



ANTLER'S RANGE SUBDIVISION

FINAL DRAINAGE REPORT

EL PASO COUNTY PROJECT NO:

ALL TERRAIN ENGINEERING PROJECT NO: 24031

FEBRUARY 2025

PREPARED FOR:

ANTLER RANGE LLC

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PREPARED BY:

ALL TERRAIN ENGINEERING LLC

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ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by 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.

Ryan Burns, PE

Date

State of Colorado No. 54412

For and on behalf of All Terrain Engineering LLC

DEVELOPER'S STATEMENT

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

Grant Langdon

Date

Antler Range LLC

PO Box 38939, Colorado Springs, CO 80937

EL PASO COUNTY ONLY

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 Palmer, PE

Date

County Engineer/ECM Administrator

Conditions:



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I. General Purpose, Location & Description

a. Purpose & Project Description

The purpose of the Preliminary Drainage Report (PDR) for the ANTLER'S RANGE SUBDIVISION is to describe the site's onsite and offsite drainage patterns, existing and proposed storm infrastructure, and to safely route developed stormwater to adequate outfalls. Additionally, the PDR will provide preliminary channel improvements for the onsite portion of Black Squirrel Creek and other onsite tributaries. Lastly, the PDR will provide preliminary full spectrum water quality and detention pond sizing and placement.

b. Location

ANTLER'S RANGE SUBDIVISION, referred to as 'the site' herein, is in a portion of the north half of Section 18, Township 12 South, Range 64 West of the 6th P.M., El Paso County, Colorado. The site is bound by Latigo County Estates Filing 1 to the north, Meridian Road to the west, The Trails Filing 2 to the east and Ayer Road to the south. Surrounding platted developments include Latigo Country Estates Filing 1, The Trail Filing 2, Camelot Subdivision and Antlers Ridge Estates. A vicinity map is presented in Appendix A.

c. Description of Property

The site is approximately 244.50 acres and is undeveloped. Existing vegetation consists of prairie grasses and sparse forest. The site is unplatted and zoned A-35. The project will be rezoned to RR-2.5 and platted. The site will be platted with eight-four (84) 2.5+ acre lots. The total disturbed area associated with the proposed development is approximately 34.6 acres.

In general, the site slopes northeasterly towards Black Squirrel Creek. Onsite elevations range from 7159' - 7290' with slopes ranging 1 – 50%. Per an NRCS soil survey, the site is made up of Type B soils including Kettle gravelly loam, Pring coarse sandy loam and Tomah-Crowfoot loamy sands.

Existing, onsite utilities include overhead electric along the northern property line and existing storm sewer culverts that discharge on to the site along the southern border. The existing culverts are detailed in the 'Existing Basin Description' section. Black Squirrel Creek runs along the site's northern boundary and is the ultimate outfall for the site's stormwater. Unnamed tributaries of Black Squirrel Creek traverse the site from south to north. An existing drainage map is presented in Appendix F.

d. Floodplain Statement

Based on FEMA Firm map 08041C0340G dated December 7, 2018, the site is Zone A and Zone X. Zone A areas are within the 1% annual chance flood. Zone X are areas determined to be outside the 0.2% annual chance flood. Site development will occur within Zone X areas.

II. Drainage Basins

a. Major Basin Description

The site is located within the Upper Black Squirrel Drainage Basin. Upper Black Squirrel is an unstudied drainage basin and an approved DBPS is not available. The site and surrounding areas were studied in the previous drainage reports:

1. "Preliminary/Final Drainage Report for Antler Ridge Estates" by Merrick and Company, approved July 2006.
2. "Final Drainage Report for Camelot Subdivision" by Classic Consulting Engineers and Surveyors, approved March 2002.
3. "Black Squirrel Creek and Snipe Creek Letter of Map Revision" by Kiowa Engineering Corporation, April 2006.

Antler Ridge Estates is located south of the site across Ayer Road. Pond UBS-2 from Antler Ridge Estates discharges under Ayer Road and into Existing Tributary A2. The pond outfall will be maintained with the development of Antler Range subdivision. See Basin A5 description for additional information.

Camelot Subdivision is located on the southwest corner of the Ayer Road and Meridian Road intersection. Pond DP-6 from Camelot Subdivision discharges onto the site, under Ayer and Meridian Road, into Existing Tributary A. The pond outfall will be maintained with the development of Antler Range. See Basin A3 description for additional information.

The "Black Squirrel Creek and Snipe Creek Letter of Map Revision" analyzed a portion of Black Squirrel Creek that is located within the site boundary. The LOMR was approved December 11, 2006 and revised the limits of Zone A.

b. Black Squirrel Creek

Black Squirrel Creek crosses on to the site along the western property boundary. This reach of Black Squirrel Creek is included in the Colorado Water Conservation Board Base Level Engineering Study by AECOM (CWCB BLE) that aimed to revise Zone A floodplain limits, establish Base Flood Elevations (BFEs) and update Flood Insurance Rate Maps (FIRMs). While the results have not been formally adopted by FEMA at this time, the County has indicated that the CWCB model may be utilized for evaluating stability within Black Squirrel Creek. See the 'Major Drainageway' section later in this report regarding the stability analysis of Black Squirrel Creek.

c. Existing Subbasin Description

The existing site's drainage patterns are generally to the northeast towards Black Squirrel Creek. Unnamed tributaries convey onsite and offsite stormwater through the site to Black Squirrel Creek. The site is divided into 15 existing drainage basins. See below for existing basin descriptions.

Basin A is 11.9 acres of onsite undeveloped area and portions of Meridian and Ayer Road. The Camelot Subdivision Pond (Camelot DP-6) discharges through an existing 30" culvert into the southwest corner of Basin A. Camelot DP6 discharges ($Q_5 = 11$ cfs $Q_{100} = 22$ cfs) into Existing Tributary A and combines with Basin A flows ($Q_5 = 3.3$ cfs $Q_{100} = 18.1$ cfs). The combined stormwater is conveyed in Existing Tributary A to DP1 ($Q_5 = 11.7$ cfs $Q_{100} = 32.2$ cfs). DP1 conveys the stormwater offsite into Basin OS-A.

Basin B is 34.9 acres of onsite undeveloped area and a portion of Ayer Road. The Antler's Ridge Estates Pond (UBS-2 Pond) discharges through an existing 42" culvert under Ayer Road and into Existing Tributary A2 within Basin B. UBS-2 discharges ($Q_5 = 32.9$ cfs $Q_{100} = 69.2$ cfs) into Existing Tributary A2 and combines with Basin B ($Q_5 = 6.2$ cfs $Q_{100} = 36.1$ cfs) and Basin OS-B flows. The combined stormwater is conveyed in Existing Tributary

A2 to DP3 ($Q_5 = 41.1$ cfs $Q_{100} = 117.8$ cfs). DP3 is located within an existing stock pond. DP3 overtops the stock pond berm and flows into Basin G.

Basin C is 44.1 acres of onsite undeveloped area and a portion of Ayer Road. Basin C stormwater ($Q_5 = 6.7$ cfs $Q_{100} = 42.9$ cfs) is conveyed north in Existing Tributary C. Basin OS-C flow overtops Ayer Road at DP5 and discharges into Existing Tributary C. There is no drainage structure that conveys Basin OS-C flow under Ayer Road. The combined flow in Existing Tributary C flows north to DP6 in Black Squirrel Creek.

Basin D is 20.0 acres of onsite undeveloped area. Basin D stormwater ($Q_5 = 3.1$ cfs $Q_{100} = 21.1$ cfs) is conveyed north in poorly defined drainages to DP11 ($Q_5 = 3.1$ cfs $Q_{100} = 21.1$ cfs) in Black Squirrel Creek. There is no offsite flow conveyance in the poorly defined drainage that conveys Basin D flow.

Basin E is 40.8 acres of onsite undeveloped area and a portion of Ayer Road. Basin E stormwater ($Q_5 = 7.3$ cfs $Q_{100} = 47.4$ cfs) is conveyed north in Existing Tributary E to DP9. DP9 is in an existing stock pond, however; the downstream berm has been partially removed and facilitates flow north. Basin OS-E flow overtops Ayer Road at DP8 and discharges into Existing Tributary E. There is no drainage structure that conveys Basin OS-E flow under Ayer Road. The combined flow in Existing Tributary E flows north to DP9 ($Q_5 = 11.5$ cfs $Q_{100} = 75.4$ cfs).

Basin F is 12.0 acres of onsite undeveloped area and Black Squirrel Creek. Basin F stormwater ($Q_5 = 3.0$ cfs $Q_{100} = 20.2$ cfs) is conveyed north in poorly defined drainages to DP14 ($Q_5 = 3.0$ cfs $Q_{100} = 20.2$ cfs) in Black Squirrel Creek. There is no offsite flow conveyance in the poorly defined drainages that convey Basin F flow.

Basin G is 18.2 acres of onsite undeveloped area and Black Squirrel Creek. Basin G stormwater ($Q_5 = 3.5$ cfs $Q_{100} = 23.6$ cfs) combines with DP3 flow and is conveyed north in Existing Tributary A2 to DP4 ($Q_5 = 43.1$ cfs $Q_{100} = 131.1$ cfs) in Black Squirrel Creek.

Basin H is 9.1 acres of onsite undeveloped area and Black Squirrel Creek. Basin H stormwater ($Q_5 = 1.9$ cfs $Q_{100} = 12.8$ cfs) is conveyed north in poorly defined drainages to DP15 ($Q_5 = 1.9$ cfs $Q_{100} = 12.8$ cfs) in Black Squirrel Creek. There is no offsite flow conveyance in the poorly defined drainage that conveys Basin H flow.

Basin I is 40.4 acres of onsite undeveloped area. Basin I stormwater ($Q_5 = 7.1$ cfs $Q_{100} = 47.3$ cfs) combines with DP9 ($Q_5 = 11.5$ cfs $Q_{100} = 75.4$ cfs) and is conveyed north in Existing Tributary E to DP10 ($Q_5 = 16.4$ cfs $Q_{100} = 108$ cfs) in Black Squirrel Creek.

Basin J is 9.5 acres of onsite undeveloped area, Black Squirrel Creek and a portion of Latigo County Estates. Basin J stormwater ($Q_5 = 1.1$ cfs $Q_{100} = 7.7$ cfs) is conveyed east in Black Squirrel Creek to DP7 ($Q_5 = 1.1$ cfs $Q_{100} = 7.7$ cfs).

Basin K is 4.7 acres of onsite undeveloped area. Basin K stormwater ($Q_5 = 1.1$ cfs $Q_{100} = 7.3$ cfs) flows easterly offsite at DP12 ($Q_5 = 1.1$ cfs $Q_{100} = 7.3$ cfs) into The Trails Filing 2.

Basin OS-A is 14.7 acres of offsite undeveloped area along the northern limits of Basin A. Basin OS-A stormwater ($Q_5 = 2.6$ cfs $Q_{100} = 17.5$ cfs) combines with DP1 flow ($Q_5 = 11.7$ cfs $Q_{100} = 32.2$ cfs) and is conveyed

east in Existing Tributary A to DP2 ($Q_5 = 13.2$ cfs $Q_{100} = 45.1$ cfs). DP2 discharges into Basin B and is conveyed to DP3 ($Q_5 = 41.1$ cfs $Q_{100} = 117.8$ cfs).

Basin OS-B is 3.2 acres of offsite undeveloped area along the northern and western limits of Basin B. Basin OS-B stormwater ($Q_5 = 0.8$ cfs $Q_{100} = 5.7$ cfs) flows easterly to DP13 ($Q_5 = 0.8$ cfs $Q_{100} = 5.7$ cfs) and into Basin B. DP13 combines with Basin B flow and is conveyed north in Existing Tributary A2 to DP3 ($Q_5 = 41.1$ cfs $Q_{100} = 117.8$ cfs).

Basin OS-C is 9.3 acres of offsite undeveloped area located south of Basin C and Ayer Road. Basin OS-C stormwater ($Q_5 = 2.9$ cfs $Q_{100} = 15.7$ cfs) collects in a low point adjacent to Ayer Road at DP5 ($Q_5 = 2.9$ cfs $Q_{100} = 15.7$ cfs). There is no culvert present at DP5 and flows overtop Ayer Road into Existing Drainageway C/Basin C.

Basin OS-E is 37.2 acres of offsite undeveloped area located south of Basin E and Ayer Road. Basin OS-E stormwater ($Q_5 = 7.3$ cfs $Q_{100} = 48.0$ cfs) collects in an existing stock pond adjacent to Ayer Road at DP3 ($Q_5 = 7.3$ cfs $Q_{100} = 48.0$ cfs). There is no culvert present that conveys DP3 flow under Ayer Road. Based upon survey and field observations, DP3 overtops Ayer Road into Existing Drainageway E/Basin E.

d. Proposed Subbasin Description

In the proposed condition, the site will be subdivided into eighty-four (84) 2.5+ acre lots with public, rural local roadways. Lots will not be developed at this time. However, to account for future home building, proposed lot areas are analyzed for their future condition. A 7% impervious is applied to the portion of lots that will be developed in the future, while the remaining lot area is analyzed as undeveloped. All pipe sizes provided in the basin descriptions are preliminary in nature. Final sizes and calculations will be provided during the FDR phase. All proposed storm sewer and water quality and detention ponds will be privately owned and maintained. Based upon proposed roadway profiles and grading, the site has been divided into 55 proposed drainage basins. See below for proposed basin descriptions.

Basin A:

Basin A1 is 4.7 acres of large lot residential, roadway and undeveloped area. Basin A1 stormwater ($Q_5 = 2.0$ cfs $Q_{100} = 8.2$ cfs) is conveyed in a roadside ditch to DP1 ($Q_5 = 2.0$ cfs $Q_{100} = 8.2$ cfs) and ultimately to Pond A. Water quality and detention for Basin A1 is provided in Pond A.

Basin A2 is 0.8 acres of large lot residential, roadway and undeveloped area. Basin A2 stormwater ($Q_5 = 0.8$ cfs $Q_{100} = 2.3$ cfs) is conveyed in a roadside ditch to DP2 ($Q_5 = 2.6$ cfs $Q_{100} = 9.9$ cfs) at Pond A. Water quality and detention for Basin A2 is provided in Pond A.

Basin A3 is 4.8 acres of large lot residential and undeveloped area. Basin A3 stormwater ($Q_5 = 1.4$ cfs $Q_{100} = 6.8$ cfs) is captured in Proposed Swale A and combines with flow from The Camelot Subdivision Pond DP-6 ($Q_5 = 11.0$ cfs $Q_{100} = 22$ cfs), located southwest of the site, which discharges into Basin A3. Proposed Swale A is conveyed to DP3 ($Q_5 = 11.2$ cfs $Q_{100} = 31.0$ cfs). DP3 combines with the Pond A discharge and continues north towards Basin O-A1. Basin A3 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B –

Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin A4 is 2.1 acres of large lot residential and undeveloped area. Basin A4 stormwater ($Q_5 = 0.7$ cfs $Q_{100} = 3.7$ cfs) is conveyed to DP3 ($Q_5 = 11.2$ cfs $Q_{100} = 31.0$ cfs). DP3 combines with the Pond A discharge and continues north towards Basin O-A1. Basin A3 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin A5 is 13.5 acres of large lot residential and undeveloped area. Basin A5 stormwater ($Q_5 = 4.1$ cfs $Q_{100} = 19.9$ cfs) is captured in Proposed Swale A2 and conveyed to DP4 ($Q_5 = 33.6$ cfs $Q_{100} = 82.3$ cfs). Additionally, Pond DP-US2 from Antler Ridge Estates discharges ($Q_5 = 32.9$ cfs $Q_{100} = 69.2$ cfs) into Proposed Swale A2 along the interface between Basin A5 and A6. Pond DP-US2 flow will not be detained within the project and will be bypassed around onsite ponds to Black Squirrel Creek. Basin A5 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin A6 is 3.7 acres of large lot residential and undeveloped area. Basin A6 stormwater ($Q_5 = 1.7$ cfs $Q_{100} = 6.8$ cfs) is captured in Proposed Swale A2 and conveyed to DP4 ($Q_5 = 33.6$ cfs $Q_{100} = 82.3$ cfs). Basin A6 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin A7 is 11.6 acres of large lot residential and undeveloped area. Basin A7 stormwater ($Q_5 = 3.0$ cfs $Q_{100} = 15.8$ cfs) is captured in Proposed Swale A2 and conveyed to DP5 ($Q_5 = 33.8$ cfs $Q_{100} = 91.1$ cfs). Basin A7 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin A8 is 1.2 acres of large lot residential and undeveloped area. Basin A8 stormwater ($Q_5 = 0.5$ cfs $Q_{100} = 2.7$ cfs) is captured in Proposed Swale A2 and conveyed to DP7 ($Q_5 = 40.2$ cfs $Q_{100} = 120$ cfs) where it combines with DP5 and DP6 flow. A 48" RCP culvert at DP7 conveys stormwater underneath Road B and is piped to its ultimate outfall at Black Squirrel Creek. Basin A8 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin A9 is 8.3 acres of large lot residential and undeveloped area. Basin A9 stormwater ($Q_5 = 2.2$ cfs $Q_{100} = 14.1$ cfs) follows historic drainage patterns to DP8 ($Q_5 = 43.8$ cfs $Q_{100} = 129.5$ cfs) before discharging to Black Squirrel Creek. Basin A9 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin OA1 is 14.7 acres of offsite, undeveloped area. Basin OA1 will remain undeveloped and undisturbed in the proposed condition. Basin OA1 stormwater ($Q_5 = 0.6$ cfs $Q_{100} = 16.7$ cfs) is captured in Existing Tributary A and conveyed to DP6 ($Q_5 = 11.3$ cfs $Q_{100} = 43.5$ cfs) where it combines with DP3 flows. Basin OA1 is excluded from water quality and detention as it is an offsite area that will remain undeveloped.

Basin OA2 is 3.2 acres of offsite, undeveloped area. Basin OA2 will remain undeveloped and undisturbed in the proposed condition. Basin OA2 stormwater ($Q_5 = 0.2$ cfs $Q_{100} = 5.2$ cfs) is captured in Proposed Swale A2 and conveyed to DP5 ($Q_5 = 33.8$ cfs $Q_{100} = 91.1$ cfs) where it combines with DP4 flows. Basin OA2 is excluded from water quality and detention as it is an offsite area that will remain undeveloped.

Basin B:

Basin B1 is 1.2 acres of large lot residential, roadway and undeveloped area. Basin B1 stormwater ($Q_5 = 0.9$ cfs $Q_{100} = 3.1$ cfs) is conveyed in a roadside ditch to DP9 ($Q_5 = 1.2$ cfs $Q_{100} = 4.2$ cfs) where an 18" RCP culvert conveys the flow under Road C and towards Pond B. Water quality and detention for Basin B1 is provided in Pond B.

Basin B2 is 0.4 acres of large lot residential, roadway and undeveloped area. Basin B2 stormwater ($Q_5 = 0.4$ cfs $Q_{100} = 1.3$ cfs) is conveyed in a roadside ditch to DP9 ($Q_5 = 1.2$ cfs $Q_{100} = 4.2$ cfs) and combines with Basin B1 flow. An 18" RCP culvert conveys DP9 under Road C and towards Pond B. Water quality and detention for Basin B2 is provided in Pond B.

Basin B3 is 3.9 acres of large lot residential, roadway and undeveloped area. Basin B3 stormwater ($Q_5 = 1.9$ cfs $Q_{100} = 7.3$ cfs) is conveyed in a roadside ditch to DP11 ($Q_5 = 4.0$ cfs $Q_{100} = 13.7$ cfs) and combines with DP9 flow. DP11 continues in a roadside ditch along Road C to Pond B. Water quality and detention for Basin B3 is provided in Pond B.

Basin B4 is 1.2 acres of large lot residential, roadway and undeveloped area. Basin B3 stormwater ($Q_5 = 1.3$ cfs $Q_{100} = 3.2$ cfs) is conveyed in a roadside ditch to DP10 ($Q_5 = 1.3$ cfs $Q_{100} = 3.2$ cfs) where an 18" RCP culvert conveys the flow under Road B to DP11. DP11 continues in a roadside ditch along Road C to Pond B. Water quality and detention for Basin B4 is provided in Pond B.

Basin B5 is 6.0 acres of large lot residential, roadway and undeveloped area. Basin B5 stormwater ($Q_5 = 2.2$ cfs $Q_{100} = 9.8$ cfs) is conveyed in a roadside ditch to DP12 ($Q_5 = 6.7$ cfs $Q_{100} = 27.4$ cfs) where a 30" RCP culvert conveys the flow under Road G and into a roadside ditch along Road C towards DP13. Water quality and detention for Basin B5 is provided in Pond B.

Basin B6 is 6.6 acres of large lot residential, roadway and undeveloped area. Basin B6 stormwater ($Q_5 = 2.4$ cfs $Q_{100} = 10.6$ cfs) is conveyed in a roadside ditch to DP12 ($Q_5 = 6.7$ cfs $Q_{100} = 27.4$ cfs) where an 18" RCP culvert conveys the flow under Road G and into a roadside ditch along Road C towards DP13. Water quality and detention for Basin B6 is provided in Pond B.

Basin B7 is 2.2 acres of large lot residential, roadway and undeveloped area. Basin B7 stormwater ($Q_5 = 1.5$ cfs $Q_{100} = 4.4$ cfs) is conveyed in a roadside ditch to DP12 ($Q_5 = 6.7$ cfs $Q_{100} = 27.4$ cfs) where a 30" RCP culvert conveys the flow under Road G and into a roadside ditch along Road C towards DP13. Water quality and detention for Basin B7 is provided in Pond B.

Basin B8 is 2.0 acres of large lot residential, roadway and undeveloped area. Basin B8 stormwater ($Q_5 = 1.3$ cfs $Q_{100} = 3.8$ cfs) is conveyed in a roadside ditch to DP14 ($Q_5 = 8.1$ cfs $Q_{100} = 30.9$ cfs) at Pond B. Water quality and detention for Basin B8 is provided in Pond B.

Basin B9 is 30.50 acres of large lot residential and undeveloped area. Basin B9 stormwater ($Q_5 = 7.4$ cfs $Q_{100} = 39.7$ cfs) is captured in Drainage C1 swale and conveyed to DP19 ($Q_5 = 8.7$ cfs $Q_{100} = 45.0$ cfs). A 36" RCP culvert conveys DP19 under Road C and to Black Squirrel Creek. Water quality and detention for Basin B8 is provided in Pond B. Basin B9 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. Additionally, Basin B9 includes a total of 0.06 acres of paved roadway that will not be detained. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin B10 is 1.4 acres of large lot residential and undeveloped area. Basin B10 stormwater ($Q_5 = 0.8$ cfs $Q_{100} = 3.8$ cfs) follows historic drainage patterns to Black Squirrel Creek. Basin B10 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin C:

Basin OC1 is 9.3 acres of offsite, undeveloped area and offsite, large lot residential area. Basin OC1 will remain in its existing condition and will not be disturbed by the project development. Basin OC1 stormwater ($Q_5 = 2.8$ cfs $Q_{100} = 15.2$ cfs) follows historic drainage patterns towards DP15 ($Q_5 = 2.8$ cfs $Q_{100} = 15.2$ cfs), an existing low point adjacent to Ayer Road. Basin OC1 flows overtop Ayer Road and flow into Basin C2. Water quality and detention for Basin OC1 is provided in Pond C.

Basin C2 is 10.2 acres of large lot residential, roadway and undeveloped area. Basin C2 stormwater ($Q_5 = 3.6$ cfs $Q_{100} = 17.3$ cfs) combines with Basin OC1 and is conveyed in Existing Tributary C to DP16 ($Q_5 = 6.1$ cfs $Q_{100} = 29.8$ cfs) where a 30" RCP culvert conveys the flow under Road C to Pond C. Water quality and detention for Basin C2 is provided in Pond C.

Basin C3 is 1.0 acres of large lot residential, roadway and undeveloped area. Basin C3 stormwater ($Q_5 = 0.9$ cfs $Q_{100} = 2.6$ cfs) is conveyed in a roadside ditch to DP16 ($Q_5 = 6.1$ cfs $Q_{100} = 29.8$ cfs). At DP16, a 30" RCP culvert conveys the flow under Road C to Pond C. Water quality and detention for Basin C3 is provided in Pond C.

Basin C4 is 1.0 acres of roadway and roadside ditch. Basin C4 stormwater ($Q_5 = 0.9$ cfs $Q_{100} = 2.6$ cfs) is conveyed in a roadside ditch to DP17 ($Q_5 = 7.0$ cfs $Q_{100} = 32.6$ cfs) and discharges into Pond C. Water quality and detention for Basin C4 is provided in Pond C.

Basin C5 is 0.3 acres of large lot residential and roadside ditch. Basin C5 stormwater ($Q_5 = 0.4$ cfs $Q_{100} = 1.0$ cfs) is conveyed in a roadside ditch to DP16 ($Q_5 = 6.1$ cfs $Q_{100} = 29.8$ cfs). At DP16, a 30" RCP culvert conveys the flow under Road C to Pond C. Water quality and detention for Basin C5 is provided in Pond C.

Basin C6 is 0.5 acres of roadway, undeveloped area and roadside ditch. Basin C6 stormwater ($Q_5 = 0.5$ cfs $Q_{100} = 1.5$ cfs) is conveyed in a roadside ditch to DP17 ($Q_5 = 7.0$ cfs $Q_{100} = 32.6$ cfs) and discharges into Pond C. Water quality and detention for Basin C6 is provided in Pond C.

Basin E:

Basin OE1 is 33.7 acres of offsite, undeveloped area and offsite, large lot residential area. Basin OE1 will remain as is and will not be disturbed by the project development. Basin OE1 stormwater ($Q_5 = 1.9$ cfs $Q_{100} = 41.9$ cfs) follows historic drainage patterns towards DP22 ($Q_5 = 1.9$ cfs $Q_{100} = 41.9$ cfs), an existing stock pond adjacent to Ayer Road. Based upon field survey, there is no drainage structure present that conveys DP22 flows under Ayer Road. Stormwater in the stock pond would overtop the northern berm and flow across Ayer Road into Basin E2. Basin OA1 is excluded from water quality and detention as it is an offsite area that will remain undisturbed.

Basin E2 is 7.1 acres of large lot residential, roadway and undeveloped area. Basin E2 stormwater ($Q_5 = 2.4$ cfs $Q_{100} = 12.6$ cfs) combines with Basin OE1 and is conveyed in Existing Tributary E1 to DP23 ($Q_5 = 3.2$ cfs $Q_{100} = 44.8$ cfs) where a 36" RCP culvert conveys the flow under Road C to Proposed Swale E1. Basin E2 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. Additionally, Basin E2 includes a total of 0.02 acres of paved roadway that will not be detained. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin E3 is 1.9 acres of large lot residential, roadway and undeveloped area. Basin E3 stormwater ($Q_5 = 1.3$ cfs $Q_{100} = 4.9$ cfs) is conveyed in a roadside ditch to DP24 ($Q_5 = 1.3$ cfs $Q_{100} = 4.9$ cfs) where an 18" RCP culvert conveys DP24 under Road D and to Pond E1. Water quality and detention for Basin E3 is provided in Pond E1.

Basin E4 is 7.6 acres of large lot residential, roadway and undeveloped area. Basin E4 stormwater ($Q_5 = 2.6$ cfs $Q_{100} = 12.3$ cfs) is conveyed in a roadside ditch to DP25 ($Q_5 = 2.6$ cfs $Q_{100} = 12.3$ cfs) where a 24" RCP culvert conveys DP25 under Road C to Pond E1. Water quality and detention for Basin E4 is provided in Pond E1.

Basin E5 is 0.8 acres of large lot residential, roadway and undeveloped area. Basin E5 stormwater ($Q_5 = 0.7$ cfs $Q_{100} = 1.9$ cfs) is conveyed in a roadside ditch to DP26 ($Q_5 = 4.1$ cfs $Q_{100} = 17.7$ cfs) and discharges into Pond E1. Water quality and detention for Basin E5 is provided in Pond E1.

Basin E6 is 11.6 acres of large lot residential and undeveloped area. Basin E6 stormwater ($Q_5 = 3.3$ cfs $Q_{100} = 17.8$ cfs) is captured in Proposed Swale E1 and is conveyed to DP28 ($Q_5 = 6.5$ cfs $Q_{100} = 53.8$ cfs) where it combines with DP27 flow. Basin E6 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B –

Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin E7 is 3.2 acres of large lot residential, roadway and undeveloped area. Basin E7 stormwater ($Q_5 = 1.6$ cfs $Q_{100} = 6.5$ cfs) is conveyed in a roadside ditch to DP29 ($Q_5 = 1.6$ cfs $Q_{100} = 6.5$ cfs) and discharges into Pond E2. Water quality and detention for Basin E7 is provided in Pond E2.

Basin E8 is 1.0 acres of large lot residential, roadway and undeveloped area. Basin E8 stormwater ($Q_5 = 1.0$ cfs $Q_{100} = 2.8$ cfs) is conveyed in a roadside ditch to DP30 ($Q_5 = 2.5$ cfs $Q_{100} = 9.2$ cfs) and discharges into Pond E2. Water quality and detention for Basin E8 is provided in Pond E2.

Basin E9 is 1.4 acres of large lot residential, roadway and undeveloped area. Basin E9 stormwater ($Q_5 = 1.1$ cfs $Q_{100} = 3.3$ cfs) is conveyed in a roadside ditch to DP32 ($Q_5 = 1.1$ cfs $Q_{100} = 3.3$ cfs) where an 18" RCP culvert conveys the flow under Road C and into Pond E3. Water quality and detention for Basin E9 is provided in Pond E3.

Basin E10 is 1.5 acres of large lot residential, roadway and undeveloped area. Basin E10 stormwater ($Q_5 = 1.0$ cfs $Q_{100} = 3.2$ cfs) is conveyed in a roadside ditch to DP33 ($Q_5 = 2.0$ cfs $Q_{100} = 6.4$ cfs) and into Pond E3. Water quality and detention for Basin E10 is provided in Pond E3.

Basin E11 is 6.6 acres of large lot residential and undeveloped area. Basin E11 stormwater ($Q_5 = 1.9$ cfs $Q_{100} = 10.2$ cfs) is captured in Proposed Swale E1 and conveyed to DP34 ($Q_5 = 7.8$ cfs $Q_{100} = 59.2$ cfs) where it combines with DP31 and DP32. At DP34, a 36" RCP culvert conveys the flow under Road C and towards DP35. Basin E11 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin E12 is 11.9 acres of large lot residential and undeveloped area. Basin E12 stormwater ($Q_5 = 3.4$ cfs $Q_{100} = 18.4$ cfs) is captured in Proposed Swale E1 and conveyed to DP34 ($Q_5 = 7.8$ cfs $Q_{100} = 59.2$ cfs) where it combines with DP31 and DP32. At DP34, a 36" RCP culvert conveys the flow under Road C and towards DP35. Basin E12 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin E13 is 0.4 acres of large lot residential, roadway and undeveloped area. Basin E13 stormwater ($Q_5 = 0.5$ cfs $Q_{100} = 1.4$ cfs) is conveyed in Existing Tributary E to DP35 ($Q_5 = 7.9$ cfs $Q_{100} = 59.8$ cfs) and is not detained in a water quality and detention pond. Basin E13 includes a total of 0.09 acres of paved roadway that will not be detained. The remaining basin area is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin E14 is 2.6 acres of large lot residential, roadway and undeveloped area. Basin E14 stormwater ($Q_5 = 1.6$ cfs $Q_{100} = 5.9$ cfs) is conveyed in a roadside ditch to DP37 ($Q_5 = 1.6$ cfs $Q_{100} = 5.9$ cfs) where an 18" RCP culvert

conveys the flow under Road E and towards DP38. Water quality and detention for Basin E14 is provided in Pond E4.

Basin E15 is 9.6 acres of large lot residential, roadway and undeveloped area. Basin E15 stormwater ($Q_5 = 3.1$ cfs $Q_{100} = 14.2$ cfs) is conveyed in a roadside ditch to DP38 ($Q_5 = 4.8$ cfs $Q_{100} = 22.4$ cfs) and continues in a roadside ditch to DP40. Water quality and detention for Basin E15 is provided in Pond E4.

Basin E16 is 4.2 acres of large lot residential, roadway and undeveloped area. Basin E16 stormwater ($Q_5 = 1.9$ cfs $Q_{100} = 8.3$ cfs) is conveyed in a roadside ditch to DP40 ($Q_5 = 6.0$ cfs $Q_{100} = 25.9$ cfs) and continues in a roadside ditch to DP41 at Pond E4. Water quality and detention for Basin E16 is provided in Pond E4.

Basin E17 is 2.1 acres of large lot residential, roadway and undeveloped area. Basin E17 stormwater ($Q_5 = 1.6$ cfs $Q_{100} = 4.5$ cfs) is conveyed in a roadside ditch to DP39 ($Q_5 = 1.6$ cfs $Q_{100} = 4.5$ cfs) where an 18" RCP culvert conveys the flow under Road C to DP40. Water quality and detention for Basin E17 is provided in Pond E4.

Basin E18 is 2.4 acres of large lot residential, roadway and undeveloped area. Basin E18 stormwater ($Q_5 = 1.6$ cfs $Q_{100} = 5.9$ cfs) is conveyed in a roadside ditch to DP41 ($Q_5 = 6.1$ cfs $Q_{100} = 26.1$ cfs) and into Pond E4. Water quality and detention for Basin E18 is provided in Pond E4.

Basin E19 is 8.8 acres of large lot residential and undeveloped area. Basin E19 stormwater ($Q_5 = 3.4$ cfs $Q_{100} = 18.5$ cfs) is captured in Existing Tributary E and is conveyed to DP42 ($Q_5 = 11.1$ cfs $Q_{100} = 75.1$ cfs) where it flows offsite towards Black Squirrel Creek. Basin E19 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin OE2 is 3.6 acres of offsite, undeveloped area and offsite, large lot residential area. Basin OE2 will remain as is and will not be disturbed by the project development. Basin OE2 stormwater ($Q_5 = 1.1$ cfs $Q_{100} = 6.2$ cfs) follows historic drainage patterns to DP36 ($Q_5 = 1.6$ cfs $Q_{100} = 5.9$ cfs) where it flows into Basin E15. Water quality and detention for Basin OE2 is provided in Pond E4.

Basin F:

Basin F1 is 3.3 acres of large lot residential, roadway and undeveloped area. Basin F1 stormwater ($Q_5 = 1.7$ cfs $Q_{100} = 6.6$ cfs) is conveyed in a roadside ditch to DP43 ($Q_5 = 2.5$ cfs $Q_{100} = 8.9$ cfs) and into Pond F. Water quality and detention for Basin F1 is provided in Pond F.

Basin F2 is 0.9 acres of large lot residential, roadway and undeveloped area. Basin F2 stormwater ($Q_5 = 0.8$ cfs $Q_{100} = 2.3$ cfs) is conveyed in a roadside ditch to DP43 ($Q_5 = 2.5$ cfs $Q_{100} = 8.9$ cfs) and into Pond F. Water quality and detention for Basin F2 is provided in Pond F.

Basin F3 is 8.8 acres of large lot residential and undeveloped area. Basin F3 stormwater ($Q_5 = 1.7$ cfs $Q_{100} = 10.9$ cfs) is conveyed to DP44 ($Q_5 = 44.8$ cfs $Q_{100} = 136.2$ cfs) where it flows into Black Squirrel Creek. Basin F3 is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A

table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Miscellaneous Basins:

Basin H is 7.0 acres of large lot residential, undeveloped area and Black Squirrel Creek. Basin H stormwater ($Q_5 = 2.0$ cfs $Q_{100} = 11.8$ cfs) follows historic drainage patterns to DP45 ($Q_5 = 2.0$ cfs $Q_{100} = 11.8$ cfs) in Black Squirrel Creek and then flows offsite. Basin H is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin I is 4.8 acres of large lot residential, undeveloped area and Black Squirrel Creek. Basin I stormwater ($Q_5 = 1.5$ cfs $Q_{100} = 8.4$ cfs) follows historic drainage patterns to DP47 ($Q_5 = 1.5$ cfs $Q_{100} = 8.4$ cfs) in Black Squirrel Creek and then flows offsite. Basin I is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin J is 9.5 acres of undeveloped area and Black Squirrel Creek. This area will not be developed and will remain in its historic condition. Basin J stormwater ($Q_5 = 0.2$ cfs $Q_{100} = 7.3$ cfs) follows historic drainage patterns and is conveyed in Black Squirrel Creek to DP46 ($Q_5 = 0.2$ cfs $Q_{100} = 7.3$ cfs). Basin F3 is excluded from water quality treatment as no development will occur in this basin.

Basin K is 4.7 acres of large lot residential and undeveloped area. Basin K stormwater ($Q_5 = 1.5$ cfs $Q_{100} = 8.4$ cfs) follows historic drainage patterns to DP49 ($Q_5 = 1.5$ cfs $Q_{100} = 4.8$ cfs) and flows easterly offsite. Basin K is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

Basin L is 2.4 acres of large lot residential and undeveloped area. Basin L stormwater ($Q_5 = 1.0$ cfs $Q_{100} = 5.4$ cfs) follows historic drainage patterns to DP48 ($Q_5 = 1.0$ cfs $Q_{100} = 5.4$ cfs) and flows northerly offsite. Basin L is excluded from water quality treatment per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites. A table is provided in the 'Water Quality and Detention' section that details the negligible increase in 100-year flow resulting from undetained, large lot residential areas.

III. Drainage Design Criteria

a. Development Criteria Reference

The drainage analysis follows the criteria from the "Drainage Criteria Manual County of El Paso, Colorado" Volumes 1 and 2," as amended.

b. Hydrologic Criteria

Onsite drainage analysis included the 5-year storm (minor event) and 100-year storm (major event) using the Rational Method per EPCDCM Chapter 5 – Storm Runoff Method of Analysis.

d. Hydraulic Criteria

Hydraulic criteria for channel analysis are obtained from EPCDCM Chapter 9 – Culvert Design & Chapter 10 - Open Channels and Structures.

IV. Drainage Facility Design

a. General Concept

In the proposed condition, the site will be subdivided into eighty-four (84) 2.5+ acre lots with public, rural local roadways. Lots will not be developed at this time. However, to account for future home building, proposed lot areas are analyzed for their future condition. Roadway flow and tributary portions of lot area are captured in roadside swales and conveyed to full spectrum water quality and detention ponds (FSD ponds). Where grade allows, roadside ditches discharge directly into FSD ponds down grouted riprap rundowns. Otherwise, roadside ditch flows are captured in Type C inlets and piped into the FSD ponds. A total of 8 FSD ponds provide water quality treatment and detention for the site. Portions of lots that do not drain towards proposed roadways will follow historic drainage patterns to the drainageway tributaries. See 'Water Quality & Detention' section below for additional information.

b. Water Quality & Detention

Historically, undeveloped site area drains directly to the onsite drainageways and Black Squirrel Creek. In the proposed condition, road profiles are designed to direct developed lot area towards roadside ditches. Due to the size and variability of existing grade on the proposed lots, not all lot area drains towards the proposed roadways. In this scenario, those lot areas will utilize the EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites water quality exclusion. However, the exclusion does not relinquish detention requirements for developed area. However, based upon proposed condition Rational Method calculations, the development of the site has a marginal increase on peak flows in the 5-year and 100-year scenarios. The table below compares the ultimate discharge to Black Squirrel Creek between the existing and proposed conditions. The marginal increase in flows will not adversely affect downstream drainageways and associated facilities.

EXISTING V. PROPOSED FLOW COMPARISON – DESIGN POINT BSC		
CONDITION	Q_{5-YR}	Q_{100-YR}
EXISTING	68.3	295.9
PROPOSED	75.0	311.8
% Difference	9.8%	5.4%

Water quality and detention for captured roadway and large lot residential areas are provided in a total of 8 FSD ponds. See below for pond descriptions.

Pond A: Pond A is located at the northern end of Road A. Pond A provides water quality and detention for Basin A1 and A2, a total of 5.50 acres at 17.8% impervious. The WQCV is 0.049 ac-ft, the EURV is 0.048 ac-ft, and the 100-year volume is 0.174 ac-ft. The WQCV, EURV and 100-year storms are released in 40, 61 and 70 hours, respectively. A riprap impact stilling basin is provided at the proposed swale outfall into the pond. A riprap trickle channel conveys flow towards the outlet structure. A 10' maintenance road is provided to the bottom of the pond to facilitate future maintenance of the pond facilities. A 3' riprap emergency overflow spillway conveys the developed, peak 100-yr flow rate with 1.0' of freeboard towards Proposed Swale A. Final calculations for forebay, trickle channel, riprap and spillway sizing will be provided during the Final Drainage Report phase.

Pond B: Pond B is located along the northern portion of Road C. Pond B provides water quality and detention for Basin B1 and B8, a total of 23.50 acres at 18.4% impervious. The WQCV is 0.213 ac-ft, the EURV is 0.213 ac-ft, and the 100-year volume is 0.751 ac-ft. The WQCV, EURV and 100-year storms are released in 40, 59 and 53 hours, respectively. A riprap impact stilling basin is provided at the proposed swale outfall into the pond. A riprap trickle channel conveys flow towards the outlet structure. A 10' maintenance road is provided to the bottom of the pond to facilitate future maintenance of the pond facilities. A 13' riprap emergency overflow spillway conveys the developed, peak 100-yr flow rate with 1.0' of freeboard towards Existing Tributary C. Final calculations for forebay, trickle channel, riprap and spillway sizing will be provided during the Final Drainage Report phase.

Pond C: Pond C is located within Existing Tributary C. Pond C provides water quality and detention for Basin OC1 and Basins C2-C6, a total of 22.30 acres at 11.5% impervious. The WQCV is 0.140 ac-ft, the EURV is 0.104 ac-ft, and the 100-year volume is 0.636 ac-ft. The WQCV, EURV and 100-year storms are released in 40, 53 and 42 hours, respectively. A riprap impact stilling basin is provided at the proposed swale outfall into the pond. A riprap trickle channel conveys flow towards the outlet structure. A 10' maintenance road is provided to the bottom of the pond to facilitate future maintenance of the pond facilities. A 16' riprap emergency overflow spillway conveys the developed, peak 100-yr flow rate with 1.0' of freeboard towards Proposed Swale C1. Final calculations for forebay, trickle channel, riprap and spillway sizing will be provided during the Final Drainage Report phase.

Pond E1: Pond E1 is located adjacent to Proposed Swale E1. Pond E1 provides water quality and detention for Basins E3-E5, a total of 10.30 acres at 13.5% impervious. The WQCV is 0.074 ac-ft, the EURV is 0.060 ac-ft, and the 100-year volume is 0.306 ac-ft. The WQCV, EURV and 100-year storms are released in 40, 57 and 50 hours, respectively. A riprap impact stilling basin is provided at the proposed swale outfall into the pond. A riprap trickle channel conveys flow towards the outlet structure. A 10' maintenance road is provided to the bottom of the pond to facilitate future maintenance of the pond facilities. A 6' riprap emergency overflow spillway conveys the developed, peak 100-yr flow rate with 1.0' of freeboard towards Proposed Swale E1. Final calculations for forebay, trickle channel, riprap and spillway sizing will be provided during the Final Drainage Report phase.

Pond E2: Pond E2 is located at the north end of Road D. Pond E2 provides water quality and detention for Basins E3-E5, a total of 4.20 acres at 19.6% impervious. The WQCV is 0.040 ac-ft, the EURV is 0.042 ac-ft, and the 100-year volume is 0.136 ac-ft. The WQCV, EURV and 100-year storms are released in 40, 59 and 53 hours, respectively. A riprap impact stilling basin is provided at the proposed swale outfall into the pond. A

riprap trickle channel conveys flow towards the outlet structure. A 10' maintenance road is provided to the bottom of the pond to facilitate future maintenance of the pond facilities. A 6' riprap emergency overflow spillway conveys the developed, peak 100-yr flow rate with 1.0' of freeboard towards Proposed Swale E1. Final calculations for forebay, trickle channel, riprap and spillway sizing will be provided during the Final Drainage Report phase.

Pond E3: Pond E3 is located to the west of Road F. Pond E3 provides water quality and detention for Basins E9 & E10, a total of 2.9 acres at 26.3% impervious. The WQCV is 0.034 ac-ft, the EURV is 0.044 ac-ft, and the 100-year volume is 0.100 ac-ft. The WQCV, EURV and 100-year storms are released in 40, 64 and 65 hours, respectively. A riprap impact stilling basin is provided at the proposed swale outfall into the pond. A riprap trickle channel conveys flow towards the outlet structure. A 10' maintenance road is provided to the bottom of the pond to facilitate future maintenance of the pond facilities. A 2' riprap emergency overflow spillway conveys the developed, peak 100-yr flow rate with 1.0' of freeboard towards Existing Tributary E, north of Road C. Final calculations for forebay, trickle channel, riprap and spillway sizing will be provided during the Final Drainage Report phase.

Pond E4: Pond E4 is located at the north end of Road F. Pond E4 provides water quality and detention for Basins OE2 and Basins E14-18, a total of 24.5 acres at 14% impervious. The WQCV is 0.180 ac-ft, the EURV is 0.151 ac-ft, and the 100-year volume is 0.733 ac-ft. The WQCV, EURV and 100-year storms are released in 40, 52 and 41 hours, respectively. A riprap impact stilling basin is provided at the proposed swale outfall into the pond. A riprap trickle channel conveys flow towards the outlet structure. A 10' maintenance road is provided to the bottom of the pond to facilitate future maintenance of the pond facilities. A 13' riprap emergency overflow spillway conveys the developed, peak 100-yr flow rate with 1.0' of freeboard towards Existing Tributary E, north of Road C. Final calculations for forebay, trickle channel, riprap and spillway sizing will be provided during the Final Drainage Report phase.

Pond F: Pond F is located at the north end of Road B. Pond F provides water quality and detention for Basins F1 – F2, a total of 4.20 acres at 20% impervious. The WQCV is 0.040 ac-ft, the EURV is 0.043 ac-ft, and the 100-year volume is 0.137 ac-ft. The WQCV, EURV and 100-year storms are released in 40, 60 and 56 hours, respectively. A riprap impact stilling basin is provided at the proposed swale outfall into the pond. A riprap trickle channel conveys flow towards the outlet structure. A 10' maintenance road is provided to the bottom of the pond to facilitate future maintenance of the pond facilities. A 3' riprap emergency overflow spillway conveys the developed, peak 100-yr flow rate with 1.0' of freeboard towards Existing Tributary A2. Final calculations for forebay, trickle channel, riprap and spillway sizing will be provided during the Final Drainage Report phase.

c. Major Drainageways

Black Squirrel Creek crosses onto the site along the western property boundary. This reach of Black Squirrel Creek is included in the CWCB Base Level Engineering Study (CWCB BLE) by AECOM. The model is utilized to evaluate the existing stability of Black Squirrel Creek. Per the CWCB BLE, the 10-year and 100-year flow in Black Squirrel Creek for the onsite reach is 209 cfs and 1,209 cfs, respectively. The CWCB BLE flow rates include the tributary site area. Cross sectional output tables from the CWCB BLE are included in Appendix C for both the 10-year and 100-year scenarios.

Reaches 263886 - 267793 are within the site boundary. See table below for summary of hydraulic parameters from the 10-year and 100-year AECOM analysis of Black Squirrel Creek.

Black Squirrel Creek - Cross Section Summary Table								
Reach	10-year Depth, ft	10-year Avg. Velocity, ft/s	10-yr Shear Stress, lbs/sq. ft.	Froude, 5-yr	100-year Depth, ft	100-year Avg. Velocity, ft/s	100-yr Shear Stress, lbs/sq. ft.	Froude, 100-yr
267793	1.23	6.37	1.32	1.02	2.97	8.16	1.62	0.70
267383	1.89	4.01	0.5	0.26	3.95	8.14	1.48	0.52
266904	1.17	5.96	1.17	0.94	3.29	9.98	2.33	0.94
266414	1.41	3.6	0.4	0.29	2.9	6.32	0.98	0.43
265800	0.97	5.65	1.12	1.02	3.15	9.64	2.21	0.92
265413	1.43	4.4	0.60	0.42	3.6	9.39	2.0	0.76
264977	0.93	4.49	0.7	0.67	2.57	8.74	1.94	0.92
264577	0.74	3.13	0.4	0.41	1.91	6.92	1.34	0.78
264187	0.5	4	0.7	0.99	1.56	7.13	1.52	1.01
263886	1.58	7.12	1.53	1.00	5.32	10.34	2.16	0.62

The AECOM model indicates that there are unstable reaches of Black Squirrel Creek within the project boundary. However, further investigation and analysis is required to determine the limits of required and suitable stability measures. Based upon a trapping study approximately 2 miles downstream of the site, Preble's Jumping Mouse habitat has been identified. Coordination is ongoing with United States Fish and Wildlife Service to determine if Preble's Jumping Mouse are present within the on-site reaches. The presence of Preble's Jumping Mouse limits the allowable disturbance and stabilization measures that would be approvable, on a federal level. Additionally, the on-site portion of Black Squirrel Creek has been identified to contain jurisdictional wetlands throughout. Jurisdictional wetlands present additional challenges and limits the allowable stabilization measures. We recommend a channel walk with the Stormwater Department from El Paso County to further evaluate the existing channel stability, ecological concerns and any proposed mitigation measures.

The onsite reach of Black Squirrel Creek is classified as Zone A. Base flood elevations, interpolated from the AECOM HEC RAS model, are shown on the proposed drainage map.

In addition to Black Squirrel Creek, there are four existing tributaries that convey stormwater north through the site. These tributaries convey onsite and offsite flow to Black Squirrel Creek.

Existing Tributary A: In the existing condition, Existing Tributary A conveys offsite and onsite flow northerly through the site and to Black Squirrel Creek. At the upstream limit Camelot Subdivision DP-6 Pond discharges into the tributary. To accommodate the proposed subdivision lot boundaries, the tributary is routed around the western and northern limits of Basin A3 as Proposed Swale A. Proposed Swale A will continue to bypass the existing discharge from the Camelot Subdivision DP-6 Pond, in addition to the

discharge from on-site Pond A. Where the tributary crosses offsite along the northern boundary of Basin A3, the proposed swale will tie into the existing tributary for the offsite portion. Once the tributary crosses back on site at DP6, it combines with Proposed Swale A2. The existing stock pond located within Existing Tributary A will be removed and a proposed 48" RCP storm sewer will capture the flow at the Road B crossing and pipe flows the remaining distance to its historic outfall at Black Squirrel Creek. Cross sectional output tables for Proposed Swale A are presented in Appendix C.

Existing Tributary A2: In the existing condition, Existing Tributary A2 conveys offsite and onsite flow northerly through the site and to Black Squirrel Creek. At the upstream limit, Antler Ridge Estates DP UBS-2 Pond discharges into the tributary. To accommodate the proposed subdivision lot boundaries, the tributary is routed around the western limits of Basin A7 as Proposed Swale A2. Proposed Swale A2 will continue to bypass the existing discharge from the Antler Ridge Estates DP UBS-2 Pond, in addition to the discharge from on-site areas. Proposed Swale A2 combines with Proposed Swale A at DP6. A proposed 48" RCP storm sewer will capture the combined flow at the Road B crossing and pipe flows the remaining distance to its historic outfall at Black Squirrel Creek. Cross sectional output tables for Proposed Swale A2 are presented in Appendix C.

Existing Tributary C: In the existing condition, Existing Tributary C conveys offsite and onsite flow northerly through the site and to Black Squirrel Creek. To accommodate the proposed subdivision lot boundaries, Existing Tributary C flows are picked up in a 30" RCP culvert and piped into Pond C. Pond C discharges into Proposed Swale C1 and is routed along rear property lines through Basin B9. At DP19, Proposed Swale C is captured in a 36" RCP culvert and piped the remaining distance to its historic outfall at Black Squirrel Creek. Cross sectional output tables for Proposed Swale C are presented in Appendix C.

Existing Tributary E: In the existing condition, Existing Tributary E conveys offsite and onsite flow northerly through the site and to Black Squirrel Creek. To accommodate the proposed subdivision lot boundaries, Existing Tributary E flows are picked up in a 36" RCP culvert at DP23 and piped to Proposed Swale E1, which follows rear lot lines through Basin E6, E11 and E12. Pond E1 discharges into Proposed Swale E1. At DP34, Proposed Swale E1 is captured in a 36" RCP culvert and piped into the existing channel section, north of Road C where it follows historic drainage patterns to its existing outfall in Black Squirrel Creek. Cross sectional output tables for Proposed Swale E1 are presented in Appendix C.

d. Operations & Maintenance

An Operations and Maintenance Manual will not be provided during the Final Drainage Report phase to detail maintenance intervals and required actions to maintain the stormwater facilities.

e. Grading & Erosion Control Plan

A Grading and Erosion Control plan will be provided during the Final Drainage Report phase of the project.

f. Four Step Method

Step 1 – Reducing Runoff Volumes: Roof drains should route across landscape areas whenever possible to promote infiltration. In addition, grass lined swales will capture and convey developed roadway and lot flows

to FSD ponds. Furthermore, existing, vegetated drainageways convey stormwater, that cannot be captured in roadside ditches, to the historic outfall at the northeast corner of the site.

Step 2 – Treat and slowly release the WQCV: Water quality for the site is provided in 8 FSD ponds. The ponds provide water quality treatment and detention for proposed roadways and developed lot areas that drain towards roadside ditches. Portions of developed lots that do not drain towards the roadside ditches will be excluded from water quality treatment, per EPC DCM Appendix I.7.1.B – Large Lot Single Family Sites.

Step 3 – Stabilize stream channels: All new and re-development projects are required to construct or participate in the funding of channel stabilization measures. Drainage basin fees paid, at the time of platting, go towards channel stabilization with the drainage basin. However, the site is within the Upper Black Squirrel Drainage Basin which does not have established basin or bridge fees. Instead, channel stability analysis is performed for Black Squirrel Creek and the existing, onsite tributaries. See 'Major Drainageway' section and Appendix C for channel analysis.

Step 4 – Consider the need for source controls: No industrial or commercial uses are proposed within this development and therefore no source controls are proposed.

g. **Drainage Basin & Bridge Fees**

The site is within the Upper Black Squirrel Drainage Basin which does not have established basin or bridge fees. Therefore, no drainage fees are required at the time of platting.

V. Summary

ANTLER'S RANGE SUBDIVISION remains consistent with pre-development drainage conditions. The proposed development will not adversely affect downstream stormwater infrastructure or surrounding developments. This report is in accordance with the latest El Paso County Drainage criteria.



VI. References

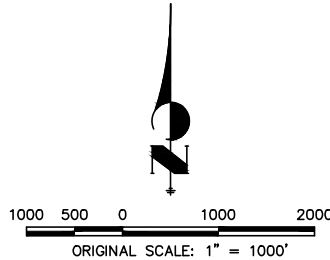
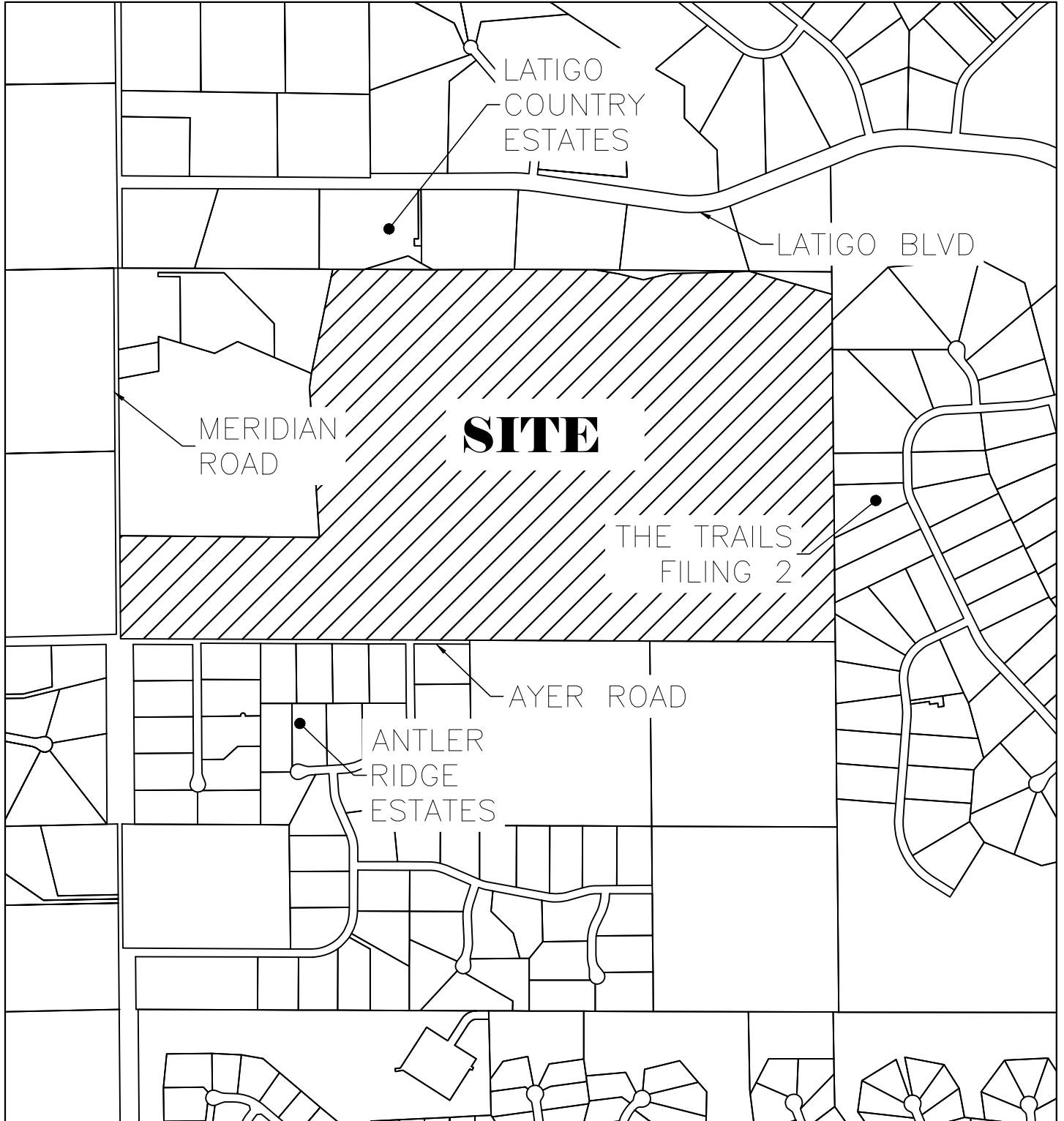
1. El Paso County – Drainage Criteria Manual, current revisions.
2. Urban Storm Drainage Criteria Manual, Mile High Flood District, March 2024.
3. Federal Emergency Management Agency, Flood Map Service Center - <https://msc.fema.gov/portal/home>, September 2024.
4. Web Soil Survey, Natural Resources Conservation Service - <https://websoilsurvey.nrcs.usda.gov/app/>, September 2024.
5. Preliminary/Final Drainage Report for Antler Ridge Estates by Merrick and Company, approved July 2006.
6. Final Drainage Report for Camelot Subdivision by Classic Consulting Engineers and Surveyors, approved March 2002.
7. Black Squirrel Creek and Snipe Creek Letter of Map Revision by Kiowa Engineering Corporation, April 2006.
8. Hydraulic Analysis Technical Support Data Notebook (TSDN) for El Paso County, Colorado by AECOM, submitted January 17th, 2025



**APPENDIX A – VICINITY MAP, FEMA MAP, NRCS WEB SOIL SURVEY & NOAA
ATLAS 14**

ANTLERS RANGE SUBDIVISION

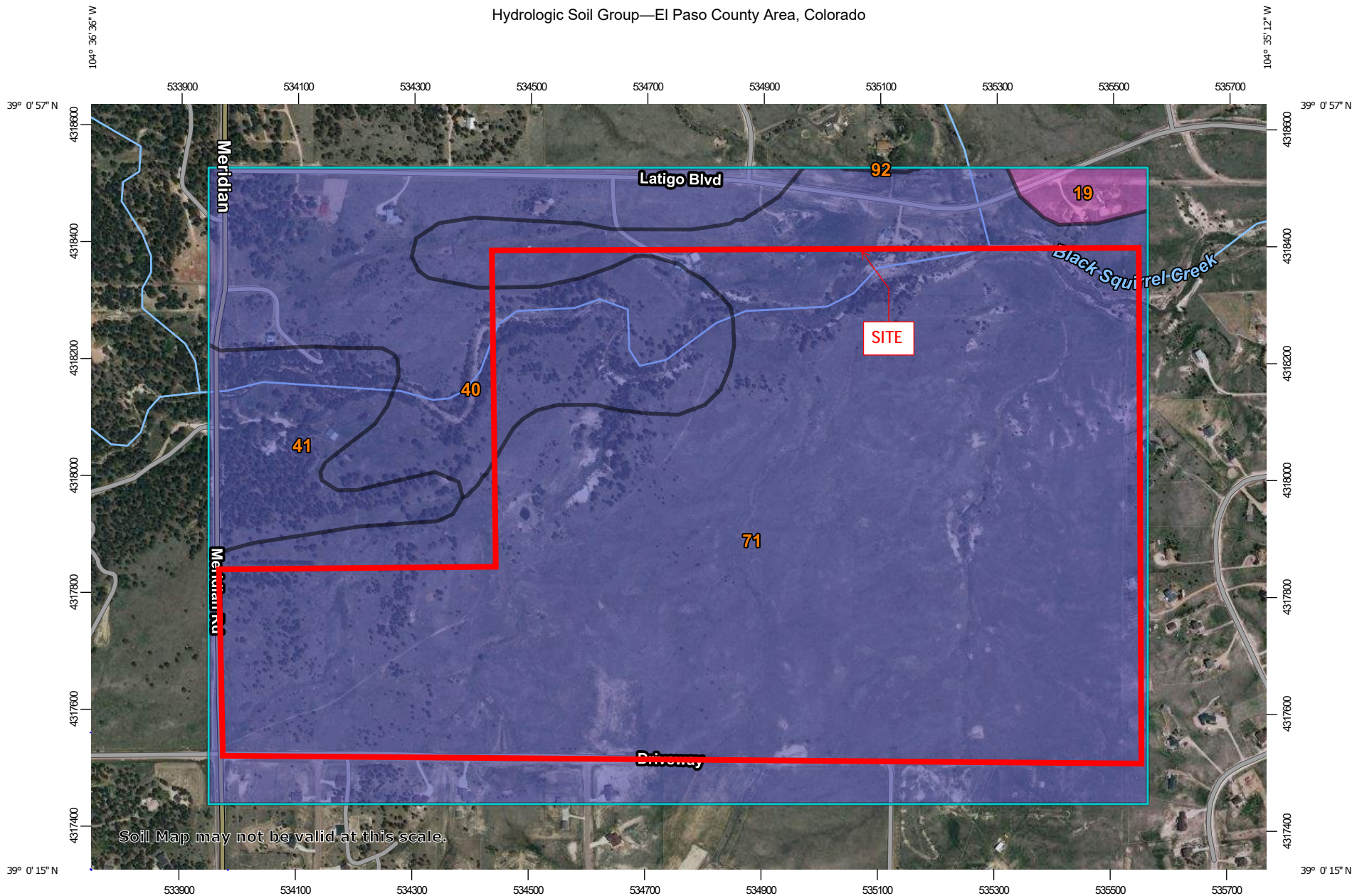
VICINITY MAP



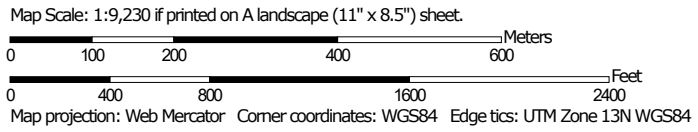
VICINITY MAP	
ANTLERS RANGE SUB.	
JOB NO. 24031	
LOCATION: EPC	SHEET
02/14/2025	
SHEET: 1	

TALL
ENGINEERING
1004 WEST VAN BUREN STREET
COLORADO SPRINGS, CO 80907

Hydrologic Soil Group—El Paso County Area, Colorado



Soil Map may not be valid at this scale.



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Lines

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Points



-  A
-  A/D
-  B
-  B/D

-  C
-  C/D
-  D
-  Not rated or not available


Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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 22, Sep 3, 2024

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	4.8	1.1%
40	Kettle gravelly loamy sand, 3 to 8 percent slopes	B	81.6	18.7%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	24.9	5.7%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	324.5	74.4%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	B	0.2	0.0%
Totals for Area of Interest			436.0	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



APPENDIX B – HYDROLOGIC CALCULATIONS

Subdivision: Antlers Range Subdivision
Location: El Paso County
Project Name: Antlers Range Subdivision
Project Number: 24031
Calculated By: REB
Checked By:
Date: 2/14/2025

EXISTING CONDITIONS - BASIN SUMMARY TABLE							
Sub-basin	Area (ac)	Impervious	C ₅	C ₁₀₀	t _c (min)	Q _{5-YR} (cfs)	Q _{100-YR} (cfs)
A	11.90	5%	0.12	0.38	31.8	3.3	18.1
B	34.90	4%	0.11	0.38	52.9	6.2	36.1
C	44.10	3%	0.10	0.36	54.1	6.7	42.9
D	20.00	2%	0.09	0.36	49.0	3.1	21.1
E	40.80	3%	0.09	0.36	43.9	7.3	47.4
F	12.00	2%	0.09	0.36	24.4	3.0	20.2
G	18.20	2%	0.09	0.36	37.4	3.5	23.6
H	9.10	2%	0.09	0.36	33.3	1.9	12.8
I	40.40	2%	0.09	0.36	43.0	7.1	47.3
J	9.50	2%	0.09	0.36	64.3	1.1	7.7
K	4.70	2%	0.09	0.36	28.1	1.1	7.3
OS-A	14.70	2%	0.09	0.36	42.3	2.6	17.5
OS-B	3.20	2%	0.09	0.36	22.3	0.8	5.7
OS-C	9.30	7%	0.12	0.39	28.1	2.9	15.7
OS-E	37.20	2%	0.09	0.36	38.0	7.3	48.0

EXISTING CONDITIONS - DESIGN POINT SUMMARY TABLE		
DP#	Q _{5-YR}	Q _{100-YR}
1	11.7	32.2
2	13.2	45.1
3	41.1	117.8
4	43.1	131.1
5	2.9	15.7
6	8.5	52.6
7	1.1	7.7
8	7.3	48.0
9	11.5	75.4
10	16.4	108.0
11	3.1	21.1
12	1.1	7.3
13	0.8	5.7
14	3.0	20.2
15	1.9	12.8
BSC	68.3	295.9

COMPOSITE % IMPERVIOUS CALCULATIONS - EXISTING CONDITIONS

Subdivision: Antlers Range Subdivision
 Location: El Paso County

Project Name: Antlers Range Subdivision
 Project No.: 24031.00
 Calculated By: REB
 Checked By: _____
 Date: 2/14/25

Basin ID	Total Area (ac)	Gravel Drives				Paved				Large Residential Lots(7%)				Undeveloped/Agriculture				Weighted C ₅ & C ₁₀₀		Basins Total Weighted % Imp.
		C ₅	C ₁₀₀	Area (ac)	% Imp.	C ₅	C ₁₀₀	Area (ac)	% Imp.	C ₅	C ₁₀₀	Area (ac)	% Imp.	C ₅	C ₁₀₀	Area (ac)	% Imp.	C ₅	C ₁₀₀	
A	11.90	0.59	0.70	0.04	80.0%	0.90	0.96	0.35	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	11.51	2.0%	0.12	0.38	5.1%
OS-A	14.70	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	14.70	2.0%	0.09	0.36	2.0%
OS-B	3.20	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	3.20	2.0%	0.09	0.36	2.0%
B	34.90	0.59	0.70	0.13	80.0%	0.90	0.96	0.64	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	34.77	2.0%	0.11	0.38	4.1%
OS-C	9.30	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	9.30	7.0%	0.09	0.36	0.00	2.0%	0.12	0.39	7.0%
C	44.10	0.59	0.70	0.45	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	43.65	2.0%	0.10	0.36	2.8%
D	20.00	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	20.00	2.0%	0.09	0.36	2.0%
OS-E	37.20	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	2.50	7.0%	0.09	0.36	34.70	2.0%	0.09	0.36	2.3%
E	40.80	0.59	0.70	0.30	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	40.50	2.0%	0.09	0.36	2.6%
F	12.00	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	12.00	2.0%	0.09	0.36	2.0%
G	18.20	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	18.20	2.0%	0.09	0.36	2.0%
H	9.10	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	9.10	2.0%	0.09	0.36	2.0%
I	40.40	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	40.40	2.0%	0.09	0.36	2.0%
J	9.50	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	9.50	2.0%	0.09	0.36	2.0%
K	4.70	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.09	0.36	4.70	2.0%	0.09	0.36	2.0%
Total	310.00																			2.7%

STANDARD FORM SF-2 - EXISTING CONDITIONS TIME OF CONCENTRATION

Subdivision: Antlers Range Subdivision
Location: El Paso County

Project Name: Antlers Range Subdivision
Project No.: 24031.00
Calculated By: REB
Checked By:
Date: 2/14/25

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					tc CHECK			FINAL
DATA						(Ti)			(Tt)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Weighted C5	Weighted C100	Impervious (%)	L (ft)	So (%)	ti (min)	Lt (ft)	St (%)	K	VEL. (ft/s)	tt (min)	COMP. tc (min)	TOTAL LENGTH (ft)	Urbanized tc (min)	
A	11.90	B	0.12	0.38	5.1%	50	2.0%	10.0	1055	2.6%	5.0	0.8	21.8	31.8	1105.0	36.3	31.8
OS-A	14.70	B	0.09	0.36	2.0%	250	3.4%	19.3	1433	2.4%	5.0	0.8	30.8	50.1	1683.0	42.3	42.3
OS-B	3.20	B	0.09	0.36	2.0%	260	3.2%	20.0	172	6.6%	5.0	1.3	2.2	22.3	432.0	26.9	22.3
B	34.90	B	0.11	0.38	4.1%	263	4.1%	18.2	2461	2.4%	5.0	0.8	53.0	71.2	2724.0	52.9	52.9
OS-C	9.30	B	0.12	0.39	7.0%	293	3.5%	20.0	576	3.9%	6.0	1.2	8.1	28.1	869.0	29.7	28.1
C	44.10	B	0.10	0.36	2.8%	277	4.7%	18.1	2973	3.4%	5.0	0.9	53.7	71.9	3250.0	54.1	54.1
D	20.00	B	0.09	0.36	2.0%	296	5.0%	18.4	2289	3.1%	5.0	0.9	43.3	61.8	2585.0	49.0	49.0
OS-E	37.20	B	0.09	0.36	2.3%	299	3.6%	20.6	1317	3.6%	5.0	0.9	23.1	43.8	1616.0	38.0	38.0
E	40.80	B	0.09	0.36	2.6%	285	7.5%	15.8	1816	3.1%	5.0	0.9	34.4	50.2	2101.0	43.9	43.9
F	12.00	B	0.09	0.36	2.0%	266	7.7%	15.2	613	4.9%	5.0	1.1	9.2	24.4	879.0	30.6	24.4
G	18.20	B	0.09	0.36	2.0%	293	3.0%	21.7	1592	5.9%	5.0	1.2	21.8	43.6	1885.0	37.4	37.4
H	9.10	B	0.09	0.36	2.0%	245	4.5%	17.4	1092	5.2%	5.0	1.1	16.0	33.3	1337.0	34.3	33.3
I	40.40	B	0.09	0.36	2.0%	299	6.3%	17.2	1834	3.6%	5.0	0.9	32.2	49.4	2133.0	43.0	43.0
J	9.50	B	0.09	0.36	2.0%	201	7.5%	13.3	2546	1.4%	5.0	0.6	71.7	85.0	2747.0	64.3	64.3
K	4.70	B	0.09	0.36	2.0%	271	5.3%	17.3	594	3.4%	5.0	0.9	10.7	28.1	865.0	31.4	28.1

NOTES:

$$t_c = t_i + t_t$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

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

Where:

t_t = channelized flow time (travel time, min)

L_t = waterway length (ft)

S_o = waterway slope (ft/ft)

V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$

K = NRCS conveyance factor (see Table 6-2).

$$\text{Eq } t_i = \frac{0.395(1.1 - C_s)\sqrt{L_i}}{S_o^{0.33}}$$

Where:

t_i = overland (initial) flow time (minutes)

C_s = runoff coefficient for 5-year frequency (from Table 6-4)

L_i = length of overland flow (ft)

S_o = average slope along the overland flow path (ft/ft).

$$\text{Equation 6-4 } t_c = 6 - 17t_i + \frac{L_t}{60(14i + 9)\sqrt{S_o}}$$

∴

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.

