

**PRELIMINARY AND  
FINAL DRAINAGE PLAN  
SF 23-003**

**CREEKSIDE AT  
LORSON RANCH FILING NO. 2**

**JANUARY, 2023**

***Prepared for:***

Lorson, LLC  
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Colorado Springs, Colorado 80903  
(719) 635-3200

***Prepared by:***

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Project No. 100.069



**CORE**  

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**ENGINEERING GROUP**

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### **APPENDIX A**

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*STORM SEWER SCHEMATIC and HYDRAFLOW STORM SEWER CALCS*

### **BACK POCKET**

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**ENGINEER'S STATEMENT**

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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.

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Richard L. Schindler, P.E. #33997

Date

For and on Behalf of Core Engineering Group, LLC

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**OWNER'S STATEMENT**

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

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Lorson, LLC

Date

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By  
Jeff Mark

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Title  
Manager

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Address  
212 N. Wahsatch Avenue, Suite 301, Colorado Springs, CO 80903

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**FLOODPLAIN STATEMENT**

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To the best of my knowledge and belief, this development is not located within a designated floodplain as shown on Flood Insurance Rate Map Panel No. and 08041C0957 G, dated December 7, 2018. (See Appendix A, FEMA FIRM Exhibit)

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Richard L. Schindler, #33997

Date

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**EL PASO COUNTY**

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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.

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

Date

Conditions: \_\_\_\_\_

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## 1.0 LOCATION and DESCRIPTION

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**Creekside at Lorson Ranch Filing No. 2** is located east and southeasterly of the East Tributary of Jimmy Camp Creek. The site is located on approximately 6.009 acres of vacant land. This project will develop this site into single-family residential developments. The land for the residential lots is currently owned by Lorson LLC or its nominees for Lorson Ranch.

The site is located in the Northeast 1/2 of Section 23, Township 15 South and Range 65 West of the 6<sup>th</sup> Principal Meridian. The site is bounded on the north by Lorson Boulevard, on the east by Trappe Drive, on the south by Luneth Drive, and the East Tributary of Jimmy Camp Creek (East Tributary) on the west. For reference, a vicinity map is included in Appendix A of this report.

### Conformance with applicable Drainage Basin Planning Studies

There is an existing (unapproved) DBPS for Jimmy Camp Creek prepared by Wilson & Company in 1987, 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 and in 2018 the East Tributary was reconstructed from downstream of Lorson Boulevard north to the northern property line of Lorson Ranch in accordance with the 1987 study. The last section of the East Tributary (to the south property line of Lorson Ranch) has been designed by Kiowa Engineering and will be completed in 2020. There are no further improvements to be made on the East Tributary. On March 9, 2015, a new DBPS for Jimmy Camp Creek and the East Tributary was completed by Kiowa Engineering. The Kiowa Engineering DBPS for Jimmy Camp Creek has not been adopted by El Paso County but is allowed for concept design. The concept design includes the East Tributary armoring concept and the full spectrum detention pond requirements. The Kiowa DBPS did not calculate drainage fees so current El Paso County drainage/bridge fees apply to this development.

### Conformance with Lorson East MDDP by Core Engineering Group

Core Engineering Group has an approved MDDP for Lorson East, which covers this study area. This PDR conforms to the MDDP for Lorson East and is referenced in this report. The major infrastructure required for this site is existing Detention/WQ Pond E2 and Pond D2 and the East Tributary of Jimmy Camp Creek which was discussed above. Existing Pond E2 and Pond D2 are full spectrum detention/WQ ponds (including outlet structures) completed as part of the Creekside South at Lorson Ranch Filing No. 1 and Lorson Ranch East Filing No. 1 and detain/treats runoff from this project site for detention and water quality. There are no improvements to be made to Pond E2 and Pond D2 for this project. There are also two bridges over the East Tributary that were built in 2018 to provide access to this development across the East Tributary. The bridges are located at Fontaine Boulevard and Lorson Boulevard.

Creekside at Lorson Ranch Filing No. 2 is located within the ***“Jimmy Camp Creek Drainage Basin”***, which is a fee basin in El Paso County.

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## 2.0 DRAINAGE CRITERIA

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The supporting drainage design and calculations were performed in accordance with the City of Colorado Springs and El Paso County “Drainage Criteria Manual (DCM)”, dated November, 1991, the El Paso County “Engineering Criteria Manual”, Chapter 6 and Section 3.2.1 Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014, and the UDFCD “Urban Storm Drainage Criteria Manual” Volumes 1, 2 and 3 for inlet sizing and full spectrum ponds. No deviations from these published criteria are requested for this site.

The Rational Method as outlined in Section 6.3.0 of the May 2014 “Drainage Criteria Manual” and in Section 3.2.8.F of the El Paso County “Engineering Criteria Manual” was used for basins less than 130 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 the if detention is necessary, Full Spectrum Detention will be included in the design, based on this criteria. Full Spectrum Detention including water quality is provided in existing Pond E2 and Pond D2.

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### 3.0 EXISTING HYDROLOGICAL CONDITIONS

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This site is currently rough graded and undeveloped, with vegetation (grass with no shrubs) and moderate to steep slopes in a westerly direction to the East Tributary of Jimmy Camp Creek.

The Soil Conservation Service (SCS) classifies the soils within the Creekside at Lorson Ranch Filing No. 2 property as Manzanola Clay Loam and Wiley silt loam (see Table 3.1 below). Weathered bedrock may 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
52-Manzanola Clay Loam (59%)	C	Moderate to High	Slow	Medium	Moderate
108-Wiley Silt Loam	B	Moderate	Moderate	Medium	Moderate

Excerpts from the SCS “Soil Survey of El Paso County Area, Colorado” are provided in **Appendix A** for further reference.

In preparing hydrologic calculations for this report, the soil of each basin was weighted and used in the preparation of this report.

This site is located adjacent to 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 08041C10957 G, effective December 7, 2018.

Basin EX-E1

This existing basin directs runoff via overland, southerly and westerly, and drains into Existing Pond E2, then outlets to the East Tributary of Jimmy Camp Creek. The existing flow from this 3.90 acre basin is 0.8cfs and 5.4cfs for the 5-year and 100-year events.

Basin EX-E2

This existing basin directs runoff via overland, northerly and easterly to an existing inlet at the SW corner of Trappe Dr/Lorson Blvd. The existing runoff from this 1.04 acre basin is 0.4cfs and 2.3cfs for the 5-year and 100-year events.

Basin EX-E3

This existing basin directs runoff via overland, northerly and easterly to an existing inlet in the south side of Lorson Blvd. The existing runoff from this 0.1 acre basin is 0.1cfs and 0.3cfs for the 5-year and 100-year events.

Basin EX-E4

This existing basin directs runoff via overland westerly directly to the East Tributary of Jimmy Camp Creek. The existing runoff from this 0.65 acre basin is 0.4cfs and 2.2cfs for the 5-year and 100-year events.

Basin EX-E5

This existing basin directs runoff via overland, southerly and westerly to an existing inlet in the north side of Luneth Drive. The existing runoff from this 0.12 acre basin is 0.1cfs and 0.4cfs for the 5-year and 100-year events.

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#### 4.0 DEVELOPED HYDROLOGICAL CONDITIONS

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Hydrology for **Creekside at Lorson Ranch Filing No. 2** drainage report was based on the City of Colorado Springs/El Paso County Drainage Criteria. Sub-basins that lie within this project were determined and the 5-year and 100-year peak discharges for the developed conditions have been presented in this report. Based on these flows, storm inlets will be added when the street capacity is exceeded.

Soil types B and C have been weighted for the developed hydrologic conditions. See the appendix for the SCS Soils Map and detailed calculations.

The time of concentration for each basin was developed using an overland, ditch, street and pipe flow components. The maximum overland flow length for developed conditions was limited to 100 feet. Travel time velocities ranged from 2 to 6 feet per second. The travel time calculations are included in the back of this report.

Runoff coefficients for the various land uses were obtained from Table 6-6 dated May 2014 from the updated City of Colorado Springs/El Paso County Drainage Criteria Manual. See the appendix.

Drainage concepts for each of the basins are briefly discussed as follow:

##### Basin D1.1

This basin consists of runoff from residential development and the cul-de-sac in Akela Lane. Runoff will be directed towards Akela Lane, then routed north via curb/gutter to Design Point 1 and will be collected by a 5' Type R sump inlet. Runoff from this inlet is routed east in an 18" storm sewer to Trappe Drive, then north to existing pond D2 in existing storm sewer constructed as part of Lorson Ranch East Filing No. 1. For more detailed information, see the design point discussions. The developed flow from this 0.57 acre basin is 1.1cfs and 2.6cfs for the 5-year and 100-year storm event. See the appendix for detailed calculations.

##### Basin D1.2

This basin consists of runoff from residential development and Trappe Drive. Runoff will be directed easterly as sheet flow to Trappe Drive, then routed north via existing curb/gutter in Trappe Drive to an existing 25' Type R sump inlet. Runoff from this inlet is routed north via the existing storm drain system to the aforementioned existing Pond D2 built as part of Lorson Ranch East Filing No. 1. The proposed developed flow from this 0.55 acre basin is 1.1cfs and 2.5cfs for the 5-year and 100-year storm event. See the appendix for detailed calculations. The final drainage report for Lorson Ranch East Filing No.4 allows 0.57acres generating 1.4cfs/3.0cfs for the 5-year and 100-year storm event to drain to the existing sump inlet in this basin. The proposed flow is less than previously designed flow.

##### Basin D1.3

This basin consists of runoff from residential development and Lorson Blvd.. Runoff will be directed north as sheet flow to Lorson Blvd, then routed via existing curb/gutter in Lorson Blvd. to an existing 5' Type R sump inlet. Runoff from this inlet is routed north via the existing storm drain system to the existing Pond D2 built as part of Lorson Ranch East Filing No. 1. The proposed developed flow from this 0.61 acre basin is 1.5cfs and 3.3cfs for the 5-year and 100-year storm event. See the appendix for detailed calculations. The final drainage report for Lorson Ranch East Filing No.4 allows 2.0cfs/3.6cfs for the 5-year and 100-year storm event to drain to the existing sump inlet in this basin. The proposed flow is less than previously designed flow.

#### Basin E1.1

This basin consists of runoff from residential development and the eastern portion of Akela Lane. Runoff will be directed southwesterly and northwesterly to Akela Lane, then routed southerly and northerly via curb/gutter in Akela Lane to Design Point 2 and will be collected by a 5' Type R sump inlet. Runoff from this inlet is routed via the proposed and existing storm drain system to existing pond E2, located west of Creekside at Lorson Ranch Filing No. 2. For more detailed information, see the design point discussions. The developed flow from this 2.33 acre basin is 4.1cfs and 9.1cfs for the 5-year and 100-year storm event. See the appendix for detailed calculations.

#### Basin E1.2

This basin consists of runoff from residential development and the western portion of Akela Lane. Runoff will be directed southeasterly to Akela Lane, then routed southerly and northerly via curb/gutter in Akela Lane to Design Point 3 and will be collected by a 5' Type R sump inlet. Runoff from this inlet is routed via the proposed and existing storm drain system to the aforementioned existing pond E2. For more detailed information, see the design point discussions. The developed flow from this 1.27 acre basin is 2.1cfs and 4.7cfs for the 5-year and 100-year storm event. See the appendix for detailed calculations.

#### Basin E1.3

This basin consists of runoff from residential development and open space. Runoff sheetflows in a northerly direction to the aforementioned existing pond E2. The developed flow from this 0.32 acre basin is 0.7cfs and 1.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin E1.4

This basin consists of runoff from residential development and Luneth Drive. Runoff is directed southerly to Luneth Drive, then routed via curb/gutter in Luneth Drive to twin existing 10' Type R sump inlets. Runoff from these inlets is routed north via the storm drain system to the aforementioned existing Pond E2. The developed flow from this 0.29 acre basin is 0.7cfs and 1.5cfs for the 5-year and 100-year storm event. See the appendix for detailed calculations. The allowable flow to the existing inlets per the Creekside South at Lorson Ranch Filing No. 1 final drainage report is 0.9cfs/2.0cfs for the 5-year and 100-year storm events. The proposed flow is less than previously designed flow.

#### Basin E1.5

This basin consists of runoff from open space that flows west directly to the East Tributary of Jimmy Camp Creek. The developed flow from this 0.72 acre basin is 0.4cfs and 2.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

See the Developed Conditions Hydrology Calculations in the back of this report and the Developed Conditions Drainage Map (Map Pocket) for the 5-year and 100-year storm event amounts. All developed areas within this project are directed to Existing Pond D2 or Existing Pond E2 and both existing ponds are full spectrum WQ/Detention ponds owned/maintained by Lorson Ranch Metro District. Un-developed open space tract (Basin E1.5) adjacent to the East Tributary of Jimmy Camp Creek is allowed to drain west directly to the creek.

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## **5.0 HYDRAULIC SUMMARY**

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The sizing of the hydraulic structures and detentions ponds were prepared by using the *StormSewers* and *Hydrographs* computer software programs developed by Intellisolve, which conforms to the methods outlined in the "City of Colorado Springs/El Paso County Drainage Criteria Manual". Street capacities and Inlets were sized by Denver Urban Drainage's xcel spreadsheet UD-Inlet.

It is the intent of this drainage report to use the proposed curb/gutter and storm sewer in the streets to convey runoff to detention and water quality ponds then to the East Tributary of Jimmy Camp Creek. Inlet size and location are preliminary only as shown on the storm sewer layout in the appendix. See Appendix C for detailed hydraulic calculations and the storm sewer model.

Table 1: Street Capacities (100-year capacity is only 1/2 of street)

Street Slope	Residential Local		Residential Collector		Principal Arterial	
	5-year	100-year	5-year	100-year	5-year	100-year
0.5%	6.3	26.4	9.7	29.3	9.5	28.5
0.6%	6.9	28.9	10.6	32.1	10.4	31.2
0.7%	7.5	31.2	11.5	34.6	11.2	33.7
0.8%	8.0	33.4	12.3	37.0	12.0	36.0
0.9%	8.5	35.4	13.0	39.3	12.7	38.2
1.0%	9.0	37.3	13.7	41.4	13.4	40.2
1.4%	10.5	44.1	16.2	49.0	15.9	47.6
1.8%	12.0	45.4	18.4	50.4	18.0	50.4
2.2%	13.3	42.8	19.4	47.5	19.5	47.5
2.6%	14.4	40.7	18.5	45.1	18.5	45.1
3.0%	15.5	39.0	17.7	43.2	17.8	43.2
3.5%	16.7	37.2	16.9	41.3	17.0	41.3
4.0%	17.9	35.7	16.2	39.7	16.3	39.7
4.5%	19.0	34.5	15.7	38.3	15.7	38.3
5.0%	19.9	33.4	15.2	37.1	15.2	37.1

Note: all flows are in cfs (cubic feet per second)

Design Point 1

Design Point 1 is located at the north end of Akela Lane and accepts flows from (Basin D1.1).

