MASTER DEVELOPMENT DRAINAGE PLAN

FOR

LORSON RANCH EAST
EAST OF THE EAST TRIBUTARY OF JIMMY CAMP CREEK

PUDSP-16-003

JUNE 30, 2017

Prepared for:

Lorson, LLC
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Project No. 100.013

CORE
ENGINEERING GROUP

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ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

Richard L. Schindler, P.E. #33997 Date

OWNER'S STATEMENT

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

Lorson, LLC

Business Name Date

By

Jeff Mark, Manager

Title

212 North Wahsatch Avenue, Suite 301

Address

Colorado Springs, Colorado 80903

FLOODPLAIN STATEMENT

To the best of my knowledge and belief, this development is located within a designated floodplain as shown on Flood Insurance Rate Map Panel No. 08041C0957 F and 08041C1000 F, dated March 17, 1997 and modified by modified per LOMR Case No. 14-08-0534P. (See Appendix A, FEMA FIRM Exhibit)

Richard L. Schindler, #33997 Date

EL PASO COUNTY

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual, Volume 1 and 2, and Engineering Criteria Manual, As Amended.

Jennifer Irvine Date
County Engineer/ECM Administrator

delete or reword (not partially adopted, but allowed for concept)

1.0 INTRODUCTION

Purpose and Scope

The purpose of this Master Development Drainage Plan (MDDP) is to provide an overview of the overall drainage impacts/mitigation due to development in the proposed Lorson Ranch East development located to the east of the East Tributary of Jimmy Camp Creek (hereafter referred to as the East Tributary). The study area of this report is approximately 790 acres. See ***Appendix A*** for vicinity map.

A Drainage Basin Planning Study (DBPS) has been approved by the City of Colorado Springs and partially approved for the entire Jimmy Camp Creek Basin, including the East Tributary prepared by Kiowa Engineering [7]. Lorson Ranch East will meet the requirements of the Kiowa DBPS. See the East Tributary section of this report for discussion on the status of the East Tributary.

There is an existing (unapproved) DBPS for Jimmy Camp Creek prepared by Wilson & Company in 1987 [3], which is referenced in this report but the use of the report has been limited since it was never officially adopted and has been superseded by the Kiowa Engineering DPBS partially adopted by El Paso County.

There is very little offsite runoff from the north which will be routed through this site to the East Tributary as in existing conditions. On site runoff will be conveyed to the East Tributary through a system of swales, constructed streets, ponds, inlets, culverts, and storm sewers. Detention basins are strategically located to reduce developed runoff into the East Tributary at a rate equal to or less than existing conditions. Detention ponds will comply with current county requirements which include full spectrum detention.

Other than flows actually conveyed by the East Tributary...

A few small sub basins flow offsite on the south side of Lorson Ranch will be detained in individual ponds and released offsite at a rate equal to or less than existing conditions and at the historic location. For these basins that flow offsite there is a possibility of extending storm sewer to intercept the runoff which will be discussed in this report.

in a historic manner

Property Location and Description

The proposed 790 acre portion of the Lorson Ranch development herein referred to as Lorson Ranch East is located east of the East Tributary of Jimmy Camp Creek (hereafter referred to as the East Tributary), which flows from the north in a southwesterly direction through the property. The portion of the property addressed with this report is bounded on the west by East Tributary and on the east by existing ranch land and the future Meridian Road. The property is bounded on the north by Banning Lewis Ranch, Rolling Hills Ranch and on the south by Peaceful Valley Estates (a residential subdivision and golf course within El Paso County and an undeveloped land which is currently used for farming and ranching.

by the developer

A previous Master Development Drainage Plan was created and approved by El Paso County (November 2006) for the portion of the Lorson Ranch development that exists between the main channel of Jimmy Camp Creek and the East Tributary.

The East Tributary of Jimmy Camp Creek enters the site at the center of the northern boundary and flows south. In the southern portion of the site it turns west then turns south again before it connects to the main channel of Jimmy Camp Creek, approximately 1,300 feet south of Peaceful Valley Road. The confluence of the East Tributary with the main channel is south of and offsite the Lorson Ranch.

delete or reword (not partially adopted, but allowed for concept)

The legal description for the Lorson Ranch property is:

The Lorson Ranch Development is located within portions of the north half of Section 23, the north half of Section 24, the south half of Section 13, the south half of Section 14 and the northeast quarter of Section 22, all in Township 15 South, Range 65 West of the 6th Principal Meridian, east of the county road known as Marksheffel Road, except any portion of said northeast quarter within the plat of Brownsville Subdivision No. 2 as recorded in plat book H-6 at page 81 of the County of El Paso, State of Colorado Records. The total site consists of 1,361.4 acres, more or less all in Township 15 South, Range 65 West of the 6th Principal Meridian, County of El Paso, State of Colorado. This report addresses only 790 acres east of the East Tributary of Jimmy Camp Creek (Lorson Ranch East).

(fees were not calculated for El Paso County)

Conformance with applicable Drainage Basin Planning Studies

There is an existing (unapproved) DBPS for Jimmy Camp Creek prepared by Wilson & Company in 1987, adopted by El Paso County, and is referenced in this report. The only major drainage improvements for this study area according to the 1987 Wilson study was the reconstruction of the East Tributary of Jimmy Camp Creek (East Tributary). In 2014 a portion of the East Tributary was reconstructed from Fontaine Boulevard south 2,800 feet in accordance with the 1987 study. This section of the East Tributary included a trapezoidal channel section with 6:1 side slopes and a sand bottom. On March 9, 2015 a new DBPS for Jimmy Camp Creek and the East Tributary was completed by Kiowa Engineering. The Kiowa Engineering DPBS has been adopted by the City of Colorado Springs and partially adopted by El Paso County for the entire Jimmy Camp Creek Basin, including the East Tributary and the full spectrum detention pond requirements. El Paso county has not approved the drainage fees detailed in the Kiowa DBPS so current county drainage/bridge fees apply to this development. Per the Kiowa DBPS the preferred channel improvements include selective channel armoring with a low flow channel for the East Tributary. All remaining channel improvements are reimbursable against drainage fees for future development within the study area. The only major infrastructure not shown in the Kiowa DBPS is the future bridge for Fontaine Boulevard and Lorson Boulevard on the East Tributary. The Fontaine Boulevard bridge is considered to be reimbursable since it is shown on the El Paso County 2060 Major Thoroughfare Plan as a Principal Arterial roadway. Lorson Boulevard bridge is not considered reimbursable.

S

see below

Reconstruction of the East Tributary of Jimmy Camp Creek

The Kiowa DBPS shows the East Tributary to be protected using selective armoring (soil rip rap) at the outside stream bends (500' minimum radius) and a stabilized low flow channel. The East Tributary can be divided into three different sections, south, middle, and north. The first section (south) is from the south property line east and north to design point ET-3 (see drainage map) and is roughly 2,900 feet in length. The south section does not have any development located next to it at this time and will be armored per the Kiowa DBPS in the future as development occurs. During site visits with ACOE (Van Truan) and El Paso County Staff (Rich Harvey) it was discussed that the south section may be a good candidate to eliminate the stabilized low flow channel because of the large amounts of existing vegetation have already stabilized the low flow channel. The vegetation in this section is much more robust than the northern sections since it is supported by a higher groundwater table. The final design plans will further evaluate the low flow channel alternate. The 100-year flow rate for design is 5,500cfs. A CLOMR is not necessary for constructing the improvements in the south section

reimbursable in accordance with adopted DBPS -- improvements from the new DBPS need to go through the process

because there are no proposed bridge crossings or channel re-alignment. The middle section is from Design Point ET-3 north 2,800 feet to the future extension of Fontaine Boulevard. The channel for this section was reconstructed and stabilized in 2014 in accordance with the 1987 Wilson DBPS. The only infrastructure left to construct are the bridges over the creek at Fontaine Boulevard and Lorson Boulevard. LOMR Case No. 14-08-0534P was approved by FEMA for this middle section. The northern section is from Fontaine Boulevard and extends north to the north property line. The north section will be protected per the Kiowa DBPS during the first phase of development east of the East Tributary. The channel consists of a stabilized low flow channel and soil rip rap armored outer bends. Kiowa Engineering has submitted construction plans to El Paso County for this section of creek including bridges for Lorson Boulevard and Fontaine Boulevard. A CLOMR for the creek and bridge construction is currently submitted to FEMA. The 100-year flow rate for design is 4,750cfs for this section.

in conformance with (?)

2.0 DRAINAGE DESIGN CRITERIA

The supporting drainage design and calculations were performed in accordance with the City of Colorado Springs/El Paso County Drainage Criteria Manual DCM dated 1994; and Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014.

The proposed improvements to the Lorson Ranch Development will be in substantial compliance with the "Jimmy Camp Creek Drainage Basin Planning Study", dated March 9, 2014 prepared by Kiowa Engineering, which has been adopted by El Paso County excluding the drainage fees.

see previous comments

The Rational Method as outlined in Section 3.2.7.F of the El Paso County "Engineering Criteria Manual" [5] was used for basins less than 100 acres to determine the rainfall and runoff conditions for the proposed development of the site. The soil Conservation Service (SCS) Hydrograph Procedure as outlined in the same section was used for basins larger than 100 acres to determine the rainfall and runoff conditions for the proposed development of the site. The runoff rates for the 5-year initial storm and 100-year major design storm were calculated.

Current updates to the Drainage Criteria manual for El Paso County states when detention is necessary, Full Spectrum Detention will be included in the design. Based on this criteria, Full Spectrum Detention will be required for this development

3.0 EXISTING HYDROLOGICAL CONDITIONS

The site is located within the Jimmy Camp Creek Drainage Basin. The roughly 43,000-acre (66.9 square miles) basin is located within unincorporated El Paso County, the City of Colorado Springs, and the City of Fountain, Colorado. The "Jimmy Camp Creek Drainage Basin Planning Study" [7] establishes drainage guidelines and mitigation for development within the Jimmy Camp Creek Drainage Basin. This report has been adopted by the City of Colorado Springs and by El Paso County excluding drainage fees. El Paso County has yet to adopt the drainage fee portions of the DBPS.

see previous comments

The area that is the subject of this Master Development Drainage Plan covers approximately 808 acres of undeveloped land (790 acres onsite) that has recently been used for agriculture and grazing, and is currently zoned as RRS (rural residential district). The land east and south of the East Tributary consists of hilly terrain with slopes up to 12%.

bedrock

The Soil Conservation Service (SCS) classifies the soils within the Lorson Ranch East property as Ascalon sandy loam; Manzanola clay loam; Nelson-Tassel fine Sandy loam; Razor clay loam; and Wiley silt loam (13%) [3]. The sandy and silty loams are considered hydrologic soil group B soils with moderate to moderately rapid permeability. The Razor clay loams are considered hydrologic soil group C soils with slow permeability. All of these soils are susceptible to erosion by wind and water, have low bearing strength, moderate shrink-swell potential, and high frost heave potential (see table 3.1 below). The clay loams are difficult to vegetate and comprise of a small portion of the study area. These soils can be mitigated easily by limiting their use as topsoil since they comprise of a small portion of the study area. Weathered will be encountered beneath some of the site but it can be excavated using conventional techniques.

Table 3.1: SCS Soils Survey

Soil	Hydro. Group	Shrink/Swell Potential	Permeability	Surface Runoff Potential	Erosion Hazard
2-Ascalon Sandy Loam - (4%)	B	Moderate	Moderate	Slow to Medium	Moderate
3-Ascalon Sandy Loam - (9%)	B	Moderate	Moderate	Slow to Medium	Moderate
52-Manzanola Clay Loam (17%)	C	High	Slow	Medium	Moderate
54-Midway Clay Loam (3%)	D	High	Slow	Medium	Moderate
56-Nelson – Tassel Fine Sandy Loam (50%)	B	Moderate	Moderately Rapid	Slow	Moderate
75-Razor Clay Loam (10%)	C	High	Slow	Medium	Moderate
104-Vona Sandy Loam (1%)	B	Low	Moderate	Slow	Moderate
108-Wiley Silt Loam (13%)	B	Moderate	Moderate	Medium	Moderate

Excerpts from the SCS "Soil Survey of El Paso County Area, Colorado" [2] are provided in ***Appendix A*** for further reference.

For the purpose of preparing hydrologic calculations for this report, the soil of each basin are assumed to be wholly comprised of the majority soil hydrologic group.

An existing electrical easement, within existing transmission towers, runs through the center of this portion of the development and will be set aside as open space in the future. It is the intent of this drainage plans to utilize some of the open space under the towers for detention of developed storm flows.

The FMIC (irrigation canal) that runs parallel with the East Tributary through this site was decommissioned in 2006 and for the purpose of existing drainage calculations the canal was ignored and all flow was assumed to flow to the East Tributary.

Portions of the site are located within the delineated 100-year floodplain of the East Tributary of Jimmy Camp Creek per the Federal Emergency Management Agency (FEMA) Flood Rate Insurance Map (FIRM) number 08041C0957 F & 08041C1000 F, effective 17 March 1997 [2]. Floodplain along the East Tributary middle section was modified per LOMR Case No. 14-08-0534P (see appendix). Floodplain designations include Zone AE and Zone X within the property boundary. A portion of this map is provided in ***Appendix A*** for reference.

The existing drainage area of this MDDP has been divided into major basins and numerous smaller sub basins. The majority of the area drains naturally to the East Tributary, with some smaller basins flowing offsite to the east and south, and north. See the map pocket in the rear of this report for the existing conditions map. The rational method was used to estimate the runoff from each basin for both 5-year and 100-year storm events except for the three (3) basins which are larger than 100 acres where the SCS method was utilized (see ***Appendix B*** for calculation and break out of the sub basins). Following is a description of the Existing Major Basins:

Basin EX-A1

This 4.28 acre basin is in the northwest corner of the site and includes part of the East Tributary. Under existing conditions, this area contributes 1.1 cfs and 8.0 cfs to the East Tributary for 5-year and 100-year events respectively. This basin comprises of the East Tributary and will not be developed in the future.

Overall Basin EX-B flows to Design Point 1

This 20.06 acre basin is the northeast corner of the site and includes off-site flows from the east (Basin OS-B1), on-site flows (Basin B1.1). All runoff flows overland to the northwest to the East Tributary. The calculated existing flows are 10.5 cfs and 58.8 cfs for the 5-year and 100-year storm events respectively and drain overland.

Overall Basin EX-C flows to Design Point 2

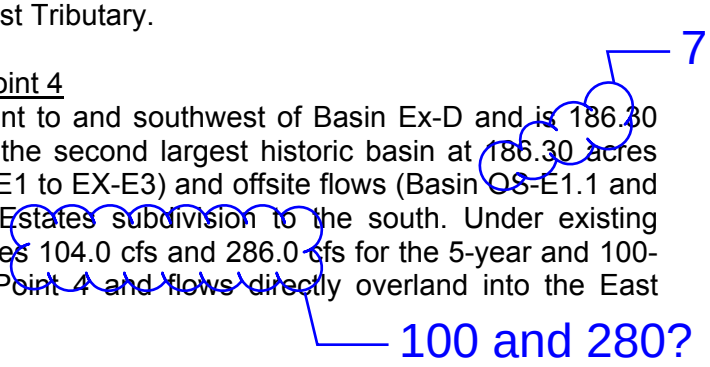
This is the largest existing basin at 452.97 acres which includes approximately the northern half of the site. This basin is an overall existing basin including Basins EX-C1 to EX-C10. There are two offsite basins (OS-C6.1 and OS-C5.1) which flow onto the site from the north and east and are included in the flow at Design Point 2. Under existing conditions, this basin contributes 141.0 cfs and 458.0 cfs for the 5-year and 100-year events respectively at Design Point 2. Design Point 2 is located at the East Tributary and all flow is routed to the East Tributary in an existing swale that is eroded and is not armored.

Overall Basin EX-D flows to Design Point 3

Overall Basin EX-D is located adjacent to and southwest of Basin Ex-C and is 109.55 acres in size. This basin is an overall existing on-site basin. The existing runoff of 29.7cfs and 166.5cfs for the 5-year and 100-year events at Design Point 3 respectively and flows directly overland into the East Tributary.

Overall Basin EX-E flows to Design Point 4

Overall Basin EX-E is located adjacent to and southwest of Basin Ex-D and is 186.30 acres in size. Overall Basin EX-E is the second largest historic basin at 186.30 acres and includes on-site flow (Basins EX-E1 to EX-E3) and offsite flows (Basin OS-E1.1 and OS-E2.1) from the Peaceful Valley Estates subdivision to the south. Under existing conditions, this overall basin contributes 104.0 cfs and 286.0 cfs for the 5-year and 100-year events respectively at Design Point 4 and flows directly overland into the East Tributary.



Basin EX-F flows to Design Point 5

This 39.85 acre basin flows offsite to the east toward the future Meridian Road. This basin is an overall existing on-site basin including Basins EX-F1 to EX-F2. The existing runoff is 19.3 cfs and 113.7 cfs for the 5-year and 100-year events respectively.

Basin EX-G-Design Point 6

Basin Ex-G is relatively small basin of 14.91 acres in the southeast portion of the site and flow south overland offsite to the Peaceful Valley Lake Estates subdivision. The existing flows are 7.9cfs and 44.1cfs for the 5-year and 100-year storm events respectively.

Basin EX-H-Design Point 7

This 28.13 acre basin flows offsite overland to the south onto the adjacent subdivision. The existing flows are 12.3cfs and 73.2cfs for 5-year and 100-year events respectively.

Overall Basin EX-I flows to Design Point 8

This 32.92 acre overall basin includes on-site flow (Basins EX-I1) and offsite flows (Basin OS-I1.1) and flows directly into the East Tributary. Under existing conditions, this overall basin contributes 12.4cfs and 74.1cfs for the 5-year and 100-year events respectively at Design Point 8.

Overall Basin EX-J flows to Design Point 9

This 25.78 acre overall basin includes on-site flow (Basins EX-J1) and offsite flows (Basin OS-J1.1) and flows directly into the East Tributary. Under existing conditions, this basin contributes 9.0cfs and 55.9cfs for the 5-year and 100-year events respectively at Design Point 9.

Overall Basin EX-K flows to Design Point 10

This 7.57 acre overall basin is located in the southwest corner of the site and includes on-site flow (Basins EX-K1) and offsite flows (Basin OS-K1.1) and flows directly into the East Tributary. The existing flows are 2.1cfs and 15.2 cfs for 5-year and 100-year storm events respectively at Design Point 10.

4.0 DEVELOPED HYDROLOGICAL CONDITIONS

Under developed conditions, there will essentially be seven (7) drainage basins that will drain directly into the East Tributary and for (4) basins that could drain offsite unless directed back on-site via storm sewer. These basins closely mimic the existing drainage patterns and locations and flow rates.

The site will be divided into multiple phases with total build out in the year 2033. The proposed total build out of this portion of the development will include residential development and a school site.

The runoff coefficient of 0.49 (5-year) and 0.65 (100-year) were used to calculate developed runoff.

Fontaine Boulevard and Lorson Boulevard will extend through the development from the west as major roadways. There will also be several local and collector roads that will be constructed for access throughout the site. Only the arterial and collector streets have been shown on the plans. The proposed detention ponds, storm sewer, drainage channels, and diversion swales shown on the plan are schematic in nature and shown for information only. As more of the development is designed in greater detail, localized, detailed drainage plans will need to be created that follow the general plan set forth in this document.

As summary table of design point developed flow rates can be found on the Developed Conditions map in the back pocket of this report. The following is a description of the Developed basins and Design Points:

discuss pond concept and design

Basin A

This 2.6 acre basin is in the northwest corner of the site and includes the East Tributary. This basin consists of open space contributes 1.4 cfs and 7.7 cfs to the East Tributary for 5-year and 100-year events respectively. This basin comprises of the East Tributary and will not be developed.

Basin OS-B1

Offsite Basin OS-B1 is 5.64 acres and will flow overland onto Basin B2. Meridian Road may be constructed along the eastern border of Lorson Ranch in the future which will intercept the flows going to Basin B2. For this report the flows are assumed to flow overland to Basin B2. Assuming the runoff does reach the development it will flow onto Basin B2 and can be expected to be approximately 3.4 cfs and 19.0 cfs for the 5-year and 100-year design storms respectively.

Basin B2

This basin is located in the northeast corner of the site and consists of residential development. It is 3.9 acres and flows offsite to the northwest. The runoff for Basin B2 under developed conditions is estimated at 6.4 cfs and 14.3 cfs for the 5-year and 100-year storm events.

Overall Basin B at Design Point 1

Overall Basin B is located at the northeast corner of the site and receives offsite flow from Basin OS-B1 and Basin B2. The total flow for the basin is 8.5 cfs and 28.0 cfs for the 5-year and 100-year storm events which is less than the existing runoff. (see Design Pt. 1 in existing conditions). Developed runoff will flow offsite to the northwest as in

existing conditions. These developed flows will not need to be detained but will require water quality treatment.

Basin C1

Basin C1 consists of residential development and is located in the upstream portion of Overall Basin C. This basin is 23.2 acres and flows downstream to a low point in Lorson Boulevard and into Basin C2. The runoff under developed conditions is estimated at 34.9 cfs and 77.7cfs for the 5-year and 100-year storm events. A 36" storm sewer will be necessary to convey runoff under Lorson Boulevard into Basin C2.

Basin C2 and Design Point 2

Basin C2 consists of residential development and is located in the upstream portion of Overall Basin C. This basin is 34.5 acres and flows downstream into Pond C1. Detention Pond C1 is proposed at the downstream portion of this basin within the existing electrical transmission easement. The runoff for Basin C2 under developed conditions is estimated at 66.6cfs and 148.4 cfs for the 5-year and 100-year storm events.

The total combined flow reaching Pond C1 at Design Point 2 is from Basin C1 and C2 and is 80.1 cfs and 171 cfs for the 5-year and 100-year storm events respectively. It is estimated that a 48" storm will be necessary to convey runoff into Pond C1.

Basin C3

This is small sub basin of 8.3 acres and flows downstream north into Basin C4 at Design Point 3a. The runoff for Basin C3 under developed conditions is estimated at 13.9 cfs and 31.0 cfs for the 5-year and 100-year storm events. Runoff from this basin will be collected in storm sewer at Lorson Boulevard and will be directed west to Detention Pond C2.1.

Basin C4

This relatively large sub basin is located in the upstream portion of Basin C. The 57.5 acre basin contributes 79.7 cfs and 177.4 cfs for the 5-year and 100-year storm events. Runoff from this basin will be collected in storm sewer at Lorson Boulevard and will be directed west to Detention Pond C2.1.

Basin C5

Basin C5 is located in the upstream portion of Basin C in the northeast corner of Fontaine and Lorson Boulevards. The 25.0 acre basin contributes 42.4 cfs and 94.4 cfs for the 5-year and 100-year storm events to Design Point 3d. Runoff from this basin will be collected in storm sewer at Lorson Boulevard/Fontaine and will be directed west in Fontaine Boulevard to Detention Pond C2.2.

Basin C6

Basin C6 is located south of Fontaine Boulevard and is in the upstream portion of Basin C. Basin C6 is 18.7 acres and under developed conditions the flow is estimated to be 31.7cfs and 70.5 cfs for the 5-year and 100-year storm events respectively. Runoff will be directed to Pond C2.3. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

Design Point 3a
This design point is the total outflow flow from Pond C2.1. The total developed flow is 11.0cfs and 65.0 cfs for the 5-year and 100-year storm events.

flowing to Pond C2.3?

Design Point 3b
This design point is the total inflow to Pond C2.3. Runoff at this design point is from Design Point 3a and Basin C6. The total developed flow is 46.3cfs and 111.0 cfs for the 5-year and 100-year storm events at Design Point 3b. Runoff from this basin will be collected in storm sewer and will be directed to Detention Pond C2.3. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

Design Point 3c
This design point is the total outflow flow from Pond C2.3. The total developed flow is 4.0cfs and 46.0 cfs for the 5-year and 100-year storm events.

Is Pond C2.1 release (65 cfs) flowing through this pond?

Basin C7
Basin C7 is located north of Fontaine Boulevard and is in the upstream portion of Basin C. Basin C7 is 14.5 acres and under developed conditions the flow is estimated to be 26.4 cfs and 58.9 cfs for the 5-year and 100-year storm events respectively. Runoff will be directed to Pond C2.2.

Basin OS-C9.1
Offsite Basin OS-C9.1 is 3.59 acres and will flow overland onto Basin C8. Meridian Road may be constructed along the eastern border of Lorson Ranch in the future which will intercept the flows going to Basin C8. For this report the flows are assumed to flow overland to Basin C8. Assuming the runoff does reach the development it will flow onto Basin C8 and can be expected to be approximately 4.0 cfs and 10.6 cfs for the 5-year and 100-year design storms respectively.

Basin C8
Basin C8 is located north of Fontaine Boulevard and is in the northeast portion of Basin C. Portions of the northeast corner of this basin will be graded so the runoff flows southwest instead of north to Basin B. This grading will reduce the runoff flowing offsite into Basin B. Basin C8 is 74.5 acres and under developed conditions the flow is estimated to be 119.3 cfs and 265.5 cfs for the 5-year and 100-year storm events respectively at Design Point 5 flowing into Pond C4.

add Pond C4 outflow rates

Basin C8a
Basin C8a is located east of Pond C3. Basin C8a is 11.7acres and under developed conditions the flow is estimated to be 22.0 cfs and 49.0 cfs for the 5-year and 100-year storm events respectively. Runoff will be directed to Pond C3.

Basin OS-C9
Sub Basin OS-C9 is 5.2 acres and will flow into Basin C10 and Lorson Boulevard. The runoff for sub Basin OS-C9 is estimated at 10.1 cfs and 22.4 cfs for the 5-year and 100-year storms respectively.

Basin C10
Basin C10 is a 13.0 acre basin is located in the north portion of Basin C and accepts offsite flow from Basin OS-C9. Runoff flows south to Lorson Boulevard and then to a

low point in Lorson Boulevard at Design Point 4. The on-site developed flows this basin are 22.8 cfs and 50.7 cfs for the 5-year and 100-year events respectively.

add the inflow values

Design Point 4
This design point is located at a low point in Lorson Boulevard (north of Fontaine Blvd.) and is the total flow into Pond C3. Runoff at this design point is from Basin C8a, OS-C9, C10, and from Pond C4. The total developed flow is 51.6cfs and 134.0 cfs for the 5-year and 100-year storm events into Detention Pond C3. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

discuss overflow path for developed flows

Design Point 3d
This design point is the total flow into Pond C2.2 (24" storm sewer outfall) from Basin C5, C7, and Pond C3. The total developed flow is 70.0cfs and 138.0cfs for the 5-year and 100-year storm events. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

add the inflow values

Design Point 3e
This design point is the total outflow flow from Pond C2.2. The total developed outflow is 6.0cfs and 40.0 cfs for the 5-year and 100-year storm events.

Discuss pond designs and modeling ponds in series.

Design Point 3f
This design point is the total flow in a storm sewer in Fontaine Boulevard consisting of Pond C2.3 outflow, Pond C2.2 outflow, and Pond C1 outflow. The total developed flow is 14.0cfs and 104.0cfs for the 5-year and 100-year storm events in the pipe.

Basin C12
Basin C12 is a 19.6 acre basin is located to the east of the school site and south of Lamprey Drive (collector road). The developed flows from this basin are 33.0cfs and 73.5cfs for the 5-year and 100-year events respectively. Flows will be directed north in streets/storm sewer to Lamprey Drive. A 30" storm sewer at 1% will flow west in Lamprey Drive to Design Point 6a. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

Basin C13
Basin C13 is a 21.2 acre basin is the majority of the school site. The school site will be required to detain developed flows within the basin. Stormwater quality will be provided for this basin in Pond C5. The allowable runoff from this basin is limited to existing conditions and is 7.6 cfs and 40.5 cfs for the 5-year and 100-year events respectively. Flows will be directed west within the basin to Design Point 6b where a 30" storm sewer stub will be located.

Basin C14
Basin C14 is a 11.1acre basin that contains a portion of the school site and Fontaine Boulevard that drains south to Fontaine Boulevard. Approximately 4.0acres of the school site is allowed to direct runoff to Fontaine Bouelvard but must be detained to existing flows within the school site. The allowed runoff from Basin C14 is 16.6cfs and 37.0 cfs for the 5-year and 100-year events respectively.

Basin C15

Basin C15 is a 40.2 acre basin is located south of Fontaine Boulevard, east of Lamprey Drive, and west of Pond C1. The developed flows from this basin are 57.6 cfs and 128.3cfs for the 5-year and 100-year events respectively. Flows from this basin will be directed north to Design Point 7 in a 42" storm sewer at 2.4% slope. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

Basin OS-C11

Offsite Basin OS-C11 is 5.6 acres and will flow overland west directly to the East Tributary of Jimmy Camp Creek in a swale. The runoff for sub Basin OS-C11 is estimated at 10.2 cfs and 22.7 cfs for the 5-year and 100-year storms.

show on plan

Basin C16a

Basin C16a is a 21.29 acre basin is located north of Lamprey Drive and flows to Design Point 6a. The developed flows from this basin are 35.1 cfs and 78.3 cfs for the 5-year and 100-year events respectively. Flows from this basin will be directed south to Design Point 6a. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

Design Point 6a

Design Point 6a is located in the southwest corner of Basin C16a and flows are from Basin C16a Basin C12. The developed flows are 68.1cfs and 151.8cfs for the 5-year and 100-year events respectively. Flows will be directed west in Lamprey Drive via streets/storm sewer to Design Point 6c located next to Pond C5. A 42" storm sewer at 1.0% will flow west in Lamprey Drive to Design Point 6c. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

Design Point 6b

Design Point 6b is located on Lamprey Drive and flows are from Design Point 6a and Basin C12. The developed flows are 75.7cfs and 192.3cfs for the 5-year and 100-year events respectively. Flows will be directed west in Lamprey Drive via streets/storm sewer to Design Point 6c located next to Pond C5. A 54" storm sewer at 1.0% will flow west in Lamprey Drive to Design Point 6c. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

from Lamprey Dr.?

Basin C16b

Basin C16b is a 32.23 acre basin is located north of Fontaine Boulevard, east of Pond C5, and west of Lamprey Drive and flows to Design Point 6c. The developed flows from this basin are 55.6cfs and 123.8cfs for the 5-year and 100-year events respectively. Flows from this basin will be directed to Design Point 6c. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

Design Point 6c

Design Point 6c is located east of Pond C5 and is the flow from the C16 basins, C12, and C13. The developed flows are 90.0cfs and 222.0cfs for the 5-year and 100-year events respectively. Flows will be directed west into Pond C5 in a 66" storm sewer. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

Design Point 7
This design point is the total flow in a storm sewer in a low point in Lamprey Drive and Fontaine Boulevard. The total developed flow is 88.0cfs and 270.0cfs for the 5-year and 100-year storm events and flows west in Fontaine Boulevard to Design Point 7a in a 60" storm sewer at a 1.0% grade. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

Basin C17
Basin C17 is a 22.7acre basin that contains portions of Fontaine Boulevard, and residential areas south of Fontaine Boulevard. The developed flows from this basin are 31.7cfs and 70.6cfs for the 5-year and 100-year events respectively. Flows from this basin will be directed north to Design Point 7a.

Design Point 7a
Design Point 7a is located on Fontaine Boulevard south of Pond C5. Flows at this design Point are from Design Point 7 and Basin C17 and is the flow into Pond C5 from the south. The developed flows are 114.0 cfs and 337.0 cfs for the 5-year and 100-year events respectively. A 60" storm sewer at 1.0% will flow north to Pond C5. When the future preliminary drainage report for this area is prepared the actual street flows and storm sewer capacities will need to be verified.

Design Point 7b
Design Point 7b is the total inflow into Pond C5. The developed flows are 204 cfs and 484 cfs for the 5-year and 100-year events respectively.

Discuss pond design, add contributing acreage

Design Point 7c
Design Point 7c is the total outflow from Pond C5. The developed flows are 121.0 cfs and 420.0 cfs for the 5-year and 100-year events respectively and flow west into the East Tributary. These flows closely mimic the existing conditions flows into the East Tributary. See Table 6.2 for a comparison of existing versus develop runoff to the East Tributary.

==========“D” BASINS==========

Basin D1
This 17.0 acre basin consists of residential development and Lorson Boulevard that flows to Pond D1 south of Lorson Boulevard. The developed flows from this basin are 32.0 cfs and 71.1cfs for the 5-year and 100-year events respectively.

Basin D2
This 8.0 acre basin consists of residential development and flows south to Design Point 8 in Lorson Boulevard. The developed flows from this basin are 16.0 cfs and 35.5cfs for the 5-year and 100-year events respectively.

Discuss pond D1 design

Design Point 8
This design point is in Lorson Boulevard just east of Lamprey Drive. Flows are from Basin D2 and Pond D1 outflow. The developed flows from this basin are 18.0cfs and 46.0cfs for the 5-year and 100-year events respectively. A 30" storm sewer is needed to convey flows to Pond D2

Basin D3 - Design Point 9a
This 23 acre basin consists of residential development and flows north to Pond D2. The developed flows from this basin are 38.0cfs and 84.5 cfs for the 5-year and 100-year events respectively.

Basin D4 - Design Point 9b
This 36.4 acre basin consists of residential development and flows west to Design Point 9b just east of Pond D2. The developed flows from this basin are 61.7 cfs and 137.5 cfs for the 5-year and 100-year events respectively.

Basin D5
Basin D5 is a 4.6 acre basin that contains Pond D2, portions of Lorson Boulevard, and residential areas. The developed flows from this basin are 7.5cfs and 20.6 cfs for the 5-year and 100-year events respectively. Flows from this basin will be directed to Pond D2.

Design Point 10a
This design point is the total flow into Pond D2 from Design Points 8, 9a, 9b and Basin D5. The developed flow at this design point is 106.0 cfs and 243.0cfs for the 5-year and 100-year events respectively.

Discuss pond D2 design

Design Point 10b
This design point is the outfall of Pond D2 into the East Tributary. The developed flows at this design point are 67.0cfs and 131.2cfs for the 5-year and 100-year events respectively. These flows closely mimic the existing conditions flows into the East Tributary. See Table 6.2 for a comparison of existing versus develop runoff to the East Tributary.

==========“E” BASINS==========

Basin OS-E3
Offsite Basin OS-E3 is 9.90 acres and consists of runoff from the Peaceful Valley Lake Estates 1st Filing which is an existing residential large lot subdivision consisting of 2.5acre to 5acre lots. The runoff will flow overland onto Lorson Ranch into Basin E4 where it will be conveyed to Pond E3 and the East Tributary. Runoff from Basin OS-E3 is 9.2cfs and 32.7cfs respectively for the 5-year and 100-year storm events.

Basin OS-E6
Offsite Basin OS-E6 is 21.1 acres and consists of runoff from the Peaceful Valley Lake Estates 1st Filing which is an existing residential large lot subdivision consisting of 2.5acre to 5acre lots. The runoff will flow overland onto Lorson Ranch into Basin E7 where it will be conveyed to Pond E3 and the East Tributary. Runoff from Basin OS-E6 is 18.4cfs and 65.3cfs respectively for the 5-year and 100-year storm events.

Basin OS-E9
Offsite Basin OS-E9 is 46.9 acres and consists of runoff from the Peaceful Valley Lake Estates 1st Filing which is an existing residential large lot subdivision consisting of 2.5acre to 5acre lots. The runoff will flow overland onto Lorson Ranch into Basin E10-E11 where it will be conveyed to Pond E3 and the East Tributary. Runoff from Basin OS-E9 is 15.2 cfs and 102.0 cfs respectively for the 5-year and 100-year storm events.

Basin E1
This 10.2 acre basin is located in the upstream portion of Basin E. The developed flows from this basin are 18.5cfs and 41.1 cfs for the 5-year and 100-year events respectively. Flows from both Basins E1 will be directed to Pond E1 via storm sewer.

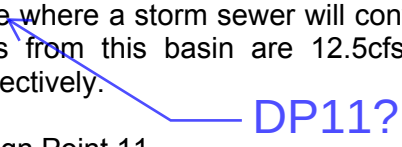
Basin E2
This 10.3 acre basin is located directly north of Basin E1. The developed flows from this basin are 19.9cfs and 44.3cfs for the 5-year and 100-year events respectively. Detention Pond E1 is proposed downstream of this basin within the existing electrical transmission easement.

Basin E4
This 12.8 acre basin is located just to the west of Basin E1 and flows north to Trappe Drive and then to Pond E1. The developed flows from this basin are 23.6cfs and 52.5cfs for the 5-year and 100-year events respectively.

Basin E5
This 13.3 acre basin is located directly east of Pond E1. The developed flows from this basin are 24.4cfs and 54.3 cfs for the 5-year and 100-year events respectively.

Basins E1-E5 at Design Point 12
The total flows reaching Pond E1 at Design Point 12 from basins E1-E5 is 88.7 cfs and 209.5 cfs for the 5-year and 100-year storm events respectively.

Basin E7
This 6.7acre basin is located directly south of Basin OS-E6 and flows west to Trappe Drive where a storm sewer will convey the flow west to Design Point 13. The developed flows from this basin are 12.5cfs and 27.9cfs for the 5-year and 100-year events respectively.



Design Point 11
This design point is located on Trappe Drive where a 48" storm sewer will convey the flow west to Design Point 13. The developed flows from this basin are 26.2cfs and 89.8cfs for the 5-year and 100-year events respectively.

Basin E8
This 21.6acre basin is located directly north of Basin E7 and flows south and west to Trappe Drive where a storm sewer will convey the flow west to Design Point 13. The developed flows from this basin are 35.4cfs and 78.8 cfs for the 5-year and 100-year events respectively.

Design Point 13
This design point is located at a low point on Trappe Drive where a 48" storm sewer will convey the flow south to Design Point 14 and Pond E2 The developed flows at this design point are 78.0cfs and 205.0cfs for the 5-year and 100-year events respectively.

Design Point 14
This design point is the total inflow to Pond E2 including the significant offsite areas in Basin OS-E6 and OS-E9. The developed flows at this design point are 190.0cfs and 423.0 cfs for the 5-year and 100-year events respectively.

Design Point 14a

This design point is the total outflow from Pond E2 into the East Tributary. The pond outflow at this design point is 97.0cfs and 260.0cfs for the 5-year and 100-year events respectively. These flows closely mimic the existing conditions flows into the East Tributary. See Table 6.2 for a comparison of existing versus develop runoff to the East Tributary. This pond will only include water quality for development within Lorson Ranch.

full-spectrum sizing is based on contributing impervious area

==========" F, G, H, I, J, K " BASINS==========

Basin F at Design Point 15

This 33.0 acre basin is located on the very east portion of the site and discharges into Pond F to the east where the future proposed Meridian Road will be constructed. The total flows reaching Pond F at Design Point 15 are 50 cfs and 111.3cfs for the 5-year and 100-year storm events respectively. These flows closely mimic the existing conditions flows offsite to the east. See Table 6.2 for a comparison of existing versus develop runoff to the East Tributary.

Discuss pond F design

Design Point 15a

Design Point 15a is the total outflow from Pond F. The developed flows are 3.5 cfs and 41.0 cfs for the 5-year and 100-year events respectively and flow west into the East Tributary. These flows closely mimic the existing conditions flowing east. Table 6.2 for a comparison of existing versus develop runoff to the East Tributary.

where?

Basin G-Design Point 16

This basin is located in the southeast corner of the study areas. It is 20.05 acres in size and contributes flows offsite. Detention Pond G is proposed near the southern boundary of the property and will be utilized to reduce the runoff to less than pre-development rates. The total flows reaching Pond G at Design Point 16 are 36 cfs and 80.2cfs for the 5-year and 100-year storm events respectively.

Discuss pond G design

Design Point 16a

Design Point 16a is the total outflow from Pond G. The developed flows are 2.0 cfs and 33.0 cfs for the 5-year and 100-year events respectively and flow south offsite. These flows closely mimic the existing conditions flowing south. See Table 6.2 for a comparison of existing versus develop runoff to the East Tributary. Since this flow is offsite is should also be designed to spread the flow onto the adjacent property and not concentrate the flow which can be accomplished using a rip rap berm. It may be possible to route the pond flow west into Pond H which should be evaluated in the preliminary design phase.

?

Basin H-Design Point 17

This basin is located in the southeast corner of the study areas. It is 22.3 acres in size and contributes flows offsite. The total flows reaching Pond H at Design Point 17 are 38.7 cfs and 86.3cfs for the 5-year and 100-year storm events respectively.

Design Point 17a

Design Point 17a is the total outflow from Pond H. The developed flows are 2.0 cfs and 35.3 cfs for the 5-year and 100-year events respectively and flow south offsite. These flows closely mimic the existing conditions flowing south. See Table 6.2 for a comparison of existing versus develop runoff to the East Tributary. Since this flow is offsite is should also be designed to spread the flow onto the adjacent property and not concentrate the flow which can be accomplished using a rip rap berm. It may be possible to route the pond flow west into Pond H which should be evaluated in the preliminary design phase.

Basin OS-I1

Offsite Basin OS-I1 is 15.96 acres and consists of runoff from the Peaceful Valley Lake Estates 1st Filing which is an existing residential large lot subdivision consisting of 2.5acre to 5acre lots. The runoff will flow overland onto Lorson Ranch into Basin I2 where it will be conveyed to Pond I and the East Tributary. Runoff from Basin OS-I1 is 14.1 cfs and 50.0 cfs respectively for the 5-year and 100-year storm events.

consisting of future residential lots?

Basin I2

Basin I2 ~~is~~ located south of the East Tributary and north of Basin OS-I1. This basin accepts runoff from Basin OS-I1 and flows north to the East Tributary. Runoff from Basin I2 is 25.2cfs and 56.1 cfs respectively for the 5-year and 100-year storm events.

Design Point 18a

Design Point 18a is the flow from Pond I and is located adjacent to the East Tributary. This pond accepts runoff from Basin I2, detains, treats runoff, and discharges it north to the East Tributary. The pond outflow is 1.0cfs and 21.1cfs respectively for the 5-year and 100-year storm events. Runoff from Basin OS-I1 is routed around Pond I and will not be detained or treated for water quality.

how? by swale?

Design Point 18

Design Point 18 is located at the southwest corner of the site, is adjacent to the East Tributary, and receives flows from Pond I and basin OS-I1. The developed flow is 15.1 cfs and 71.0cfs for the 5-year and 100-year event and flows. These flows closely mimic the existing conditions flowing to the East Tributary. Table 6.2 for a comparison of existing versus develop runoff to the East Tributary.

Basin OS-J1

Offsite Basin OS-J1 is 12.36 acres and consists of runoff from the Peaceful Valley Lake Estates 1st Filing which is an existing residential large lot subdivision consisting of 2.5acre to 5acre lots and Apple Ridge Subdivision. The runoff will flow overland onto Lorson Ranch into Basin J2 where it will be conveyed to Pond J and the East Tributary. Runoff from Basin OS-E9 is 10.8 cfs and 38.3 cfs respectively for the 5-year and 100-year storm events.

Basin J2

Basin J2 is located south of the East Tributary and north of Basin OS-J1. This basin accepts runoff from Basin OS-J1 and flows north to the East Tributary. Runoff from Basin J2 is 22.0cfs and 49.1cfs respectively for the 5-year and 100-year storm events.

Design Point 19a

Design Point 19a is the flow from Pond J and is located adjacent to the East Tributary. This pond accepts runoff from Basin J2, detains, treats runoff, and discharges it north to

the East Tributary. The pond outflow is 0.4cfs and 20.3cfs respectively for the 5-year and 100-year storm events. Runoff from Basin OS-J1 is routed around Pond J and will not be detained or treated for water quality.

how? by swale?

Design Point 19

Design Point 19 is located at the southwest corner of the site, is adjacent to the East Tributary, and receives flows from Pond J and basin OS-J1. The developed flow is 11.2 cfs and 58.6cfs for the 5-year and 100-year event and flows. These flows closely mimic the existing conditions flowing to the East Tributary. Table 6.2 for a comparison of existing versus develop runoff to the East Tributary.

Basin OS-K1

Offsite Basin OS-K1 is 1.98 acres and consists of runoff from the Apple Tree Golf Course. The runoff will flow overland onto Lorson Ranch into Basin K2 where it will be conveyed to Pond K and the East Tributary. Runoff from Basin OS-K1 is 2.0 cfs and 7.3 cfs respectively for the 5-year and 100-year storm events.

consisting of future residential lots?

Basin K2

Basin K2 is located south of the East Tributary and north of Basin OS-K1. Runoff from Basin K2 is 7.3cfs and 16.3cfs respectively for the 5-year and 100-year storm events.

Design Point 20a

Design Point 20a is the flow from Pond K and is located adjacent to the East Tributary. This pond accepts runoff from Basin K2, detains, treats runoff, and discharges it north to the East Tributary. The pond outflow is 0.1cfs and 5.6cfs respectively for the 5-year and 100-year storm events. Runoff from Basin OS-K1 is routed around Pond K and will not be detained or treated for water quality.

how? by swale?

Design Point 20

Design Point 20 is located at the southwest corner of the site, is adjacent to the East Tributary, and receives flows from Pond K and basin OS-K1. The developed flow is 2.1 cfs and 12.9cfs for the 5-year and 100-year event and flows. These flows closely mimic the existing conditions flowing to the East Tributary. Table 6.2 for a comparison of existing versus develop runoff to the East Tributary.

5.0 DRAINAGE AND BRIDGE FEES

Lorson Ranch is located within the Jimmy Camp Creek drainage basin which is currently a fee basin in El Paso County. Current El Paso County regulations require drainage and bridge fees to be paid for platting of land. Fees will be paid according to the fee at the time of platting. Construction of the major drainage improvements on the East Tributary to be completed as part of development will be eligible for reimbursement.

There will be two creek crossings associated with the construction of the East Tributary to serve this development. The two crossings will be at Fontaine Boulevard and Lorson Boulevard as they cross the East Tributary. At each crossing, a Conspan will be used to span the creek. The arches will be secured with engineered footer and the channel bottom will consist of natural material. Only the Fontaine Boulevard crossing will be eligible for reimbursement since it is a principal arterial in the 2060 Major Thoroughfare Plan.

Reword that reimbursement may be requested through the DCM and Drainage Board process.

6.0 DETENTION AND WATER QUALITY POND

The purpose of this MDDP is to provide an overview of the overall drainage impacts/mitigation due to development in the proposed Lorson Ranch Development on the East side of the East Tributary. It is recommended to construct larger (semi-regional off-line) on-site detention ponds to reduce the developed runoff at or below pre-development runoff rates. This approach to detention ponds is in compliance with the Jimmy Camp DBPS. Also included within the detention ponds are provisions for storm water quality as required by El Paso County DCM, Volume 2 [4].

There is existing 325 foot electrical transmission line easement that runs diagonally through the middle of the site in a north-south direction. It is the intention of this report to utilize this area for detention ponding, thereby decreasing the runoff further downstream and resulting in smaller storm sewer sizes. The detention ponds within the easement shall not adversely affect the existing power poles and should be at existing grade or lower as to not raise the grade under the power lines.

The detention ponds will be Full Spectrum have been preliminary sized using the Full Spectrum Detention Pond excel spreadsheets from Denver Urban Drainage for ponds that are not in series (no upstream ponds tributary). For ponds in series, the WQ portion of the pond was calculated by the excel spreadsheets and the 5-year/100-year sizing/outflows were determined using hydrologic modeling software called Hydraflow Hydrographs by Intellisolve. See Table 6.1 below for the required volumes of the 5-year, 100-year, and the allowable release rates of each pond. Please see the plan in the back pocket of this report for the location. The detention ponds shown are schematic and will need to be designed with greater detail when the localized plans are designed. All ponds will include WQCV and full spectrum detention design as part of the preliminary plan drainage design.

This needs to be clarified.

Table 6.1: Detention Pond Data (full-spectrum (?))

Pond	5-year Volume (Ac-ft)	100-year Volume (Ac-ft)	Release Rate 5-year (cfs)	Release Rate 100-year (cfs)
Pond C1	5.98	10.22	3.0	17.7
Pond C2.1	4.83	8.33	11.0	65.0
Pond C2.2	3.72	6.38	6.0	40.0
Pond C2.3	1.48	4.32	4.0	46.0
Pond C3	1.73	6.33	4.6	17.8
Pond C4	5.69	10.72	12.4	38.3
Pond C5	13.01	15.56	121.0	420.0
Pond D1	1.25	2.48	2.0	10.5
Pond D2	5.61	8.53	31.2	131.2
Pond E1	3.60	6.57	9.4	32.0
Pond E2	5.94	9.67	97.0	260.0
Pond F	2.42	3.48	3.5	41.0
Pond G	1.41	2.20	1.1	33.0

Add contributing area column

Pond H	1.57	2.35	1.7	35.3
Pond I	0.91	1.38	1.0	21.0
Pond J	0.86	1.25	0.4	20.3
Pond K	0.26	0.47	0.1	5.6

The detention ponds within Basins G and H , which historically flow onto the subdivision to the south will not only need to release at the pre-development rate and location, but shall be designed as to not concentrate the flow onto the adjacent property, but rather spread it by using a rip rap berm. There is a possibility that the pond outflow may be routed west in storm sewer which should be analyzed in the preliminary drainage reports.

Table 6.2: Existing versus Developed Runoff Summary at Outfall Points

Existing Runoff			Developed Runoff			
Design Point	Runoff 5-yr (cfs)	Runoff 100-yr (cfs)	Corresponding Developed Design Point	Runoff 5-yr (cfs)	Runoff 100-yr (cfs)	Outfall
1	10.5	58.8	1	8.5	28.0	“B” basins to north
2	141.0	458.0	7c	121.0	420.0	“C” basins to Etrib
3	29.7	166.5	10b	31.2	131.2	“D” basins to Etrib
4	104.0	286.0	14a	97.0	260.0	“E” basins to Etrib
5	19.3	113.7	15a	3.5	41.0	Basin F to east
6	7.9	44.1	16	2.0	33.0	Basin G to south
7	12.3	73.2	17	2.0	35.3	Basin H to south
8	12.4	74.1	18	15.1	71.0	Basin I to Etrib
9	9.0	55.9	19	11.2	58.6	Basin J to Etrib
10	2.1	15.2	20	2.1	12.9	Basin K to Etrib

7.0 CONCLUSIONS

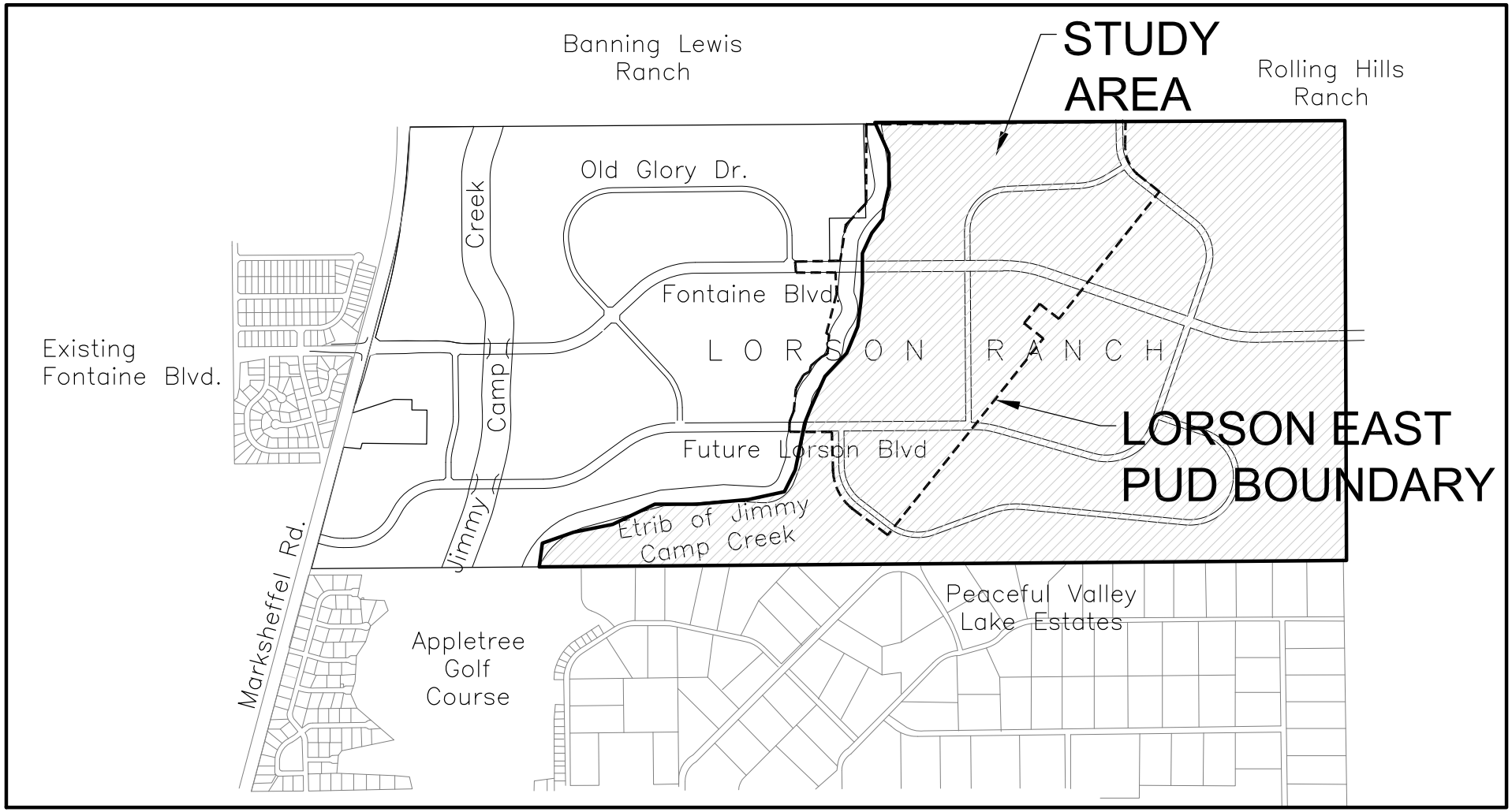
This drainage report has been prepared in accordance with the City of Colorado Springs/El Paso County Drainage Criteria Manual. The proposed development and drainage infrastructure will not cause adverse impacts to adjacent properties or properties located downstream. Several key aspects of the development discussed above are summarized as follows:

- Developed runoff will be conveyed via curb/gutter and storm sewer facilities
- Full Spectrum Detention is provided in all ponds
- Water Quality Capture Volume will be provided in all ponds

8.0 REFERENCES

1. City of Colorado Springs/El Paso County Drainage Criteria Manual DCM
2. Soil Survey of El Paso County Area, Colorado by USDA, SCS
3. Jimmy Camp Creek Drainage Basin Planning Study, 1987, Wilson & Co.
4. City of Colorado Springs "Drainage Criteria Manual, Volume 2
5. El Paso County "Engineering Criteria Manual"
6. Final Drainage Report for Fontaine Boulevard, Old Glory Drive, and Marksheffel Road Phase 1 Improvements, Dated February 6, 2006, Revised September 7, 2006, by Pentacor Engineering.
7. Drainage Basin Planning Study, Dated March 9, 2015, by Kiowa Engineering Corporation
8. El Paso County Resolution #15-042, El Paso County adoption of Chapter 6 and Section 3.2.1 of the City of Colorado Springs Drainage Criteria Manual dated May, 2014.

APPENDIX A – VICINTIY MAP, SOILS MAP, FEMA MAP



N

VICINITY MAP

NO SCALE

CORE ENGINEERING GROUP

15004 1ST AVE. S.
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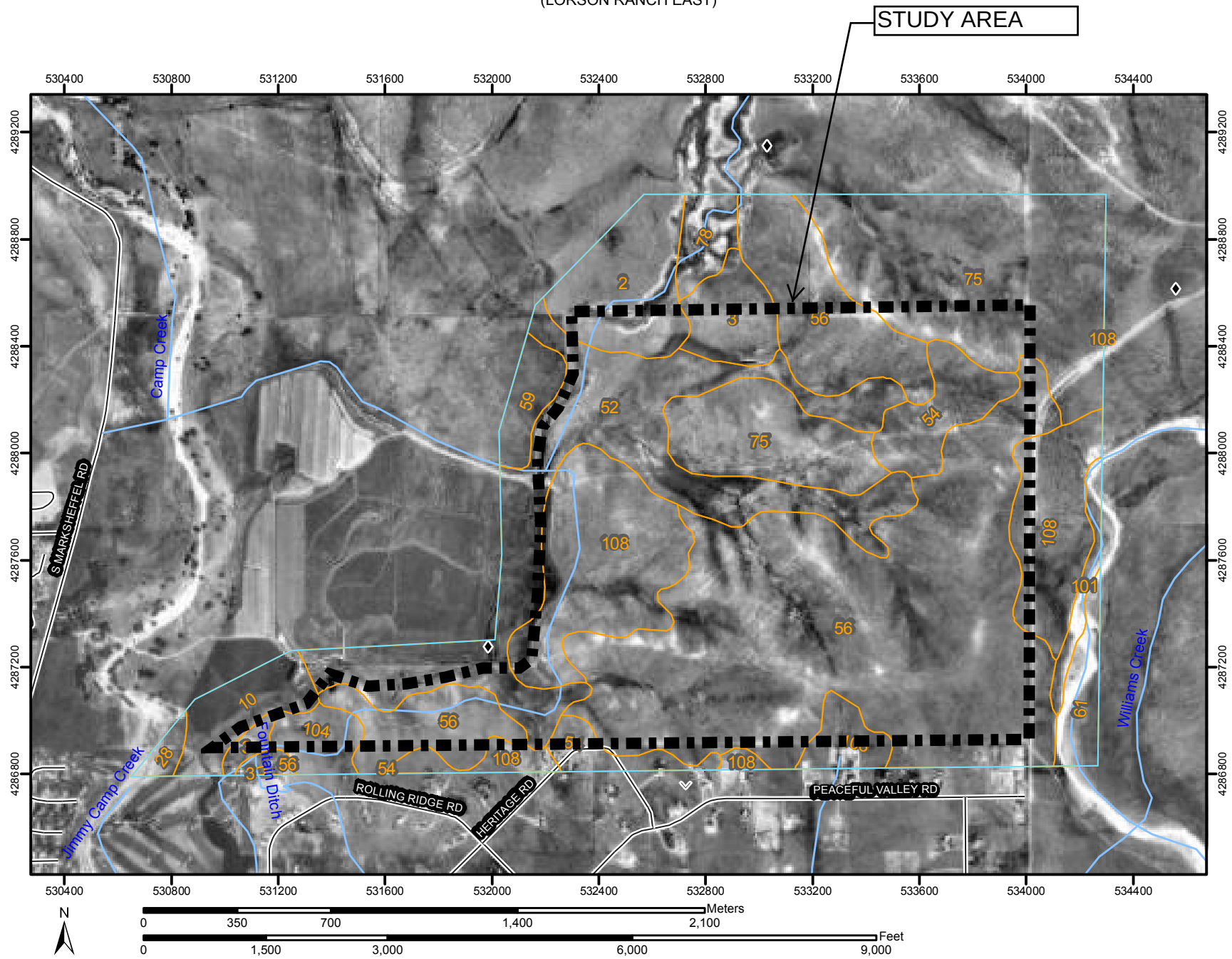
EMAIL: Rich@ceg1.com

LORSON RANCH EAST-MDDP
VICINITY MAP

SCALE:	DATE:	FIGURE NO.
NTS	JUNE, 2017	--

Soil Map–El Paso County Area, Colorado
(LORSON RANCH EAST)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

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

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features

Municipalities
- Cities
- Urban Areas

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N

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

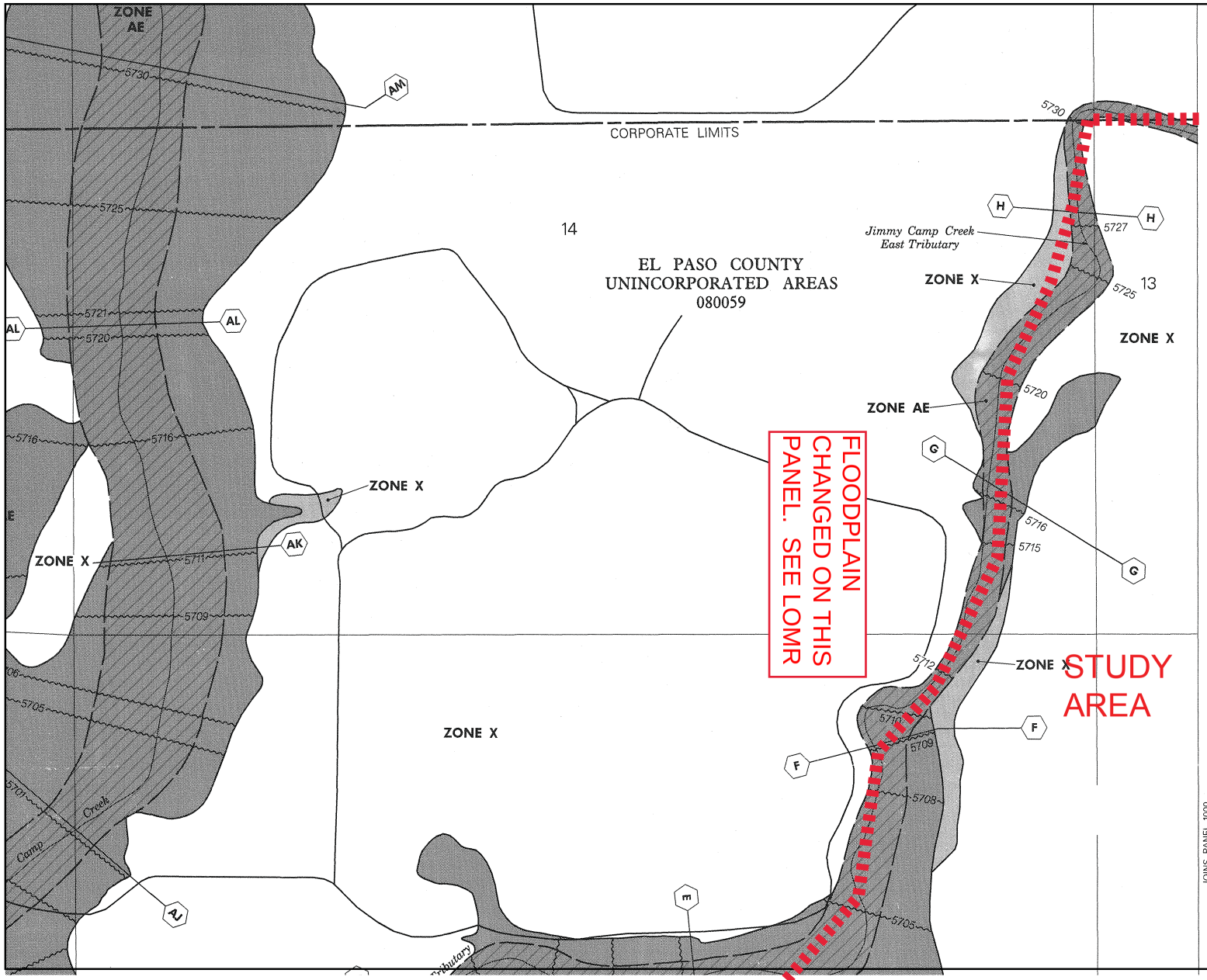
Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 5, Jan 15, 2008

Date(s) aerial images were photographed: 1999

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

Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
2	Ascalon sandy loam, 1 to 3 percent slopes	54.4	4.2%
3	Ascalon sandy loam, 3 to 9 percent slopes	32.6	2.5%
10	Blendon sandy loam, 0 to 3 percent slopes	29.0	2.2%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	5.5	0.4%
52	Manzanola clay loam, 1 to 3 percent slopes	180.3	14.0%
54	Midway clay loam, 3 to 25 percent slopes	46.2	3.6%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	476.6	37.0%
59	Nunn clay loam, 0 to 3 percent slopes	16.8	1.3%
61	Olney sandy loam, 3 to 5 percent slopes	18.8	1.5%
75	Razor-Midway complex	213.9	16.6%
78	Sampson loam, 0 to 3 percent slopes	16.4	1.3%
101	Ustic Torrifluvents, loamy	11.3	0.9%
104	Vona sandy loam, 1 to 3 percent slopes	17.4	1.4%
108	Wiley silt loam, 3 to 9 percent slopes	170.2	13.2%
Totals for Area of Interest (AOI)		1,289.3	100.0%



APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY,
COLORADO AND
INCORPORATED AREAS

PANEL 957 OF 1300

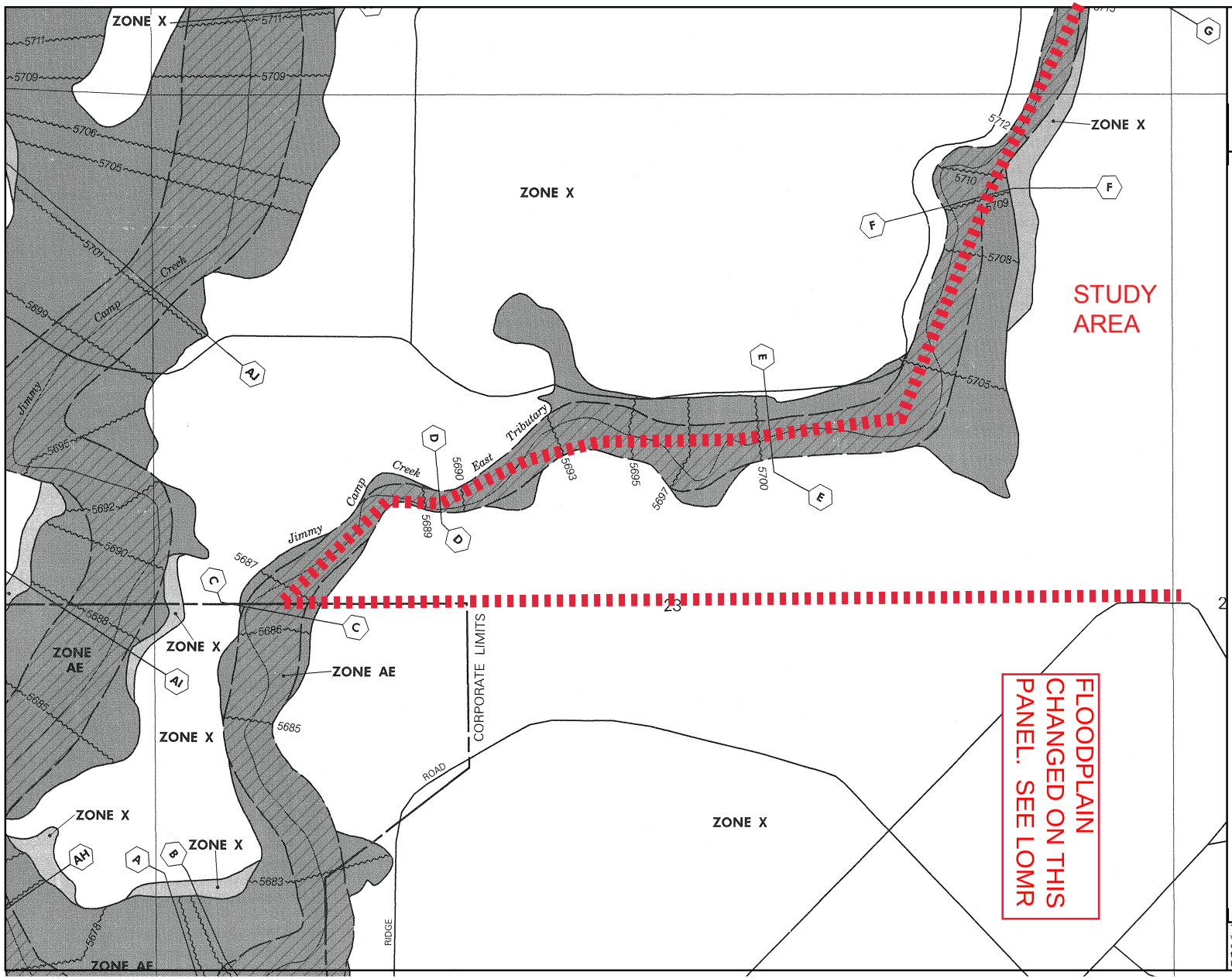
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0957	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0957	F
FOUNTAIN, CITY OF	080061	0957	F

MAP NUMBER
08041C0957 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency



APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 957 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0957	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0957	F
FOUNTAIN, CITY OF	080061	0957	F

MAP NUMBER 08041C0957 F

EFFECTIVE DATE: MARCH 17, 1997

Federal Emergency Management Agency

FLOODPLAIN CHANGED ON THIS PANEL. SEE LOMR

Legend

1% annual chance (100-Year) Floodplain

1% annual chance (100-Year) Floodway

0.2% annual chance (500-Year) Floodplain

APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

REVISED TO REFLECT LOMR EFFECTIVE: January 29, 2015

PANEL 957 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0957	F
EL PASO COUNTY UNINCORPORATED AREAS	080059	0957	F
FOUNTAIN, CITY OF	080061	0957	F

MAP NUMBER 08041C0957 F

EFFECTIVE DATE: MARCH 17, 1997

Federal Emergency Management Agency

JOINS PANEL 0769

104°37'30"

38°45'00"

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 15 SOUTH, RANGE 65 WEST.