L_t = length of channelized flow path (ft)

i = imperviousness (expressed as a decimal)

S_o = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

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

Equation 6-3

Equation 6-5

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

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

Subdivision: Antlers Range Subdivision
Location: El Paso County
Design Storm: 5-Year

Project Name: Antlers Range Subdivision
Project No.: 24031.00
Calculated By: REB
Checked By:
Date: 2/14/25

DESCRIPTION	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
Camelot DP-6					36.7	5.05	2.18	11.0												475	0.8	9.8	Offsite Flows from Camelot Subdivision, DP-6, 11 cfs controlled release, combines w/ Basin A flows @ DP-1
	1	A	11.90	0.12	31.8	1.37	2.39	3.3	46.5	6.42	1.82	11.7							188	0.8	4.0	Runoff sheet flows to the NE, enters semi-defined flow path where flows combine @ DP-1 with controlled release from ex 30" culvert from Camelot Subdivision DP-6, flow continue to DP-2	
	2	OS-A	14.70	0.09	42.3	1.32	1.97	2.6	50.6	7.75	1.70	13.2										Runoff from off-site, sheet flows NE, combines in loosely defined flow path w/ flows from DP-1 @ DP2	
	13	OS-B	3.20	0.09	22.3	0.29	2.93	0.8														Runoff from off-site, sheet flows to E, enters on-site basin B at DP-13	
Antlers Ridge Estates UBS-2					57.6	21.89	1.50	32.9											456	0.6	12.0	Offsite Flows from Antlers Ridge Estates, DP UBS-2, 32.9 cfs controlled release, combines w/ Basin B flows @ DP-3	
	3	B	34.90	0.11	52.9	3.78	1.63	6.2	69.6	33.71	1.22	41.1										Runoff sheet flows to NE, enter loosely defined drainage, combines w/ upstream flows @ DP-3	
	5	OS-C	9.30	0.12	28.1	1.12	2.58	2.9											513	0.9	9.9	Runoff from off-site Antler Ridge Estates back of lots 54 & 55 + unplatted lot , sheet flows north to Ayer Road and enters on-site basin C, @ DP-5	
	6	C	44.10	0.10	54.1	4.19	1.60	6.7	54.1	5.31	1.60	8.5										Runoff sheet flows NE, enters semi-defined drainage and flows north to Black Squirrel Creek @ DP-6	
	11	D	20.00	0.09	49.0	1.80	1.74	3.1														Runoff sheet flows north, enters loosely defined drainage, flows north to DP-11 and enters Black Squirrel Creek	
	8	OS-E	37.20	0.09	38.0	3.42	2.13	7.3											708	0.7	16.3	Runoff from off-site un-platted lots, sheet flows NE to Ayer Road, enters on-site basin E @ DP-8.	
	9	E	40.80	0.09	43.9	3.82	1.91	7.3	54.3	7.25	1.59	11.5							208	1.1	3.2	Runoff sheet flows NE, enters loosely defined drianage and combines w/ DP-8 flows at DP-9	
	14	F	12.00	0.09	24.4	1.08	2.79	3.0														Runoff sheet flow north and enter Black Squirrel Creek @ DP-14	
	4	G	18.20	0.09	37.4	1.64	2.15	3.5	69.6	35.35	1.22	43.1										Runoff sheet flows north to defined drainage, continues in drainage to Black Squirrel Creek at DP-4	
	15	H	9.10	0.09	33.3	0.82	2.32	1.9														Runoff sheet flows North, enters Black Squirrel Creek at DP-15	
	10	I	40.40	0.09	43.0	3.64	1.94	7.1	57.5	10.88	1.50	16.4										Runoff sheet flows NE, enters semi defined drainage, flows NE and enters Black Squirrel Creek @ DP-10	
	7	J	9.50	0.09	64.3	0.86	1.34	1.1														Majority of Basin is Black Squirrel Creek, runoff sheet flows to Creek, continues off-site to DP-7	
	12	K	4.70	0.09	28.1	0.42	2.58	1.1														Runoff sheet flows to the NE, flows off-site at DP-12	
BSC	BSC								69.6	56.09	1.22	68.3										Total Flow to Black Squirrel Creek	

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

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

Project Name: Antlers Range Subdivision

Project No.: 24031.00

Calculated By: REB

Checked By:

Date: 2/14/25

Subdivision: Antlers Range Subdivision

Location: El Paso County

Design Storm: 100-Year

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE			TRAVEL TIME			REMARKS	
		Basin ID	Area (ac)	Runoff Coeff.	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)		t _r (min)
Camelot DP-6					36.7	6.02	3.66	22.0												475	0.8	9.8	Offsite Flows from Camelot Subdivision, DP-6, 11 cfs controlled release, combines w/ Basin A flows @ DP-1
	1	A	11.90	0.38	31.8	4.51	4.02	18.1	46.5	10.53	3.06	32.2							188	0.8	4.0	Runoff sheet flows to the NE, enters semi-defined flow path where flows combine @ DP-1 with controlled release from ex 30" culvert from Camelot Subdivision DP-6, flow continue to DP-2	
	2	OS-A	14.70	0.36	42.3	5.29	3.30	17.5	50.6	15.82	2.85	45.1										Runoff from off-site, sheet flows NE, combines in loosely defined flow path w/ flows from DP-1 @ DP2	
	13	OS-B	3.20	0.36	22.3	1.15	4.92	5.7														Runoff from off-site, sheet flows to E, enters on-site basin B at DP-13	
Antlers Ridge Estates UBS-2					57.6	27.46	2.52	69.2											456	0.6	12.0	Offsite Flows from Antlers Ridge Estates, DP UBS-2, 32.9 cfs controlled release, combines w/ Basin B flows @ DP-3	
	3	B	34.90	0.38	52.9	13.22	2.73	36.1	69.6	57.65	2.04	117.8										Runoff sheet flows to NE, enter loosely defined drainage, combines w/ upstream flows @ DP-3	
	5	OS-C	9.30	0.39	28.1	3.63	4.33	15.7											513	0.9	9.9	Runoff from off-site Antler Ridge Estates back of lots 54 & 55 + unplatted lot , sheet flows north to Ayer Road and enters on-site basin C, @ DP-5	
	6	C	44.10	0.36	54.1	16.03	2.68	42.9	54.1	19.66	2.68	52.6										Runoff sheet flows NE, enters semi-defined drainage and flows north to Black Squirrel Creek @ DP-6	
	11	D	20.00	0.36	49.0	7.20	2.93	21.1														Runoff sheet flows north, enters loosely defined drainage, flows north to DP-11 and enters Black Squirrel Creek	
	8	OS-E	37.20	0.36	38.0	13.47	3.57	48.0											708	0.7	16.3	Runoff from off-site un-platted lots, sheet flows NE to Ayer Road, enters on-site basin E @ DP-8.	
	9	E	40.80	0.36	43.9	14.79	3.20	47.4	54.3	28.26	2.67	75.4							208	1.1	3.2	Runoff sheet flows NE, enters loosely defined drianage and combines w/ DP-8 flows at DP-9	
	14	F	12.00	0.36	24.4	4.32	4.69	20.2														Runoff sheet flow north and enter Black Squirrel Creek @ DP-14	
	4	G	9.89	0.36	37.4	3.56	3.61	12.8	69.6	61.21	2.04	125.0										Runoff sheet flows north to defined drainage, continues in drainage to Black Squirrel Creek at DP-4	
	15	H	9.10	0.36	33.3	3.28	3.90	12.8														Runoff sheet flows North, enters Black Squirrel Creek at DP-15	
	10	I	40.40	0.36	43.0	14.54	3.26	47.3	57.5	42.80	2.52	108.0										Runoff sheet flows NE, enters semi defined drainage, flows NE and enters Black Squirrel Creek @ DP-10	
	7	J	9.50	0.36	64.3	3.42	2.24	7.7														Majority of Basin is Black Squirrle Creek, runoff sheet flows to Creek, continues off-site to DP-7	
	12	K	4.70	0.36	28.1	1.69	4.33	7.3														Runoff sheet flows to the NE, flows off-site at DP-12	
BSC	BSC								69.6	141.88	2.04	289.8										Total Flow to Black Squirrle Creek	

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

Subdivision: Antlers Subdivision Proposed
Location: El Paso County
Project Name: Antlers Subdivision Proposed
Project Number: 24031
Calculated By: REB
Checked By:
Date: 1/30/2025

PROPOSED DRAINAGE CALCS - BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
A1	4.70	15%	0.18	0.44	32.41	2.0	8.2
A2	0.80	33%	0.32	0.55	20.12	0.8	2.3
A3	4.80	10%	0.14	0.41	39.51	1.4	6.8
A4	2.10	7%	0.12	0.39	25.97	0.7	3.7
A5	13.50	10%	0.14	0.41	37.00	4.1	19.9
A6	3.70	17%	0.19	0.44	29.63	1.7	6.8
A7	11.60	9%	0.13	0.40	40.29	3.0	15.8
OA1	14.70	0%	0.02	0.35	43.13	0.6	16.7
OA2	3.20	0%	0.02	0.35	24.66	0.2	5.2
A8	1.20	6%	0.11	0.39	15.65	0.5	2.7
A9	8.30	6%	0.10	0.38	27.01	2.2	14.1
B1	1.20	22%	0.23	0.47	17.81	0.9	3.1
B2	0.40	26%	0.27	0.50	12.69	0.4	1.3
B3	3.90	16%	0.19	0.44	29.74	1.9	7.3
B4	1.20	43%	0.40	0.60	26.36	1.3	3.2
B5	6.00	12%	0.16	0.42	33.60	2.2	9.8
B6	6.60	12%	0.16	0.42	33.85	2.4	10.6
B7	2.20	31%	0.31	0.53	35.39	1.5	4.4
B8	2.00	32%	0.30	0.54	39.03	1.3	3.8
B9	30.50	7%	0.12	0.39	41.79	7.4	39.7
B10	1.40	10%	0.14	0.41	11.17	0.8	3.8
O-C1	9.30	7%	0.12	0.39	29.68	2.8	15.2
C2	10.20	10%	0.14	0.40	29.43	3.6	17.3
C3	1.00	32%	0.31	0.54	22.62	0.9	2.6
C4	1.00	32%	0.31	0.54	22.68	0.9	2.6
C5	0.30	36%	0.34	0.56	13.54	0.4	1.0
C6	0.50	25%	0.26	0.49	14.73	0.5	1.5
O-E1	33.70	1%	0.03	0.35	38.66	1.9	41.9
E2	7.10	8%	0.13	0.39	26.06	2.4	12.6
E3	1.90	18%	0.20	0.45	16.28	1.3	4.9
E4	7.60	10%	0.15	0.41	32.83	2.6	12.3
E5	0.80	33%	0.31	0.55	27.89	0.7	1.9
E6	11.60	7%	0.12	0.39	32.99	3.3	17.8
E7	3.20	15%	0.19	0.44	24.88	1.6	6.5
E8	1.00	33%	0.33	0.55	21.15	1.0	2.8
E9	1.40	28%	0.28	0.51	25.92	1.1	3.3
E10	1.50	25%	0.25	0.50	28.48	1.0	3.2
E11	6.60	8%	0.13	0.39	32.90	1.9	10.2
E12	11.90	7%	0.12	0.39	32.70	3.4	18.4
E13	0.40	28%	0.28	0.51	10.42	0.5	1.4
E14	2.60	17%	0.20	0.45	20.73	1.6	5.9
O-E2	3.60	7%	0.12	0.39	27.13	1.1	6.2
E15	9.60	11%	0.15	0.41	37.85	3.1	14.2
E16	4.20	13%	0.17	0.43	24.58	1.9	8.3
E17	2.10	34%	0.33	0.55	33.82	1.6	4.5
E18	2.40	19%	0.21	0.46	18.98	1.6	5.9
E19	8.80	7%	0.12	0.39	18.45	3.4	18.5
F1	3.30	16%	0.19	0.44	25.92	1.7	6.6
F2	0.90	35%	0.33	0.56	26.43	0.8	2.3
F3	8.80	6%	0.10	0.38	43.22	1.7	10.9
H	7.00	6%	0.11	0.39	27.49	2.0	11.8
I	4.80	7%	0.11	0.39	26.15	1.5	8.4
J	9.50	0%	0.02	0.35	65.85	0.2	7.3
K	4.70	7%	0.12	0.39	27.54	1.5	4.8
L	2.40	7%	0.12	0.39	15.64	1.0	5.4

DESIGN POINT SUMMARY TABLE		
DP#	Q _{5-YR}	Q _{100-YR}
1	2.0	8.2
2	2.6	9.9
2.1	2.6	9.9
3	11.2	31.0
4	33.6	82.3
5	33.8	91.1
6	11.3	43.5
7	40.2	120.0
8	43.8	129.5
9	1.2	4.2
10	1.3	3.2
11	4.0	13.7
12	6.7	27.4
13	7.1	27.8
14	8.1	30.9
14.1	8.1	30.9
15	2.8	15.2
16	6.1	29.8
17	7.0	32.6
18.1	7.0	32.6
19	8.7	45.0
20	14.5	67.6
21	14.7	67.6
22	1.9	41.9
23	3.2	44.8
24	1.3	4.9
25	2.6	12.3
26	4.1	17.7
26.1	4.1	17.7
27	5.8	53.4
28	6.5	53.8
29	1.6	6.5
30	2.5	9.2
30.1	2.5	9.2
31	6.8	54.8
32	1.1	3.3
33	2.0	6.4
33.1	2.0	6.4
34	7.8	59.2
35	7.9	59.8
36	1.1	6.2
37	1.6	5.9
38	4.8	22.4
39	1.6	4.5
40	6.0	25.9
41	6.1	26.1
41.1	6.1	26.1
42	11.1	75.1
43	2.5	8.9
43.1	2.5	8.9
44	44.8	136.2
45	2.0	11.8
46	0.2	7.3
47	1.5	8.4
48	1.0	5.4
BSC	119.1	311.8

COMPOSITE % IMPERVIOUS CALCULATIONS - PROPOSED CONDITIONS

Subdivision: Antlers Subdivision Proposed
 Location: El Paso County

Project Name: Antlers Subdivision Proposed
 Project No.: 24031.00
 Calculated By: REB
 Checked By:
 Date: 1/30/25

Basin ID ¹	Total Area (ac)	Gravel Drives				Paved				LARGE RESIDENTIAL LOTS (7%)				Lawns/undeveloped ²				Weighted C ₅ & C ₁₀₀		Basins Total Weighted % Imp.
		C ₅	C ₁₀₀	Area (ac)	% Imp.	C ₅	C ₁₀₀	Area (ac)	% Imp.	C ₅	C ₁₀₀	Area (ac)	% Imp.	C ₅	C ₁₀₀	Area (ac)	% Imp.	C ₅	C ₁₀₀	
A1	4.70	0.59	0.70	0.04	80.0%	0.90	0.96	0.41	100.0%	0.12	0.39	3.80	7.0%	0.02	0.35	0.44	0.0%	0.18	0.44	15.2%
A2	0.80	0.59	0.70	0.03	80.0%	0.90	0.96	0.23	100.0%	0.12	0.39	0.21	7.0%	0.02	0.35	0.34	0.0%	0.32	0.55	33.2%
Subtotal Pond A	5.50																			17.8%
A3	4.80	0.59	0.70	0.03	80.0%	0.90	0.96	0.23	100.0%	0.12	0.39	3.36	7.0%	0.02	0.35	1.18	0.0%	0.14	0.41	10.2%
A4	2.10	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	2.10	7.0%	0.02	0.35	0.00	0.0%	0.12	0.39	7.0%
A5	13.50	0.59	0.70	0.05	80.0%	0.90	0.96	0.37	100.0%	0.12	0.39	12.51	7.0%	0.02	0.35	0.57	0.0%	0.14	0.41	9.5%
A6	3.70	0.59	0.70	0.35	80.0%	0.90	0.96	0.17	100.0%	0.12	0.39	2.77	7.0%	0.02	0.35	0.41	0.0%	0.19	0.44	17.4%
A7	11.60	0.59	0.70	0.25	80.0%	0.90	0.96	0.08	100.0%	0.12	0.39	10.46	7.0%	0.02	0.35	0.81	0.0%	0.13	0.40	8.7%
OA1	14.70	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.02	0.35	14.70	0.0%	0.02	0.35	0.0%
OA2	3.20	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.02	0.35	3.20	0.0%	0.02	0.35	0.0%
A8	1.20	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	1.07	7.0%	0.02	0.35	0.13	0.0%	0.11	0.39	6.2%
A9	8.30	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	6.85	7.0%	0.02	0.35	1.45	0.0%	0.10	0.38	5.8%
B1	1.20	0.59	0.70	0.08	80.0%	0.90	0.96	0.14	100.0%	0.12	0.39	0.84	7.0%	0.02	0.35	0.14	0.0%	0.23	0.47	21.7%
B2	0.40	0.59	0.70	0.01	80.0%	0.90	0.96	0.08	100.0%	0.12	0.39	0.24	7.0%	0.02	0.35	0.07	0.0%	0.27	0.50	26.0%
B3	3.90	0.59	0.70	0.05	80.0%	0.90	0.96	0.37	100.0%	0.12	0.39	3.12	7.0%	0.02	0.35	0.36	0.0%	0.19	0.44	16.2%
B4	1.20	0.59	0.70	0.08	80.0%	0.90	0.96	0.43	100.0%	0.12	0.39	0.29	7.0%	0.02	0.35	0.40	0.0%	0.40	0.60	42.7%
B5	6.00	0.59	0.70	0.04	80.0%	0.90	0.96	0.31	100.0%	0.12	0.39	5.36	7.0%	0.02	0.35	0.29	0.0%	0.16	0.42	11.9%
B6	6.60	0.59	0.70	0.04	80.0%	0.90	0.96	0.32	100.0%	0.12	0.39	6.00	7.0%	0.02	0.35	0.24	0.0%	0.16	0.42	11.6%
B7	2.20	0.59	0.70	0.07	80.0%	0.90	0.96	0.55	100.0%	0.12	0.39	1.10	7.0%	0.02	0.35	0.47	0.0%	0.31	0.53	31.2%
B8	2.00	0.59	0.70	0.08	80.0%	0.90	0.96	0.54	100.0%	0.12	0.39	0.50	7.0%	0.02	0.35	0.89	0.0%	0.30	0.54	31.7%
Subtotal Pond B	23.50																			18.4%
B9	30.50	0.59	0.70	0.01	80.0%	0.90	0.96	0.06	100.0%	0.12	0.39	30.37	7.0%	0.02	0.35	0.06	0.0%	0.12	0.39	7.2%
B10	1.40	0.59	0.70	0.01	80.0%	0.90	0.96	0.06	100.0%	0.12	0.39	1.17	7.0%	0.02	0.35	0.17	0.0%	0.14	0.41	10.2%
O-C1	9.30	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	9.30	7.0%	0.02	0.35	0.00	0.0%	0.12	0.39	7.0%
C2	10.20	0.59	0.70	0.45	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	9.75	7.0%	0.02	0.35	0.00	0.0%	0.14	0.40	10.2%
C3	1.00	0.59	0.70	0.04	80.0%	0.90	0.96	0.26	100.0%	0.12	0.39	0.45	7.0%	0.02	0.35	0.26	0.0%	0.31	0.54	31.8%
C4	1.00	0.59	0.70	0.04	80.0%	0.90	0.96	0.26	100.0%	0.12	0.39	0.45	7.0%	0.02	0.35	0.26	0.0%	0.31	0.54	31.8%
C5	0.30	0.59	0.70	0.01	80.0%	0.90	0.96	0.09	100.0%	0.12	0.39	0.11	7.0%	0.02	0.35	0.09	0.0%	0.34	0.56	35.7%
C6	0.50	0.59	0.70	0.01	80.0%	0.90	0.96	0.09	100.0%	0.12	0.39	0.30	7.0%	0.02	0.35	0.09	0.0%	0.26	0.49	24.6%
Subtotal Pond C	22.30																			11.5%
O-E1	33.70	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	2.50	7.0%	0.02	0.35	31.20	0.0%	0.03	0.35	0.5%
E2	7.10	0.59	0.70	0.06	80.0%	0.90	0.96	0.02	100.0%	0.12	0.39	6.98	7.0%	0.02	0.35	0.04	0.0%	0.13	0.39	7.8%
E3	1.90	0.59	0.70	0.03	80.0%	0.90	0.96	0.21	100.0%	0.12	0.39	1.46	7.0%	0.02	0.35	0.20	0.0%	0.20	0.45	17.8%
E4	7.60	0.59	0.70	0.04	80.0%	0.90	0.96	0.26	100.0%	0.12	0.39	7.05	7.0%	0.02	0.35	0.25	0.0%	0.15	0.41	10.3%
E5	0.80	0.59	0.70	0.03	80.0%	0.90	0.96	0.23	100.0%	0.12	0.39	0.12	7.0%	0.02	0.35	0.42	0.0%	0.31	0.55	33.3%
Subtotal Pond E1	10.30																			13.5%
E6	11.60	0.59	0.70	0.00	80.0%	0.90	0.96	0.01	100.0%	0.12	0.39	11.58	7.0%	0.02	0.35	0.01	0.0%	0.12	0.39	7.1%
E7	3.20	0.59	0.70	0.03	80.0%	0.90	0.96	0.28	100.0%	0.12	0.39	2.68	7.0%	0.02	0.35	0.21	0.0%	0.19	0.44	15.3%
E8	1.00	0.59	0.70	0.03	80.0%	0.90	0.96	0.28	100.0%	0.12	0.39	0.48	7.0%	0.02	0.35	0.21	0.0%	0.33	0.55	33.5%
Subtotal Pond E2	4.20																			19.6%
E9	1.40	0.59	0.70	0.04	80.0%	0.90	0.96	0.30	100.0%	0.12	0.39	0.76	7.0%	0.02	0.35	0.30	0.0%	0.28	0.51	27.6%
E10	1.50	0.59	0.70	0.04	80.0%	0.90	0.96	0.30	100.0%	0.12	0.39	0.58	7.0%	0.02	0.35	0.57	0.0%	0.25	0.50	25.2%
Subtotal Pond E3	2.90																			26.3%
E11	6.60	0.59	0.70	0.01	80.0%	0.90	0.96	0.04	100.0%	0.12	0.39	6.50	7.0%	0.02	0.35	0.05	0.0%	0.13	0.39	7.7%
E12	11.90	0.59	0.70	0.01	80.0%	0.90	0.96	0.04	100.0%	0.12	0.39	11.82	7.0%	0.02	0.35	0.03	0.0%	0.12	0.39	7.3%

Basin ID ¹	Total Area (ac)	Gravel Drives				Paved				LARGE RESIDENTIAL LOTS (7%)				Lawns/undeveloped ²				Weighted C ₅ & C ₁₀₀		Basins Total Weighted % Imp.
		C ₅	C ₁₀₀	Area (ac)	% Imp.	C ₅	C ₁₀₀	Area (ac)	% Imp.	C ₅	C ₁₀₀	Area (ac)	% Imp.	C ₅	C ₁₀₀	Area (ac)	% Imp.	C ₅	C ₁₀₀	
E13	0.40	0.59	0.70	0.01	80.0%	0.90	0.96	0.09	100.0%	0.12	0.39	0.22	7.0%	0.02	0.35	0.08	0.0%	0.28	0.51	27.9%
E14	2.60	0.59	0.70	0.03	80.0%	0.90	0.96	0.26	100.0%	0.12	0.39	2.12	7.0%	0.02	0.35	0.18	0.0%	0.20	0.45	16.7%
O-E2	3.60	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	3.60	7.0%	0.02	0.35	0.00	0.0%	0.12	0.39	7.0%
E15	9.60	0.59	0.70	0.04	80.0%	0.90	0.96	0.37	100.0%	0.12	0.39	8.89	7.0%	0.02	0.35	0.30	0.0%	0.15	0.41	10.7%
E16	4.20	0.59	0.70	0.04	80.0%	0.90	0.96	0.26	100.0%	0.12	0.39	3.65	7.0%	0.02	0.35	0.26	0.0%	0.17	0.43	12.9%
E17	2.10	0.59	0.70	0.08	80.0%	0.90	0.96	0.58	100.0%	0.12	0.39	0.87	7.0%	0.02	0.35	0.57	0.0%	0.33	0.55	33.8%
E18	2.40	0.59	0.70	0.03	80.0%	0.90	0.96	0.31	100.0%	0.12	0.39	1.69	7.0%	0.02	0.35	0.37	0.0%	0.21	0.46	18.8%
Subtotal Pond E4	24.50																			14.0%
E19	8.80	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	8.80	7.0%	0.02	0.35	0.00	0.0%	0.12	0.39	7.0%
F1	3.30	0.59	0.70	0.03	80.0%	0.90	0.96	0.30	100.0%	0.12	0.39	2.75	7.0%	0.02	0.35	0.21	0.0%	0.19	0.44	15.8%
F2	0.90	0.59	0.70	0.03	80.0%	0.90	0.96	0.27	100.0%	0.12	0.39	0.21	7.0%	0.02	0.35	0.39	0.0%	0.33	0.56	35.0%
Subtotal Pond F	4.20																			20.0%
F3	8.80	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	7.18	7.0%	0.02	0.35	1.62	0.0%	0.10	0.38	5.7%
H	7.00	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	6.25	7.0%	0.02	0.35	0.75	0.0%	0.11	0.39	6.3%
I	4.80	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	4.50	7.0%	0.02	0.35	0.30	0.0%	0.11	0.39	6.6%
J	9.50	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	0.00	7.0%	0.02	0.35	9.50	0.0%	0.02	0.35	0.0%
K	4.70	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	4.70	7.0%	0.02	0.35	0.00	0.0%	0.12	0.39	7.0%
L	2.40	0.59	0.70	0.00	80.0%	0.90	0.96	0.00	100.0%	0.12	0.39	2.40	7.0%	0.02	0.35	0.00	0.0%	0.12	0.39	7.0%
Total	309.70																			8.7%

1A. Blue shaded basins are tributary/included in the Pond area and imperviousness subtotals

1B. Purple shaded basins utilize are "large lot residential" sites, exempt from water quality per ECM Appendix I.7.1.B.5

2. Lawns/Undeveloped areas include roadside ditches and/or drainage easements that will remain impervious

STANDARD FORM SF-2 - PROPOSED CONDITIONS TIME OF CONCENTRATION

Subdivision: Antlers Subdivision Proposed
 Location: El Paso County

Project Name: Antlers Subdivision Proposed
 Project No.: 24031.00
 Calculated By: REB
 Checked By: _____
 Date: 1/30/25

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					tc CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Weighted C ₅	Weighted C ₁₀₀	Impervious (%)	L (ft)	S _o (%)	t _i (min)	L _t (ft)	S _t (%)	K	VEL. (ft/s)	t _t (min)	COMP. t _c (min)	TOTAL LENGTH (ft)	Urbanized t _c (min)	
A1	4.70	B	0.18	0.44	15.2%	50	2.0%	9.3	930	1.8%	5.0	0.7	23.1	32.4	980.0	33.8	32.4
A2	0.80	B	0.32	0.55	33.2%	50	2.0%	7.9	490	1.8%	5.0	0.7	12.2	20.1	540.0	24.8	20.1
A3	4.80	B	0.14	0.41	10.2%	60	2.0%	10.7	1280	1.8%	5.0	0.7	31.8	42.5	1340.0	39.5	39.5
A4	2.10	B	0.12	0.39	7.0%	215	2.1%	20.3	360	4.5%	5.0	1.1	5.7	26.0	575.0	27.6	26.0
A5	13.50	B	0.14	0.41	9.5%	210	2.4%	18.8	1160	2.2%	5.0	0.7	26.1	44.9	1370.0	37.0	37.0
A6	3.70	B	0.19	0.44	17.4%	50	2.0%	9.3	1041	2.9%	5.0	0.9	20.4	29.6	1091.0	32.0	29.6
A7	11.60	B	0.13	0.40	8.7%	250	5.0%	16.3	1400	2.1%	5.0	0.7	32.2	48.5	1650.0	40.3	40.3
OA1	14.70	B	0.02	0.35	0.0%	270	3.4%	21.4	1433	2.4%	5.0	0.8	30.8	52.2	1703.0	43.1	43.1
OA2	3.20	B	0.02	0.35	0.0%	285	3.2%	22.4	172	6.6%	5.0	1.3	2.2	24.7	457.0	27.2	24.7
A8	1.20	B	0.11	0.39	6.2%	115	10.5%	8.8	360	3.1%	5.0	0.9	6.8	15.6	475.0	28.4	15.6
A9	8.30	B	0.10	0.38	5.8%	250	2.8%	20.3	550	7.4%	5.0	1.4	6.7	27.0	800.0	28.5	27.0
B1	1.20	B	0.23	0.47	21.7%	50	2.0%	8.8	450	2.8%	5.0	0.8	9.0	17.8	500.0	26.0	17.8
B2	0.40	B	0.27	0.50	26.0%	50	2.0%	8.4	180	2.0%	5.0	0.7	4.2	12.7	230.0	23.3	12.7
B3	3.90	B	0.19	0.44	16.2%	155	4.8%	12.2	1000	3.6%	5.0	0.9	17.6	29.7	1155.0	31.0	29.7
B4	1.20	B	0.40	0.60	42.7%	50	2.0%	7.1	1261	3.4%	5.0	0.9	22.8	29.9	1311.0	26.4	26.4
B5	6.00	B	0.16	0.42	11.9%	245	7.0%	14.0	975	2.5%	5.0	0.8	20.6	34.6	1220.0	33.6	33.6
B6	6.60	B	0.16	0.42	11.6%	260	8.4%	13.6	1104	3.1%	5.0	0.9	20.9	34.5	1364.0	33.9	33.9
B7	2.20	B	0.31	0.53	31.2%	55	2.0%	8.4	1445	1.5%	5.0	0.6	39.3	47.7	1500.0	35.4	35.4
B8	2.00	B	0.30	0.54	31.7%	50	2.0%	8.1	1756	1.4%	5.0	0.6	49.5	57.6	1806.0	39.0	39.0
B9	30.50	B	0.12	0.39	7.2%	295	7.4%	15.7	1827	3.2%	5.0	0.9	34.0	49.7	2122.0	41.8	41.8
B10	1.40	B	0.14	0.41	10.2%	85	7.0%	8.4	300	13.0%	5.0	1.8	2.8	11.2	385.0	25.6	11.2
O-C1	9.30	B	0.12	0.39	7.0%	293	3.5%	20.0	576	3.9%	5.0	1.0	9.7	29.8	869.0	29.7	29.7
C2	10.20	B	0.14	0.40	10.2%	240	6.2%	14.7	803	3.3%	5.0	0.9	14.7	29.4	1043.0	31.3	29.4
C3	1.00	B	0.31	0.54	31.8%	180	7.6%	9.8	700	3.3%	5.0	0.9	12.8	22.6	880.0	25.4	22.6
C4	1.00	B	0.31	0.54	31.8%	50	2.0%	8.0	800	3.3%	5.0	0.9	14.7	22.7	850.0	26.0	22.7
C5	0.30	B	0.34	0.56	35.7%	50	2.0%	7.7	266	2.3%	5.0	0.8	5.8	13.5	316.0	22.0	13.5
C6	0.50	B	0.26	0.49	24.6%	50	2.0%	8.6	280	2.3%	5.0	0.8	6.2	14.7	330.0	24.3	14.7
O-E1	33.70	B	0.03	0.35	0.5%	299	3.6%	21.9	1317	3.6%	5.0	0.9	23.1	45.1	1616.0	38.7	38.7

STANDARD FORM SF-2 - PROPOSED CONDITIONS TIME OF CONCENTRATION

Subdivision: Antlers Subdivision Proposed
 Location: El Paso County

Project Name: Antlers Subdivision Proposed
 Project No.: 24031.00
 Calculated By: REB
 Checked By: _____
 Date: 1/30/25

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					tc CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Weighted C ₅	Weighted C ₁₀₀	Impervious (%)	L (ft)	S _o (%)	t _i (min)	L _t (ft)	S _t (%)	K	VEL. (ft/s)	t _t (min)	COMP. t _c (min)	TOTAL LENGTH (ft)	Urbanized t _c (min)	
E2	7.10	B	0.13	0.39	7.8%	275	7.2%	15.2	564	3.0%	5.0	0.9	10.9	26.1	839.0	30.0	26.1
E3	1.90	B	0.20	0.45	17.8%	174	6.5%	11.5	244	2.9%	5.0	0.9	4.8	16.3	418.0	25.1	16.3
E4	7.60	B	0.15	0.41	10.3%	279	7.5%	14.8	889	2.7%	5.0	0.8	18.0	32.8	1168.0	32.9	32.8
E5	0.80	B	0.31	0.55	33.3%	50	2.0%	8.0	650	1.1%	5.0	0.5	20.7	28.6	700.0	27.9	27.9
E6	11.60	B	0.12	0.39	7.1%	286	4.5%	18.2	822	2.8%	5.0	0.8	16.4	34.6	1108.0	33.0	33.0
E7	3.20	B	0.19	0.44	15.3%	213	6.1%	13.3	593	2.9%	5.0	0.9	11.6	24.9	806.0	28.6	24.9
E8	1.00	B	0.33	0.55	33.5%	50	2.0%	7.8	727	2.3%	6.0	0.9	13.3	21.1	777.0	26.1	21.1
E9	1.40	B	0.28	0.51	27.6%	182	5.8%	11.2	778	3.1%	5.0	0.9	14.7	25.9	960.0	27.0	25.9
E10	1.50	B	0.25	0.50	25.2%	50	2.0%	8.6	1050	3.1%	5.0	0.9	19.9	28.5	1100.0	29.6	28.5
E11	6.60	B	0.13	0.39	7.7%	283	4.7%	17.8	991	4.0%	5.0	1.0	16.5	34.3	1274.0	32.9	32.9
E12	11.90	B	0.12	0.39	7.3%	291	6.3%	16.4	953	3.8%	5.0	1.0	16.3	32.7	1244.0	32.9	32.7
E13	0.40	B	0.28	0.51	27.9%	50	2.0%	8.3	200	10.0%	5.0	1.6	2.1	10.4	250.0	22.1	10.4
E14	2.60	B	0.20	0.45	16.7%	263	6.9%	14.0	405	4.0%	5.0	1.0	6.8	20.7	668.0	26.1	20.7
O-E2	3.60	B	0.12	0.39	7.0%	170	1.0%	23.1	170	1.5%	5.0	0.6	4.6	27.7	340.0	27.1	27.1
E15	9.60	B	0.15	0.41	10.7%	231	3.9%	16.6	1363	2.5%	5.0	0.8	28.7	45.4	1594.0	37.9	37.9
E16	4.20	B	0.17	0.43	12.9%	251	6.3%	14.6	609	4.1%	5.0	1.0	10.0	24.6	860.0	28.4	24.6
E17	2.10	B	0.33	0.55	33.8%	50	2.0%	7.8	1730	2.4%	5.0	0.8	37.2	45.1	1780.0	33.8	33.8
E18	2.40	B	0.21	0.46	18.8%	195	6.0%	12.4	471	5.7%	5.0	1.2	6.6	19.0	666.0	25.6	19.0
E19	8.80	B	0.12	0.39	7.0%	211	11.0%	11.6	470	5.3%	5.0	1.2	6.8	18.5	681.0	28.2	18.5
F1	3.30	B	0.19	0.44	15.8%	224	7.8%	12.5	510	1.6%	5.0	0.6	13.4	25.9	734.0	29.3	25.9
F2	0.90	B	0.33	0.56	35.0%	50	2.0%	7.8	750	1.8%	5.0	0.7	18.6	26.4	800.0	26.7	26.4
F3	8.80	B	0.10	0.38	5.7%	275	5.0%	17.6	1550	2.1%	5.0	0.7	35.7	53.2	1825.0	43.2	43.2
H	7.00	B	0.11	0.39	6.3%	297	5.5%	17.6	692	5.4%	5.0	1.2	9.9	27.5	989.0	30.0	27.5
I	4.80	B	0.11	0.39	6.6%	245	3.0%	19.4	395	3.8%	5.0	1.0	6.8	26.2	640.0	28.3	26.2
J	9.50	B	0.02	0.35	0.0%	201	7.5%	14.2	2546	1.4%	5.0	0.6	71.7	85.9	2747.0	65.8	65.8
K	4.70	B	0.12	0.39	7.0%	271	5.3%	16.8	594	3.4%	5.0	0.9	10.7	27.5	865.0	30.2	27.5
L	2.40	B	0.12	0.39	7.0%	200	11.5%	11.2	390	8.5%	5.0	1.5	4.5	15.6	590.0	27.0	15.6

STANDARD FORM SF-2 - PROPOSED CONDITIONS TIME OF CONCENTRATION

Subdivision: Antlers Subdivision Proposed
 Location: El Paso County

Project Name: Antlers Subdivision Proposed
 Project No.: 24031.00
 Calculated By: REB
 Checked By: _____
 Date: 1/30/25

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					tc CHECK			FINAL
DATA						(Ti)			(Tt)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Weighted Cs	Weighted C100	Impervious (%)	L (ft)	So (ft)	ti (min)	Lt (ft)	St (%)	K	VEL. (ft/s)	tt (min)	COMP. tc (min)	TOTAL LENGTH (ft)	Urbanized tc (min)	tc (min)

NOTES:

$$t_c = t_i + t_t$$

Where:

- t_c = computed time of concentration (minutes)
- t_i = overland (initial) flow time (minutes)
- t_t = channelized flow time (minutes).

Eq
$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L_i}}{S_o^{0.33}}$$

Where:

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

Equation 6-3 Table 6-2. NRCS Conveyance factors, K

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

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

Where:

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

Equation 6-4
$$t_c = (6 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_o}}$$

Where:

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

Equation 6-5

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

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

Subdivision: Antlers Subdivision Proposed
Location: El Paso County
Design Storm: 5-Year

Project Name: Antlers Subdivision Proposed
Project No.: 24031.00
Calculated By: REB
Checked By:
Date: 1/30/25

DESCRIPTION	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
Camelot DP-6					36.7	5.05	2.18	11.0												1325	1.2	17.8	Offsite Flows from Camelot Subdivision, DP-6, 11 cfs controlled release, combines w/ Basin A3 flows @ DP-3
	1	A1	4.70	0.18	32.4	0.86	2.37	2.0												60	0.8	1.3	Runoff sheet flows NE, enters roadside ditch and continues north to DP1
	2	A2	0.80	0.32	20.1	0.25	3.08	0.8	33.7	1.12	2.31	2.6											Runoff sheet flows NW, enters roadside ditch and continues north to proposed FSEDB @ DP2. combines w/ DP1 flows in Pond.
	2.1								33.7	1.12	2.31	2.6								120	1.0	2.0	Controlled release from FSEDB Pond A, continues to DP3
	3	A4	2.10	0.12	26.0	0.25	2.70	0.7															Runoff sheet flows N to DP3, combines with flows from Basin A3, and DP2.1
	3	A3	4.80	0.14	39.5	0.65	2.07	1.4															Runoff sheet flows NE, enters proposed drainage A swale, continues to DP3 and combines with flows from Basin A4 and DP2.1
	3								54.5	7.07	1.59	11.2											Total flow at DP3, continues offsite NE along existing semi-defined drainage of Basin OA1 to DP5
Antlers Ridge Estates UBS-2					57.6	21.89	1.50	32.9												200	0.6	5.3	Offsite Flows from Antlers Ridge Estates, DP UBS-2, 32.9 cfs controlled release, combines w/ Basin A5 & A6 flows @ DP-4
	4	A5	13.50	0.14	37.0	1.88	2.17	4.1															Runoff sheet flows NE, enters proposed Drainage A2 swale, continues north to DP4 where it combines with Basin A6 flows.
	4	A6	3.70	0.19	29.6	0.70	2.50	1.7															Runoff sheet flows NW, enters proposed Drainage A2 swale, continues north to DP4 where it combines with Basin A5 flows.
	4								62.9	24.47	1.37	33.6								110	0.6	3.1	Total flow in proposed Drainage A2 swale @ DP4, flows continue to DP5 where they combine with basin OA2 & A7 flows.
	5	A7	11.60	0.13	40.3	1.49	2.04	3.0															Runoff sheet flows NW, enters proposed Drainage A2 swale, continues north to DP4 where it combines with Basin A5 flows.
	5	OA2	3.20	0.02	24.7	0.06	2.78	0.2															Offsite runoff sheet flows NE, enters proposed Drainage A2 swale @ DP5, combines with flows from Basin A7 and DP4
	5								66.0	26.02	1.30	33.8								200	0.7	4.5	Total flow in proposed Drainage A2 swale @ DP5, flows continue to DP7 where they combine with flows from Basin A8 and DP6
	6	OA1	14.70	0.02	43.1	0.29	1.94	0.6															Offsite runoff , sheet flows NE, enters semi defined drainage and continues to site boundary @ DP6 and combines with flows from DP3
	6								56.6	7.36	1.53	11.3								200	0.7	4.5	Total flow in existing off-site drainage, enters site and Basin A8 at DP6, flows continue to DP7, where they combine with flows from Basin A8 & DP5
	7	A8	1.20	0.11	15.6	0.13	3.46	0.5															Runoff sheet flows SE, enters proposed Drainage A2 swale @ DP7, where it combines with flows from DP5 and DP6
	7								70.5	33.51	1.20	40.2			40.2	33.51	4.0	48	750	16.2	0.8	Total flows in proposed SE Drainage A2 swale @ DP7, enters proposed culvert and is piped to DP8, where it combines with the controlled release of FSEDB Pond F @ DP8	
	8	A9	8.30	0.10	27.0	0.85	2.64	2.2															Runoff sheet flows to existing Drainage A2 natural swale @ DP8 continue to BSC @ DP44, where they combine with DP8 piped & basin F3 flows.
	8								71.2	37.04	1.18	43.8	1.15	0.969	3	42.7	36.07	4.0	48	162	16.2	0.2	Total flows in pipe @ DP8, & Natural Drainage A2, flows continues to BSC @ DP44
	9	B1	1.20	0.23	17.8	0.28	3.26	0.9															Runoff sheet flows NE, enters roadside ditch and continues north to DP9, where it combines with flows from Basin B2

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

Subdivision: Antlers Subdivision Proposed
Location: El Paso County
Design Storm: 5-Year

Project Name: Antlers Subdivision Proposed
Project No.: 24031.00
Calculated By: REB
Checked By:
Date: 1/30/25

DESCRIPTION	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
	9	B2	0.40	0.27	12.7	0.11	3.77	0.4															runoff sheet flows SW, enters roadside ditch and continues west to DP9, where it combines with flows from Basin B1
	9								17.8	0.38	3.26	1.2								800	1.3	10.0	Total flow in roadside ditch @ DP9, enters proposed culvert and continues north to DP11, where flows combine with Basin B3 and DP10 flows.
	10	B4	1.20	0.40	26.4	0.48	2.68	1.3															runoff sheet flows NW, enters roadside ditch and continues north to DP10. Flows enter proposed culvert and continue to DP11 where they combine with flows from DP9 & Basin B3 flows.
	11	B3	3.90	0.19	29.7	0.75	2.49	1.9															runoff sheet flows NW, enters roadside ditch and continues north to DP10. Flows enter proposed culvert and continue to DP11 where they combine with flows from DP9 & Basin B3 flows.
	11								29.7	1.61	2.49	4.0								850	0.9	15.1	Total flow in roadside ditch @ DP11, flows continue in roadside ditch to DP12, where they combine with flows from Basin B5 and B6
	12	B5	6.00	0.16	33.6	0.95	2.31	2.2															runoff sheet flows north to roadside ditch, continues in ditch to DP12, where flows combine with DP11 and Basin B6 flows.
	12	B6	6.60	0.16	33.9	1.03	2.30	2.4															runoff sheet flows northeast to roadside ditch, continues in ditch to DP12, where flows combine with DP11 and Basin B5 flows.
	12								44.8	3.59	1.88	6.7								550	1.3	6.8	Total flow in roadside ditch @ DP12, flows continue in roadside ditch to DP13, where they combine with flows from basin B7
	13	B7	2.20	0.31	35.4	0.68	2.23	1.5															runoff sheet flows NE to roadside ditch, continues in ditch north and east to DP 13 where flows combine with flows from DP12
	13								51.7	4.27	1.67	7.1											Total flow in roadside ditch @ DP13, flows enter proposed culvert and continue to DP14, where they combine with Basin B8 flows in the proposed FSEDB (pond B)
	14	B8	2.00	0.30	39.0	0.61	2.09	1.3															runoff sheet flows NE to roadside ditch, continues in ditch north and east to DP 14 where flows combine with flows from DP13 in the proposed FSEDB (pond B)
	14								51.7	4.88	1.67	8.1											Total flow @ DP14 (proposed FSEDB Pond B), released through outlet full-spectrum outlet structure to DP14.1
	14.1								51.7	4.88	1.67	8.1											Controlled release from FSEDB Pond B, piped to DP20, where flows combine with piped flows from DP19
	15	O-C1	9.30	0.12	29.7	1.12	2.50	2.8												513	0.9	10.0	offsite runoff sheet flows NE to private drive (continuation of Ayer Road), enter site @ DP15 and continue through Basin C2 to DP16
	16	C2	10.20	0.14	29.4	1.44	2.51	3.6															Runoff sheet flows north and east to DP16, where they combined with flows from DP15, and Basin C3
	16	C3	1.00	0.31	22.6	0.31	2.90	0.9															Runoff sheet flows to proposed roadside ditch, continues east in ditch to DP16, where flows combine with flows from DP15, and Basin C2
	16	C5	0.30	0.34	13.5	0.10	3.67	0.4															Runoff sheet flows to proposed roadside ditch, continues west in ditch to DP16, where flows combine with flows from DP15, Basin C2, & Basin C3.
	16								39.7	2.97	2.06	6.1											Total flow @ DP16, enters proposed culvert and continue north under road to proposed FSEDB Pond C @ DP17
	17	C4	1.00	0.31	22.7	0.31	2.90	0.9															Runoff sheet flows to proposed roadside ditch, continues east in ditch to proposed FSEDB Pond C @ DP17, where flows combine with flows from DP16
	17	C6	0.50	0.26	14.7	0.13	3.55	0.5															Runoff sheet flows to proposed roadside ditch, continues west in ditch to proposed FSEDB Pond C @ DP17, where flows combine with flows from DP16 & Basin C4
	17								39.7	3.41	2.06	7.0											Total flow @ DP17 (proposed FSEDB Pond C), release to proposed Drainage C swale @ DP18.1 through full-spectrum outlet structure.

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

Subdivision: Antlers Subdivision Proposed
Location: El Paso County
Design Storm: 5-Year

Project Name: Antlers Subdivision Proposed
Project No.: 24031.00
Calculated By: REB
Checked By:
Date: 1/30/25

DESCRIPTION	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
	18.1							39.7	3.41	2.06	7.0									1450	0.8	30.0	Controlled release from FSEDB Pond C, continues in proposed Drainage C Swale to DP19, where it combines with flows from Basin B9
	19	B9	30.50	0.12	41.8	3.71	1.98	7.4															runoff sheet flows NE to proposed Drainage C Swale, continues NE to DP 19 where flows combine with controlled release from Pond C (DP18.1) and enter proposed culvert.
	19							69.7	7.11	1.22	8.7				8.7	7.11	4.0	36		220	10.6	0.3	Total flow @ DP19, enters proposed culvert and continues in pipe to DP20, where it combines with controlled release of Pond B.
	20	B10	1.40	0.14	11.2	0.20	3.96	0.8															runoff sheet flows NE to proposed Drainage C2 Swale and continues to BSC @ DP 21, where flows combine with flows from Basin B10
	20							70.0	11.99	1.21	14.5				14.5	11.99	4.0	36		220	12.3	0.3	Total flow in proposed storm pipe @ DP20, piped to BSC @ DP21, where flows combine with Basin B10 flows.
	21							70.3	12.19	1.20	14.7												Total flows to BSC @ DP21
	22	O-E1	33.70	0.03	38.7	0.92	2.10	1.9												380	0.7	9.4	offsite runoff sheet flows NE to existing low point/stock pond, enters on-site Basin E2 @ DP22, continues in existing natural drainage to proposed culvert @ DP23
	23	E2	7.10	0.13	26.1	0.89	2.69	2.4															Runoff sheet flows north east to existing natural drainage to proposed culvert @ DP23
	23							48.1	1.82	1.77	3.2									250	0.8	5.2	Total flow at DP23 from DP22 and Basin E2, enters proposed culvert and continues in proposed Drainage Swale E1 to DP27
	24	E3	1.90	0.20	16.3	0.39	3.40	1.3												375	0.5	12.5	Runoff sheet flows SE to proposed roadside ditch @ DP24, enters proposed culvert and continues in roadside ditch to proposed FSEDB Pond E1 @ DP26
	25	E4	7.60	0.15	32.8	1.11	2.35	2.6															Runoff sheet flows NE to proposed roadside ditch, flows in ditch to DP24, enters proposed culvert and combines with flows from DP24 & Basin E5 in proposed FSEDB Pond E1 @ DP26
	26	E5	0.80	0.31	27.9	0.25	2.59	0.7															Runoff sheet flows to proposed roadside ditch, flows in ditch to FSEDB Pond E1 @ DP26, where it combines with flows from DP24 & DP25
	26							32.8	1.75	2.35	4.1												Total flow @ DP26 in proposed FSEDB Pond E1. Releases through full-spectrum outlet structure to DP26.1
	26.1							32.8	1.75	2.35	4.1												Controlled release from FSEDB Pond E1, continues in proposed Drainage E1 Swale to DP27, where it combines with flows from DP23
	27							53.3	3.56	1.62	5.8									610	0.8	12.4	Total flow @ DP27 in proposed Drainage E1 Swale, continues in Swale to DP28, where it combines with Basin E6 flows.
	28	E6	11.60	0.12	33.0	1.40	2.34	3.3															Runoff sheet flows to proposed Drainage E1 Swale @ DP28, where it combines with Flows from DP 27
	28							65.6	4.96	1.31	6.5									350	0.8	7.1	Total flow in proposed Drainage E1 Swale @ DP28, continues in Swale to DP31, where it combines with flows from DP30.1
	29	E7	3.20	0.19	24.9	0.59	2.76	1.6															Runoff sheet flows NE to proposed roadside ditch, flows continue north in ditch to DP29, and then continue to the proposed FSEDB Pond E2 @ DP30, where flows combine with Basin E8 flows
	30	E8	1.00	0.33	21.1	0.33	3.01	1.0															Runoff sheet flows NE to proposed roadside ditch, flows continue north in ditch to proposed FSEDB Pond E2 @ DP30, where flows combine with Basin E7 flows
	30							24.9	0.92	2.76	2.5												Total flow to proposed FSEDB Pond E2. Flows released through full-spectrum outlet structure to DP30.1
	30.1							24.9	0.92	2.76	2.5									450	1.2	6.3	Controlled release from FSEDB Pond E2, continues to proposed Drainage E1 Swale @ DP31

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

Subdivision: Antlers Subdivision Proposed
Location: El Paso County
Design Storm: 5-Year

Project Name: Antlers Subdivision Proposed
Project No.: 24031.00
Calculated By: REB
Checked By:
Date: 1/30/25

DESCRIPTION	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
	31							72.7	5.88	1.15	6.8									540	0.9	10.1	Total flow in proposed Drainage E1 Swale @ DP31, continues in Swale to DP34, where flows combine with Basin E11 & E12 flows
	34	E11	6.60	0.13	32.9	0.83	2.34	1.9															Runoff sheet flows NW to proposed drainage E1 Swale, continues in swale to DP34, where flows combine with flows from Basin E12 & DP31
	34	E12	11.90	0.12	32.7	1.46	2.35	3.4															Runoff sheet flows NE to proposed drainage E1 Swale, continues in swale to DP34, where flows combine with flows from Basin E11 & DP31
	34								82.8	8.17	0.96	7.8								250	0.9	4.7	Total flow in proposed Drainage E1 Swale @ DP34, flows enter proposed culvert and continue in proposed swale to DP35
	32	E9	1.40	0.28	25.9	0.39	2.70	1.1															Runoff sheet flows N to proposed roadside ditch, continues in ditch east to proposed culvert @ DP32
	33	E10	1.50	0.25	28.5	0.38	2.56	1.0															Runoff sheet flows NE to proposed roadside ditch, continues in ditch east to proposed FSEDB @ DP33, where flows combine with DP32 flows
	33								28.5	0.77	2.56	2.0											Total flow to proposed FSEDB Pond E3. Flows released through full-spectrum outlet structure to DP33.1
	33.1								28.5	0.77	2.56	2.0								100	1.2	1.4	Controlled release from FSEDB Pond E3, continues to proposed Drainage E1 Swale @ DP35, where they combine with flows from DP34
	35	E13	0.40	0.28	10.4	0.11	4.07	0.5															Runoff sheet flows NE to DP35, combines with flows from DP33.1 & DP34
	35								87.5	9.05	0.88	7.9								415	1.1	6.2	Total flow in proposed Drainage E1 Swale @ DP35, flows continue in swale to DP42, where they combine with flows from Basin E19 and DP39.1
	36	O-E2	3.60	0.12	27.1	0.43	2.63	1.1												580	0.9	10.8	offsite runoff sheet flows NE to site boundary @ DP36, flows enter on-site basin E15
	37	E14	2.60	0.20	20.7	0.51	3.04	1.6												650	0.5	20.7	Runoff sheet flows to proposed roadside ditch, continues in ditch to proposed culvert @ DP37, flows continue in ditch to DP38, where they combine with flows from DP36 and basin E15
	38	E15	9.60	0.15	37.9	1.43	2.13	3.1															Runoff sheet flows to proposed roadside ditch, continues in ditch to DP38, where they combine with flows from DP37 and DP36
	38								41.4	2.38	2.00	4.8								790	1.0	13.2	Total flow in roadside ditch @ DP38, flows continue in ditch to DP40, where they combine with flows from Basin E16 & DP39
	40	E16	4.20	0.17	24.6	0.70	2.78	1.9															Runoff sheet flows NE to proposed roadside ditch, continues in ditch to DP40, where they combine with flows from DP38 & DP39
	39	E17	2.10	0.33	33.8	0.69	2.30	1.6															Runoff sheet flows to proposed roadside ditch, continues in ditch to DP39, where they enter a proposed culvert to DP40, where they combine with flows from DP38 & Basin E16
	40								54.6	3.76	1.58	6.0								320	0.9	6.2	Total flow in roadside ditch @ DP40, flows continue in ditch to proposed FSEDB Pond E4 @ DP41, where they combine with flows from Basin E18.
	41	E18	2.40	0.21	19.0	0.51	3.17	1.6															Runoff sheet flows to proposed roadside ditch, continues in ditch to proposed FSEDB @ DP41, where they combine with flows from DP40.
	41								60.7	4.27	1.42	6.1											Total flow to proposed FSEDB Pond E4. Flows released through full-spectrum outlet structure to DP41.1.
	41.1								60.7	4.27	1.42	6.1								220	0.9	4.2	Controlled release from FSEDB Pond E4, continues to proposed Drainage E1 Swale @ DP42, where they combine with flows from DP35 & Basin E19.
	42	E19	8.80	0.12	18.5	1.06	3.21	3.4															Runoff sheet flows north towards BSC and leaves the site per historic patterns @ DP42, where flows combine with DP35 and DP41.1 flows.

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

Subdivision: Antlers Subdivision Proposed
Location: El Paso County
Design Storm: 5-Year

Project Name: Antlers Subdivision Proposed
Project No.: 24031.00
Calculated By: REB
Checked By:
Date: 1/30/25

DESCRIPTION	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
	42							93.7	14.38	0.77	11.1												Total flow to Drainage E1 Swale, exits site towards BSC @ DP42
	43	F1	3.30	0.19	25.9	0.63	2.70	1.7															Runoff sheet flows NE towards the proposed roadside ditch, continues in ditch to proposed FSEDB Pond F @ DP43, where flows combine with Basin F2 flows.
	43	F2	0.90	0.33	26.4	0.30	2.67	0.8															Runoff sheet flows NE towards the proposed roadside ditch, continues in ditch to proposed FSEDB Pond F @ DP43, where flows combine with Basin F1 flows.
	43							26.4	0.93	2.67	2.5												Total flow to proposed FSEDB Pond F. Flows released through full-spectrum outlet structure to DP43.1
	43.1							26.4	0.93	2.67	2.5				2.5	0.93	5.0	18	240	1.2	3.3		Controlled release from FSEDB Pond F, continues to BSC @ DP44, where flows combine with Basin F3 flows
	44	F3	8.80	0.10	43.2	0.89	1.93	1.7															Runoff sheet flows towards BSC, enters BSC @ DP44, where flows combine with DP43.1 flows.
	44							71.4	37.93	1.18	44.8												Total flow to BSC @ DP44
	45	H	7.00	0.11	27.5	0.77	2.61	2.0															Runoff sheet flows towards BSC, enters BSC @ DP45
	47	I	4.80	0.11	26.2	0.55	2.69	1.5															Runoff sheet flows towards BSC, enters BSC @ DP47
	46	J	9.50	0.02	65.8	0.19	1.30	0.2															Runoff sheet flows towards BSC, enters BSC @ DP46
	49	K	4.70	0.12	27.5	0.56	2.61	1.5															Runoff sheet flows offsite per historic drainage patterns.
	48	L	2.40	0.12	15.6	0.29	3.46	1.0															Runoff sheet flows towards BSC, enters BSC @ DP46
BSC	BSC										119.1												Total Flow to Black Squirrel Creek

Notes:
Street and Pipe C*A values are determined by Q/I using the catchment's intensity value.
Gray shaded cells indicate a controlled release from an off-site pond.
Blue shaded cells indicate a controlled release from an on-site detention and water quality pond. The total tributary peak flow and tributary C*A values to each pond have been used as the "controlled release" for the purposes of the rational analysis.
Red shaded cells indicate design point is tributary to Black Squirrel Creek. DP BSC is a direct summation of all BSC Tributary design points above.

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

Subdivision: Antlers Subdivision Proposed
Location: El Paso County
Design Storm: 100-Year

Project Name: Antlers Subdivision Proposed
Project No.: 24031.00
Calculated By: REB
Checked By:
Date: 1/30/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t _c (min)	C*A (ac)	f (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	f (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _r (min)	
Camelot DP-6					36.7	6.02	3.66	22.0												1325	1.2	17.8	Offsite Flows from Camelot Subdivision, DP-6, 11 cfs controlled release, combines w/ Basin A3 flows @ DP-3
	1	A1	4.70	0.44	32.4	2.06	3.97	8.2												60	0.8	1.3	Runoff sheet flows NE, enters roadside ditch and continues north to DP1
	2	A2	0.80	0.55	20.1	0.44	5.17	2.3	33.7	2.50	3.94	9.9											Runoff sheet flows NW, enters roadside ditch and continues north to proposed FSEDB @ DP2. combines w/ DP1 flows in Pond.
	2.1								33.7	2.50	3.94	9.9								120	1.0	2.0	Controlled release from FSEDB Pond A, continues to DP3
	3	A4	2.10	0.39	26.0	0.82	4.53	3.7															Runoff sheet flows N to DP3, combines with flows from Basin A3, and DP2.1
	3	A3	4.80	0.41	39.5	1.97	3.47	6.8															Runoff sheet flows NE, enters proposed drainage A swale, continues to DP3 and combines with flows from Basin A4 and DP2.1
	3								54.5	11.30	2.74	31.0								175	1.4	2.1	Total flow at DP3, continues offsite NE along existing semi-defined drainage of Basin OA1 to DP5
Antlers Ridge Estates UBS-2					57.6	27.46	2.52	69.2												200	0.6	5.3	Offsite Flows from Antlers Ridge Estates, DP UBS-2, 32.9 cfs controlled release, combines w/ Basin A5 & A6 flows @ DP-4
	4	A5	13.50	0.41	37.0	5.47	3.64	19.9															Runoff sheet flows NE, enters proposed Drainage A2 swale, continues north to DP4 where it combines with Basin A6 flows.
	4	A6	3.70	0.44	29.6	1.63	4.20	6.8															Runoff sheet flows NW, enters proposed Drainage A2 swale, continues north to DP4 where it combines with Basin A5 flows.
	4								62.9	34.56	2.38	82.3								110	0.6	3.1	Total flow in proposed Drainage A2 swale @ DP4, flows continue to DP5 where they combine with basin OA2 & A7 flows.
	5	A7	11.60	0.40	40.3	4.61	3.42	15.8															Runoff sheet flows NW, enters proposed Drainage A2 swale, continues north to DP4 where it combines with Basin A5 flows.
	5	OA2	3.20	0.35	24.7	1.12	4.66	5.2															Offsite runoff sheet flows NE, enters proposed Drainage A2 swale @ DP5, combines with flows from Basin A7 and DP4
	5								66.0	40.29	2.26	91.1								200	0.7	4.5	Total flow in proposed Drainage A2 swale @ DP5, flows continue to DP7 where they combine with flows from Basin A8 and DP6
	6	OA1	14.70	0.35	43.1	5.15	3.25	16.7															Offsite runoff, sheet flows NE, enters semi defined drainage and continues to site boundary @ DP6 and combines with flows from DP3
	6								56.6	16.45	2.65	43.5								200	0.7	4.5	Total flow in existing off-site drainage, enters site and Basin A8 at DP6, flows continue to DP7, where they combine with flows from Basin A8 & DP5
	7	A8	1.20	0.39	15.6	0.46	5.80	2.7															Runoff sheet flows SE, enters proposed Drainage A2 swale @ DP7, where it combines with flows from DP5 and DP6
	7								70.5	57.20	2.10	120.0			120.0	57.20	4.0	48	750	21.9	0.6		Total flows in proposed Drainage A2 swale @ DP7, enters proposed culvert and is piped to DP8, where it combines with the controlled release of FSEDB Pond F @ DP8
	8	A9	8.30	0.38	27.0	3.18	4.43	14.1															Runoff sheet flows to existing Drainage A2 natural swale @ DP8 continue to BSC @ DP44, where they combine with DP8 piped & basin F3 flows.
	8								71.0	62.35	2.08	129.5	0.59	0.29	3	128.9	62.06	4.0	48	162	22.2	0.1	Total flows in pipe @ DP8, & Natural Drainage A2, flows continues to BSC @ DP44
																							Runoff sheet flows NE, enters roadside ditch and continues north to DP9, where it combines with flows from Basin

STANDARD FORM SF-3 - PROPOSED CONDITIONS
STORM DRAINAGE SYSTEM DESIGN
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Location: El Paso County
Design Storm: 100-Year

Project Name: Antlers Subdivision Proposed
Project No.: 24031.00
Calculated By: REB
Checked By:
Date: 1/30/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_r (min)	
	9	B1	1.20	0.47	17.8	0.57	5.48	3.1															B2
	9	B2	0.40	0.50	12.7	0.20	6.33	1.3															runoff sheet flows SW, enters roadside ditch and continues west to DP9, where it combines with flows from Basin B1
	9								17.8	0.77	5.54	4.2							800	1.3	10.0		Total flow in roadside ditch @ DP9, enters proposed culvert and continues north to DP11, where flows combine with Basin B3 and DP10 flows.
	10	B4	1.20	0.60	26.4	0.72	4.49	3.2															runoff sheet flows NW, enters roadside ditch and continues north to DP10. Flows enter proposed culvert and continue to DP11 where they combine with flows from DP9 & Basin B3 flows.
	11	B3	3.90	0.44	29.7	1.74	4.19	7.3															runoff sheet flows NW, enters roadside ditch and continues north to DP10. Flows enter proposed culvert and continue to DP11 where they combine with flows from DP9 & Basin B3 flows.
	11								29.7	3.22	4.25	13.7							850	0.9	15.1		Total flow in roadside ditch @ DP11, flows continue in roadside ditch to DP12, where they combine with flows from Basin B5 and B6
	12	B5	6.00	0.42	33.6	2.52	3.88	9.8															runoff sheet flows north to roadside ditch, continues in ditch to DP12, where flows combine with DP11 and Basin B6 flows.
	12	B6	6.60	0.42	33.9	2.76	3.86	10.6															runoff sheet flows northeast to roadside ditch, continues in ditch to DP12, where flows combine with DP11 and Basin B5 flows.
	12								44.8	8.50	3.23	27.4							550	1.3	6.8		Total flow in roadside ditch @ DP12, flows continue in roadside ditch to DP13, where they combine with flows from basin B7
	13	B7	2.20	0.53	35.4	1.18	3.75	4.4															runoff sheet flows NE to roadside ditch, continues in ditch north and east to DP 13 where flows combine with flows from DP12
	13								51.7	9.67	2.87	27.8											Total flow in roadside ditch @ DP13, flows enter proposed culvert and continue to DP14, where they combine with Basin B8 flows in the proposed FSEDB (pond B)
	14	B8	2.00	0.54	39.0	1.07	3.50	3.8															runoff sheet flows NE to roadside ditch, continues in ditch north and east to DP 14 where flows combine with flows from DP13 in the proposed FSEDB (pond B)
	14								51.7	10.75	2.87	30.9											Total flow @ DP14 (proposed FSEDB Pond B), released through outlet full-spectrum outlet structure to DP14.1
	14.1								51.7	10.75	2.87	30.9											Controlled release from FSEDB Pond B, continues in proposed Drainage C2 Swale to DP20, where it combines with flows from Basin B10 and DP19
	15	O-C1	9.30	0.39	29.7	3.63	4.19	15.2											513	0.9	10.0		offsite runoff sheet flows NE to private drive (continuation of Ayer Road), enter site @ DP15 and continue through Basin C2 to DP16
	16	C2	10.20	0.40	29.4	4.12	4.21	17.3															Runoff sheet flows north and east to DP16, where they combined with flows from DP15, and Basin C3
	16	C3	1.00	0.54	22.6	0.54	4.88	2.6															Runoff sheet flows to proposed roadside ditch, continues east in ditch to DP16, where flows combine with flows from DP15, and Basin C2
	16	C5	0.30	0.56	13.5	0.17	6.17	1.0															Runoff sheet flows to proposed roadside ditch, continues west in ditch to DP16, where flows combine with flows from DP15, Basin C2, & Basin C3.
	16								39.7	8.45	3.53	29.8											Total flow @ DP16, enters proposed culvert and continue north under road to proposed FSEDB Pond C @ DP17
	17	C4	1.00	0.54	22.7	0.54	4.87	2.6															Runoff sheet flows to proposed roadside ditch, continues east in ditch to proposed FSEDB Pond C @ DP17, where flows combine with flows from DP16
																							Runoff sheet flows to proposed roadside ditch, continues west in ditch to proposed FSEDB Pond C @ DP17, where

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Project No.: 24031.00
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Date: 1/30/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t _c (min)	C*A (ac)	Q (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	Q (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _r (min)	
	17	C6	0.50	0.49	14.7	0.25	5.96	1.5															flows combine with flows from DP16 & Basin C4
	17								39.7	9.24	3.53	32.6											Total flow @ DP17 (proposed FSEDB Pond C), release to proposed Drainage C swale @ DP18.1 through full-spectrum outlet structure.
	18.1								39.7	9.24	3.53	32.6								1450	0.8	30.0	Controlled release from FSEDB Pond C, continues in proposed Drainage C Swale to DP19, where it combines with flows from Basin B9
	19	B9	30.50	0.39	41.8	11.93	3.33	39.7															runoff sheet flows NE to proposed Drainage C Swale, continues NE to DP 19 where flows combine with controlled release from Pond C (DP18.1) and enter proposed culvert.
	19								69.7	21.17	2.12	45.0			45.0	21.17	4.0	36		220	17.0	0.2	Total flow @ DP19, enters proposed culvert and continues in pipe to DP20, where it combines with controlled release of Pond B.
	20	B10	1.40	0.41	11.2	0.57	6.65	3.8															runoff sheet flows NE to proposed Drainage C2 Swale and continues to BSC @ DP 21, where flows combine with flows from Basin B10
	20								69.9	31.92	2.12	67.6			67.6	31.92	4.0	36		220	19.0	0.2	Total flow in proposed storm pipe @ DP20, piped to BSC @ DP21, where flows combine with Basin B10 flows.
	21								70.1	32.49	2.11	67.6											BSC
	22	O-E1	33.70	0.35	38.7	11.90	3.52	41.9												380	0.7	9.4	offsite runoff sheet flows NE to existing low point/stock pond, enters on-site Basin E2 @ DP22, continues in existing natural drainage to proposed culvert @ DP23
	23	E2	7.10	0.39	26.1	2.80	4.52	12.6															Runoff sheet flows north east to existing natural drainage to proposed culvert @ DP23
	23								48.1	14.69	3.05	44.8								250	0.8	5.2	Total flow at DP23 from DP22 and Basin E2, enters proposed culvert and continues in proposed Drainage Swale E1 to DP27
	24	E3	1.90	0.45	16.3	0.86	5.70	4.9												375	0.5	12.5	Runoff sheet flows SE to proposed roadside ditch @ DP24, enters proposed culvert and continues in roadside ditch to proposed FSEDB Pond E1 @ DP26
	25	E4	7.60	0.41	32.8	3.12	3.94	12.3															Runoff sheet flows NE to proposed roadside ditch, flows in ditch to DP24, enters proposed culvert and combines with flows from DP24 & Basin E5 in proposed FSEDB Pond E1 @ DP26
	26	E5	0.80	0.55	27.9	0.44	4.35	1.9															Runoff sheet flows to proposed roadside ditch, flows in ditch to FSEDB Pond E1 @ DP26, where it combines with flows from DP24 & DP25
	26								32.8	4.42	4.01	17.7											Total flow @ DP26 in proposed FSEDB Pond E1. Releases through full-spectrum outlet structure to DP26.1
	26.1								32.8	4.42	4.01	17.7											Controlled release from FSEDB Pond E1, continues in proposed Drainage E1 Swale to DP27, where it combines with flows from DP23
	27								53.3	19.11	2.80	53.4								610	0.8	12.4	Total flow @ DP27 in proposed Drainage E1 Swale, continues in Swale to DP28, where it combines with Basin E6 flows.
	28	E6	11.60	0.39	33.0	4.53	3.92	17.8															Runoff sheet flows to proposed Drainage E1 Swale @ DP28, where it combines with Flows from DP 27
	28								65.6	23.64	2.27	53.8								350	1.6	3.6	Total flow in proposed Drainage E1 Swale @ DP28, continues in Swale to DP31, where it combines with flows from DP30.1
	29	E7	3.20	0.44	24.9	1.41	4.64	6.5															Runoff sheet flows NE to proposed roadside ditch, flows continue north in ditch to DP29, and then continue to the proposed FSEDB Pond E2 @ DP30, where flows combine with Basin E8 flows
																							Runoff sheet flows NE to proposed roadside ditch, flows continue north in ditch to proposed FSEDB Pond E2 @

STANDARD FORM SF-3 - PROPOSED CONDITIONS
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Project No.: 24031.00
Calculated By: REB
Checked By:
Date: 1/30/25

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t _c (min)	C*A (ac)	l (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	l (in/hr)	Q (cfs)	Q _{street} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _r (min)	
	30	E8	1.00	0.55	21.1	0.55	5.05	2.8															DP30, where flows combine with Basin E7 flows
	30								24.9	1.96	4.70	9.2											Total flow to proposed FSEDB Pond E2. Flows released through full-spectrum outlet structure to DP30.1
	30.1								24.9	1.96	4.70	9.2							450	1.2	6.3		Controlled release from FSEDB Pond E2, continues to proposed Drainage E1 Swale @ DP31
	31								69.2	25.59	2.14	54.8							540	0.9	10.1		Total flow in proposed Drainage E1 Swale @ DP31, continues in swale to DP34, where flows combine with Basin E11 & E12 flows
	34	E11	6.60	0.39	32.9	2.60	3.93	10.2															Runoff sheet flows NW to proposed drainage E1 Swale, continues in swale to DP34, where flows combine with flows from Basin E12 & DP31
	34	E12	11.90	0.39	32.7	4.66	3.95	18.4															Runoff sheet flows NE to proposed drainage E1 Swale, continues in swale to DP34, where flows combine with flows from Basin E11 & DP31
	34								79.3	32.86	1.80	59.2							250	1.8	2.3		Total flow in proposed Drainage E1 Swale @ DP34, flows enter proposed culvert and continue in proposed swale to DP35
	32	E9	1.40	0.51	25.9	0.72	4.53	3.3															Runoff sheet flows N to proposed roadside ditch, continues in ditch east to proposed culvert @ DP32
	33	E10	1.50	0.50	28.5	0.75	4.29	3.2															Runoff sheet flows NE to proposed roadside ditch, continues in ditch east to proposed FSEDB @ DP33, where flows combine with DP32 flows
	33								28.5	1.47	4.36	6.4											Total flow to proposed FSEDB Pond E3. Flows released through full-spectrum outlet structure to DP33.1
	33.1								28.5	1.47	4.36	6.4							100	1.2	1.4		Controlled release from FSEDB Pond E3, continues to proposed Drainage E1 Swale @ DP35, where they combine with flows from DP34
	35	E13	0.40	0.51	10.4	0.21	6.83	1.4															Runoff sheet flows NE to DP35, combines with flows from DP33.1 & DP34
	35								81.6	34.53	1.73	59.8							415	1.1	6.2		Total flow in proposed Drainage E1 Swale @ DP35, flows continue in swale to DP42, where they combine with flows from Basin E19 and DP39.1
	36	O-E2	3.60	0.39	27.1	1.40	4.42	6.2											580	0.9	10.8		offsite runoff sheet flows NE to site boundary @ DP36, flows enter on-site basin E15
	37	E14	2.60	0.45	20.7	1.17	5.10	5.9											650	0.5	20.7		Runoff sheet flows to proposed roadside ditch, continues in ditch to proposed culvert @ DP37, flows continue in ditch to DP38, where they combine with flows from DP36 and basin E15
	38	E15	9.60	0.41	37.9	3.96	3.58	14.2															Runoff sheet flows to proposed roadside ditch, continues in ditch to DP38, where they combine with flows from DP37 and DP36
	38								41.4	6.53	3.43	22.4							790	1.0	13.2		Total flow in roadside ditch @ DP38, flows continue in ditch to DP40, where they combine with flows from Basin E16 & DP39
	40	E16	4.20	0.43	24.6	1.79	4.67	8.3															Runoff sheet flows NE to proposed roadside ditch, continues in ditch to DP40, where they combine with flows from DP38 & DP39
	39	E17	2.10	0.55	33.8	1.15	3.86	4.5															Runoff sheet flows to proposed roadside ditch, continues in ditch to DP39, where they enter a proposed culvert to DP40, where they combine with flows from DP38 & Basin E16
	40								54.6	9.47	2.74	25.9							320	0.9	6.2		Total flow in roadside ditch @ DP40, flows continue in ditch to proposed FSEDB Pond E4 @ DP41, where they combine with flows from Basin E18.
																							Runoff sheet flows to proposed roadside ditch, continues in ditch to proposed FSEDB @ DP41, where they combine

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STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	i (in/hr)	Q (cfs)	t_c (min)	C*A (ac)	i (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_r (min)	
	41	E18	2.40	0.46	19.0	1.11	5.32	5.9															with flows from DP40.
	41								60.7	10.58	2.47	26.1											Total flow to proposed FSEDB Pond E4. Flows released through full-spectrum outlet structure to DP41.1.
	41.1								60.7	10.58	2.47	26.1								220	0.9	4.2	Controlled release from FSEDB Pond E4, continues to proposed Drainage E1 Swale @ DP42, where they combine with flows from DP35 & Basin E19.
	42	E19	8.80	0.39	18.5	3.43	5.39	18.5															Runoff sheet flows north towards BSC and leaves the site per historic patterns @ DP42, where flows combine with DP35 and DP41.1 flows.
	42								87.8	48.54	1.55	75.1											Total flow to Drainage E1 Swale, exits site towards BSC @ DP42
	43	F1	3.30	0.44	25.9	1.46	4.53	6.6															Runoff sheet flows NE towards the proposed roadside ditch, continues in ditch to proposed FSEDB Pond F @ DP43, where flows combine with Basin F2 flows.
	43	F2	0.90	0.56	26.4	0.50	4.48	2.3															Runoff sheet flows NE towards the proposed roadside ditch, continues in ditch to proposed FSEDB Pond F @ DP43, where flows combine with Basin F1 flows.
	43								26.4	1.96	4.55	8.9											Total flow to proposed FSEDB Pond F. Flows released through full-spectrum outlet structure to DP43.1
	43.1								26.4	1.96	4.55	8.9											Controlled release from FSEDB Pond F, piped to DP8, continues in pipe to BSC @ DP44
	44	F3	8.80	0.38	43.2	3.37	3.24	10.9															Runoff sheet flows towards BSC, enters BSC @ DP44, where flows combine with DP43.1 flows.
	44								71.2	65.71	2.07	136.2											Total flow to BSC @ DP44 (from piped flows @ DP8 & Basins A9 & F3 runoff)
	45	H	7.00	0.39	27.5	2.70	4.38	11.8															Runoff sheet flows towards BSC, enters BSC @ DP45
	47	I	4.80	0.39	26.2	1.86	4.51	8.4															Runoff sheet flows towards BSC, enters BSC @ DP47
	46	J	9.50	0.35	65.8	3.33	2.18	7.3															Runoff sheet flows towards BSC, enters BSC @ DP46
	49	K	4.70	0.39	27.5	1.83	2.61	4.8															Runoff sheet flows offsite per historic drainage patterns.
	48	L	2.40	0.39	15.6	0.94	5.81	5.4															Runoff sheet flows towards BSC, enters BSC @ DP46
BSC	BSC											311.8											Total Flow to Black Squirrel Creek

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
Gray shaded cells indicate a controlled release from an off-site pond.
Blue shaded cells indicate a controlled release from an on-site detention and water quality pond. The total tributary peak flow and tributary C*A values to each pond have been used as the "controlled release" for the purposes of the rational analysis.
Red shaded cells indicate design point is tributary to Black Squirrel Creek. DP BSC is a direct summation of all BSC Tributary design points above.



