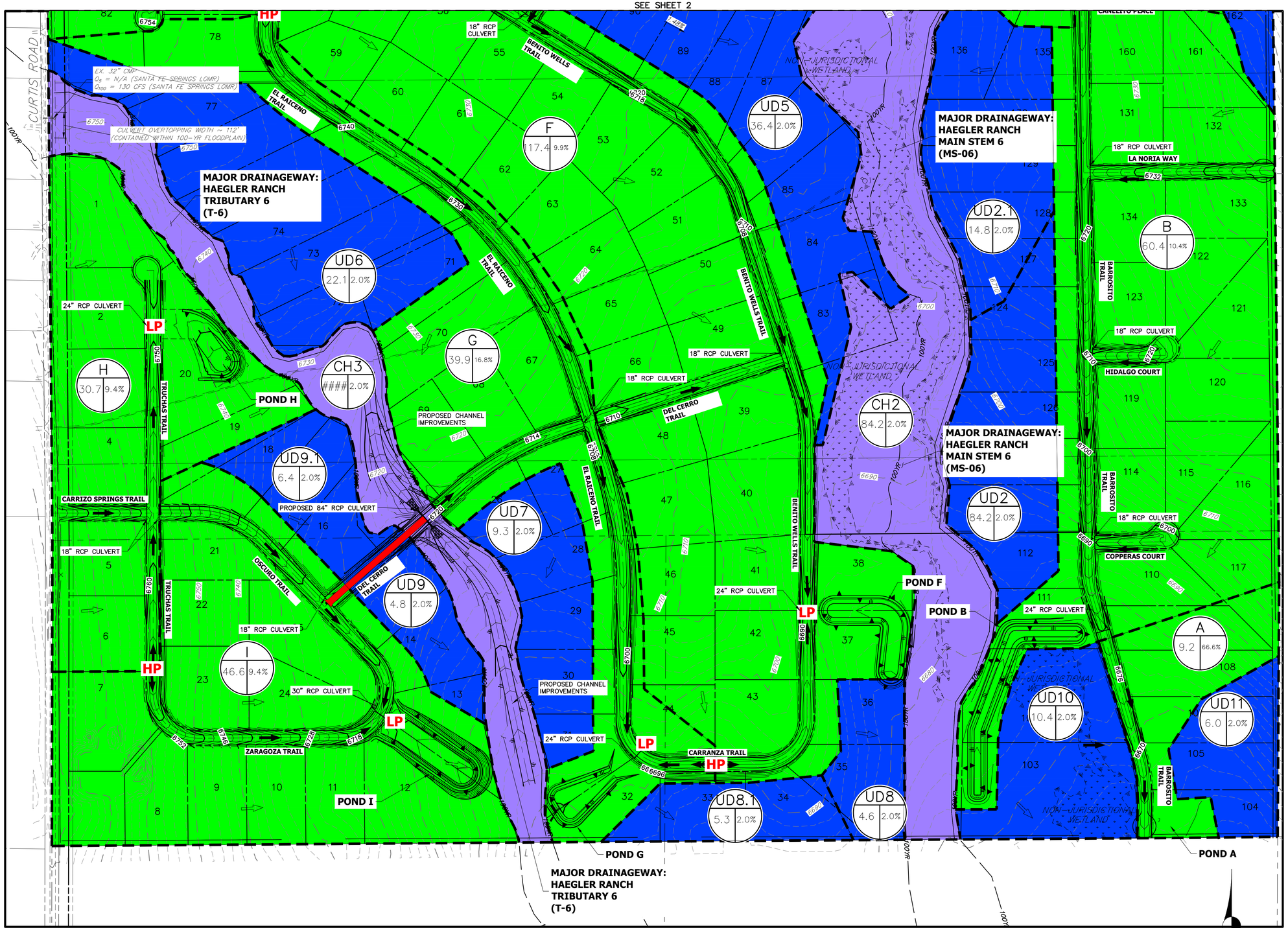
Centennial 303–740–9393 • Colorado Springs 719–593–2593
Fort Collins 970–491–9888 • www.jrengineering.com

X:\2510000.all\2514200\Drawings\Sheet Dwgs_Drainage\Pr_Drainage Map.dwg, TYP SECTIONS, 12/18/2019 9:37:12 AM, CS

# SADDLEHORN RANCH SUBDIVISION

## PERMANENT BMP APPLICABILITY MAP

SEE SHEET 2




### LEGEND

- I.D. (A / B): BASIN DESIGNATION
  I.D.: BASIN IDENTIFIER
  A: BASIN AREA
  B: COMP. % IMPERVIOUS
- 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
- AREA DETAINED IN PBMP
- AREA NOT DETAINED IN PBMP PER SECTION I.7.1.B.5 (RURAL 2.5+ ACRE LOTS W/ IMPERVIOUSNESS < 10%)
- AREA NOT DETAINED IN PBMP PER SECTION I.7.1.C.1 (20%, UP TO 1 AC, OF DEVELOPMENT SITE CAN BE EXCLUDED – DUE TO TOPOGRAPHY)
- AREA NOT DETAINED IN PBMP PER SECTION I.7.1.B.7 (LAND DISTURBANCE TO UNDEV. LAND THAT WILL REMAIN UNDEV.)

### NOTES

1. ALL CULVERT SIZES ARE PRELIMINARY AND SUBJECT TO CHANGE WITH FINAL DRAINAGE REPORTS.

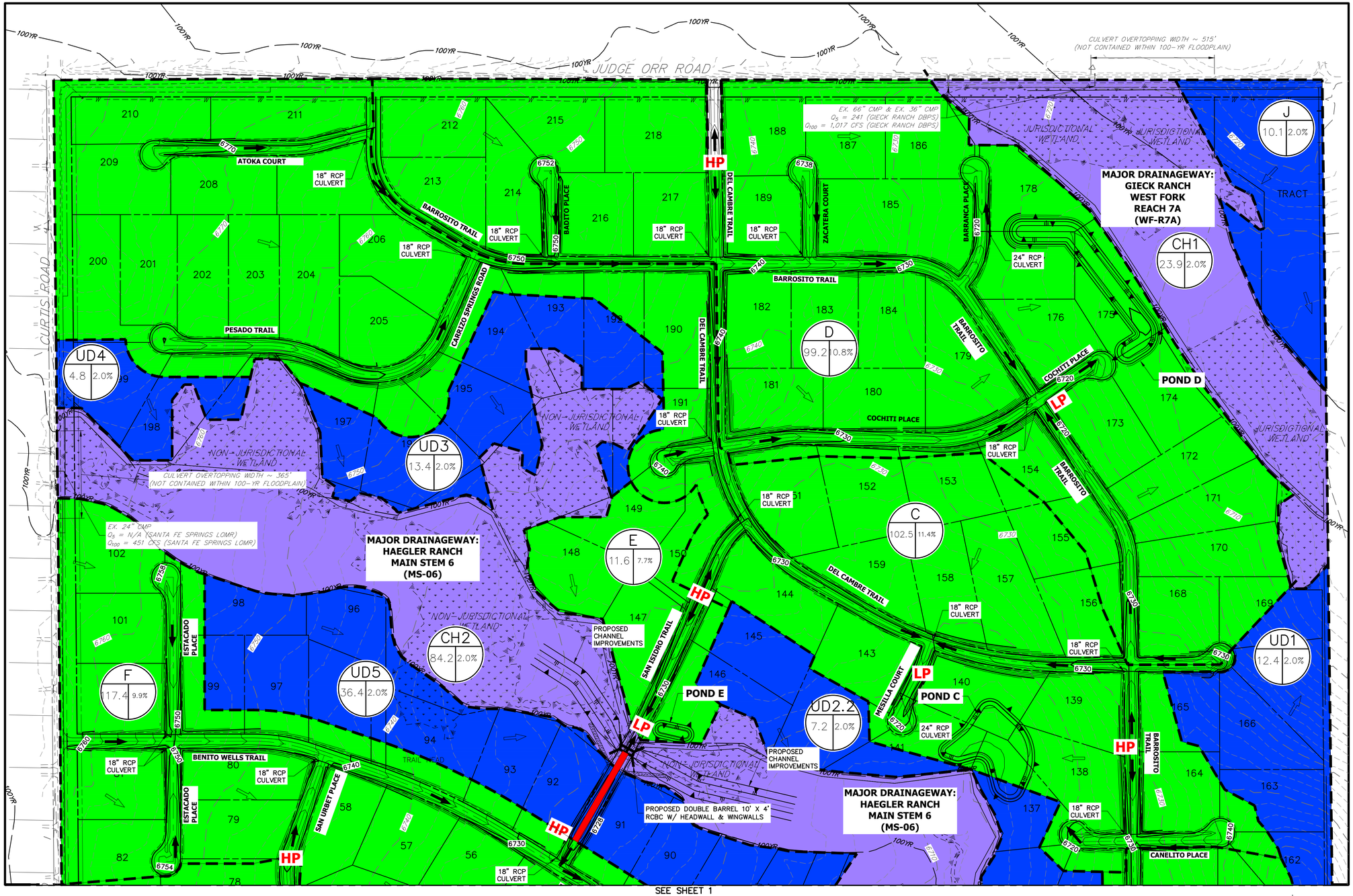
200 100 0 200 400
ORIGINAL SCALE: 1" = 200'

SADDLEHORN RANCH
SUBDIVISION
DRAINAGE MAP
25142.00
11/27/19
SHEET 1 OF 2

J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

X:\25100\00_all\25142\00\Drawings\Sheet Dwgs_Drainage\2019-12-02_MS4 Exclusion Map.dwg, DR01_200, 12/2/2019 11:47:07 AM, CS

# SADDLEHORN RANCH SUBDIVISION
## PERMANENT BMP APPLICABILITY MAP




## LEGEND

- I.D. (A / B): BASIN DESIGNATION
  - I.D.: BASIN IDENTIFIER
  - A: BASIN AREA
  - B: COMP. % IMPERVIOUS
- 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
- AREA DETAINED IN PBMP
- AREA NOT DETAINED IN PBMP PER SECTION I.7.1.B.5 (RURAL 2.5+ ACRE LOTS W/ IMPERVIOUSNESS < 10%)
- AREA NOT DETAINED IN PBMP PER SECTION I.7.1.C.1 (20%, UP TO 1 AC, OF DEVELOPMENT SITE CAN BE EXCLUDED – DUE TO TOPOGRAPHY)
- AREA NOT DETAINED IN PBMP PER SECTION I.7.1.B.7 (LAND DISTURBANCE TO UNDEV. LAND THAT WILL REMAIN UNDEV.)

## NOTES

1. ALL CULVERT SIZES ARE PRELIMINARY AND SUBJECT TO CHANGE WITH FINAL DRAINAGE REPORTS.

SADDLEHORN RANCH
DRAINAGE MAP
25142.00
11/27/19
SHEET 2 OF 2

200 100 0 200 400
ORIGINAL SCALE: 1" = 200'


J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com



X:\25\25000-all\25142\00\Drawings\Sheet Dwgs_Drainage\2019-12-02_MS4 Exclusion Map.dwg, DR01_200(1), 12/2/2019 11:47:09 AM, CS