EPC STORMWATER REVIEW COMMENTS IN ORANGE BOXES WITH BLACK TEXT

PRELIMINARY DRAINAGE REPORT
FOR
TRIPLE H RANCH - PRELIMINARY PLAN
AND
FINAL DRAINAGE REPORT FOR EARLY GRADING
(TEMP. ACCESS ROAD AND TANK/WELL SITE)

CCES RESPONSES

Please provide a stand-alone final drainage report for the early grading.

Prepared for:
P760 LAND, LLC
13395 VOYAGER PKWY., SUITE 130
COLORADO SPRINGS CO 80921

AS DISCUSSED WITH ENGINEERING AND SW, WE HAVE NOW REMOVED THE EARLY GEC PLAN REQUEST

Prepared by:
CLASSIC CONSULTING
619 N. CASCADE AVE SUITE 200
COLORADO SPRINGS CO 80903
(719) 785-2802

Job No. 2604.00

PCD Project No. SP 254

ADDED PROJ. NO.

PRELIMINARY DRAINAGE REPORT FOR
TRIPLE H RANCH PRELIMINARY PLAN

ENGINEER'S STATEMENT:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable 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.

_____ _____
Marc A. Whorton Colorado P.E. #37155 Date

OWNER'S/DEVELOPER'S STATEMENT:
I, the owner/developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: P760 LAND, LLC

By: _____

Title: _____

Address: 13395 Voyager Pkwy., Suite 130

Colorado Springs, CO 80921

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

Joshua J. Palmer, P.E. CORRECTED

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

Conditions:

PRELIMINARY DRAINAGE REPORT FOR
TRIPLE H RANCH PRELIMINARY PLAN

TABLE OF CONTENTS:

APPENDICES

PURPOSE

The purpose of this Preliminary Drainage Report is to address on-site and off-site drainage patterns and identify specific drainage improvements and facilities required to minimize impacts to the adjacent properties. It is also a Final Drainage Report to allow for early grading of a temporary gravel access road up to tank/well site and initial grading of the tank/well site for well drilling operations.

GENERAL DESCRIPTION

The Triple H Ranch Preliminary Plan is 752.68-acre site located in portions of sections 19 and 20, township 13 south, range 63 west of the sixth principal meridian. 244 rural residential 2.5-ac. lots are planned along with two park tracts, two pond tracts and a tract for a water tank/well site. The site is bounded on the north and east by unplatted rural property zoned A-35, to the west by Government lots owned by various individuals that remain rural undeveloped property zoned A-35 and to the south by existing Jones Road and an existing 40-ac. rural residential out parcel zoned A-35 with a current homestead owned by Russel and Loretta Branham. This existing residence accesses directly to Jones Road. The site lies within both the Gieck Ranch and Haegler Ranch Drainage Basins. This site was recently rezoned from A-35 to RR-2.5 approved by BOCC August 28, 2025 (P251).

The majority soil condition reflects Hydrologic Group "A" (Blakeland loamy sand - 8 and Truckton sandy loam – 95, 96 & 97) as determined by the "Web Soil Survey of El Paso County Area," prepared by the Natural Resources Conservation Service (see map in Appendix). These type A soils exhibit a high to very high capacity to transmit water (5.95 to 19.98 in/hr. for soil type 8 and 2.0 to 6.0 in/hr. for soil types 95, 96 & 97). Given the proposed land use of rural residential, large lot (2.5 ac. min.), only roadways, sideroad/drainage ditches and stormwater quality/detention ponds are planned to be graded. No significant overlot grading within the lot areas will take place. Therefore, the pre-developed soils condition will remain in-tact for the majority of the site. As such, Type A soils are utilized for both pre-developed and developed site conditions.

EXISTING DRAINAGE CONDITIONS

The Triple H Ranch property is located in the middle portion of Haegler Ranch Drainage Basin with the extreme northeast portion of the site within the Gieck Ranch Drainage Basin. The entire site generally drains in a southeast direction towards Jones Road along the south boundary. The entire site is covered with native grasses with no trees or other vegetation. There are fenced portions of the site being used for cattle grazing. Off-site flows come onto the property at the northwest corner from undeveloped property within the High Plains Ranch Sketch Plan, approved in 2008. However, no other planning or development has taken place on this adjacent property yet. There is about 136 feet of fall from the northwest portion to the southeast portion of the property but over a dozen low areas throughout the site that appear to have no gravity outfall. Given the well-draining Type A soils across the entire property, these areas show no signs of ponding water. This is consistent with the findings contained in the "Soil and Geology Study – Jones Road", prepared by RMG – Rocky Mountain Group dated September 2023. Based on the bore logs contained within said report, no evidence of groundwater was found on-site.

The main stem channel within the Haegler Ranch Basin crosses the extreme southwest corner of the property at a low point in Jones Road. This channel is currently within an unstudied, Zone A FEMA 100-yr. floodplain and crosses Jones Road with three 60" CMP culverts that appear to be in good condition. There are also multiple other low points along Jones Road further to the east adjacent to this property with various sized CMP and RCP culvert crossings, most of which are severely silted in and overgrown.

To our knowledge, this site has not been studied in any site-specific drainage report. Only the "Haegler Ranch Drainage Basin Planning Study", prepared for El Paso County by URS Corporation, approved June 2009 contains drainage information for this property. Reference the Appendix for excepts from the DBPS that refer to this site and drainage crossings of Jones Road adjacent to the property. Several drainage facilities crossing Jones Road are discussed as reimbursable facilities. These will be further discussed later in this report.

The following descriptions represent both the off-site and on-site pre-developed drainage basins for the property all within the **Haegler Ranch Drainage Basin**:

Basin EX-1 (Q_5 = 1.3 cfs, Q_{100} = 8.3 cfs) consists of approximately 9.9 acres of off-site undeveloped property currently zoned A-35 that sheet flows in a southeasterly direction on-site directly into Basin EX-2. Upon any future development in this basin, these total pre-developed flows must be adhered to.

Basin EX-2 (Q_5 = 6.3 cfs, Q_{100} = 27.7 cfs) consists of approximately 64.1 acres of on-site property that sheet flows in a southeasterly direction towards Jones Road combined with the off-site flows from Basin EX-1. These combined flows sheet flow to a low point north of Jones Road shown as **Design Point E2 (Q_5 = 6.3 cfs, Q_{100} = 34.0 cfs).** Based on current field conditions, no culvert crossing of Jones Road was found in this low area. It appears that the flows pond in this low area to a depth of about 12"-18" and then spill over the high point in the ditch and travel to the west into Basin EX-5 down the north side of Jones Road towards the existing channel.

Basin EX-3 (Q_5 = 3.5 cfs, Q_{100} = 18.1 cfs) consists of approximately 20.2 acres of on-site property that sheet flows in a southeasterly direction towards another low area on-site just north of Jones Road shown as **Design Point E3 (Q_5 = 3.5 cfs, Q_{100} = 18.1 cfs).** Based on current field conditions, no culvert crossing of Jones Road could be located at this crossing. However, the DBPS shows a 15" RCP culvert crossing at this location. This crossing will be confirmed with Final Drainage Report. It appears that these pre-developed flows pond in this low area on-site approximately 150' north of Jones Road. No evidence of overtopping of Jones Road was found.

Basin EX-4 (Q_5 = 0.3 cfs, Q_{100} = 3.7 cfs) consists of approximately 1.3 acres of on-site property just west of the unplatted out parcel that sheet flows in a southerly direction towards Jones Road. The minor flows from this basin flow into the ditch along the north side of Jones Road and then east within Basin EX-10.

Basin EX-5 (Q_5 = 3.6 cfs, Q_{100} = 18.7 cfs) consists of approximately 21.9 acres of on-site property that sheet flows in a southwesterly direction directly into the creek that crosses the southwest corner of the property and Jones Road. This location is represented by **Design Point E1 (Q_5 = 3.6 cfs, Q_{100} = 18.7 cfs),** which only accounts for the on-site flows entering the channel. This crossing of Jones Road is represented by Junction JHR0370 in the Haegler Ranch DBPS with a total flow of (Q_{100} = 2300 cfs). (Reference the Off-site Drainage Map in the Appendix) Three 60" CMP culverts, that appear to be clean and in good working condition exist currently at this roadway crossing. The DBPS recommends multiple box culverts to be installed at this location which also appear to be a reimbursable expense within the basin.

Basin EX-6 (Q_5 = 80.5 cfs, Q_{100} = 211.7 cfs) consists of approximately 536 acres of tributary off-site property as found within basins HR0510, HR0520 and HR0530 in the Haegler Ranch DBPS. (Reference Off-site Drainage Map in Appendix) This area covers the very upper portion of the Haegler Ranch Drainage Basin. The off-site area appears to be partially developed with basins HR0510 and HR0520 and not developed in Basin HR0530. The DBPS analyzes this area as Reach T1. DBPS Junction JHR0520 represents the upstream off-site crossing of Murr Road as (Q_{100} = 200 cfs). **Design Point E4 (Q_5 = 80.5 cfs, Q_{100} = 211.7 cfs)** represents the total off-site pre-developed flows entering the property at the northwest corner. Upon future development upstream, these total pre-developed flows must be adhered to.

Basin EX-7 (Q_5 = 10.4 cfs, Q_{100} = 43.8 cfs) consists of approximately 132.5 acres of tributary off-site property as found within basins HR0540 and HR0560 in the Haegler Ranch DBPS. (Reference Off-site Drainage Map in Appendix) This off-site area appears to not be developed yet even with a Sketch plan approved for this area as found by "High Plains Ranch Sketch Plan", approved in 2008. Upon future development in this basin, these total pre-developed flows must be adhered to. These off-site flows sheet flow on-site directly into Basin EX-8.

Basin EX-9 (Q_5 = 2.0 cfs, Q_{100} = 10.3 cfs) consists of approximately 9.7 acres of off-site property within the unplatted out parcel and found to be a contained within basin HR0570 in the Haegler

Ranch DBPS. (Reference Off-site Drainage Map in Appendix) This off-site area contains the northern portion of the existing homestead currently on this adjacent property. Upon any future development in this basin, these total pre-developed flows must be adhered to. These off-site flows sheet flow on-site directly into Basin EX-8.

The various off-site flows from Basins EX-6, EX-7 and EX-9 then travel in a southeasterly direction across the site within **Basin EX-8 (Q_5 = 34.4 cfs, Q_{100} = 106.6 cfs)**. This large on-site basin that makes up the major portion of the property combines with these off-site flows as they travel within a not-well defined corridor through multiple low areas. Again, this corridor is represented by Reach T1 in the DBPS and its length across the property is approximately 7800 LF to another low point at Jones Road represented by **Design Point E5 (Q_5 = 125.4 cfs, Q_{100} = 360.4 cfs).** This crossing of Jones Road is represented by Junction JHR0570 in the Haegler Ranch DBPS with a total flow of (Q_{100} = 370 cfs). (Reference the Off-site Drainage Map in the Appendix) Both Dual 24" CMP culverts and dual 24" RCP culverts, that appear to be almost completely silted in and overgrown exist currently at this roadway crossing. The DBPS recommends a box culvert to be installed at this location which also appears to be a reimbursable expense within the basin.

Basin EX-10 (Q_5 = 6.2 cfs, Q_{100} = 30.5 cfs) consists of approximately 30.3 acres of off-site property within the unplatted out parcel. This off-site area contains the major portion of the existing homestead currently on this adjacent property. Upon any future development in this basin, these total pre-developed flows must be adhered to. These off-site flows travel in a southeasterly direction towards the sideroad ditch along Jones Road and then on-site directly into Basin EX-11.

Basin EX-11 (Q_5 = 2.0 cfs, Q_{100} = 10.4 cfs) consists of approximately 8.2 acres of on-site property that sheet flows in a southeasterly direction towards another low point adjacent to Jones Road found as **Design Point E6 (Q_5 = 7.4 cfs, Q_{100} = 42.7 cfs).** This Design Point represents the total pre-developed flows at this location from Basins EX-4, EX-10 and EX-11. An existing 18" RCP culvert, that appears to be severely silted in and overgrown was found at this road crossing.

However, the DBPS did not describe any culvert crossing at his location. This crossing will be confirmed with Final Drainage Report.

Basin EX-12 (Q_5 = 0.5 cfs, Q_{100} = 9.0 cfs) consists of approximately 6.5 acres of off-site undeveloped property currently zoned A-35 that sheet flows in a southeasterly direction on-site directly into Basin EX-13. Upon any future development in this basin, these total pre-developed flows must be adhered to.

Basin EX-13 (Q_5 = 14.9 cfs, Q_{100} = 48.8 cfs). This large on-site basin, of approximately 173.2 acres, consists of the eastern portion of the property that drains in a southeasterly direction towards Jones Road. This corridor length across the property is approximately 5700 LF towards **Design Point E7 (Q_5 = 14.9 cfs, Q_{100} = 48.8 cfs)** and includes multiple low points throughout this basin. At Design Point E7, the flows exist the property just north of Jones Road.

Indicate that DP E7 is for Basins EX-12, EX-13 & EX-18

ADDED

Basin EX-18 (Q_5 = 0.1 cfs, Q_{100} = 2.7 cfs) consists of approximately 1.7 acres of off-site undeveloped property currently zoned A-35 that sheet flows in a southwesterly direction on-site directly into Basin EX-13. Upon any future development in this basin, these total pre-developed flows must be adhered to.

The following descriptions represent both the off-site and on-site pre-developed drainage basins for the property all within the **Gieck Ranch Drainage Basin**:

Basin EX-14 (Q_5 = 0.2 cfs, Q_{100} = 3.6 cfs) consists of approximately 2.4 acres of off-site undeveloped property within the Gieck Ranch Drainage Basin that sheet flows in a southeasterly direction on-site directly into Basin EX-16. Upon any future development in this basin, these total pre-developed flows must be adhered to.

Basin EX-16 (Q_5 = 1.1 cfs, Q_{100} = 9.2 cfs) consists of approximately 14.0 acres of on-site property at the extreme northeast corner of the site. This area is also within the Gieck Ranch Drainage basin. The combined flows sheet flow in a southeasterly direction through several low points on-site towards **Design Point E10 (Q_5 = 1.1 cfs, Q_{100} = 12.3 cfs).** At this location, the flows will exit the property along the east boundary.

Basin EX-15 (Q_5 = 0.1 cfs, Q_{100} = 2.6 cfs) consists of approximately 1.2 acres of on-site property again at the extreme northeast corner of the site. This area is also within the Gieck Ranch Drainage basin and sheet flows in an easterly direction towards **Design Point E11 (Q_5 = 0.1 cfs, Q_{100} = 2.6 cfs).** At this location, the flows will exit the property along the east boundary.

Basin EX-17 (Q_5 = 0.3 cfs, Q_{100} = 6.1 cfs) consists of approximately 3.5 acres of on-site property along the eastern boundary. This area is within the Gieck Ranch Drainage basin and sheet flows in a southeasterly direction towards **Design Point E9 (Q_5 = 0.3 cfs, Q_{100} = 6.1 cfs).** At this location, the flows will exit the property along the east boundary.

Basin EX-19 (Q_5 = 0.3 cfs, Q_{100} = 5.3 cfs) consists of approximately 3.8 acres of on-site property along the eastern boundary. This area is within the Gieck Ranch Drainage basin and sheet flows in a southeasterly direction towards **Design Point E8 (Q_5 = 0.3 cfs, Q_{100} = 5.3 cfs).** At this location, the flows will exit the property along the east boundary.

PROPOSED DRAINAGE CONDITIONS

Proposed development will consist of 244 large lot rural residential properties with a 2.5 ac. min. lot size. These lots will be accessed from public paved rural streets with roadside ditches. Development of these rural lots will be limited to roadways, ditches and building pads, conserving the natural feature areas. Individual home sites on these lots are to be left generally in their natural condition with minimal disturbance to existing conditions per individual lot construction. Per the El Paso County ECM, Appendix I.7.1.B.5, rural lots of 2.5 ac. and larger are not required

to provide Water Quality Capture Volume (WQCV). However, based on the current County/Urban Drainage stormwater quality standards, a WQCV component is automatically built into the UD Detention spreadsheet utilized in the detention basin design. Multiple proposed permanent detention/stormwater quality facilities will provide WQCV along with an Excess Urban Runoff Volume (EURV) in the lower portion of the facilities storage volume with an outlet control device. Frequent and infrequent inflows are released at rates approximating undeveloped conditions. This concept provides some mitigation of increased runoff volume by releasing a portion of the increased runoff at a low rate over an extended period of time, up to 72 hours. This means that frequent storms, smaller than the 2-year event, will be reduced to very low flows near or below the sediment carrying threshold value for downstream drainage ways. Also, by incorporating an outlet structure that limits the 100-year runoff to the undeveloped condition rate, the discharge hydrograph for storms between the 2 year and the 100-year event will approximate the hydrograph for the undeveloped conditions and will help effectively mitigate the effects of development. The following describes how this development proposes to handle both the off-site and on-site drainage conditions:

The following descriptions represent the proposed developed design points that are **tributary to Pond 1 West:**

Will review this section when proposed hydrology calculations are provided with next submittal

PROPOSED HYDROLOGY CALCS. NOW INCLUDED

Design Point 1 (Q_5 = 3.6 cfs, Q_{100} = 15.5 cfs) represents developed flows from Basin W-A (9.0 ac.) that sheet flow in a southerly direction towards Design Point 1. At this location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the west side of the road. Sizing of this facility will be provided in a future FDR.

Design Point 2 (Q_5 = 3.8 cfs, Q_{100} = 17.6 cfs) represents developed flows from Basin W-B (9.5 ac.) that sheet flow in a southwesterly direction towards the low point at Design Point 2. At this location, a public area inlet will be sized to completely accept both the 5-yr. and 100-yr.

developed flows. A public storm sewer will then convey these developed flows further west downstream towards Design Point 3. Sizing of these facilities will be provided in a future FDR.

Design Point 3 (Q_5 = 14.6 cfs, Q_{100} = 44.9 cfs) represents developed flows from Basin W-C (37.5 ac.) that sheet flow in a southerly direction towards the low point at Design Point 3. At this location, a public area inlet will be sized to completely accept both the 5-yr. and 100-yr. developed flows. A public storm sewer will then convey these developed flows along with the collected flows from DP-2 further south downstream and directly into the proposed Pond 1W. Sizing of these facilities will be provided in a future FDR.

Design Point 4 (Q_5 = 23.7 cfs, Q_{100} = 79.0 cfs) represents the total developed flows from Design Points 1-3 along with Basin W-D (15.4 ac.) that sheet flows into the sideroad ditch and then directly into Pond1W. The following represents the proposed **Pond 1W design**:
(See MHFD-Detention Design Sheets in Appendix)

Total Tributary acreage: 71.4 Ac.
0.399 Ac.-ft. WQCV required
0.170 Ac.-ft. EURV required
1.470 Ac.-ft. 100-yr. Storage
2.038 Ac.-ft. Total
Total In-flow: **Q_5 = 23.7 cfs, Q_{100} = 79 cfs**
Pond Design Release: **Q_5 = 0.2 cfs, Q_{100} = 37.2 cfs**
(Ownership and maintenance by the Triple H Ranch Metro District)

Design Point 5 (Q_5 = 0.2 cfs, Q_{100} = 37.2 cfs) represents the proposed Pond 1W release into the existing sideroad ditch that then routes the flows directly into the adjacent creek.

Basin W-F (Q_5 = 0.4 cfs, Q_{100} = 3.5 cfs) is a 1.1 ac. basin that represents developed flows within the public Right-of-Way along the north side of Jones Road that are also currently directly tributary to the creek.

Basin W-G (Q_5 = 7.6 cfs, Q_{100} = 26.3 cfs) is a 21.9 ac. basin that represents the rear of lots 11-18 that sheet flow in a southwest direction into Tract A of Filing No. 1 that the existing creek flows through. This basin will continue to sheet flow directly into the creek. Per the El Paso County ECM, Appendix I.7.1.B.5, rural lots of 2.5 ac. and larger are not required to provide WQCV.

Basin W-E (Q_5 = 4.5 cfs, Q_{100} = 21.0 cfs) is a 11.5 ac. basin that represents developed flows from lots 47-50 that sheet flow in a southwest direction towards a low point along the north side of Jones Road. A proposed drainage easement will be provided within lots 49 and 50 as necessary to handle any stormwater ponding area. Again, per the El Paso County ECM, Appendix I.7.1.B.5, rural lots of 2.5 ac. and larger are not required to provide WQCV. An existing 15" RCP culvert crosses Jones Road at this location. This facility may be upsized and further analyzed in the FDR.

The following descriptions represent the proposed developed design points that are **tributary to Pond 1 East:**

As described in the existing conditions section of this report, Basin EX-6 is a 536 ac. off-site basin within the top portion of the Haegler Ranch Drainage Basin. **Design Point 16 (Q_5 = 80.5 cfs, Q_{100} = 211.7 cfs)** represents this off-site tributary area known as Reach T1 within the DBPS and enters the proposed site within Basin E-A at the northwest corner of the property. This development proposes to construct a diversion channel along the west boundary to convey these significant off-site flows around the property rather than through the proposed residential lots. This channel will be located within a public drainage easement on all proposed

lots and will be maintained by the Triple H Ranch Metro District. (See Channel Section in Appendix) **Design Point 17 (Q_5 = 65.1 cfs, Q_{100} = 214.2 cfs)** represents the total off-site pre-developed flows conveyed within the channel that directly enter the existing creek at the southwest corner of the property.

Basin OS-3 (Q_5 = 0.2 cfs, Q_{100} = 6.7 cfs) is a 3.1 ac. basin that represents off-site pre-developed flows from undeveloped property to the west. This tributary area sheet flows easterly onto the property directly into the proposed diversion channel.

Basin OS-2 (Q_5 = 1.0 cfs, Q_{100} = 13.7 cfs) is a 12.5 ac. basin that also represents off-site pre-developed flows from undeveloped property to the west. This tributary area sheet flows easterly onto the property directly into the proposed diversion channel.

Basin OS-1 (Q_5 = 1.3 cfs, Q_{100} = 8.3 cfs) is a 9.9 ac. basin that also represents off-site pre-developed flows from undeveloped property to the west. This tributary area sheet flows easterly onto the property directly into the proposed diversion channel.

Design Point 6 (Q_5 = 0.8 cfs, Q_{100} = 4.5 cfs) represents developed flows from Basin E-F (1.9 ac.) that sheet flow in an easterly direction towards Design Point 6. At this location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the south side of the road. Sizing of this facility will be provided in a future FDR.

Design Point 7 (Q_5 = 2.9 cfs, Q_{100} = 15.3 cfs) represents developed flows from Basin E-G (5.7 ac.) along with the ditch flows from DP-6 that sheet flow in a northeasterly direction towards the low point at Design Point 7. At this location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and be conveyed in a proposed ditch across lots 43 and 41 to the sideroad ditch and then towards DP-8. Sizing of these facilities will be provided in a future FDR.

Design Point 8 (Q_5 = 10.8 cfs, Q_{100} = 40.1 cfs) represents developed flows from Basin E-E (28.6 ac.) along with the previously described upstream flows that sheet flow in an easterly direction towards Design Point 8. At this location, multiple proposed public culverts will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the north side of the road. Sizing of these facilities will be provided in a future FDR.

Design Point 9 (Q_5 = 0.9 cfs, Q_{100} = 4.5 cfs) represents developed flows from Basin E-H (2.2 ac.) that sheet flow in an easterly direction towards Design Point 9. At this location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the south side of the road. Sizing of this facility will be provided in a future FDR.

Design Point 10 (Q_5 = 3.9 cfs, Q_{100} = 15.6 cfs) represents developed flows from Basin E-C (9.8 ac.) that sheet flow in an easterly direction towards Design Point 10. At this location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the north side of the road. Sizing of this facility will be provided in a future FDR.

Design Point 11 (Q_5 = 3.5 cfs, Q_{100} = 11.4 cfs) represents developed flows from Basin E-A (8.9 ac.) that sheet flow in a southerly direction towards Design Point 11. At this location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the east side of the road. Sizing of this facility will be provided in a future FDR.

Design Point 12 (Q_5 = 8.4 cfs, Q_{100} = 38.3 cfs) represents the off-site pre-developed flows from Basin OS-5 (106.6 ac.) that sheet flow in a southerly direction towards the property. This condition will remain until this adjacent property (High Plains Sketch Plan) is developed. At that

time, based on the Sketch Plan, it is anticipated that approximately 12.0 acres of large lot residential development will be tributary to this Design Point.

Design Point 13 (Q_5 = 11.8 cfs, Q_{100} = 47.8 cfs) represents developed flows from Basin E-B (11.9 ac.) along with the previously described off-site flows from DP-12 that sheet flow in a southerly direction towards Design Point 13. At this location, multiple proposed public culverts will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and then be conveyed in a ditch within a drainage easement across lots 26 and 31 (Filing 2) towards DP-15. Sizing of these facilities will be provided in a future FDR.

Design Point 14 (Q_5 = 3.5 cfs, Q_{100} = 13.0 cfs) represents developed flows from Basins TANK (1.9 ac.) and E-N (2.7 ac.) that sheet flow in a westerly direction towards the sideroad ditch and then south to Design Point 14. At this location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the southeast side of the road. Sizing of this facility will be provided in a future FDR.

Design Point 15 (Q_5 = 22.9 cfs, Q_{100} = 99.7 cfs) represents developed flows from Basin E-D (29.0 ac.) that sheet flow in a southerly direction along with ditch flows from the previously described Design Points 10-13 all towards Design Point 15. At this location, multiple proposed public culverts will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the north side of the road. Sizing of these facilities will be provided in a future FDR.

Design Point 18 (Q_5 = 0.3 cfs, Q_{100} = 5.8 cfs) represents the off-site pre-developed flows from Basin OS-6 (4.0 ac.) that sheet flow in a southeasterly direction directly onto the property. This condition will remain until this adjacent property (High Plains Sketch Plan) is developed. At that time, based on the Sketch Plan, it is anticipated that approximately the same acreage of large lot residential development will be tributary to this Design Point.

Design Point 19 (Q_5 = 1.5 cfs, Q_{100} = 15.2 cfs) represents the off-site pre-developed flows from Basin OS-7 (19.3 ac.) that sheet flow in a southerly direction towards the property. This condition will remain until this adjacent property (High Plains Sketch Plan) is developed. At that time, based on the Sketch Plan, it is anticipated that approximately 6.0 acres of large lot residential development will be tributary to this Design Point.

Design Point 20 (Q_5 = 0.2 cfs, Q_{100} = 5.5 cfs) represents the off-site pre-developed flows from Basin OS-8 (2.3 ac.) that sheet flow in a southeasterly direction directly onto the property. This condition will remain until this adjacent property (High Plains Sketch Plan) is developed. At that time, based on the Sketch Plan, it is anticipated that approximately the same acreage of large lot residential development will be tributary to this Design Point.