APPENDIX C – HYDRAULIC CALCULATIONS

Channel Report

Drainage A Swale - DP Camelot_22 cfs

Trapezoidal

Bottom Width (ft) = 3.00
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 2.00
Invert Elev (ft) = 1.00
Slope (%) = 1.10
N-Value = 0.035

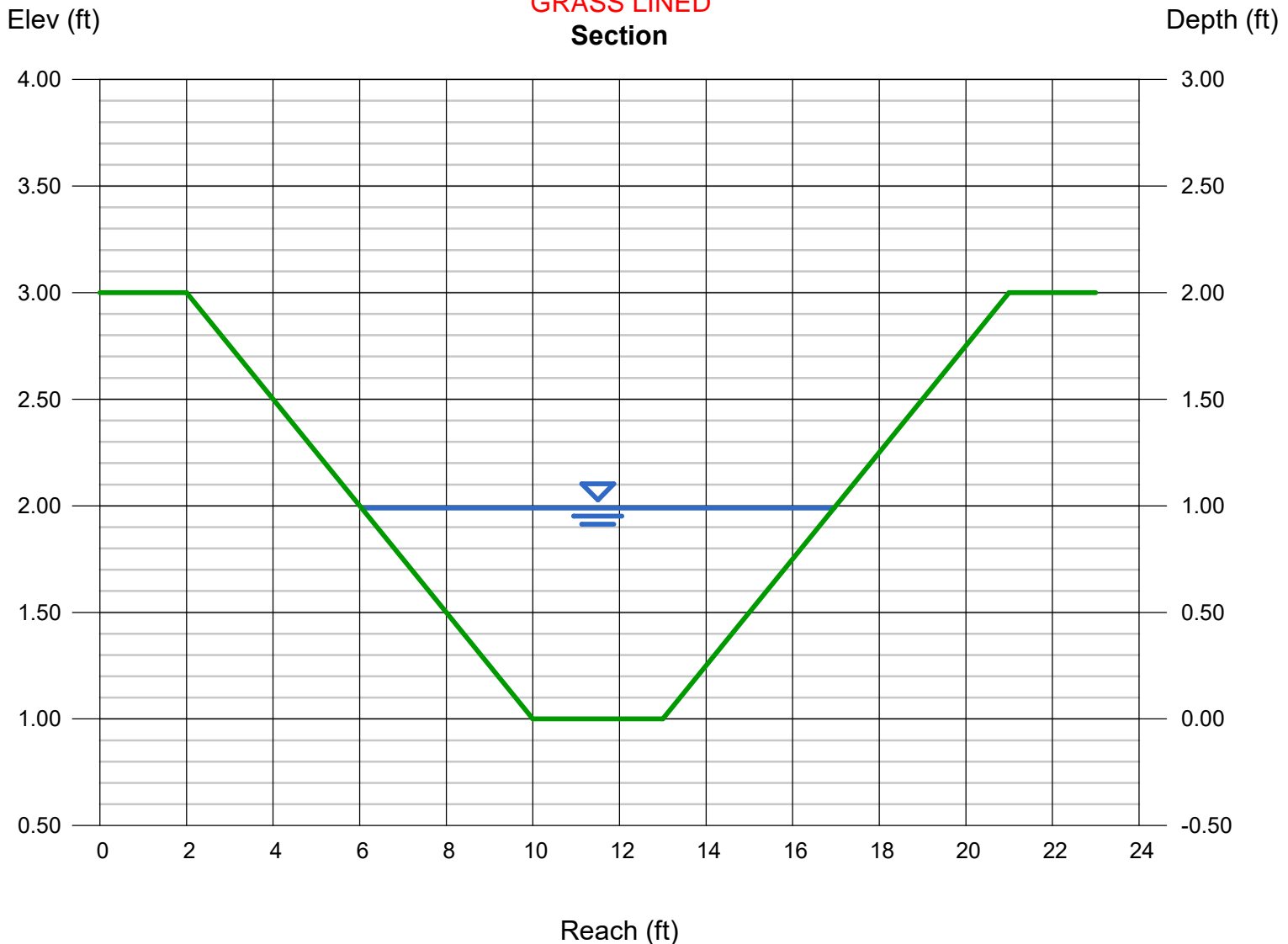
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Depth (ft) = 0.99
Q (cfs) = 22.00
Area (sqft) = 6.89
Velocity (ft/s) = 3.19
Wetted Perim (ft) = 11.16
Crit Depth, Yc (ft) = 0.84
Top Width (ft) = 10.92
EGL (ft) = 1.15

Calculations

Compute by: Known Q
Known Q (cfs) = 22.00

GRASS LINED Section



Channel Report

Drainage A Swale - DP 3_30 cfs

Trapezoidal

Bottom Width (ft) = 3.00
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 2.00
Invert Elev (ft) = 1.00
Slope (%) = 2.70
N-Value = 0.035

Highlighted

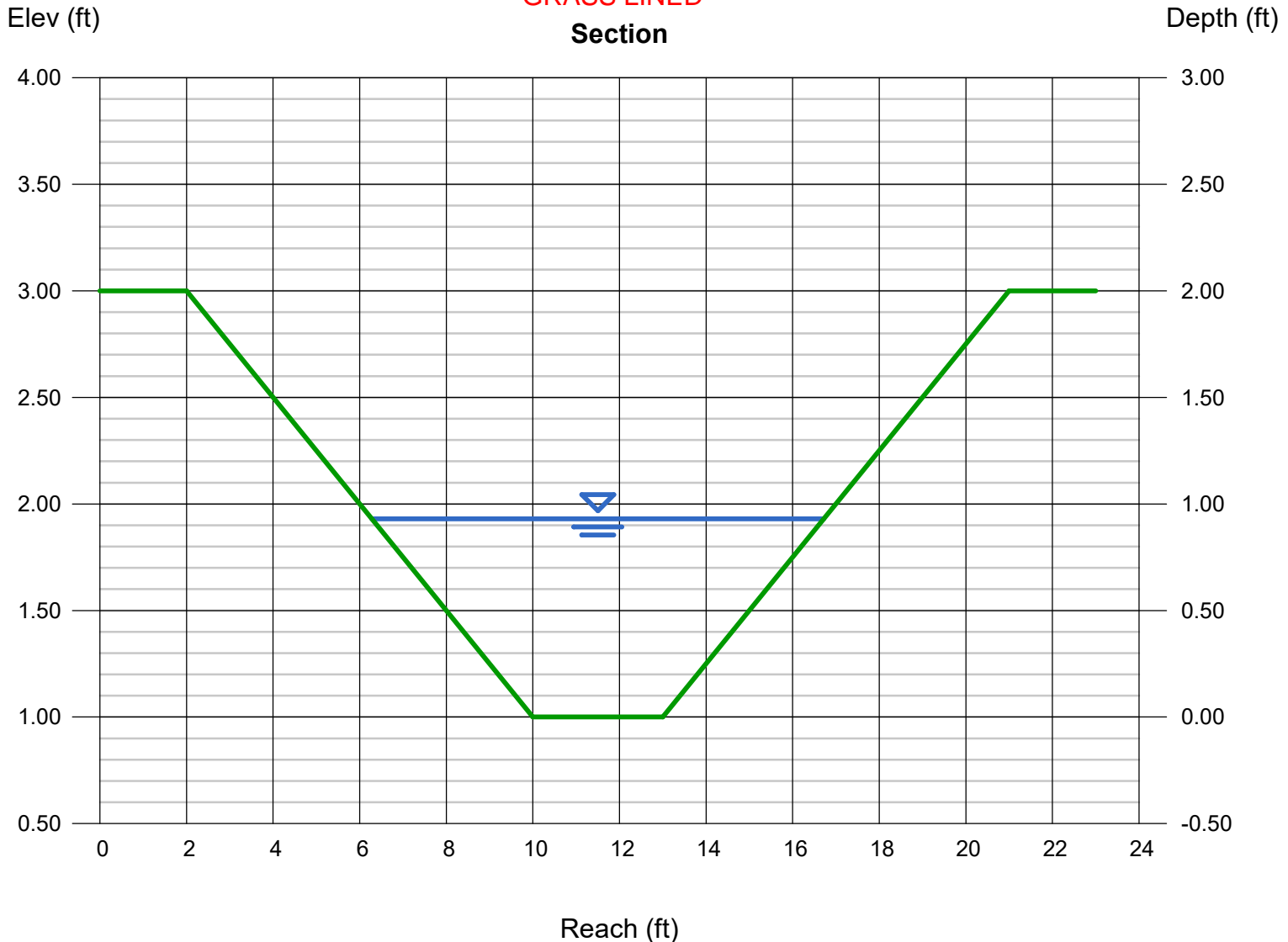
Depth (ft) = 0.93
Q (cfs) = 30.00
Area (sqft) = 6.25
Velocity (ft/s) = 4.80
Wetted Perim (ft) = 10.67
Crit Depth, Yc (ft) = 0.98
Top Width (ft) = 10.44
EGL (ft) = 1.29

Calculations

Compute by: Known Q
Known Q (cfs) = 30.00

GRASS LINED

Section



Channel Report

Drainage A2 Swale - DP UBS-2 - DP4_83 cfs

Trapezoidal

Bottom Width (ft) = 10.00
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 2.25
Invert Elev (ft) = 1.00
Slope (%) = 1.40
N-Value = 0.035

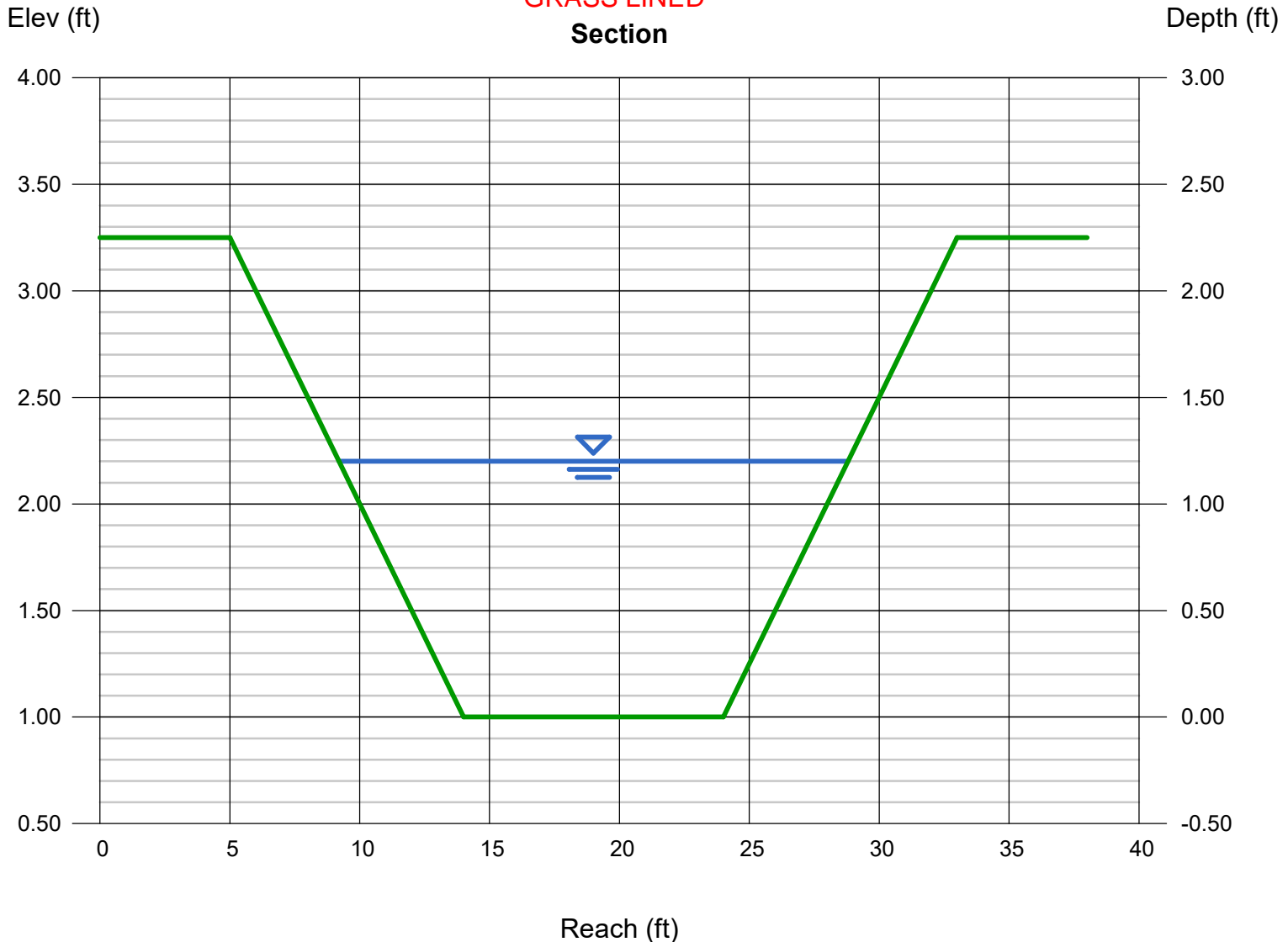
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Depth (ft) = 1.20
Q (cfs) = 82.00
Area (sqft) = 17.76
Velocity (ft/s) = 4.62
Wetted Perim (ft) = 19.90
Crit Depth, Yc (ft) = 1.10
Top Width (ft) = 19.60
EGL (ft) = 1.53

Calculations

Compute by: Known Q
Known Q (cfs) = 82.00

GRASS LINED Section



Channel Report

Drainage A2 Swale - DP4 - DP5_92 cfs

Trapezoidal

Bottom Width (ft) = 10.00
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 2.27
Invert Elev (ft) = 1.00
Slope (%) = 1.40
N-Value = 0.035

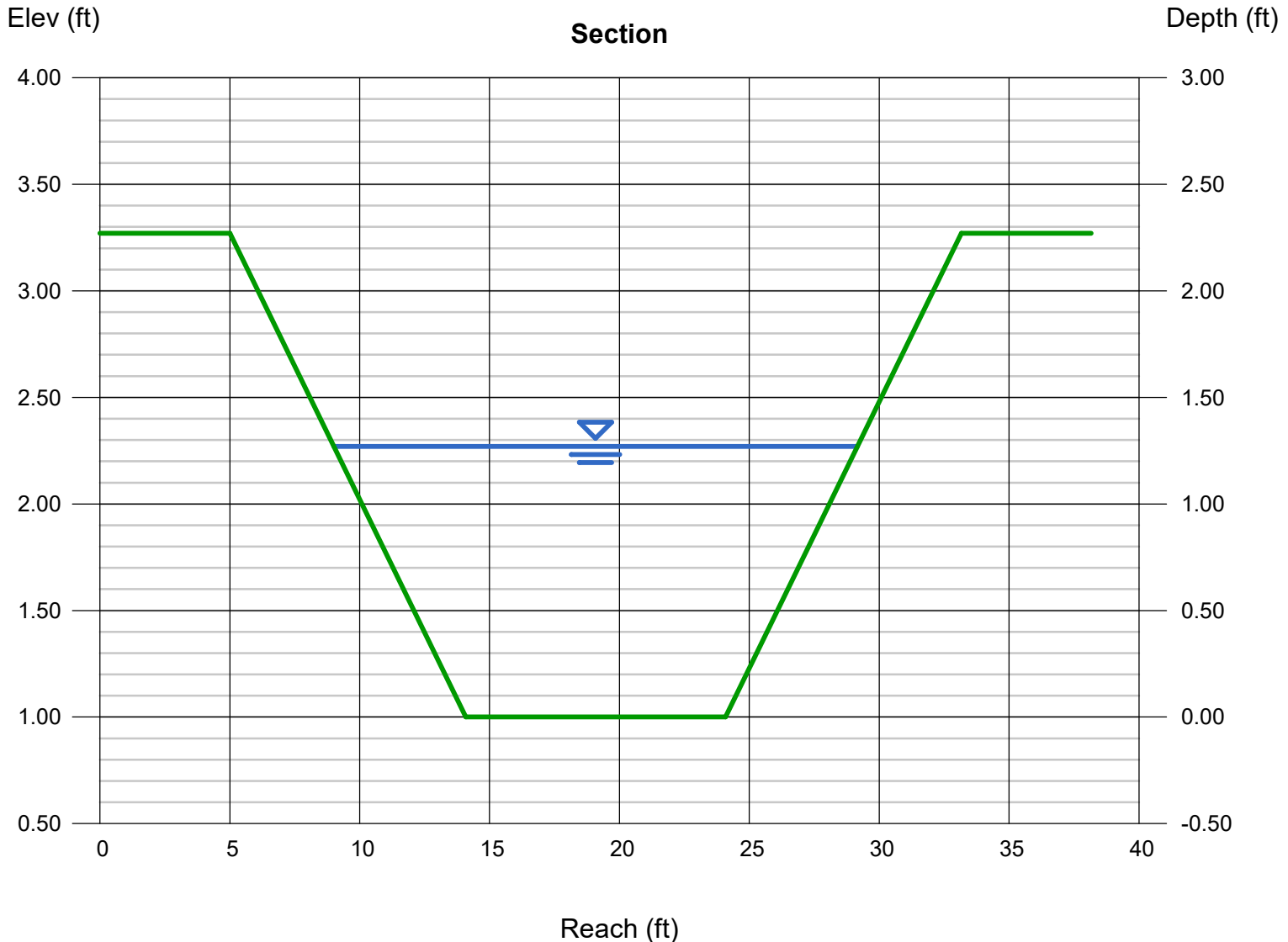
Highlighted

Depth (ft) = 1.27
Q (cfs) = 92.00
Area (sqft) = 19.15
Velocity (ft/s) = 4.80
Wetted Perim (ft) = 20.47
Crit Depth, Yc (ft) = 1.18
Top Width (ft) = 20.16
EGL (ft) = 1.63

Calculations

Compute by: Known Q
Known Q (cfs) = 92.00

GRASS LINED



Channel Report

Drainage A2 Swale - DP5 - DP7_120 cfs

Trapezoidal

Bottom Width (ft) = 10.00
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 2.25
Invert Elev (ft) = 1.00
Slope (%) = 3.00
N-Value = 0.035

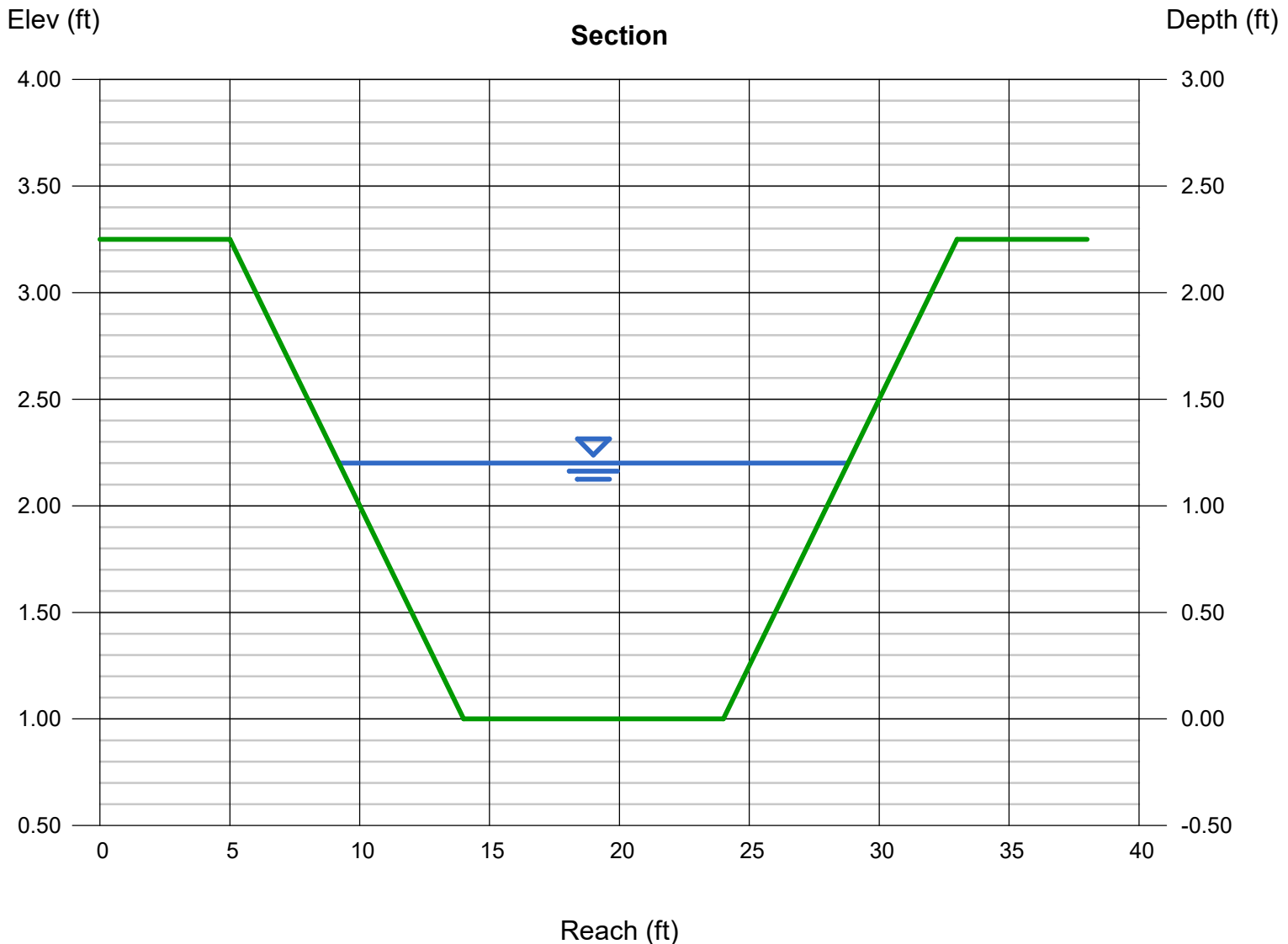
Highlighted

Depth (ft) = 1.20
Q (cfs) = 120.00
Area (sqft) = 17.76
Velocity (ft/s) = 6.76
Wetted Perim (ft) = 19.90
Crit Depth, Yc (ft) = 1.37
Top Width (ft) = 19.60
EGL (ft) = 1.91

Calculations

Compute by: Known Q
Known Q (cfs) = 120.00

**CHANNEL TO BE LINED WITH TURF
REINFORCEMENT MAT OR RIPRAP**



Channel Report

Drainage C1 Swale - DP18.1_33 cfs

Trapezoidal

Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 3.50 MAX SLOPE
N-Value	= 0.035

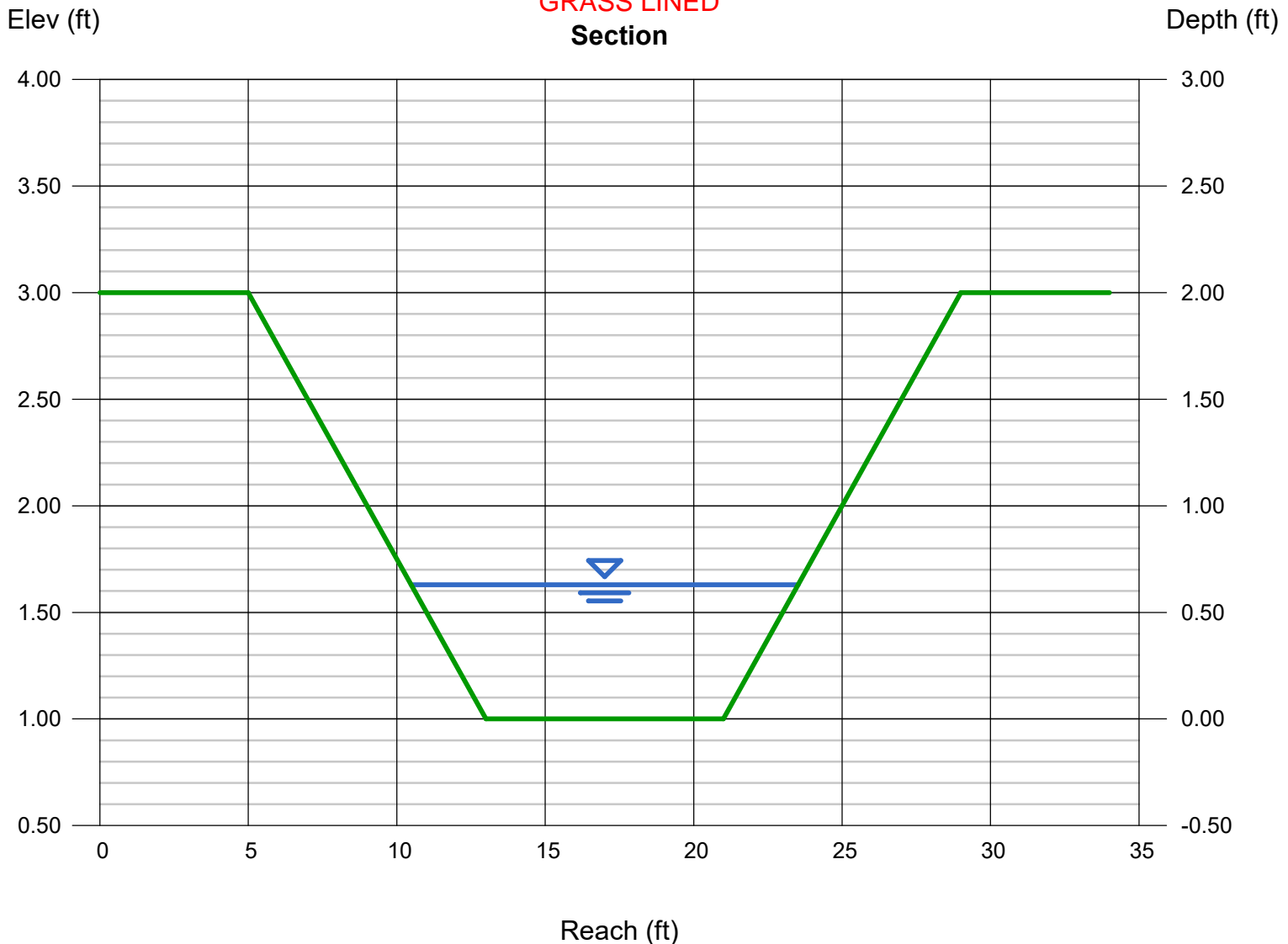
Highlighted

Depth (ft)	= 0.63
Q (cfs)	= 33.00
Area (sqft)	= 6.63
Velocity (ft/s)	= 4.98
Wetted Perim (ft)	= 13.20
Crit Depth, Yc (ft)	= 0.72
Top Width (ft)	= 13.04
EGL (ft)	= 1.02

Calculations

Compute by:	Known Q
Known Q (cfs)	= 33.00

GRASS LINED Section



Channel Report

Drainage C1 Swale - DP19_33 cfs

Trapezoidal

Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00 MIN. SLOPE
N-Value	= 0.035

Highlighted

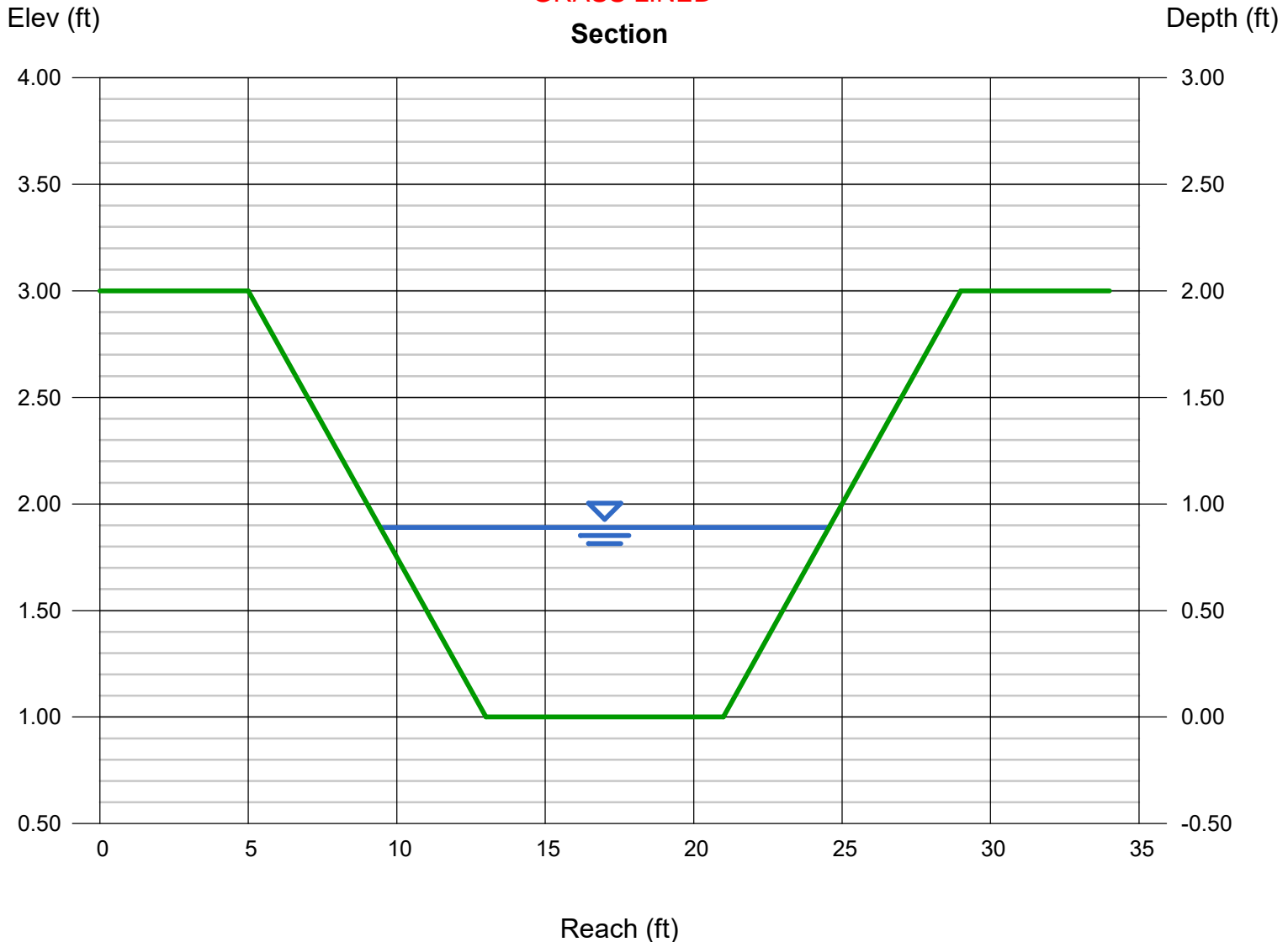
Depth (ft)	= 0.89
Q (cfs)	= 33.00
Area (sqft)	= 10.29
Velocity (ft/s)	= 3.21
Wetted Perim (ft)	= 15.34
Crit Depth, Yc (ft)	= 0.72
Top Width (ft)	= 15.12
EGL (ft)	= 1.05

Calculations

Compute by:	Known Q
Known Q (cfs)	= 33.00

GRASS LINED

Section



Channel Report

Drainage C1 Swale - DP19_45 cfs

Trapezoidal

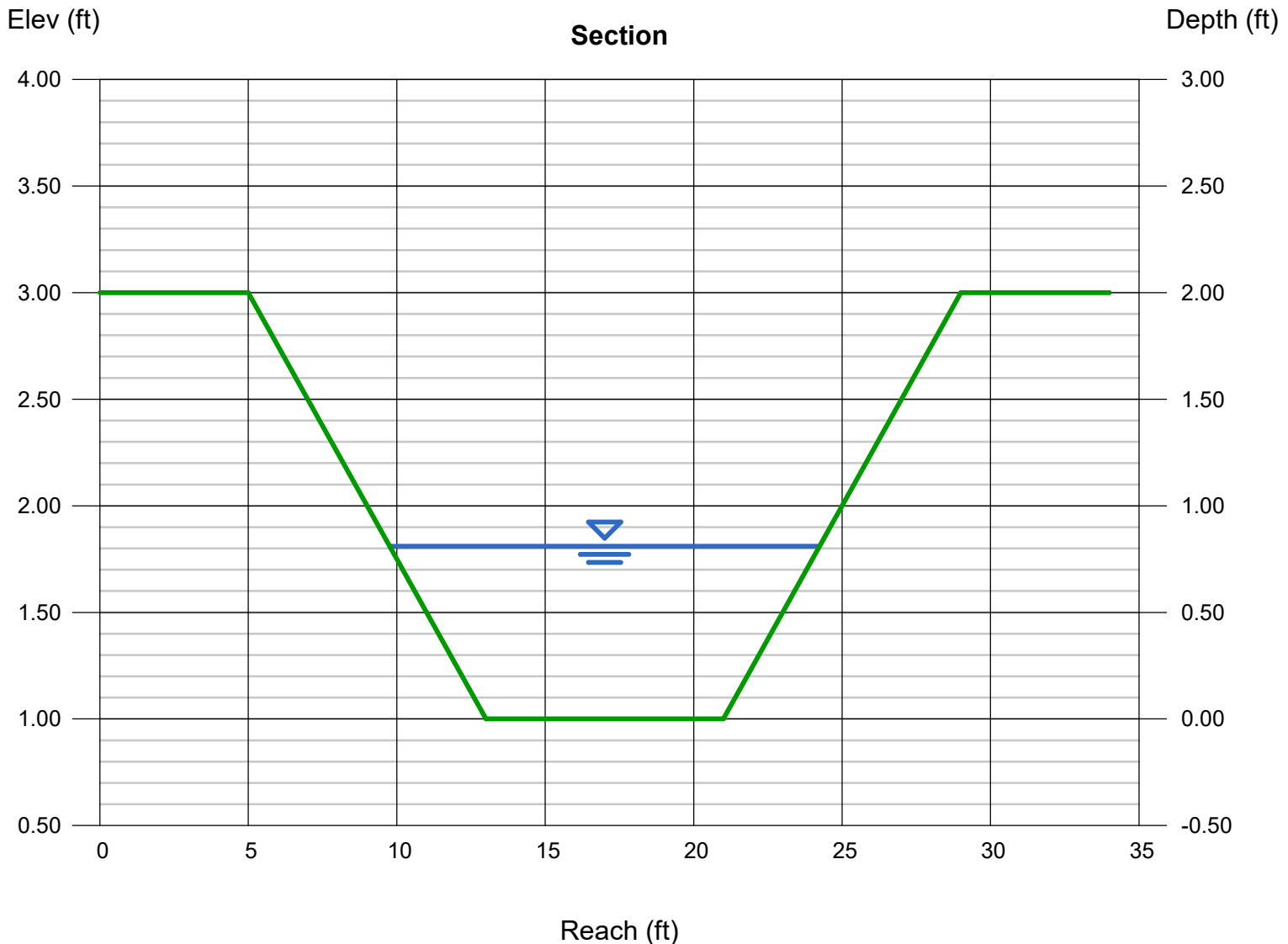
Bottom Width (ft) = 8.00
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 2.00
Invert Elev (ft) = 1.00
Slope (%) = 2.65
N-Value = 0.035

Highlighted

Depth (ft) = 0.81
Q (cfs) = 45.00
Area (sqft) = 9.10
Velocity (ft/s) = 4.94
Wetted Perim (ft) = 14.68
Crit Depth, Yc (ft) = 0.86
Top Width (ft) = 14.48
EGL (ft) = 1.19

Calculations

Compute by: Known Q
Known Q (cfs) = 45.00



Channel Report

DP22-23 - Drainage E - Natural Channel Section 1

User-defined

Invert Elev (ft) = 29.53
Slope (%) = 5.00
N-Value = 0.035

Highlighted

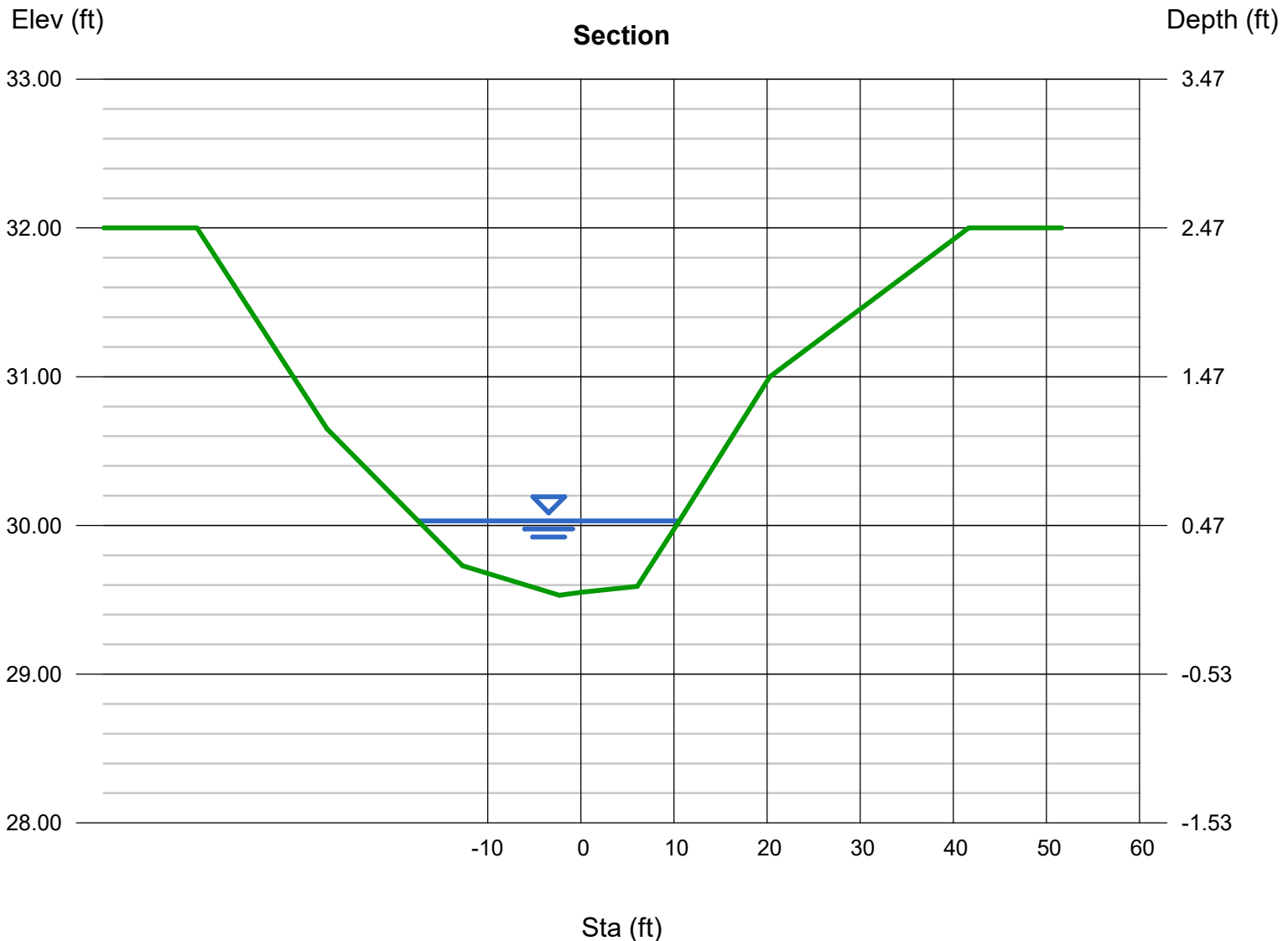
Depth (ft) = 0.50
Q (cfs) = 45.00
Area (sqft) = 9.78
Velocity (ft/s) = 4.60
Wetted Perim (ft) = 28.06
Crit Depth, Yc (ft) = 0.60
Top Width (ft) = 28.03
EGL (ft) = 0.83

Calculations

Compute by: Known Q
Known Q (cfs) = 45.00

(Sta, El, n)-(Sta, El, n)...

(-41.22, 32.00)-(6.06, 29.59, 0.035)-(10.28, 30.00, 0.035)-(20.31, 31.00, 0.035)-(41.67, 32.00, 0.035)



Channel Report

DP22 - Drainage E - Section 2 Natural Channel

User-defined

Invert Elev (ft) = 27.99
Slope (%) = 4.30
N-Value = 0.035

Highlighted

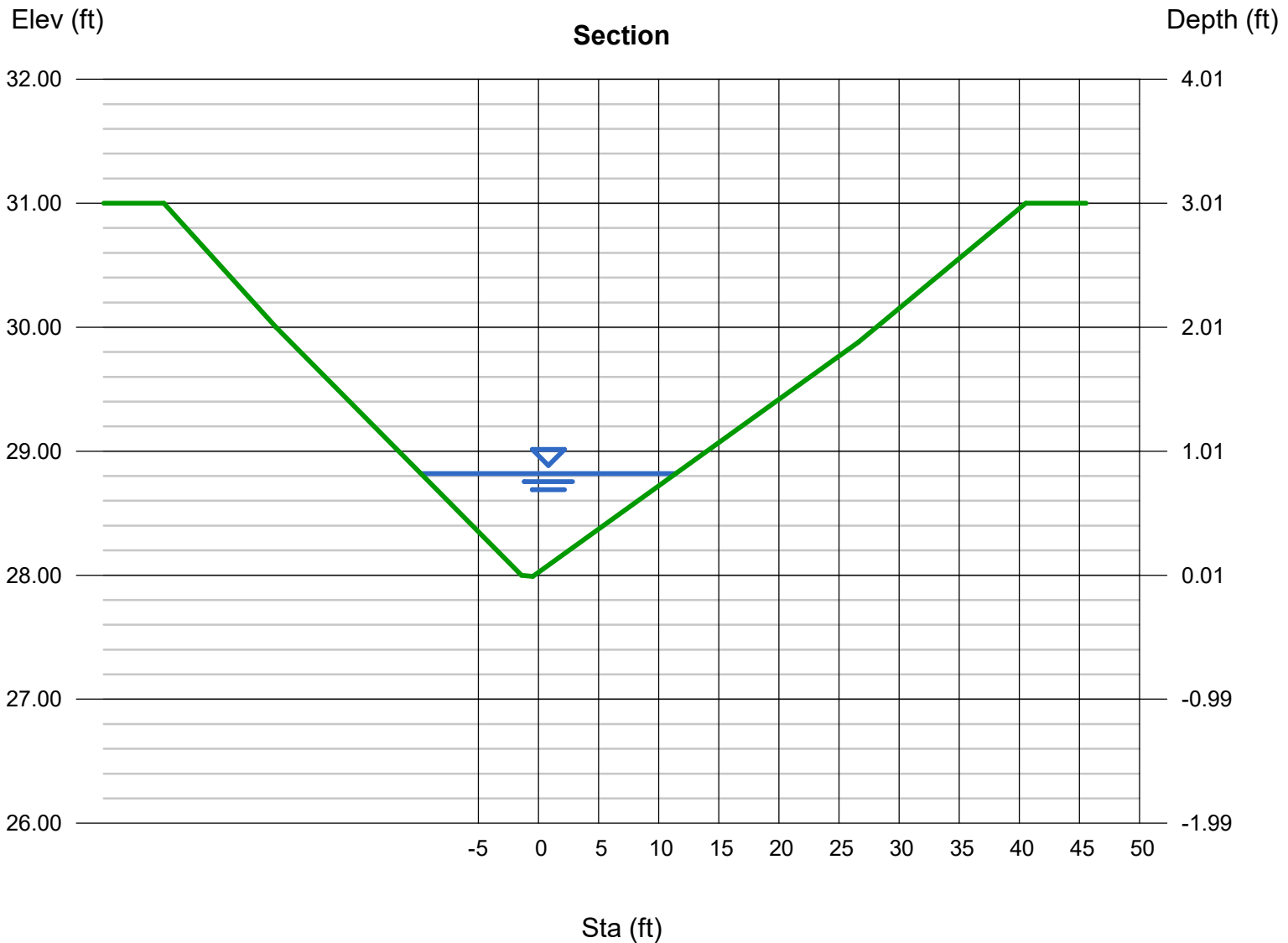
Depth (ft) = 0.83
Q (cfs) = 45.00
Area (sqft) = 9.15
Velocity (ft/s) = 4.92
Wetted Perim (ft) = 21.28
Crit Depth, Yc (ft) = 0.94
Top Width (ft) = 21.21
EGL (ft) = 1.21

Calculations

Compute by: Known Q
Known Q (cfs) = 45.00

(Sta, El, n)-(Sta, El, n)...

(-31.15, 31.00)-(26.64, 29.88, 0.035)-(40.55, 31.00, 0.035)



Channel Report

DP23 - Drainage E Natural Channel Section 3

User-defined

Invert Elev (ft) = 25.45
Slope (%) = 2.00
N-Value = 0.035

Highlighted

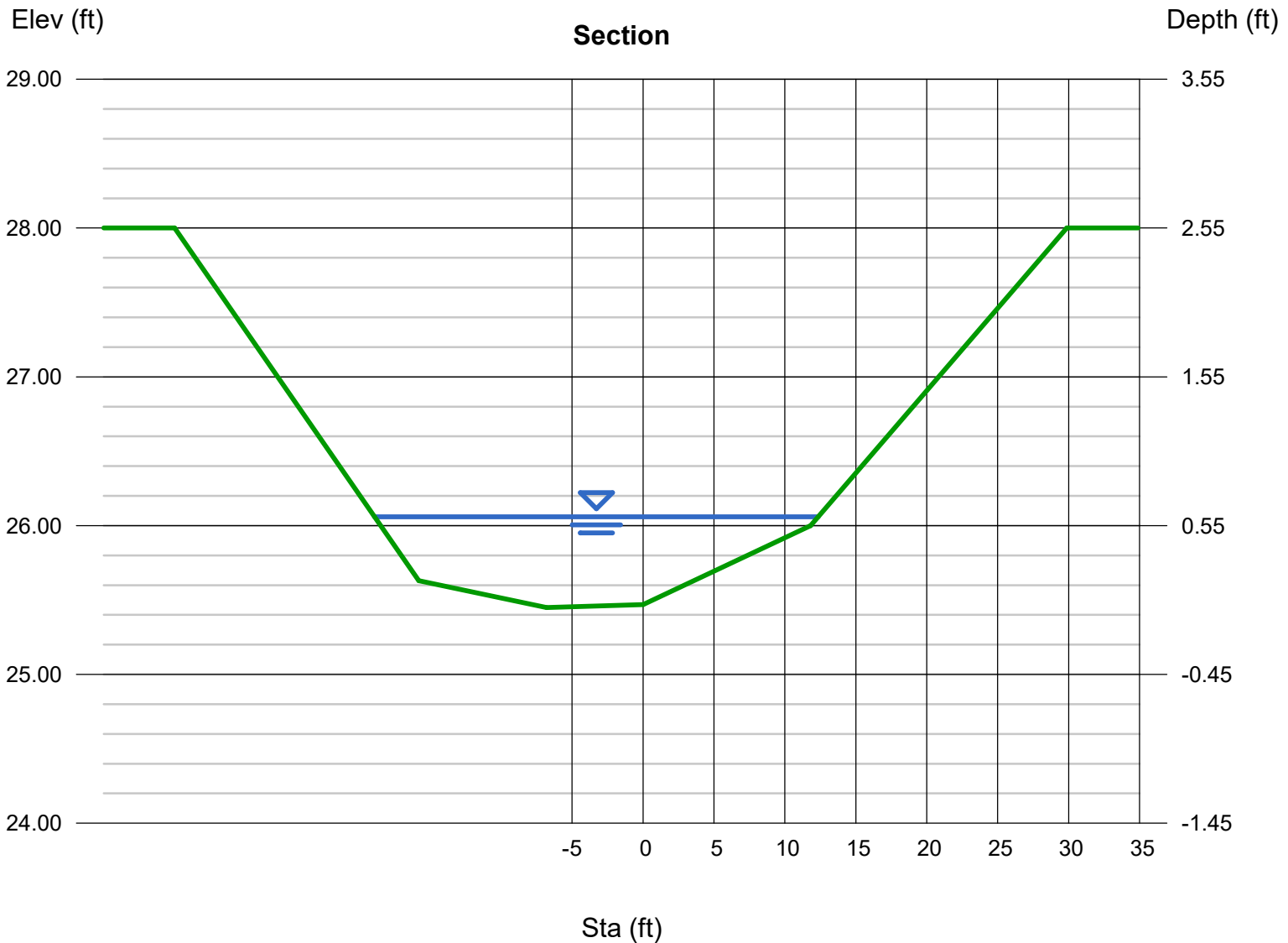
Depth (ft) = 0.61
Q (cfs) = 45.00
Area (sqft) = 13.29
Velocity (ft/s) = 3.39
Wetted Perim (ft) = 31.32
Crit Depth, Yc (ft) = 0.59
Top Width (ft) = 31.27
EGL (ft) = 0.79

Calculations

Compute by: Known Q
Known Q (cfs) = 45.00

(Sta, El, n)-(Sta, El, n)...

(-33.01, 28.00)-(11.81, 26.00, 0.035)-(29.88, 28.00, 0.035)



Channel Report

Drainage E1 Swale - DP27-DP28_54 cfs

Trapezoidal

Bottom Width (ft) = 11.00
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 2.00
Invert Elev (ft) = 1.00
Slope (%) = 2.70
N-Value = 0.035

Highlighted

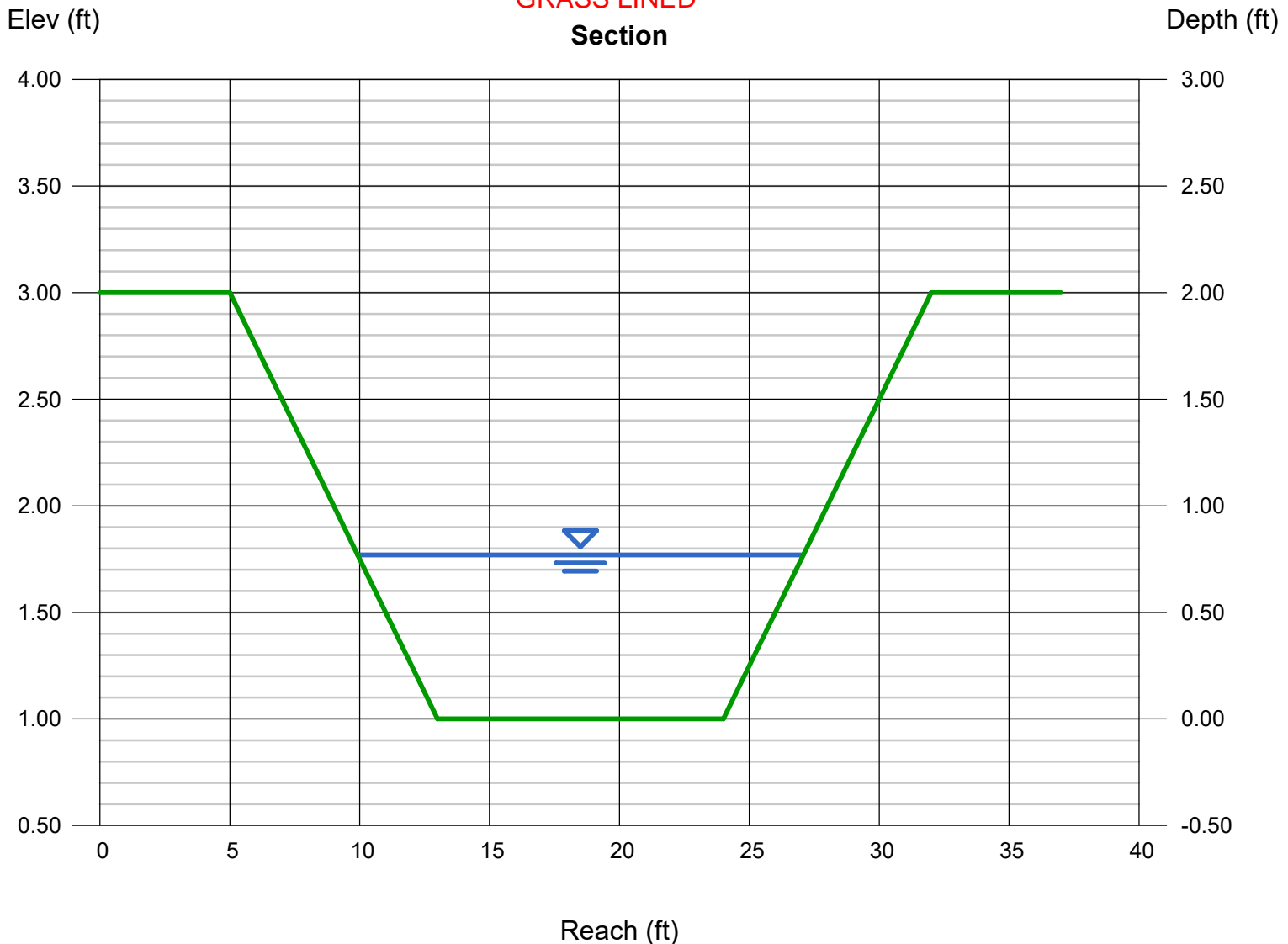
Depth (ft) = 0.77
Q (cfs) = 54.00
Area (sqft) = 10.84
Velocity (ft/s) = 4.98
Wetted Perim (ft) = 17.35
Crit Depth, Yc (ft) = 0.82
Top Width (ft) = 17.16
EGL (ft) = 1.16

Calculations

Compute by: Known Q
Known Q (cfs) = 54.00

GRASS LINED

Section



Channel Report

Drainage E1 Swale - DP28-DP34_60 cfs

Trapezoidal

Bottom Width (ft) = 17.00
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 1.75
Invert Elev (ft) = 1.00
Slope (%) = 3.20
N-Value = 0.035

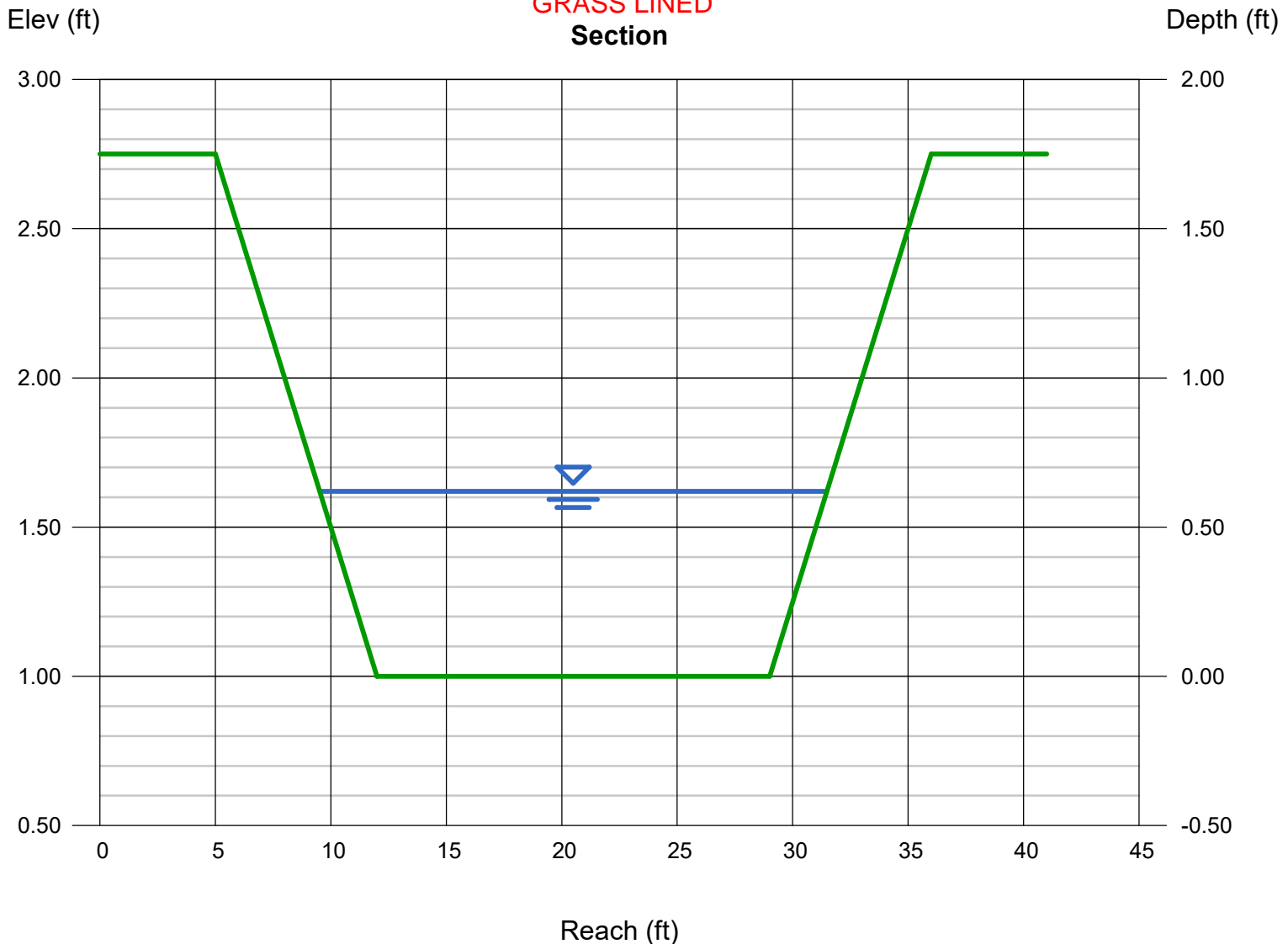
Highlighted

Depth (ft) = 0.62
Q (cfs) = 60.00
Area (sqft) = 12.08
Velocity (ft/s) = 4.97
Wetted Perim (ft) = 22.11
Crit Depth, Yc (ft) = 0.69
Top Width (ft) = 21.96
EGL (ft) = 1.00

Calculations

Compute by: Known Q
Known Q (cfs) = 60.00

GRASS LINED Section



Culvert Report

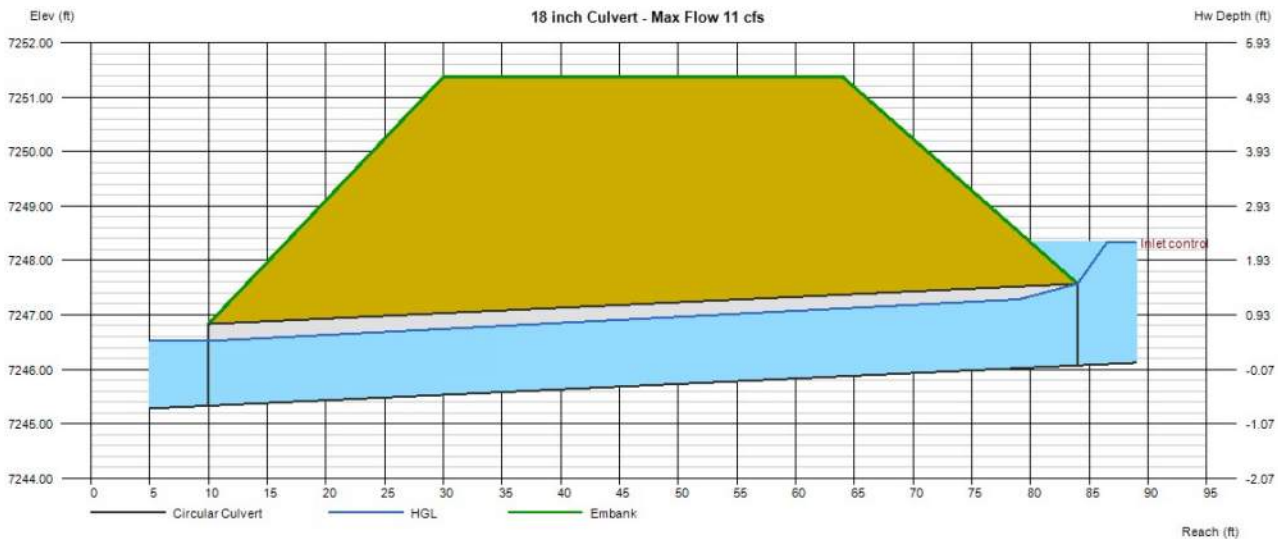
18 inch Culvert - Max Flow 11 cfs

Invert Elev Dn (ft)	= 7245.33
Pipe Length (ft)	= 74.00
Slope (%)	= 1.00
Invert Elev Up (ft)	= 7246.07
Rise (in)	= 18.0
Shape	= Circular
Span (in)	= 18.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

Embankment	
Top Elevation (ft)	= 7251.37
Top Width (ft)	= 34.00
Crest Width (ft)	= 50.00

Calculations	
Qmin (cfs)	= 7.00
Qmax (cfs)	= 11.00
Tailwater Elev (ft)	= Normal

Highlighted	
Qtotal (cfs)	= 11.00
Qpipe (cfs)	= 11.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 7.33
Veloc Up (ft/s)	= 6.90
HGL Dn (ft)	= 7246.52
HGL Up (ft)	= 7247.34
Hw Elev (ft)	= 7248.33
Hw/D (ft)	= 1.50
Flow Regime	= Inlet Control



Culvert Report

24 inch Culvert - Max Flow 22 cfs

Invert Elev Dn (ft)	= 7245.33
Pipe Length (ft)	= 74.00
Slope (%)	= 1.00
Invert Elev Up (ft)	= 7246.07
Rise (in)	= 24.0
Shape	= Circular
Span (in)	= 24.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

Embankment

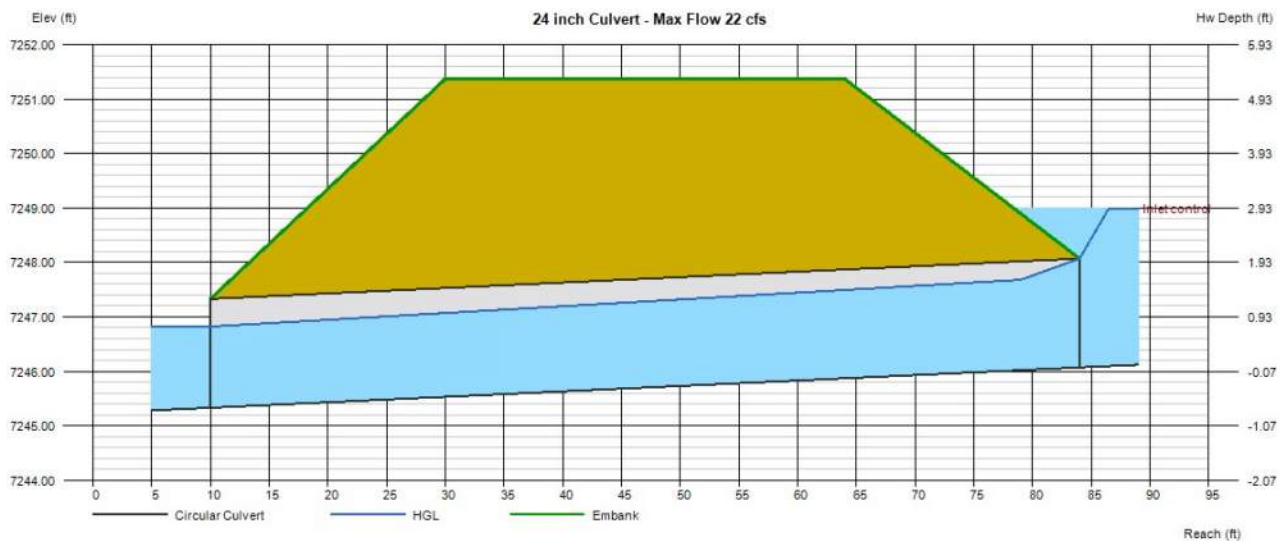
Top Elevation (ft)	= 7251.37
Top Width (ft)	= 34.00
Crest Width (ft)	= 50.00

Calculations

Qmin (cfs)	= 7.00
Qmax (cfs)	= 22.00
Tailwater Elev (ft)	= Normal

Highlighted

Qtotal (cfs)	= 22.00
Qpipe (cfs)	= 22.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 8.75
Veloc Up (ft/s)	= 7.84
HGL Dn (ft)	= 7246.82
HGL Up (ft)	= 7247.74
Hw Elev (ft)	= 7248.99
Hw/D (ft)	= 1.46
Flow Regime	= Inlet Control



Culvert Report

30 inch Culvert - Max Flow 39 cfs

Invert Elev Dn (ft)	= 7245.33
Pipe Length (ft)	= 74.00
Slope (%)	= 1.00
Invert Elev Up (ft)	= 7246.07
Rise (in)	= 30.0
Shape	= Circular
Span (in)	= 30.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

