FINAL DRAINAGE REPORT
FOR
SADDLEHORN RANCH – FILING 1

Prepared For:
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May 7, 2020
Project No. 25142.02

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El Paso County PCD File No.:
SF-19-012

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.

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

11/30/20

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

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: FOR ROI PROPERTY GROUP, LLC

Title: AGENT/POA

Address: 2495 Rigdon Street
Napa, CA 94558

El Paso County:

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

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

APPROVED
Engineering Department
05/05/2021 10:44:38 AM
dsdnijkamp
EPC Planning & Community Development Department

Conditions:

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PURPOSE

This document is the Final Drainage report for Filing 1 of Saddlehorn Ranch. The purpose of this report is to:

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

GENERAL LOCATION AND DESCRIPTION

Location

The proposed Saddlehorn Ranch Filing 1, known as "Filing 1" from herein, is a parcel of land located in Section 3 and 10, Township 13 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. Saddlehorn Ranch is an 824 acre, rural, single family-development. Filing 1 is 174 acres and is comprised of 55 lots of the overall Saddlehorn Ranch development. Saddlehorn Ranch is bound by Judge Orr Road to the North and Curtis Road to the West. To the East, Saddlehorn Ranch is bound by undeveloped land owned by Brent Houser Enterprises, LLC. To the south, Saddlehorn Ranch is bound by undeveloped properties owned by Carolyn Gudzunas and Faye Reyonlds. Filing 1 is bound by future filings to the North and East while it is bound by Curtis Road to the West and to the South by undeveloped properties owned by Carolyn Gudzunas and Faye Reyonlds. A vicinity map is presented in Appendix A.

Currently, is one major Drainageway that bisects Filing 1: Haegler Ranch Tributary 6 (T-6). This Drainageway was analyzed, both hydrologically and hydraulically, in the following reports:

- Haegler Ranch Basin Drainage Basin Planning Study (DBPS), May 2009.
- Santa Fe Springs – Haegler Ranch Drainage Basin Letter of Map Revision, June 2004.
- Preliminary Drainage Report/Master Development Drainage Plan for Saddlehorn Ranch, April 2019.

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

Description of Property

Filing 1 is currently unoccupied and undeveloped. The existing ground cover is sparse vegetation and open space, typical of a Colorado rolling range land condition. In general, Filing 1 slopes from northwest to southeast and the existing Drainageway follows this topography.

Per a NRCS web soil survey of the area, Filing 1 is made up of Type A and B soils. Type A soils cover roughly 91% of Filing 1 while Type B soils cover 9% of Filing 1. Group A soils have a high infiltration rate when thoroughly wet. Type B soils have a moderate infiltration when thoroughly wet. A NRCS soil survey map has been presented in Appendix A.

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

Floodplain Statement

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

DRAINAGE BASINS AND SUBBASINS

Existing Major Basin Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 1: Major Drainageway Naming Convention

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

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

Drainageway Name	**Q_{100} Per *Haegler Ranch DBPS*:**	**Q_{100} Per Sante Fe Springs LOMR:**
T-6	120 cfs	130 cfs

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

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

Existing Sub-basin Drainage

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

Proposed Sub-basin Drainage

The proposed Filing 1 basin delineation is as follows;

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

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

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

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

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

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

Basin UD1-UD6 combine for a total of 53.4 acres. In their existing condition, these basins are rolling rangeland. Runoff from Basins UD1-UD3 generally flows south and east to Drainageway T-6, while Basins UD4 & UD5 generally flow south and west to Drainageway T-6. Basin UD-6 flows directly south and off site. In the proposed condition, Basins UD1-UD6 will be rural 2.5 acre lots with an Imperviousness = 6.2% and will be excluded from permanent stormwater quality management per Section I.7.1.B.5 of the ECM – Stormwater Quality Policy and Procedures. However; Basin UD2 and UD3 contain approximately 0.30 ac of paved roadway, equal to approximately 0.20% of the total development site. Due to existing topography, these basins can't be captured and routed to a permanent, full spectrum water quality and detention pond. We respectfully request that Basin UD2 and UD3 be excluded from permanent stormwater quality management, per Section I.7.1.C.1.

Basin OS1-OS3 combine for a total of 2.06 acres of offsite area. In their existing condition, these basins are paved roadway (Curtis Road) and undeveloped area. In the proposed condition, Basin OS2 and OS3 will be improved with 1' of pavement width and the stretch of Curtis Road within basin OS1 will be improved with a deceleration lane for access to Filing 1. Basin OS1-OS2 will follow existing drainage patterns and will flow on-site prior to capture in a roadside ditch and conveyed to Pond H. Pond H will be a full spectrum water quality and detention pond and will release at less than historic rates into Drainageway T-6. Basin OS3 will not be detained in Pond H due to its location relative to Pond H as well as Section I.7.1.B.2 of the ECM – Stormwater Quality Policy and Procedures states that site's adding less than 1 acre of paved area per mile of roadway to an existing roadway can be excluded from permanent stormwater quality. The improvements along Curtis Road would add 5,280 ft^2 over the length of one mile and therefore meet the exclusion present in Section I.7.1.B.2.

A summary table of proposed basin parameters and flow rates is presented in Appendix B.

Basins G, H and I runoff will be captured in roadside ditches and conveyed to a corresponding full spectrum water quality and detention pond. Each full spectrum pond will release treated flows at less than historic rates to minimize adverse impacts downstream. Ponds G, H and I will discharge into Major Drainageway T-6. Basin F flows will be captured in roadside ditches and conveyed to two temporary sediment basins. When Filing 2 development commences, these sediment basins will be replaced with a single full spectrum water quality pond (Pond F).

See Table 5 below for comparison of proposed Filing 1 pond parameters.

Table 3: Pond Summary

Tributary Sub-Basin	Pond Name	Tributary Acres	WQ Volume (ac-ft)	Total Detention Volume (ac-ft)	Provided Volume (ac-ft)	Maximum 100-Year Discharge (cfs)
G	POND G	33.57	0.307	1.244	1.286	8.2
H	POND H	21.16	0.181	0.730	0.772	6.5
I	POND I	38.04	0.325	1.335	1.391	20.0

Proposed Channel Improvements – Haegler Ranch T-6

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

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

DRAINAGE DESIGN CRITERIA

Development Criteria Reference

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

Hydrologic Criteria

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

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

Hydraulic Criteria

The Federal Highway Administration's HY-8 program (Volume 7.50) was used to analyze the proposed box culvert within Drainageway T-6. Per Section 14.3.2 of the CCS/EPCDCM, a maximum headwater to rise ratio of 1.5 was used to size the 84" RCP culvert. The culvert was designed in conjunction with channel improvements to ensure a no rise scenario of the current floodplain elevations. A summary report of the 84" RCP culvert design is presented in Appendix C.

Autodesk Inc.'s Hydraflow Express Extension (Volume 10.5) was used for roadside ditch design. Ditches were checked for velocity and capacity per the CCS/EPCDCM Section 12.3.2.2. In order to check capacity, a cross section analysis was performed on the roadside ditch with the basin's minimum ditch slope. In order to check velocity, a cross section analysis was performed on the roadside ditch with the basin's maximum ditch slope. Ditch cross sections have been presented in Appendix C.

Autodesk Inc.'s Hydraflow Express Extension (Volume 10.5) was used for local road crossing culvert design. Culvert size was determined based on 100-year flows and hydraulic criteria from EPCDCM Chapter 9 –Culvert Design. All local road crossing culverts are 18" or 24" RCP. Culvert design reports are presented in Appendix C.

DRAINAGE FACILITY DESIGN

General Concept

The proposed stormwater conveyance system was designed to convey the developed Filing 1 runoff to full spectrum water quality and detention ponds (Pond G, H, I) via roadside ditches and local street culverts. Pond G, H, and I were designed to release at less than historic rates to minimize adverse impacts downstream.

An 84" RCP culvert is proposed within Drainageway T-6 to convey existing, off site flows underneath Del Cerro Trail and through Filing 1, to maintain T-6 drainage patterns presented with the *Haegler Ranch DBPS*.

A trapezoidal channel section, 50' bottom width w/ 10:1 daylights to existing, is proposed 1,200 feet downstream and 650 feet upstream of the 84" RCP culvert in order to maintain water surface elevations at or below the current floodplain's base flood elevations. A proposed drainage map is presented in Appendix F showing locations of channel and culvert improvements.

Specific Details

Four Step Process to Minimize Adverse Impacts of Urbanization

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

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

Step 2, Stabilize Drainageways: Filing 1 utilizes roadside ditches with culvert crossings throughout. These roadside ditches direct the on-site development flows to the multiple detention ponds within the project that release at or below historic rates into Drainageway T-6. Drainageway T-6 is stabilized upstream and downstream of the Del Cerro Trail culvert crossing. Based upon the proposed reduction in released flows compared to the pre-developed flows, no impact to downstream Drainageway T-6 is anticipated.

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

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

Water Quality

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

Erosion Control Plan

The El Paso County Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate must be submitted with each Final Drainage Report. The Erosion Control Plan for Filing 1 is submitted concurrently with this report.

Operation & Maintenance

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

Drainage and Bridge Fees

Drainage and Bridge Fees are due at time of final platting. An estimate of basin fees for the proposed development within Haegler Ranch drainage basin is provided below. Fee reduction for low density lots are applied to the overall basin fees in the next section. Additionally, reimbursable expenses are detailed below.

Total Filing 1 Platted Acres: 175.7 ac
Total Filing 1 Impervious Acres = 15.8 ac (175.7 ac x 9%)

Filing 1 Fee Totals (Prior to Reductions):

Bridge Fees
$ 1,524/ac x 15.8 ac = $24,079

Drainage Fees
$10,324/ac x 15.8 ac = $163,119

Filing 1 Drainage Fee Reduction: 25% Reduction for Low Density Lots: $163,119 x 25% = $40,780

Filing 1 Fee Totals (After Reductions):

Bridge Fees
$ 1,524/ac x 15.8 ac = $24,079

Drainage Fees
$163,119 - $40,780 = $122,339

Reimbursable Improvements:

The Haegler Ranch DBPS recommended channel improvements and a culvert crossing within the portions of on-site Drainageway T-6, DBPS excerpts are presented in Appendix E. Therefore, Filing 1 channel and culvert improvements within Drainageway T-6 will be considered reimbursable. See below for an analysis of the applicable DBPS cost for the proposed channel and culvert improvements.

Hagler T-6 DBPS Cost Analysis

DBPS Reference	Item	Unit	Qty.	Total Cost	30% Contin.	15% Engr.	Total	$/Unit
Table 6-13	Channel Improvement Costs	LF	4,270	179,000	53,700	26,850	259,550	61
Table 6-13	Drop Structure Costs	Ea	9	330,000	99,000	49,500	478,500	53,167
Table 6-16	Double 66" RCP Culvert Crossing	Ea	1	43,000	12,900	6,450	62,350	62,350

Drainage Basin Fee Cost Ratio

DBPS Fee	7,633
2020 Fee	10,324
Ratio	1.35

Saddlehorn Filing 1 Reimbursable Improvements (DBPS Basis)

Item	Unit	Qty.	$/Unit	Total	DBPS Ratio	Reimbursable Est.
Channel Improvement Costs	LF	1,992	61	121,083	1.35	163,770
Drop Structure Costs	Ea	0	53,167	0	1.35	0
84" RCP Culvert Crossing	Ea	1	62,350	62,350	1.35	84,331
					Total	**248,102**

Due to the reimbursable improvements, no drainage fees are required to be paid at time of final platting.

Construction Cost Opinion

(For Information Only / Non-Reimbursable)
Cost opinion has been presented in Appendix A.

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 and is in accordance with the PDR/MDDP for Saddlehorn Ranch.

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.

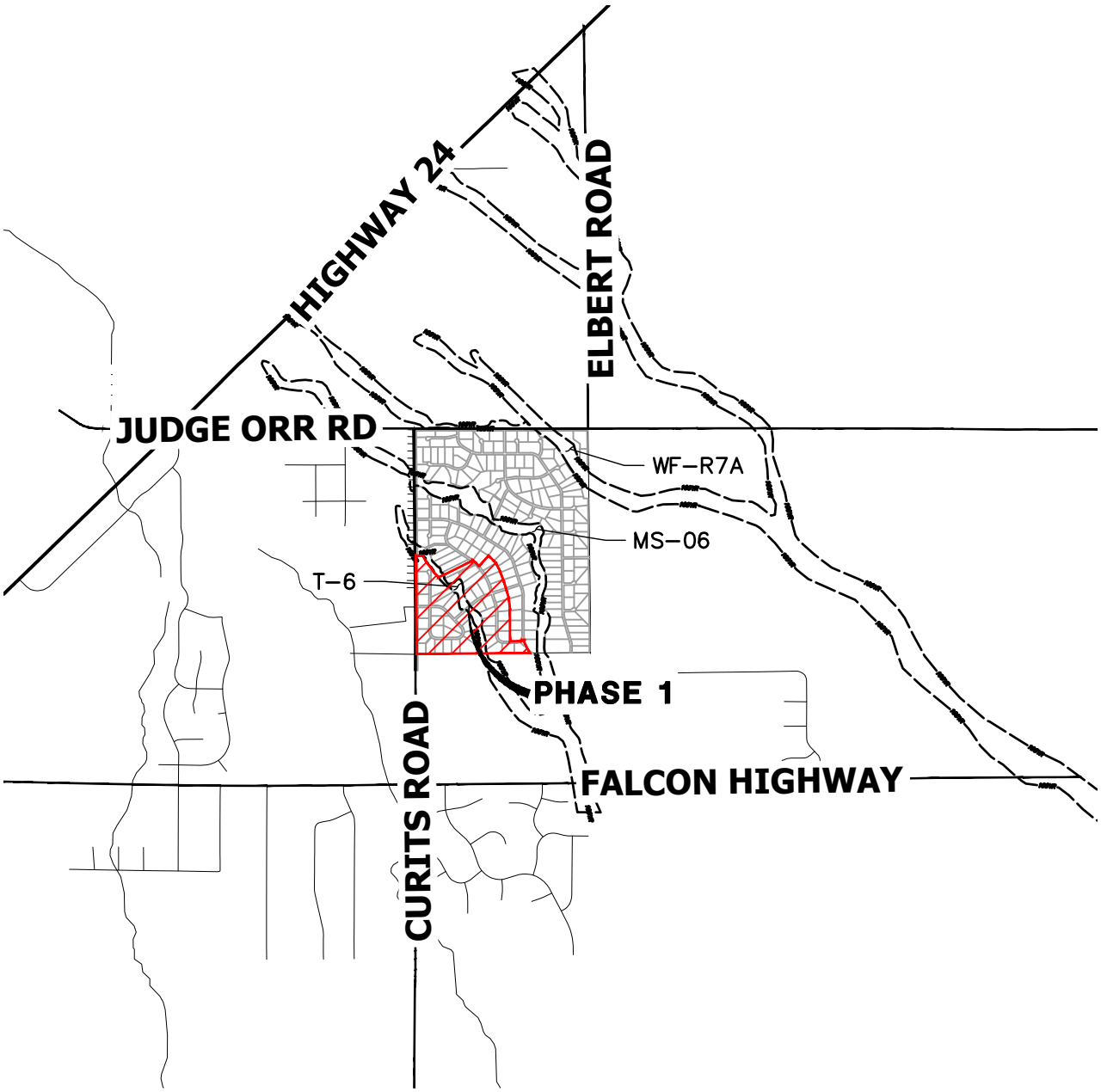
3. Preliminary Drainage Report/Master Development Drainage Plan for Saddlehorn Ranch, J.R. Engineering, April 2019.

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

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

APPENDIX A

FIGURES AND EXHIBITS



5000 2500 0 5000 10000

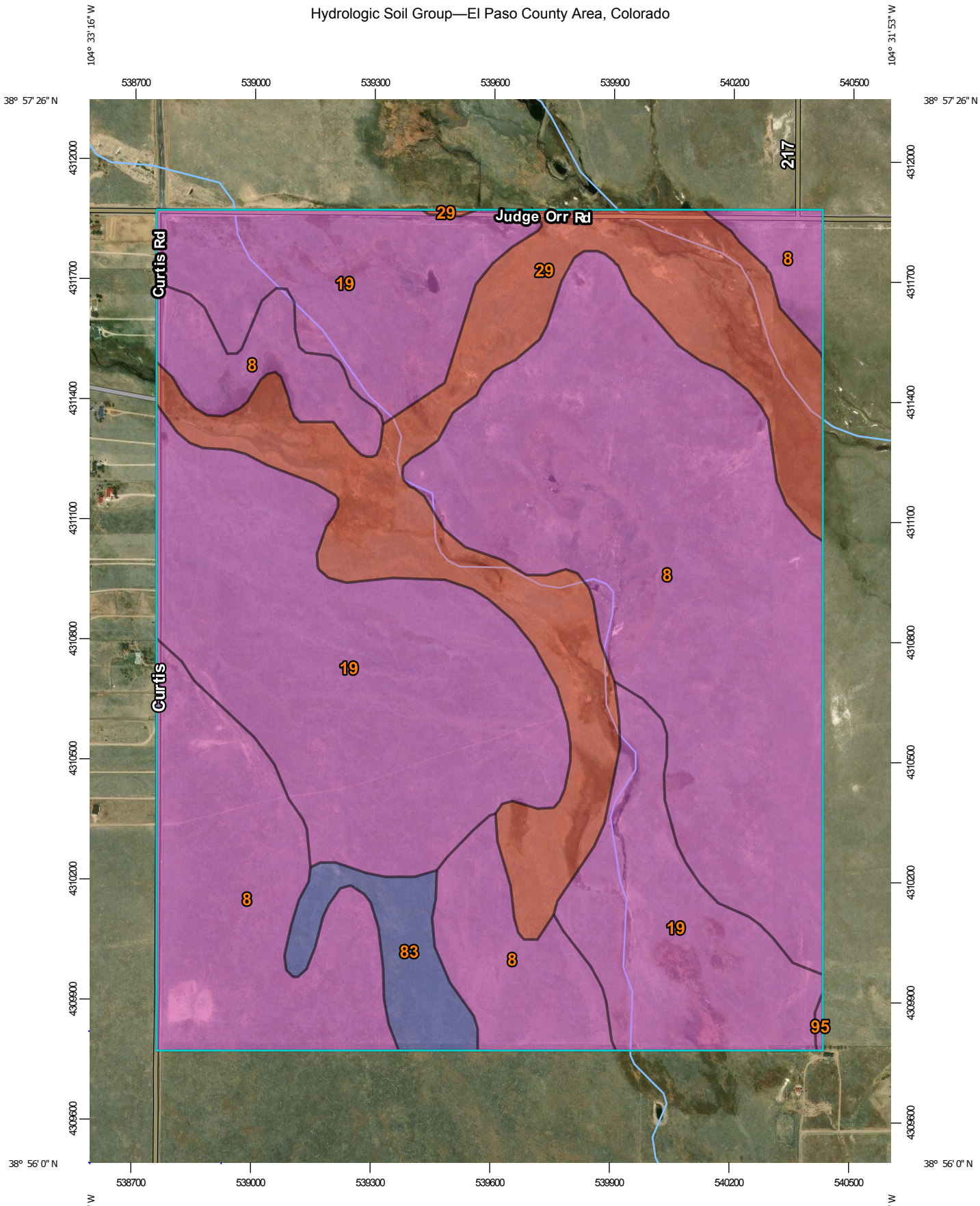
ORIGINAL SCALE: 1" = 5000'

VICINITY MAP
SADDLEHORN RANCH FILING 1
25142.02
11/19/19
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:\25100000.all\25142202\Drawings\Blocks\25142202_VIC MAP.dwg, VICINITY MAP, 11/19/2019 2:32:06 PM, CS


104° 33' 16" W
104° 31' 53" W
538700
539000
539300
539600
539900
540200
540500
38° 57' 26" N
38° 56' 0" N
4312000
4311700
4311400
4311100
4310800
4310500
4310200
4309900
4309600
Judge Orr Rd
Curtis Rd
Curtis
217
29
19
8
83
95
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/.

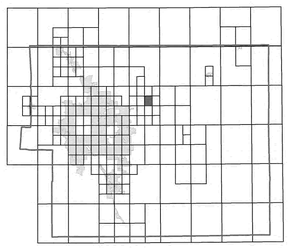
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

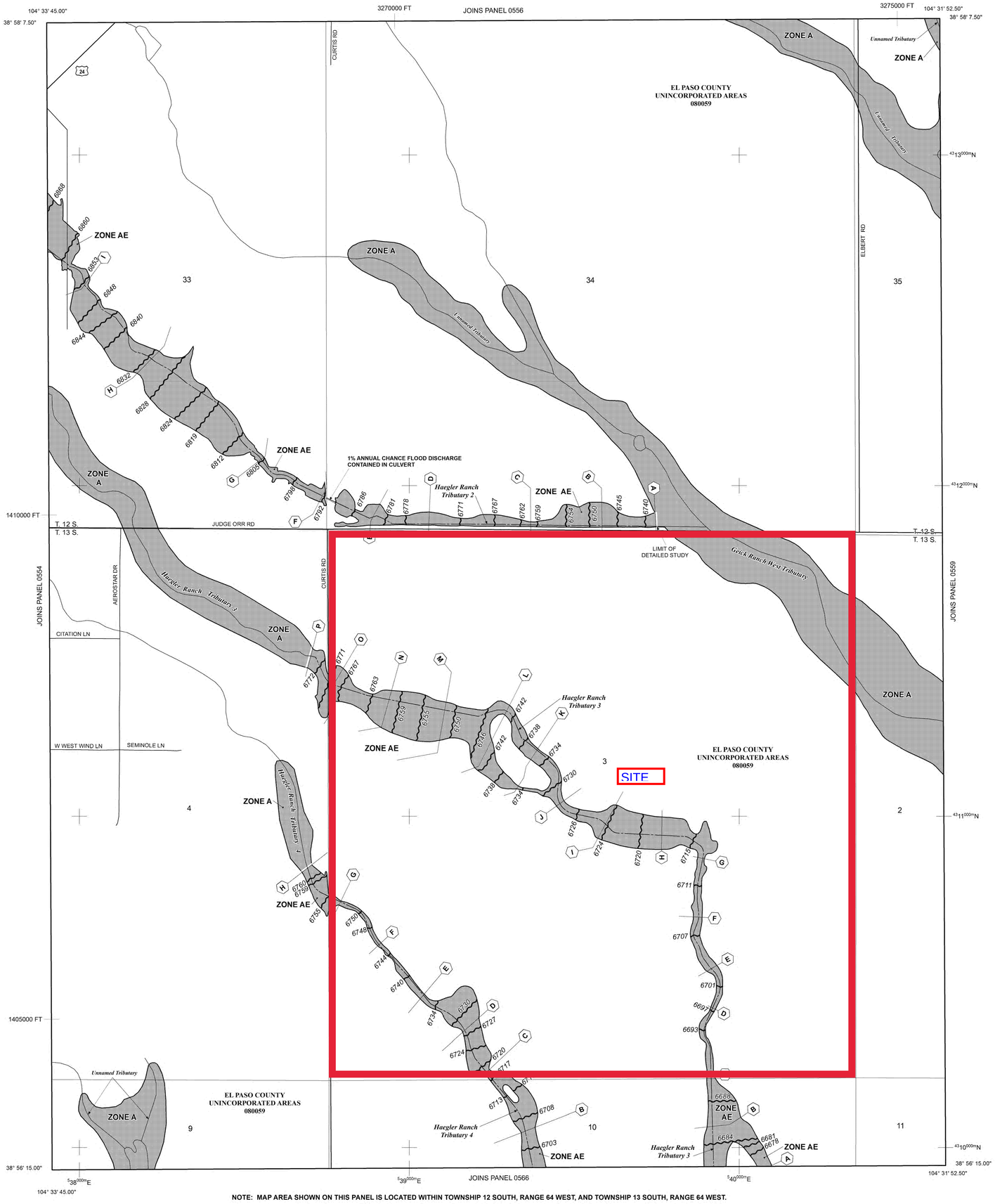
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

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

MAP REVISED TO REFLECT LOMR(S)

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

2019 Financial Assurance Estimate Form
(with pre-plat construction)

Updated: 6/7/2019

PROJECT INFORMATION		
SADDLEHORN RANCH FILING 1	12/19/2019	SP-19-006
Project Name	Date	PCD File No.

Description	Quantity	Units	Unit Cost		Total	(with Pre-Plat Construction) % Complete	Remaining	
SECTION 1 - GRADING AND EROSION CONTROL (Construction and Permanent BMPs)								
* Earthwork								*
less than 1,000; $5,300 min		CY	$ 8.00	=	$ -		$ -	*
1,000-5,000; $8,000 min		CY	$ 6.00	=	$ -		$ -	*
5,001-20,000; $30,000 min		CY	$ 5.00	=	$ -		$ -	*
20,001-50,000; $100,000 min		CY	$ 3.50	=	$ -		$ -	*
50,001-200,000; $175,000 min	61,992	CY	$ 2.50	=	$ 175,000.00		$ 175,000.00	*
greater than 200,000; $500,000 min		CY	$ 2.00	=	$ -		$ -	*
* Permanent Seeding (inc. noxious weed mgmnt.)	5	AC	$ 800.00	=	$ 3,680.00		$ 3,680.00	*
* Mulching	5	AC	$ 750.00	=	$ 3,450.00		$ 3,450.00	*
* Permanent Erosion Control Blanket	10,120	SY	$ 6.00	=	$ 60,720.00		$ 60,720.00	*
* Permanent Pond/BMP Construction		CY	$ 20.00	=	$ -		$ -	*
* Permanent Pond/BMP (Spillway)		EA		=	$ -		$ -	*
* Permanent Pond/BMP (Outlet Structure)		EA		=	$ -		$ -	
Safety Fence		LF	$ 3.00	=	$ -		$ -	
Temporary Erosion Control Blanket		SY	$ 3.00	=	$ -		$ -	
Vehicle Tracking Control	1	EA	$ 2,370.00	=	$ 2,370.00		$ 2,370.00	
Silt Fence	11,840	LF	$ 2.50	=	$ 29,600.00		$ 29,600.00	
Temporary Seeding		AC	$ 628.00	=	$ -		$ -	
Temporary Mulch		AC	$ 750.00	=	$ -		$ -	
Erosion Bales		EA	$ 25.00	=	$ -		$ -	
Erosion Logs/Straw Waddle		LF	$ 5.00	=	$ -		$ -	
Rock Check Dams		EA	$ 500.00	=	$ -		$ -	
Inlet Protection	13	EA	$ 167.00	=	$ 2,171.00		$ 2,171.00	
Sediment Basin	5	EA	$ 1,762.00	=	$ 8,810.00		$ 8,810.00	
Concrete Washout Basin	1	EA	$ 900.00	=	$ 900.00		$ 900.00	
Construction Markers	11,050	LF	$ 4.00	=	$ 44,200.00		$ 44,200.00	
Outlet Protection	15	EA	$ 153.00		$ 2,295.00		$ 2,295.00	
[insert items not listed but part of construction plans]				=	$ -		$ -	
	MAINTENANCE (35% of Construction BMPs)			=	$ 31,621.10		$ 31,621.10	
* - Subject to defect warranty financial assurance. A minimum of 20% shall be retained until final acceptance (MAXIMUM OF 80% COMPLETE ALLOWED)			**Section 1 Subtotal**	=	$ 364,817.10		$ 364,817.10	
SECTION 2 - PUBLIC IMPROVEMENTS *								
ROADWAY IMPROVEMENTS								*
Construction Traffic Control	1	LS	$ 25,000.00	=	$ 25,000.00		$ 25,000.00	*
Aggregate Base Course (135 lbs/cf)	14,111	Tons	$ 28.00	=	$ 395,108.00		$ 395,108.00	*
Aggregate Base Course (135 lbs/cf)		CY	$ 50.00		$ -		$ -	*
Asphalt Pavement (3" thick)		SY	$ 14.00		$ -		$ -	*
Asphalt Pavement (4" thick)		SY	$ 19.00		$ -		$ -	*
Asphalt Pavement (6" thick)		SY	$ 29.00		$ -		$ -	*
Asphalt Pavement (147 lbs/cf) 2" thick	146	Tons	$ 88.00		$ 12,848.00		$ 12,848.00	
Asphalt Pavement (147 lbs/cf) 8" thick	15,367	Tons	$ 88.00	=	$ 1,352,296.00		$ 1,352,296.00	*
Raised Median, Paved		SF	$ 8.00	=	$ -		$ -	*
Regulatory Sign/Advisory Sign	9	EA	$ 300.00	=	$ 2,700.00		$ 2,700.00	*
Guide/Street Name Sign	6	EA		=	$ -		$ -	*
Epoxy Pavement Marking	668	SF	$ 13.00	=	$ 8,684.00		$ 8,684.00	*
Thermoplastic Pavement Marking		SF	$ 23.00	=	$ -		$ -	*
Barricade - Type 3	2	EA	$ 200.00	=	$ 400.00		$ 400.00	*
Delineator - Type I		EA	$ 24.00	=	$ -		$ -	*
Curb and Gutter, Type A (6" Vertical)		LF	$ 30.00	=	$ -		$ -	*
Curb and Gutter, Type B (Median)		LF	$ 30.00	=	$ -		$ -	*
Curb and Gutter, Type C (Ramp)		LF	$ 30.00	=	$ -		$ -	*
4" Sidewalk (common areas only)		SY	$ 48.00	=	$ -		$ -	*
5" Sidewalk		SY	$ 60.00	=	$ -		$ -	*
6" Sidewalk		SY	$ 72.00	=	$ -		$ -	*
8" Sidewalk		SY	$ 96.00		$ -		$ -	*
Pedestrian Ramp		EA	$ 1,150.00	=	$ -		$ -	*
Cross Pan, local (8" thick, 6' wide to include return)		LF	$ 61.00	=	$ -		$ -	*
Cross Pan, collector (9" thick, 8' wide to include return)		LF	$ 92.00		$ -		$ -	*
Curb Chase		EA	$ 1,480.00	=	$ -		$ -	*
Guardrail Type 3 (W-Beam)		LF	$ 49.00	=	$ -		$ -	*
Guardrail Type 7 (Concrete)		LF	$ 72.00	=	$ -		$ -	*
Guardrail End Anchorage		EA	$ 2,098.00	=	$ -		$ -	*
Guardrail Impact Attenuator		EA	$ 3,767.00	=	$ -		$ -	*
Sound Barrier Fence (CMU block, 6' high)		LF	$ 78.00		$ -		$ -	*
Sound Barrier Fence (panels, 6' high)		LF	$ 80.00	=	$ -		$ -	*
Electrical Conduit, Size =		LF	$ 16.00	=	$ -		$ -	*
Traffic Signal, complete intersection		EA	$ 425,000	=	$ -		$ -	*

PROJECT INFORMATION		
SADDLEHORN RANCH FILING 1	12/19/2019	SP-19-006
Project Name	Date	PCD File No.

Description	Quantity	Units	Unit Cost		Total	(with Pre-Plat Construction) % Complete	Remaining	
				=	$ -		$ -	
[insert items not listed but part of construction plans]				=	$ -		$ -	*
STORM DRAIN IMPROVEMENTS								*
Concrete Box Culvert (M Standard), Size (W x H)		LF		=	$ -		$ -	*
18" Reinforced Concrete Pipe	341	LF	$ 65.00	=	$ 22,165.00		$ 22,165.00	*
24" Reinforced Concrete Pipe	155	LF	$ 78.00	=	$ 12,090.00		$ 12,090.00	*
30" Reinforced Concrete Pipe	70	LF	$ 97.00	=	$ 6,790.00		$ 6,790.00	*
36" Reinforced Concrete Pipe		LF	$ 120.00	=	$ -		$ -	*
42" Reinforced Concrete Pipe		LF	$ 160.00	=	$ -		$ -	*
48" Reinforced Concrete Pipe		LF	$ 195.00	=	$ -		$ -	*
54" Reinforced Concrete Pipe		LF	$ 245.00	=	$ -		$ -	*
60" Reinforced Concrete Pipe		LF	$ 288.00	=	$ -		$ -	*
66" Reinforced Concrete Pipe		LF	$ 332.00	=	$ -		$ -	*
72" Reinforced Concrete Pipe		LF	$ 380.00	=	$ -		$ -	*
18" Corrugated Steel Pipe		LF	$ 84.00	=	$ -		$ -	*
24" Corrugated Steel Pipe		LF	$ 96.00	=	$ -		$ -	*
30" Corrugated Steel Pipe		LF	$ 122.00	=	$ -		$ -	*
36" Corrugated Steel Pipe		LF	$ 147.00	=	$ -		$ -	*
42" Corrugated Steel Pipe		LF	$ 168.00	=	$ -		$ -	*
48" Corrugated Steel Pipe		LF	$ 178.00	=	$ -		$ -	*
54" Corrugated Steel Pipe		LF	$ 260.00	=	$ -		$ -	*
60" Corrugated Steel Pipe		LF	$ 280.00	=	$ -		$ -	*
66" Corrugated Steel Pipe		LF	$ 340.00	=	$ -		$ -	*
72" Corrugated Steel Pipe		LF	$ 400.00	=	$ -		$ -	*
78" Corrugated Steel Pipe		LF	$ 460.00	=	$ -		$ -	*
84" Corrugated Steel Pipe		LF	$ 550.00	=	$ -		$ -	*
Flared End Section (FES) RCP Size = 18" (unit cost = 6x pipe unit cost)	16	EA	$ 250.00	=	$ 4,000.00		$ 4,000.00	*
Flared End Section (FES) RCP Size = 24" (unit cost = 6x pipe unit cost)	6	EA	$ 335.00		$ 2,010.00		$ 2,010.00	
Flared End Section (FES) RCP Size = 30" (unit cost = 6x pipe unit cost)	2	EA	$ 475.00		$ 950.00		$ 950.00	
Flared End Section (FES) CSP Size = (unit cost = 6x pipe unit cost)		EA		=	$ -		$ -	*
End Treatment- Headwall		EA		=	$ -		$ -	*
End Treatment- Wingwall		EA		=	$ -		$ -	*
End Treatment - Cutoff Wall		EA		=	$ -		$ -	*
Curb Inlet (Type R) L=5', Depth < 5'		EA	$ 5,542.00	=	$ -		$ -	*
Curb Inlet (Type R) L=5', 5' ≤ Depth < 10'		EA	$ 7,188.00	=	$ -		$ -	*
Curb Inlet (Type R) L =5', 10' ≤ Depth < 15'		EA	$ 8,345.00	=	$ -		$ -	*
Curb Inlet (Type R) L =10', Depth < 5'		EA	$ 7,627.00	=	$ -		$ -	*
Curb Inlet (Type R) L =10', 5' ≤ Depth < 10'		EA	$ 7,861.00	=	$ -		$ -	*
Curb Inlet (Type R) L =10', 10' ≤ Depth < 15'		EA	$ 9,841.00	=	$ -		$ -	*
Curb Inlet (Type R) L =15', Depth < 5'		EA	$ 9,918.00	=	$ -		$ -	*
Curb Inlet (Type R) L =15', 5' ≤ Depth < 10'		EA	$ 10,633.00	=	$ -		$ -	*
Curb Inlet (Type R) L =15', 10' ≤ Depth < 15'		EA	$ 11,627.00	=	$ -		$ -	*
Curb Inlet (Type R) L =20', Depth < 5'		EA	$ 10,570.00	=	$ -		$ -	*
Curb Inlet (Type R) L =20', 5' ≤ Depth < 10'		EA	$ 11,667.00	=	$ -		$ -	*
Grated Inlet (Type C), Depth < 5'		EA	$ 4,640.00	=	$ -		$ -	*
Grated Inlet (Type D), Depth < 5'		EA	$ 5,731.00	=	$ -		$ -	*
Storm Sewer Manhole, Box Base		EA	$ 11,627.00	=	$ -		$ -	*
Storm Sewer Manhole, Slab Base		EA	$ 6,395.00	=	$ -		$ -	*
Geotextile (Erosion Control)		SY	$ 6.00	=	$ -		$ -	*
Rip Rap, d50 size from 6" to 24" (TYPE L)	344	Tons	$ 80.00	=	$ 27,520.00		$ 27,520.00	*
Rip Rap, Grouted		Tons	$ 95.00	=	$ -		$ -	*
Drainage Channel Construction, Size (W x H)		LF		=	$ -		$ -	*
Drainage Channel Lining, Concrete		CY	$ 570.00	=	$ -		$ -	*
Drainage Channel Lining, Rip Rap		CY	$ 112.00	=	$ -		$ -	*
Drainage Channel Lining, Grass		AC	$ 1,469.00	=	$ -		$ -	
Drainage Channel Lining, Other Stabilization				=	$ -		$ -	*
				=	$ -		$ -	
[insert items not listed but part of construction plans]				=	$ -		$ -	
* - Subject to defect warranty financial assurance. A minimum of 20% shall be retained until final acceptance (MAXIMUM OF 80% COMPLETE ALLOWED)			**Section 2 Subtotal**	=	$ 1,872,561.00		$ 1,872,561.00	

PROJECT INFORMATION		
SADDLEHORN RANCH FILING 1	12/19/2019	SP-19-006
Project Name	Date	PCD File No.

Description	Quantity	Units	Unit Cost		Total	(with Pre-Plat Construction) % Complete	(with Pre-Plat Construction) Remaining
SECTION 3 - COMMON DEVELOPMENT IMPROVEMENTS (Private or District and NOT Maintained by EPC)**							
ROADWAY IMPROVEMENTS							
				=	$ -		$ -
STORM DRAIN IMPROVEMENTS (Exception: Permanent Pond/BMP shall be itemized under Section 1)							
18" RCP	130	LF	$ 65.00		$ 8,450.00		$ 8,450.00
84" RCP	110	LF	$ 420.00	=	$ 46,200.00		$ 46,200.00
84" FES	2	EA	$ 6,500.00		$ 13,000.00		$ 13,000.00
Detention Outlet Structure	3	EA	$ 5,000.00	=	$ 15,000.00		$ 15,000.00
Concrete/Riprap Forebay	3	EA	$ 3,000.00		$ 9,000.00		$ 9,000.00
Concrete Trickle Channel	210	CY	$ 95.00		$ 19,950.00		$ 19,950.00
Detention Emergency Spillway	3	EA	$ 4,000.00	=	$ 12,000.00		$ 12,000.00
18" - Flared End Sections (FES) RCP	3	EA	$ 390.00	=	$ 1,170.00		$ 1,170.00
Permanent WQ Feature (EDB)	3	EA	$ 5,000.00	=	$ 15,000.00		$ 15,000.00
Gravel Pond Maintenance Access Road	1,500	SY	$ 45.00		$ 67,500.00		$ 67,500.00
Channel Lining, Riprap	1,334	CY	$ 98.00		$ 130,732.00		$ 130,732.00
Channel Lining, Grass	5	AC	$ 1,287.00		$ 6,435.00		$ 6,435.00
				=	$ -		$ -
WATER SYSTEM IMPROVEMENTS							
Water Main Pipe (PVC), Size 8"	7,000	LF	$ 64.00	=	$ 448,000.00		$ 448,000.00
Water Main Pipe (PVC), Size 16"	3,200	LF	$ 130.00		$ 416,000.00		$ 416,000.00
Water Main Pipe (Ductile Iron), Size 8"		LF	$ 75.00	=	$ -		$ -
Gate Valves, 8"	63	EA	$ 1,858.00	=	$ 117,054.00		$ 117,054.00
Gate Valves, 16"	11	EA	$ 1,858.00		$ 20,438.00		$ 20,438.00
Fire Hydrant Assembly, w/ all valves	13	EA	$ 6,597.00	=	$ 85,761.00		$ 85,761.00
Water Service Line Installation, inc. tap and valves	55	EA	$ 1,324.00	=	$ 72,820.00		$ 72,820.00
Water Treatment Plant	1	LS	$ 3,800,000.00		$ 3,800,000.00		$ 3,800,000.00
Fire Cistern Installation, complete		EA		=	$ -		$ -
				=	$ -		$ -
[insert items not listed but part of construction plans]				=	$ -		$ -
SANITARY SEWER IMPROVEMENTS							
Sewer Main Pipe (PVC), Size 8"		LF	$ 64.00	=	$ -		$ -
Sanitary Sewer Manhole, Depth < 15 feet		EA	$ 4,386.00	=	$ -		$ -
Sanitary Service Line Installation, complete		EA	$ 1,402.00	=	$ -		$ -
Sanitary Sewer Lift Station, complete		EA		=	$ -		$ -
				=	$ -		$ -
[insert items not listed but part of construction plans]				=	$ -		$ -
LANDSCAPING IMPROVEMENTS (For subdivision specific condition of approval, or PUD)							
		EA		=	$ -		$ -
** - Section 3 is not subject to defect warranty requirements			**Section 3 Subtotal**	=	$ 5,304,510.00		$ 5,304,510.00
AS-BUILT PLANS (Public Improvements inc. Permanent WQCV BMPs)		LS		=	$ -		$ -
POND/BMP CERTIFICATION (inc. elevations and volume calculations)		LS		=	$ -		$ -

Total Construction Financial Assurance $ 7,541,888.10
(Sum of all section subtotals plus as-builts and pond/BMP certification)

Total Remaining Construction Financial Assurance (with Pre-Plat Construction) $ 7,541,888.10
(Sum of all section totals less credit for items complete plus as-builts and pond/BMP certification)

Total Defect Warranty Financial Assurance $ 423,082.20
(20% of all items identified as (*). To be collateralized at time of preliminary acceptance)

Approvals

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

Engineer (P.E. Seal Required)

Approved by Owner / Applicant — Date

Approved by El Paso County Engineer / ECM Administrator — Date

APPENDIX B

HYDROLOGIC CALCULATIONS

FILING 1 - SUB-BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
H1	7.90	11%	0.05	0.20	26.7	1.1	6.9
H2	10.40	11%	0.05	0.20	24.2	1.5	9.7
H3	0.96	45%	0.31	0.46	14.7	1.1	2.6
H4	1.90	2%	0.01	0.13	7.9	0.1	1.8
I1	1.10	45%	0.32	0.49	16.0	1.2	3.1
I2	0.74	45%	0.32	0.49	11.3	0.9	2.4
I3	0.61	45%	0.32	0.48	11.8	0.7	1.9
I4	14.85	7%	0.03	0.21	18.6	1.5	16.9
I5	0.82	45%	0.31	0.46	11.0	1.0	2.5
I6	19.92	8%	0.04	0.17	20.9	2.2	17.6
I7	3.91	6%	0.03	0.18	5.5	0.5	6.1
F-G1	12.40	9%	0.04	0.18	39.3	1.1	7.9
F-G2	1.00	45%	0.31	0.46	15.5	1.1	2.7
G1	13.20	11%	0.05	0.19	31.3	1.6	10.5
G2	0.98	45%	0.31	0.46	15.8	1.0	2.6
G3	0.63	45%	0.31	0.46	13.9	0.7	1.8
G4	2.50	26%	0.16	0.31	37.0	0.8	2.8
G5	11.15	11%	0.05	0.19	18.4	1.8	11.5
G6	4.36	5%	0.03	0.29	23.4	0.3	6.0
G7	0.31	45%	0.31	0.46	12.0	0.4	0.9
F1	11.30	7%	0.03	0.17	27.4	0.9	8.2
F2	0.36	2%	0.01	0.13	12.8	0.0	0.3
F3	2.39	7%	0.03	0.16	27.0	0.2	1.7
F4	0.47	45%	0.31	0.46	10.2	0.6	1.5
UD1	4.30	6%	0.03	0.16	9.1	0.5	4.9
UD2	13.00	7%	0.03	0.21	18.3	1.4	14.6
UD3	9.60	8%	0.04	0.26	14.6	1.3	14.7
UD4	16.50	6%	0.03	0.16	22.6	1.2	12.7
UD5	10.00	6%	0.03	0.27	24.9	0.9	12.7
UD6	6.80	6%	0.03	0.22	11.2	0.8	10.0
OS1	1.00	24%	0.14	0.29	27.2	0.4	1.3
OS2	0.76	18%	0.09	0.25	14.8	0.3	1.1
OS3	0.30	18%	0.09	0.25	7.9	0.1	0.6

FILING 1 - DESIGN POINT SUMMARY TABLE

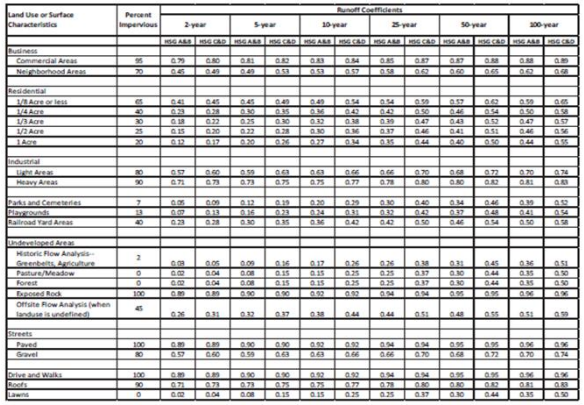
Design Point	Contributing Acreage (ac)	Q_5 (cfs)	Q_{100} (Cfs)
1	8.9	1.4	8.2
2	20.1	2.7	15.7
3	22.9	3.4	18.3
4	0.7	0.9	2.4
5	16.8	3.4	21.8
6	38.0	6.7	41.5
7	25.6	2.1	14.8
8	2.0	1.8	4.4
9	26.2	2.5	15.6
10	13.1	2.7	11.7
11	46.5	4.7	25.9
12	11.7	1.2	12.0
13	2.86	0.6	2.7

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: Saddlehorn Ranch
Location: El Paso County

Project Name: Saddlehorn Ranch
Project No.: 25142.02
Calculated By: NQJ
Checked By: TBD
Date: 11/27/19

Basin ID	Total Area (ac)	Paved Roads			2.5 Acre Rural Lots			Lawns			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
H1	7.90	45%	1.00	5.7%	6.2%	6.90	5.4%	2%	0.00	0.0%	11.1%
H2	10.4	45%	1.35	5.8%	6.2%	9.05	5.4%	2%	0.00	0.0%	11.2%
H3	0.96	45%	0.96	45.0%	6.2%	0.00	0.0%	2%	0.00	0.0%	45.0%
H4	1.90	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	1.90	2.0%	2.0%
I1	1.10	45%	1.10	45.0%	6.2%	0.00	0.0%	2%	0.00	0.0%	45.0%
I2	0.74	45%	0.74	45.0%	6.2%	0.00	0.0%	2%	0.00	0.0%	45.0%
I3	0.61	45%	0.61	45.0%	6.2%	0.00	0.0%	2%	0.00	0.0%	45.0%
I4	14.9	45%	0.25	0.8%	6.2%	14.60	6.1%	2%	0.00	0.0%	6.9%
I5	0.82	45%	0.82	45.0%	6.2%	0.00	0.0%	2%	0.00	0.0%	45.0%
I6	19.92	45%	1.05	2.4%	6.2%	18.87	5.9%	2%	0.00	0.0%	8.2%
I7	3.91	45%	0.00	0.0%	6.2%	3.91	6.2%	2%	0.00	0.0%	6.2%
F-G1	12.40	45%	0.99	3.6%	6.2%	11.41	5.7%	2%	0.00	0.0%	9.3%
F-G2	1.00	45%	1.00	45.0%	6.2%	0.00	0.0%	2%	0.00	0.0%	45.0%
G1	13.2	45%	1.61	5.5%	6.2%	11.59	5.4%	2%	0.00	0.0%	10.9%
G2	0.98	45%	0.98	45.0%	6.2%	0.00	0.0%	2%	0.00	0.0%	45.0%
G3	0.63	45%	0.63	45.0%	6.2%	0.00	0.0%	2%	0.00	0.0%	45.0%
G4	2.50	45%	1.28	23.0%	6.2%	1.22	3.0%	2%	0.00	0.0%	26.1%
G5	11.2	45%	1.25	5.0%	6.2%	9.90	5.5%	2%	0.00	0.0%	10.5%
G6	4.36	45%	0.00	0.0%	6.2%	3.46	4.9%	2%	0.90	0.4%	5.3%
G7	0.31	45%	0.31	45.0%	6.2%	0.00	0.0%	2%	0.00	0.0%	45.0%
F1	11.3	45%	0.36	1.4%	6.2%	9.75	5.3%	2%	1.19	0.2%	7.0%
F2	0.36	45%	0.00	0.0%	6.2%	0.00	0.0%	2%	0.36	2.0%	2.0%
F3	2.4	45%	0.26	4.9%	6.2%	0.00	0.0%	2%	2.13	1.8%	6.7%
F4	0.47	45%	0.47	45.0%	6.2%	0.00	0.0%	2%	0.00	0.0%	45.0%
UD1	4.30	45%	0.00	0.0%	6.2%	4.30	6.2%	2%	0.00	0.0%	6.2%
UD2	13.0	45%	0.38	1.3%	6.2%	12.62	6.0%	2%	0.00	0.0%	7.3%
UD3	9.60	45%	0.38	1.8%	6.2%	9.22	6.0%	2%	0.00	0.0%	7.7%
UD4	16.50	45%	0.00	0.0%	6.2%	16.50	6.2%	2%	0.00	0.0%	6.2%
UD5	10.0	45%	0.00	0.0%	6.2%	10.00	6.2%	2%	0.00	0.0%	6.2%
UD6	6.80	45%	0.00	0.0%	6.2%	6.80	6.2%	2%	0.00	0.0%	6.2%
OS1	1.00	45%	0.50	22.5%	6.2%	0.00	0.0%	2%	0.50	1.0%	23.5%
OS2	0.76	45%	0.28	16.6%	6.2%	0.00	0.0%	2%	0.48	1.3%	17.8%
OS3	0.30	45%	0.11	16.5%	6.2%	0.00	0.0%	2%	0.19	1.3%	17.8%
TOTAL	186.42										9.9%



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

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

Roads w/ Roadside Ditches - Comp. % Impervious Calculation		
Area* (ac)	Area - Ditch (5%)	Area - Roads (100%)
0.2124	0.1320	0.0804
Comp % Imperviousness	0.41	

*Area based on 250 LF roadway from CL to outside edge of roadside ditch

The above conservatively rounded to 45%.

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

bdivision: Saddlehorn Ranch
Location: El Paso County

Project Name: Saddlehorn Ranch
Project No.: 25142.02
Calculated By: NQJ
Checked By: TBD
Date: #######

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Hydrologic Soil Group			Minor Coefficients			Major Coefficients			Basins Total Weighted C_5	Basins Total Weighted C_{100}
			Area A (ac)	Area B (ac)	Area C/D (ac)	% A (ac)	% B (ac)	% C/D (ac)	$C_{5,A}$	$C_{5,B}$	$C_{5,C/D}$	$C_{100,A}$	$C_{100,B}$	$C_{100,C/D}$		
H1	7.90	11.1%	7.90	0.00	0.00	100%	0%	0%	0.05	0.08	0.13	0.20	0.48	0.53	0.05	0.20
H2	10.40	11.2%	10.40	0.00	0.00	100%	0%	0%	0.05	0.08	0.13	0.20	0.48	0.53	0.05	0.20
H3	0.96	45.0%	0.96	0.00	0.00	100%	0%	0%	0.31	0.36	0.40	0.46	0.64	0.67	0.31	0.46
H4	1.90	2.0%	1.90	0.00	0.00	100%	0%	0%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13
I1	1.10	45.0%	0.89	0.21	0.00	81%	19%	0%	0.31	0.36	0.40	0.46	0.64	0.67	0.32	0.49
I2	0.74	45.0%	0.63	0.11	0.00	85%	15%	0%	0.31	0.36	0.40	0.46	0.64	0.67	0.32	0.49
I3	0.61	45.0%	0.54	0.07	0.00	89%	11%	0%	0.31	0.36	0.40	0.46	0.64	0.67	0.32	0.48
I4	14.85	6.9%	12.40	2.45	0.00	84%	16%	0%	0.03	0.05	0.09	0.16	0.46	0.51	0.03	0.21
I5	0.82	45.0%	0.82	0.00	0.00	100%	0%	0%	0.31	0.36	0.40	0.46	0.64	0.67	0.31	0.46
I6	19.92	8.2%	19.92	0.00	0.00	100%	0%	0%	0.04	0.06	0.10	0.17	0.47	0.52	0.04	0.17
I7	3.91	6.2%	3.57	0.34	0.00	91%	9%	0%	0.03	0.04	0.09	0.16	0.46	0.51	0.03	0.18
F-G1	12.40	9.3%	12.40	0.00	0.00	100%	0%	0%	0.04	0.06	0.11	0.18	0.47	0.52	0.04	0.18
F-G2	1.00	45.0%	1.00	0.00	0.00	100%	0%	0%	0.31	0.36	0.40	0.46	0.64	0.67	0.31	0.46
G1	13.20	10.9%	13.20	0.00	0.00	100%	0%	0%	0.05	0.08	0.13	0.19	0.48	0.53	0.05	0.19
G2	0.98	45.0%	0.98	0.00	0.00	100%	0%	0%	0.31	0.36	0.40	0.46	0.64	0.67	0.31	0.46
G3	0.63	45.0%	0.63	0.00	0.00	100%	0%	0%	0.31	0.36	0.40	0.46	0.64	0.67	0.31	0.46
G4	2.50	26.1%	2.50	0.00	0.00	100%	0%	0%	0.16	0.20	0.25	0.31	0.55	0.59	0.16	0.31
G5	11.15	10.5%	11.15	0.00	0.00	100%	0%	0%	0.05	0.07	0.12	0.19	0.48	0.53	0.05	0.19
G6	4.36	5.3%	2.36	2.00	0.00	54%	46%	0%	0.02	0.04	0.08	0.15	0.45	0.51	0.03	0.29
G7	0.31	45.0%	0.31	0.00	0.00	100%	0%	0%	0.31	0.36	0.40	0.46	0.64	0.67	0.31	0.46
F1	11.30	7.0%	11.30	0.00	0.00	100%	0%	0%	0.03	0.05	0.09	0.17	0.46	0.51	0.03	0.17
F2	0.36	2.0%	0.36	0.00	0.00	100%	0%	0%	0.01	0.01	0.05	0.13	0.44	0.49	0.01	0.13
F3	2.39	6.7%	2.39	0.00	0.00	100%	0%	0%	0.03	0.05	0.09	0.16	0.46	0.51	0.03	0.16
F4	0.47	45.0%	0.47	0.00	0.00	100%	0%	0%	0.31	0.36	0.40	0.46	0.64	0.67	0.31	0.46
UD1	4.30	6.2%	4.30	0.00	0.00	100%	0%	0%	0.03	0.04	0.09	0.16	0.46	0.51	0.03	0.16
UD2	13.00	7.3%	11.17	1.83	0.00	86%	14%	0%	0.03	0.05	0.09	0.17	0.46	0.51	0.03	0.21
UD3	9.60	7.7%	6.74	2.86	0.00	70%	30%	0%	0.03	0.05	0.10	0.17	0.46	0.52	0.04	0.26
UD4	16.50	6.2%	16.50	0.00	0.00	100%	0%	0%	0.03	0.04	0.09	0.16	0.46	0.51	0.03	0.16
UD5	10.00	6.2%	6.09	3.91	0.00	61%	39%	0%	0.03	0.04	0.09	0.16	0.46	0.51	0.03	0.27
UD6	6.80	6.2%	5.37	1.43	0.00	79%	21%	0%	0.03	0.04	0.09	0.16	0.46	0.51	0.03	0.22
OS1	1.00	23.5%	1.00	0.00	0.00	100%	0%	0%	0.14	0.18	0.23	0.29	0.54	0.58	0.14	0.29
OS2	0.76	17.8%	0.76	0.00	0.00	100%	0%	0%	0.09	0.13	0.18	0.25	0.51	0.56	0.09	0.25
OS3	0.30	17.8%	0.30	0.00	0.00	100%	0%	0%	0.09	0.13	0.18	0.25	0.51	0.56	0.09	0.25
TOTAL	186.42	9.9%	171.21	15.21	0.00	92%	8%	0%	---	---	---	---	---	---	0.05	0.21

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

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

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

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

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Saddlehorn Ranch
Location: El Paso County

Project Name: Saddlehorn Ranch
Project No.: 25142.02
Calculated By: NQJ
Checked By: TBD
Date: 11/27/19

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
H1	7.90	A	11%	0.05	0.20	200	4.9%	15.8	975	1.0%	15.0	1.5	10.8	26.7	1175.0	39.5	26.7
H2	10.40	A	11%	0.05	0.20	200	4.5%	16.3	961	1.8%	15.0	2.0	8.0	24.2	1161.0	35.4	24.2
H3	0.96	A	45%	0.31	0.46	28	2.0%	6.0	784	1.0%	15.0	1.5	8.7	14.7	812.0	26.9	14.7
H4	1.90	A	2%	0.01	0.13	20	3.4%	5.9	343	2.1%	20.0	2.9	2.0	7.9	363.0	29.9	7.9
I1	1.10	A	45%	0.32	0.49	28	2.0%	5.9	1482	2.7%	15.0	2.5	10.0	16.0	1510.0	28.2	16.0
I2	0.74	A	45%	0.32	0.49	28	2.0%	5.9	860	3.2%	15.0	2.7	5.3	11.3	888.0	23.6	11.3
I3	0.61	A	45%	0.32	0.48	28	2.0%	6.0	735	1.9%	15.0	2.1	5.9	11.8	763.0	24.1	11.8
I4	14.85	A	7%	0.03	0.21	200	5.5%	15.5	683	3.5%	20.0	3.7	3.0	18.6	883.0	30.9	18.6
I5	0.82	A	45%	0.31	0.46	28	2.0%	6.0	1062	5.5%	15.0	3.5	5.0	11.0	1090.0	23.3	11.0
I6	19.92	A	8%	0.04	0.17	200	5.3%	15.7	1332	4.5%	20.0	4.2	5.2	20.9	1532.0	34.9	20.9
I7	3.91	A	6%	0.03	0.18	5	3.3%	2.9	560	3.3%	20.0	3.6	2.6	5.5	565.0	30.2	5.5
F-G1	12.40	A	9%	0.04	0.18	200	1.6%	23.2	1622	1.3%	15.0	1.7	16.1	39.3	1822.0	47.9	39.3
F-G2	1.00	A	45%	0.31	0.46	28	2.0%	6.0	1117	1.7%	15.0	2.0	9.5	15.5	1145.0	27.7	15.5
G1	13.20	A	11%	0.05	0.19	200	1.9%	21.8	1100	1.7%	15.0	1.9	9.4	31.3	1300.0	37.6	31.3
G2	0.98	A	45%	0.31	0.46	28	2.0%	6.0	1150	1.7%	15.0	2.0	9.8	15.8	1178.0	28.0	15.8
G3	0.63	A	45%	0.31	0.46	28	2.0%	6.0	729	1.0%	15.0	1.5	7.9	13.9	757.0	26.1	13.9
G4	2.50	A	26%	0.16	0.31	200	1.3%	22.4	1387	1.1%	15.0	1.6	14.6	37.0	1587.0	38.9	37.0
G5	11.15	A	11%	0.05	0.19	120	3.3%	14.0	817	2.4%	20.0	3.1	4.4	18.4	937.0	32.6	18.4
G6	4.36	A	5%	0.03	0.29	200	2.7%	19.6	598	1.8%	20.0	2.7	3.7	23.4	798.0	32.7	23.4
G7	0.31	A	45%	0.31	0.46	28	2.0%	6.0	540	1.0%	15.0	1.5	6.0	12.0	568.0	24.2	12.0
F1	11.30	A	7%	0.03	0.17	200	2.0%	21.8	930	1.9%	20.0	2.7	5.7	27.4	1130.0	36.1	27.4
F2	0.36	A	2%	0.01	0.13	28	2.0%	8.3	417	1.1%	15.0	1.5	4.5	12.8	445.0	33.0	12.8
F3	2.39	D	7%	0.03	0.16	134	0.8%	24.7	315	1.3%	20.0	2.3	2.3	27.0	449.0	29.6	27.0
F4	0.47	A	45%	0.31	0.46	28	2.0%	6.0	378	1.0%	15.0	1.5	4.2	10.2	406.0	22.5	10.2
UD1	4.30	A	6%	0.03	0.16	60	6.7%	8.0	297	5.0%	20.0	4.5	1.1	9.1	357.0	27.2	9.1
UD2	13.00	A	7%	0.03	0.21	154	3.9%	15.2	707	3.7%	20.0	3.8	3.1	18.3	861.0	30.9	18.3
UD3	9.60	A	8%	0.04	0.26	167	6.6%	13.3	287	3.4%	20.0	3.7	1.3	14.6	454.0	27.3	14.6
UD4	16.50	A	6%	0.03	0.16	118	1.8%	17.4	819	1.8%	20.0	2.6	5.2	22.6	937.0	35.4	22.6
UD5	10.00	A	6%	0.03	0.27	180	2.2%	19.9	777	1.7%	20.0	2.6	5.0	24.9	957.0	35.1	24.9
UD6	6.80	A	6%	0.03	0.22	43	2.4%	9.5	232	1.3%	20.0	2.3	1.7	11.2	275.0	28.4	11.2
OS1	1.00	A	24%	0.14	0.29	15	2.0%	5.4	1436	0.3%	20.0	1.1	21.8	27.2	1451.0	57.6	27.2
OS2	0.76	A	18%	0.09	0.25	15	2.0%	5.6	1101	1.0%	20.0	2.0	9.2	14.8	1116.0	38.9	14.8
OS3	0.30	A	18%	0.09	0.25	15	2.0%	5.6	431	2.4%	20.0	3.1	2.3	7.9	446.0	27.0	7.9

NOTES:

$$t_c = t_i + t_t$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

Equation 6-2

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S_o^{0.33}}$$

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

Equation 6-4

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Equation 6-3

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Equation 6-5

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Saddlehorn Ranch
Location: El Paso County
Design Storm: 5-Year

Project Name: Saddlehorn Ranch
Project No.: 25142.02
Calculated By: NQJ
Checked By: TBD
Date: 11/27/19