Design Point 21 (Q_5 = 5.4 cfs, Q_{100} = 21.2 cfs) represents developed flows from Basin E-O (15.4 ac.) that sheet flow in a southerly direction towards Design Point 21 along with the combined off-site flows previously described from DP-20. At this location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the north side of the road. Sizing of this facility will be provided in a future FDR.

Design Point 22 (Q_5 = 14.3 cfs, Q_{100} = 59.6 cfs) represents developed flows from Basin E-P (31.6 ac.) that sheet flow in a southeasterly direction towards Design Point 22 along with the previously described flows from Design Points 18-21. At this location, multiple proposed public culverts will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the north side of the road. Sizing of these facilities will be provided in a future FDR.

Design Point 23 (Q_5 = 5.9 cfs, Q_{100} = 20.3 cfs) represents developed flows from Basin E-I (13.7 ac.) that sheet flow in an easterly direction towards the low point at Design Point 23. At this

location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within a ditch across the park within Tract A (Filing 1) towards the sideroad ditch along Appaloosa Run Dr. Sizing of these facilities will be provided in a future FDR.

Design Point 24 (Q_5 = 0.3 cfs, Q_{100} = 2.5 cfs) represents developed flows from Basin E-J (0.68 ac.) that sheet flow in a northwesterly direction to Design Point 24. At this location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the east side of the road. Sizing of this facility will be provided in a future FDR.

Design Point 25 (Q_5 = 13.9 cfs, Q_{100} = 52.2 cfs) represents developed flows from Basins E-K (8.3 ac.) and E-L (25.1 ac.) that sheet flow to sideroad ditches and then towards Design Point 25 along with the previously described developed flows from Design Points 9, 23 and 24. At this location, multiple proposed public culverts will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the south side of the road. Sizing of these facilities will be provided in a future FDR.

Design Point 26 (Q_5 = 0.2 cfs, Q_{100} = 4.4 cfs) represents the off-site pre-developed flows from Basin OS-12 (2.9 ac.) that sheet flow in a northerly direction directly onto the property.

Design Point 27 (Q_5 = 27.3 cfs, Q_{100} = 101.2 cfs) represents developed flows from Basin E-S (26.5 ac.) and Basin E-Q (24.8 ac.) that sheet flow in a southerly direction towards Design Point 27 along with the combined off-site flows previously described from DP-22. At this location, multiple proposed public culverts will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the north side of the road. Sizing of these facilities will be provided in a future FDR.

Design Point 28 (Q_5 = 31.1 cfs, Q_{100} = 183.9 cfs) represents developed flows from Basin E-R (65.2 ac.) that sheet flow in a southerly direction towards Design Point 28 along with the

combined off-site flows previously described from Design Points 8 and 15. At this location, multiple proposed public culverts will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within a proposed channel across lots 26, 27 and 34 (Filing 1) that will convey these developed flows further downstream. Public drainage easements will be provided on these lots. Sizing of these facilities will be provided in a future FDR.

Design Point 29 (Q_5 = 30.9 cfs, Q_{100} = 109.5 cfs) represents developed flows from Basin E-T1 (9.8 ac.) that sheet flow in a southerly direction towards Design Point 29 along with the combined off-site flows previously described from Design Point 27. At this location, multiple proposed public culverts will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within a proposed channel across lots 26, 27 and 34 (Filing 1) that will convey these developed flows further downstream. Public drainage easements will be provided on these lots. Sizing of these facilities will be provided in a future FDR.

Design Point 30 (Q_5 = 77.7 cfs, Q_{100} = 225.1 cfs) represents the combined developed flows from Basin E-V (7.5 ac.), Basin E-M (19.0 ac.) along with the combined off-site flows previously described from Design Points 25, 26, 28 and 29. At this location, the developed flows exit the site and cross the corner of the adjacent property for only 200 feet and then enter the site again at Lot 26 (Filing 1).

Design Point 31 (Q_5 = 79.1 cfs, Q_{100} = 235.3 cfs) represents the combined developed flows that re-enter the site into Lot 26 (Filing 1) along with off-site sheet flows from Basin OS-13 (6.8 ac.). At this location, the proposed channel will be constructed across lots 26 and 27 (Filing 1) that will convey these developed flows further downstream. Public drainage easements will be provided on these lots. Sizing of this facility will be provided in a future FDR.

Design Point 32 (Q_5 = 4.2 cfs, Q_{100} = 15.6 cfs) represents developed flows from Basin E-T2 (10.7 ac.) that sheet flow in a southerly direction towards the low point at Design Point 32. At this location, the developed flows will be routed further east within the sideroad ditch towards Design Point 33.

Design Point 33 (Q_5 = 9.4 cfs, Q_{100} = 36.3 cfs) represents developed flows from Basin E-U (16.8 ac.) that sheet flow in a southerly direction towards the low point at Design Point 33. At this location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the west side of the road. Sizing of this facility will be provided in a future FDR.

Design Point 34 (Q_5 = 88.7 cfs, Q_{100} = 295.4 cfs) represents the developed flows from Basin E-X (6.7 ac.) along with the combined developed flows previously described from Design Points 31 and 33. At this location, the developed flows will be completely collected by a public storm system that will route the flows directly to the proposed Pond 1E. Sizing of this facility will be provided in a future FDR.

Design Point 35 (Q_5 = 2.1 cfs, Q_{100} = 9.3 cfs) represents the developed flows from Basin E-Y (5.3 ac.) that sheet flow in an easterly direction towards Design Point 35. At this location, the developed flows will be completely collected by a public storm system that will route the flows directly to the proposed Pond 1E. Sizing of this facility will be provided in a future FDR.

Design Point 36 (Q_5 = 6.1 cfs, Q_{100} = 33.5 cfs) represents the off-site pre-developed flows from Basin OS-14 (30.3 ac.) and Basin E-MM (1.3 ac.) that combine and sheet flow into the sideroad ditch along the north side of Jones Roads and then towards Design Point 36. At this location, the combined flows continue to travel in the sideroad ditch towards Design Point 37.

Design Point 37 (Q_5 = 8.2 cfs, Q_{100} = 43.9 cfs) represents the developed flows from Basin E-NN (8.3 ac.) along with the previously described flows from Design Point 36. At this location, the

combined flows are collected by a public storm system and routed directly into Pond 1E. Sizing of this facility will be provided in a future FDR.

Design Point 38 (Q_5 = 0.5 cfs, Q_{100} = 9.0 cfs) represents the off-site pre-developed flows from Basin OS-9 (6.5 ac.) that sheet flow in a southeasterly direction directly onto the property. This condition will remain until this adjacent property (High Plains Sketch Plan) is developed. At that time, based on the Sketch Plan, it is anticipated that approximately the same acreage of large lot residential development will be tributary to this Design Point.

Design Point 39 (Q_5 = 7.6 cfs, Q_{100} = 25.4 cfs) represents developed flows from Basin E-AA (19.2 ac.) that sheet flow in a southeasterly direction towards Design Point 39 along with the combined off-site flows previously described from DP-38. At this location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the north side of the road. Sizing of this facility will be provided in a future FDR.

Design Point 40 (Q_5 = 0.2 cfs, Q_{100} = 3.6 cfs) represents the off-site pre-developed flows from Basin OS-10 (2.4 ac.) that sheet flow in a southeasterly direction directly onto the property. This condition will remain until this adjacent property (High Plains Sketch Plan) is developed. At that time, based on the Sketch Plan, it is anticipated that approximately the same acreage of large lot residential development will be tributary to this Design Point.

Design Point 41 (Q_5 = 7.3 cfs, Q_{100} = 29.0 cfs) represents developed flows from the northern portion of Basin E-DD (Approx. 6.5 ac.) that sheet flow in a southeasterly direction towards Design Point 41 along with the combined off-site flows previously described from Design Points 39 and 40. At this location, multiple proposed public culverts will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the west side of the road. Sizing of these facilities will be provided in a future FDR.

Design Point 42 (Q_5 = 22.4 cfs, Q_{100} = 69.0 cfs) represents developed flows from Basin E-BB (46.2 ac.) that sheet flow in a southerly direction towards the sideroad ditch and then conveyed along the north side of the roadway towards Design Point 42 along with the combined off-site flows previously described from Design Point 41. At this location, multiple proposed public culverts will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the west side of the road. Sizing of this facility will be provided in a future FDR.

Design Point 43 (Q_5 = 6.6 cfs, Q_{100} = 21.1 cfs) represents developed flows from Basin E-CC (16.9 ac.) that sheet flow in a southeasterly direction towards Design Point 43. At this location, a proposed public culvert will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the north side of the road. Sizing of this facility will be provided in a future FDR.

Design Point 44 (Q_5 = 30.4 cfs, Q_{100} = 106.0 cfs) represents developed flows from Basin E-EE (19.8 ac.) that sheet flow in a southeasterly direction towards the sideroad ditch and then to Design Point 44 along with the combined off-site flows previously described from Design Points 42 and 43. At this location, multiple proposed public culverts will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the west side of the road. Sizing of these facilities will be provided in a future FDR.

Design Point 45 (Q_5 = 0.1 cfs, Q_{100} = 2.7 cfs) represents the off-site pre-developed flows from Basin OS-11 (1.7 ac.) that sheet flow in a southwesterly direction directly onto the property.

Design Point 46 (Q_5 = 32.3 cfs, Q_{100} = 128.2 cfs) represents developed flows from Basin E-GG (24.0 ac.) that sheet flow in a southeasterly direction towards the sideroad ditch and then to Design Point 46 along with the combined off-site flows previously described from Design Point

44. At this location, multiple proposed public culverts will be sized to completely convey both the 5-yr. and 100-yr. developed flows under the roadway and continue within the sideroad ditch along the west side of the road. Sizing of these facilities will be provided in a future FDR.

Design Point 47 (Q_5 = 8.2 cfs, Q_{100} = 31.4 cfs) represents developed flows from Basin E-DD (17.5 ac.), Basin E-HH (21.0 ac.) that sheet flow in a southwesterly direction towards the sideroad ditch and then south to the low point at Design Point 47 along with the minor off-site flows previously described from Design Point 45. At this location, the developed flows will be completely collected by a public storm system that will route the flows directly to the proposed Pond 1E. Sizing of this facility will be provided in a future FDR.

Design Point 48 (Q_5 = 41.6 cfs, Q_{100} = 175.8 cfs) represents developed flows from Basin E-II (15.7 ac.) that sheet flow in an easterly direction towards the sideroad ditch and then south to the low point at Design Point 48 along with the developed flows previously described from Design Point 46. At this location, the developed flows will be completely collected by a public storm system that will route the flows directly to the proposed Pond 1E. Sizing of this facility will be provided in a future FDR.

Basin E-Z (Q_5 = 7.5 cfs, Q_{100} = 24.1 cfs) is a 21.4 ac. basin that sheet flows in a southerly direction directly into the proposed Pond 1E.

Basin E-LL (Q_5 = 1.8 cfs, Q_{100} = 9.0 cfs) is a 5.7 ac. basin that represents developed flows within the rear of Lots 6 and 7 (Filing 3) that sheet flow in a southerly direction towards the sideroad ditch along Jones Road. These flows will continue to be conveyed to the existing culvert crossings of Jones Road. Per the El Paso County ECM, Appendix I.7.1.B.5, rural lots of 2.5 ac. and larger are not required to provide WQCV.

The following represents the total developed inflow to Pond 1E (Q_5 = 131.0 cfs, Q_{100} = 526.6 cfs) and the proposed **Pond 1E design**:
(See MHFD-Detention Design Sheets in Appendix)

Total Tributary acreage: 693.1 Ac.

3.870 Ac.-ft. WQCV required

1.649 Ac.-ft. EURV required

14.269 Ac.-ft. 100-yr. Storage

19.788 Ac.-ft. Total

Total In-flow: **Q_5 = 131.0 cfs, Q_{100} = 526.6 cfs**

Pond Design Release: **Q_5 = 1.8 cfs, Q_{100} = 164.5 cfs**

(Ownership and maintenance by the Triple H Ranch Metro District)

The following descriptions represent the proposed developed design points within the **Gieck Ranch Drainage Basin:**

A minor basin transfer of approximately 16.4 ac. from the Gieck Ranch basin into the Haegler Ranch basin is proposed due to the site layout and grading. (See Developed Drainage Map)

Basin E-JJ (Q_5 = 1.2 cfs, Q_{100} = 6.3 cfs) is a 3.8 ac. basin that represents the rear of lots 13-18 (Filing 3) that will continue to sheet flow in a southeast direction off-site. Per the El Paso County ECM, Appendix I.7.1.B.5, rural lots of 2.5 ac. and larger are not required to provide WQCV.

Basin E-KK (Q_5 = 6.1 cfs, Q_{100} = 20.5 cfs) is a 15.5 ac. basin that represents lots 7-14 (Filing 3) that will continue to sheet flow in a southeast direction off-site. Per the El Paso County ECM, Appendix I.7.1.B.5, rural lots of 2.5 ac. and larger are not required to provide WQCV.

Basin E-FF (Q_5 = 1.1 cfs, Q_{100} = 7.2 cfs) is a 3.5 ac. basin that represents lots 1-4 (Filing 4) that will continue to sheet flow in a southeast direction off-site. Per the El Paso County ECM, Appendix I.7.1.B.5, rural lots of 2.5 ac. and larger are not required to provide WQCV.

Basin E-OO (Q_5 = 0.1 cfs, Q_{100} = 2.7 cfs) is a 1.2 ac. basin that represents the rear of Lot 6 (Filing 4) and will continue to sheet flow in an easterly direction off-site. Per t
Appendix I.7.1.B.5, rural lots of 2.5 ac. and larger are not required to pr

AS DISCUSSED WITH ENGINEERING AND SW, WE HAVE NOW REMOVED THE EARLY GEC PLAN REQUEST

The early grading condition will require its own 4-step process and discussion of existing/proposed basins, final stabilization, WQ facilities, calculations, etc. Please provide a separate FDR for the early grading condition.

FINAL DRAINAGE REPORT (EARLY GEC PLAN)

Provide an interim/Early Grading drainage map for this scenario/condition

An early GEC Plan has been requested along with the Preliminary Plan submittal to allow for early grading of a temporary gravel access road from Jones Road up to the proposed tank/well site at the north end of the property (Tract A, Filing 2). The plan will also allow for initial grading within Tract A for well drilling. This temporary gravel roadway will allow trucks and heavy equipment to access this site prior to development for the on-site drilling of the wells. This access road will follow the proposed planned public right-of-way as shown by Harmony Hill Drive and Palomino Run Drive. No public right-of-way will be platted at this time but just a 28' wide gravel constructed along the centerline of each of these planned roads. The grades will match the ultimate proposed grading for these roadways. As necessary, sideroad ditches and culverts will also be constructed to convey pre-developed drainage along and under the temporary access road.

The temporary access road is planned within pre-developed basins EX-2, EX-3 and EX-8. The following culverts are planned to be installed at the associated Design Points:

Design Point 23 (Q_5 = 5.9 cfs, Q_{100} = 20.3 cfs)
Design Point 8 (Q_5 = 10.8 cfs, Q_{100} = 40.1 cfs)
Design Point 9 (Q_5 = 0.9 cfs, Q_{100} = 4.5 cfs) 18" CMP culvert

NOW HAVE REMOVED THE ENTIRE EARLY GEC SECTION

Include and label these items on the interim/EG drainage map

Design Point 15 (Q_5 = 22.9 cfs, Q_{100} = 99.7 cfs) Three 30" CMP culverts

Additional rip-rap may be added at this temporary crossing to allow for overflow of the access road if needed.

Reference Early GEC Plan for grading and erosion control design/details.

DETENTION / STORMWATER QUALITY FACILITES

As required, storm water quality measures will be utilized in order to reduce the amount of sediment, debris and pollutants that are allowed to be released downstream. These features include but are not limited to Pond 1W and Pond 1E (both owned and maintained by the Triple H Ranch Metropolitan District). These proposed facilities will provide a detention and Water Quality Capture Volume (WQCV) and Excess Urban Runoff Volume (EURV) in the lower portion of the facility storage volume that will release the more frequent storms at a slower rate to help minimize the effects of development of the property. The proposed facilities are to be private facilities with ownership and maintenance by the Triple H Ranch Metropolitan District. After completion of construction and upon the Board of County Commissioners acceptance, all the drainage facilities within the public Right-of-Way will be owned and maintained by El Paso County.

DRAINAGE CRITERIA

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014. Per the ECM and the size of this proposed development, all off-site and on-site developed basin design was calculated using EPA SWMM Modeling as discussed in Chapter 6. Percent Impervious Area per Table 3-1 and imperviousness of the particular land use and the hydrologic soil type in accordance with Table 6-6. Point Precipitation Frequency Estimates determined from NOAA Atlas 14 for the specific site location. These 1-Hour

rainfall depths then converted to 2-Hour Design Storms for a drainage basin area of 1-5 sq. mi. (See Appendix)

The City of Colorado Springs/El Paso County DCM requires the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring storm events, as opposed to larger storms for which drainage and flood control infrastructure are sized. Implementation of these four steps helps to achieve storm water permit requirements.
This site adheres to this **Four Step Process** as follows:

1. **Employ Runoff Reduction Practices:** All proposed lot impervious area (roof tops, patios, etc.) will sheet flow across landscaped portions of the large lots (2.5 ac. min.) and through open space/park areas to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets, sideroad ditches and detention facilities. This will minimize directly connected impervious areas within the project site. Final Drainage Report will provide further detail on basins that will be providing Runoff Reduction.

2. **Stabilize Drainageways:** After developed flows utilize the runoff reduction practices through these large lots, developed flows will travel via sideroad ditches and culverts within the public streets and eventually public storm systems. These collected flows are then routed directly to the proposed extended detention basins (full-spectrum facilities). Where developed flows are not able to be routed to public street, sheet flows will travel across landscaped rear yards and then through undeveloped property prior to being released off-site. Final Drainage Report will provide further detail on basins that will be providing Runoff Reduction.

3. **Provide Water Quality Capture Volume (WQCV):** Runoff from this development will be treated through capture and slow release of the WQCV and excess urban runoff volume

(EURV) in the proposed Full-Spectrum permanent Extended Detention Basins designed per current El Paso County drainage criteria. For any area that is not able to be captured and routed to a permanent EDB, Runoff Reduction practices may be utilized. However, per the El Paso County ECM, Appendix I.7.1.B.5, rural lots of 2.5 ac. and larger are not required to provide WQCV. Final Drainage Report will provide further detail on basins that may be providing Runoff Reduction.

4. **Consider need for Industrial and Commercial BMPs**: No industrial or commercial uses are proposed within this development. However, a site-specific storm water quality and erosion control plan and narrative along with the grading and erosion control plan will be submitted with the future Final Plat submittal. Details such as site-specific sediment and erosion control construction BMP's as well as temporary and permanent BMP's will be detailed in this plan and narrative to protect receiving waters. BMP's will be constructed and maintained as the development has been graded and erosion control methods employed.

FLOODPLAIN STATEMENT

A portion of this site is located within a floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Number 08041C0590G with effective date of December 7, 2018 (See Appendix).

DRAINAGE AND BRIDGE FEES

The majority of this site lies within the **Haegler Ranch Drainage Basin** boundaries with just a small portion along the northeast corner and eastern edge within the **Gieck Ranch Drainage Basin.** There is no final platting proposed at this time. Fees using the impervious acreage method approved by El Paso County will be defined in the future Final Drainage Report(s).

Include discussion on suitable outfalls for all the locations where flows leave the site.

DISCUSSION OF SUITABLE OUTFALLS ARE NOW ADDED TO NARRATIVE AT EACH SPECIFIC OUTFALL.

SUMMARY

The proposed Triple H Ranch Preliminary Plan is within the Haegler Ranch and Gieck Ranch Drainage Basins. Recommendations are made within this report concerning necessary improvements that will be required as a result of development of this property. The points of storm water release from the proposed site are required to be at or below the calculated pre-developed flow quantities. The development of the proposed site does not significantly impact any downstream facility or property to an extent greater than that which currently exists in the pre-development conditions. All drainage facilities within this report were sized according to the Drainage Criteria Manuals and the full-spectrum storm water quality requirements.

PREPARED BY:

Classic Consulting Engineers & Surveyors, LLC

Marc A. Whorton, P.E.
Project Manager

maw/260400 PDR.doc

REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014.

2. "Urban Storm Drainage Criteria Manual Volume 1, 2 & 3" Urban Drainage and Flood Control District, dated January 2016.

3. "General Drainage Report for High Plains Ranch" Kiowa Engineering Corporation, dated June 2008.

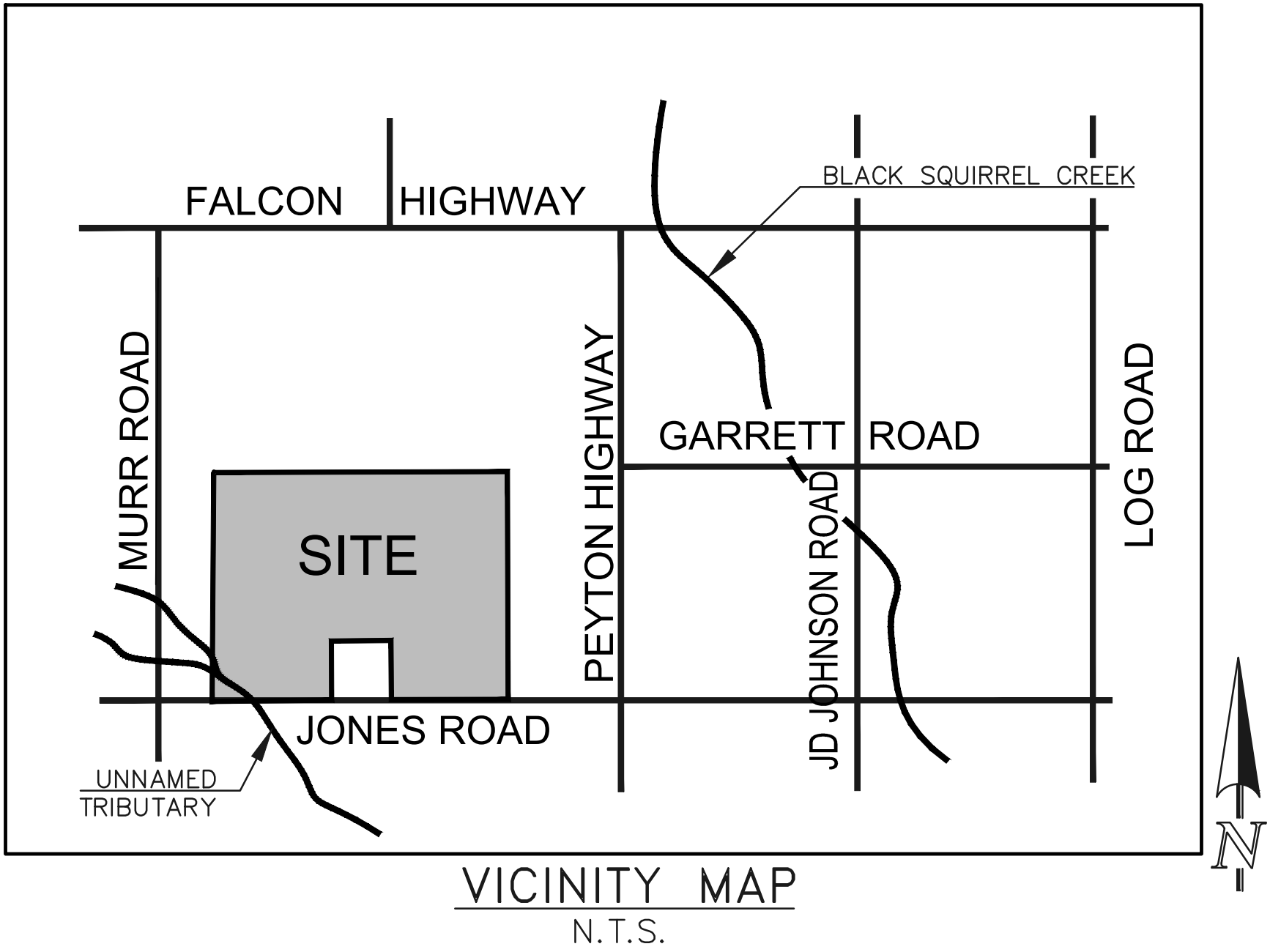
4. "Haegler Ranch Drainage Basin Planning Study", URS Corporation, dated May 2009.

5. "Gieck Ranch Drainage Basin Planning Study", Drexel, Barrell & Co., dated Feb. 2010

APPENDIX

VICINITY MAP

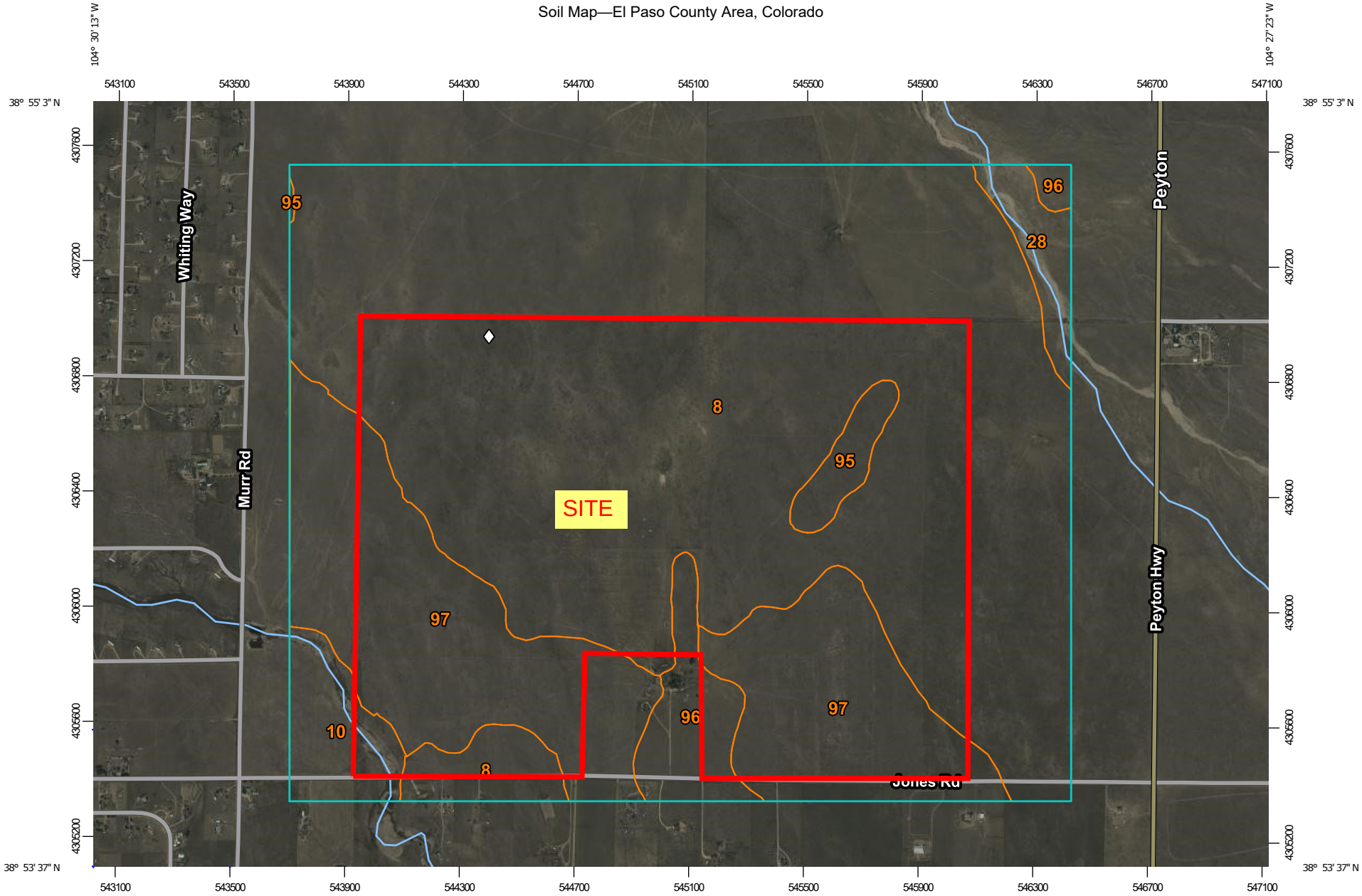
CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS



VICINITY MAP

N.T.S.