Embankment

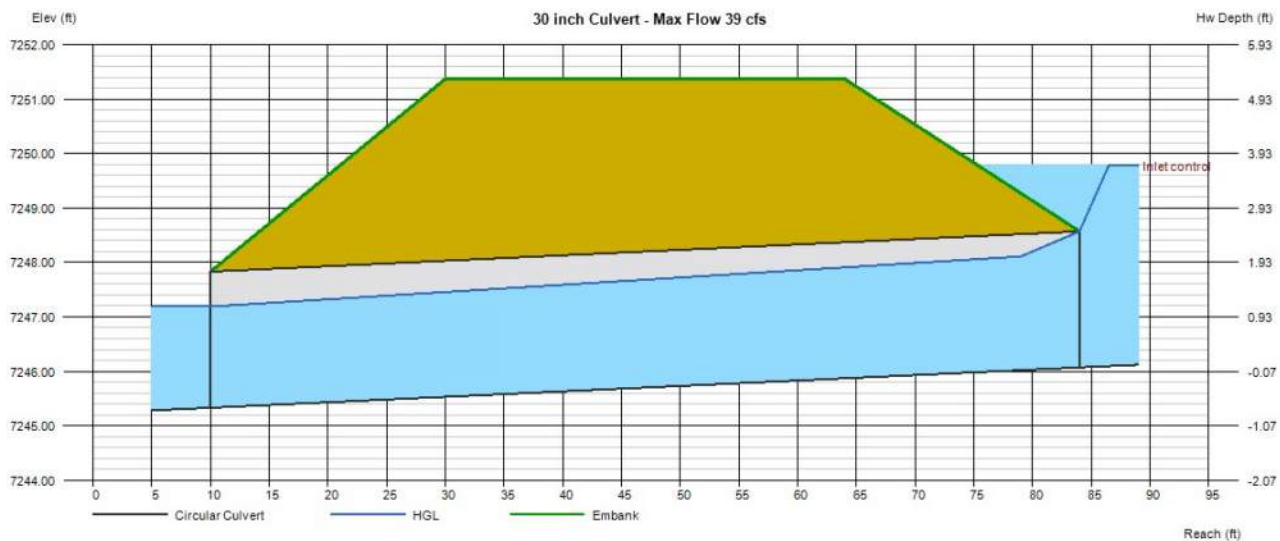
Top Elevation (ft)	= 7251.37
Top Width (ft)	= 34.00
Crest Width (ft)	= 50.00

Calculations

Qmin (cfs)	= 7.00
Qmax (cfs)	= 39.00
Tailwater Elev (ft)	= Normal

Highlighted

Qtotal (cfs)	= 39.00
Qpipe (cfs)	= 39.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 9.96
Veloc Up (ft/s)	= 8.84
HGL Dn (ft)	= 7247.19
HGL Up (ft)	= 7248.18
Hw Elev (ft)	= 7249.78
Hw/D (ft)	= 1.49
Flow Regime	= Inlet Control



Culvert Report

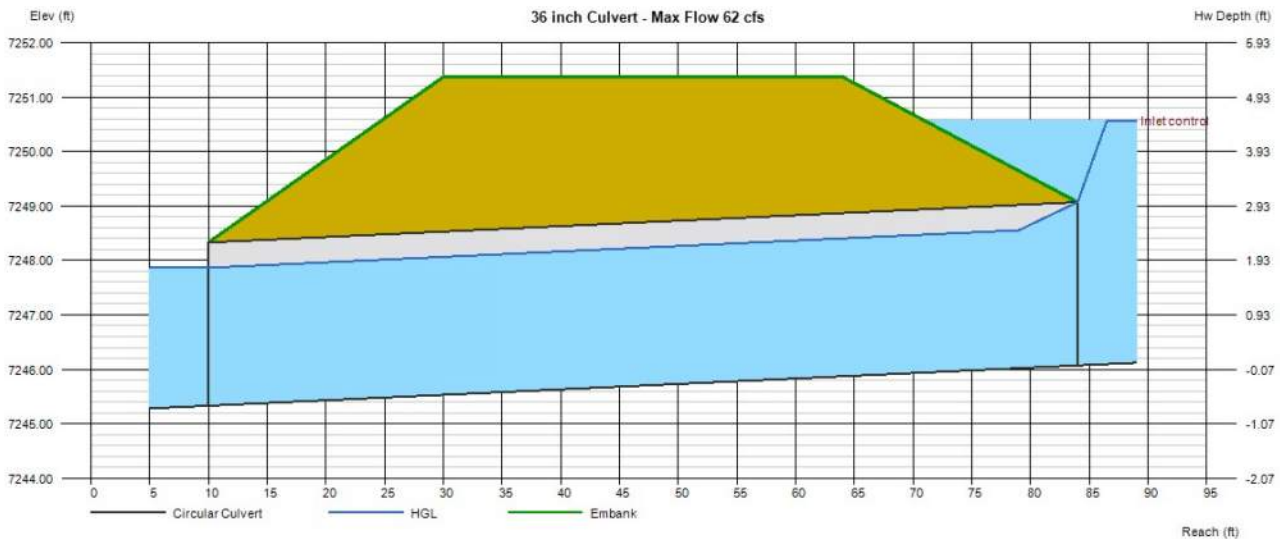
36 inch Culvert - Max Flow 62 cfs

Invert Elev Dn (ft)	= 7245.33
Pipe Length (ft)	= 74.00
Slope (%)	= 1.00
Invert Elev Up (ft)	= 7246.07
Rise (in)	= 36.0
Shape	= Circular
Span (in)	= 36.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

Embankment	
Top Elevation (ft)	= 7251.37
Top Width (ft)	= 34.00
Crest Width (ft)	= 50.00

Calculations	
Qmin (cfs)	= 7.00
Qmax (cfs)	= 62.00
Tailwater Elev (ft)	= Normal

Highlighted	
Qtotal (cfs)	= 62.00
Qpipe (cfs)	= 62.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 9.73
Veloc Up (ft/s)	= 9.73
HGL Dn (ft)	= 7247.87
HGL Up (ft)	= 7248.60
Hw Elev (ft)	= 7250.56
Hw/D (ft)	= 1.50
Flow Regime	= Inlet Control



Culvert Report

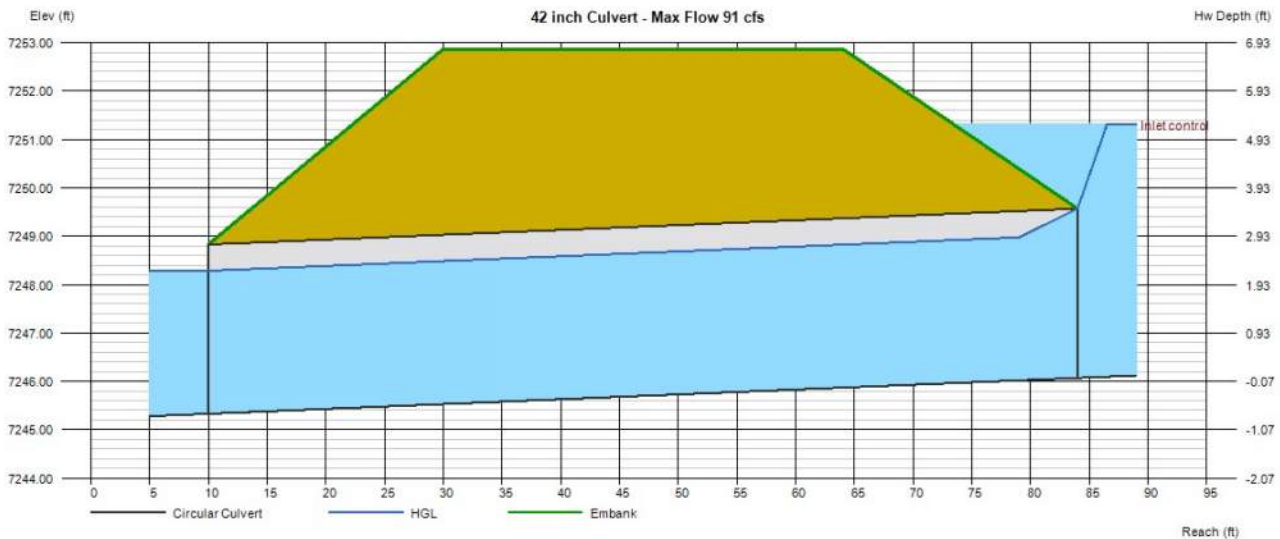
42 inch Culvert - Max Flow 91 cfs

Invert Elev Dn (ft)	= 7245.33
Pipe Length (ft)	= 74.00
Slope (%)	= 1.00
Invert Elev Up (ft)	= 7246.07
Rise (in)	= 42.0
Shape	= Circular
Span (in)	= 42.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

Embankment	
Top Elevation (ft)	= 7252.87
Top Width (ft)	= 34.00
Crest Width (ft)	= 50.00

Calculations	
Qmin (cfs)	= 7.00
Qmax (cfs)	= 91.00
Tailwater Elev (ft)	= Normal

Highlighted	
Qtotal (cfs)	= 91.00
Qpipe (cfs)	= 91.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 10.50
Veloc Up (ft/s)	= 10.50
HGL Dn (ft)	= 7248.29
HGL Up (ft)	= 7249.03
Hw Elev (ft)	= 7251.30
Hw/D (ft)	= 1.50
Flow Regime	= Inlet Control



Culvert Report

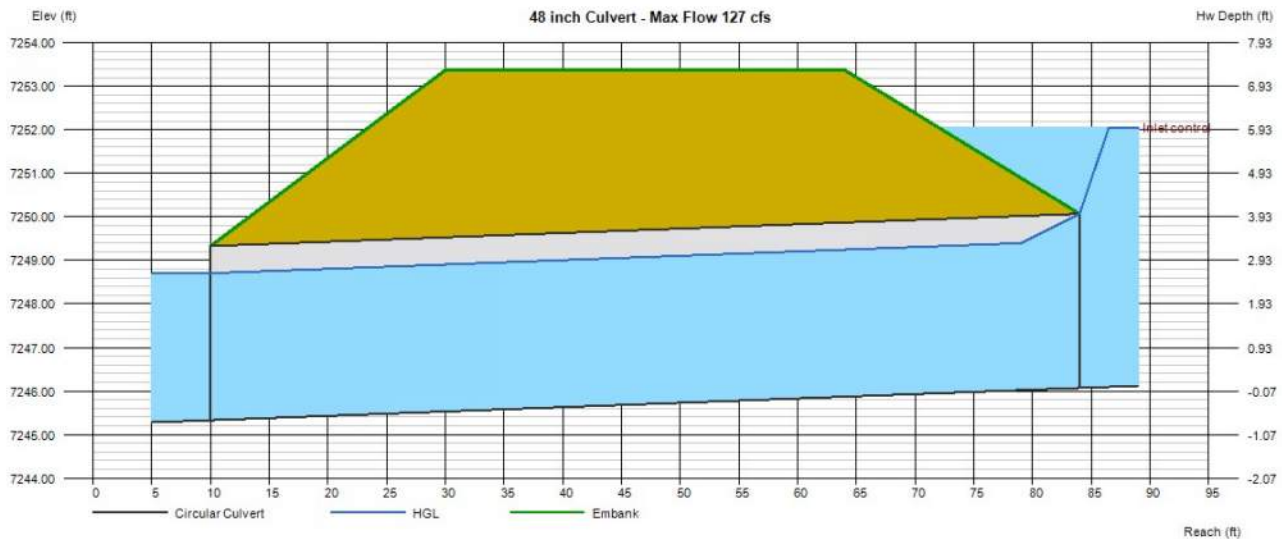
48 inch Culvert - Max Flow 127 cfs

Invert Elev Dn (ft)	= 7245.33
Pipe Length (ft)	= 74.00
Slope (%)	= 1.00
Invert Elev Up (ft)	= 7246.07
Rise (in)	= 48.0
Shape	= Circular
Span (in)	= 48.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

Embankment	
Top Elevation (ft)	= 7253.37
Top Width (ft)	= 34.00
Crest Width (ft)	= 50.00

Calculations	
Qmin (cfs)	= 75.00
Qmax (cfs)	= 127.00
Tailwater Elev (ft)	= Normal

Highlighted	
Qtotal (cfs)	= 127.00
Qpipe (cfs)	= 127.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 11.22
Veloc Up (ft/s)	= 11.22
HGL Dn (ft)	= 7248.71
HGL Up (ft)	= 7249.45
Hw Elev (ft)	= 7252.05
Hw/D (ft)	= 1.49
Flow Regime	= Inlet Control



ANTLERS RANGE SUBDIVISION



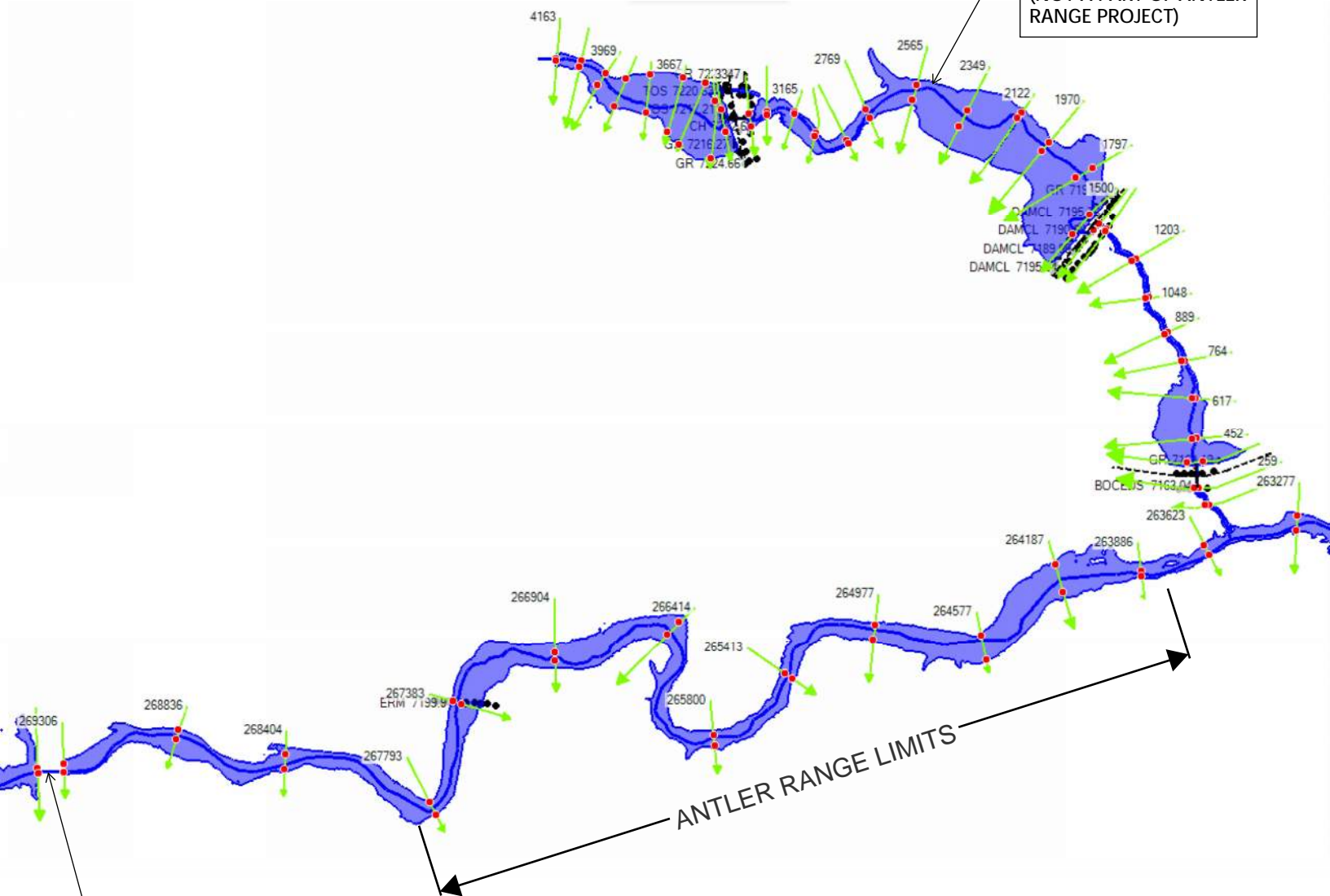
CULVERT SIZING – SUMMARY TABLE

Culvert Sizing by Flow	
Pipe Size	Max Flow (cfs)
18 Inch	11
24 Inch	22
30 Inch	39
36 Inch	62
42 Inch	91
48 Inch	127

Proposed Culvert Sizing		
Design Point	Flow Q100 (cfs)	Culvert Size
7	120.0	48 Inch
9	4.2	18 Inch
10	3.2	18 Inch
12	27.4	30 Inch
13	27.8	30 Inch
16	29.8	30 Inch
19	45.0	36 Inch
23	44.8	36 Inch
24	4.9	18 Inch
25	12.3	24 Inch
32	3.3	18 Inch
34	59.2	36 Inch
37	5.9	18 Inch
39	4.5	18 Inch

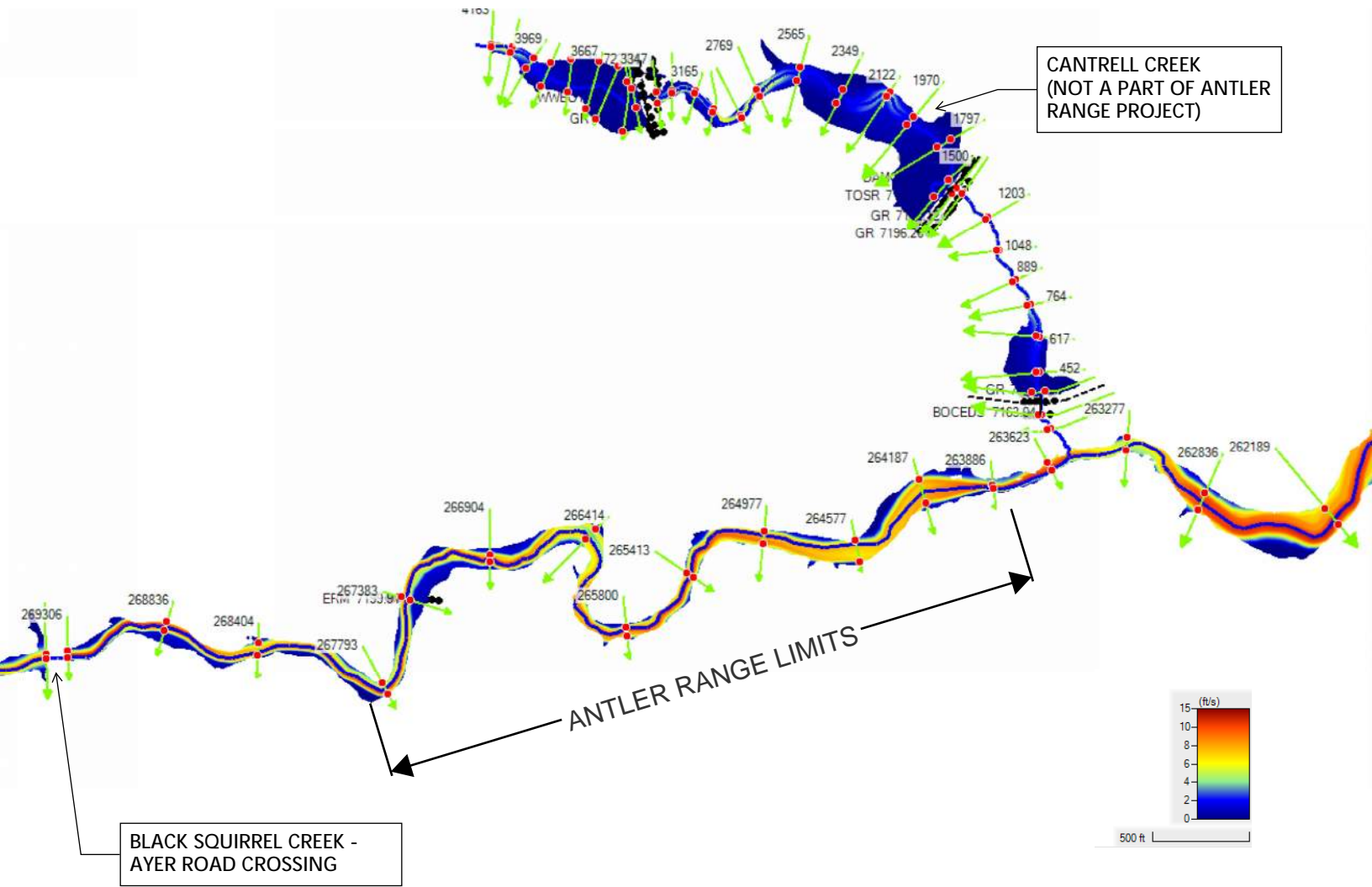
HEC RAS MODEL OUTPUT:
100-YEAR INNUNDATION BOUNDARY

CANTRELL CREEK
(NOT A PART OF ANTLER
RANGE PROJECT)



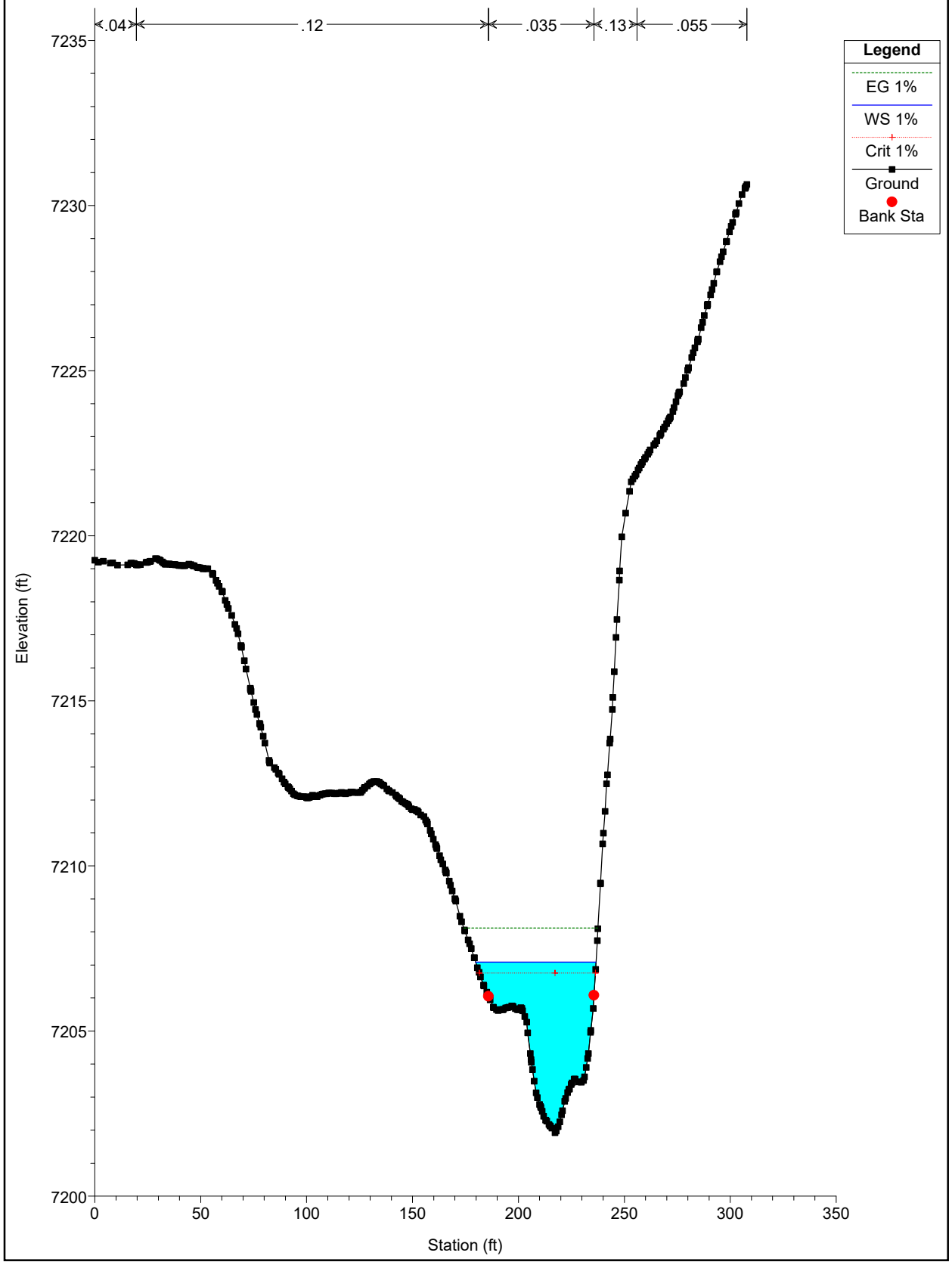
BLACK SQUIRREL CREEK -
AYER ROAD CROSSING

HEC RAS MODEL OUTPUT:
100-YEAR VELOCITIES



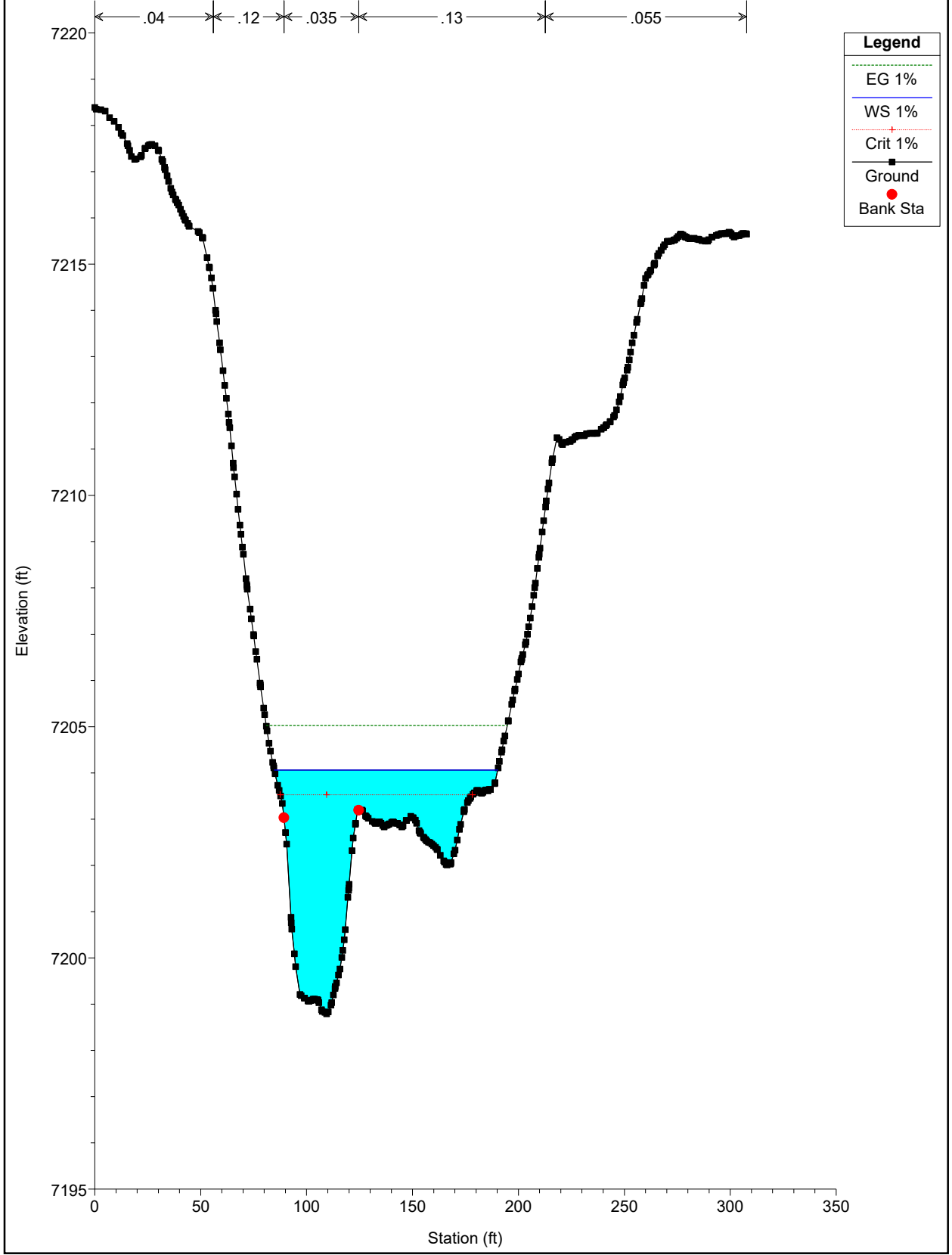
267793

BSqC Plan: BSqC 2/6/2025



267383

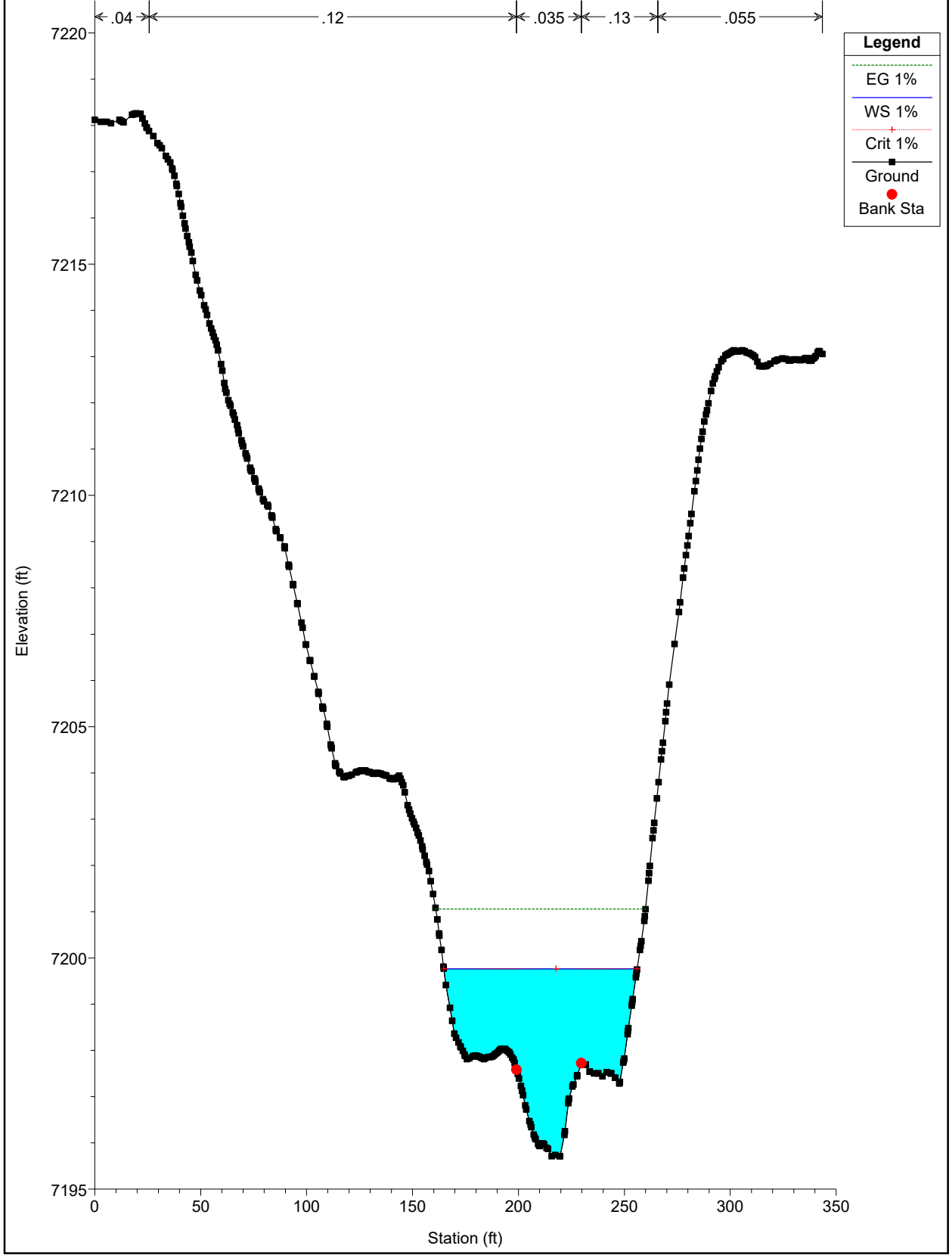
BSqC Plan: BSqC 2/6/2025



Legend	
EG 1%	(Dotted green line)
WS 1%	(Solid blue line)
Crit 1%	(Dotted red line with crosshair)
Ground	(Dashed black line)
Bank Sta	(Red dot)

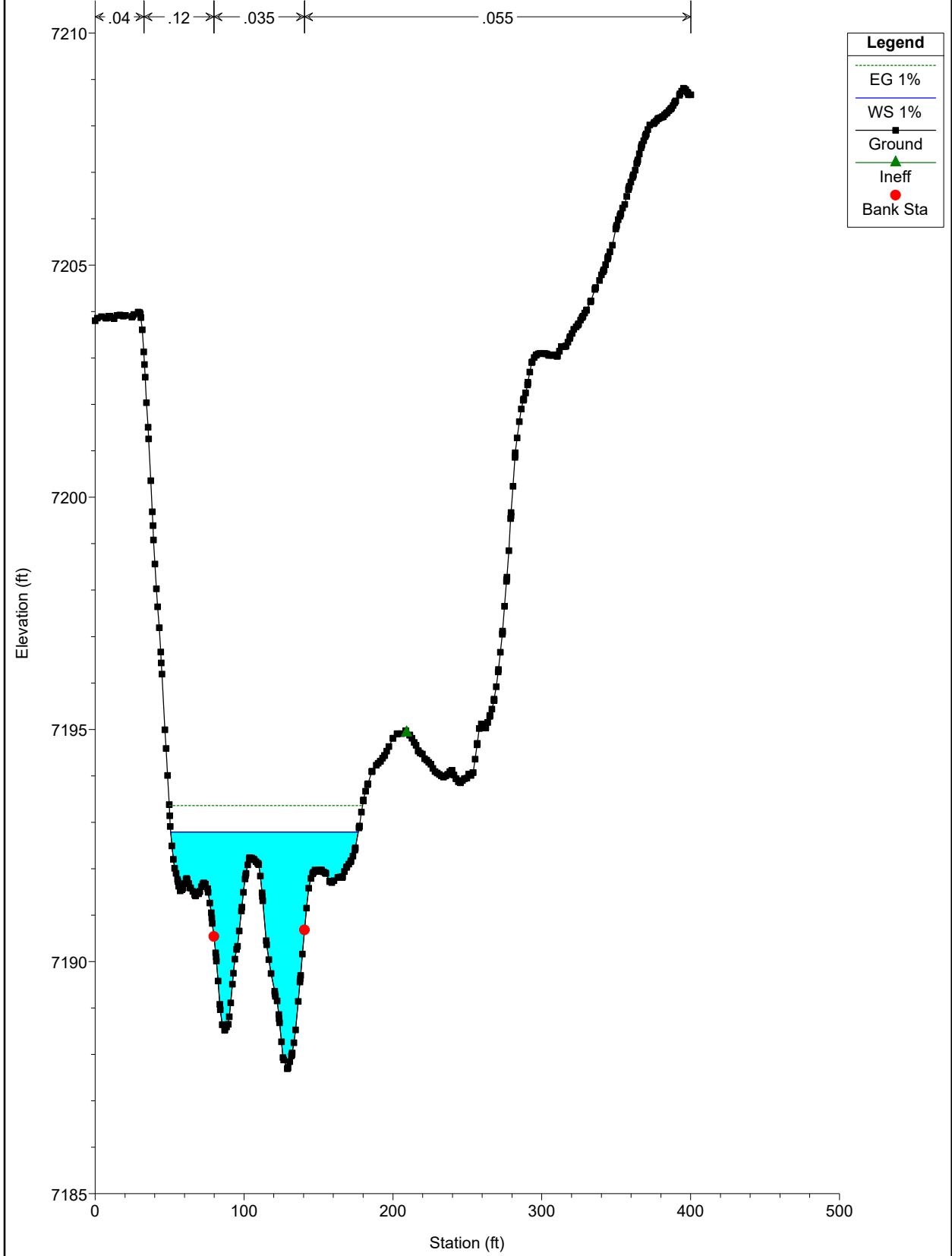
266904

BSqC Plan: BSqC 2/6/2025



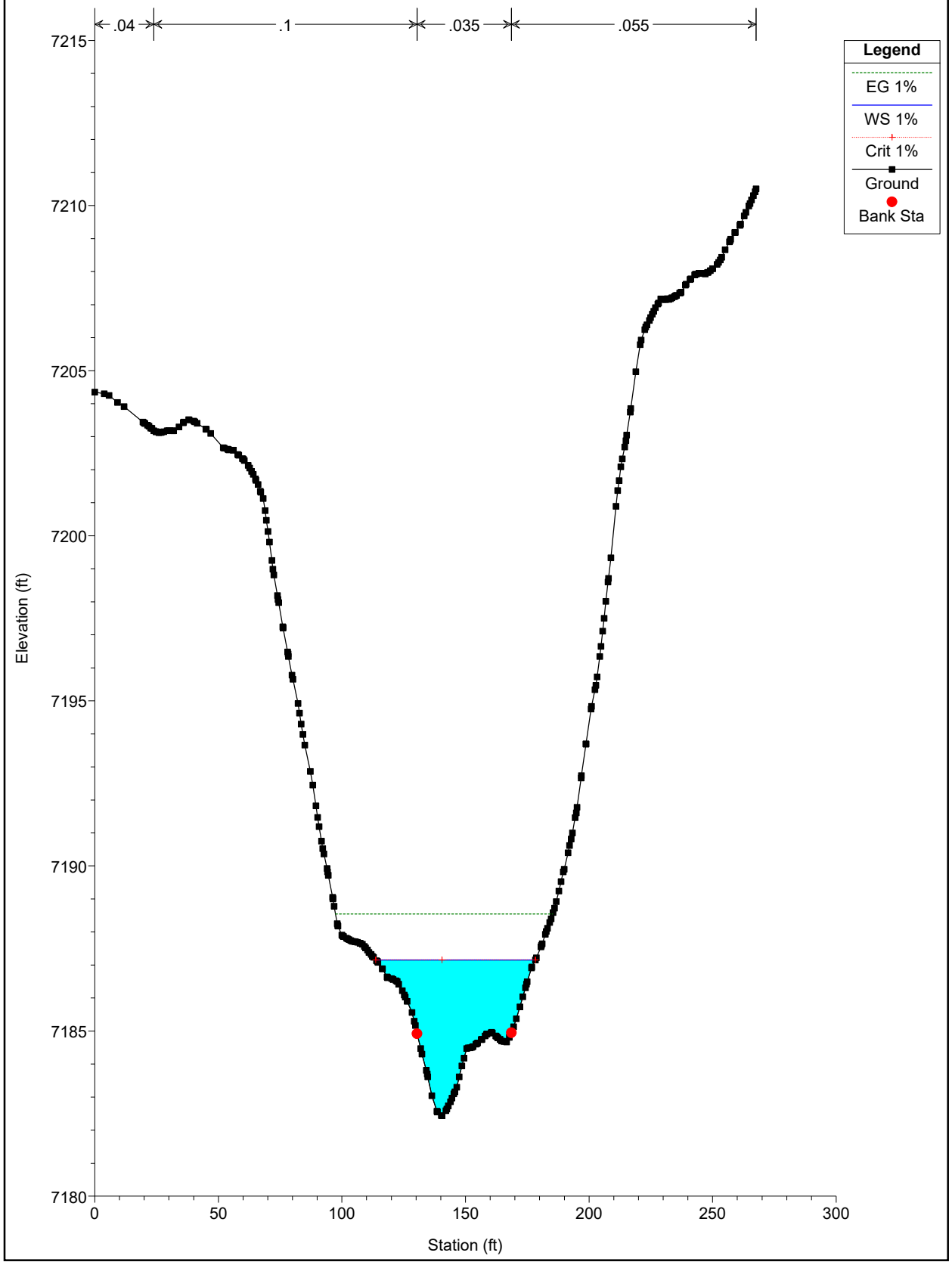
266414

BSqC Plan: BSqC 2/6/2025



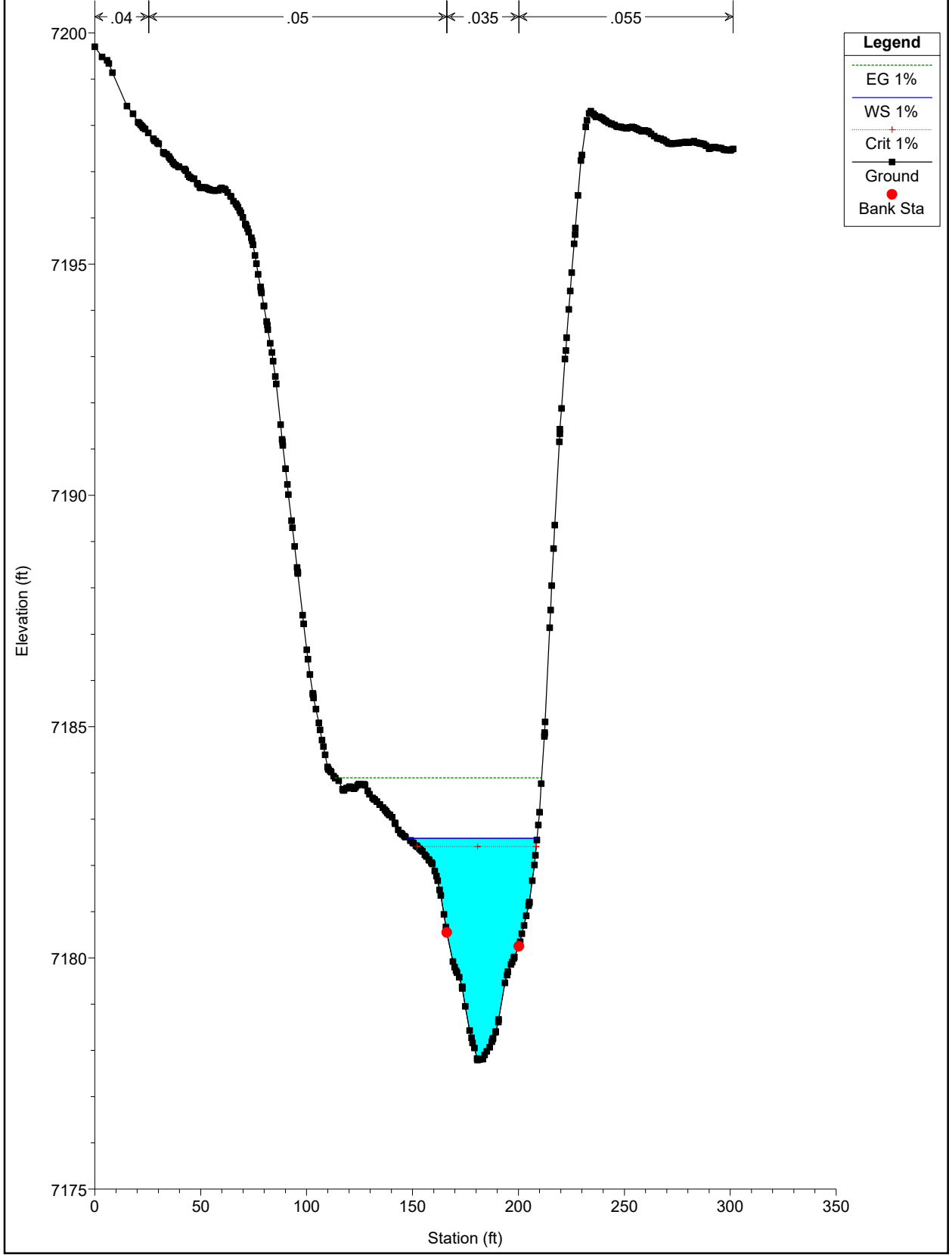
265800

BSqC Plan: BSqC 2/6/2025



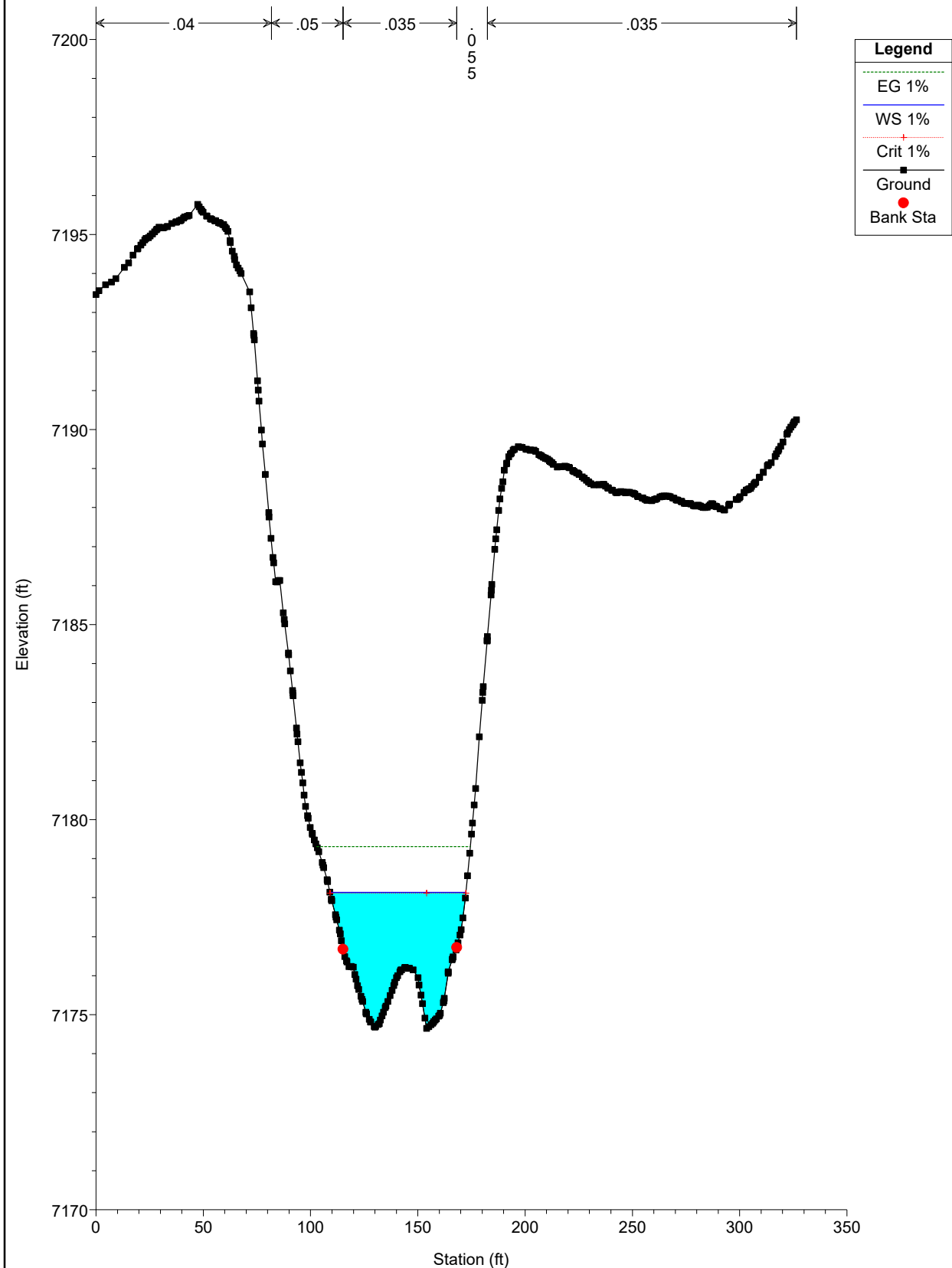
265413

BSqC Plan: BSqC 2/6/2025



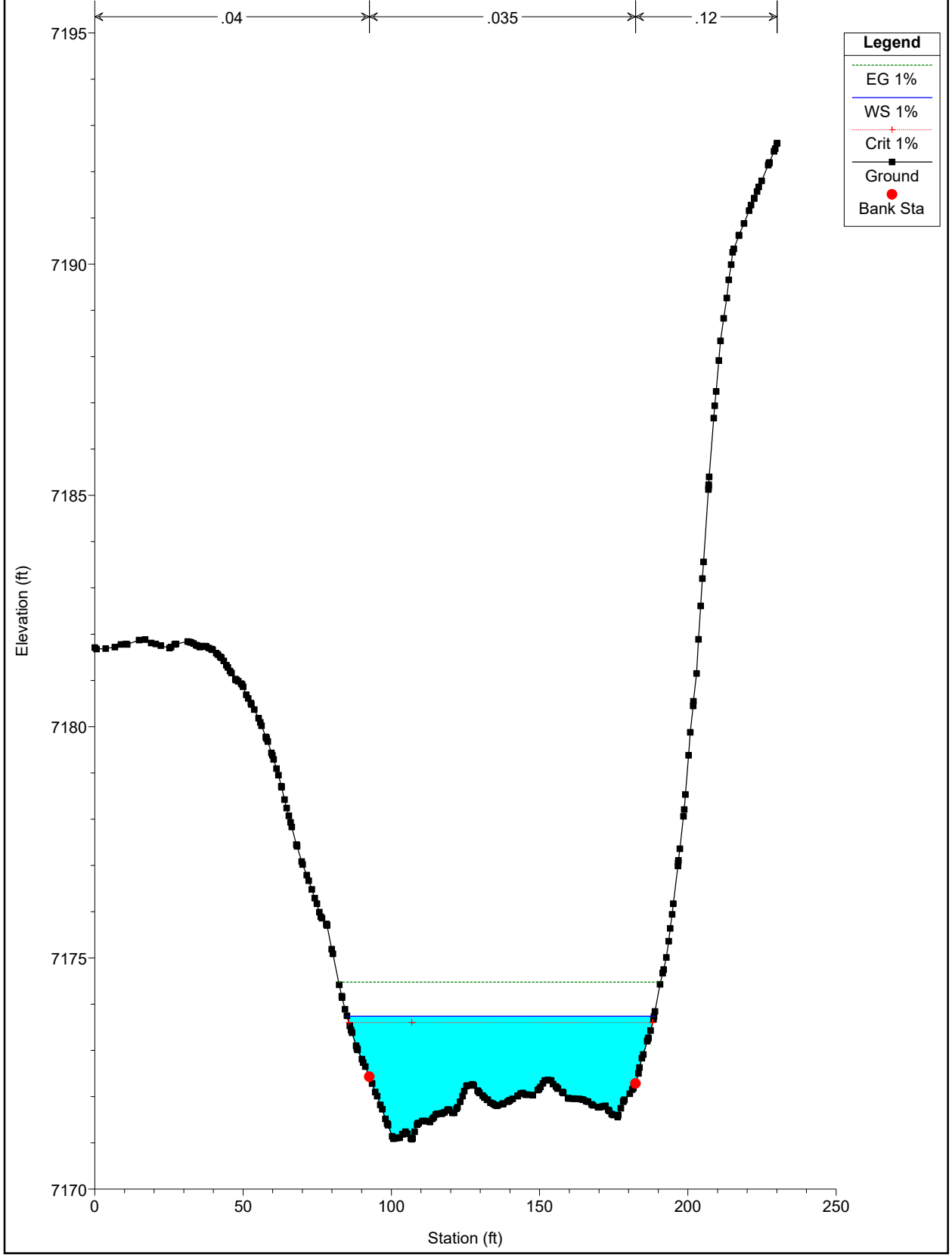
264977

BSqC Plan: BSqC 2/6/2025



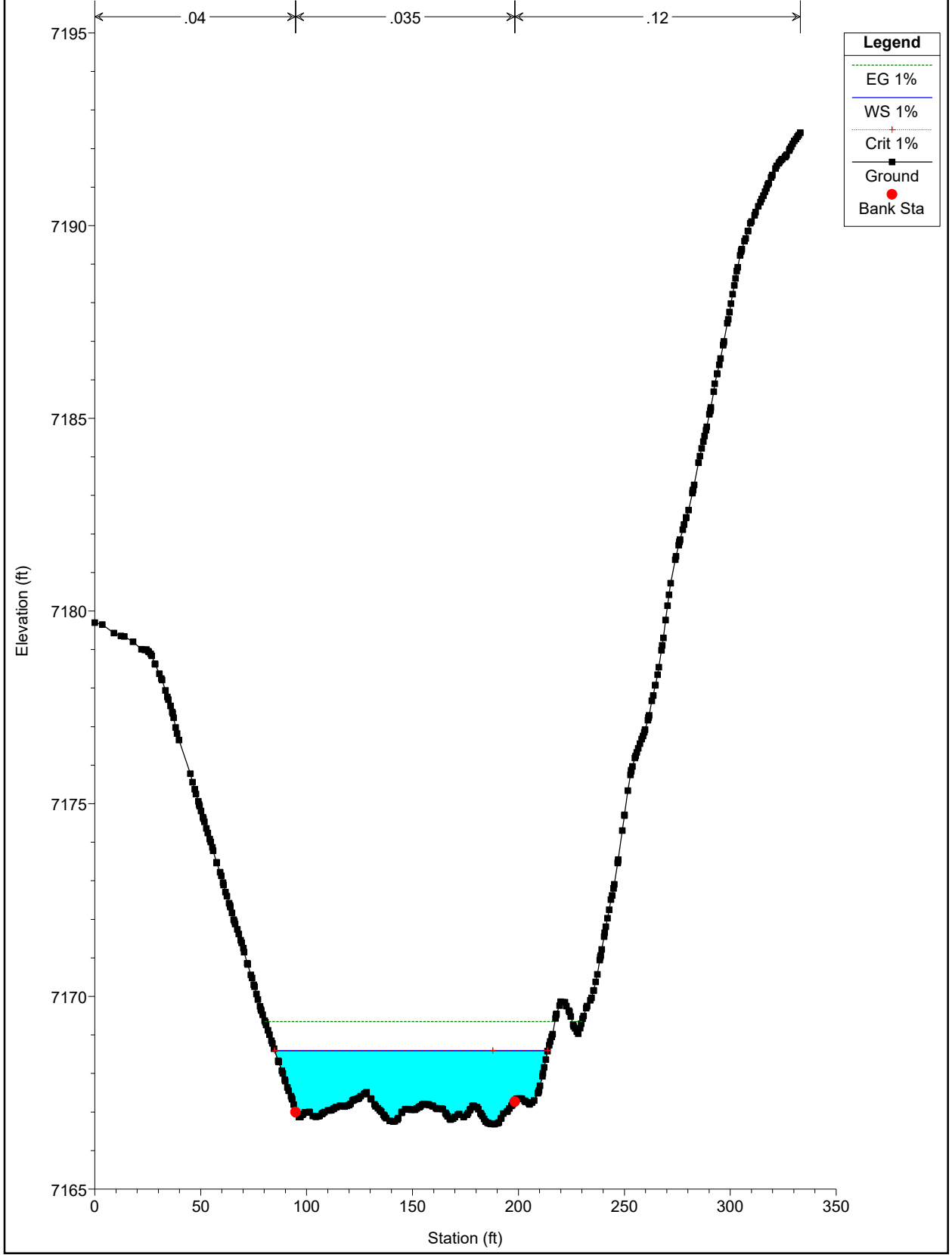
264577

BSqC Plan: BSqC 2/6/2025



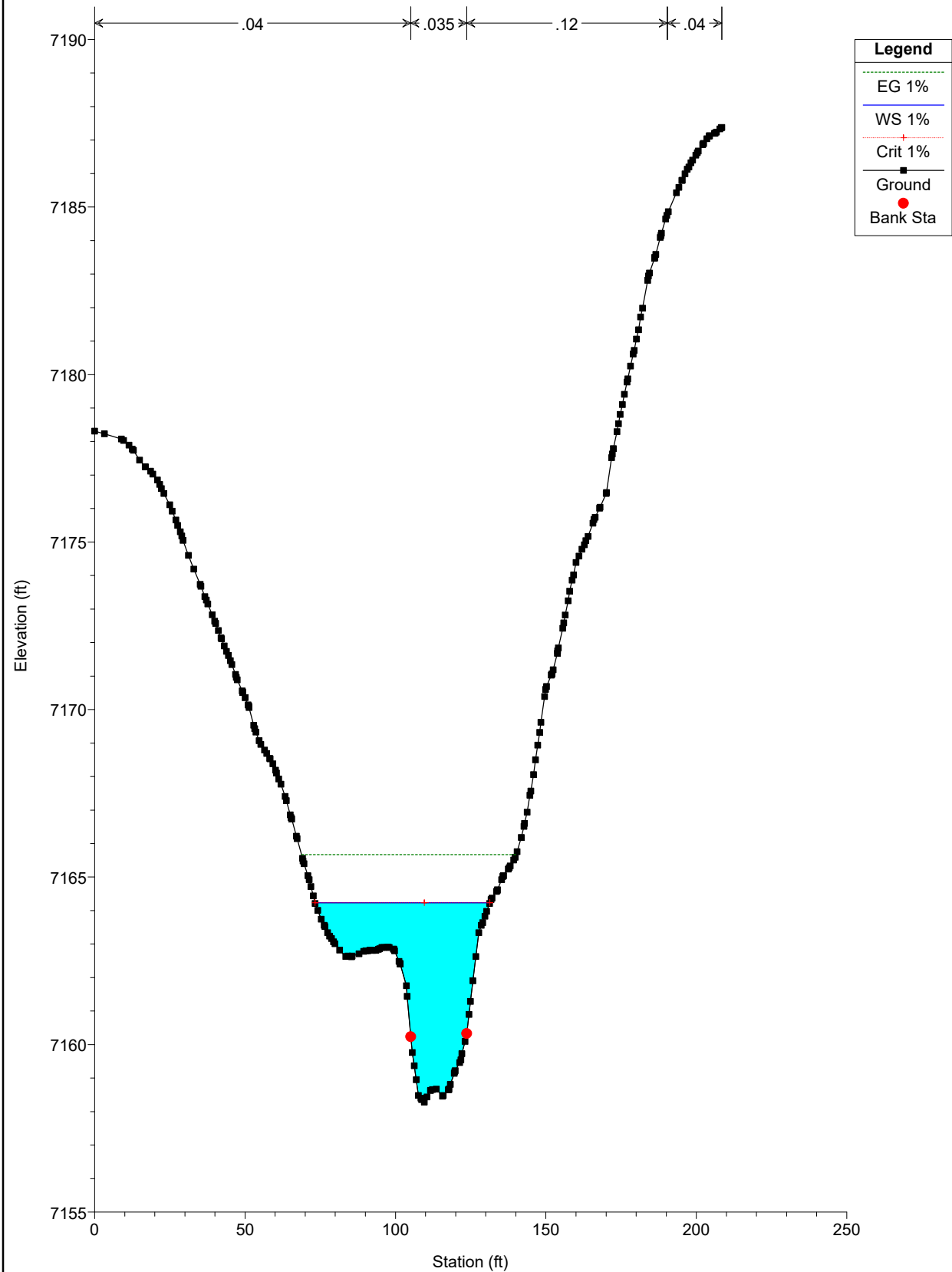
264187

BSqC Plan: BSqC 2/6/2025



263886

BSqC Plan: BSqC 2/6/2025



10-YEAR (10%) & 100-YEAR (1%)
CROSS SECTIONAL OUTPUT TABLES

Plan: BSqC BSqC BSqC **RS: 267793** Profile: 10%

E.G. Elev (ft)	7204.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.63	Wt. n-Val.		0.035	
W.S. Elev (ft)	7204.14	Reach Len. (ft)	335.10	410.00	441.60
Crit W.S. (ft)	7204.14	Flow Area (sq ft)		32.81	
E.G. Slope (ft/ft)	0.017645	Area (sq ft)		32.81	
Q Total (cfs)	209.00	Flow (cfs)		209.00	
Top Width (ft)	26.75	Top Width (ft)		26.75	
Vel Total (ft/s)	6.37	Avg. Vel. (ft/s)		6.37	
Max Chl Dpth (ft)	2.22	Hydr. Depth (ft)		1.23	
Conv. Total (cfs)	1573.4	Conv. (cfs)		1573.4	
Length Wtd. (ft)	410.00	Wetted Per. (ft)		27.33	
Min Ch El (ft)	7201.92	Shear (lb/sq ft)		1.32	
Alpha	1.00	Stream Power (lb/ft s)		8.42	
Frctn Loss (ft)	3.01	Cum Volume (acre-ft)	2.86	30.09	1.63
C & E Loss (ft)	0.11	Cum SA (acres)	5.06	24.04	2.55

Plan: BSqC BSqC BSqC RS: 267793 Profile: 1%

E.G. Elev (ft)	7208.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.03	Wt. n-Val.	0.120	0.035	0.130
W.S. Elev (ft)	7207.08	Reach Len. (ft)	335.10	410.00	441.60
Crit W.S. (ft)	7206.76	Flow Area (sq ft)	3.34	147.74	0.45
E.G. Slope (ft/ft)	0.009032	Area (sq ft)	3.34	147.74	0.45
Q Total (cfs)	1209.00	Flow (cfs)	2.61	1206.16	0.23
Top Width (ft)	56.76	Top Width (ft)	6.06	49.80	0.90
Vel Total (ft/s)	7.98	Avg. Vel. (ft/s)	0.78	8.16	0.52
Max Chl Dpth (ft)	5.16	Hydr. Depth (ft)	0.55	2.97	0.50
Conv. Total (cfs)	12721.6	Conv. (cfs)	27.5	12691.7	2.4
Length Wtd. (ft)	410.83	Wetted Per. (ft)	6.16	51.33	1.34
Min Ch El (ft)	7201.92	Shear (lb/sq ft)	0.31	1.62	0.19
Alpha	1.04	Stream Power (lb/ft s)	0.24	13.25	0.10
Frctn Loss (ft)	3.07	Cum Volume (acre-ft)	22.98	78.92	15.24
C & E Loss (ft)	0.02	Cum SA (acres)	16.14	24.77	11.69

Plan: BSqC BSqC BSqC **RS: 267383** Profile: 10%

E.G. Elev (ft)	7201.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.		0.035	
W.S. Elev (ft)	7201.35	Reach Len. (ft)	532.30	478.80	367.20
Crit W.S. (ft)		Flow Area (sq ft)		52.09	
E.G. Slope (ft/ft)	0.003997	Area (sq ft)		52.09	
Q Total (cfs)	209.00	Flow (cfs)		209.00	
Top Width (ft)	27.56	Top Width (ft)		27.56	
Vel Total (ft/s)	4.01	Avg. Vel. (ft/s)		4.01	
Max Chl Dpth (ft)	2.55	Hydr. Depth (ft)		1.89	
Conv. Total (cfs)	3305.6	Conv. (cfs)		3305.6	
Length Wtd. (ft)	478.57	Wetted Per. (ft)		28.50	
Min Ch El (ft)	7198.79	Shear (lb/sq ft)		0.46	
Alpha	1.00	Stream Power (lb/ft s)		1.83	
Frctn Loss (ft)	3.42	Cum Volume (acre-ft)	2.86	29.70	1.63
C & E Loss (ft)	0.03	Cum SA (acres)	5.06	23.79	2.55

Plan: BSqC BSqC BSqC RS: 267383 Profile: 1%

E.G. Elev (ft)	7205.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.97	Wt. n-Val.	0.120	0.035	0.130
W.S. Elev (ft)	7204.06	Reach Len. (ft)	532.30	478.80	367.20
Crit W.S. (ft)	7203.53	Flow Area (sq ft)	2.07	139.57	73.67
E.G. Slope (ft/ft)	0.006288	Area (sq ft)	2.07	139.57	73.67
Q Total (cfs)	1209.00	Flow (cfs)	1.18	1135.82	72.00
Top Width (ft)	105.42	Top Width (ft)	4.56	35.30	65.56
Vel Total (ft/s)	5.62	Avg. Vel. (ft/s)	0.57	8.14	0.98
Max Chl Dpth (ft)	5.27	Hydr. Depth (ft)	0.45	3.95	1.12
Conv. Total (cfs)	15246.1	Conv. (cfs)	14.8	14323.3	908.0
Length Wtd. (ft)	473.41	Wetted Per. (ft)	4.69	37.14	65.80
Min Ch El (ft)	7198.79	Shear (lb/sq ft)	0.17	1.48	0.44
Alpha	1.98	Stream Power (lb/ft s)	0.10	12.01	0.43
Frctn Loss (ft)	3.93	Cum Volume (acre-ft)	22.96	77.57	14.86
C & E Loss (ft)	0.03	Cum SA (acres)	16.10	24.37	11.36

Plan: BSqC BSqC BSqC RS: 266904 Profile: 10%

E.G. Elev (ft)	7198.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.	0.000	0.035	0.130
W.S. Elev (ft)	7197.61	Reach Len. (ft)	519.40	490.10	369.80
Crit W.S. (ft)	7197.61	Flow Area (sq ft)	0.00	34.95	2.21
E.G. Slope (ft/ft)	0.016202	Area (sq ft)	0.00	34.95	2.21
Q Total (cfs)	209.00	Flow (cfs)	0.00	208.15	0.85
Top Width (ft)	46.26	Top Width (ft)	0.19	29.82	16.24
Vel Total (ft/s)	5.62	Avg. Vel. (ft/s)	0.09	5.96	0.38
Max Chl Dpth (ft)	1.90	Hydr. Depth (ft)	0.01	1.17	0.14
Conv. Total (cfs)	1641.9	Conv. (cfs)	0.0	1635.3	6.7
Length Wtd. (ft)	489.86	Wetted Per. (ft)	0.19	30.21	16.29
Min Ch El (ft)	7195.71	Shear (lb/sq ft)		1.17	0.14
Alpha	1.12	Stream Power (lb/ft s)		6.97	0.05
Frctn Loss (ft)	3.92	Cum Volume (acre-ft)	2.86	29.22	1.62
C & E Loss (ft)	0.10	Cum SA (acres)	5.06	23.47	2.48

Plan: BSqC BSqC BSqC RS: 266904 Profile: 1%

E.G. Elev (ft)	7201.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.30	Wt. n-Val.	0.120	0.035	0.130
W.S. Elev (ft)	7199.76	Reach Len. (ft)	519.40	490.10	369.80
Crit W.S. (ft)	7199.76	Flow Area (sq ft)	57.57	100.76	51.20
E.G. Slope (ft/ft)	0.011467	Area (sq ft)	57.57	100.76	51.20
Q Total (cfs)	1209.00	Flow (cfs)	107.12	1005.21	96.67
Top Width (ft)	91.32	Top Width (ft)	34.38	30.60	26.34
Vel Total (ft/s)	5.77	Avg. Vel. (ft/s)	1.86	9.98	1.89
Max Chl Dpth (ft)	4.05	Hydr. Depth (ft)	1.67	3.29	1.94
Conv. Total (cfs)	11290.2	Conv. (cfs)	1000.3	9387.2	902.8
Length Wtd. (ft)	484.02	Wetted Per. (ft)	34.63	30.99	26.72
Min Ch El (ft)	7195.71	Shear (lb/sq ft)	1.19	2.33	1.37
Alpha	2.50	Stream Power (lb/ft s)	2.21	23.22	2.59
Frctn Loss (ft)	3.75	Cum Volume (acre-ft)	22.60	76.25	14.34
C & E Loss (ft)	0.22	Cum SA (acres)	15.86	24.01	10.97

Plan: BSqC BSqC BSqC RS: 266414 Profile: 10%

E.G. Elev (ft)	7190.67	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.		0.035	
W.S. Elev (ft)	7190.47	Reach Len. (ft)	550.90	613.30	608.70
Crit W.S. (ft)		Flow Area (sq ft)		58.10	
E.G. Slope (ft/ft)	0.004756	Area (sq ft)		58.10	
Q Total (cfs)	209.00	Flow (cfs)		209.00	
Top Width (ft)	41.34	Top Width (ft)		41.34	
Vel Total (ft/s)	3.60	Avg. Vel. (ft/s)		3.60	
Max Chl Dpth (ft)	2.78	Hydr. Depth (ft)		1.41	
Conv. Total (cfs)	3030.4	Conv. (cfs)		3030.4	
Length Wtd. (ft)	613.30	Wetted Per. (ft)		42.66	
Min Ch El (ft)	7187.69	Shear (lb/sq ft)		0.40	
Alpha	1.00	Stream Power (lb/ft s)		1.45	
Frctn Loss (ft)	5.17	Cum Volume (acre-ft)	2.86	28.69	1.61
C & E Loss (ft)	0.03	Cum SA (acres)	5.06	23.07	2.41

Plan: BSqC BSqC BSqC RS: 266414 Profile: 1%

E.G. Elev (ft)	7193.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.	0.120	0.035	0.055
W.S. Elev (ft)	7192.79	Reach Len. (ft)	550.90	613.30	608.70
Crit W.S. (ft)		Flow Area (sq ft)	34.31	176.18	32.29
E.G. Slope (ft/ft)	0.005585	Area (sq ft)	34.31	176.18	32.29
Q Total (cfs)	1209.00	Flow (cfs)	35.26	1113.51	60.23
Top Width (ft)	125.94	Top Width (ft)	29.01	60.80	36.14
Vel Total (ft/s)	4.98	Avg. Vel. (ft/s)	1.03	6.32	1.87
Max Chl Dpth (ft)	5.10	Hydr. Depth (ft)	1.18	2.90	0.89
Conv. Total (cfs)	16177.8	Conv. (cfs)	471.8	14900.0	806.0
Length Wtd. (ft)	611.71	Wetted Per. (ft)	29.33	62.66	36.36
Min Ch El (ft)	7187.69	Shear (lb/sq ft)	0.41	0.98	0.31
Alpha	1.49	Stream Power (lb/ft s)	0.42	6.20	0.58
Frctn Loss (ft)	4.74	Cum Volume (acre-ft)	22.05	74.69	13.98
C & E Loss (ft)	0.08	Cum SA (acres)	15.48	23.50	10.70

Plan: BSqC BSqC BSqC RS: 265800 Profile: 10%

E.G. Elev (ft)	7185.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.	0.001	0.035	0.000
W.S. Elev (ft)	7184.98	Reach Len. (ft)	325.70	388.00	427.70
Crit W.S. (ft)	7184.98	Flow Area (sq ft)	0.00	37.01	0.00
E.G. Slope (ft/ft)	0.018863	Area (sq ft)	0.00	37.01	0.00
Q Total (cfs)	209.00	Flow (cfs)	0.00	209.00	0.00
Top Width (ft)	38.51	Top Width (ft)	0.16	38.20	0.14
Vel Total (ft/s)	5.65	Avg. Vel. (ft/s)	0.19	5.65	0.21
Max Chl Dpth (ft)	2.55	Hydr. Depth (ft)	0.03	0.97	0.01
Conv. Total (cfs)	1521.7	Conv. (cfs)	0.0	1521.7	0.0
Length Wtd. (ft)	388.00	Wetted Per. (ft)	0.17	38.83	0.14
Min Ch El (ft)	7182.43	Shear (lb/sq ft)		1.12	
Alpha	1.00	Stream Power (lb/ft s)		6.34	
Frctn Loss (ft)	4.12	Cum Volume (acre-ft)	2.86	28.02	1.61
C & E Loss (ft)	0.06	Cum SA (acres)	5.06	22.51	2.41

