FINAL DRAINAGE PLAN

LORSON RANCH EAST FILING NO. 1

MARCH 1, 2018
MAY 1, 2018
JULY 2, 2018

SF-18-008

Prepared for:

Lorson, LLC
212 N. Wahsatch Ave, Suite 301
Colorado Springs, Colorado 80903
(719) 635-3200

Prepared by:

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Project No. 100.042

CORE ENGINEERING GROUP

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ENGINEER'S STATEMENT

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

7-16-2018

Richard L. Schindler, P.E. #33997 Date
For and on Behalf of Core Engineering Group, LLC

OWNER'S STATEMENT

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

7/16/18

Lorson, LLC Date

By
Jeff Mark

Title
Manager

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

FLOODPLAIN STATEMENT

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

7-16-2018

Richard L. Schindler, #33997 Date

EL PASO COUNTY

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

Approved
by Elizabeth Nijkamp
El Paso County Planning and Community Development
on behalf of Jennifer Irvine, County Engineer, ECM Administrator
07/24/2018 4:18:32 PM

Jennifer Irvine Date
County Engineer/ECM Administrator

Conditions: ____________________

1.0 LOCATION and DESCRIPTION

Lorson Ranch East is located east of the East Tributary of Jimmy Camp Creek. The site is located on approximately 126.25 acres of vacant land. This project will develop this site into single-family residential developments. This plat does include a school site but it is offsite and is only platted as a tract of land. Future development of the school site will require it's own final drainage report. The land for the residential lots is currently owned by Lorson LLC or its nominees for Lorson Ranch.

The site is located in the West 1/2 of Sections 14 & 23, South ½ of Section 13, and the North ½ of Section 24, Township 15 South and Range 65 West of the 6th Principal Meridian. The property is bounded on the north by Fontaine Boulevard, on the east by Lamprey Drive, on the west by The East Tributary of Jimmy Camp Creek, and the south by Lorson Boulevard. 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 a portion of the East Tributary was reconstructed from Fontaine Boulevard south 2,800 feet in accordance with the 1987 study. This section of the East Tributary included a trapezoidal channel section with 6:1 side slopes and a sand bottom. On March 9, 2015 a new DBPS for Jimmy Camp Creek and the East Tributary was completed by Kiowa Engineering. The Kiowa Engineering 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. Channel improvements in the East Tributary north of Fontaine Boulevard were designed by Kiowa Engineering and are currently under construction and must be completed before this final plat is recorded. Channel improvements south of Fontaine Boulevard within this final plat limits were constructed in 2014.

Conformance with Lorson East MDDP and PDR by Core Engineering Group

Core Engineering Group has an approved MDDP for Lorson East and PDR for Lorson Ranch East which covers this final plat area and the East Tributary. This FDR conforms to the MDDP and PDR for Lorson East and is referenced in this report. The major infrastructure to be constructed in this final plat site includes Detention/WQ Ponds C5 and D2. Ponds C5 and D2 were graded in the Early Grading Plans for Lorson Ranch East under PUDSP-16-003. There are also two bridges over the East Tributary that are required to be built for this plat. The bridges are located at Fontaine Boulevard and Lorson Boulevard. Both bridge construction plans were prepared by Kiowa Engineering and have been approved. Construction is currently underway for both bridges and must be complete prior to recordation of this plat.

Lorson Ranch East is located within the ***"Jimmy Camp Creek Drainage Basin"***, which is a fee basin in El Paso County.

2.0 DRAINAGE CRITERIA

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 will be required for this development. The ponds were graded under PUDSP-16-003 and this plat will construct the forebays and outlet structure.

3.0 EXISTING HYDROLOGICAL CONDITIONS

Prior to the early grading of Lorson Ranch East the site was undeveloped with native vegetation (grass with no shrubs) and moderate to steep slopes in a westerly direction the East Tributary of Jimmy Camp Creek.

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

Table 3.1: SCS Soils Survey

Soil	Hydro. Group	Shrink/Swell Potential	Permeability	Surface Runoff Potential	Erosion Hazard
52-Manzanola Clay Loam	C	High	Slow	Medium	Moderate
56-Nelson – Tassel Fine Sandy Loam	B	Moderate	Moderately Rapid	Slow	Moderate
75-Razor Clay Loam	C	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” [2] are provided in ***Appendix A*** for further reference.

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

An existing electrical easement, with existing transmission towers, is located east side of this site and will be set aside as open space in the future. It is the intent to utilize some of the open space under the towers for detention of storm flows in future filings.

The FMIC (irrigation canal) that runs parallel with the East Tributary through this site was decommissioned in 2006 and will be filled in during the early grading process. For the purpose of existing drainage calculations the canal was ignored and all flow was assumed to flow to the East Tributary.

Portions of the site are located within the delineated 100-year floodplain of the East Tributary of Jimmy Camp Creek per the Federal Emergency Management Agency (FEMA) Flood Rate Insurance Map (FIRM) number 08041C0957 F & 08041C1000 F, effective 17 March 1997 [2]. Floodplain along the East Tributary was modified per LOMR Case No. 14-08-0534P (see appendix). Floodplain designations include Zone AE and Zone X within the property boundary. A portion of this map is provided in ***Appendix A*** for reference. A CLOMR for the creek and bridge construction which includes grading to remove some areas north of Fontaine Boulevard from the current floodplain is currently submitted to FEMA under Case No. 17-08-1043R.

The existing basins for this large site were taken from the Lorson Ranch East MDDP East of the East Tributary. A map from the MDDP has been included in the appendix.

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

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

3.1 INTERIM HYDROLOGICAL CONDITIONS

Interim hydrological conditions have been calculated based on grading that has been completed in accordance with Phase 1 of the Early Grading for Lorson Ranch East (PUDSP 16-003) and Fontaine Boulevard/Lamprey Drive constructed in accordance with CDR 183. Interim condition existing flows have been calculated to determine drainage impacts to the first plat which is located downstream of several drainage basins and the runoff must be accommodated by the street/storm sewer system constructed as part of this plat and CDR 183. These interim condition calculations also include hydraulic modeling of Pond C5 and D2 to see what effect the existing upstream flows have on the downstream pond outflow rates when compared to pre-developed conditions at the East Tributary.

Interim conditions consist of Fontaine Boulevard construction from Old Glory Drive eastward 3,500 feet to the existing electric transmission lines and Lamprey Drive from Fontaine Boulevard northeast 1,800 feet per CDR 183. CDR 183 includes street, storm sewer, sanitary sewer, and watermain construction which provides access to this plat and to the proposed school site. Interim conditions also include Lorson Boulevard construction from Stingray Lane east to Lamprey Drive and all the interior streets for this final plat. Interim conditions does <u>not</u> include construction of the school site which will be analyzed in the next final plat for areas north of Fontaine Boulevard since nothing has been graded or constructed on the school site.

<u>Interim Basin EX1</u>
This interim basin consists of existing flow from undeveloped areas east of the electric transmission line. Runoff flows overland to the east end of Fontaine Boulevard where a 54" storm sewer constructed

as part of CDR 183 will convey the flows west to Pond C5. The existing runoff is 56cfs and 176cfs for the 5-year and 100-year events.

Interim Basin EX2
This interim basin consists of existing flow from undeveloped areas east of the electric transmission line. Runoff flows overland to the SE corner of Fontaine Boulevard and Lamprey where a 42" storm sewer constructed as part of CDR 183 will convey the flows west to Pond C5. The existing runoff is 31cfs and 110cfs for the 5-year and 100-year events.

Interim Basin EX3
This interim basin consists of existing flow from undeveloped areas east of the electric transmission line, the future school site, and areas north of Lamprey Drive. Runoff flows overland westward where a 66" storm sewer constructed as part of CDR 183 will convey the flows west to Pond C5. The existing runoff is 70cfs and 242cfs for the 5-year and 100-year events.

Interim Basin EX4
This interim basin consists of existing flow from undeveloped areas east of the electric transmission line. Runoff flows overland westward where a 36" storm sewer and 48" riser will convey the flows west to Pond D2. The riser will pond to a depth of 1.23' at a flow rate of 57.0cfs. The capacity of the 36" storm sewer in Lorson Boulevard is sized for future developed flows of 75.4cfs so the pipe has capacity for interim flows. The existing runoff is 11.0cfs and 57.0cfs for the 5-year and 100-year events

Interim Basin EX5
This interim basin consists of existing flow from undeveloped areas south of Lorson Boulevard. Runoff flows overland northwest to curb/gutter in Lorson Boulevard. There are inlets at Design Points 59f and 60 which are designed for future flows that have the capacity to collect the interim flows. The existing runoff is 6.0cfs and 31.0cfs for the 5-year and 100-year events. The street capacity at Design Point 59f designed for future flows is 31cfs so the interim flows will not exceed the capacity of the street and inlets.

Pond C5 for Interim Flow Conditions
These interim calculations for this pond include routing the interim existing/developed flows to Pond C5 in Hydraflow modeling software (See Appendix F). See map pocket for the Interim Conditions drainage. Pond C5 is proposed to be constructed to the ultimate buildout design as shown in the MDDP/PDR for Lorson Ranch East including the forebays, trickle channels, and the outlet structure. The interim conditions outflow for Pond C5 is 144cfs and 467cfs for the 5/100 year storm events at Design Point 46. The pre-developed flow conditions at Design Point 46 (Etrib) are 141cfs and 458cfs for the 5/100 year storm events. The flows are only a few cfs higher than pre-developed conditions and will not cause negative downstream impacts. The outlet structure does not need modification at this time to accommodate interim flows.

Pond D2 for Interim Flow Conditions
These interim calculations for this pond include routing the interim existing/developed flows to Pond D2 in the full spectrum spreadsheets (See Appendix F). See map pocket for the Interim Conditions drainage map. Pond D2 is proposed to be constructed to the ultimate buildout design as shown in the MDDP/PDR for Lorson Ranch East including the forebays, trickle channels, and the outlet structure. The interim conditions outflow for Pond D2 was calculated using the full buildout outlet structure and changing the inflow basin to 78acres with a 48% imperviousness. The full spectrum worksheets estimate the interim conditions outflow of 9.8cfs and 91cfs for the 5/100 year storm events at Design Point 58a. The pre-developed flow conditions at Design Point 58a (Etrib) from the full spectrum worksheets are 11.1cfs and 118.4cfs for the 5/100 year storm events. The flows are only a few cfs lower than pre-developed conditions and will not cause negative downstream impacts. The outlet structure does not need modification at this time to accommodate interim flows.

4.0 DEVELOPED HYDROLOGICAL CONDITIONS

Hydrology for the **Lorson Ranch East** 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 type C/D has been assumed for the hydrologic conditions because mass grading will occur and soil types will be moved around. This approach will provide a more conservative approach to designing the storm sewer infrastructure. See Appendix A for SCS Soils Map.

The time of concentration for each basin and sub-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 Appendix B.

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

Overall Basin C (fully developed)
Overall Basin C includes all of the "C" basins that drain to Pond C5 in their ultimate developed future condition. This basin was taken from the MDDP/PDR for Lorson Ranch East and included to provide sizing data to design Pond C5 WQ and EURV in the full spectrum worksheets for ultimate buildout. The pond and outlet structure will be constructed for full buildout. See Section 3.1 for interim conditions flow rates from Pond C5. The total size of this basin is 171 acres and comprises of residential development. There is runoff from a future school site which has been included for water quality in Pond C5. The future school site will be required to detain runoff to existing flow rates to several storm outfall points provided on Lamprey Drive and Fontaine Boulevard. This basin has been studied in the Final Drainage Report for Fontaine Boulevard and the map from the PDR is included in the map pocket.

Overall Basin D
Overall Basin D includes all of the "D" basins that drain to Pond D2 in the fully developed future condition. This basin was taken from the MDDP/PDR for Lorson Ranch East and was included to provide sizing data to design Pond D2 in the full spectrum worksheets. The pond and outlet structure will be constructed for full buildout. See Section 3.1 for interim conditions flow rates from Pond D2. The total size of this basin is 89 acres and comprises of residential development.

Basin D1-ex
This 17-acre basin was included in this FDR and the PDR for Lorson Ranch East to determine existing runoff draining to a future storm sewer stub in Lorson Boulevard. The existing runoff will be used to design a future sediment basin and riser when the storm sewer in Lorson Boulevard is extended east from Lamprey Drive to Design Point 59b. The runoff is 8cfs and 47cfs for the 5/100-year storm event.

Basin C15.14
This basin consists of runoff from future residential development and Lamprey Drive. Runoff will be directed north to Design Point 29 in curb/gutter where it will be collected by a Type R inlet on Lamprey Drive. See the Fontaine FDR for inlet calculations. The developed flow from this basin is 2.9cfs and 6.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C15.15
This basin consists of runoff from residential development and Lamprey Drive. Runoff will be directed north to Design Point 30 in curb/gutter where it will be collected by a Type R inlet on Lamprey Drive. See the Fontaine FDR for inlet calculations. The developed flow from this basin is 7.2cfs and 16.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C17.1
Basin C17.1 consists of residential development located in Weiser and Matta Drives. Runoff is directed northwest in curb/gutter to Design Point 38 to a proposed Type "R" inlet in Matta Drive. The peak developed flow from this basin is 5.9cfs and 13.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C17.1a
Basin C17.1a consists of residential development located in Weiser, Pigeon, and Aliso Drives. Runoff is directed north in curb/gutter to Design Point 28 to a proposed Type "R" inlet in Weiser Drive. The peak developed flow from this basin is 5.3cfs and 11.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C17.2
Basin C17.2 consists of residential development located in Chaplin, Pigeon, Aliso, and Matta Drives. Runoff is directed north in curb/gutter to Design Point 39 to a proposed Type "R" inlet in Matta Drive. The peak developed flow from this basin is 8.6cfs and 19.1cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C17.3
Basin C17.3 consists of residential development located in Lamine and Matta Drives. Runoff is directed north in curb/gutter to Design Point 40 to a proposed Type "R" inlet in Lamine Drive. The peak developed flow from this basin is 4.5cfs and 10.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C17.4
Basin C17.4 consists of residential development located in Matta Drive. Runoff is directed west in curb/gutter to Design Point 40 to a proposed Type "R" inlet in Lamine Drive. The peak developed flow from this basin is 3.2cfs and 7.1cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C17.5
Basin C17.5 consists of residential development and Fontaine Boulevard. Runoff is directed west in curb/gutter to Design Point 40 to a proposed Type "R" inlet in Lamine Drive. The peak developed flow from this basin is 6.7cfs and 22.1cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C17.6
Basin C17.6 consists of residential development located in Lamine Drive. Runoff is directed north in curb/gutter to Design Point 41 to a proposed Type "R" inlet in Lamine Drive. The peak developed flow from this basin is 1.9cfs and 6.1cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin C17.7
Basin C17.7 consists of backyards of houses on Lamine Drive, East Tributary, and open space. Runoff is directed overland to the East Tributary. See Section 6.0 for water quality discussions for backyards. See the appendix for detailed calculations

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Basin D1.1 & D1.2

Basin D1.1 & D1.2 consists of residential development, Saco Drive, Weiser Drive, and Lamprey Drive. Runoff is directed south and west in curb/gutter to Design Point 50 to a proposed Type “R” inlet in Saco Drive on the south side. The peak developed flow from Basin D1.1 is 8.0cfs and 17.9cfs for the 5/100-year storm event. The peak developed flow from Basin D1.2 is 2.5cfs and 15.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin D1.3

Basin D1.3 consists of residential development, Saco Drive, and Lamine Drive. Runoff is directed west and north in curb/gutter to Design Point 56 to a proposed Type “R” inlet in Lamine Drive. See the appendix for detailed calculations. The peak developed flow from this basin is 1.7cfs and 3.8cfs for the 5/100-year storm event.

Basin D1.4 & D1.5

Basin D1.4 & D1.5 consists of residential development. Runoff is directed south in curb/gutter to Design Point 52 in Chaplin Drive. The peak developed flow from Basin D1.4 is 5.2cfs and 11.6cfs for the 5/100-year storm event. The peak developed flow from Basin D1.5 is 10.6cfs and 23.7cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin D1.6

Basin D1.6 consists of residential development, Yuba Drive, and Chaplin Drive. Runoff is directed south and west in curb/gutter to Design Point 53 to a proposed Type “R” inlet in Yuba Drive. See the appendix for detailed calculations. The peak developed flow from this basin is 8.4cfs and 18.7cfs for the 5/100-year storm event.

Basin D1.7

Basin D1.7 consists of residential development and Lamine Drive. Runoff is directed south in curb/gutter to Design Point 54 in Lamine Drive. See the appendix for detailed calculations. The peak developed flow from this basin is 7.0cfs and 15.5cfs for the 5/100-year storm event.

Basin D1.8

Basin D1.8 consists of residential development, Chaplin Drive, and Yuba Drive. Runoff is directed south and west in curb/gutter to Design Point 53 in Yuba Drive. See the appendix for detailed calculations. The peak developed flow from this basin is 3.2cfs and 7.1cfs for the 5/100-year storm event.

Basin D1.9 & D1.10

Basin D1.9 & D1.10 consists of residential development, Saco Drive, Lamine Drive, and Yuba Drive. Runoff is directed west in curb/gutter to Design Point 55 in Lamine Drive. The peak developed flow from Basin D1.9 is 4.1cfs and 9.1cfs for the 5/100-year storm event. The peak developed flow from Basin D1.10 is 9.9cfs and 22.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin D1.11

Basin D1.11 consists of residential development and Lamine Drive. Runoff is directed south in curb/gutter to Design Point 56 to a proposed Type "R" inlet in Lamine Drive. See the appendix for detailed calculations. The peak developed flow from this basin is 2.6cfs and 5.8cfs for the 5/100-year storm event.

Basin D1.12

Basin D1.12 consists of residential development and Pond D2. Runoff is directly tributary to Pond D2. See the appendix for detailed calculations. The peak developed flow from this basin is 3.9 cfs and 15.4cfs for the 5/100-year storm event.

Basin D2.1 & D2.3

Basin D2.1 & D2.3 consists of future residential development, open space under the electric easement, Vedder Drive, Lamprey Drive, and Lorson Boulevard. The peak developed flow from Basin D2.1 is 5.4cfs and 12.1cfs for the 5/100-year storm event. The peak developed flow from Basin D2.3 is 2.7cfs and 9.7cfs for the 5/100-year storm event. Runoff is directed south and west in curb/gutter to Design Point 59d in Lamprey Drive. See the appendix for detailed calculations. Interim conveyance for Basin 2.1 will be overland to the curb/gutter in Lamprey Drive and then to Design Point 59d. Interim conveyance for Basin D2.3 is included and discussed in Interim Basin Ex-4 (see Section 3.1) and flows overland to a proposed 48" riser east of Design Point 59e on the 36" storm sewer in Lorson Boulevard.

Basin D2.2

Basin D2.2 consists of future residential development and Tillamook Drive. Runoff is directed south in curb/gutter to Design Point 59a. See the appendix for detailed calculations. The peak developed flow from this basin is 2.1cfs and 4.7cfs for the 5/100-year storm event. Interim conveyance for Basin D2.3 is included and discussed in Interim Basin Ex-4 (see Section 3.1) and flows overland to a proposed 48" riser east of Design Point 59e on the 36" storm sewer in Lorson Boulevard and a portion flows to the inlet at Design Point 59d.

Basin D2.4

Basin D2.4 consists of future residential development, Lorson Boulevard, and open space area under the electric easement. Runoff is directed west in curb/gutter in Lorson Boulevard to Design Point 59f. See the appendix for detailed calculations. The peak developed flow from this basin is 3.6cfs and 11.9cfs for the 5/100-year storm event.

Basin D2.5

Basin D2.5 consists of future residential development, Skuna Drive, and Witcher Drive. Runoff is directed north in curb/gutter to Lorson Boulevard to Design Point 59f. See the appendix for detailed calculations. The peak developed flow from this basin is 8.8cfs and 19.6cfs for the 5/100-year storm event.

Basin D2.6 & D2.7

Basin D2.6 & D2.7 consists of future residential development, Skuna Drive, Abita Drive, Witcher Drive, and Yocona Drive. Runoff is directed west in curb/gutter to Design Point 61 in Witcher Drive. See the appendix for detailed calculations. The peak developed flow from Basin D2.6 is 4.3cfs and 9.5cfs for the 5/100-year storm event. The peak developed flow from Basin D2.7 is 6.7cfs and 15.0cfs for the 5/100-year storm event.

Basin D2.8

Basin D2.8 consists of future residential development, Volga Drive, and Witcher Drive. Runoff is directed west and south in curb/gutter to Design Point 62 in Volga Drive. The peak developed flow from this basin is 7.7cfs and 17.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin D2.9

Basin D2.9 consists of future residential development, Volga Drive, Trappe Drive, and Witcher Drive. Runoff is directed west and north in curb/gutter to Design Point 60 in Trappe Drive. The peak developed flow from this basin is 5.5cfs and 12.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin D2.10

Basin D2.10 consists of Trappe Drive and future adjacent areas. Runoff is directed north in curb/gutter in Trappe Drive to Design Point 64. See the appendix for detailed calculations. The peak developed flow from this basin is 1.9cfs and 5.0cfs for the 5/100-year storm event.

Basin D2.11

Basin D2.11 consists of runoff from Lorson Boulevard on the south side. Runoff is directed west in curb/gutter to Design Point 65a in Lorson Boulevard. The peak developed flow from this basin is 2.0cfs and 3.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin D2.12

Basin D2.12 consists of runoff from future residential development and Lorson Boulevard on the south side. Runoff is directed west in curb/gutter to Design Point 60 in Trappe Drive. The peak developed flow from this basin is 5.4cfs and 12.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

Basin D2.13

Basin D2.13 consists of runoff from Lorson Boulevard on the north side. Runoff is directed west in curb/gutter to Design Point 65b in Lorson Boulevard. The peak developed flow from this basin is 4.0cfs and 9.0cfs 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.

5.0 HYDRAULIC SUMMARY

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 ½ of street)

	Residential Local		Residential Collector		Principal Arterial	
Street Slope	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	29.7
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)

It is the intent of this report to construct inlets on Fontaine Boulevard located at the ultimate 4-lane curb location so reconstruction of inlets will not be necessary when Fontaine is widened.

<u>Design Point 28</u>
Design Point 28 is located on Weiser Drive north of Pigeon Drive.

<u>(5-year storm)</u>
Tributary Basins: C17.1a — **Inlet/MH Number:** Inlet DP28
Upstream flowby: — **Total Street Flow:** 5.3cfs

Flow Intercepted: 5.3cfs — **Flow Bypassed:**
Inlet Size: 15’ type R, on-grade

Street Capacity: Street slope = 1.0%, capacity = 9.0cfs, okay

<u>(100-year storm)</u>
Tributary Basins: C17.1a — **Inlet/MH Number:** Inlet DP28
Upstream flowby: — **Total Street Flow:** 11.56cfs

Flow Intercepted: 10.36cfs — **Flow Bypassed:** 1.2cfs to Inlet DP38
Inlet Size: 15’ type R, on-grade

Street Capacity: Street slope = 1.0%, capacity = 37.3cfs (half street) is okay

Design Point 38

Design Point 38 is located east of Chaplin Drive on the south side of Matta Drive.

(5-year storm)
Tributary Basins: C17.1 **Inlet/MH Number:** Inlet DP38
Upstream flowby: **Total Street Flow:** 5.9cfs

Flow Intercepted: 5.9cfs **Flow Bypassed:**
Inlet Size: 15' type R, on-grade

Street Capacity: Street slope = 1.0%, capacity = 9.0cfs is okay

(100-year storm)
Tributary Basins: C17.1 **Inlet/MH Number:** Inlet DP39
Upstream flowby: 1.2cfs **Total Street Flow:** 14.43cfs

Flow Intercepted: 11.83cfs **Flow Bypassed:** 2.6cfs to Inlet DP39
Inlet Size: 15' type R, on-grade

Street Capacity: Street slope = 1.0%, capacity = 37.3cfs (half street) is okay

Design Point 39

Design Point 39 is located in the SW corner of Chaplin Drive and Matta Drive.

(5-year storm)
Tributary Basins: C17.2 **Inlet/MH Number:** Inlet DP39
Upstream flowby: **Total Street Flow:** 8.61cfs

Flow Intercepted: 8.41cfs **Flow Bypassed:** 0.2cfs to Inlet DP40
Inlet Size: 15' type R, on-grade

Street Capacity: Street slope = 3.5%, capacity = 16.7cfs is okay

(100-year storm)
Tributary Basins: C17.2 **Inlet/MH Number:** Inlet DP39
Upstream flowby: 2.6cfs **Total Street Flow:** 21.53cfs

Flow Intercepted: 14.93cfs **Flow Bypassed:** 6.6cfs to Inlet DP40
Inlet Size: 15' type R, on-grade

Street Capacity: Street slope = 3.5%, capacity = 37.2cfs (half street) is okay

Design Point 50

Design Point 50 is located on the south side of Saco Drive just east of Willapa Drive.

(5-year storm)
Tributary Basins: D1.1 & D1.2 **Inlet/MH Number:** Inlet DP50
Upstream flowby: **Total Street Flow:** 10.01cfs

Flow Intercepted: 7.34cfs **Flow Bypassed:** 2.7cfs to DP56
Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 2.2%, capacity = 13.3cfs is okay

(100-year storm)
Tributary Basins: D1.1 & D1.2 **Inlet/MH Number:** Inlet DP50
Upstream flowby: **Total Street Flow:** 22.27cfs

Flow Intercepted: 10.77cfs **Flow Bypassed:** 11.5cfs to DP56
Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 2.2%, capacity = 42.8cfs (half street) is okay

Design Point 51

Design Point 51 is located downstream of Design Point 50 in Saco Drive just west of Willapa Drive and is the flow in the storm sewer. The total flow in the storm sewer (Line 3) is 14.68cfs/21.60cfs in the 5/100-year storm events in the storm sewer.

Design Point 52

Design Point 52 is located on the east side of Chaplin Drive north of Yuba Drive

(5-year storm)
Tributary Basins: D1.4+D1.5 **Inlet/MH Number:** Inlet DP52
Upstream flowby: **Total Street Flow:** 15.44cfs

Flow Intercepted: 12.44cfs **Flow Bypassed:** 3.0cfs to DP53
Inlet Size: 15' type R, on-grade

Street Capacity: Street slope = 3.8%, capacity = 16.9cfs is okay

(100-year storm)
Tributary Basins: D1.4+D1.5 **Inlet/MH Number:** Inlet DP52
Upstream flowby: **Total Street Flow:** 34.7cfs

Flow Intercepted: 18.8cfs **Flow Bypassed:** 15.9cfs to DP53
Inlet Size: 15' type R, on-grade

Street Capacity: Street slope = 3.8%, capacity = 36cfs (half street) is okay

Design Point 53

Design Point 53 is located at Chaplin Drive and Yuba Drive on the north side of the street.

(5-year storm)

Tributary Basins: D1.6, D1.8 **Inlet/MH Number:** Inlet DP53

Upstream flowby: 3.0cfs **Total Street Flow:** 14.65cfs

Flow Intercepted: 14.05cfs **Flow Bypassed:** 0.6cfs to DP-55

Inlet Size: 20’ type R, on-grade

Street Capacity: Street slope = 3.5%, capacity = 16.7cfs, okay

(100-year storm)

Tributary Basins: D1.6, D1.8 **Inlet/MH Number:** Inlet DP53

Upstream flowby: 15.9cfs **Total Street Flow:** 41.47cfs

Flow Intercepted: 25.97cfs **Flow Bypassed:** 15.50cfs to DP55

Inlet Size: 20’ type R, on-grade

Street Capacity: Street slope = 3.5%, capacity = 37.2cfs (half street) flow tops crown

Design Point 54

Design Point 54 is located at Lamine Drive and Yuba Drive on the northeast corner

(5-year storm)

Tributary Basins: D1.7 **Inlet/MH Number:** Inlet DP54

Upstream flowby: **Total Street Flow:** 7.26cfs

Flow Intercepted: 7.26cfs **Flow Bypassed:**

Inlet Size: 15’ type R, on-grade

Street Capacity: Street slope = 1.2%, capacity = 10 cfs, okay

(100-year storm)

Tributary Basins: D1.7 **Inlet/MH Number:** Inlet DP54

Upstream flowby: **Total Street Flow:** 15.5cfs

Flow Intercepted: 12.6cfs **Flow Bypassed:** 3.0cfs to DP55

Inlet Size: 15’ type R, on-grade

Street Capacity: Street slope = 1.2%, capacity = 37cfs (half street)

Design Point 55a

Design Point 55a is located on the north side of Saco Drive west of Willapa Drive

(5-year storm)

Tributary Basins: D1.10 **Inlet/MH Number:** Inlet DP55a

Upstream flowby: **Total Street Flow:** 10.18cfs

Flow Intercepted: 7.38cfs **Flow Bypassed:** 2.8cfs to DP55

Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 2.5%, capacity = 14.0cfs, okay

(100-year storm)

Tributary Basins: D1.10 **Inlet/MH Number:** Inlet DP55a

Upstream flowby: **Total Street Flow:** 22.63cfs

Flow Intercepted: 10.83cfs **Flow Bypassed:** 11.80cfs to DP55

Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 2.5%, capacity = 40.0cfs (half street) is okay

Design Point 55

Design Point 55 is located on the east side of Lamine Drive at a low point south of Yuba Drive.

(5-year storm)

Tributary Basins: D1.9 **Inlet/MH Number:** Inlet DP55

Upstream flowby: 3.7cfs **Total Street Flow:** 7.8cfs

Flow Intercepted: 7.8cfs **Flow Bypassed:**

Inlet Size: 25' type R, sump

Street Capacity: Street slope = 1.9%, capacity = 12.0cfs, okay

(100-year storm)

Tributary Basins: D1.9 **Inlet/MH Number:** Inlet DP55

Upstream flowby: 30.8cfs **Total Street Flow:** 40.0cfs

Flow Intercepted: 31.7cfs **Flow Bypassed:** 8.3cfs to Inlet DP56

Inlet Size: 25' type R, sump

Street Capacity: Street slope = 1.9%, capacity = 45cfs (half street) is okay

Design Point 56
Design Point 56 is located on the west side of Lamine Drive at a low point south of Yuba Drive..

(5-year storm)
Tributary Basins: D1.11 **Inlet/MH Number:** Inlet DP56
Upstream flowby: 2.7cfs **Total Street Flow:** 7.2cfs

Flow Intercepted: 7.2cfs **Flow Bypassed:**
Inlet Size: 25' type R, sump

Street Capacity: Street slope = 1.9%, capacity = 12.0cfs, okay

(100-year storm)
Tributary Basins: D1.11 **Inlet/MH Number:** Inlet DP56
Upstream flowby: 19.8cfs **Total Street Flow:** 29.7cfs

Flow Intercepted: 29.7cfs **Flow Bypassed:**
Inlet Size: 25' type R, sump

Street Capacity: Street slope = 1.9%, capacity = 45cfs (half street) is okay

The trapezoidal overflow swale between the lots is sized for 150cfs, 2.0' deep, 4:1 side slopes, 8' wide bottom, 2% slope, velocity of 8.38cfs, and has a flow depth of 1.34 feet.

Design Point 57
Design Point 57 is located in a low point in Lamine Drive south of Yuba and is the flow in the pipe to Pond D2 from Lamine Drive. The total pipe flow is 63.6cfs/122cfs in the 5/100 year storm events.

Design Point 58
Design Point 58 is the total flow into Pond D2. The total pond inflow is 118.2cfs/277.1cfs in the 5/100-year storm events taken from the full spectrum worksheets.

Design Point 58a
Design Point 58a flow is from Pond D2 which is modeled in the full spectrum excel worksheets. The release rates are directly from the spreadsheet and are less than the existing. There are no ponds in series for this basin. The total pond out flow is 2.1cfs/119.7cfs in the 5/100-year storm events from the full spectrum excel worksheets and complies with discharge similar to existing conditions. See Pond D2 for more information.

Design Point 59a

Design Point 59a is located at the south end of future Tillamook Drive in a cul-de-sac

(5-year storm)
Tributary Basins: D2.2 **Inlet/MH Number:** Inlet DP59a
Upstream flowby: **Total Street Flow:** 2.2cfs

Flow Intercepted: 2.2cfs **Flow Bypassed:**
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 1.0%, capacity = 9.0cfs, okay

(100-year storm)
Tributary Basins: D2.2 **Inlet/MH Number:** Inlet DP59a
Upstream flowby: **Total Street Flow:** 4.8cfs

Flow Intercepted: 4.8cfs **Flow Bypassed:**
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 1.0%, capacity = 37.3cfs (half street) is okay

Design Point 59b

Design Point 59b is located south of Lorson Boulevard under the electric easement and is the flow in the pipe from future Basin D1. The total future pipe flow (Line 27) is 23cfs/60cfs in the 5/100-year storm events.

Design Point 59c

Design Point 59c is located east of Lorson Boulevard and Lamprey Drive and is the flow in the pipe to Design Point 59e. The total pipe flow is 25.7cfs/75.4cfs in the 5/100 year storm events.

Design Point 59d

Design Point 59d is located in the northeast corner of Lorson Boulevard and Lamprey Drive.

(5-year storm)
Tributary Basins: D2.1 & D2.3 **Inlet/MH Number:** Inlet DP59d
Upstream flowby: **Total Street Flow:** 10.7cfs

Flow Intercepted: 10.7cfs **Flow Bypassed:**
Inlet Size: 15' type R, sump

Street Capacity: Street slope = 0.7%, capacity = 11.5cfs, okay

(100-year storm)
Tributary Basins: D2.1 & D2.3 **Inlet/MH Number:** Inlet DP59d
Upstream flowby: **Total Street Flow:** 23.7cfs

Flow Intercepted: 20.3cfs **Flow Bypassed:** 3.7cfs to Inlet DP65b
Inlet Size: 15' type R, sump

Street Capacity: Street slope = 0.7%, capacity = 34.6cfs (half street) is okay

Design Point 59e
Design Point 59e is located west of Lorson Boulevard and Lamprey Drive and is the flow in the pipe (Line 24) in Lorson Boulevard flowing west to Trappe Drive. The total pipe flow is 36.4cfs/93.2cfs in the 5/100 year storm events.

Design Point 59f
Design Point 59f is located at the SW corner of Lorson Boulevard and Skuna Drive.

(5-year storm)
Tributary Basins: D2.4 & D2.5
Inlet/MH Number: Inlet DP59f
Upstream flowby:
Total Street Flow: 13.68cfs

Flow Intercepted: 8.58cfs
Flow Bypassed: 5.1cfs to Inlet DP60
Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 1.9%, capacity Lorson Blvd.= 18.4cfs, okay

(100-year storm)
Tributary Basins: D2.4 & D2.5
Inlet/MH Number: Inlet DP59f
Upstream flowby:
Total Street Flow: 30.47cfs

Flow Intercepted: 12.37cfs
Flow Bypassed: 18.1cfs to Inlet DP60
Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 1.9%, capacity Lorson Blvd. = 50.4cfs (half street) is okay

Design Point 59g
Design Point 59g is located on Lorson Boulevard west of Skuna Drive and is the flow in the pipe (Line 23) in Lorson Boulevard flowing west to Trappe Drive. The total pipe flow is 45.0cfs/104.2cfs in the 5/100 year storm events.

Design Point 60
Design Point 60 is located in the SE corner of Lorson Boulevard and Trappe Drive

(5-year storm)
Tributary Basins: D2.9, D2.12
Inlet/MH Number: Inlet DP60
Upstream flowby: 5.1cfs
Total Street Flow: 15.8cfs

Flow Intercepted: 15.8cfs
Flow Bypassed:
Inlet Size: 25' type R, sump

Street Capacity: Street slope = 1.8%, capacity = 18.4cfs, okay

(100-year storm)
Tributary Basins: D2.9, D2.12
Inlet/MH Number: Inlet DP60
Upstream flowby: 32.1cfs
Total Street Flow: 55.9cfs

Flow Intercepted: 31.7cfs
Flow Bypassed: 24.2cfs to Design Point 64
Inlet Size: 25' type R, sump

Street Capacity: Street slope = 1.8%, capacity = 50.4cfs (half street) is okay since half is from Lorson Blvd and half is from Trappe Drive.

Design Point 61
Design Point 61 is located on Witcher Drive just west of Yocona Drive.

(5-year storm)
Tributary Basins: D2.6 & D2.7 **Inlet/MH Number:** Inlet DP61
Upstream flowby: **Total Street Flow:** 10.57cfs

Flow Intercepted: 7.57cfs **Flow Bypassed:** 3.0cfs to Design Point 62
Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 3.1%, capacity = 15.5cfs, okay

(100-year storm)
Tributary Basins: D2.6 & D2.7 **Inlet/MH Number:** Inlet DP61
Upstream flowby: **Total Street Flow:** 23.68cfs

Flow Intercepted: 11.07cfs **Flow Bypassed:** 12.6cfs to Design Point 62
Inlet Size: 10' type R, on-grade

Street Capacity: Street slope = 3.1%, capacity = 39.0cfs (half street) is okay

Design Point 62
Design Point 62 is located on the east side of Volga Drive at Magothy Drive.