SOILS MAP (S.C.S SURVEY)



Map Scale: 1:18,700 if printed on A landscape (11" x 8.5") sheet.

N

0 250 500 1000 1500 Meters

0 500 1000 2000 3000 Feet

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 21, Aug 24, 2023

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

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	1,026.5	68.7%
10	Blendon sandy loam, 0 to 3 percent slopes	43.2	2.9%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	26.5	1.8%
95	Truckton loamy sand, 1 to 9 percent slopes	19.7	1.3%
96	Truckton sandy loam, 0 to 3 percent slopes	49.5	3.3%
97	Truckton sandy loam, 3 to 9 percent slopes	329.8	22.1%
Totals for Area of Interest		**1,495.2**	**100.0%**

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 21, Aug 24, 2023

El Paso County Area, Colorado

10—Blendon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3671
Elevation: 6,000 to 6,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blendon and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blendon

Setting

Landform: Terraces, alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 10 inches: sandy loam
Bw - 10 to 36 inches: sandy loam
C - 36 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 21, Aug 24, 2023

El Paso County Area, Colorado

95—Truckton loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2yvrm
Elevation: 5,800 to 7,100 feet
Mean annual precipitation: 12 to 19 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 90 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Truckton and similar soils: 87 percent
Minor components: 13 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Truckton

Setting

Landform: Fan remnants, interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind re-worked alluvium derived from arkose

Typical profile

A - 0 to 4 inches: loamy sand
Bt1 - 4 to 12 inches: sandy loam
Bt2 - 12 to 19 inches: sandy loam
C - 19 to 80 inches: sandy loam

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A

Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Blakeland
Percent of map unit: 5 percent
Landform: Hills, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Bresser
Percent of map unit: 5 percent
Landform: Terraces, interfluves
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Urban land
Percent of map unit: 2 percent
Hydric soil rating: No

Ellicott, occasionally flooded
Percent of map unit: 1 percent
Landform: Drainageways, flood plains
Down-slope shape: Linear
Across-slope shape: Concave, linear
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 21, Aug 24, 2023

El Paso County Area, Colorado

96—Truckton sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2yvrd
Elevation: 5,400 to 7,000 feet
Mean annual precipitation: 14 to 23 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 90 to 155 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition

Truckton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Truckton

Setting

Landform: Interfluves, fan remnants
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind re-worked alluvium derived from arkose

Typical profile

A - 0 to 4 inches: sandy loam
Bt1 - 4 to 12 inches: sandy loam
Bt2 - 12 to 19 inches: sandy loam
C - 19 to 80 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Blakeland
Percent of map unit: 5 percent
Landform: Interfluves, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Bresser
Percent of map unit: 5 percent
Landform: Interfluves, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Pleasant, frequently ponded
Percent of map unit: 2 percent
Landform: Closed depressions
Down-slope shape: Concave, linear
Across-slope shape: Concave
Ecological site: R067BY010CO - Closed Depression
Hydric soil rating: Yes

Urban land
Percent of map unit: 2 percent
Hydric soil rating: No

Ellicott, occasionally flooded
Percent of map unit: 1 percent
Landform: Flood plains, drainageways
Down-slope shape: Linear
Across-slope shape: Concave, linear
Ecological site: R067BY031CO - Sandy Bottomland
Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 21, Aug 24, 2023

El Paso County Area, Colorado

97—Truckton sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2x0j2
Elevation: 5,300 to 6,850 feet
Mean annual precipitation: 14 to 19 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 85 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Truckton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Truckton

Setting

Landform: Interfluves, hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Re-worked alluvium derived from arkose

Typical profile

A - 0 to 4 inches: sandy loam
Bt1 - 4 to 12 inches: sandy loam
Bt2 - 12 to 19 inches: sandy loam
C - 19 to 80 inches: sandy loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline (0.1 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Blakeland

Percent of map unit: 8 percent
Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Bresser

Percent of map unit: 7 percent
Landform: Interfluves, low hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 21, Aug 24, 2023

F.E.M.A. MAP

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/.

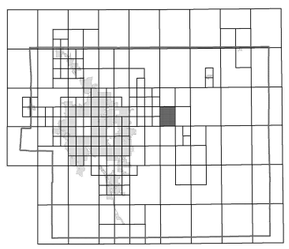
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

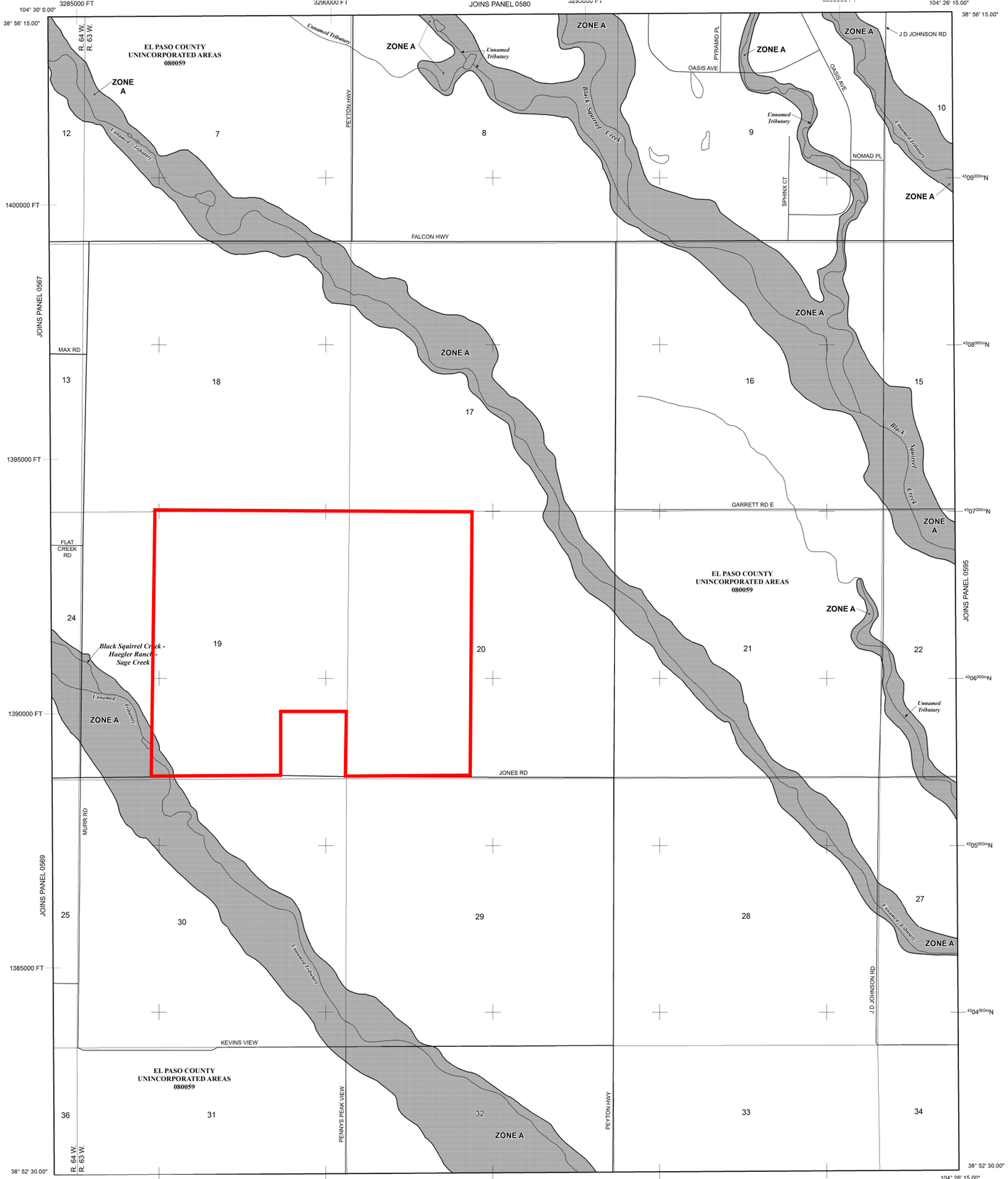
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

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.



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" = 1000'
500 0 1000 2000
FEET
METERS
300 0 300 600

NFIP

PANEL 0590G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 590 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0590	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.

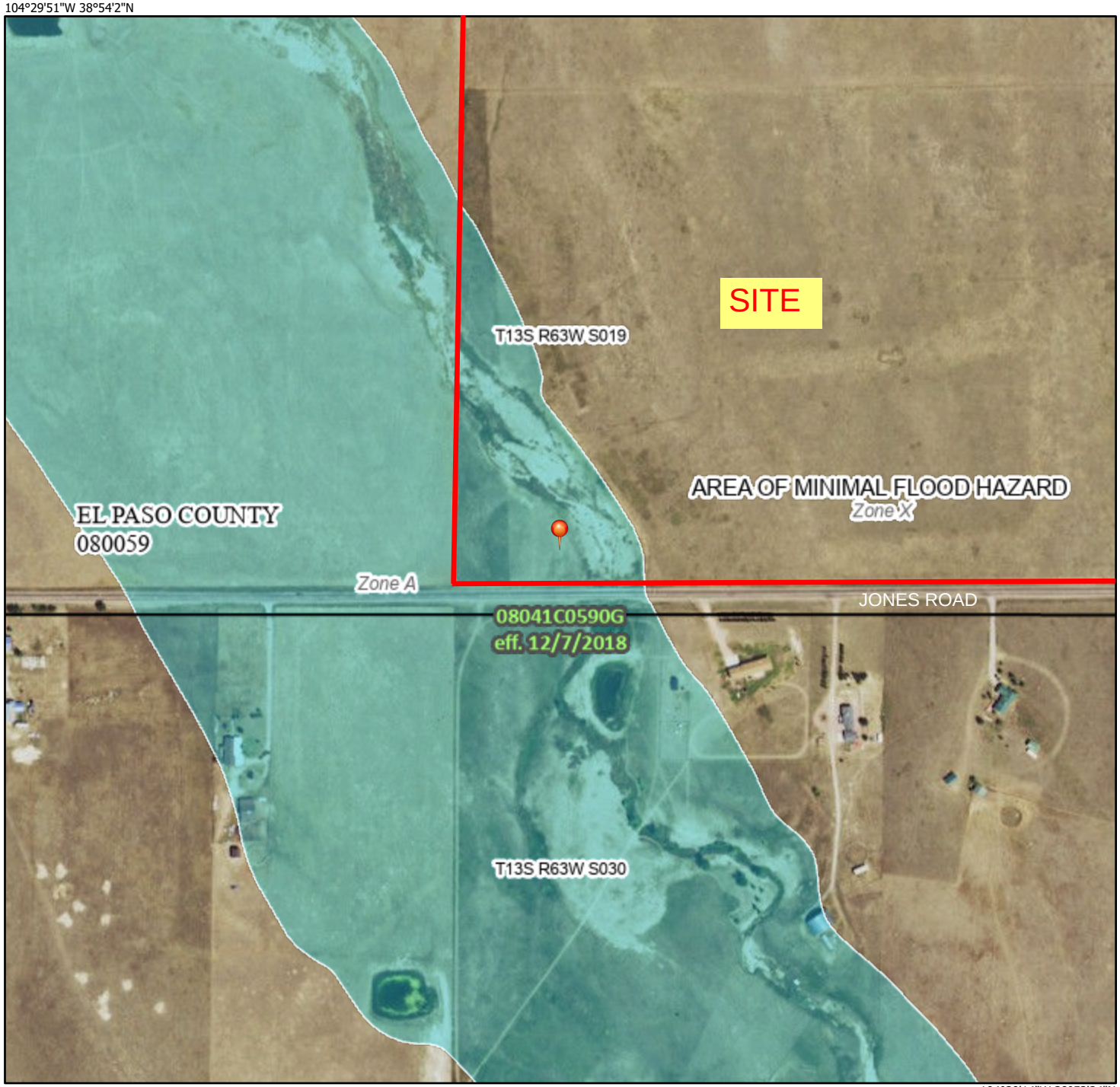
MAP NUMBER
08041C0590G

MAP REVISED

National Flood Hazard Layer FIRMette

FEMA

104°29'51"W 38°54'2"N



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

1:6,000

104°29'14"W 38°53'34"N

Basemap Imagery Source: USGS National Map 2023

Legend

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

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

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

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

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

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

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

N

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

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

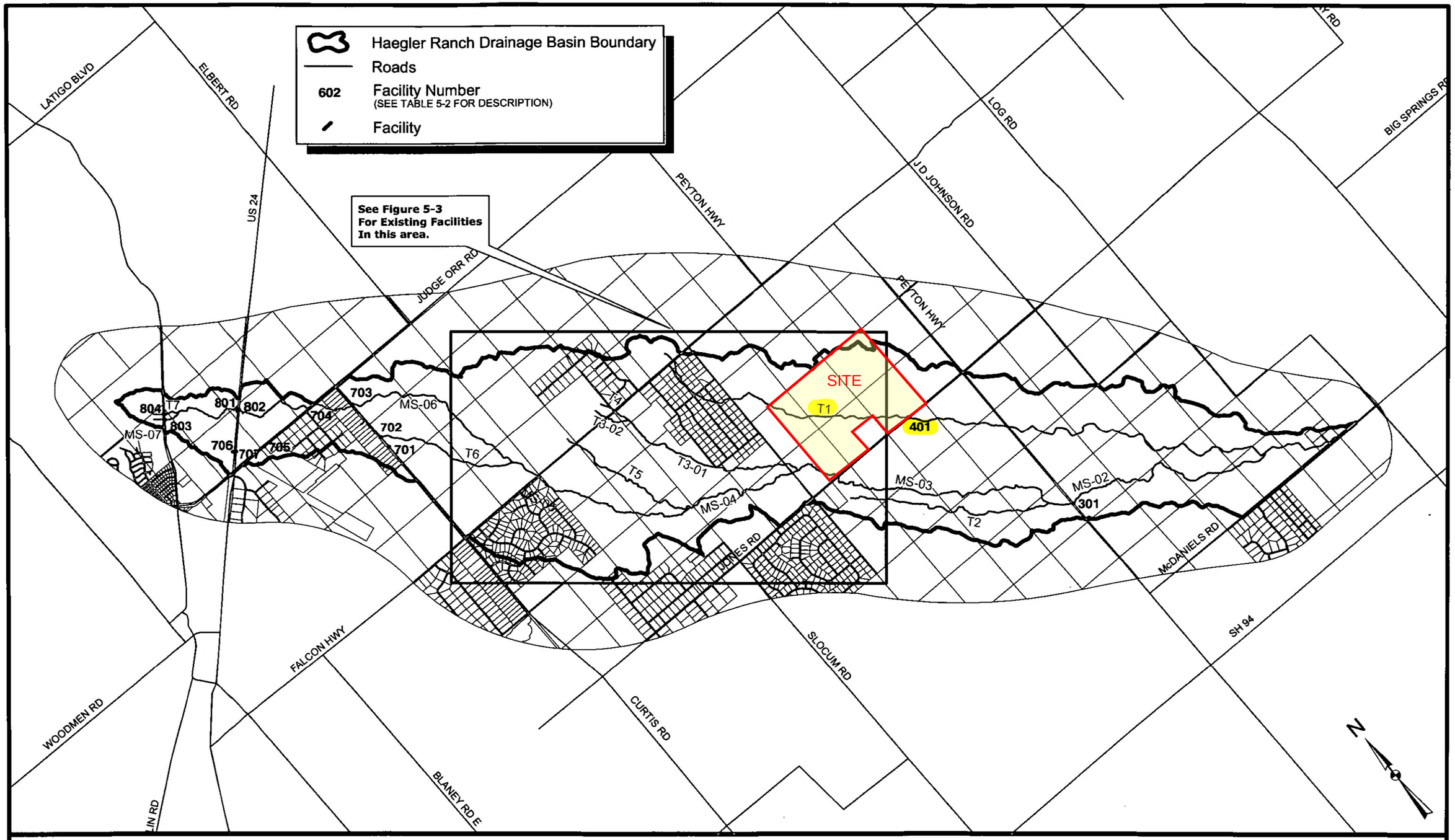
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/8/2023 at 12:19 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

REFERENCES FROM

HAEGLER RANCH DBPS

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS



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

5,000 2,500 0 5,000 Feet

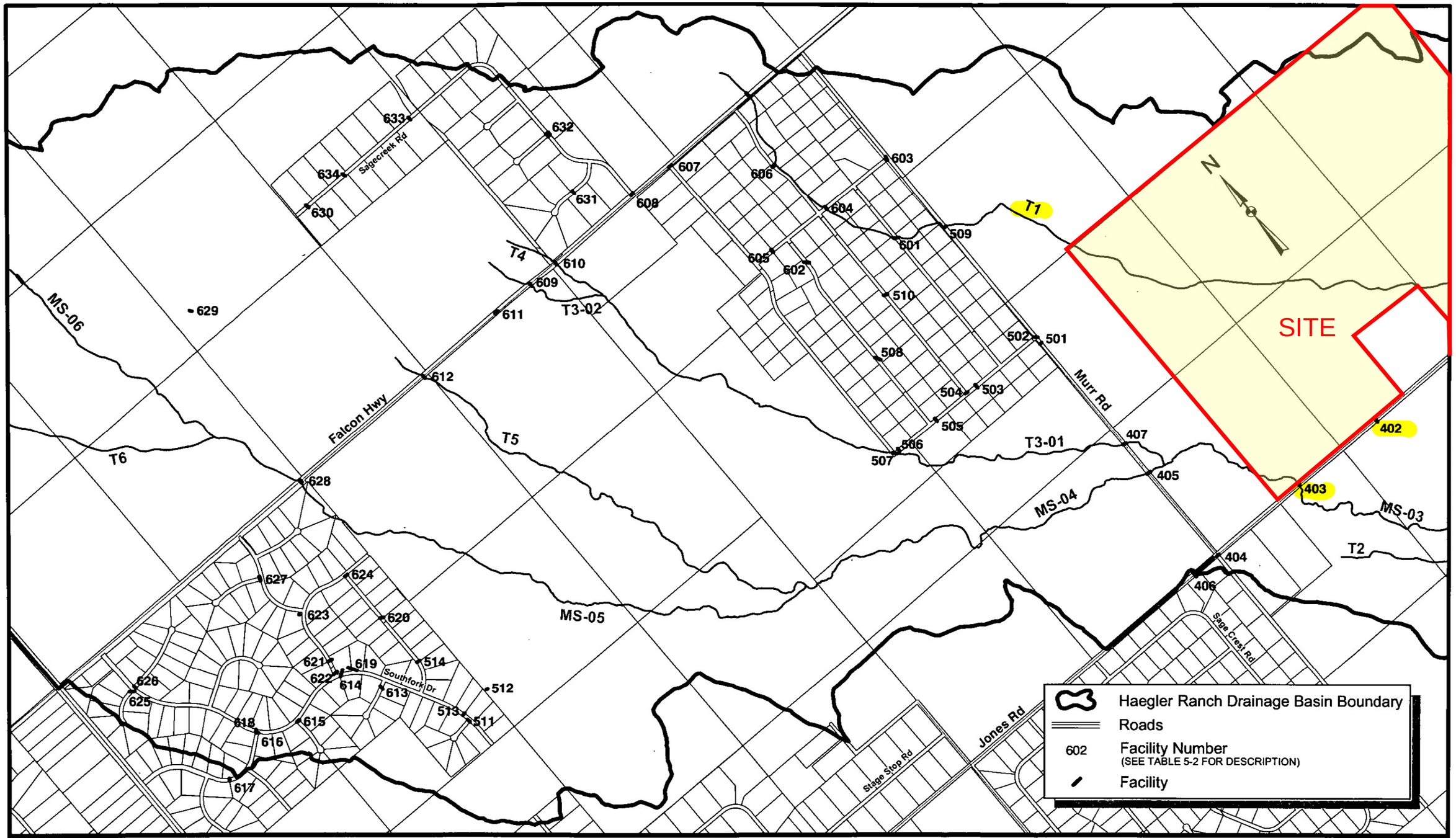
1" = 5,000'

DATE: 09/08

HAEGLER RANCH DRAINAGE BASIN

FACILITY INVENTORY A
FIGURE 5-2

URS NO. 21711039



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

1,500 750 0 1,500 Feet

1" = 1,500'

DATE: 09/08

HAEGLER RANCH DRAINAGE BASIN

FACILITY INVENTORY B

FIGURE 5-3

URS NO. 21711039

Table C3
Existing Condition Culvert Improvements Cost Estimate

Facility Number	Road Crossing	Channel	Existing Size	Existing 100-yr Flow (cfs)	Deficiency	Necessary Facility for Existing 100-year Flow	Number of Culverts	Assumed Length (LF)[1]	Unit Cost	End Section Unit Cost	Headwall Concrete (LF/HW)	Headwall Steel (LB/HW)	Wingwall Concrete (CY)[2]	Wingwall Steel (tons)	Concrete Unit Cost $/CY	Steel Unit Cost $/ton	Total Cost
301	Peyton Highway	Main Stem (MS-02)	2-33"X48" CMPs	2,500	Overtops	7-6'X6' RCBs	7	90	$475		0.581	151	19.7	774.4	$435	$1.1	$314,535
401	Jones Road	Tributary 1 (T1)	2-24" CMPs	370	Overtops	6'X6' RCB	1	90	$475		0.652	169.4	19.7	774.4	$435	$1.1	$53,111
403	Jones Road	Main Stem (MS-03)	3-60" CMPs	2,300	Overtops	6-6'X6' RCBs	6	90	$475		0.581	151	19.7	774.4	$435	$1.1	$270,947
405	Murr Road	Main Stem (MS-04)	66" RCP	1,700	Overtops	5-6'X6' RCBs	5	70	$475		0.652	169.4	19.7	774.4	$435	$1.1	$180,371
407	Murr Road	Tributary 3 (T3-01)	66" RCP	670	Overtops	2-6'X6' RCBs	2	70	$475		0.652	169.4	19.7	774.4	$435	$1.1	$77,801
507	Peerless Farms Road	Tributary 3 (T3-01)	60" CMP	600	Overtops	2-6'X6' RCBs	2	110	$475		0.652	169.4	19.7	774.4	$435	$1.1	$115,801
509	Murr Road	Tributary 1 (T1)	2-15" RCPs	220	Overtops	66" RCP	1	70	$210	$2,300							$19,300
601	Whiting Way	Tributary 1 (T1)	24" CMP	220	Overtops	66" RCP	1	90	$210	$2,300							$23,500
604	Max Road	Tributary 1 (T1)	18" CMP	220	Overtops	66" RCP	1	70	$210	$2,300							$19,300
609	Falcon Highway	Tributary 3 (T3-02)	18" CMP	180	Overtops	66" RCP	1	100	$210	$2,300							$25,600
610	Falcon Highway	Tributary 4 (T4)	24" CMP	200	Overtops	66" RCP	1	90	$210	$2,300							$23,500
612	Falcon Highway	Tributary 5 (T5)	24" CMP	150	Overtops	60" RCP	1	90	$185	$2,275							$21,200
628	Falcon Highway	Main Stem (MS-05)	2-60" CMPs	1,000	Overtops	3-6'X6' RCBs	3	100	$475		0.652	169.4	19.7	774.4	$435	$1.1	$154,741
702	Curtis Road	Tributary 6 (T6)	36" CMP	120	Overtops	54" RCP	1	130	$145	$2,150							$23,150
703	Curtis Road	Main Stem (MS-06)	24" CMP	590	Overtops	2-6'X6' RCBs	2	120	$475		0.652	169.4	19.7	774.4	$435	$1.1	$125,301
704	Judge Orr Road	Main Stem (MS-06)	Blocked Culvert	540	Overtops	2-72" RCPs	2	160	$230	$2,400							$83,200
801	Pedestrain Bridge	Main Stem (MS-06)	Bridge	350	Meets Capacity	Existing Bridge											$0
802	US24	Main Stem (MS-06)	2-66" CMPs	350	Meets Capacity	Existing Culvert											$0
803	Eastonville Road	Main Stem (MS-07)	27"X21" CMP	25	Overtops	30" RCP	1	110	$68	$1,100							$9,680
804	Eastonville Road	Tributary 7 (T7)	18" CMP	99	Overtops	48" RCP	1	100	$110	$1,990							$14,980
N/A	Peyton Highway	Tributary 1 (T1)	No Culvert	500	Overtops	2-72" RCPs	2	90	$230	$2,400							$51,000
N/A	Falcon Highway	Tributary 1 (T1)	No Culvert	33	Overtops	36" RCP	1	90	$80	$1,275							$9,750

[1] Length is based on Future Land Use Road widths

[2] Wingwalls assumed 15' long for calculations. Calculations based on CDOT cross sections.

Sub-Total	**$1,616,769**
30% Construction Contingency	**$485,031**
15% Engineering Contingency	**$242,515**
Total	**$2,344,315**

6.4. Cost Estimates

The regional and subregional detention alternatives have been evaluated by assembling necessary design requirements using the above criteria and estimating the capital cost of the improvements. Proposed improvements are separated into existing or future, depending on whether facilities are designed for the existing or future peak flow rates. Unit rates for all cost estimating are based on an average of the bid tabulations published by CDOT for 2006. These unit rates are presented in Table 6-11. Land acquisition costs were included only for the detention facilities in the alternatives analysis, because channel improvements would essentially be in floodplain areas not otherwise developable. Cost estimates are included in Appendix C.