CITY OF COLORADO SPRINGS 080060

13

Jimmy Camp Creek East Tribuary

5730

5731

5733

5729

REVISED AREA

5727

5725

5724

H

ZONE AE

14

5723

5722

5719

5721

5717

5711

G

5710

5707

EL PASO COUNTY UNINCORPORATED AREAS 080059

JOINS PANEL 1000

AREA REVISED BY LOMR DATED AUGUST 29, 2007.

5703

5704

F

23

PROFILE BASELINE

Jimmy Camp Creek East Tribuary

5702

ZONE AE

24

5699

E

5694

ZONE AE

5693

D

5701

5700

5697

5689

5690

5692

5696

5698

E

STUDY AREA

Legend

- 1% annual chance (100-Year) Floodplain
- 1% annual chance (100-Year) Floodway
- 0.2% annual chance (500-Year) Floodplain

APPROXIMATE SCALE IN FEET

2,000 0 2,000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 1000 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	1000	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	1000	F

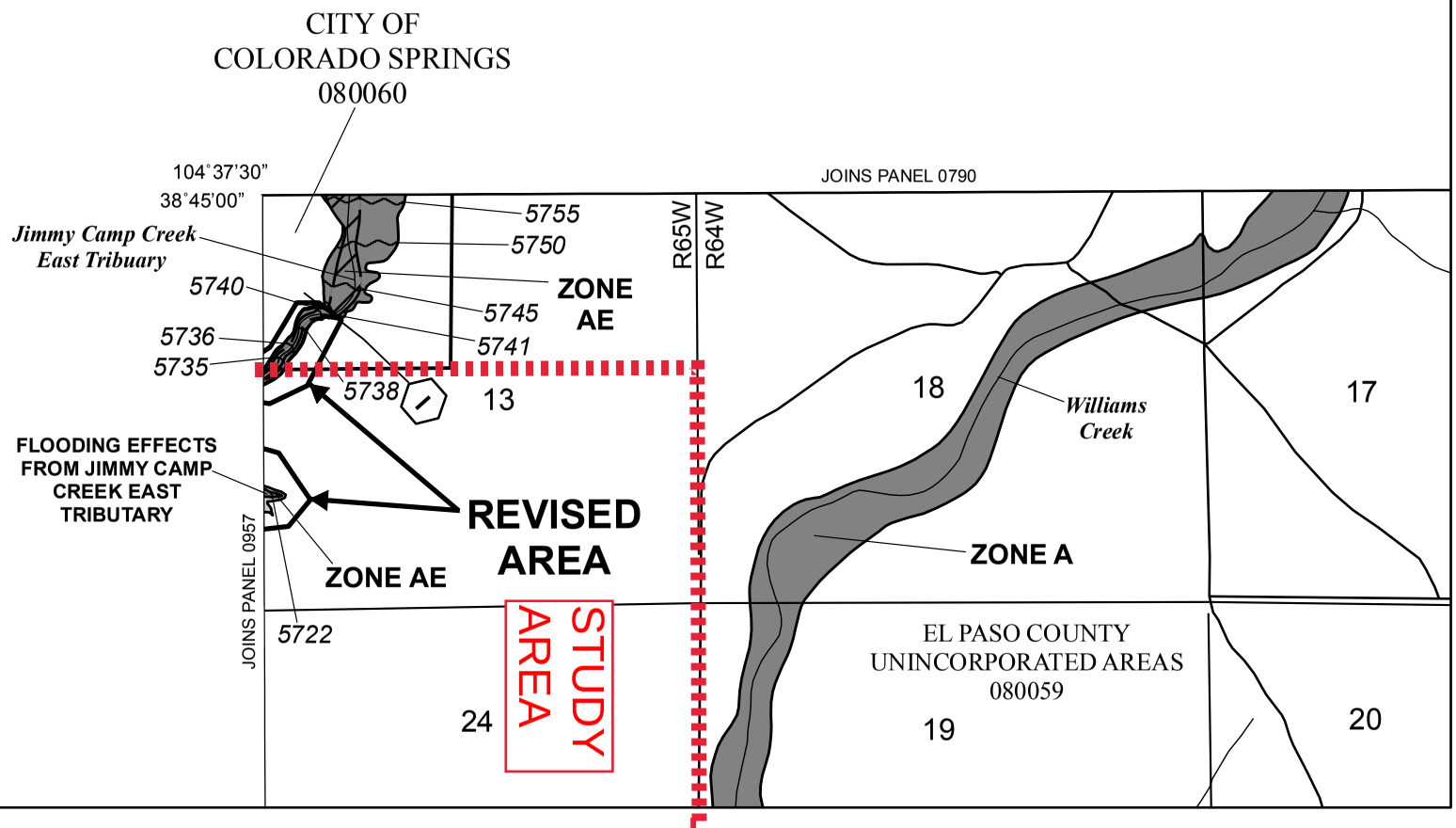
REVISED TO REFLECT LOMR EFFECTIVE: January 29, 2015

MAP NUMBER
08041C1000 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 15 SOUTH, RANGE 64 WEST AND TOWNSHIP 16 SOUTH, RANGE 65 WEST.



APPENDIX B – HYDROLOGY & HYDRAULIC CALCULATIONS

CORE ENGINEERING GROUP
15004 1st Avenue South
Burnsville, MN 55306

PROJECT NAME: Lorson Ranch East MDDP
PROJECT NUMBER: 100.032
ENGINEER: LAB
DATE: April 27, 2016

Master Development Drainage Plan
EXISTING CONDITIONS RUNOFF COEFFICIENTS

BASIN	Soil No.	Hydro Group	Area	Cover (%)	C5	Wtd. C5	C100	Wtd. C100	CN	Wtd. CN	Type of Cover
EX-C1	108	B	0.10	0.09%	0.08	0.00	0.35	0.00	61	0.1	
	56	C	107.02	97.32%	0.15	0.15	0.50	0.49	74	72.0	
	54	D	2.85	2.59%	0.15	0.00	0.50	0.01	80	2.1	
			109.97	100.00%		0.15		0.50		74.1	
EX-C2	75	C	9.84	92.22%	0.15	0.14	0.50	0.46	74	68.2	
	54	D	0.83	7.78%	0.15	0.01	0.50	0.04	80	6.2	
			10.67	100.00%		0.15		0.50		74.5	
EX-C3	108	B	4.22	5.67%	0.08	0.00	0.35	0.02	61	3.5	
	52 & 56	C	70.18	94.33%	0.15	0.14	0.50	0.47	74	69.8	
			74.40	100.00%		0.15		0.49		73.3	
EX-C5	108	B	1.46	1.43%	0.08	0.00	0.35	0.01	61	0.9	
	56	C	71.84	70.30%	0.15	0.11	0.50	0.35	74	52.0	
	54	D	28.89	28.27%	0.15	0.04	0.50	0.14	80	22.6	
			102.19	100.00%		0.15		0.50		75.5	
EX-C6	3	B	1.02	8.94%	0.08	0.01	0.35	0.03	61	5.5	
	56	C	10.39	91.06%	0.15	0.14	0.50	0.46	74	67.4	
			11.41	100.00%		0.14		0.49		72.8	
EX-C7	3	B	6.24	15.99%	0.08	0.01	0.35	0.06	61	9.8	
	75	C	32.78	84.01%	0.15	0.13	0.50	0.42	74	62.2	
			39.02	100.00%		0.14		0.48		71.9	
EX-C8	108	B	3.90	30.90%	0.08	0.02	0.35	0.11	61	18.9	
	75	C	8.72	69.10%	0.15	0.10	0.50	0.35	74	51.1	
			12.62	100.00%		0.13		0.45		70.0	
EX-C9	2 & 3	B	15.57	37.81%	0.08	0.03	0.35	0.13	61	23.1	
	52	C	25.61	62.19%	0.15	0.09	0.50	0.31	74	46.0	
			41.18	100.00%		0.12		0.44		69.1	

CORE ENGINEERING GROUP
15004 1st Avenue South
Burnsville, MN 55306

PROJECT NAME: Lorson Ranch East MDDP
PROJECT NUMBER: 100.032
ENGINEER: LAB
DATE: April 27, 2016

Master Development Drainage Plan
EXISTING CONDITIONS RUNOFF COEFFICIENTS

BASIN	Soil No.	Hydro Group	Area	Cover (%)	C5	Wtd. C5	C100	Wtd. C100	CN	Wtd. CN	Type of Cover
EX-C10	108	B	7.51	68.96%	0.08	0.06	0.35	0.24	61	42.1	
	52	C	3.38	31.04%	0.15	0.05	0.50	0.16	74	23.0	
			10.89	100.00%		0.10		0.40		65.0	
EX-C	108	B	40.02	8.84%	0.08	0.01	0.35	0.03	40	3.5	
	56	C	380.38	83.97%	0.15	0.13	0.50	0.42	54	45.3	
	54	D	32.57	7.19%	0.15	0.01	0.50	0.04	63	4.5	
			452.97	100.00%		0.14		0.49		53.4	
EX-D1	108	B	18.79	93.95%	0.08	0.08	0.35	0.33	61	57.3	
	56	C	1.21	6.05%	0.15	0.01	0.50	0.03	74	4.5	
			20.00	100.00%		0.08		0.36		61.8	
EX-D2	108	B	50.90	56.84%	0.08	0.05	0.35	0.20	61	34.7	
	56	C	38.65	43.16%	0.15	0.06	0.50	0.22	74	31.9	
			89.55	100.00%		0.11		0.41		66.6	
EX-D	108	B	69.69	63.61%	0.08	0.05	0.35	0.22	61	38.8	
	56	C	39.86	36.39%	0.15	0.05	0.50	0.18	74	26.9	
			109.55	100.00%		0.11		0.40		65.7	
EX-E1	108	B	5.47	6.88%	0.08	0.01	0.35	0.02	61	4.2	
	56	C	73.88	92.86%	0.15	0.14	0.50	0.46	74	68.7	
	54	D	0.21	0.26%	0.15	0.00	0.50	0.00	80	0.2	
			79.56	100.00%		0.15		0.49		73.1	
EX-E2	108	B	0.44	2.56%	0.08	0.00	0.35	0.01	61	1.6	
	56	C	13.55	78.73%	0.15	0.12	0.50	0.39	74	58.3	
	54	D	3.22	18.71%	0.15	0.03	0.50	0.09	80	15.0	
			17.21	100.00%		0.15		0.50		74.8	

CORE ENGINEERING GROUP
15004 1st Avenue South
Burnsville, MN 55306

PROJECT NAME: Lorson Ranch East MDDP
PROJECT NUMBER: 100.032
ENGINEER: LAB
DATE: April 27, 2016

Master Development Drainage Plan
EXISTING CONDITIONS RUNOFF COEFFICIENTS

BASIN	Soil No.	Hydro Group	Area	Cover (%)	C5	Wtd. C5	C100	Wtd. C100	CN	Wtd. CN	Type of Cover
OS-E1.1	108	B	4.76	15.50%	0.08	0.01	0.35	0.05	61	9.5	
	56	C	7.72	25.15%	0.15	0.04	0.50	0.13	74	18.6	
	54	D	18.22	59.35%	0.15	0.09	0.50	0.30	80	47.5	
			30.70	100.00%		0.14		0.48		75.5	
OS-E2.1	108	B	32.76	69.84%	0.08	0.06	0.35	0.24	61	42.6	
	56	C	0.89	1.90%	0.15	0.00	0.50	0.01	74	1.4	
	54	D	13.26	28.27%	0.15	0.04	0.50	0.14	80	22.6	
			46.91	100.00%		0.10		0.40		66.6	
EX-E	108	B	43.43	23.31%	0.08	0.02	0.35	0.08	40	9.3	
	56	C	107.96	57.95%	0.15	0.09	0.50	0.29	54	31.3	
	54	D	34.91	18.74%	0.15	0.03	0.50	0.09	63	11.8	
			186.30	100.00%		0.13		0.47		52.4	
EX-F1	108	B	8.74	39.09%	0.08	0.03	0.35	0.14	61	23.8	
	56	C	13.62	60.91%	0.15	0.09	0.50	0.30	74	45.1	
			22.36	100.00%		0.12		0.44		68.9	
EX-F2	108	B	0.23	1.32%	0.08	0.00	0.35	0.00	61	0.8	
	56	C	17.26	98.68%	0.15	0.15	0.50	0.49	74	73.0	
			17.49	100.00%		0.15		0.50		73.8	
EX-F	108	B	8.97	22.51%	0.08	0.02	0.35	0.08	61	13.7	
	56	C	30.88	77.49%	0.15	0.12	0.50	0.39	74	57.3	
			39.85	100.00%		0.13		0.47		71.1	
EX-H1	108	B	7.70	27.37%	0.08	0.02	0.35	0.10	61	16.7	
	56	C	20.43	72.63%	0.15	0.11	0.50	0.36	74	53.7	
			28.13	100.00%		0.13		0.46		70.4	
OS-I1.1	108	B	11.51	72.12%	0.08	0.06	0.35	0.25	61	44.0	
	56	C	4.45	27.88%	0.15	0.04	0.50	0.14	74	20.6	
			15.96	100.00%		0.10		0.39		64.6	

These seem high for existing. Provide land use/impervious table and coefficients tables.

CORE ENGINEERING GROUP
15004 1st Avenue South
Burnsville, MN 55306

PROJECT NAME: Lorson Ranch East MDDP
PROJECT NUMBER: 100.032
ENGINEER: LAB
DATE: April 27, 2016

Master Development Drainage Plan
EXISTING CONDITIONS RUNOFF COEFFICIENTS

BASIN	Soil No.	Hydro Group	Area	Cover (%)	C5	Wtd. C5	C100	Wtd. C100	CN	Wtd. CN	Type of Cover
EX-I	108	B	11.51	34.96%	0.08	0.03	0.35	0.12	61	21.3	
	56	C	21.41	65.04%	0.15	0.10	0.50	0.33	74	48.1	
			32.92	100.00%		0.13		0.45		69.5	
EX-J1	104	B	9.20	68.55%	0.08	0.05	0.35	0.24	61	41.8	
	56	C	4.22	31.45%	0.15	0.05	0.50	0.16	74	23.3	
			13.42	100.00%		0.10		0.40		65.1	
OS-J1.1	104	B	3.84	31.07%	0.08	0.02	0.35	0.11	61	19.0	
	56	C	8.52	68.93%	0.15	0.10	0.50	0.34	74	51.0	
			12.36	100.00%		0.13		0.45		70.0	
EX-J	104	B	13.08	50.74%	0.08	0.04	0.35	0.18	61	30.9	
	56	C	12.70	49.26%	0.15	0.07	0.50	0.25	74	36.5	
			25.78	100.00%		0.11		0.42		67.4	

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: June, 2017
Checked By: Leonard Beasley

Job No: 100.013
Project: Lorson Ranch East MDDP
Design Storm: **5 - Year Event, Existing Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
EX-A1			4.28	0.08	18.6	0.34	3.20	1.1													
EX-B1			14.42	0.15	16.9	2.16	3.34	7.2													
OS-B1.1			5.64	0.15	14.7	0.85	3.55	3.0													
EX-B	**DP-1**		20.06	0.15					15.3	3.01	3.49	10.5									
EX-C1			109.97	0.15	29.6	16.50	2.50	41.3													
EX-C2			10.67	0.15	14.7	1.60	3.55	5.7													
EX-C3			74.40	0.15	30.2	11.16	2.47	27.6													
EX-C4			27.13	0.15	19.6	4.07	3.12	12.7													
OS-C5.1			3.59	0.15	12.6	0.54	3.78	2.0													
EX-C5			102.19	0.15	30.4	15.33	2.46	37.7													
OS-C6.1			9.96	0.15	14.1	1.49	3.61	5.4													
EX-C6			11.47	0.14	19.5	1.61	3.13	5.0													
EX-C7			39.02	0.14	22.7	5.46	2.90	15.8													
EX-C8			12.62	0.13	19.8	1.64	3.10	5.1													
EX-C9			41.18	0.12	21.7	4.94	2.97	14.7													
EX-C10			10.89	0.10	18.1	1.09	3.24	3.5													
EX-C	**DP-2**		452.97	CN = 67						SCS =		141.0									
EX-D	**DP-3**		109.55	0.12	34.7	13.15	2.26	29.7													
OS-E1.1			31.10	0.25	17.0	7.78	3.33	25.9													
EX-E1			79.50	0.15	33.0	11.93	2.34	27.9													
OS-E2.1			46.90	0.25	18.1	11.73	3.24	38.0													
EX-E2			30.40	0.15	17.0	4.56	3.33	15.2													
EX-E	**DP-4**		187.30	CN =73						SCS =		100.0									
EX-F1			22.36	0.12	13.8	2.68	3.65	9.8													
EX-F2			17.49	0.15	13.5	2.62	3.68	9.7													
EX-F	**DP-5**		39.85	0.13					13.8	5.31	3.65	19.3									
EX-G			14.91	0.15	15.0	2.24	3.52	7.9													
EX-H			28.13	0.13	16.6	3.66	3.37	12.3													
OS-I1.1			15.96	0.10	16.4	1.60	3.39	5.4													

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

CORE ENGINEERING GROUP

Calculated By: Leonard Beasley
Date: June, 2017
Checked By: Leonard Beasley

Job No: 100.013
Project: Lorson Ranch East MDDP
Design Storm: **5 - Year Event, Existing Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
EX-I1			16.96	0.15	15.7	2.54	3.45	8.8													
EX-I	**DP-8**		32.92	0.13					21.2	4.14	3.00	12.4									
OS-J1.1			12.36	0.13	17.0	1.61	3.33	5.4													
EX-J1			13.42	0.10	15.3	1.34	3.49	4.7													
EX-J	**DP-9**		25.78	0.11					20.6	2.95	3.05	9.0									
OS-K1.1			1.98	0.08	16.0	0.16	3.42	0.5													
EX-K1			5.59	0.08	15.3	0.45	3.49	1.6													
EX-K	**DP-10**		7.57	0.08					16.0	0.61	3.42	2.1									

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: April 28, 2016
Checked By: Leonard Beasley

Job No: 100.032
Project: Lorson Ranch East MDDP
Design Storm: **100 - Year Event, Existing Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
EX-A1			4.28	0.35	18.6	1.50	5.37	8.0													
EX-B1			14.42	0.50	16.9	7.21	5.61	40.4													
OS-B1.1			5.64	0.50	14.7	2.82	5.96	16.8													
EX-B	**DP-1**		20.06	0.50					15.3	10.03	5.86	58.8									
EX-C1			109.97	0.50	29.6	54.99	4.20	230.8													
EX-C2			10.67	0.50	14.7	5.34	5.96	31.8													
EX-C3			74.40	0.49	30.2	36.46	4.15	151.2													
EX-C4			27.13	0.50	19.6	13.57	5.24	71.0													
OS-C5.1			3.59	0.50	12.6	1.80	6.35	11.4													
EX-C5			102.19	0.50	30.4	51.10	4.13	211.1													
OS-C6.1			9.96	0.50	14.1	4.98	6.07	30.2													
EX-C6			11.47	0.49	19.5	5.62	5.25	29.5													
EX-C7			39.02	0.48	22.7	18.73	4.87	91.2													
EX-C8			12.62	0.45	19.8	5.68	5.21	29.6													
EX-C9			41.18	0.44	21.7	18.12	4.98	90.2													
EX-C10			10.89	0.40	18.1	4.36	5.44	23.7													
EX-C	**DP-2**		452.97	CN = 67						SCS =		458.0									
EX-D	**DP-3**		109.55	0.40	34.7	43.82	3.80	166.5													
OS-E1.1			31.10	0.48	17.0	14.93	5.60	83.5													
EX-E1			79.50	0.49	33.0	38.96	3.92	152.9													
OS-E2.1			46.90	0.40	18.1	18.76	5.44	102.0													
EX-E2			30.40	0.50	17.0	15.20	5.60	85.0													
EX-E	**DP-4**		187.30	CN = 73						SCS =		280.0									
EX-F1			22.36	0.44	13.8	9.84	6.12	60.2													
EX-F2			17.49	0.50	13.5	8.75	6.18	54.0													
EX-F	**DP-5**		39.85	0.47					13.8	18.58	6.12	113.7									
EX-G			14.91	0.50	15.0	7.46	5.91	44.1													
EX-H			28.13	0.46	16.6	12.94	5.66	73.2													
OS-I1.1			15.96	0.39	16.4	6.22	5.69	35.4													

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: April 28, 2016
Checked By: Leonard Beasley

Job No: 100.032
Project: Lorson Ranch East MDDP
Design Storm: **100 - Year Event, Existing Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
EX-I1			16.96	0.50	15.7	8.48	5.80	49.1													
EX-I	**DP-8**		32.92	0.45					21.2	14.70	5.04	74.1									
OS-J1.1			12.36	0.45	17.0	5.56	5.60	31.1													
EX-J1			13.42	0.40	15.3	5.37	5.86	31.5													
EX-J	**DP-9**		25.78	0.42					20.6	10.93	5.11	55.9									
OS-K1.1			1.98	0.35	16.0	0.69	5.75	4.0													
EX-K1			5.59	0.35	15.3	1.96	5.86	11.5													
EX-K	**DP-10**		7.57	0.35					16.0	2.65	5.75	15.2									

Hydrograph Plot

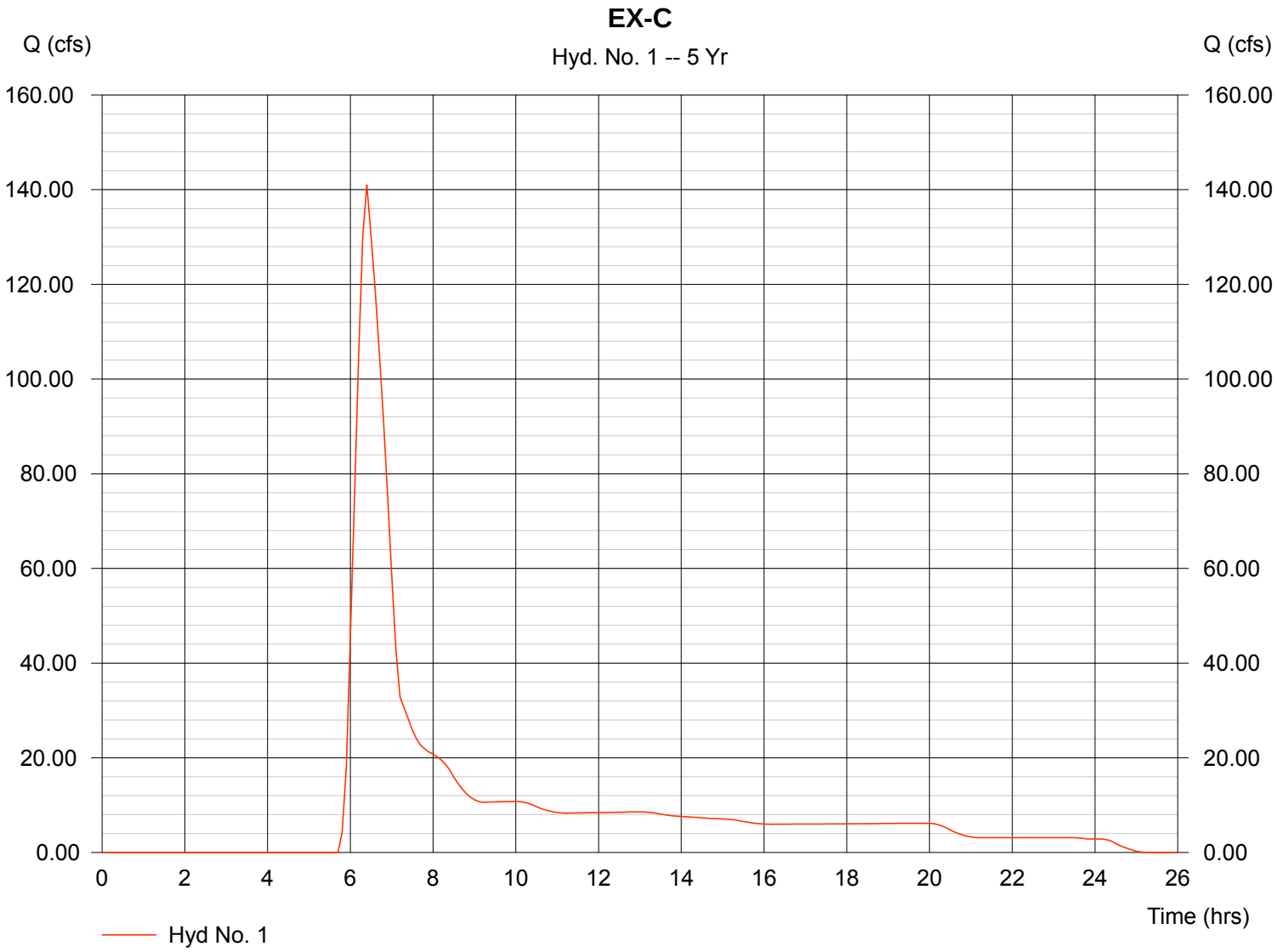
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 4:1 PM

Hyd. No. 1

EX-C

Hydrograph type	= SCS Runoff	Peak discharge	= 140.99 cfs
Storm frequency	= 5 yrs	Time interval	= 6 min
Drainage area	= 452.970 ac	Curve number	= 69
Basin Slope	= 0.0 %	Hydraulic length	= 7400 ft
Tc method	= USER	Time of conc. (Tc)	= 49.50 min
Total precip.	= 2.80 in	Distribution	= Custom
Storm duration	= CSpring_IIA-6min.cds	Shape factor	= 484

Hydrograph Volume = 905,484 cuft



Hydrograph Plot

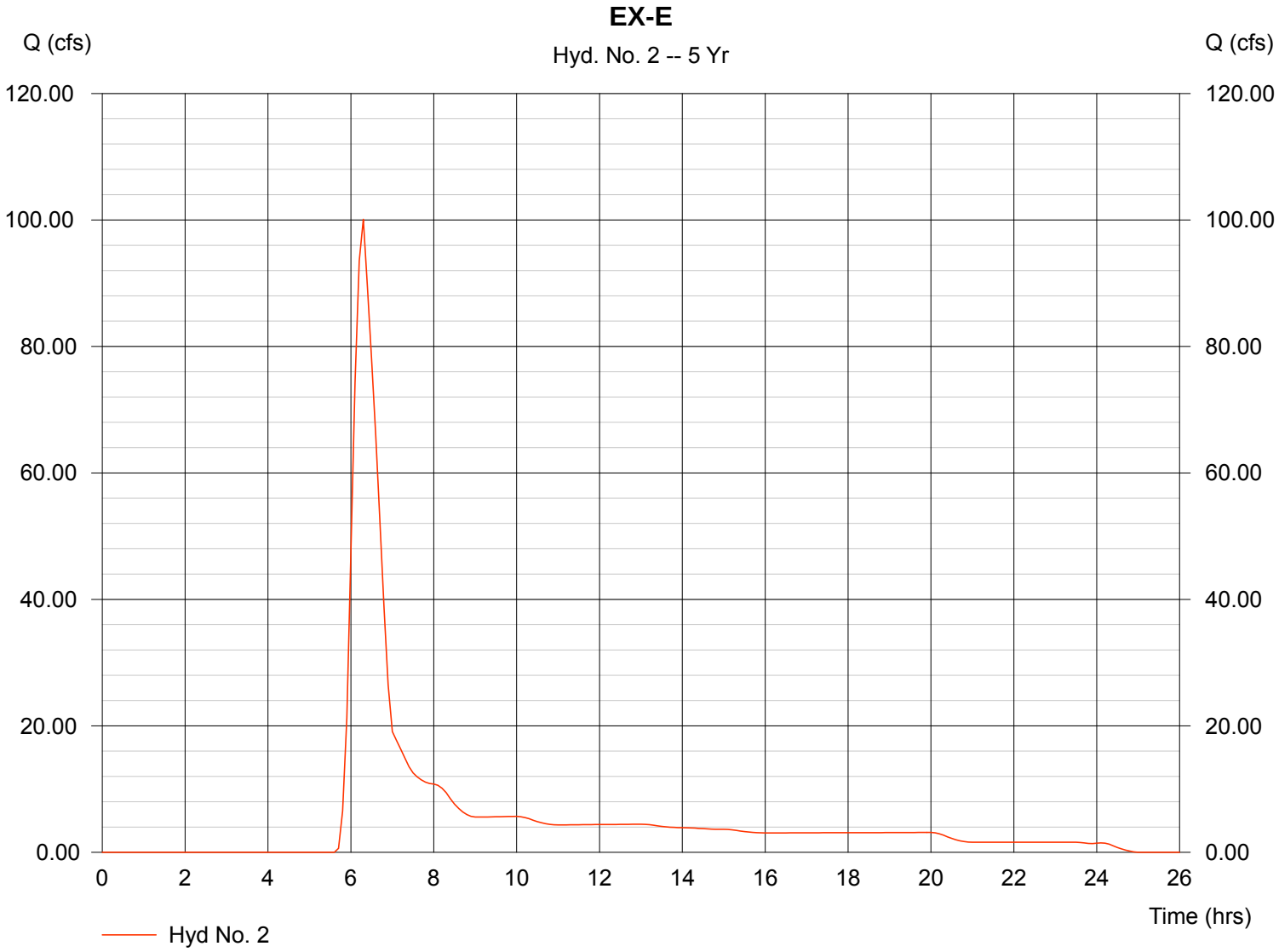
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 4:1 PM

Hyd. No. 2

EX-E

Hydrograph type	=	SCS Runoff	Peak discharge	=	100.11 cfs
Storm frequency	=	5 yrs	Time interval	=	6 min
Drainage area	=	187.300 ac	Curve number	=	73
Basin Slope	=	3.0 %	Hydraulic length	=	4150 ft
Tc method	=	USER	Time of conc. (Tc)	=	33.00 min
Total precip.	=	2.80 in	Distribution	=	Custom
Storm duration	=	CSpring_IIA-6min.cds	Shape factor	=	484

Hydrograph Volume = 513,793 cuft



Hydrograph Plot

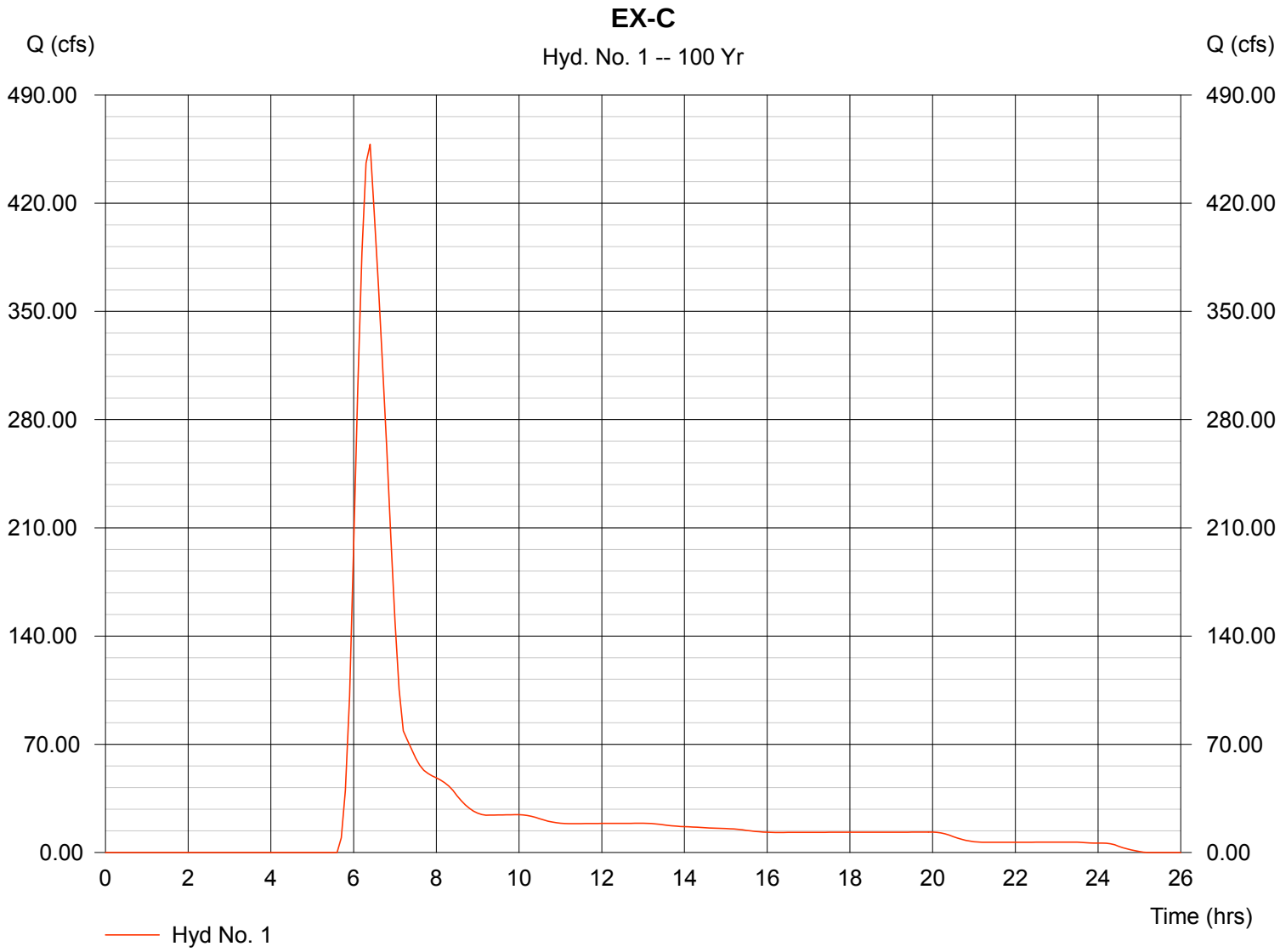
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 4:1 PM

Hyd. No. 1

EX-C

Hydrograph type	= SCS Runoff	Peak discharge	= 458.13 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 452.970 ac	Curve number	= 69
Basin Slope	= 0.0 %	Hydraulic length	= 7400 ft
Tc method	= USER	Time of conc. (Tc)	= 49.50 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= CSpring_IIA-6min.cds	Shape factor	= 484

Hydrograph Volume = 2,456,980 cuft



Hydrograph Plot

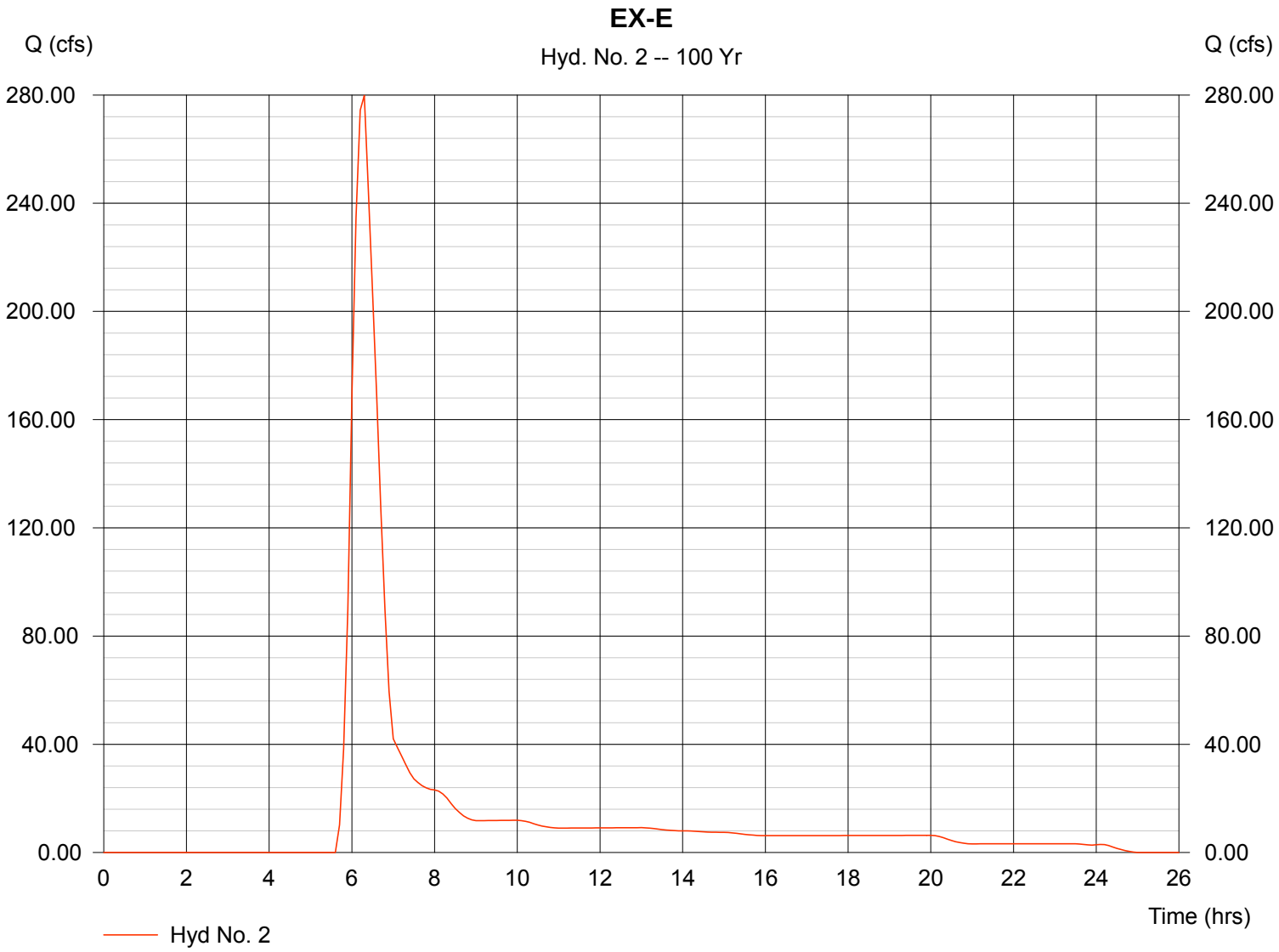
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 4:1 PM

Hyd. No. 2

EX-E

Hydrograph type	= SCS Runoff		Peak discharge	= 279.84 cfs	
Storm frequency	= 100 yrs		Time interval	= 6 min	
Drainage area	= 187.300 ac		Curve number	= 73	
Basin Slope	= 3.0 %		Hydraulic length	= 4150 ft	
Tc method	= USER		Time of conc. (Tc)	= 33.00 min	
Total precip.	= 4.40 in		Distribution	= Custom	
Storm duration	= CSpring_IIA-6min.cds		Shape factor	= 484	

Hydrograph Volume = 1,267,200 cuft



CORE ENGINEERING GROUP

Standard Form SF-1. Time of Concentration-Proposed

Calculated By: Leonard Beasley
Date: September, 2016
Checked By: Leonard Beasley

Job No: 100.013
Project: Lorson Ranch East MDDP

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended tc=ti+tt (min)
A	0.08	2.6	7.0	100.00	8.00%	0.18	9.27	928.00	0.54%	0.51	30.07	39.34	1028.00	15.71	15.71
OS-B1	0.15	5.6	20.0	100.00	7.00%	0.18	9.02	435.00	4.25%	4.12	1.76	10.78	535.00	12.97	10.78
B2	0.49	3.9	20.0	100.00	3.60%	0.23	7.22	1652.00	2.08%	2.88	9.55	16.76	1752.00	19.73	16.76
B	0.15	9.5	20.0	100.00	7.00%	0.18	9.02	2119.00	2.55%	3.19	11.06	20.08	2219.00	22.33	20.08
C1	0.49	23.2	15.0	100.00	1.30%	0.17	10.10	900.00	3.30%	2.72	5.50				
			20.0					1000.00	3.20%	3.58	4.66	20.26	2000.00	21.11	20.26
C2	0.49	34.5	15.0	75.00	2.00%	0.16	7.59	5.00	0.72%	1.27	0.07				
			20.0					510.00	3.70%	3.85	2.21				
			pipe					1385.00	2.70%	15.63	1.48	11.34	1975.00	20.97	11.34
DP-2	0.49	57.7	15.0	100.00	0.90%	0.15	11.40	1105.00	3.19%	2.68	6.87				
			20.0					547.00	4.02%	4.01	2.27				
			pipe					1494.00	1.00%	15.63	1.59	22.14	3246.00	28.03	22.14
C3	0.49	8.3	15.0	100.00	2.70%	0.21	7.94	200.00	2.70%	2.46	1.35				
			20.0					1161.00	2.07%	2.88	6.72	16.01	1461.00	18.12	16.01
C4	0.49	57.5	15.0	100.00	1.87%	0.19	8.96	755.00	1.87%	2.05	6.13				
			20.0					1318.00	2.28%	3.02	7.27				
			pipe					1230.00	2.93%	14.30	1.43	23.80	3403.00	28.91	23.80
C5	0.49	25.0	15.0	100.00	4.20%	0.24	6.86	200.00	4.15%	3.06	1.09				
			15.0					498.00	5.12%	3.39	2.45				
			20.0					1328.00	4.52%	4.25	5.21	15.60	1428.00	17.93	15.60
C6	0.49	18.7	20.0	100.00	1.00%	0.15	11.01	885.00	3.62%	3.81	3.88				
			pipe					831.00	2.41%	17.73	0.78	15.67	1816.00	20.09	15.67
C7	0.49	14.5	20.0	100.00	2.00%	0.19	8.76	681.00	2.50%	3.16	3.59				
			pipe					831.00	2.41%	17.73	0.78	13.13	1612.00	18.96	13.13
DP-4	0.49	124.0	15.0	100.00	1.87%	0.19	8.96	755.00	1.87%	2.05	6.13				
			20.0					1318.00	2.28%	3.02	7.27				
			24"					1230.00	2.93%	14.30	1.43				
			48"					831.00	2.41%	17.73	0.78				
			54"					200.00	2.50%	19.55	0.17	24.75	4434.00	34.63	24.75
C8	0.49	74.5	15.0	100.00	5.30%	0.26	6.35	1415.00	5.40%	3.49	6.77				
			20.0					883.00	2.50%	3.16	4.65	17.77	2398.00	23.32	17.77
C8a	0.49	11.7	15.0	100.00	2.00%	0.19	8.76	100.00	2.00%	2.12	0.79				
			20.0					715.00	5.17%	4.55	2.62	12.17	915.00	15.08	12.17
OS-C9	0.49	5.2	15.0	100.00	4.18%	0.24	6.87	810.00	4.18%	3.07	4.40	11.27	910.00	15.06	11.27
C10	0.49	13.0	15.0	100.00	3.00%	0.22	7.66	100.00	3.00%	2.60	0.64				

CORE ENGINEERING GROUP

Standard Form SF-1. Time of Concentration-Proposed

Calculated By: Leonard Beasley
Date: September, 2016
Checked By: Leonard Beasley

Job No: 100.013
Project: Lorson Ranch East MDDP

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended tc=ti+tt (min)
			20.0					957.00	2.60%	3.22	4.95				
			pipe					653.00	1.50%	8.91	1.22	14.47	1810.00	20.06	14.47
OS-C11	0.49	5.6	15.0	100.00	3.00%	0.22	7.66	100.00	3.00%	2.60	0.64				
			20.0					957.00	2.60%	3.22	4.95	13.25	1157.00	16.43	13.25
DP-5	0.49	5.2	15.0	100.00	4.18%	0.24	6.87	810.00	4.18%	3.07	4.40				
			20.0					1758.00	2.39%	3.09	9.48	20.75	2668.00	24.82	20.75
C12	0.49	19.6	15.0	100.00	3.00%	0.22	7.66	969.00	1.34%	1.74	9.30				
			20.0					292.00	0.60%	1.55	3.14	20.11	1361.00	17.56	17.56
C13	0.16	21.2	15.0	100.00	3.17%	0.14	11.60	595.00	3.17%	2.67	3.71				
			20.0					2968.00	1.00%	2.00	24.73	40.04	3663.00	30.35	30.35
DP-6	0.49	40.8	15.0	100.00	3.00%	0.22	7.66	969.00	1.34%	1.41	11.45				
			20.0					3280.00	0.82%	1.81	30.18	49.30	4349.00	34.16	34.16
C14	0.16	7.6	15.0	100.00	4.82%	0.17	10.10	382.00	4.82%	1.41	4.52				
			20.0					1404.00	4.50%	4.24	5.52	20.13	1886.00	20.48	20.48
C15	0.49	44.0	15.0	100.00	1.00%	0.15	11.01	238.00	2.10%	2.17	1.82				
			20.0					1758.00	2.39%	3.09	9.48	22.31	2096.00	21.64	22.31
C16	0.49	69.0	15.0	100.00	5.00%	0.26	6.48	100.00	5.00%	3.35	0.50				
			20.0					596.00	3.40%	3.69	2.69				
			pipe					2801.00	1.20%	7.93	5.89	15.55	3597.00	29.98	15.55
C17	0.49	18.8	15.0	100.00	4.00%	0.24	6.97	1462.00	3.42%	2.77	8.78				
			pipe					95.00	6.30%	18.10	0.09	15.84	1657.00	19.21	15.84
Basin C	0.49	464.9	15.0	100.00	4.18%	0.24	6.87	865.00	4.18%	3.07	4.70				
			20.0					4150.00	1.40%	2.37	29.23	40.80	5115.00	38.42	38.42
D1	0.49	17.0	15.0	100.00	3.30%	0.22	7.43	200.00	3.30%	2.72	1.22				
			20.0					909.00	4.50%	4.24	3.57	12.22	1209.00	16.72	12.22
D2	0.49	8.0	15.0	100.00	4.00%	0.24	6.97	600.00	3.69%	2.88	3.47	10.44	700.00	13.89	10.44
D3	0.49	23.0	15.0	100.00	3.00%	0.22	7.66	700.00	1.00%	1.50	7.78				
			20.0					400.00	3.00%	3.46	1.92	17.37	1200.00	16.67	16.67
D4	0.49	36.4	15.0	100.00	2.50%	0.20	8.14	100.00	3.50%	2.81	0.59				
			20.0					1400.00	2.90%	3.41	6.85	15.58	1600.00	18.89	15.58
D5	0.40	4.6	20.0	70.00	4.00%	0.17	6.69	300.00	0.50%	1.41	3.54				
								0.00	2.60%	15.17	0.00	10.23	370.00	12.06	10.23

CORE ENGINEERING GROUP

Standard Form SF-1. Time of Concentration-Proposed

Calculated By: Leonard Beasley
Date: September, 2016
Checked By: Leonard Beasley

Job No: 100.013
Project: Lorson Ranch East MDDP

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended tc=ti+tt (min)
DP-10	0.49	92.5	15.0	100.00	3.30%	0.22	7.43	200.00	3.30%	2.72	1.22				
			20.0					909.00	4.50%	4.24	3.57				
			20.0					1865.00	2.68%	3.27	9.49	21.71	1965.00	20.92	20.92
E1	0.49	10.2	15.0	100.00	2.30%	0.20	8.37	120.00	2.30%	2.27	0.88				
			20.0					1098.00	4.90%	4.43	4.13	13.38	1318.00	17.32	13.38
E2	0.49	10.3	15.0	100.00	4.90%	0.26	6.52	43.00	4.90%	3.32	0.22				
			20.0					1186.00	4.60%	4.29	4.61	11.34	1329.00	17.38	11.34
OS-E3	0.26	9.9	15.0	100.00	2.90%	0.16	10.67	200.00	2.90%	2.55	1.30				
			15.0					500.00	3.50%	2.81	2.97	14.95	800.00	14.44	14.44
E4	0.49	12.8	15.0	100.00	3.00%	0.22	7.66	900.00	4.70%	3.25	4.61				
			20.0					100.00	2.50%	3.16	0.53	12.80	1100.00	16.11	12.80
E5	0.49	13.3	15.0	100.00	3.00%	0.22	7.66	391.00	6.14%	3.72	1.75				
			20.0					657.00	2.40%	3.10	3.53	12.95	1148.00	16.38	12.95
DP-12	0.49	43.4	15.0	100.00	2.90%	0.22	7.75	200.00	2.90%	2.55	1.30				
			20.0					1400.00	3.50%	3.74	6.24	15.29	1700.00	19.44	15.29
OS-E6	0.26	20.8	15.0	100.00	2.70%	0.15	10.93	200.00	2.70%	2.46	1.35				
			20.0					920.00	1.70%	2.61	5.88	18.16	1220.00	16.78	16.78
E7	0.49	8.8	15.0	100.00	3.50%	0.23	7.28	900.00	4.05%	3.02	4.97	12.25	1000.00	15.56	12.25
E8	0.49	21.6	15.0	100.00	6.00%	0.27	6.10	600.00	6.00%	3.67	2.72				
			20.0					1300.00	1.80%	2.68	8.07	16.89	2000.00	21.11	16.89
OS-E9	0.26	46.9	15.0	100.00	3.00%	0.16	10.55	200.00	3.00%	2.60	1.28				
			20.0					1160.00	1.70%	2.61	7.41	19.25	1460.00	18.11	18.11
E10	0.49	20.0	15.0	100.00	2.00%	0.19	8.76	1411.00	2.83%	2.52	9.32	18.08	1511.00	18.39	18.08
E11	0.49	14.5	15.0	100.00	2.82%	0.21	7.82	965.00	2.82%	2.52	6.38	14.21	1065.00	15.92	14.21
E9-E11	0.36	81.4	15.0	100.00	3.00%	0.18	9.30	200.00	3.00%	2.60	1.28				
			20.0					2000.00	2.80%	3.35	9.96	20.54	2300.00	22.78	20.54
F1	0.49	5.1	15.0	100.00	4.00%	0.24	6.97	654.00	5.05%	3.37	3.23				
			20.0					175.00	0.60%	1.55	1.88	12.09	929.00	15.16	12.09
F2	0.49	28.0	15.0	100.00	5.70%	0.27	6.20	1704.00	1.84%	2.03	13.96	20.16	1804.00	20.02	20.02
G	0.49	20.1	15.0	100.00	2.70%	0.21	7.94	862.00	2.82%	2.52	5.70	13.64	962.00	15.34	13.64
H1	0.49	4.3	15.0	100.00	1.00%	0.15	11.01	46.00	1.00%	1.50	0.51				
			20.0					863.00	4.90%	4.43	3.25	14.77	1009.00	15.61	14.77
H2	0.49	18.0	15.0	100.00	4.00%	0.24	6.97	1132.00	4.42%	3.15	5.98	12.95	1232.00	16.84	12.95

CORE ENGINEERING GROUP

Standard Form SF-1. Time of Concentration-Proposed

Calculated By: Leonard Beasley
Date: September, 2016
Checked By: Leonard Beasley

Job No: 100.013
Project: Lorson Ranch East MDDP

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
OS-I1	0.26	16.0	15.0	100.00	2.00%	0.14	12.07	200.00	2.00%	2.12	1.57				
			20.0					845.00	3.20%	3.58	3.94	17.57	1145.00	16.36	16.36
I2	0.49	13.0	15.0	100.00	3.50%	0.23	7.28	762.00	4.53%	3.19	3.98	11.26	862.00	14.79	11.26
I	0.38	29.0	15.0	100.00	2.00%	0.16	10.34	200.00	3.00%	2.60	1.28				
			20.0					1470.00	1.70%	2.61	9.40	21.02	1770.00	19.83	19.83
OS-J1	0.26	12.4	15.0	100.00	3.00%	0.16	10.55	200.00	3.00%	2.60	1.28				
			20.0					965.00	2.70%	3.29	4.89	16.73	1265.00	17.03	16.73
J2	0.49	12.0	15.0	100.00	2.00%	0.19	8.76	737.00	3.93%	2.97	4.13	12.89	837.00	14.65	12.89
J	0.38	24.4	15.0	100.00	3.00%	0.18	9.05	200.00	3.00%	2.60	1.28				
			20.0					1802.00	3.17%	3.56	8.43	18.76	2102.00	21.68	18.76
OS-K1	0.26	2.0	15.0	100.00	4.00%	0.17	9.60	200.00	6.97%	3.96	0.84				
			20.0					216.00	6.97%	5.28	0.68	11.12	516.00	12.87	11.12
K2	0.49	3.7	15.0	100.00	3.64%	0.23	7.19	586.00	3.64%	2.86	3.41	10.60	686.00	13.81	10.60
K	0.43	5.7	15.0	100.00	8.00%	0.27	6.09	750.00	2.27%	2.26	5.53	11.62	850.00	14.72	11.62

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: September, 2016
Checked By: Leonard Beasley

Job No: 100.013
Project: Lorson Ranch East MDDP
Design Storm: **5 - Year Event, Proposed Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
A			2.59	0.16	15.7	0.41	3.45	1.4													
OS-B1			5.64	0.15	10.8	0.85	4.02	3.4													
B2			3.90	0.49	16.8	1.91	3.35	6.4													
Basin B	**DP-1**	9.54							20.1	2.76	3.08	8.5									
C1			23.20	0.49	20.3	11.37	3.07	34.9													
C2			34.50	0.49	11.3	16.91	3.94	66.6													
	DP-2	57.70							22.1			80.1									
C3			8.30	0.49	16.0	4.07	3.42	13.9													
C4			57.50	0.49	23.8	28.18	2.83	79.7													
C5			25.00	0.49	15.6	12.25	3.46	42.4													
C6			18.70	0.49	15.7	9.16	3.46	31.7													
C7			14.50	0.49	13.1	7.11	3.72	26.4													
C8a			11.70	0.49	12.2	5.73	3.83	22.0													
C8			74.50	0.49	17.8	36.51	3.27	119.3													
OS-C9			5.20	0.49	11.3	2.55	3.95	10.1													
C10			13.00	0.49	14.5	6.37	3.57	22.8													
OS-C11			5.60	0.49	13.3	2.74	3.71	10.2													
C12			20.50	0.49	17.6	10.05	3.28	33.0													
C13			19.20	0.16	30.4	3.07	2.46	7.6													
	DP-6c	93.22							34.2	39.34	2.29	90.0									
C14			11.10	0.49	20.5	5.44	3.05	16.6													
C15			40.20	0.49	22.3	19.70	2.93	57.6													
C16a			21.29	0.49	16.6	10.43	3.37	35.1													
C16b			32.23	0.49	15.0	15.79	3.52	55.6													
Overall C16			53.52	0.49	16.6	26.22	3.37	88.3													
C17			18.80	0.49	15.8	9.21	3.44	31.7													
C17a			7.50	0.16	8.0	1.20	4.46	5.4													
D1			17.00	0.49	12.2	8.33	3.83	31.9													
D2			8.00	0.49	10.4	3.92	4.07	16.0													

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: September, 2016
Checked By: Leonard Beasley

Job No: 100.013
Project: Lorson Ranch East MDDP
Design Storm: **5 - Year Event, Proposed Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
		ac.			min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
D3			23.00	0.49	16.6	11.27	3.37	38.0													
D4			36.40	0.49	15.6	17.84	3.46	61.7													
D5			4.60	0.40	10.2	1.84	4.10	7.5													
Basin D		89.00							20.9	43.20	3.02	130.5									
E1			10.20	0.49	13.4	5.00	3.69	18.5													
E2			10.30	0.49	11.3	5.05	3.94	19.9													
OS-E3			9.90	0.26	14.4	2.57	3.58	9.2													
E4			12.80	0.49	12.8	6.27	3.76	23.6													
E5			13.30	0.49	13.0	6.52	3.74	24.4													
	DP-12	56.50							15.3	25.41	3.49	88.7									
OS-E6			21.10	0.22	16.8	4.54	3.35	15.2													
E7			6.70	0.49	12.3	3.28	3.82	12.5													
	DP-11	27.80							16.8	7.82	3.35	26.2									
E8			21.60	0.49	16.9	10.58	3.34	35.4													
OS-E9			46.90	0.26	18.1	12.19	3.24	39.5													
E10			20.00	0.49	18.1	9.80	3.24	31.8													
E11			14.50	0.49	14.2	7.11	3.60	25.6													
	E9-E11	81.40							20.5	29.10	3.05	88.8									
Basin E		187.30																			
F1			5.06	0.49	12.1	2.48	3.84	9.5													
F2			27.97	0.49	20.0	13.71	3.09	42.3													
Basin F		33.03							20.0	16.18	3.09	50.0									
G			20.05	0.49	13.6	9.82	3.66	36.0													
H1			4.27	0.49	14.8	2.09	3.54	7.4													
H2			18.04	0.49	13.0	8.84	3.74	33.1													
Basin H		22.31							14.8	10.93	3.54	38.7									
OS-I1			15.96	0.26	16.4	4.15	3.39	14.1													
I2			13.00	0.49	11.3	6.37	3.95	25.2													

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: September, 2016
Checked By: Leonard Beasley

Job No: 100.013
Project: Lorson Ranch East MDDP
Design Storm: **5 - Year Event, Proposed Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
OS-J1			12.36	0.26	16.7	3.21	3.36	10.8													
J2			12.00	0.49	12.9	5.88	3.75	22.0													
OS-K1			1.98	0.26	11.1	0.51	3.97	2.0													
K2			3.70	0.49	10.6	1.81	4.04	7.3													

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Date: September, 2016
Checked By: Leonard Beasley

Job No: 100.013
Project: Lorson Ranch East MDDP
Design Storm: **100 - Year Event, Proposed Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
		ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
A			2.59	0.51	15.7	1.32	5.79	7.7													
OS-B1			5.64	0.50	10.8	2.82	6.74	19.0													
B2			3.90	0.65	16.8	2.54	5.63	14.3													
Basin B	**DP-1**	9.54							20.1	5.36	5.18	27.7									
C1			23.20	0.65	20.3	15.08	5.15	77.7													
C2			34.50	0.65	11.3	22.43	6.62	148.4													
	DP-2	57.70							22.1			171.0									
C3			8.30	0.65	16.0	5.40	5.75	31.0													
C4			57.50	0.65	23.8	37.38	4.75	177.4													
C5			25.00	0.65	15.6	16.25	5.81	94.4													
C6			18.70	0.65	15.7	12.16	5.80	70.5													
C7			14.50	0.65	13.1	9.43	6.25	58.9													
C8a			11.70	0.65	12.2	7.61	6.44	49.0													
C8			74.50	0.65	17.8	48.43	5.48	265.5													
OS-C9			5.20	0.65	11.3	3.38	6.63	22.4													
C10			13.00	0.65	14.5	8.45	6.00	50.7													
OS-C11			5.60	0.65	13.3	3.64	6.22	22.7													
C12			20.50	0.65	17.6	13.33	5.51	73.5													
C13			19.20	0.51	30.4	9.79	4.13	40.5													
	DP-6c	93.22							34.2	57.91	3.84	222.2									
C14			11.10	0.65	20.5	7.22	5.13	37.0													
C15			40.20	0.65	22.3	26.13	4.91	128.3													
C16a			21.29	0.65	16.6	13.84	5.66	78.3													
C16b			32.23	0.65	15.0	20.95	5.91	123.8													
Overall C16			53.52	0.65	16.6	34.79	5.66	196.7													
C17			18.80	0.65	15.8	12.22	5.77	70.6													
C17a			7.50	0.51	8.0	3.83	7.49	28.7													

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Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley | Job No: 100.013

Date: September, 2016 | Project: Lorson Ranch East MDDP

Checked By: Leonard Beasley | Design Storm: **100 - Year Event, Proposed Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	$\sum$ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
		ac.			min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
D1			17.00	0.65	12.2	11.05	6.43	71.1													
D2			8.00	0.65	10.4	5.20	6.83	35.5													
D3			23.00	0.65	16.6	14.95	5.66	84.5													
D4			36.40	0.65	15.6	23.66	5.81	137.5													
D5			4.60	0.65	10.2	2.99	6.88	20.6													
E1			10.20	0.65	13.4	6.63	6.20	41.1													
E2			10.30	0.65	11.3	6.70	6.62	44.3													
OS-E3			9.90	0.55	14.4	5.45	6.01	32.7													
E4			12.80	0.65	12.8	8.32	6.31	52.5													
E5			13.30	0.65	13.0	8.65	6.28	54.3													
	DP-12	56.50							15.3	35.74	5.86	209.5									
OS-E6			21.10	0.55	16.8	11.61	5.63	65.3													
E7			6.70	0.65	12.3	4.36	6.41	27.9													
	DP-11	27.80							16.8	15.96	5.63	89.8									
E8			21.60	0.65	16.9	14.04	5.61	78.8													
	E6-E8	49.40							21.6	30.00	5.61	168.3									
OS-E9			46.90	0.40	18.1	18.76	5.44	102.0													
E10			20.00	0.65	18.1	13.00	5.44	70.7													
E11			14.50	0.65	14.2	9.43	6.05	57.0													
	E9-E11	81.40							22.0	41.19	4.95	203.9									
Basin E		187.30																			
F1			5.06	0.65	12.1	3.29	6.45	21.2													
F2			27.97	0.65	20.0	18.18	5.18	94.2													

CORE ENGINEERING GROUP

Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)

Calculated By: Leonard Beasley
Job No: 100.013
Date: September, 2016
Project: Lorson Ranch East MDDP
Checked By: Leonard Beasley
Design Storm: **100 - Year Event, Proposed Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t_c	CA	i	Q	t_c	$\sum$ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t_t	
		ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
Basin F		33.03							20.0	21.47	5.18	111.3									
G			20.05	0.65	13.6	13.03	6.15	80.2													
H1			4.27	0.65	14.8	2.78	5.95	16.5													
H2			18.04	0.65	13.0	11.73	6.28	73.7													
Basin H		22.31							14.8	14.50	5.95	86.3									
OS-I1			15.96	0.55	16.4	8.78	5.69	50.0													
I2			13.00	0.65	11.3	8.45	6.63	56.1													
OS-J1			12.36	0.55	16.7	6.80	5.64	38.3													
J2			12.00	0.65	12.9	7.80	6.29	49.1													
OS-K1			1.98	0.55	11.1	1.09	6.66	7.3													
K2			3.70	0.65	10.6	2.41	6.79	16.3													

Channel Report

Hydraflow Express by Intelisolve | Sunday, Aug 7 2016, 10:17 AM

36-inch from Basin C1 under Lorson Blvd.