<u>(5-year storm)</u>	
<b>Tributary Basins:</b> D1.1	<b>Inlet/MH Number:</b> Inlet DP1
<b>Upstream flowby:</b>	<b>Total Street Flow:</b> 1.1cfs
<b>Flow Intercepted:</b> 1.1cfs	<b>Flow Bypassed:</b> 0
<b>Inlet Size:</b> 5' type R, sump	
<b>Street Capacity:</b> Street slope = 0.6%, capacity = 6.9cfs, okay	
<u>(100-year storm)</u>	
<b>Tributary Basins:</b> D1.1	<b>Inlet/MH Number:</b> Inlet DP1
<b>Upstream flowby:</b>	<b>Total Street Flow:</b> 2.6cfs
<b>Flow Intercepted:</b> 2.6cfs	<b>Flow Bypassed:</b>
<b>Inlet Size:</b> 5' type R, sump	
<b>Street Capacity:</b> Street slope = 0.6%, capacity = 28.9cfs (half street) is okay Overflow path on this sump inlet is north directly to Lorson Boulevard.	



Design Point 1a

Design Point 1a is located at the SW corner of Lorson Boulevard and Trappe Drive and is located at an existing 18" RCP storm sewer constructed as part of Lorson Ranch East Filing No. 4. The total proposed flow in the pipe is from Design Point 1 and is 1.1cfs/2.6cfs in the 5/100-year storm events. The existing storm sewer was previously designed for 2.1cfs/4.6cfs in the 5/100-year storm events in the storm sewer per Lorson Ranch East Filing No. 4 for (Basin D.2.10a). The proposed flows are less than the previously designed flows resulting in lower HGL's. The storm sewer flows north in existing storm sewer to Pond D2 where the runoff is detained/treated for WQ. See Lorson Ranch East Filing No. 4 drainage report.

Design Point 2

Design Point 2 is located at the east side of Akela Lane at a low point and accepts flows from Akela Lane (Basin E1.1).

(5-year storm)

**Tributary Basins:** E1.1  
**Upstream flowby:**

**Inlet/MH Number:** Inlet DP2  
**Total Street Flow:** 4.1cfs

**Flow Intercepted:** 4.1cfs  
**Inlet Size:** 5' type R, sump

**Flow Bypassed:** 0

**Street Capacity:** Street slope = 0.6%, capacity = 6.9cfs, okay

(100-year storm)

**Tributary Basins:** E1.1  
**Upstream flowby:**

**Inlet/MH Number:** Inlet DP2  
**Total Street Flow:** 9.1cfs

**Flow Intercepted:** 9.1cfs  
**Inlet Size:** 5' type R, sump

**Flow Bypassed:**

**Street Capacity:** Street slope = 0.6%, capacity = 28.9cfs (half street) is okay

The overflow path on this sump inlet is west directly to Existing Pond E2

### Design Point 3

Design Point 3 is located at the west side of Akela Lane at a low point and accepts flows from Akela Lane (Basin E1.2).

#### (5-year storm)

**Tributary Basins:** E1.2  
**Upstream flowby:**

**Inlet/MH Number:** Inlet DP3  
**Total Street Flow:** 2.1cfs

**Flow Intercepted:** 2.1cfs  
**Inlet Size:** 5' type R, sump

**Flow Bypassed:** 0

**Street Capacity:** Street slope = 0.6%, capacity = 6.9cfs, okay

#### (100-year storm)

**Tributary Basins:** E1.2  
**Upstream flowby:**

**Inlet/MH Number:** Inlet DP3  
**Total Street Flow:** 4.7cfs

**Flow Intercepted:** 4.7cfs  
**Inlet Size:** 5' type R, sump

**Flow Bypassed:**

**Street Capacity:** Street slope = 0.6%, capacity = 28.9cfs (half street) is okay

The overflow path on this sump inlet is west directly to Existing Pond E2

### Design Point 4

Design Point 4 is the storm sewer pipe flow in Akela Lane from Design Pt's 2 and 3. The total pipe flow is 6.2cfs/13.8cfs in the 5/100-year storm events in the 24" storm sewer. The proposed storm sewer flows south and connects to an existing manhole constructed as part of Lorson Ranch East Filing No. 4. The existing type 1 storm manhole was constructed in LRE4 to accommodate a pipe size increase from 48" to 54" RCP and to accommodate flows from the future Akela Lane. The existing manhole was also constructed with a bulkheaded opening for a future 24" storm sewer (to the north) which will be connected to for this project. Included in this report is a hydraulic model of the storm sewer system including the existing 54" storm sewer draining to Pond E2. Per the hydraulic model, the HGL's meet criteria for the 5/100 year storm sewer events and not headwaters extend into the proposed 24" storm sewer.

### Overflow Swale from Trappe Drive to Des. Pt. 4

There are two existing sump inlets on Trappe Drive located east of Des. Pt. 4 that need an overflow path between lots 8 and 9 to reach Pond E2. The design flow can be taken from the Lorson Ranch East Filing No. 4 final drainage report and is the total flow in the existing 48" storm sewer pipe. The total design flow is 211.5cfs in the 100-yr storm event. A trapezoid swale (lined with TRM) with a 16' bottom, 3:1 side slopes and a 1.5' depth will convey the overflow between the lots directly to Pond E2. Hydraulic calculations for the swale can be found in the appendix. The TRM for the swale shall be American Green C350 or equal.

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## **6.0 DETENTION AND WATER QUALITY PONDS**

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Detention and Storm Water Quality for Creekside at Lorson Ranch Filing No. 2 is required per El Paso County criteria. There are two existing permanent full spectrum ponds including water quality that were designed/constructed to accommodate developed runoff from this development to be in compliance with the Lorson Ranch East MDDP. The ponds have been constructed and include access roads, outlet pipes, overflow structures, and low flow channels. Existing Pond D2 treats/detains runoff for the

“D” basins (Lorson Ranch East Filing No. 1) and Existing Pond E2 treats/detains runoff for the “E” basins (Creekside South Filing No. 1). The pond spreadsheets from the full spectrum design MHFD spreadsheets are included in the appendix of this report. Both existing ponds function as designed.

Water Quality

All developed areas within this project are directed to Existing Pond D2 or Existing Pond E2 and both existing ponds are full spectrum WQ/Detention ponds owned/maintained by Lorson Ranch Metro District. Runoff from Basin E1.5 (Tract A) which is an open space tract adjacent to the East Tributary of Jimmy Camp Creek is allowed to drain west directly to the creek per ECM Appendix I.7.1.B.7 which allows runoff from undeveloped land to flow offsite without WQ.

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**7.0 DRAINAGE AND BRIDGE FEES**

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Creekside at Lorson Ranch Filing No. 2 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 as part of the plat recordation process.

**Table 7.1: Public Drainage Facility Costs (non-reimbursable)**

Item	Quantity	Unit	Unit Cost	Item Total
Inlets/Manholes	4	EA	\$3000/EA	\$12,000
18” Storm	160	LF	\$35	\$5,600
24” Storm	96	LF	\$40	\$3,840
			Subtotal	\$21,440
			Eng/Cont (10%)	\$2,144
			Total Est. Cost	\$23,584

Creekside at Lorson Ranch Filing No. 2 contains 6.009 acres and is in the JCC drainage basin. The 2023 drainage fees are \$23,078 and the bridge fees are \$1,079 per impervious acre per Resolution 21-468. The drainage and bridge fees are calculated when the final plat is submitted and are due at plat recordation. Lorson Ranch intends to use the Bridge Fee credits for the bridge fees and pay drainage fees unless the Jimmy Camp Creek DBPS drainage fee structure is updated by El Paso County. The following table details the drainage fees for this filing:

**Table 7.2: 2023 Drainage/Bridge Fees**

Type of Land Use	Total Area (ac)	Imperviousness	Drainage Fee	Bridge Fee	Surety Fee
JCC Residential Area	4.665	62%	\$66,748	\$3,120	\$21,070
Open Space, Landscape Tracts	1.344	2%	\$620	\$29	\$195
		Total	\$67,368	\$3,149	\$21,265

Surety Fees have been removed from JCC. This can be taken out of the fee table.

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## 8.0 FOUR STEP PROCESS

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The site has been developed to minimize wherever possible the rate of developed runoff that will leave the site and to provide water quality management for the runoff produced by the site as proposed on the development plan. The following four step process should be considered and incorporated into the storm water collection system and storage facilities where applicable.

### Step 1: Employ Runoff Reduction Practices

Creekside at Lorson Ranch Filing No. 2 has employed several methods of reducing runoff.

- The street configuration was laid out to minimize the length of streets. Many streets are straight and perpendicular resulting in lots with less wasted space.
- There are open space buffers next to the East Tributary of Jimmy Camp Creek
- Utilize two existing full spectrum detention ponds for detention/water quality. The full spectrum detention mimics existing storm discharges and includes water quality.

### Step 2: Stabilize Drainageways

East Tributary of Jimmy Camp Creek is a major drainageway located west of this site. In 2014 and in 2018 the East Tributary of JCC was reconstructed and stabilized per county criteria. The design included a natural sand bottom and armored sides.

### Step 3: Provide Water Quality Capture Volume

Treatment of the water quality capture volume (WQCV) is required for all new developments. Creekside at Lorson Ranch Filing No. 2 will utilize the two existing full spectrum stormwater extended detention basins which include Water Quality Volumes and WQ outlet structures.

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

There are no commercial or industrial areas within this site.

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## 9.0 CONCLUSIONS

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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
- The East Tributary of Jimmy Camp Creek has been reconstructed west of this study area
- Bridges over the East Tributary at Lorson Boulevard and Fontaine Boulevard and have been constructed providing access to this site.
- Detention and water quality for this site area is provided in two existing full spectrum permanent ponds
- The proposed development and drainage infrastructure will not cause adverse impacts to adjacent properties or properties/facilities located downstream.

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## 10.0 REFERENCES

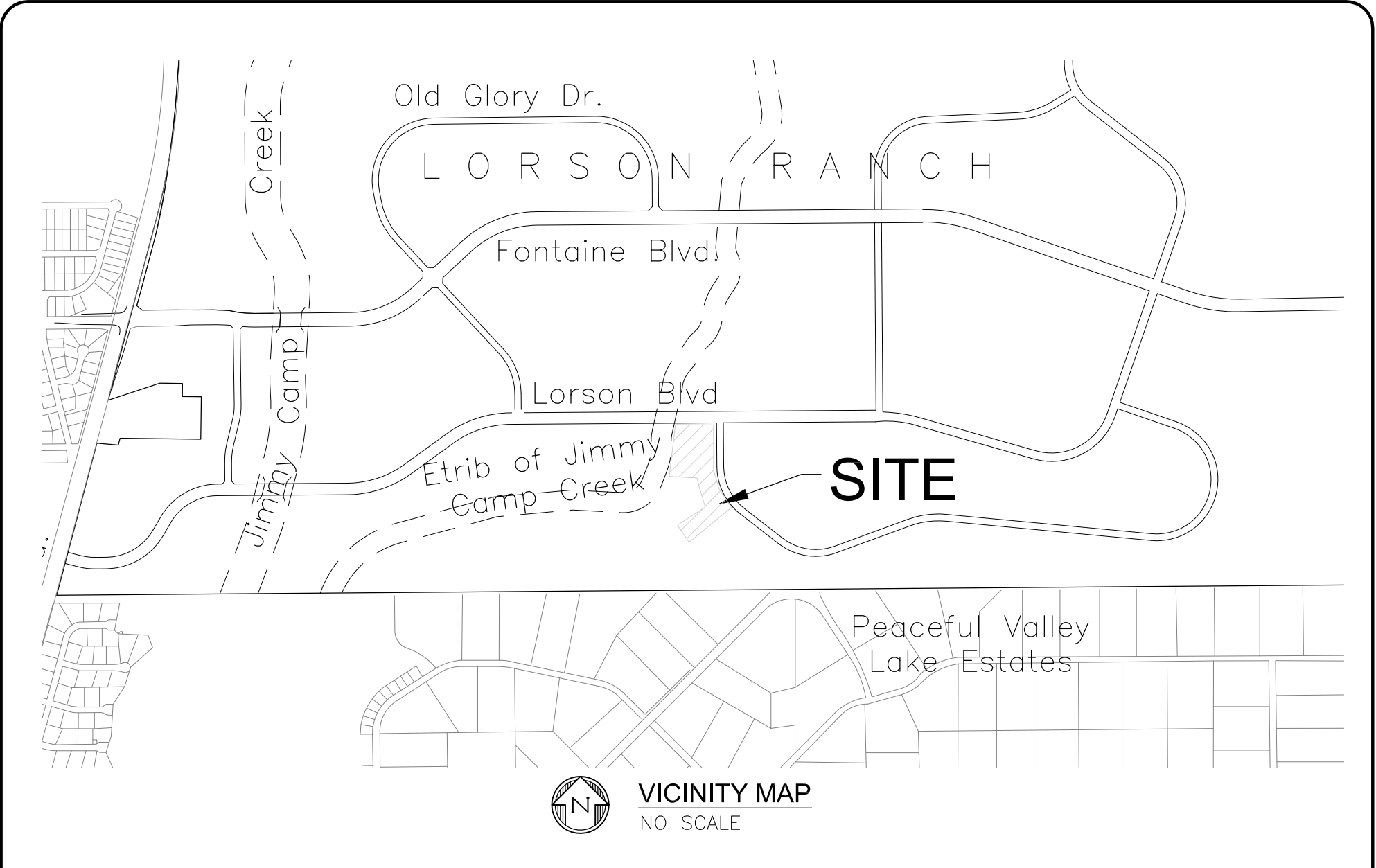
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1. City of Colorado Springs/El Paso County Drainage Criteria Manual DCM, dated November, 1991
2. Soil Survey of El Paso County Area, Colorado by USDA, SCS
3. Jimmy Camp Creek Drainage Basin Planning Study, Dated March 9, 2015, by Kiowa Engineering Corporation
4. City of Colorado Springs "Drainage Criteria Manual, Volume 2
5. El Paso County "Engineering Criteria Manual"
6. Lorson Ranch East MDDP, June 30, 2017 by Core Engineering.
7. 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.
8. Lorson Ranch East MDDP prepared by Core Engineering Group, dated November 27, 2017
9. Final Drainage Report for Lorson Ranch East Filing No. 1 prepared by Core Engineering Group, Reference SF18-008, approved July 24, 2018
10. Final Drainage Report for Lorson Ranch East Filing No. 4 prepared by Core Engineering Group, Reference SF19-008, approved September 12, 2019
11. Final Drainage Report for Creekside South at Lorson Ranch Filing No. 1 prepared by Core Engineering Group, Reference SF 20-017, approved September 20, 2020

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**APPENDIX A – VICINTIY MAP, SOILS MAP, FEMA MAP**

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**VICINITY MAP**  
NO SCALE



**CORE**  
ENGINEERING GROUP

15004 1ST AVE. S.  
BURNSVILLE, MN 55306  
PH: 719.570.1100

CONTACT: RICHARD L. SCHINDLER, P.E.  
EMAIL: Rich@ceg1.com

**CREEKSIDE SOUTH AT LORSON RANCH FIL. NO. 2**  
**VICINITY MAP**

SCALE:  
NTS

DATE:  
MAY, 2022

FIGURE NO.  
--

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

City of Colorado Springs  
080060

REVISED AREA

REVISED AREA

SITE

El Paso County  
Unincorporated Areas  
080059

City of Fountain  
080061

JOINS PANEL 0976

**SPECIAL FLOOD HAZARD AREAS**

- Without Base Flood Elevation (BFE)  
Zone A, V, AS9
- With BFE or Depth Zone AE, AD, AH, VE, AR
- Regulatory Floodway
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee See Notes, Zone X

**SCALE**

Map Projection:  
Universal Transverse Mercator NAD 1983 UTM Zone 13N  
Western Hemisphere, Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