Table 6-11 Unit Rates

Item Number	Description	Units	URS Estimated Unit Price
203-00010	Unclassified Excavation (Complete In Place)	CY	$7.00
203-00060	Embankment Material (Complete In Place)	CY	$9.00
207-00205	Topsoil	CY	$8.00
212-00006	Seeding (Native)	ACRE	$580.00
420-00100	Geotextile (Erosion Control) (Class A)	SY	$3.00
506-00206	Riprap (6 Inch)	CY	$80.00
506-00212	Riprap (12 Inch)	CY	$76.00
506-00218	Riprap (18 Inch)	CY	$64.00
507-00100	Concrete Slope and Ditch Paving (Reinforced)	CY	$300.00
601-03030	Concrete Class D (Box Culvert)	CY	$435.00
602-00000	Reinforcing Steel	LB	$1.10
603-01185	18 Inch Reinforced Concrete Pipe (Complete In Place)	LF	$48.00
603-01245	24 Inch Reinforced Concrete Pipe (Complete In Place)	LF	$56.00
603-01305	30 Inch Reinforced Concrete Pipe (Complete In Place)	LF	$68.00
603-01365	36 Inch Reinforced Concrete Pipe (Complete In Place)	LF	$80.00
603-01425	42 Inch Reinforced Concrete Pipe (Complete In Place)	LF	$100.00
603-01485	48 Inch Reinforced Concrete Pipe (Complete In Place)	LF	$110.00
603-01545	54 Inch Reinforced Concrete Pipe (Complete In Place)	LF	$145.00
603-01605	60 Inch Reinforced Concrete Pipe (Complete In Place)	LF	$185.00
603-01665	66 Inch Reinforced Concrete Pipe (Complete In Place)	LF	$210.00
603-01725	72 Inch Reinforced Concrete Pipe (Complete In Place)	LF	$230.00
603-05018	18 Inch Reinforced Concrete End Section	EACH	$735.00
603-05024	24 Inch Reinforced Concrete End Section	EACH	$850.00
603-05030	30 Inch Reinforced Concrete End Section	EACH	$1,100.00
603-05036	36 Inch Reinforced Concrete End Section	EACH	$1,275.00
603-05042	42 Inch Reinforced Concrete End Section	EACH	$1,550.00
603-05048	48 Inch Reinforced Concrete End Section	EACH	$1,990.00
603-05054	54 Inch Reinforced Concrete End Section	EACH	$2,150.00
603-05060	60 Inch Reinforced Concrete End Section	EACH	$2,275.00
603-05066	66 Inch Reinforced Concrete End Section	EACH	$2,300.00
603-05072	72 Inch Reinforced Concrete End Section	EACH	$2,400.00
603-70606	6x6 Foot Concrete Box Culvert (Precast)	LF	$475.00
603-70806	8x6 Foot Concrete Box Culvert (Precast)	LF	$535.00
603-71006	10x6 Foot Concrete Box Culvert (Precast)	LF	$570.00
N/A	Land Acquisition	ACRE	$55,000

Note: Land acquisition costs were provided by El Paso County

Cost estimates have been prepared for public roadway crossing facilities designed for existing peak flow rates and are shown in Table 6-12.

Table 6-12 Existing Conditions Roadway Crossing Deficiencies and Costs to Correct

Facility Number	Road Crossing	Channel	Necessary Facility	Cost
301	Peyton Highway	Main Stem (MS-02)	7-6'X6' RCBs	$314,535
401	Jones Road	Tributary 1 (T1)	6'X6' RCB	$53,111
403	Jones Road	Main Stem (MS-03)	6-6'X6' RCBs	$270,947
405	Murr Road	Main Stem (MS-04)	5-6'X6' RCBs	$180,371
407	Murr Road	Tributary 3 (T3-01)	2-6'X6' RCBs	$77,801
507	Peerless Farms Road	Tributary 3 (T3-01)	2-6'X6' RCBs	$115,801
509	Murr Road	Tributary 1 (T1)	66" RCP	$19,300
601	Whiting Way	Tributary 1 (T1)	66" RCP	$23,500
604	Max Road	Tributary 1 (T1)	66" RCP	$19,300
609	Falcon Highway	Tributary 3 (T3-02)	66" RCP	$25,600
610	Falcon Highway	Tributary 4 (T4)	66" RCP	$23,500
612	Falcon Highway	Tributary 5 (T5)	60" RCP	$21,200
628	Falcon Highway	Main Stem (MS-05)	3-6'X6' RCBs	$154,741
702	Curtis Road	Tributary 6 (T6)	54" RCP	$23,150
703	Curtis Road	Main Stem (MS-06)	2-6'X6' RCBs	$125,301
704	Judge Orr Road	Main Stem (MS-06)	2-72" RCPs	$83,200
801	Pedestrian Bridge	Main Stem (MS-06)	Existing Bridge	$0
802	US24	Main Stem (MS-06)	Existing Culvert	$0
803	Eastonville Road	Main Stem (MS-07)	30" RCP	$9,680
804	Eastonville Road	Tributary 7 (T7)	48" RCP	$14,980
N/A	Peyton Highway	Tributary 1 (T1)	2-72" RCPs	$51,000
N/A	Falcon Highway	Tributary 1 (T1)	36" RCP	$9,750
Sub-Total				$1,616,769
30% Construction Contingency				$485,031
15% Engineering Contingency				$242,515
Total				$2,344,315

(See Table C3 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

Table 5-3 Existing Hydraulic Deficiencies

Facility Number	Road Crossing	Channel	Existing Size	Existing 100-yr Flow (cfs)	Deficiency
301	Peyton Highway	Main Stem (MS-02)	2-33"X48" CMPs	2,500	Overtops
N/A	Peyton Highway	Tributary 1 (T1)	No Culvert	500	Overtops
401	Jones Road	Tributary 1 (T1)	2-24" CMPs	370	Overtops
402	Jones Road	N/A	15" RCP	N/A	N/A
403	Jones Road	Main Stem (MS-03)	3-60" CMPs	2,300	Overtops
404	Jones Road	N/A	18" CMP	N/A	N/A
405	Murr Road	Main Stem (MS-04)	66" RCP	1,700	Overtops
406	Jones Road	N/A	4.1' x 6.9' RCP	N/A	N/A
407	Murr Road	Tributary 3 (T3-01)	66" RCP	670	Overtops
501	Murr Road	N/A	2-14" RCP	N/A	N/A
502	Murr Road	N/A	2-18" CMP	N/A	N/A
503	Flat Creek Road	N/A	30" CMP	N/A	N/A
504	Flat Creek Road	N/A	18" CMP	N/A	N/A
505	Flat Creek Road	N/A	36" CMP	N/A	N/A
506	Flat Creek Road	N/A	60" CMP	N/A	N/A
507	Peerless Farms Road	Tributary 3 (T3-01)	60" CMP	600	Overtops
508	Whipsaw Road	N/A	30" CMP	N/A	N/A
509	Murr Road	Tributary 1 (T1)	2-15" RCPs	220	Overtops
510	Prospero Road	N/A	18" CMP	N/A	N/A
511	Southfork Dr	N/A	24" CMP	N/A	N/A
512	Falcon Grassy Hts	N/A	2-12" CMP	N/A	N/A
513	Southfork Dr	N/A	36" CMP	N/A	N/A
514	Oil Baron Dr	N/A	30" CMP	N/A	N/A
601	Whiting Way	Tributary 1 (T1)	24" CMP	220	Overtops
602	Whipsaw Road	N/A	24" CMP	N/A	N/A
603	Murr Road	N/A	24" CMP	N/A	N/A
604	Max Road	Tributary 1 (T1)	18" CMP	220	Overtops
605	Max Road	N/A	2-24" CMP	N/A	N/A

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**

HYDROLOGIC CALCULATIONS

- Provide input data/files for SWMM models

- Provide interim conditions calculations (early grading, but no infrastructure)

- Provide proposed drainage calculations

INPUT SWMM DATA NOW INCLUDED ALONG WITH PROPOSED SWMM MODEL CALCS.

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS

EPA- 600/R-14/413b
Revisied September 2015

Storm Water Management Model User's Manual Version 5.1

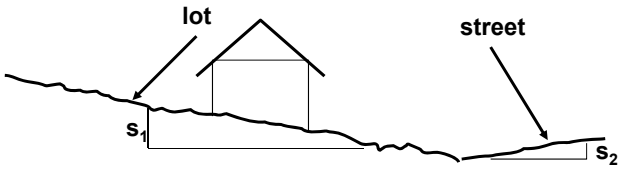
by

Lewis A. Rossman
Envronmental Scientist, Emeritus
U.S. Environmental Protection Agency

National Risk Management Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency
26 Martin Luther King Drive
Cincinnati, OH 45268

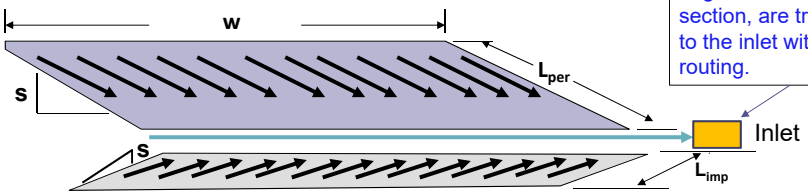
September 2015

Subcatchment Conceptual Model



Pervious and Impervious areas are processed independently and are then combined.
Both have the same tributary width (W).

Flows calculated at edge for rectangular section, are transferred to the inlet without flow routing.



You can set them up as separate subcatchments.

Width Parameter

NEVER use default value

Approx. Width = (Area) ÷ (Length)

Length = average overland sheet flow length of runoff

Suggested Rules of Thumb:

Undeveloped:

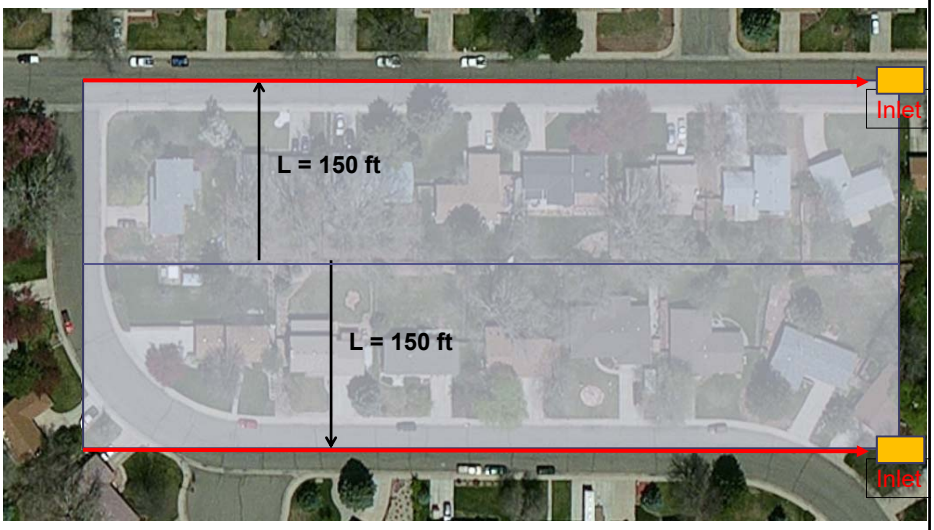
- **Maximum length = 100- to 500-feet**

Residential Catchments:

- **Maximum length = 100 to 300 feet**
- **back of lot to street gutter (100-175 ft)**

11

Width Parameter

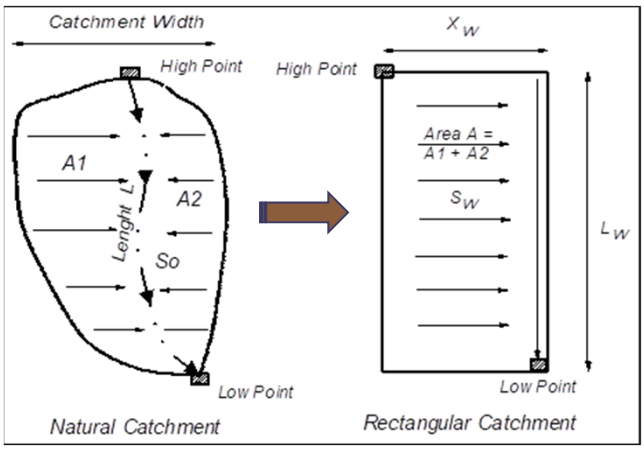


11

12

Transforming Subcatchment Shape to a Rectangle

Equations Suggested by Guo and Urbonas, 2009



Dimensionless Variables:

$X = {}^{A}/_{L^2}$

$Y = {}^{L_w}/_{L}$

Skewness:

$Z = max(A1, A2)/A$

$0.5 \le Z \le 1.0$

$$Y = \frac{Lw}{L} = (1.5 - Z)(2.286X - 0.286X^2) \Rightarrow {}^{L_w}/_{L} = (1.5 - Z)\left\{2.286\left({}^{A}/_{L^2}\right) - 0.286\left({}^{A}/_{L^2}\right)^2\right\}$$

$${}^{S_o}/_{S_w} = ({}^{X}/_{Y} + Y) \Rightarrow {}^{S_o}/_{S_w} = {}^{A}/_{LL_w} + {}^{L_w}/_{L}$$

12

Percent Impervious

Estimating/Measuring Percent Impervious:

- **If site-specific information is not available, use land use classification**
- **Sometimes, site-specific impervious GIS layers are available**

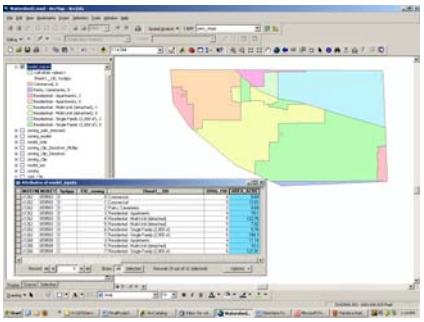


Table RO-3—Recommended Percentage Imperviousness Values

Land Use or Surface Characteristics	Percentage Imperviousness
Business:	
Commercial areas	95
Neighborhood areas	85
Residential:	
Single-family	*
Multi-unit (detached)	60
Multi-unit (attached)	75
Half-acre lot or larger	*
Apartments	80
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	5
Playgrounds	10
Schools	50
Railroad yard areas	15
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	0
Lawns, clayey soil	0

* See Figures RO-3 through RO-5 for percentage imperviousness.

Source: UDFCD Storm Drainage Criteria Manual

City of Colorado Springs DCM - Manning's n

Table 6-11. Roughness Coefficients (Manning's n) for NRCS Overland Flow

Surface description	n[1]
Smooth surfaces (concrete, asphalt, gravel, bare soil, etc.)	0.011
Fallow (no residue)	0.05
Cultivated Soils:	
Residue cover ≤20%	0.06
Residue cover >20%	0.17
Grass:	
Short grass prairie	0.15
Dense grasses [2]	0.24
Bermuda grass	0.41
Range (natural)	0.13
Woods [3]	
Light underbrush	0.40
Dense underbrush	0.80

Table 3-1 Impervious area as a percentage of land use.

Land Use	Percent Impervious Area
Commercial	56
Industrial	76
High density residential	51
Medium density residential	38
Low density residential	19
Institutional	34
Agricultural	2
Forest	1.9
Open Urban Land	11

As mentioned earlier, impervious areas in SWMM are hydraulically (directly) connected to the drainage system – called directly connected impervious areas (DCIA). For instance, if rooftops drain onto adjacent pervious lawn areas, they should not be treated as a hydraulically effective impervious area. Such areas are non-effective impervious areas (Doyle and Miller, 1980). On the other hand, if a driveway drains to a street and then to a stormwater inlet, the driveway would be considered hydraulically connected. Rooftops with downspouts connected directly to a sewer are clearly hydraulically connected. An example of careful measurements and statistics on imperviousness may be found in Field et al. (2000), Lee (2003), and Roy and Shuster (2007). Lee and Heaney (2003) provide detailed comparisons of imperviousness computations and their implications for modeling.

Should rooftops be treated as "pervious," the real surrounding pervious area is subject to more incoming water than rainfall alone and thus might produce runoff sooner than if rainfall alone were considered. In the possible event that this effect is important (a judgment based on infiltration parameters) it can be modeled using the overland flow re-routing option discussed earlier in Section 3.7. For example, if disconnected rooftops comprised 25 percent of the total impervious area of a subcatchment (as opposed to the total DCIA) then one could tell SWMM that this percentage of impervious area should be internally routed onto the pervious sub-area of the subcatchment.

Another method of estimating the effective impervious area given measured data is to plot the runoff (in. or mm) vs. rainfall (in. or mm) for small storms. The slope of the regression line is a good estimate of the effective impervious area (Doyle and Miller, 1980).

Table 3-5 Estimates of Manning's roughness coefficient for overland flow

Source	Ground Cover	n	Range
Crawford and Linsley (1966)[a]	Smooth asphalt	0.01	
	Asphalt of concrete paving	0.014	
	Packed clay	0.03	
	Light turf	0.20	
	Dense turf	0.35	
	Dense shrubbery and forest litter	0.4	
Engman (1986)[b]	Concrete or asphalt	0.011	0.010-0.013
	Bare sand	0.010	0.01-0.016
	Graveled surface	0.02	0.012-0.03
	Bare clay-loam (eroded)	0.02	0.012-0.033
	Range (natural)	0.13	0.01-0.32
	Bluegrass sod	0.45	0.39-0.63
	Short grass prairie	0.15	0.10-0.20
	Bermuda grass	0.41	0.30-0.48
Yen (2001)[c]	Smooth asphalt pavement	0.012	0.010-0.015
	Smooth impervious surface	0.013	0.011-0.015
	Tar and sand pavement	0.014	0.012-0.016
	Concrete pavement	0.017	0.014-0.020
	Rough impervious surface	0.019	0.015-0.023
	Smooth bare packed soil	0.021	0.017-0.025
	Moderate bare packed soil	0.030	0.025-0.035
	Rough bare packed soil	0.038	0.032-0.045
	Gravel soil	0.032	0.025-0.045
	Mowed poor grass	0.038	0.030-0.045
	Average grass, closely clipped sod	0.050	0.040-0.060
	Pasture	0.055	0.040-0.070
	Timberland	0.090	0.060-0.120
	Dense grass	0.090	0.060-0.120
	Shrubs and bushes	0.120	0.080-0.180
	Business land use	0.022	0.014-0.035
	Semi-business land use	0.035	0.022-0.050
	Industrial land use	0.035	0.020-0.050
	Dense residential land use	0.040	0.025-0.060
	Suburban residential land use	0.055	0.030-0.080
	Parks and lawns	0.075	0.040-0.120

[a]Obtained by calibration of Stanford Watershed Model.
[b]Computed by Engman (1986) by kinematic wave and storage analysis of measured rainfall-runoff data.
[c]Computed on basis of kinematic wave analysis.

General Information
Homepage
Progress Reports
FAQ
Glossary

Precipitation Frequency
Data Server
GIS Grids
Maps
Time Series
Temporals
Documents

Probable Maximum Precipitation
Documents

Miscellaneous
Publications
Storm Analysis
Record Precipitation

Contact Us
Inquiries

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CO

Data description

Data type: Precipitation depth **Units:** English **Time series type:** Partial duration

Select location

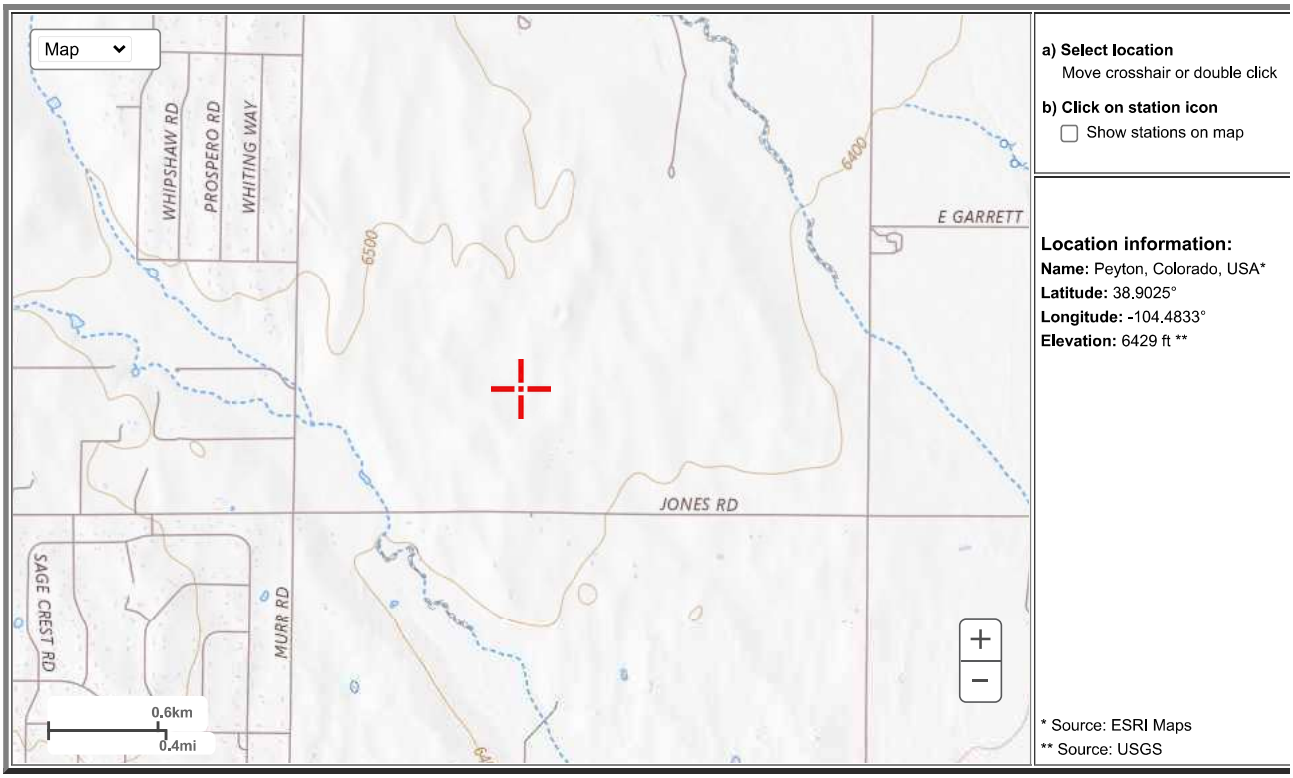
1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude: Longitude: Submit

b) By station (list of CO stations): Select station

c) By address Search

2) Use map:



a) Select location
Move crosshair or double click

b) Click on station icon
Show stations on map

Location information:
Name: Peyton, Colorado, USA*
Latitude: 38.9025°
Longitude: -104.4833°
Elevation: 6429 ft **

* Source: ESRI Maps
** Source: USGS

NOAA Atlas 14, Volume 8, Version 2
Location name: Peyton, Colorado, USA*
Latitude: 38.9025°, Longitude: -104.4833°
Elevation: 6429 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.241 (0.193-0.304)	0.294 (0.235-0.371)	0.386 (0.308-0.489)	0.468 (0.371-0.594)	0.587 (0.453-0.778)	0.685 (0.515-0.916)	0.787 (0.572-1.08)	0.897 (0.625-1.26)	1.05 (0.703-1.51)	1.17 (0.763-1.70)
10-min	0.353 (0.282-0.445)	0.431 (0.344-0.544)	0.566 (0.451-0.716)	0.685 (0.543-0.870)	0.859 (0.663-1.14)	1.00 (0.754-1.34)	1.15 (0.838-1.58)	1.31 (0.915-1.84)	1.54 (1.03-2.21)	1.71 (1.12-2.49)
15-min	0.430 (0.344-0.543)	0.525 (0.420-0.663)	0.690 (0.550-0.873)	0.835 (0.662-1.06)	1.05 (0.808-1.39)	1.22 (0.919-1.64)	1.41 (1.02-1.92)	1.60 (1.12-2.25)	1.87 (1.26-2.69)	2.09 (1.36-3.03)
30-min	0.621 (0.497-0.784)	0.758 (0.606-0.957)	0.994 (0.792-1.26)	1.20 (0.952-1.53)	1.51 (1.16-2.00)	1.76 (1.32-2.35)	2.02 (1.47-2.76)	2.30 (1.60-3.22)	2.69 (1.80-3.86)	3.00 (1.95-4.35)
60-min	0.797 (0.638-1.00)	0.963 (0.770-1.22)	1.26 (1.00-1.59)	1.52 (1.21-1.94)	1.92 (1.49-2.56)	2.26 (1.70-3.03)	2.61 (1.90-3.58)	3.00 (2.09-4.21)	3.54 (2.37-5.10)	3.97 (2.59-5.77)
2-hr	0.972 (0.783-1.22)	1.17 (0.940-1.46)	1.52 (1.22-1.91)	1.85 (1.47-2.33)	2.34 (1.83-3.10)	2.76 (2.09-3.68)	3.20 (2.35-4.38)	3.69 (2.60-5.17)	4.39 (2.97-6.29)	4.95 (3.25-7.14)
3-hr	1.06 (0.858-1.32)	1.26 (1.02-1.58)	1.64 (1.32-2.05)	1.99 (1.60-2.50)	2.54 (2.00-3.36)	3.01 (2.30-4.01)	3.52 (2.60-4.79)	4.08 (2.89-5.69)	4.88 (3.32-6.98)	5.53 (3.65-7.95)
6-hr	1.21 (0.985-1.49)	1.43 (1.16-1.77)	1.84 (1.50-2.29)	2.24 (1.81-2.79)	2.86 (2.27-3.77)	3.40 (2.62-4.51)	3.99 (2.97-5.41)	4.64 (3.32-6.45)	5.59 (3.84-7.95)	6.37 (4.24-9.08)
12-hr	1.36 (1.12-1.68)	1.61 (1.32-1.98)	2.06 (1.69-2.54)	2.50 (2.03-3.08)	3.17 (2.53-4.14)	3.75 (2.91-4.93)	4.38 (3.29-5.90)	5.08 (3.66-7.01)	6.10 (4.22-8.61)	6.92 (4.64-9.82)
24-hr	1.55 (1.28-1.89)	1.82 (1.50-2.21)	2.30 (1.90-2.82)	2.76 (2.26-3.39)	3.47 (2.79-4.48)	4.08 (3.18-5.31)	4.74 (3.58-6.31)	5.46 (3.96-7.46)	6.49 (4.53-9.10)	7.34 (4.96-10.3)
2-day	1.78 (1.48-2.15)	2.07 (1.72-2.51)	2.60 (2.16-3.16)	3.10 (2.55-3.77)	3.85 (3.11-4.92)	4.49 (3.53-5.79)	5.18 (3.94-6.84)	5.93 (4.33-8.03)	7.00 (4.92-9.73)	7.87 (5.37-11.0)
3-day	1.94 (1.62-2.33)	2.27 (1.90-2.73)	2.86 (2.38-3.45)	3.40 (2.81-4.12)	4.20 (3.40-5.34)	4.88 (3.85-6.26)	5.61 (4.28-7.36)	6.39 (4.68-8.61)	7.50 (5.29-10.4)	8.40 (5.75-11.7)
4-day	2.08 (1.75-2.50)	2.44 (2.04-2.93)	3.07 (2.56-3.69)	3.64 (3.02-4.40)	4.49 (3.64-5.67)	5.20 (4.11-6.63)	5.95 (4.55-7.78)	6.76 (4.97-9.07)	7.90 (5.59-10.9)	8.82 (6.07-12.3)
7-day	2.47 (2.09-2.94)	2.86 (2.41-3.41)	3.54 (2.98-4.23)	4.16 (3.47-4.99)	5.07 (4.14-6.36)	5.83 (4.64-7.39)	6.64 (5.11-8.62)	7.50 (5.55-10.0)	8.73 (6.22-12.0)	9.71 (6.72-13.4)
10-day	2.81 (2.38-3.33)	3.23 (2.73-3.84)	3.97 (3.35-4.73)	4.63 (3.88-5.54)	5.61 (4.59-6.99)	6.41 (5.12-8.09)	7.26 (5.61-9.38)	8.17 (6.07-10.8)	9.45 (6.76-12.9)	10.5 (7.28-14.4)
20-day	3.70 (3.16-4.35)	4.30 (3.66-5.06)	5.29 (4.49-6.24)	6.14 (5.18-7.27)	7.33 (6.01-9.00)	8.28 (6.64-10.3)	9.25 (7.18-11.8)	10.3 (7.66-13.4)	11.6 (8.36-15.7)	12.7 (8.90-17.4)
30-day	4.44 (3.80-5.20)	5.17 (4.42-6.06)	6.36 (5.42-7.47)	7.34 (6.23-8.66)	8.70 (7.14-10.6)	9.74 (7.83-12.0)	10.8 (8.40-13.6)	11.8 (8.87-15.4)	13.2 (9.56-17.7)	14.3 (10.1-19.5)
45-day	5.40 (4.65-6.29)	6.26 (5.38-7.30)	7.64 (6.54-8.93)	8.76 (7.46-10.3)	10.3 (8.44-12.4)	11.4 (9.18-14.0)	12.5 (9.75-15.7)	13.6 (10.2-17.6)	15.0 (10.9-19.9)	16.0 (11.4-21.7)
60-day	6.24 (5.38-7.24)	7.18 (6.19-8.34)	8.68 (7.46-10.1)	9.87 (8.44-11.6)	11.5 (9.44-13.7)	12.6 (10.2-15.4)	13.8 (10.8-17.2)	14.9 (11.2-19.1)	16.2 (11.8-21.5)	17.2 (12.3-23.3)

