Winsome Subdivision
17480 Meridian Road North
Colorado Springs, Colorado 80924

Preliminary Drainage Report

MAY 15, 2019

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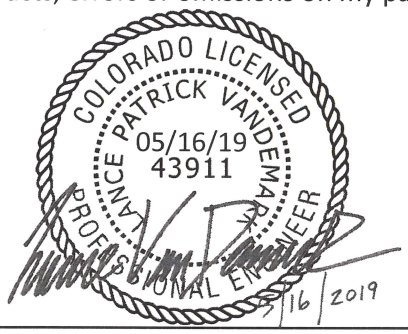
VERTEX Project: 49388
PCD File No. SP-18-006
FEMA Case No: 19-08-0185R

Jason Priddy
Project Engineer

Lance VanDemark, P.E.
Project Manager

Engineer's Certification

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.



Lance VanDemark, P.E.
Registered Professional Engineer
State of Colorado No. 43911

Owner Certification

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

Joseph W DesJardin
Director of Projects
PT McCune, LLC

5/21/19
Date

El Paso County

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

Approved
By: Elizabeth NijKamp
Date:05/22/2019
El Paso County Planning & Community Development

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

Date

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1.0 GENERAL LOCATION AND DESCRIPTION

The following report provides detailed drainage information for existing and proposed conditions for the Winsome Subdivision project. The intent of this report is to show the routing of minor and major storms through the proposed site in accordance with El Paso County Standards. For this site, a minor flow is defined as the 5-year frequency storm and a major flow as the 100-year frequency storm. The information given in this report is intended to provide an adequately detailed analysis of on-site drainage areas and receiving facilities. This development will consist of large-lot single family residential lots, access roads, and the required infrastructure to serve them.

GENERAL LOCATION

The site is located at 17480 Meridian Road North or, more generally, at the northwest corner of Hodgen Road and Meridian Road North in unincorporated El Paso County, latitude 39°04'38" N and longitude 104°36'47" W. The subject property is undeveloped and situated in Sections 13 and 24, Township 11 South, Range 65 West of the 6th P.M., County of El Paso, State of Colorado.

The site is bounded to the south by Hodgen Road, to the east by Meridian Road North, and to the north and west by several parcels zoned primarily as Agricultural and Residential use with some Forest Land. On the east side of Median Road is Forest Green Subdivision, a low-density single-family development. On the south side of Hodgen Road is Bison Meadows Subdivision which is also a low-density single family residential subdivision. The remainder of properties surrounding the site have not yet been formally platted. The site has not been included in any previous drainage study. West Kiowa Creek flows approximately through the center of the property from the southwest corner to the northeast corner, upstream to the west and southwest of the property lie 3 Kiowa Creek Watershed Reservoirs notated as 1-N-10, 1-P-10, and 1-P-20. There are no irrigation ditches on the property.

DESCRIPTION OF PROPERTY

The existing site contains 767 acres of agricultural grazing land and dry farm land. Ground cover consists mainly of native grasses, shrubs, and several stands of evergreen trees along its northern and southern boundary. Existing wetlands are present along West Kiowa Creek and its tributaries, wetland boundaries are located roughly 50 feet to either side of the thalweg of West Kiowa Creek and the drainageway way to the south of the creek on the property. There are no existing irrigation canals or ditches on the project site nor are there any major geologic features. The property generally slopes in a northeasterly direction with slopes ranging between 1-16%. Soils consist of Alamosa loam, Brussett loam, Cruckton sandy loam, Elbeth sandy loam, Holderness loam, Kettle gravelly loamy sands, Peyton sandy loam, Peyton-Pring complex, Pring course sandy loam, Tomah-Crowford loamy sands and Tomah-Crowfoot complex. Most of the site has soils classified in Hydrologic Soil Group B; however, the property also contains a small mixture of soils from Hydrologic Soils Groups C and D located in the areas in and adjacent to West Kiowa Creek and its tributaries. A soils map prepared by Natural Resources Conservation Service is included in the Appendix.

The development of this property will consist of 143 2.5 to 10-acre single family residential lots and the requisite public roads and stormwater infrastructure to serve them. The project will have a phased development plan. Anticipated construction activities include earthwork and paving associated with the public road development, as well as the installation of culverts and stormwater detention ponds to convey and treat stormwater on the site. As previously discussed, West Kiowa Creek bisects the property, flowing from southwest to northeast. In addition, a major tributary of West Kiowa Creek flows north from a point halfway along the southern property boundary and intersects West Kiowa Creek in the middle of the property. The primary access for the site will be from 3 points along Hodgen Road and 1 entry point along Meridian Road.

2.0 DRAINAGE BASINS AND SUB-BASINS

MAJOR BASIN DESCRIPTION

The site resides within the West Kiowa Creek Drainage Basin (KIKI0200) which is located near the northern boundary of El Paso County, approximately 14.5 miles east of downtown Monument, CO. This watershed begins approximately 5 miles southwest of the Winsome property and continues another 10 miles to the northeast where it outfalls into Kiowa Creek which eventually discharges into the South Platte River near Fort Morgan, CO.

DRAINAGE STUDIES, OUTFALL SYSTEM PLANS, & SITE CONSTRAINTS

There are no major drainage studies (DBPS or MDDP) for this area on record and no base flood elevations for this reach of West Kiowa Creek that have been established. In conjunction with the development of this site, a floodplain study has been performed on the section of West Kiowa Creek located within the property. A Conditional Letter of Map Revision (CLOMR) has been submitted to FEMA to establish the floodplain boundary on-site. A plan showing the new proposed 100-year floodplain line is included in the appendix along with supporting documentation. The site is shown on FEMA flood map 08041C0350G with an effective date of 12/7/2018 which indicates that the site is in Zone X – an area outside of the 0.2% annual chance of flood (see the accompanying exhibits in the Appendix). The areas immediately adjacent to West Kiowa Creek are designated as Zone A, which is a 100-year Flood Hazard Area in which no base flood elevations have been determined. There are no known irrigation facilities located on the property at the current time.

EXISTING SUB-BASIN DESCRIPTION

Historically, the runoff from the property flows into West Kiowa Creek, which bisects the site flowing from the southwest corner of the property to the northeast corner. There are 10 on-site sub-basins and 6 off-site sub-basin that contribute flows to West Kiowa Creek. The 10 on-site

sub-basins correspond to the largest defined natural drainage channels that occur on site, while the 6 off-site basins are defined by the entire West Kiowa Creek watershed that is upstream from the subject property.

As previously discussed, the site is currently undeveloped, containing mainly native grasses and shrubs, with limited forested areas along the northern and southern boundary of the site. The existing topography of the site slopes generally in a northerly direction with grades varying from 1-16%. There are no existing irrigation canals or ditches on the project site nor are there any major geologic features. The existing site can be described as 12 sub-basins as follows:

Sub-Basin A is the 915.4-acre watershed of the western tributary to West Kiowa Creek. This sub-basin contains the West Kiowa Creek 1-N-10 Reservoir which is located about a quarter-mile upstream of the property to the west. The sub-basin generates peak runoff of 87.1cfs in the 5-year event and peak runoff of 585.9cfs in the 100-year event. Stormwater generated within the basin flows east from Southwood Drive to the subject property and discharges into West Kiowa Creek immediately to the east of the western property boundary.

Consisting of the entire West Kiowa Creek watershed that is south of Hodgen Road, Sub-Basin Ba encompasses 3836.7 acres and generates peak runoff of 271.5cfs in the 5-year event and peak runoff of 1448.9cfs in the 100-year event. This sub-basin contains 2 Kiowa Creek Watershed Reservoirs noted as 1-P-10 and 1-P-20 located upstream of the property to the southwest. The largest of these reservoirs is evaluated later in the report for risk hazard. Sub-Basin Ba begins approximately 5 miles to the southwest of the Winsome property near Black Forest, CO. Stormwater generated within the basin flows from southwest to northeast passing under a bridge on Hogden Road into sub-basin Bb.

Stormwater generated within the 100.6-acre sub-basin Bb has a peak runoff of 19.2cfs in the 5-year event and peak runoff of 127.7cfs in the 100-year event. Sub-Basin Bb is located at the

southwest corner of the property and consists of the land immediately tributary to West Kiowa Creek on the north side of Hodgen Road. Flows from this sub-basin travel to the northeast discharging into the Creek.

Sub-Basin Ca consists of an off-site area located near the southwest corner of the property. This sub-basin has an area of 162.7-acres and generates peak runoff of 20.7cfs in the 5-year event and peak runoff of 127.8cfs in the 100-year event. This sub-basin discharges into a 30" CMP culvert under Hodgen Road flowing into sub-basin Cb.

Sub-Basin Cb located in the southwest corner of the property. This sub-basin has an area of 70-acres and generates peak runoff of 9.9cfs in the 5-year event and peak runoff of 88.0cfs in the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that discharges into sub-basin H.

Sub-Basin Da is the 161.3-acre watershed of the southern tributary to West Kiowa Creek. The sub-basin generates peak runoff of 20.6cfs in the 5-year event and peak runoff of 127.3cfs in the 100-year event. Stormwater generated within the basin flows north from Pole Pine Point to the subject property and discharges into a 72" CMP culvert under Hodgen Road into sub-basin Dc.

Sub-Basin Db is the 49.9-acre watershed of the southern tributary to West Kiowa Creek. The sub-basin generates peak runoff of 5.7cfs in the 5-year event and peak runoff of 34.1cfs in the 100-year event. Stormwater generated within the basin flows north from Pole Pine Point to the subject property and discharges into a 30" CMP culvert under Hodgen Road into sub-basin Dc.

Sub-Basin Dc is the 249.7-acre watershed of the southern tributary to West Kiowa Creek. This sub-basin contains a significant fraction of the southern half of the Winsome property. The sub-basin generates peak runoff of 28.1cfs in the 5-year event and peak runoff of 275.7cfs in the 100-

year event. Stormwater generated within the basin flows north discharges into West Kiowa Creek immediately near the center of the project site.

Sub-Basin Ea consists of an off-site area located near the southeast corner of the property. This sub-basin has an area of 37.9-acres and generates peak runoff of 5.4cfs in the 5-year event and peak runoff of 34.8cfs in the 100-year event. This sub-basin discharges into a 30" RCP culvert under Hodgen Road flowing into sub-basin Eb.

Sub-Basin Eb located in the southeast corner of the property and consists of an on-site watershed that discharges into West Kiowa Creek at the eastern property line. This sub-basin has an area of 74.6-acres and generates peak runoff of 4.0cfs in the 5-year event and peak runoff of 85.8cfs in the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that is north of Hodgen Road on the eastern side of the site.

Sub-Basin F located in the southeast corner of the property and consists of an on-site watershed that discharges into West Kiowa Creek to the east of the property. This sub-basin has an area of 44.5-acres and generates peak runoff of 6.6cfs in the 5-year event and peak runoff of 56.6cfs in the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that is north of Hodgen Road on the eastern side of the site.

Sub-Basin G located on the western side of the property and consists of an on-site watershed of a minor natural drainage channel that flows from west to east and discharges into West Kiowa Creek near the west of the property. This sub-basin has an area of 107.6 acres and generates peak runoff of 45.3cfs in the 5-year event and peak runoff of 199.0cfs in the 100-year event.

Sub-Basin H located in the northern side corner of the property and consists of an on-site watershed that discharges into West Kiowa Creek on the north side of the property. This sub-basin has an area of 121.8 acres and generates peak runoff of 34.8cfs in the 5-year event and

peak runoff of 197.2cfs in the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that is north of West Kiowa Creek on the western side of the site.

Sub-Basin I located in the northeast corner of the property and consists of an on-site watershed that discharges into West Kiowa Creek to the east of the property. This sub-basin has an area of 37.5-acres and generates peak runoff of 26.4cfs in the 5-year event and peak runoff of 88.5cfs in the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that is north of West Kiowa Creek on the eastern side of the site.

Sub-Basin J located in the northeast corner of the property and consists of an on-site watershed that discharges to the north of the property in existing natural drainage channels. This sub-basin has an area of 10.1-acres and generates peak runoff of 3.4cfs in the 5-year event and peak runoff of 19.9cfs in the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that is north of Hodgen Road on the eastern side of the site.

Sub-Basin K located in the northeast corner of the property and consists of an on-site watershed that discharges to the north of the property in existing natural drainage channels. This sub-basin has an area of 17.8-acres and generates peak runoff of 12.9cfs in the 5-year event and peak runoff of 45.1cfs in the 100-year event. This sub-basin consists of the land tributary to a minor drainage channel that is north of Hodgen Road on the eastern side of the site.

Flow rate numbers were generated using NRCS Curve Number Methodology with HEC-HMS modeling software. Colorado Springs Stormwater Manual criteria was used for identifying curve numbers of the type B, C, and D NRCS Hydrologic Soil Groups as they applied to the various sub-basins. A summary of the results of calculations for the existing conditions can be found in the Appendix.

PROPOSED SUB-BASIN DESCRIPTION

In the proposed condition, stormwater runoff will generally flow from southwest to northeast as it does in the existing condition. The main difference between the existing and proposed conditions is the flow paths of West Kiowa Creek and the various tributary drainageways will intersect the proposed public roads that access the residential lots. All existing drainage patterns will be maintained throughout the site to the extent possible. To calculate the design flows for each of the proposed culverts that will convey runoff across the proposed roads, the existing basins were subdivided to create design points at each of the proposed crossing locations. As a result, there are 35 on-site sub-basins and 8 off-site sub-basins in the proposed condition.

In accordance with the above-mentioned drainage patterns, the proposed project will be divided into 43 sub-basins that are described as follows:

Sub-Basin A1 is an off-site sub-basin to the west of the property that consists mostly of agricultural land and has an area of 865.9 acres. Sub-Basin A1 also contains West Kiowa Creek 10-N-1 Reservoir. The curve number for Sub-Basin A1 is 64.4. The basin will generate runoff of 83.3cfs and 481.8cfs in the minor and major storms, respectively. Flows from this sub-basin will be conveyed by a natural drainage channel through Sub-Basin A3 to West Kiowa Creek, which will convey flows off the site to the northeast.

Sub-Basin A2 is a small off-site sub-basin to the west of the property consisting of mostly of native grasslands and has an area of 37.0 acres. The curve number for Sub-Basin A2 is 66.00. The basin will generate runoff of 4.7cfs and 43.4cfs in the minor and major storms, respectively. Flows from this sub-basin will also be conveyed by a natural drainage channel through Sub-Basin A3 to West Kiowa Creek, which will convey flows off the site to the northeast.

Sub-Basin A3 consists of 3 large residential lots to the west of Alamar Way on the western boundary of the site and has an area of 41.5 acres. The curve number for Sub-Basin A3 is 76.50.

The basin will generate runoff of 22.8cfs and 85.4cfs in the minor and major storms, respectively. Flows from this sub-basin will be conveyed by natural drainageways and along the side of Alamar Way from the northwest to the southeast end of the basin into Sub-basin G2.

Sub-Basin B1 consists of the West Kiowa Creek watershed to the south of Hodgen Road. This sub-basin has an area of 3836.70 acres. The curve number for Sub-Basin B1 is 60.34. The basin will generate runoff of 284.7cfs and 1537.4cfs in the minor and major storms, respectively. Flows from this sub-basin will pass under Hodgen Road and then conveyed by a natural drainage channel through Sub-Basin B3 via West Kiowa Creek, which will convey flows off the site to the northeast.

Sub-Basin B2 consists of 4 large residential lots at the southwest corner of the project. This sub-basin has an area of 13.10 acres. The curve number for Sub-Basin B2 is 64.00. The basin will generate runoff of 3.3cfs and 19.9cfs in the minor and major storms, respectively. Flows from this basin will travel across the lots from south to north where they will be intercepted by a culvert in Clove Hitch Ct. From the culvert flows will be conveyed by a natural drainage channel through Sub-Basin B4 to West Kiowa Creek, which will convey flows off the site to the northeast.

Sub-Basin B3 is an off-site sub-basin to the west of the site near the southwest corner of the property. This sub-basin has an area of 54.90 acres. The curve number for Sub-Basin B3 is 65.10. The basin will generate runoff of 6.7cfs and 57.9cfs in the minor and major storms, respectively. Flows from this sub-basin will be conveyed by a natural drainage channel through Sub-Basin B4 to West Kiowa Creek, which will convey flows off the site to the northeast.

Sub-Basin B4 consists of 6 large residential lots and West Kiowa Creek at the southwest corner of the property. This sub-basin has an area of 41.48 acres. The curve number for Sub-Basin B4 is 47.99. The basin will generate runoff of 8.8cfs and 53.1cfs in the minor and major storms, respectively. Flows from this basin will flow north to northeast and will be conveyed by a natural

drainage channel through Sub-Basin B4 to West Kiowa Creek, which will convey flows off the site to the northeast.

Sub-Basin C1 is an off-site sub-basin to the south of Hodgen Road. This sub-basin has an area of 162.70 acres. The curve number for Sub-Basin C1 is 60.00. The basin will generate runoff of 20.7cfs and 127.8cfs in the minor and major storms, respectively. Flows from this sub-basin will be conveyed north by a natural drainage channel to Hodgen Road or through an existing 30" CMP culvert that will convey flows under Hodgen Road into Sub-Basin C2.

Sub-Basin C2 consists of 7 large residential lots along the southern boundary of the property. This sub-basin has an area of 22.40 acres. The curve number for Sub-Basin C2 is 64.00. The basin will generate runoff of 3.1cfs and 19.5cfs in the minor and major storms, respectively. Stormwater from this basin will flow north across the lots to a culvert under Mosey Trail. The culvert flows will be conveyed across Sub-Basin C3 and ultimately will discharge into West Kiowa Creek.

Sub-Basin C3 consists of 5 large residential lots in southern half of the property, just south of Winding Way Circle. This sub-basin has an area of 16.10 acres. The curve number for Sub-Basin C3 is 64.00. The basin will generate runoff of 3.7cfs and 22.1cfs in the minor and major storms, respectively. Runoff from this basin will flow to the northwest across the lots to a culvert under Winsome Way. From the culvert runoff will convey across Sub-Basin B4 and will be discharged into West Kiowa Creek.

Sub-Basin C4 consists of only two residential lots and a portion of West Kiowa Creek north of the southern loop of Alamar Way. This sub-basin has an area of 23.80 acres. The curve number for Sub-Basin C4 is 65.00. The basin will generate runoff of 1.8cfs and 22.9cfs in the minor and major storms, respectively. Stormwater from this sub-basin will flow north across the residential lots to West Kiowa Creek.

Sub-Basin D1.1 is an off-site sub-basin to the south of Hodgen Road consisting of agricultural land and large residential lots. This sub-basin has an area of 161.30 acres. The curve number for Sub-Basin D1 is 60.00. The basin will generate runoff of 20.6cfs and 127.3cfs in the minor and major storms, respectively. Flows from this sub-basin will be conveyed north by a natural drainage channel to an existing 72" CMP culvert that will convey flows under Hodgen Road into Sub-Basin D2.

Sub-Basin D1.2 is an off-site sub-basin to the south of Hodgen Road consisting of agricultural land and large residential lots. This sub-basin has an area of 49.90 acres. The curve number for Sub-Basin D1 is 60.00. The basin will generate runoff of 5.7cfs and 34.1cfs in the minor and major storms, respectively. Flows from this sub-basin will be conveyed north by a natural drainage channel to a 30" CMP culvert that will convey flows under Hodgen Road into Sub-Basin D3.

Sub-Basin D2 consists of 17 large residential lots and the southern tributary to West Kiowa Creek. This sub-basin has an area of 68.70 acres. The curve number for Sub-Basin D2 is 65.50. The basin will generate runoff of 11.7cfs and 81.3cfs in the minor and major storms, respectively. A culvert will convey flows across Alamar Way into Sub-Basin D5.

Sub-Basin D3 consists of 12 large residential lots at the southeast corner of the property. This sub-basin has an area of 41.20 acres. The curve number for Sub-Basin D3 is 64.00. The basin will generate runoff of 7.9cfs and 44.2cfs in the minor and major storms, respectively. Stormwater from this sub-basin will flow west across the residential lots to a natural channel that will convey flows to the north to a culvert under Asteria Lane. From the culvert runoff will continue to flow north through Sub-Basin D4 in a natural drainageway.

Sub-Basin D4 consists of 12 large residential lots to the south of the southern loop of Alamar Way. This sub-basin has an area of 34.30 acres. The curve number for Sub-Basin D4 is 64.00. The basin will generate runoff of 7.7cfs and 44.8cfs in the minor and major storms, respectively.

Stormwater from this sub-basin will flow across the residential lots to a natural drainage channel that will convey flows north to a culvert under Alamar Way. From the culvert, runoff will continue north through Sub-Basin D6 to stormwater detention pond 3 and then discharge to a natural drainage channel flowing to West Kiowa Creek.

Sub-Basin D5 consists of a portion of the southern tributary to West Kiowa Creek immediately to the north of the southern loop of Alamar Way. This sub-basin has an area of 12.80 acres. The curve number for Sub-Basin D5 is 67.20. The basin will generate runoff of 0.8cfs and 17.5cfs in the minor and major storms, respectively. Stormwater from this sub-basin generally flows south to north along the southern tributary streambed.

Sub-Basin D6 consists of 5 large residential lots and the portion of West Kiowa Creek on the northwest corner of Twinkling Star Lane and Alamar Way. This sub-basin has an area of 41.80 acres. The curve number for Sub-Basin D6 is 64.80. The basin will generate runoff of 4.4cfs and 33.2cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows northwest across the residential lots to the 7.1 ac-ft stormwater detention pond, Pond 3, which will discharge to West Kiowa Creek. Flows in the creek pass under Alamar Way through a double box culvert.

Sub-Basin E0 off-site sub-basin is located south of the southeast corner of the property. This sub-basin has an area of 37.9 acres. The curve number for Sub-Basin E0 is 60.00. The basin will generate runoff of 4.8cfs and 29.7cfs in the minor and major storms, respectively. Stormwater from this sub-basin will flow north across the residential lots to a 30” RCP culvert under Hodgen Road. From the culvert flows proceed north through Sub-Basin E1.1 to be treated in stormwater detention pond P6.

Sub-Basin E1.1 consists of one commercial lot in the southeast corner of the property. The commercial lot will have its own full spectrum stormwater detention pond, Pond 6 in place and

outlet to the road side ditch still ultimately flowing to the culvert at the north end of the basin. This sub-basin has an area of 7.9 acres. Half of this lot is forested and will remain undeveloped. The curve number for Sub-Basin E1.1 is 76.00. The basin will generate runoff of 9.0cfs and 20.7cfs in the minor and major storms, respectively.

Sub-Basin E1.2 consists of 3 large lots towards the southeast corner of the property. This sub-basin has an area of 16.30 acres. The curve number for Sub-Basin E1.2 is 64.00. The basin will generate runoff of 2.7cfs and 15.5cfs in the minor and major storms, respectively. Stormwater from this sub-basin will flow north across the residential lots through a culvert under Woodridge Terrace to Sub-basin F1.

Sub-Basin E2 consists of a portion of a large residential lot at the southwest corner of Flapjack Lane and Early Light Drive. This sub-basin has an area of 2.60 acres. The curve number for Sub-Basin E2 is 64.00. The basin will generate runoff of 0.7cfs and 4.2cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows north to a culvert under Flapjack Lane. Form the culvert, runoff flows in a natural drainage channel to Sub-Basin E3.

Sub-Basin E3 consists of 6 large residential lots on the south side of Asteria Lane. This sub-basin has an area of 19.80 acres. The curve number for Sub-Basin E3 is 64.00. The sub-basin will generate runoff of 4.7cfs and 27.9cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows east across the lots to a natural drainage channel which conveys flows north to the culvert under Asteria Lane. From the culvert, runoff continues down the proposed swale through Sub-Basins E4.

Sub-Basin E4 consists of 5 large residential lots to the north of Asteria Lane in the southeast corner of the property. This sub-basin has an area of 18.20 acres. The curve number for Sub-Basin E4 is 64.00. The basin will generate runoff of 4.2cfs and 25.1cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows to the proposed swale running through the

center of the sub-basin and are conveyed north to the culvert under Alamar Way. From the culvert, the flows continue north through the proposed swale that runs through Sub-Basin E7.

Sub-Basin E5 consists of portions of 7 large residential lots south of Alamar Way near the southern terminus of Clove Hitch Ct. This sub-basin has an area of 13.50 acres. The curve number for Sub-Basin E5 is 64.00. The basin will generate runoff of 3.2cfs and 19.2cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots through the center of the sub-basin and is conveyed north to the culvert under Alamar Way. From the culvert the flows continue north through Sub-Basin E6 in a natural drainage channel.

Sub-Basin E6 consists of 6 large residential lots along the eastern boundary of the property north of Alamar Way. This sub-basin has an area of 28.90 acres. The curve number for Sub-Basin E6 is 61.70. The basin will generate runoff of 5.5cfs and 34.4cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the natural drainage channel running through the center of the sub-basin and are conveyed north to stormwater detention pond 5. From the pond flows continue north in a natural drainage channel and are discharged from the property to the north as they were in the existing condition.

Sub-Basin E7 consists of a portion of 5 large residential lots on the eastern side of the property north of Alamar Way. This sub-basin has an area of 9.80 acres. The curve number for Sub-Basin E7 is 62.00. The basin will generate runoff of 2.0cfs and 12.3cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the proposed swale running through the center of the sub-basin and discharges to the proposed swale to the north that flows through to Sub-basin E6 into stormwater detention pond 5.

Sub-Basin F1 consists of portions of 8 large residential lots along the eastern boundary of the project, on the east side of Twinkling Star Lane. This sub-basin has an area of 42.90 acres. The curve number for Sub-Basin F2 is 60.40. The basin will generate runoff of 6.0cfs and 36.0cfs in

the minor and major storms, respectively. Stormwater from this sub-basin flows across the existing drainage channel through the center of the sub-basin and is discharged from the property to the north to a proposed swale that runs along the north property line ultimately entering detention pond P5.

Sub-Basin G1 consists of a portion of 3 large residential lots and off-site grassland along the western boundary of the project, on the west side of Alamar Way. This sub-basin has an area of 25.20 acres. The curve number for Sub-Basin G1 is 66.00. The basin will generate runoff of 2.5cfs and 36.3cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the natural drainage channel running through the center of the sub-basin and are conveyed east to a culvert under Alamar Way. From the culvert the flows continue east through Sub-Basin G2.

Sub-Basin G2 consists of a portion of 5 large residential lots on the east side of the western loop of Alamar Way. This sub-basin has an area of 21.20 acres. The curve number for Sub-Basin G2 is 73.40. The basin will generate runoff of 7.6cfs and 35.9cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the proposed swale running through the center of the sub-basin and are conveyed east to the 8.8 ac-ft stormwater detention pond, Pond 1. From the pond flows continue east and are discharged to West Kiowa Creek.

Sub-Basin H1 consists portions of 3 large residential lots along the western boundary of the project, on the north side of Alamar Way. This sub-basin has an area of 13.90 acres. The curve number for Sub-Basin H1 is 60.00. The basin will generate runoff of 5.5cfs and 26.2cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the natural drainage channel running through the center of the sub-basin and are conveyed southeast to the culvert under Alamar Way. From the culvert, the flows continue southeast through Sub-Basin H4.

Sub-Basin H2 consists portions of 6 large residential lots along the northern boundary of the project, on the north side of Alamar Way. This sub-basin has an area of 39.10 acres. The curve number for Sub-Basin H2 is 67.20. The basin will generate runoff of 5.3cfs and 53.6cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the natural drainage channel running through the center of the sub-basin and are conveyed southeast to the culvert under Alamar Way. From the culvert the flows continue southeast through Sub-Basin H6.

Sub-Basin H3 consists of portions of 3 large residential lots, and a small offsite residential area, along the northern boundary of the project. This sub-basin has an area of 5.80 acres. The curve number for Sub-Basin H2 is 66.00. The basin will generate runoff of 1.2cfs and 9.6cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the natural drainage channel running through the center of the sub-basin and are conveyed southeast to the culvert under Alamar Way. From the culvert the flows continue southeast through Sub-Basin H7.

Sub-Basin H4 consists of a portion of 4 large residential lots on the east side of the western loop of Alamar Way. This sub-basin has an area of 27.10 acres. The curve number for Sub-Basin H4 is 73.75. The basin will generate runoff of 12.3cfs and 50.2cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the natural drainage channel running through the center of the sub-basin and are conveyed southeast to stormwater detention pond 1. From the pond, flows continue southeast and are discharged to West Kiowa Creek.

Sub-Basin H5 consists of a portion of 3 large residential lots on the east side of the western loop of Alamar Way. This sub-basin has an area of 20.20 acres. The curve number for Sub-Basin H5 is 74.10. The basin will generate runoff of 10.1cfs and 40.0cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the proposed swale running

through the center of the sub-basin and are conveyed southeast to stormwater detention pond 2. From the pond, flows continue southeast and are discharged to West Kiowa Creek.

Sub-Basin H6 consists of a portion of 2 large residential lots on the east side of the western loop of Alamar Way. This sub-basin has an area of 31.60 acres. The curve number for Sub-Basin H6 is 66.60. The basin will generate runoff of 1.8cfs and 37.1cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the proposed swale running through the center of the sub-basin and are conveyed southeast to the 8.1 ac-ft stormwater detention pond, Pond 2. From the pond flows continue southeast and are discharged to West Kiowa Creek.

Sub-Basin H7 consists of a portion of 3 large residential lots on the east side of the western loop of Alamar Way. This sub-basin has an area of 25.80 acres. The curve number for Sub-Basin H7 is 70.50. The basin will generate runoff of 8.1cfs and 42.8cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the natural drainage channel running through the center of the sub-basin and are discharged to West Kiowa Creek.

Sub-Basin H8 consists of a portion of 2 large residential lots on the east side of Clove Hitch Ct. This sub-basin has an area of 8.50 acres. The curve number for Sub-Basin H8 is 74.55. The basin will generate runoff of 4.9cfs and 19.3cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots and south along the road, conveyed southeast to the eastern boundary of the project and discharged onto the neighboring property as they were in the existing condition.

Sub-Basin H9 consists of a portion of 2 large residential lots on the east side of Clove Hitch Ct. This sub-basin has an area of 6.90 acres. The curve number for Sub-Basin H9 is 60.00. The basin will generate runoff of 2.9cfs and 14.0cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the natural drainage channel running

through the center of the sub-basin and are conveyed southeast to the proposed swale and into the 1.5 ac-ft stormwater detention pond, Pond 4. From the pond flows continue southeast and are discharged from the property to the east as they were in the existing condition.

Sub-Basin I1 consists of a portion of 3 large residential lots at the northwest corner of the intersection of Twinkling Star Lane and Alamar Way. This sub-basin has an area of 6.80 acres. The curve number for Sub-Basin H2 is 72.00. The basin will generate runoff of 3.3cfs and 14.7cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots and along the road, conveyed southeast to the culvert under Twinkling Star Lane. From the culvert the flows continue southeast through Sub-Basin I2.

Sub-Basin I2 consists of a portion of 3 large residential lots on the east side of Clove Hitch Ct, north of Sub-Basin H9. This sub-basin has an area of 14.80 acres. The curve number for Sub-Basin I2 is 72.00. The basin will generate runoff of 7.2cfs and 32.2cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows across the lots to the natural drainage channel running through the center of the sub-basin. A proposed swale then directs the water south to detention pond P4.

Sub-Basin J1 consists of portions of 2 large residential lots along the northern boundary of the project. This sub-basin has an area of 10.10 acres. The curve number for Sub-Basin J1 would appear to be lower than the historic use at 68.5 versus 69.5. This could result from cleanup of leaves, pine needles, and other debris exposing more ground and allowing more direct contact with water. Conservatively however, using the larger of the two curve numbers, the basin will generate runoff of 3.4cfs and 19.9cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows north across the lots from the property to the north boundary of the project as it did in the existing condition. Flows going offsite will be at or below historic levels.

Sub-Basin K1 consists of portions of 4 large residential lots along the northern boundary of the project. This sub-basin has an area of 17.80 acres. The curve number for Sub-Basin K1 would appear to be lower than the historic use at 72 versus 76. This could result from cleanup of leaves, pine needles, and other debris exposing more ground and allowing more direct contact with water. Conservatively however, using the larger of the two curve numbers, the basin will generate runoff of 12.9cfs and 45.1cfs in the minor and major storms, respectively. Stormwater from this sub-basin flows north across the lots from the property to the north boundary of the project as it did in the existing condition. Flows flowing offsite will be at or below historic levels.

3.0 DRAINAGE DESIGN CRITERIA

REGULATIONS

The hydrologic calculations in this report comply with the El Paso County Drainage Criteria Manuals. There are no previous drainage studies that cover this property.

HYDROLOGICAL CRITERIA

Since this project contains both sub-basins over 100 acres and sub-basins less than 100 acres, times of concentration and peak runoff values were calculated for the 5-year and 100-year storm events using the NRCS Curve Number Method as required by the City of Colorado Springs/El Paso County Drainage Criteria Manuals. The model utilizes the NRCS Type II 24-hr rainfall distribution, the cumulative depth for the 5-year storm is 2.7 inches and cumulative depth of the 100-year storm is 4.6 inches. Per the Drainage Criteria Manual, both Frontal Storms and Thunder Storms were evaluated to determine the higher design flow. The comparative analysis of these storms show that the Frontal Storm produces significantly higher flow rates, so this storm type was used for drainage design. The table below outlines the rain gage data used for the comparison.

Frontal Storm Rainfall Depths		
	1 H	24 H
5 Year	1.5	2.7
100 Year	2.52	4.6

Thunder Storm 2H Rainfall Depths			
Minutes	Fraction of 1 H	5Y	100Y
5	0.01	0.02	0.04
10	0.05	0.07	0.12
15	0.08	0.12	0.20
20	0.12	0.18	0.30
25	0.18	0.27	0.45
30	0.26	0.39	0.65
35	0.42	0.63	1.06
40	0.71	1.07	1.79
45	0.82	1.24	2.08
50	0.89	1.34	2.25
55	0.94	1.40	2.36
60	0.97	1.46	2.45
65	1.00	1.51	2.53
70	1.02	1.53	2.57
75	1.03	1.55	2.60
80	1.04	1.56	2.62
85	1.05	1.58	2.65
90	1.06	1.59	2.68
95	1.07	1.61	2.70
100	1.08	1.62	2.73
105	1.09	1.64	2.75
110	1.10	1.65	2.77
115	1.11	1.66	2.79
120	1.12	1.68	2.82

The peak outfall results for each storm type were reviewed and the frontal storm was identified to have over a 200% greater peak.

NRCS TR-55 CURVE NUMBER SELECTION

Basin runoff curve numbers were generated using the runoff curve tables and methods presented in the Colorado Springs/El Paso County Stormwater Criteria Manual.

With curve values for a developed condition only listed up to a 2-acre lot size, some conservative interpolation was necessary. Taking into account that the curve numbers are not linear as the lot sizes increase, the following table was extrapolated for this study.

LOT SIZE	IMPERVIOUS %	SOIL GROUP A	SOIL GROUP B	SOIL GROUP C	SOIL GROUP D
2 ½ ACRE	11%	NA	64	76	81
5 ACRE	7%	NA	60	72	77

Impervious areas were referenced from the county Engineering Criteria Manual (Appendix L Table 3-1) in the table shown below.

Table 3-1
Typical Values of Percent Impervious

Type of Development	Percent Impervious
Commercial	95%
Industrial	85%
Multi-Family	65%
Single Family - 0.1377 acre lots (6,000 SF)	53%
Single-Family – 0.20 acre lots	43%
Single-Family – 0.25 acre lots	40%
Single-Family – 0.33 acre lots	30%
Single-Family – 0.5 acre lots	25%
Single-Family – 1.0 acre lots	20%
Single-Family – 2.5 acre lots	11%
Single-Family – 5 acre lots	7%

FLOODPLAIN STUDY

A formal floodplain study has not been done for this site in the past. A CLOMR submittal has been assembled for this project and was submitted to FEMA in November 2018. The proposed 100-year floodplain line has been calculated and is shown on the plans.

HYDRAULIC CRITERIA

Routing of stormwater runoff and modelling of drainageways on the site, was done using the NRCS Curve Number Method as required by the City of Colorado Springs. However, ultimate culvert and full spectrum detention pond sizing shall be based on Rational Method peak flows and will utilize Urban Drainage UD-Culvert & UD-Detention calculations. Culvert sizing will be included in the final drainage report and has not been completed at this time.

Time of Concentration

Assumptions were made for channelized flows through basins to calculate Time of Concentration values. To recognize that larger basins produce more runoff, we structured the hydrology model with 2 channelized flow profiles for basin over and under 100 acres. The table below outlines these assumptions:

	Shape	Side Slopes	Depth	Wetted Perimeter	Cross Sectional Area
< 100 Acre Basin Channels	Triangular	4:1	4’	32.98’	64 sqft
> 100 Acre Basin Channels	Triangular	4:1	3’	24.74’	36 sqft

Conveyance Flow Paths

For conveyance flow paths between basins and the main channel where basins converge, 3 flow profiles were used. Triangular profiles were used for a majority of the conveyances, larger branching tributaries were trapezoidal with an 8’ bottom, and the main channel was modeled as trapezoidal with a 20’ bottom. A full HEC-RAS section analysis was completed that modeled the shape of the main floodplain drainage way. The 20’ bottom is a conservative average.

Box Culvert Sizing Requirements

Detailed sizing of road bridge crossings will be included in a subsequent Final Drainage Report. Hydraulic modeling associated with determining the floodplain width and box culvert requirements has been performed and the requirements outlined in the Drainage Criteria Manual V1 section 6.4 have been referenced. Both of the 2 bridge crossings will have a Q100 value over 1500cfs and the 2' freeboard requirement will apply. The culvert design will follow standard dimensions from the Colorado Department of Transportation specifications.

Detention Pond Summary

Preliminary full spectrum detention pond sizing has been completed. A summary is shown in the table below and full details are included in the appendix. A total of 6 ponds are proposed, all providing over detention to account for basins that are not being detained. This network of detention ponds works together to achieve a lower proposed flow at the main outfall relative to historic levels. Ownership and maintenance of the ponds will be through a subdivision metro district. An overview of the pond characteristics is shown in the table below:

	Proposed Volume	Q100 Flow Entering Pond (Developed)	Flow Exiting Pond (Developed)	Flow Ratio (Developed vs Historic)
Pond 1	7.9 ac-ft	174.1cfs	31.9cfs	0.3
Pond 2	7.2 ac-ft	184.5cfs	35.1cfs	0.3
Pond 3	6.9 ac-ft	220.6cfs	126.8cfs	0.8
Pond 4	1.3 ac-ft	56.1cfs	30.6cfs	0.8
Pond 5	9.7 ac-ft	257.1cfs	120cfs	0.7
Pond 6	3.8 ac-ft	79.5cfs	18.0cfs	0.4

Pond 5 is a unique situation with having tributary basins that flow into it, and also receiving the outfall of Pond 6. To accurately calculate this situation, the outflow hydrograph of Pond 6 was

added to the inflow hydrograph of Pond 5. Our analysis found a 24.97 minute lag time between the two ponds which was incorporated as well. The table below shows this calculation:

Reach Name	Reach Length (ft)	Flow Velocity (ft/s)	Travel Time (Seconds)	
E1.2	791.59	3.53	224.3	
CULV E1.2	60.00	10.75	5.6	
F1	1032.69	5.35	193.0	
F1.2	1886.42	2.76	683.5	
E6-2	1915.96	4.89	391.8	
			1498.2	Seconds
			24.97	Minutes

The new hydrograph was then imported into UD Detention for the final calculations of Pond 5. A copy of this effort is included in the appendix. Research will continue as to whether this is the most appropriate method to model the situation in UD Detention, and may be updated in the Final Drainage Report.

PRUDENT LINE ANALYSIS

A Prudent Line analysis has been performed on the West Kiowa Creek reach for the site, and the resulting prudent line is included on the Drainage Plan. The Prudent Line method decision tree would direct use of the simplified approach based on developed density < 1 unit per acre, channel capacity > 10-year storm event requirements, dedicated open space determination, and < 15% impervious criteria. An analysis was done for each 500' segment of the Kiowa Creek across the project. The prudent line that was developed crossed a small portion of two proposed lots. Easements have been placed at these locations to prevent any building. A summary of the prudent line calculations can be found in the appendix.

The basins for the site flow to the 150-acre dedicated open space area containing the onsite reach of West Kiowa Creek. The open space roughly bisects the site from the southwest corner

of the property to the northeast corner of the property. In addition to the creek itself, this tract contains preservation areas for wetlands and wildlife. To accommodate these areas, the tract will be further restricted as a natural corridor by the county requiring submittal to the US Fish & Wildlife for habitat preservation, and then also submitted to FEMA for floodplain preservation. The proposed post development flows will all be at or below historic levels. To maintain this natural environment, and likely required by US Fish and Wildlife, we propose not making any channel improvements to this area.

4.0 DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

This project is a low density residential development with lots varying between 2.5 acres and 5 acres in size. Adjoining properties and drainage facilities downstream from the site will not be affected. In order to maintain historic runoff levels for this site, a series of 6 full spectrum detention ponds are being proposed that will capture and control the flows from roads and residential lots. The runoff from these areas will be treated before releasing it into West Kiowa Creek or on to the downstream properties at the historic discharge points. The 6 ponds are sized to over-detain stormwater making up for other basins that are not captured.

As this is a phased project, detention ponds will be installed to maintain flow rates below historic levels at each phase of the project. To achieve this, some ponds will be built and put on line that are outside of the boundary area for a given phase.

SPECIFIC DETAILS

In the existing condition, the subject property is undeveloped land consisting mostly of grassland with a few forested areas near the northern and southern boundaries. Runoff from the site is collected by natural swales and channels that convey flows to West Kiowa Creek, which carries water from the site. The proposed development does not aim to change these natural drainage

patterns, but rather to preserve them to the extent possible. With this philosophy in mind, culverts were added to the design to convey water under proposed roads as it flows through the site. Culverts will be sized using the Rational Method and the Urban Drainage UD-Culvert spreadsheets. These sizing results will be presented in the Final Drainage Report.

Results of the hydrologic model show that in the existing condition 100-year storm event, 2470.0cfs leaves the site at the northeast corner of the property and in the proposed condition 2437.3cfs leaves the site. This development will not adversely impact the drainageways and related facilities downstream from the development.

CONSTRUCTION PHASING

Due to the size and scope of this project, the site has been broken into phases that will be built one at a time. There are currently 4 phased land releases planned as shown on the Lot Release Exhibit in the Appendix. Culverts and stormwater detention ponds will be installed and staggered according to these releases. However, stormwater flows will be maintained below historic levels through all phases of the project. Stormwater will flow through historic conveyances in areas of the project where construction has not started or impacted the area.

Anticipated Detention Pond Buildout	
Phase 1	Pond 1
Phase 2	Pond 2
Phase 3	Pond 3, 5
Phase 4	Pond 4, 6

A separate hydrology model has been constructed for each of the phases. The results show that outfall flow rates will be below historic levels during buildout for all interim phases of the project.

100Y Flow Rates At Main Outfall	
Historic	2470.0cfs

Phase 1	1826.1cfs
Phase 2	2438.1cfs
Phase 3	2421.1cfs
Phase 4 (final)	2437.3cfs

RISK ASSESSMENT

The site has been further evaluated for future flooding risk with respect to three documented reservoirs upstream from the project. The reservoirs are listed as 1-N-10, 1-P-10, and 1-P-20 in the Kiowa Creek Watershed. The reservoirs were installed as part of jurisdictional flood control and are documented by the state. The Colorado State Dam Safety Engineering office has been contacted. With input criteria from John Hunyadi who oversees jurisdictional dams in this area, the largest of the 3 dams in question has been modeled and results have been provided back to the state. A breaching “sunny day” flow rate of 9500cfs is the largest of the 3 dams and results in a small portion of two proposed lots (lot 24 and 64) being affected. Easements have been added so that no building will occur in these areas and the current low risk level associated with the dams will remain unchanged. An exhibit of the floodplain area associated with the dam failure, and an approval letter from the Colorado Dam Safety Engineering Office is included in the appendix.

DRAINAGE BASIN FEE

Currently the West Kiowa Creek Drainage Basin is not part of the El Paso County Drainage Basin Fee Program.

CONCLUSIONS

This report has been prepared in accordance with El Paso County stormwater criteria. It outlines the routing of the 5-Year and 100-year storm events through the project’s drainage system. The proposed drainage facilities were designed to convey and treat stormwater flows in accordance with the requirements presented by El Paso County and the Colorado Springs

Drainage Criteria Manual. These proposed improvements provide adequate protection to this site without adverse impacts on adjoining upstream and downstream properties.

Consideration has been given to the Four-Step Process outlined in the El Paso County Engineering Criteria Manual for BMP selection as noted below:

Step 1: Employ Runoff Reduction Practices

This project is a low density residential development with lots varying between 2.5 acres and 5 acres in size. The development is designed to have a minimal impact and maintain the rural nature of the existing area. Relative to the size of the site, a small amount of paving is proposed as residential roadways. Roadside ditches and swales will be placed to slow down the velocity and effectively reduce runoff peaks. Full Spectrum Detention Basins will be used to capture stormwater and maintain flows off the site at below historic levels.

Step 2: Stabilize Drainageways

Stabilizing the flow paths with in the development will be addressed by roadside ditch designs, flow controls, and swales. Roadside ditch slopes will be designed to control flow rates, and check dams will be used in areas of steeper slopes to slow storm runoff. Low sloping swales are proposed to direct water from adjacent basins to the full spectrum detention ponds. The swales will be graded to reduce the velocity of the water before it enters the ponds. By controlling stormwater along the flow paths we anticipate minimal erosion.

Step 3: Provide Water Quality Capture Volumes (WQCV)

The development proposes 6 full spectrum detention basins to capture stormwater runoff. These ponds have all been sized using UD-Detention and will provide full spectrum detention. Per ECM Appendix I Section 1.7.1.B in development areas of low

density housing, water quality is not required across all areas, but full spectrum detention ponds are required when stormwater detention is employed.

Step 4: Consider Need for Industrial and Commercial BMP's

There is one proposed lot on the site with an intended commercial use. At this time, the specific type of use for this area has not been determined. The only proposed development for this area currently is a dedicated full spectrum detention pond. When the commercial area is developed, Covering of Storage/Handling Areas and Spill Containment & Control can be addressed if appropriate.

5.0 REFERENCES

1. Urban Storm Drainage Criteria Manuals (Volumes 1, 2, and 3) Urban Drainage & Flood Control District.

2. El Paso County Drainage Criteria Manual, Volumes 1 & 2, Stormwater Quality Policies, Procedures and Best Management Practices (BMPs), Dates May 2014.

3. Federal Emergency Management Agency, Flood Insurance Rate Map Index 08041C0507F and 08041C0530F, dated March 17, 1997.

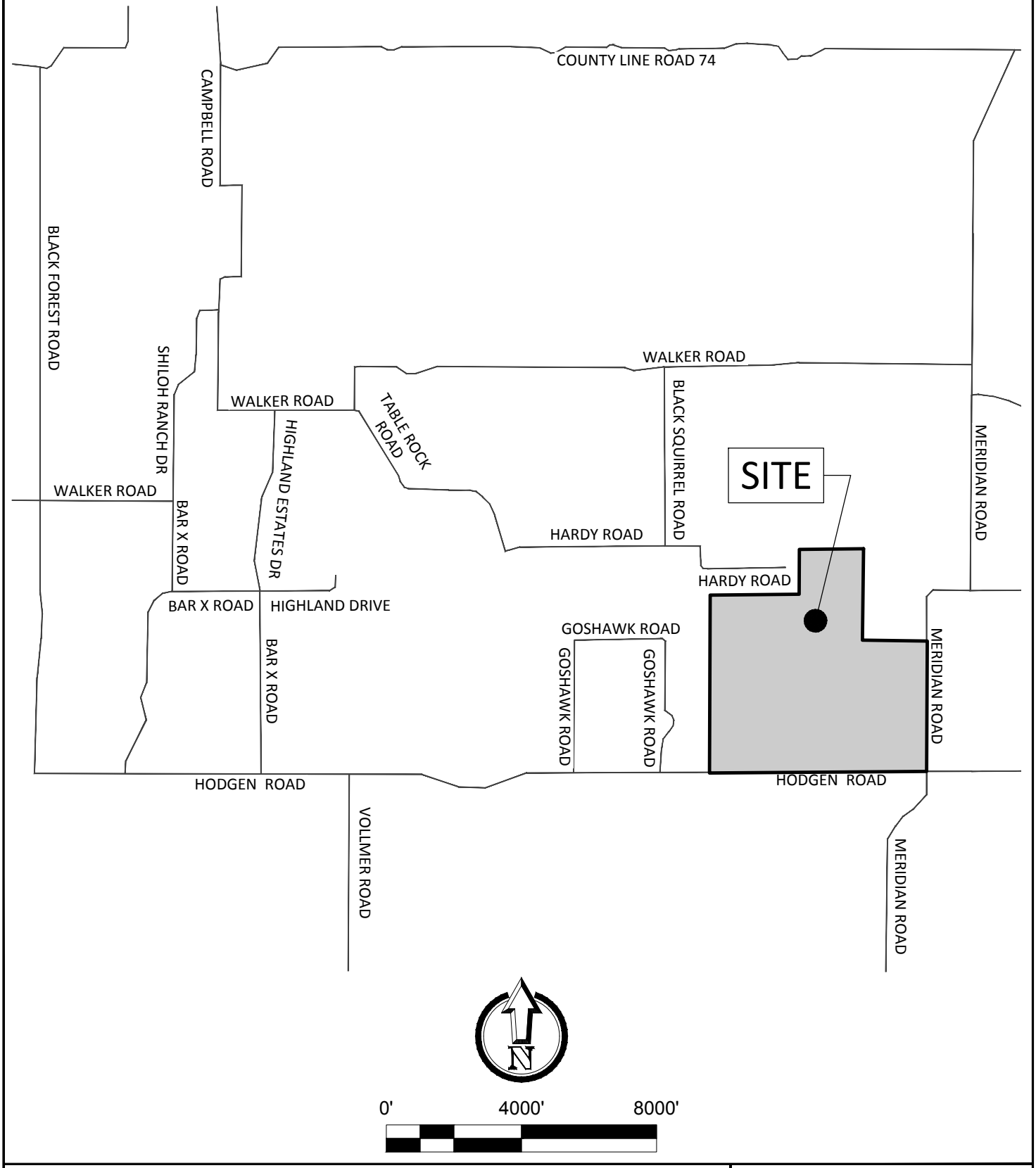
4. Natural Resources Conservation Service, Web Soil Survey, dated October 10, 2017.

5. Entech Engineering Geotechnical Report, Dated October 2, 2018

6. El Paso County Planning Website, Tri-Lakes Drainage and Flood Control Vision: http://dev.adm2.elpasoco.com/Planning/Tri-Lakes/Tri-Drainage.asp

1.0 VICINITY MAP

VICINITY MAP



VICINITY MAP

MCCUNE RANCH SUBDIVISION

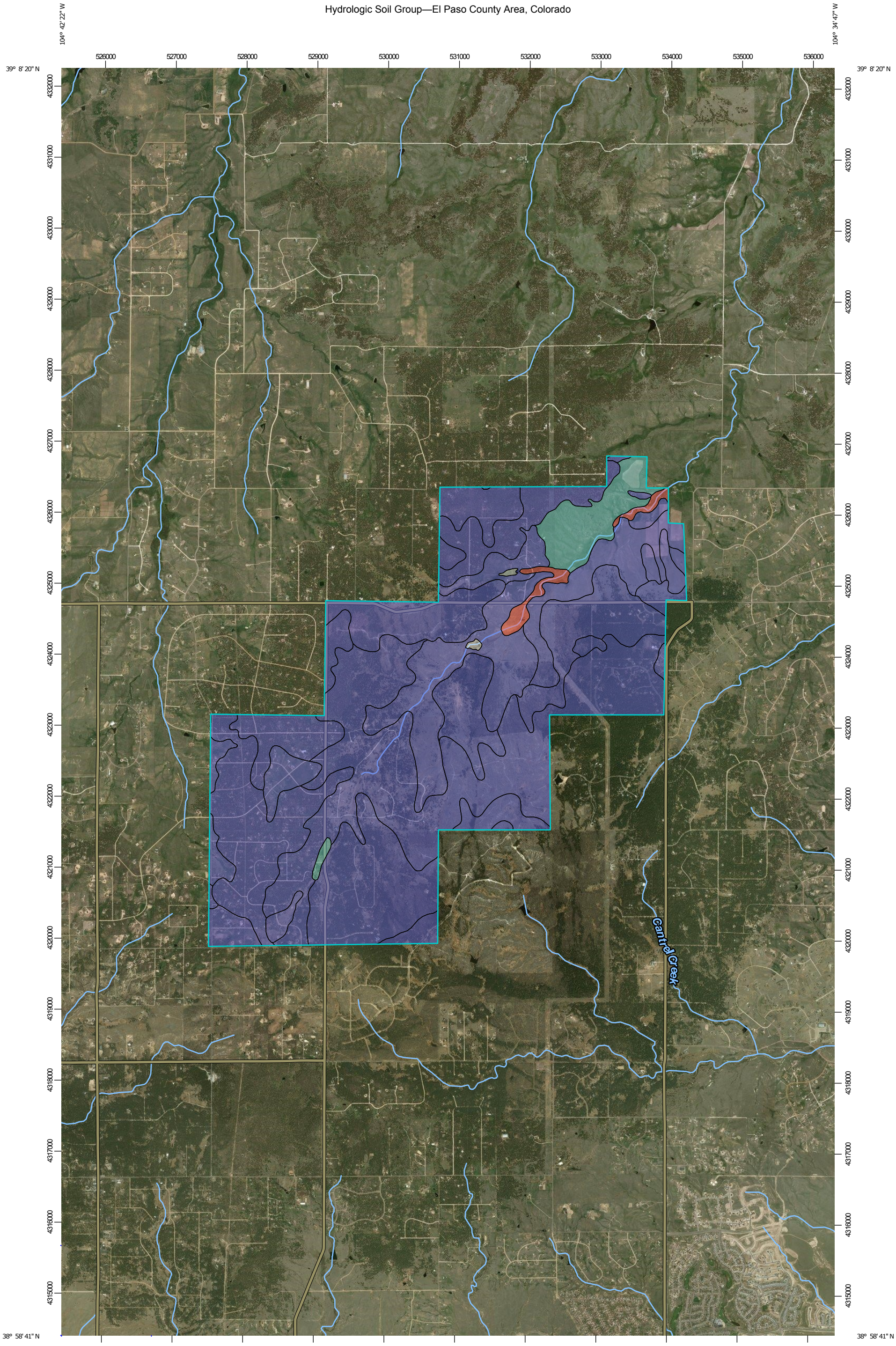
17480 MERIDIAN ROAD
ELBERT, COLORADO

File No.:	
Date:	10/04/2018
Drawn:	JCP
Checked:	LPV
Job No.:	49388

FIGURE 1

VERTEX®

2.0 HYDROLOGIC SOILS MAP



Map Scale: 1:50,000 if printed on B portrait (11" x 17") sheet.

N

Meters
0 500 1000 2000 3000

Feet
0 2000 4000 8000 12000

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 15, Oct 10, 2017

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

Date(s) aerial images were photographed: May 22, 2016—Mar 9, 2017

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Alamosa loam, 1 to 3 percent slopes	D	80.6	1.2%
15	Brussett loam, 3 to 5 percent slopes	B	6.0	0.1%
21	Cruckton sandy loam, 1 to 9 percent slopes	B	4.7	0.1%
25	Elbeth sandy loam, 3 to 8 percent slopes	B	2,081.3	31.8%
26	Elbeth sandy loam, 8 to 15 percent slopes	B	2,075.9	31.7%
34	Holderness loam, 1 to 5 percent slopes	C	15.5	0.2%
36	Holderness loam, 8 to 15 percent slopes	C	278.7	4.3%
40	Kettle gravelly loamy sand, 3 to 8 percent slopes	B	400.4	6.1%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	265.1	4.0%
67	Peyton sandy loam, 5 to 9 percent slopes	B	36.3	0.6%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	38.1	0.6%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	26.0	0.4%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	B	661.6	10.1%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	B	574.4	8.8%
111	Water		10.0	0.2%
Totals for Area of Interest			**6,554.4**	**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.

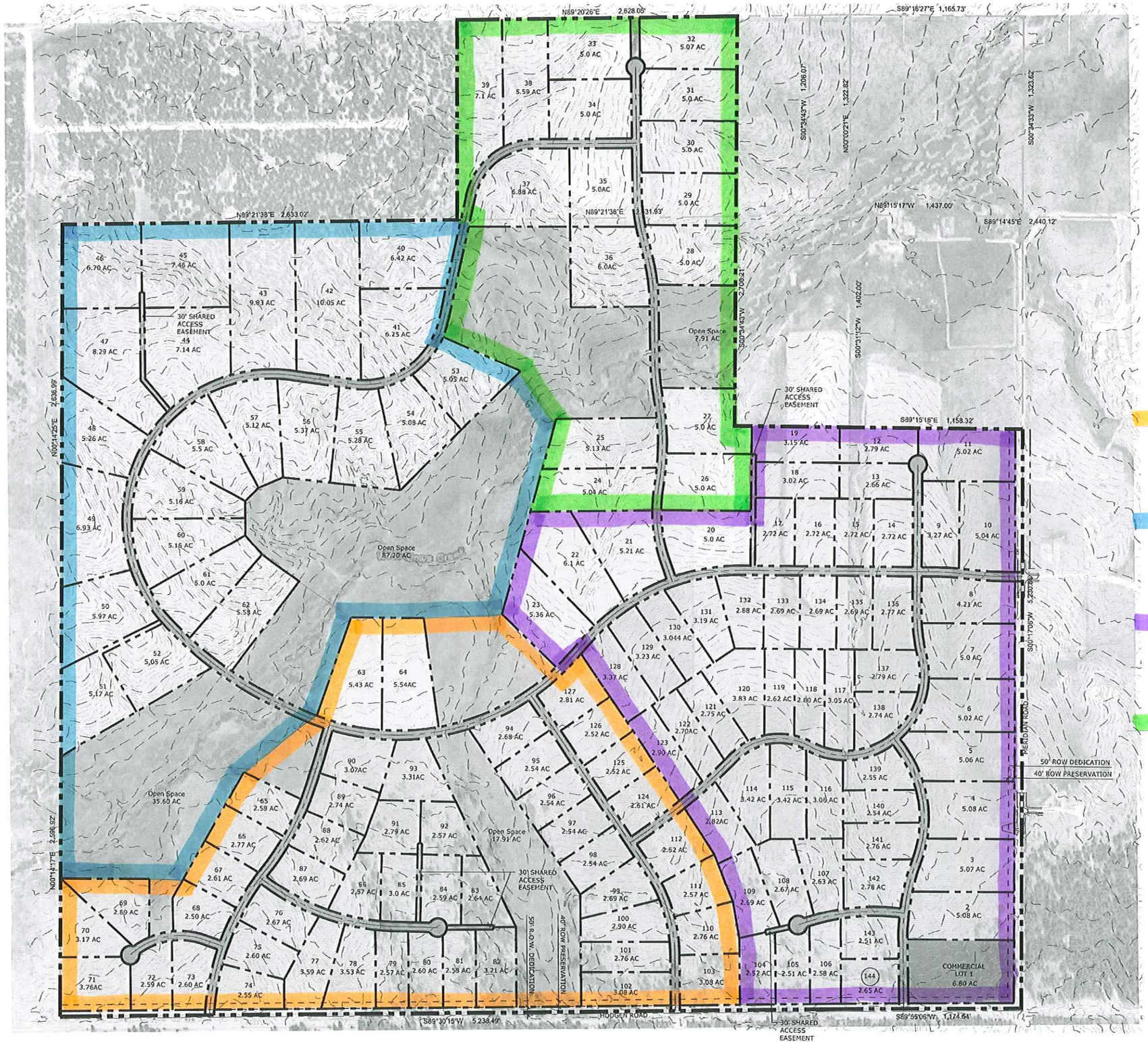
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

3.0 LOT RELEASE EXHIBIT



LOT COUNT

5+ ACRE LOTS = 52
2.5 ACRE LOTS = 91
6.80 ACRE COMMERCIAL = 1
TOTAL = 144

SHARED ACCESS TRACTS = 2.18 AC

OPEN SPACE AREA TOTAL = 148.62 AC

LINEAR FEET ROAD = 28,334

PHASE	LOTS
1	48
2	23
3	56+1
4	16

NORTH

0 150 300 600
SCALE: 1" = 300'

Land Planning
Landscape Architecture
Urban Design

NES

N.E.S. Inc.
619 N. Cascade Avenue, Suite 200
Colorado Springs, CO 80903

Tel. 719.471.0073
Fax 719.471.0267

www.nescolorado.com

McCune Ranch

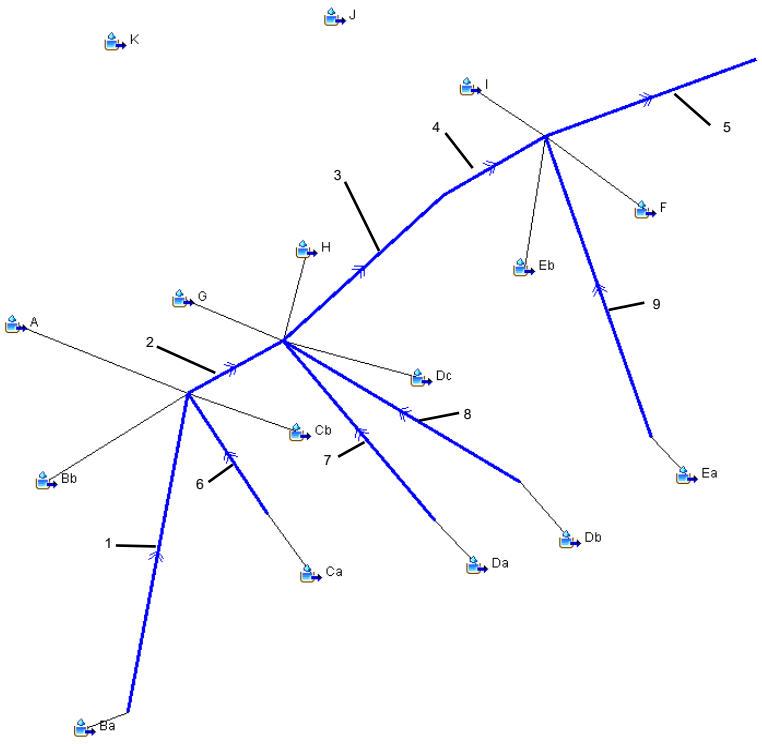
CONCEPT LAYOUT

DATE: 8.29.18
PROJECT MGR: A. BARLOW
PREPARED BY: B. SWENSON

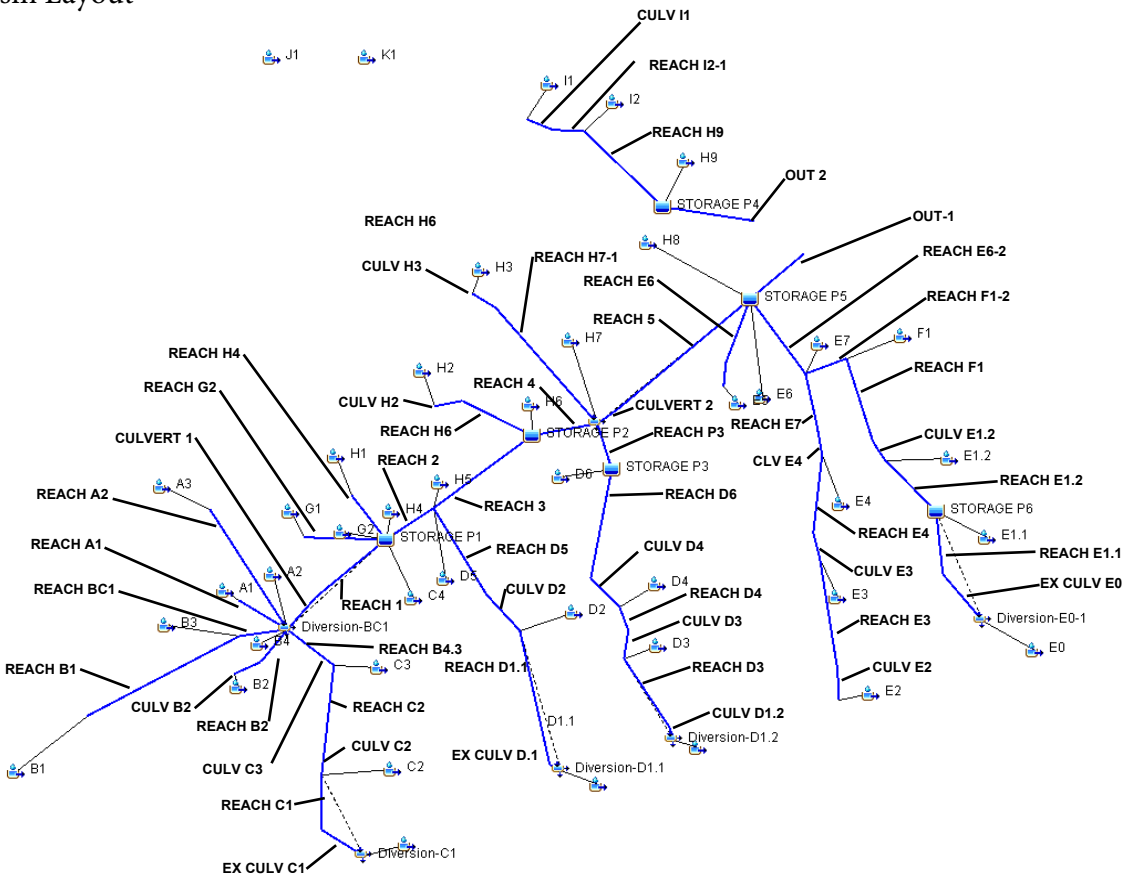
DATE	BY	DESCRIPTION

4.1 MODEL SCHEMATICS

Existing Basin Layout



Proposed Basin Layout



4.2 FRONTAL STORM RAIN GAGE DATA

Frontal Storm Rain Gage

Time	5Y Values	100Y Values	Time	5Y Values	100Y Values
0:00	0	0	12:00	1.7901	3.0498
0:06	0.00273	0.00465	12:06	1.84129	3.13702
0:12	0.00545	0.00929	12:12	1.88633	3.21374
0:18	0.00824	0.01403	12:18	1.92521	3.27998
0:24	0.01102	0.01877	12:24	1.95793	3.33574
0:30	0.01385	0.0236	12:30	1.9845	3.381
0:36	0.01669	0.02843	12:36	2.00729	3.41982
0:42	0.01958	0.03335	12:42	2.02867	3.45626
0:48	0.02246	0.03827	12:48	2.04865	3.4903
0:54	0.02541	0.04329	12:54	2.06723	3.52194
1:00	0.02835	0.0483	13:00	2.0844	3.5512
1:06	0.03135	0.05341	13:06	2.10049	3.57862
1:12	0.03434	0.05851	13:12	2.11583	3.60474
1:18	0.0374	0.06371	13:18	2.13041	3.62958
1:24	0.04045	0.06891	13:24	2.14423	3.65314
1:30	0.04355	0.0742	13:30	2.1573	3.6754
1:36	0.04666	0.07949	13:36	2.16972	3.69656
1:42	0.04982	0.08487	13:42	2.1816	3.7168
1:48	0.05297	0.09025	13:48	2.19294	3.73612
1:54	0.05619	0.09573	13:54	2.20374	3.75452
2:00	0.0594	0.1012	14:00	2.214	3.772
2:06	0.06267	0.10677	14:06	2.22391	3.78888
2:12	0.06593	0.11233	14:12	2.2336	3.8054
2:18	0.06926	0.11799	14:18	2.24313	3.82163
2:24	0.07258	0.12365	14:24	2.25245	3.8375
2:30	0.07595	0.1294	14:30	2.2616	3.8531
2:36	0.07933	0.13515	14:36	2.27054	3.86832
2:42	0.08276	0.14099	14:42	2.27931	3.88327
2:48	0.08618	0.14683	14:48	2.28787	3.89786
2:54	0.08967	0.15277	14:54	2.29627	3.91216
3:00	0.09315	0.1587	15:00	2.30445	3.9261
3:06	0.09669	0.16473	15:06	2.31247	3.93976
3:12	0.10022	0.17075	15:12	2.32027	3.95306
3:18	0.10381	0.17687	15:18	2.32791	3.96607
3:24	0.10741	0.18299	15:24	2.33534	3.97872
3:30	0.11105	0.1892	15:30	2.3426	3.9911
3:36	0.1147	0.19541	15:36	2.34965	4.0031
3:42	0.1184	0.20171	15:42	2.35653	4.01483
3:48	0.12209	0.20801	15:48	2.3632	4.0262
3:54	0.12585	0.21441	15:54	2.36971	4.03728
4:00	0.1296	0.2208	16:00	2.376	4.048
4:06	0.13341	0.22729	16:06	2.38218	4.05853
4:12	0.13727	0.23386	16:12	2.38828	4.06893
4:18	0.14118	0.24053	16:18	2.39433	4.07923
4:24	0.14515	0.2473	16:24	2.4003	4.0894
4:30	0.14918	0.25415	16:30	2.40621	4.09947
4:36	0.15325	0.2611	16:36	2.41205	4.10941
4:42	0.15738	0.26813	16:42	2.41782	4.11925
4:48	0.16157	0.27526	16:48	2.42352	4.12896
4:54	0.16581	0.28249	16:54	2.42916	4.13857
5:00	0.1701	0.2898	17:00	2.43473	4.14805
5:06	0.17445	0.29721	17:06	2.44023	4.15743
5:12	0.17885	0.3047	17:12	2.44566	4.16668
5:18	0.1833	0.31229	17:18	2.45103	4.17583
5:24	0.18781	0.31998	17:24	2.45632	4.18485
5:30	0.19238	0.32775	17:30	2.46156	4.19377
5:36	0.19699	0.33562	17:36	2.46672	4.20256
5:42	0.20166	0.34357	17:42	2.47182	4.21125
5:48	0.20639	0.35162	17:48	2.47685	4.21981
5:54	0.21117	0.35977	17:54	2.48181	4.22827
6:00	0.216	0.368	18:00	2.4867	4.2366
6:06	0.22089	0.37633	18:06	2.49153	4.24483
6:12	0.22583	0.38474	18:12	2.49629	4.25293
6:18	0.23082	0.39325	18:18	2.50098	4.26093
6:24	0.23587	0.40186	18:24	2.5056	4.2688
6:30	0.24098	0.41055	18:30	2.51016	4.27657
6:36	0.24613	0.41934	18:36	2.51465	4.28421
6:42	0.25134	0.42821	18:42	2.51907	4.29175
6:48	0.25661	0.43718	18:48	2.52342	4.29916
6:54	0.26193	0.44625	18:54	2.52771	4.30647
7:00	0.2673	0.4554	19:00	2.53192	4.31365
7:06	0.27273	0.46465	19:06	2.53608	4.32073
7:12	0.27821	0.47398	19:12	2.54016	4.32768
7:18	0.28374	0.48341	19:18	2.54418	4.33453
7:24	0.28933	0.49294	19:24	2.54812	4.34125
7:30	0.29498	0.50255	19:30	2.55201	4.34787
7:36	0.30067	0.51226	19:36	2.55582	4.35436
7:42	0.30642	0.52205	19:42	2.55957	4.36075
7:48	0.31223	0.53194	19:48	2.56325	4.36701
7:54	0.31809	0.54193	19:54	2.56686	4.37317
8:00	0.324	0.552	20:00	2.5704	4.3792
8:06	0.33008	0.56235	20:06	2.57391	4.38518
8:12	0.33642	0.57316	20:12	2.57739	4.39111
8:18	0.34304	0.58443	20:18	2.58088	4.39705
8:24	0.34992	0.59616	20:24	2.58433	4.40294
8:30	0.35708	0.60835	20:30	2.58779	4.40882
8:36	0.3645	0.621	20:36	2.59122	4.41467
8:42	0.3722	0.63411	20:42	2.59465	4.42051
8:48	0.38016	0.64768	20:48	2.59805	4.4263
8:54	0.3884	0.66171	20:54	2.60145	4.4321
9:00	0.3969	0.6762	21:00	2.60483	4.43785
9:06	0.40554	0.69092	21:06	2.6082	4.4436
9:12	0.41418	0.70564	21:12	2.61155	4.4493
9:18	0.42282	0.72036	21:18	2.6149	4.45501
9:24	0.43146	0.73508	21:24	2.61822	4.46067
9:30	0.4401	0.7498	21:30	2.62154	4.46632
9:36	0.44896	0.76489	21:36	2.62483	4.47194
9:42	0.45824	0.78071	21:42	2.62813	4.47755
9:48	0.46796	0.79727	21:48	2.63139	4.48311
9:54	0.47812	0.81457	21:54	2.63466	4.48868
10:00	0.4887	0.8326	22:00	2.6379	4.4942
10:06	0.49982	0.85155	22:06	2.64114	4.49972
10:12	0.5116	0.87161	22:12	2.64435	4.50519
10:18	0.52402	0.89277	22:18	2.64757	4.51067
10:24	0.53708	0.91503	22:24	2.65075	4.5161
10:30	0.5508	0.9384	22:30	2.65394	4.52152
10:36	0.56538	0.96324	22:36	2.6571	4.52691
10:42	0.58104	0.98992	22:42	2.66026	4.53229
10:48	0.59778	1.01844	22:48	2.66339	4.53762
10:54	0.6156	1.0488	22:54	2.66652	4.54296
11:00	0.6345	1.081	23:00	2.66963	4.54825
11:06	0.65524	1.11633	23:06	2.67273	4.55354
11:12	0.67856	1.15607	23:12	2.67581	4.55878
11:18	0.70448	1.20023	23:18	2.67889	4.56403
11:24	0.733	1.24881	23:24	2.68194	4.56923
11:30	0.7641	1.3018	23:30	2.68499	4.57442
11:36	0.82847	1.41146	23:36	2.68801	4.57958
11:42	0.95677	1.63006	23:42	2.69104	4.58473
11:48	1.16313	1.98163	23:48	2.69403	4.58983
11:54	1.53322	2.61216	23:54	2.69703	4.59494
			24:00:00	2.7	4.6

4.3 INITIAL ABSTRACTION CALCULATIONS

Ia = 0.1[(1000/CN) - 10]

Existing Sub-Basin Initial Abstraction Summary		
Sub-Basin	**Curve Number**	**Initial Abstraction**
A	61.83	0.617
Ba	60.34	0.657
Bb	69.79	0.433
Ca	60	0.667
Cb	68.7	0.456
Da	60	0.667
Db	60	0.667
Dc	67.7	0.477
Ea	60	0.667
Eb	67.2	0.488
F	69	0.449
G	74.5	0.342
H	71.76	0.394
I	79	0.266
J	69.5	0.439
K	76	0.316

Proposed Sub-Basin Initial Abstraction Summary		
Sub-Basin	**Curve Number**	**Initial Abstraction**
A1	60.36	0.657
A2	66	0.515
A3	76.5	0.307
B1	60.34	0.657
B2	64	0.563
B3	65.1	0.536
B4	68.5	0.460
C1	60	0.667
C2	60	0.667
C3	64	0.563
C4	65	0.538
D1.1	60	0.667
D1.2	60	0.667
D2	64.75	0.544
D3	64	0.563
D4	64	0.563
D5	67.2	0.488
D6	61.65	0.622
E0	60	0.667
E1.1	76	0.316
E1.2	62	0.613
E2	64	0.563
E3	64	0.563
E4	64	0.563
E5	64	0.563
E6	62.4	0.603
E7	62	0.613
F1	60.4	0.656
G1	66	0.515
G2	72.7	0.376
H1	70.8	0.412
H2	67.2	0.488
H3	66	0.515
H4	73.75	0.356
H5	74.8	0.337
H6	66.6	0.502
H7	70.5	0.418
H8	74.55	0.341
H9	70.8	0.412
I1	72	0.389
I2	72	0.389
J1	69.5	0.439
K1	76	0.316

4.4 TIME OF CONCENTRATION CALCULATIONS

Subbasin Hydrology

Subbasin : A

Input Data

Area (ac) 915.40
Weighted Curve Number 61.83
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	823.86	B	60.00
Pasture, grassland, or range, Fair	9.15	D	84.00
Pasture, grassland, or range, Fair	64.08	C	79.00
Pasture, grassland, or range, Fair	9.15	B	69.00
5 Acre Lots, 7% Impervious	9.15	D	77.00
Composite Area & Weighted CN	915.39		61.83

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

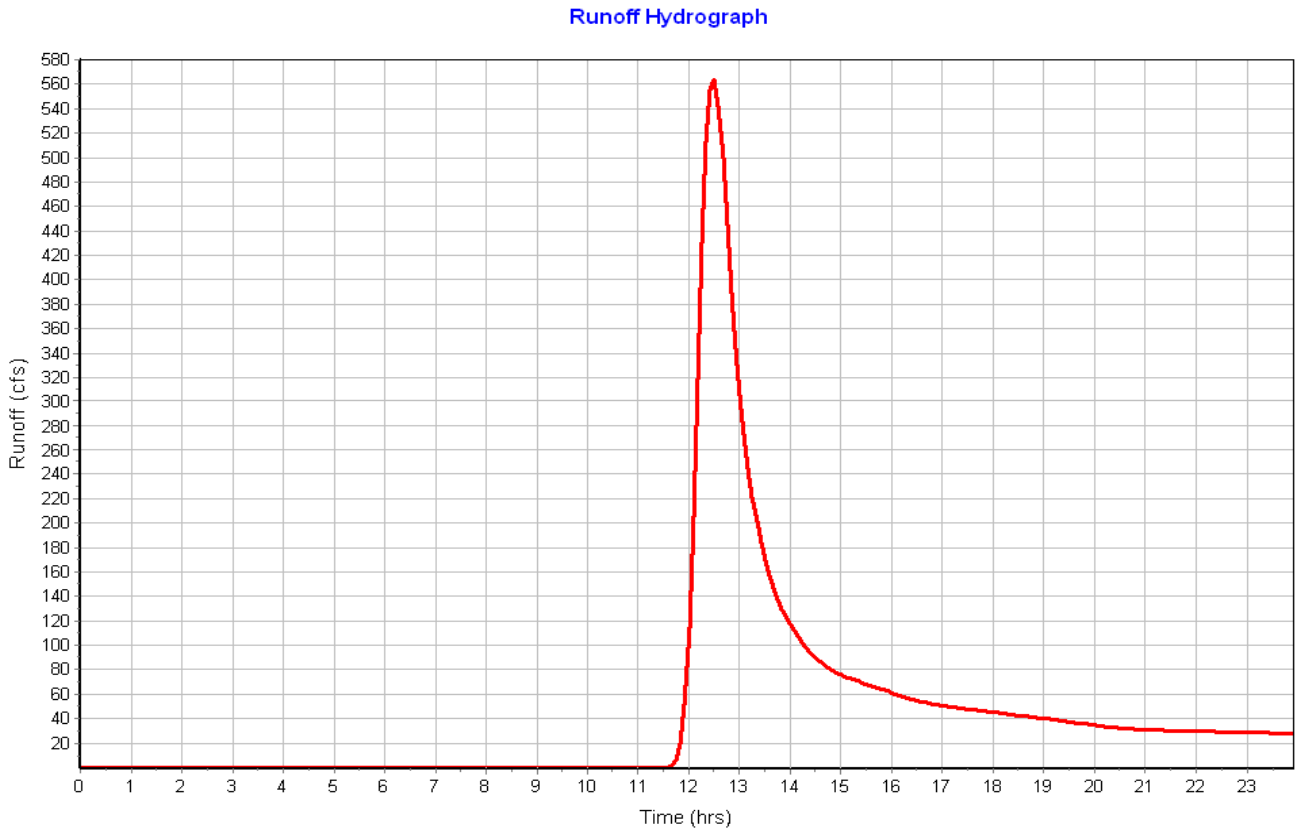
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	10.62	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	10494	0.00	0.00
Channel Slope (%) :	2	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	8.20	0.00	0.00
Computed Flow Time (min) :	21.34	0.00	0.00