Plan: BSqC BSqC BSqC RS: 265800 Profile: 1%

E.G. Elev (ft)	7188.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.39	Wt. n-Val.	0.100	0.035	0.055
W.S. Elev (ft)	7187.16	Reach Len. (ft)	325.70	388.00	427.70
Crit W.S. (ft)	7187.16	Flow Area (sq ft)	13.94	120.16	10.34
E.G. Slope (ft/ft)	0.011444	Area (sq ft)	13.94	120.16	10.34
Q Total (cfs)	1209.00	Flow (cfs)	19.48	1158.95	30.58
Top Width (ft)	64.63	Top Width (ft)	16.70	38.20	9.73
Vel Total (ft/s)	8.37	Avg. Vel. (ft/s)	1.40	9.64	2.96
Max Chl Dpth (ft)	4.73	Hydr. Depth (ft)	0.83	3.15	1.06
Conv. Total (cfs)	11301.3	Conv. (cfs)	182.1	10833.4	285.8
Length Wtd. (ft)	388.05	Wetted Per. (ft)	16.91	38.83	9.99
Min Ch El (ft)	7182.43	Shear (lb/sq ft)	0.59	2.21	0.74
Alpha	1.28	Stream Power (lb/ft s)	0.82	21.33	2.19
Frctn Loss (ft)	3.93	Cum Volume (acre-ft)	21.74	72.60	13.68
C & E Loss (ft)	0.02	Cum SA (acres)	15.19	22.80	10.38

Plan: BSqC BSqC BSqC RS: 265413 Profile: 10%

E.G. Elev (ft)	7180.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.30	Wt. n-Val.		0.035	0.055
W.S. Elev (ft)	7180.38	Reach Len. (ft)	482.40	435.80	339.80
Crit W.S. (ft)		Flow Area (sq ft)		47.50	0.05
E.G. Slope (ft/ft)	0.006810	Area (sq ft)		47.50	0.05
Q Total (cfs)	209.00	Flow (cfs)		208.98	0.02
Top Width (ft)	33.98	Top Width (ft)		33.24	0.73
Vel Total (ft/s)	4.40	Avg. Vel. (ft/s)		4.40	0.36
Max Chl Dpth (ft)	2.59	Hydr. Depth (ft)		1.43	0.07
Conv. Total (cfs)	2532.6	Conv. (cfs)		2532.4	0.2
Length Wtd. (ft)	435.80	Wetted Per. (ft)		33.75	0.74
Min Ch El (ft)	7177.79	Shear (lb/sq ft)		0.60	0.03
Alpha	1.00	Stream Power (lb/ft s)		2.63	0.01
Frctn Loss (ft)	3.93	Cum Volume (acre-ft)	2.86	27.65	1.61
C & E Loss (ft)	0.00	Cum SA (acres)	5.05	22.19	2.40

Plan: BSqC BSqC BSqC RS: 265413 Profile: 1%

E.G. Elev (ft)	7183.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.31	Wt. n-Val.	0.050	0.035	0.055
W.S. Elev (ft)	7182.59	Reach Len. (ft)	482.40	435.80	339.80
Crit W.S. (ft)	7182.41	Flow Area (sq ft)	11.04	122.51	11.93
E.G. Slope (ft/ft)	0.009036	Area (sq ft)	11.04	122.51	11.93
Q Total (cfs)	1209.00	Flow (cfs)	21.79	1150.04	37.17
Top Width (ft)	61.31	Top Width (ft)	18.73	34.00	8.58
Vel Total (ft/s)	8.31	Avg. Vel. (ft/s)	1.97	9.39	3.12
Max Chl Dpth (ft)	4.80	Hydr. Depth (ft)	0.59	3.60	1.39
Conv. Total (cfs)	12718.8	Conv. (cfs)	229.2	12098.6	391.0
Length Wtd. (ft)	434.60	Wetted Per. (ft)	18.91	34.53	8.93
Min Ch El (ft)	7177.79	Shear (lb/sq ft)	0.33	2.00	0.75
Alpha	1.22	Stream Power (lb/ft s)	0.65	18.79	2.35
Frctn Loss (ft)	4.55	Cum Volume (acre-ft)	21.65	71.52	13.57
C & E Loss (ft)	0.04	Cum SA (acres)	15.06	22.48	10.29

Plan: BSqC BSqC BSqC RS: 264977 Profile: 10%

E.G. Elev (ft)	7176.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.		0.035	
W.S. Elev (ft)	7176.44	Reach Len. (ft)	384.20	400.00	425.70
Crit W.S. (ft)	7176.30	Flow Area (sq ft)		46.57	
E.G. Slope (ft/ft)	0.012499	Area (sq ft)		46.57	
Q Total (cfs)	209.00	Flow (cfs)		209.00	
Top Width (ft)	49.97	Top Width (ft)		49.97	
Vel Total (ft/s)	4.49	Avg. Vel. (ft/s)		4.49	
Max Chl Dpth (ft)	1.79	Hydr. Depth (ft)		0.93	
Conv. Total (cfs)	1869.4	Conv. (cfs)		1869.4	
Length Wtd. (ft)	400.00	Wetted Per. (ft)		50.65	
Min Ch El (ft)	7174.65	Shear (lb/sq ft)		0.72	
Alpha	1.00	Stream Power (lb/ft s)		3.22	
Frctn Loss (ft)	3.99	Cum Volume (acre-ft)	2.86	27.18	1.61
C & E Loss (ft)	0.05	Cum SA (acres)	5.05	21.78	2.40

Plan: BSqC BSqC BSqC RS: 264977 Profile: 1%

E.G. Elev (ft)	7179.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.17	Wt. n-Val.	0.050	0.035	0.055
W.S. Elev (ft)	7178.14	Reach Len. (ft)	384.20	400.00	425.70
Crit W.S. (ft)	7178.12	Flow Area (sq ft)	4.33	136.01	3.52
E.G. Slope (ft/ft)	0.012293	Area (sq ft)	4.33	136.01	3.52
Q Total (cfs)	1209.00	Flow (cfs)	11.05	1189.01	8.94
Top Width (ft)	63.45	Top Width (ft)	6.19	53.00	4.26
Vel Total (ft/s)	8.40	Avg. Vel. (ft/s)	2.55	8.74	2.54
Max Chl Dpth (ft)	3.49	Hydr. Depth (ft)	0.70	2.57	0.83
Conv. Total (cfs)	10904.1	Conv. (cfs)	99.7	10723.8	80.6
Length Wtd. (ft)	399.96	Wetted Per. (ft)	6.36	53.74	4.51
Min Ch El (ft)	7174.65	Shear (lb/sq ft)	0.52	1.94	0.60
Alpha	1.07	Stream Power (lb/ft s)	1.33	16.98	1.52
Frctn Loss (ft)	4.71	Cum Volume (acre-ft)	21.56	70.23	13.51
C & E Loss (ft)	0.13	Cum SA (acres)	14.92	22.04	10.24

Plan: BSqC BSqC BSqC RS: 264577 Profile: 10%

E.G. Elev (ft)	7172.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.040	0.035	0.120
W.S. Elev (ft)	7172.57	Reach Len. (ft)	393.00	389.40	381.00
Crit W.S. (ft)	7172.39	Flow Area (sq ft)	0.06	66.68	0.17
E.G. Slope (ft/ft)	0.008140	Area (sq ft)	0.06	66.68	0.17
Q Total (cfs)	209.00	Flow (cfs)	0.04	208.91	0.05
Top Width (ft)	91.82	Top Width (ft)	0.90	89.80	1.12
Vel Total (ft/s)	3.12	Avg. Vel. (ft/s)	0.57	3.13	0.31
Max Chl Dpth (ft)	1.49	Hydr. Depth (ft)	0.07	0.74	0.15
Conv. Total (cfs)	2316.5	Conv. (cfs)	0.4	2315.5	0.6
Length Wtd. (ft)	389.38	Wetted Per. (ft)	0.91	90.13	1.16
Min Ch El (ft)	7171.08	Shear (lb/sq ft)	0.04	0.38	0.08
Alpha	1.01	Stream Power (lb/ft s)	0.02	1.18	0.02
Frctn Loss (ft)	4.95	Cum Volume (acre-ft)	2.86	26.66	1.61
C & E Loss (ft)	0.01	Cum SA (acres)	5.05	21.14	2.39

Plan: BSqC BSqC BSqC RS: 264577 Profile: 1%

E.G. Elev (ft)	7174.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.73	Wt. n-Val.	0.040	0.035	0.120
W.S. Elev (ft)	7173.74	Reach Len. (ft)	393.00	389.40	381.00
Crit W.S. (ft)	7173.60	Flow Area (sq ft)	5.39	171.56	4.49
E.G. Slope (ft/ft)	0.011269	Area (sq ft)	5.39	171.56	4.49
Q Total (cfs)	1209.00	Flow (cfs)	16.78	1187.57	4.66
Top Width (ft)	103.58	Top Width (ft)	7.55	89.80	6.23
Vel Total (ft/s)	6.66	Avg. Vel. (ft/s)	3.12	6.92	1.04
Max Chl Dpth (ft)	2.66	Hydr. Depth (ft)	0.71	1.91	0.72
Conv. Total (cfs)	11388.8	Conv. (cfs)	158.0	11186.9	43.9
Length Wtd. (ft)	389.36	Wetted Per. (ft)	7.67	90.13	6.40
Min Ch El (ft)	7171.08	Shear (lb/sq ft)	0.49	1.34	0.49
Alpha	1.06	Stream Power (lb/ft s)	1.54	9.27	0.51
Frctn Loss (ft)	5.13	Cum Volume (acre-ft)	21.52	68.82	13.47
C & E Loss (ft)	0.00	Cum SA (acres)	14.86	21.39	10.19

Plan: BSqC BSqC BSqC RS: 264187 Profile: 10%

E.G. Elev (ft)	7167.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.	0.040	0.035	0.120
W.S. Elev (ft)	7167.53	Reach Len. (ft)	318.50	301.70	287.90
Crit W.S. (ft)	7167.53	Flow Area (sq ft)	0.74	51.46	2.38
E.G. Slope (ft/ft)	0.022576	Area (sq ft)	0.74	51.46	2.38
Q Total (cfs)	209.00	Flow (cfs)	1.56	205.87	1.57
Top Width (ft)	117.83	Top Width (ft)	3.16	103.45	11.23
Vel Total (ft/s)	3.83	Avg. Vel. (ft/s)	2.10	4.00	0.66
Max Chl Dpth (ft)	0.84	Hydr. Depth (ft)	0.23	0.50	0.21
Conv. Total (cfs)	1391.0	Conv. (cfs)	10.4	1370.2	10.4
Length Wtd. (ft)	301.71	Wetted Per. (ft)	3.21	103.60	11.25
Min Ch El (ft)	7166.69	Shear (lb/sq ft)	0.33	0.70	0.30
Alpha	1.08	Stream Power (lb/ft s)	0.68	2.80	0.20
Frctn Loss (ft)	5.74	Cum Volume (acre-ft)	2.86	26.13	1.60
C & E Loss (ft)	0.05	Cum SA (acres)	5.03	20.27	2.34

Plan: BSqC BSqC BSqC RS: 264187 Profile: 1%

E.G. Elev (ft)	7169.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.76	Wt. n-Val.	0.040	0.035	0.120
W.S. Elev (ft)	7168.59	Reach Len. (ft)	318.50	301.70	287.90
Crit W.S. (ft)	7168.59	Flow Area (sq ft)	7.69	161.57	16.66
E.G. Slope (ft/ft)	0.015602	Area (sq ft)	7.69	161.57	16.66
Q Total (cfs)	1209.00	Flow (cfs)	29.83	1152.26	26.91
Top Width (ft)	128.83	Top Width (ft)	9.93	103.45	15.45
Vel Total (ft/s)	6.50	Avg. Vel. (ft/s)	3.88	7.13	1.62
Max Chl Dpth (ft)	1.90	Hydr. Depth (ft)	0.77	1.56	1.08
Conv. Total (cfs)	9679.2	Conv. (cfs)	238.8	9224.9	215.5
Length Wtd. (ft)	302.88	Wetted Per. (ft)	10.06	103.60	15.61
Min Ch El (ft)	7166.69	Shear (lb/sq ft)	0.74	1.52	1.04
Alpha	1.16	Stream Power (lb/ft s)	2.89	10.83	1.68
Frctn Loss (ft)	2.99	Cum Volume (acre-ft)	21.46	67.33	13.38
C & E Loss (ft)	0.07	Cum SA (acres)	14.78	20.52	10.10

Plan: BSqC BSqC BSqC RS: 263886 Profile: 10%

E.G. Elev (ft)	7161.28	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.79	Wt. n-Val.	0.040	0.035	0.120
W.S. Elev (ft)	7160.49	Reach Len. (ft)	240.70	262.90	273.90
Crit W.S. (ft)	7160.49	Flow Area (sq ft)	0.03	29.36	0.02
E.G. Slope (ft/ft)	0.016269	Area (sq ft)	0.03	29.36	0.02
Q Total (cfs)	209.00	Flow (cfs)	0.03	208.96	0.00
Top Width (ft)	19.06	Top Width (ft)	0.26	18.60	0.20
Vel Total (ft/s)	7.11	Avg. Vel. (ft/s)	0.97	7.12	0.25
Max Chl Dpth (ft)	2.21	Hydr. Depth (ft)	0.13	1.58	0.08
Conv. Total (cfs)	1638.6	Conv. (cfs)	0.3	1638.3	0.0
Length Wtd. (ft)	262.90	Wetted Per. (ft)	0.37	19.48	0.26
Min Ch El (ft)	7158.28	Shear (lb/sq ft)	0.09	1.53	0.06
Alpha	1.00	Stream Power (lb/ft s)	0.09	10.89	0.02
Frctn Loss (ft)	4.01	Cum Volume (acre-ft)	2.85	25.85	1.59
C & E Loss (ft)	0.11	Cum SA (acres)	5.02	19.85	2.30

Plan: BSqC BSqC BSqC RS: 263886 Profile: 1%

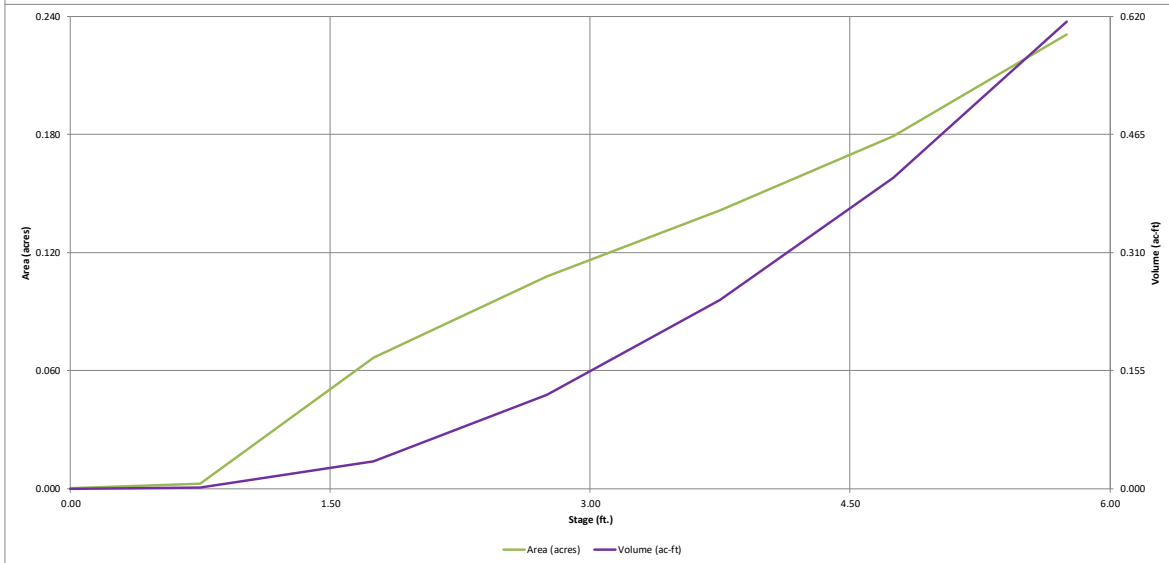
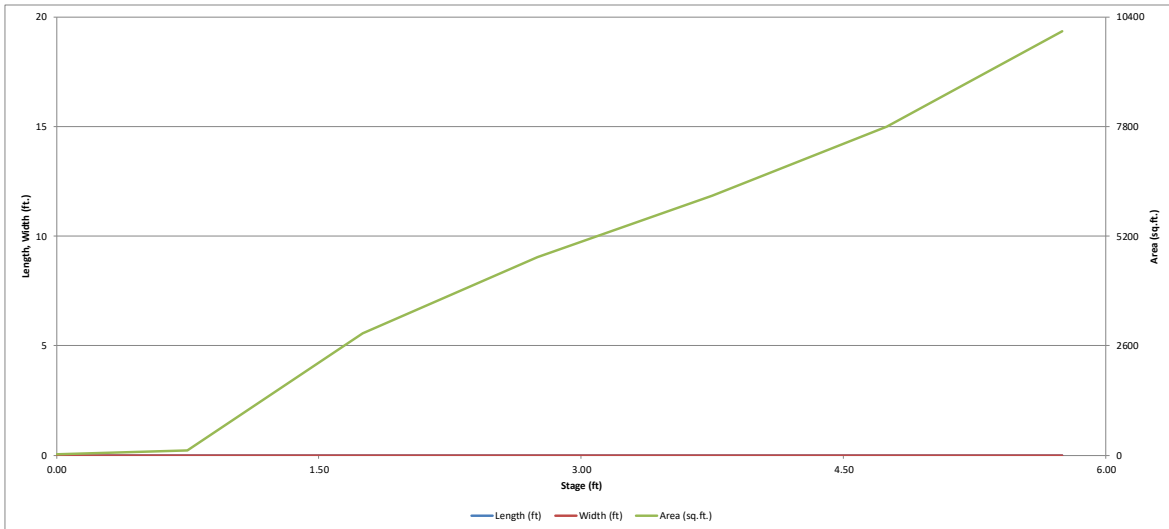
E.G. Elev (ft)	7165.67	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.44	Wt. n-Val.	0.040	0.035	0.120
W.S. Elev (ft)	7164.23	Reach Len. (ft)	240.70	262.90	273.90
Crit W.S. (ft)	7164.23	Flow Area (sq ft)	45.43	98.90	11.04
E.G. Slope (ft/ft)	0.006803	Area (sq ft)	45.43	98.90	11.04
Q Total (cfs)	1209.00	Flow (cfs)	172.93	1022.95	13.12
Top Width (ft)	58.15	Top Width (ft)	31.86	18.60	7.69
Vel Total (ft/s)	7.78	Avg. Vel. (ft/s)	3.81	10.34	1.19
Max Chl Dpth (ft)	5.95	Hydr. Depth (ft)	1.43	5.32	1.44
Conv. Total (cfs)	14657.6	Conv. (cfs)	2096.6	12402.0	159.0
Length Wtd. (ft)	261.32	Wetted Per. (ft)	32.80	19.48	8.81
Min Ch El (ft)	7158.28	Shear (lb/sq ft)	0.59	2.16	0.53
Alpha	1.53	Stream Power (lb/ft s)	2.24	22.30	0.63
Frctn Loss (ft)	2.32	Cum Volume (acre-ft)	21.27	66.43	13.29
C & E Loss (ft)	0.00	Cum SA (acres)	14.63	20.10	10.02



APPENDIX D – WATER QUALITY & DETENTION

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

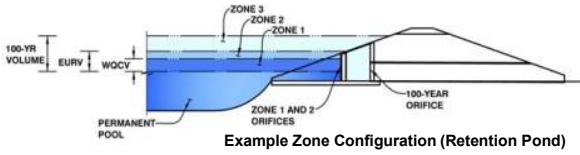


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention, Version 4.06 (July 2022)*

Project: ANTLERS RANGE

Basin ID: POND A



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.94	0.049	Orifice Plate
Zone 2 (EURV)	2.50	0.048	Circular Orifice
Zone 3 (100-year)	3.91	0.174	Weir&Pipe (Restrict)
Total (all zones)		0.271	

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
 Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain
 Underdrain Orifice Area = ft²
 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 BMP)

Centroid of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = inches
 Orifice Plate: Orifice Area per Row = sq. inches

Calculated Parameters for Plate
 WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	1.60					
Orifice Area (sq. inches)	0.23	0.23	0.25					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	<input type="text" value="2.25"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	<input type="text" value="2.86"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	<input type="text" value="0.38"/>	<input type="text" value="N/A"/>	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	ft ²
Vertical Orifice Centroid =	<input type="text" value="0.02"/>	<input type="text" value="N/A"/>	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	<input type="text" value="2.86"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	<input type="text" value="3.00"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Gate Slope =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	H:V
Horiz. Length of Weir Sides =	<input type="text" value="3.00"/>	<input type="text" value="N/A"/>	feet
Overflow Gate Type =	<input type="text" value="Type C Gate"/>	<input type="text" value="N/A"/>	
Debris Clogging % =	<input type="text" value="50%"/>	<input type="text" value="N/A"/>	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Gate Upper Edge, H ₁ =	<input type="text" value="2.86"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Slope Length =	<input type="text" value="3.00"/>	<input type="text" value="N/A"/>	feet
Grate Open Area / 100-yr Orifice Area =	<input type="text" value="7.99"/>	<input type="text" value="N/A"/>	
Overflow Gate Open Area w/o Debris =	<input type="text" value="6.26"/>	<input type="text" value="N/A"/>	ft ²
Overflow Gate Open Area w/ Debris =	<input type="text" value="3.13"/>	<input type="text" value="N/A"/>	ft ²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	<input type="text" value="1.00"/>	<input type="text" value="N/A"/>	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	<input type="text" value="18.00"/>	<input type="text" value="N/A"/>	inches
Restrictor Plate Height Above Pipe Invert =	<input type="text" value="8.20"/>	<input type="text" value="N/A"/>	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	<input type="text" value="0.78"/>	<input type="text" value="N/A"/>	ft ²
Outlet Orifice Centroid =	<input type="text" value="0.40"/>	<input type="text" value="N/A"/>	feet
Half-Central Angle of Restrictor Plate on Pipe =	<input type="text" value="1.48"/>	<input type="text" value="N/A"/>	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
 Spillway Crest Length = feet
 Spillway End Slopes = H:V
 Freeboard above Max Water Surface = feet

Calculated Parameters for Spillway

Spillway Design Flow Depth = feet
 Stage at Top of Freeboard = feet
 Basin Area at Top of Freeboard = acres
 Basin Volume at Top of Freeboard = acre-ft

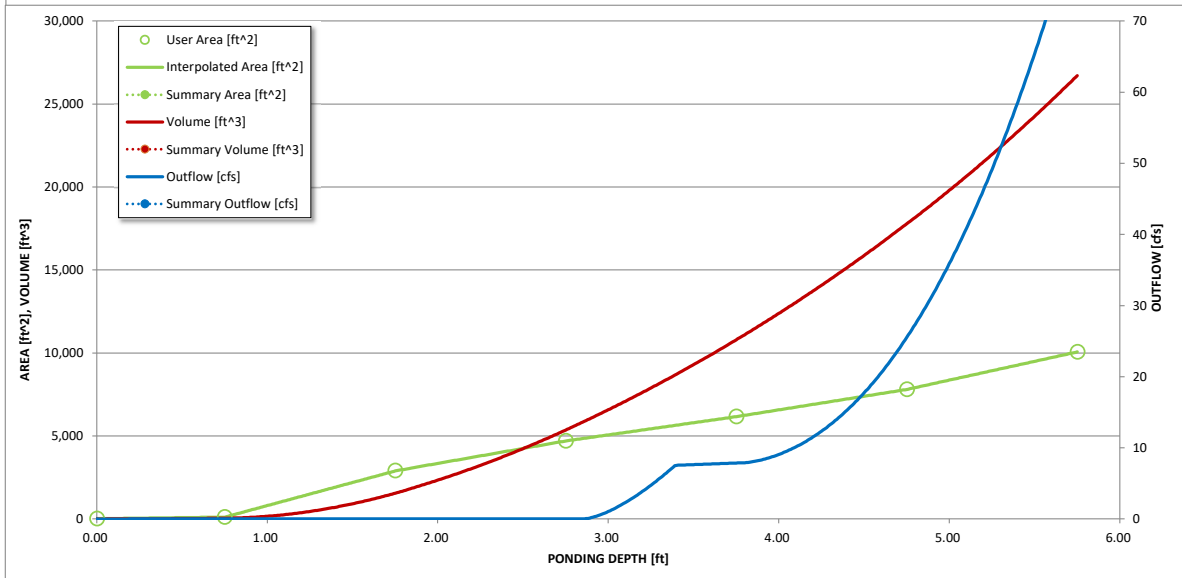
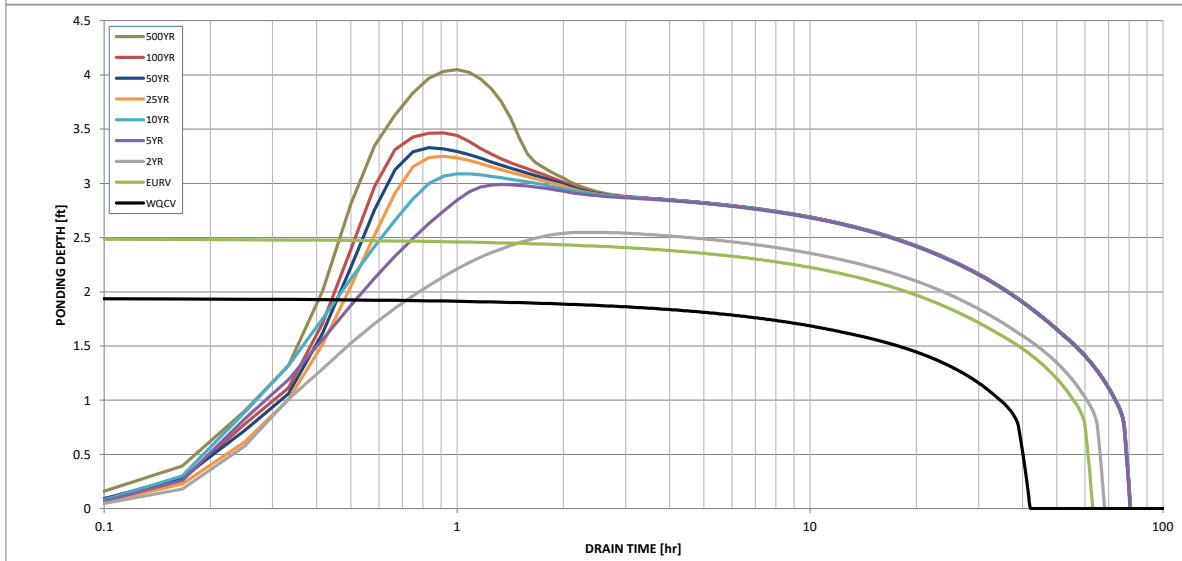
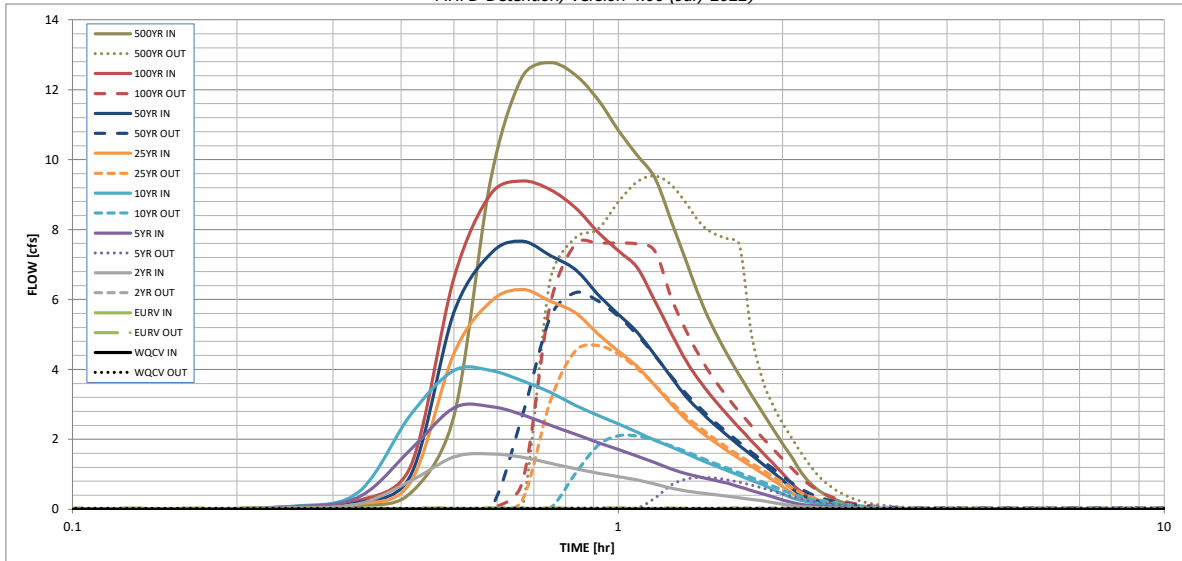
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.049	0.096	0.108	0.202	0.294	0.445	0.552	0.702	0.981
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.108	0.202	0.294	0.445	0.552	0.702	0.981
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.7	2.0	3.0	5.3	6.7	8.3	11.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.13	0.37	0.55	0.97	1.21	1.51	2.11
Peak Inflow Q (cfs) =	N/A	N/A	1.6	2.9	4.0	6.3	7.7	9.4	12.8
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.9	2.1	4.7	6.2	7.6	9.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.7	0.9	0.9	0.9	0.8
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	0.1	0.3	0.8	1.0	1.2	1.3
Max Velocity through Gate 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	57	62	70	68	63	60	57	50
Time to Drain 99% of Inflow Volume (hours) =	40	61	65	76	75	72	71	70	67
Maximum Ponding Depth (ft) =	1.94	2.49	2.55	2.99	3.08	3.25	3.33	3.46	4.05
Area at Maximum Ponding Depth (acres) =	0.07	0.10	0.10	0.12	0.12	0.12	0.13	0.13	0.15
Maximum Volume Stored (acre-ft) =	0.049	0.096	0.101	0.149	0.160	0.180	0.190	0.208	0.290

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



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.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	0:15:00	0.00	0.00	0.04	0.07	0.08	0.06	0.07	0.07	0.10
	0:20:00	0.00	0.00	0.15	0.33	0.48	0.14	0.19	0.25	0.46
	0:25:00	0.00	0.00	0.81	1.71	2.71	0.78	0.97	1.23	2.66
	0:30:00	0.00	0.00	1.50	2.90	3.97	4.46	5.63	6.62	9.43
	0:35:00	0.00	0.00	1.59	2.94	3.97	5.94	7.31	9.01	12.37
	0:40:00	0.00	0.00	1.49	2.71	3.68	6.29	7.67	9.39	12.78
	0:45:00	0.00	0.00	1.32	2.40	3.35	5.95	7.26	9.14	12.42
	0:50:00	0.00	0.00	1.16	2.15	2.98	5.63	6.86	8.63	11.73
	0:55:00	0.00	0.00	1.04	1.91	2.69	5.02	6.15	7.93	10.84
	1:00:00	0.00	0.00	0.94	1.71	2.44	4.52	5.58	7.39	10.12
	1:05:00	0.00	0.00	0.84	1.52	2.20	4.09	5.06	6.91	9.48
	1:10:00	0.00	0.00	0.72	1.33	1.97	3.54	4.41	5.95	8.24
	1:15:00	0.00	0.00	0.61	1.15	1.78	3.01	3.78	5.03	7.06
	1:20:00	0.00	0.00	0.52	1.01	1.59	2.55	3.20	4.22	5.96
	1:25:00	0.00	0.00	0.47	0.92	1.41	2.22	2.79	3.62	5.12
	1:30:00	0.00	0.00	0.42	0.83	1.25	1.93	2.42	3.13	4.43
	1:35:00	0.00	0.00	0.37	0.75	1.10	1.67	2.11	2.71	3.83
	1:40:00	0.00	0.00	0.33	0.64	0.97	1.45	1.82	2.32	3.29
	1:45:00	0.00	0.00	0.28	0.54	0.84	1.24	1.56	1.97	2.79
	1:50:00	0.00	0.00	0.24	0.45	0.71	1.03	1.31	1.63	2.32
	1:55:00	0.00	0.00	0.19	0.35	0.58	0.84	1.07	1.32	1.88
	2:00:00	0.00	0.00	0.15	0.27	0.44	0.65	0.83	1.03	1.46
	2:05:00	0.00	0.00	0.10	0.19	0.32	0.45	0.58	0.72	1.04
	2:10:00	0.00	0.00	0.08	0.14	0.25	0.31	0.40	0.49	0.73
	2:15:00	0.00	0.00	0.06	0.11	0.20	0.22	0.29	0.35	0.53
	2:20:00	0.00	0.00	0.05	0.09	0.16	0.16	0.21	0.25	0.39
	2:25:00	0.00	0.00	0.04	0.07	0.13	0.11	0.16	0.17	0.28
	2:30:00	0.00	0.00	0.03	0.05	0.10	0.08	0.12	0.12	0.20
	2:35:00	0.00	0.00	0.02	0.04	0.08	0.06	0.09	0.08	0.13
	2:40:00	0.00	0.00	0.02	0.03	0.06	0.05	0.06	0.05	0.09
	2:45:00	0.00	0.00	0.01	0.03	0.04	0.03	0.05	0.04	0.06
	2:50:00	0.00	0.00	0.01	0.02	0.03	0.03	0.04	0.03	0.05
	2:55:00	0.00	0.00	0.01	0.01	0.03	0.02	0.03	0.02	0.04
	3:00:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	3:05:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02
	3:10:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	3:15:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

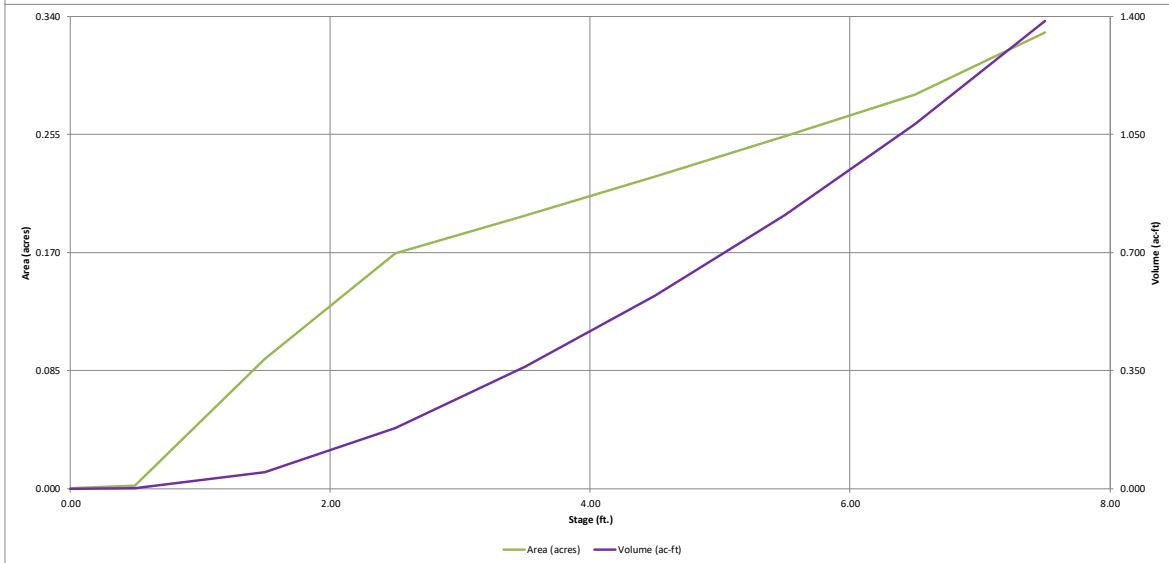
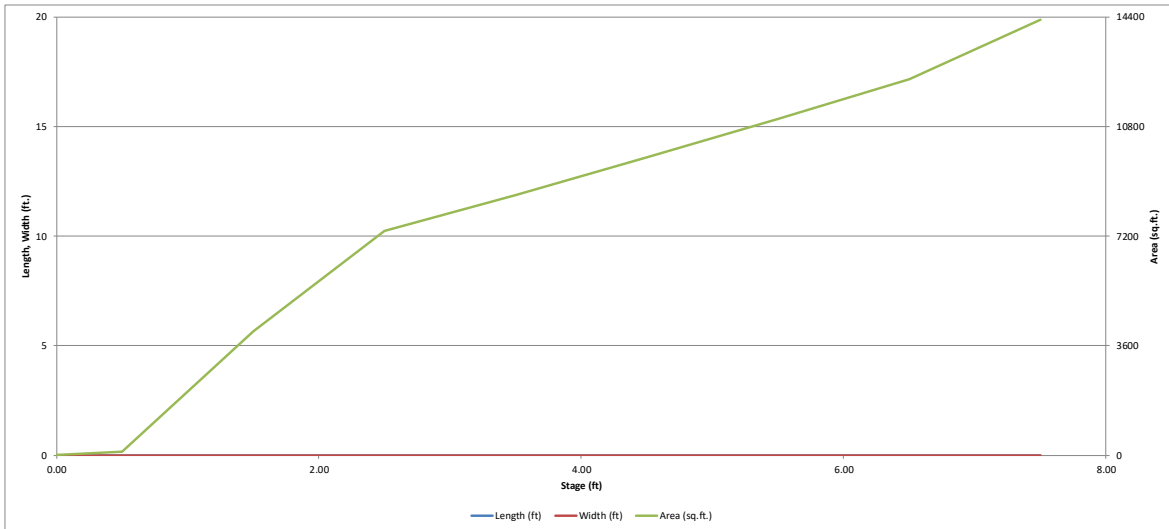
Stage - Storage Description	Stage [ft]	Area [ft ²]	Area [acres]	Volume [ft ³]	Volume [ac-ft]	Total Outflow [cfs]

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

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

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

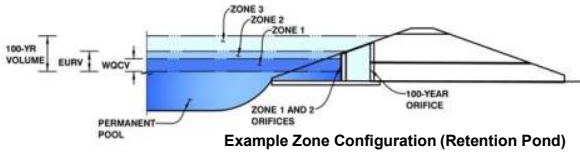


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention, Version 4.06 (July 2022)*

Project: ANTLERS RANGE

Basin ID: POND B



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.70	0.213	Orifice Plate
Zone 2 (EURV)	3.82	0.213	Circular Orifice
Zone 3 (100-year)	6.84	0.751	Weir&Pipe (Restrict)
Total (all zones)		1.177	

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
 Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain
 Underdrain Orifice Area = ft²
 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 BMP)

Centroid of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = inches
 Orifice Plate: Orifice Area per Row = sq. inches

Calculated Parameters for Plate
 WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = ft²

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					
Orifice Area (sq. inches)	0.78	0.78	0.80					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	<input type="text" value="2.70"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	<input type="text" value="3.82"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	<input type="text" value="0.38"/>	<input type="text" value="N/A"/>	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	ft ²
Vertical Orifice Centroid =	<input type="text" value="0.02"/>	<input type="text" value="N/A"/>	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	<input type="text" value="3.82"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	<input type="text" value="5.00"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Gate Slope =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	H:V
Horiz. Length of Weir Sides =	<input type="text" value="5.00"/>	<input type="text" value="N/A"/>	feet
Overflow Gate Type =	<input type="text" value="Type C Gate"/>	<input type="text" value="N/A"/>	
Debris Clogging % =	<input type="text" value="50%"/>	<input type="text" value="N/A"/>	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Gate Upper Edge, H ₁ =	<input type="text" value="3.82"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Slope Length =	<input type="text" value="5.00"/>	<input type="text" value="N/A"/>	feet
Grate Open Area / 100-yr Orifice Area =	<input type="text" value="7.09"/>	<input type="text" value="N/A"/>	
Overflow Gate Open Area w/o Debris =	<input type="text" value="17.40"/>	<input type="text" value="N/A"/>	ft ²
Overflow Gate Open Area w/ Debris =	<input type="text" value="8.70"/>	<input type="text" value="N/A"/>	ft ²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	<input type="text" value="2.50"/>	<input type="text" value="N/A"/>	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	<input type="text" value="24.00"/>	<input type="text" value="N/A"/>	inches
Restrictor Plate Height Above Pipe Invert =	<input type="text" value="17.50"/>	<input type="text" value="N/A"/>	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	<input type="text" value="2.45"/>	<input type="text" value="N/A"/>	ft ²
Outlet Orifice Centroid =	<input type="text" value="0.81"/>	<input type="text" value="N/A"/>	feet
Half-Central Angle of Restrictor Plate on Pipe =	<input type="text" value="2.05"/>	<input type="text" value="N/A"/>	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
 Spillway Crest Length = feet
 Spillway End Slopes = H:V
 Freeboard above Max Water Surface = feet

Calculated Parameters for Spillway

Spillway Design Flow Depth = feet
 Stage at Top of Freeboard = feet
 Basin Area at Top of Freeboard = acres
 Basin Volume at Top of Freeboard = acre-ft

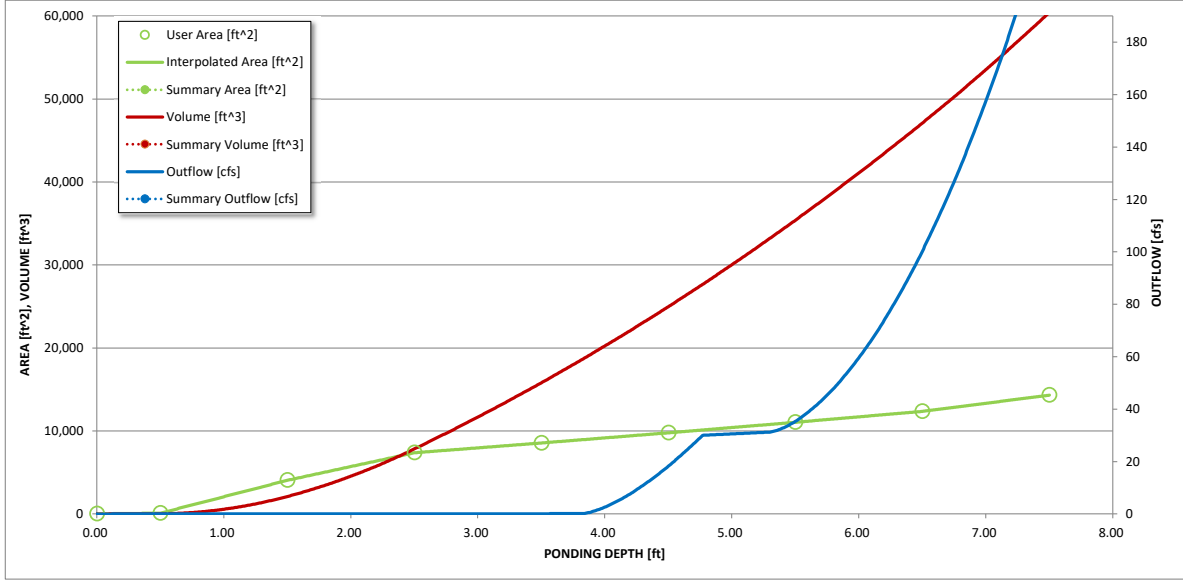
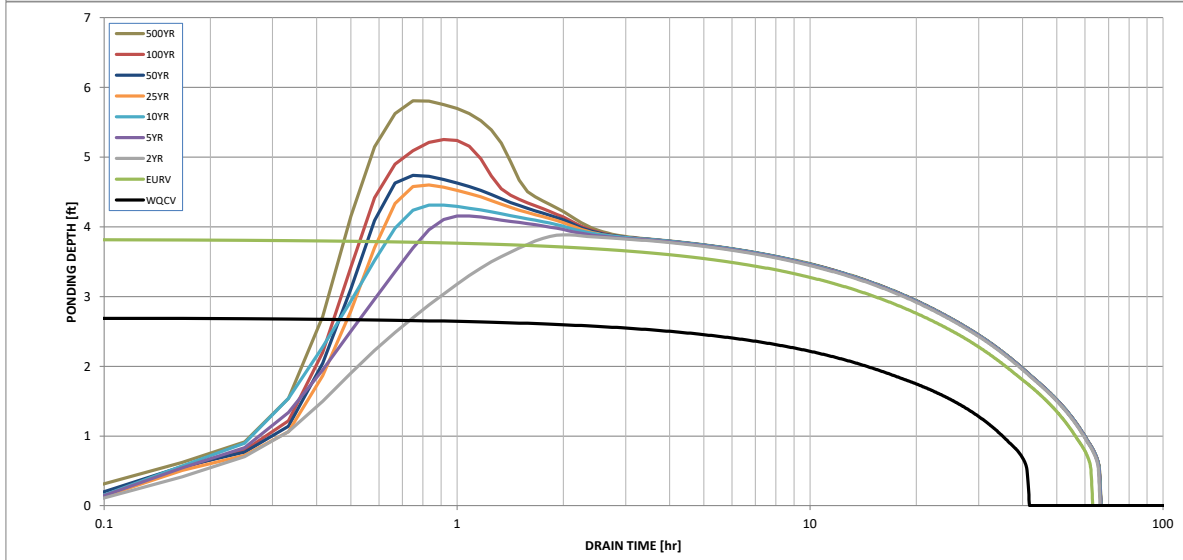
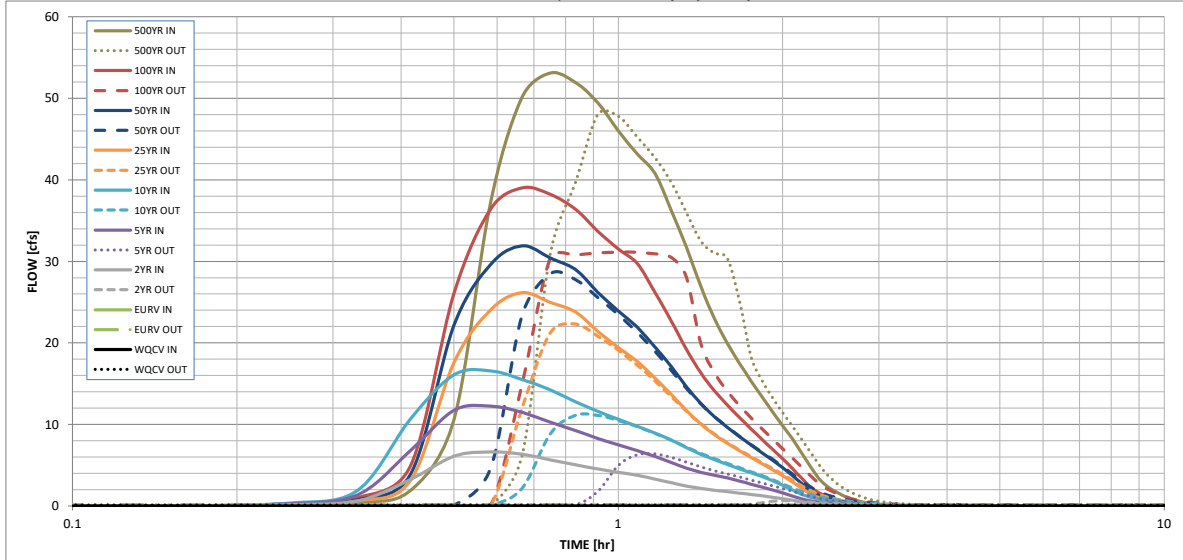
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in) =	0.213	0.427	0.480	0.895	1.293	1.949	2.416	3.067	4.281
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.480	0.895	1.293	1.949	2.416	3.067	4.281
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.9	8.1	12.3	21.6	27.1	33.9	47.3
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.12	0.35	0.52	0.92	1.15	1.44	2.01
Peak Inflow Q (cfs) =	N/A	N/A	6.6	12.3	16.6	26.2	31.9	39.0	53.1
Peak Outflow Q (cfs) =	0.1	0.1	0.7	6.4	11.1	22.3	28.5	31.1	48.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.9	1.0	1.1	0.9	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	0.03	0.4	0.6	1.3	1.6	1.8	1.8
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	57	59	56	53	48	45	41	36
Time to Drain 99% of Inflow Volume (hours) =	40	61	63	62	60	58	57	55	52
Maximum Ponding Depth (ft) =	2.70	3.82	3.88	4.15	4.31	4.60	4.74	5.25	5.80
Area at Maximum Ponding Depth (acres) =	0.17	0.21	0.21	0.21	0.22	0.23	0.23	0.25	0.26
Maximum Volume Stored (acre-ft) =	0.214	0.427	0.439	0.496	0.529	0.594	0.626	0.750	0.890

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



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: _____

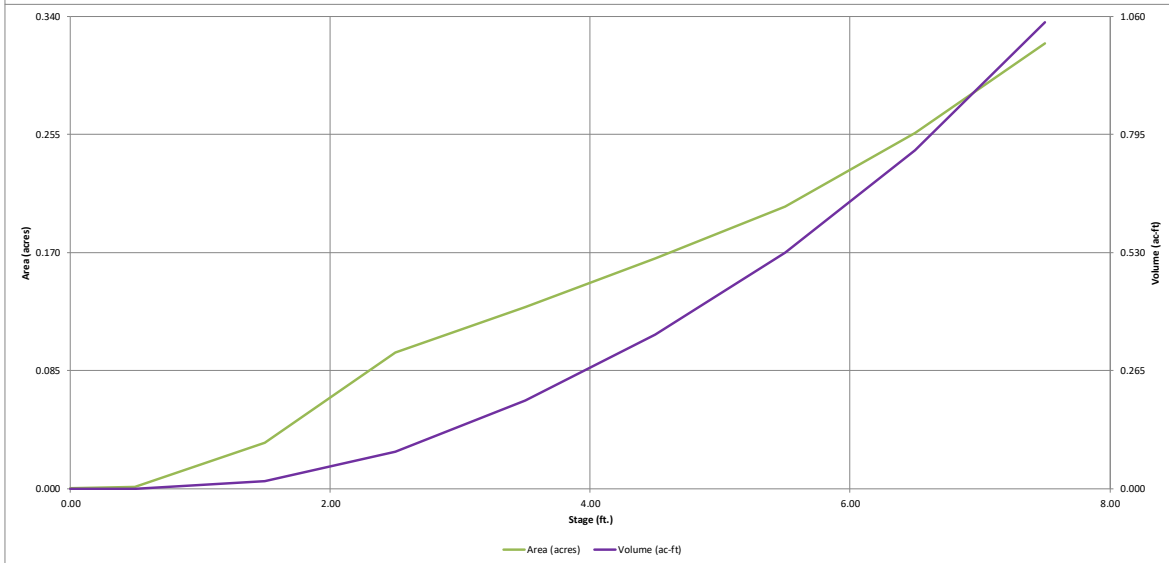
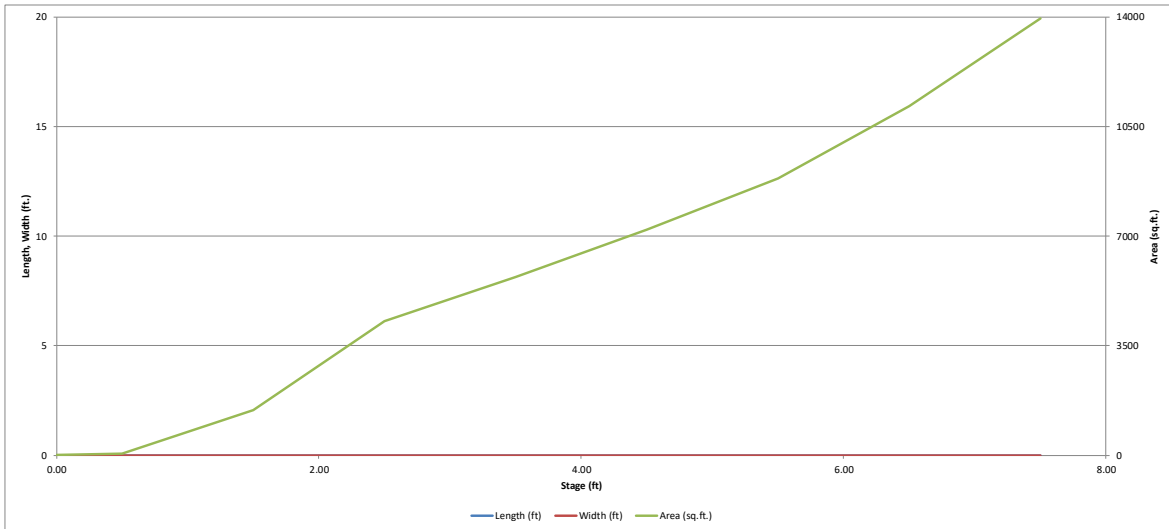
Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.06
	0:15:00	0.00	0.00	0.17	0.28	0.34	0.23	0.29	0.28	0.41
	0:20:00	0.00	0.00	0.62	1.37	1.94	0.61	0.79	1.04	1.90
	0:25:00	0.00	0.00	3.27	6.82	10.73	3.17	3.94	4.98	10.56
	0:30:00	0.00	0.00	6.11	11.72	16.08	17.58	22.18	26.06	37.29
	0:35:00	0.00	0.00	6.64	12.26	16.58	24.05	29.62	36.40	50.14
	0:40:00	0.00	0.00	6.36	11.48	15.52	26.16	31.92	39.00	53.10
	0:45:00	0.00	0.00	5.66	10.27	14.25	24.95	30.40	38.22	51.96
	0:50:00	0.00	0.00	5.05	9.27	12.79	23.82	29.03	36.41	49.49
	0:55:00	0.00	0.00	4.53	8.29	11.60	21.43	26.23	33.72	46.00
	1:00:00	0.00	0.00	4.13	7.50	10.64	19.43	23.91	31.52	43.16
	1:05:00	0.00	0.00	3.77	6.78	9.78	17.72	21.93	29.73	40.80
	1:10:00	0.00	0.00	3.31	6.09	8.93	15.69	19.50	26.20	36.25
	1:15:00	0.00	0.00	2.85	5.34	8.10	13.69	17.11	22.70	31.71
	1:20:00	0.00	0.00	2.44	4.64	7.14	11.68	14.61	19.18	26.90
	1:25:00	0.00	0.00	2.14	4.14	6.33	10.03	12.56	16.30	22.98
	1:30:00	0.00	0.00	1.93	3.78	5.67	8.74	10.96	14.14	19.96
	1:35:00	0.00	0.00	1.75	3.46	5.09	7.69	9.66	12.39	17.51
	1:40:00	0.00	0.00	1.58	3.06	4.57	6.77	8.52	10.86	15.35
	1:45:00	0.00	0.00	1.42	2.68	4.07	5.95	7.48	9.46	13.38
	1:50:00	0.00	0.00	1.26	2.31	3.59	5.18	6.52	8.17	11.55
	1:55:00	0.00	0.00	1.07	1.96	3.09	4.44	5.59	6.95	9.84
	2:00:00	0.00	0.00	0.89	1.61	2.54	3.73	4.71	5.81	8.23
	2:05:00	0.00	0.00	0.69	1.23	1.96	2.94	3.71	4.59	6.49
	2:10:00	0.00	0.00	0.50	0.87	1.42	2.16	2.74	3.40	4.80
	2:15:00	0.00	0.00	0.35	0.62	1.07	1.44	1.85	2.29	3.32
	2:20:00	0.00	0.00	0.26	0.47	0.85	1.00	1.31	1.60	2.39
	2:25:00	0.00	0.00	0.20	0.37	0.68	0.71	0.95	1.15	1.75
	2:30:00	0.00	0.00	0.16	0.30	0.55	0.52	0.71	0.81	1.27
	2:35:00	0.00	0.00	0.13	0.24	0.44	0.38	0.52	0.57	0.91
	2:40:00	0.00	0.00	0.10	0.19	0.35	0.29	0.39	0.39	0.63
	2:45:00	0.00	0.00	0.08	0.15	0.27	0.21	0.29	0.26	0.43
	2:50:00	0.00	0.00	0.06	0.12	0.20	0.16	0.21	0.17	0.29
	2:55:00	0.00	0.00	0.05	0.09	0.15	0.12	0.16	0.14	0.22
	3:00:00	0.00	0.00	0.04	0.07	0.12	0.09	0.12	0.11	0.17
	3:05:00	0.00	0.00	0.03	0.05	0.09	0.07	0.10	0.09	0.14
	3:10:00	0.00	0.00	0.03	0.04	0.07	0.05	0.07	0.07	0.11
	3:15:00	0.00	0.00	0.02	0.02	0.05	0.04	0.06	0.05	0.08
	3:20:00	0.00	0.00	0.01	0.02	0.03	0.03	0.04	0.04	0.06
	3:25:00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.02	0.04
	3:30:00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.01	0.02
	3:35:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	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 4.06 (July 2022)

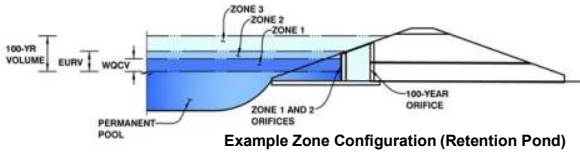


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention, Version 4.06 (July 2022)*

Project: ANTLERS RANGE

Basin ID: POND C



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.04	0.140	Orifice Plate
Zone 2 (EURV)	3.84	0.104	Circular Orifice
Zone 3 (100-year)	6.95	0.636	Weir&Pipe (Restrict)
Total (all zones)		0.879	

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
 Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain
 Underdrain Orifice Area = ft²
 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 BMP)

Centroid of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = inches
 Orifice Plate: Orifice Area per Row = sq. inches (diameter = 3/4 inch)

Calculated Parameters for Plate
 WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.01	2.03					
Orifice Area (sq. inches)	0.46	0.46	0.46					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	<input type="text" value="3.04"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	<input type="text" value="3.84"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	<input type="text" value="0.38"/>	<input type="text" value="N/A"/>	inches

Calculated Parameters for Vertical Orifice
 Vertical Orifice Area = ft²
 Vertical Orifice Centroid = feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	<input type="text" value="3.84"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	<input type="text" value="6.00"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Gate Slope =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	H:V
Horiz. Length of Weir Sides =	<input type="text" value="6.00"/>	<input type="text" value="N/A"/>	feet
Overflow Gate Type =	<input type="text" value="Type C Gate"/>	<input type="text" value="N/A"/>	
Debris Clogging % =	<input type="text" value="50%"/>	<input type="text" value="N/A"/>	%

Calculated Parameters for Overflow Weir
 Height of Gate Upper Edge, H₁ = feet
 Overflow Weir Slope Length = feet
 Gate Open Area / 100-yr Orifice Area =
 Overflow Gate Open Area w/o Debris = ft²
 Overflow Gate Open Area w/ Debris = ft²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	<input type="text" value="1.00"/>	<input type="text" value="N/A"/>	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	<input type="text" value="30.00"/>	<input type="text" value="N/A"/>	inches
Restrictor Plate Height Above Pipe Invert =	<input type="text" value="22.10"/>	<input type="text" value="N/A"/>	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
 Outlet Orifice Area = ft²
 Outlet Orifice Centroid = feet
 Half-Central Angle of Restrictor Plate on Pipe = radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
 Spillway Crest Length = feet
 Spillway End Slopes = H:V
 Freeboard above Max Water Surface = feet

Calculated Parameters for Spillway
 Spillway Design Flow Depth = feet
 Stage at Top of Freeboard = feet
 Basin Area at Top of Freeboard = acres
 Basin Volume at Top of Freeboard = acre-ft

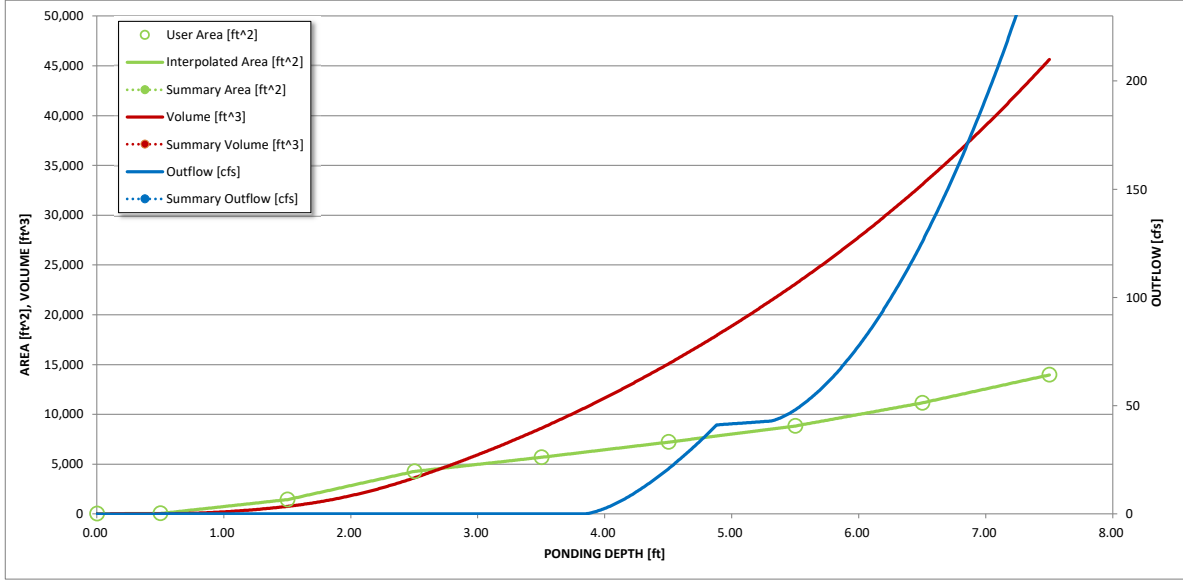
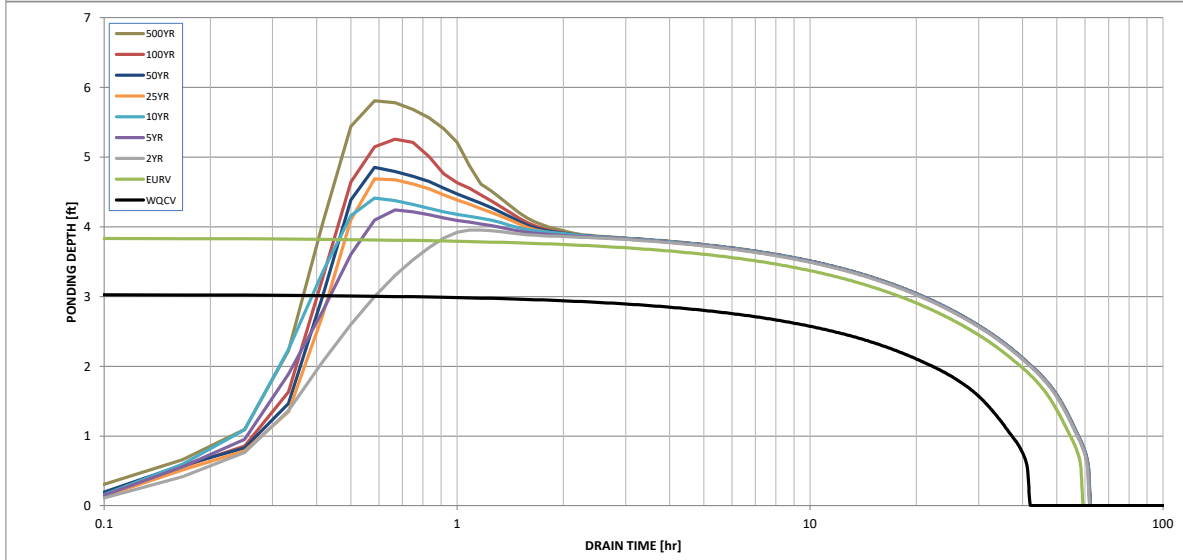
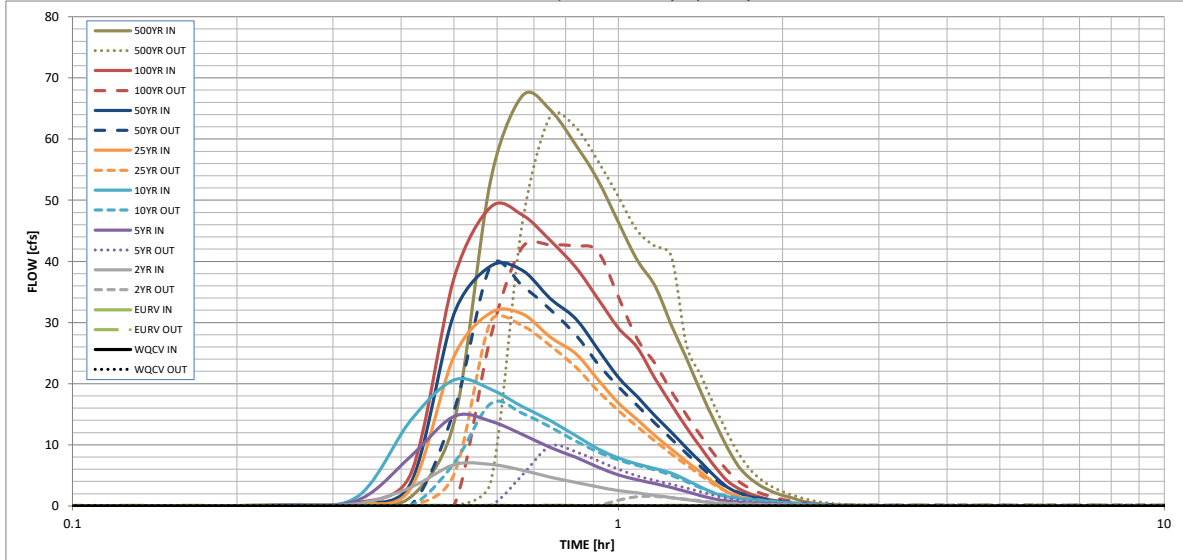
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in) =	0.140	0.244	0.318	0.676	1.030	1.651	2.079	2.690	3.810
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.318	0.676	1.030	1.651	2.079	2.690	3.810
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.2	11.5	17.5	29.1	36.5	46.1	64.1
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.19	0.52	0.78	1.30	1.64	2.07	2.88
Peak Inflow Q (cfs) =	N/A	N/A	6.8	14.7	20.6	31.6	39.3	48.9	67.0
Peak Outflow Q (cfs) =	0.1	0.1	1.5	9.8	16.7	30.2	39.3	42.7	63.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	1.0	1.0	1.1	0.9	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	0.06	0.4	0.7	1.2	1.6	1.7	1.8
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	53	55	50	46	40	37	32	25
Time to Drain 99% of Inflow Volume (hours) =	40	57	59	56	55	52	50	48	44
Maximum Ponding Depth (ft) =	3.04	3.84	3.95	4.24	4.41	4.69	4.85	5.26	5.80
Area at Maximum Ponding Depth (acres) =	0.12	0.14	0.15	0.16	0.16	0.17	0.18	0.19	0.22
Maximum Volume Stored (acre-ft) =	0.141	0.244	0.260	0.302	0.331	0.376	0.404	0.480	0.593

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



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.

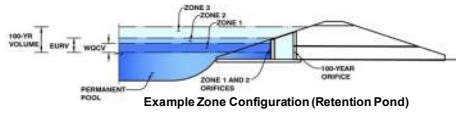
Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.04
	0:15:00	0.00	0.00	0.10	0.17	0.21	0.14	0.17	0.17	0.24
	0:20:00	0.00	0.00	0.36	0.94	1.55	0.35	0.41	0.54	1.46
	0:25:00	0.00	0.00	3.01	8.10	14.00	2.85	3.68	5.22	13.61
	0:30:00	0.00	0.00	6.73	14.67	20.59	24.44	31.39	37.20	53.31
	0:35:00	0.00	0.00	6.80	13.88	19.09	31.60	39.26	48.89	67.05
	0:40:00	0.00	0.00	5.86	11.69	16.27	31.42	38.56	47.62	64.78
	0:45:00	0.00	0.00	4.71	9.56	13.95	27.61	33.89	43.44	59.19
	0:50:00	0.00	0.00	3.86	7.99	11.56	24.98	30.72	39.14	53.37
	0:55:00	0.00	0.00	3.11	6.35	9.36	20.73	25.68	33.93	46.40
	1:00:00	0.00	0.00	2.50	5.08	7.83	16.83	21.03	29.11	40.16
	1:05:00	0.00	0.00	2.11	4.27	6.87	14.14	17.90	25.91	36.04
	1:10:00	0.00	0.00	1.72	3.66	6.10	11.50	14.73	20.89	29.62
	1:15:00	0.00	0.00	1.38	3.01	5.38	9.31	12.09	16.62	24.12
	1:20:00	0.00	0.00	1.05	2.33	4.26	7.28	9.47	12.83	18.63
	1:25:00	0.00	0.00	0.75	1.69	3.07	5.49	7.14	9.54	13.84
	1:30:00	0.00	0.00	0.47	1.14	2.08	3.73	4.90	6.53	9.58
	1:35:00	0.00	0.00	0.30	0.82	1.52	2.27	3.07	4.12	6.29
	1:40:00	0.00	0.00	0.23	0.62	1.22	1.48	2.08	2.77	4.38
	1:45:00	0.00	0.00	0.20	0.48	1.02	1.01	1.48	1.93	3.16
	1:50:00	0.00	0.00	0.19	0.39	0.88	0.72	1.10	1.35	2.31
	1:55:00	0.00	0.00	0.16	0.32	0.75	0.53	0.84	0.95	1.71
	2:00:00	0.00	0.00	0.13	0.27	0.59	0.42	0.69	0.67	1.29
	2:05:00	0.00	0.00	0.10	0.20	0.43	0.29	0.47	0.41	0.83
	2:10:00	0.00	0.00	0.07	0.14	0.30	0.20	0.32	0.25	0.53
	2:15:00	0.00	0.00	0.06	0.10	0.20	0.14	0.23	0.18	0.37
	2:20:00	0.00	0.00	0.04	0.07	0.14	0.10	0.16	0.13	0.26
	2:25:00	0.00	0.00	0.03	0.05	0.10	0.07	0.12	0.10	0.19
	2:30:00	0.00	0.00	0.02	0.03	0.07	0.05	0.08	0.07	0.14
	2:35:00	0.00	0.00	0.02	0.02	0.05	0.04	0.06	0.05	0.10
	2:40:00	0.00	0.00	0.01	0.01	0.03	0.02	0.04	0.04	0.07
	2:45:00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.02	0.05
	2:50:00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.01	0.03
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	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 4.06 (July 2022)

Project: **ANTLERS RANGE**

Basin ID: **POND E1**



Watershed Information

Selected BMP Type =	EDB
Watershed Area =	10.30 acres
Watershed Length =	1,168 ft
Watershed Length to Centroid =	343 ft
Watershed Slope =	0.040 ft/ft
Watershed Imperviousness =	13.50% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	100.0% percent
Percentage Hydrologic Soil Groups C/D =	0.0% percent
Target WQC 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.