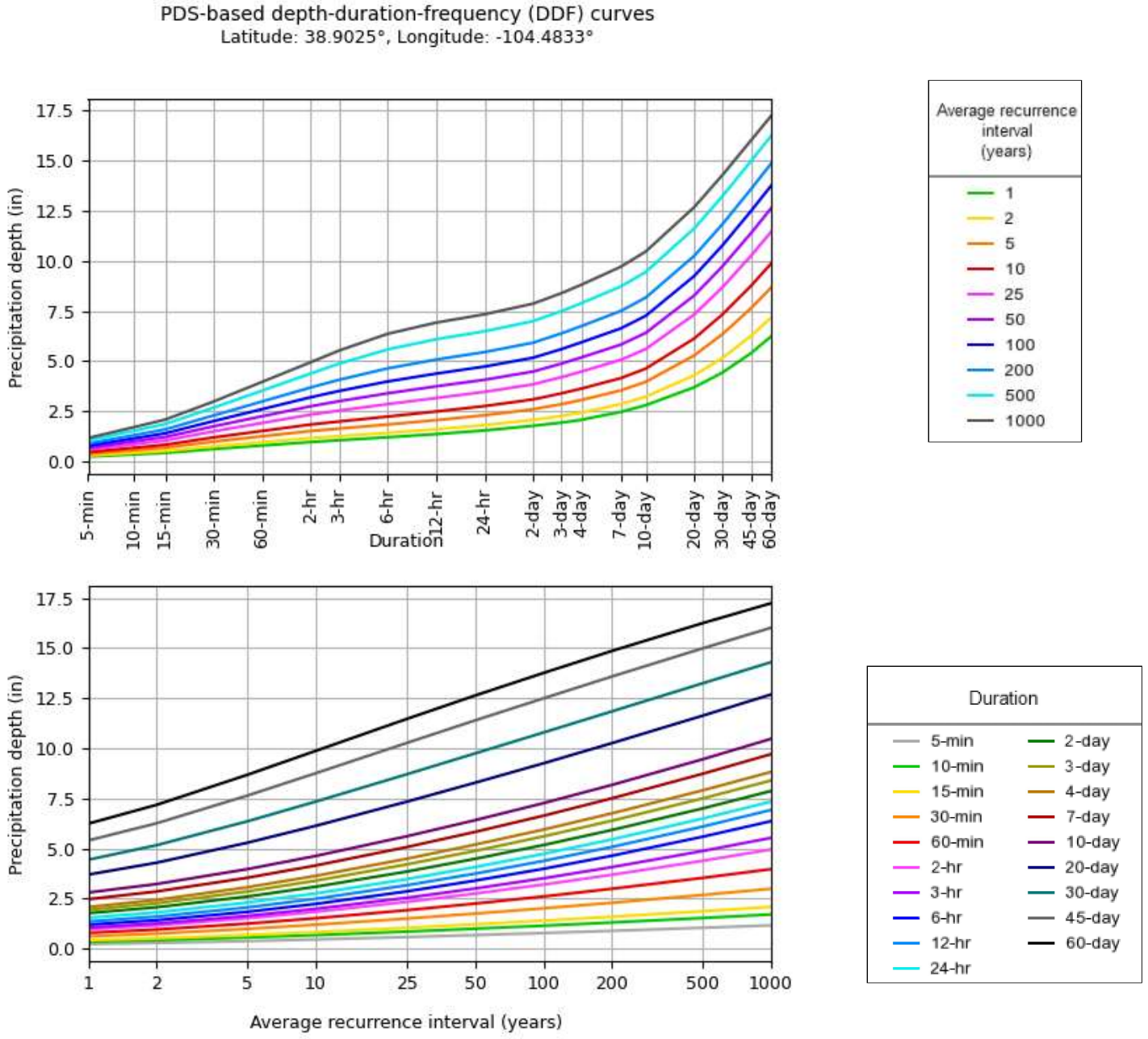
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Thu Aug 21 14:02:54 2025

Back to Top

Maps & aerials

Small scale terrain

Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

City of Colorado Springs **2-Hour Design Storms** (Cumulative Depth Distributions) (inches)

DCM Storm Depths - Inches

Return Period	1-Hour Depth	6-Hour Depth	24-Hour Depth
2	0.963	1.7	2.1
5	1.26	2.1	2.7
10	1.52	2.4	3.2
25	1.92	2.9	3.6
50	2.26	3.2	4.2
100	2.61	3.5	4.6
500	3.54	5.95	7.34

Values from NOAA chart for site

Cumulative Rainfall Depths in Inches - **5-yr Storm**

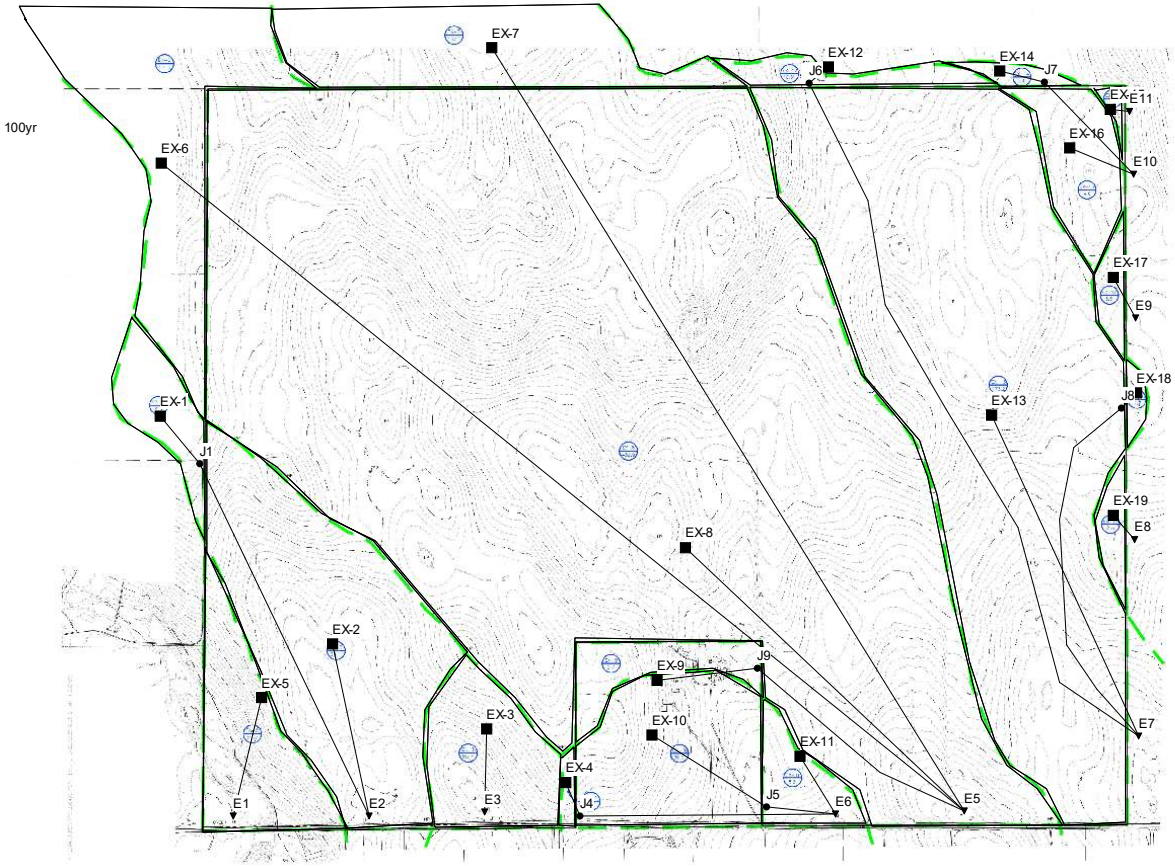
Time Min.	Drainage Basin Area (square miles)						
	0-1	>1-5	>5-10	>10-15	>15-20	>20-40	>40-60
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.018	0.018	0.018	0.018	0.019	0.019	0.021
10	0.058	0.055	0.052	0.052	0.053	0.053	0.050
15	0.100	0.096	0.093	0.093	0.092	0.088	0.086
20	0.151	0.146	0.137	0.137	0.134	0.129	0.120
25	0.226	0.222	0.213	0.212	0.205	0.198	0.185
30	0.325	0.314	0.301	0.297	0.286	0.272	0.249
35	0.530	0.499	0.446	0.412	0.387	0.348	0.305
40	0.897	0.825	0.704	0.624	0.564	0.480	0.397
45	1.038	0.953	0.803	0.706	0.638	0.532	0.435
50	1.124	1.038	0.882	0.780	0.713	0.604	0.499
55	1.178	1.091	0.932	0.829	0.757	0.645	0.539
60	1.225	1.135	0.975	0.869	0.799	0.684	0.575
65	1.265	1.177	1.016	0.903	0.833	0.718	0.607
70	1.283	1.194	1.034	0.922	0.854	0.742	0.631
75	1.298	1.212	1.052	0.940	0.872	0.760	0.649
80	1.312	1.226	1.070	0.958	0.890	0.777	0.667
85	1.326	1.240	1.087	0.975	0.907	0.795	0.684
90	1.339	1.254	1.103	0.993	0.925	0.813	0.702
95	1.351	1.268	1.116	1.011	0.942	0.830	0.719
100	1.363	1.281	1.129	1.024	0.960	0.848	0.737
105	1.375	1.293	1.143	1.038	0.974	0.866	0.755
110	1.386	1.305	1.157	1.052	0.987	0.879	0.770
115	1.397	1.317	1.171	1.066	1.000	0.893	0.784
120	1.410	1.328	1.182	1.080	1.014	0.907	0.798

Cumulative Rainfall Depths in Inches - **100-yr Storm**

Time Min.	Drainage Basin Area (square miles)						
	0-1	>1-5	>5-10	>10-15	>15-20	>20-40	>40-60
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.037	0.037	0.037	0.037	0.039	0.039	0.044
10	0.120	0.115	0.107	0.107	0.110	0.110	0.104
15	0.206	0.198	0.193	0.193	0.191	0.183	0.177
20	0.313	0.303	0.284	0.284	0.277	0.266	0.248
25	0.467	0.459	0.441	0.438	0.425	0.410	0.384
30	0.673	0.650	0.624	0.616	0.592	0.564	0.517
35	1.099	1.034	0.924	0.853	0.801	0.720	0.632
40	1.858	1.710	1.459	1.292	1.169	0.994	0.822
45	2.151	1.973	1.663	1.462	1.321	1.101	0.900
50	2.328	2.151	1.827	1.616	1.477	1.250	1.034
55	2.440	2.260	1.931	1.717	1.569	1.336	1.117
60	2.537	2.352	2.020	1.801	1.655	1.417	1.190
65	2.620	2.438	2.104	1.871	1.725	1.488	1.258
70	2.657	2.474	2.143	1.911	1.770	1.537	1.308
75	2.688	2.511	2.179	1.947	1.806	1.574	1.344
80	2.717	2.540	2.216	1.984	1.843	1.610	1.381
85	2.746	2.568	2.252	2.020	1.879	1.647	1.417
90	2.774	2.597	2.284	2.057	1.916	1.683	1.454
95	2.798	2.626	2.312	2.093	1.952	1.720	1.490
100	2.824	2.654	2.339	2.122	1.989	1.757	1.527
105	2.848	2.678	2.367	2.151	2.018	1.793	1.563
110	2.871	2.704	2.396	2.179	2.044	1.822	1.595
115	2.894	2.727	2.425	2.208	2.072	1.850	1.623
120	2.921	2.751	2.448	2.237	2.101	1.879	1.652

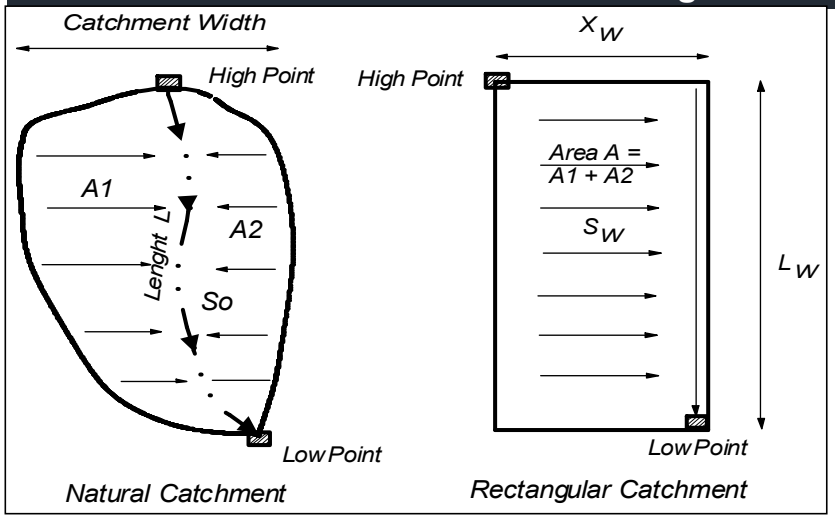
TRIPLE H RANCH Pre-Developed Conditions

08/22/2025 00:15:00



Password: *Width*

Convert Natural Catchment to a Rectangular Shape



Subcatchment Center	Z=0.5
Side Collector	Z=1
Skewed Location	0.5<Z<1

Dimensionless Variables

$$Y = \frac{L}{L_w}; \qquad X = \frac{A}{L^2}$$

$$Y = (1.5 - Z)(2.286X - 0.286X^2)$$

$$\frac{Lw}{L} = (1.5 - Z)[2.286(\frac{A}{L^2}) - 0.286(\frac{A}{L^2})^2]$$

$$S_o/S_w = A/(LL_w) + L_w/L$$

$$X_w = A/L_w$$

Subarea ID	Area acre	A1 acre	A2 acre	L ft	High Pt Elev. ft	Low Pt Elev. ft	Z=Am/A	X=A/L²	Y=Lw/L	Lw ft	Xw ft	So %	So/Sw	Sw %
EX-1	9.90	5.00	4.90	1,200	6498.0	6484.0	0.51	0.30	0.66	787	548	1.17	1.11	1.05
EX-2	64.10	21.00	43.10	2,900	6484.0	6428.0	0.67	0.33	0.60	1,746	1,599	1.93	1.15	1.67
EX-3	20.20	5.00	15.20	1,200	6,472	6,428	0.75	0.61	0.96	1,157	760	3.67	1.60	2.29
EX-4	1.30	0.70	0.60	420	6,465	6,442	0.54	0.32	0.68	284	199	5.48	1.15	4.76
EX-5	21.90	7.00	14.90	1,350	6,452	6,410	0.68	0.52	0.92	1,237	771	3.11	1.49	2.09
EX-6	536.00	210.00	326.00	7,400	6,610	6,498	0.61	0.43	0.82	6,089	3,834	1.51	1.34	1.13
EX-7	132.50	60.00	72.50	3,940	6,560	6,500	0.55	0.37	0.77	3,042	1,897	1.52	1.25	1.21
EX-8	439.90	150.00	289.90	7,220	6,500	6,380	0.66	0.37	0.67	4,868	3,937	1.66	1.22	1.36
EX-9	9.70	3.50	6.20	1,500	6,467	6,417	0.64	0.19	0.36	541	781	3.33	0.88	3.78
EX-10	30.30	15.00	15.30	1,340	6,467	6,408	0.50	0.74	1.52	2,034	649	4.40	2.00	2.20
EX-11	8.20	2.00	6.20	540	6,415	6,398	0.76	1.22	1.76	952	375	3.15	2.46	1.28
EX-12	6.50	3.00	3.50	745	6,504	6,479	0.54	0.51	1.05	782	362	3.36	1.54	2.19
EX-13	173.20	43.20	130.00	5,700	6,479	6,382	0.75	0.23	0.39	2,202	3,427	1.70	0.99	1.72
EX-14	2.40	1.20	1.20	600	6,467	6,456	0.50	0.29	0.64	384	272	1.83	1.09	1.68
EX-15	1.20	0.40	0.80	200	6,452	6,446	0.67	1.31	2.08	416	126	3.00	2.71	1.11
EX-16	14.00	8.00	6.00	1,000	6,457	6,448	0.57	0.61	1.20	1,196	510	0.90	1.71	0.53
EX-17	3.50	1.70	1.80	250	6,452	6,442	0.51	2.44	3.82	955	160	4.00	4.46	0.90
EX-18	1.70	0.80	0.90	130	6,441	6,438	0.53	4.38	4.39	571	130	2.31	5.39	0.43
EX-19	3.80	2.20	1.60	670	6,432	6,416	0.58	0.37	0.74	496	334	2.39	1.24	1.93

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

TRIPLE H RANCH - 5-yr. Pre-Developed Conditions

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... KINWAVE
Starting Date 08/22/2025 00:00:00
Ending Date 08/22/2025 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:15:00
Wet Time Step 00:05:00
Dry Time Step 01:00:00
Routing Time Step ..... 30.00 sec

**********	Volume	Depth
Runoff Quantity Continuity	acre-feet	inches
**********	---	---
Total Precipitation	163.820	1.328
Evaporation Loss	0.000	0.000
Infiltration Loss	158.812	1.287
Surface Runoff	4.777	0.039
Final Storage	0.275	0.002
Continuity Error (%)	-0.027	

**********	Volume	Volume
Flow Routing Continuity	acre-feet	10^6 gal
**********	---	---

Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	4.777	1.557
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	4.821	1.571
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.004	0.001
Continuity Error (%)	-0.996	

****
Highest Flow Instability Indexes
****
Link C4 (2)
Link C9 (1)
Link C1 (1)

****
Routing Time Step Summary
****
Minimum Time Step	:	30.00 sec
Average Time Step	:	30.00 sec
Maximum Time Step	:	30.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	1.00
Percent Not Converging	:	0.00

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-1	1.33	0.00	0.00	1.28	0.04			

0.01 1.25 0.034
EX-10 1.33 0.00 0.00 1.25 0.07
0.06 6.21 0.054
EX-11 1.33 0.00 0.00 1.24 0.09
0.02 2.01 0.064
EX-12 1.33 0.00 0.00 1.29 0.03
0.01 0.51 0.026
EX-13 1.33 0.00 0.00 1.30 0.03
0.14 14.93 0.022
EX-14 1.33 0.00 0.00 1.29 0.04
0.00 0.19 0.027
EX-15 1.33 0.00 0.00 1.28 0.04
0.00 0.09 0.032
EX-16 1.33 0.00 0.00 1.30 0.03
0.01 1.10 0.022
EX-17 1.33 0.00 0.00 1.29 0.04
0.00 0.28 0.029
EX-18 1.33 0.00 0.00 1.29 0.04
0.00 0.13 0.028
EX-19 1.33 0.00 0.00 1.29 0.03
0.00 0.30 0.026
EX-2 1.33 0.00 0.00 1.29 0.03
0.06 6.32 0.025
EX-3 1.33 0.00 0.00 1.26 0.06
0.03 3.51 0.045
EX-4 1.33 0.00 0.00 1.22 0.10
0.00 0.33 0.077
EX-6 1.33 0.00 0.00 1.27 0.05
0.75 80.48 0.039
EX-7 1.33 0.00 0.00 1.30 0.03
0.10 10.44 0.020
EX-5 1.33 0.00 0.00 1.27 0.06
0.03 3.63 0.043
EX-8 1.33 0.00 0.00 1.30 0.03
0.31 34.35 0.020
EX-9 1.33 0.00 0.00 1.25 0.07
0.02 1.99 0.054

****
Node Depth Summary
****

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
J1	JUNCTION	0.06	0.33	6484.33	0 00:45	0.33
J4	JUNCTION	0.06	0.32	6442.32	0 00:45	0.32

J5	JUNCTION	0.17	1.00	6409.00	0	00:45	0.99
J6	JUNCTION	0.05	0.24	6479.24	0	00:45	0.24
J7	JUNCTION	0.04	0.19	6456.19	0	00:45	0.19
J8	JUNCTION	0.03	0.15	6438.15	0	00:45	0.14
J9	JUNCTION	0.07	0.39	6415.39	0	00:45	0.38
E2	OUTFALL	0.09	0.24	6430.24	0	01:15	0.24
E3	OUTFALL	0.00	0.00	6428.00	0	00:00	0.00
E6	OUTFALL	0.18	0.97	6398.97	0	00:47	0.88
E5	OUTFALL	0.09	0.30	6380.30	0	00:54	0.30
E7	OUTFALL	0.10	0.19	6382.19	0	01:25	0.19
E1	OUTFALL	0.00	0.00	6410.00	0	00:00	0.00
E10	OUTFALL	0.05	0.16	6448.16	0	01:15	0.16
E9	OUTFALL	0.00	0.00	6440.00	0	00:00	0.00
E8	OUTFALL	0.00	0.00	6418.00	0	00:00	0.00
E11	OUTFALL	0.00	0.00	6448.00	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min		Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
J1	JUNCTION	1.25	1.25	0	00:45	0.0121	0.0121	0.000
J4	JUNCTION	0.33	0.33	0	00:45	0.00363	0.00363	0.000
J5	JUNCTION	6.21	6.21	0	00:45	0.0585	0.0585	0.000
J6	JUNCTION	0.51	0.51	0	00:45	0.00612	0.00612	0.000
J7	JUNCTION	0.19	0.19	0	00:45	0.00235	0.00235	0.000
J8	JUNCTION	0.13	0.13	0	00:45	0.00169	0.00169	0.000
J9	JUNCTION	1.99	1.99	0	00:45	0.0189	0.0189	0.000
E2	OUTFALL	6.32	6.32	0	00:45	0.0585		

```
0.0751       0.000
  E3                 OUTFALL       3.51     3.51     0  00:45      0.0331
0.0331       0.000
  E6                 OUTFALL       2.01     7.35     0  00:47       0.019
0.0815       0.000
  E5                 OUTFALL     125.27   125.37     0  00:45        1.15
1.17       0.000
  E7                 OUTFALL      14.93    14.93     0  00:45       0.135
0.151       0.000
  E1                 OUTFALL       3.63     3.63     0  00:45      0.0343
0.0343       0.000
  E10                OUTFALL       1.10     1.11     0  00:45      0.0109
0.0135       0.000
  E9                 OUTFALL       0.28     0.28     0  00:45     0.00364
0.00364       0.000
  E8                 OUTFALL       0.30     0.30     0  00:45      0.0036
0.0036       0.000
  E11                OUTFALL       0.09     0.09     0  00:45     0.00138
0.00138       0.000


  **********************
  Node Flooding Summary
  **********************

  No nodes were flooded.


  ************************
  Outfall Loading Summary
  ************************

  -------------------------------------------------------------
                          Flow       Avg       Max       Total
                          Freq      Flow      Flow      Volume
  Outfall Node            Pcnt       CFS       CFS    10^6 gal
  -------------------------------------------------------------
  E2                     98.47      0.47      6.32       0.075
  E3                     43.19      0.47      3.51       0.033
  E6                     69.72      0.72      7.35       0.081
  E5                     98.47      7.38    125.37       1.173
  E7                     98.47      0.95     14.93       0.151
  E1                     43.47      0.49      3.63       0.034
  E10                    63.33      0.13      1.11       0.014
  E9                     34.31      0.07      0.28       0.004
  E8                     34.31      0.06      0.30       0.004
  E11                    33.33      0.03      0.09       0.001
  -------------------------------------------------------------
  System                 61.71     10.77    162.19       1.571
```

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	0.54	0	01:15	1.85	0.00	0.12
C3	CONDUIT	0.17	0	01:15	1.76	0.00	0.08
C4	CONDUIT	5.67	0	00:47	2.59	0.05	0.32
C6	CONDUIT	0.12	0	01:15	0.87	0.00	0.07
C7	CONDUIT	0.28	0	01:25	2.15	0.00	0.08
C8	CONDUIT	0.08	0	01:20	1.40	0.00	0.05
C9	CONDUIT	1.00	0	00:54	1.60	0.01	0.15

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Tue Nov 25 10:44:02 2025
Analysis ended on: Tue Nov 25 10:44:03 2025
Total elapsed time: 00:00:01