Total TOC (min) 53.01

Subbasin : A


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
580
560
540
520
500
480
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : Ba

Input Data

Area (ac) 3836.70
Weighted Curve Number 60.34
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	3759.97	B	60.00
5 Acre Lots, 7% Impervious	76.73	D	77.00
Composite Area & Weighted CN	3836.70		60.34

Time of Concentration

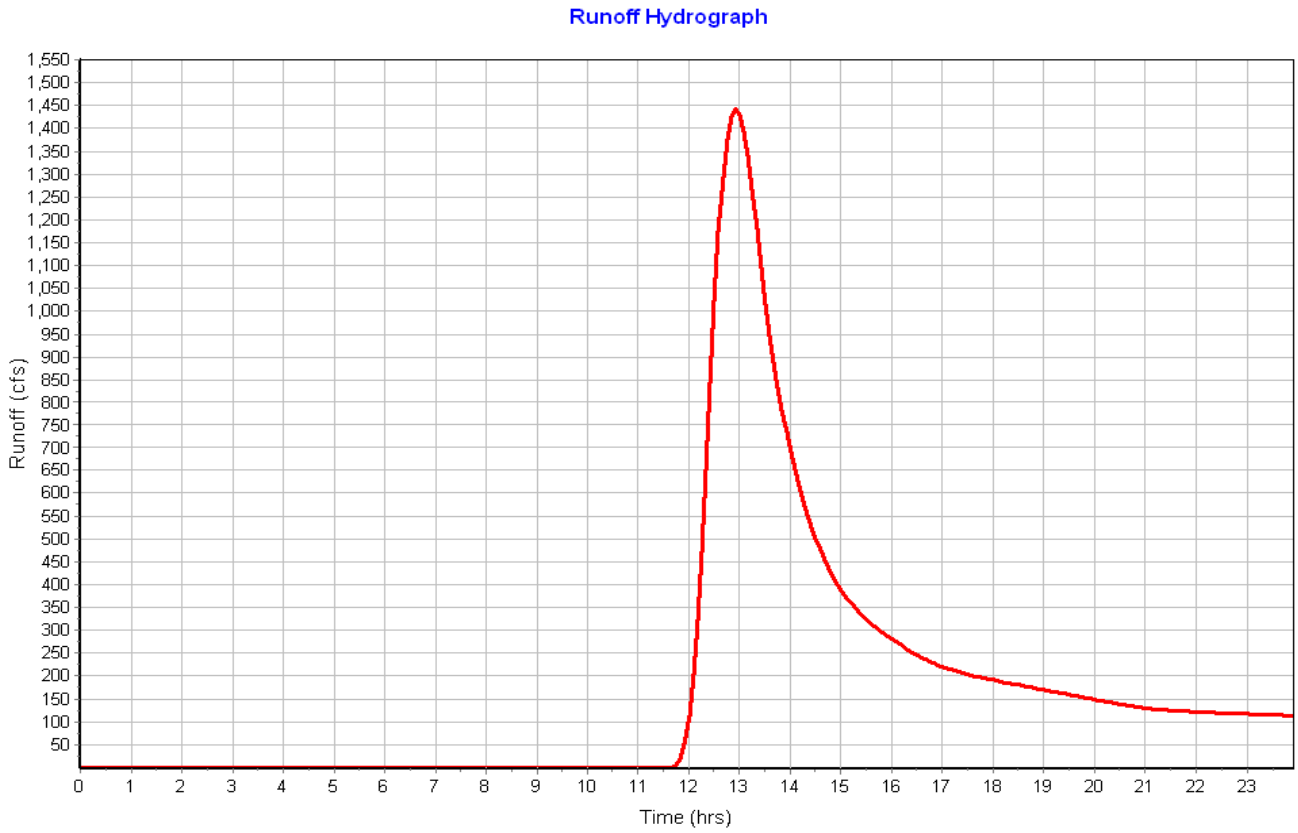
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.40	0.00	0.00
Computed Flow Time (min) :	11.90	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	23284	0.00	0.00
Channel Slope (%) :	1.4	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	6.86	0.00	0.00
Computed Flow Time (min) :	56.59	0.00	0.00

Total TOC (min) 89.56

Subbasin : Ba


Runoff Hydrograph
Runoff (cfs)
1,550
1,500
1,450
1,400
1,350
1,300
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time (hrs)

Subbasin : Bb

Input Data

Area (ac) 100.60
Weighted Curve Number 69.79
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	90.54	B	69.00
Pasture, grassland, or range, Fair	5.03	D	84.00
Composite Area & Weighted CN	95.57		69.79

Time of Concentration

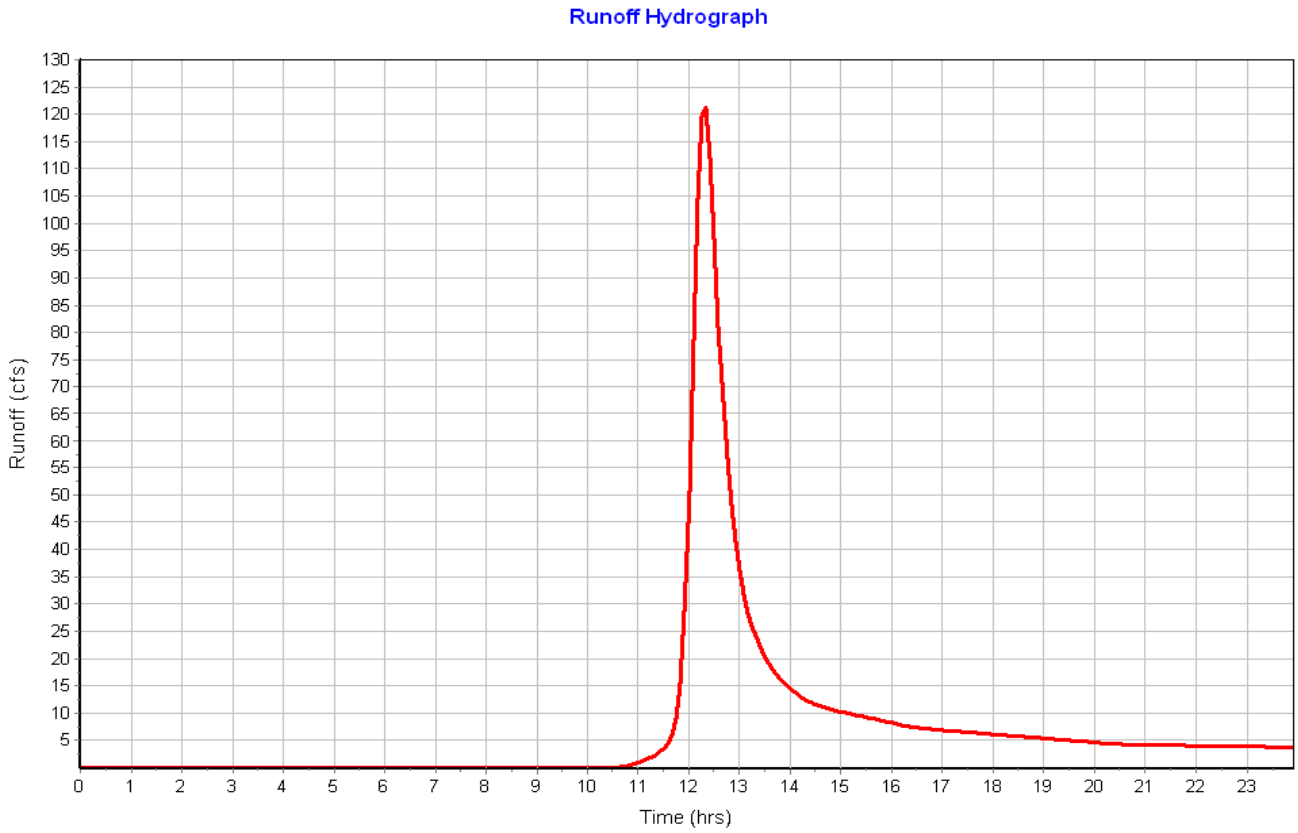
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.48	0.00	0.00
Computed Flow Time (min) :	11.26	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	4140	0.00	0.00
Channel Slope (%) :	2.4	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	8.98	0.00	0.00
Computed Flow Time (min) :	7.69	0.00	0.00

Total TOC (min) 40.00

Subbasin : Bb


Runoff Hydrograph
Runoff (cfs)
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
Time (hrs)

Subbasin : Ca

Input Data

Area (ac) 162.70
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	162.70	B	60.00
Composite Area & Weighted CN	162.70		60.00

Time of Concentration

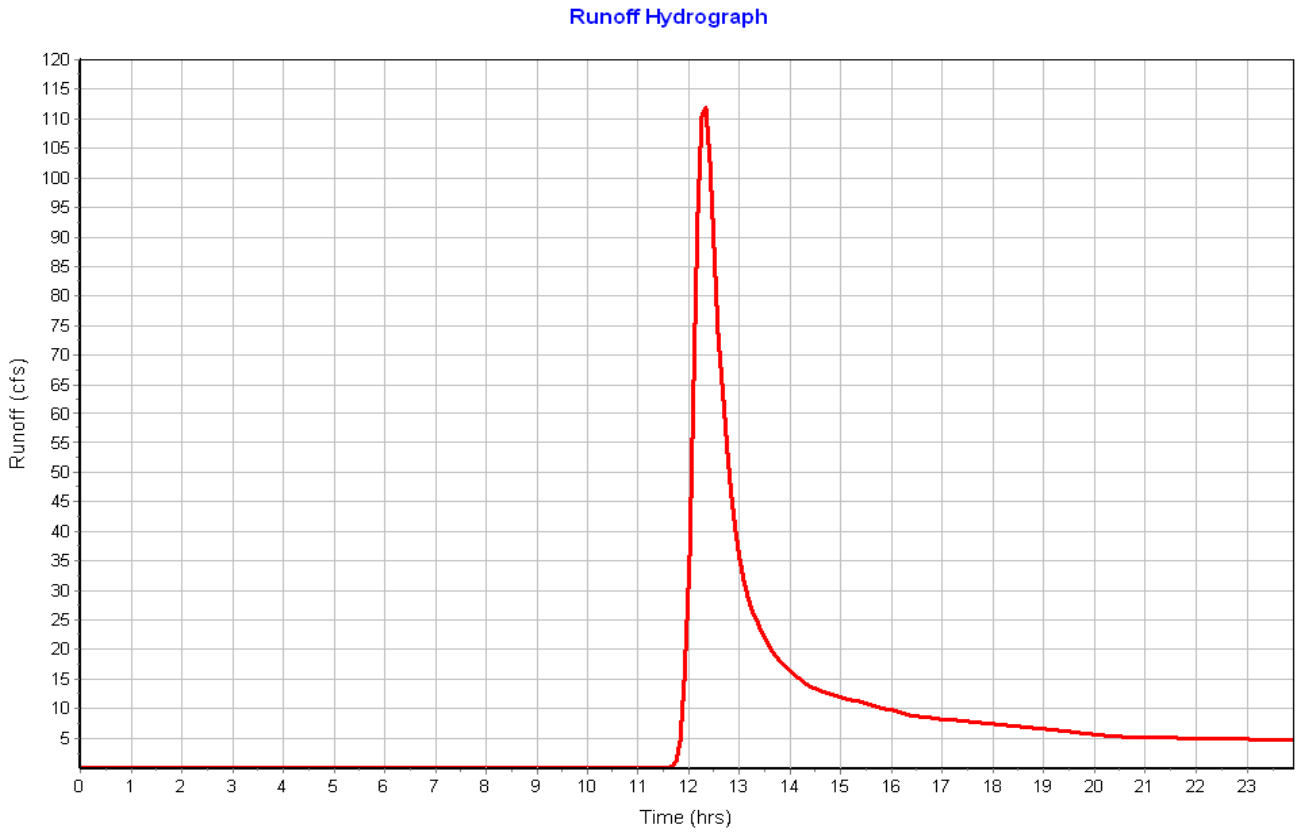
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.42	0.00	0.00
Computed Flow Time (min) :	11.74	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	3099	0.00	0.00
Channel Slope (%) :	4.1	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	11.73	0.00	0.00
Computed Flow Time (min) :	4.40	0.00	0.00

Total TOC (min) 37.20

Subbasin : Ca


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : Cb

Input Data

Area (ac) 70.00
Weighted Curve Number 68.70
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	10.50	B	65.00
Pasture, grassland, or range, Fair	2.10	C	79.00
Pasture, grassland, or range, Fair	57.40	B	69.00
Composite Area & Weighted CN	70.00		68.70

Time of Concentration

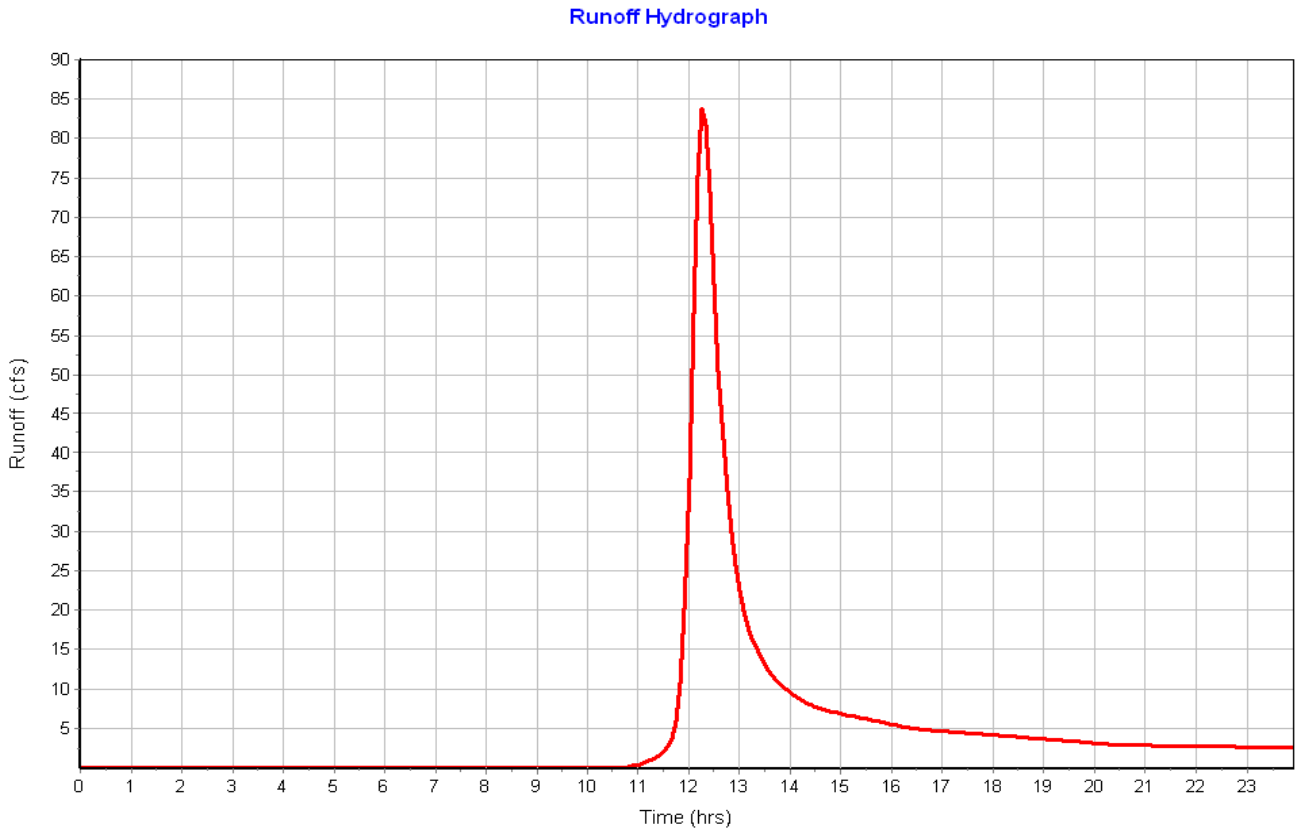
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.6	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.33	0.00	0.00
Computed Flow Time (min) :	12.53	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	2084	0.00	0.00
Channel Slope (%) :	3.6	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.08	0.00	0.00
Computed Flow Time (min) :	3.83	0.00	0.00

Total TOC (min) 37.42

Subbasin : Cb


Runoff Hydrograph
Runoff (cfs)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time (hrs)

Subbasin : Da

Input Data

Area (ac) 161.30
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	161.30	B	60.00
Composite Area & Weighted CN	161.30		60.00

Time of Concentration

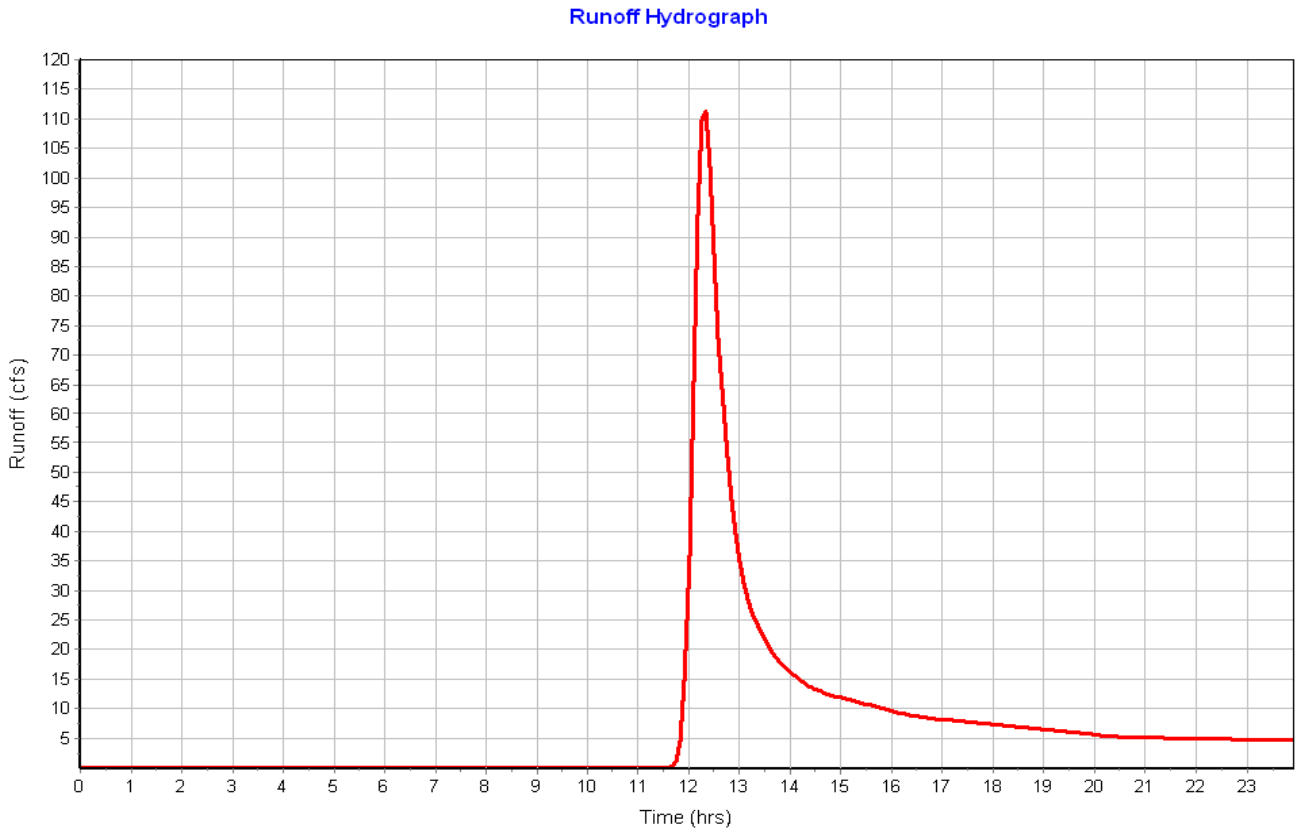
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5.7	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.19	0.00	0.00
Computed Flow Time (min) :	14.01	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1601	0.00	0.00
Channel Slope (%) :	5.7	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	13.84	0.00	0.00
Computed Flow Time (min) :	1.93	0.00	0.00

Total TOC (min) 36.99

Subbasin : Da


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : Db

Input Data

Area (ac) 49.90
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	49.90	B	60.00
Composite Area & Weighted CN	49.90		60.00

Time of Concentration

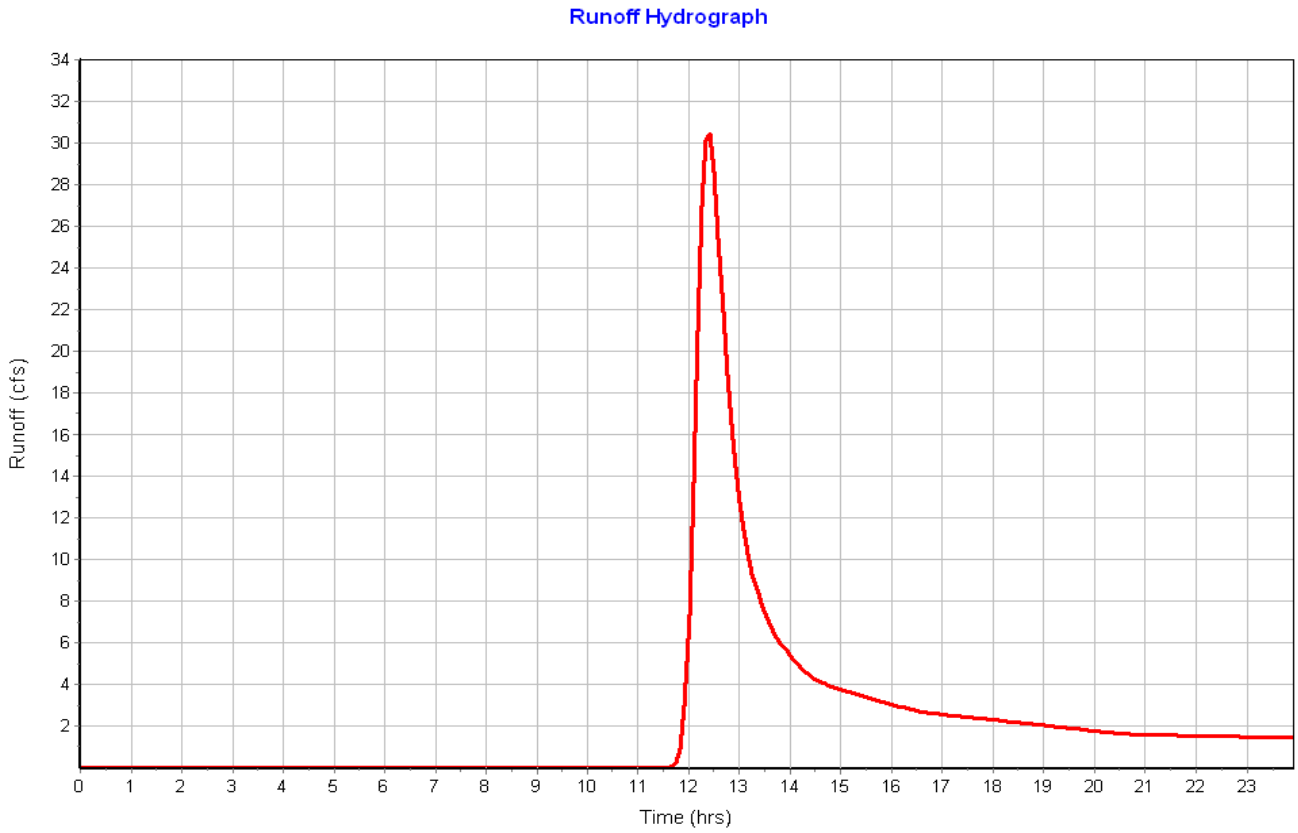
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	2.48	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	0.79	0.00	0.00
Computed Flow Time (min) :	21.10	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	922	0.00	0.00
Channel Slope (%) :	2.48	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	7.53	0.00	0.00
Computed Flow Time (min) :	2.04	0.00	0.00

Total TOC (min) 44.20

Subbasin : Db


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : Dc

Input Data

Area (ac) 249.70
Weighted Curve Number 67.70
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	83.80	B	65.00
Pasture, grassland, or range, Fair	4.19	D	84.00
Pasture, grassland, or range, Fair	121.51	B	69.00
Composite Area & Weighted CN	209.50		67.70

Time of Concentration

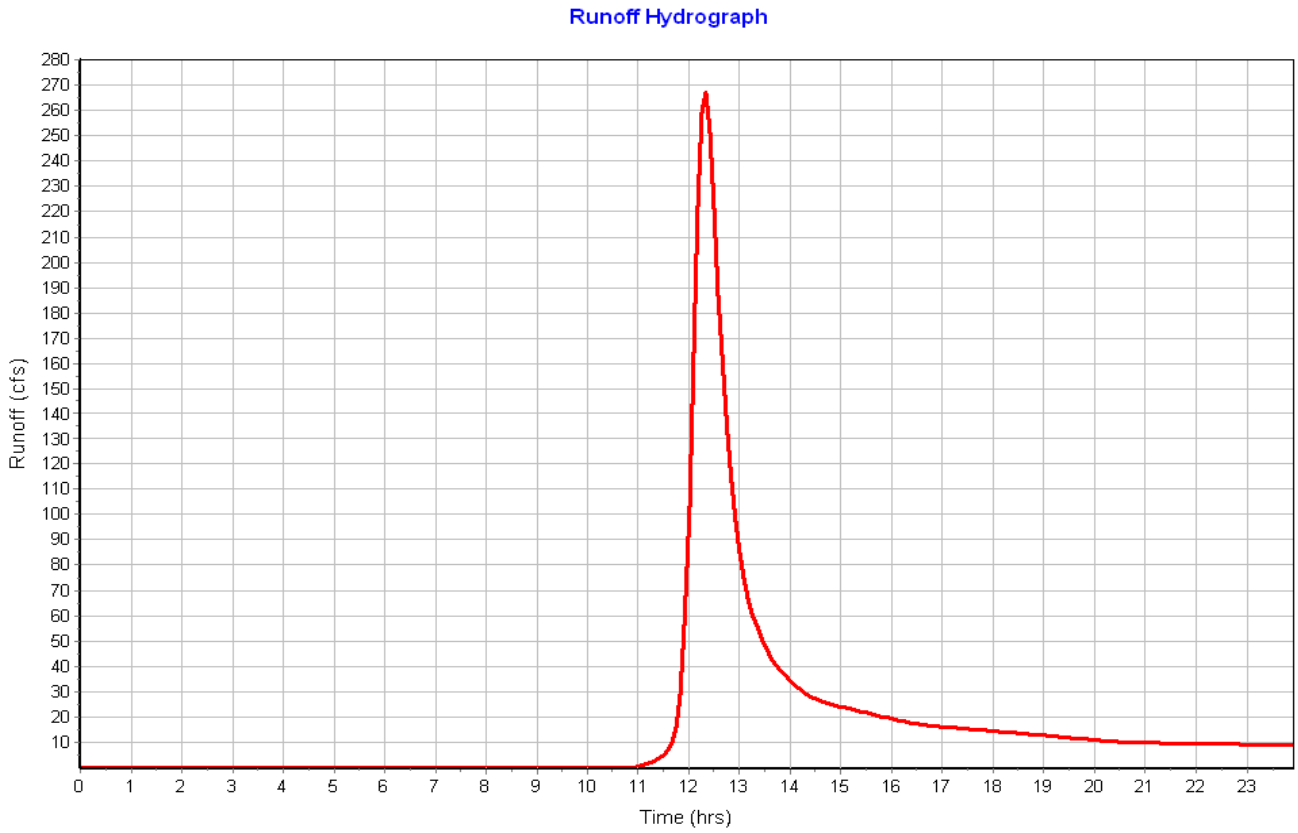
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.21	0.00	0.00
Computed Flow Time (min) :	13.77	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	3678	0.00	0.00
Channel Slope (%) :	3	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	10.04	0.00	0.00
Computed Flow Time (min) :	6.11	0.00	0.00

Total TOC (min) 40.94

Subbasin : Dc


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : Ea

Input Data

Area (ac) 37.90
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	37.90	B	60.00
Composite Area & Weighted CN	37.90		60.00

Time of Concentration

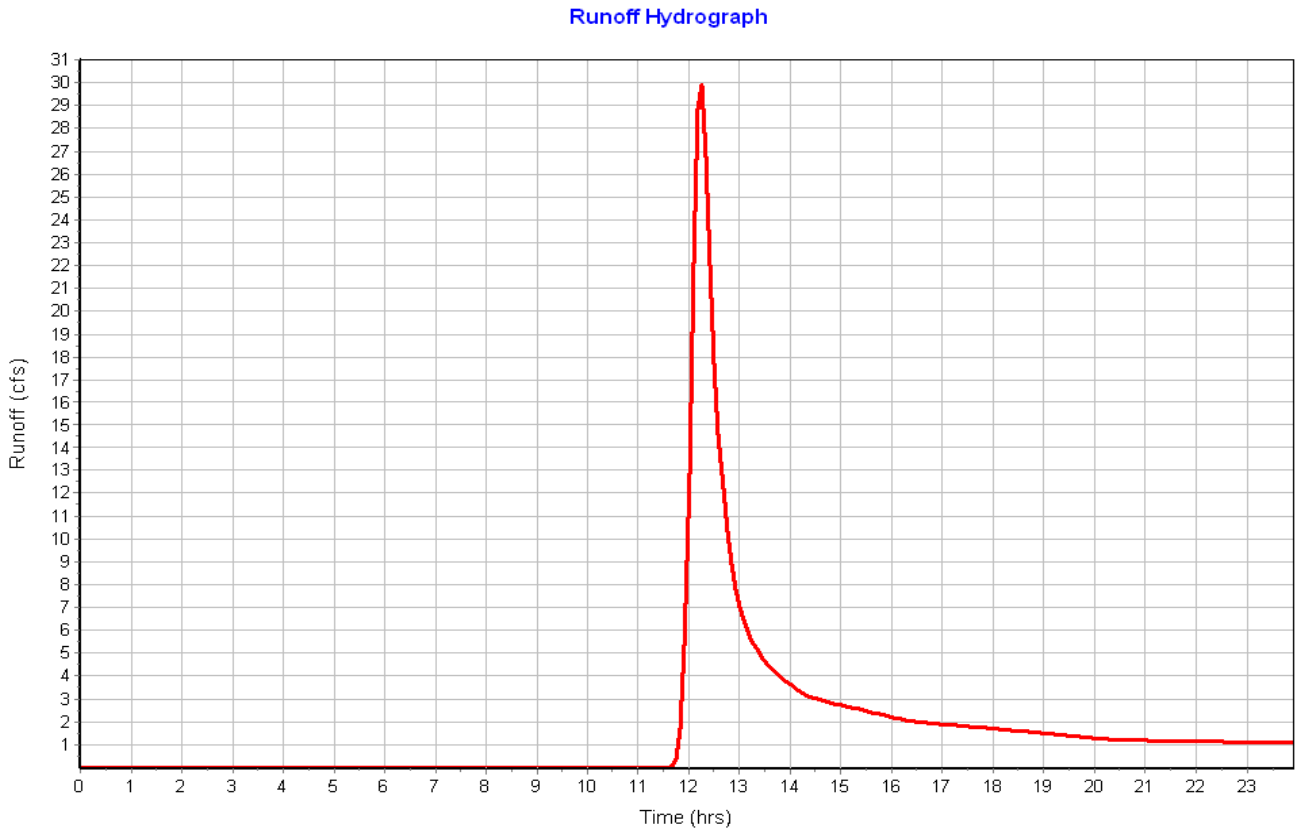
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	4.9	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.11	0.00	0.00
Computed Flow Time (min) :	7.51	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1227	0.00	0.00
Channel Slope (%) :	4.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.59	0.00	0.00
Computed Flow Time (min) :	1.93	0.00	0.00

Total TOC (min) 30.50

Subbasin : Ea


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Subbasin : Eb

Input Data

Area (ac) 74.60
Weighted Curve Number 67.20
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	91.84	B	69.00
5 Acre Lots, 7% Impervious	22.96	B	60.00
Composite Area & Weighted CN	114.80		67.20

Time of Concentration

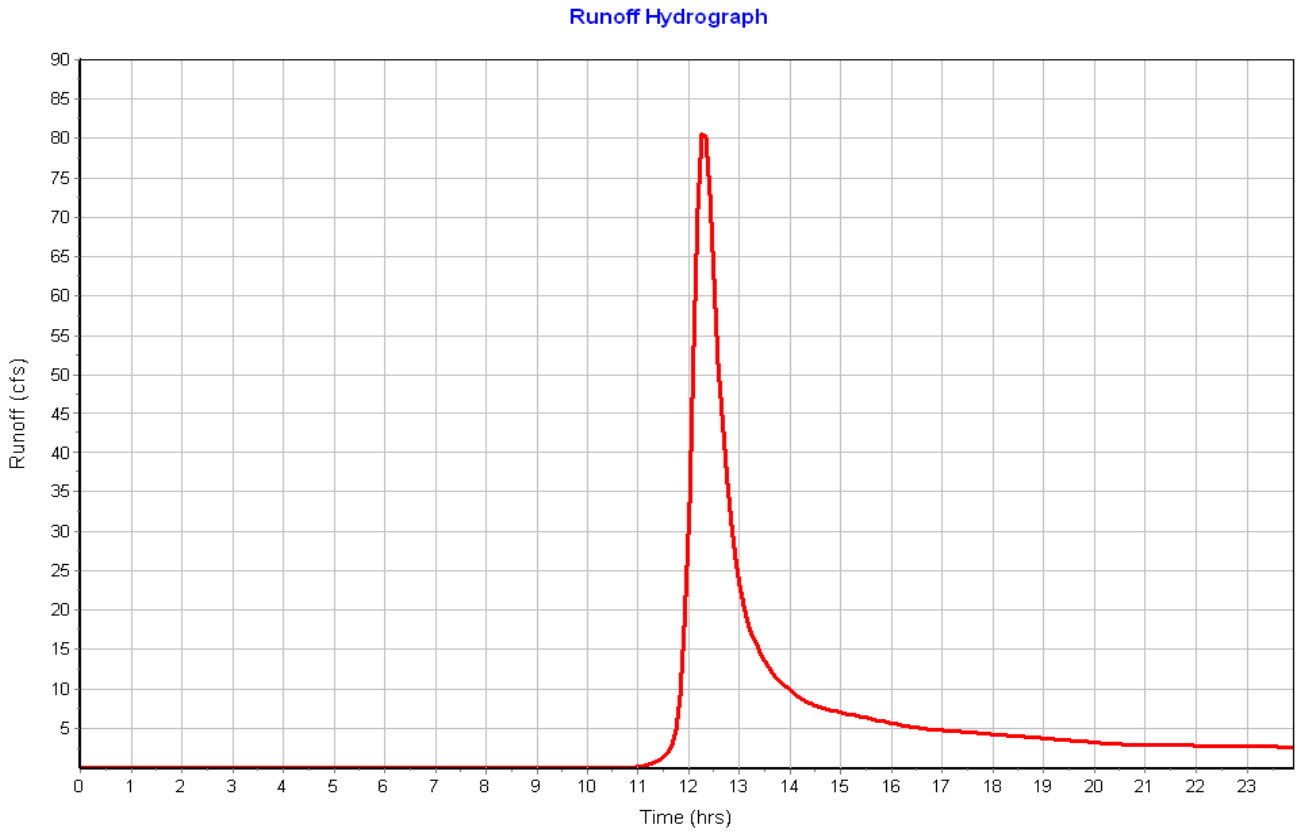
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.36	0.00	0.00
Computed Flow Time (min) :	12.25	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	2766	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.32	0.00	0.00
Computed Flow Time (min) :	4.94	0.00	0.00

Total TOC (min) 38.26

Subbasin : Eb


Runoff Hydrograph
Runoff (cfs)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time (hrs)

Subbasin : F

Input Data

Area (ac) 44.50
Weighted Curve Number 69.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	44.50	B	69.00
Composite Area & Weighted CN	44.50		69.00

Time of Concentration

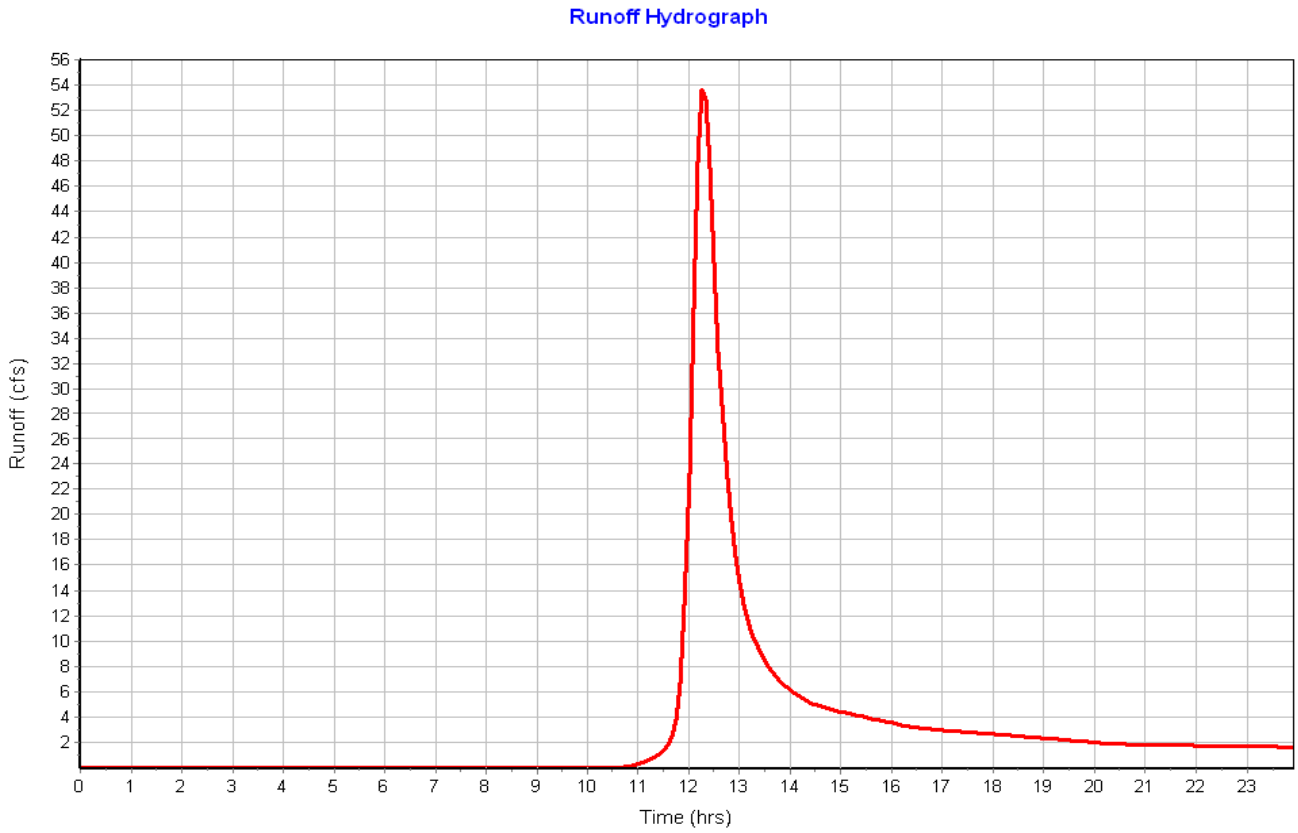
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.25	0.00	0.00
Computed Flow Time (min) :	13.33	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1707	0.00	0.00
Channel Slope (%) :	3.2	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	8.56	0.00	0.00
Computed Flow Time (min) :	3.32	0.00	0.00

Total TOC (min) 37.72

Subbasin : F


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
56
54
52
50
48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
10
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18
19
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21
22
23

Subbasin : G

Input Data

Area (ac) 107.60
Weighted Curve Number 74.50
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	59.18	C	79.00
Pasture, grassland, or range, Fair	48.42	B	69.00
Composite Area & Weighted CN	107.60		74.50

Time of Concentration

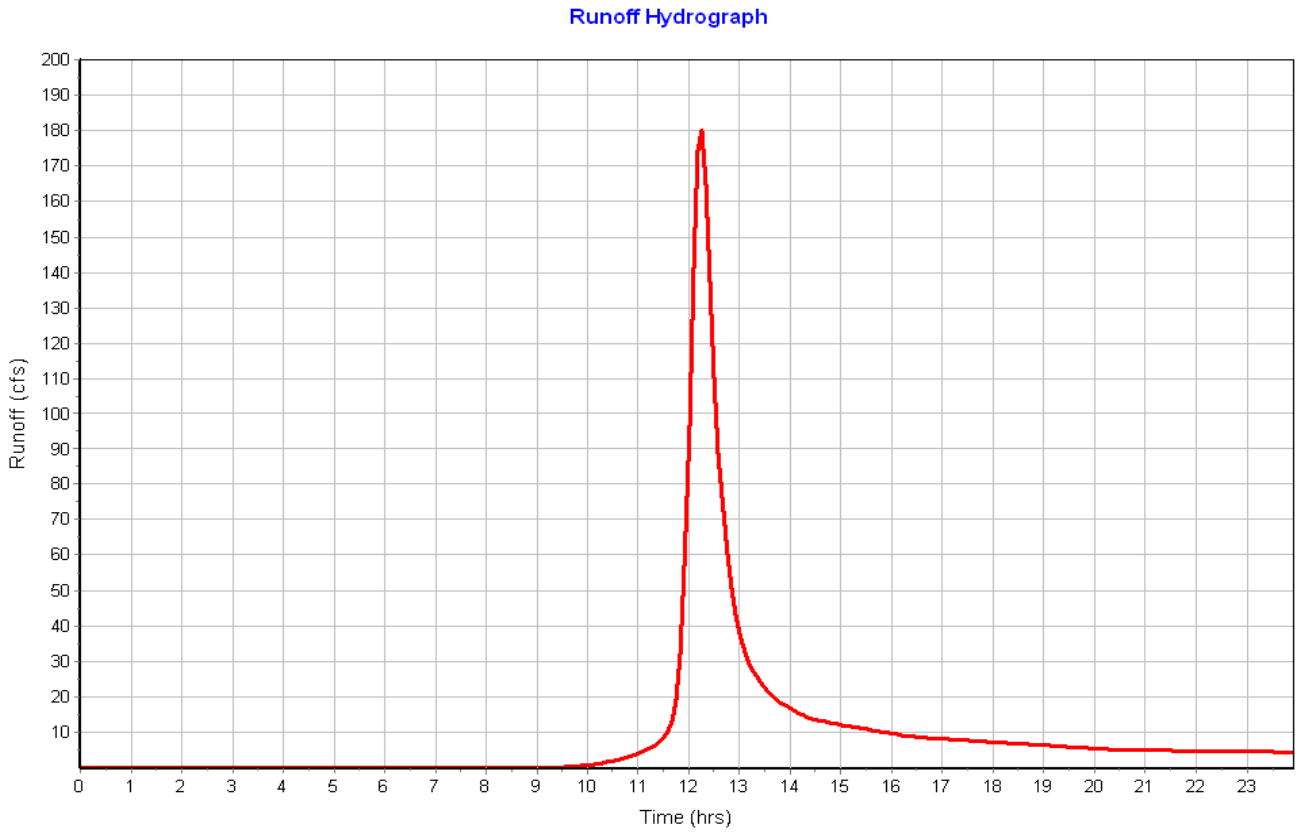
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.7	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.52	0.00	0.00
Computed Flow Time (min) :	10.96	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1441	0.00	0.00
Channel Slope (%) :	4.7	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	12.56	0.00	0.00
Computed Flow Time (min) :	1.91	0.00	0.00

Total TOC (min) 33.93

Subbasin : G


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : H

Input Data

Area (ac) 121.80
Weighted Curve Number 71.76
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	54.81	C	79.00
Woods, Fair	31.67	B	60.00
Pasture, grassland, or range, Fair	30.45	B	69.00
Pasture, grassland, or range, Fair	4.87	D	84.00
Composite Area & Weighted CN	121.80		71.76

Time of Concentration

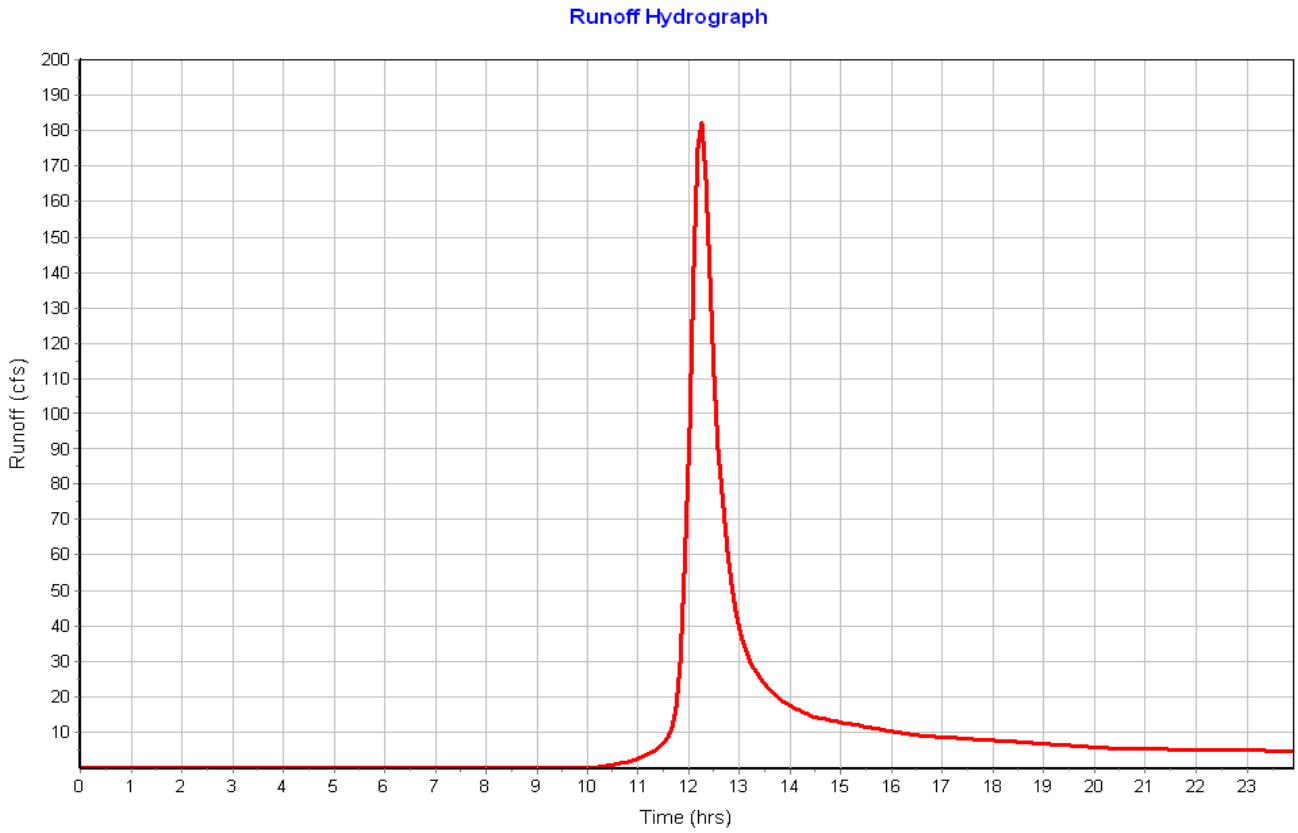
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.43	0.00	0.00
Computed Flow Time (min) :	11.66	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	676	0.00	0.00
Channel Slope (%) :	4.2	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	11.88	0.00	0.00
Computed Flow Time (min) :	0.95	0.00	0.00

Total TOC (min) 33.66

Subbasin : H


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : I

Input Data

Area (ac) 37.50
Weighted Curve Number 79.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	37.50	C	79.00
Composite Area & Weighted CN	37.50		79.00

Time of Concentration

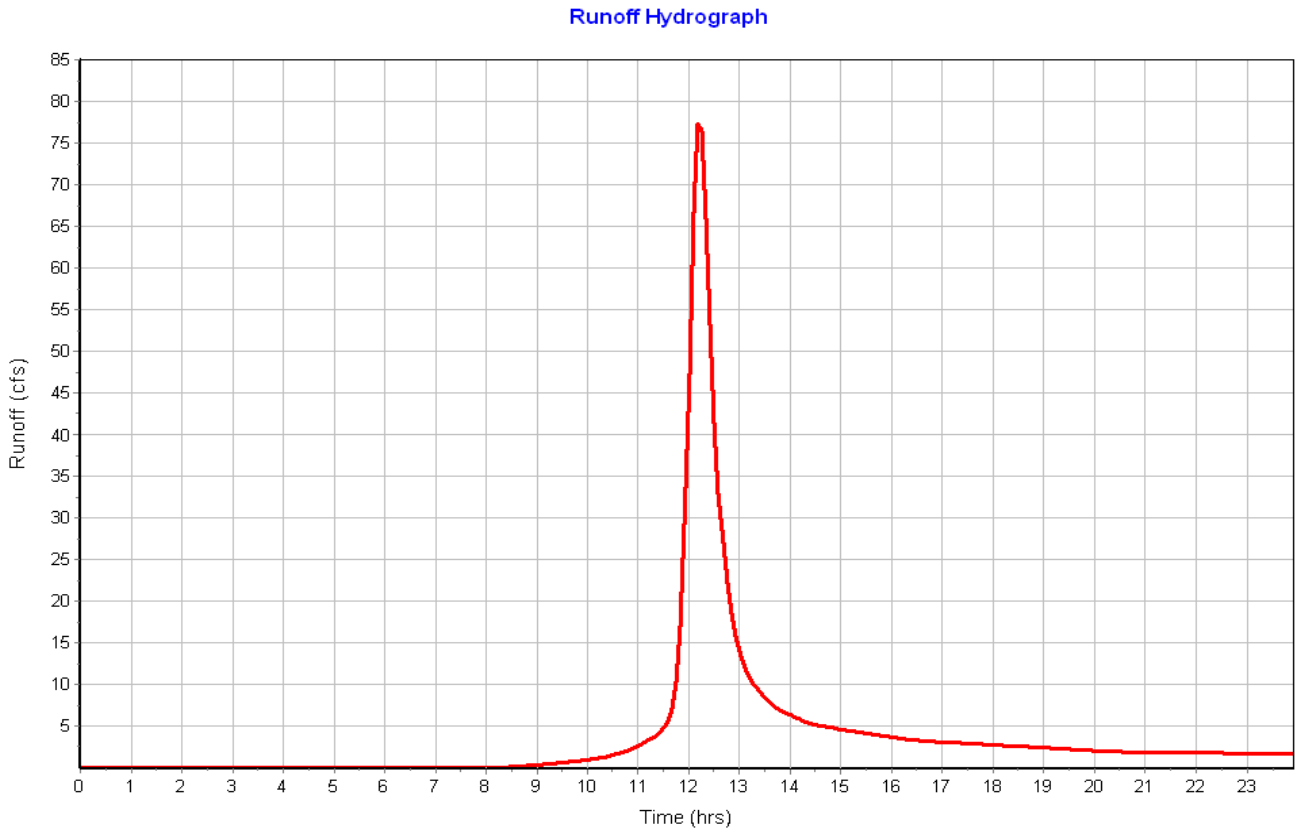
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.58	0.00	0.00
Computed Flow Time (min) :	10.55	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	134	0.00	0.00
Channel Slope (%) :	5.1	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.80	0.00	0.00
Computed Flow Time (min) :	0.21	0.00	0.00

Total TOC (min) 31.81

Subbasin : I


Runoff Hydrograph
Runoff (cfs)
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time (hrs)

Subbasin : J

Input Data

Area (ac) 10.10
Weighted Curve Number 69.50
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Fair	5.05	B	60.00
Woods, Fair	5.05	D	79.00
Composite Area & Weighted CN	10.10		69.50

Time of Concentration

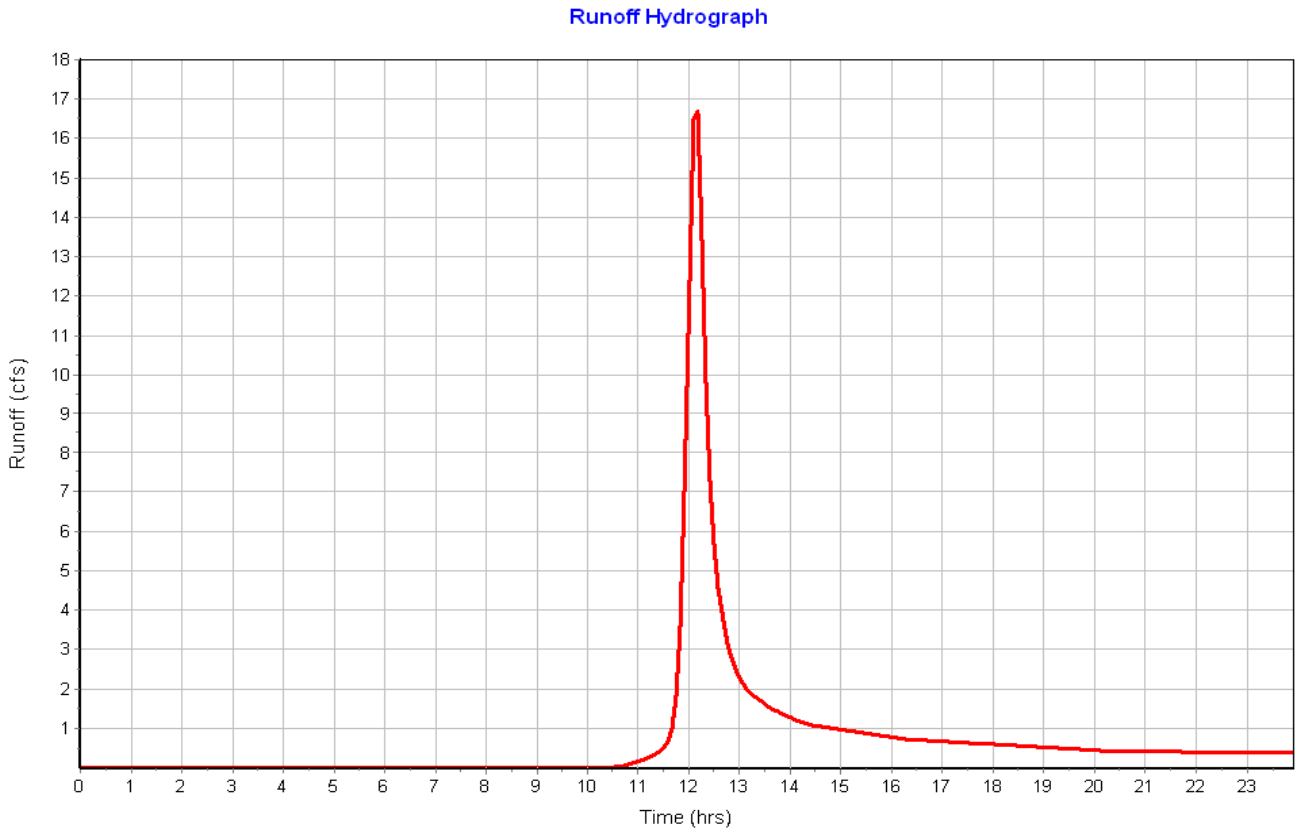
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	8.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	2.08	0.00	0.00
Computed Flow Time (min) :	1.60	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	228	0.00	0.00
Channel Slope (%) :	8.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	14.19	0.00	0.00
Computed Flow Time (min) :	0.27	0.00	0.00

Total TOC (min) 22.93

Subbasin : J


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Subbasin : K

Input Data

Area (ac) 17.80
Weighted Curve Number 76.00
Rain Gage ID ..... Rain Gage-01

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods & grass combination, Fair	17.80	C	76.00
Composite Area & Weighted CN	17.80		76.00

Time of Concentration

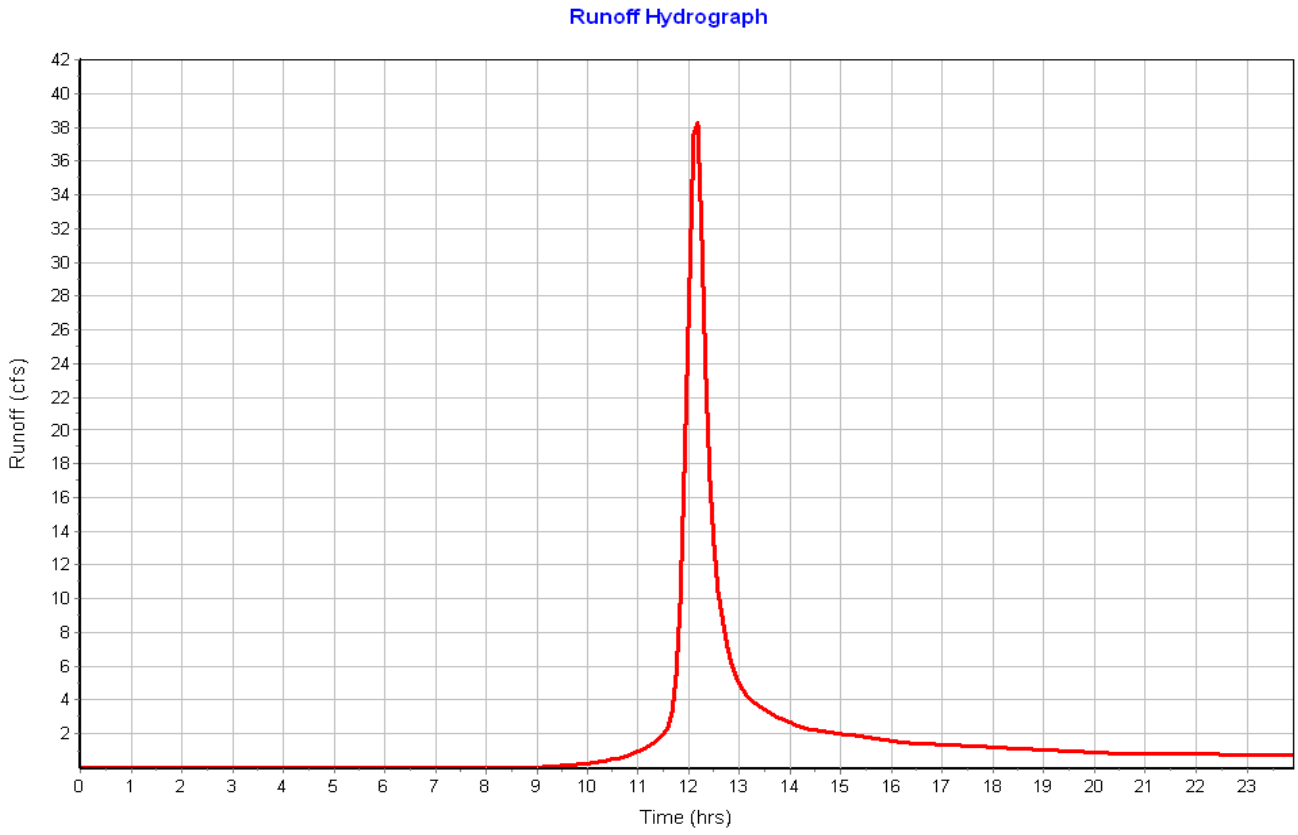
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	3.9	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.38	0.00	0.00
Computed Flow Time (min) :	2.42	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	354	0.00	0.00
Channel Slope (%) :	3.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.45	0.00	0.00
Computed Flow Time (min) :	0.62	0.00	0.00

Total TOC (min) 24.10

Subbasin : K


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Subbasin Hydrology

Subbasin : A1

Input Data

Area (ac) 865.90
Weighted Curve Number 60.36
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	839.92	B	60.00
Pasture, grassland, or range, Fair	8.66	D	84.00
5 Acre Lots, 7% Impervious	8.66	C	72.00
Composite Area & Weighted CN	857.24		60.36

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

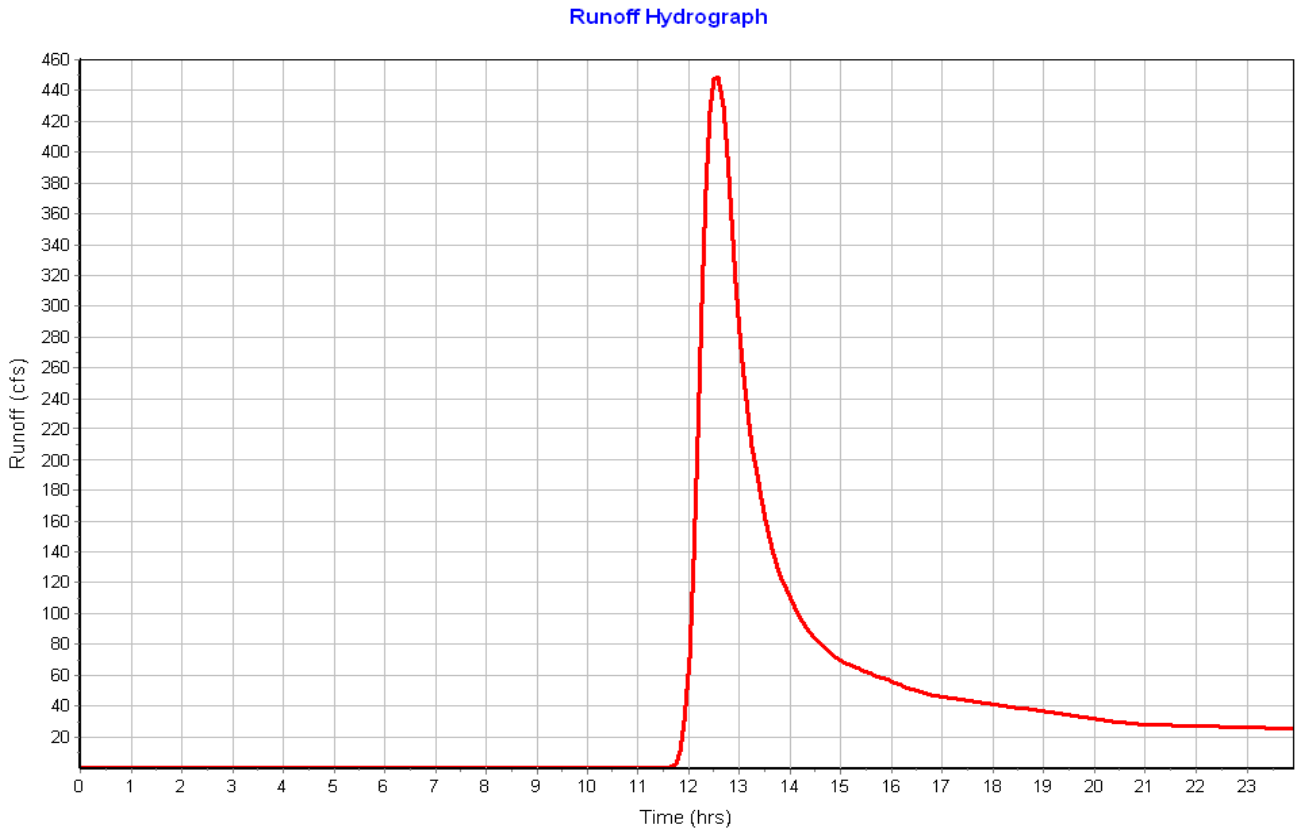
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	10.62	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	12115	0.00	0.00
Channel Slope (%) :	1.8	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	7.78	0.00	0.00
Computed Flow Time (min) :	25.97	0.00	0.00

Total TOC (min) 57.64

Subbasin : A1


Runoff Hydrograph
Runoff (cfs)
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time (hrs)

Subbasin : A2

Input Data

Area (ac) 37.00
Weighted Curve Number 66.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	18.50	C	72.00
5 Acre Lots, 7% Impervious	18.50	B	60.00
Composite Area & Weighted CN	37.00		66.00

Time of Concentration

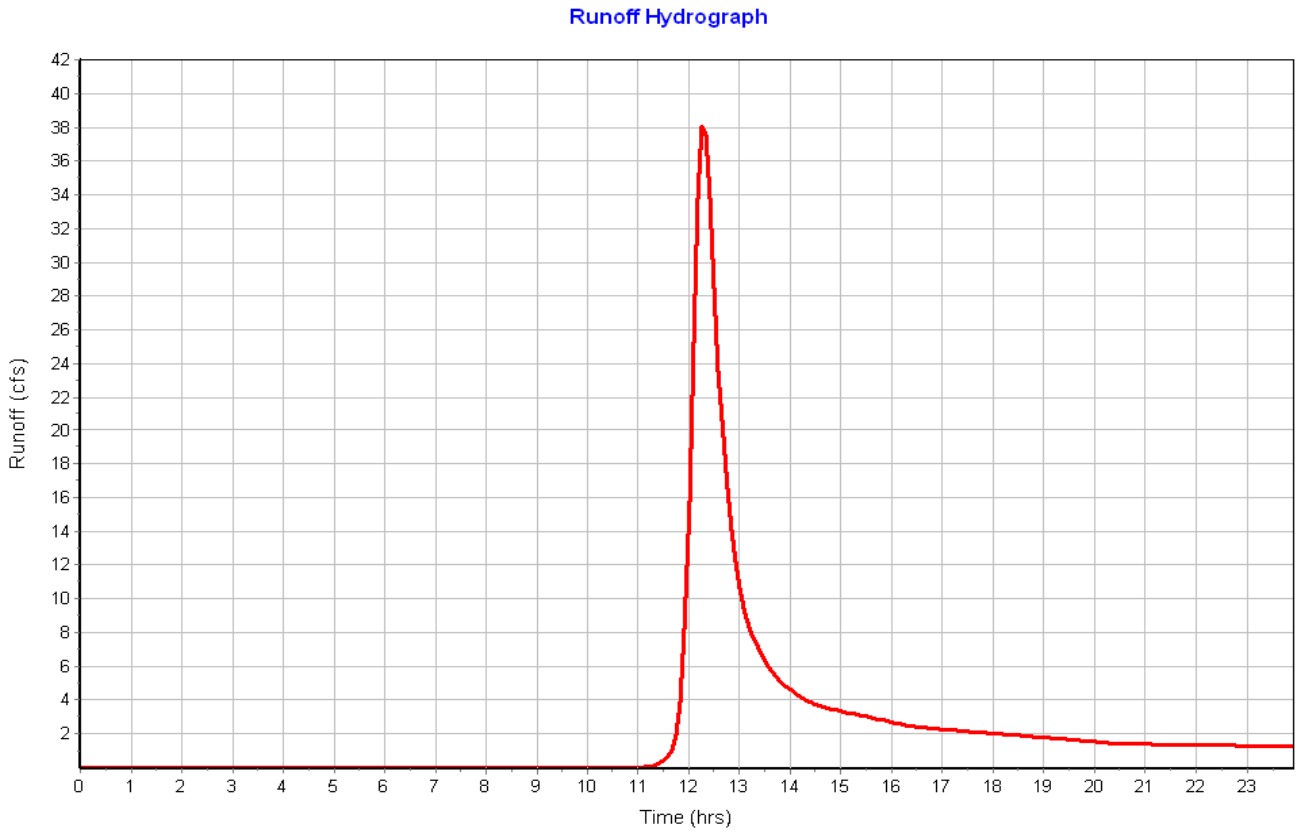
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	2.9	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.19	0.00	0.00
Computed Flow Time (min) :	14.01	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1157	0.00	0.00
Channel Slope (%) :	2.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	8.15	0.00	0.00
Computed Flow Time (min) :	2.37	0.00	0.00

Total TOC (min) 37.43

Subbasin : A2


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : A3

Input Data

Area (ac) 41.48
Weighted Curve Number 76.50
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	20.74	C	72.00
Pasture, grassland, or range, Fair	8.30	D	84.00
Pasture, grassland, or range, Fair	12.44	C	79.00
Composite Area & Weighted CN	41.48		76.50

Time of Concentration

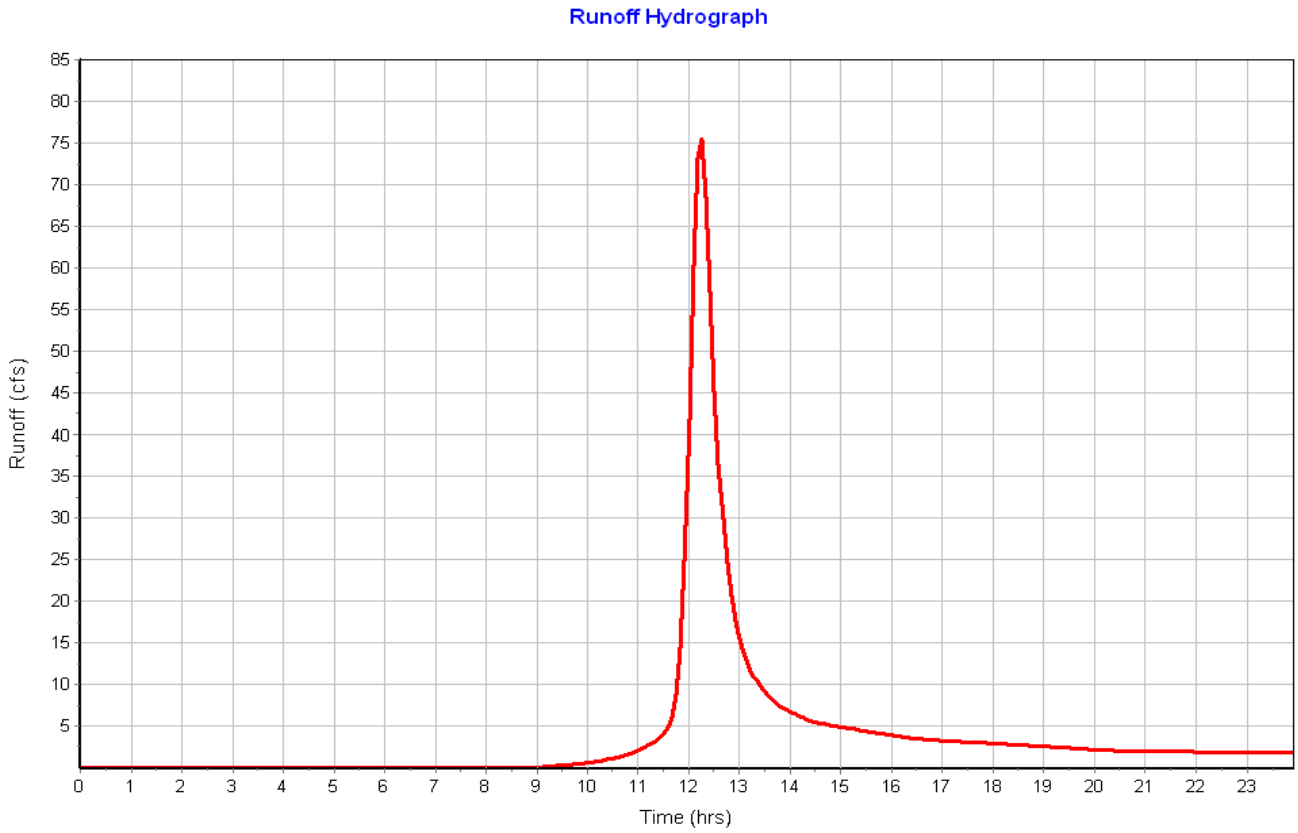
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.53	0.00	0.00
Computed Flow Time (min) :	10.89	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1188	0.00	0.00
Channel Slope (%) :	4.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.48	0.00	0.00
Computed Flow Time (min) :	1.89	0.00	0.00

Total TOC (min) 33.84

Subbasin : A3


Runoff Hydrograph
Runoff (cfs)
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time (hrs)

Subbasin : B1

Input Data

Area (ac) 3836.70
Weighted Curve Number 60.34
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	3759.97	B	60.00
5 Acre Lots, 7% Impervious	76.73	D	77.00
Composite Area & Weighted CN	3836.70		60.34

Time of Concentration

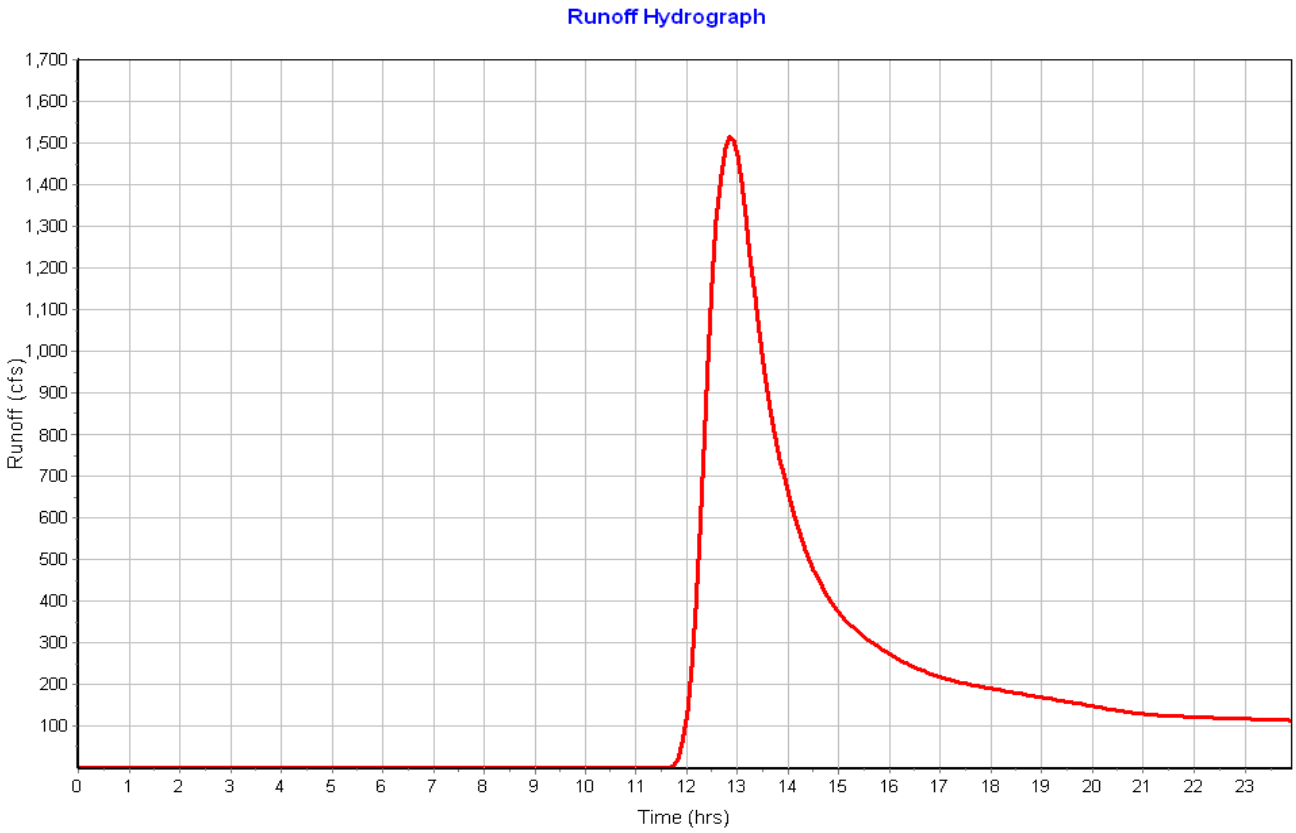
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.40	0.00	0.00
Computed Flow Time (min) :	11.90	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	20154	0.00	0.00
Channel Slope (%) :	1.3	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	6.61	0.00	0.00
Computed Flow Time (min) :	50.83	0.00	0.00

Total TOC (min) 83.80

Subbasin : B1


Runoff Hydrograph
Runoff (cfs)
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time (hrs)

Subbasin : B2

Input Data

Area (ac) 13.10
Weighted Curve Number 64.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	13.10	B	64.00
Composite Area & Weighted CN	13.10		64.00