Water Quality Capture Volume (WQCV) =	0.074 acre-feet
Excess Urban Runoff Volume (EURV) =	0.134 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.165 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.336 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.503 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	0.792 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	0.992 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	1.277 acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	1.801 acre-feet
Approximate 2-yr Detention Volume =	0.088 acre-feet
Approximate 5-yr Detention Volume =	0.135 acre-feet
Approximate 10-yr Detention Volume =	0.248 acre-feet
Approximate 25-yr Detention Volume =	0.329 acre-feet
Approximate 50-yr Detention Volume =	0.347 acre-feet
Approximate 100-yr Detention Volume =	0.439 acre-feet

Optional User Overrides

	acre-feet
	acre-feet
	1.19 inches
	1.50 inches
	1.75 inches
	2.00 inches
	2.25 inches
	2.52 inches
	inches

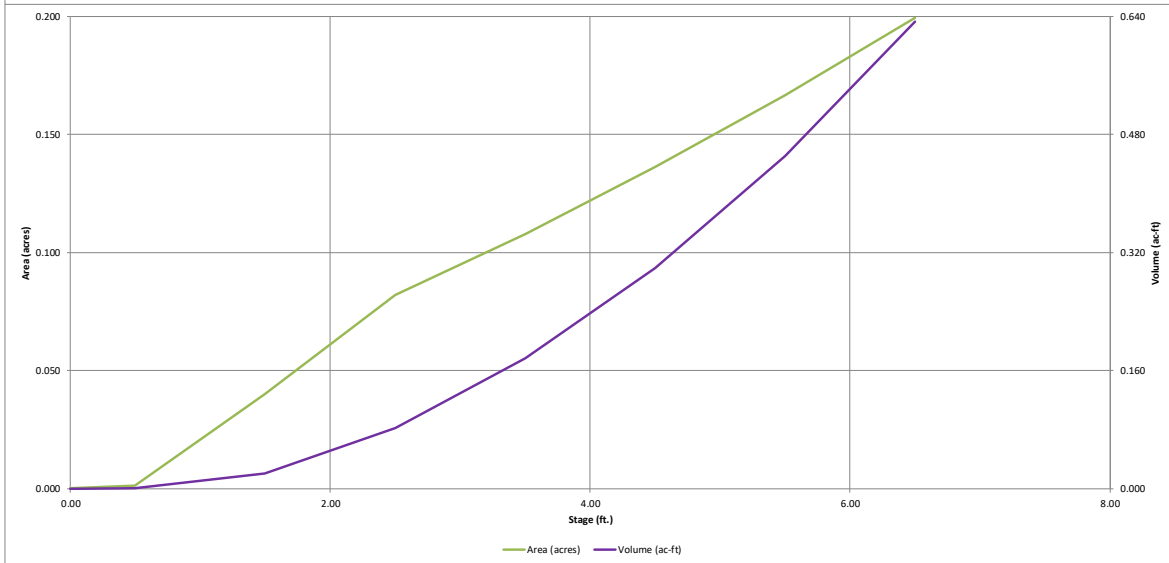
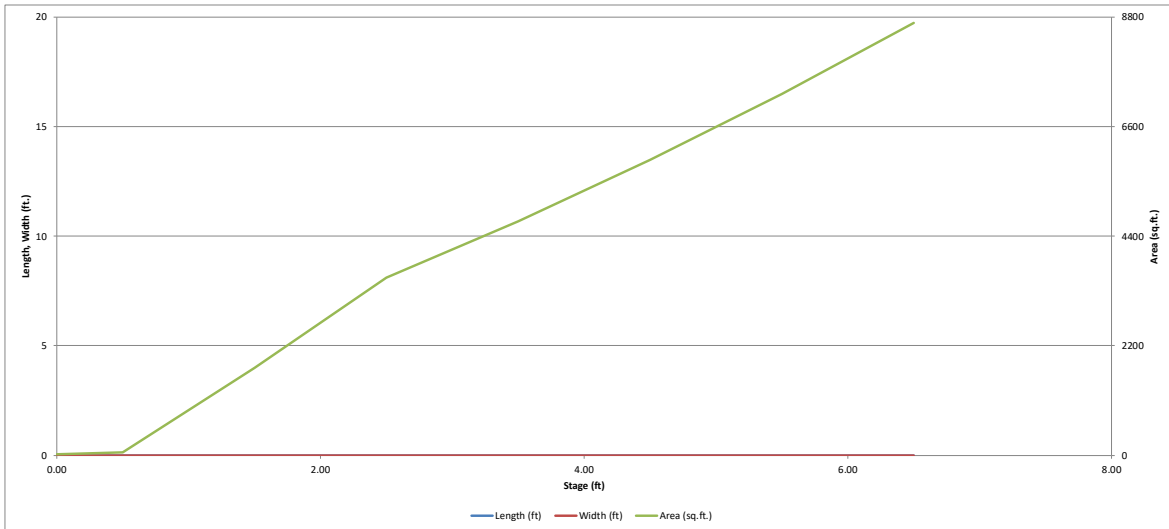
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.074 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.060 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.306 acre-feet
Total Detention Basin Volume =	0.439 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 _{MAN}) =	user ft
Length of Main Basin (L _{MAN}) =	user ft
Width of Main Basin (W _{MAN}) =	user ft
Area of Main Basin (A _{MAN}) =	user ft ²
Volume of Main Basin (V _{MAN}) =	user ft ³
Calculated Total Basin Volume (V _{total}) =	user acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (acre)	Volume (ft ³)	Volume (ac-ft)
7221.5 Top of Micropool	--	0.00	--	--	--	20	0.000		
7222	--	0.50	--	--	--	53	0.001	18	0.000
7223	--	1.50	--	--	--	1,746	0.040	918	0.021
7224	--	2.50	--	--	--	3,570	0.082	3,576	0.082
7225	--	3.50	--	--	--	4,699	0.108	7,710	0.177
7226	--	4.50	--	--	--	5,931	0.136	13,025	0.299
7227	--	5.50	--	--	--	7,261	0.167	19,621	0.450
7228	--	6.50	--	--	--	8,690	0.199	27,597	0.634
7229	--	--	--	--	--	--	--	--	--

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

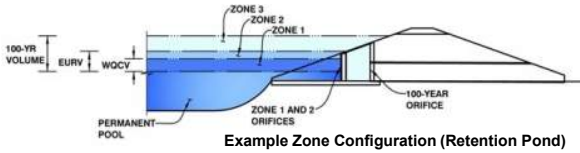


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention, Version 4.06 (July 2022)*

Project: ANTLERS RANGE

Basin ID: POND E1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.40	0.074	Orifice Plate
Zone 2 (EURV)	3.08	0.060	Circular Orifice
Zone 3 (100-year)	5.44	0.306	Weir&Pipe (Restrict)
Total (all zones)		0.439	

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft ²
Underdrain Orifice Centroid =	N/A	feet

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.40	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	9.60	inches
Orifice Plate: Orifice Area per Row =	0.28	sq. inches (diameter = 9/16 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.944E-03	ft ²
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft ²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.80	1.60					
Orifice Area (sq. inches)	0.28	0.28	0.28					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.40	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.08	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	0.38	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.00	N/A	ft ²
Vertical Orifice Centroid =	0.02	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.08	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Gate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Gate Type =	Type C Gate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Gate Upper Edge, H ₁ =	3.08	N/A	feet
Overflow Weir Slope Length =	4.00	N/A	feet
Gate Open Area / 100-yr Orifice Area =	8.29	N/A	
Overflow Gate Open Area w/o Debris =	11.14	N/A	ft ²
Overflow Gate Open Area w/ Debris =	5.57	N/A	ft ²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	12.80		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.34	N/A	ft ²
Outlet Orifice Centroid =	0.59	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.01	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	4.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	6.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =	0.76	feet
Stage at Top of Freeboard =	6.26	feet
Basin Area at Top of Freeboard =	0.19	acres
Basin Volume at Top of Freeboard =	0.59	acre-ft

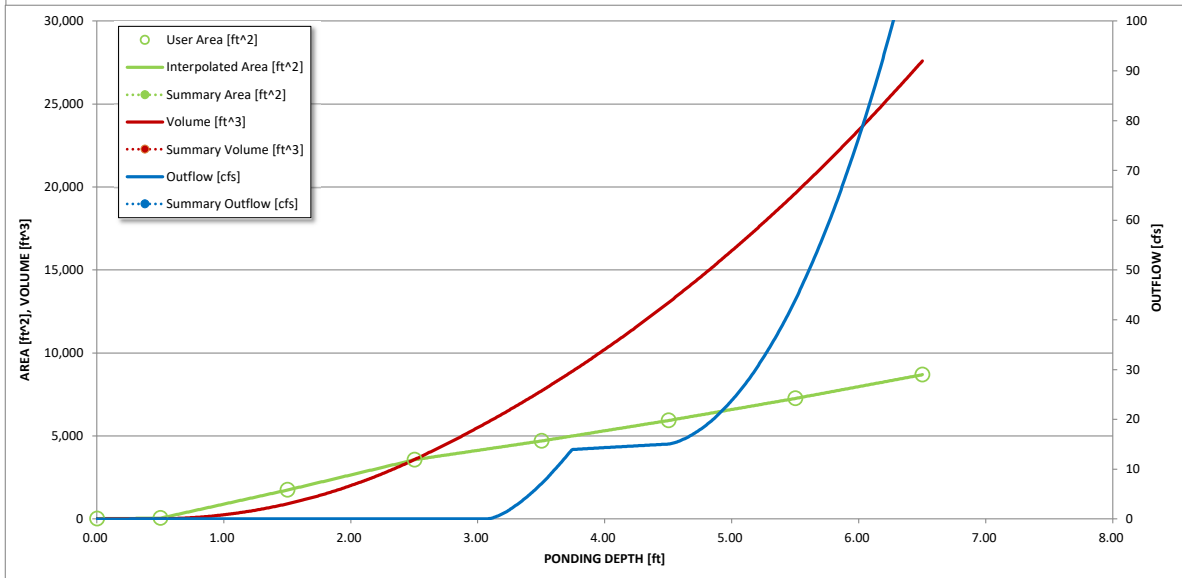
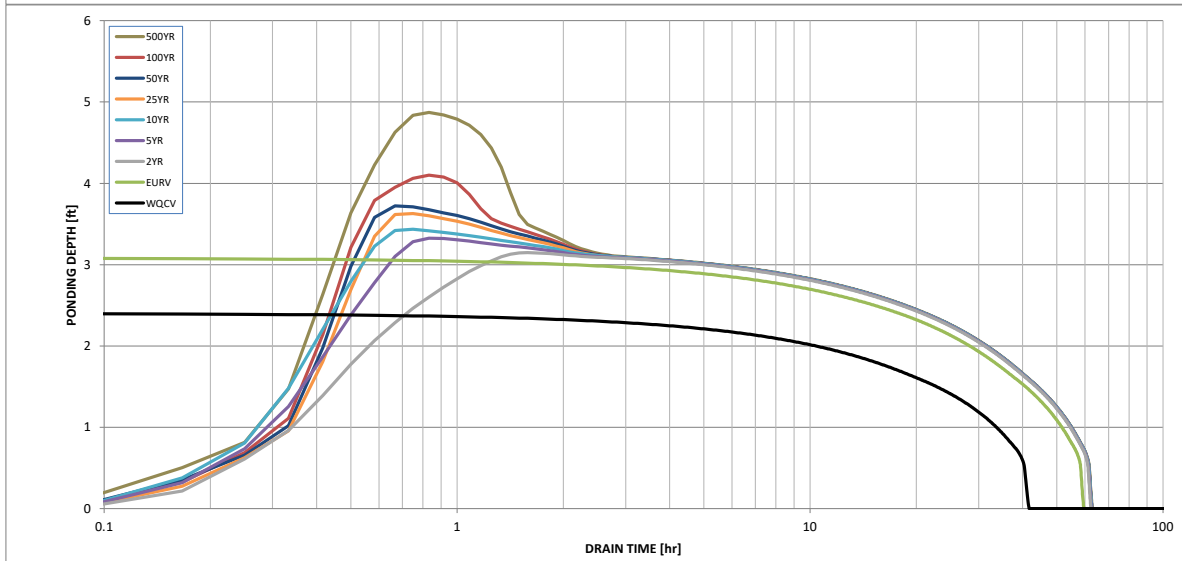
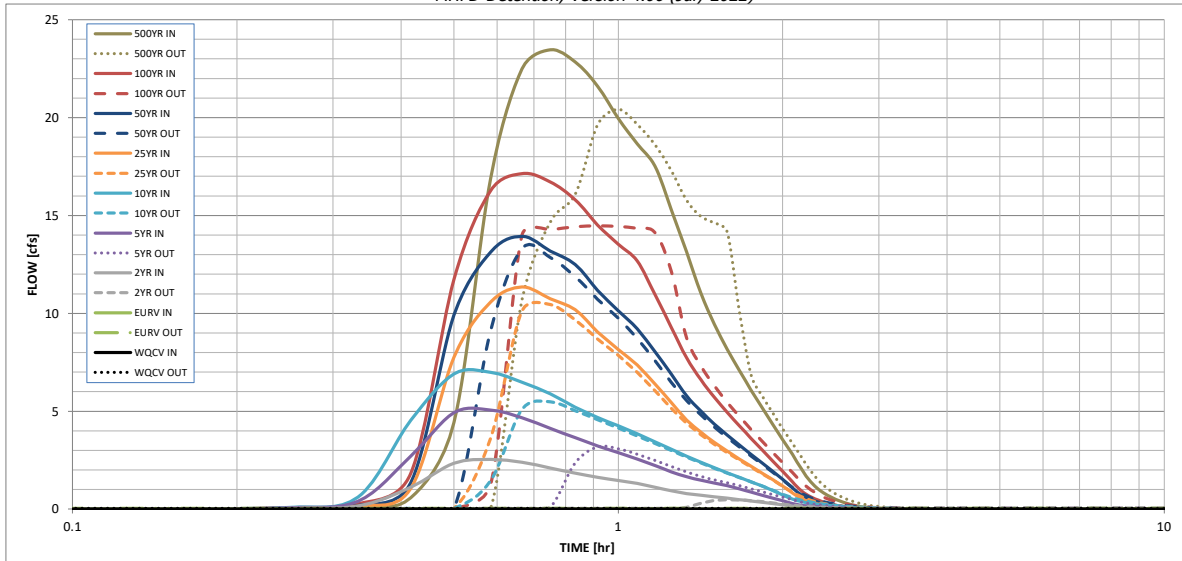
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in) =	0.074	0.134	0.165	0.336	0.503	0.792	0.992	1.277	1.801
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.165	0.336	0.503	0.792	0.992	1.277	1.801
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.4	3.8	5.7	10.1	12.7	15.8	22.1
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.13	0.37	0.56	0.98	1.23	1.54	2.14
Peak Inflow Q (cfs) =	N/A	N/A	2.5	5.1	7.0	11.3	13.9	17.1	23.5
Peak Outflow Q (cfs) =	0.0	0.0	0.5	3.2	5.5	10.4	13.3	14.5	20.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	1.0	1.0	1.1	0.9	0.9
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	0.00	0.04	0.3	0.5	0.9	1.2	1.3	1.4
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	54	56	51	48	42	39	35	29
Time to Drain 99% of Inflow Volume (hours) =	40	59	59	57	56	53	52	50	46
Maximum Ponding Depth (ft) =	2.40	3.09	3.15	3.33	3.43	3.63	3.72	4.10	4.87
Area at Maximum Ponding Depth (acres) =	0.08	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.15
Maximum Volume Stored (acre-ft) =	0.074	0.135	0.140	0.158	0.170	0.190	0.201	0.246	0.351

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



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.

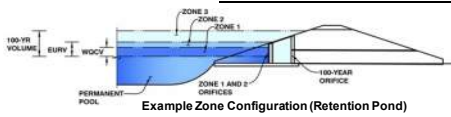
Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	0:15:00	0.00	0.00	0.04	0.07	0.09	0.06	0.07	0.07	0.10
	0:20:00	0.00	0.00	0.16	0.39	0.60	0.15	0.18	0.26	0.58
	0:25:00	0.00	0.00	1.11	2.71	4.53	1.06	1.35	1.82	4.42
	0:30:00	0.00	0.00	2.35	4.92	6.91	7.76	9.91	11.73	16.91
	0:35:00	0.00	0.00	2.54	5.06	6.99	10.58	13.13	16.27	22.50
	0:40:00	0.00	0.00	2.39	4.67	6.47	11.35	13.94	17.14	23.46
	0:45:00	0.00	0.00	2.10	4.12	5.89	10.75	13.19	16.72	22.85
	0:50:00	0.00	0.00	1.84	3.66	5.21	10.18	12.50	15.80	21.61
	0:55:00	0.00	0.00	1.63	3.23	4.68	9.05	11.17	14.51	19.95
	1:00:00	0.00	0.00	1.46	2.89	4.25	8.15	10.13	13.53	18.66
	1:05:00	0.00	0.00	1.31	2.56	3.84	7.37	9.21	12.68	17.53
	1:10:00	0.00	0.00	1.12	2.24	3.44	6.39	8.04	10.97	15.31
	1:15:00	0.00	0.00	0.93	1.91	3.07	5.45	6.90	9.30	13.15
	1:20:00	0.00	0.00	0.79	1.65	2.71	4.56	5.79	7.74	11.03
	1:25:00	0.00	0.00	0.70	1.48	2.39	3.93	5.00	6.61	9.44
	1:30:00	0.00	0.00	0.62	1.33	2.11	3.41	4.34	5.71	8.17
	1:35:00	0.00	0.00	0.56	1.19	1.86	2.96	3.78	4.94	7.08
	1:40:00	0.00	0.00	0.49	1.03	1.62	2.56	3.27	4.25	6.09
	1:45:00	0.00	0.00	0.42	0.87	1.40	2.19	2.81	3.62	5.19
	1:50:00	0.00	0.00	0.36	0.72	1.18	1.84	2.36	3.02	4.34
	1:55:00	0.00	0.00	0.29	0.57	0.96	1.50	1.93	2.47	3.55
	2:00:00	0.00	0.00	0.22	0.42	0.73	1.18	1.52	1.94	2.80
	2:05:00	0.00	0.00	0.15	0.28	0.51	0.83	1.09	1.39	2.03
	2:10:00	0.00	0.00	0.10	0.19	0.37	0.53	0.71	0.92	1.39
	2:15:00	0.00	0.00	0.07	0.15	0.30	0.35	0.49	0.63	0.98
	2:20:00	0.00	0.00	0.05	0.11	0.23	0.24	0.35	0.44	0.70
	2:25:00	0.00	0.00	0.04	0.09	0.19	0.17	0.25	0.30	0.50
	2:30:00	0.00	0.00	0.03	0.07	0.15	0.12	0.18	0.20	0.35
	2:35:00	0.00	0.00	0.03	0.06	0.11	0.09	0.13	0.13	0.23
	2:40:00	0.00	0.00	0.02	0.04	0.08	0.06	0.09	0.08	0.15
	2:45:00	0.00	0.00	0.02	0.03	0.06	0.04	0.06	0.05	0.10
	2:50:00	0.00	0.00	0.01	0.02	0.05	0.03	0.05	0.04	0.07
	2:55:00	0.00	0.00	0.01	0.02	0.03	0.02	0.04	0.03	0.06
	3:00:00	0.00	0.00	0.01	0.01	0.03	0.02	0.03	0.02	0.04
	3:05:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.02	0.03
	3:10:00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.01	0.03
	3:15:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	3:20:00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	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 4.06 (July 2022)

Project: **ANTLERS RANGE**

Basin ID: **POND E2**



Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	4.20	acres
Watershed Length =	806	ft
Watershed Length to Centroid =	95	ft
Watershed Slope =	0.036	ft/ft
Watershed Imperviousness =	19.60%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQC 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.

Water Quality Capture Volume (WQCV) =	0.040	acre-feet
Excess Urban Runoff Volume (EURV) =	0.082	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.087	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.159	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.227	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	0.340	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	0.420	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	0.531	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	0.740	acre-feet
Approximate 2-yr Detention Volume =	0.056	acre-feet
Approximate 5-yr Detention Volume =	0.083	acre-feet
Approximate 10-yr Detention Volume =	0.135	acre-feet
Approximate 25-yr Detention Volume =	0.167	acre-feet
Approximate 50-yr Detention Volume =	0.177	acre-feet
Approximate 100-yr Detention Volume =	0.218	acre-feet

Optional User Overrides

		acre-feet
		acre-feet
	1.19	inches
	1.50	inches
	1.75	inches
	2.00	inches
	2.25	inches
	2.52	inches
		inches

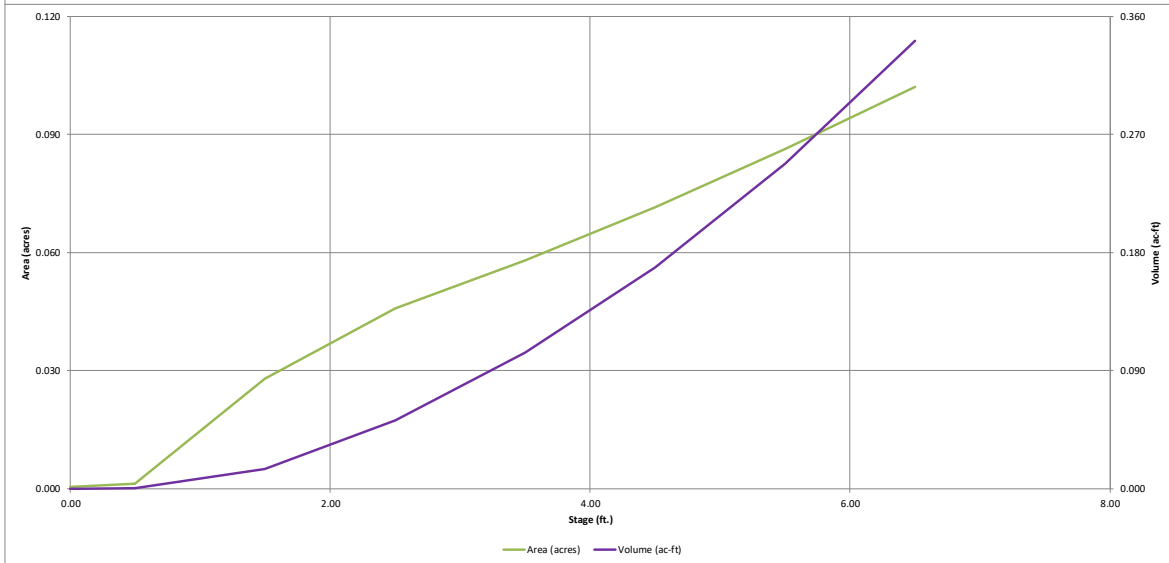
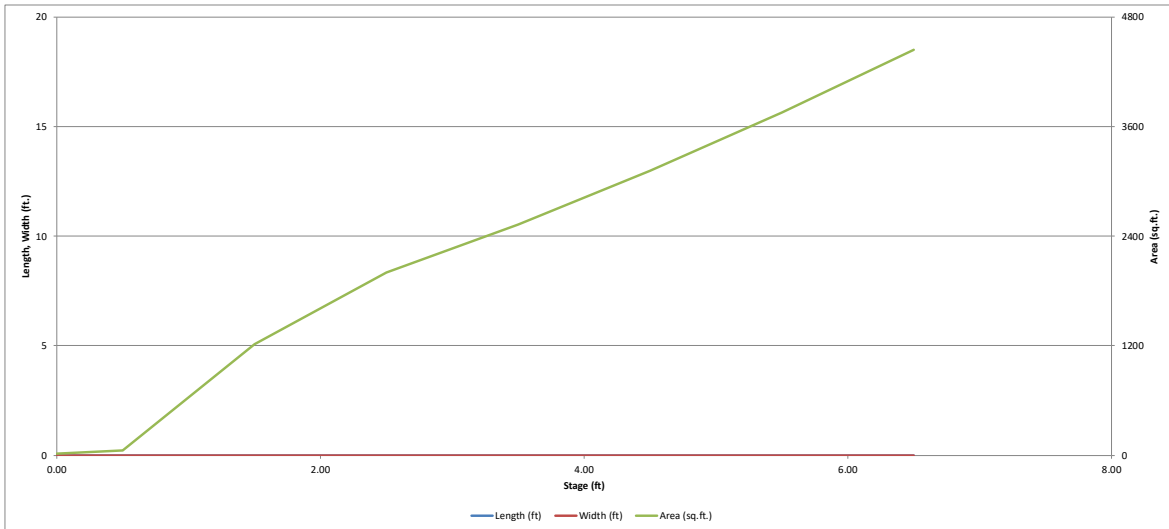
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.040	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.042	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.136	acre-feet
Total Detention Basin Volume =	0.218	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 _{SV}) =	user	ft
Surcharge Volume Width (W _{SV}) =	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 _{MAN}) =	user	ft
Length of Main Basin (L _{MAN}) =	user	ft
Width of Main Basin (W _{MAN}) =	user	ft
Area of Main Basin (A _{MAN}) =	user	ft ²
Volume of Main Basin (V _{MAN}) =	user	ft ³
Calculated Total Basin Volume (V _{total}) =	user	acre-feet

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (acre)	Volume (ft ³)	Volume (ac-ft)
7217.5 Top of Micropool	--	0.00	--	--	--	20	0.000		
7218	--	0.50	--	--	--	53	0.001	18	0.000
7219	--	1.50	--	--	--	1,217	0.028	653	0.015
7220	--	2.50	--	--	--	1,998	0.046	2,261	0.052
7221	--	3.50	--	--	--	2,530	0.058	4,525	0.104
7222	--	4.50	--	--	--	3,116	0.072	7,348	0.169
7223	--	5.50	--	--	--	3,756	0.086	10,784	0.248
	--	6.50	--	--	--	4,448	0.102	14,886	0.342

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

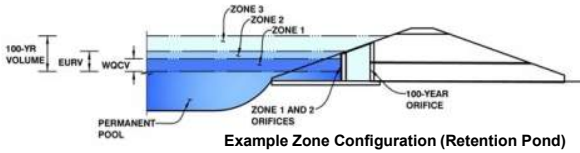


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention, Version 4.06 (July 2022)*

Project: ANTLERS RANGE

Basin ID: POND E2



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.23	0.040	Orifice Plate
Zone 2 (EURV)	3.11	0.042	Circular Orifice
Zone 3 (100-year)	5.15	0.136	Weir&Pipe (Restrict)
Total (all zones)		0.218	

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
 Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain
 Underdrain Orifice Area = ft²
 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 BMP)

Centroid of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = inches
 Orifice Plate: Orifice Area per Row = sq. inches

Calculated Parameters for Plate
 WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = ft²

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	0.80	1.60					
Orifice Area (sq. inches)	0.17	0.17	0.17					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.40	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.08	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	0.38	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.00	N/A	ft ²
Vertical Orifice Centroid =	0.02	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.08	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Gate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Gate Type =	Type C Gate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Gate Upper Edge, H ₁ =	3.08	N/A	feet
Overflow Weir Slope Length =	4.00	N/A	feet
Gate Open Area / 100-yr Orifice Area =	8.29	N/A	
Overflow Gate Open Area w/o Debris =	11.14	N/A	ft ²
Overflow Gate Open Area w/ Debris =	5.57	N/A	ft ²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	12.80		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.34	N/A	ft ²
Outlet Orifice Centroid =	0.59	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.01	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
 Spillway Crest Length = feet
 Spillway End Slopes = H:V
 Freeboard above Max Water Surface = feet

Calculated Parameters for Spillway
 Spillway Design Flow Depth = feet
 Stage at Top of Freeboard = feet
 Basin Area at Top of Freeboard = acres
 Basin Volume at Top of Freeboard = acre-ft

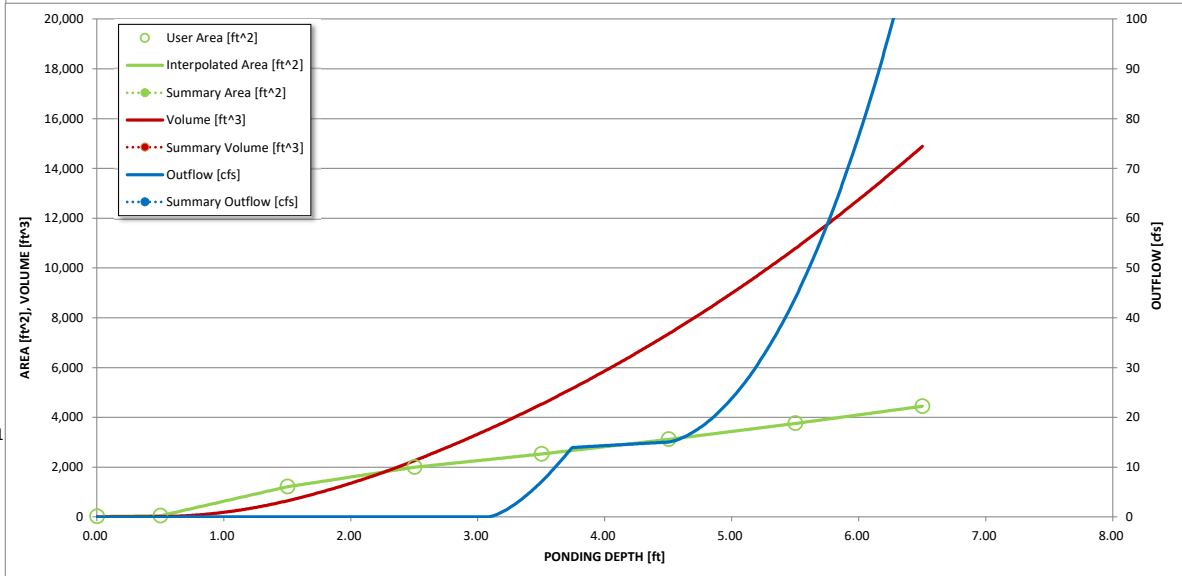
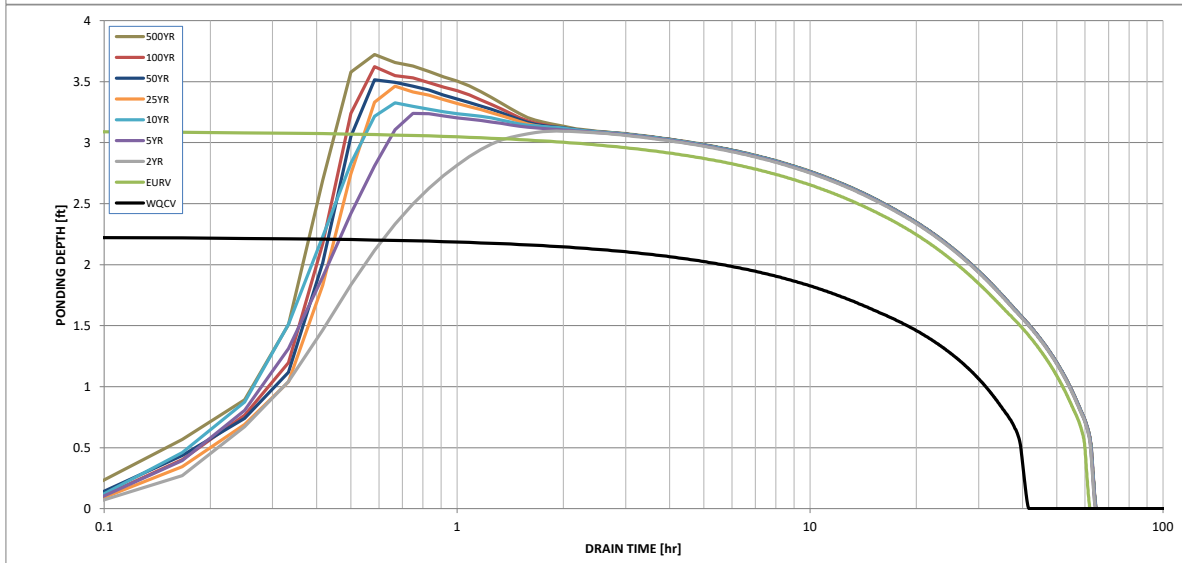
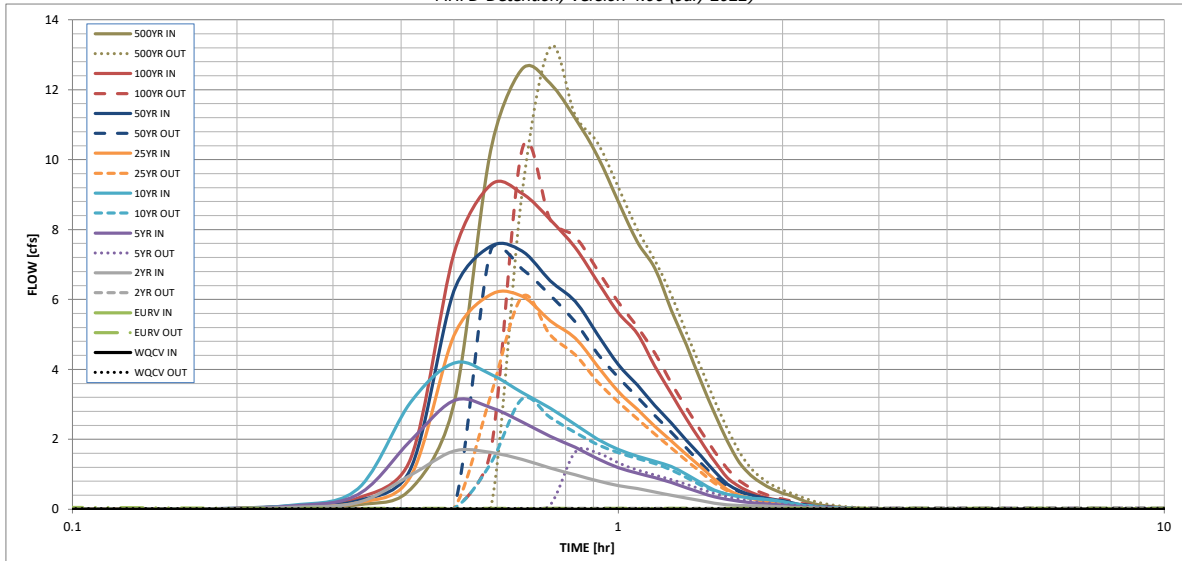
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in) =	0.040	0.082	0.087	0.159	0.227	0.340	0.420	0.531	0.740
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.087	0.159	0.227	0.340	0.420	0.531	0.740
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.7	2.0	3.1	5.1	6.4	8.1	11.2
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.18	0.48	0.73	1.22	1.52	1.92	2.67
Peak Inflow Q (cfs) =	N/A	N/A	1.7	3.1	4.2	6.1	7.5	9.3	12.6
Peak Outflow Q (cfs) =	0.0	0.1	0.1	1.6	3.2	6.1	7.4	10.3	13.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	1.0	1.2	1.2	1.3	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Gate 1 (fps) =	N/A	0.01	0.00	0.1	0.3	0.5	0.7	0.9	1.2
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	55	57	54	51	47	44	41	35
Time to Drain 99% of Inflow Volume (hours) =	40	59	61	59	58	56	55	53	51
Maximum Ponding Depth (ft) =	2.23	3.11	3.09	3.24	3.32	3.46	3.51	3.62	3.72
Area at Maximum Ponding Depth (acres) =	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06
Maximum Volume Stored (acre-ft) =	0.040	0.082	0.081	0.089	0.094	0.102	0.104	0.111	0.116

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



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.

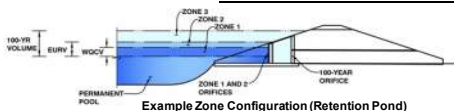
Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02
	0:15:00	0.00	0.00	0.06	0.09	0.11	0.07	0.09	0.09	0.13
	0:20:00	0.00	0.00	0.19	0.42	0.59	0.19	0.25	0.32	0.57
	0:25:00	0.00	0.00	0.97	1.97	3.06	0.94	1.16	1.45	3.01
	0:30:00	0.00	0.00	1.67	3.11	4.18	4.97	6.25	7.31	10.27
	0:35:00	0.00	0.00	1.62	2.91	3.86	6.14	7.52	9.28	12.59
	0:40:00	0.00	0.00	1.42	2.49	3.34	6.09	7.39	9.03	12.18
	0:45:00	0.00	0.00	1.18	2.08	2.89	5.39	6.54	8.28	11.18
	0:50:00	0.00	0.00	0.98	1.77	2.43	4.90	5.95	7.48	10.10
	0:55:00	0.00	0.00	0.81	1.44	2.00	4.09	4.99	6.51	8.80
	1:00:00	0.00	0.00	0.68	1.19	1.71	3.36	4.14	5.62	7.65
	1:05:00	0.00	0.00	0.59	1.03	1.52	2.87	3.56	5.03	6.89
	1:10:00	0.00	0.00	0.49	0.90	1.37	2.37	2.96	4.09	5.70
	1:15:00	0.00	0.00	0.40	0.76	1.22	1.96	2.47	3.31	4.69
	1:20:00	0.00	0.00	0.32	0.61	1.00	1.56	1.97	2.58	3.66
	1:25:00	0.00	0.00	0.24	0.48	0.75	1.21	1.52	1.95	2.76
	1:30:00	0.00	0.00	0.17	0.35	0.55	0.86	1.09	1.38	1.96
	1:35:00	0.00	0.00	0.13	0.28	0.43	0.57	0.73	0.91	1.33
	1:40:00	0.00	0.00	0.11	0.23	0.37	0.40	0.53	0.65	0.97
	1:45:00	0.00	0.00	0.10	0.19	0.32	0.31	0.41	0.48	0.74
	1:50:00	0.00	0.00	0.09	0.16	0.29	0.25	0.33	0.37	0.57
	1:55:00	0.00	0.00	0.08	0.14	0.26	0.20	0.28	0.29	0.46
	2:00:00	0.00	0.00	0.07	0.12	0.21	0.18	0.24	0.23	0.38
	2:05:00	0.00	0.00	0.05	0.09	0.16	0.13	0.18	0.16	0.26
	2:10:00	0.00	0.00	0.04	0.07	0.12	0.09	0.13	0.11	0.18
	2:15:00	0.00	0.00	0.03	0.05	0.08	0.07	0.09	0.08	0.13
	2:20:00	0.00	0.00	0.02	0.04	0.06	0.05	0.07	0.06	0.09
	2:25:00	0.00	0.00	0.02	0.02	0.04	0.04	0.05	0.04	0.07
	2:30:00	0.00	0.00	0.01	0.02	0.03	0.03	0.04	0.03	0.05
	2:35:00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.02	0.04
	2:40:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.02	0.03
	2:45:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	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 4.06 (July 2022)

Project: ANTLERS RANGE

Basin ID: POND E3



Watershed Information

Selected BMP Type =	EDB
Watershed Area =	2.90 acres
Watershed Length =	950 ft
Watershed Length to Centroid =	231 ft
Watershed Slope =	0.043 ft/ft
Watershed Imperviousness =	26.30% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	100.0% percent
Percentage Hydrologic Soil Groups C/D =	0.0% percent
Target WQC 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.

Water Quality Capture Volume (WQCV) =	0.034 acre-feet
Excess Urban Runoff Volume (EURV) =	0.077 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.079 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	0.133 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	0.183 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	0.261 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	0.318 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	0.397 acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	0.546 acre-feet
Approximate 2-yr Detention Volume =	0.055 acre-feet
Approximate 5-yr Detention Volume =	0.079 acre-feet
Approximate 10-yr Detention Volume =	0.119 acre-feet
Approximate 25-yr Detention Volume =	0.141 acre-feet
Approximate 50-yr Detention Volume =	0.148 acre-feet
Approximate 100-yr Detention Volume =	0.178 acre-feet

Optional User Overrides

	acre-feet
	acre-feet
	1.19 inches
	1.50 inches
	1.75 inches
	2.00 inches
	2.25 inches
	2.52 inches
	inches

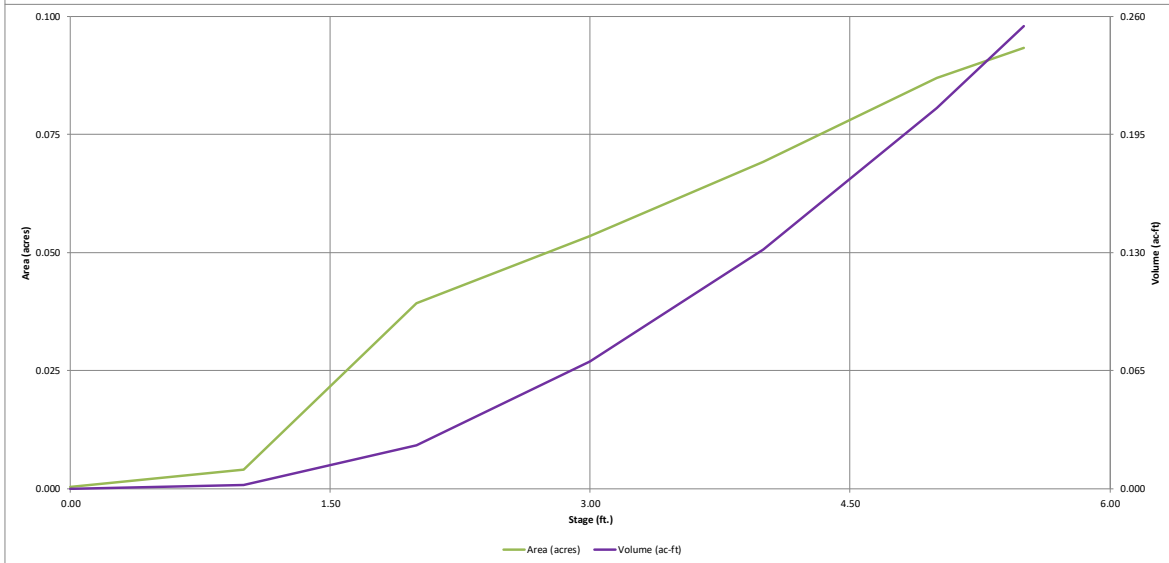
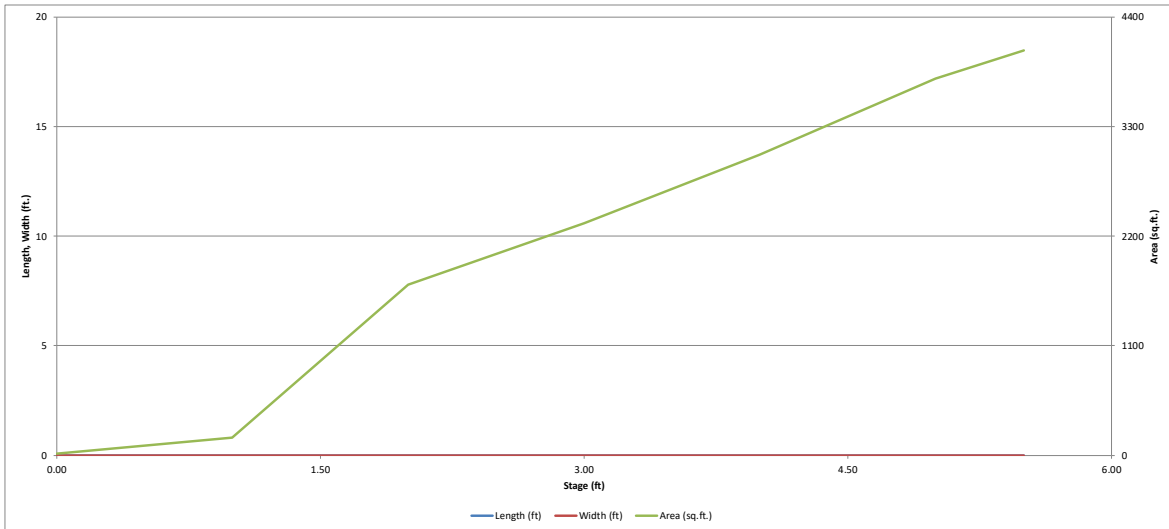
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.034 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.044 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.100 acre-feet
Total Detention Basin Volume =	0.178 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

7070	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	--	--	--	20	0.000		
	7171	--	1.00	--	--	--	175	0.004	97	0.002
	7172	--	2.00	--	--	--	1,709	0.039	1,039	0.024
	7173	--	3.00	--	--	--	2,329	0.053	3,058	0.070
	7174	--	4.00	--	--	--	3,016	0.069	5,731	0.132
	7175	--	5.00	--	--	--	3,785	0.087	9,131	0.210
	7175.5	--	5.50	--	--	--	4,070	0.093	11,095	0.255

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

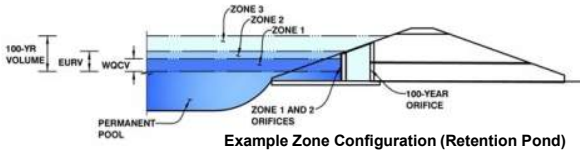


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention, Version 4.06 (July 2022)*

Project: ANTLERS RANGE

Basin ID: POND E3



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.24	0.034	Orifice Plate
Zone 2 (EURV)	3.14	0.044	Circular Orifice
Zone 3 (100-year)	4.62	0.100	Weir&Pipe (Restrict)
Total (all zones)		0.178	

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
 Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain
 Underdrain Orifice Area = ft²
 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 BMP)

Centroid of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = inches
 Orifice Plate: Orifice Area per Row = sq. inches (diameter = 3/8 inch)

Calculated Parameters for Plate
 WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = ft²

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	0.80	1.55					
Orifice Area (sq. inches)	0.13	0.13	0.13					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	<input type="text" value="2.30"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	<input type="text" value="3.14"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	<input type="text" value="0.38"/>	<input type="text" value="N/A"/>	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	ft ²
Vertical Orifice Centroid =	<input type="text" value="0.02"/>	<input type="text" value="N/A"/>	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	<input type="text" value="3.25"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	<input type="text" value="2.00"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Gate Slope =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	H:V
Horiz. Length of Weir Sides =	<input type="text" value="2.00"/>	<input type="text" value="N/A"/>	feet
Overflow Gate Type =	<input type="text" value="Type C Gate"/>	<input type="text" value="N/A"/>	
Debris Clogging % =	<input type="text" value="50%"/>	<input type="text" value="N/A"/>	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Gate Upper Edge, H ₁ =	<input type="text" value="3.25"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Slope Length =	<input type="text" value="2.00"/>	<input type="text" value="N/A"/>	feet
Grate Open Area / 100-yr Orifice Area =	<input type="text" value="9.87"/>	<input type="text" value="N/A"/>	
Overflow Gate Open Area w/o Debris =	<input type="text" value="2.78"/>	<input type="text" value="N/A"/>	ft ²
Overflow Gate Open Area w/ Debris =	<input type="text" value="1.39"/>	<input type="text" value="N/A"/>	ft ²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	<input type="text" value="2.50"/>	<input type="text" value="N/A"/>	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	<input type="text" value="18.00"/>	<input type="text" value="N/A"/>	inches
Restrictor Plate Height Above Pipe Invert =	<input type="text" value="3.90"/>	<input type="text" value="N/A"/>	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	<input type="text" value="0.28"/>	<input type="text" value="N/A"/>	ft ²
Outlet Orifice Centroid =	<input type="text" value="0.19"/>	<input type="text" value="N/A"/>	feet
Half-Central Angle of Restrictor Plate on Pipe =	<input type="text" value="0.97"/>	<input type="text" value="N/A"/>	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
 Spillway Crest Length = feet
 Spillway End Slopes = H:V
 Freeboard above Max Water Surface = feet

Calculated Parameters for Spillway

Spillway Design Flow Depth = feet
 Stage at Top of Freeboard = feet
 Basin Area at Top of Freeboard = acres
 Basin Volume at Top of Freeboard = acre-ft

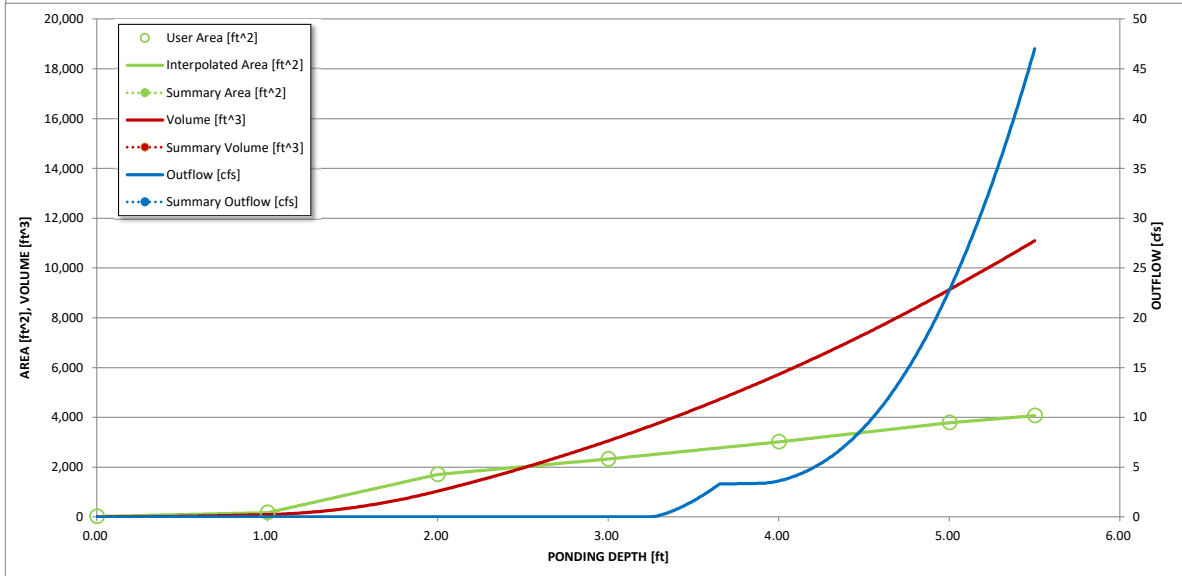
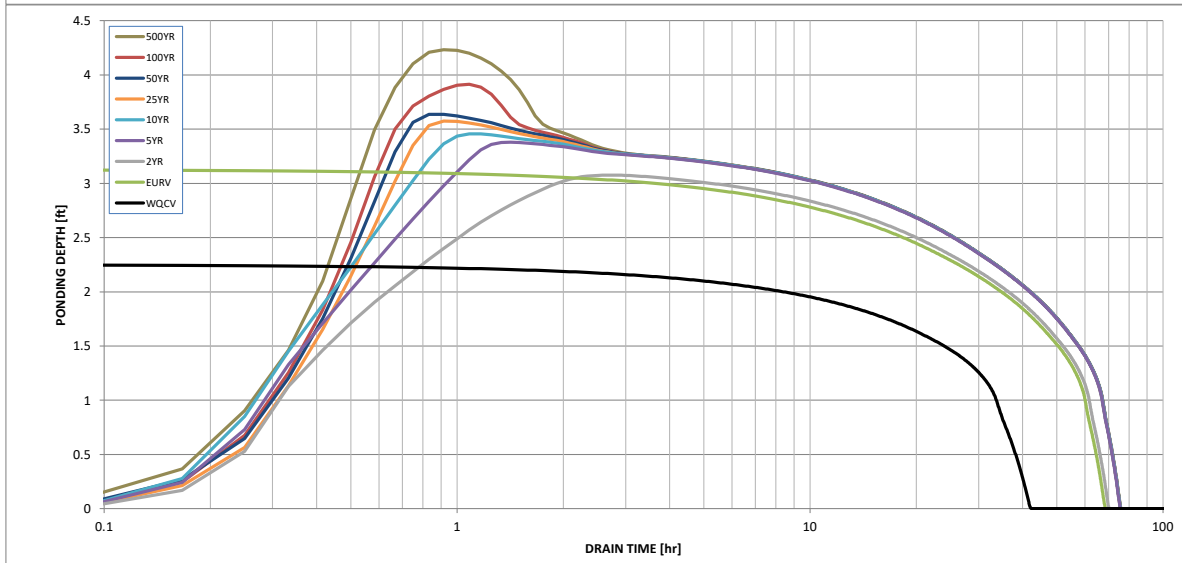
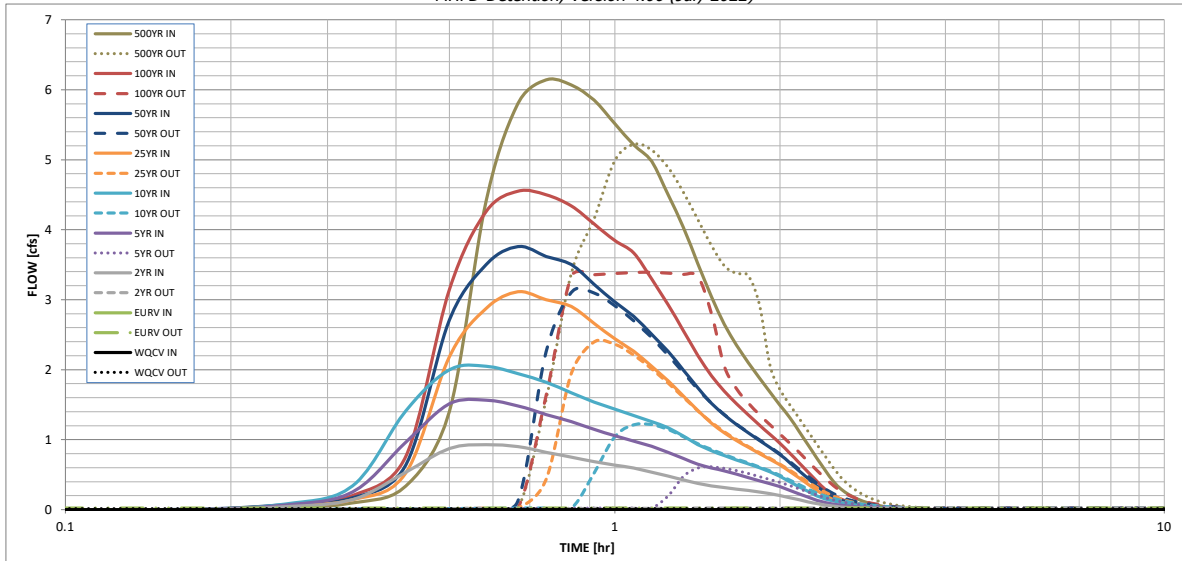
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in) =	0.034	0.077	0.079	0.133	0.183	0.261	0.318	0.397	0.546
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.079	0.133	0.183	0.261	0.318	0.397	0.546
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.3	0.9	1.3	2.3	2.9	3.6	5.1
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.29	0.44	0.79	0.99	1.25	1.75
Peak Inflow Q (cfs) =	N/A	N/A	0.9	1.6	2.0	3.1	3.8	4.5	6.1
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.6	1.2	2.4	3.1	3.4	5.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.9	1.0	1.1	0.9	1.0
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	0.2	0.4	0.8	1.1	1.2	1.2
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	60	62	64	62	59	57	54	49
Time to Drain 99% of Inflow Volume (hours) =	40	64	66	70	68	67	66	65	62
Maximum Ponding Depth (ft) =	2.25	3.13	3.07	3.38	3.45	3.57	3.63	3.91	4.23
Area at Maximum Ponding Depth (acres) =	0.04	0.06	0.05	0.06	0.06	0.06	0.06	0.07	0.07
Maximum Volume Stored (acre-ft) =	0.034	0.077	0.074	0.091	0.096	0.103	0.107	0.125	0.148

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



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: _____

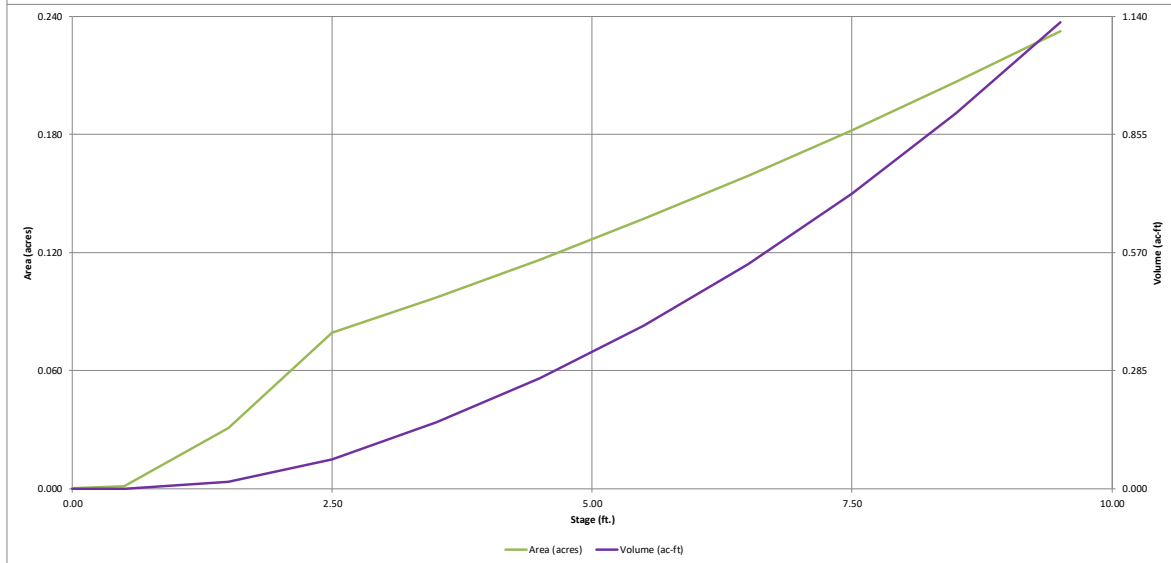
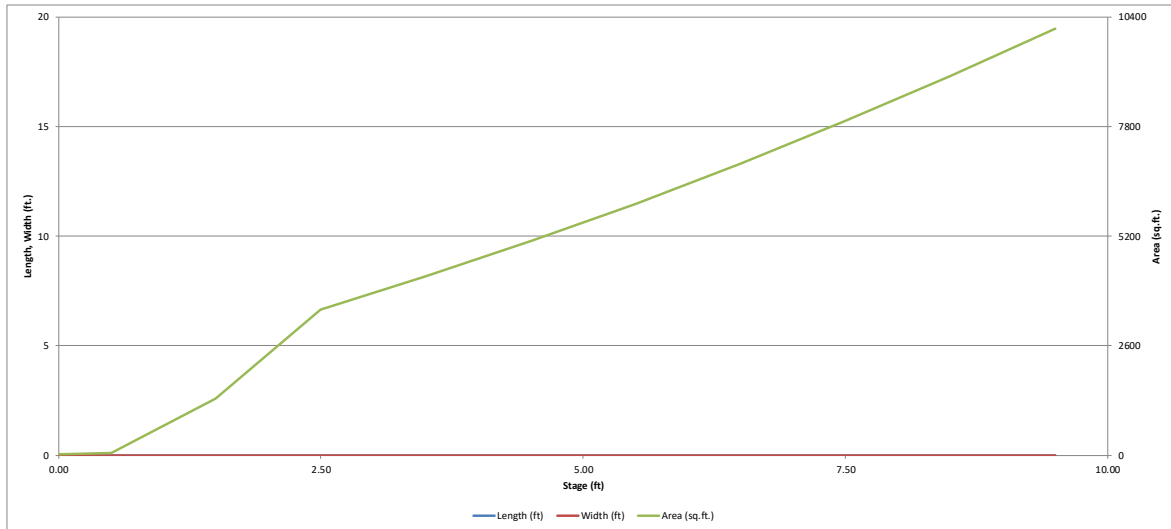
Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	0:15:00	0.00	0.00	0.04	0.06	0.08	0.05	0.07	0.07	0.09
	0:20:00	0.00	0.00	0.14	0.25	0.34	0.14	0.17	0.20	0.34
	0:25:00	0.00	0.00	0.54	0.97	1.41	0.52	0.64	0.76	1.41
	0:30:00	0.00	0.00	0.87	1.51	2.00	2.19	2.71	3.15	4.42
	0:35:00	0.00	0.00	0.93	1.56	2.05	2.88	3.50	4.26	5.80
	0:40:00	0.00	0.00	0.90	1.48	1.94	3.11	3.76	4.55	6.14
	0:45:00	0.00	0.00	0.82	1.36	1.82	3.00	3.62	4.50	6.07
	0:50:00	0.00	0.00	0.75	1.26	1.67	2.90	3.50	4.34	5.85
	0:55:00	0.00	0.00	0.69	1.15	1.54	2.66	3.22	4.08	5.51
	1:00:00	0.00	0.00	0.64	1.06	1.43	2.44	2.97	3.85	5.21
	1:05:00	0.00	0.00	0.59	0.98	1.35	2.26	2.76	3.67	4.98
	1:10:00	0.00	0.00	0.54	0.91	1.26	2.05	2.51	3.29	4.50
	1:15:00	0.00	0.00	0.48	0.82	1.17	1.84	2.26	2.93	4.03
	1:20:00	0.00	0.00	0.42	0.73	1.05	1.62	1.99	2.55	3.52
	1:25:00	0.00	0.00	0.38	0.65	0.93	1.42	1.74	2.21	3.04
	1:30:00	0.00	0.00	0.34	0.60	0.84	1.23	1.52	1.91	2.65
	1:35:00	0.00	0.00	0.31	0.56	0.77	1.10	1.35	1.69	2.35
	1:40:00	0.00	0.00	0.29	0.51	0.71	0.99	1.22	1.51	2.10
	1:45:00	0.00	0.00	0.27	0.46	0.65	0.89	1.10	1.35	1.88
	1:50:00	0.00	0.00	0.25	0.41	0.60	0.80	0.99	1.21	1.68
	1:55:00	0.00	0.00	0.23	0.37	0.54	0.72	0.89	1.07	1.49
	2:00:00	0.00	0.00	0.20	0.33	0.48	0.64	0.79	0.95	1.31
	2:05:00	0.00	0.00	0.17	0.28	0.40	0.54	0.67	0.80	1.11
	2:10:00	0.00	0.00	0.14	0.23	0.33	0.45	0.55	0.67	0.92
	2:15:00	0.00	0.00	0.11	0.18	0.26	0.36	0.44	0.53	0.74
	2:20:00	0.00	0.00	0.09	0.13	0.20	0.28	0.34	0.41	0.56
	2:25:00	0.00	0.00	0.06	0.10	0.15	0.20	0.24	0.29	0.40
	2:30:00	0.00	0.00	0.05	0.08	0.12	0.14	0.17	0.21	0.29
	2:35:00	0.00	0.00	0.04	0.06	0.10	0.10	0.13	0.15	0.22
	2:40:00	0.00	0.00	0.03	0.05	0.08	0.08	0.10	0.11	0.16
	2:45:00	0.00	0.00	0.03	0.04	0.07	0.06	0.08	0.08	0.12
	2:50:00	0.00	0.00	0.02	0.03	0.05	0.05	0.06	0.06	0.09
	2:55:00	0.00	0.00	0.02	0.03	0.04	0.03	0.04	0.04	0.06
	3:00:00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.03	0.05
	3:05:00	0.00	0.00	0.01	0.02	0.03	0.02	0.03	0.02	0.04
	3:10:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	3:15:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.01	0.02
	3:20:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	3:25:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:30:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	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 4.06 (July 2022)

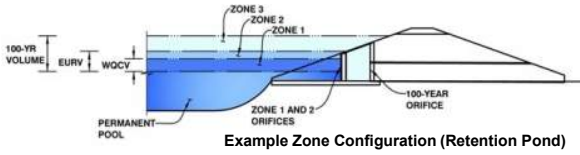


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention, Version 4.06 (July 2022)*

Project: ANTLERS RANGE

Basin ID: POND E4



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.71	0.180	Orifice Plate
Zone 2 (EURV)	5.03	0.151	Circular Orifice
Zone 3 (100-year)	9.24	0.733	Weir&Pipe (Restrict)
Total (all zones)		1.065	

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
 Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain
 Underdrain Orifice Area = ft²
 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 BMP)

Centroid of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = inches
 Orifice Plate: Orifice Area per Row = sq. inches (diameter = 7/8 inch)

Calculated Parameters for Plate
 WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.25	2.50					
Orifice Area (sq. inches)	0.58	0.58	0.58					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	<input type="text" value="3.71"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	<input type="text" value="5.03"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	<input type="text" value="0.38"/>	<input type="text" value="N/A"/>	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	ft ²
Vertical Orifice Centroid =	<input type="text" value="0.02"/>	<input type="text" value="N/A"/>	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	<input type="text" value="5.03"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	<input type="text" value="5.00"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Gate Slope =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	H:V
Horiz. Length of Weir Sides =	<input type="text" value="5.00"/>	<input type="text" value="N/A"/>	feet
Overflow Gate Type =	<input type="text" value="Type C Gate"/>	<input type="text" value="N/A"/>	
Debris Clogging % =	<input type="text" value="50%"/>	<input type="text" value="N/A"/>	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Gate Upper Edge, H _g =	<input type="text" value="5.03"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Slope Length =	<input type="text" value="5.00"/>	<input type="text" value="N/A"/>	feet
Gate Open Area / 100-yr Orifice Area =	<input type="text" value="7.56"/>	<input type="text" value="N/A"/>	
Overflow Gate Open Area w/o Debris =	<input type="text" value="17.40"/>	<input type="text" value="N/A"/>	ft ²
Overflow Gate Open Area w/ Debris =	<input type="text" value="8.70"/>	<input type="text" value="N/A"/>	ft ²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	<input type="text" value="2.50"/>	<input type="text" value="N/A"/>	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	<input type="text" value="24.00"/>	<input type="text" value="N/A"/>	inches
Restrictor Plate Height Above Pipe Invert =	<input type="text" value="16.50"/>	<input type="text" value="N/A"/>	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	<input type="text" value="2.30"/>	<input type="text" value="N/A"/>	ft ²
Outlet Orifice Centroid =	<input type="text" value="0.77"/>	<input type="text" value="N/A"/>	feet
Half-Central Angle of Restrictor Plate on Pipe =	<input type="text" value="1.96"/>	<input type="text" value="N/A"/>	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	<input type="text" value="7.00"/>	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	<input type="text" value="13.00"/>	feet
Spillway End Slopes =	<input type="text" value="4.00"/>	H:V
Freeboard above Max Water Surface =	<input type="text" value="1.00"/>	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =	<input type="text" value="0.89"/>	feet
Stage at Top of Freeboard =	<input type="text" value="8.89"/>	feet
Basin Area at Top of Freeboard =	<input type="text" value="0.22"/>	acres
Basin Volume at Top of Freeboard =	<input type="text" value="0.99"/>	acre-ft

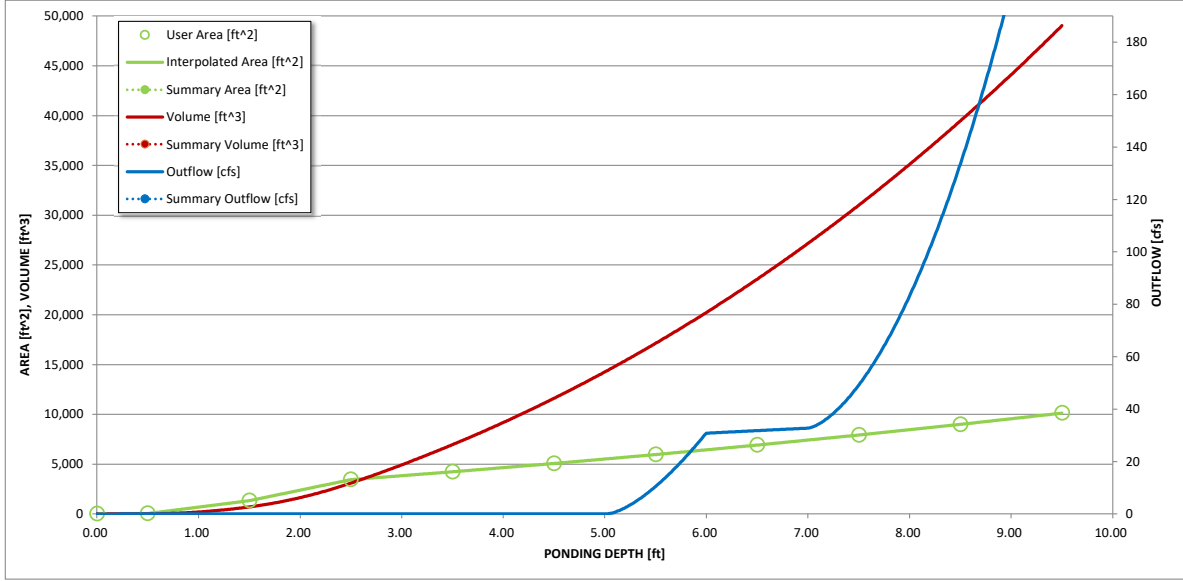
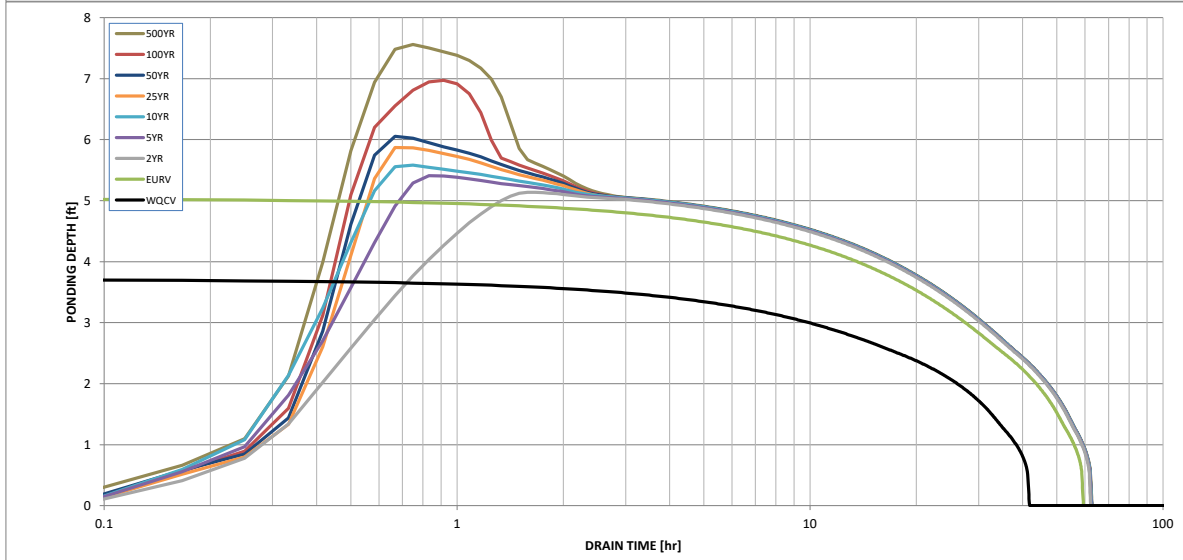
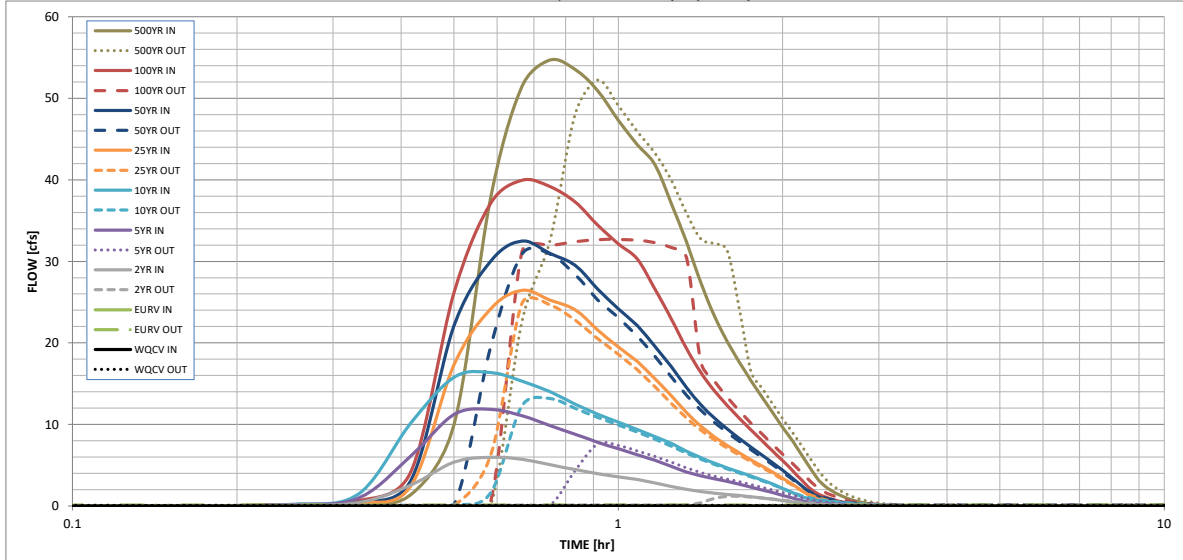
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in) =	0.180	0.331	0.407	0.821	1.225	1.917	2.400	3.083	4.344
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.407	0.821	1.225	1.917	2.400	3.083	4.344
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.1	8.7	13.2	23.2	29.1	36.4	50.7
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.13	0.36	0.54	0.95	1.19	1.49	2.07
Peak Inflow Q (cfs) =	N/A	N/A	6.0	11.8	16.4	26.5	32.5	39.9	54.7
Peak Outflow Q (cfs) =	0.1	0.1	1.2	7.6	13.2	24.9	30.9	32.7	52.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	1.0	1.1	1.1	0.9	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	0.06	0.4	0.8	1.4	1.8	1.9	1.9
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	53	55	51	47	42	39	34	28
Time to Drain 99% of Inflow Volume (hours) =	40	57	59	57	55	53	51	49	46
Maximum Ponding Depth (ft) =	3.71	5.03	5.13	5.41	5.58	5.87	6.05	6.97	7.56
Area at Maximum Ponding Depth (acres) =	0.10	0.13	0.13	0.13	0.14	0.14	0.15	0.17	0.18
Maximum Volume Stored (acre-ft) =	0.181	0.331	0.344	0.380	0.403	0.444	0.472	0.619	0.721