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
		OS1	1.00	0.14	27.2	0.14	2.63	0.4															BASIN OS1 FLOW TO DP1 (ROUTED IN SF2)
	1	H1	7.90	0.05	26.7	0.41	2.66	1.1	27.2	0.55	2.63	1.4	1.4	0.55	1					840	2.0	7.0	BASIN H1 & OS1 FLOW AT DP1, SWALE FLOW TO DP2
		OS2	0.76	0.09	14.8	0.07	3.54	0.2															
	2	H2	10.40	0.05	24.2	0.55	2.80	1.5	34.2	1.17	2.28	2.7				2.7	1.2	0.5	24	56	3.7	0.3	DP1, BASIN OS2 & BASIN H2 FLOW AT DP2, PIPED TO DP3
		H3	0.96	0.31	14.7	0.30	3.55	1.1															BASIN H3 FLOW, SWALE FLOW TO DP3 (ROUTED IN SF2)
		H4	1.90	0.01	7.9	0.01	4.49	0.04															BASIN H4 FLOW
	3								34.5	1.48	2.27	3.4											DP2, BASIN H3 & BASIN H4 COMBINED FLOW, TOTAL FLOW ENTERING POND H
		I1	1.10	0.32	16.0	0.35	3.43	1.2															BASIN I1 FLOW, SWALE FLOW TO DP5 (ROUTED IN SF2)
	4	I2	0.74	0.32	11.3	0.24	3.95	0.9					0.9	0.2	1.9					790	2.8	4.8	BASIN I2 FLOW AT DP4, SWALE FLOW TO DP6
		I3	0.61	0.32	11.8	0.19	3.88	0.7															BASIN I3 FLOW, SWALE FLOW TO DP6 (ROUTED IN SF2)
		I4	14.85	0.03	18.6	0.46	3.20	1.5															BASIN I4 FLOW, SWALE FLOW TO DP5 (ROUTED IN SF2)
		I5	0.82	0.31	11.0	0.25	3.98	1.0															BASIN I5 FLOW, SWALE FLOW TO DP5 (ROUTED IN SF2)
		I6	19.92	0.04	20.9	0.72	3.02	2.2															BASIN I6 FLOW, SWALE FLOW TO DP6 (ROUTED IN SF2)
		I7	3.91	0.03	5.5	0.10	5.03	0.5															BASIN I7 FLOW, SHEET FLOW TO DRAINAGEWAY T-6
	5								18.6	1.06	3.20	3.4				3.4	1.1	0.5	24	80	4.0	0.3	BASIN I1, I4, & I5 FLOW AT DP5, PIPED TO DP6
	6								20.9	2.21	3.02	6.7											DP4, DP5, I3, I6, I7 FLOW, TOTAL FLOW ENTERING POND I

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Saddlehorn Ranch
Location: El Paso County
Design Storm: 5-Year

Project Name: Saddlehorn Ranch
Project No.: 25142.02
Calculated By: NQJ
Checked By: TBD
Date: 11/27/19

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
		F-G1	12.40	0.04	39.3	0.51	2.08	1.1					1.1	0.5	1.7					1135	2.6	7.3	F-G1 BASIN FLOW, SWALE FLOW TO DP7
		G1	13.20	0.05	31.3	0.67	2.42	1.6															BASIN G1 FLOW, SWALE FLOW TO DP7 (ROUTED IN SF2)
	7								46.6	1.18	1.82	2.1				2.1	1.2	0.5	24	56	3.5	0.3	BASIN F-G1 & G1 FLOW AT DP7, PIPE TO DP9
		F-G2	1.00	0.31	15.5	0.31	3.47	1.1					1.1	0.31	1.7					1135	2.6	7.3	BASIN F-G2 FLOW, SWALE FLOW TO DP8
		G2	0.98	0.31	15.8	0.30	3.44	1.0															BASIN G2 FLOW, SWALE FLOW TO DP8 (ROUTED IN SF2)
	8								22.8	0.61	2.89	1.8	1.8	0.61	1.13					1429	2.1	11.2	BASIN F-G2 & G2 FLOW AT DP8, PIED THEN SWALE FLOW TO DP10
	9	G3	0.63	0.31	13.9	0.20	3.63	0.7	46.8	1.38	1.81	2.5	2.5	1.38	1.13					1429	2.1	11.2	DP7 & BASIN G3 FLOW AT DP9, SWALE FLOW TO DP11
		G4	2.50	0.16	37.0	0.39	2.16	0.8															BASIN G4 FLOW, SWALE FLOW TO DP11 (ROUTED IN SF2)
		G5	11.15	0.05	18.4	0.55	3.21	1.8															BASIN G5 FLOW, SWALE FLOW TO DP10 (ROUTED IN SF2)
		G6	4.36	0.03	23.4	0.12	2.86	0.3															BASIN G6 FLOW, SWALE FLOW TO DP11 (ROUTED IN SF2)
		G7	0.31	0.31	12.0	0.10	3.86	0.4															BASIN G7 FLOW, SWALE FLOW TO DP11 (ROUTED IN SF2)
	10								34.0	1.16	2.29	2.7				2.7	1.2	0.5	24	100	3.7	0.5	DP8 & BASIN G5 FLOW AT DP10, PIPE TO DP11
	11								58.0	3.15	1.49	4.7											DP9, DP10, BASIN G4 & G6 FLOW AT DP11, TOTAL FLOW ENTERING POND G
		F1	11.30	0.03	27.4	0.33	2.62	0.9								0.9	0.3	0.5	18	60	2.8	0.4	BASIN F1 FLOW AT DP12, PIPE TO SED. BASIN F1
		F2	0.36	0.01	12.8	0.00	3.75	0.0															BASIN F12 FLOW AT DP12, SWALE FLOW TO SED. BASIN F1
	12								12.8	0.33	3.75	1.2											TOTAL FLOW ENTERING SEDIMENT BASIN F1 (SEE GESC PLANS)
		F3	2.39	0.03	27.0	0.06	2.64	0.2															BASIN F3 FLOW, SWALE FLOW TO SEDIMENT BASIN F2
		F4	0.47	0.31	10.2	0.15	4.10	0.6															BASIN F4 FLOW, SWALE FLOW TO SEDIMENT BASIN F2
	13								27.0	0.21	2.64	0.6											TOTAL FLOW ENTERING SEDIMENT BASIN F2 (SEE GESC PLANS)

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

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

Subdivision: Saddlehorn Ranch
Location: El Paso County
Design Storm: 100-Year

Project Name: Saddlehorn Ranch
Project No.: 25142.02
Calculated By: NQJ
Checked By: TBD
Date: 11/27/19

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
		OS1	1.00	0.29	27.2	0.29	4.41	1.3															BASIN OS1 FLOW TO DP1 (ROUTED IN SF2)
	1	H1	7.90	0.20	26.7	1.56	4.46	7.0	27.2	1.85	4.41	8.2	8.2	1.85	1					840	2.0	7.0	BASIN H1 & OS1 FLOW AT DP1, SWALE FLOW TO DP2
		OS2	0.76	0.25	14.8	0.19	5.95	1.1															
	2	H2	10.40	0.20	24.2	2.06	4.70	9.7	34.2	4.10	3.83	15.7				15.7	4.1	0.5	24	56	5.8	0.2	DP1, BASIN OS2 & BASIN H2 FLOW AT DP2, PIPED TO DP3
		H3	0.96	0.46	14.7	0.44	5.96	2.6															BASIN H3 FLOW, SWALE FLOW TO DP3 (ROUTED IN SF2)
		H4	1.90	0.13	7.9	0.24	7.54	1.81															BASIN H4 FLOW
	3								34.4	4.78	3.82	18.3											DP2, BASIN H3 & BASIN H4 COMBINED FLOW, TOTAL FLOW ENTERING POND H
		I1	1.10	0.49	16.0	0.54	5.76	3.1															BASIN I1 FLOW, SWALE FLOW TO DP5 (ROUTED IN SF2)
	4	I2	0.74	0.49	11.3	0.36	6.63	2.4					2.4	0.4	1.9					790	2.8	4.8	BASIN I2 FLOW AT DP4, SWALE FLOW TO DP6
		I3	0.61	0.48	11.8	0.29	6.51	1.9															BASIN I3 FLOW, SWALE FLOW TO DP6 (ROUTED IN SF2)
		I4	14.85	0.21	18.6	3.14	5.37	16.9															BASIN I4 FLOW, SWALE FLOW TO DP5 (ROUTED IN SF2)
		I5	0.82	0.46	11.0	0.38	6.68	2.5															BASIN I5 FLOW, SWALE FLOW TO DP5 (ROUTED IN SF2)
		I6	19.92	0.17	20.9	3.47	5.07	17.6															BASIN I6 FLOW, SWALE FLOW TO DP6 (ROUTED IN SF2)
		I7	3.91	0.18	5.5	0.72	8.44	6.1															BASIN I7 FLOW, SHEET FLOW TO DRAINAGEWAY T-6
	5								18.6	4.06	5.37	21.8				21.8	4.1	0.5	24	80	6.9	0.2	BASIN I1, I4, & I5 FLOW AT DP5, PIPED TO DP6
	6								20.9	8.18	5.07	41.5											DP4, DP5, I3, I6, I7 FLOW, TOTAL FLOW ENTERING POND I

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

Subdivision: Saddlehorn Ranch
Location: El Paso County
Design Storm: 100-Year

Project Name: Saddlehorn Ranch
Project No.: 25142.02
Calculated By: NQJ
Checked By: TBD
Date: 11/27/19

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
		F-G1	12.40	0.18	39.3	2.26	3.49	7.9					7.9	2.3	1.7					1135	2.6	7.3	F-G1 BASIN FLOW, SWALE FLOW TO DP7
		G1	13.20	0.19	31.3	2.57	4.06	10.4															BASIN G1 FLOW, SWALE FLOW TO DP7 (ROUTED IN SF2)
	7								46.6	4.83	3.06	14.8				14.8	4.8	0.5	24	56	5.8	0.2	BASIN F-G1 & G1 FLOW AT DP7, PIPE TO DP9
		F-G2	1.00	0.46	15.5	0.46	5.82	2.7					2.7	0.46	1.7					1135	2.6	7.3	BASIN F-G2 FLOW, SWALE FLOW TO DP8
		G2	0.98	0.46	15.8	0.45	5.78	2.6															BASIN G2 FLOW, SWALE FLOW TO DP8 (ROUTED IN SF2)
	8								22.8	0.91	4.86	4.4	4.4	0.91	1.13					1429	2.1	11.2	BASIN F-G2 & G2 FLOW AT DP8, PIED THEN SWALE FLOW TO DP10
	9	G3	0.63	0.46	13.9	0.29	6.09	1.8	46.7	5.12	3.05	15.6	15.6	5.12	1.13					1429	2.1	11.2	DP7 & BASIN G3 FLOW AT DP9, SWALE FLOW TO DP11
		G4	2.50	0.31	37.0	0.78	3.63	2.8															BASIN G4 FLOW, SWALE FLOW TO DP11 (ROUTED IN SF2)
		G5	11.15	0.19	18.4	2.14	5.39	11.5															BASIN G5 FLOW, SWALE FLOW TO DP10 (ROUTED IN SF2)
		G6	4.36	0.29	23.4	1.26	4.79	6.0															BASIN G6 FLOW, SWALE FLOW TO DP11 (ROUTED IN SF2)
		G7	0.31	0.46	12.0	0.14	6.47	0.9															BASIN G7 FLOW, SWALE FLOW TO DP11 (ROUTED IN SF2)
	10								34.0	3.05	3.85	11.7				11.7	3.1	0.5	24	100	5.5	0.3	DP8 & BASIN G5 FLOW AT DP10, PIPE TO DP11
	11								57.9	10.35	2.51	25.9											DP9, DP10, BASIN G4 & G6 FLOW AT DP11, TOTAL FLOW ENTERING POND G
		F1	11.30	0.17	27.4	1.86	4.39	8.2								8.2	1.9	0.5	18	60	4.6	0.2	BASIN F1 FLOW AT DP12, PIPE TO SED. BASIN F1
		F2	0.36	0.13	12.8	0.05	6.30	0.3															BASIN F12 FLOW AT DP12, SWALE FLOW TO SED. BASIN F1
	12								12.8	1.91	6.30	12.0											TOTAL FLOW ENTERING SEDIMENT BASIN F1 (SEE GESC PLANS)
		F3	2.39	0.16	27.0	0.39	4.43	1.7															BASIN F3 FLOW, SWALE FLOW TO SEDIMENT BASIN F2
		F4	0.47	0.46	10.2	0.22	6.88	1.5															BASIN F4 FLOW, SWALE FLOW TO SEDIMENT BASIN F2
	13								27.0	0.61	4.43	2.7											TOTAL FLOW ENTERING SEDIMENT BASIN F2 (SEE GESC PLANS)

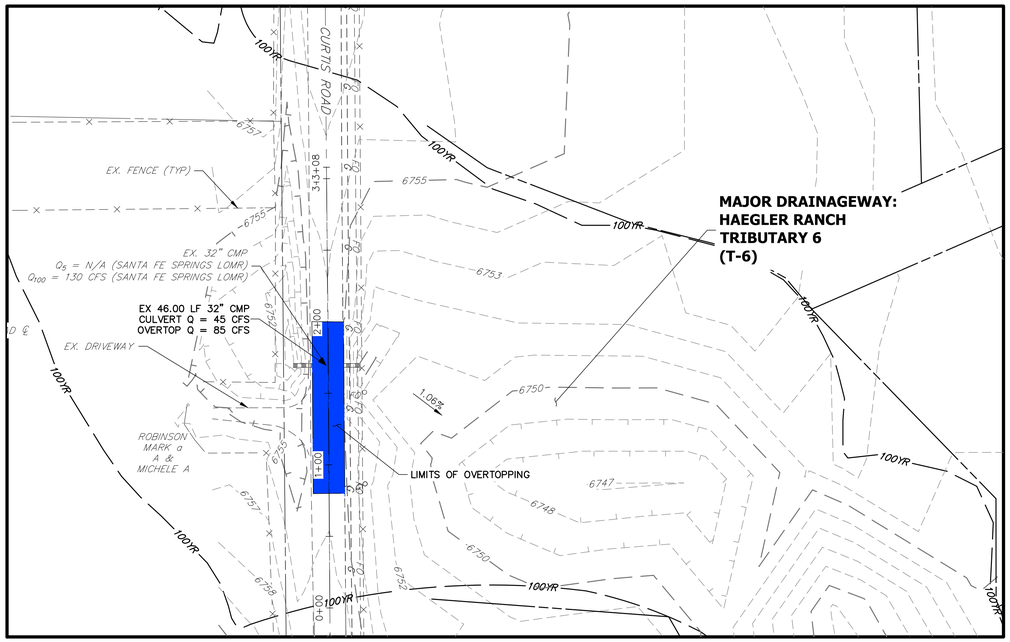
Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

APPENDIX C

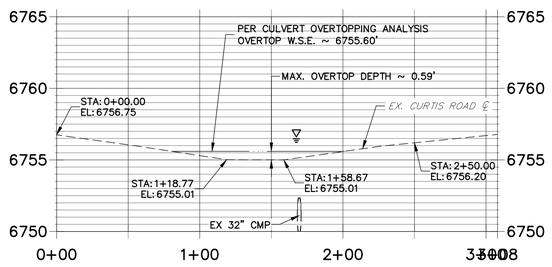
HYDRAULIC CALCULATIONS

SADDLEHORN RANCH

SOUTHERNMOST CURTIS ROAD CULVERT - 36" CMP

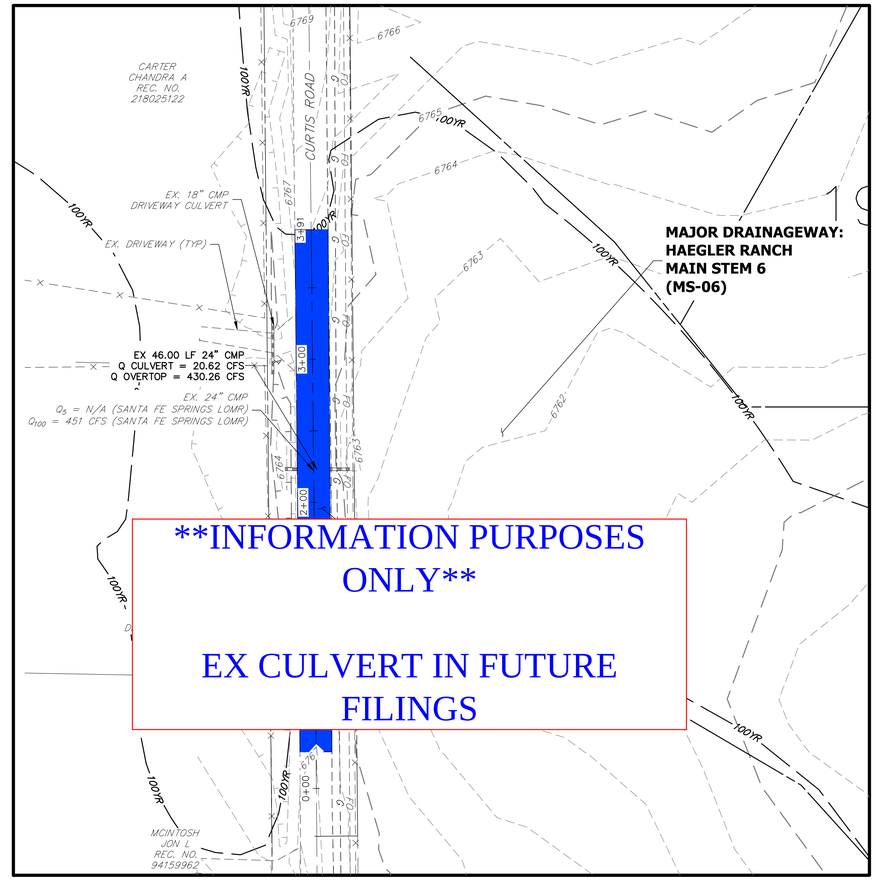


CURTIS ROAD CL PROFILE
STA 0+00.00 TO 3+08.03



EX CULVERT WITHIN FILING 1

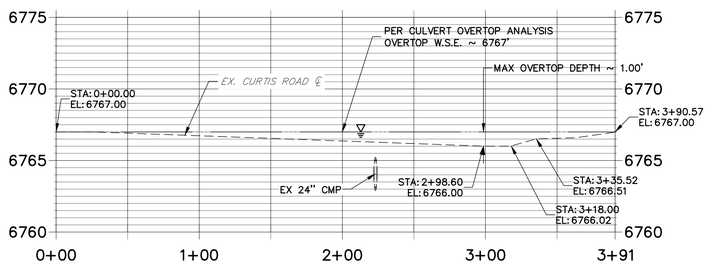
NORTHERNMOST CURTIS ROAD CULVERT - 24" CMP



INFORMATION PURPOSES ONLY

EX CULVERT IN FUTURE FILINGS

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



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

J·R ENGINEERING
A Westrian Company

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

X:\2510000.all\2514200\Drainage\Sheet Dwgs_Drainage\2019-11-12_Culvert Overtop Analysis.dwg, Overtop_Curtis, 11/20/2019 1:59:08 PM, CS

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

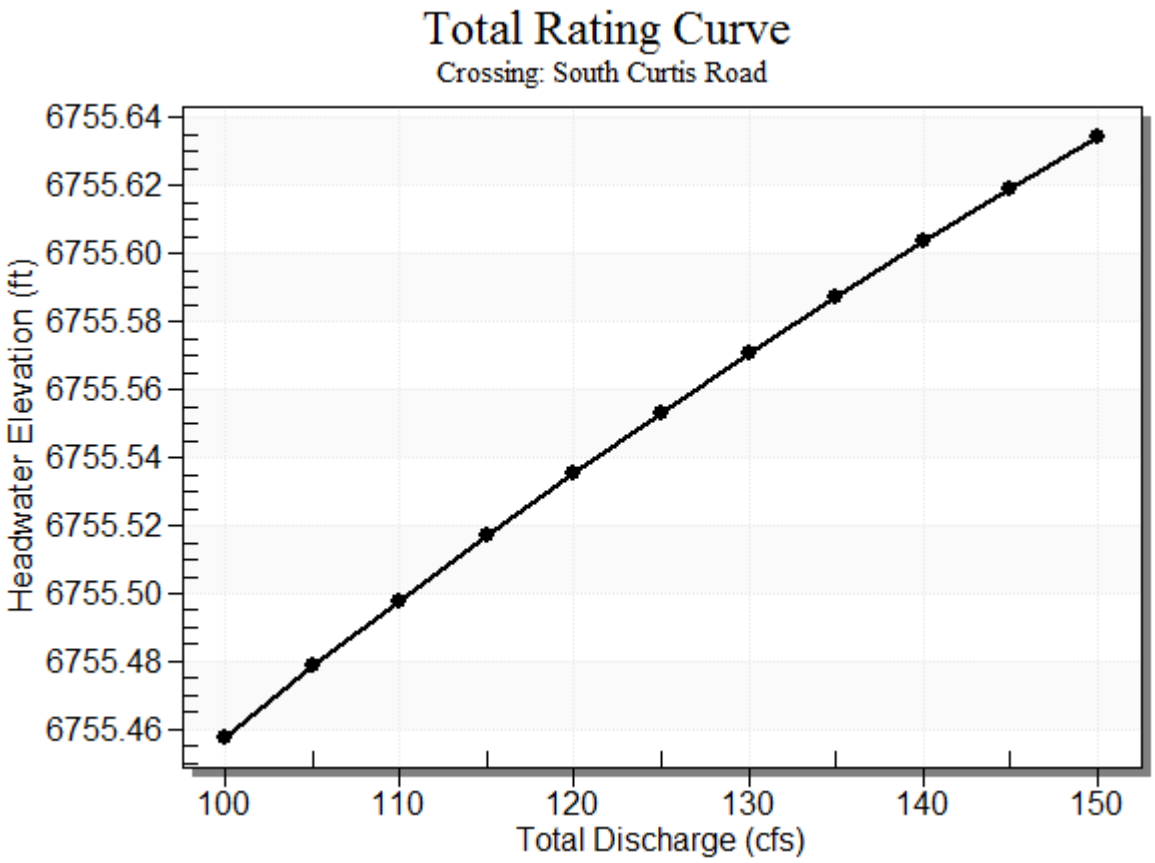


Table 8 - Culvert Summary Table: Culvert 1

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

****

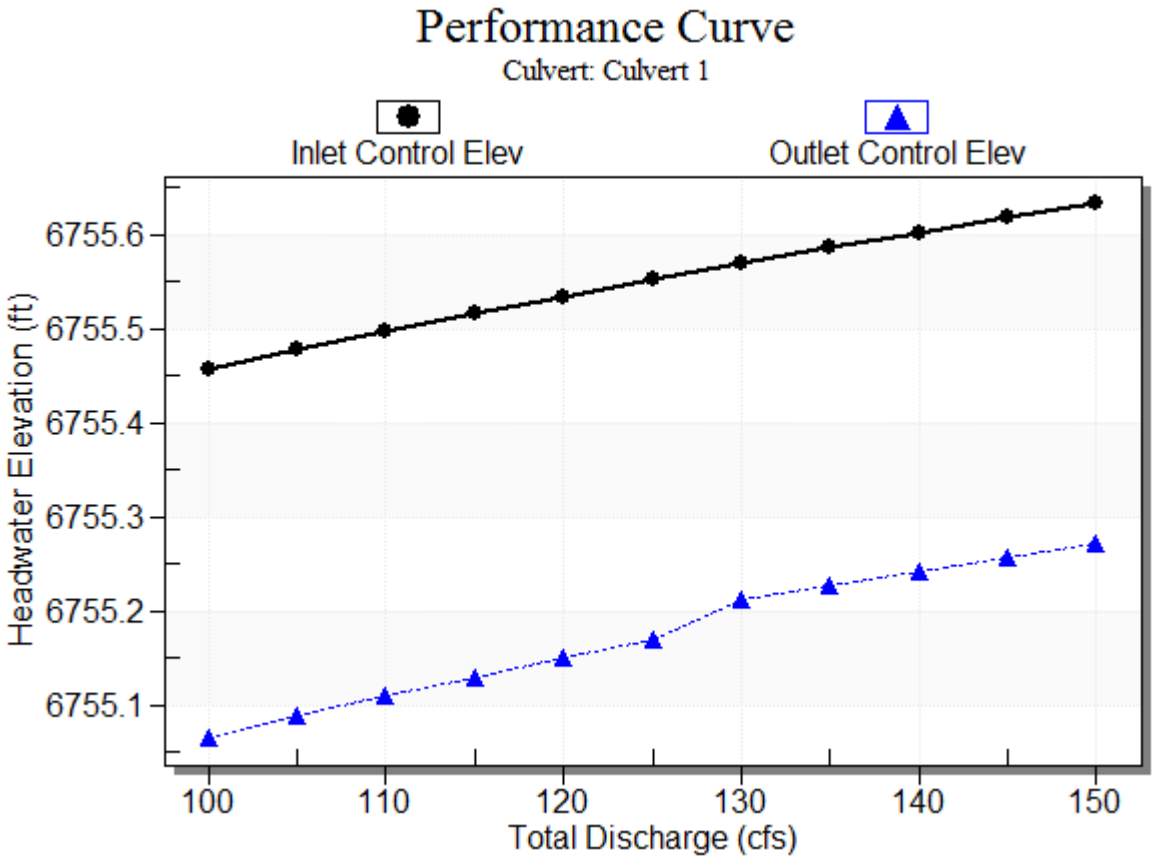
Straight Culvert

Inlet Elevation (invert): 6750.33 ft, Outlet Elevation (invert): 6749.44 ft

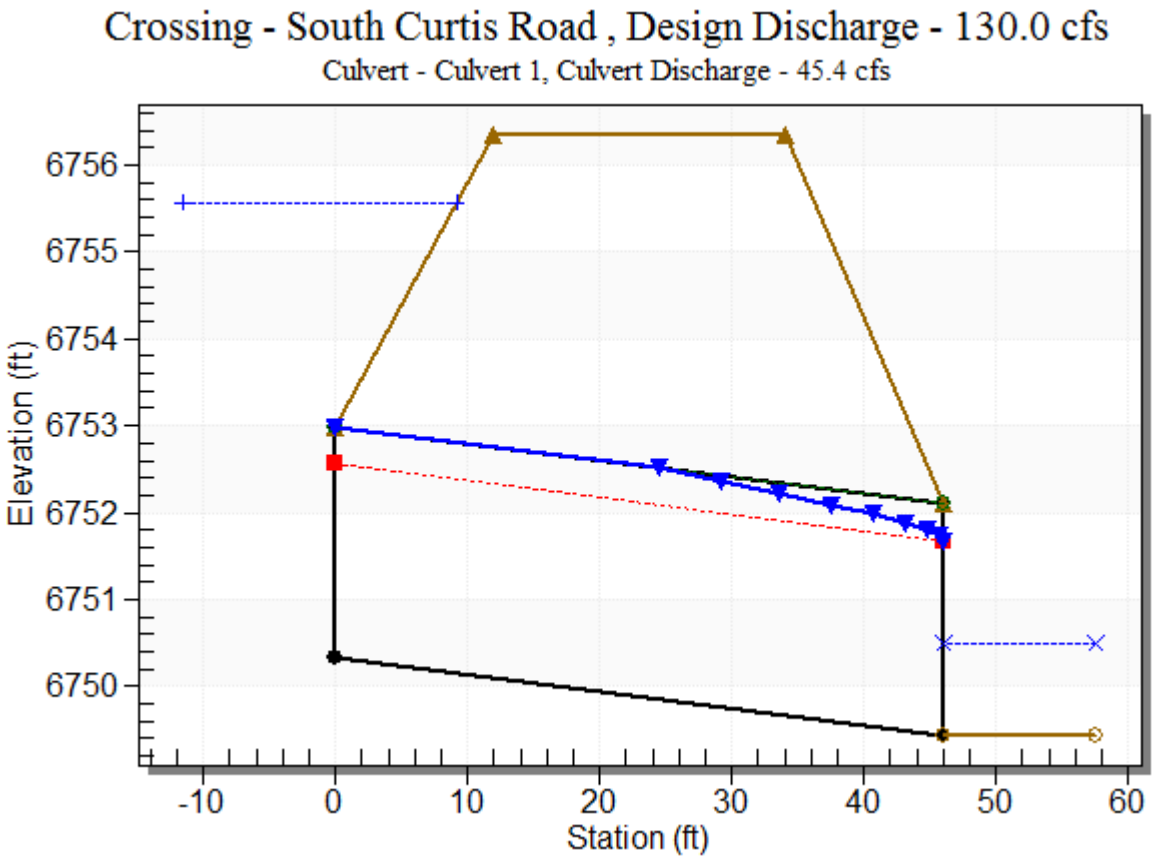
Culvert Length: 46.01 ft, Culvert Slope: 0.0193

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6750.33 ft

Outlet Station: 46.00 ft

Outlet Elevation: 6749.44 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 2.66 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Crossing Front View (Roadway Profile): South Curtis Road

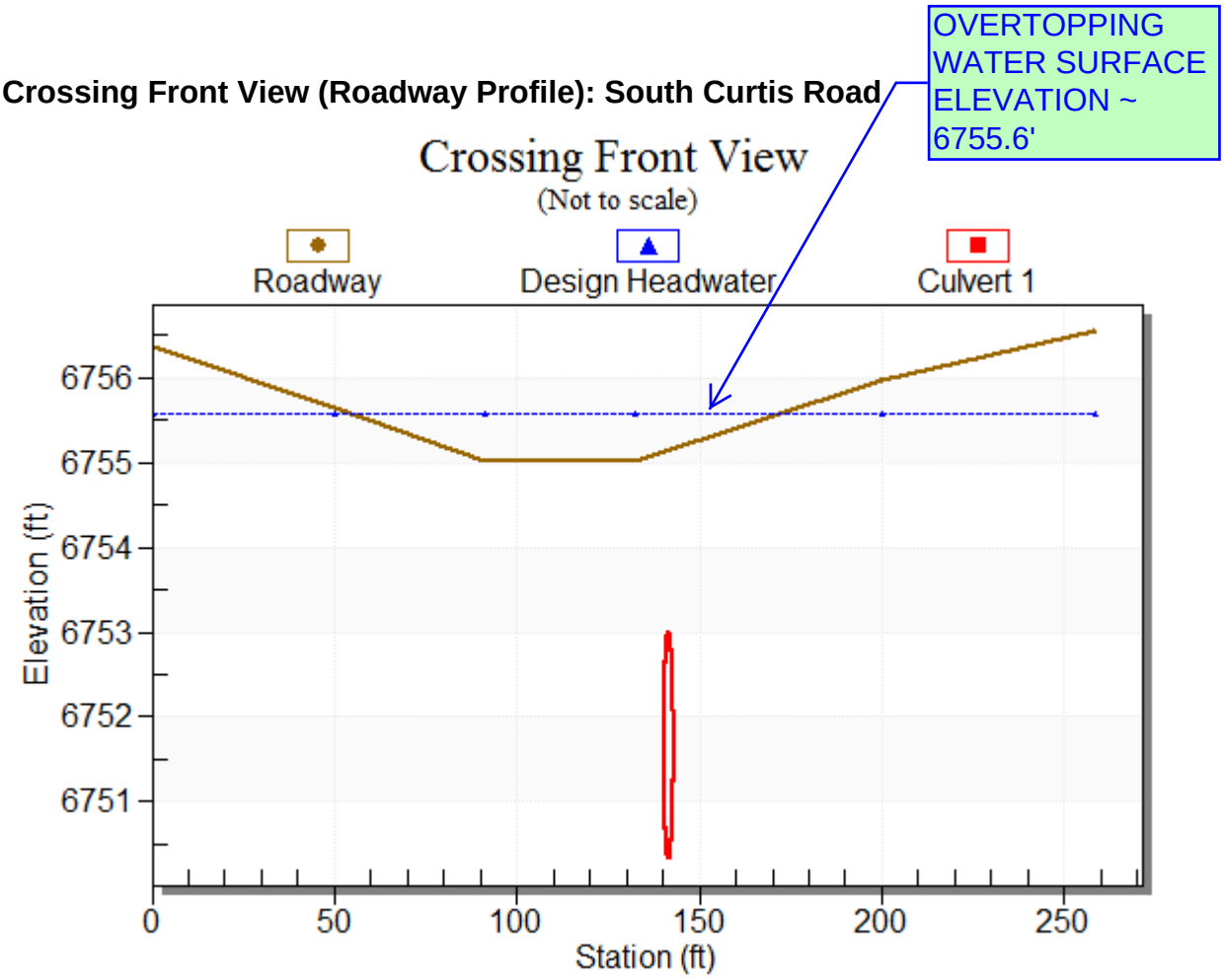


Table 9 - Downstream Channel Rating Curve (Crossing: South Curtis Road)

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

Tailwater Channel Data - South Curtis Road

Tailwater Channel Option: Rectangular Channel

Bottom Width: 30.00 ft

Channel Slope: 0.0100

Channel Manning's n: 0.0350

Channel Invert Elevation: 6749.44 ft

Roadway Data for Crossing: South Curtis Road

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

Channel Report

Swale A-A: Basin H Capacity Check - (Q_100 = DP2 = 15.7 cfs)

Triangular

Side Slopes (z:1)	= 3.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 6700.00
Slope (%)	= 0.56
N-Value	= 0.040

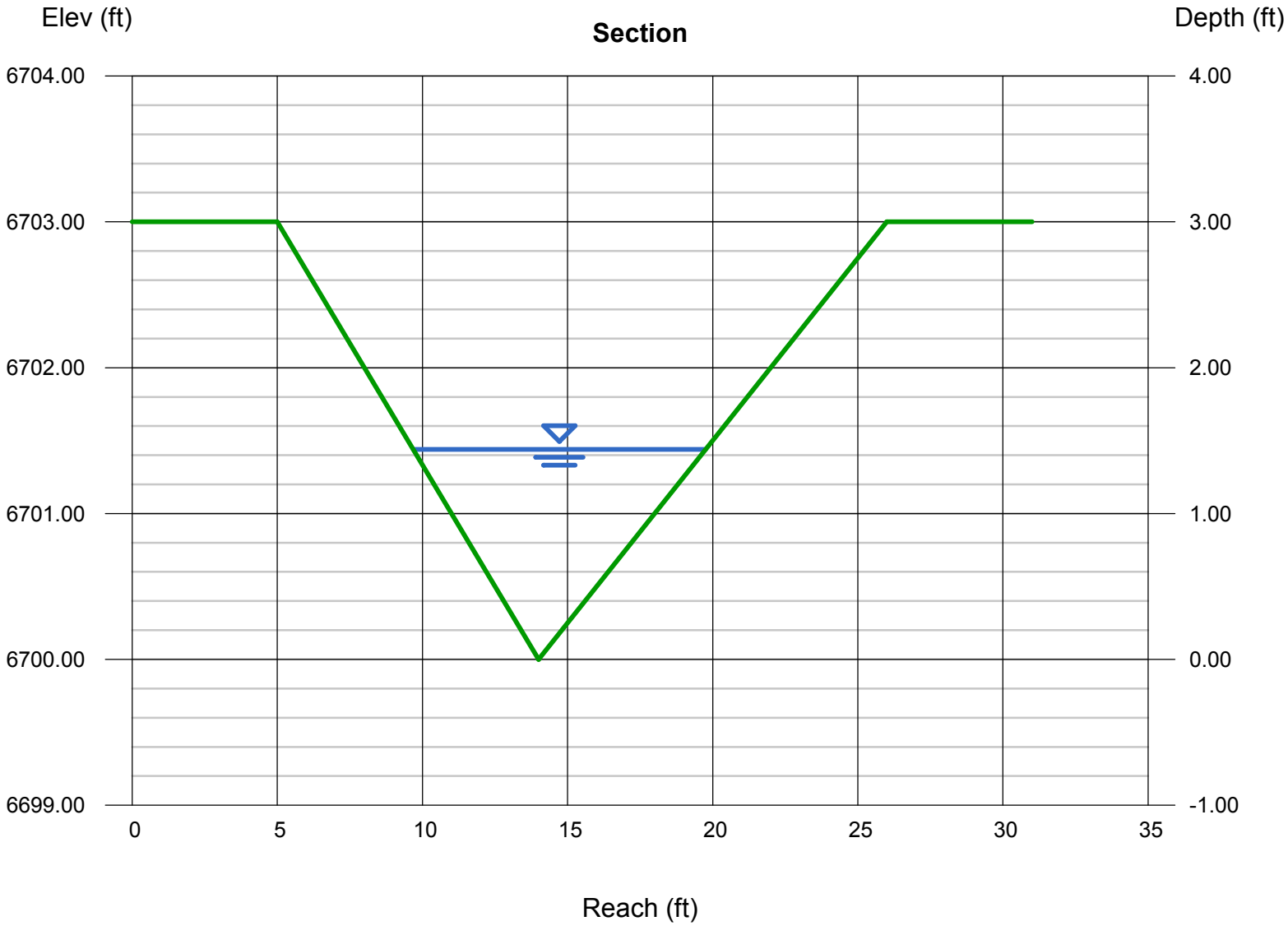
Calculations

Compute by:	Known Q
Known Q (cfs)	= 15.70

Highlighted

Depth (ft)	= 1.44
Q (cfs)	= 15.70
Area (sqft)	= 7.26
Velocity (ft/s)	= 2.16
Wetted Perim (ft)	= 10.49
Crit Depth, Yc (ft)	= 1.05
Top Width (ft)	= 10.08
EGL (ft)	= 1.51

FROUDE # = 0.32 (SUBCRITICAL)



Channel Report

Swale B-B: Basin H Velocity Check - (Q_100 = DP2 = 15.7 cfs)

Triangular

Side Slopes (z:1)	= 3.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 6700.00
Slope (%)	= 1.03
N-Value	= 0.030

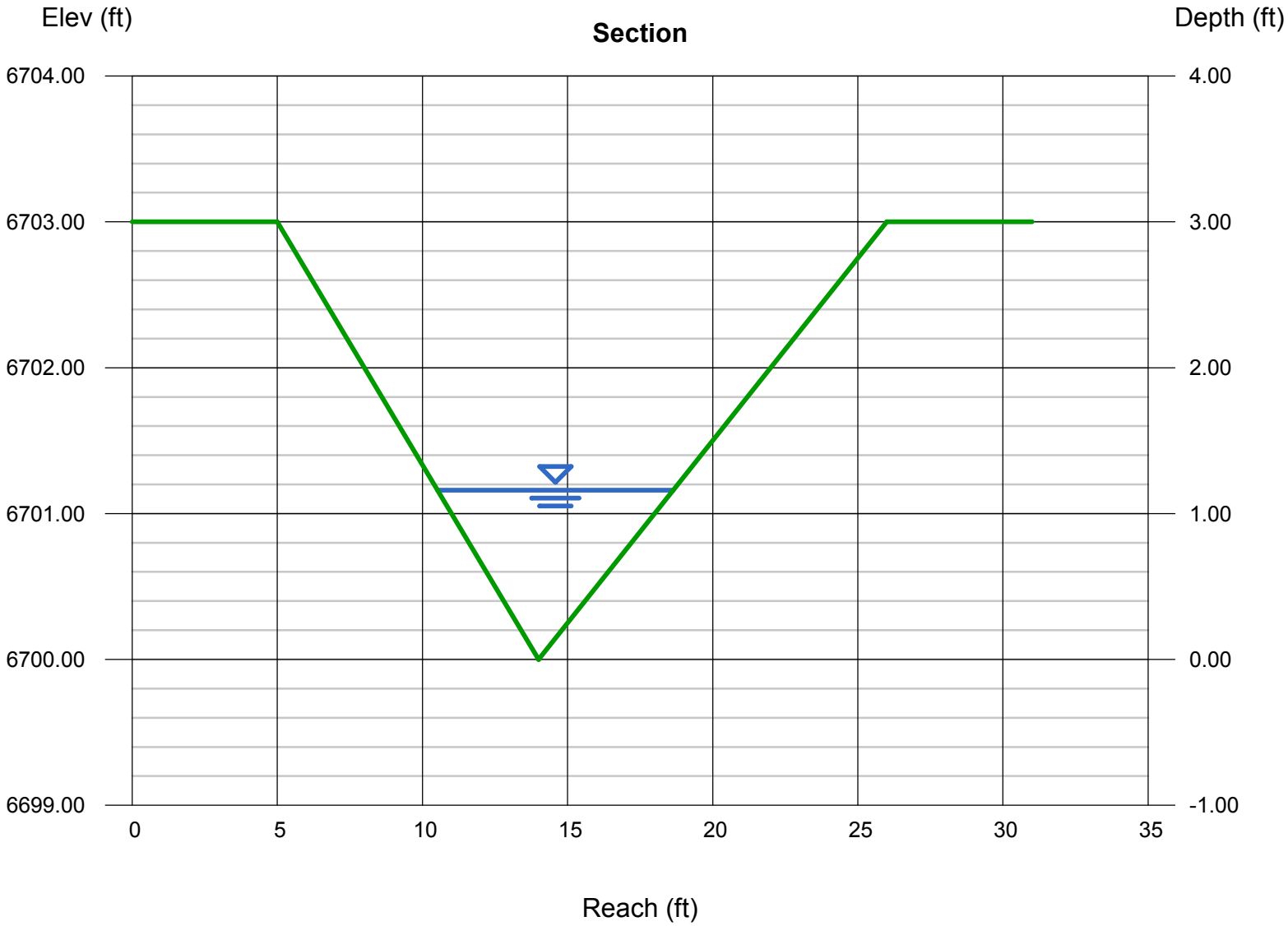
Calculations

Compute by:	Known Q
Known Q (cfs)	= 15.70

Highlighted

Depth (ft)	= 1.16
Q (cfs)	= 15.70
Area (sqft)	= 4.71
Velocity (ft/s)	= 3.33
Wetted Perim (ft)	= 8.45
Crit Depth, Yc (ft)	= 1.05
Top Width (ft)	= 8.12
EGL (ft)	= 1.33

FROUDE # = 0.55 (SUBCRITICAL)



Channel Report

Swale C-C: Basin I Capacity Check - (Q_100 = Basin I4 = 16.9 cfs)

Triangular

Side Slopes (z:1)	= 3.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 6700.00
Slope (%)	= 1.94
N-Value	= 0.030

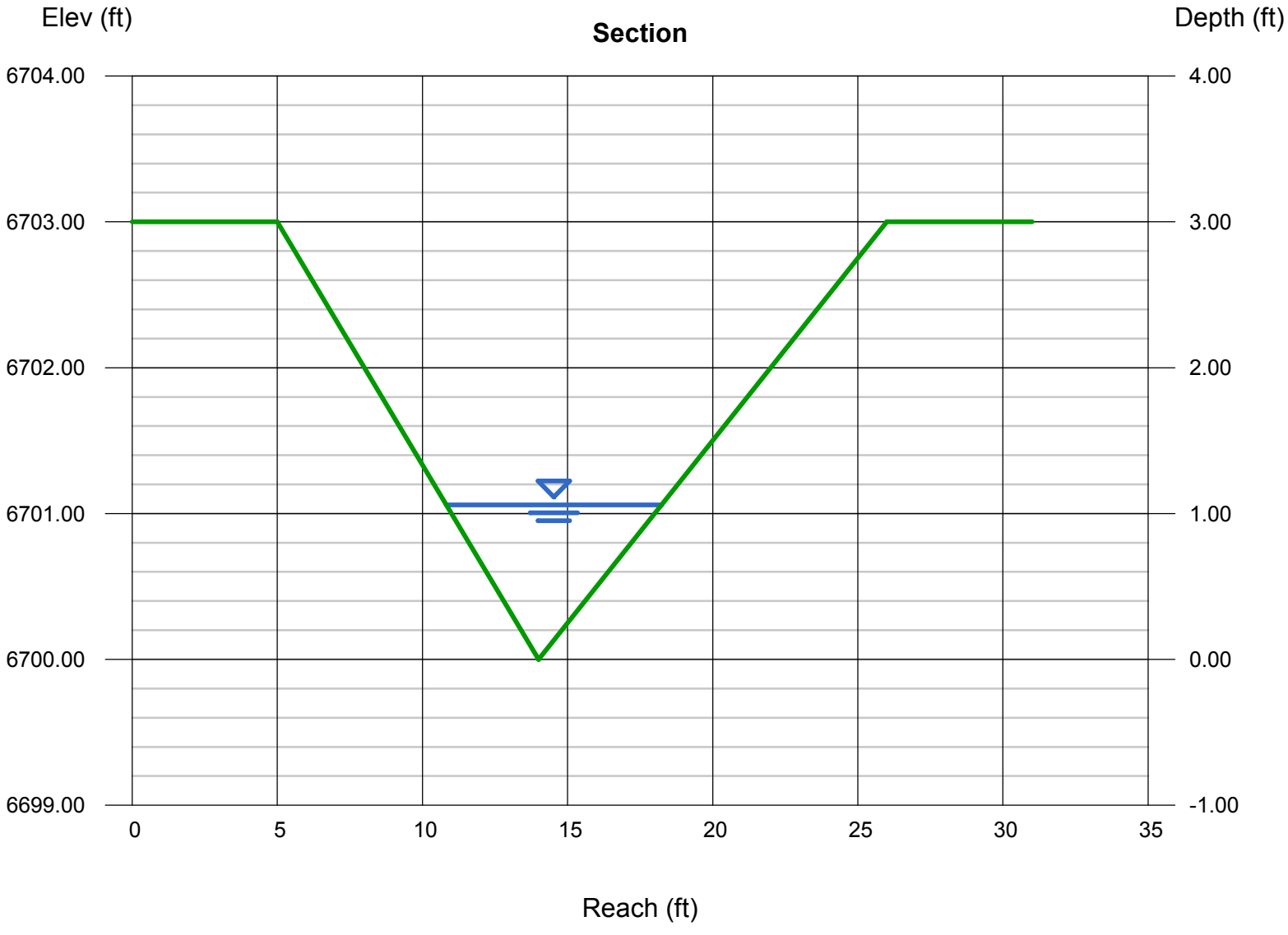
Calculations

Compute by:	Known Q
Known Q (cfs)	= 16.90

Highlighted

Depth (ft)	= 1.06
Q (cfs)	= 16.90
Area (sqft)	= 3.93
Velocity (ft/s)	= 4.30
Wetted Perim (ft)	= 7.72
Crit Depth, Yc (ft)	= 1.08
Top Width (ft)	= 7.42
EGL (ft)	= 1.35

FROUDE # = 0.74 (SUBCRITICAL)



Channel Report

Swale D-D: Basin I Velocity Check - (Q_100 = Basin I5 = 2.5 cfs)

Triangular

Side Slopes (z:1)	= 3.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 6700.00
Slope (%)	= 5.49
N-Value	= 0.030

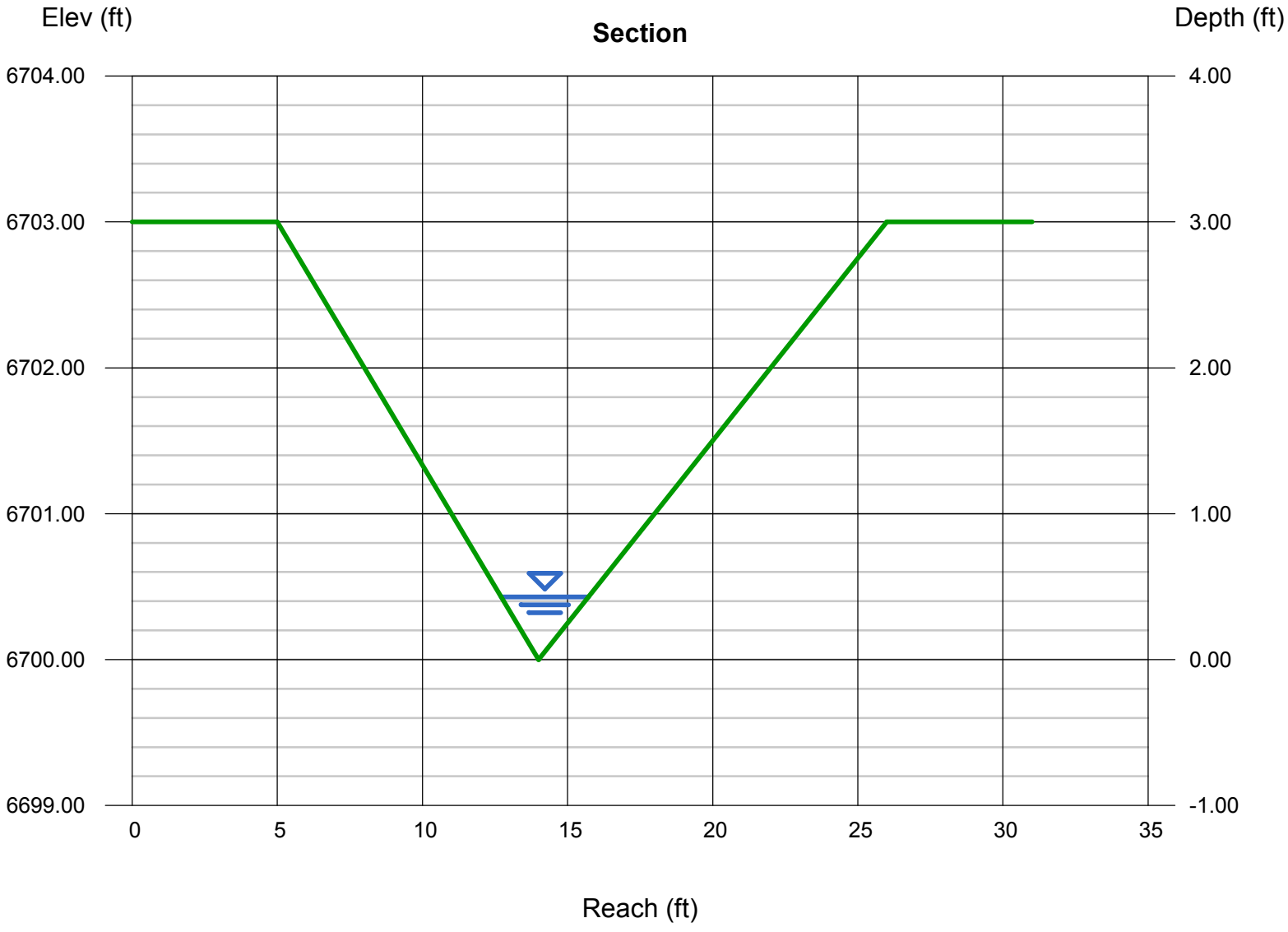
Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.50

Highlighted

Depth (ft)	= 0.43
Q (cfs)	= 2.500
Area (sqft)	= 0.65
Velocity (ft/s)	= 3.86
Wetted Perim (ft)	= 3.13
Crit Depth, Yc (ft)	= 0.51
Top Width (ft)	= 3.01
EGL (ft)	= 0.66

FROUDE # = 1.04 (SUPERCRITICAL)
SEE CONSTRUCTION PLANS FOR THIS STRETCH OF OSCURO TRAIL, CHECK DAMS ARE PROPOSED AT 200' SPACING TO LIMIT EROSIVE VELOCITIES.



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Nov 25 2019

Swale E-E: Basin I Velocity Check #2 - (Q_100 = Basin I4 = 16.9 cfs)

Triangular

Side Slopes (z:1)	= 3.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 6700.00
Slope (%)	= 0.65
N-Value	= 0.030

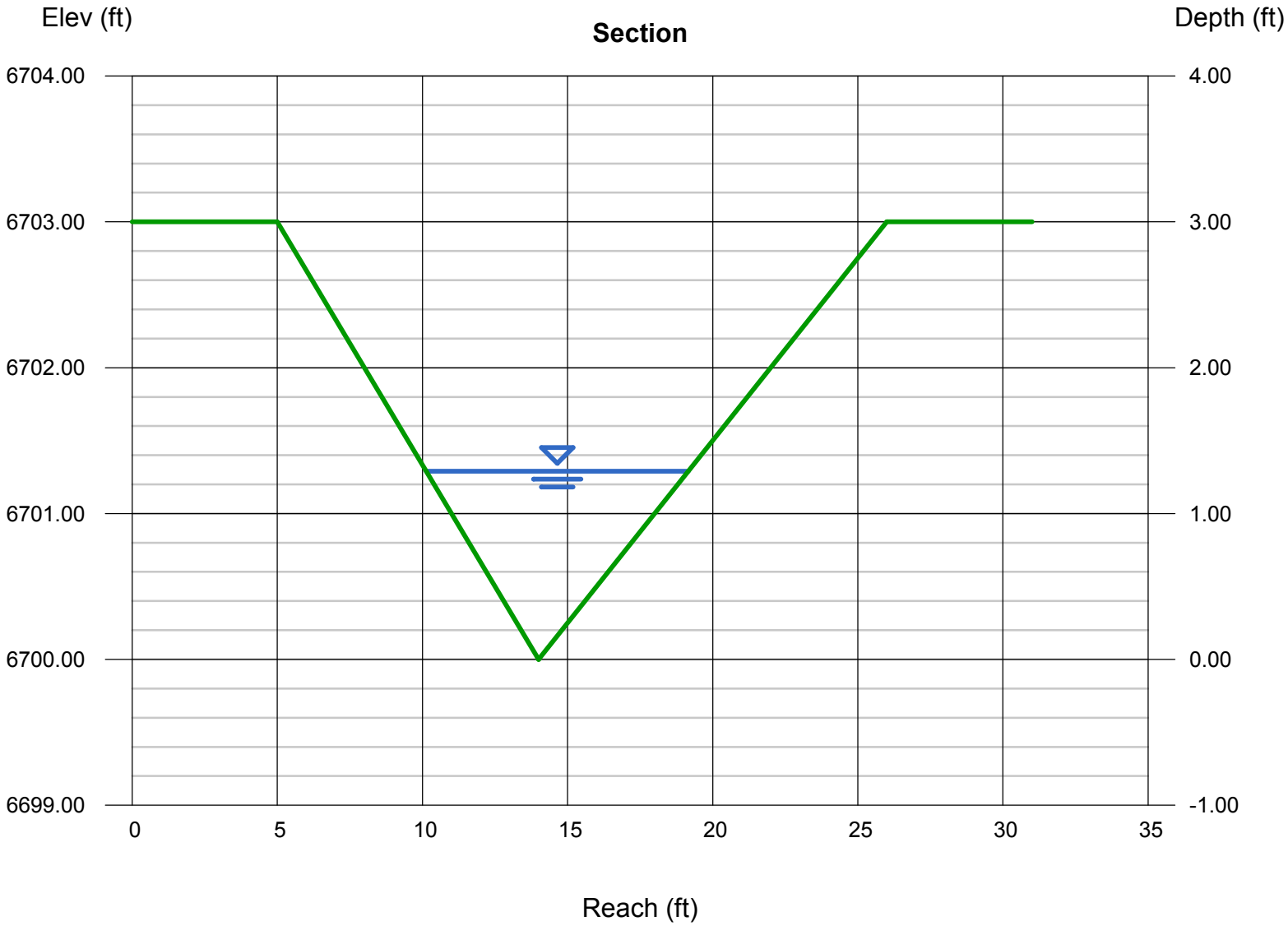
Calculations

Compute by:	Known Q
Known Q (cfs)	= 16.90

Highlighted

Depth (ft)	= 1.29
Q (cfs)	= 16.90
Area (sqft)	= 5.82
Velocity (ft/s)	= 2.90
Wetted Perim (ft)	= 9.40
Crit Depth, Yc (ft)	= 1.08
Top Width (ft)	= 9.03
EGL (ft)	= 1.42

FROUDE # = 0.45
(SUBCRITICAL)



Channel Report

Swale F-F: Basin I Velocity Check #3 - (Q_100 = Basin I2 = 2.4 cfs)

Triangular

Side Slopes (z:1)	= 3.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 6700.00
Slope (%)	= 4.68
N-Value	= 0.030

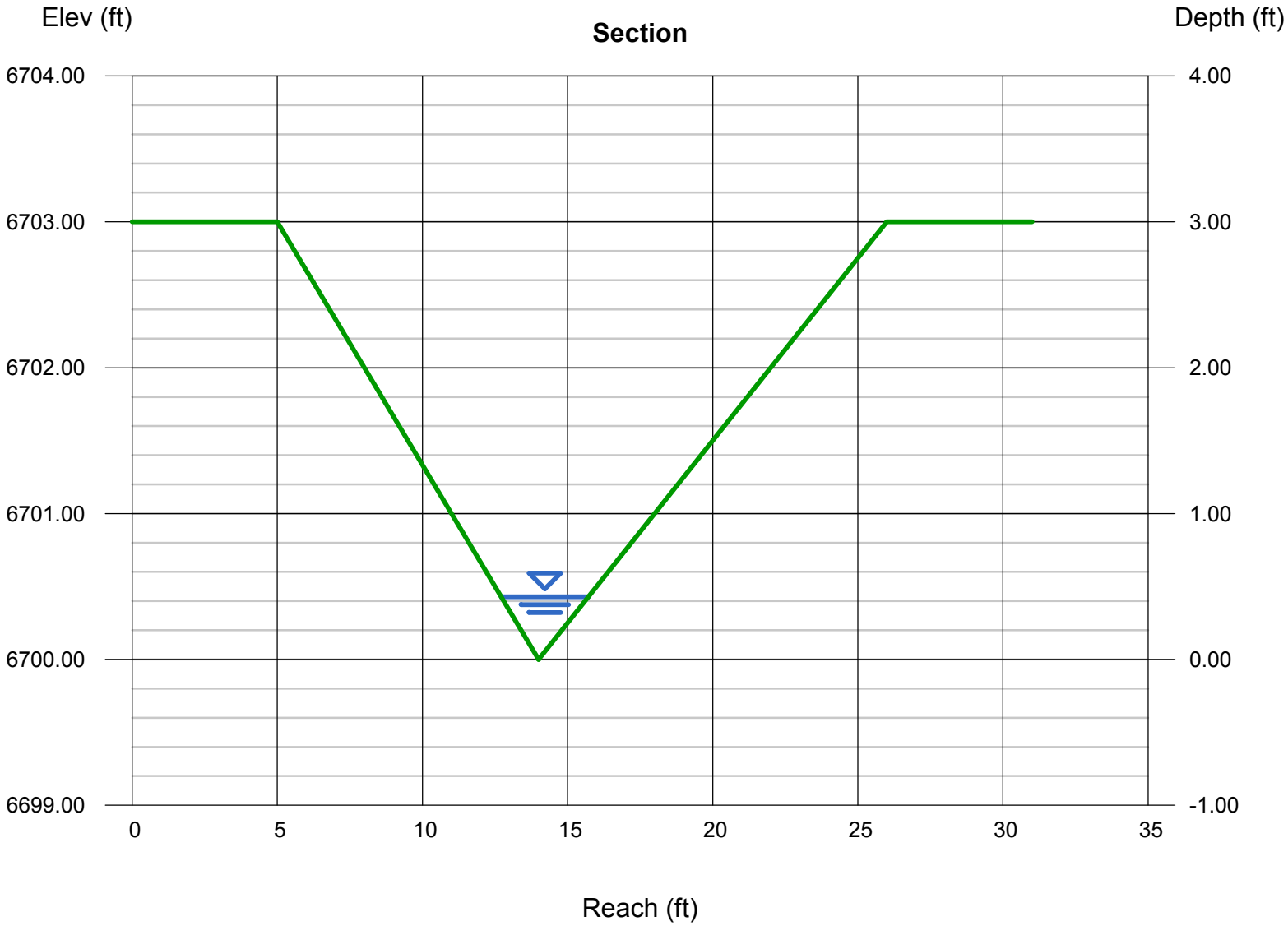
Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.40

Highlighted

Depth (ft)	= 0.43
Q (cfs)	= 2.400
Area (sqft)	= 0.65
Velocity (ft/s)	= 3.71
Wetted Perim (ft)	= 3.13
Crit Depth, Yc (ft)	= 0.50
Top Width (ft)	= 3.01
EGL (ft)	= 0.64

FROUDE # = 1.0
(SUPERCRITICAL)
SEE CONSTRUCTION PLANS FOR THIS STRETCH OF OSCURO TRAIL, CHECK DAMS ARE PROPOSED AT 200' SPACING TO LIMIT EROSIVE VELOCITIES.