Circular

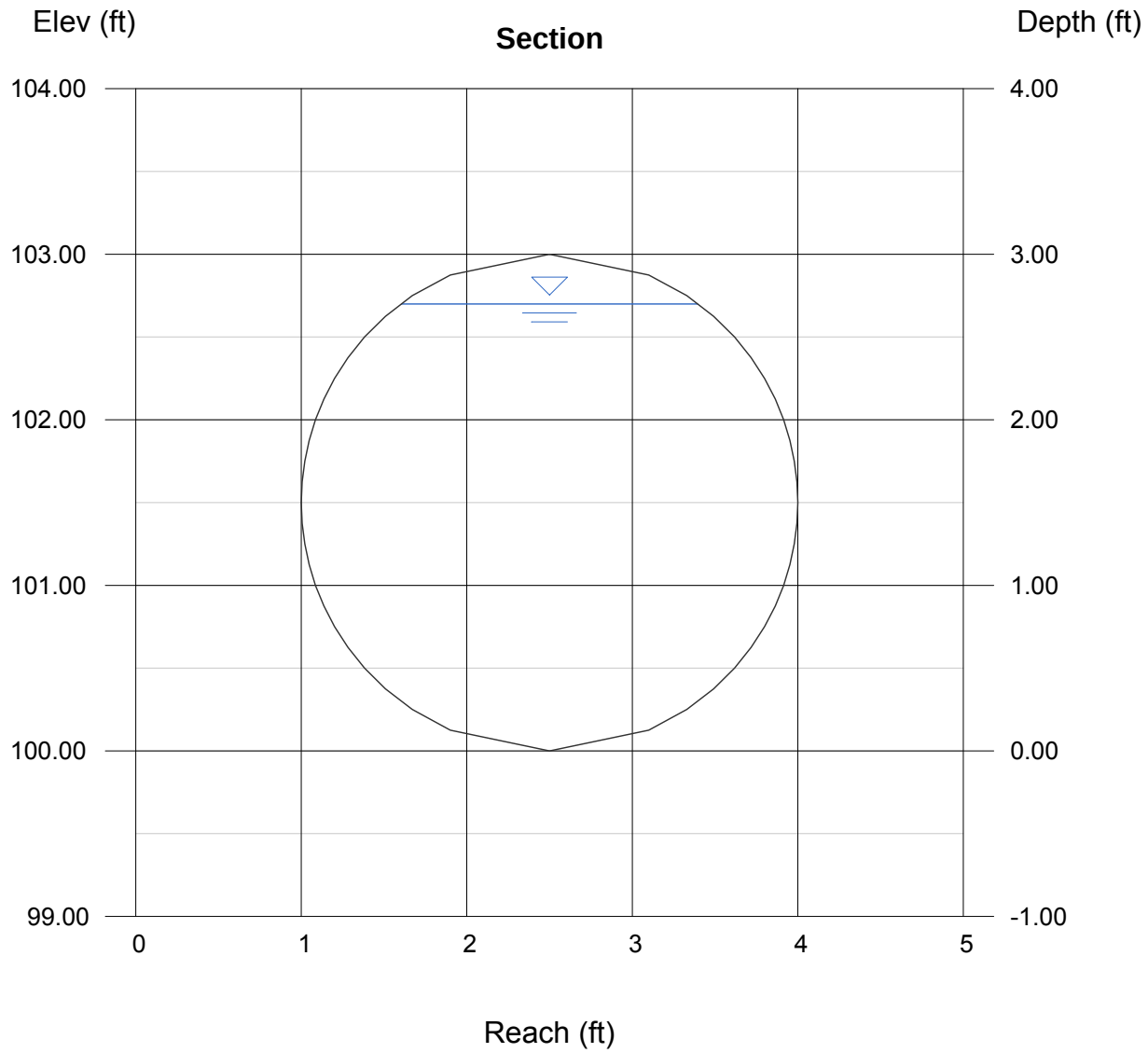
Diameter (ft)	= 3.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Q vs Depth
No. Increments	= 10

Highlighted

Depth (ft)	= 2.70
Q (cfs)	= 71.10
Area (sqft)	= 6.70
Velocity (ft/s)	= 10.61
Wetted Perim (ft)	= 7.50
Crit Depth, Yc (ft)	= 2.59
Top Width (ft)	= 1.80
EGL (ft)	= 4.45



Channel Report

Hydraflow Express by Intelisolve | Sunday, Aug 7 2016, 9:42 AM

48-inch at Des. Pt. 2 into Pond C1

Circular

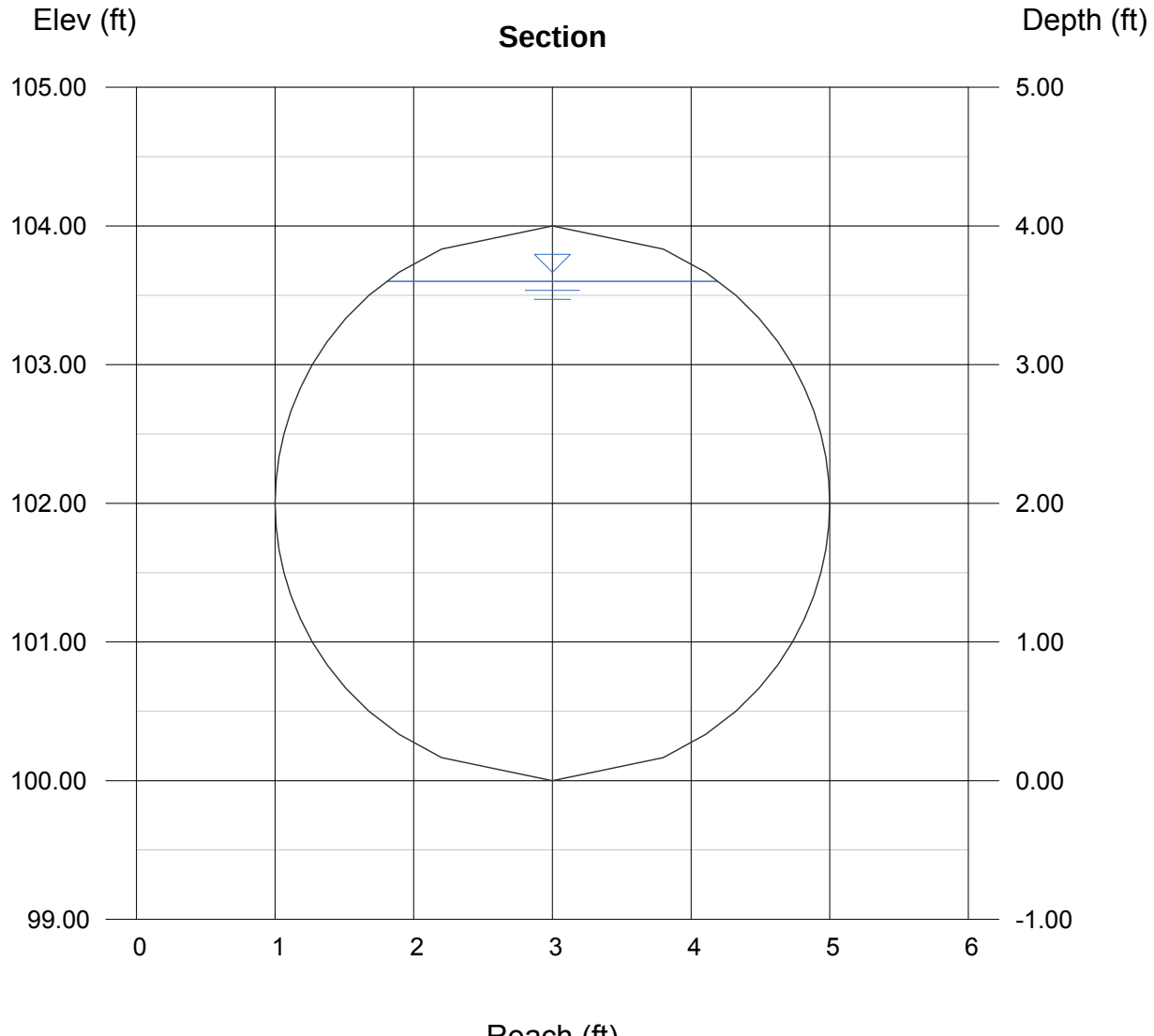
Diameter (ft)	= 4.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Q vs Depth
No. Increments	= 10

Highlighted

Depth (ft)	= 3.60
Q (cfs)	= 153.14
Area (sqft)	= 11.92
Velocity (ft/s)	= 12.85
Wetted Perim (ft)	= 10.00
Crit Depth, Yc (ft)	= 3.52
Top Width (ft)	= 2.39
EGL (ft)	= 6.17



Channel Report

Hydraflow Express by Intelisolve | Sunday, Aug 7 2016, 2:34 PM

42-inch from Design Pt. 3e to Design Pt. 7

Circular

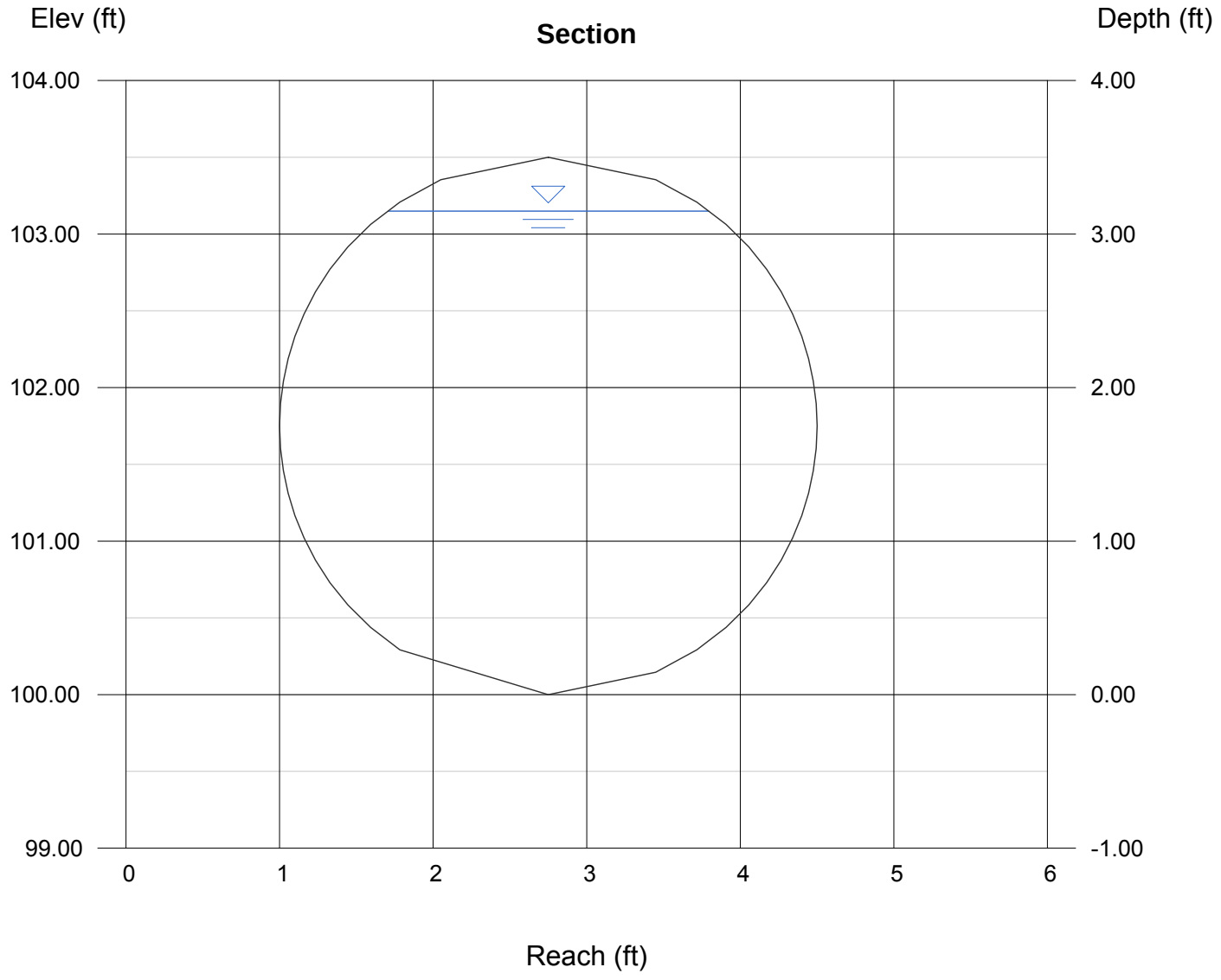
Diameter (ft)	= 3.50
Invert Elev (ft)	= 100.00
Slope (%)	= 1.30
N-Value	= 0.013

Calculations

Compute by:	Q vs Depth
No. Increments	= 10

Highlighted

Depth (ft)	= 3.15
Q (cfs)	= 122.29
Area (sqft)	= 9.12
Velocity (ft/s)	= 13.40
Wetted Perim (ft)	= 8.75
Crit Depth, Yc (ft)	= 3.19
Top Width (ft)	= 2.09
EGL (ft)	= 5.94



Channel Report

Hydraflow Express by Intelisolve | Friday, Sep 2 2016, 10:37 PM

Design Pt. 6a to 6c

42" RCP

Circular

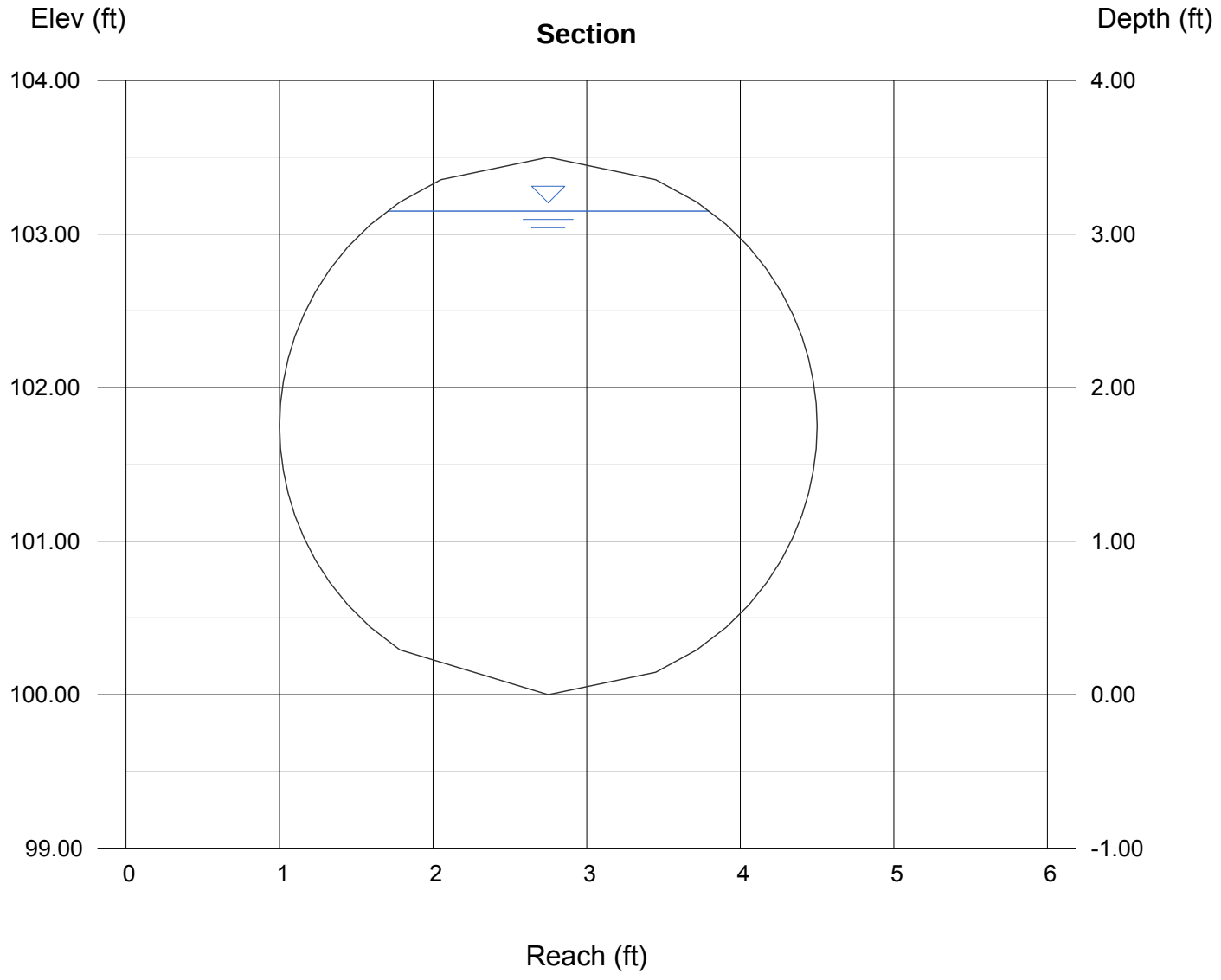
Diameter (ft)	= 3.50
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Q vs Depth
No. Increments	= 10

Highlighted

Depth (ft)	= 3.15
Q (cfs)	= 107.26
Area (sqft)	= 9.12
Velocity (ft/s)	= 11.75
Wetted Perim (ft)	= 8.75
Crit Depth, Yc (ft)	= 3.05
Top Width (ft)	= 2.09
EGL (ft)	= 5.30



Channel Report

Hydraflow Express by Intelisolve | Sunday, Aug 7 2016, 3:36 PM

48-inch from Design Pt.6c to Design Point 6

Circular

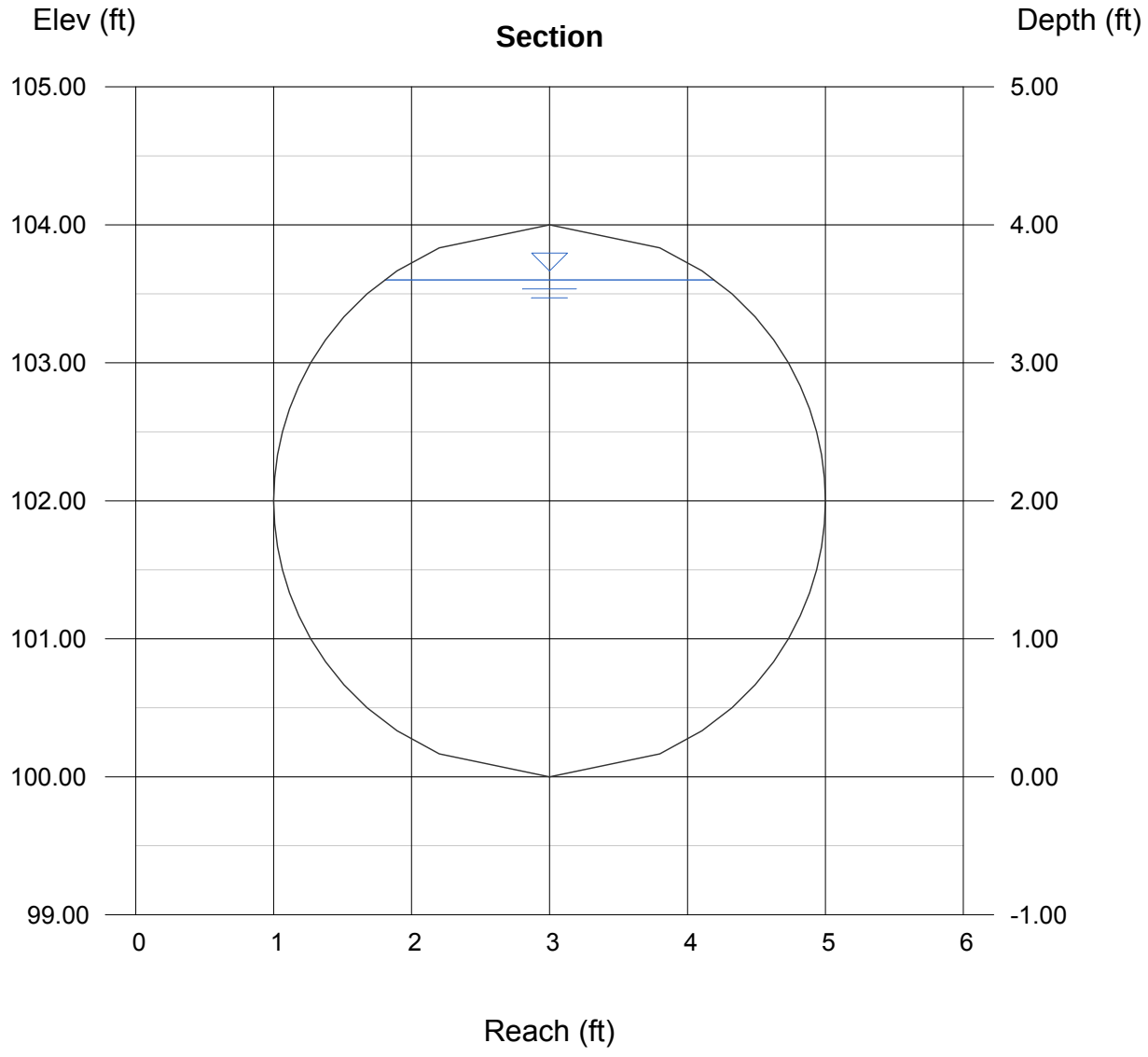
Diameter (ft)	= 4.00
Invert Elev (ft)	= 100.00
Slope (%)	= 0.70
N-Value	= 0.013

Calculations

Compute by:	Q vs Depth
No. Increments	= 10

Highlighted

Depth (ft)	= 3.60
Q (cfs)	= 128.13
Area (sqft)	= 11.92
Velocity (ft/s)	= 10.75
Wetted Perim (ft)	= 10.00
Crit Depth, Yc (ft)	= 3.27
Top Width (ft)	= 2.39
EGL (ft)	= 5.40



Channel Report

Hydraflow Express by Intelisolve | Friday, Sep 2 2016, 10:44 PM

66-inch cmp from Design Pt. 6 to Pond C5

Circular

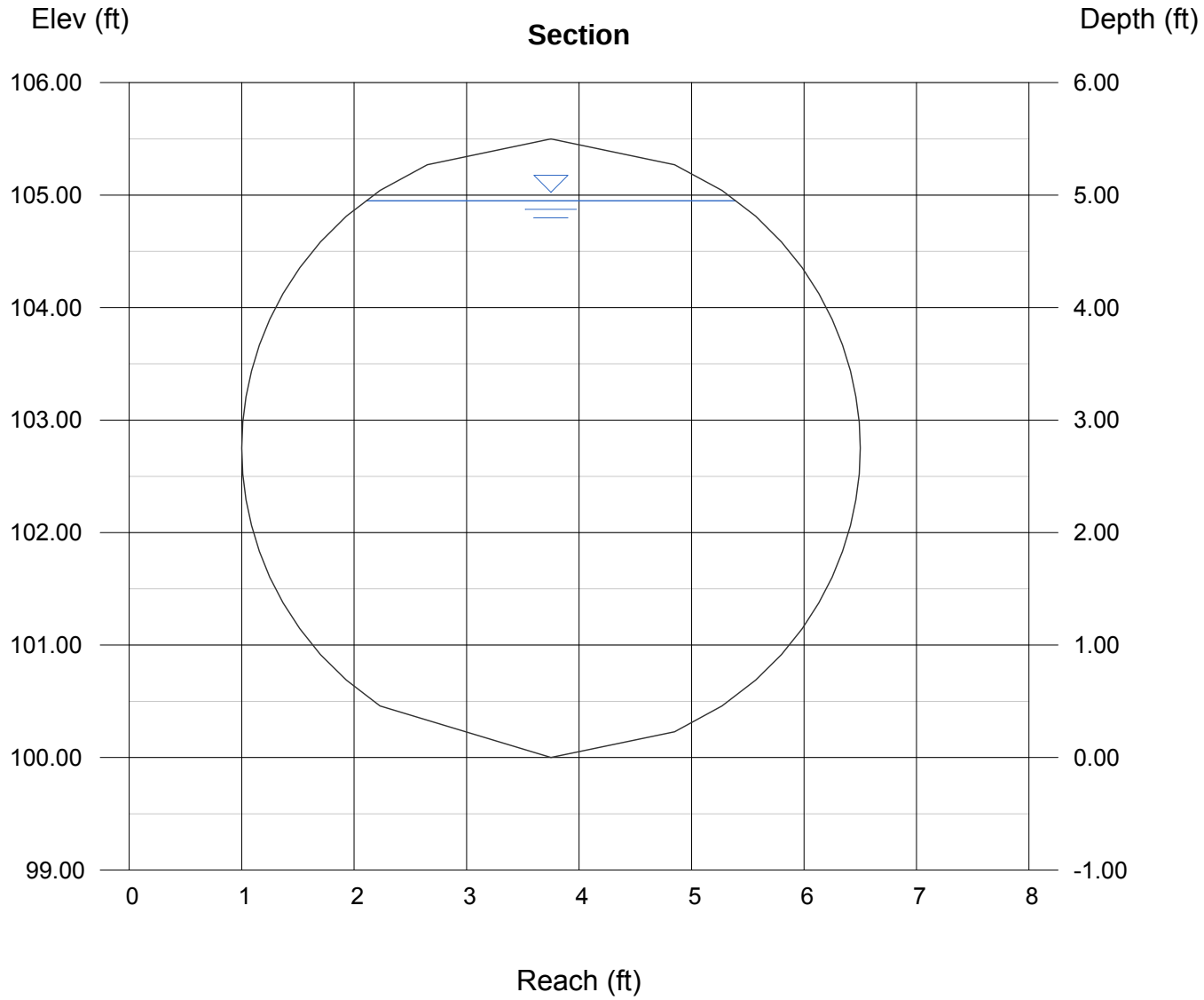
Diameter (ft)	= 5.50
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Q vs Depth
No. Increments	= 10

Highlighted

Depth (ft)	= 4.95
Q (cfs)	= 358.06
Area (sqft)	= 22.53
Velocity (ft/s)	= 15.89
Wetted Perim (ft)	= 13.75
Crit Depth, Yc (ft)	= 4.92
Top Width (ft)	= 3.29
EGL (ft)	= 8.88



APPENDIX C – HYDRAFLOW CALCULATIONS

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	140.99	6	384	905,484	----	------	------	EX-C
2	SCS Runoff	104.56	6	378	530,876	----	------	------	EX-E

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	458.13	6	384	2,456,980	----	------	------	EX-C
2	SCS Runoff	286.52	6	378	1,291,638	----	------	------	EX-E

Hydrograph Plot

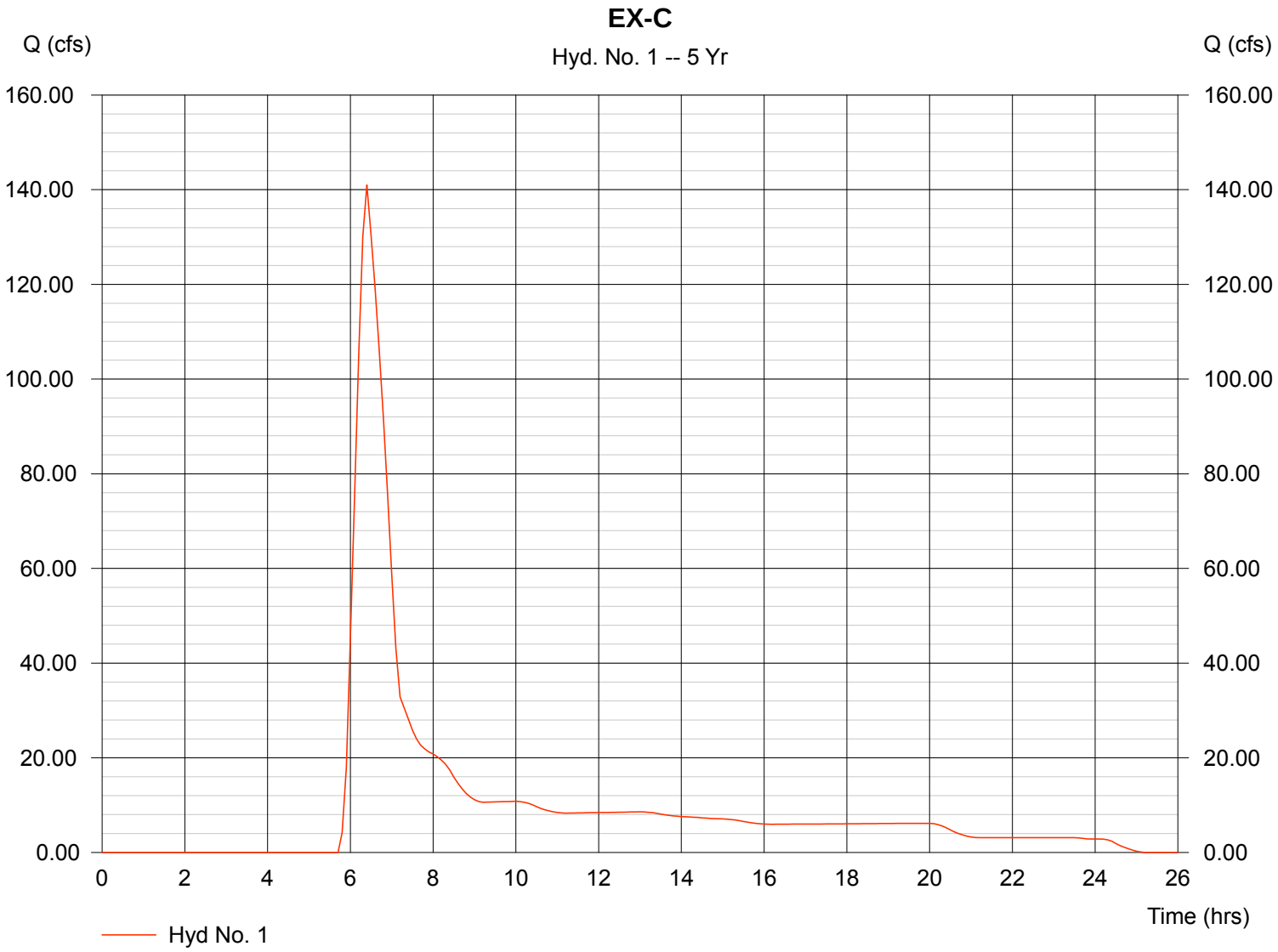
Hydraflow Hydrographs by Intelisolve | Tuesday, May 23 2017, 7:39 AM

Hyd. No. 1

EX-C

Hydrograph type	= SCS Runoff	Peak discharge	= 140.99 cfs
Storm frequency	= 5 yrs	Time interval	= 6 min
Drainage area	= 452.970 ac	Curve number	= 69
Basin Slope	= 0.0 %	Hydraulic length	= 7400 ft
Tc method	= USER	Time of conc. (Tc)	= 49.50 min
Total precip.	= 2.80 in	Distribution	= Custom
Storm duration	= CSpring_IIA-6min.cds	Shape factor	= 484

Hydrograph Volume = 905,484 cuft



Hydrograph Plot

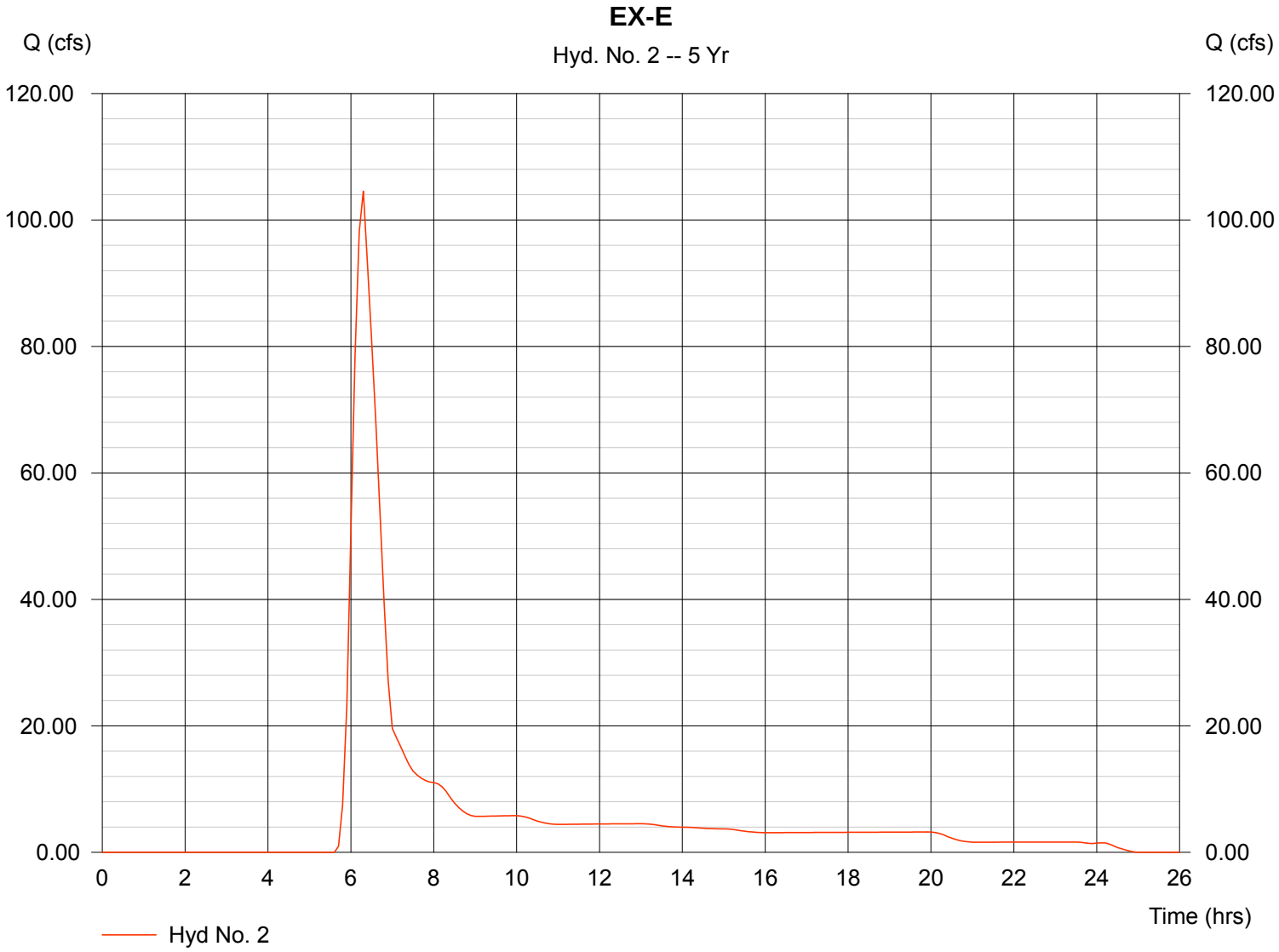
Hydraflow Hydrographs by Intelisolve | Tuesday, May 23 2017, 7:12 AM

Hyd. No. 2

EX-E

Hydrograph type	= SCS Runoff		Peak discharge	= 104.56 cfs	
Storm frequency	= 5 yrs		Time interval	= 6 min	
Drainage area	= 187.300 ac		Curve number	= 73.5	
Basin Slope	= 3.0 %		Hydraulic length	= 4150 ft	
Tc method	= USER		Time of conc. (Tc)	= 33.00 min	
Total precip.	= 2.80 in		Distribution	= Custom	
Storm duration	= CSpring_IIA-6min.cds		Shape factor	= 484	

Hydrograph Volume = 530,876 cuft



Hydrograph Plot

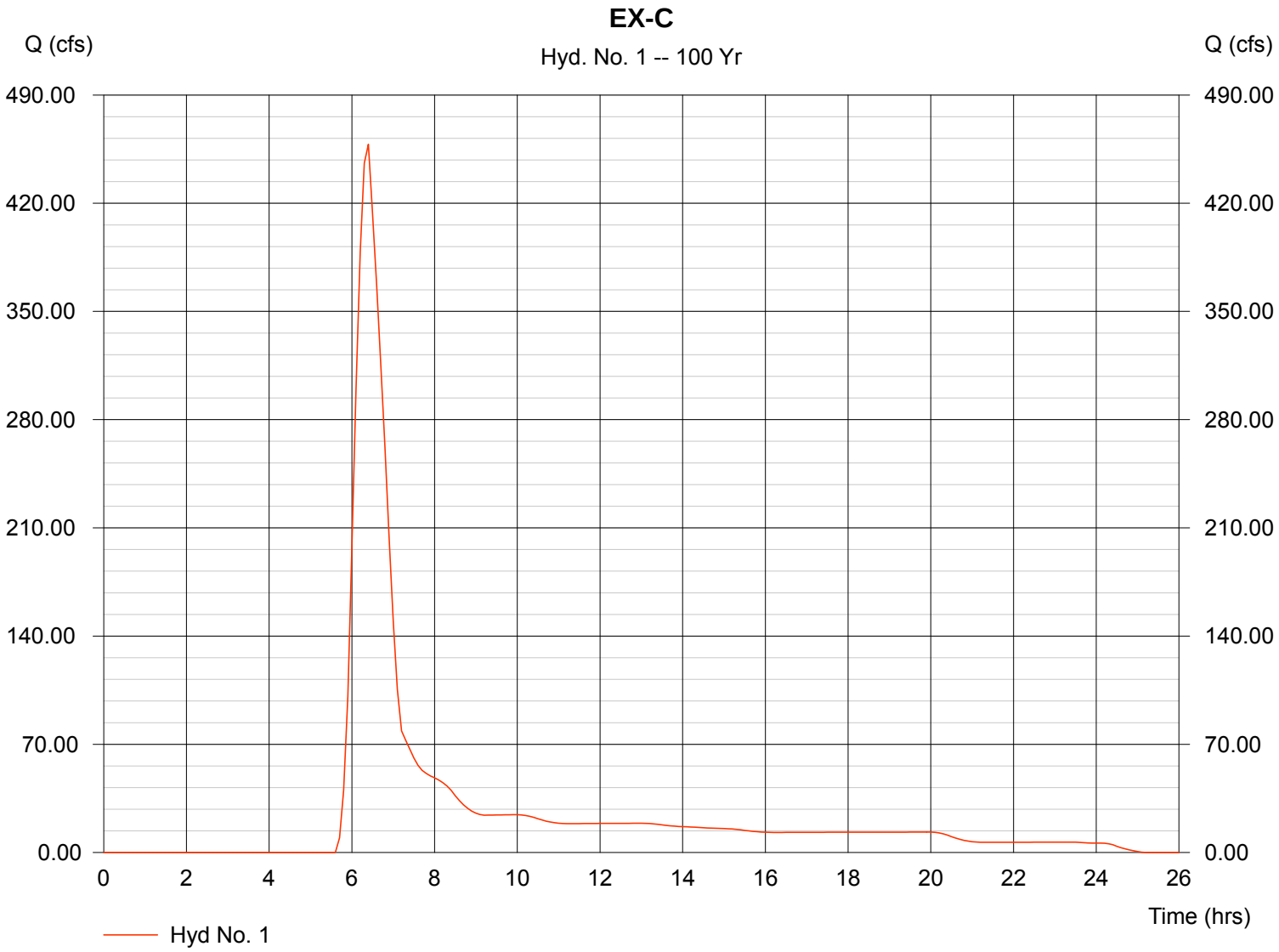
Hydraflow Hydrographs by Intelisolve | Tuesday, May 23 2017, 7:39 AM

Hyd. No. 1

EX-C

Hydrograph type	= SCS Runoff	Peak discharge	= 458.13 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 452.970 ac	Curve number	= 69
Basin Slope	= 0.0 %	Hydraulic length	= 7400 ft
Tc method	= USER	Time of conc. (Tc)	= 49.50 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= CSpring_IIA-6min.cds	Shape factor	= 484

Hydrograph Volume = 2,456,980 cuft



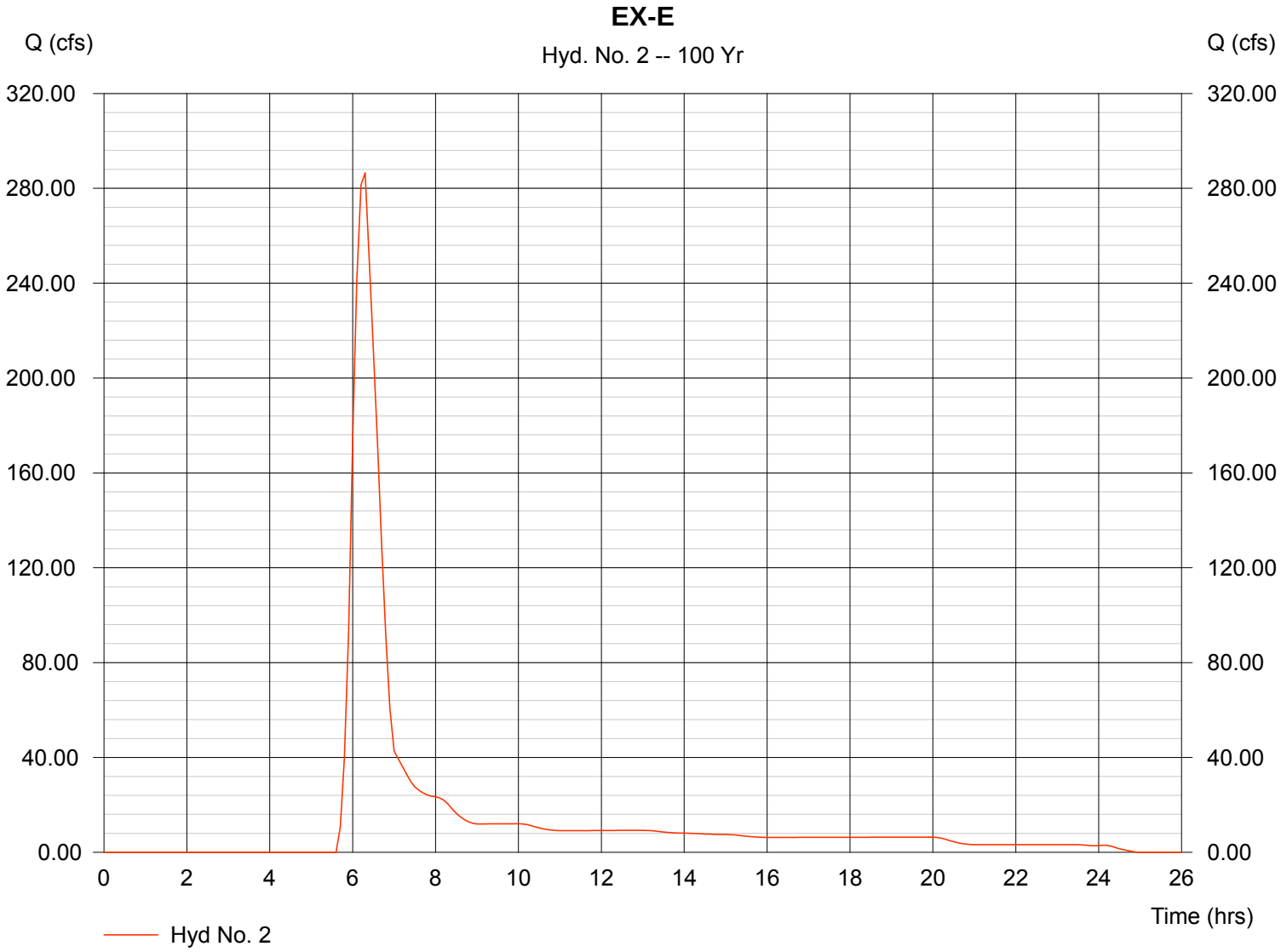
Hydrograph Plot

Hyd. No. 2

EX-E

Hydrograph type	=	SCS Runoff	Peak discharge	=	286.52 cfs
Storm frequency	=	100 yrs	Time interval	=	6 min
Drainage area	=	187.300 ac	Curve number	=	73.5
Basin Slope	=	3.0 %	Hydraulic length	=	4150 ft
Tc method	=	USER	Time of conc. (Tc)	=	33.00 min
Total precip.	=	4.40 in	Distribution	=	Custom
Storm duration	=	CSpring_IIA-6min.cds	Shape factor	=	484

Hydrograph Volume = 1,291,638 cuft



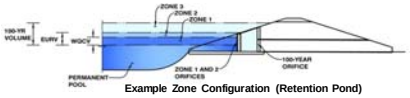
APPENDIX D – POND CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin C1, C2 & C3 Pond "C1"



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	57.70	acres
Watershed Length =	2,400	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	1.222	acre-feet
Excess Urban Runoff Volume (EURV) =	3.623	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	3.370	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	4.678	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	5.763	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	7.356	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	8.625	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	10.193	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	3.162	acre-feet
Approximate 5-yr Detention Volume =	4.406	acre-feet
Approximate 10-yr Detention Volume =	5.038	acre-feet
Approximate 25-yr Detention Volume =	5.375	acre-feet
Approximate 50-yr Detention Volume =	5.533	acre-feet
Approximate 100-yr Detention Volume =	6.046	acre-feet

Optional User Override 1-hr Precipitation

1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	1.222	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.401	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.423	acre-feet
Total Detention Basin Volume =	6.046	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 = 0.2 ft

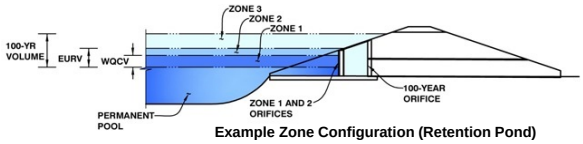
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	4,020	0.092		
5745.33	--	0.33	--	--	--	10,492	0.241	2,290	0.053
5746	--	1.00	--	--	--	23,632	0.543	13,591	0.312
5747	--	2.00	--	--	--	53,900	1.237	52,054	1.195
5748	--	3.00	--	--	--	57,925	1.330	108,504	2.491
5749	--	4.00	--	--	--	62,019	1.424	168,476	3.868
5750	--	5.00	--	--	--	66,200	1.520	232,586	5.339
5751	--	6.00	--	--	--	70,500	1.618	300,936	6.909
5752	--	7.00	--	--	--	74,920	1.720	373,646	8.578
5753	--	8.00	--	--	--	78,760	1.808	450,486	10.342
5754	--	9.00	--	--	--	80,000	1.837	529,866	12.164
5755	--	10.00	--	--	--	82,000	1.882	610,866	14.024

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin C1, C2 & C3, Pond "C1"



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.02	1.222	Orifice Plate
Zone 2 (EURV)	3.83	2.401	Rectangular Orifice
Zone 3 (100-year)	5.46	2.423	Weir&Pipe (Restrict)
		6.046	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	5.000E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.32	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.30	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	7.20	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.77	1.55					
Orifice Area (sq. inches)	7.20	7.20	7.20					

	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 Rectangular	Not Selected		Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.02	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.36	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	3.83	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.21	N/A	feet
Vertical Orifice Height =	5.00	N/A	inches				
Vertical Orifice Width =	10.49		inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected		Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.47	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.47	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Over Flow Weir Slope Length =	6.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	11.39	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	6.00	N/A	feet	Overflow Grate Open Area w/o Debris =	16.80	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	12.60	N/A	ft^2
Debris Clogging % =	25%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected		Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.47	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.64	N/A	feet
Restrictor Plate Height Above Pipe Invert =	14.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.16	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.16	feet
Spillway Crest Length =	50.00	feet	Stage at Top of Freeboard =	9.16	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.84	acres
Freeboard above Max Water Surface =		feet			

Calculated Parameters for Spillway

Routed Hydrograph Results

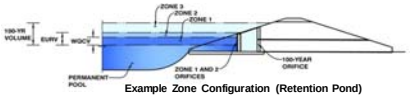
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	1.222	3.623	3.370	4.678	5.763	7.356	8.625	10.193	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.223	3.625	3.372	4.680	5.765	7.355	8.621	10.194	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.13	0.35	0.81	1.07	1.39	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.9	7.4	20.2	46.7	61.6	80.2	0.0
Peak Inflow Q (cfs) =	21.3	62.4	58.1	80.1	98.2	124.6	145.4	171.0	#N/A
Peak Outflow Q (cfs) =	0.7	3.2	3.1	3.8	4.4	12.6	16.8	17.9	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.2	0.3	0.3	0.2	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	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	0.5	0.7	0.7	#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	46	46	47	48	48	47	46	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	51	54	56	58	57	57	#N/A
Maximum Ponding Depth (ft) =	1.93	3.56	3.40	4.25	4.93	5.71	6.23	6.98	#N/A
Area at Maximum Ponding Depth (acres) =	1.19	1.38	1.37	1.45	1.51	1.59	1.64	1.72	#N/A
Maximum Volume Stored (acre-ft) =	1.122	3.250	3.017	4.212	5.218	6.443	7.267	8.526	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin C3 & C4, Pond "C2.1"



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	68.00	acres
Watershed Length =	2,500	ft
Watershed Slope =	0.038	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	1.440	acre-feet
Excess Urban Runoff Volume (EURV) =	4.270	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	3.972	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	5.513	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	6.792	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	8.669	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	10.164	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	12.013	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	3.727	acre-feet
Approximate 5-yr Detention Volume =	5.192	acre-feet
Approximate 10-yr Detention Volume =	5.937	acre-feet
Approximate 25-yr Detention Volume =	6.335	acre-feet
Approximate 50-yr Detention Volume =	6.520	acre-feet
Approximate 100-yr Detention Volume =	7.126	acre-feet

Optional User Override 1-hr Precipitation	
1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	1.440	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.830	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.855	acre-feet
Total Detention Basin Volume =	7.126	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 = 0.2 ft

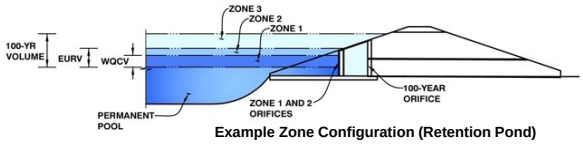
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
5765.33	--	0.33	--	--	--	200	0.005	39	0.001
5766	--	1.00	--	--	--	5,012	0.115	1,737	0.040
5767	--	2.00	--	--	--	29,041	0.667	18,524	0.425
5768	--	3.00	--	--	--	43,198	0.992	54,933	1.261
5769	--	4.00	--	--	--	46,089	1.058	99,576	2.286
5770	--	5.00	--	--	--	49,051	1.126	147,146	3.378
5771	--	6.00	--	--	--	52,082	1.196	197,713	4.539
5772	--	7.00	--	--	--	55,183	1.267	251,345	5.770
5773	--	8.00	--	--	--	58,358	1.340	308,116	7.073
5774	--	9.00	--	--	--	61,000	1.400	367,795	8.443

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin C3 & C4, Pond C2.1



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.18	1.440	Orifice Plate
Zone 2 (EURV)	5.78	2.830	Rectangular Orifice
Zone 3 (100-year)	8.04	2.855	Weir&Pipe (Restrict)
		7.126	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	3.236E-02	ft^2
Depth at top of Zone using Orifice Plate =	3.20	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	12.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	4.66	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	2.00	3.00				
Orifice Area (sq. inches)	4.66	4.66	4.66	4.66				

	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 Rectangular	Not Selected		Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	3.18	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.39	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	5.78	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.17	N/A	feet
Vertical Orifice Height =	4.00	N/A	inches				
Vertical Orifice Width =	13.86		inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected		Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.00	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Over Flow Weir Slope Length =	12.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	6.84	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	12.00	N/A	feet	Overflow Grate Open Area w/o Debris =	33.60	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	16.80	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected		Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.91	N/A	ft^2
Outlet Pipe Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	1.25	N/A	feet
Restrictor Plate Height Above Pipe Invert =	48.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.39	feet
Spillway Crest Length =	50.00	feet	Stage at Top of Freeboard =	10.39	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.40	acres
Freeboard above Max Water Surface =		feet			

Calculated Parameters for Spillway

Routed Hydrograph Results

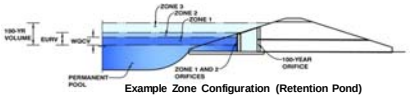
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	1.440	4.270	3.972	5.513	6.792	8.669	10.164	12.013	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.440	4.271	3.972	5.513	6.784	8.669	10.161	12.008	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.13	0.36	0.83	1.09	1.42	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.1	8.9	24.4	56.2	74.2	96.5	0.0
Peak Inflow Q (cfs) =	25.6	74.7	69.6	95.9	117.4	149.0	173.8	204.2	#N/A
Peak Outflow Q (cfs) =	0.7	3.9	3.7	10.8	33.5	56.6	59.4	63.3	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.2	1.4	1.0	0.8	0.7	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 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	0.2	0.9	1.5	1.6	1.7	#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	48	47	49	47	45	44	42	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	51	54	53	52	52	51	#N/A
Maximum Ponding Depth (ft) =	3.08	5.40	5.16	6.20	6.56	6.99	7.58	8.42	#N/A
Area at Maximum Ponding Depth (acres) =	1.00	1.15	1.14	1.21	1.23	1.27	1.31	1.37	#N/A
Maximum Volume Stored (acre-ft) =	1.341	3.834	3.559	4.779	5.207	5.745	6.504	7.641	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin C5 & C7, Pond C2.2



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	40.00	acres
Watershed Length =	2,500	ft
Watershed Slope =	0.045	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.847	acre-feet
Excess Urban Runoff Volume (EURV) =	2.512	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	2.336	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	3.243	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	3.995	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	5.100	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	5.979	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	7.066	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	2.192	acre-feet
Approximate 5-yr Detention Volume =	3.054	acre-feet
Approximate 10-yr Detention Volume =	3.493	acre-feet
Approximate 25-yr Detention Volume =	3.726	acre-feet
Approximate 50-yr Detention Volume =	3.835	acre-feet
Approximate 100-yr Detention Volume =	4.191	acre-feet

Optional User Override 1-hr Precipitation	
1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.847	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.665	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.680	acre-feet
Total Detention Basin Volume =	4.191	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 = 0.2 ft

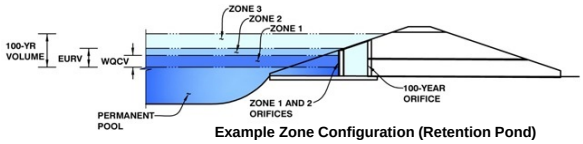
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	30	0.001		
5745.33	--	0.33	--	--	--	200	0.005	36	0.001
5746	--	1.00	--	--	--	2,363	0.054	873	0.020
5747	--	2.00	--	--	--	23,792	0.546	13,737	0.315
5748	--	3.00	--	--	--	25,787	0.592	38,763	0.890
5749	--	4.00	--	--	--	27,855	0.639	65,584	1.506
5750	--	5.00	--	--	--	29,992	0.689	94,508	2.170
5751	--	6.00	--	--	--	32,230	0.740	125,619	2.884
5752	--	7.00	--	--	--	34,712	0.797	159,090	3.652
5753	--	8.00	--	--	--	37,000	0.849	194,946	4.475
5754	--	9.00	--	--	--	40,000	0.918	233,446	5.359

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin C5 & C7, Pond C2.2



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.93	0.847	Orifice Plate
Zone 2 (EURV)	5.49	1.665	Rectangular Orifice
Zone 3 (100-year)	7.67	1.680	Weir&Pipe (Restrict)
		4.191	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	2.014E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.93	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	12.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.90	sq. inches (diameter = 1-15/16 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	2.00	3.00				
Orifice Area (sq. inches)	2.90	2.90	2.90	2.90				

	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 Rectangular	Not Selected		Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	3.10	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.11	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	5.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.17	N/A	feet
Vertical Orifice Height =	4.00	N/A	inches				
Vertical Orifice Width =	4.00		inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected		Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.80	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.80	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Over Flow Weir Slope Length =	10.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	8.91	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	10.00	N/A	feet	Overflow Grate Open Area w/o Debris =	28.00	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	14.00	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected		Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.14	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	1.00	N/A	feet
Restrictor Plate Height Above Pipe Invert =	48.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.03	feet
Spillway Crest Length =	30.00	feet	Stage at Top of Freeboard =	9.03	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.92	acres
Freeboard above Max Water Surface =		feet			

Calculated Parameters for Spillway

Routed Hydrograph Results

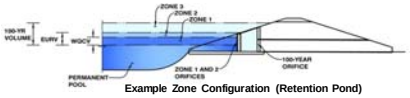
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	0.847	2.512	2.336	3.243	3.995	5.100	5.979	7.066	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.846	2.509	2.334	3.240	3.991	5.087	5.967	7.056	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.11	0.29	0.69	0.91	1.19	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.5	4.2	11.7	27.5	36.3	47.6	0.0
Peak Inflow Q (cfs) =	13.1	38.3	35.7	49.3	60.5	76.7	89.6	105.5	#N/A
Peak Outflow Q (cfs) =	0.4	1.5	1.4	5.4	19.1	35.5	36.8	39.1	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.3	1.6	1.3	1.0	0.8	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 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	0.1	0.6	1.2	1.2	1.3	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	38	56	55	58	57	55	53	52	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**41**	60	59	63	63	62	61	60	#N/A
Maximum Ponding Depth (ft) =	2.82	5.20	4.96	5.96	6.24	6.51	6.93	7.67	#N/A
Area at Maximum Ponding Depth (acres) =	0.58	0.70	0.69	0.74	0.75	0.77	0.79	0.83	#N/A
Maximum Volume Stored (acre-ft) =	0.784	2.301	2.135	2.847	3.055	3.261	3.597	4.198	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin C6, Pond C2.3



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	18.70	acres
Watershed Length =	900	ft
Watershed Slope =	0.050	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.396	acre-feet
Excess Urban Runoff Volume (EURV) =	1.174	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	1.092	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	1.516	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	1.868	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	2.384	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	2.795	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	3.304	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	1.025	acre-feet
Approximate 5-yr Detention Volume =	1.428	acre-feet
Approximate 10-yr Detention Volume =	1.633	acre-feet
Approximate 25-yr Detention Volume =	1.742	acre-feet
Approximate 50-yr Detention Volume =	1.793	acre-feet
Approximate 100-yr Detention Volume =	1.960	acre-feet

Optional User Override 1-hr Precipitation

1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.396	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.778	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.785	acre-feet
Total Detention Basin Volume =	1.960	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 = 0.2 ft

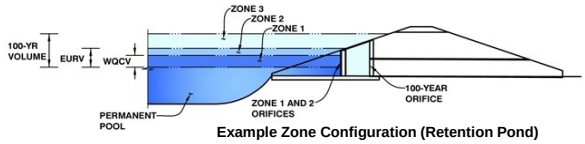
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	30	0.001		
5746.33	--	0.33	--	--	--	500	0.011	83	0.002
5747	--	1.00	--	--	--	22,141	0.508	7,452	0.171
5748	--	2.00	--	--	--	24,321	0.558	30,660	0.704
5749	--	3.00	--	--	--	26,601	0.611	56,364	1.294
5750	--	4.00	--	--	--	28,983	0.665	84,156	1.932
5751	--	5.00	--	--	--	31,466	0.722	114,380	2.626
5752	--	6.00	--	--	--	34,050	0.782	147,138	3.378
5753	--	7.00	--	--	--	36,742	0.843	182,534	4.190
5754	--	8.00	--	--	--	38,000	0.872	219,905	5.048
5755	--	9.00	--	--	--	40,000	0.918	258,905	5.944

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin C6, Pond C2.3



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.43	0.396	Orifice Plate
Zone 2 (EURV)	2.81	0.778	Rectangular Orifice
Zone 3 (100-year)	4.05	0.785	Weir&Pipe (Restrict)
		1.960	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 Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.813E-02	ft²
Depth at top of Zone using Orifice Plate =	1.43	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	8.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.61	sq. inches (diameter = 1-13/16 inches)	Elliptical Slot Area =	N/A	ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.70	1.40					
Orifice Area (sq. inches)	2.61	2.61	2.61					

	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 Rectangular	Not Selected		Calculated Parameters for Vertical Orifice	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	1.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.21	N/A	ft²
Depth at top of Zone using Vertical Orifice =	2.81	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.17	N/A	feet
Vertical Orifice Height =	4.00	N/A	inches				
Vertical Orifice Width =	7.39		inches				

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

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.00	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Over Flow Weir Slope Length =	6.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	4.23	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	6.00	N/A	feet	Overflow Grate Open Area w/o Debris =	16.80	N/A	ft²
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	8.40	N/A	ft²
Debris Clogging % =	50%	N/A	%				

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

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.98	N/A	ft²
Outlet Pipe Diameter =	27.00	N/A	inches	Outlet Orifice Centroid =	1.13	N/A	feet
Restrictor Plate Height Above Pipe Invert =	27.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.84	feet
Spillway Crest Length =	30.00	feet	Stage at Top of Freeboard =	8.84	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.91	acres
Freeboard above Max Water Surface =		feet			

Routed Hydrograph Results

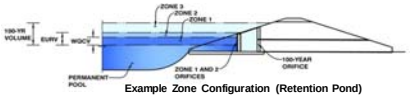
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	0.396	1.174	1.092	1.516	1.868	2.384	2.795	3.304	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.396	1.174	1.092	1.516	1.867	2.383	2.794	3.302	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.18	0.49	1.09	1.44	1.86	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	3.4	9.2	20.5	27.0	34.7	0.0
Peak Inflow Q (cfs) =	9.4	27.4	25.5	35.3	43.4	55.2	64.5	76.1	#N/A
Peak Outflow Q (cfs) =	0.2	1.3	1.2	2.7	9.8	20.6	29.0	32.5	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	1.1	1.0	1.1	0.9	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.5	1.1	1.6	1.8	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	38	49	49	50	48	46	44	43	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	54	53	55	55	54	53	52	#N/A
Maximum Ponding Depth (ft) =	1.39	2.62	2.49	3.09	3.33	3.58	3.73	4.00	#N/A
Area at Maximum Ponding Depth (acres) =	0.53	0.59	0.58	0.62	0.63	0.64	0.65	0.67	#N/A
Maximum Volume Stored (acre-ft) =	0.373	1.060	0.989	1.343	1.492	1.651	1.754	1.932	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin C8a & C10, Pond "C3"



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	24.70	acres
Watershed Length =	1,250	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	30.0%	percent
Percentage Hydrologic Soil Groups C/D =	70.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.523	acre-feet
Excess Urban Runoff Volume (EURV) =	1.612	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	1.434	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	1.960	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	2.445	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	3.128	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	3.658	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	4.326	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	1.345	acre-feet
Approximate 5-yr Detention Volume =	1.845	acre-feet
Approximate 10-yr Detention Volume =	2.179	acre-feet
Approximate 25-yr Detention Volume =	2.331	acre-feet
Approximate 50-yr Detention Volume =	2.408	acre-feet
Approximate 100-yr Detention Volume =	2.623	acre-feet

Optional User Override 1-hr Precipitation	
1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.523	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.089	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.012	acre-feet
Total Detention Basin Volume =	2.623	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 = 0.2 ft

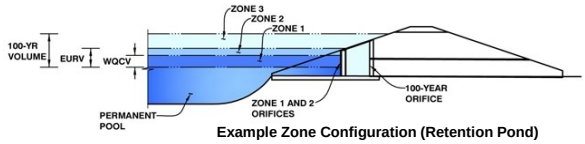
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	262	0.006		
5757.33	--	0.33	--	--	--	4,657	0.107	766	0.018
5758	--	1.00	--	--	--	13,580	0.312	6,786	0.156
5759	--	2.00	--	--	--	33,254	0.763	30,006	0.689
5760	--	3.00	--	--	--	46,803	1.074	70,366	1.615
5761	--	4.00	--	--	--	50,425	1.158	118,980	2.731
5762	--	5.00	--	--	--	54,123	1.242	171,254	3.931
5763	--	6.00	--	--	--	57,909	1.329	227,270	5.217
5764	--	7.00	--	--	--	61,796	1.419	287,123	6.591

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin C8a & C10, Pond "C3"



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.76	0.523	Orifice Plate
Zone 2 (EURV)	3.00	1.089	Rectangular Orifice
Zone 3 (100-year)	3.91	1.012	Weir&Pipe (Restrict)
		2.623	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 Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	2.083E-02	ft²
Depth at top of Zone using Orifice Plate =	1.76	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	8.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	3.00	sq. inches (diameter = 1-15/16 inches)	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.70	1.40					
Orifice Area (sq. inches)	3.00	3.00	3.00					

	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 Rectangular	Not Selected	
Invert of Vertical Orifice =	1.80	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	3.00	N/A	inches
Vertical Orifice Width =	3.00		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.06	N/A	ft²
Vertical Orifice Centroid =	0.13	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.10	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	8.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.10	N/A	feet
Over Flow Weir Slope Length =	8.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	12.68	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	22.40	N/A	ft²
Overflow Grate Open Area w/ Debris =	11.20	N/A	ft²

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

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.77	N/A	ft²
Outlet Orifice Centroid =	0.75	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	20.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =		feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.13	feet
Stage at Top of Freeboard =	8.13	feet
Basin Area at Top of Freeboard =	1.42	acres

Routed Hydrograph Results

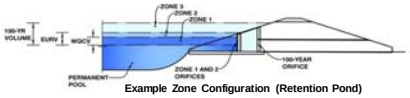
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	0.523	1.612	1.434	1.960	2.445	3.128	3.658	4.326	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.523	1.612	1.434	1.960	2.445	3.129	3.659	4.327	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.12	0.37	0.91	1.22	1.59	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	2.9	9.2	22.5	30.1	39.3	0.0
Peak Inflow Q (cfs) =	10.6	32.3	28.8	39.2	48.7	62.1	72.5	85.4	#N/A
Peak Outflow Q (cfs) =	0.3	0.7	0.7	2.1	8.8	14.5	15.3	16.3	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	1.0	0.6	0.5	0.4	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 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	0.1	0.4	0.6	0.6	0.7	#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	58	56	60	58	56	54	53	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**42**	64	61	67	66	65	64	64	#N/A
Maximum Ponding Depth (ft) =	1.70	2.91	2.75	3.19	3.39	3.67	3.98	4.40	#N/A
Area at Maximum Ponding Depth (acres) =	0.63	1.05	0.99	1.09	1.11	1.13	1.16	1.19	#N/A
Maximum Volume Stored (acre-ft) =	0.488	1.520	1.347	1.810	2.030	2.354	2.708	3.189	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin C8, Pond "C4"



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	75.00	acres
Watershed Length =	2,300	ft
Watershed Slope =	0.055	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	1.588	acre-feet
Excess Urban Runoff Volume (EURV) =	4.710	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	4.381	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	6.080	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	7.491	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	9.562	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	11.210	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	13.250	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	4.110	acre-feet
Approximate 5-yr Detention Volume =	5.727	acre-feet
Approximate 10-yr Detention Volume =	6.549	acre-feet
Approximate 25-yr Detention Volume =	6.987	acre-feet
Approximate 50-yr Detention Volume =	7.191	acre-feet
Approximate 100-yr Detention Volume =	7.859	acre-feet

Optional User Override 1-hr Precipitation

1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	1.588	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.122	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.149	acre-feet
Total Detention Basin Volume =	7.859	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

Depth Increment = 0.2 ft

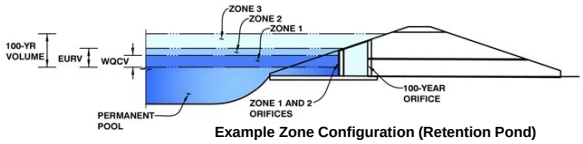
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	500	0.011		
5767.33	--	0.33	--	--	--	5,000	0.115	858	0.020
5768	--	1.00	--	--	--	48,694	1.118	18,411	0.423
5769	--	2.00	--	--	--	51,543	1.183	68,497	1.572
5770	--	3.00	--	--	--	54,460	1.250	122,014	2.801
5771	--	4.00	--	--	--	57,445	1.319	177,967	4.086
5772	--	5.00	--	--	--	60,499	1.389	236,939	5.439
5773	--	6.00	--	--	--	63,620	1.461	298,998	6.864
5774	--	7.00	--	--	--	66,809	1.534	364,213	8.361
5775	--	8.00	--	--	--	70,066	1.608	432,650	9.932
5776	--	9.00	--	--	--	73,392	1.685	504,379	11.579
5777	--	10.00	--	--	--	76,785	1.763	579,468	13.303
5778	--	11.00	--	--	--	80,246	1.842	657,983	15.105
5779	--	12.00	--	--	--	83,760	1.923	739,986	16.988

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin C8, Pond C4



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.01	1.588	Orifice Plate
Zone 2 (EURV)	4.47	3.122	Rectangular Orifice
Zone 3 (100-year)	6.68	3.149	Weir&Pipe (Restrict)
		7.859	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 Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	5.556E-02	ft²
Depth at top of Zone using Orifice Plate =	2.10	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	6.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	8.00	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.70	1.40					
Orifice Area (sq. inches)	8.00	8.00	8.00					

	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 Rectangular	Not Selected		Calculated Parameters for Vertical Orifice	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.30	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.11	N/A	ft²
Depth at top of Zone using Vertical Orifice =	4.70	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.08	N/A	feet
Vertical Orifice Height =	2.00	N/A	inches				
Vertical Orifice Width =	8.00		inches				

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

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.70	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.70	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Over Flow Weir Slope Length =	12.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	10.70	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	12.00	N/A	feet	Overflow Grate Open Area w/o Debris =	33.60	N/A	ft²
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	16.80	N/A	ft²
Debris Clogging % =	50%	N/A	%				

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

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.14	N/A	ft²
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	1.00	N/A	feet
Restrictor Plate Height Above Pipe Invert =	48.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.39	feet
Spillway Crest Length =	50.00	feet	Stage at Top of Freeboard =	10.39	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.79	acres
Freeboard above Max Water Surface =		feet			

Routed Hydrograph Results

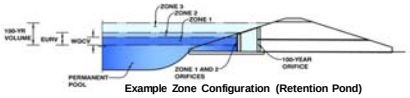
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	1.588	4.710	4.381	6.080	7.491	9.562	11.210	13.250	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.587	4.707	4.378	6.068	7.486	9.546	11.194	13.239	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.15	0.40	0.92	1.21	1.57	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.3	11.1	30.2	68.9	90.9	117.7	0.0
Peak Inflow Q (cfs) =	31.9	93.2	86.8	119.5	146.6	185.6	216.5	254.5	#N/A
Peak Outflow Q (cfs) =	0.9	2.2	2.1	12.4	31.7	34.9	37.5	40.5	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.1	1.0	0.5	0.4	0.3	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.3	0.9	1.0	1.0	1.1	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	40	58	57	60	58	56	55	54	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**42**	64	62	67	66	65	65	64	#N/A
Maximum Ponding Depth (ft) =	1.92	4.27	4.04	4.97	5.38	6.32	7.14	8.16	#N/A
Area at Maximum Ponding Depth (acres) =	1.18	1.34	1.32	1.39	1.42	1.48	1.54	1.62	#N/A
Maximum Volume Stored (acre-ft) =	1.478	4.444	4.125	5.398	5.972	7.335	8.561	10.174	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP (100.013)

Basin ID: Pond C5



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	171.00	acres
Watershed Length =	3,200	ft
Watershed Slope =	0.018	ft/ft
Watershed Imperviousness =	63.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building	
Water Quality Capture Volume (WQCV) =	3.515	acre-feet
Excess Urban Runoff Volume (EURV) =	10.382	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	9.641	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	13.459	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	16.659	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	21.433	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	25.205	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	29.878	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	41.092	acre-feet
Approximate 2-yr Detention Volume =	9.045	acre-feet
Approximate 5-yr Detention Volume =	12.678	acre-feet
Approximate 10-yr Detention Volume =	14.486	acre-feet
Approximate 25-yr Detention Volume =	15.477	acre-feet
Approximate 50-yr Detention Volume =	15.943	acre-feet
Approximate 100-yr Detention Volume =	17.508	acre-feet

Optional User Override 1-hr Precipitation

1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	3.515	acre-feet
Zone 2 Volume (EURV - Zone 1) =	6.868	acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	10.382	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

Total detention volume is less than 100-year volume.