(5-year storm)
Tributary Basins: D2.8 **Inlet/MH Number:** Inlet DP62
Upstream flowby: **Total Street Flow:** 10.1cfs

Flow Intercepted: 10.1cfs **Flow Bypassed:**
Inlet Size: 10' type R, sump

Street Capacity: Street slope = 1.0%, capacity = 9.0cfs, okay

(100-year storm)
Tributary Basins: D2.8 **Inlet/MH Number:** Inlet DP62
Upstream flowby: **Total Street Flow:** 30.3cfs

Flow Intercepted: 16.3cfs **Flow Bypassed:** 14.0cfs to Design Point 60
Inlet Size: 10' type R, sump

Street Capacity: Street slope = 1.0%, capacity = 37.3cfs (half street) is okay

Design Point 63

Design Point 63 is located in the SE corner of Magothy Drive and Volga Drive and is the flow in the pipe (Line 35) in Magothy Drive flowing west to Trappe Drive. The total pipe flow is 17.67cfs/27.38cfs in the 5/100 year storm events.

Design Point 64

Design Point 64 is located in the SW corner of Lorson Boulevard and Trappe Drive

(5-year storm)

Tributary Basins: D2.10 **Inlet/MH Number:** Inlet DP64
Upstream flowby: **Total Street Flow:** 3.2cfs

Flow Intercepted: 3.2cfs **Flow Bypassed:**
Inlet Size: 25' type R, sump

Street Capacity: Street slope = 1.8%, capacity = 18.4cfs, okay

(100-year storm)

Tributary Basins: D2.10 **Inlet/MH Number:** Inlet DP64
Upstream flowby: 24.2cfs **Total Street Flow:** 29.2cfs

Flow Intercepted: 29.2cfs **Flow Bypassed:**
Inlet Size: 25' type R, sump

Street Capacity: Street slope = 1.8%, capacity = 50.4cfs, okay

Design Point 65

Design Point 65 is located at the SW corner of Lorson Boulevard and Trappe Drive and is the flow in the pipe north (Line 30) to Design Point 65c. The total pipe flow is 36.60cfs/88.3cfs in the 5/100 year storm events.

Design Point 65a

Design Point 65a is located on the south side of Lorson Boulevard west of Trappe Drive

(5-year storm)

Tributary Basins: D2.11 **Inlet/MH Number:** Inlet DP65a
Upstream flowby: **Total Street Flow:** 2.0cfs

Flow Intercepted: 2.0cfs **Flow Bypassed:**
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 0.66%, capacity = 10.6 cfs, okay

(100-year storm)

Tributary Basins: D2.11 **Inlet/MH Number:** Inlet DP65a
Upstream flowby: **Total Street Flow:** 3.6cfs

Flow Intercepted: 3.6cfs **Flow Bypassed:**
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 0.66%, capacity = 32.1cfs (half street) is okay

Design Point 65b

Design Point 65b is located on the north side of Lorson Boulevard west of Trappe Drive

(5-year storm)
Tributary Basins: D2.13 **Inlet/MH Number:** Inlet DP65b
Upstream flowby: **Total Street Flow:** 4.2cfs

Flow Intercepted: 4.2cfs **Flow Bypassed:**
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 0.66%, capacity = 10.6cfs, okay

(100-year storm)
Tributary Basins: D2.13 **Inlet/MH Number:** Inlet DP65b
Upstream flowby: 3.7cfs **Total Street Flow:** 12.7cfs

Flow Intercepted: 12.7cfs **Flow Bypassed:**
Inlet Size: 5' type R, sump

Street Capacity: Street slope = 0.66%, capacity = 32.1cfs (half street) is okay

Design Point 65c

Design Point 65c is located west of Lorson Boulevard and Trappe Drive and is the flow in the pipe (Line 17) north to Pond D2. The total pipe flow is 88.3cfs/174.2cfs in the 5/100 year storm events.

Design Point 70 and 71

Design Point 70 is located on the north side of Lorson Boulevard east of Stingray Lane. Flow at this design point is half of Basin B7.1 which was taken from the Meadows No. 3 final drainage report. The flow captured in the 10' type R inlets is 9.3cfs/19.1cfs in the 5/100 year storm events. This amount was rounded up to 10cfs/20cfs in the 5/100yr storm events. Each inlet will capture half of the total flow.

Design Point 72

Design Point 72 is located on Lorson Boulevard west of Stingray Lane and is the flow in the pipe. The total pipe flow is 10cfs/20cfs in the 5/100 year storm events which matches the allowable flow rate per the Meadows Filing No. 3 final drainage report. Water quality and detention for this basin was also provided by The Meadows Filing No. 3 final drainage report.

6.0 DETENTION AND WATER QUALITY PONDS

Detention and Storm Water Quality for Lorson Ranch East is required per El Paso County criteria. We have implemented the Full Spectrum approach for detention for Lorson Ranch East per the Denver Urban Drainage Districts specifications. There are two permanent full spectrum ponds proposed for this development. The two full spectrum ponds (Pond C5 and Pond D2) which incorporate storm water quality features and comply with the Lorson Ranch East MDDP. These two ponds have been sized, graded, access roads, outlet pipes, overflow structures are provided with the Lorson Ranch East Early Grading. This final drainage report provides design information for the construction drawings on the outlet structure, trickle channel, and the forebays.

Full Spectrum Pond Construction Requirements

Both Ponds C5 and D2 will be constructed to the ultimate buildout including the forebays and outlet structures with this final plat. Interim upstream conditions that occur before ultimate upstream buildout and the resultant pond routings are detailed in Section 3.1 including flow comparisons to pre-development flows at the pond discharges into the East Tributary. Section 3.1 concludes that there are no negative downstream affects from constructing the ultimate pond outlet structure and only having interim upstream development conditions for the tributary pond area. Future filings of Lorson Ranch East will need to update the interim conditions pond modelling as platting continues.

Design calculations for full spectrum Ponds C5 and D2 are included in this report. Grading of the ponds is shown on the Early Grading plans for Lorson Ranch East at this time in the Preliminary Plan submittal. The final design will include a 10' wide gravel access road on a 15' wide bench at a maximum 10% slope to the pond bottom. The final design of the full spectrum ponds consists of an outlet structure, storm sewer outfall to the East Tributary, concrete low flow channels, sediment forebays, and overflow weirs to the East Tributary. Soil borings, embankment, slope, and compaction requirements for detention ponds can be found in the geotechnical report for the Lorson Ranch East prepared by RMG.

Detention Pond C5 (Full Spectrum and Hydraflow Design, Ultimate Conditions)

This is an on-site permanent full spectrum detention pond that includes water quality and discharges directly into the East Tributary. Pond C5 is designed in the UDCF Full Spectrum spreadsheets for Water Quality and EURV volumes only. The 5-year and 100-year flow rates are taken from the Lorson East MDDP and have been modeled in a hydraulic modeling software. See MDDP (Table 6.2) for pre/post development release rates into the East Tributary at this location. Pond C5 is required to release runoff (5-yr/100-yr) so it closely mimics the pre-developed flow rates into the East Tributary. The outlet structure is a five cell CDOT type D outlet in parallel and the overflow spillway is a wier set slightly above the outlet structure so it releases the 5yr/100yr storm events quickly to match pre-developed rates. The full spectrum print outs are in the appendix of this report. See map in appendix for watershed areas.

- Watershed Ares: 171 acres (Ultimate Area)
- Watershed Imperviousness: 63%
- Hydrologic Soils Group C/D
- Forebay: 3.51ac-ft (see spreadsheet in appendix) divided between two forebays
- Zone 1 WQCV: 3.298ac-ft, WSEL: 5709.92
- Zone 2 EURV: 9.524ac-ft, WSEL: 5712.27, Top outlet structure set at 5712.60, 3'x30' five CDOT Type D outlets in parallel.
- (5-yr): 13.06ac-ft, WSEL: 5713.49, 126.3cfs (hydraflow)
- Zone 3 (100-yr): 15.86ac-ft, WSEL: 5714.42, 453.2cfs (hydraflow)
- Pipe Outlet: 48" RCP at 0.5%
- Overflow Spillway: 52' wide bottom, elevation=5713, 4:1 side slopes, flow depth=2.0' at 519cfs inflow, 1' freeboard

- Pre-development release rate into East Tributary=141cfs/458cfs in the 5yr/100 yr storm at this pond outfall (Design Pt. 2, Table 6.2 in MDDP). See Design Point 46 for discussion on flows in creek from this pond
- Pond Bottom Elevation: 5706.00

Design: Composite, WQ/EURV by Full Spectrum Excel Worksheets, 5/100yr by Hydraflow

	WQ	EURV	5-yr	100-yr Interim	100-yr Full buildout
Peak Inflow	63.1cfs	181.4cfs	167.5cfs	496cfs	519.1cfs
Peak Outflow	1.4cfs	7.3cfs	126.3cfs	374cfs	453.2cfs
Ponding Depth	3.92ft	6.27ft	7.49ft	7.84ft	8.42ft
Stored Volume	3.29ac-ft	9.52ac-ft	13.01ac-ft	14.07ac-ft	15.86ac-ft
Spillway Stage		7.00ft, 52' wide			
Structure Type:		3'x30' flat top outlet structure (cdot type d) with top at stage 6.60ft			

Detention Pond D2 (Full Spectrum Design, Ultimate Conditions)

This is an on-site permanent full spectrum detention pond that includes water quality and discharges directly into the East Tributary. Pond D2 is a typical full spectrum pond is designed using the UDCF Full Spectrum spreadsheets. There are no ponds in series for the "D" basins. The outlet structure is a standard 4'x20' full spectrum sloped outlet structure and the overflow spillway is a weir set above the outlet structure designed by the full spectrum spreadsheets to match pre-developed rates. The full spectrum print outs are in the appendix of this report. See map in appendix for watershed areas.

- Watershed Ares: 89 acres (Ultimate Area)
- Watershed Imperviousness: 55%
- Hydrologic Soils Group B
- Forebay: 1.635ac-ft (see spreadsheet in appendix) divided between two forebays
- Zone 1 WQCV: 1.52ac-ft, WSEL: 5697.72
- Zone 2 EURV: 5.02ac-ft, WSEL: 5699.74, Top EURV set at 5700.00, 4'x20' outlet with 20:1 slope, 2.0cfs
- (5-yr): 5.53ac-ft, WSEL: 5700.02, 2.1cfs
- Zone 3 (100-yr): 9.05ac-ft, WSEL: 5701.84, 145cfs
- Pipe Outlet: 54" RCP at 0.5% with restrictor plate up 35"
- Overflow Spillway: 30' wide bottom, elevation=5702.00, 4:1 side slopes, flow depth=1.64' at 277.1cfs
- Pre-development release rate into creek compliance from full spectrum pond spreadsheets
- Pond Bottom Elevation: 5695.00

Design: Full Spectrum Excel Worksheets Only

	WQ	EURV	5-yr	100-yr
Peak Inflow	32.1cfs	101.5cfs	111.7cfs	277.3cfs
Peak Outflow	0.7cfs	2.0cfs	2.1cfs	119.7cfs
Ponding Depth	2.72ft	4.74ft	5.02ft	6.84ft
Stored Volume	1.53ac-ft	5.02ac-ft	5.53ac-ft	9.05ac-ft

Spillway Stage	7.00ft, 30' wide
Structure Type:	4'x20' outlet structure with 20:1 slopes. Top at stage 6.0ft

Water Quality Design

Water quality will be provided by the two permanent extended detention basins for 98.42% of the 126.25acre site. Approximately 1.58% of the total 126.25-acre final plat area consists of backyards that drain directly to the East Tributary over a grass buffer constructed and maintained in accordance with DCM Volume 2. Final platting of these areas includes a deviation from county criteria for a grass buffer bmp. Water Quality for the "C" and "D" basins is provided by the two on-site full spectrum ponds Pond C5 and Pond D2.

7.0 DRAINAGE AND BRIDGE FEES

Lorson Ranch East 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.

Lorson Ranch Metro District will compile and submit to the county on a yearly basis the Drainage and bridge fees for the approved plats, and shall show all credits they have received for the same yearly time frame.

Lorson East Filing No. 1 contains 126.25 acres. The 126.25 acres will be assessed Drainage, Bridge and Surety fees. The 2018 drainage fees are $17,197, bridge fees are $804 and Drainage Surety fees are $7,285 per impervious acre per Resolution 17-348. The drainage and bridge fees are calculated when the final plat is submitted. The fees are due at plat recordation. The following table details the drainage fees for the platted area.

Table 1: Drainage/Bridge Fees

Type of Land Use	Total Area (ac)	Imperviousness	Drainage Fee	Bridge Fee	Surety Fee
Residential Area	99.51	52%	$889,862	$41,603	$376,963
Open Space, Landscape Tracts, Detention Ponds, Jimmy Camp Creek	26.74	2%	$9,196	$430	$3,896
		Total	$899,058	$42,033	$380,859

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

Item	Quantity	Unit	Unit Cost	Item Total
Rip Rap	100	CY	$50/CY	$5,000
Inlets/Manholes	34	EA	$3000/EA	$102,000
18" Storm	570	LF	$35	$19,950

24" Storm	1263	LF	$40	$50,520
30" Storm	260	LF	$45	$11,700
36" Storm	1840	LF	$55	$101,200
42" Storm	52	LF	$65	$3,380
48" Storm	270	LF	$85	$22,950
			Subtotal	$316,700
			Eng/Cont (15%)	$47,505
			Total Est. Cost	$364,205

Table 7.2: Lorson Ranch Metro District Drainage Facility Costs (non-reimbursable)

Item	Quantity	Unit	Unit Cost	Item Total
Full Spectrum Ponds and Outlet	2	LS	$150,000	$300,000
			Subtotal	$300,000
			Eng/Cont (15%)	$45,000
			Total Est. Cost	$345,000

8.0 FOUR STEP PROCESS

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
Lorson Ranch East Filing No. 1 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.
- East Tributary of Jimmy Camp Creek with a natural sand bottom and vegetated slopes has been preserved through this site
- Lots on the west side of the site discharge runoff westward over an open space buffer prior to discharge into the creek
- A buffer tract has been added along the SDS watermain easement which reduces impervious areas
- Construct Full Spectrum Detention Pond C5 and D2. The full spectrum detention mimics existing storm discharges

Step 2: Implement BMP's that Slowly Release the Water Quality Capture Volume
Treatment and slow release of the water quality capture volume (WQCV) is required. Lorson Ranch East Filing No. 1 will construct two full spectrum stormwater detention pond which includes Water Quality Volumes and WQ outlet structures.

Step 3: Stabilize Drainageways
East Tributary of Jimmy Camp Creek is a major drainageway located within this site. In 2014 the East Tributary of JCC was reconstructed and stabilized per county criteria. The design included a natural sand bottom and armored sides.

Step 4: Implement Site Specific & Source Control BMP's
There are no potential sources of contaminants that could be introduced to the County's MS4. During construction source control will be provided with the proper installation of erosion control BMPs to limit erosion and transport of sediment. Area disturbed by construction will be seeded and mulched. Cut and fill slopes will be reseeded, and the slopes equal to or greater than three-to-one will be protected with erosion control fabric. Silt fences will be placed at the bottom of re-vegetated and rough graded slopes. Inlet protection will be used around proposed inlets. In addition, temporary sediment basins will be constructed so runoff will be treated prior to discharge. Construction BMPs in the form of vehicle tracking control, sediment basins, concrete washout area, rock socks, buffers, and silt fences will be utilized to protect receiving waters.

9.0 CONCLUSIONS

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

- Developed runoff will be conveyed via curb/gutter and storm sewer facilities
- The East Tributary of Jimmy Camp Creek has been reconstructed within this study area
- Bridges over the East Tributary will be required at Lorson Boulevard and Fontaine Boulevard and have been previously designed by Kiowa Engineering providing access to this site.
- Detention and water quality for this site area will be provided in two permanent ponds
- Access to existing maintenance trails for the East Tributary of Jimmy Camp Creek will be provided on the west side from Lamine Drive at Fontaine Boulevard and from Lorson Boulevard at the East Tributary.
- Access to existing maintenance trails for the East Tributary of Jimmy Camp Creek will be provided on the east side from Fontaine Boulevard and from Lorson Boulevard at the East Tributary.

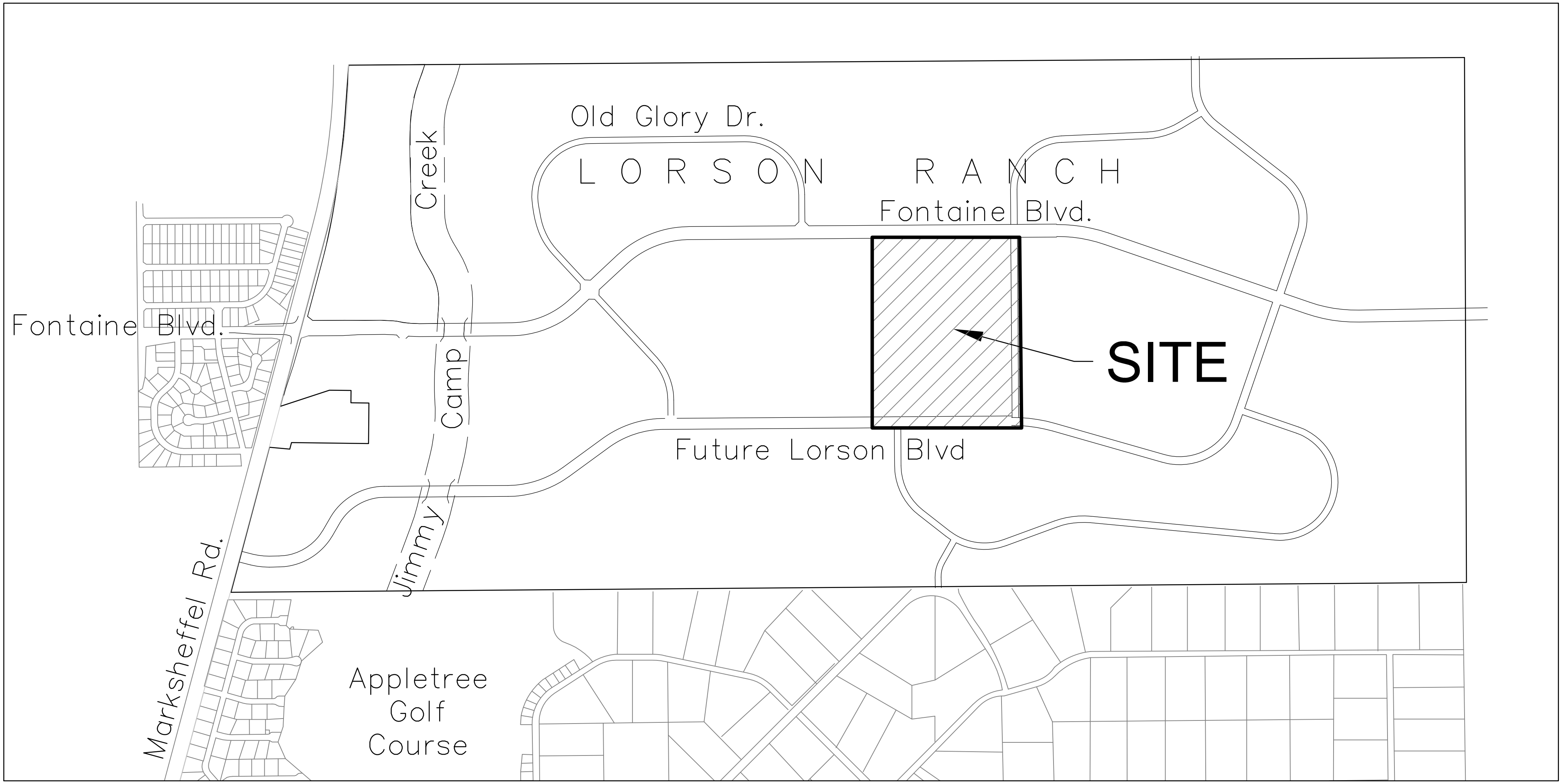
10.0 REFERENCES

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. Final Drainage Report for Fontaine Boulevard, Old Glory Drive, and Marksheffel Road Phase 1 Improvements, Dated February 6, 2006, Revised September 7, 2006, by Pentacor Engineering.
8. Final construction plans "Fontaine Boulevard and East Fork Jimmy Camp Creek Channel Design", Dated March 10, 2017, by Kiowa Engineering Corporation

9. 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.
10. Kiowa Engineering Corporation "Final Bridge and Channel Design Report, CDR 16-009" revised August 24, 2017
11. Lorson Ranch East MDDP prepared by Core Engineering Group, dated November 27, 2017
12. Lorson Ranch East PDR prepared by Core Engineering Group, dated December 18, 2017
13. Final Drainage Report for Fontaine Boulevard prepared by Core Engineering Group, Reference CDR183, dated December 20, 2017

APPENDIX A – VICINTIY MAP, SOILS MAP, FEMA MAP



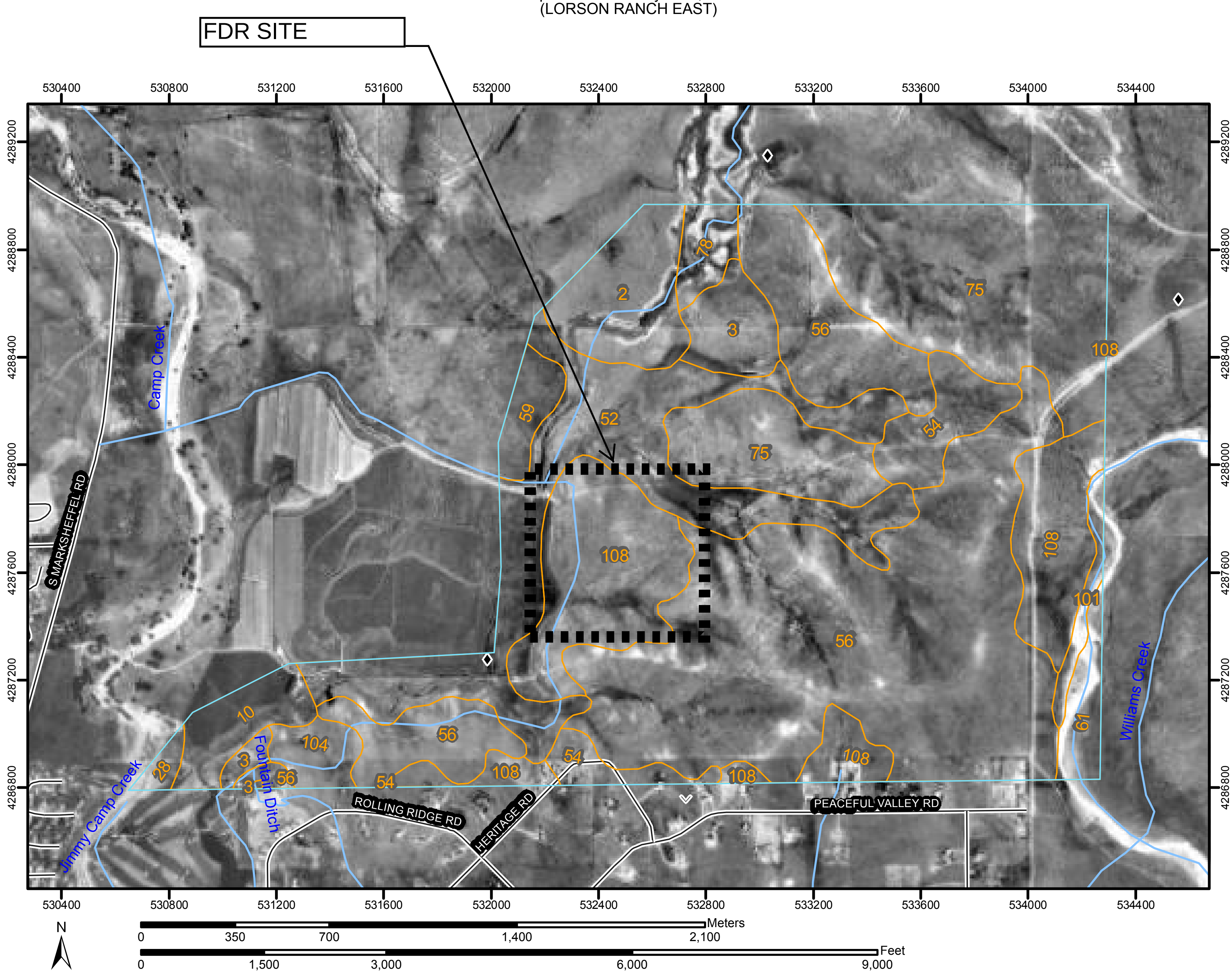
N

VICINITY MAP

NO SCALE

LORSON RANCH EAST FILING NO. 1

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



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Special Point Features

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

Special Line Features

- Gully
- Short Steep Slope
- Other

Political Features

Municipalities

- Cities
- Urban Areas

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails

Roads

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

MAP INFORMATION

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

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

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

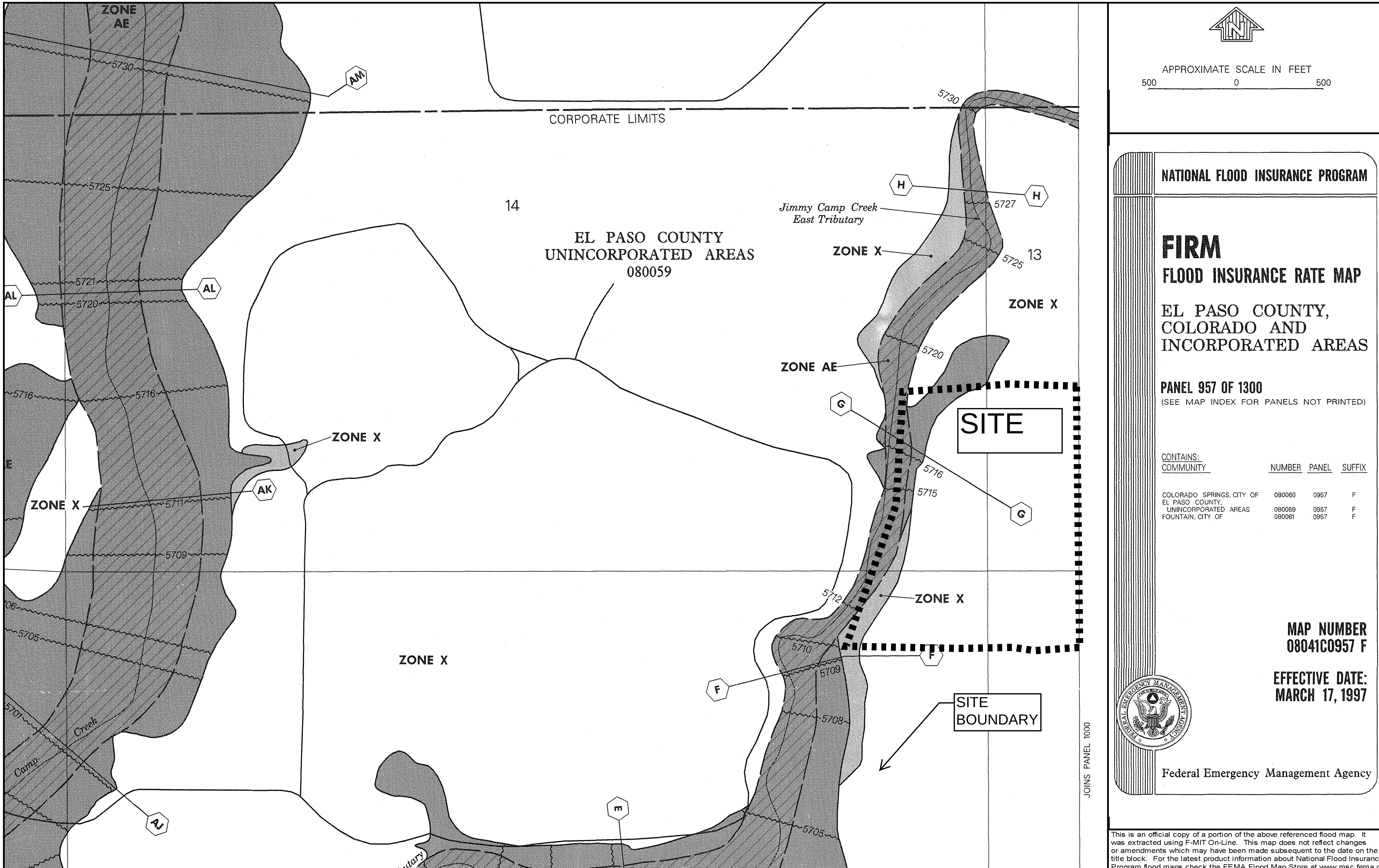
Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 5, Jan 15, 2008

Date(s) aerial images were photographed: 1999

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

Map Unit Legend

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



ZONE AE
5730
AM
CORPORATE LIMITS
5725
14
EL PASO COUNTY
UNINCORPORATED AREAS
080059
5721
AL
AL
5720
5716
5716
ZONE X
AK
ZONE X
5711
5709
5705
5701
Camp Creek
AJ
ZONE X
E
Tributary
F
5710
5709
5708
5705
F
5712
ZONE X
5715
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G
G
ZONE AE
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ZONE X
Jimmy Camp Creek
East Tributary
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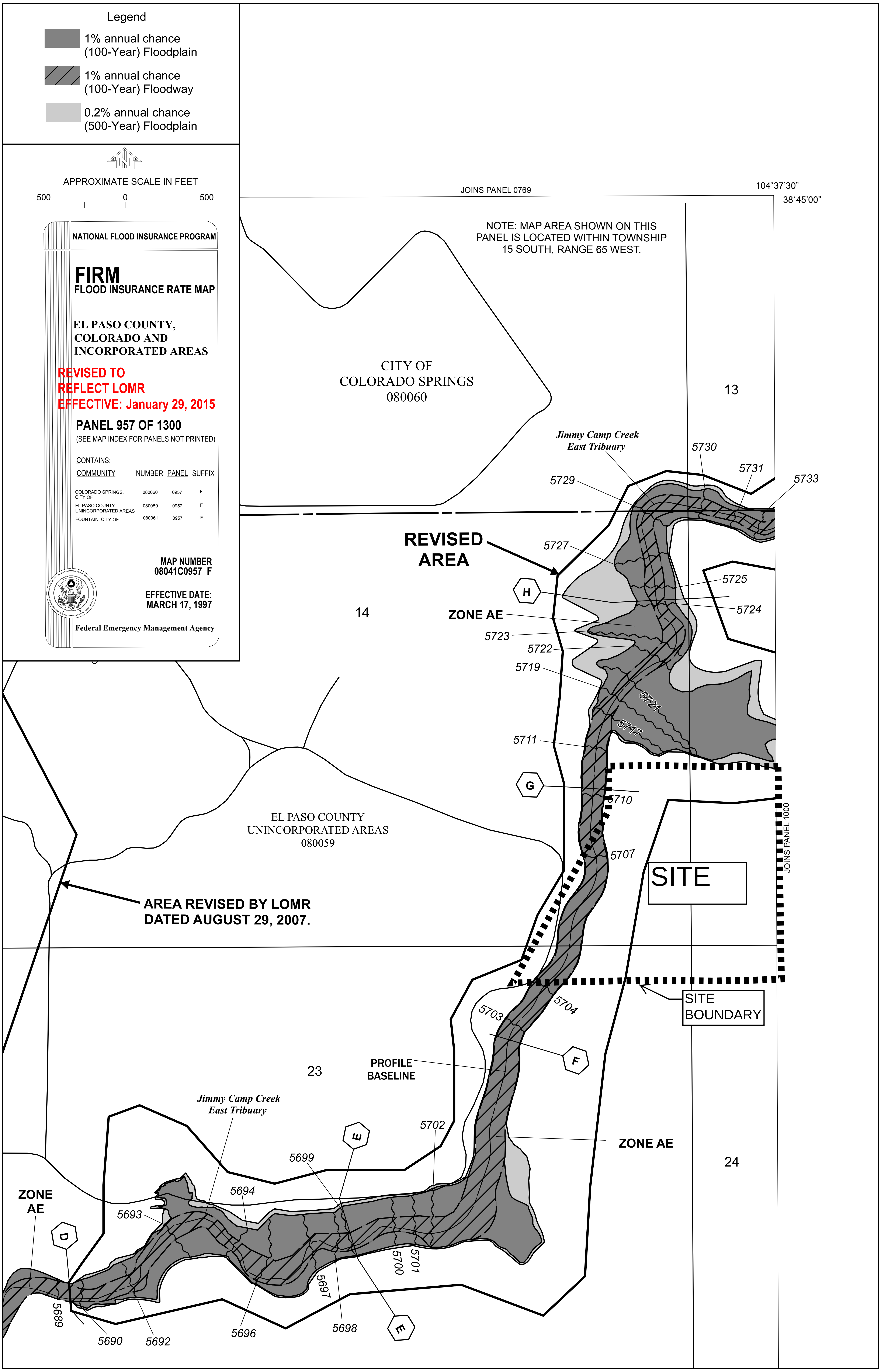
ZONE X
5730
SITE
SITE
BOUNDARY
JOINS PANEL 1000
APPROXIMATE SCALE IN FEET
500 0 500
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY,
COLORADO AND
INCORPORATED AREAS
PANEL 957 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
COLORADO SPRINGS, CITY OF 080060 0957 F
EL PASO COUNTY, UNINCORPORATED AREAS 080059 0957 F
FOUNTAIN, CITY OF 080061 0957 F
MAP NUMBER
08041C0957 F
EFFECTIVE DATE:
MARCH 17, 1997
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
APPROXIMATE SCALE IN FEET
500 0 500
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS
REVISED TO REFLECT LOMR EFFECTIVE: January 29, 2015
PANEL 957 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
COLORADO SPRINGS, CITY OF 080060 0957 F
EL PASO COUNTY UNINCORPORATED AREAS 080059 0957 F
FOUNTAIN, CITY OF 080061 0957 F
MAP NUMBER 08041C0957 F
EFFECTIVE DATE: MARCH 17, 1997
Federal Emergency Management Agency
JOINS PANEL 0769
104°37'30"
38°45'00"
NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 15 SOUTH, RANGE 65 WEST.
CITY OF COLORADO SPRINGS 080060
13
Jimmy Camp Creek East Tribuary
5730
5731
5733
5729
REVISED AREA
5727
5725
5724
H
14
ZONE AE
5723
5722
5719
5721
5717
5711
G
5710
EL PASO COUNTY UNINCORPORATED AREAS 080059
5707
JOINS PANEL 1000
SITE
AREA REVISED BY LOMR DATED AUGUST 29, 2007.
SITE BOUNDARY
5703
5704
F
23
PROFILE BASELINE
Jimmy Camp Creek East Tribuary
5702
ZONE AE
24
E
5699
ZONE AE
5694
5693
D
5701
5700
5697
5689
5690
5692
5696
5698
E

APPENDIX B – HYDROLOGY CALCULATIONS

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis-- Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

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

CORE ENGINEERING GROUP

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

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

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	tc	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	tt	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
EX-A1			4.28	0.08	18.6	0.34	3.20	1.1													
EX-C	**DP-2**		452.97	CN = 67							SCS =	141.0									
EX-D	**DP-3**		109.55	0.12	34.7	13.15	2.26	29.7													
EX-E	**DP-4**		187.30	CN =73							SCS =	100.0									

CORE ENGINEERING GROUP

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

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

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

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	tc	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	tt	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
EX-A1			4.28	0.35	18.6	1.50	5.37	8.0													
EX-C	**DP-2**		452.97	CN = 67						SCS =		458.0									
EX-D	**DP-3**		109.55	0.40	34.7	43.82	3.80	166.5													
EX-E	**DP-4**		187.30	CN = 73						SCS =		280.0									