**FEMA**  
National Flood Insurance Program

**NATIONAL FLOOD INSURANCE PROGRAM**  
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO  
and Incorporated Areas

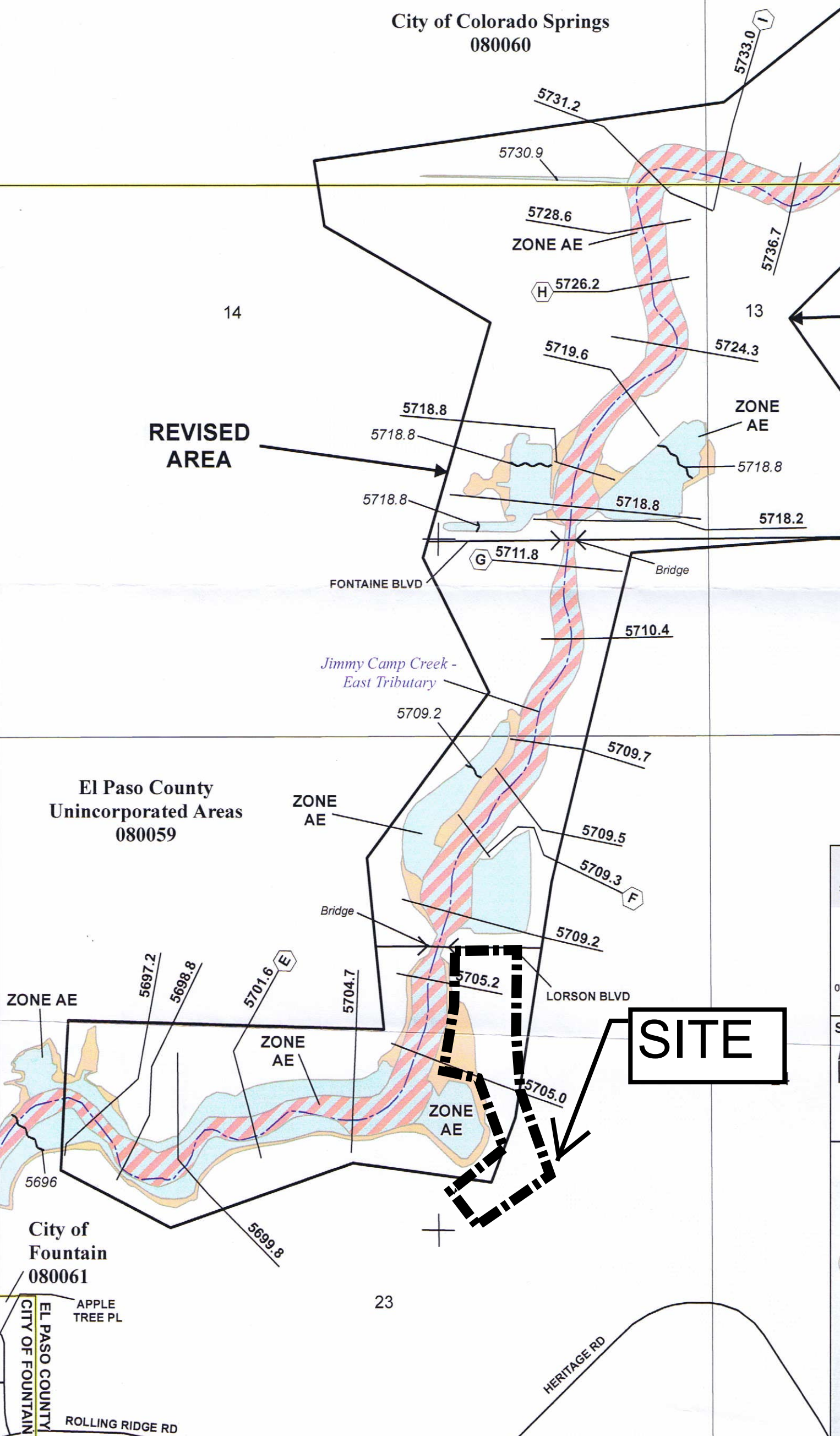
PANEL 957 OF 1300

Panel Contains:

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

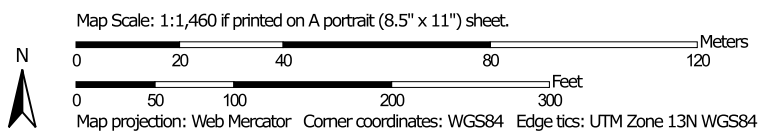
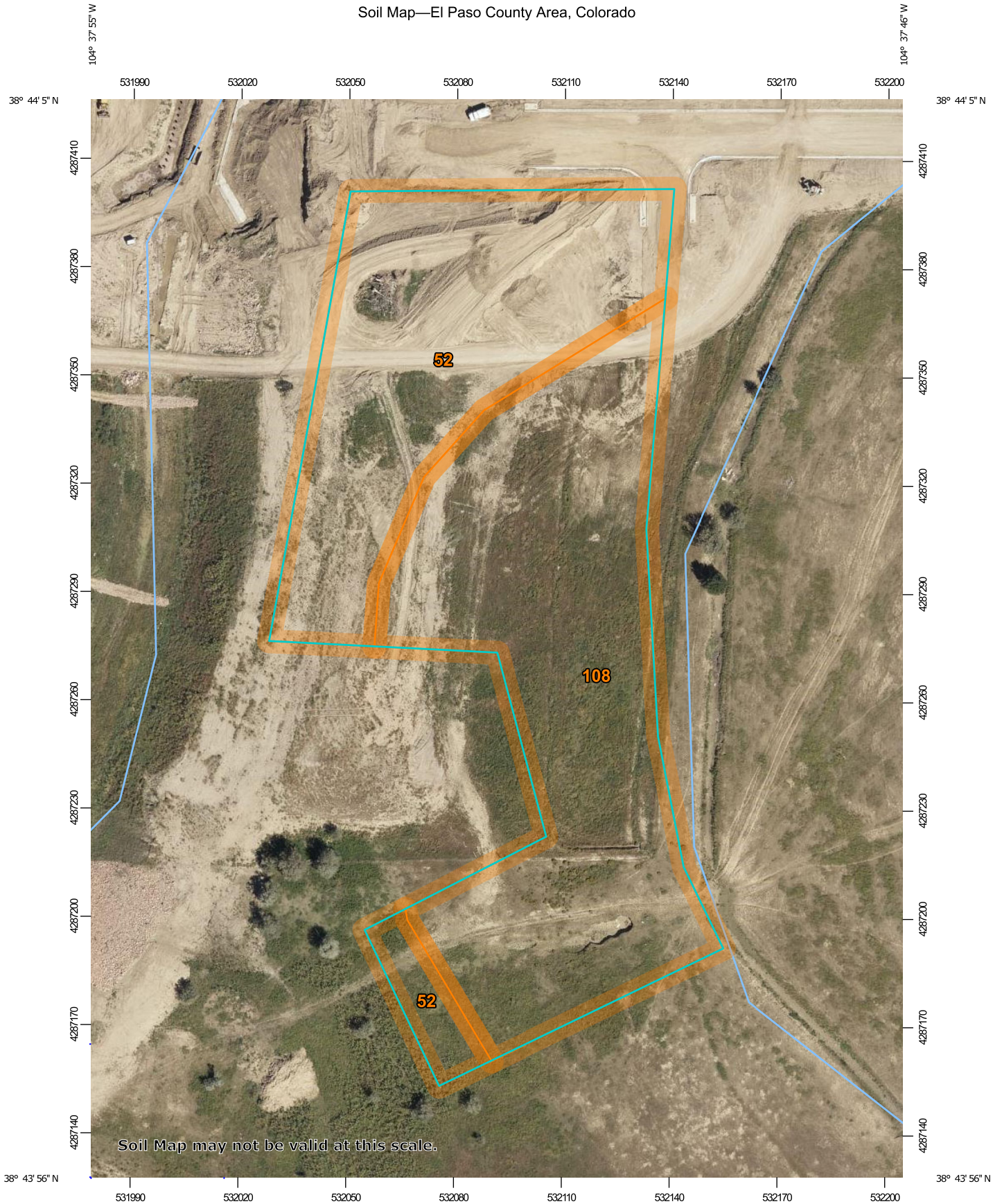
REVISED TO REFLECT LOMR EFFECTIVE: May 4, 2020

VERSION NUMBER 1.1.1.0  
MAP NUMBER 08041C0957G  
MAP REVISED DECEMBER 7, 2018










































Soil Map—El Paso County Area, Colorado



## MAP LEGEND

-  Area of Interest (AOI)
-  Area of Interest (AOI)
- Soils**
-  Soil Map Unit Polygons
-  Soil Map Unit Lines
-  Soil Map Unit Points
- Special Point Features**
-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot
-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features
- Water Features**
-  Streams and Canals
- Transportation**
-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads
- Background**
-  Aerial Photography

## MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado  
 Survey Area Data: Version 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Aug 14, 2018—Sep 23, 2018

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

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
52	Manzanst clay loam, 0 to 3 percent slopes	1.9	42.2%
108	Wiley silt loam, 3 to 9 percent slopes	2.6	57.8%
<b>Totals for Area of Interest</b>		<b>4.6</b>	<b>100.0%</b>

## El Paso County Area, Colorado

### 52—Manzanst clay loam, 0 to 3 percent slopes

#### Map Unit Setting

*National map unit symbol:* 2w4nr  
*Elevation:* 4,060 to 6,660 feet  
*Mean annual precipitation:* 14 to 16 inches  
*Mean annual air temperature:* 50 to 54 degrees F  
*Frost-free period:* 130 to 170 days  
*Farmland classification:* Prime farmland if irrigated

#### Map Unit Composition

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

#### Description of Manzanst

##### Setting

*Landform:* Terraces, drainageways  
*Landform position (three-dimensional):* Tread  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear, concave  
*Parent material:* Clayey alluvium derived from shale

##### Typical profile

*A - 0 to 3 inches:* clay loam  
*Bt - 3 to 12 inches:* clay  
*Btk - 12 to 37 inches:* clay  
*Bk1 - 37 to 52 inches:* clay  
*Bk2 - 52 to 79 inches:* clay

##### Properties and qualities

*Slope:* 0 to 3 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Well drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum content:* 15 percent  
*Gypsum, maximum content:* 3 percent  
*Maximum salinity:* Slightly saline (4.0 to 7.0 mmhos/cm)  
*Sodium adsorption ratio, maximum:* 10.0  
*Available water supply, 0 to 60 inches:* High (about 9.0 inches)

##### Interpretive groups

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

*Hydrologic Soil Group:* C  
*Ecological site:* R067BY037CO - Saline Overflow  
*Hydric soil rating:* No

### **Minor Components**

#### **Ritoazul**

*Percent of map unit:* 7 percent  
*Landform:* Drainageways, interfluves  
*Landform position (three-dimensional):* Rise  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Ecological site:* R067BY042CO - Clayey Plains  
*Hydric soil rating:* No

#### **Arvada**

*Percent of map unit:* 6 percent  
*Landform:* Drainageways, interfluves  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Ecological site:* R067BY033CO - Salt Flat  
*Hydric soil rating:* No

#### **Wiley**

*Percent of map unit:* 2 percent  
*Landform:* Interfluves  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Ecological site:* R067BY002CO - Loamy Plains  
*Hydric soil rating:* No

## **Data Source Information**

Soil Survey Area: El Paso County Area, Colorado  
Survey Area Data: Version 19, Aug 31, 2021

## El Paso County Area, Colorado

### 108—Wiley silt loam, 3 to 9 percent slopes

#### Map Unit Setting

*National map unit symbol:* 367b  
*Elevation:* 5,200 to 6,200 feet  
*Mean annual precipitation:* 12 to 14 inches  
*Mean annual air temperature:* 48 to 52 degrees F  
*Frost-free period:* 135 to 155 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Wiley and similar soils:* 95 percent  
*Minor components:* 5 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Wiley

##### Setting

*Landform:* Hills  
*Landform position (three-dimensional):* Side slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Calcareous silty eolian deposits

##### Typical profile

*A - 0 to 4 inches:* silt loam  
*Bt - 4 to 16 inches:* silt loam  
*Bk - 16 to 60 inches:* silt loam

##### Properties and qualities

*Slope:* 3 to 9 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Well drained  
*Runoff class:* Medium  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum content:* 15 percent  
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)  
*Available water supply, 0 to 60 inches:* High (about 11.5 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 4e  
*Land capability classification (nonirrigated):* 6e  
*Hydrologic Soil Group:* B  
*Ecological site:* R067BY002CO - Loamy Plains

*Other vegetative classification:* LOAMY PLAINS (069AY006CO)

*Hydric soil rating:* No

### **Minor Components**

#### **Other soils**

*Percent of map unit:* 4 percent

*Hydric soil rating:* No

#### **Pleasant**

*Percent of map unit:* 1 percent

*Landform:* Depressions

*Hydric soil rating:* Yes

## **Data Source Information**

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 19, Aug 31, 2021

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**APPENDIX B – HYDROLOGY CALCULATIONS**

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

Calculated By: Leonard Beasley

Date: Feb. 3, 2022

Checked By: Leonard Beasley

Job No: 100.069

Project: Creekside South at Lorson Ranch Filing No. 2

Design Storm: 5 - Year Event (Current)

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t <sub>c</sub>	CA	i	Q	t <sub>c</sub>	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t <sub>t</sub>	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
EX-E1			3.90	0.09	35.1	0.35	2.24	0.8													
EX-E2			1.04	0.13	23.2	0.14	2.86	0.4													
EX-E3			0.10	0.13	8.0	0.01	4.46	0.1													
EX-E4			0.65	0.13	9.0	0.08	4.29	0.4													
EX-E5			0.12	0.13	9.0	0.02	4.29	0.1													



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

Calculated By: Leonard Beasley  
 Date: Aug, 2022  
 Checked By: Leonard Beasley

Job No: 100.069  
 Project: Creekside South at Lorson Ranch Filing No. 2  
 Design Storm: **100-Year Event (Current)**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	t <sub>c</sub>	CA	i	Q	t <sub>c</sub>	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	t <sub>t</sub>	
			ac.			min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	
EX-E1			3.90	0.37	35.1	1.44	3.77	5.4													
EX-E2			1.04	0.46	23.2	0.48	4.81	2.3													
EX-E3			0.10	0.46	8.0	0.05	7.49	0.3													
EX-E4			0.65	0.46	9.0	0.30	7.20	2.2													
EX-E5			0.12	0.46	9.0	0.06	7.20	0.4													



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

Calculated By: Leonard Beasley  
 Date: Aug, 2022  
 Checked By: Leonard Beasley

Job No: 100.069  
 Project: Creekside South at Lorson Ranch Filing No. 2  
 Design Storm: **5 - Year Event (Proposed)**

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	$t_c$	$\Sigma$ (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	
D1.1			0.57	0.48	9.7	0.27	4.18	1.1													
D1.2			0.55	0.45	7.4	0.25	4.58	1.1													
D1.3			0.61	0.49	6.0	0.30	4.90	1.5													
E1.1			2.33	0.45	11.3	1.05	3.95	4.1													
E1.2			1.27	0.45	13.2	0.57	3.71	2.1													
E1.3			0.32	0.48	7.8	0.15	4.51	0.7													
E1.4			0.29	0.48	5.9	0.14	4.93	0.7													
E1.5			0.72	0.13	10.4	0.09	4.07	0.4													