TRIPLE H RANCH - 5-yr. Pre-Developed Conditions

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-1	1.33	0.00	0.00	1.28	0.04	0.01	1.25	0.034
EX-10	1.33	0.00	0.00	1.25	0.07	0.06	6.21	0.054
EX-11	1.33	0.00	0.00	1.24	0.09	0.02	2.01	0.064
EX-12	1.33	0.00	0.00	1.29	0.03	0.01	0.51	0.026
EX-13	1.33	0.00	0.00	1.30	0.03	0.14	14.93	0.022
EX-14	1.33	0.00	0.00	1.29	0.04	0.00	0.19	0.027
EX-15	1.33	0.00	0.00	1.28	0.04	0.00	0.09	0.032
EX-16	1.33	0.00	0.00	1.30	0.03	0.01	1.10	0.022
EX-17	1.33	0.00	0.00	1.29	0.04	0.00	0.28	0.029
EX-18	1.33	0.00	0.00	1.29	0.04	0.00	0.13	0.028
EX-19	1.33	0.00	0.00	1.29	0.03	0.00	0.30	0.026
EX-2	1.33	0.00	0.00	1.29	0.03	0.06	6.32	0.025
EX-3	1.33	0.00	0.00	1.26	0.06	0.03	3.51	0.045
EX-4	1.33	0.00	0.00	1.22	0.10	0.00	0.33	0.077
EX-6	1.33	0.00	0.00	1.27	0.05	0.75	80.48	0.039
EX-7	1.33	0.00	0.00	1.30	0.03	0.10	10.44	0.020

TRIPLE H RANCH - 5-yr. Pre-Developed Conditions

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-5	1.33	0.00	0.00	1.27	0.06	0.03	3.63	0.043
EX-8	1.33	0.00	0.00	1.30	0.03	0.31	34.35	0.020
EX-9	1.33	0.00	0.00	1.25	0.07	0.02	1.99	0.054

TRIPLE H RANCH - 5-yr. Pre-Developed Conditions

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
J1	JUNCTION	1.25	1.25	0	00:45	0.0121	0.0121	0.000
J4	JUNCTION	0.33	0.33	0	00:45	0.00363	0.00363	0.000
J5	JUNCTION	6.21	6.21	0	00:45	0.0585	0.0585	0.000
J6	JUNCTION	0.51	0.51	0	00:45	0.00612	0.00612	0.000
J7	JUNCTION	0.19	0.19	0	00:45	0.00235	0.00235	0.000
J8	JUNCTION	0.13	0.13	0	00:45	0.00169	0.00169	0.000
J9	JUNCTION	1.99	1.99	0	00:45	0.0189	0.0189	0.000
E2	OUTFALL	6.32	6.32	0	00:45	0.0585	0.0751	0.000
E3	OUTFALL	3.51	3.51	0	00:45	0.0331	0.0331	0.000
E6	OUTFALL	2.01	7.35	0	00:47	0.019	0.0815	0.000
E5	OUTFALL	125.27	125.37	0	00:45	1.15	1.17	0.000
E7	OUTFALL	14.93	14.93	0	00:45	0.135	0.151	0.000
E1	OUTFALL	3.63	3.63	0	00:45	0.0343	0.0343	0.000
E10	OUTFALL	1.10	1.11	0	00:45	0.0109	0.0135	0.000
E9	OUTFALL	0.28	0.28	0	00:45	0.00364	0.00364	0.000
E8	OUTFALL	0.30	0.30	0	00:45	0.0036	0.0036	0.000

TRIPLE H RANCH - 5-yr. Pre-Developed Conditions

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
E11	OUTFALL	0.09	0.09	0	00:45	0.00138	0.00138	0.000

TRIPLE H RANCH - 5-yr. Pre-Developed Conditions

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
E2	98.47	0.47	6.32	0.075
E3	43.19	0.47	3.51	0.033
E6	69.72	0.72	7.35	0.081
E5	98.47	7.38	125.37	1.173
E7	98.47	0.95	14.93	0.151
E1	43.47	0.49	3.63	0.034
E10	63.33	0.13	1.11	0.014
E9	34.31	0.07	0.28	0.004
E8	34.31	0.06	0.30	0.004
E11	33.33	0.03	0.09	0.001

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

TRIPLE H RANCH - 100-yr. Pre-Developed Conditions

****
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
****

****
Analysis Options
****
Flow Units ..... CFS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... KINWAVE
Starting Date 08/22/2025 00:00:00
Ending Date 08/22/2025 06:00:00
Antecedent Dry Days 0.0
Report Time Step 00:15:00
Wet Time Step 00:05:00
Dry Time Step 01:00:00
Routing Time Step ..... 30.00 sec

**********	Volume	Depth
Runoff Quantity Continuity	acre-feet	inches
**********	---	---
Total Precipitation	339.359	2.751
Evaporation Loss	0.000	0.000
Infiltration Loss	288.876	2.342
Surface Runoff	50.433	0.409
Final Storage	0.275	0.002
Continuity Error (%)	-0.066	

**********	Volume	Volume
Flow Routing Continuity	acre-feet	10^6 gal
**********	---	---

```
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......        50.433        16.434
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         0.000         0.000
  External Outflow .........        50.741        16.535
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.009         0.003
  Continuity Error (%) .....        -0.629


  ******************************
  Highest Flow Instability Indexes
  ******************************
  Link C4 (2)


  ************************
  Routing Time Step Summary
  ************************
  Minimum Time Step           :    30.00 sec
  Average Time Step           :    30.00 sec
  Maximum Time Step           :    30.00 sec
  Percent in Steady State     :     0.00
  Average Iterations per Step :     1.04
  Percent Not Converging      :     0.00


  *************************
  Subcatchment Runoff Summary
  *************************


-------------------------------------------------------------------------------
--------------------
                            Total      Total      Total      Total      Total
Total     Peak  Runoff
                           Precip      Runon       Evap      Infil     Runoff
Runoff   Runoff   Coeff
  Subcatchment                in         in         in         in         in
10^6 gal      CFS

-------------------------------------------------------------------------------
--------------------
  EX-1                      2.75       0.00       0.00       1.94       0.81
0.22     8.25   0.295
  EX-10                     2.75       0.00       0.00       1.85       0.91
```

0.75   30.53   0.330
  EX-11   2.75   0.00   0.00   1.76   1.00
0.22   10.35   0.362
  EX-12   2.75   0.00   0.00   1.78   0.98
0.17   9.02   0.357
  EX-13   2.75   0.00   0.00   2.38   0.37
1.73   48.78   0.134
  EX-14   2.75   0.00   0.00   1.75   1.01
0.07   3.64   0.368
  EX-15   2.75   0.00   0.00   1.65   1.11
0.04   2.58   0.405
  EX-16   2.75   0.00   0.00   2.04   0.71
0.27   9.19   0.258
  EX-17   2.75   0.00   0.00   1.71   1.06
0.10   6.14   0.384
  EX-18   2.75   0.00   0.00   1.74   1.03
0.05   2.68   0.373
  EX-19   2.75   0.00   0.00   1.77   0.99
0.10   5.33   0.358
  EX-2   2.75   0.00   0.00   2.19   0.56
0.98   27.69   0.204
  EX-3   2.75   0.00   0.00   1.90   0.85
0.47   18.10   0.311
  EX-4   2.75   0.00   0.00   1.54   1.23
0.04   3.69   0.446
  EX-6   2.75   0.00   0.00   2.40   0.35
5.11   211.67   0.128
  EX-7   2.75   0.00   0.00   2.29   0.46
1.66   43.83   0.168
  EX-5   2.75   0.00   0.00   1.92   0.83
0.50   18.73   0.303
  EX-8   2.75   0.00   0.00   2.44   0.31
3.71   106.57   0.113
  EX-9   2.75   0.00   0.00   1.82   0.93
0.24   10.29   0.338

  ****
  Node Depth Summary
  ****

                                Average Maximum Maximum Time of Max   Reported
                                  Depth   Depth   HGL   Occurrence   Max Depth
  Node   Type   Feet   Feet   Feet days hr:min   Feet

  J1   JUNCTION   0.19   0.68 6484.68   0 00:55   0.67
  J4   JUNCTION   0.13   0.80 6442.80   0 00:45   0.77
  J5   JUNCTION   0.47   1.82 6409.82   0 00:45   1.78
  J6   JUNCTION   0.15   0.71 6479.71   0 00:55   0.69

J7	JUNCTION	0.12	0.57	6456.57	0	00:55	0.55
J8	JUNCTION	0.09	0.45	6438.45	0	00:50	0.43
J9	JUNCTION	0.18	0.72	6415.72	0	00:55	0.71
E2	OUTFALL	0.24	0.64	6430.64	0	01:19	0.64
E3	OUTFALL	0.00	0.00	6428.00	0	00:00	0.00
E6	OUTFALL	0.48	1.82	6399.82	0	00:56	1.80
E5	OUTFALL	0.21	0.70	6380.70	0	01:07	0.69
E7	OUTFALL	0.27	0.62	6382.62	0	01:25	0.62
E1	OUTFALL	0.00	0.00	6410.00	0	00:00	0.00
E10	OUTFALL	0.14	0.55	6448.55	0	01:04	0.54
E9	OUTFALL	0.00	0.00	6440.00	0	00:00	0.00
E8	OUTFALL	0.00	0.00	6418.00	0	00:00	0.00
E11	OUTFALL	0.00	0.00	6448.00	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
J1	JUNCTION	8.25	8.25	0 00:55	0.218	0.218	0.000
J4	JUNCTION	3.69	3.69	0 00:45	0.0433	0.0433	0.000
J5	JUNCTION	30.53	30.53	0 00:45	0.747	0.747	0.000
J6	JUNCTION	9.02	9.02	0 00:55	0.173	0.173	0.000
J7	JUNCTION	3.64	3.64	0 00:55	0.066	0.066	0.000
J8	JUNCTION	2.68	2.68	0 00:50	0.0473	0.0473	0.000
J9	JUNCTION	10.29	10.29	0 00:55	0.245	0.245	0.000
E2	OUTFALL	27.69	34.00	0 01:10	0.978	1.22	0.000
E3	OUTFALL	18.10	18.10	0 00:55	0.469		

```
0.469       0.000
  E6                   OUTFALL      10.35    42.69     0  00:56       0.222
1.02        0.000
  E5                   OUTFALL     360.28   360.44     0  00:45        10.5
10.7        0.000
  E7                   OUTFALL      48.78    48.78     0  00:45        1.73
2.03        0.000
  E1                   OUTFALL      18.73    18.73     0  00:55       0.496
0.496       0.000
  E10                  OUTFALL       9.19    12.30     0  01:03        0.27
0.339       0.000
  E9                   OUTFALL       6.14     6.14     0  00:50         0.1
0.1       0.000
  E8                   OUTFALL       5.33     5.33     0  00:55       0.102
0.102       0.000
  E11                  OUTFALL       2.58     2.58     0  00:50      0.0363
0.0363       0.000
```

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
E2	98.47	7.64	34.00	1.215
E3	45.69	6.35	18.10	0.469
E6	75.56	8.31	42.69	1.015
E5	98.47	67.47	360.44	10.734
E7	98.47	12.74	48.78	2.027
E1	45.69	6.72	18.73	0.496
E10	77.64	2.70	12.30	0.339
E9	37.22	1.67	6.14	0.100
E8	38.61	1.63	5.33	0.102
E11	34.17	0.66	2.58	0.036
System	65.00	115.89	523.57	16.533

****

Link Flow Summary
****

Link	Type	Maximum |Flow| CFS	Time of Max Occurrence days	hr:min	Maximum |Veloc| ft/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	7.12	0	01:19	3.91	0.05	0.32
C3	CONDUIT	2.79	0	01:00	2.90	0.02	0.23
C4	CONDUIT	30.24	0	00:56	3.45	0.26	0.61
C6	CONDUIT	3.24	0	01:04	1.90	0.03	0.27
C7	CONDUIT	6.19	0	01:25	4.82	0.04	0.30
C8	CONDUIT	1.93	0	01:20	3.21	0.01	0.19
C9	CONDUIT	9.31	0	01:07	3.37	0.06	0.35

****
Conduit Surcharge Summary
****

No conduits were surcharged.

Analysis begun on: Fri Nov 21 14:02:05 2025
Analysis ended on: Fri Nov 21 14:02:05 2025
Total elapsed time: < 1 sec

TRIPLE H RANCH - 100-yr. Pre-Developed Conditions

Subcatchment Runoff Summary

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-1	2.75	0.00	0.00	1.94	0.81	0.22	8.25	0.295
EX-10	2.75	0.00	0.00	1.85	0.91	0.75	30.53	0.330
EX-11	2.75	0.00	0.00	1.76	1.00	0.22	10.35	0.362
EX-12	2.75	0.00	0.00	1.78	0.98	0.17	9.02	0.357
EX-13	2.75	0.00	0.00	2.38	0.37	1.73	48.78	0.134
EX-14	2.75	0.00	0.00	1.75	1.01	0.07	3.64	0.368
EX-15	2.75	0.00	0.00	1.65	1.11	0.04	2.58	0.405
EX-16	2.75	0.00	0.00	2.04	0.71	0.27	9.19	0.258
EX-17	2.75	0.00	0.00	1.71	1.06	0.10	6.14	0.384
EX-18	2.75	0.00	0.00	1.74	1.03	0.05	2.68	0.373
EX-19	2.75	0.00	0.00	1.77	0.99	0.10	5.33	0.358
EX-2	2.75	0.00	0.00	2.19	0.56	0.98	27.69	0.204
EX-3	2.75	0.00	0.00	1.90	0.85	0.47	18.10	0.311
EX-4	2.75	0.00	0.00	1.54	1.23	0.04	3.69	0.446
EX-6	2.75	0.00	0.00	2.40	0.35	5.11	211.67	0.128
EX-7	2.75	0.00	0.00	2.29	0.46	1.66	43.83	0.168

TRIPLE H RANCH - 100-yr. Pre-Developed Conditions

Subcatchment	Total Precip in	Total Runon in	Total Evap in	Total Infil in	Total Runoff in	Total Runoff 10^6 gal	Peak Runoff CFS	Runoff Coeff
EX-5	2.75	0.00	0.00	1.92	0.83	0.50	18.73	0.303
EX-8	2.75	0.00	0.00	2.44	0.31	3.71	106.57	0.113
EX-9	2.75	0.00	0.00	1.82	0.93	0.24	10.29	0.338

TRIPLE H RANCH - 100-yr. Pre-Developed Conditions

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
J1	JUNCTION	8.25	8.25	0	00:55	0.218	0.218	0.000
J4	JUNCTION	3.69	3.69	0	00:45	0.0433	0.0433	0.000
J5	JUNCTION	30.53	30.53	0	00:45	0.747	0.747	0.000
J6	JUNCTION	9.02	9.02	0	00:55	0.173	0.173	0.000
J7	JUNCTION	3.64	3.64	0	00:55	0.066	0.066	0.000
J8	JUNCTION	2.68	2.68	0	00:50	0.0473	0.0473	0.000
J9	JUNCTION	10.29	10.29	0	00:55	0.245	0.245	0.000
E2	OUTFALL	27.69	34.00	0	01:10	0.978	1.22	0.000
E3	OUTFALL	18.10	18.10	0	00:55	0.469	0.469	0.000
E6	OUTFALL	10.35	42.69	0	00:56	0.222	1.02	0.000
E5	OUTFALL	360.28	360.44	0	00:45	10.5	10.7	0.000
E7	OUTFALL	48.78	48.78	0	00:45	1.73	2.03	0.000
E1	OUTFALL	18.73	18.73	0	00:55	0.496	0.496	0.000
E10	OUTFALL	9.19	12.30	0	01:03	0.27	0.339	0.000
E9	OUTFALL	6.14	6.14	0	00:50	0.1	0.1	0.000
E8	OUTFALL	5.33	5.33	0	00:55	0.102	0.102	0.000

TRIPLE H RANCH - 100-yr. Pre-Developed Conditions

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Day of Maximum Inflow	Hour of Maximum Inflow	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
E11	OUTFALL	2.58	2.58	0	00:50	0.0363	0.0363	0.000

TRIPLE H RANCH - 100-yr. Pre-Developed Conditions

Outfall Loading Summary

Outfall Node	Flow Freq. Pcnt.	Avg. Flow CFS	Max. Flow CFS	Total Volume 10^6 gal
E2	98.47	7.64	34.00	1.215
E3	45.69	6.35	18.10	0.469
E6	75.56	8.31	42.69	1.015
E5	98.47	67.47	360.44	10.734
E7	98.47	12.74	48.78	2.027
E1	45.69	6.72	18.73	0.496
E10	77.64	2.70	12.30	0.339
E9	37.22	1.67	6.14	0.100
E8	38.61	1.63	5.33	0.102
E11	34.17	0.66	2.58	0.036

Diversion Channel

Show and label this channel on the drainage map

NOW BETTER LABELED ON MAP.

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	0.005 ft/ft
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	20.00 ft
Discharge	220.00 cfs

Results	
Normal Depth	23.8 in
Flow Area	55.4 ft²
Wetted Perimeter	36.3 ft
Hydraulic Radius	18.3 in
Top Width	35.86 ft
Critical Depth	16.9 in
Critical Slope	0.017 ft/ft
Velocity	3.97 ft/s
Velocity Head	0.25 ft
Specific Energy	2.23 ft
Froude Number	0.564
Flow Type	Subcritical

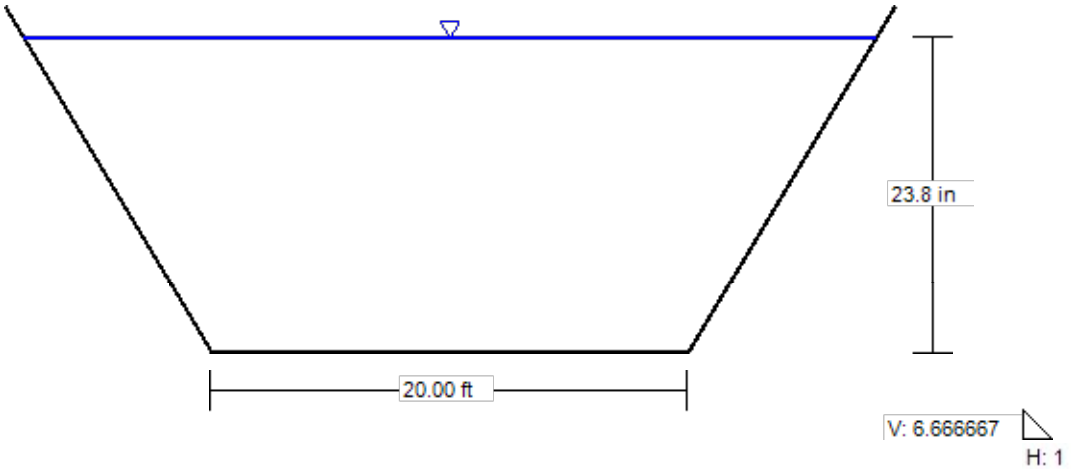
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	23.8 in
Critical Depth	16.9 in
Channel Slope	0.005 ft/ft
Critical Slope	0.017 ft/ft

Diversion Channel

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.035
Channel Slope	0.005 ft/ft
Normal Depth	23.8 in
Left Side Slope	4.000 H:V
Right Side Slope	4.000 H:V
Bottom Width	20.00 ft
Discharge	220.00 cfs



STORMWATER QUALITY CALCULATIONS

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS

EFFECTIVE IMPERVIOUSNESS - POND 1 West

Basin	Acreage	Imp.%
W-A	9.0	10.0%
W-B	9.5	10.0%
W-C	37.5	10.0%
W-D	15.4	10.0%
Total	**71.4**	**10.0%**

EFFECTIVE IMPERVIOUSNESS - POND 1 East

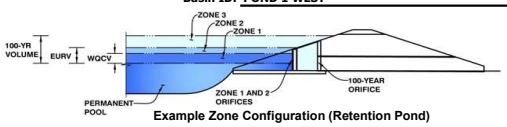
Basin	Acreage	Imp.%
OS-4	2.0	2.0%
OS-5	12.0	2.0%
OS-6	4.0	2.0%
OS-7	6.0	2.0%
OS-8	2.3	2.0%
OS-9	6.5	2.0%
OS-10	2.4	2.0%
OS-11	1.7	2.0%
OS-12	2.9	2.0%
OS-13	6.8	11.0%
OS-14	30.3	5.0%
E-A	8.9	2.0%
E-B	11.9	11.0%
E-C	9.8	11.0%
E-D	29.0	11.0%
E-E	28.6	11.0%
E-F	1.9	11.0%
E-G	5.7	11.0%
E-H	2.2	11.0%
E-I	13.7	11.0%
E-J	0.68	11.0%
E-K	8.3	6.0%
E-L	25.1	9.0%
E-M	19.0	11.0%
E-N	2.7	11.0%
E-O	15.4	11.0%
E-P	31.6	11.0%
E-Q	24.8	11.0%
E-R	65.2	11.0%
E-S	26.5	11.0%
E-T1	9.8	11.0%
E-T2	10.7	11.0%
E-U	16.8	11.0%
E-V	7.5	11.0%
E-W	15.2	11.0%
E-X	6.7	11.0%
E-Y	5.3	11.0%
E-Z	21.4	9.0%
E-AA	19.2	11.0%
E-BB	46.2	11.0%
E-CC	16.9	11.0%
E-DD	17.5	11.0%
E-EE	19.8	11.0%
E-GG	24.0	11.0%
E-HH	21.0	11.0%
E-II	15.7	11.0%
E-MM	1.3	11.0%
E-NN	8.3	11.0%
TANK	1.9	50.0%
Total	**693.1**	**10.0%**

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

Project: TRIPLE H RANCH PRELIMINARY PLAN - PDR

Basin ID: POND 1 WEST



Example Zone Configuration (Retention Pond)

Pond calcs will be reviewed with project that ponds will be constructed with

OK

Watershed Information

Selected SCM Type =	**EDB**	
Watershed Area =	71.40	acres
Watershed Length =	3,120	ft
Watershed Length to Centroid =	1,500	ft
Watershed Slope =	0.015	ft/ft
Watershed Imperviousness =	10.00%	percent
Percentage Hydrologic Soil Group A =	70.0%	percent
Percentage Hydrologic Soil Group B =	30.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.399	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.569	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.96 in.) =	0.194	acre-feet	0.96	inches
5-yr Runoff Volume (P1 = 1.26 in.) =	0.382	acre-feet	1.26	inches
10-yr Runoff Volume (P1 = 1.52 in.) =	0.581	acre-feet	1.52	inches
25-yr Runoff Volume (P1 = 1.92 in.) =	2.514	acre-feet	1.92	inches
50-yr Runoff Volume (P1 = 2.26 in.) =	4.008	acre-feet	2.26	inches
100-yr Runoff Volume (P1 = 2.61 in.) =	6.341	acre-feet	2.61	inches
500-yr Runoff Volume (P1 = 3.54 in.) =	11.538	acre-feet	3.54	inches
Approximate 2-yr Detention Volume =	0.282	acre-feet		
Approximate 5-yr Detention Volume =	0.423	acre-feet		
Approximate 10-yr Detention Volume =	0.709	acre-feet		
Approximate 25-yr Detention Volume =	1.078	acre-feet		
Approximate 50-yr Detention Volume =	1.342	acre-feet		
Approximate 100-yr Detention Volume =	2.038	acre-feet		

Define Zones and Basin Geometry

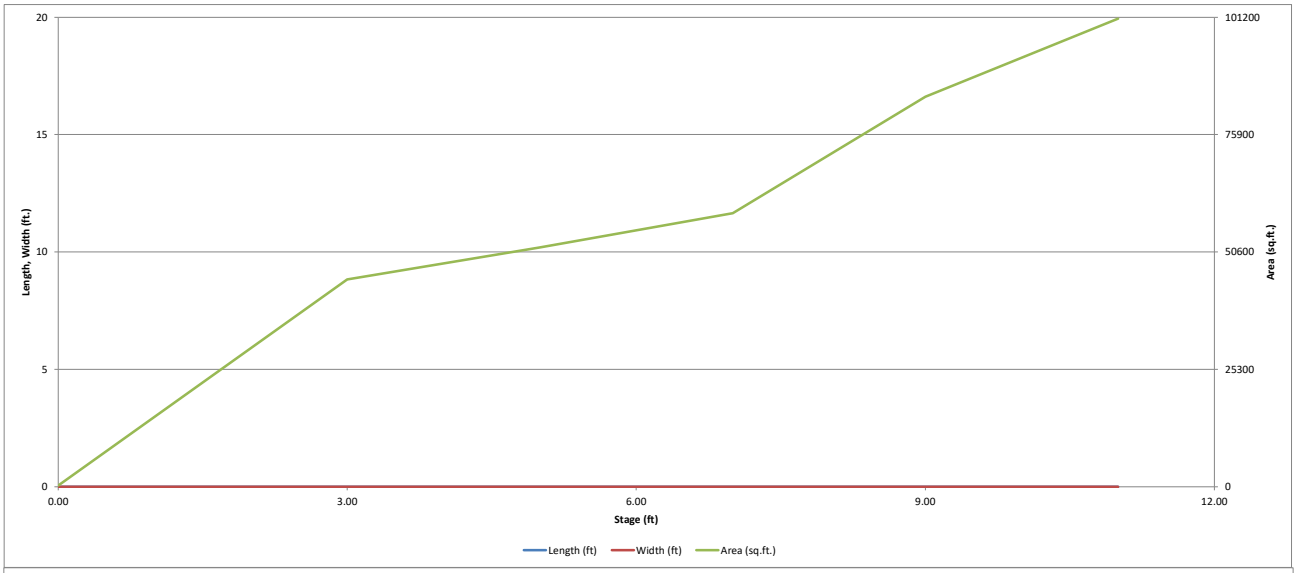
Zone 1 Volume (WQCV) =	0.399	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.170	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.470	acre-feet
Total Detention Basin Volume =	2.038	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