Depth Increment = 0.2 ft

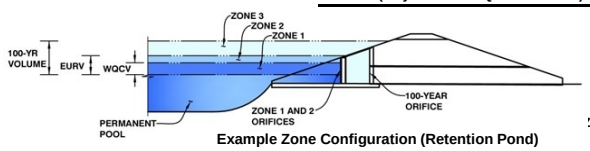
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
5706.33	--	0.33	--	--	--	100	0.002	24	0.001
5707	--	1.00	--	--	--	1,000	0.023	383	0.009
5708	--	2.00	--	--	--	18,898	0.434	10,154	0.233
5709	--	3.00	--	--	--	77,432	1.778	58,507	1.343
5710	--	4.00	--	--	--	110,270	2.531	152,358	3.498
5711	--	5.00	--	--	--	115,455	2.650	265,220	6.089
5712	--	6.00	--	--	--	120,720	2.771	383,308	8.800
5713	--	7.00	--	--	--	126,045	2.894	506,690	11.632
5714	--	8.00	--	--	--	131,696	3.023	635,561	14.590
5715	--	9.00	--	--	--	136,745	3.139	769,781	17.672
5716	--	10.00	--	--	--	141,857	3.257	909,082	20.870

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP (100.013)

Basin ID: Pond C5 (only used for WQCV and EURV) Do not use for 100-yr Storm Event!!!!!!



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.01	3.515	Orifice Plate
Zone 2 (EURV)	6.57	6.868	Rectangular Orifice
Zone 3 (100-year)	8.95	7.126	Weir&Pipe (Restrict)
		17.508	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	6.396E-02	ft^2
Depth at top of Zone using Orifice Plate =	4.01	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	16.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	9.21	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.34	2.67					
Orifice Area (sq. inches)	9.21	9.21	9.21					

	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 Rectangular	Not Selected		Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	4.01	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.78	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	6.57	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.25	N/A	feet
Vertical Orifice Height =	6.00	N/A	inches				
Vertical Orifice Width =	18.68		inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected		Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.60	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.60	N/A	feet
Overflow Weir Front Edge Length =	18.00	N/A	feet	Over Flow Weir Slope Length =	3.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	3.01	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	37.80	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	18.90	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected		Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	12.57	N/A	ft^2
Outlet Pipe Diameter =	48.00	N/A	inches	Outlet Orifice Centroid =	2.00	N/A	feet
Restrictor Plate Height Above Pipe Invert =	48.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=		ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=		feet
Spillway Crest Length =		feet	Stage at Top of Freeboard =		feet
Spillway End Slopes =		H:V	Basin Area at Top of Freeboard =		acres
Freeboard above Max Water Surface =		feet			

Calculated Parameters for Spillway

Routed Hydrograph Results

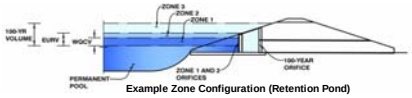
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	3.14
Calculated Runoff Volume (acre-ft) =	3.515	10.382	9.641	13.459	16.659	21.433	25.205	29.878	41.092
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	3.517	10.386	9.640	13.467	16.663	21.449	25.222	29.902	41.123
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.14	0.37	0.85	1.12	1.46	2.19
Predevelopment Peak Q (cfs) =	0.0	0.0	2.8	23.2	63.2	145.3	191.8	249.0	374.8
Peak Inflow Q (cfs) =	63.1	181.4	168.8	233.0	286.9	364.1	424.6	497.8	660.8
Peak Outflow Q (cfs) =	1.4	7.3	7.0	30.7	77.5	132.6	154.2	163.7	171.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.3	1.2	0.9	0.8	0.7	0.5
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.6	1.8	3.3	3.8	4.0	4.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	54	53	55	54	52	50	48	45
Time to Drain 99% of Inflow Volume (hours) =	**40**	58	57	60	59	58	58	57	56
Maximum Ponding Depth (ft) =	3.92	6.27	6.02	6.99	7.43	7.99	8.50	9.32	10.00
Area at Maximum Ponding Depth (acres) =	2.47	2.80	2.77	2.89	2.95	3.02	3.08	3.18	3.26
Maximum Volume Stored (acre-ft) =	3.298	9.524	8.827	11.603	12.888	14.530	16.086	18.682	20.870

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin D1, Pond "D1"



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	17.00	acres
Watershed Length =	850	ft
Watershed Slope =	0.060	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =		
Water Quality Capture Volume (WQCV) =	0.360	acre-feet
Excess Urban Runoff Volume (EURV) =	1.068	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	0.993	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	1.378	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	1.698	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	2.167	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	2.541	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	3.003	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	0.932	acre-feet
Approximate 5-yr Detention Volume =	1.298	acre-feet
Approximate 10-yr Detention Volume =	1.484	acre-feet
Approximate 25-yr Detention Volume =	1.584	acre-feet
Approximate 50-yr Detention Volume =	1.630	acre-feet
Approximate 100-yr Detention Volume =	1.781	acre-feet

Optional User Override 1-hr Precipitation

1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.360	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.708	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.714	acre-feet
Total Detention Basin Volume =	1.781	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 = 0.2 ft

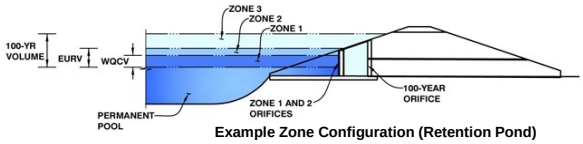
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
5752	--	1.00	--	--	--	10,904	0.250	5,368	0.123
5753	--	2.00	--	--	--	19,275	0.442	20,374	0.468
5754	--	3.00	--	--	--	21,293	0.489	40,850	0.938
5755	--	4.00	--	--	--	23,346	0.536	63,170	1.450
5756	--	5.00	--	--	--	25,482	0.585	87,584	2.011
5757	--	6.00	--	--	--	27,711	0.636	114,180	2.621
5758	--	7.00	--	--	--	30,034	0.689	143,053	3.284
5759	--	8.00	--	--	--	32,451	0.745	174,295	4.001
5760	--	9.00	--	--	--	37,565	0.862	209,303	4.805

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin D1, Pond "D1"



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.74	0.360	Orifice Plate
Zone 2 (EURV)	3.27	0.708	Rectangular Orifice
Zone 3 (100-year)	4.61	0.714	Weir&Pipe (Restrict)
		1.781	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 Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.451E-02	ft²
Depth at top of Zone using Orifice Plate =	1.75	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	7.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.09	sq. inches (diameter = 1-5/8 inches)	Elliptical Slot Area =	N/A	ft²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.60	1.20					
Orifice Area (sq. inches)	2.09	2.09	2.09					

	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 Rectangular	Not Selected		Calculated Parameters for Vertical Orifice	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	1.74	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.10	N/A	ft²
Depth at top of Zone using Vertical Orifice =	3.27	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.08	N/A	feet
Vertical Orifice Height =	2.00	N/A	inches				
Vertical Orifice Width =	7.51		inches				

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

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.50	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.50	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Over Flow Weir Slope Length =	6.08	N/A	feet
Overflow Weir Slope =	6.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	16.89	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	6.00	N/A	feet	Overflow Grate Open Area w/o Debris =	17.03	N/A	ft²
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	8.52	N/A	ft²
Debris Clogging % =	50%	N/A	%				

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

	Zone 3 Restrictor	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.01	N/A	ft²
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.48	N/A	feet
Restrictor Plate Height Above Pipe Invert =	10.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.68	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.90	feet
Spillway Crest Length =	25.00	feet	Stage at Top of Freeboard =	9.90	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.86	acres
Freeboard above Max Water Surface =		feet			

Routed Hydrograph Results

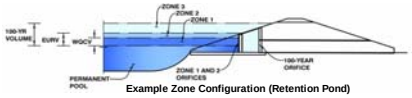
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	0.360	1.068	0.993	1.378	1.698	2.167	2.541	3.003	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.360	1.068	0.993	1.379	1.700	2.170	2.543	3.006	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.18	0.49	1.09	1.44	1.86	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	3.1	8.3	18.6	24.6	31.6	0.0
Peak Inflow Q (cfs) =	8.8	25.8	24.0	33.2	40.8	51.9	60.7	71.6	#N/A
Peak Outflow Q (cfs) =	0.2	0.9	0.9	1.6	5.2	9.7	10.3	10.9	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.6	0.5	0.4	0.3	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 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	0.0	0.2	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) =	37	46	46	47	46	44	43	41	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	51	54	54	53	52	52	#N/A
Maximum Ponding Depth (ft) =	1.68	3.10	2.96	3.66	4.01	4.47	4.94	5.54	#N/A
Area at Maximum Ponding Depth (acres) =	0.38	0.49	0.49	0.52	0.54	0.56	0.58	0.61	#N/A
Maximum Volume Stored (acre-ft) =	0.337	0.987	0.913	1.265	1.456	1.707	1.970	2.334	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond D2 - Lorson Blvd at East Tributary of JCC



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	72.00	acres
Watershed Length =	2,200	ft
Watershed Slope =	0.025	ft/ft
Watershed Imperviousness =	64.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building	
Water Quality Capture Volume (WQCV) =	1.502	acre-feet
Excess Urban Runoff Volume (EURV) =	4.446	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	4.132	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	5.752	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	7.103	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	9.102	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	10.687	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	12.650	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	17.372	acre-feet
Approximate 2-yr Detention Volume =	3.877	acre-feet
Approximate 5-yr Detention Volume =	5.418	acre-feet
Approximate 10-yr Detention Volume =	6.193	acre-feet
Approximate 25-yr Detention Volume =	6.612	acre-feet
Approximate 50-yr Detention Volume =	6.808	acre-feet
Approximate 100-yr Detention Volume =	7.458	acre-feet

Optional User Override 1-hr Precipitation

1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	1.502	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.944	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.012	acre-feet
Total Detention Basin Volume =	7.458	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 = 0.2 ft

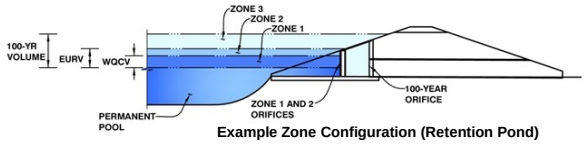
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	1,068	0.025		
5696.33	--	0.33	--	--	--	15,000	0.344	2,503	0.057
5697	--	1.00	--	--	--	48,988	1.125	23,599	0.542
5698	--	2.00	--	--	--	72,821	1.672	84,264	1.934
5699	--	3.00	--	--	--	76,610	1.759	159,706	3.666
5700	--	4.00	--	--	--	80,493	1.848	238,258	5.470
5701	--	5.00	--	--	--	84,486	1.940	320,747	7.363
5702	--	6.00	--	--	--	88,582	2.034	407,281	9.350
5703	--	7.00	--	--	--	92,768	2.130	497,956	11.432
5704	--	8.00	--	--	--	97,074	2.229	592,877	13.611
5705	--	9.00	--	--	--	102,033	2.342	692,431	15.896
5706	--	10.00	--	--	--	106,000	2.433	796,447	18.284

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East MDDP

Basin ID: Pond D2 - Lorson Blvd at East Tributary of JCC



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.72	1.502	Orifice Plate
Zone 2 (EURV)	3.44	2.944	Rectangular Orifice
Zone 3 (100-year)	5.05	3.012	Weir&Pipe (Restrict)
		7.458	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	6.215E-02	ft^2
Depth at top of Zone using Orifice Plate =	1.72	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	6.70	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	8.95	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.60	1.20					
Orifice Area (sq. inches)	8.95	8.95	8.95					

	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 Rectangular	Not Selected	
Invert of Vertical Orifice =	1.72	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.44	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	6.00	N/A	inches
Vertical Orifice Width =	12.22		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.51	N/A	ft^2
Vertical Orifice Centroid =	0.25	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	14.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.50	N/A	feet
Over Flow Weir Slope Length =	14.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	3.12	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	39.20	N/A	ft^2
Overflow Grate Open Area w/ Debris =	19.60	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	48.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	60.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	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 =	3.14	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 =	30.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	3.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.64	feet
Stage at Top of Freeboard =	10.64	feet
Basin Area at Top of Freeboard =	2.43	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	1.16	1.44	1.68	1.92	2.16	2.42	3.14
Calculated Runoff Volume (acre-ft) =	1.502	4.446	4.132	5.752	7.103	9.102	10.687	12.650	17.372
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.503	4.450	4.137	5.758	7.109	9.104	10.696	12.654	17.382
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.14	0.38	0.86	1.14	1.48	2.22
Predevelopment Peak Q (cfs) =	0.0	0.0	1.2	9.9	27.0	62.1	81.9	106.3	160.0
Peak Inflow Q (cfs) =	27.6	80.5	75.0	103.6	127.2	161.8	189.2	222.5	303.4
Peak Outflow Q (cfs) =	0.9	4.1	3.9	12.7	33.6	64.7	89.1	102.8	125.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.3	1.2	1.0	1.1	1.0	0.8
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.7	1.5	2.1	2.5	2.9
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	47	46	46	45	42	41	39	36
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	52	53	53	51	50	49	47
Maximum Ponding Depth (ft) =	1.65	3.19	3.03	3.72	4.01	4.34	4.55	4.89	6.10
Area at Maximum Ponding Depth (acres) =	1.47	1.78	1.76	1.82	1.85	1.88	1.90	1.93	2.04
Maximum Volume Stored (acre-ft) =	1.385	4.002	3.719	4.938	5.488	6.084	6.481	7.131	9.533

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
	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]
4.47 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:04:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:08:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:13:25	1.20	3.32	3.11	4.16	4.96	6.05	6.86	7.77	9.72
1.120	0:17:53	3.26	9.26	8.65	11.74	14.21	17.69	20.35	23.49	30.62
	0:22:21	8.38	23.78	22.21	30.15	36.48	45.43	52.28	60.40	78.83
	0:26:49	23.00	65.18	60.88	82.59	99.85	124.22	142.83	164.84	214.65
	0:31:17	27.65	80.54	74.98	103.62	127.25	161.82	189.15	222.46	301.49
	0:35:46	26.45	77.58	72.14	100.29	123.79	158.57	186.39	220.63	303.35
	0:40:14	24.08	70.69	65.70	91.58	113.26	145.48	171.32	203.24	280.77
	0:44:42	21.59	63.69	59.18	82.55	102.14	131.26	154.63	183.50	253.63
	0:49:10	18.74	55.74	51.77	72.38	89.70	115.50	136.24	161.89	224.33
	0:53:38	16.28	48.68	45.19	63.28	78.48	101.12	119.33	141.85	196.67
	0:58:07	14.77	43.92	40.80	56.98	70.54	90.68	106.84	126.77	175.14
	1:02:35	12.28	36.84	34.19	47.94	59.53	76.84	90.79	108.07	150.22
	1:07:03	10.11	30.54	28.33	39.79	49.46	63.91	75.56	90.00	125.27
	1:11:31	7.89	24.22	22.45	31.69	39.52	51.26	60.76	72.57	101.55
	1:15:59	5.98	18.73	17.34	24.59	30.74	39.99	47.48	56.81	79.78
	1:20:28	4.37	14.00	12.95	18.47	23.17	30.26	36.00	43.19	61.04
	1:24:56	3.33	10.49	9.71	13.78	17.22	22.40	26.58	31.87	45.29
	1:29:24	2.72	8.43	7.81	11.02	13.73	17.79	21.05	25.15	35.40
	1:33:52	2.30	7.09	6.57	9.26	11.53	14.91	17.63	21.02	29.42
	1:38:20	2.01	6.17	5.72	8.04	9.99	12.90	15.23	18.14	25.30
	1:42:49	1.81	5.51	5.11	7.18	8.91	11.49	13.56	16.13	22.45
	1:47:17	1.66	5.05	4.68	6.57	8.15	10.49	12.37	14.70	20.40
	1:51:45	1.22	3.77	3.49	4.94	6.17	8.03	9.54	11.43	16.13
	1:56:13	0.89	2.73	2.53	3.57	4.46	5.79	6.87	8.23	11.64
	2:00:41	0.66	2.02	1.87	2.64	3.30	4.30	5.10	6.11	8.61
	2:05:10	0.49	1.50	1.39	1.97	2.46	3.19	3.79	4.53	6.39
	2:09:38	0.35	1.10	1.02	1.44	1.81	2.36	2.80	3.36	4.74
	2:14:06	0.25	0.79	0.73	1.04	1.31	1.70	2.03	2.43	3.44
	2:18:34	0.18	0.57	0.53	0.75	0.95	1.23	1.47	1.76	2.49
	2:23:02	0.12	0.40	0.37	0.53	0.67	0.88	1.05	1.26	1.79
	2:27:31	0.08	0.26	0.24	0.35	0.44	0.58	0.69	0.84	1.21
	2:31:59	0.04	0.15	0.14	0.20	0.26	0.34	0.42	0.51	0.74
	2:36:27	0.02	0.07	0.06	0.10	0.12	0.17	0.21	0.26	0.39
	2:40:55	0.00	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.15
	2:45:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	2:49:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:54:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:58:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:03:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:07:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:12:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:16:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:21:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:34:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:39:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:43:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:47:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:52:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:56:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:01:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:14:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:19:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:23:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:28:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:32:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:37:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:41:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:46:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:59:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:03:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:08:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:12:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:17:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:21:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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'.

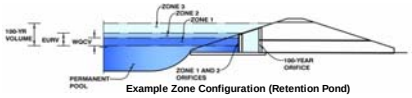
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin E1 - E5, Pond "E1"



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	56.50	acres
Watershed Length =	1,600	ft
Watershed Slope =	0.038	ft/ft
Watershed Imperviousness =	61.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	6.0%	percent
Percentage Hydrologic Soil Groups C/D =	94.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	1.128	acre-feet
Excess Urban Runoff Volume (EURV) =	3.339	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	3.067	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	4.293	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	5.354	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	6.949	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	8.194	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	9.743	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	2.877	acre-feet
Approximate 5-yr Detention Volume =	4.044	acre-feet
Approximate 10-yr Detention Volume =	4.650	acre-feet
Approximate 25-yr Detention Volume =	4.978	acre-feet
Approximate 50-yr Detention Volume =	5.136	acre-feet
Approximate 100-yr Detention Volume =	5.664	acre-feet

Optional User Override 1-hr Precipitation

1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	1.128	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.211	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.325	acre-feet
Total Detention Basin Volume =	5.664	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 = 0.2 ft

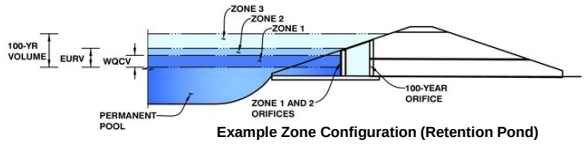
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	200	0.005		
5728.33	--	0.33	--	--	--	500	0.011	111	0.003
5729	--	1.00	--	--	--	2,550	0.059	1,112	0.026
5730	--	2.00	--	--	--	25,900	0.595	15,104	0.347
5731	--	3.00	--	--	--	31,341	0.719	43,982	1.010
5732	--	4.00	--	--	--	33,851	0.777	76,578	1.758
5733	--	5.00	--	--	--	36,442	0.837	111,725	2.565
5734	--	6.00	--	--	--	39,105	0.898	149,498	3.432
5735	--	7.00	--	--	--	41,838	0.960	189,970	4.361
5736	--	8.00	--	--	--	44,644	1.025	233,211	5.354
5737	--	9.00	--	--	--	47,527	1.091	279,296	6.412
5738	--	10.00	--	--	--	50,487	1.159	328,303	7.537

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East, MDDP Prelim. Full Spectrum Design, #100.013

Basin ID: Basin E1 - E5, Pond "E1"



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.17	1.128	Orifice Plate
Zone 2 (EURV)	5.90	2.211	Rectangular Orifice
Zone 3 (100-year)	8.30	2.325	Weir&Pipe (Restrict)
		5.664	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	2.708E-02	ft^2
Depth at top of Zone using Orifice Plate =	3.20	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	13.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	3.90	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.10	2.20					
Orifice Area (sq. inches)	3.90	3.90	3.90					

	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 Rectangular	Not Selected		Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	3.17	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.36	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	5.90	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.25	N/A	feet
Vertical Orifice Height =	6.00	N/A	inches				
Vertical Orifice Width =	8.56		inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected		Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.00	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Over Flow Weir Slope Length =	10.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	11.08	N/A	should be ≥ 4
Horiz. Length of Weir Sides =	10.00	N/A	feet	Overflow Grate Open Area w/o Debris =	28.00	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	14.00	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected		Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	2.53	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.83	N/A	feet
Restrictor Plate Height Above Pipe Invert =	18.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.09	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	10.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.93	feet
Spillway Crest Length =	75.00	feet	Stage at Top of Freeboard =	10.93	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.16	acres
Freeboard above Max Water Surface =		feet			

Calculated Parameters for Spillway

Routed Hydrograph Results

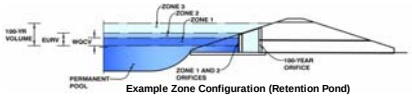
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	1.128	3.339	3.067	4.293	5.354	6.949	8.194	9.743	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.126	3.334	3.063	4.287	5.344	6.933	8.178	9.728	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.17	0.47	1.06	1.40	1.81	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.2	9.5	26.3	59.9	79.2	102.1	0.0
Peak Inflow Q (cfs) =	25.0	72.9	67.0	93.3	115.8	149.2	175.2	207.3	#N/A
Peak Outflow Q (cfs) =	0.5	3.3	3.1	12.7	29.5	32.0	34.0	36.3	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.3	1.1	0.5	0.4	0.4	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.3	0.9	1.0	1.0	1.1	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	38	48	47	48	47	45	44	42	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	51	53	52	52	51	51	#N/A
Maximum Ponding Depth (ft) =	3.08	5.55	5.26	6.28	6.71	7.74	8.62	9.73	#N/A
Area at Maximum Ponding Depth (acres) =	0.72	0.87	0.85	0.91	0.94	1.01	1.07	1.14	#N/A
Maximum Volume Stored (acre-ft) =	1.060	3.026	2.776	3.677	4.076	5.089	6.002	7.226	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East MDDP

Basin ID: Pond E2



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	62.80	acres
Watershed Length =	2,000	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	61.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building	
Water Quality Capture Volume (WQCV) =	1.254	acre-feet
Excess Urban Runoff Volume (EURV) =	3.682	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	3.414	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	4.795	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	5.964	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	7.736	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	9.126	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	10.851	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	14.969	acre-feet
Approximate 2-yr Detention Volume =	3.202	acre-feet
Approximate 5-yr Detention Volume =	4.517	acre-feet
Approximate 10-yr Detention Volume =	5.157	acre-feet
Approximate 25-yr Detention Volume =	5.519	acre-feet
Approximate 50-yr Detention Volume =	5.689	acre-feet
Approximate 100-yr Detention Volume =	6.280	acre-feet

Optional User Override 1-hr Precipitation

1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	1.254	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.429	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	2.597	acre-feet
Total Detention Basin Volume =	6.280	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 = 0.2 ft

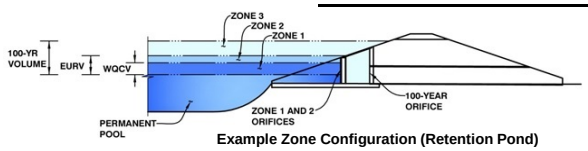
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	100	0.002		
5694.33	--	0.33	--	--	--	15,000	0.344	2,469	0.057
5695	--	1.00	--	--	--	57,500	1.320	26,121	0.600
5696	--	2.00	--	--	--	60,400	1.387	85,039	1.952
5697	--	3.00	--	--	--	63,400	1.455	147,543	3.387
5698	--	4.00	--	--	--	66,500	1.527	212,493	4.878
5699	--	5.00	--	--	--	69,700	1.600	280,593	6.442
5700	--	6.00	--	--	--	72,900	1.674	351,893	8.078
5701	--	7.00	--	--	--	76,300	1.752	426,493	9.791
5702	--	8.00	--	--	--	79,600	1.827	504,443	11.580

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East MDDP

Basin ID: Pond E2



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.48	1.254	Orifice Plate
Zone 2 (EURV)	3.21	2.429	Rectangular Orifice
Zone 3 (100-year)	4.90	2.597	Weir&Pipe (Restrict)
		6.280	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	5.326E-02	ft^2
Depth at top of Zone using Orifice Plate =	1.48	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	5.90	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	7.67	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	1.00					
Orifice Area (sq. inches)	7.67	7.67	7.67					

	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 Rectangular	Not Selected	
Invert of Vertical Orifice =	1.48	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.21	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	6.00	N/A	inches
Vertical Orifice Width =	11.16		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.47	N/A	ft^2
Vertical Orifice Centroid =	0.25	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 =	4.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	16.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.00	N/A	feet
Over Flow Weir Slope Length =	16.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	3.57	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	44.80	N/A	ft^2
Overflow Grate Open Area w/ Debris =	22.40	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	48.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	60.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	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 =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	50.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.15	feet
Stage at Top of Freeboard =	11.15	feet
Basin Area at Top of Freeboard =	1.83	acres

Routed Hydrograph Results

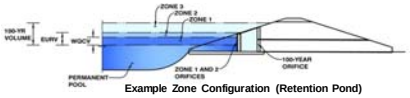
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	3.14
Calculated Runoff Volume (acre-ft) =	1.254	3.682	3.414	4.795	5.964	7.736	9.126	10.851	14.969
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.254	3.685	3.416	4.798	5.967	7.737	9.132	10.853	14.977
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.15	0.40	0.91	1.20	1.55	2.33
Predevelopment Peak Q (cfs) =	0.0	0.0	1.1	9.2	25.0	57.0	75.2	97.4	146.4
Peak Inflow Q (cfs) =	24.1	69.9	64.9	90.5	112.1	144.3	169.5	200.4	273.1
Peak Outflow Q (cfs) =	0.7	3.7	3.5	20.0	40.6	70.7	86.8	95.8	118.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.2	1.6	1.2	1.2	1.0	0.8
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.3	0.8	1.5	1.8	2.0	2.5
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	46	46	45	43	41	39	38	34
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	51	52	51	50	49	47	45
Maximum Ponding Depth (ft) =	1.42	2.95	2.78	3.32	3.56	3.84	4.06	4.50	5.80
Area at Maximum Ponding Depth (acres) =	1.35	1.45	1.44	1.48	1.50	1.51	1.53	1.56	1.66
Maximum Volume Stored (acre-ft) =	1.160	3.300	3.069	3.857	4.213	4.620	4.955	5.651	7.745

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond F



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	33.00	acres
Watershed Length =	1,550	ft
Watershed Slope =	0.026	ft/ft
Watershed Imperviousness =	65.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building	
Water Quality Capture Volume (WQCV) =	0.699	acre-feet
Excess Urban Runoff Volume (EURV) =	2.072	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	1.928	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	2.675	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	3.296	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	4.207	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	4.933	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	5.830	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	7.994	acre-feet
Approximate 2-yr Detention Volume =	1.808	acre-feet
Approximate 5-yr Detention Volume =	2.520	acre-feet
Approximate 10-yr Detention Volume =	2.881	acre-feet
Approximate 25-yr Detention Volume =	3.074	acre-feet
Approximate 50-yr Detention Volume =	3.164	acre-feet
Approximate 100-yr Detention Volume =	3.458	acre-feet

Optional User Override 1-hr Precipitation

1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.699	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.373	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.386	acre-feet
Total Detention Basin Volume =	3.458	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

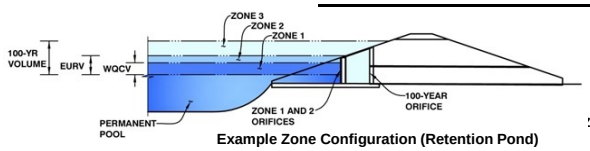
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
	--	1.00	--	--	--	5,000	0.115	2,475	0.057
	--	2.00	--	--	--	16,000	0.367	12,865	0.295
	--	3.00	--	--	--	17,200	0.395	29,625	0.680
	--	4.00	--	--	--	18,400	0.422	47,425	1.089
	--	5.00	--	--	--	19,600	0.450	66,425	1.525
	--	6.00	--	--	--	20,800	0.478	86,625	1.989
	--	7.00	--	--	--	22,000	0.505	108,025	2.480
	--	8.00	--	--	--	23,400	0.537	130,725	3.001
	--	9.00	--	--	--	24,600	0.565	154,725	3.552
	--	10.00	--	--	--	25,800	0.592	179,925	4.131

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond F



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.05	0.699	Orifice Plate
Zone 2 (EURV)	6.18	1.373	Rectangular Orifice
Zone 3 (100-year)	8.84	1.386	Weir&Pipe (Restrict)
		3.458	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.951E-02	ft^2
Depth at top of Zone using Orifice Plate =	3.05	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	12.20	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.81	sq. inches (diameter = 1-7/8 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.02	2.03					
Orifice Area (sq. inches)	2.81	2.81	2.81					

	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 Rectangular	Not Selected	
Invert of Vertical Orifice =	3.05	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	6.18	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.00	N/A	inches
Vertical Orifice Width =	2.22		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.03	N/A	ft^2
Vertical Orifice Centroid =	0.08	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	6.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	12.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	8.50	N/A	feet
Over Flow Weir Slope Length =	12.17	N/A	feet
Grate Open Area / 100-yr Orifice Area =	11.29	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	34.06	N/A	ft^2
Overflow Grate Open Area w/ Debris =	17.03	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	22.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	3.02	N/A	ft^2
Outlet Orifice Centroid =	0.96	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.56	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway

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

Routed Hydrograph Results

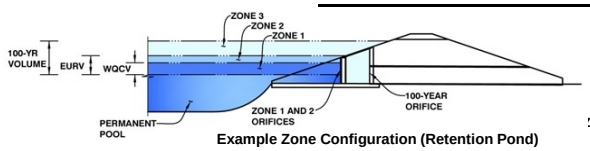
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	3.14
Calculated Runoff Volume (acre-ft) =	0.699	2.072	1.928	2.675	3.296	4.207	4.933	5.830	7.994
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.699	2.073	1.927	2.675	3.296	4.208	4.934	5.824	7.991
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.13	0.37	0.84	1.11	1.45	2.18
Predevelopment Peak Q (cfs) =	0.0	0.0	0.5	4.4	12.1	27.8	36.7	47.7	71.8
Peak Inflow Q (cfs) =	12.7	37.3	34.7	48.0	58.9	74.9	87.5	102.9	140.1
Peak Outflow Q (cfs) =	0.4	0.9	0.8	3.5	13.2	29.7	39.0	40.9	43.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	1.1	1.1	1.1	0.9	0.6
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.4	0.8	1.1	1.2	1.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	56	55	60	58	56	55	53	49
Time to Drain 99% of Inflow Volume (hours) =	40	62	60	66	65	64	63	62	60
Maximum Ponding Depth (ft) =	2.92	5.94	5.64	6.90	7.39	7.85	8.16	8.89	10.00
Area at Maximum Ponding Depth (acres) =	0.39	0.48	0.47	0.50	0.52	0.53	0.54	0.56	0.59
Maximum Volume Stored (acre-ft) =	0.649	1.955	1.814	2.425	2.679	2.921	3.087	3.484	4.131

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond G



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.19	0.394	Orifice Plate
Zone 2 (EURV)	5.17	0.758	Rectangular Orifice
Zone 3 (100-year)	8.10	0.824	Weir&Pipe (Restrict)
		1.976	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.556E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.19	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	8.80	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.24	sq. inches (diameter = 1-11/16 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.73	1.46					
Orifice Area (sq. inches)	2.24	2.24	2.24					

	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 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.19	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.17	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	4.00	N/A	inches
Vertical Orifice Width =	2.34		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.07	N/A	ft^2
Vertical Orifice Centroid =	0.17	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.20	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	5.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	10.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	8.20	N/A	feet
Over Flow Weir Slope Length =	10.20	N/A	feet
Grate Open Area / 100-yr Orifice Area =	12.00	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	28.55	N/A	ft^2
Overflow Grate Open Area w/ Debris =	14.28	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	17.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	2.38	N/A	ft^2
Outlet Orifice Centroid =	0.79	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.00	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	30.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.98	feet
Stage at Top of Freeboard =	10.98	feet
Basin Area at Top of Freeboard =	0.31	acres

Routed Hydrograph Results

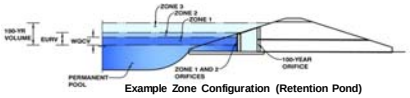
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	0.394	1.152	1.067	1.503	1.875	2.442	2.886	3.436	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.393	1.152	1.068	1.505	1.876	2.445	2.889	3.440	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.18	0.49	1.09	1.44	1.86	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	3.7	9.8	21.9	28.9	37.1	0.0
Peak Inflow Q (cfs) =	11.4	32.9	30.5	42.8	53.2	69.1	81.5	96.8	#N/A
Peak Outflow Q (cfs) =	0.3	1.0	0.9	1.1	7.4	23.7	30.6	32.6	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.8	1.1	1.1	0.9	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 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	0.2	0.8	1.0	1.1	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	38	46	46	48	47	44	42	40	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	52	51	55	55	54	53	51	#N/A
Maximum Ponding Depth (ft) =	2.09	4.89	4.59	6.13	6.87	7.48	7.94	8.87	#N/A
Area at Maximum Ponding Depth (acres) =	0.24	0.27	0.26	0.28	0.28	0.29	0.29	0.30	#N/A
Maximum Volume Stored (acre-ft) =	0.371	1.078	0.999	1.414	1.618	1.796	1.927	2.203	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond G



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	20.00	acres	Note: L / W Ratio < 1
Watershed Length =	650	ft	L / W Ratio = 0.5
Watershed Slope =	0.043	ft/ft	
Watershed Imperviousness =	60.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	0.0%	percent	
Percentage Hydrologic Soil Groups C/D =	100.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.394	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	1.152	acre-feet	
2-yr Runoff Volume (P1 = 1.16 in.) =	1.067	acre-feet	1.16 inches
5-yr Runoff Volume (P1 = 1.44 in.) =	1.503	acre-feet	1.44 inches
10-yr Runoff Volume (P1 = 1.68 in.) =	1.875	acre-feet	1.68 inches
25-yr Runoff Volume (P1 = 1.92 in.) =	2.442	acre-feet	1.92 inches
50-yr Runoff Volume (P1 = 2.16 in.) =	2.886	acre-feet	2.16 inches
100-yr Runoff Volume (P1 = 2.42 in.) =	3.436	acre-feet	2.42 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	inches
Approximate 2-yr Detention Volume =	1.001	acre-feet	
Approximate 5-yr Detention Volume =	1.416	acre-feet	
Approximate 10-yr Detention Volume =	1.617	acre-feet	
Approximate 25-yr Detention Volume =	1.731	acre-feet	
Approximate 50-yr Detention Volume =	1.786	acre-feet	
Approximate 100-yr Detention Volume =	1.976	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.394	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.758	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.824	acre-feet
Total Detention Basin Volume =	1.976	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

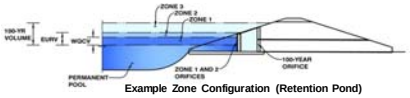
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
	--	1.00	--	--	--	10,000	0.230	4,925	0.113
	--	2.00	--	--	--	10,400	0.239	15,121	0.347
	--	3.00	--	--	--	10,800	0.248	25,825	0.593
	--	4.00	--	--	--	11,200	0.257	36,825	0.845
	--	5.00	--	--	--	11,600	0.266	48,225	1.107
	--	6.00	--	--	--	12,000	0.275	60,025	1.378
	--	7.00	--	--	--	12,400	0.285	72,225	1.658
	--	8.00	--	--	--	12,800	0.294	84,825	1.947
	--	9.00	--	--	--	13,200	0.303	97,825	2.246
	--	10.00	--	--	--	13,600	0.312	111,225	2.553

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond H



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	22.30	acres	Note: L / W Ratio < 1
Watershed Length =	900	ft	L / W Ratio = 0.8
Watershed Slope =	0.050	ft/ft	
Watershed Imperviousness =	60.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	0.0%	percent	
Percentage Hydrologic Soil Groups C/D =	100.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.439	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	1.284	acre-feet	
2-yr Runoff Volume (P1 = 1.16 in.) =	1.190	acre-feet	1.16 inches
5-yr Runoff Volume (P1 = 1.44 in.) =	1.676	acre-feet	1.44 inches
10-yr Runoff Volume (P1 = 1.68 in.) =	2.090	acre-feet	1.68 inches
25-yr Runoff Volume (P1 = 1.92 in.) =	2.723	acre-feet	1.92 inches
50-yr Runoff Volume (P1 = 2.16 in.) =	3.218	acre-feet	2.16 inches
100-yr Runoff Volume (P1 = 2.42 in.) =	3.832	acre-feet	2.42 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	inches
Approximate 2-yr Detention Volume =	1.116	acre-feet	
Approximate 5-yr Detention Volume =	1.579	acre-feet	
Approximate 10-yr Detention Volume =	1.803	acre-feet	
Approximate 25-yr Detention Volume =	1.930	acre-feet	
Approximate 50-yr Detention Volume =	1.991	acre-feet	
Approximate 100-yr Detention Volume =	2.203	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.439	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.846	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.919	acre-feet
Total Detention Basin Volume =	2.203	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

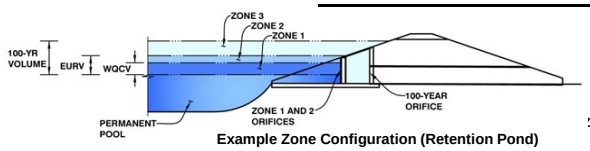
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
	--	1.00	--	--	--	6,000	0.138	2,965	0.068
	--	2.00	--	--	--	14,000	0.321	12,885	0.296
	--	3.00	--	--	--	14,500	0.333	27,275	0.626
	--	4.00	--	--	--	15,000	0.344	42,025	0.965
	--	5.00	--	--	--	15,500	0.356	57,275	1.315
	--	6.00	--	--	--	16,000	0.367	73,025	1.676
	--	7.00	--	--	--	16,500	0.379	89,275	2.049
	--	8.00	--	--	--	17,000	0.390	106,025	2.434
	--	9.00	--	--	--	17,500	0.402	123,275	2.830
	--	10.00	--	--	--	18,000	0.413	141,025	3.237

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond H



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.44	0.439	Orifice Plate
Zone 2 (EURV)	4.92	0.846	Rectangular Orifice
Zone 3 (100-year)	7.41	0.919	Weir&Pipe (Restrict)
		2.203	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.410E-02	ft^2
Depth at top of Zone using Orifice Plate =	2.44	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.80	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.03	sq. inches (diameter = 1-5/8 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.81	1.63					
Orifice Area (sq. inches)	2.03	2.03	2.03					

	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 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.44	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	4.92	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.00	N/A	inches
Vertical Orifice Width =	2.84		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.04	N/A	ft^2
Vertical Orifice Centroid =	0.08	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	6.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	12.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	7.50	N/A	feet
Over Flow Weir Slope Length =	12.17	N/A	feet
Grate Open Area / 100-yr Orifice Area =	12.18	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	34.06	N/A	ft^2
Overflow Grate Open Area w/ Debris =	17.03	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	20.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	2.80	N/A	ft^2
Outlet Orifice Centroid =	0.90	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.30	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway

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

Routed Hydrograph Results

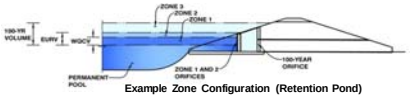
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	0.439	1.284	1.190	1.676	2.090	2.723	3.218	3.832	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.438	1.285	1.190	1.677	2.092	2.725	3.220	3.835	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.18	0.49	1.09	1.44	1.86	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.5	4.1	10.9	24.4	32.2	41.4	0.0
Peak Inflow Q (cfs) =	10.9	31.7	29.4	41.2	51.3	66.5	78.4	93.2	#N/A
Peak Outflow Q (cfs) =	0.2	0.7	0.7	1.7	9.1	24.5	33.4	35.3	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.8	1.0	1.0	0.9	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.2	0.7	1.0	1.0	#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	52	51	55	54	52	50	48	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	58	57	62	62	60	59	58	#N/A
Maximum Ponding Depth (ft) =	2.36	4.73	4.47	5.72	6.23	6.74	7.04	7.78	#N/A
Area at Maximum Ponding Depth (acres) =	0.33	0.35	0.35	0.36	0.37	0.38	0.38	0.39	#N/A
Maximum Volume Stored (acre-ft) =	0.412	1.219	1.128	1.574	1.761	1.948	2.065	2.348	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond i



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	13.00	acres	Note: L / W Ratio < 1
Watershed Length =	700	ft	L / W Ratio = 0.9
Watershed Slope =	0.050	ft/ft	
Watershed Imperviousness =	60.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	0.0%	percent	
Percentage Hydrologic Soil Groups C/D =	100.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.256	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.749	acre-feet	
2-yr Runoff Volume (P1 = 1.16 in.) =	0.694	acre-feet	1.16 inches
5-yr Runoff Volume (P1 = 1.44 in.) =	0.977	acre-feet	1.44 inches
10-yr Runoff Volume (P1 = 1.68 in.) =	1.219	acre-feet	1.68 inches
25-yr Runoff Volume (P1 = 1.92 in.) =	1.587	acre-feet	1.92 inches
50-yr Runoff Volume (P1 = 2.16 in.) =	1.876	acre-feet	2.16 inches
100-yr Runoff Volume (P1 = 2.42 in.) =	2.234	acre-feet	2.42 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	inches
Approximate 2-yr Detention Volume =	0.651	acre-feet	
Approximate 5-yr Detention Volume =	0.921	acre-feet	
Approximate 10-yr Detention Volume =	1.051	acre-feet	
Approximate 25-yr Detention Volume =	1.125	acre-feet	
Approximate 50-yr Detention Volume =	1.161	acre-feet	
Approximate 100-yr Detention Volume =	1.284	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.256	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.493	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.536	acre-feet
Total Detention Basin Volume =	1.284	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

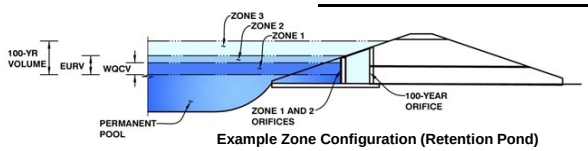
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
	--	1.00	--	--	--	2,000	0.046	1,005	0.023
	--	2.00	--	--	--	8,000	0.184	5,945	0.136
	--	3.00	--	--	--	8,400	0.193	14,225	0.327
	--	4.00	--	--	--	9,200	0.211	23,025	0.529
	--	5.00	--	--	--	9,600	0.220	32,425	0.744
	--	6.00	--	--	--	10,000	0.230	42,225	0.969
	--	7.00	--	--	--	10,400	0.239	52,425	1.204
	--	8.00	--	--	--	10,800	0.248	63,025	1.447
	--	9.00	--	--	--	11,200	0.257	74,025	1.699
	--	10.00	--	--	--	11,600	0.266	85,425	1.961

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond i



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.64	0.256	Orifice Plate
Zone 2 (EURV)	5.02	0.493	Rectangular Orifice
Zone 3 (100-year)	7.34	0.536	Weir&Pipe (Restrict)
		1.284	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	7.153E-03	ft^2
Depth at top of Zone using Orifice Plate =	2.64	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	10.60	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.03	sq. inches (diameter = 1-1/8 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.88	1.76					
Orifice Area (sq. inches)	1.03	1.03	1.03					

	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 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.64	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.02	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.00	N/A	inches
Vertical Orifice Width =	2.00		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.03	N/A	ft^2
Vertical Orifice Centroid =	0.08	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	5.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	10.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	7.60	N/A	feet
Over Flow Weir Slope Length =	10.20	N/A	feet
Grate Open Area / 100-yr Orifice Area =	17.20	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	28.55	N/A	ft^2
Overflow Grate Open Area w/ Debris =	14.28	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	16.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.66	N/A	ft^2
Outlet Orifice Centroid =	0.71	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.46	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway

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

Routed Hydrograph Results

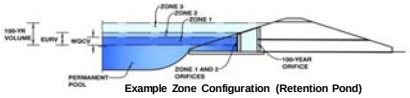
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	0.256	0.749	0.694	0.977	1.219	1.587	1.876	2.234	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.255	0.749	0.693	0.977	1.219	1.588	1.877	2.235	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.18	0.49	1.09	1.44	1.86	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.3	2.4	6.4	14.2	18.8	24.1	0.0
Peak Inflow Q (cfs) =	6.3	18.4	17.0	23.9	29.7	38.6	45.5	54.1	#N/A
Peak Outflow Q (cfs) =	0.1	0.4	0.4	1.0	5.7	15.1	19.9	21.0	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.9	1.1	1.1	0.9	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.2	0.5	0.7	0.7	#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	53	52	57	55	53	52	50	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	59	57	63	62	61	60	59	#N/A
Maximum Ponding Depth (ft) =	2.56	4.85	4.60	5.77	6.21	6.64	6.92	7.60	#N/A
Area at Maximum Ponding Depth (acres) =	0.19	0.22	0.22	0.23	0.23	0.24	0.24	0.24	#N/A
Maximum Volume Stored (acre-ft) =	0.241	0.709	0.657	0.917	1.018	1.116	1.182	1.348	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond J



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	12.00	acres	Note: L / W Ratio < 1
Watershed Length =	700	ft	L / W Ratio = 0.9
Watershed Slope =	0.050	ft/ft	
Watershed Imperviousness =	60.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	0.0%	percent	
Percentage Hydrologic Soil Groups C/D =	100.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.236	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.691	acre-feet	
2-yr Runoff Volume (P1 = 1.16 in.) =	0.640	acre-feet	1.16 inches
5-yr Runoff Volume (P1 = 1.44 in.) =	0.902	acre-feet	1.44 inches
10-yr Runoff Volume (P1 = 1.68 in.) =	1.125	acre-feet	1.68 inches
25-yr Runoff Volume (P1 = 1.92 in.) =	1.465	acre-feet	1.92 inches
50-yr Runoff Volume (P1 = 2.16 in.) =	1.731	acre-feet	2.16 inches
100-yr Runoff Volume (P1 = 2.42 in.) =	2.062	acre-feet	2.42 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	inches
Approximate 2-yr Detention Volume =	0.601	acre-feet	
Approximate 5-yr Detention Volume =	0.850	acre-feet	
Approximate 10-yr Detention Volume =	0.970	acre-feet	
Approximate 25-yr Detention Volume =	1.039	acre-feet	
Approximate 50-yr Detention Volume =	1.071	acre-feet	
Approximate 100-yr Detention Volume =	1.186	acre-feet	

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.236	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.455	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.494	acre-feet
Total Detention Basin Volume =	1.186	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

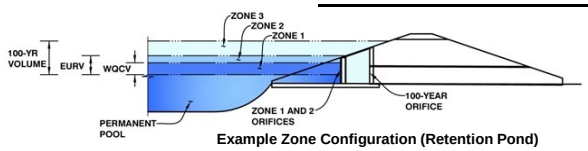
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	50	0.001		
	--	1.00	--	--	--	2,000	0.046	1,005	0.023
	--	2.00	--	--	--	8,000	0.184	5,945	0.136
	--	3.00	--	--	--	8,400	0.193	14,225	0.327
	--	4.00	--	--	--	9,200	0.211	23,025	0.529
	--	5.00	--	--	--	9,600	0.220	32,425	0.744
	--	6.00	--	--	--	10,000	0.230	42,225	0.969
	--	7.00	--	--	--	10,400	0.239	52,425	1.204
	--	8.00	--	--	--	10,800	0.248	63,025	1.447
	--	9.00	--	--	--	11,200	0.257	74,025	1.699
	--	10.00	--	--	--	11,600	0.266	85,425	1.961

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond J



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.53	0.236	Orifice Plate
Zone 2 (EURV)	4.76	0.455	Rectangular Orifice
Zone 3 (100-year)	6.93	0.494	Weir&Pipe (Restrict)
		1.186	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	6.875E-03	ft^2
Depth at top of Zone using Orifice Plate =	2.64	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	10.60	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.99	sq. inches (diameter = 1-1/8 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.88	1.76					
Orifice Area (sq. inches)	0.99	0.99	0.99					

	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 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.53	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	4.76	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.00	N/A	inches
Vertical Orifice Width =	2.00		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.03	N/A	ft^2
Vertical Orifice Centroid =	0.08	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	5.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	10.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	7.60	N/A	feet
Over Flow Weir Slope Length =	10.20	N/A	feet
Grate Open Area / 100-yr Orifice Area =	17.20	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	28.55	N/A	ft^2
Overflow Grate Open Area w/ Debris =	14.28	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	16.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.66	N/A	ft^2
Outlet Orifice Centroid =	0.71	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.46	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=		ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=		feet
Spillway Crest Length =		feet	Stage at Top of Freeboard =		feet
Spillway End Slopes =		H:V	Basin Area at Top of Freeboard =		acres
Freeboard above Max Water Surface =		feet			

Calculated Parameters for Spillway

Routed Hydrograph Results

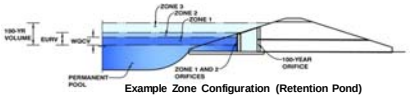
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	0.236	0.691	0.640	0.902	1.125	1.465	1.731	2.062	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.236	0.690	0.639	0.900	1.123	1.463	1.729	2.059	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.18	0.49	1.09	1.44	1.86	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.3	2.2	5.9	13.1	17.3	22.3	0.0
Peak Inflow Q (cfs) =	5.7	16.5	15.3	21.5	26.8	34.8	41.0	48.7	#N/A
Peak Outflow Q (cfs) =	0.1	0.4	0.4	0.4	3.4	11.7	18.3	20.3	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.6	0.9	1.1	0.9	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 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	0.1	0.4	0.6	0.7	#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	52	51	57	56	54	53	51	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	58	57	63	63	62	61	60	#N/A
Maximum Ponding Depth (ft) =	2.46	4.58	4.35	5.50	6.05	6.51	6.75	7.19	#N/A
Area at Maximum Ponding Depth (acres) =	0.19	0.22	0.21	0.22	0.23	0.23	0.24	0.24	#N/A
Maximum Volume Stored (acre-ft) =	0.222	0.653	0.603	0.856	0.981	1.085	1.142	1.247	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond K



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	3.70	acres
Watershed Length =	450	ft
Watershed Slope =	0.070	ft/ft
Watershed Imperviousness =	60.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Denver - Capitol Building	
Water Quality Capture Volume (WQCV) =	0.073	acre-feet
Excess Urban Runoff Volume (EURV) =	0.213	acre-feet
2-yr Runoff Volume (P1 = 1.16 in.) =	0.197	acre-feet
5-yr Runoff Volume (P1 = 1.44 in.) =	0.278	acre-feet
10-yr Runoff Volume (P1 = 1.68 in.) =	0.347	acre-feet
25-yr Runoff Volume (P1 = 1.92 in.) =	0.452	acre-feet
50-yr Runoff Volume (P1 = 2.16 in.) =	0.534	acre-feet
100-yr Runoff Volume (P1 = 2.42 in.) =	0.636	acre-feet
500-yr Runoff Volume (P1 = 3.14 in.) =	0.878	acre-feet
Approximate 2-yr Detention Volume =	0.185	acre-feet
Approximate 5-yr Detention Volume =	0.262	acre-feet
Approximate 10-yr Detention Volume =	0.299	acre-feet
Approximate 25-yr Detention Volume =	0.320	acre-feet
Approximate 50-yr Detention Volume =	0.330	acre-feet
Approximate 100-yr Detention Volume =	0.366	acre-feet

Optional User Override 1-hr Precipitation

1.16	inches
1.44	inches
1.68	inches
1.92	inches
2.16	inches
2.42	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.073	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.140	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.152	acre-feet
Total Detention Basin Volume =	0.366	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

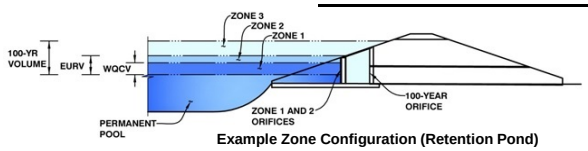
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	20	0.000		
	--	1.00	--	--	--	200	0.005	108	0.002
	--	2.00	--	--	--	3,000	0.069	1,680	0.039
	--	3.00	--	--	--	3,100	0.071	4,760	0.109
	--	4.00	--	--	--	3,200	0.073	7,910	0.182
	--	5.00	--	--	--	3,300	0.076	11,160	0.256
	--	6.00	--	--	--	3,400	0.078	14,510	0.333
	--	7.00	--	--	--	3,500	0.080	17,960	0.412
	--	8.00	--	--	--	3,600	0.083	21,510	0.494
	--	9.00	--	--	--	3,700	0.085	25,160	0.578
	--	10.00	--	--	--	3,800	0.087	28,910	0.664

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP

Basin ID: Pond K



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.49	0.073	Orifice Plate
Zone 2 (EURV)	4.43	0.140	Rectangular Orifice
Zone 3 (100-year)	6.42	0.152	Weir&Pipe (Restrict)
		0.366	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.736E-03	ft^2
Depth at top of Zone using Orifice Plate =	2.49	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.96	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.25	sq. inches (diameter = 9/16 inch)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.80	1.60	2.40				
Orifice Area (sq. inches)	0.25	0.25	0.25	0.25				

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.49	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	4.43	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.00	N/A	inches
Vertical Orifice Width =	0.73		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.01	N/A	ft^2
Vertical Orifice Centroid =	0.08	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	7.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	8.00	N/A	feet
Over Flow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	15.21	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	11.54	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.77	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	8.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.76	N/A	ft^2
Outlet Orifice Centroid =	0.39	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.46	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

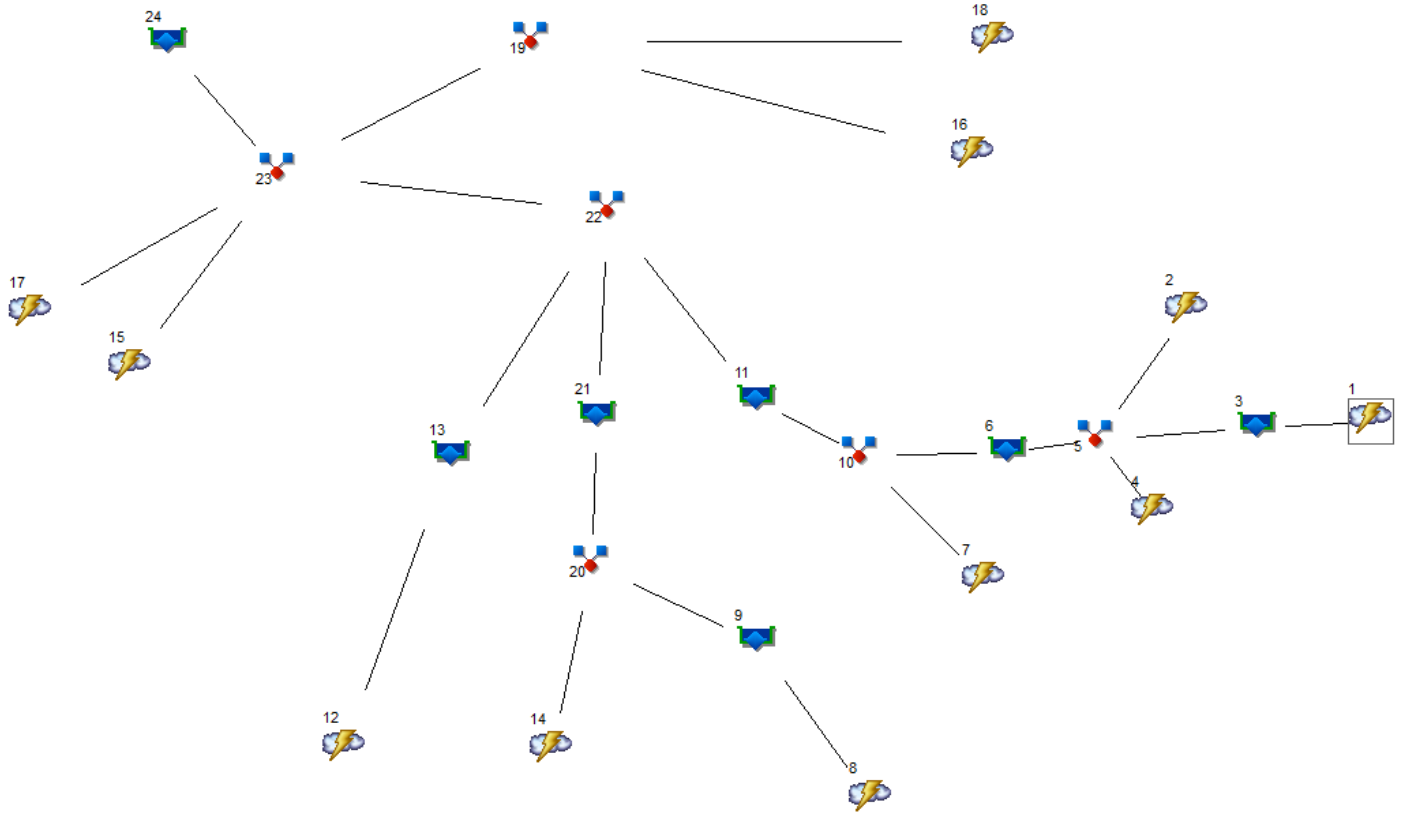
Calculated Parameters for Spillway

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

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	1.16	1.44	1.68	1.92	2.16	2.42	3.14
Calculated Runoff Volume (acre-ft) =	0.073	0.213	0.197	0.278	0.347	0.452	0.534	0.636	0.878
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.072	0.213	0.197	0.277	0.347	0.452	0.534	0.636	0.878
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.17	0.45	1.01	1.33	1.71	2.57
Predevelopment Peak Q (cfs) =	0.0	0.0	0.1	0.6	1.7	3.7	4.9	6.3	9.5
Peak Inflow Q (cfs) =	1.7	4.9	4.5	6.4	7.9	10.3	12.1	14.4	19.9
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.1	0.2	0.5	2.7	5.6	10.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.1	0.1	0.5	0.9	1.1
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.2	0.5	0.9
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	54	53	59	62	66	65	63	59
Time to Drain 99% of Inflow Volume (hours) =	39	58	57	63	68	73	72	72	70
Maximum Ponding Depth (ft) =	2.42	4.26	4.05	5.09	5.96	7.13	7.43	7.66	8.11
Area at Maximum Ponding Depth (acres) =	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08
Maximum Volume Stored (acre-ft) =	0.068	0.201	0.185	0.262	0.329	0.423	0.446	0.466	0.503

APPENDIX E – HYDROGRAPHS



Legend

Hyd.	Origin	Description
1	Rational	C8
2	Rational	Basins OS-C9 & C10
3	Reservoir	Pond C4 outflow
4	Rational	Basin C8a
5	Combine	Inflow Pond C3
6	Reservoir	Pond C3 outflow
7	Rational	Basins C5 & C7
8	Rational	Basin C3 & C4
9	Reservoir	Pond C2.1 outflow
10	Combine	Inflow Pond C2.2
11	Reservoir	Pond C2.2 outflow
12	Rational	Basins C1 & C2
13	Reservoir	Pond C1 outflow
14	Rational	Basin C6
15	Rational	Basin C14+C15
16	Rational	Basin C13
17	Rational	C17
18	Rational	Basins C16 & C12
19	Combine	Des.Pt.6c to Pond C5
20	Combine	inflow Pond C2.3
21	Reservoir	Pond C2.3 outflow
22	Combine	Des. Pt 3f
23	Combine	Inflow Pond C5
24	Reservoir	Pond C5 outflow