Hydrograph Plot

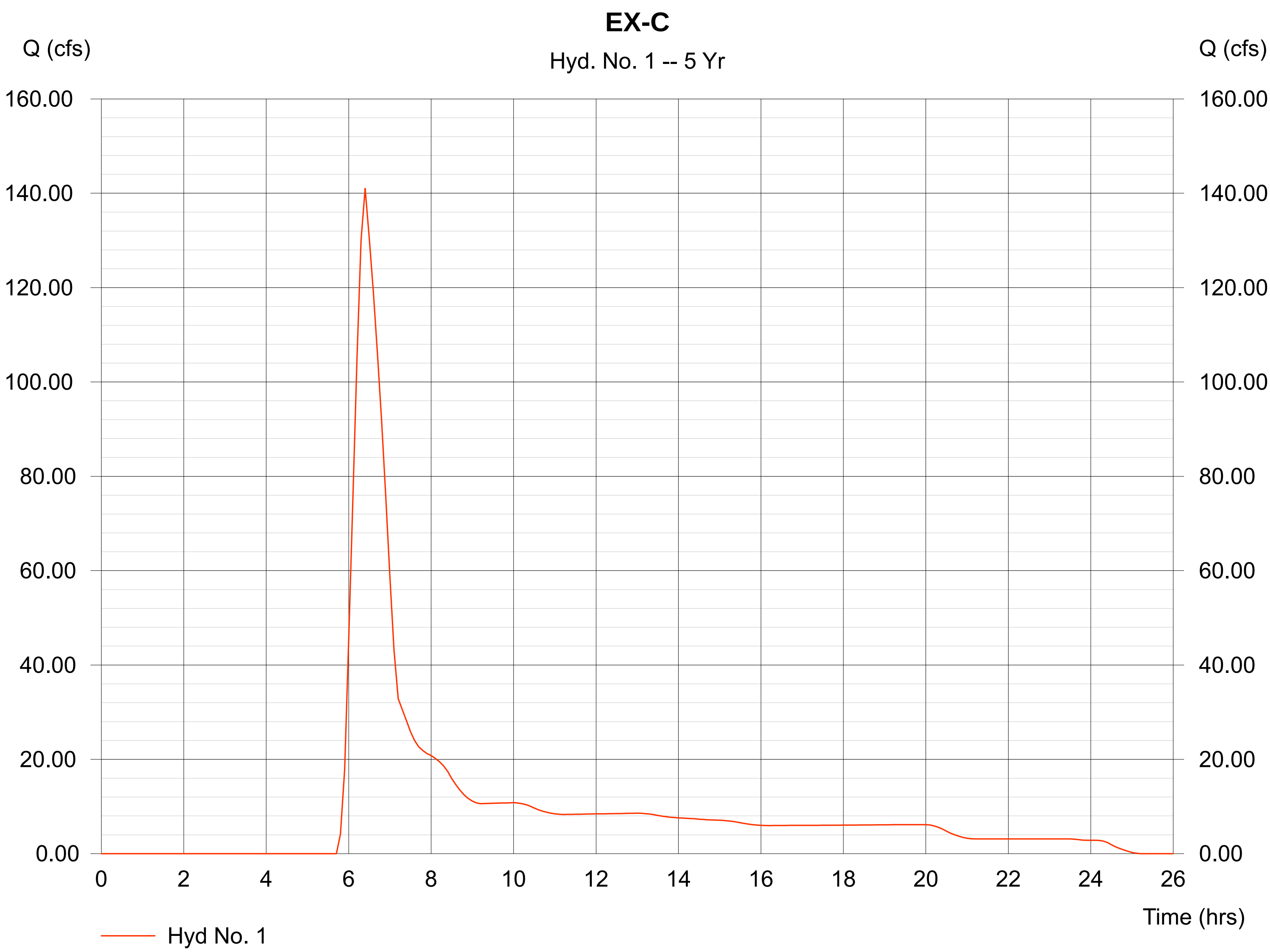
Hydraflow Hydrographs by Intelisolve — Monday, Jun 5 2017, 4:1 PM

Hyd. No. 1

EX-C

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

Hydrograph Volume = 905,484 cuft



Hydrograph Plot

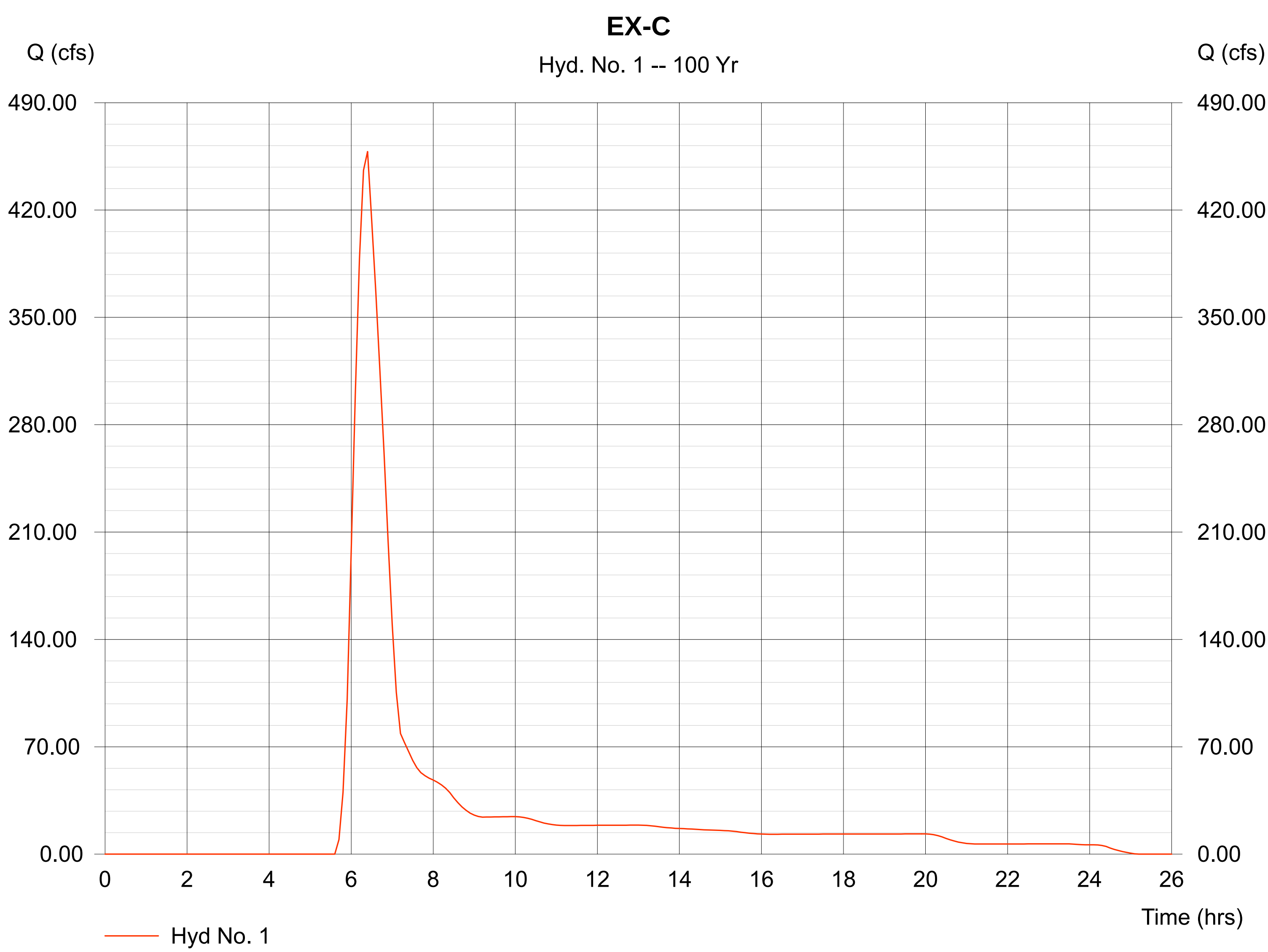
Hydraflow Hydrographs by Intelisolve — Monday, Jun 5 2017, 4:1 PM

Hyd. No. 1

EX-C

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

Hydrograph Volume = 2,456,980 cuft



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

CORE ENGINEERING GROUP

Calculated By: Leonard Beasley
Date: August 16, 2016, June 30, 2017
Checked By: Leonard Beasley

Job No: 100.040
Project: Lorson Ranch East Preliminary Drainage
Design Storm: **5 - Year Event, Proposed Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	tc	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	tt	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
C15.14			1.32	0.49	8.11	0.65	4.44	2.9													
C15.15			4.02	0.49	13.72	1.97	3.65	7.2													
C17.1a			2.81	0.49	12.11	1.38	3.84	5.3													
C17.1			2.68	0.49	7.69	1.31	4.52	5.9													
C17.2			4.11	0.49	9.19	2.01	4.26	8.6													
C17.3			2.21	0.49	9.78	1.08	4.16	4.5													
C17.4			1.98	0.49	17.58	0.97	3.28	3.2													
C17.5			3.72	0.49	13.41	1.82	3.69	6.7													
C17.6			1.04	0.49	13.89	0.51	3.64	1.9													
C17.7			2.68	0.49	7.62	1.31	4.54	6.0													
C17.7-2 yr storm			2.68	0.04	7.62	0.11	4.54	0.5													
C17.8			1.52	0.55	12.41	0.84	3.81	3.2													
C17.9			1.73	0.90	5.65	1.56	4.99	7.8													
C17.10			2.34	0.90	9.34	2.11	4.23	8.9													
D1.1			5.09	0.49	18.38	2.49	3.22	8.0													
D1.2			1.10	0.49	6.86	0.54	4.69	2.5													
D1.3			0.86	0.49	10.65	0.42	4.03	1.7													
D1.4			2.80	0.49	12.39	1.37	3.81	5.2													
D1.5			5.15	0.49	9.43	2.52	4.22	10.6													
D1.6			5.10	0.49	16.74	2.50	3.36	8.4													
D1.7			3.50	0.49	10.40	1.72	4.07	7.0													
D1.8			1.70	0.49	12.37	0.83	3.81	3.2													
D1.9			2.20	0.49	12.70	1.08	3.77	4.1													
D1.10			5.50	0.49	13.39	2.70	3.69	9.9													
D1.11			1.40	0.49	12.38	0.69	3.81	2.6													
D1.12			4.45	0.24	14.08	1.07	3.62	3.9													
D2.1			3.14	0.49	14.87	1.54	3.53	5.4													
D2.2			1.11	0.49	11.93	0.54	3.86	2.1													
D2.3			2.80	0.27	14.09	0.76	3.61	2.7													
D2.4			3.33	0.29	13.48	0.97	3.68	3.6													
D2.5			3.93	0.49	7.40	1.93	4.58	8.8													

CORE ENGINEERING GROUP

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

Calculated By: Leonard Beasley
Date: August 16, 2016, June 30, 2017
Checked By: Leonard Beasley

Job No: 100.040
Project: Lorson Ranch East Preliminary Drainage
Design Storm: **5 - Year Event, Proposed Conditions**

			Direct Runoff						Total Runoff				Street		Pipe			Travel Time			
Street or Basin	Design Point	Area Design	Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	tc	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	tt	Remarks
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
D2.6			2.13	0.49	10.37	1.04	4.07	4.3													
D2.7			2.98	0.49	7.22	1.46	4.62	6.7													
D2.8			3.70	0.49	9.24	1.81	4.25	7.7													
D2.9			3.15	0.49	14.83	1.54	3.54	5.5													
D2.10			0.80	0.80	6.24	0.64	4.84	3.1													
D2.11			0.40	0.90	3.68	0.36	5.63	2.0													
D2.12			2.78	0.49	11.27	1.36	3.95	5.4													
D2.13			2.51	0.49	17.67	1.23	3.28	4.0													
D1-ex			17	0.15	17.78	2.55	3.27	8													
EX4			23	0.15	17.78	3.45	3.27	11													
EX5			9.7	0.15	10.00	1.46	4.13	6													

CORE ENGINEERING GROUP

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

Calculated By: Leonard Beasley
Date: August 16, 2016, June 30, 2017
Checked By: Leonard Beasley

Job No: 100.040
Project: Lorson Ranch East Preliminary Drainage
Design Storm: **100 - Year Event, Proposed Conditions**

		Direct Runoff							Total Runoff				Street		Pipe			Travel Time			
Street or Basin	Design Point	Area Design	Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	tc	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	tt	Remarks
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
C15.14			1.32	0.65	8.11	0.86	7.46	6.4													
C15.15			4.02	0.65	13.72	2.61	6.14	16.0													
C17.1a			2.81	0.65	12.11	1.83	6.45	11.8													
C17.1			2.68	0.65	7.69	1.74	7.59	13.2													
C17.2			4.11	0.65	9.19	2.67	7.15	19.1													
C17.3			2.21	0.65	9.78	1.44	6.99	10.0													
C17.4			1.98	0.65	17.58	1.29	5.51	7.1													
C17.5			3.72	0.96	13.41	3.57	6.19	22.1													
C17.6			1.04	0.96	13.89	1.00	6.10	6.1													
C17.7			2.68	0.65	7.62	1.74	7.62	13.3													
C17.8			1.52	0.74	12.41	1.12	6.39	7.2													
C17.9			1.73	0.96	5.65	1.66	8.37	13.9													
C17.10			2.34	0.96	9.34	2.25	7.10	16.0													
D1.1			5.09	0.65	18.38	3.31	5.40	17.9													
D1.2			1.10	0.65	6.86	0.72	7.88	5.6													
D1.3			0.86	0.65	10.65	0.56	6.77	3.8													
D1.4			2.80	0.65	12.39	1.82	6.39	11.6													
D1.5			5.15	0.65	9.43	3.35	7.08	23.7													
D1.6			5.10	0.65	16.74	3.32	5.63	18.7													
D1.7			3.50	0.65	10.40	2.28	6.83	15.5													
D1.8			1.70	0.65	12.37	1.11	6.40	7.1													
D1.9			2.20	0.65	12.70	1.43	6.33	9.1													
D1.10			5.50	0.65	13.39	3.58	6.20	22.2													
D1.11			1.40	0.65	12.38	0.91	6.39	5.8													
D1.12			4.45	0.57	14.08	2.54	6.07	15.4													
D2.1			3.14	0.65	14.87	2.04	5.93	12.1													
D2.2			1.11	0.65	11.93	0.72	6.49	4.7													
D2.3			2.80	0.57	14.09	1.60	6.07	9.7													

CORE ENGINEERING GROUP

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

Calculated By: Leonard Beasley
Date: August 16, 2016, June 30, 2017
Checked By: Leonard Beasley

Job No: 100.040
Project: Lorson Ranch East Preliminary Drainage
Design Storm: **100 - Year Event, Proposed Conditions**

Street or Basin	Design Point	Direct Runoff							Total Runoff				Street		Pipe			Travel Time			Remarks
		Area Design	Area (A)	Runoff Coeff. (C)	tc	CA	i	Q	tc	Σ (CA)	i	Q	Slope	Street Flow	Design Flow	Slope	Pipe Size	Length	Velocity	tt	
			ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	in	ft	ft/sec	min	
D2.4			3.33	0.58	13.48	1.93	6.18	11.9													
D2.5			3.93	0.65	7.40	2.55	7.69	19.6													
D2.6			2.13	0.65	10.37	1.38	6.84	9.5													
D2.7			2.98	0.65	7.22	1.94	7.75	15.0													
D2.8			3.70	0.65	9.24	2.41	7.13	17.2													
D2.9			3.15	0.65	14.83	2.05	5.94	12.2													
D2.10			0.80	0.90	6.24	0.72	8.12	5.8													
D2.11			0.40	0.96	3.68	0.38	9.45	3.6													
D2.12			2.78	0.65	11.27	1.81	6.63	12.0													
D2.13			2.51	0.65	17.67	1.63	5.50	9.0													
D1-ex			17	0.45	17.78	7.65	5.48	41.9													
EX4			23	0.45	17.78	10.35	5.48	56.7													
EX5			9.7	0.45	10.00	4.37	6.93	30.3													

CORE ENGINEERING GROUP

Standard Form SF-1. Time of Concentration-Proposed

Calculated By: Leonard Beasley
Date: August 16, 2016, June 30, 2017
Checked By: Leonard Beasley

Job No: 100.040
Project: Lorson Ranch East Preliminary Drainage

Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)				t_c Check (urbanized Basins)			Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
C15.4	0.49	1.25	15.0	91.00	7.14%	0.28	5.49	100.0	2.60%	1.41	1.18				
			20.0					406.0	2.02%	2.84	2.38	9.05	597.00	13.32	9.05
C15.5	0.49	2.90	20.0	35.00	2.00%	0.11	5.18	979.0	3.04%	3.49	4.68	9.86	1014.00	15.63	9.86
C15.6	0.49	1.80	15.0	59.00	1.36%	0.13	7.64	100.0	2.00%	2.12	0.79				
			20.0					731.0	1.87%	2.73	4.45	12.88	890.00	14.94	12.88
C15.7	0.49	2.07	20.0	39.00	2.05%	0.12	5.43	966.0	1.63%	2.55	6.31	11.73	1005.00	15.58	11.73
C15.8	0.40	3.76	15.0	100.00	7.00%	0.25	6.65	89.0	11.35%	5.05	0.29				
			15.0					463.0	0.60%	1.16	6.64				
			20.0					240.0	1.08%	2.08	1.92	15.51	892.00	14.96	15.51
C15.9	0.49	2.27	15.0	53.00	1.20%	0.12	7.55	96.0	3.02%	2.61	0.61				
			20.0					8.6	1.61%	2.54	0.06	8.22	157.55	10.88	8.22
C15.10	0.49	0.60	15.0	100.00	2.20%	0.20	8.49	37.0	2.20%	2.22	0.28				
			20.0					160.0	1.51%	2.46	1.09	9.85	297.00	11.65	9.85
C15.11	0.49	3.20	20.0	74.00	4.19%	0.21	5.90	1105.0	2.63%	3.24	5.68	11.58	1179.00	16.55	11.58
C15.12	0.49	0.61	15.0	100.00	2.16%	0.20	8.54	34.0	2.16%	2.20	0.26				
			20.0					321.0	1.00%	2.00	2.68	11.47	455.00	12.53	11.47
C15.13	0.49	2.35	20.0	52.00	2.12%	0.14	6.20	967.0	2.32%	3.05	5.29	11.49	1019.00	15.66	11.49
C15.14	0.49	1.32	20.0	33.00	1.82%	0.11	5.19	595.0	2.89%	3.40	2.92	8.11	628.00	13.49	8.11
C15.15	0.49	4.02	20.0	100.00	2.88%	0.21	7.77	1111.0	2.42%	3.11	5.95	13.72	1211.00	16.73	13.72
C17.1a	0.49	2.81	20.0	90.00	2.00%	0.18	8.31	733.0	2.58%	3.21	3.80	12.11	823.00	14.57	12.11
C17.1	0.49	2.68	15.0	28.00	18.57%	0.21	2.22	160.0	2.88%	2.55	1.05				
			20.0					530.0	1.00%	2.00	4.42	7.69	718.00	13.99	7.69
C17.2	0.49	4.11	20.0	33.00	2.00%	0.11	5.03	903.0	3.27%	3.62	4.16	9.19	936.00	15.20	9.19
C17.3	0.49	2.21	15.0	100.00	8.40%	0.31	5.46	152.0	4.47%	3.17	0.80				
			20.0					416.0	0.97%	1.97	3.52	9.78	668.00	13.71	9.78
C17.4	0.49	1.98	20.0	36.00	2.00%	0.11	5.26	1579.0	1.14%	2.14	12.32	17.58	1615.00	18.97	17.58
C17.5	0.49	3.72	15.0	66.00	7.73%	0.24	4.56	77.0	4.63%	3.23	0.40				
			20.0					1050.0	1.07%	2.07	8.46	13.41	1193.00	16.63	13.41
C17.6	0.49	1.04	20.0	94.00	1.06%	0.15	10.47	527.0	1.65%	2.57	3.42	13.89	621.00	13.45	13.89
C17.7	0.49	2.68	15.0	90.00	4.44%	0.23	6.39	107.0	0.93%	1.45	1.23	7.62	197.00	11.09	7.62
C17.8	0.55	1.52	20.0	100.00	3.00%	0.24	6.91	643.0	0.95%	1.95	5.50	12.41	743.00	14.13	12.41
C17.9	0.90	1.73	20.0	31.00	2.00%	0.32	1.60	464.0	0.91%	1.91	4.05	5.65	495.00	12.75	5.65
C17.10	0.90	2.34	20.0	45.00	2.00%	0.39	1.93	723.0	0.66%	1.62	7.42	9.34	768.00	14.27	9.34
D1.1	0.49	5.09	20.0	100.00	1.50%	0.17	9.63	1484.0	2.00%	2.83	8.74	18.38	1584.00	18.80	18.38
D1.2	0.49	1.10	15.0	65.00	7.85%	0.24	4.50	81.0	2.72%	2.47	0.55				

CORE ENGINEERING GROUP

Standard Form SF-1. Time of Concentration-Proposed

Calculated By: Leonard Beasley
Date: August 16, 2016, June 30, 2017
Checked By: Leonard Beasley

Job No: 100.040
Project: Lorson Ranch East Preliminary Drainage

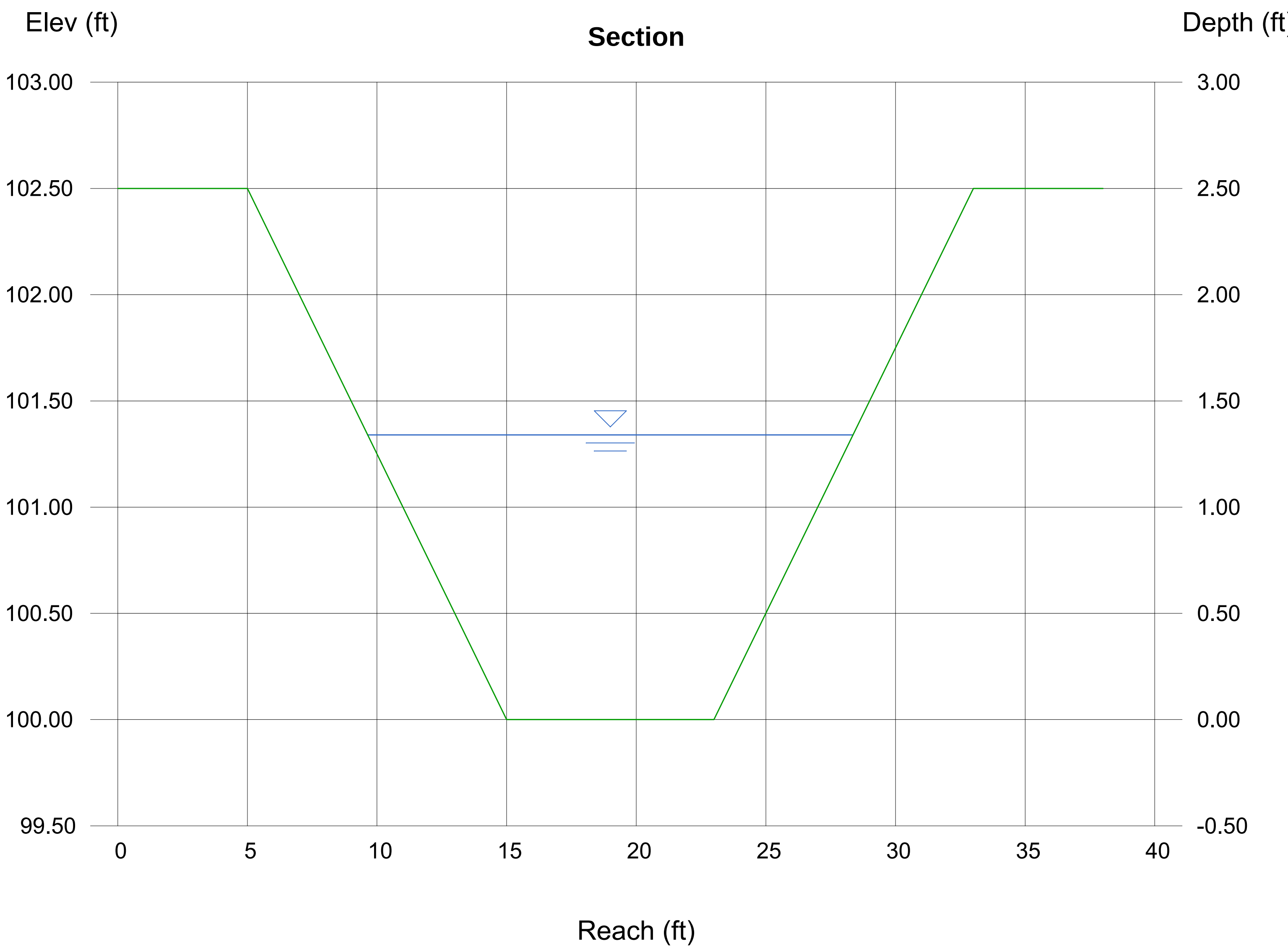
Sub-Basin Data				Initial Overland Time (t_i)				Travel Time (t_t)					t_c Check (urbanized Basins)		Final t_c
BASIN or DESIGN	C_5	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	t_t minutes	Computed t_c Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended $t_c=t_i+t_t$ (min)
			20.0					309.0	2.01%	2.84	1.82	6.86	455.00	12.53	6.86
D1.3	0.49	0.86	20.0	100.00	2.60%	0.21	8.03	420.0	1.79%	2.68	2.62	10.65	520.00	12.89	10.65
D1.4	0.49	2.80	15.0	100.00	1.60%	0.18	9.43	33.0	2.42%	2.33	0.24				
			20.0					582.0	3.18%	3.57	2.72	12.39	715.00	13.97	12.39
D1.5	0.49	5.15	20.0	36.00	4.22%	0.15	4.11	1132.0	3.14%	3.54	5.32	9.43	1168.00	16.49	9.43
D1.6	0.49	5.10	20.0	90.00	1.44%	0.16	9.26	1421.0	2.51%	3.17	7.47	16.74	1511.00	18.39	16.74
D1.7	0.49	3.50	15.0	90.00	12.33%	0.33	4.56	107.0	3.74%	2.90	0.61				
			20.0					781.0	1.55%	2.49	5.23	10.40	978.00	15.43	10.40
D1.8	0.49	1.70	20.0	45.00	1.11%	0.11	7.14	1004.0	2.56%	3.20	5.23	12.37	1049.00	15.83	12.37
D1.9	0.49	2.20	20.0	50.00	2.00%	0.13	6.20	1265.0	2.63%	3.24	6.50	12.70	1315.00	17.31	12.70
D1.10	0.49	5.50	20.0	47.00	2.49%	0.14	5.59	1460.0	2.43%	3.12	7.80	13.39	1507.00	18.37	13.39
D1.11	0.49	1.40	20.0	50.00	2.00%	0.13	6.20	951.0	1.64%	2.56	6.19	12.38	1001.00	15.56	12.38
D1.12	0.24	4.45	15.0	95.00	7.16%	0.20	7.90	177.0	6.78%	3.91	0.76				
			15.0					463.0	0.50%	1.06	7.28	15.93	735.00	14.08	14.08
D2.1	0.49	3.14	15.0	100.00	2.32%	0.20	8.34	90.0	2.32%	2.28	0.66				
			20.0					897.0	1.62%	2.55	5.87	14.87	1087.00	16.04	14.87
D2.2	0.49	1.11	15.0	100.00	1.70%	0.18	9.24	167.0	3.47%	2.79	1.00				
			20.0					218.0	1.15%	2.14	1.69	11.93	485.00	12.69	11.93
D2.3	0.27	2.80	15.0	100.00	2.10%	0.14	11.73	344.0	4.77%	3.28	1.75				
			20.0					292.0	3.20%	3.58	1.36	14.84	736.00	14.09	14.09
D2.4	0.29	3.33	15.0	100.00	4.50%	0.19	8.90	386.0	6.30%	3.76	1.71				
			20.0					487.0	2.00%	2.83	2.87	13.48	973.00	15.41	13.48
D2.5	0.49	3.93	15.0	61.00	14.75%	0.29	3.54	219.0	2.19%	2.22	1.64				
			20.0					447.0	2.82%	3.36	2.22	7.40	727.00	14.04	7.40
D2.6	0.49	2.13	15.0	100.00	3.00%	0.22	7.66	20.0	2.50%	2.37	0.14				
			20.0					528.0	2.94%	3.43	2.57	10.37	648.00	13.60	10.37
D2.7	0.49	2.98	20.0	25.00	2.00%	0.10	4.38	631.0	3.44%	3.71	2.84	7.22	656.00	13.64	7.22
D2.8	0.49	3.70	15.0	35.00	15.71%	0.22	2.63	162.0	2.34%	2.29	1.18				
			20.0					665.0	1.04%	2.04	5.43	9.24	862.00	14.79	9.24
D2.9	0.49	3.15	20.0	75.00	1.87%	0.16	7.76	1342.0	2.50%	3.16	7.07	14.83	1417.00	17.87	14.83
D2.10	0.49	0.80	20.0	17.00	2.00%	0.08	3.61	392.0	1.54%	2.48	2.63	6.24	409.00	12.27	6.24
D2.11	0.90	0.40	20.0	10.00	2.00%	0.18	0.91	278.0	0.70%	1.67	2.77	3.68	288.00	11.60	3.68
D2.12	0.49	2.78	20.0	100.00	5.20%	0.26	6.39	1009.0	2.97%	3.45	4.88	11.27	1109.00	16.16	11.27
D2.13	0.49	2.51	20.0	20.00	2.00%	0.09	3.92	2334.0	2.00%	2.83	13.75	17.67	2354.00	23.08	17.67

APPENDIX C – HYDRAULIC CALCULATIONS

Channel Report

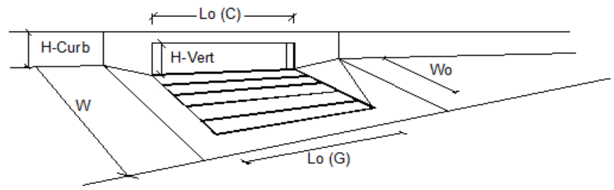
Lamine low point to Pond D2 Overflow Swale - Design Point 56

Trapezoidal		**Highlighted**	
Botom Width (ft)	= 8.00	Depth (ft)	= 1.34
Side Slope (z:1)	= 4.00	Q (cfs)	= 150.00
Total Depth (ft)	= 2.50	Area (sqft)	= 17.90
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 8.38
Slope (%)	= 2.00	Wetted Perim (ft)	= 19.05
N-Value	= 0.024	Crit Depth, Yc (ft)	= 1.68
		Top Width (ft)	= 18.72
Calculations		EGL (ft)	= 2.43
Compute by:	Known Q		
Known Q (cfs)	= 150.00		



INLET ON A CONTINUOUS GRADE

Project: **Lorson East Prelim Plan #100.040**
Inlet ID: **Inlet DP-28 (Basin C17.1a)**

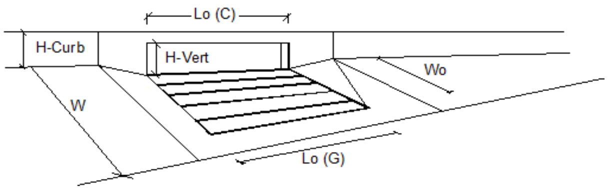


		MINOR	MAJOR	
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	Q_o =	5.3	11.5	cfs
Water Spread Width	T =	10.8	15.1	ft
Water Depth at Flowline (outside of local depression)	d =	4.1	5.1	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.541	0.396	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	2.4	7.0	cfs
Discharge within the Gutter Section W	Q_w =	2.9	4.6	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	1.29	2.39	sq ft
Velocity within the Gutter Section W	V_W =	4.1	4.8	fps
Water Depth for Design Condition	d_{LOCAL} =	7.1	8.1	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	Q_a =	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.122	0.094	ft/ft
Required Length L_T to Have 100% Interception	L_T =	12.04	20.09	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	12.04	15.00	ft
Interception Capacity	Q_i =	5.3	10.5	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	13.03	13.03	ft
Actual Interception Capacity	Q_a =	5.3	10.4	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	Q_b =	0.0	1.2	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.30**	**10.36**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**90**	**%**

INLET ON A CONTINUOUS GRADE

Project: Lorson East Prelim Plan #100.040

Inlet ID: Inlet DP-38 (Basin C17.1+bypass from Inlet DP-28)

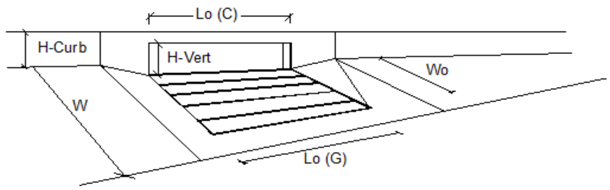


		MINOR	MAJOR	
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	Q_o =	5.9	14.4	cfs
Water Spread Width	T =	13.6	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	4.8	6.2	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.6	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.437	0.304	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	3.3	10.0	cfs
Discharge within the Gutter Section W	Q_w =	2.6	4.4	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	1.98	3.91	sq ft
Velocity within the Gutter Section W	V_W =	3.0	3.7	fps
Water Depth for Design Condition	d_{LOCAL} =	7.8	9.2	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	Q_a =	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.102	0.077	ft/ft
Required Length L_T to Have 100% Interception	L_T =	13.12	23.51	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	13.12	15.00	ft
Interception Capacity	Q_i =	5.9	12.1	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	13.03	13.03	ft
Actual Interception Capacity	Q_a =	5.9	11.8	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	Q_b =	0.0	2.6	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.90**	**11.83**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**82**	**%**

INLET ON A CONTINUOUS GRADE

Project: Lorson East Prelim Plan #100.040

Inlet ID: Inlet DP-39 (Basin C17.2+bypass from Inlet DP-38)

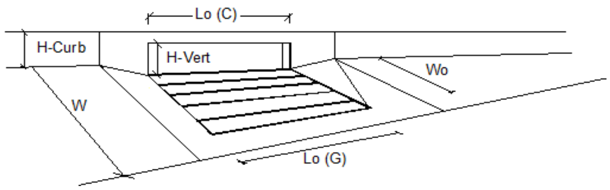


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	**Q_o =**	8.6	21.6	cfs
Water Spread Width	T =	12.5	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	4.5	5.9	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.3	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.473	0.326	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	4.5	14.5	cfs
Discharge within the Gutter Section W	Q_w =	4.1	7.0	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	1.69	3.45	sq ft
Velocity within the Gutter Section W	V_W =	5.1	6.2	fps
Water Depth for Design Condition	d_{LOCAL} =	7.5	8.9	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.109	0.081	ft/ft
Required Length L_T to Have 100% Interception	L_T =	16.50	30.17	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	15.00	15.00	ft
Interception Capacity	Q_i =	8.5	15.3	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	13.03	13.03	ft
Actual Interception Capacity	**Q_a =**	8.4	14.9	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	0.2	6.6	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**8.41**	**14.93**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.2**	**6.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**98**	**69**	**%**

INLET ON A CONTINUOUS GRADE

Project: Lorson East Prelim Plan #100.040

Inlet ID: Inlet DP-50 (Basins D1.1+D1.2)

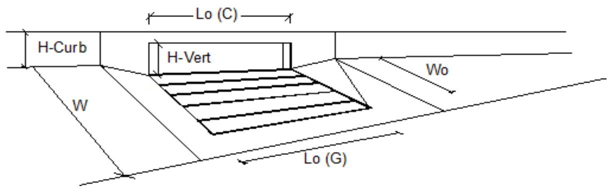


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	Q_o =	10.1	22.3	cfs
Water Spread Width	T =	14.6	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	5.0	6.4	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.8	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.408	0.296	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	6.0	15.7	cfs
Discharge within the Gutter Section W	Q_w =	4.1	6.6	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	2.25	4.09	sq ft
Velocity within the Gutter Section W	V_W =	4.5	5.5	fps
Water Depth for Design Condition	d_{LOCAL} =	8.0	9.4	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	Q_a =	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.097	0.076	ft/ft
Required Length L_T to Have 100% Interception	L_T =	18.43	30.94	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	10.00	10.00	ft
Interception Capacity	Q_i =	7.6	11.2	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.75	8.75	ft
Actual Interception Capacity	Q_a =	7.3	10.8	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	Q_b =	2.7	11.5	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	**7.34**	**10.77**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	**2.7**	**11.5**	**cfs**
Capture Percentage = Q_a/Q_o =	C% =	**73**	**48**	**%**

INLET ON A CONTINUOUS GRADE

Project: Lorson East Prelim Plan #100.040

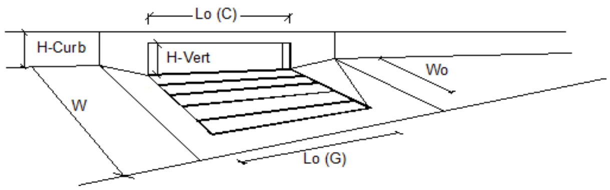
Inlet ID: Inlet DP-52 (Basin D1.4+D1.5)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	Q_o =	15.5	34.7	cfs
Water Spread Width	T =	16.5	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	5.5	7.0	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	1.4	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.362	0.265	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	9.9	25.2	cfs
Discharge within the Gutter Section W	Q_w =	5.6	9.1	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.4	cfs
Flow Area within the Gutter Section W	A_W =	2.85	5.00	sq ft
Velocity within the Gutter Section W	V_W =	5.4	6.9	fps
Water Depth for Design Condition	d_{LOCAL} =	8.5	10.0	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	Q_a =	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.088	0.070	ft/ft
Required Length L_T to Have 100% Interception	L_T =	24.34	40.62	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	15.00	15.00	ft
Interception Capacity	Q_i =	12.7	19.3	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	13.03	13.03	ft
Actual Interception Capacity	Q_a =	12.4	18.8	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	Q_b =	3.0	15.9	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	**12.44**	**18.80**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	**3.0**	**15.9**	**cfs**
Capture Percentage = Q_a/Q_o =	C% =	**80**	**54**	**%**