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Nov 25 2019

Swale G-G: Basin G Capacity Check - (Q_100 = DP9 +G4 = 18.4 cfs)

Triangular

Side Slopes (z:1)	= 3.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 6700.00
Slope (%)	= 1.06
N-Value	= 0.030

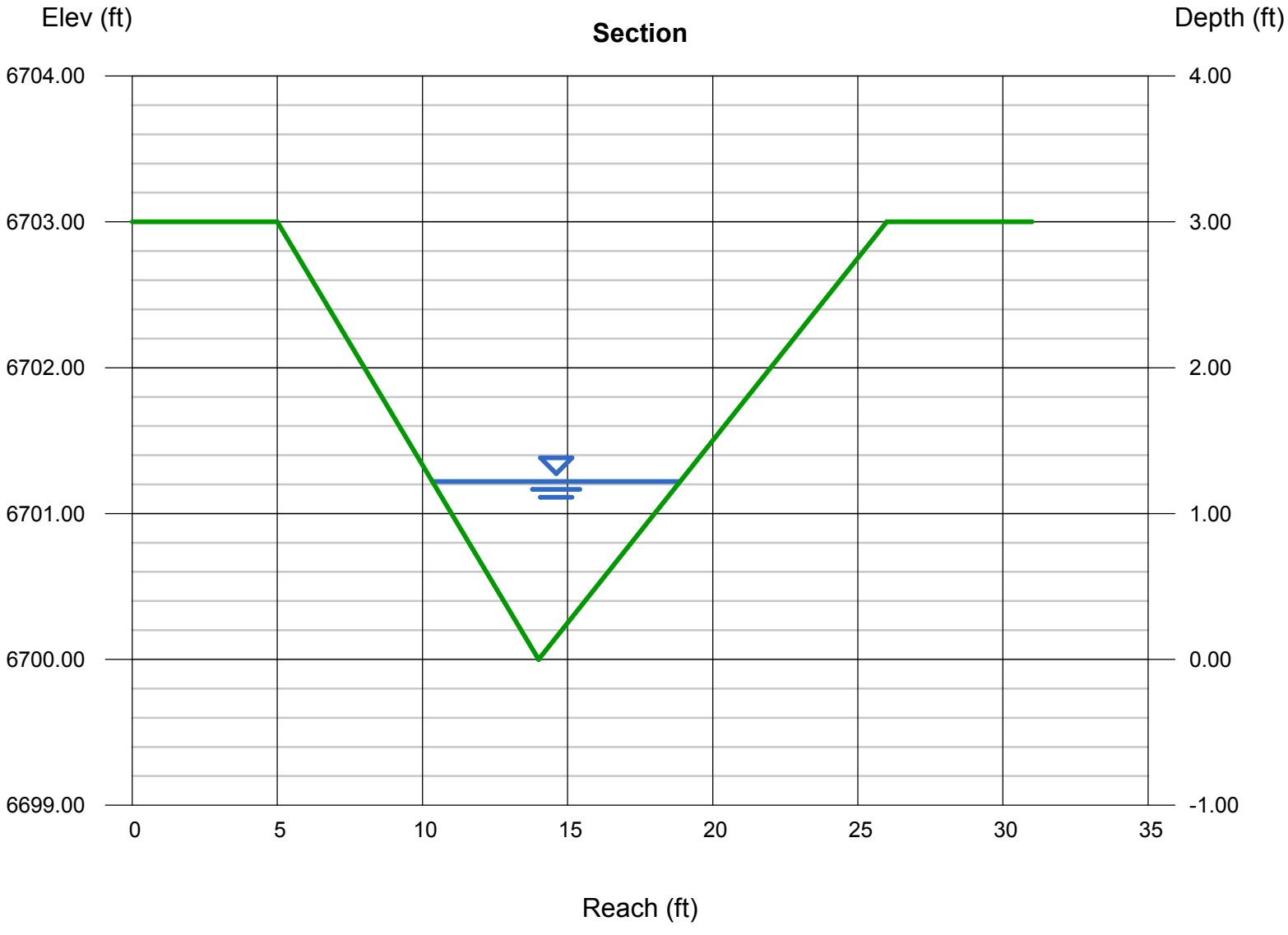
Calculations

Compute by:	Known Q
Known Q (cfs)	= 18.40

Highlighted

Depth (ft)	= 1.22
Q (cfs)	= 18.40
Area (sqft)	= 5.21
Velocity (ft/s)	= 3.53
Wetted Perim (ft)	= 8.89
Crit Depth, Yc (ft)	= 1.12
Top Width (ft)	= 8.54
EGL (ft)	= 1.41

FROUDE # = 0.56 (SUBCRITICAL)



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Nov 25 2019

Swale H-H: Basin G Velocity Check - (Q_100 = Basin G1 = 10.4 cfs)

Triangular

Side Slopes (z:1)	= 3.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 6700.00
Slope (%)	= 1.69
N-Value	= 0.030

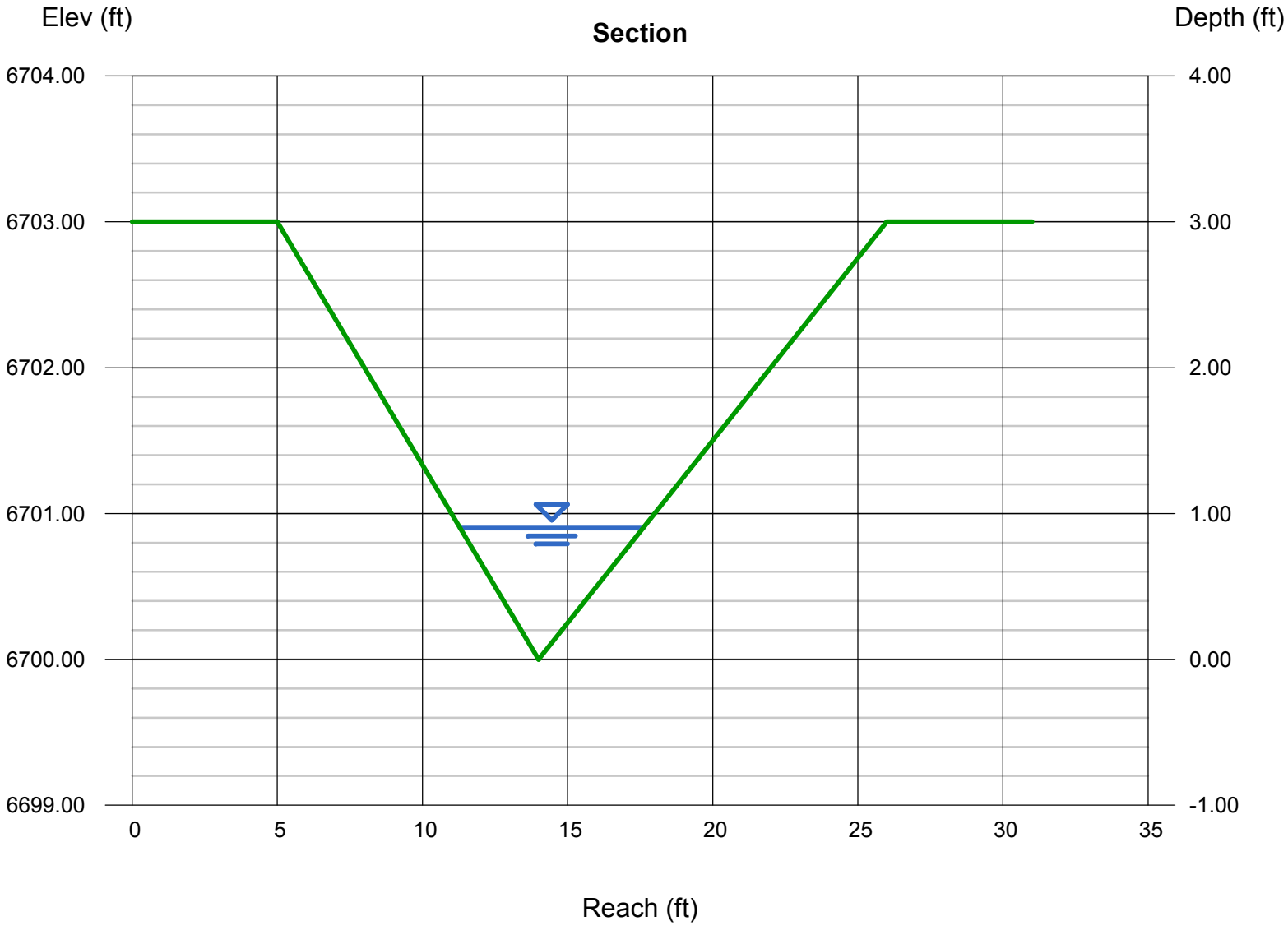
Calculations

Compute by:	Known Q
Known Q (cfs)	= 10.40

Highlighted

Depth (ft)	= 0.90
Q (cfs)	= 10.40
Area (sqft)	= 2.83
Velocity (ft/s)	= 3.67
Wetted Perim (ft)	= 6.56
Crit Depth, Yc (ft)	= 0.89
Top Width (ft)	= 6.30
EGL (ft)	= 1.11

FROUDE # = 0.68 (SUBCRITICAL)



Culvert Report

Design Point #1 Q5 = 1.4 cfs & Q100 = 8.2 cfs

Invert Elev Dn (ft)	=	6753.68
Pipe Length (ft)	=	73.18
Slope (%)	=	1.04
Invert Elev Up (ft)	=	6754.44
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

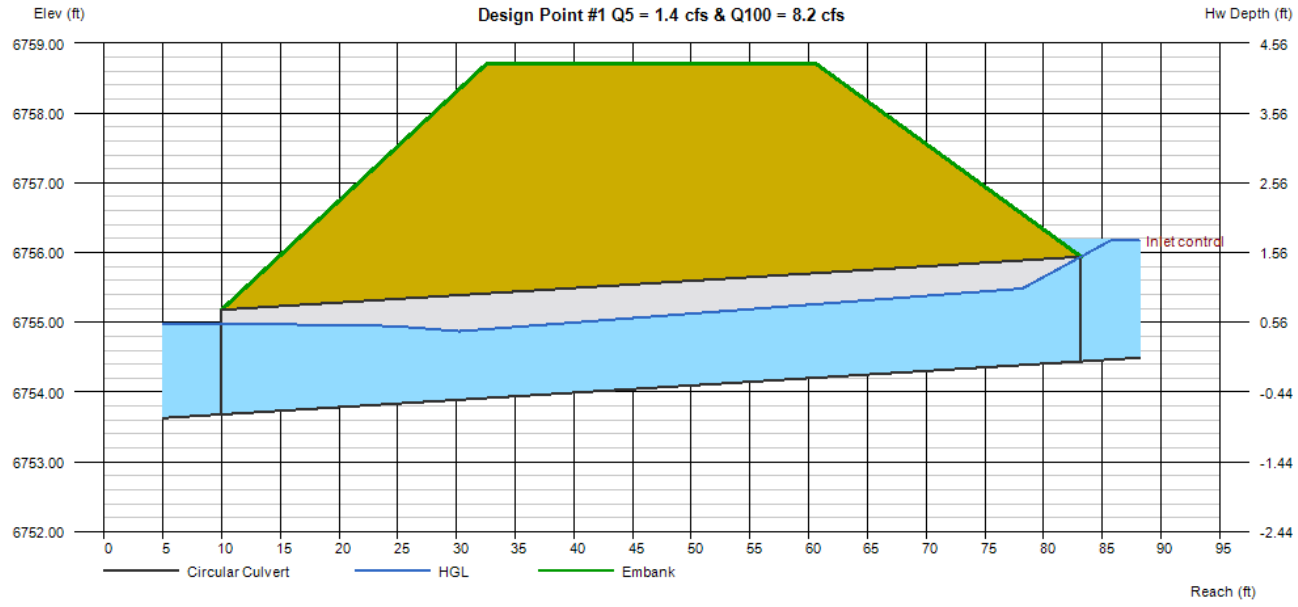
Top Elevation (ft)	=	6758.71
Top Width (ft)	=	28.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.40
Qmax (cfs)	=	10.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	8.20
Qpipe (cfs)	=	8.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.03
Veloc Up (ft/s)	=	5.86
HGL Dn (ft)	=	6754.98
HGL Up (ft)	=	6755.55
Hw Elev (ft)	=	6756.17
Hw/D (ft)	=	1.15
Flow Regime	=	Inlet Control



Culvert Report

Design Point #2 Q5 = 2.7 cfs & Q100 = 15.7 cfs

Invert Elev Dn (ft)	=	6744.34
Pipe Length (ft)	=	65.00
Slope (%)	=	2.26
Invert Elev Up (ft)	=	6745.81
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

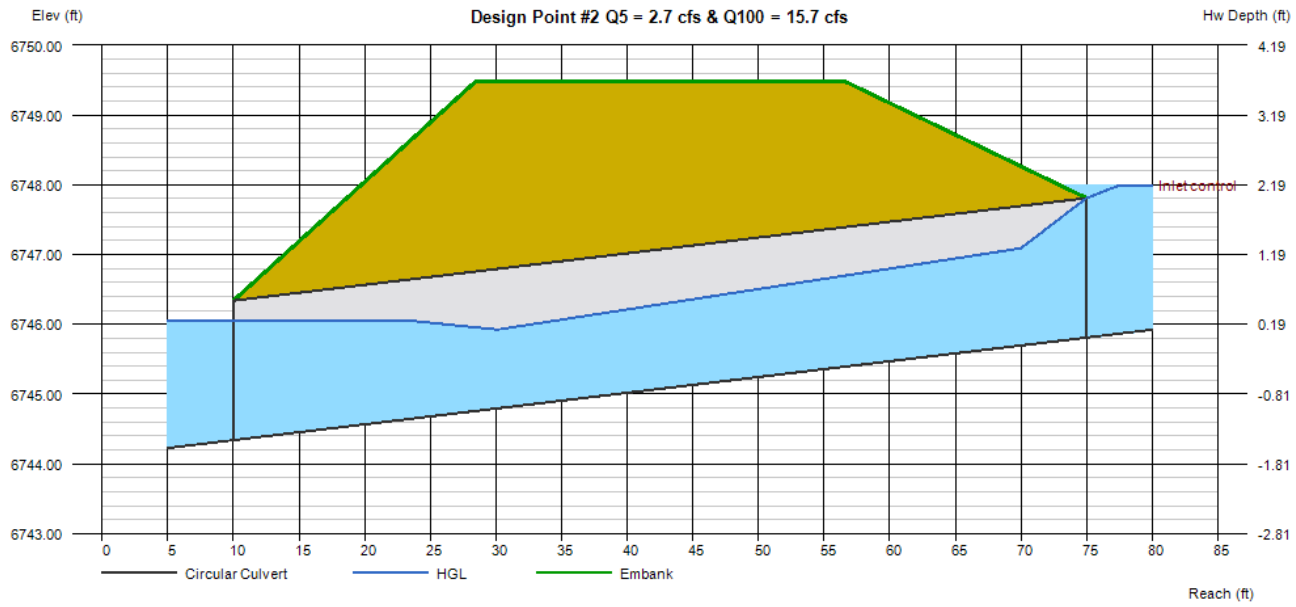
Top Elevation (ft)	=	6749.49
Top Width (ft)	=	28.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	2.70
Qmax (cfs)	=	16.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	15.70
Qpipe (cfs)	=	15.70
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.48
Veloc Up (ft/s)	=	6.54
HGL Dn (ft)	=	6746.05
HGL Up (ft)	=	6747.24
Hw Elev (ft)	=	6747.99
Hw/D (ft)	=	1.09
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Nov 22 2019

Design Point #4 Q5 = 0.9 cfs & Q100 = 2.4 cfs

Invert Elev Dn (ft)	=	6723.39
Pipe Length (ft)	=	56.00
Slope (%)	=	0.75
Invert Elev Up (ft)	=	6723.81
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

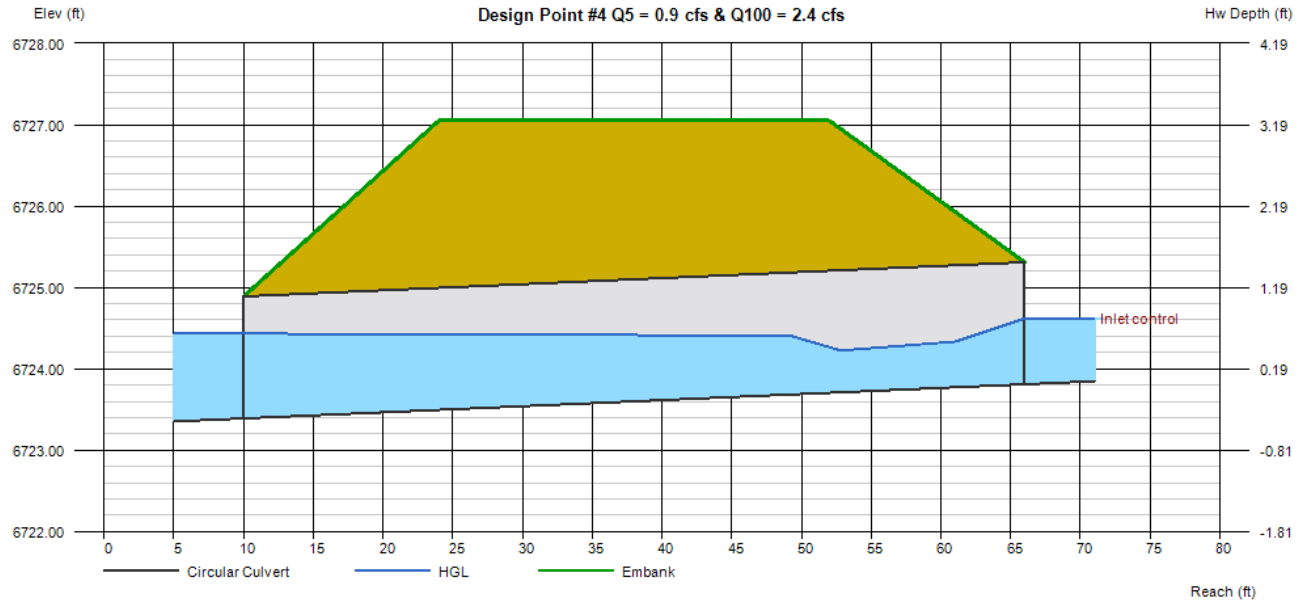
Top Elevation (ft)	=	6727.05
Top Width (ft)	=	28.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.90
Qmax (cfs)	=	2.40
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	2.40
Qpipe (cfs)	=	2.40
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	1.83
Veloc Up (ft/s)	=	3.72
HGL Dn (ft)	=	6724.43
HGL Up (ft)	=	6724.40
Hw Elev (ft)	=	6724.62
Hw/D (ft)	=	0.54
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Nov 22 2019

Design Point #5 Q5 = 3.4 cfs & Q100 = 21.8 cfs

Invert Elev Dn (ft)	=	6710.95
Pipe Length (ft)	=	56.17
Slope (%)	=	1.09
Invert Elev Up (ft)	=	6711.56
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

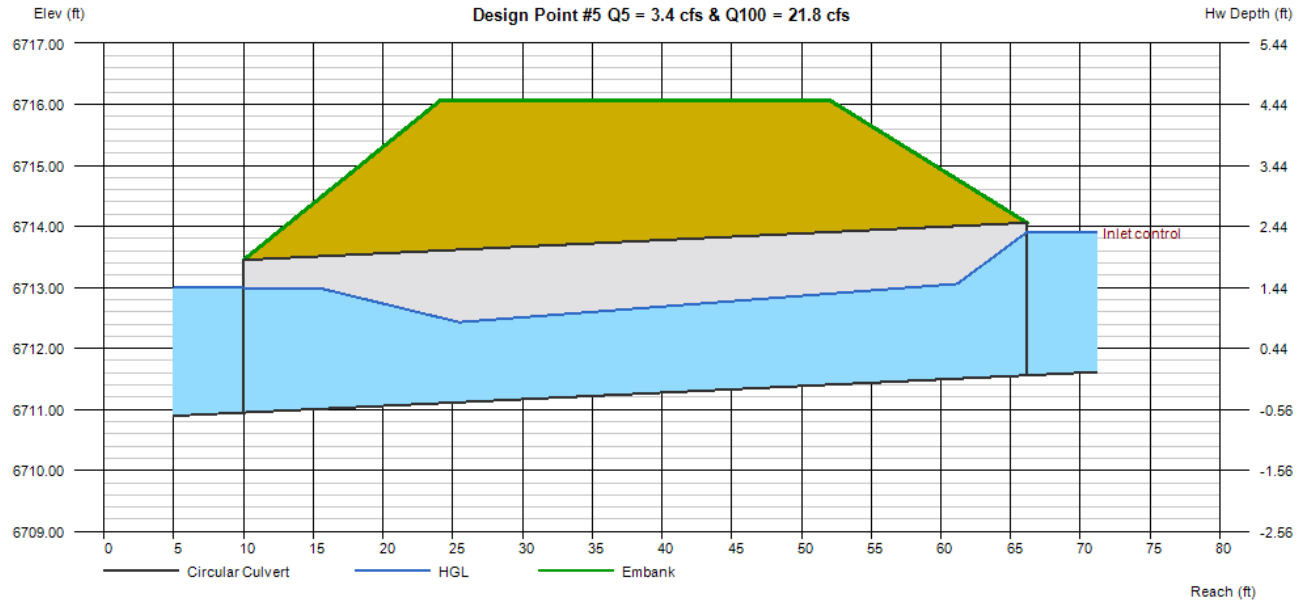
Top Elevation (ft)	=	6716.06
Top Width (ft)	=	28.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	3.40
Qmax (cfs)	=	30.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	21.80
Qpipe (cfs)	=	21.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.08
Veloc Up (ft/s)	=	6.64
HGL Dn (ft)	=	6712.99
HGL Up (ft)	=	6713.15
Hw Elev (ft)	=	6713.91
Hw/D (ft)	=	0.94
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Nov 22 2019

Design Point #7 Q5 = 2.1 cfs & Q100 = 14.8 cfs

Invert Elev Dn (ft)	=	6708.07
Pipe Length (ft)	=	56.00
Slope (%)	=	0.50
Invert Elev Up (ft)	=	6708.35
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

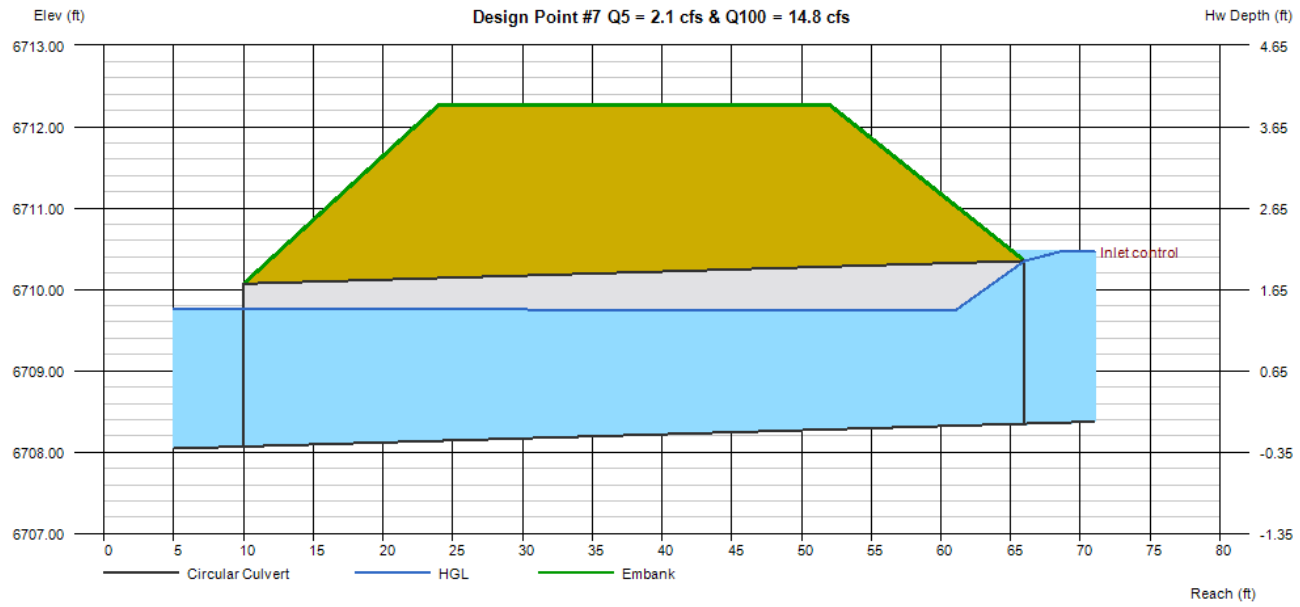
Top Elevation (ft)	=	6712.27
Top Width (ft)	=	28.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	2.00
Qmax (cfs)	=	15.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	14.80
Qpipe (cfs)	=	14.80
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.22
Veloc Up (ft/s)	=	6.37
HGL Dn (ft)	=	6709.76
HGL Up (ft)	=	6709.74
Hw Elev (ft)	=	6710.46
Hw/D (ft)	=	1.06
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Nov 22 2019

Design Point #8 Q5 = 1.8 cfs & Q100 = 4.4 cfs

Invert Elev Dn (ft)	=	6707.99
Pipe Length (ft)	=	56.00
Slope (%)	=	0.50
Invert Elev Up (ft)	=	6708.27
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

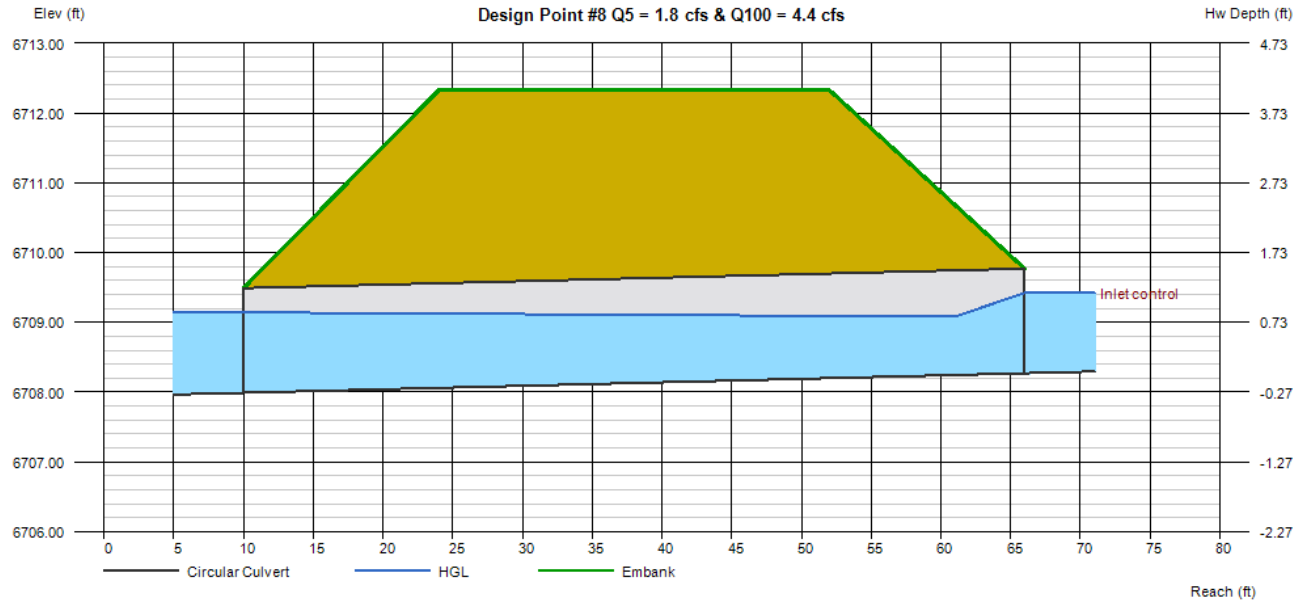
Top Elevation (ft)	=	6712.33
Top Width (ft)	=	28.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.80
Qmax (cfs)	=	4.40
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	4.40
Qpipe (cfs)	=	4.40
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.02
Veloc Up (ft/s)	=	4.56
HGL Dn (ft)	=	6709.14
HGL Up (ft)	=	6709.07
Hw Elev (ft)	=	6709.42
Hw/D (ft)	=	0.77
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Nov 22 2019

Design Point #10 Q5 = 2.7 cfs & Q100 = 11.7 cfs

Invert Elev Dn (ft)	=	6692.00
Pipe Length (ft)	=	54.50
Slope (%)	=	1.27
Invert Elev Up (ft)	=	6692.69
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.020
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

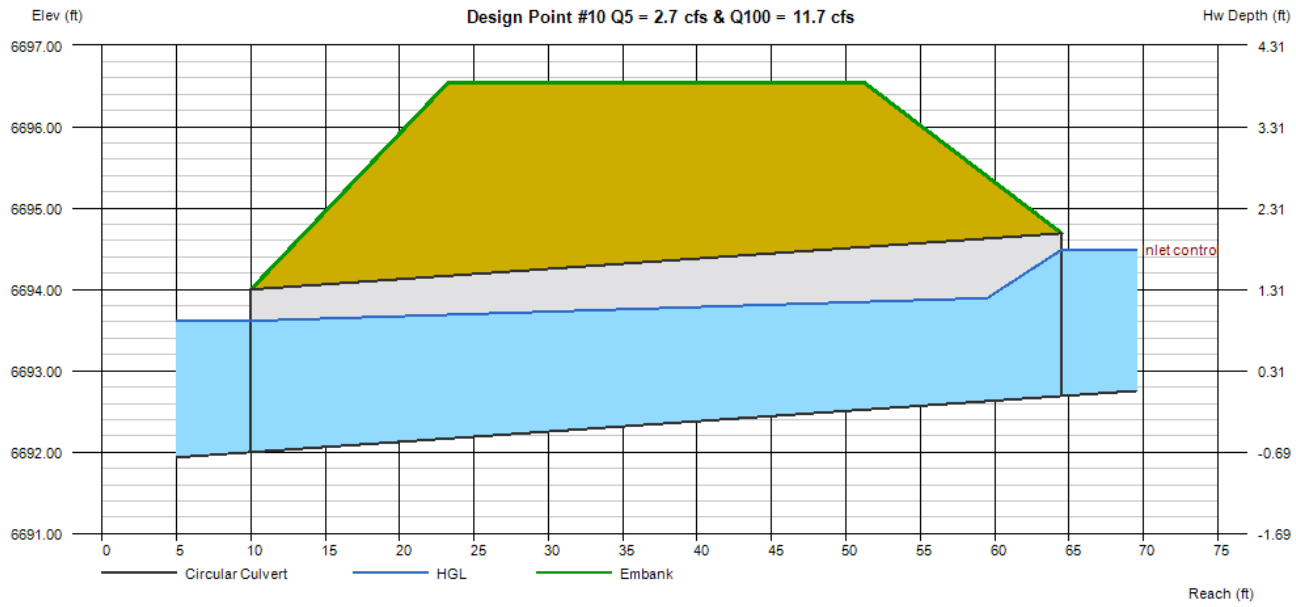
Top Elevation (ft)	=	6696.54
Top Width (ft)	=	28.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	2.70
Qmax (cfs)	=	11.70
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	11.70
Qpipe (cfs)	=	11.70
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.31
Veloc Up (ft/s)	=	5.76
HGL Dn (ft)	=	6693.61
HGL Up (ft)	=	6693.92
Hw Elev (ft)	=	6694.49
Hw/D (ft)	=	0.90
Flow Regime	=	Inlet Control



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

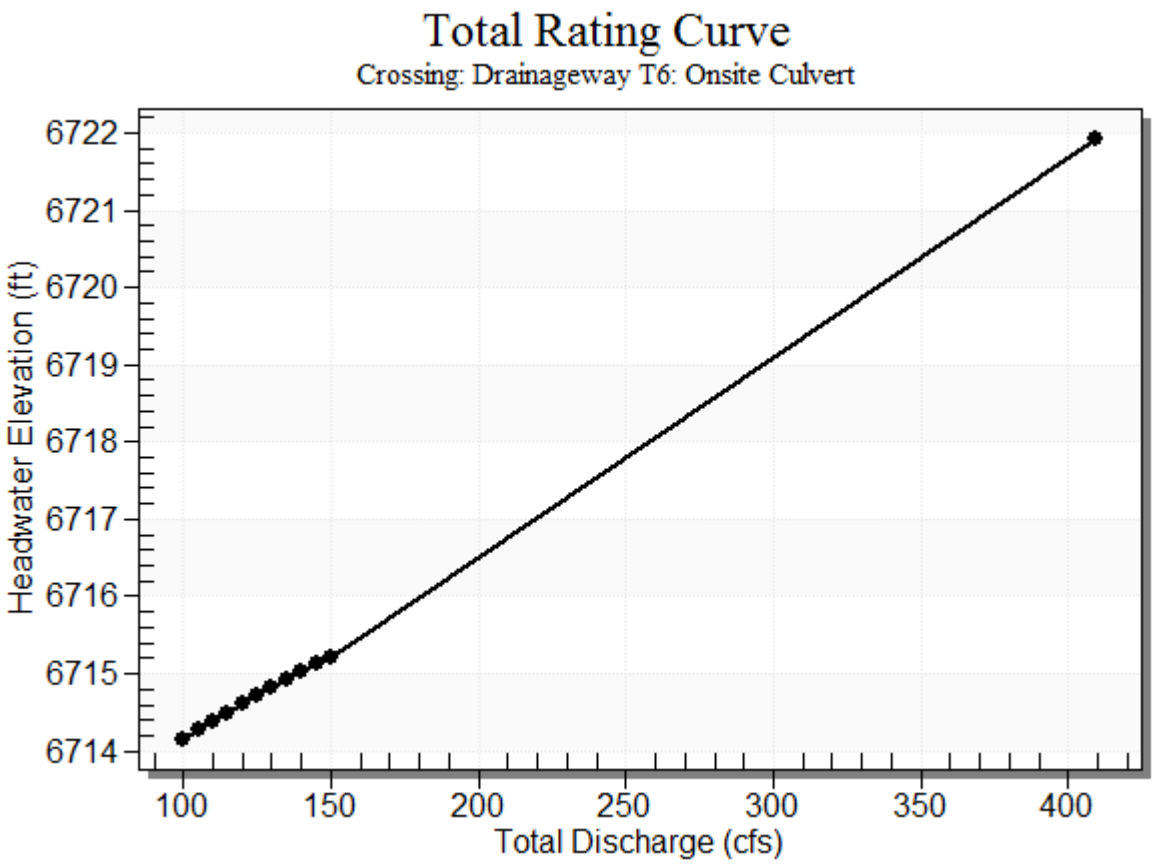


Table 2 - Culvert Summary Table: Del Cerro Trail Culvert

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	100.00	6714.16	3.719	4.160	2-M2c	3.517	2.564	2.564	1.554	7.830	3.969
105.00	105.00	6714.27	3.823	4.273	2-M2c	3.622	2.631	2.631	1.593	7.942	4.025
110.00	110.00	6714.38	3.925	4.384	2-M2c	3.727	2.696	2.696	1.632	8.051	4.078
115.00	115.00	6714.49	4.025	4.494	2-M2c	3.831	2.756	2.756	1.670	8.172	4.129
120.00	120.00	6714.60	4.123	4.602	2-M2c	3.935	2.819	2.819	1.707	8.272	4.179
125.00	125.00	6714.71	4.218	4.708	2-M2c	4.040	2.881	2.881	1.743	8.372	4.227
130.00	130.00	6714.81	4.312	4.813	2-M2c	4.144	2.941	2.941	1.778	8.470	4.273
135.00	135.00	6714.92	4.404	4.917	2-M2c	4.250	2.998	2.998	1.812	8.577	4.318
140.00	140.00	6715.02	4.495	5.020	2-M2c	4.357	3.057	3.057	1.846	8.668	4.362
145.00	145.00	6715.12	4.584	5.122	2-M2c	4.464	3.115	3.115	1.879	8.759	4.405
150.00	150.00	6715.22	4.672	5.222	2-M2c	4.574	3.172	3.172	1.912	8.850	4.446

****

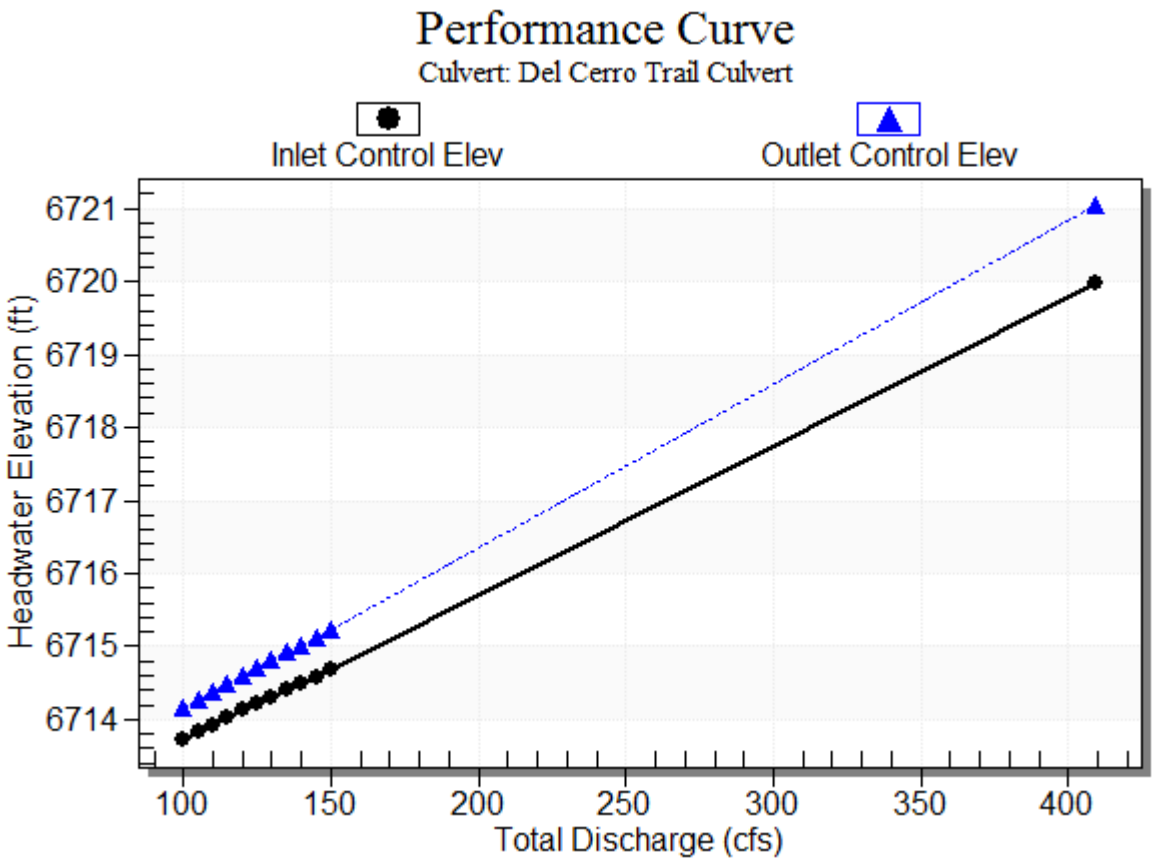
Straight Culvert

Inlet Elevation (invert): 6710.00 ft, Outlet Elevation (invert): 6709.46 ft

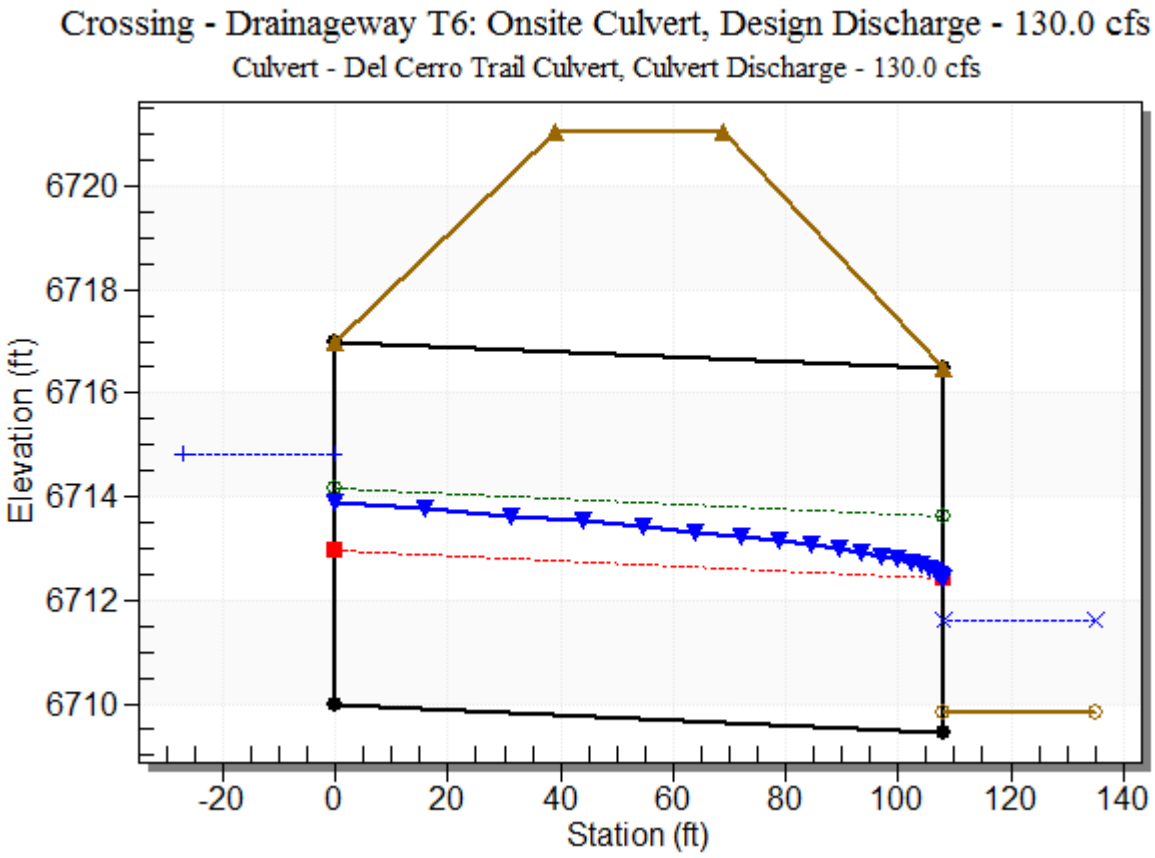
Culvert Length: 108.00 ft, Culvert Slope: 0.0050

****

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: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0310

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: Drainageway T6: Onsite

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
100.00	6711.38	1.55	3.97	0.97	0.66
105.00	6711.42	1.59	4.02	0.99	0.66
110.00	6711.46	1.63	4.08	1.02	0.66
115.00	6711.50	1.67	4.13	1.04	0.67
120.00	6711.54	1.71	4.18	1.06	0.67
125.00	6711.57	1.74	4.23	1.09	0.67
130.00	6711.61	1.78	4.27	1.11	0.67
135.00	6711.64	1.81	4.32	1.13	0.67
140.00	6711.68	1.85	4.36	1.15	0.68
145.00	6711.71	1.88	4.40	1.17	0.68
150.00	6711.74	1.91	4.45	1.19	0.68

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

Culvert Report

Pond G Maintenance & Access Road Culvert (Q_5 = 0.4 cfs & Q_100 = 0.9 cfs)

Invert Elev Dn (ft)	=	6692.48
Pipe Length (ft)	=	18.39
Slope (%)	=	2.56
Invert Elev Up (ft)	=	6692.95
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.022
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

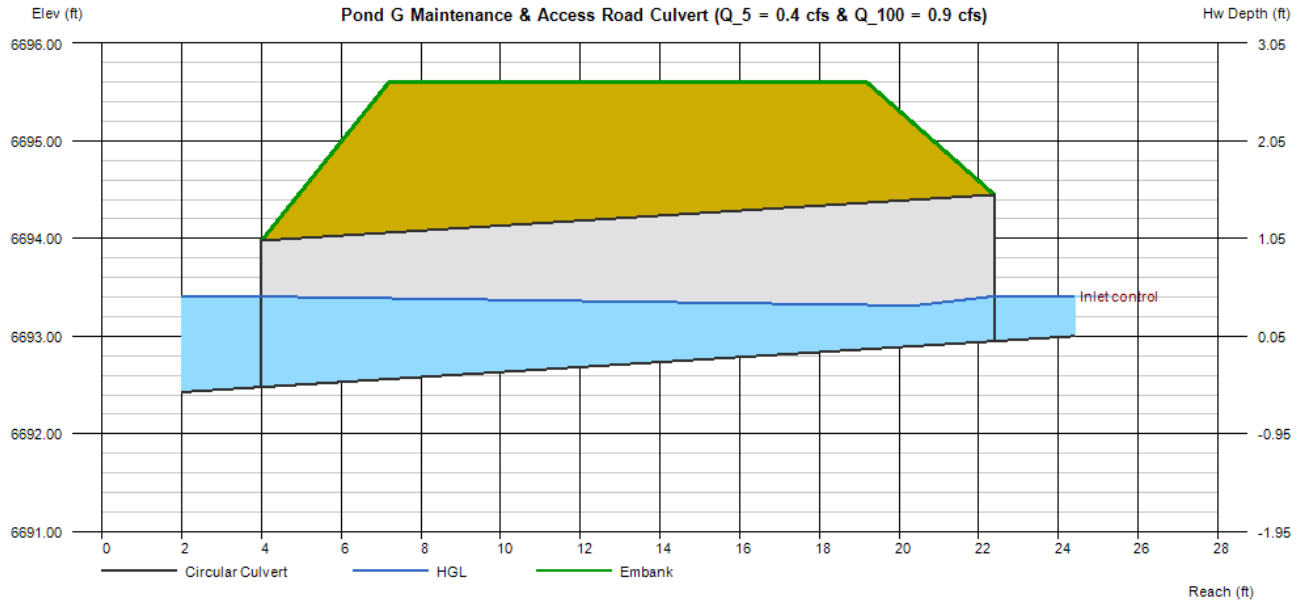
Top Elevation (ft)	=	6695.60
Top Width (ft)	=	12.00
Crest Width (ft)	=	25.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	2.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	0.90
Qpipe (cfs)	=	0.90
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	0.79
Veloc Up (ft/s)	=	2.84
HGL Dn (ft)	=	6693.41
HGL Up (ft)	=	6693.30
Hw Elev (ft)	=	6693.41
Hw/D (ft)	=	0.31
Flow Regime	=	Inlet Control



Culvert Report

Pond H Maintenance & Access Road Culvert (Q_5= 0.3 cfsQ_100 = 0.8 cfs)

Invert Elev Dn (ft)	=	6745.09
Pipe Length (ft)	=	32.57
Slope (%)	=	1.66
Invert Elev Up (ft)	=	6745.63
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.022
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

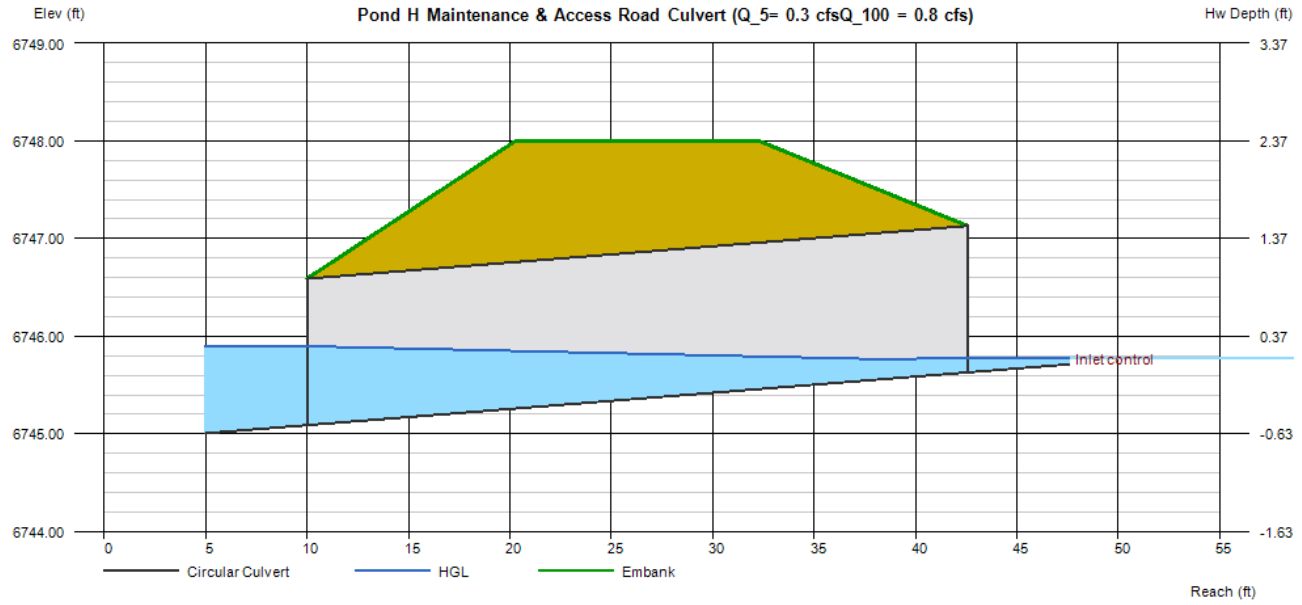
Top Elevation (ft)	=	6748.00
Top Width (ft)	=	12.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	1.10
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	0.10
Qpipe (cfs)	=	0.10
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	0.10
Veloc Up (ft/s)	=	1.59
HGL Dn (ft)	=	6745.90
HGL Up (ft)	=	6745.75
Hw Elev (ft)	=	6745.77
Hw/D (ft)	=	0.10
Flow Regime	=	Inlet Control



Culvert Report

Pond I Maintenance & Access Road Culvert (Q_5 = 1.6 cfs Q_100 = 4.3 cfs)

Invert Elev Dn (ft)	=	6711.51
Pipe Length (ft)	=	34.17
Slope (%)	=	2.22
Invert Elev Up (ft)	=	6712.27
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.022
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

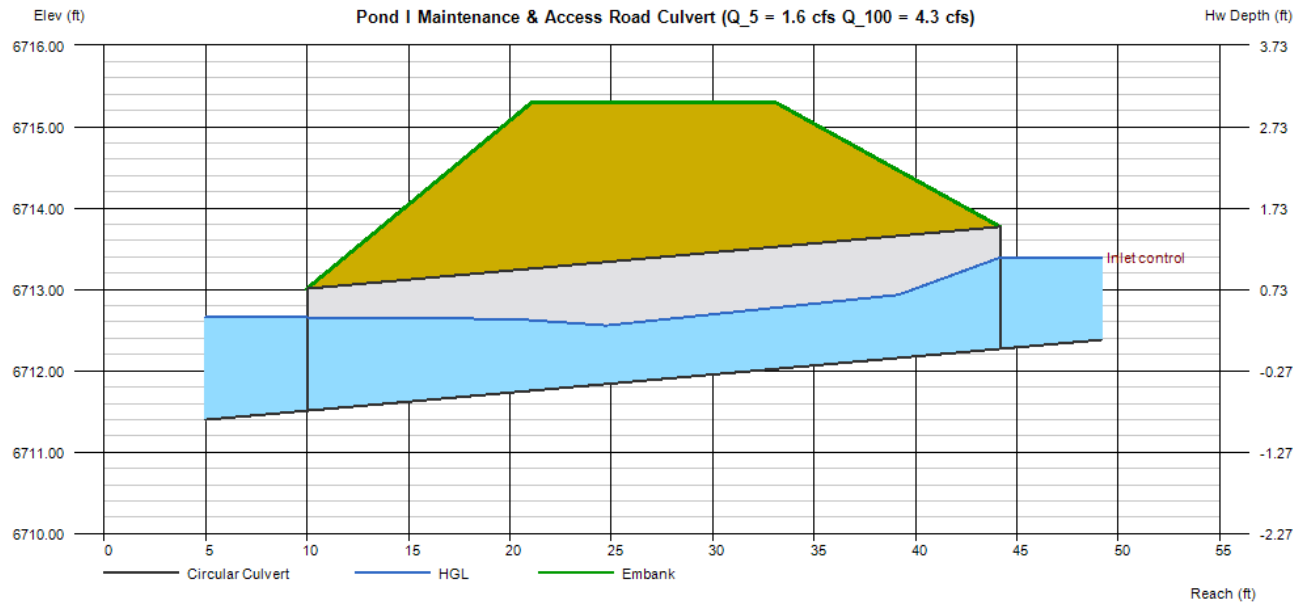
Top Elevation (ft)	=	6715.30
Top Width (ft)	=	12.00
Crest Width (ft)	=	25.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	4.50
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	4.30
Qpipe (cfs)	=	4.30
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.97
Veloc Up (ft/s)	=	4.53
HGL Dn (ft)	=	6712.66
HGL Up (ft)	=	6713.06
Hw Elev (ft)	=	6713.39
Hw/D (ft)	=	0.75
Flow Regime	=	Inlet Control



Weir Report

POND G FOREBAY WEIR: Q_100 = 2% PEAK, UNDET. 100-YR = 0.52 CFS

V-Notch Weir

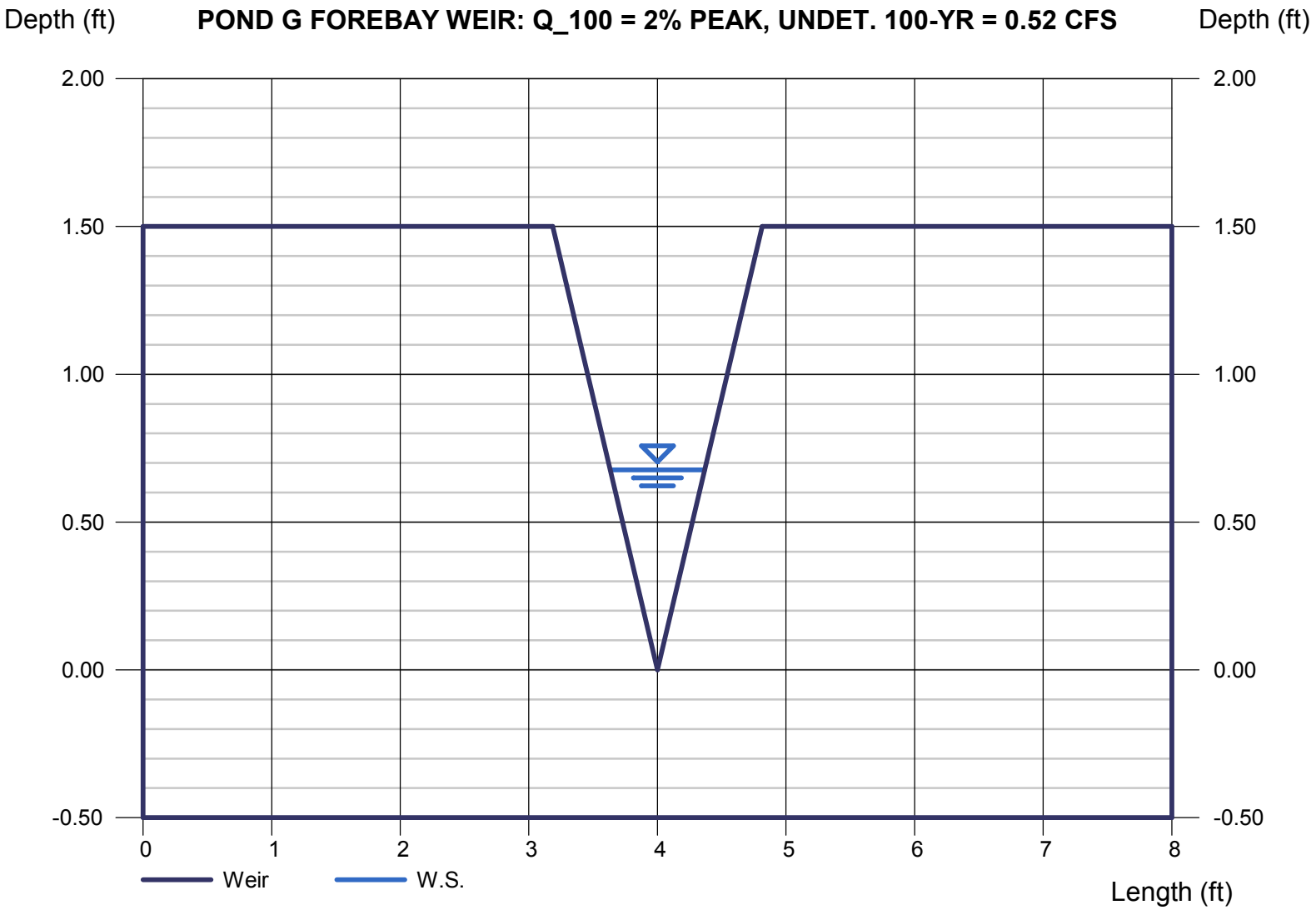
Crest	= Sharp
Angle (Deg)	= 57
Total Depth (ft)	= 1.50

Calculations

Weir Coeff. Cw	= 1.38
Compute by:	Known Q
Known Q (cfs)	= 0.52

Highlighted

Depth (ft)	= 0.68
Q (cfs)	= 0.520
Area (sqft)	= 0.25
Velocity (ft/s)	= 2.09
Top Width (ft)	= 0.73



Weir Report

POND H FOREBAY WEIR: Q=2% OF PEAK, UNDET. 100-YR = 0.37 CFS

V-Notch Weir

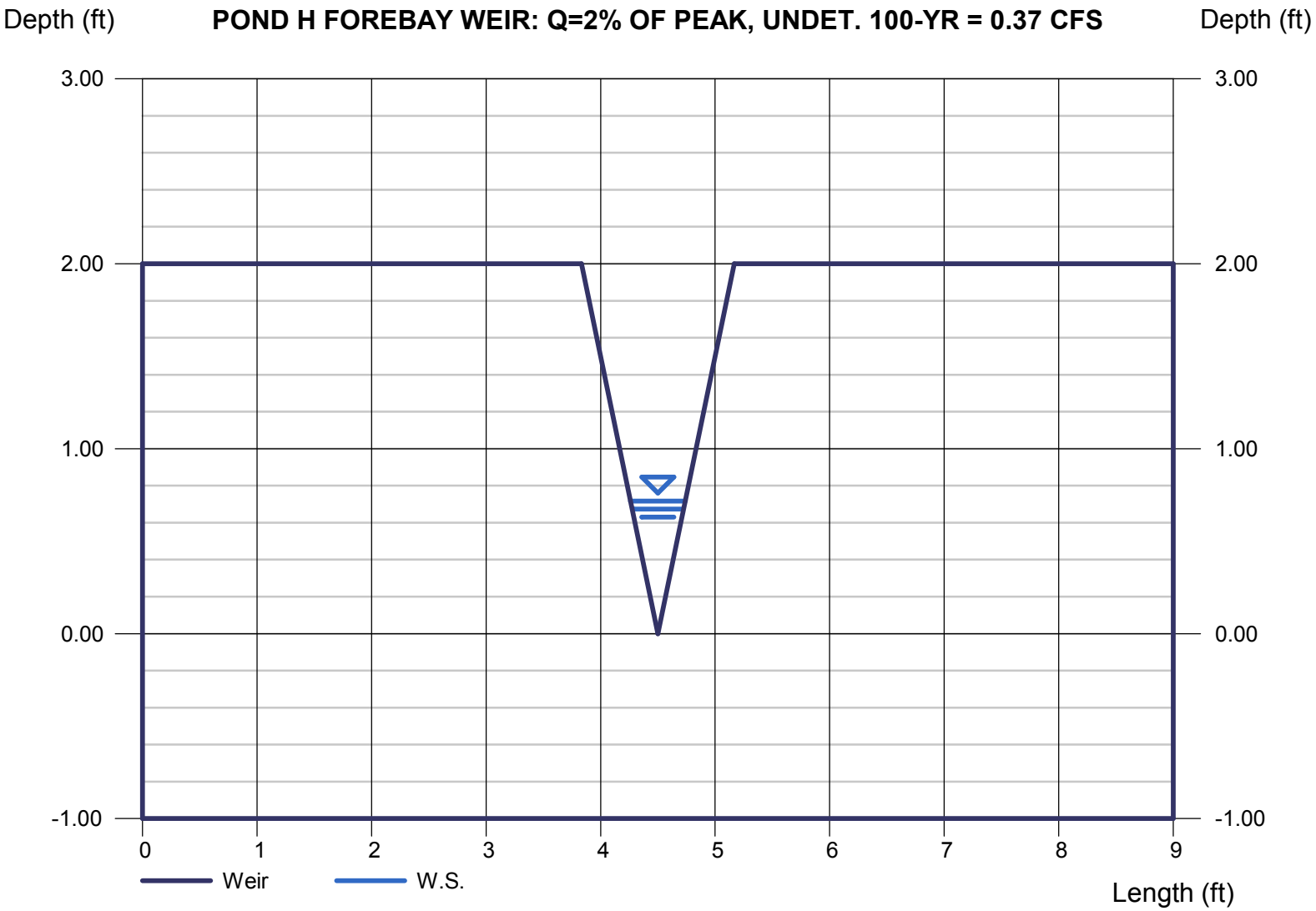
Crest	= Sharp
Angle (Deg)	= 37
Total Depth (ft)	= 2.00

Calculations

Weir Coeff. Cw	= 0.85
Compute by:	Known Q
Known Q (cfs)	= 0.37

Highlighted

Depth (ft)	= 0.72
Q (cfs)	= 0.370
Area (sqft)	= 0.17
Velocity (ft/s)	= 2.16
Top Width (ft)	= 0.48



Weir Report

POND I FOREBAY WEIR: Q_100 = 2% PEAK, UNDET. 100-YR = 0.83 CFS

V-Notch Weir

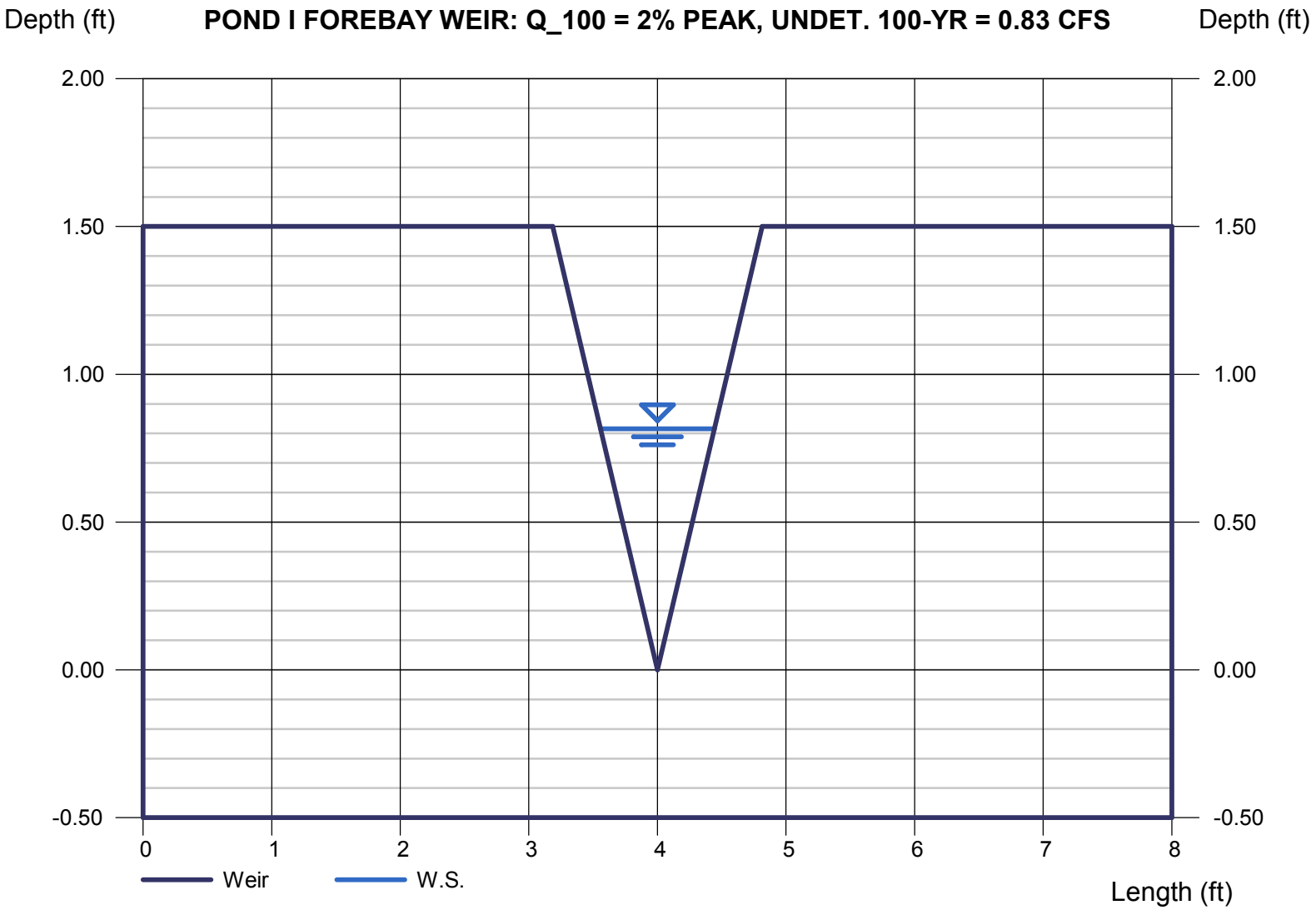
Crest	= Sharp
Angle (Deg)	= 57
Total Depth (ft)	= 1.50

Calculations

Weir Coeff. Cw	= 1.38
Compute by:	Known Q
Known Q (cfs)	= 0.83

Highlighted

Depth (ft)	= 0.82
Q (cfs)	= 0.830
Area (sqft)	= 0.36
Velocity (ft/s)	= 2.30
Top Width (ft)	= 0.89



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 26 2019

Haegler Ranch Tributary 6 - Prop. Cross Section (Q_100 = 130 cfs, Slope = 0.9%)

User-defined

Invert Elev (ft)	= 6719.81
Slope (%)	= 0.90
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 130.00

Highlighted

Depth (ft)	= 1.63
Q (cfs)	= 130.00
Area (sqft)	= 37.82
Velocity (ft/s)	= 3.44
Wetted Perim (ft)	= 59.09
Crit Depth, Yc (ft)	= 1.52
Top Width (ft)	= 58.80
EGL (ft)	= 1.81

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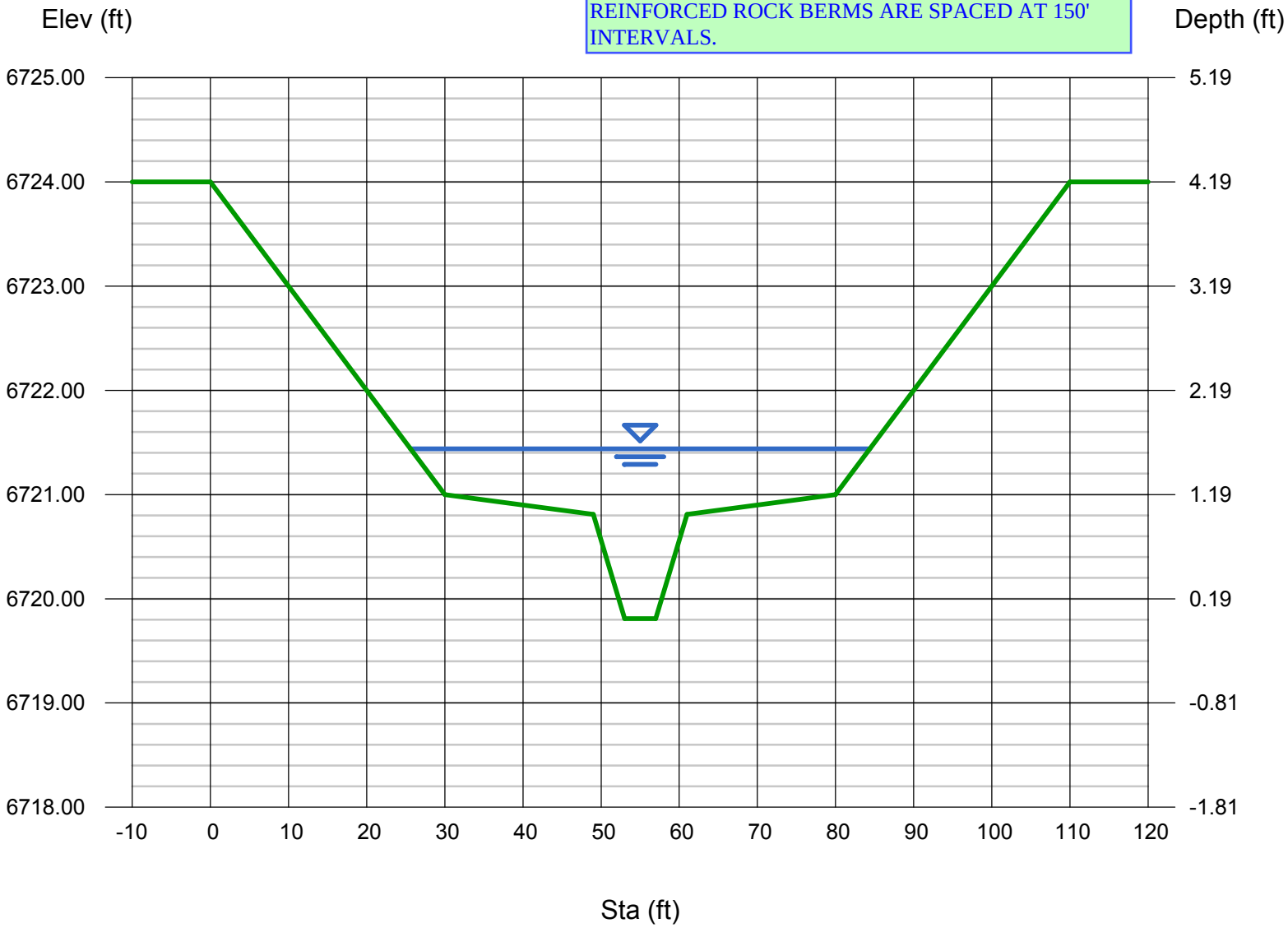
THIS REACH OF CHANNEL WILL BE LINED WITH EROSION CONTROL BLANKET AND SEEDED WITH PAWNEE BUTTEE SEED INC - "LOW GROW NATIVE SEED MIX" WHICH INCLUDES A COMBINATION OF FESCUE AND BLUEGRASS. PER EPC DCM TABLE 10-4, FESCUE AND BLUEGRASS PERMISSIBLE VELOCITIES ARE 5 FT/S. FUTHERMORE, REINFORCED ROCK BERMS ARE SPACED AT 150' INTERVALS.