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	106.80	1	19	121,752	----	------	------	C8
2	Rational	29.21	1	15	26,289	----	------	------	Basins OS-C9 & C10
3	Reservoir	12.40	1	36	24,518	1	5772.03	247,806	Pond C4 outflow
4	Rational	20.81	1	12	14,982	----	------	------	Basin C8a
5	Combine	44.82	1	15	65,789	2, 3, 4	------	------	Inflow Pond C3
6	Reservoir	4.568	1	58	20,897	5	5760.24	75,308	Pond C3 outflow
7	Rational	48.92	1	25	73,387	----	------	------	Basins C5 & C7
8	Rational	83.17	1	25	124,758	----	------	------	Basin C3 & C4
9	Reservoir	11.73	1	46	17,691	8	5771.23	210,648	Pond C2.1 outflow
10	Combine	48.92	1	25	94,284	6, 7,	------	------	Inflow Pond C2.2
11	Reservoir	6.735	1	49	28,966	10	5750.97	162,116	Pond C2.2 outflow
12	Rational	70.57	1	25	105,861	----	------	------	Basins C1 & C2- Pond C1 inflow
13	Reservoir	2.952	1	49	14,392	12	5750.59	260,656	Pond C1 outflow
14	Rational	31.01	1	14	26,052	----	------	------	Basin C6
15	Rational	65.81	1	23	90,814	----	------	------	Basin C14+C15
16	Rational	6.881	1	30	12,386	----	------	------	Basin C13
17	Rational	46.96	1	16	45,084	----	------	------	C17
18	Rational	79.61	1	31	148,075	----	------	------	Basins C16 & C12
19	Combine	86.26	1	31	160,462	16, 18	------	------	Des.Pt.6c to Pond C5
20	Combine	31.01	1	14	43,743	9, 14,	------	------	inflow Pond C2.3
21	Reservoir	4.548	1	61	13,634	20	5749.16	64,350	Pond C2.3 outflow
22	Combine	12.37	1	57	56,992	11, 13, 21	------	------	Des. Pt 3f
23	Combine	156.57	1	23	353,350	15, 17, 19, 22	------	------	Inflow Pond C5
24	Reservoir	121.19	1	32	341,003	23	5713.47	566,932	Pond C5 outflow

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	266.64	1	19	303,974	----	------	------	C8
2	Rational	63.71	1	15	57,341	----	------	------	Basins OS-C9 & C10
3	Reservoir	38.34	1	35	298,076	1	5775.34	467,055	Pond C4 outflow
4	Rational	51.32	1	12	36,953	----	------	------	Basin C8a
5	Combine	133.89	1	15	392,370	2, 3, 4	------	------	Inflow Pond C3
6	Reservoir	17.79	1	144	367,493	5	5763.93	275,851	Pond C3 outflow
7	Rational	121.62	1	25	182,430	----	------	------	Basins C5 & C7
8	Rational	206.75	1	25	310,131	----	------	------	Basin C3 & C4
9	Reservoir	65.13	1	42	279,789	8	5773.91	363,096	Pond C2.1 outflow
10	Combine	137.71	1	25	549,923	6, 7,	------	------	Inflow Pond C2.2
11	Reservoir	40.34	1	45	530,339	10	5753.55	278,207	Pond C2.2 outflow
12	Rational	175.44	1	25	263,155	----	------	------	Basins C1 & C2
13	Reservoir	17.68	1	47	222,974	12	5753.09	445,161	Pond C1 outflow
14	Rational	76.98	1	14	64,659	----	------	------	Basin C6
15	Rational	163.99	1	23	226,299	----	------	------	Basin C14+C15
16	Rational	40.73	1	30	73,322	----	------	------	Basin C13
17	Rational	108.00	1	16	103,681	----	------	------	C17
18	Rational	195.70	1	31	363,995	----	------	------	Basins C16 & C12
19	Combine	235.07	1	31	437,317	16, 18	------	------	Des.Pt.6c to Pond C5
20	Combine	110.99	1	17	344,448	9, 14,	------	------	inflow Pond C2.3
21	Reservoir	45.83	1	84	334,262	20	5753.06	188,378	Pond C2.3 outflow
22	Combine	99.75	1	48	1,087,511	11, 13, 21	------	------	Des. Pt 3f
23	Combine	484.24	1	23	1,854,809	15, 17, 19, 22	------	------	Inflow Pond C5
24	Reservoir	419.90	1	32	1,757,155	23	5714.32	677,645	Pond C5 outflow

Pond Report

Pond No. 4 - Pond C1

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5746.00	26,303	0	0
1.00	5747.00	53,900	40,102	40,102
2.00	5748.00	57,925	55,913	96,014
3.00	5749.00	62,019	59,972	155,986
4.00	5750.00	66,200	64,110	220,096
5.00	5751.00	70,500	68,350	288,446
6.00	5752.00	74,920	72,710	361,156
7.00	5753.00	78,760	76,840	437,996
8.00	5754.00	80,000	79,380	517,376
9.00	5755.00	82,000	81,000	598,376
10.00	5756.00	85,000	83,500	681,876

Culvert / Orifice Structures

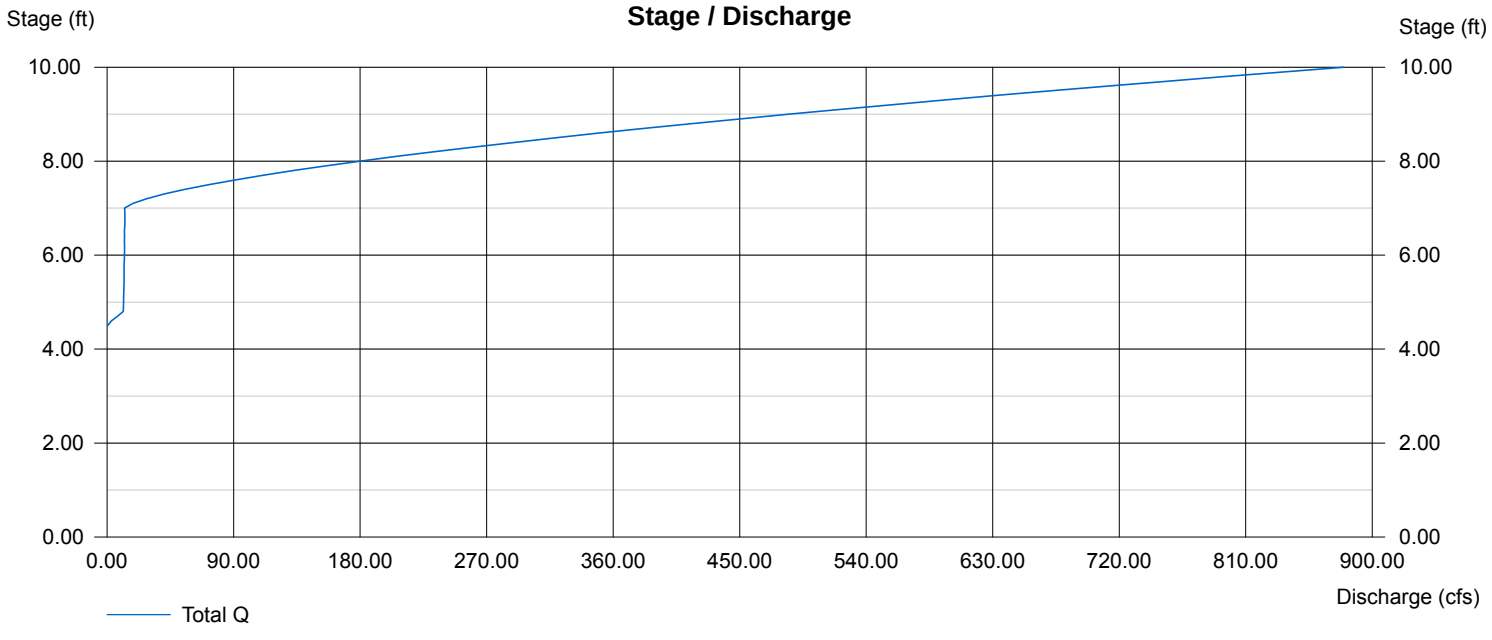
	[A]	[B]	[C]	[D]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 5743.50	0.00	0.00	0.00
Length (ft)	= 675.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	50.00	0.00	0.00
Crest El. (ft)	= 5750.47	5753.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Riser	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Hydraflow Hydrographs by Intelisolve | Monday, May 22 2017, 8:31 AM

Pond No. 7 - Pond C2.1

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5765.00	50	0	0
1.00	5766.00	5,012	2,531	2,531
2.00	5767.00	29,041	17,027	19,558
3.00	5768.00	43,198	36,120	55,677
4.00	5769.00	46,089	44,644	100,321
5.00	5770.00	49,051	47,570	147,891
6.00	5771.00	52,082	50,567	198,457
7.00	5772.00	55,183	53,633	252,090
8.00	5773.00	58,358	56,771	308,860
9.00	5774.00	61,000	59,679	368,539

Culvert / Orifice Structures

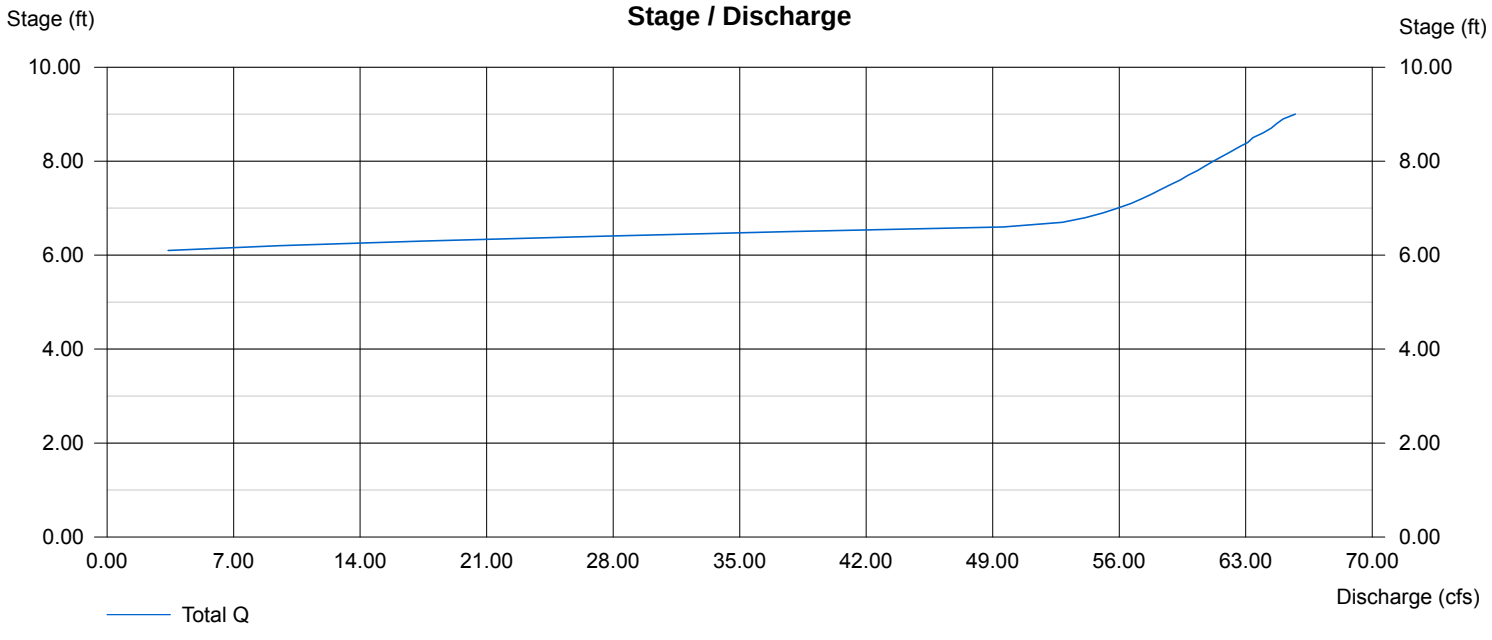
	[A]	[B]	[C]	[D]
Rise (in)	= 30.00	0.00	0.00	0.00
Span (in)	= 30.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 5765.00	0.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 32.00	50.00	0.00	0.00
Crest El. (ft)	= 5771.00	5774.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Riser	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Hydraflow Hydrographs by Intelisolve | Monday, May 22 2017, 8:31 AM

Pond No. 3 - Pond C2.2

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5745.00	10	0	0
1.00	5746.00	2,363	1,187	1,187
2.00	5747.00	31,533	16,948	18,135
3.00	5748.00	33,850	32,692	50,826
4.00	5749.00	36,237	35,044	85,870
5.00	5750.00	38,701	37,469	123,339
6.00	5751.00	41,268	39,985	163,323
7.00	5752.00	44,081	42,675	205,998
8.00	5753.00	47,000	45,541	251,538
9.00	5754.00	50,000	48,500	300,038
10.00	5755.00	53,000	51,500	351,538
11.00	5756.00	56,000	54,500	406,038

Culvert / Orifice Structures

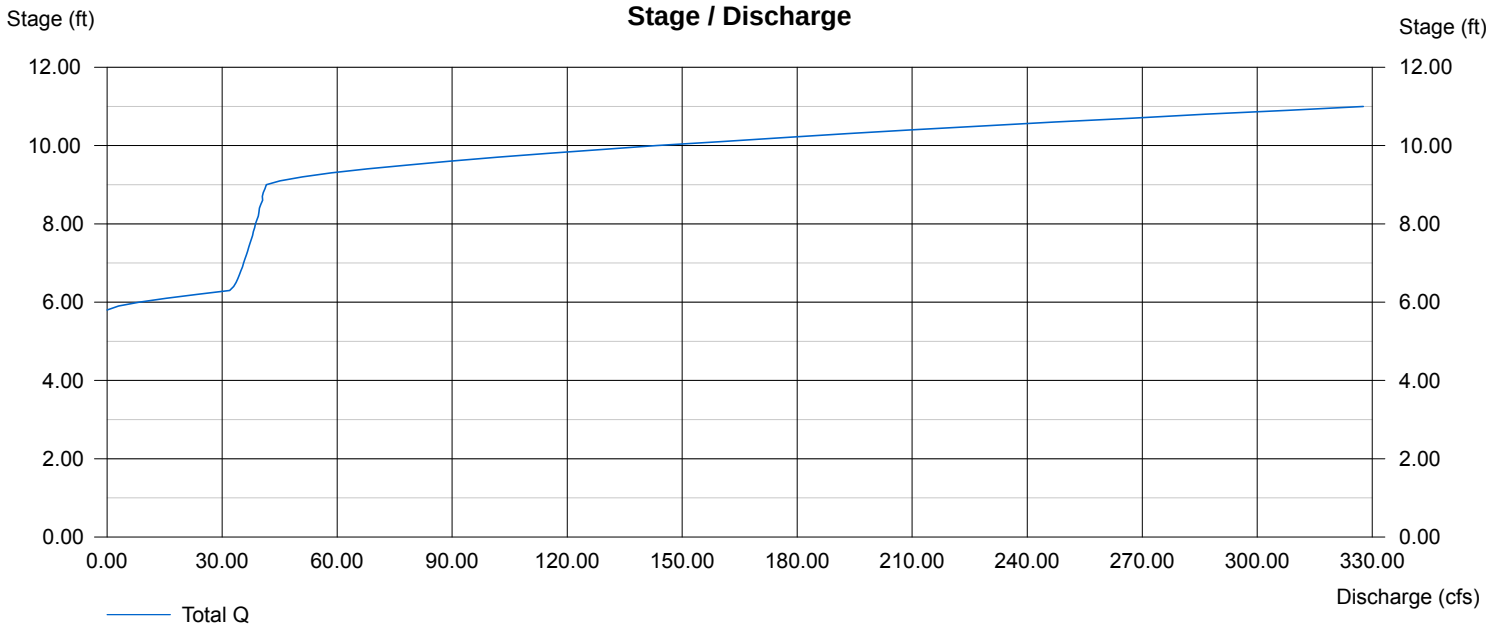
	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 5745.00	0.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 28.00	30.00	0.00	0.00
Crest El. (ft)	= 5750.80	5754.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Riser	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Hydraflow Hydrographs by Intelisolve | Monday, May 22 2017, 8:31 AM

Pond No. 6 - Pond C2.3

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5746.00	100	0	0
1.00	5747.00	22,141	11,121	11,121
2.00	5748.00	24,321	23,231	34,352
3.00	5749.00	26,601	25,461	59,813
4.00	5750.00	28,983	27,792	87,605
5.00	5751.00	31,466	30,225	117,829
6.00	5752.00	34,050	32,758	150,587
7.00	5753.00	36,742	35,396	185,983
8.00	5754.00	38,000	37,371	223,354

Culvert / Orifice Structures

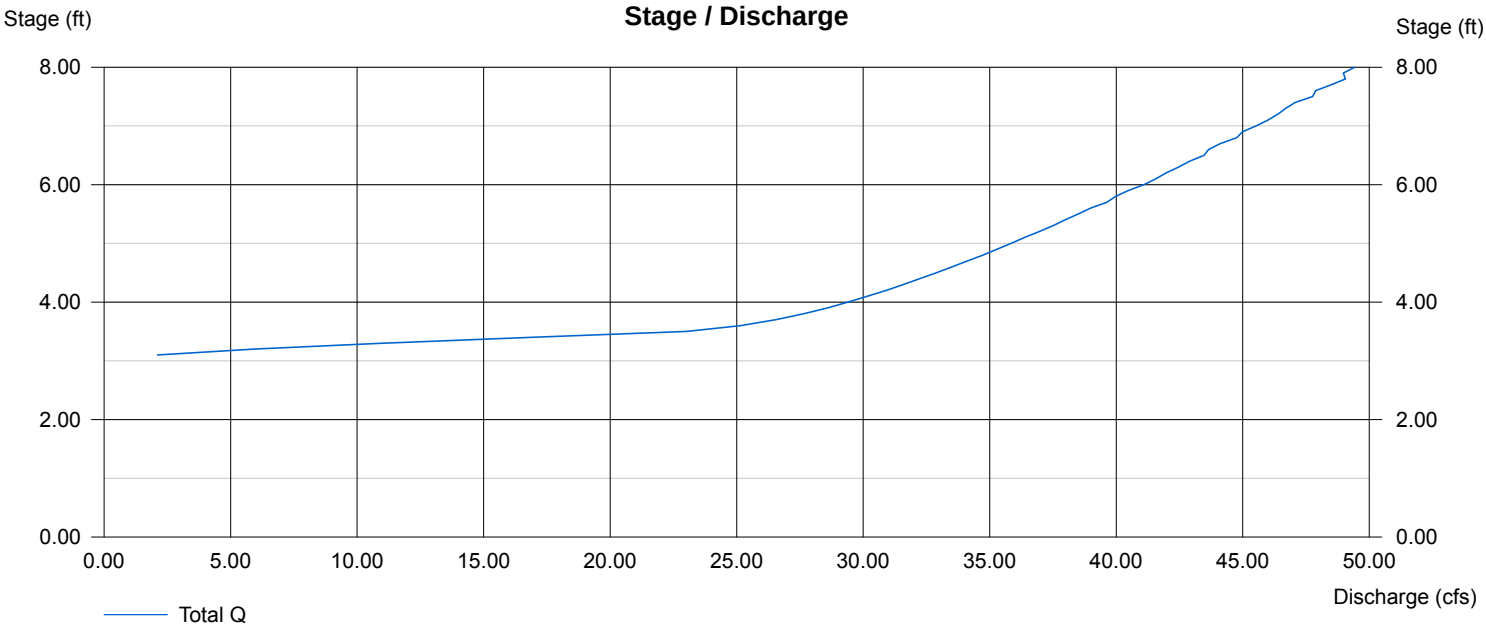
	[A]	[B]	[C]	[D]
Rise (in)	= 27.00	0.00	0.00	0.00
Span (in)	= 27.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 5746.00	0.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.000	.000	.000
Orif. Coeff.	= 0.60	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	30.00	0.00	0.00
Crest El. (ft)	= 5749.00	5754.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Riser	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Pond No. 2 - Pond C3

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5758.00	13,580	0	0
1.00	5759.00	33,254	23,417	23,417
2.00	5760.00	46,803	40,029	63,446
3.00	5761.00	50,425	48,614	112,060
4.00	5762.00	54,123	52,274	164,334
5.00	5763.00	57,909	56,016	220,350
6.00	5764.00	61,796	59,853	280,202
7.00	5765.00	70,319	66,058	346,260
8.00	5766.00	74,258	72,289	418,548
9.00	5767.00	78,270	76,264	494,812
10.00	5768.00	82,343	80,307	575,119

Culvert / Orifice Structures

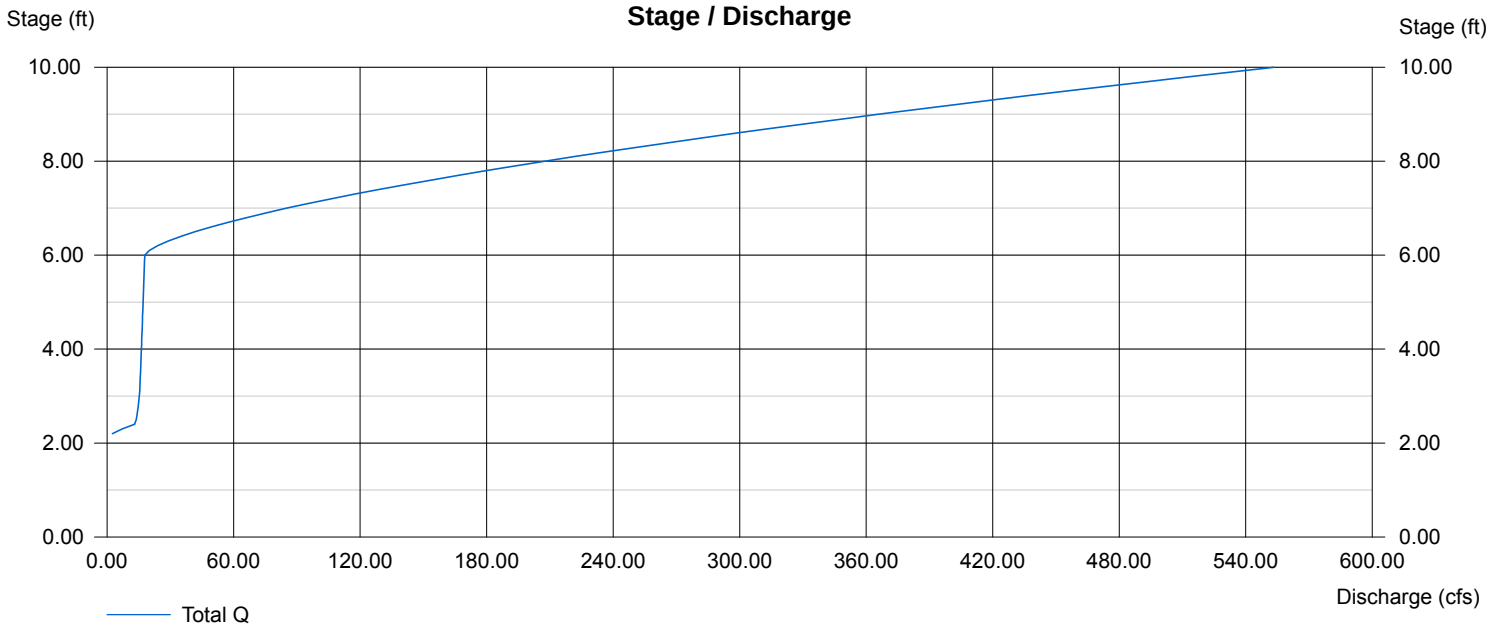
	[A]	[B]	[C]	[D]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 5757.00	0.00	0.00	0.00
Length (ft)	= 325.00	0.00	0.00	0.00
Slope (%)	= 1.90	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 24.00	20.00	0.00	0.00
Crest El. (ft)	= 5760.10	5764.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Riser	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Pond No. 1 - Pond C4

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5766.50	500	0	0
0.50	5767.00	5,000	1,375	1,375
1.50	5768.00	48,694	26,847	28,222
2.50	5769.00	51,543	50,119	78,341
3.50	5770.00	54,460	53,002	131,342
4.50	5771.00	57,445	55,953	187,295
5.50	5772.00	60,499	58,972	246,267
6.50	5773.00	63,620	62,060	308,326
7.50	5774.00	66,809	65,215	373,541
8.50	5775.00	70,666	68,738	442,278
9.50	5776.00	73,392	72,029	514,307
10.50	5777.00	76,785	75,089	589,396
11.50	5778.00	80,246	78,516	667,911

Culvert / Orifice Structures

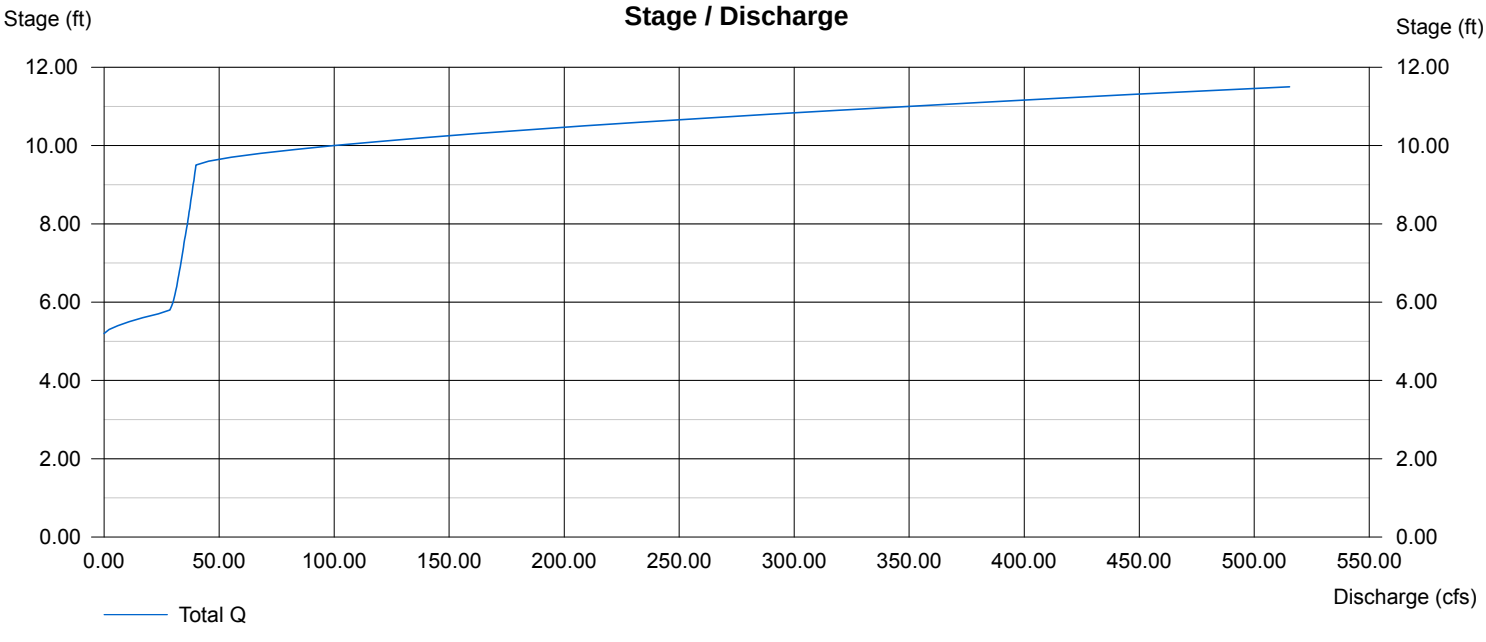
	[A]	[B]	[C]	[D]
Rise (in)	= 24.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 5766.50	0.00	0.00	0.00
Length (ft)	= 150.00	0.00	0.00	0.00
Slope (%)	= 0.60	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 20.00	50.00	0.00	0.00
Crest El. (ft)	= 5771.70	5776.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Riser	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Pond No. 5 - Pond C5

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5707.00	1,000	0	0
1.00	5708.00	18,898	9,949	9,949
2.00	5709.00	77,432	48,165	58,114
3.00	5710.00	110,270	93,851	151,965
4.00	5711.00	115,455	112,863	264,828
5.00	5712.00	120,720	118,088	382,915
6.00	5713.00	126,045	123,383	506,298
7.00	5714.00	131,696	128,871	635,168
8.00	5715.00	136,745	134,221	769,389
9.00	5716.00	141,857	139,301	908,690

Culvert / Orifice Structures

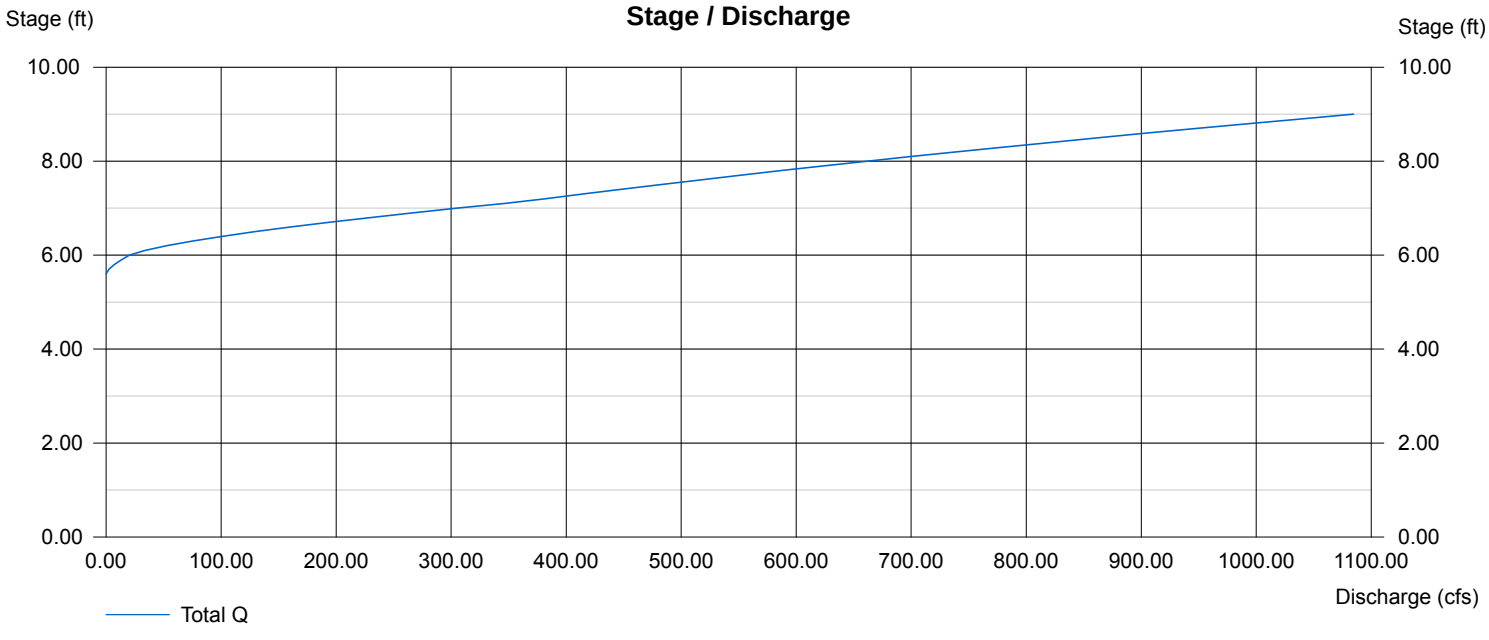
	[A]	[B]	[C]	[D]
Rise (in)	= 48.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 5704.50	0.00	0.00	0.00
Length (ft)	= 120.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 24.00	52.00	0.00	0.00
Crest El. (ft)	= 5712.60	5713.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Riser	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



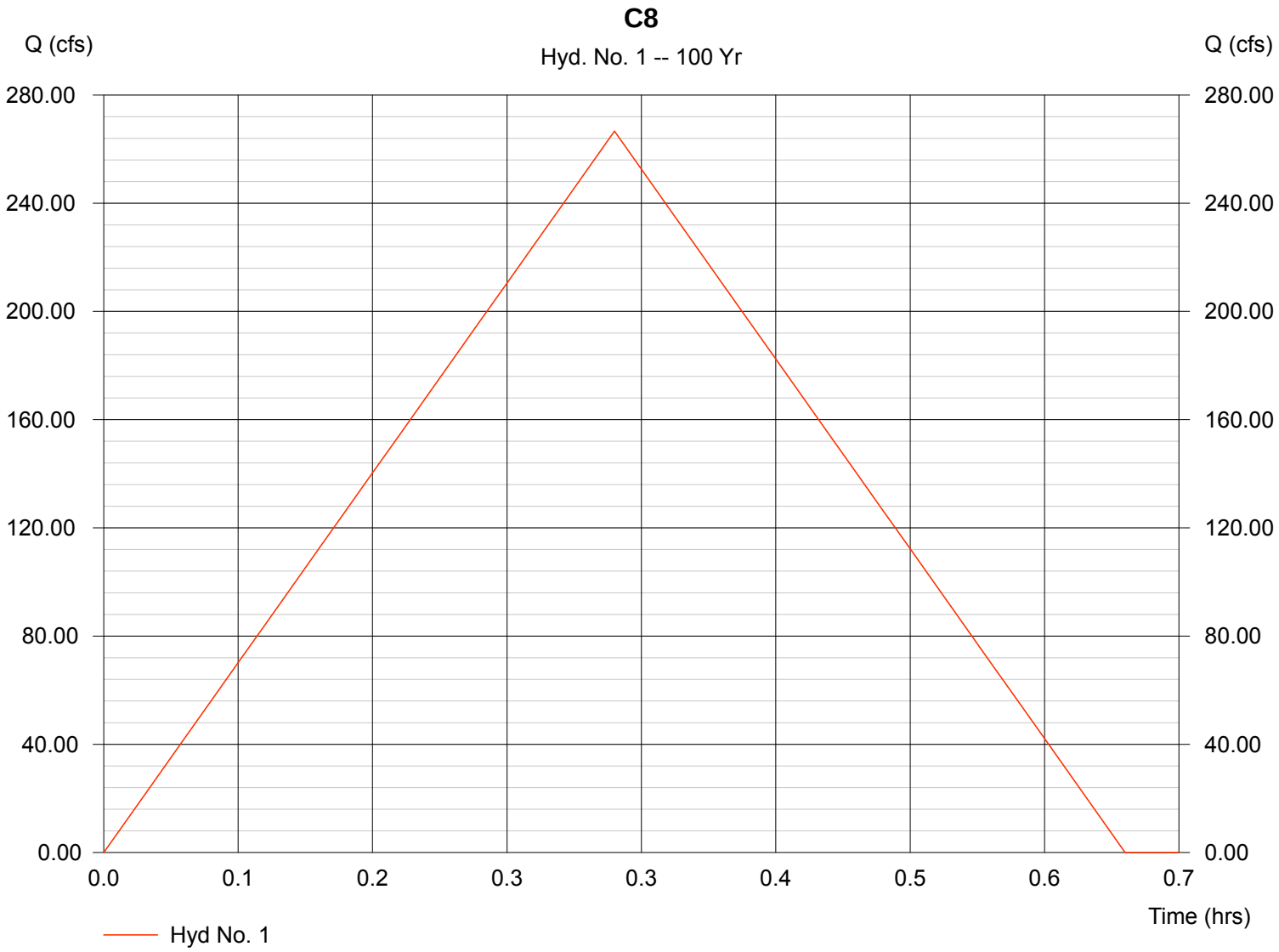
Hydrograph Plot

Hyd. No. 1

C8

Hydrograph type	=	Rational	Peak discharge	=	266.64 cfs
Storm frequency	=	100 yrs	Time interval	=	1 min
Drainage area	=	75.000 ac	Runoff coeff.	=	0.65
Intensity	=	5.470 in/hr	Tc by User	=	19.00 min
IDF Curve	=	2016-idf curves-rls.IDF	Asc/Rec limb fact	=	1/1

Hydrograph Volume = 303,974 cuft



Hydrograph Plot

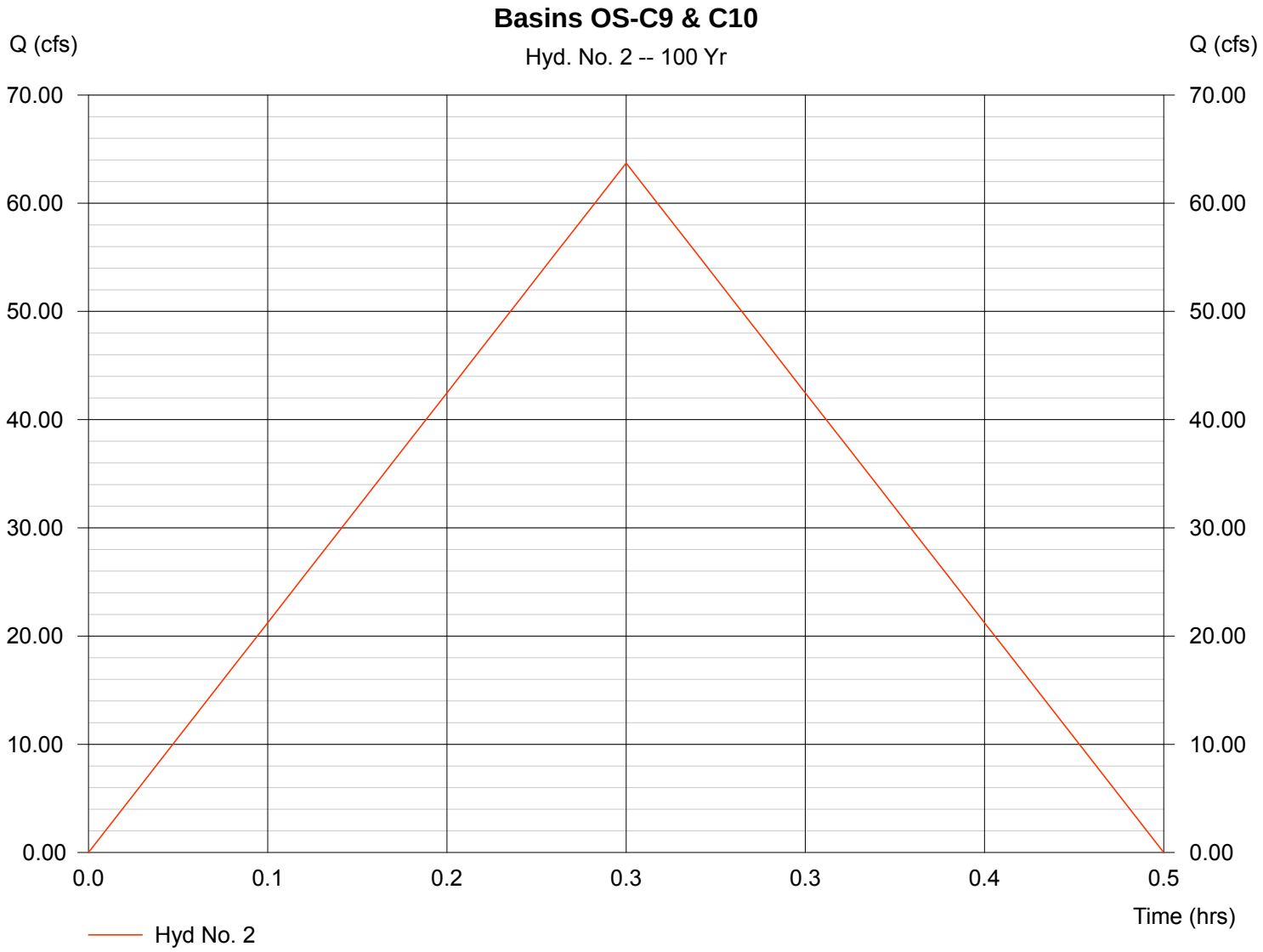
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 2

Basins OS-C9 & C10

Hydrograph type	= Rational	Peak discharge	= 63.71 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 18.200 ac	Runoff coeff.	= 0.57
Intensity	= 6.142 in/hr	Tc by User	= 15.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 57,341 cuft



Hydrograph Plot

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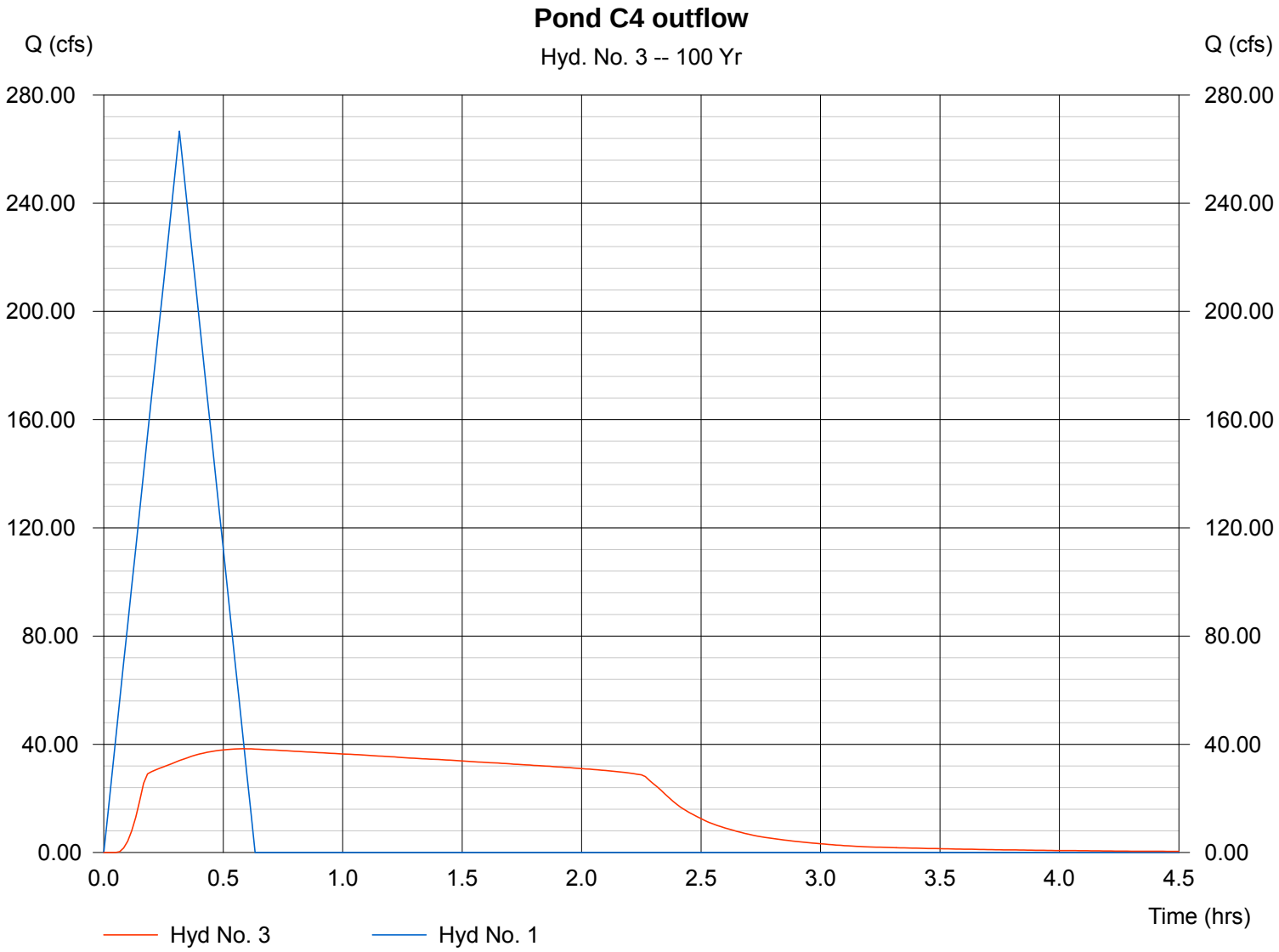
Hyd. No. 3

Pond C4 outflow

Hydrograph type	= Reservoir	Peak discharge	= 38.34 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 1	Max. Elevation	= 5775.34 ft
Reservoir name	= Pond C4	Max. Storage	= 467,055 cuft

Storage Indication method used. Wet pond routing start elevation = 5771.60 ft. | Hydrograph Volume = 298,076 cuft



Hydrograph Plot

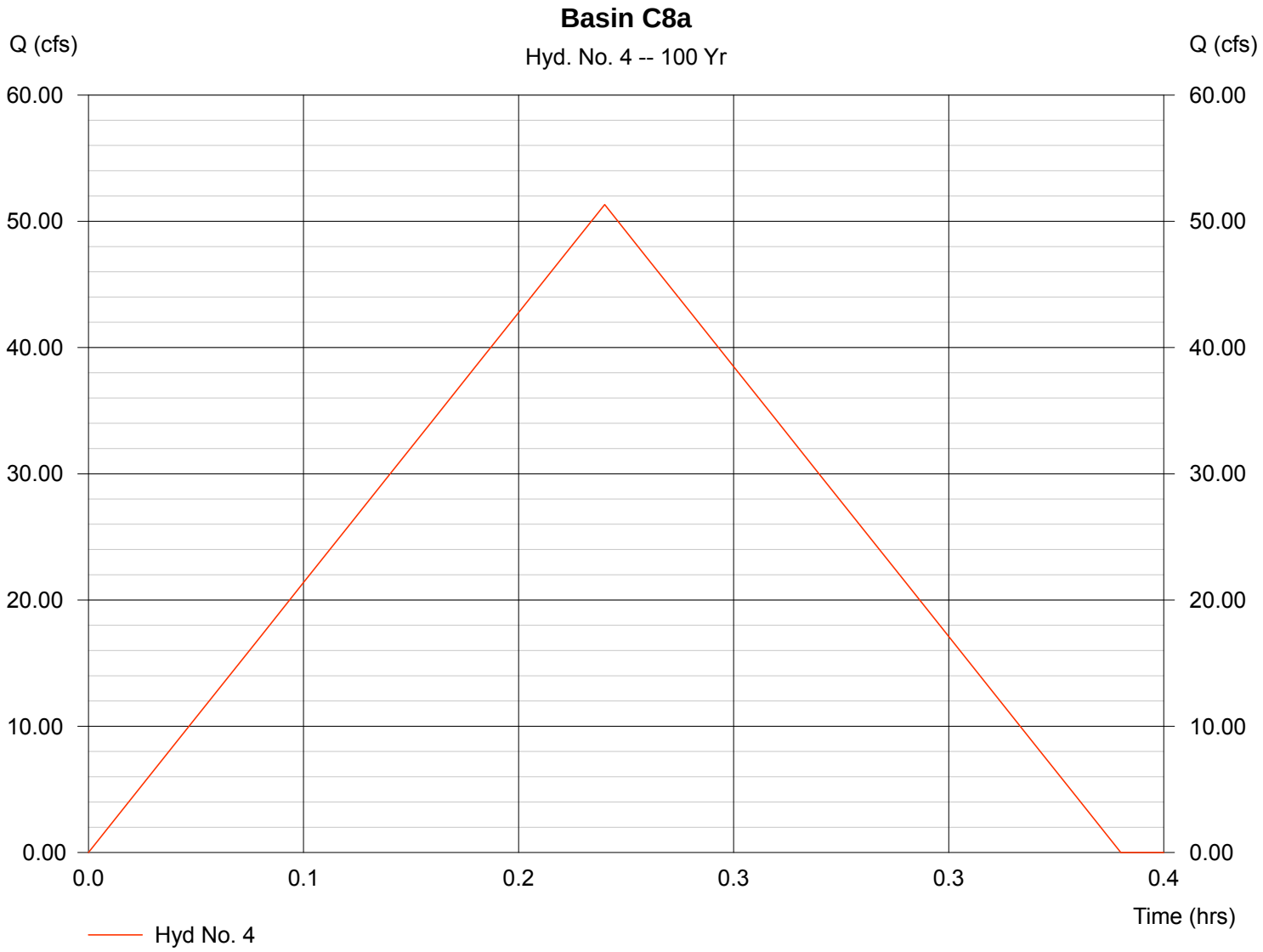
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 4

Basin C8a

Hydrograph type	= Rational	Peak discharge	= 51.32 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 11.700 ac	Runoff coeff.	= 0.65
Intensity	= 6.749 in/hr	Tc by User	= 12.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 36,953 cuft



Hydrograph Plot

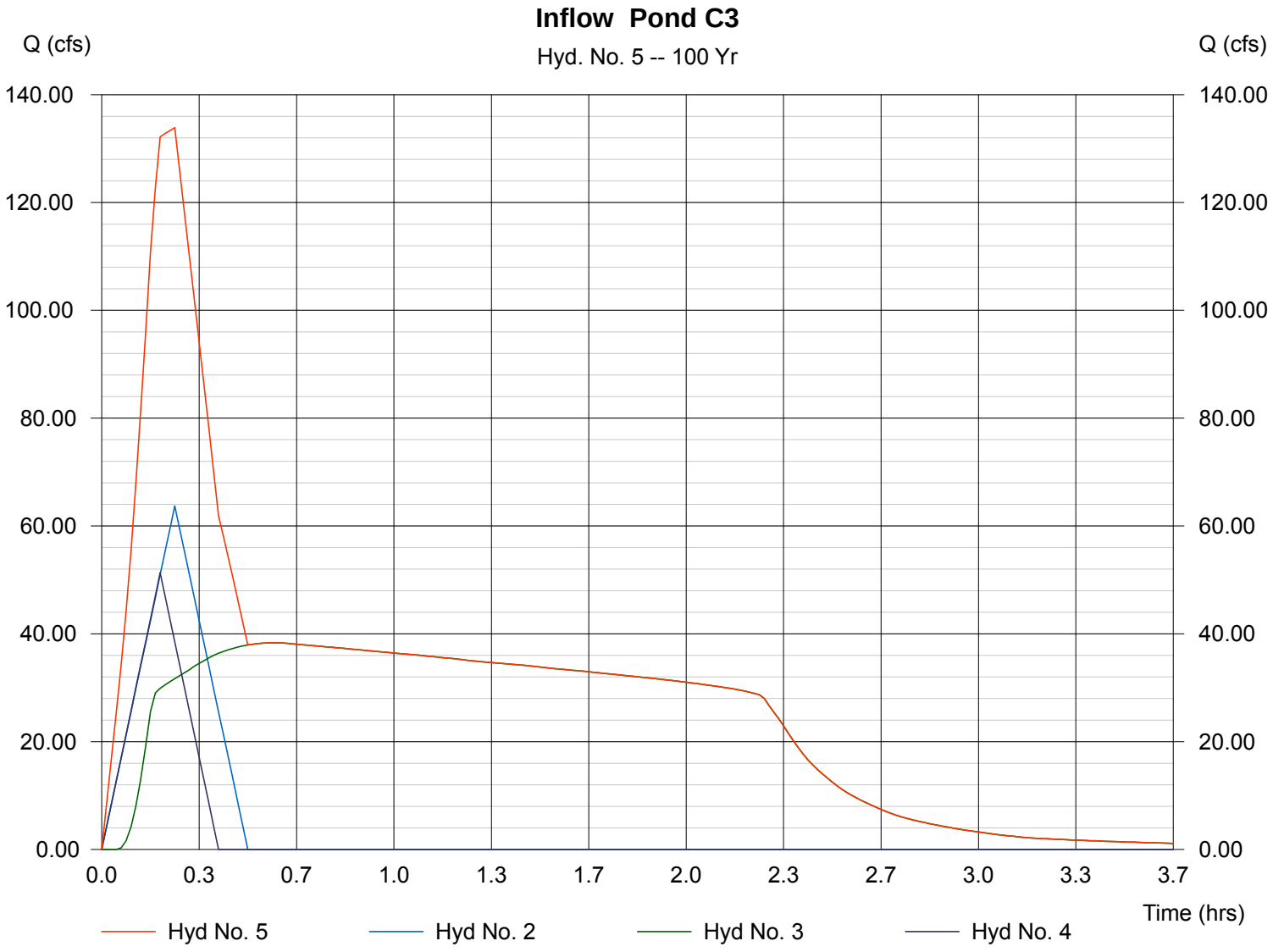
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 5

Inflow Pond C3

Hydrograph type	= Combine	Peak discharge	= 133.89 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyds.	= 2, 3, 4		

Hydrograph Volume = 392,370 cuft



Hydrograph Plot

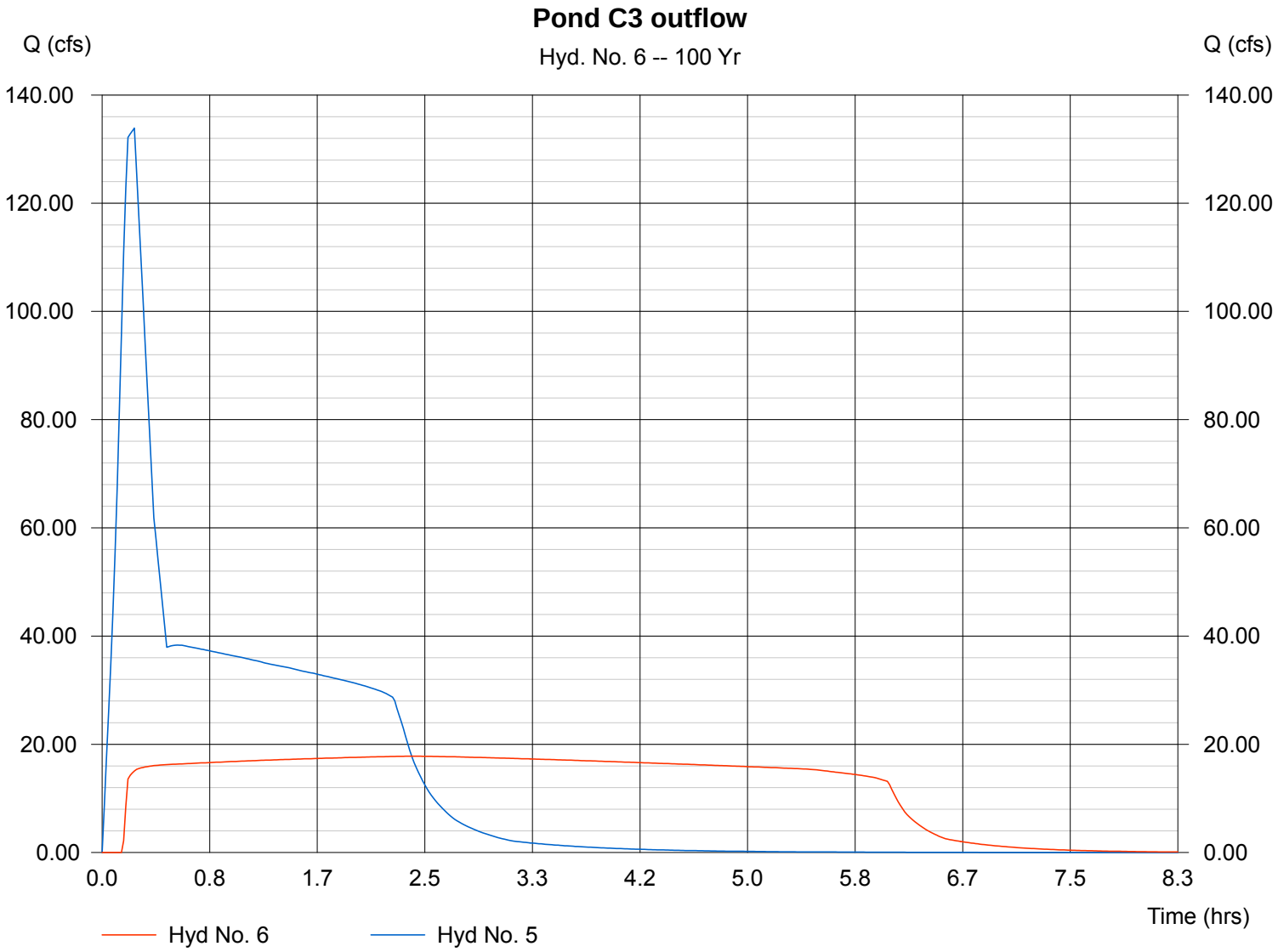
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 6

Pond C3 outflow

Hydrograph type	=	Reservoir	Peak discharge	=	17.79 cfs
Storm frequency	=	100 yrs	Time interval	=	1 min
Inflow hyd. No.	=	5	Max. Elevation	=	5763.93 ft
Reservoir name	=	Pond C3	Max. Storage	=	275,851 cuft

Storage Indication method used. Wet pond routing start elevation = 5759.50 ft. | Hydrograph Volume = 367,493 cuft



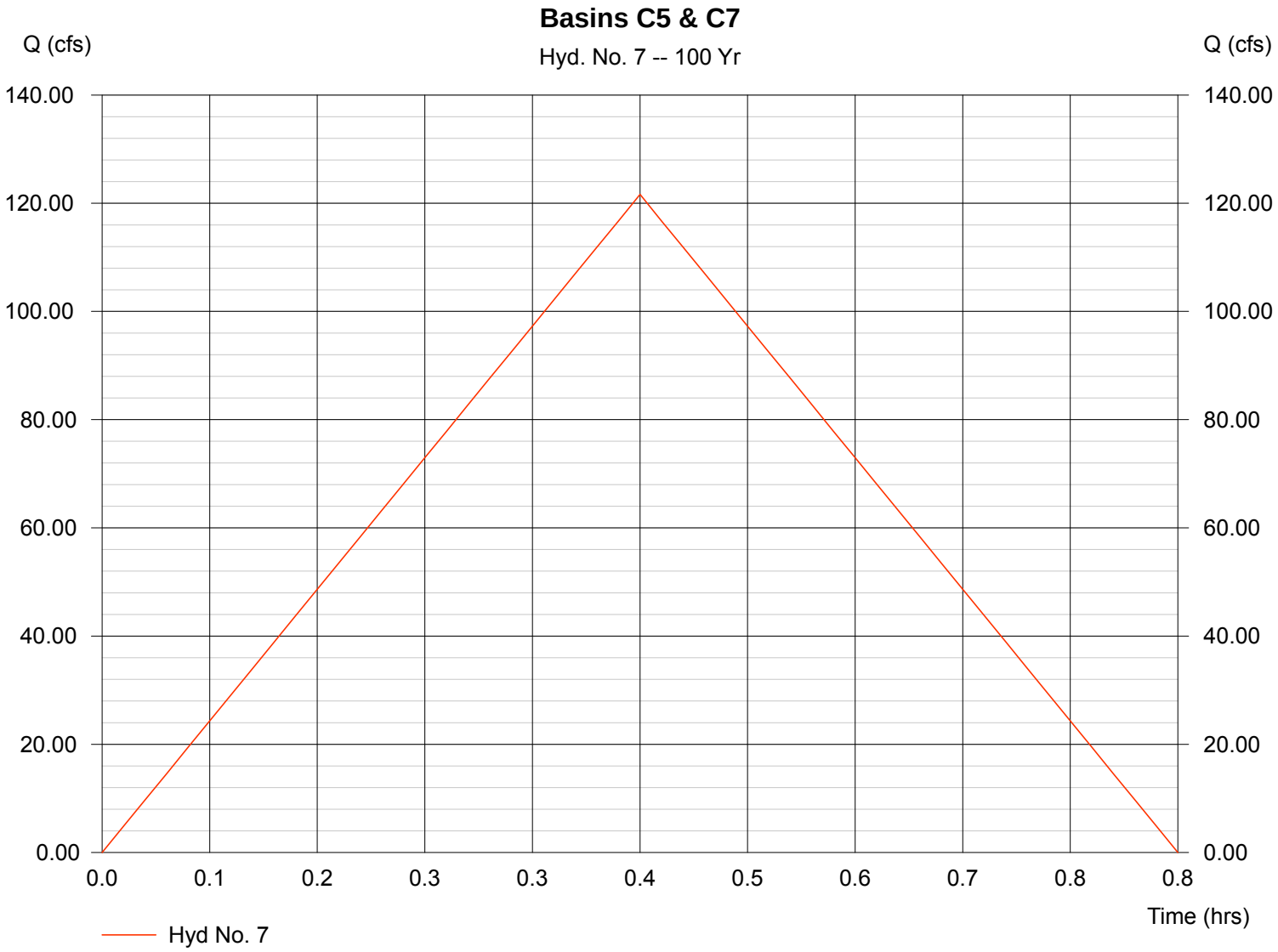
Hydrograph Plot

Hyd. No. 7

Basins C5 & C7

Hydrograph type	= Rational	Peak discharge	= 121.62 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 40.000 ac	Runoff coeff.	= 0.65
Intensity	= 4.678 in/hr	Tc by User	= 25.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 182,430 cuft



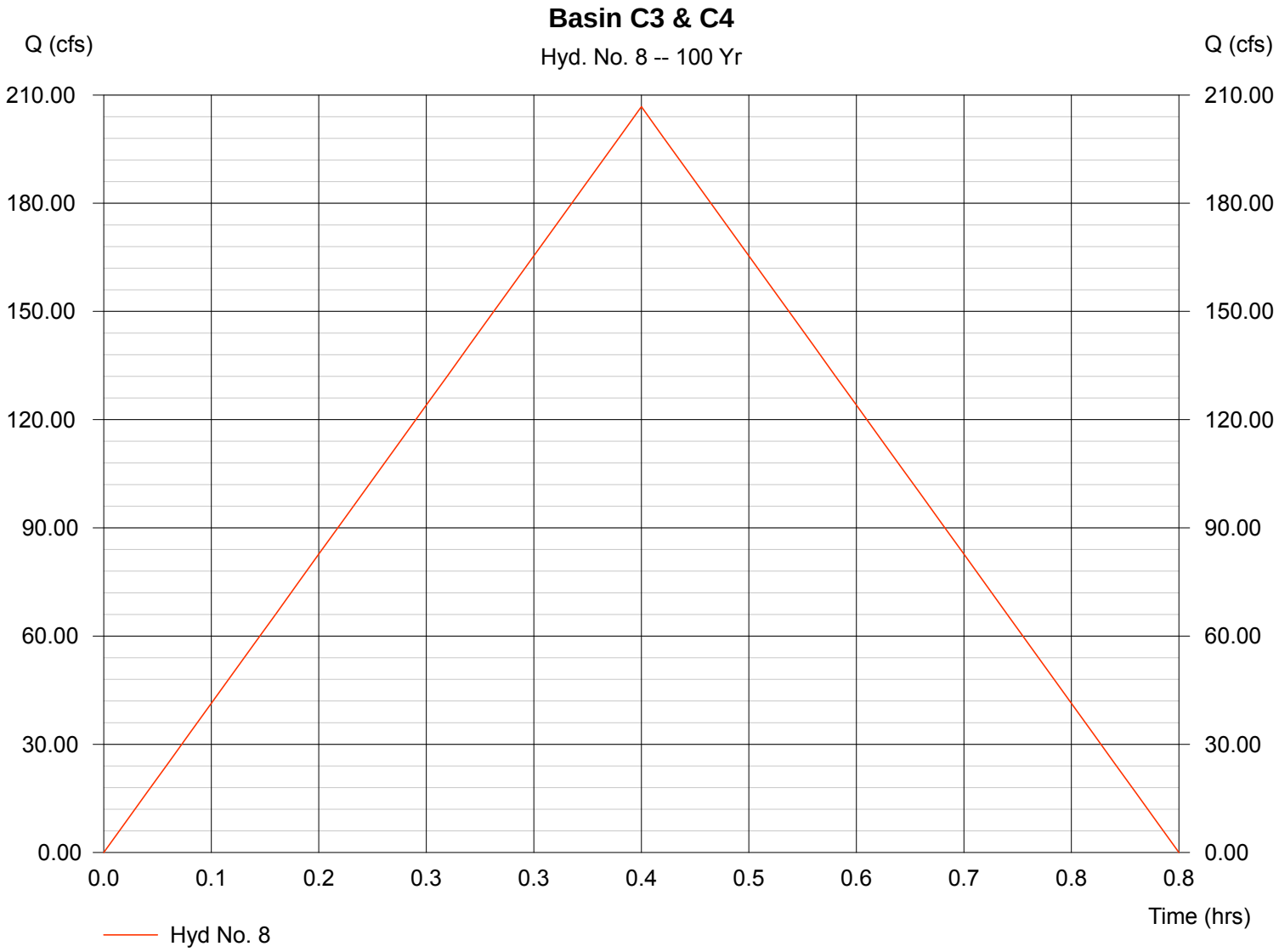
Hydrograph Plot

Hyd. No. 8

Basin C3 & C4

Hydrograph type	= Rational	Peak discharge	= 206.75 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 68.000 ac	Runoff coeff.	= 0.65
Intensity	= 4.678 in/hr	Tc by User	= 25.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 310,131 cuft