INLET ON A CONTINUOUS GRADE

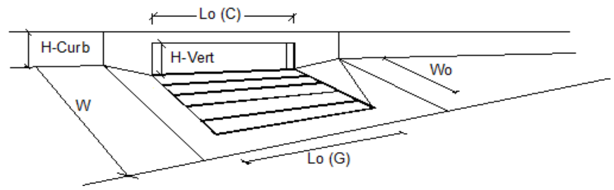
Project: Lorson East Prelim Plan #100.040
Inlet ID: Inlet DP-53 (Basin D1.6+D1.8+bypass from Inlet DP-52)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	20.00	20.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	Q_o =	14.6	41.5	cfs
Water Spread Width	T =	15.6	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	5.3	7.2	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	1.6	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.382	0.256	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	9.1	30.3	cfs
Discharge within the Gutter Section W	Q_w =	5.6	10.4	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.8	cfs
Flow Area within the Gutter Section W	A_W =	2.57	5.32	sq ft
Velocity within the Gutter Section W	V_W =	5.7	7.7	fps
Water Depth for Design Condition	d_{LOCAL} =	8.3	10.2	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	Q_a =	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.092	0.068	ft/ft
Required Length L_T to Have 100% Interception	L_T =	23.41	45.23	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	20.00	20.00	ft
Interception Capacity	Q_i =	14.2	26.5	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.33	1.33	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.03	0.03	
Effective (Unclogged) Length	L_e =	17.34	17.34	ft
Actual Interception Capacity	Q_a =	14.0	26.0	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	Q_b =	0.6	15.5	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**14.05**	**25.97**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.6**	**15.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**96**	**63**	**%**

INLET ON A CONTINUOUS GRADE

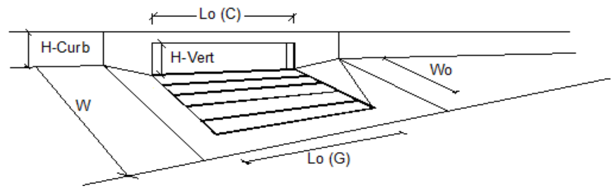
Project: Lorson East Prelim Plan #100.040
Inlet ID: Inlet DP-54 (Basin D1.7)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	Q_o =	7.3	16.1	cfs
Water Spread Width	T =	14.6	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	5.0	6.4	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.8	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.408	0.296	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	4.3	11.3	cfs
Discharge within the Gutter Section W	Q_w =	3.0	4.8	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	2.26	4.09	sq ft
Velocity within the Gutter Section W	V_W =	3.2	3.9	fps
Water Depth for Design Condition	d_{LOCAL} =	8.0	9.4	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	Q_a =	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.097	0.076	ft/ft
Required Length L_T to Have 100% Interception	L_T =	15.05	25.23	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	15.00	15.00	ft
Interception Capacity	Q_i =	7.3	12.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	13.03	13.03	ft
Actual Interception Capacity	Q_a =	7.3	12.6	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	Q_b =	0.0	3.5	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.26**	**12.63**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**3.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**78**	**%**

INLET ON A CONTINUOUS GRADE

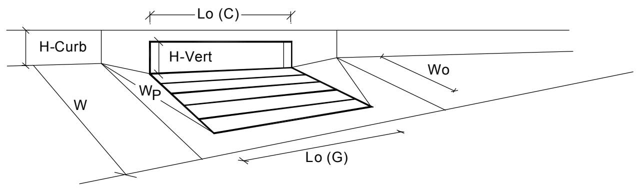
Project: Lorson East Prelim Plan #100.040
Inlet ID: Inlet DP-55a (Basin D1.10)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	Q_o =	10.2	22.6	cfs
Water Spread Width	T =	14.7	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	5.0	6.4	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.8	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.406	0.295	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	6.1	15.9	cfs
Discharge within the Gutter Section W	Q_w =	4.1	6.7	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	2.28	4.13	sq ft
Velocity within the Gutter Section W	V_W =	4.5	5.5	fps
Water Depth for Design Condition	d_{LOCAL} =	8.0	9.4	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	Q_a =	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.096	0.075	ft/ft
Required Length L_T to Have 100% Interception	L_T =	18.57	31.20	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	10.00	10.00	ft
Interception Capacity	Q_i =	7.6	11.3	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.75	8.75	ft
Actual Interception Capacity	Q_a =	7.4	10.8	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	Q_b =	2.8	11.8	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.38**	**10.83**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**2.8**	**11.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**72**	**48**	**%**

INLET IN A SUMP OR SAG LOCATION

Project = Lorson East Prelim Plan #100.040
Inlet ID = Inlet DP-55 (Basin D1.9+bypass from Inlet DP55a+bypass from Inlet DP53)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	25.00	25.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	**N/A**	**N/A**	**cfs**

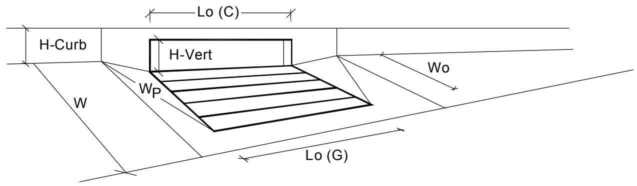
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	
Clogging Factor for Multiple Units	Clog =	0.03	0.03	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	19.14	32.57	cfs
Interception with Clogging	Q_{wa} =	18.63	31.70	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	50.55	55.95	cfs
Interception with Clogging	Q_{oa} =	49.20	54.47	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	28.92	39.70	cfs
Interception with Clogging	Q_{ma} =	28.16	38.64	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	**18.63**	**31.70**	**cfs**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	25.00	25.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	20.7	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.9	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**18.6**	**31.7**	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	7.8	40.0	cfs

INLET IN A SUMP OR SAG LOCATION

Project = Lorson East Prelim Plan #100.040

Inlet ID = Inlet DP-56 (Basin D1.11+bypass from Inlet DP50) +bypass from Inlet DP-55 in 100yr



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	25.00	25.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	**N/A**	**N/A**	**cfs**

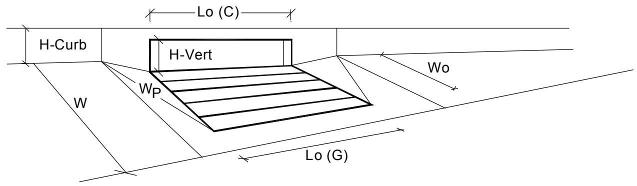
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	
Clogging Factor for Multiple Units	Clog =	0.03	0.03	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	19.14	32.57	cfs
Interception with Clogging	Q_{wa} =	18.63	31.70	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	50.55	55.95	cfs
Interception with Clogging	Q_{oa} =	49.20	54.47	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	28.92	39.70	cfs
Interception with Clogging	Q_{ma} =	28.16	38.64	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	**18.63**	**31.70**	**cfs**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	25.00	25.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	20.7	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.9	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**18.6**	**31.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	7.2	29.7	cfs

INLET IN A SUMP OR SAG LOCATION

Project = **Lorson East Prelim Plan #100.040**

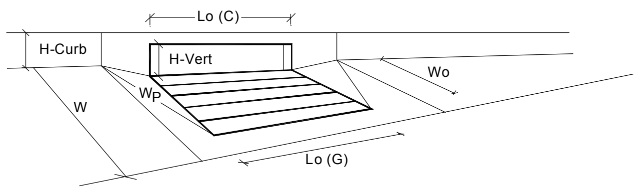
Inlet ID = **Inlet DP-59a (Basin D2.2)**



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	7.06	10.97	cfs
Interception with Clogging	Q_{wa} =	6.35	9.87	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	10.11	11.19	cfs
Interception with Clogging	Q_{oa} =	9.10	10.07	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	7.86	10.30	cfs
Interception with Clogging	Q_{ma} =	7.07	9.27	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	**6.35**	**9.27**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	20.7	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.9	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**6.4**	**9.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.2	4.8	cfs

INLET IN A SUMP OR SAG LOCATION

Project = Lorson East Prelim Plan #100.040
Inlet ID = Inlet DP-59d (Basin D2.1+D2.3)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

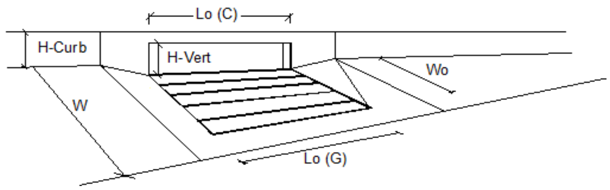
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	**N/A**	**N/A**	**cfs**

Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	
Clogging Factor for Multiple Units	Clog =	0.04	0.04	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	12.45	21.18	cfs
Interception with Clogging	Q_{wa} =	11.90	20.25	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	30.33	33.57	cfs
Interception with Clogging	Q_{oa} =	29.00	32.11	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	18.07	24.80	cfs
Interception with Clogging	Q_{ma} =	17.28	23.72	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	**11.90**	**20.25**	**cfs**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.00	15.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	20.7	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.9	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**11.9**	**20.3**	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	10.7	23.7	cfs

INLET ON A CONTINUOUS GRADE

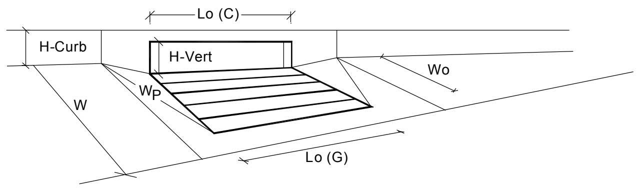
Project: **Lorson East Prelim Plan #100.040**
Inlet ID: **Inlet DP-59f (Basins D2.4+D2.5)**



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	Q_o =	13.6	30.5	cfs
Water Spread Width	T =	15.8	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	5.3	6.8	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	1.2	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.378	0.275	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	8.5	22.0	cfs
Discharge within the Gutter Section W	Q_w =	5.2	8.3	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.2	cfs
Flow Area within the Gutter Section W	A_W =	2.61	4.66	sq ft
Velocity within the Gutter Section W	V_W =	5.2	6.5	fps
Water Depth for Design Condition	d_{LOCAL} =	8.3	9.8	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	Q_a =	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.091	0.072	ft/ft
Required Length L_T to Have 100% Interception	L_T =	22.42	37.58	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	10.00	10.00	ft
Interception Capacity	Q_i =	8.9	12.9	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.75	8.75	ft
Actual Interception Capacity	Q_a =	8.6	12.4	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	Q_b =	5.1	18.1	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**8.58**	**12.37**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**5.1**	**18.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**63**	**41**	**%**

INLET IN A SUMP OR SAG LOCATION

Project = **Lorson East Prelim Plan #100.040**
Inlet ID = **Inlet DP-60 (Basin D2.9+D2.12+bypass from Inlet DP59f)+bypass from Inlet DP62 in 100year**

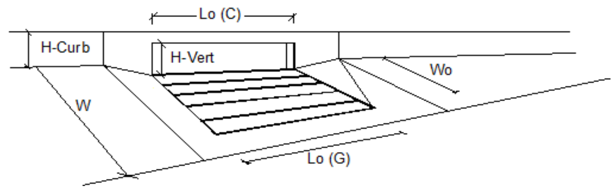


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	25.00	25.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	
Clogging Factor for Multiple Units	Clog =	0.03	0.03	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	19.14	32.57	cfs
Interception with Clogging	Q_{wa} =	18.63	31.70	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	50.55	55.95	cfs
Interception with Clogging	Q_{oa} =	49.20	54.47	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	28.92	39.70	cfs
Interception with Clogging	Q_{ma} =	28.16	38.64	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	**18.63**	**31.70**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	25.00	25.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	20.7	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.9	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**18.6**	**31.7**	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	15.8	55.9	cfs

INLET ON A CONTINUOUS GRADE

Project: **Lorson East Prelim Plan #100.040**

Inlet ID: **Inlet DP-61 (Basins D2.6+D2.7)**

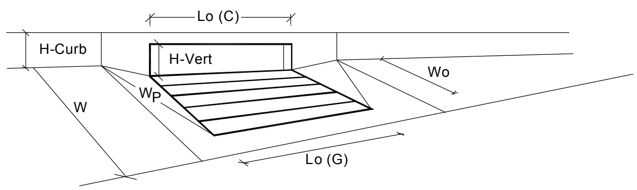


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Design Discharge for Half of Street (from Sheet *Q-Peak*)	**Q_o =**	10.6	23.6	cfs
Water Spread Width	T =	14.0	17.0	ft
Water Depth at Flowline (outside of local depression)	d =	4.9	6.2	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.6	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.424	0.307	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	6.1	16.4	cfs
Discharge within the Gutter Section W	Q_w =	4.5	7.3	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	2.09	3.85	sq ft
Velocity within the Gutter Section W	V_W =	5.1	6.1	fps
Water Depth for Design Condition	d_{LOCAL} =	7.9	9.2	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.100	0.078	ft/ft
Required Length L_T to Have 100% Interception	L_T =	19.00	32.06	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	10.00	10.00	ft
Interception Capacity	Q_i =	7.9	11.6	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.75	8.75	ft
Actual Interception Capacity	**Q_a =**	7.6	11.1	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	3.0	12.6	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.57**	**11.08**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**3.0**	**12.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**71**	**47**	**%**

INLET IN A SUMP OR SAG LOCATION

Project = Lorson East Prelim Plan #100.040

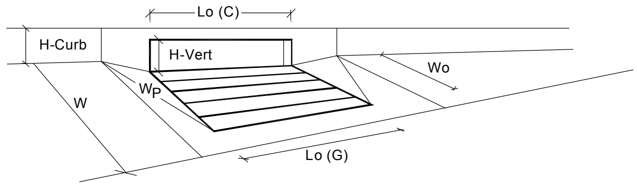
Inlet ID = Inlet DP-62 (Basin D2.8+bypass from Inlet DP61)



		MINOR	MAJOR	
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.0	inches
			☑ Override Depths	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.06	0.06	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	10.72	17.34	cfs
Interception with Clogging	Q_{wa} =	10.05	16.26	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	20.22	22.38	cfs
Interception with Clogging	Q_{oa} =	18.96	20.98	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	13.69	18.32	cfs
Interception with Clogging	Q_{ma} =	12.84	17.18	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	**10.05**	**16.26**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	20.7	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.9	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**10.1**	**16.3**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Minor and Major Storms	$Q_{PEAK\ REQUIRED}$ =	11.1	30.3	cfs

INLET IN A SUMP OR SAG LOCATION

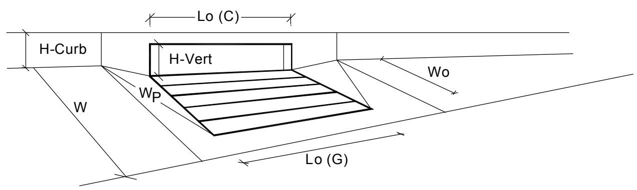
Project = **Lorson East Prelim Plan #100.040**
Inlet ID = **Inlet DP-64 (Basin D2.10+bypass from Inlet DP60 in 100 year)**



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.0	inches
			☑ Override Depths	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	25.00	25.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.33	1.33	
Clogging Factor for Multiple Units	Clog =	0.03	0.03	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	19.14	32.57	cfs
Interception with Clogging	Q_{wa} =	18.63	31.70	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	50.55	55.95	cfs
Interception with Clogging	Q_{oa} =	49.20	54.47	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	28.92	39.70	cfs
Interception with Clogging	Q_{ma} =	28.16	38.64	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	**18.63**	**31.70**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	25.00	25.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	20.7	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.9	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**18.6**	**31.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.2	29.2	cfs

INLET IN A SUMP OR SAG LOCATION

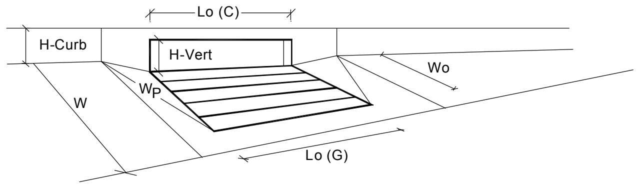
Project = **Lorson East Prelim Plan #100.040**
Inlet ID = **Inlet DP-65a (Basin D2.11)**



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	7.06	10.97	cfs
Interception with Clogging	Q_{wa} =	6.35	9.87	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	10.11	11.19	cfs
Interception with Clogging	Q_{oa} =	9.10	10.07	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	7.86	10.30	cfs
Interception with Clogging	Q_{ma} =	7.07	9.27	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	**6.35**	**9.27**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	20.7	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.9	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**6.4**	**9.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.0	4.0	cfs

INLET IN A SUMP OR SAG LOCATION

Project = **Lorson East Prelim Plan #100.040**
Inlet ID = **Inlet DP-65b (Basin D2.13)+bypass from Inlet DP59d in 100 year**



		MINOR	MAJOR	
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.0	inches
			☑ Override Depths	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	**N/A**	**N/A**	**cfs**
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	
Clogging Factor for Multiple Units	Clog =	0.06	0.06	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	10.72	17.34	cfs
Interception with Clogging	Q_{wa} =	10.05	16.26	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	20.22	22.38	cfs
Interception with Clogging	Q_{oa} =	18.96	20.98	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	13.69	18.32	cfs
Interception with Clogging	Q_{ma} =	12.84	17.18	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	**10.05**	**16.26**	**cfs**
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.00	10.00	feet
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	20.7	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.9	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**10.1**	**16.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	4.2	12.7	cfs

APPENDIX D – POND AND ROUTING CALCULATIONS

Design Procedure Form: Grass Buffer (GB)

UD-BMP (Version 3.06, November 2016)

Designer:
Company: Core Engineering Group
Date: February 27, 2018
Project: Lorson Ranch East Filing No. 1
Location: Lorson Ranch

1. Design Discharge A) 2-Year Peak Flow Rate of the Area Draining to the Grass Buffer	Q_2 = 0.5 cfs
2. Minimum Width of Grass Buffer	W_G = 10 ft
3. Length of Grass Buffer (14' or greater recommended)	L_G = 14 ft
4. Buffer Slope (in the direction of flow, not to exceed 0.1 ft / ft)	S_G = 0.100 ft / ft
5. Flow Characteristics (sheet or concentrated) A) Does runoff flow into the grass buffer across the entire width of the buffer? B) Watershed Flow Length C) Interface Slope (normal to flow) D) Type of Flow Sheet Flow: $F_L * S_I \le 1$ Concentrated Flow: $F_L * S_I > 1$	Choose One ◉ Yes ○ No F_L= 60 ft S_I= 0.002 ft / ft SHEET FLOW
6. Flow Distribution for Concentrated Flows	Choose One ◉ None (sheet flow) ○ Slotted Curbing ○ Level Spreader ○ Other (Explain):
7 Soil Preparation (Describe soil amendment)	4" topsoil
8 Vegetation (Check the type used or describe "Other")	Choose One ◉ Existing Xeric Turf Grass ○ Irrigated Turf Grass ○ Other (Explain):
9. Irrigation (*Select None if existing buffer area has 80% vegetation AND will not be disturbed during construction.)	Choose One ○ Temporary ○ Permanent ◉ None*
10. Outflow Collection (Check the type used or describe "Other")	Choose One ○ Grass Swale ○ Street Gutter ○ Storm Sewer Inlet ◉ Other (Explain): Etrib of Jimmy Camp Creek

Notes:

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**February 13, 2018**
Project:	**Lorson Ranch East PDR - Pond c5 forebay design**
Location:	**Pond C5 forebay design (split forebay in two parts)**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 63.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.630
C) Contributing Watershed Area	Area = 171.000 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV); ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$)	V_{DESIGN}= 3.515 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= 3.300 ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A; ( ) B; ( ) C / D — **WQCV selected. Soil group not required.**
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = ____ ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 0.33 ft / ft **TOO STEEP (< 3)**
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**February 13, 2018**
Project:	**Lorson Ranch East PDR - Pond c5 forebay design**
Location:	**Pond C5 forebay design (split forebay in two parts)**

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.099 ac-ft
B) Actual Forebay Volume	V_F = 0.150 ac-ft
C) Forebay Depth (D_F = 30 inch maximum)	D_F = 30.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 484.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 9.68 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe; ● Wall with Rect. Notch; ○ Wall with V-Notch Weir
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = ____ in
G) Rectangular Notch Width	Calculated W_N = 14.8 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ● Concrete; ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0040 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 88 sq ft
C) Outlet Type	Choose One: ● Orifice Plate; ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 3.03 inches
E) Total Outlet Area	A_{ot} = 27.63 square inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**February 13, 2018**
Project:	**Lorson Ranch East PDR - Pond c5 forebay design**
Location:	**Pond C5 forebay design (split forebay in two parts)**

8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 431.2 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 29.3 cu ft

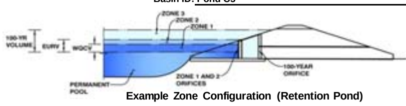
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 798 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): Y	*Other (Please describe below)* stainless steel wellscreen
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio = 0.6
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 1329 sq. in. Based on type 'Other' screen ratio
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 3 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 64 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 20.8 inches

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP (100.013)

Basin ID: Pond C5



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	171.00	acres		
Watershed Length =	3,200	ft		
Watershed Slope =	0.018	ft/ft		
Watershed Imperviousness =	60.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	100.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	3.365	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	9.849	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	9.359	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	13.389	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	16.698	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	21.751	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	25.701	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	30.595	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	8.779	acre-feet		
Approximate 5-yr Detention Volume =	12.613	acre-feet		
Approximate 10-yr Detention Volume =	14.398	acre-feet		
Approximate 25-yr Detention Volume =	15.419	acre-feet		
Approximate 50-yr Detention Volume =	15.902	acre-feet		
Approximate 100-yr Detention Volume =	17.592	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	3.365	acre-feet
Zone 2 Volume (EURV - Zone 1) =	6.484	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	0.100	acre-feet
Total Detention Basin Volume =	9.949	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Total detention volume is less than 100-year volume.

Depth Increment = 0.2 ft

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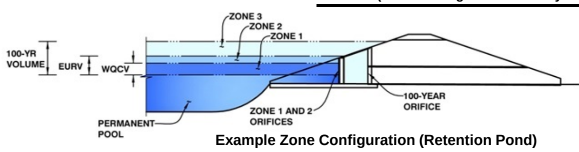
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson East MDDP (100.013)

Basin ID: Pond C5 (interim design for LRE2 only & school pond)



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.95	3.365	Orifice Plate
Zone 2 (EURV)	6.38	6.484	Rectangular Orifice
Zone 3 (User)	6.42	0.100	Weir&Pipe (Restrict)
		9.949	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.95	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	16.00	inches
Orifice Plate: Orifice Area per Row =	9.21	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	6.396E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.32	2.63					
Orifice Area (sq. inches)	9.21	9.21	9.21					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.78	N/A	ft^2
Vertical Orifice Centroid =	0.25	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	30.00	N/A	feet
Overflow Grate Open Area % =	80%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.60	N/A	feet
Over Flow Weir Slope Length =	30.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	5.73	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	72.00	N/A	ft^2
Overflow Grate Open Area w/ Debris =	36.00	N/A	ft^2

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

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	12.57	N/A	ft^2
Outlet Orifice Centroid =	2.00	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	52.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	3.00	feet

Calculated Parameters for Spillway

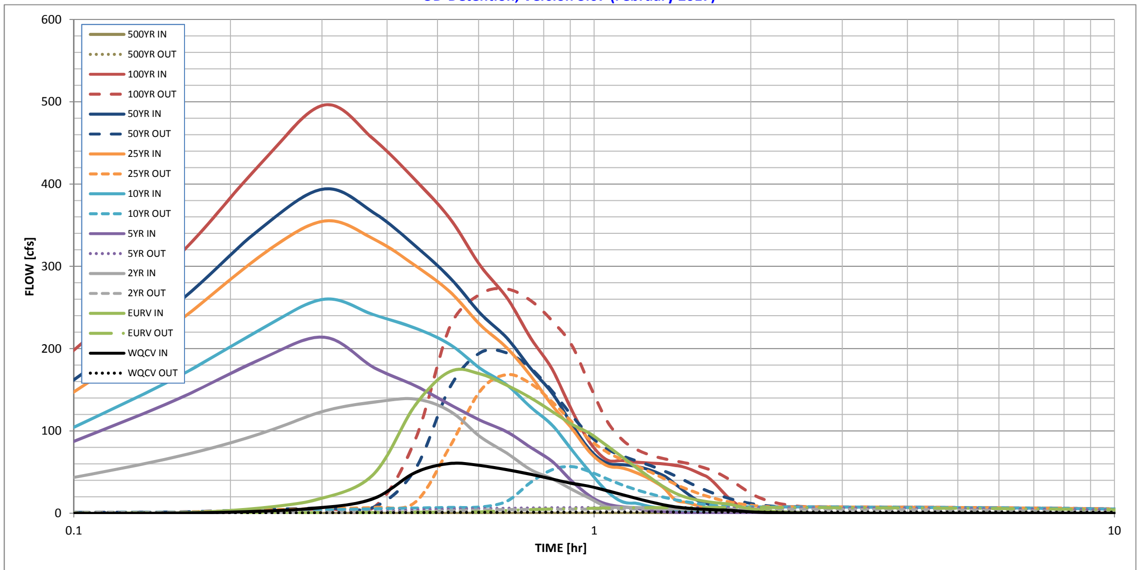
Spillway Design Flow Depth=	2.05	feet
Stage at Top of Freeboard =	12.05	feet
Basin Area at Top of Freeboard =	3.26	acres

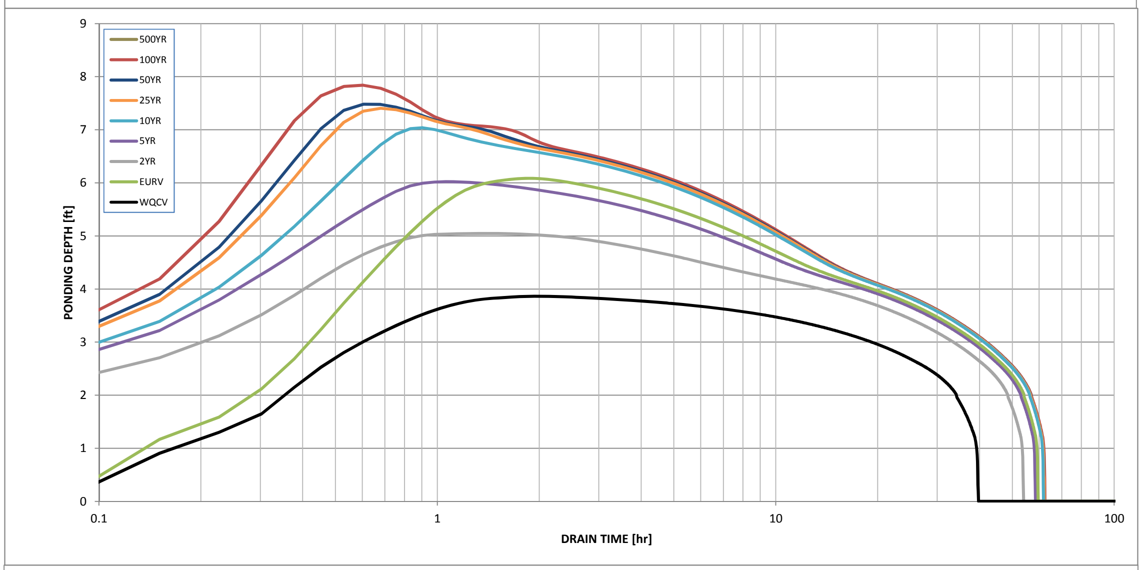
Routed Hydrograph Results

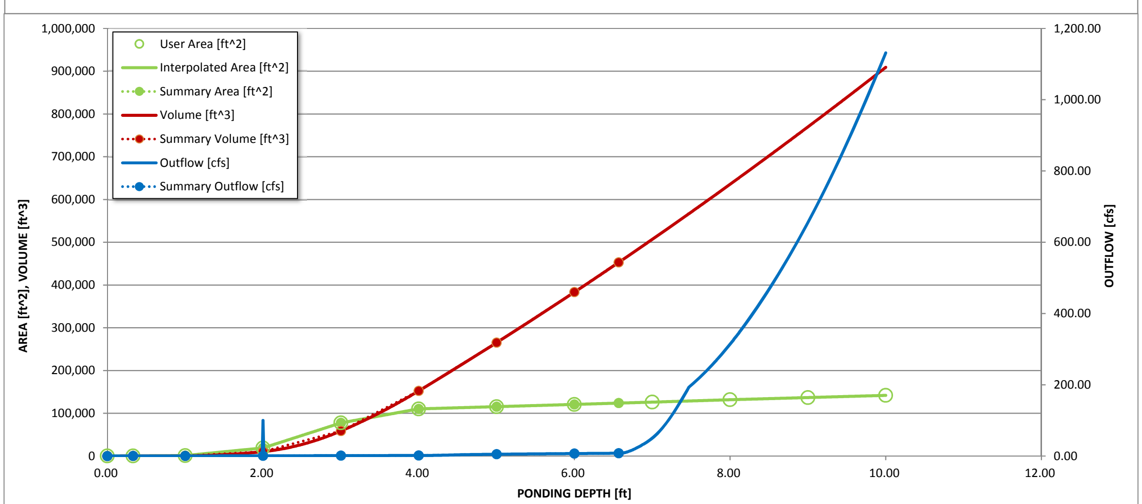
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	3.365	9.849	9.359	13.389	16.698	21.751	25.701	30.595	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	3.368	9.849	6.877	9.360	13.403	19.206	21.246	26.856	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.14	0.39	0.89	1.17	1.52	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	2.9	24.2	65.9	151.4	199.8	259.3	0.0
Peak Inflow Q (cfs) =	60.4	172.3	138.8	214.0	260.0	355.0	394.0	496.0	#N/A
Peak Outflow Q (cfs) =	3.0	7.1	5.1	7.0	56.7	168.4	195.1	272.5	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.9	1.1	1.0	1.1	#N/A
Structure Controlling Flow =	User Defined	User Defined	User Defined	User Defined	User Defined	User Defined	User Defined	User Defined	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.7	1.6	1.8	1.9	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	37	53	49	52	54	51	51	48	#N/A
Time to Drain 99% of Inflow Volume (hours) =	38	57	52	56	58	57	57	57	#N/A
Maximum Ponding Depth (ft) =	3.86	6.09	5.05	6.02	7.04	7.41	7.48	7.84	#N/A
Area at Maximum Ponding Depth (acres) =	2.43	2.78	2.66	2.77	2.90	2.95	2.96	3.00	#N/A
Maximum Volume Stored (acre-ft) =	3.151	9.022	6.195	8.855	11.719	12.800	13.036	14.078	#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			

Interim conditions include no upstream ponds and the school site is built

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

	SOURCE	WORKBOOK	WORKBOOK	USER	USER	USER	USER	USER	USER	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
4.53 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:04:32	0.00	0.00	29.00	57.00	68.00	97.00	107.00	131.00	#N/A
Hydrograph	0:09:04	0.00	0.00	66.00	133.00	159.00	223.00	245.00	299.00	#N/A
Constant	0:13:35	2.55	6.35	96.00	186.00	222.00	311.00	344.00	422.00	0.00
1.105	0:18:07	7.03	18.69	124.00	214.00	260.00	355.00	394.00	496.00	0.00
	0:22:39	18.04	48.02	135.00	177.00	241.00	333.00	365.00	454.00	0.00
	0:27:11	49.48	131.24	138.80	155.00	225.00	301.00	325.00	405.00	0.00
	0:31:43	60.45	172.31	124.00	132.00	205.00	269.00	286.00	358.00	0.00
	0:36:14	58.03	169.30	93.00	113.00	176.00	229.00	243.00	301.00	0.00
	0:40:46	52.81	155.46	73.00	99.00	156.00	201.00	213.00	262.00	0.00
	0:45:18	47.54	140.29	53.00	80.00	129.00	167.00	176.00	213.00	0.00
	0:49:50	41.51	123.52	42.00	63.00	107.00	131.00	146.00	175.00	0.00
	0:54:22	36.20	108.17	29.00	39.00	77.00	103.00	108.00	125.00	0.00
	0:58:53	32.72	96.93	18.00	21.00	50.00	74.00	77.00	86.00	0.00
	1:03:25	27.38	82.24	8.00	11.00	27.00	58.00	61.00	65.00	0.00
	1:07:57	22.66	68.43	7.40	8.00	14.00	55.00	59.00	64.00	0.00
	1:12:29	17.90	54.95	6.90	6.00	12.00	49.00	57.00	62.00	0.00
	1:17:01	13.78	42.91	6.30	3.00	8.00	41.00	52.00	61.00	0.00
	1:21:32	10.25	32.50	5.70	2.00	6.00	31.00	46.00	60.00	0.00
	1:26:04	7.71	24.02	5.40	1.00	3.00	16.00	35.00	58.00	0.00
	1:30:36	6.22	19.05	4.70	0.00	2.00	13.00	24.00	55.00	0.00
	1:35:08	5.24	15.96	4.50	0.00	1.00	9.00	15.00	49.00	0.00
	1:39:40	4.57	13.80	4.00	0.00	0.00	6.00	11.00	43.00	0.00
	1:44:11	4.09	12.29	3.60	0.00	0.00	3.00	7.00	31.00	0.00
	1:48:43	3.74	11.22	3.10	0.00	0.00	2.00	5.00	19.00	0.00
	1:53:15	2.78	8.62	3.00	0.00	0.00	1.00	3.00	10.00	0.00
	1:57:47	2.02	6.21	2.50	0.00	0.00	0.00	1.00	0.00	0.00
	2:02:19	1.49	4.61	2.40	0.00	0.00	0.00	0.00	0.00	0.00
	2:06:50	1.11	3.42	2.30	0.00	0.00	0.00	0.00	0.00	0.00
	2:11:22	0.81	2.53	2.20	0.00	0.00	0.00	0.00	0.00	0.00
	2:15:54	0.58	1.83	1.90	0.00	0.00	0.00	0.00	0.00	0.00
	2:20:26	0.42	1.32	1.70	0.00	0.00	0.00	0.00	0.00	0.00
	2:24:58	0.29	0.94	1.50	0.00	0.00	0.00	0.00	0.00	0.00
	2:29:29	0.19	0.62	1.30	0.00	0.00	0.00	0.00	0.00	0.00
	2:34:01	0.11	0.37	1.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:38:33	0.05	0.18	0.90	0.00	0.00	0.00	0.00	0.00	0.00
	2:43:05	0.01	0.06	0.80	0.00	0.00	0.00	0.00	0.00	0.00
	2:47:37	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00
	2:52:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:56:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:01:12	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	3:05:44	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	3:10:16	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	3:14:47	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
	3:19:19	0.00	0.00			0.00	0.00	0.00	0.00	0.00
	3:23:51	0.00	0.00			0.00	0.00	0.00	0.00	0.00
	3:28:23	0.00	0.00			0.00	0.00	0.00	0.00	0.00
	3:32:55	0.00	0.00				0.00	0.00	0.00	0.00
	3:37:26	0.00	0.00				0.00	0.00	0.00	0.00
	3:41:58	0.00	0.00				0.00	0.00	0.00	0.00
	3:46:30	0.00	0.00				0.00	0.00	0.00	0.00
	3:51:02	0.00	0.00				0.00	0.00	0.00	0.00
	3:55:34	0.00	0.00					0.00	0.00	0.00
	4:00:05	0.00	0.00					0.00	0.00	0.00
	4:04:37	0.00	0.00					0.00	0.00	0.00
	4:09:09	0.00	0.00					0.00	0.00	0.00
	4:13:41	0.00	0.00					0.00	0.00	0.00
	4:18:13	0.00	0.00					0.00	0.00	#N/A
	4:22:44	0.00	0.00					0.00	0.00	#N/A
	4:27:16	0.00	0.00					0.00	0.00	#N/A
	4:31:48	0.00	0.00					0.00	0.00	#N/A
	4:36:20	0.00	0.00						0.00	#N/A
	4:40:52	0.00	0.00						0.00	#N/A
	4:45:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:49:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:54:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:58:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:03:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:08:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:12:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:17:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:21:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:26:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