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



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: _____

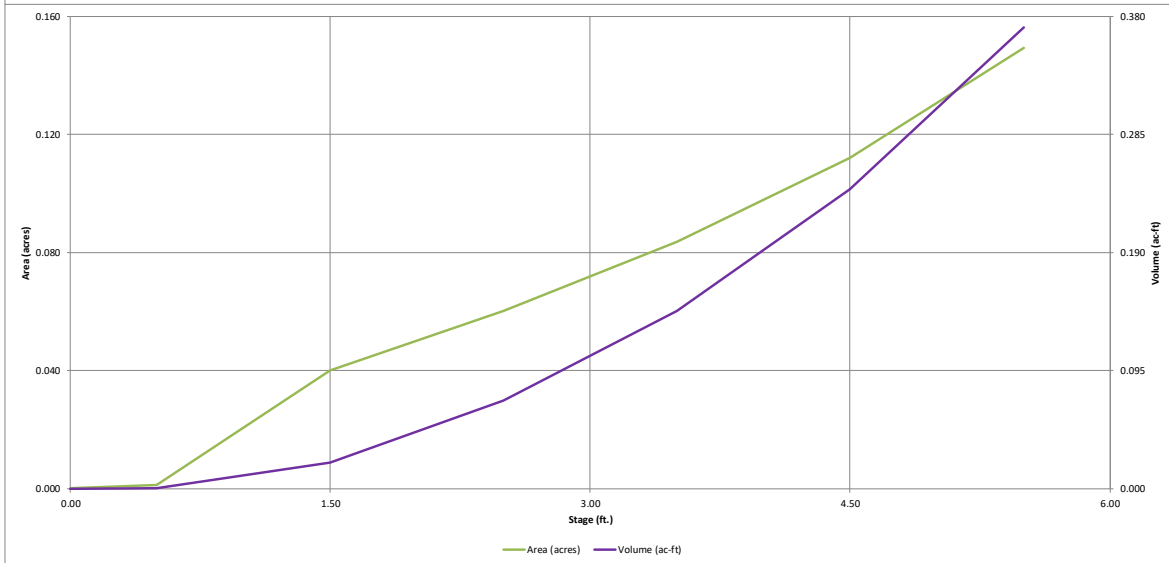
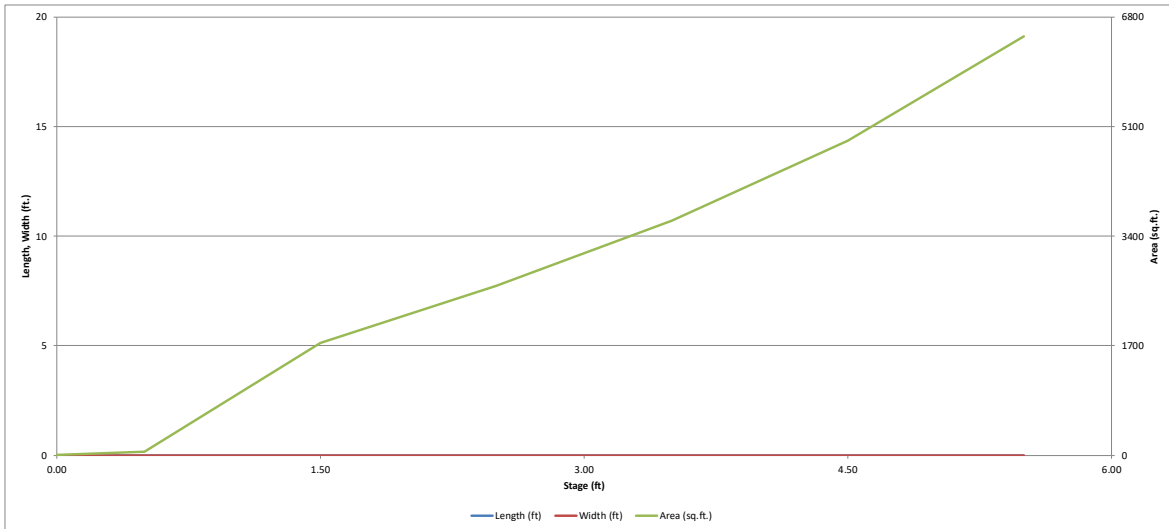
Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.04
	0:15:00	0.00	0.00	0.10	0.17	0.21	0.14	0.17	0.17	0.25
	0:20:00	0.00	0.00	0.37	0.92	1.41	0.37	0.43	0.63	1.36
	0:25:00	0.00	0.00	2.55	6.11	10.16	2.45	3.10	4.16	9.93
	0:30:00	0.00	0.00	5.39	11.22	15.78	17.31	22.09	26.14	37.83
	0:35:00	0.00	0.00	5.97	11.85	16.36	24.18	30.02	37.12	51.47
	0:40:00	0.00	0.00	5.71	11.07	15.29	26.46	32.51	39.95	54.69
	0:45:00	0.00	0.00	5.05	9.83	13.99	25.23	30.95	39.15	53.52
	0:50:00	0.00	0.00	4.47	8.80	12.49	24.07	29.52	37.27	50.95
	0:55:00	0.00	0.00	3.97	7.80	11.25	21.57	26.60	34.44	47.29
	1:00:00	0.00	0.00	3.58	7.01	10.28	19.49	24.18	32.15	44.33
	1:05:00	0.00	0.00	3.25	6.29	9.40	17.72	22.12	30.29	41.87
	1:10:00	0.00	0.00	2.83	5.60	8.53	15.61	19.60	26.62	37.13
	1:15:00	0.00	0.00	2.41	4.85	7.68	13.53	17.10	22.95	32.37
	1:20:00	0.00	0.00	2.04	4.17	6.71	11.46	14.50	19.30	27.36
	1:25:00	0.00	0.00	1.77	3.69	5.91	9.78	12.40	16.35	23.30
	1:30:00	0.00	0.00	1.58	3.34	5.26	8.48	10.77	14.13	20.17
	1:35:00	0.00	0.00	1.42	3.03	4.68	7.42	9.45	12.34	17.63
	1:40:00	0.00	0.00	1.27	2.66	4.16	6.50	8.28	10.76	15.38
	1:45:00	0.00	0.00	1.13	2.31	3.67	5.67	7.23	9.32	13.34
	1:50:00	0.00	0.00	0.98	1.97	3.19	4.89	6.24	7.99	11.45
	1:55:00	0.00	0.00	0.82	1.64	2.70	4.14	5.30	6.74	9.67
	2:00:00	0.00	0.00	0.67	1.31	2.17	3.42	4.40	5.57	8.00
	2:05:00	0.00	0.00	0.50	0.97	1.63	2.65	3.42	4.36	6.25
	2:10:00	0.00	0.00	0.34	0.65	1.14	1.90	2.47	3.17	4.57
	2:15:00	0.00	0.00	0.22	0.44	0.84	1.21	1.60	2.08	3.12
	2:20:00	0.00	0.00	0.16	0.33	0.66	0.81	1.11	1.43	2.21
	2:25:00	0.00	0.00	0.13	0.26	0.53	0.56	0.79	1.00	1.59
	2:30:00	0.00	0.00	0.10	0.21	0.42	0.40	0.57	0.69	1.13
	2:35:00	0.00	0.00	0.08	0.16	0.33	0.28	0.41	0.46	0.78
	2:40:00	0.00	0.00	0.06	0.13	0.26	0.20	0.30	0.30	0.53
	2:45:00	0.00	0.00	0.05	0.10	0.20	0.14	0.21	0.19	0.34
	2:50:00	0.00	0.00	0.04	0.08	0.15	0.10	0.15	0.12	0.22
	2:55:00	0.00	0.00	0.03	0.06	0.11	0.08	0.11	0.09	0.17
	3:00:00	0.00	0.00	0.02	0.04	0.08	0.06	0.09	0.07	0.13
	3:05:00	0.00	0.00	0.02	0.03	0.06	0.04	0.07	0.06	0.10
	3:10:00	0.00	0.00	0.01	0.02	0.05	0.03	0.05	0.04	0.08
	3:15:00	0.00	0.00	0.01	0.01	0.03	0.03	0.04	0.03	0.06
	3:20:00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.02	0.04
	3:25:00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03
	3:30:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6:00:00	0.00	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 4.06 (July 2022)

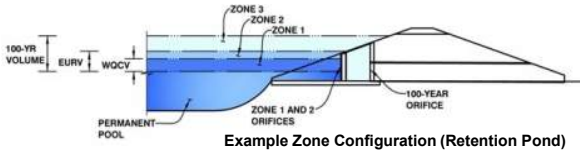


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-*Detention, Version 4.06 (July 2022)*

Project: ANTLERS RANGE

Basin ID: POND F



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.94	0.040	Orifice Plate
Zone 2 (EURV)	2.70	0.043	Circular Orifice
Zone 3 (100-year)	4.32	0.137	Weir&Pipe (Restrict)
Total (all zones)		0.220	

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
 Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain
 Underdrain Orifice Area = ft²
 Underdrain Orifice Centroid = feet

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

Centroid of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = inches
 Orifice Plate: Orifice Area per Row = sq. inches (diameter = 7/16 inch)

Calculated Parameters for Plate
 WQ Orifice Area per Row = ft²
 Elliptical Half-Width = feet
 Elliptical Slot Centroid = feet
 Elliptical Slot Area = ft²

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	0.68	1.30					
Orifice Area (sq. inches)	0.17	0.17	0.17					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	1.94	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	2.70	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	0.38	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.00	N/A	ft ²
Vertical Orifice Centroid =	0.02	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.70	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Gate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Gate Type =	Type C Gate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Gate Upper Edge, H _g =	2.70	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	13.70	N/A	
Overflow Grate Open Area w/o Debris =	6.26	N/A	ft ²
Overflow Grate Open Area w/ Debris =	3.13	N/A	ft ²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	5.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	5.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.46	N/A	ft ²
Outlet Orifice Centroid =	0.27	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.17	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
 Spillway Crest Length = feet
 Spillway End Slopes = H:V
 Freeboard above Max Water Surface = feet

Calculated Parameters for Spillway
 Spillway Design Flow Depth = feet
 Stage at Top of Freeboard = feet
 Basin Area at Top of Freeboard = acres
 Basin Volume at Top of Freeboard = acre-ft

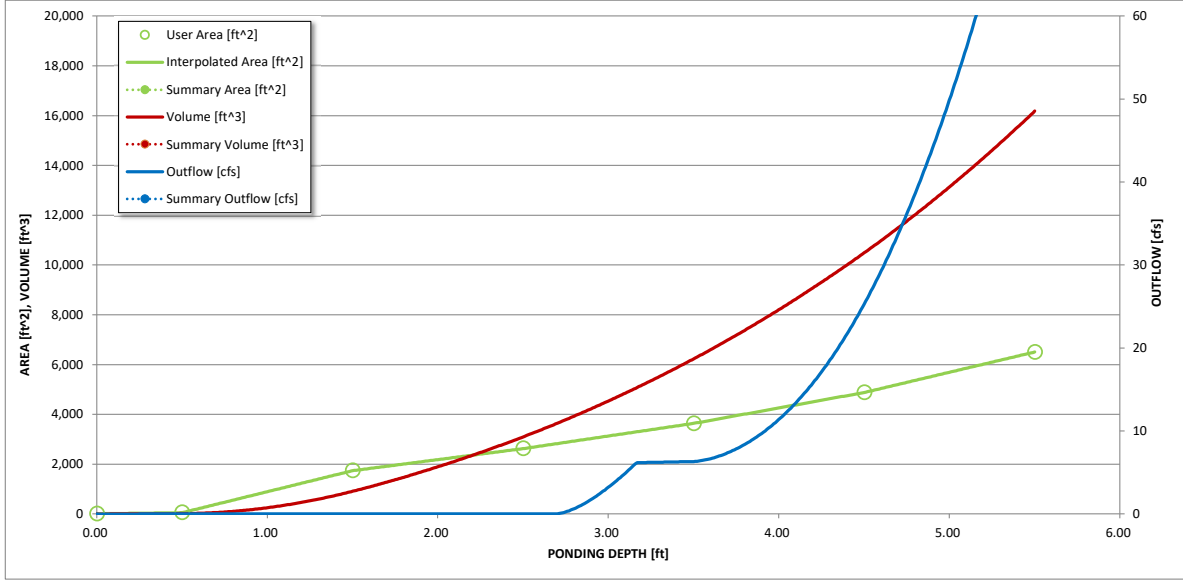
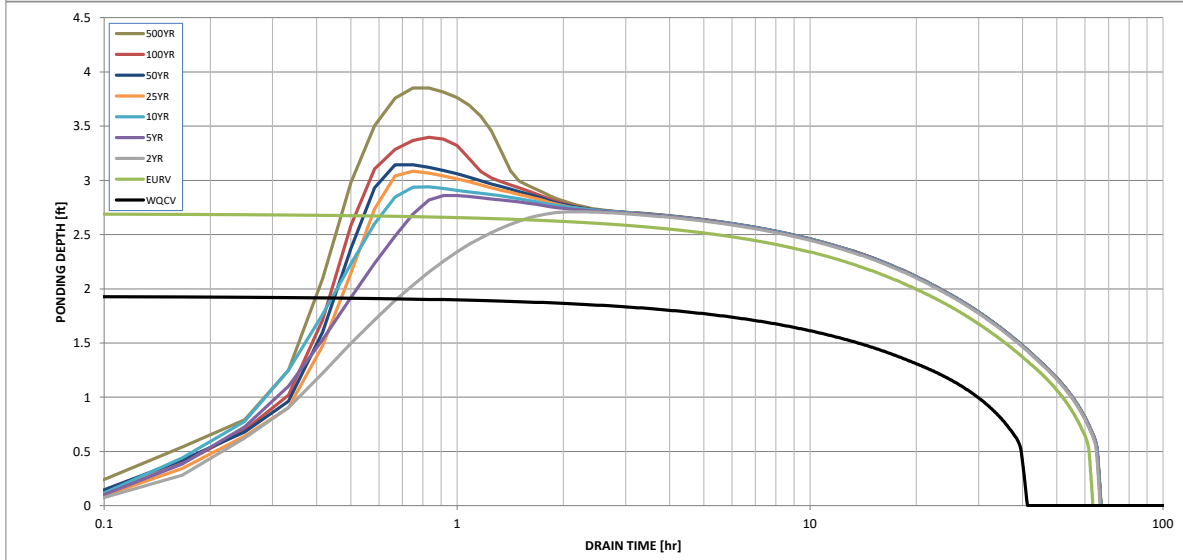
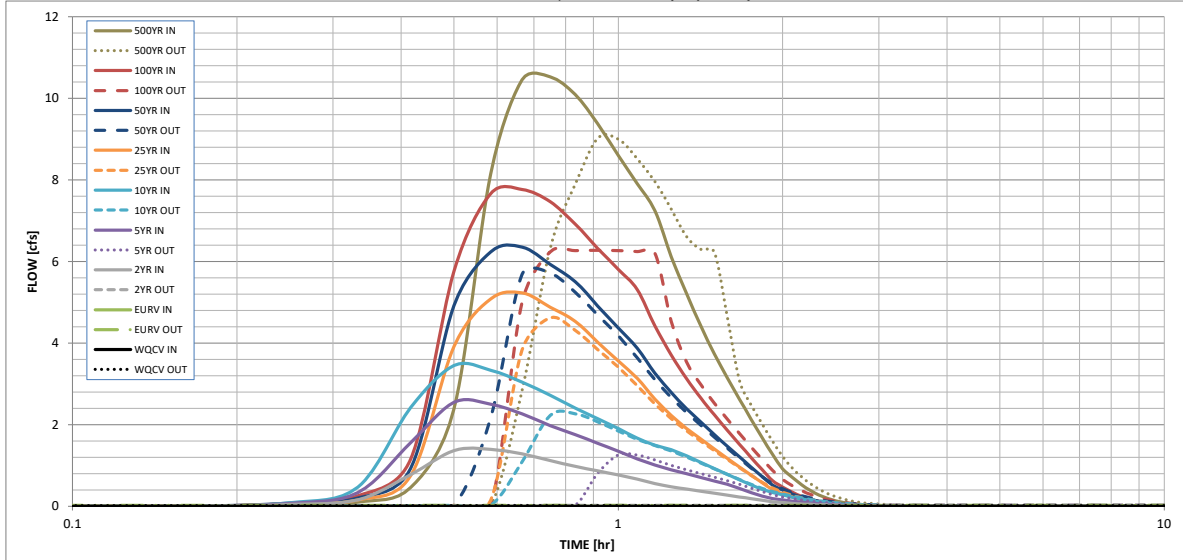
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in) =	0.040	0.083	0.089	0.163	0.232	0.346	0.427	0.540	0.752
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.089	0.163	0.232	0.346	0.427	0.540	0.752
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.6	1.6	2.4	4.3	5.4	6.8	9.4
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.14	0.39	0.58	1.03	1.29	1.61	2.24
Peak Inflow Q (cfs) =	N/A	N/A	1.4	2.5	3.4	5.2	6.4	7.8	10.5
Peak Outflow Q (cfs) =	0.0	0.0	0.0	1.3	2.3	4.6	5.7	6.3	9.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.9	1.1	1.1	0.9	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	0.00	0.2	0.4	0.7	0.9	1.0	1.0
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	57	60	57	54	50	47	43	38
Time to Drain 99% of Inflow Volume (hours) =	40	60	63	62	61	59	58	56	53
Maximum Ponding Depth (ft) =	1.93	2.70	2.71	2.86	2.94	3.08	3.14	3.40	3.85
Area at Maximum Ponding Depth (acres) =	0.05	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.09
Maximum Volume Stored (acre-ft) =	0.040	0.084	0.084	0.094	0.099	0.110	0.114	0.134	0.174

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)



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.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02
	0:15:00	0.00	0.00	0.04	0.07	0.09	0.06	0.08	0.07	0.11
	0:20:00	0.00	0.00	0.16	0.34	0.47	0.16	0.20	0.26	0.46
	0:25:00	0.00	0.00	0.78	1.56	2.42	0.76	0.93	1.16	2.38
	0:30:00	0.00	0.00	1.37	2.55	3.45	3.92	4.92	5.76	8.15
	0:35:00	0.00	0.00	1.40	2.51	3.34	5.09	6.24	7.66	10.45
	0:40:00	0.00	0.00	1.29	2.26	3.04	5.23	6.36	7.77	10.53
	0:45:00	0.00	0.00	1.12	1.98	2.73	4.88	5.93	7.46	10.09
	0:50:00	0.00	0.00	0.98	1.76	2.41	4.54	5.51	6.92	9.38
	0:55:00	0.00	0.00	0.87	1.55	2.15	4.02	4.91	6.32	8.60
	1:00:00	0.00	0.00	0.77	1.35	1.90	3.56	4.37	5.81	7.91
	1:05:00	0.00	0.00	0.67	1.16	1.67	3.14	3.88	5.31	7.25
	1:10:00	0.00	0.00	0.56	1.01	1.50	2.63	3.26	4.43	6.12
	1:15:00	0.00	0.00	0.48	0.90	1.39	2.23	2.79	3.71	5.22
	1:20:00	0.00	0.00	0.42	0.80	1.24	1.91	2.39	3.13	4.41
	1:25:00	0.00	0.00	0.37	0.71	1.07	1.65	2.06	2.65	3.73
	1:30:00	0.00	0.00	0.32	0.62	0.93	1.40	1.75	2.24	3.16
	1:35:00	0.00	0.00	0.28	0.54	0.79	1.18	1.47	1.87	2.63
	1:40:00	0.00	0.00	0.23	0.44	0.65	0.97	1.21	1.52	2.14
	1:45:00	0.00	0.00	0.19	0.34	0.53	0.77	0.97	1.20	1.69
	1:50:00	0.00	0.00	0.15	0.25	0.41	0.58	0.73	0.90	1.27
	1:55:00	0.00	0.00	0.11	0.19	0.34	0.41	0.52	0.63	0.92
	2:00:00	0.00	0.00	0.09	0.16	0.28	0.31	0.40	0.47	0.71
	2:05:00	0.00	0.00	0.07	0.13	0.22	0.23	0.30	0.34	0.53
	2:10:00	0.00	0.00	0.06	0.10	0.18	0.17	0.22	0.25	0.38
	2:15:00	0.00	0.00	0.05	0.08	0.14	0.12	0.16	0.17	0.27
	2:20:00	0.00	0.00	0.04	0.06	0.11	0.09	0.12	0.12	0.19
	2:25:00	0.00	0.00	0.03	0.05	0.08	0.07	0.09	0.08	0.13
	2:30:00	0.00	0.00	0.02	0.04	0.06	0.05	0.07	0.06	0.09
	2:35:00	0.00	0.00	0.02	0.03	0.05	0.04	0.05	0.04	0.07
	2:40:00	0.00	0.00	0.01	0.02	0.03	0.03	0.04	0.03	0.05
	2:45:00	0.00	0.00	0.01	0.02	0.03	0.02	0.03	0.03	0.04
	2:50:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.03
	2:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02
	3:00:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02
	3:05:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

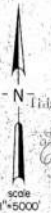


APPENDIX E – REFERENCE MATERIAL

APPROXIMATE SITE



CITY COUNTY DRAINAGE BASINS

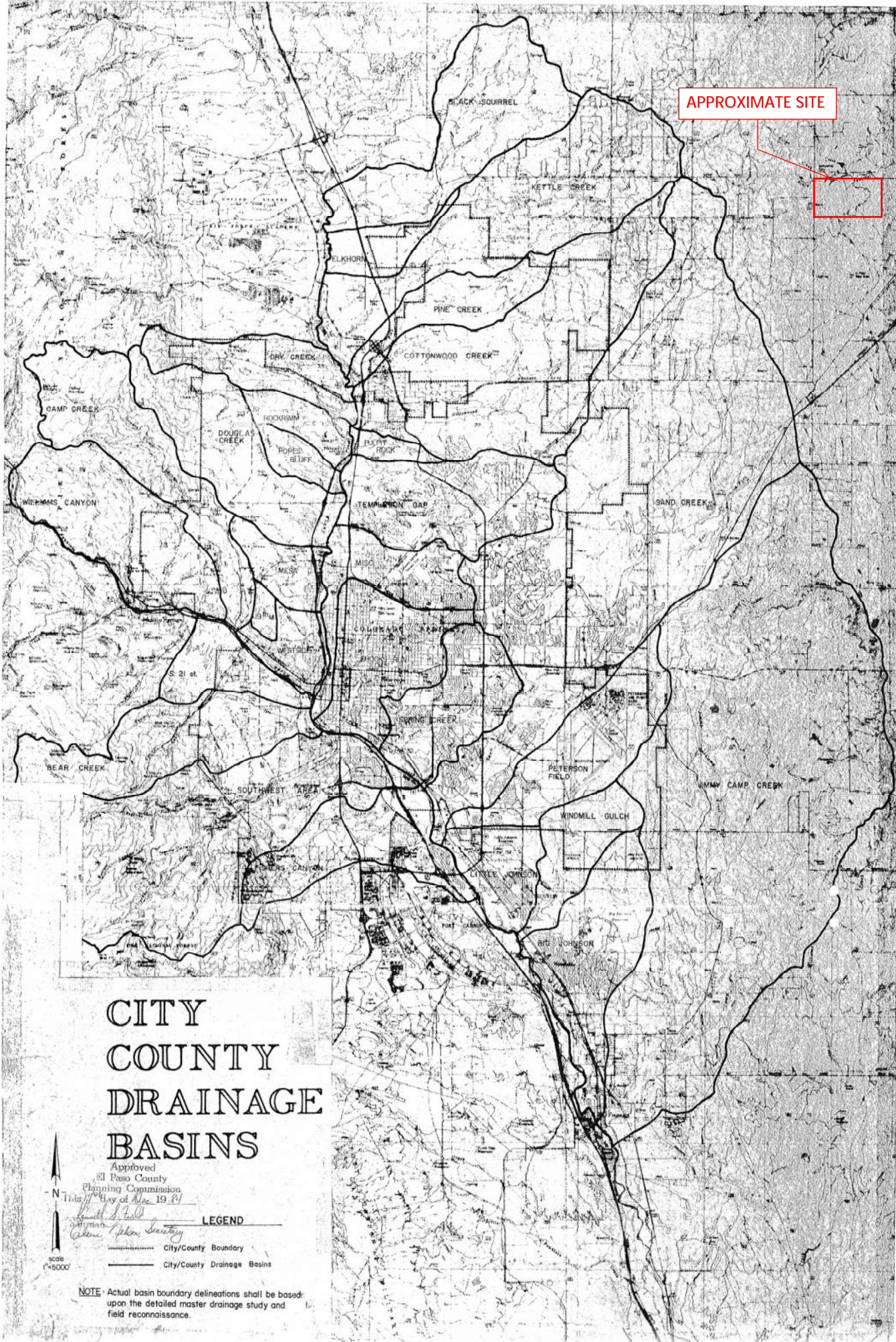


Approved
El Paso County
Planning Commission
This 11th Day of Nov. 19 84

Paul J. Hill
City Engineer

- LEGEND**
- City/County Boundary
 - City/County Drainage Basins

NOTE: Actual basin boundary delineations shall be based upon the detailed master drainage study and field reconnaissance.



APPENDIX E
DETENTION POND CALCULATIONS

ANTLERS RIDGE ESTATES - DEVELOPED CONDITION
 PRELIMINARY/FINAL DRAINAGE REPORT
 (Detention Pond / Sediment Basin Summary)



	Pond:		BR-4	GR-2 N	GR-4 W	GR-4 N
	UBS-2 E	UBS-2 W				
Tributary Area (Ac.)		59.15	25.13	36.72		41.09
Provided Detention Pond Volume (cu. ft.)		69,412	45,297	62,199		87,006
Provided Detention Pond Volume (Ac-ft.)		1.59	1.04	1.43		2.00
Emergency Spillway Elev.		7,264.00	7,235.50	7,216.00		7,209.50
Required Detention Pond Volume (cu. ft.)		58,589	40,727	53,598		80,876
Required Detention Pond Volume (Ac-ft.)		1.34	0.93	1.23		1.86
Calculated 10-yr Water Surface Elev.		7,262.13	7,234.03	7,214.25		7,206.93
Calculated 100-yr Water Surface Elev.		7,263.55	7,235.13	7,215.59		7,209.19
100-yr W.S. Area (sq. ft.)		26,669	17,312	21,240		19,349
Detention Pond W.S. Footprint (Ac-ft.)		0.61	0.40	0.49		0.44
Calculated WQCV (Ac-ft.)		0.43	0.18	0.27		0.30
Calculated Pre-Sedimentation Volume (Ac-ft.)		0.09	0.04	0.05		0.06
Provided Pre-Sedimentation Volume (Ac-ft.)	0.04	0.06	0.10	0.10	0.07	0.02
Provided Pre-Sedimentation Volume (cu-ft.)	1,577	2,613	4,445	4,369	2,954	998
Pre-Sedimentation Depth (ft.)	2.50	2.50	2.00	2.50	1.50	1.50
Berm Length (ft.)	180	100	90	90	50	28
Berm Width (ft.)	0 to 1	0 to 1	4	4	4	4
One-hour Drain Rate (cts)	0.44	0.73	1.23	1.21	0.82	0.28
Outlet Pipe Size (in.)	8	8	8	8	8	8
Outlet Pipe Invert In (Elev.)	7,262.5	7,262.5	7,231.5	7,212.0	7,215.1	7,212.1
Outlet Pipe Invert Out (Elev.)	7,262.0	7,262.0	7,231.0	7,211.8	7,215.0	7,212.0
Outlet Pipe Slope (%)	2.50	2.50	1.25	0.67	0.63	0.83
Outlet Pipe Length (ft.)	20	20	40	30	16	12
Number of Rows in Riser (4" Vert. Spacing)	6	6	5	6	3	3
Number of Holes Per Row	4	4	7	7	5	3
Hole Size (in.)	1	1 1/4	1 1/4	1 1/4	1 3/8	1
Number of Riser Pipes	1	1	1	1	1	1
Riser Pipe Size (in.)	8	8	12	12	8	8

Date: _____
 Checked by: _____

Date: 3/30/2006
 Checked by: _____

UBS-10

CO-EIPaso 10-Year Duration=41 min, Inten=2.25 in/hr

Prepared by {enter your company name here}

Page 2

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3/30/2006

Time span=0.00-3.00 hrs, dt=0.01 hrs, 301 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind method - Pond routing by Stor-Ind method

Subcatchment 6S: UBS

Runoff Area=59.150 ac Runoff Depth=0.71"

Tc=41.2 min C=0.31 Runoff=41.31 cfs 3.510 af

Pond 5p: UBS-2 Pond

Peak Elev=7,262.13' Storage=23,869 cf Inflow=41.31 cfs 3.510 af

Primary=32.91 cfs 3.510 af Secondary=0.00 cfs 0.000 af Outflow=32.91 cfs 3.510 af

Total Runoff Area = 59.150 ac Runoff Volume = 3.510 af Average Runoff Depth = 0.71"

UBS-10

CO-EIPaso 10-Year Duration=41 min, Inten=2.25 in/hr

Prepared by {enter your company name here}

HydroCAD® 7.00 s/n 002861 © 1986-2003 Applied Microcomputer Systems

3/30/2006

Subcatchment 6S: UBS

Runoff = 41.31 cfs @ 0.68 hrs, Volume= 3.510 af, Depth= 0.71"

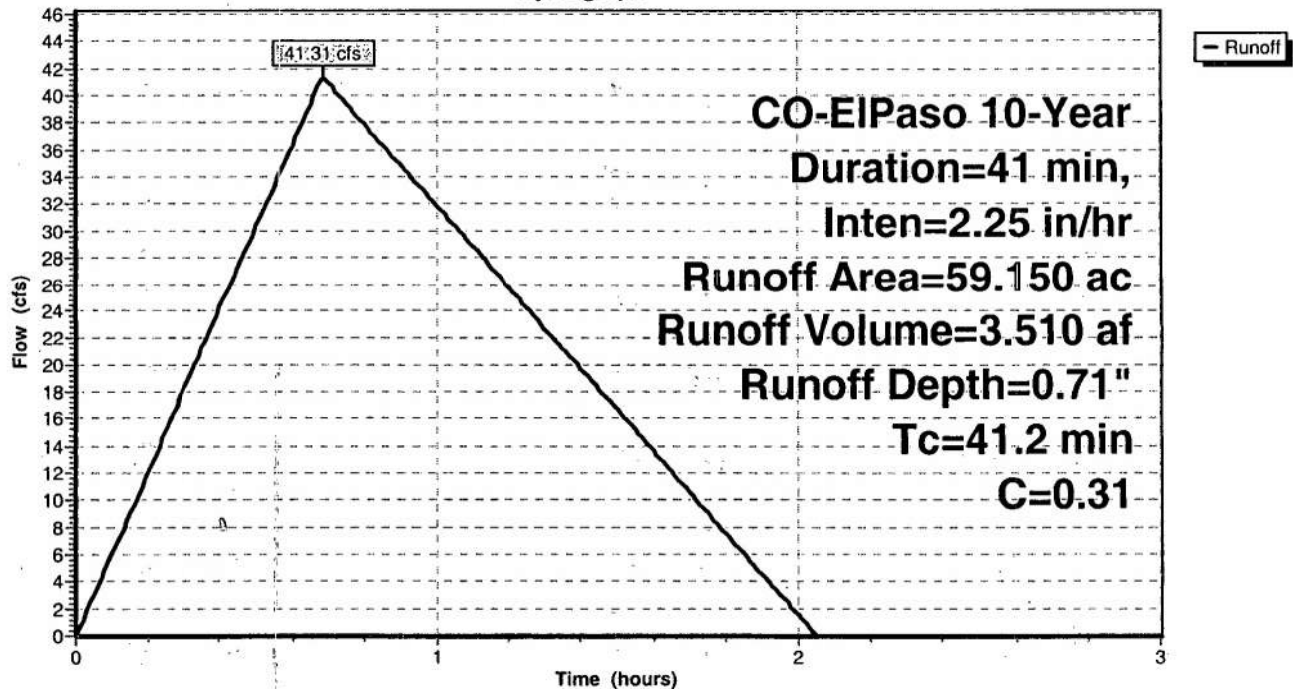
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
CO-EIPaso 10-Year Duration=41 min, Inten=2.25 in/hr

Area (ac)	C	Description
13.070	0.31	PR-1 with C10 value
39.590	0.31	PR-2 with C10 value
1.950	0.30	PR-3 with C10 value
1.390	0.30	PR-5 with C10 value
1.050	0.30	PR-6 with C10 value
2.100	0.30	PR-7 with C10 value
59.150	0.31	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
41.2					Direct Entry, UBS

Subcatchment 6S: UBS

Hydrograph



Pond 5p: UBS-2 Pond

Inflow Area = 59.150 ac, Inflow Depth = 0.71" for 10-Year event
 Inflow = 41.31 cfs @ 0.68 hrs, Volume= 3.510 af
Outflow = 32.91 cfs @ 0.96 hrs, Volume= 3.510 af, Atten= 20%, Lag= 16.8 min
 Primary = 32.91 cfs @ 0.96 hrs, Volume= 3.510 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 Peak Elev= 7,262.13' @ 0.96 hrs Surf.Area= 20,796 sf Storage= 23,869 cf
 Plug-Flow detention time= 10.1 min calculated for 3.510 af (100% of inflow)
 Center-of-Mass det. time= 10.1 min (64.7 - 54.7)

#	Invert	Avail.Storage	Storage Description
1	7,259.00'	102,261 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
7,259.00	40	0	0
7,260.00	3,000	1,520	1,520
7,261.00	7,482	5,241	6,761
7,262.00	20,244	13,863	20,624
7,264.00	28,544	48,788	69,412
7,265.00	37,153	32,849	102,261

#	Routing	Invert	Outlet Devices
1	Primary	7,258.05'	42.0" x 88.0' long Culvert RCP, square edge headwall, Ke= 0.500 Outlet Invert= 7,257.52' S= 0.0060 ' n= 0.013 Cc= 0.900
2	Device 1	7,258.05'	1.00' x 1.00' Vert. Orifice/Grate X 0.27 C= 0.600
3	Device 1	7,259.30'	2.00' x 2.75' Vert. Orifice/Grate C= 0.600
4	Device 1	7,262.30'	5.0' long x 4.5' high Sharp-Crested Rectangular Weir 2 End Contraction(s)
5	Secondary	7,264.00'	200.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=32.92 cfs @ 0.96 hrs HW=7,262.13' (Free Discharge)

- 1=Culvert (Passes 32.92 cfs of 64.62 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 2.46 cfs @ 2.5 fps)
- 3=Orifice/Grate (Orifice Controls 30.46 cfs @ 5.5 fps)
- 4=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=7,259.00' (Free Discharge)

- 5=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

UBS-100

CO-EIPaso 100-Year Duration=41 min, Inten=3.43 in/hr

Prepared by {enter your company name here}

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Subcatchment 6S: UBS

Runoff = 85.22 cfs @ 0.68 hrs, Volume= 7.241 af, Depth= 1.47"

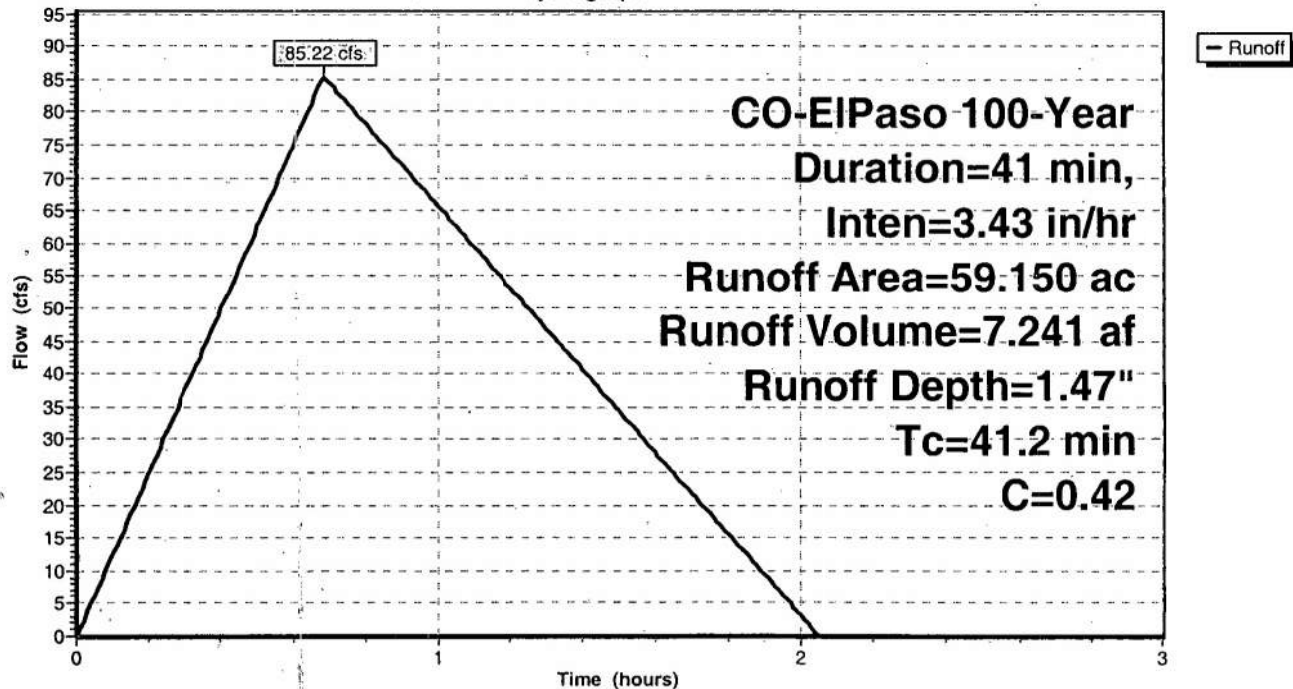
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
CO-EIPaso 100-Year Duration=41 min, Inten=3.43 in/hr

Area (ac)	C	Description
13.070	0.42	PR-1 with C10 value
39.590	0.42	PR-2 with C10 value
1.950	0.42	PR-3 with C10 value
1.390	0.42	PR-5 with C10 value
1.050	0.42	PR-6 with C10 value
2.100	0.42	PR-7 with C10 value
59.150	0.42	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
41.2					Direct Entry, UBS

Subcatchment 6S: UBS

Hydrograph



Pond 5p: UBS-2 Pond

Inflow Area = 59.150 ac, Inflow Depth = 1.47" for 100-Year event
 Inflow = 85.22 cfs @ 0.68 hrs, Volume= 7.241 af
Outflow = 69.74 cfs @ 0.93 hrs, Volume= 7.241 af, Atten= 18%, Lag= 15.0 min
 Primary = 69.74 cfs @ 0.93 hrs, Volume= 7.241 af
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-3.00 hrs, dt= 0.01 hrs
 Peak Elev= 7,263.55' @ 0.93 hrs Surf.Area= 26,669 sf Storage= 58,389 cf
 Plug-Flow detention time= 13.3 min calculated for 7.241 af (100% of inflow)
 Center-of-Mass det. time= 13.2 min (67.9 - 54.7)

#	Invert	Avail.Storage	Storage Description
1	7,259.00'	102,261 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
7,259.00	40	0	0
7,260.00	3,000	1,520	1,520
7,261.00	7,482	5,241	6,761
7,262.00	20,244	13,863	20,624
7,264.00	28,544	48,788	69,412
7,265.00	37,153	32,849	102,261

#	Routing	Invert	Outlet Devices
1	Primary	7,258.05'	42.0" x 88.0' long Culvert RCP, square edge headwall, Ke= 0.500 Outlet Invert= 7,257.52' S= 0.0060 '/ n= 0.013 Cc= 0.900
2	Device 1	7,258.05'	1.00' x 1.00' Vert. Orifice/Grate X 0.27 C= 0.600
3	Device 1	7,259.30'	2.00' x 2.75' Vert. Orifice/Grate C= 0.600
4	Device 1	7,262.30'	5.0' long x 4.5' high Sharp-Crested Rectangular Weir 2 End Contraction(s)
5	Secondary	7,264.00'	200.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=69.74 cfs @ 0.93 hrs HW=7,263.55' (Free Discharge)

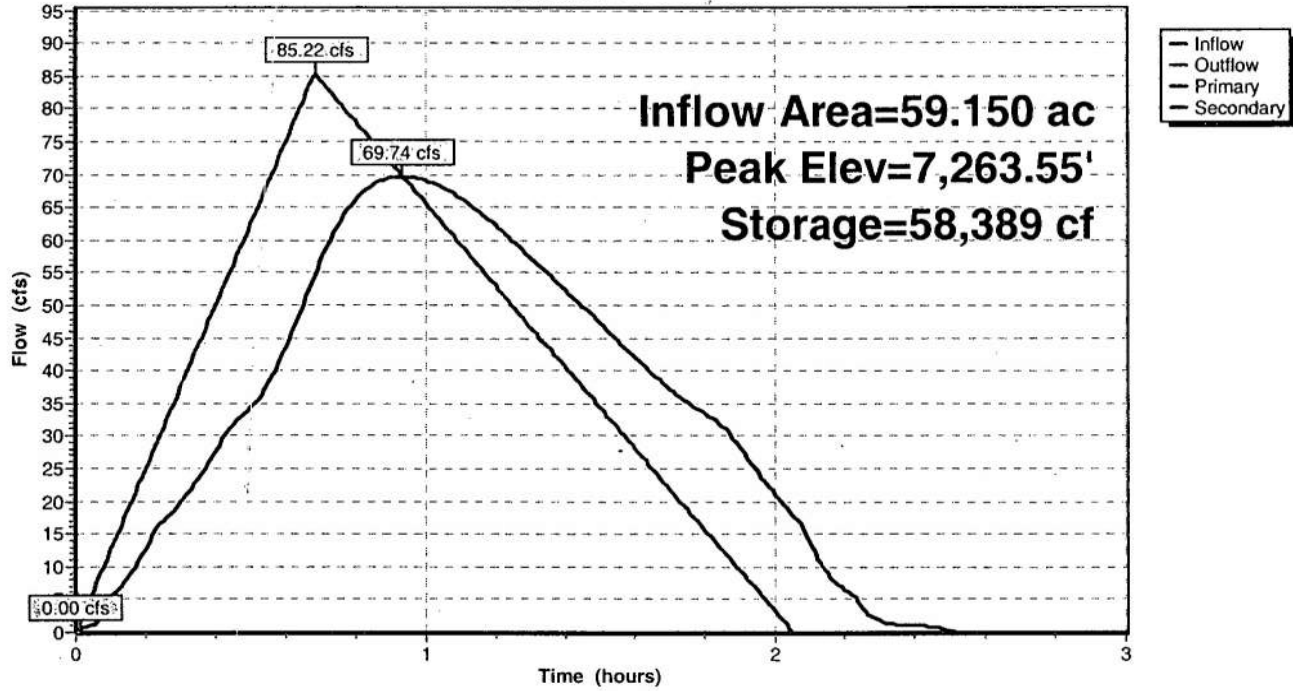
- 1=Culvert (Passes 69.74 cfs of 86.37 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 2.91 cfs @ 2.9 fps)
- 3=Orifice/Grate (Orifice Controls 44.44 cfs @ 8.1 fps)
- 4=Sharp-Crested Rectangular Weir (Weir Controls 22.39 cfs @ 3.8 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=7,259.00' (Free Discharge)

- 5=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 5p: UBS-2 Pond

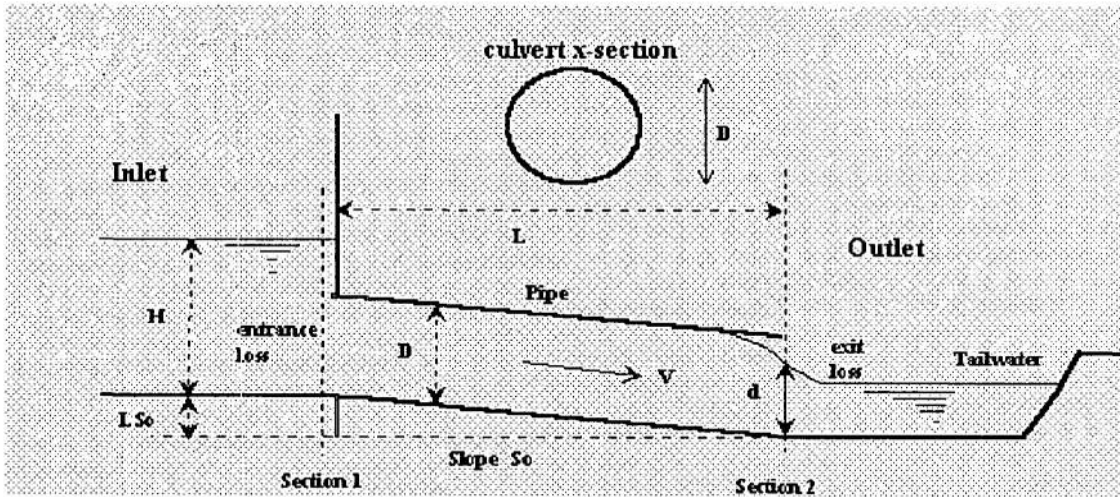
Hydrograph



Headwater Depth For Circular Culvert

Project: Antlers Ridge

Pipe ID: UBS-2



Design Information (input)

Design Discharge	Q =	69.2 cfs
Pipe Diameter	D =	42.00 inches
Inlet Edge Type (choose from pull-down list)	Inlet Type =	Square End with Headwall
Inlet Invert Elevation	I _e =	58.05 ft
Outlet Invert Elevation	O _e =	57.52 ft
Pipe Length	L =	88.0 ft
Manning's Roughness n-value	n =	0.013
Bend Loss Coefficient	K _b =	0.00
Exit Loss Coefficient	K _x =	0.50
Tailwater Water Surface Elevation	El. Y _t =	59.02 ft

Calculations (output)

Pipe Cross Sectional Area	A _o =	9.62 sq ft
Culvert Slope	S _o =	0.0060 ft/ft
Normal Flow Depth	Y _n =	2.56 ft
Critical Flow Depth	Y _c =	2.61 ft

Headwater Depth by Inlet Control

Headwater Depth by Inlet Control HW-inlet= 4.40 ft

Headwater Depth by Outlet Control

Tailwater Depth for Design d = 3.05 ft

Friction Loss Coefficient over Culvert Length K_f = 0.52

Sum of All Loss Coefficients K_s = 1.52

Headwater Depth by Outlet Control HW-outlet= 4.54 ft

Design Headwater Depth HW= 4.54 ft

HW/D Ratio = HW/D= 1.30

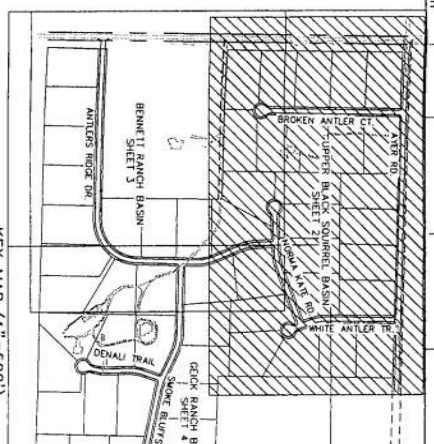
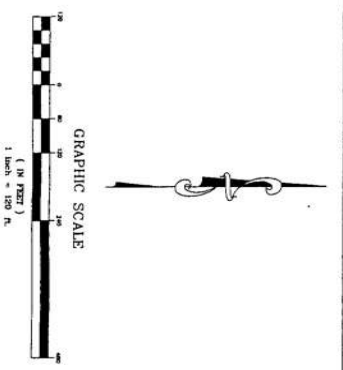
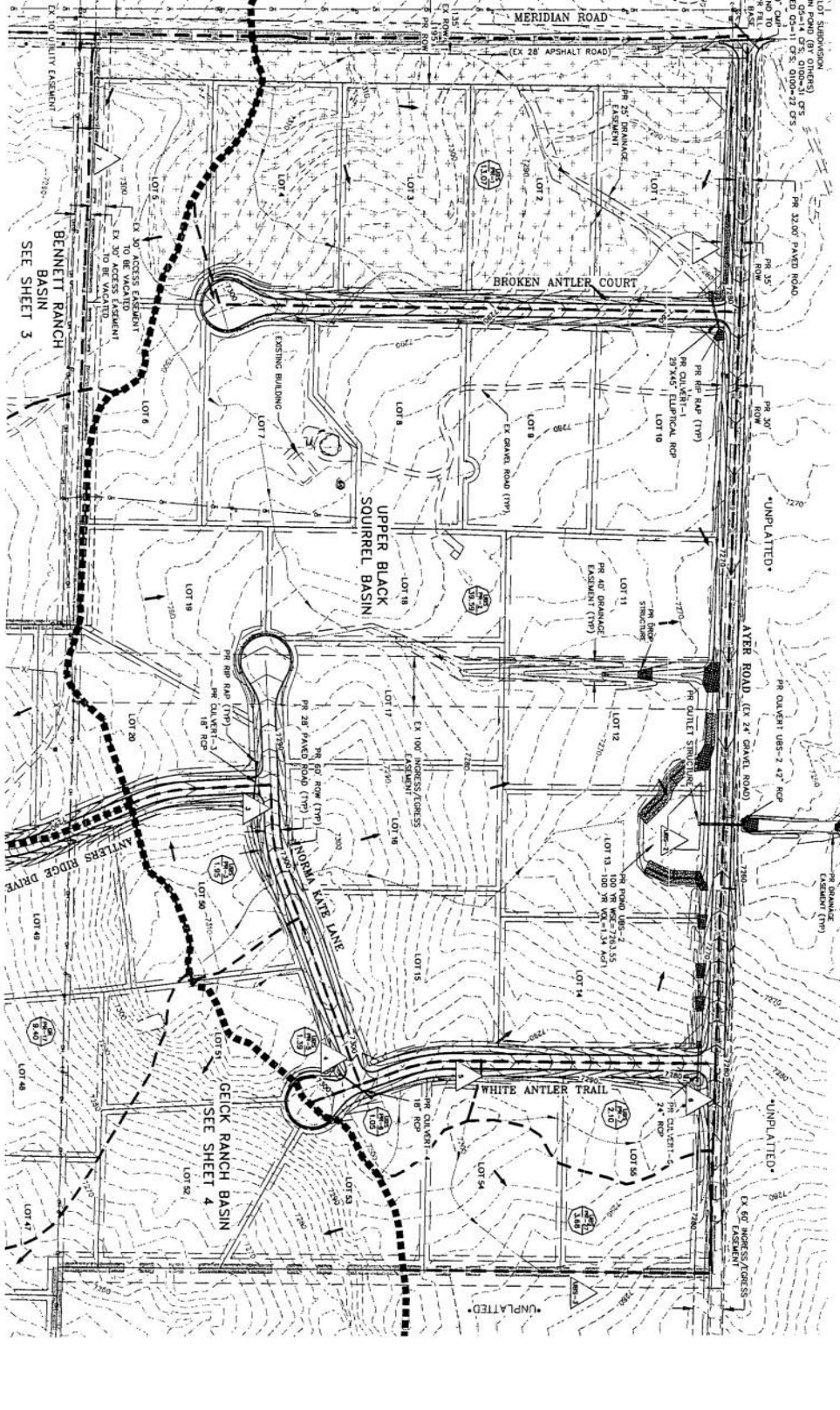
ANTLERS RIDGE

COUNTY OF EL PASO, STATE OF COLORADO

FINAL DRAINAGE PLAN

DEVELOPED CONDITIONS

MARCH, 2006



AREA DRAINAGE SUMMARY

AREA	AREA (SQ FT)	PERCENT
LOT 1	1,000	0.1
LOT 2	1,000	0.1
LOT 3	1,000	0.1
LOT 4	1,000	0.1
LOT 5	1,000	0.1
LOT 6	1,000	0.1
LOT 7	1,000	0.1
LOT 8	1,000	0.1
LOT 9	1,000	0.1
LOT 10	1,000	0.1
LOT 11	1,000	0.1
LOT 12	1,000	0.1
LOT 13	1,000	0.1
LOT 14	1,000	0.1
LOT 15	1,000	0.1
LOT 16	1,000	0.1
LOT 17	1,000	0.1
LOT 18	1,000	0.1
LOT 19	1,000	0.1
LOT 20	1,000	0.1
LOT 21	1,000	0.1
LOT 22	1,000	0.1
LOT 23	1,000	0.1
LOT 24	1,000	0.1
LOT 25	1,000	0.1
LOT 26	1,000	0.1
LOT 27	1,000	0.1
LOT 28	1,000	0.1
LOT 29	1,000	0.1
LOT 30	1,000	0.1

DESIGN POINT SUMMARY

DESIGN POINT	AREA (SQ FT)	PERCENT
DP 1	1,000	0.1
DP 2	1,000	0.1
DP 3	1,000	0.1
DP 4	1,000	0.1
DP 5	1,000	0.1
DP 6	1,000	0.1
DP 7	1,000	0.1
DP 8	1,000	0.1
DP 9	1,000	0.1
DP 10	1,000	0.1

LEGEND

PROJECT BOUNDARY
MAJOR BASIN BOUNDARY
SUB-BASIN BOUNDARY
DIRECTION OF FLOW
CONDUIT - MAJOR (EXIST.)
CONDUIT - MAJOR (PROJ.)
CONDUIT - MINOR (PROJ.)
SUBDIVISION BOUNDARY
LOT LINES
OVERLAND TIME FLOW PATH
CHANNEL FLOW PATH
EX OVERHEAD POWER LINE
EX ELECTRICAL POST
EX TELEPHONE RISER
EX FENCE
EX ELECTRICAL BOX
EX OUTLINE
EX DRYPILE
EX DAM
EX DRAIN SILENT
EX BOLLARD
EX SHADY MANHOLE
EX WELL
EX ELECTRIC METER
EX TRANSFORMER
EX MAN-FILED DRAINAGE DRAIN
EX EROSION CONTROL TERRACE

MAJOR BASIN BOUNDARY
SUB-BASIN BOUNDARY
DIRECTION OF FLOW
CONDUIT - MAJOR (EXIST.)
CONDUIT - MAJOR (PROJ.)
CONDUIT - MINOR (PROJ.)
SUBDIVISION BOUNDARY
LOT LINES
OVERLAND TIME FLOW PATH
CHANNEL FLOW PATH
EX OVERHEAD POWER LINE
EX ELECTRICAL POST
EX TELEPHONE RISER
EX FENCE
EX ELECTRICAL BOX
EX OUTLINE
EX DRYPILE
EX DAM
EX DRAIN SILENT
EX BOLLARD
EX SHADY MANHOLE
EX WELL
EX ELECTRIC METER
EX TRANSFORMER
EX MAN-FILED DRAINAGE DRAIN
EX EROSION CONTROL TERRACE

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Phone: 970.226.1111
Fax: 970.226.1112
www.merrickinc.com

PROJECT NO. 47770-DRP-R02 DWG

DATE: 2/11/05

CLIENT: MERRICK PROJECT NO. 18014777

SCALE: 1" = 120'

ANTLERS RIDGE
FINAL DRAINAGE I
DEVELOPED CONDITION
UPPER BLACK SQUIR



**FINAL DRAINAGE REPORT
FOR
CAMELOT SUBDIVISION**

OCTOBER 26, 2001

PREPARED FOR:

**TRANSWESTERN DEVELOPMENT COMPANY
3730 SINTON ROAD, #250
COLORADO SPRINGS, CO 80907**

ATTN: MR. JERRY SMITH

PREPARED BY:

**CLASSIC CONSULTING ENGINEERS & SURVEYORS, LLC
6385 CORPORATE DRIVE, SUITE 304
COLORADO SPRINGS, CO 80919
(719) 785-0790**

2037.00



**FINAL DRAINAGE REPORT FOR
CAMELOT SUBDIVISION**

DRAINAGE REPORT STATEMENT

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 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.

Kyle R. Campbell
Kyle R. Campbell, Professional Engineer #29794



1-16-02
Date

DEVELOPER'S STATEMENT:

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

Business Name: Transwestern Development Corp.

By: *[Signature]*

Title: President

Address: P.O. Box 63419
Colo. Spgs CO 80962

EL PASO COUNTY:
Filed in accordance with Section 51.1 of the El Paso Land Development Code, as amended.

John A. McCarty
El Paso County Engineer/Director

3-7-02
Date

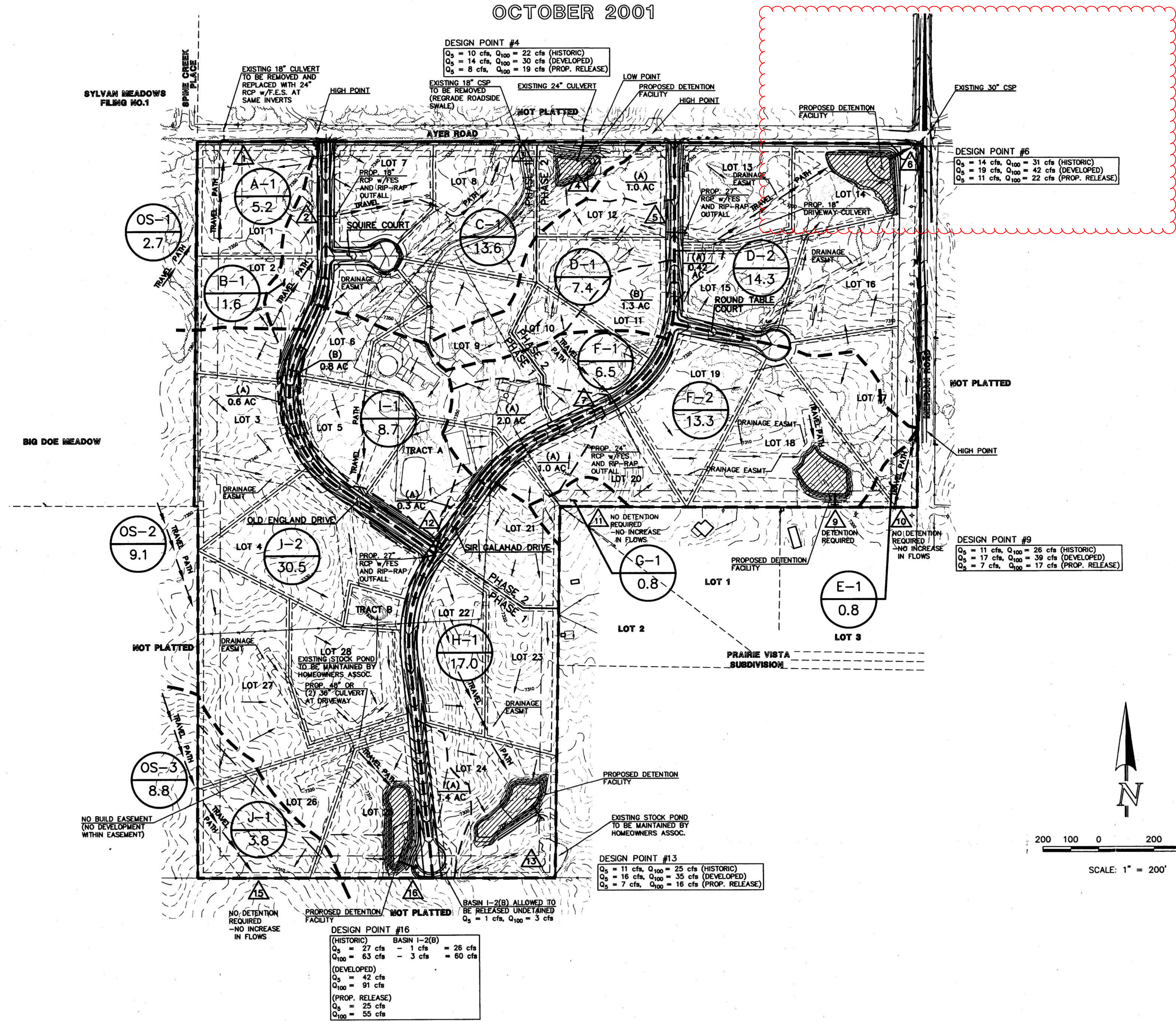
Conditions:

CAMELOT SUBDIVISION

COUNTY OF EL PASO, STATE OF COLORADO

FINAL DRAINAGE MAP

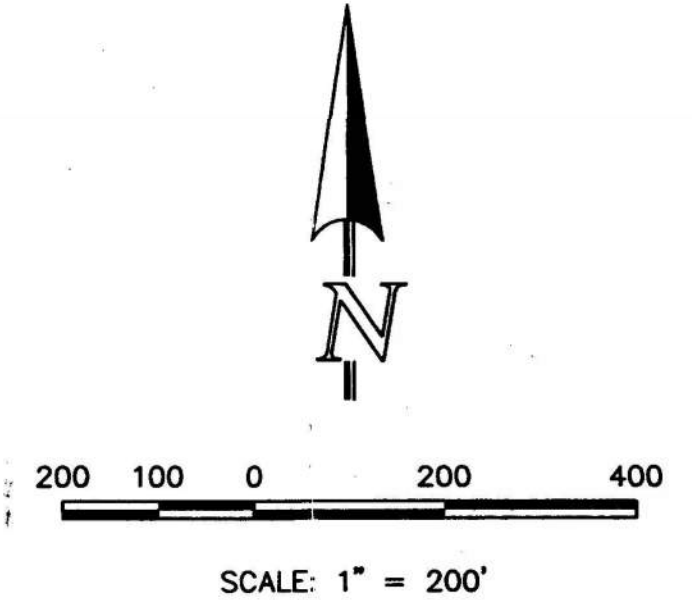
OCTOBER 2001



LEGEND	SYMBOL
EXISTING GROUND CONTOUR	6910
PROPOSED GROUND CONTOUR	6920
SUBDIVISION BOUNDARY	---
BASIN BOUNDARY	---
BASIN IDENTIFIER	C4
AREA IN ACRES	22

DESIGN POINT	PROPOSED	
	Q _s (CFS)	Q ₁₀₀ (CFS)
1	7	16
2	2	3
4	14	30
5	7	16
6	19	42
7	6	14
9	17	39
10	1	2
11	1	2
12	8	18
13	16	35
15	9	21
16	42	91

NOTE:
ALL STORM CROSSINGS TO INCLUDE 5' X 8' RIP-RAP PAD AT OUTFALL AND F.E.S.'S AT EACH END (SEE CONSTRUCTION PLANS).