Time of Concentration

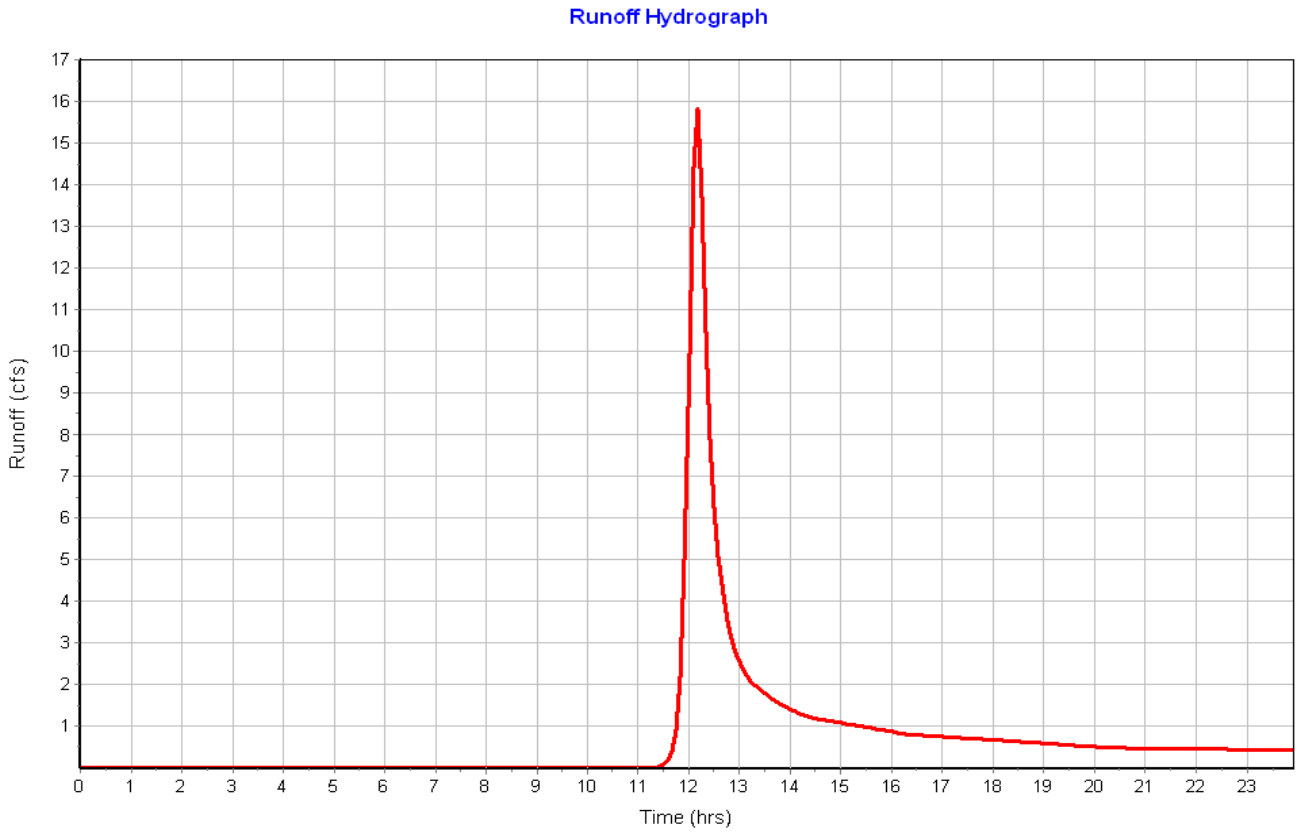
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	5.2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.60	0.00	0.00
Computed Flow Time (min) :	3.13	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	177	0.00	0.00
Channel Slope (%) :	5.2	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.91	0.00	0.00
Computed Flow Time (min) :	0.27	0.00	0.00

Total TOC (min) 24.45

Subbasin : B2


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Subbasin : B3

Input Data

Area (ac) 54.90
Weighted Curve Number 65.10
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	38.43	B	60.00
5 Acre Lots, 7% Impervious	16.47	D	77.00
Composite Area & Weighted CN	54.90		65.10

Time of Concentration

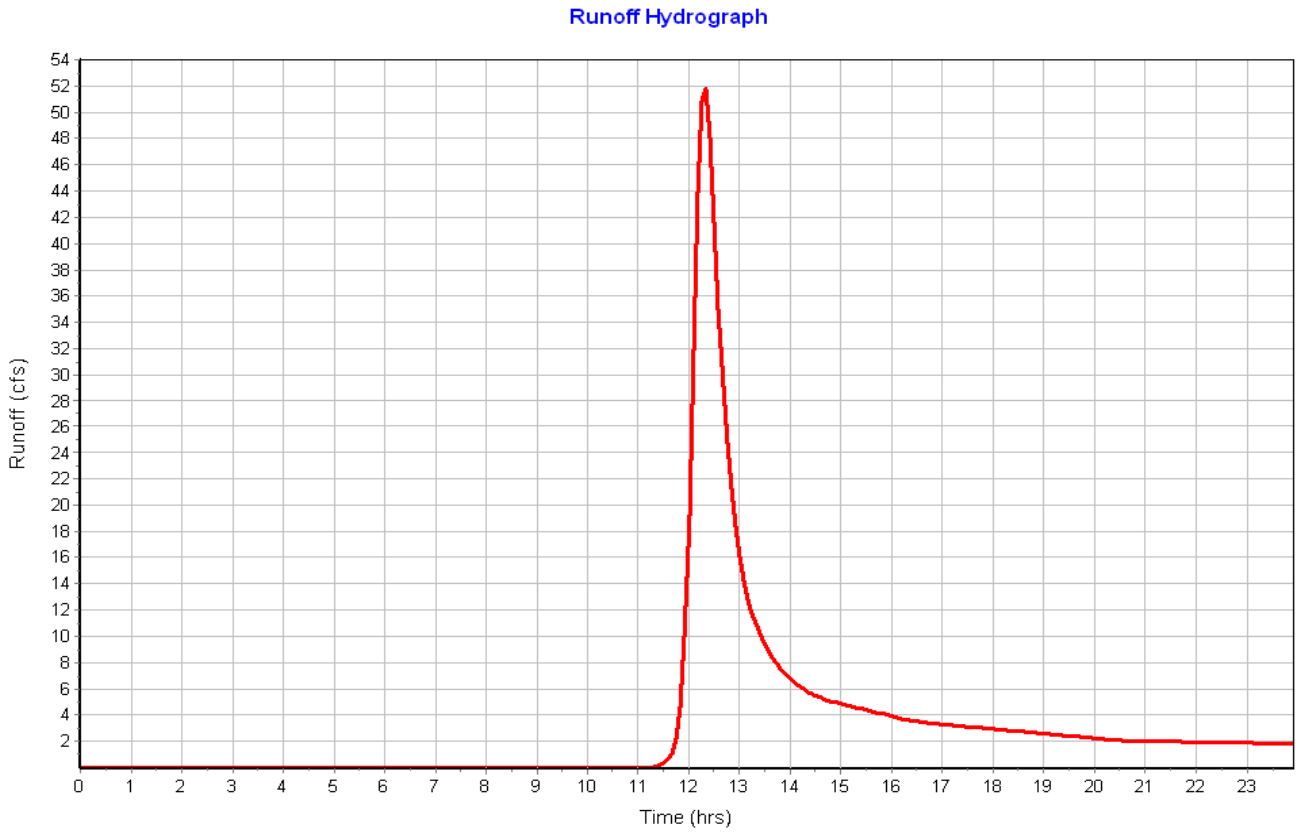
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.27	0.00	0.00
Computed Flow Time (min) :	13.12	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	2693	0.00	0.00
Channel Slope (%) :	3.3	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	8.69	0.00	0.00
Computed Flow Time (min) :	5.17	0.00	0.00

Total TOC (min) 39.35

Subbasin : B3


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
54
52
50
48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : B4

Input Data

Area (ac) 41.48
Weighted Curve Number 68.50
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	22.81	B	64.00
Pasture, grassland, or range, Fair	12.44	B	69.00
Pasture, grassland, or range, Fair	6.22	D	84.00
Composite Area & Weighted CN	41.47		68.50

Time of Concentration

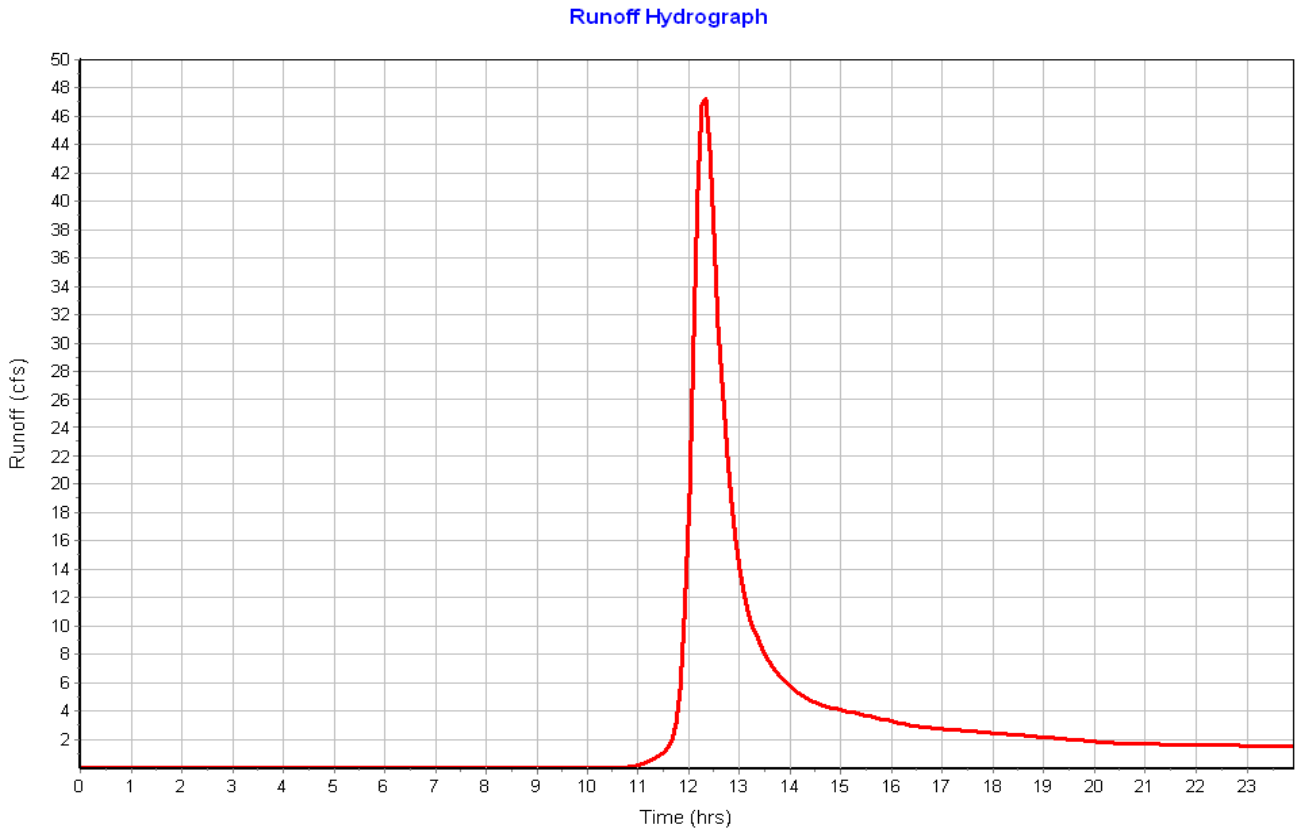
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	2.3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.06	0.00	0.00
Computed Flow Time (min) :	15.72	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1188	0.00	0.00
Channel Slope (%) :	2.3	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	7.25	0.00	0.00
Computed Flow Time (min) :	2.73	0.00	0.00

Total TOC (min) 39.51

Subbasin : B4


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
50
48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : C1

Input Data

Area (ac) 162.70
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	162.70	B	60.00
Composite Area & Weighted CN	162.70		60.00

Time of Concentration

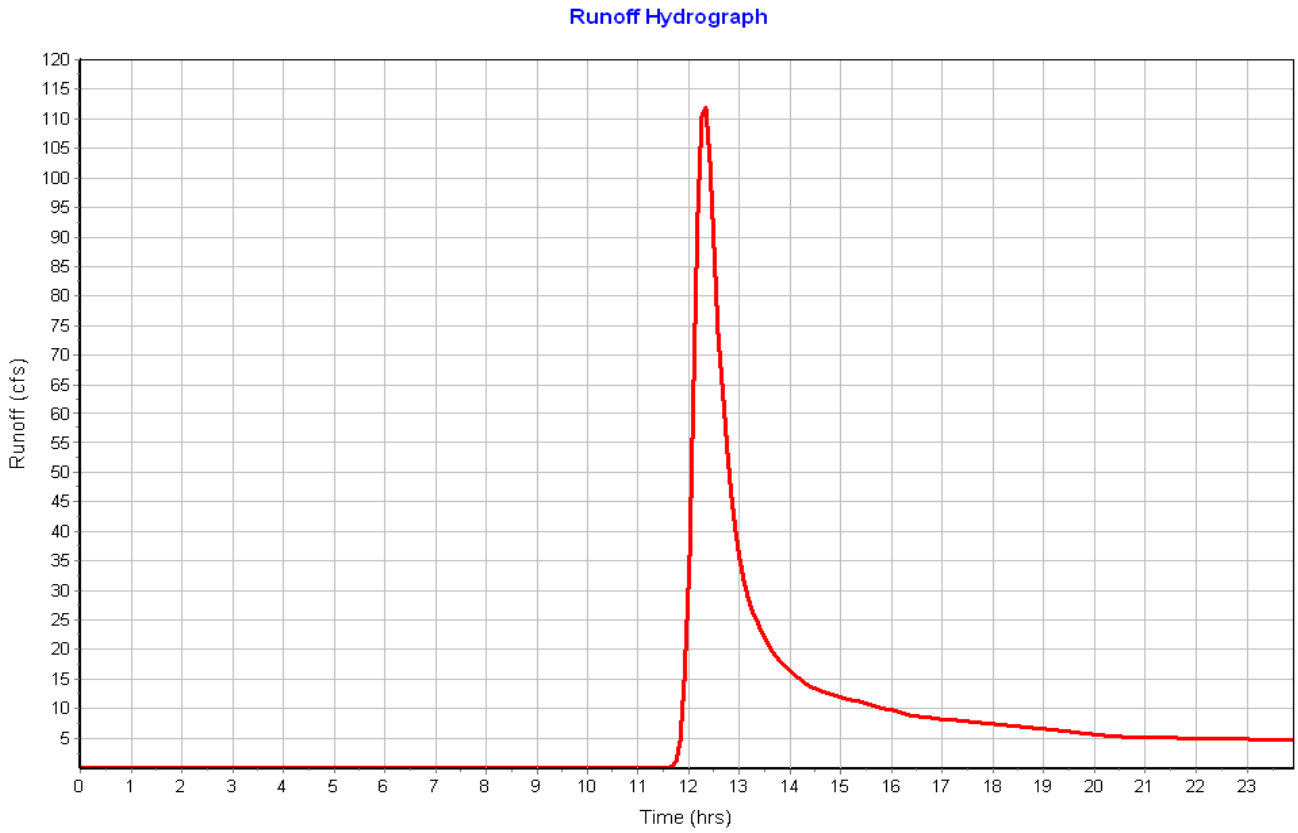
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.42	0.00	0.00
Computed Flow Time (min) :	11.74	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	3099	0.00	0.00
Channel Slope (%) :	4.1	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	11.73	0.00	0.00
Computed Flow Time (min) :	4.40	0.00	0.00

Total TOC (min) 37.20

Subbasin : C1


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : C2

Input Data

Area (ac) 22.40
Weighted Curve Number 64.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	22.40	B	64.00
Composite Area & Weighted CN	22.40		64.00

Time of Concentration

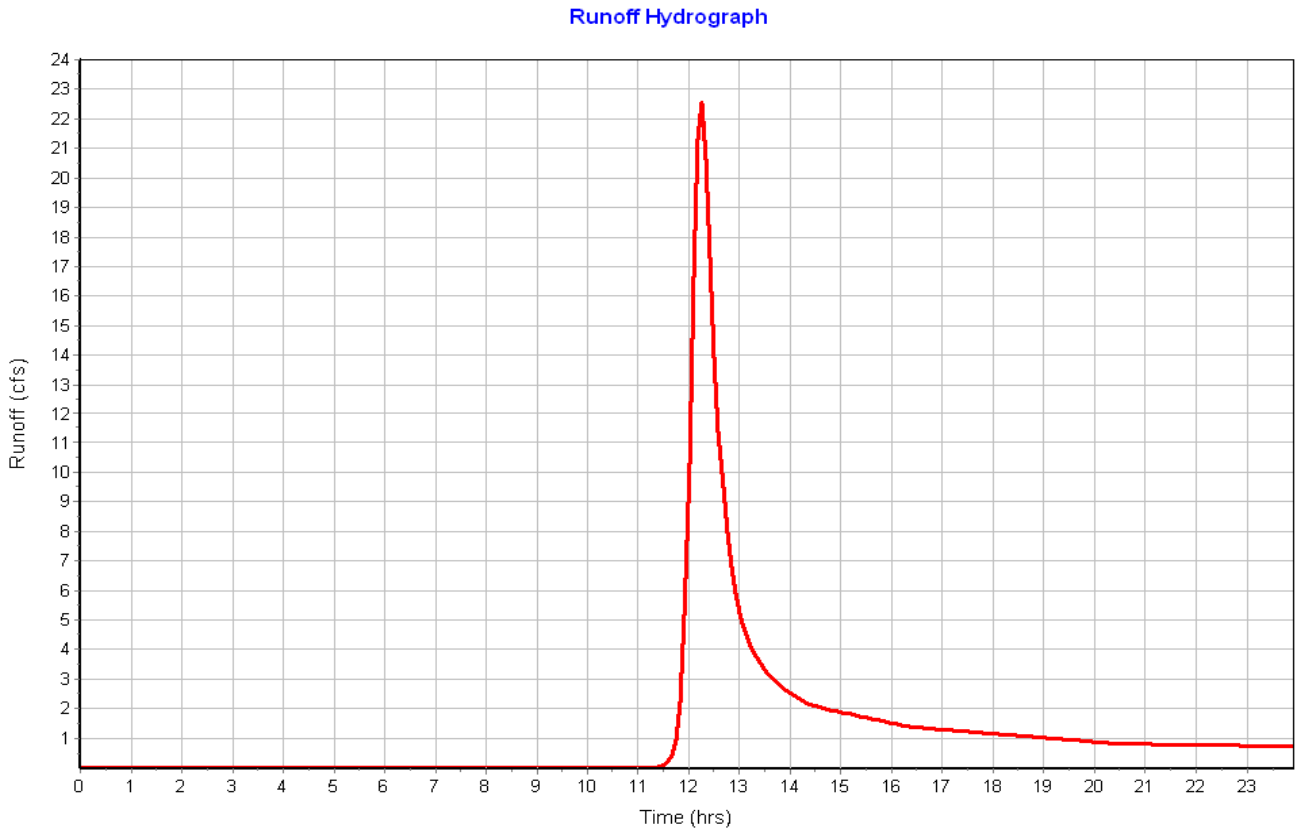
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	5.31	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	401	0.00	0.00
Channel Slope (%) :	.05	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	1.07	0.00	0.00
Computed Flow Time (min) :	6.25	0.00	0.00

Total TOC (min) 32.61

Subbasin : C2


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Subbasin : C3

Input Data

Area (ac) 16.10
Weighted Curve Number 64.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	16.10	B	64.00
Composite Area & Weighted CN	16.10		64.00

Time of Concentration

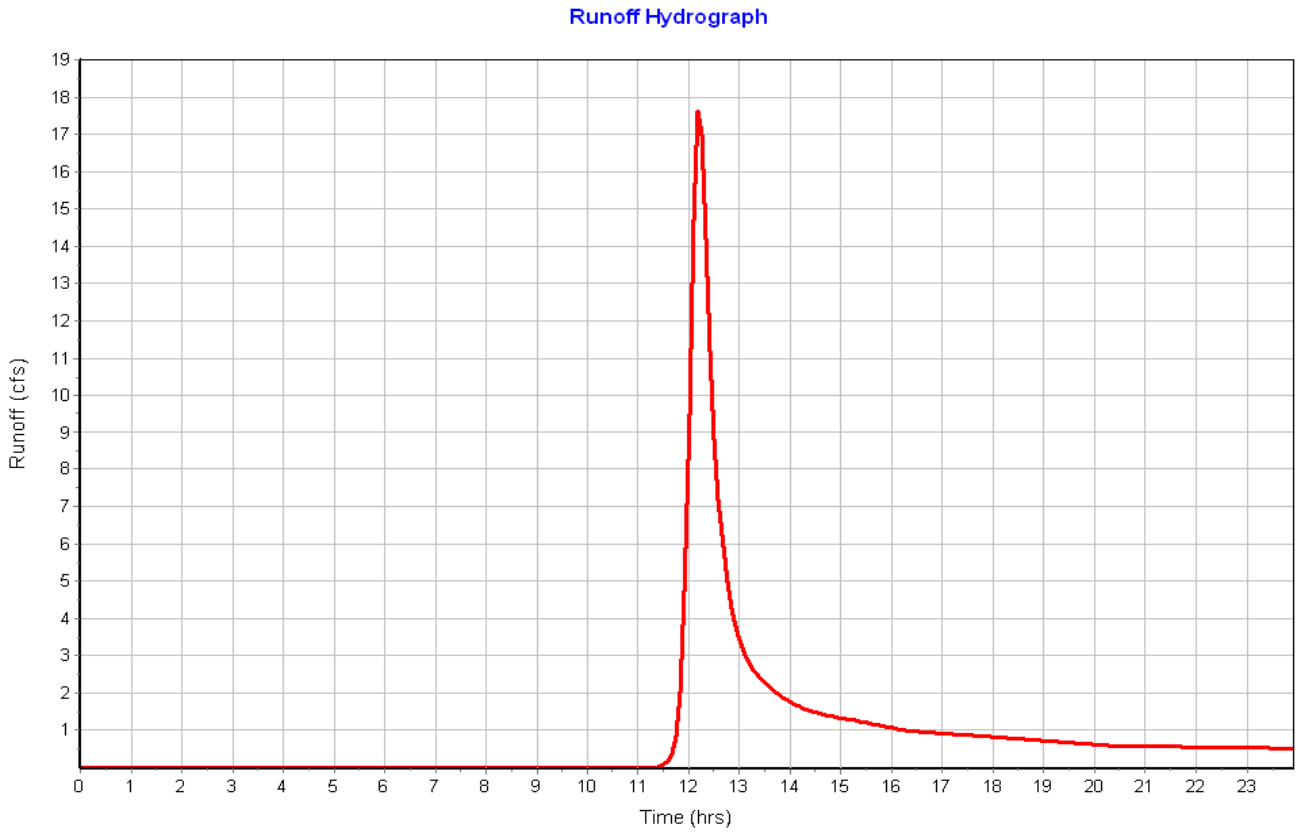
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	3.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.36	0.00	0.00
Computed Flow Time (min) :	6.13	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	666	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.32	0.00	0.00
Computed Flow Time (min) :	1.19	0.00	0.00

Total TOC (min) 28.38

Subbasin : C3


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Subbasin : C4

Input Data

Area (ac) 23.80
Weighted Curve Number 65.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	11.90	B	60.00
Pasture, grassland, or range, Fair	1.19	C	79.00
Pasture, grassland, or range, Fair	10.71	B	69.00
Composite Area & Weighted CN	23.80		65.00

Time of Concentration

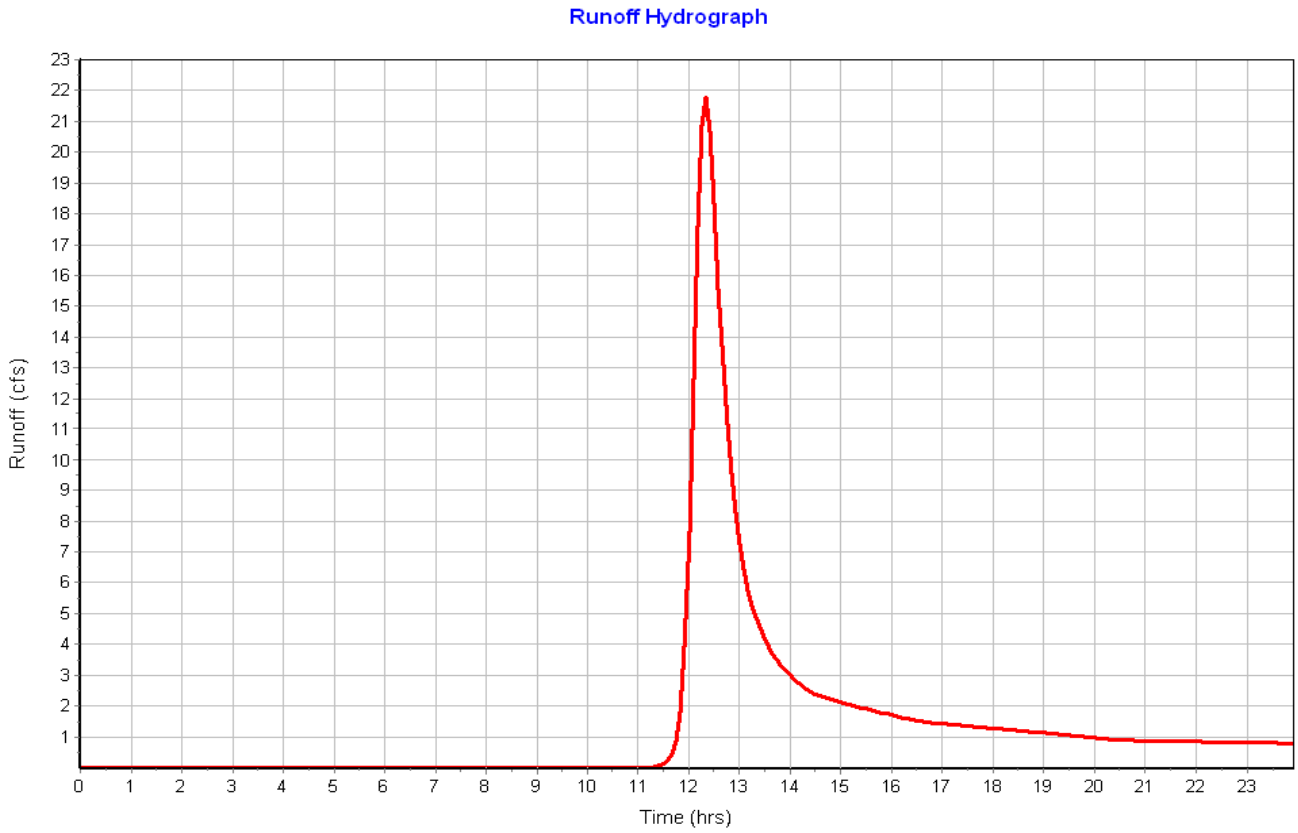
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	1.9	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	0.96	0.00	0.00
Computed Flow Time (min) :	17.36	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1074	0.00	0.00
Channel Slope (%) :	1.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	6.59	0.00	0.00
Computed Flow Time (min) :	2.71	0.00	0.00

Total TOC (min) 41.13

Subbasin : C4


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Subbasin : D1.1

Input Data

Area (ac) 161.30
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	161.30	B	60.00
Composite Area & Weighted CN	161.30		60.00

Time of Concentration

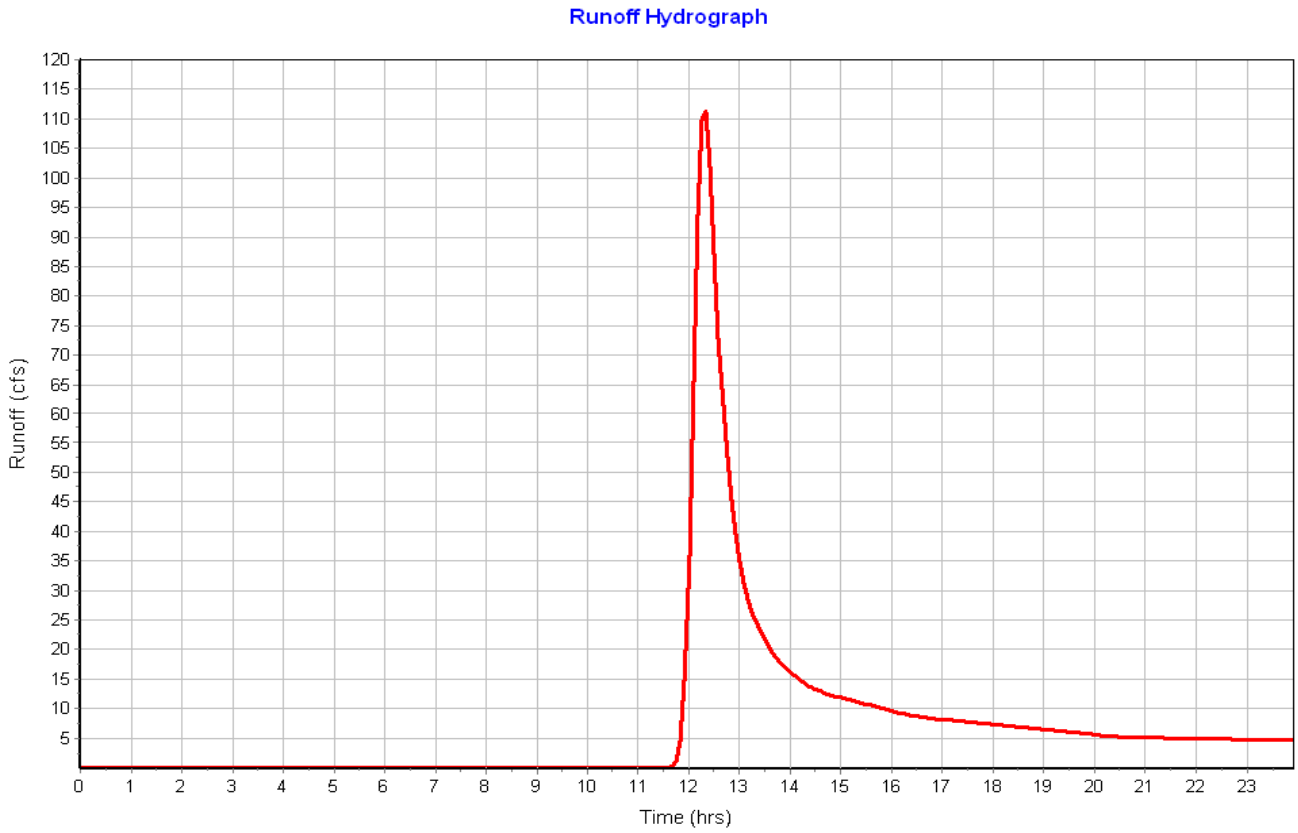
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5.7	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.19	0.00	0.00
Computed Flow Time (min) :	14.01	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1601	0.00	0.00
Channel Slope (%) :	5.7	0.00	0.00
Cross Section Area (ft^2) :	64	0.00	0.00
Wetted Perimeter (ft) :	32.98	0.00	0.00
Velocity (ft/sec) :	13.84	0.00	0.00
Computed Flow Time (min) :	1.93	0.00	0.00

Total TOC (min) 36.99

Subbasin : D1.1



Subbasin : D1.2

Input Data

Area (ac) 49.90
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	49.90	B	60.00
Composite Area & Weighted CN	49.90		60.00

Time of Concentration

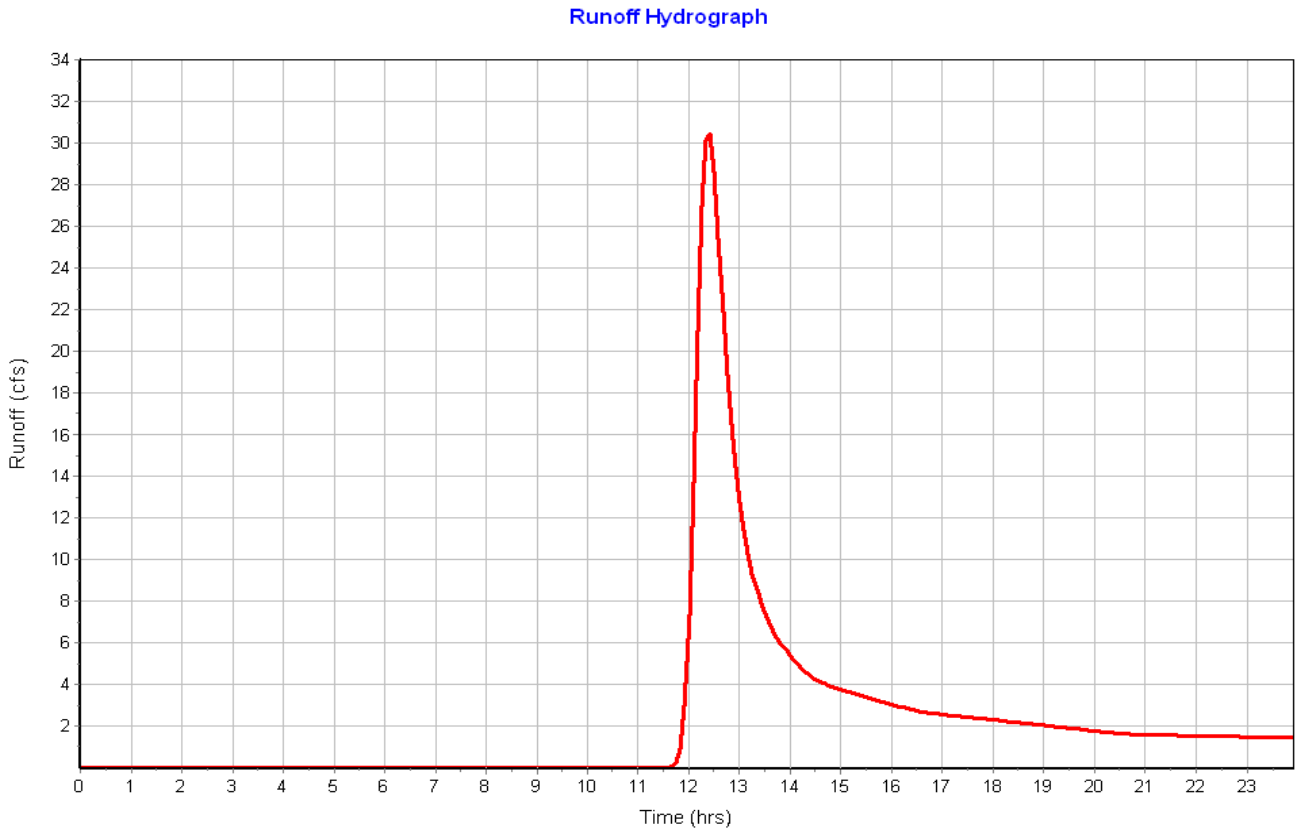
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	2.48	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	0.79	0.00	0.00
Computed Flow Time (min) :	21.10	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	922	0.00	0.00
Channel Slope (%) :	2.48	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	7.53	0.00	0.00
Computed Flow Time (min) :	2.04	0.00	0.00

Total TOC (min) 44.20

Subbasin : D1.2



Subbasin : D2

Input Data

Area (ac) 68.70
Weighted Curve Number 64.75
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	10.31	B	69.00
2.5 Acre Lots, 11% Impervious	58.40	B	64.00
Composite Area & Weighted CN	68.71		64.75

Time of Concentration

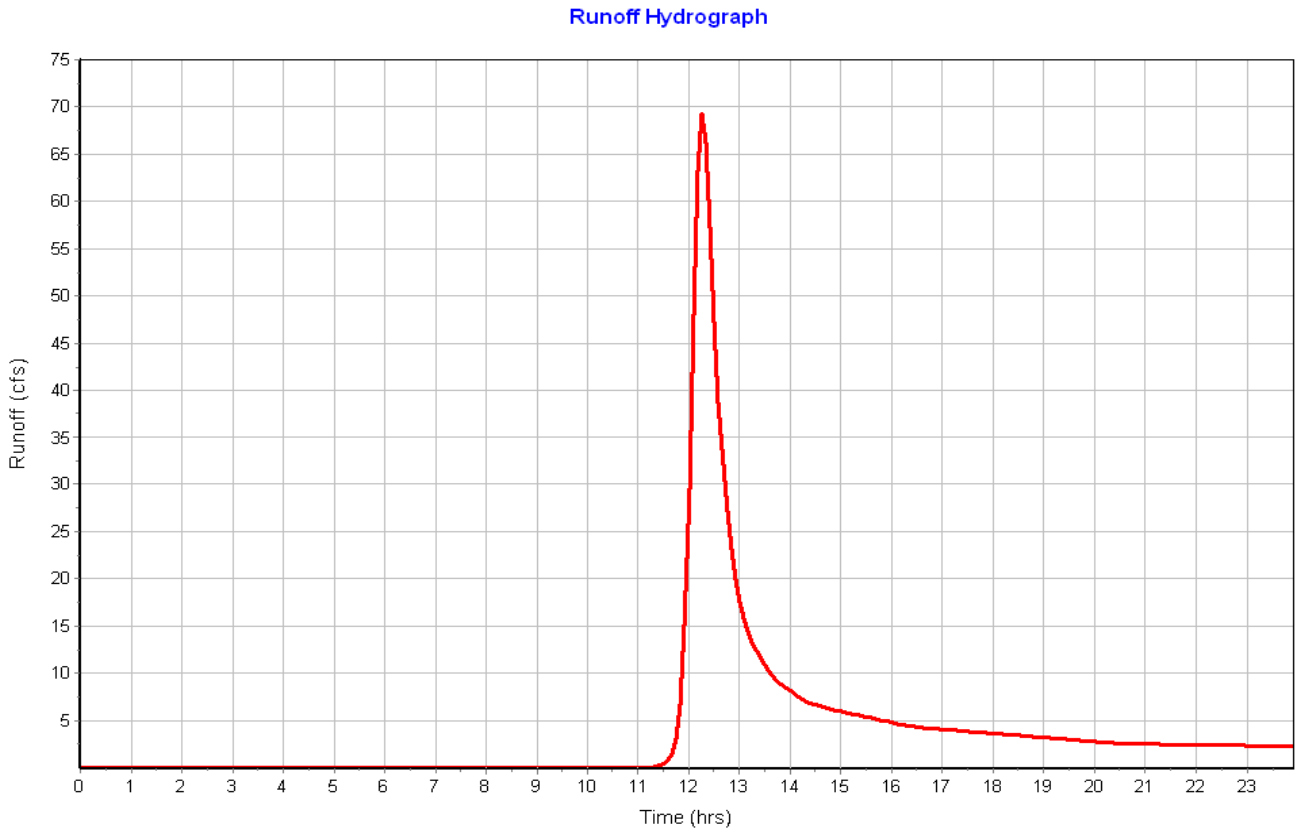
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.36	0.00	0.00
Computed Flow Time (min) :	12.25	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	848	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.32	0.00	0.00
Computed Flow Time (min) :	1.52	0.00	0.00

Total TOC (min) 34.83

Subbasin : D2


Runoff Hydrograph
Runoff (cfs)
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Time (hrs)

Subbasin : D3

Input Data

Area (ac) 41.20
Weighted Curve Number 64.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	41.20	B	64.00
Composite Area & Weighted CN	41.20		64.00

Time of Concentration

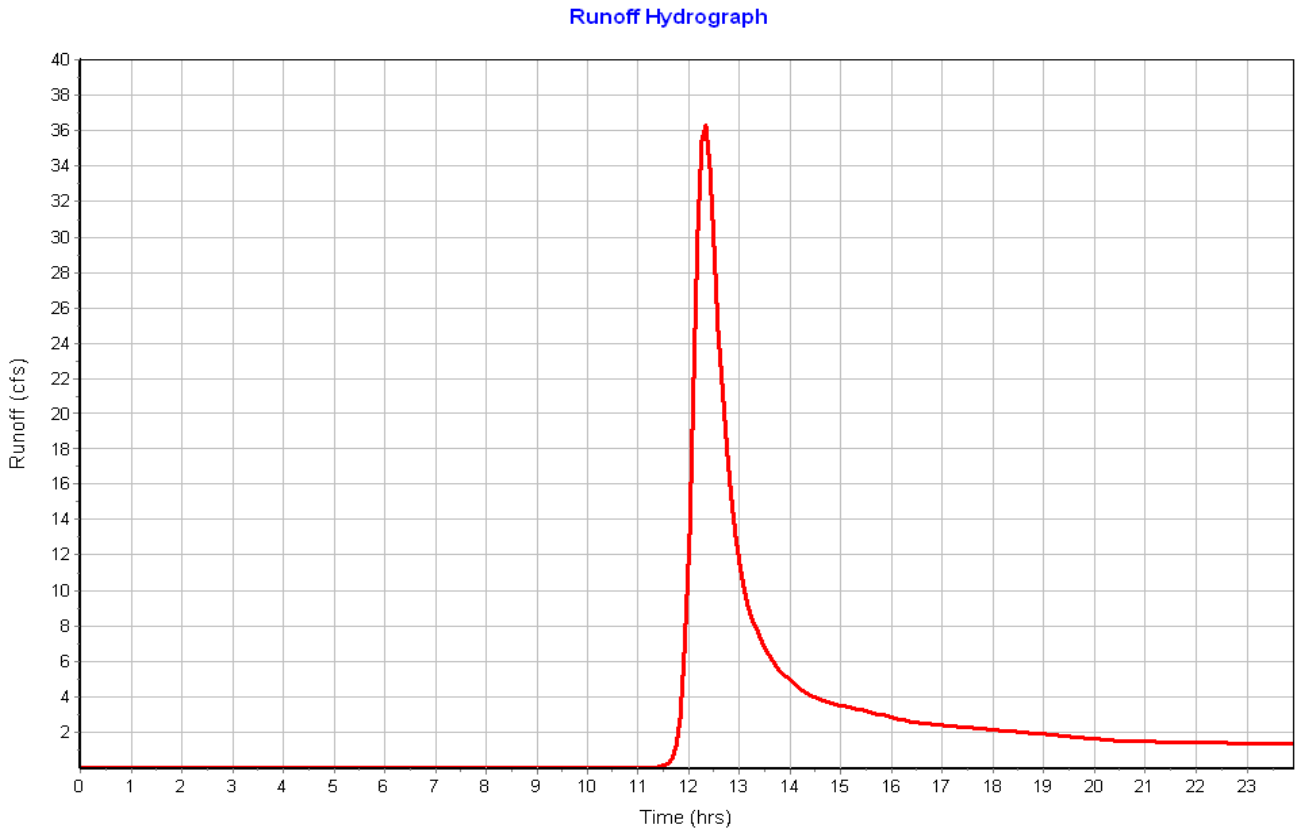
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	2.3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.06	0.00	0.00
Computed Flow Time (min) :	15.72	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1128	0.00	0.00
Channel Slope (%) :	2.3	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	7.25	0.00	0.00
Computed Flow Time (min) :	2.59	0.00	0.00

Total TOC (min) 39.37

Subbasin : D3


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40

Subbasin : D4

Input Data

Area (ac) 34.30
Weighted Curve Number 64.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	34.30	B	64.00
Composite Area & Weighted CN	34.30		64.00

Time of Concentration

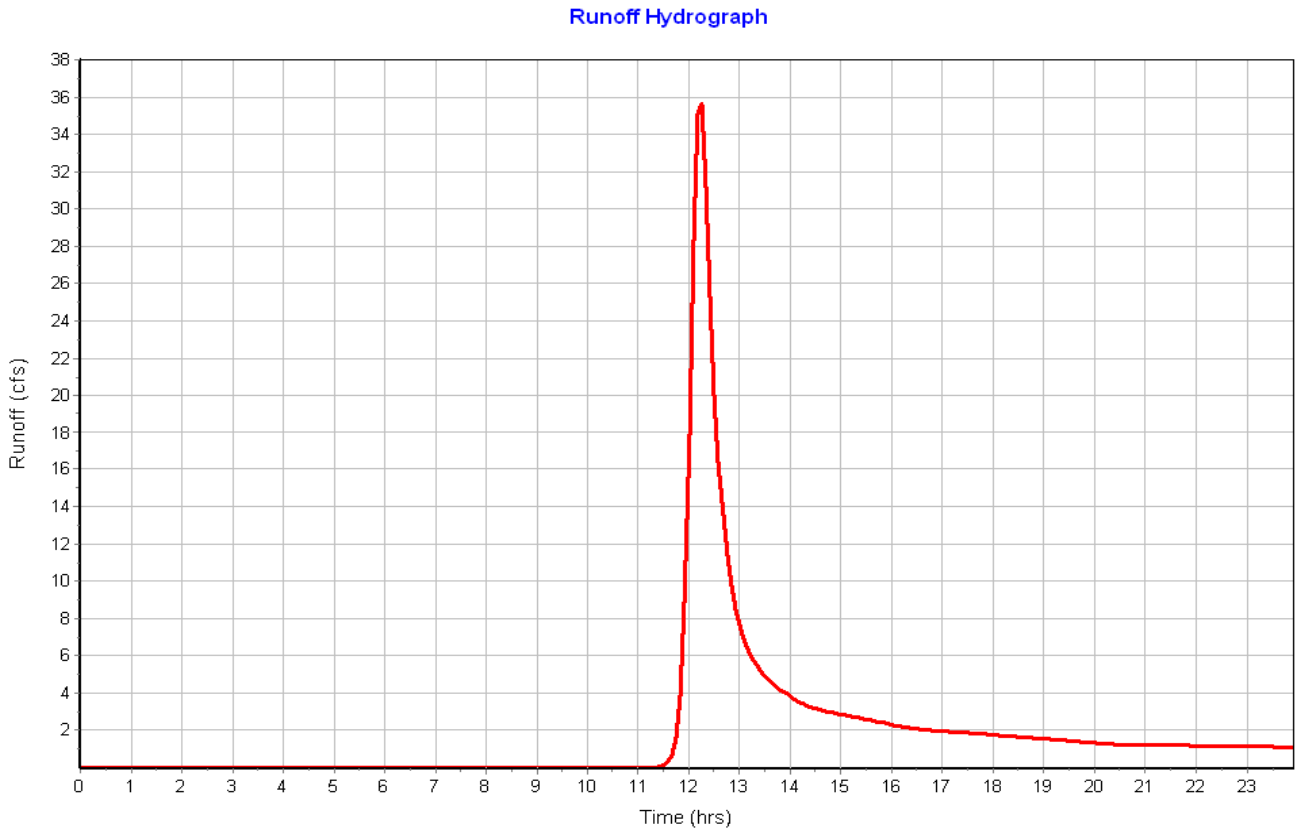
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	2.3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.06	0.00	0.00
Computed Flow Time (min) :	7.86	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	658	0.00	0.00
Channel Slope (%) :	2.3	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	7.25	0.00	0.00
Computed Flow Time (min) :	1.51	0.00	0.00

Total TOC (min) 30.43

Subbasin : D4


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Subbasin : D5

Input Data

Area (ac) 12.80
Weighted Curve Number 67.20
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	2.56	B	60.00
Pasture, grassland, or range, Fair	10.24	B	69.00
Composite Area & Weighted CN	12.80		67.20

Time of Concentration

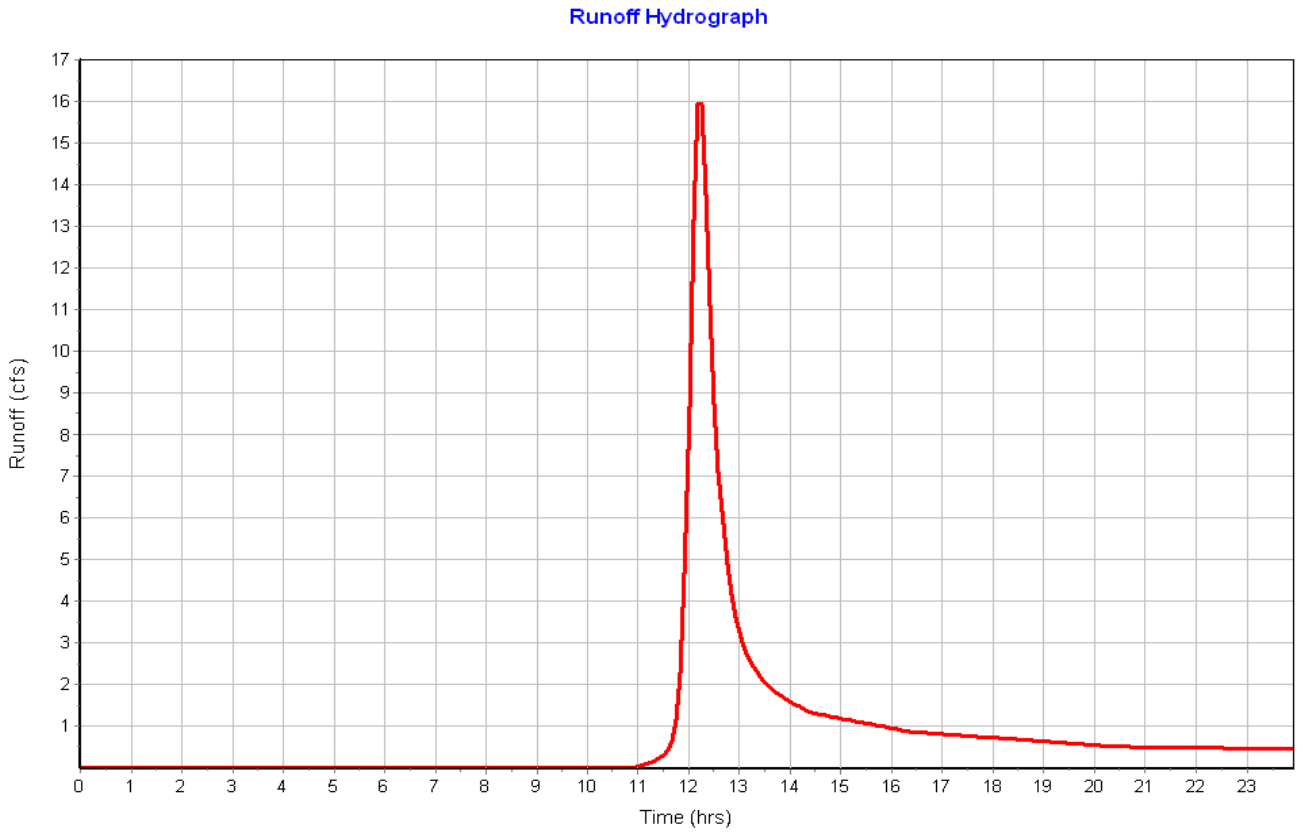
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	2.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.01	0.00	0.00
Computed Flow Time (min) :	8.25	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	506	0.00	0.00
Channel Slope (%) :	2.1	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	6.93	0.00	0.00
Computed Flow Time (min) :	1.22	0.00	0.00

Total TOC (min) 30.53

Subbasin : D5


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Subbasin : D6

Input Data

Area (ac) 41.80
Weighted Curve Number 61.65
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	37.62	B	60.00
Pasture, grassland, or range, Fair	2.09	D	84.00
Pasture, grassland, or range, Fair	2.09	B	69.00
Composite Area & Weighted CN	41.80		61.65

Time of Concentration

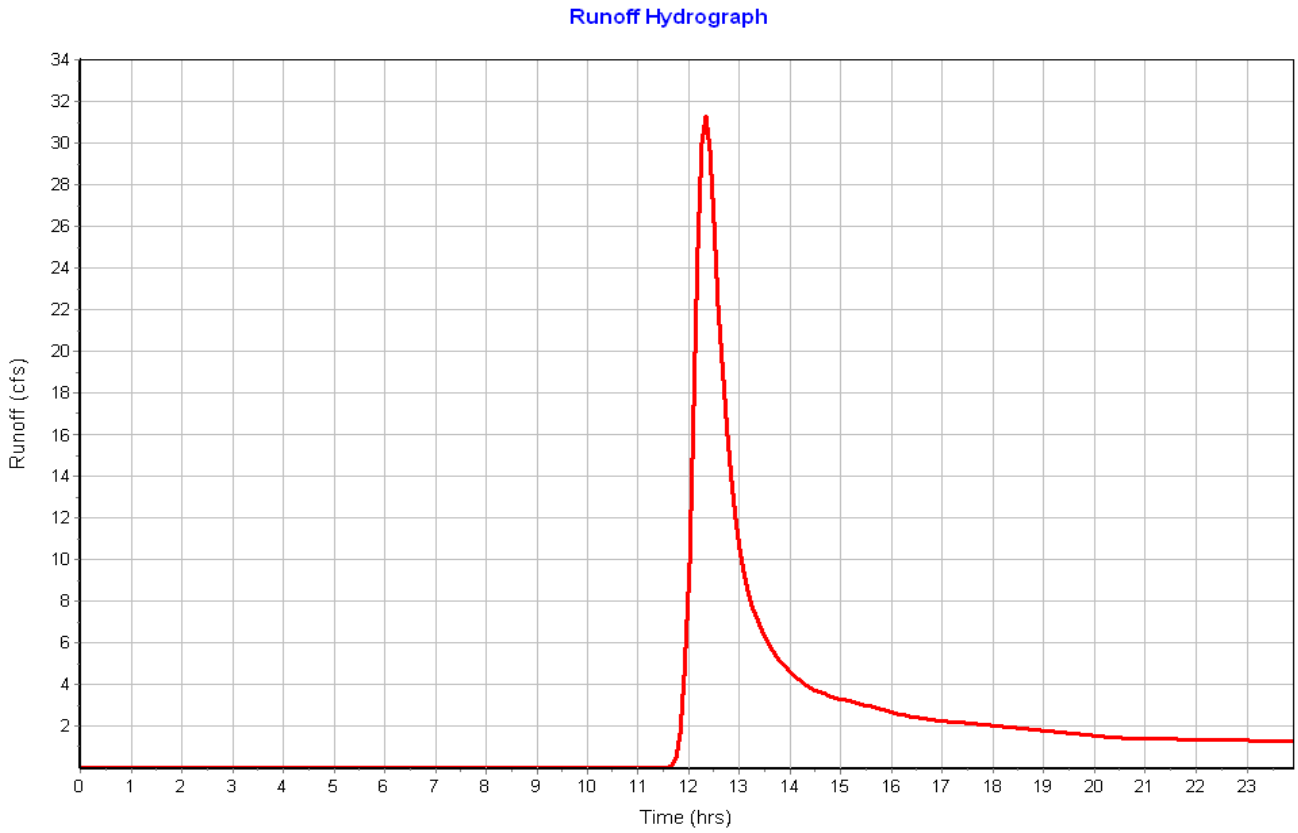
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	2.3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.06	0.00	0.00
Computed Flow Time (min) :	15.72	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1255	0.00	0.00
Channel Slope (%) :	2.3	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	7.25	0.00	0.00
Computed Flow Time (min) :	2.88	0.00	0.00

Total TOC (min) 39.67

Subbasin : D6


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : E0

Input Data

Area (ac) 37.90
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	37.90	B	60.00
Composite Area & Weighted CN	37.90		60.00

Time of Concentration

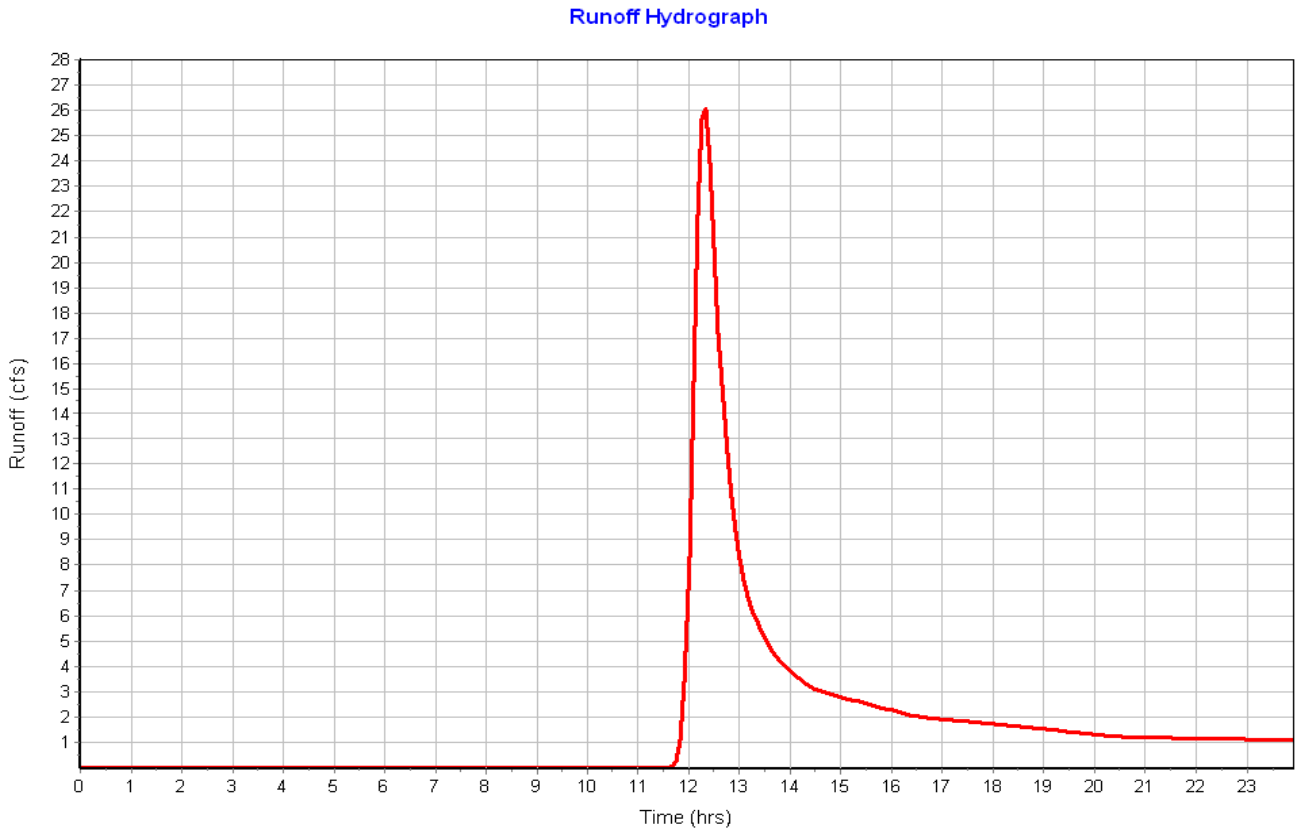
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.9	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.11	0.00	0.00
Computed Flow Time (min) :	15.02	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	748	0.00	0.00
Channel Slope (%) :	4.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.59	0.00	0.00
Computed Flow Time (min) :	1.18	0.00	0.00

Total TOC (min) 37.25

Subbasin : E0


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28

Subbasin : E1.1

Input Data

Area (ac) 7.90
Weighted Curve Number 76.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Woods, Fair	3.95	B	60.00
Urban commercial, 85% imp	3.95	B	92.00
Composite Area & Weighted CN	7.90		76.00

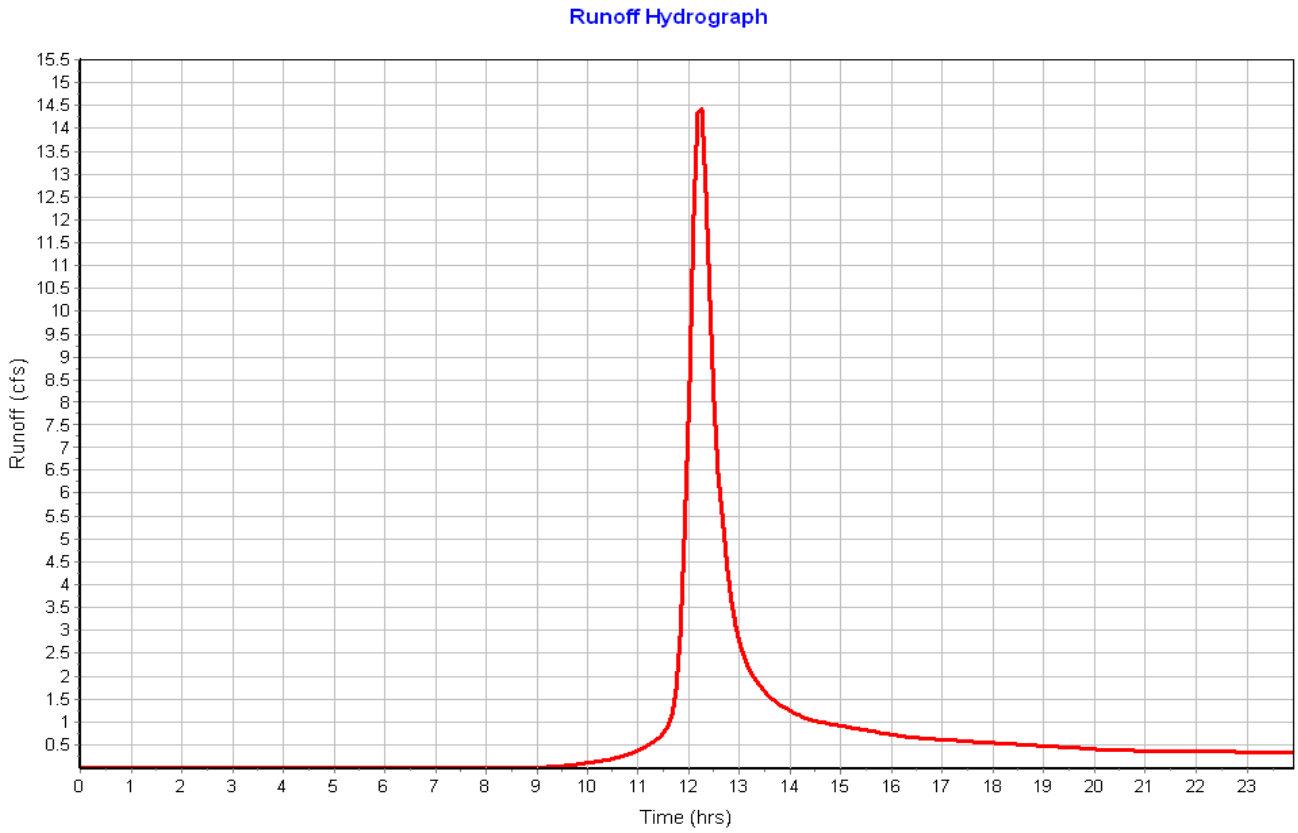
Time of Concentration

Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.1	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	583	0.00	0.00
Slope (%) :	3.17	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	0.89	0.00	0.00
Computed Flow Time (min) :	10.92	0.00	0.00

Total TOC (min) 31.98

Subbasin : E1.1



Subbasin : E1.2

Input Data

Area (ac) 16.30
Weighted Curve Number 62.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	8.15	B	60.00
2.5 Acre Lots, 11% Impervious	8.15	B	64.00
Composite Area & Weighted CN	16.30		62.00

Time of Concentration

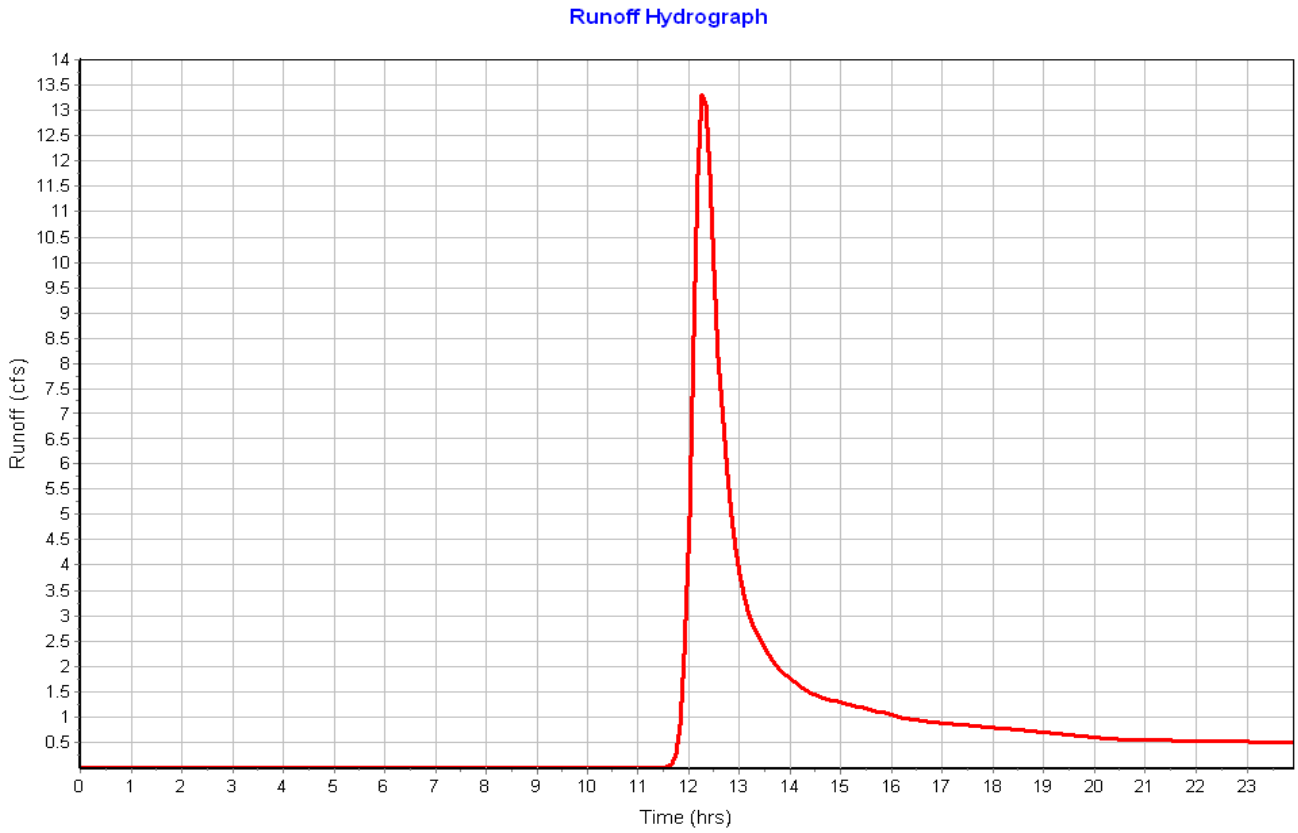
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	2.7	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.15	0.00	0.00
Computed Flow Time (min) :	14.49	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	228	0.00	0.00
Channel Slope (%) :	2.7	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	7.86	0.00	0.00
Computed Flow Time (min) :	0.48	0.00	0.00

Total TOC (min) 36.03

Subbasin : E1.2



Subbasin : E2

Input Data

Area (ac) 2.60
Weighted Curve Number 64.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	2.60	B	64.00
Composite Area & Weighted CN	2.60		64.00

Time of Concentration

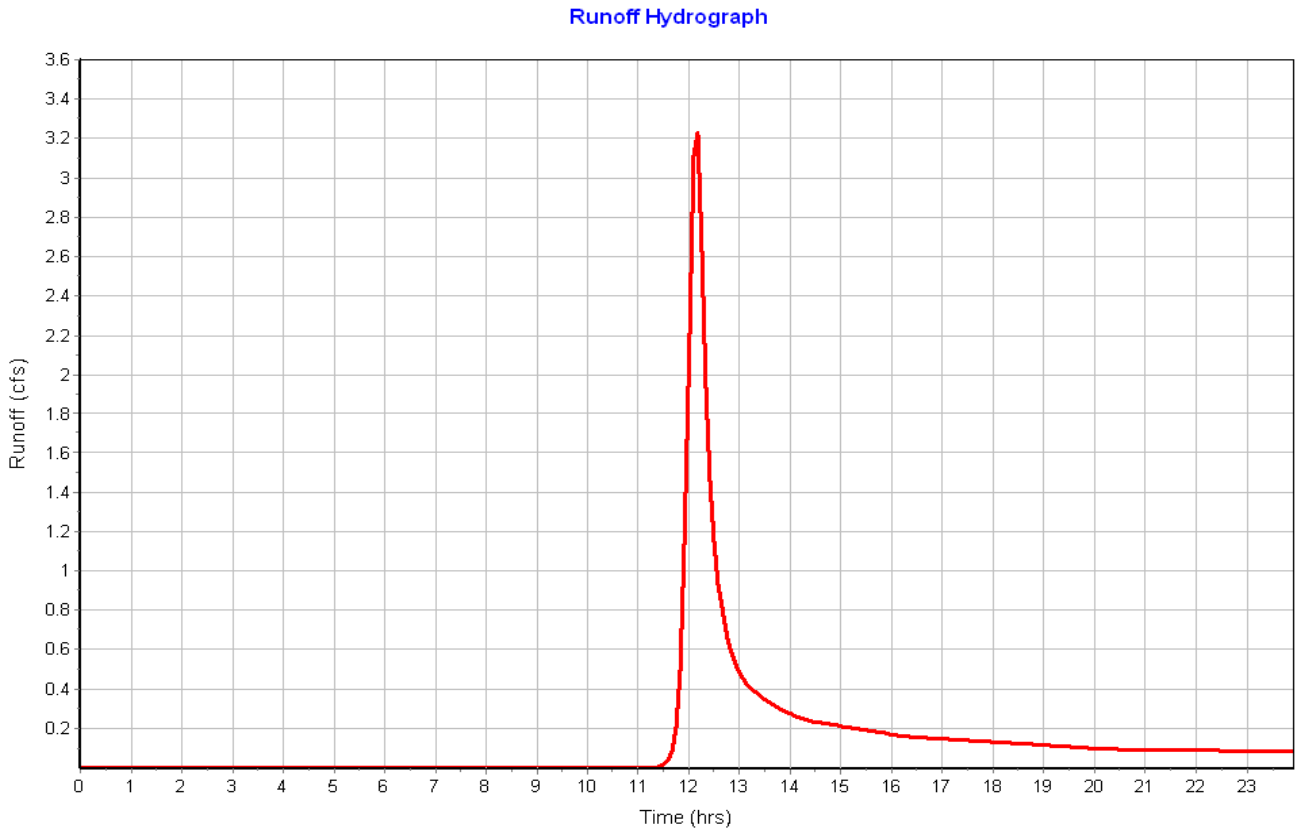
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	100	0.00	0.00
Slope (%) :	5.4	0.00	0.00
Surface Type :	Woodland	Unpaved	Unpaved
Velocity (ft/sec) :	1.16	0.00	0.00
Computed Flow Time (min) :	1.44	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	101	0.00	0.00
Channel Slope (%) :	5.4	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	11.12	0.00	0.00
Computed Flow Time (min) :	0.15	0.00	0.00

Total TOC (min) 22.65

Subbasin : E2


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3
3.2
3.4
3.6

Subbasin : E3

Input Data

Area (ac) 19.80
Weighted Curve Number 64.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	19.80	B	64.00
Composite Area & Weighted CN	19.80		64.00

Time of Concentration

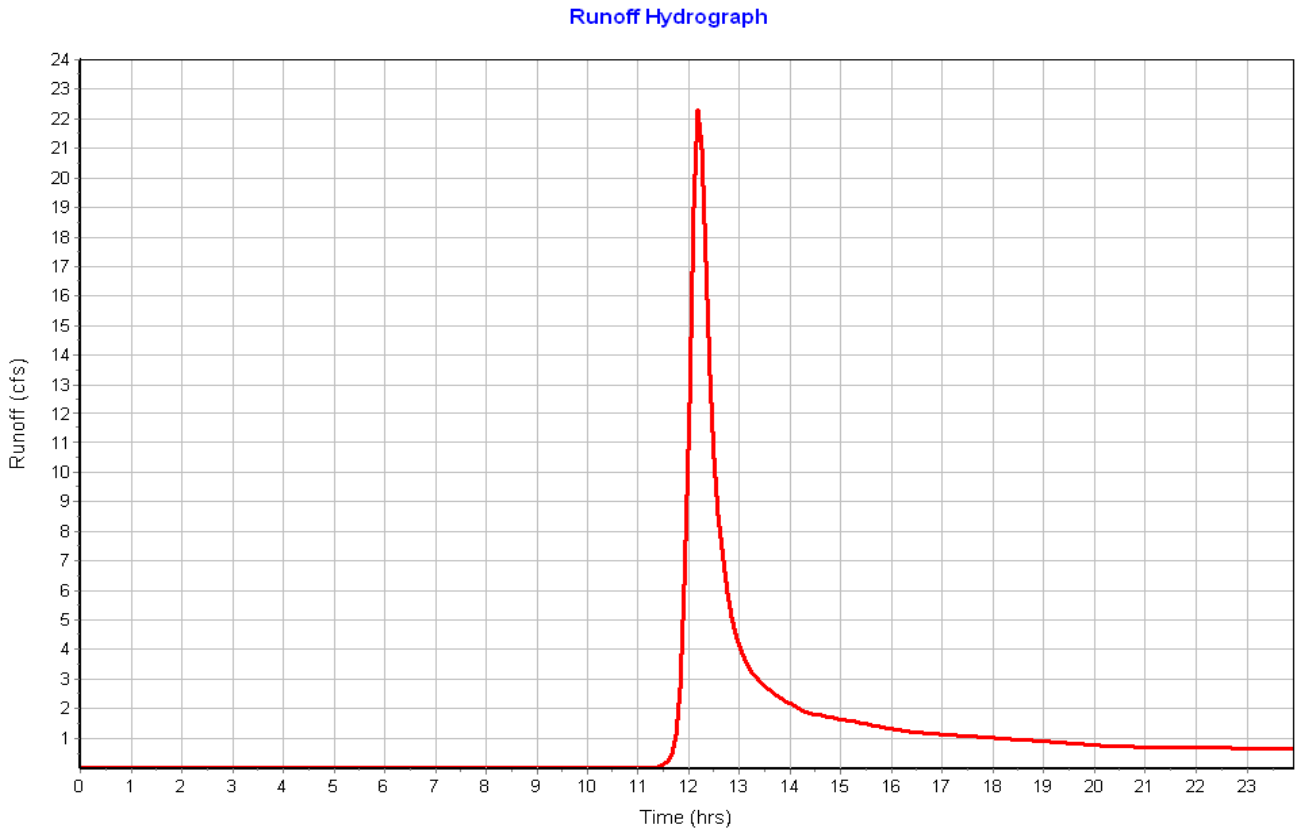
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	4.6	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.50	0.00	0.00
Computed Flow Time (min) :	5.56	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	453	0.00	0.00
Channel Slope (%) :	4.6	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.26	0.00	0.00
Computed Flow Time (min) :	0.74	0.00	0.00

Total TOC (min) 27.35

Subbasin : E3


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Subbasin : E4

Input Data

Area (ac) 18.20
Weighted Curve Number 64.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	18.20	B	64.00
Composite Area & Weighted CN	18.20		64.00

Time of Concentration

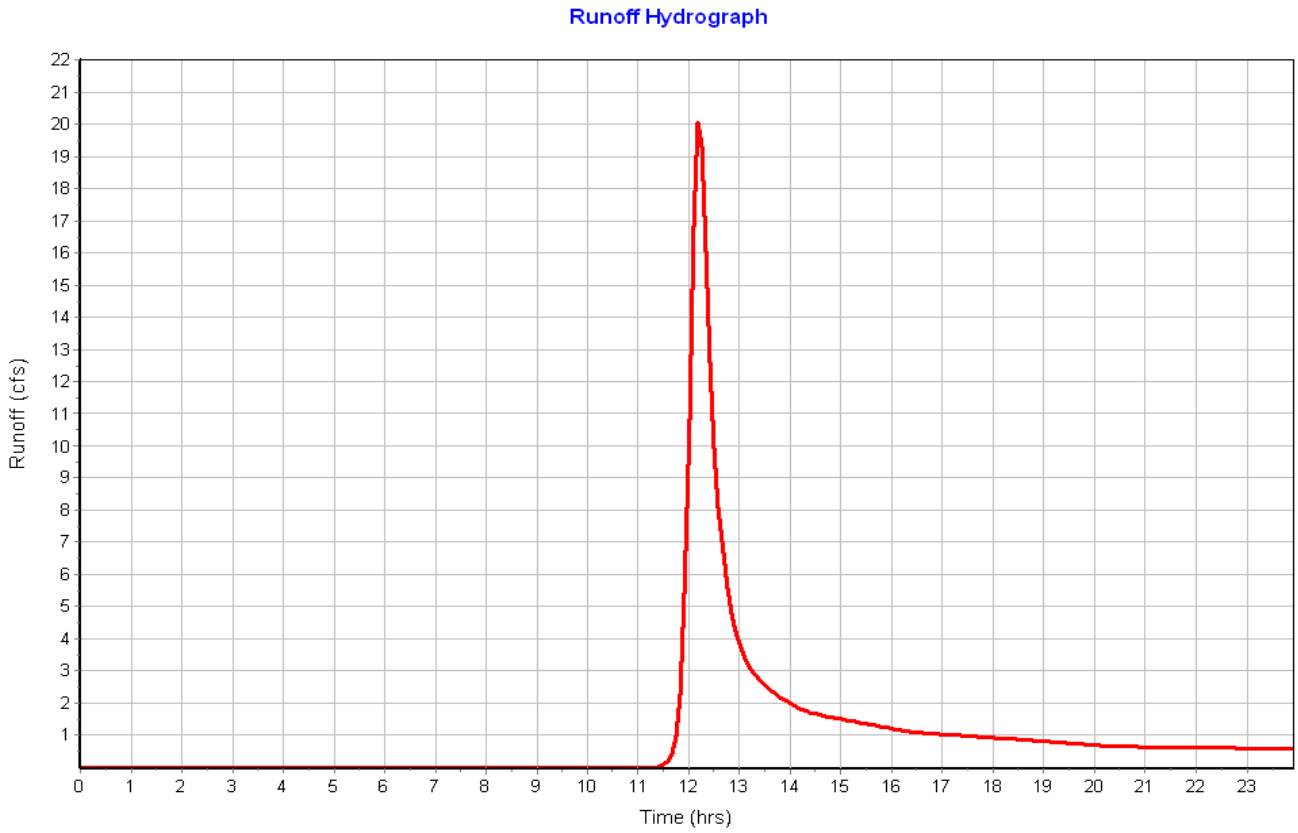
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	3.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.36	0.00	0.00
Computed Flow Time (min) :	6.13	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	528	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.32	0.00	0.00
Computed Flow Time (min) :	0.94	0.00	0.00

Total TOC (min) 28.13

Subbasin : E4


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

Subbasin : E5

Input Data

Area (ac) 13.50
Weighted Curve Number 64.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	13.50	B	64.00
Composite Area & Weighted CN	13.50		64.00