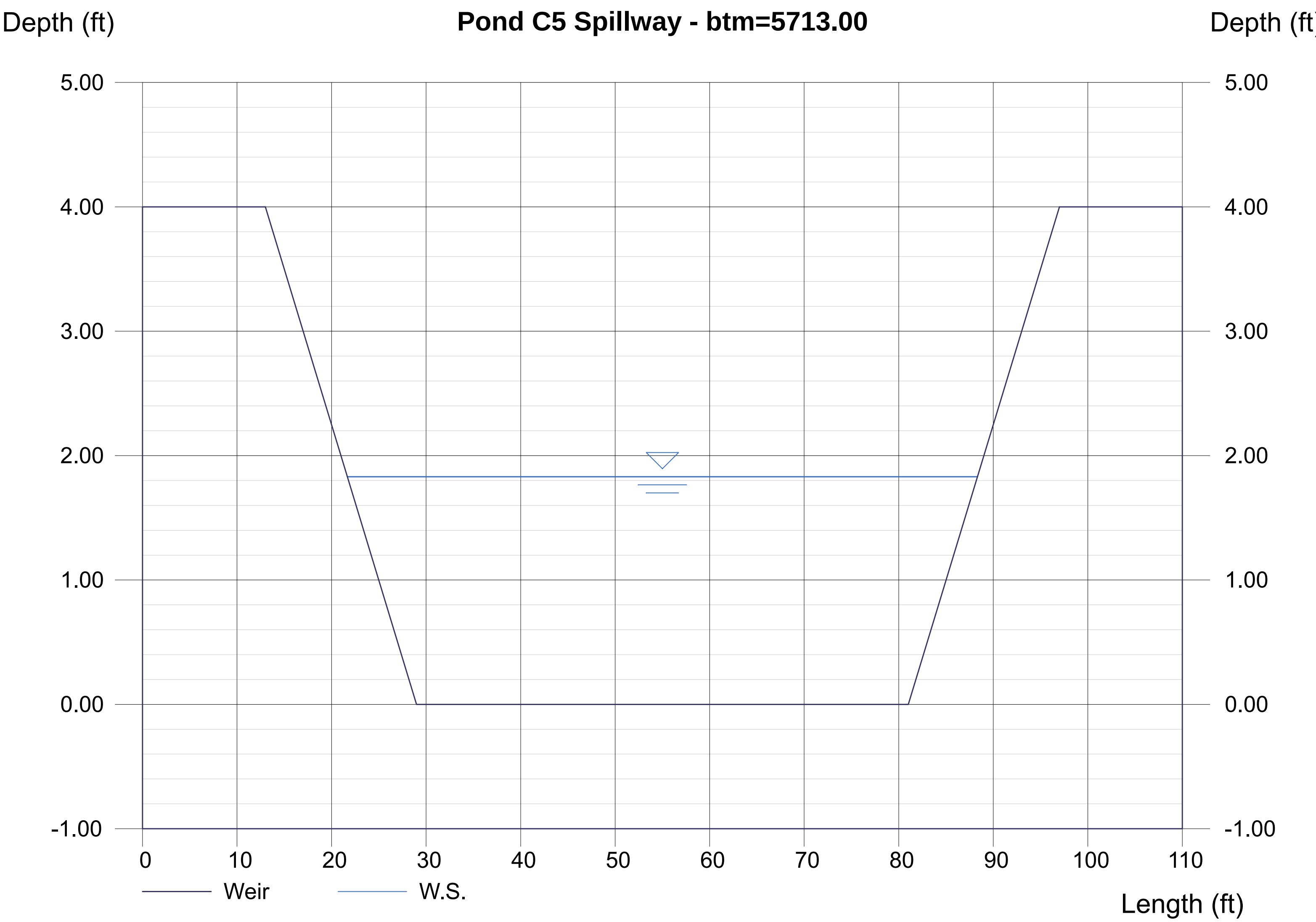
Weir Report

Pond C5 Spillway - btm=5713.00

Trapezoidal Weir
Crest = Sharp
Bottom Length (ft) = 52.00
Total Depth (ft) = 4.00
Side Slope (z:1) = 4.00

Calculations
Weir Coeff. Cw = 3.10
Compute by: Known Q
Known Q (cfs) = 443.00

Highlighted
Depth (ft) = 1.83
Q (cfs) = 443.00
Area (sqft) = 108.56
Velocity (ft/s) = 4.08
Top Width (ft) = 66.64

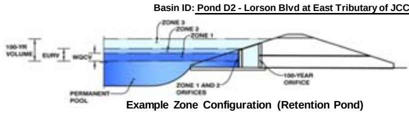


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East MDDP

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



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	89.00	acres		
Watershed Length =	2,200	ft		
Watershed Slope =	0.025	ft/ft		
Watershed Imperviousness =	55.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	1.635	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	5.273	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	4.292	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	5.817	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	7.717	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	10.440	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	12.355	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	14.870	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	4.018	acre-feet		
Approximate 5-yr Detention Volume =	5.464	acre-feet		
Approximate 10-yr Detention Volume =	7.132	acre-feet		
Approximate 25-yr Detention Volume =	7.753	acre-feet		
Approximate 50-yr Detention Volume =	8.093	acre-feet		
Approximate 100-yr Detention Volume =	8.929	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	1.635	acre-feet
Zone 2 Volume (EURV - Zone 1) =	3.638	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	4.474	acre-feet
Total Detention Basin Volume =	9.747	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.2 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	20	0.000		
5695.33	--	0.33	--	--	--	100	0.002	19	0.000
5696	--	1.00	--	--	--	1,074	0.025	402	0.009
5697	--	2.00	--	--	--	48,988	1.125	24,956	0.573
5698	--	3.00	--	--	--	72,821	1.672	86,348	1.982
5699	--	4.00	--	--	--	76,610	1.759	161,063	3.698
5700	--	5.00	--	--	--	80,493	1.848	239,615	5.501
5701	--	6.00	--	--	--	84,486	1.940	322,104	7.394
5702	--	7.00	--	--	--	88,582	2.034	408,638	9.381
5703	--	8.00	--	--	--	92,768	2.130	499,313	11.463
5704	--	9.00	--	--	--	97,074	2.229	594,234	13.642
5705	--	10.00	--	--	--	102,033	2.342	693,788	15.927
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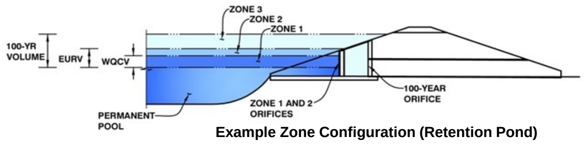
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East MDDP

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



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.79	1.635	Orifice Plate
Zone 2 (EURV)	4.88	3.638	Rectangular Orifice
(100+1/2WQCV)	7.18	4.474	Weir&Pipe (Restrict)
		9.747	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.80	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	9.00	inches
Orifice Plate: Orifice Area per Row =	4.60	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	3.194E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.80	1.60	2.40				
Orifice Area (sq. inches)	4.60	4.60	4.60	4.60				

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 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^2
Vertical Orifice Centroid =	0.42	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	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 Slope =	20.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	20.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.00	N/A	feet
Over Flow Weir Slope Length =	20.02	N/A	feet
Grate Open Area / 100-yr Orifice Area =	5.14	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	56.07	N/A	ft^2
Overflow Grate Open Area w/ Debris =	28.03	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	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^2
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

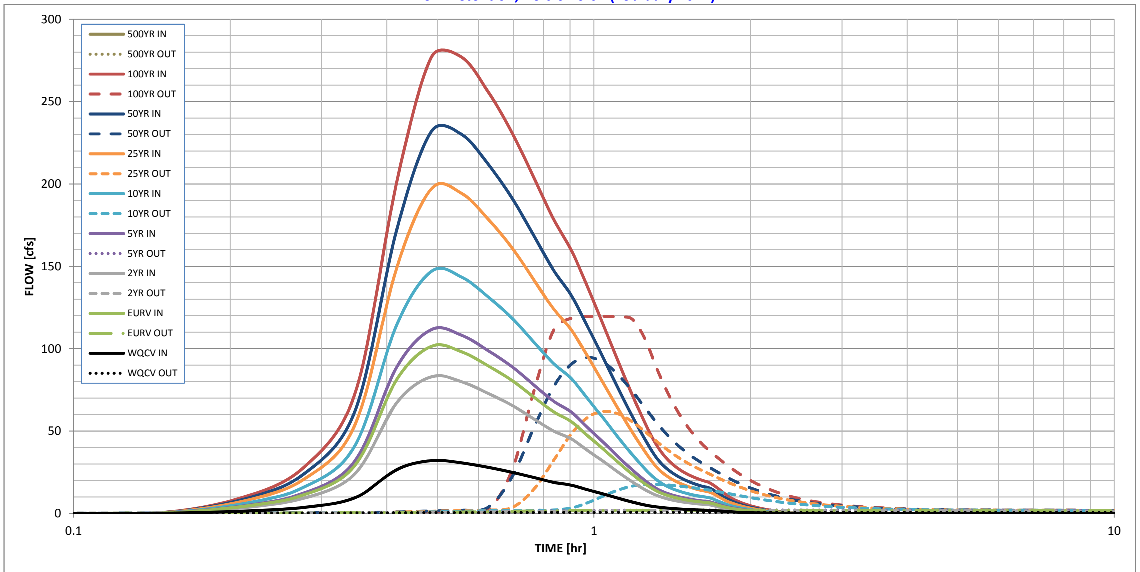
Spillway Design Flow Depth=	1.91	feet
Stage at Top of Freeboard =	11.93	feet
Basin Area at Top of Freeboard =	2.34	acres

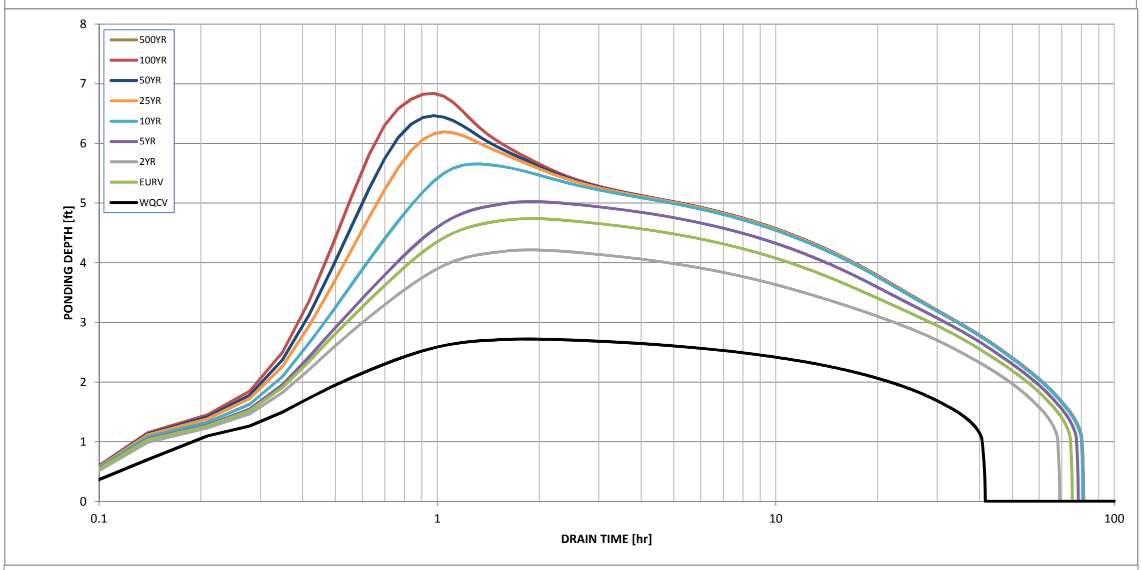
Routed Hydrograph Results

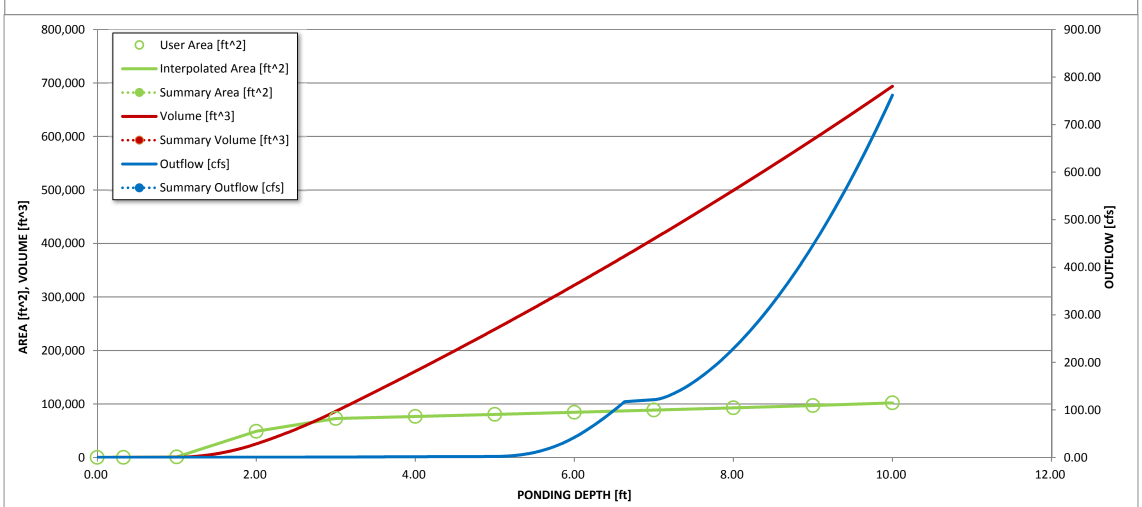
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	1.635	5.273	4.292	5.817	7.717	10.440	12.355	14.870	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.632	5.265	4.286	5.805	7.701	10.424	12.338	14.847	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.03	0.26	0.82	1.14	1.52	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.4	2.3	23.1	73.3	101.2	135.0	0.0
Peak Inflow Q (cfs) =	32.1	101.5	83.0	111.7	147.1	197.3	232.2	277.3	#N/A
Peak Outflow Q (cfs) =	0.7	2.0	1.7	2.1	17.7	62.0	94.7	119.7	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	0.8	0.8	0.9	0.9	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.3	1.1	1.7	2.1	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	39	68	63	71	71	69	67	65	#N/A
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	67	75	77	76	75	75	#N/A
Maximum Ponding Depth (ft) =	2.72	4.74	4.22	5.02	5.66	6.19	6.47	6.84	#N/A
Area at Maximum Ponding Depth (acres) =	1.52	1.82	1.78	1.85	1.91	1.96	1.98	2.02	#N/A
Maximum Volume Stored (acre-ft) =	1.536	5.023	4.069	5.538	6.721	7.765	8.297	9.057	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
4.18 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:04:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:08:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:12:32	1.39	4.12	3.44	4.48	5.66	7.19	8.15	9.32	#N/A
1.195	0:16:43	3.78	11.57	9.56	12.65	16.31	21.27	24.58	28.73	#N/A
	0:20:54	9.70	29.70	24.54	32.47	41.89	54.66	63.19	73.90	#N/A
	0:25:05	26.64	81.38	67.29	88.96	114.62	149.34	172.48	201.46	#N/A
	0:29:16	32.07	101.52	83.01	111.68	147.08	197.28	232.15	277.30	#N/A
	0:33:26	30.69	98.08	79.91	108.12	143.40	194.24	230.03	276.95	#N/A
	0:37:37	27.94	89.50	72.79	98.74	131.32	178.48	211.83	255.70	#N/A
	0:41:48	25.06	80.66	65.58	89.01	118.45	161.09	191.25	230.93	#N/A
	0:45:59	21.76	70.68	57.38	78.05	104.09	141.90	168.69	204.00	#N/A
	0:50:10	18.90	61.77	50.10	68.24	91.09	124.28	147.80	178.80	#N/A
	0:54:20	17.14	55.66	45.22	61.44	81.81	111.30	132.13	159.51	#N/A
	0:58:31	14.27	46.78	37.91	51.70	69.14	94.54	112.58	136.40	#N/A
	1:02:42	11.75	38.81	31.42	42.92	57.46	78.67	93.75	113.67	#N/A
	1:06:53	9.19	30.86	24.91	34.18	45.97	63.24	75.57	91.91	#N/A
	1:11:04	6.97	23.92	19.25	26.52	35.80	49.41	59.14	72.09	#N/A
	1:15:14	5.11	17.94	14.38	19.93	27.02	37.45	44.94	54.99	#N/A
	1:19:25	3.89	13.40	10.78	14.86	20.05	27.66	33.15	40.69	#N/A
	1:23:36	3.17	10.74	8.67	11.89	15.97	21.92	26.18	31.95	#N/A
	1:27:47	2.68	9.03	7.29	9.99	13.40	18.35	21.89	26.63	#N/A
	1:31:58	2.35	7.84	6.34	8.67	11.61	15.87	18.89	22.94	#N/A
	1:36:08	2.11	7.00	5.67	7.74	10.35	14.12	16.80	20.37	#N/A
	1:40:19	1.93	6.41	5.19	7.08	9.45	12.88	15.31	18.54	#N/A
	1:44:30	1.43	4.81	3.87	5.33	7.19	9.92	11.89	14.54	#N/A
	1:48:41	1.04	3.48	2.80	3.85	5.18	7.15	8.56	10.48	#N/A
	1:52:52	0.76	2.57	2.07	2.85	3.85	5.31	6.36	7.77	#N/A
	1:57:02	0.57	1.91	1.54	2.12	2.86	3.94	4.72	5.76	#N/A
	2:01:13	0.41	1.41	1.13	1.56	2.11	2.91	3.49	4.27	#N/A
	2:05:24	0.29	1.01	0.81	1.12	1.52	2.11	2.53	3.10	#N/A
	2:09:35	0.21	0.73	0.59	0.81	1.10	1.53	1.83	2.24	#N/A
	2:13:46	0.14	0.52	0.41	0.57	0.78	1.09	1.31	1.61	#N/A
	2:17:56	0.09	0.34	0.27	0.37	0.51	0.72	0.87	1.08	#N/A
	2:22:07	0.05	0.19	0.15	0.22	0.30	0.43	0.53	0.66	#N/A
	2:26:18	0.02	0.09	0.07	0.10	0.15	0.21	0.26	0.34	#N/A
	2:30:29	0.00	0.03	0.02	0.03	0.05	0.07	0.09	0.12	#N/A
	2:34:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	#N/A
	2:38:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:43:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:47:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:51:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:55:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:59:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:03:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:08:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:12:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:16:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:20:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:24:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:29:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:33:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:37:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:41:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:45:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:49:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:54:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:58:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:02:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:06:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:10:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:14:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:19:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:23:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:27:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:31:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:35:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:40:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:44:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:48:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:52:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:56:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:00:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer: Richard Schindler
Company: Core Engineering Group
Date: February 13, 2018
Project: Lorson Ranch East PDR - Pond D2 forebay design
Location:

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 55.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.550
C) Contributing Watershed Area	Area = 89.000 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$)	V_{DESIGN}= 1.635 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$= ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= 1.390 ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A ( ) B ( ) C / D — **WQCV selected. Soil group not required.**
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 0.33 ft / ft **TOO STEEP (< 3)**
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**Richard Schindler**
Company:	**Core Engineering Group**
Date:	**February 13, 2018**
Project:	**Lorson Ranch East PDR - Pond D2 forebay design**
Location:	

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.042 ac-ft
B) Actual Forebay Volume	V_F = 0.045 ac-ft
C) Forebay Depth (D_F = 30 inch maximum)	D_F = 30.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 243.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 4.86 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe; ● Wall with Rect. Notch; ○ Wall with V-Notch Weir
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 10.4 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ● Concrete; ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 121 sq ft
C) Outlet Type	Choose One: ● Orifice Plate; ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 3.05 inches
E) Total Outlet Area	A_{ot} = 26.85 square inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: Richard Schindler
Company: Core Engineering Group
Date: February 13, 2018
Project: Lorson Ranch East PDR - Pond D2 forebay design
Location:

8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 181.6 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 40.3 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 774 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*Other (Please describe below)* well screen stainless steel
Other (Y/N): Y	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio = 0.6
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 1289 sq. in. Based on type 'Other' screen ratio
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 2.7 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 60.4 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 21.3 inches

Weir Report

Pond D2 Spillway - btm=5702.00

Trapezoidal Weir

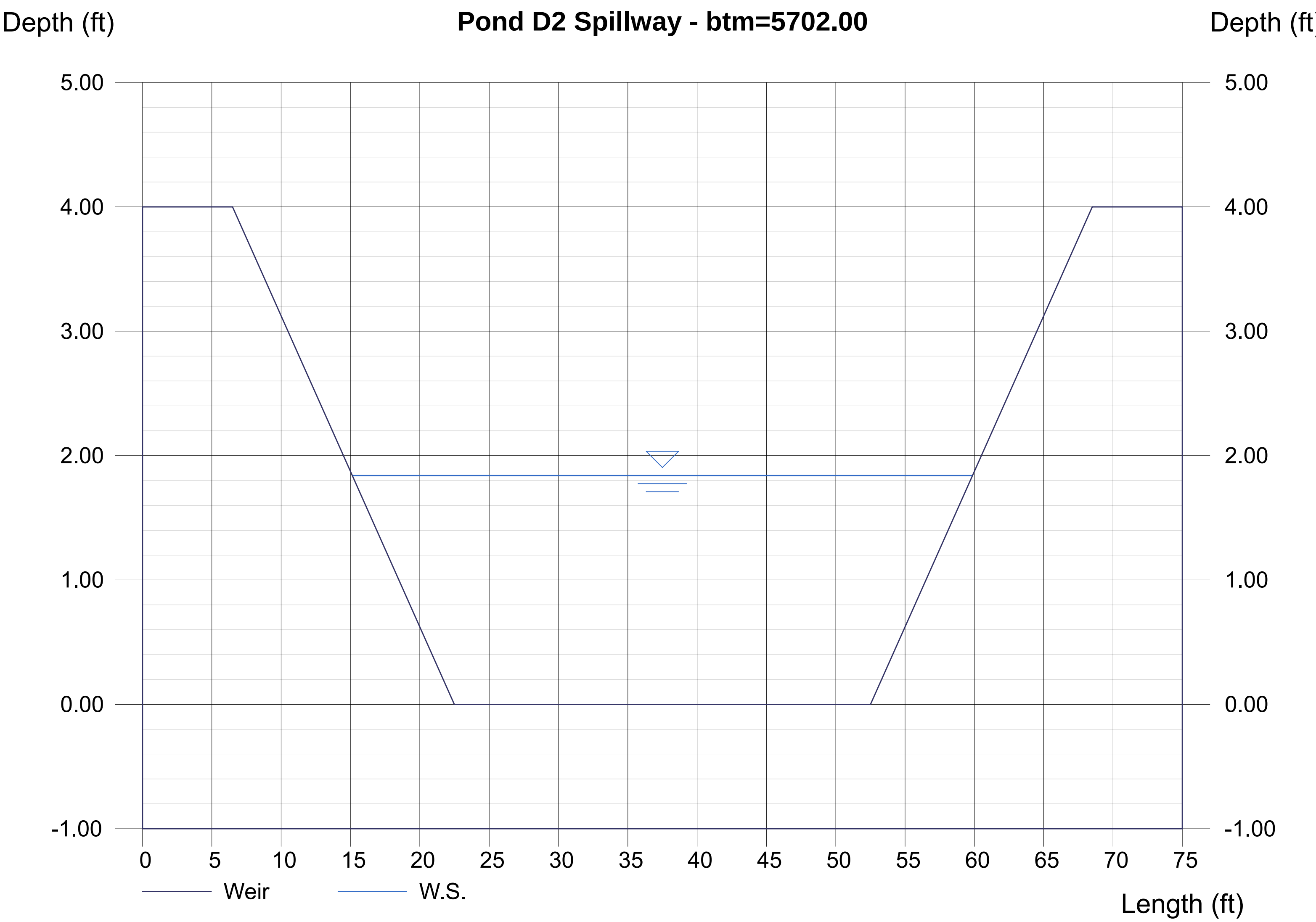
Crest	= Sharp
Bottom Length (ft)	= 30.00
Total Depth (ft)	= 4.00
Side Slope (z:1)	= 4.00

Calculations

Weir Coeff. Cw	= 3.10
Compute by:	Known Q
Known Q (cfs)	= 277.10

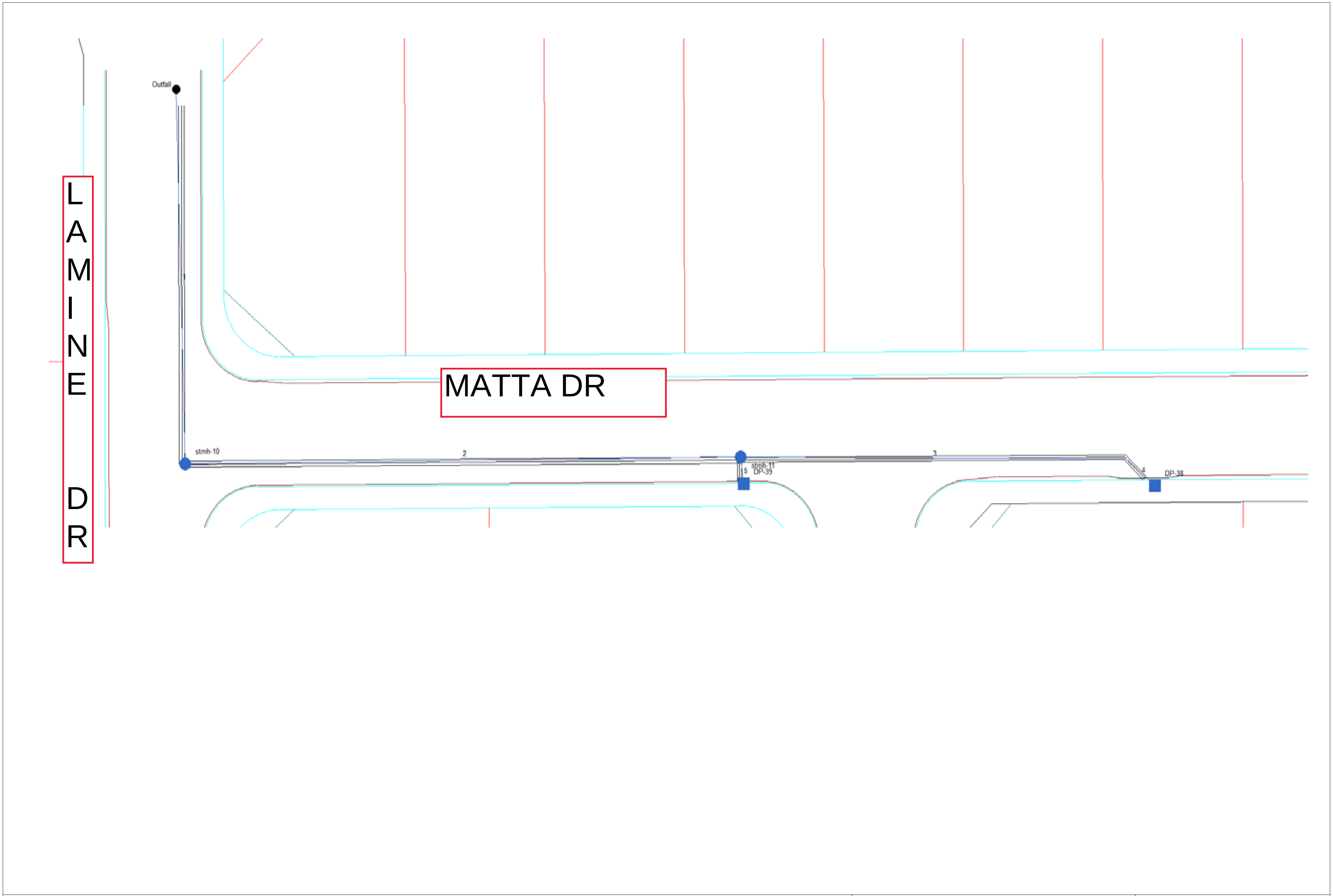
Highlighted

Depth (ft)	= 1.84
Q (cfs)	= 277.10
Area (sqft)	= 68.74
Velocity (ft/s)	= 4.03
Top Width (ft)	= 44.72



APPENDIX E– STORM SEWER SCHEMATIC AND HYDRAFLOW STORM SEWER CALCS

Hydraflow Plan View



Project File: 100.042-fdr-c17-5yr.stm	No. Lines: 5	02-12-2018

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		13.91	24 c	122.5	5713.91	5716.81	2.367	5715.26	5718.13	n/a	5718.13 j	End
2		13.97	24 c	199.0	5717.11	5722.80	2.860	5718.44	5724.12	n/a	5724.12 j	1
3		5.88	18 c	137.9	5724.70	5726.36	1.203	5725.46	5727.29	0.12	5727.29	2
4		5.91	18 c	13.6	5726.36	5726.48	0.886	5727.52	5727.50	0.03	5727.53	3
5		8.43	18 c	8.8	5723.80	5724.01	2.382	5724.57*	5725.68*	0.11	5725.79	2

Project File: 100.042-fdr-c17-5yr.stm	Number of lines: 5	Run Date: 02-12-2018

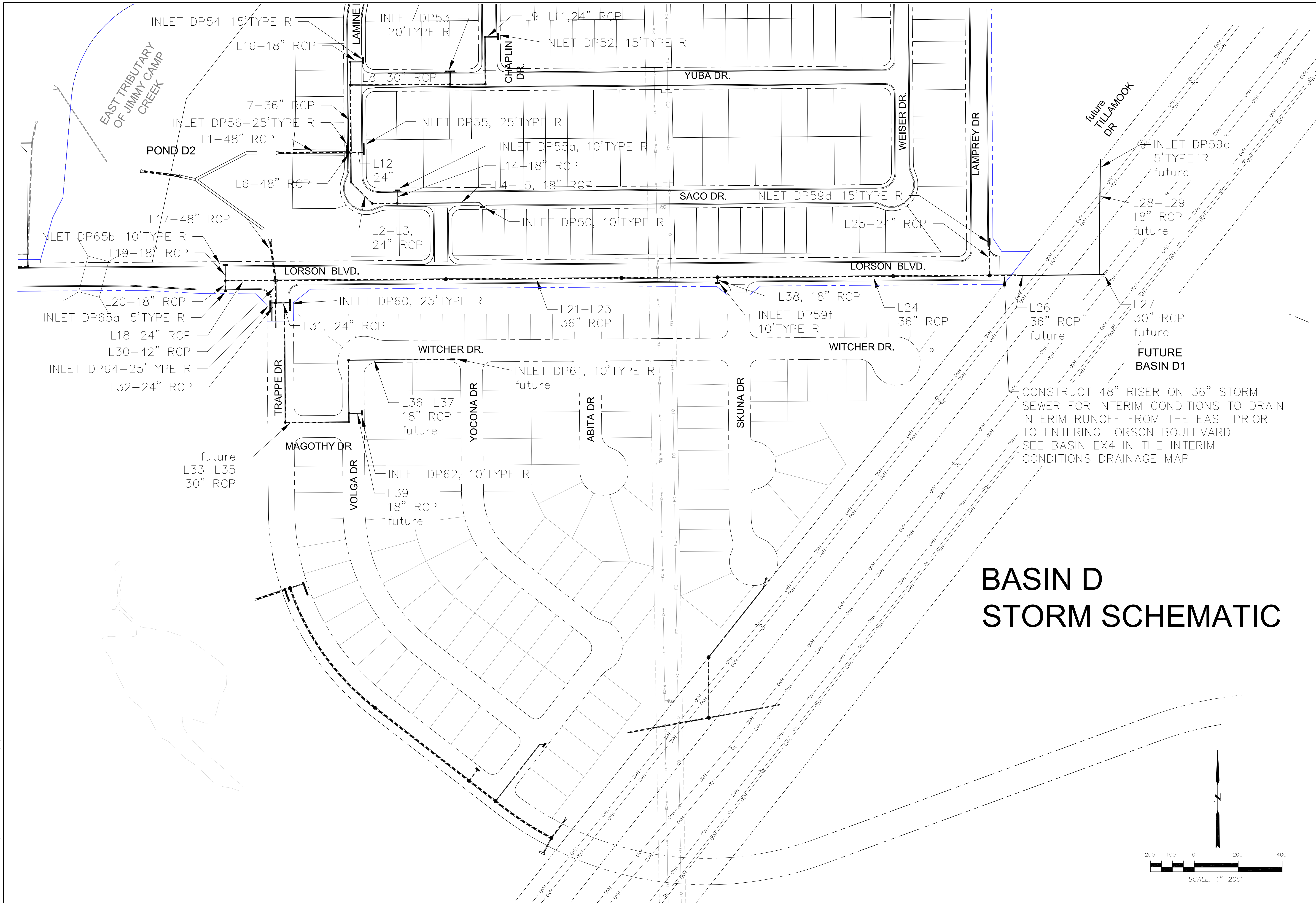
NOTES: c = cir; e = ellip; b = box; Return period = 5 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

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		26.76	24 c	122.5	5713.91	5716.81	2.367	5715.72	5718.62	n/a	5718.62 j	End
2		26.76	24 c	199.0	5717.11	5722.80	2.860	5718.74	5724.61	0.37	5724.61	1
3		11.83	18 c	137.9	5724.70	5726.36	1.203	5725.97	5727.86	0.21	5728.07	2
4		11.83	18 c	13.6	5726.36	5726.48	0.886	5728.07*	5728.24*	0.07	5728.31	3
5		14.93	18 c	8.8	5723.80	5724.01	2.382	5724.94*	5725.70*	0.33	5726.04	2

Project File: 100.042-fdr-c17-100yr.stm | Number of lines: 5 | Run Date: 02-12-2018

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.