48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
1-800-922-1987
CITY OF COLORADO SPRINGS DEPT. OF UTILITIES
GAS, ELECTRIC, WATER AND WASTEWATER

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE
1	REVISED PER COUNTY COMMENTS	1/25/02
2	REVISED EXISTING CULVERT SIZE AT DESIGN POINT 4	3/05/02

REVIEW:
PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

KYLE R. CAMPBELL, COLORADO P.E. #29794 DATE

CAMELOT SUBDIVISION			
FINAL DRAINAGE MAP			
DESIGNED BY	KRC	SCALE	DATE 10/31/01
DRAWN BY	PRA	(H) 1" = 200'	SHEET 1 OF 1
CHECKED BY	(V) 1" = N/A	JOB NO.	2037.00

CLASSIC CONSULTING ENGINEERS & SURVEYORS

X:\203700\DRAWINGS\203700DR.dwg, 03/05/2002 10:36:32 AM, CCEI055C.plt

DETENTION FACILITY SUMMARY

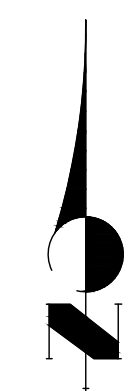
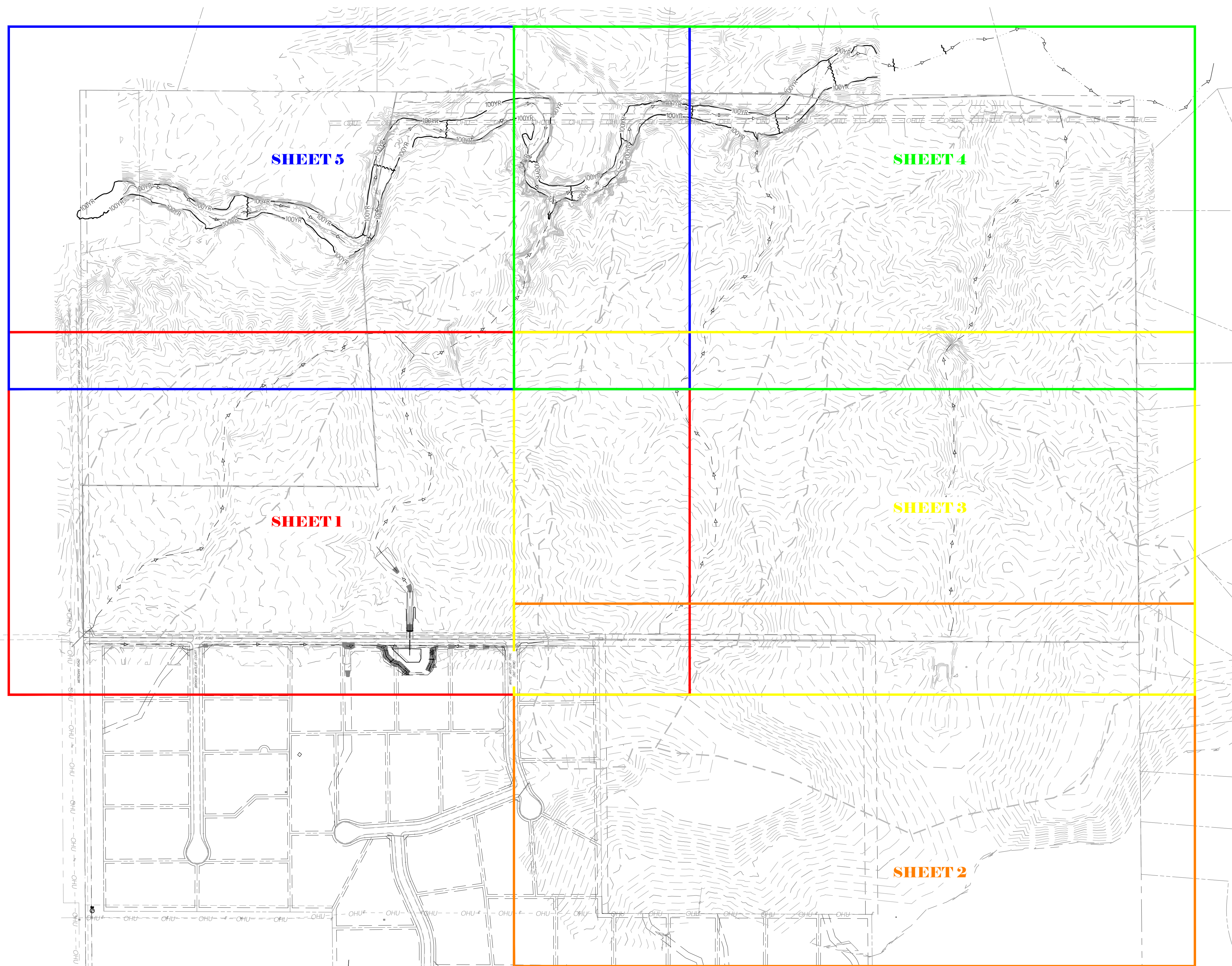
DETENTION FACILITY	HISTORIC	PROPOSED
"A" DP #13	BASIN H	BASIN H-1
	19.1 AC	17.0 AC
	$T_C = 33.2$	$T_C = 19.9$
	$Q_5 = 11$	$Q_5 = 16$
	$Q_{100} = 25$	$Q_{100} = 35$
"B" DP#4	BASIN B & C	BASIN B-1, C-1
	15.2 AC	15.2 AC
	$T_C = 28.7$	$T_C = 19.9$
	$Q_5 = 10$	$Q_5 = 14$
	$Q_{100} = 22$	$Q_{100} = 30$
"C" DP#6	BASIN D	BASIN D-1, D-2
	24.7 AC	21.7 AC
	$T_C = 36.7$	$T_C = 21.9$
	$Q_5 = 14$	$Q_5 = 19$
	$Q_{100} = 31$	$Q_{100} = 42$
"D" DP#16	BASIN I, OS-2	BASIN I-1, I-2, OS-2
	47.6 AC	48.3 AC
	$T_C = 33.2$	$T_C = 21.9$
	$Q_5 = 27$	$Q_5 = 42$
	$Q_{100} = 63$	$Q_{100} = 91$
"E" DP#9	BASIN F	BASIN F-1, F-2
	19.8 AC	19.8 AC
	$T_C = 35.0$	$T_C = 19.9$
	$Q_5 = 11$	$Q_5 = 17$
	$Q_{100} = 26$	$Q_{100} = 39$



APPENDIX F – DRAINAGE MAPS

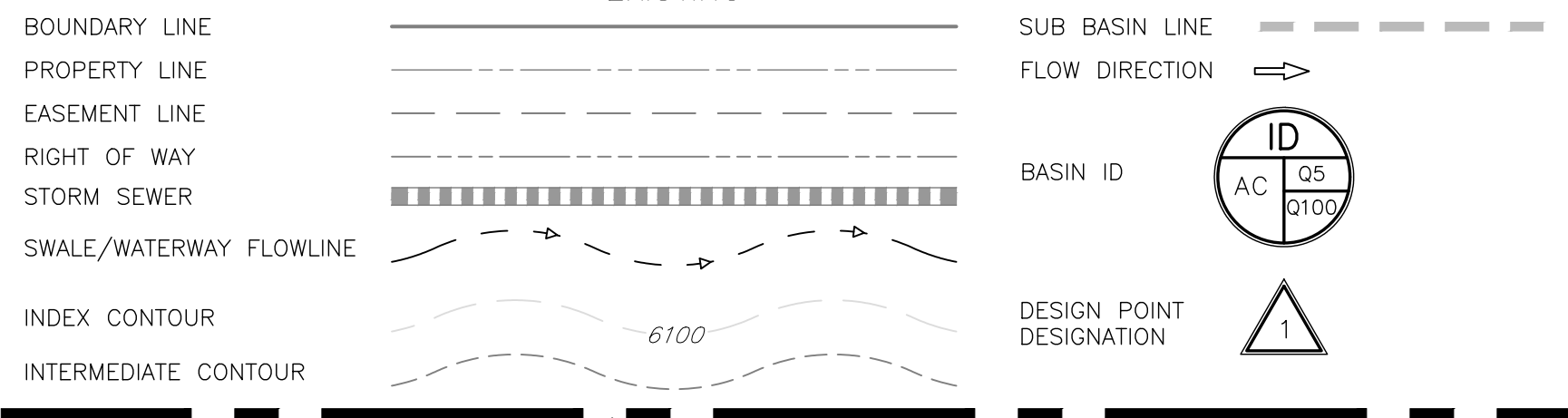
ANTLERS RANGE SUBDIVISION

EXISTING DRAINAGE MAP



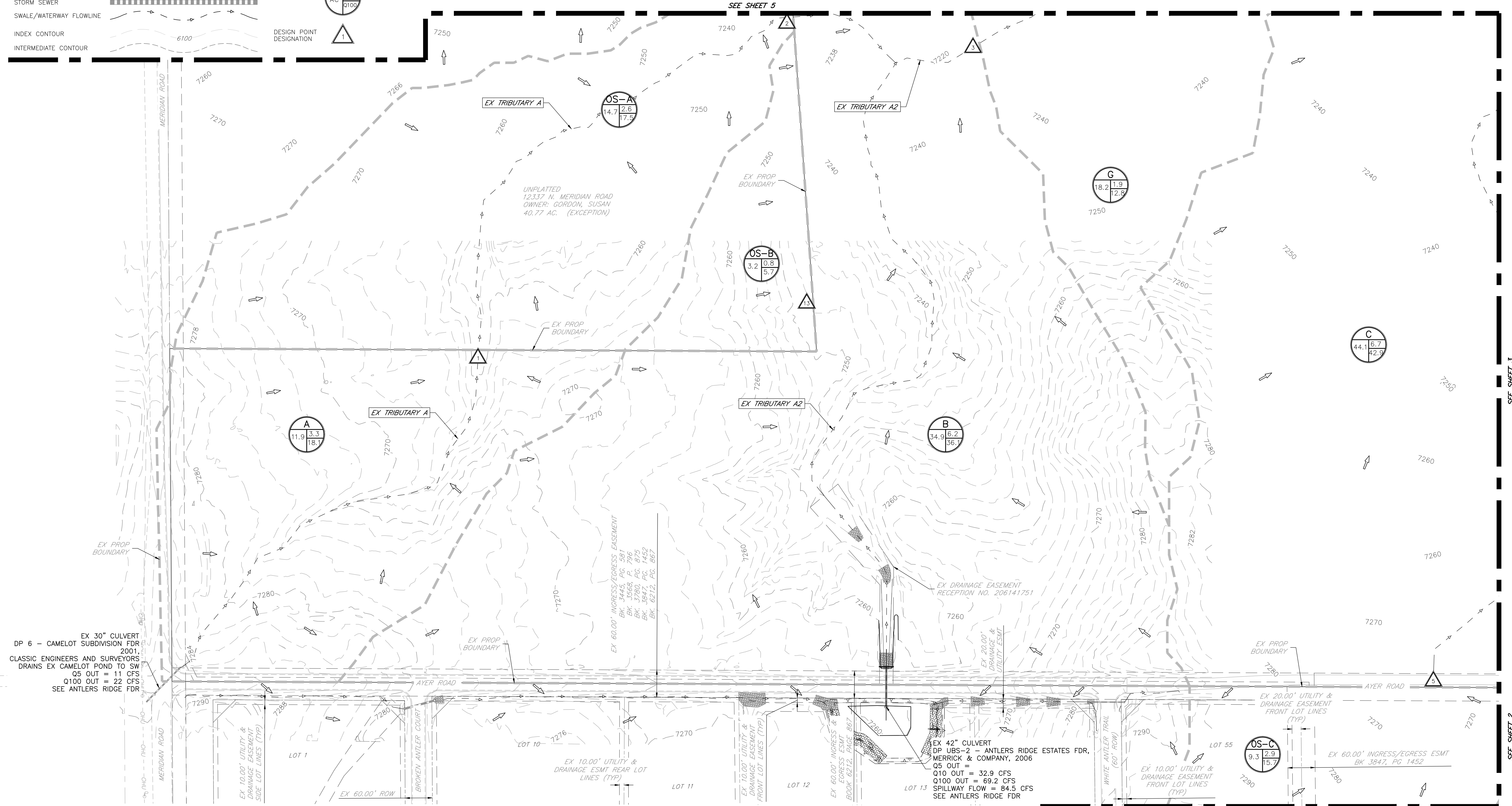
EXISTING DRAINAGE MAP	
ANTLERS RANGE SUBDIVISION	
JOB NO. 24031	SHEET
LOCATION: EPC	KEY
02/14/2025	

LEGEND



ANTLERS RANGE SUBDIVISION

EXISTING DRAINAGE MAP



EXISTING CONDITIONS - BASIN SUMMARY TABLE

Sub-basin	Area (ac)	Impervious	C _s	C ₁₀₀	t _c (min)	Q _{s-yr} (cfs)	Q _{100-yr} (cfs)
A	11.90	5%	0.12	0.38	31.8	3.3	18.1
B	34.90	4%	0.11	0.38	52.9	6.2	36.1
C	44.10	3%	0.10	0.36	54.1	6.7	42.9
D	20.00	2%	0.09	0.36	49.0	3.1	21.1
E	40.80	3%	0.09	0.36	43.9	7.3	47.4
F	12.00	2%	0.09	0.36	24.4	3.0	20.2
G	18.20	2%	0.09	0.36	37.4	3.5	23.6
H	9.10	2%	0.09	0.36	33.3	1.9	12.8
I	40.40	2%	0.09	0.36	43.0	7.1	47.3
J	9.50	2%	0.09	0.36	64.3	1.1	7.7

EXISTING CONDITIONS - BASIN SUMMARY TABLE

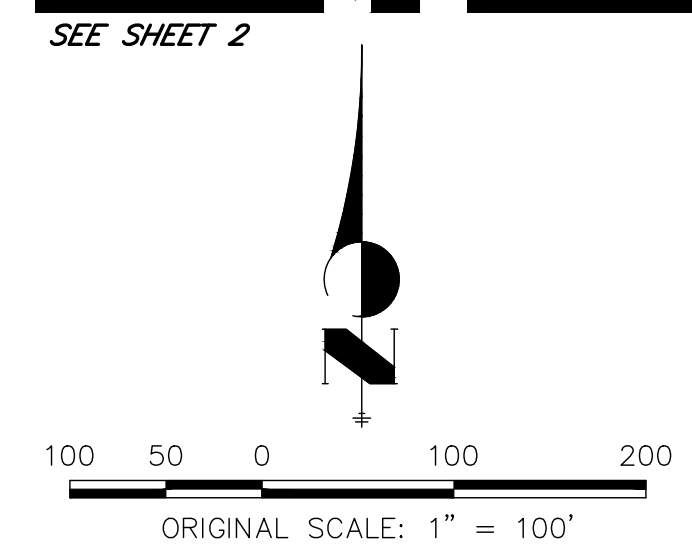
Sub-basin	Area (ac)	Impervious	C _s	C ₁₀₀	t _c (min)	Q _{s-yr} (cfs)	Q _{100-yr} (cfs)
K	11.90	5%	0.12	0.38	31.8	1.1	7.3
OS-A	34.90	4%	0.11	0.38	52.9	2.6	17.5
OS-B	44.10	3%	0.10	0.36	54.1	0.8	5.7
OS-C	20.00	2%	0.09	0.36	49.0	2.9	15.7
OS-E	40.80	3%	0.09	0.36	43.9	7.3	48.0

EXISTING CONDITIONS - DESIGN POINT SUMMARY TABLE

DP#	Q _{s-yr}	Q _{100-yr}
1	11.7	32.2
2	13.2	45.1
3	41.1	117.8
4	43.1	131.1
5	2.9	15.7
6	8.5	52.6
7	1.1	7.7
8	7.3	48.0
9	11.5	75.4

EXISTING CONDITIONS - DESIGN POINT SUMMARY TABLE

DP#	Q _{s-yr}	Q _{100-yr}
10	16.4	108.0
11	3.1	21.1
12	1.1	7.3
13	0.8	5.7
14	3.0	20.2
15	1.9	12.8
BSC	68.3	295.9



EXISTING DRAINAGE MAP

ANTLERS RANGE SUBDIVISION

JOB NO. 24031
LOCATION: EPC
02/14/2025

SHEET 1

ALL TERRAIN
ENGINEERING

SEE SHEET 3

SEE SHEET 2

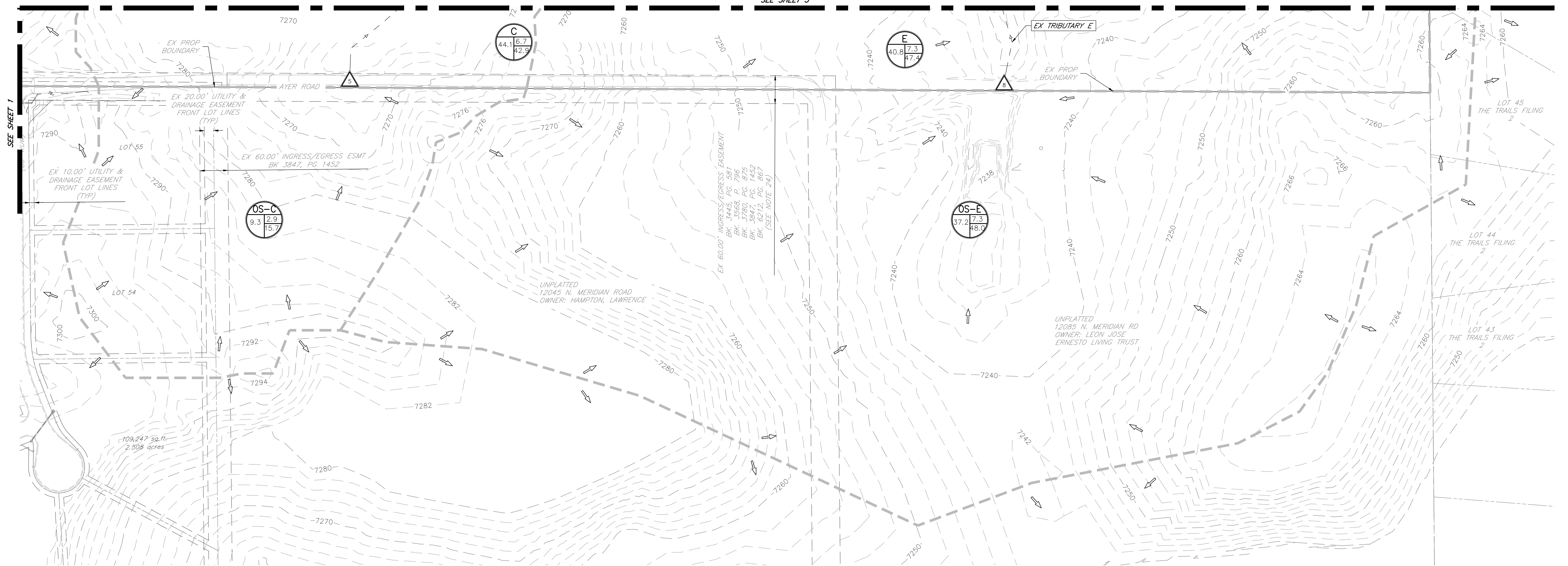
SEE SHEET 2

SEE SHEET 5

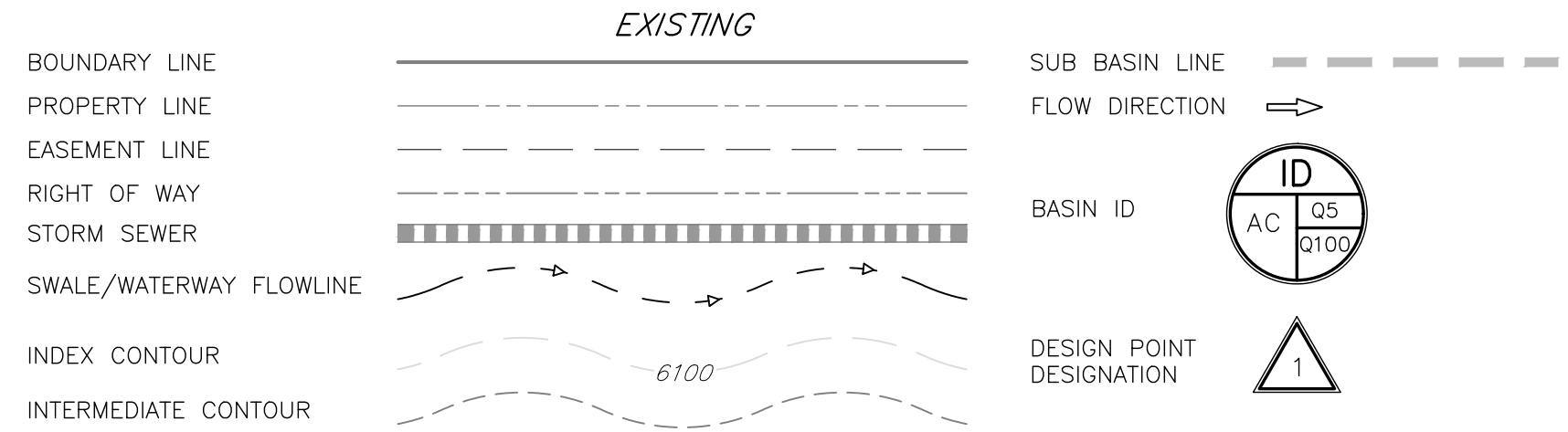
ANTLERS RANGE SUBDIVISION

EXISTING DRAINAGE MAP

SEE SHEET 3



LEGEND

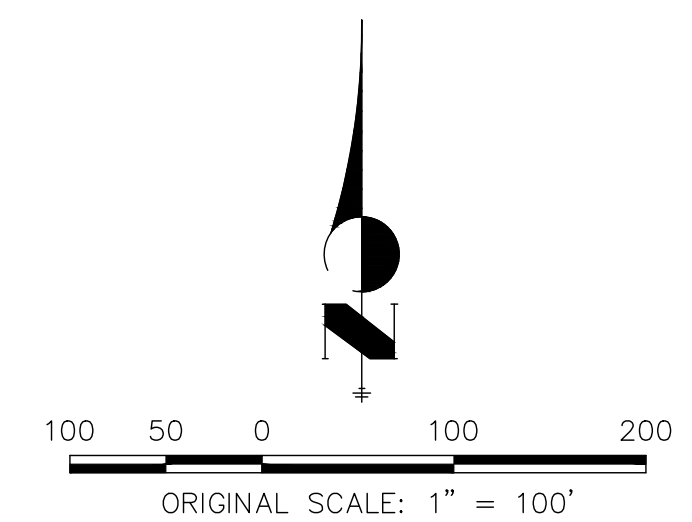


Sub-basin	Area (ac)	Impervious	C _s	C ₁₀₀	t _c (min)	Q _s -yr (cfs)	Q ₁₀₀ -yr (cfs)
A	11.90	5%	0.12	0.38	31.8	3.3	18.1
B	34.90	4%	0.11	0.38	52.9	6.2	36.1
C	44.10	3%	0.10	0.36	54.1	6.7	42.9
D	20.00	2%	0.09	0.36	49.0	3.1	21.1
E	40.80	3%	0.09	0.36	43.9	7.3	47.4
F	12.00	2%	0.09	0.36	24.4	3.0	20.2
G	18.20	2%	0.09	0.36	37.4	3.5	23.6
H	9.10	2%	0.09	0.36	33.3	1.9	12.8
I	40.40	2%	0.09	0.36	43.0	7.1	47.3
J	9.50	2%	0.09	0.36	64.3	1.1	7.7

Sub-basin	Area (ac)	Impervious	C _s	C ₁₀₀	t _c (min)	Q _s -yr (cfs)	Q ₁₀₀ -yr (cfs)
K	11.90	5%	0.12	0.38	31.8	1.1	7.3
OS-A	34.90	4%	0.11	0.38	52.9	2.6	17.5
OS-B	44.10	3%	0.10	0.36	54.1	0.8	5.7
OS-C	20.00	2%	0.09	0.36	49.0	2.9	15.7
OS-E	40.80	3%	0.09	0.36	43.9	7.3	48.0

DP#	Q _s -yr	Q ₁₀₀ -yr
1	11.7	32.2
2	13.2	45.1
3	41.1	117.8
4	43.1	131.1
5	2.9	15.7
6	8.5	52.6
7	1.1	7.7
8	7.3	48.0
9	11.5	75.4

DP#	Q _s -yr	Q ₁₀₀ -yr
10	16.4	108.0
11	3.1	21.1
12	1.1	7.3
13	0.8	5.7
14	3.0	20.2
15	1.9	12.8
BSC	68.3	295.9



EXISTING DRAINAGE MAP	
ANTLERS RANGE SUBDIVISION	
JOB NO. 24031	SHEET
LOCATION: EPC	1
02/14/2025	

ANTLERS RANGE SUBDIVISION

EXISTING DRAINAGE MAP

SEE SHEET 4



EXISTING CONDITIONS - BASIN SUMMARY TABLE

Sub-basin	Area (ac)	Impervious	C _s	C ₁₀₀	t _c (min)	Q _{s-yr} (cfs)	Q _{100-yr} (cfs)
A	11.90	5%	0.12	0.38	31.8	3.3	18.1
B	34.90	4%	0.11	0.38	52.9	6.2	36.1
C	44.10	3%	0.10	0.36	54.1	6.7	42.9
D	20.00	2%	0.09	0.36	49.0	3.1	21.1
E	40.80	3%	0.09	0.36	43.9	7.3	47.4
F	12.00	2%	0.09	0.36	24.4	3.0	20.2
G	18.20	2%	0.09	0.36	37.4	3.5	23.6
H	9.10	2%	0.09	0.36	33.3	1.9	12.8
I	40.40	2%	0.09	0.36	43.0	7.1	47.3
J	9.50	2%	0.09	0.36	64.3	1.1	7.7

EXISTING CONDITIONS - BASIN SUMMARY TABLE

Sub-basin	Area (ac)	Impervious	C _s	C ₁₀₀	t _c (min)	Q _{s-yr} (cfs)	Q _{100-yr} (cfs)
K	11.90	5%	0.12	0.38	31.8	1.1	7.3
OS-A	34.90	4%	0.11	0.38	52.9	2.6	17.5
OS-B	44.10	3%	0.10	0.36	54.1	0.8	5.7
OS-C	20.00	2%	0.09	0.36	49.0	2.9	15.7
OS-E	40.80	3%	0.09	0.36	43.9	7.3	48.0

EXISTING CONDITIONS - DESIGN POINT SUMMARY TABLE

DP#	Q _{s-yr}	Q _{100-yr}
1	11.7	32.2
2	13.2	45.1
3	41.1	117.8
4	43.1	131.1
5	2.9	15.7
6	8.5	52.6
7	1.1	7.7
8	7.3	48.0
9	11.5	75.4

EXISTING CONDITIONS - DESIGN POINT SUMMARY TABLE

DP#	Q _{s-yr}	Q _{100-yr}
10	16.4	108.0
11	3.1	21.1
12	1.1	7.3
13	0.8	5.7
14	3.0	20.2
15	1.9	12.8
BSC	68.3	295.9

SEE SHEET 2

LEGEND

EXISTING

- BOUNDARY LINE: Dashed line
- PROPERTY LINE: Solid line
- EASEMENT LINE: Dashed line with arrows
- RIGHT OF WAY: Dashed line with arrows
- STORM SEWER: Dashed line with arrows
- SWALE/WATERWAY FLOWLINE: Dashed line with arrows
- INDEX CONTOUR: Solid line with elevation (e.g., 6100)
- INTERMEDIATE CONTOUR: Dashed line with elevation (e.g., 6100)
- SUB BASIN LINE: Dashed line
- FLOW DIRECTION: Arrow
- BASIN ID: Circle with 'ID' and 'AC' (e.g., 05/0100)
- DESIGN POINT DESIGNATION: Triangle with number (e.g., 1)

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

EXISTING DRAINAGE MAP

ANTLERS RANGE SUBDIVISION

JOB NO. 24031

LOCATION: EPC

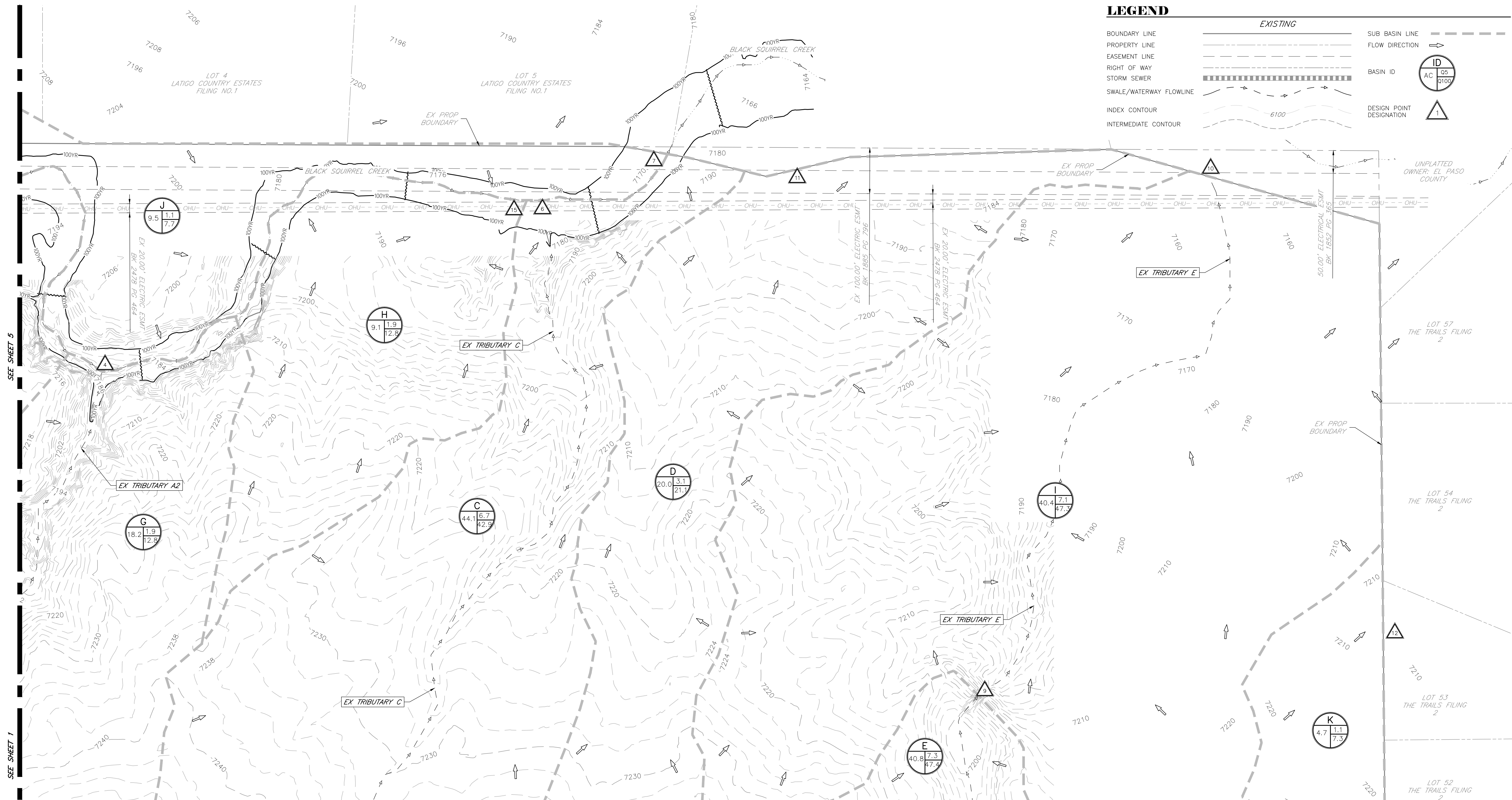
02/14/2025

SHEET 3

ALL TERRAIN ENGINEERING

ANTLERS RANGE SUBDIVISION

EXISTING DRAINAGE MAP



LEGEND

EXISTING

- BOUNDARY LINE
- PROPERTY LINE
- EASEMENT LINE
- RIGHT OF WAY
- STORM SEWER
- SWALE/WATERWAY FLOWLINE
- INDEX CONTOUR
- INTERMEDIATE CONTOUR

SUB BASIN LINE

FLOW DIRECTION

BASIN ID

DESIGN POINT DESIGNATION

EXISTING CONDITIONS - BASIN SUMMARY TABLE

Sub-basin	Area (ac)	Impervious	C _s	C ₁₀₀	t _c (min)	Q _{s-yr} (cfs)	Q _{100-yr} (cfs)
A	11.90	5%	0.12	0.38	31.8	3.3	18.1
B	34.90	4%	0.11	0.38	52.9	6.2	36.1
C	44.10	3%	0.10	0.36	54.1	6.7	42.9
D	20.00	2%	0.09	0.36	49.0	3.1	21.1
E	40.80	3%	0.09	0.36	43.9	7.3	47.4
F	12.00	2%	0.09	0.36	24.4	3.0	20.2
G	18.20	2%	0.09	0.36	37.4	3.5	23.6
H	9.10	2%	0.09	0.36	33.3	1.9	12.8
I	40.40	2%	0.09	0.36	43.0	7.1	47.3
J	9.50	2%	0.09	0.36	64.3	1.1	7.7

EXISTING CONDITIONS - BASIN SUMMARY TABLE

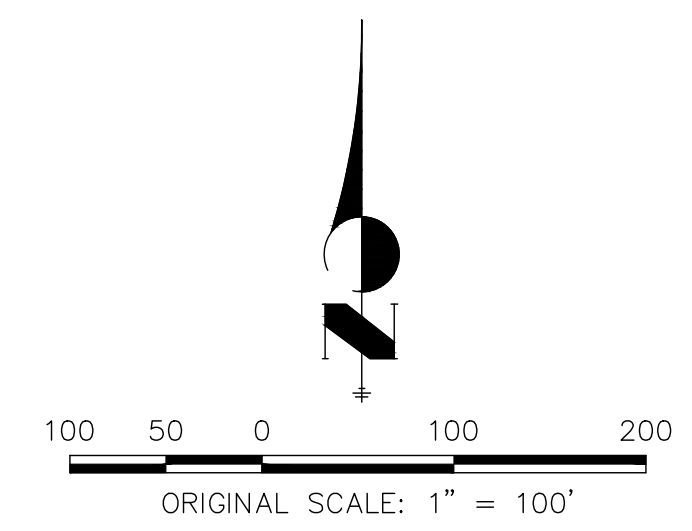
Sub-basin	Area (ac)	Impervious	C _s	C ₁₀₀	t _c (min)	Q _{s-yr} (cfs)	Q _{100-yr} (cfs)
K	11.90	5%	0.12	0.38	31.8	1.1	7.3
OS-A	34.90	4%	0.11	0.38	52.9	2.6	17.5
OS-B	44.10	3%	0.10	0.36	54.1	0.8	5.7
OS-C	20.00	2%	0.09	0.36	49.0	2.9	15.7
OS-E	40.80	3%	0.09	0.36	43.9	7.3	48.0

EXISTING CONDITIONS - DESIGN POINT SUMMARY TABLE

DP#	Q _{s-yr}	Q _{100-yr}
1	11.7	32.2
2	13.2	45.1
3	41.1	117.8
4	43.1	131.1
5	2.9	15.7
6	8.5	52.6
7	1.1	7.7
8	7.3	48.0
9	11.5	75.4

EXISTING CONDITIONS - DESIGN POINT SUMMARY TABLE

DP#	Q _{s-yr}	Q _{100-yr}
10	16.4	108.0
11	3.1	21.1
12	1.1	7.3
13	0.8	5.7
14	3.0	20.2
15	1.9	12.8
BSC	68.3	295.9



EXISTING DRAINAGE MAP

ANTLERS RANGE SUBDIVISION

JOB NO. 24031

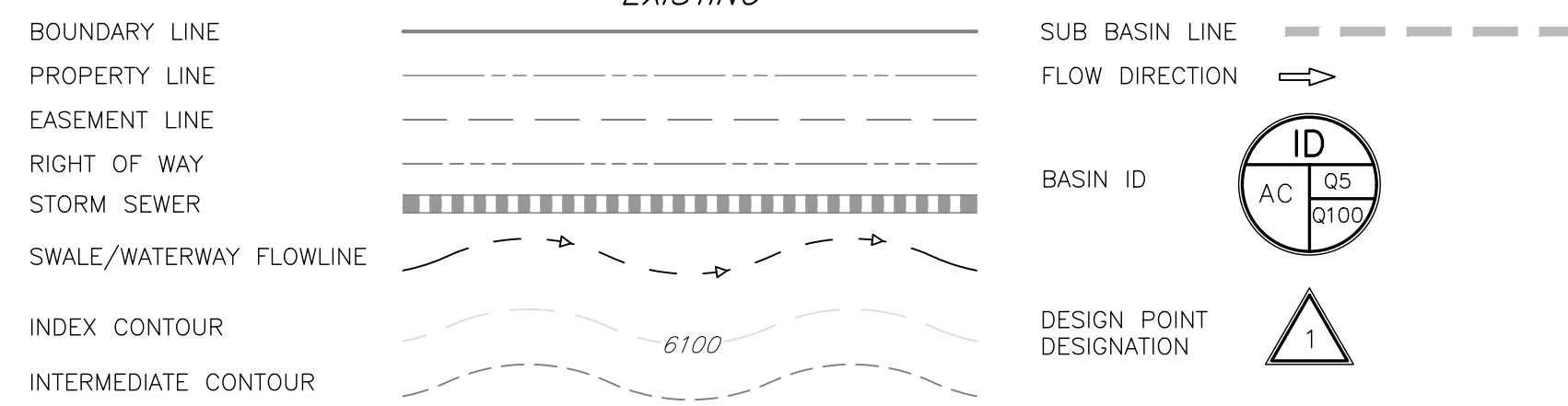
LOCATION: EPC

02/14/2025

SHEET
4

ALL TERRAIN
ENGINEERING

LEGEND



ANTLERS RANGE SUBDIVISION

EXISTING DRAINAGE MAP



EXISTING CONDITIONS - BASIN SUMMARY TABLE

Sub-basin	Area (ac)	Impervious	C _s	C ₁₀₀	t _c (min)	Q _{s-yr} (cfs)	Q _{100-yr} (cfs)
A	11.90	5%	0.12	0.38	31.8	3.3	18.1
B	34.90	4%	0.11	0.38	52.9	6.2	36.1
C	44.10	3%	0.10	0.36	54.1	6.7	42.9
D	20.00	2%	0.09	0.36	49.0	3.1	21.1
E	40.80	3%	0.09	0.36	43.9	7.3	47.4
F	12.00	2%	0.09	0.36	24.4	3.0	20.2
G	18.20	2%	0.09	0.36	37.4	3.5	23.6
H	9.10	2%	0.09	0.36	33.3	1.9	12.8
I	40.40	2%	0.09	0.36	43.0	7.1	47.3
J	9.50	2%	0.09	0.36	64.3	1.1	7.7

EXISTING CONDITIONS - BASIN SUMMARY TABLE

Sub-basin	Area (ac)	Impervious	C _s	C ₁₀₀	t _c (min)	Q _{s-yr} (cfs)	Q _{100-yr} (cfs)
K	11.90	5%	0.12	0.38	31.8	1.1	7.3
OS-A	34.90	4%	0.11	0.38	52.9	2.6	17.5
OS-B	44.10	3%	0.10	0.36	54.1	0.8	5.7
OS-C	20.00	2%	0.09	0.36	49.0	2.9	15.7
OS-E	40.80	3%	0.09	0.36	43.9	7.3	48.0

EXISTING CONDITIONS - DESIGN POINT SUMMARY TABLE

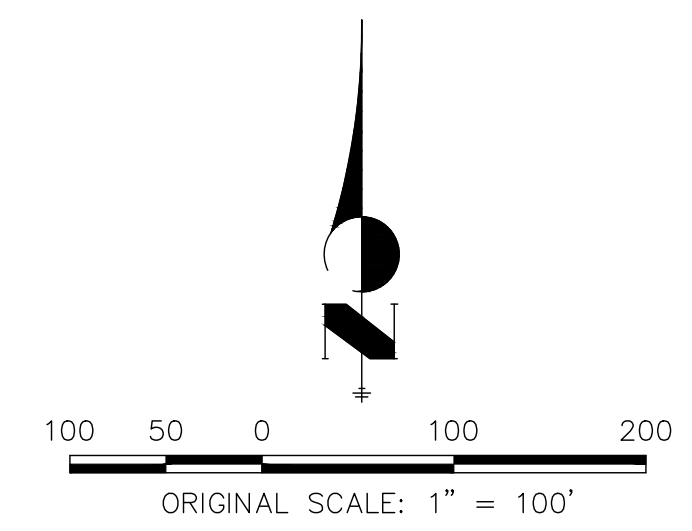
DP#	Q _{s-yr}	Q _{100-yr}
1	11.7	32.2
2	13.2	45.1
3	41.1	117.8
4	43.1	131.1
5	2.9	15.7
6	8.5	52.6
7	1.1	7.7
8	7.3	48.0
9	11.5	75.4

EXISTING CONDITIONS - DESIGN POINT SUMMARY TABLE

DP#	Q _{s-yr}	Q _{100-yr}
10	16.4	108.0
11	3.1	21.1
12	1.1	7.3
13	0.8	5.7
14	3.0	20.2
15	1.9	12.8
BSC	68.3	295.9

SEE SHEET 1

SEE SHEET 3



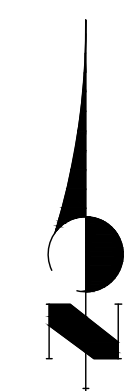
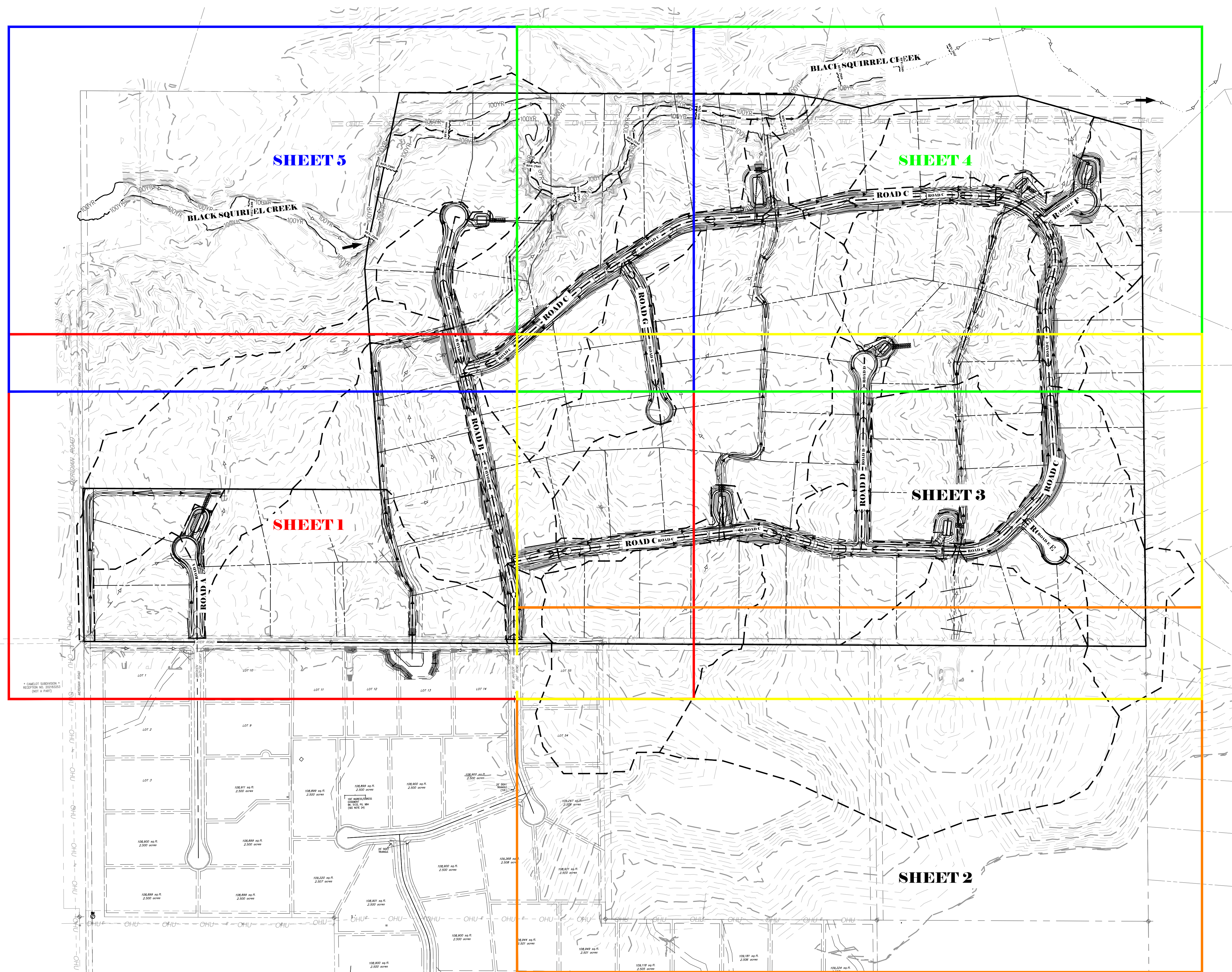
EXISTING DRAINAGE MAP

ANTLERS RANGE SUBDIVISION
JOB NO. 24031
LOCATION: EPC
02/14/2025

SHEET 5

ALL TERRAIN ENGINEERING

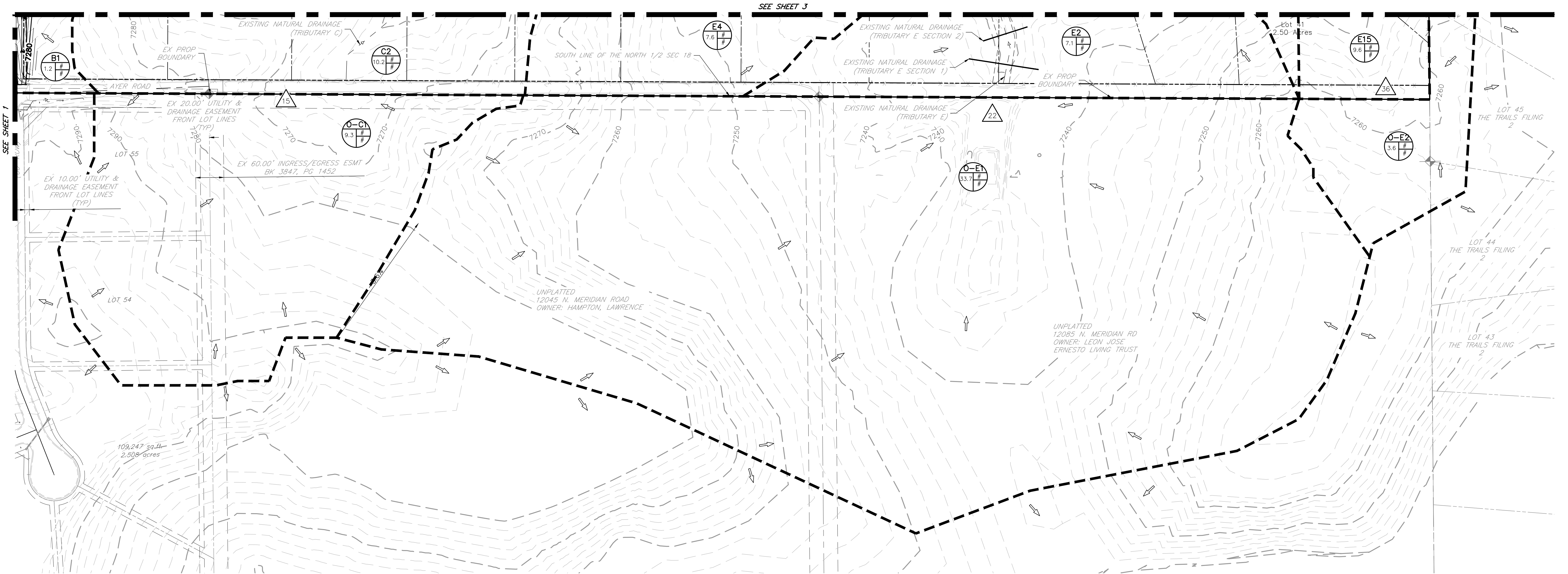
ANTLERS RANGE SUBDIVISION PROPOSED DRAINAGE MAP



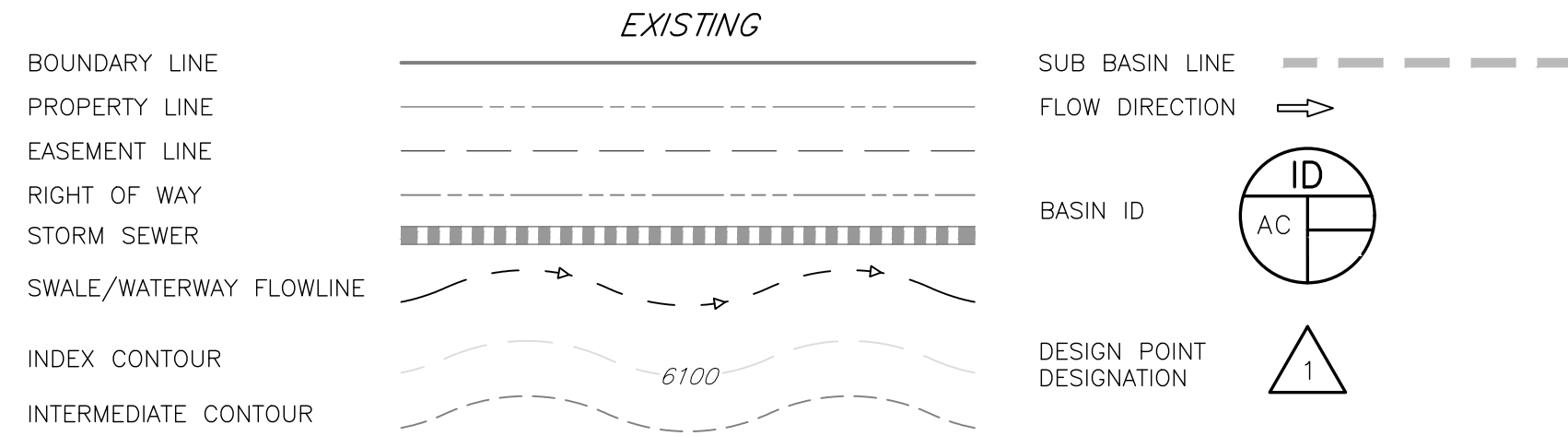
PROPOSED DRAINAGE MAP	
ANTLERS RANGE SUBDIVISION	
JOB NO. 24031	SHEET
LOCATION: EPC	KEY
02/14/2025	

ANTLERS RANGE SUBDIVISION

PROPOSED DRAINAGE MAP



LEGEND

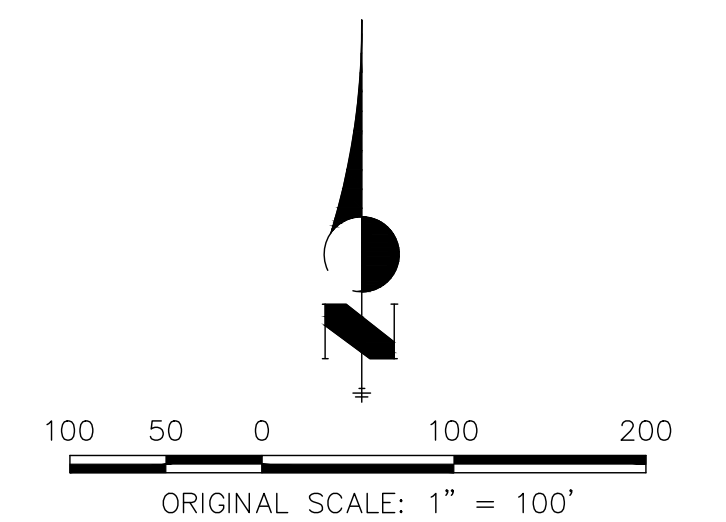


PROPOSED DRAINAGE CALCS - BASIN SUMMARY TABLE

Tributary	Area	Percent	C _s	C ₁₀₀	t _c	Q _s	Q ₁₀₀
Sub-basin	(acres)	Imperviou			(min)	(cfs)	(cfs)
B2	4.70	15%	0.18	0.44	32.41	2.0	8.2
B3	0.80	33%	0.32	0.55	20.12	0.8	2.3
B4	4.80	10%	0.14	0.41	39.51	1.4	6.8
B5	2.10	7%	0.12	0.39	25.97	0.7	3.7
B6	13.50	10%	0.14	0.41	37.00	4.1	19.9
B7	3.70	17%	0.19	0.44	29.63	1.7	6.8
B8	11.60	9%	0.13	0.40	40.29	3.0	15.8
B9	14.70	0%	0.02	0.35	43.13	0.6	16.7
B10	3.20	0%	0.02	0.35	24.66	0.2	5.2
O-C1	1.20	6%	0.11	0.39	15.65	0.5	2.7
C2	8.30	6%	0.10	0.38	27.01	2.2	14.1
C3	1.20	22%	0.23	0.47	17.81	0.9	3.1
C4	0.40	26%	0.27	0.50	12.69	0.4	1.3
C5	3.90	16%	0.19	0.44	29.74	1.9	7.3
C6	1.20	43%	0.40	0.60	26.36	1.3	3.2
O-E1	6.00	12%	0.16	0.42	33.60	2.2	9.8
E2	6.60	12%	0.16	0.42	33.85	2.4	10.6
E3	2.20	31%	0.31	0.53	35.39	1.5	4.4
E4	2.00	32%	0.30	0.54	39.03	1.3	3.8
E5	30.50	7%	0.12	0.39	41.79	7.4	39.7
E6	1.40	10%	0.14	0.41	11.17	0.8	3.8
E7	9.30	7%	0.12	0.39	29.68	2.8	15.2
E8	10.20	10%	0.14	0.40	29.43	3.6	17.3
E9	1.00	32%	0.31	0.54	22.62	0.9	2.6
E10	1.00	32%	0.31	0.54	22.68	0.9	2.6
E11	0.30	36%	0.34	0.56	13.54	0.4	1.0
E12	0.50	25%	0.26	0.49	14.73	0.5	1.5
E13	33.70	1%	0.03	0.35	38.66	1.9	41.9
E14	7.10	8%	0.13	0.39	26.06	2.4	12.6
O-E2	1.90	18%	0.20	0.45	16.28	1.3	4.9
E15	7.60	10%	0.15	0.41	32.83	2.6	12.3
E16	0.80	33%	0.31	0.55	27.89	0.7	1.9

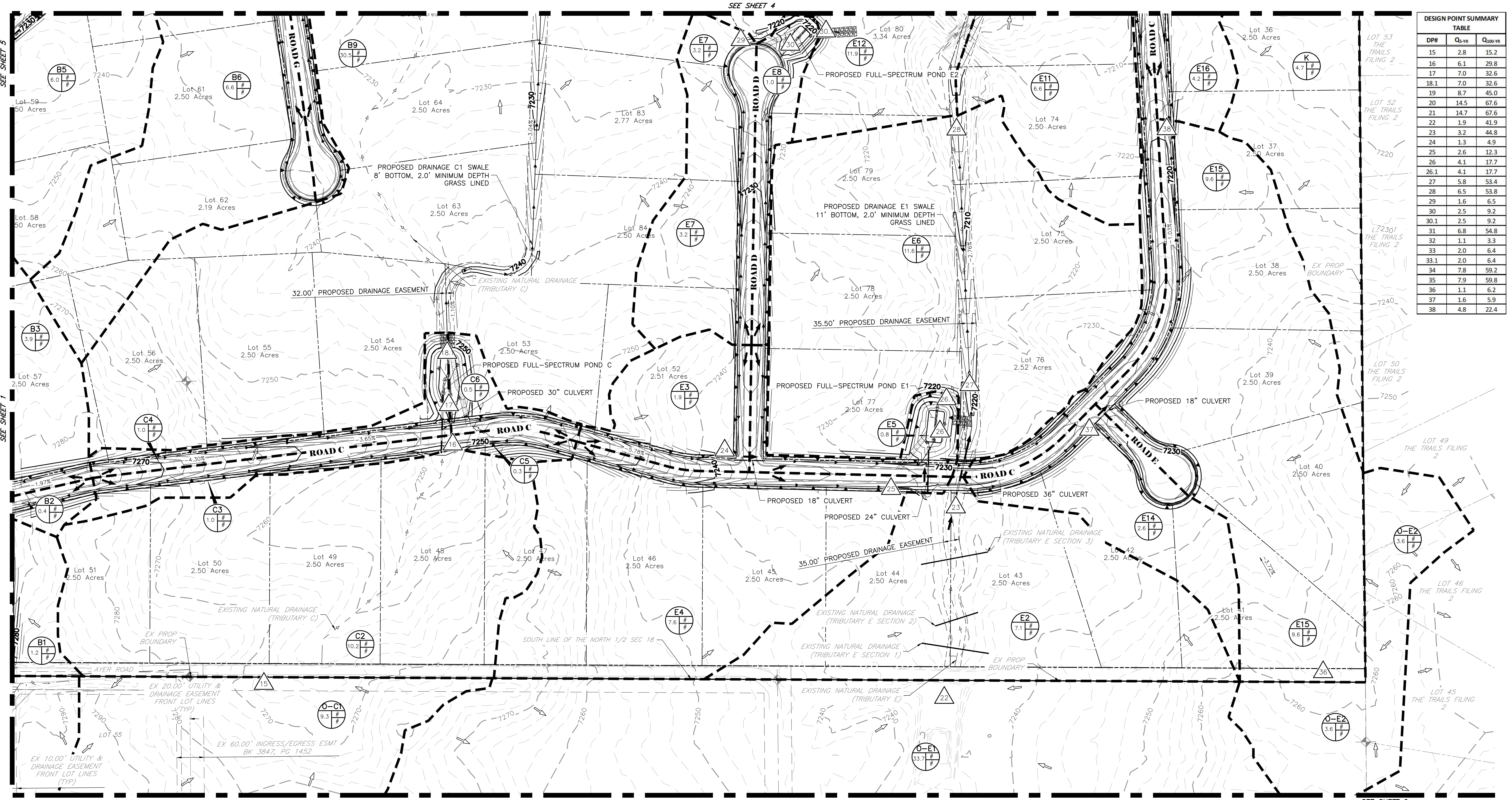
DESIGN POINT SUMMARY TABLE

DP#	Q _s -yr	Q ₁₀₀ -yr
15	2.8	15.2
16	6.1	29.8
17	7.0	32.6
18.1	7.0	32.6
19	8.7	45.0
20	14.5	67.6
21	14.7	67.6
22	1.9	41.9
23	3.2	44.8
24	1.3	4.9
25	2.6	12.3
26	4.1	17.7
26.1	4.1	17.7
27	5.8	53.4
28	6.5	53.8
29	1.6	6.5
30	2.5	9.2
30.1	2.5	9.2
31	6.8	54.8
32	1.1	3.3
33	2.0	6.4
33.1	2.0	6.4
34	7.8	59.2
35	7.9	59.8
36	1.1	6.2



PROPOSED DRAINAGE MAP	
ANTLERS RANGE SUBDIVISION	
JOB NO. 24031	SHEET
LOCATION: EPC	1
02/14/2025	

ANTLERS RANGE SUBDIVISION PROPOSED DRAINAGE MAP



DP#	Q ₅ -YR	Q ₁₀₀ -YR
15	2.8	15.2
16	6.1	29.8
17	7.0	32.6
18.1	7.0	32.6
19	8.7	45.0
20	14.5	67.6
21	14.7	67.6
22	1.9	41.9
23	3.2	44.8
24	1.3	4.9
25	2.6	12.3
26	4.1	17.7
26.1	4.1	17.7
27	5.8	53.4
28	6.5	53.8
29	1.6	6.5
30	2.5	9.2
30.1	2.5	9.2
31	6.8	54.8
32	1.1	3.3
33	2.0	6.4
33.1	2.0	6.4
34	7.8	59.2
35	7.9	59.8
36	1.1	6.2
37	1.6	5.9
38	4.8	22.4

Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
B1	4.70	15%	0.18	0.44	32.41	2.0	8.2
B2	0.80	33%	0.32	0.55	20.12	0.8	2.3
B3	4.80	10%	0.14	0.41	39.51	1.4	6.8
B4	2.10	7%	0.12	0.39	25.97	0.7	3.7
B5	13.50	10%	0.14	0.41	37.00	4.1	19.9
B6	3.70	17%	0.19	0.44	29.63	1.7	6.8
B7	11.60	9%	0.13	0.40	40.29	3.0	15.8
B8	14.70	0%	0.02	0.35	43.13	0.6	16.7
B9	3.20	0%	0.02	0.35	24.66	0.2	5.2
O-C1	1.20	6%	0.11	0.39	15.65	0.5	2.7

Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
C2	4.80	33%	0.32	0.55	20.12	0.8	2.3
C3	4.80	10%	0.14	0.41	39.51	1.4	6.8
C4	2.10	7%	0.12	0.39	25.97	0.7	3.7
C5	13.50	10%	0.14	0.41	37.00	4.1	19.9
C6	3.70	17%	0.19	0.44	29.63	1.7	6.8
O-E1	11.60	9%	0.13	0.40	40.29	3.0	15.8
E2	14.70	0%	0.02	0.35	43.13	0.6	16.7
E3	3.20	0%	0.02	0.35	24.66	0.2	5.2
E4	3.20	0%	0.02	0.35	24.66	0.2	5.2
E5	1.20	6%	0.11	0.39	15.65	0.5	2.7

Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
E6	4.80	10%	0.14	0.41	39.51	1.4	6.8
E7	2.10	7%	0.12	0.39	25.97	0.7	3.7
E8	13.50	10%	0.14	0.41	37.00	4.1	19.9
E11	3.70	17%	0.19	0.44	29.63	1.7	6.8
E12	11.60	9%	0.13	0.40	40.29	3.0	15.8
E13	14.70	0%	0.02	0.35	43.13	0.6	16.7
E14	3.20	0%	0.02	0.35	24.66	0.2	5.2
O-E2	1.20	6%	0.11	0.39	15.65	0.5	2.7
E15	8.30	6%	0.10	0.38	27.01	2.2	14.1
E16	1.20	22%	0.23	0.47	17.81	0.9	3.1

LEGEND

BOUNDARY LINE: Dashed line

PROPERTY LINE: Dotted line

EASEMENT LINE: Long dashed line

RIGHT OF WAY: Solid line with arrows

STORM SEWER: Thick dashed line with cross-hatching

SWALE/WATERWAY FLOWLINE: Dashed line with arrows

INDEX CONTOUR: Dashed line with elevation (e.g., 6100)

INTERMEDIATE CONTOUR: Dotted line with elevation (e.g., 6100)

EXISTING: Solid line

SUB BASIN LINE: Dashed line

FLOW DIRECTION: Arrow

BASIN ID: Circle with ID number (e.g., AC)

DESIGN POINT DESIGNATION: Triangle with ID number (e.g., 1)

Scale: 1" = 100'

PROPOSED DRAINAGE MAP

ANTLERS RANGE SUBDIVISION

JOB NO. 24031

LOCATION: EPC

02/14/2025

SHEET 3

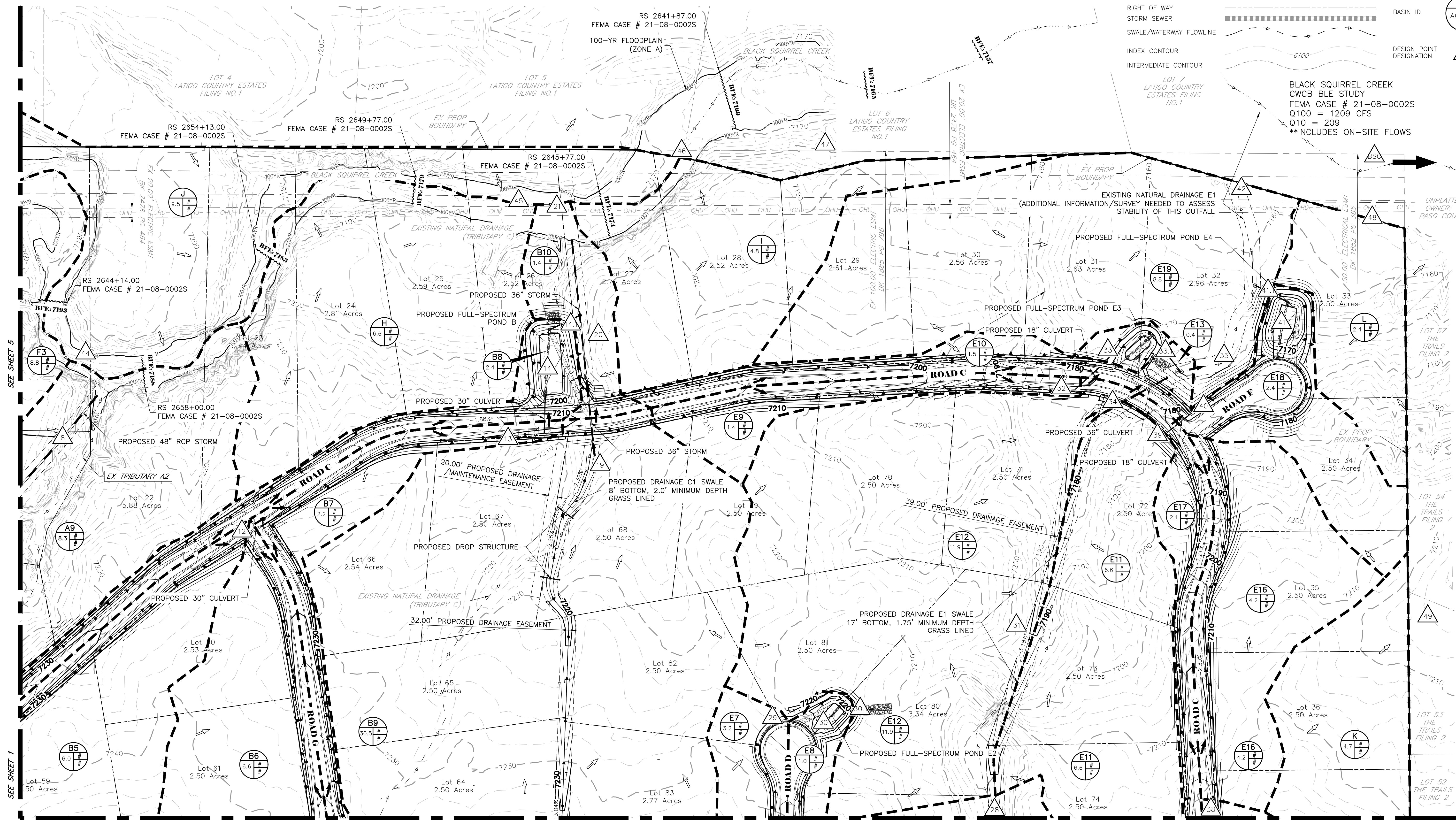
ALL TERRAIN ENGINEERING

ANTLERS RANGE SUBDIVISION PROPOSED DRAINAGE MAP

LEGEND

BOUNDARY LINE	EXISTING	SUB BASIN LINE	---
PROPERTY LINE	---	FLOW DIRECTION	→
EASEMENT LINE	---	BASIN ID	⊕
RIGHT OF WAY	---	DESIGN POINT DESIGNATION	△
STORM SEWER	---		
SWALE/WATERWAY FLOWLINE	---		
INDEX CONTOUR	---		
INTERMEDIATE CONTOUR	---		

BLACK SQUIRREL CREEK
CWCB BLE STUDY
FEMA CASE # 21-08-0002S
Q100 = 1209 CFS
Q10 = 209
**INCLUDES ON-SITE FLOWS



DESIGN POINT SUMMARY TABLE			
DP#	Q ₅ -YR	Q ₁₀₀ -YR	
1	2.0	8.2	
2	2.6	9.9	
2.1	2.6	9.9	
3	11.2	31.0	
4	33.6	82.3	
5	33.8	91.1	
6	11.3	43.5	
7	40.2	120.0	
8	43.8	129.5	
9	1.2	4.2	
10	1.3	3.2	
11	4.0	13.7	
12	6.7	27.4	
13	7.1	27.8	
14	8.1	30.9	
14.1	8.1	30.9	
15	2.8	15.2	
16	6.1	29.8	
17	7.0	32.6	
18.1	7.0	32.6	
19	8.7	45.0	
20	14.5	67.6	
21	14.7	67.6	
22	1.9	41.9	
23	3.2	44.8	
24	1.3	4.9	
25	2.6	12.3	
26	4.1	17.7	
26.1	4.1	17.7	
27	5.8	53.4	
28	6.5	53.8	
29	1.6	6.5	
30	2.5	9.2	
30.1	2.5	9.2	
31	6.8	54.8	
32	1.1	3.3	
33	2.0	6.4	
33.1	2.0	6.4	
34	7.8	59.2	
35	7.9	59.8	
36	1.1	6.2	
37	1.6	5.9	
38	4.8	22.4	
39	1.6	4.5	
40	6.0	25.9	
41	6.1	26.1	
41.1	6.1	26.1	
42	11.1	75.1	
43	2.5	8.9	
43.1	2.5	8.9	
44	44.8	136.2	
45	2.0	11.8	
46	0.2	7.3	
47	1.5	8.4	
48	1.0	5.4	
49	1.5	4.8	
BSC	75.3	311.8	

Tributary	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
A9	4.70	15%	0.18	0.44	32.41	2.0	8.2
B5	4.70	15%	0.18	0.44	32.41	2.0	8.2
B6	0.80	33%	0.32	0.55	20.12	0.8	2.3
B7	4.80	10%	0.14	0.41	39.51	1.4	6.8
B8	2.10	7%	0.12	0.39	25.97	0.7	3.7
B9	13.50	10%	0.14	0.41	37.00	4.1	19.9
B10	3.70	17%	0.19	0.44	29.63	1.7	6.8
E7	14.70	0%	0.02	0.35	43.13	0.6	16.7
E8	3.20	0%	0.02	0.35	24.66	0.2	5.2
E9	1.20	6%	0.11	0.39	15.65	0.5	2.7

Tributary	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
E10	8.30	6%	0.10	0.38	27.01	2.2	14.1
E11	1.20	22%	0.23	0.47	17.81	0.9	3.1
E12	0.40	26%	0.27	0.50	12.69	0.4	1.3
E13	3.90	16%	0.19	0.44	29.74	1.9	7.3
E16	13.50	10%	0.14	0.41	37.00	4.1	19.9
E17	3.70	17%	0.19	0.44	29.63	1.7	6.8
E18	11.60	9%	0.13	0.40	40.29	3.0	15.8
E19	14.70	0%	0.02	0.35	43.13	0.6	16.7
F3	3.20	0%	0.02	0.35	24.66	0.2	5.2
H	1.20	6%	0.11	0.39	15.65	0.5	2.7

Tributary	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
H	4.70	15%	0.18	0.44	32.41	2.0	8.2
I	0.80	33%	0.32	0.55	20.12	0.8	2.3
J	4.80	10%	0.14	0.41	39.51	1.4	6.8
K	2.10	7%	0.12	0.39	25.97	0.7	3.7
L	13.50	10%	0.14	0.41	37.00	4.1	19.9

PROPOSED DRAINAGE MAP
ANTLERS RANGE SUBDIVISION
JOB NO. 24031
LOCATION: EPC
02/14/2025

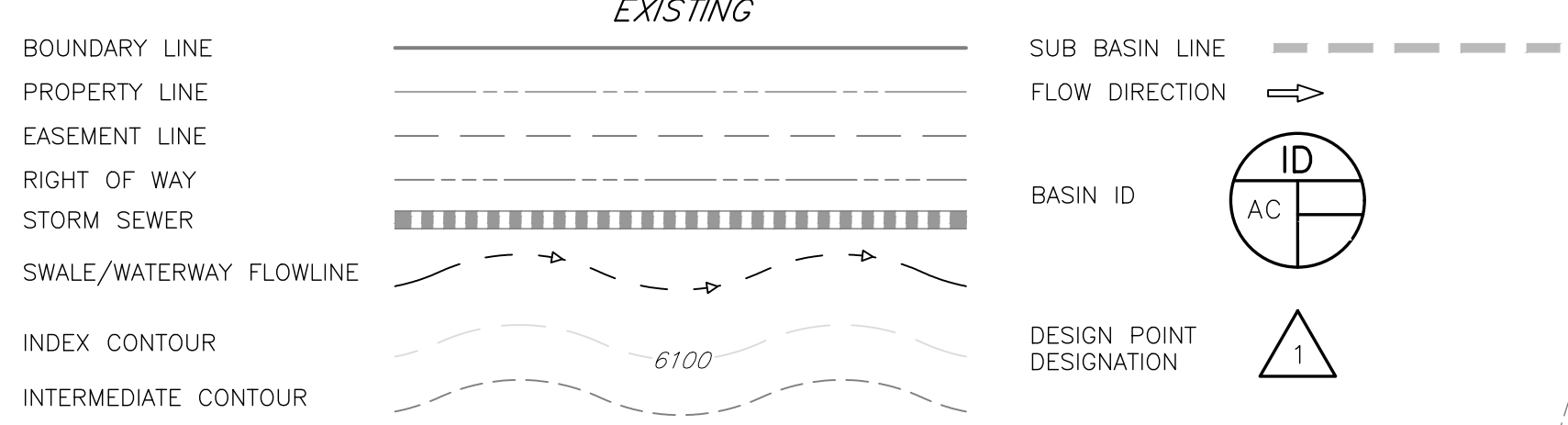
SHEET 4

ALL TERRAIN ENGINEERING



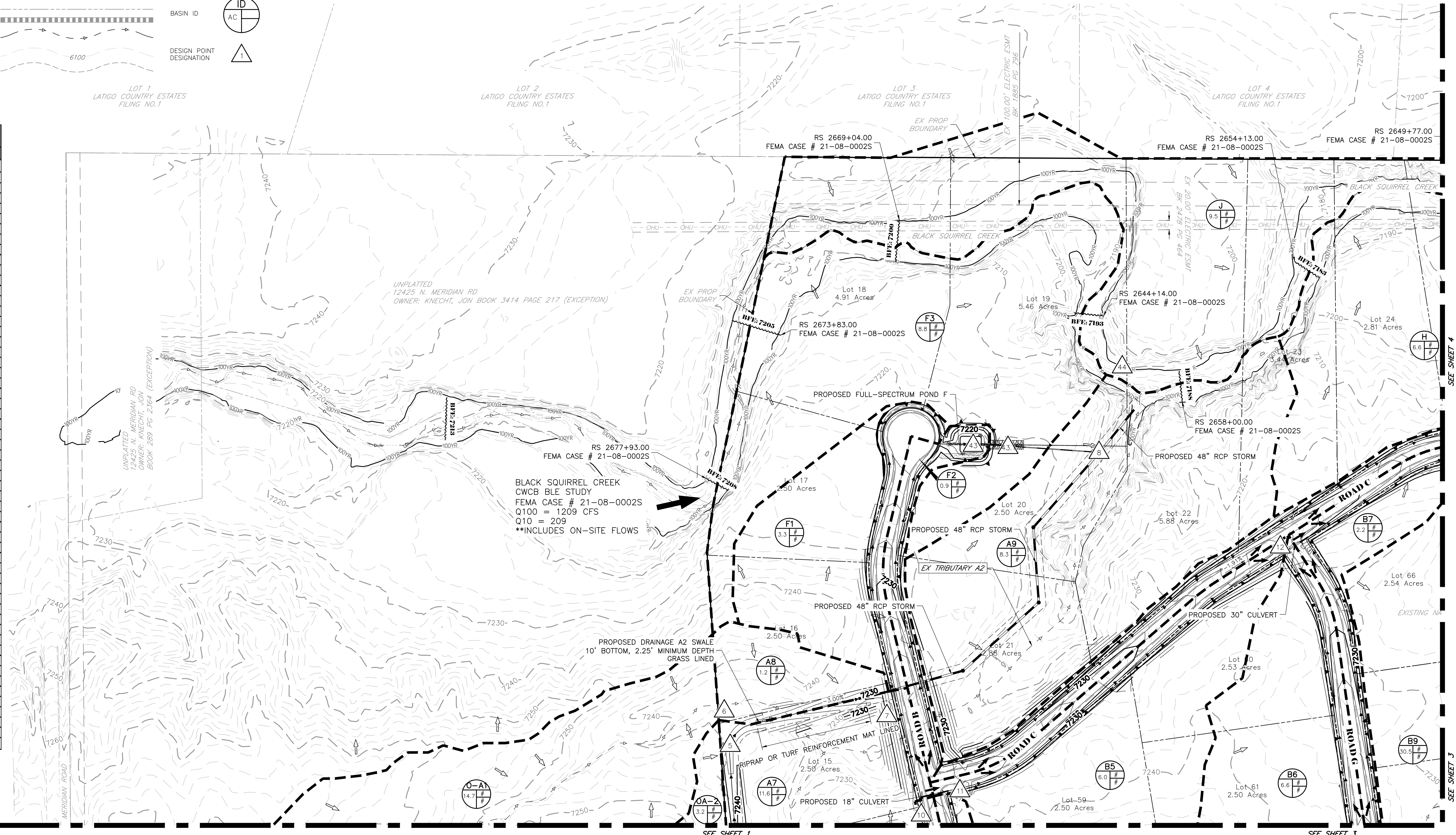
ANTLERS RANGE SUBDIVISION PROPOSED DRAINAGE MAP

LEGEND



DESIGN POINT SUMMARY TABLE

DP#	Q _{5-YR}	Q _{100-YR}
1	2.0	8.2
2	2.6	9.9
2.1	2.6	9.9
3	11.2	31.0
4	33.6	82.3
5	33.8	91.1
6	11.3	43.5
7	40.2	120.0
8	43.8	129.5
9	1.2	4.2
10	1.3	3.2
11	4.0	13.7
12	6.7	27.4
13	7.1	27.8
14	8.1	30.9
14.1	8.1	30.9
15	2.8	15.2
16	6.1	29.8
17	7.0	32.6
18.1	7.0	32.6
19	8.7	45.0
20	14.5	67.6
21	14.7	67.6
22	1.9	41.9
23	3.2	44.8
24	1.3	4.9
25	2.6	12.3
26	4.1	17.7
26.1	4.1	17.7
27	5.8	53.4
28	6.5	53.8
29	1.6	6.5
30	2.5	9.2
30.1	2.5	9.2
31	6.8	54.8
32	1.1	3.3
33	2.0	6.4
33.1	2.0	6.4
34	7.8	59.2
35	7.9	59.8
36	1.1	6.2
37	1.6	5.9
38	4.8	22.4
39	1.6	4.5
40	6.0	25.9
41	6.1	26.1
41.1	6.1	26.1
42	11.1	75.1
43	2.5	8.9
43.1	2.5	8.9
44	44.8	136.2
45	2.0	11.8
46	0.2	7.3
47	1.5	8.4
48	1.0	5.4
49	1.5	4.8
BSC	75.3	311.8



PROPOSED DRAINAGE CALCS - BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
A1	4.70	15%	0.18	0.44	32.41	2.0	8.2
A7	0.80	33%	0.32	0.55	20.12	0.8	2.3
OA1	4.80	10%	0.14	0.41	39.51	1.4	6.8
OA2	2.10	7%	0.12	0.39	25.97	0.7	3.7
A8	13.50	10%	0.14	0.41	37.00	4.1	19.9
A9	3.70	17%	0.19	0.44	29.63	1.7	6.8
B5	11.60	9%	0.13	0.40	40.29	3.0	15.8
B6	14.70	0%	0.02	0.35	43.13	0.6	16.7
B7	3.20	0%	0.02	0.35	24.66	0.2	5.2
B9	8.30	6%	0.10	0.38	27.01	2.2	14.1

PROPOSED DRAINAGE CALCS - BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
F1	4.70	15%	0.18	0.44	32.41	2.0	8.2
F2	0.80	33%	0.32	0.55	20.12	0.8	2.3
F3	4.80	10%	0.14	0.41	39.51	1.4	6.8
H	2.10	7%	0.12	0.39	25.97	0.7	3.7
J	13.50	10%	0.14	0.41	37.00	4.1	19.9

PROPOSED DRAINAGE MAP

ANTLERS RANGE SUBDIVISION

JOB NO. 24031

LOCATION: EPC

02/14/2025

SHEET 5