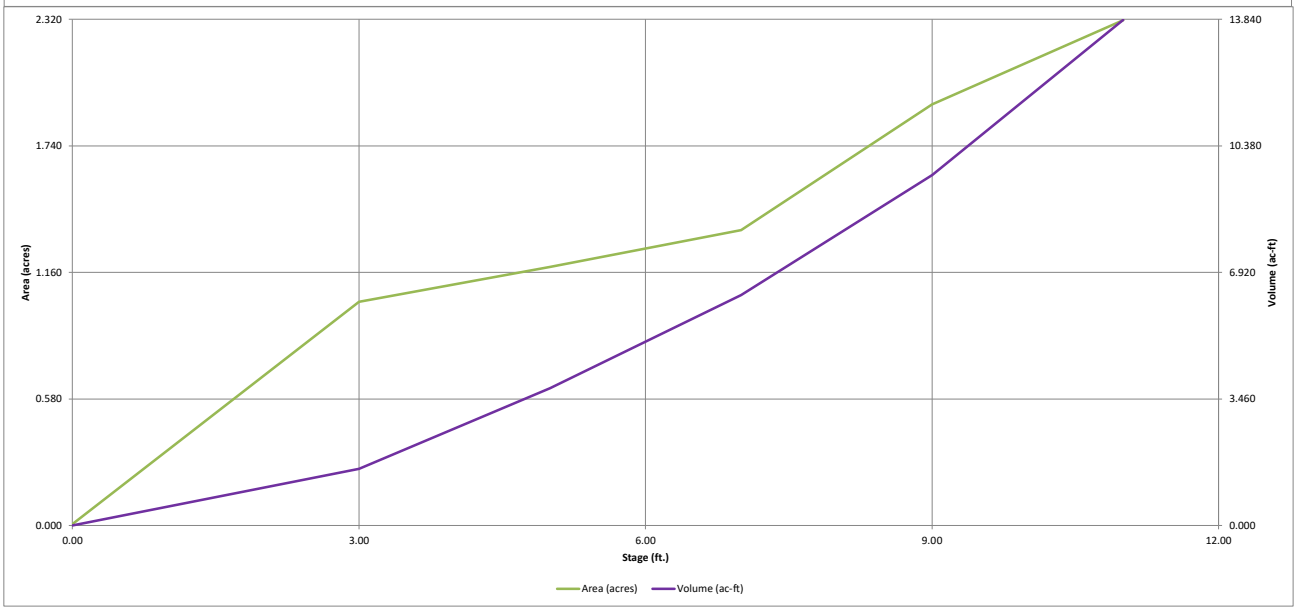
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area		Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--				
6426	--	3.00	--	--	--	4		67,483	1.549
6428	--	5.00	--	--	--	51,621	1.185	163,793	3.760
6430	--	7.00	--	--	--	58,962	1.354	274,376	6.299
6432	--	9.00	--	--	--	84,100	1.931	417,438	9.583
6434	--	11.00	--	--	--	100,900	2.316	602,438	13.830

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)



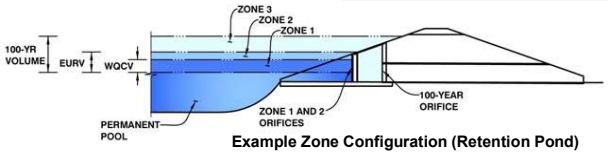


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project: **TRIPLE H RANCH PRELIMINARY PLAN - PDR**

Basin ID: **POND 1 WEST**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.52	0.399	Orifice Plate
Zone 2 (EURV)	1.81	0.170	Orifice Plate
Zone 3 (100-year)	3.47	1.470	Weir&Pipe (Restrict)
Total (all zones)		2.038	

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

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

Calculated Parameters for Underdrain

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

Centroid 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 =	2.00	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	8.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	0.70	1.40					
Orifice Area (sq. inches)	2.00	2.84	2.84					

	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			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				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	2.75	N/A	feet
Overflow Weir Front Edge Length =	8.00	N/A	feet	Overflow Weir Slope Length =	3.09	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	3.99	N/A	
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	19.57	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	9.78	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.91	N/A	ft^2
Outlet Pipe Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	1.25	N/A	feet
Restrictor Plate Height Above Pipe Invert =	30.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.82	feet
Spillway Crest Length =	25.00	feet	Stage at Top of Freeboard =	6.82	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	1.34	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	6.06	acre-ft

Calculated Parameters for Spillway

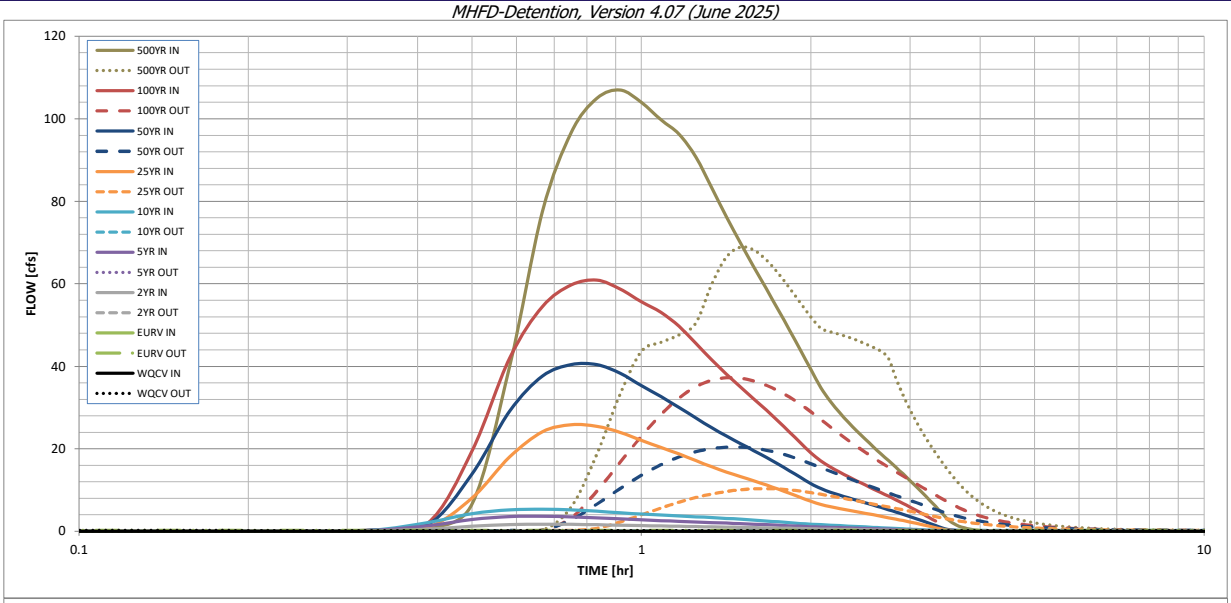
Routed Hydrograph Results

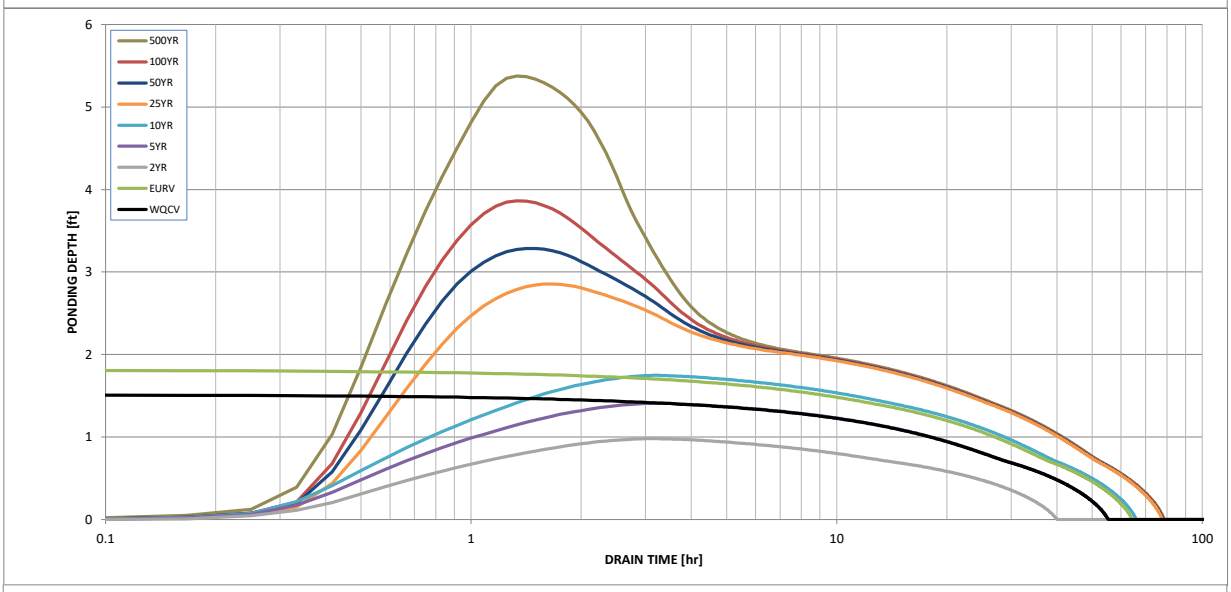
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

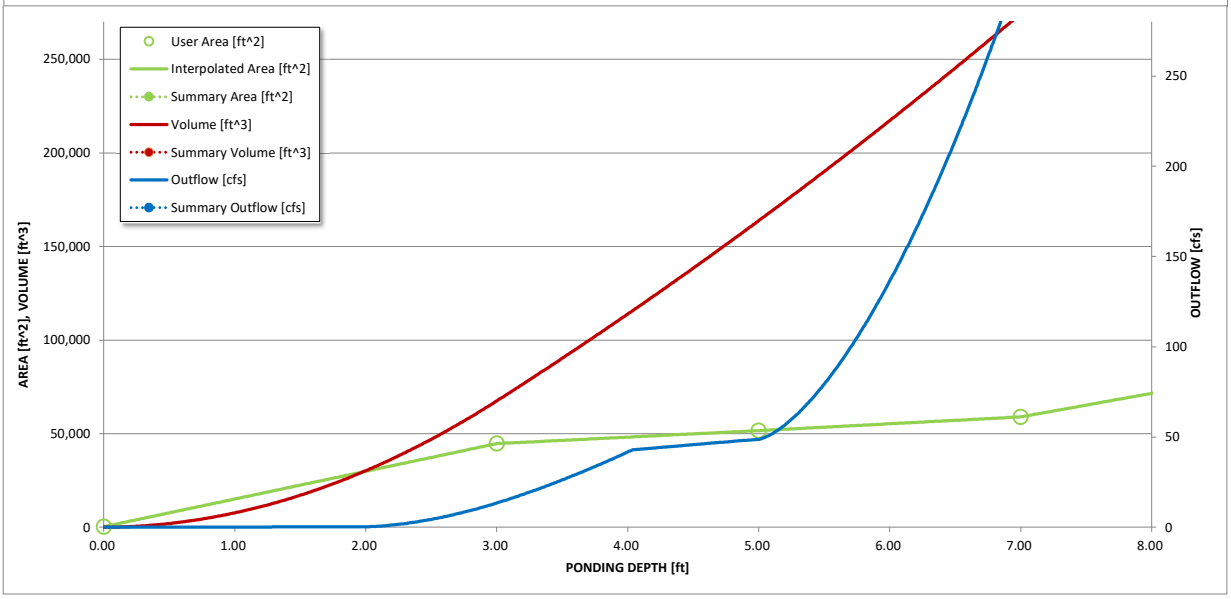
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.96	1.26	1.52	1.92	2.26	2.61	3.54
CUHP Runoff Volume (acre-ft) =	0.399	0.569	0.194	0.382	0.581	2.514	4.008	6.341	11.538
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.194	0.382	0.581	2.514	4.008	6.341	11.538
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.8	1.8	2.6	22.3	36.7	57.0	102.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.04	0.31	0.51	0.80	1.44
Peak Inflow Q (cfs) =	N/A	N/A	1.7	3.6	5.4	25.9	40.4	60.9	107.0
Peak Outflow Q (cfs) =	0.2	0.3	0.1	0.2	0.2	10.4	20.4	37.2	68.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.1	0.5	0.6	0.7	0.7
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.5	1.0	1.9	2.6
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) =	49	57	36	50	58	55	47	40	27
Time to Drain 99% of Inflow Volume (hours) =	**53**	61	38	53	62	67	64	58	49
Maximum Ponding Depth (ft) =	1.52	1.82	0.98	1.41	1.75	2.86	3.29	3.86	5.38
Area at Maximum Ponding Depth (acres) =	0.52	0.63	0.34	0.48	0.60	0.97	1.05	1.09	1.22
Maximum Volume Stored (acre-ft) =	0.403	0.575	0.170	0.343	0.526	1.399	1.840	2.461	4.204

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)







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:

Inflow Hydrographs

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

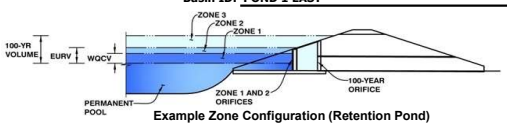
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.03
	0:15:00	0	0.00	0.03	0.06	0.08	0.06	0.09	0.09	0.17
	0:20:00	0	0.00	0.15	0.23	0.30	0.22	0.29	0.31	0.67
	0:25:00	0	0.00	0.52	1.35	2.11	0.92	1.53	1.94	6.61
	0:30:00	0	0.00	1.22	2.86	4.29	8.10	13.92	19.48	40.09
	0:35:00	0	0.00	1.66	3.57	5.20	18.05	29.19	42.06	77.49
	0:40:00	0	0.00	1.73	3.65	5.36	24.13	37.64	54.50	96.64
	0:45:00	0	0.00	1.69	3.52	5.21	25.86	40.42	59.70	104.94
	0:50:00	0	0.00	1.60	3.28	4.86	25.48	40.38	60.89	106.99
	0:55:00	0	0.00	1.48	3.01	4.47	24.00	38.30	58.73	103.95
	1:00:00	0	0.00	1.39	2.79	4.17	22.05	35.30	55.61	99.73
	1:05:00	0	0.00	1.31	2.60	3.93	20.35	32.62	53.07	96.29
	1:10:00	0	0.00	1.23	2.42	3.70	18.74	30.05	49.70	90.68
	1:15:00	0	0.00	1.14	2.25	3.52	17.13	27.47	45.53	83.29
	1:20:00	0	0.00	1.08	2.11	3.35	15.64	25.10	41.57	76.23
	1:25:00	0	0.00	1.02	1.99	3.15	14.39	23.10	38.13	69.93
	1:30:00	0	0.00	0.97	1.87	2.94	13.28	21.29	35.01	64.14
	1:35:00	0	0.00	0.91	1.74	2.72	12.24	19.58	32.12	58.77
	1:40:00	0	0.00	0.86	1.62	2.51	11.22	17.92	29.38	53.70
	1:45:00	0	0.00	0.80	1.48	2.30	10.22	16.30	26.70	48.77
	1:50:00	0	0.00	0.75	1.35	2.09	9.22	14.69	24.08	43.96
	1:55:00	0	0.00	0.69	1.22	1.89	8.23	13.10	21.51	39.27
	2:00:00	0	0.00	0.63	1.13	1.74	7.27	11.55	19.03	34.86
	2:05:00	0	0.00	0.59	1.05	1.62	6.52	10.38	17.10	31.48
	2:10:00	0	0.00	0.54	0.97	1.50	5.97	9.50	15.62	28.78
	2:15:00	0	0.00	0.50	0.90	1.39	5.53	8.79	14.37	26.43
	2:20:00	0	0.00	0.46	0.83	1.28	5.13	8.13	13.24	24.30
	2:25:00	0	0.00	0.42	0.76	1.17	4.74	7.52	12.20	22.34
	2:30:00	0	0.00	0.39	0.70	1.07	4.37	6.93	11.22	20.49
	2:35:00	0	0.00	0.35	0.63	0.97	4.01	6.36	10.28	18.75
	2:40:00	0	0.00	0.32	0.57	0.87	3.65	5.79	9.39	17.12
	2:45:00	0	0.00	0.29	0.51	0.78	3.30	5.23	8.51	15.52
	2:50:00	0	0.00	0.26	0.45	0.70	2.95	4.68	7.64	13.94
	2:55:00	0	0.00	0.23	0.40	0.61	2.61	4.13	6.78	12.35
	3:00:00	0	0.00	0.20	0.34	0.53	2.26	3.58	5.91	10.77
	3:05:00	0	0.00	0.17	0.29	0.44	1.92	3.03	5.05	9.19
	3:10:00	0	0.00	0.14	0.23	0.36	1.57	2.49	4.18	7.61
	3:15:00	0	0.00	0.11	0.18	0.28	1.23	1.94	3.32	6.04
	3:20:00	0	0.00	0.08	0.13	0.20	0.89	1.40	2.46	4.47
	3:25:00	0	0.00	0.06	0.09	0.14	0.56	0.87	1.62	2.98
	3:30:00	0	0.00	0.05	0.07	0.11	0.30	0.48	0.99	1.91
	3:35:00	0	0.00	0.04	0.06	0.09	0.17	0.28	0.62	1.27
	3:40:00	0	0.00	0.04	0.05	0.08	0.11	0.18	0.41	0.85
	3:45:00	0	0.00	0.03	0.04	0.07	0.08	0.12	0.26	0.56
	3:50:00	0	0.00	0.03	0.04	0.06	0.06	0.08	0.16	0.35
	3:55:00	0	0.00	0.02	0.03	0.05	0.05	0.06	0.10	0.20
	4:00:00	0	0.00	0.02	0.02	0.04	0.04	0.05	0.05	0.10
	4:05:00	0	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.06
	4:10:00	0	0.00	0.01	0.02	0.02	0.02	0.03	0.02	0.05
	4:15:00	0	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.04
	4:20:00	0	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03
	4:25:00	0	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	4:30:00	0	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	4:35:00	0	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
	4:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	4:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

Project: TRIPLE H RANCH PRELIMINARY PLAN - PDR

Basin ID: POND 1 EAST



Example Zone Configuration (Retention Pond)

Watershed Information

Area > 1 sq.mi. for WQ Facility

Selected SCM Type =	**EDB**	
Watershed Area =	693.10	acres
Watershed Length =	7,950	ft
Watershed Length to Centroid =	3,900	ft
Watershed Slope =	0.015	ft/ft
Watershed Imperviousness =	10.00%	percent
Percentage Hydrologic Soil Group A =	70.0%	percent
Percentage Hydrologic Soil Group B =	30.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	3.870	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	5.519	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.96 in.) =	1.886	acre-feet	0.96	inches
5-yr Runoff Volume (P1 = 1.26 in.) =	3.709	acre-feet	1.26	inches
10-yr Runoff Volume (P1 = 1.52 in.) =	5.639	acre-feet	1.52	inches
25-yr Runoff Volume (P1 = 1.92 in.) =	24.386	acre-feet	1.92	inches
50-yr Runoff Volume (P1 = 2.26 in.) =	38.888	acre-feet	2.26	inches
100-yr Runoff Volume (P1 = 2.61 in.) =	61.523	acre-feet	2.61	inches
500-yr Runoff Volume (P1 = 3.54 in.) =	111.940	acre-feet	3.54	inches
Approximate 2-yr Detention Volume =	2.738	acre-feet		
Approximate 5-yr Detention Volume =	4.106	acre-feet		
Approximate 10-yr Detention Volume =	6.880	acre-feet		
Approximate 25-yr Detention Volume =	10.461	acre-feet		
Approximate 50-yr Detention Volume =	13.028	acre-feet		
Approximate 100-yr Detention Volume =	19.788	acre-feet		

Define Zones and Basin Geometry

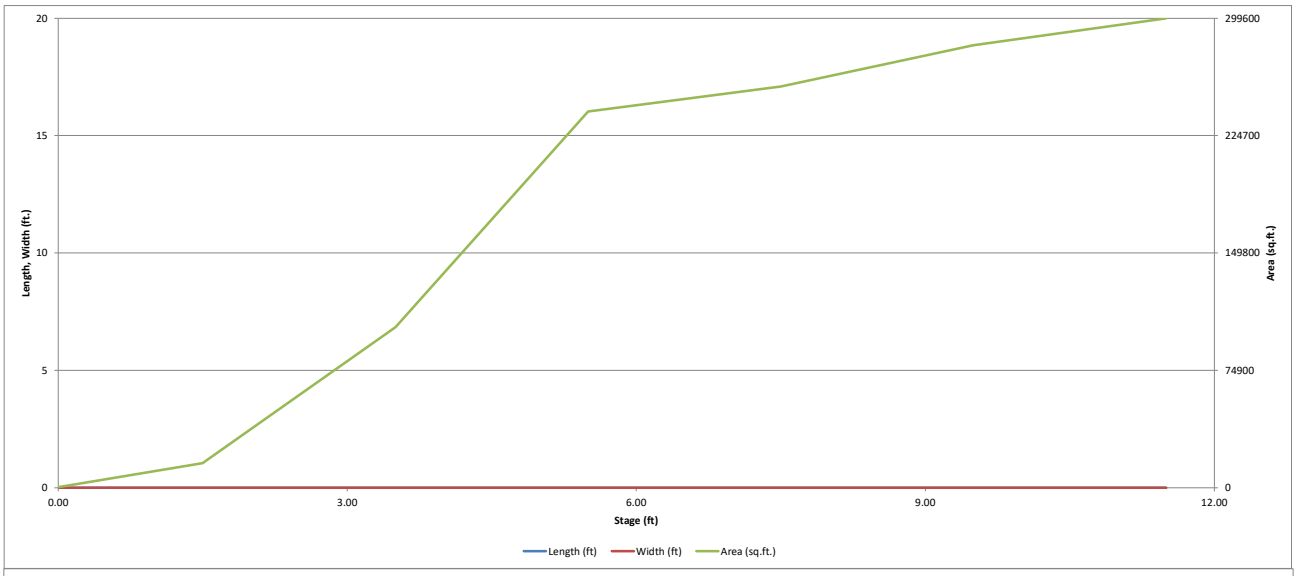
Zone 1 Volume (WQCV) =	3.870	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.649	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	14.269	acre-feet
Total Detention Basin Volume =	19.788	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

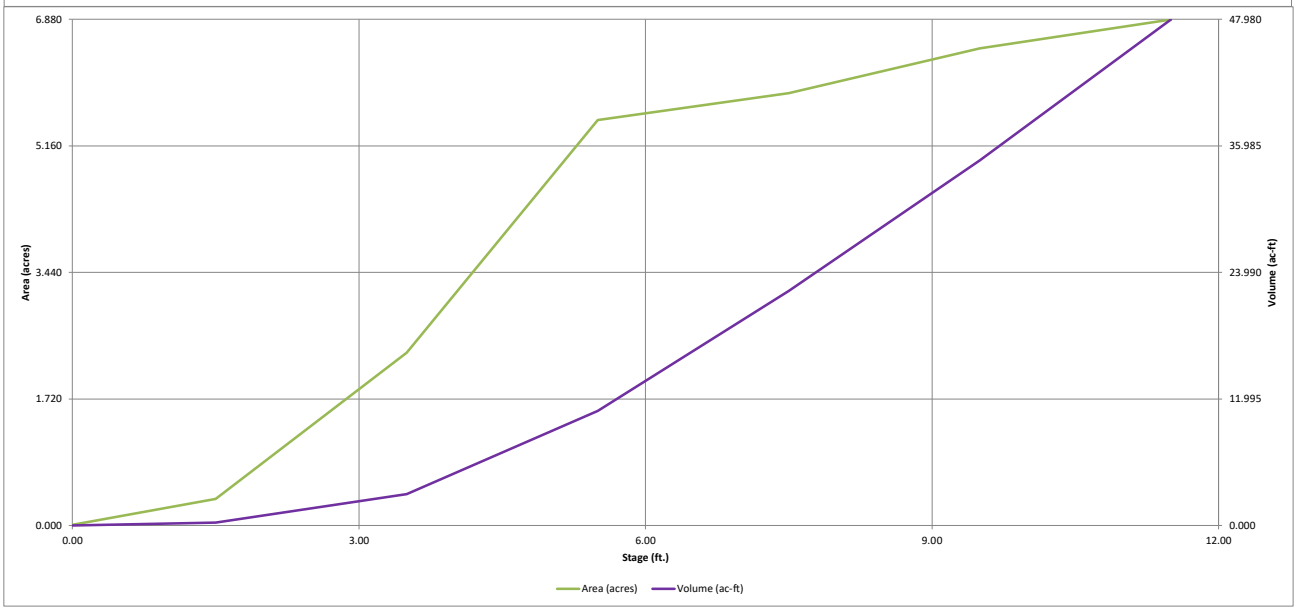
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	500	0.011		
6384	--	1.50	--	--	--	15,711	0.361	12,158	0.279
6386	--	3.50	--	--	--	102,444	2.352	130,313	2.992
6388	--	5.50	--	--	--	240,105	5.512	472,862	10.855
6390	--	7.50	--	--	--	255,950	5.876	968,917	22.243
6392	--	9.50	--	--	--	282,425	6.484	1,507,292	34.603
6394	--	11.50	--	--	--	299,580	6.877	2,089,297	47.964

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)



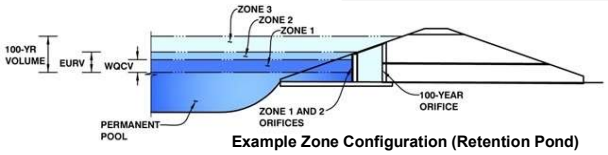


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project: **TRIPLE H RANCH PRELIMINARY PLAN - PDR**

Basin ID: **POND 1 EAST**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.84	3.870	Orifice Plate
Zone 2 (EURV)	4.34	1.649	Orifice Plate
Zone 3 (100-year)	7.08	14.269	Weir&Pipe (Restrict)
Total (all zones)		19.788	

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

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

			Calculated Parameters for Plate		
Centroid 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 =	4.50	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	10.80	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. 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	0.90	1.80	2.70	3.60			
Orifice Area (sq. inches)	8.00	9.16	9.16	9.16	9.16			

	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)

				Calculated Parameters for Vertical Orifice		
	Not Selected	Not Selected		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 with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

				Calculated Parameters for Overflow Weir		
	Zone 3 Weir	Not Selected		Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.50	N/A feet
Overflow Weir Front Edge Length =	24.00	N/A	feet	Overflow Weir Slope Length =	4.12	N/A feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.54	N/A
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	78.27	N/A ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	39.14	N/A ft^2
Debris Clogging % =	50%	N/A	%			

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

				Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate		
	Zone 3 Restrictor	Not Selected		Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	11.96	N/A ft^2
Outlet Pipe Diameter =	54.00	N/A	inches	Outlet Orifice Centroid =	1.77	N/A feet
Restrictor Plate Height Above Pipe Invert =	38.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.99	N/A radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	9.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.02	feet
Spillway Crest Length =	170.00	feet	Stage at Top of Freeboard =	11.52	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	6.88	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	47.96	acre-ft