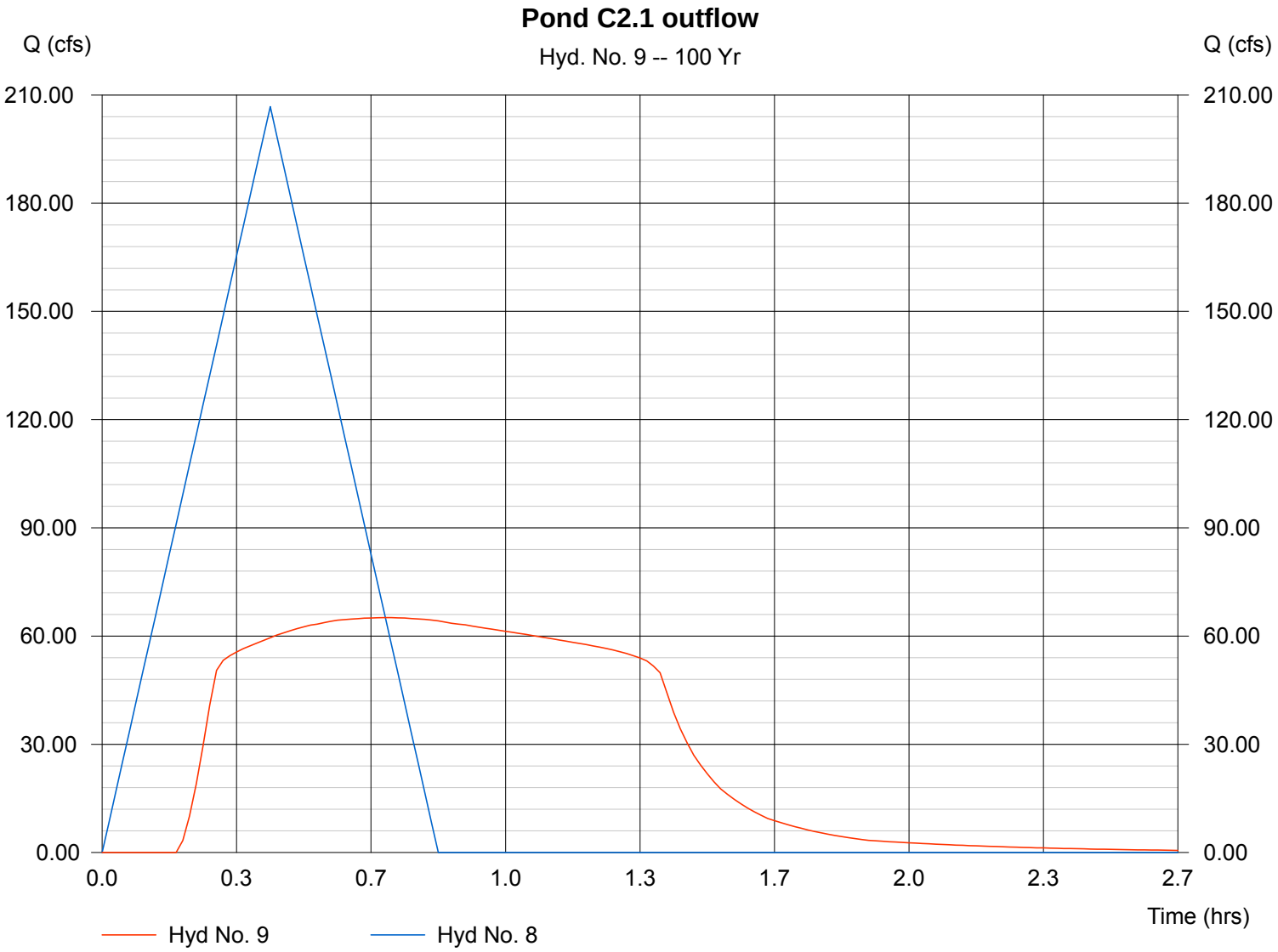
Hydrograph Plot

Hyd. No. 9

Pond C2.1 outflow

Hydrograph type	=	Reservoir	Peak discharge	=	65.13 cfs
Storm frequency	=	100 yrs	Time interval	=	1 min
Inflow hyd. No.	=	8	Max. Elevation	=	5773.91 ft
Reservoir name	=	Pond C2.1	Max. Storage	=	363,096 cuft

Storage Indication method used. Wet pond routing start elevation = 5770.40 ft. Hydrograph Volume = 279,789 cuft



Hydrograph Plot

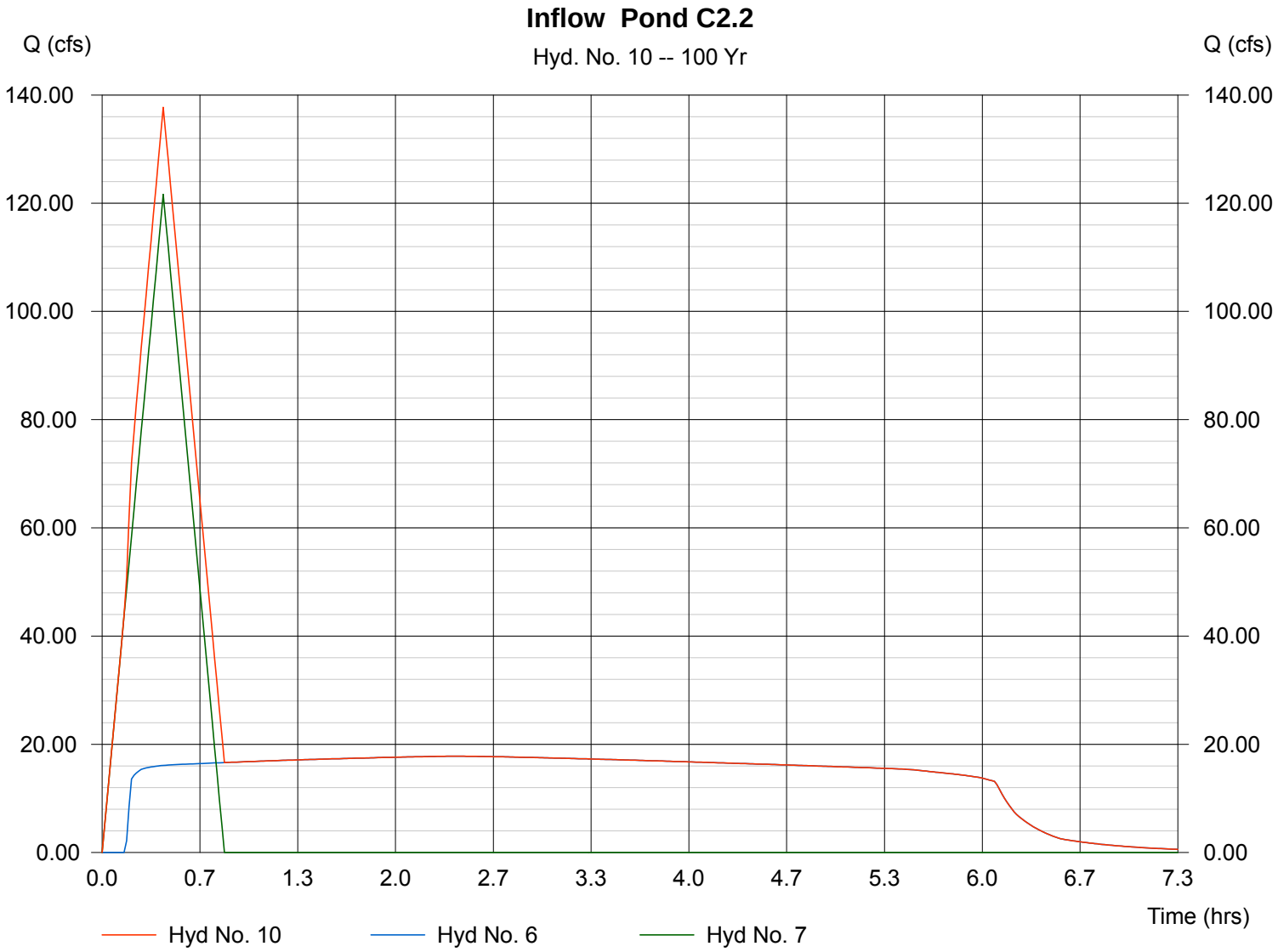
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 10

Inflow Pond C2.2

Hydrograph type	= Combine	Peak discharge	= 137.71 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyds.	= 6, 7		

Hydrograph Volume = 549,923 cuft



Hydrograph Plot

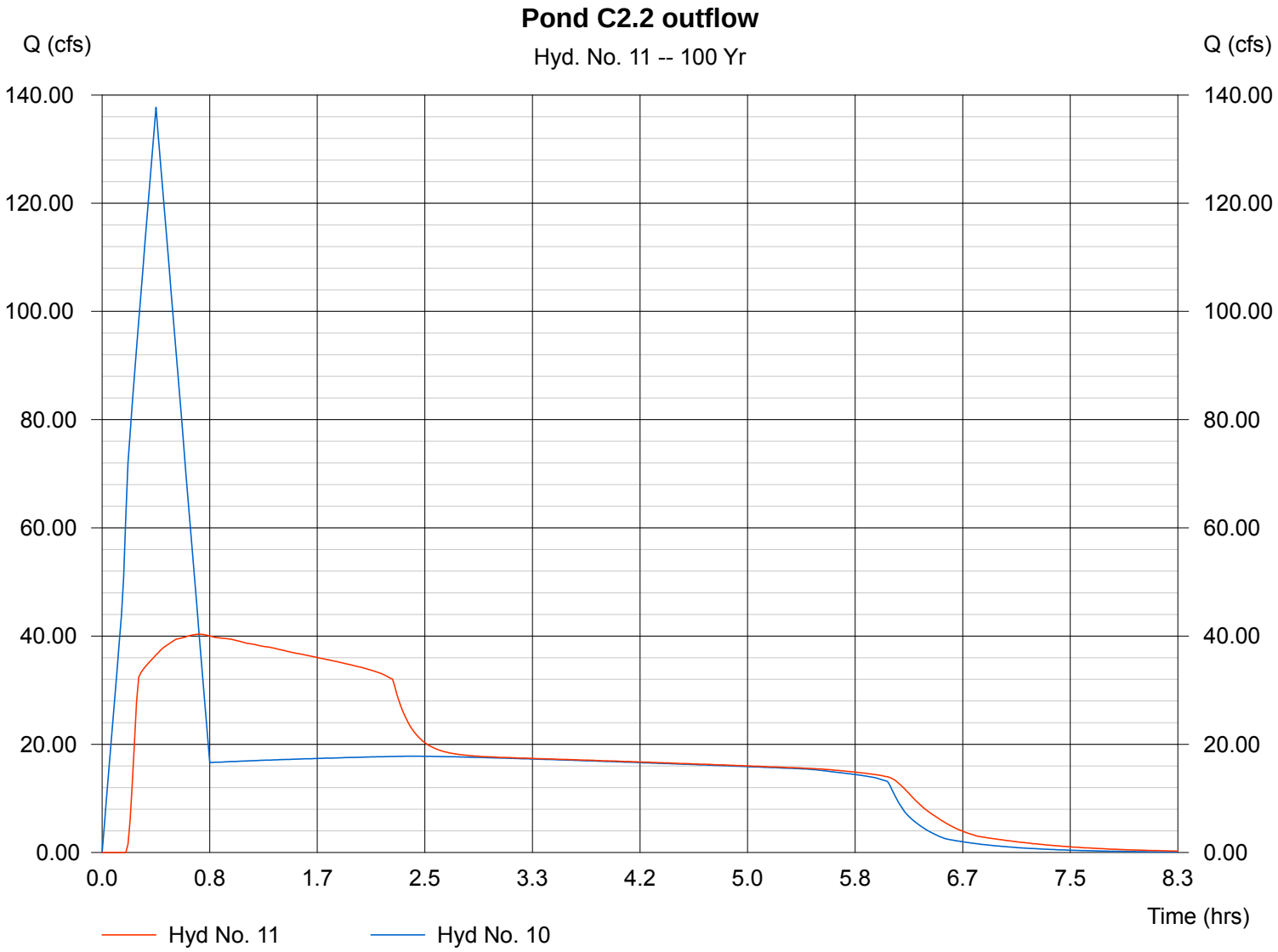
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 11

Pond C2.2 outflow

Hydrograph type	= Reservoir	Peak discharge	= 40.34 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 10	Max. Elevation	= 5753.55 ft
Reservoir name	= Pond C2.2	Max. Storage	= 278,207 cuft

Storage Indication method used. Wet pond routing start elevation = 5750.30 ft. | Hydrograph Volume = 530,339 cuft



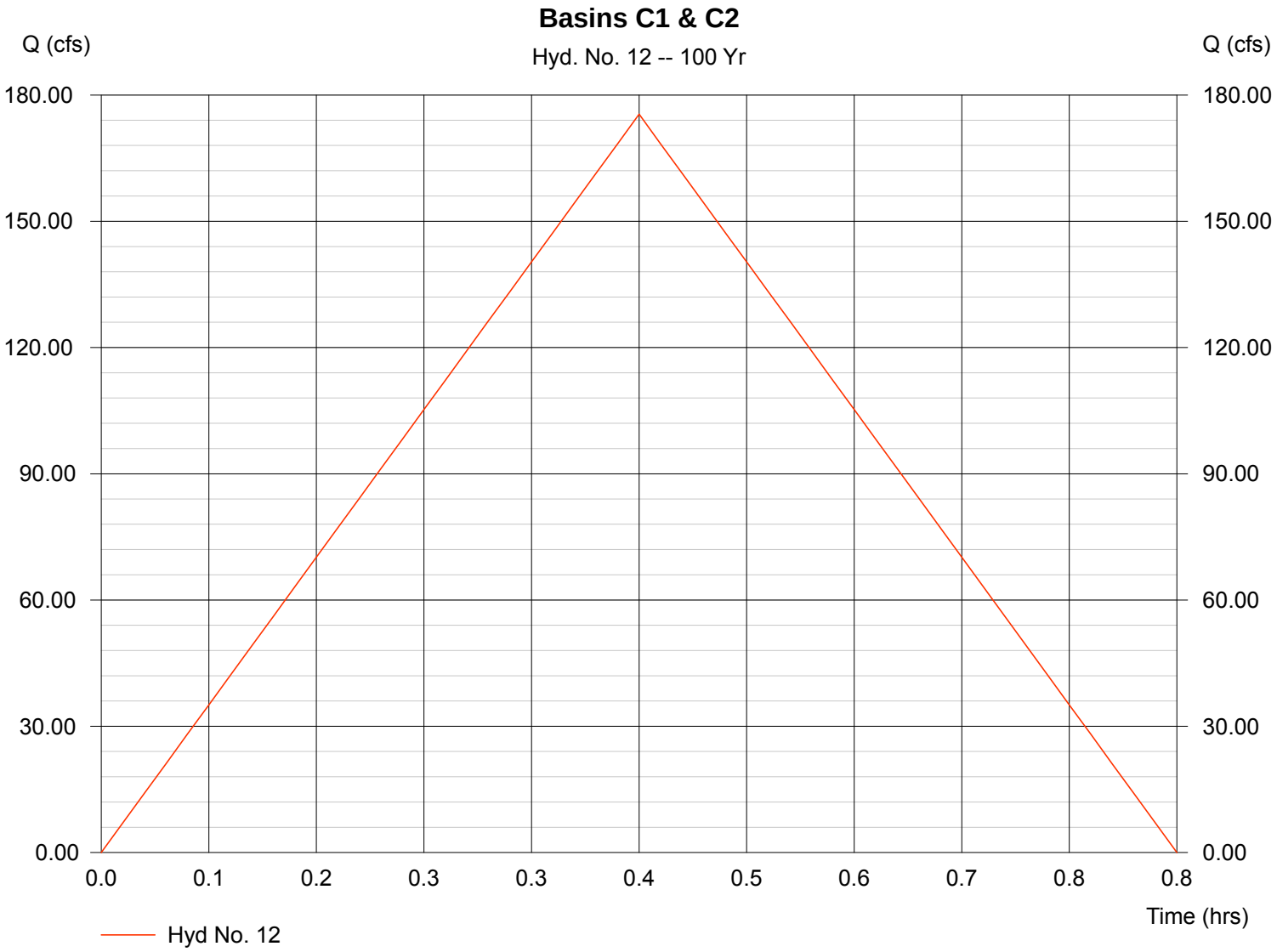
Hydrograph Plot

Hyd. No. 12

Basins C1 & C2

Hydrograph type	= Rational	Peak discharge	= 175.44 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 57.700 ac	Runoff coeff.	= 0.65
Intensity	= 4.678 in/hr	Tc by User	= 25.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 263,155 cuft



Hydrograph Plot

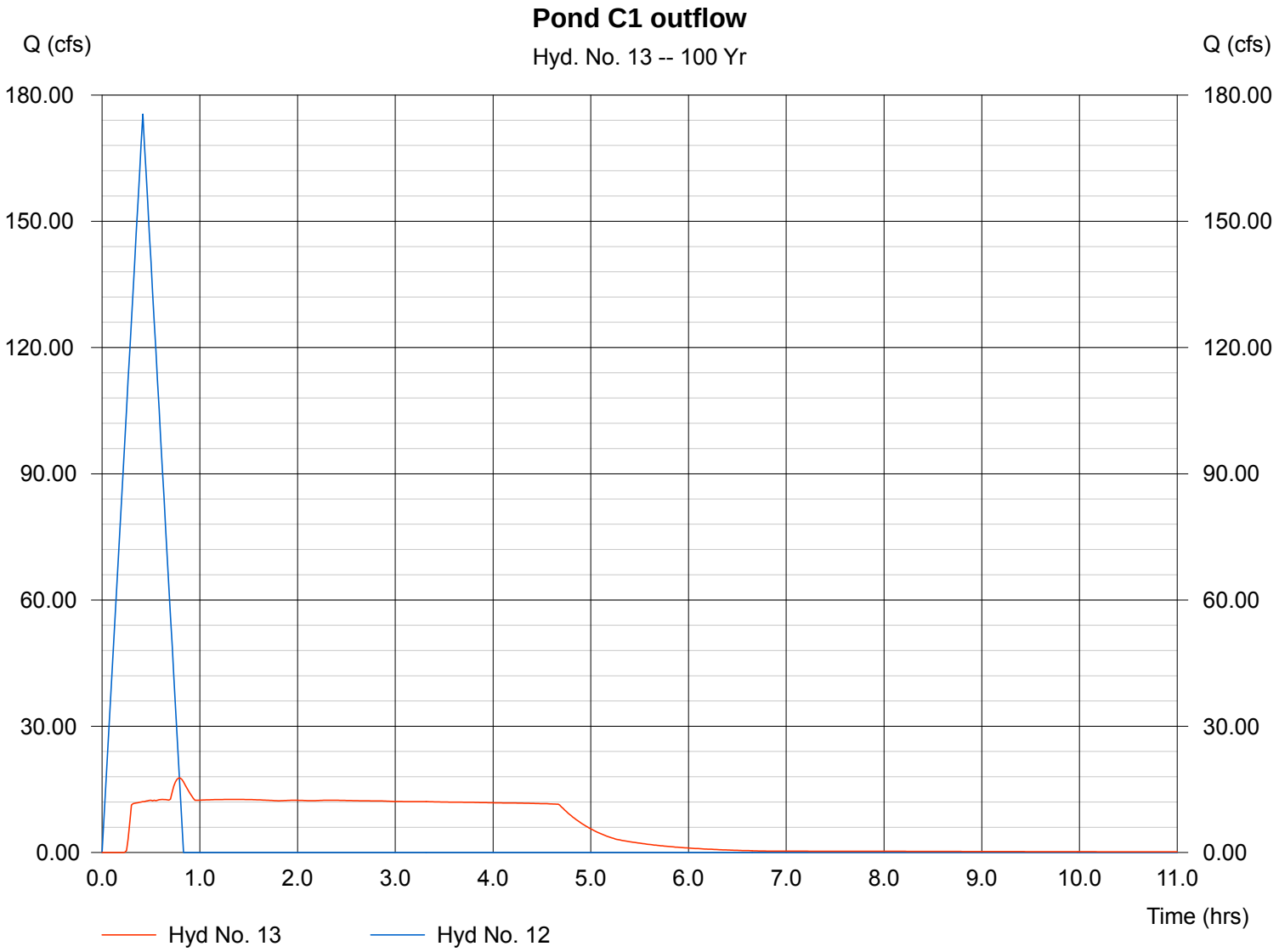
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 13

Pond C1 outflow

Hydrograph type	= Reservoir	Peak discharge	= 17.68 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 12	Max. Elevation	= 5753.09 ft
Reservoir name	= Pond C1	Max. Storage	= 445,161 cuft

Storage Indication method used. Wet pond routing start elevation = 5749.80 ft. | Hydrograph Volume = 222,974 cuft



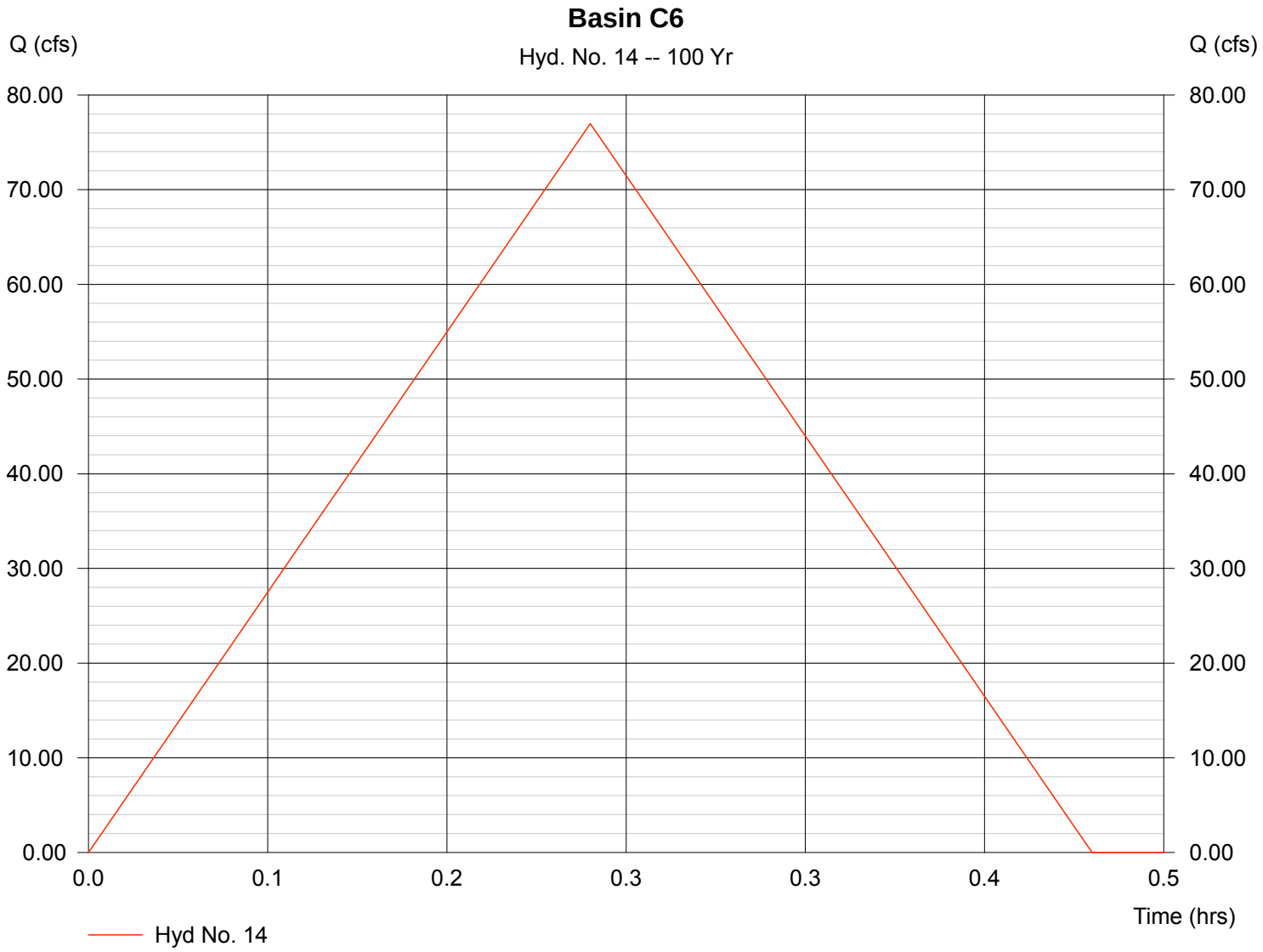
Hydrograph Plot

Hyd. No. 14

Basin C6

Hydrograph type	= Rational	Peak discharge	= 76.98 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 18.700 ac	Runoff coeff.	= 0.65
Intensity	= 6.333 in/hr	Tc by User	= 14.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 64,659 cuft



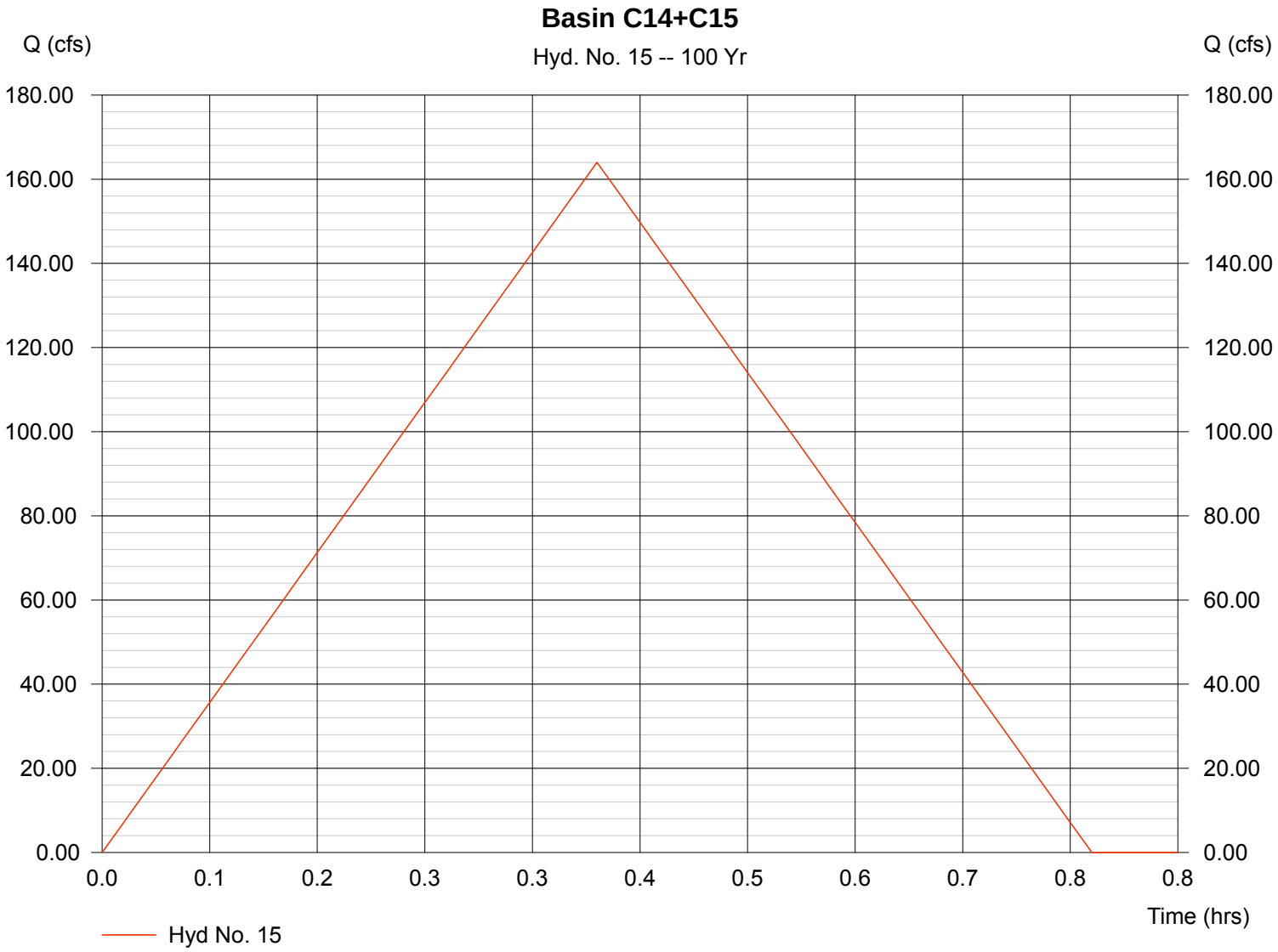
Hydrograph Plot

Hyd. No. 15

Basin C14+C15

Hydrograph type	= Rational	Peak discharge	= 163.99 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 51.300 ac	Runoff coeff.	= 0.65
Intensity	= 4.918 in/hr	Tc by User	= 23.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 226,299 cuft



Hydrograph Plot

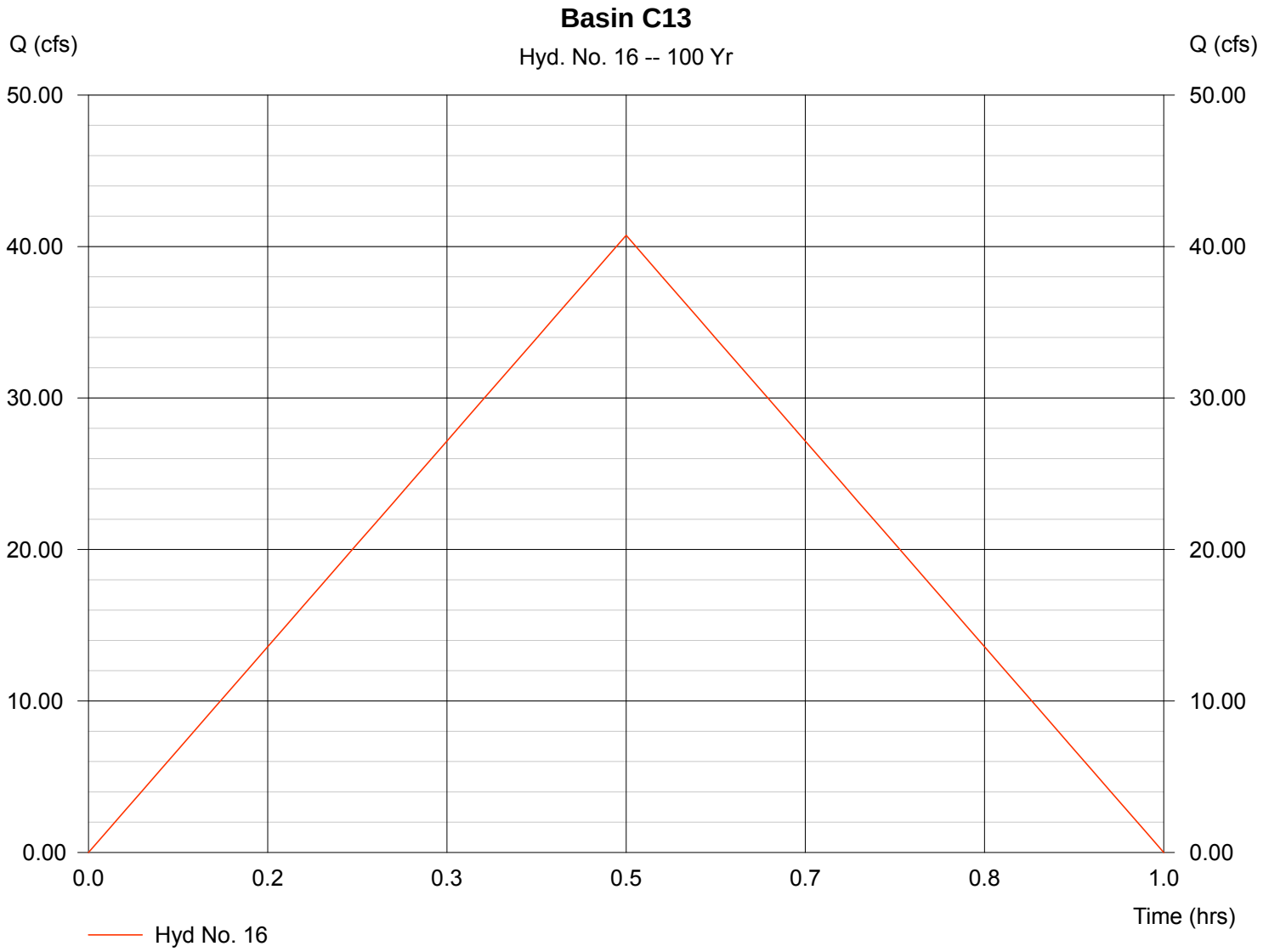
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 16

Basin C13

Hydrograph type	= Rational	Peak discharge	= 40.73 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 19.200 ac	Runoff coeff.	= 0.51
Intensity	= 4.160 in/hr	Tc by User	= 30.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 73,322 cuft



Hydrograph Plot

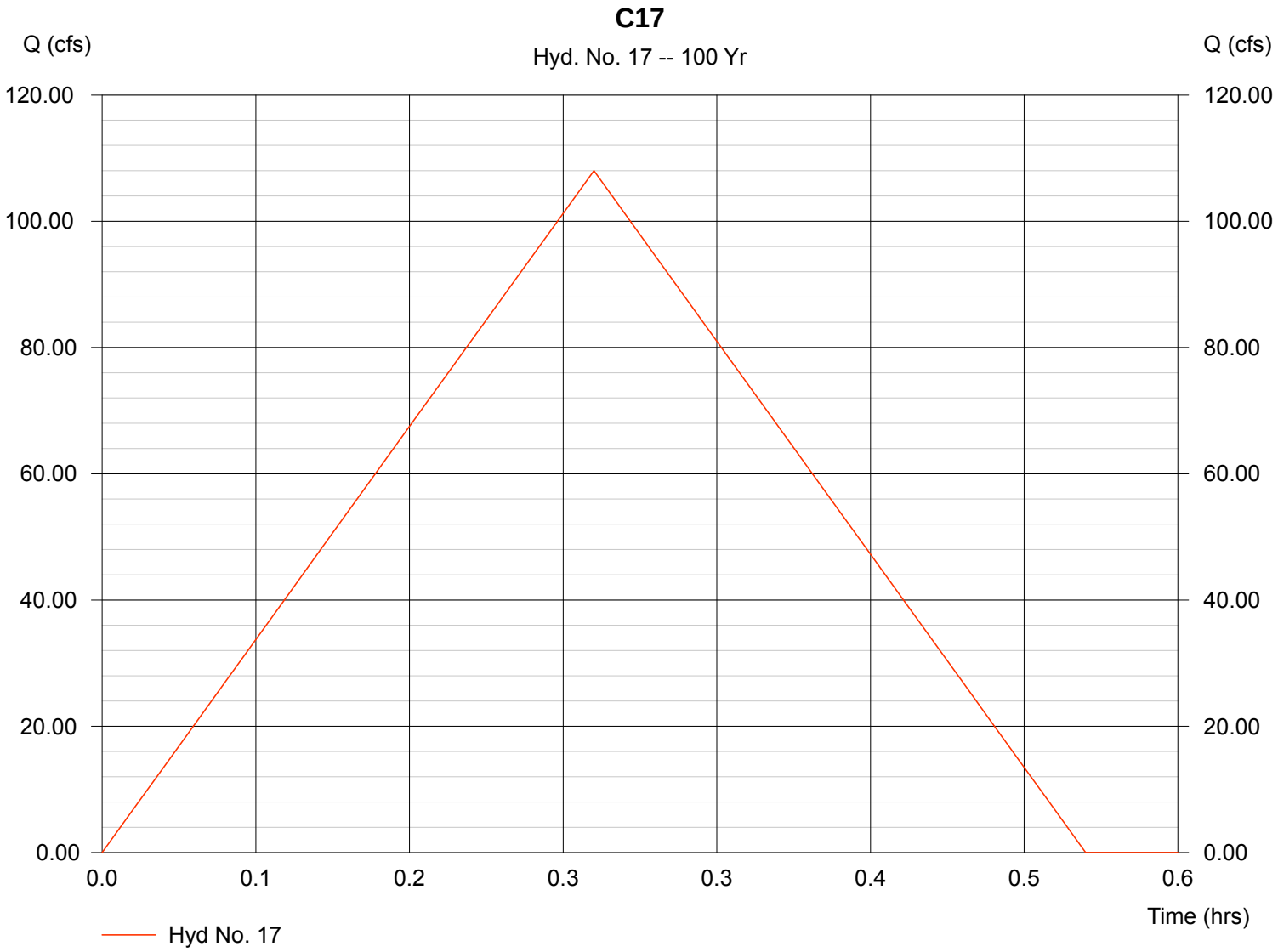
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 17

C17

Hydrograph type	=	Rational	Peak discharge	=	108.00 cfs
Storm frequency	=	100 yrs	Time interval	=	1 min
Drainage area	=	30.200 ac	Runoff coeff.	=	0.6
Intensity	=	5.960 in/hr	Tc by User	=	16.00 min
IDF Curve	=	2016-idf curves-rls.IDF	Asc/Rec limb fact	=	1/1

Hydrograph Volume = 103,681 cuft



Hydrograph Plot

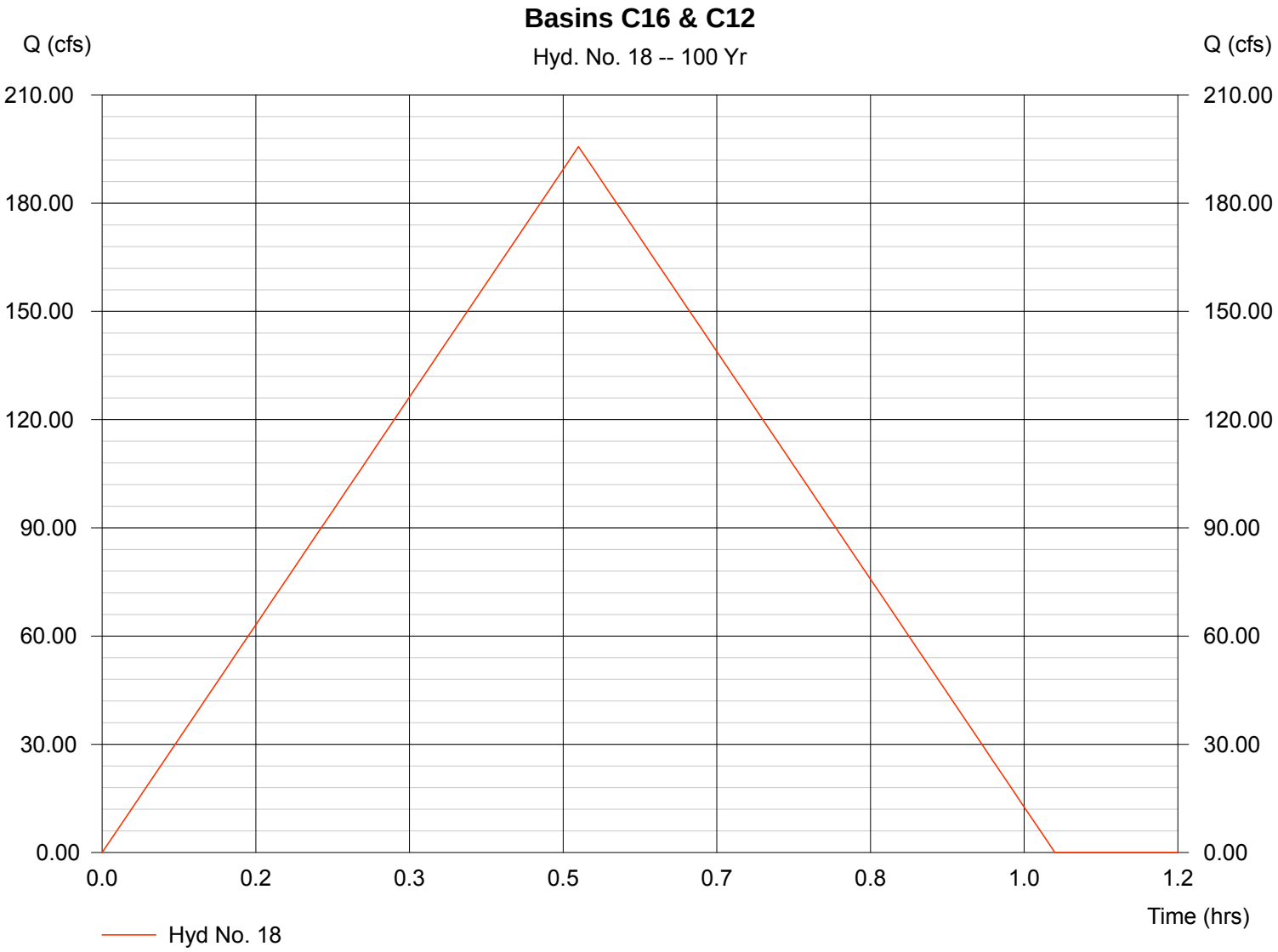
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 18

Basins C16 & C12

Hydrograph type	= Rational	Peak discharge	= 195.70 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 74.000 ac	Runoff coeff.	= 0.65
Intensity	= 4.069 in/hr	Tc by User	= 31.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 363,995 cuft



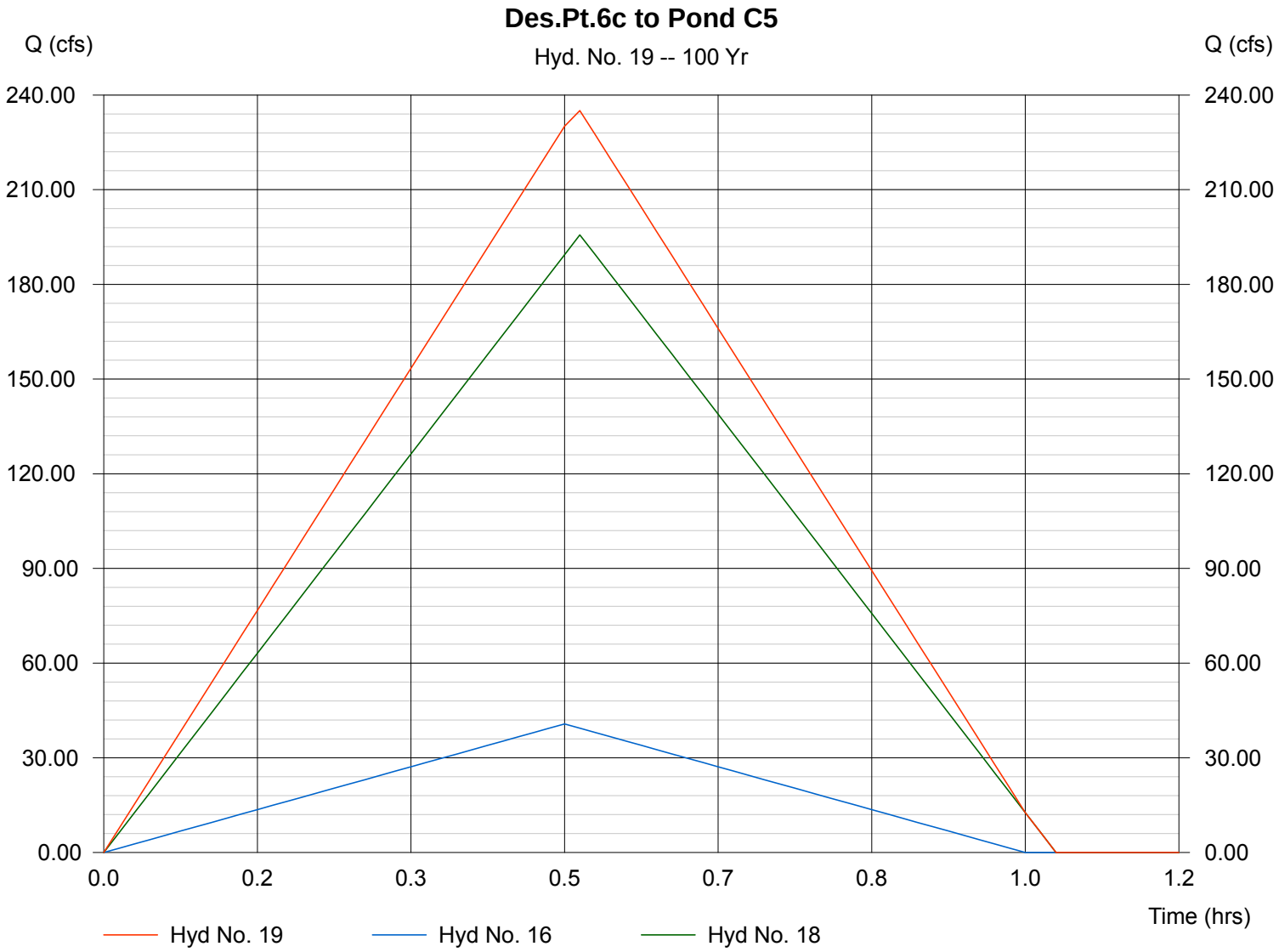
Hydrograph Plot

Hyd. No. 19

Des.Pt.6c to Pond C5

Hydrograph type	=	Combine	Peak discharge	=	235.07 cfs
Storm frequency	=	100 yrs	Time interval	=	1 min
Inflow hyds.	=	16, 18			

Hydrograph Volume = 437,317 cuft



Hydrograph Plot

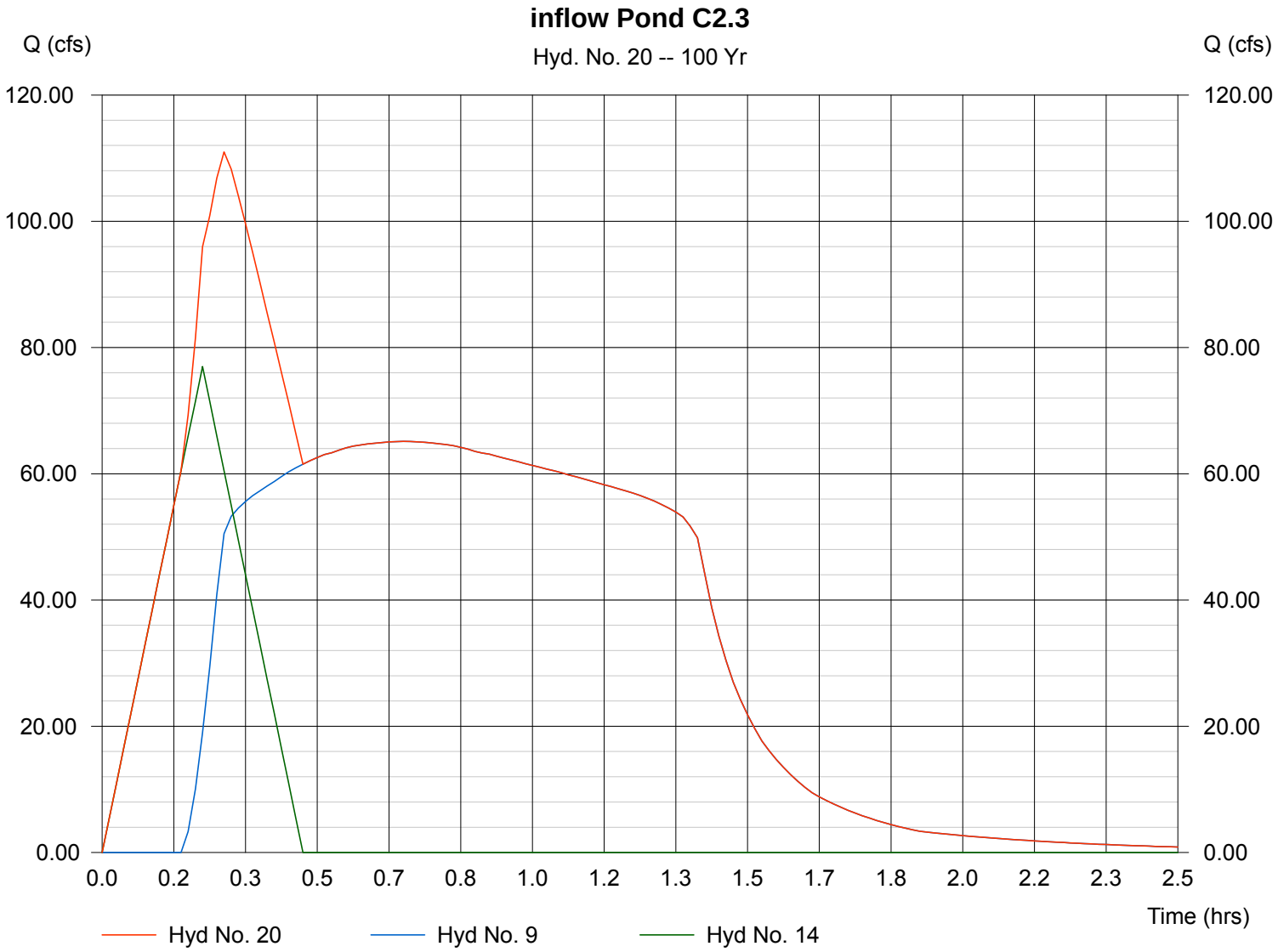
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 20

inflow Pond C2.3

Hydrograph type	= Combine	Peak discharge	= 110.99 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyds.	= 9, 14		

Hydrograph Volume = 344,448 cuft



Hydrograph Plot

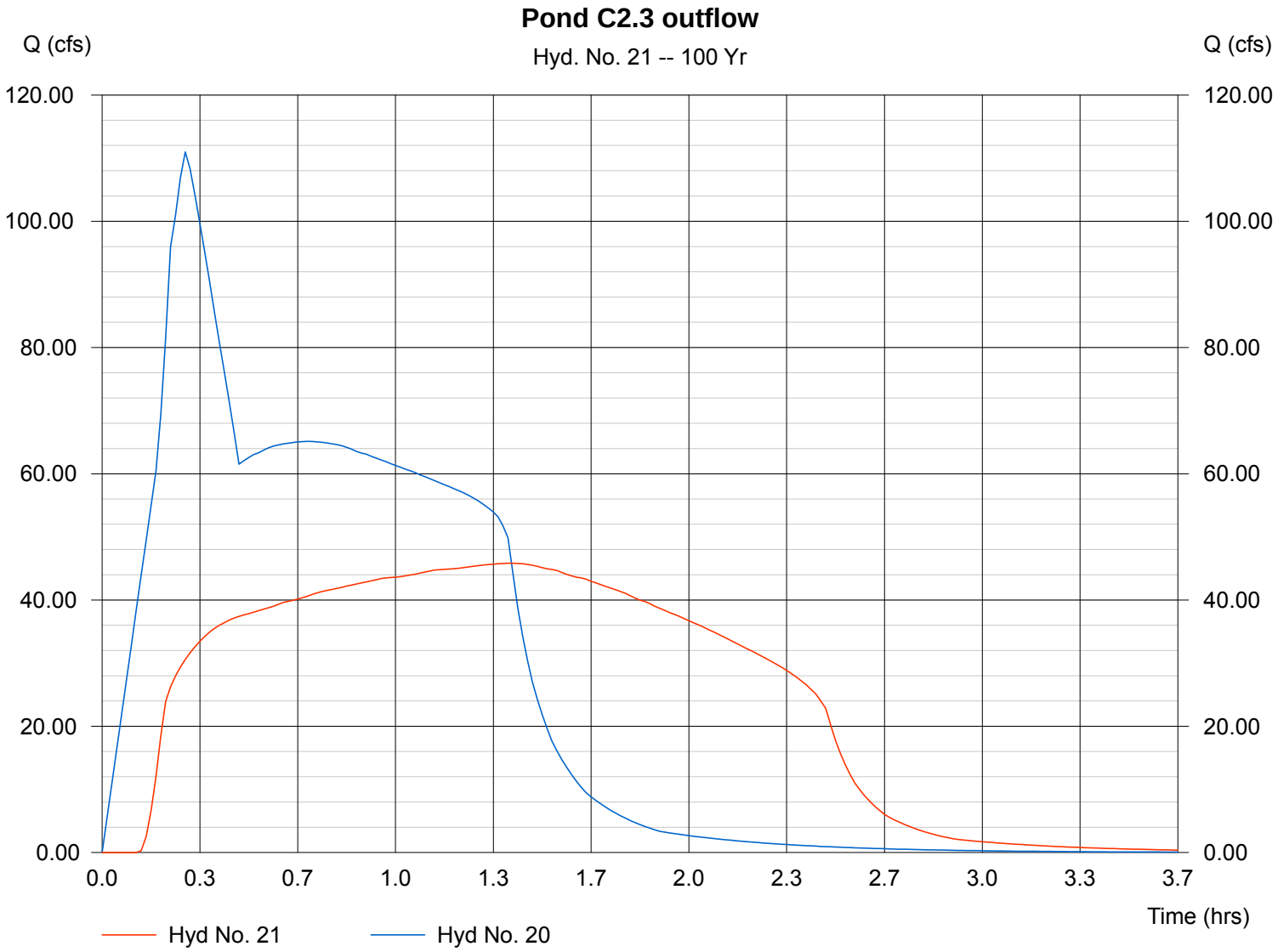
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 21

Pond C2.3 outflow

Hydrograph type	= Reservoir	Peak discharge	= 45.83 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 20	Max. Elevation	= 5753.06 ft
Reservoir name	= Pond C2.3	Max. Storage	= 188,378 cuft

Storage Indication method used. Wet pond routing start elevation = 5748.60 ft. | Hydrograph Volume = 334,262 cuft



Hydrograph Plot

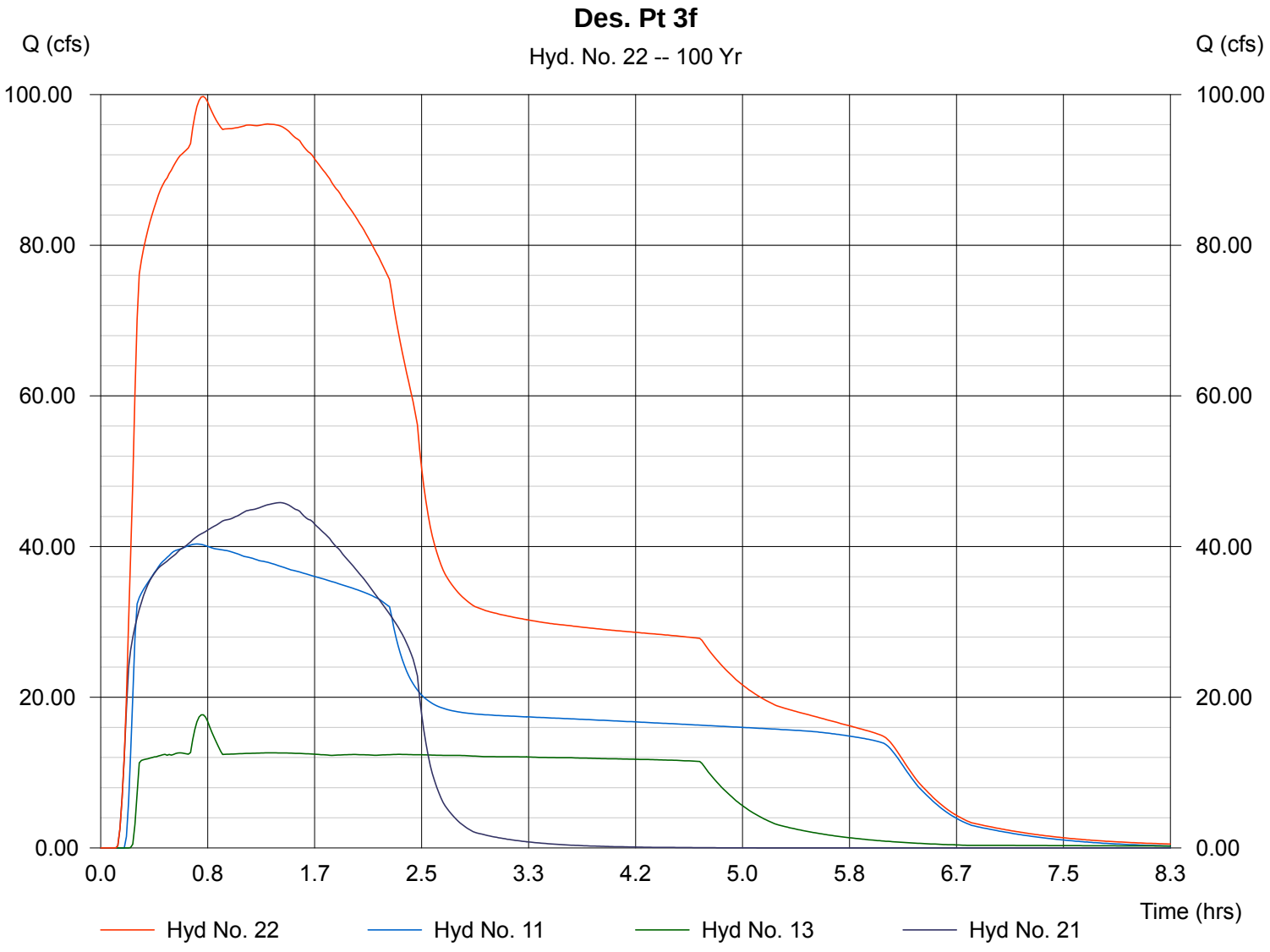
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 22

Des. Pt 3f

Hydrograph type	= Combine	Peak discharge	= 99.75 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyds.	= 11, 13, 21		

Hydrograph Volume = 1,087,511 cuft



Hydrograph Plot

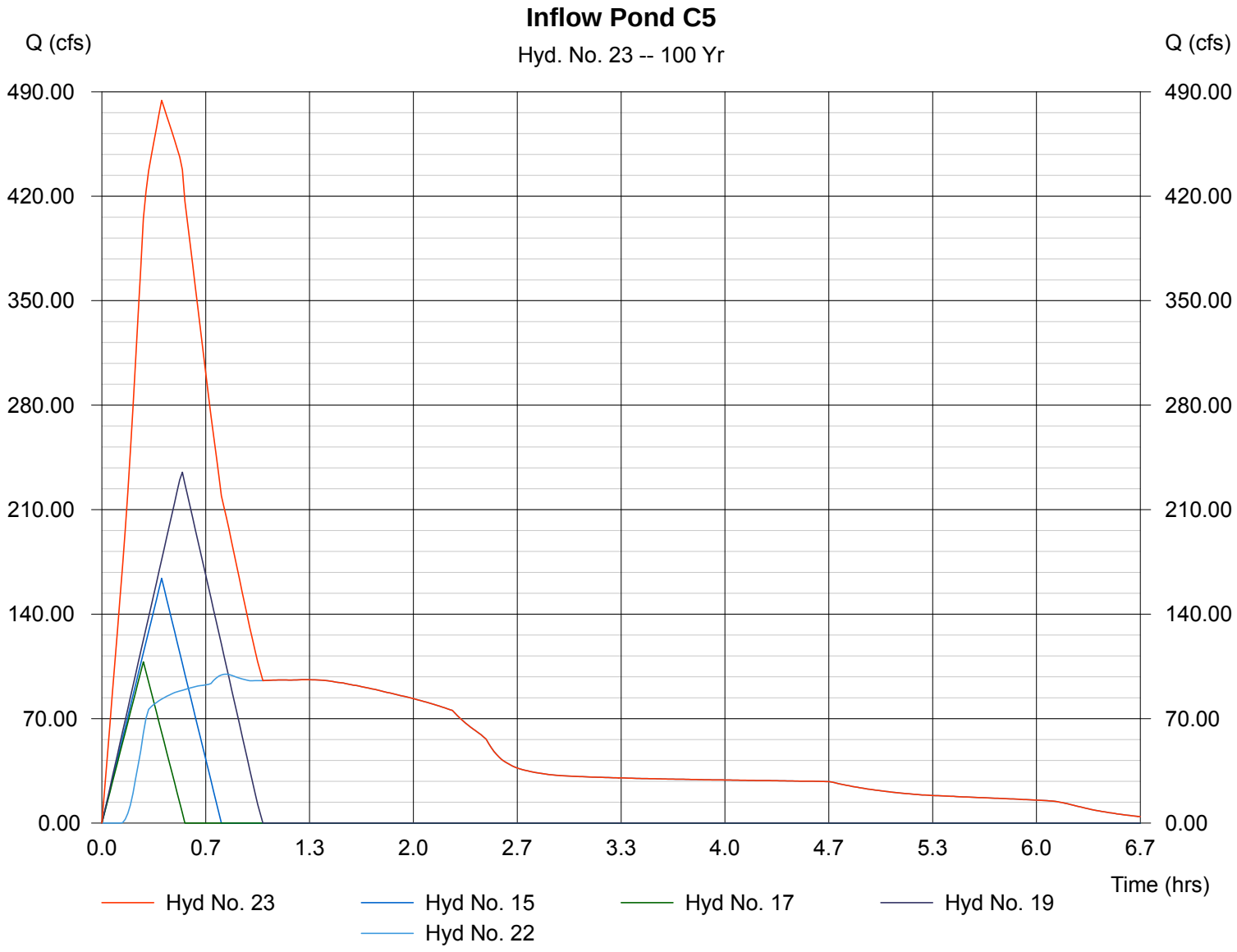
Hydraflow Hydrographs by Intelisolve | Friday, May 19 2017, 6:32 AM

Hyd. No. 23

Inflow Pond C5

Hydrograph type	= Combine	Peak discharge	= 484.24 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyds.	= 15, 17, 19, 22		

Hydrograph Volume = 1,854,809 cuft



Hydrograph Plot

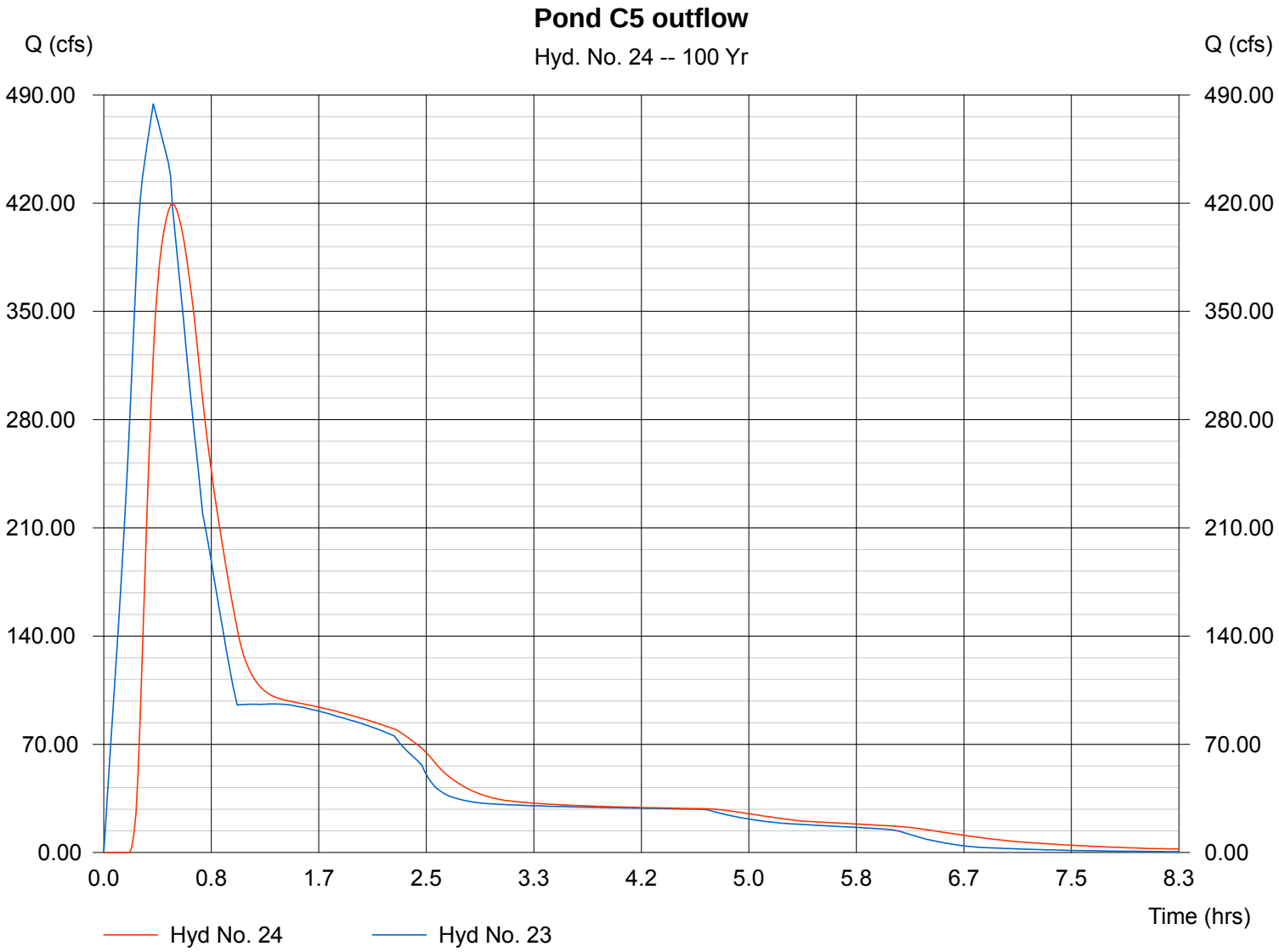
Hydraflow Hydrographs by Intelisolve | Tuesday, May 23 2017, 7:33 AM