Time of Concentration

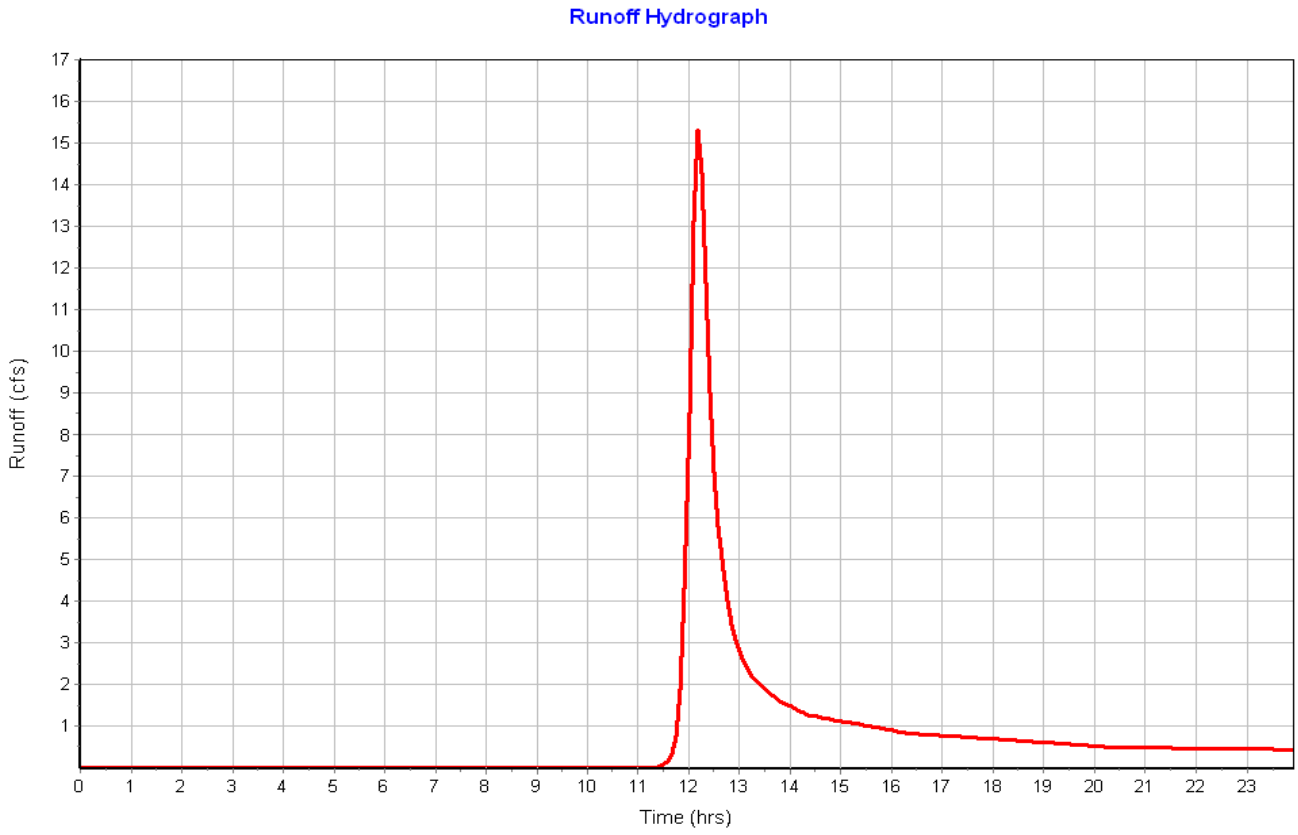
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	4.7	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.52	0.00	0.00
Computed Flow Time (min) :	5.48	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	335	0.00	0.00
Channel Slope (%) :	4.7	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.37	0.00	0.00
Computed Flow Time (min) :	0.54	0.00	0.00

Total TOC (min) 27.08

Subbasin : E5


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Subbasin : E6

Input Data

Area (ac) 28.90
Weighted Curve Number 62.40
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
2.5 Acre Lots, 11% Impervious	8.67	B	64.00
5 Acre Lots, 7% Impervious	18.79	B	60.00
Pasture, grassland, or range, Fair	1.45	D	84.00
Composite Area & Weighted CN	28.91		62.40

Time of Concentration

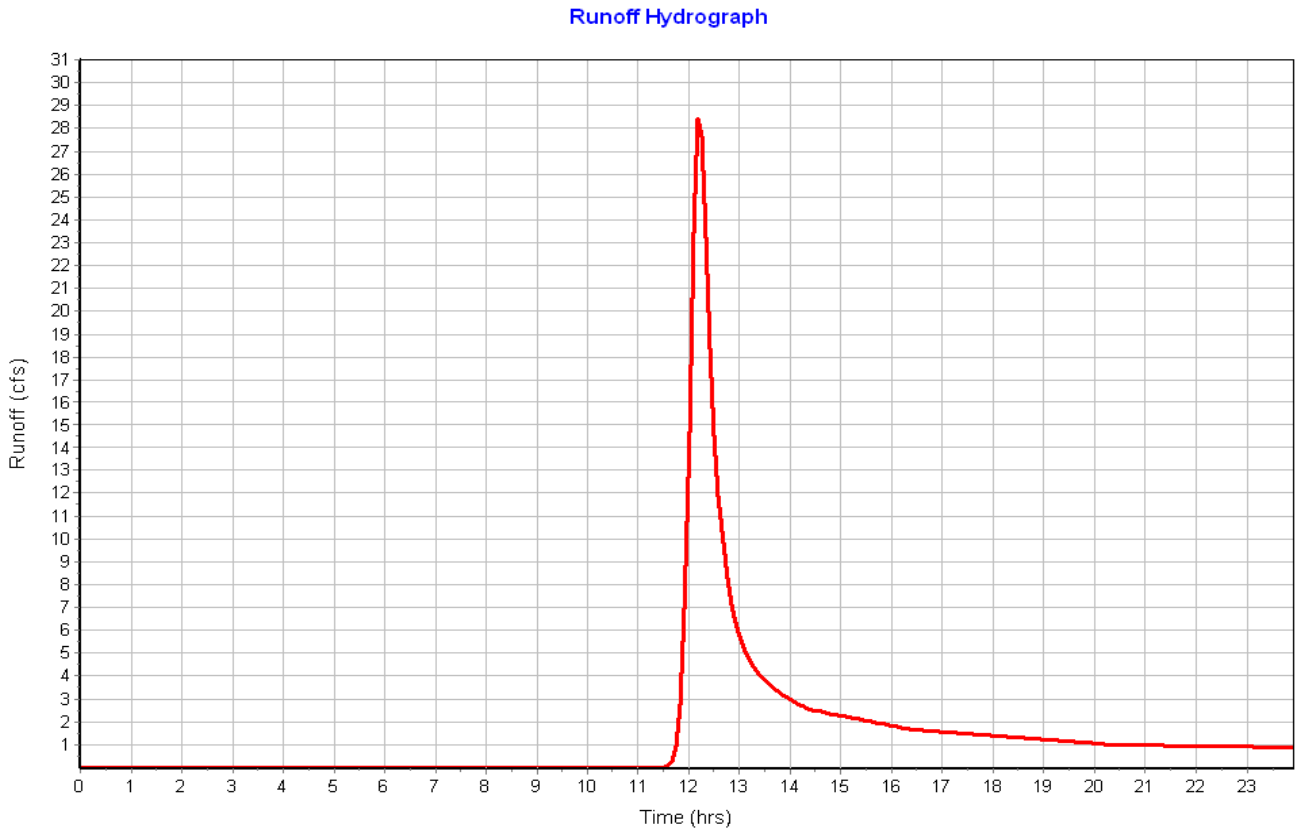
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	4.2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.43	0.00	0.00
Computed Flow Time (min) :	5.83	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	859	0.00	0.00
Channel Slope (%) :	4.2	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.80	0.00	0.00
Computed Flow Time (min) :	1.46	0.00	0.00

Total TOC (min) 28.35

Subbasin : E6


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Subbasin : E7

Input Data

Area (ac) 9.80
Weighted Curve Number 62.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	4.90	B	60.00
2.5 Acre Lots, 11% Impervious	4.90	B	64.00
Composite Area & Weighted CN	9.80		62.00

Time of Concentration

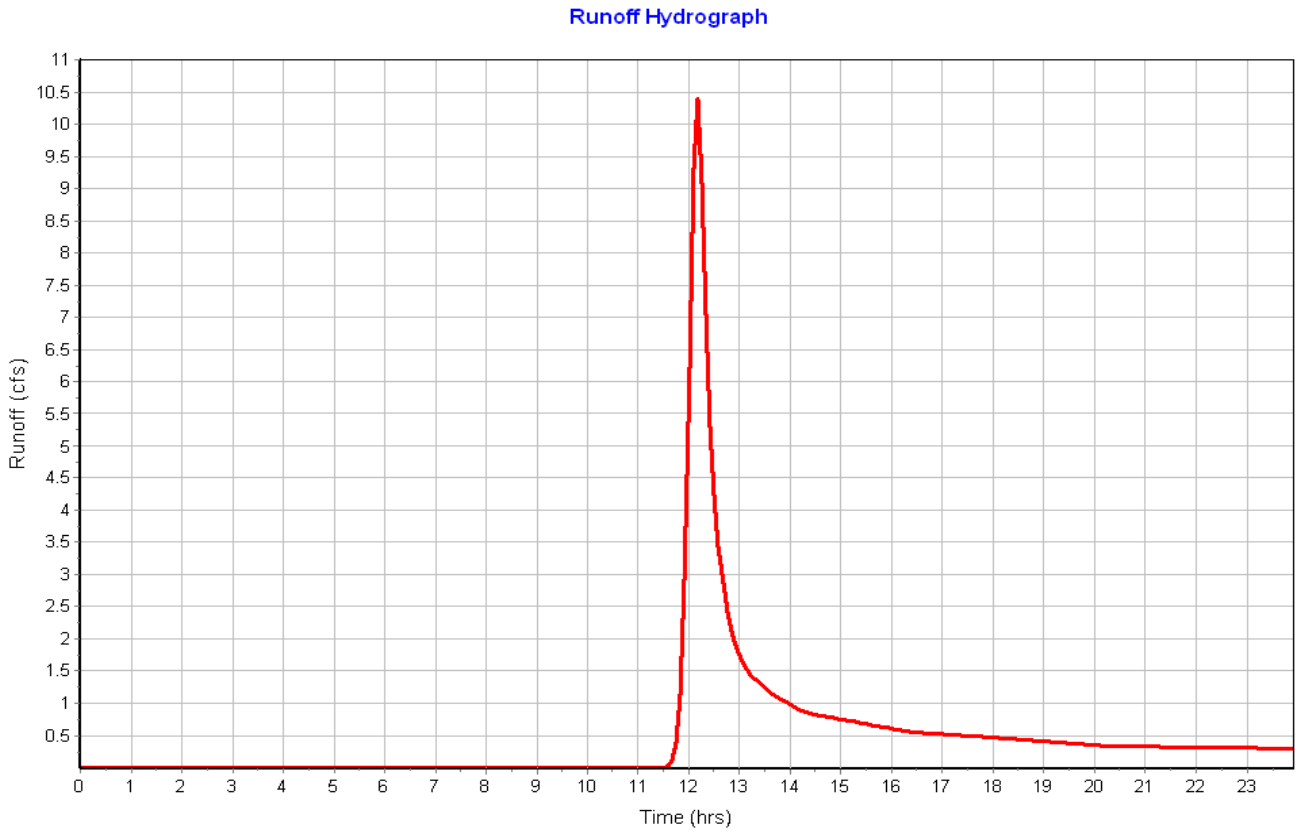
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	3.5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.31	0.00	0.00
Computed Flow Time (min) :	2.54	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	474	0.00	0.00
Channel Slope (%) :	3.5	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	8.95	0.00	0.00
Computed Flow Time (min) :	0.88	0.00	0.00

Total TOC (min) 24.49

Subbasin : E7


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Subbasin : F1

Input Data

Area (ac) 42.90
Weighted Curve Number 60.40
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	38.61	B	60.00
2.5 Acre Lots, 11% Impervious	4.29	B	64.00
Composite Area & Weighted CN	42.90		60.40

Time of Concentration

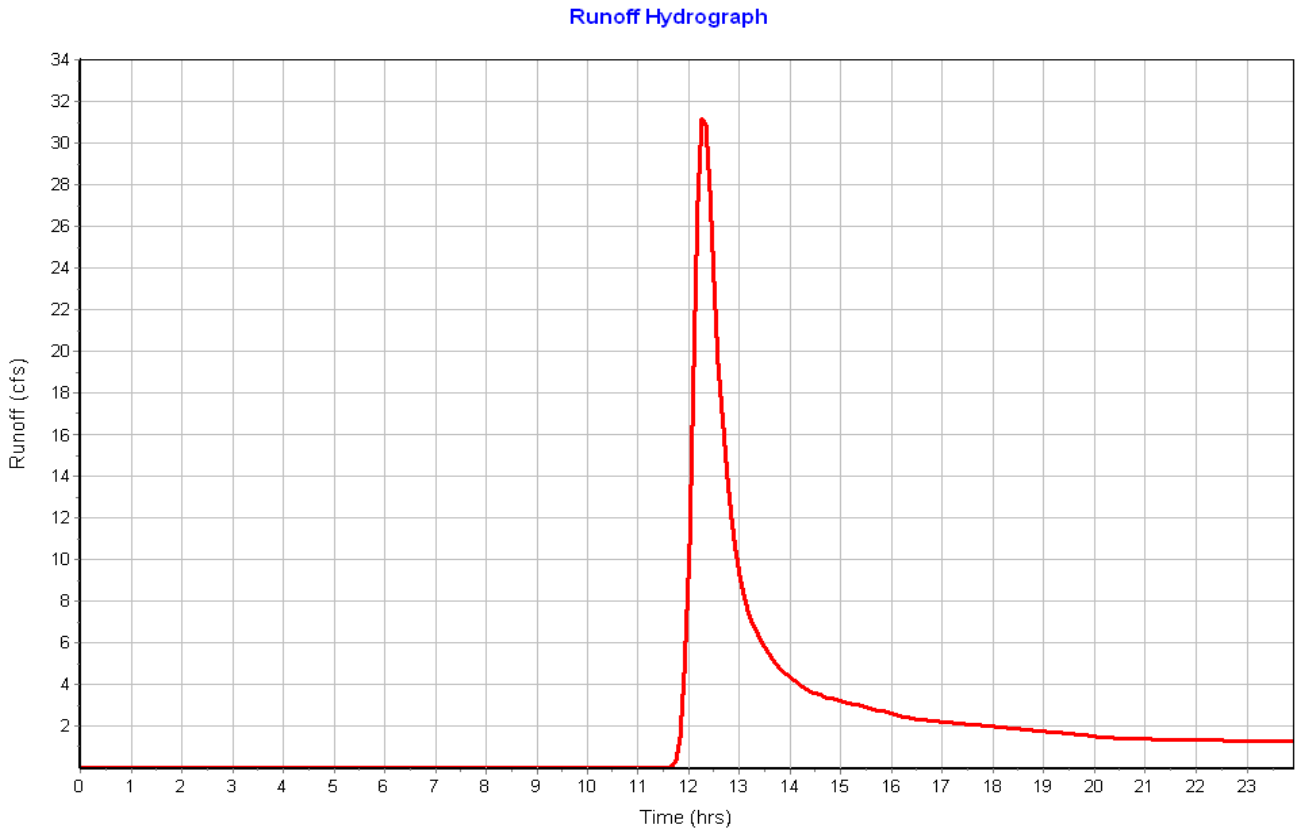
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.25	0.00	0.00
Computed Flow Time (min) :	13.33	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	745	0.00	0.00
Channel Slope (%) :	3.2	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	8.56	0.00	0.00
Computed Flow Time (min) :	1.45	0.00	0.00

Total TOC (min) 35.84

Subbasin : F1


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : G1

Input Data

Area (ac) 25.20
Weighted Curve Number 66.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	12.60	C	72.00
Woods, Fair	12.60	B	60.00
Composite Area & Weighted CN	25.20		66.00

Time of Concentration

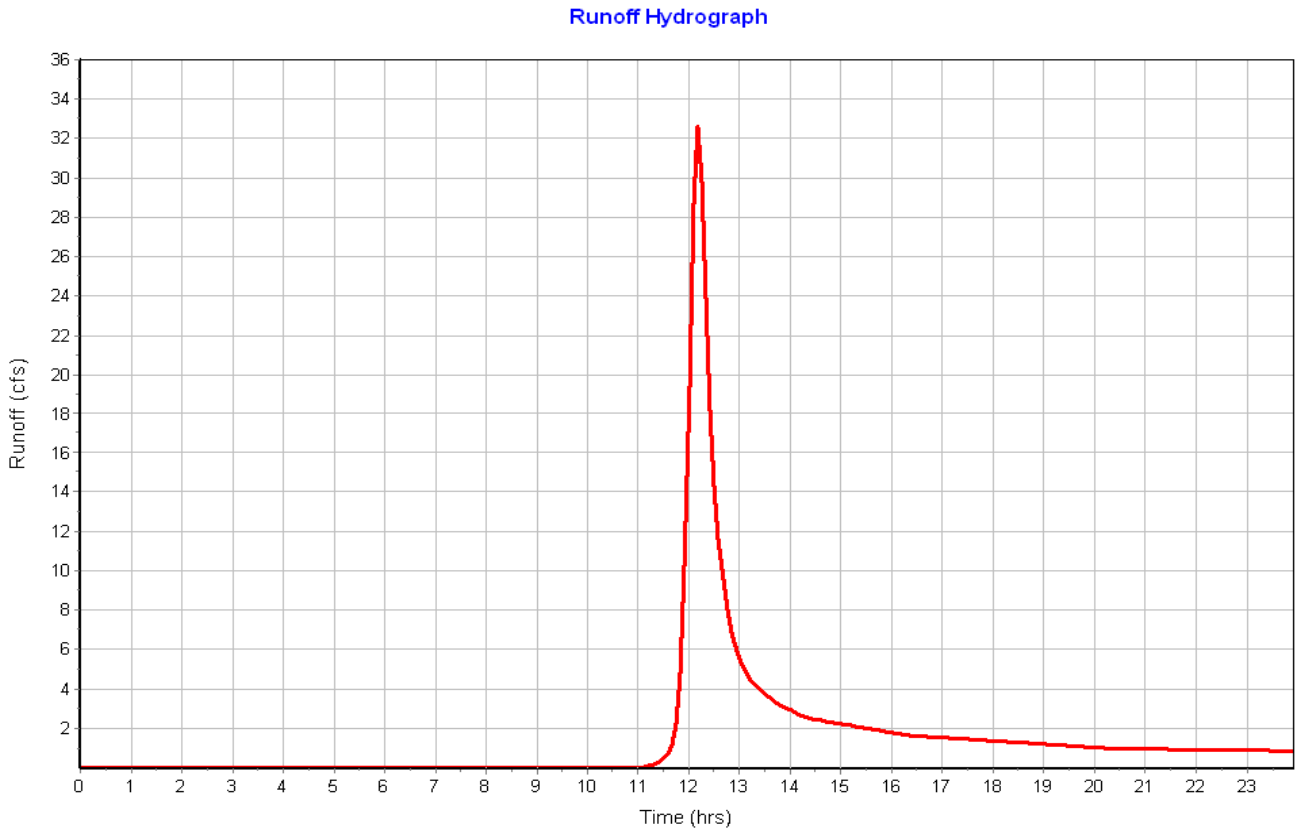
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	6.1	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.73	0.00	0.00
Computed Flow Time (min) :	4.82	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	658	0.00	0.00
Channel Slope (%) :	6.1	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	11.81	0.00	0.00
Computed Flow Time (min) :	0.93	0.00	0.00

Total TOC (min) 26.80

Subbasin : G1


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Subbasin : G2

Input Data

Area (ac) 21.20
Weighted Curve Number 72.70
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	19.08	C	72.00
Pasture, grassland, or range, Fair	2.12	C	79.00
Composite Area & Weighted CN	21.20		72.70

Time of Concentration

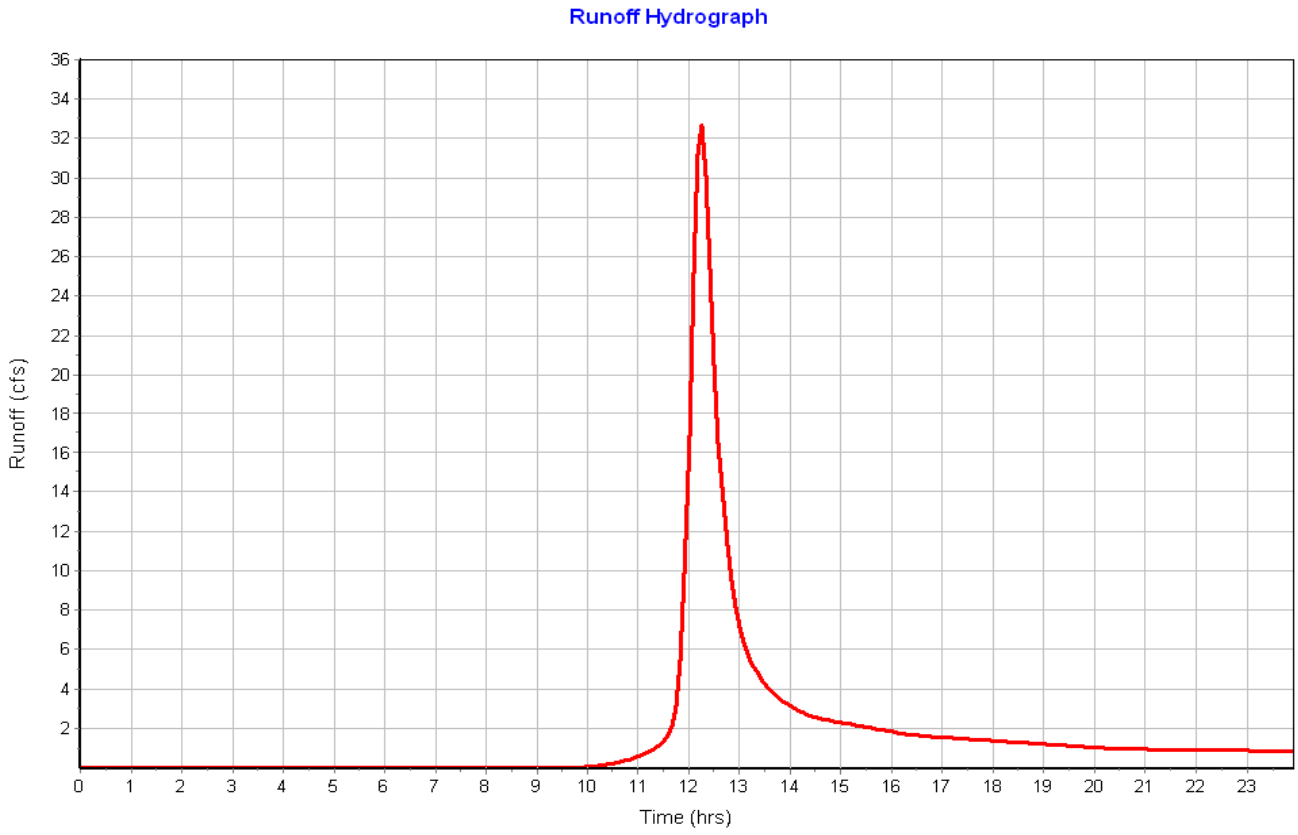
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.9	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.38	0.00	0.00
Computed Flow Time (min) :	12.08	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	695	0.00	0.00
Channel Slope (%) :	3.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.45	0.00	0.00
Computed Flow Time (min) :	1.23	0.00	0.00

Total TOC (min) 34.36

Subbasin : G2


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Subbasin : H1

Input Data

Area (ac) 13.90
Weighted Curve Number 70.80
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	1.39	B	60.00
5 Acre Lots, 7% Impervious	12.51	C	72.00
Composite Area & Weighted CN	13.90		70.80

Time of Concentration

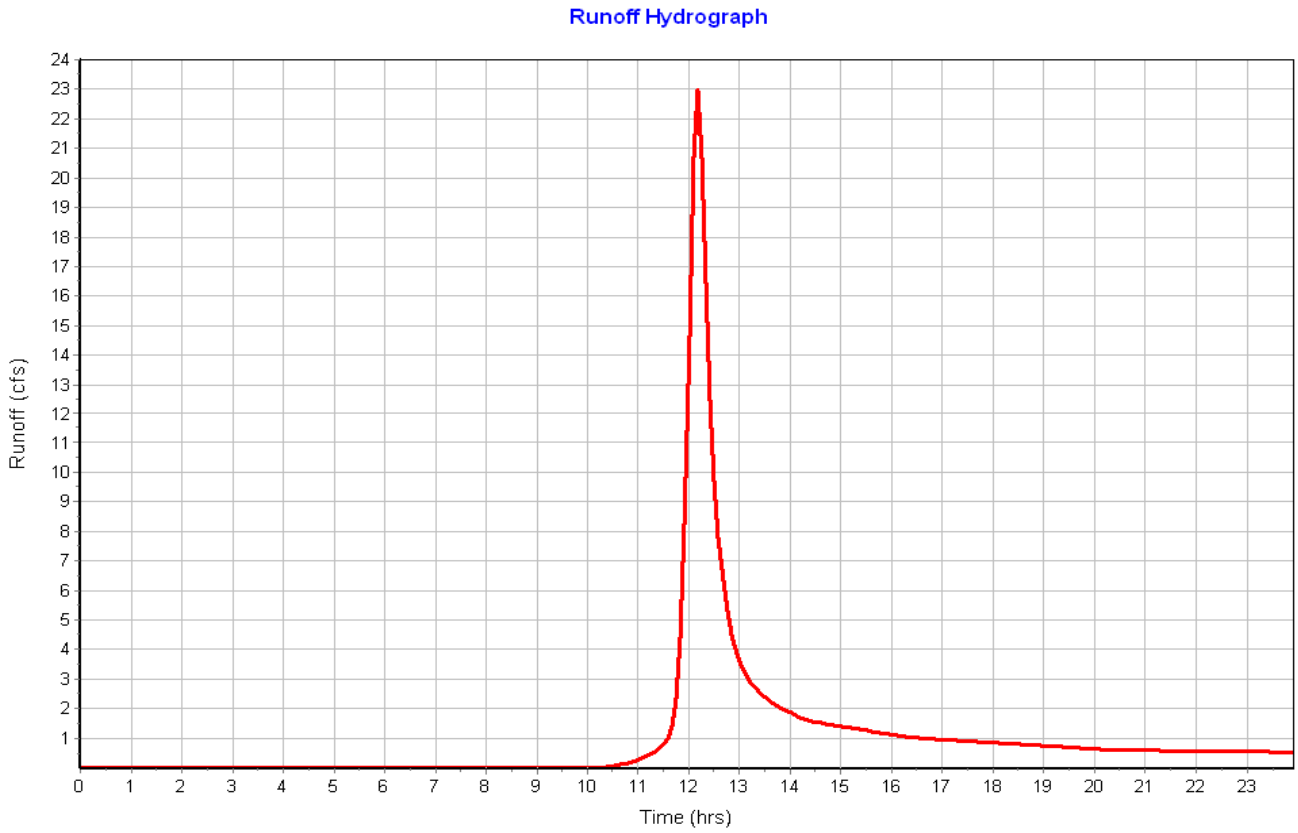
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	4.9	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.55	0.00	0.00
Computed Flow Time (min) :	5.38	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	328	0.00	0.00
Channel Slope (%) :	4.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.59	0.00	0.00
Computed Flow Time (min) :	0.52	0.00	0.00

Total TOC (min) 26.95

Subbasin : H1


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Subbasin : H2

Input Data

Area (ac) 39.10
Weighted Curve Number 67.20
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	15.64	B	60.00
5 Acre Lots, 7% Impervious	23.46	C	72.00
Composite Area & Weighted CN	39.10		67.20

Time of Concentration

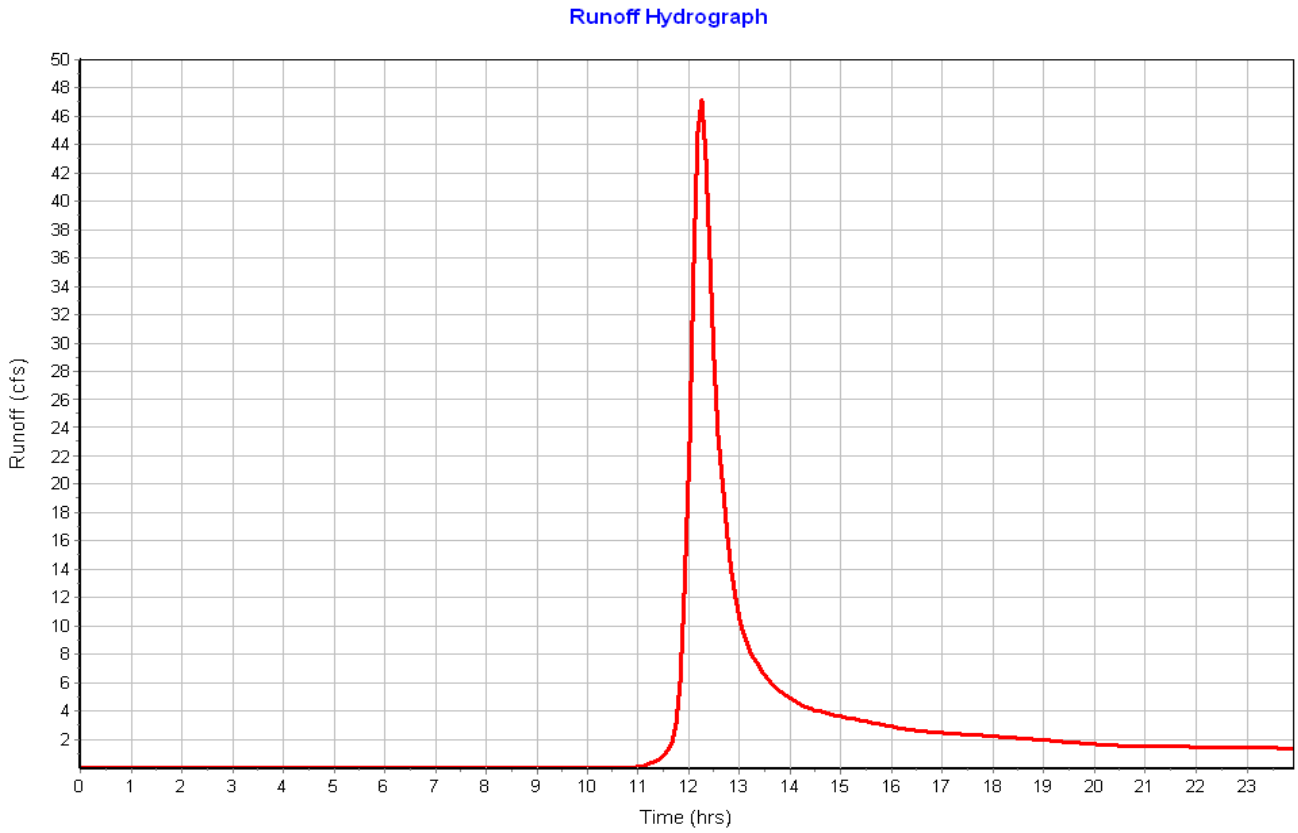
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.57	0.00	0.00
Computed Flow Time (min) :	10.62	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	851	0.00	0.00
Channel Slope (%) :	5	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.70	0.00	0.00
Computed Flow Time (min) :	1.33	0.00	0.00

Total TOC (min) 33.00

Subbasin : H2


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
50
48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : H3

Input Data

Area (ac) 5.80
Weighted Curve Number 66.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	2.90	C	72.00
Woods, Fair	2.90	B	60.00
Composite Area & Weighted CN	5.80		66.00

Time of Concentration

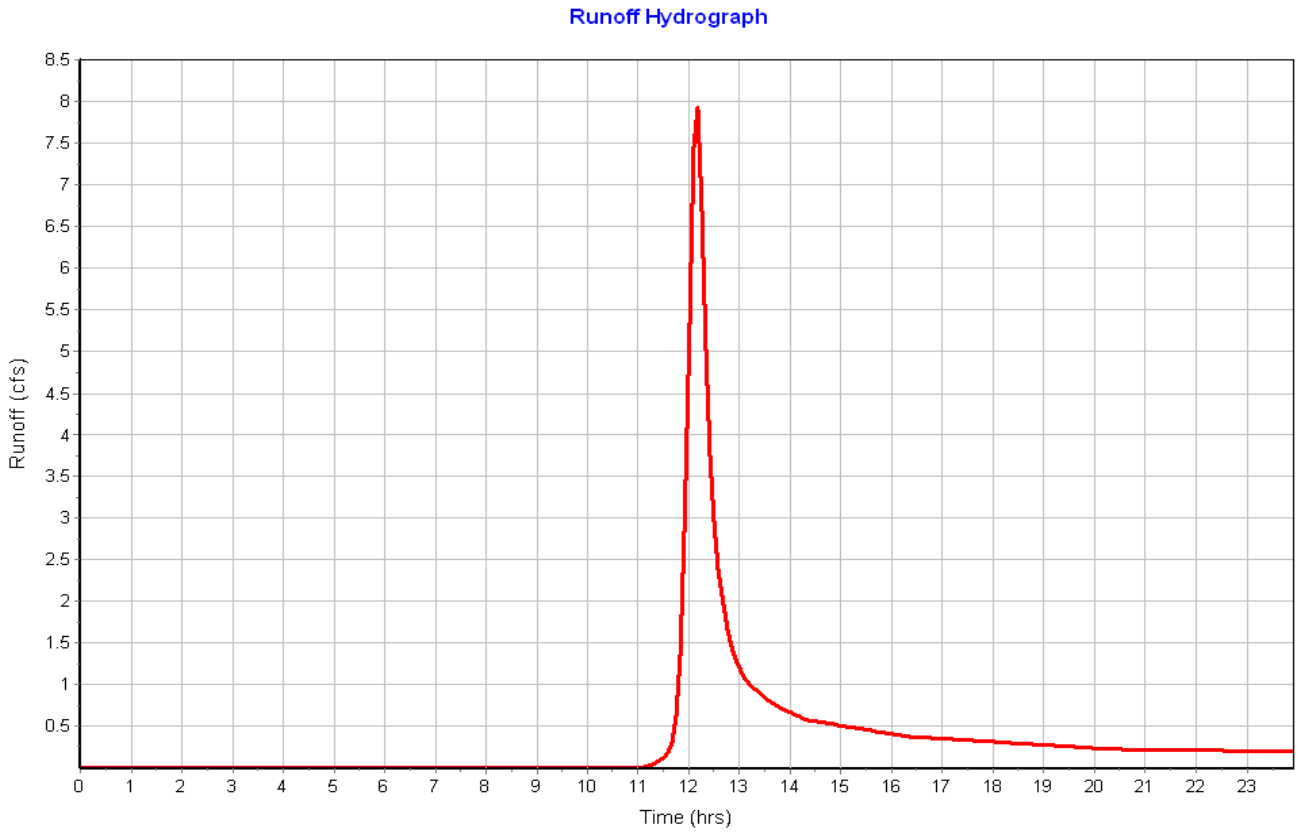
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	3.2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.25	0.00	0.00
Computed Flow Time (min) :	2.67	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	133	0.00	0.00
Channel Slope (%) :	3.2	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	8.56	0.00	0.00
Computed Flow Time (min) :	0.26	0.00	0.00

Total TOC (min) 23.98

Subbasin : H3


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

Subbasin : H4

Input Data

Area (ac) 27.10
Weighted Curve Number 73.75
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	20.33	C	72.00
Pasture, grassland, or range, Fair	6.78	C	79.00
Composite Area & Weighted CN	27.11		73.75

Time of Concentration

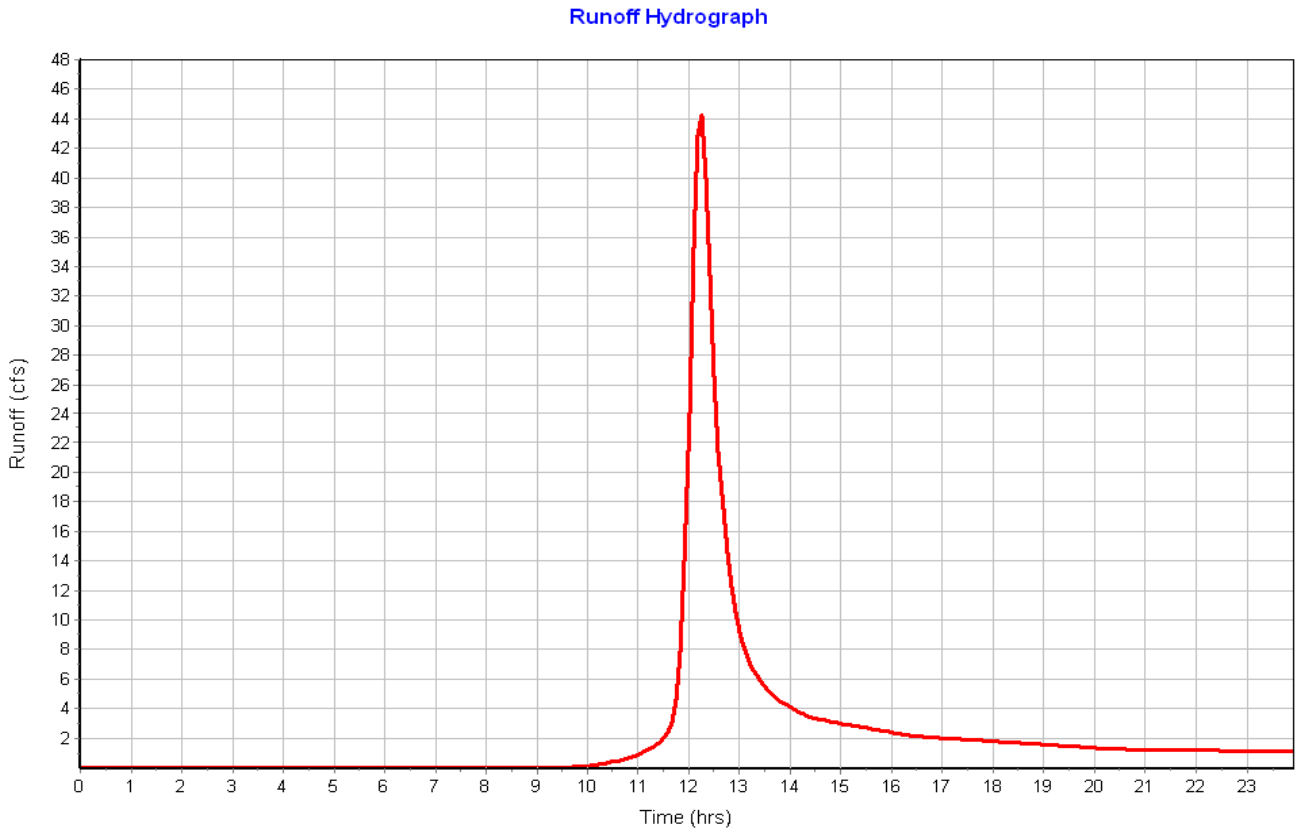
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	4.5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.48	0.00	0.00
Computed Flow Time (min) :	11.26	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	791	0.00	0.00
Channel Slope (%) :	4.5	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.15	0.00	0.00
Computed Flow Time (min) :	1.30	0.00	0.00

Total TOC (min) 33.62

Subbasin : H4


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Subbasin : H5

Input Data

Area (ac) 20.20
Weighted Curve Number 74.80
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Pasture, grassland, or range, Fair	8.08	C	79.00
5 Acre Lots, 7% Impervious	12.12	C	72.00
Composite Area & Weighted CN	20.20		74.80

Time of Concentration

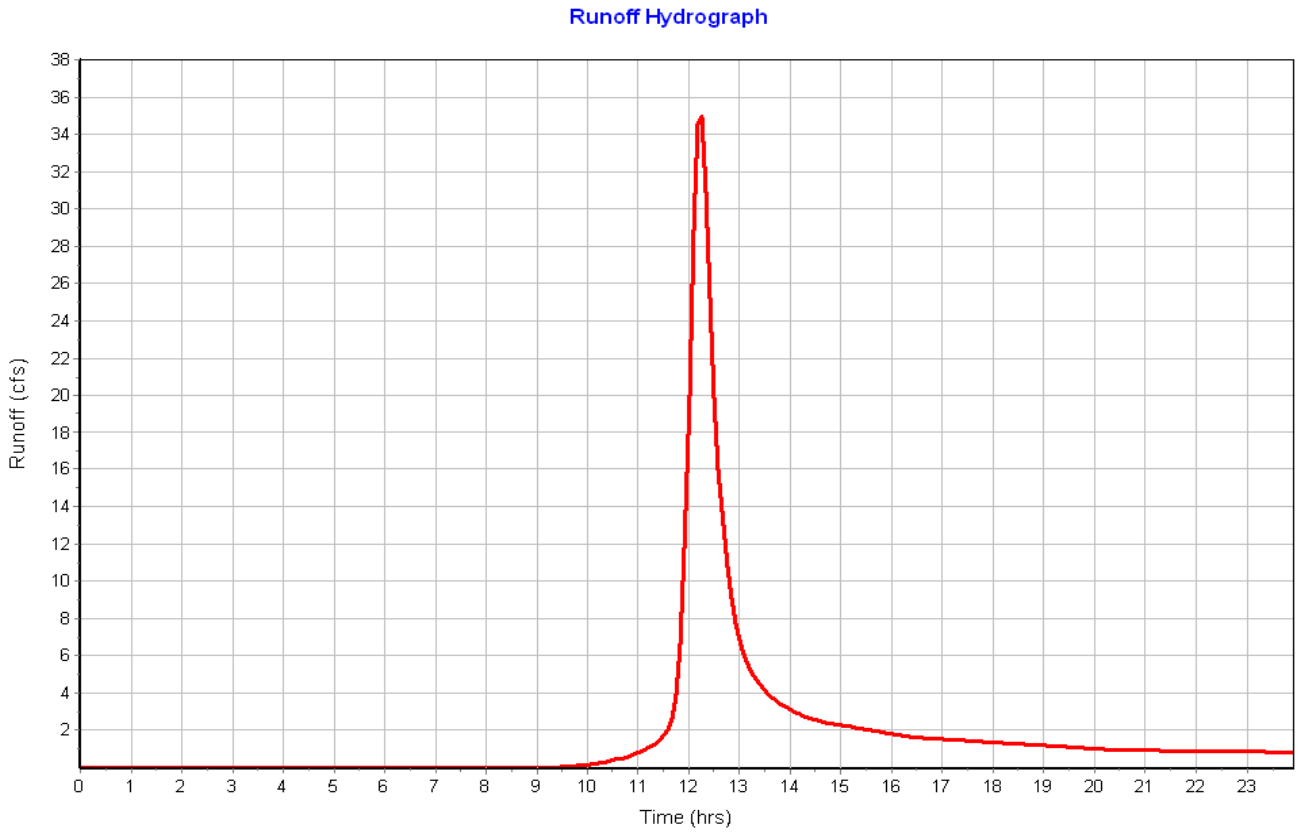
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	5.3	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.61	0.00	0.00
Computed Flow Time (min) :	10.35	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	655	0.00	0.00
Channel Slope (%) :	5.3	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	11.01	0.00	0.00
Computed Flow Time (min) :	0.99	0.00	0.00

Total TOC (min) 32.40

Subbasin : H5


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38

Subbasin : H6

Input Data

Area (ac) 31.60
Weighted Curve Number 66.60
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	11.06	B	60.00
Pasture, grassland, or range, Fair	18.96	B	69.00
Pasture, grassland, or range, Fair	1.58	D	84.00
Composite Area & Weighted CN	31.60		66.60

Time of Concentration

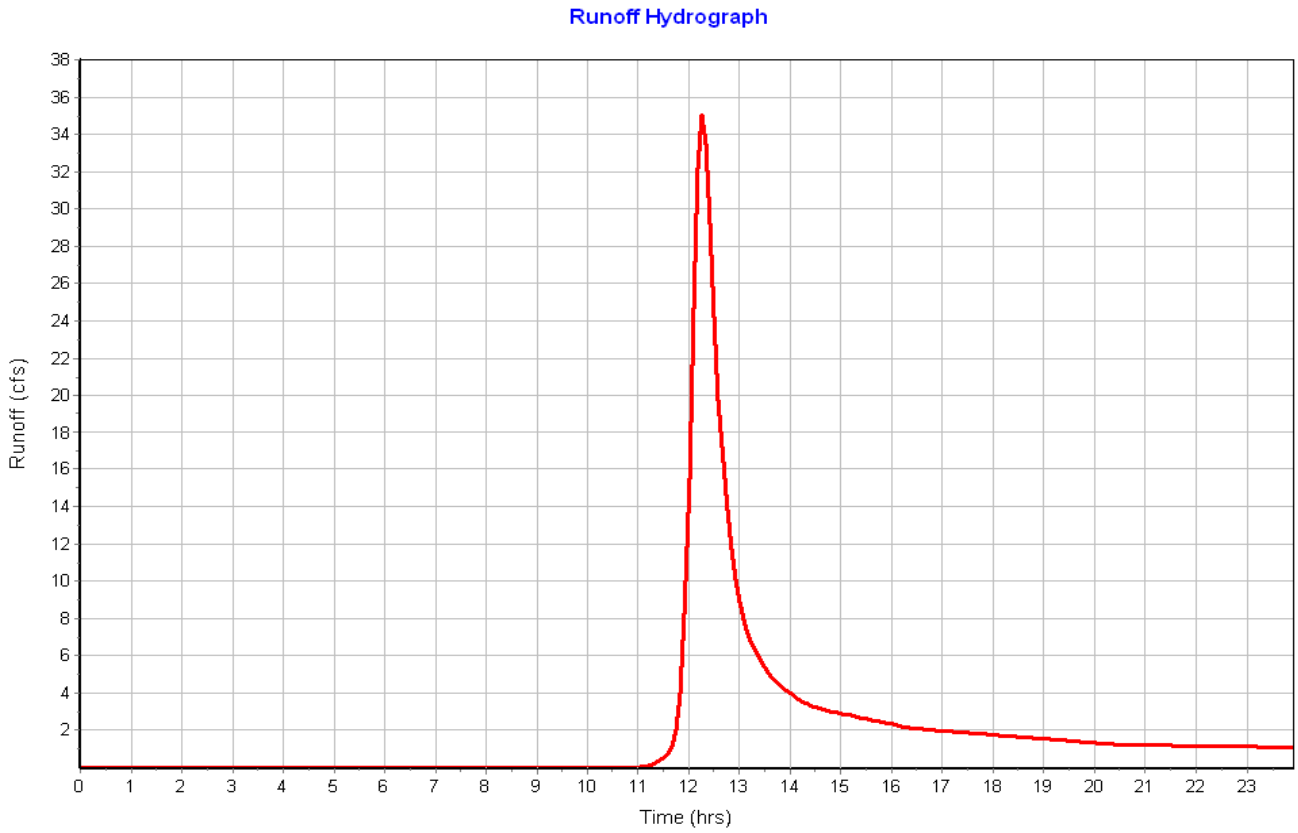
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	3.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.36	0.00	0.00
Computed Flow Time (min) :	12.25	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	1275	0.00	0.00
Channel Slope (%) :	3.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.32	0.00	0.00
Computed Flow Time (min) :	2.28	0.00	0.00

Total TOC (min) 35.59

Subbasin : H6


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38

Subbasin : H7

Input Data

Area (ac) 25.80
Weighted Curve Number 70.50
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	10.32	C	72.00
Pasture, grassland, or range, Fair	7.74	C	79.00
5 Acre Lots, 7% Impervious	7.74	B	60.00
Composite Area & Weighted CN	25.80		70.50

Time of Concentration

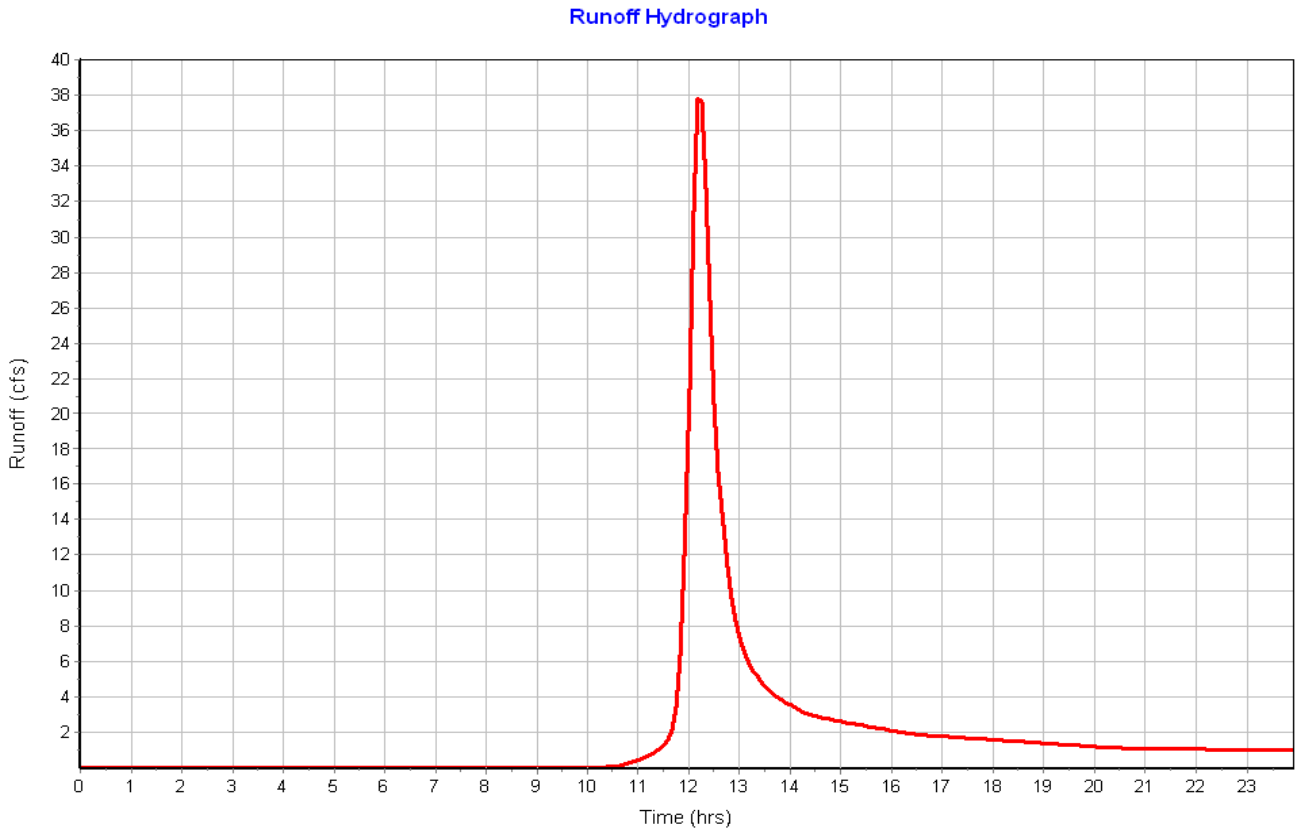
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	1000	0.00	0.00
Slope (%) :	6.5	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.78	0.00	0.00
Computed Flow Time (min) :	9.36	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	343	0.00	0.00
Channel Slope (%) :	6.5	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	12.20	0.00	0.00
Computed Flow Time (min) :	0.47	0.00	0.00

Total TOC (min) 30.89

Subbasin : H7


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Subbasin : H8

Input Data

Area (ac) 8.50
Weighted Curve Number 74.55
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	2.55	B	60.00
Pasture, grassland, or range, Fair	2.13	D	84.00
Pasture, grassland, or range, Fair	3.83	C	79.00
Composite Area & Weighted CN	8.51		74.55

Time of Concentration

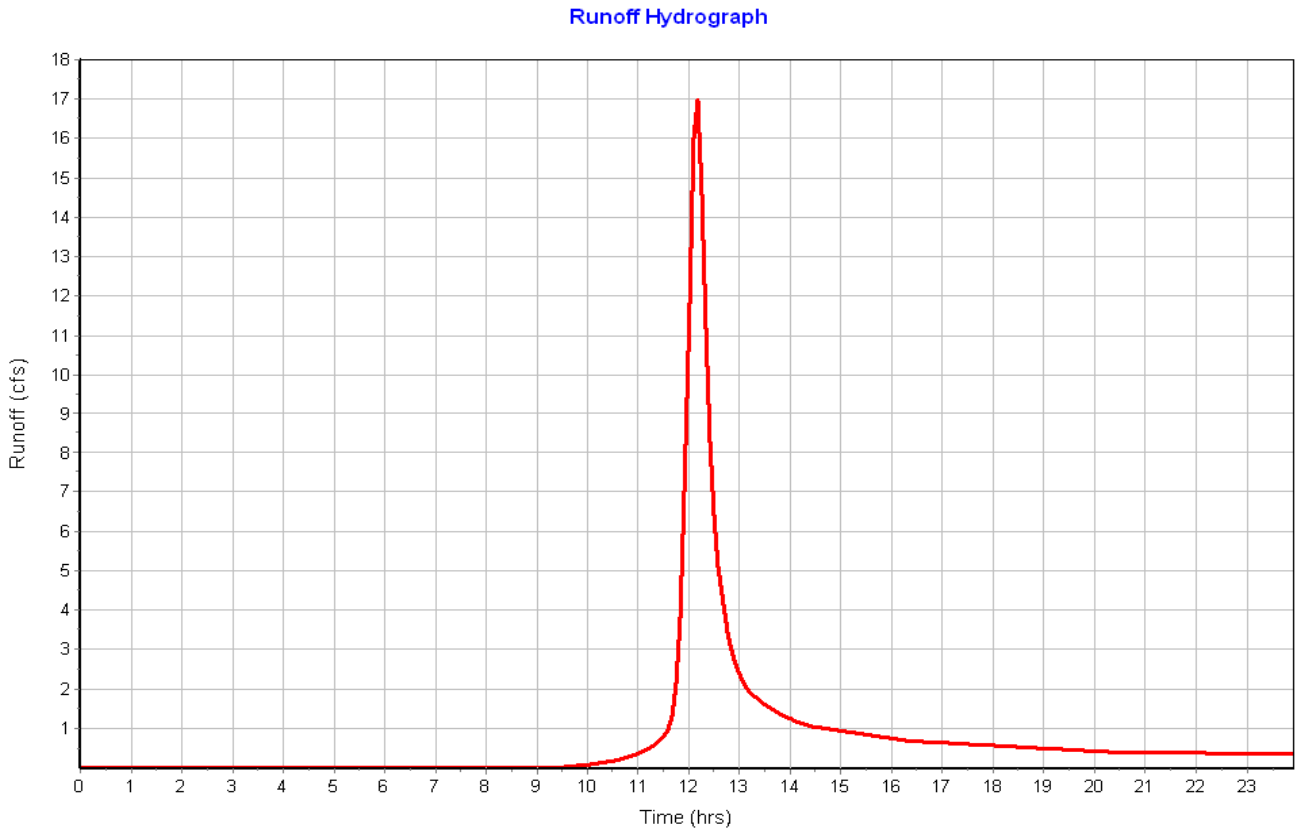
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	500	0.00	0.00
Slope (%) :	7.9	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.97	0.00	0.00
Computed Flow Time (min) :	4.23	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	159	0.00	0.00
Channel Slope (%) :	7.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	13.44	0.00	0.00
Computed Flow Time (min) :	0.20	0.00	0.00

Total TOC (min) 25.49

Subbasin : H8


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Subbasin : H9

Input Data

Area (ac) 6.90
Weighted Curve Number 70.80
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	0.69	B	60.00
5 Acre Lots, 7% Impervious	6.21	C	72.00
Composite Area & Weighted CN	6.90		70.80

Time of Concentration

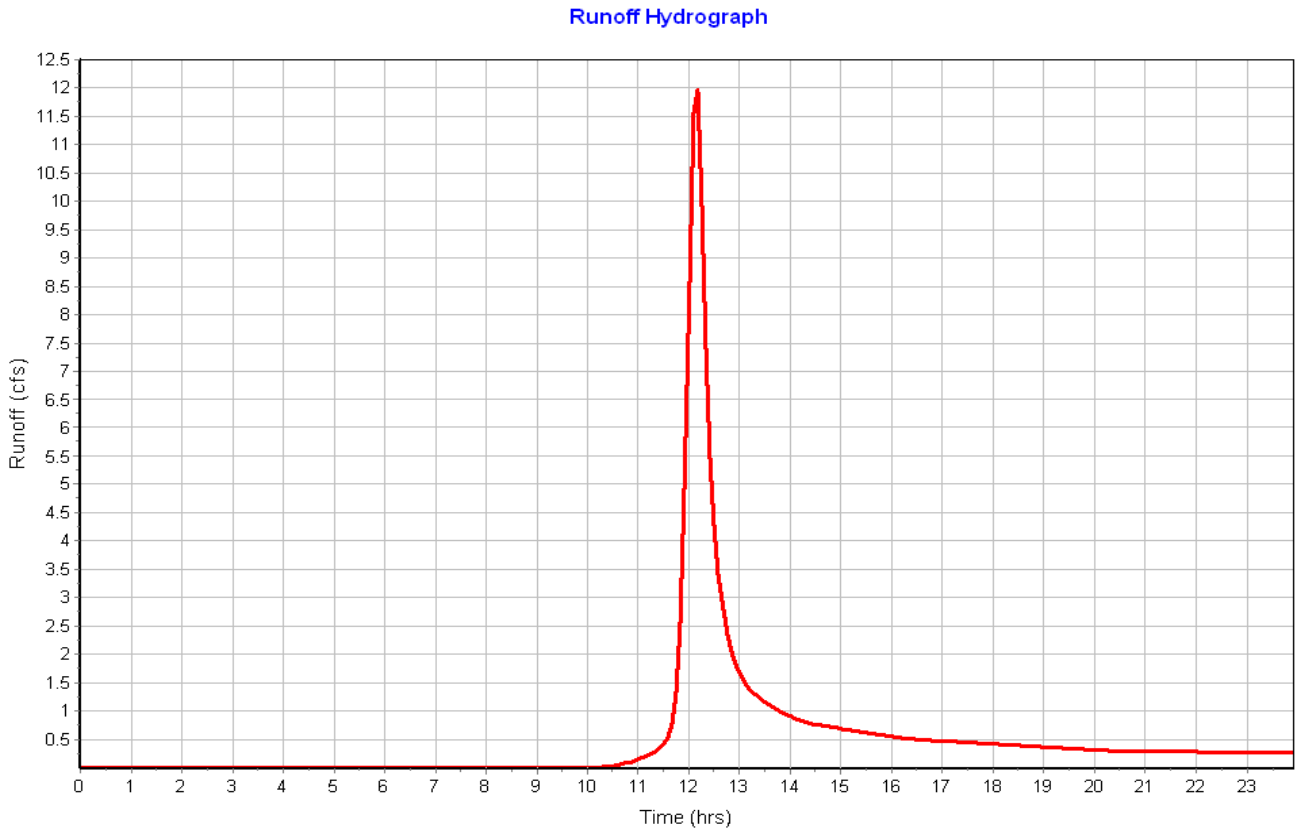
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	6.7	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.81	0.00	0.00
Computed Flow Time (min) :	2.76	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	171	0.00	0.00
Channel Slope (%) :	6.7	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	12.38	0.00	0.00
Computed Flow Time (min) :	0.23	0.00	0.00

Total TOC (min) 24.05

Subbasin : H9


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
12.5
12
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Subbasin : I1

Input Data

Area (ac) 6.80
Weighted Curve Number 72.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	6.80	C	72.00
Composite Area & Weighted CN	6.80		72.00

Time of Concentration

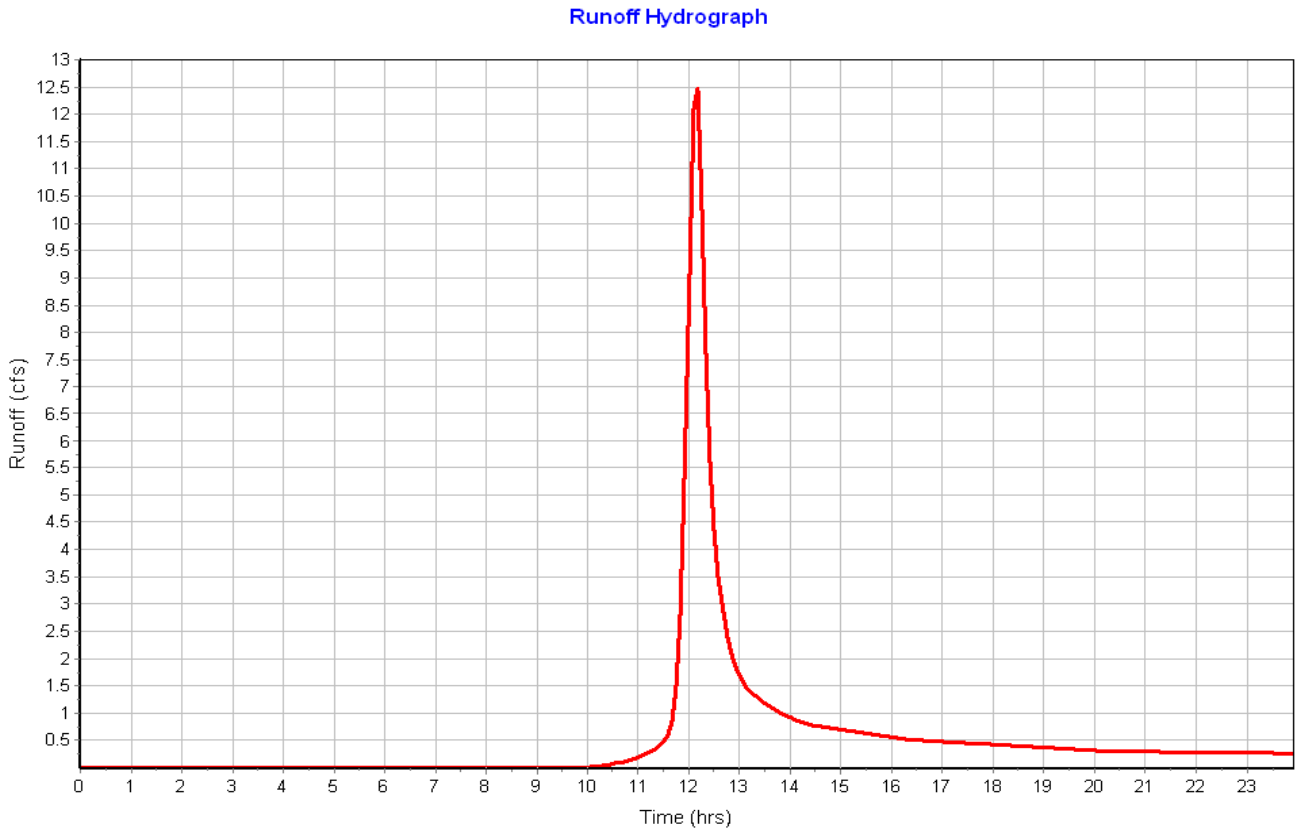
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	4	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.40	0.00	0.00
Computed Flow Time (min) :	2.38	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	268	0.00	0.00
Channel Slope (%) :	4	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.57	0.00	0.00
Computed Flow Time (min) :	0.47	0.00	0.00

Total TOC (min) 23.91

Subbasin : I1


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
13
12.5
12
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Subbasin : I2

Input Data

Area (ac) 14.80
Weighted Curve Number 72.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	14.80	C	72.00
Composite Area & Weighted CN	14.80		72.00

Time of Concentration

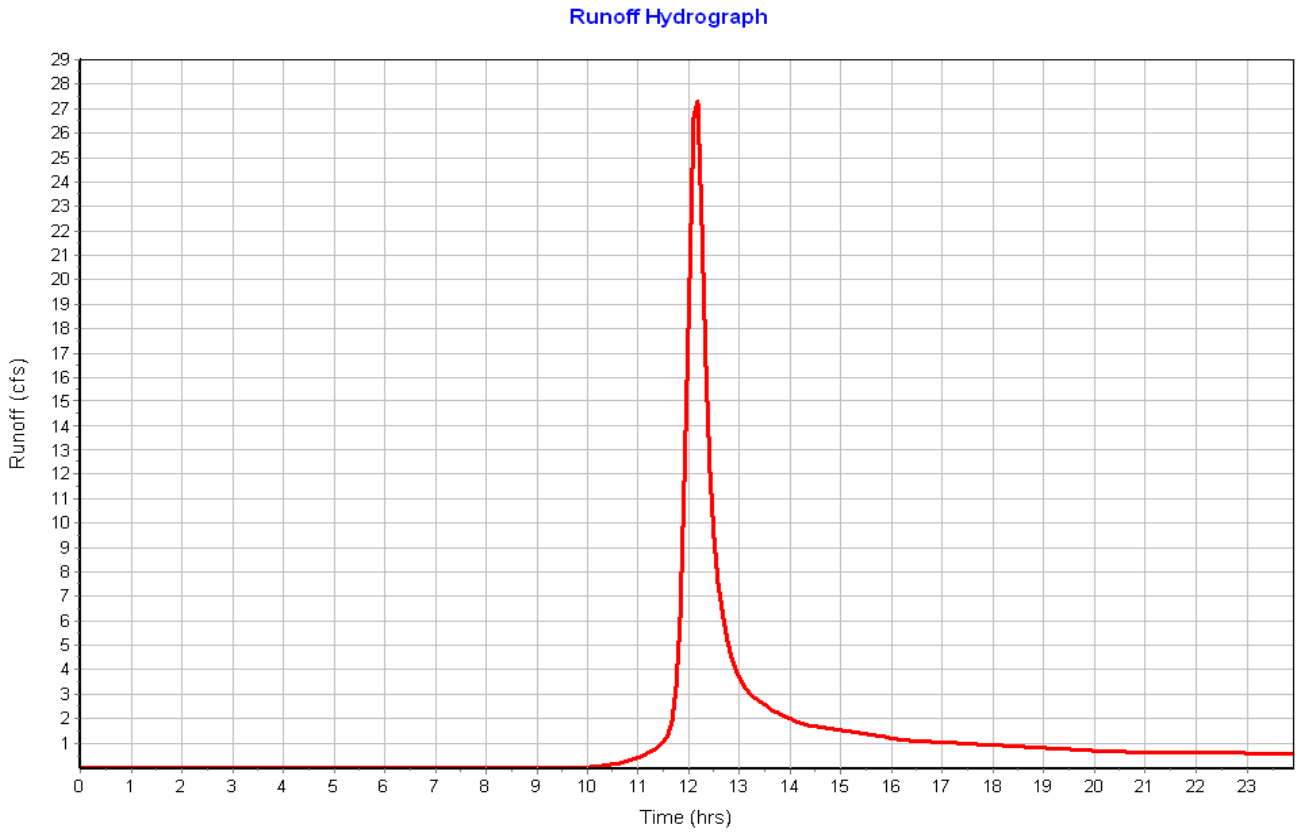
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	5.2	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.60	0.00	0.00
Computed Flow Time (min) :	2.08	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	285	0.00	0.00
Channel Slope (%) :	5.2	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	10.91	0.00	0.00
Computed Flow Time (min) :	0.44	0.00	0.00

Total TOC (min) 23.58

Subbasin : I2


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

Subbasin : J1

Input Data

Area (ac) 10.10
Weighted Curve Number 60.00
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	10.10	B	60.00
Composite Area & Weighted CN	10.10		60.00

Time of Concentration

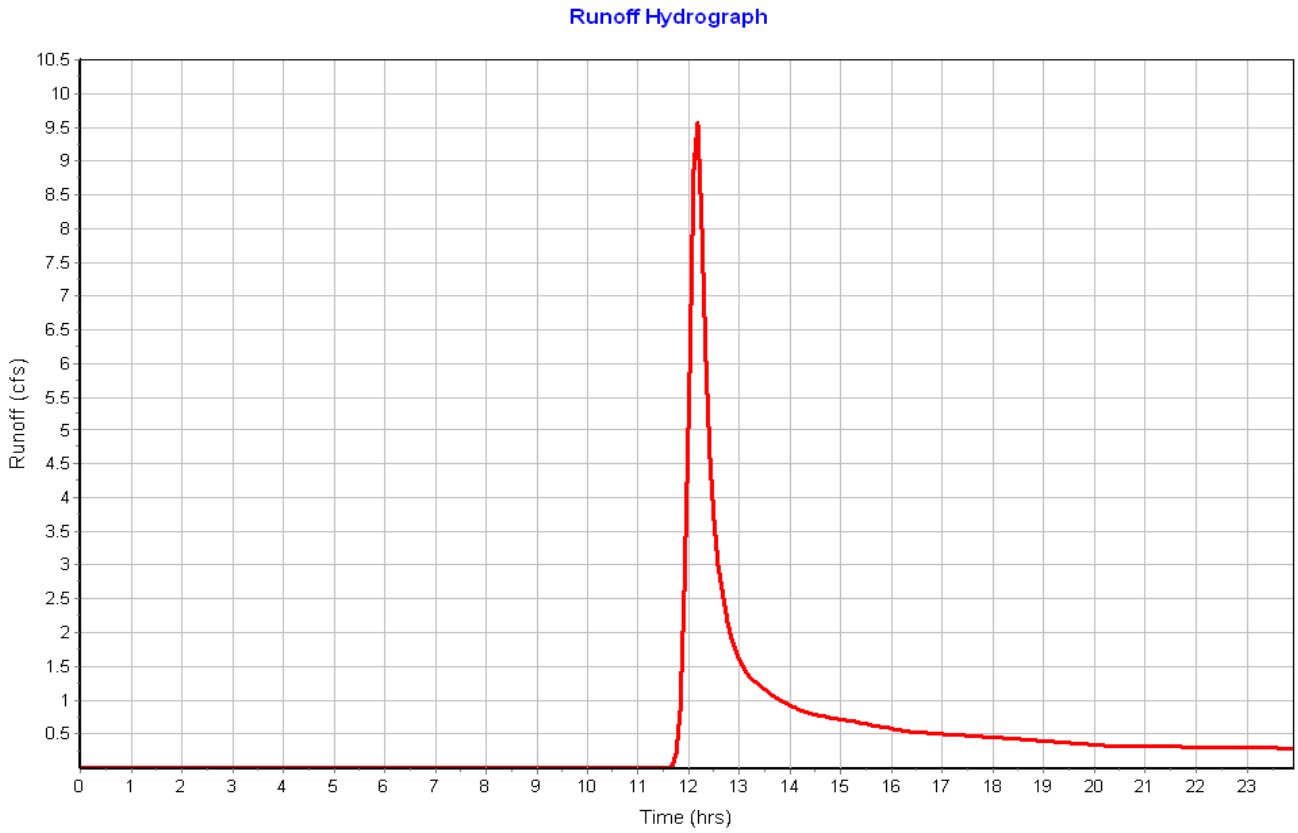
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	8.8	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	2.08	0.00	0.00
Computed Flow Time (min) :	1.60	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	228	0.00	0.00
Channel Slope (%) :	8.8	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	14.19	0.00	0.00
Computed Flow Time (min) :	0.27	0.00	0.00

Total TOC (min) 22.93

Subbasin : J1


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Subbasin : K1

Input Data

Area (ac) 17.80
Weighted Curve Number 69.60
Rain Gage ID ..... Rain Gage-1

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
5 Acre Lots, 7% Impervious	3.56	B	60.00
5 Acre Lots, 7% Impervious	14.24	C	72.00
Composite Area & Weighted CN	17.80		69.60

Time of Concentration

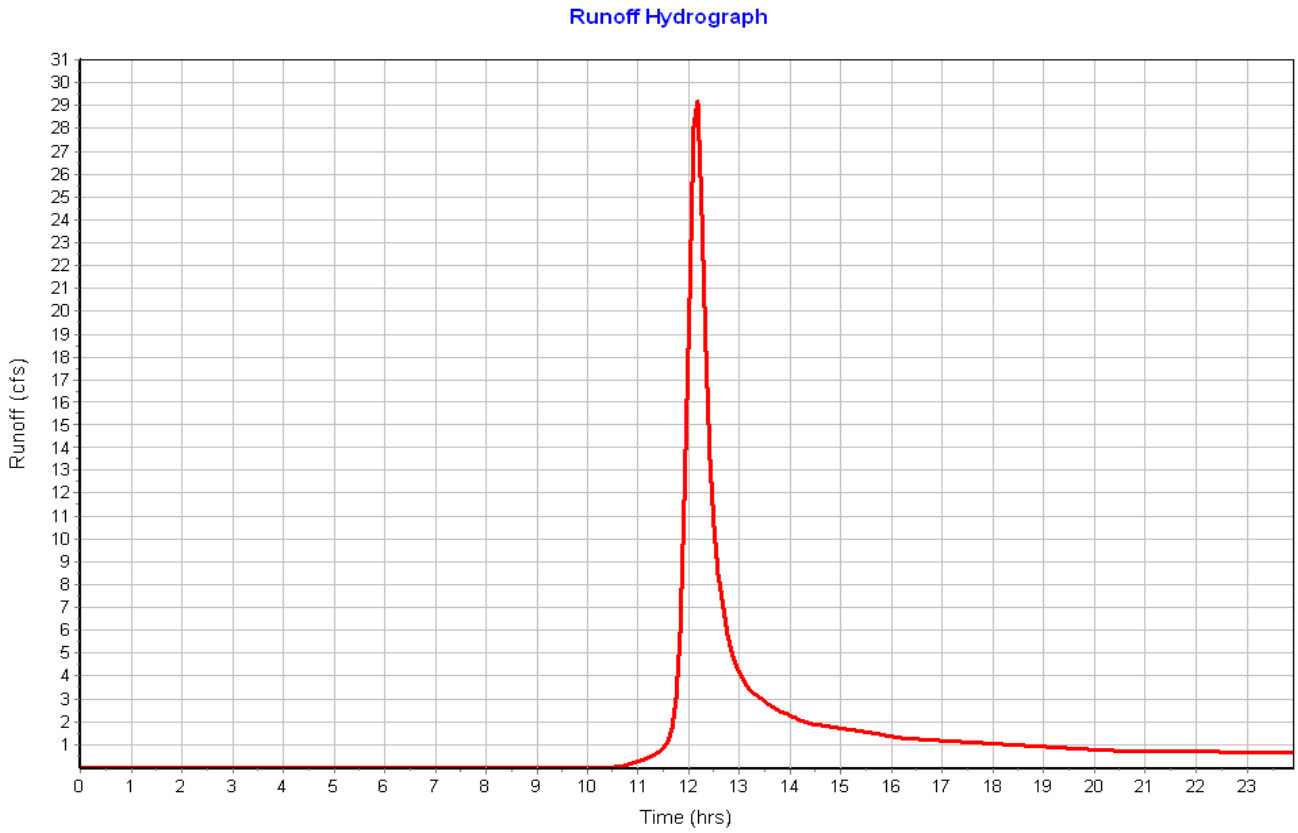
Sheet Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.1	0.00	0.00
Flow Length (ft) :	300	0.00	0.00
Slope (%) :	2	0.00	0.00
2 yr, 24 hr Rainfall (in) :	2.10	0.00	0.00
Velocity (ft/sec) :	0.24	0.00	0.00
Computed Flow Time (min) :	21.06	0.00	0.00

Shallow Concentrated Flow Computations	Flowpath A	Flowpath B	Flowpath C
Flow Length (ft) :	200	0.00	0.00
Slope (%) :	3.9	0.00	0.00
Surface Type :	Grass pasture	Unpaved	Unpaved
Velocity (ft/sec) :	1.38	0.00	0.00
Computed Flow Time (min) :	2.42	0.00	0.00

Channel Flow Computations	Flowpath A	Flowpath B	Flowpath C
Manning's Roughness :	.04	0.00	0.00
Flow Length (ft) :	354	0.00	0.00
Channel Slope (%) :	3.9	0.00	0.00
Cross Section Area (ft^2) :	36	0.00	0.00
Wetted Perimeter (ft) :	24.74	0.00	0.00
Velocity (ft/sec) :	9.45	0.00	0.00
Computed Flow Time (min) :	0.62	0.00	0.00

Total TOC (min) 24.10

Subbasin : K1


Runoff Hydrograph
Runoff (cfs)
Time (hrs)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

4.5 BASIN INPUT DETAILS

HEC - HMS Existing Sub-Basin Input Summary							
Sub-Basin	**Area (sq. mi.)**	**Initial Storage (%)**	**Max. Storage (in)**	**Initial Abstraction**	**Curve Number**	**Impervious (%)**	**Lag Time (min)**
A	1.4303	5	0.035	0.617	61.8	6.55	31.80
Ba	5.9948	5	0.035	0.657	60.3	7.00	53.74
Bb	0.1572	5	0.035	0.433	69.8	2.00	24.00
Ca	0.2542	5	0.035	0.667	60.0	7.00	22.32
Cb	0.1094	5	0.035	0.456	68.7	2.00	22.45
Da	0.2520	5	0.035	0.667	60.0	7.00	22.19
Db	0.0780	5	0.035	0.667	60.0	7.00	26.52
Dc	0.3902	5	0.035	0.477	67.7	2.00	24.56
Ea	0.0592	5	0.035	0.667	60.0	7.00	18.30
Eb	0.1166	5	0.035	0.488	67.2	3.00	22.96
F	0.0695	5	0.035	0.449	69.0	2.00	22.63
G	0.1681	5	0.035	0.342	74.5	2.00	20.36
H	0.1903	5	0.035	0.394	71.8	2.00	20.19
I	0.0586	5	0.035	0.266	79.0	2.00	19.08
J	0.0158	5	0.035	0.439	69.5	7.00	13.75
K	0.0278	5	0.035	0.316	76.0	7.00	14.46

HEC - HMS Proposed Sub-Basin Input Summary							
Sub-Basin	**Area (sq. mi.)**	**Initial Storage (%)**	**Max. Storage (in)**	**Initial Abstraction**	**Curve Number**	**Impervious (%)**	**Lag Time (min)**
A1	1.3529	5	0.035	0.657	60.4	7.0	34.58
A2	0.0578	5	0.035	0.515	66.0	7.0	22.45
A3	0.0648	5	0.035	0.307	76.5	4.5	20.30
B1	5.9948	5	0.035	0.657	60.3	7.0	50.28
B2	0.0205	5	0.035	0.563	64.0	11.0	14.67
B3	0.0858	5	0.035	0.536	65.1	7.0	23.61
B4	0.0648	5	0.035	0.460	68.5	7.0	23.71
C1	0.2542	5	0.035	0.667	60.0	7.0	22.32
C2	0.0350	5	0.035	0.667	60.0	7.0	19.57
C3	0.0252	5	0.035	0.563	64.0	11.0	17.03
C4	0.0372	5	0.035	0.538	65.0	4.5	24.68
D1.1	0.2520	5	0.035	0.667	60.0	7.0	22.19
D1.2	0.0780	5	0.035	0.667	60.0	7.0	26.52
D2	0.1073	5	0.035	0.544	64.8	9.0	20.89
D3	0.0644	5	0.035	0.563	64.0	11.0	23.62
D4	0.0536	5	0.035	0.563	64.0	11.0	18.26
D5	0.0200	5	0.035	0.488	67.2	3.0	18.32
D6	0.0653	5	0.035	0.622	61.7	6.0	23.80
E0	0.0592	5	0.035	0.667	60.0	7.0	22.35
E1.1	0.0123	5	0.035	0.316	76.0	44.0	19.19
E1.2	0.0255	5	0.035	0.613	62.0	9.0	21.61
E2	0.0041	5	0.035	0.563	64.0	11.0	13.59
E3	0.0309	5	0.035	0.563	64.0	11.0	16.41
E4	0.0284	5	0.035	0.563	64.0	11.0	16.88
E5	0.0211	5	0.035	0.563	64.0	11.0	16.25
E6	0.0452	5	0.035	0.603	62.4	9.0	17.01
E7	0.0153	5	0.035	0.613	62.0	9.0	14.69
F1	0.0670	5	0.035	0.656	60.4	7.5	21.50
G1	0.0394	5	0.035	0.515	66.0	4.5	16.08
G2	0.0331	5	0.035	0.376	72.7	3.0	20.62
H1	0.0217	5	0.035	0.412	70.8	7.0	16.17
H2	0.0611	5	0.035	0.488	67.2	7.0	19.80
H3	0.0091	5	0.035	0.515	66.0	9.0	14.39
H4	0.0423	5	0.035	0.356	73.8	6.0	20.17
H5	0.0316	5	0.035	0.337	74.8	5.0	19.44
H6	0.0494	5	0.035	0.502	66.6	3.0	21.35
H7	0.0403	5	0.035	0.418	70.5	5.0	18.53
H8	0.0133	5	0.035	0.341	74.6	4.0	15.29
H9	0.0108	5	0.035	0.412	70.8	7.0	14.43
I1	0.0106	5	0.035	0.389	72.0	7.0	14.35
I2	0.0231	5	0.035	0.389	72.0	7.0	14.15
J1	0.0158	5	0.035	0.439	69.5	7.0	13.76
K1	0.0278	5	0.035	0.316	76.0	7.0	14.46