BASIN D STORM SCHEMATIC

CORE ENGINEERING GROUP
15004 1ST AVE. S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

NO.	DESCRIPTION	DATE

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

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

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

STORM SEWER SCHEMATIC
BASIN D
LORSON RANCH EAST

DATE: MAY 1, 2018
PROJECT NO. 100.042
SHEET NUMBER 1
TOTAL SHEETS: 1

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	L1	63.59	48 c	151.0	5697.00	5702.09	3.371	5699.36	5704.45	n/a	5704.45	End
2	L2	14.68	24 c	134.6	5706.29	5708.14	1.376	5707.35	5709.50	n/a	5709.50	1
3	L3	14.68	24 c	64.8	5708.24	5709.42	1.819	5709.81	5710.78	n/a	5710.78 j	2
4	L4	7.34	18 c	186.0	5710.17	5715.01	2.602	5711.16	5716.04	0.10	5716.04	3
5	L5	7.34	18 c	10.0	5715.11	5715.38	2.700	5716.27	5716.41	0.45	5716.41	4
6	L6	41.62	48 c	9.0	5702.59	5704.23	18.224	5705.34	5706.14	0.31	5706.14	1
7	L7	33.79	36 c	147.3	5705.33	5707.67	1.588	5706.65	5709.52	0.34	5709.52	6
8	L8	26.49	30 c	226.5	5708.37	5713.87	2.428	5709.91	5715.59	0.25	5715.59	7
9	L9	12.44	24 c	78.4	5714.92	5718.39	4.425	5716.19	5719.64	n/a	5719.64 j	8
10	L10	12.44	24 c	83.9	5718.68	5720.50	2.168	5719.96	5721.75	n/a	5721.75 j	9
11	L11	12.44	24 c	24.9	5720.70	5721.08	1.525	5722.07	5722.33	n/a	5722.33	10
12	L12	7.83	24 c	25.3	5706.33	5707.11	3.087	5706.93	5708.71	0.00	5708.71	6
13	L13	7.29	30 c	6.0	5707.13	5707.37	4.004	5707.63	5709.37	0.00	5709.37	1
14	L14	7.34	18 c	26.6	5710.44	5710.86	1.577	5711.24	5712.07	0.32	5712.39	3
15	L15	14.05	24 c	29.2	5715.08	5716.06	3.360	5716.12	5717.39	0.00	5717.39	8
16	L16	7.30	18 c	58.9	5709.75	5710.83	1.832	5710.51	5711.86	n/a	5711.86	7
17	L17	87.73	48 c	100.0	5697.00	5699.50	2.500	5699.78	5702.27	0.56	5702.27	End
18	L18	6.17	18 c	101.3	5701.90	5702.93	1.017	5703.47	5703.88	n/a	5703.88 j	17
19	L19	4.16	18 c	30.6	5703.13	5703.45	1.048	5704.22	5704.23	n/a	5704.23 j	18
20	L20	2.00	18 c	20.0	5703.33	5703.73	2.000	5704.29	5704.27	n/a	5704.27 j	18
21	L21	44.98	36 c	403.4	5700.75	5715.00	3.533	5703.03	5717.14	n/a	5717.14 j	17
22	L22	44.98	36 c	400.0	5715.30	5725.70	2.600	5717.59	5727.84	n/a	5727.84 j	21
23	L23	44.98	36 c	217.3	5726.00	5732.00	2.762	5728.29	5734.14	n/a	5734.14 j	22
24	L24	36.40	36 c	621.3	5732.00	5743.26	1.812	5734.81	5745.18	n/a	5745.18 j	23
25	L25	10.66	24 c	67.0	5745.16	5745.96	1.192	5746.08	5747.12	n/a	5747.12	24
26	L26	25.74	36 c	248.8	5743.86	5748.50	1.865	5745.88	5750.12	n/a	5750.12 j	24
27	L27	23.56	30 c	19.8	5749.50	5749.69	0.962	5750.88	5751.60	0.00	5751.60	26
28	L28	2.19	18 c	249.0	5752.72	5762.38	3.879	5753.05	5762.94	n/a	5762.94	26
29	L29	2.19	18 c	10.0	5762.38	5762.68	3.003	5763.12	5763.25	n/a	5763.25 j	28
30	L30	36.58	42 c	53.0	5700.23	5701.27	1.962	5703.43	5703.12	n/a	5703.12	17
31	L31	15.76	24 c	28.1	5702.57	5703.37	2.852	5703.51	5705.36	0.00	5705.36	30
32	L32	3.15	24 c	12.5	5702.97	5703.53	4.493	5703.89	5704.16	n/a	5704.16 j	30

Lorson East fdr-D Basins-5yr	Number of lines: 39	Run Date: 02-13-2018

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.
33	L33	17.67	24 c	273.9	5702.93	5707.47	1.658	5704.06	5708.96	0.31	5708.96	30
34	L34	17.67	24 c	145.5	5707.81	5710.70	1.987	5709.24	5712.19	0.31	5712.19	33
35	L35	17.67	24 c	19.4	5711.00	5711.30	1.548	5712.47	5712.79	0.31	5712.79	34
36	L36	7.57	18 c	120.7	5711.80	5713.30	1.242	5713.27	5714.35	n/a	5714.35 j	35
37	L37	7.57	18 c	219.8	5713.60	5719.23	2.562	5714.58	5720.28	0.00	5720.28	36
38	L38	8.58	18 c	13.6	5733.60	5733.93	2.430	5734.85	5735.05	0.00	5735.05	23
39	L39	10.10	18 c	28.3	5711.80	5712.09	1.023	5713.05	5713.31	0.00	5713.31	35

Lorson East fdr-D Basins-5yr	Number of lines: 39	Run Date: 02-13-2018

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	L1	122.0	48 c	141.4	5697.00	5702.09	3.601	5700.27	5705.36	0.77	5705.36	End
2	L2	21.57	24 c	134.2	5706.09	5707.84	1.304	5707.49	5709.49	0.19	5709.49	1
3	L3	21.60	24 c	61.7	5708.24	5709.42	1.910	5709.70	5711.07	0.28	5711.07	2
4	L4	10.76	18 c	186.4	5710.17	5715.01	2.597	5711.44	5716.26	n/a	5716.26 j	3
5	L5	10.77	18 c	10.0	5715.11	5715.38	2.700	5716.41	5716.63	0.65	5716.63	4
6	L6	109.9	48 c	8.5	5702.59	5704.23	19.305	5706.08	5707.33	n/a	5707.33	1
7	L7	57.07	36 c	146.7	5705.33	5707.67	1.594	5708.03	5710.08	n/a	5710.08	6
8	L8	44.73	30 c	226.5	5708.37	5713.87	2.428	5710.15	5716.10	n/a	5716.10	7
9	L9	18.65	24 c	78.4	5714.92	5718.39	4.425	5717.01	5719.92	n/a	5719.92 j	8
10	L10	18.77	24 c	83.9	5718.68	5720.50	2.168	5720.18	5722.04	0.25	5722.04	9
11	L11	18.80	24 c	24.9	5720.70	5720.98	1.123	5722.30	5722.52	0.00	5722.52	10
12	L12	31.70	24 c	25.6	5706.33	5707.11	3.051	5707.69*	5709.78*	0.00	5709.78	6
13	L13	29.70	30 c	6.0	5707.13	5707.37	4.004	5708.17*	5711.41*	0.00	5711.41	1
14	L14	10.83	18 c	26.6	5710.44	5710.86	1.577	5711.48	5712.28	0.55	5712.83	3
15	L15	25.53	24 c	29.2	5715.08	5716.06	3.360	5716.53	5717.84	0.00	5717.84	8
16	L16	12.63	18 c	58.9	5709.75	5710.83	1.832	5710.85	5712.17	0.00	5712.17	7
17	L17	173.6	48 c	100.0	5697.00	5699.50	2.500	5700.75	5703.25	1.25	5703.25	End
18	L18	15.99	24 c	101.3	5701.50	5702.63	1.115	5705.97*	5706.48*	0.16	5706.64	17
19	L19	12.70	18 c	30.6	5702.93	5703.25	1.046	5706.64*	5707.09*	0.00	5707.09	18
20	L20	3.59	18 c	20.0	5702.93	5703.33	2.000	5706.98*	5707.00*	0.00	5707.00	18
21	L21	103.3	36 c	400.0	5700.75	5715.00	3.563	5703.25	5717.91	n/a	5717.91	17
22	L22	103.9	36 c	400.0	5715.30	5725.70	2.600	5717.93	5728.61	0.00	5728.61	21
23	L23	104.2	36 c	217.3	5726.00	5732.00	2.762	5728.65	5734.91	1.03	5734.91	22
24	L24	93.04	36 c	621.3	5732.00	5743.26	1.812	5735.66*	5747.75*	1.08	5748.83	23
25	L25	20.30	24 c	67.0	5745.06	5745.96	1.343	5750.87*	5751.41*	0.00	5751.41	24
26	L26	75.38	36 c	251.2	5744.56	5749.20	1.847	5749.75*	5752.96*	0.53	5753.49	24
27	L27	60.85	30 c	27.3	5750.00	5750.49	1.793	5753.49*	5754.10*	0.00	5754.10	26
28	L28	4.84	18 c	249.0	5752.72	5762.38	3.879	5755.15	5763.22	n/a	5763.22 j	26
29	L29	4.85	18 c	10.0	5762.38	5762.68	3.003	5763.45	5763.52	n/a	5763.52 j	28
30	L30	88.30	42 c	53.7	5700.23	5701.27	1.935	5705.07*	5705.48*	0.52	5706.01	17
31	L31	31.70	24 c	28.1	5702.97	5703.77	2.843	5706.01*	5706.56*	0.00	5706.56	30
32	L32	29.20	24 c	13.0	5702.97	5703.48	3.934	5706.01*	5706.22*	0.40	5706.63	30

Lorson East fdr- D Basins-100y	Number of lines: 39	Run Date: 02-13-2018

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; 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.
33	L33	27.33	24 c	272.5	5702.98	5707.49	1.655	5706.14*	5710.12*	0.35	5710.47	30
34	L34	27.37	24 c	144.3	5707.81	5710.40	1.795	5710.47*	5712.58*	0.35	5712.94	33
35	L35	27.38	24 c	19.4	5710.70	5711.20	2.581	5712.94	5713.20	0.47	5713.67	34
36	L36	11.08	18 c	120.7	5711.70	5714.00	1.905	5714.24	5715.46	0.19	5715.65	35
37	L37	11.08	18 c	219.8	5714.20	5719.23	2.288	5715.66	5720.50	n/a	5720.50 j	36
38	L38	12.37	18 c	13.6	5733.60	5733.93	2.430	5737.59*	5737.78*	0.00	5737.78	23
39	L39	16.30	18 c	28.3	5711.80	5712.09	1.023	5713.67*	5714.35*	0.00	5714.35	35

Lorson East fdr- D Basins-100y | Number of lines: 39 | Run Date: 02-13-2018

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

APPENDIX F –INTERIM POND CALCULATIONS

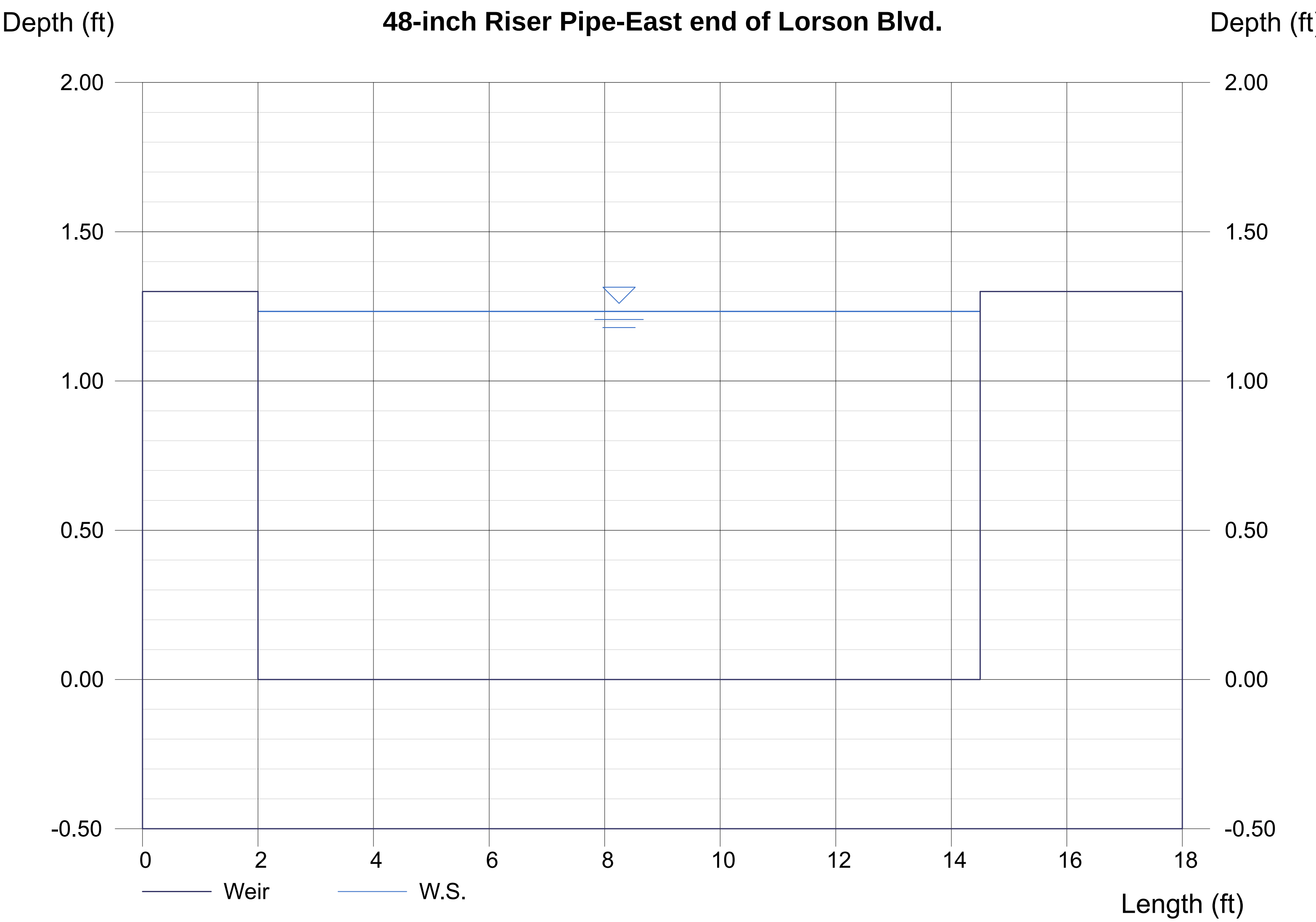
Weir Report

48-inch Riser Pipe-East end of Lorson Blvd.

Rectangular Weir
Crest = Sharp
Bottom Length (ft) = 12.50
Total Depth (ft) = 1.30

Calculations
Weir Coeff. Cw = 3.33
Compute by: Known Q
Known Q (cfs) = 57.00

Highlighted
Depth (ft) = 1.23
Q (cfs) = 57.00
Area (sqft) = 15.42
Velocity (ft/s) = 3.70
Top Width (ft) = 12.50



Weir Report

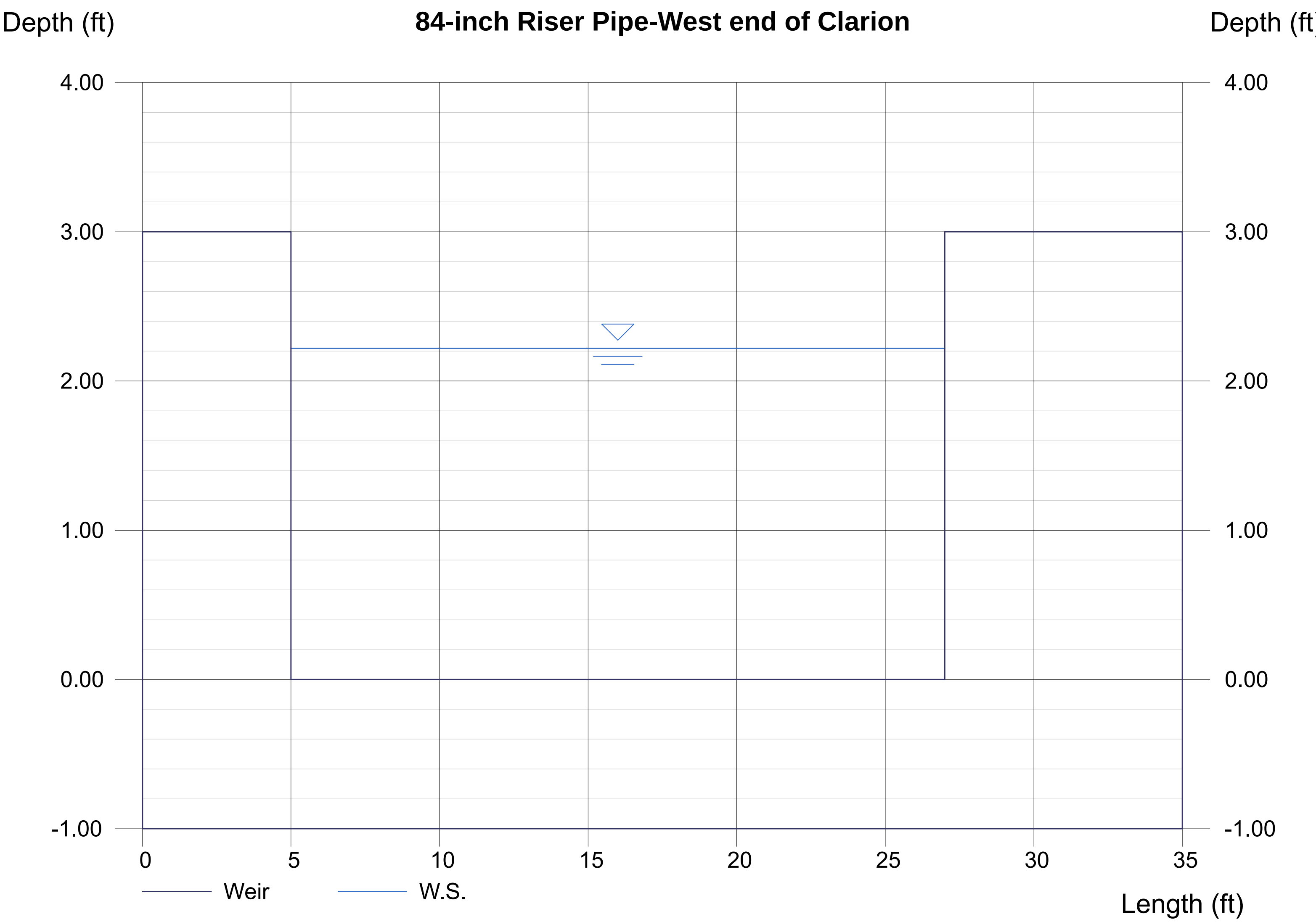
Hydraflow Express by Intelisolve — Tuesday, Apr 24 2018, 10:5 AM

84-inch Riser Pipe-West end of Clarion

Rectangular Weir
Crest = Sharp
Bottom Length (ft) = 22.00
Total Depth (ft) = 3.00

Calculations
Weir Coeff. Cw = 3.33
Compute by: Known Q
Known Q (cfs) = 242.00

Highlighted
Depth (ft) = 2.22
Q (cfs) = 242.00
Area (sqft) = 48.82
Velocity (ft/s) = 4.96
Top Width (ft) = 22.00



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	140.99	6	384	905,484	----	------	------	EX-C
2	SCS Runoff	56.24	6	372	246,030	----	------	------	EX1
3	SCS Runoff	30.54	6	372	141,852	----	------	------	EX2
4	SCS Runoff	69.85	6	372	324,487	----	------	------	EX3

existing Flows.gpw	Return Period: 5 Year	Tuesday, Apr 24 2018, 8:07 AM

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	458.13	6	384	2,456,980	----	------	------	EX-C
2	SCS Runoff	178.11	6	372	667,589	----	------	------	EX1
3	SCS Runoff	106.13	6	372	406,031	----	------	------	EX2
4	SCS Runoff	242.77	6	372	928,796	----	------	------	EX3

existing Flows.gpw	Return Period: 100 Year	Tuesday, Apr 24 2018, 8:07 AM

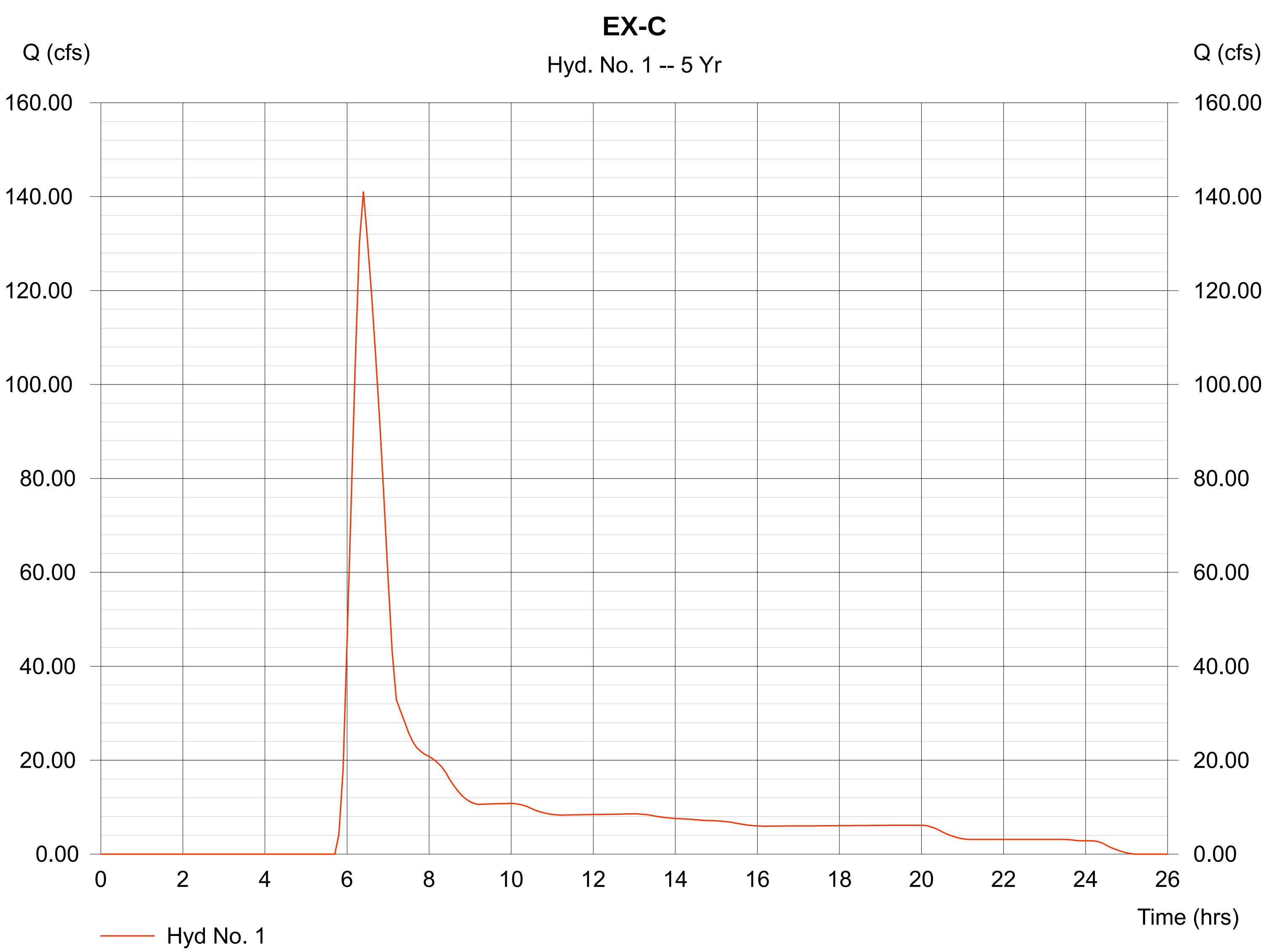
Hydrograph Plot

Hyd. No. 1

EX-C

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

Hydrograph Volume = 905,484 cuft



Hydrograph Plot

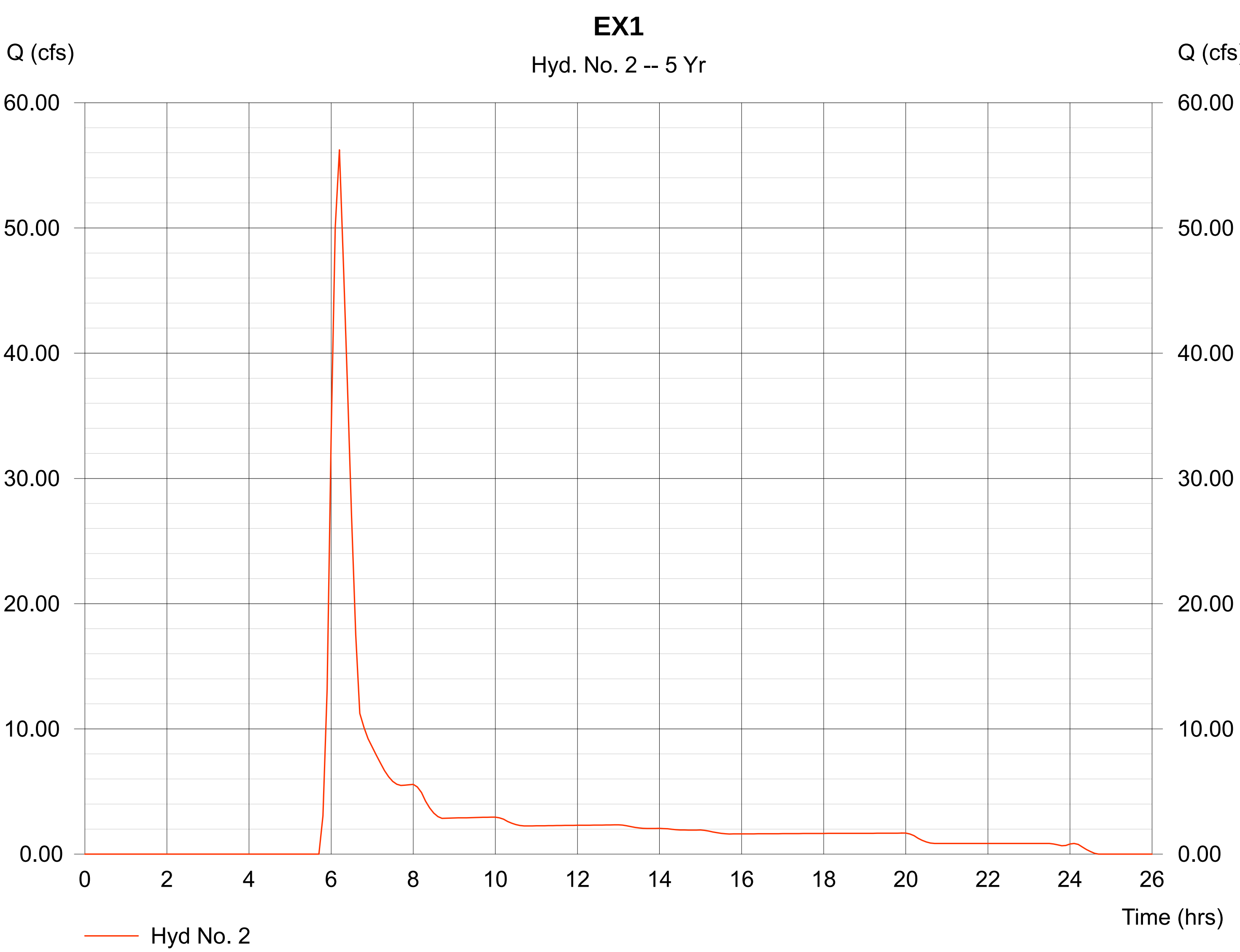
Hydraflow Hydrographs by Intelisolve | Tuesday, Apr 24 2018, 8:8 AM

Hyd. No. 2

EX1

Hydrograph type	= SCS Runoff	Peak discharge	= 56.24 cfs
Storm frequency	= 5 yrs	Time interval	= 6 min
Drainage area	= 120.000 ac	Curve number	= 69
Basin Slope	= 3.0 %	Hydraulic length	= 3000 ft
Tc method	= USER	Time of conc. (Tc)	= 25.00 min
Total precip.	= 2.80 in	Distribution	= Custom
Storm duration	= CSpring_IIA-6min.cds	Shape factor	= 484

Hydrograph Volume = 246,030 cuft



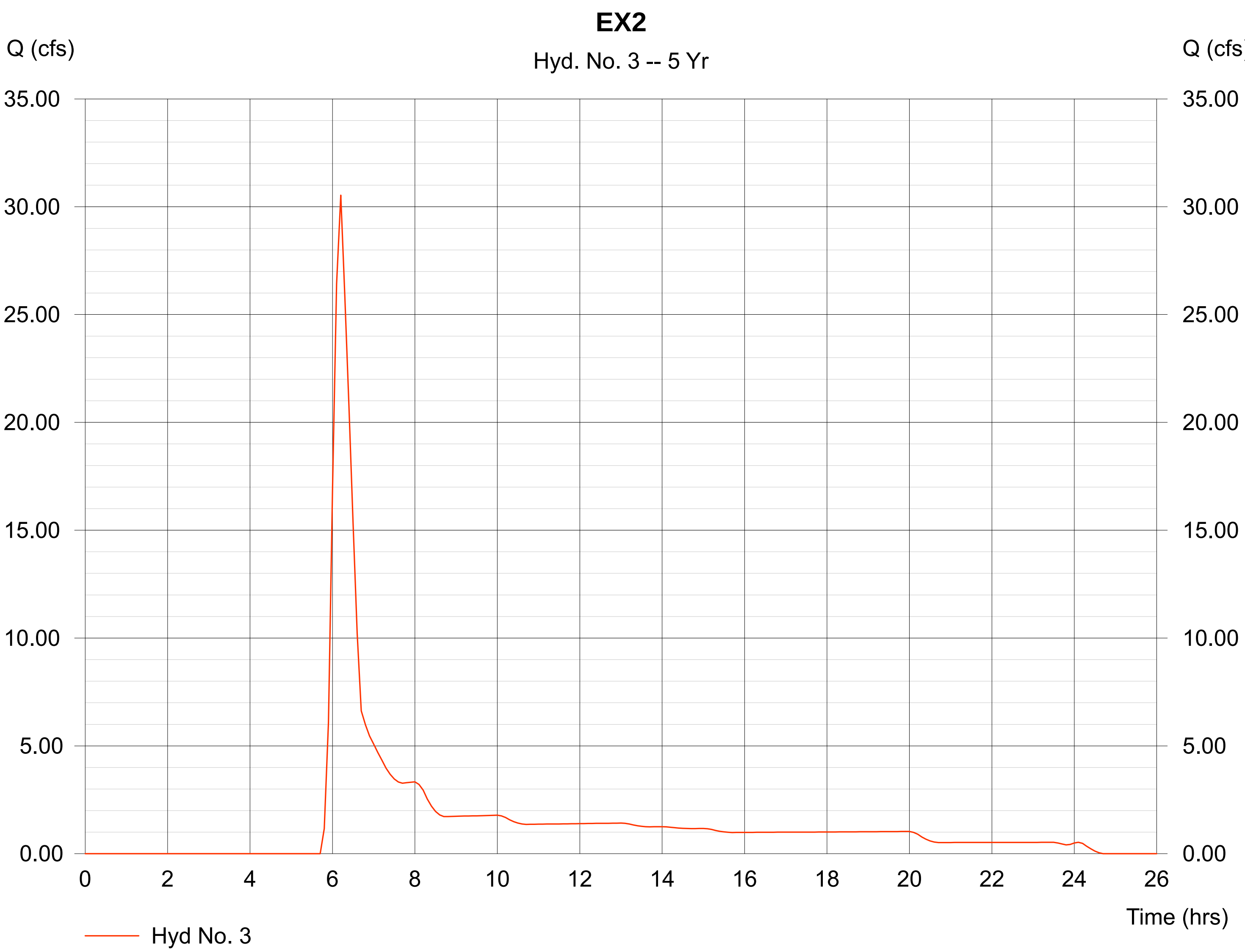
Hydrograph Plot

Hyd. No. 3

EX2

Hydrograph type	= SCS Runoff	Peak discharge	= 30.54 cfs
Storm frequency	= 5 yrs	Time interval	= 6 min
Drainage area	= 80.000 ac	Curve number	= 67
Basin Slope	= 0.0 %	Hydraulic length	= 3000 ft
Tc method	= USER	Time of conc. (Tc)	= 25.00 min
Total precip.	= 2.80 in	Distribution	= Custom
Storm duration	= CSpring_IIA-6min.cds	Shape factor	= 484

Hydrograph Volume = 141,852 cuft



Hydrograph Plot

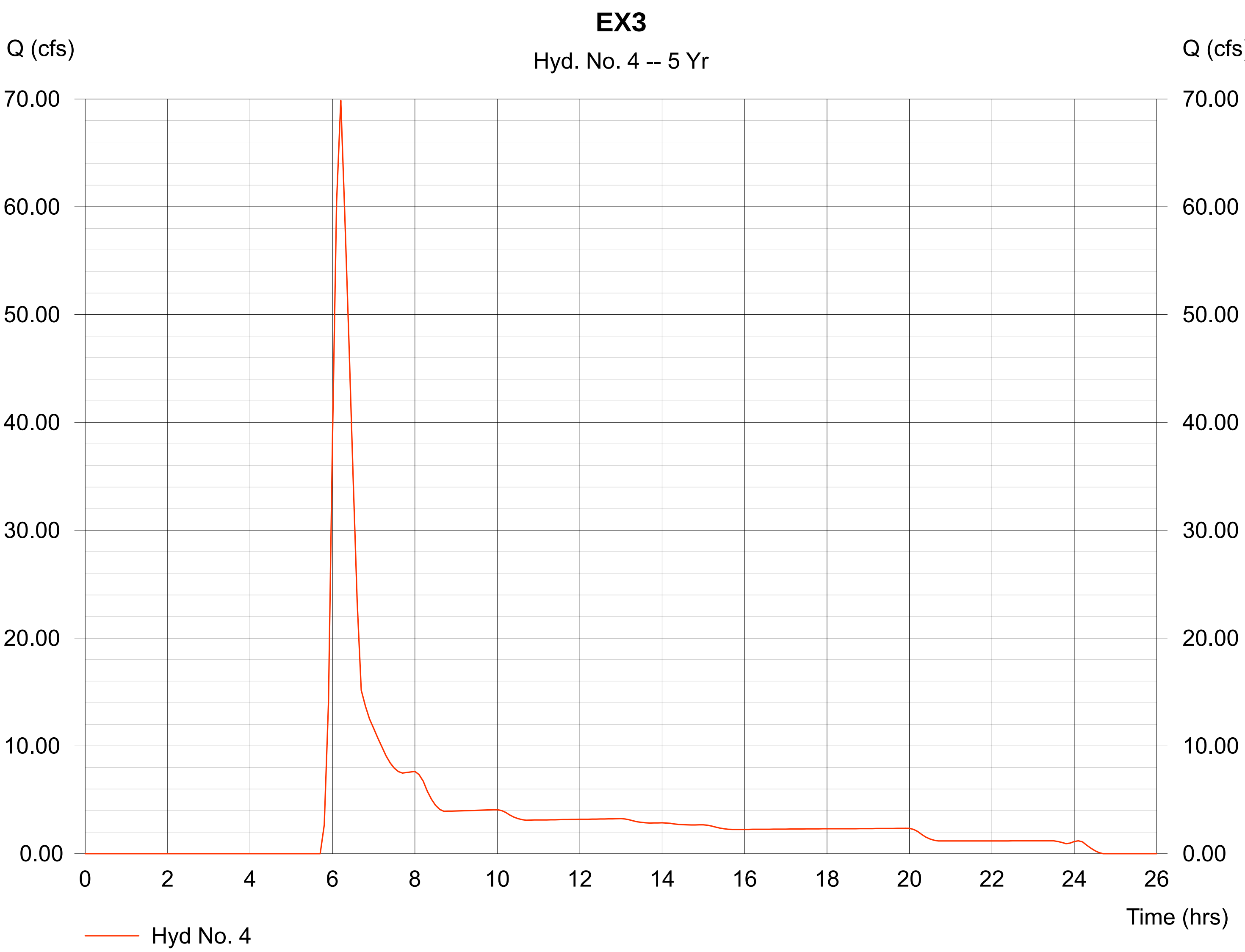
Hydraflow Hydrographs by Intelisolve — Tuesday, Apr 24 2018, 8:8 AM

Hyd. No. 4

EX3

Hydrograph type	= SCS Runoff	Peak discharge	= 69.85 cfs
Storm frequency	= 5 yrs	Time interval	= 6 min
Drainage area	= 183.000 ac	Curve number	= 67
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 29.00 min
Total precip.	= 2.80 in	Distribution	= Custom
Storm duration	= CSpring_IIA-6min.cds	Shape factor	= 484

Hydrograph Volume = 324,487 cuft



Hydrograph Plot

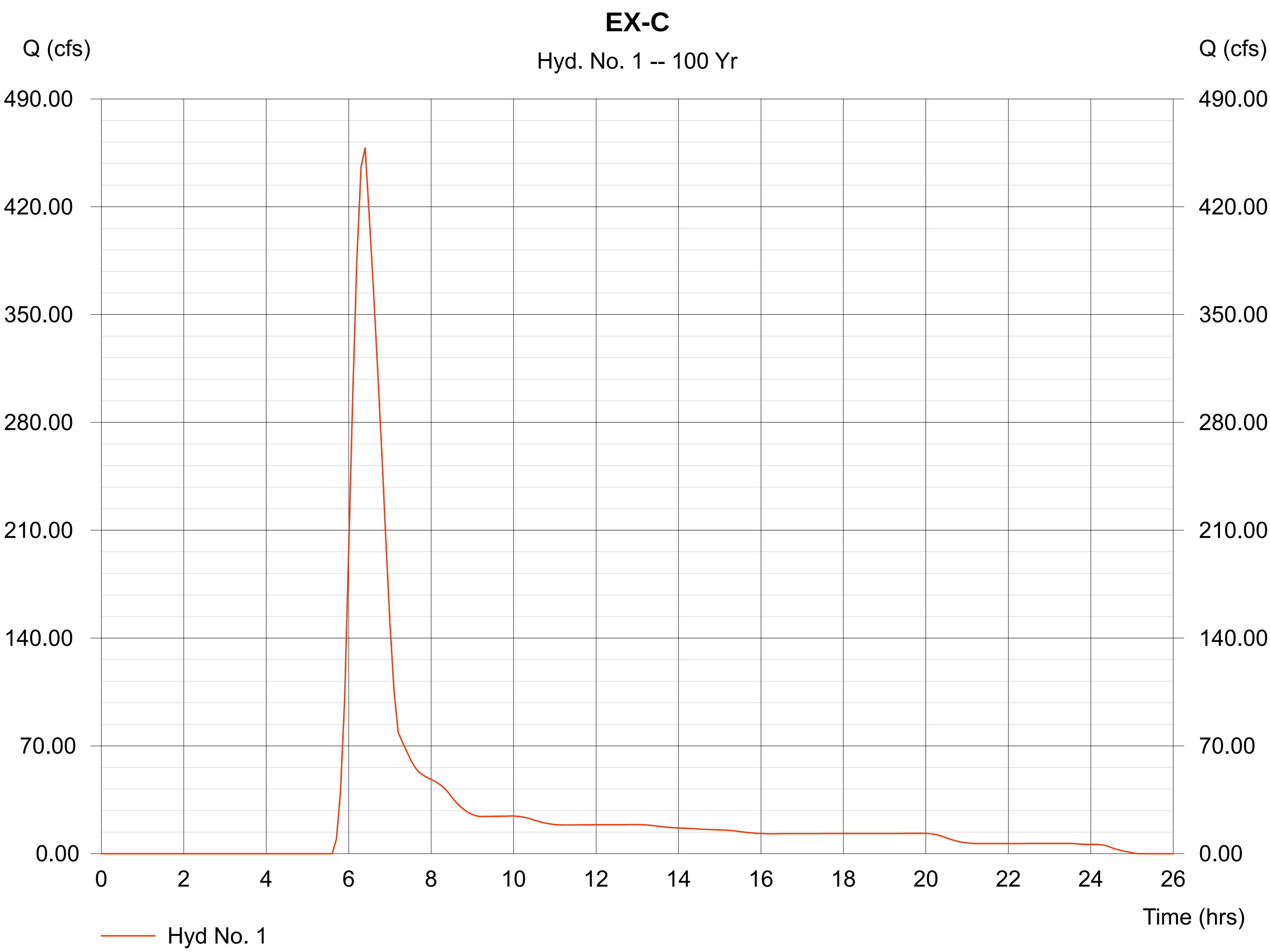
Hydraflow Hydrographs by Intelisolve | Tuesday, Apr 24 2018, 8:9 AM