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

Calculated By: Leonard Beasley  
 Date: Aug. 2022  
 Checked By: Leonard Beasley

Job No: 100.069  
 Project: Creekside South at Lorson Ranch Filing No. 2  
 Design Storm: **100 - Year Event (Proposed)**

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	$t_c$	$\Sigma(CA)$	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	
D1.1			0.57	0.64	9.7	0.36	7.02	2.6													
D1.2			0.55	0.59	7.4	0.32	7.69	2.5													
D1.3			0.61	0.65	6.0	0.40	8.22	3.3													
E1.1			2.33	0.59	11.3	1.37	6.63	9.1													
E1.2			1.27	0.59	13.2	0.75	6.23	4.7													
E1.3			0.32	0.64	7.8	0.20	7.57	1.6													
E1.4			0.29	0.64	5.9	0.19	8.27	1.5													
E1.5			0.72	0.44	10.4	0.32	6.83	2.2													



15004 1st Avenue South  
Burnsville, MN 55306

**PROJECT NAME:** Creekside South at Lorson Ranch Filing No. 2  
**PROJECT NUMBER:** 100.069  
**ENGINEER:** LAB  
**DATE:** August, 2022

Preliminary Drainage Plan

**CURRENT CONDITIONS COEFFICIENT "C" CALCULATIONS**

BASIN	Soil No.	Hydro Group	Area	Cover (%)	C5	Wtd. C5	C100	Wtd. C100	Impervious	Type of Cover
EX-E1	108	B	3.72	95.38%	0.09	0.09	0.36	0.34	100%	Undeveloped
	52	C	0.18	4.62%	0.16	0.01	0.51	0.02	80%	Undeveloped
			3.90	100.00%		0.09		0.37		
EX-E2	108	B	0.38	36.54%	0.09	0.03	0.36	0.13	10%	Undeveloped
	52	C	0.66	63.46%	0.16	0.10	0.51	0.32	10%	Undeveloped
			1.04	100.00%		0.13		0.46		
EX-E3	108	B	0.04	36.36%	0.09	0.03	0.36	0.13	10%	Undeveloped
	52	C	0.06	63.64%	0.16	0.10	0.51	0.32	10%	Undeveloped
			0.10	100.00%		0.13		0.46		
EX-E4	108	B	0.23	36.12%	0.09	0.03	0.36	0.13	10%	Undeveloped
	52	C	0.41	63.88%	0.16	0.10	0.51	0.33	10%	Undeveloped
			0.65	100.00%		0.13		0.46		
EX-E5	108	B	0.04	36.44%	0.09	0.03	0.36	0.13	10%	Undeveloped
	52	C	0.08	63.56%	0.16	0.10	0.51	0.32	10%	Undeveloped
			0.12	100.00%		0.13		0.46		



**Standard Form SF-1. Time of Concentration-Current**

Calculated By: Leonard Beasley  
 Date: Feb. 3, 2022  
 Checked By: Leonard Beasley

Job No: 100.069  
 Project: Creekside South at Lorson Ranch Filing No. 2

Sub-Basin Data				Initial Overland Time (t <sub>i</sub> )				Travel Time (t <sub>t</sub> )					Final t <sub>c</sub>
BASIN or DESIGN	C <sub>s</sub>	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t <sub>i</sub> minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t <sub>t</sub> minutes	Computed t <sub>c</sub> Minutes	USDCM Recommended t <sub>c</sub> =t <sub>i</sub> +t <sub>t</sub> (min)
EX-E1	0.09	3.72	10.0	140.00	0.71%	0.10	24.16	506.00	0.59%	0.77	10.98	35.14	35.14
EX-E2	0.13	1.04	10.0	114.00	0.88%	0.10	19.50	232.00	1.08%	1.04	3.72	23.23	23.23
EX-E3	0.13	0.10	10.0	20.00	1.00%	0.04	7.83	5.00	1.00%	1.00	0.08	7.92	7.92
EX-E4	0.13	0.65	10.0	30.00	1.00%	0.05	9.59	5.00	1.00%	1.00	0.08	9.68	9.68
EX-E5	0.13	0.12	10.0	40.00	2.00%	0.08	8.81	5.00	2.00%	1.41	0.06	8.87	8.87



15004 1st Avenue South  
Burnsville, MN 55306

**PROJECT NAME:** Creekside South at Lorson Ranch 2  
**PROJECT NUMBER:** 100.069  
**ENGINEER:** LAB  
**DATE:** Aug, 2022

**Preliminary Drainage Plan**  
**PROPOSED CONDITIONS COEFFICIENT "C" CALCULATIONS**

BASIN	Soil No.	Hydro Group	Area	Cover (%)	C5	Wtd. C5	C100	Wtd. C100	Impervious	Type of Cover
D1.1	108	B	0.09	15.79%	0.45	0.07	0.59	0.09	65%	1/8 ac. Single Family
	52	C	0.48	84.21%	0.49	0.41	0.65	0.55	65%	1/8 ac. Single Family
			0.57	100.00%		0.48		0.64		
D1.2	108	B	0.53	96.36%	0.45	0.43	0.59	0.57	65%	1/8 ac. Single Family
	52	C	0.02	3.64%	0.49	0.02	0.65	0.02	65%	1/8 ac. Single Family
			0.55	100.00%		0.45		0.59		
D1.3	108	B	0.00	0.00%	0.45	0.00	0.59	0.00	65%	1/8 ac. Single Family
	52	C	0.61	100.00%	0.49	0.49	0.65	0.65	65%	1/8 ac. Single Family
			0.61	100.00%		0.49		0.65		
E1.1	108	B	2.32	99.57%	0.45	0.45	0.59	0.59	65%	1/8 ac. Single Family
	52	C	0.01	0.43%	0.49	0.00	0.65	0.00	65%	1/8 ac. Single Family
			2.33	100.00%		0.45		0.59		
E1.2	108	B	1.19	93.70%	0.45	0.42	0.59	0.55	65%	1/8 ac. Single Family
	52	C	0.08	6.30%	0.49	0.03	0.65	0.04	65%	1/8 ac. Single Family
			1.27	100.00%		0.45		0.59		
E1.3	108	B	0.06	18.75%	0.45	0.08	0.59	0.11	65%	1/8 ac. Single Family
	52	C	0.26	81.25%	0.49	0.40	0.65	0.53	65%	1/8 ac. Single Family
			0.32	100.00%		0.48		0.64		
E1.4	108	B	0.04	13.79%	0.45	0.06	0.59	0.08	65%	1/8 ac. Single Family
	52	C	0.25	86.21%	0.49	0.42	0.65	0.56	65%	1/8 ac. Single Family
			0.29	100.00%		0.48		0.64		
E1.5	108	B	0.30	41.67%	0.10	0.04	0.35	0.15	10%	OPEN SPACE
	52	C	0.42	58.33%	0.15	0.09	0.50	0.29	10%	OPEN SPACE
			0.72	100.00%		0.13		0.44		



**Standard Form SF-1. Time of Concentration-Proposed**

Calculated By: Leonard Beasley

Job No: 100.069

Date: Nov. 23, 2021

Project: Creeksid South at Lorson Ranch 2

Checked By: Leonard Beasley

Sub-Basin Data				Initial Overland Time (t <sub>i</sub> )				Travel Time (t <sub>t</sub> )					t <sub>c</sub> Check (urbanized Basins)		Final t <sub>c</sub>
BASIN or DESIGN	C <sub>s</sub>	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t <sub>i</sub> minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t <sub>t</sub> minutes	Computed t <sub>c</sub> Minutes	TOTAL LENGTH (L) feet	Regional t <sub>c</sub> tc=(L/180)+10 minutes	USDCM Recommended tc=ti+tt (min)
D1.1	0.48	0.57	20.0	94.00	2.24%	0.19	8.35	156.00	1.00%	2.00	1.30	9.65	250.00	11.39	9.65
D1.2	0.45	0.55	20.0	37.00	2.00%	0.11	5.70	258.00	1.60%	2.53	1.70	7.40	295.00	11.64	7.40
D1.3	0.61	0.55	20.0	50.00	2.00%	0.17	5.00	100.00	0.70%	1.67	1.00	5.99	150.00	10.83	5.99
E1.1	0.45	2.33	20.0	74.00	2.17%	0.16	7.85	413.00	1.00%	2.00	3.44	11.29	487.00	12.71	11.29
E1.2	0.45	1.27	20.0	97.00	2.00%	0.18	9.23	484.00	1.00%	2.00	4.03	13.26	581.00	13.23	13.23
E1.3	0.48	0.32	20.0	92.00	2.72%	0.20	7.75	0.00	0.00%	0.00	0.00	7.75	92.00	10.51	7.75
E1.4	0.49	0.29	20.0	39.00	2.56%	0.13	5.06	183.00	3.55%	3.77	0.81	5.87	222.00	11.23	5.87
E1.5	0.13	0.72	20.0	70.00	2.00%	0.10	11.70	5.00	25.00%	10.00	0.01	11.71	75.00	10.42	11.71



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## APPENDIX C – HYDRAULIC CALCULATIONS

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# Channel Report

Hydraflow Express by Intelisolve

Wednesday, Apr 27 2022, 12:5 PM

## Overflow Swale

### Trapezoidal

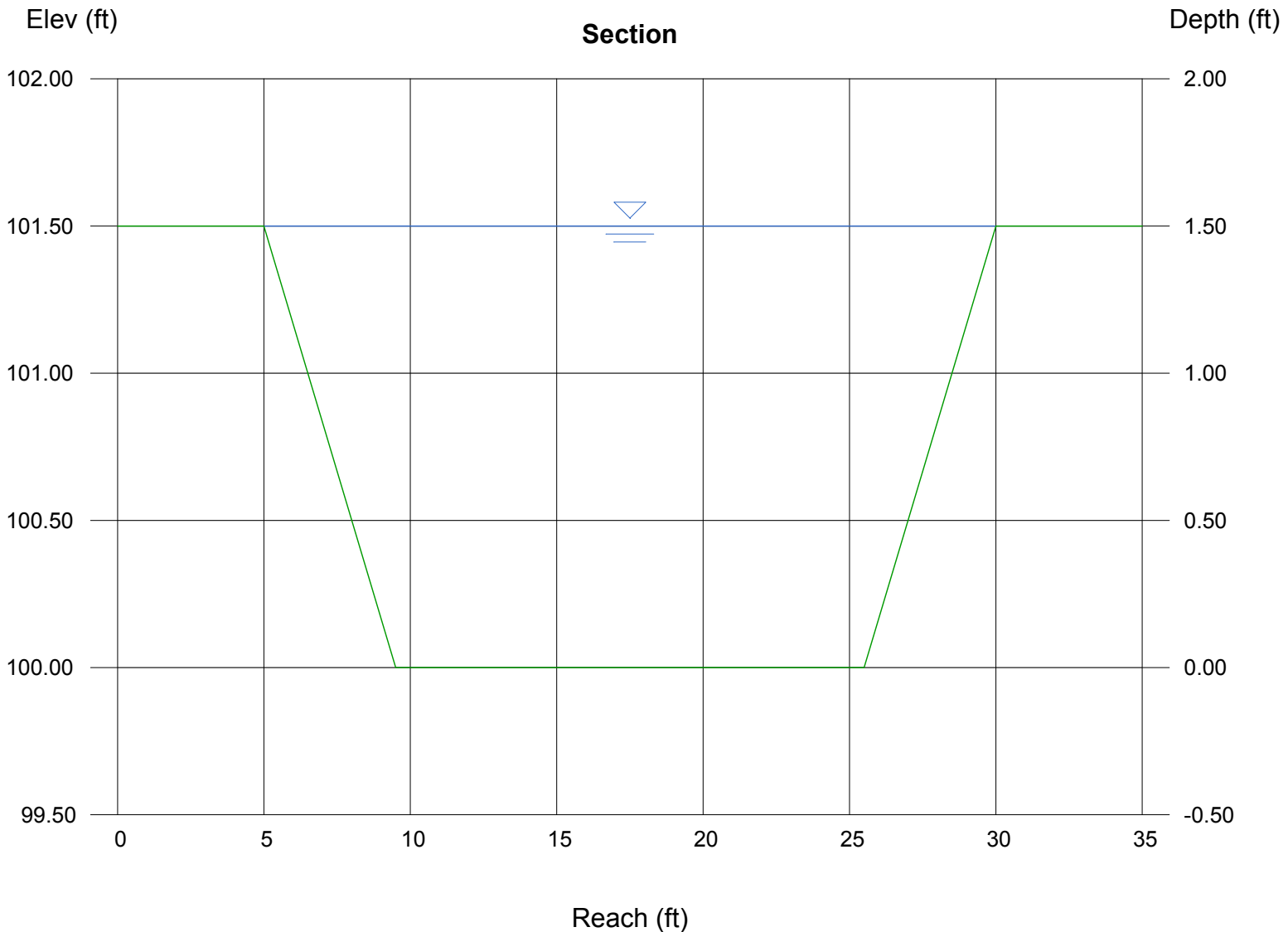
Bottom Width (ft) = 16.00  
Side Slope (z:1) = 3.00  
Total Depth (ft) = 1.50  
Invert Elev (ft) = 100.00  
Slope (%) = 0.50  
N-Value = 0.017

### Highlighted

Depth (ft) = 1.50  
Q (cfs) = 215.42  
Area (sqft) = 30.75  
Velocity (ft/s) = 7.01  
Wetted Perim (ft) = 25.49  
Crit Depth,  $Y_c$  (ft) = 1.43  
Top Width (ft) = 25.00  
EGL (ft) = 2.26

### Calculations

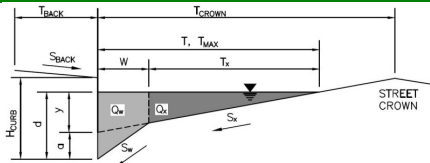
Compute by: Q vs Depth  
No. Increments = 10



**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

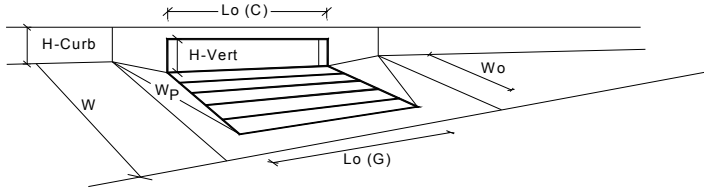
Project: Creekside South at Lorson Ranch Filing No. 2, #100.069  
 Inlet ID: Inlet I-1, DP-1 (D1.1)



Gutter Geometry (Enter data in the blue cells)							
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 8.0$ ft						
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft						
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.015$						
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches						
Distance from Curb Face to Street Crown	$T_{CROWN} = 47.0$ ft						
Gutter Width	$W = 2.00$ ft						
Street Transverse Slope	$S_x = 0.020$ ft/ft						
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft						
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.000$ ft/ft						
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.017$						
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>ft</th> </tr> </thead> <tbody> <tr> <td><math>T_{MAX} = 18.5</math></td> <td><math>T_{MAX} = 24.5</math></td> <td></td> </tr> </tbody> </table>	Minor Storm	Major Storm	ft	$T_{MAX} = 18.5$	$T_{MAX} = 24.5$	
Minor Storm	Major Storm	ft					
$T_{MAX} = 18.5$	$T_{MAX} = 24.5$						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1"> <thead> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>inches</th> </tr> </thead> <tbody> <tr> <td><math>d_{MAX} = 6.0</math></td> <td><math>d_{MAX} = 7.9</math></td> <td></td> </tr> </tbody> </table>	Minor Storm	Major Storm	inches	$d_{MAX} = 6.0$	$d_{MAX} = 7.9$	
Minor Storm	Major Storm	inches					
$d_{MAX} = 6.0$	$d_{MAX} = 7.9$						
Check boxes are not applicable in SUMP conditions	<input type="checkbox"/> <input type="checkbox"/>						
<b>MINOR STORM Allowable Capacity is based on Depth Criterion</b>							
<b>MAJOR STORM Allowable Capacity is based on Depth Criterion</b>							
	<table border="1"> <thead> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>cfs</th> </tr> </thead> <tbody> <tr> <td><math>Q_{allow} = \text{SUMP}</math></td> <td><math>Q_{allow} = \text{SUMP}</math></td> <td></td> </tr> </tbody> </table>	Minor Storm	Major Storm	cfs	$Q_{allow} = \text{SUMP}$	$Q_{allow} = \text{SUMP}$	
Minor Storm	Major Storm	cfs					
$Q_{allow} = \text{SUMP}$	$Q_{allow} = \text{SUMP}$						

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	MINOR      MAJOR	
Type of Inlet	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a' from above)	Type =	CDOT Type R Curb Opening
Number of Unit Inlets (Grate or Curb Opening)	a <sub>local</sub> =	3.00      3.00 inches
Water Depth at Flowline (outside of local depression)	No =	1      1
<b>Grate Information</b>	Ponding Depth =	3.4      4.5 inches
Length of a Unit Grate		<input checked="" type="checkbox"/> Override Depths
Width of a Unit Grate	L <sub>o</sub> (G) =	MINOR      MAJOR
Area Opening Ratio for a Grate (typical values 0.15-0.90)	W <sub>o</sub> =	N/A      N/A feet
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	A <sub>ratio</sub> =	N/A      N/A feet
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>r</sub> (G) =	N/A      N/A
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>w</sub> (G) =	N/A      N/A
<b>Curb Opening Information</b>	C <sub>o</sub> (G) =	N/A      N/A
Length of a Unit Curb Opening		MINOR      MAJOR
Height of Vertical Curb Opening in Inches	L <sub>o</sub> (C) =	5.00      5.00 feet
Height of Curb Orifice Throat in Inches	H <sub>vert</sub> =	6.00      6.00 inches
Angle of Throat (see USDCM Figure ST-5)	H <sub>throat</sub> =	6.00      6.00 inches
Side Width for Depression Pan (typically the gutter width of 2 feet)	Theta =	63.40      63.40 degrees
Clogging Factor for a Single Curb Opening (typical value 0.10)	W <sub>p</sub> =	2.00      2.00 feet
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>r</sub> (C) =	0.10      0.10
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>w</sub> (C) =	3.60      3.60
<b>Low Head Performance Reduction (Calculated)</b>	C <sub>o</sub> (C) =	0.67      0.67
Depth for Grate Midwidth		MINOR      MAJOR
Depth for Curb Opening Weir Equation	d <sub>grate</sub> =	N/A      N/A ft
Combination Inlet Performance Reduction Factor for Long Inlets	d <sub>curb</sub> =	0.12      0.21 ft
Curb Opening Performance Reduction Factor for Long Inlets	RF <sub>Combination</sub> =	0.44      0.57
Grated Inlet Performance Reduction Factor for Long Inlets	RF <sub>Curb</sub> =	0.98      1.00
	RF <sub>Grate</sub> =	N/A      N/A
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>		MINOR      MAJOR
<b>Inlet Capacity IS GOOD for Minor and Major Storms(&gt;Q PEAK)</b>	Q <sub>a</sub> =	1.1      2.6 cfs
	Q <sub>PEAK REQUIRED</sub> =	1.1      2.6 cfs

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

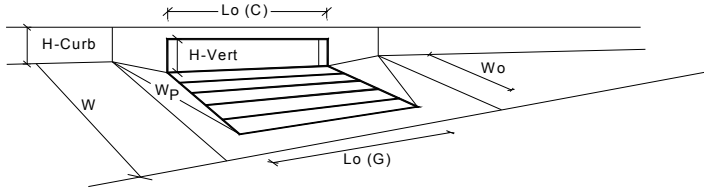
Project: Creekside South at Lorson Ranch Filing No. 2, #100.069  
 Inlet ID: Inlet I-2, DP-2 (E1.1)



<b>Gutter Geometry (Enter data in the blue cells)</b>									
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="8.0"/> ft								
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.015"/>								
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches								
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="17.0"/> ft								
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.00"/> ft								
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft								
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.000"/> ft/ft								
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.017"/>								
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"></td> <td style="text-align: center; border: none;">Minor Storm</td> <td style="text-align: center; border: none;">Major Storm</td> <td style="border: none;"></td> </tr> <tr> <td style="border: none;"><math>T_{MAX} = </math></td> <td style="border: 1px solid blue; width: 50px; text-align: center;">16.5</td> <td style="border: 1px solid blue; width: 50px; text-align: center;">17.0</td> <td style="border: none;">ft</td> </tr> </table>		Minor Storm	Major Storm		$T_{MAX} = $	16.5	17.0	ft
	Minor Storm	Major Storm							
$T_{MAX} = $	16.5	17.0	ft						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"></td> <td style="text-align: center; border: none;">Minor Storm</td> <td style="text-align: center; border: none;">Major Storm</td> <td style="border: none;"></td> </tr> <tr> <td style="border: none;"><math>d_{MAX} = </math></td> <td style="border: 1px solid blue; width: 50px; text-align: center;">6.0</td> <td style="border: 1px solid blue; width: 50px; text-align: center;">7.9</td> <td style="border: none;">inches</td> </tr> </table>		Minor Storm	Major Storm		$d_{MAX} = $	6.0	7.9	inches
	Minor Storm	Major Storm							
$d_{MAX} = $	6.0	7.9	inches						
Check boxes are not applicable in SUMP conditions	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center;"><input type="checkbox"/></td> <td style="width: 50%; text-align: center;"><input type="checkbox"/></td> </tr> </table>	<input type="checkbox"/>	<input type="checkbox"/>						
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	Minor Storm	Major Storm							
$Q_{allow} = $	SUMP	SUMP	cfs						

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



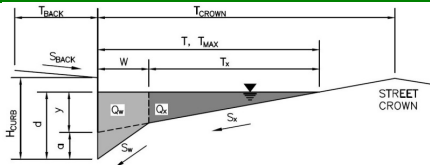
Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	5.4	7.9	inches
<b>Grate Information</b>	MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
<b>Curb Opening Information</b>	MINOR	MAJOR	
Length of a Unit Curb Opening	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>	MINOR	MAJOR	
Depth for Grate Midwidth	N/A	N/A	ft
Depth for Curb Opening Weir Equation	0.28	0.49	ft
Combination Inlet Performance Reduction Factor for Long Inlets	0.69	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>	MINOR	MAJOR	
<b>Q<sub>a</sub></b>	4.1	9.1	cfs
Q <sub>PEAK REQUIRED</sub>	4.1	9.1	cfs

Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)

**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

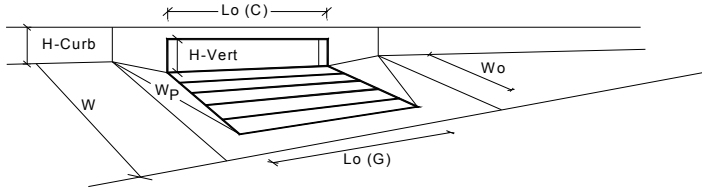
Project: Creekside South at Lorson Ranch Filing No. 2, #100.069  
 Inlet ID: Inlet I-3, DP-3 (E1.2)



<b>Gutter Geometry (Enter data in the blue cells)</b>									
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="8.0"/> ft								
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.015"/>								
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches								
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="17.0"/> ft								
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.00"/> ft								
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft								
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.000"/> ft/ft								
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Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th style="width: 10%;"></th> </tr> <tr> <td><math>T_{MAX} = </math></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="16.5"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="17.0"/></td> <td style="text-align: right;">ft</td> </tr> </table>		Minor Storm	Major Storm		$T_{MAX} = $	<input style="width: 50px;" type="text" value="16.5"/>	<input style="width: 50px;" type="text" value="17.0"/>	ft
	Minor Storm	Major Storm							
$T_{MAX} = $	<input style="width: 50px;" type="text" value="16.5"/>	<input style="width: 50px;" type="text" value="17.0"/>	ft						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th style="width: 10%;"></th> </tr> <tr> <td><math>d_{MAX} = </math></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="6.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="7.9"/></td> <td style="text-align: right;">inches</td> </tr> </table>		Minor Storm	Major Storm		$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="7.9"/>	inches
	Minor Storm	Major Storm							
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Check boxes are not applicable in SUMP conditions	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;"><input type="checkbox"/></td> <td style="width: 50%; text-align: center;"><input type="checkbox"/></td> </tr> </table>	<input type="checkbox"/>	<input type="checkbox"/>						
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<b>MAJOR STORM Allowable Capacity is based on Depth Criterion</b>	<table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th style="width: 10%;"></th> </tr> <tr> <td><math>Q_{allow} = </math></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: right;">cfs</td> </tr> </table>		Minor Storm	Major Storm		$Q_{allow} = $	<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs
	Minor Storm	Major Storm							
$Q_{allow} = $	<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs						

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	4.2	5.7	inches
<b>Grate Information</b>	MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
<b>Curb Opening Information</b>	MINOR	MAJOR	
Length of a Unit Curb Opening	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>	MINOR	MAJOR	
Depth for Grate Midwidth	N/A	N/A	ft
Depth for Curb Opening Weir Equation	0.18	0.31	ft
Combination Inlet Performance Reduction Factor for Long Inlets	0.53	0.73	
Curb Opening Performance Reduction Factor for Long Inlets	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>	MINOR	MAJOR	
<b>Q<sub>a</sub></b>	2.1	4.7	cfs
Q <sub>PEAK REQUIRED</sub>	2.1	4.7	cfs

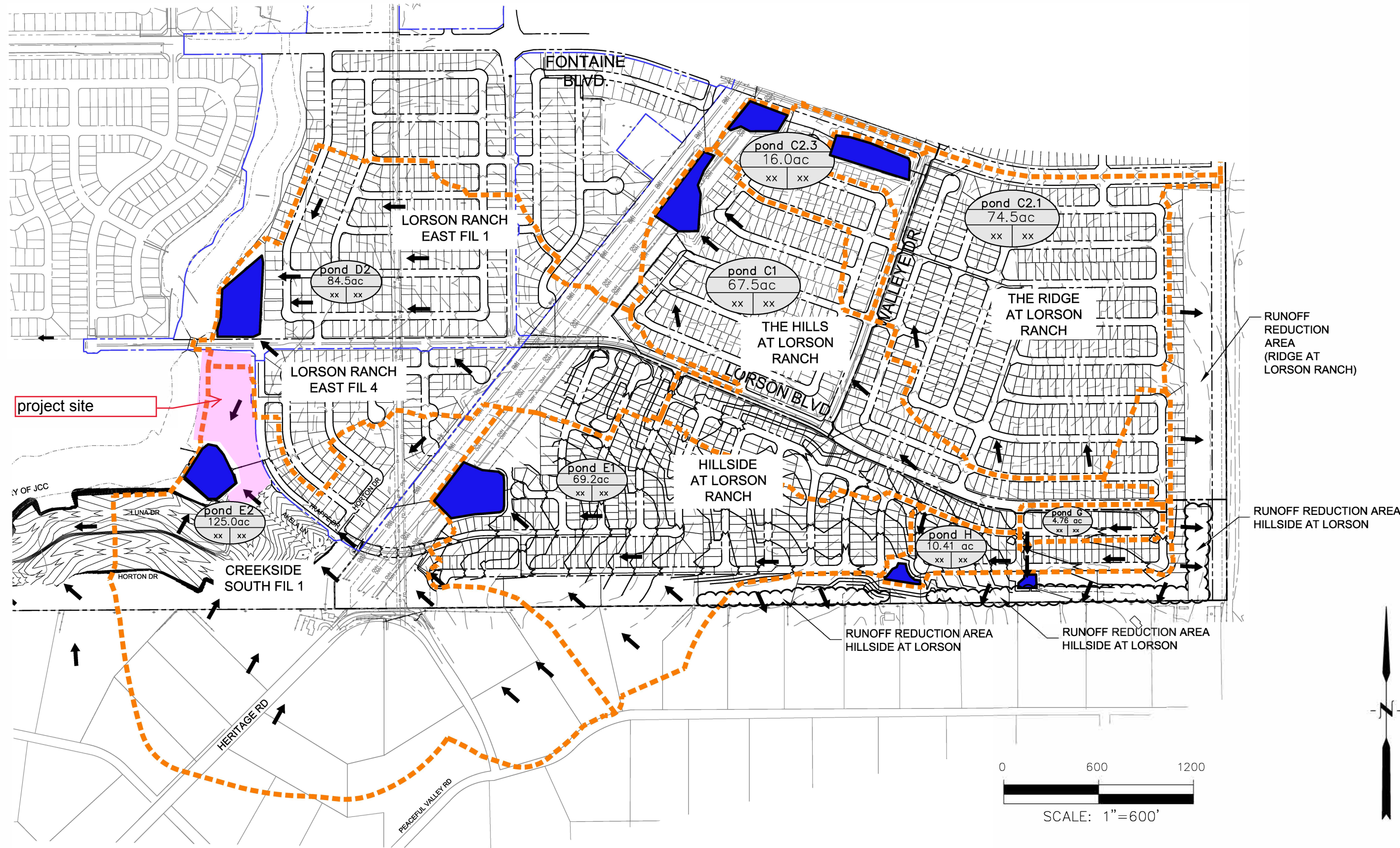
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)



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## APPENDIX D – POND AND ROUTING CALCULATIONS

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**CORE ENGINEERING GROUP**

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**CREEKSIDE SOUTH AT LORSON RANCH FIL 2  
 WATER QUALITY & POND TRIBUTARY AREAS**

SCALE:  
 NTS

DATE:  
 APRIL, 2022

FIGURE NO.  
 1

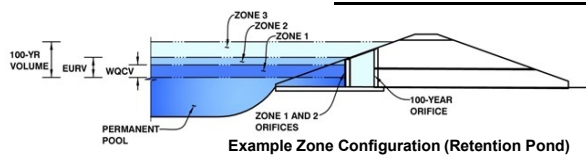


# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

**Project:** Creekside South Filing No. 2

**Basin ID:** Pond D2



**Example Zone Configuration (Retention Pond)**

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.74	1.552	Orifice Plate
Zone 2 (EURV)	4.74	3.454	Rectangular Orifice
3 (100+1/2WQCV)	6.94	4.248	Weir&Pipe (Restrict)
<b>Total (all zones)</b>		<b>9.254</b>	

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

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

**Calculated Parameters for Underdrain**

Underdrain Orifice Area =	N/A	ft <sup>2</sup>
Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.74	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	9.00	inches
Orifice Plate: Orifice Area per Row =	4.50	sq. inches (use rectangular openings)

**Calculated Parameters for Plate**

WQ Orifice Area per Row =	3.125E-02	ft <sup>2</sup>
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft <sup>2</sup>

**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)	4.50	4.50	4.50	4.50				

	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 =	2.80	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	4.88	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	10.00	N/A	inches
Vertical Orifice Width =	2.00		inches

**Calculated Parameters for Vertical Orifice**

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.14	N/A	ft <sup>2</sup>
Vertical Orifice Centroid =	0.42	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H <sub>o</sub> =	5.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Gate Slope =	20.00	N/A	H:V
Horiz. Length of Weir Sides =	20.00	N/A	feet
Overflow Gate Type =	Close Mesh Gate	N/A	
Debris Clogging % =	50%	N/A	%

**Calculated Parameters for Overflow Weir**

	Zone 3 Weir	Not Selected	
Height of Gate Upper Edge, H <sub>t</sub> =	6.00	N/A	feet
Overflow Weir Slope Length =	20.02	N/A	feet
Gate Open Area / 100-yr Orifice Area =	5.81	N/A	
Overflow Gate Open Area w/o Debris =	63.36	N/A	ft <sup>2</sup>
Overflow Gate Open Area w/ Debris =	31.68	N/A	ft <sup>2</sup>

**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 =	54.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	35.00		inches

**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate**

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	10.91	N/A	ft <sup>2</sup>
Outlet Orifice Centroid =	1.64	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.87	N/A	radians

**User Input: Emergency Spillway (Rectangular or Trapezoidal)**

Spillway Invert Stage =	7.02	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 =	1.87	feet
Stage at Top of Freeboard =	11.89	feet
Basin Area at Top of Freeboard =	2.34	acres
Basin Volume at Top of Freeboard =	15.93	acre-ft

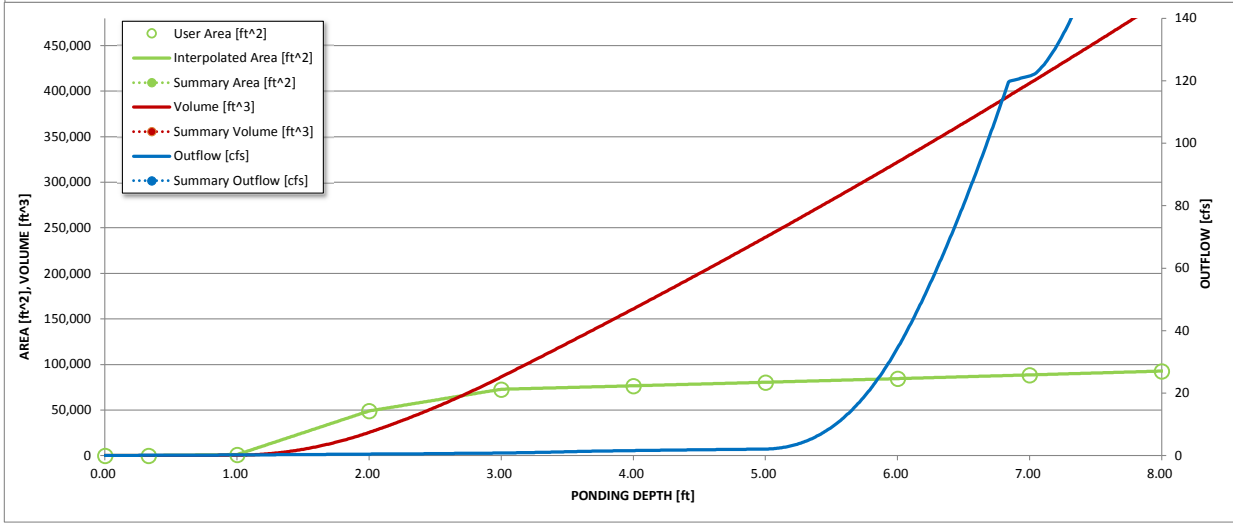
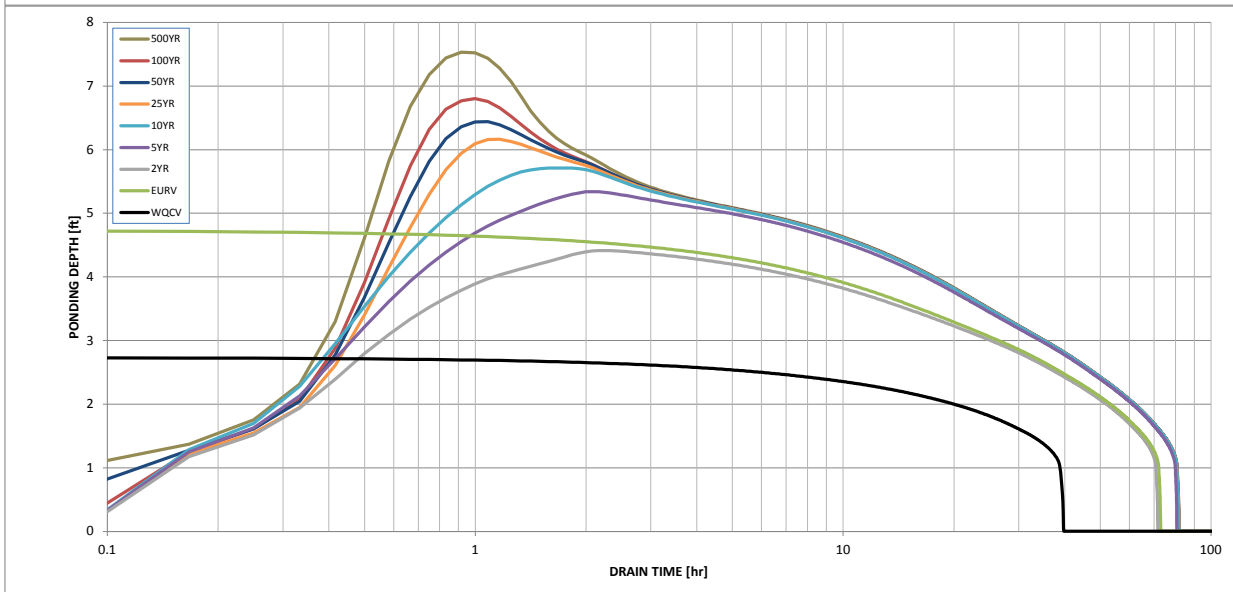
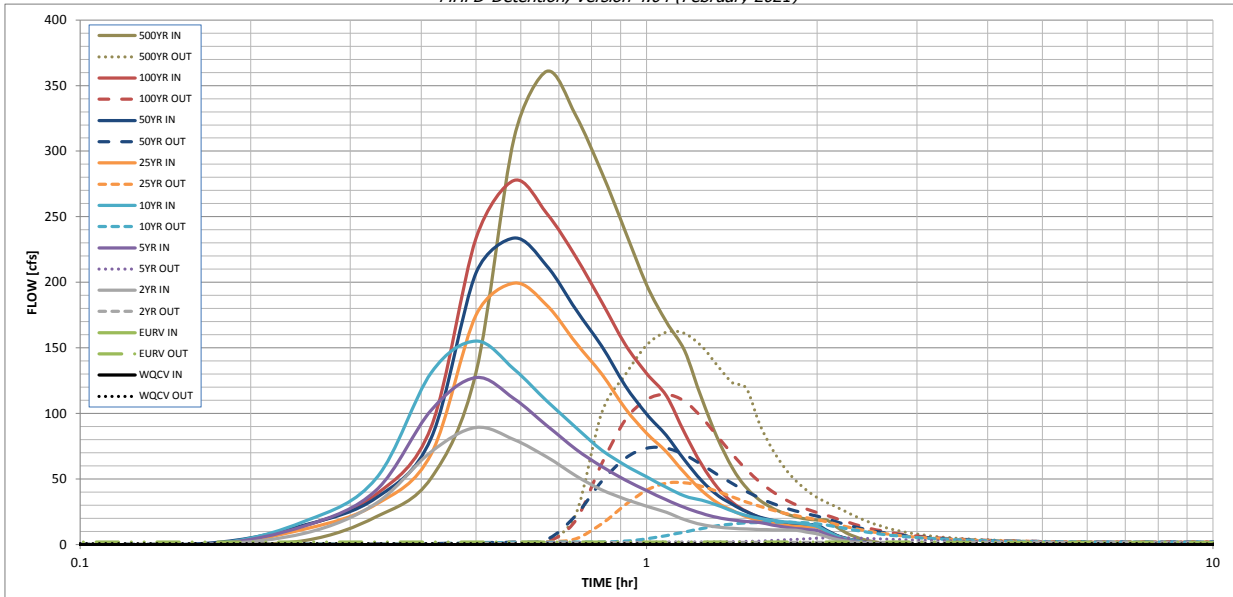
**Routed Hydrograph Results**

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	1.552	5.006	4.691	6.579	8.219	10.357	12.122	14.334	18.867
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	4.691	6.579	8.219	10.357	12.122	14.334	18.867
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	11.2	31.0	47.0	81.8	103.0	129.7	180.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.13	0.37	0.56	0.97	1.22	1.54	2.13
Peak Inflow Q (cfs) =	N/A	N/A	89.3	127.5	155.1	199.5	233.7	277.7	360.9
Peak Outflow Q (cfs) =	0.7	1.9	1.8	5.2	17.1	47.2	73.5	114.4	161.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.4	0.6	0.7	0.9	0.9
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Gate 1 (fps) =	N/A	N/A	N/A	0.0	0.2	0.7	1.1	1.8	2.0
Max Velocity through Gate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	68	67	74	73	71	69	67	64
Time to Drain 99% of Inflow Volume (hours) =	40	72	71	79	79	78	78	77	75
Maximum Ponding Depth (ft) =	2.74	4.74	4.41	5.34	5.71	6.16	6.44	6.80	7.53
Area at Maximum Ponding Depth (acres) =	1.53	1.82	1.80	1.88	1.91	1.95	1.98	2.01	2.08
Maximum Volume Stored (acre-ft) =	1.566	5.023	4.426	6.134	6.836	7.686	8.237	8.956	10.451

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.04 (February 2021)*



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

# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: \_\_\_\_\_

## Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	1.01	0.10	3.24
	0:15:00	0.00	0.00	8.87	14.50	17.97	12.07	15.06	14.71	21.12
	0:20:00	0.00	0.00	31.56	41.53	50.43	30.75	35.73	38.34	50.84
	0:25:00	0.00	0.00	70.78	102.59	131.08	69.16	81.33	89.82	131.28
	0:30:00	0.00	0.00	89.31	127.46	155.15	174.84	207.05	233.53	309.93
	0:35:00	0.00	0.00	80.02	111.27	133.66	199.46	233.72	277.73	360.92
	0:40:00	0.00	0.00	66.74	90.80	109.54	182.46	212.61	252.58	327.25
	0:45:00	0.00	0.00	52.58	72.78	89.37	153.85	179.21	219.43	283.77
	0:50:00	0.00	0.00	41.76	59.54	72.09	129.94	151.23	184.95	239.22
	0:55:00	0.00	0.00	34.69	49.34	60.61	103.99	121.34	152.70	198.22
	1:00:00	0.00	0.00	29.29	41.14	51.61	84.99	99.56	130.53	169.83
	1:05:00	0.00	0.00	24.55	34.12	43.65	70.79	83.19	113.56	147.84
	1:10:00	0.00	0.00	19.05	28.31	37.06	54.73	64.44	85.27	111.69
	1:15:00	0.00	0.00	15.29	23.80	33.84	41.36	48.87	61.15	81.48
	1:20:00	0.00	0.00	13.41	20.72	30.08	31.93	37.79	43.65	58.55
	1:25:00	0.00	0.00	12.41	18.82	25.52	26.00	30.73	32.27	43.35
	1:30:00	0.00	0.00	11.88	17.61	22.21	21.34	25.04	25.26	33.93
	1:35:00	0.00	0.00	11.56	16.81	20.00	18.10	21.03	20.81	27.89
	1:40:00	0.00	0.00	11.31	14.94	18.46	16.13	18.57	17.83	23.84
	1:45:00	0.00	0.00	11.14	13.38	17.42	14.80	16.91	15.83	21.12
	1:50:00	0.00	0.00	11.04	12.32	16.68	13.93	15.81	14.62	19.45
	1:55:00	0.00	0.00	9.54	11.58	15.63	13.46	15.21	14.19	18.81
	2:00:00	0.00	0.00	8.23	10.75	13.96	13.16	14.84	14.00	18.53
	2:05:00	0.00	0.00	5.87	7.70	9.91	9.51	10.69	10.16	13.43
	2:10:00	0.00	0.00	3.92	5.12	6.63	6.34	7.12	6.81	8.99
	2:15:00	0.00	0.00	2.61	3.38	4.43	4.27	4.79	4.59	6.05
	2:20:00	0.00	0.00	1.68	2.15	2.87	2.77	3.11	2.97	3.91
	2:25:00	0.00	0.00	1.03	1.36	1.80	1.76	1.97	1.89	2.48
	2:30:00	0.00	0.00	0.58	0.83	1.07	1.08	1.21	1.16	1.51
	2:35:00	0.00	0.00	0.28	0.43	0.53	0.57	0.63	0.60	0.78
	2:40:00	0.00	0.00	0.10	0.17	0.19	0.22	0.24	0.23	0.29
	2:45:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.02	0.03
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

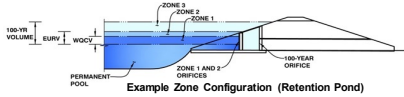


**DETENTION BASIN STAGE-STORAGE TABLE BUILDER**

UD-Detention, Version 3.07 (February 2017)

Project: **Creekside South FDR**

Basin ID: **POND E2**



**Required Volume Calculation**

Selected BMP Type =	<b>EDB</b>	
Watershed Area =	125.00	acres
Watershed Length =	2,900	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	35.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	40.0%	percent
Percentage Hydrologic Soil Groups C/D =	60.0%	percent
Desired WCCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	1,732	acre-feet
Excess Urban Runoff Volume (EURV) =	4,232	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	3,645	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	5,556	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	7,847	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	12,045	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	14,974	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	18,724	acre-feet
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet
Approximate 2-yr Detention Volume =	3,411	acre-feet
Approximate 5-yr Detention Volume =	5,233	acre-feet
Approximate 10-yr Detention Volume =	6,508	acre-feet
Approximate 25-yr Detention Volume =	7,293	acre-feet
Approximate 50-yr Detention Volume =	7,634	acre-feet
Approximate 100-yr Detention Volume =	9,039	acre-feet

<b>Optional User Override</b>	
1-hr Precipitation	1.19 inches
	1.50 inches
	1.75 inches
	2.00 inches
	2.25 inches
	2.52 inches

**Stage-Storage Calculation**

Zone 1 Volume (WQCV) =	1,732	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2,500	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	5,673	acre-feet
Total Detention Basin Volume =	9,905	acre-feet
Initial Surcharge Volume (SV) =	user	ft <sup>3</sup>
Initial Surcharge Depth (SD) =	user	ft
Total Available Detention Depth (H <sub>total</sub> ) =	user	ft
Depth of Trickle Channel (H <sub>tc</sub> ) =	user	ft
Slope of Trickle Channel (S <sub>tc</sub> ) =	user	ft/ft
Slopes of Main Basin Sides (S <sub>main</sub> ) =	user	H:V
Basin Length-to-Width Ratio (R <sub>l:w</sub> ) =	user	
Initial Surcharge Area (A <sub>sv</sub> ) =	user	ft <sup>2</sup>
Surcharge Volume Length (L <sub>sv</sub> ) =	user	ft
Surcharge Volume Width (W <sub>sv</sub> ) =	user	ft
Depth of Basin Floor (H <sub>b,100yr</sub> ) =	user	ft
Length of Basin Floor (L <sub>b,100yr</sub> ) =	user	ft
Width of Basin Floor (W <sub>b,100yr</sub> ) =	user	ft
Area of Basin Floor (A <sub>b,100yr</sub> ) =	user	ft <sup>2</sup>
Volume of Basin Floor (V <sub>b,100yr</sub> ) =	user	ft <sup>3</sup>
Depth of Main Basin (H <sub>main</sub> ) =	user	ft
Length of Main Basin (L <sub>main</sub> ) =	user	ft
Width of Main Basin (W <sub>main</sub> ) =	user	ft
Area of Main Basin (A <sub>main</sub> ) =	user	ft <sup>2</sup>
Volume of Main Basin (V <sub>main</sub> ) =	user	ft <sup>3</sup>
Calculated Total Basin Volume (V <sub>total</sub> ) =	user	acre-feet

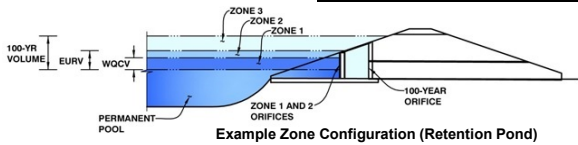
Depth Increment = 0.2 ft									
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft <sup>2</sup> )	Optional Override Area (ft <sup>2</sup> )	Area (acre)	Volume (ft <sup>3</sup> )	Volume (ac-ft)
<b>Top of Micropool</b>	--	0.00	--	--	--	20	0.000		
<b>5693.33</b>	--	0.33	--	--	--	50	0.001	11	0.000
<b>5694</b>	--	1.00	--	--	--	2,250	0.052	760	0.017
<b>5695</b>	--	2.00	--	--	--	35,024	0.804	19,070	0.438
<b>5696</b>	--	3.00	--	--	--	62,057	1.425	67,959	1.560
<b>5697</b>	--	4.00	--	--	--	65,120	1.495	131,548	3.020
<b>5698</b>	--	5.00	--	--	--	68,248	1.567	198,232	4.551
<b>5699</b>	--	6.00	--	--	--	71,443	1.640	268,077	6.154
<b>5700</b>	--	7.00	--	--	--	74,705	1.715	341,151	7.832
<b>5701</b>	--	8.00	--	--	--	78,040	1.792	417,524	9.585
<b>5702</b>	--	9.00	--	--	--	81,442	1.870	497,265	11.416



## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Creekside South FDR  
Basin ID: POND E2



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.13	1.732	Orifice Plate
Zone 2 (EURV)	4.80	2.500	Rectangular Orifice
(100+1/2WQCV)	8.18	5.673	Weir&Pipe (Restrict)
		9.905	Total

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

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

Calculated Parameters for Plate

WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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)	5.25	5.25	5.25	5.25				

	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 =	<input type="text" value="3.50"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	<input type="text" value="4.80"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	<input type="text" value="4.00"/>	<input type="text" value="N/A"/>	inches
Vertical Orifice Width =	<input type="text" value="18.00"/>		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	<input type="text" value="0.50"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Vertical Orifice Centroid =	<input type="text" value="0.17"/>	<input type="text" value="N/A"/>	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	<input type="text" value="5.85"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	<input type="text" value="17.00"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Slope =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	<input type="text" value="6.70"/>	<input type="text" value="N/A"/>	feet
Overflow Grate Open Area % =	<input type="text" value="70%"/>	<input type="text" value="N/A"/>	%, grate open area/total area
Debris Clogging % =	<input type="text" value="50%"/>	<input type="text" value="N/A"/>	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>1</sub> =	<input type="text" value="5.85"/>	<input type="text" value="N/A"/>	feet
Over Flow Weir Slope Length =	<input type="text" value="6.70"/>	<input type="text" value="N/A"/>	feet
Grate Open Area / 100-yr Orifice Area =	<input type="text" value="6.34"/>	<input type="text" value="N/A"/>	should be ≥ 4
Overflow Grate Open Area w/o Debris =	<input type="text" value="79.73"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	<input type="text" value="39.87"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	<input type="text" value="0.10"/>	<input type="text" value="N/A"/>	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	<input type="text" value="48.00"/>	<input type="text" value="N/A"/>	inches
Restrictor Plate Height Above Pipe Invert =	<input type="text" value="48.00"/>		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	<input type="text" value="12.57"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Outlet Orifice Centroid =	<input type="text" value="2.00"/>	<input type="text" value="N/A"/>	feet
Half-Central Angle of Restrictor Plate on Pipe =	<input type="text" value="3.14"/>	<input type="text" value="N/A"/>	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

Calculated Parameters for Spillway

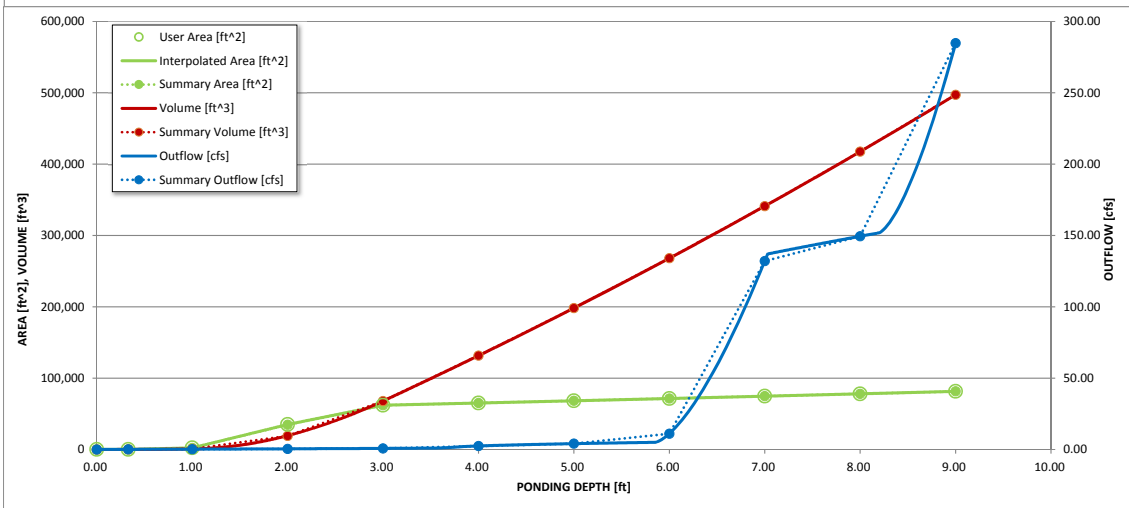
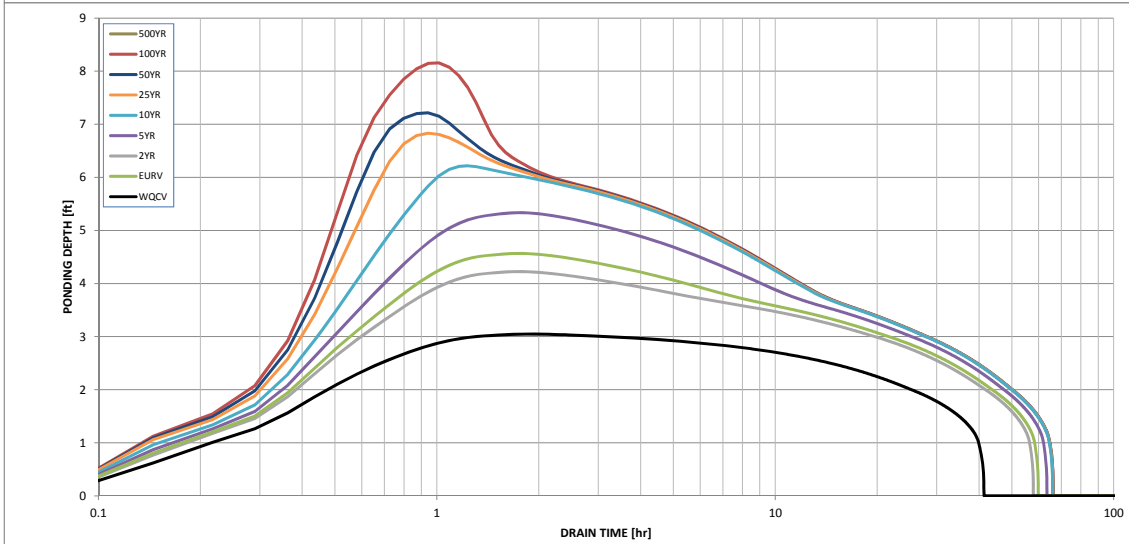
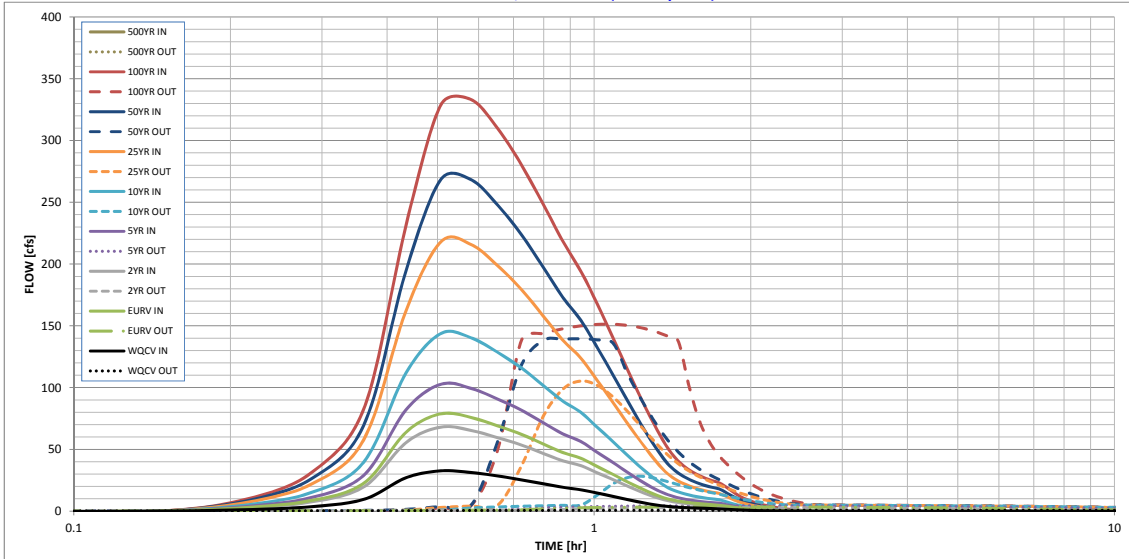
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres

### Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	1.732	4.232	3.645	5.556	7.847	12.045	14.974	18.724	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.732	4.233	3.646	5.554	7.843	12.049	14.970	18.731	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.10	0.34	0.87	1.17	1.53	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	2.0	12.4	42.6	108.8	146.0	191.3	0.0
Peak Inflow Q (cfs) =	32.7	78.8	68.1	102.8	143.9	218.1	268.6	333.2	#N/A
Peak Outflow Q (cfs) =	0.8	3.5	2.9	4.5	28.3	105.4	139.5	151.3	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.7	1.0	1.0	0.8	#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	0.3	1.2	1.7	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	54	53	56	56	53	50	47	#N/A
Time to Drain 99% of Inflow Volume (hours) =	40	57	56	60	62	60	59	58	#N/A
Maximum Ponding Depth (ft) =	3.05	4.57	4.23	5.34	6.22	6.83	7.22	8.16	#N/A
Area at Maximum Ponding Depth (acres) =	1.43	1.54	1.51	1.59	1.66	1.70	1.73	1.80	#N/A
Maximum Volume Stored (acre-ft) =	1.617	3.868	3.351	5.072	6.500	7.541	8.194	9.855	#N/A

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



**S-A-V-D Chart Axis Override**

	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			



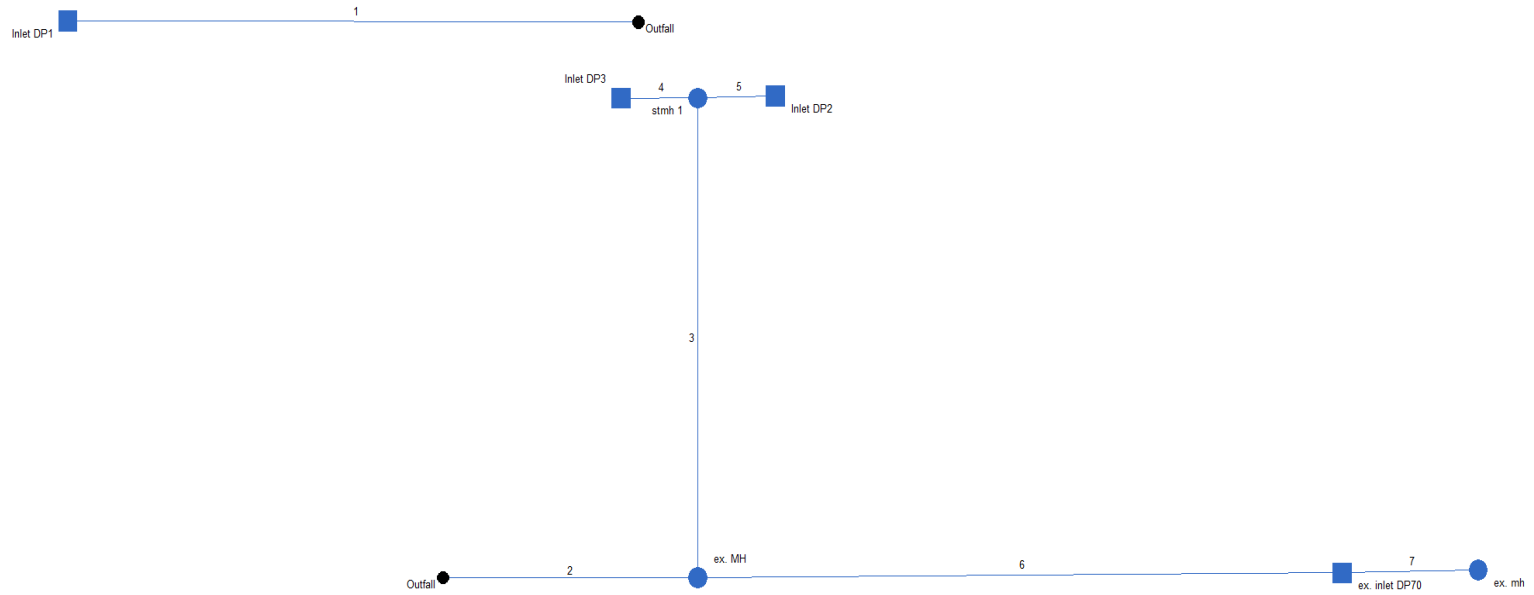


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**APPENDIX E- STORM SEWER SCHEMATIC AND HYDRAFLOW STORM SEWER CALCS**

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# Hydraflow Plan View



# Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		1.10	18 c	125.8	5704.30	5705.56	1.003	5704.70	5705.96	n/a	5705.96 j	End
2		75.90	54 c	56.2	5695.49	5695.83	0.600	5699.99	5700.05	0.37	5700.42	End
3		6.20	24 c	96.4	5701.16	5702.60	1.493	5701.80	5703.48	n/a	5703.48	2
4		2.10	18 c	16.9	5703.40	5703.57	1.008	5703.85	5704.13	0.19	5704.32	3
5		4.10	18 c	17.2	5703.40	5703.57	0.991	5704.05	5704.39	0.27	5704.66	3
6		69.70	48 c	142.0	5699.16	5702.00	2.000	5700.78	5704.99	0.37	5705.36	2
7		64.10	48 c	30.0	5702.30	5702.60	1.001	5705.36	5705.17	0.88	5706.05	6

<b>Creekside South 2 - 5yr</b>	Number of lines: 7	Run Date: 06-15-2022
--------------------------------	--------------------	----------------------

NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs. ; j - Line contains hyd. jump.

# Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.
1		2.60	18 c	125.8	5704.30	5705.56	1.002	5704.92	5706.18	n/a	5706.18 j	End
2		225.3	54 c	56.2	5695.49	5695.83	0.605	5699.99*	5700.73*	1.56	5702.29	End
3		13.80	24 c	96.4	5701.16	5702.60	1.493	5705.11*	5705.47*	0.30	5705.77	2
4		4.70	18 c	16.9	5703.40	5703.57	1.008	5705.96*	5705.99*	0.11	5706.10	3
5		9.10	18 c	17.2	5703.40	5703.57	0.991	5705.77*	5705.90*	0.41	5706.31	3
6		211.5	48 c	142.0	5699.16	5702.00	2.000	5702.61*	5706.40*	2.20	5708.60	2
7		174.5	48 c	30.0	5702.30	5702.60	1.001	5710.01*	5710.45*	3.00	5713.45	6





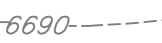
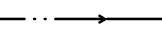

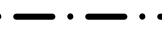
<b>Creekside South 2 - 100yr</b>	Number of lines: 7	Run Date: 06-15-2022
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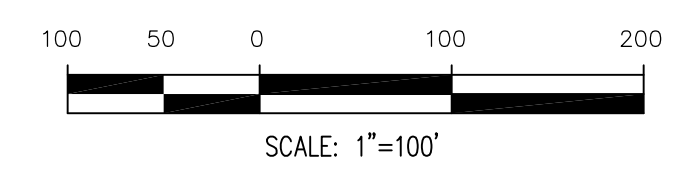
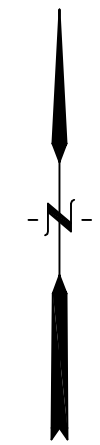
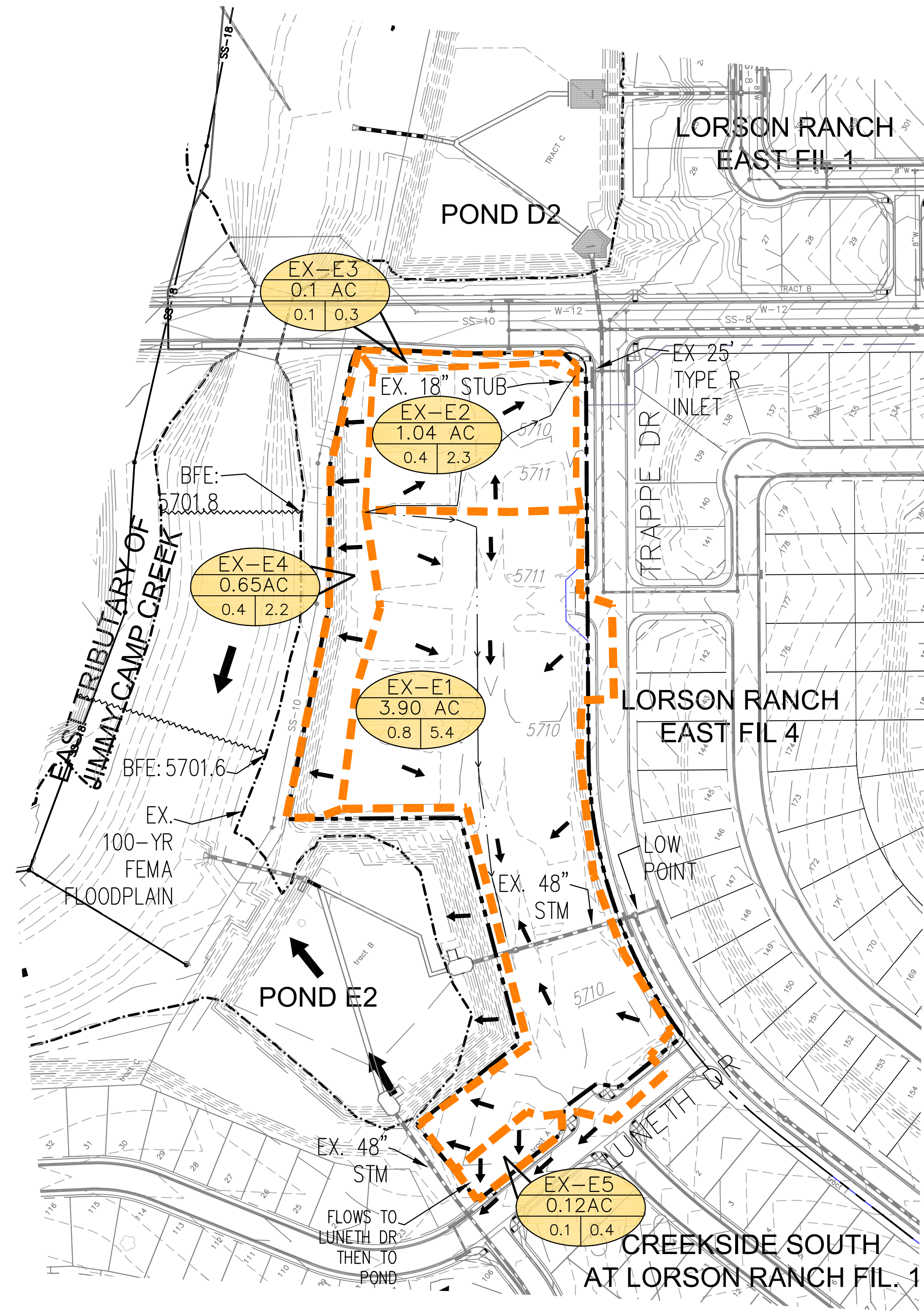
NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; \*Surcharged (HGL above crown). ; j - Line contains hyd. jump.



# MAP POCKET

**LEGEND**

-  BASIN BOUNDARY
-  BASIN DESIGN POINT
-  BASIN I.D.  
ACREAGE  
5 YR/100 YR CFS
-  DIRECTION OF FLOW
-  EXISTING CONTOUR
-  TIME OF CONCENTRATION
-  PRELIMINARY PLAN SITE AREA
-  100-YR FLOODPLAIN (FEMA)



DATE:	
DESCRIPTION:	
NO.:	
PROJECT:	
DRAWN:	LAB
DESIGNED:	LAB
CHECKED:	RLS
PREPARED FOR:	LORSON LLC
	212 NORTH WAHSATCH AVE, SUITE 301 COLORADO SPRINGS, COLORADO 80903 (719) 635-3200 CONTACT: KEF MARK
	CREEKSIDE SOUTH TRAPPE DRIVE - HORTON DR EL PASO COUNTY, COLORADO

**EXISTING CONDITIONS  
 CREEKSIDE SOUTH  
 AT LORSON RANCH FILING NO. 2**

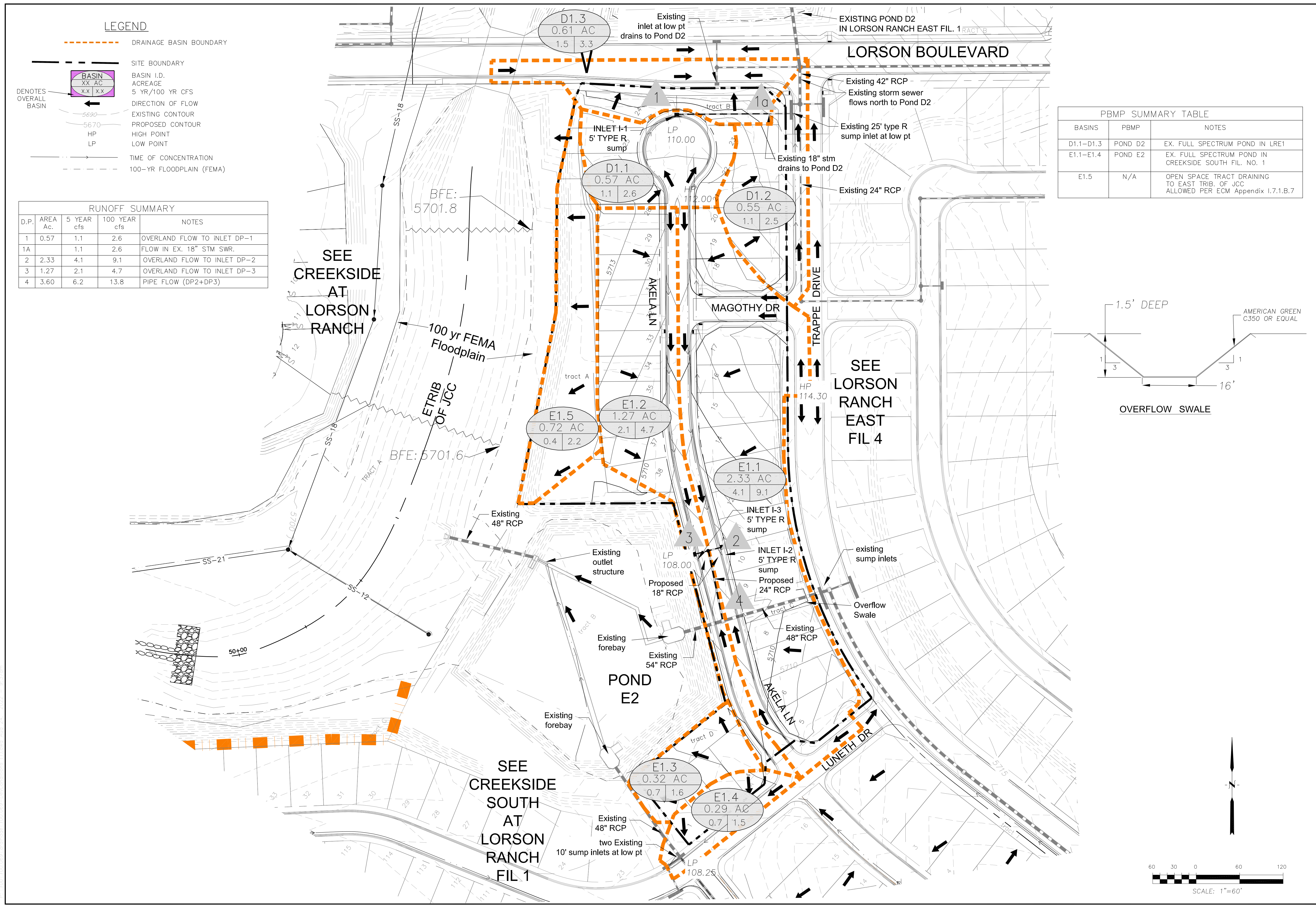
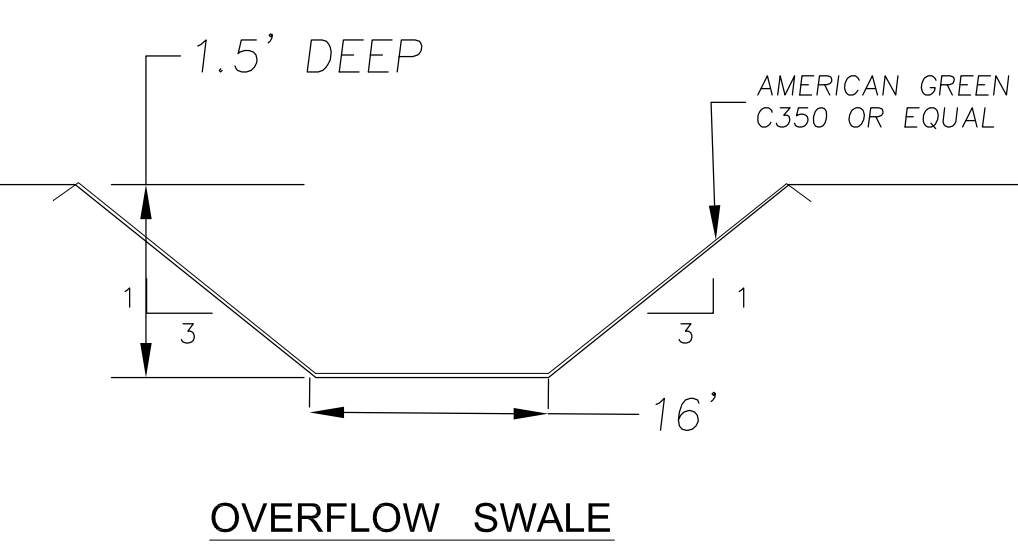
DATE:	AUGUST, 2022
PROJECT NO.	100.069
SHEET NUMBER	1
TOTAL SHEETS:	1

**LEGEND**

- DRAINAGE BASIN BOUNDARY
- SITE BOUNDARY
- BASIN I.D.  
ACREAGE
- DIRECTION OF FLOW
- EXISTING CONTOUR
- PROPOSED CONTOUR
- HIGH POINT
- LOW POINT
- TIME OF CONCENTRATION
- 100-YR FLOODPLAIN (FEMA)

RUNOFF SUMMARY				
D.P.	AREA Ac.	5 YEAR cfs	100 YEAR cfs	NOTES
1	0.57	1.1	2.6	OVERLAND FLOW TO INLET DP-1
1A	1.1	1.1	2.6	FLOW IN EX. 18" STM SWR.
2	2.33	4.1	9.1	OVERLAND FLOW TO INLET DP-2
3	1.27	2.1	4.7	OVERLAND FLOW TO INLET DP-3
4	3.60	6.2	13.8	PIPE FLOW (DP2+DP3)

PBMP SUMMARY TABLE		
BASINS	PBMP	NOTES
D1.1-D1.3	POND D2	EX. FULL SPECTRUM POND IN LRE1
E1.1-E1.4	POND E2	EX. FULL SPECTRUM POND IN CREEKSIDE SOUTH FIL. NO. 1
E1.5	N/A	OPEN SPACE TRACT DRAINING TO EAST TRIB. OF JCC ALLOWED PER ECM Appendix I.7.1.B.7



**CORE ENGINEERING GROUP**

15004 1ST AVE. S.  
BURNSVILLE, MN 55306  
PH: 719.570.1100  
CONTACT: RICHARD L. SCHINDLER, P.E.  
EMAIL: Rich@cegi.com

DATE: \_\_\_\_\_

DESCRIPTION: \_\_\_\_\_

NO. \_\_\_\_\_

DRAWN: RLS  
DESIGNED: LAB  
CHECKED: LAB

PREPARED FOR: **LORSON, LLC**  
212 N. WASHBACH AVE. SUITE 301  
COLORADO SPRING, COLORADO 80903  
CONTACT: JEFF MARK

PROJECT: **CREEKSIDE SOUTH FIL. 2**  
TRAPE DRIVE, MAGOTHY DR  
EL PASO COUNTY, COLORADO

**DEVELOPED CONDITIONS**

**CREEKSIDE SOUTH AT**

**LORSON RANCH/FILING NO. 2**

DATE: **AUG, 2022**

PROJECT NO.: **100.069**

SHEET NUMBER: **1**

TOTAL SHEETS: **1**