4.6 REACH INPUT DETAILS

Reach Summary Table - 5 Year Existing Conditions				
Reach Name	Drainage Area (sq. m	Peak Discharge (cfs)	Time of Peak	Volume (in)
1	5.9948	271.40	26Feb2019, 12:50	0.19
2	7.9459	348.70	26Feb2019, 12:46	0.19
3	9.0245	397.40	26Feb2019, 12:40	0.18
4	9.0245	397.20	26Feb2019, 12:46	0.18
5	9.3284	408.60	26Feb2019, 12:44	0.18
6	0.2542	20.20	26Feb2019, 12:22	0.19
7	0.2520	20.00	26Feb2019, 12:28	0.19
8	0.0780	5.60	26Feb2019, 12:30	0.19
9	0.0592	5.00	26Feb2019, 12:36	0.19

Reach Summary Table - 100 Year Existing Conditions				
Reach Name	Drainage Area (sq. m	Peak Discharge (cfs)	Time of Peak	Volume (in)
1	5.9948	1448.60	26Feb2019, 12:50	0.63
2	7.9459	1964.00	26Feb2019, 12:42	0.64
3	9.0245	2352.60	26Feb2019, 12:36	0.67
4	9.0245	2351.60	26Feb2019, 12:38	0.67
5	9.3284	2470.00	26Feb2019, 12:36	0.68
6	0.2542	127.50	26Feb2019, 12:22	0.62
7	0.2520	126.30	26Feb2019, 12:26	0.62
8	0.0780	34.00	26Feb2019, 12:28	0.62
9	0.0592	34.30	26Feb2019, 12:28	0.62

Reach Summary Table - 5 Year Proposed Conditions				
Reach Name	Drainage Area (sq. mi.)	Peak Discharge (cfs)	Time of Peak	Volume (in)
BOX CULVERT 1	7.9557	376.70	26Feb2019, 12:42	0.19
BOX CULV 2	8.9615	424.90	26Feb2019, 12:48	0.19
CLV E4	0.0634	9.20	26Feb2019, 12:12	0.30
CULV B2	0.0205	3.30	26Feb2019, 12:06	0.30
CULV C2	0.2892	23.40	26Feb2019, 12:16	0.19
CULV C3	0.3144	26.10	26Feb2019, 12:18	0.20
CULV D2	0.3594	31.20	26Feb2019, 12:18	0.21
CULV D3	0.1423	13.10	26Feb2019, 12:20	0.24
CULV D4	0.1959	18.60	26Feb2019, 12:18	0.25
CULV E1.2	0.0970	7.70	26Feb2019, 12:26	0.35
CULV E2	0.0041	0.70	26Feb2019, 12:06	0.30
CULV E5	0.0211	3.20	26Feb2019, 12:08	0.30
CULV H2	0.0611	5.30	26Feb2019, 12:12	0.19
CULV H3	0.0091	1.20	26Feb2019, 12:06	0.24
CULV I1	0.0106	3.30	26Feb2019, 12:10	0.31
CULV-E3	0.0350	5.30	26Feb2019, 12:10	0.30
EX CULV C1	0.2542	20.70	26Feb2019, 12:14	0.19
EX CULV D1.1	0.2520	20.60	26Feb2019, 12:14	0.19
EX CULV D1.2	0.0780	5.70	26Feb2019, 12:18	0.19
EX CULV E0	0.0592	4.80	26Feb2019, 12:14	0.19
OUT 2	0.0445	9.50	26Feb2019, 12:24	0.30
OUT-1	9.2839	444.50	26Feb2019, 12:50	0.20
REACH A1	1.3529	83.10	26Feb2019, 12:32	0.19
Reach H7	0.0494	9.20	26Feb2019, 12:14	0.23
Reach-A2	0.0648	22.70	26Feb2019, 12:16	0.35
Reach-B1	5.9948	284.50	26Feb2019, 12:46	0.19
Reach-B2	0.0205	3.20	26Feb2019, 12:14	0.30
Reach-B3	6.0806	286.80	26Feb2019, 12:50	0.19
Reach-B4-3	0.3144	26.10	26Feb2019, 12:18	0.20
Reach-C1	0.2542	20.60	26Feb2019, 12:18	0.19
Reach-C2	0.2892	23.40	26Feb2019, 12:20	0.19
Reach-D1.1	0.2520	20.60	26Feb2019, 12:20	0.19
Reach-D3	0.0780	5.70	26Feb2019, 12:24	0.19
Reach-D4	0.1423	13.10	26Feb2019, 12:24	0.24
Reach-D5	0.3594	31.10	26Feb2019, 12:22	0.21
Reach-D6	0.1959	18.60	26Feb2019, 12:24	0.25
Reach-E1.1	0.0592	4.70	26Feb2019, 12:24	0.19
Reach-E1.2	0.0716	6.30	26Feb2019, 12:40	0.38
Reach-E3	0.0041	0.70	26Feb2019, 12:14	0.30
Reach-E4	0.0350	5.20	26Feb2019, 12:14	0.30
Reach-E6	0.0211	3.20	26Feb2019, 12:14	0.30
Reach-E6-2	0.2428	18.50	26Feb2019, 12:34	0.29
Reach-E7	0.0634	9.10	26Feb2019, 12:16	0.30
Reach-F1	0.0970	7.70	26Feb2019, 12:30	0.35
Reach-F1-2	0.1641	12.40	26Feb2019, 12:34	0.29
Reach-G2	0.0394	2.50	26Feb2019, 12:14	0.12
Reach-H4	0.0217	5.40	26Feb2019, 12:16	0.29
Reach-H6	0.0611	5.30	26Feb2019, 12:14	0.19
Reach-H7-1	0.0091	1.20	26Feb2019, 12:12	0.24
Reach-H9	0.0338	10.30	26Feb2019, 12:12	0.31
Reach-I2-1	0.0106	3.30	26Feb2019, 12:12	0.31
Reach-P3	0.2613	21.30	26Feb2019, 12:28	0.23
Reach-1	7.9557	376.70	26Feb2019, 12:44	0.19
Reach-2	8.1295	388.30	26Feb2019, 12:46	0.19
Reach-3	8.5404	405.10	26Feb2019, 12:46	0.19
Reach-4	8.6509	408.80	26Feb2019, 12:48	0.19
Reach-5	8.9615	424.80	26Feb2019, 12:48	0.19
Reach-6 Kiowa Outfall	9.3284	447.40	26Feb2019, 12:48	0.20

Reach Summary Table - 100 Year Proposed Conditions				
Reach Name	Drainage Area (sq. mi.)	Peak Discharge (cfs)	Time of Peak	Volume (in)
BOX CULVERT 1	7.9557	2062.20	26Feb2019, 12:40	0.65
BOX CULV 2	8.9615	2321.10	26Feb2019, 12:44	0.67
CLV E4	0.0634	55.70	26Feb2019, 12:12	0.93
CULV B2	0.0205	19.90	26Feb2019, 12:08	0.94
CULV C2	0.2892	145.80	26Feb2019, 12:18	0.63
CULV C3	0.3144	162.10	26Feb2019, 12:18	0.65
CULV D2	0.3594	203.70	26Feb2019, 12:18	0.70
CULV D3	0.1423	75.70	26Feb2019, 12:20	0.76
CULV D4	0.1959	108.50	26Feb2019, 12:20	0.81
CULV E1.2	0.0970	24.20	26Feb2019, 12:20	0.95
CULV E2	0.0041	4.10	26Feb2019, 12:08	0.94
CULV E5	0.0211	19.20	26Feb2019, 12:10	0.94
CULV H2	0.0611	53.60	26Feb2019, 12:14	0.92
CULV H3	0.0091	9.60	26Feb2019, 12:08	0.94
CULV I1	0.0106	14.60	26Feb2019, 12:08	1.20
CULV-E3	0.0350	31.80	26Feb2019, 12:10	0.93
EX CULV C1	0.2542	127.70	26Feb2019, 12:16	0.63
EX CULV D1.1	0.2520	127.20	26Feb2019, 12:16	0.63
EX CULV D1.2	0.0780	34.00	26Feb2019, 12:20	0.63
EX CULV E0	0.0592	29.70	26Feb2019, 12:16	0.63
OUT 2	0.0445	28.80	26Feb2019, 12:26	1.17
OUT-1	9.2839	2413.10	26Feb2019, 12:44	0.68
REACH A1	1.3529	480.90	26Feb2019, 12:32	0.63
Reach H7	0.0494	52.20	26Feb2019, 12:12	1.00
Reach-A2	0.0648	85.30	26Feb2019, 12:14	1.77
Reach-B1	5.9948	1537.10	26Feb2019, 12:46	0.63
Reach-B2	0.0205	19.80	26Feb2019, 12:14	0.93
Reach-B3	6.0806	1552.00	26Feb2019, 12:48	0.64
Reach-B4-3	0.3144	161.70	26Feb2019, 12:18	0.65
Reach-C1	0.2542	127.70	26Feb2019, 12:18	0.63
Reach-C2	0.2892	145.80	26Feb2019, 12:20	0.63
Reach-D1.1	0.2520	126.70	26Feb2019, 12:20	0.62
Reach-D3	0.0780	33.90	26Feb2019, 12:24	0.62
Reach-D4	0.1423	75.40	26Feb2019, 12:24	0.76
Reach-D5	0.3594	203.10	26Feb2019, 12:20	0.70
Reach-D6	0.1959	108.50	26Feb2019, 12:22	0.81
Reach-E1.1	0.0592	29.70	26Feb2019, 12:22	0.62
Reach-E1.2	0.0716	14.10	26Feb2019, 12:50	1.02
Reach-E3	0.0041	4.10	26Feb2019, 12:12	0.93
Reach-E4	0.0350	31.70	26Feb2019, 12:14	0.93
Reach-E6	0.0211	19.00	26Feb2019, 12:12	0.93
Reach-E6-2	0.2428	103.80	26Feb2019, 12:26	0.85
Reach-E7	0.0634	55.70	26Feb2019, 12:14	0.93
Reach-F1	0.0970	24.10	26Feb2019, 12:22	0.95
Reach-F1-2	0.1641	58.40	26Feb2019, 12:28	0.83
Reach-G2	0.0394	36.00	26Feb2019, 12:12	0.76
Reach-H4	0.0217	26.10	26Feb2019, 12:12	1.11
Reach-H6	0.0611	53.40	26Feb2019, 12:14	0.92
Reach-H7-1	0.0091	9.60	26Feb2019, 12:12	0.94
Reach-H9	0.0338	46.50	26Feb2019, 12:10	1.20
Reach-I2-1	0.0106	14.50	26Feb2019, 12:10	1.20
Reach-P3	0.2613	95.50	26Feb2019, 12:36	0.76
Reach-1	7.9557	2061.70	26Feb2019, 12:42	0.65
Reach-2	8.1295	2100.20	26Feb2019, 12:44	0.66
Reach-3	8.5404	2195.30	26Feb2019, 12:42	0.66
Reach-4	8.6509	2219.80	26Feb2019, 12:44	0.67
Reach-5	8.9615	2320.80	26Feb2019, 12:44	0.67
Reach-6 Kiowa Outfall	9.3284	2437.30	26Feb2019, 12:44	0.68

4.7 DETENTION POND SUMMARY

VERTEX®

DETENTION POND WORKSHEET

CALCULATED BY: JP
CHECKED BY:

PROJECT: Winsome Subdivision
MAJOR BASIN: West Kiowa Creek

JOB NO: **48157**
LOCATION: **Monument, CO**

				IMPERVIOUS FACTOR						SOIL				WATERSHED				CALCULATIONS		
LOCATION	**DESIGN POINT**	**BASIN**	**AREA (Acres)**	**5 ACRE LOT (7%)**	**2.5 ACRE LOT (11%)**	**OPEN SPACE (2%)**	**COMMERCIAL (85%)**	**TOTAL % CHECK**	**WEIGHTED IMPERVIOUSNESS**	**SOIL GROUP A %**	**SOIL GROUP B %**	**SOIL GROUP C/D %**	**TOTAL % CHECK**	**WATERSHED LENGTH**	**WATERSHED HIGH POINT**	**WATERSHED LOW POINT**	**WATERSHED SLOPE**	**100-YEAR REQUIRED VOLUME (AC-FT)**	**PROPOSED VOLUME**	**PEAK OUTFLOW VS PREDEVELOPED FLOW RATIO**
POND 1	P1	G1	25.2	70%	0%	30%	0%	100%	6%	0%	0%	100%	100%							
		G2	21.2	90%	0%	10%	0%	100%	7%	0%	0%	100%	100%							
		H1	13.9	100%	0%	0%	0%	100%	7%	0%	10%	90%	100%							
		H4	27.1	70%	0%	30%	0%	100%	6%	0%	0%	100%	100%							
			87.4						6.0%	0.0%	1.6%	98.4%	100%	3,246	7,465	7,317	0.046	2.6	7.9	0.32
POND 2	P2	H2	31.9	100%	0%	0%	0%	100%	7%	0%	70%	30%	100%							
		H5	20.2	70%	0%	30%	0%	100%	6%	0%	0%	100%	100%							
		H6	31.6	35%	0%	65%	0%	100%	4%	0%	0%	100%	100%							
			83.7						5.4%	0%	27%	73%	100%	2,628	7,444	7,305	0.053	2.3	7.2	0.33
POND 3	P3	D1.2	49.9	100%	0%	0%	0%	100%	7%	0.0%	100.0%	0.0%	100%							
		D3	41.2	0%	10%	90%	0%	100%	3%	0.0%	100.0%	0.0%	100%							
		D4	34.3	0%	100%	0%	0%	100%	11%	0.0%	100.0%	0.0%	100%							
		D6	41.8	80%	0%	20%	0%	100%	6%	0.0%	90.0%	10.0%	100%							
			167.2						6.6%	0.0%	97.5%	2.5%	100%	6,480	7,480	7,292	0.029	5.1	6.9	0.74
POND 4	P4	I1	6.8	100%	0%	0%	0%	100%	7%	0%	0%	100%	100%							
		I2	14.8	100%	0%	0%	0%	100%	7%	0%	0%	100%	100%							
		H9	6.9	100%	0%	0%	0%	100%	7%	0%	20%	80%	100%							
			28.5						7.0%	0.0%	4.8%	95.2%	100%	1,895	7,388	7,322	0.035	0.9	1.3	0.69
POND 5	P5	E1.2	16.3	50%	50%	0%	0%	100%	9%	0%	100%	0%	100%							
		E2	2.6	0%	100%	0%	0%	100%	11%	0%	100%	0%	100%							
		E3	19.8	0%	100%	0%	0%	100%	11%	0%	100%	0%	100%							
		E4	18.2	0%	100%	0%	0%	100%	11%	0%	100%	0%	100%							
		E5	13.5	0%	100%	0%	0%	100%	11%	0%	100%	0%	100%							
		E6	28.9	70%	20%	10%	0%	100%	7%	0%	90%	10%	100%							
		E7	9.8	0%	100%	0%	0%	100%	11%	0%	100%	0%	100%							
		F1	42.9	100%	0%	0%	0%	100%	7%	0%	100%	0%	100%							
			152.0						9.0%	0.0%	98.1%	1.9%	100%	4,755	7,427	7,295	0.028	5.3	9.7	0.55
POND 6	P6	E0	37.9	100%	0%	0%	0%	100%	7%	0%	100%	0%	100%							
		E1.1	7.9	0%	0%	50%	50%	100%	50%	0%	100%	0%	100%							
			45.8						14.5%	0.0%	100%	0%	100%	2,615	7,480	7,404	0.029	2.0	3.8	0.53

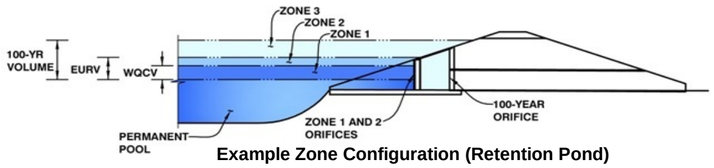
4.8 UD DETENTION CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: Pond 1



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	87.40	acres		
Watershed Length =	3,246	ft		
Watershed Slope =	0.046	ft/ft		
Watershed Imperviousness =	6.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	1.6%	percent		
Percentage Hydrologic Soil Groups C/D =	98.4%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input	70.7		
Water Quality Capture Volume (WQCV) =	0.311	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.420	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.352	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.030	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.489	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	5.816	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	8.021	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	10.860	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.329	acre-feet		
Approximate 5-yr Detention Volume =	0.988	acre-feet		
Approximate 10-yr Detention Volume =	1.444	acre-feet		
Approximate 25-yr Detention Volume =	1.726	acre-feet		
Approximate 50-yr Detention Volume =	1.754	acre-feet		
Approximate 100-yr Detention Volume =	2.557	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.311	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.108	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.137	acre-feet
Total Detention Basin Volume =	2.557	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	

Depth Increment = 1 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	--	--	--	58,000	1.331		
Spillway Invert	--	5.50	--	--	--	69,000	1.584	349,250	8.018
Freeboard	--	7.50	--	--	--	73,000	1.676	491,250	11.278
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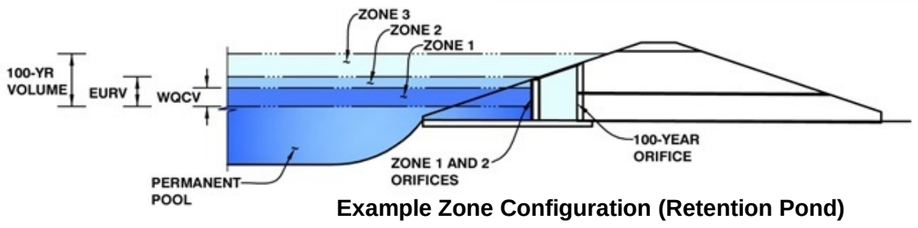
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: Pond 1



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.24	0.311	Orifice Plate
Zone 2 (EURV)	0.32	0.108	Circular Orifice
Zone 3 (100-year)	1.87	2.137	Weir&Pipe (Circular)
		2.557	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	0.32	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	3.00	inches
Orifice Plate: Orifice Area per Row =	9.00	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	6.250E-02	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	0.11	0.21					
Orifice Area (sq. inches)	9.00	9.00	9.00					

	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 =	0.24	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	0.32	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	20.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	2.18	N/A	ft^2
Vertical Orifice Centroid =	0.83	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	3.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	85%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.33	N/A	feet
Over Flow Weir Slope Length =	4.22	N/A	feet
Grate Open Area / 100-yr Orifice Area =	4.56	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	14.34	N/A	ft^2
Overflow Grate Open Area w/ Debris =	7.17	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	24.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	3.14	N/A	ft^2
Outlet Orifice Centroid =	1.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	58.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

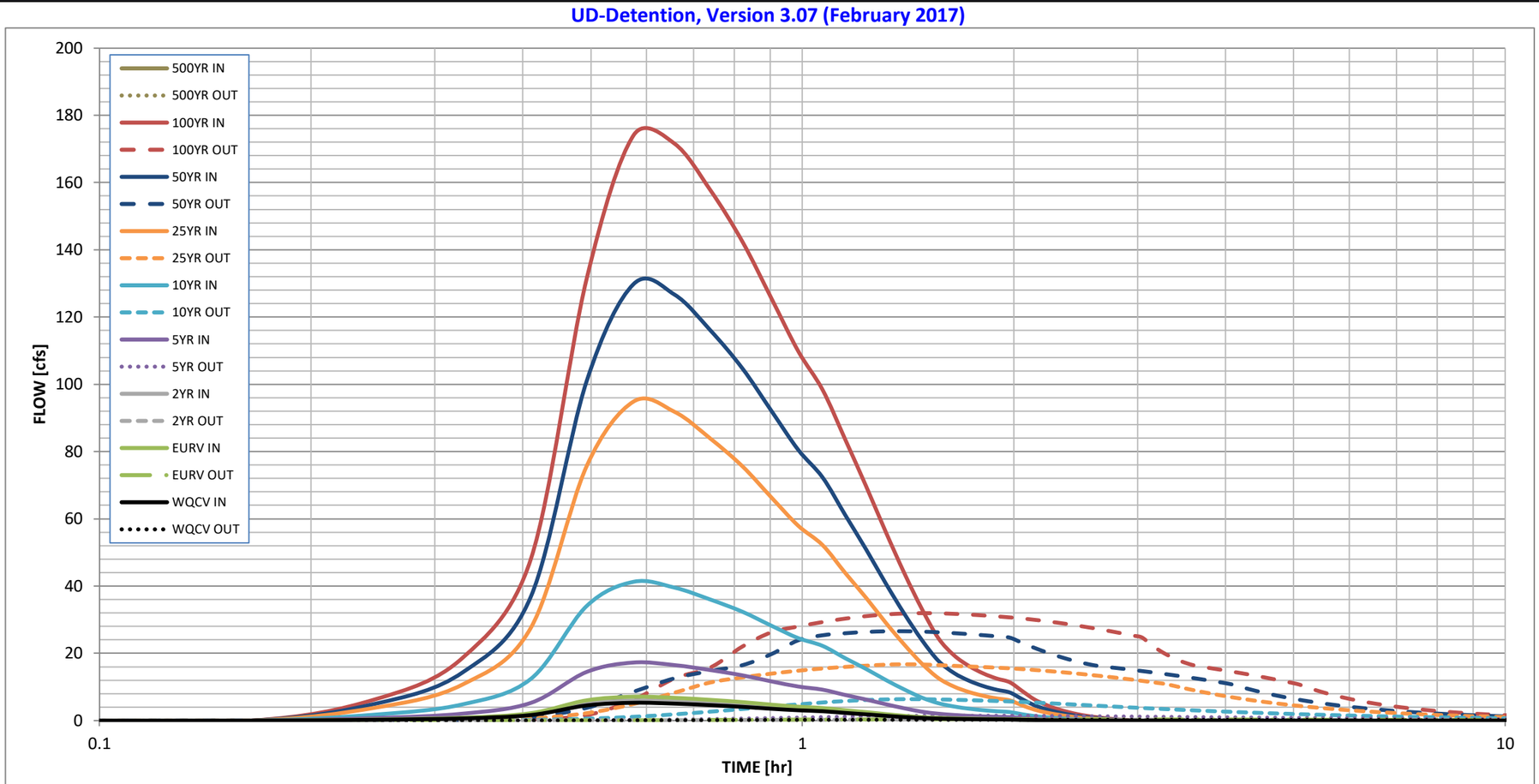
Spillway Design Flow Depth=	0.96	feet
Stage at Top of Freeboard =	7.46	feet
Basin Area at Top of Freeboard =	1.67	acres

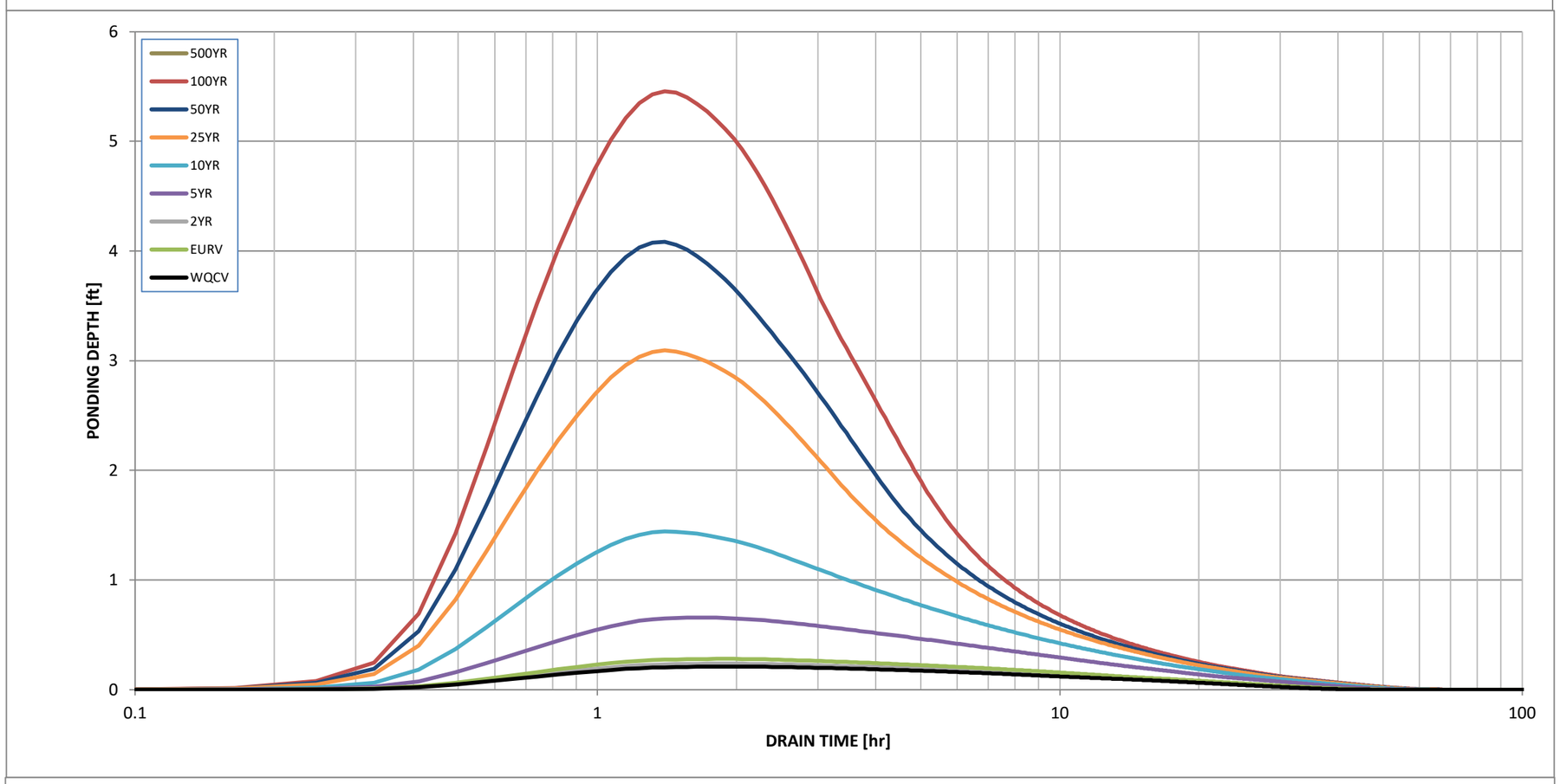
Routed Hydrograph Results

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.311	0.420	0.352	1.030	2.489	5.816	8.021	10.860	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.311	0.419	0.352	1.030	2.491	5.816	8.024	10.861	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.12	0.34	0.79	1.04	1.35	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.3	10.6	29.3	68.6	90.6	118.3	0.0
Peak Inflow Q (cfs) =	5.3	7.1	6.0	17.3	41.3	94.9	129.8	174.1	#N/A
Peak Outflow Q (cfs) =	0.2	0.4	0.3	1.5	6.4	16.7	26.6	31.9	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.2	0.2	0.3	0.3	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.5	0.5	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	38	40	39	43	38	27	24	21	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**44**	46	45	50	49	43	40	37	#N/A
Maximum Ponding Depth (ft) =	0.21	0.28	0.24	0.66	1.44	3.09	4.08	5.46	#N/A
Area at Maximum Ponding Depth (acres) =	1.34	1.34	1.34	1.36	1.40	1.47	1.52	1.58	#N/A
Maximum Volume Stored (acre-ft) =	0.281	0.375	0.307	0.875	1.965	4.334	5.815	7.939	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)





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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
4.93 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:04:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:09:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:14:47	0.24	0.32	0.27	0.76	1.76	3.80	4.96	6.29	#N/A
1.015	0:19:43	0.64	0.85	0.72	2.05	4.83	10.74	14.35	18.69	#N/A
	0:24:39	1.63	2.19	1.85	5.26	12.39	27.58	36.85	48.03	#N/A
	0:29:35	4.49	6.01	5.08	14.44	34.01	75.56	100.81	131.20	#N/A
	0:34:31	5.28	7.09	5.98	17.26	41.26	94.87	129.79	174.05	#N/A
	0:39:26	5.03	6.76	5.69	16.49	39.54	91.84	126.70	171.61	#N/A
	0:44:22	4.58	6.15	5.18	15.01	35.99	83.87	116.07	157.76	#N/A
	0:49:18	4.07	5.48	4.61	13.44	32.35	75.60	104.70	142.40	#N/A
	0:54:14	3.50	4.72	3.97	11.64	28.18	66.30	92.04	125.48	#N/A
	0:59:10	3.06	4.12	3.46	10.12	24.52	57.96	80.55	109.91	#N/A
	1:04:05	2.77	3.73	3.13	9.18	22.21	52.19	72.32	98.39	#N/A
	1:09:01	2.27	3.06	2.57	7.61	18.54	43.92	61.15	83.63	#N/A
	1:13:57	1.84	2.49	2.09	6.24	15.31	36.45	50.84	69.61	#N/A
	1:18:53	1.40	1.91	1.59	4.84	12.05	29.03	40.70	55.99	#N/A
	1:23:49	1.03	1.41	1.17	3.64	9.22	22.53	31.70	43.76	#N/A
	1:28:44	0.75	1.03	0.86	2.63	6.82	16.93	23.94	33.18	#N/A
	1:33:40	0.59	0.80	0.67	2.03	5.15	12.62	17.76	24.49	#N/A
	1:38:36	0.48	0.66	0.55	1.66	4.18	10.10	14.13	19.40	#N/A
	1:43:32	0.41	0.56	0.47	1.41	3.52	8.48	11.85	16.24	#N/A
	1:48:28	0.36	0.49	0.41	1.24	3.08	7.37	10.27	14.03	#N/A
	1:53:23	0.33	0.44	0.37	1.11	2.76	6.58	9.15	12.49	#N/A
	1:58:19	0.30	0.41	0.34	1.02	2.53	6.02	8.36	11.39	#N/A
	2:03:15	0.22	0.30	0.25	0.75	1.87	4.53	6.37	8.79	#N/A
	2:08:11	0.16	0.22	0.18	0.55	1.36	3.27	4.59	6.33	#N/A
	2:13:07	0.12	0.16	0.13	0.40	1.00	2.42	3.41	4.70	#N/A
	2:18:02	0.09	0.12	0.10	0.30	0.74	1.80	2.53	3.49	#N/A
	2:22:58	0.06	0.08	0.07	0.21	0.54	1.32	1.87	2.58	#N/A
	2:27:54	0.04	0.06	0.05	0.15	0.39	0.95	1.35	1.87	#N/A
	2:32:50	0.03	0.04	0.03	0.11	0.28	0.69	0.98	1.35	#N/A
	2:37:46	0.02	0.03	0.02	0.07	0.19	0.49	0.69	0.96	#N/A
	2:42:41	0.01	0.02	0.01	0.04	0.12	0.32	0.46	0.64	#N/A
	2:47:37	0.01	0.01	0.01	0.02	0.07	0.18	0.27	0.38	#N/A
	2:52:33	0.00	0.00	0.00	0.01	0.03	0.09	0.13	0.19	#N/A
	2:57:29	0.00	0.00	0.00	0.00	0.01	0.03	0.04	0.06	#N/A
	3:02:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:07:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:12:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:17:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:22:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:27:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:31:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:36:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:41:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:46:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:51:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:56:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:01:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:06:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:11:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:16:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:21:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:26:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:31:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:36:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:41:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:45:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:50:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:55:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:00:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:05:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:10:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:15:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:20:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:25:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:30:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:35:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:40:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:45:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:50:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:54:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

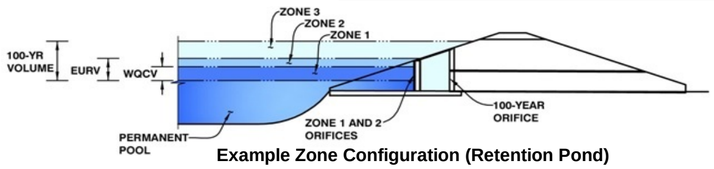
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: Pond 2



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	83.70	acres		
Watershed Length =	2,628	ft		
Watershed Slope =	0.053	ft/ft		
Watershed Imperviousness =	5.40%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	27.0%	percent		
Percentage Hydrologic Soil Groups C/D =	73.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input	70.7		
Water Quality Capture Volume (WQCV) =	0.271	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.370	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.290	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.796	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.075	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	5.274	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	7.356	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	10.046	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.270	acre-feet		
Approximate 5-yr Detention Volume =	0.762	acre-feet		
Approximate 10-yr Detention Volume =	1.275	acre-feet		
Approximate 25-yr Detention Volume =	1.612	acre-feet		
Approximate 50-yr Detention Volume =	1.634	acre-feet		
Approximate 100-yr Detention Volume =	2.341	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.271	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.100	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.970	acre-feet
Total Detention Basin Volume =	2.341	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	

Depth Increment = 1 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	--	--	--	43,000	0.987		
Spillway Invert	--	6.50	--	--	--	56,000	1.286	321,750	7.386
Freeboard	--	8.50	--	--	--	60,000	1.377	437,750	10.049
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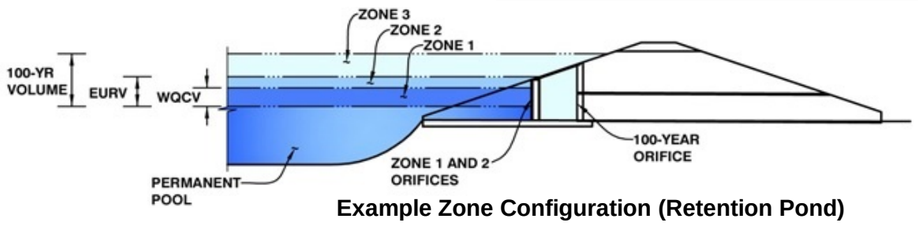
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: Pond 2



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.28	0.271	Orifice Plate
Zone 2 (EURV)	0.38	0.100	Circular Orifice
Zone 3 (100-year)	2.26	1.970	Weir&Pipe (Circular)
		2.341	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	0.38	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	2.90	inches
Orifice Plate: Orifice Area per Row =	7.00	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	4.861E-02	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	0.13	0.25					
Orifice Area (sq. inches)	7.00	7.00	7.00					

	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 =	0.33	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	0.45	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	10.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.55	N/A	ft^2
Vertical Orifice Centroid =	0.42	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	3.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	85%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.33	N/A	feet
Over Flow Weir Slope Length =	4.22	N/A	feet
Grate Open Area / 100-yr Orifice Area =	4.56	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	14.34	N/A	ft^2
Overflow Grate Open Area w/ Debris =	7.17	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	24.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	3.14	N/A	ft^2
Outlet Orifice Centroid =	1.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	61.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

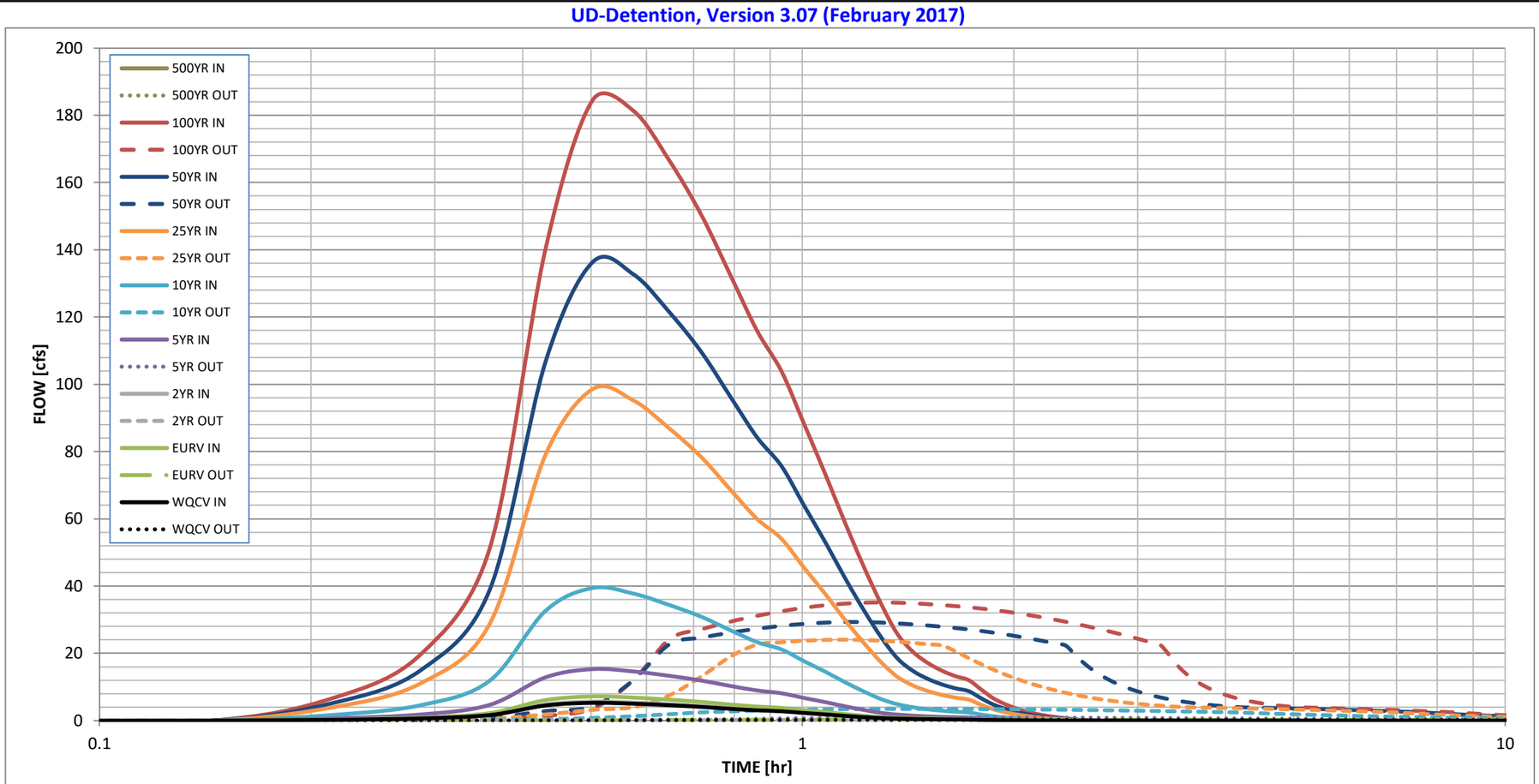
Spillway Design Flow Depth=	0.97	feet
Stage at Top of Freeboard =	8.47	feet
Basin Area at Top of Freeboard =	1.38	acres

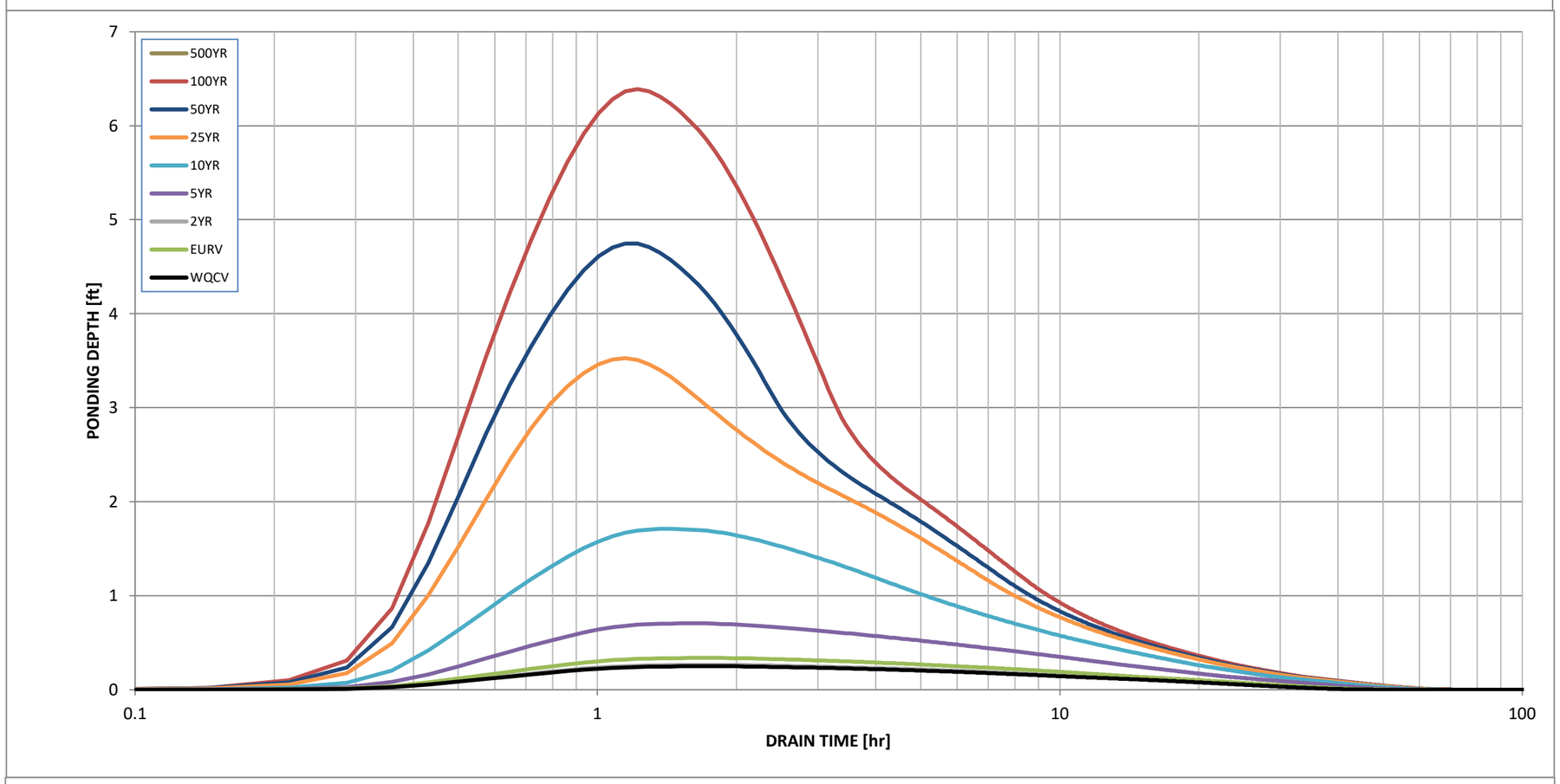
Routed Hydrograph Results

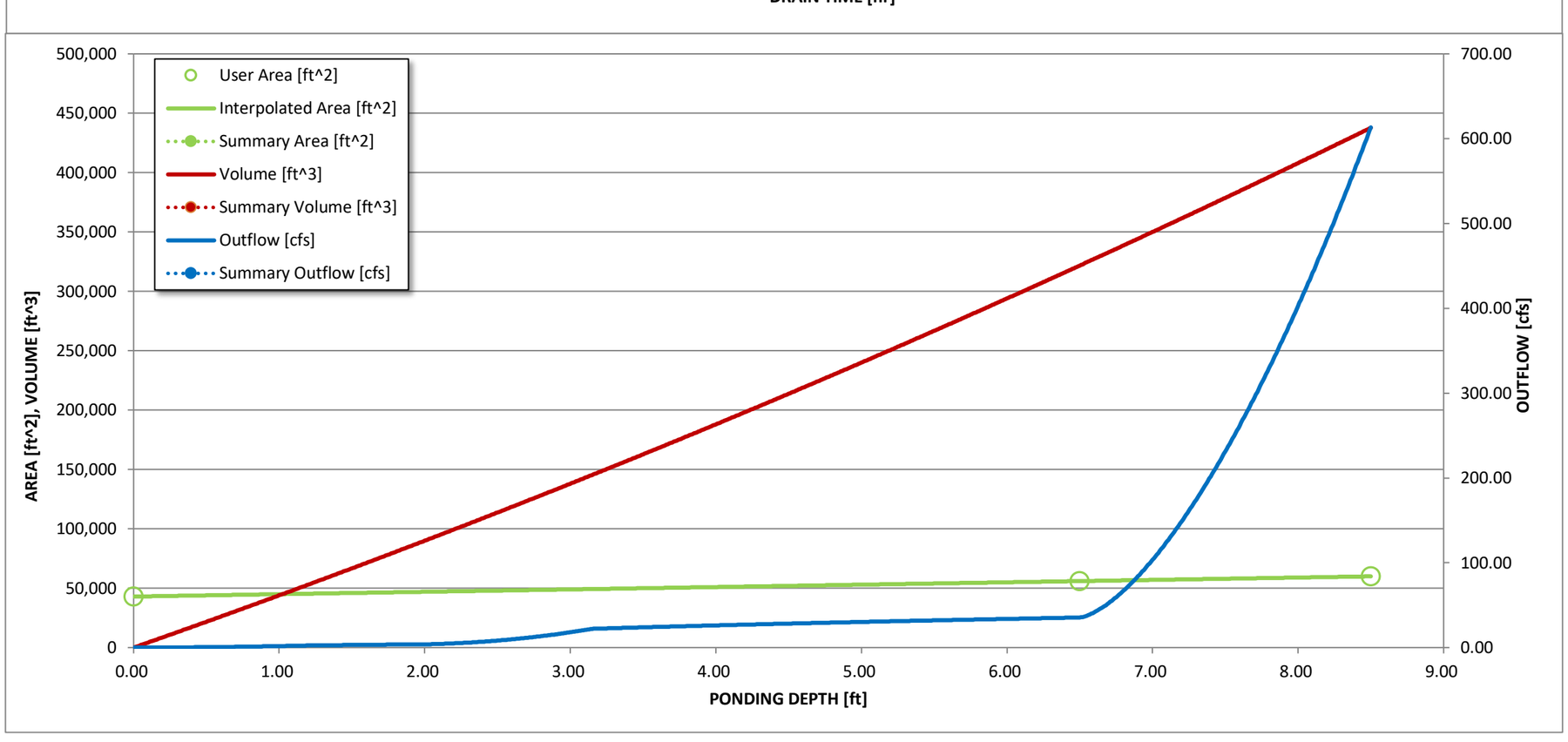
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.271	0.370	0.290	0.796	2.075	5.274	7.356	10.046	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.270	0.369	0.289	0.796	2.075	5.270	7.349	10.037	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.11	0.35	0.87	1.16	1.51	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.4	9.4	29.4	72.5	96.8	126.5	0.0
Peak Inflow Q (cfs) =	5.3	7.2	5.6	15.3	39.4	98.6	136.3	184.5	#N/A
Peak Outflow Q (cfs) =	0.2	0.3	0.2	0.9	3.5	24.0	29.3	35.1	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.1	0.3	0.3	0.3	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Plate	Vertical Orifice 1	Vertical Orifice 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	1.3	1.6	1.9	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	39	42	40	45	42	30	26	22	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**45**	48	46	52	52	47	43	39	#N/A
Maximum Ponding Depth (ft) =	0.25	0.34	0.27	0.71	1.71	3.53	4.75	6.39	#N/A
Area at Maximum Ponding Depth (acres) =	1.00	1.00	1.00	1.02	1.07	1.15	1.20	1.28	#N/A
Maximum Volume Stored (acre-ft) =	0.248	0.328	0.258	0.702	1.755	3.759	5.195	7.232	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
4.31 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:04:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph Constant	0:08:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:12:56	0.24	0.32	0.25	0.67	1.69	4.00	5.29	6.77	#N/A
1.160	0:17:14	0.63	0.86	0.68	1.82	4.63	11.23	15.18	19.97	#N/A
	0:21:33	1.63	2.21	1.74	4.68	11.88	28.83	38.97	51.30	#N/A
	0:25:52	4.48	6.08	4.78	12.85	32.60	78.99	106.66	140.19	#N/A
	0:30:10	5.27	7.16	5.62	15.29	39.41	98.55	136.30	184.45	#N/A
	0:34:29	5.01	6.83	5.35	14.60	37.75	95.21	132.72	181.35	#N/A
	0:38:47	4.56	6.21	4.86	13.29	34.36	86.88	121.48	166.57	#N/A
	0:43:06	4.05	5.53	4.33	11.89	30.85	78.30	109.56	150.32	#N/A
	0:47:25	3.48	4.76	3.71	10.28	26.83	68.61	96.24	132.37	#N/A
	0:51:43	3.04	4.15	3.24	8.95	23.32	59.96	84.21	115.93	#N/A
	0:56:02	2.75	3.76	2.94	8.11	21.14	54.03	75.67	103.86	#N/A
	1:00:20	2.25	3.08	2.40	6.71	17.63	45.41	63.89	88.16	#N/A
	1:04:39	1.82	2.51	1.95	5.49	14.55	37.67	53.10	73.35	#N/A
	1:08:58	1.38	1.91	1.48	4.24	11.41	29.96	42.45	58.93	#N/A
	1:13:16	1.01	1.41	1.09	3.17	8.70	23.22	33.03	46.02	#N/A
	1:17:35	0.74	1.03	0.79	2.29	6.41	17.42	24.91	34.86	#N/A
	1:21:53	0.58	0.80	0.62	1.77	4.86	13.01	18.51	25.76	#N/A
	1:26:12	0.48	0.66	0.51	1.45	3.95	10.42	14.75	20.43	#N/A
	1:30:31	0.41	0.56	0.44	1.23	3.34	8.76	12.37	17.11	#N/A
	1:34:49	0.36	0.49	0.38	1.08	2.91	7.61	10.73	14.80	#N/A
	1:39:08	0.32	0.45	0.35	0.97	2.61	6.80	9.57	13.18	#N/A
	1:43:26	0.30	0.41	0.32	0.90	2.40	6.22	8.74	12.02	#N/A
	1:47:45	0.22	0.30	0.23	0.66	1.77	4.67	6.63	9.24	#N/A
	1:52:04	0.16	0.22	0.17	0.48	1.29	3.37	4.79	6.66	#N/A
	1:56:22	0.12	0.16	0.13	0.35	0.95	2.50	3.55	4.94	#N/A
	2:00:41	0.09	0.12	0.09	0.26	0.70	1.86	2.64	3.67	#N/A
	2:04:59	0.06	0.08	0.07	0.19	0.51	1.36	1.94	2.71	#N/A
	2:09:18	0.04	0.06	0.05	0.13	0.36	0.98	1.40	1.96	#N/A
	2:13:37	0.03	0.04	0.03	0.09	0.26	0.71	1.02	1.42	#N/A
	2:17:55	0.02	0.03	0.02	0.06	0.18	0.50	0.72	1.01	#N/A
	2:22:14	0.01	0.02	0.01	0.04	0.11	0.33	0.47	0.67	#N/A
	2:26:32	0.00	0.01	0.01	0.02	0.06	0.19	0.28	0.40	#N/A
	2:30:51	0.00	0.00	0.00	0.01	0.03	0.09	0.13	0.20	#N/A
	2:35:10	0.00	0.00	0.00	0.00	0.01	0.03	0.04	0.06	#N/A
	2:39:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:43:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:48:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:52:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:56:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:01:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:05:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:09:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:13:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:18:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:22:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:26:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:31:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:35:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:39:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:44:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:48:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:52:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:57:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:01:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:05:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:09:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:14:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:18:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:22:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:27:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:31:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:35:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:40:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:44:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:48:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:53:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:57:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:01:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:06:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:10:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

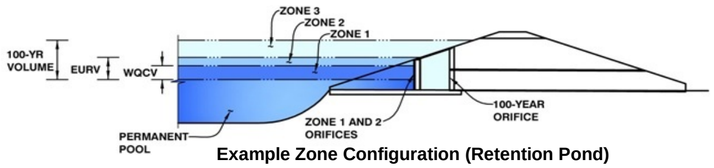
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: Pond 3



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	167.20	acres		
Watershed Length =	6,480	ft		
Watershed Slope =	0.029	ft/ft		
Watershed Imperviousness =	6.60%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	97.5%	percent		
Percentage Hydrologic Soil Groups C/D =	2.5%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input	70.7		
Water Quality Capture Volume (WQCV) =	0.649	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	1.000	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.664	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.091	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	3.075	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	9.462	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	13.432	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	18.613	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.615	acre-feet		
Approximate 5-yr Detention Volume =	1.022	acre-feet		
Approximate 10-yr Detention Volume =	2.542	acre-feet		
Approximate 25-yr Detention Volume =	3.747	acre-feet		
Approximate 50-yr Detention Volume =	3.861	acre-feet		
Approximate 100-yr Detention Volume =	5.110	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.649	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.352	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.109	acre-feet
Total Detention Basin Volume =	5.110	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	

Depth Increment = 1 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	--	--	--	41,000	0.941		
Spillway Invert	--	6.50	--	--	--	54,000	1.240	308,750	7.088
Freeboard	--	8.50	--	--	--	58,000	1.331	420,750	9.659
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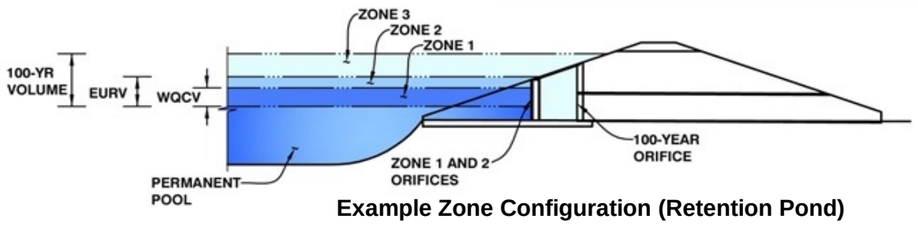
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: Pond 3



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.68	0.649	Orifice Plate
Zone 2 (EURV)	1.04	0.352	Circular Orifice
Zone 3 (100-year)	4.86	4.109	Weir&Pipe (Circular)
		5.110	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	1.04	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	4.00	inches
Orifice Plate: Orifice Area per Row =	10.00	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	6.944E-02	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	0.30	0.60	0.90	1.20			
Orifice Area (sq. inches)	10.00	10.00	10.00	10.00	10.00			

	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 =	0.68	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	1.04	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	34.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	6.31	N/A	ft^2
Vertical Orifice Centroid =	1.42	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Slope =	3.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	85%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.33	N/A	feet
Over Flow Weir Slope Length =	4.22	N/A	feet
Grate Open Area / 100-yr Orifice Area =	2.28	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	28.67	N/A	ft^2
Overflow Grate Open Area w/ Debris =	14.34	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	48.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	12.57	N/A	ft^2
Outlet Orifice Centroid =	2.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	51.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

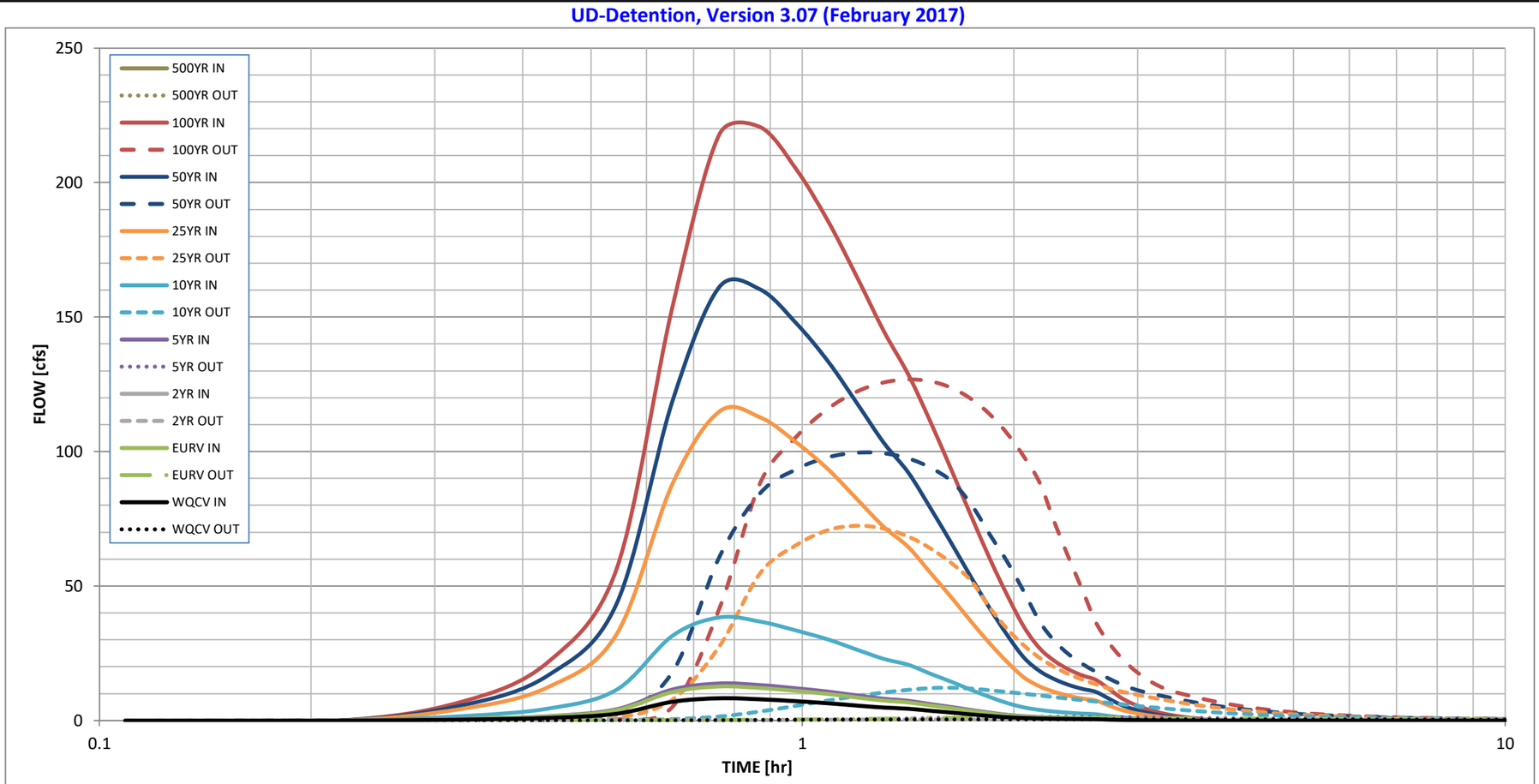
Spillway Design Flow Depth=	0.96	feet
Stage at Top of Freeboard =	8.46	feet
Basin Area at Top of Freeboard =	1.33	acres

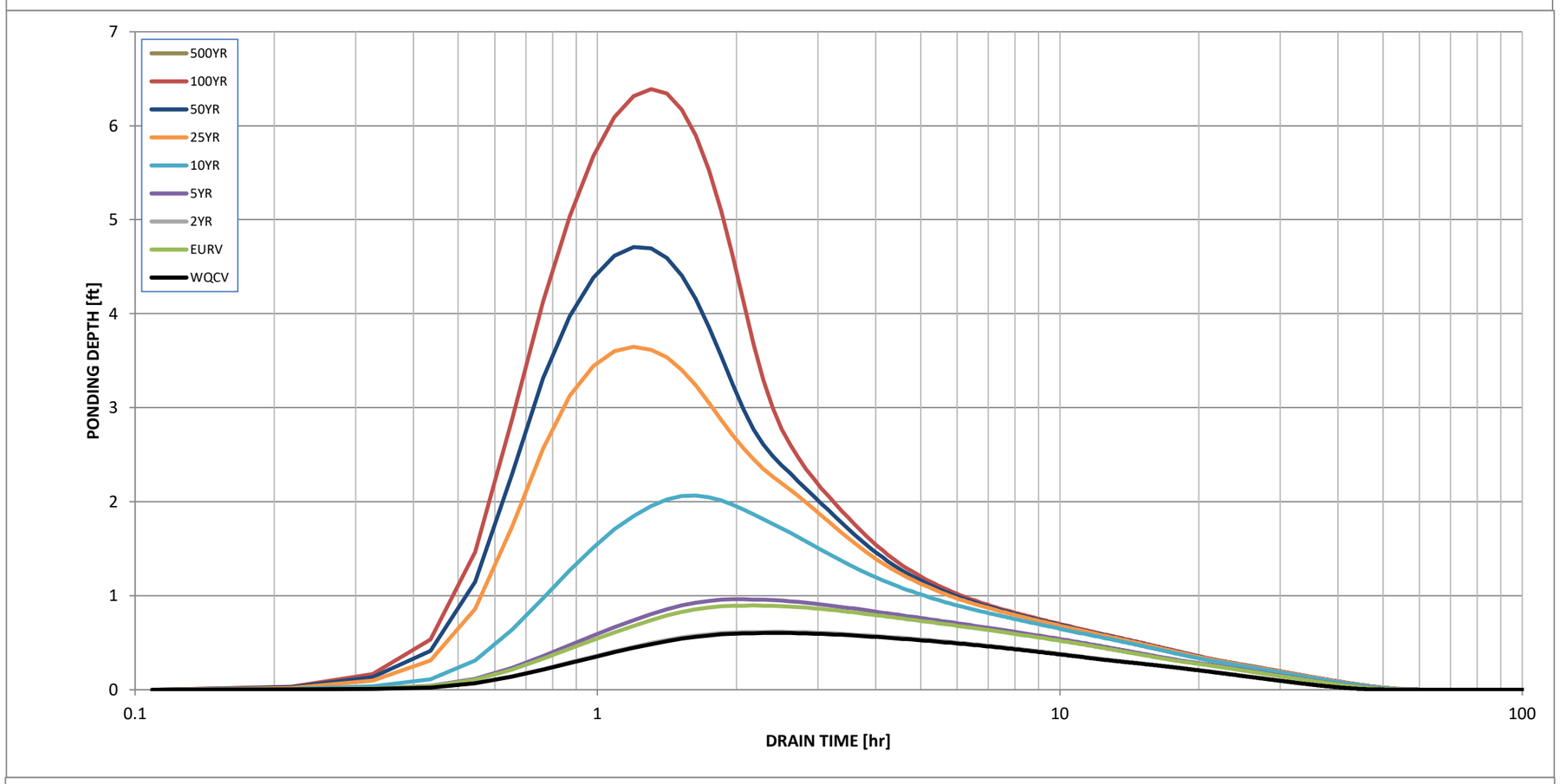
Routed Hydrograph Results

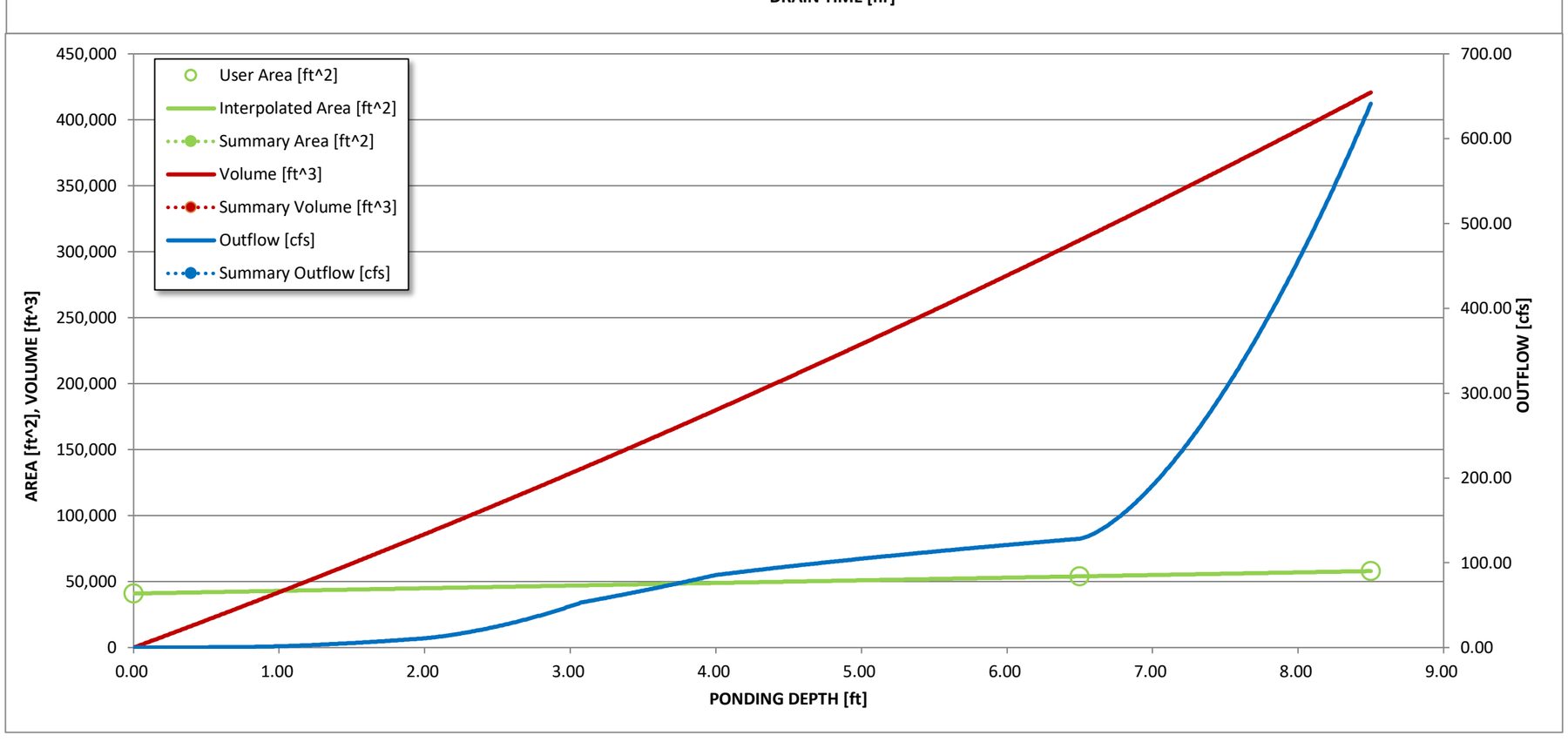
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.649	1.000	0.664	1.091	3.075	9.462	13.432	18.613	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.648	1.000	0.664	1.091	3.075	9.452	13.425	18.605	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.14	0.48	0.67	0.91	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.4	2.7	23.1	80.3	111.2	151.6	0.0
Peak Inflow Q (cfs) =	8.2	12.7	8.4	13.8	38.3	114.9	161.2	220.6	#N/A
Peak Outflow Q (cfs) =	0.5	1.1	0.5	1.4	12.2	72.4	99.6	126.8	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.5	0.9	0.9	0.8	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Plate	Vertical Orifice 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	1.1	1.6	2.1	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	41	44	42	44	38	23	17	13	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**46**	49	46	49	47	38	34	30	#N/A
Maximum Ponding Depth (ft) =	0.60	0.90	0.62	0.96	2.07	3.65	4.71	6.39	#N/A
Area at Maximum Ponding Depth (acres) =	0.97	0.98	0.97	0.99	1.04	1.11	1.16	1.23	#N/A
Maximum Volume Stored (acre-ft) =	0.573	0.856	0.583	0.925	2.036	3.730	4.931	6.952	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
6.53 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:06:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:13:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:19:35	0.37	0.55	0.37	0.60	1.62	4.27	5.55	6.88	#N/A
0.766	0:26:07	0.98	1.50	1.01	1.63	4.47	12.51	16.90	21.89	#N/A
	0:32:39	2.53	3.86	2.58	4.20	11.47	32.13	43.47	56.41	#N/A
	0:39:11	6.94	10.59	7.10	11.53	31.46	87.84	118.58	153.55	#N/A
	0:45:43	8.24	12.65	8.43	13.79	38.34	114.87	161.18	217.90	#N/A
	0:52:14	7.86	12.09	8.05	13.18	36.78	112.71	160.25	220.61	#N/A
	0:58:46	7.16	11.01	7.33	12.00	33.47	103.45	147.74	205.02	#N/A
	1:05:18	6.39	9.85	6.55	10.74	30.12	93.34	133.41	185.51	#N/A
	1:11:50	5.52	8.53	5.65	9.31	26.28	82.16	117.75	164.59	#N/A
	1:18:22	4.81	7.42	4.93	8.10	22.90	71.94	103.19	144.68	#N/A
	1:24:53	4.36	6.73	4.46	7.34	20.71	64.49	92.16	128.61	#N/A
	1:31:25	3.60	5.57	3.68	6.09	17.32	54.68	78.65	110.63	#N/A
	1:37:57	2.94	4.57	3.01	4.99	14.32	45.49	65.52	92.63	#N/A
	1:44:29	2.26	3.54	2.32	3.88	11.30	36.51	52.89	75.57	#N/A
	1:51:01	1.68	2.66	1.73	2.92	8.68	28.49	41.43	59.82	#N/A
	1:57:32	1.22	1.93	1.25	2.12	6.45	21.57	31.54	46.27	#N/A
	2:04:04	0.95	1.48	0.97	1.63	4.86	15.96	23.30	34.68	#N/A
	2:10:36	0.78	1.22	0.80	1.33	3.93	12.66	18.35	26.78	#N/A
	2:17:08	0.66	1.03	0.68	1.13	3.31	10.61	15.32	22.10	#N/A
	2:23:40	0.58	0.90	0.59	0.99	2.88	9.18	13.21	18.94	#N/A
	2:30:11	0.52	0.81	0.53	0.89	2.58	8.18	11.74	16.75	#N/A
	2:36:43	0.48	0.75	0.49	0.82	2.37	7.46	10.70	15.18	#N/A
	2:43:15	0.35	0.55	0.36	0.60	1.76	5.72	8.34	12.06	#N/A
	2:49:47	0.26	0.40	0.27	0.44	1.27	4.12	6.01	8.73	#N/A
	2:56:19	0.19	0.30	0.19	0.32	0.94	3.06	4.46	6.44	#N/A
	3:02:50	0.14	0.22	0.14	0.24	0.70	2.27	3.31	4.79	#N/A
	3:09:22	0.10	0.16	0.10	0.17	0.51	1.68	2.45	3.56	#N/A
	3:15:54	0.07	0.11	0.07	0.12	0.36	1.21	1.78	2.61	#N/A
	3:22:26	0.05	0.08	0.05	0.09	0.26	0.88	1.28	1.89	#N/A
	3:28:58	0.03	0.05	0.03	0.06	0.18	0.62	0.92	1.38	#N/A
	3:35:29	0.02	0.03	0.02	0.04	0.12	0.41	0.62	0.95	#N/A
	3:42:01	0.01	0.02	0.01	0.02	0.07	0.25	0.37	0.60	#N/A
	3:48:33	0.00	0.01	0.00	0.01	0.03	0.12	0.19	0.33	#N/A
	3:55:05	0.00	0.00	0.00	0.00	0.01	0.04	0.07	0.14	#N/A
	4:01:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	#N/A
	4:08:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:14:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:21:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:27:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:34:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:40:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:47:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:53:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:00:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:06:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:13:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:19:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:26:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:33:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:39:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:46:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:52:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:59:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:05:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:12:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:18:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:25:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:31:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:38:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:44:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:51:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:57:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:04:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:10:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:17:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:24:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:30:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:37:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:43:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:50:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

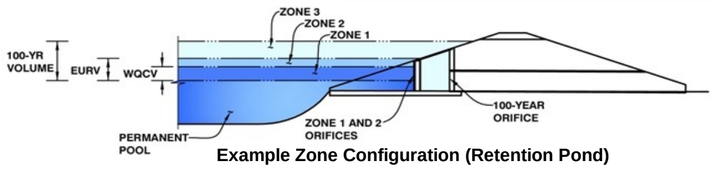
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: **Winsome**

Basin ID: **Pond 4**



Example Zone Configuration (Retention Pond)

Required Volume Calculation

			Optional User Override 1-hr Precipitation	
Selected BMP Type =	**EDB**			
Watershed Area =	28.50	acres		
Watershed Length =	1,895	ft		
Watershed Slope =	0.035	ft/ft		
Watershed Imperviousness =	7.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	4.8%	percent		
Percentage Hydrologic Soil Groups C/D =	95.2%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input		70.7	
Water Quality Capture Volume (WQCV) =	0.117	acre-feet		
Excess Urban Runoff Volume (EURV) =	0.162	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.136	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.365	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.838	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.918	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	2.635	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.557	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.127	acre-feet		
Approximate 5-yr Detention Volume =	0.349	acre-feet		
Approximate 10-yr Detention Volume =	0.504	acre-feet		
Approximate 25-yr Detention Volume =	0.608	acre-feet		
Approximate 50-yr Detention Volume =	0.623	acre-feet		
Approximate 100-yr Detention Volume =	0.892	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.117	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.046	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.730	acre-feet
Total Detention Basin Volume =	0.892	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	

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	6,000	0.138		
Spillway Invert	--	5.50	--	--	--	17,000	0.390	63,250	1.452
Freeboard	--	7.50	--	--	--	21,000	0.482	101,250	2.324
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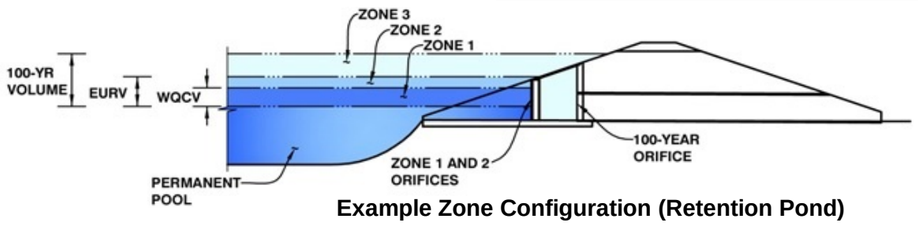
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: Pond 4



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.76	0.117	Orifice Plate
Zone 2 (EURV)	1.01	0.046	Circular Orifice
Zone 3 (100-year)	3.92	0.730	Weir&Pipe (Circular)
		0.892	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	0.76	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	3.20	inches
Orifice Plate: Orifice Area per Row =	1.60	sq. inches (diameter = 1-7/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.111E-02	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	0.25	0.51					
Orifice Area (sq. inches)	1.60	1.60	1.60					

	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 =	1.01	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	1.01	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	12.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.79	N/A	ft^2
Vertical Orifice Centroid =	0.50	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	3.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	85%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.33	N/A	feet
Over Flow Weir Slope Length =	4.22	N/A	feet
Grate Open Area / 100-yr Orifice Area =	4.56	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	14.34	N/A	ft^2
Overflow Grate Open Area w/ Debris =	7.17	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	24.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	3.14	N/A	ft^2
Outlet Orifice Centroid =	1.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	19.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

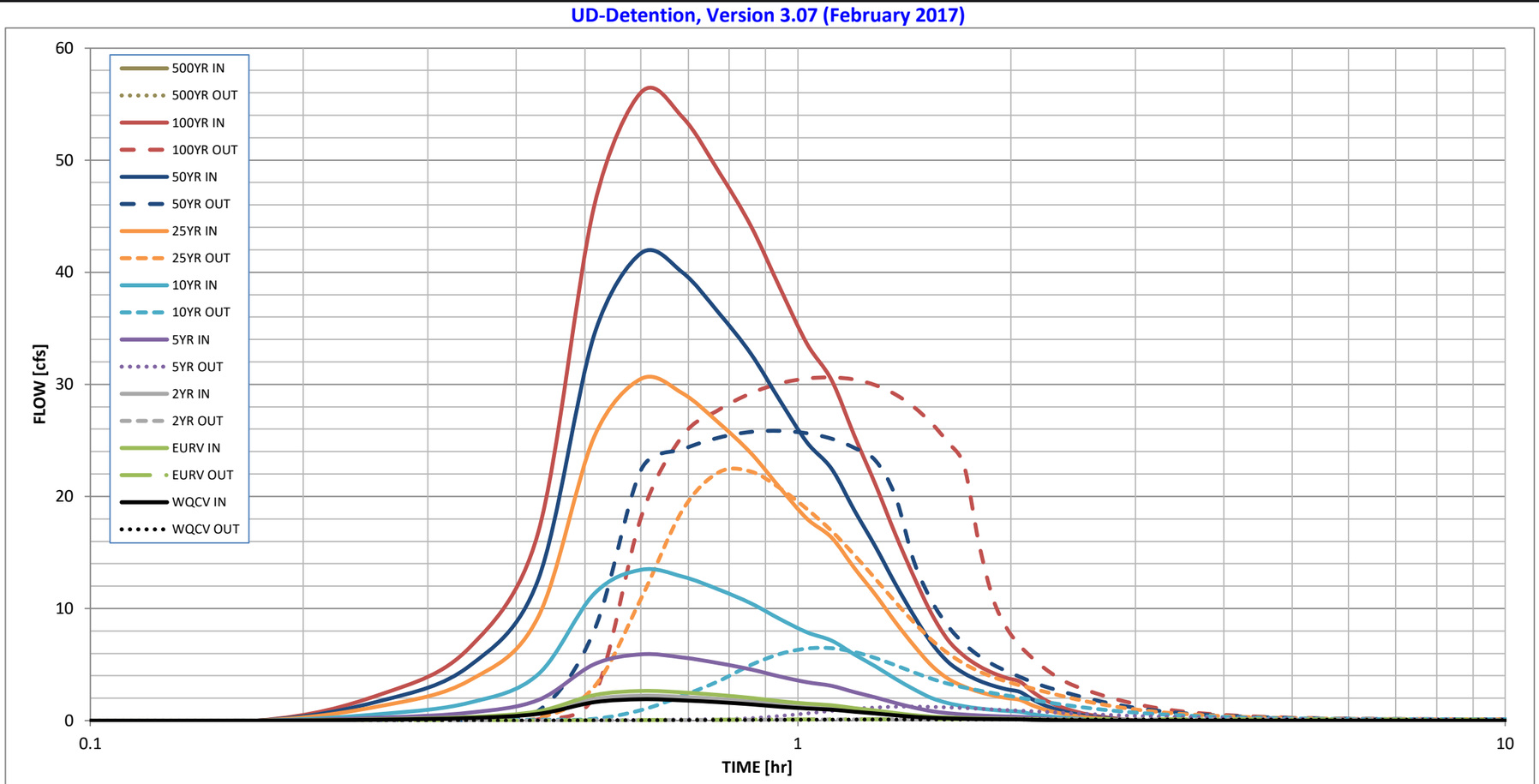
Spillway Design Flow Depth=	0.90	feet
Stage at Top of Freeboard =	7.40	feet
Basin Area at Top of Freeboard =	0.48	acres

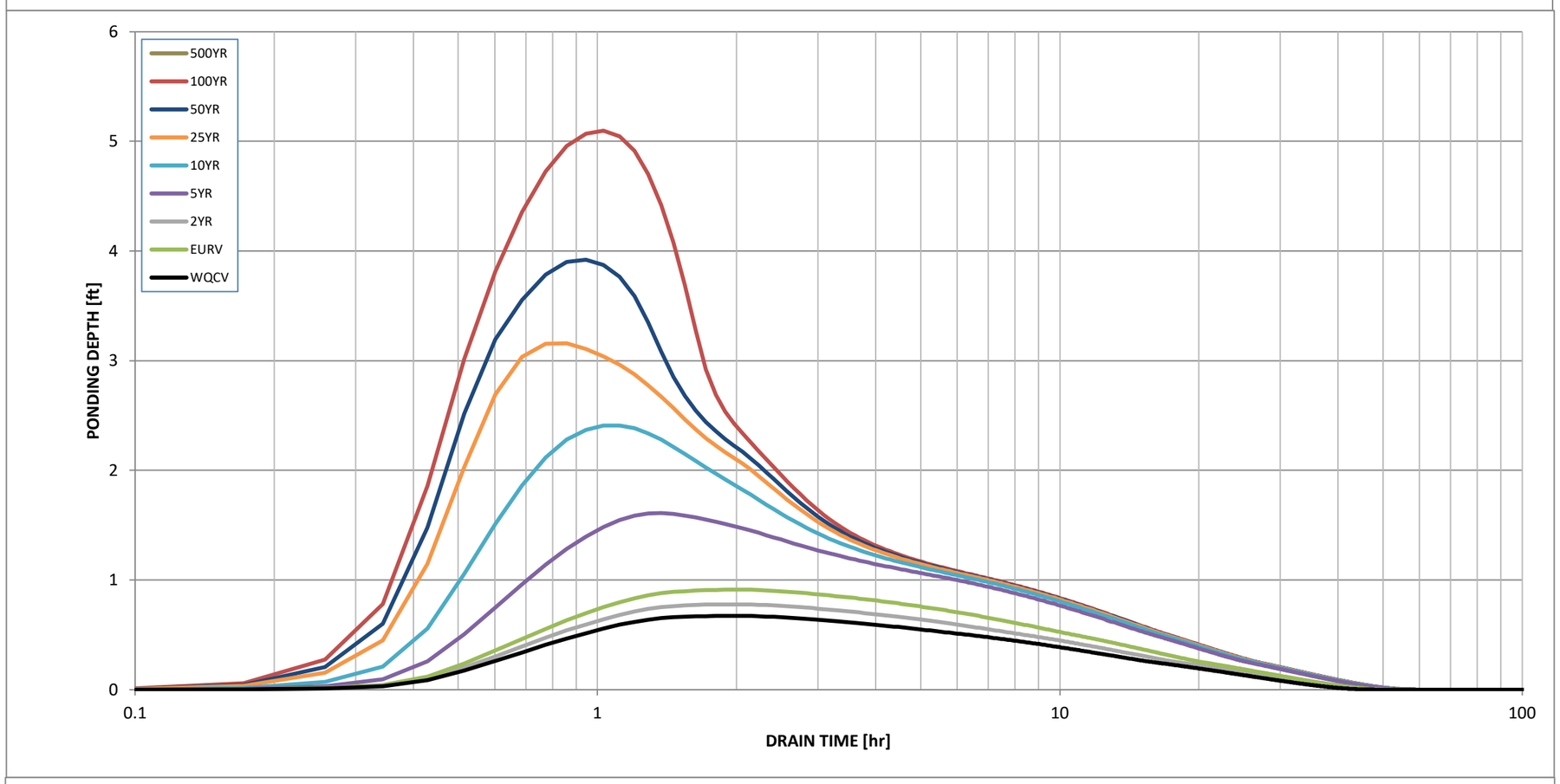
Routed Hydrograph Results

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.117	0.162	0.136	0.365	0.838	1.918	2.635	3.557	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.116	0.161	0.136	0.364	0.837	1.916	2.633	3.554	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.11	0.32	0.75	0.99	1.30	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	3.2	9.0	21.4	28.3	37.0	0.0
Peak Inflow Q (cfs) =	1.9	2.6	2.2	5.9	13.5	30.5	41.7	56.1	#N/A
Peak Outflow Q (cfs) =	0.1	0.1	0.1	1.3	6.5	22.2	25.8	30.6	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.7	1.0	0.9	0.8	#N/A
Structure Controlling Flow =	Plate	Plate	Plate	Vertical Orifice 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.2	1.2	1.4	1.6	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	38	41	39	40	32	21	16	13	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**42**	46	44	48	43	35	31	27	#N/A
Maximum Ponding Depth (ft) =	0.67	0.91	0.78	1.61	2.41	3.16	3.92	5.10	#N/A
Area at Maximum Ponding Depth (acres) =	0.17	0.18	0.17	0.21	0.25	0.28	0.32	0.37	#N/A
Maximum Volume Stored (acre-ft) =	0.103	0.144	0.120	0.281	0.463	0.662	0.890	1.296	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)





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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.15 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:05:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph Constant	0:10:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:15:27	0.09	0.12	0.10	0.27	0.59	1.31	1.78	2.35	#N/A
0.970	0:20:36	0.23	0.32	0.27	0.71	1.60	3.58	4.87	6.50	#N/A
	0:25:45	0.60	0.82	0.70	1.83	4.11	9.20	12.52	16.70	#N/A
	0:30:54	1.64	2.27	1.92	5.02	11.30	25.27	34.35	45.80	#N/A
	0:36:03	1.91	2.65	2.23	5.92	13.46	30.50	41.71	56.07	#N/A
	0:41:12	1.81	2.52	2.12	5.64	12.85	29.21	39.99	53.84	#N/A
	0:46:21	1.64	2.29	1.93	5.13	11.70	26.58	36.39	49.00	#N/A
	0:51:30	1.45	2.03	1.70	4.57	10.46	23.86	32.72	44.12	#N/A
	0:56:39	1.24	1.73	1.46	3.93	9.05	20.74	28.52	38.55	#N/A
	1:01:48	1.09	1.52	1.27	3.43	7.88	18.02	24.83	33.63	#N/A
	1:06:57	0.98	1.37	1.15	3.10	7.14	16.34	22.48	30.39	#N/A
	1:12:06	0.79	1.11	0.93	2.55	5.91	13.62	18.77	25.43	#N/A
	1:17:15	0.64	0.90	0.75	2.07	4.84	11.23	15.51	21.06	#N/A
	1:22:24	0.48	0.67	0.56	1.58	3.74	8.80	12.21	16.64	#N/A
	1:27:33	0.34	0.49	0.41	1.16	2.80	6.70	9.36	12.83	#N/A
	1:32:42	0.25	0.36	0.30	0.85	2.02	4.92	6.93	9.55	#N/A
	1:37:51	0.20	0.28	0.24	0.66	1.56	3.74	5.23	7.18	#N/A
	1:43:00	0.17	0.23	0.20	0.54	1.28	3.04	4.24	5.79	#N/A
	1:48:09	0.14	0.20	0.17	0.46	1.09	2.57	3.57	4.87	#N/A
	1:53:18	0.13	0.18	0.15	0.41	0.95	2.25	3.12	4.25	#N/A
	1:58:27	0.11	0.16	0.13	0.37	0.86	2.02	2.79	3.80	#N/A
	2:03:36	0.11	0.15	0.12	0.34	0.79	1.85	2.56	3.48	#N/A
	2:08:45	0.08	0.11	0.09	0.25	0.58	1.37	1.90	2.59	#N/A
	2:13:54	0.06	0.08	0.07	0.18	0.43	0.99	1.38	1.87	#N/A
	2:19:03	0.04	0.06	0.05	0.13	0.31	0.73	1.02	1.38	#N/A
	2:24:12	0.03	0.04	0.04	0.10	0.23	0.54	0.75	1.03	#N/A
	2:29:21	0.02	0.03	0.02	0.07	0.17	0.39	0.55	0.75	#N/A
	2:34:30	0.01	0.02	0.02	0.05	0.12	0.28	0.39	0.54	#N/A
	2:39:39	0.01	0.01	0.01	0.03	0.08	0.20	0.28	0.39	#N/A
	2:44:48	0.01	0.01	0.01	0.02	0.06	0.14	0.20	0.27	#N/A
	2:49:57	0.00	0.00	0.00	0.01	0.03	0.09	0.12	0.17	#N/A
	2:55:06	0.00	0.00	0.00	0.01	0.02	0.05	0.07	0.10	#N/A
	3:00:15	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.04	#N/A
	3:05:24	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	#N/A
	3:10:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:15:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:20:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:26:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:31:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:36:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:41:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:46:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:51:45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:56:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:02:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:07:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:12:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:17:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:22:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:27:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:32:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:38:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:43:15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:48:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:53:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:58:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:03:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:09:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:14:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:19:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:24:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:29:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:34:45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:39:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:45:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:50:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:55:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:00:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:05:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:10:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

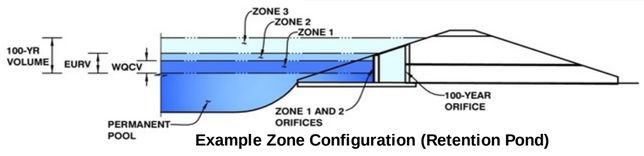
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: Pond 5



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	152.00	acres		
Watershed Length =	4,755	ft		
Watershed Slope =	0.028	ft/ft		
Watershed Imperviousness =	9.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	98.1%	percent		
Percentage Hydrologic Soil Groups C/D =	1.9%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths = User Input				
Water Quality Capture Volume (WQCV) =	0.776	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	1.272	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.869	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.380	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	3.301	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	9.051	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	12.642	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	17.330	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.807	acre-feet		
Approximate 5-yr Detention Volume =	1.293	acre-feet		
Approximate 10-yr Detention Volume =	2.779	acre-feet		
Approximate 25-yr Detention Volume =	3.933	acre-feet		
Approximate 50-yr Detention Volume =	4.100	acre-feet		
Approximate 100-yr Detention Volume =	5.340	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.776	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.497	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.067	acre-feet
Total Detention Basin Volume =	5.340	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	56,000	1.286		
	--	6.00	--	--	--	68,000	1.561	372,000	8.540
	--	8.00	--	--	--	72,000	1.653	512,000	11.754
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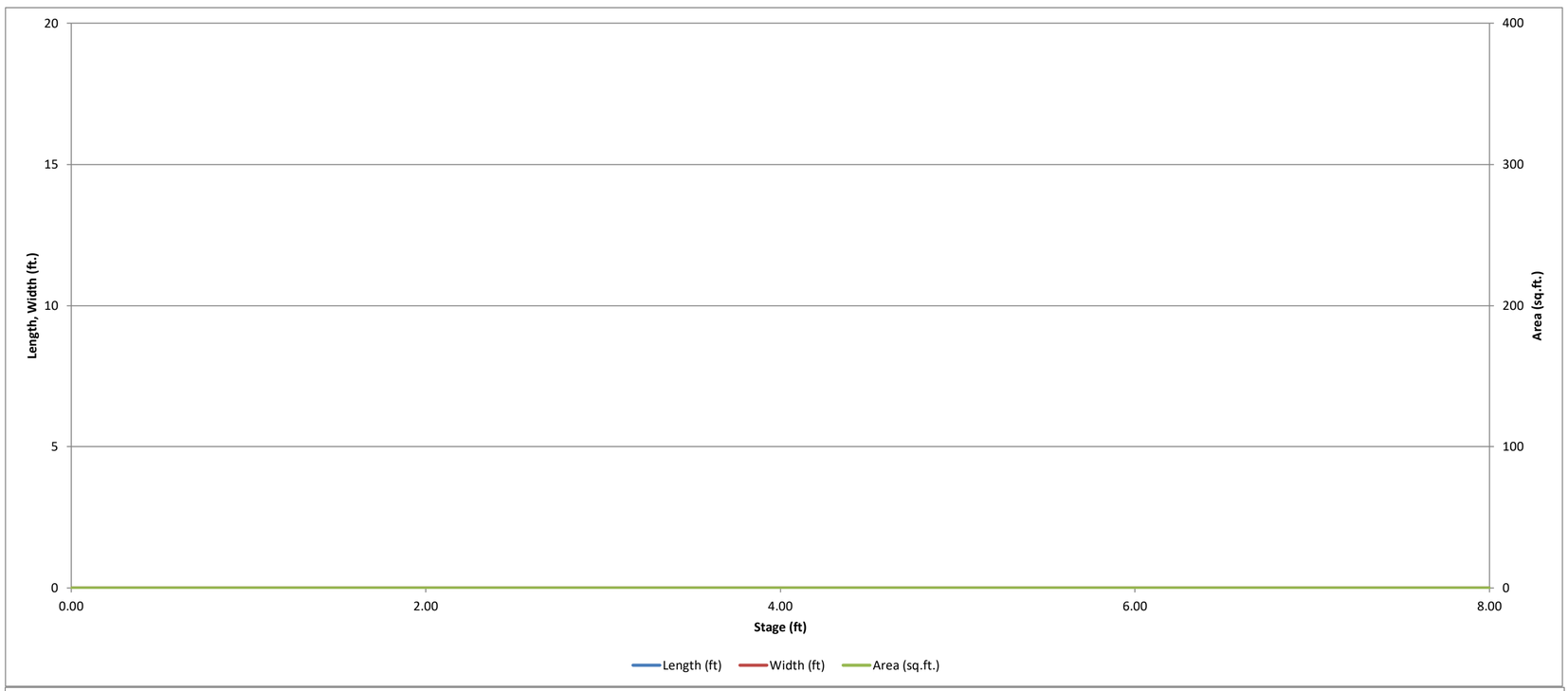
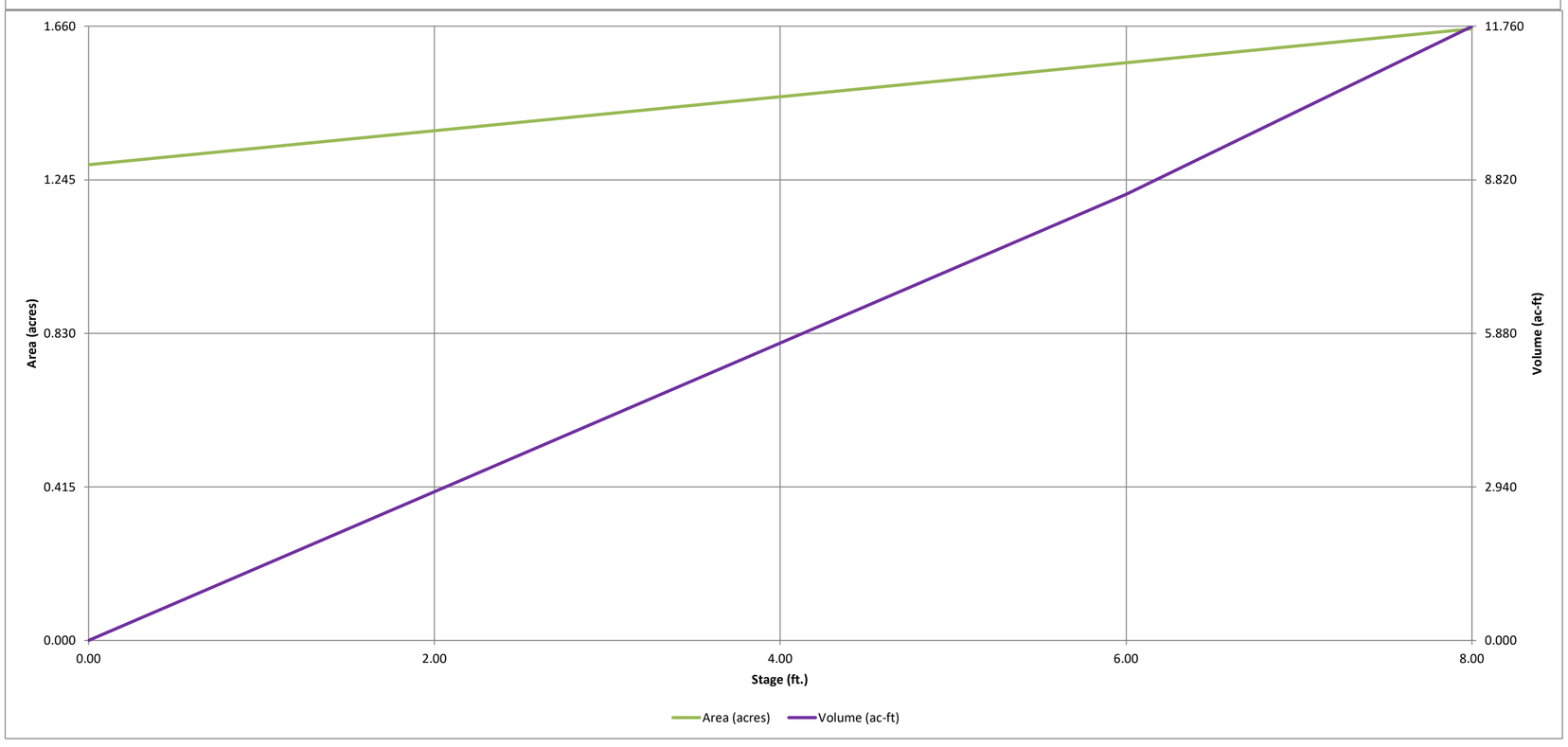
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



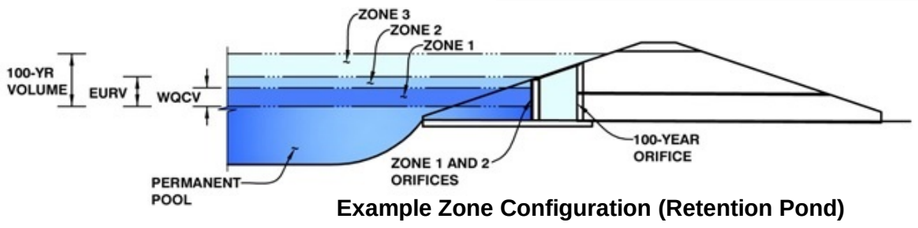


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: Pond 5



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.60	0.776	Orifice Plate
Zone 2 (EURV)	0.98	0.497	Circular Orifice
Zone 3 (100-year)	3.89	4.067	Weir&Pipe (Circular)
		5.340	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	1.01	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	2.10	inches
Orifice Plate: Orifice Area per Row =	14.92	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.036E-01	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	0.34	0.67					
Orifice Area (sq. inches)	14.92	14.92	14.92					

	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 =	0.52	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	0.85	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	28.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	4.28	N/A	ft^2
Vertical Orifice Centroid =	1.17	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Slope =	3.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	85%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.33	N/A	feet
Over Flow Weir Slope Length =	4.22	N/A	feet
Grate Open Area / 100-yr Orifice Area =	2.28	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	28.67	N/A	ft^2
Overflow Grate Open Area w/ Debris =	14.34	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	48.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	12.57	N/A	ft^2
Outlet Orifice Centroid =	2.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	81.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

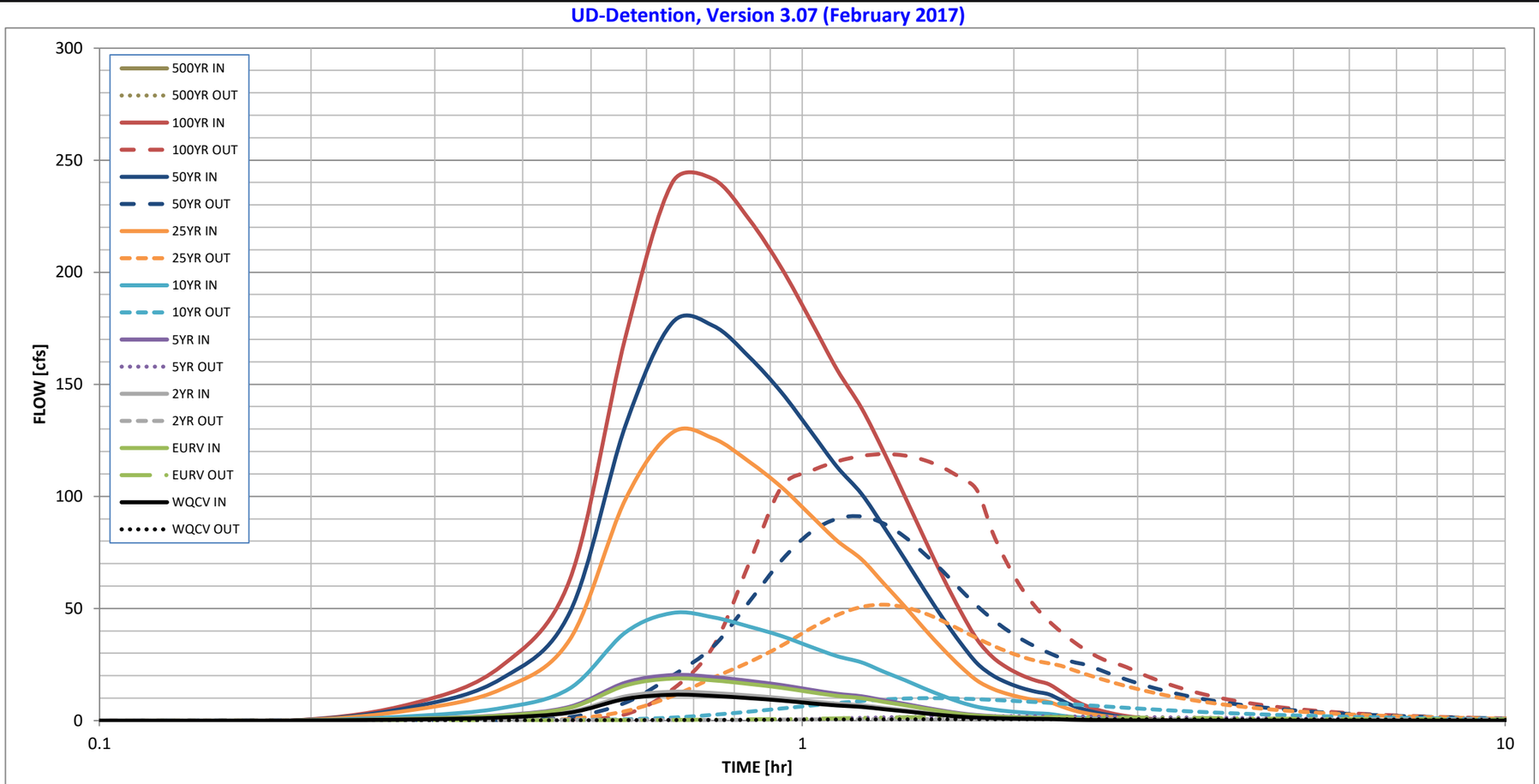
Spillway Design Flow Depth=	0.97	feet
Stage at Top of Freeboard =	7.97	feet
Basin Area at Top of Freeboard =	1.65	acres

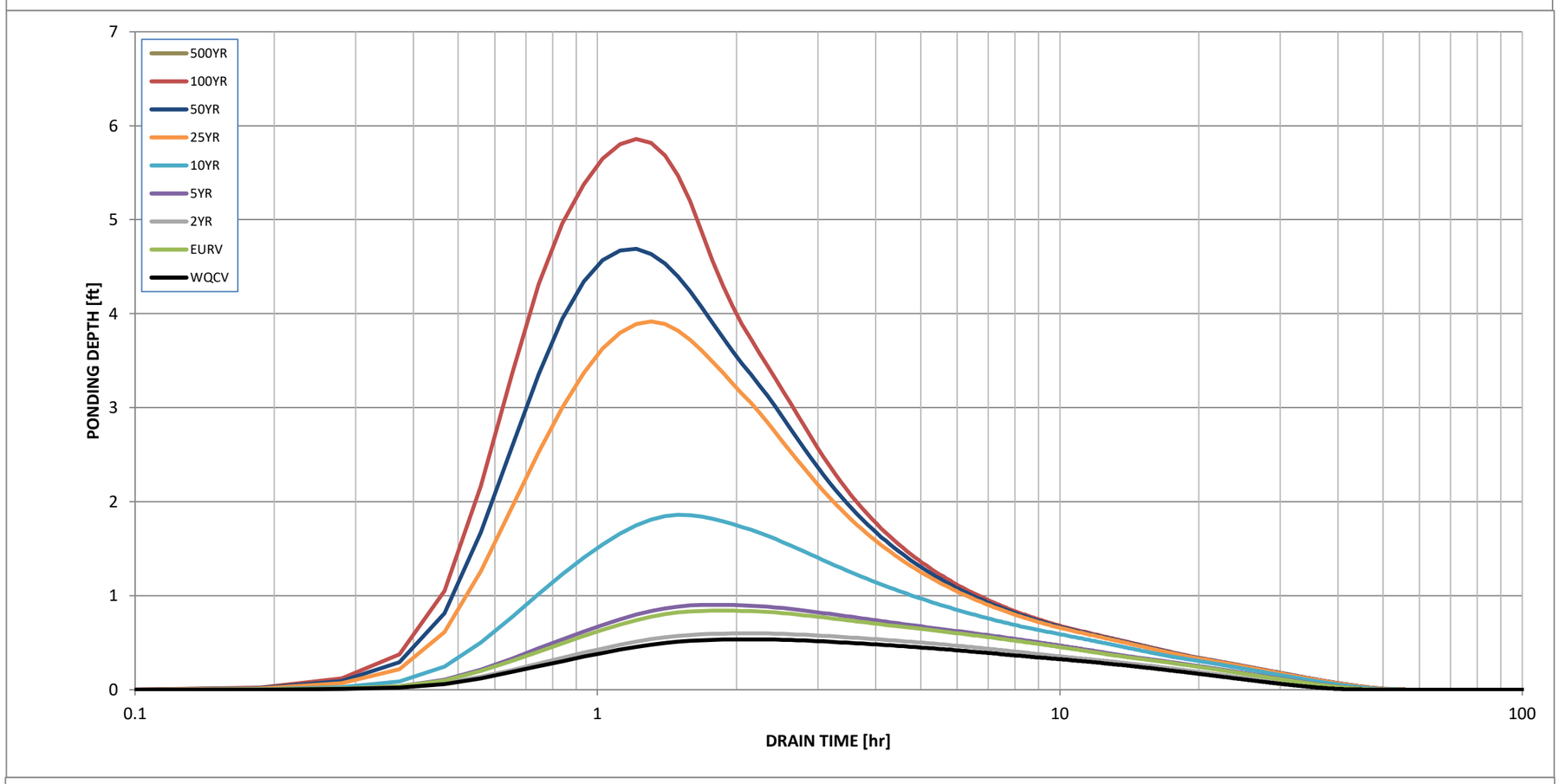
Routed Hydrograph Results

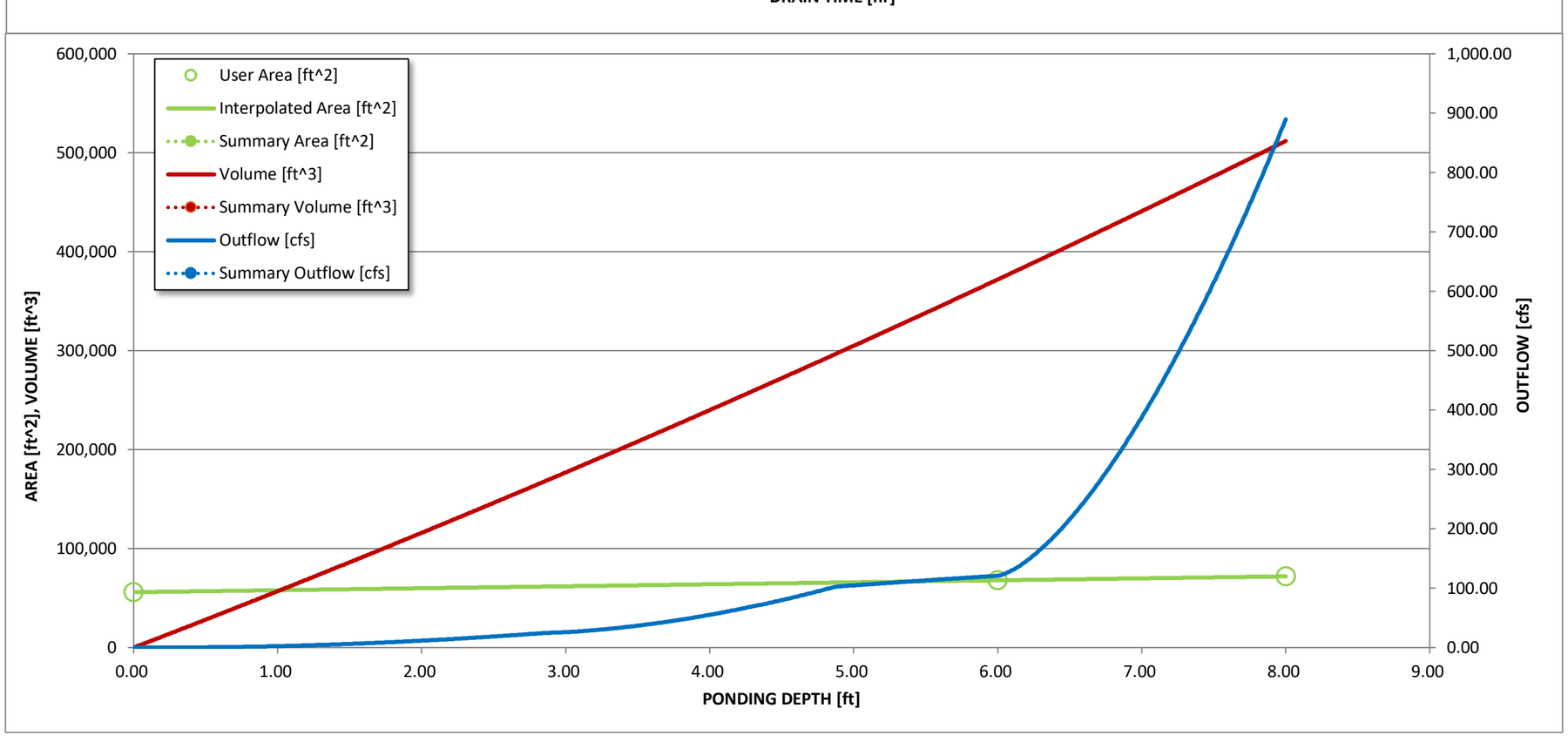
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.776	1.272	0.869	1.380	3.301	9.051	12.642	17.330	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.776	1.273	0.870	1.382	3.303	9.053	12.652	17.338	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.17	0.58	0.80	1.08	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.6	3.0	26.1	88.1	121.9	164.8	0.0
Peak Inflow Q (cfs) =	11.5	18.7	12.9	20.3	48.0	128.5	177.5	241.5	#N/A
Peak Outflow Q (cfs) =	0.6	1.6	0.7	1.9	10.0	51.7	91.0	118.9	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.4	0.6	0.7	0.7	#N/A
Structure Controlling Flow =	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.6	1.8	2.6	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	37	40	39	40	37	27	22	18	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**41**	45	42	45	45	40	37	34	#N/A
Maximum Ponding Depth (ft) =	0.54	0.84	0.60	0.90	1.86	3.92	4.69	5.86	#N/A
Area at Maximum Ponding Depth (acres) =	1.31	1.32	1.31	1.33	1.37	1.47	1.50	1.55	#N/A
Maximum Volume Stored (acre-ft) =	0.688	1.096	0.766	1.176	2.457	5.378	6.519	8.306	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.60 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:05:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph Constant	0:11:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:16:48	0.51	0.82	0.57	0.88	2.02	4.81	6.20	7.75	#N/A
0.894	0:22:24	1.37	2.21	1.53	2.40	5.58	14.05	18.75	24.39	#N/A
	0:28:00	3.51	5.69	3.92	6.16	14.33	36.08	48.20	62.79	#N/A
	0:33:36	9.65	15.62	10.78	16.91	39.30	98.66	131.55	170.98	#N/A
	0:39:12	11.48	18.73	12.85	20.30	47.98	128.45	177.53	240.08	#N/A
	0:44:48	10.96	17.91	12.28	19.42	46.05	125.86	176.07	241.53	#N/A
	0:50:24	9.98	16.30	11.18	17.68	41.91	115.45	162.19	223.54	#N/A
	0:56:00	8.92	14.61	10.00	15.85	37.72	104.17	146.44	201.94	#N/A
	1:01:36	7.71	12.66	8.65	13.74	32.94	91.66	129.19	178.61	#N/A
	1:07:12	6.72	11.01	7.53	11.95	28.72	80.25	113.20	156.58	#N/A
	1:12:48	6.09	9.98	6.82	10.83	25.96	71.97	101.17	139.44	#N/A
	1:18:24	5.03	8.29	5.65	9.00	21.72	60.98	86.24	119.60	#N/A
	1:24:00	4.12	6.81	4.62	7.40	17.97	50.71	71.82	99.73	#N/A
	1:29:36	3.18	5.31	3.58	5.77	14.19	40.68	57.92	80.85	#N/A
	1:35:12	2.37	4.00	2.68	4.37	10.92	31.73	45.34	63.52	#N/A
	1:40:48	1.72	2.92	1.93	3.18	8.12	24.00	34.47	48.59	#N/A
	1:46:24	1.33	2.23	1.49	2.43	6.11	17.77	25.43	36.05	#N/A
	1:52:00	1.09	1.83	1.23	1.99	4.93	14.11	20.07	28.18	#N/A
	1:57:36	0.93	1.55	1.04	1.68	4.16	11.83	16.77	23.42	#N/A
	2:03:12	0.81	1.35	0.91	1.47	3.62	10.24	14.48	20.15	#N/A
	2:08:48	0.73	1.22	0.82	1.32	3.24	9.12	12.87	17.87	#N/A
	2:14:24	0.67	1.12	0.76	1.22	2.97	8.32	11.73	16.24	#N/A
	2:20:00	0.49	0.82	0.55	0.90	2.20	6.37	9.12	12.84	#N/A
	2:25:36	0.36	0.60	0.41	0.65	1.60	4.59	6.57	9.26	#N/A
	2:31:12	0.27	0.44	0.30	0.48	1.18	3.41	4.87	6.86	#N/A
	2:36:48	0.20	0.33	0.22	0.36	0.88	2.53	3.62	5.09	#N/A
	2:42:24	0.14	0.24	0.16	0.26	0.64	1.87	2.68	3.77	#N/A
	2:48:00	0.10	0.17	0.11	0.18	0.46	1.35	1.94	2.74	#N/A
	2:53:36	0.07	0.12	0.08	0.13	0.33	0.98	1.40	1.98	#N/A
	2:59:12	0.05	0.08	0.05	0.09	0.23	0.69	1.00	1.43	#N/A
	3:04:48	0.03	0.05	0.03	0.05	0.15	0.46	0.67	0.97	#N/A
	3:10:24	0.01	0.03	0.02	0.03	0.08	0.27	0.40	0.59	#N/A
	3:16:00	0.00	0.01	0.01	0.01	0.04	0.13	0.20	0.31	#N/A
	3:21:36	0.00	0.00	0.00	0.00	0.01	0.04	0.07	0.12	#N/A
	3:27:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	#N/A
	3:32:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:38:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:44:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:49:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:55:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:00:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:06:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:12:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:17:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:23:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:28:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:34:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:45:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:51:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:56:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:02:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:08:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:13:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:19:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:24:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:30:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:36:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:41:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:47:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:52:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:58:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:04:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:09:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:15:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:20:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:26:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:32:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:37:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:43:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

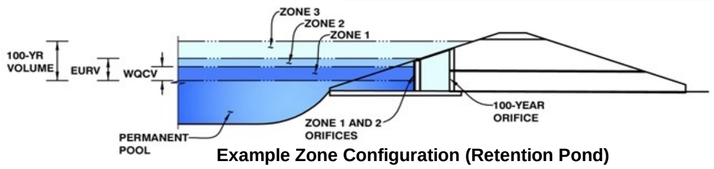
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: Pond 6



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type = **EDB**
Watershed Area = 45.80 acres
Watershed Length = 2,615 ft
Watershed Slope = 0.029 ft/ft
Watershed Imperviousness = 14.50% 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
Desired WQCV Drain Time = 40.0 hours
Location for 1-hr Rainfall Depths = User Input 70.7
Water Quality Capture Volume (WQCV) = 0.347 acre-feet
Excess Urban Runoff Volume (EURV) = 0.643 acre-feet

		Optional User Override 1-hr Precipitation	
2-yr Runoff Volume (P1 = 1.19 in.) = 0.459	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) = 0.692	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) = 1.342	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) = 3.035	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) = 4.104	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) = 5.502	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) = 0.000	acre-feet		inches

Approximate 2-yr Detention Volume = 0.427 acre-feet
Approximate 5-yr Detention Volume = 0.649 acre-feet
Approximate 10-yr Detention Volume = 1.163 acre-feet
Approximate 25-yr Detention Volume = 1.524 acre-feet
Approximate 50-yr Detention Volume = 1.606 acre-feet
Approximate 100-yr Detention Volume = 2.026 acre-feet

Stage-Storage Calculation

Zone 1 Volume (WQCV) = 0.347 acre-feet
Zone 2 Volume (EURV - Zone 1) = 0.296 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) = 1.383 acre-feet
Total Detention Basin Volume = 2.026 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

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	--	--	--	26,000	0.597		
Spillway Invert	--	5.50	--	--	--	37,000	0.849	173,250	3.977
Freeboard	--	7.50	--	--	--	41,000	0.941	251,250	5.768
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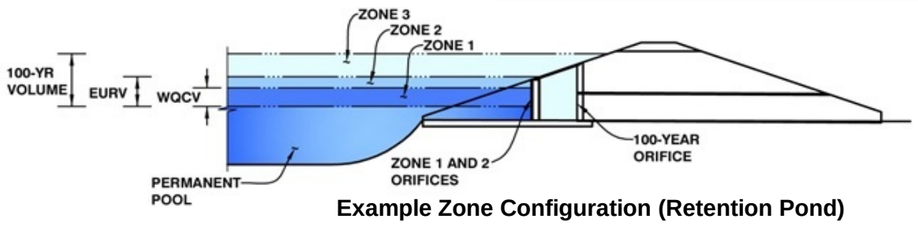
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: Pond 6



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.57	0.347	Orifice Plate
Zone 2 (EURV)	1.04	0.296	Circular Orifice
Zone 3 (100-year)	3.04	1.383	Weir&Pipe (Circular)
		2.026	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	1.04	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	3.20	inches
Orifice Plate: Orifice Area per Row =	6.00	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	4.167E-02	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	0.35	0.69					
Orifice Area (sq. inches)	6.00	6.00	6.00					

	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 =	0.73	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	1.32	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	12.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.79	N/A	ft^2
Vertical Orifice Centroid =	0.50	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	3.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	85%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.33	N/A	feet
Over Flow Weir Slope Length =	4.22	N/A	feet
Grate Open Area / 100-yr Orifice Area =	8.11	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	14.34	N/A	ft^2
Overflow Grate Open Area w/ Debris =	7.17	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	18.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

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

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	26.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

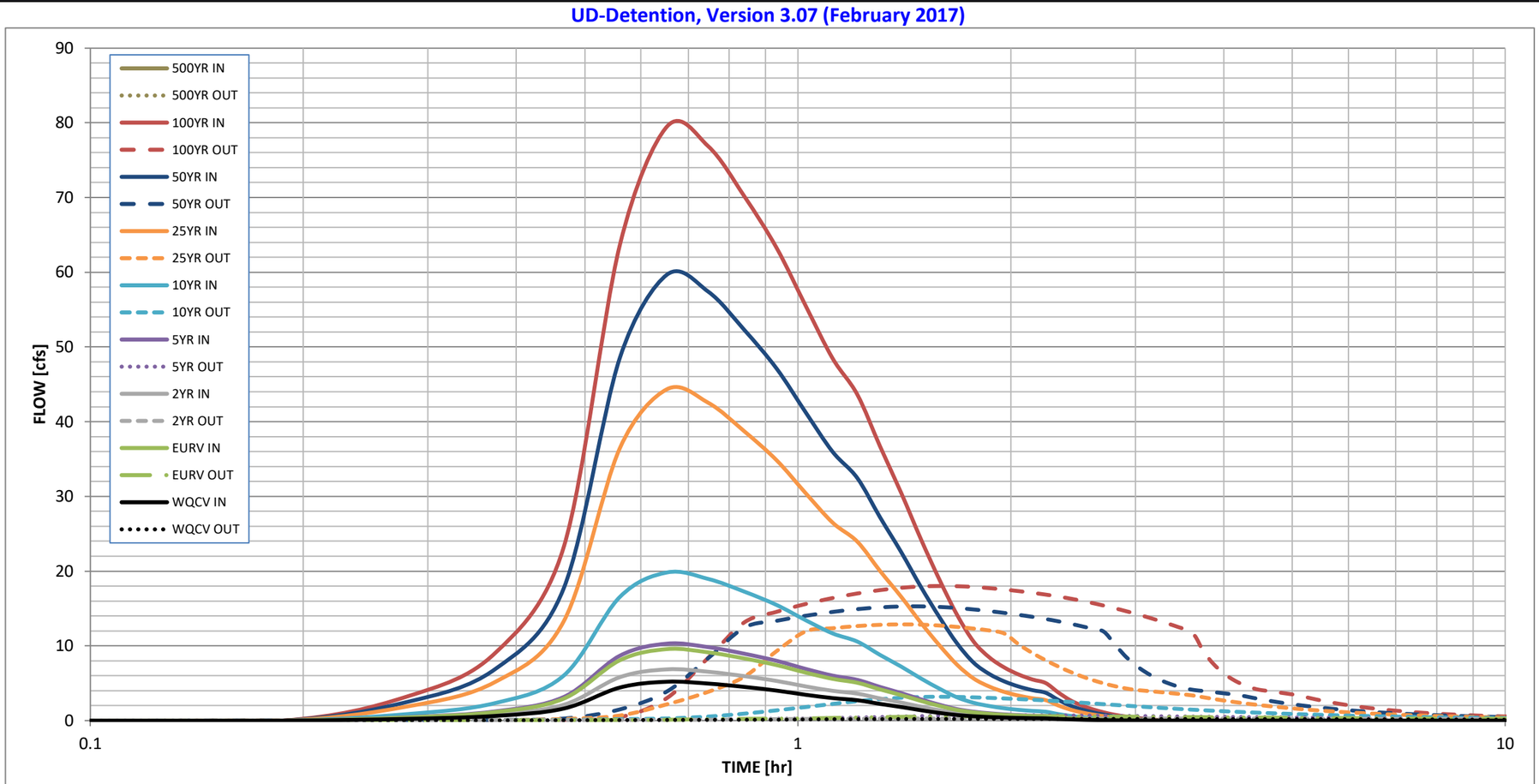
Spillway Design Flow Depth=	0.94	feet
Stage at Top of Freeboard =	7.44	feet
Basin Area at Top of Freeboard =	0.94	acres

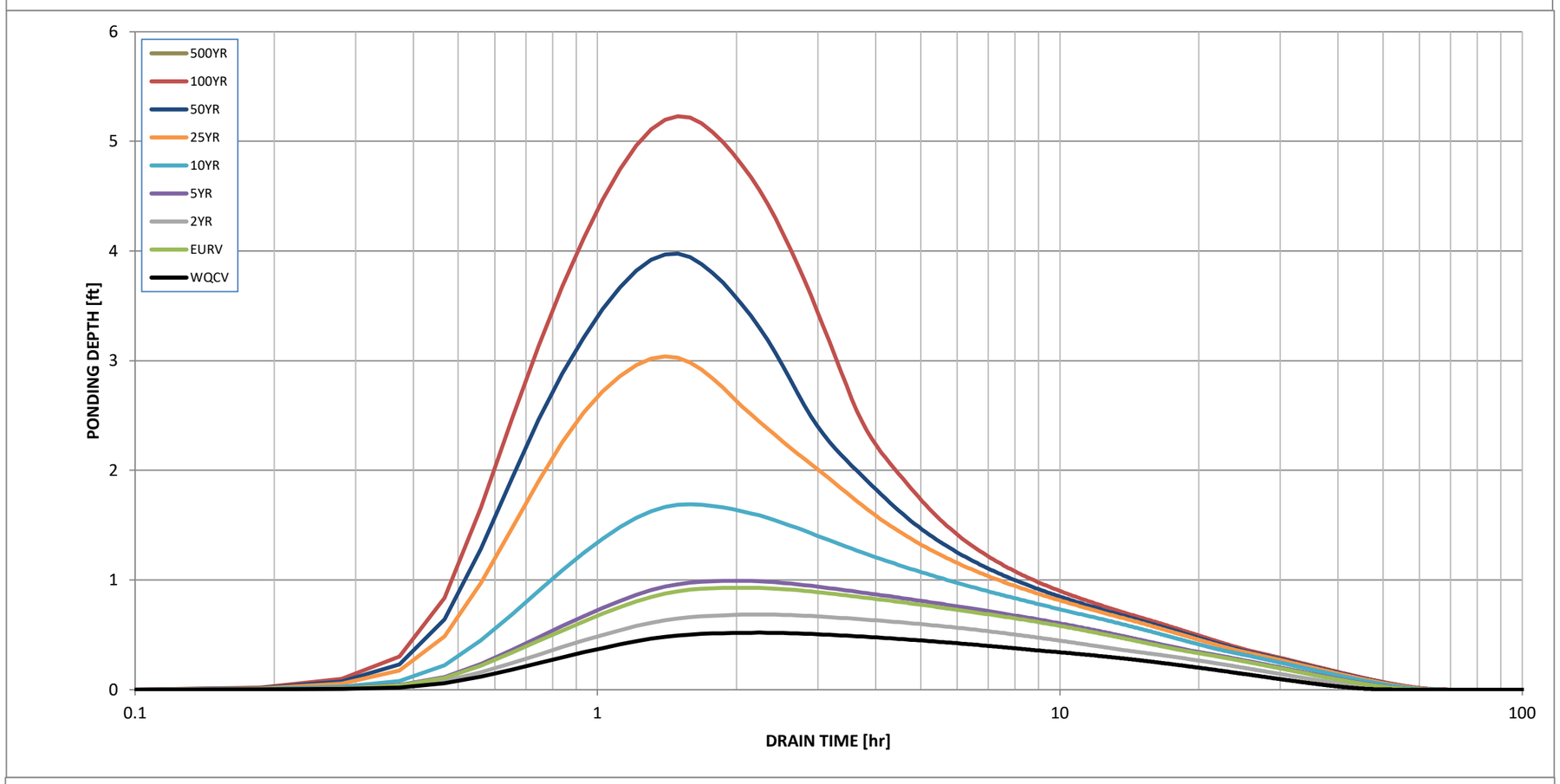
Routed Hydrograph Results

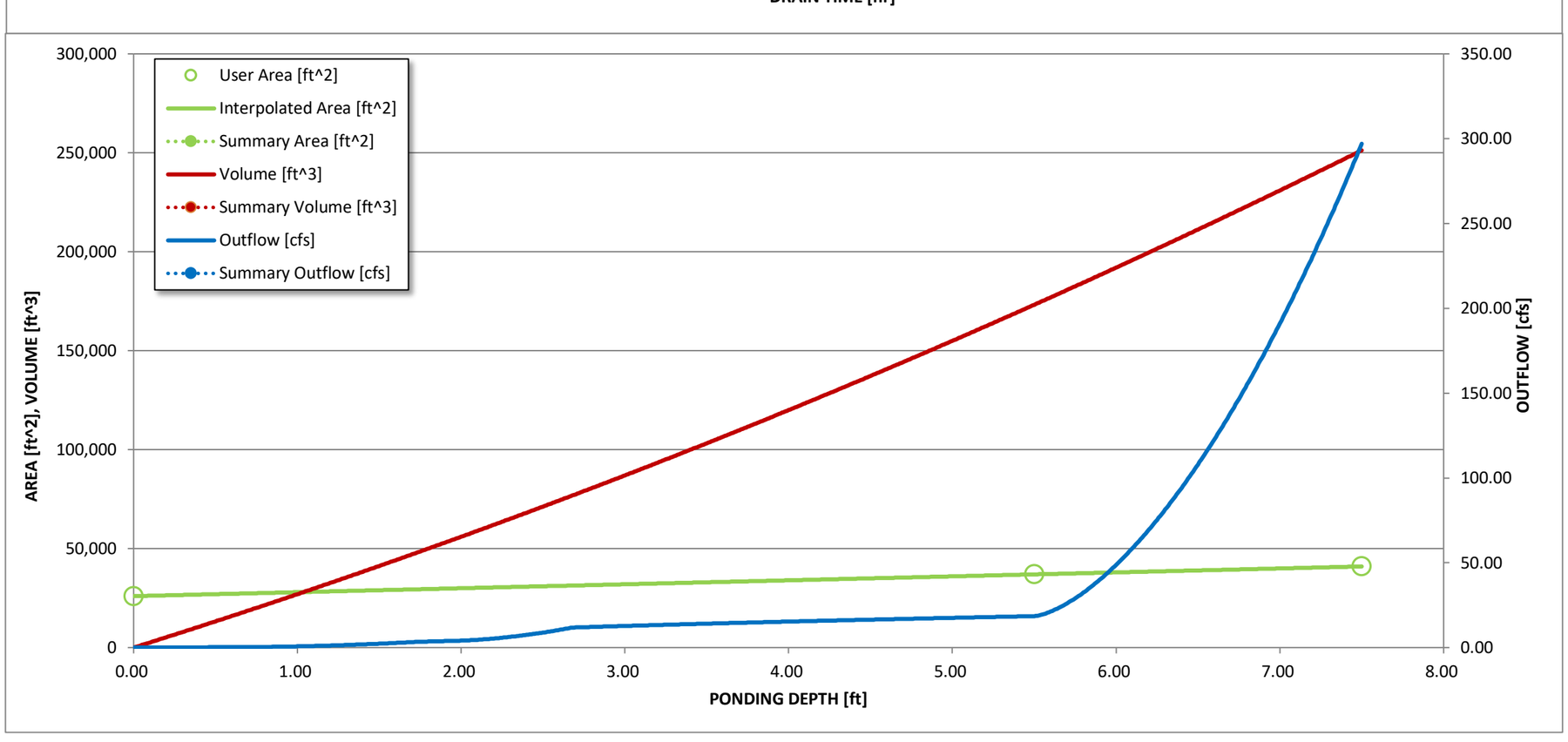
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.347	0.643	0.459	0.692	1.342	3.035	4.104	5.502	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.348	0.645	0.461	0.695	1.349	3.049	4.124	5.529	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.17	0.58	0.80	1.09	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.5	0.8	7.8	26.6	36.8	49.8	0.0
Peak Inflow Q (cfs) =	5.2	9.6	6.9	10.3	19.8	44.3	59.7	79.5	#N/A
Peak Outflow Q (cfs) =	0.2	0.6	0.3	0.7	3.2	12.9	15.3	18.0	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	0.4	0.5	0.4	0.4	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Plate	Vertical Orifice 1	Vertical Orifice 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.5	0.5	0.6	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	43	49	47	49	47	40	36	31	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**47**	55	51	55	55	51	49	47	#N/A
Maximum Ponding Depth (ft) =	0.52	0.93	0.69	0.99	1.69	3.04	3.98	5.23	#N/A
Area at Maximum Ponding Depth (acres) =	0.62	0.64	0.63	0.64	0.67	0.74	0.78	0.84	#N/A
Maximum Volume Stored (acre-ft) =	0.317	0.575	0.416	0.613	1.074	2.019	2.731	3.750	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename: .\P6 - Outflow Hydrographs.xlsx

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

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

User-Defined	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.60 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:05:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:11:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:16:48	0.23	0.42	0.31	0.46	0.86	1.88	2.48	3.21	#N/A
0.897	0:22:24	0.62	1.14	0.82	1.23	2.34	5.17	6.89	9.03	#N/A
	0:28:00	1.61	2.93	2.11	3.15	6.02	13.27	17.68	23.20	#N/A
	0:33:36	4.42	8.06	5.80	8.67	16.52	36.40	48.48	63.55	#N/A
	0:39:12	5.20	9.57	6.86	10.30	19.82	44.35	59.68	79.50	#N/A
	0:44:48	4.95	9.13	6.54	9.83	18.96	42.54	57.41	76.87	#N/A
	0:50:24	4.51	8.31	5.95	8.95	17.26	38.71	52.28	70.17	#N/A
	0:56:00	4.01	7.43	5.30	8.00	15.47	34.83	47.10	63.24	#N/A
	1:01:36	3.45	6.41	4.57	6.91	13.41	30.39	41.20	55.44	#N/A
	1:07:12	3.01	5.59	3.98	6.02	11.66	26.48	35.96	48.46	#N/A
	1:12:48	2.73	5.06	3.61	5.45	10.58	23.96	32.47	43.65	#N/A
	1:18:24	2.24	4.18	2.97	4.50	8.79	20.03	27.21	36.70	#N/A
	1:24:00	1.82	3.41	2.42	3.68	7.22	16.56	22.54	30.46	#N/A
	1:29:36	1.38	2.63	1.85	2.84	5.63	13.06	17.86	24.24	#N/A
	1:35:12	1.02	1.96	1.37	2.11	4.25	10.04	13.79	18.80	#N/A
	1:40:48	0.74	1.42	1.00	1.53	3.10	7.45	10.30	14.11	#N/A
	1:46:24	0.58	1.10	0.77	1.18	2.37	5.62	7.72	10.53	#N/A
	1:52:00	0.48	0.90	0.64	0.97	1.94	4.54	6.21	8.43	#N/A
	1:57:36	0.41	0.77	0.54	0.83	1.64	3.82	5.23	7.09	#N/A
	2:03:12	0.36	0.67	0.48	0.73	1.44	3.33	4.55	6.15	#N/A
	2:08:48	0.32	0.61	0.43	0.65	1.29	2.99	4.07	5.50	#N/A
	2:14:24	0.30	0.56	0.40	0.60	1.19	2.74	3.73	5.03	#N/A
	2:20:00	0.22	0.41	0.29	0.44	0.87	2.03	2.78	3.78	#N/A
	2:25:36	0.16	0.30	0.21	0.32	0.64	1.47	2.01	2.73	#N/A
	2:31:12	0.12	0.22	0.16	0.24	0.47	1.09	1.49	2.02	#N/A
	2:36:48	0.09	0.16	0.11	0.18	0.35	0.81	1.11	1.50	#N/A
	2:42:24	0.06	0.12	0.08	0.13	0.25	0.59	0.81	1.10	#N/A
	2:48:00	0.04	0.08	0.06	0.09	0.18	0.42	0.58	0.80	#N/A
	2:53:36	0.03	0.06	0.04	0.06	0.13	0.31	0.42	0.58	#N/A
	2:59:12	0.02	0.04	0.03	0.04	0.09	0.21	0.29	0.41	#N/A
	3:04:48	0.01	0.02	0.02	0.02	0.05	0.14	0.19	0.26	#N/A
	3:10:24	0.01	0.01	0.01	0.01	0.03	0.08	0.11	0.15	#N/A
	3:16:00	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.07	#N/A
	3:21:36	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	#N/A
	3:27:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:32:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:38:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:44:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:49:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:55:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:00:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:06:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:12:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:17:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:23:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:28:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:34:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:45:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:51:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:56:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:02:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:08:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:13:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:19:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:24:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:30:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:36:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:41:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:47:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:52:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:58:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:04:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:09:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:15:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:20:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:26:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:32:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:37:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:43:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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).

UD-Detention Outflow Hydrographs

Pond 6 Outlet Hydrograph

Time [hr]	Time [min]	WQCV Outflow2 - [cfs]	EURV Outflow2 - [cfs]	2 Year Outflow2 - [cfs]	5 Year Outflow2 - [cfs]	10 Year Outflow2 - [cfs]	25 Year Outflow2 - [cfs]	50 Year Outflow2 - [cfs]	100 Year Outflow2 - [cfs]	500 Year Outflow2 - [cfs]
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0.09	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0.19	11.20	0.00	0.01	0.00	0.01	0.01	0.02	0.02	0.03	#N/A
0.28	16.80	0.01	0.02	0.02	0.02	0.03	0.05	0.06	0.06	#N/A
0.37	22.40	0.03	0.04	0.03	0.04	0.06	0.08	0.10	0.11	#N/A
0.47	28.00	0.05	0.07	0.06	0.07	0.09	0.21	0.27	0.45	#N/A
0.56	33.60	0.07	0.09	0.08	0.10	0.20	0.67	1.49	3.03	#N/A
0.65	39.20	0.09	0.12	0.10	0.14	0.28	2.18	3.91	8.39	#N/A
0.75	44.80	0.10	0.20	0.11	0.21	0.54	3.84	8.34	13.14	#N/A
0.84	50.40	0.11	0.23	0.16	0.25	0.93	5.87	12.43	14.55	#N/A
0.93	56.00	0.12	0.26	0.20	0.28	1.37	9.30	13.35	15.61	#N/A
1.03	61.60	0.16	0.29	0.22	0.35	1.82	11.95	14.03	16.40	#N/A
1.12	67.20	0.18	0.36	0.24	0.41	2.23	12.36	14.54	17.01	#N/A
1.21	72.80	0.19	0.41	0.25	0.48	2.59	12.65	14.91	17.46	#N/A
1.31	78.40	0.21	0.46	0.26	0.55	2.87	12.82	15.15	17.77	#N/A
1.40	84.00	0.21	0.50	0.27	0.61	3.06	12.87	15.27	17.94	#N/A
1.49	89.60	0.22	0.54	0.27	0.65	3.16	12.84	15.28	18.01	#N/A
1.59	95.20	0.22	0.56	0.28	0.68	3.19	12.72	15.21	17.98	#N/A
1.68	100.80	0.22	0.57	0.28	0.69	3.17	12.53	15.06	17.88	#N/A
1.77	106.40	0.22	0.58	0.28	0.70	3.11	12.30	14.87	17.72	#N/A
1.87	112.00	0.23	0.59	0.28	0.71	3.04	12.05	14.64	17.53	#N/A
1.96	117.60	0.23	0.59	0.28	0.71	2.96	11.63	14.40	17.32	#N/A
2.05	123.20	0.23	0.59	0.28	0.71	2.87	10.18	14.15	17.10	#N/A
2.15	128.80	0.23	0.59	0.28	0.70	2.79	9.03	13.88	16.86	#N/A
2.24	134.40	0.23	0.59	0.28	0.70	2.70	8.08	13.60	16.61	#N/A
2.33	140.00	0.23	0.58	0.28	0.69	2.60	7.24	13.29	16.33	#N/A
2.43	145.60	0.23	0.58	0.28	0.68	2.50	6.53	12.96	16.03	#N/A
2.52	151.20	0.23	0.57	0.28	0.67	2.40	5.92	12.62	15.71	#N/A
2.61	156.80	0.23	0.56	0.28	0.66	2.30	5.41	12.27	15.39	#N/A
2.71	162.40	0.22	0.55	0.28	0.65	2.20	4.98	11.90	15.05	#N/A
2.80	168.00	0.22	0.54	0.28	0.63	2.10	4.63	10.32	14.71	#N/A
2.89	173.60	0.22	0.53	0.28	0.62	2.01	4.34	8.77	14.35	#N/A
2.99	179.20	0.22	0.52	0.28	0.61	1.93	4.13	7.58	13.99	#N/A
3.08	184.80	0.22	0.51	0.28	0.60	1.85	4.01	6.66	13.63	#N/A
3.17	190.40	0.22	0.50	0.28	0.58	1.77	3.90	5.94	13.26	#N/A
3.27	196.00	0.22	0.50	0.27	0.57	1.70	3.79	5.36	12.88	#N/A
3.36	201.60	0.22	0.49	0.27	0.56	1.63	3.68	4.90	12.50	#N/A
3.45	207.20	0.22	0.48	0.27	0.55	1.56	3.57	4.54	12.12	#N/A
3.55	212.80	0.22	0.47	0.27	0.54	1.50	3.46	4.26	11.35	#N/A
3.64	218.40	0.21	0.46	0.27	0.53	1.45	3.32	4.08	9.47	#N/A
3.73	224.00	0.21	0.46	0.27	0.52	1.39	3.14	3.97	8.08	#N/A
3.83	229.60	0.21	0.45	0.27	0.51	1.34	2.97	3.86	7.03	#N/A
3.92	235.20	0.21	0.44	0.27	0.50	1.29	2.81	3.75	6.21	#N/A
4.01	240.80	0.21	0.43	0.27	0.49	1.25	2.67	3.64	5.58	#N/A
4.11	246.40	0.21	0.43	0.27	0.48	1.20	2.53	3.53	5.07	#N/A
4.20	252.00	0.21	0.42	0.26	0.47	1.16	2.41	3.41	4.67	#N/A
4.29	257.60	0.21	0.42	0.26	0.47	1.13	2.29	3.25	4.36	#N/A
4.39	263.20	0.21	0.41	0.26	0.46	1.09	2.19	3.07	4.14	#N/A
4.48	268.80	0.20	0.40	0.26	0.45	1.05	2.09	2.90	4.01	#N/A
4.57	274.40	0.20	0.40	0.26	0.44	1.02	1.99	2.75	3.90	#N/A
4.67	280.00	0.20	0.39	0.26	0.44	0.99	1.91	2.61	3.79	#N/A
4.76	285.60	0.20	0.39	0.26	0.43	0.96	1.82	2.48	3.68	#N/A
4.85	291.20	0.20	0.38	0.26	0.42	0.93	1.75	2.36	3.57	#N/A
4.95	296.80	0.20	0.38	0.26	0.42	0.90	1.68	2.25	3.46	#N/A
5.04	302.40	0.20	0.37	0.25	0.41	0.88	1.61	2.14	3.32	#N/A
5.13	308.00	0.20	0.37	0.25	0.41	0.85	1.54	2.05	3.14	#N/A
5.23	313.60	0.19	0.36	0.25	0.40	0.83	1.48	1.96	2.97	#N/A
5.32	319.20	0.19	0.36	0.25	0.40	0.81	1.43	1.87	2.81	#N/A
5.41	324.80	0.19	0.36	0.25	0.39	0.79	1.38	1.79	2.67	#N/A
5.51	330.40	0.19	0.35	0.25	0.39	0.77	1.33	1.72	2.53	#N/A
5.60	336.00	0.19	0.35	0.25	0.38	0.75	1.28	1.65	2.41	#N/A
5.69	341.60	0.19	0.35	0.25	0.38	0.73	1.23	1.58	2.29	#N/A
5.79	347.20	0.19	0.34	0.25	0.37	0.71	1.19	1.52	2.19	#N/A
5.88	352.80	0.19	0.34	0.25	0.37	0.69	1.15	1.46	2.09	#N/A
5.97	358.40	0.19	0.33	0.24	0.36	0.68	1.11	1.41	1.99	#N/A
6.07	364.00	0.18	0.33	0.24	0.36	0.66	1.08	1.36	1.90	#N/A
6.16	369.60	0.18	0.33	0.24	0.35	0.65	1.04	1.31	1.82	#N/A
6.25	375.20	0.18	0.32	0.24	0.35	0.63	1.01	1.26	1.75	#N/A
6.35	380.80	0.18	0.32	0.24	0.35	0.62	0.98	1.22	1.67	#N/A
6.44	386.40	0.18	0.32	0.24	0.34	0.60	0.95	1.18	1.61	#N/A
6.53	392.00	0.18	0.31	0.24	0.34	0.59	0.92	1.14	1.54	#N/A
6.63	397.60	0.18	0.31	0.24	0.34	0.58	0.90	1.10	1.48	#N/A
6.72	403.20	0.18	0.30	0.24	0.33	0.57	0.87	1.06	1.43	#N/A
6.81	408.80	0.17	0.29	0.23	0.33	0.56	0.85	1.03	1.38	#N/A
6.91	414.40	0.17	0.29	0.23	0.33	0.55	0.82	1.00	1.33	#N/A
7.00	420.00	0.17	0.28	0.23	0.32	0.53	0.80	0.97	1.28	#N/A
7.09	425.60	0.17	0.28	0.23	0.32	0.52	0.78	0.94	1.23	#N/A
7.19	431.20	0.17	0.28	0.23	0.32	0.51	0.76	0.91	1.19	#N/A

Pond 5 (Offset 28 min, approximated to 26.76 min)

Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]
5.60									
Hydrograph Constant 0.89									
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.01	0.51	0.82	0.57	0.88	2.02	4.81	6.20	7.75
	0.02	1.37	2.21	1.53	2.40	5.58	14.05	18.75	24.39
	0.02	3.51	5.69	3.92	6.16	14.33	36.08	48.20	62.79
	0.02	9.65	15.62	10.78	16.91	39.30	98.66	131.55	170.98
	0.03	11.48	18.73	12.85	20.30	47.98	128.45	177.53	240.08
	0.03	10.96	17.91	12.28	19.42	46.05	125.86	176.07	241.53
	0.04	9.98	16.30	11.18	17.68	41.91	115.45	162.19	223.54
	0.04	8.92	14.61	10.00	15.85	37.72	104.17	146.44	201.94
	0.04	7.71	12.66	8.65	13.74	32.94	91.66	129.19	178.61
	0.05	6.72	11.01	7.53	11.95	28.72	80.25	113.20	156.58
	0.05	6.09	9.98	6.82	10.83	25.96	71.97	101.17	139.44
	0.05	5.03	8.29	5.65	9.00	21.72	60.98	86.24	119.60
	0.06	4.12	6.81	4.62	7.40	17.97	50.71	71.82	99.73
	0.06	3.18	5.31	3.58	5.77	14.19	40.68	57.92	80.85
	0.07	2.37	4.00	2.68	4.37	10.92	31.73	45.34	63.52
	0.07	1.72	2.92	1.93	3.18	8.12	24.00	34.47	48.59
	0.07	1.33	2.23	1.49	2.43	6.11	17.77	25.43	36.05
	0.08	1.09	1.83	1.23	1.99	4.93	14.11	20.07	28.18
	0.08	0.93	1.55	1.04	1.68	4.16	11.83	16.77	23.42
	0.09	0.81	1.35	0.91	1.47	3.62	10.24	14.48	20.15
	0.09	0.73	1.22	0.82	1.32	3.24	9.12	12.87	17.87
	0.09	0.67	1.12	0.76	1.22	2.97	8.32	11.73	16.24
	0.10	0.49	0.82	0.55	0.90	2.20	6.37	9.12	12.84
	0.10	0.36	0.60	0.41	0.65	1.60	4.59	6.57	9.26
	0.11	0.27	0.44	0.30	0.48	1.18	3.41	4.87	6.86
	0.11	0.20	0.33	0.22	0.36	0.88	2.53	3.62	5.09
	0.11	0.14	0.24	0.16	0.26	0.64	1.87	2.68	3.77
	0.12	0.10	0.17	0.11	0.18	0.46	1.35	1.94	2.74
	0.12	0.07	0.12	0.08	0.13	0.33	0.98	1.40	1.98
	0.12	0.05	0.08	0.05	0.09	0.23	0.69	1.00	1.43
	0.13	0.03	0.05	0.03	0.05	0.15	0.46	0.67	0.97
	0.13	0.01	0.03	0.02	0.03	0.08	0.27	0.40	0.59
	0.14	0.00	0.01	0.01	0.01	0.04	0.13	0.20	0.31
	0.14	0.00	0.00	0.00	0.00	0.01	0.04	0.07	0.12
	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

P5 w/ P6 Outlet (manual hydrograph)

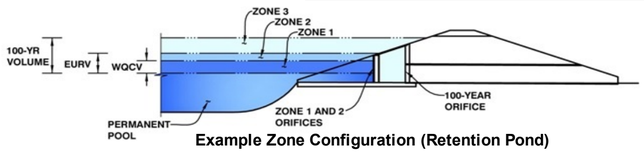
WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.01	0.00	0.01	0.01	0.02	0.02	0.03
0.01	0.02	0.02	0.02	0.03	0.05	0.06	0.06
0.03	0.04	0.03	0.04	0.06	0.08	0.10	0.11
0.56	0.88	0.62	0.95	2.12	5.02	6.47	8.19
1.44	2.31	1.61	2.50	5.78	14.72	20.24	27.41
3.60	5.80	4.02	6.30	14.61	38.27	52.11	71.18
9.75	15.82	10.90	17.12	39.84	102.50	139.89	184.12
11.59	18.96	13.02	20.55	48.91	134.32	189.97	254.63
11.08	18.17	12.47	19.69	47.43	135.16	189.43	257.14
10.14	16.59	11.40	18.02	43.72	127.40	176.22	239.94
9.10	14.96	10.23	16.26	39.95	116.53	160.98	218.95
7.91	13.07	8.90	14.23	35.53	104.31	144.11	196.07
6.92	11.47	7.79	12.50	31.59	93.06	128.35	174.35
6.30	10.49	7.09	11.44	29.02	84.84	116.44	157.39
5.25	8.83	5.92	9.65	24.88	73.81	101.52	137.61
4.34	7.37	4.90	8.08	21.16	63.43	87.03	117.72
3.40	5.88	3.85	6.46	17.36	53.21	72.97	98.72
2.60	4.59	2.96	5.07	14.03	44.03	60.21	81.24
1.94	3.50	2.21	3.89	11.16	36.05	49.11	66.13
1.55	2.82	1.77	3.14	9.07	29.40	39.84	53.37
1.32	2.42	1.51	2.70	7.81	24.30	34.22	45.28
1.15	2.14	1.32	2.39	6.94	20.86	30.65	40.28
1.04	1.94	1.20	2.17	6.32	18.31	28.07	36.75
0.96	1.80	1.10	2.02	5.84	16.36	26.16	34.20
0.90	1.70	1.04	1.90	5.47	14.85	24.69	32.27
0.72	1.39	0.84	1.57	4.60	12.29	21.74	28.55
0.59	1.16	0.69	1.31	3.89	10.00	18.83	24.65
0.49	0.99	0.58	1.13	3.38	8.39	16.78	21.91
0.42	0.87	0.50	0.99	2.98	7.16	13.94	19.79
0.36	0.77	0.44	0.88	2.65	6.21	11.45	18.12
0.32	0.69	0.39	0.79	2.39	5.48	9.53	16.73
0.29	0.63	0.36	0.73	2.18	4.99	8.07	15.61
0.27	0.59	0.33	0.67	2.00	4.60	6.94	14.69
0.25	0.55	0.31	0.63	1.84	4.25	6.03	13.85
0.23	0.51	0.29	0.59	1.71	3.96	5.31	13.09
0.22	0.49	0.28	0.56	1.60	3.71	4.74	12.43
0.22	0.47	0.27	0.54	1.51	3.50	4.33	11.47
0.21	0.46	0.27	0.53	1.45	3.32	4.08	9.48
0.21	0.46	0.27	0.52	1.39	3.14	3.97	8.08
0.21	0.45	0.27	0.51	1.34	2.97	3.86	7.03
0.21	0.44	0.27	0.50	1.29	2.81	3.75	6.21
0.21	0.43	0.27	0.49	1.25	2.67	3.64	5.58
0.21	0.43	0.27	0.48	1.20	2.53	3.53	5.07
0.21	0.42	0.26	0.47	1.16	2.41	3.41	4.67
0.21	0.42	0.26	0.47	1.13	2.29	3.25	4.36
0.21	0.41	0.26	0.46	1.09	2.19	3.07	4.14
0.20	0.40	0.26	0.45	1.05	2.09	2.90	4.01
0.20	0.40	0.26	0.44	1.02	1.99	2.75	3.90
0.20	0.39	0.26	0.44	0.99	1.91	2.61	3.79
0.20	0.39	0.26	0.43	0.96	1.82	2.48	3.68
0.20	0.38	0.26	0.42	0.93	1.75	2.36	3.57
0.20	0.38	0.26	0.42	0.90	1.68	2.25	3.46
0.20	0.37	0.25	0.41	0.88	1.61	2.14	3.32
0.20	0.37	0.25	0.41	0.85	1.54	2.05	3.14
0.19	0.36	0.25	0.40	0.83	1.48	1.96	2.97
0.19	0.36	0.25	0.40	0.81	1.43	1.87	2.81
0.19	0.36	0.25	0.39	0.79	1.38	1.79	2.67
0.19	0.35	0.25	0.39	0.77	1.33	1.72	2.53
0.19	0.35	0.25	0.38	0.75	1.28	1.65	2.41
0.19	0.35	0.25	0.38	0.73	1.23	1.58	2.29
0.19	0.34	0.25	0.37	0.71	1.19	1.52	2.19
0.19	0.34	0.25	0.37	0.69	1.15	1.46	2.09
0.19	0.33	0.24	0.36	0.68	1.11	1.41	1.99
0.18	0.33	0.24	0.36	0.66	1.08	1.36	1.90
0.18	0.33	0.24	0.35	0.65	1.04	1.31	1.82
0.18	0.32	0.24	0.35	0.63	1.01	1.26	1.75
0.18	0.32	0.24	0.35	0.62	0.98	1.22	1.67
0.18	0.32	0.24	0.34	0.60	0.95	1.18	1.61
0.18	0.31	0.24	0.34	0.59	0.92	1.14	1.54
0.18	0.31	0.24	0.34	0.58	0.90	1.10	1.48
0.18	0.30	0.24	0.33	0.57	0.87	1.06	1.43
0.17	0.29	0.23	0.33	0.56	0.85	1.03	1.38
0.17	0.29	0.23	0.33	0.55	0.82	1.00	1.33

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: P5 w/ P6 Outlet (manual hydrograph)



Example Zone Configuration (Retention Pond)

Required Volume Calculation

			Optional User Override 1-hr Precipitation	
Selected BMP Type =	**EDB**			
Watershed Area =	152.00	acres		
Watershed Length =	4,755	ft		
Watershed Slope =	0.028	ft/ft		
Watershed Imperviousness =	9.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	98.1%	percent		
Percentage Hydrologic Soil Groups C/D =	1.9%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	0.776	acre-feet		
Excess Urban Runoff Volume (EURV) =	1.272	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.869	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.380	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	3.301	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	9.051	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	12.642	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	17.330	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.807	acre-feet		
Approximate 5-yr Detention Volume =	1.293	acre-feet		
Approximate 10-yr Detention Volume =	2.779	acre-feet		
Approximate 25-yr Detention Volume =	3.933	acre-feet		
Approximate 50-yr Detention Volume =	4.100	acre-feet		
Approximate 100-yr Detention Volume =	5.340	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.776	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.497	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	4.067	acre-feet
Total Detention Basin Volume =	5.340	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	65,000	1.492		
Spillway	--	6.00	--	--	--	77,000	1.768	426,000	9.780
Freeboard	--	8.00	--	--	--	81,000	1.860	584,000	13.407
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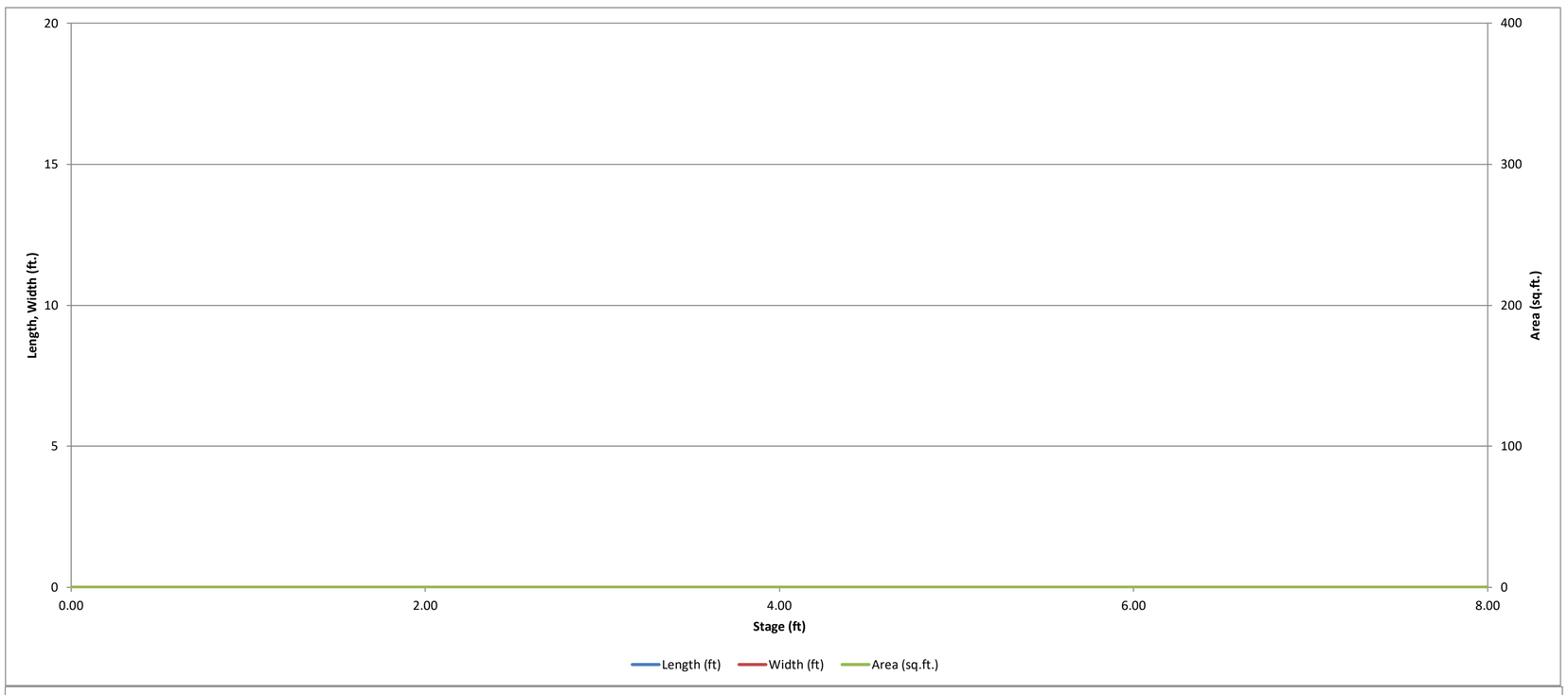
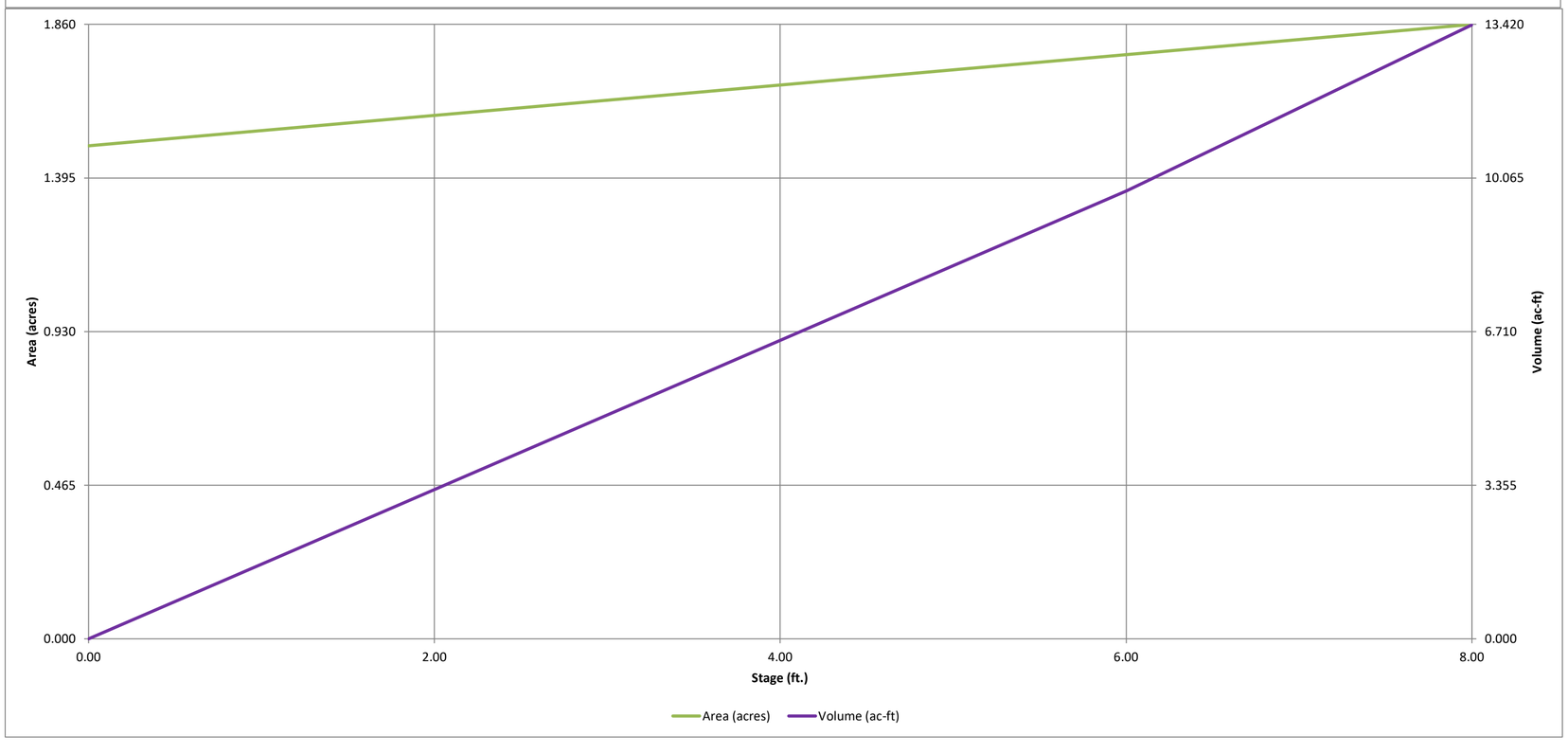
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