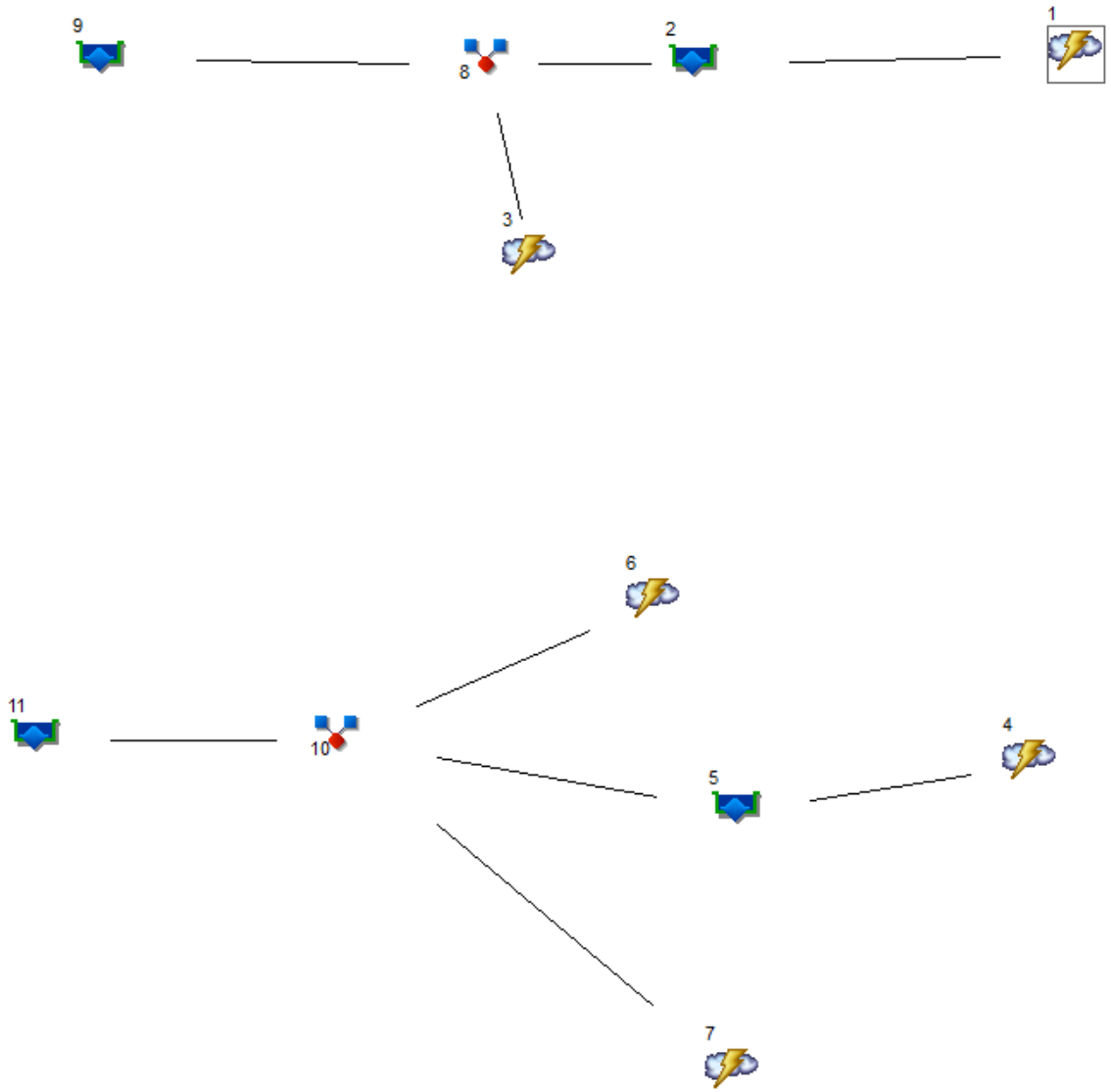
Hyd. No. 24

Pond C5 outflow

Hydrograph type	= Reservoir	Peak discharge	= 419.90 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 23	Max. Elevation	= 5714.32 ft
Reservoir name	= Pond C5	Max. Storage	= 677,645 cuft

Storage Indication method used. Wet pond routing start elevation = 5711.80 ft. | Hydrograph Volume = 1,757,155 cuft





Legend

Hyd.	Origin	Description
1	Rational	Basin D1
2	Reservoir	Pond D1 outflow
3	Rational	Basin D2-D5
4	Rational	Pond E1 Inflow
5	Reservoir	Pond E1 Outflow
6	Rational	Basin E6-E8
7	Rational	Basin E9-E11
8	Combine	Pond D2 Inflow
9	Reservoir	Pond D2 Outflow
10	Combine	Pond E2 Inflow
11	Reservoir	Pond E2 Outflow

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	33.48	1	12	36,160	----	------	------	Basin D1
2	Reservoir	1.915	1	35	3,207	1	5754.62	54,571	Pond D1 outflow
3	Rational	106.13	1	22	210,141	----	------	------	Basin D2-D5
4	Rational	97.18	1	15	87,458	----	------	------	Pond E1 Inflow
5	Reservoir	9.385	1	29	11,277	4	5734.22	157,054	Pond E1 Outflow
6	Rational	76.79	1	20	92,144	----	------	------	Basin E6-E8
7	Rational	119.99	1	22	158,384	----	------	------	Basin E9-E11
8	Combine	106.13	1	22	213,348	2, 3,	------	------	Pond D2 Inflow
9	Reservoir	31.20	1	53	81,085	8	5700.07	244,557	Pond D2 Outflow
10	Combine	189.10	1	22	261,805	5, 6, 7,	------	------	Pond E2 Inflow
11	Reservoir	96.43	1	33	224,662	10	5698.66	259,062	Pond E2 Outflow

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	74.60	1	12	80,573	----	------	------	Basin D1
2	Reservoir	10.52	1	33	71,644	1	5756.78	108,212	Pond D1 outflow
3	Rational	232.67	1	22	460,692	----	------	------	Basin D2-D5
4	Rational	208.33	1	15	187,500	----	------	------	Pond E1 Inflow
5	Reservoir	31.62	1	28	187,499	4	5737.32	293,609	Pond E1 Outflow
6	Rational	165.73	1	20	198,882	----	------	------	Basin E6-E8
7	Rational	242.50	1	22	320,099	----	------	------	Basin E9-E11
8	Combine	242.93	1	22	532,337	2, 3,	------	------	Pond D2 Inflow
9	Reservoir	131.19	1	43	508,771	8	5701.75	386,691	Pond D2 Outflow
10	Combine	422.93	1	22	706,480	5, 6, 7,	------	------	Pond E2 Inflow
11	Reservoir	257.97	1	31	669,336	10	5700.91	421,789	Pond E2 Outflow

Pond Report

Pond No. 1 - Pond D1

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5751.00	00	0	0
1.00	5752.00	10,904	5,452	5,452
2.00	5753.00	19,275	15,090	20,542
3.00	5754.00	21,293	20,284	40,826
4.00	5755.00	23,346	22,320	63,145
5.00	5756.00	25,482	24,414	87,559
6.00	5757.00	27,711	26,597	114,156
7.00	5758.00	30,034	28,873	143,028
8.00	5759.00	32,451	31,243	174,271
9.00	5760.00	37,565	35,008	209,279
10.00	5761.00	40,000	38,783	248,061
11.00	5762.00	43,000	41,500	289,561

Culvert / Orifice Structures

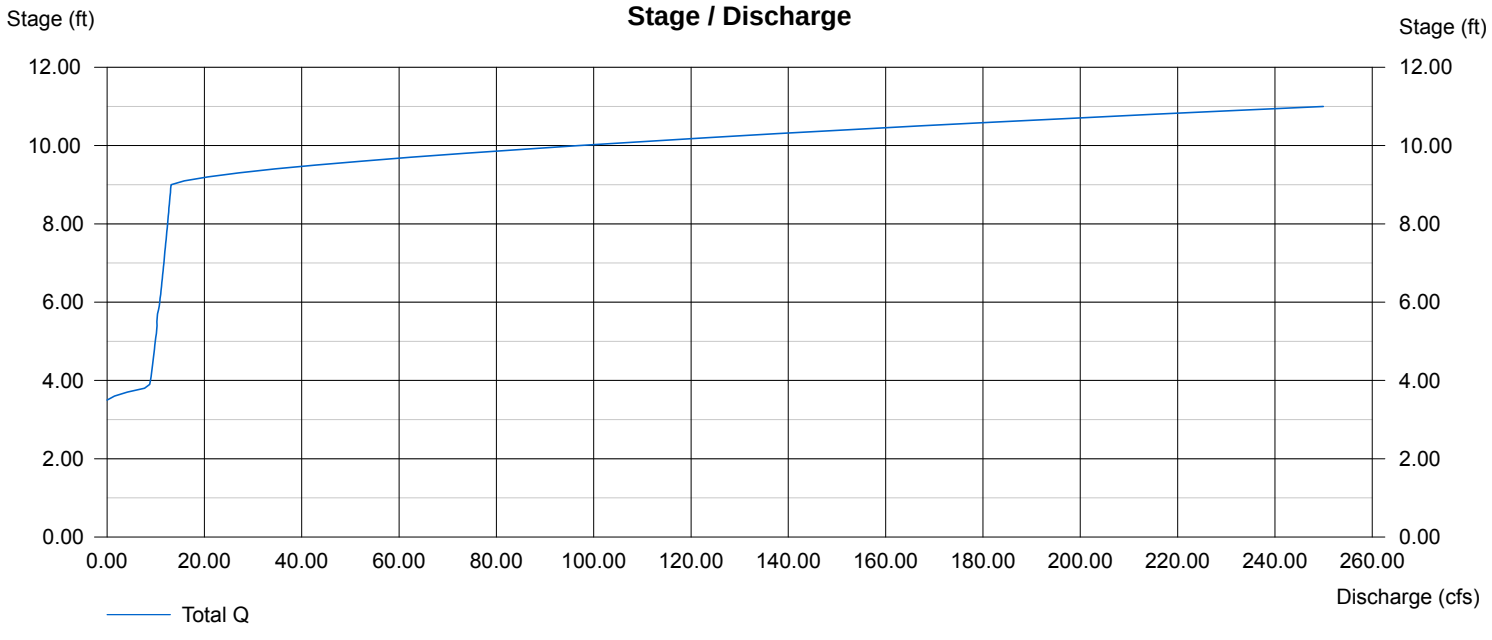
	[A]	[B]	[C]	[D]
Rise (in)	= 10.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 5750.50	0.00	0.00	0.00
Length (ft)	= 140.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.013	.013
Orif. Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 14.00	25.00	0.00	0.00
Crest El. (ft)	= 5754.50	5760.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Riser	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Pond No. 2 - Pond D2

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5696.00	1,068	0	0
1.00	5697.00	48,988	25,028	25,028
2.00	5698.00	72,821	60,905	85,933
3.00	5699.00	76,610	74,716	160,648
4.00	5700.00	80,490	78,550	239,198
5.00	5701.00	84,486	82,488	321,686
6.00	5702.00	88,582	86,534	408,220
7.00	5703.00	92,768	90,675	498,895
8.00	5704.00	97,074	94,921	593,816
9.00	5705.00	102,033	99,554	693,370
10.00	5706.00	106,000	104,017	797,386

Culvert / Orifice Structures

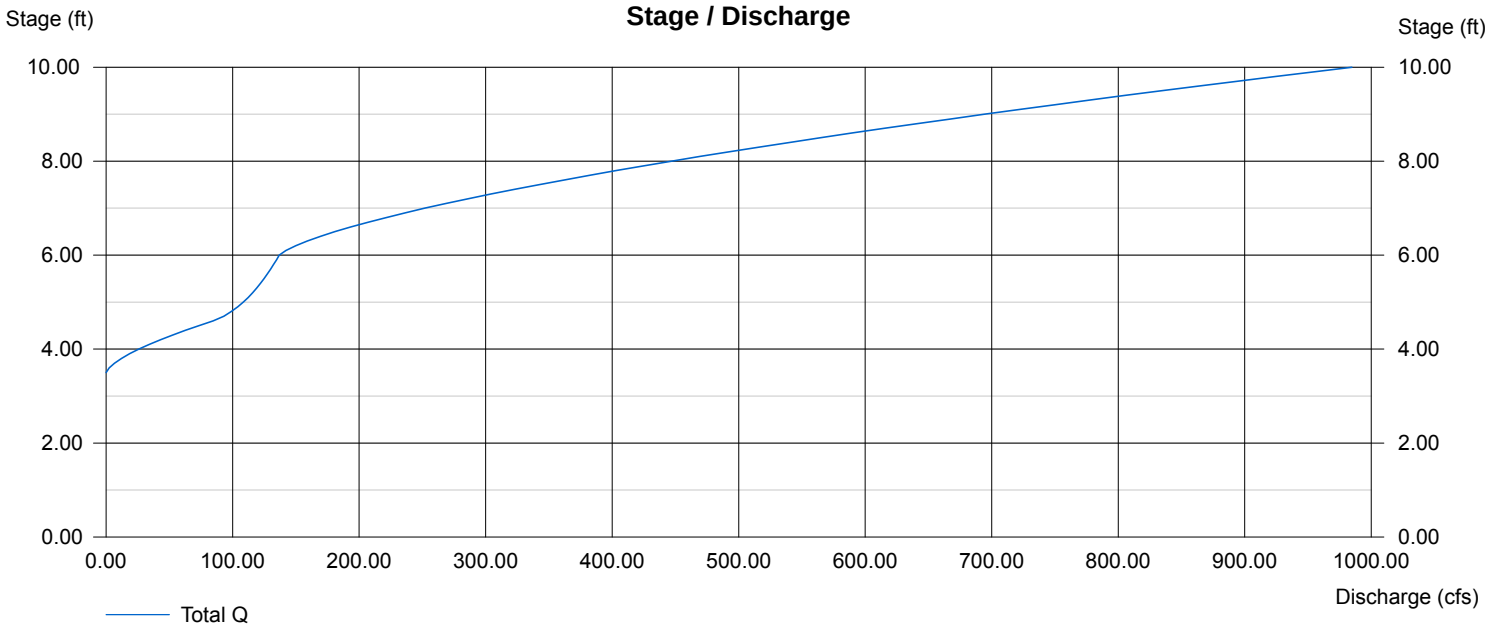
	[A]	[B]	[C]	[D]
Rise (in)	= 48.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 5694.55	0.00	0.00	0.00
Length (ft)	= 110.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.013	.013
Orif. Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 22.00	30.00	0.00	0.00
Crest El. (ft)	= 5699.50	5702.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Riser	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Pond No. 3 - Pond E1

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5729.00	2,550	0	0
1.00	5730.00	25,900	14,225	14,225
2.00	5731.00	31,341	28,621	42,846
3.00	5732.00	33,851	32,596	75,442
4.00	5733.00	36,442	35,147	110,588
5.00	5734.00	39,105	37,774	148,362
6.00	5735.00	41,838	40,472	188,833
7.00	5736.00	44,644	43,241	232,074
8.00	5737.00	47,527	46,086	278,160
9.00	5738.00	50,487	49,007	327,167
10.00	5739.00	52,120	51,304	378,470
11.00	5740.00	55,072	53,596	432,066

Culvert / Orifice Structures

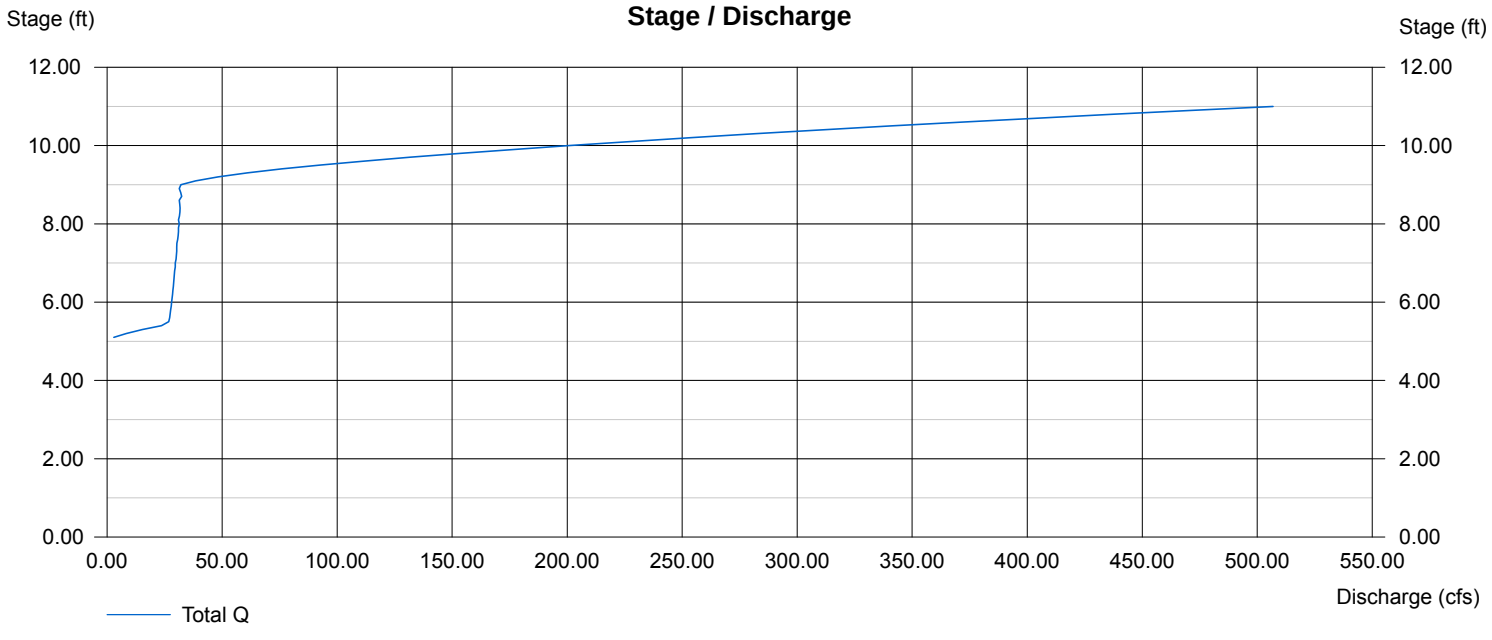
	[A]	[B]	[C]	[D]
Rise (in)	= 20.00	0.00	0.00	0.00
Span (in)	= 24.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 5727.50	0.00	0.00	0.00
Length (ft)	= 400.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 28.00	50.00	0.00	0.00
Crest El. (ft)	= 5734.00	5738.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Riser	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Pond Report

Hydraflow Hydrographs by Intelisolve — Monday, May 22 2017, 8:22 AM

Pond No. 4 - Pond E2

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5694.00	00	0	0
1.00	5695.00	57,500	28,750	28,750
2.00	5696.00	60,400	58,950	87,700
3.00	5697.00	63,400	61,900	149,600
4.00	5698.00	66,500	64,950	214,550
5.00	5699.00	69,700	68,100	282,650
6.00	5700.00	72,900	71,300	353,950
7.00	5701.00	76,300	74,600	428,550
8.00	5702.00	79,600	77,950	506,500

Culvert / Orifice Structures

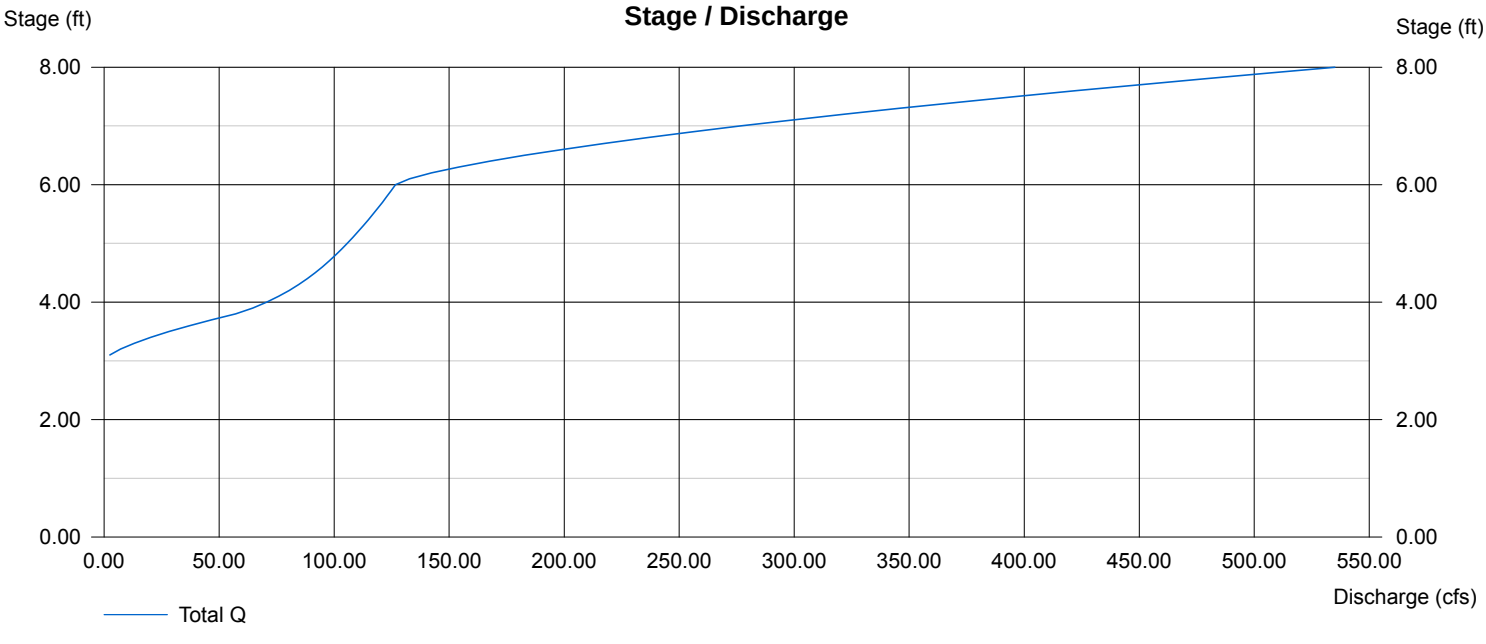
	[A]	[B]	[C]	[D]
Rise (in)	= 48.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 5693.10	0.00	0.00	0.00
Length (ft)	= 160.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.013	.013
Orif. Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 24.00	40.00	0.00	0.00
Crest El. (ft)	= 5697.00	5700.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	0.00	0.00
Weir Type	= Riser	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.



Hydrograph Plot

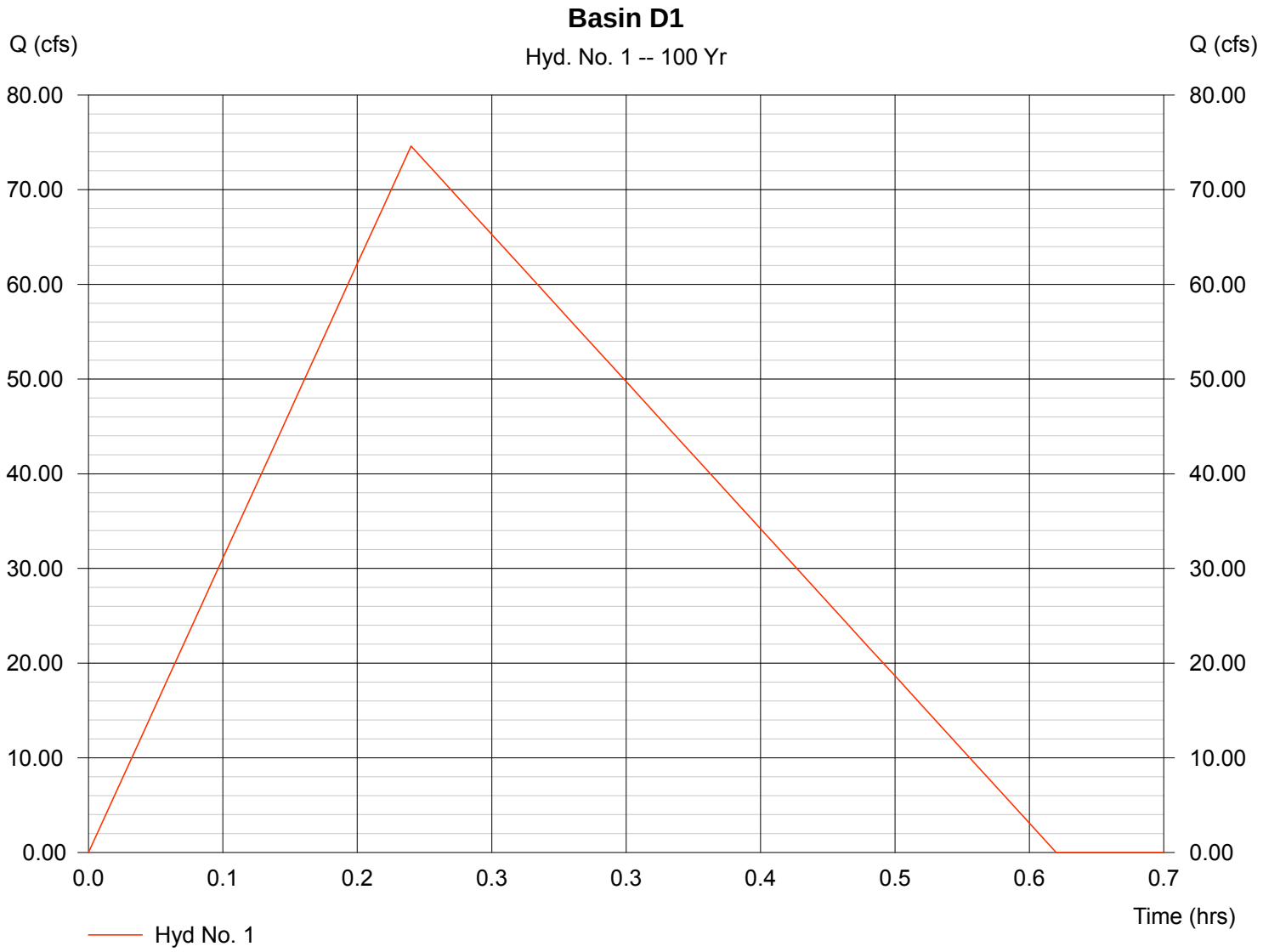
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 6:15 AM

Hyd. No. 1

Basin D1

Hydrograph type	= Rational	Peak discharge	= 74.60 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 17.000 ac	Runoff coeff.	= 0.65
Intensity	= 6.752 in/hr	Tc by User	= 12.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/2

Hydrograph Volume = 80,573 cuft



Hydrograph Plot

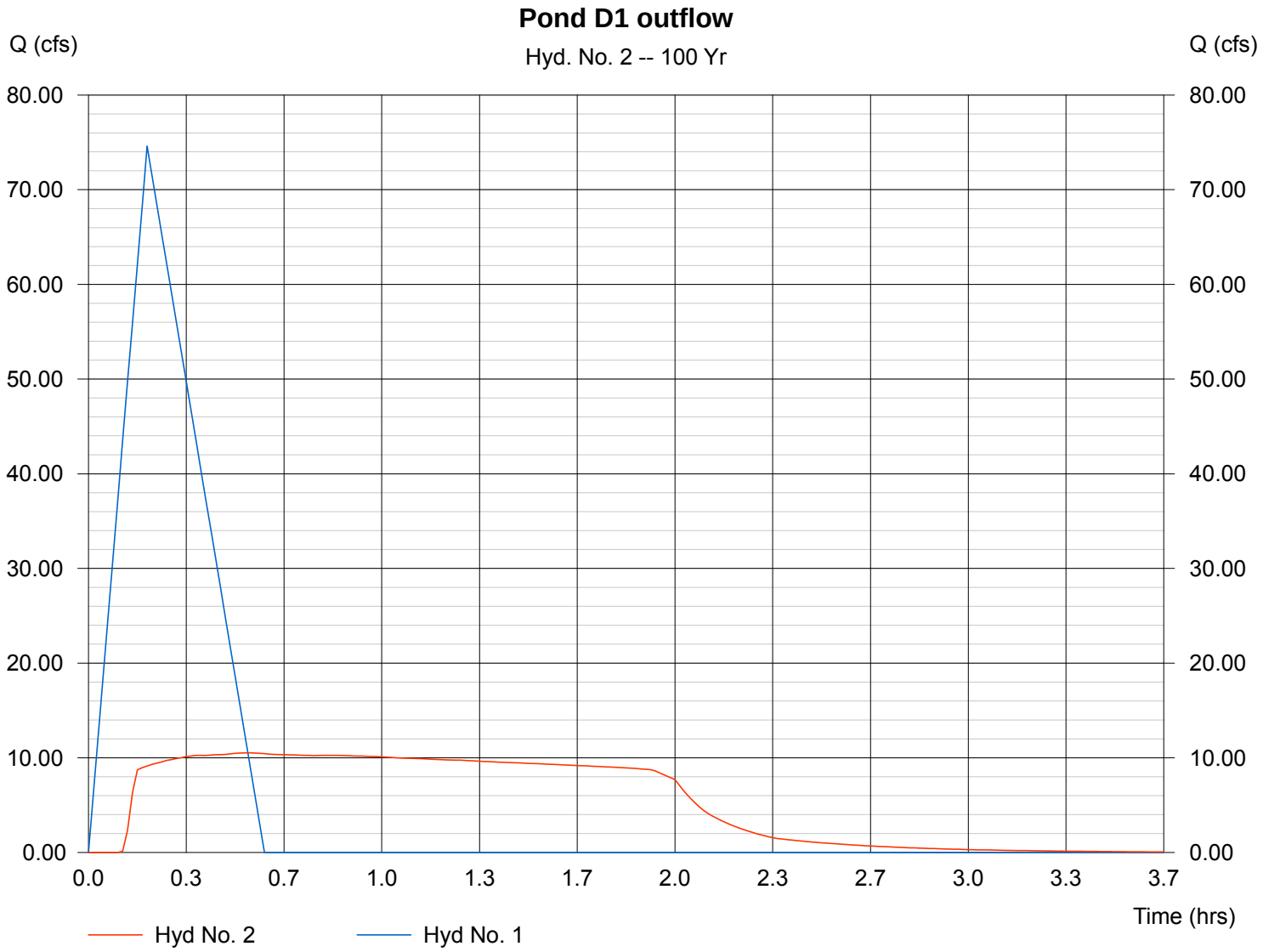
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 6:15 AM

Hyd. No. 2

Pond D1 outflow

Hydrograph type	=	Reservoir	Peak discharge	=	10.52 cfs
Storm frequency	=	100 yrs	Time interval	=	1 min
Inflow hyd. No.	=	1	Max. Elevation	=	5756.78 ft
Reservoir name	=	Pond D1	Max. Storage	=	108,212 cuft

Storage Indication method used. Wet pond routing start elevation = 5754.10 ft. | Hydrograph Volume = 71,644 cuft



Hydrograph Plot

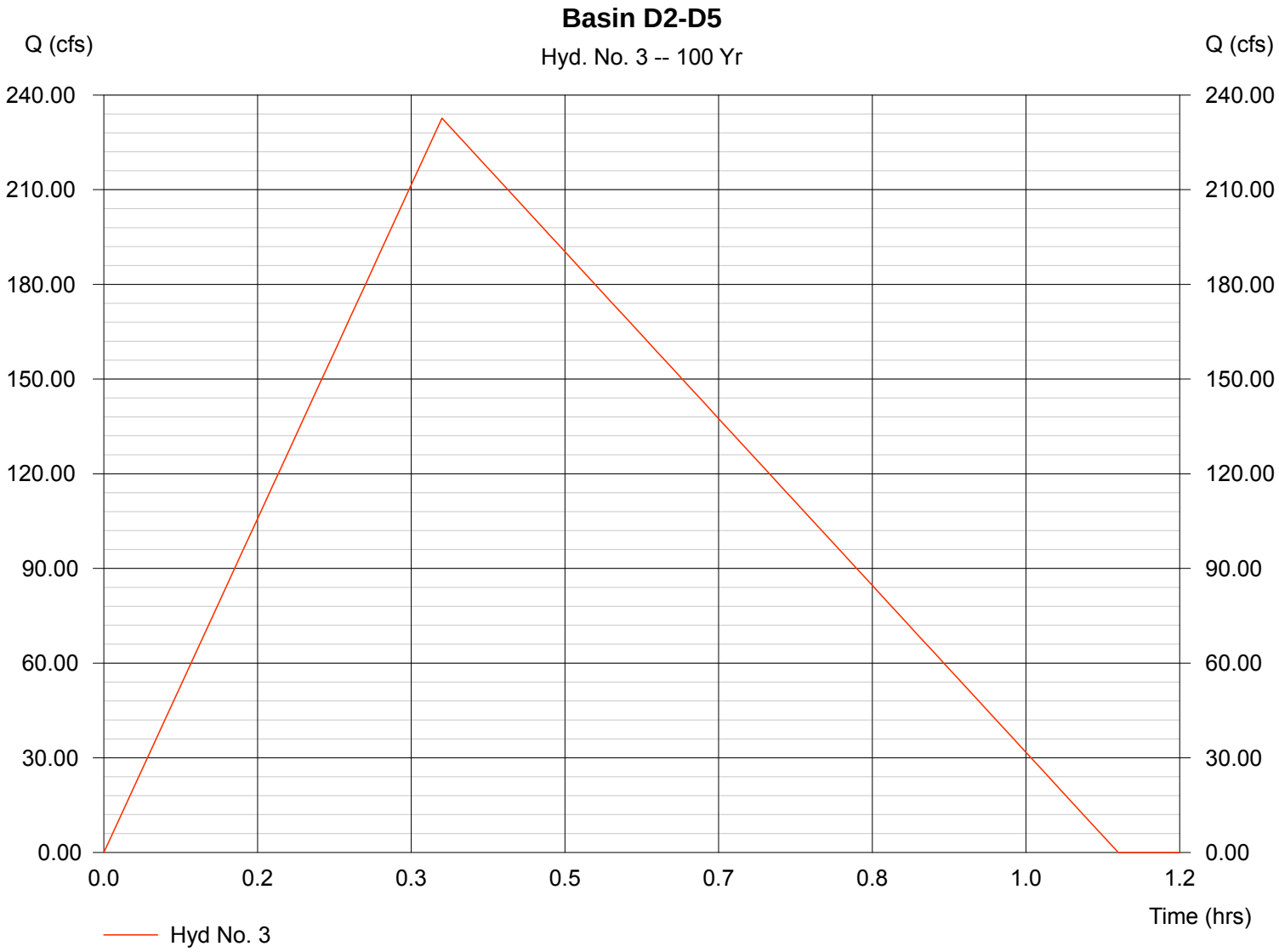
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 6:15 AM

Hyd. No. 3

Basin D2-D5

Hydrograph type	= Rational	Peak discharge	= 232.67 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 72.000 ac	Runoff coeff.	= 0.64
Intensity	= 5.049 in/hr	Tc by User	= 22.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/2

Hydrograph Volume = 460,692 cuft



Hydrograph Plot

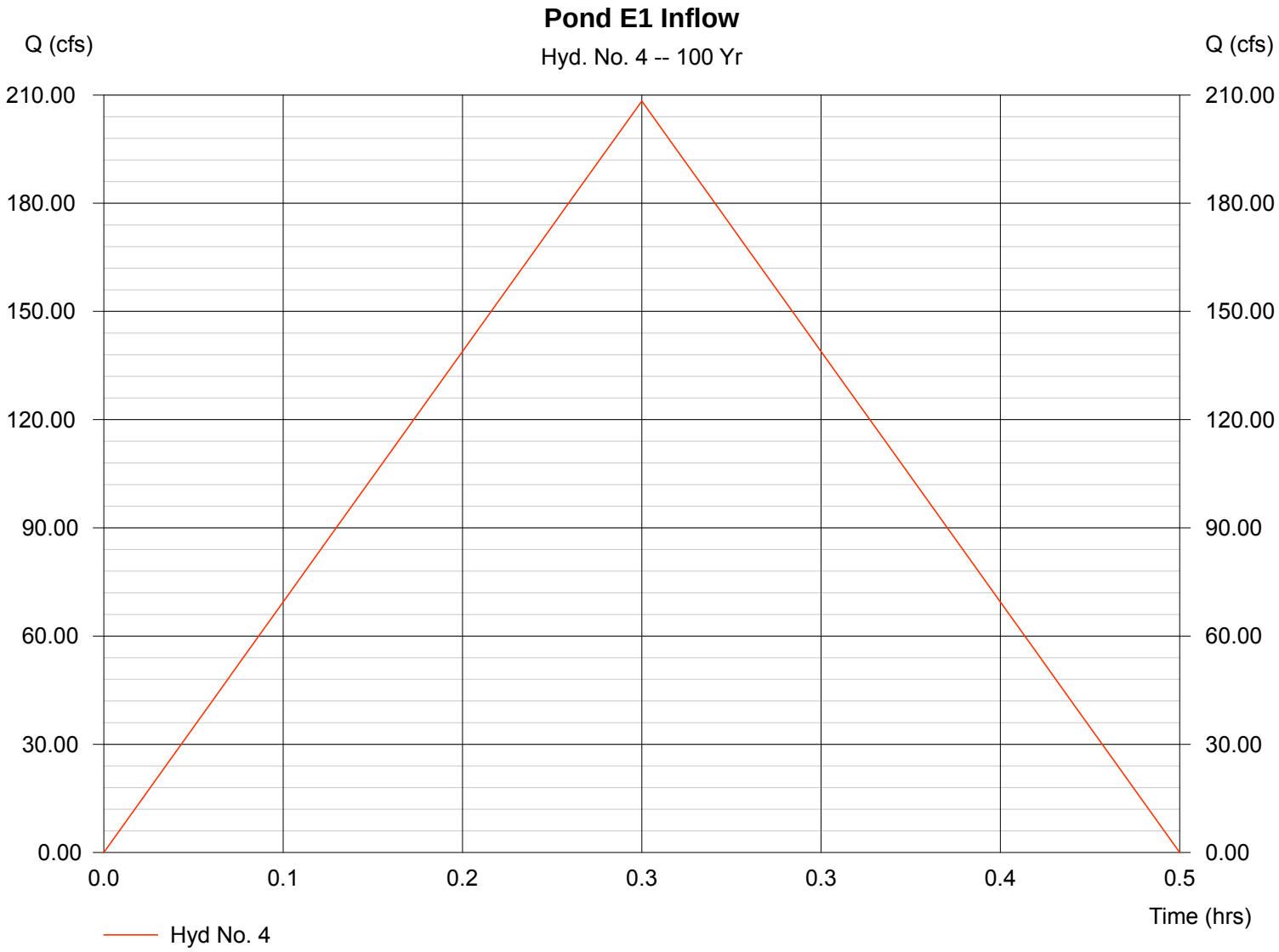
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 6:15 AM

Hyd. No. 4

Pond E1 Inflow

Hydrograph type	= Rational	Peak discharge	= 208.33 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 56.500 ac	Runoff coeff.	= 0.6
Intensity	= 6.146 in/hr	Tc by User	= 15.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 187,500 cuft



Hydrograph Plot

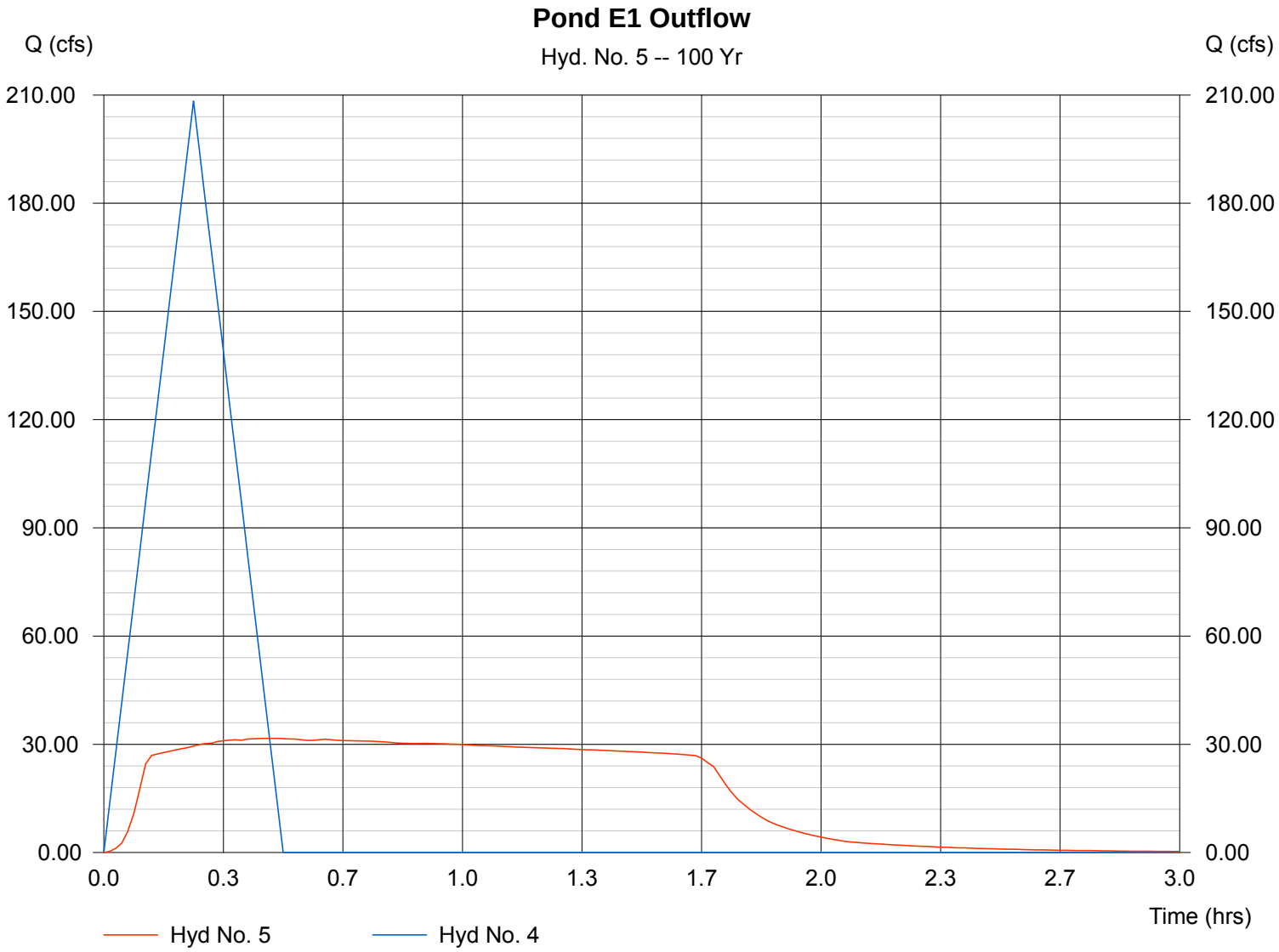
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 6:15 AM

Hyd. No. 5

Pond E1 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 31.62 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 4	Max. Elevation	= 5737.32 ft
Reservoir name	= Pond E1	Max. Storage	= 293,609 cuft

Storage Indication method used. Wet pond routing start elevation = 5734.00 ft. | Hydrograph Volume = 187,499 cuft



Hydrograph Plot

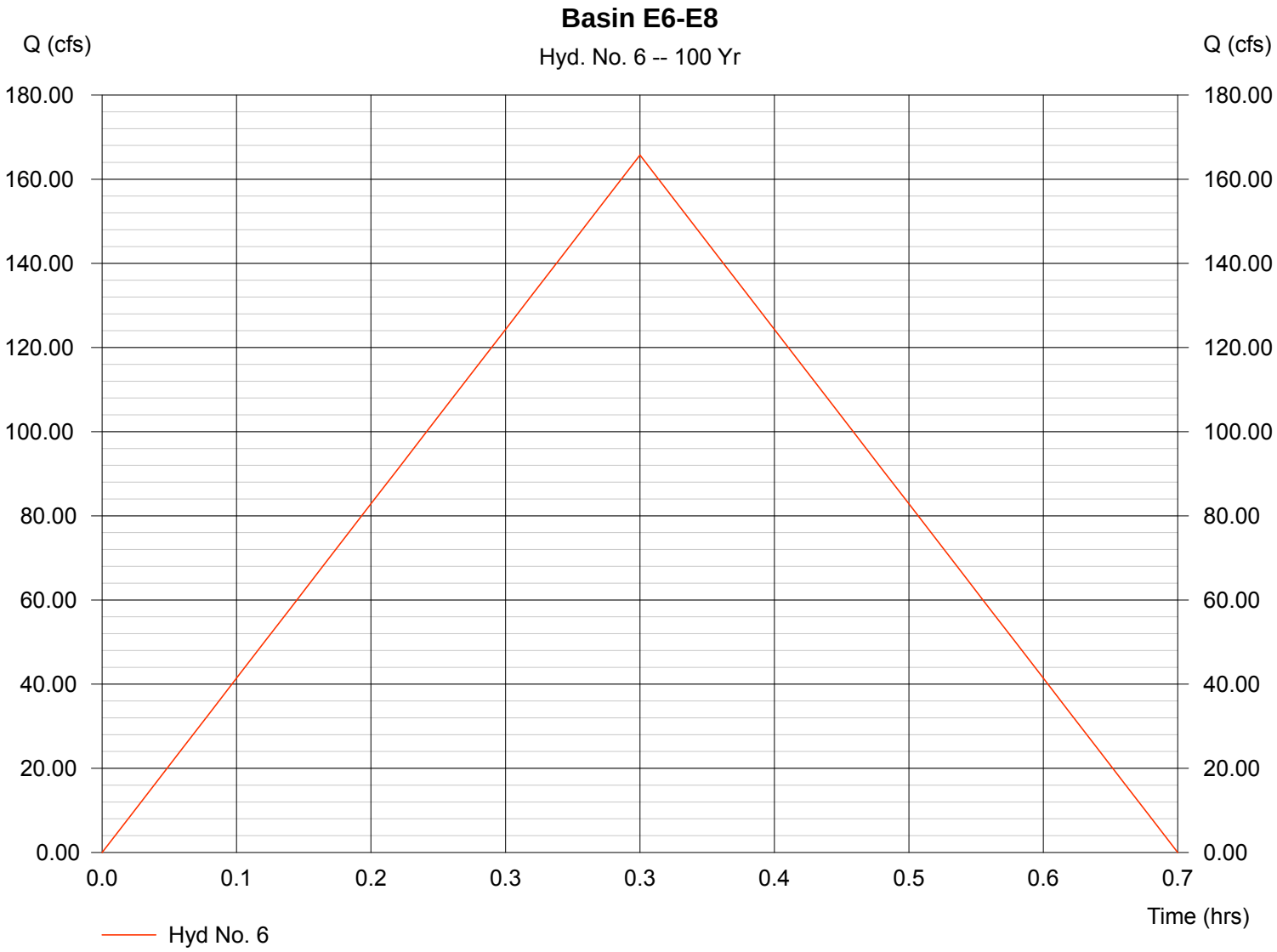
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 6:15 AM

Hyd. No. 6

Basin E6-E8

Hydrograph type	= Rational	Peak discharge	= 165.73 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 49.400 ac	Runoff coeff.	= 0.63
Intensity	= 5.325 in/hr	Tc by User	= 20.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 198,882 cuft



Hydrograph Plot

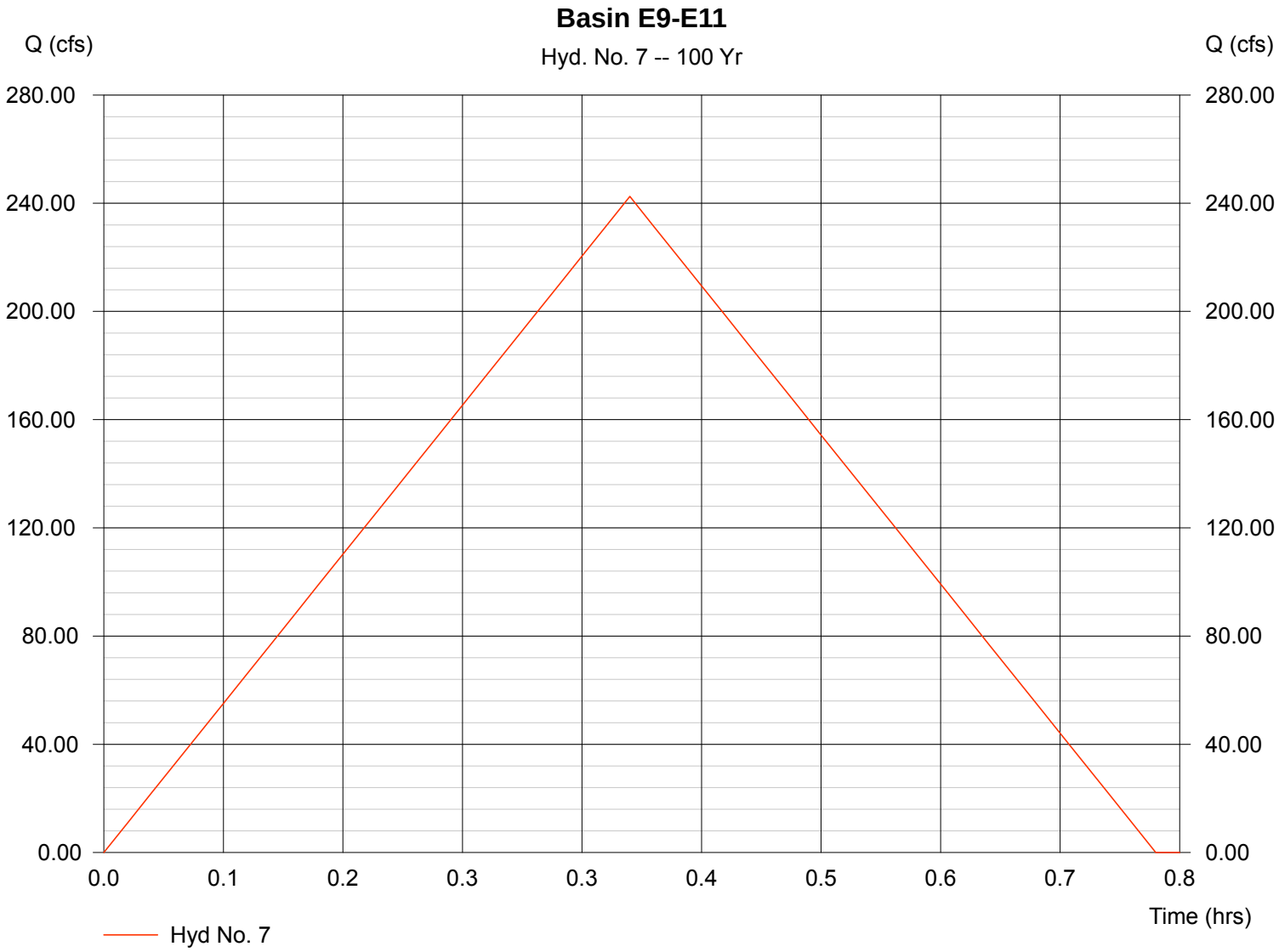
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 6:15 AM

Hyd. No. 7

Basin E9-E11

Hydrograph type	= Rational	Peak discharge	= 242.50 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 81.400 ac	Runoff coeff.	= 0.59
Intensity	= 5.049 in/hr	Tc by User	= 22.00 min
IDF Curve	= 2016-idf curves-rls.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Volume = 320,099 cuft



Hydrograph Plot

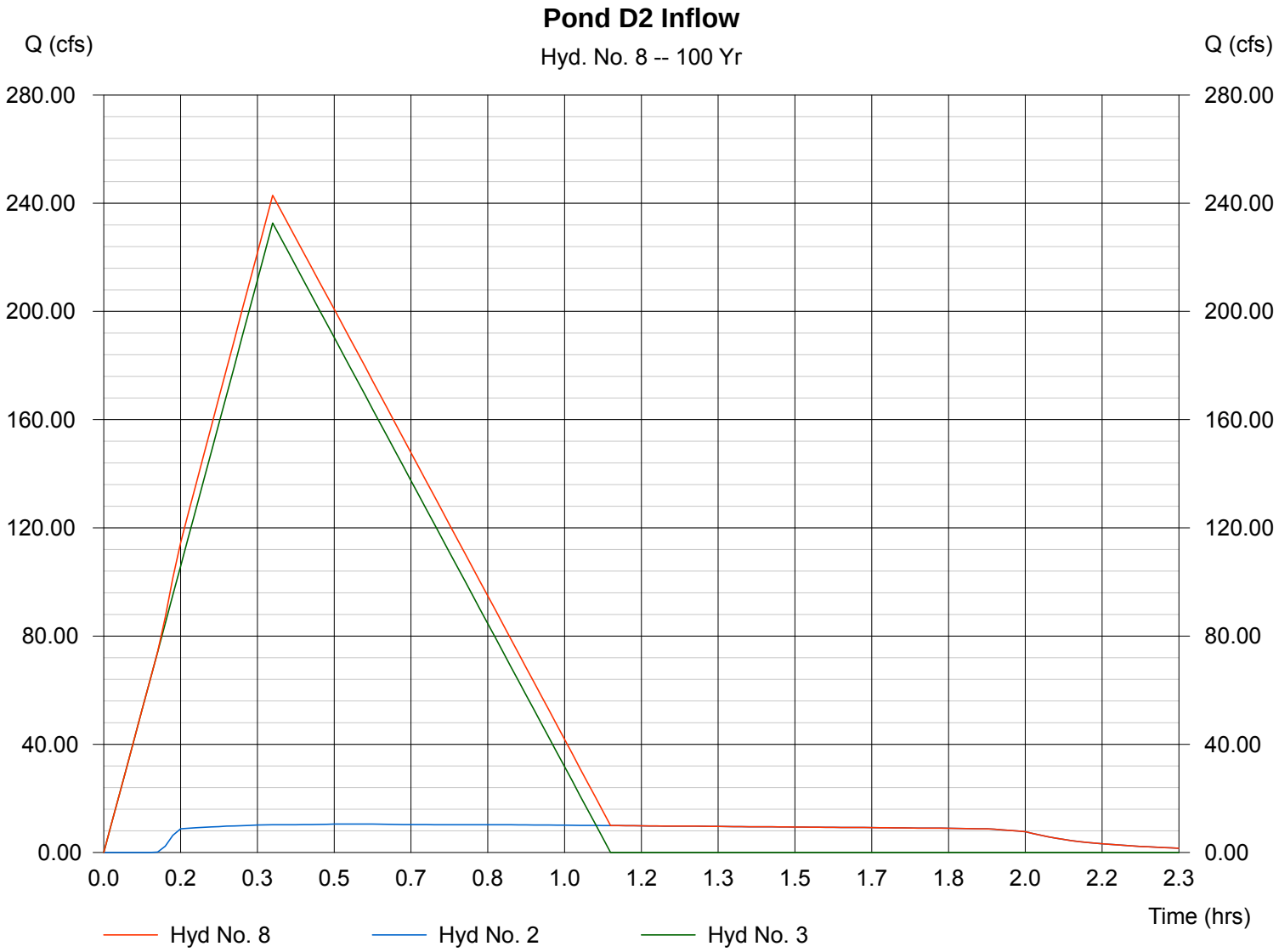
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 6:15 AM

Hyd. No. 8

Pond D2 Inflow

Hydrograph type	= Combine	Peak discharge	= 242.93 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyds.	= 2, 3		

Hydrograph Volume = 532,337 cuft



Hydrograph Plot

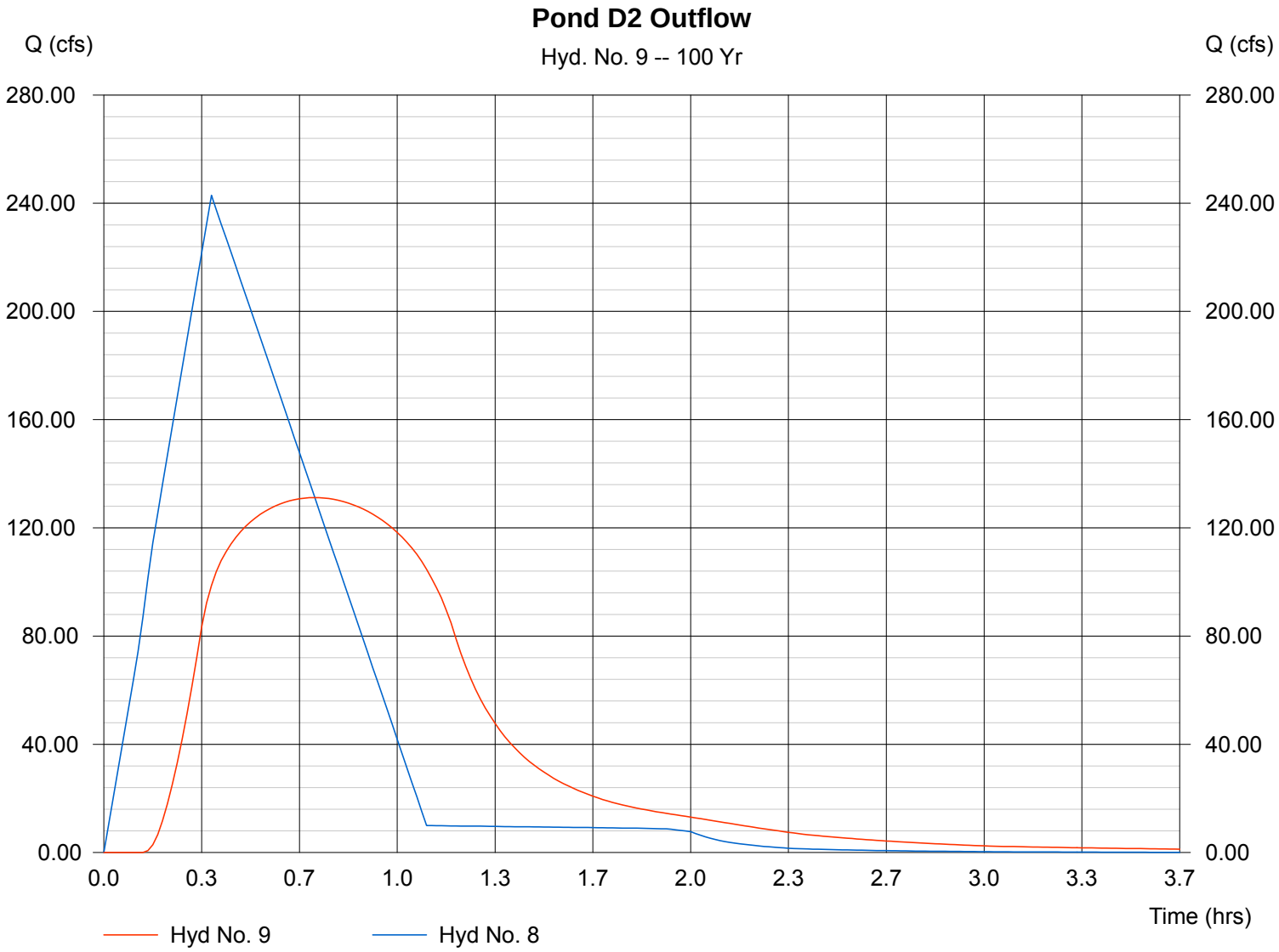
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 6:15 AM

Hyd. No. 9

Pond D2 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 131.19 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 8	Max. Elevation	= 5701.75 ft
Reservoir name	= Pond D2	Max. Storage	= 386,691 cuft

Storage Indication method used. Wet pond routing start elevation = 5699.20 ft. | Hydrograph Volume = 508,771 cuft



Hydrograph Plot

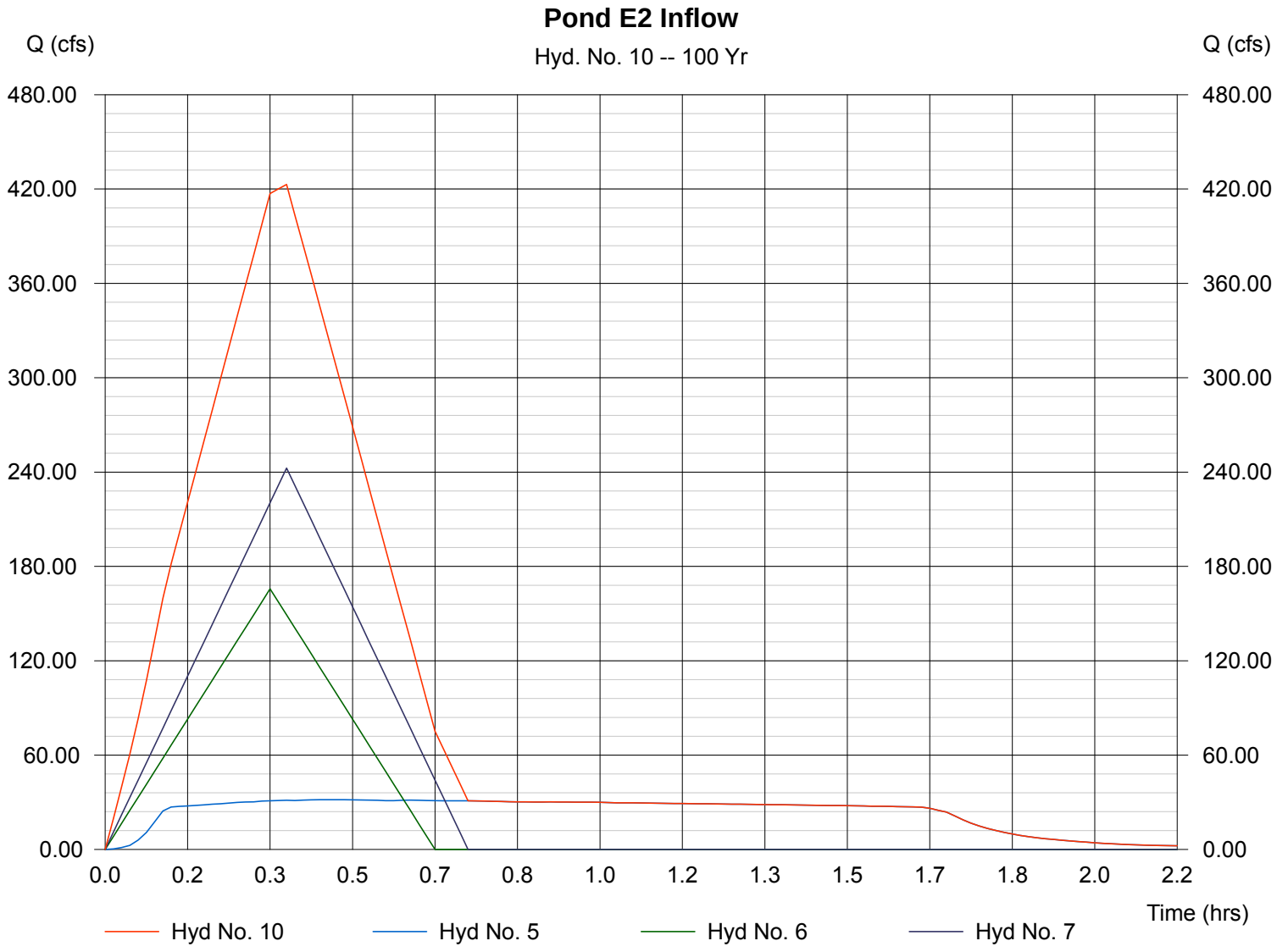
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 6:15 AM

Hyd. No. 10

Pond E2 Inflow

Hydrograph type	= Combine	Peak discharge	= 422.93 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyds.	= 5, 6, 7		

Hydrograph Volume = 706,480 cuft



Hydrograph Plot

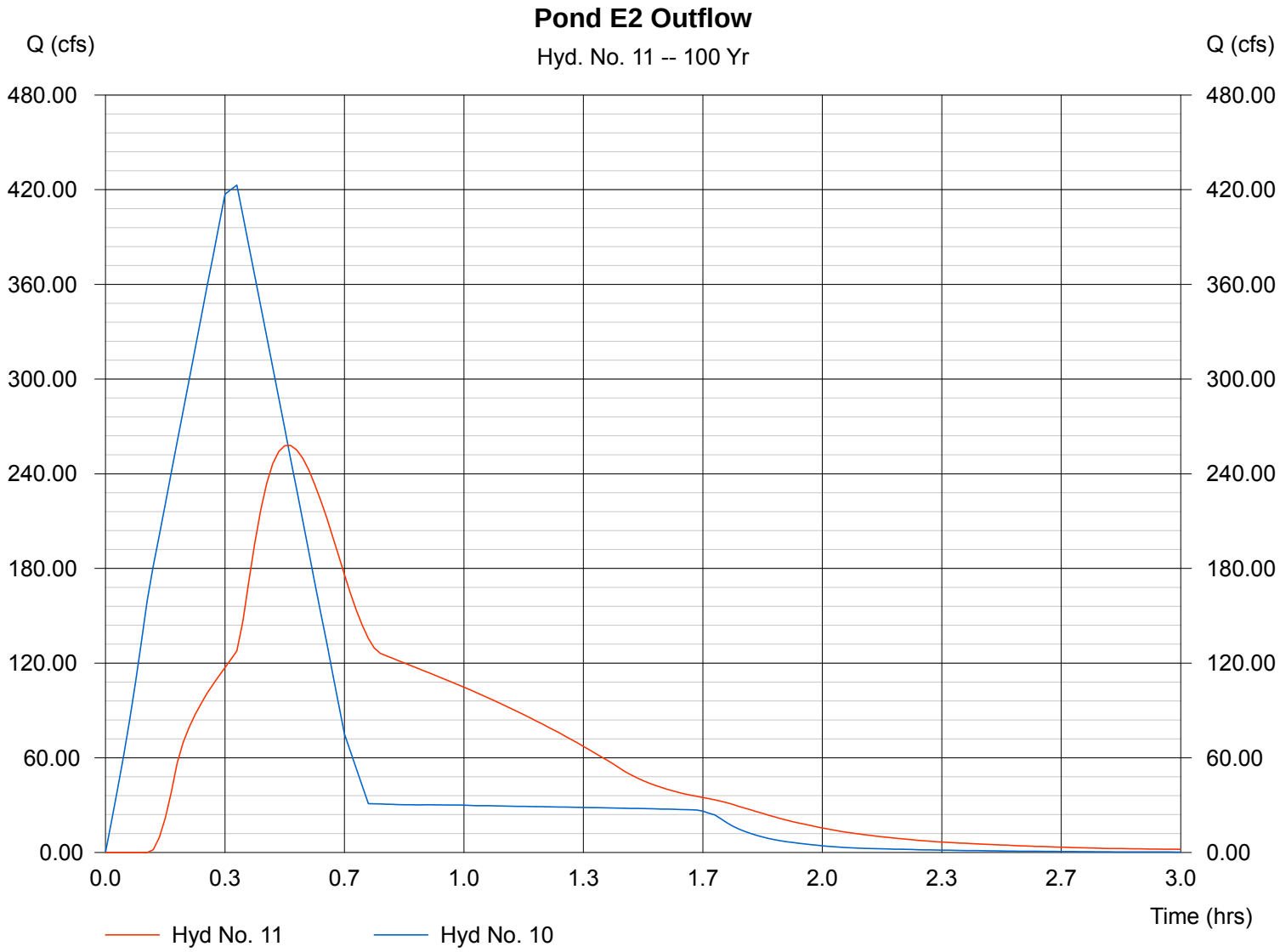
Hydraflow Hydrographs by Intelisolve | Monday, Jun 5 2017, 6:15 AM

Hyd. No. 11

Pond E2 Outflow

Hydrograph type	= Reservoir	Peak discharge	= 257.97 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 10	Max. Elevation	= 5700.91 ft
Reservoir name	= Pond E2	Max. Storage	= 421,789 cuft

Storage Indication method used. Wet pond routing start elevation = 5696.40 ft. | Hydrograph Volume = 669,336 cuft



APPENDIX F – JIMMY CAMP CREEK DBPS – KIOWA ENGINEERING

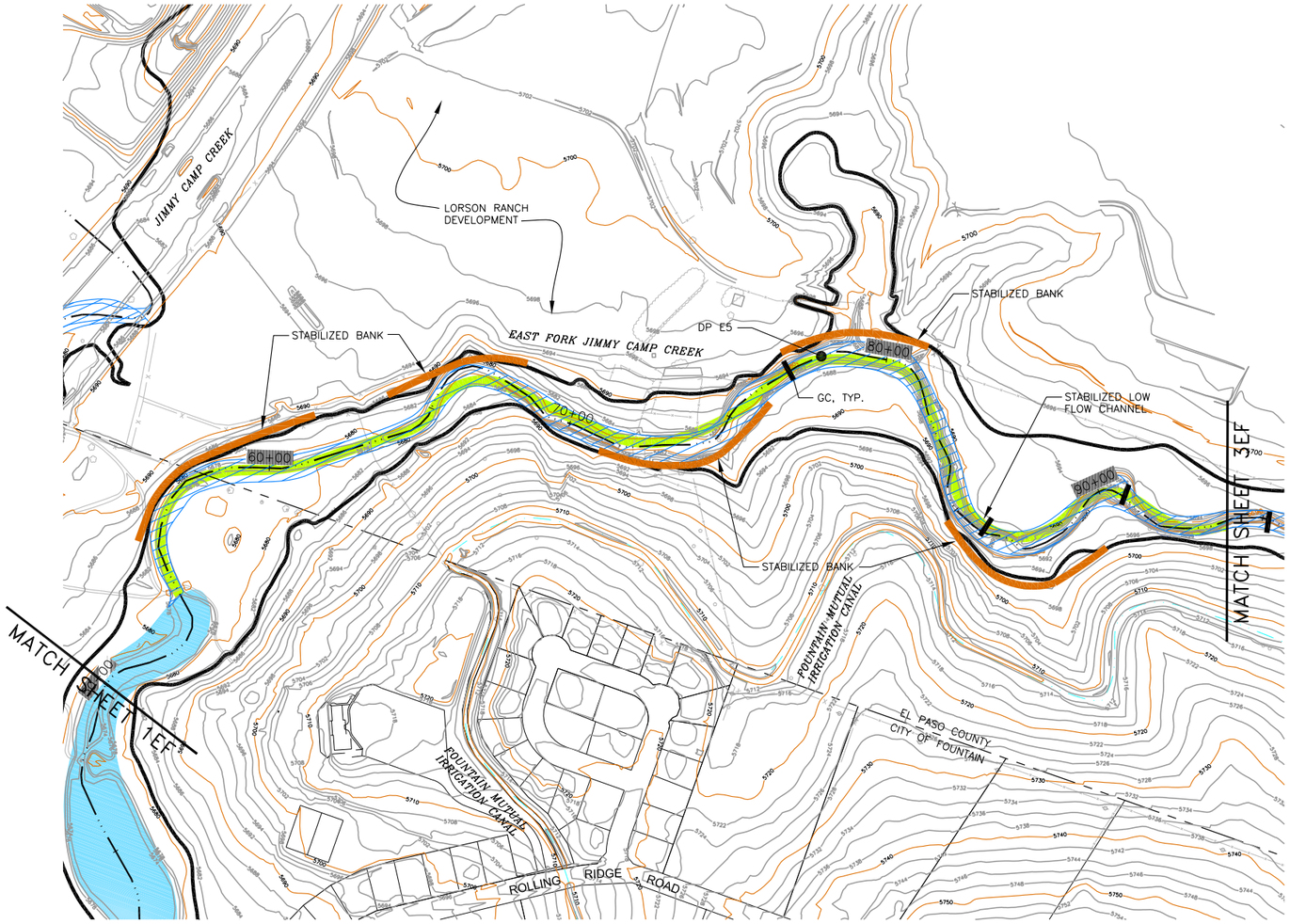
LEGEND

- 100-YR FLOODPLAIN
- STREAM FLOWLINE
- CORPORATE LIMITS
- STABILIZED LOW FLOW CHANNEL
- STABILIZED BANK
- PROPOSED FILL
- POTENTIAL JURISDICTIONAL WETLANDS
- OPEN WATER
- RIPARIAN TREES AND SHRUBS MAY INCLUDE SMALL AREAS OF WETLANDS
- POTENTIAL JURISDICTIONAL WATERS OF THE U.S. MAY INCLUDE SMALL AREAS OF WETLANDS AND/OR RIPARIAN SPECIES

FLOODPLAIN BOUNDARIES ARE FOR PLANNING INFORMATION ONLY AND ARE NOT INTENDED TO BE USED FOR FLOODPLAIN REGULATION OR MANAGEMENT.