Hyd. No. 1

EX-C

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

Hydrograph Volume = 2,456,980 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

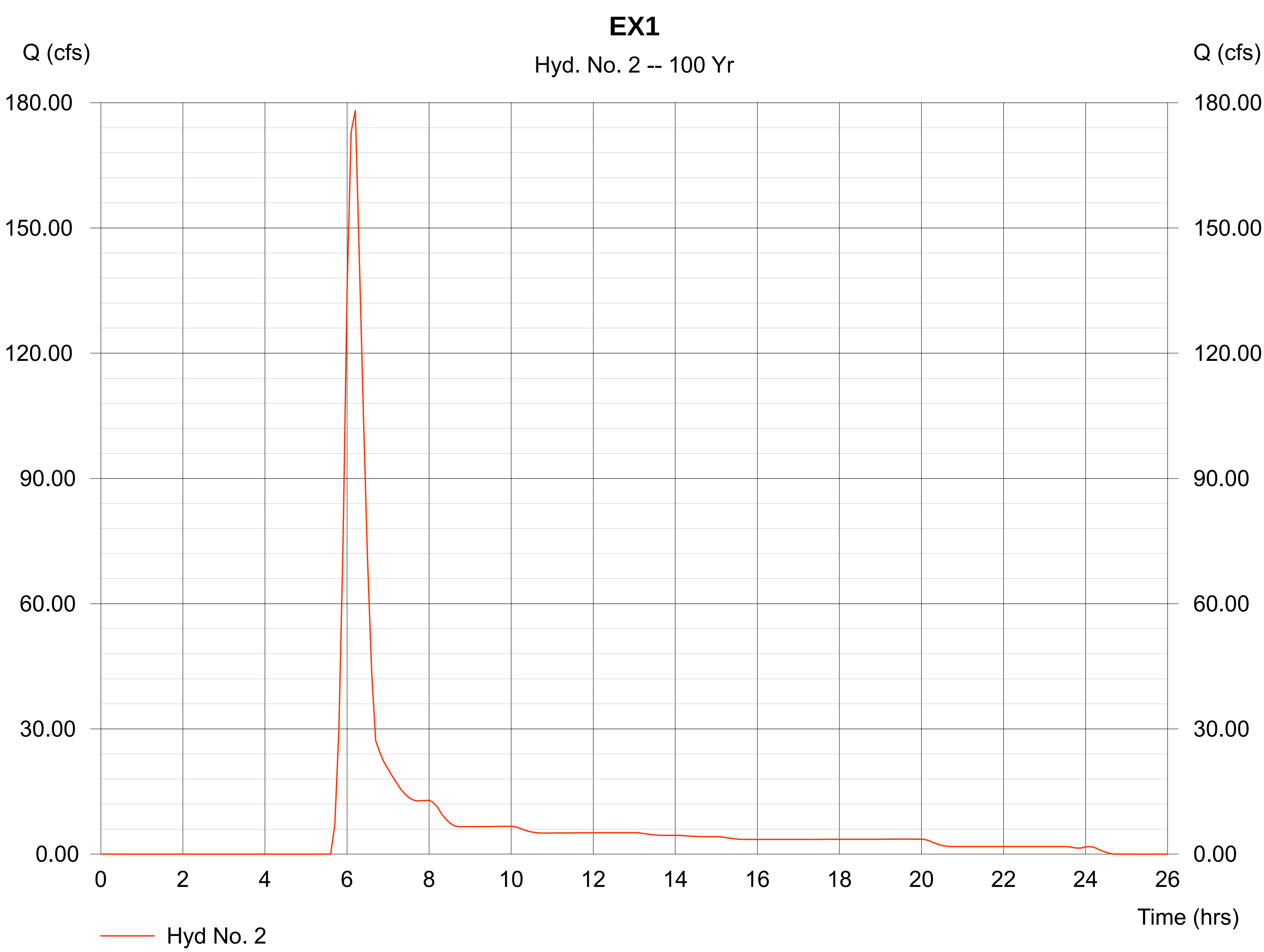
Tuesday, Apr 24 2018, 8:9 AM

Hyd. No. 2

EX1

Hydrograph type	= SCS Runoff	Peak discharge	= 178.11 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 120.000 ac	Curve number	= 69
Basin Slope	= 3.0 %	Hydraulic length	= 3000 ft
Tc method	= USER	Time of conc. (Tc)	= 25.00 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= CSpring_IIA-6min.cds	Shape factor	= 484

Hydrograph Volume = 667,589 cuft



Hydrograph Plot

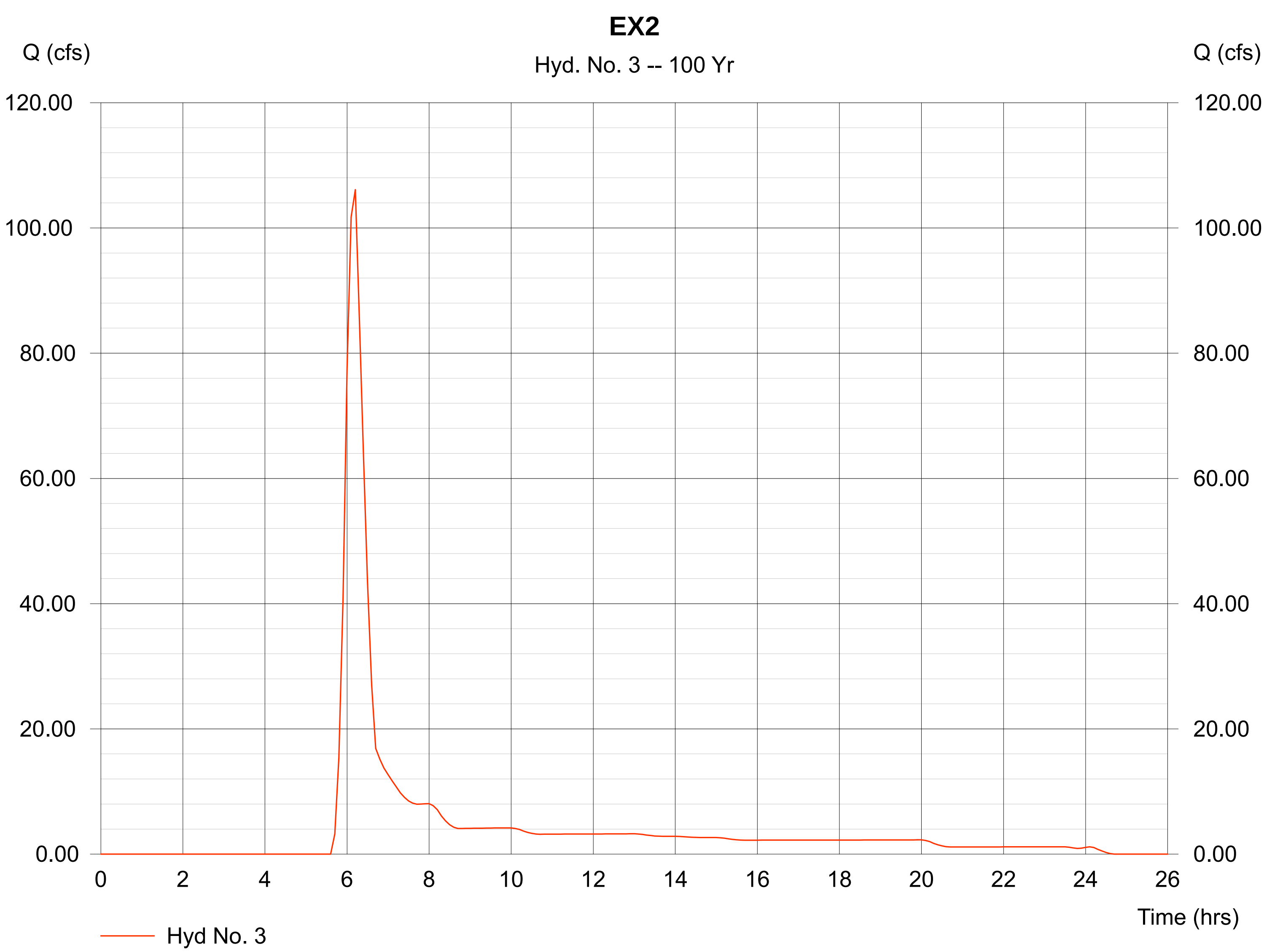
Hydraflow Hydrographs by Intelisolve — Tuesday, Apr 24 2018, 8:9 AM

Hyd. No. 3

EX2

Hydrograph type	= SCS Runoff	Peak discharge	= 106.13 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 80.000 ac	Curve number	= 67
Basin Slope	= 0.0 %	Hydraulic length	= 3000 ft
Tc method	= USER	Time of conc. (Tc)	= 25.00 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= CSpring_IIA-6min.cds	Shape factor	= 484

Hydrograph Volume = 406,031 cuft



Hydrograph Plot

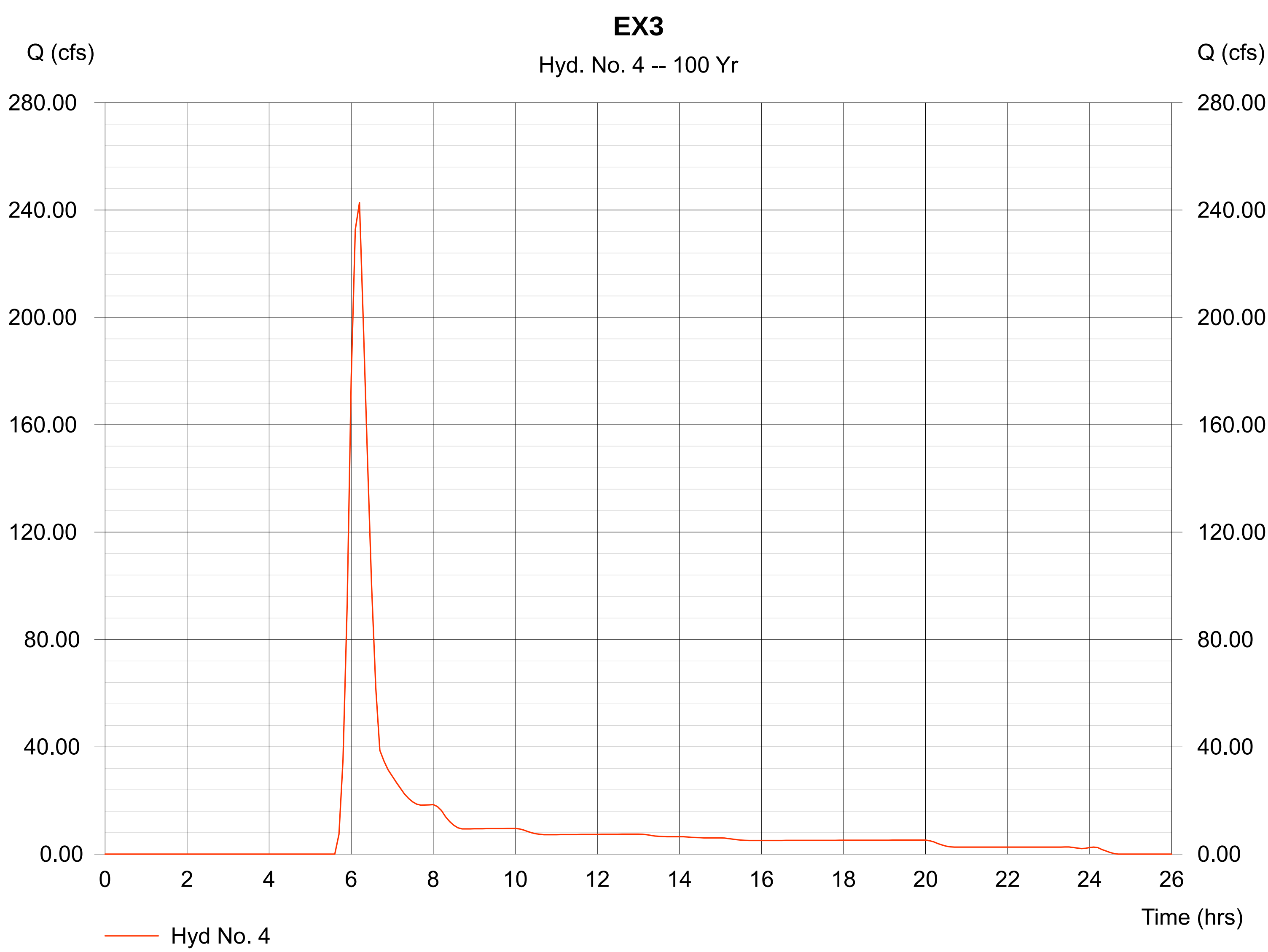
Hydraflow Hydrographs by Intelisolve
Tuesday, Apr 24 2018, 8:9 AM

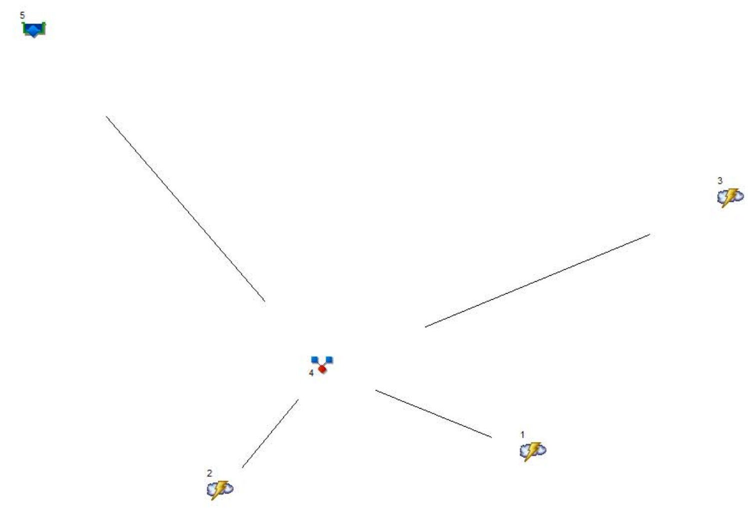
Hyd. No. 4

EX3

Hydrograph type	= SCS Runoff	Peak discharge	= 242.77 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 183.000 ac	Curve number	= 67
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 29.00 min
Total precip.	= 4.40 in	Distribution	= Custom
Storm duration	= CSpring_IIA-6min.cds	Shape factor	= 484

Hydrograph Volume = 928,796 cuft





Legend

Hyd.	Origin	Description
1	Rational	Basin Ex-1&2
2	Rational	C17
3	Rational	Basins Ex-3
4	Combine	Inflow Pond C5
5	Reservoir	Pond C5 outflow

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	99.20	1	30	178,560	----	------	------	Basin Ex-1&2
2	Rational	52.59	1	16	50,488	----	------	------	C17
3	Rational	78.16	1	32	150,068	----	------	------	Basins Ex-3
4	Combine	176.07	1	30	373,012	1, 2, 3	------	------	Inflow Pond C5
5	Reservoir	144.27	1	36	335,997	4	5713.55	576,839	Pond C5 outflow

5yr ponds C5 interim.gpw	Return Period: 5 Year	Tuesday, Apr 24 2018, 8:15 AM

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	Rational	291.20	1	30	524,160	----	------	------	Basin Ex-1&2
2	Rational	108.00	1	16	103,681	----	------	------	C17
3	Rational	240.39	1	32	461,541	----	------	------	Basins Ex-3
4	Combine	530.06	1	30	1,089,381	1, 2, 3	------	------	Inflow Pond C5
5	Reservoir	467.06	1	35	991,733	4	5714.46	696,619	Pond C5 outflow

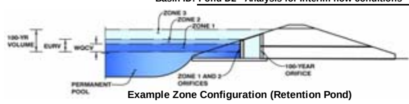
100yr ponds C5 interim.gpw	Return Period: 100 Year	Tuesday, Apr 24 2018, 8:18 AM

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: LRE Filing No. 1

Basin ID: Pond D2 - Analysis for Interim flow conditions



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**				
Watershed Area =	78.00	acres			
Watershed Length =	2,200	ft			
Watershed Slope =	0.025	ft/ft			
Watershed Imperviousness =	48.00%	percent			
Percentage Hydrologic Soil Group A =	0.0%	percent			
Percentage Hydrologic Soil Group B =	0.0%	percent			
Percentage Hydrologic Soil Groups C/D =	100.0%	percent			
Desired WQCV Drain Time =	40.0	hours			
Location for 1-hr Rainfall Depths =	User Input				
Water Quality Capture Volume (WQCV) =	1.306	acre-feet	Optional User Override		
Excess Urban Runoff Volume (EURV) =	3.530	acre-feet	1-hr Precipitation		
2-yr Runoff Volume (P1 = 1.16 in.) =	3.232	acre-feet	1.16	inches	
5-yr Runoff Volume (P1 = 1.44 in.) =	4.758	acre-feet	1.44	inches	
10-yr Runoff Volume (P1 = 1.68 in.) =	6.164	acre-feet	1.68	inches	
25-yr Runoff Volume (P1 = 1.92 in.) =	8.518	acre-feet	1.92	inches	
50-yr Runoff Volume (P1 = 2.16 in.) =	10.284	acre-feet	2.16	inches	
100-yr Runoff Volume (P1 = 2.42 in.) =	12.496	acre-feet	2.42	inches	
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches	
Approximate 2-yr Detention Volume =	3.031	acre-feet			
Approximate 5-yr Detention Volume =	4.485	acre-feet			
Approximate 10-yr Detention Volume =	5.115	acre-feet			
Approximate 25-yr Detention Volume =	5.549	acre-feet			
Approximate 50-yr Detention Volume =	5.754	acre-feet			
Approximate 100-yr Detention Volume =	6.589	acre-feet			

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	1.306	acre-feet
Zone 2 Volume (EURV - Zone 1) =	2.225	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.058	acre-feet
Total Detention Basin Volume =	6.589	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.2 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	20	0.000		
5695.33	--	0.33	--	--	--	100	0.002	19	0.000
5696	--	1.00	--	--	--	1,074	0.025	402	0.009
5697	--	2.00	--	--	--	48,988	1.125	24,956	0.573
5698	--	3.00	--	--	--	72,821	1.672	86,348	1.982
5699	--	4.00	--	--	--	76,610	1.759	161,063	3.698
5700	--	5.00	--	--	--	80,493	1.848	239,615	5.501
5701	--	6.00	--	--	--	84,486	1.940	322,104	7.394
5702	--	7.00	--	--	--	88,582	2.034	408,638	9.381
5703	--	8.00	--	--	--	92,768	2.130	499,313	11.463
5704	--	9.00	--	--	--	97,074	2.229	594,234	13.642
5705	--	10.00	--	--	--	102,033	2.342	693,788	15.927
5706	--	11.00	--	--	--	106,000	2.433	797,804	18.315
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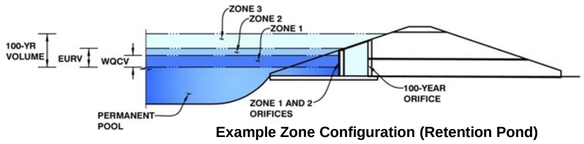
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Lorson Ranch East MDDP

Basin ID: Pond D2 - Analysis for Interim flow conditions



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.57	1.306	Orifice Plate
Zone 2 (EURV)	3.91	2.225	Rectangular Orifice
Zone 3 (100-year)	5.59	3.058	Weir&Pipe (Restrict)
		6.589	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.80	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	9.00	inches
Orifice Plate: Orifice Area per Row =	4.20	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.917E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.60	1.20					
Orifice Area (sq. inches)	4.20	4.20	4.20					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.57	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.91	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	10.00	N/A	inches
Vertical Orifice Width =	25.21		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	1.75	N/A	ft^2
Vertical Orifice Centroid =	0.42	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Slope =	10.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	20.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.60	N/A	feet
Over Flow Weir Slope Length =	20.10	N/A	feet
Grate Open Area / 100-yr Orifice Area =	3.54	N/A	should be $\geq$ 4
Overflow Grate Open Area w/o Debris =	56.28	N/A	ft^2
Overflow Grate Open Area w/ Debris =	28.14	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	54.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	54.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	15.90	N/A	ft^2
Outlet Orifice Centroid =	2.25	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	30.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	3.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	1.64	feet
Stage at Top of Freeboard =	11.64	feet
Basin Area at Top of Freeboard =	2.43	acres

Routed Hydrograph Results

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.16	1.44	1.68	1.92	2.16	2.42	0.00
Calculated Runoff Volume (acre-ft) =	1.306	3.530	3.232	4.758	6.164	8.518	10.284	12.496	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	1.306	3.533	3.234	4.761	6.166	8.523	10.284	12.500	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.02	0.14	0.39	0.89	1.17	1.52	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	1.3	11.1	30.3	69.2	91.4	118.4	0.0
Peak Inflow Q (cfs) =	24.7	65.8	60.4	88.2	113.6	155.6	186.7	225.4	#N/A
Peak Outflow Q (cfs) =	0.6	7.2	6.5	9.8	12.8	34.0	57.8	91.0	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	0.4	0.5	0.6	0.8	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.3	0.8	1.3	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	32	42	42	42	42	41	40	38	#N/A
Time to Drain 99% of Inflow Volume (hours) =	34	45	45	46	46	46	46	45	#N/A
Maximum Ponding Depth (ft) =	2.51	3.58	3.45	4.13	4.77	5.54	5.94	6.32	#N/A
Area at Maximum Ponding Depth (acres) =	1.40	1.72	1.71	1.77	1.83	1.90	1.93	1.97	#N/A
Maximum Volume Stored (acre-ft) =	1.215	2.967	2.743	3.927	5.060	6.512	7.259	8.020	#N/A

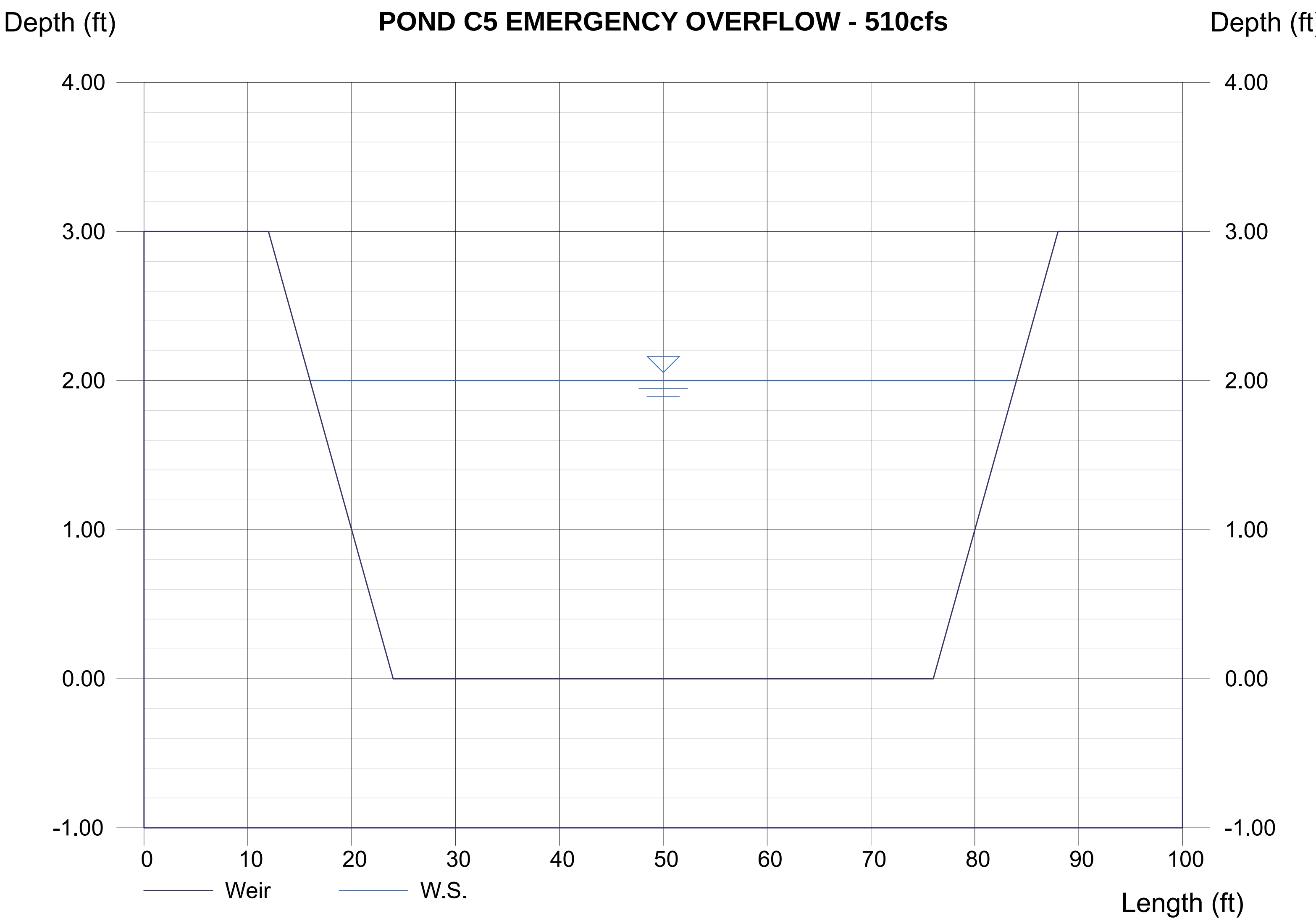
Weir Report

POND C5 EMERGENCY OVERFLOW - 510cfs

Trapezoidal Weir		Highlighted	
Crest	= Sharp	Depth (ft)	= 2.00
Bottom Length (ft)	= 52.00	Q (cfs)	= 510.00
Total Depth (ft)	= 3.00	Area (sqft)	= 120.00
Side Slope (z:1)	= 4.00	Velocity (ft/s)	= 4.25
		Top Width (ft)	= 68.00

Calculations

Weir Coeff. Cw	= 3.10
Compute by:	Known Q
Known Q (cfs)	= 510.00



APPENDIX G – FONTAINE BOULEVARD FDR (CDR 183)

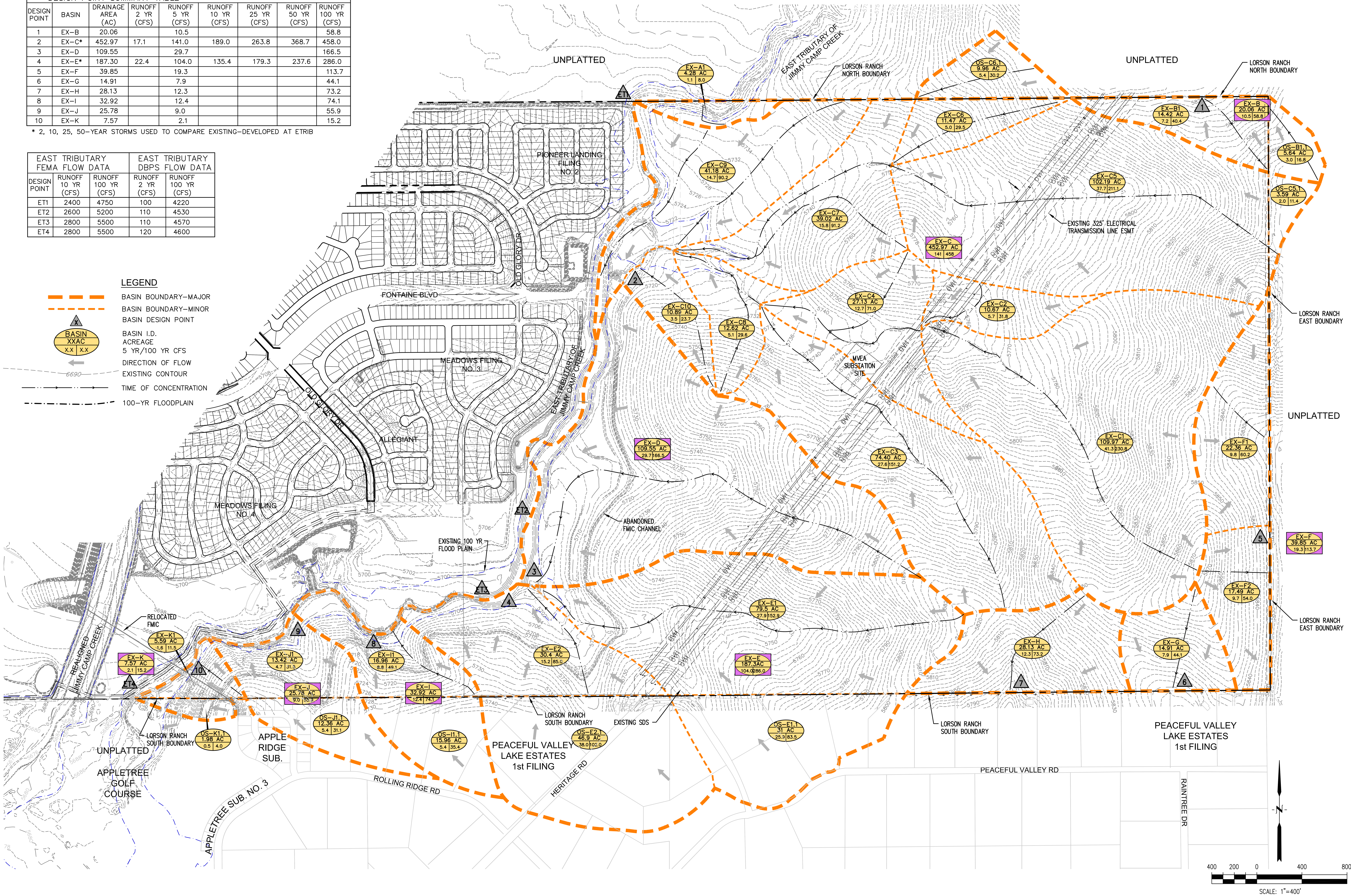
MAP POCKET

DESIGN POINT SUMMARY TABLE

DESIGN POINT	BASIN	DRAINAGE AREA (AC)	RUNOFF 2 YR (CFS)	RUNOFF 5 YR (CFS)	RUNOFF 10 YR (CFS)	RUNOFF 25 YR (CFS)	RUNOFF 50 YR (CFS)	RUNOFF 100 YR (CFS)
1	EX–B	20.06		10.5				58.8
2	EX–C*	452.97	17.1	141.0	189.0	263.8	368.7	458.0
3	EX–D	109.55		29.7				166.5
4	EX–E*	187.30	22.4	104.0	135.4	179.3	237.6	286.0
5	EX–F	39.85		19.3				113.7
6	EX–G	14.91		7.9				44.1
7	EX–H	28.13		12.3				73.2
8	EX–I	32.92		12.4				74.1
9	EX–J	25.78		9.0				55.9
10	EX–K	7.57		2.1				15.2

* 2, 10, 25, 50–YEAR STORMS USED TO COMPARE EXISTING–DEVELOPED AT ETRIB

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



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

CORE ENGINEERING GROUP
15004 1ST AVENUE S.
BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

NO. | DESCRIPTION | DATE

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

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

DRAWN: LJA
DESIGNED: LAB
CHECKED: RLS

DATE: NOV, 2017
PROJECT NO. 100.013
SHEET NUMBER 1
TOTAL SHEETS: 1

LEGEND

- BASIN BOUNDARY–MAJOR
- BASIN I.D. / ACREAGE / 5 YR/100 YR CFS (symbol: BASIN XXAC X.X X.X)
- DIRECTION OF FLOW
- EXISTING CONTOUR (6690)
- PROPOSED CONTOUR (6690)
- PRELIMINARY PLAN SITE AREA

EXISTING VERSUSES DEVELOPED FLOW AT OUTFLOWS TO ETRIB				
DESIGN POINT	EXISTING RUNOFF 5 YR (CFS)	EXISTING RUNOFF 100 YR (CFS)	DEVELOPED RUNOFF 5 YR (CFS)	DEVELOPED RUNOFF 100 YR (CFS)
46	141	458	121	443
58a	29.7	166.5	8.8	133.6
73	100	280	120*	280*

DATA FROM LORSON EAST MDDP AND PDR
*INTERIM FLOW RATES FROM PDR

NOTE:

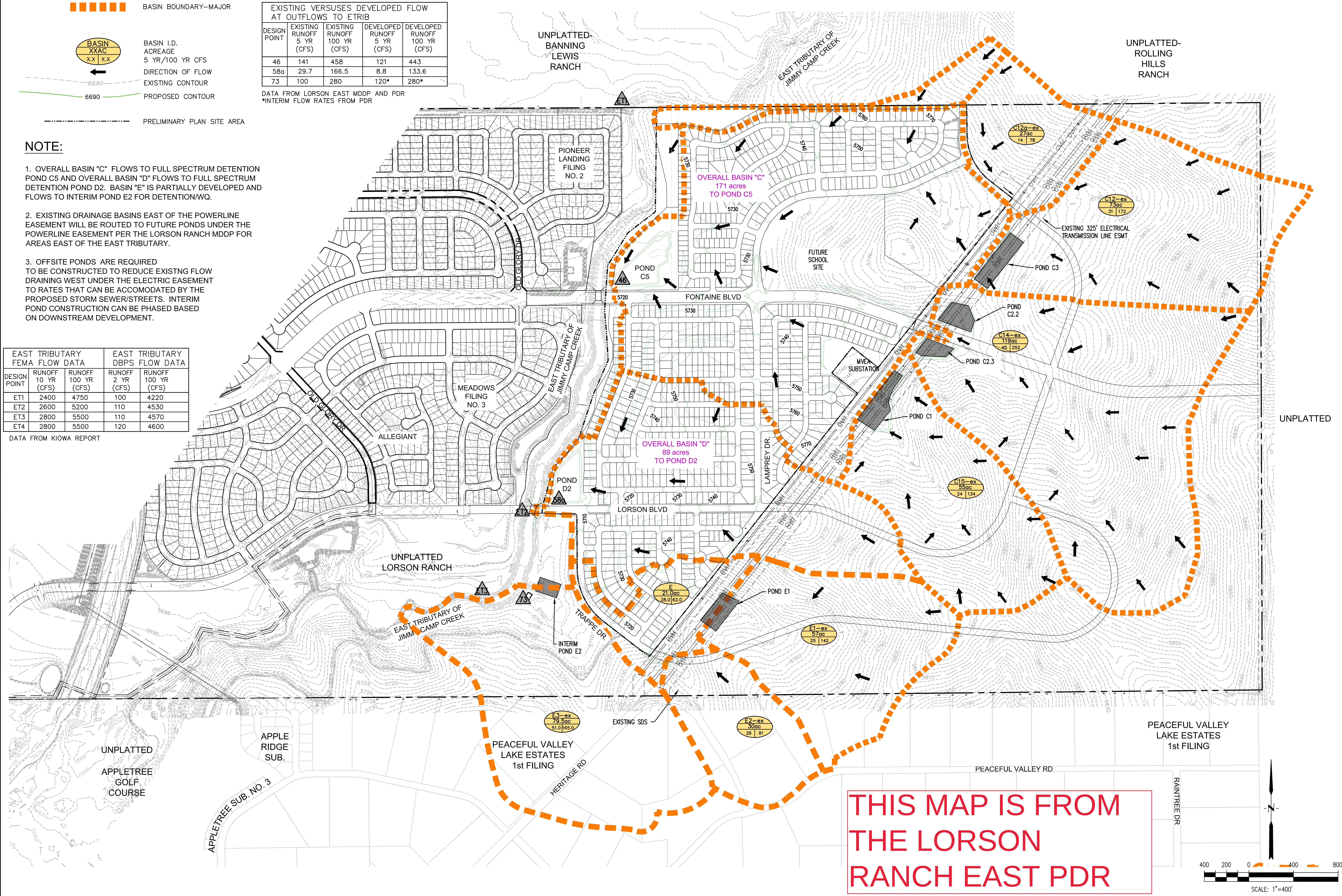
1. OVERALL BASIN "C" FLOWS TO FULL SPECTRUM DETENTION POND C5 AND OVERALL BASIN "D" FLOWS TO FULL SPECTRUM DETENTION POND D2. BASIN "E" IS PARTIALLY DEVELOPED AND FLOWS TO INTERIM POND E2 FOR DETENTION/WQ.

2. EXISTING DRAINAGE BASINS EAST OF THE POWERLINE EASEMENT WILL BE ROUTED TO FUTURE PONDS UNDER THE POWERLINE EASEMENT PER THE LORSON RANCH MDDP FOR AREAS EAST OF THE EAST TRIBUTARY.

3. OFFSITE PONDS ARE REQUIRED TO BE CONSTRUCTED TO REDUCE EXISTNG FLOW DRAINING WEST UNDER THE ELECTRIC EASEMENT TO RATES THAT CAN BE ACCOMODATED BY THE PROPOSED STORM SEWER/STREETS. INTERIM POND CONSTRUCTION CAN BE PHASED BASED ON DOWNSTREAM DEVELOPMENT.