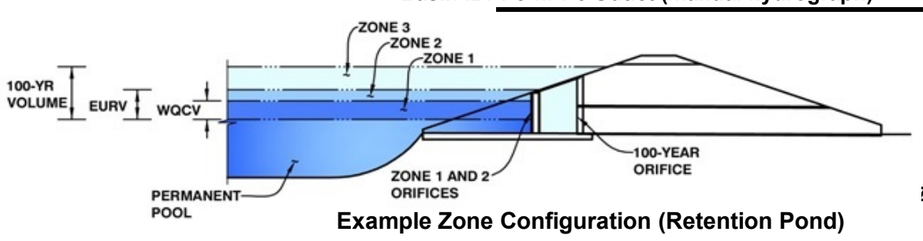


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Winsome

Basin ID: P5 w/ P6 Outlet (manual hydrograph)



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.52	0.776	Orifice Plate
Zone 2 (EURV)	0.85	0.497	Circular Orifice
Zone 3 (100-year)	3.41	4.067	Weir&Pipe (Circular)
		5.340	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	0.85	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	3.20	inches
Orifice Plate: Orifice Area per Row =	16.00	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	1.111E-01	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	0.30	0.60					
Orifice Area (sq. inches)	16.00	16.00	16.00					

	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 =	0.49	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	0.79	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	30.00	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	4.91	N/A	ft^2
Vertical Orifice Centroid =	1.25	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	8.00	N/A	feet
Overflow Weir Slope =	3.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	85%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.33	N/A	feet
Over Flow Weir Slope Length =	4.22	N/A	feet
Grate Open Area / 100-yr Orifice Area =	2.28	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	28.67	N/A	ft^2
Overflow Grate Open Area w/ Debris =	14.34	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	48.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	12.57	N/A	ft^2
Outlet Orifice Centroid =	2.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	86.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

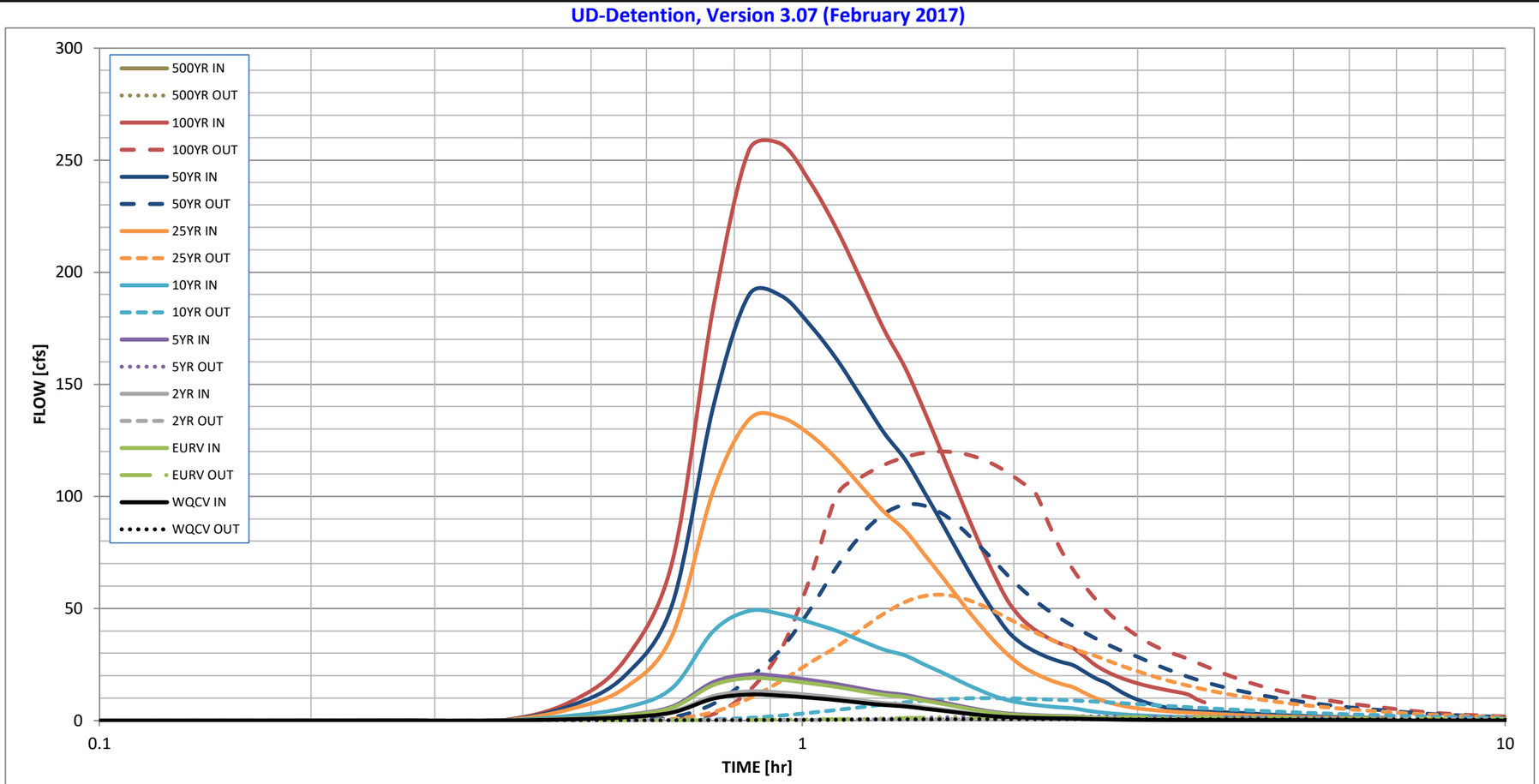
Spillway Design Flow Depth=	0.97	feet
Stage at Top of Freeboard =	7.97	feet
Basin Area at Top of Freeboard =	1.86	acres

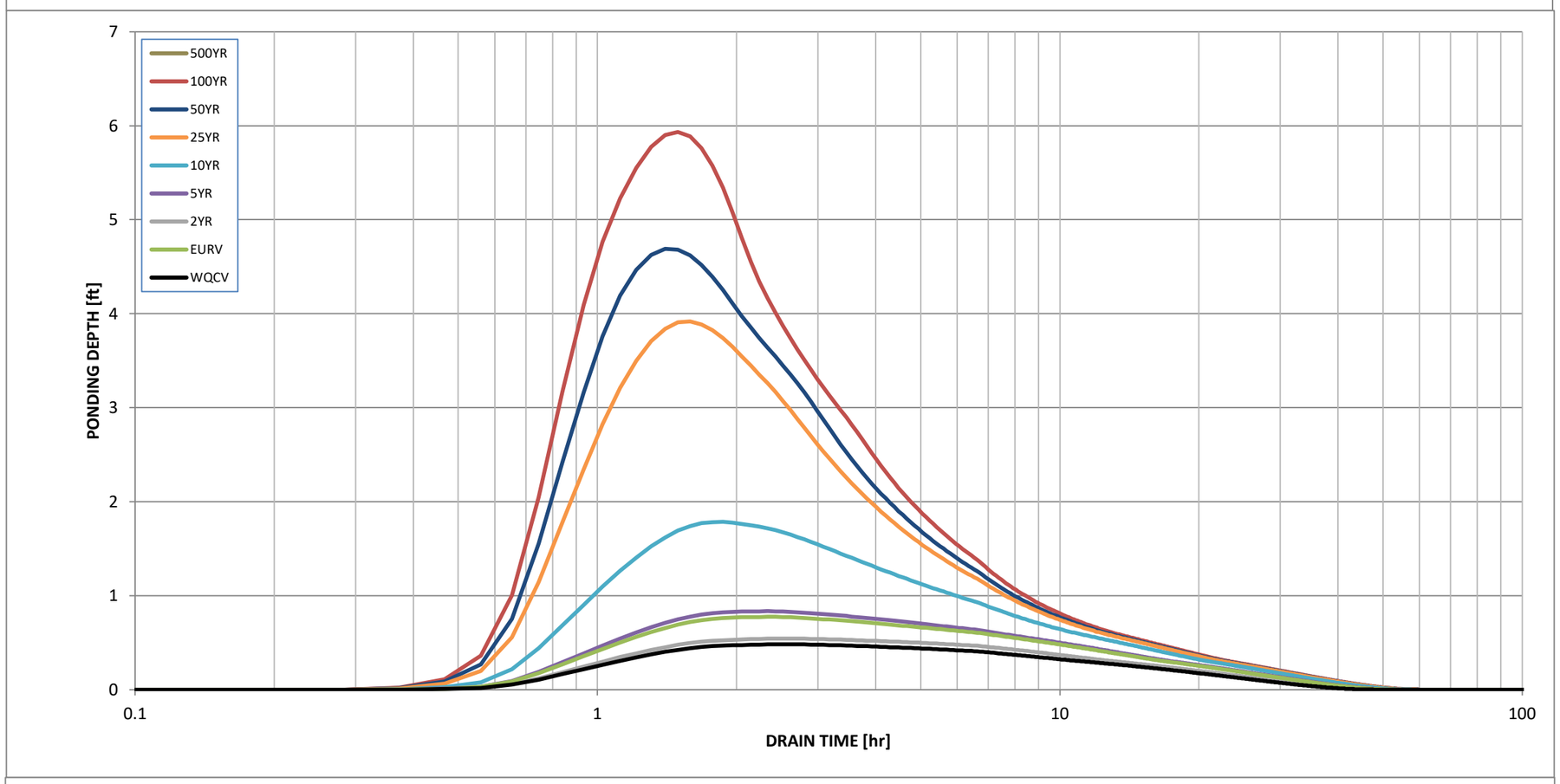
Routed Hydrograph Results

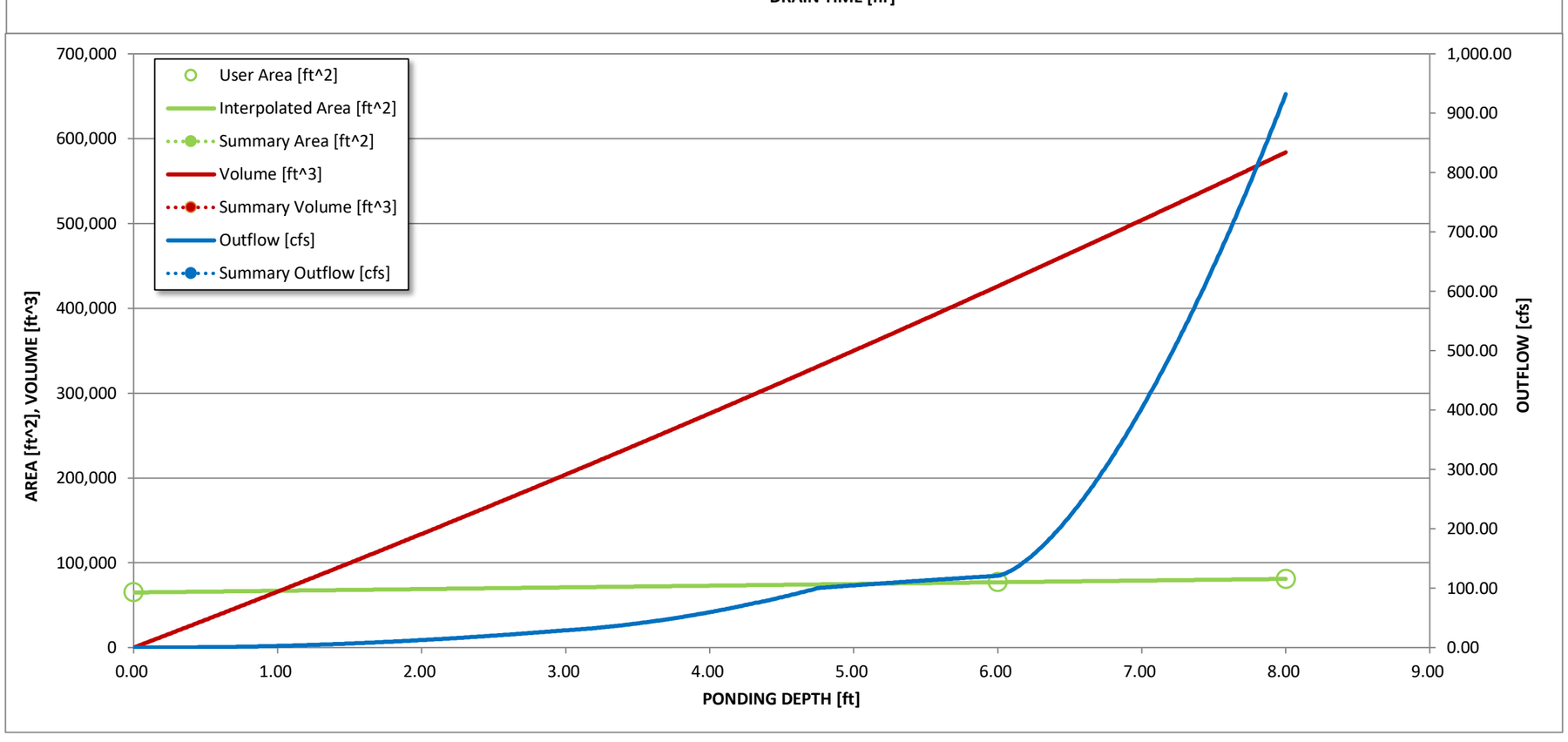
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.776	1.272	0.869	1.380	3.301	9.051	12.642	17.330	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.879	1.492	1.001	1.632	4.087	11.443	16.069	22.082	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.17	0.58	0.80	1.08	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.6	3.0	26.1	88.1	121.9	164.8	0.0
Peak Inflow Q (cfs) =	11.6	19.0	13.0	20.6	48.9	135.2	190.0	257.1	#N/A
Peak Outflow Q (cfs) =	0.6	1.6	0.7	1.9	10.0	56.1	96.3	120.0	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.4	0.6	0.8	0.7	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.6	1.8	2.4	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	40	43	41	43	39	27	22	18	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**44**	47	45	48	47	41	38	35	#N/A
Maximum Ponding Depth (ft) =	0.48	0.77	0.54	0.83	1.78	3.92	4.69	5.93	#N/A
Area at Maximum Ponding Depth (acres) =	1.51	1.53	1.52	1.53	1.57	1.67	1.71	1.76	#N/A
Maximum Volume Stored (acre-ft) =	0.722	1.163	0.812	1.254	2.729	6.185	7.503	9.656	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

	SOURCE	USER	USER	USER	USER	USER	USER	USER	USER	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.60 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:05:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:11:12	0.00	0.01	0.00	0.01	0.01	0.02	0.02	0.03	#N/A
Constant	0:16:48	0.01	0.02	0.02	0.02	0.03	0.05	0.06	0.06	#N/A
0.894	0:22:24	0.03	0.04	0.03	0.04	0.06	0.08	0.10	0.11	#N/A
	0:28:00	0.56	0.88	0.62	0.95	2.12	5.02	6.47	8.19	#N/A
	0:33:36	1.44	2.31	1.61	2.50	5.78	14.72	20.24	27.41	#N/A
	0:39:12	3.60	5.80	4.02	6.30	14.61	38.27	52.11	71.18	#N/A
	0:44:48	9.75	15.82	10.90	17.12	39.84	102.50	139.89	184.12	#N/A
	0:50:24	11.59	18.96	13.02	20.55	48.91	134.32	189.97	254.63	#N/A
	0:56:00	11.08	18.17	12.47	19.69	47.43	135.16	189.43	257.14	#N/A
	1:01:36	10.14	16.59	11.40	18.02	43.72	127.40	176.22	239.94	#N/A
	1:07:12	9.10	14.96	10.23	16.26	39.95	116.53	160.98	218.95	#N/A
	1:12:48	7.91	13.07	8.90	14.23	35.53	104.31	144.11	196.07	#N/A
	1:18:24	6.92	11.47	7.79	12.50	31.59	93.06	128.35	174.35	#N/A
	1:24:00	6.30	10.49	7.09	11.44	29.02	84.84	116.44	157.39	#N/A
	1:29:36	5.25	8.83	5.92	9.65	24.88	73.81	101.52	137.61	#N/A
	1:35:12	4.34	7.37	4.90	8.08	21.16	63.43	87.03	117.72	#N/A
	1:40:48	3.40	5.88	3.85	6.46	17.36	53.21	72.97	98.72	#N/A
	1:46:24	2.60	4.59	2.96	5.07	14.03	44.03	60.21	81.24	#N/A
	1:52:00	1.94	3.50	2.21	3.89	11.16	36.05	49.11	66.13	#N/A
	1:57:36	1.55	2.82	1.77	3.14	9.07	29.40	39.84	53.37	#N/A
	2:03:12	1.32	2.42	1.51	2.70	7.81	24.30	34.22	45.28	#N/A
	2:08:48	1.15	2.14	1.32	2.39	6.94	20.86	30.65	40.28	#N/A
	2:14:24	1.04	1.94	1.20	2.17	6.32	18.31	28.07	36.75	#N/A
	2:20:00	0.96	1.80	1.10	2.02	5.84	16.36	26.16	34.20	#N/A
	2:25:36	0.90	1.70	1.04	1.90	5.47	14.85	24.69	32.27	#N/A
	2:31:12	0.72	1.39	0.84	1.57	4.60	12.29	21.74	28.55	#N/A
	2:36:48	0.59	1.16	0.69	1.31	3.89	10.00	18.83	24.65	#N/A
	2:42:24	0.49	0.99	0.58	1.13	3.38	8.39	16.78	21.91	#N/A
	2:48:00	0.42	0.87	0.50	0.99	2.98	7.16	13.94	19.79	#N/A
	2:53:36	0.36	0.77	0.44	0.88	2.65	6.21	11.45	18.12	#N/A
	2:59:12	0.32	0.69	0.39	0.79	2.39	5.48	9.53	16.73	#N/A
	3:04:48	0.29	0.63	0.36	0.73	2.18	4.99	8.07	15.61	#N/A
	3:10:24	0.27	0.59	0.33	0.67	2.00	4.60	6.94	14.69	#N/A
	3:16:00	0.25	0.55	0.31	0.63	1.84	4.25	6.03	13.85	#N/A
	3:21:36	0.23	0.51	0.29	0.59	1.71	3.96	5.31	13.09	#N/A
	3:27:12	0.22	0.49	0.28	0.56	1.60	3.71	4.74	12.43	#N/A
	3:32:48	0.22	0.47	0.27	0.54	1.51	3.50	4.33	11.47	#N/A
	3:38:24	0.21	0.46	0.27	0.53	1.45	3.32	4.08	9.48	#N/A
	3:44:00	0.21	0.46	0.27	0.52	1.39	3.14	3.97	8.08	#N/A
	3:49:36	0.21	0.45	0.27	0.51	1.34	2.97	3.86	7.03	#N/A
	3:55:12	0.21	0.44	0.27	0.50	1.29	2.81	3.75	6.21	#N/A
	4:00:48	0.21	0.43	0.27	0.49	1.25	2.67	3.64	5.58	#N/A
	4:06:24	0.21	0.43	0.27	0.48	1.20	2.53	3.53	5.07	#N/A
	4:12:00	0.21	0.42	0.26	0.47	1.16	2.41	3.41	4.67	#N/A
	4:17:36	0.21	0.42	0.26	0.47	1.13	2.29	3.25	4.36	#N/A
	4:23:12	0.21	0.41	0.26	0.46	1.09	2.19	3.07	4.14	#N/A
	4:28:48	0.20	0.40	0.26	0.45	1.05	2.09	2.90	4.01	#N/A
	4:34:24	0.20	0.40	0.26	0.44	1.02	1.99	2.75	3.90	#N/A
	4:40:00	0.20	0.39	0.26	0.44	0.99	1.91	2.61	3.79	#N/A
	4:45:36	0.20	0.39	0.26	0.43	0.96	1.82	2.48	3.68	#N/A
	4:51:12	0.20	0.38	0.26	0.42	0.93	1.75	2.36	3.57	#N/A
	4:56:48	0.20	0.38	0.26	0.42	0.90	1.68	2.25	3.46	#N/A
	5:02:24	0.20	0.37	0.25	0.41	0.88	1.61	2.14	3.32	#N/A
	5:08:00	0.20	0.37	0.25	0.41	0.85	1.54	2.05	3.14	#N/A
	5:13:36	0.19	0.36	0.25	0.40	0.83	1.48	1.96	2.97	#N/A
	5:19:12	0.19	0.36	0.25	0.40	0.81	1.43	1.87	2.81	#N/A
	5:24:48	0.19	0.36	0.25	0.39	0.79	1.38	1.79	2.67	#N/A
	5:30:24	0.19	0.35	0.25	0.39	0.77	1.33	1.72	2.53	#N/A
	5:36:00	0.19	0.35	0.25	0.38	0.75	1.28	1.65	2.41	#N/A
	5:41:36	0.19	0.35	0.25	0.38	0.73	1.23	1.58	2.29	#N/A
	5:47:12	0.19	0.34	0.25	0.37	0.71	1.19	1.52	2.19	#N/A
	5:52:48	0.19	0.34	0.25	0.37	0.69	1.15	1.46	2.09	#N/A
	5:58:24	0.19	0.33	0.24	0.36	0.68	1.11	1.41	1.99	#N/A
	6:04:00	0.18	0.33	0.24	0.36	0.66	1.08	1.36	1.90	#N/A
	6:09:36	0.18	0.33	0.24	0.35	0.65	1.04	1.31	1.82	#N/A
	6:15:12	0.18	0.32	0.24	0.35	0.63	1.01	1.26	1.75	#N/A
	6:20:48	0.18	0.32	0.24	0.35	0.62	0.98	1.22	1.67	#N/A
	6:26:24	0.18	0.32	0.24	0.34	0.60	0.95	1.18	1.61	#N/A
	6:32:00	0.18	0.31	0.24	0.34	0.59	0.92	1.14	1.54	#N/A
	6:37:36	0.18	0.31	0.24	0.34	0.58	0.90	1.10	1.48	#N/A
	6:43:12	0.18	0.30	0.24	0.33	0.57	0.87	1.06	1.43	#N/A

5.1 BASIN RUNOFF SUMMARY

5-yr Existing				
Basin	**Area**	**Peak Q**	**Time of Peak**	**Volume (In)**
A	1.4303	87.10	26Feb2019, 12:24	0.18
Ba	5.9948	271.50	26Feb2019, 12:46	0.19
Bb	0.1572	19.20	26Feb2019, 12:20	0.14
Ca	0.2542	20.70	26Feb2019, 12:14	0.19
Cb	0.1094	9.90	26Feb2019, 12:18	0.11
Da	0.2520	20.60	26Feb2019, 12:14	0.19
Db	0.0780	5.70	26Feb2019, 12:18	0.19
Dc	0.3902	28.10	26Feb2019, 12:20	0.10
Ea	0.0592	5.40	26Feb2019, 12:10	0.19
Eb	0.1166	4.00	26Feb2019, 12:14	0.08
F	0.0695	6.60	26Feb2019, 12:18	0.11
G	0.1681	45.30	26Feb2019, 12:14	0.24
H	0.1903	34.80	26Feb2019, 12:16	0.17
I	0.0586	26.40	26Feb2019, 12:14	0.37
J	0.0158	3.40	26Feb2019, 12:10	0.25
K	0.0278	12.90	26Feb2019, 12:08	0.40

100-yr Existing				
Basin	**Area**	**Peak Q**	**Time of Peak**	**Volume (In)**
A	1.4303	585.90	26Feb2019, 12:26	0.65
Ba	5.9948	1448.90	26Feb2019, 12:48	0.63
Bb	0.1572	127.70	26Feb2019, 12:18	0.86
Ca	0.2542	127.80	26Feb2019, 12:16	0.63
Cb	0.1094	88.00	26Feb2019, 12:16	0.79
Da	0.2520	127.30	26Feb2019, 12:16	0.63
Db	0.0780	34.10	26Feb2019, 12:20	0.63
Dc	0.3902	275.70	26Feb2019, 12:18	0.74
Ea	0.0592	34.80	26Feb2019, 12:12	0.63
Eb	0.1166	85.80	26Feb2019, 12:16	0.76
F	0.0695	56.60	26Feb2019, 12:16	0.81
G	0.1681	199.00	26Feb2019, 12:14	1.42
H	0.1903	197.20	26Feb2019, 12:14	1.00
I	0.0586	88.50	26Feb2019, 12:12	2.03
J	0.0158	19.90	26Feb2019, 12:08	1.03
K	0.0278	45.10	26Feb2019, 12:08	1.78

5-yr Proposed				
Basin	**Area**	**Peak Q**	**Time of Peak**	**Volume (In)**
A1	1.3529	83.30	26Feb2019, 12:26	0.19
A2	0.0578	4.70	26Feb2019, 12:14	0.19
A3	0.0648	22.80	26Feb2019, 12:14	0.35
B1	5.9948	284.70	26Feb2019, 12:42	0.19
B2	0.0205	3.30	26Feb2019, 12:06	0.30
B3	0.0858	6.70	26Feb2019, 12:16	0.19
B4	0.0648	8.80	26Feb2019, 12:18	0.24
C1	0.2542	20.70	26Feb2019, 12:14	0.19
C2	0.0350	3.10	26Feb2019, 12:12	0.19
C3	0.0252	3.70	26Feb2019, 12:08	0.30
C4	0.0372	1.80	26Feb2019, 12:16	0.12
D1.1	0.2520	20.60	26Feb2019, 12:14	0.19
D1.2	0.0780	5.70	26Feb2019, 12:18	0.19
D2	0.1073	11.70	26Feb2019, 12:12	0.24
D3	0.0644	7.90	26Feb2019, 12:16	0.30
D4	0.0536	7.70	26Feb2019, 12:10	0.30
D5	0.0200	0.80	26Feb2019, 12:10	0.08
D6	0.0653	4.40	26Feb2019, 12:16	0.16
E0	0.0592	4.80	26Feb2019, 12:14	0.19
E1.1	0.0123	9.00	26Feb2019, 12:12	1.32
E1.2	0.0255	2.70	26Feb2019, 12:14	0.24
E2	0.0041	0.70	26Feb2019, 12:06	0.30
E3	0.0309	4.70	26Feb2019, 12:08	0.30
E4	0.0284	4.20	26Feb2019, 12:08	0.30
E5	0.0211	3.20	26Feb2019, 12:08	0.30
E6	0.0452	5.50	26Feb2019, 12:08	0.24
E7	0.0153	2.00	26Feb2019, 12:06	0.24
F1	0.0670	6.00	26Feb2019, 12:14	0.20
G1	0.0394	2.50	26Feb2019, 12:08	0.12
G2	0.0331	7.60	26Feb2019, 12:16	0.23
H1	0.0217	5.50	26Feb2019, 12:12	0.29
H2	0.0611	5.30	26Feb2019, 12:12	0.19
H3	0.0091	1.20	26Feb2019, 12:06	0.24
H4	0.0423	12.30	26Feb2019, 12:14	0.33
H5	0.0316	10.10	26Feb2019, 12:14	0.32
H6	0.0494	1.80	26Feb2019, 12:12	0.08
H7	0.0403	8.10	26Feb2019, 12:14	0.23
H8	0.0133	4.90	26Feb2019, 12:10	0.29
H9	0.0108	2.90	26Feb2019, 12:10	0.29
I1	0.0106	3.30	26Feb2019, 12:10	0.31
I2	0.0231	7.20	26Feb2019, 12:10	0.31
J1	0.0158	3.40	26Feb2019, 12:10	0.25
K1	0.0278	12.90	26Feb2019, 12:08	0.40

100-yr Proposed				
Basin	**Area**	**Peak Q**	**Time of Peak**	**Volume (In)**
A1	1.3529	481.80	26Feb2019, 12:28	0.63
A2	0.0578	43.40	26Feb2019, 12:16	0.86
A3	0.0648	85.40	26Feb2019, 12:14	1.77
B1	5.9948	1537.40	26Feb2019, 12:44	0.63
B2	0.0205	19.90	26Feb2019, 12:08	0.94
B3	0.0858	57.90	26Feb2019, 12:18	0.81
B4	0.0648	53.10	26Feb2019, 12:18	0.98
C1	0.2542	127.80	26Feb2019, 12:16	0.63
C2	0.0350	19.50	26Feb2019, 12:14	0.63
C3	0.0252	22.10	26Feb2019, 12:10	0.94
C4	0.0372	22.90	26Feb2019, 12:18	0.71
D1.1	0.2520	127.30	26Feb2019, 12:16	0.63
D1.2	0.0780	34.10	26Feb2019, 12:20	0.63
D2	0.1073	81.30	26Feb2019, 12:14	0.88
D3	0.0644	44.20	26Feb2019, 12:16	0.94
D4	0.0536	44.80	26Feb2019, 12:12	0.94
D5	0.0200	17.50	26Feb2019, 12:12	0.76
D6	0.0653	33.20	26Feb2019, 12:18	0.62
E0	0.0592	29.70	26Feb2019, 12:16	0.63
E1.1	0.0123	20.70	26Feb2019, 12:12	2.90
E1.2	0.0255	15.50	26Feb2019, 12:16	0.76
E2	0.0041	4.20	26Feb2019, 12:08	0.94
E3	0.0309	27.90	26Feb2019, 12:10	0.94
E4	0.0284	25.10	26Feb2019, 12:10	0.94
E5	0.0211	19.20	26Feb2019, 12:10	0.94
E6	0.0452	34.40	26Feb2019, 12:10	0.79
E7	0.0153	12.30	26Feb2019, 12:08	0.76
F1	0.0670	36.00	26Feb2019, 12:16	0.66
G1	0.0394	36.30	26Feb2019, 12:10	0.76
G2	0.0331	35.90	26Feb2019, 12:14	1.11
H1	0.0217	26.20	26Feb2019, 12:10	1.11
H2	0.0611	53.60	26Feb2019, 12:14	0.92
H3	0.0091	9.60	26Feb2019, 12:08	0.94
H4	0.0423	50.20	26Feb2019, 12:14	1.44
H5	0.0316	40.00	26Feb2019, 12:12	1.55
H6	0.0494	37.10	26Feb2019, 12:16	0.73
H7	0.0403	42.80	26Feb2019, 12:12	1.01
H8	0.0133	19.30	26Feb2019, 12:08	1.49
H9	0.0108	14.00	26Feb2019, 12:08	1.11
I1	0.0106	14.70	26Feb2019, 12:08	1.20
I2	0.0231	32.20	26Feb2019, 12:08	1.20
J1	0.0158	19.90	26Feb2019, 12:08	1.03
K1	0.0278	45.10	26Feb2019, 12:08	1.78

5.2 CONVEYANCE REACH SUMMARY

Reach Summary Table - 5 Year Existing Conditions				
Reach Name	Drainage Area (sq. mi.)	Peak Discharge (cfs)	Time of Peak	Volume (in)
1	5.9948	271.40	26Feb2019, 12:50	0.19
2	7.9459	348.70	26Feb2019, 12:46	0.19
3	9.0245	397.40	26Feb2019, 12:40	0.18
4	9.0245	397.20	26Feb2019, 12:46	0.18
5	9.3284	408.60	26Feb2019, 12:44	0.18
6	0.2542	20.20	26Feb2019, 12:22	0.19
7	0.2520	20.00	26Feb2019, 12:28	0.19
8	0.0780	5.60	26Feb2019, 12:30	0.19
9	0.0592	5.00	26Feb2019, 12:36	0.19

Reach Summary Table - 100 Year Existing Conditions				
Reach Name	Drainage Area (sq. mi.)	Peak Discharge (cfs)	Time of Peak	Volume (in)
1	5.9948	1448.60	26Feb2019, 12:50	0.63
2	7.9459	1964.00	26Feb2019, 12:42	0.64
3	9.0245	2352.60	26Feb2019, 12:36	0.67
4	9.0245	2351.60	26Feb2019, 12:38	0.67
5	9.3284	2470.00	26Feb2019, 12:36	0.68
6	0.2542	127.50	26Feb2019, 12:22	0.62
7	0.2520	126.30	26Feb2019, 12:26	0.62
8	0.0780	34.00	26Feb2019, 12:28	0.62
9	0.0592	34.30	26Feb2019, 12:28	0.62

Reach Summary Table - 5 Year Proposed Conditions				
Reach Name	Drainage Area (sq. mi.)	Peak Discharge (cfs)	Time of Peak	Volume (in)
BOX CULVERT 1	7.9557	376.70	26Feb2019, 12:42	0.19
BOX CULV 2	8.9615	424.90	26Feb2019, 12:48	0.19
CLV E4	0.0634	9.20	26Feb2019, 12:12	0.30
CULV B2	0.0205	3.30	26Feb2019, 12:06	0.30
CULV C2	0.2892	23.40	26Feb2019, 12:16	0.19
CULV C3	0.3144	26.10	26Feb2019, 12:18	0.20
CULV D2	0.3594	31.20	26Feb2019, 12:18	0.21
CULV D3	0.1423	13.10	26Feb2019, 12:20	0.24
CULV D4	0.1959	18.60	26Feb2019, 12:18	0.25
CULV E1.2	0.0970	7.70	26Feb2019, 12:26	0.35
CULV E2	0.0041	0.70	26Feb2019, 12:06	0.30
CULV E5	0.0211	3.20	26Feb2019, 12:08	0.30
CULV H2	0.0611	5.30	26Feb2019, 12:12	0.19
CULV H3	0.0091	1.20	26Feb2019, 12:06	0.24
CULV I1	0.0106	3.30	26Feb2019, 12:10	0.31
CULV-E3	0.0350	5.30	26Feb2019, 12:10	0.30
EX CULV C1	0.2542	20.70	26Feb2019, 12:14	0.19
EX CULV D1.1	0.2520	20.60	26Feb2019, 12:14	0.19
EX CULV D1.2	0.0780	5.70	26Feb2019, 12:18	0.19
EX CULV E0	0.0592	4.80	26Feb2019, 12:14	0.19
OUT 2	0.0445	9.50	26Feb2019, 12:24	0.30
OUT-1	9.2839	444.50	26Feb2019, 12:50	0.20
REACH A1	1.3529	83.10	26Feb2019, 12:32	0.19
Reach H7	0.0494	9.20	26Feb2019, 12:14	0.23
Reach-A2	0.0648	22.70	26Feb2019, 12:16	0.35
Reach-B1	5.9948	284.50	26Feb2019, 12:46	0.19
Reach-B2	0.0205	3.20	26Feb2019, 12:14	0.30
Reach-B3	6.0806	286.80	26Feb2019, 12:50	0.19
Reach-B4-3	0.3144	26.10	26Feb2019, 12:18	0.20
Reach-C1	0.2542	20.60	26Feb2019, 12:18	0.19
Reach-C2	0.2892	23.40	26Feb2019, 12:20	0.19
Reach-D1.1	0.2520	20.60	26Feb2019, 12:20	0.19
Reach-D3	0.0780	5.70	26Feb2019, 12:24	0.19
Reach-D4	0.1423	13.10	26Feb2019, 12:24	0.24
Reach-D5	0.3594	31.10	26Feb2019, 12:22	0.21
Reach-D6	0.1959	18.60	26Feb2019, 12:24	0.25
Reach-E1.1	0.0592	4.70	26Feb2019, 12:24	0.19
Reach-E1.2	0.0716	6.30	26Feb2019, 12:40	0.38
Reach-E3	0.0041	0.70	26Feb2019, 12:14	0.30
Reach-E4	0.0350	5.20	26Feb2019, 12:14	0.30
Reach-E6	0.0211	3.20	26Feb2019, 12:14	0.30
Reach-E6-2	0.2428	18.50	26Feb2019, 12:34	0.29
Reach-E7	0.0634	9.10	26Feb2019, 12:16	0.30
Reach-F1	0.0970	7.70	26Feb2019, 12:30	0.35
Reach-F1-2	0.1641	12.40	26Feb2019, 12:34	0.29
Reach-G2	0.0394	2.50	26Feb2019, 12:14	0.12
Reach-H4	0.0217	5.40	26Feb2019, 12:16	0.29
Reach-H6	0.0611	5.30	26Feb2019, 12:14	0.19
Reach-H7-1	0.0091	1.20	26Feb2019, 12:12	0.24
Reach-H9	0.0338	10.30	26Feb2019, 12:12	0.31
Reach-I2-1	0.0106	3.30	26Feb2019, 12:12	0.31
Reach-P3	0.2613	21.30	26Feb2019, 12:28	0.23
Reach-1	7.9557	376.70	26Feb2019, 12:44	0.19
Reach-2	8.1295	388.30	26Feb2019, 12:46	0.19
Reach-3	8.5404	405.10	26Feb2019, 12:46	0.19
Reach-4	8.6509	408.80	26Feb2019, 12:48	0.19
Reach-5	8.9615	424.80	26Feb2019, 12:48	0.19
Reach-6 Kiowa Outfall	9.3284	447.40	26Feb2019, 12:48	0.20

Reach Summary Table - 100 Year Proposed Conditions				
Reach Name	Drainage Area (sq. mi.)	Peak Discharge (cfs)	Time of Peak	Volume (in)
BOX CULVERT 1	7.9557	2062.20	26Feb2019, 12:40	0.65
BOX CULV 2	8.9615	2321.10	26Feb2019, 12:44	0.67
CLV E4	0.0634	55.70	26Feb2019, 12:12	0.93
CULV B2	0.0205	19.90	26Feb2019, 12:08	0.94
CULV C2	0.2892	145.80	26Feb2019, 12:18	0.63
CULV C3	0.3144	162.10	26Feb2019, 12:18	0.65
CULV D2	0.3594	203.70	26Feb2019, 12:18	0.70
CULV D3	0.1423	75.70	26Feb2019, 12:20	0.76
CULV D4	0.1959	108.50	26Feb2019, 12:20	0.81
CULV E1.2	0.0970	24.20	26Feb2019, 12:20	0.95
CULV E2	0.0041	4.10	26Feb2019, 12:08	0.94
CULV E5	0.0211	19.20	26Feb2019, 12:10	0.94
CULV H2	0.0611	53.60	26Feb2019, 12:14	0.92
CULV H3	0.0091	9.60	26Feb2019, 12:08	0.94
CULV I1	0.0106	14.60	26Feb2019, 12:08	1.20
CULV-E3	0.0350	31.80	26Feb2019, 12:10	0.93
EX CULV C1	0.2542	127.70	26Feb2019, 12:16	0.63
EX CULV D1.1	0.2520	127.20	26Feb2019, 12:16	0.63
EX CULV D1.2	0.0780	34.00	26Feb2019, 12:20	0.63
EX CULV E0	0.0592	29.70	26Feb2019, 12:16	0.63
OUT 2	0.0445	28.80	26Feb2019, 12:26	1.17
OUT-1	9.2839	2413.10	26Feb2019, 12:44	0.68
REACH A1	1.3529	480.90	26Feb2019, 12:32	0.63
Reach H7	0.0494	52.20	26Feb2019, 12:12	1.00
Reach-A2	0.0648	85.30	26Feb2019, 12:14	1.77
Reach-B1	5.9948	1537.10	26Feb2019, 12:46	0.63
Reach-B2	0.0205	19.80	26Feb2019, 12:14	0.93
Reach-B3	6.0806	1552.00	26Feb2019, 12:48	0.64
Reach-B4-3	0.3144	161.70	26Feb2019, 12:18	0.65
Reach-C1	0.2542	127.70	26Feb2019, 12:18	0.63
Reach-C2	0.2892	145.80	26Feb2019, 12:20	0.63
Reach-D1.1	0.2520	126.70	26Feb2019, 12:20	0.62
Reach-D3	0.0780	33.90	26Feb2019, 12:24	0.62
Reach-D4	0.1423	75.40	26Feb2019, 12:24	0.76
Reach-D5	0.3594	203.10	26Feb2019, 12:20	0.70
Reach-D6	0.1959	108.50	26Feb2019, 12:22	0.81
Reach-E1.1	0.0592	29.70	26Feb2019, 12:22	0.62
Reach-E1.2	0.0716	14.10	26Feb2019, 12:50	1.02
Reach-E3	0.0041	4.10	26Feb2019, 12:12	0.93
Reach-E4	0.0350	31.70	26Feb2019, 12:14	0.93
Reach-E6	0.0211	19.00	26Feb2019, 12:12	0.93
Reach-E6-2	0.2428	103.80	26Feb2019, 12:26	0.85
Reach-E7	0.0634	55.70	26Feb2019, 12:14	0.93
Reach-F1	0.0970	24.10	26Feb2019, 12:22	0.95
Reach-F1-2	0.1641	58.40	26Feb2019, 12:28	0.83
Reach-G2	0.0394	36.00	26Feb2019, 12:12	0.76
Reach-H4	0.0217	26.10	26Feb2019, 12:12	1.11
Reach-H6	0.0611	53.40	26Feb2019, 12:14	0.92
Reach-H7-1	0.0091	9.60	26Feb2019, 12:12	0.94
Reach-H9	0.0338	46.50	26Feb2019, 12:10	1.20
Reach-I2-1	0.0106	14.50	26Feb2019, 12:10	1.20
Reach-P3	0.2613	95.50	26Feb2019, 12:36	0.76
Reach-1	7.9557	2061.70	26Feb2019, 12:42	0.65
Reach-2	8.1295	2100.20	26Feb2019, 12:44	0.66
Reach-3	8.5404	2195.30	26Feb2019, 12:42	0.66
Reach-4	8.6509	2219.80	26Feb2019, 12:44	0.67
Reach-5	8.9615	2320.80	26Feb2019, 12:44	0.67
Reach-6 Kiowa Outfall	9.3284	2437.30	26Feb2019, 12:44	0.68

6.0 PRUDENT LINE ANALYSIS AND EXHIBIT

Prudent Line Channel Migration Calculations

Project: **Winsome** **Date:** **5/16/2019** **Prepared By:** **BJJ**

Downstream Station	Channel Type	Channel Side Slope	Bank Height	30-yr Sediment Deficit	30-year Bank Migration Swale	30-year Bank Migration Channel	Short-Term Sediment Deficit	Short-Term Bank Migration Swale	Short-Term Bank Migration Channel
6+50	Swale	11.75		510,017.59	154.83		146530.476	82.98754347	
11+50	Defined		6	492,237.16		164.08	141422.0741		157.1356379
16+50	Defined		6	468,186.79		156.06	134512.2883		149.4580982
21+50	Defined		6	468,186.79		156.06	134512.2883		149.4580982
26+50	Swale	4		464,396.75	86.20		133423.3921	46.20361754	
31+50	Defined		8	464,396.75		116.10	133423.3921		111.1861601
36+50	Swale	5		440,299.59	93.84		126500.1632	50.29913781	
41+50	Defined		9	440,299.59		97.84	126500.1632		93.70382461
46+50	Swale	6.67		433,514.95	107.55		124550.9046	57.64562546	
53+75	Swale	4		327,464.05	72.38		94081.97581	38.79834549	
58+75	Defined		8	322,972.15		80.74	92791.43216		77.32619347
63+75	Defined		8	322,972.15		80.74	92791.43216		77.32619347
68+75	Swale	4		322,972.15	71.89		92791.43216	38.53132381	

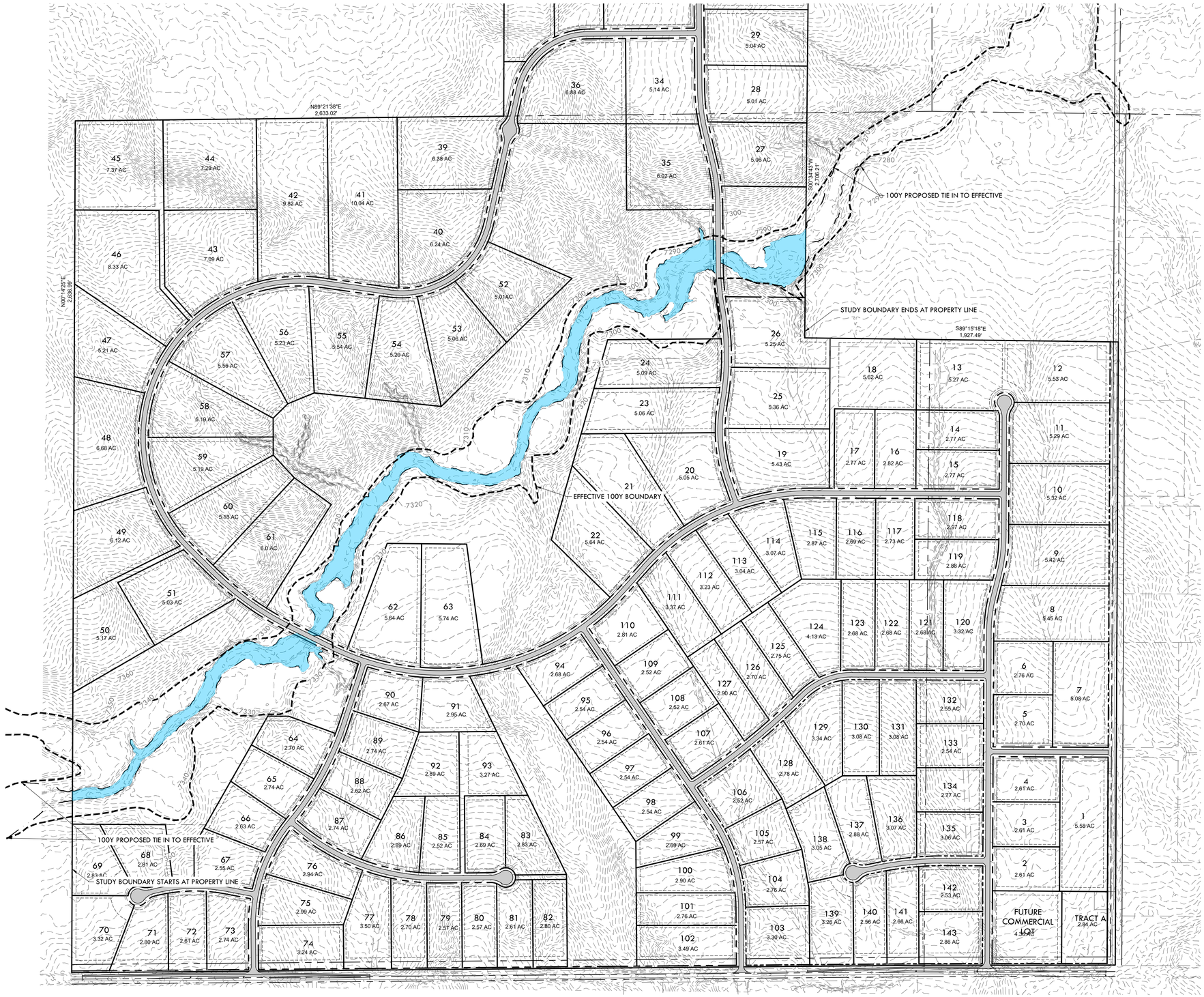
7.1 FLOODPLAIN EXHIBIT

FEMA CLOMR SUBMITTAL

MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

CASE #: 19-08-0185R



BENCHMARK: NORTHWEST CORNER OF SECTION 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M.

A 3.5" ALUMINUM CAP STAMPED "LS 12103"

ELEVATION IS 7429.30 NAVD88

0' 300' 600'

VERTEX®
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211
Main: 303.623.9116 | VERTEXENG.COM

COLORADO LICENSED
LANCE PATRICK VARNEY
4/11/19
43911
PROFESSIONAL ENGINEER

100Y FLOODPLAIN PC AND EC

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	REVISED PER REVIEW COMMENTS 3/26/19
2	
3	
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5	
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DATE: 11/16/18
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

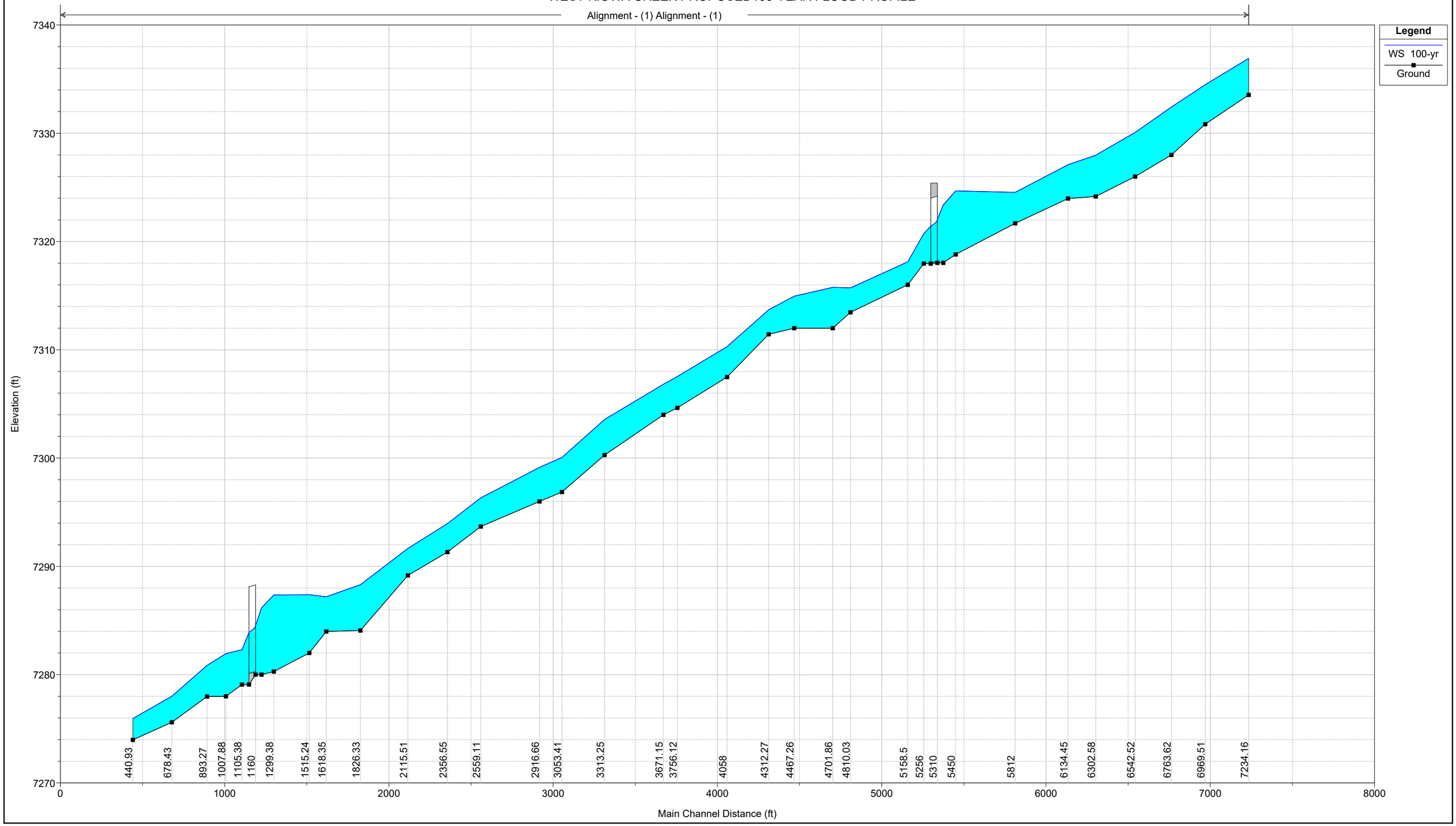
1

P:\Shared\Projects\49000-49999\49300-49399\49388.McCune Ranch\06-Engineering\Vertex Drawings\FEMA CLOMR\49388-FloodPlains SHADED.dwg
Thursday, April 11, 2019 10:43:24 AM

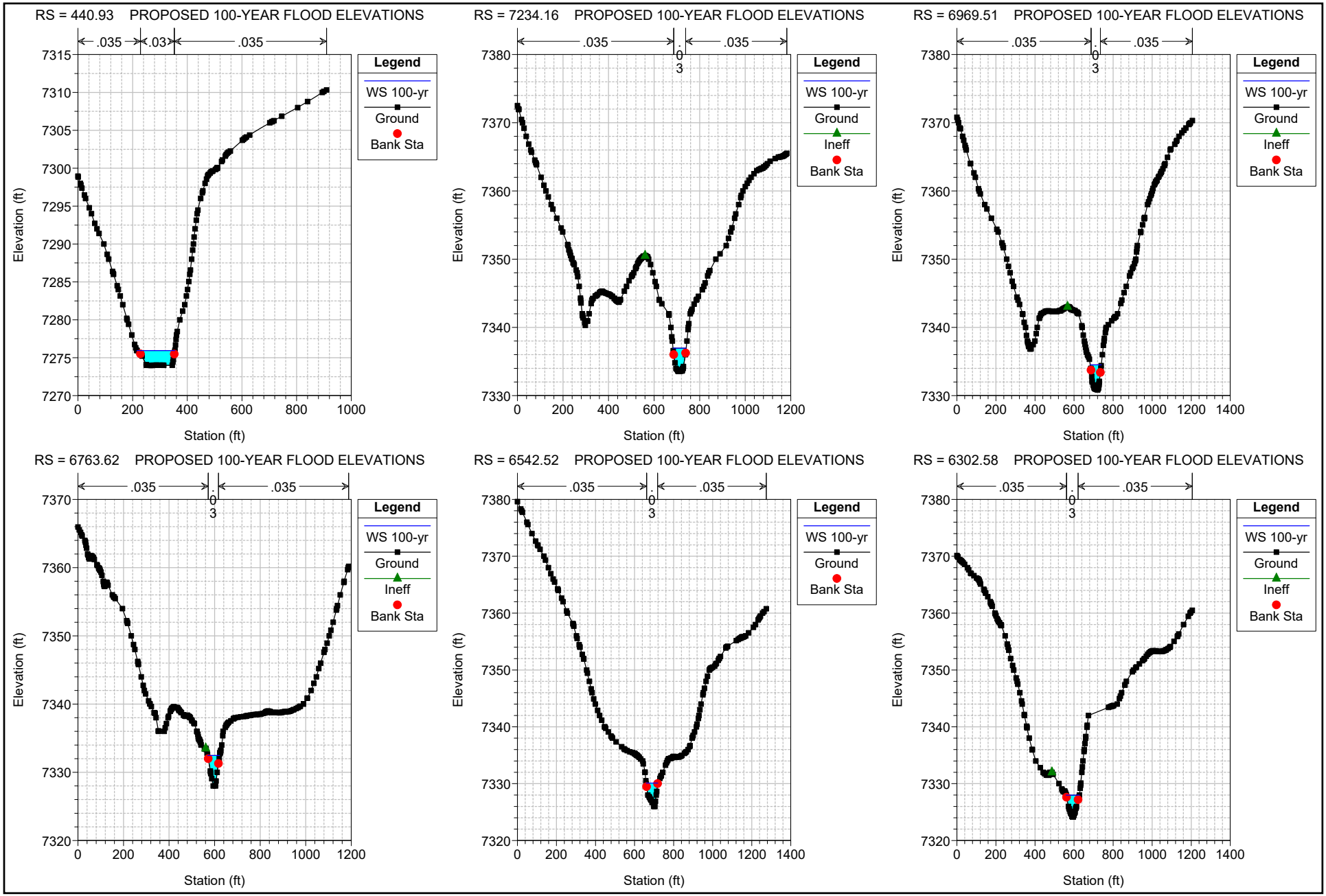
7.2 FLOODPLAIN PROFILE

WEST KIOWA CREEK PROPOSED100-YEAR FLOOD PROFILE

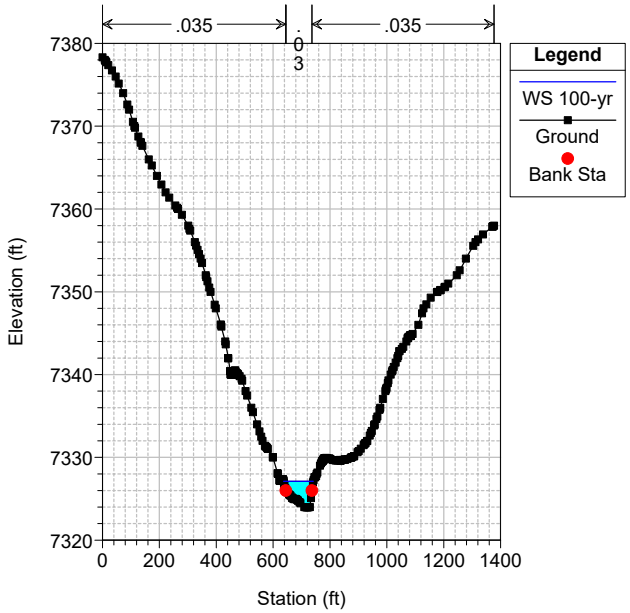
Alignment - (1) Alignment - (1)



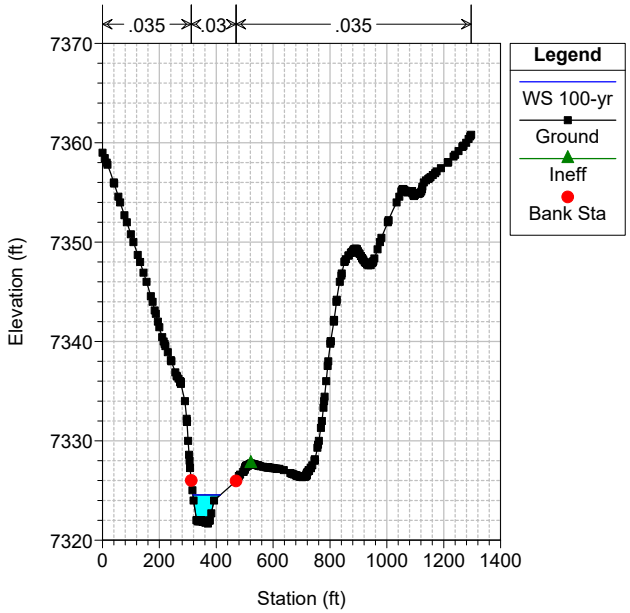
7.3 FLOODPLAIN CROSS SECTIONS


RS = 440.93 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.03
.035
Legend
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
RS = 7234.16 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.035
Legend
WS 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
RS = 6969.51 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.035
Legend
WS 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
RS = 6763.62 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.035
Legend
WS 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
RS = 6542.52 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.035
Legend
WS 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
RS = 6302.58 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.035
Legend
WS 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

RS = 6134.45 PROPOSED 100-YEAR FLOOD ELEVATIONS



RS = 5812 PROPOSED 100-YEAR FLOOD ELEVATIONS



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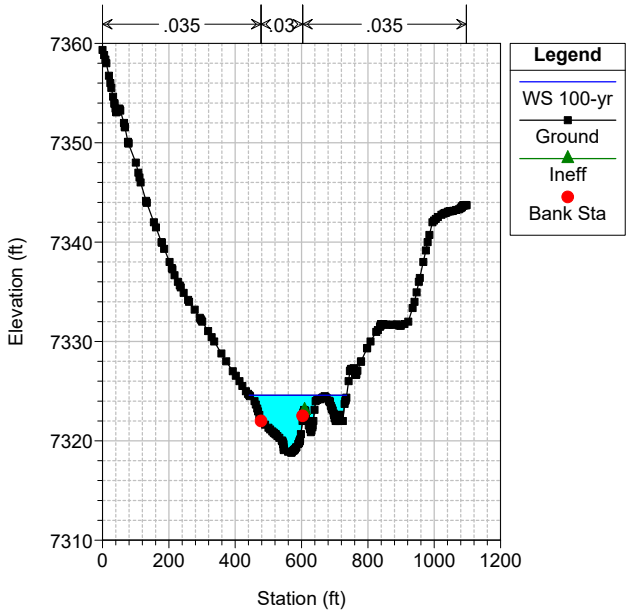
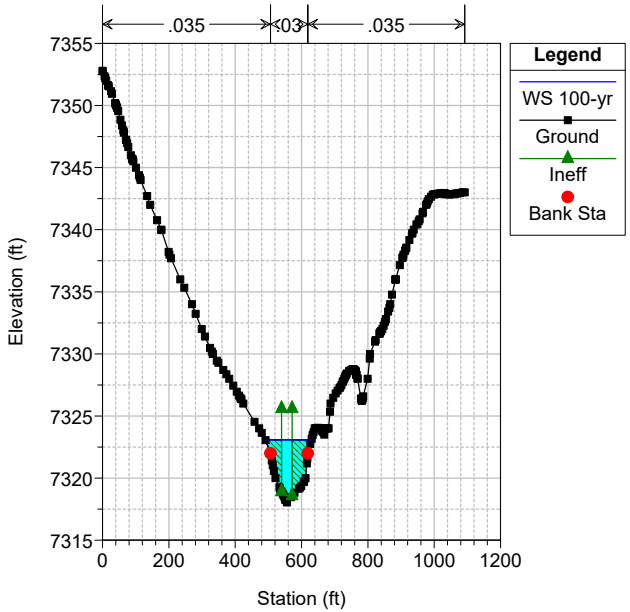


RS = 5375 PROPOSED 100-YEAR FLOOD ELEVATIONS



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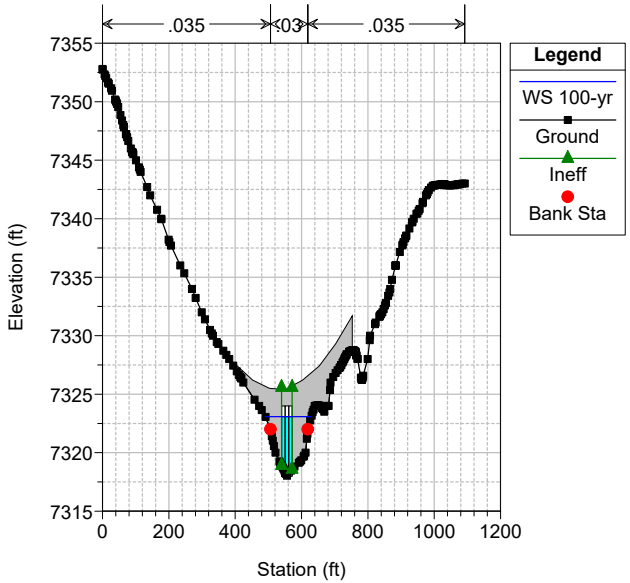
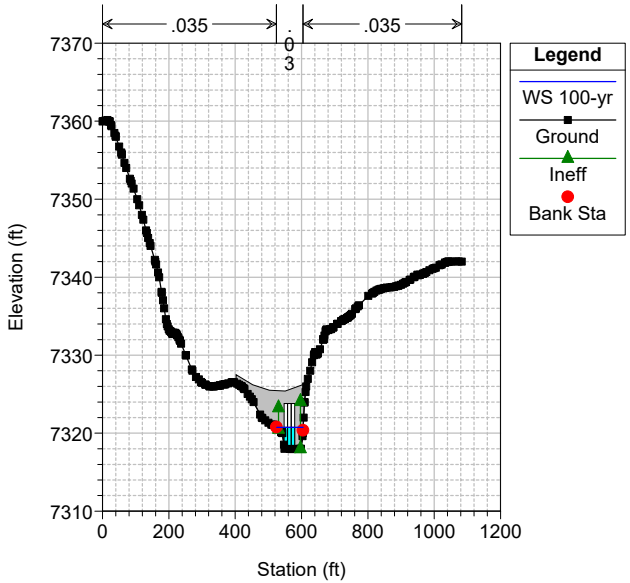
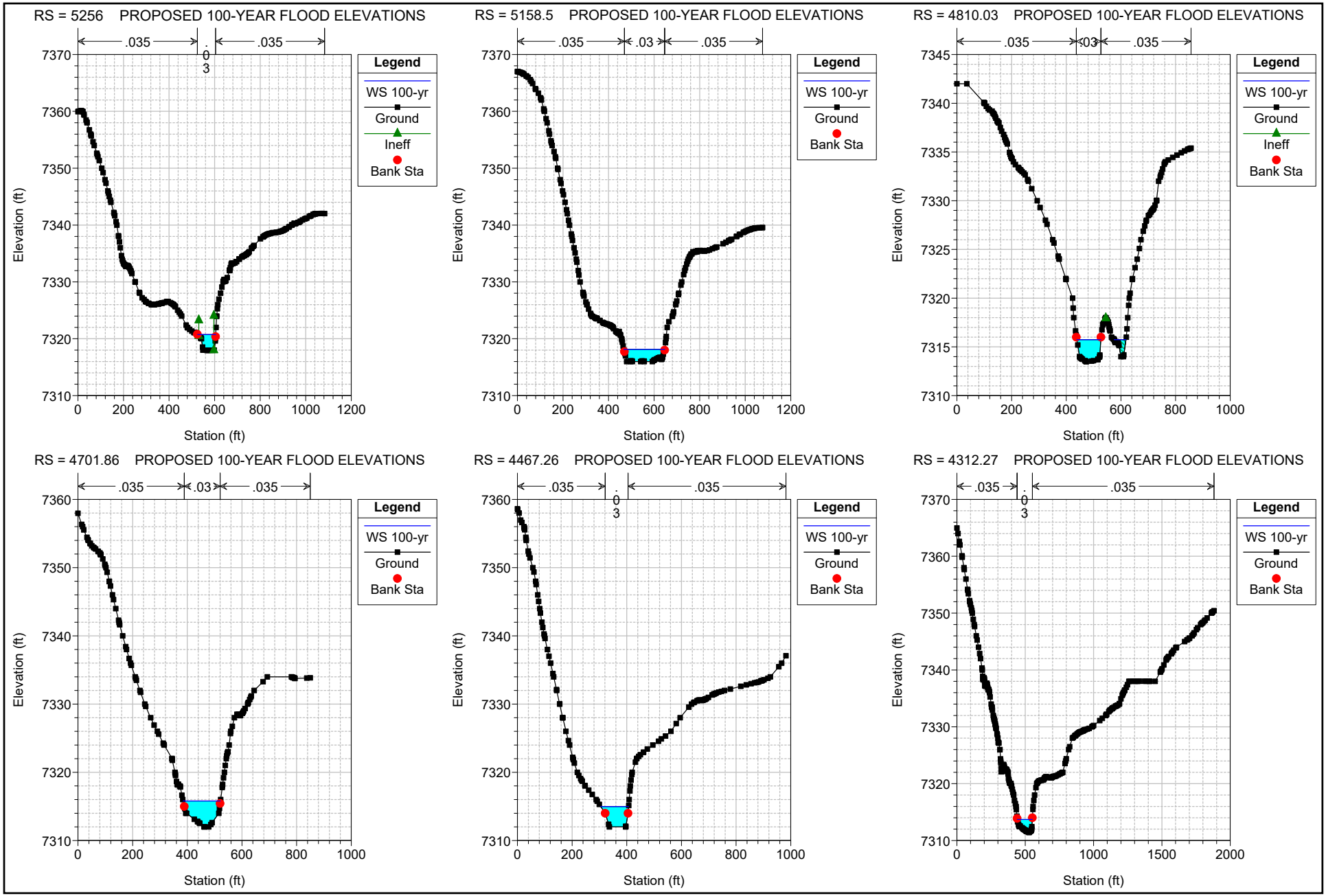
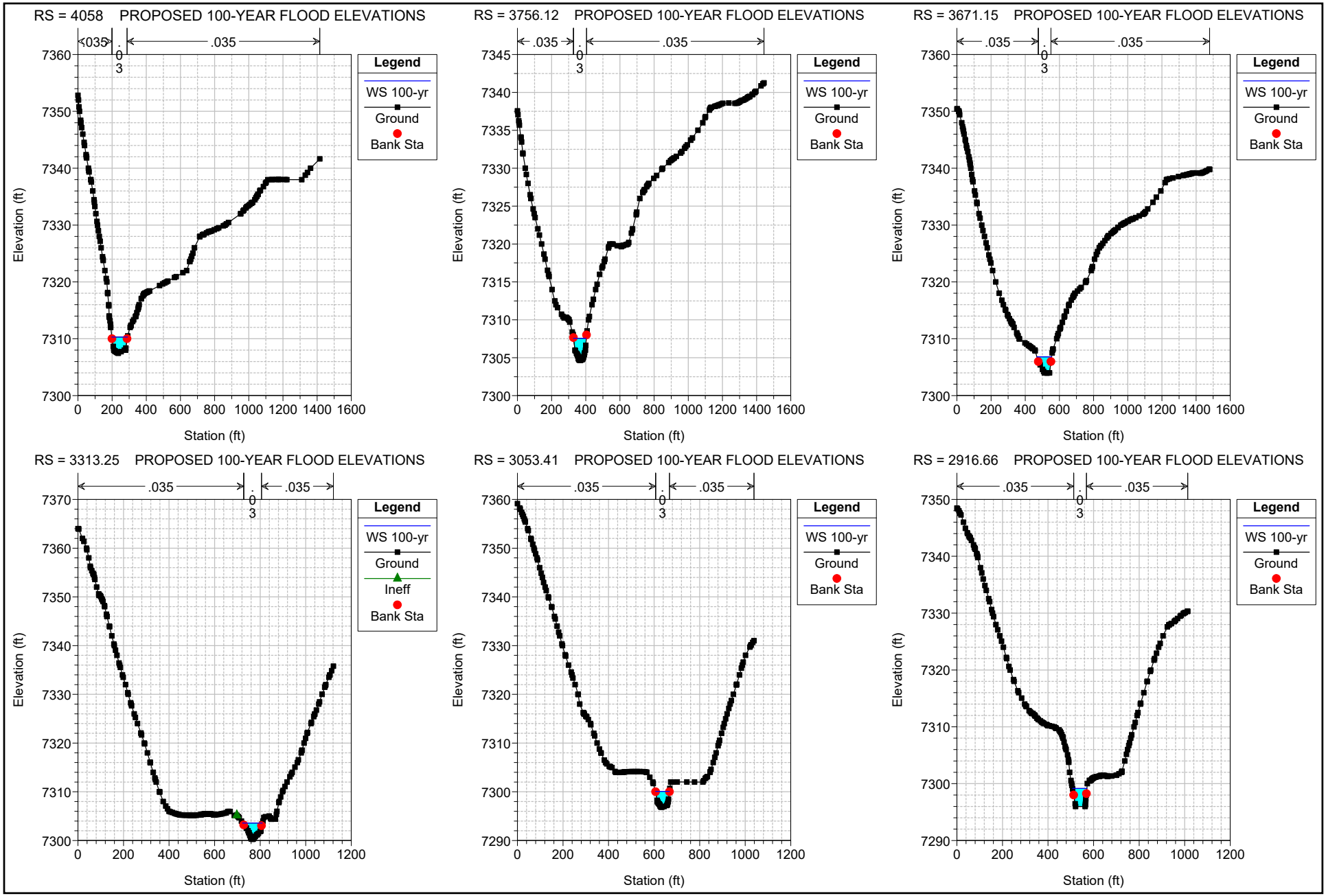
PROPOSED 100-YEAR FLOOD ELEVATIONS

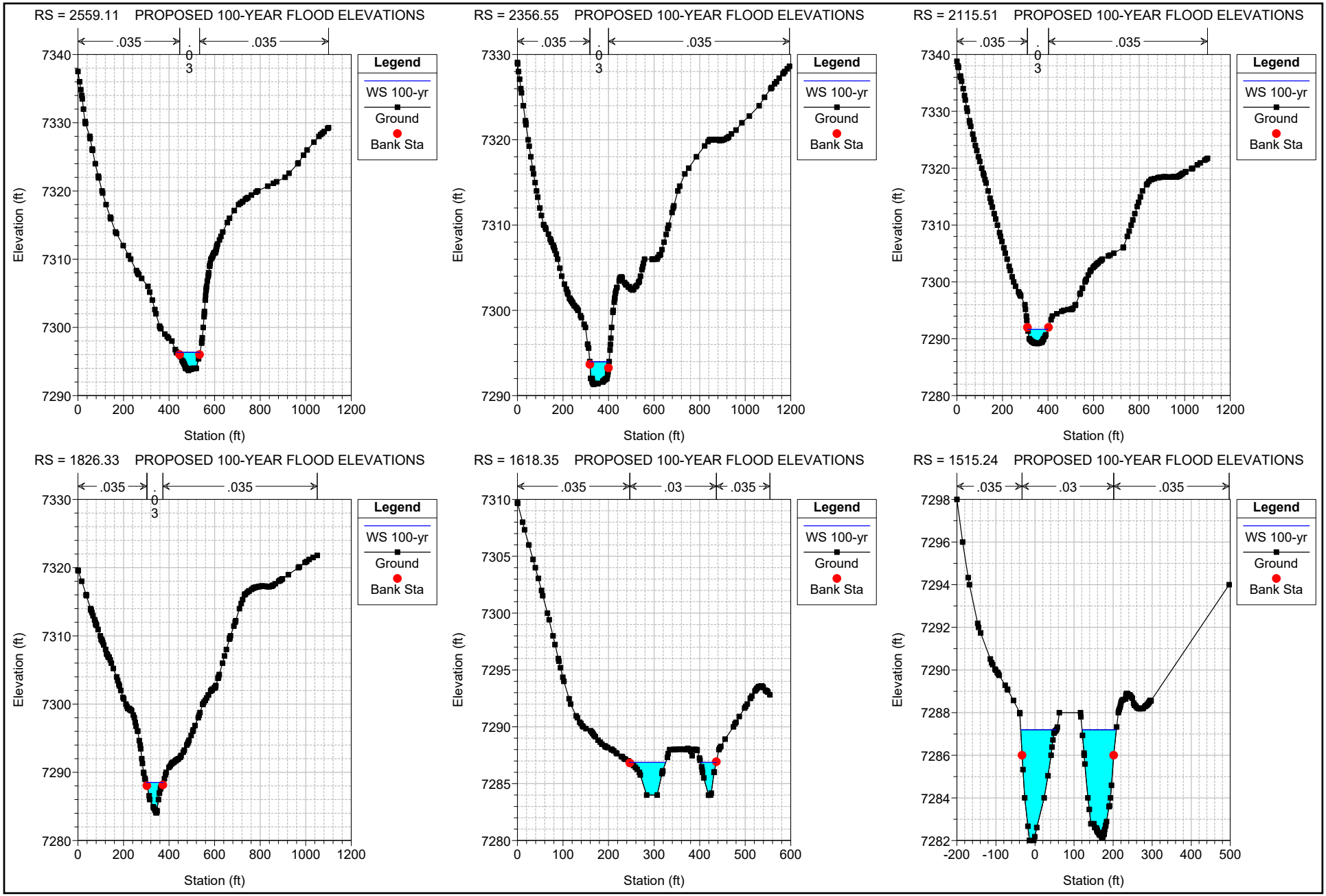


RS = 5310 Culv
PROPOSED 100-YEAR FLOOD ELEVATIONS




RS = 5256 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.03
.035
Legend
WS 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
RS = 5158.5 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.03
.035
Legend
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
RS = 4810.03 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.03
.035
Legend
WS 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
RS = 4701.86 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.03
.035
Legend
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
RS = 4467.26 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.03
.035
Legend
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
RS = 4312.27 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.03
.035
Legend
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


RS = 4058 PROPOSED 100-YEAR FLOOD ELEVATIONS
RS = 3756.12 PROPOSED 100-YEAR FLOOD ELEVATIONS
RS = 3671.15 PROPOSED 100-YEAR FLOOD ELEVATIONS
RS = 3313.25 PROPOSED 100-YEAR FLOOD ELEVATIONS
RS = 3053.41 PROPOSED 100-YEAR FLOOD ELEVATIONS
RS = 2916.66 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035
.035
0.03
Legend
WS 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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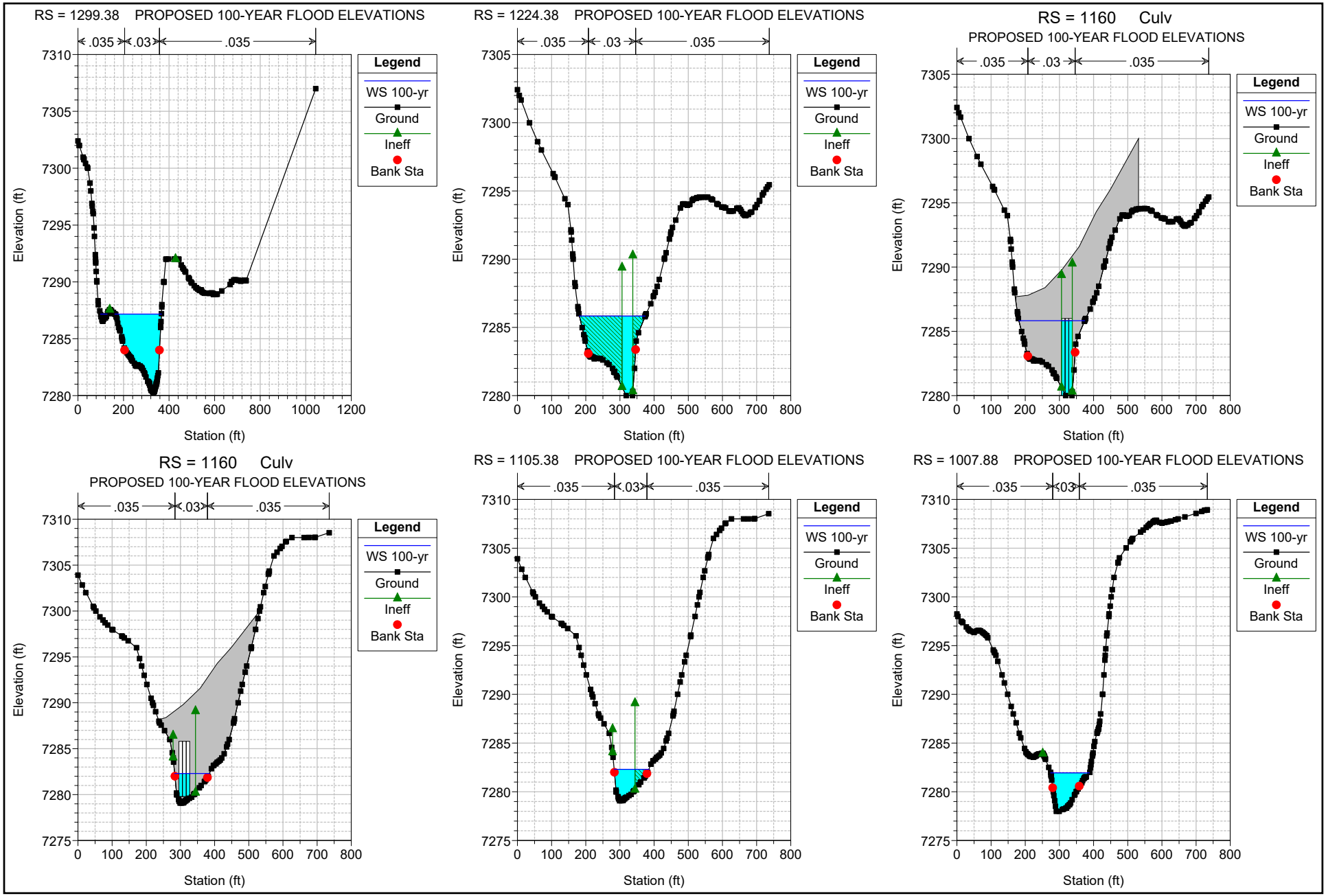
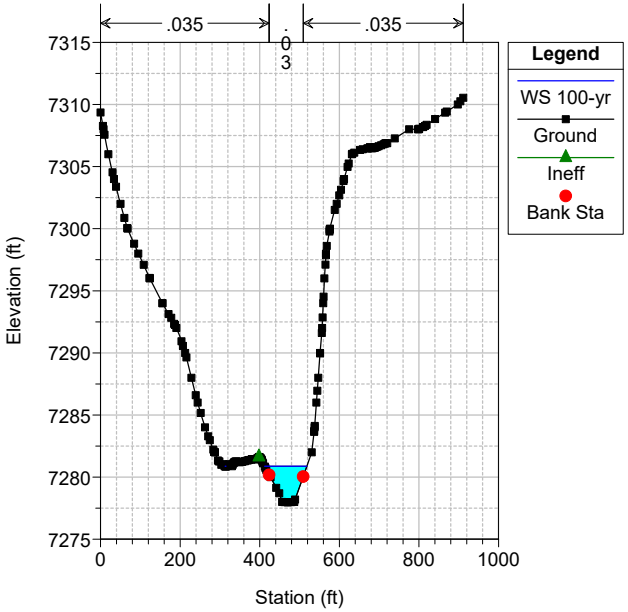
.03
.035
Legend
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
RS = 2356.55 PROPOSED 100-YEAR FLOOD ELEVATIONS
RS = 2115.51 PROPOSED 100-YEAR FLOOD ELEVATIONS
RS = 1826.33 PROPOSED 100-YEAR FLOOD ELEVATIONS
RS = 1618.35 PROPOSED 100-YEAR FLOOD ELEVATIONS
.03
RS = 1515.24 PROPOSED 100-YEAR FLOOD ELEVATIONS


RS = 1299.38 PROPOSED 100-YEAR FLOOD ELEVATIONS
.035 .03 .035
Legend
WS 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
RS = 1224.38 PROPOSED 100-YEAR FLOOD ELEVATIONS
RS = 1160 Culv
PROPOSED 100-YEAR FLOOD ELEVATIONS
RS = 1160 Culv
PROPOSED 100-YEAR FLOOD ELEVATIONS
RS = 1105.38 PROPOSED 100-YEAR FLOOD ELEVATIONS
RS = 1007.88 PROPOSED 100-YEAR FLOOD ELEVATIONS

RS = 893.27 PROPOSED 100-YEAR FLOOD ELEVATIONS



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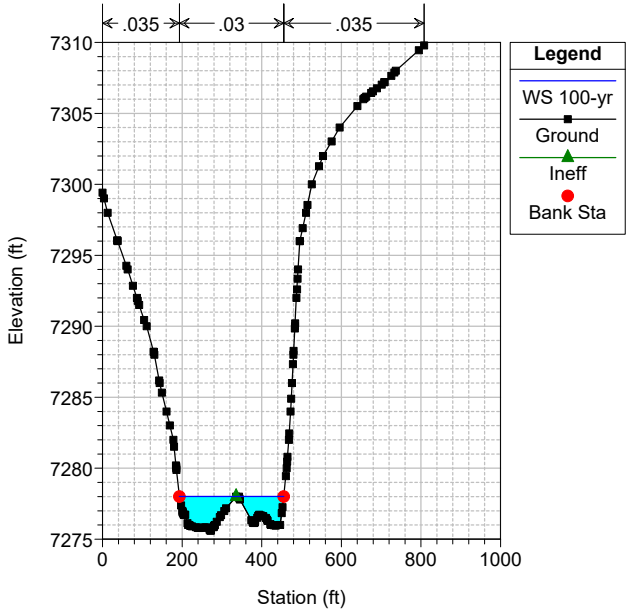


7.4 FIRM MAP

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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

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

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

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

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

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

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

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

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

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

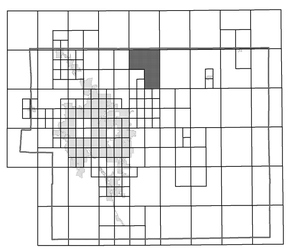
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

El Paso County Vertical Datum Offset Table

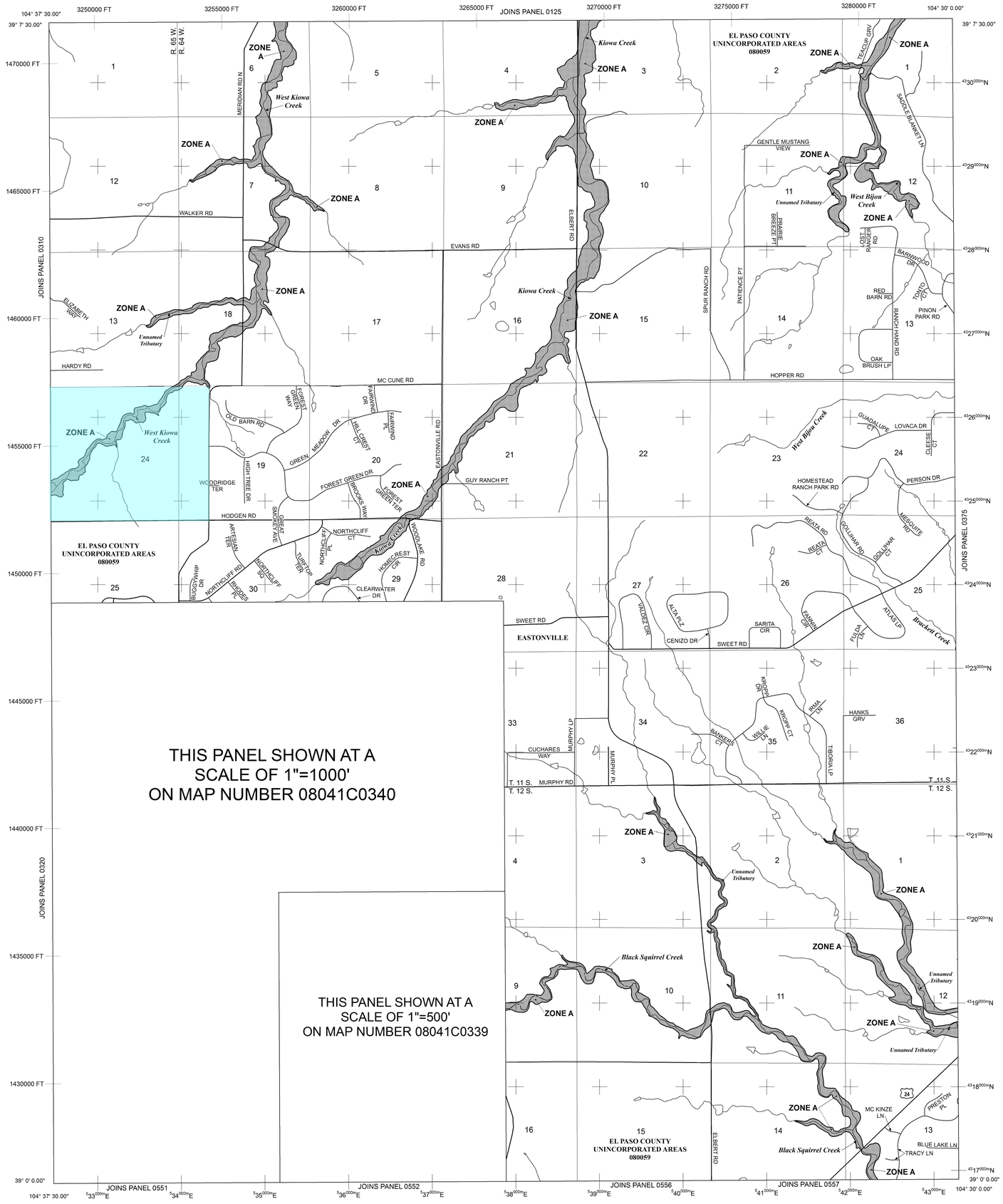
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

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

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 2000'
1000 0 2000 4000 FEET
600 0 600 1200 METERS

NFIP

PANEL 0350G

MAP REVISED DECEMBER 7, 2018

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 350 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0350	G

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

MAP NUMBER 08041C0350G

MAP REVISED DECEMBER 7, 2018

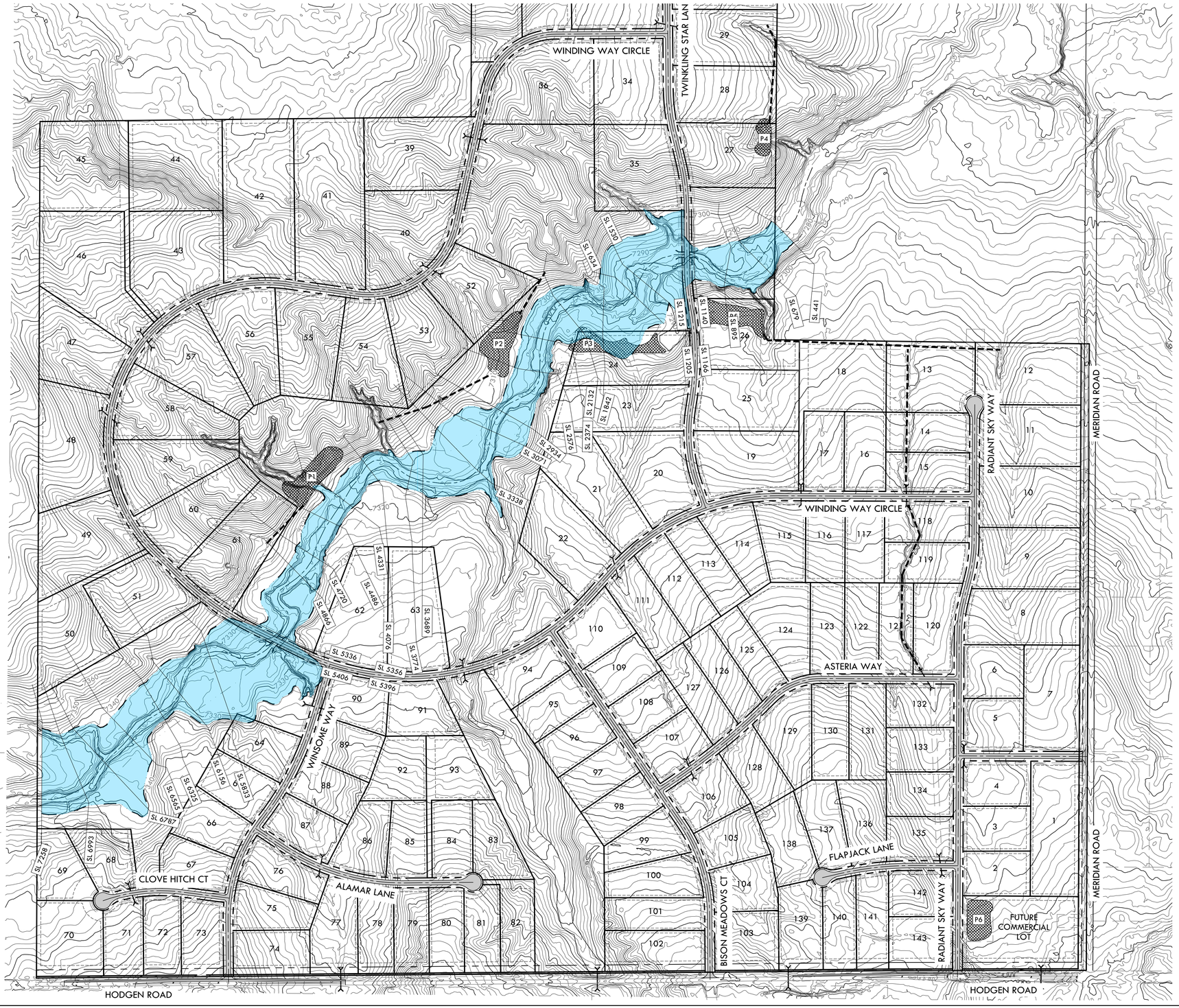
Federal Emergency Management Agency

8.1 DAM FAILURE FLOODPLAIN EXHIBIT

DAM RISK ASSESSMENT

WINSOME SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO



VERTEX®
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211
Main: 303.623.9116 | VERTEXENG.COM

9500 CFS DAM FAILURE FLOODPLAIN

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
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0' 300' 600'

DATE: 1/4/19	1
DRAWN BY: JCP	
CHECKED BY: LPV	
JOB #: 49388	

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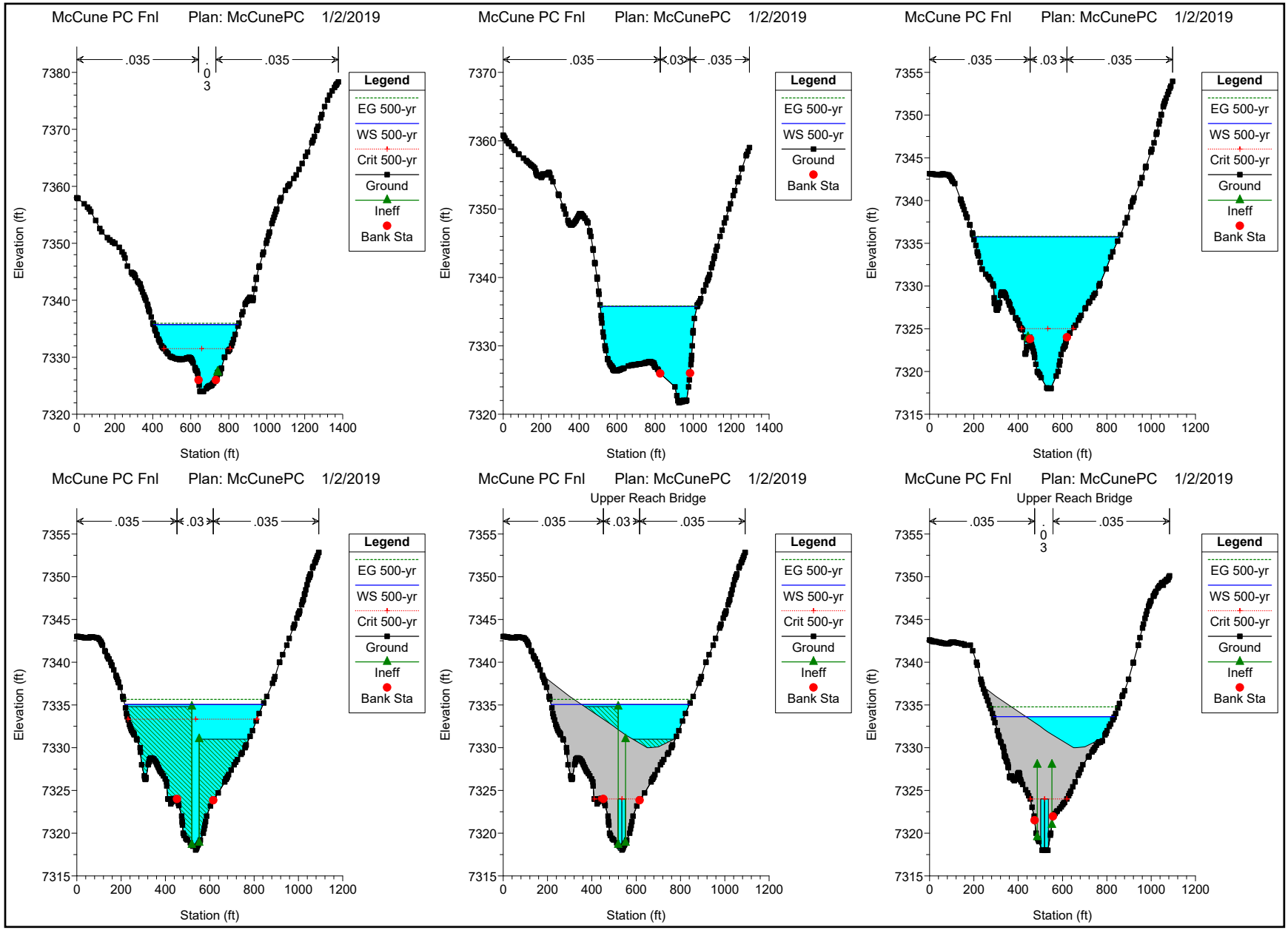
8.2 DAM FAILURE FLOODPLAIN SECTIONS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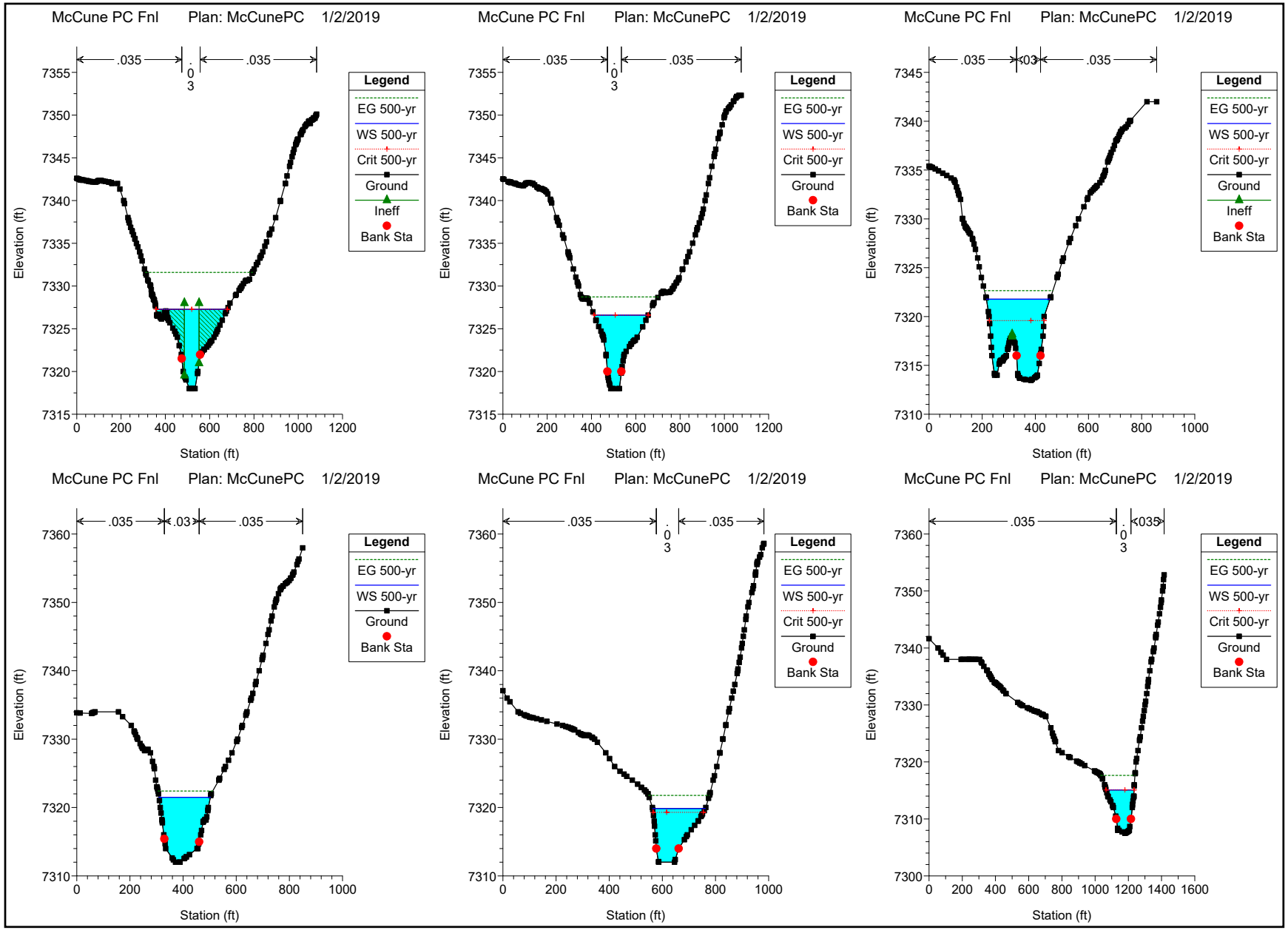
WS 500-yr
Crit 500-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Upper Reach Bridge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Legend
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WS 500-yr
Crit 500-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
7355
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7345
7340
7335
7330
7325
7320
7315
0
200
400
600
800
1000
1200

McCune PC Fnl Plan: McCunePC 1/2/2019
.035
.035
Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
7355
7350
7345
7340
7335
7330
7325
7320
7315
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200
400
600
800
1000
1200

McCune PC Fnl Plan: McCunePC 1/2/2019
.035
.035
Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
7345
7340
7335
7330
7325
7320
7315
7310
0
200
400
600
800
1000

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.035
Legend
EG 500-yr
WS 500-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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7350
7340
7330
7320
7310
0
200
400
600
800
1000

McCune PC Fnl Plan: McCunePC 1/2/2019
.035
.035
Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
7360
7350
7340
7330
7320
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McCune PC Fnl Plan: McCunePC 1/2/2019
.035
Legend
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Crit 500-yr
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Bank Sta
Elevation (ft)
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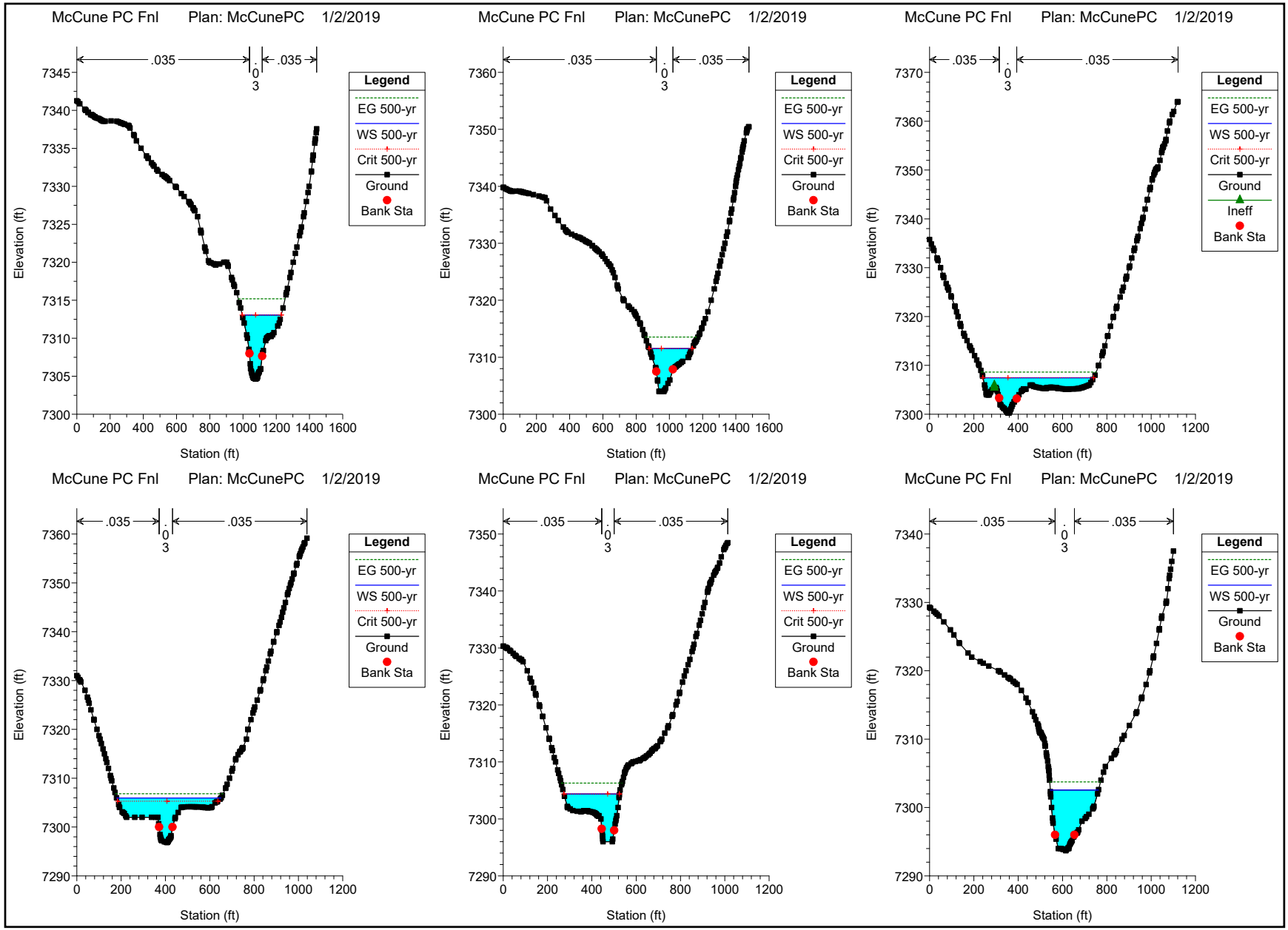
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Crit 500-yr
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Elevation (ft)
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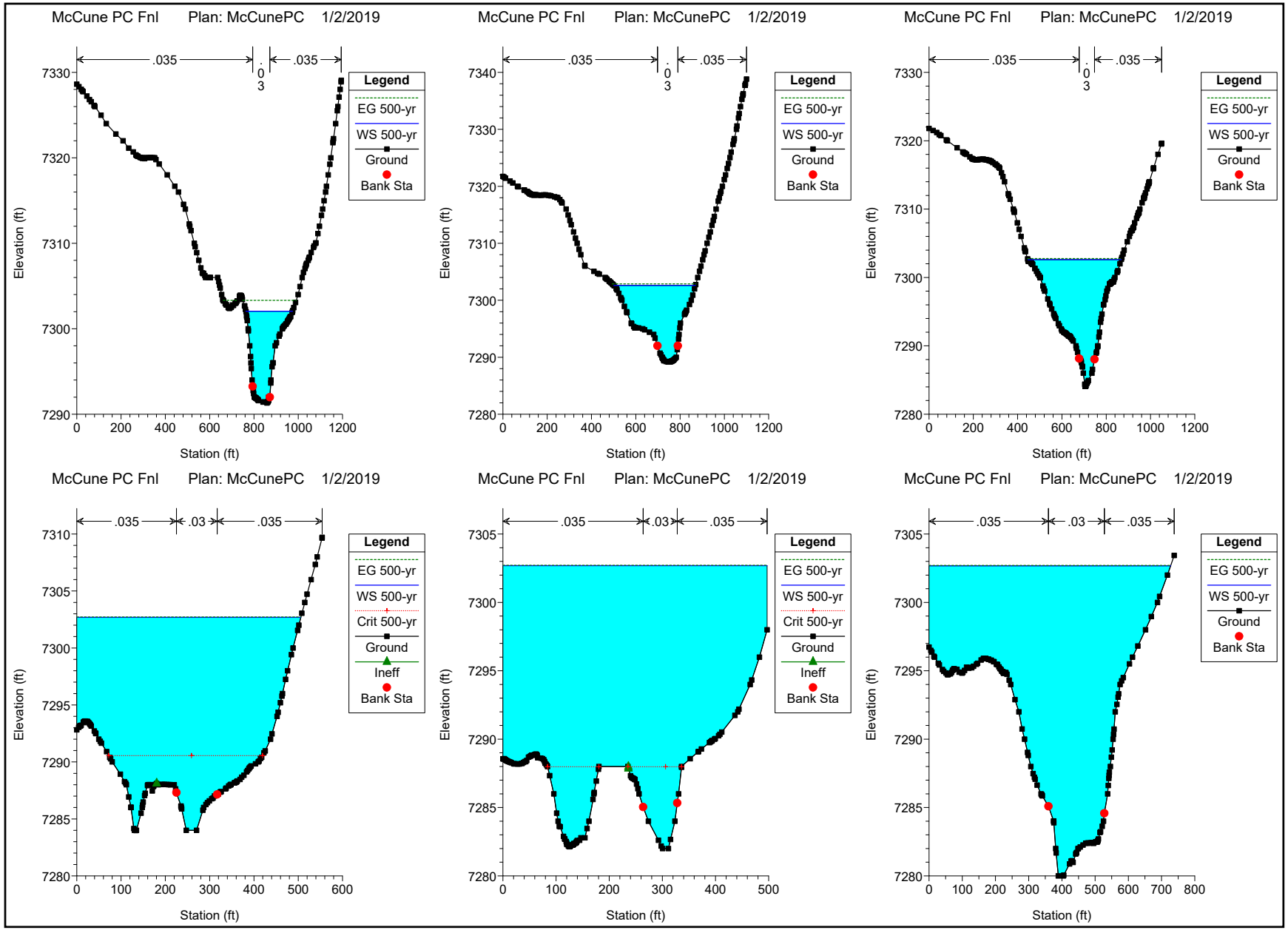
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Crit 500-yr
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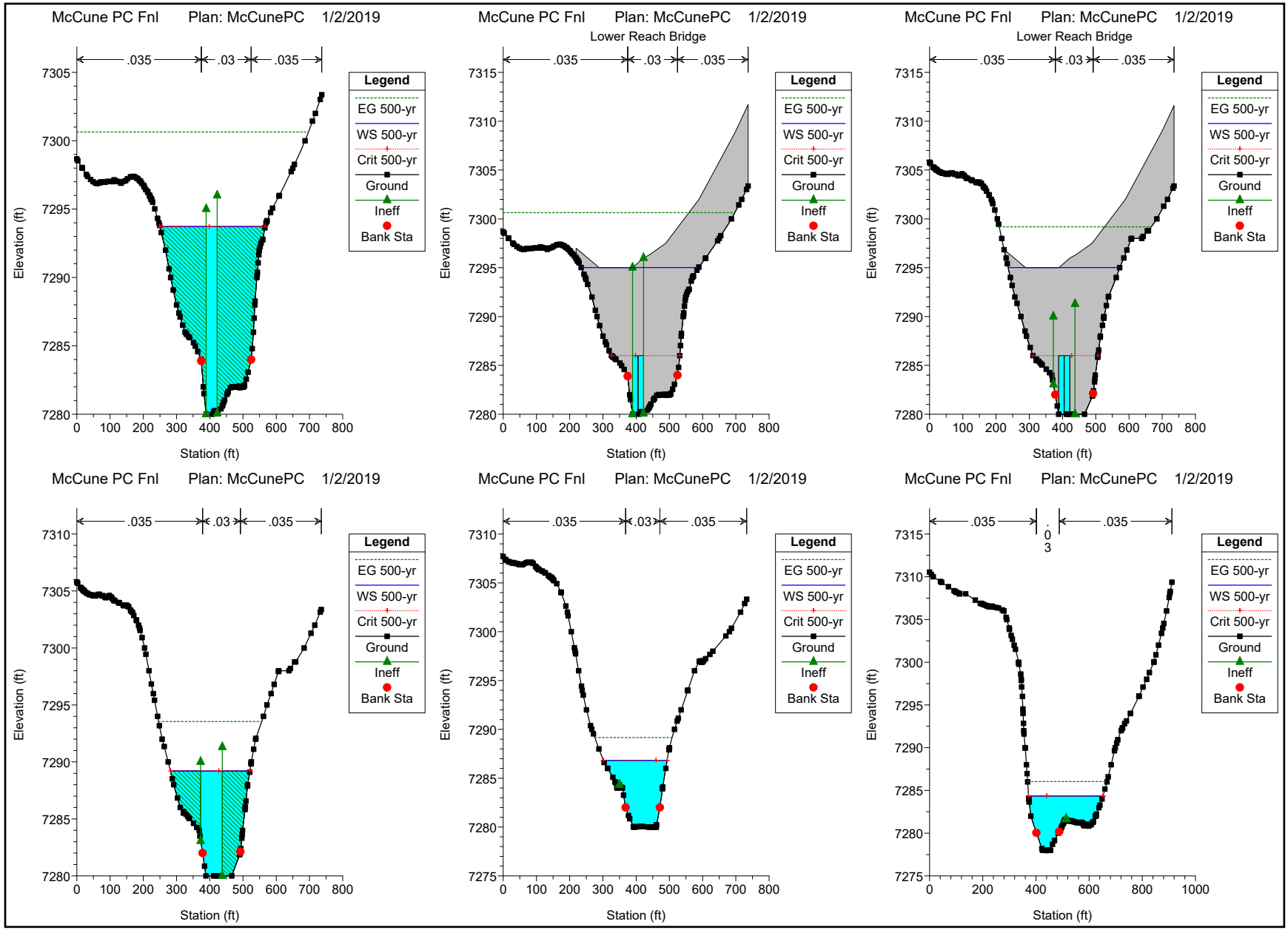
Elevation (ft)
Station (ft)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EG 500-yr
WS 500-yr
Crit 500-yr
Ground
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Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 1/2/2019
Lower Reach Bridge
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McCune PC Fnl Plan: McCunePC 1/2/2019
Lower Reach Bridge
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McCune PC Fnl Plan: McCunePC 1/2/2019
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Elevation (ft)
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McCune PC Fnl Plan: McCunePC 1/2/2019
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Elevation (ft)
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McCune PC Fnl Plan: McCunePC 1/2/2019
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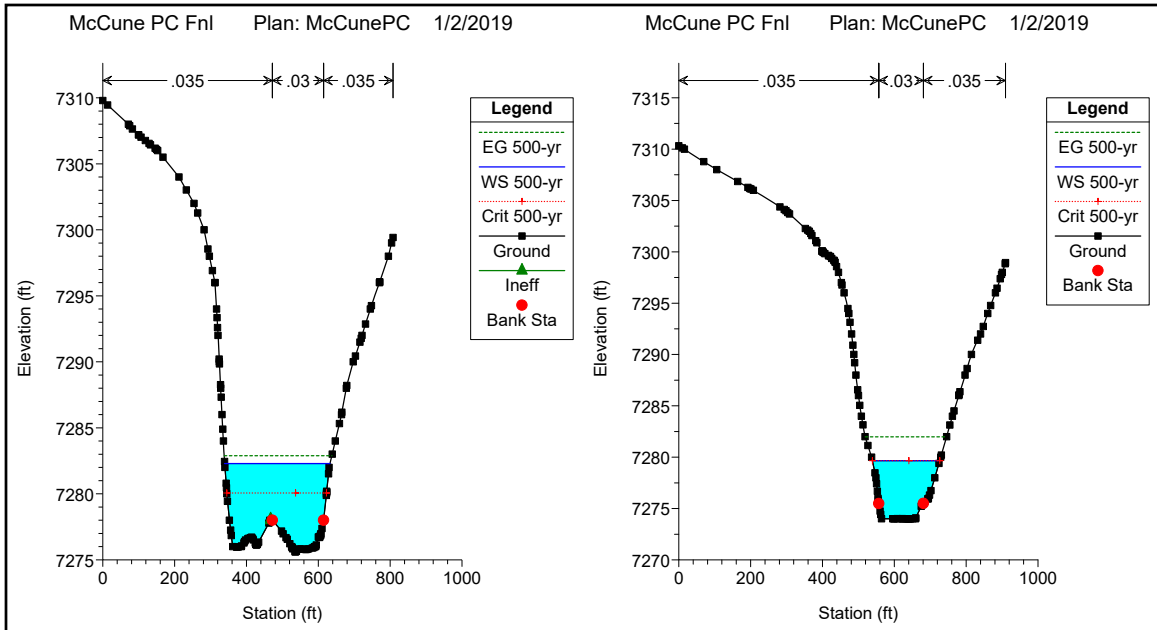
Elevation (ft)
Station (ft)


McCune PC Fnl Plan: McCunePC 1/2/2019
.035
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Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Ineff
Bank Sta

McCune PC Fnl Plan: McCunePC 1/2/2019
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Elevation (ft)
Station (ft)
Legend
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WS 500-yr
Crit 500-yr
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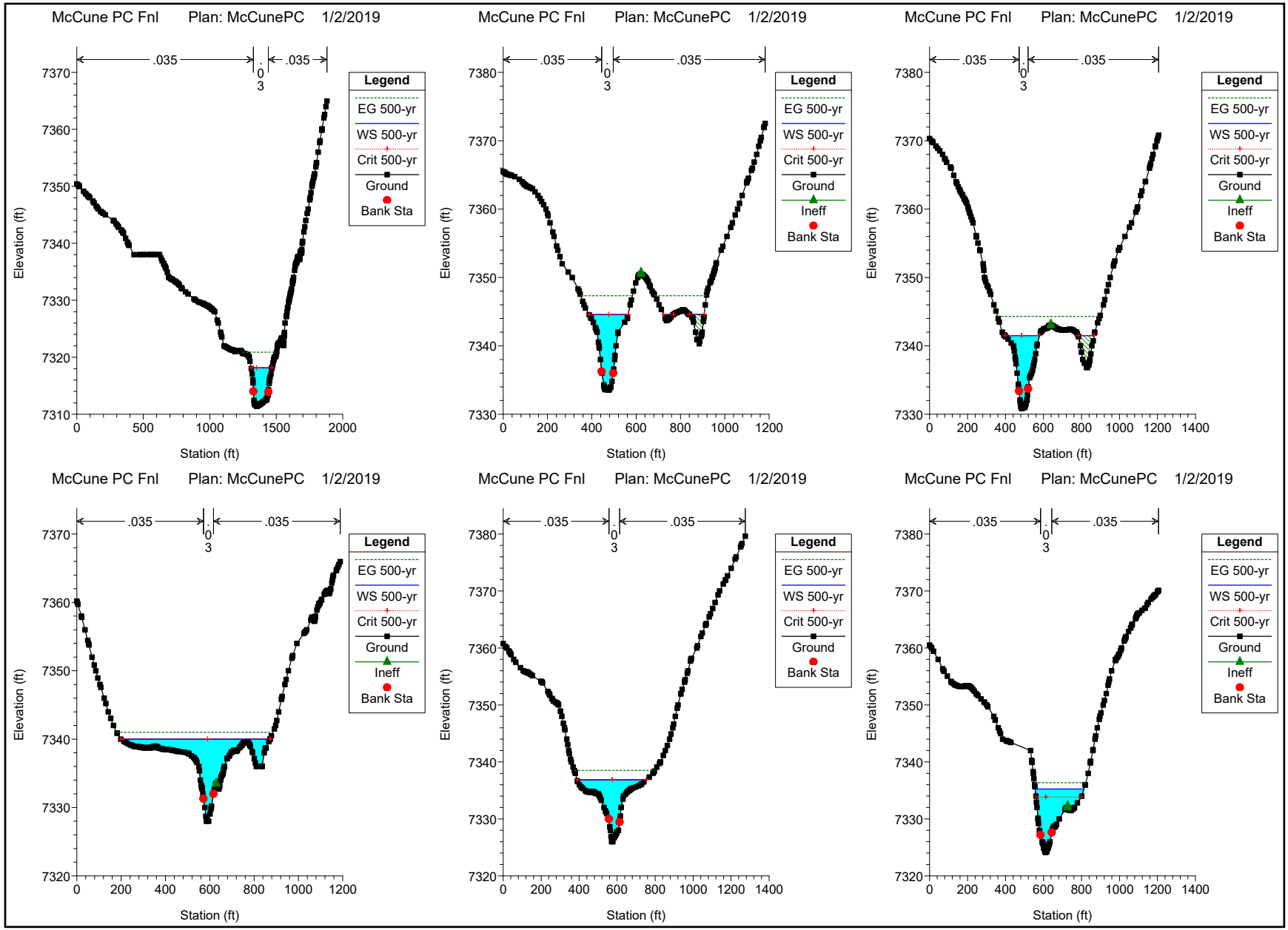
McCune PC Fnl Plan: McCunePC 1/2/2019
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Legend
EG 500-yr
WS 500-yr
Crit 500-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

8.3 LETTER FROM COLORADO STATE DAM AUTHORITY

COLORADO
Division of Water Resources
Department of Natural Resources

Dam Safety

Mr. Jason Priddy
The Vertex Companies, Inc.
2420 W. 26th Ave., Suite 100-D
Denver, Colorado 80211
jpriddy@vertexeng.com

When replying, please refer to:
Kiowa Crk Wtrshd 1-N-10, DAMID 010318
Kiowa Crk Wtrshd 1-P-10, DAMID 010319
Kiowa Crk Wtrshd 1-P-20, DAMID 010320
Water Division 1, Water District 01

January 22, 2019

SUBJECT: Winsome Subdivision – Planning Associated with Upstream Jurisdictional Dams

Dear Mr. Priddy:

I would like to start by thanking you for reaching out to me as part of your planning efforts for the Winsome Subdivision located in northeastern El Paso County, CO. The subject dams noted above are all currently registered as Low Hazard jurisdictional dams owned by the Kiowa Conservation District and are located just upstream of the planned Winsome Subdivision. Through coordination with this office, you completed hydraulic routing of a conservative peak dam breach discharge of 9,500 cfs through the planned development. This value was developed by this office in adherence to our *2010 Guidelines for Dam Breach Analysis* for the largest reservoir, 1-P-10. All three dams are situated on different drainages and do not cause cascading failure scenarios. There was concern that a failure of any one of the dams could both impact structures within the development and cause a hazard classification increase, requiring subsequent risk mitigation efforts by the dam owner.

This office has reviewed your floodplain analysis routing the peak dam break failure through the planned development. We understand that the modelling indicates the majority of the lots were not impacted at all by the peak breach. Your modelling indicates that corner of two lots (24 and 64) were within the wetted perimeter at depths less than 2 feet. To be conservative, you have chosen to place these portions of the two lots in "no-build" areas. We have reviewed the HEC-RAS model used to develop the hydraulic analysis and have no objections with the model assumptions and the slight alteration to the planned subdivision lot usage.

In conclusion, this office believes that your foresight in planning development at Winsome will retain Low Hazard classifications for the above-referenced dams. In other words, there is no risk posed by the dams to the structures of the planned development and the owner can continue to monitor and operate these in accordance with our requirements for Low Hazard dams.

Please contact me if you have questions or comments regarding the information contained in the report or if you require assistance with any dam-safety related issues.

Sincerely,

John Hunyadi, P.E.
Dam Safety Engineer

ec: Bill McCormick, Chief Dam Safety
Gilbert LaForce, El Paso County, gilbertlaforce@elpasoco.com
Linda Pollick, NRCS, linda.pollick@co.usda.gov
Pam Brewster, Kiowa Conservation District, pam.brewster@co.nacdnet.net

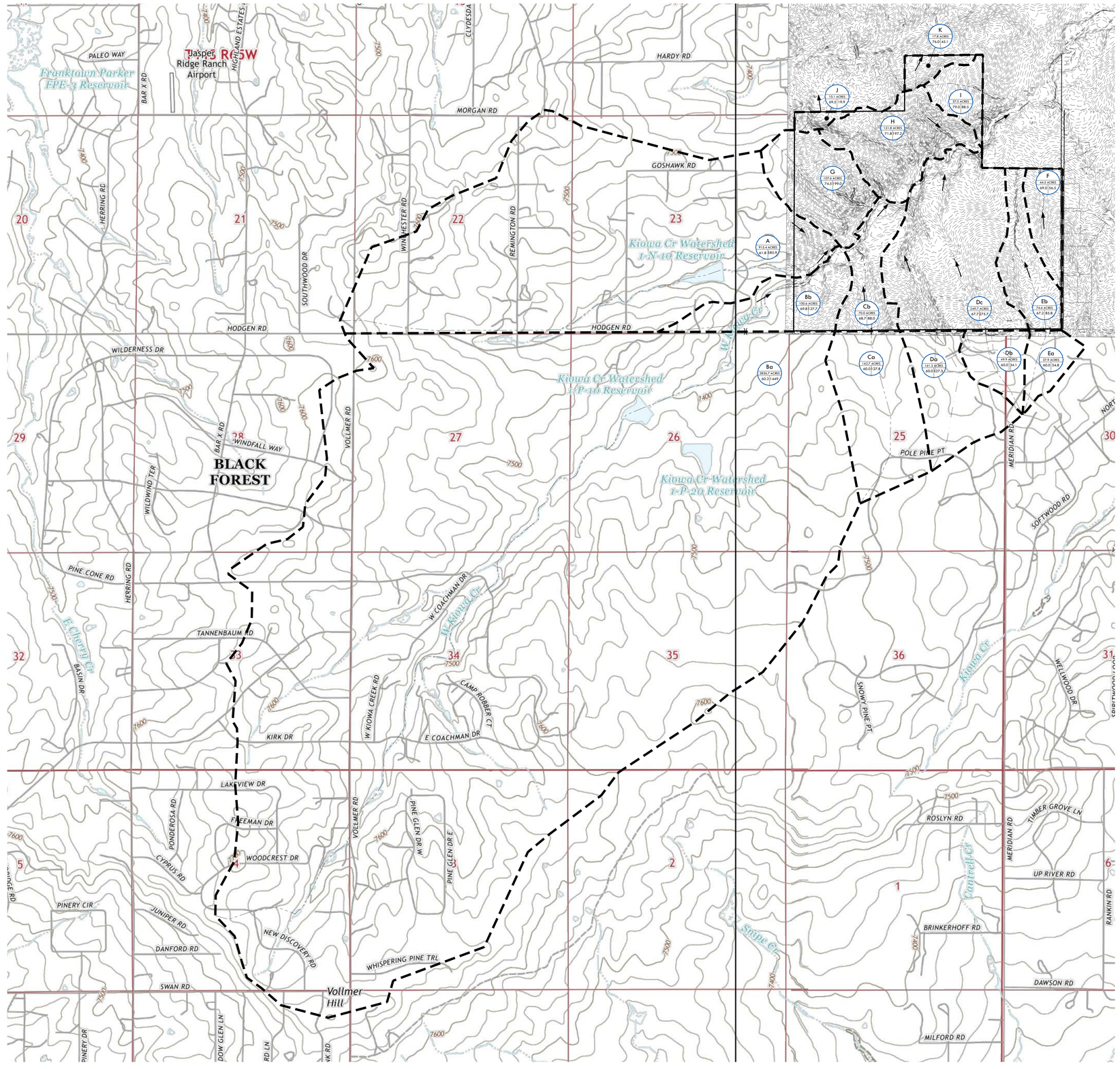
9.0 SITE PHOTOGRAPHS

10.0 DRAINAGE PLANS

PRELIMINARY PLAN SET

WINSOME SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO



EXISTING STORMWATER RUNOFF TABLE

BASIN	BASIN AREA (ACRES)	CURVE NUMBER	Q_{100}
A	915.4	61.8	585.9
Ba	3836.7	60.3	1448.9
Bb	100.6	69.8	127.7
Ca	162.7	60.0	127.8
Cb	70.0	68.7	88.0
Da	161.3	60.0	127.3
Db	49.9	60.0	34.1
Dc	249.7	67.7	275.7
Ea	37.9	60.0	34.8
Eb	74.6	67.2	85.8
F	44.5	69.0	56.6
G	107.6	74.5	199.0
H	121.8	71.8	197.2
I	37.5	79.0	88.5
J	10.1	69.5	19.9
K	17.8	76.0	45.1
	5998.1		

LEGEND

- PROPERTY BOUNDARY LINE
- 5540 EXISTING CONTOUR
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN FLOW PATH

A — BASIN NAME
4.09 ACRES — DRAINAGE BASIN SIZE
4.73 | 14.05 — 100-YEAR RUNOFF
CURVE NUMBER
FLOW ARROWS

PCD FILE NO SP-18-006

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COLORADO LICENSED 5/16/19 43911 PROFESSIONAL ENGINEER 5/16/2019

EXISTING DRAINAGE PLAN - OVERALL

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	1/11/19 PRELIMINARY RESUBMITTAL
2	3/8/19 PRELIMINARY RESUBMITTAL
3	4/11/19 PRELIMINARY RESUBMITTAL
4	5/10/19 PRELIMINARY RESUBMITTAL
5	
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9	
10	

DATE: 1/11/19
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

C1.1

PRELIMINARY PLAN SET

WINSOME SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

0' 200' 2000'

E1 MAIN OUTFALL+E5+E6+E7 Q5=408.6CFS Q100=2470.0CFS

E2 OFFSITE FLOW Q5=3.4CFS Q100=19.9CFS

E3 OFFSITE FLOW Q5=12.9CFS Q100=45.1CFS

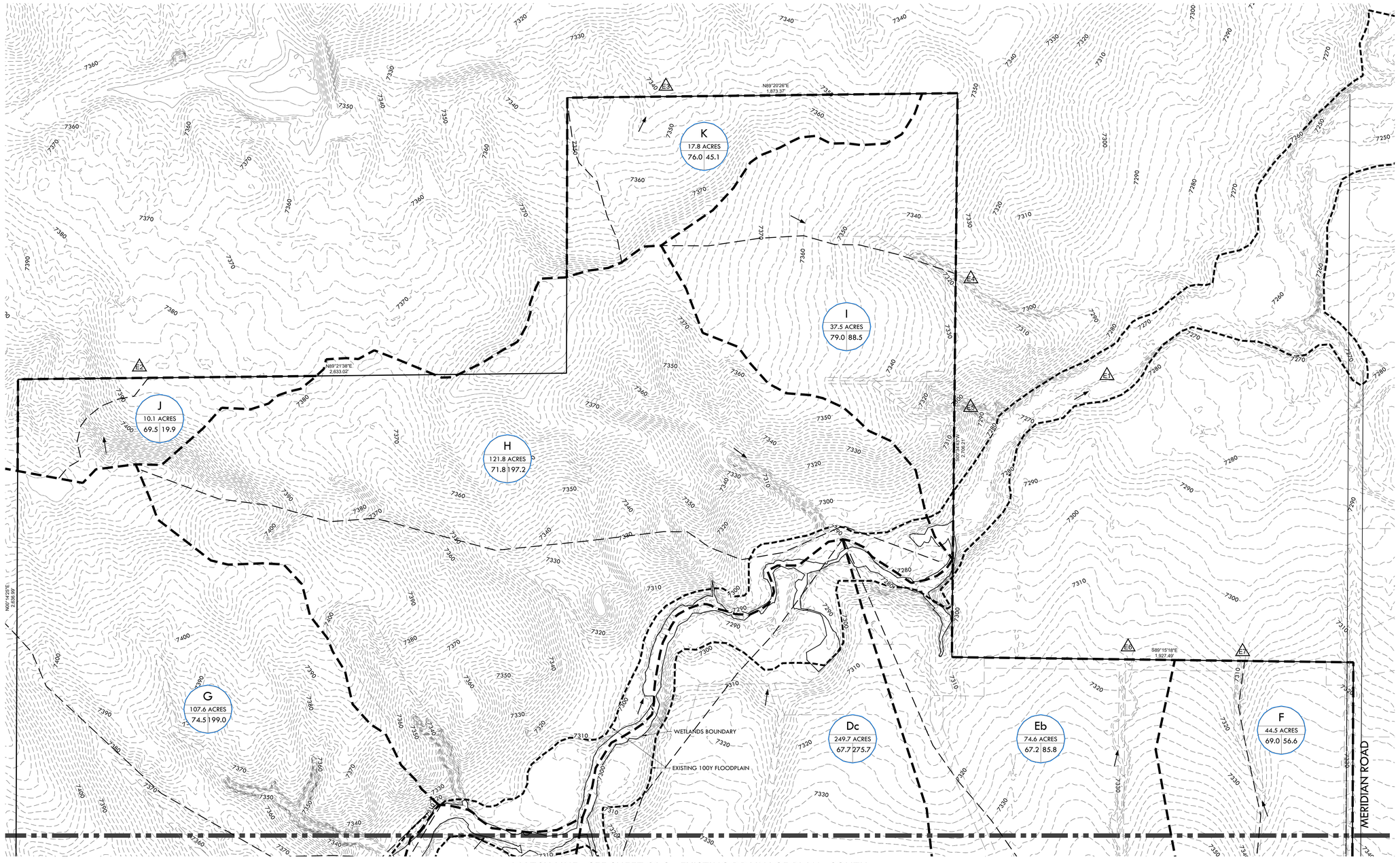
E4 + E5 OFFSITE FLOW Q5=26.4CFS Q100=88.5CFS

E6 OFFSITE FLOW Q5=9.4CFS Q100=85.8CFS

E7 OFFSITE FLOW Q5=6.6CFS Q100=56.6CFS

NOTES:

1. EXISTING FLOODPLAIN AS SHOWN BASED ON FIRM MAP #08041C0350G PANEL 350 REVISED 12/7/2018, GENERATED BY GRAPHICAL OVERLAY.



MATCH LINE - SEE SHEET C1.3 - EXISTING DRAINAGE PLAN - SOUTH

PCD FILE NO SP-18-006

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43911

EXISTING DRAINAGE PLAN - NORTH

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	1/11/19 PRELIMINARY RESUBMITTAL
2	3/8/19 PRELIMINARY RESUBMITTAL
3	4/11/19 PRELIMINARY RESUBMITTAL
4	5/10/19 PRELIMINARY RESUBMITTAL
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DATE: 1/11/19
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

C1.2

PRELIMINARY PLAN SET

WINSOME SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

0' 200' 400'

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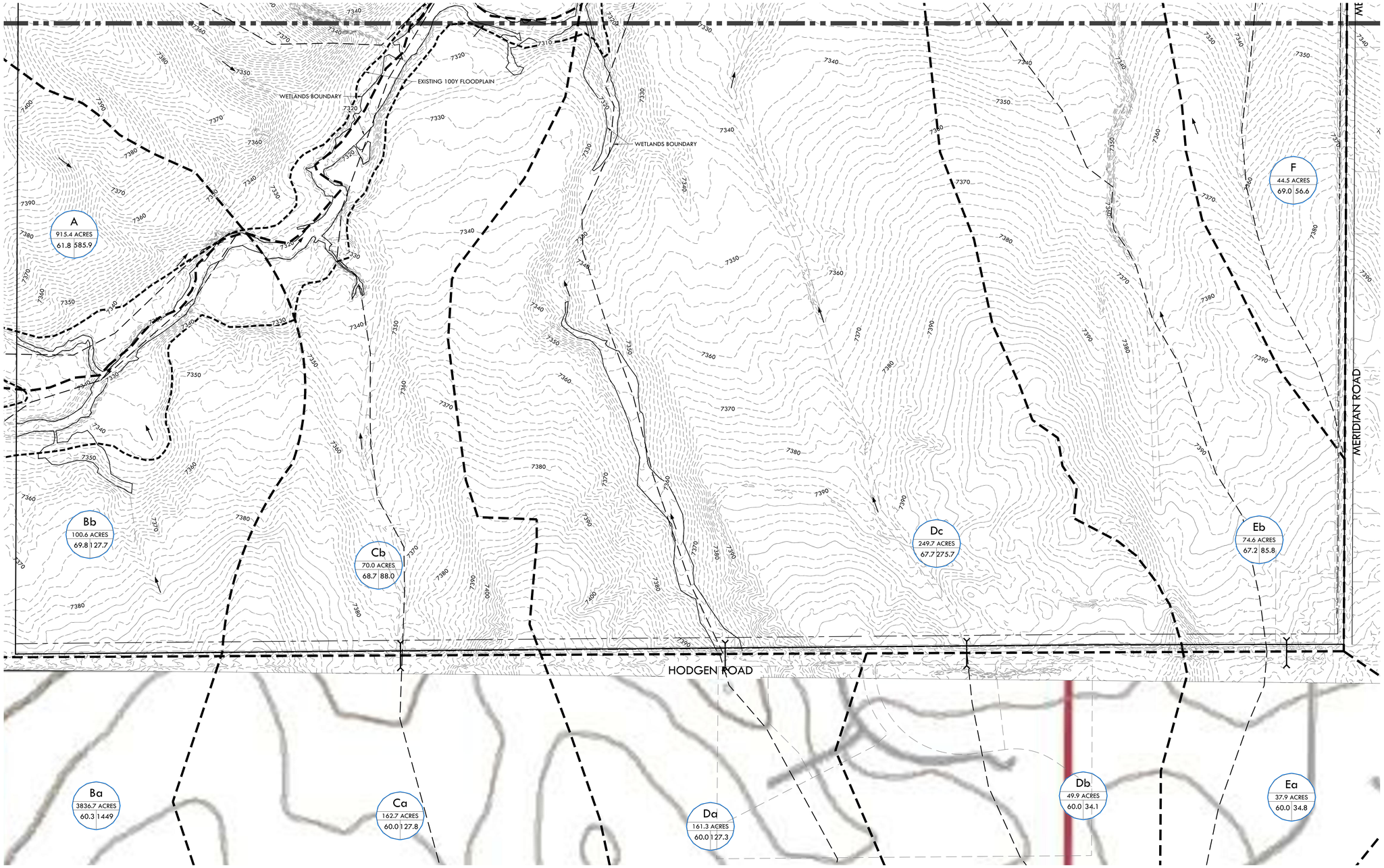
NOTES:

1. EXISTING FLOODPLAIN AS SHOWN BASED ON FIRM MAP #08041C0350G PANEL 350 REVISED 12/7/2018, GENERATED BY GRAPHICAL OVERLAY.

MATCH LINE - SEE SHEET C1.2 - EXISTING DRAINAGE PLAN - NORTH



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EXISTING DRAINAGE PLAN - SOUTH

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	1/11/19 PRELIMINARY RESUBMITTAL
2	3/8/19 PRELIMINARY RESUBMITTAL
3	4/11/19 PRELIMINARY RESUBMITTAL
4	5/10/19 PRELIMINARY RESUBMITTAL
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DATE: 1/11/19
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

C1.3

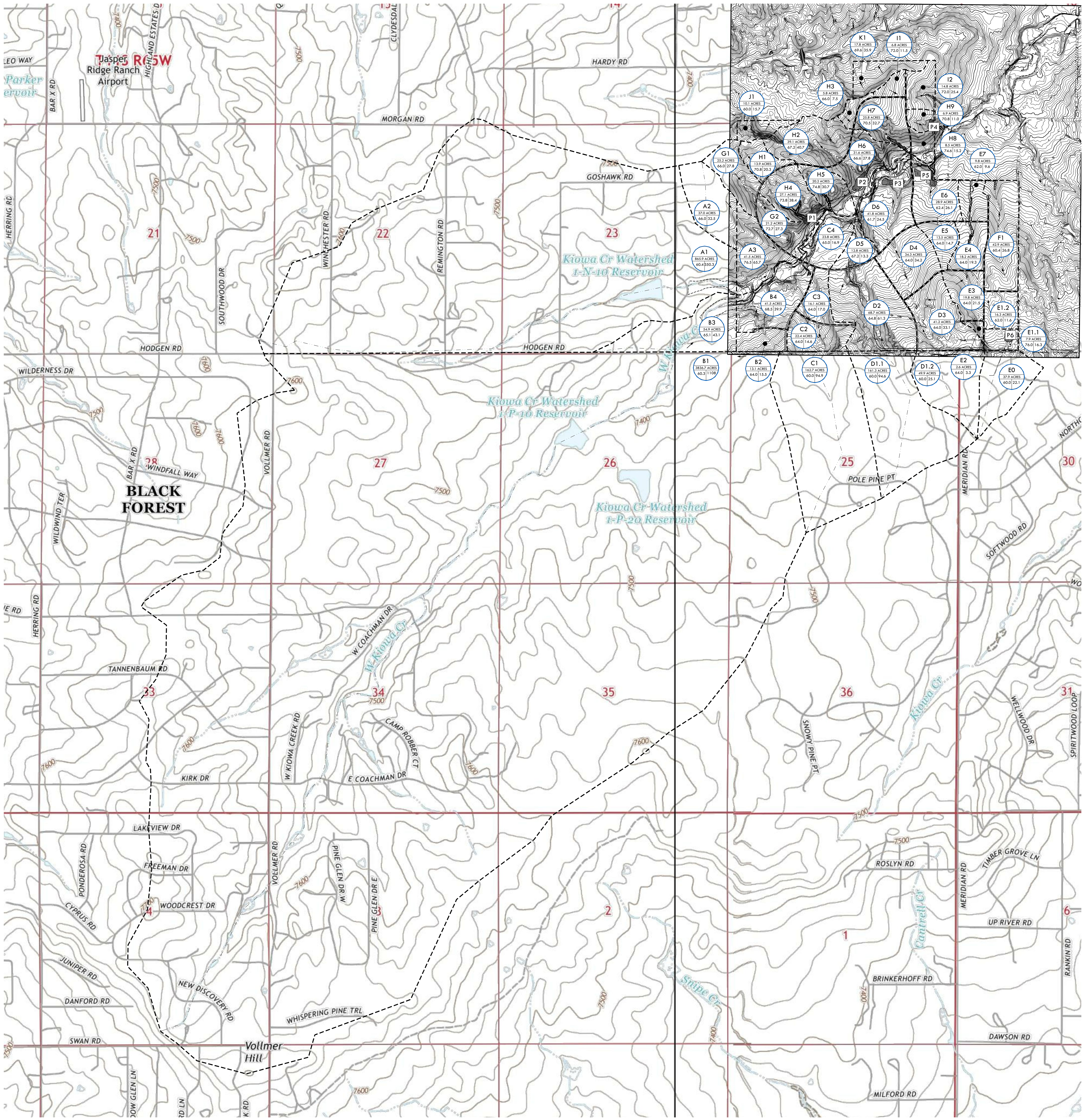
PCD FILE NO SP-18-006

PRELIMINARY PLAN SET

WINSOME SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

0' 1000' 2000'



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PROPOSED STORMWATER RUNOFF

BASIN	BASIN AREA (ACRES)	CURVE NUMBER	Q_{100}
A1	865.9	60.4	350.3
A2	37.0	66.0	32.5
A3	41.5	76.5	65.7
B1	3836.7	60.3	1107.9
B2	13.1	64.0	15.5
B3	54.9	65.1	43.1
B4	41.5	68.5	39.9
C1	162.7	60.0	94.9
C2	22.4	64.0	14.6
C3	16.1	64.0	17.0
C4	23.8	65.0	16.9
D1.1	161.3	60.0	94.6
D1.2	49.9	60.0	25.1
D2	68.7	64.8	61.3
D3	41.2	64.0	33.1
D4	34.3	64.0	34.2
D5	12.8	67.2	13.3
D6	41.8	61.7	24.5
E0	37.9	60.0	22.1
E1.1	7.9	76.0	16.3
E1.2	16.3	62.0	11.6
E2	2.6	64.0	3.3
E3	19.8	64.0	21.5
E4	18.2	64.0	19.3
E5	13.5	64.0	14.7
E6	28.9	62.4	26.1
E7	9.8	62.0	9.6
F1	42.9	60.4	26.8
G1	25.2	66.0	27.8
G2	21.2	72.7	27.3
H1	13.9	70.8	20.3
H2	39.1	67.2	40.7
H3	5.8	66.0	7.5
H4	27.1	73.8	38.4
H5	20.2	74.8	30.7
H6	31.6	66.6	27.8
H7	25.8	70.5	32.7
H8	8.5	74.6	15.2
H9	6.9	70.8	11.0
I1	6.8	72.0	11.5
I2	14.8	72.0	25.4
J1	10.1	69.5	15.7
K1	17.8	76.0	35.9
	5998.2		

DETENTION POND SUMMARY

POND NUMBER	PROPOSED VOLUME	FLOW EXITING POND
1	8.0 AC-FT	31.9 CFS
2	7.4 AC-FT	35.1 CFS
3	7.1 AC-FT	126.8 CFS
4	1.5 AC-FT	30.6 CFS
5	9.7 AC-FT	120.0 CFS
6	4.0 AC-FT	18.0 CFS

LEGEND

- PROPERTY BOUNDARY LINE
- 5540 PROPOSED CONTOUR
- 5540 EXISTING CONTOUR
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN FLOW PATH

A — BASIN NAME
4.09 ACRES — DRAINAGE BASIN SIZE
14.05 — 100-YEAR RUNOFF
4.73 — CURVE NUMBER
FLOW ARROWS

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PROPOSED DRAINAGE PLAN - OVERALL

SITE: 17480 MERIDIAN ROAD ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC 1864 WOODMORE DR, SUITE 100 MONUMENT, COLORADO 80132

NO.	REVISIONS
1	1/11/19 PRELIMINARY RESUBMITTAL
2	3/8/19 PRELIMINARY RESUBMITTAL
3	4/11/19 PRELIMINARY RESUBMITTAL
4	5/10/19 PRELIMINARY RESUBMITTAL
5	5/16/19 PRELIMINARY RESUBMITTAL
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10	

DATE: 1/11/19
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

C2.1

PRELIMINARY PLAN SET

WINSOME SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

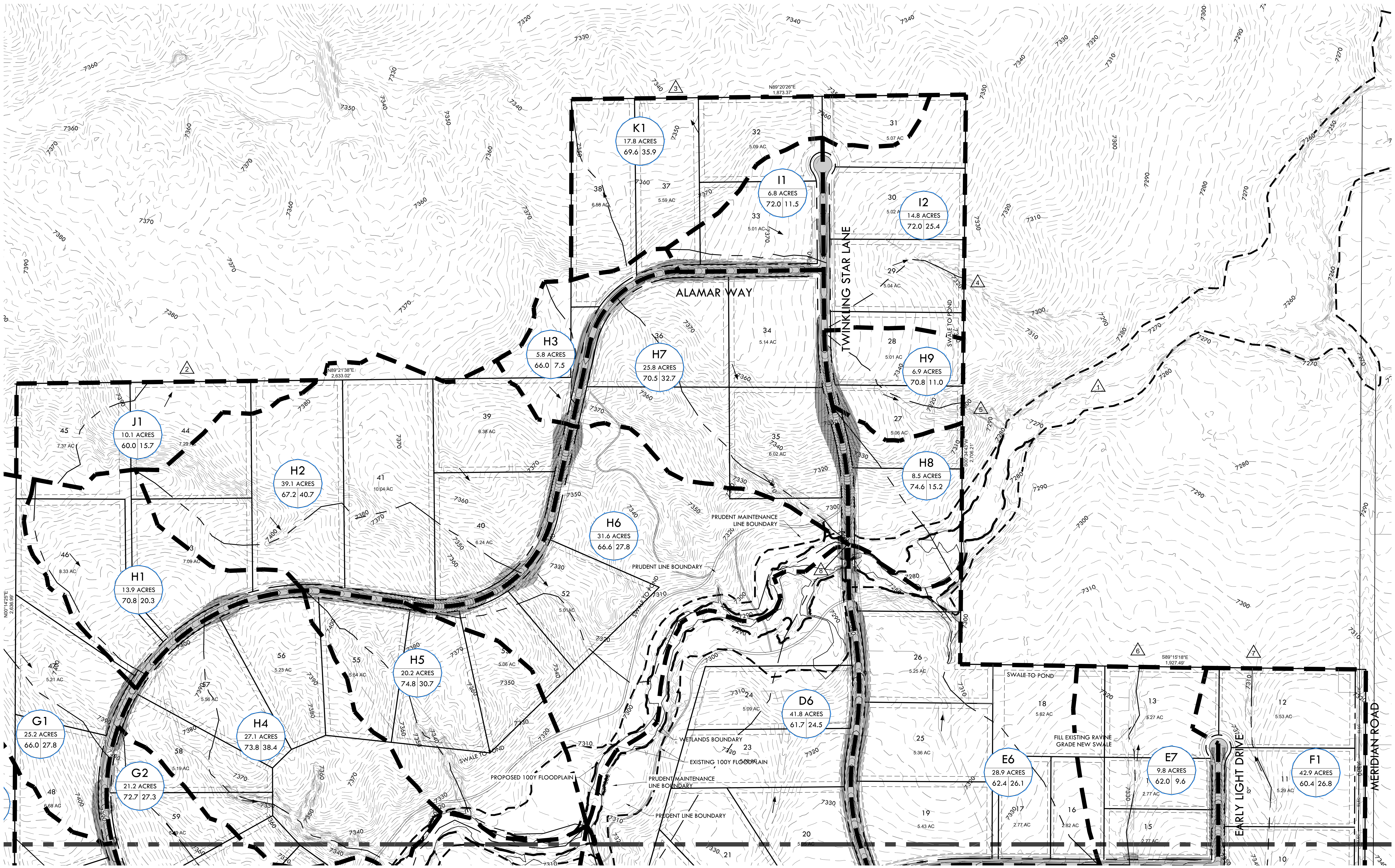
0' 200' 400'

P1	OUTFALL Q5=1.5CFS Q100=31.9CFS
P2	OUTFALL Q5=0.9CFS Q100=35.1CFS
P3	OUTFALL Q5=1.4CFS Q100=126.8CFS
P4	OUTFALL Q5=1.3CFS Q100=30.6CFS
P5	OUTFALL Q5=1.9CFS Q100=120.0CFS
P6	OUTFALL Q5=0.7CFS Q100=18.0CFS

1	MAIN OUTFALL Q5=447.4CFS Q100=2437.3CFS
2	OFFSITE FLOW Q5=3.1CFS Q100=19.9CFS
3	OFFSITE FLOW Q5=12.9CFS Q100=45.1CFS
4	OFFSITE FLOW DIRECTED TO POND P4
5	P4 OUTFALL Q5=1.3CFS Q100=30.6CFS
6	OFFSITE FLOW DIRECTED TO POND P5
7	OFFSITE FLOW DIRECTED TO POND P5
8	BOX CULVERT 2 Q100=2321.1CFS

NOTES:

1. EXISTING FLOODPLAIN AS SHOWN BASED ON FIRM MAP #08041C0350G PANEL 350 REVISED 12/7/2018, GENERATED BY GRAPHICAL OVERLAY.



MATCH LINE - SEE SHEET C2.3 - PROPOSED DRAINAGE PLAN - SOUTH

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PROPOSED DRAINAGE PLAN - NORTH

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	1/11/19 PRELIMINARY RESUBMITTAL
2	3/8/19 PRELIMINARY RESUBMITTAL
3	4/11/19 PRELIMINARY RESUBMITTAL
4	5/10/19 PRELIMINARY RESUBMITTAL
5	5/16/19 PRELIMINARY RESUBMITTAL
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10	

DATE: 1/11/19
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

C2.2

PCD FILE NO SP-18-006

PRELIMINARY PLAN SET

WINSOME SUBDIVISION

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0' 200' 400'

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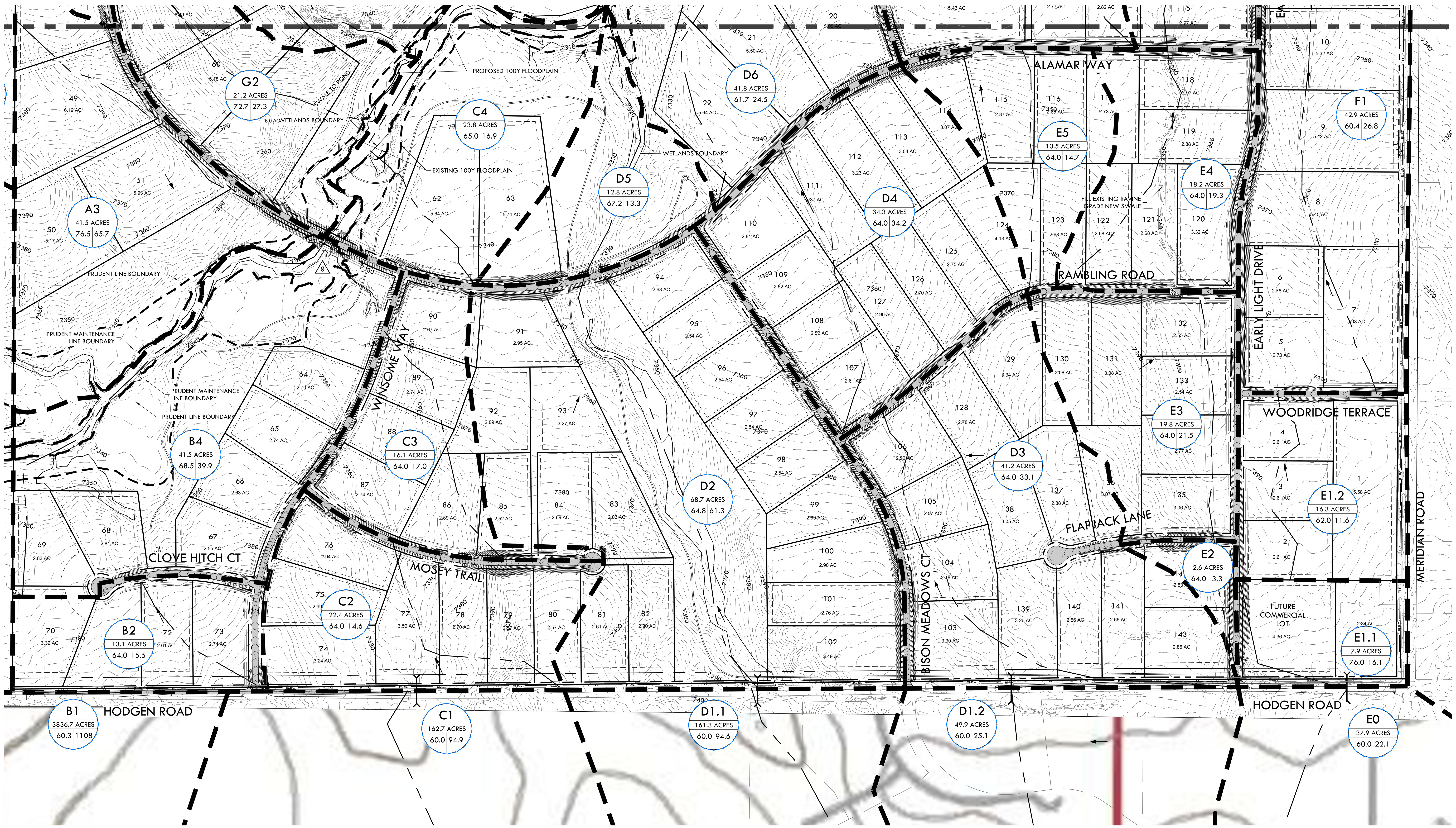
P1	OUTFALL Q5=1.5CFS Q100=31.9CFS
P2	OUTFALL Q5=0.9CFS Q100=35.1CFS
P3	OUTFALL Q5=1.4CFS Q100=126.8CFS
P4	OUTFALL Q5=1.3CFS Q100=30.6CFS
P5	OUTFALL Q5=1.9CFS Q100=120.0CFS
P6	OUTFALL Q5=0.7CFS Q100=18.0CFS
9	BOX CULVERT 1 Q100=2062.2CFS

NOTES:

1. EXISTING FLOODPLAIN AS SHOWN BASED ON FIRM MAP #08041C0350G PANEL 350 REVISED 12/7/2018, GENERATED BY GRAPHICAL OVERLAY.

MATCH LINE - SEE SHEET C2.2 - PROPOSED DRAINAGE PLAN - NORTH



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COLORADO LICENSED 43911 5/16/19

PROPOSED DRAINAGE PLAN - SOUTH

SITE: 17480 MERIDIAN ROAD ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC 1864 WOODMORE DR, SUITE 100 MONUMENT, COLORADO 80132

NO.	REVISIONS
1	1/11/19 PRELIMINARY RESUBMITTAL
2	3/8/19 PRELIMINARY RESUBMITTAL
3	4/11/19 PRELIMINARY RESUBMITTAL
4	5/10/19 PRELIMINARY RESUBMITTAL
5	5/16/19 PRELIMINARY RESUBMITTAL
6	
7	
8	
9	
10	

DATE: 1/11/19
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

C2.3

PCD FILE NO SP-18-006