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 26 2019

Haegler Ranch Tributary 6 - Prop. Cross Section (Q_100 = 130 cfs, Slope = 1.45%)

User-defined

Invert Elev (ft)	= 6719.81
Slope (%)	= 1.45
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 130.00

Highlighted

Depth (ft)	= 1.53
Q (cfs)	= 130.00
Area (sqft)	= 32.04
Velocity (ft/s)	= 4.06
Wetted Perim (ft)	= 57.08
Crit Depth, Yc (ft)	= 1.52
Top Width (ft)	= 56.80
EGL (ft)	= 1.79

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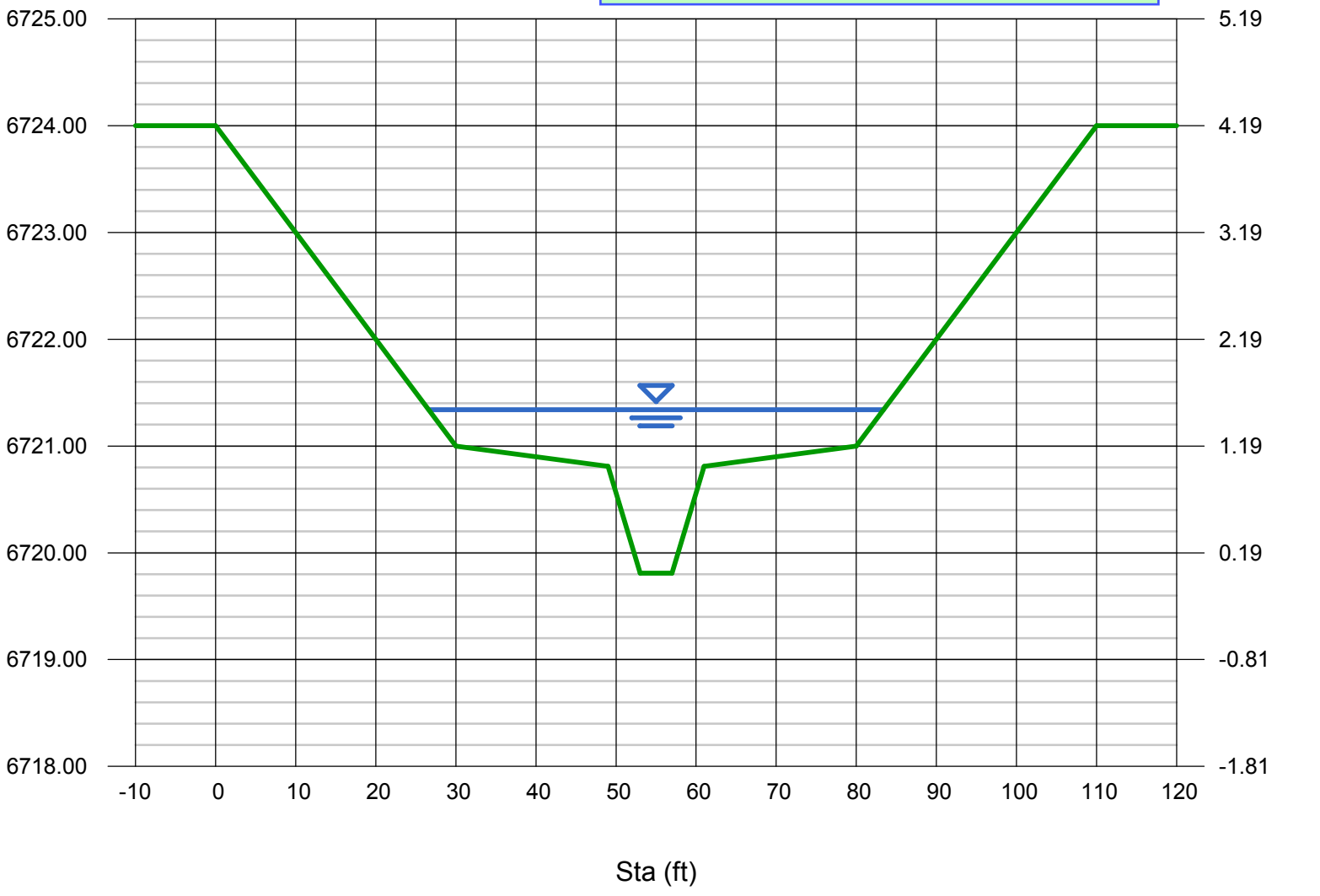

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 26 2019

Haegler Ranch Tributary 6 - Prop. Cross Section (Q_100 = 130 cfs, Slope = 2.00%)

User-defined

Invert Elev (ft)	= 6719.81
Slope (%)	= 2.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 130.00

Highlighted

Depth (ft)	= 1.48
Q (cfs)	= 130.00
Area (sqft)	= 29.23
Velocity (ft/s)	= 4.45
Wetted Perim (ft)	= 56.08
Crit Depth, Yc (ft)	= 1.52
Top Width (ft)	= 55.80
EGL (ft)	= 1.79

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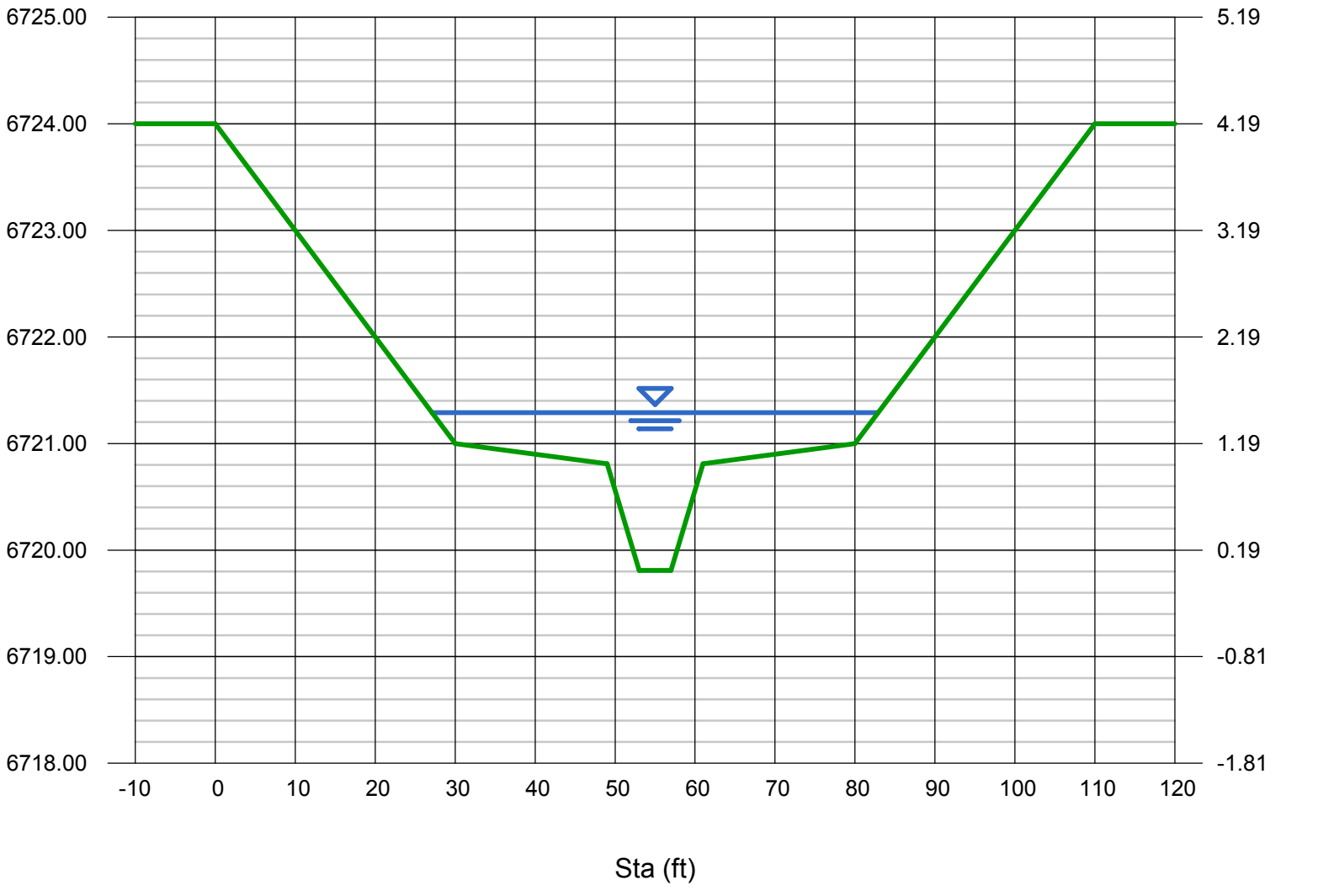

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 26 2019

Haegler Ranch Tributary 6 - Prop. Cross Section (Q_100 = 130 cfs, Slope = 2.16%)

User-defined

Invert Elev (ft)	= 6719.81
Slope (%)	= 2.16
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 130.00

Highlighted

Depth (ft)	= 1.46
Q (cfs)	= 130.00
Area (sqft)	= 28.12
Velocity (ft/s)	= 4.62
Wetted Perim (ft)	= 55.68
Crit Depth, Yc (ft)	= 1.52
Top Width (ft)	= 55.40
EGL (ft)	= 1.79

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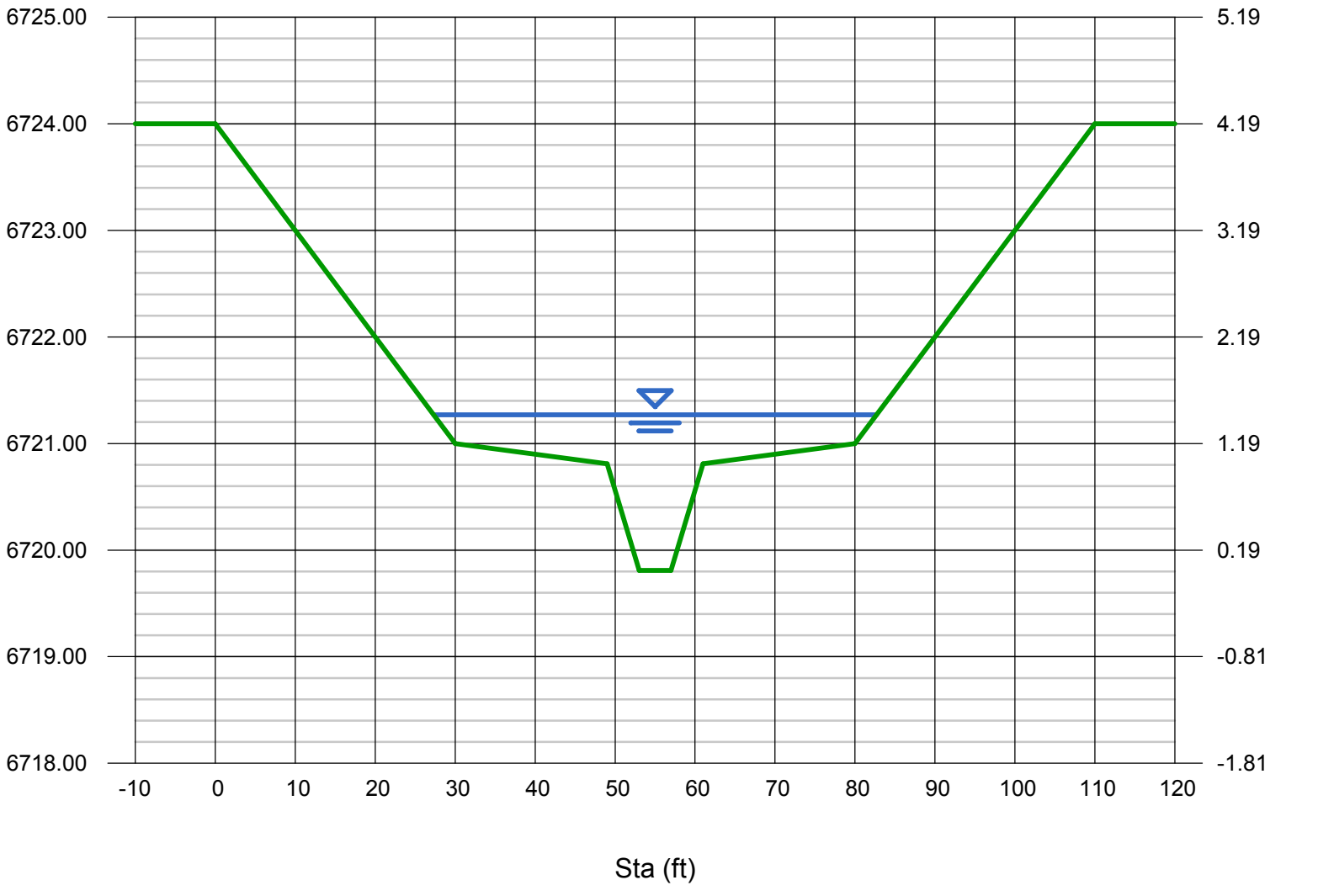

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Nov 26 2019

Haegler Ranch Tributary 6 - Prop. Cross Section (Q_100 = 130 cfs, Slope = 2.37%)

User-defined

Invert Elev (ft)	= 6719.81
Slope (%)	= 2.37
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 130.00

Highlighted

Depth (ft)	= 1.45
Q (cfs)	= 130.00
Area (sqft)	= 27.58
Velocity (ft/s)	= 4.71
Wetted Perim (ft)	= 55.48
Crit Depth, Yc (ft)	= 1.52
Top Width (ft)	= 55.21
EGL (ft)	= 1.80

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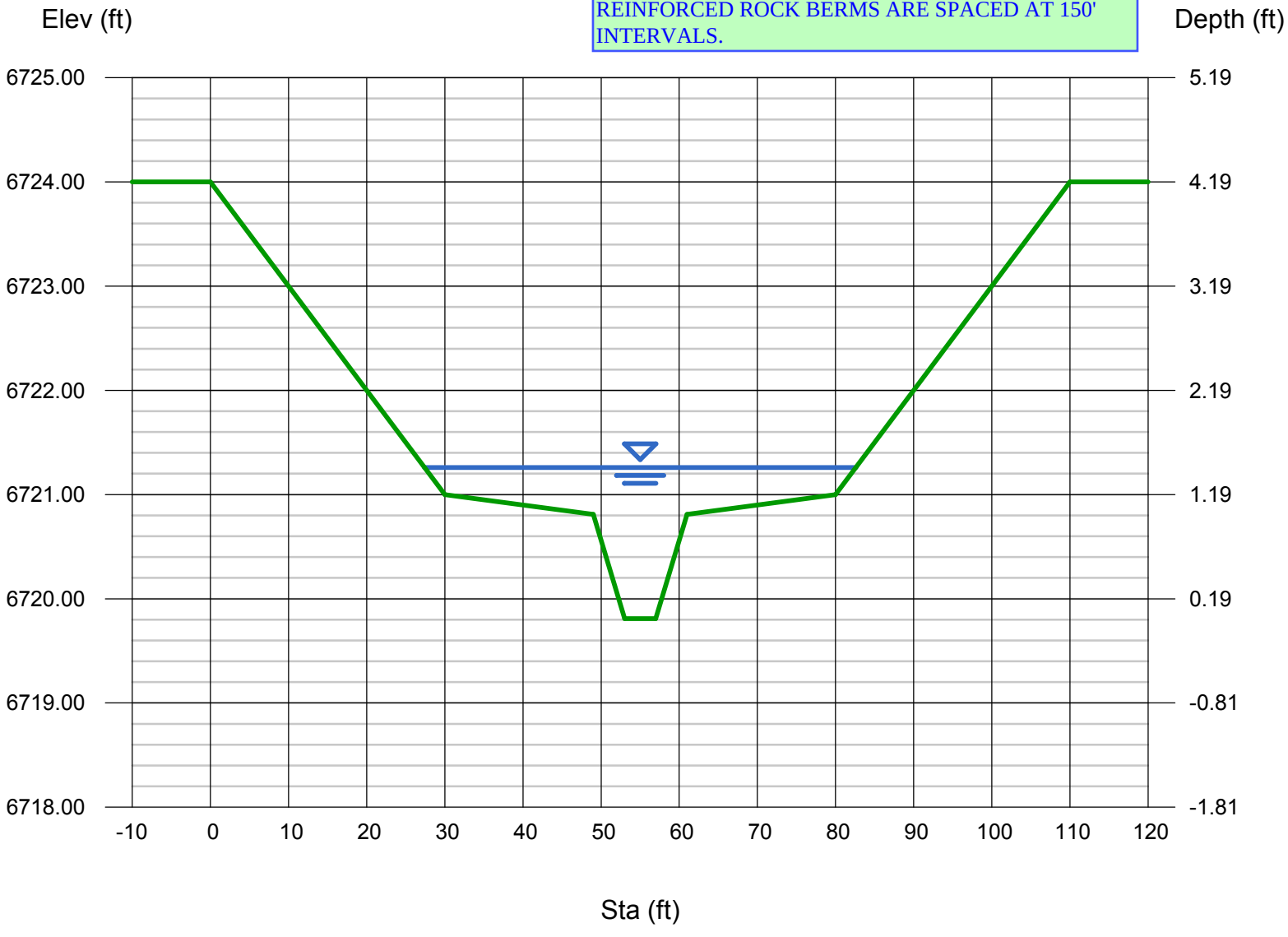


APPENDIX D

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

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

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

Questions (cont'd)	Yes	No	Not Applicable	Notes
F. Do Non-Residential or Non-Commercial Infiltration Conditions exist? 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.

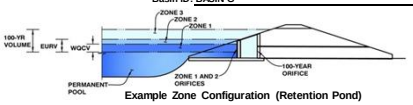
Signature of El Paso County Project Engineer _____ Date _____

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: SADDLEHORN RANCH FILING NO. 1

Basin ID: BASIN G



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	33.57	acres	Note: L / W Ratio > 8
Watershed Length =	3,700	ft	L / W Ratio = 9.4
Watershed Slope =	0.015	ft/ft	
Watershed Imperviousness =	18.60%	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) =	0.307	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.546	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.361	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.487	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.627	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	0.869	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.331	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	2.058	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	inches
Approximate 2-yr Detention Volume =	0.336	acre-feet	
Approximate 5-yr Detention Volume =	0.454	acre-feet	
Approximate 10-yr Detention Volume =	0.580	acre-feet	
Approximate 25-yr Detention Volume =	0.756	acre-feet	
Approximate 50-yr Detention Volume =	0.918	acre-feet	
Approximate 100-yr Detention Volume =	1.244	acre-feet	

Stage-Storage Calculation

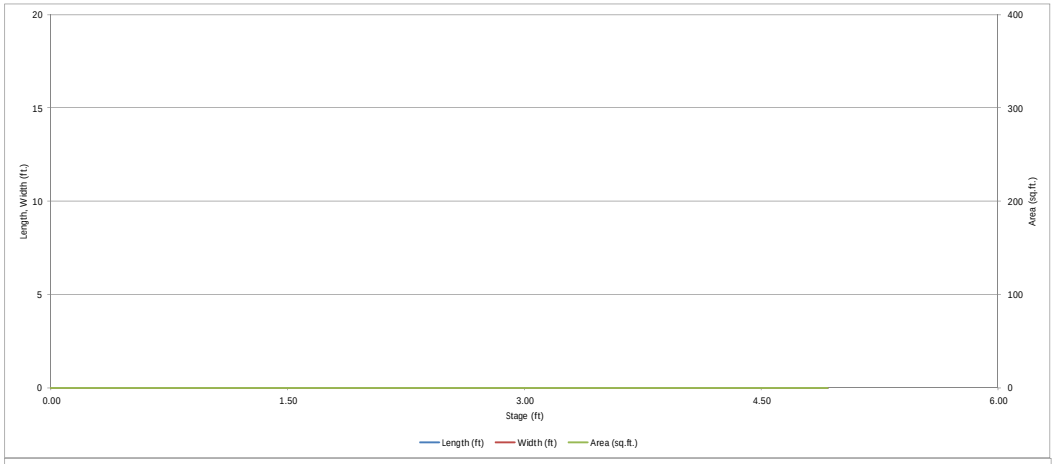
Zone 1 Volume (WQCV) =	0.307	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.239	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.698	acre-feet
Total Detention Basin Volume =	1.244	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

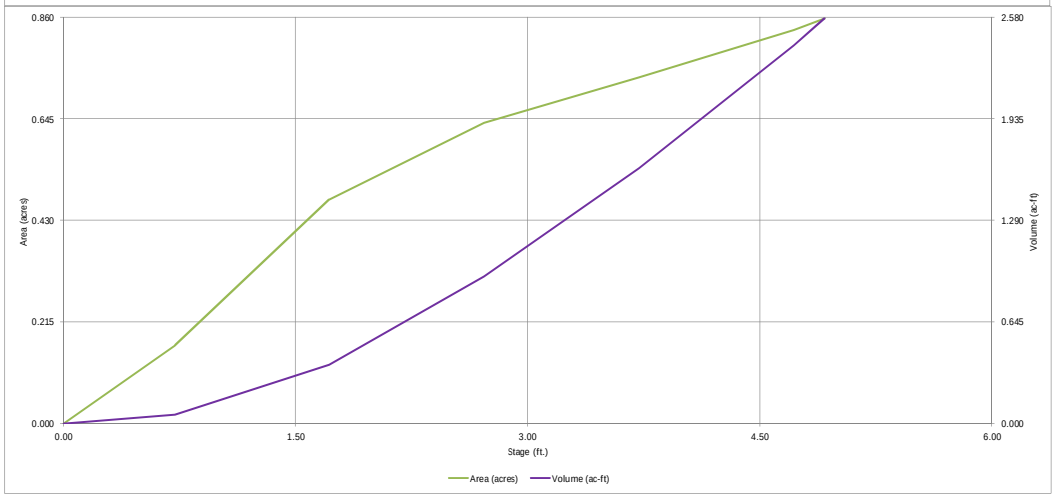
Depth Increment = ft

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	6690.28	0.00	--	--	--	0	0.000		
6691	--	0.72	--	--	--	7,201	0.165	2,521	0.058
6692	--	1.72	--	--	--	20,625	0.473	16,299	0.374
6693	--	2.72	--	--	--	27,717	0.636	40,676	0.934
6694	--	3.72	--	--	--	31,904	0.732	70,486	1.618
6695	--	4.72	--	--	--	36,248	0.832	104,562	2.400
6695.2	--	4.92	--	--	--	37,319	0.857	111,919	2.569

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



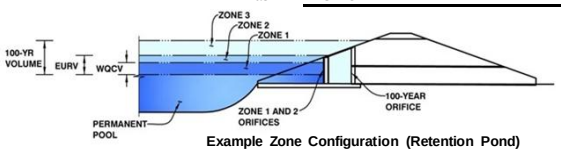


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: SADDLEHORN RANCH FILING NO. 1

Basin ID: BASIN G



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.56	0.307	Orifice Plate
Zone 2 (EURV)	2.06	0.239	Circular Orifice
Zone 3 (100-year)	3.20	0.698	Weir&Pipe (Restrict)
		1.244	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

			Calculated Parameters for Plate		
Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.229E-02	ft^2
Depth at top of Zone using Orifice Plate =	1.56	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	6.10	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.77	sq. inches (diameter = 1-1/2 inches)	Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.52	1.04					
Orifice Area (sq. inches)	1.77	1.77	1.77					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected		Calculated Parameters for Vertical Orifice	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	1.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.00	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	2.06	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.02	N/A	feet
Vertical Orifice Diameter =	0.38	N/A	inches				

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.42	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	2.42	N/A	feet
Overflow Weir Front Edge Length =	3.00	N/A	feet	Over Flow Weir Slope Length =	3.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	5.39	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	6.30	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	3.15	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.17	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.53	N/A	feet
Restrictor Plate Height Above Pipe Invert =	11.30		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.83	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

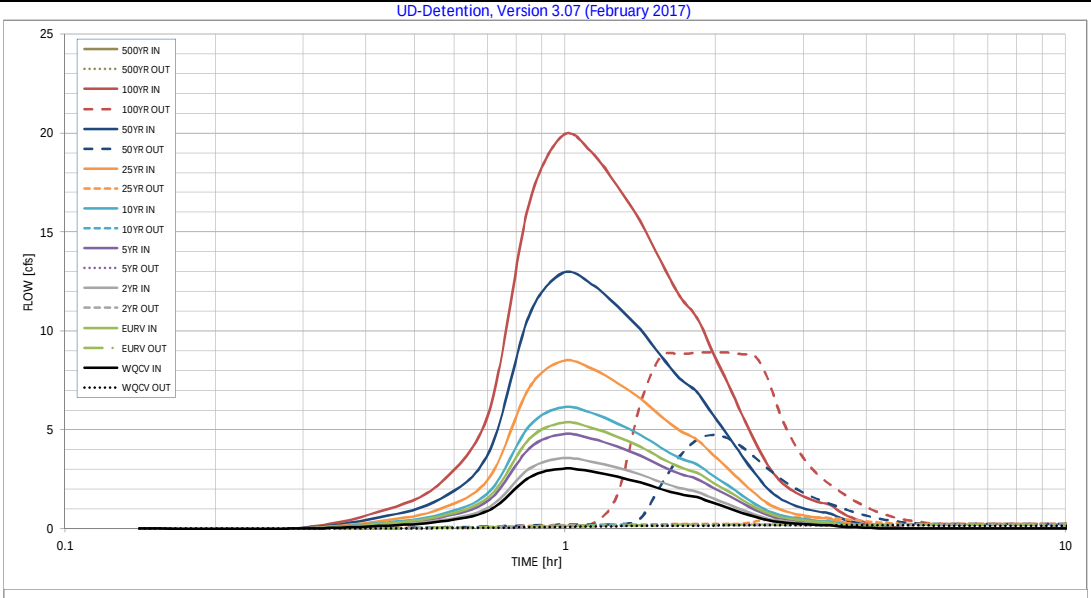
			Calculated Parameters for Spillway		
Spillway Invert Stage=	3.20	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.45	feet
Spillway Crest Length =	20.00	feet	Stage at Top of Freeboard =	4.65	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.83	acres
Freeboard above Max Water Surface =	1.00	feet			

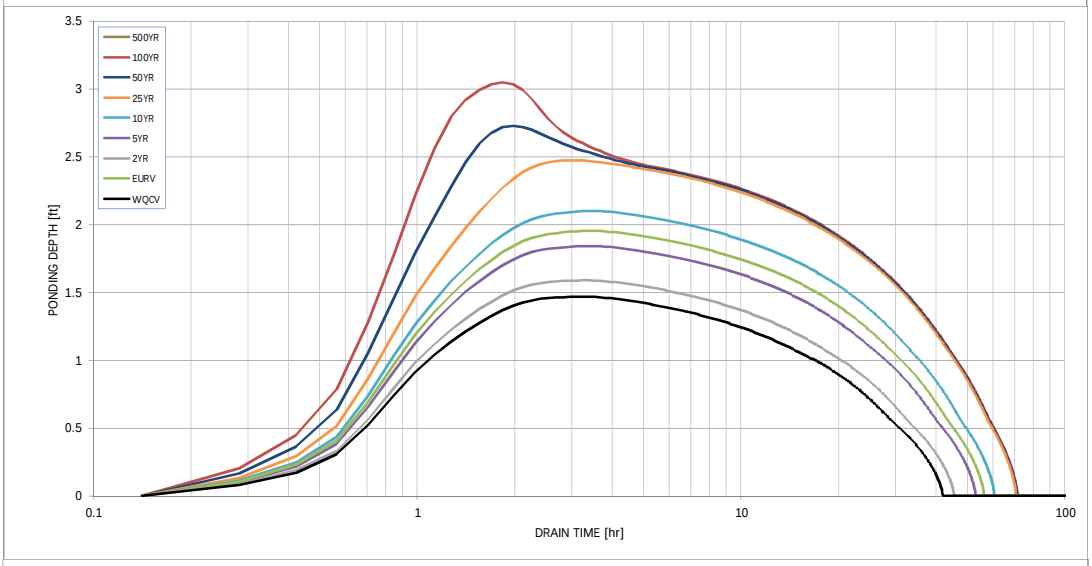
Routed Hydrograph Results

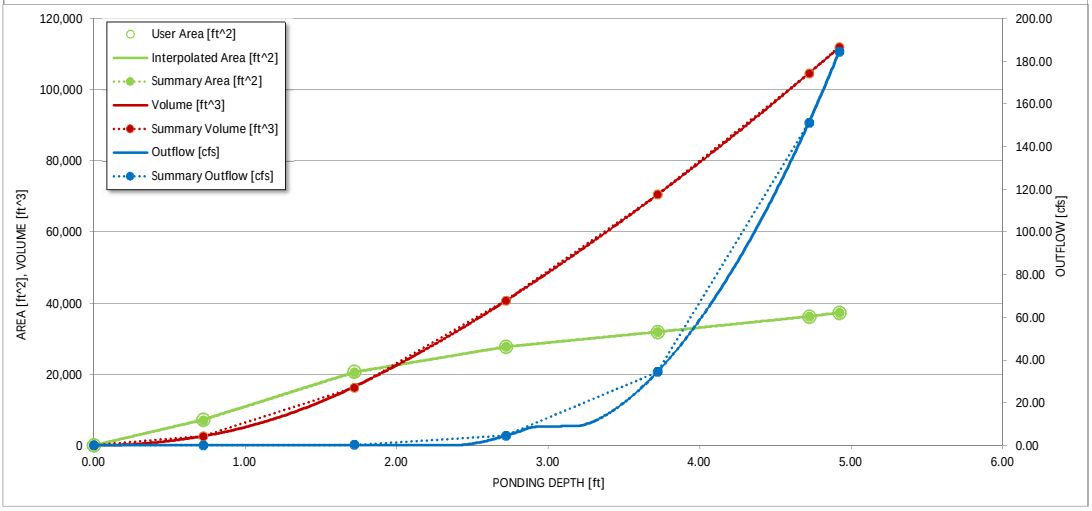
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.307	0.546	0.361	0.487	0.627	0.869	1.331	2.058	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.307	0.546	0.361	0.487	0.626	0.868	1.332	2.058	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.02	0.11	0.28	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.1	0.2	0.5	3.9	9.4	0.0
Peak Inflow Q (cfs) =	3.0	5.4	3.6	4.8	6.1	8.5	12.9	19.9	#N/A
Peak Outflow Q (cfs) =	0.2	0.2	0.2	0.2	0.2	0.6	4.7	8.9	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.0	1.0	1.1	1.2	0.9	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.7	1.4	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	37	49	40	47	53	61	58	54	#N/A
Time to Drain 99% of Inflow Volume (hours) =	40	53	43	50	57	66	65	63	#N/A
Maximum Ponding Depth (ft) =	1.47	1.95	1.59	1.84	2.10	2.47	2.73	3.05	#N/A
Area at Maximum Ponding Depth (acres) =	0.39	0.51	0.43	0.49	0.54	0.60	0.64	0.67	#N/A
Maximum Volume Stored (acre-ft) =	0.266	0.492	0.316	0.437	0.571	0.780	0.940	1.142	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs UD-Detention, Version 3.07 (February 2017)

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
8.48 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:08:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:16:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:25:26	0.14	0.24	0.16	0.21	0.27	0.37	0.56	0.85	#N/A
0.590	0:33:55	0.37	0.64	0.43	0.57	0.73	1.01	1.53	2.33	#N/A
	0:42:24	0.94	1.64	1.10	1.47	1.88	2.59	3.92	5.99	#N/A
	0:50:53	2.58	4.52	3.02	4.04	5.17	7.11	10.78	16.45	#N/A
	0:59:22	3.03	5.35	3.56	4.78	6.13	8.48	12.93	19.88	#N/A
	1:07:50	2.89	5.11	3.39	4.56	5.85	8.10	12.37	19.04	#N/A
	1:16:19	2.63	4.65	3.09	4.15	5.33	7.37	11.26	17.33	#N/A
	1:24:48	2.34	4.15	2.75	3.70	4.76	6.59	10.09	15.56	#N/A
	1:33:17	2.01	3.58	2.36	3.19	4.11	5.70	8.75	13.53	#N/A
	1:41:46	1.75	3.12	2.06	2.78	3.58	4.96	7.61	11.76	#N/A
	1:50:14	1.59	2.82	1.87	2.52	3.24	4.50	6.90	10.66	#N/A
	1:58:43	1.30	2.33	1.53	2.07	2.67	3.72	5.73	8.89	#N/A
	2:07:12	1.05	1.90	1.24	1.69	2.18	3.05	4.71	7.33	#N/A
	2:15:41	0.80	1.46	0.95	1.29	1.68	2.36	3.67	5.75	#N/A
	2:24:10	0.59	1.08	0.70	0.96	1.25	1.77	2.77	4.39	#N/A
	2:32:38	0.43	0.79	0.51	0.70	0.91	1.27	2.02	3.23	#N/A
	2:41:07	0.34	0.61	0.40	0.54	0.70	0.98	1.55	2.45	#N/A
	2:49:36	0.28	0.50	0.33	0.45	0.58	0.81	1.26	1.99	#N/A
	2:58:05	0.24	0.43	0.28	0.38	0.49	0.69	1.07	1.68	#N/A
	3:06:34	0.21	0.37	0.24	0.33	0.43	0.60	0.94	1.47	#N/A
	3:15:02	0.19	0.34	0.22	0.30	0.39	0.54	0.84	1.32	#N/A
	3:23:31	0.17	0.31	0.20	0.28	0.36	0.50	0.77	1.21	#N/A
	3:32:00	0.13	0.23	0.15	0.20	0.26	0.37	0.57	0.89	#N/A
	3:40:29	0.09	0.17	0.11	0.15	0.19	0.27	0.42	0.65	#N/A
	3:48:58	0.07	0.12	0.08	0.11	0.14	0.20	0.31	0.48	#N/A
	3:57:26	0.05	0.09	0.06	0.08	0.10	0.15	0.23	0.35	#N/A
	4:05:55	0.04	0.06	0.04	0.06	0.07	0.10	0.16	0.26	#N/A
	4:14:24	0.02	0.05	0.03	0.04	0.05	0.07	0.12	0.18	#N/A
	4:22:53	0.02	0.03	0.02	0.03	0.04	0.05	0.08	0.13	#N/A
	4:31:22	0.01	0.02	0.01	0.02	0.02	0.04	0.06	0.09	#N/A
	4:39:50	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.06	#N/A
	4:48:19	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.03	#N/A
	4:56:48	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	#N/A
	5:05:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:13:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:22:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:30:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:39:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:47:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:56:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:04:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:13:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:21:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:30:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:38:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:47:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:55:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:04:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:12:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:20:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:29:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:37:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:46:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:54:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:03:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:11:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:20:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:28:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:37:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:45:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:54:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	9:02:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	9:11:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	9:19:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	9:28:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	9:36:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	9:45:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	9:53:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	10:02:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	10:10:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

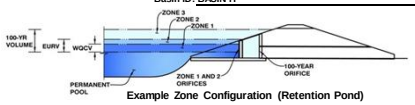
Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	0.00	0	0.000	0	0.000	0.00
	0.72	7,101	0.163	2,521	0.058	0.08
	1.72	20,491	0.470	16,299	0.374	0.19
	2.72	27,717	0.636	40,676	0.934	4.52
	3.72	31,904	0.732	70,486	1.618	34.41
	4.72	36,248	0.832	104,562	2.400	151.29
	4.92	37,319	0.857	111,919	2.569	184.37
WQCV						
EURV						
100-YR						

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: SADDLEHORN RANCH FILING NO. 1

Basin ID: BASIN H



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	21.16	acres
Watershed Length =	1,800	ft
Watershed Slope =	0.010	ft/ft
Watershed Imperviousness =	17.00%	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) =	0.181	acre-feet
Excess Urban Runoff Volume (EURV) =	0.307	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.202	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.274	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.353	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	0.494	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	0.775	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	1.231	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.188	acre-feet
Approximate 5-yr Detention Volume =	0.255	acre-feet
Approximate 10-yr Detention Volume =	0.327	acre-feet
Approximate 25-yr Detention Volume =	0.428	acre-feet
Approximate 50-yr Detention Volume =	0.526	acre-feet
Approximate 100-yr Detention Volume =	0.730	acre-feet

Optional User Override 1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
	inches

Stage-Storage Calculation

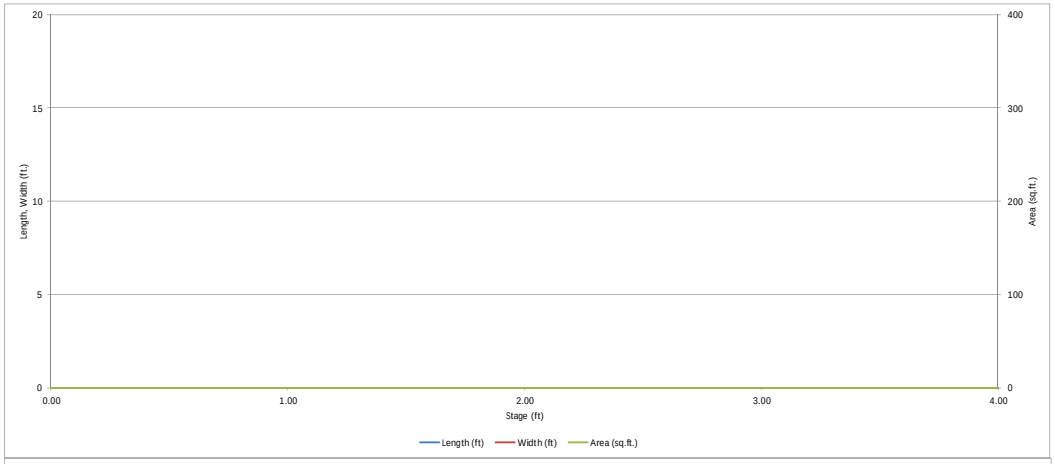
Zone 1 Volume (WQCV) =	0.181	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.126	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.423	acre-feet
Total Detention Basin Volume =	0.730	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

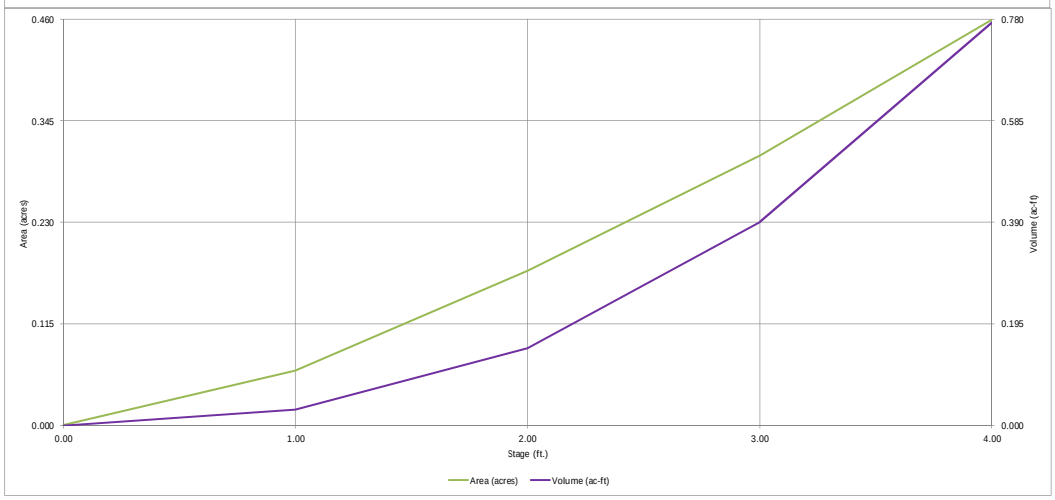
Depth Increment = ft

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	--	--	--	2,700	0.062	1,343	0.031
6738	--	2.00	--	--	--	7,616	0.175	6,452	0.148
6739.00	--	3.00	--	--	--	13,296	0.305	16,984	0.390
6740.00	--	4.00	--	--	--	19,991	0.459	33,627	0.772

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



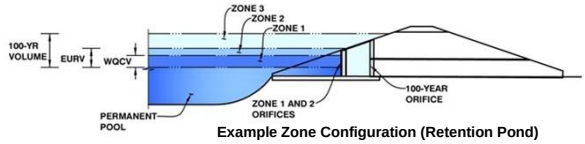


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: SADDLEHORN RANCH FILING NO. 1

Basin ID: BASIN H



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.17	0.181	Orifice Plate
Zone 2 (EURV)	2.71	0.126	Orifice Plate
Zone 3 (100-year)	3.91	0.423	Weir&Pipe (Restrict)
		0.730	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

			Calculated Parameters for Plate		
Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	2.71	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.75	2.00					
Orifice Area (sq. inches)	1.34	0.33	0.25					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected		Calculated Parameters for Vertical Orifice	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.17	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.17	N/A	feet
Overflow Weir Front Edge Length =	2.92	N/A	feet	Over Flow Weir Slope Length =	2.92	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	9.39	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	2.92	N/A	feet	Overflow Grate Open Area w/o Debris =	5.97	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	2.98	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.64	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.34	N/A	feet
Restrictor Plate Height Above Pipe Invert =	7.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.35	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

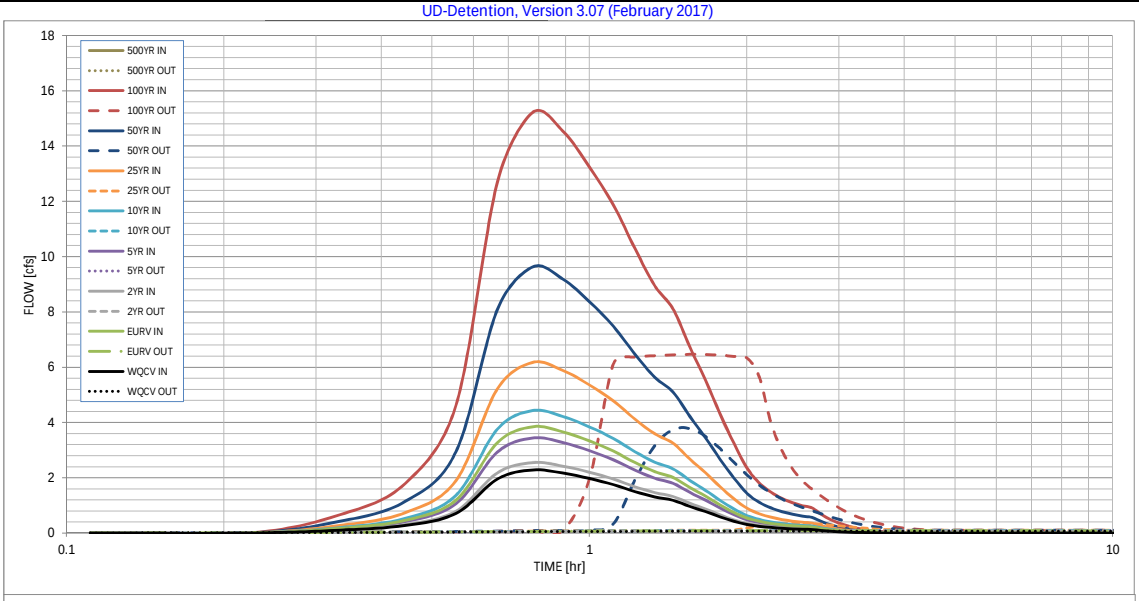
			Calculated Parameters for Spillway		
Spillway Invert Stage=	4.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.71	feet
Spillway Crest Length =	6.00	feet	Stage at Top of Freeboard =	5.71	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.46	acres
Freeboard above Max Water Surface =	1.00	feet			

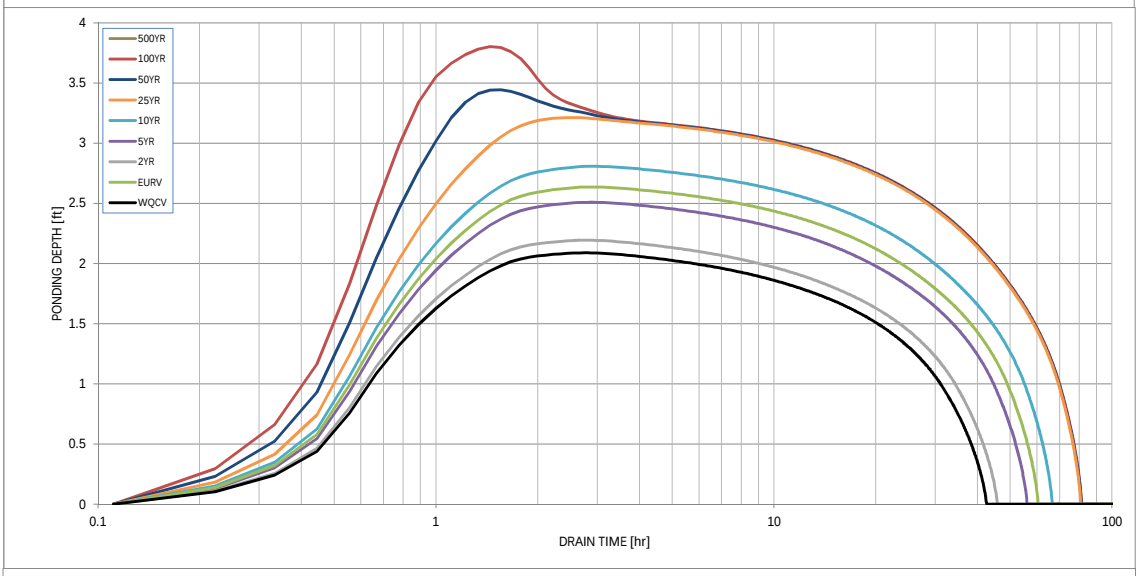
Routed Hydrograph Results

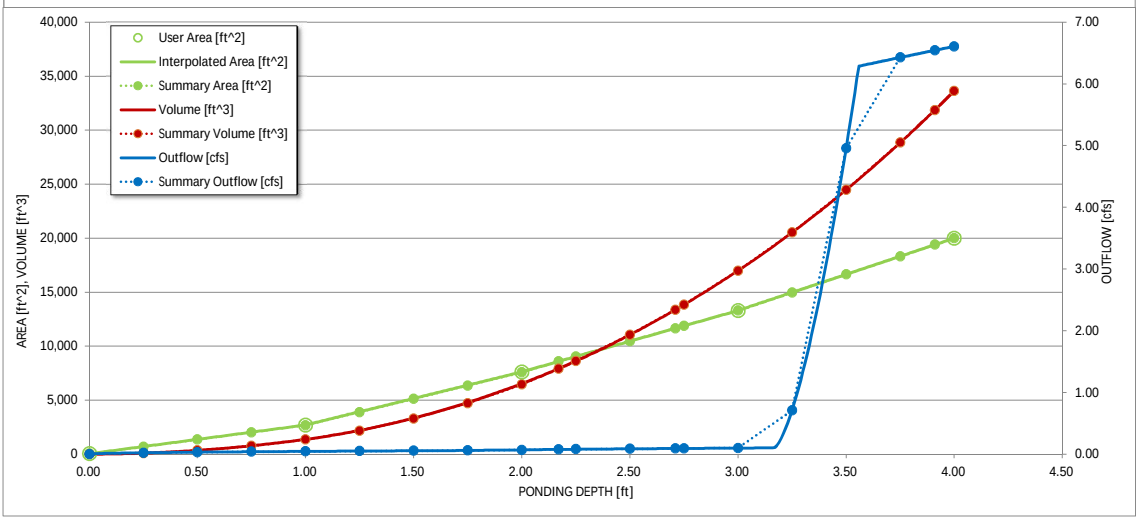
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.181	0.307	0.202	0.274	0.353	0.494	0.775	1.231	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.181	0.306	0.202	0.273	0.353	0.494	0.775	1.231	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.02	0.13	0.33	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.1	0.2	0.4	2.8	6.9	0.0
Peak Inflow Q (cfs) =	2.3	3.8	2.5	3.4	4.4	6.2	9.6	15.2	#N/A
Peak Outflow Q (cfs) =	0.1	0.1	0.1	0.1	0.1	0.4	3.8	6.5	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.2	0.6	1.0	1.3	0.9	#N/A
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.6	1.1	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	40	56	43	52	62	74	72	69	#N/A
Time to Drain 99% of Inflow Volume (hours) =	41	59	44	54	64	78	77	76	#N/A
Maximum Ponding Depth (ft) =	2.09	2.64	2.19	2.51	2.81	3.21	3.44	3.80	#N/A
Area at Maximum Ponding Depth (acres) =	0.19	0.26	0.20	0.24	0.28	0.34	0.37	0.43	#N/A
Maximum Volume Stored (acre-ft) =	0.164	0.286	0.185	0.254	0.331	0.457	0.539	0.683	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs UD-Detention, Version 3.07 (February 2017)

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
6.67 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:06:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:13:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:20:01	0.10	0.17	0.12	0.16	0.20	0.28	0.42	0.66	#N/A
0.750	0:26:41	0.28	0.46	0.31	0.41	0.53	0.74	1.15	1.80	#N/A
	0:33:21	0.71	1.19	0.79	1.07	1.37	1.90	2.94	4.62	#N/A
	0:40:01	1.96	3.27	2.18	2.93	3.76	5.22	8.09	12.70	#N/A
	0:46:41	2.28	3.85	2.55	3.44	4.43	6.17	9.62	15.21	#N/A
	0:53:22	2.17	3.66	2.42	3.27	4.22	5.88	9.19	14.54	#N/A
	1:00:02	1.97	3.33	2.20	2.98	3.84	5.36	8.37	13.24	#N/A
	1:06:42	1.75	2.96	1.95	2.65	3.42	4.78	7.48	11.86	#N/A
	1:13:22	1.50	2.55	1.67	2.27	2.94	4.12	6.46	10.28	#N/A
	1:20:02	1.31	2.22	1.46	1.99	2.57	3.59	5.63	8.94	#N/A
	1:26:43	1.18	2.01	1.32	1.80	2.32	3.25	5.10	8.11	#N/A
	1:33:23	0.96	1.65	1.08	1.47	1.91	2.68	4.22	6.73	#N/A
	1:40:03	0.78	1.34	0.87	1.19	1.55	2.18	3.45	5.53	#N/A
	1:46:43	0.59	1.02	0.66	0.90	1.18	1.67	2.66	4.30	#N/A
	1:53:23	0.43	0.75	0.48	0.66	0.87	1.24	1.99	3.25	#N/A
	2:00:04	0.31	0.55	0.35	0.48	0.63	0.90	1.44	2.36	#N/A
	2:06:44	0.25	0.43	0.28	0.38	0.49	0.70	1.11	1.81	#N/A
	2:13:24	0.20	0.35	0.23	0.31	0.41	0.58	0.91	1.48	#N/A
	2:20:04	0.17	0.30	0.19	0.27	0.35	0.49	0.78	1.25	#N/A
	2:26:44	0.15	0.26	0.17	0.23	0.30	0.43	0.68	1.10	#N/A
	2:33:25	0.14	0.24	0.15	0.21	0.27	0.39	0.61	0.99	#N/A
	2:40:05	0.13	0.22	0.14	0.20	0.25	0.36	0.57	0.91	#N/A
	2:46:45	0.09	0.16	0.11	0.14	0.19	0.26	0.41	0.67	#N/A
	2:53:25	0.07	0.12	0.08	0.11	0.14	0.19	0.30	0.49	#N/A
	3:00:05	0.05	0.09	0.06	0.08	0.10	0.14	0.22	0.36	#N/A
	3:06:46	0.04	0.06	0.04	0.06	0.07	0.10	0.16	0.27	#N/A
	3:13:26	0.03	0.04	0.03	0.04	0.05	0.07	0.12	0.19	#N/A
	3:20:06	0.02	0.03	0.02	0.03	0.04	0.05	0.08	0.14	#N/A
	3:26:46	0.01	0.02	0.01	0.02	0.03	0.04	0.06	0.10	#N/A
	3:33:26	0.01	0.01	0.01	0.01	0.02	0.02	0.04	0.07	#N/A
	3:40:07	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.04	#N/A
	3:46:47	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	#N/A
	3:53:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	#N/A
	4:00:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:06:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:13:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:20:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:26:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:33:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:40:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:46:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:53:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:00:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:06:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:13:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:20:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:26:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:33:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:40:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:46:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:53:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:00:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:06:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:13:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:20:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:26:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:33:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:40:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:46:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:53:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:00:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:06:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:13:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:20:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:26:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:33:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:40:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:46:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:53:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:00:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	0.00	40	0.001	0	0.000	0.00
	0.25	678	0.016	86	0.002	0.02
	0.50	1,343	0.031	339	0.008	0.03
	0.75	2,008	0.046	758	0.017	0.04
	1.00	2,673	0.061	1,343	0.031	0.04
	1.25	3,880	0.089	2,160	0.050	0.05
	1.50	5,109	0.117	3,283	0.075	0.05
	1.75	6,338	0.145	4,714	0.108	0.06
	2.00	7,567	0.174	6,452	0.148	0.07
WQCV	2.17	8,582	0.197	7,905	0.181	0.08
	2.25	9,036	0.207	8,609	0.198	0.08
	2.50	10,456	0.240	11,046	0.254	0.09
EURV	2.71	11,649	0.267	13,367	0.307	0.09
	2.75	11,876	0.273	13,837	0.318	0.09
	3.00	13,296	0.305	16,984	0.390	0.10
	3.25	14,970	0.344	20,517	0.471	0.71
	3.50	16,643	0.382	24,469	0.562	4.95
	3.75	18,317	0.421	28,839	0.662	6.43
100-YR	3.91	19,388	0.445	31,855	0.731	6.54
SPILLWAY CREST	4.00	19,991	0.459	33,627	0.772	6.61

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

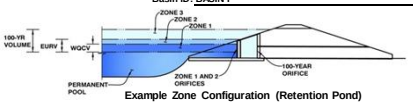
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: SADDLEHORN RANCH FILING NO. 1

Basin ID: BASIN I



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	38.04	acres
Watershed Length =	1,900	ft
Watershed Slope =	0.053	ft/ft
Watershed Imperviousness =	17.00%	percent
Percentage Hydrologic Soil Group A =	91.5%	percent
Percentage Hydrologic Soil Group B =	8.5%	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) =	0.325	acre-feet
Excess Urban Runoff Volume (EURV) =	0.558	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.372	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.508	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.687	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	1.038	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	1.575	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	2.423	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.346	acre-feet
Approximate 5-yr Detention Volume =	0.473	acre-feet
Approximate 10-yr Detention Volume =	0.630	acre-feet
Approximate 25-yr Detention Volume =	0.822	acre-feet
Approximate 50-yr Detention Volume =	0.990	acre-feet
Approximate 100-yr Detention Volume =	1.356	acre-feet

Optional User Override 1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
	inches

Stage-Storage Calculation

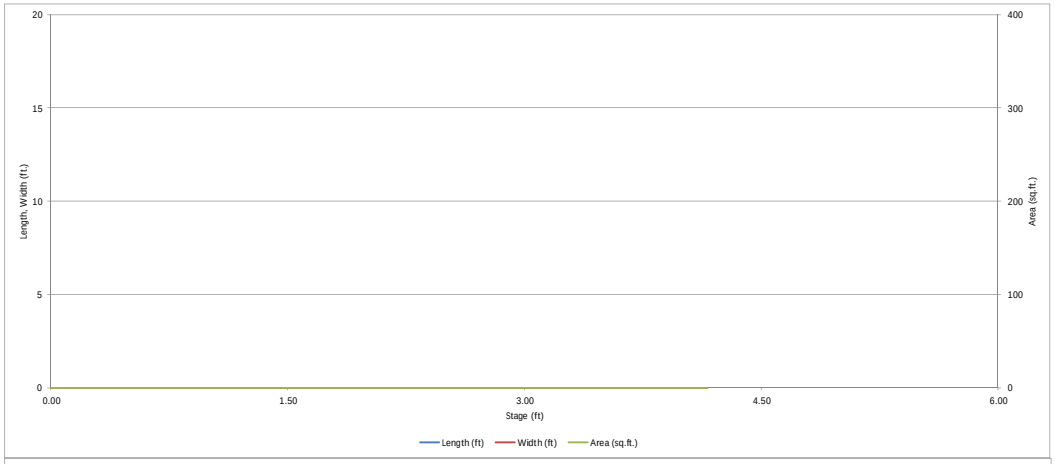
Zone 1 Volume (WQCV) =	0.325	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.233	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.797	acre-feet
Total Detention Basin Volume =	1.356	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

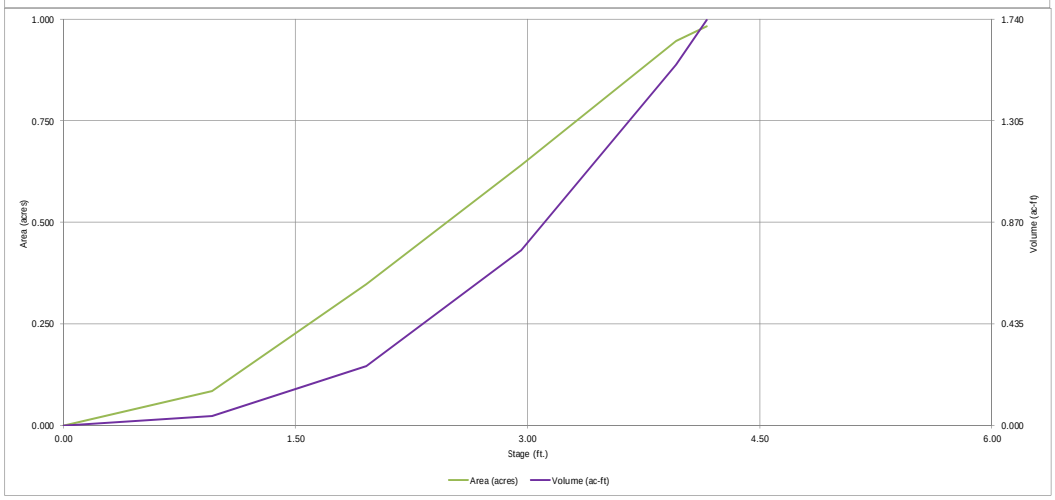
Depth Increment = ft

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)
6705.4									
Top of Micropool	--	0.00	--	--	--	0	0.000		
6706	--	0.96	--	--	--	3,720	0.085	1,748	0.040
6707	--	1.96	--	--	--	15,128	0.347	11,059	0.254
6708	--	2.96	--	--	--	27,871	0.640	32,709	0.751
6709	--	3.96	--	--	--	41,167	0.945	67,228	1.543
6709.2	--	4.16	--	--	--	42,765	0.982	75,621	1.736

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



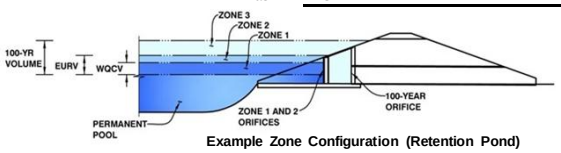


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: SADDLEHORN RANCH FILING NO. 1

Basin ID: BASIN I



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.15	0.325	Orifice Plate
Zone 2 (EURV)	2.64	0.233	Orifice Plate
Zone 3 (100-year)	3.76	0.797	Weir&Pipe (Restrict)
		1.356	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth = N/A ft (distance below the filtration media surface)

Underdrain Orifice Diameter = N/A inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = N/A ft^2

Underdrain Orifice Centroid = N/A feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 2.66 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = N/A inches

Orifice Plate: Orifice Area per Row = N/A inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft^2

Elliptical Half-Width = N/A feet

Elliptical Slot Centroid = N/A feet

Elliptical Slot Area = N/A ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	1.83					
Orifice Area (sq. inches)	2.00	1.00	0.12					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.00	N/A	feet
Over Flow Weir Slope Length =	4.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.34	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	11.20	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.60	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	18.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.77	N/A	ft^2
Outlet Orifice Centroid =	0.75	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 3.83 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 30.00 feet

Spillway End Slopes = 4.00 H:V

Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 0.58 feet

Stage at Top of Freeboard = 5.41 feet

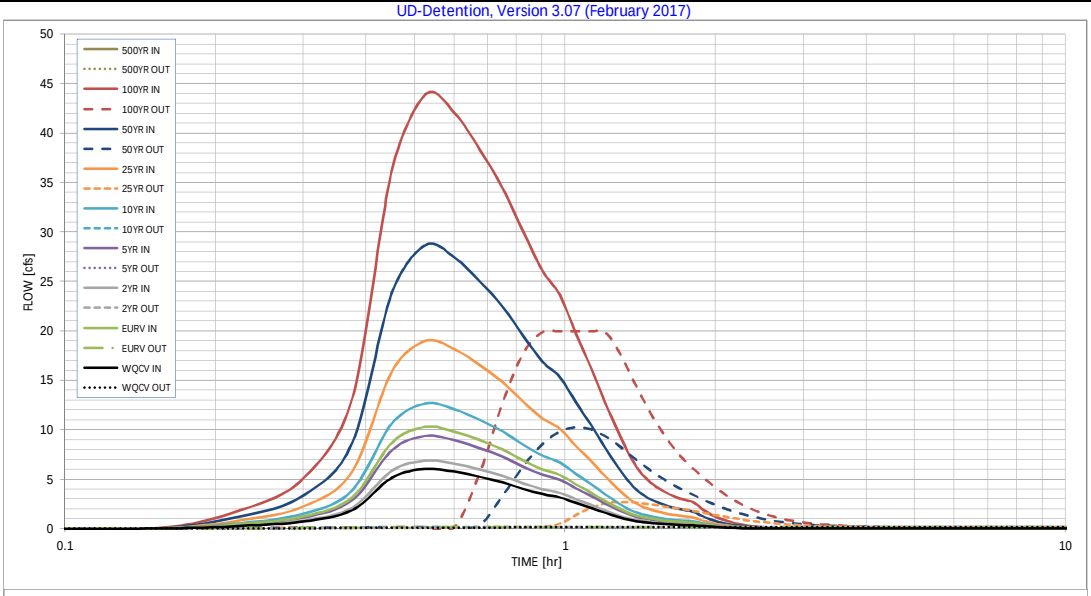
Basin Area at Top of Freeboard = 0.98 acres

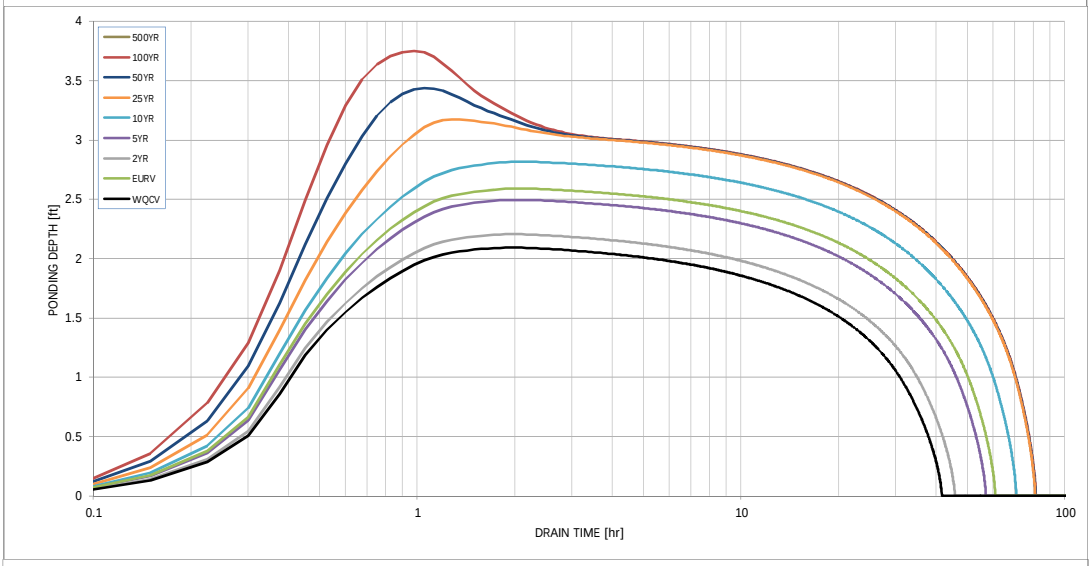
Routed Hydrograph Results

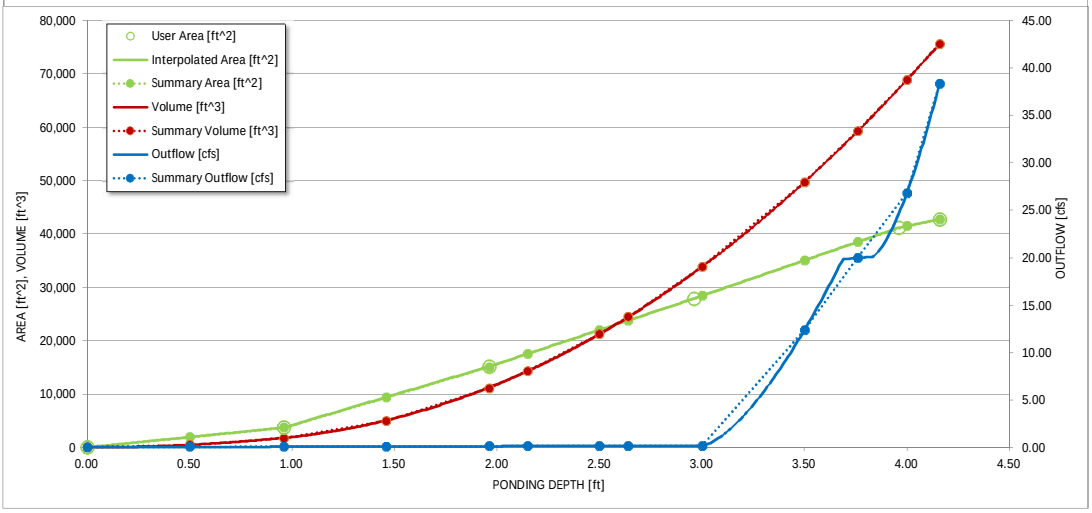
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.325	0.558	0.372	0.508	0.687	1.038	1.575	2.423	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.325	0.558	0.371	0.508	0.687	1.037	1.574	2.423	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.01	0.03	0.09	0.29	0.60	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.1	0.3	1.2	3.4	10.9	22.8	0.0
Peak Inflow Q (cfs) =	6.0	10.3	6.9	9.4	12.6	19.0	28.7	43.9	#N/A
Peak Outflow Q (cfs) =	0.1	0.2	0.1	0.1	0.2	2.7	10.2	20.0	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.1	0.8	0.9	0.9	#N/A
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.9	1.8	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	38	56	42	52	65	73	70	67	#N/A
Time to Drain 99% of Inflow Volume (hours) =	40	59	44	55	68	77	76	75	#N/A
Maximum Ponding Depth (ft) =	2.09	2.59	2.21	2.50	2.82	3.17	3.44	3.75	#N/A
Area at Maximum Ponding Depth (acres) =	0.39	0.53	0.42	0.50	0.60	0.70	0.78	0.88	#N/A
Maximum Volume Stored (acre-ft) =	0.305	0.534	0.349	0.482	0.658	0.892	1.085	1.352	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs UD-Detention, Version 3.07 (February 2017)

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
4.51 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:04:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:09:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:13:32	0.27	0.46	0.31	0.42	0.56	0.83	1.24	1.87	#N/A
1.109	0:18:02	0.73	1.23	0.83	1.12	1.51	2.25	3.38	5.14	#N/A
	0:22:33	1.87	3.16	2.12	2.88	3.87	5.78	8.68	13.19	#N/A
	0:27:04	5.13	8.68	5.84	7.92	10.64	15.89	23.83	36.20	#N/A
	0:31:34	6.04	10.29	6.88	9.37	12.64	18.99	28.67	43.89	#N/A
	0:36:05	5.75	9.81	6.56	8.93	12.06	18.15	27.43	42.06	#N/A
	0:40:35	5.23	8.93	5.97	8.13	10.98	16.52	24.97	38.28	#N/A
	0:45:06	4.66	7.97	5.31	7.25	9.81	14.79	22.40	34.40	#N/A
	0:49:37	4.00	6.88	4.57	6.25	8.47	12.81	19.44	29.96	#N/A
	0:54:07	3.49	5.99	3.99	5.45	7.38	11.14	16.89	26.07	#N/A
	0:58:38	3.16	5.43	3.61	4.94	6.69	10.10	15.32	23.61	#N/A
	1:03:08	2.59	4.47	2.96	4.07	5.52	8.37	12.75	19.71	#N/A
	1:07:39	2.10	3.65	2.41	3.31	4.51	6.87	10.49	16.28	#N/A
	1:12:10	1.60	2.80	1.84	2.54	3.48	5.33	8.20	12.80	#N/A
	1:16:40	1.18	2.08	1.36	1.89	2.59	4.00	6.22	9.79	#N/A
	1:21:11	0.86	1.51	0.99	1.37	1.88	2.90	4.55	7.23	#N/A
	1:25:41	0.67	1.17	0.77	1.06	1.45	2.23	3.47	5.47	#N/A
	1:30:12	0.55	0.96	0.63	0.88	1.20	1.83	2.83	4.44	#N/A
	1:34:43	0.47	0.82	0.54	0.74	1.01	1.55	2.39	3.74	#N/A
	1:39:13	0.41	0.72	0.47	0.65	0.89	1.36	2.09	3.27	#N/A
	1:43:44	0.37	0.65	0.43	0.59	0.80	1.22	1.88	2.93	#N/A
	1:48:14	0.35	0.60	0.40	0.54	0.74	1.13	1.73	2.69	#N/A
	1:52:45	0.25	0.44	0.29	0.40	0.54	0.83	1.27	1.99	#N/A
	1:57:16	0.19	0.32	0.21	0.29	0.40	0.61	0.93	1.44	#N/A
	2:01:46	0.14	0.24	0.16	0.21	0.29	0.44	0.68	1.06	#N/A
	2:06:17	0.10	0.17	0.11	0.16	0.21	0.33	0.51	0.79	#N/A
	2:10:47	0.07	0.12	0.08	0.11	0.15	0.24	0.37	0.57	#N/A
	2:15:18	0.05	0.09	0.06	0.08	0.11	0.17	0.26	0.41	#N/A
	2:19:49	0.03	0.06	0.04	0.06	0.08	0.12	0.19	0.30	#N/A
	2:24:19	0.02	0.04	0.03	0.04	0.05	0.08	0.13	0.21	#N/A
	2:28:50	0.01	0.02	0.02	0.02	0.03	0.05	0.08	0.13	#N/A
	2:33:20	0.01	0.01	0.01	0.01	0.01	0.02	0.04	0.07	#N/A
	2:37:51	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	#N/A
	2:42:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	#N/A
	2:46:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:51:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:55:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:00:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:04:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:09:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:13:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:18:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:22:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:27:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:31:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:36:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:40:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:45:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:50:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:54:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:59:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:03:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:08:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:12:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:17:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:21:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:26:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:30:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:35:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:39:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:44:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:48:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:53:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:57:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:02:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:06:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:11:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:15:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:20:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:24:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]
	0.00	0	0.000	0	0.000	0.00
	0.50	1,899	0.044	465	0.011	0.05
	0.96	3,681	0.085	1,748	0.040	0.07
	1.46	9,310	0.214	4,978	0.114	0.10
	1.96	15,014	0.345	11,059	0.254	0.13
WQCV	2.15	17,549	0.403	14,314	0.329	0.14
	2.50	22,009	0.505	21,236	0.488	0.15
EURV	2.64	23,793	0.546	24,443	0.561	0.16
	3.00	28,403	0.652	33,834	0.777	0.17
	3.50	35,051	0.805	49,698	1.141	12.38
100-YR	3.76	38,508	0.884	59,260	1.360	19.97
	4.00	41,487	0.952	68,881	1.581	26.83
	4.16	42,765	0.982	75,621	1.736	38.35

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: SADDLEHORN RANCH - FILING 1 - POND G

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

User Input: Watershed Characteristics

Watershed Slope =	0.015	ft/ft
Watershed Length =	3700	ft
Watershed Area =	33.57	acres
Watershed Imperviousness =	18.6%	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

Location for 1-hr Rainfall Depths (use dropdown): User Input

WQCV Treatment Method = Extended Detention

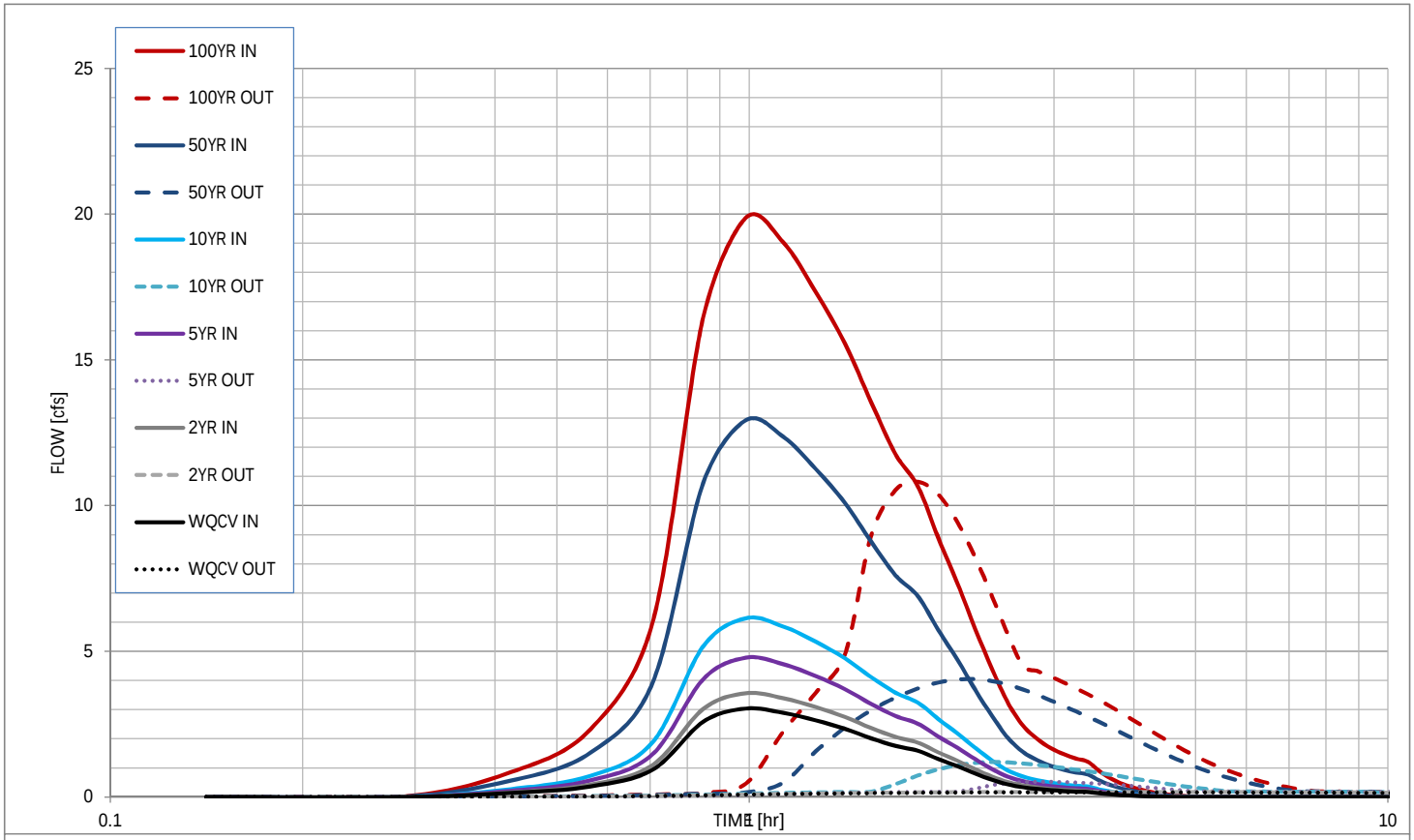
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	0	0.00	0.00
0.72	7,201	0.72	0.08
1.72	20,625	1.72	0.19
2.72	27,717	2.72	4.52
3.72	31,904	3.72	34.41
4.72	36,248	4.72	151.29
4.92	37,319	4.92	184.37

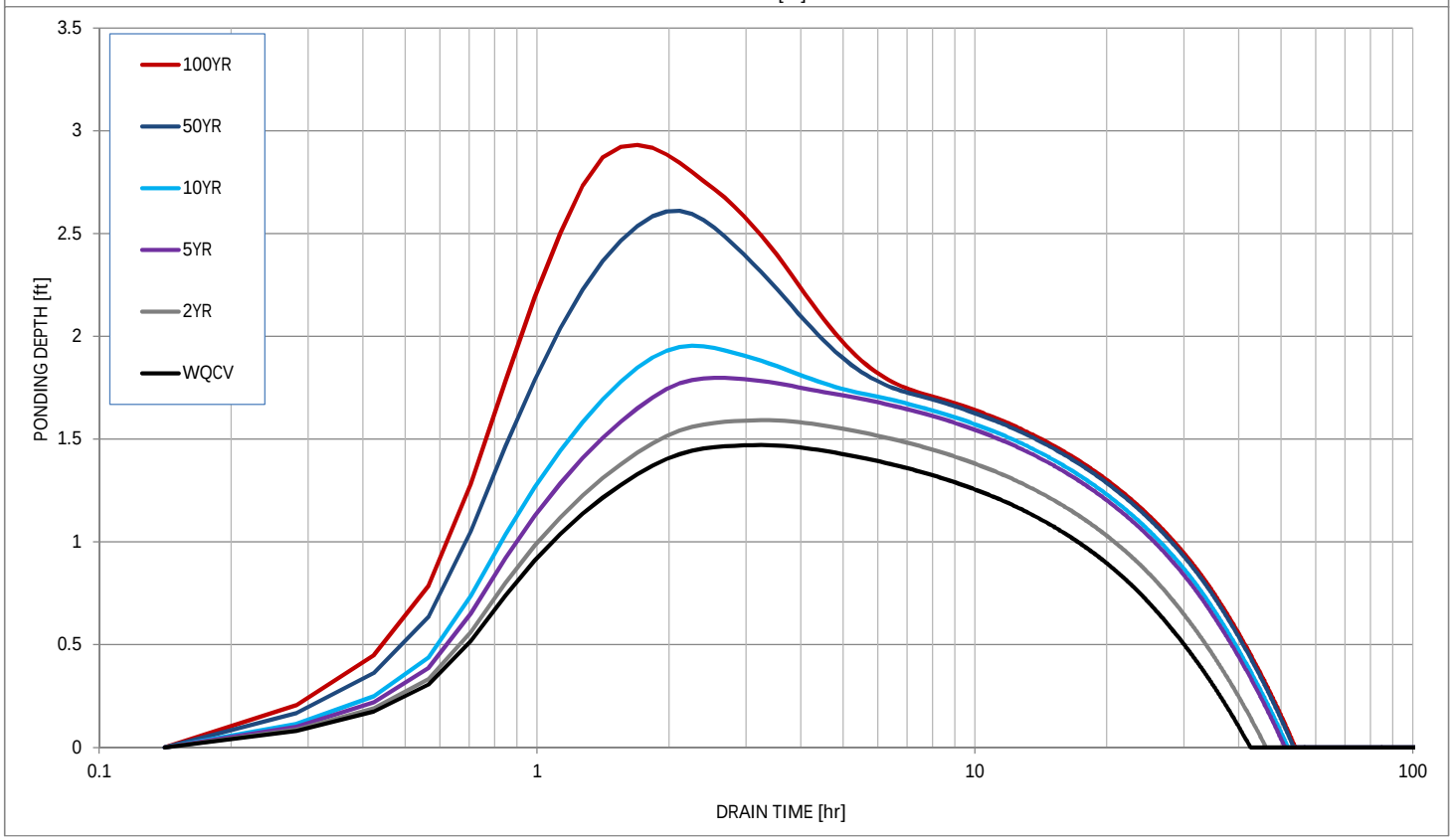
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	1.19	1.50	1.75	2.25	2.52	in
Calculated Runoff Volume =	0.307	0.361	0.487	0.627	1.331	2.058	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	0.307	0.361	0.486	0.626	1.331	2.057	acre-ft
Time to Drain 97% of Inflow Volume =	35.6	38.6	42.2	41.8	38.8	35.6	hours
Time to Drain 99% of Inflow Volume =	38.6	41.8	46.0	46.0	45.1	43.4	hours
Maximum Ponding Depth =	1.47	1.59	1.80	1.95	2.61	2.93	ft
Maximum Ponded Area =	0.40	0.43	0.49	0.51	0.62	0.66	acres
Maximum Volume Stored =	0.269	0.320	0.415	0.492	0.862	1.069	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: SADDLEHORN RANCH - FILING 1 - POND H

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

User Input: Watershed Characteristics

Watershed Slope =	0.010	ft/ft
Watershed Length =	1800	ft
Watershed Area =	21.16	acres
Watershed Imperviousness =	17.0%	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

Location for 1-hr Rainfall Depths (use dropdown): User Input

WQCV Treatment Method = Extended Detention

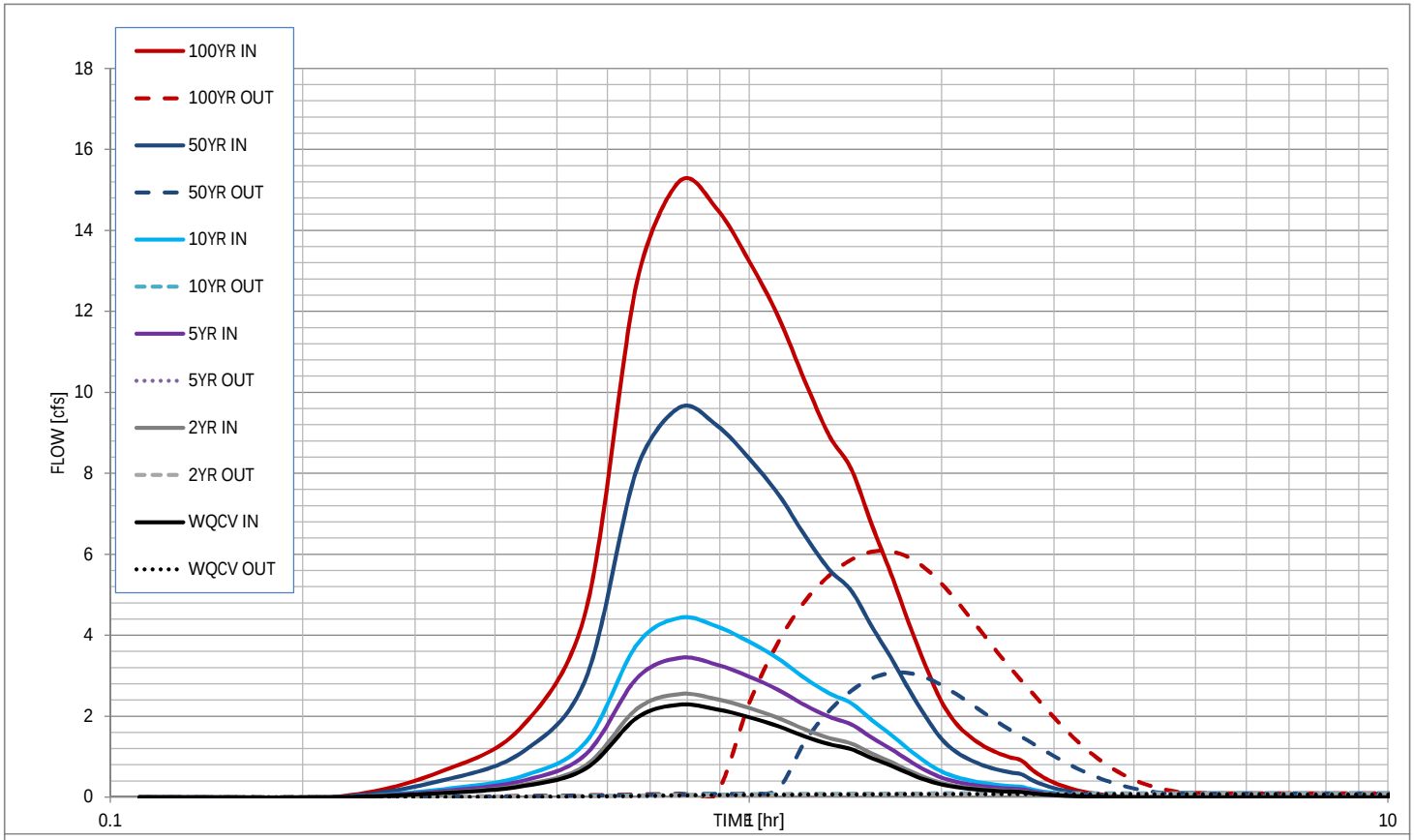
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	40	0.00	0.00
1.00	2,700	1.00	0.04
2.00	7,616	2.00	0.07
3.00	13,296	3.00	0.10
4.00	19,991	4.00	6.61

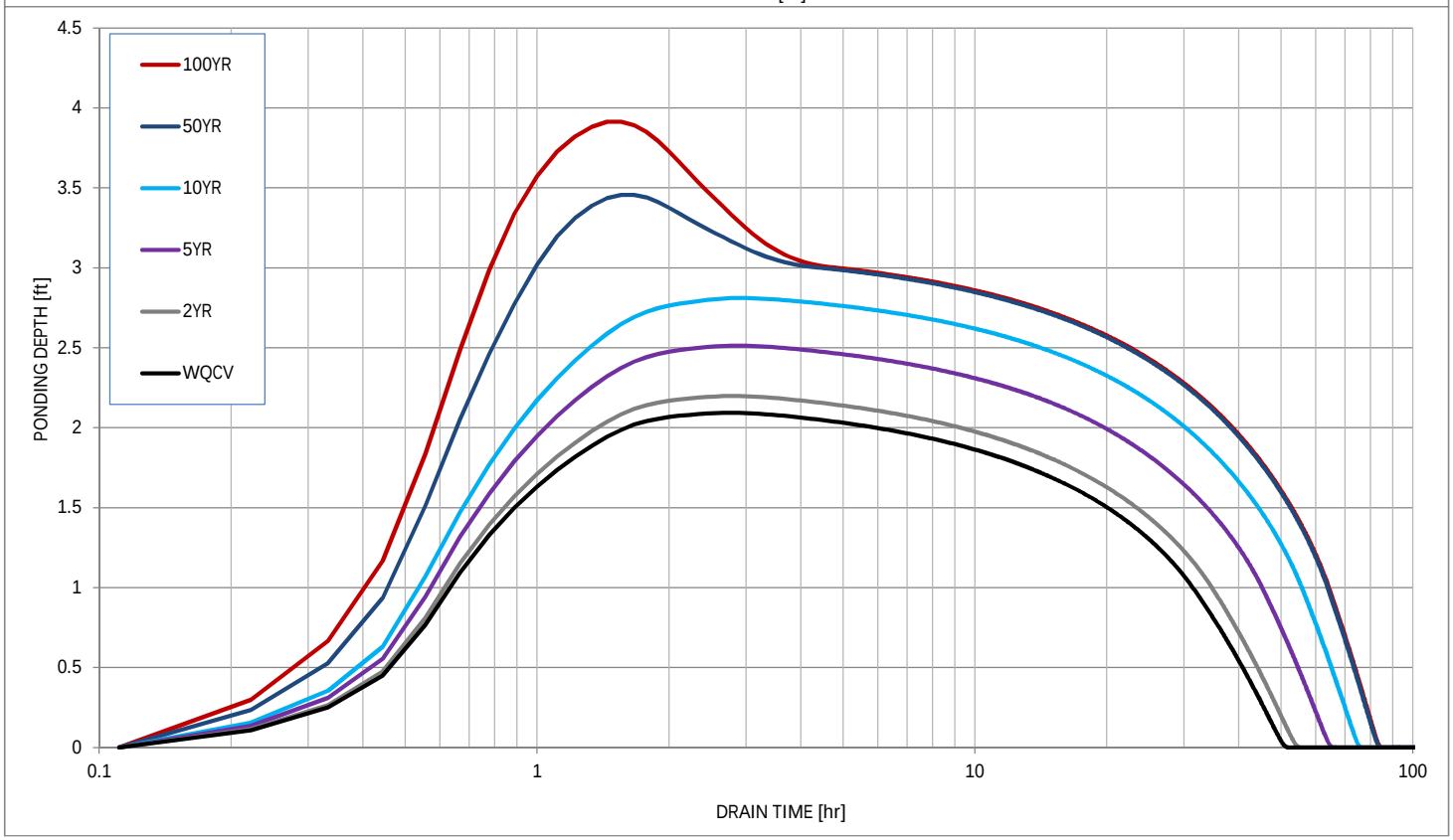
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	1.19	1.50	1.75	2.25	2.52	in
Calculated Runoff Volume =	0.181	0.202	0.274	0.353	0.775	1.231	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	0.180	0.201	0.273	0.353	0.774	1.231	acre-ft
Time to Drain 97% of Inflow Volume =	42.7	45.6	54.7	63.9	66.6	62.7	hours
Time to Drain 99% of Inflow Volume =	46.1	49.2	58.9	68.6	73.6	71.4	hours
Maximum Ponding Depth =	2.09	2.20	2.51	2.81	3.46	3.91	ft
Maximum Ponded Area =	0.19	0.20	0.24	0.28	0.37	0.45	acres
Maximum Volume Stored =	0.166	0.186	0.256	0.333	0.543	0.731	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: SADDLEHORN RANCH - FILING 1 - POND I

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

User Input: Watershed Characteristics

Watershed Slope =	0.053	ft/ft
Watershed Length =	1900	ft
Watershed Area =	38.04	acres
Watershed Imperviousness =	17.0%	percent
Percentage Hydrologic Soil Group A =	91.5%	percent
Percentage Hydrologic Soil Group B =	8.5%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent

Location for 1-hr Rainfall Depths (use dropdown): User Input

WQCV Treatment Method = Extended Detention

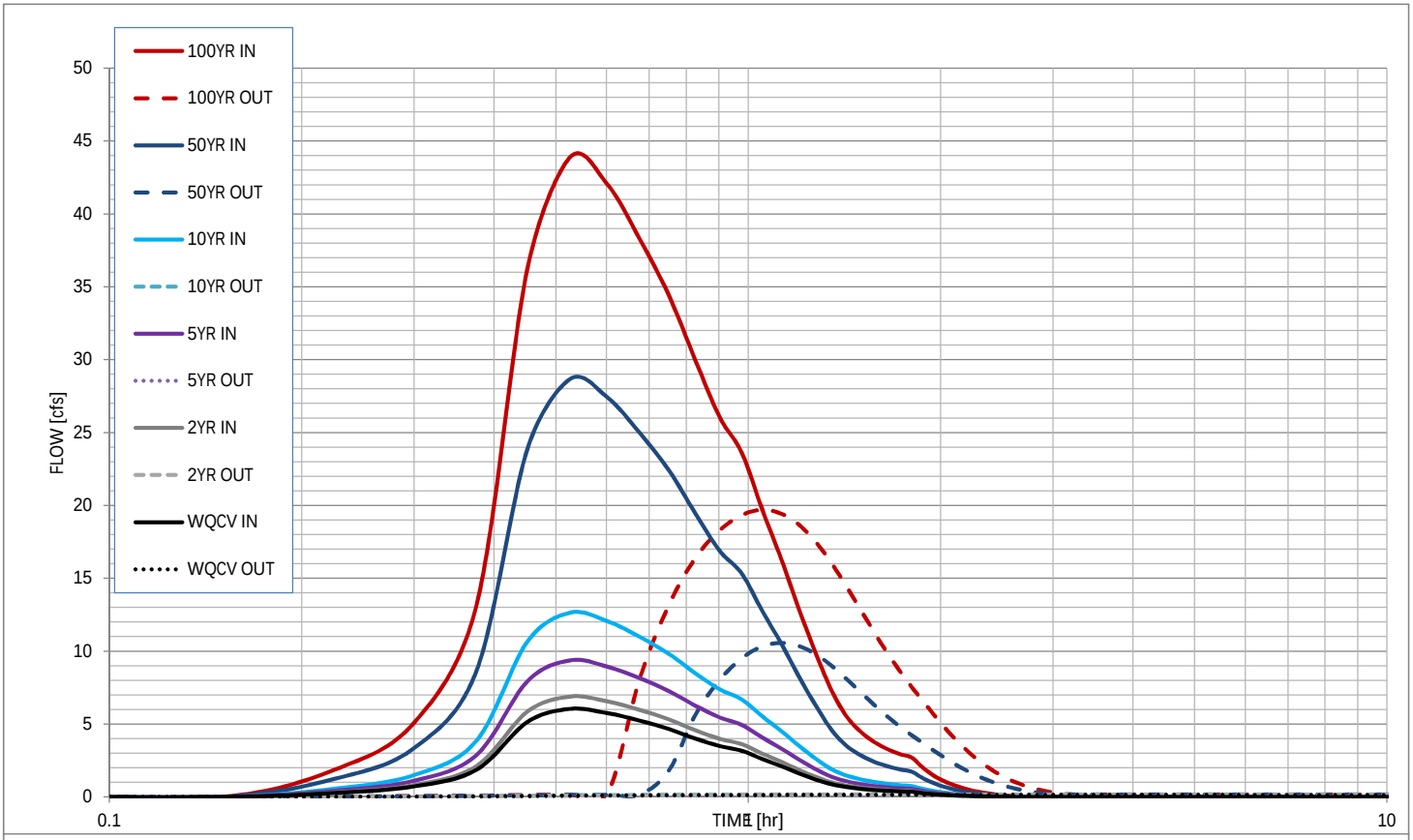
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

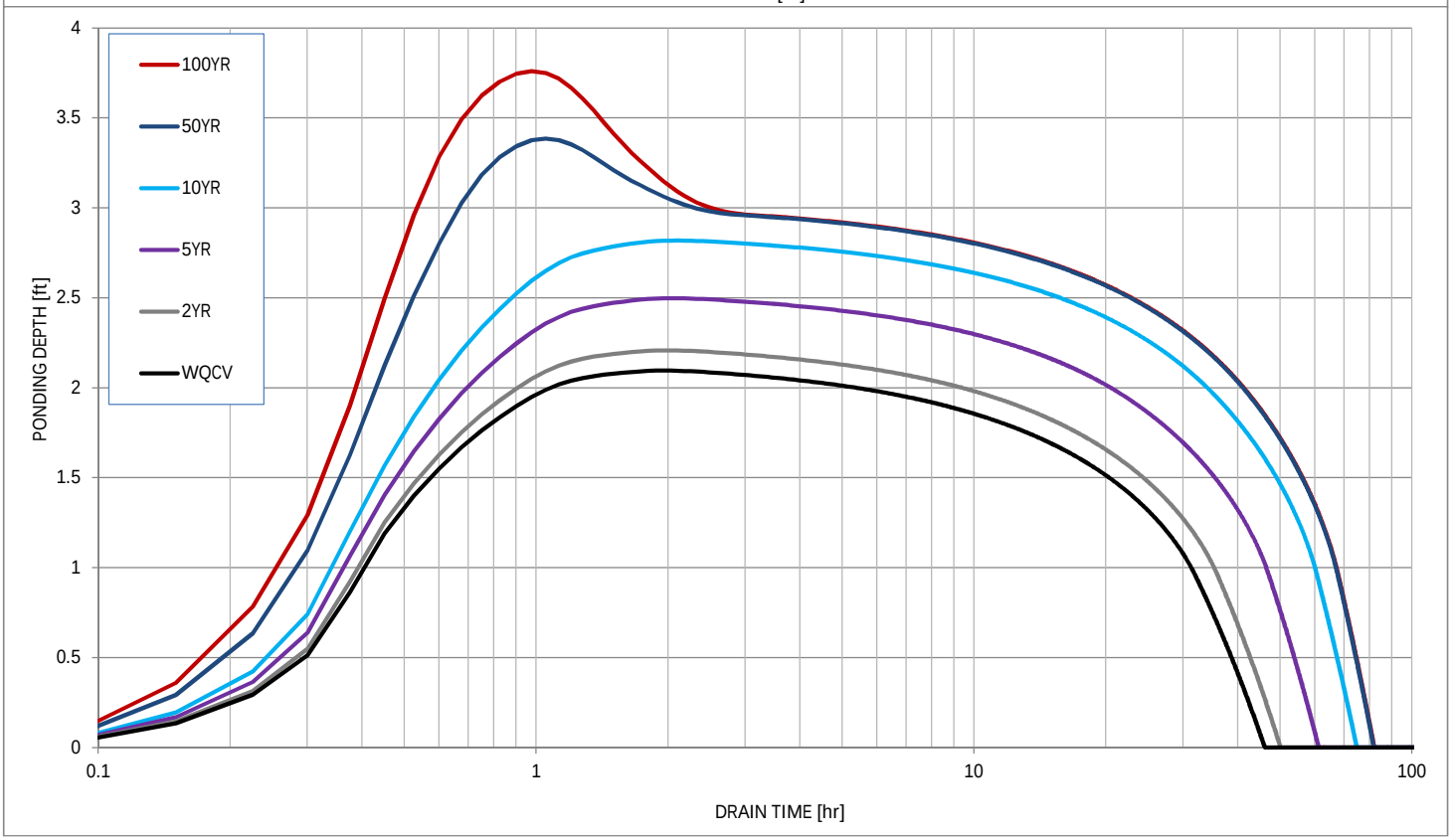
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	0	0.00	0.00
0.96	3,720	0.96	0.07
1.96	15,128	1.96	0.13
2.96	27,871	2.96	0.17
3.96	41,167	3.96	24.61
4.16	42,765	4.16	38.35

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	0.53	1.19	1.50	1.75	2.25	2.52	in
Calculated Runoff Volume =	0.325	0.372	0.508	0.687	1.575	2.423	acre-ft
OPTIONAL Override Runoff Volume =							acre-ft
Inflow Hydrograph Volume =	0.325	0.371	0.508	0.687	1.574	2.423	acre-ft
Time to Drain 97% of Inflow Volume =	39.2	42.8	52.7	64.9	66.7	63.1	hours
Time to Drain 99% of Inflow Volume =	42.2	45.9	56.4	69.1	73.1	71.2	hours
Maximum Ponding Depth =	2.10	2.21	2.50	2.82	3.39	3.76	ft
Maximum Ponded Area =	0.39	0.42	0.50	0.60	0.77	0.88	acres
Maximum Volume Stored =	0.306	0.350	0.484	0.662	1.047	1.358	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





APPENDIX E

REFERENCE MATERIALS

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

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

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

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

PUBLIC NOTIFICATION

FLOODING SOURCE	LOCATION OF REFERENCED ELEVATION	BFE (FEET NGVD)		MAP PANEL NUMBER(S)
		EFFECTIVE	REVISED	
Haegler Ranch Tributary 2	Approximately 310 feet upstream of confluence with Geick Ranch West Tributary	None	6,735	08041C0575 F
	Approximately 3,140 feet upstream of confluence with Geick Ranch West Tributary	None	6,779	08041C0575 F
Haegler Ranch Tributary 3	Approximately 8,100 feet downstream of Curtis Road	None	6,672	08041C0575 F
	Approximately 300 feet upstream of Curtis Road	None	6,769	08041C0575 F
Haegler Ranch Tributary 4	Approximately 4,000 feet downstream of Curtis Road	None	6,688	08041C0575 F
	Approximately 300 feet upstream of Curtis Road	None	6,758	08041C0575 F

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Kevin C Long

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

102929 101104080587 102IAC

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

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

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

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

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

*National Geodetic Vertical Datum, rounded to nearest whole foot

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

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

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

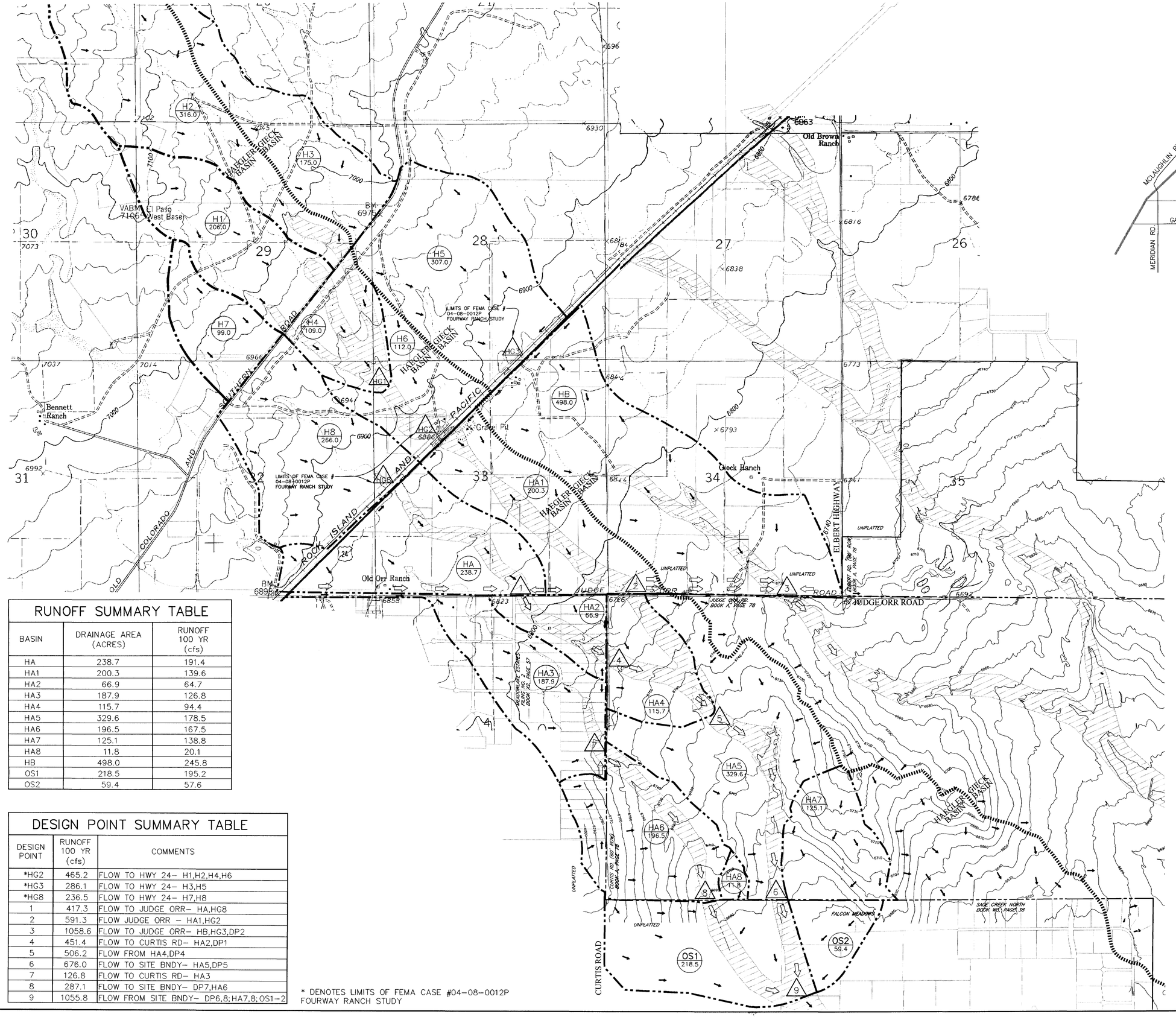
The Honorable Chuck Brown
Chairman, El Paso County
Board of Commissioners
27 Vermijo Avenue
Colorado Springs, CO 80903-2208

Table 3. Summary of Discharges

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

1 Data Not Available

REVISED TO
REFLECT LOMR
DATED FEB 16 2005



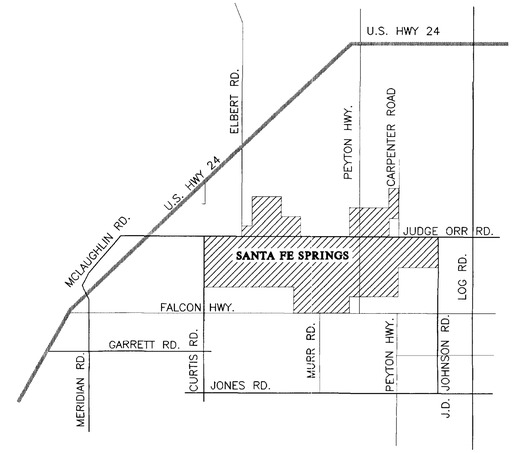
RUNOFF SUMMARY TABLE

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

DESIGN POINT SUMMARY TABLE

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

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

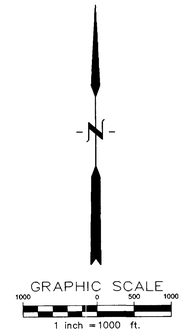


VICINTY MAP

1"=5000'

LEGEND

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



NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION

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

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

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

DATE: 05/21/04

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

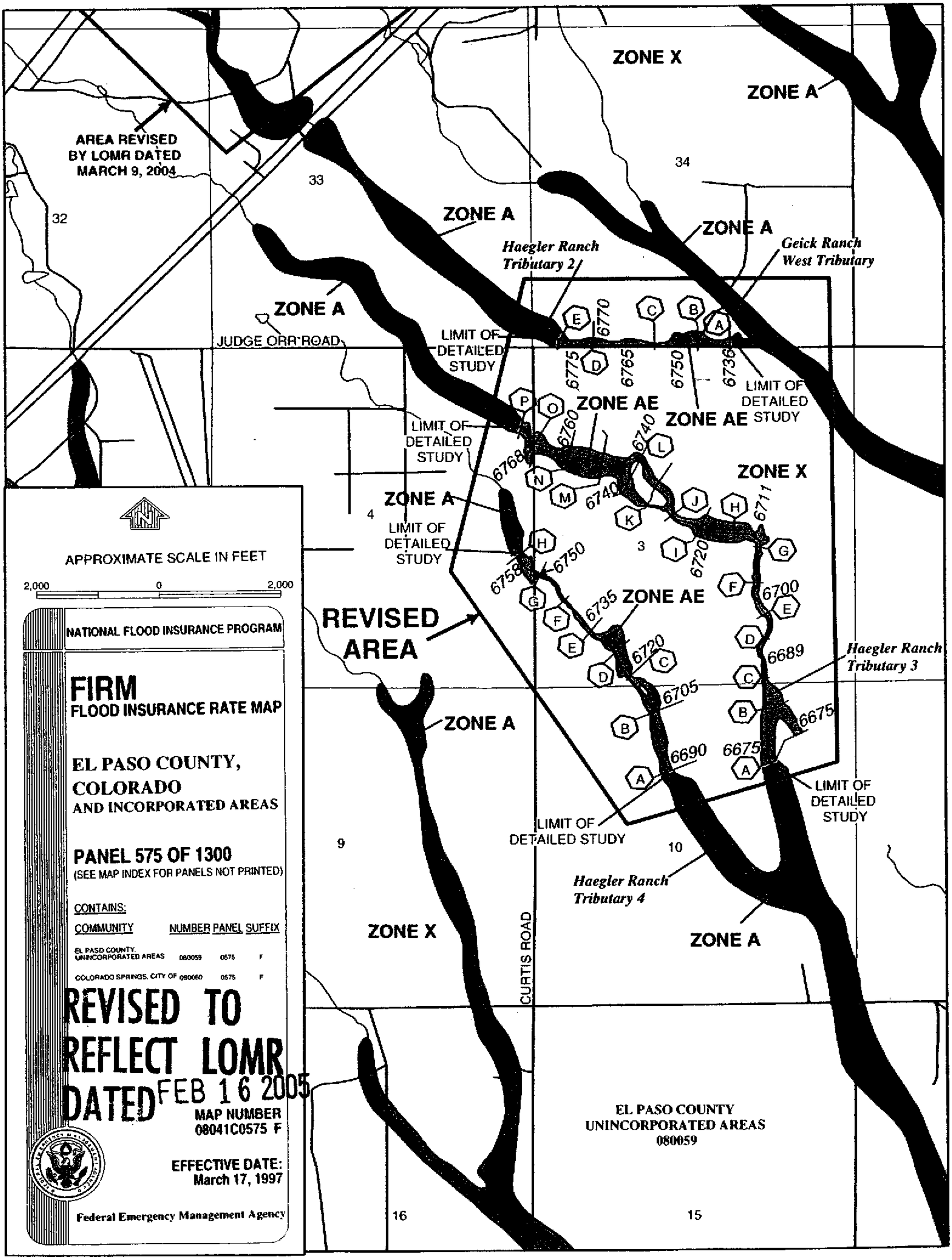
REALTY DEVELOPMENT SERVICES
25 NORTH TEJON
SUITE 300

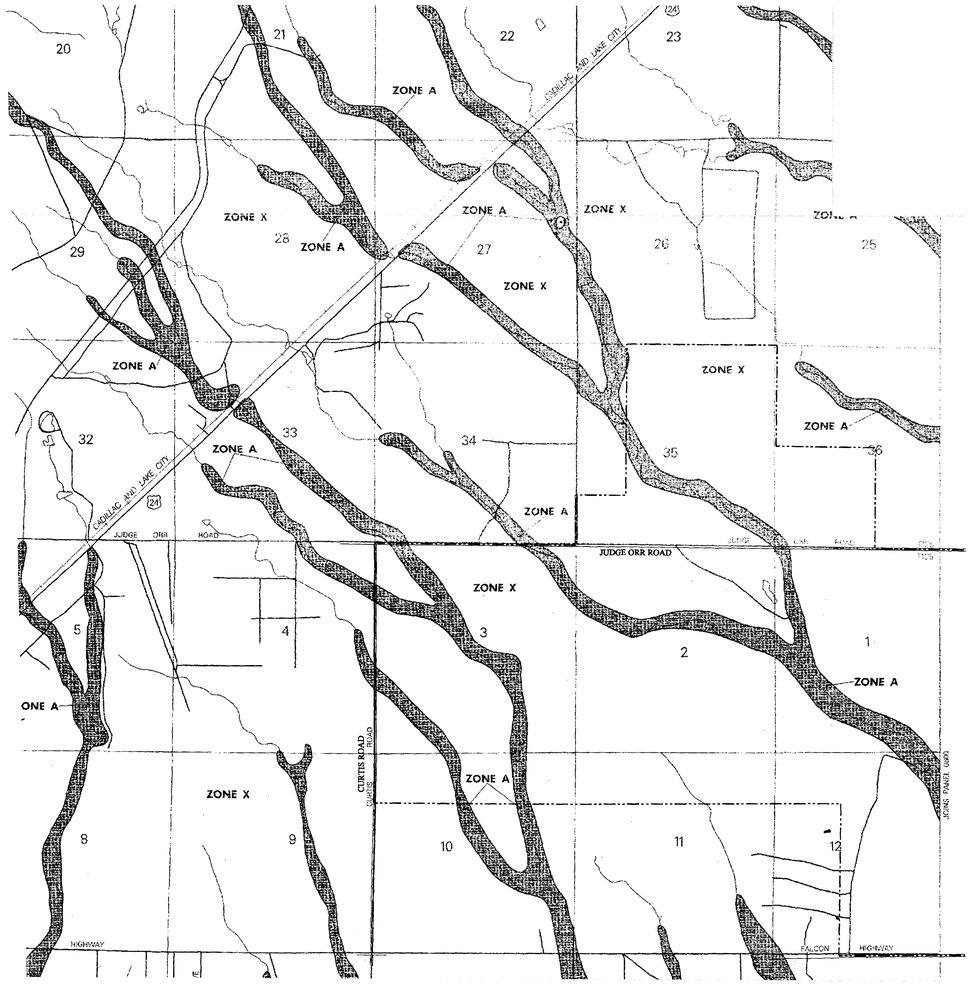
EXHIBIT 1
HYDROLOGIC SUBBASIN MAP

PROJECT NO.
6005–0001

FILENAME
01DR_HIST.DWG

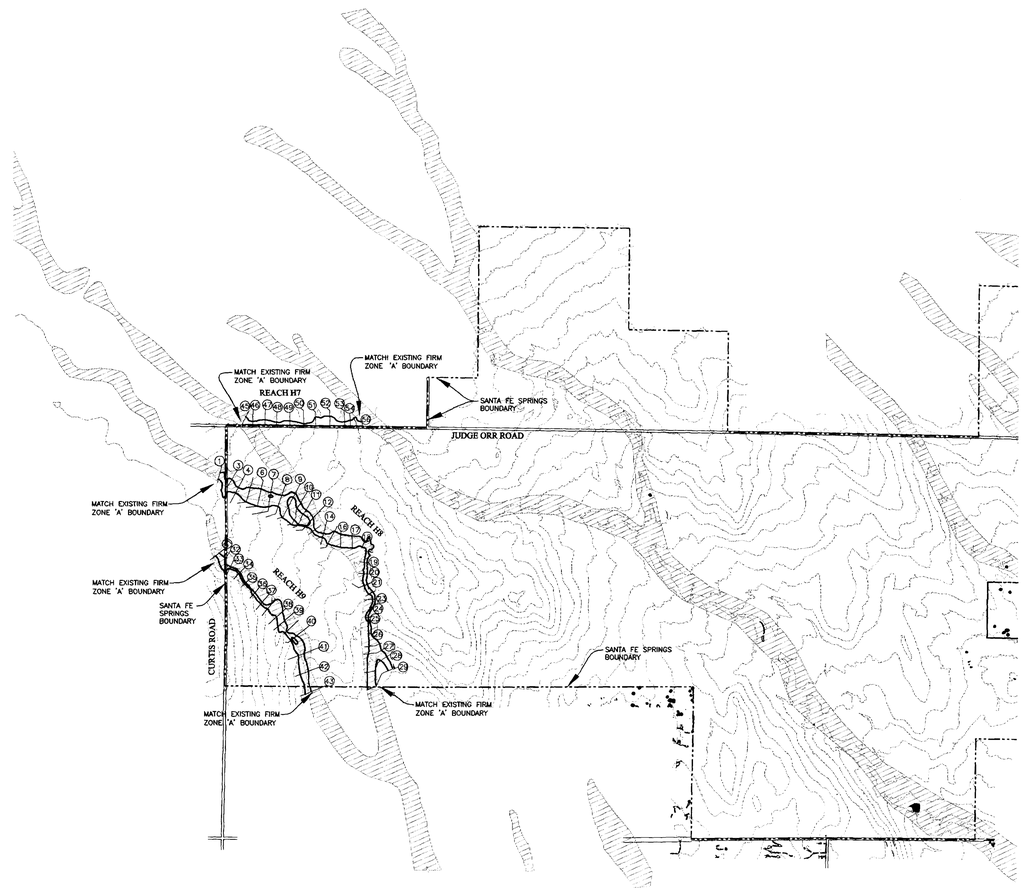
DRAWING NO.
EXH. 1


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

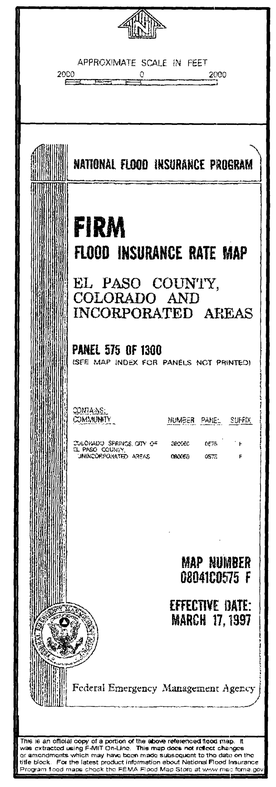


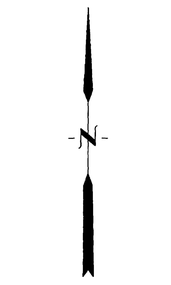
EFFECTIVE CONDITION

MAP PANEL NO. 0575F



REVISED EFFECTIVE CONDITION





REVISION				
NO.	DESCRIPTION	REV BY	CKD BY	DATE

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

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

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

DATE: 05/21/04

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

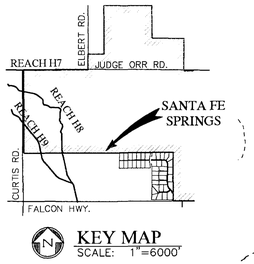
REALTY DEVELOPMENT SERVICES
25 NORTH TEJON
SUITE 300

EXHIBIT 2
REVISED FLOOD INSURANCE RATE MAP

PROJECT NO.
6005-0001

FILENAME
RATE_MAP_LOMR.DWG

DRAWING NO.
EXH. 2



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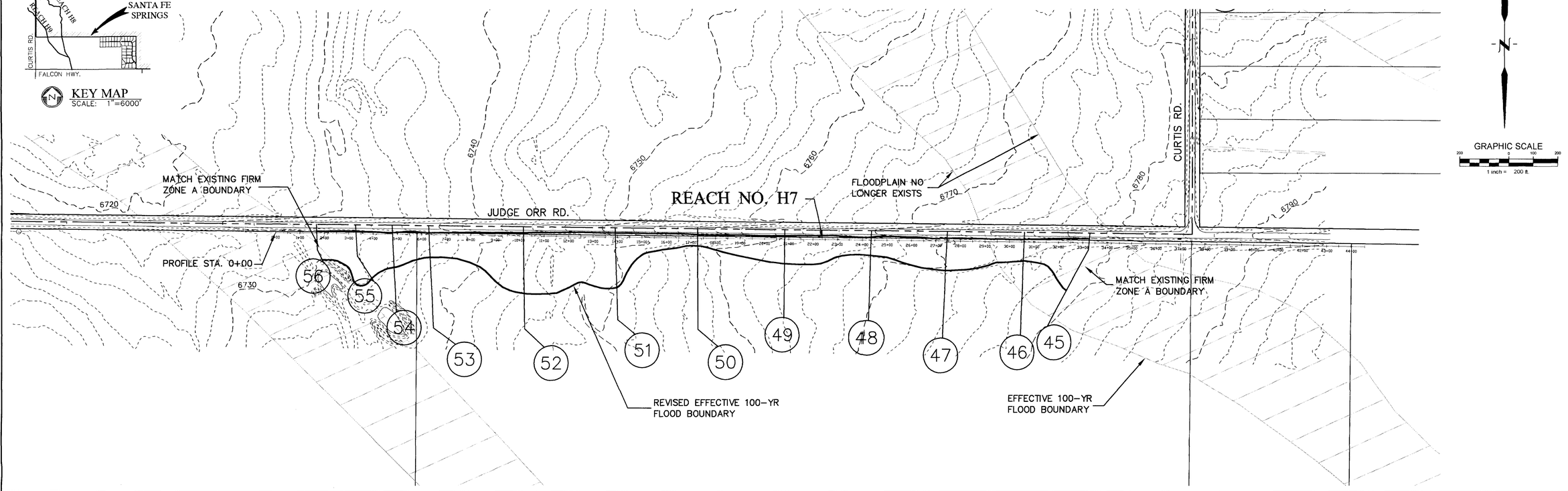

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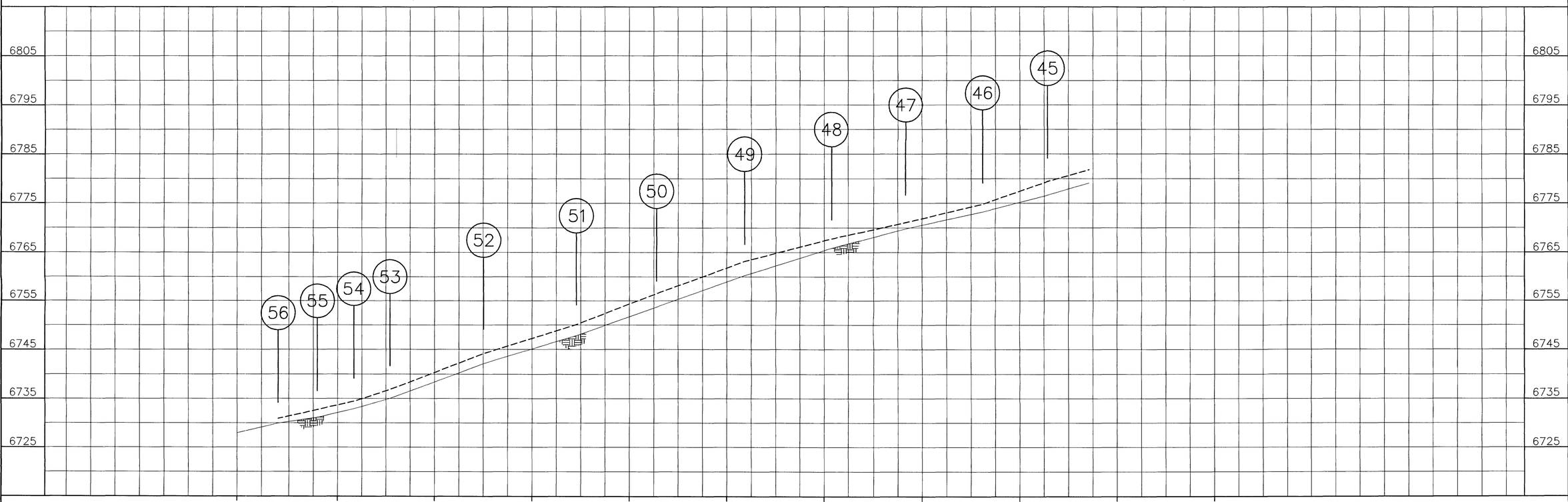

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	REVISION			

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COLORADO SPRINGS, CO 80918
PHONE (719) 264-1560
FAX (719) 264-1193

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

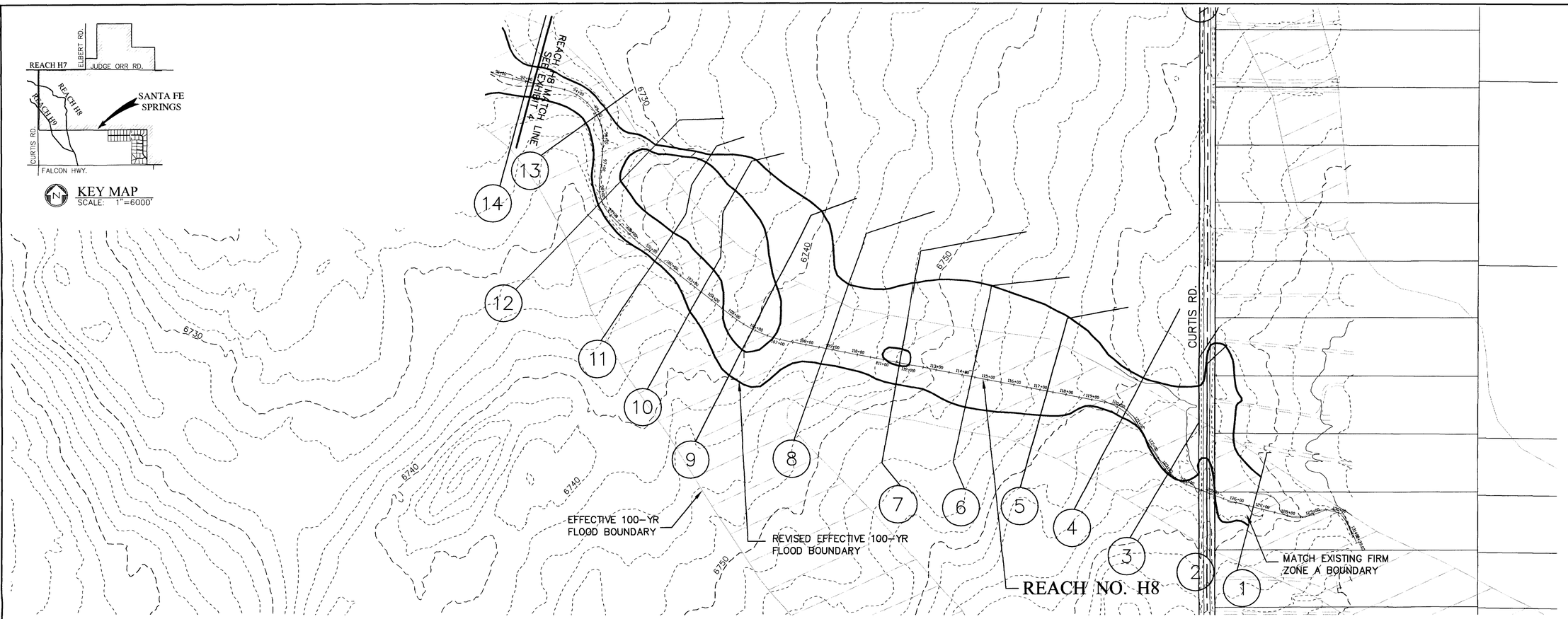
SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO COUNTY

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

EXHIBIT 3 100-YEAR FLOODPLAIN BOUNDARY & PROFILE WORKMAP

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

KEY MAP
SCALE: 1"=6000'



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1 inch = 200 ft.

REVISION				
NO.	DESCRIPTION	REV BY	CKD BY	DATE

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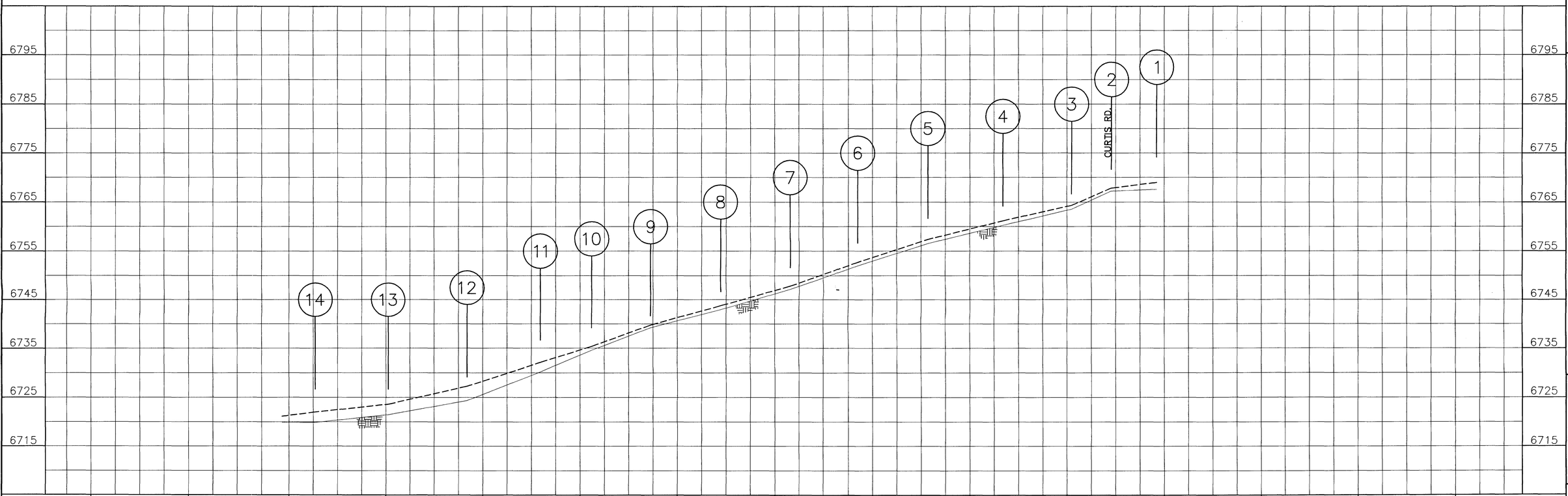

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DRAWN BY: KMV
DESIGNED BY: RLS
CHECKED BY: RLS
DATE: 06/04/04

SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO COUNTY

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

EXHIBIT 4 100-YEAR FLOODPLAIN BOUNDARY & PROFILE WORKMAP

PROJECT NO.
6005.0001

FILENAME
PP-LOMR.DWG

DRAWING NO.
EXH. 4

KEY MAP
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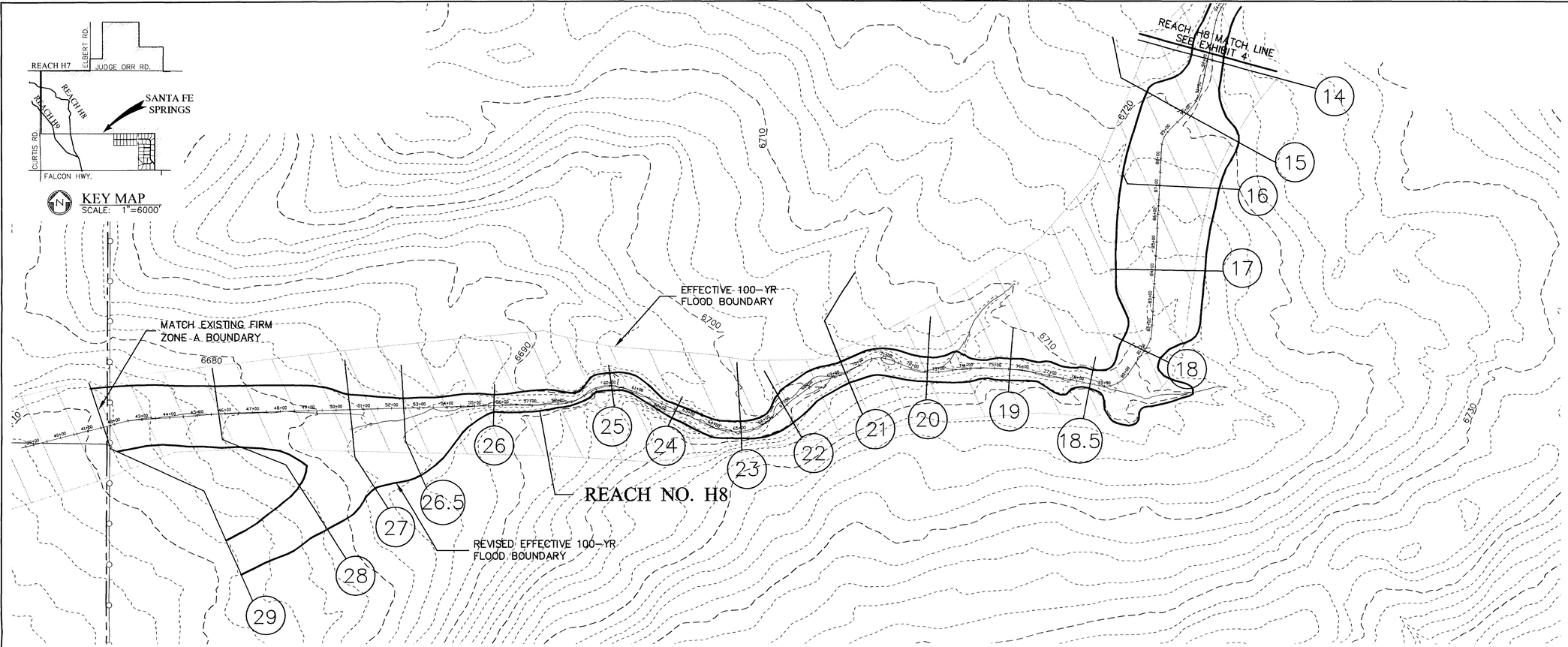

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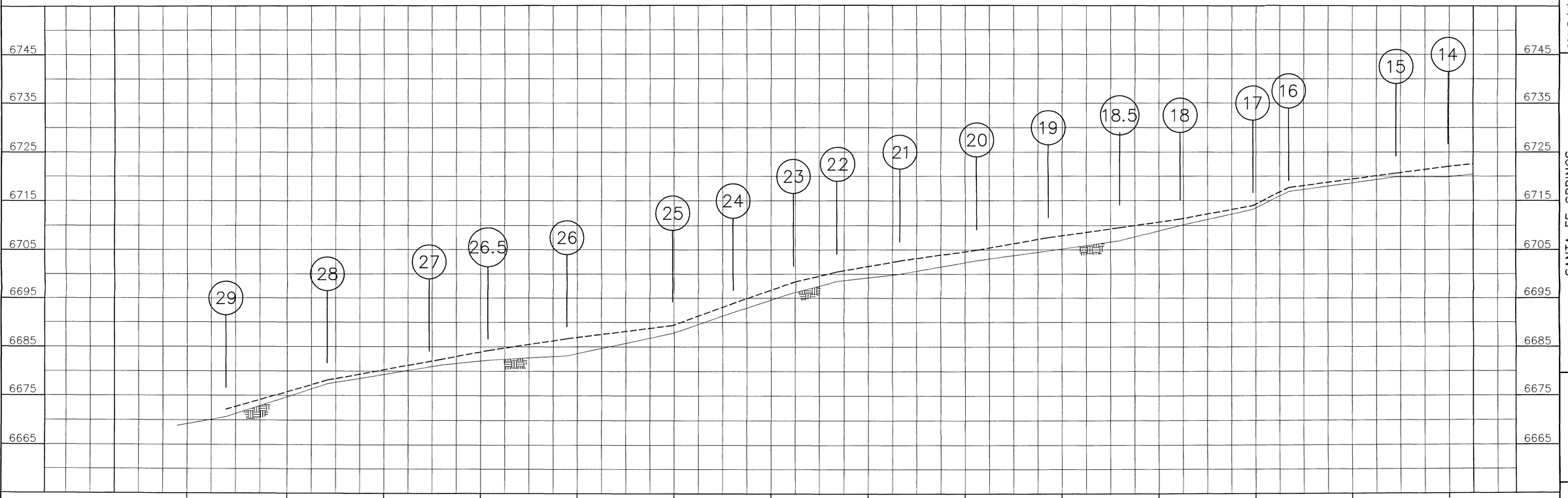

NO.	DESCRIPTION	REVISION BY	CKD	DATE

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COLORADO SPRINGS, CO 80918
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FAX (719) 264-1193

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

SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO COUNTY

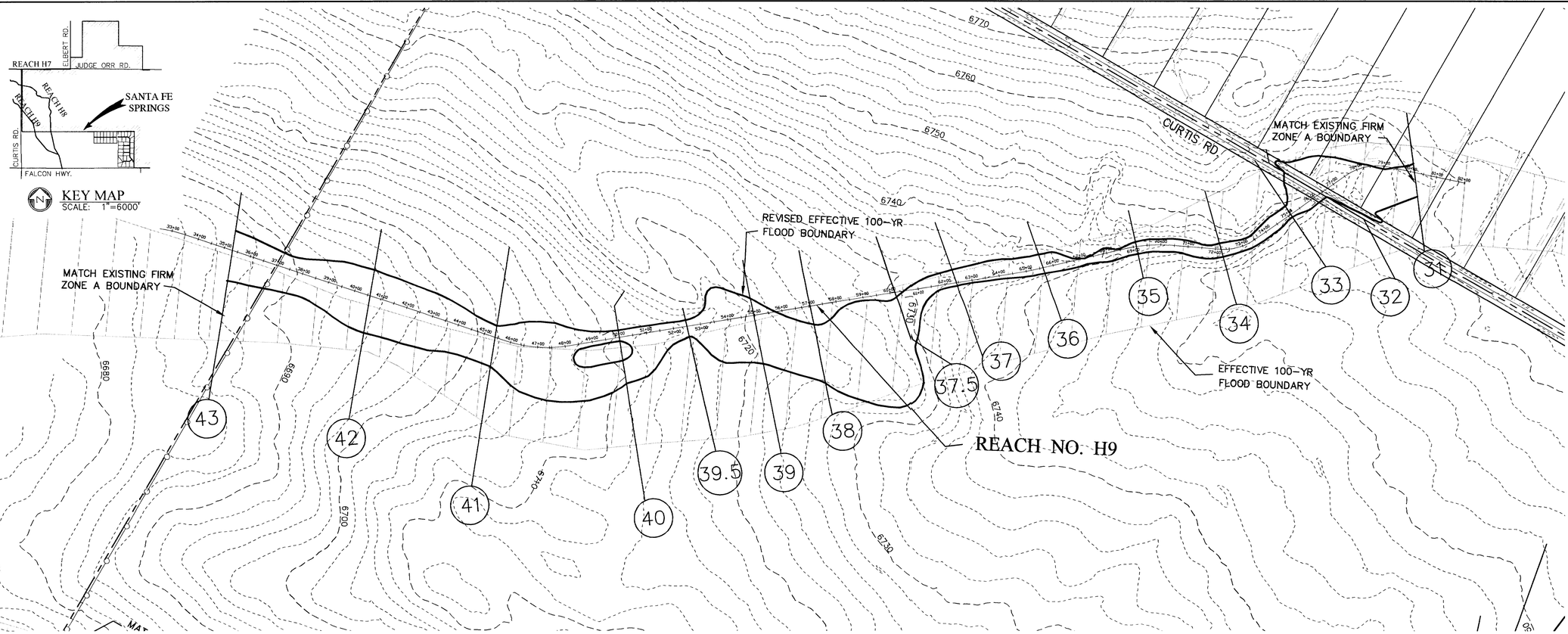
REALTY DEVELOPMENT SERVICES
25 NORTH TEJON, SUITE 300
COLORADO SPRINGS, CO 80903

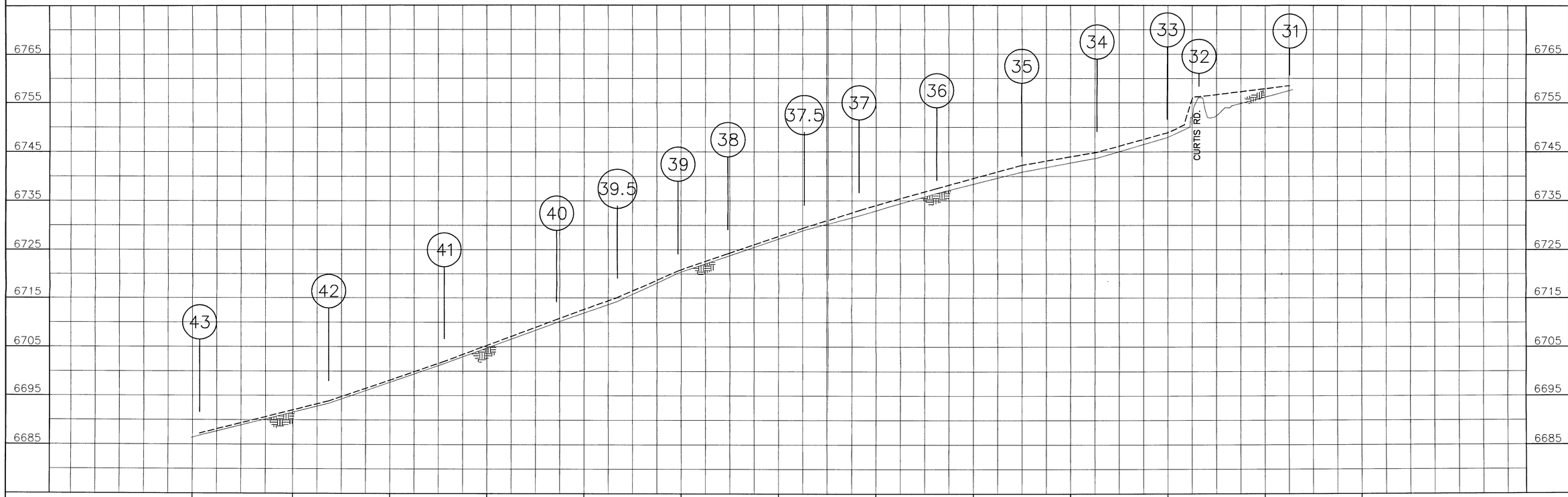
EXHIBIT 5 100-YEAR FLOODPLAIN BOUNDARY & PROFILE WORKMAP

PROJECT NO.
6005.0001

PP-LOMR.DWG

DRAWING NO.
EXH. 5





NO.	DESCRIPTION	REV BY	CKD BY	DATE
	REVISION			

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

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

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

DATE: 06/04/04

SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO COUNTY

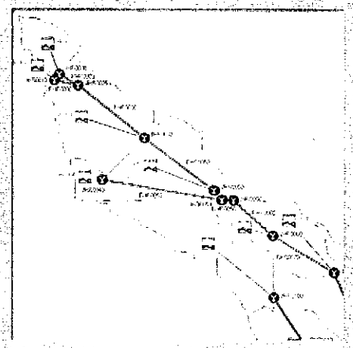
REALTY DEVELOPMENT SERVICES
25 NORTH TEJON, SUITE 300
COLORADO SPRINGS, CO 80903

EXHIBIT 6 100-YEAR FLOODPLAIN BOUNDARY & PROFILE WORKMAP

PROJECT NO.
6005.0001

PP-LOMR.DWG

DRAWING NO.
EXH. 6

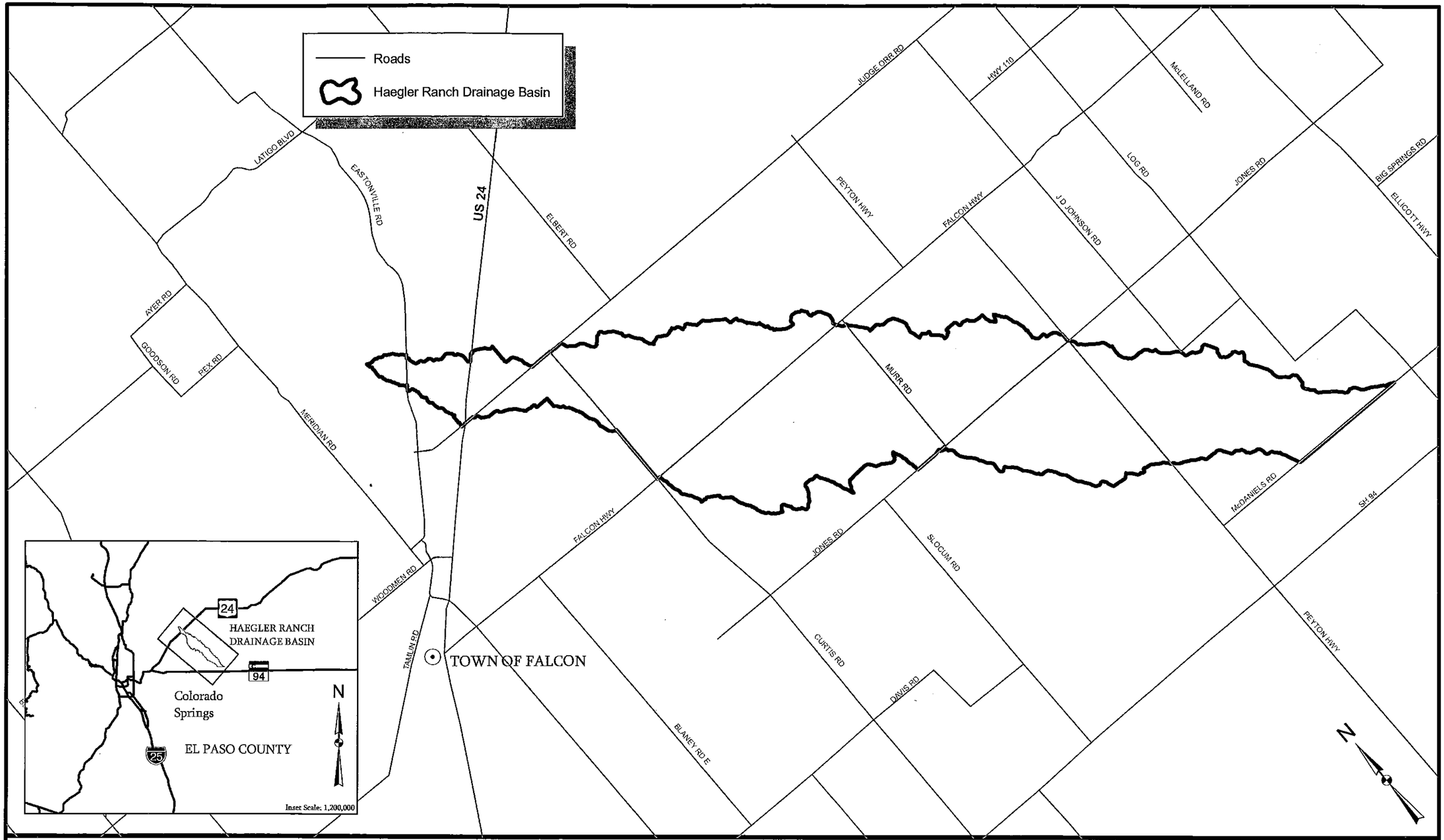


Fountain Creek Basin

Drainage Basin Planning Study

May 2009

URS



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

6,000 3,000 0 6,000 Feet

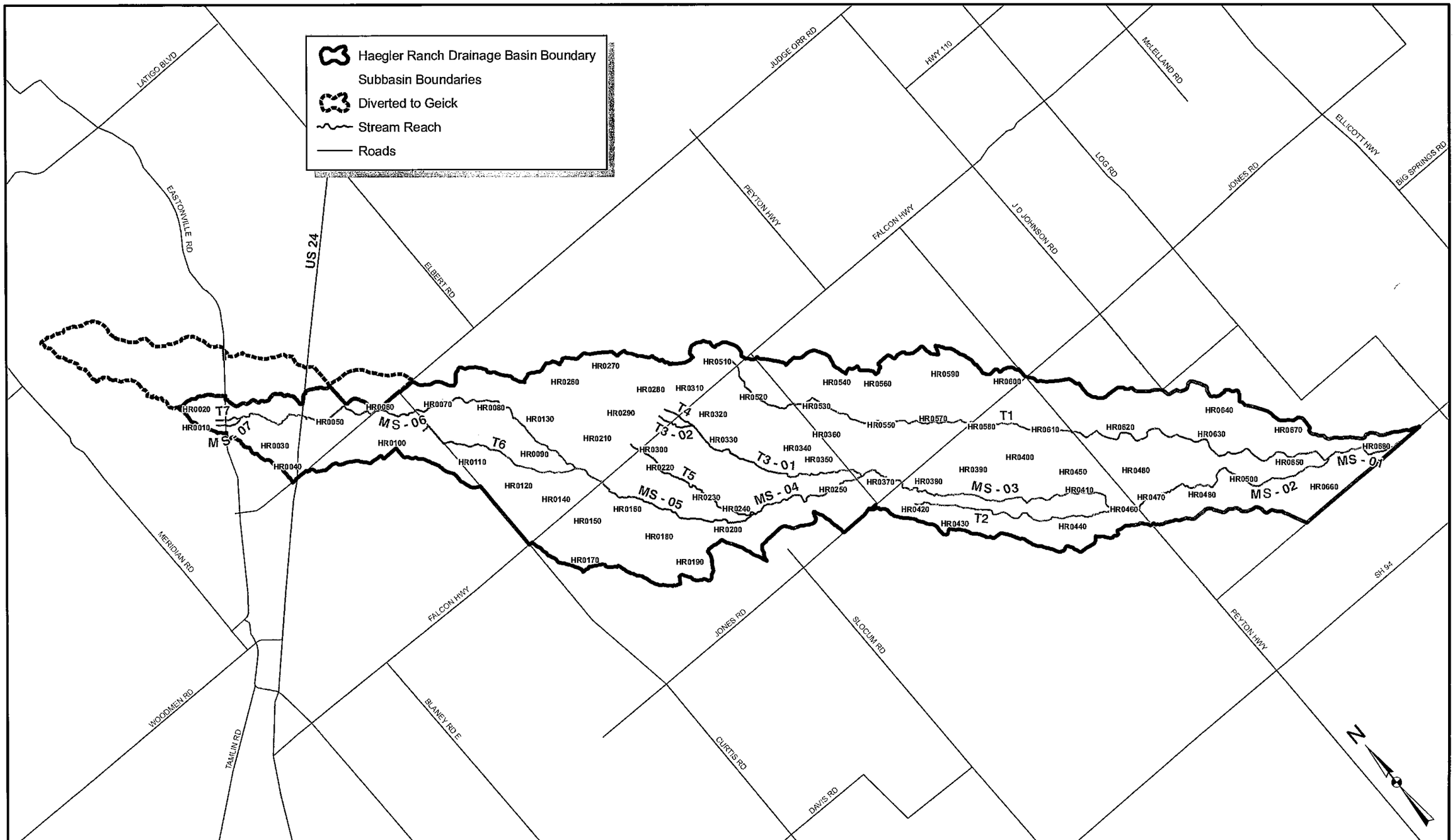
1" = 6,000'

DATE: 05/08

HAEGLER RANCH DRAINAGE BASIN

VICINITY MAP
FIGURE 1-1

URS NO. 21711039



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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.

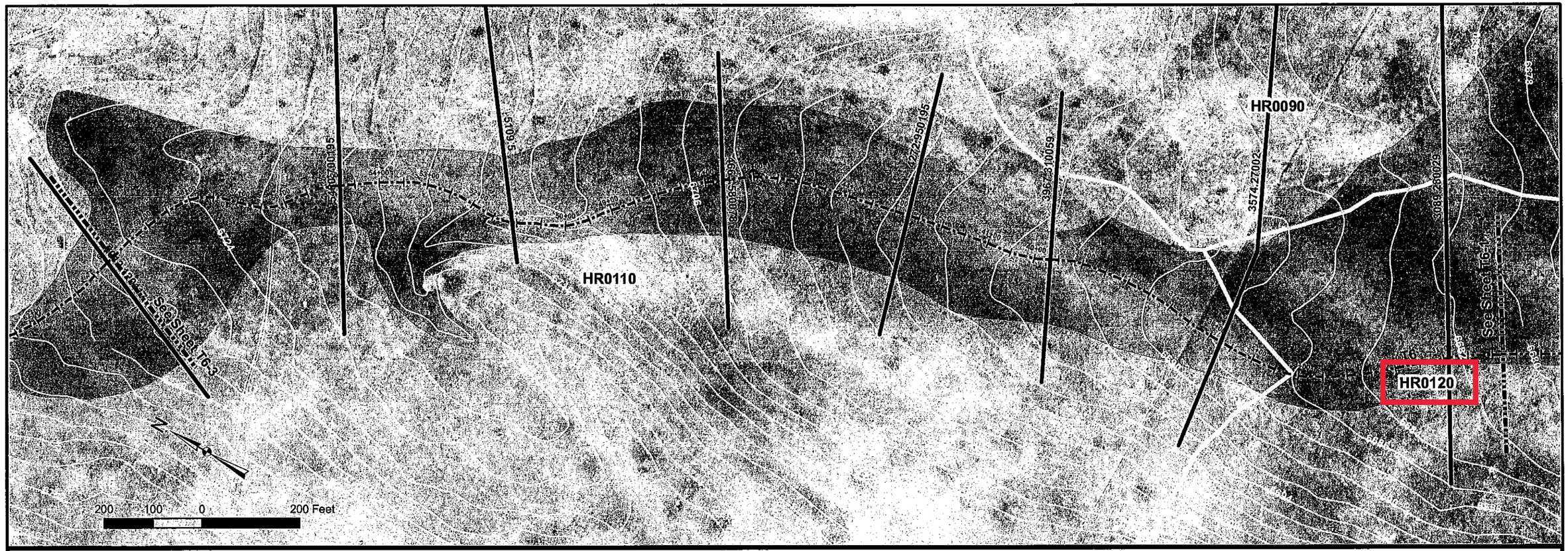
Table 6-3 Existing Conditions Culvert Design

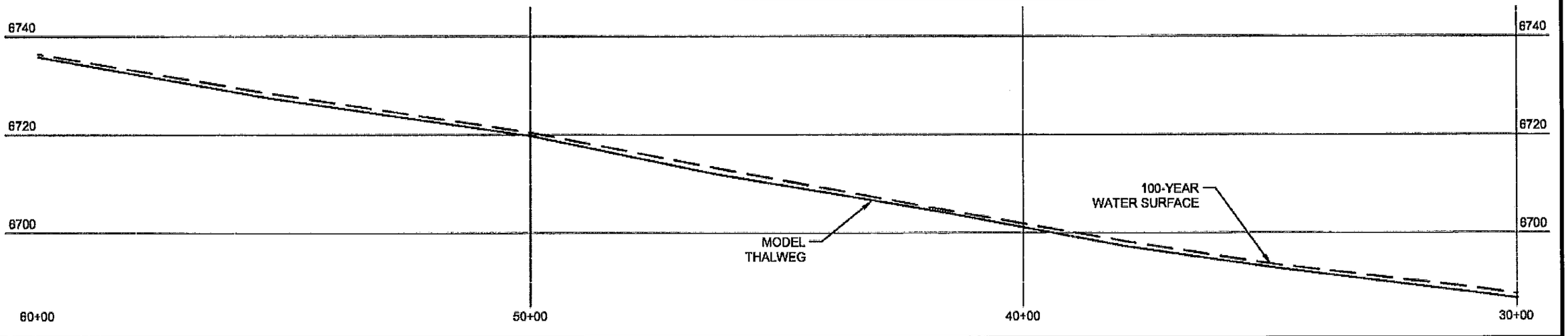
Facility Number	Road Crossing	Channel	Existing Size	Existing 100-yr Flow (cfs)	Deficiency	Necessary Facility
N/A	Peyton Highway	Tributary 1 (T1)	No Culvert	500	Overtops	2-72" RCPs
N/A	Falcon Highway	Tributary 1 (T1)	No Culvert	33	Overtops	36" RCP
301	Peyton Highway	Main Stem (MS-02)	2-33"X48" CMPs	2,500	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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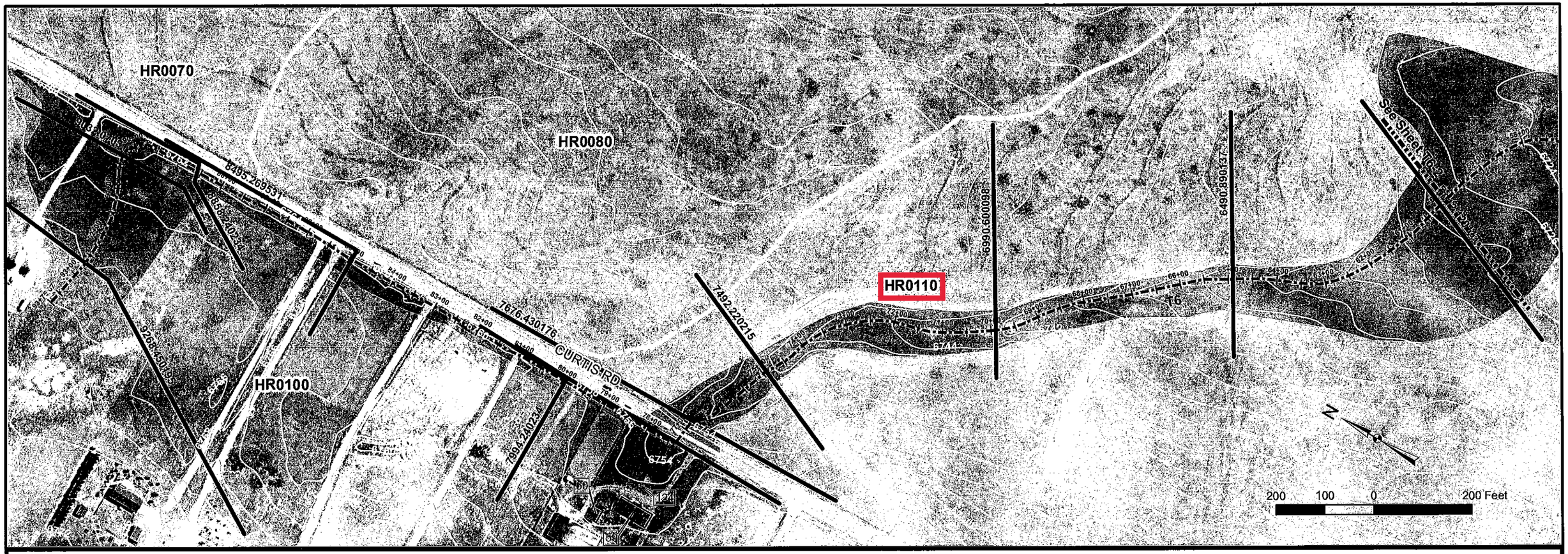
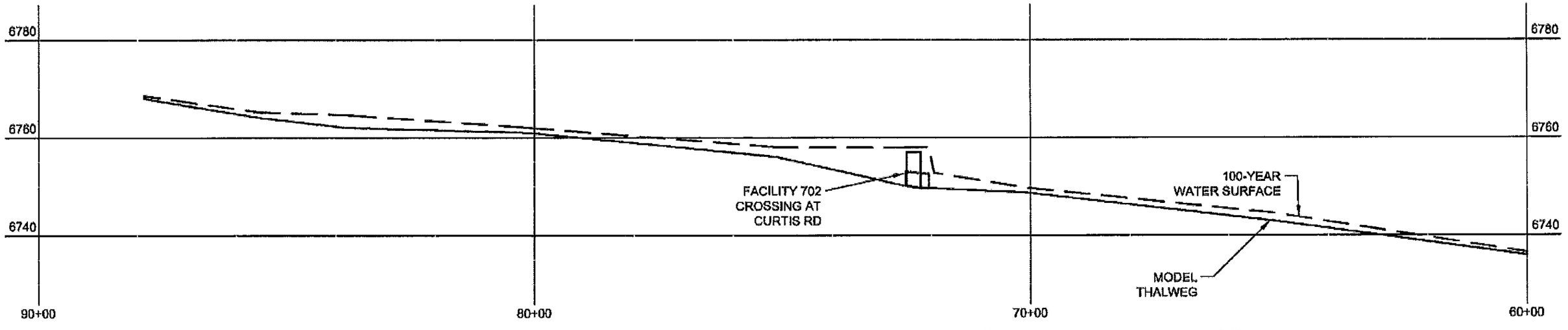
Subbasin Boundaries
Approximate 100-Year Floodplain
Thalweg
Cross Sections
2' Contours

DATE: 05/08

HAEGLER RANCH DRAINAGE BASIN
APPROXIMATE 100-YEAR FLOOD LIMITS
SHEET T6-2
FIGURE 5-4

URS NO. 21711039





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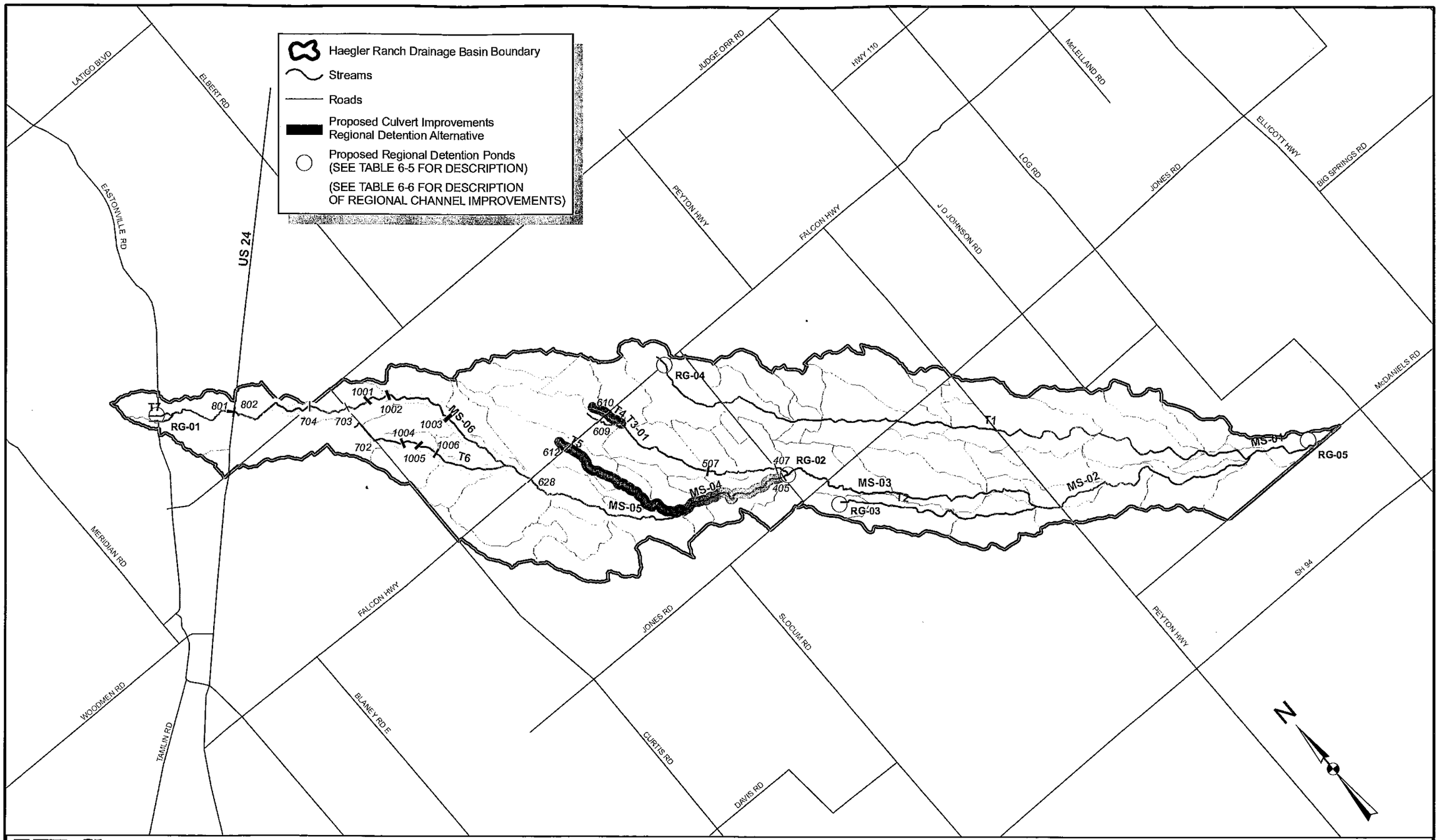
Subbasin Boundaries
Approximate 100-Year Floodplain
Thalweg
Cross Sections
2' Contours

HAEGLER RANCH DRAINAGE BASIN

APPROXIMATE 100-YEAR FLOOD LIMITS
SHEET T6-3
FIGURE 5-4

DATE: 09/08

URS NO. 21711039



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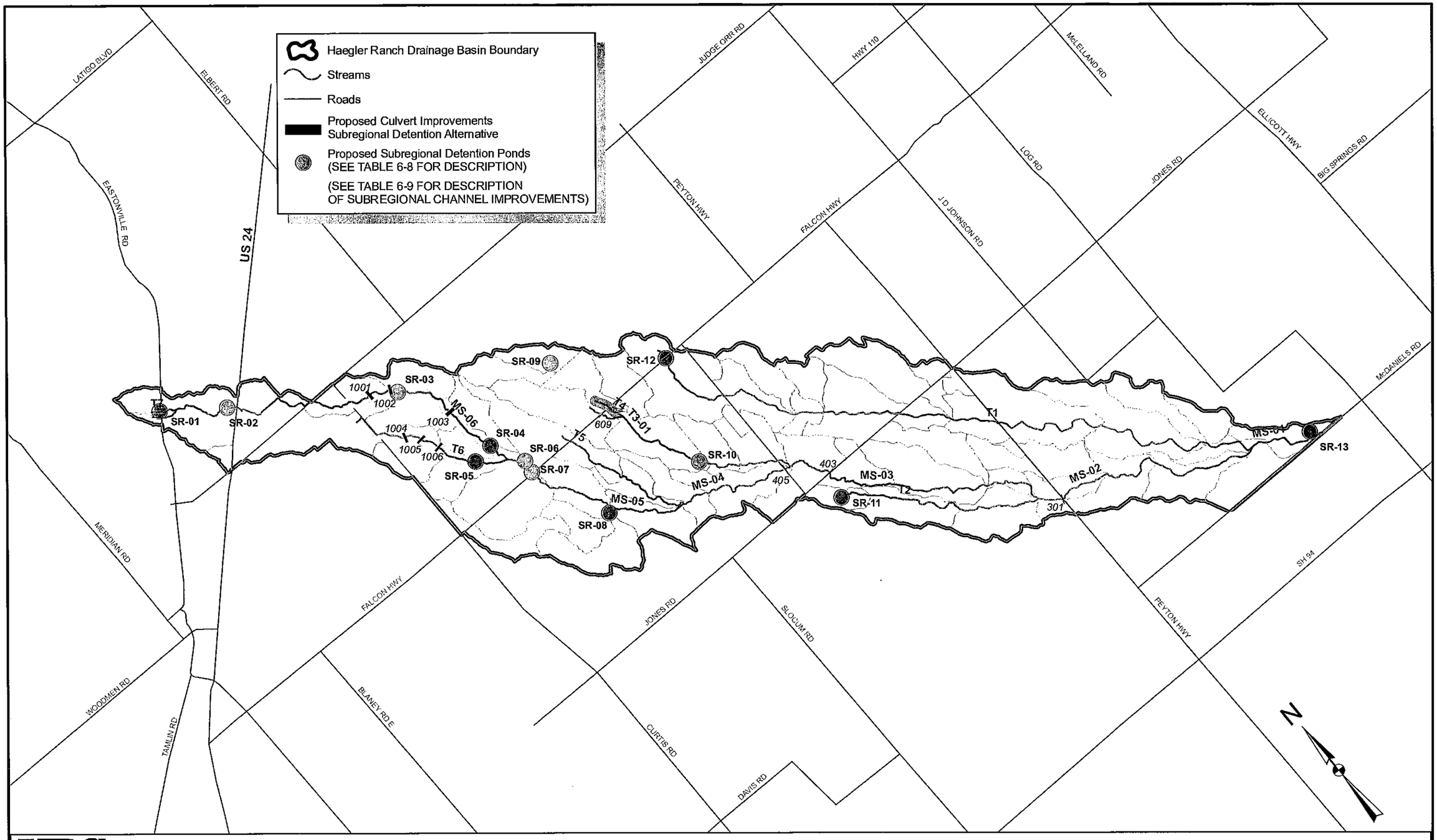
5,000 2,500 0 5,000 Feet

1" = 5,000'

DATE: 05/08

HAEGLER RANCH DRAINAGE BASIN
REGIONAL DETENTION
ALTERNATIVES
FIGURE 6-1

URS NO. 21711039



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9960 Federal Dr.
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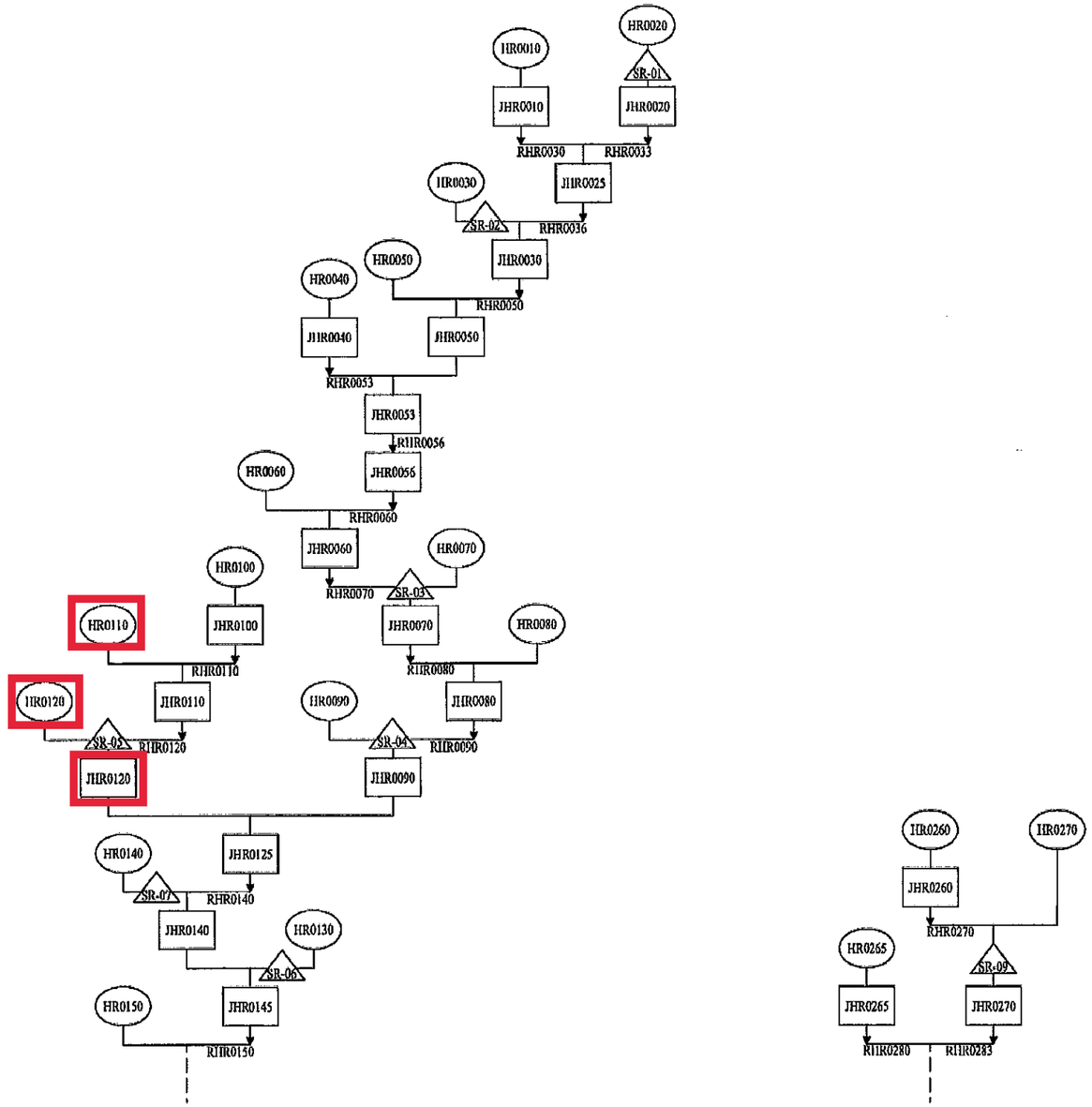
5,000 2,500 0 5,000 Feet

1" = 5,000'

DATE: 05/08

HAEGLER RANCH DRAINAGE BASIN
SUBREGIONAL DETENTION ALTERNATIVES
FIGURE 6-2

URS NO. 21711039



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DATE: 05/08

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

6.4.1. Channel & Culvert Costs

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

Table 6-13 Regional Detention Alternative Channel Cost Estimates

Channel	Design Flow (cfs)	Channel Length (ft)	Total Cost	Drop Structure Cost
Main Stem (MS-04)	3,500	7,140	$1,626,000	none
Main Stem (MS-05)	3,000	11,100	$2,216,000	$2,539,000
Main Stem (MS-06)	900	7,330	$482,000	$589,000
Main Stem (MS-06)	1,000	3,170	$231,000	$268,000
Main Stem (MS-06)	1,500	4,450	$450,000	$548,000
Main Stem (MS-06)	2,000	3,330	$477,000	$636,000
Tributary 3 (T3-01)	1,500	6,710	$1,082,000	$1,302,000
Tributary 4 (T4)	600	1,840	$96,000	$127,000
Tributary 5 (T5)	300	930	$37,000	$36,000
Tributary 5 (T5)	500	7,770	$325,000	$370,000
Tributary 6 (T6)	500	4,270	$179,000	$222,000
Tributary 6 (T6)	600	3,940	$204,000	$253,000
Sub-Total			$7,405,000	$6,888,000
30% Construction Contingency			$2,222,000	$2,066,000
15% Engineering Contingency			$1,110,000	$1,033,000
Total			$10,737,000	$9,988,000

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

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

Channel	Design Flow (cfs)	Channel Length (ft)	Total Cost	Drop Structure Cost
Main Stem (MS-05)	2,000	1,560	$224,000	$367,000
Main Stem (MS-06)	600	3,120	$162,000	$295,000
Main Stem (MS-06)	1,000	4,535	$331,000	$375,000
Main Stem (MS-06)	800	3,190	$188,000	$368,000
Tributary 3 (T3-01)	600	5,000	$259,000	$422,000
Tributary 3 (T3-02)	500	420	$18,000	$37,000
Tributary 4 (T4)	500	940	$40,000	$74,000
Tributary 6 (T6)	500	4,280	$179,000	$333,000
Tributary 6 (T6)	300	1,400	$55,000	$107,000
Sub-Total			$1,456,000	$2,374,000
30% Construction Contingency			$430,000	$712,000
15% Engineering Contingency			$218,000	$356,000
Total			$2,111,000	$3,442,000

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

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

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

Facility Number	Road Crossing	Channel	Existing Size	Proposed 100-yr Flow (cfs)	Necessary Facility for Proposed 100-year Flow	Estimated Cost
405	Murr Road	Main Stem (MS-04)	66" RCP	3,400	9-6'X6' RCBs	$256,000
507	Peerless Farms Road	Tributary 3 (T3-01)	60" CMP	1200	4-6'X6' RCBs	$139,000
609	Falcon Highway	Tributary 3 (T3-02)	18" CMP	460	2-66" RCPs	$51,600
610	Falcon Highway	Tributary 4 (T4)	24" CMP	570	2-72" RCPs	$51,000
612	Falcon Highway	Tributary 5 (T5)	24" CMP	240	72" RCP	$26,000
628	Falcon Highway	Main Stem (MS-05)	2-60" CMPs	2,200	6-6'X6' RCBs	$243,000
702	Curtis Road	Tributary 6 (T6)	36" CMP	140	60" RCP	$29,000
703	Curtis Road	Main Stem (MS-06)	24" CMP	890	3-6'X6' RCBs	$142,000
704	Judge Orr Road	Main Stem (MS-06)	Blocked Culvert	830	3-6'X6' RCBs	$185,000
1001	Future Pastura Street	Main Stem (MS-06)	N/A	930	3-6'X6' RCBs	$99,000
1002	Future Arroyo Hondo Blvd. N.	Main Stem (MS-06)	N/A	930	3-6'X6' RCBs	$99,000
1003	Future Arroyo Hondo Blvd. N	Main Stem (MS-06)	N/A	1500	4-6'X6' RCBs	$143,000
1004	Future Pastura Strect	Tributary 6 (T6)	N/A	440	2-66" RCPs	$43,000
1005	Future El Vado Road	Tributary 6 (T6)	N/A	440	2-66" RCPs	$43,000
1006	Future Socorro Trail	Tributary 6 (T6)	N/A	440	2-66" RCPs	$43,000
Sub-Total						$1,591,000
30% Construction Contingency						$477,000
15% Engineering Contingency						$239,000
Total						$2,307,000

(See Table C4 in Appendix C for details)

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

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

(See Tables C5 in Appendix C for details)

6.4.2. Detention Pond Costs

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

Table 6-17 Regional Detention Pond Cost Summary

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

(See Tables C1 in Appendix C for details)

Table 6-18 Sub-Regional Detention Pond Cost Summary

Facility	Storage (AF)	Total Cost Including Construction and Engineering Contingencies
SR-01	10	$899,000
SR-02	5	$640,000
SR-03	16	$868,000
SR-04	25	$1,453,000
SR-05	24	$1,557,000
SR-06	9	$547,000
SR-07	5	$524,000
SR-08	5	$326,000
SR-09	20	$861,000
SR-10	23	$1,069,000
SR-11	2	$182,000
SR-12	9	$477,000
SR-13	3	$376,000
Total		$9,780,000

(See Table C1 in Appendix C for details)

6.4.3. Other Costs

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

6.4.4. Conceptual Alternative Costs

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

Table 6-19 Conceptual Alternative Costs

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

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

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

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

1. Any land disturbing activity shall be conducted so as to effectively reduce unacceptable erosion and resulting sedimentation.

2. All land disturbing activities shall be designed, constructed, and completed in such a manner that the exposure time of disturbed land shall be limited to the shortest possible period of time.

3. Sediment caused by accelerated soil erosion and runoff shall be intercepted by erosion control measures such as hay bales, silt fences and / or sediment ponds, and contained within the site.

4. Any facility designed and constructed to convey storm runoff shall be designed to be non-erosive.

5. Erosion control measures will be used prior to and during construction.

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

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

7.4. Operations and Maintenance

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

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

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

7.5. Drainage and Bridge Fee Calculations

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

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

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

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

Table 7-2 Drainage Basin Fee Calculations

Channel Improvements					
Channel	**Basins**	**Channel Construction Cost**	**Drop Structure Construction Cost**	**Contingency Cost**	**Total Cost**
Main Stem (MS-05)	HR0200	$224,000	$363,600	$264,420	$852,020
Main Stem (MS-06)	HR0070	$162,000	$295,400	$205,830	$633,230
Main Stem (MS-06)	HR0080	$331,000	$374,500	$317,475	$1,022,975
Main Stem (MS-06)	HR0090	$188,000	$368,000	$250,200	$806,200
Tributary 3 (T3-01)	HR0330	$259,000	$422,000	$306,450	$987,450
Tributary 3 (T3-02)	HR0300	$18,000	$37,000	$24,750	$79,750
Tributary 4 (T4)	HR0300	$40,000	$74,000	$51,300	$165,300
Tributary 6 (T6)	HR0110	$179,000	$333,000	$230,400	$742,400
Tributary 6 (T6)	HR0120	$55,000	$106,500	$72,675	$234,175
Subtotal Channel Costs					$5,553,500

Culvert Improvements					
Culvert	**Road Crossing**	**Channel**	**Culvert Construction Cost**	**Contingency Cost**	**Total Cost**
609	Falcon Highway	Tributary 3 (T3-02)	$106,301	$47,836	$154,137
N/A	Falcon Highway	Tributary 1 (T1)	$19,500	$8,775	$28,275
1001	Future Pastura Street	Main Stem (MS-06)	$106,301	$47,836	$154,137
1002	Future Arroyo Hondo Blvd. N.	Main Stem (MS-06)	$87,301	$39,286	$126,587
1003	Future Arroyo Hondo Blvd. N.	Main Stem (MS-06)	$87,301	$39,286	$126,587
1004	Future Pasture Street	Tributary 6 (T6)	$51,000	$22,950	$73,950
1005	Future El Vado Road	Tributary 6 (T6)	$19,500	$8,775	$28,275
1006	Future Socorro Trail	Tributary 6 (T6)	$42,800	$19,260	$62,060
Subtotal Culvert Costs					$754,007

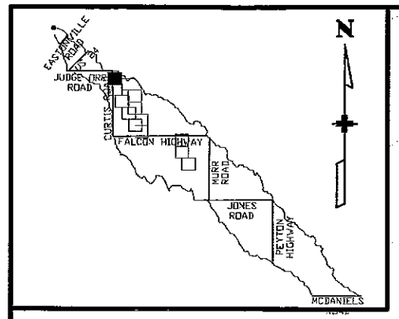
Detention Improvements					
Facility	**Storage (AF)**	**Construction Cost**		**Contingency Cost**	**Total Cost**
SR-01	10	$296,701		$133,516	$430,217
SR-02	5	$207,949		$93,577	$301,525
SR-03	16	$186,252		$83,814	$270,066
SR-04	25	$390,182		$175,582	$565,764
SR-05	24	$455,235		$204,856	$660,091
SR-06	9	$140,670		$63,301	$203,971
SR-07	5	$162,046		$72,921	$234,967
SR-08	5	$87,489		$39,370	$126,860
SR-09	20	$188,250		$84,713	$272,963
SR-10	23	$331,635		$149,236	$480,871
SR-11	2	$56,880		$25,596	$82,476
SR-12	9	$108,987		$49,044	$158,031
SR-13	3	$107,812		$48,515	$156,327
Subtotal Detention Costs					$3,944,129
Total Cost					**$10,251,636**
Total Unplatted Impervious Acres					**1,343**
Fee Per Impervious Acre					**$7,633**

Table 7-3 Bridge Fee Calculation

301	Peyton Highway	Main Stem (MS-02)	401,710	$180,770	$582,480
403	Jones Road	Main Stem (MS-03)	358,123	$161,155	$519,278
405	Murr Road	Main Stem (MS-04)	282,941	$127,323	$410,264
Subtotal Bridge Costs					$1,512,022
Total Cost					**$1,512,022**
Total Unplatted Impervious Acres					**1,343**
Bridge Fee Per Impervious Acre					**$1,126**

Table 7-4 Reimbursable Costs

Reimbursable Culvert Improvements					
Culvert	**Road Crossing**	**Channel**	**Culvert Construction Cost**	**Contingency Cost**	**Total Cost**
N/A	Peyton Highway	Tributary 1 (T1)	$51,000	$22,950	$73,950
N/A	Falcon Highway	Tributary 1 (T1)	$9,7580	$4,388	$14,138
301	Peyton Highway	Main Stem (MS-02)	$314,535	$141,541	$456,076
401	Jones Road	Tributary 1 (T1)	$53,111	$23,900	$77,011
403	Jones Road	Main Stem (MS-03)	$270,947	$121,926	$392,874
405	Murr Road	Main Stem (MS-04)	$180,371	$81,167	$261,538
407	Murr Road	Tributary 3 (T3-01)	$77,801	$35,011	$112,812
507	Peerless Farms Road	Tributary 3 (T3-01)	$115,801	$52,111	$167,912
509	Murr Road	Tributary 1 (T1)	$19,300	$8,685	$27,985
601	Whiting Way	Tributary 1 (T1)	$23,500	$10,575	$34,075
604	Max Road	Tributary 1 (T1)	$19,300	$8,685	$27,985
609	Falcon Highway	Tributary 3 (T3-02)	$25,600	$11,520	$37,120
610	Falcon Highway	Tributary 4 (T4)	$23,500	$10,575	$34,075
612	Falcon Highway	Tributary 5 (T5)	$21,200	$9,540	$30,740
628	Falcon Highway	Main Stem (MS-05)	$154,741	$69,633	$224,375
702	Curtis Road	Tributary 6 (T6)	$23,150	$10,418	$33,568
703	Curtis Road	Main Stem (MS-06)	$125,301	$56,386	$181,687
704	Judge Orr Road	Main Stem (MS-06)	$83,200	$37,440	$120,640
803	Eastonville Road	Main Stem (MS-07)	$9,680	$4,356	$14,036
804	Eastonville Road	Tributary 7 (T7)	$14,980	$6,741	$21,721
Subtotal Channel Costs					$2,344,315
Reimbursable Detention Improvements					
Facility	**Storage (AF)**	**Construction Cost**		**Contingency Cost**	**Total Cost**
SR-01	10	$296,701		$133,516	$430,217
SR-02	5	$207,949		$93,577	$301,525
SR-03	16	$186,252		$83,814	$270,066
SR-04	25	$390,182		$175,582	$565,764
SR-05	24	$455,235		$204,856	$660,091
SR-06	9	$140,670		$63,301	$203,971
SR-07	5	$162,046		$72,921	$234,967
SR-08	5	$87,489		$39,370	$126,860
SR-09	20	$188,250		$84,713	$272,963
SR-10	23	$331,635		$149,236	$480,871
SR-11	2	$56,880		$25,596	$82,476
SR-12	9	$108,987		$49,044	$158,031
SR-13	3	$107,812		$48,515	$156,327
Subtotal Detention Costs					$3,944,129
Total Reimbursable Cost					**$6,288,444**



HR0060

HR0070

HR0100

HR0070

CURTIS ROAD

BEGIN PROPOSED IMPROVEMENTS

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

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MATCHLINE MS-06 PG 2

LEGEND

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

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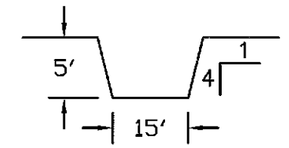

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Index of Revisions

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3			

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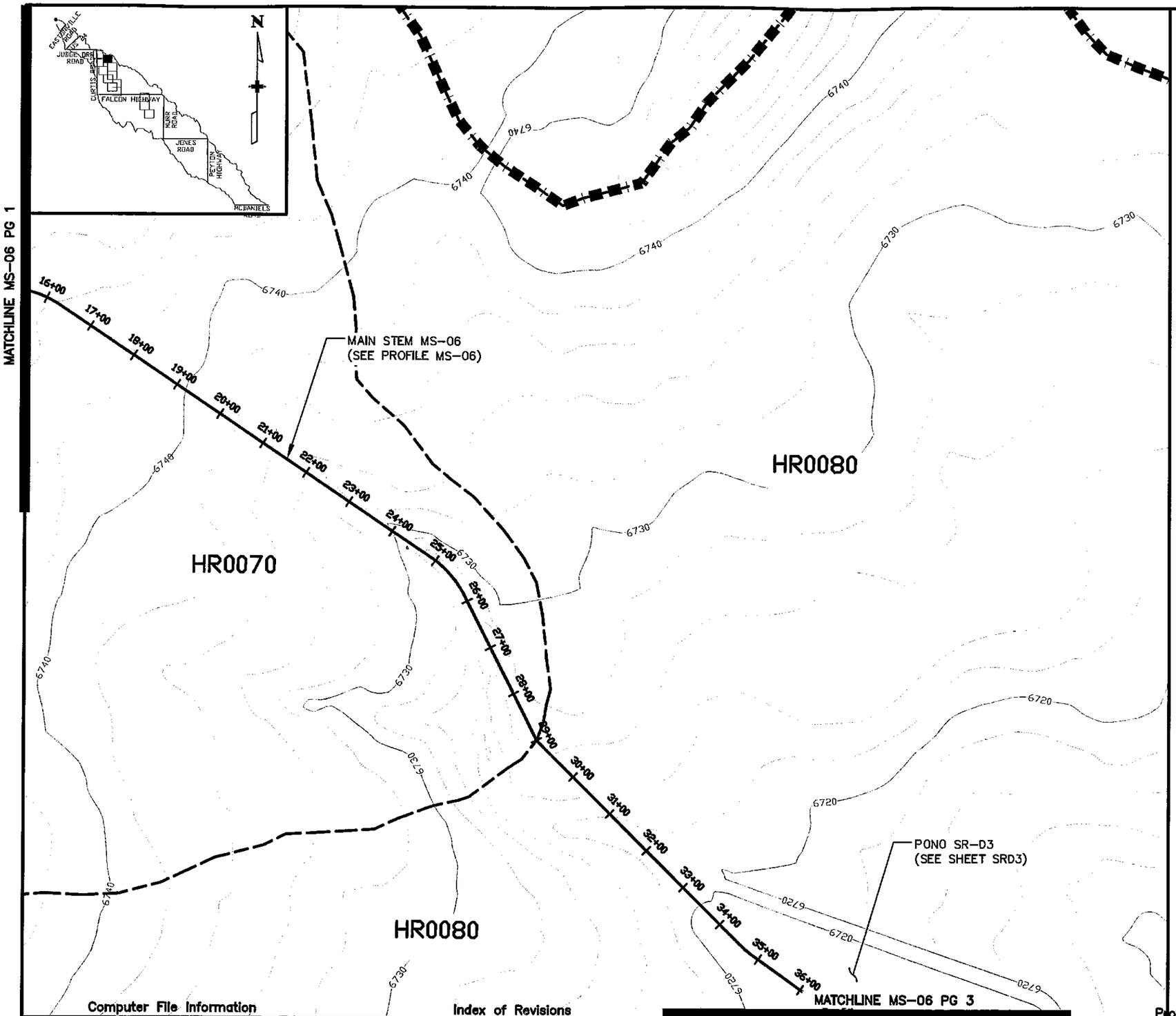
Detailed by: DRM
Checked by: JAJ

Structure Numbers

Profiles

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 1



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

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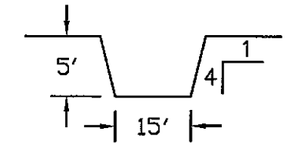

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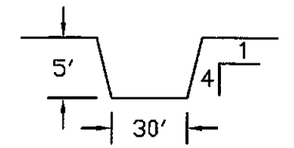

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Index of Revisions

Profiles

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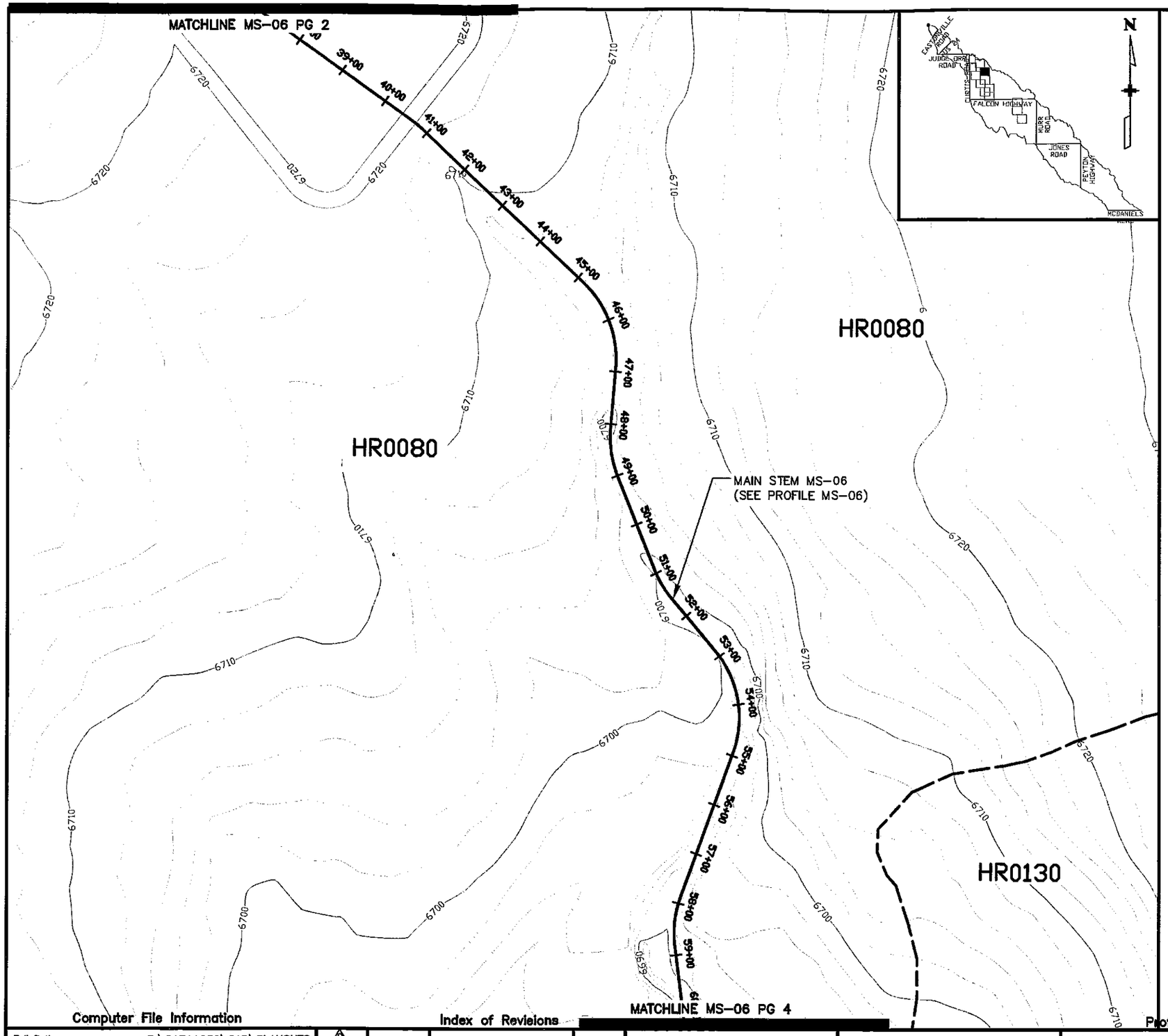
Detailed by:	DRM
Checked by:	JAJ

Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 2



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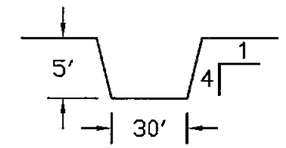
- BASIN BOUNDARY
- ROADS
- 20+00 — RIVER AND ALIGNMENT

1"=200'

200 0 200 400

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



STA: 31+34 TO STA: 74+61

Q: 1000 CFS

Computer File Information

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

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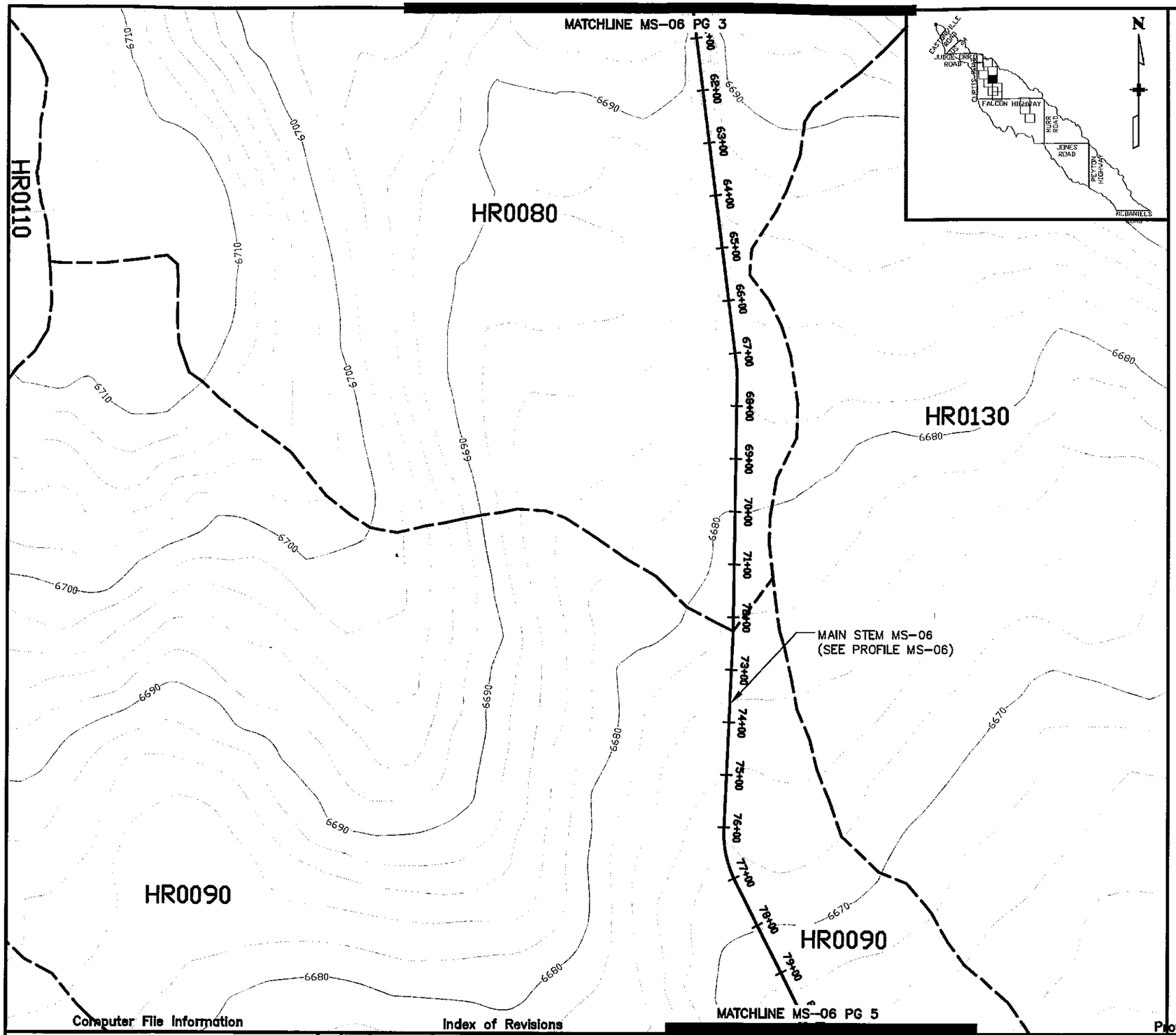
Detailed by: DRM
Checked by: JAJ

Structure Numbers

Profiles

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 3



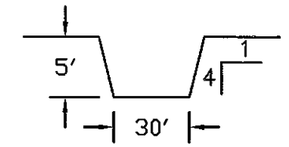
LEGEND

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

1"=200'

200 0 200 400

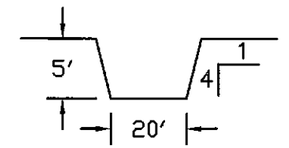
CHANNEL: MAIN STEM (MS-06)
BASIN: HR0080



STA: 31+34 TO STA: 74+61

Q: 1000 CFS

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



STA: 74+61 TO STA: 103+62

Q: 800 CFS

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Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 4

MATCHLINE MS-06 PG 4

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

HR0090

HR0130

HR0210

HR0140

POND SR-05
(SEE SHEET SR05)

POND SR-04
(SEE SHEET SR04)

MAIN STEM MS-06
(SEE MAINSTEM PAGE 5)

TRIBUTARY 6 (T6)
(SEE PROFILE TRIBUTARY 6)

MATCHLINE MS-06 PG 6

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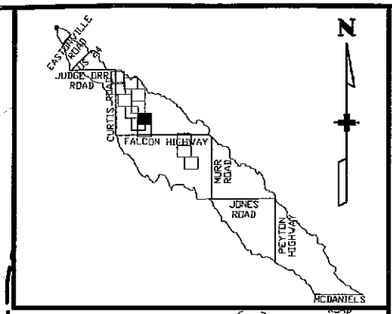
Profiles



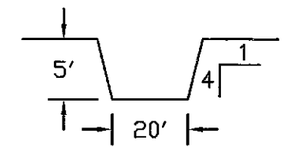
LEGEND

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

1"=200'

200 0 200 400

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



STA: 74+61 TO STA: 103+62

Q: 800 CFS

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Drawing File Name:	CHANNEL.DWG	Detailed by:	DRM
Acad. Ver. 2006	Scale: 1"=200' Units: Feet	Checked by:	JAJ

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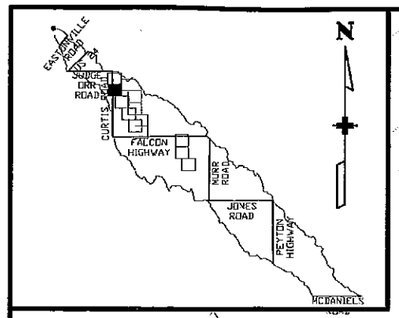
Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number MAIN STEM PG 5



HR0070

HR0100

HR0080

HR0110

HR0110

CURTIS ROAD

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

BEGIN T6 IMPROVEMENTS

TRIBUTARY 6 (T6) (SEE PROFILE TRIBUTARY 6)

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

MATCHLINE T6 PG 2

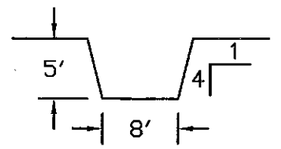
LEGEND

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

1"=200'

200 0 200 400

CHANNEL: TRIBUTARY 6 (T6)
BASIN: HR0110



STA: 0+00 TO STA: 41+73

Q: 500 CFS

Computer File Information

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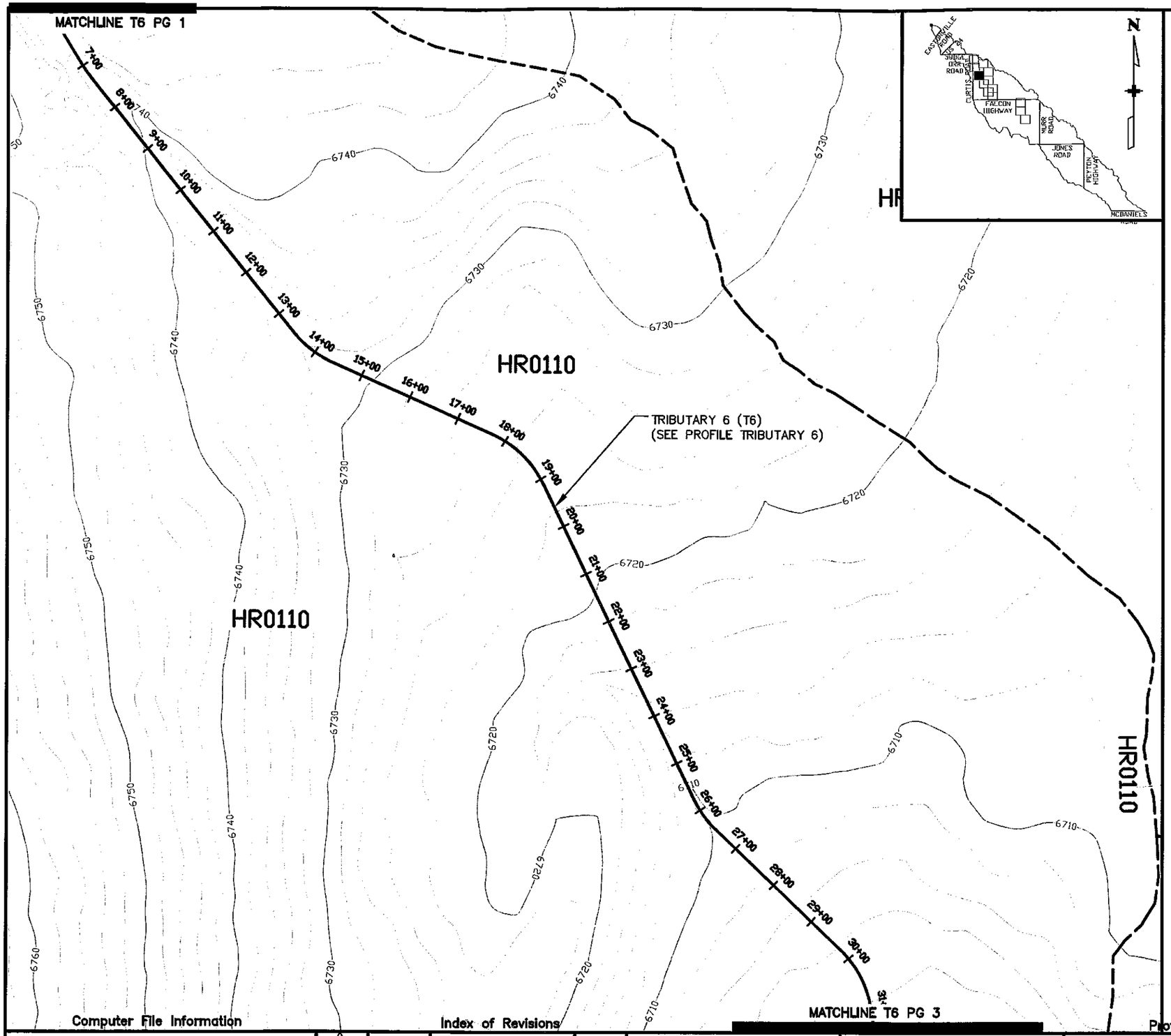
HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number TRIBUTARY 6 PG 1



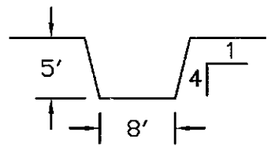
LEGEND

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

1"=200'

200 0 200 400

CHANNEL: TRIBUTARY 6 (T6)
BASIN: HR0110



STA: 0+00 TO STA: 41+73

Q: 500 CFS

Computer File Information

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HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number TRIBUTARY 6 PG 2

MATCHLINE T6 PG 2

HR0110

HR0110

HR0090

HR0120

HR0120

TRIBUTARY 6 (T6)
(SEE PROFILE TRIBUTARY 6)

0+00
33+00
34+00
35+00
36+00
37+00
38+00
39+00
40+00
41+00
42+00
43+00
44+00
45+00
46+00
47+00
48+00
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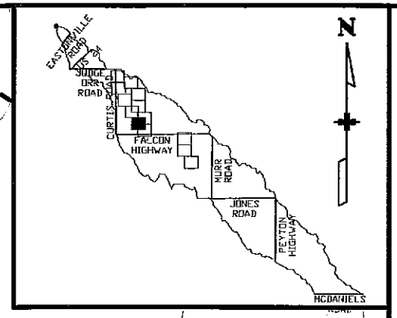
6718
6708
6699
6729



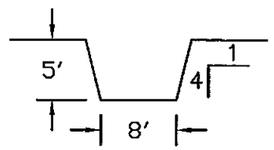
LEGEND

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

1"=200'

200 0 200 400

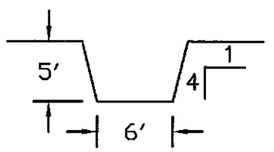
CHANNEL: TRIBUTARY 6 (T6)
BASIN: HR0110



STA: 0+00 TO STA: 41+73

Q: 500 CFS

CHANNEL: TRIBUTARY 6 (T6)
BASIN: HR0120



STA: 41+73 TO STA: 75+50

Q: 300 CFS

MATCHLINE T6 PG 4

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Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number TRIBUTARY 6 PG 3

MATCHLINE MS-06 PG 2

TRIBUTARY 6 (T6)
(SEE PROFILE TRIBUTARY 6)

HR0120

POND SR-05
(SEE SHEET SR05)

POND SR-04
(SEE SHEET SR04)

HR0090

MAIN STEM MS-06
(SEE MAINSTEM PAGE 5)

TRIBUTARY 6 (T6)
(SEE PROFILE TRIBUTARY 6)

HR0120

MATCHLINE MS-06 PG 6

LEGEND

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

1"=200'

200 0 200 400

CHANNEL: TRIBUTARY 6 (T6)
BASIN: HR0120

5' 1 4 6'

STA: 41+73 TO STA: 75+50

Q: 300 CFS

N

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

Computer File Information

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Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION
ALTERNATIVE CONCEPTUAL CHANNELS

Sheet Number TRIBUTARY 6 PG 4

MS–06 HR0070

SLOPE = 0.60%

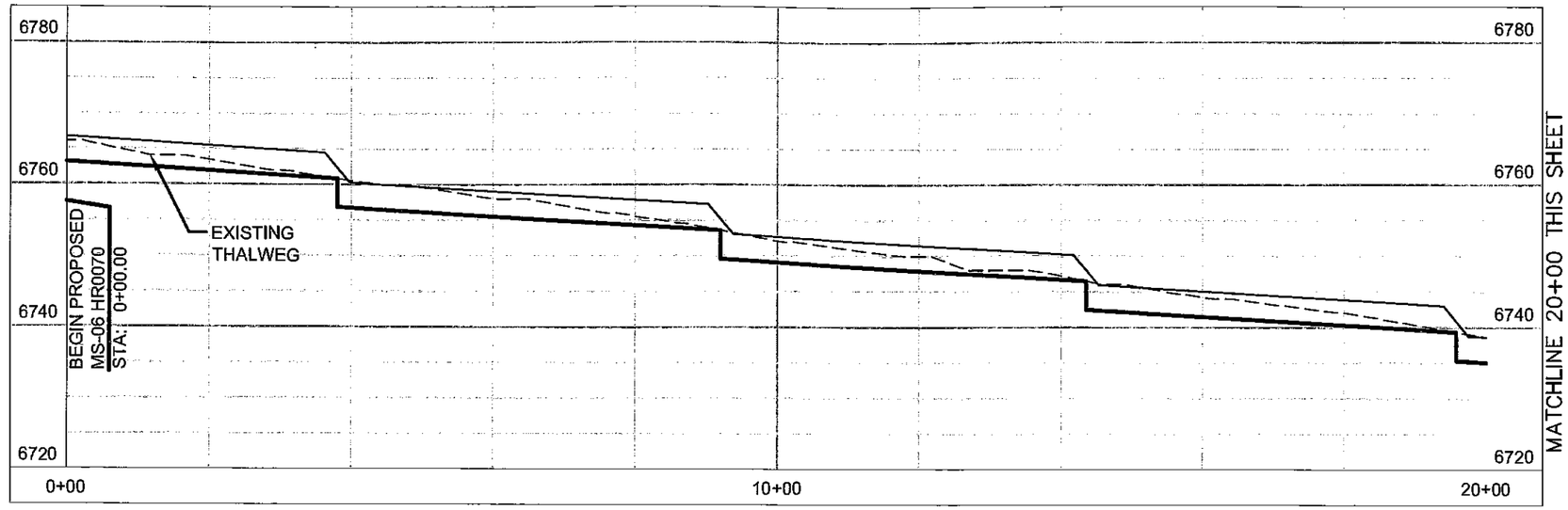
(7) 4' DROPS

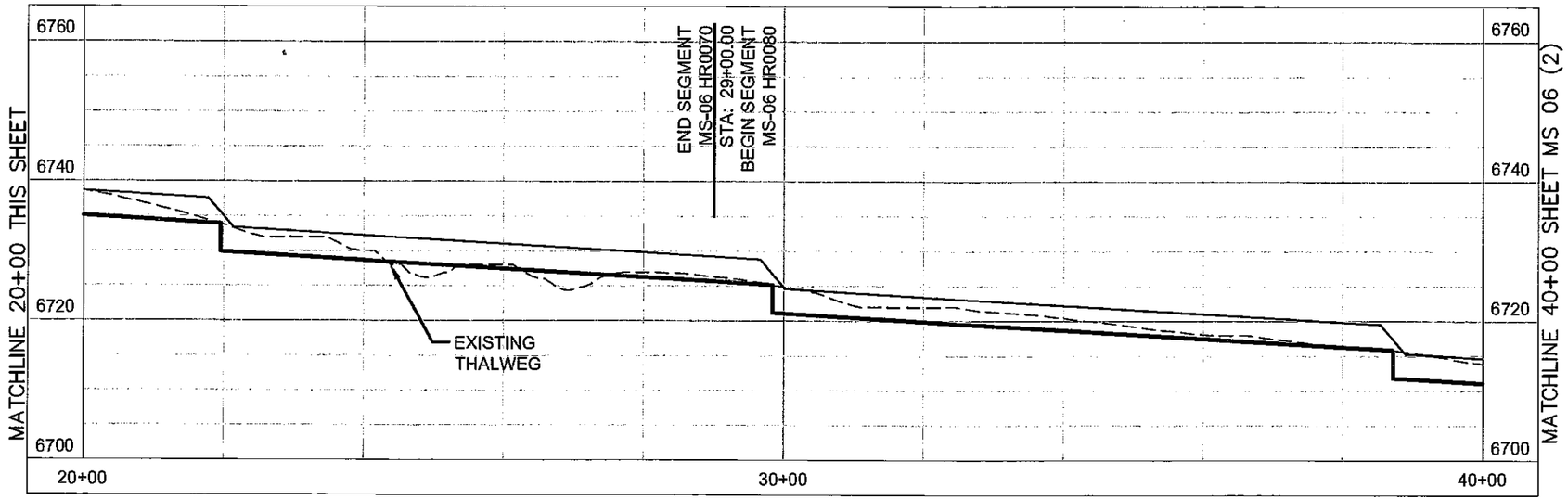
MS–06 HR0080

SLOPE = 0.60%

(7) 4' DROPS

PROFILE MAIN STEM (MS–06 & MS–05)





LEGEND

- PROPOSED DROP STRUCTURE
- EXISTING THALWEG
- HYDRAULIC GRADE LINE

Computer File Information

Full Path: P:\21711039\CAD\PLANSHTS

Drawing File Name: MAINSTEM PROFILES_PRDPOSED.DWG

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

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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 MS 06

MS–06 HR0080

SLOPE = 0.60%

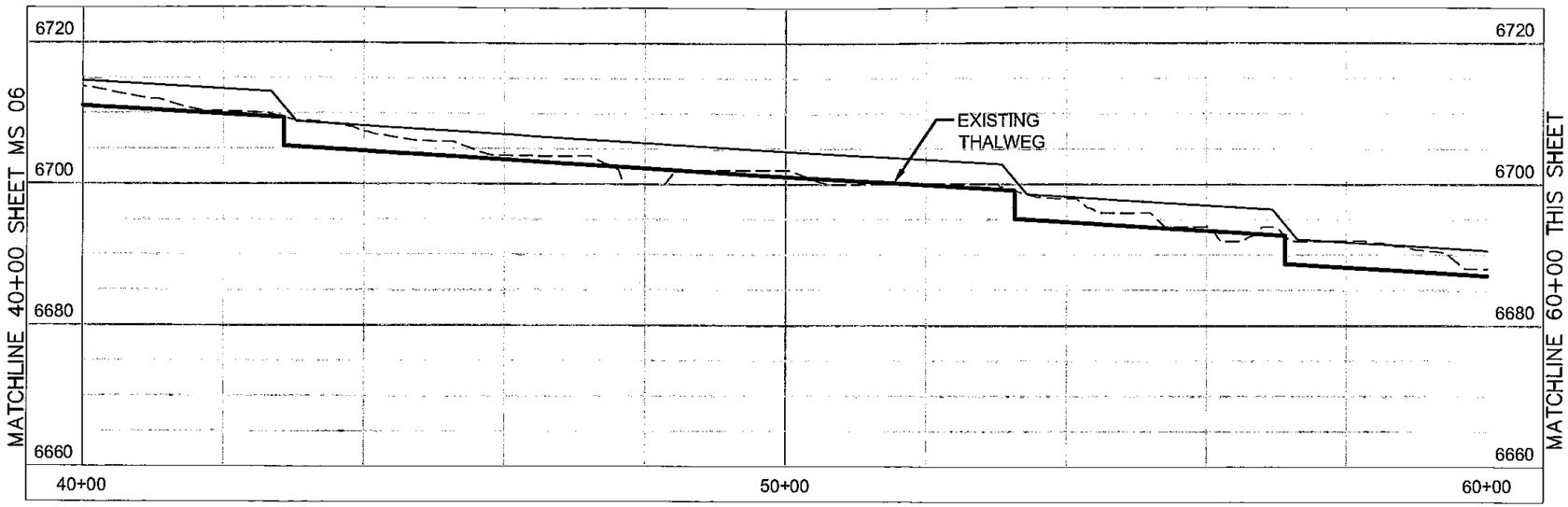
(7) 4' DROPS

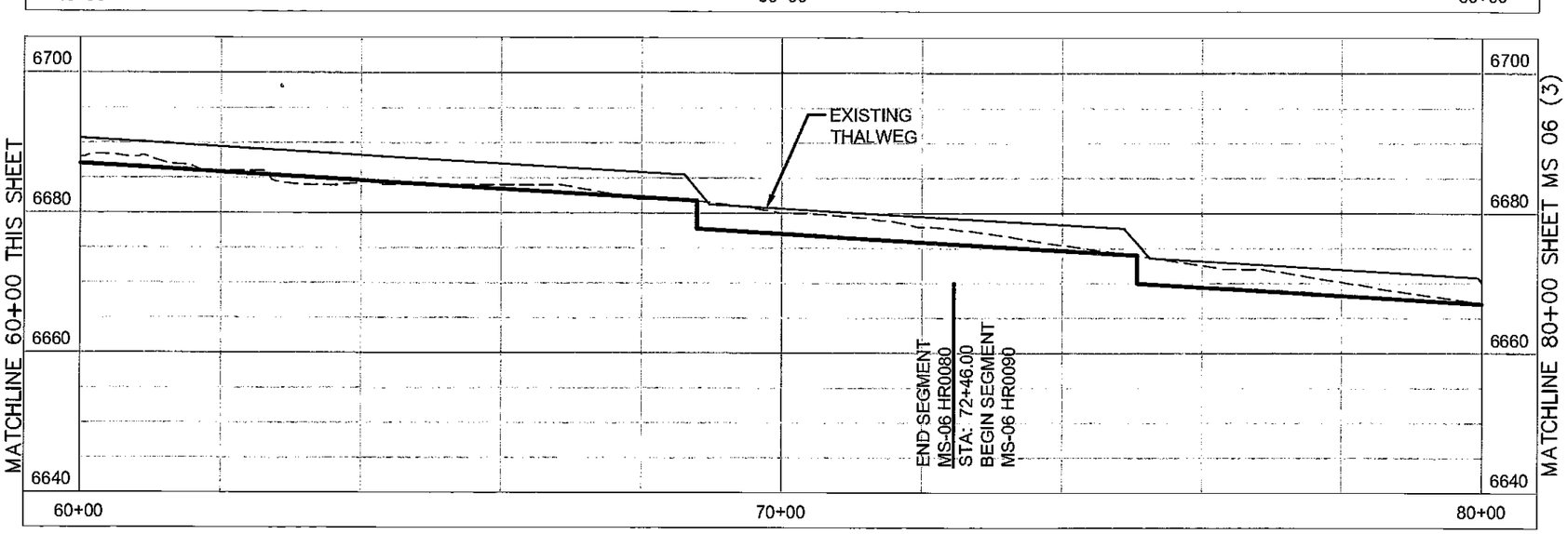
MS–06 HR0090

SLOPE = 0.60%

(8) 4' DROPS

PROFILE MAIN STEM (MS–06 & MS–05)





LEGEND

- PROPOSED DROP STRUCTURE
- EXISTING THALWEG
- HYDRAULIC GRADE LINE

Computer File Information

Full Path: P:\21711039\CAD\PLANSHTS

Drawing File Name: MAINSTEM PROFILES_PROPOSED.DWG

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Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL PROFILES

Sheet Number MS06 (2)

MS–06 HR0090

SLOPE = 0.60%

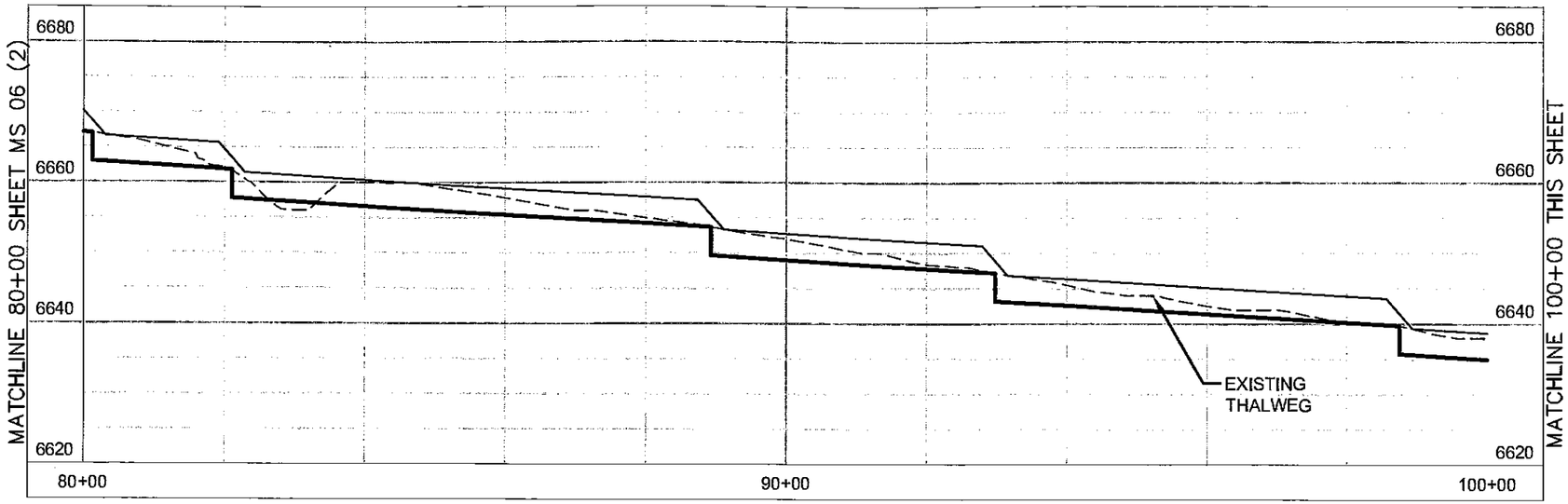
(8) 4' DROPS

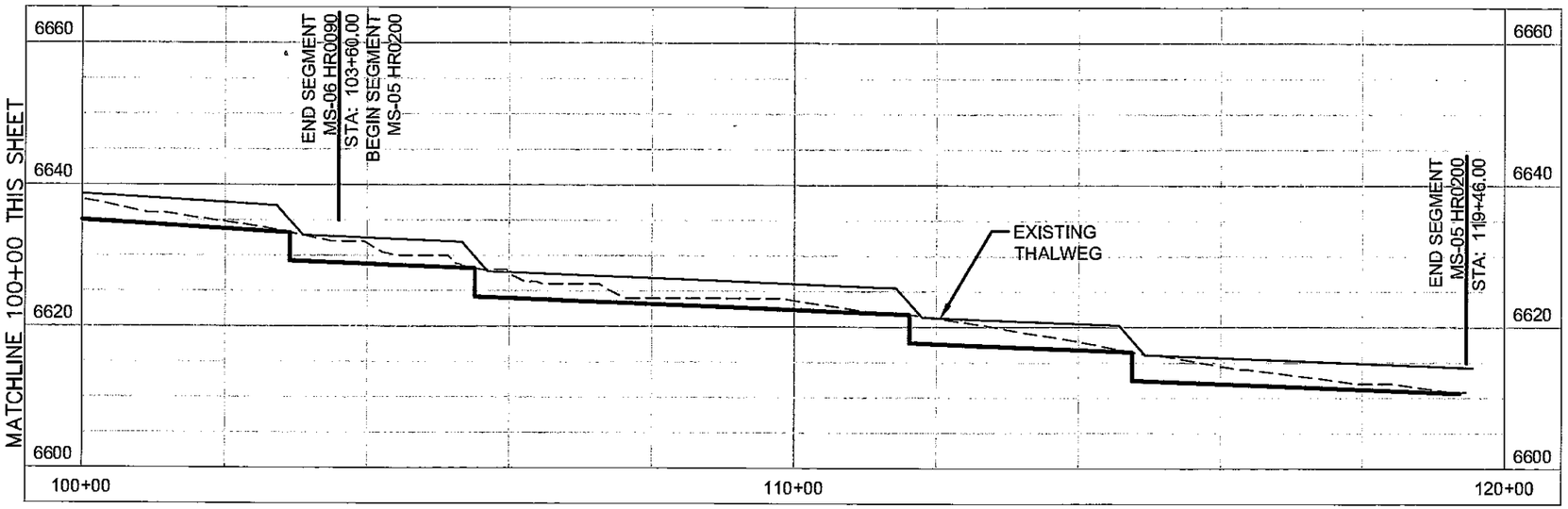
MS–05 HR0200

SLOPE = 0.40%

(4) 4' DROPS

PROFILE MAIN STEM (MS–06 & MS–05)





LEGEND

- PROPOSED DROP STRUCTURE
- EXISTING THALWEG
- HYDRAULIC GRADE LINE

Computer File Information

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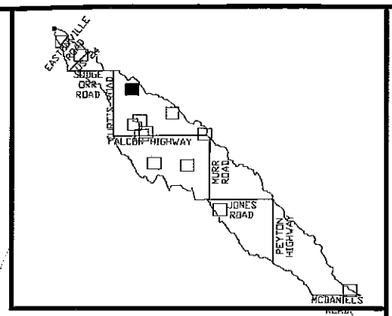
Structure Numbers

HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL PROFILES

Sheet Number MS06 & MS05 (3)

POND SR-03



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

TOP OF BERM
6724'

100 YEAR
WS 6721'

LOW POINT

6730
6720
6710
6700

LEGEND

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

POND SR-03
DISCHARGE

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

N

1"=200'

200 0 200 400

Computer File Information

Full Path:	P:\21711039\CAD\PLANSHTS
Drawing File Name:	PONDS.DWG
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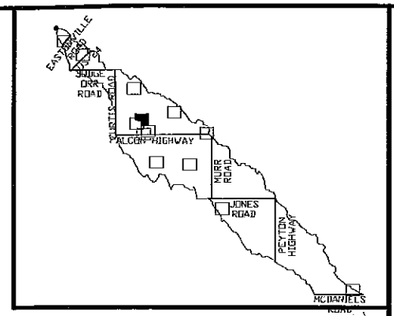
Structure Numbers

HAEGLER RANCH DRAINAGE BASIN

Sheet Number SR03

POND SR-04



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

100 YEAR
WS 6653.25'

TOP OF BERM
6656.25'

LOW POINT

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

6670 6660 6650 6640

LEGEND

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

POND SR-04
DISCHARGE

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

N

1"=200'

200 0 200 400

Computer File Information

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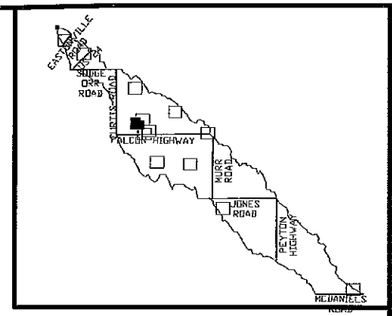
Structure Numbers	

HAEGLER RANCH DRAINAGE BASIN

Sheet Number SR04

POND SR-05



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

LOW POINT

100 YEAR
WS 6655.50'

TOP OF BERM
6658.50'

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

LEGEND

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

POND SR-05
DISCHARGE

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

N

1"=200'

200 0 200 400

Computer File Information

Full Path:	P:\21711039\CAD\PLANSHTS
Drawing File Name:	PONDS.DWG
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Detailed by:	DRM
Checked by:	JAJ

Structure Numbers

HAEGLER RANCH DRAINAGE BASIN

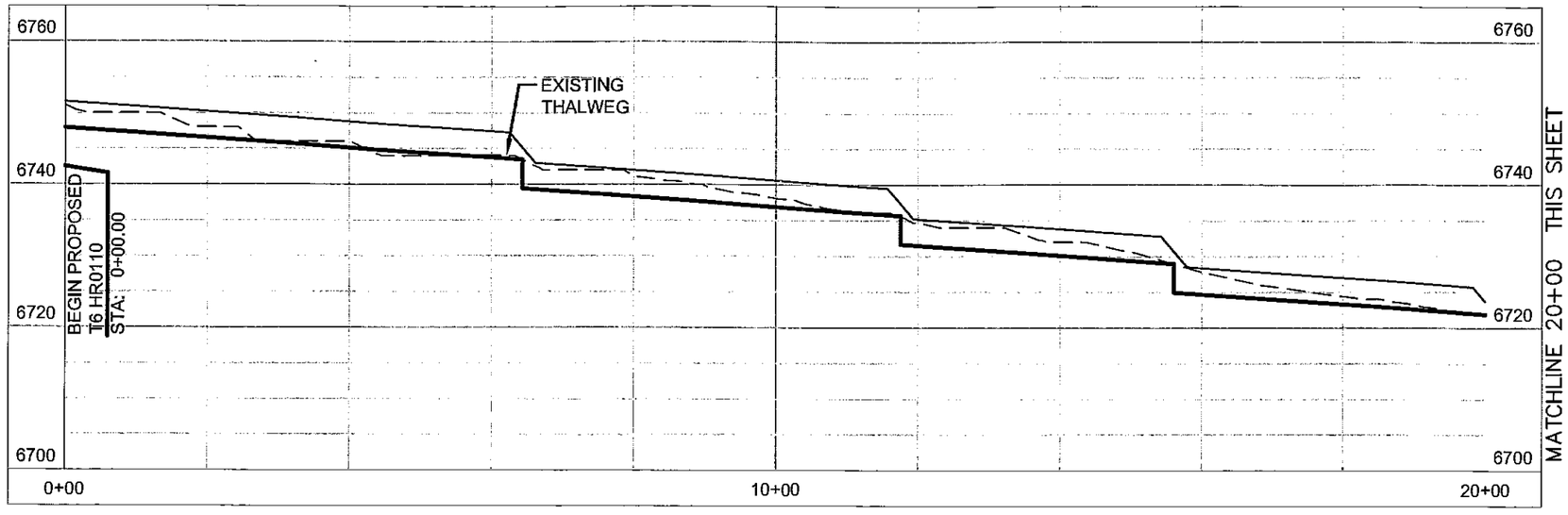
Sheet Number SR05

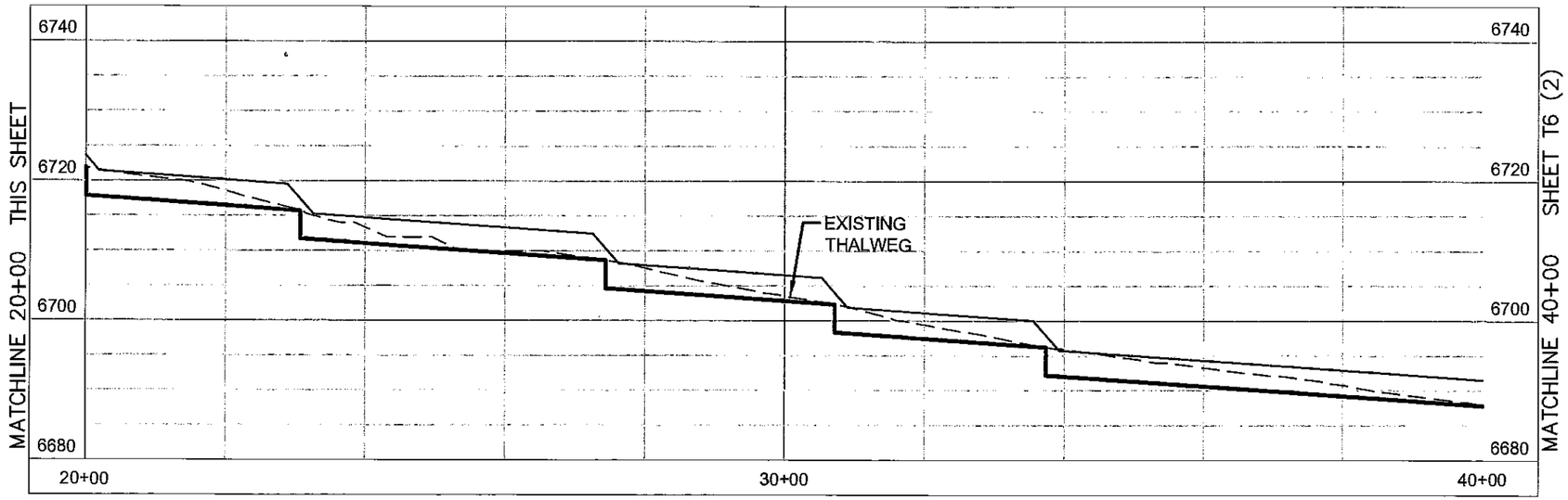
T6 HR0110

SLOPE = 0.70%

(9) 4' DROPS

PROFILE TRIBUTARY 6 (T6)





LEGEND

- PROPOSED DROP STRUCTURE
- EXISTING THALWEG
- HYDRAULIC GRADE LINE

Computer File information

Full Path: P:\21711039\CAD\PLANSHTS

Drawing File Name: T_PROFILE_SHEETS 6_PROPOSED.DWG

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

Index of Revisions

Profiles

Designed by: KAP

Detailed by: DRM

Checked by:

Structure Numbers

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

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

HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL PROFILES

Sheet Number T6

T6 HR0110

SLOPE = 0.70%

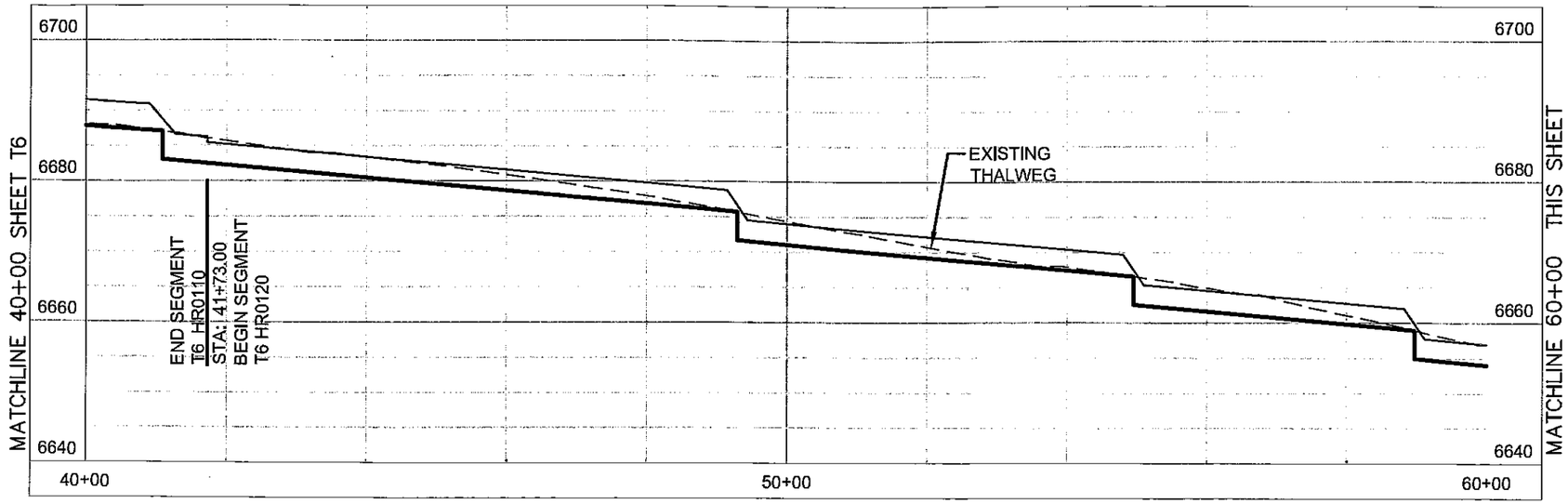
(9) 4' DROPS

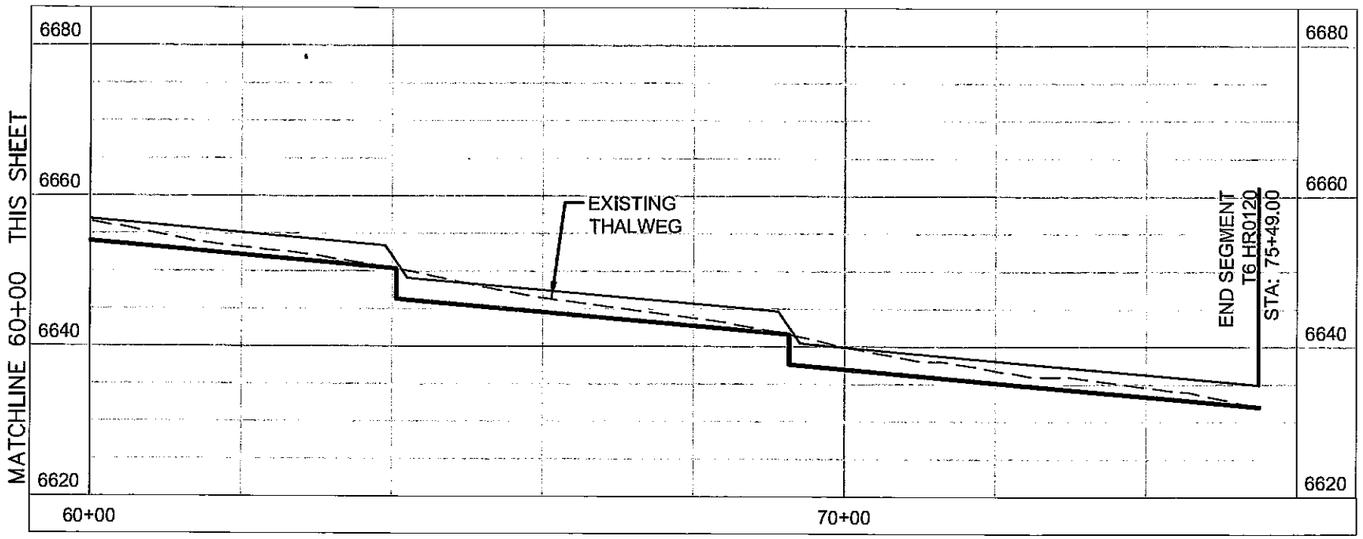
T6 HR0120

SLOPE = 0.90%

(6) 4' DROPS

PROFILE TRIBUTARY 6 (T6)





LEGEND

- PROPOSED DROP STRUCTURE
- EXISTING THALWEG
- HYDRAULIC GRADE LINE

Computer File Information

Full Path: P:\21711039\CAD\PLANSHTS

Drawing File Name: T PROFILE SHEETS 6_PROPOSED.DWG

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

Index of Revisions

Profiles

Designed by: KAP

Detailed by: DRM

Checked by:

Structure Numbers

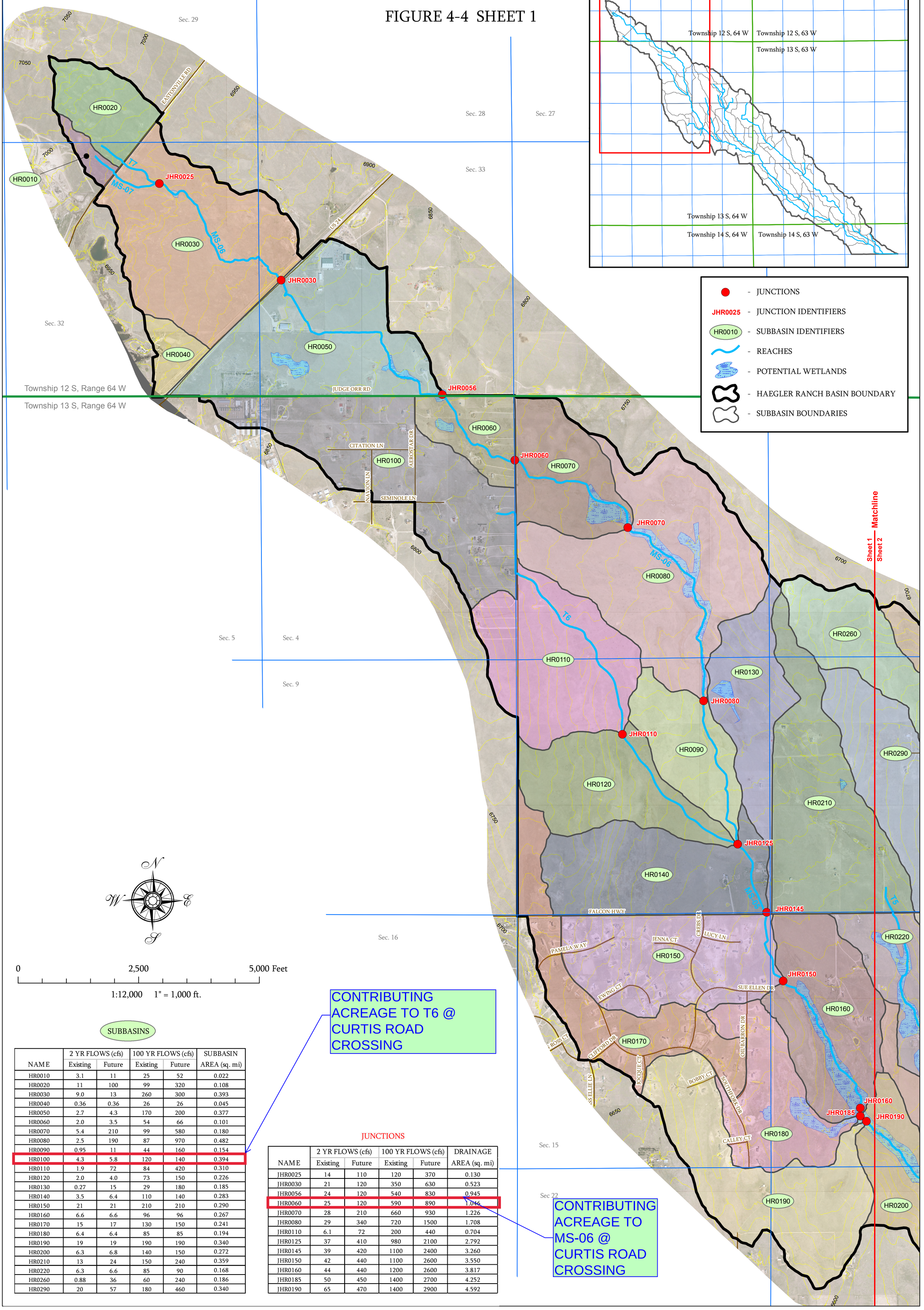
EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

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

HAEGLER RANCH SUB-REGIONAL DETENTION ALTERNATIVE CONCEPTUAL PROFILES

Sheet Number T6 (2)

FIGURE 4-4 SHEET 1



0 2,500 5,000 Feet

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

SUBBASINS

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

CONTRIBUTING ACREAGE TO T6 @ CURTIS ROAD CROSSING

JUNCTIONS

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

CONTRIBUTING ACREAGE TO MS-06 @ CURTIS ROAD CROSSING

URS

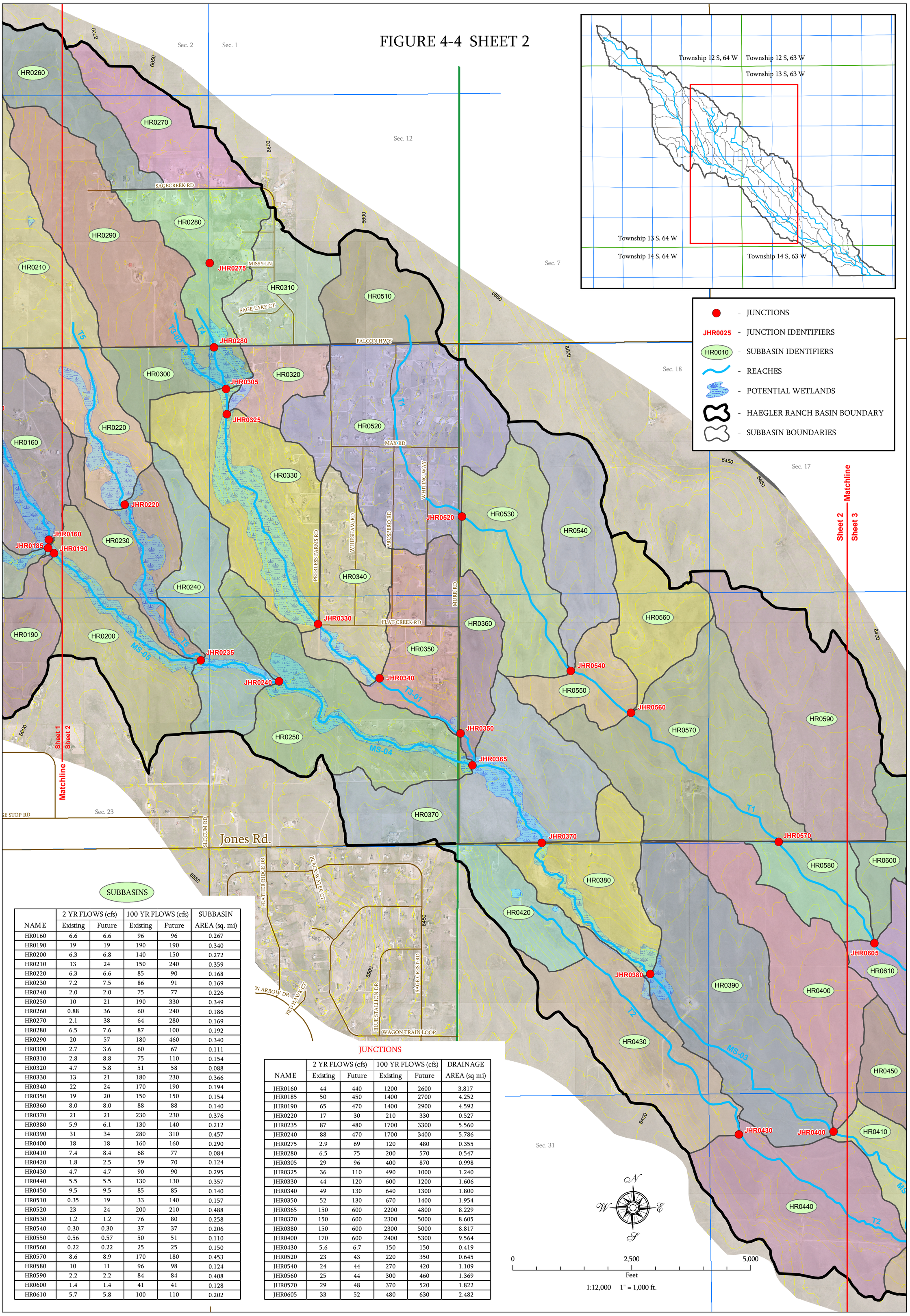
HAEGLER RANCH DRAINAGE BASIN

EXISTING AND FUTURE CONDITIONS HYDROLOGIC MODEL

URS NO. 21711039

DATE: 09/08

FIGURE 4-4 SHEET 2



SUBBASINS

NAME	2 YR FLOWS (cfs) Existing	2 YR FLOWS (cfs) Future	100 YR FLOWS (cfs) Existing	100 YR FLOWS (cfs) Future	SUBBASIN AREA (sq. mi)
HR0160	6.6	6.6	96	96	0.267
HR0190	19	19	190	190	0.340
HR0200	6.3	6.8	140	150	0.272
HR0210	13	24	150	240	0.359
HR0220	6.3	6.6	85	90	0.168
HR0230	7.2	7.5	86	91	0.169
HR0240	2.0	2.0	75	77	0.226
HR0250	10	21	190	330	0.349
HR0260	0.88	36	60	240	0.186
HR0270	2.1	38	64	280	0.169
HR0280	6.5	7.6	87	100	0.192
HR0290	20	57	180	460	0.340
HR0300	2.7	3.6	60	67	0.111
HR0310	2.8	8.8	75	110	0.154
HR0320	4.7	5.8	51	58	0.088
HR0330	13	21	180	230	0.366
HR0340	22	24	170	190	0.194
HR0350	19	20	150	150	0.154
HR0360	8.0	8.0	88	88	0.140
HR0370	21	21	230	230	0.376
HR0380	5.9	6.1	130	140	0.212
HR0390	31	34	280	310	0.457
HR0400	18	18	160	160	0.290
HR0410	7.4	8.4	68	77	0.084
HR0420	1.8	2.5	59	70	0.124
HR0430	4.7	4.7	90	90	0.295
HR0440	5.5	5.5	130	130	0.357
HR0450	9.5	9.5	85	85	0.140
HR0510	0.35	19	33	140	0.157
HR0520	23	24	200	210	0.488
HR0530	1.2	1.2	76	80	0.258
HR0540	0.30	0.30	37	37	0.206
HR0550	0.56	0.57	50	51	0.110
HR0560	0.22	0.22	25	25	0.150
HR0570	8.6	8.9	170	180	0.453
HR0580	10	11	96	98	0.124
HR0590	2.2	2.2	84	84	0.408
HR0600	1.4	1.4	41	41	0.128
HR0610	5.7	5.8	100	110	0.202

JUNCTIONS

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

URS

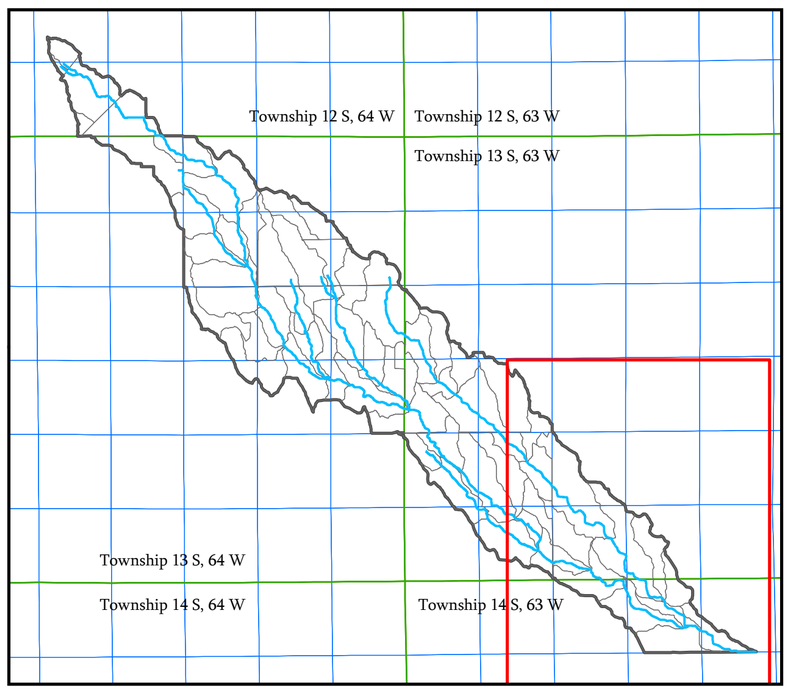
HAEGLER RANCH DRAINAGE BASIN

EXISTING AND FUTURE CONDITIONS HYDROLOGIC MODEL

URS NO. 21711039

DATE: 09/08

FIGURE 4-4 SHEET 3



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

Sheet 2 Matchline Sheet 3

Township 13 S, Range 63 W

Township 14 S, Range 63 W

SUBBASINS

NAME	2 YR FLOWS (cfs) Existing	2 YR FLOWS (cfs) Future	100 YR FLOWS (cfs) Existing	100 YR FLOWS (cfs) Future	SUBBASIN AREA (sq. mi)
HR0390	31	34	280	310	0.457
HR0400	18	18	160	160	0.290
HR0410	7.4	8.4	68	77	0.084
HR0440	5.5	5.5	130	130	0.357
HR0450	9.5	9.5	85	85	0.140
HR0460	4.0	4.0	76	76	0.109
HR0470	7.3	7.6	73	77	0.102
HR0480	0.86	0.86	34	34	0.244
HR0490	9.2	9.8	210	220	0.312
HR0500	3.3	3.4	140	150	0.326
HR0580	10	11	96	98	0.124
HR0590	2.2	2.2	84	84	0.408
HR0600	1.4	1.4	41	41	0.128
HR0610	5.7	5.8	100	110	0.202
HR0620	1.9	1.9	110	120	0.647
HR0630	2.2	2.2	86	86	0.616
HR0640	0.88	0.88	37	37	0.237
HR0650	4.2	4.3	45	46	0.092
HR0660	0.87	0.87	52	52	0.296
HR0670	0.63	0.63	31	31	0.153
HR0680	11	12	110	120	0.206

JUNCTIONS

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

N W E S

0 2,500 5,000

Feet

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

URS

HAEGLER RANCH DRAINAGE BASIN

EXISTING AND FUTURE CONDITIONS HYDROLOGIC MODEL

URS NO. 21711039

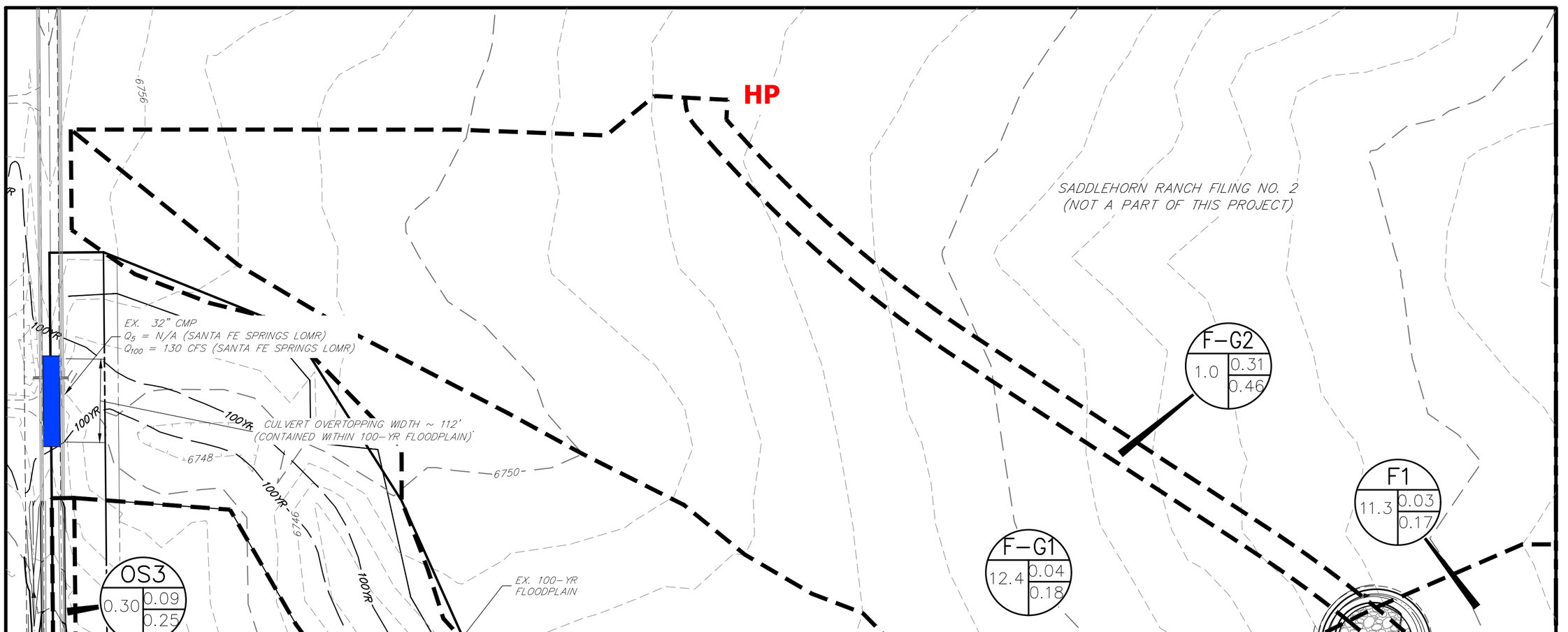
DATE: 09/08

APPENDIX F

DRAINAGE MAPS & PLANS

SADDLEHORN RANCH - FILING 1

PROPOSED DRAINAGE MAP



LEGEND

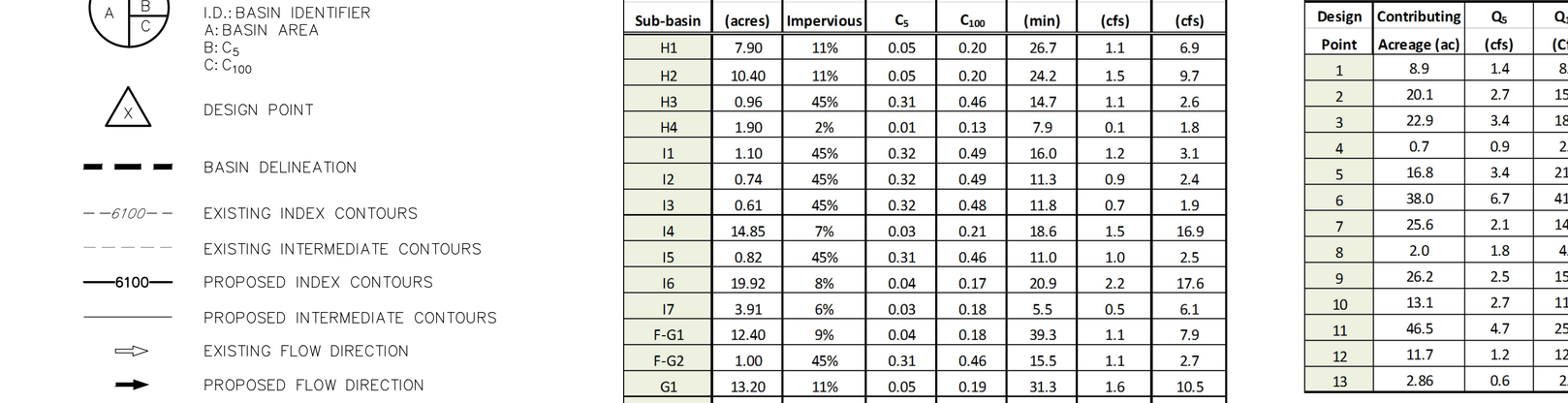
- I.D. (A / B / C): BASIN DESIGNATION
  - I.D.: BASIN IDENTIFIER
  - A: BASIN AREA
  - B: C_5
  - C: C_{100}
- X: DESIGN POINT
- BASIN DELINEATION
- 6100: EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 6100: PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- EXISTING FLOW DIRECTION
- PROPOSED FLOW DIRECTION
- HP: PROPOSED HIGH POINT
- LP: PROPOSED LOW POINT

FILING 1 - SUB-BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
H1	7.90	11%	0.05	0.20	26.7	1.1	6.9
H2	10.40	11%	0.05	0.20	24.2	1.5	9.7
H3	0.96	45%	0.31	0.46	14.7	1.1	2.6
H4	1.90	2%	0.01	0.13	7.9	0.1	1.8
I1	1.10	45%	0.32	0.49	16.0	1.2	3.1
I2	0.74	45%	0.32	0.49	11.3	0.9	2.4
I3	0.61	45%	0.32	0.48	11.8	0.7	1.9
I4	14.85	7%	0.03	0.21	18.6	1.5	16.9
I5	0.82	45%	0.31	0.46	11.0	1.0	2.5
I6	19.92	8%	0.04	0.17	20.9	2.2	17.6
I7	3.91	6%	0.03	0.18	5.5	0.5	6.1
F-G1	12.40	9%	0.04	0.18	39.3	1.1	7.9
F-G2	1.00	45%	0.31	0.46	15.5	1.1	2.7
G1	13.20	11%	0.05	0.19	31.3	1.6	10.5
G2	0.98	45%	0.31	0.46	15.8	1.0	2.6
G3	0.63	45%	0.31	0.46	13.9	0.7	1.8
G4	2.50	26%	0.16	0.31	37.0	0.8	2.8
G5	11.15	11%	0.05	0.19	18.4	1.8	11.5
G6	4.36	5%	0.03	0.29	23.4	0.3	6.0
G7	0.31	45%	0.31	0.46	12.0	0.4	0.9
F1	11.30	7%	0.03	0.17	27.4	0.9	8.2
F2	0.36	2%	0.01	0.13	12.8	0.0	0.3
F3	2.39	7%	0.03	0.16	27.0	0.2	1.7
F4	0.47	45%	0.31	0.46	10.2	0.6	1.5
UD1	4.30	6%	0.03	0.16	9.1	0.5	4.9
UD2	13.00	7%	0.03	0.21	18.3	1.4	14.6
UD3	9.60	8%	0.04	0.26	14.6	1.3	14.7
UD4	16.50	6%	0.03	0.16	22.6	1.2	12.7
UD5	10.00	6%	0.03	0.27	24.9	0.9	12.7
UD6	6.80	6%	0.03	0.22	11.2	0.8	10.0
OS1	1.00	24%	0.14	0.29	27.2	0.4	1.3
OS2	0.76	18%	0.09	0.25	14.8	0.3	1.1
OS3	0.30	18%	0.09	0.25	7.9	0.1	0.6

FILING 1 - DESIGN POINT SUMMARY TABLE

Design Point	Contributing Acreage (ac)	Q_5 (cfs)	Q_{100} (Cfs)
1	8.9	1.4	8.2
2	20.1	2.7	15.7
3	22.9	3.4	18.3
4	0.7	0.9	2.4
5	16.8	3.4	21.8
6	38.0	6.7	41.5
7	25.6	2.1	14.8
8	2.0	1.8	4.4
9	26.2	2.5	15.6
10	13.1	2.7	11.7
11	46.5	4.7	25.9
12	11.7	1.2	12.0
13	2.86	0.6	2.7



T6 CHANNEL IMPROVEMENTS - TYPICAL SECTION

SCALE: 1"=10'

CHANNEL SEED MIX: EROSION CONTROL BLANKET WITH PAWNEE BUTTES SEED INC. – "LOW GROW NATIVE MIX"
- –IDAHO FESCUE
- –SANDBERG BLUEGRASS
- –ROCKY MOUNTAIN FESCUE
- –BIG BLUEGRASS

N

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

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

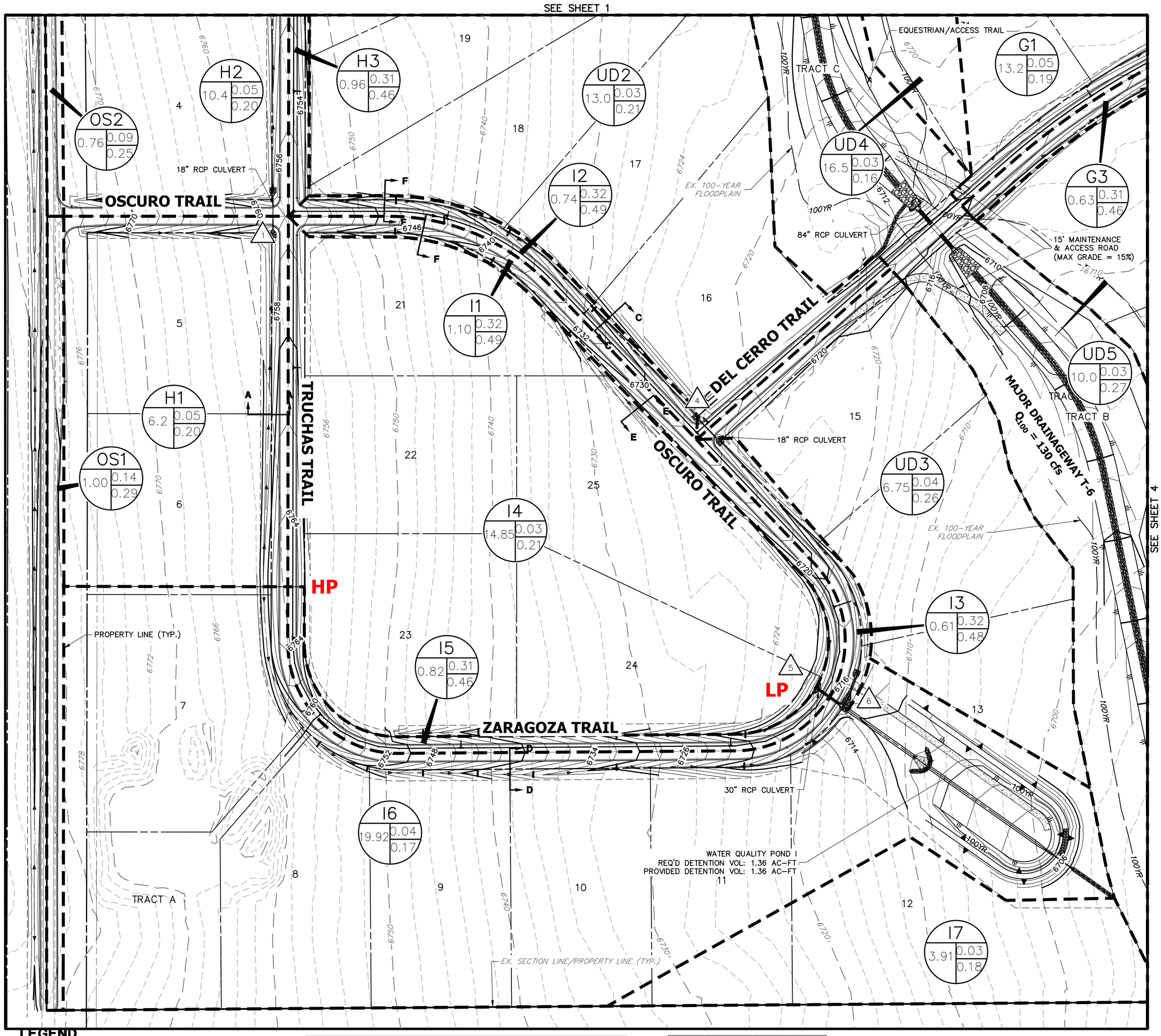
J·R ENGINEERING
A Westrian Company

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

X:\2510000.all\2514202\Drawings\Sheet Dwgs\Drainage\Filing 1 Drainage Map.dwg, DR01, 1/7/2020 1:34:31 PM, CS

SADDLEHORN RANCH - FILING 1

PROPOSED DRAINAGE MAP



LEGEND

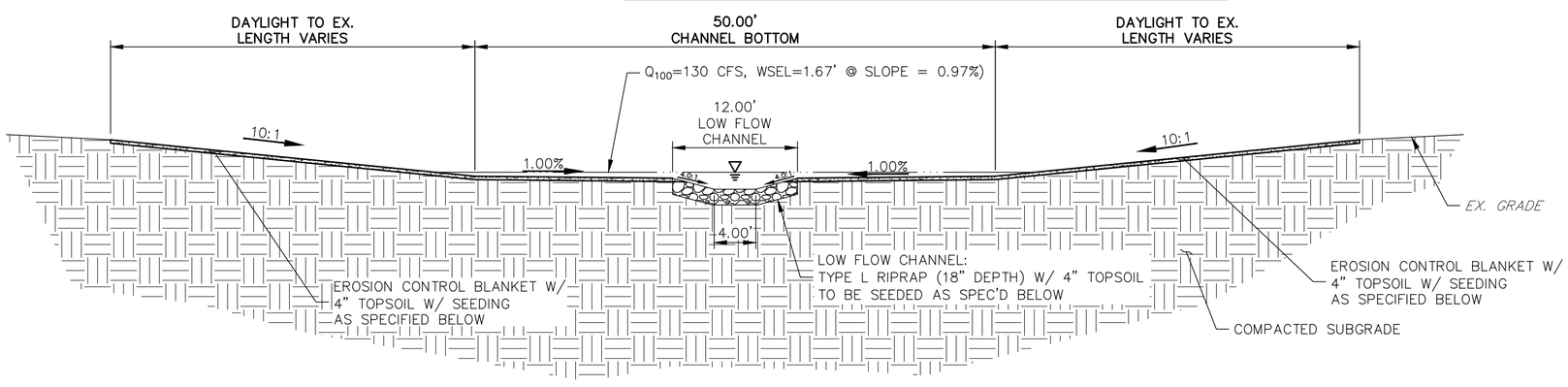
- I.D. (A: BASIN AREA, B: C_5, C: C_{100}) — BASIN DESIGNATION
- X — DESIGN POINT
- BASIN DELINEATION
- 6100 — EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 6100 — PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- EXISTING FLOW DIRECTION
- PROPOSED FLOW DIRECTION
- HP — PROPOSED HIGH POINT
- LP — PROPOSED LOW POINT

FILING 1 - SUB-BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
H1	7.90	11%	0.05	0.20	26.7	1.1	6.9
H2	10.40	11%	0.05	0.20	24.2	1.5	9.7
H3	0.96	45%	0.31	0.46	14.7	1.1	2.6
H4	1.90	2%	0.01	0.13	7.9	0.1	1.8
I1	1.10	45%	0.32	0.49	16.0	1.2	3.1
I2	0.74	45%	0.32	0.49	11.3	0.9	2.4
I3	0.61	45%	0.32	0.48	11.8	0.7	1.9
I4	14.85	7%	0.03	0.21	18.6	1.5	16.9
I5	0.82	45%	0.31	0.46	11.0	1.0	2.5
I6	19.92	8%	0.04	0.17	20.9	2.2	17.6
I7	3.91	6%	0.03	0.18	5.5	0.5	6.1
F-G1	12.40	9%	0.04	0.18	39.3	1.1	7.9
F-G2	1.00	45%	0.31	0.46	15.5	1.1	2.7
G1	13.20	11%	0.05	0.19	31.3	1.6	10.5
G2	0.98	45%	0.31	0.46	15.8	1.0	2.6
G3	0.63	45%	0.31	0.46	13.9	0.7	1.8
G4	2.50	26%	0.16	0.31	37.0	0.8	2.8
G5	11.15	11%	0.05	0.19	18.4	1.8	11.5
G6	4.36	5%	0.03	0.29	23.4	0.3	6.0
G7	0.31	45%	0.31	0.46	12.0	0.4	0.9
F1	11.30	7%	0.03	0.17	27.4	0.9	8.2
F2	0.36	2%	0.01	0.13	12.8	0.0	0.3
F3	2.39	7%	0.03	0.16	27.0	0.2	1.7
F4	0.47	45%	0.31	0.46	10.2	0.6	1.5
UD1	4.30	6%	0.03	0.16	9.1	0.5	4.9
UD2	13.00	7%	0.03	0.21	18.3	1.4	14.6
UD3	9.60	8%	0.04	0.26	14.6	1.3	14.7
UD4	16.50	6%	0.03	0.16	22.6	1.2	12.7
UD5	10.00	6%	0.03	0.27	24.9	0.9	12.7
UD6	6.80	6%	0.03	0.22	11.2	0.8	10.0
OS1	1.00	24%	0.14	0.29	27.2	0.4	1.3
OS2	0.76	18%	0.09	0.25	14.8	0.3	1.1
OS3	0.30	18%	0.09	0.25	7.9	0.1	0.6

FILING 1 - DESIGN POINT SUMMARY TABLE

Design Point	Contributing Acreage (ac)	Q_5 (cfs)	Q_{100} (Cfs)
1	8.9	1.4	8.2
2	20.1	2.7	15.7
3	22.9	3.4	18.3
4	0.7	0.9	2.4
5	16.8	3.4	21.8
6	38.0	6.7	41.5
7	25.6	2.1	14.8
8	2.0	1.8	4.4
9	26.2	2.5	15.6
10	13.1	2.7	11.7
11	46.5	4.7	25.9
12	11.7	1.2	12.0
13	2.86	0.6	2.7



T6 CHANNEL IMPROVEMENTS - TYPICAL SECTION

SCALE: 1"=10'

CHANNEL SEED MIX: EROSION CONTROL BLANKET WITH PAWNEE BUTTES SEED INC. – "LOW GROW NATIVE MIX"
- –IDAHO FESCUE
- –SANDBERG BLUEGRASS
- –ROCKY MOUNTAIN FESCUE
- –BIG BLUEGRASS

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

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

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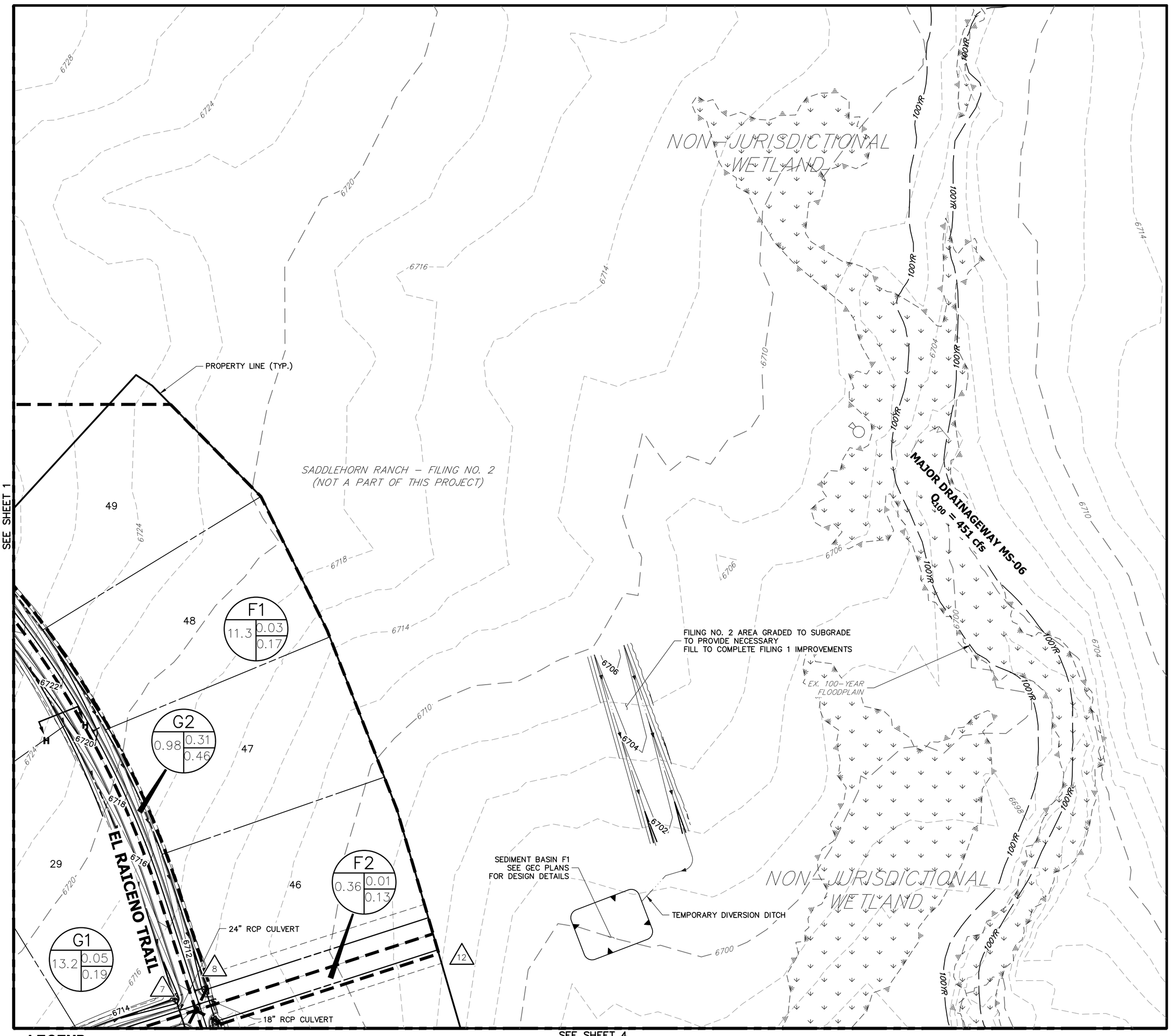
SADDLEHORN RANCH - FILING 1

PROPOSED DRAINAGE MAP



LEGEND

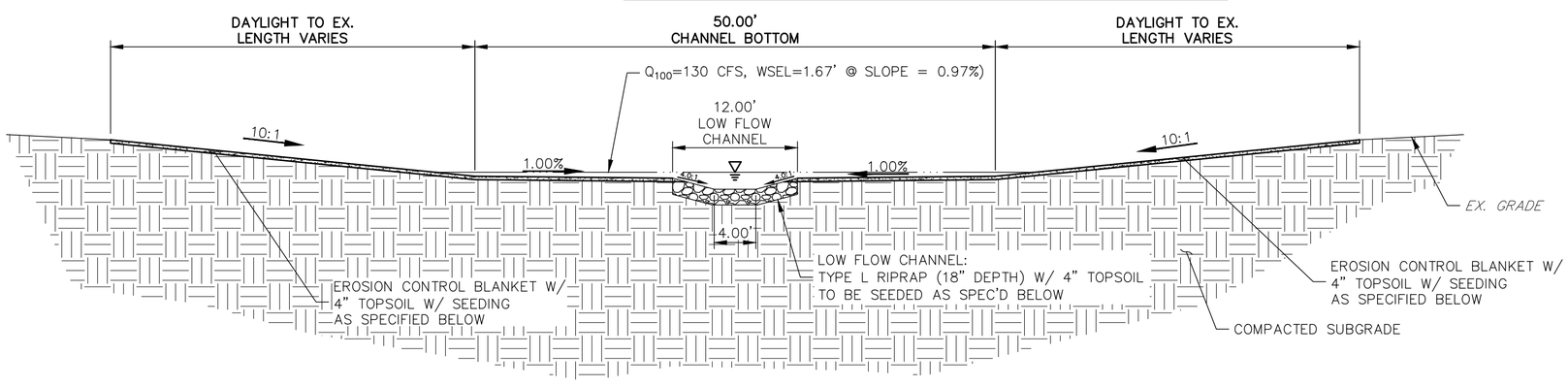
- I.D. (A / B / C): BASIN DESIGNATION
  - I.D.: BASIN IDENTIFIER
  - A: BASIN AREA
  - B: C_5
  - C: C_{100}
- X: DESIGN POINT
- BASIN DELINEATION
- --6100-- EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 6100 PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- EXISTING FLOW DIRECTION
- PROPOSED FLOW DIRECTION
- **HP** PROPOSED HIGH POINT
- **LP** PROPOSED LOW POINT

FILING 1 - SUB-BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
H1	7.90	11%	0.05	0.20	26.7	1.1	6.9
H2	10.40	11%	0.05	0.20	24.2	1.5	9.7
H3	0.96	45%	0.31	0.46	14.7	1.1	2.6
H4	1.90	2%	0.01	0.13	7.9	0.1	1.8
I1	1.10	45%	0.32	0.49	16.0	1.2	3.1
I2	0.74	45%	0.32	0.49	11.3	0.9	2.4
I3	0.61	45%	0.32	0.48	11.8	0.7	1.9
I4	14.85	7%	0.03	0.21	18.6	1.5	16.9
I5	0.82	45%	0.31	0.46	11.0	1.0	2.5
I6	19.92	8%	0.04	0.17	20.9	2.2	17.6
I7	3.91	6%	0.03	0.18	5.5	0.5	6.1
F-G1	12.40	9%	0.04	0.18	39.3	1.1	7.9
F-G2	1.00	45%	0.31	0.46	15.5	1.1	2.7
G1	13.20	11%	0.05	0.19	31.3	1.6	10.5
G2	0.98	45%	0.31	0.46	15.8	1.0	2.6
G3	0.63	45%	0.31	0.46	13.9	0.7	1.8
G4	2.50	26%	0.16	0.31	37.0	0.8	2.8
G5	11.15	11%	0.05	0.19	18.4	1.8	11.5
G6	4.36	5%	0.03	0.29	23.4	0.3	6.0
G7	0.31	45%	0.31	0.46	12.0	0.4	0.9
F1	11.30	7%	0.03	0.17	27.4	0.9	8.2
F2	0.36	2%	0.01	0.13	12.8	0.0	0.3
F3	2.39	7%	0.03	0.16	27.0	0.2	1.7
F4	0.47	45%	0.31	0.46	10.2	0.6	1.5
UD1	4.30	6%	0.03	0.16	9.1	0.5	4.9
UD2	13.00	7%	0.03	0.21	18.3	1.4	14.6
UD3	9.60	8%	0.04	0.26	14.6	1.3	14.7
UD4	16.50	6%	0.03	0.16	22.6	1.2	12.7
UD5	10.00	6%	0.03	0.27	24.9	0.9	12.7
UD6	6.80	6%	0.03	0.22	11.2	0.8	10.0
OS1	1.00	24%	0.14	0.29	27.2	0.4	1.3
OS2	0.76	18%	0.09	0.25	14.8	0.3	1.1
OS3	0.30	18%	0.09	0.25	7.9	0.1	0.6

FILING 1 - DESIGN POINT SUMMARY TABLE

Design Point	Contributing Acreage (ac)	Q_5 (cfs)	Q_{100} (Cfs)
1	8.9	1.4	8.2
2	20.1	2.7	15.7
3	22.9	3.4	18.3
4	0.7	0.9	2.4
5	16.8	3.4	21.8
6	38.0	6.7	41.5
7	25.6	2.1	14.8
8	2.0	1.8	4.4
9	26.2	2.5	15.6
10	13.1	2.7	11.7
11	46.5	4.7	25.9
12	11.7	1.2	12.0
13	2.86	0.6	2.7



T6 CHANNEL IMPROVEMENTS - TYPICAL SECTION

SCALE: 1"=10'

CHANNEL SEED MIX: EROSION CONTROL BLANKET WITH PAWNEE BUTTES SEED INC. – "LOW GROW NATIVE MIX"
- –IDAHO FESCUE
- –SANDBERG BLUEGRASS
- –ROCKY MOUNTAIN FESCUE
- –BIG BLUEGRASS

N

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

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

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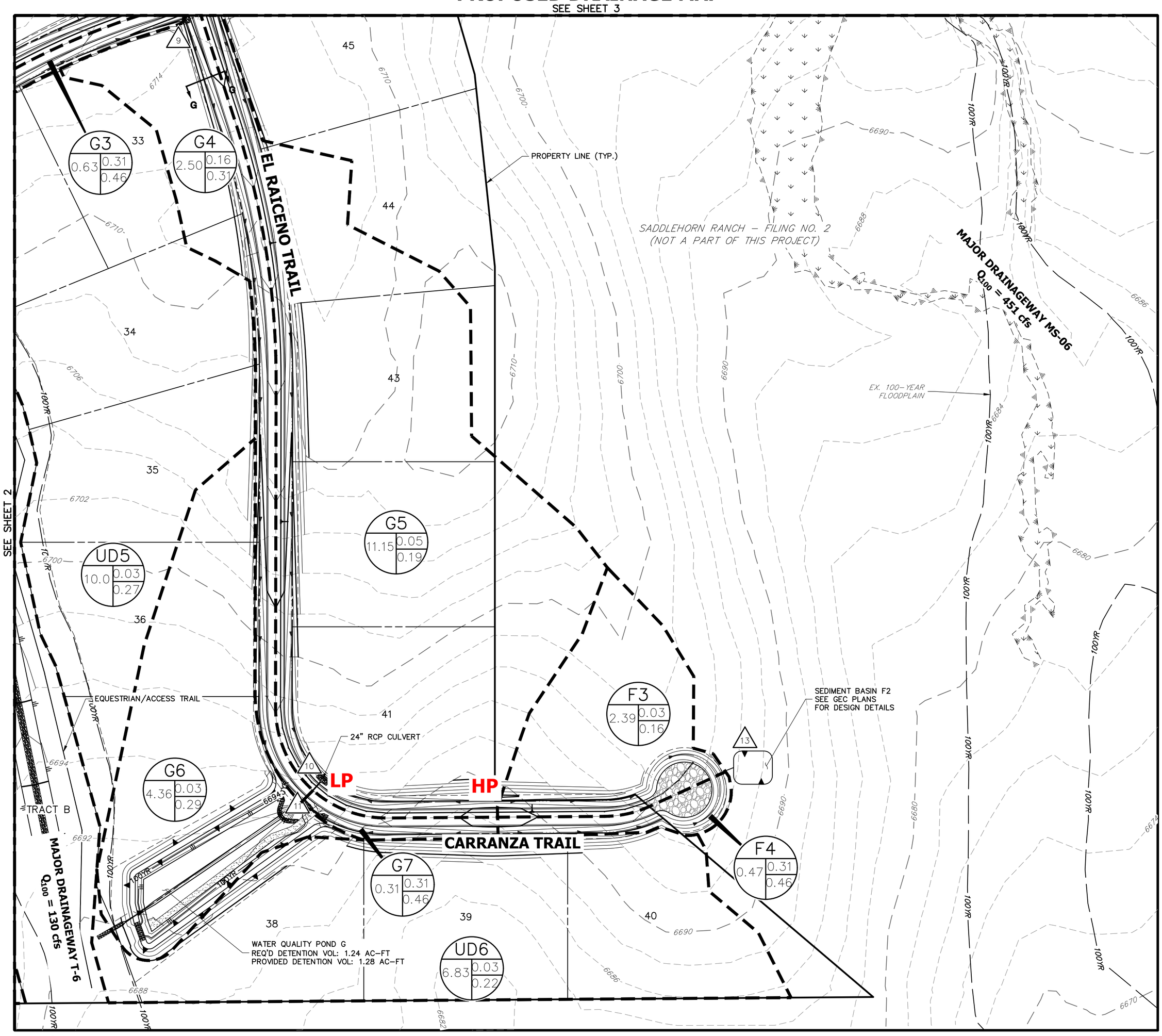
SADDLEHORN RANCH - FILING 1

PROPOSED DRAINAGE MAP



LEGEND

I.D. (A: BASIN AREA, B: C_5, C: C_{100}) — BASIN DESIGNATION

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

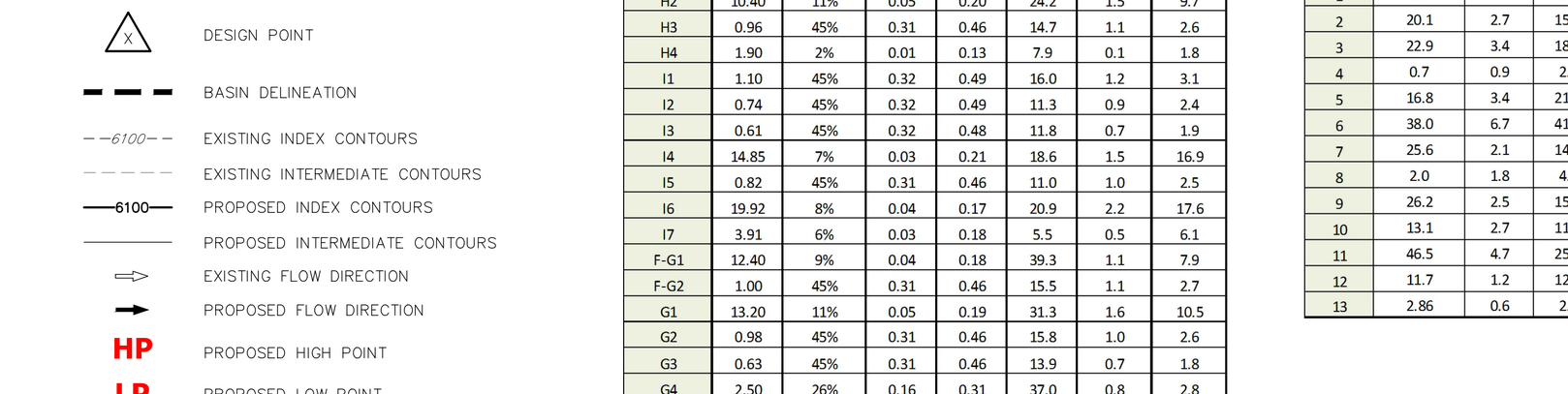
LP PROPOSED LOW POINT

FILING 1 - SUB-BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
H1	7.90	11%	0.05	0.20	26.7	1.1	6.9
H2	10.40	11%	0.05	0.20	24.2	1.5	9.7
H3	0.96	45%	0.31	0.46	14.7	1.1	2.6
H4	1.90	2%	0.01	0.13	7.9	0.1	1.8
I1	1.10	45%	0.32	0.49	16.0	1.2	3.1
I2	0.74	45%	0.32	0.49	11.3	0.9	2.4
I3	0.61	45%	0.32	0.48	11.8	0.7	1.9
I4	14.85	7%	0.03	0.21	18.6	1.5	16.9
I5	0.82	45%	0.31	0.46	11.0	1.0	2.5
I6	19.92	8%	0.04	0.17	20.9	2.2	17.6
I7	3.91	6%	0.03	0.18	5.5	0.5	6.1
F-G1	12.40	9%	0.04	0.18	39.3	1.1	7.9
F-G2	1.00	45%	0.31	0.46	15.5	1.1	2.7
G1	13.20	11%	0.05	0.19	31.3	1.6	10.5
G2	0.98	45%	0.31	0.46	15.8	1.0	2.6
G3	0.63	45%	0.31	0.46	13.9	0.7	1.8
G4	2.50	26%	0.16	0.31	37.0	0.8	2.8
G5	11.15	11%	0.05	0.19	18.4	1.8	11.5
G6	4.36	5%	0.03	0.29	23.4	0.3	6.0
G7	0.31	45%	0.31	0.46	12.0	0.4	0.9
F1	11.30	7%	0.03	0.17	27.4	0.9	8.2
F2	0.36	2%	0.01	0.13	12.8	0.0	0.3
F3	2.39	7%	0.03	0.16	27.0	0.2	1.7
F4	0.47	45%	0.31	0.46	10.2	0.6	1.5
UD1	4.30	6%	0.03	0.16	9.1	0.5	4.9
UD2	13.00	7%	0.03	0.21	18.3	1.4	14.6
UD3	9.60	8%	0.04	0.26	14.6	1.3	14.7
UD4	16.50	6%	0.03	0.16	22.6	1.2	12.7
UD5	10.00	6%	0.03	0.27	24.9	0.9	12.7
UD6	6.80	6%	0.03	0.22	11.2	0.8	10.0
OS1	1.00	24%	0.14	0.29	27.2	0.4	1.3
OS2	0.76	18%	0.09	0.25	14.8	0.3	1.1
OS3	0.30	18%	0.09	0.25	7.9	0.1	0.6

FILING 1 - DESIGN POINT SUMMARY TABLE

Design Point	Contributing Acreage (ac)	Q_5 (cfs)	Q_{100} (Cfs)
1	8.9	1.4	8.2
2	20.1	2.7	15.7
3	22.9	3.4	18.3
4	0.7	0.9	2.4
5	16.8	3.4	21.8
6	38.0	6.7	41.5
7	25.6	2.1	14.8
8	2.0	1.8	4.4
9	26.2	2.5	15.6
10	13.1	2.7	11.7
11	46.5	4.7	25.9
12	11.7	1.2	12.0
13	2.86	0.6	2.7



T6 CHANNEL IMPROVEMENTS - TYPICAL SECTION

SCALE: 1"=10'

CHANNEL SEED MIX: EROSION CONTROL BLANKET WITH PAWNEE BUTTES SEED INC. – "LOW GROW NATIVE MIX"
- –IDAHO FESCUE
- –SANDBERG BLUEGRASS
- –ROCKY MOUNTAIN FESCUE
- –BIG BLUEGRASS

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

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

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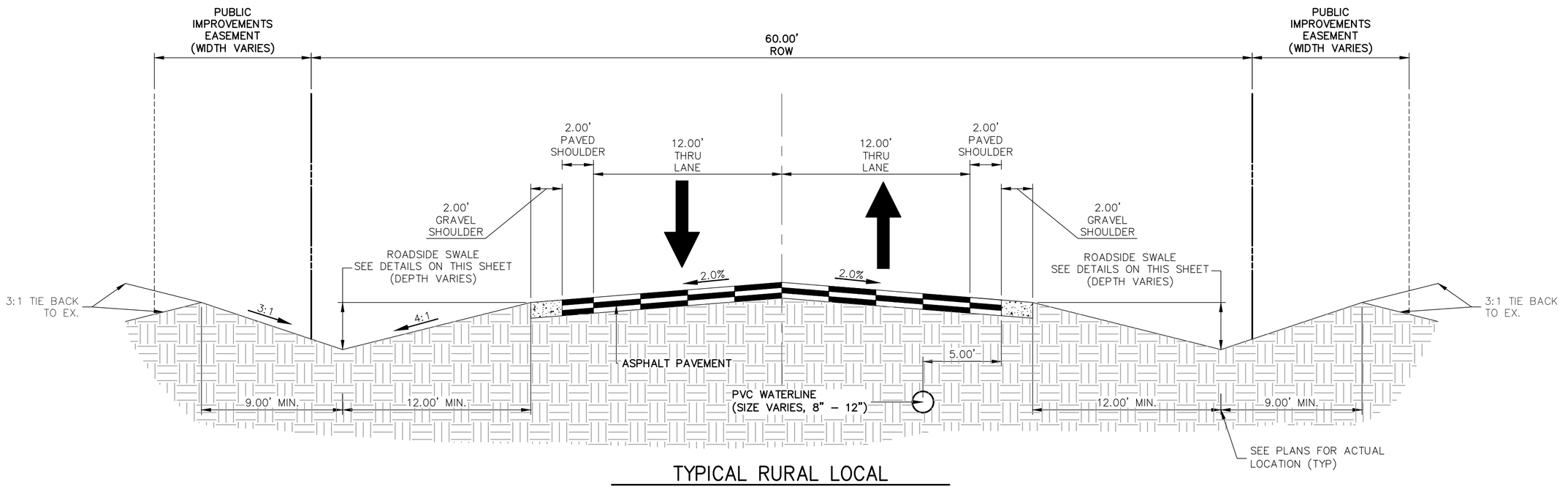
SADDLEHORN RANCH

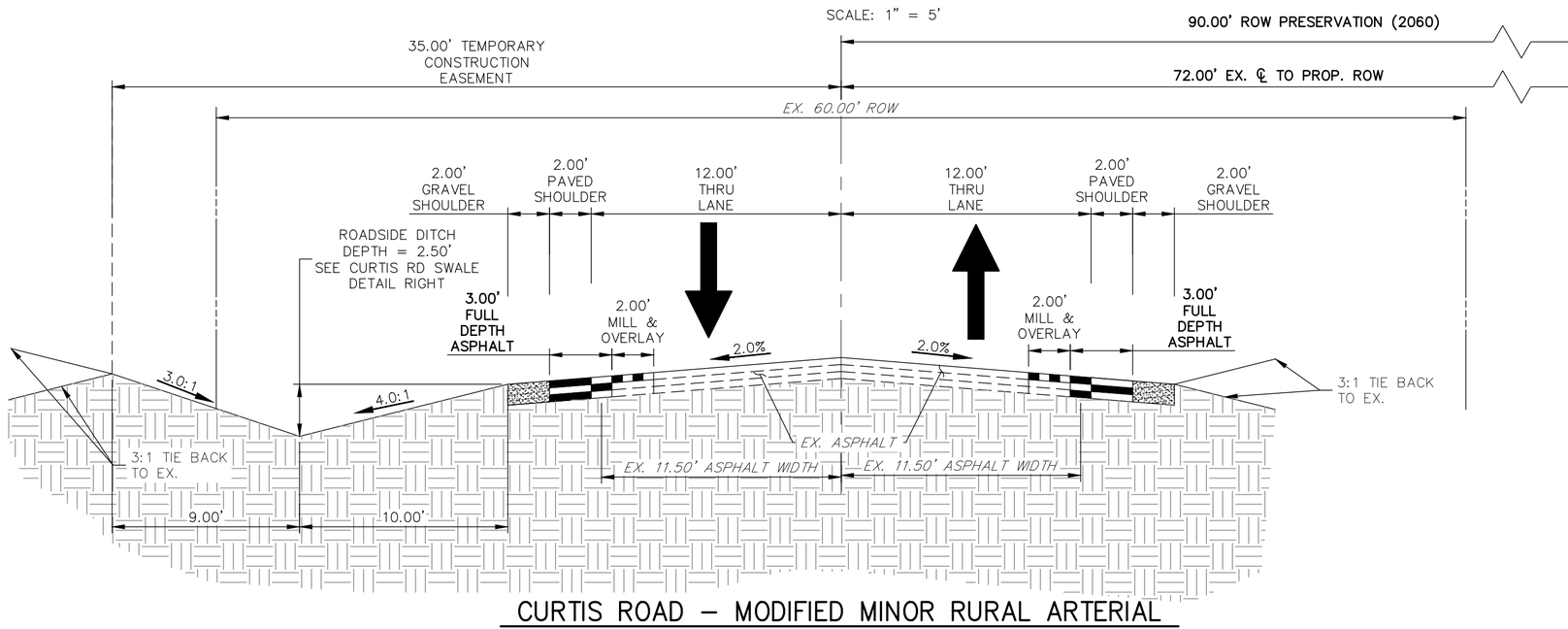
TYPICAL ROADWAY SECTIONS



TYPICAL RURAL LOCAL

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

SCALE: 1" = 5'



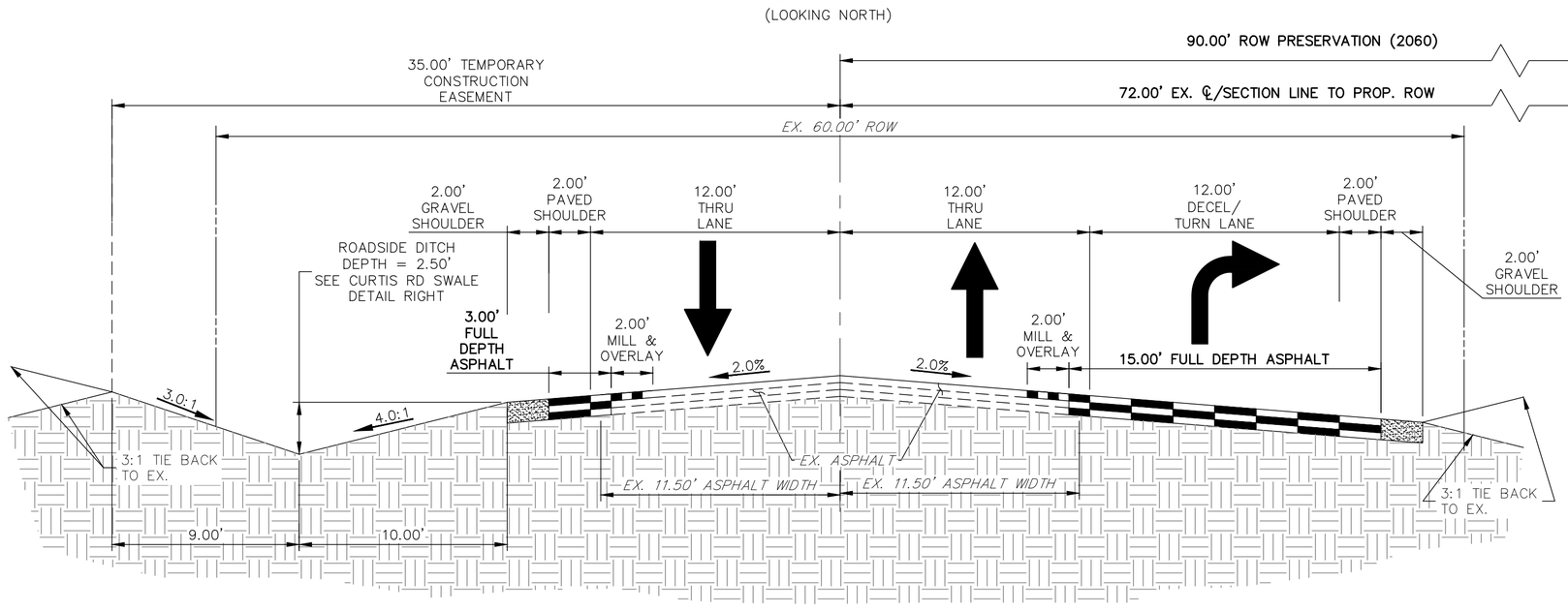
CURTIS ROAD – MODIFIED MINOR RURAL ARTERIAL

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

POSTED SPEED LIMIT = 45 MPH

SCALE: 1" = 5'

(LOOKING NORTH)



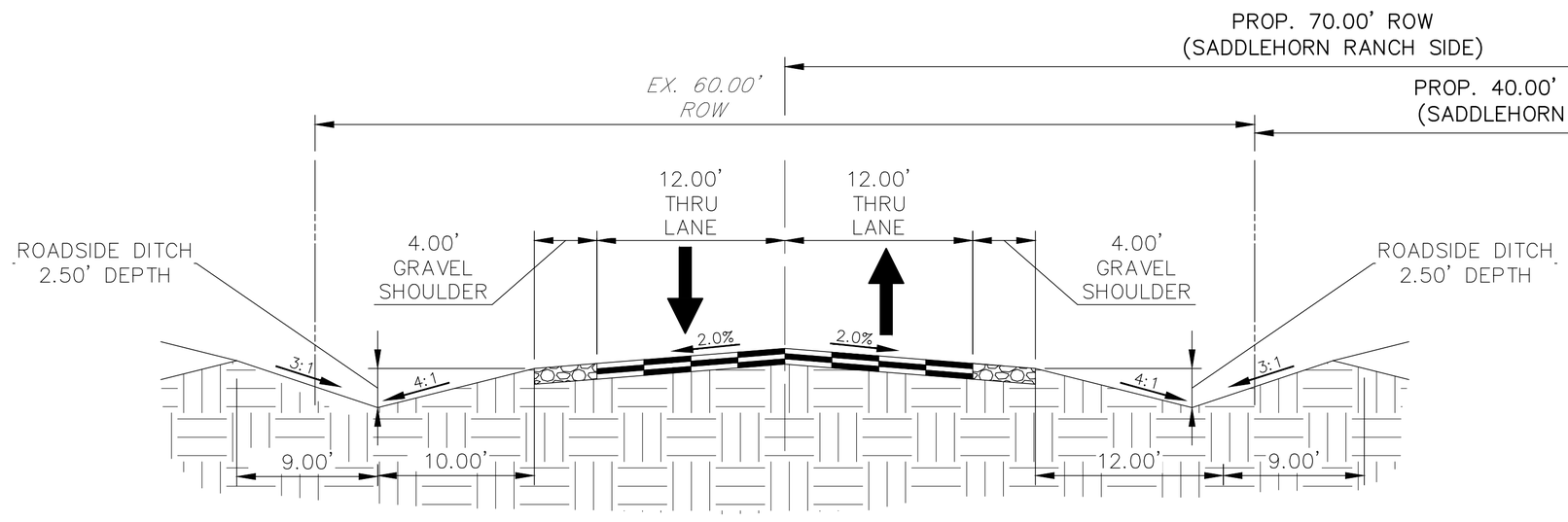
CURTIS ROAD – MODIFIED MINOR RURAL ARTERIAL

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
12/03/19
SHEET 3 OF 3

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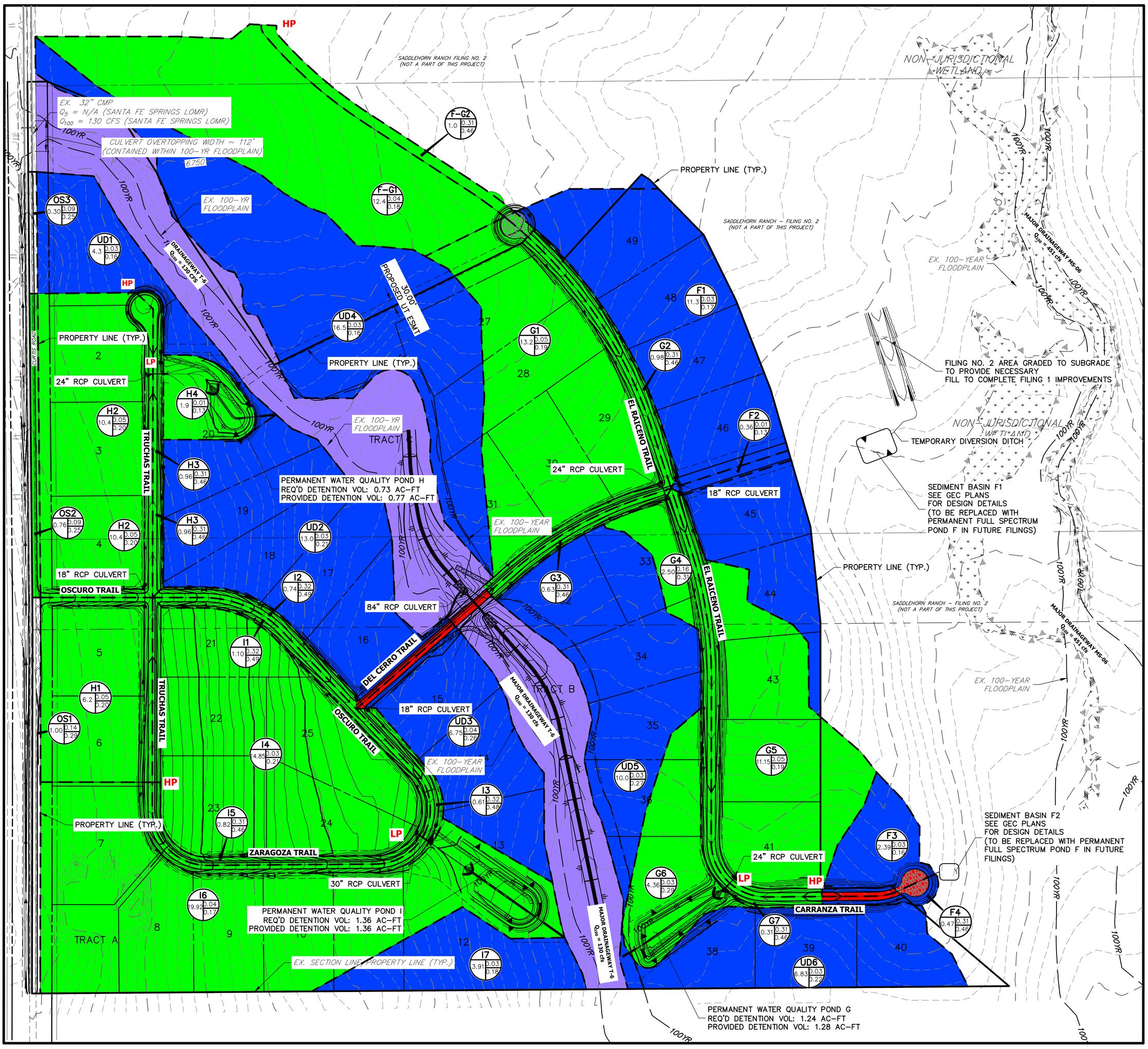
SADDLEHORN RANCH - FILING 1

PERMANENT BMP APPLICABILITY MAP



LEGEND

- I.D. (A / B / C) — BASIN DESIGNATION
  - I.D.: BASIN IDENTIFIER
  - A: BASIN AREA
  - B: C_5
  - C: C_{100}
- 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.)

200 100 0 200 400

ORIGINAL SCALE: 1" = 200'

SADDLEHORN RANCH FILING 1
MS4 PERMIT EXCLUSION AREAS
2514202
01/09/20
SHEET 1 OF 1

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