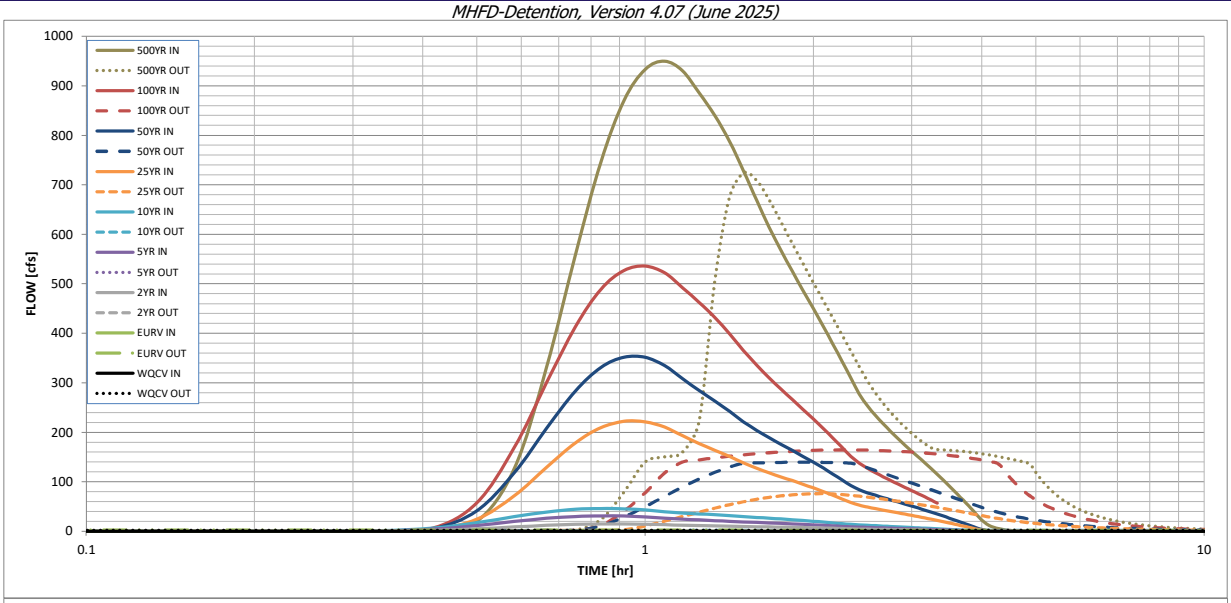
Routed Hydrograph Results

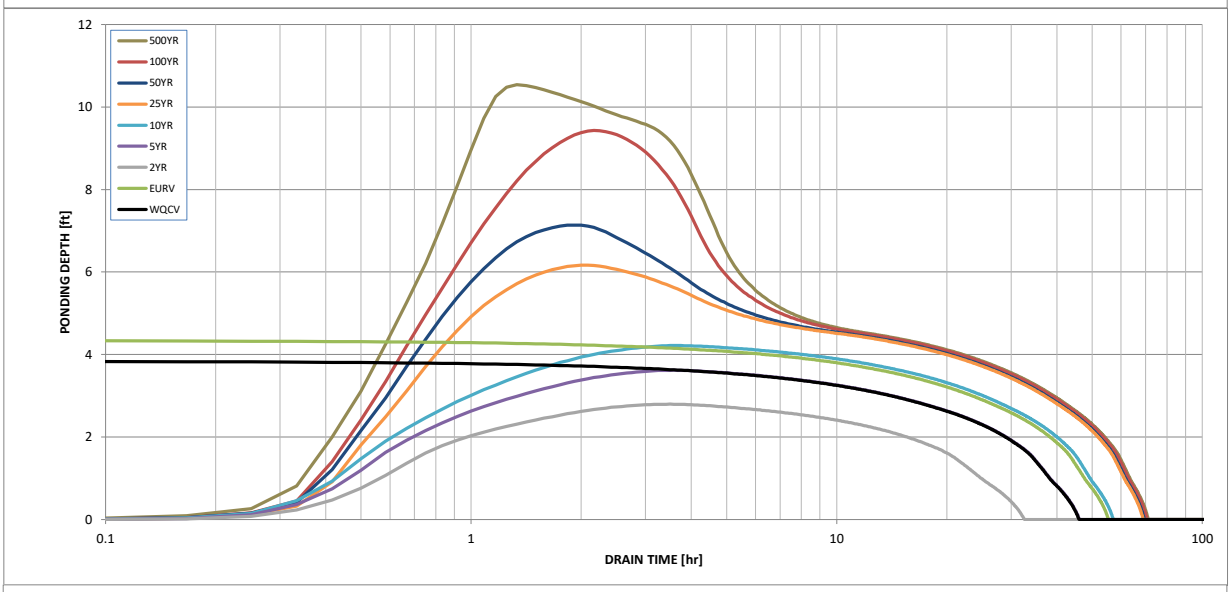
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

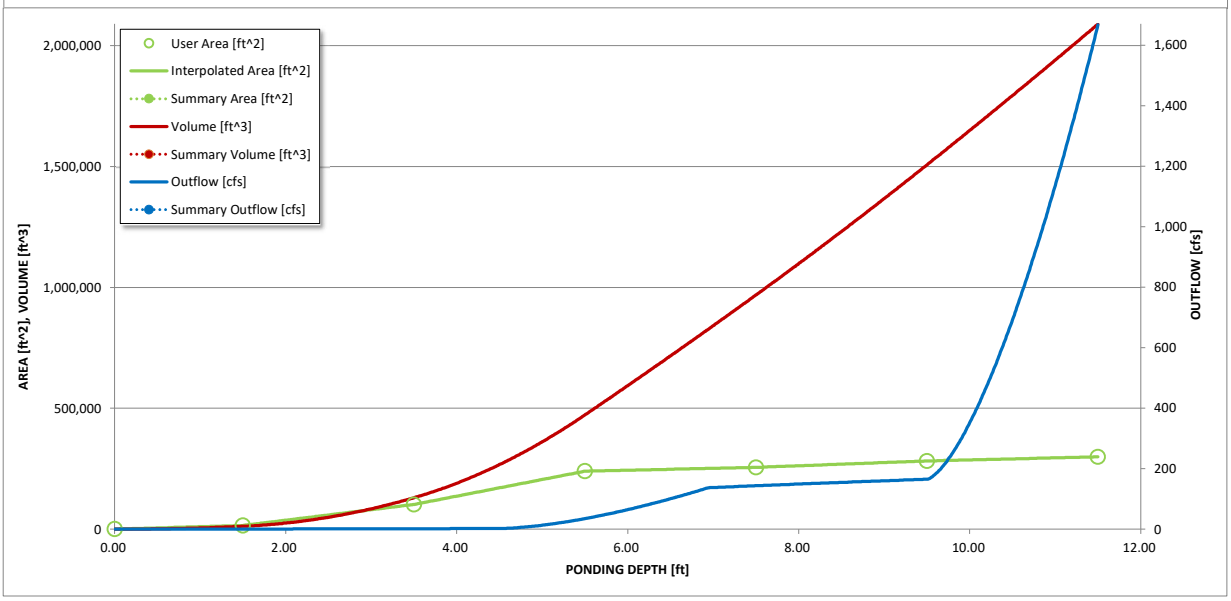
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.96	1.26	1.52	1.92	2.26	2.61	3.54
CUHP Runoff Volume (acre-ft) =	3.870	5.519	1.886	3.709	5.639	24.386	38.888	61.523	111.940
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.886	3.709	5.639	24.386	38.888	61.523	111.940
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	6.6	14.8	22.4	191.1	319.6	500.8	912.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A						370.0	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.28	0.46	0.53	1.32
Peak Inflow Q (cfs) =	N/A	N/A	14.8	31.2	46.1	222.0	351.6	535.6	949.7
Peak Outflow Q (cfs) =	2.0	2.3	1.3	1.8	2.2	76.0	139.6	164.5	723.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.1	0.4	0.4	0.4	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.9	1.7	2.0	2.2
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) =	39	47	28	39	48	50	45	40	28
Time to Drain 99% of Inflow Volume (hours) =	**43**	51	31	43	53	58	56	53	47
Maximum Ponding Depth (ft) =	3.84	4.34	2.80	3.62	4.22	6.16	7.14	9.43	10.54
Area at Maximum Ponding Depth (acres) =	2.89	3.68	1.64	2.53	3.47	5.63	5.81	6.46	6.69
Maximum Volume Stored (acre-ft) =	3.883	5.525	1.573	3.260	5.060	14.533	20.140	34.150	41.385

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)







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:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.08
	0:15:00	0	0.00	0.07	0.15	0.20	0.16	0.26	0.25	0.54
	0:20:00	0	0.00	0.47	0.76	0.99	0.75	1.02	1.08	2.32
	0:25:00	0	0.00	1.81	4.26	6.49	3.15	5.01	6.18	19.82
	0:30:00	0	0.00	4.88	11.54	17.55	24.34	41.63	57.62	126.53
	0:35:00	0	0.00	8.76	19.82	29.65	71.60	118.50	169.12	331.32
	0:40:00	0	0.00	11.98	26.27	38.98	129.59	208.35	300.38	558.16
	0:45:00	0	0.00	13.99	30.00	44.39	178.66	283.24	412.87	746.10
	0:50:00	0	0.00	14.83	31.22	46.14	209.49	331.03	488.87	870.30
	0:55:00	0	0.00	14.78	30.73	45.45	222.04	351.61	526.65	933.03
	1:00:00	0	0.00	14.19	29.08	43.05	221.18	351.44	535.59	949.72
	1:05:00	0	0.00	13.23	26.57	39.50	210.47	334.96	522.26	930.22
	1:10:00	0	0.00	12.24	24.57	37.03	193.10	308.02	492.23	885.59
	1:15:00	0	0.00	11.60	23.08	35.20	177.41	284.42	462.50	839.59
	1:20:00	0	0.00	10.94	21.61	33.40	163.83	262.89	431.92	787.43
	1:25:00	0	0.00	10.27	20.13	31.45	151.14	242.14	398.99	728.68
	1:30:00	0	0.00	9.67	18.85	29.66	138.28	221.30	365.32	668.15
	1:35:00	0	0.00	9.19	17.85	28.09	127.24	203.87	335.77	614.94
	1:40:00	0	0.00	8.79	16.96	26.54	118.10	189.17	310.25	568.05
	1:45:00	0	0.00	8.40	16.04	24.96	110.07	175.99	287.35	525.59
	1:50:00	0	0.00	8.02	15.09	23.38	102.46	163.48	266.48	486.93
	1:55:00	0	0.00	7.61	14.13	21.81	95.01	151.39	246.42	449.81
	2:00:00	0	0.00	7.17	13.15	20.26	87.67	139.54	226.86	413.81
	2:05:00	0	0.00	6.67	12.13	18.66	80.32	127.71	207.63	378.60
	2:10:00	0	0.00	6.13	11.06	16.99	72.95	115.86	188.73	344.11
	2:15:00	0	0.00	5.58	9.98	15.30	65.54	103.99	169.93	309.84
	2:20:00	0	0.00	5.07	9.11	14.03	58.26	92.41	151.52	277.18
	2:25:00	0	0.00	4.69	8.47	13.05	52.81	84.08	137.85	253.30
	2:30:00	0	0.00	4.36	7.91	12.17	48.89	77.85	127.35	234.08
	2:35:00	0	0.00	4.06	7.38	11.33	45.75	72.70	118.31	217.12
	2:40:00	0	0.00	3.77	6.86	10.54	42.81	67.94	110.19	201.77
	2:45:00	0	0.00	3.50	6.38	9.77	40.05	63.55	102.67	187.60
	2:50:00	0	0.00	3.24	5.91	9.03	37.35	59.27	95.49	174.19
	2:55:00	0	0.00	2.99	5.45	8.32	34.70	55.06	88.67	161.59
	3:00:00	0	0.00	2.75	5.00	7.63	32.11	50.94	82.22	149.82
	3:05:00	0	0.00	2.52	4.57	6.97	29.54	46.86	75.83	138.15
	3:10:00	0	0.00	2.29	4.15	6.33	27.00	42.82	69.48	126.55
	3:15:00	0	0.00	2.07	3.73	5.71	24.46	38.80	63.14	114.98
	3:20:00	0	0.00	1.85	3.32	5.10	21.94	34.78	56.81	103.41
	3:25:00	0	0.00	1.64	2.92	4.49	19.42	30.77	50.48	91.86
	3:30:00	0	0.00	1.43	2.52	3.88	16.90	26.77	44.16	80.32
	3:35:00	0	0.00	1.22	2.13	3.29	14.40	22.77	37.84	68.79
	3:40:00	0	0.00	1.02	1.74	2.70	11.89	18.78	31.54	57.28
	3:45:00	0	0.00	0.83	1.36	2.11	9.40	14.81	25.24	45.80
	3:50:00	0	0.00	0.64	0.99	1.55	6.93	10.85	18.97	34.37
	3:55:00	0	0.00	0.48	0.67	1.08	4.50	6.98	12.81	23.38
	4:00:00	0	0.00	0.36	0.50	0.84	2.45	3.84	7.77	14.88
	4:05:00	0	0.00	0.31	0.43	0.70	1.36	2.21	4.87	9.88
	4:10:00	0	0.00	0.27	0.37	0.60	0.87	1.39	3.17	6.64
	4:15:00	0	0.00	0.23	0.32	0.50	0.64	0.94	2.05	4.35
	4:20:00	0	0.00	0.20	0.27	0.42	0.47	0.64	1.30	2.74
	4:25:00	0	0.00	0.17	0.23	0.34	0.36	0.48	0.78	1.60
	4:30:00	0	0.00	0.14	0.19	0.28	0.27	0.35	0.42	0.85
	4:35:00	0	0.00	0.12	0.15	0.22	0.21	0.26	0.24	0.49
	4:40:00	0	0.00	0.09	0.12	0.17	0.16	0.20	0.19	0.37
	4:45:00	0	0.00	0.08	0.10	0.13	0.13	0.15	0.15	0.29
	4:50:00	0	0.00	0.06	0.08	0.10	0.10	0.12	0.12	0.23
	4:55:00	0	0.00	0.04	0.06	0.08	0.08	0.09	0.09	0.18
	5:00:00	0	0.00	0.03	0.04	0.06	0.06	0.07	0.07	0.13
	5:05:00	0	0.00	0.02	0.03	0.04	0.04	0.05	0.05	0.09
	5:10:00	0	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.06
	5:15:00	0	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03
	5:20:00	0	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	5:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DRAINAGE MAPS

CLASSIC SM
CONSULTING
ENGINEERS & SURVEYORS

Drainage Basins

El Paso County
Colorado

Legend

- Drainage Basins Source: Muller Engineering Company (1988)
- US Interstate Highways
- US Highways
- Colorado State Highways
- Major Roadways
- Local Streets & Roads

Creeks

- Perennial
- Intermittent
- Lakes & Reservoirs
- Summits
- Unincorporated Urban Areas
- Incorporated Cities
- Military
- Forest
- County Lines

N W E S

Miles

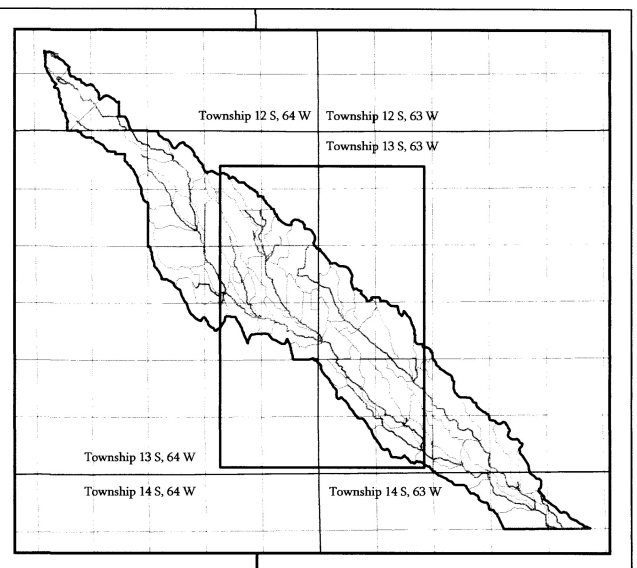
0 0.5 1 2 3 4 5

Douglas County
Elbert County
Teller County
Lincoln County
Fremont County
Pueblo County

Upper Monument Creek FOMO5800
Monument Rock FOMO5000
Dirty Woman Creek FOMO5200
West Cherry Creek CYCY0400
East Cherry Creek CYCY0200
West Kiowa Creek KIKI0200
East Kiowa Creek KIKI0400
Bijou Creek BIBI0200
Upper Big Sandy Creek BGBG1400
Lenard BGBG1200
Antelope Creek BGBG0800
Simla BGBG0400
Ramah BGBG0600
Calhan BGBG1000
Mustang Creek BGBG0200
Jackson Creek FOMO4400
Black Forest FOMO4200
Black Squirrel Creek FOMO3600
Monument Branch FOMO3800
Beaver Creek FOMO4600
Pike National Forest
Upper Black Squirrel CHBS2000
Upper Bracket Creek CHBR0600
North Fork HOHO0400
Air Force Academy FOMO3200
USAF Academy
Kettle Creek FOMO3000
Bennett Ranch CHWS1200
Geick Ranch CHMS0400
La Vega Ranch CHBR0400
Horse Creek HOHO0600
Pine Creek FOMO2800
Cottonwood Creek FOMO2200
Falcon CHWS1400
Hook And Line Ranch CHBS1800
Little Horse Creek HOHO0200
Steels Fork HOPO1000
Baggett CHBR0200
Upper Fountain FOFO7600
Dry Creek FOMO2400
South Pine Creek FOMO2600
Douglas Creek FOMO1000
Templeton Gap FOMO1200
Sand Creek FOFO5800
Williams Canyon FOFO7200
Manitou Reservoir FOFO7400
Solbers Ranch CHWS0800
Curtis Ranch CHWS1000
Haegler Ranch CHMS0200
SITE
West Big Springs Creek CHBG0200
Upper Big Springs Creek CHBG0400
Rush HOPO0800
Sand Creek FOFO4000
Livestock Company CHWS0400
West Squirrel CHWS0600
Ellicott CHBS1600
Lower Big Springs Creek CHBS1400
Telephone Exchange CHWS0200
Ellicott Consolidated CHBS1200
Upper Pond Creek HOPO0600
Lower Pond Creek HOPO0400
Ruxton Creek FOFO7000
Upper Beaver Creek BEBE0400
Sutherland Creek FOFO6400
Bear Creek FOFO4800
Shooks Run FOFO4400
Spring Creek FOFO4200
Peterson Field FOFO3400
Jimmy Camp Creek FOFO2000
Upper East Chico CHEC0400
Schriever AFB
Crows Roost CHBS1000
Drennan CHBS0400
Middle East Chico CHEC0200
Windmill Gulch FOFO3000
Fishers Canyon FOFO3600
Southwest Area FOFO4600
Big Johnson FOFO2600
Upper Williams Creek FOWI0600
Upper Chico Creek CHCH1600
Upper Dry Squirrel CHDS0200
Upper Williams Tributary FOWI0400
West Chico Tributary CHCH1200
Haynes Creek HAHA0600
St.lukes HOPO0200
Lower Black Squirrel CHBS0600
Squirrel Creek CHBS0200
Little Fountain Creek FOFO1800
Fort Carson FOFO2200
Calhan Reservoir FOFO1400
Chico Creek CHCH1400
Lower Williams Creek FOFO1000
Lower Williams Tributary FOWI0200
Lower Dry Squirrel CHBS0400
East Kramer KRKR0600
Kramer Creek KRKR0400
Sand Canyon FOFO1600
Turkey Creek TUTU0200
Lower East Chico CHCH0800
East Haynes HAHA0400
Hammer Ranch CHCH0600
Finch Ranch CHCH0400
Windmill CHCH0200
West Haynes HAHA0200
Sand Creek FOFO0600
Williams Ranch FOFO0400
Midway Ranch FOFO0800
West Chico Creek CHCH0600
West Kramer KRKR0200
Red Creek BEBE0200
Young Hollow FOFO0200
Fort Carson
Peyton
Falcon
Calhan
Ellicott
Yoder
Rush
Truckton
Ramah
Cascade
Chipita Park
Crystola
Manitou Springs
COLORADO SPRINGS
Peterson AFB
Schriever AFB
FOUNTAIN

FIGURE 4-4 SHEET 2

OFF-SITE DRAINAGE MAP



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

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

* JHR0370, JHR0570

0 2,500 5,000 Feet

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

URS

HAEGLER RANCH DRAINAGE BASIN

EXISTING AND FUTURE CONDITIONS HYDROLOGIC MODEL

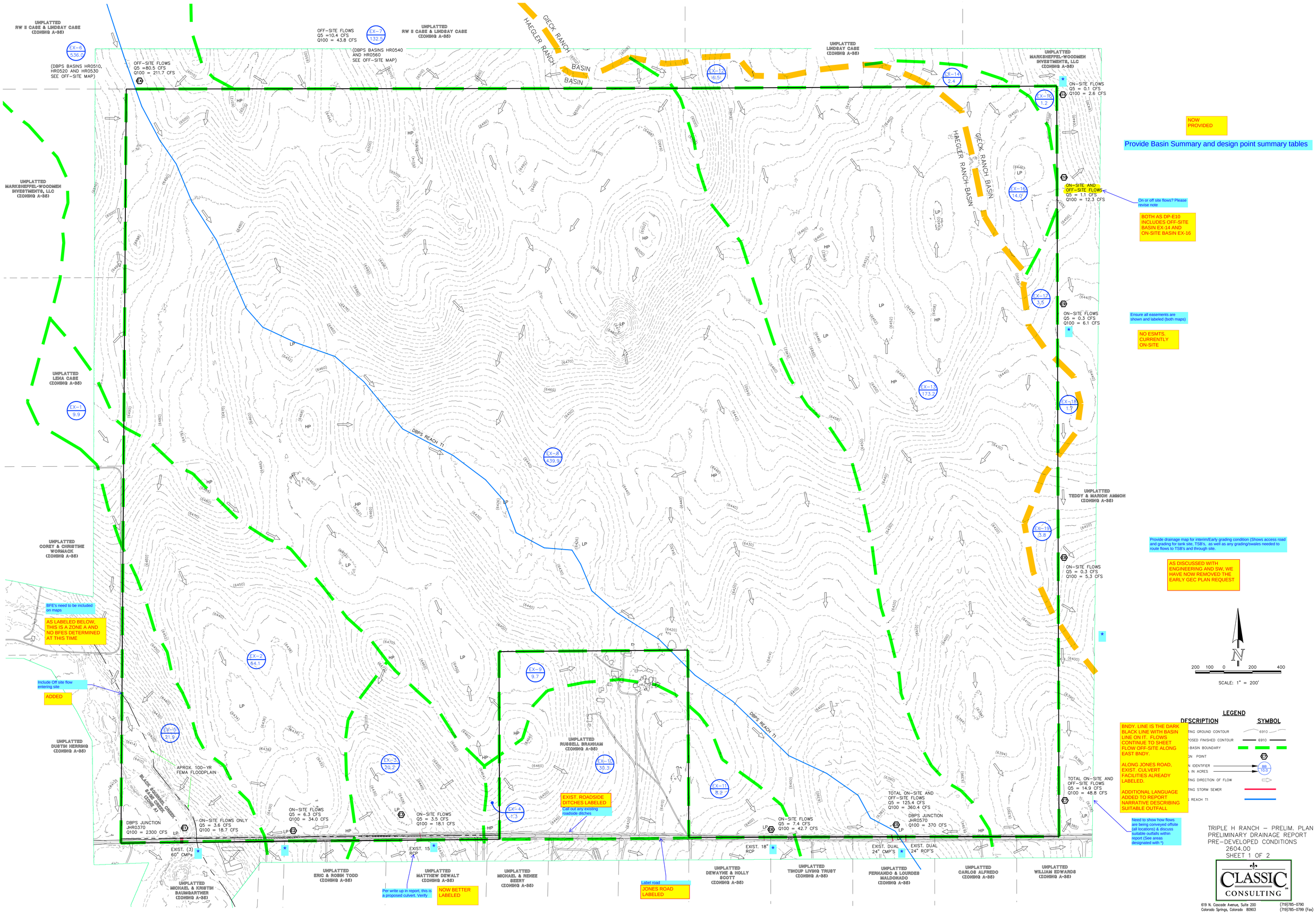
URS NO. 21711039

DATE: 09/08

TRIPLE H RANCH - PRELIMINARY PLAN

PRELIMINARY DRAINAGE REPORT

PRE-DEVELOPED CONDITIONS



NOW PROVIDED

Provide Basin Summary and design point summary tables

On or off site flows? Please revise note

BOTH AS DP-E10 INCLUDES OFF-SITE BASIN EX-14 AND ON-SITE BASIN EX-16

Ensure all easements are shown and labeled (both maps)

NO ESMTS. CURRENTLY ON-SITE

BFE's need to be included on maps

AS LABELED BELOW, THIS IS A ZONE A AND NO BFES DETERMINED AT THIS TIME

Include Off site flow entering site

ADDED

Per write up in report, this is a proposed culvert. Verify

NOW BETTER LABELED

Label road

JONES ROAD LABELED

Need to show how flows are being conveyed offsite (all locations) & discuss suitable outfalls within report (See areas designated with *)

Provide drainage map for interim/Early grading condition (Shows access road and grading for tank site, TSB's, as well as any grading/swales needed to route flows to TSB's and through site.

AS DISCUSSED WITH ENGINEERING AND SW, WE HAVE NOW REMOVED THE EARLY GEC PLAN REQUEST

200 100 0 200 400

SCALE: 1" = 200'

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
SUB-BASIN BOUNDARY	
DESIGN POINT	
BASIN IDENTIFIER	B8 10.0
AREA IN ACRES	
EXISTING DIRECTION OF FLOW	
EXISTING STORM SEWER	
DBPS REACH T1	

BNDY. LINE IS THE DARK BLACK LINE WITH BASIN LINE ON IT. FLOWS CONTINUE TO SHEET FLOW OFF-SITE ALONG EAST BNDY.

ALONG JONES ROAD, EXIST. CULVERT FACILITIES ALREADY LABELED.

ADDITIONAL LANGUAGE ADDED TO REPORT NARRATIVE DESCRIBING SUITABLE OUTFALL

TRIPLE H RANCH – PRELIM. PLAN
PRELIMINARY DRAINAGE REPORT
PRE-DEVELOPED CONDITIONS
2604.00
SHEET 1 OF 2

CLASSIC CONSULTING
619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)

TRIPLE H RANCH

PRELIMINARY DRAINAGE REPORT

DEVELOPED CONDITIONS

Map will be reviewed in more detail once proposed hydrology calculations have been provided with next submittal

ADDED

Provide basin summary table

Provide Design Point table with flow values

Include Off site flow entering site

ADDED

Show BFEs

AS LABELED BELOW, THIS IS A ZONE A AND NO BFES DETERMINED AT THIS TIME

show easement boundaries lines

ALREADY LABELED

Provide and call out culverts along Jones Rd

REVISED

Revise to match

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED FINISHED CONTOUR	6910
SUB-BASIN BOUNDARY	
DESIGN POINT	
BASIN IDENTIFIER / AREA IN ACRES	B8 / 10.0
EXISTING DIRECTION OF FLOW	
EXISTING STORM SEWER	

200 100 0 200 400

SCALE: 1" = 200'

TRIPLE H RANCH
PRELIMINARY DRAINAGE REPORT
DEVELOPED CONDITIONS
2604.00
SHEET 2 OF 2

CLASSIC CONSULTING

619 N. Cascade Avenue, Suite 200
Colorado Springs, Colorado 80903
(719)785-0790
(719)785-0799 (Fax)