THIS DRAWING IS A PLANNING EXHIBIT REPRESENTING CONCEPTUAL ENGINEERING AND IS SUBJECT TO REFINEMENT. THIS DRAWING SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.

DISCHARGES UPSTREAM OF DP E1 HAD NO AREA ADJUSTMENT APPLIED



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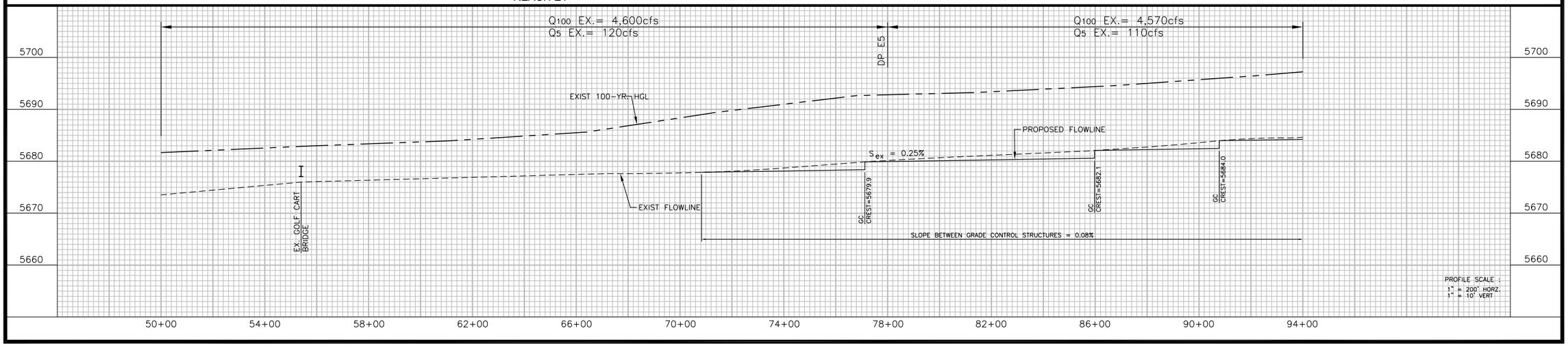
SCALE: 1"=200'

REACH E1



Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

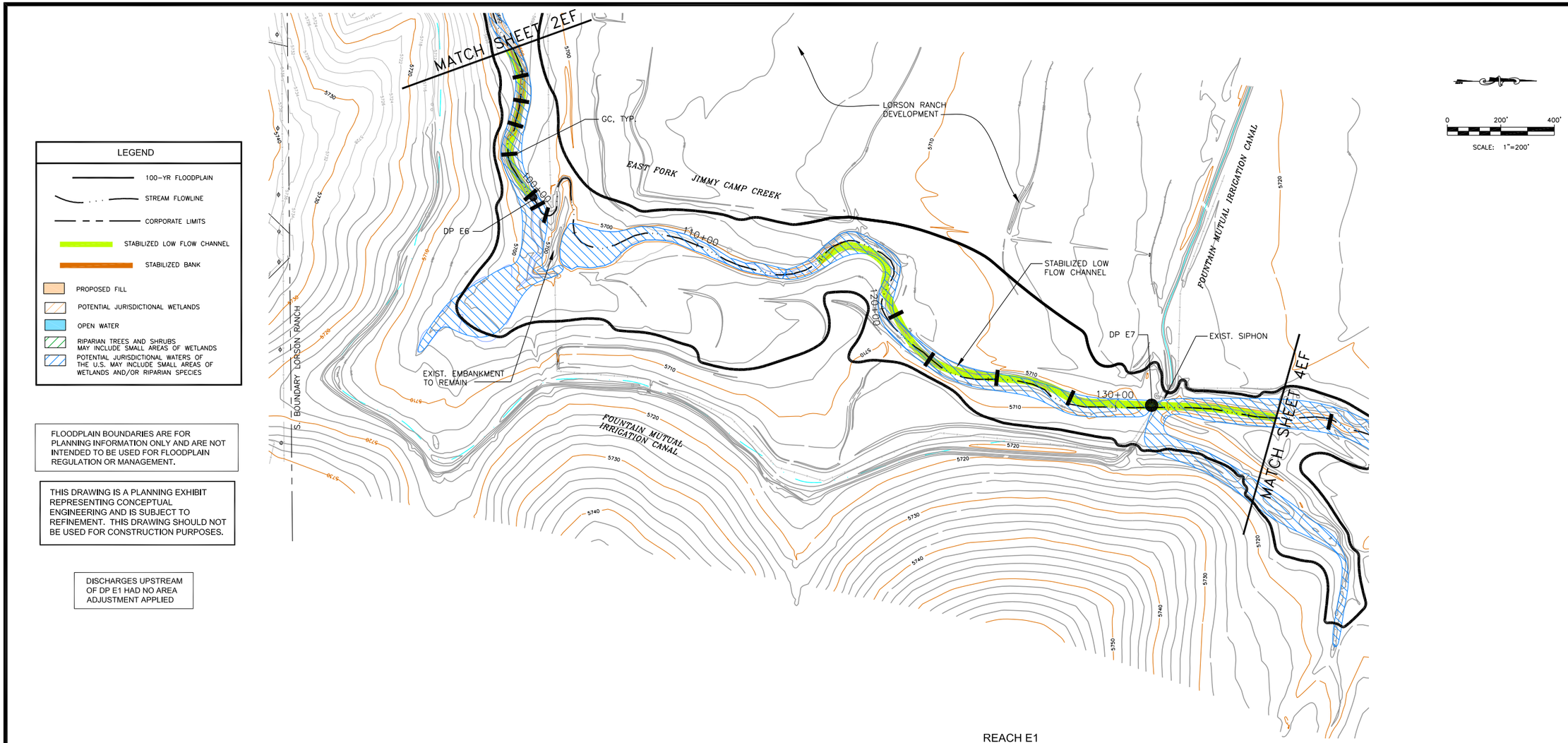
JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY
EAST FORK JIMMY CAMP CREEK

CONCEPTUAL DESIGN PLAN & PROFILE
CITY OF COLORADO SPRINGS, COLORADO

Project No.:	14008
Date:	OCTOBER 2014
Design:	RNW
Drawn:	JLN
Check:	RNW
Revisions:	

2EF

14008-2EF-736cdpp.dwg/Aug 19, 2014



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JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY
EAST FORK JIMMY CAMP CREEK
CONCEPTUAL DESIGN PLAN & PROFILE
CITY OF COLORADO SPRINGS, COLORADO

Project No.:	14008
Date:	OCTOBER 2014
Design:	RNW
Drawn:	JLN
Check:	RNW
Revisions:	

3EF

LEGEND

- 100-YR FLOODPLAIN
- STREAM FLOWLINE
- CORPORATE LIMITS
- STABILIZED LOW FLOW CHANNEL
- STABILIZED BANK
- PROPOSED FILL
- POTENTIAL JURISDICTIONAL WETLANDS
- OPEN WATER
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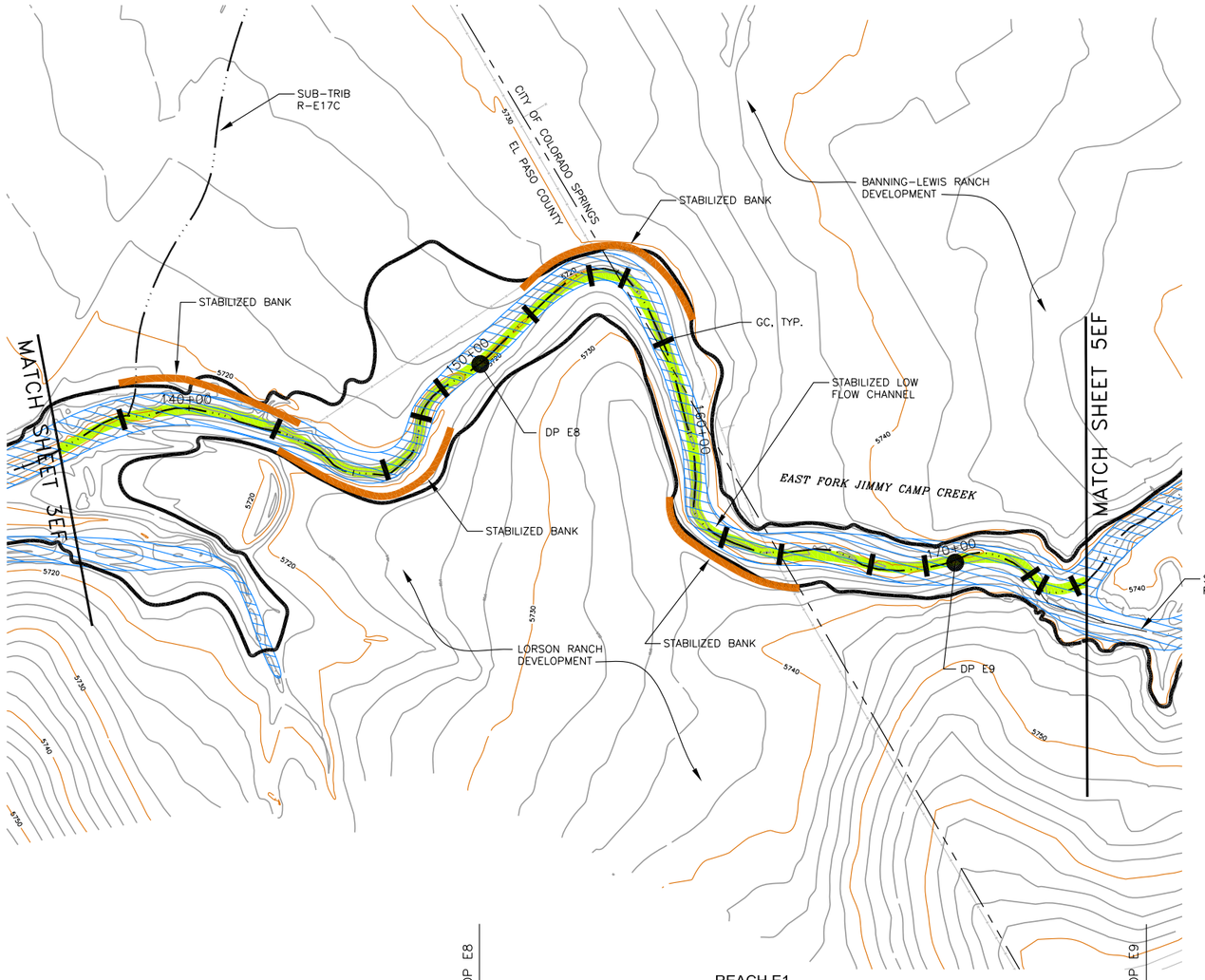
DISCHARGES UPSTREAM OF DP E1 HAD NO AREA ADJUSTMENT APPLIED



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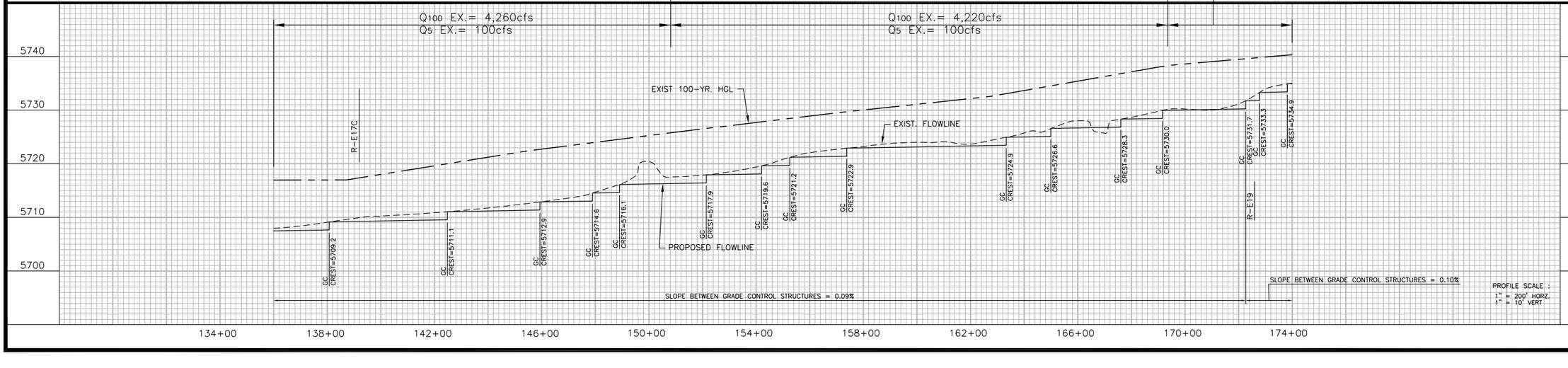
SCALE: 1"=200'

REACH E1



Kiowa Engineering Corporation
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Colorado Springs, Colorado 80904
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JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY
EAST FORK JIMMY CAMP CREEK

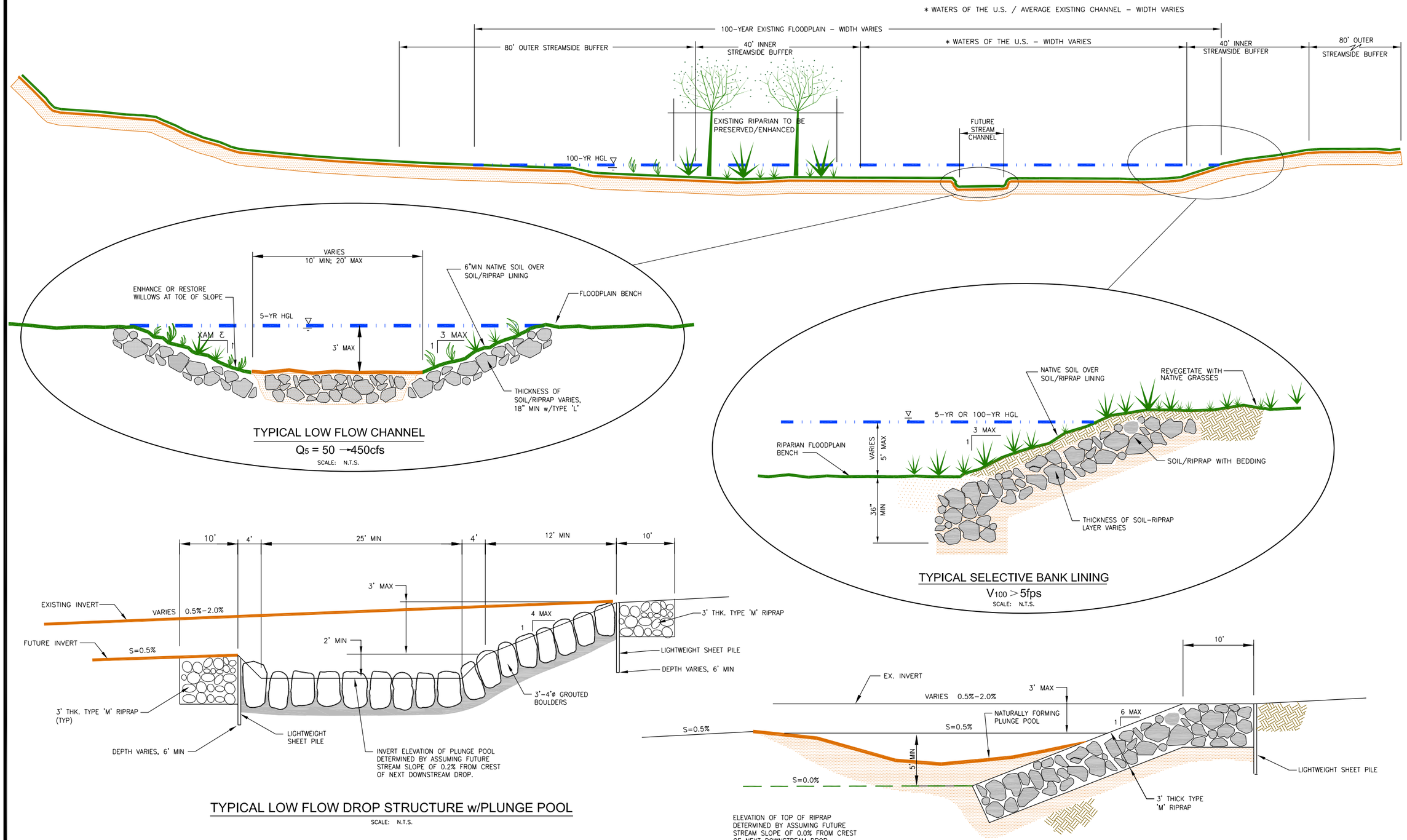
CONCEPTUAL DESIGN PLAN & PROFILE

CITY OF COLORADO SPRINGS, COLORADO

Project No.:	14008
Date:	OCTOBER 2014
Design:	RNW
Drawn:	JLN
Check:	RNW
Revisions:	

4EF

14008-4EF-766cdpp.dwg/Aug 19, 2014



TYPICAL LOW FLOW CHANNEL

Q_5 = 50 –450cfs

SCALE: N.T.S.

TYPICAL SELECTIVE BANK LINING

$V_{100} > 5$fps

SCALE: N.T.S.

TYPICAL LOW FLOW DROP STRUCTURE w/PLUNGE POOL

SCALE: N.T.S.

TYPICAL LOW FLOW DROP w/o PLUNGE POOL

SCALE: N.T.S.

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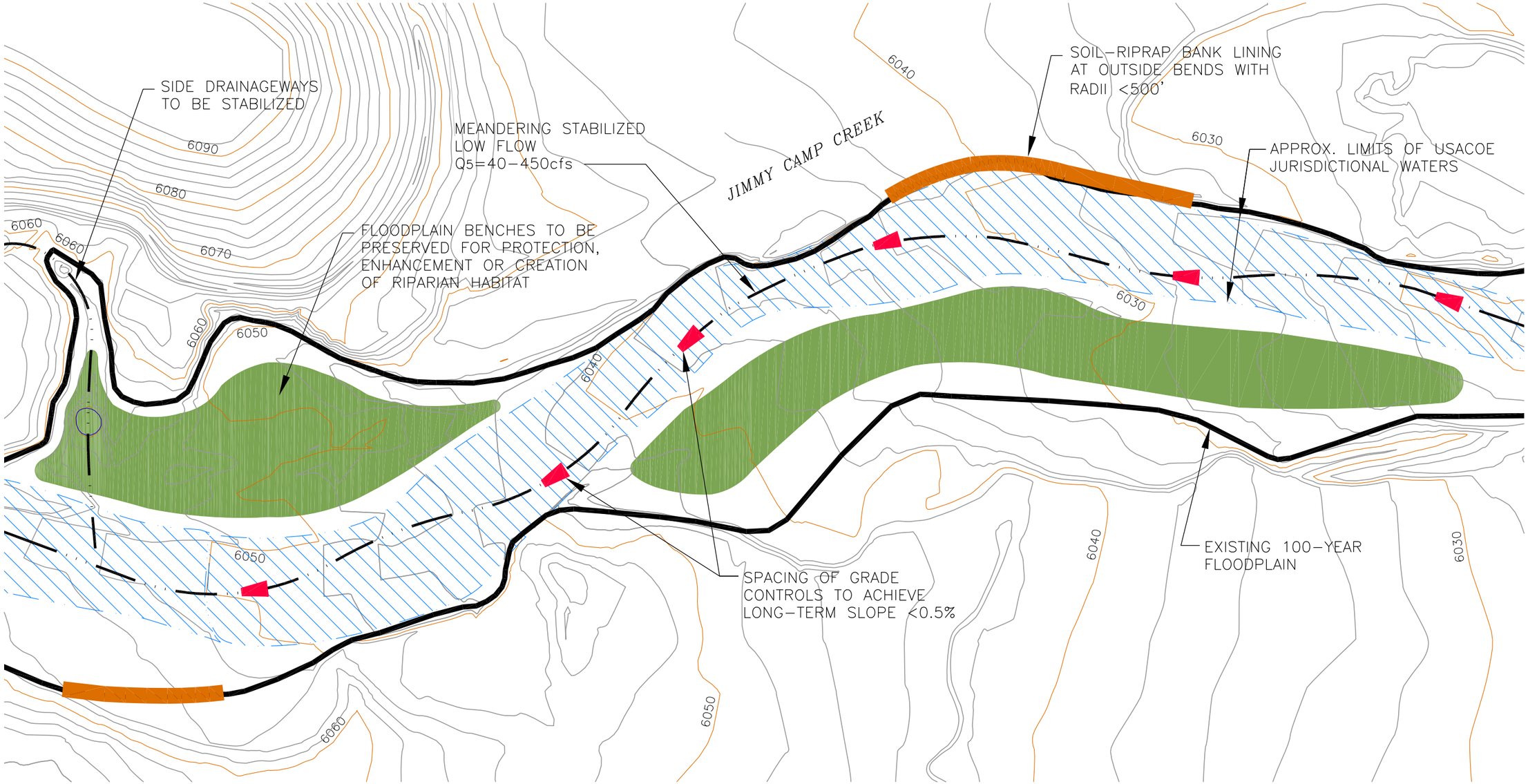
JIMMY CAMP CREEK
DRAINAGE BASIN PLANNING STUDY
TYPICAL FLOODPLAIN PRESERVATION SECTIONS & DETAILS
CITY OF COLORADO SPRINGS, COLORADO

Project No.:	14008
Date:	OCTOBER 2014
Design:	RNW
Drawn:	JLN
Check:	RNW
Revisions:	

SHEET 2

14008-cd-sht2.dwg/Aug 27, 2014



0 100' 200'

SCALE: 1"=200'

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY

JIMMY CAMP CREEK

TYPICAL FLOODPLAIN PRESERVATION PLAN

CITY OF COLORADO SPRINGS, COLORADO

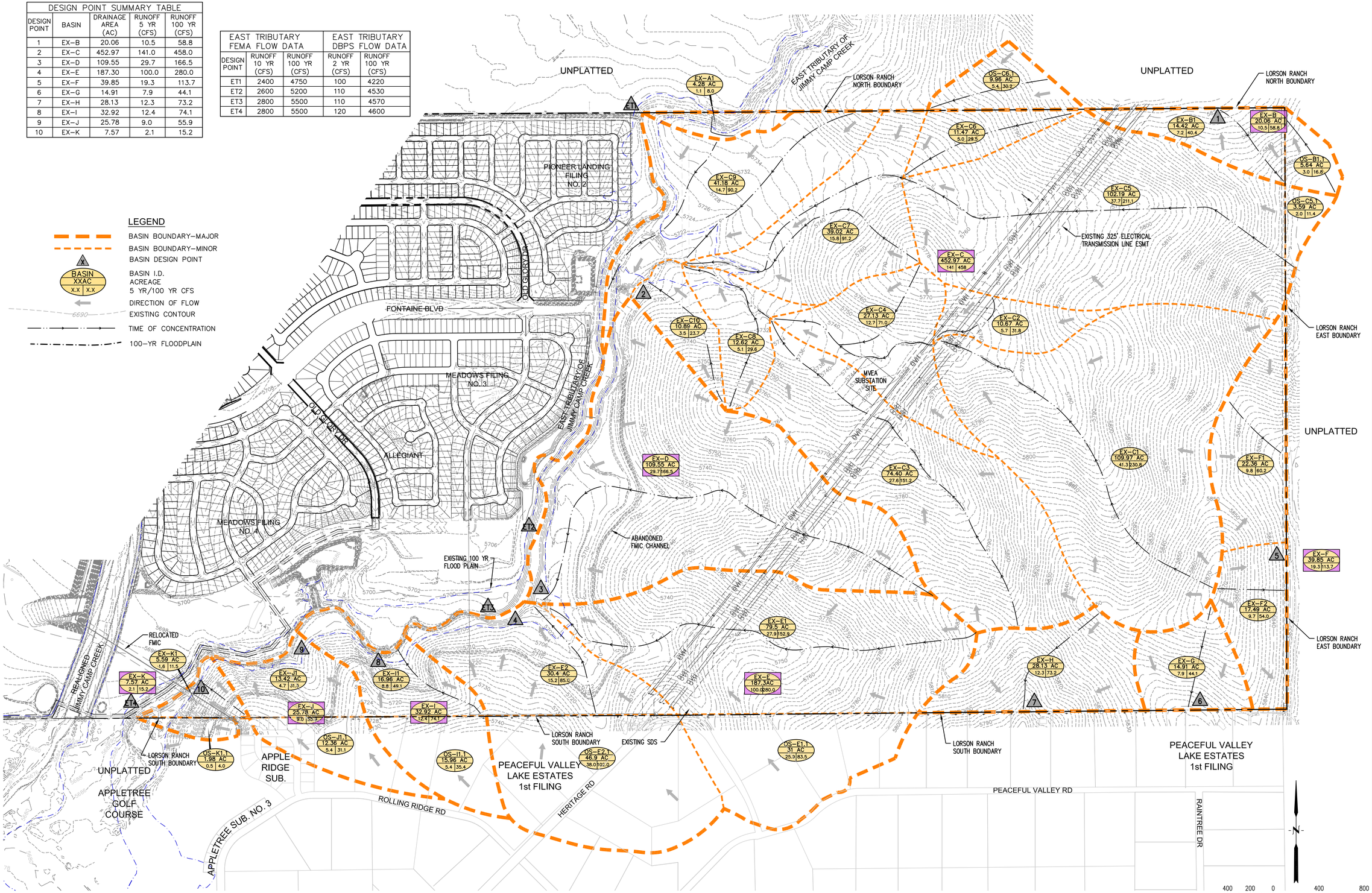
Project No.:	14008
Date:	OCTOBER 2014
Design:	RNW
Drawn:	JLN
Check:	RNW
Revisions:	

SHEET 3

14008-cd-sht3.dwg/Aug 27, 2014

DESIGN POINT SUMMARY TABLE				
DESIGN POINT	BASIN	DRAINAGE AREA (AC)	RUNOFF 5 YR (CFS)	RUNOFF 100 YR (CFS)
1	EX–B	20.06	10.5	58.8
2	EX–C	452.97	141.0	458.0
3	EX–D	109.55	29.7	166.5
4	EX–E	187.30	100.0	280.0
5	EX–F	39.85	19.3	113.7
6	EX–G	14.91	7.9	44.1
7	EX–H	28.13	12.3	73.2
8	EX–I	32.92	12.4	74.1
9	EX–J	25.78	9.0	55.9
10	EX–K	7.57	2.1	15.2

EAST TRIBUTARY FEMA FLOW DATA			EAST TRIBUTARY DBPS FLOW DATA	
DESIGN POINT	RUNOFF 10 YR (CFS)	RUNOFF 100 YR (CFS)	RUNOFF 2 YR (CFS)	RUNOFF 100 YR (CFS)
ET1	2400	4750	100	4220
ET2	2600	5200	110	4530
ET3	2800	5500	110	4570
ET4	2800	5500	120	4600



CORE ENGINEERING GROUP
15304 1ST AVENUE S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L SCHINDLER, P.E.
EMAIL: rlsch@esg1.com

NO.	DESCRIPTION	DATE

PREPARED FOR:
LORSON LLC
212 NORTH WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903 (719) 635-3200
CONTACT: JEFF MINER

PROJECT:
LORSON RANCH EAST MDDP
EAST OF THE EAST TRIBUTARY
EL PASO COUNTY, COLORADO

DRAWN: LJA
DESIGNED: LAB
CHECKED: RLS

EXISTING CONDITIONS
LORSON RANCH EAST MDDP
EAST OF ETRIB OF JIMMY CAMP CREEK

DATE:
JUNE, 2017

PROJECT NO.
100.013

SHEET NUMBER
1

TOTAL SHEETS: 1

DESIGN POINT SUMMARY TABLE				
DESIGN POINT	DRAINAGE AREA	RUNOFF 5 YR (CFS)	RUNOFF 100 YR (CFS)	COMMENTS
1	9.54ac	8.5	28	
2	57.7ac	80.1	171.0	INFLOW POND C1
3a		11.0	65.0	POND C2.1 OUTFLOW
3b		46.3	111.0	INFLOW POND C2.3
3c		4.0	46.0	POND C2.3 OUTFLOW
3d		70.0	138.0	INFLOW POND C2.2
3e		6.0	40.0	POND C2.2 OUTFLOW
3f		14.0	104.0	FLOW IN PIPE
4		51.6	134.0	INFLOW POND C3
5	74.5	119.3	265.5	INFLOW POND C4
6a		68.1	151.8	
6b		75.7	192.3	
6c	93.2	90	222	INFLOW C16+C12+C13
7		88	270	
7a		114	337	INFLOW FROM FONTAINE
7b		204	484	INFLOW POND C5
7c		121	420	POND C5 OUTFLOW
8		18.0	46.0	
9a	23.0	38.0	84.5	
9b	36.4	61.7	137.5	
10a		106.0	243.0	INFLOW POND D2
10b		31.2	131.2	FROM POND D2
11		26.2	89.8	
12		88.7	209.5	INFLOW POND E1
13		78.0	205.0	
14		190.0	423.0	INFLOW POND E2
14a		97.0	260.0	FROM POND E2
15	33.0	50.0	111.3	INFLOW POND F
15a		3.5	41.0	FROM POND F
16	20.05	36.0	80.2	INFLOW POND G
16a		2.0	33.0	FROM POND G
17	22.3	38.7	86.3	INFLOW POND H
17a		2.0	35.3	FROM POND H
18		15.1	71.0	POND I + OS-I
18a		1.0	21.0	FROM POND I
19		11.2	58.6	POND J + OS-J1
19a		0.4	20.3	FROM POND J
20		2.1	12.9	POND K + OS-K1
20a		0.1	5.6	FROM POND K

LEGEND

- BASIN BOUNDARY-MAJOR
- BASIN BOUNDARY-MINOR
- BASIN DESIGN POINT
- BASIN I.D. (A / BASIN XXAC / X.X | X.X)
- ACREAGE 5 YR/100 YR CFS
- DIRECTION OF FLOW
- 6690 EXISTING CONTOUR
- 100-YR FLOODPLAIN
- HP HIGH POINT
- LP LOW POINT
- TIME OF CONCENTRATION

NOTES:

1. ALL DETENTION PONDS, RIGHTS-OF-WAY AND STORM SEWERS PRESENTED HERE ARE SCHEMATIC IN NATURE, AND ARE SHOWN FOR INFORMATION ONLY. FINAL DESIGN OF DRAINAGE SYSTEM WILL OCCUR WITH THE DESIGN OF THE ROADS AND SUBDIVISIONS.

2. PROPOSED DETENTION PONDS WITHIN THE EXISTING 325' ELECTRICAL TRANSMISSION LINE EASEMENT WILL NEED TO BE DESIGNED WITH A 40' BUFFER FROM EXISTING POWER POLES.

EAST TRIBUTARY FEMA FLOW DATA		EXISTING FLOW DATA FROM JCC DBPS	
DESIGN POINT	RUNOFF 10 YR (CFS)	RUNOFF 100 YR (CFS)	RUNOFF 2 YR (CFS)	RUNOFF 100 YR (CFS)
ET1	2400	4750	100	4220
ET2	2600	5200	110	4530
ET3	2800	5500	110	4570
ET4	2800	5500	120	4600

Table 6.1: Detention Pond Data

Pond	5-year Volume (Ac-ft)	100-year Volume (Ac-ft)	Release Rate 5-year (cfs)	Release Rate 100-year (cfs)
Pond C1	5.98	10.22	3.0	17.7
Pond C2.1	4.83	8.33	11.0	65.0
Pond C2.2	3.72	6.38	6.0	40.0
Pond C2.3	1.48	4.32	4.0	46.0
Pond C3	1.73	6.33	4.6	17.8
Pond C4	5.69	10.72	12.4	38.3
Pond C5	13.01	15.56	121.0	420.0
Pond D1	1.25	2.48	2.0	10.5
Pond D2	5.61	8.53	31.2	131.2
Pond E1	3.60	6.57	9.4	32.0
Pond E2	5.94	9.67	97.0	260.0
Pond F	2.42	3.48	3.5	41.0
Pond G	1.41	2.20	1.1	33.0
Pond H	1.57	2.35	1.7	35.3
Pond I	0.91	1.38	1.0	21.0
Pond J	0.86	1.25	0.4	20.3
Pond K	0.26	0.47	0.1	5.6

EXISTING VERSUS DEVELOPED RUNOFF SUMMARY TABLE					
EXISTING RUNOFF			DEVELOPED RUNOFF		
DESIGN POINT	RUNOFF 5 YR (CFS)	RUNOFF 100 YR (CFS)	DESIGN POINT	RUNOFF 5 YR (CFS)	RUNOFF 100 YR (CFS)	COMMENTS
1	10.5	58.8	1	8.5	28.0	
2	141.0	458.0	7c	121.0	420.0	"C" BASINS
3	29.7	166.5	10b	31.2	131.2	"D" BASINS
4	104.0	286.0	14a	97.0	260.0	"E" BASINS
5	19.3	113.7	15a	3.5	41.0	BASIN F
6	7.9	44.1	16	2.0	33.0	BASIN G
7	12.3	73.2	17	2.0	35.3	BASIN H
8	12.4	74.1	18	15.1	71.0	BASIN I
9	9.0	55.9	19	11.2	58.6	BASIN J
10	2.1	15.2	20	2.1	12.9	BASIN K

CORE ENGINEERING GROUP
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BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: rlschindler@coreg1.com

DATE

DESCRIPTION

PREPARED FOR:
LORSON LLC
212 NORTH WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903 (719) 635-3200
CONTACT: DAVE DODSON

NO.

PROJECT:
LORSON RANCH EAST MDDP
EAST OF THE EAST TRIBUTARY
EL PASO COUNTY, COLORADO

DRAWN: LJA
DESIGNED: LAB
CHECKED: RLS

OVERALL DEVELOPED CONDITIONS LORSON RANCH EAST MDDP EAST OF EAST TRIBUTARY OF JCC

DATE: JUNE, 2017

PROJECT NO. 100.013

SHEET NUMBER 1

TOTAL SHEETS: 5

SCALE: 1"=400'

Show proposed grading on sheets 2-5

UNPLATTED BANNING LEWIS RANCH

ETRIB OF JCC

LORSON RANCH NORTH BOUNDARY

UNPLATTED ROLLING HILLS RANCH

ET1

ETRIB CHANNEL TO BE SELECTIVELY ARMORED FROM FONTAINE BOULEVARD NORTH TO PROPERTY LINE SEE KIOWA DBPS (REIMBURSABLE) DESIGN Q100=4750cfs

PIONEER LANDING 2 AT LORSON RANCH

PONDEROSA 2 AT LORSON RANCH

100 LF 48"RCP @ 0.5%

FUTURE BRIDGE OVER JCC (REIMBURSABLE) DESIGN Q100=4750cfs

FONTAINE BLVD.

THE MEADOWS 3 AT LORSON RANCH

100 YR FLOOD PLAIN

ETRIB OF JCC

ETRIB CHANNEL RECONSTRUCTED IN 2013 FROM ET-3 NORTH TO FONTAINE BLVD. SEE SHEET 3

A 2.6ac 1.4 | 7.7

C16a 21.29ac 35.1 | 78.3

C16b 32.23ac 55.6 | 123.8

C17a 7.5ac 5.4 | 28.7

C17 22.7 AC 31.7 | 70.6

C13 19.2 AC 7.6 | 40.5

C15 40.2 AC 57.6 | 128.3

OS-C11 5.6 AC 10.2 | 22.7

OS-C9 5.2 AC 10.1 | 22.4

C10 13.0 AC 22.8 | 50.7

C12 20.5 AC 33.0 | 73.5

C8 74.5 AC 119.3 | 265.5

C14 11.1 AC 16.6 | 37.0

C8a 11.7 AC 22.0 | 49.0

C7 14.5 AC 26.4 | 58.9

C5 25.0 AC 42.4 | 94.4

C6 18.7 AC 31.7 | 70.5

6a 6b 6c 7 7a 7b 7c 5 4 3a 3b 3c 3d 3e 3f 2

650 LF 54"RCP @ 0.60% (min)

210 LF 66"CMP @ 0.5% (min)

690 LF 42"RCP @ 1.50%

660 LF 30"RCP @ 1.00%

30" RCP @ 1.00% stub

900 LF 60"RCP @ 1.0%

100 LF 36"RCP @ 0.6%

54"RCP @ 1.0%

48"RCP @ 1.0%

42"RCP @ 0.9%

42" RCP @ 2.4% stub

18"RCP @ 0.50%

780 LF 30"RCP @ 3.0%

360 LF 24"RCP @ 1.9%

360 LF 18"RCP @ 1.9%

LAMPREY DR

LORSON BLVD.

EXISTIN TRANSM

POND C4

POND C3

POND C2.2

POND C2.3

POND C2.1

school site

MVEA SUBSTATION SITE

L.P.

H.P.

8WH

OWH

200 100 0 200 400

SCALE: 1"=200'

CORE ENGINEERING GROUP
15004 1ST AVENUE S
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: rlschindler@coreg1.com

PREPARED FOR:
LORSON LLC
212 NORTH WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903 (719) 635-3200
CONTACT: DAVE DODSON

PROJECT:
LORSON RANCH EAST MDDP
EAST OF THE EAST TRIBUTARY
EL PASO COUNTY, COLORADO

NO. | DESCRIPTION | DATE

DRAWN: RLS
DESIGNED: LAB
CHECKED: RLS

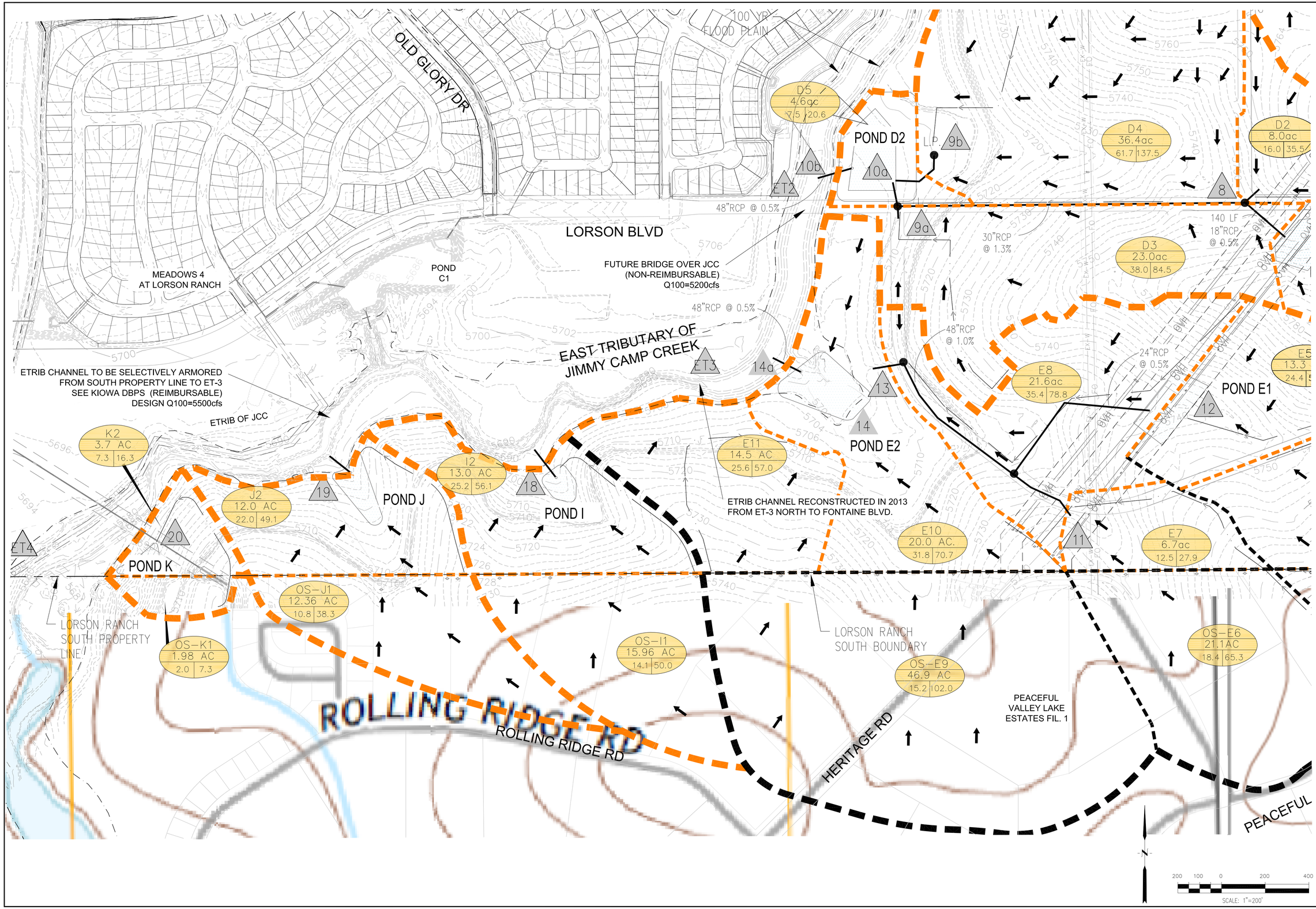
DEVELOPED CONDITIONS LORSON RANCH EAST MDDP NORTHWEST AREA

DATE: JUNE, 2017

PROJECT NO. 100.013

SHEET NUMBER 2

TOTAL SHEETS: 5



CORE ENGINEERING GROUP
15004 1ST AVENUE S
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L SCHINDLER, P.E.
EMAIL: rlss@decgl.com

DATE

DESCRIPTION

NO.

PREPARED FOR:
LORSON LLC
212 NORTH WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903 (719) 635-3200
CONTACT: DAVE DODSON

PROJECT:
LORSON RANCH EAST MDDP
EAST OF THE EAST TRIBUTARY
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: RLS

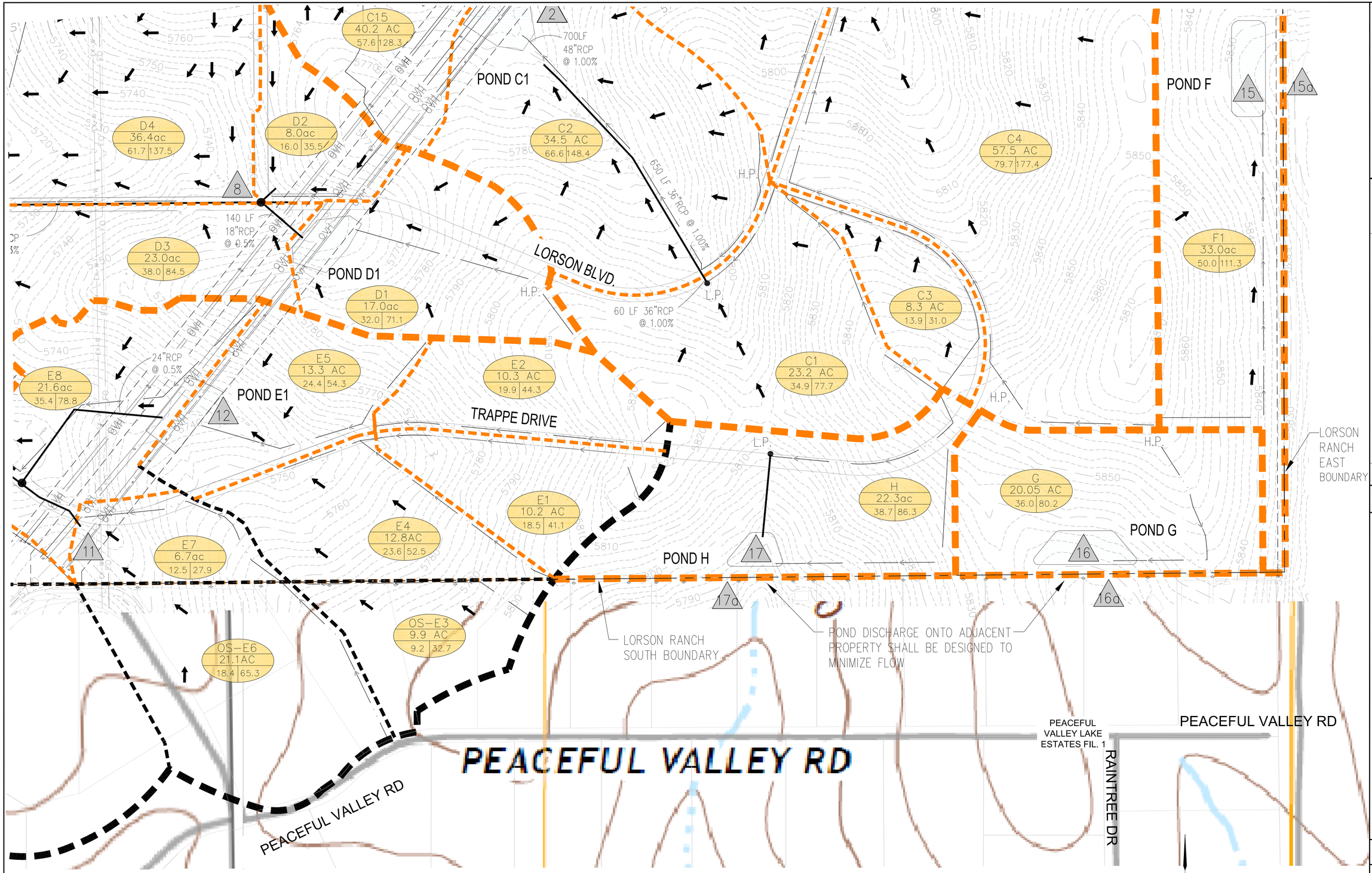
DEVELOPED CONDITIONS
LORSON RANCH EAST MDDP
SOUTHWEST AREA

DATE:
JUNE, 2017

PROJECT NO.
100.013

SHEET NUMBER
3

TOTAL SHEETS: 5



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PH: 719.570.1100
CONTACT: RICHARD L SCHINDLER, P.E.
EMAIL: rlschindler@coreengr.com

DATE
DESCRIPTION
NO.

PREPARED FOR:
LORSON LLC
212 NORTH WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903 (719) 635-3200
CONTACT: DAVE DODSON

PROJECT: LORSON RANCH EAST MDDP
EAST OF THE EAST TRIBUTARY
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: RLS

DEVELOPED CONDITIONS
LORSON RANCH EAST MDDP
SOUTHEAST AREA

DATE:
JUNE, 2017

PROJECT NO.
100.013

SHEET NUMBER
4

TOTAL SHEETS: 5

UNPLATTED ROLLING HILLS RANCH

LORSON RANCH NORTH BOUNDARY

LORSON RANCH NORTH BOUNDARY

ETRIB OF JCC

A 2.6ac 1.4 | 7.7

OS-C11 5.6 AC 10.2 | 22.7

OS-C9 5.2 AC 10.1 | 22.4

B 9.54 AC 8.5 | 28.0

1

B2 3.9 AC 6.4 | 14.3

C16a 21.29ac 35.1 | 78.3

C10 13.0 AC 22.8 | 50.7

LORSON BLVD

EXISTING 325' ELECTRICAL TRANSMISSION LINE ESMT

OS-B1 5.64 AC 3.4 | 19.0

C16b 32.23ac 55.6 | 123.8

6a

C8 74.5 AC 119.3 | 265.5

POND C4

OS-C9.1 3.59 AC 4.0 | 10.6

690 LF 42"RCP @ 1.50%

LAMPREY DR

660 LF 30"RCP @ 1.00%

C12 20.5 AC 33.0 | 73.5

C13 19.2 AC 7.6 | 40.5

6c

6b

650 LF 54"RCP @ 0.60% (min)

210 LF 66"CMP @ 0.5% (min)

L.P.

30" RCP @ 1.00% stub

school site

5

4

360 LF 24"RCP @ 1.9%

POND C3

C8a 11.7 AC 22.0 | 49.0

C5

7a

54"RCP @ 1.0%

48"RCP @ 1.0%

C14 11.1 AC 16.6 | 37.0

7

360 LF 18"RCP @ 1.9%

H.P.

900 LF 60"RCP @ 1.0%

42"RCP @ 0.9%

C7 14.5 AC 26.4 | 58.9

POND C2.2

3e

3f

3d

100 LF 36"RCP @ 0.6%

C5 25.0 AC 42.4 | 94.4

LORSON RANCH EAST BOUNDARY

42" RCP @ 2.4% stub

18"RCP @ 0.50%

3c

780 LF 30"RCP @ 3.0%

MVEA SUBSTATION SITE

POND C2.3

3b

3a

POND C2.1

C6 18.7 AC 31.7 | 70.5

LAMPREY DR

H.P.

FONTAINE BLVD.

2

700LF 48"RCP @ 1.00%

C15 40.2 AC 57.6 | 128.3

POND C1

POND F

15

15a

D4 36.4ac 61.7 | 137.5

D2 8.0ac 16.0 | 35.5

C2 34.5 AC 66.6 | 148.4

C4 57.5 AC 79.7 | 177.4

N

200 100 0 200 400

SCALE: 1"=200'

CORE ENGINEERING GROUP
15004 1ST AVENUE S
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: rlschindler@coreeg1.com

NO. | DESCRIPTION | DATE

PREPARED FOR:
LORSON LLC
212 NORTH WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903 (719) 635-3200
CONTACT: DAVE DODSON

PROJECT:
LORSON RANCH EAST MDDP
EAST OF THE EAST TRIBUTARY
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: RLS

DEVELOPED CONDITIONS
LORSON RANCH EAST MDDP
NORTHEAST AREA

DATE:
JUNE, 2017

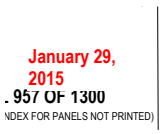
PROJECT NO.
100.013

SHEET NUMBER
5

TOTAL SHEETS: 5

Markup Summary

alex.dabdub (4)



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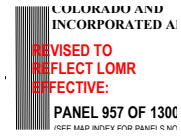
Author: alex.dabdub
Date: 9/16/2014 1:47:49 PM
Color:

January 29, 2015



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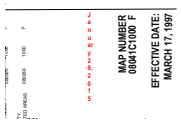

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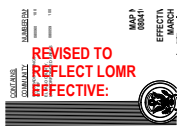
January 29, 2015



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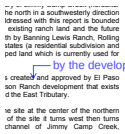
dsdrice (56)



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Date: 8/14/2017 8:29:04 AM
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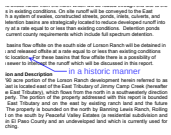
by the developer



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Author: dsdrice
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in a historic manner

Subject: Cloud+
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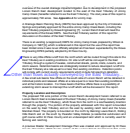
Checkmark: Unchecked
Author: dsdrice
Date: 8/2/2017 2:45:41 PM
Color:

delete or reword (not partially adopted, but allowed for concept)



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Author: dsdrice
Date: 8/14/2017 8:26:55 AM
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Other than flows actually conveyed by the East Tributary...

Subject: Cloud+
Page Label: 5
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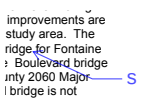
Checkmark: Unchecked
Author: dsdrice
Date: 8/2/2017 2:45:49 PM
Color:

delete or reword (not partially adopted, but allowed for concept)



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Author: dsdrice
Date: 8/2/2017 2:55:29 PM
Color:

s

Subject: Cloud+
Page Label: 5
Lock: Unlocked
Status:
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Author: dsdrice
Date: 8/2/2017 2:54:52 PM
Color:

reimbursable in accordance with adopted DBPS -- improvements from the new DBPS need to go through the process

---

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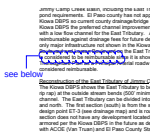
Date: 8/2/2017 2:48:00 PM
Color:

(fees were not calculated for El Paso County)



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Date: 8/2/2017 2:57:03 PM
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see below

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Status:
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Author: dsdrice
Date: 8/14/2017 8:33:55 AM
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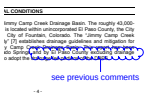
in conformance with (?)



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Date: 8/2/2017 3:03:34 PM
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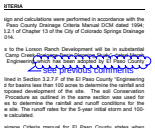
see previous comments



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Author: dsdrice
Date: 8/2/2017 3:02:22 PM
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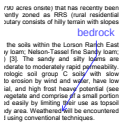
see previous comments



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Author: dsdrice
Date: 8/2/2017 3:09:05 PM
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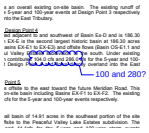
bedrock



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Date: 8/2/2017 3:19:10 PM
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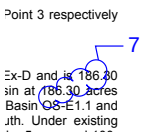
100 and 280?



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Author: dsdrice
Date: 8/2/2017 3:18:00 PM
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7

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Author: dsdrice
Date: 8/2/2017 3:29:28 PM
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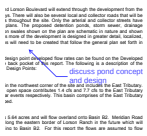

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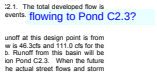
Author: dsdrice
Date: 8/14/2017 10:27:02 AM
Color:

discuss pond concept and design



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Date: 8/14/2017 10:02:43 AM
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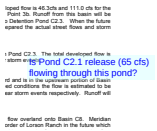
flowing to Pond C2.3?



Subject: Text Box
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Author: dsdrice
Date: 8/14/2017 10:02:04 AM
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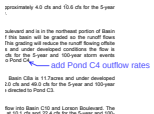
Is Pond C2.1 release (65 cfs) flowing through this pond?



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Author: dsdrice
Date: 8/14/2017 10:16:31 AM
Color:

add Pond C4 outflow rates

Subject: Callout
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Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:13:59 AM
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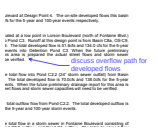
add the inflow values



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Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:13:32 AM
Color:

discuss overflow path for developed flows

Subject: Callout
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Lock: Unlocked
Status:
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Author: dsdrice
Date: 8/14/2017 10:12:49 AM
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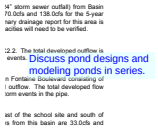
add the inflow values



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Date: 8/14/2017 10:32:41 AM
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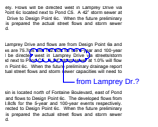
Discuss pond designs and modeling ponds in series.



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Author: dsdrice
Date: 8/14/2017 10:23:09 AM
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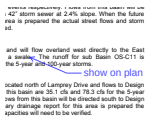
from Lamprey Dr.?



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Date: 8/14/2017 10:20:15 AM
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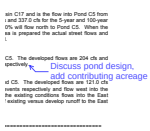
show on plan



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Date: 8/14/2017 10:32:05 AM
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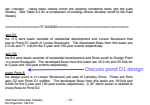
Discuss pond design, add contributing acreage



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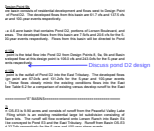
Discuss pond D1 design



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Date: 8/14/2017 10:31:33 AM
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Discuss pond D2 design

Subject: Callout
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Author: dsdrice
Date: 8/14/2017 10:36:33 AM
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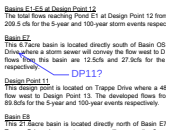
Discuss pond E2 design



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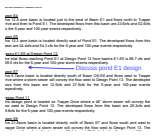
DP11?



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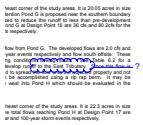
Discuss pond E1 design



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Author: dsdrice
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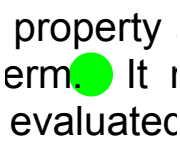

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Date: 8/14/2017 10:39:47 AM
Color:

Subject: Callout
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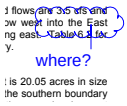
Author: dsdrice
Date: 8/14/2017 10:37:41 AM
Color:

Discuss pond F design



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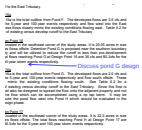
Author: dsdrice
Date: 8/14/2017 10:38:29 AM
Color:

where?



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Page Label: 18
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Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:39:02 AM
Color:

Discuss pond G design

Subject: Cloud+
Page Label: 18
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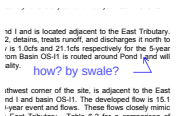
Checkmark: Unchecked
Author: dsdrice
Date: 8/11/2017 4:21:11 PM
Color:

full-spectrum sizing is based on contributing impervious area



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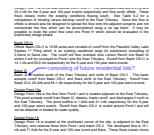
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:43:25 AM
Color:

how? by swale?

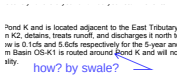


Subject: Callout
Page Label: 19
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:41:47 AM
Color:

consisting of future residential lots?

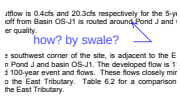
Subject: Callout
Page Label: 20
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:47:58 AM
Color:

consisting of future residential lots?



Subject: Callout
Page Label: 20
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:48:54 AM
Color:

how? by swale?

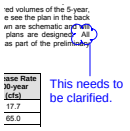


Subject: Callout
Page Label: 20
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:49:00 AM
Color:

how? by swale?

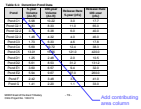
Subject: Cloud+
Page Label: 20
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:52:30 AM
Color:

Reword that reimbursement may be requested through the DCM and Drainage Board process.



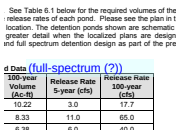
Subject: Cloud+
Page Label: 21
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/15/2017 12:55:13 PM
Color:

This needs to be clarified.



Subject: Callout
Page Label: 21
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/15/2017 12:57:08 PM
Color:

Add contributing area column

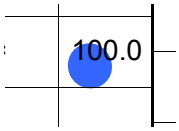


Subject: Text Box
Page Label: 21
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/15/2017 12:56:02 PM
Color:

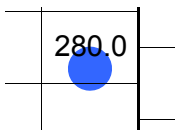
(full-spectrum (?))

Subject: Cloud+
Page Label: 37
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/15/2017 10:11:42 AM
Color:

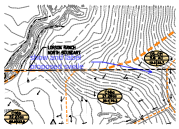
These seem high for existing. Provide land use/impervious table and coefficients tables.



Subject: Highlight
Page Label: 38
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/2/2017 3:20:11 PM
Color:



Subject: Highlight
Page Label: 40
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/2/2017 3:19:29 PM
Color:

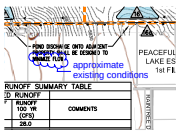


Subject: Callout
Page Label: 166
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:20:57 AM
Color:

show and label proposed swale

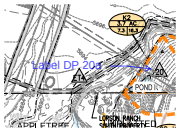
Subject: Callout
Page Label: 166
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:47:24 AM
Color:

Label DP 19a



Subject: Cloud+
Page Label: 166
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/11/2017 2:15:09 PM
Color:

approximate existing conditions

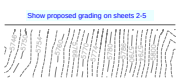


Subject: Callout
Page Label: 166
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:48:20 AM
Color:

Label DP 20a

Subject: Callout
Page Label: 166
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 10:45:04 AM
Color:

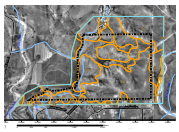
Label DP 18a



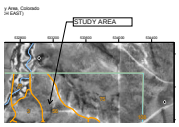
Subject: Text Box
Page Label: 167
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: dsdrice
Date: 8/14/2017 11:27:22 AM
Color:

Show proposed grading on sheets 2-5

RSchindler (13)

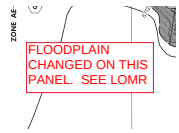


Subject: Polygonal Line
Page Label: 26
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 6/5/2017 10:56:22 AM
Color:



Subject: Callout
Page Label: 26
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 6/5/2017 10:54:45 AM
Color:

STUDY AREA

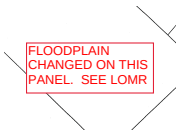


Subject: Text Box
Page Label: 29
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 6/5/2017 11:40:28 AM
Color:

FLOODPLAIN CHANGED ON THIS PANEL. SEE LOMR

Subject: Polygonal Line
Page Label: 29
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 6/5/2017 11:37:11 AM
Color:

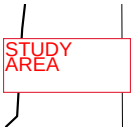
Subject: Polygonal Line
Page Label: 30
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 6/5/2017 11:38:41 AM
Color:



Subject: Text Box
Page Label: 30
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 6/5/2017 11:39:46 AM
Color:

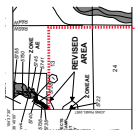
FLOODPLAIN CHANGED ON THIS PANEL. SEE LOMR

Subject: Polygonal Line
Page Label: 31
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 6/5/2017 11:43:17 AM
Color:



Subject: Text Box
Page Label: 31
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 6/5/2017 11:42:11 AM
Color:

STUDY
AREA



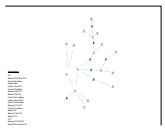
Subject: Polygonal Line
Page Label: 32
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 6/5/2017 11:46:42 AM
Color:

Subject: Text Box
Page Label: 32
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 6/5/2017 11:47:03 AM
Color:

STUDY
AREA

Subject: Text Box
Page Label: 59
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 9/2/2016 9:38:55 PM
Color:

42" RCP



Subject: Stamp
Page Label: 107
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 5/19/2017 5:19:42 AM
Color:

Subject: Stamp
Page Label: 141
Lock: Unlocked
Status:
Checkmark: Unchecked
Author: RSchindler
Date: 5/22/2017 7:18:53 AM
Color: