MASTER DEVELOPMENT DRAINAGE PLAN
and PRELIMINARY DRAINAGE REPORT
FOR
SADDLEHORN RANCH

Prepared For:
ROI Property Group, LLC
2495 Rigdon Street
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May 8, 2020
Project No. 25142.00

Prepared By:
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El Paso County PCD File No.
SP-19-006

Add text:
PPR21-020

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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 11/30/20

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

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

Date

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 Munro 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:

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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.

<u>Existing Gieck Ranch Drainage Basin</u>

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.

<u>Existing Haegler Ranch Drainage Basin</u>

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;

<u>Existing Geick Ranch West Fork Reach 7A (WF-R7A)</u>

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.

<u>Existing Haegler Ranch Main Stem (MS-06)</u>

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'

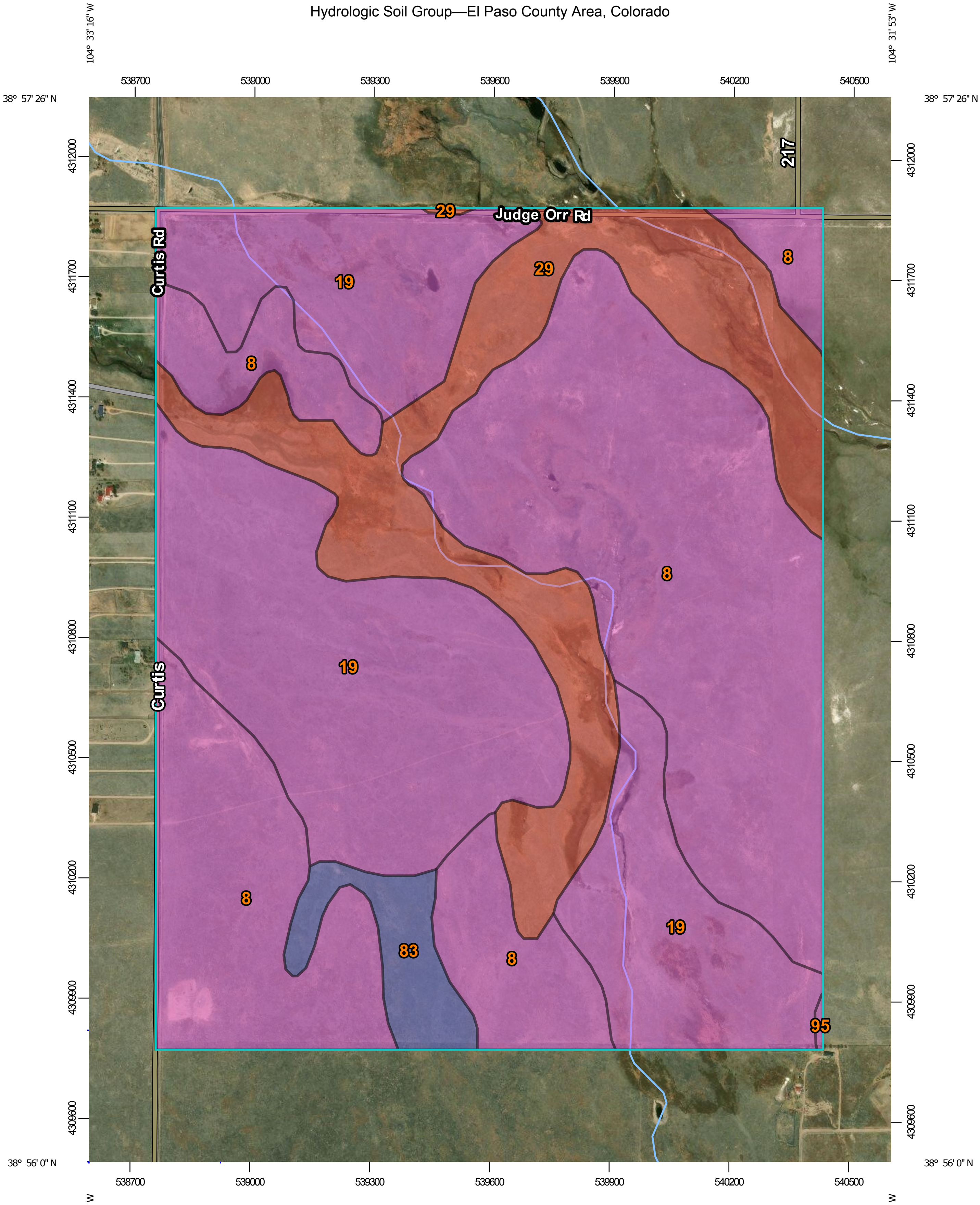
N

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.

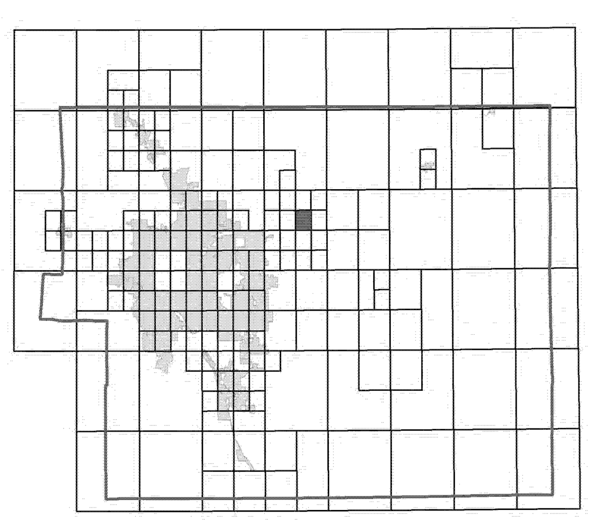
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this 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

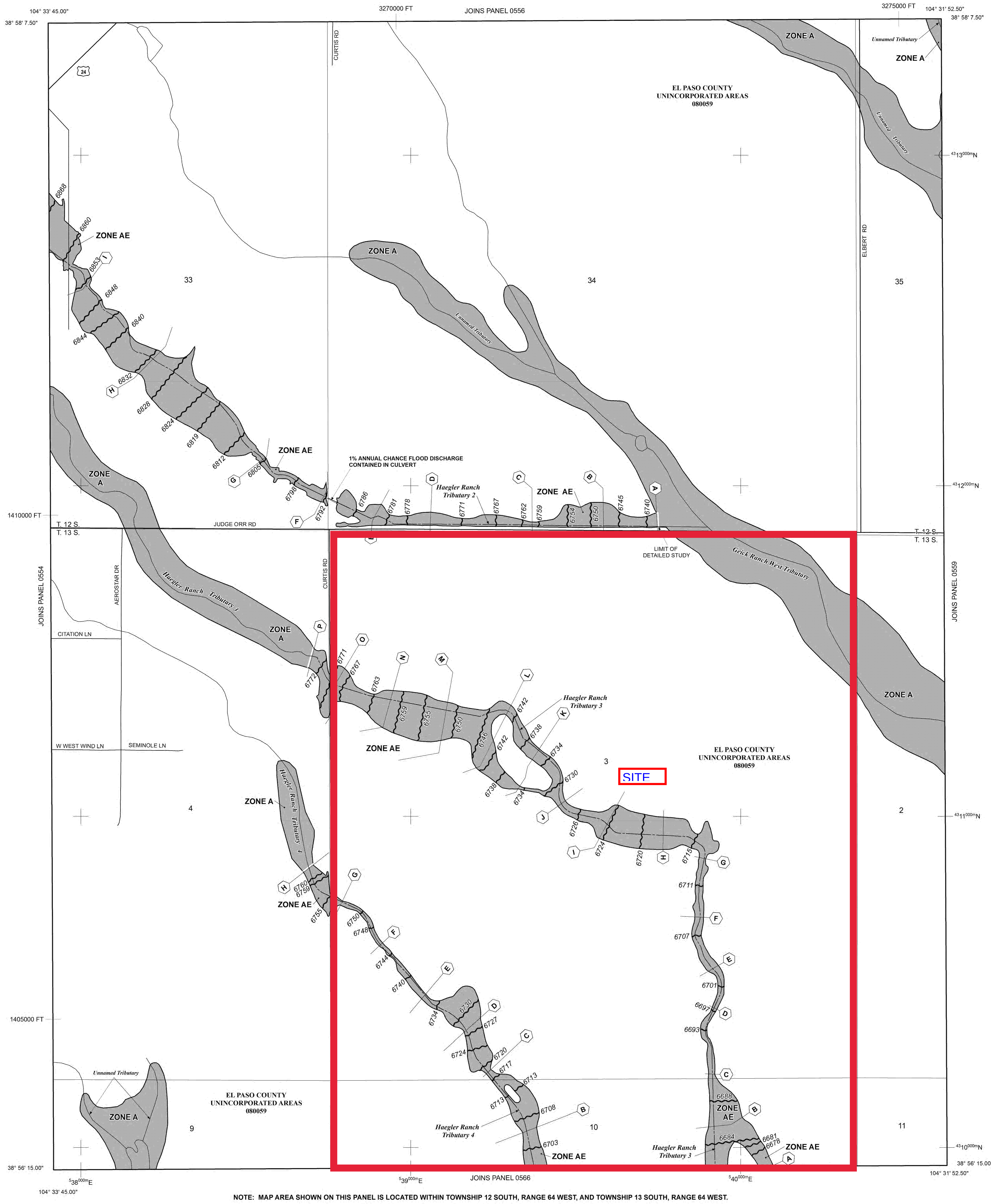
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

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.



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

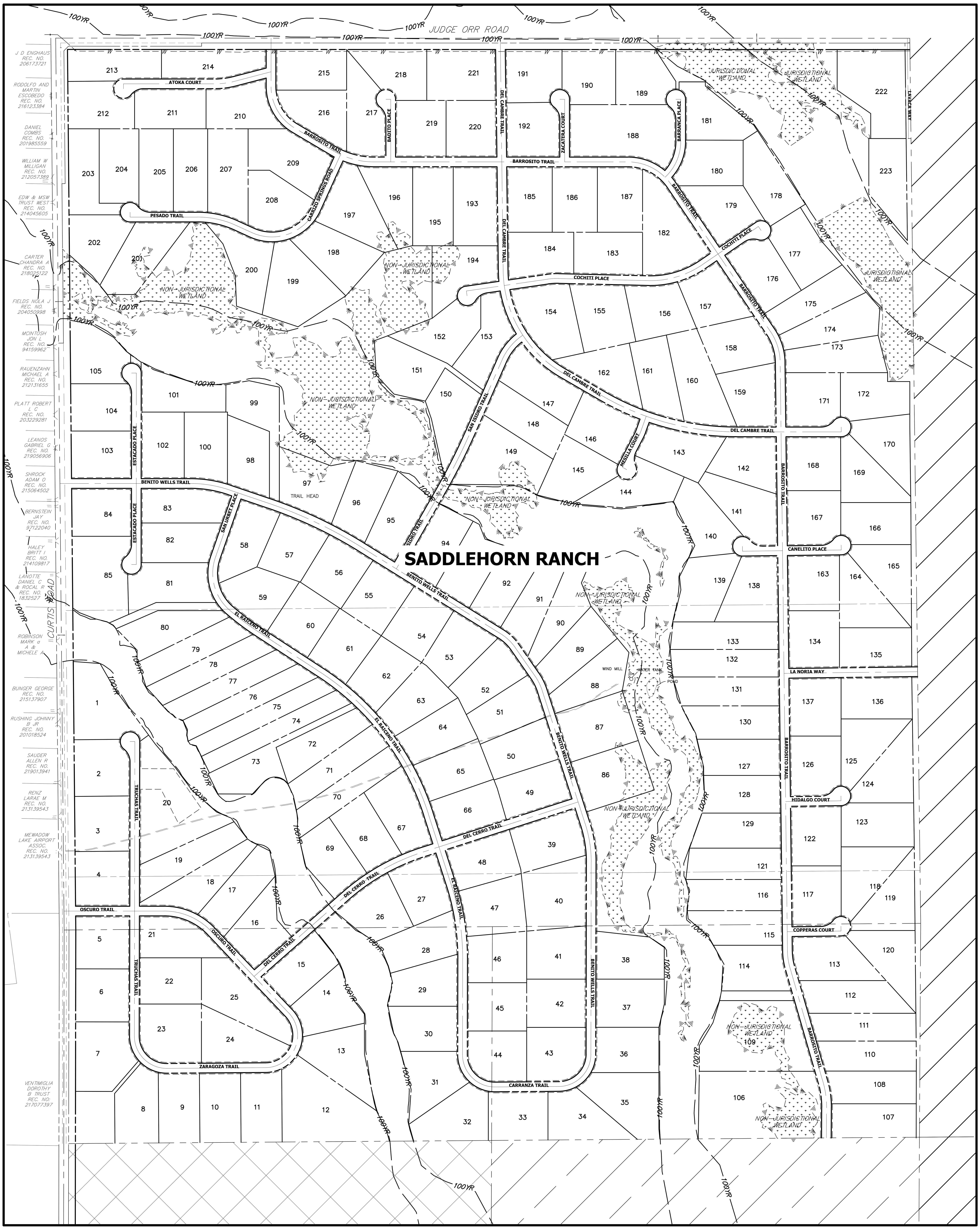
Notice to User: The **Map Number** shown below should be used when placing map orders: the **Community Number** shown above should be used on insurance applications for the subject community.

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

300 150 0 300 600
ORIGINAL SCALE: 1" = 300'

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

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Fort Collins 970-491-9888 • www.jrengineering.com

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 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 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 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 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 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 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 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

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	

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			
Time	Adjusted Depth	Unadjusted Depth		NOAA Atlas 14 Point Precipitation Frequency	
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

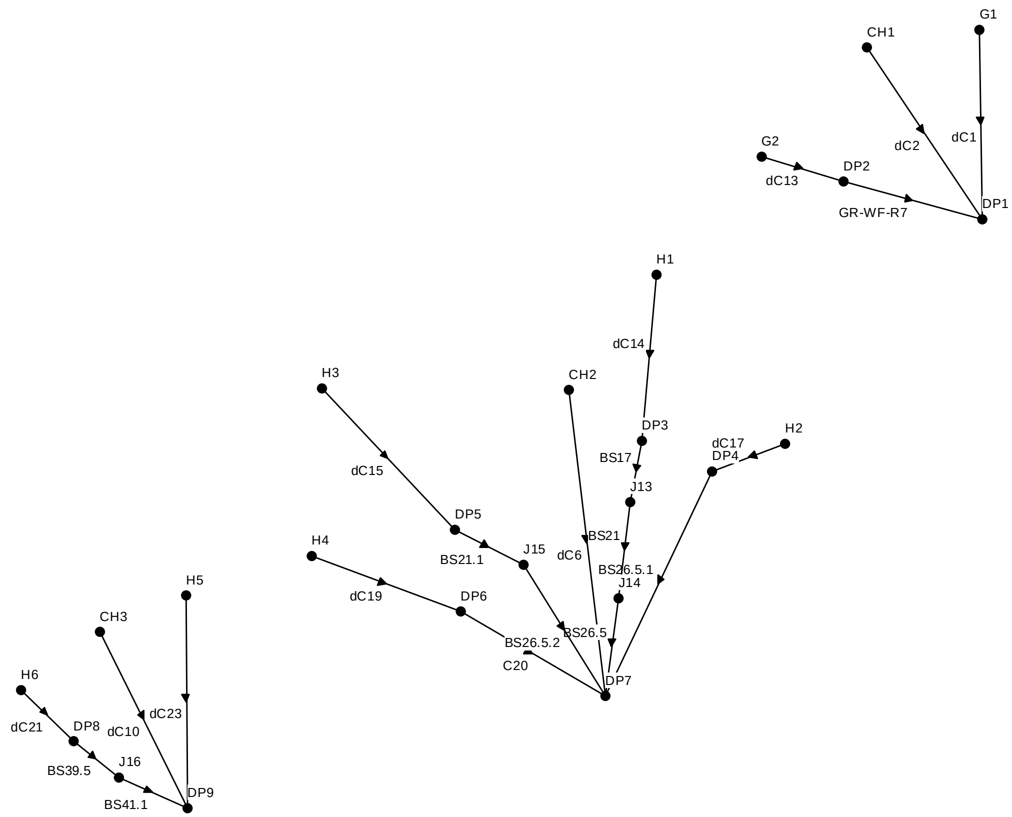
Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
CH1	JUNCTION	1038.04	1038.04	0	00:55	165	165	0.000
CH2	JUNCTION	485.11	485.11	0	01:15	75.2	75.2	0.000
CH3	JUNCTION	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

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
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

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 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

SADDLEHORN RANCH - PROPOSED CONDITIONS SWMM MODEL

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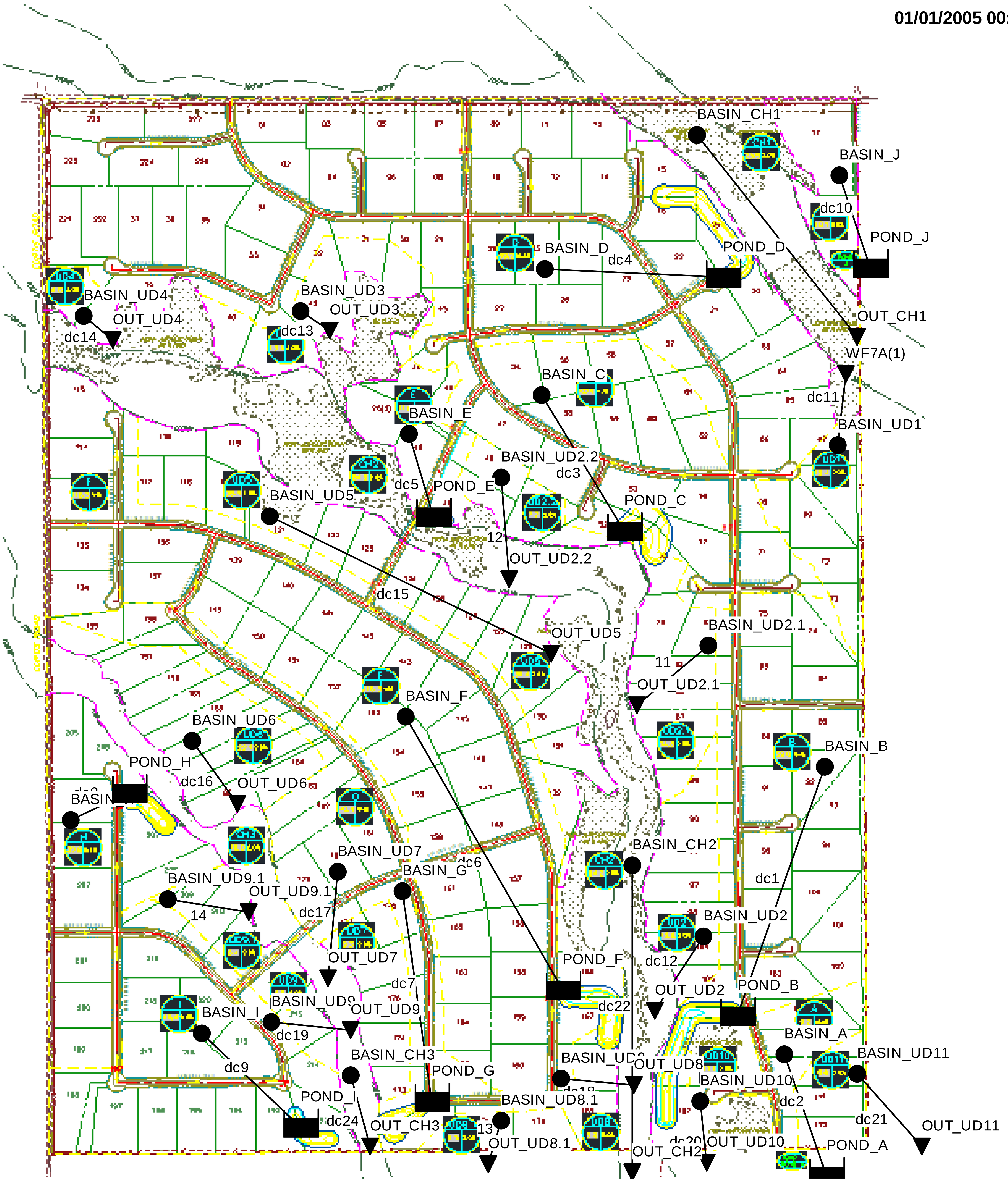
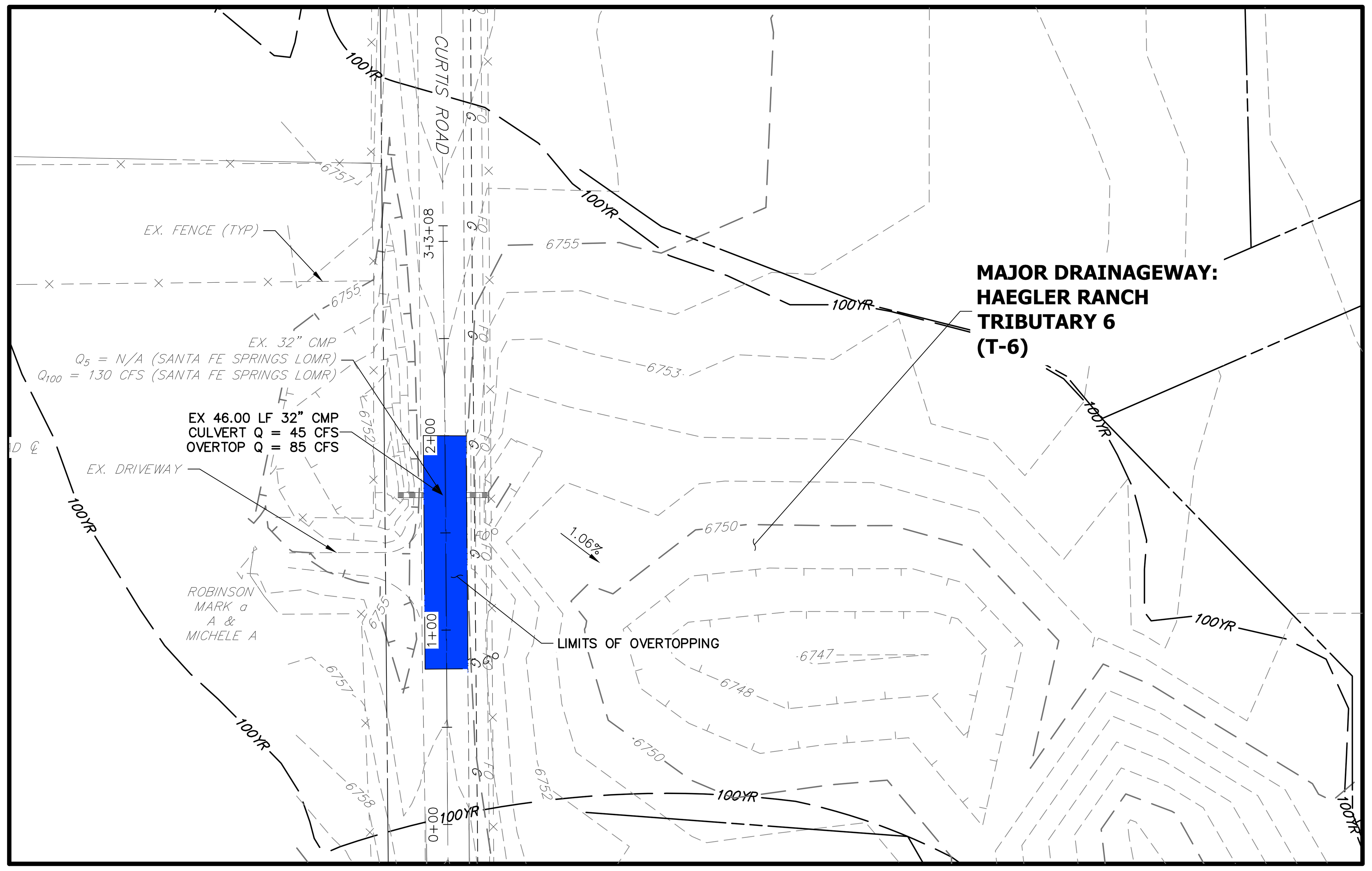


APPENDIX C

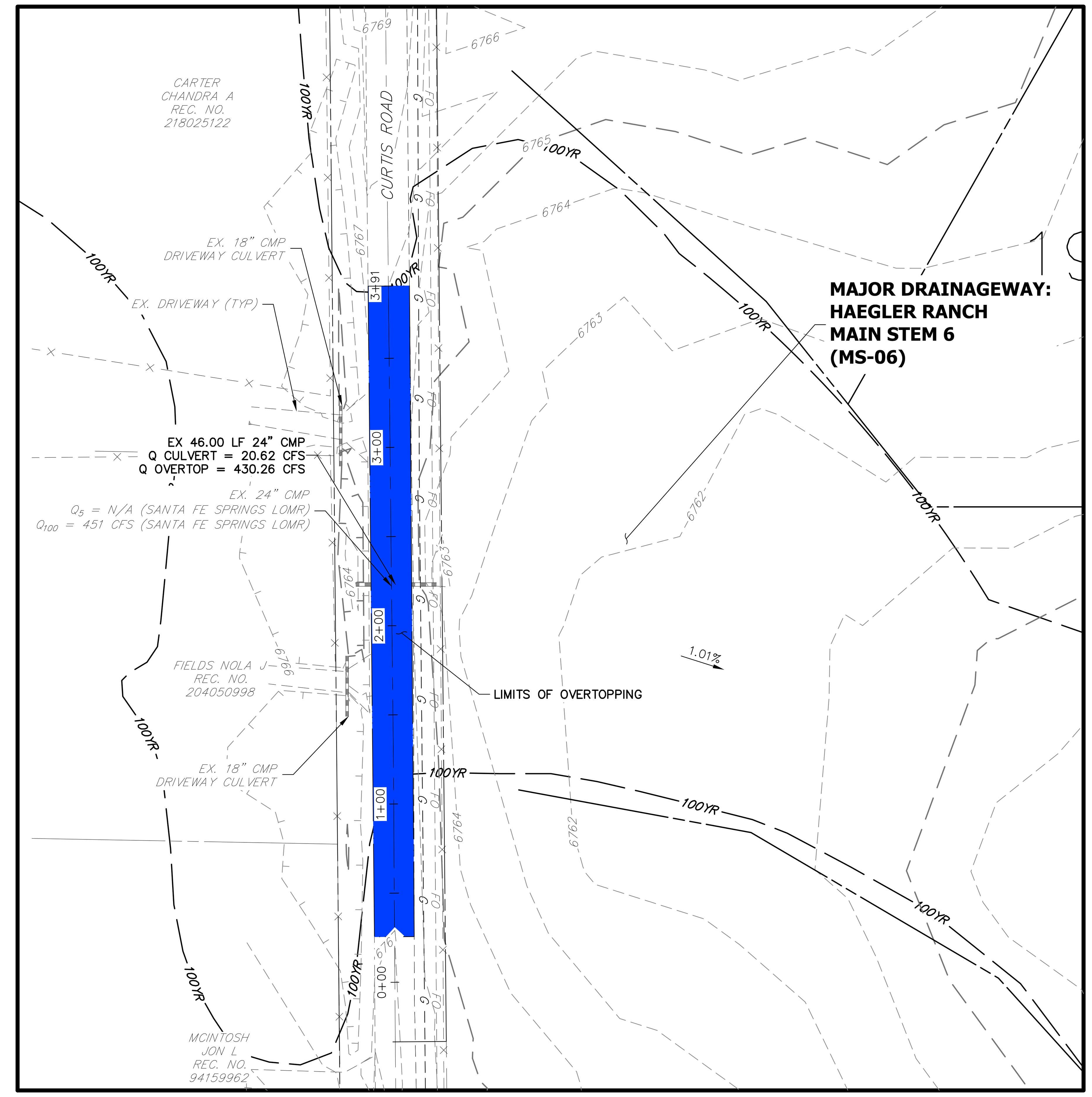
HYDRAULIC CALCULATIONS

SADDLEHORN RANCH

SOUTHERNMOST CURTIS ROAD CULVERT - 36" CMP



NORTHERNMOST CURTIS ROAD CULVERT - 24" CMP



CURTIS ROAD CL PROFILE
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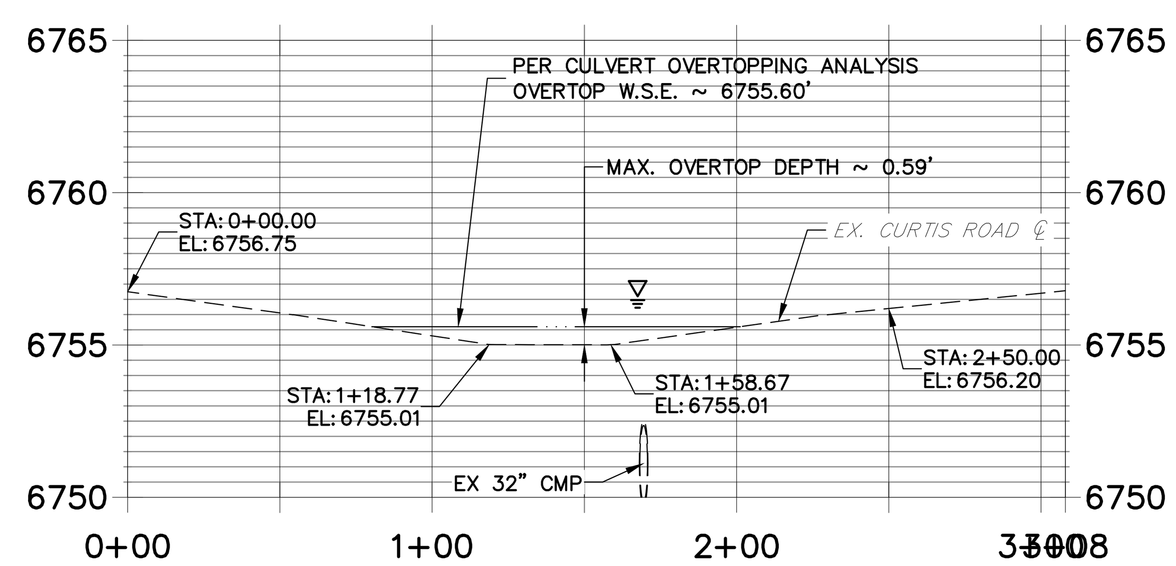

CURTIS ROAD NORTH CULVERT ROAD PROFILE PROFILE
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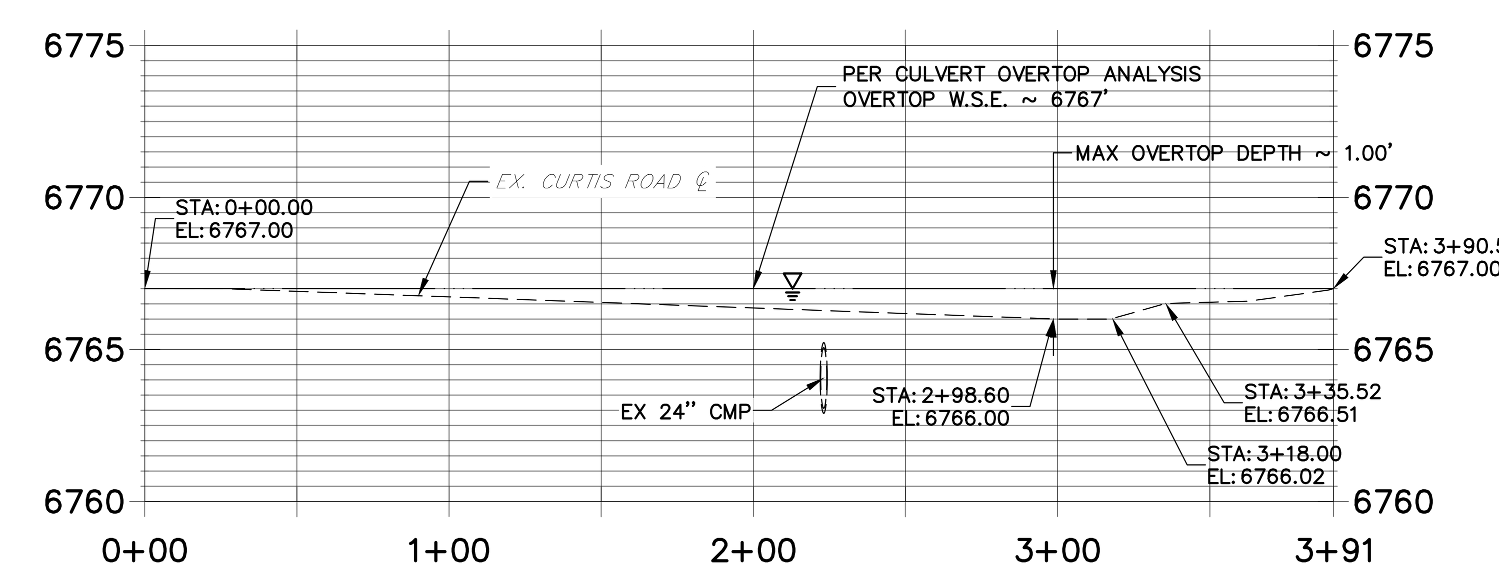

SADDLEHORN RANCH
EX. CULVERT OVERTOPPING
2514200
11/27/19
SHEET 1 OF 2

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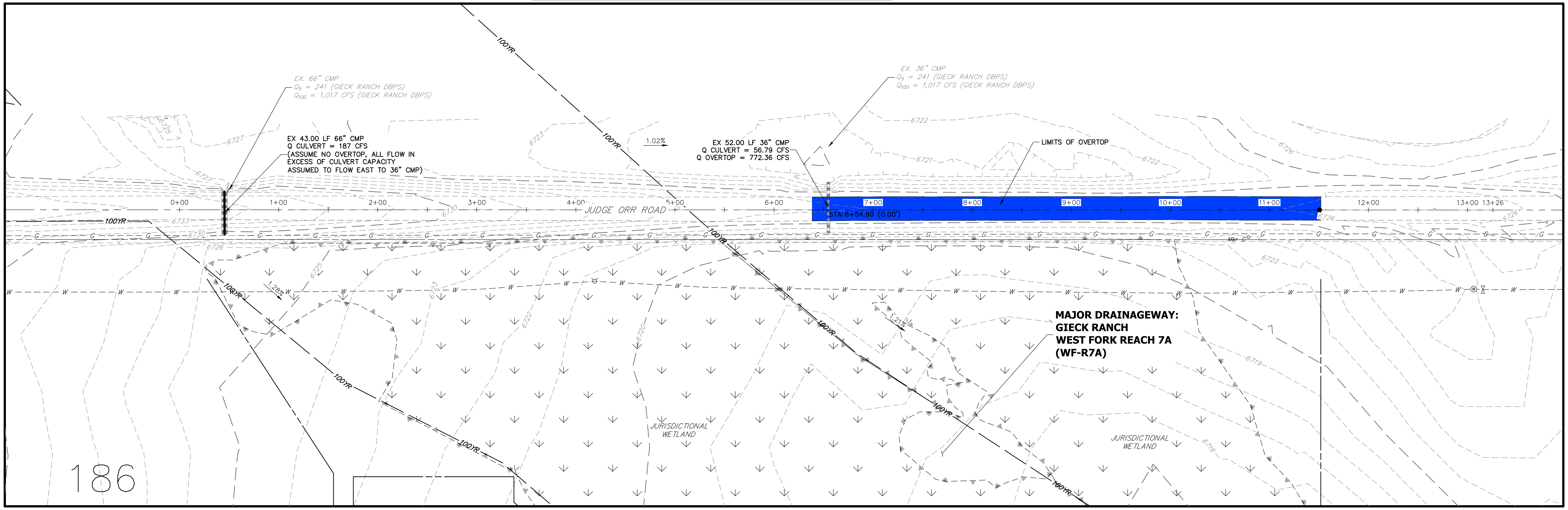
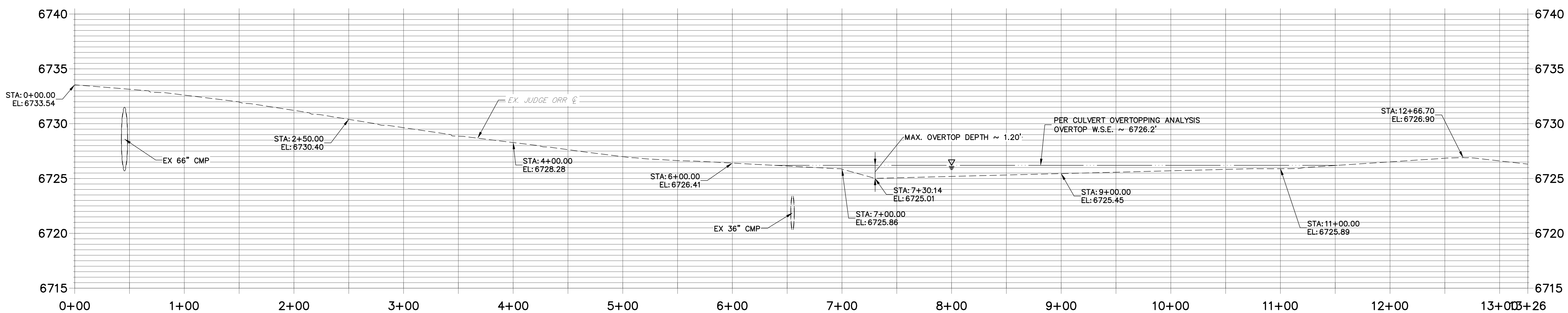
Fort Collins 970-491-9888 • www.jrengineering.com

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

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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

CULVERT CAPACITY = 187 CFS. ASSUMED THAT ALL FLOWS IN EXCESS OF CULVERT CAPACTIY FLOW IN ROADSIDE DITCH ON NORTH SIDE OF JUDGE ORR ROAD AND FLOW TO EX. 36" CMP TO THE EAST.

THEREFORE, Q_36 CMP= 1,017 CFS-187 CFS= 830 CFS

Rating Curve Plot for Crossing: West Judge Orr Road

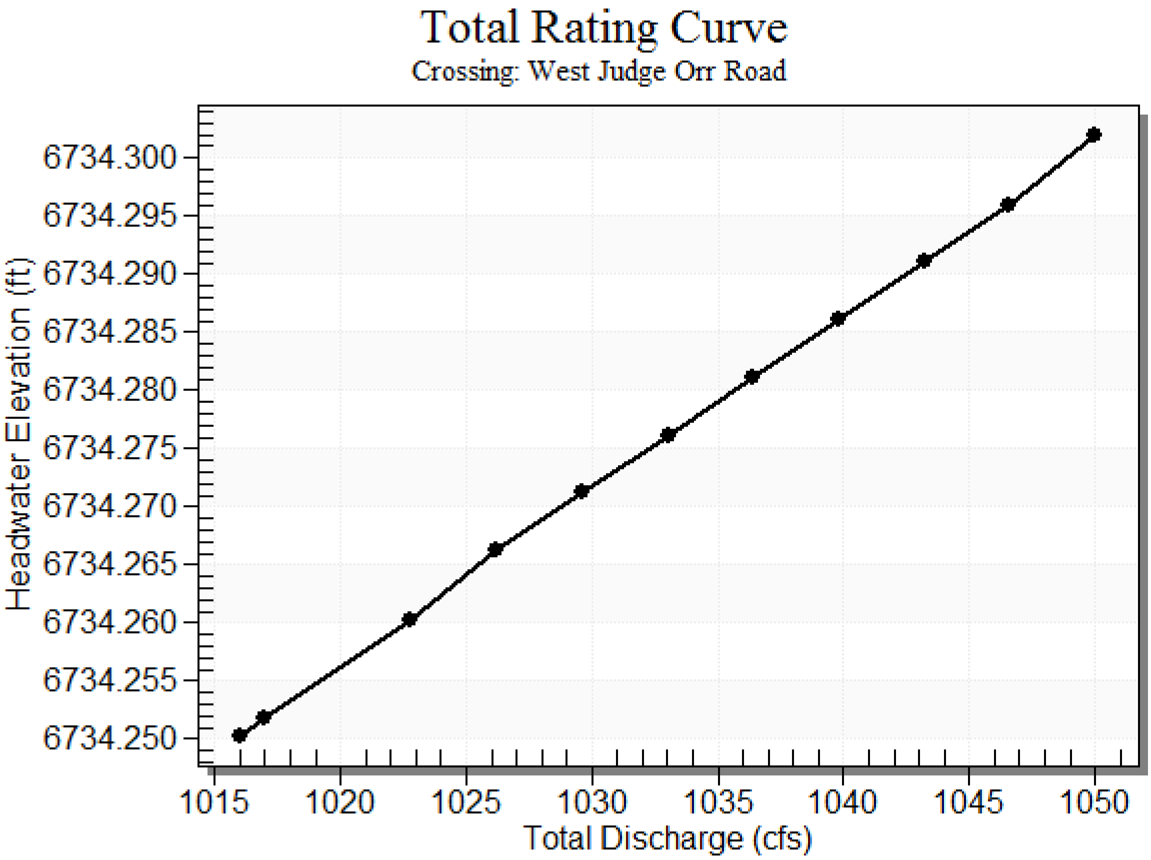
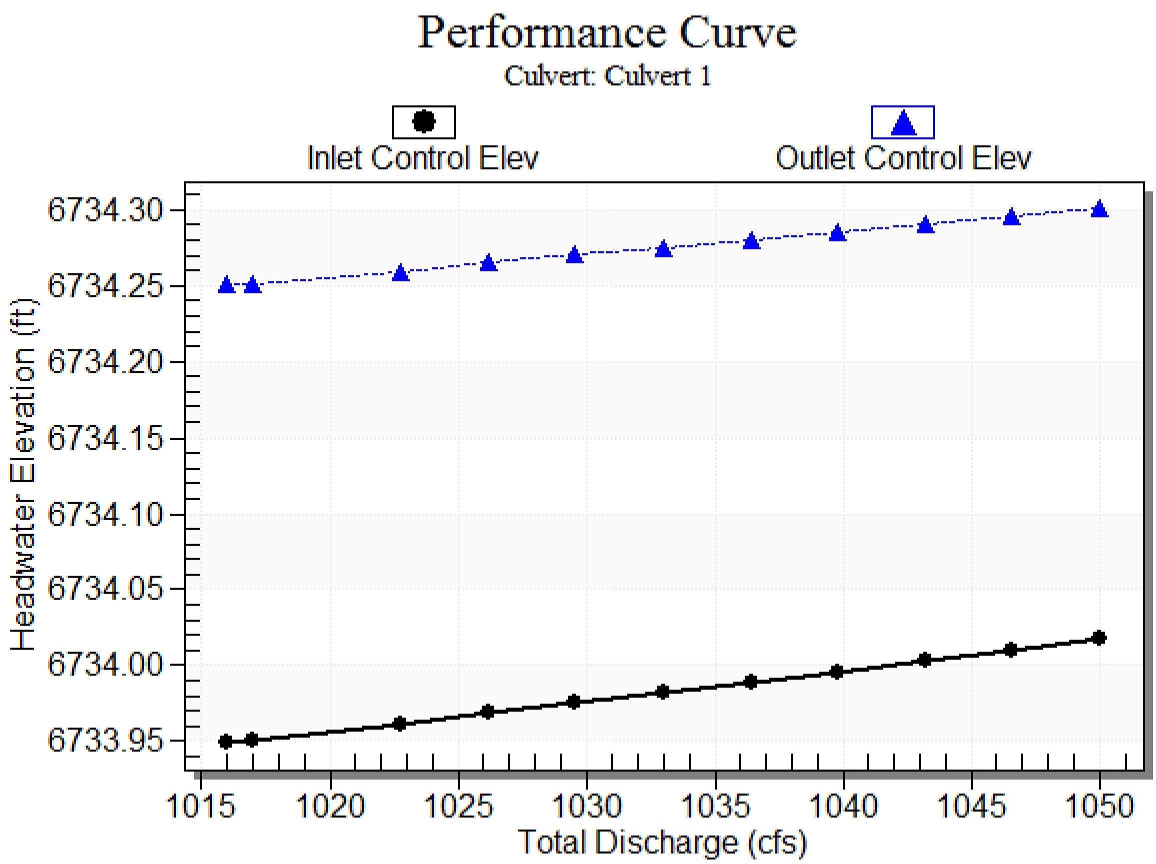


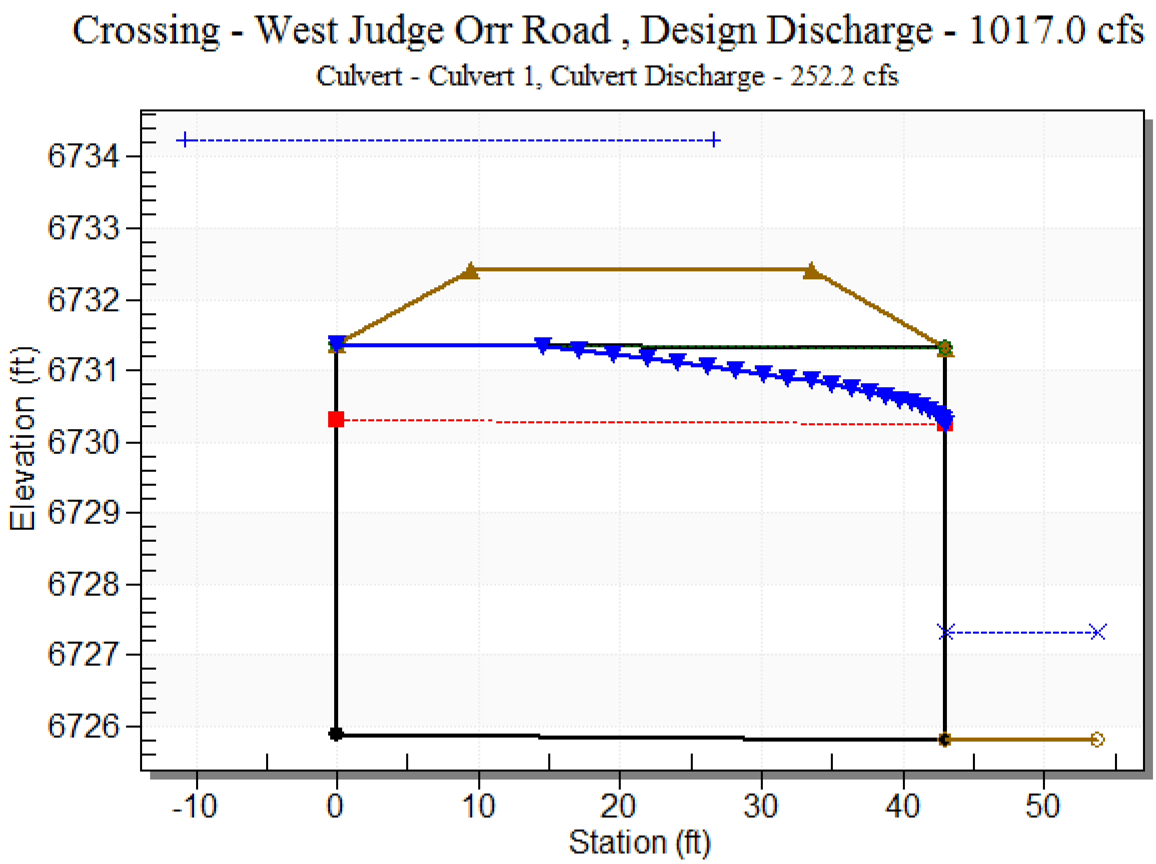
Table 2 - Culvert Summary Table: Culvert 1

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

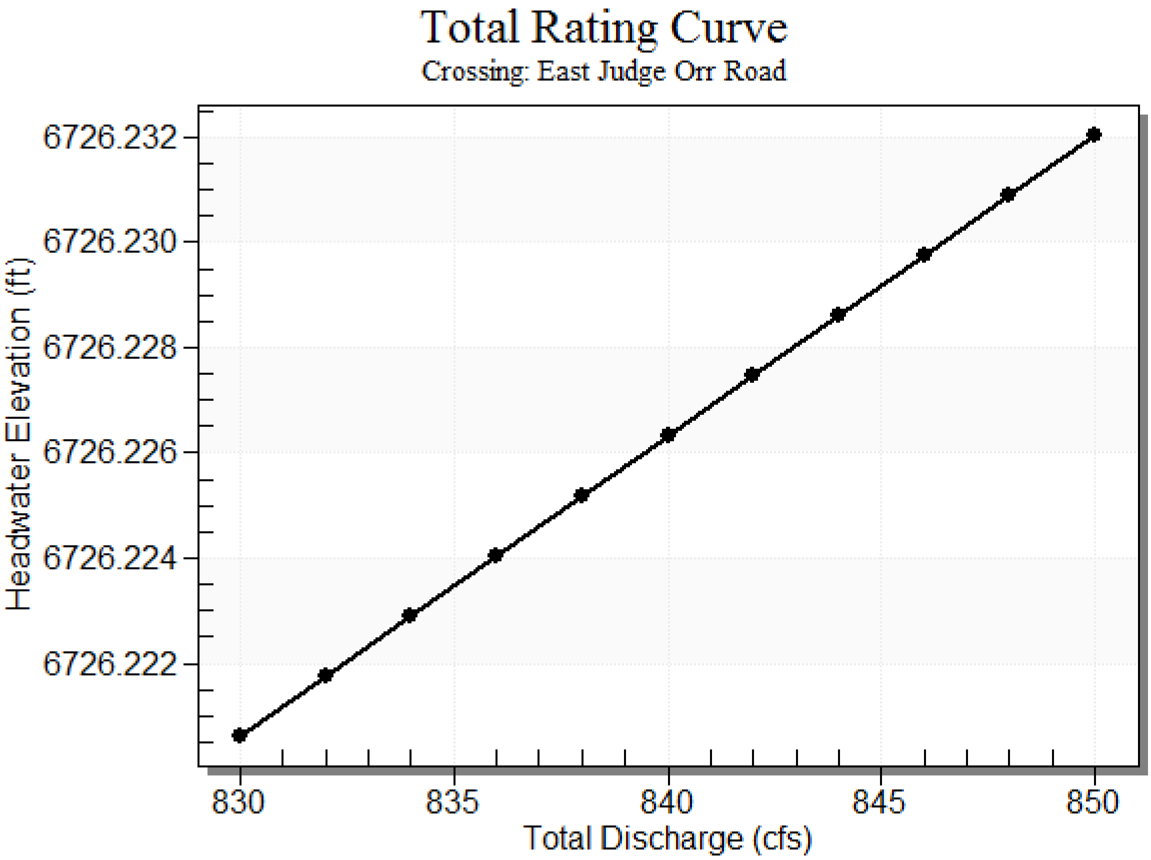
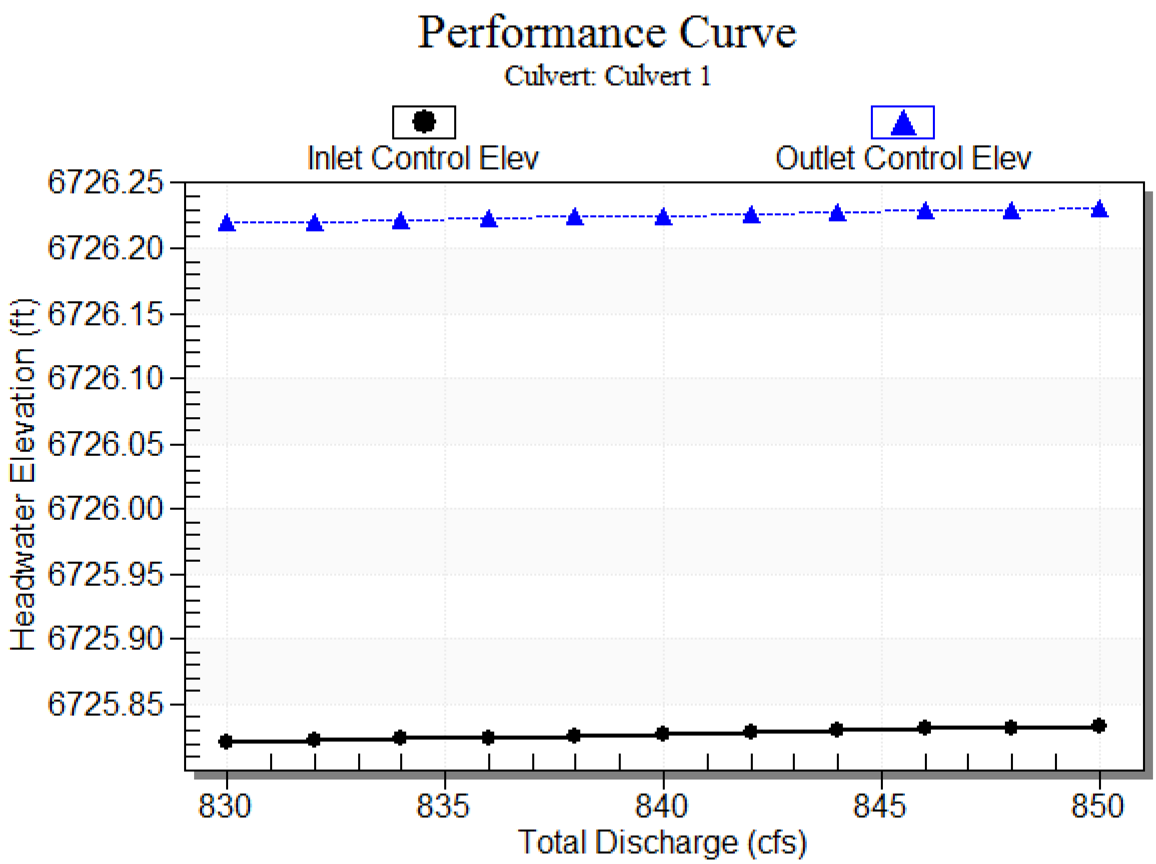


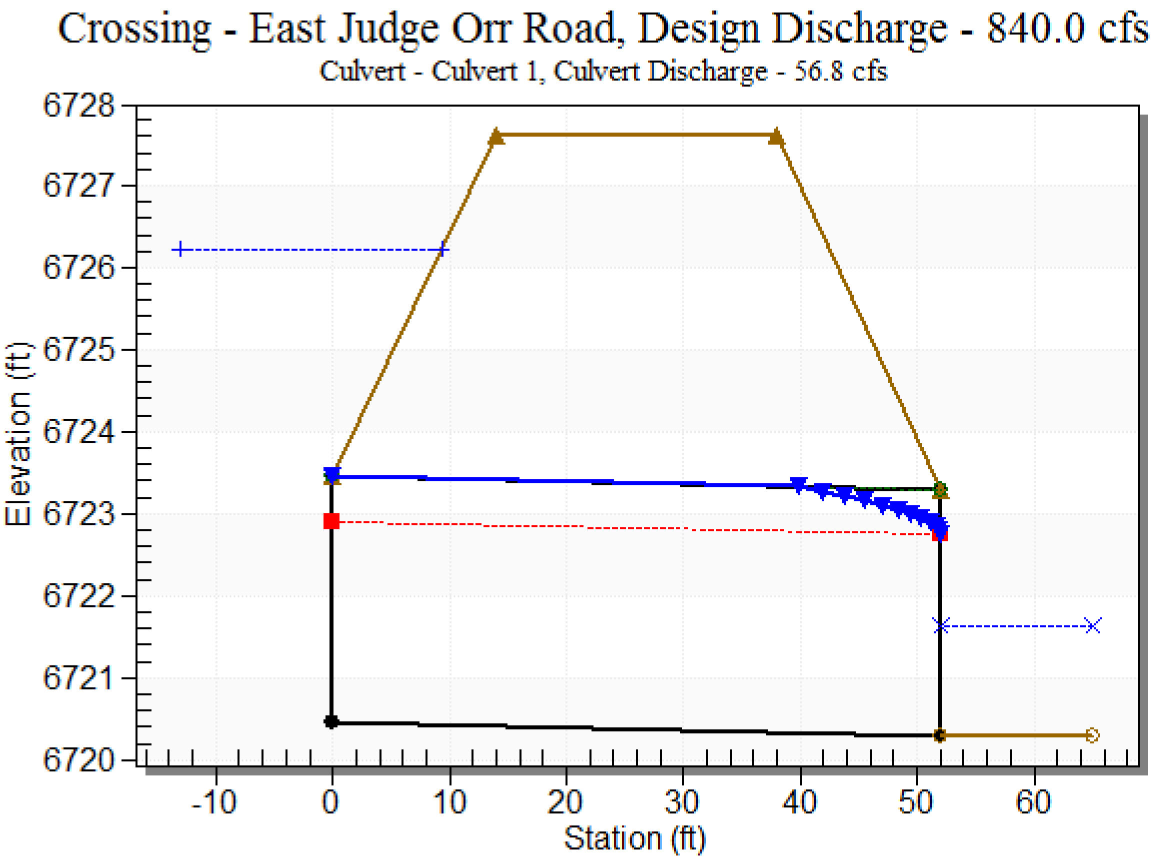
Table 5 - Culvert Summary Table: Culvert 1

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

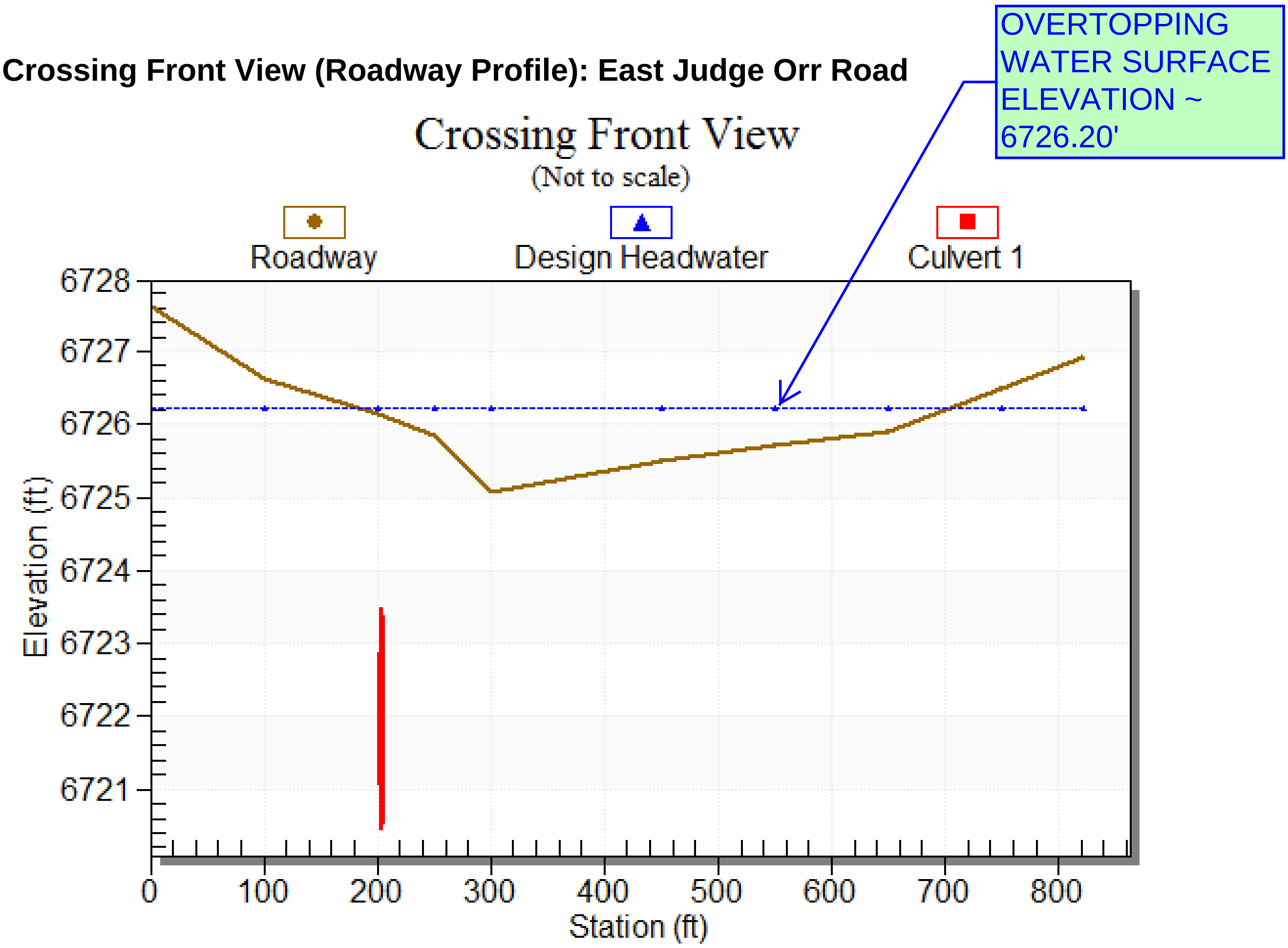
Barrel Manning's n: 0.0240

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

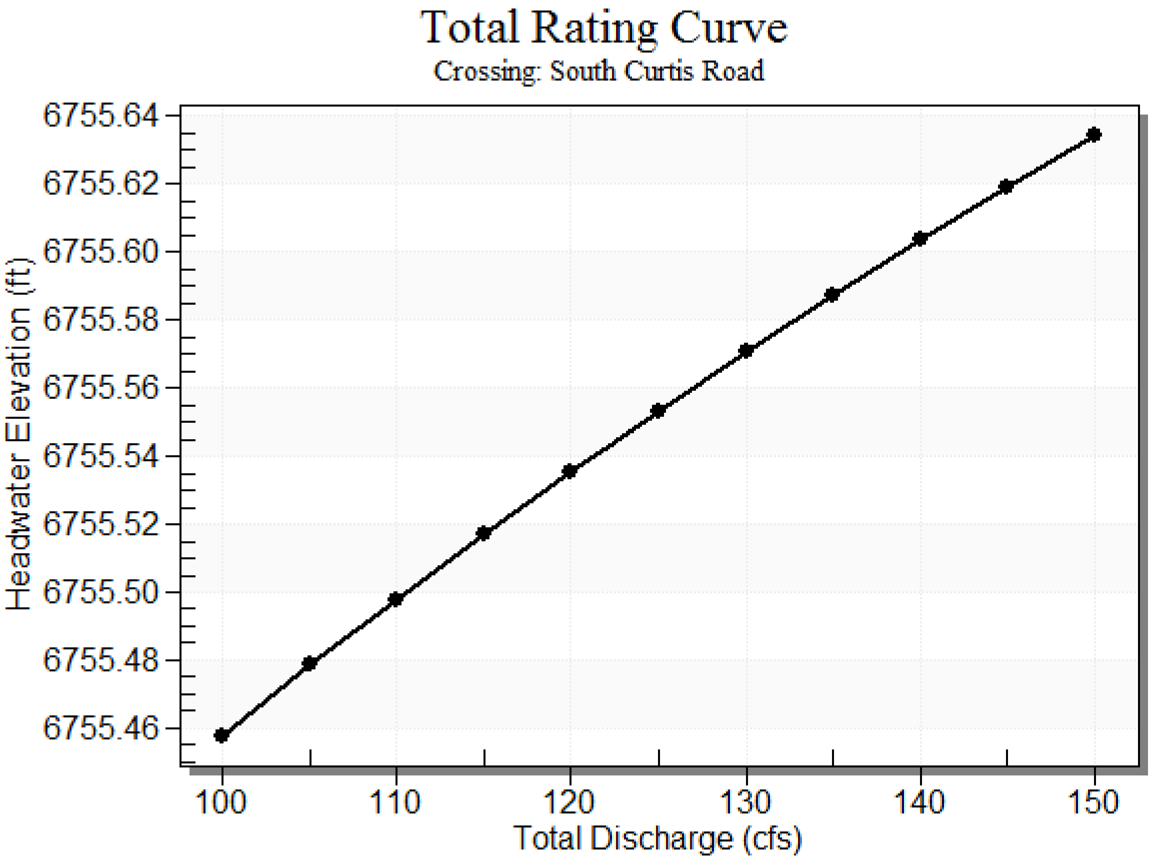
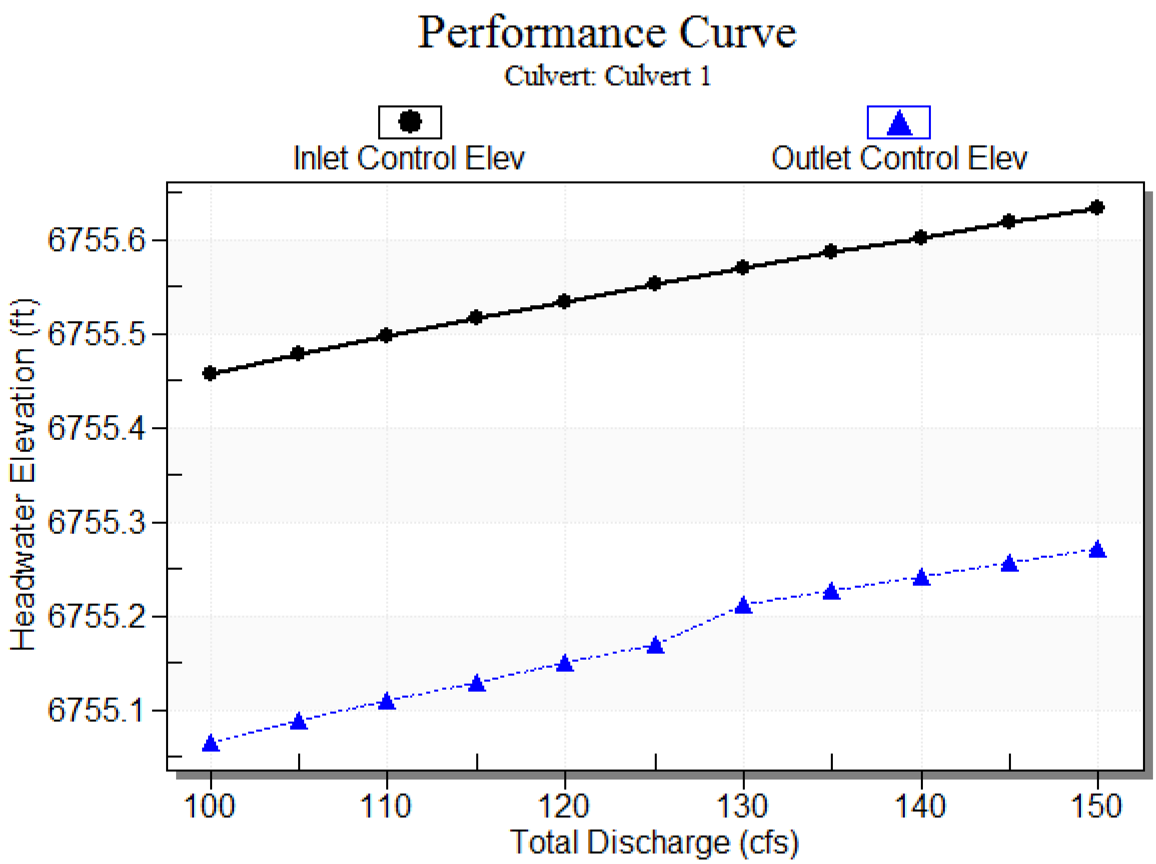


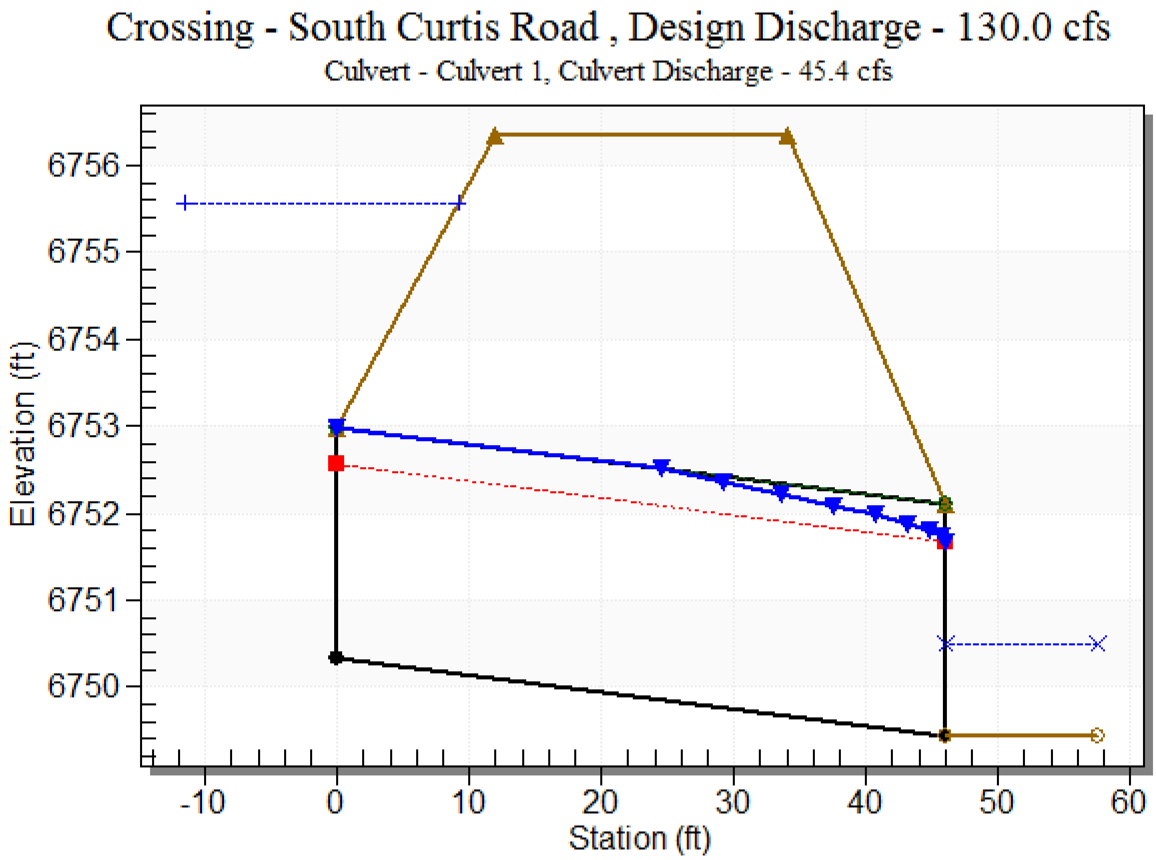
Table 8 - Culvert Summary Table: Culvert 1

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

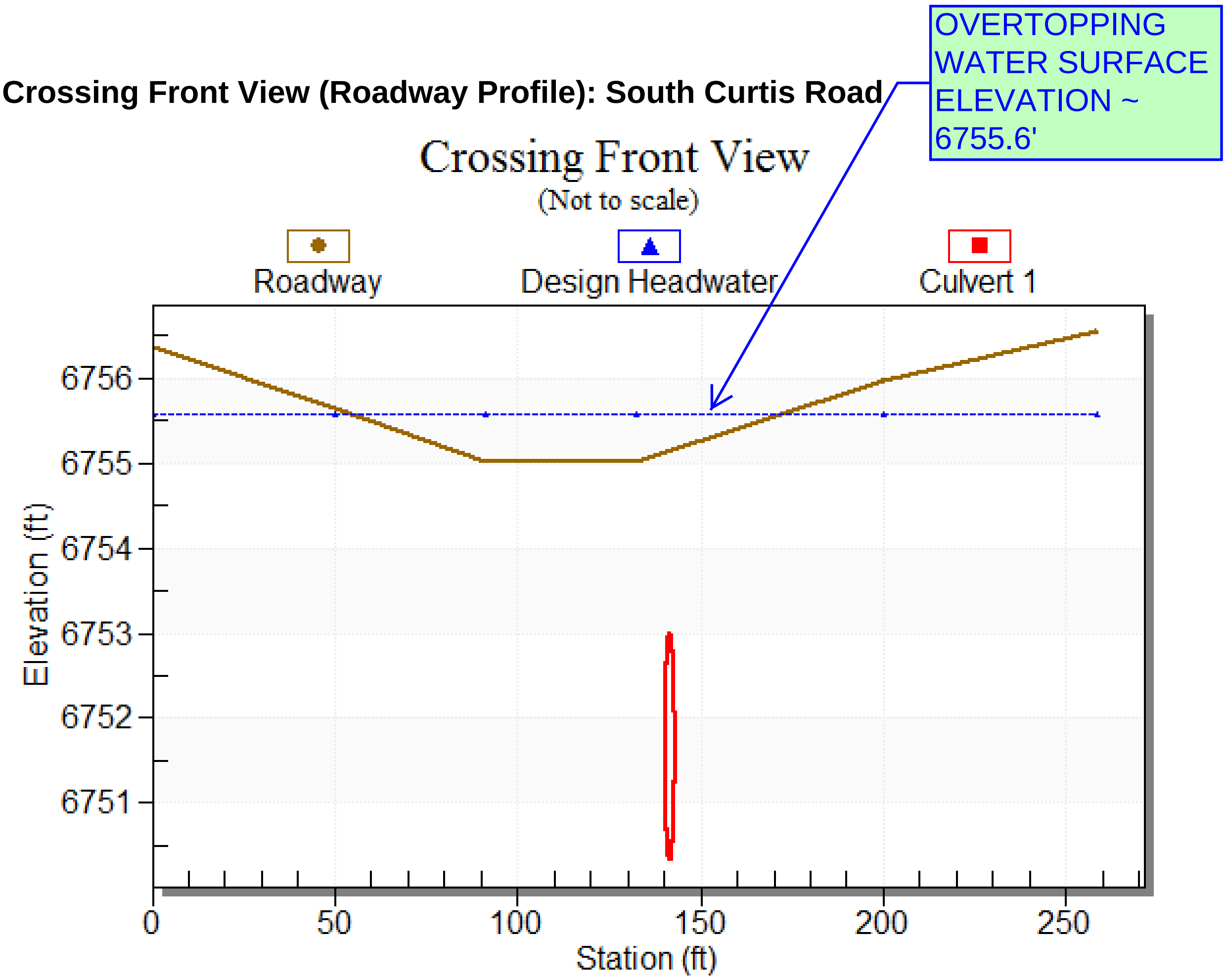
Barrel Manning's n: 0.0240

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

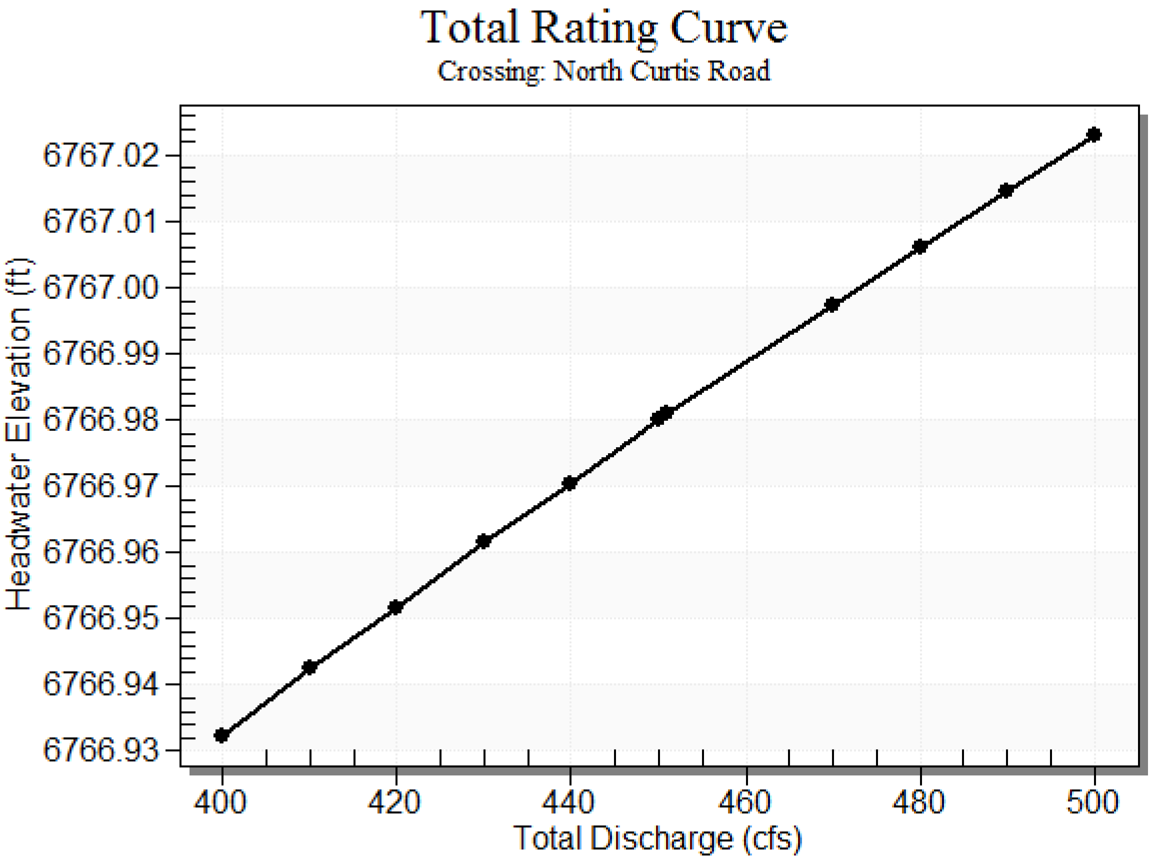
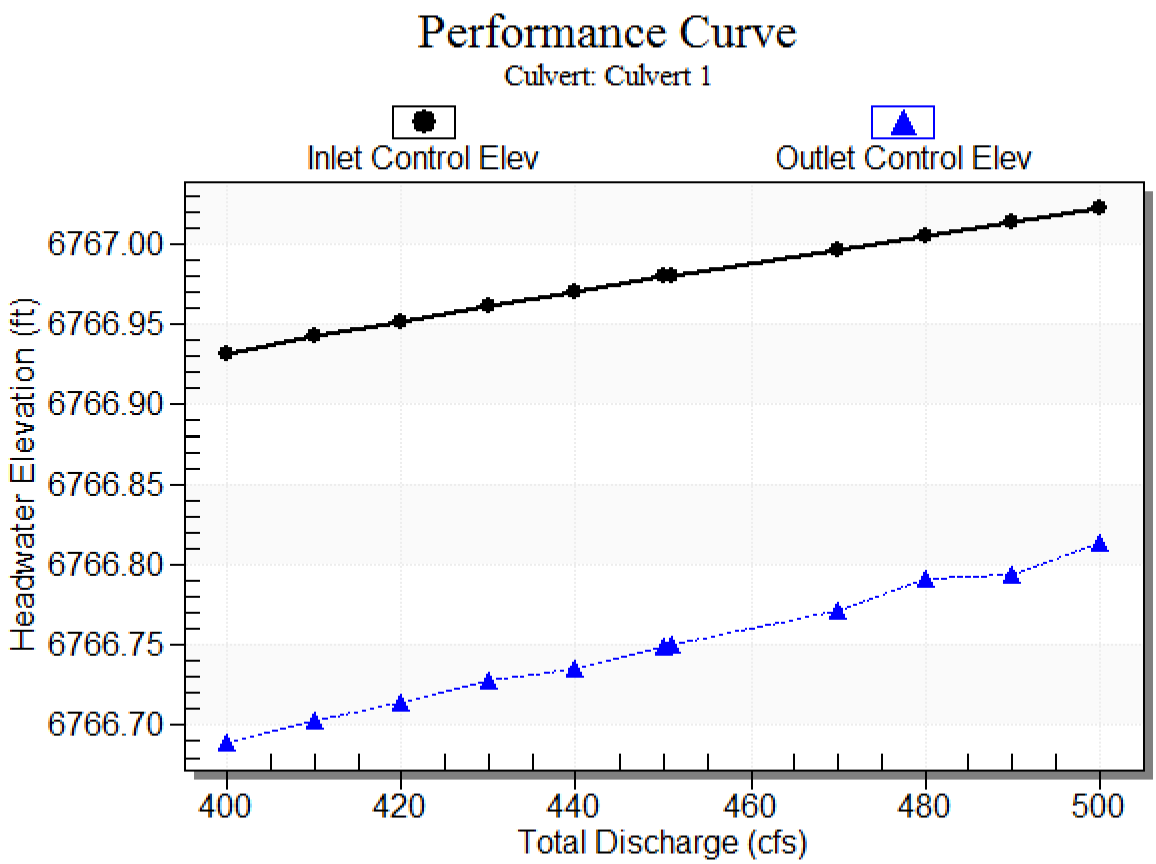


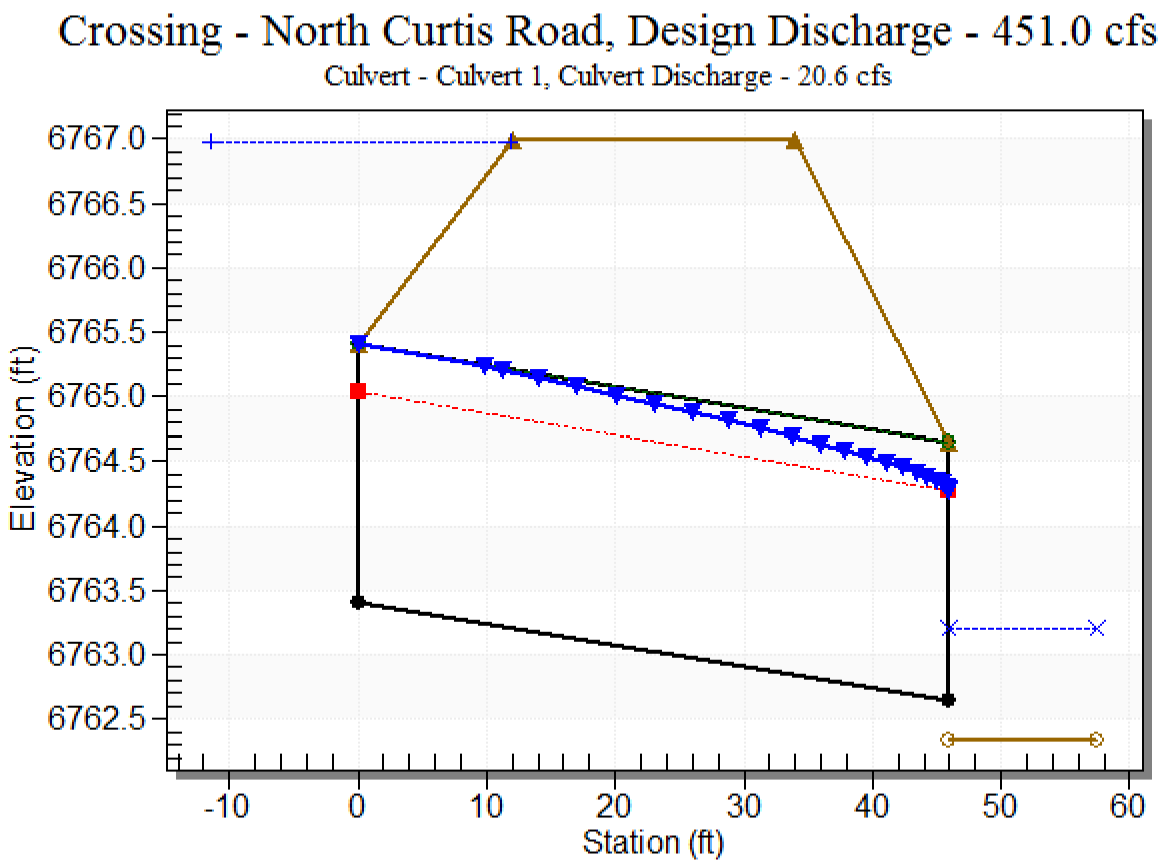
Table 11 - Culvert Summary Table: Culvert 1

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

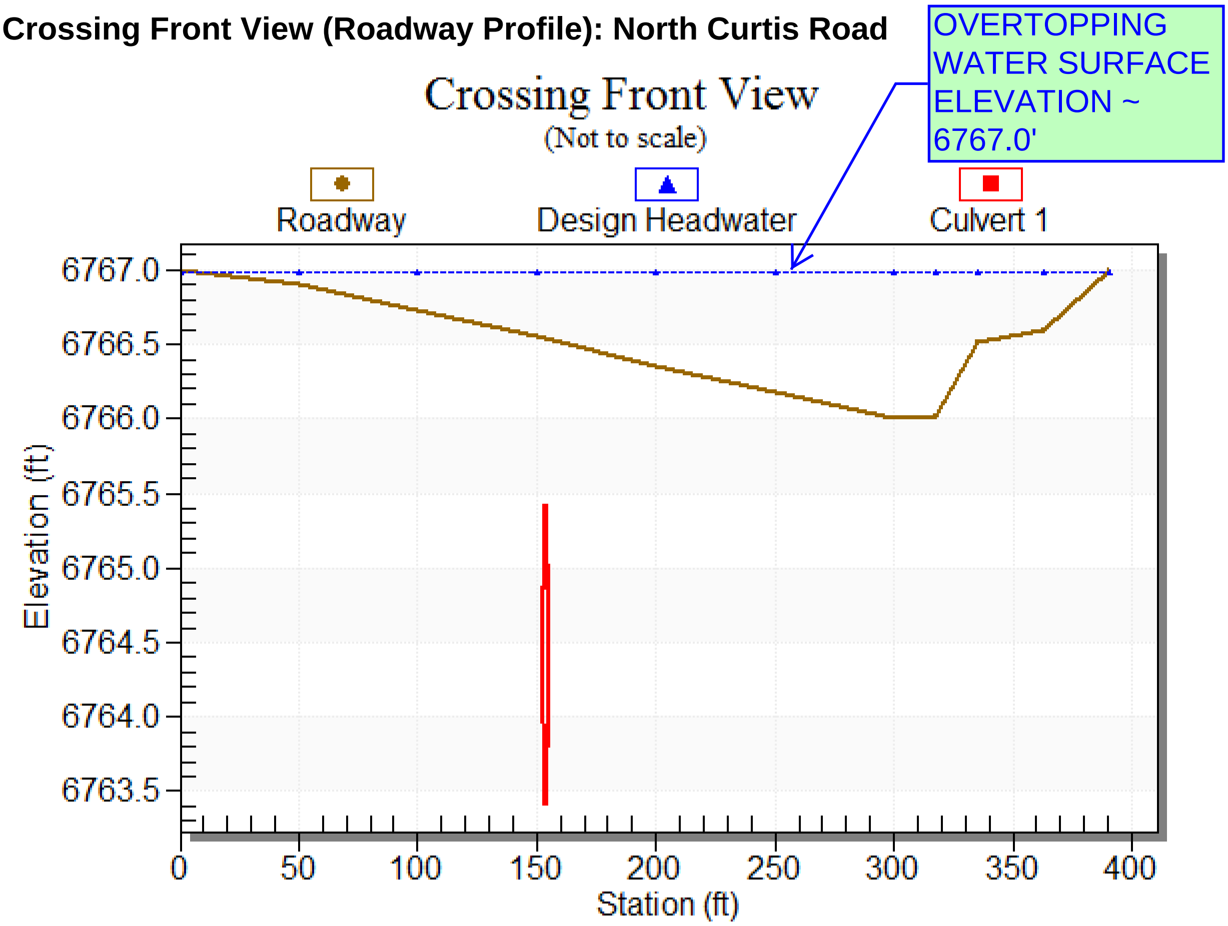
Barrel Manning's n: 0.0220

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

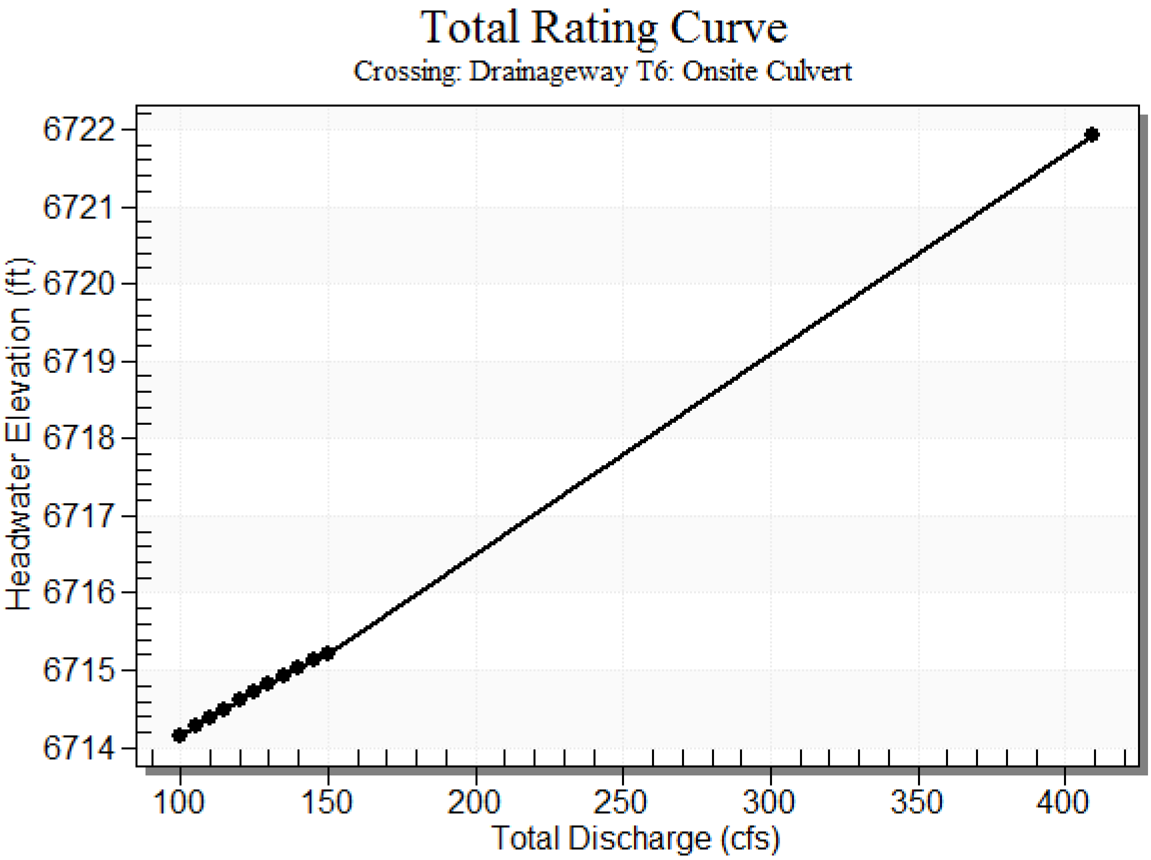
Design Flow: 130 cfs

Maximum Flow: 150 cfs

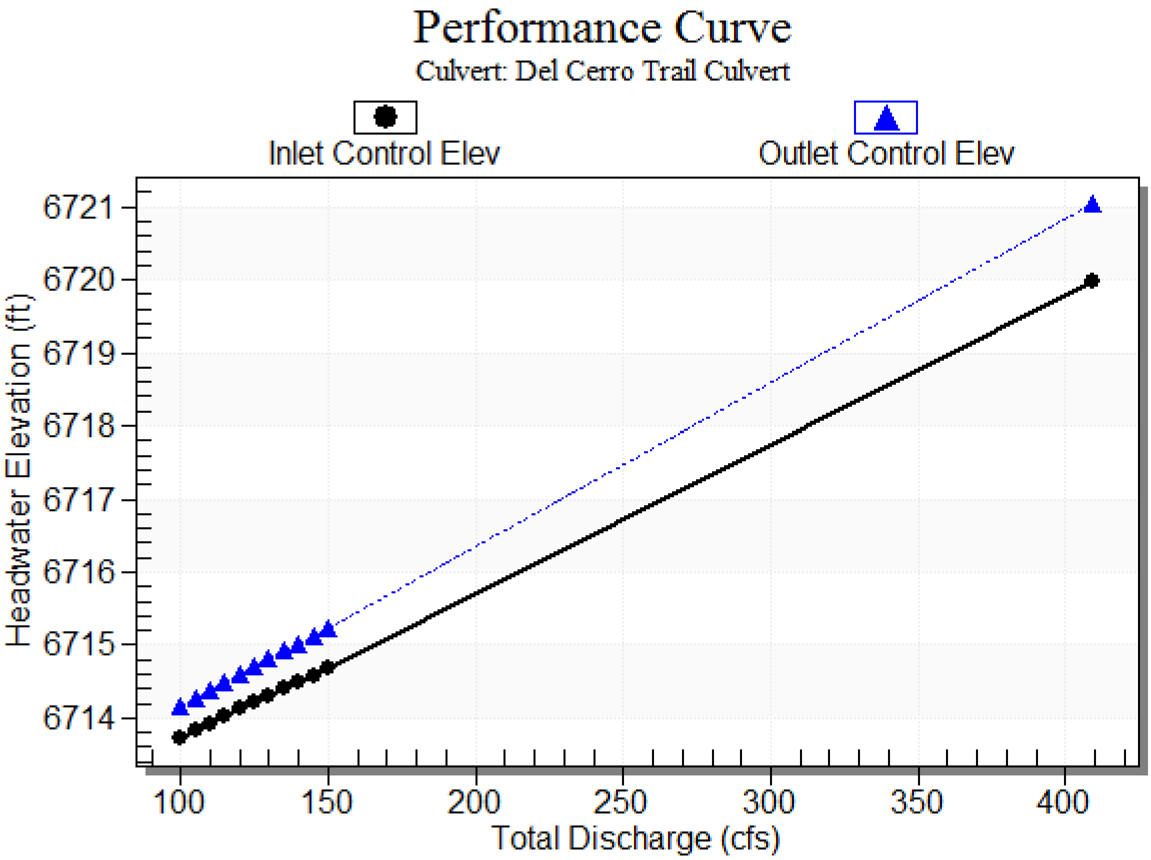
Table 1 - Summary of Culvert Flows at Crossing: Drainageway T6: Onsite Culvert

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

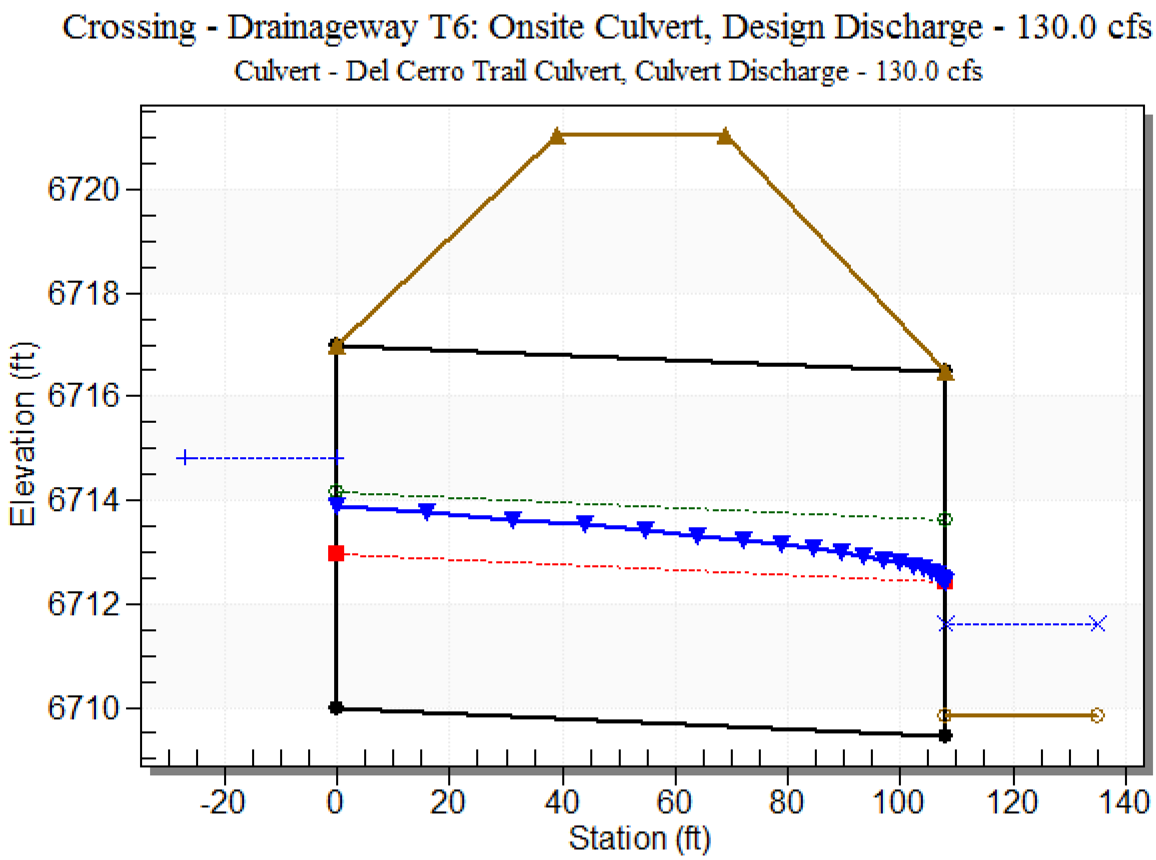
Rating Curve Plot for Crossing: Drainageway T6: Onsite Culvert



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

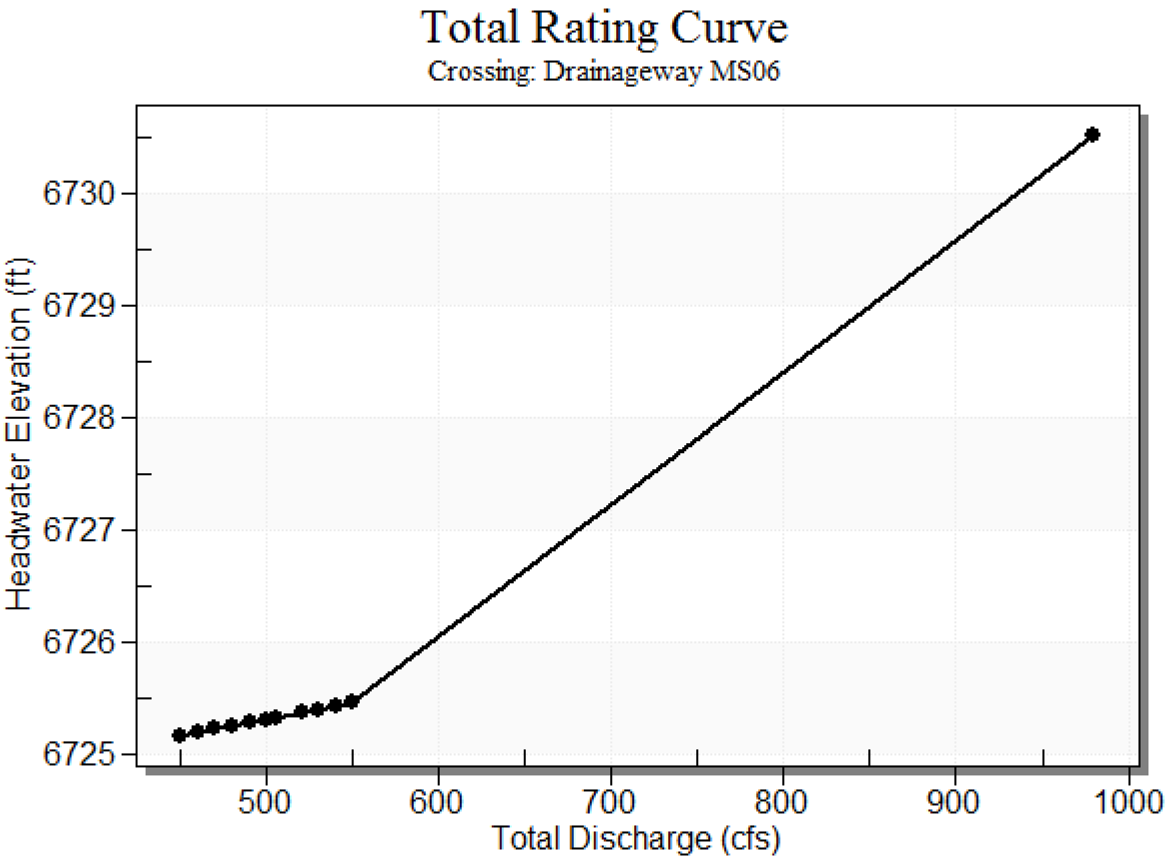
Design Flow: 505 cfs

Maximum Flow: 550 cfs

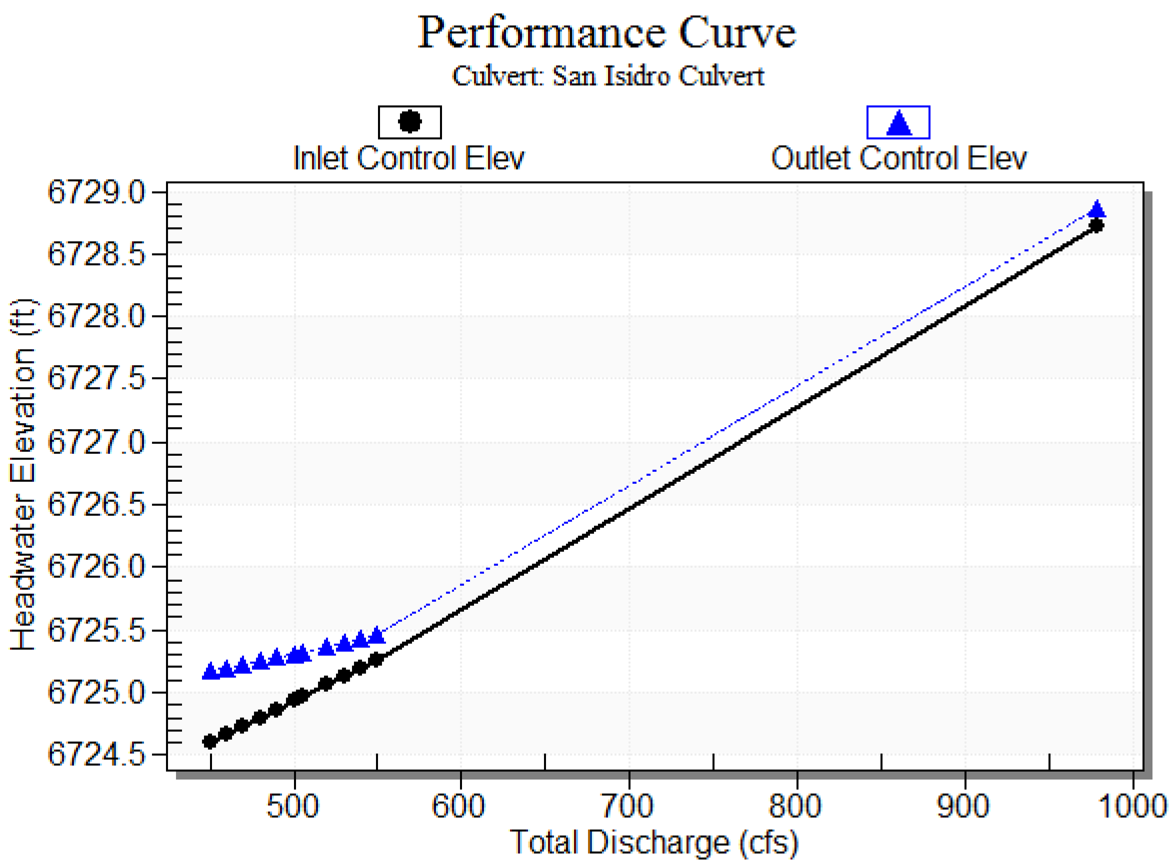
Table 1 - Summary of Culvert Flows at Crossing: Drainageway MS06

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

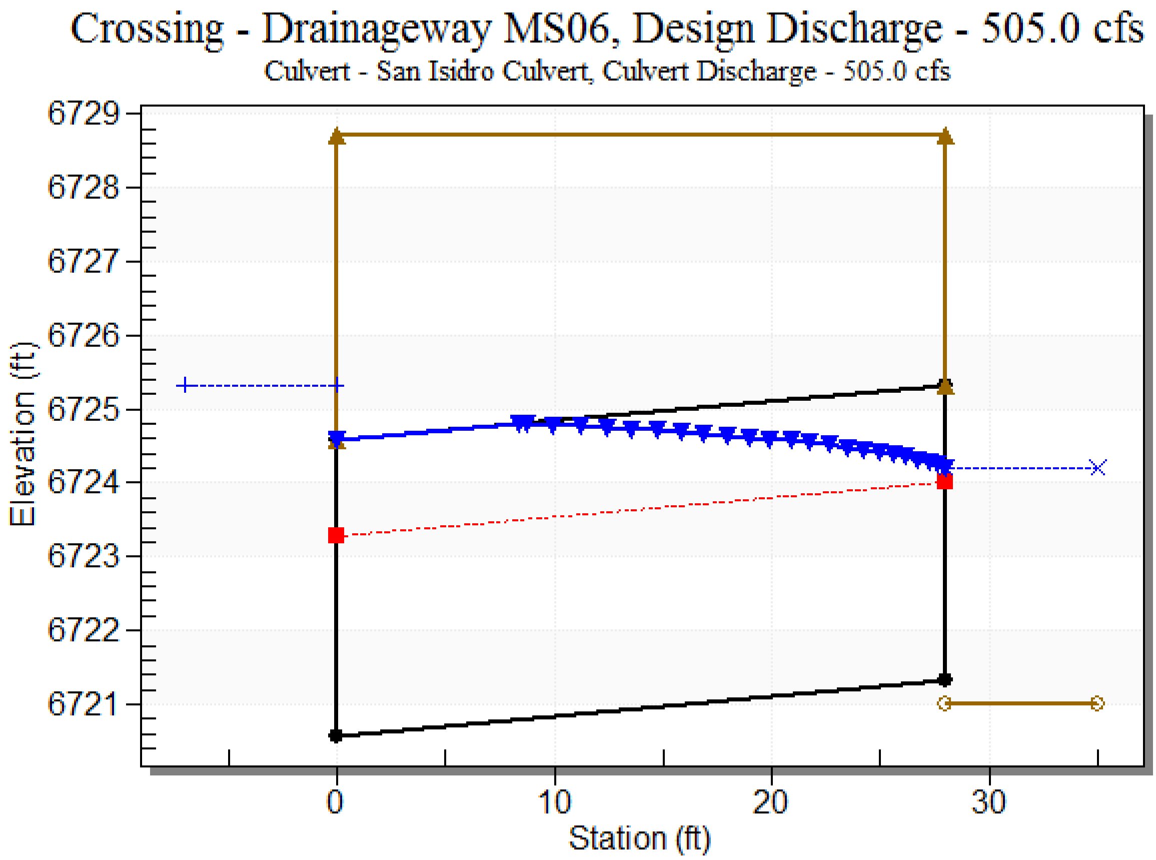
Rating Curve Plot for Crossing: Drainageway MS06



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

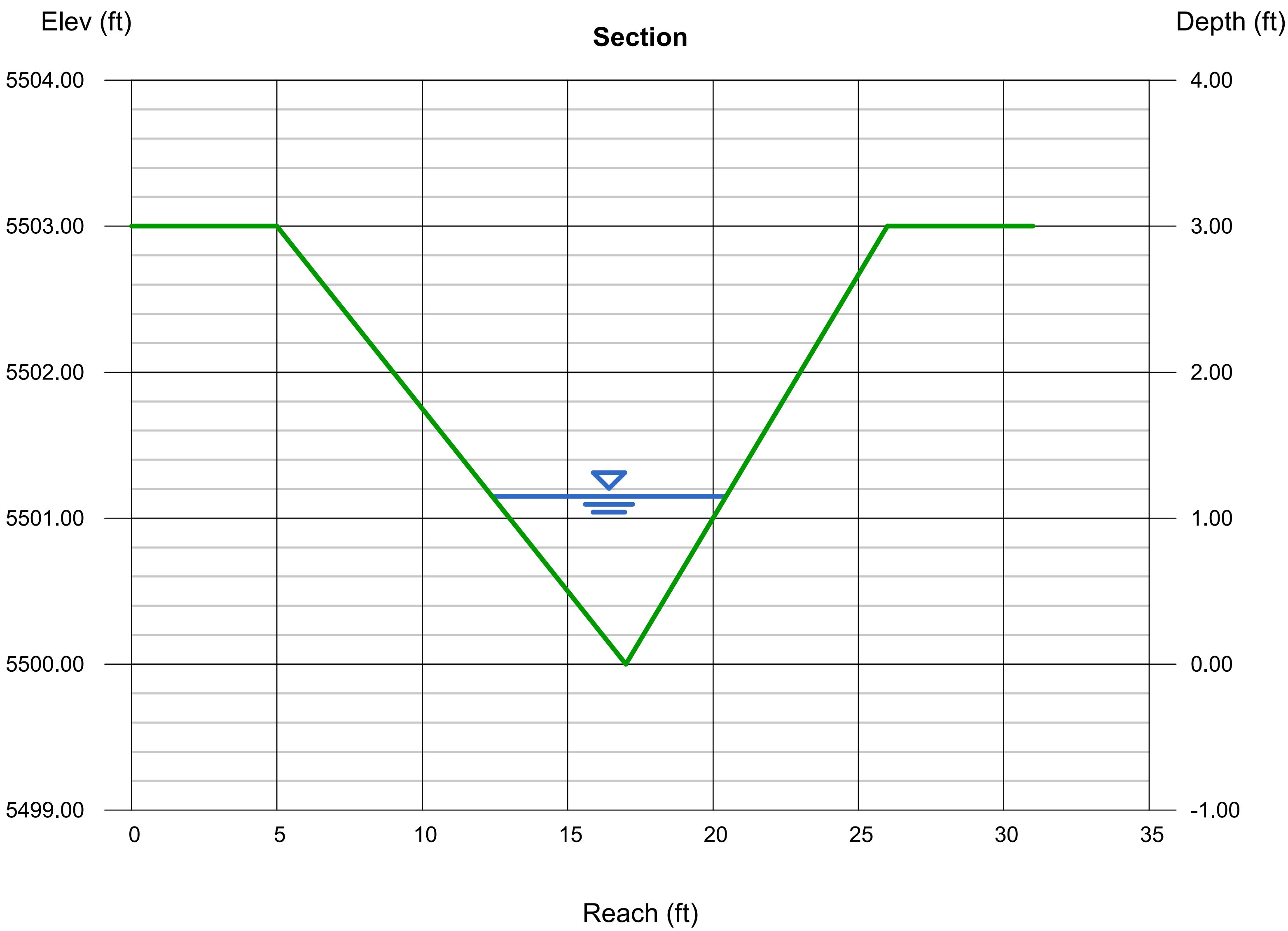
Channel Report

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

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

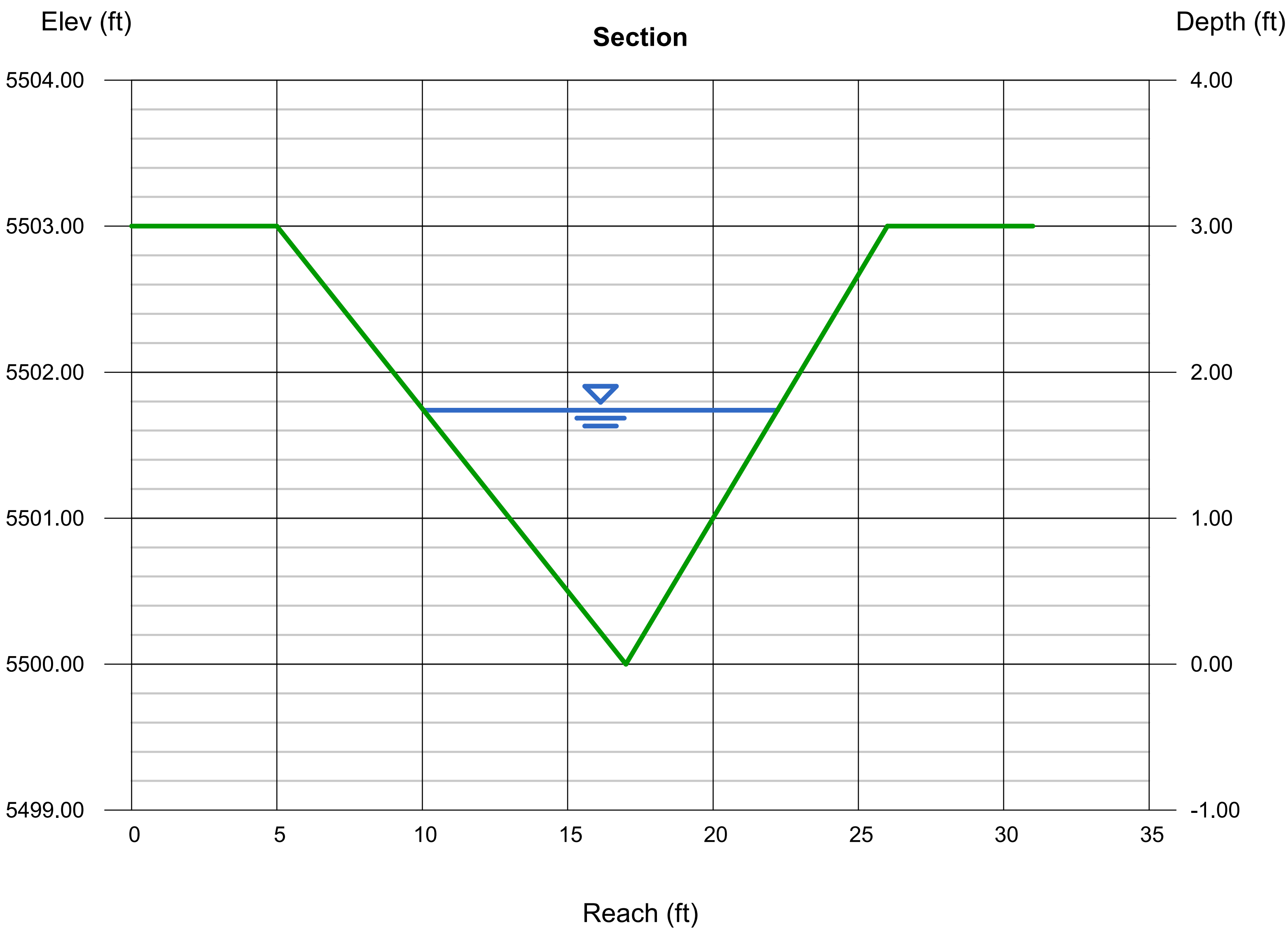
Calculations

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)

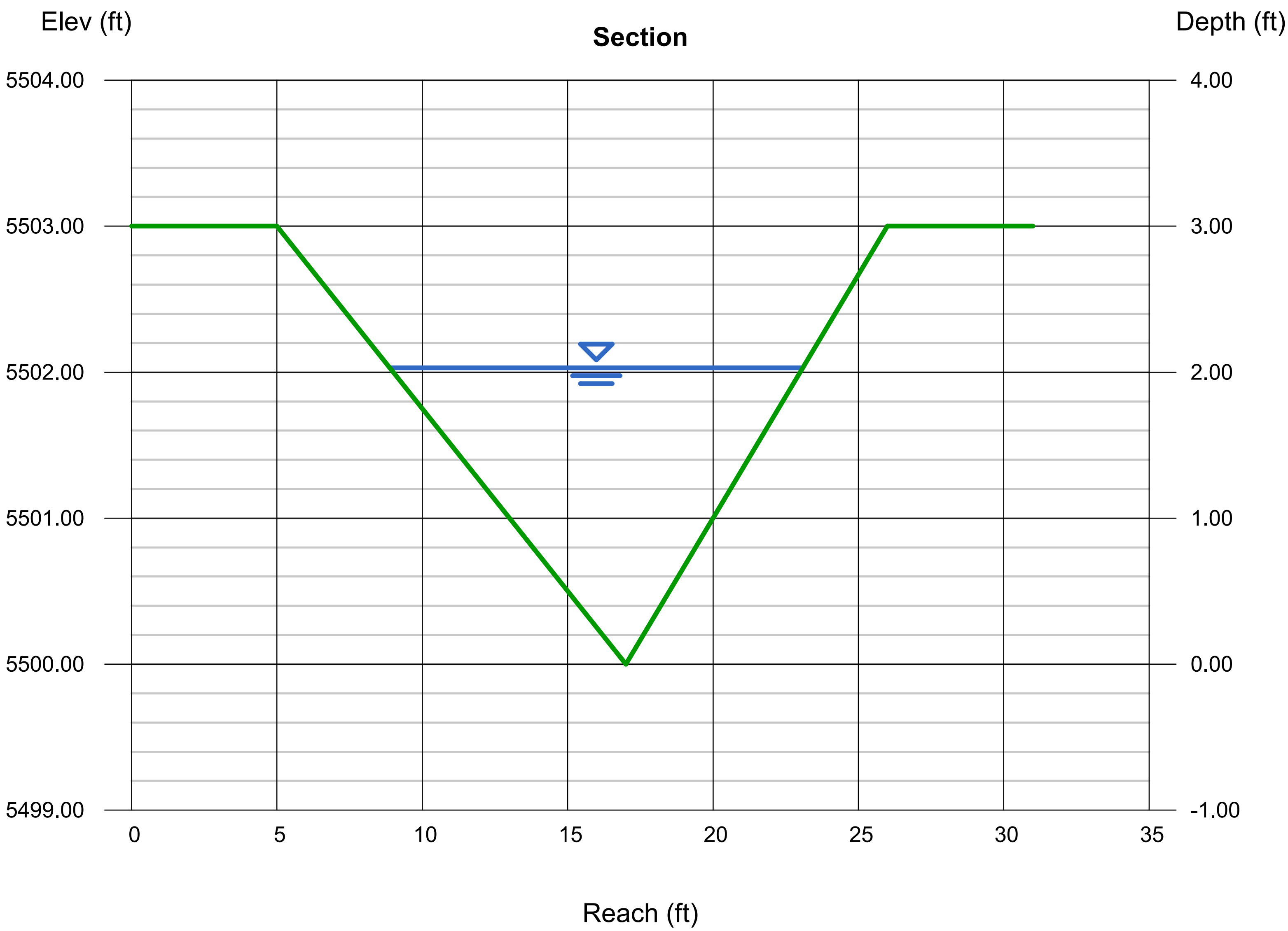


Channel Report

Basin C - Roadside Ditch - Q100_Peak = 69.36 cfs

Triangular		**Highlighted**	
Side Slopes (z:1)	= 4.00, 3.00	Depth (ft)	= 2.03
Total Depth (ft)	= 3.00	Q (cfs)	= 69.36
		Area (sqft)	= 14.42
Invert Elev (ft)	= 5500.00	Velocity (ft/s)	= 4.81
Slope (%)	= 1.00	Wetted Perim (ft)	= 14.79
N-Value	= 0.030	Crit Depth, Yc (ft)	= 1.90
		Top Width (ft)	= 14.21
Calculations		EGL (ft)	= 2.39
Compute by:	Known Q		
Known Q (cfs)	= 69.36		

FROUDE = 0.6 (SUBCRITICAL)



Channel Report

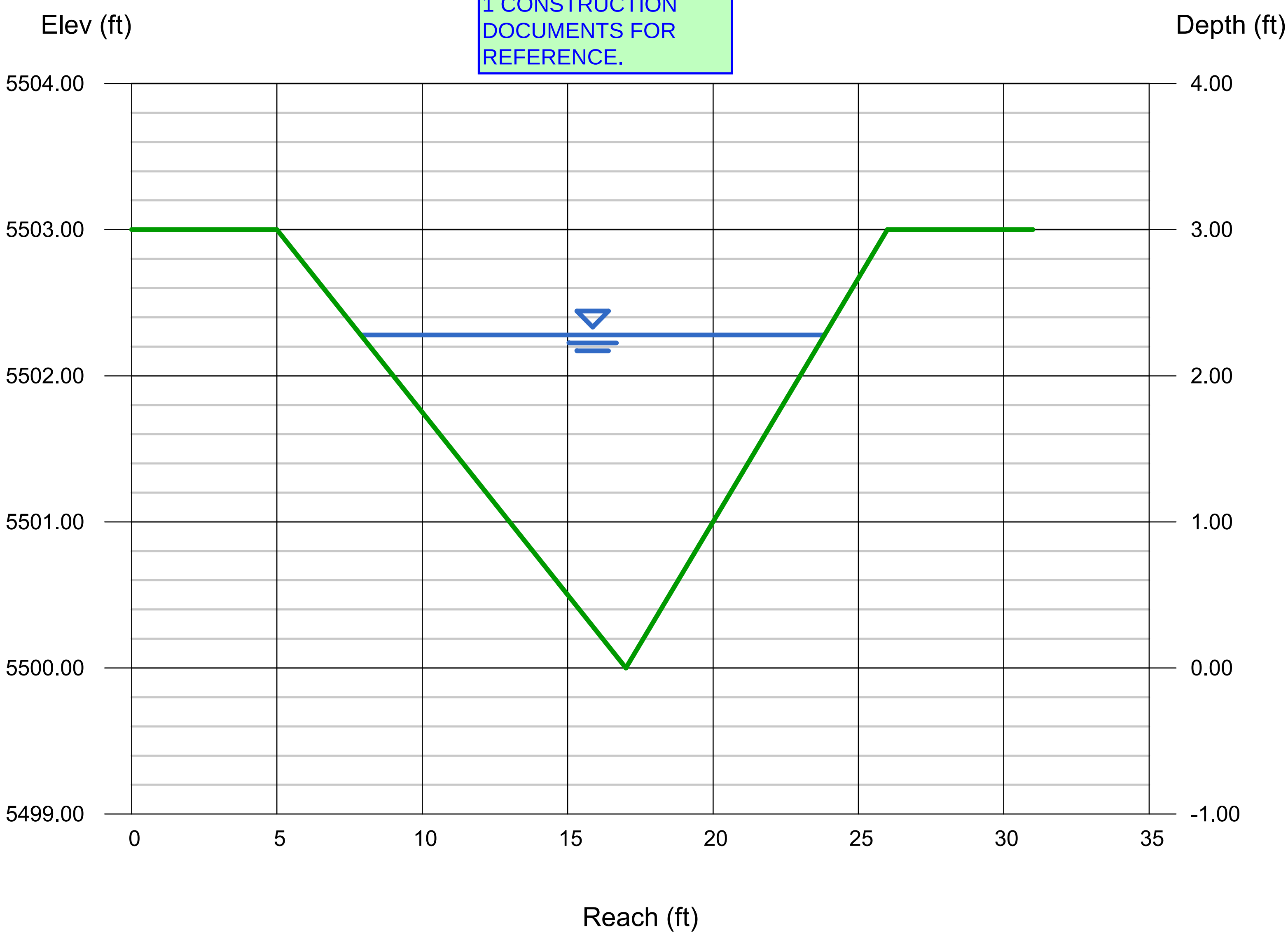
Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Jul 15 2019

Basin D - Roadside Ditch - Q100_Peak = 95.4 cfs

Triangular		**Highlighted**	
Side Slopes (z:1)	= 4.00, 3.00	Depth (ft)	= 2.28
Total Depth (ft)	= 3.00	Q (cfs)	= 95.40
		Area (sqft)	= 18.19
Invert Elev (ft)	= 5500.00	Velocity (ft/s)	= 5.24
Slope (%)	= 1.00	Wetted Perim (ft)	= 16.61
N-Value	= 0.030	Crit Depth, Yc (ft)	= 2.16
		Top Width (ft)	= 15.96
Calculations		EGL (ft)	= 2.71
Compute by:	Known Q		
Known Q (cfs)	= 95.40		

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)



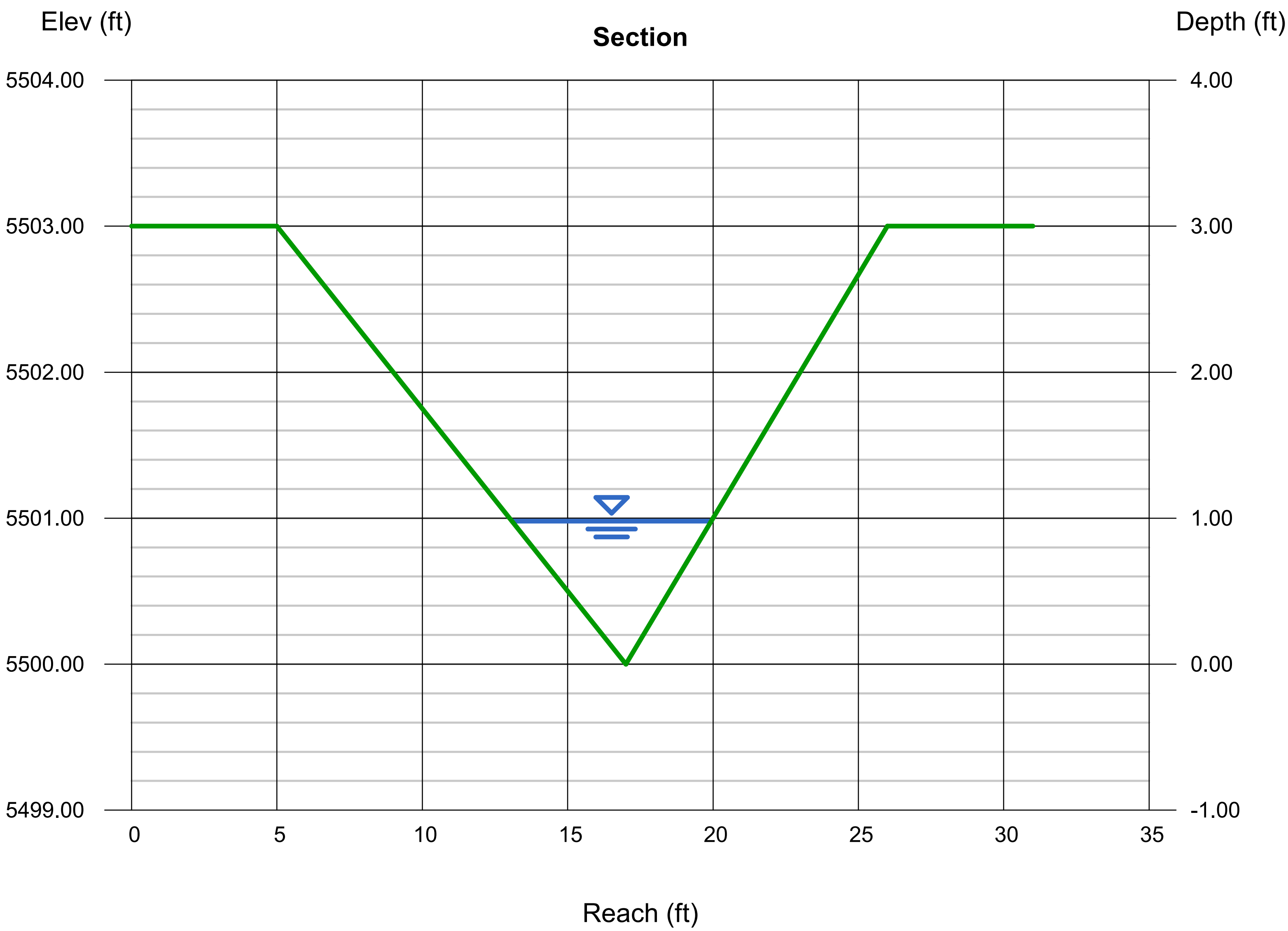
Channel Report

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		**Highlighted**	
Side Slopes (z:1)	= 4.00, 3.00	Depth (ft)	= 0.98
Total Depth (ft)	= 3.00	Q (cfs)	= 9.900
		Area (sqft)	= 3.36
Invert Elev (ft)	= 5500.00	Velocity (ft/s)	= 2.95
Slope (%)	= 1.00	Wetted Perim (ft)	= 7.14
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.87
		Top Width (ft)	= 6.86
Calculations		EGL (ft)	= 1.11
Compute by:	Known Q		
Known Q (cfs)	= 9.90		

FROUDE = 0.5
(SUBCRITICAL)



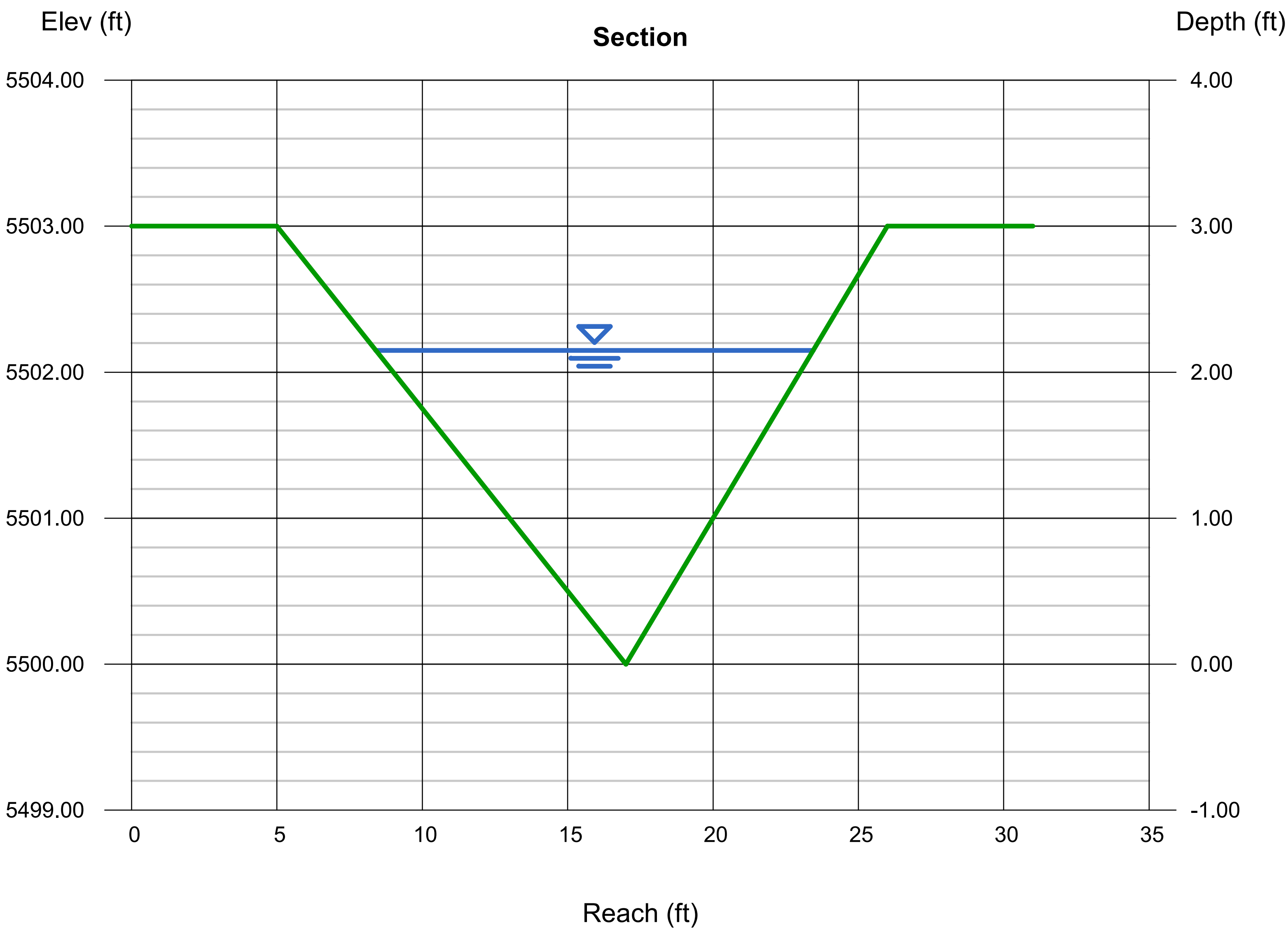
Channel Report

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		**Highlighted**	
Side Slopes (z:1)	= 4.00, 3.00	Depth (ft)	= 2.15
Total Depth (ft)	= 3.00	Q (cfs)	= 69.89
		Area (sqft)	= 16.18
Invert Elev (ft)	= 5500.00	Velocity (ft/s)	= 4.32
Slope (%)	= 1.31	Wetted Perim (ft)	= 15.66
N-Value	= 0.040	Crit Depth, Yc (ft)	= 1.91
		Top Width (ft)	= 15.05
Calculations		EGL (ft)	= 2.44
Compute by:	Known Q		
Known Q (cfs)	= 69.89		

FROUDE = 0.5
(SUBCRITICAL)



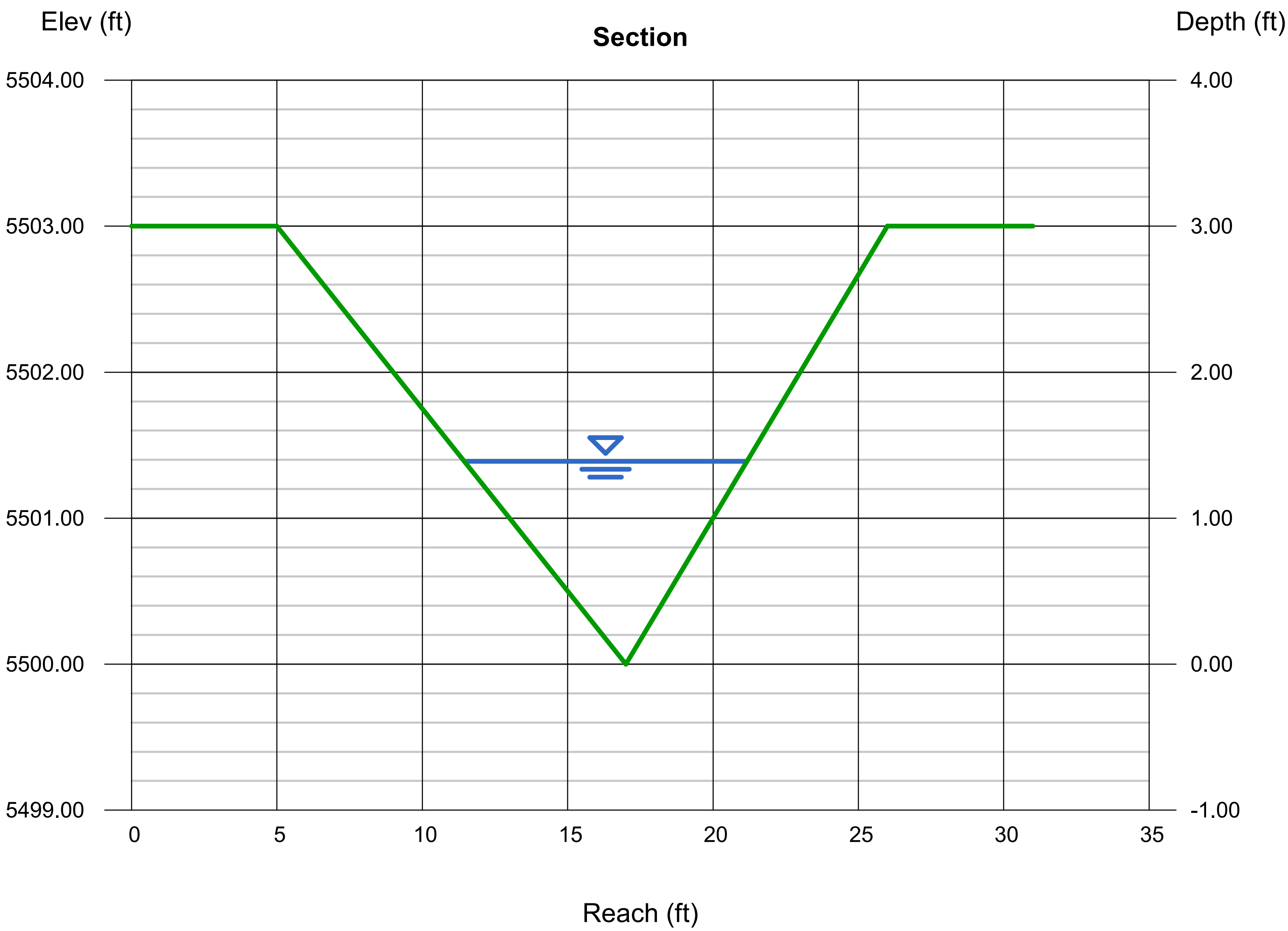
Channel Report

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

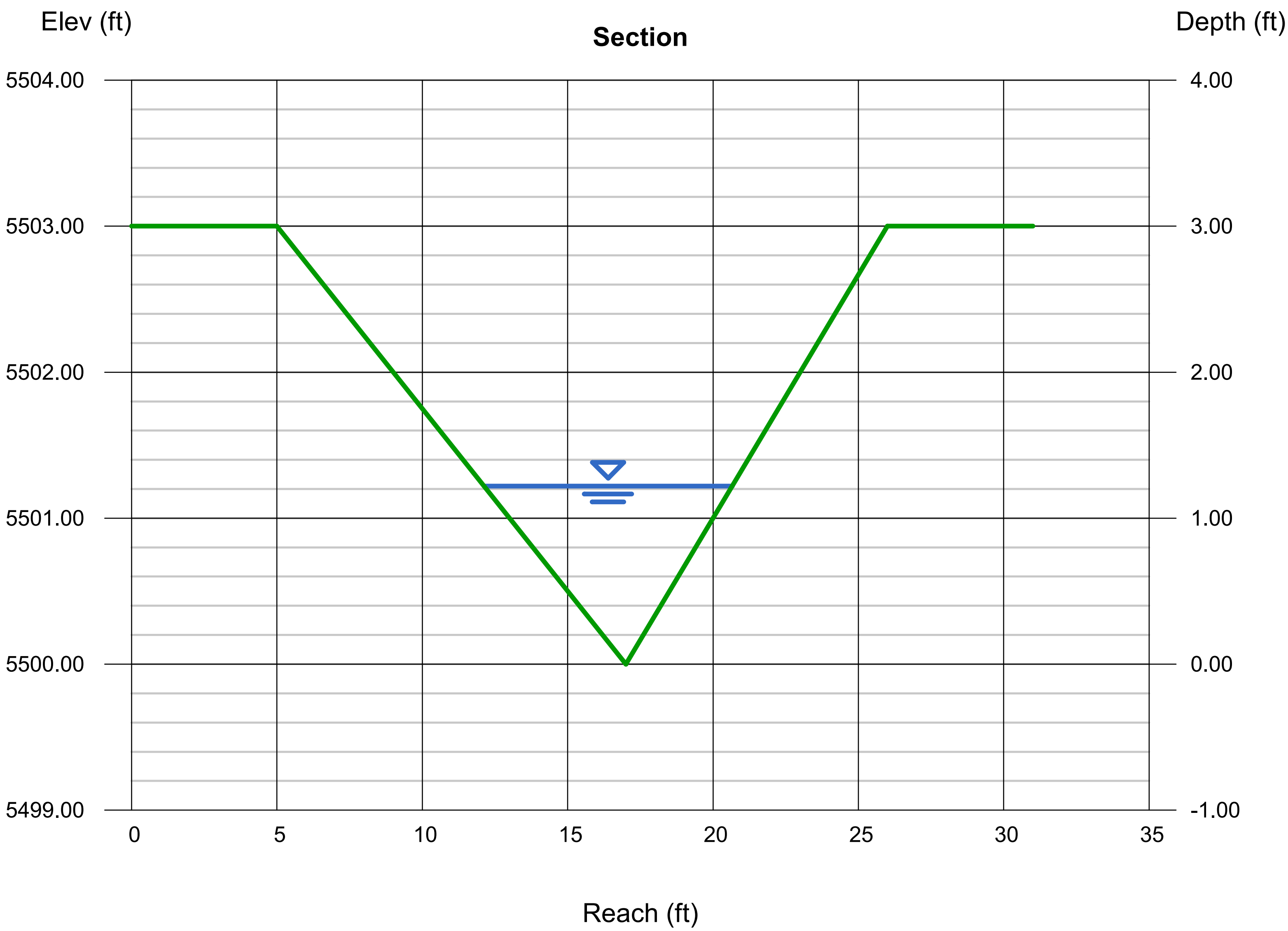
Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Sep 9 2019

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

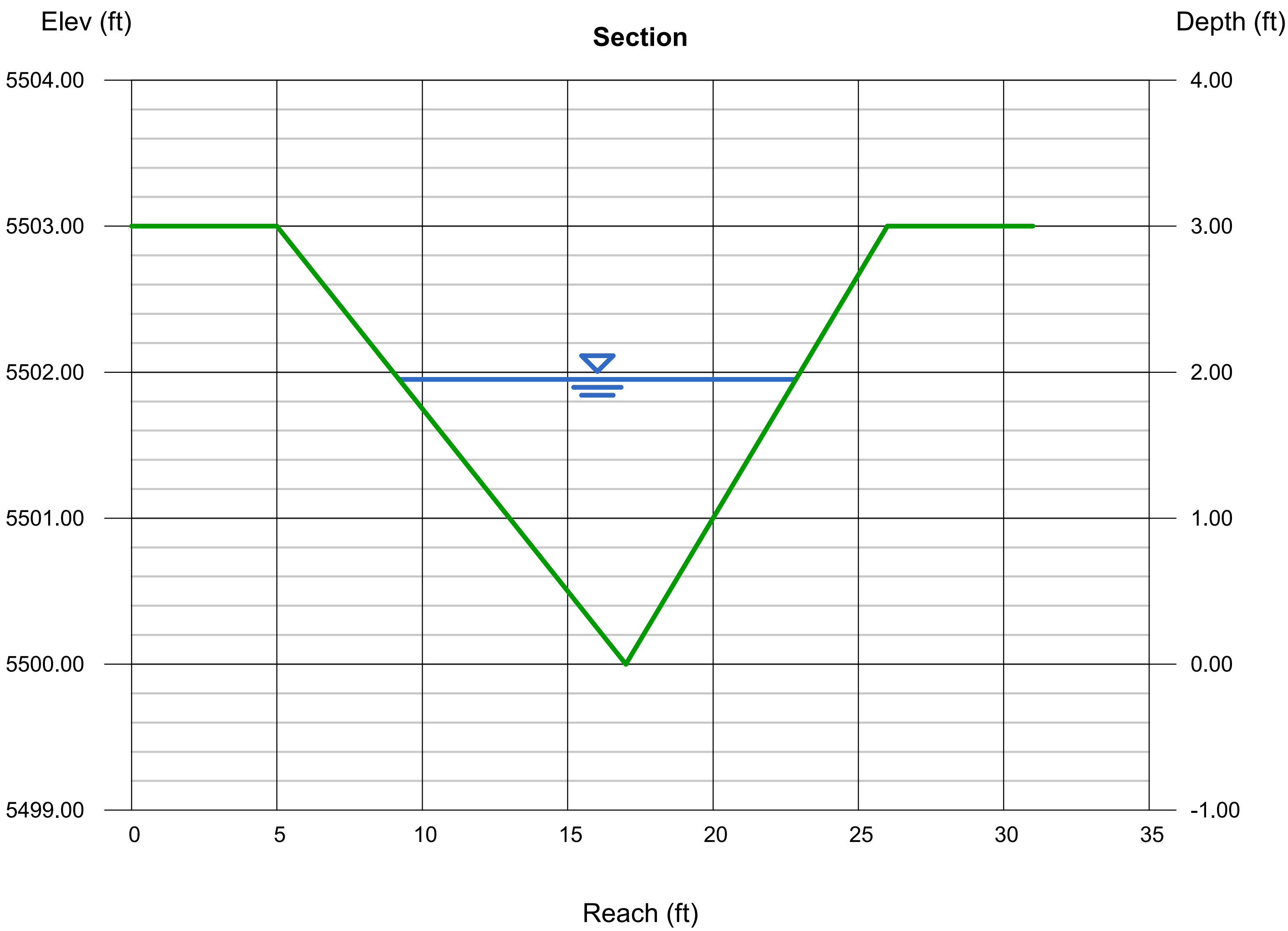
Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Sep 9 2019

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

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

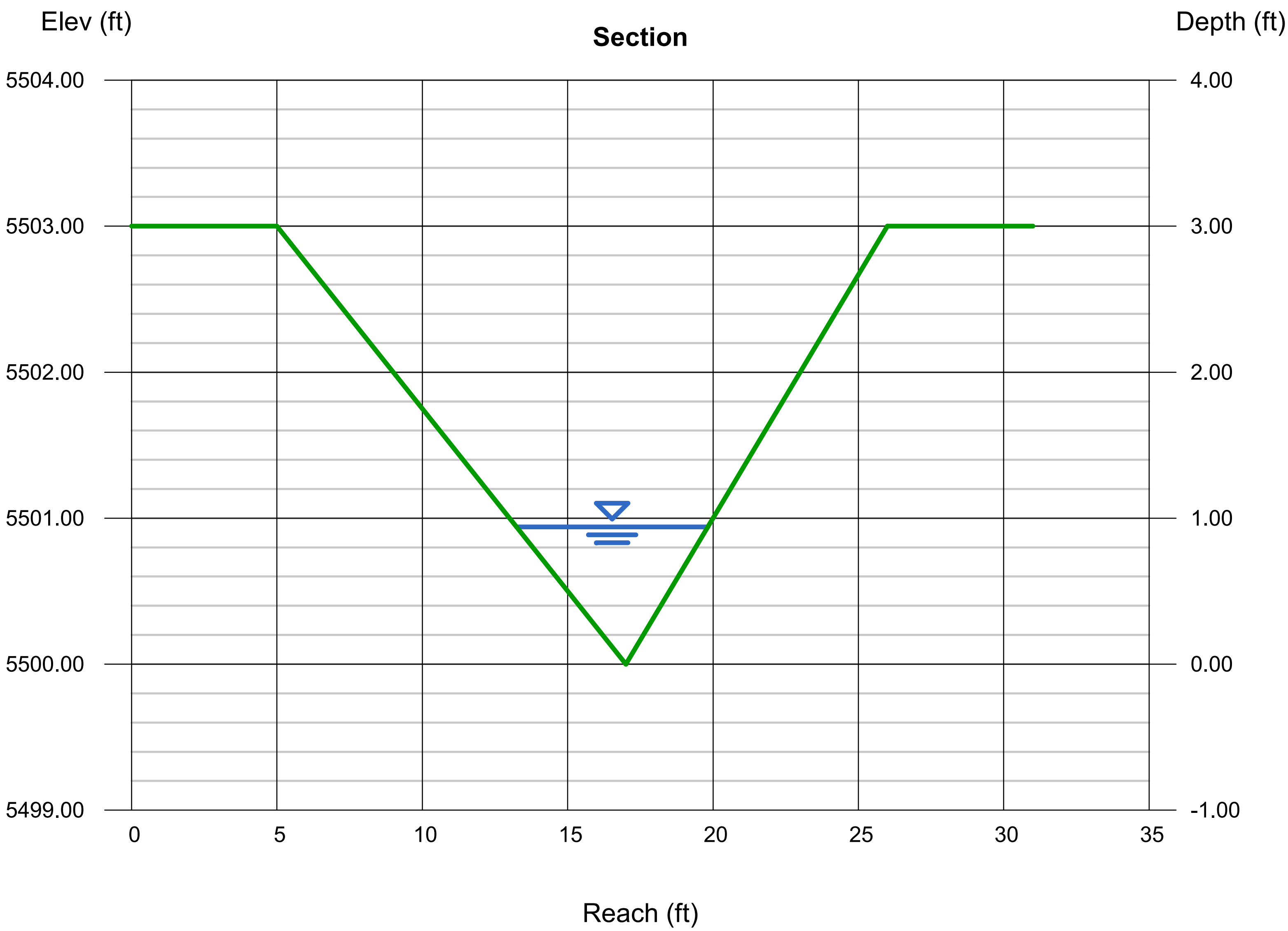
Calculations

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, ≥ 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? 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. 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. 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? 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)? 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.

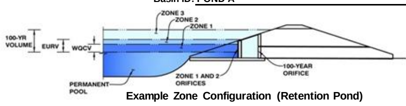
Signature of El Paso County Project Engineer Date

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	Optional User Override 1-hr Precipitation		
Excess Urban Runoff Volume (EURV) =	0.766	acre-feet			
2-yr Runoff Volume (P1 = 1.19 in.) =	0.527	acre-feet		1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.688	acre-feet		1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.836	acre-feet		1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.010	acre-feet		2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.199	acre-feet		2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.421	acre-feet		2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet			inches
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			

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
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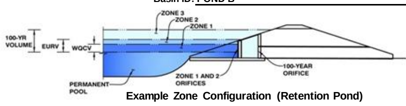
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

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	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.467	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.304	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.416	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.549	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.810	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.460	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.742	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
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		

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
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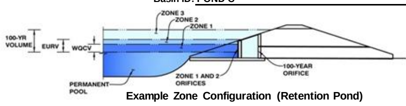
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

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	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.892	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.590	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.835	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.143	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.757	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.960	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	5.186	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
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		

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
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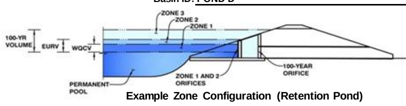
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

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	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.833	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.601	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.031	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.696	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.117	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	4.622	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	7.053	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
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		

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
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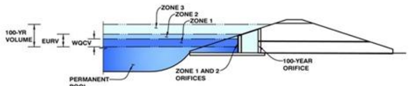
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

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	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.061	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.039	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.054	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.072	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.110	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.221	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.465	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
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		

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
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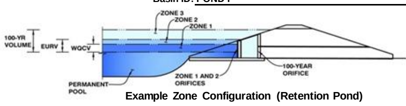
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: SADDLEHORN RANCH MDDP/PDR

Basin ID: POND F



Example Zone Configuration (Retention Pond)

Depth Increment = | ft

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	Optional User Override 1-hr Precipitation		
Excess Urban Runoff Volume (EURV) =	0.885	acre-feet			
2-yr Runoff Volume (P1 = 1.19 in.) =	0.635	acre-feet		1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.106	acre-feet		1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	1.857	acre-feet		1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.476	acre-feet		2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	5.210	acre-feet		2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	8.074	acre-feet		2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet			inches
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			

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

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
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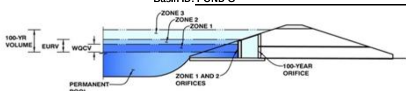
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

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	Optional User Override 1-hr Precipitation		
Excess Urban Runoff Volume (EURV) =	0.565	acre-feet			
2-yr Runoff Volume (P1 = 1.19 in.) =	0.373	acre-feet		1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.504	acre-feet		1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.651	acre-feet		1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.914	acre-feet		2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.439	acre-feet		2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.298	acre-feet		2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet			inches
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			

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
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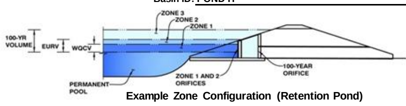
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

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	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.209	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.135	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.186	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.246	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.368	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.685	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.335	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
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		

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		--		--	--	--				
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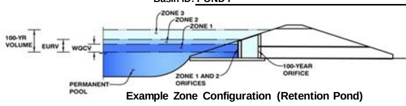
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

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	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.322	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.210	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.292	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.418	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.712	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.236	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.254	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
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		

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

6699

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	--	--	--	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
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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) EFFECTIVE	BFE (FEET NGVD) REVISED	MAP PANEL NUMBER(S)
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

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:

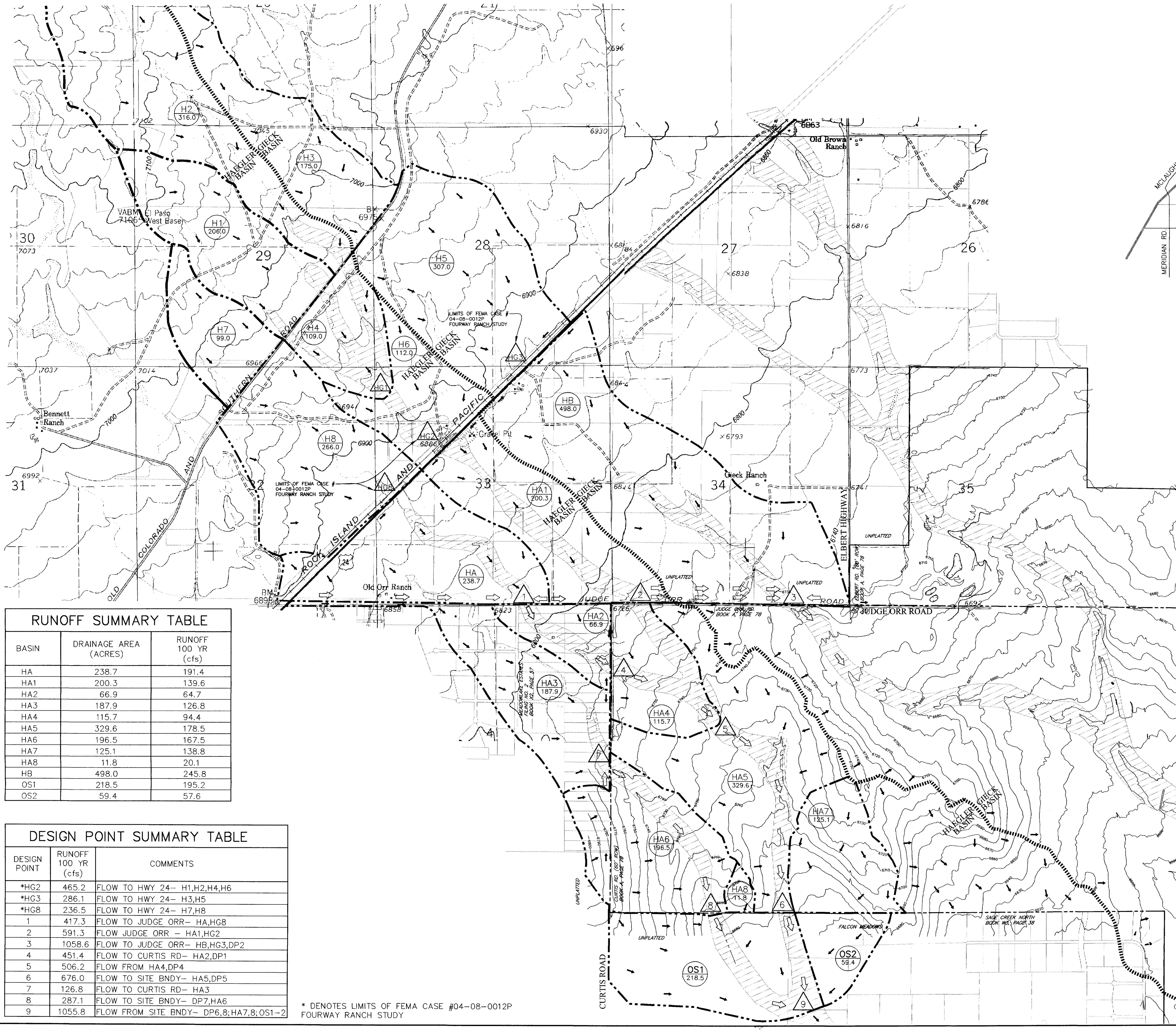
The Honorable Chuck Brown
Chairman, El Paso County
Board of Commissioners
27 Vermijo Avenue
Colorado Springs, CO 80903-2208

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



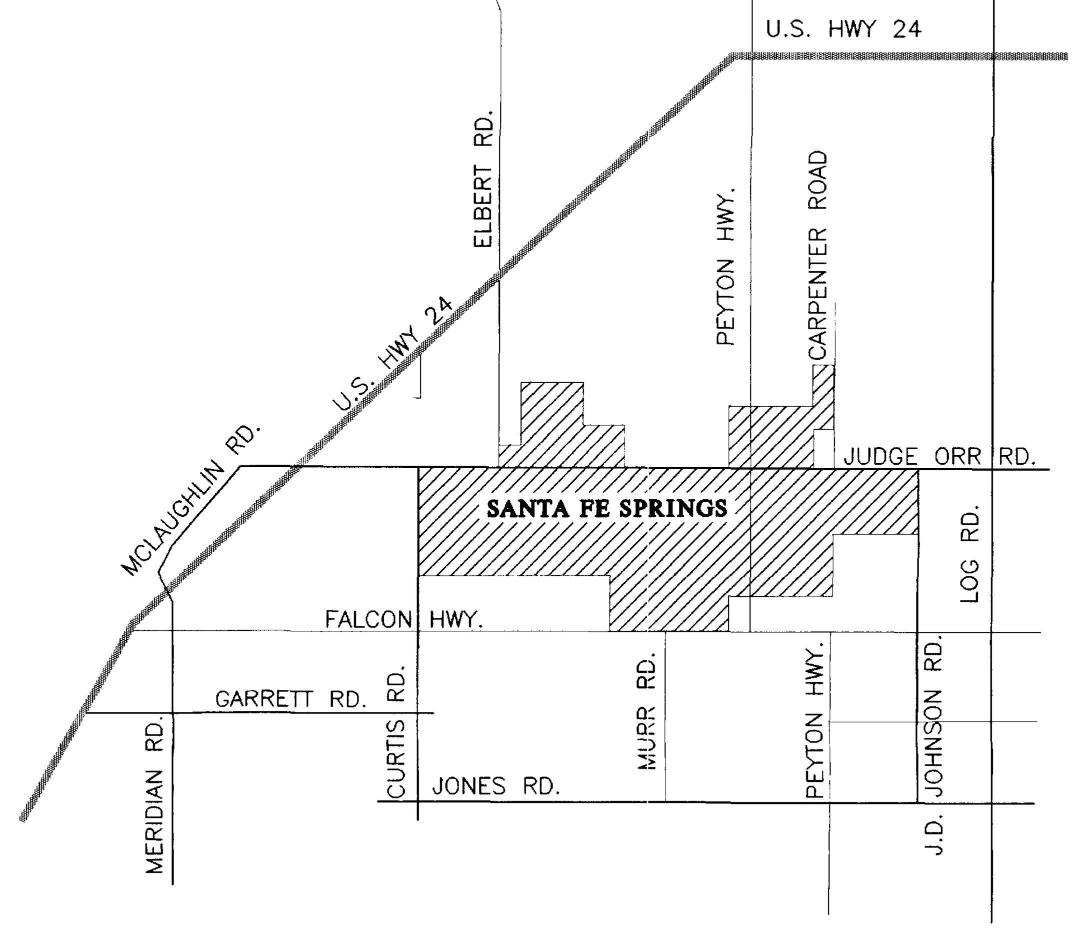
RUNOFF SUMMARY TABLE

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



VICINITY MAP
1"=5000'

LEGEND

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

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

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

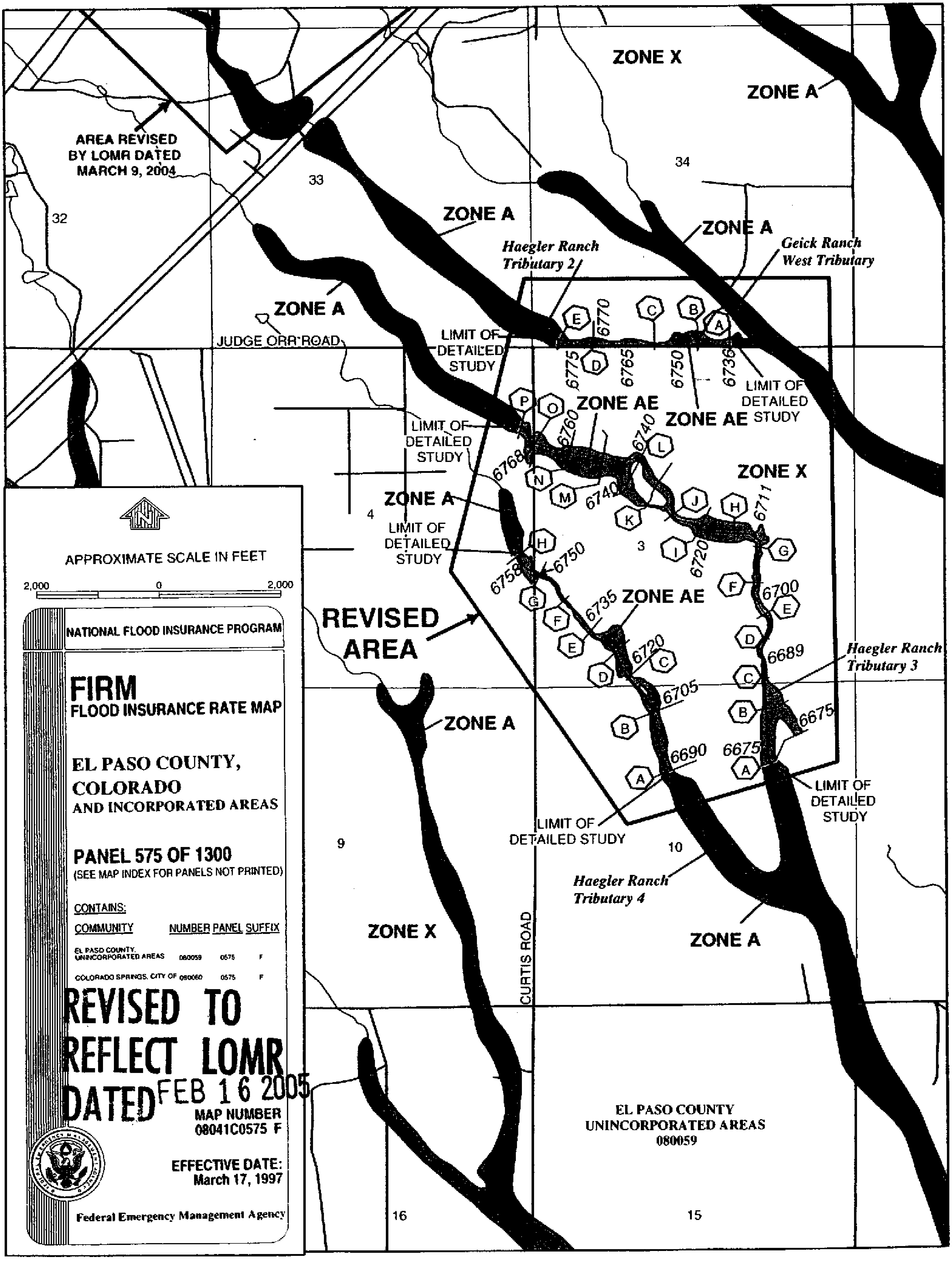
DATE: 05/21/04

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
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STUDY
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ZONE X
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6758
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6735
ZONE AE
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6689
Haegler Ranch
Tributary 3
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ZONE A
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LIMIT OF
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STUDY
LIMIT OF
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Haegler Ranch
Tributary 4
ZONE X
CURTIS ROAD
ZONE A
EL PASO COUNTY
UNINCORPORATED AREAS
080059
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15
APPROXIMATE SCALE IN FEET
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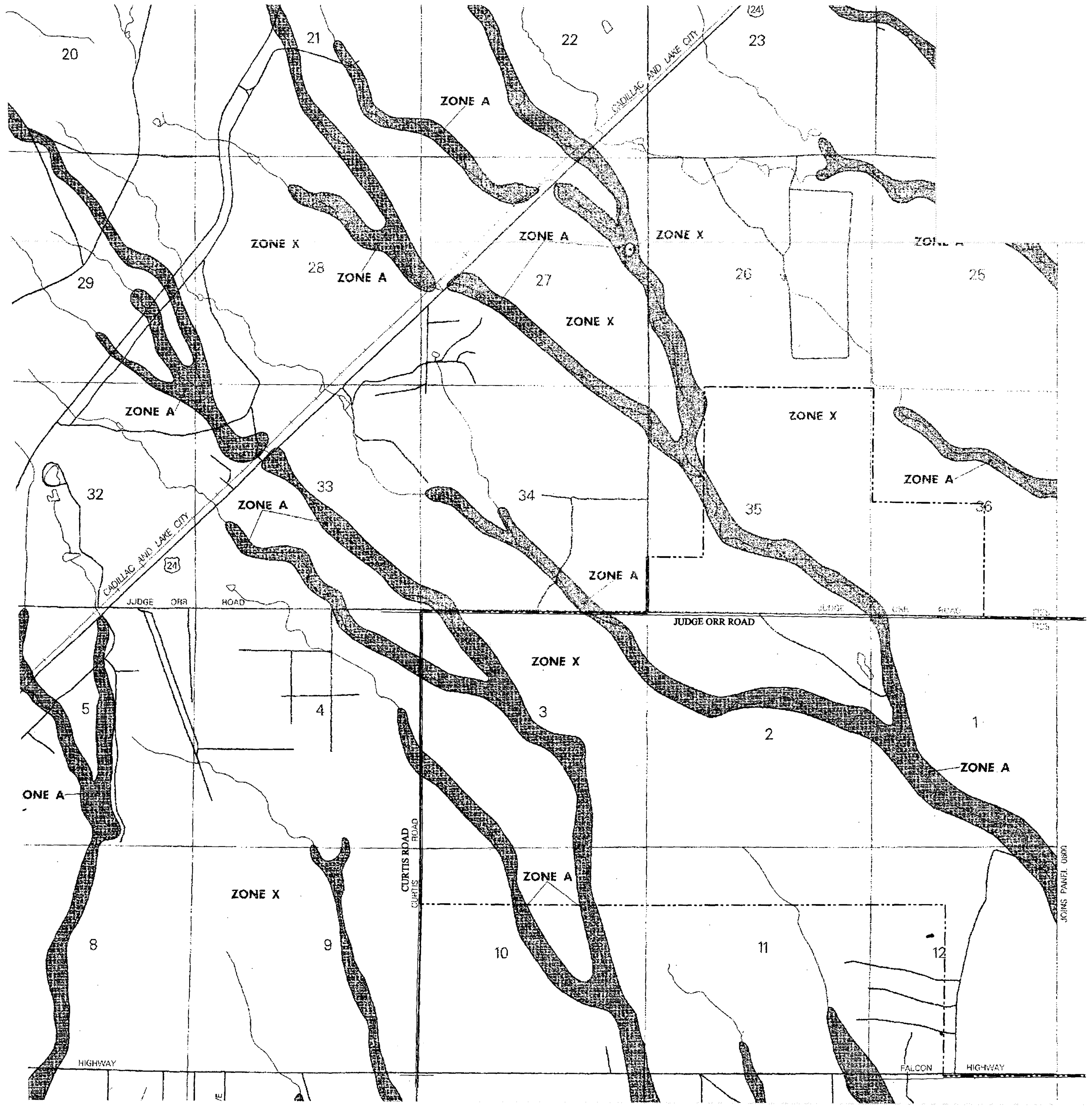
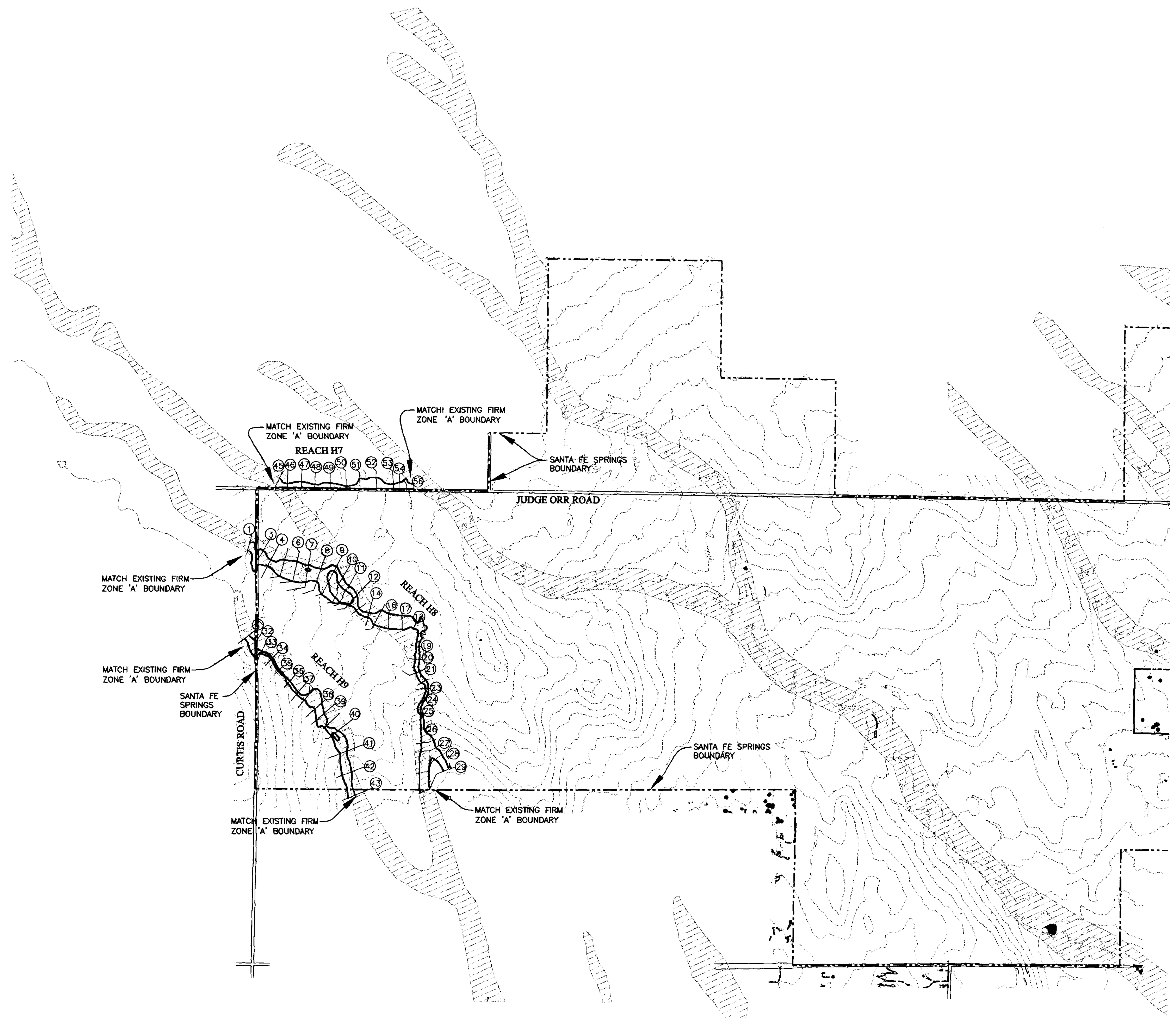
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY,
COLORADO
AND INCORPORATED AREAS
PANEL 575 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY
NUMBER PANEL SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS 080059 0575 F
COLORADO SPRINGS, CITY OF 080060 0575 F
REVISED TO
REFLECT LOMR
DATED FEB 16 2005
MAP NUMBER
08041C0575 F
EFFECTIVE DATE:
March 17, 1997
Federal Emergency Management Agency



EFFECTIVE CONDITION

MAP PANEL NO. 0575F



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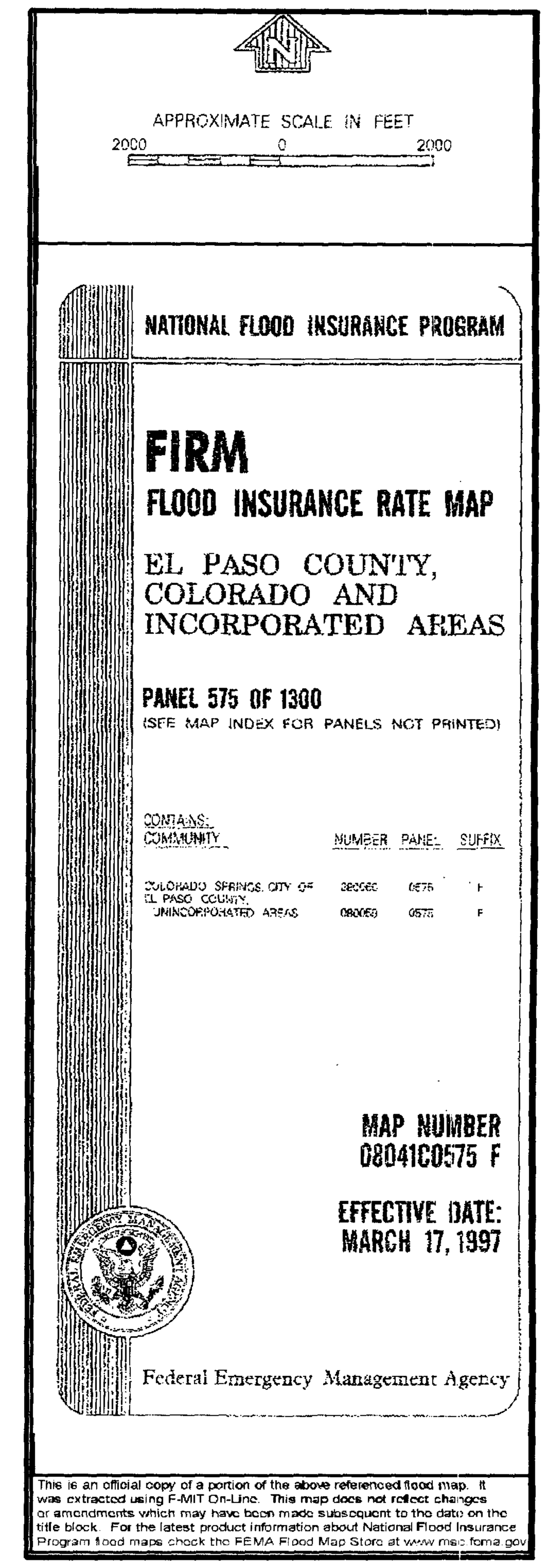

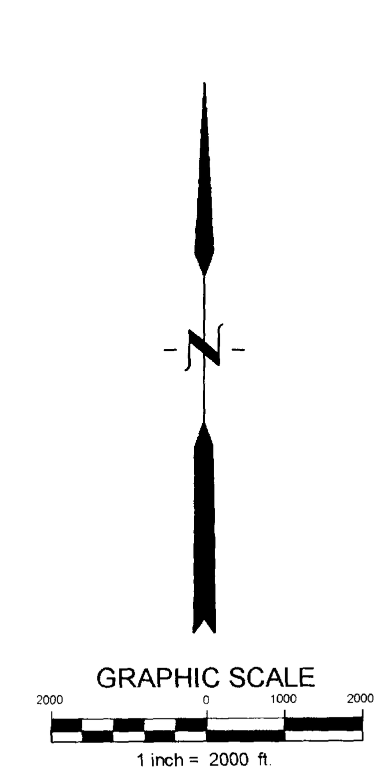

NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION

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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

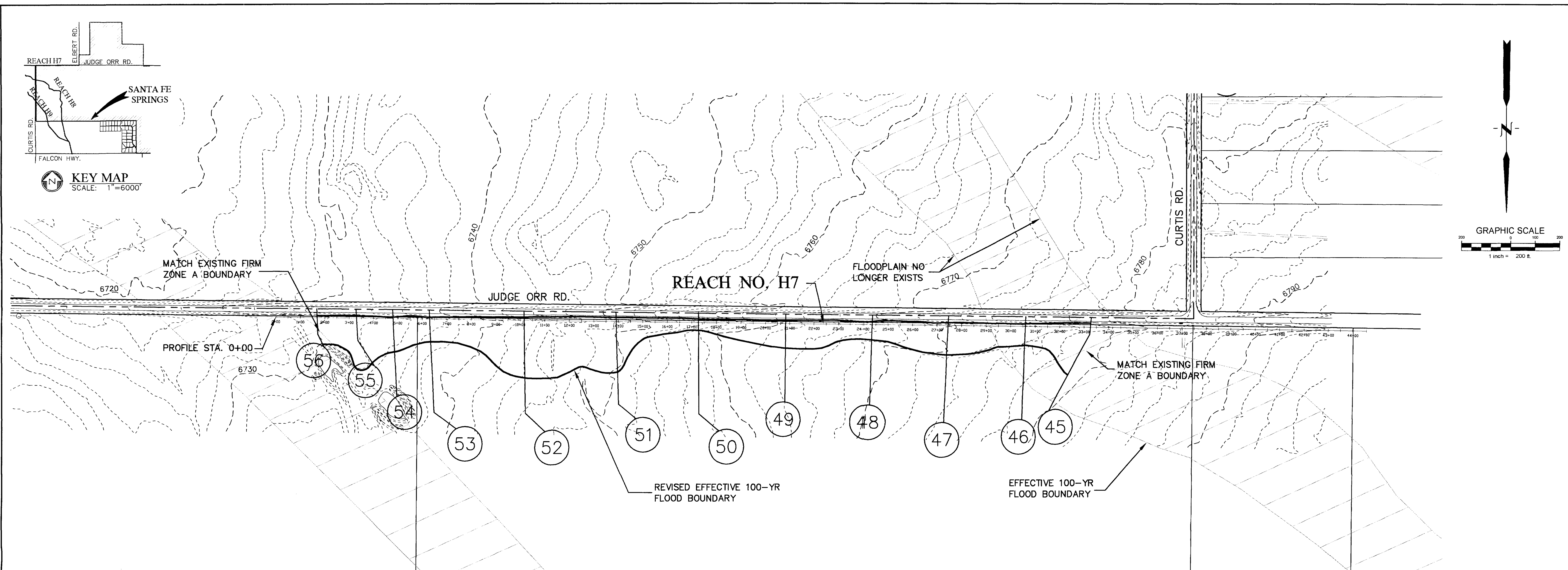
REALTY DEVELOPMENT SERVICES
25 NORTH TEJON
SUITE 300

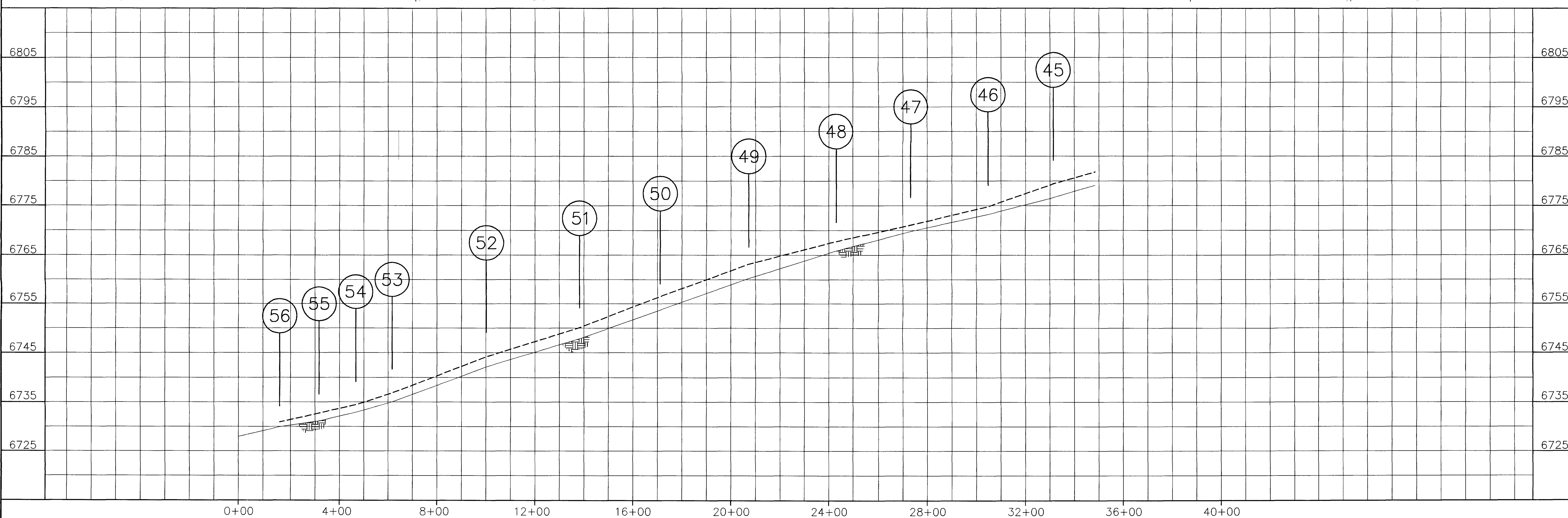
EXHIBIT 2
REVISED FLOOD INSURANCE RATE MAP

PROJECT NO.
6005-0001

FILENAME
RATE_MAP_LOMR.DWG

DRAWING NO.
EXH. 2





REVISION

NO.	DESCRIPTION	REV BY	CKD BY	DATE

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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

NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION

TRI-CORE ENGINEERING
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SCALE (H): 1"=200'
SCALE (V): 1"=10'

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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

REVISION				
NO.	DESCRIPTION	REV BY	CKD BY	DATE

TRI-CORE ENGINEERING
5526 N. ACADEMY BLVD., SUITE 204
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SCALE (H): 1"=200'
SCALE (V): 1"=10'

DRAWN BY: KMV
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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.	REVISION DESCRIPTION	REV BY	CKD BY	DATE

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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

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DBC Project Number: C-7706-2

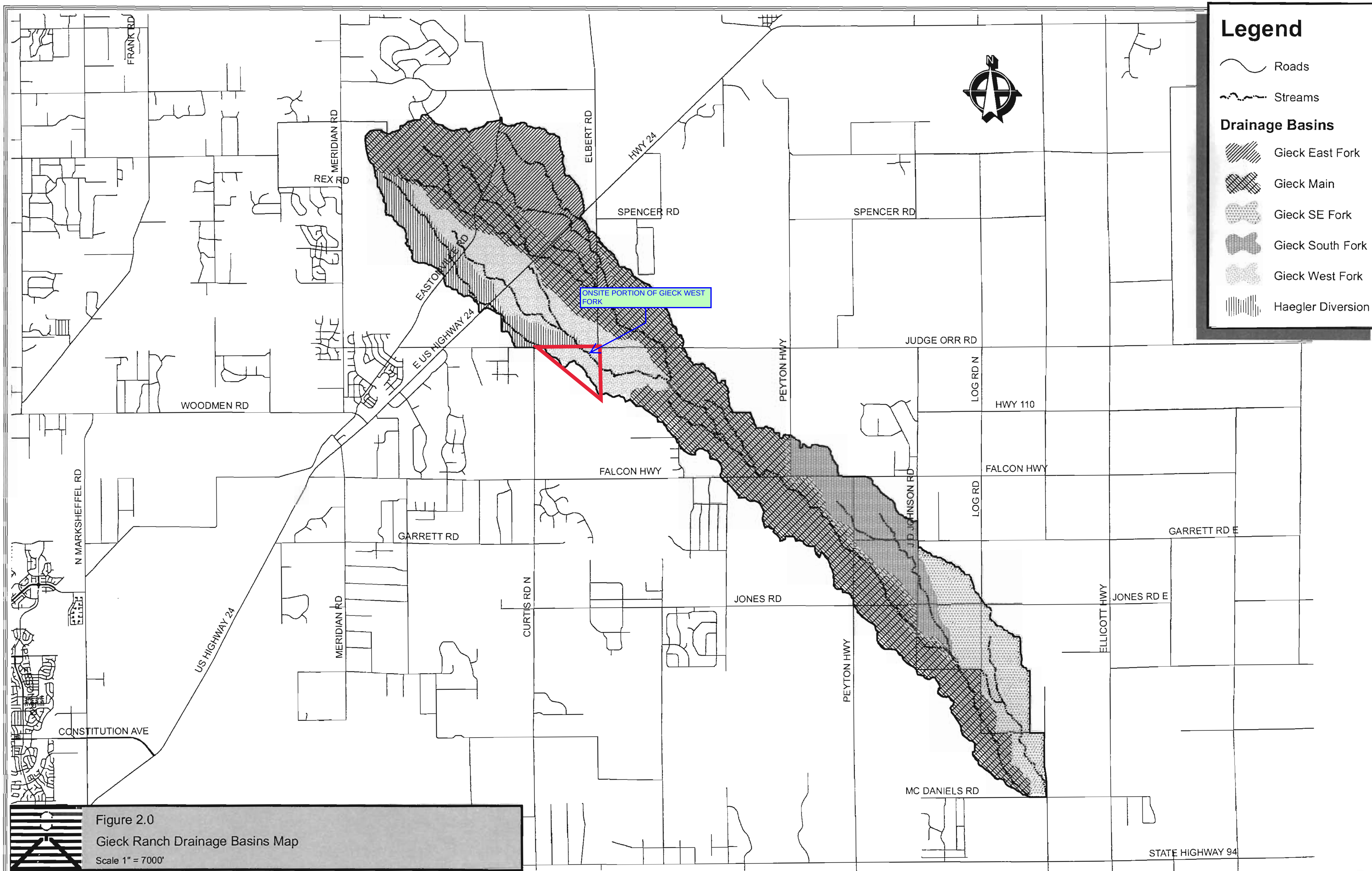


Figure 2.0

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

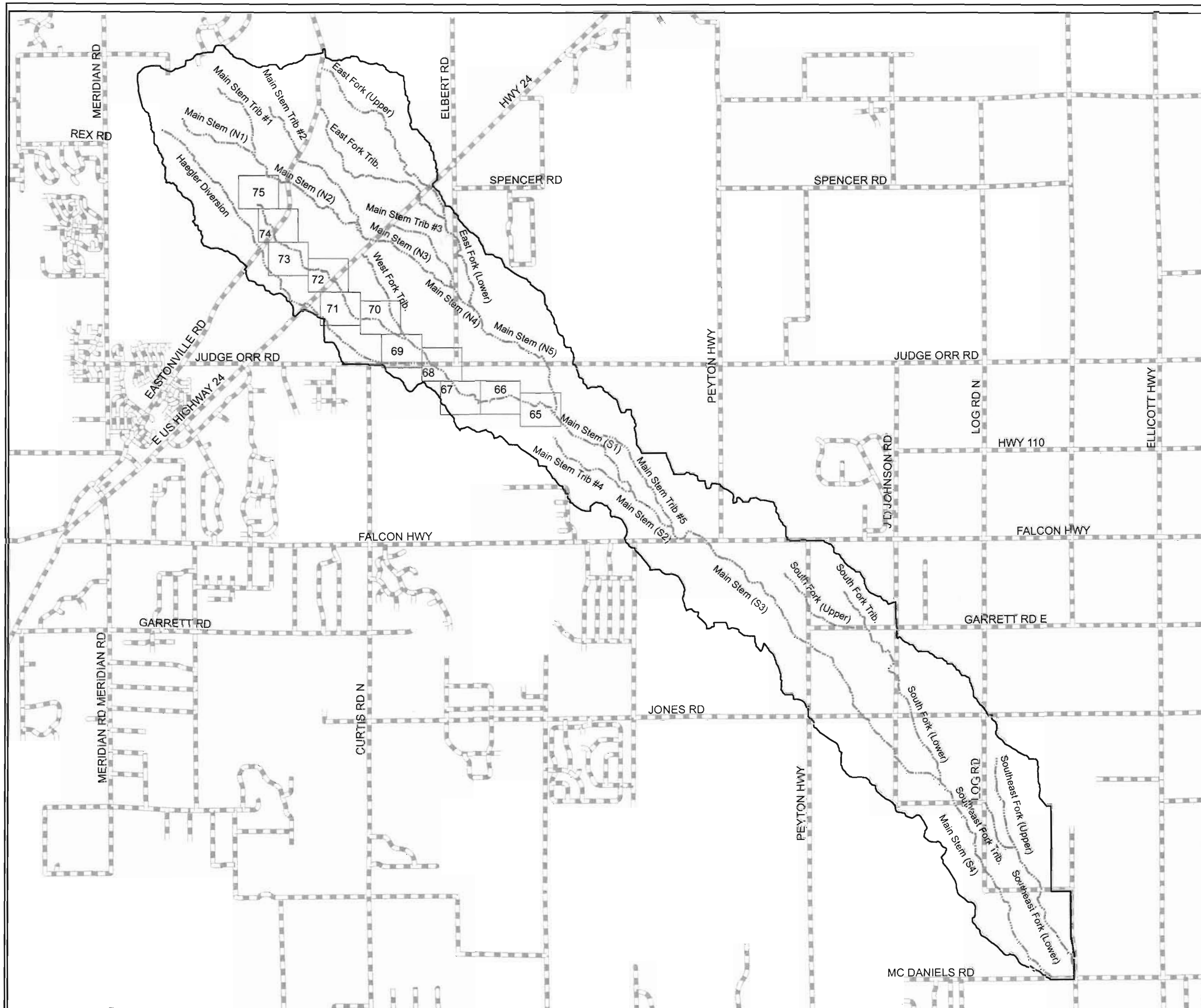
The 100-year storm event future undetained peak flow is estimated to increase by 78% over the existing peak flow while the future volume of runoff is estimated to increase by 20%.

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



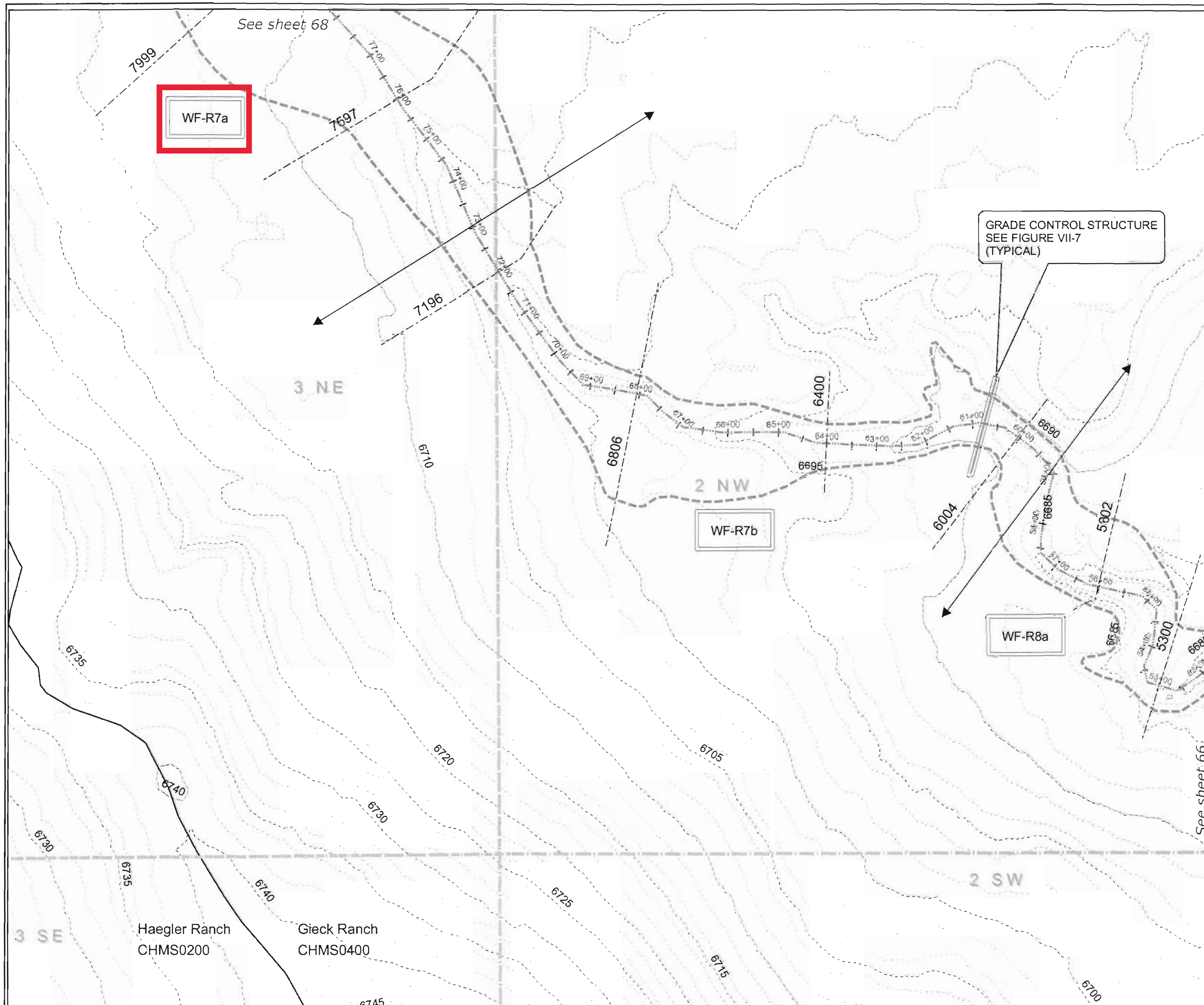
THIS DRAWING IS CONCEPTUAL IN NATURE AND IS NOT TO BE USED AS THE SOLE BASIS FOR FINAL DESIGN, CONSTRUCTION, OR REMEDIAL ACTION. FURTHER STUDIES UNDER EPC DOT'S DIRECTION SHOULD BE PERFORMED PRIOR TO SUCH DECISIONS.

Legend

- Streams
- Roads
- Basin Boundary
- Matchlines

0 1 2 Miles

PREPARED BY:	PREPARED FOR:	PROJECT INFO:		DRAWING INFO:		
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	REALTY DEVELOPMENT SERVICES 25 NORTH TEJON STREET, SUITE 300 COLORADO SPRINGS, COLORADO 80903 CONTACT: RAY O' SULLIVAN (719) 227-1022	GIECK RANCH DRAINAGE BASIN PLANNING STUDY EL PASO COUNTY, COLORADO	DESIGNED BY: RJB DRAWN BY: BLF CHECKED BY: RJB REVISION DESCRIPTIONS / DATE	GIECK RANCH KEY MAP WEST FORK	DATE: AUGUST 2007 SCALE: H: 1" = 6000' V:	JOB NO: C7706-1 DRAWING NO.: 6D 038 SET: PL 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

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.

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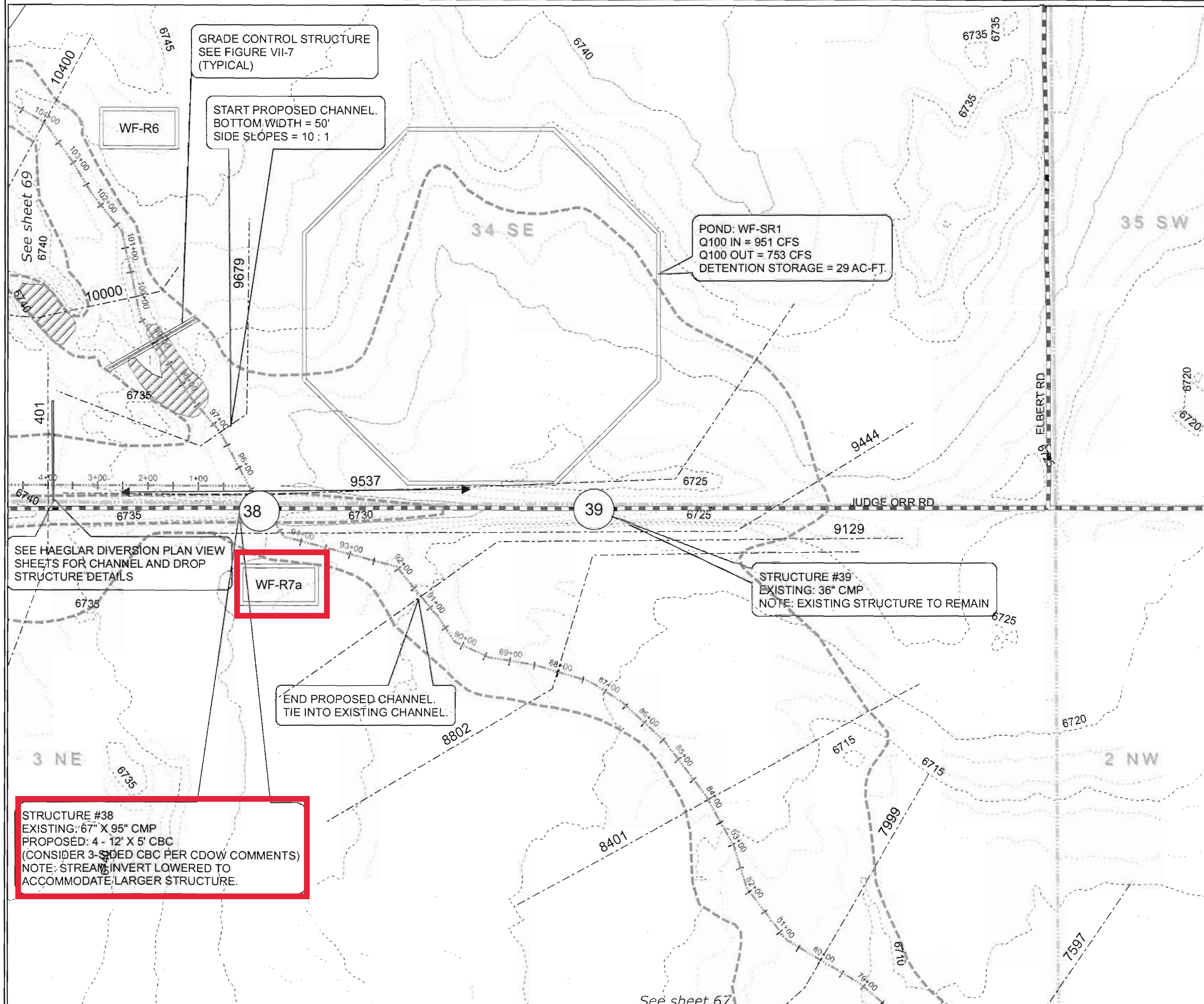
PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

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



Environmental Key

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

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

N

0 100 200 Feet

Legend

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

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.

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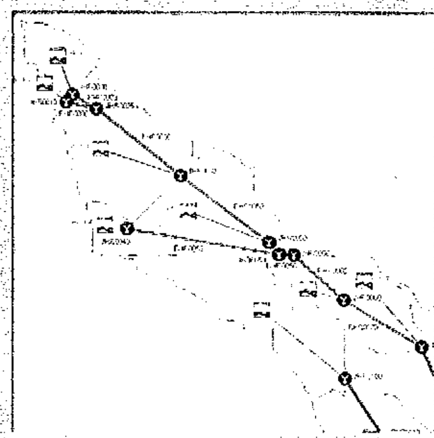
PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

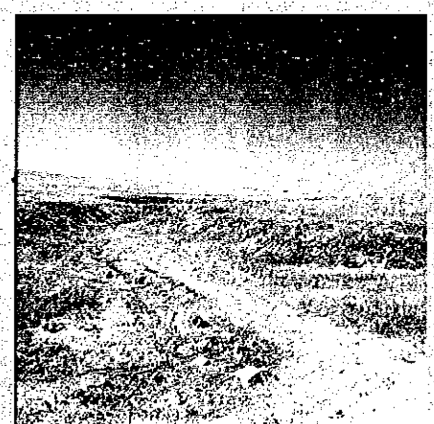
DESIGNED BY: RJB
DRAWN BY: BLF/MLM
CHECKED BY: RJB/TML

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

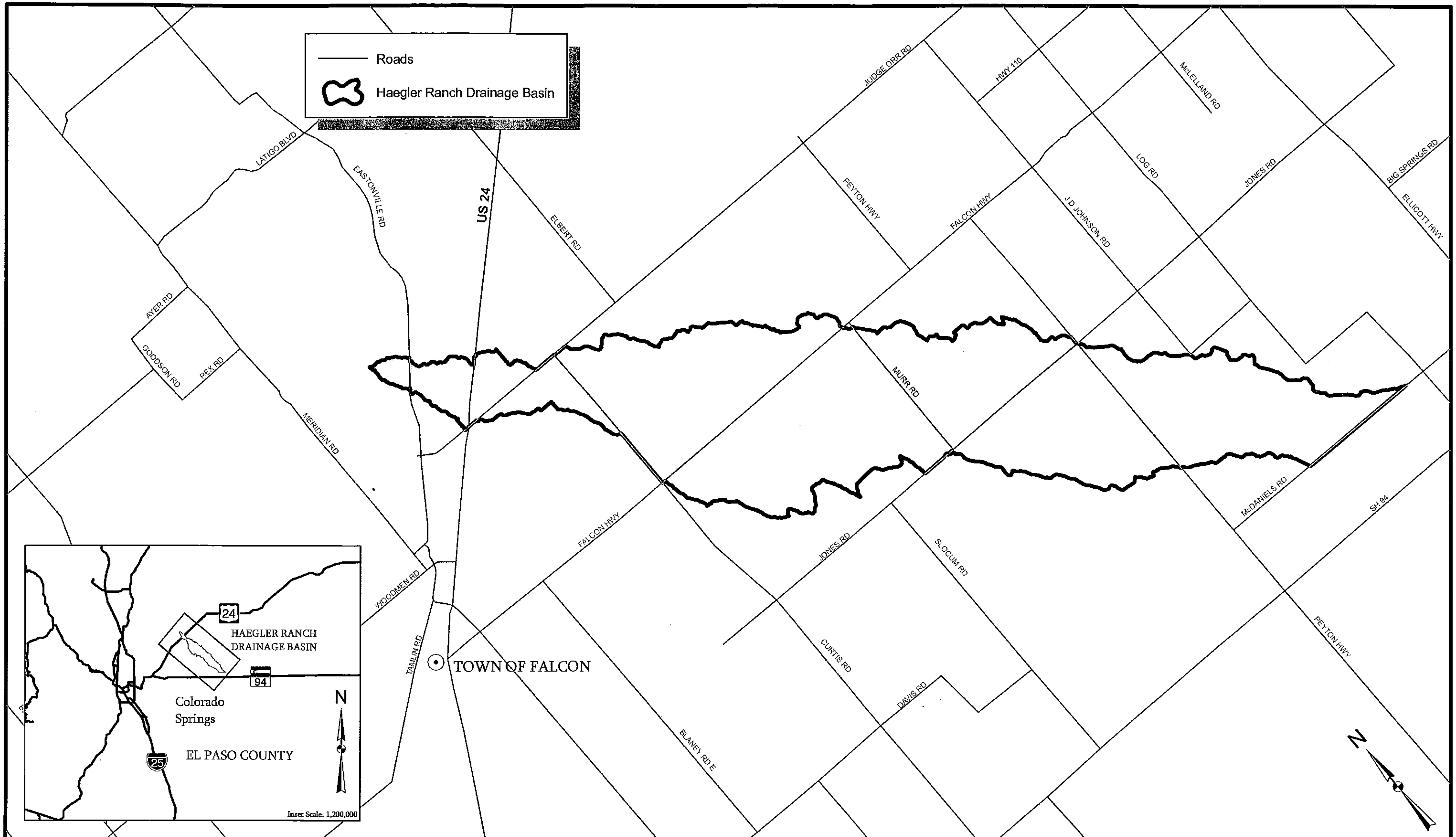




Haegler Ranch Basin

Drainage Basin Planning Study

May 2009



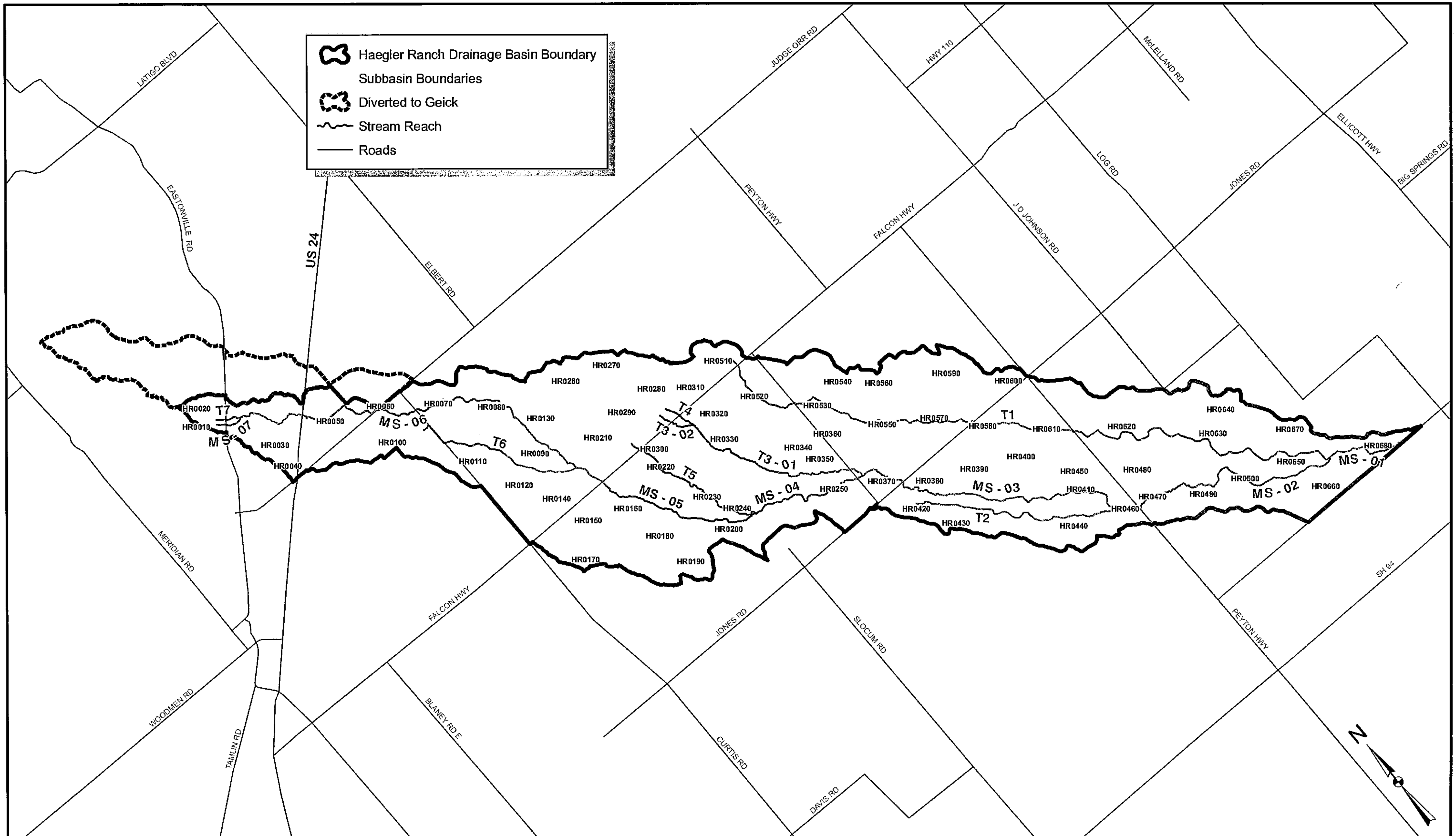
URS
9960 Federal Dr.
Suite 300
Colorado Springs, CO 80921
719.531.0001

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.

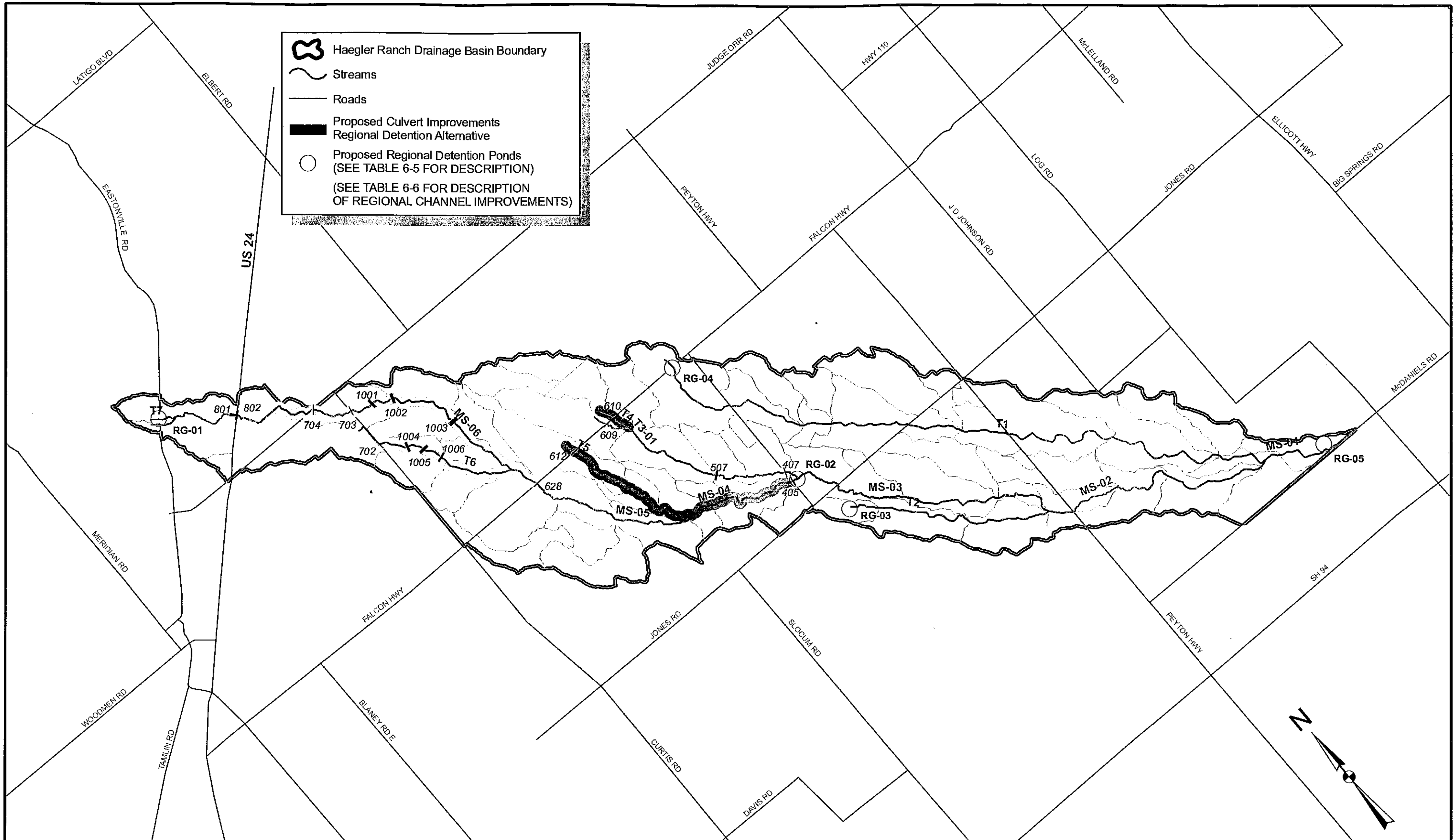
Table 6-3 Existing Conditions Culvert Design

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



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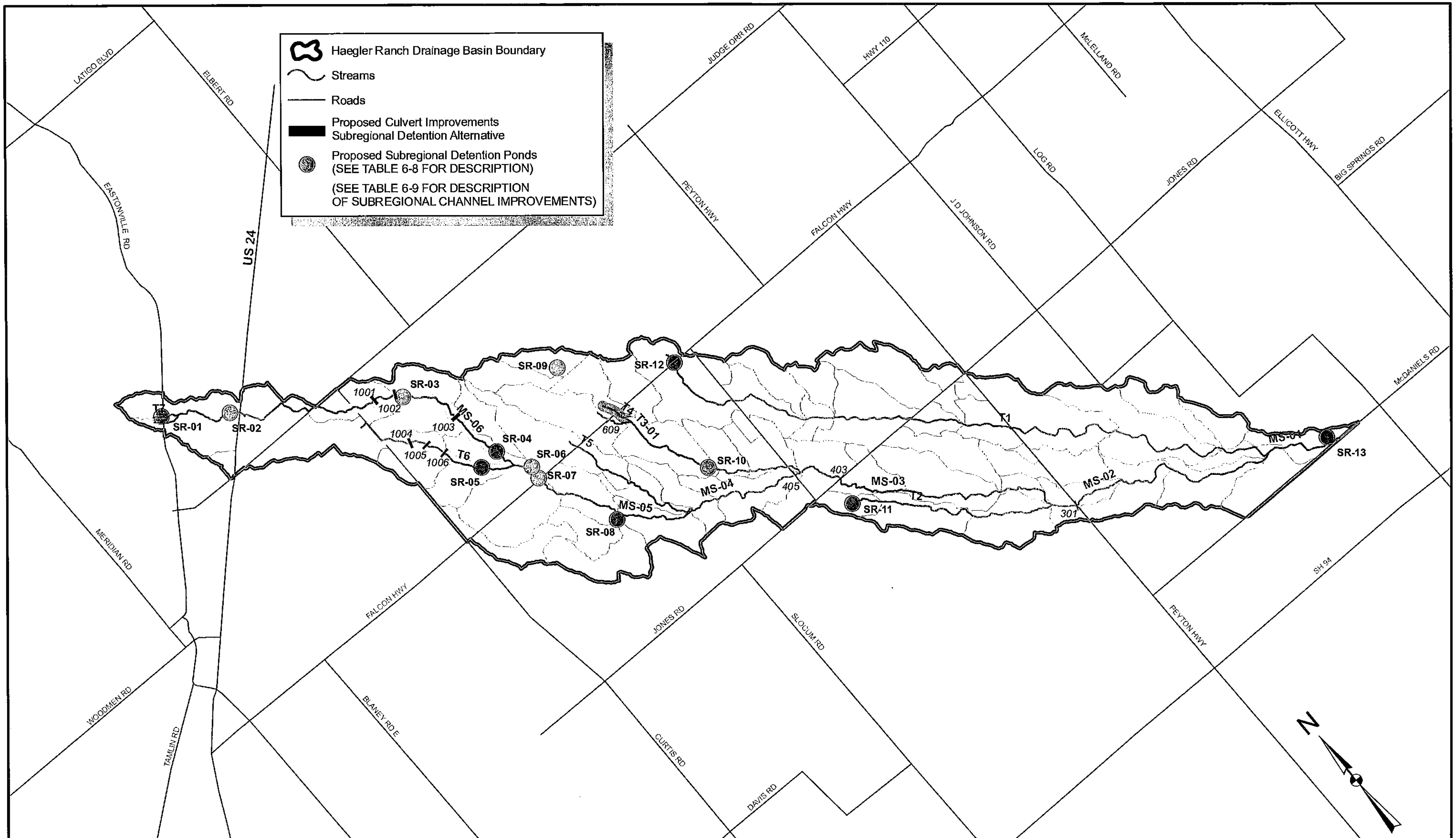
5,000 2,500 0 5,000 Feet
1" = 5,000'

DATE: 05/08

HAEGLER RANCH DRAINAGE BASIN
REGIONAL DETENTION ALTERNATIVES
FIGURE 6-1

URS NO. 21711039



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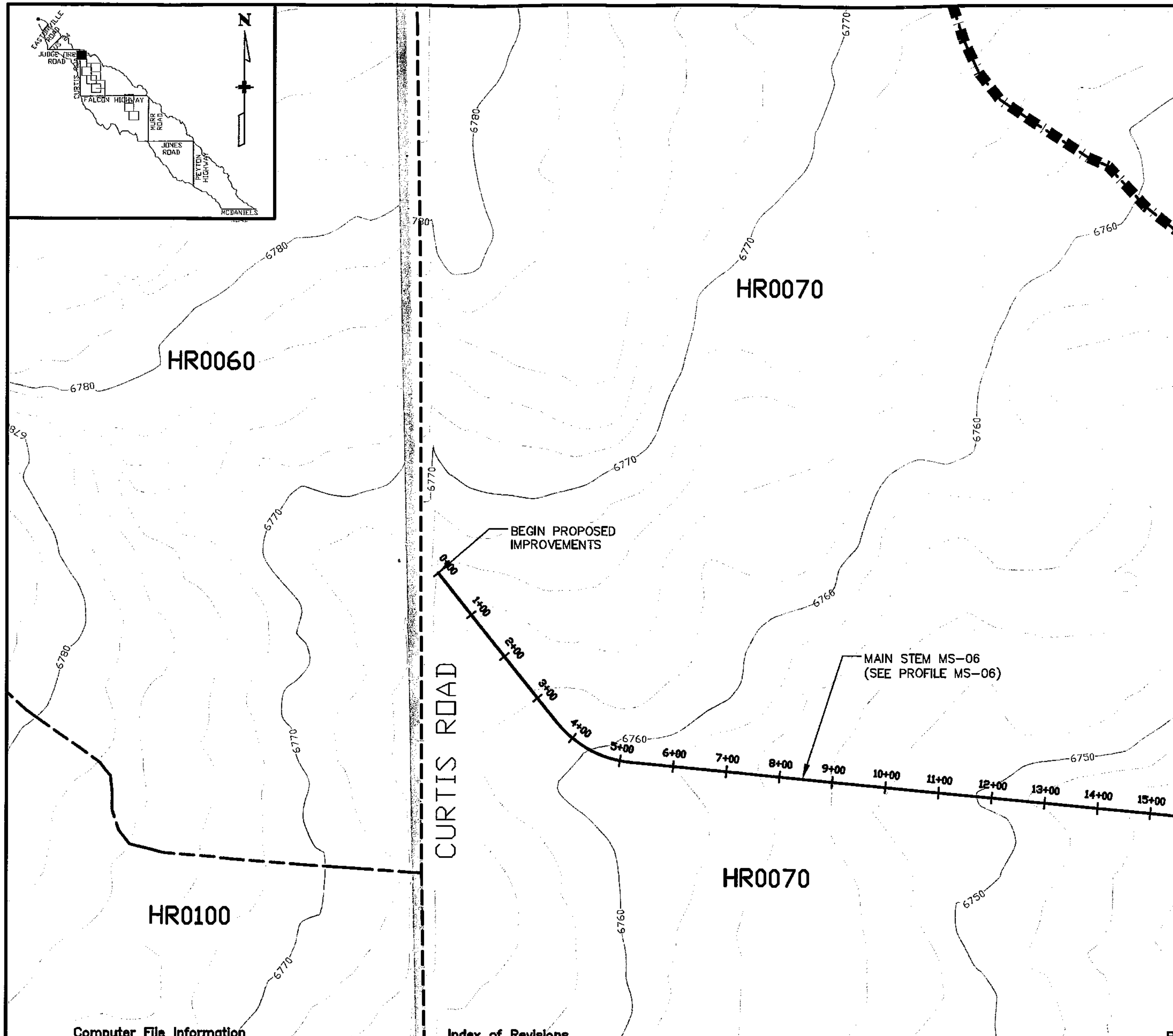
5,000 2,500 0 5,000 Feet
1" = 5,000'

DATE: 05/08

HAEGLER RANCH DRAINAGE BASIN
SUBREGIONAL DETENTION ALTERNATIVES
FIGURE 6-2

URS NO. 21711039



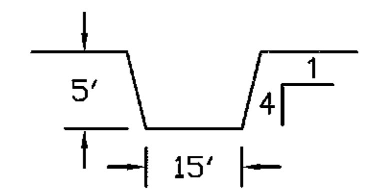
LEGEND

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

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Acad. Ver. 2006	Scale: 1"=200' Units: Feet		

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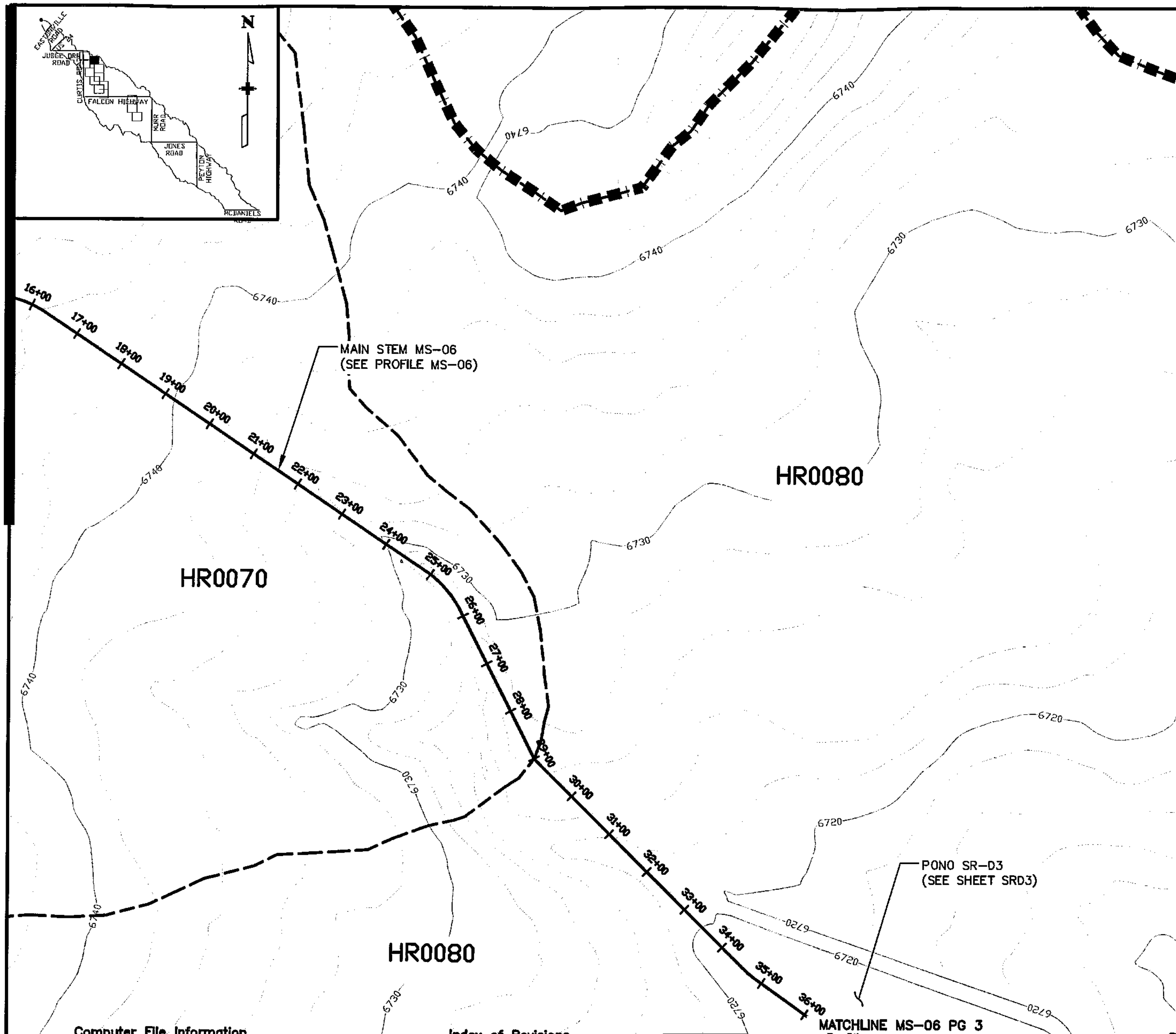
Detailed by:	DRM
Checked by:	JAJ

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 1



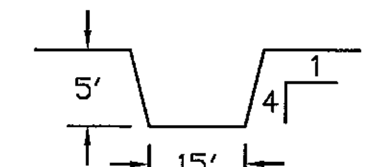
LEGEND

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

1"=200'

200 0 200 400

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



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Q: 600 CFS

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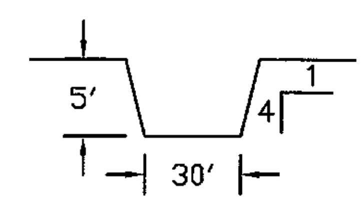

STA: 31+34 TO STA: 74+61

Q: 1000 CFS

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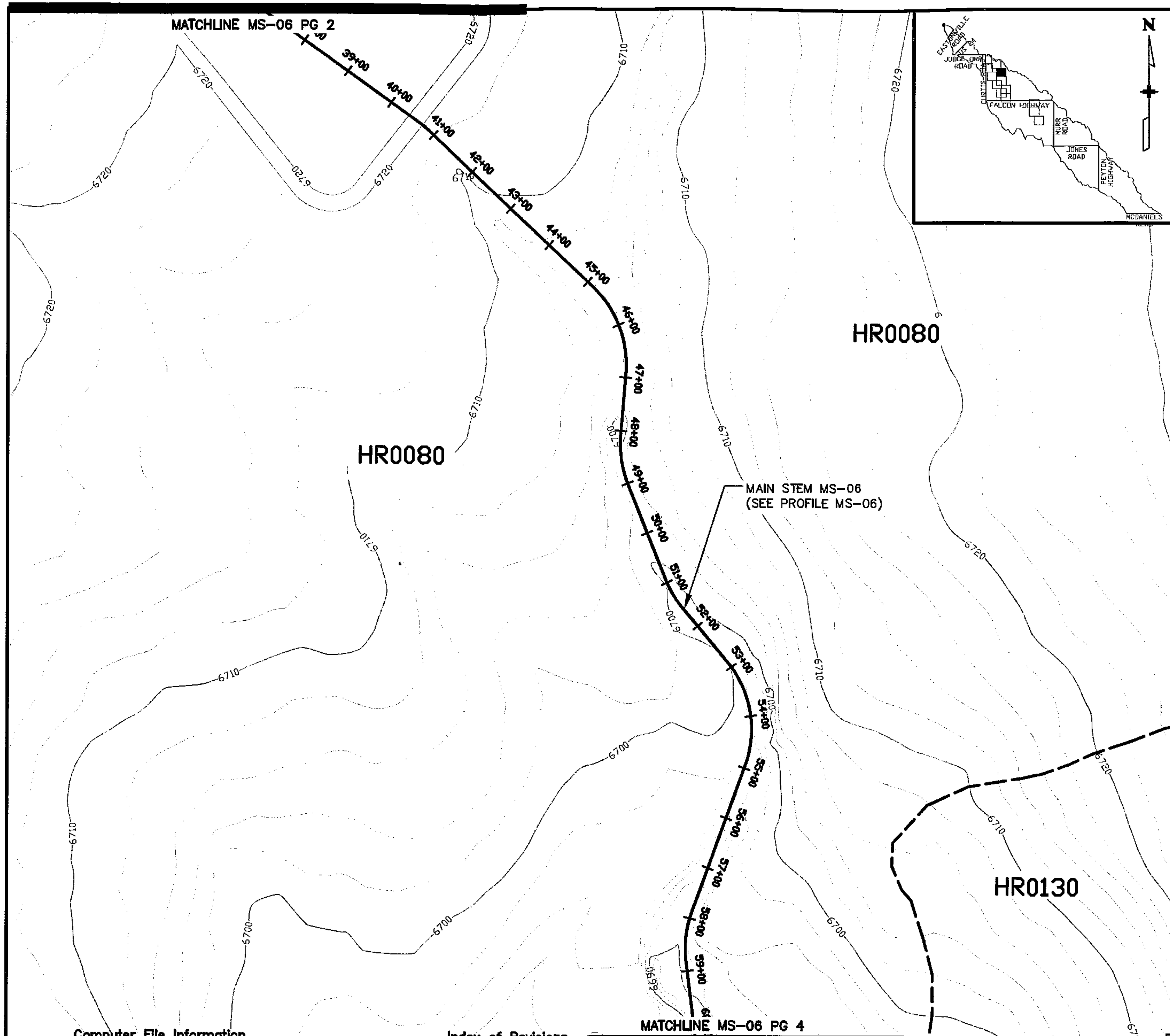
HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 2



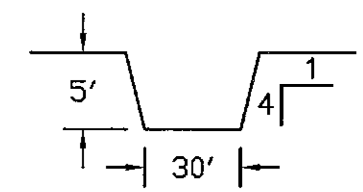
LEGEND

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

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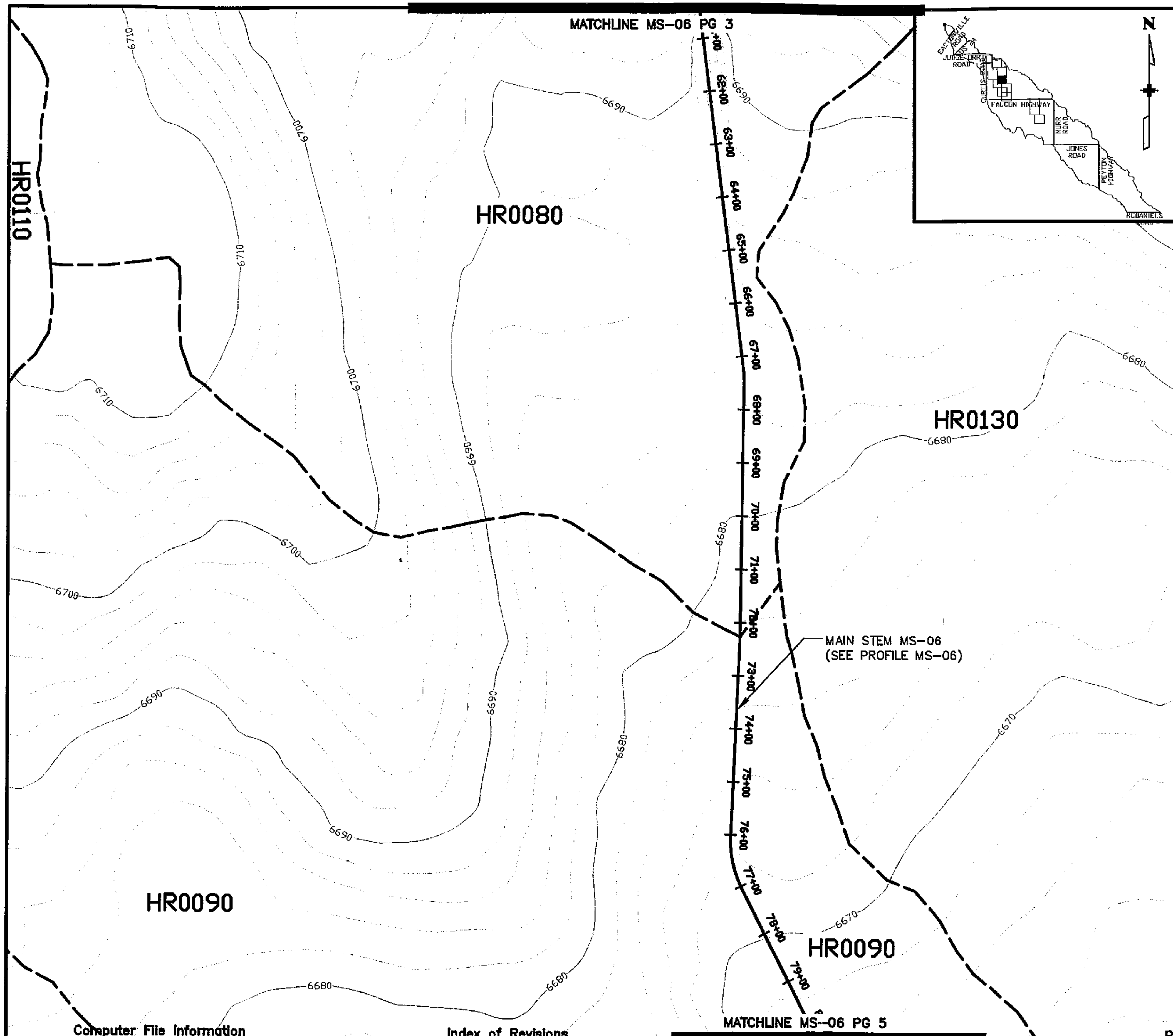


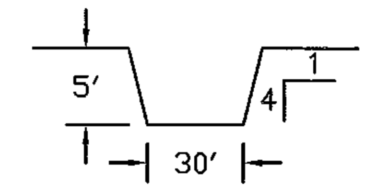
LEGEND

- 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



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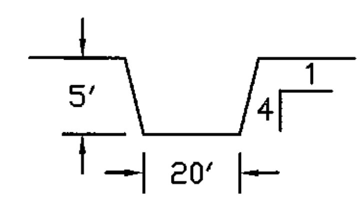
BASIN: HR0090



STA: 74+61 TO STA: 103+62

Q: 800 CFS

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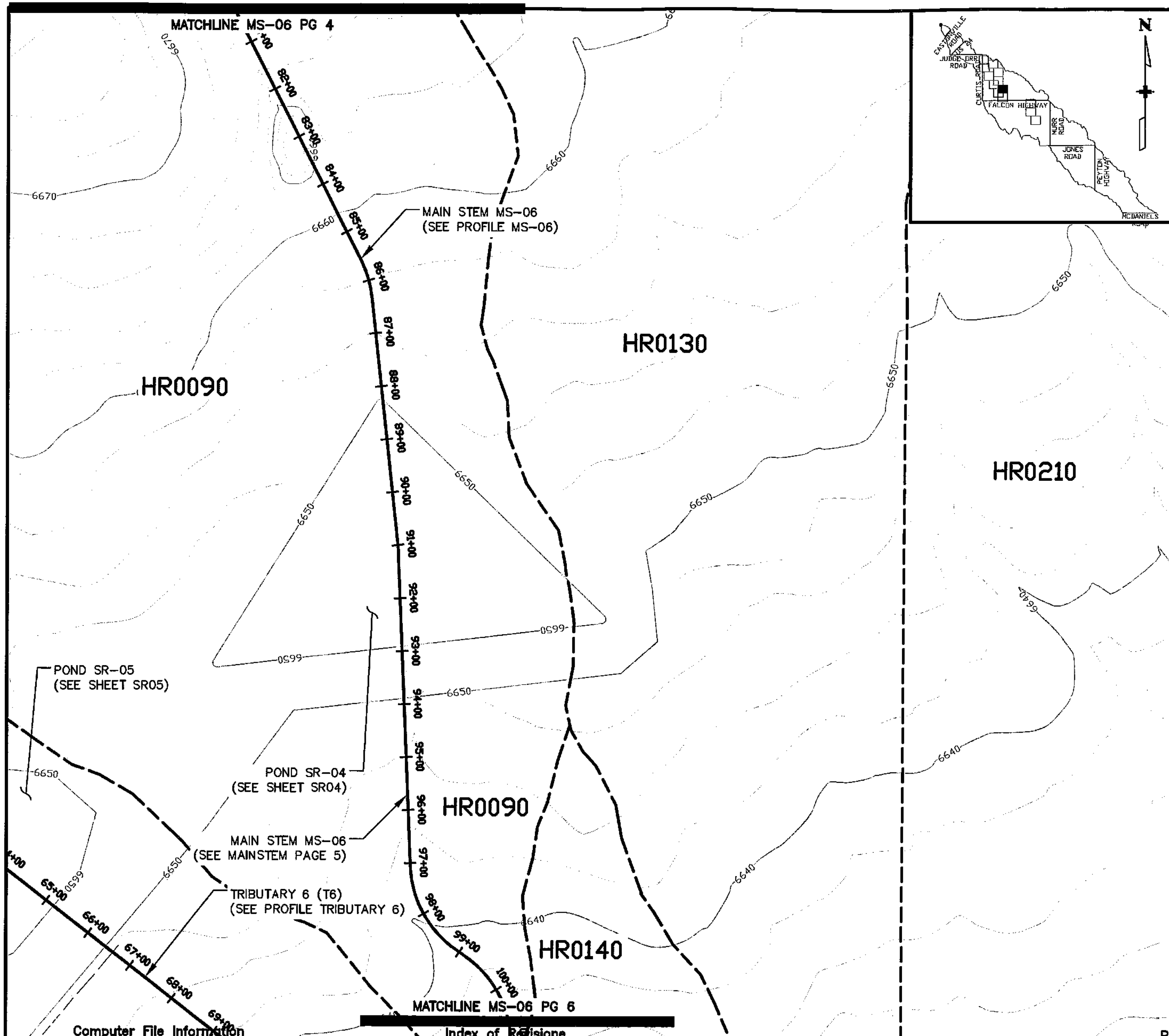


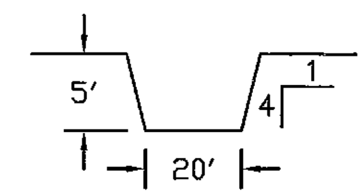
LEGEND

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

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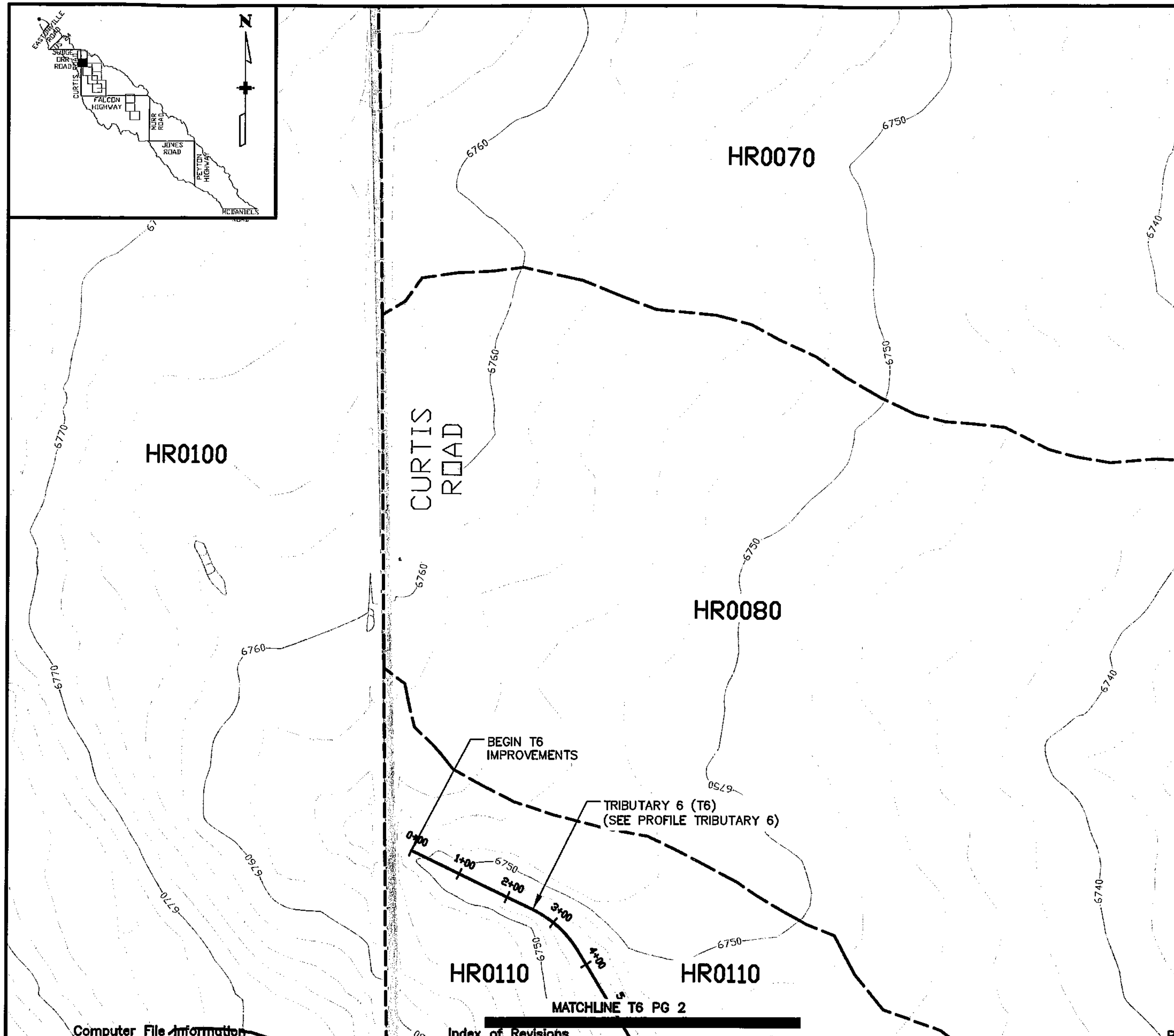
HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 5



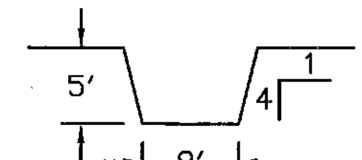
LEGEND

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

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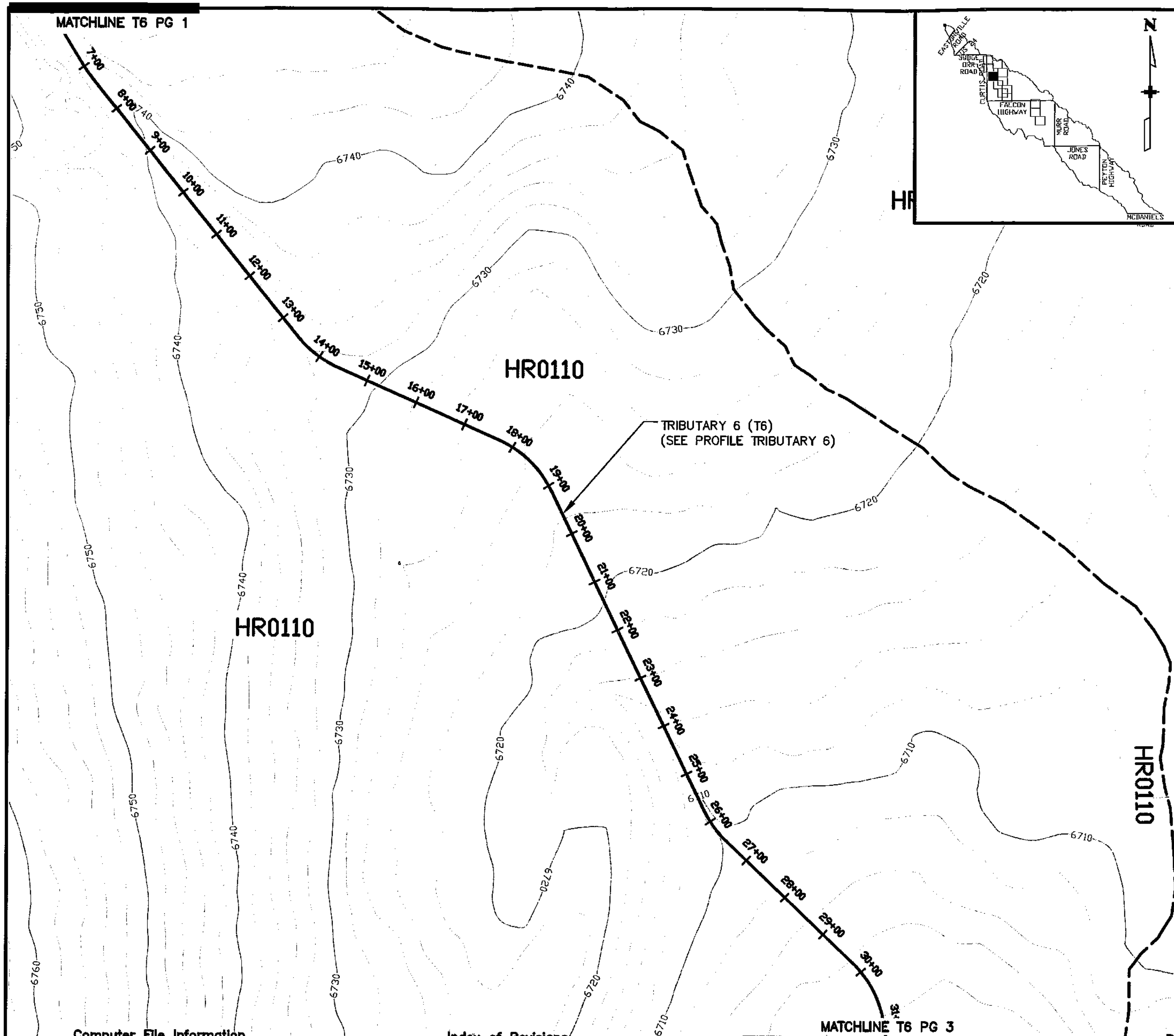
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number TRIBUTARY 6 PG 1

MATCHLINE T6 PG 1



MATCHLINE T6 PG 3

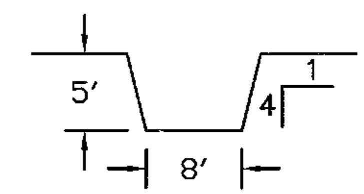
LEGEND

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

1"=200'

200 0 200 400

CHANNEL: TRIBUTARY 6 (T6)
BASIN: HR0110



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Q: 500 CFS

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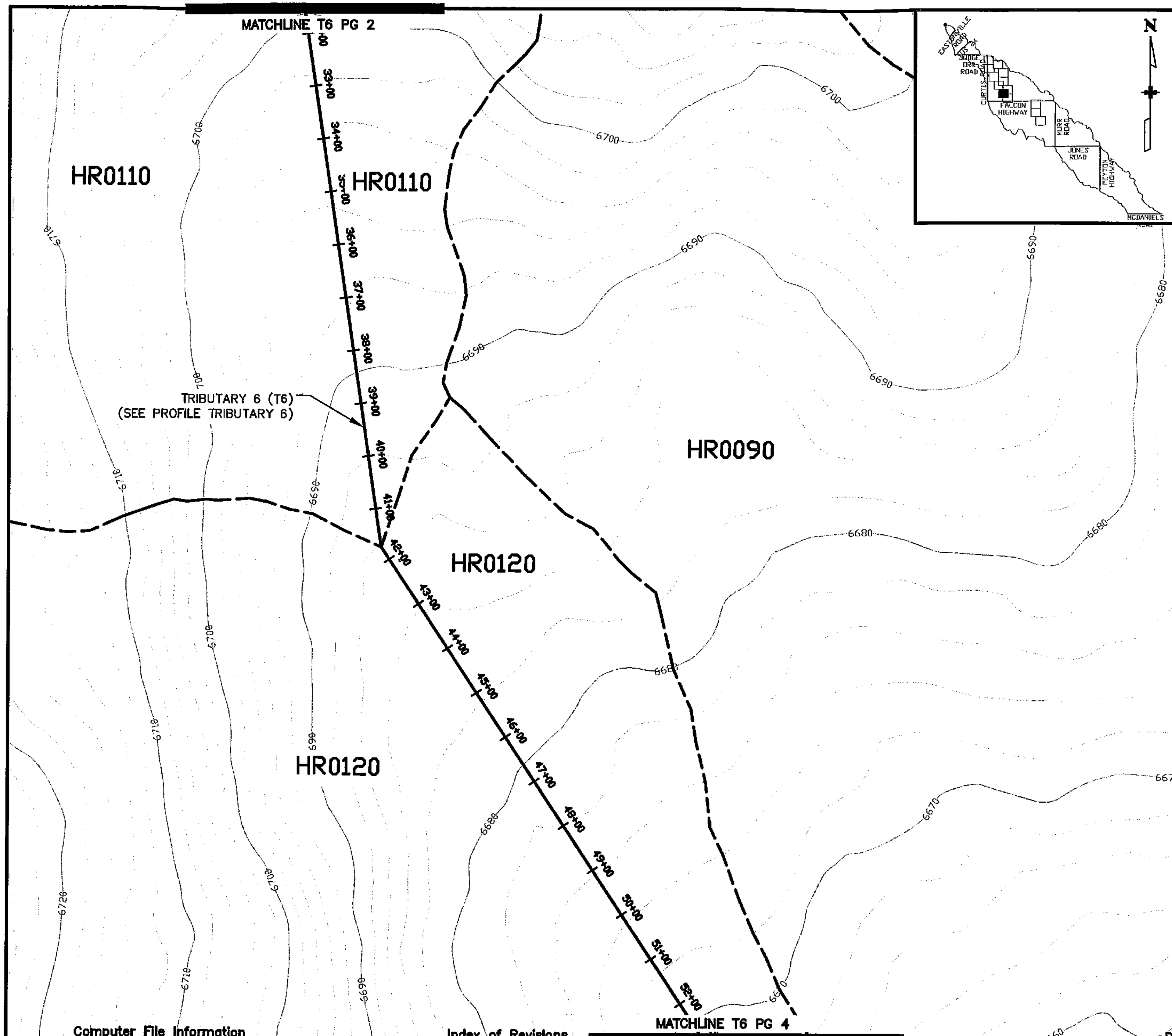


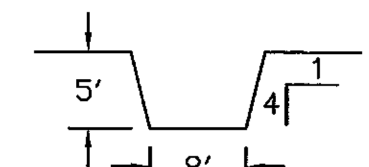
LEGEND

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

1"=200'

200 0 200 400

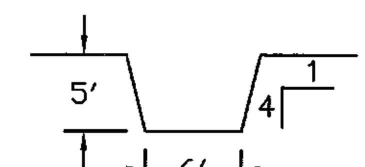
CHANNEL: TRIBUTARY 6 (T6)
BASIN: HR0110



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

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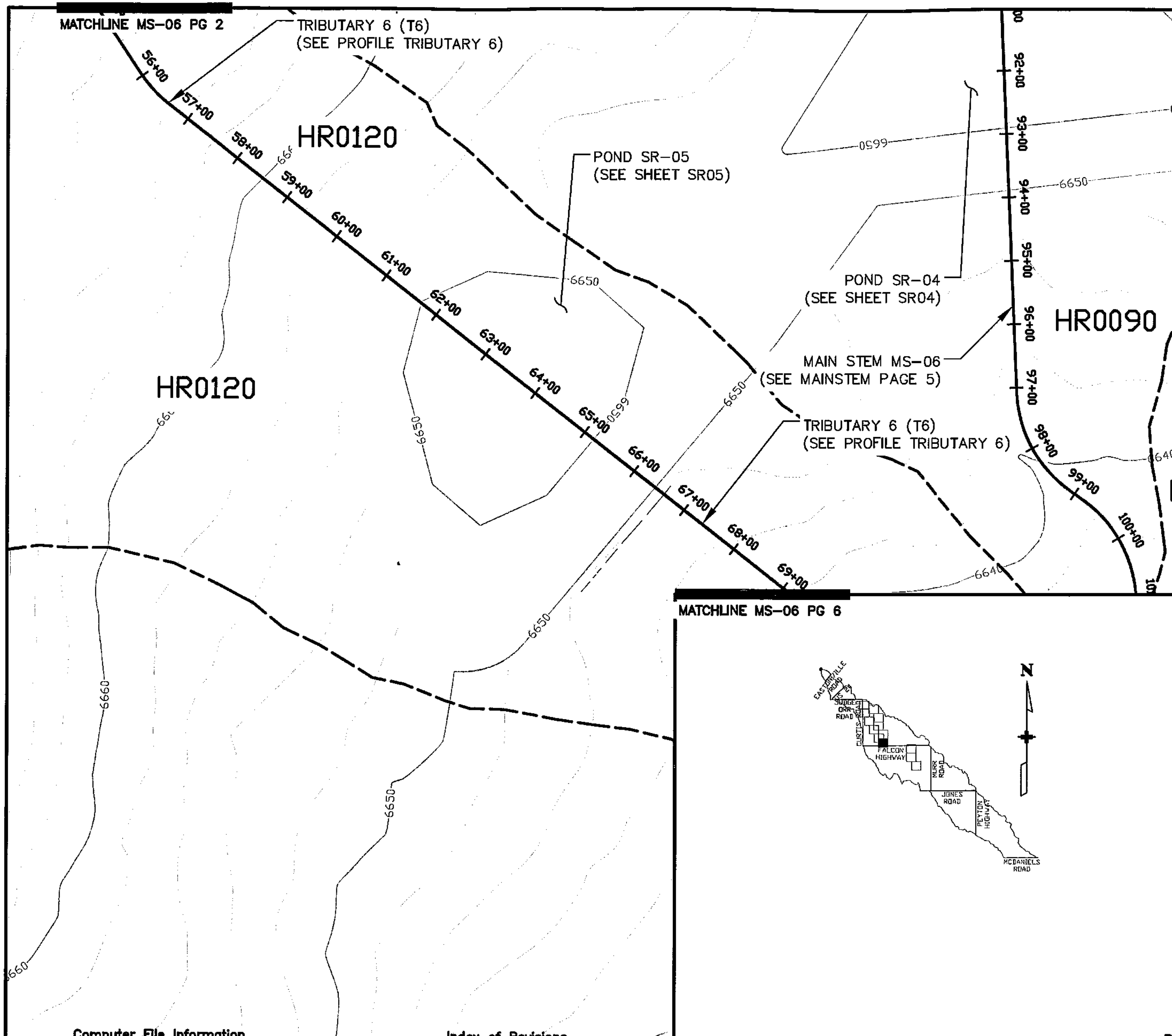
HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number TRIBUTARY 6 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: TRIBUTARY 6 (T6)
BASIN: HR0120

5'
6'
4
1

STA: 41+73 TO STA: 75+50

Q: 300 CFS

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Acad. Ver. 2006 Scale: 1"=200' Units: Feet			Checked by: JAJ	Sheet Number TRIBUTARY 6 PG 4

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MS–06 HR0070

SLOPE = 0.60%

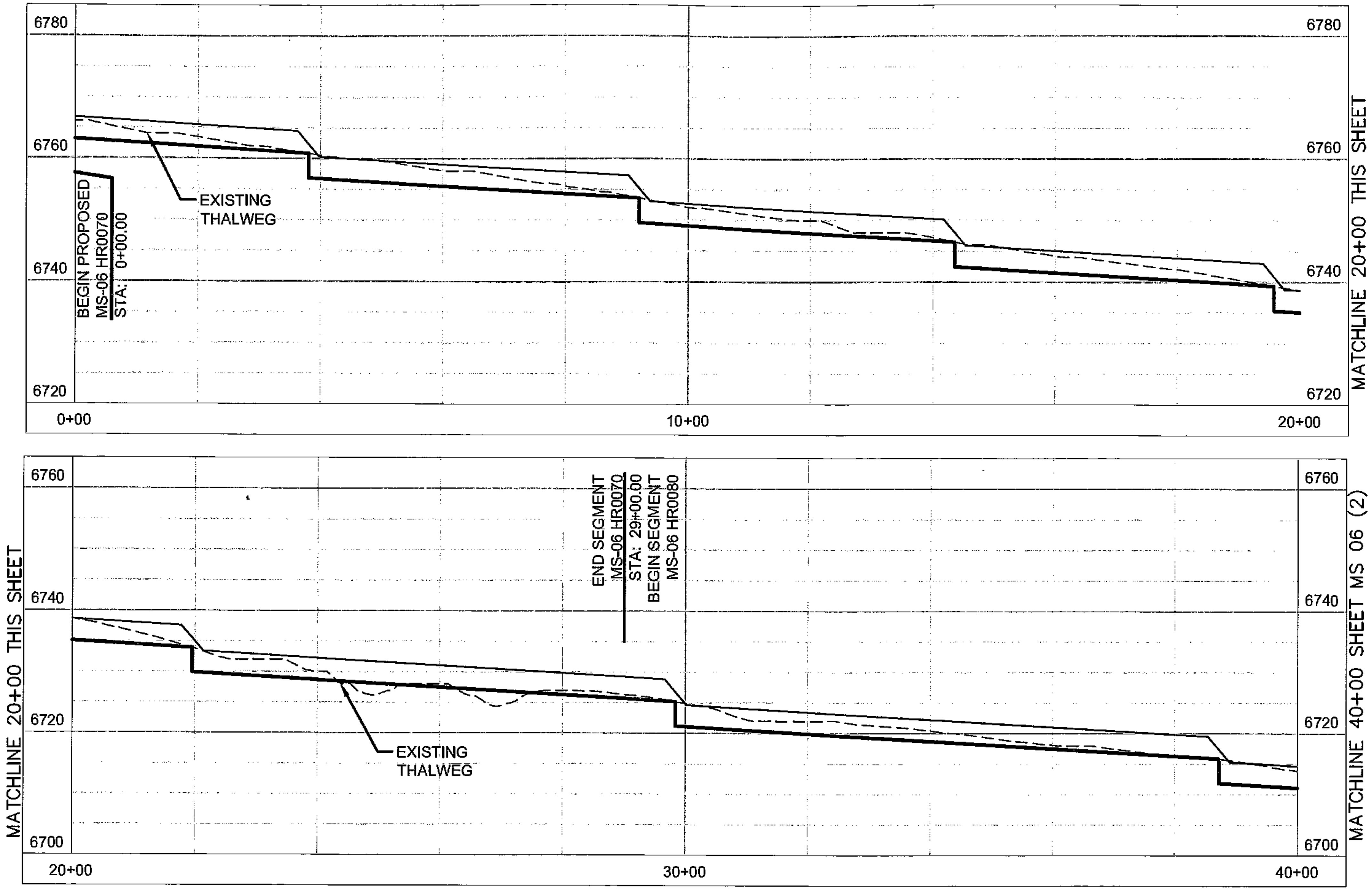
(7) 4' DROPS

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		Index of Revisions		Profiles	
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Acad. Ver. 2006	Scale: 1"=20' Units: Feet			Checked by:	Sheet Number MS 06

MS-06 HR0080

SLOPE = 0.60%

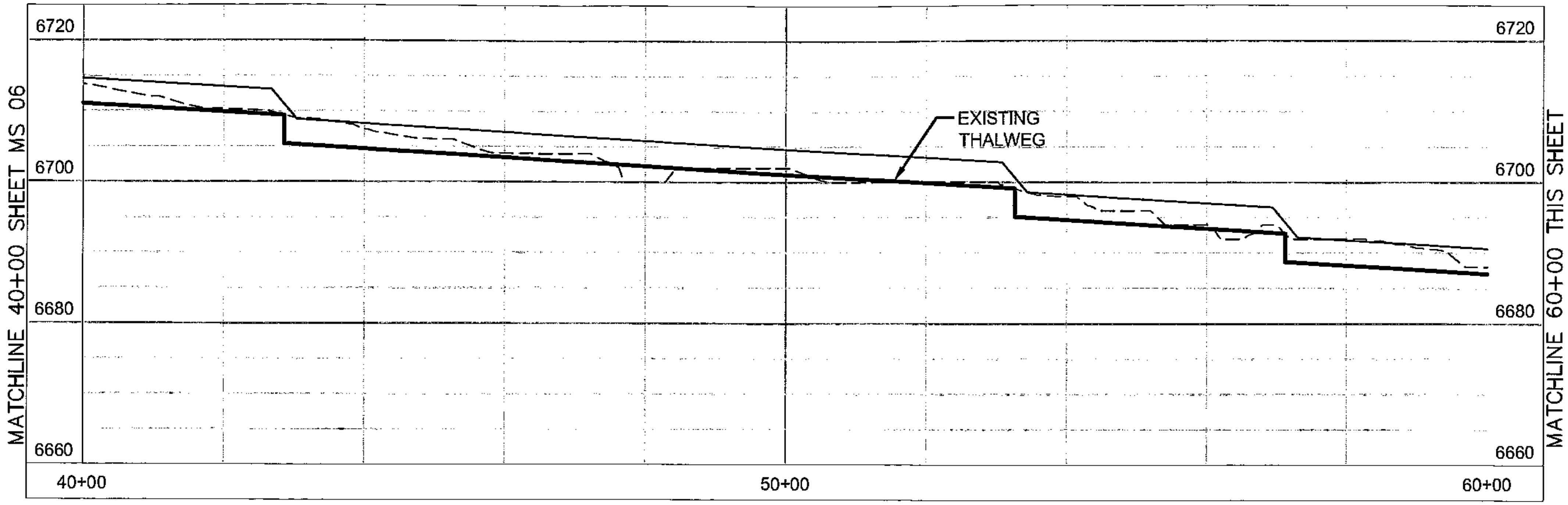
(7) 4' DROPS

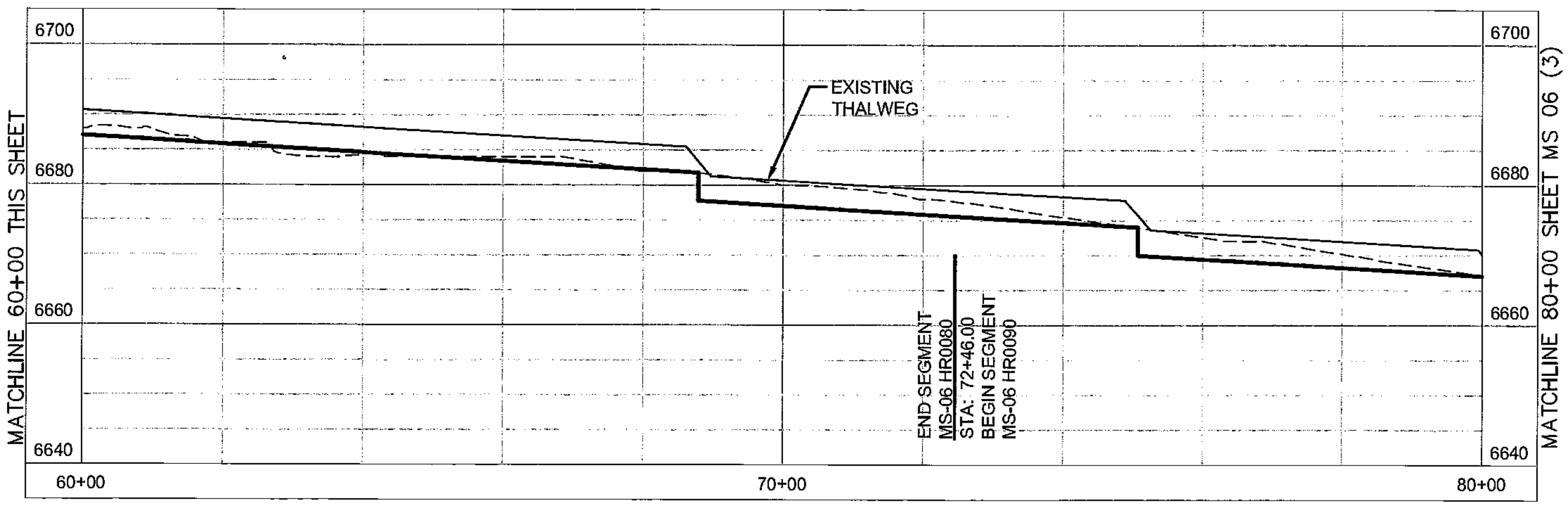
MS-06 HR0090

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		Index of Revisions		Profiles	
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EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

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HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL PROFILES

Sheet Number MS06 (2)

MS-06 HR0090

SLOPE = 0.60%

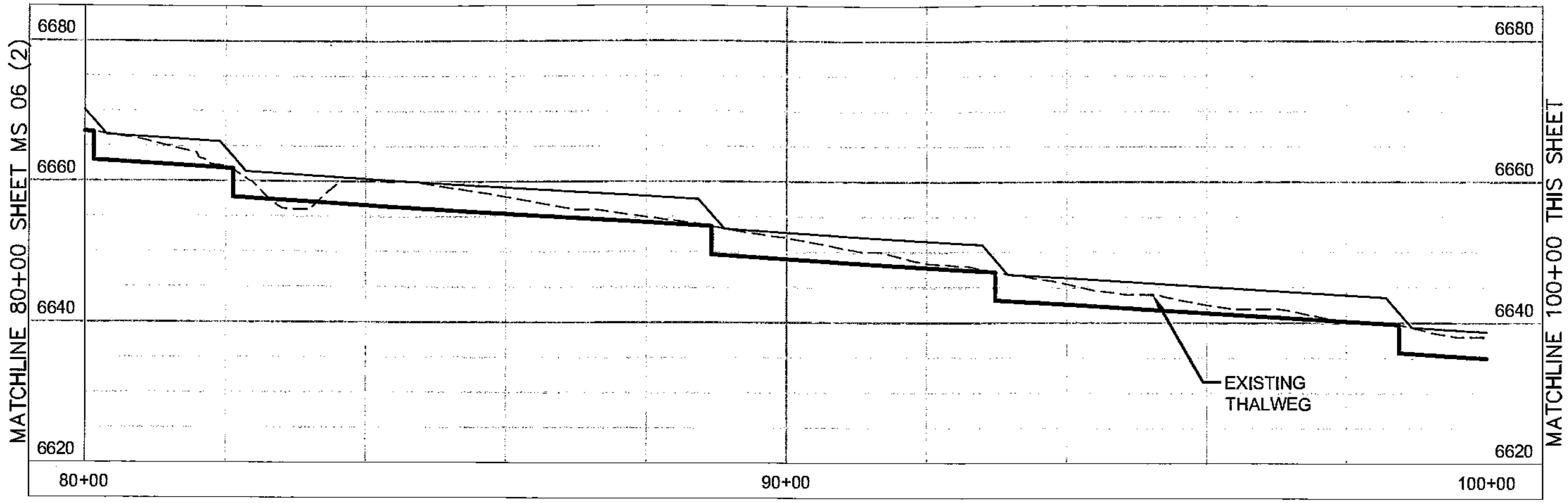
(8) 4' DROPS

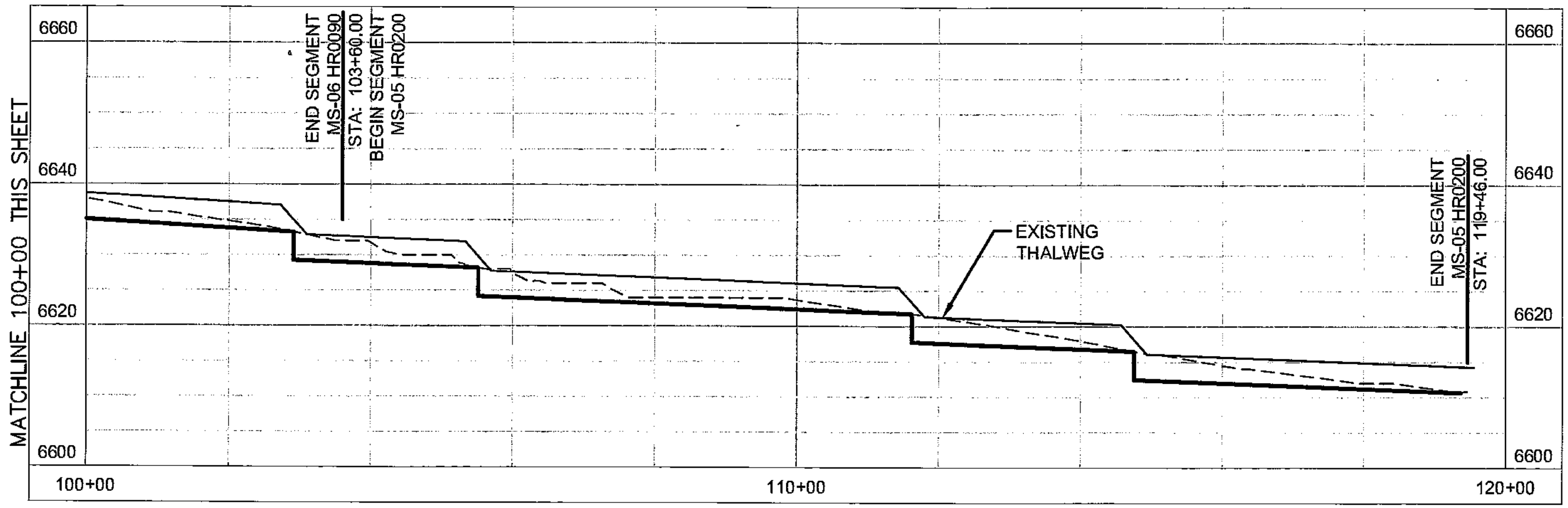
MS-05 HR0200

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

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EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

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Profiles

Designed by: KAP

Detailed by: DRM

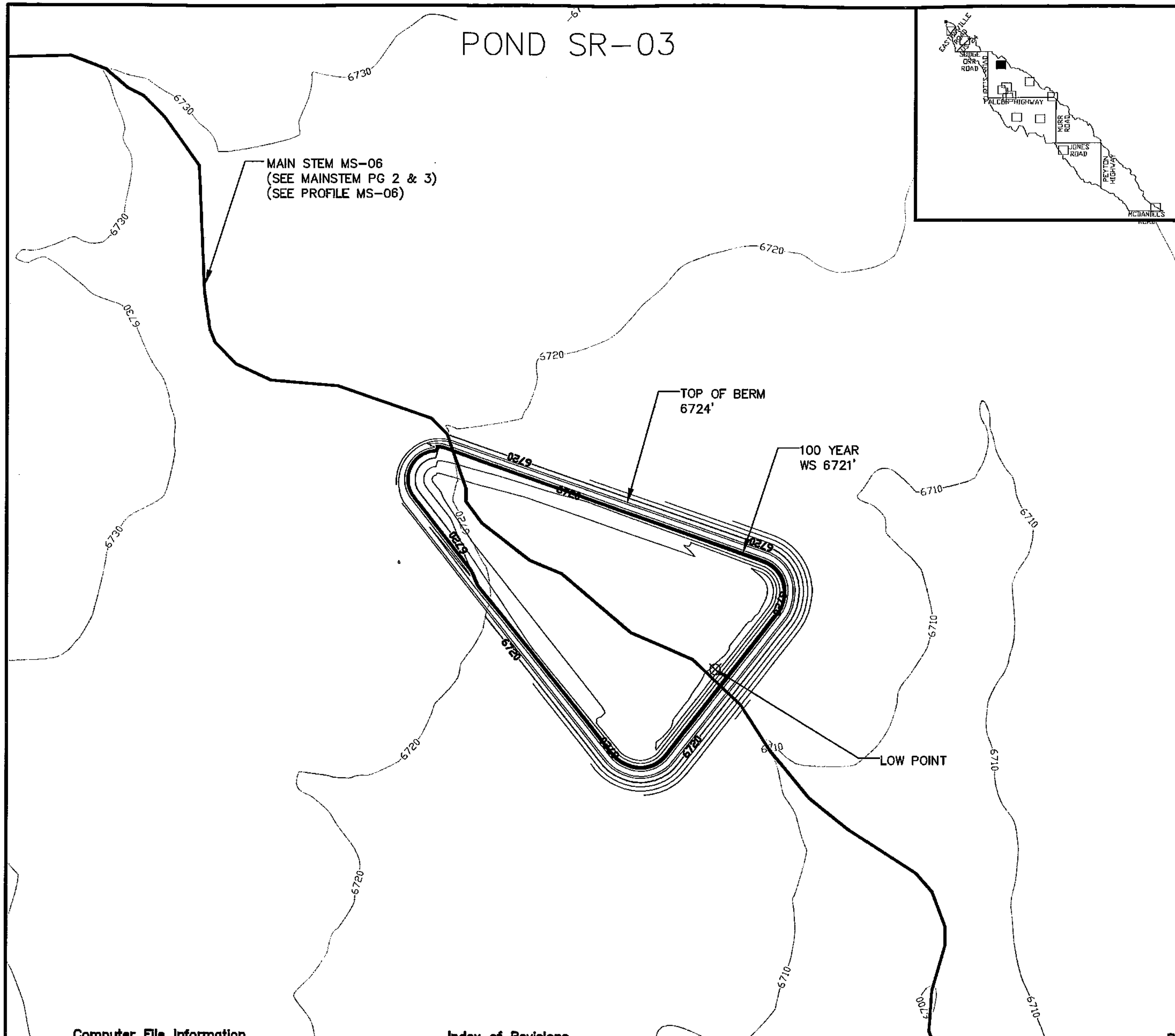
Checked by:

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL PROFILES

Sheet Number MS06 & MS05 (3)

POND SR-03



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"=200' Units: Feet

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Profiles

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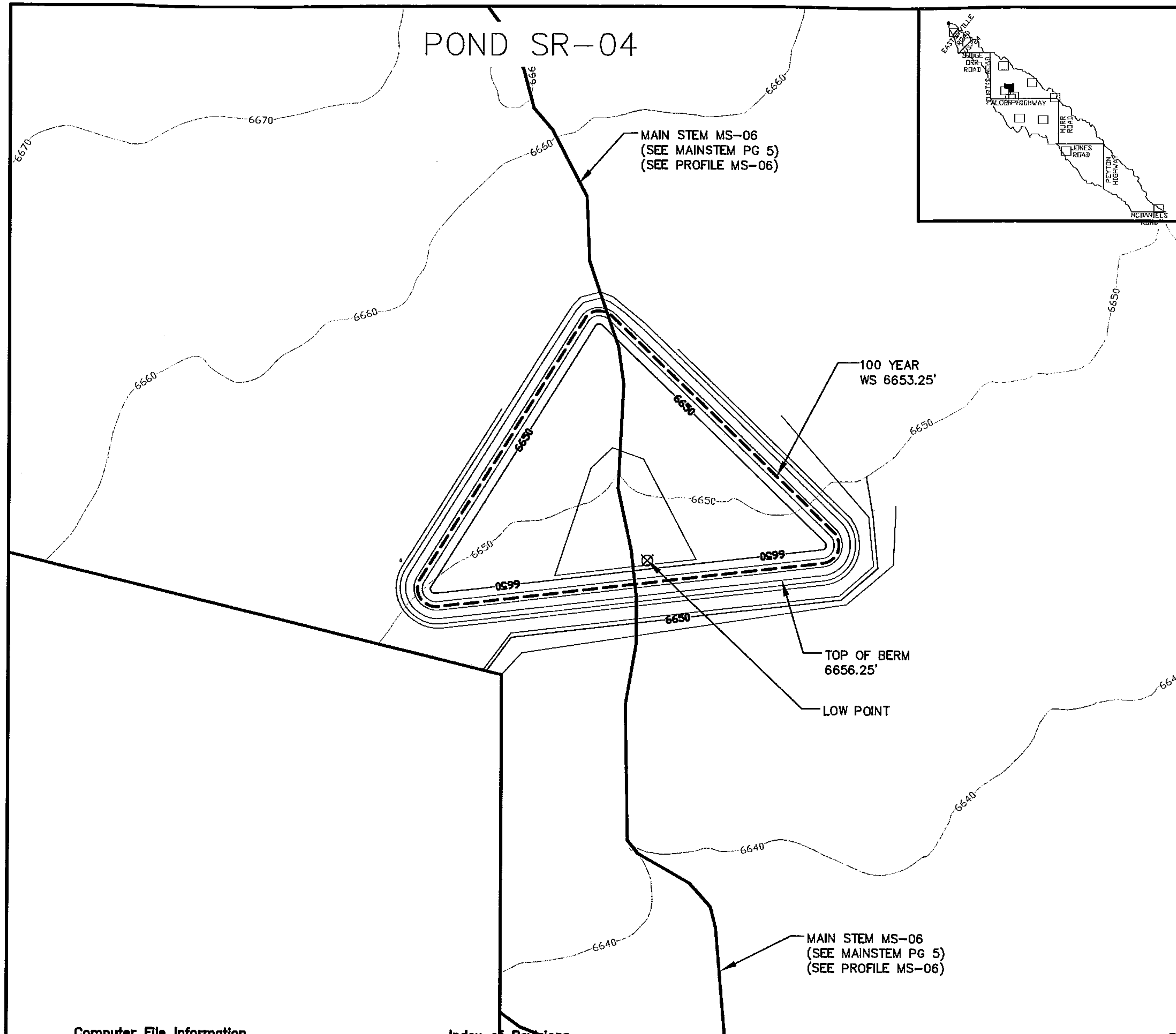
Detailed by:	DRM
Checked by:	JAJ

Structure Numbers

HAEGLER RANCH DRAINAGE BASIN

Sheet Number SR03

POND SR-04



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\CAO\PLANSHTS
Drawing File Name:	PONOS.OWG
Acad. Ver. 2006	Scale: 1"=200' Units: Feet

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Profiles

URS

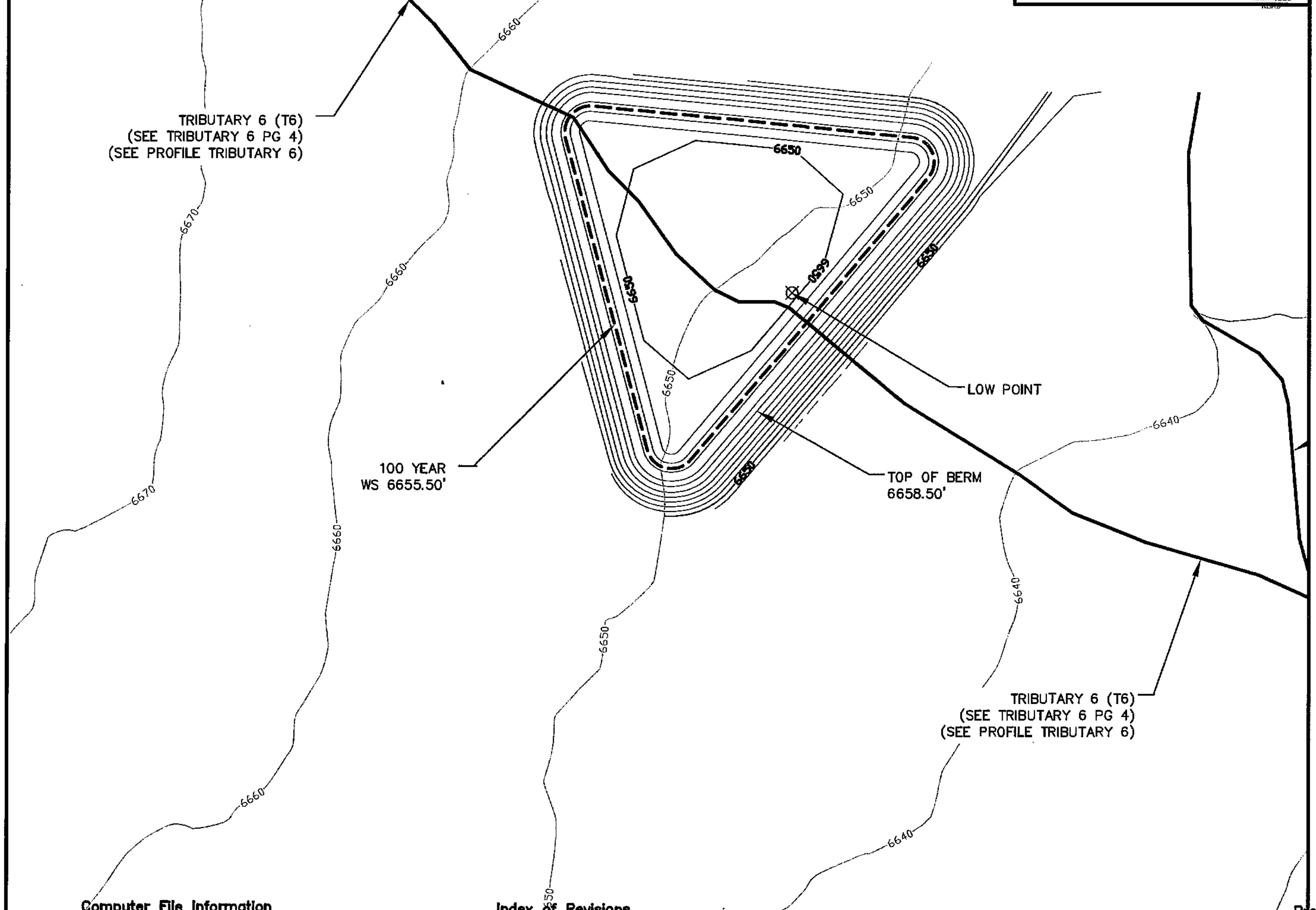
Designed by: KAP
Detailed by: DRM
Checked by: JAJ

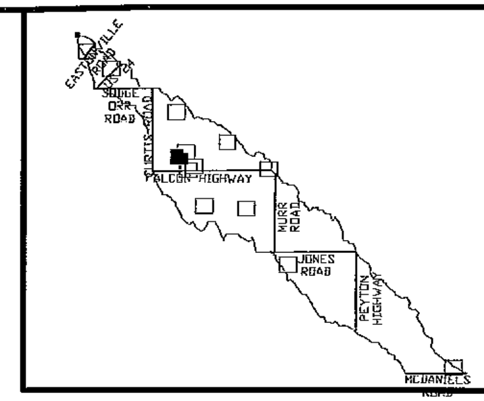
Structure Numbers

HAEGLER RANCH DRAINAGE BASIN

Sheet Number SR04

POND SR-05





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		Index of Revisions	Profiles	
Full Path: P:\21711039\CAD\PLANSHTS			Designed by: KAP	HAEGLER RANCH DRAINAGE BASIN
Drawing File Name: PONDS.DWG			Detailed by: DRM	Structure Numbers
Acad. Ver. 20D6 Scale: 1"=200' Units: Feet			Checked by: JAJ	Sheet Number SR05

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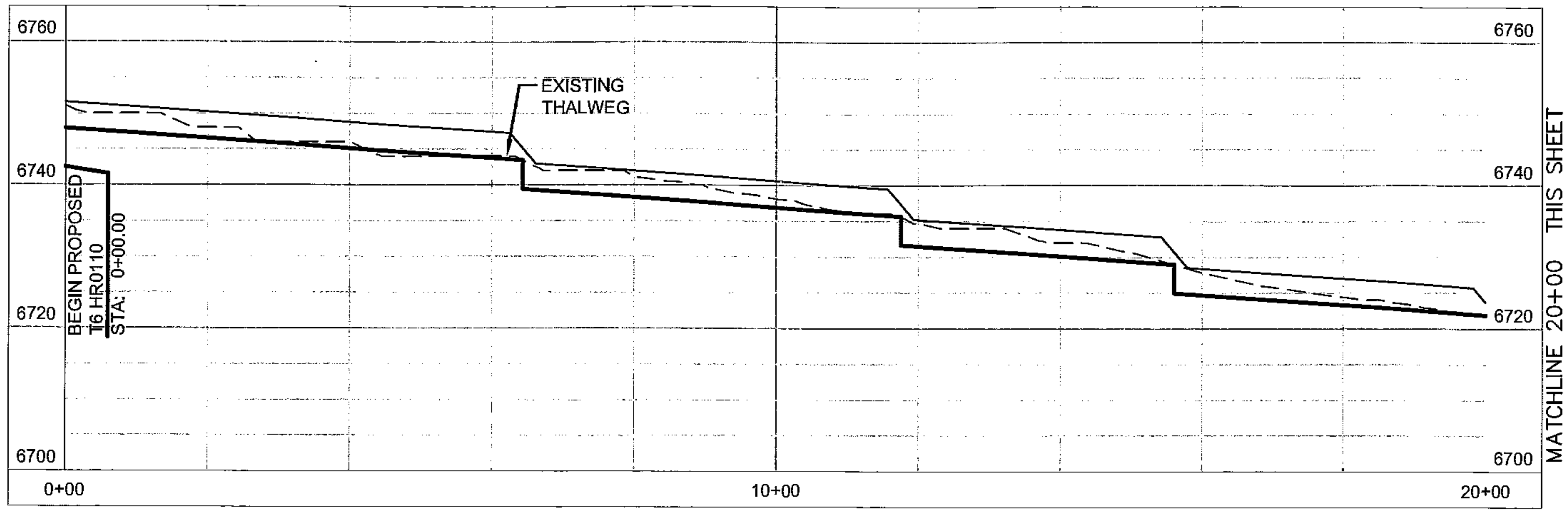
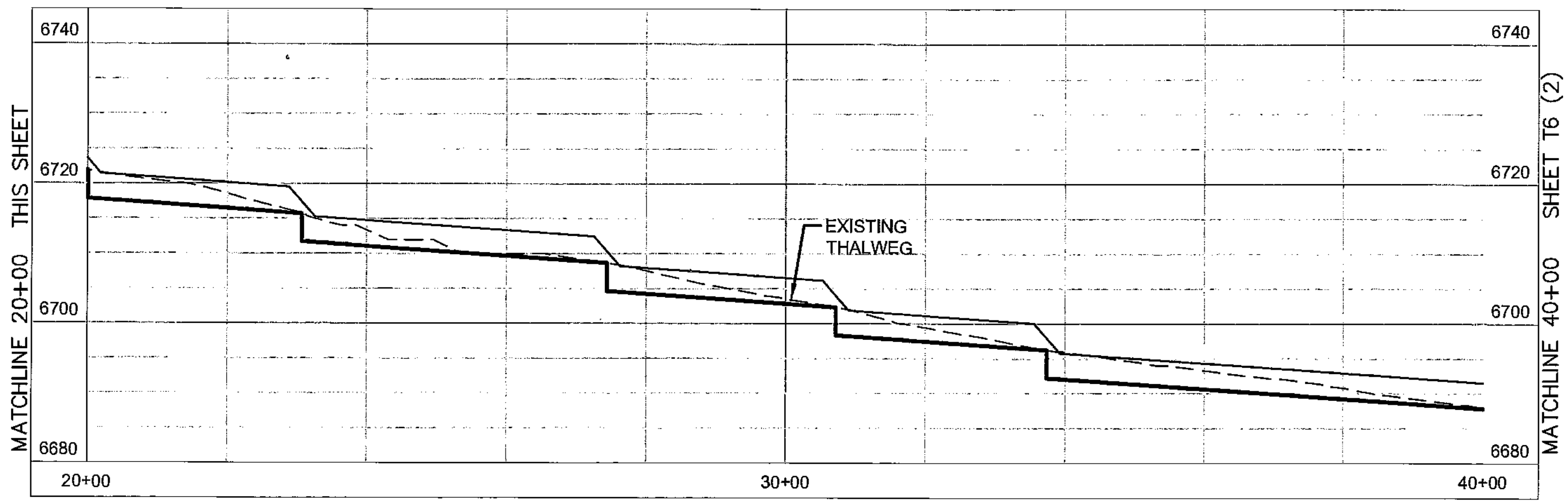
T6 HR0110

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

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EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

URS

Profiles

Designed by: KAP

Detailed by: DRM

Checked by:

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL PROFILES

Sheet Number T6

T6 HR0110

SLOPE = 0.70%

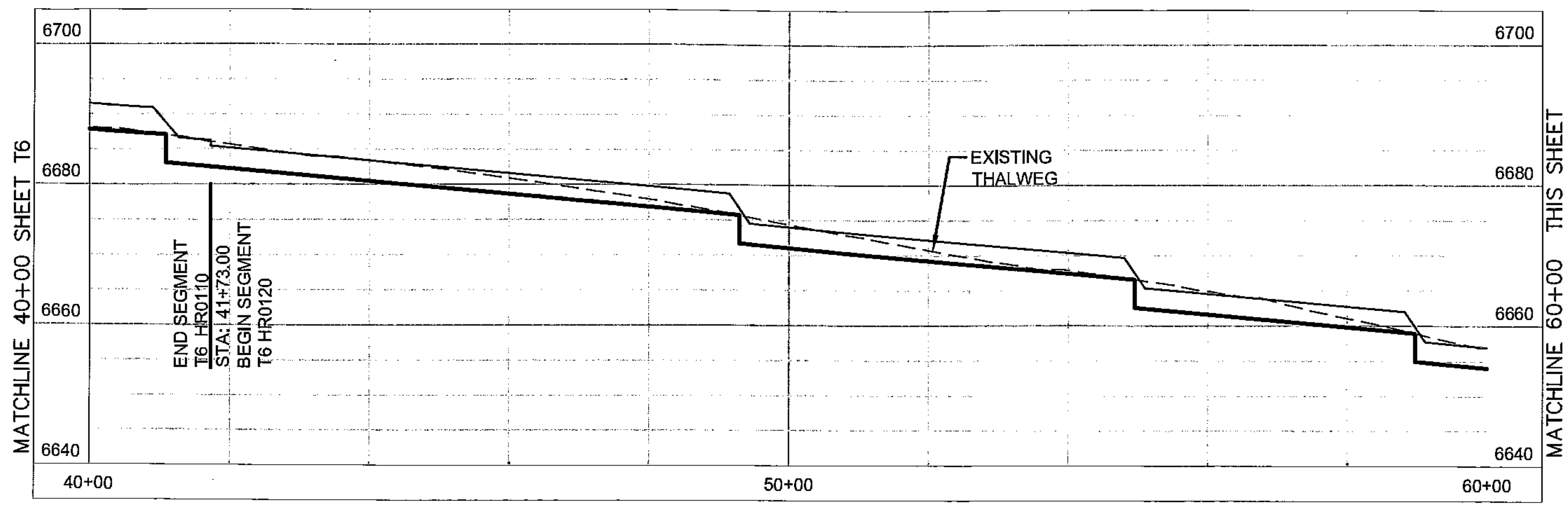
(9) 4' OROPS

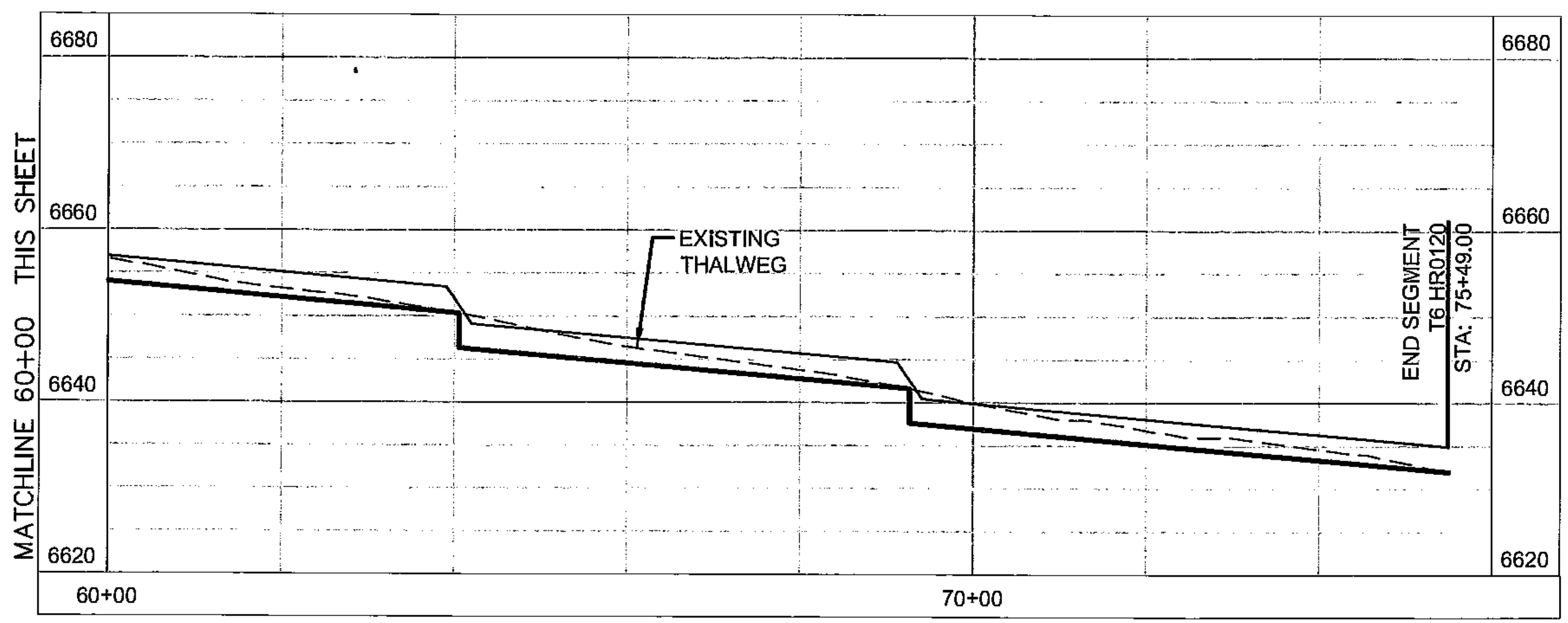
T6 HR0120

SLOPE = 0.90%

(6) 4' DROPS

PROFILE TRIBUTARY 6 (T6)





LEGEND

PROPOSEO OROP STRUCTURE

EXISTING THALWEG

HYORAULIC GRADE LINE

Computer File Information

Full Path: P:\21711039\CAD\PLANSHTS

Drawing File Name:T PROFILE SHEETS 6_PROPOSED.OWG

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

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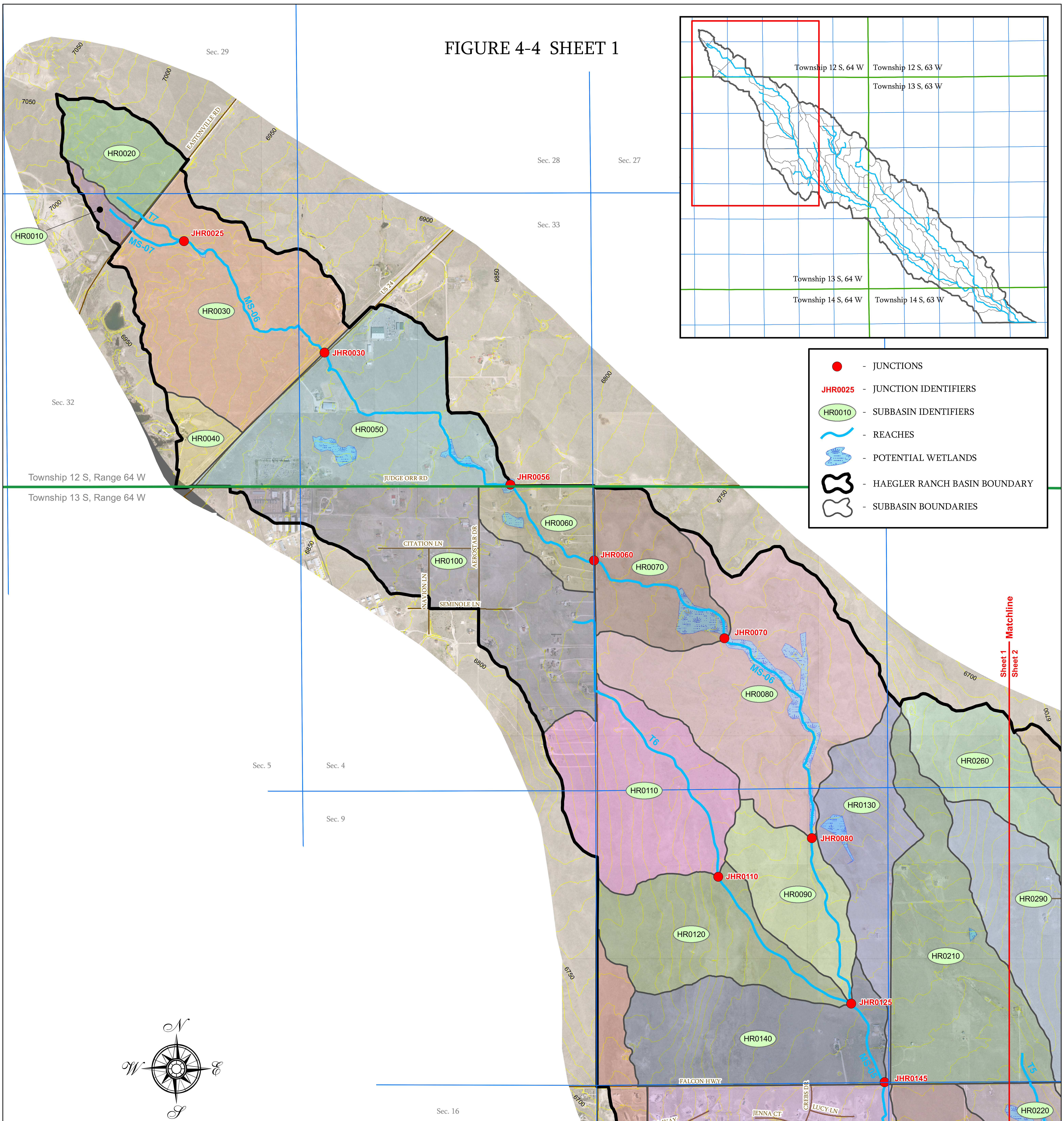
Checked by:

Structure Numbers

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.

CONTRIBUTING ACREAGE TO T6 @ CURTIS ROAD CROSSING

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

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

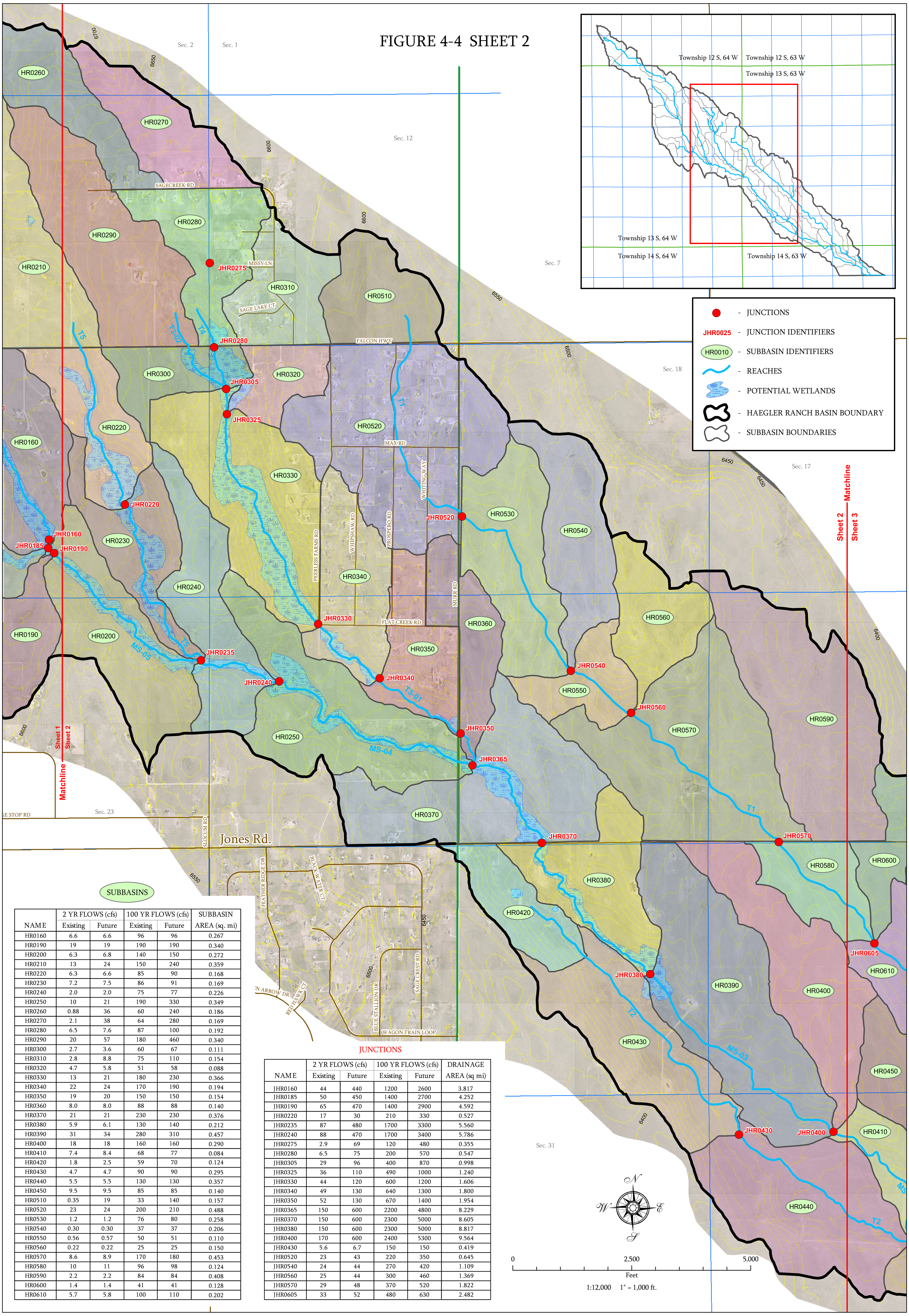
HAEGLER RANCH DRAINAGE BASIN

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

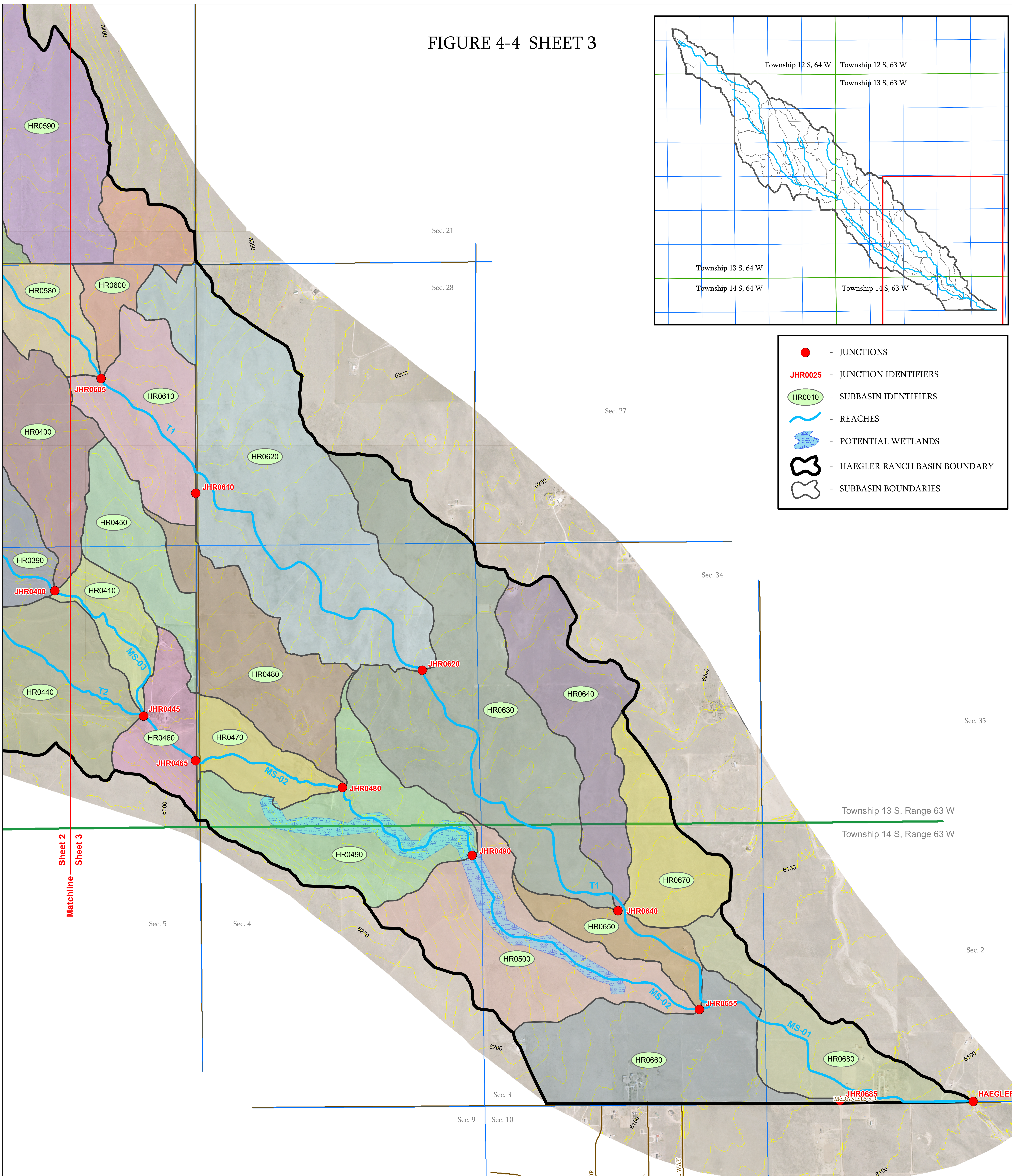
HAEGLER RANCH DRAINAGE BASIN

EXISTING AND FUTURE CONDITIONS HYDROLOGIC MODEL

URS NO. 21711039

DATE: 09/08

FIGURE 4-4 SHEET 3



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

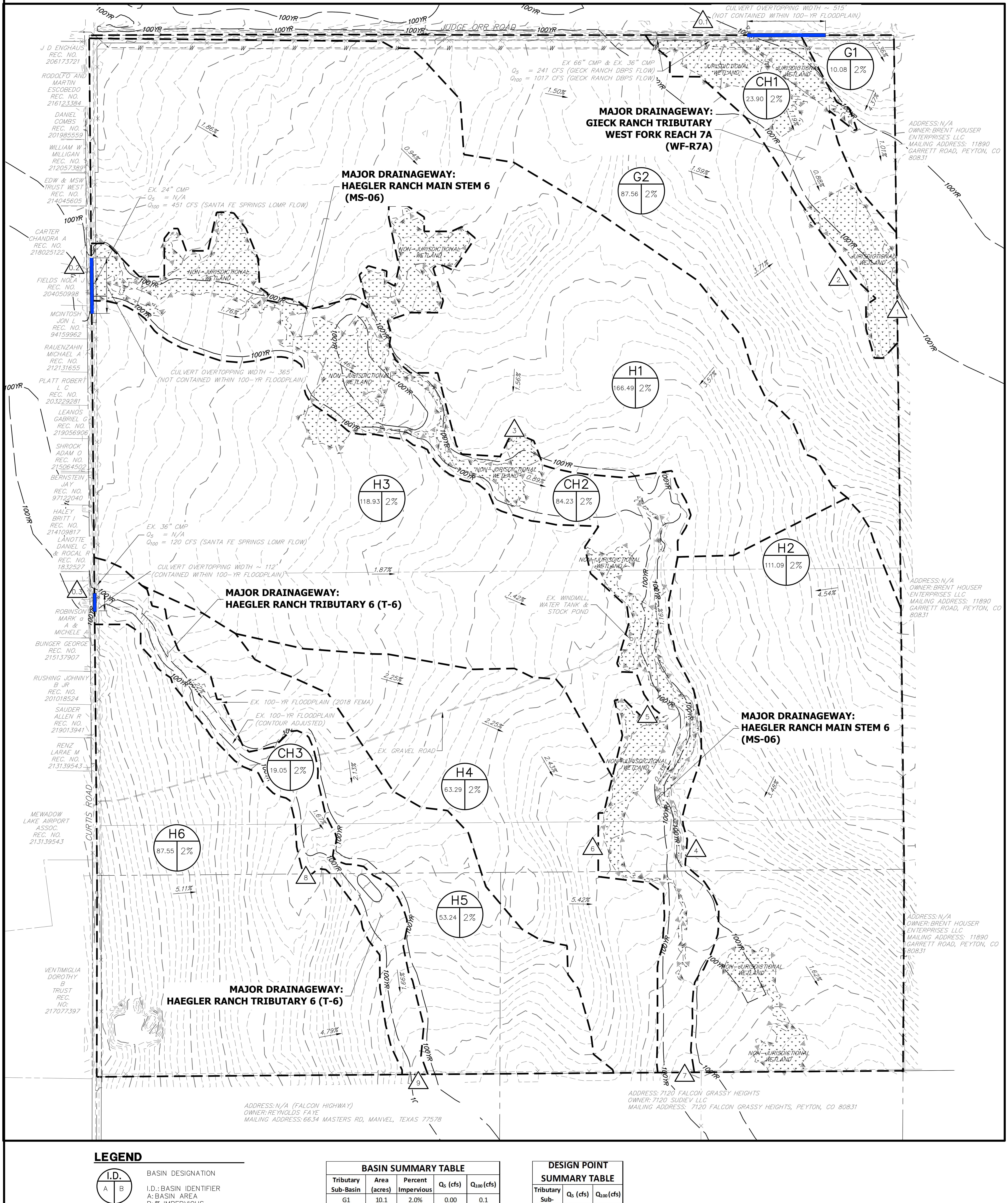
URS NO. 21711039

DATE: 09/08

APPENDIX F

DRAINAGE MAPS

824 ACRE CURTIS ROAD SUBDIVISION
EX. CONDITIONS DRAINAGE MAP



LEGEND

- BASIN DESIGNATION — I.D.: BASIN IDENTIFIER; A: BASIN AREA; B: % IMPERVIOUS
- DESIGN POINT
- BASIN DELINEATION
- 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

300 150 0 300 600
ORIGINAL SCALE: 1" = 300'

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

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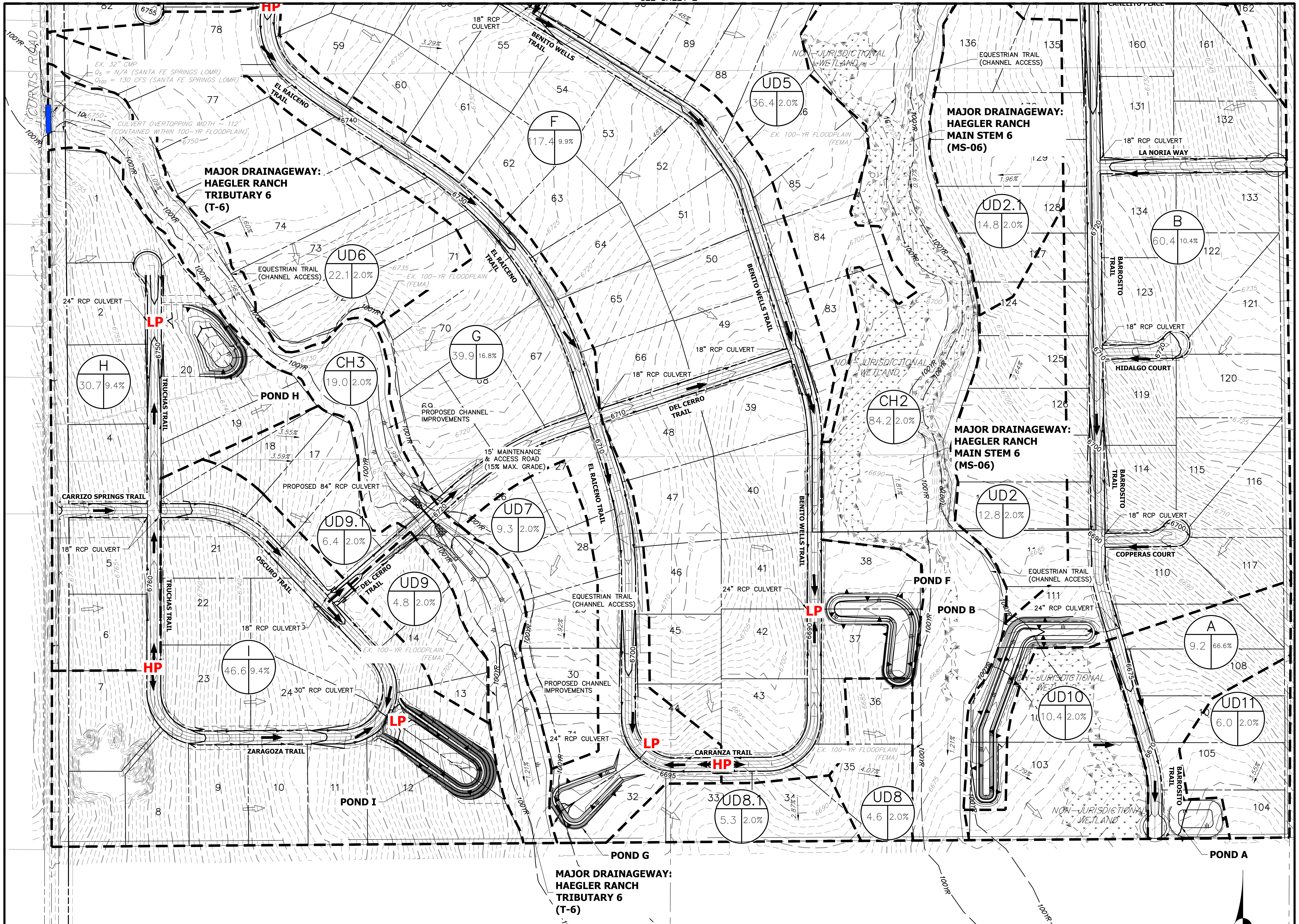
SADDLEHORN RANCH SUBDIVISION
PROPOSED DRAINAGE MAP

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

- 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

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'

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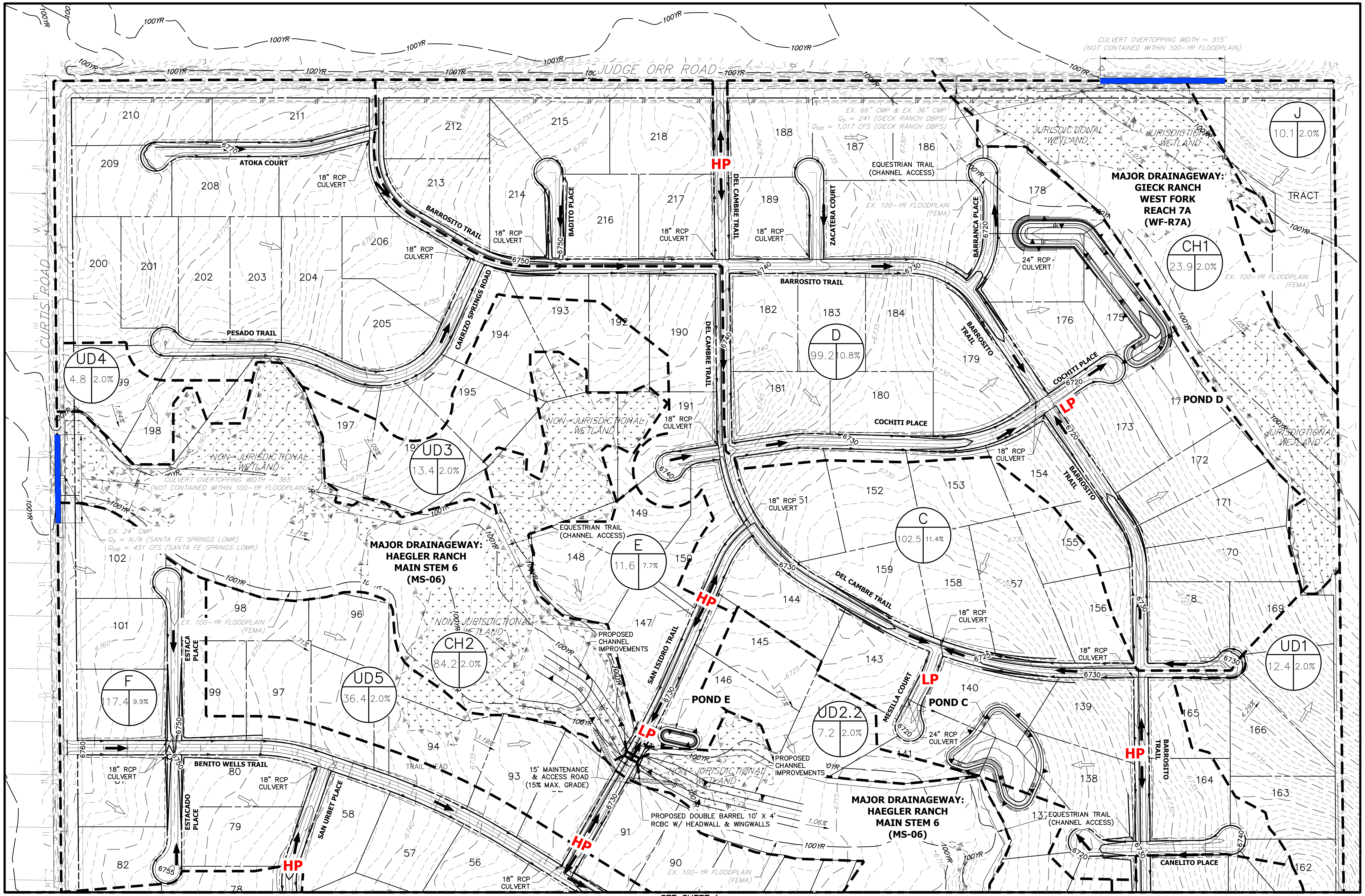
SADDLEHORN RANCH SUBDIVISION
PROPOSED DRAINAGE MAP



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

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

NOTES

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

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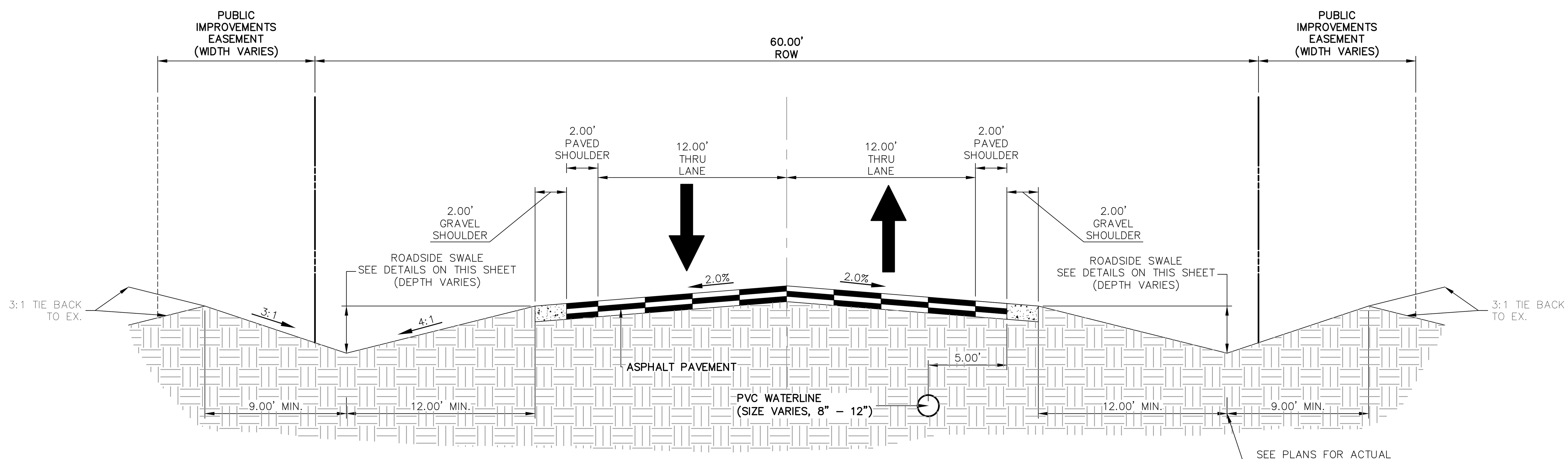
SADDLEHORN RANCH

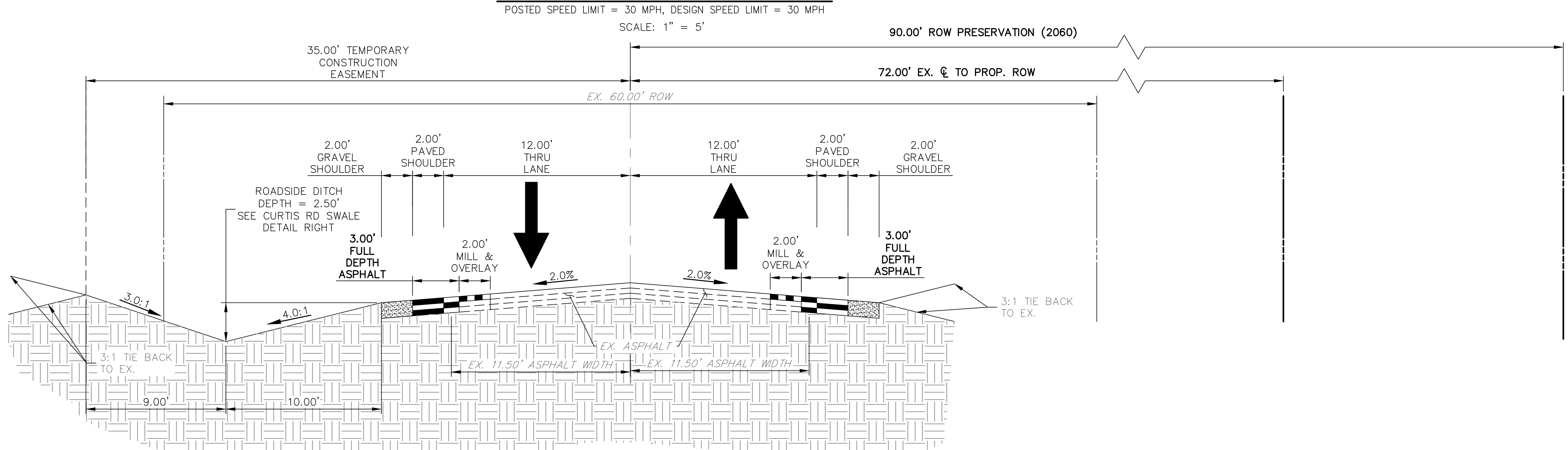
TYPICAL ROADWAY SECTIONS



TYPICAL RURAL LOCAL

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

SCALE: 1" = 5'



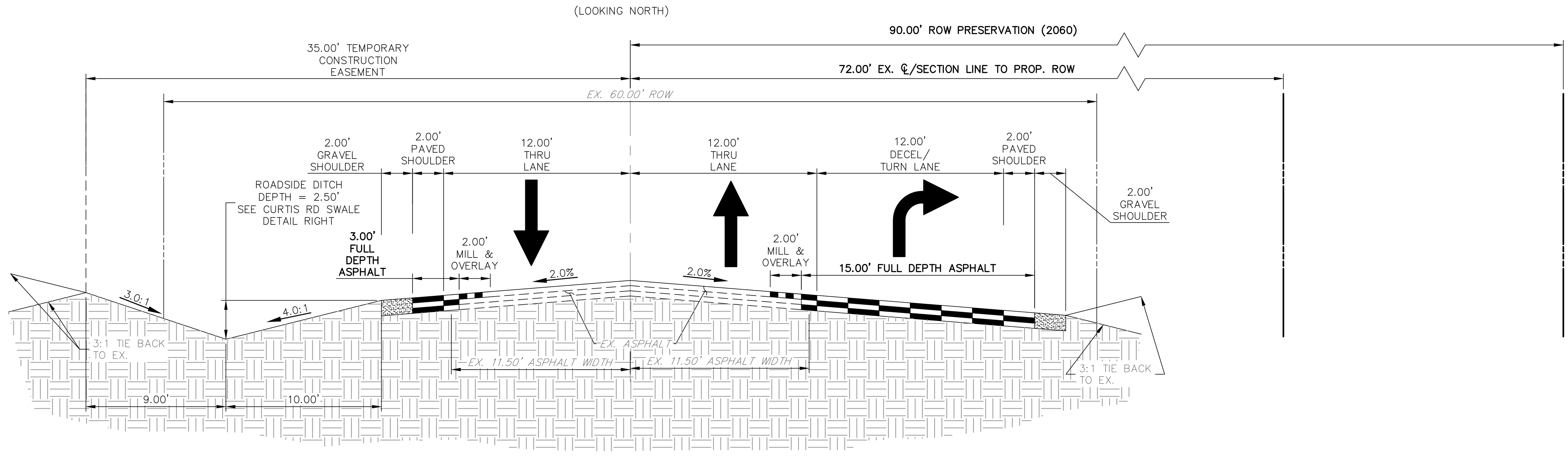
CURTIS ROAD – MODIFIED MINOR RURAL ARTERIAL

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

POSTED SPEED LIMIT = 45 MPH

SCALE: 1" = 5'

(LOOKING NORTH)



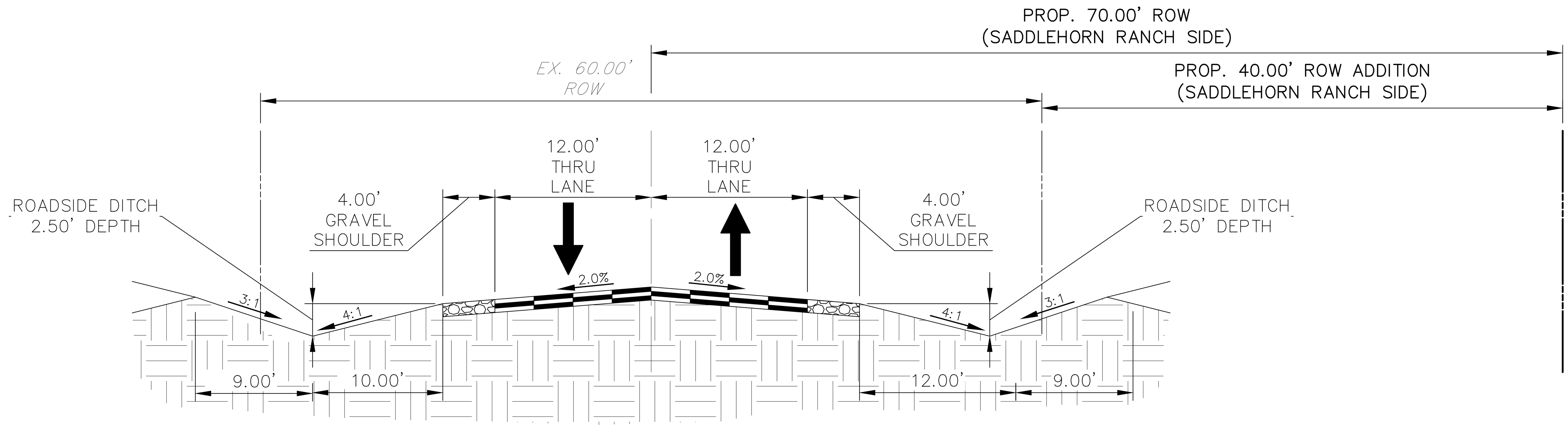
CURTIS ROAD – MODIFIED MINOR RURAL ARTERIAL

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

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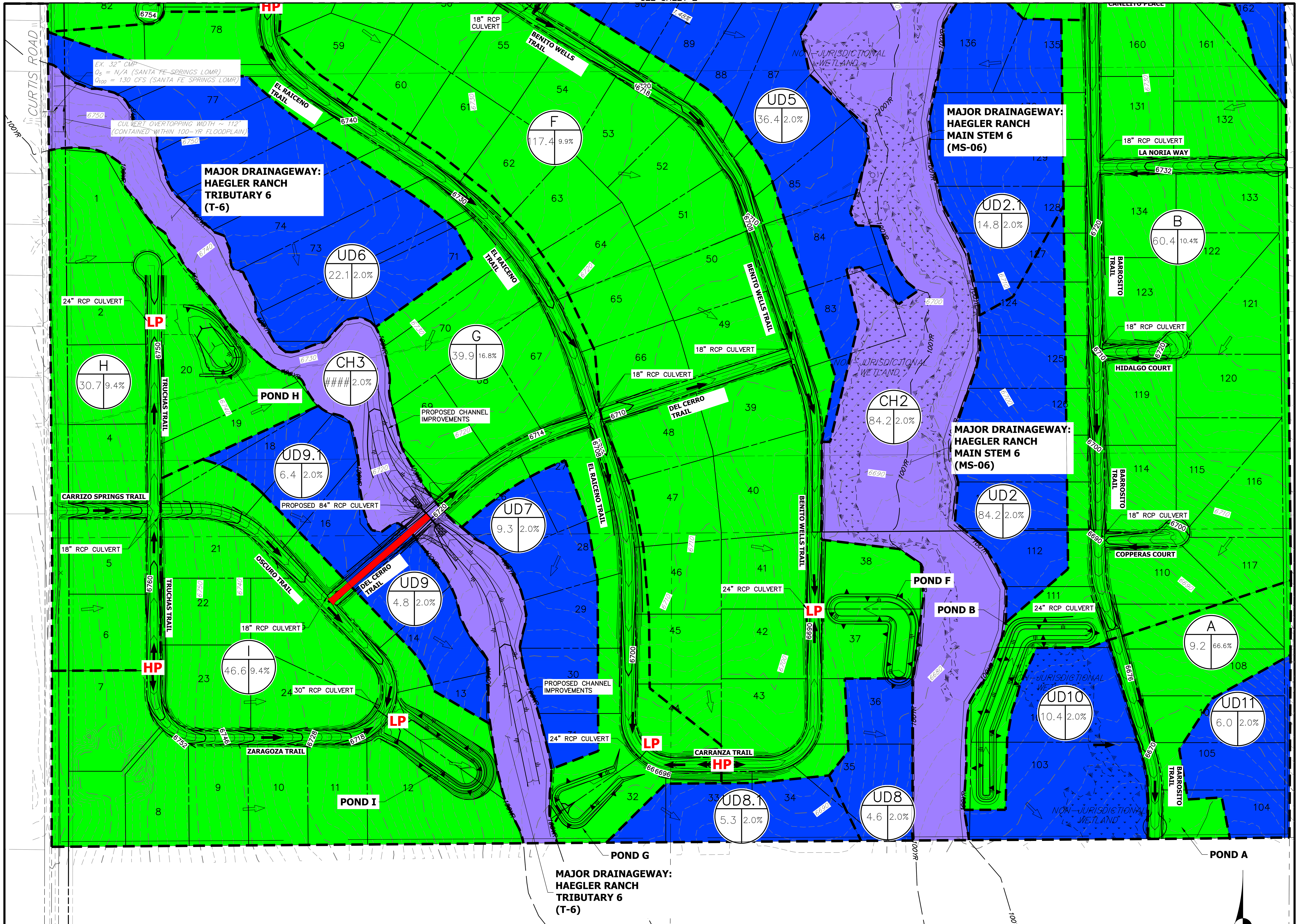
SADDLEHORN RANCH SUBDIVISION
PERMANENT BMP APPLICABILITY MAP

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
(green)	AREA DETAINED IN PBMP
(blue)	AREA NOT DETAINED IN PBMP PER SECTION I.7.1.B.5 (RURAL 2.5+ ACRE LOTS W/ IMPERVIOUSNESS < 10%)
(red)	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)
(purple)	AREA NOT DETAINED IN PBMP PER SECTION I.7.1.B.7 (LAND DISTURBANCE TO UNDEV. LAND THAT WILL REMAIN UNDEV.)

NOTES

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

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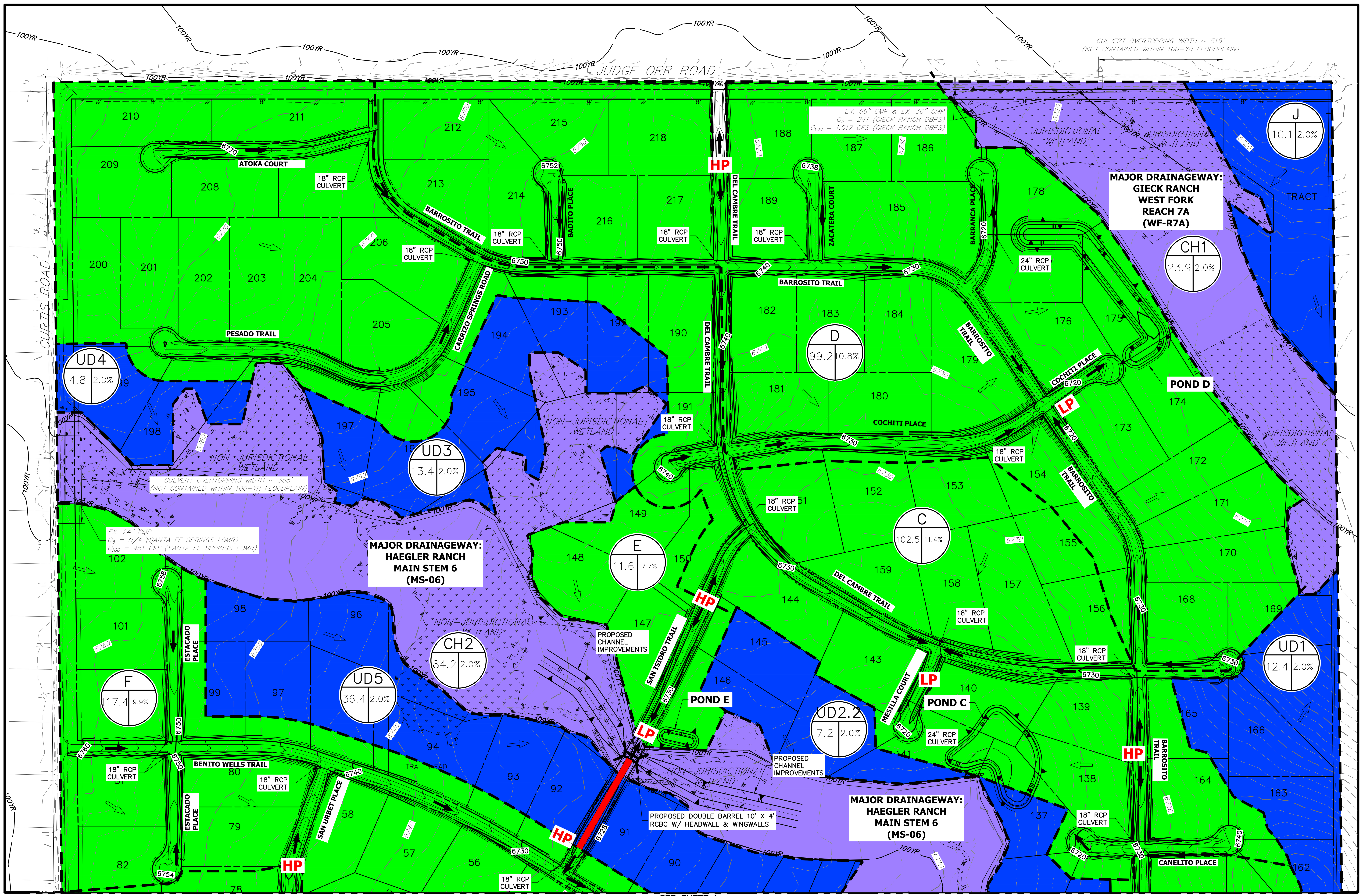
SADDLEHORN RANCH SUBDIVISION
PERMANENT BMP APPLICABILITY MAP



SEE SHEET 1

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

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200 100 0 200 400

ORIGINAL SCALE: 1" = 200'

SADDLEHORN RANCH
DRAINAGE MAP
25142.00
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SHEET 2 OF 2

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