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

DATA FROM KIOWA REPORT



THIS MAP IS FROM THE LORSON RANCH EAST PDR

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NO.	DESCRIPTION	DATE

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

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

DRAWN: LJA
DESIGNED: LAB
CHECKED: RLS

OVERALL DEVELOPED CONDITIONS
LORSON RANCH EAST
EAST OF ETRIB OF JIMMY CAMP CREEK

DATE: OCTOBER 20, 2017
PROJECT NO. 100.040
SHEET NUMBER 1
TOTAL SHEETS: 1

LEGEND

BASIN BOUNDARY–MAJOR

BASIN XXAC x.x x.x — BASIN I.D., ACREAGE, 5 YR/100 YR CFS

DIRECTION OF FLOW

6690 — EXISTING CONTOUR

6690 — PROPOSED CONTOUR

TRUNK STORM SEWER SYSTEM SEE (CDR183) FOR STORM IN FONTAINE BLVD.

LORSON RANCH EAST FILING NO. 1 FINAL PLAT SITE AREA

EXISTING VERSUSES INTERIM DEVELOPED FLOW AT OUTFLOWS TO ETRIB				
DESIGN POINT	EXISTING RUNOFF 5 YR (CFS)	EXISTING RUNOFF 100 YR (CFS)	INTERIM DEVELOPED RUNOFF 5 YR (CFS)	INTERIM DEVELOPED RUNOFF 100 YR (CFS)
46	141	458	144	467
58a	11.1*	118.4*	9.8*	91.0*

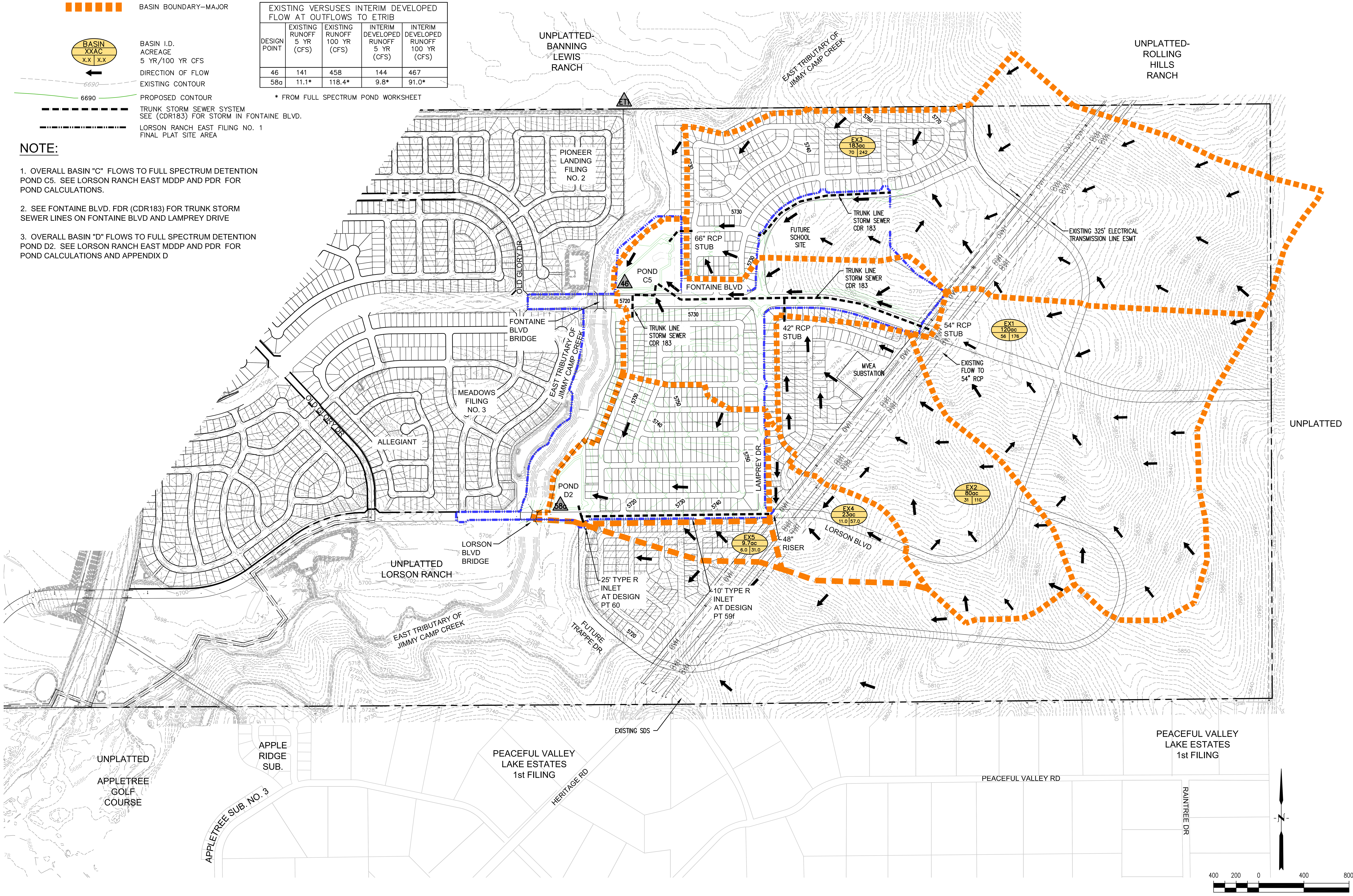
* FROM FULL SPECTRUM POND WORKSHEET

NOTE:

1. OVERALL BASIN "C" FLOWS TO FULL SPECTRUM DETENTION POND C5. SEE LORSON RANCH EAST MDDP AND PDR FOR POND CALCULATIONS.

2. SEE FONTAINE BLVD. FDR (CDR183) FOR TRUNK STORM SEWER LINES ON FONTAINE BLVD AND LAMPREY DRIVE

3. OVERALL BASIN "D" FLOWS TO FULL SPECTRUM DETENTION POND D2. SEE LORSON RANCH EAST MDDP AND PDR FOR POND CALCULATIONS AND APPENDIX D



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NO.	DESCRIPTION	DATE

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COLORADO SPRINGS, COLORADO 80903 (719) 635-3200
CONTACT: JEFF MARK

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

DRAWN: RLS
DESIGNED: RLS
CHECKED: RLS

INTERIM HYDROLOGICAL CONDITIONS LORSON RANCH EAST FILING NO. 1 BASIN "C" AND "D"

DATE: MAY 1, 2018

PROJECT NO. 100.042

SHEET NUMBER 1

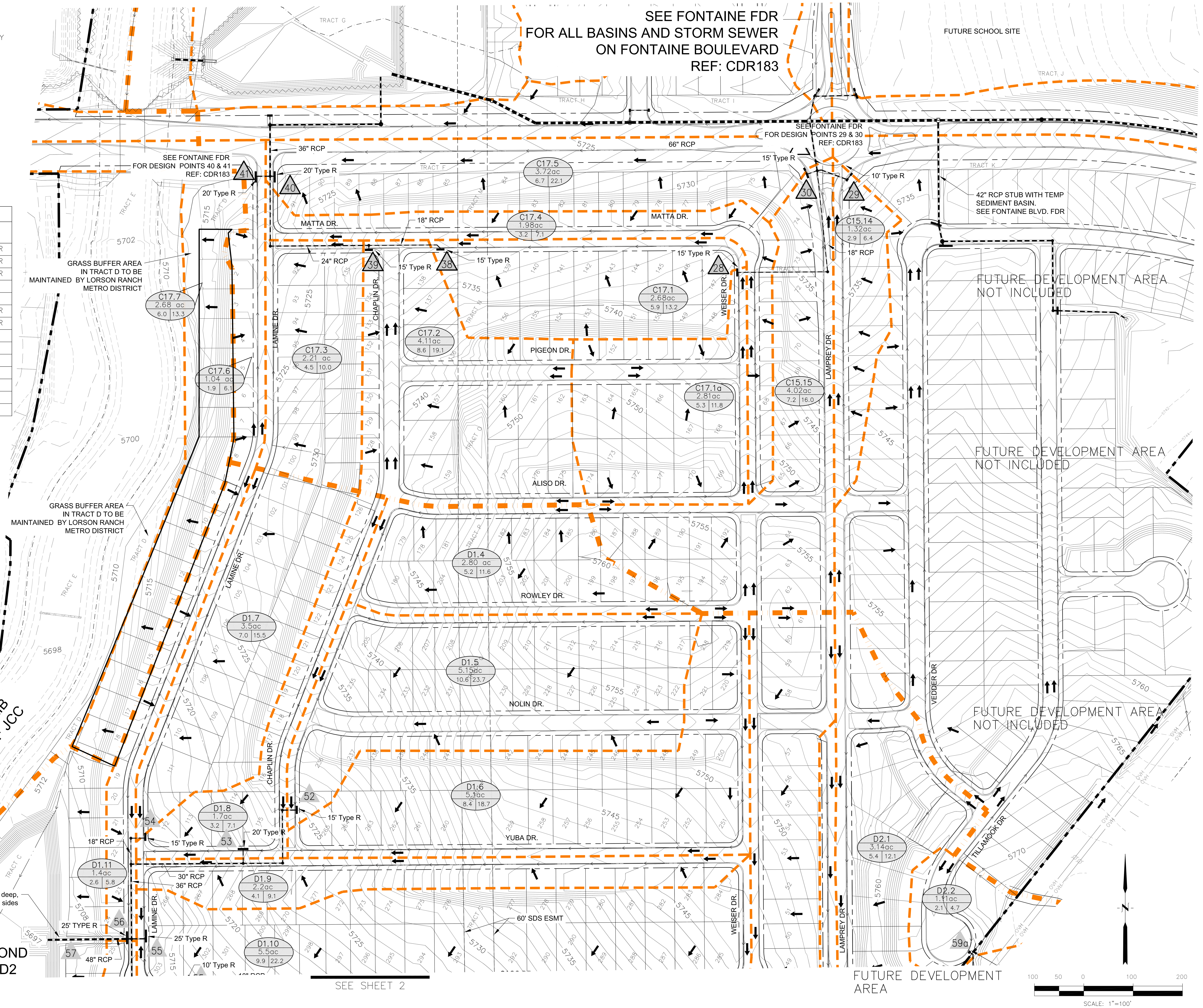
TOTAL SHEETS: 1

LEGEND

(orange dash-dot line)	DRAINAGE MAJOR BASIN BOUNDARY
(orange dashed line)	DRAINAGE MINOR BASIN BOUNDARY (OFF-SITE)
(black dash-dot line)	SITE BOUNDARY
BASIN / XX AC / X.X | X.X	BASIN I.D. / ACREAGE / 5 YR/100 YR CFS
(arrow)	DIRECTION OF FLOW
6690	EXISTING CONTOUR
6670	PROPOSED CONTOUR
HP	HIGH POINT
LP	LOW POINT
(line with arrow)	TIME OF CONCENTRATION
(dash-dot line)	100-YR FLOODPLAIN (FEMA)

RUNOFF SUMMARY

DESIGN POINT	5 YEAR	100 YEAR	NOTES
28	5.3	11.56	STREET FLOW–SEE FONTAINE FDR
29	8.6	20.8	STREET FLOW–SEE FONTAINE FDR
30	7.2	20.1	STREET FLOW–SEE FONTAINE FDR
38	5.9	14.43	STREET FLOW
39	8.61	21.53	STREET FLOW
40	12.9	39.4	STREET FLOW–SEE FONTAINE FDR
41	2.0	19.3	STREET FLOW–SEE FONTAINE FDR
52	15.44	34.7	STREET FLOW
53	14.65	41.47	STREET FLOW
54	7.26	15.5	STREET FLOW
55a	10.18	22.63	STREET FLOW
55	7.8	40.0	STREET FLOW
56	7.2	29.7	STREET FLOW
59a	2.2	4.8	STREET FLOW



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NO.	DESCRIPTION	DATE

PREPARED FOR:
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(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
LORSON RANCH EAST
FONTAINE BLVD. – EAST TRIBUTARY OF JCC
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

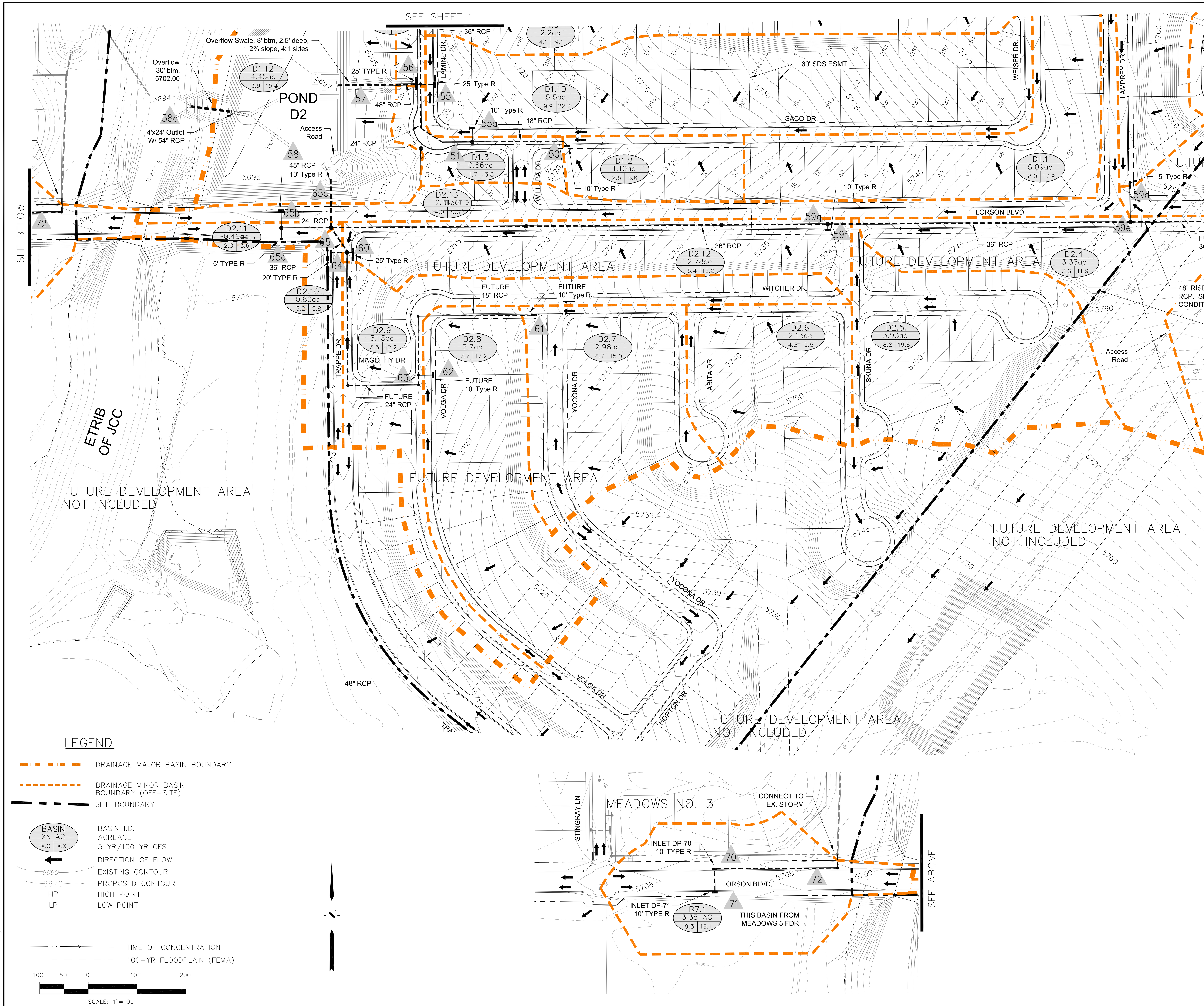
DEVELOPED CONDITIONS
LORSON RANCH EAST FILING NO. 1

DATE
JUNE 12, 2018

PROJECT NO.
100.042

SHEET NUMBER
1

TOTAL SHEETS: 2



RUNOFF SUMMARY			
DESIGN POINT	5 YEAR	100 YEAR	NOTES
50	10.01	22.27	STREET FLOW
51	14.68	21.6	FLOW IN STM SWR
55a	10.18	22.63	STREET FLOW
55	7.8	40.0	STREET FLOW
56	7.2	29.7	STREET FLOW
57	63.6	122.0	STM SWR INTO POND D2
58	118.2	277.1	TOTAL FLOW INTO POND D2
58a	2.1	119.7	FLOW FROM POND D2
59a	2.2	4.8	STREET FLOW
59b	23	60	STM SWR FROM FUTURE D1
59c	25.7	75.4	FLOW IN STM SWR
59d	10.7	23.7	STREET FLOW
59e	36.4	93.2	FLOW IN STM SWR
59f	13.68	30.47	STREET FLOW
59g	45.0	104.2	FLOW IN STM SWR
60	15.8	55.9	STREET FLOW
61	10.57	23.68	STREET FLOW
62	10.1	30.3	STREET FLOW
63	17.67	27.38	FLOW IN STM SWR
64	3.2	29.2	STREET FLOW
65	36.60	88.30	FLOW IN STM SWR
65a	2.0	3.6	STREET FLOW
65b	4.2	12.7	STREET FLOW
65c	88.3	174.2	STM SWR INTO POND D2
70	5	10	STREET FLOW
71	5	10	STREET FLOW
72	10	20	FLOW IN STM SWR

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NO. | DESCRIPTION | DATE

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(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
LORSON RANCH EAST
FONTAINE BLVD. – EAST TRIBUTARY OF JCC
EL PASO COUNTY, COLORADO

DRAWN: RLS
DESIGNED: LAB
CHECKED: LAB

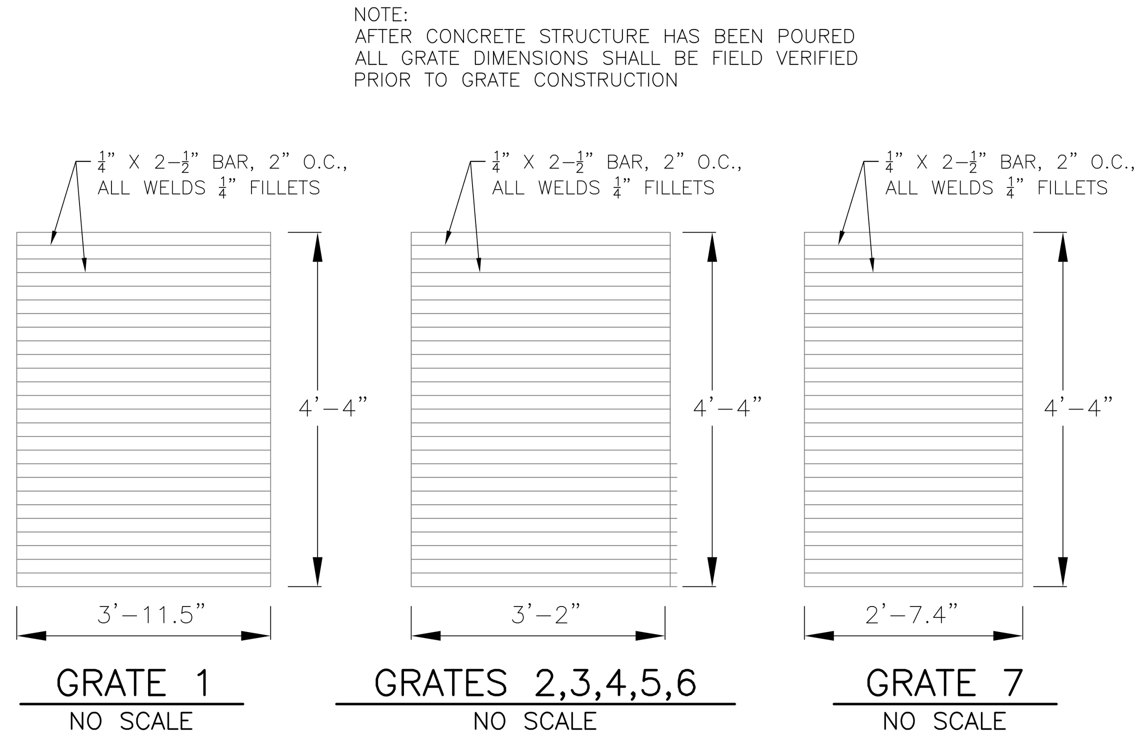
DEVELOPED CONDITIONS DRAINAGE PLAN
LORSON RANCH EAST FILING NO. 1

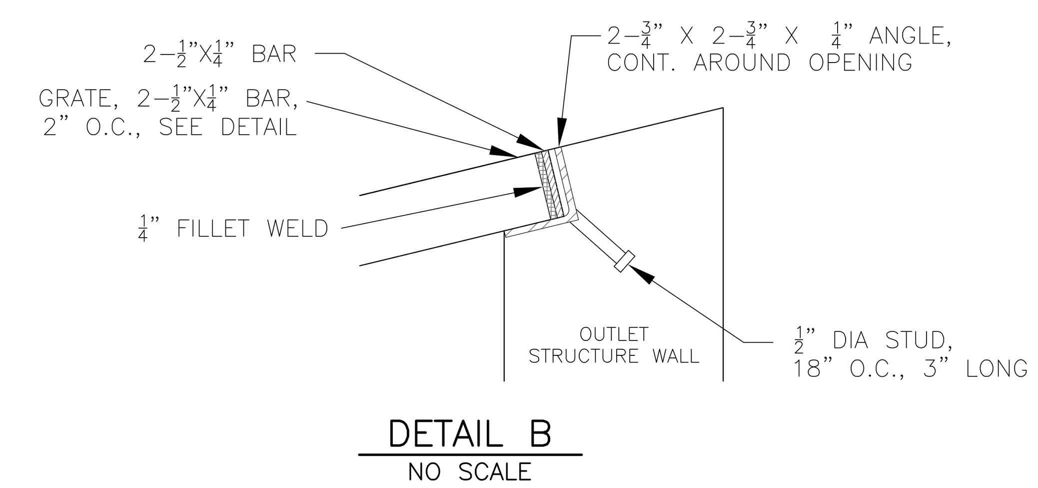
DATE
JUNE 12, 2018

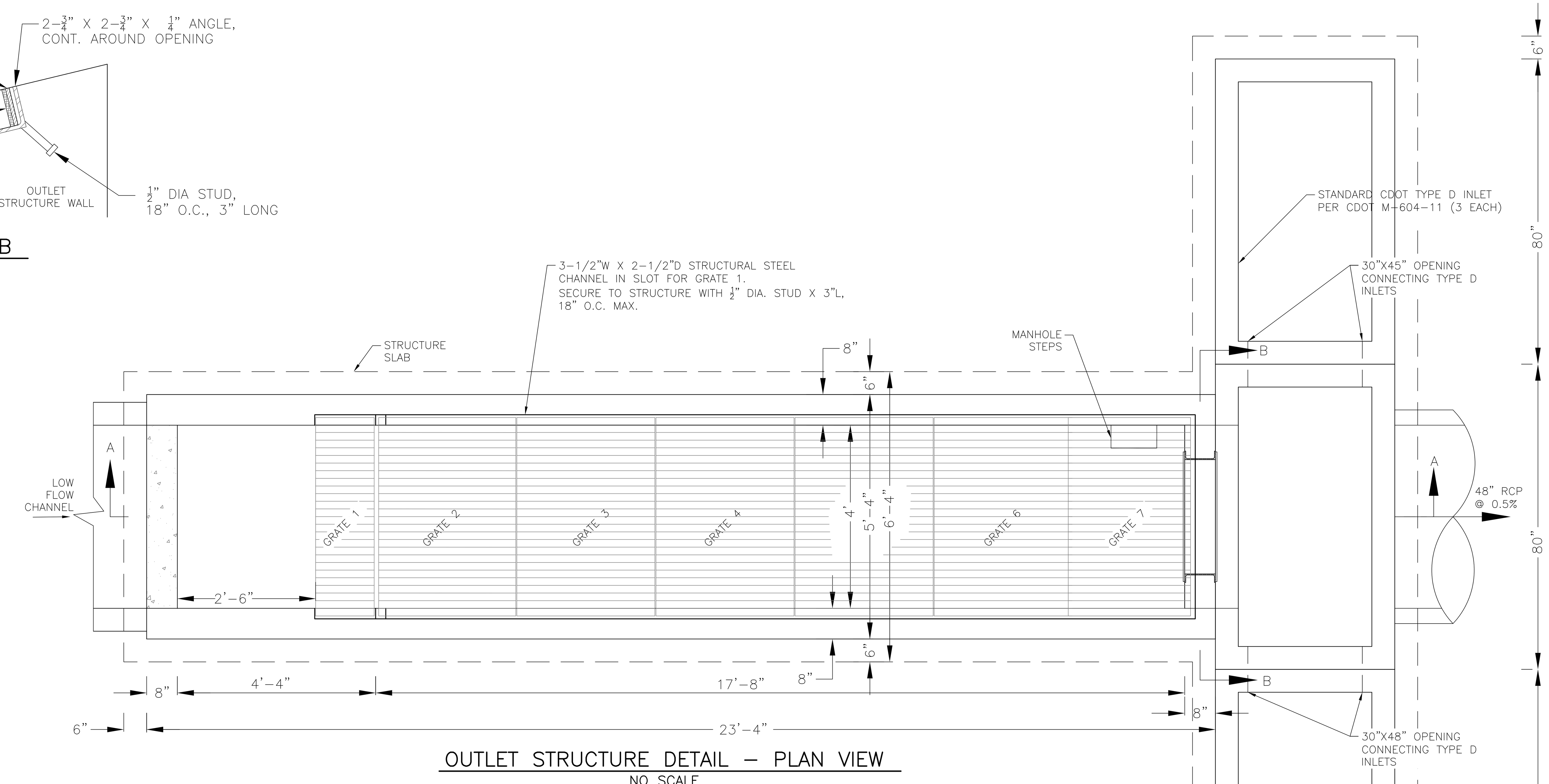
PROJECT NO.
100.042

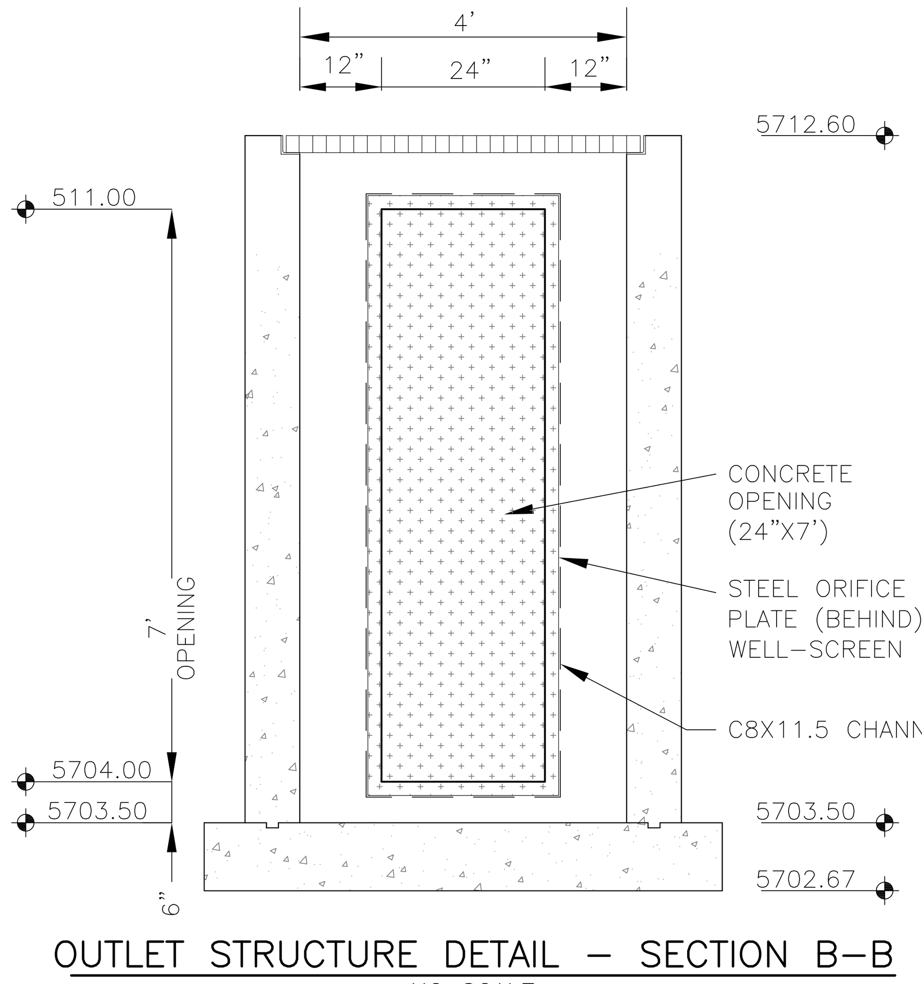
SHEET NUMBER
2

TOTAL SHEETS: 2









WQCV WELL-SCREEN NOTES:

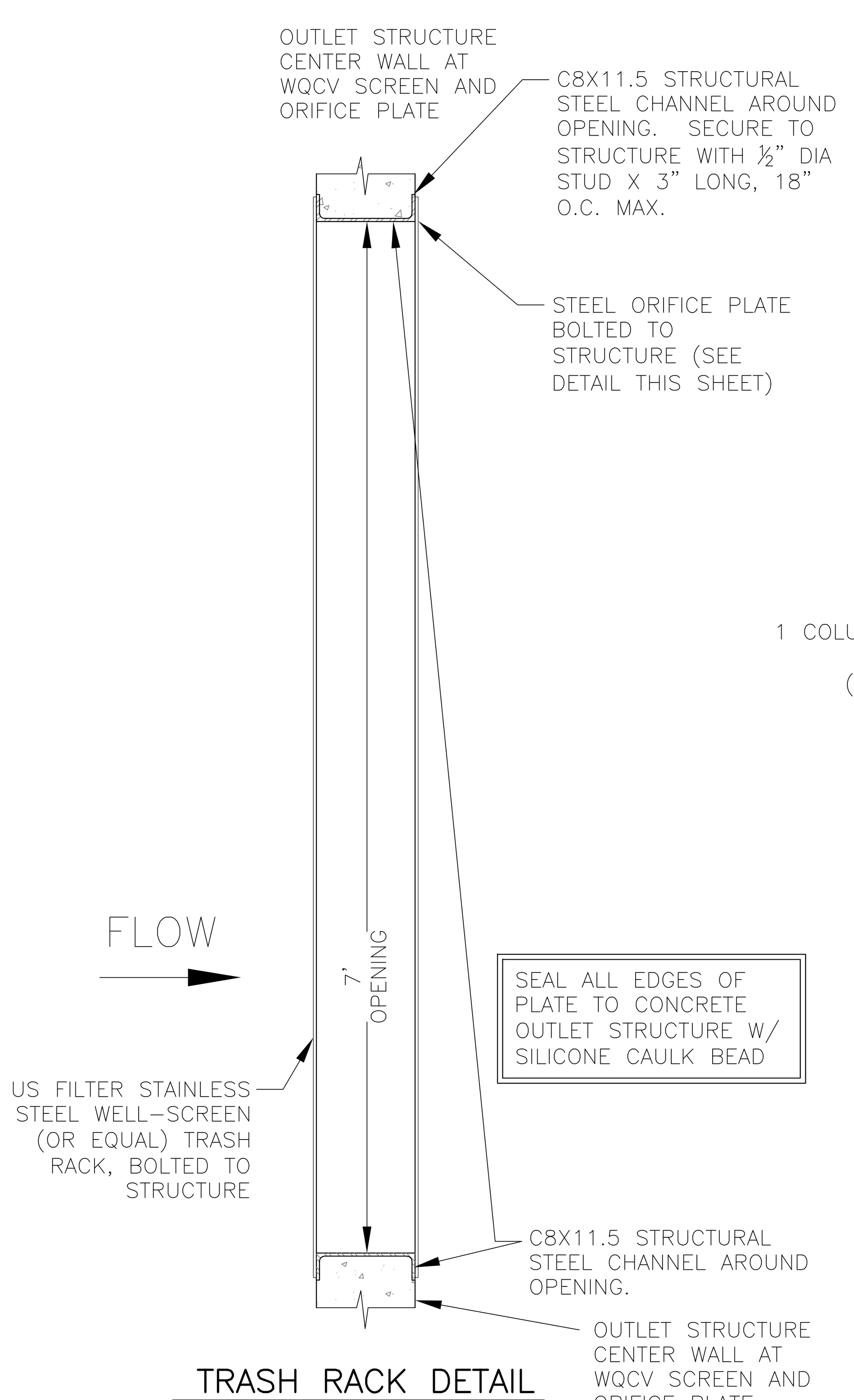
1. Well-Screen shall be stainless steel and attached by stainless steel bolts along edge of the mounting frame.
2. WQCV Well Screen
   - Type of Screen: Stainless steel #93 Vee Wire (Johnson Vee Wire (tm) Stainless Steel Screen or equivalent with 60% open area)
   - Screen slot opening dimension: 0.139" (Screen #93 Vee Wire Slot Opening)
   - Type and Size of Support Rod: TE 0.074"X0.50"
   - Spacing of Support Rod (O.C.): 1.0 Inch
   - Total Screen Thickness: 0.655"
   - Carbon Steel Holding Frame Type: 3/4" x 1.0" angle

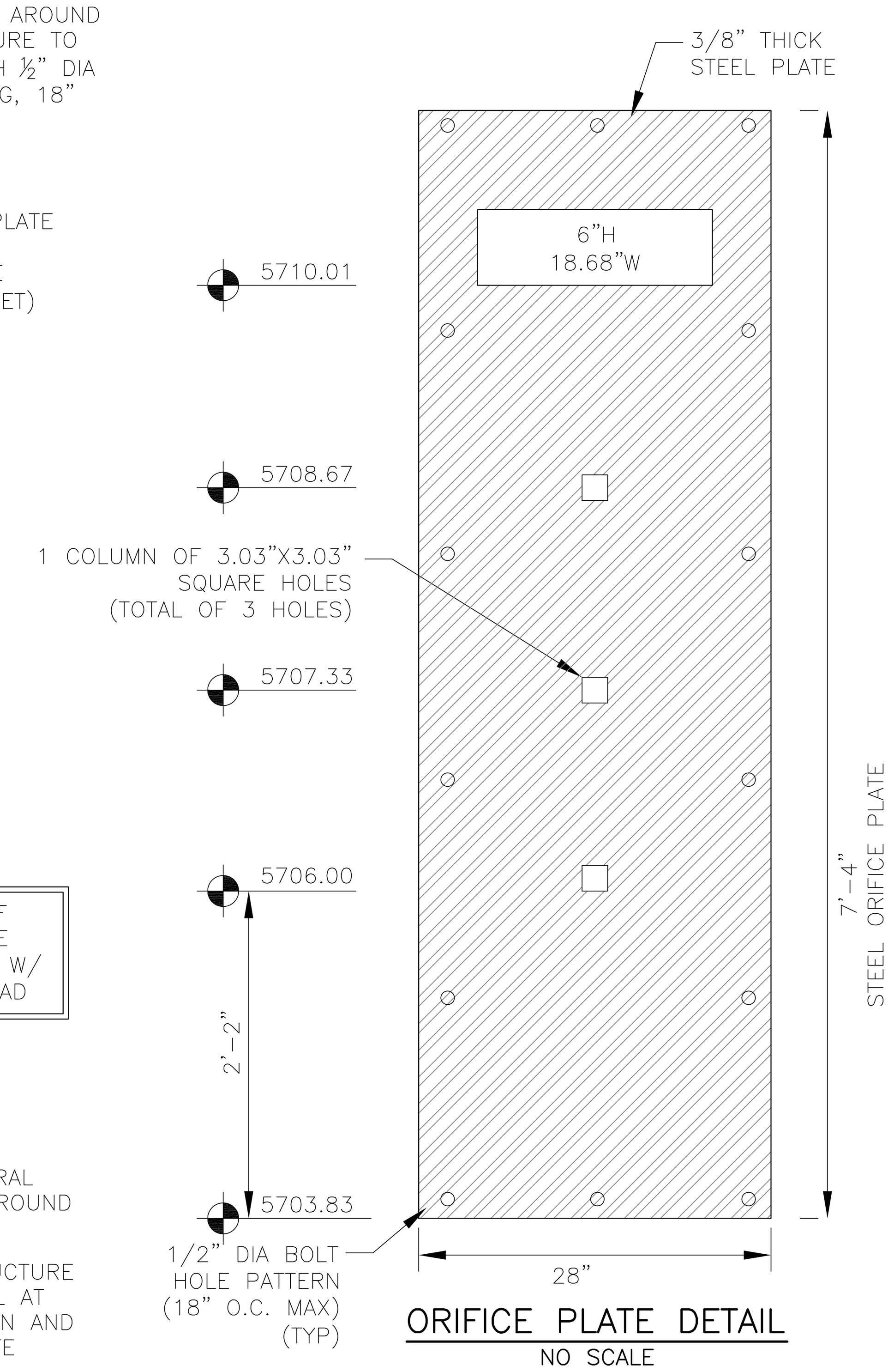
OUTLET STRUCTURE, FOREBAY, AND DRAIN CHANNEL NOTES:

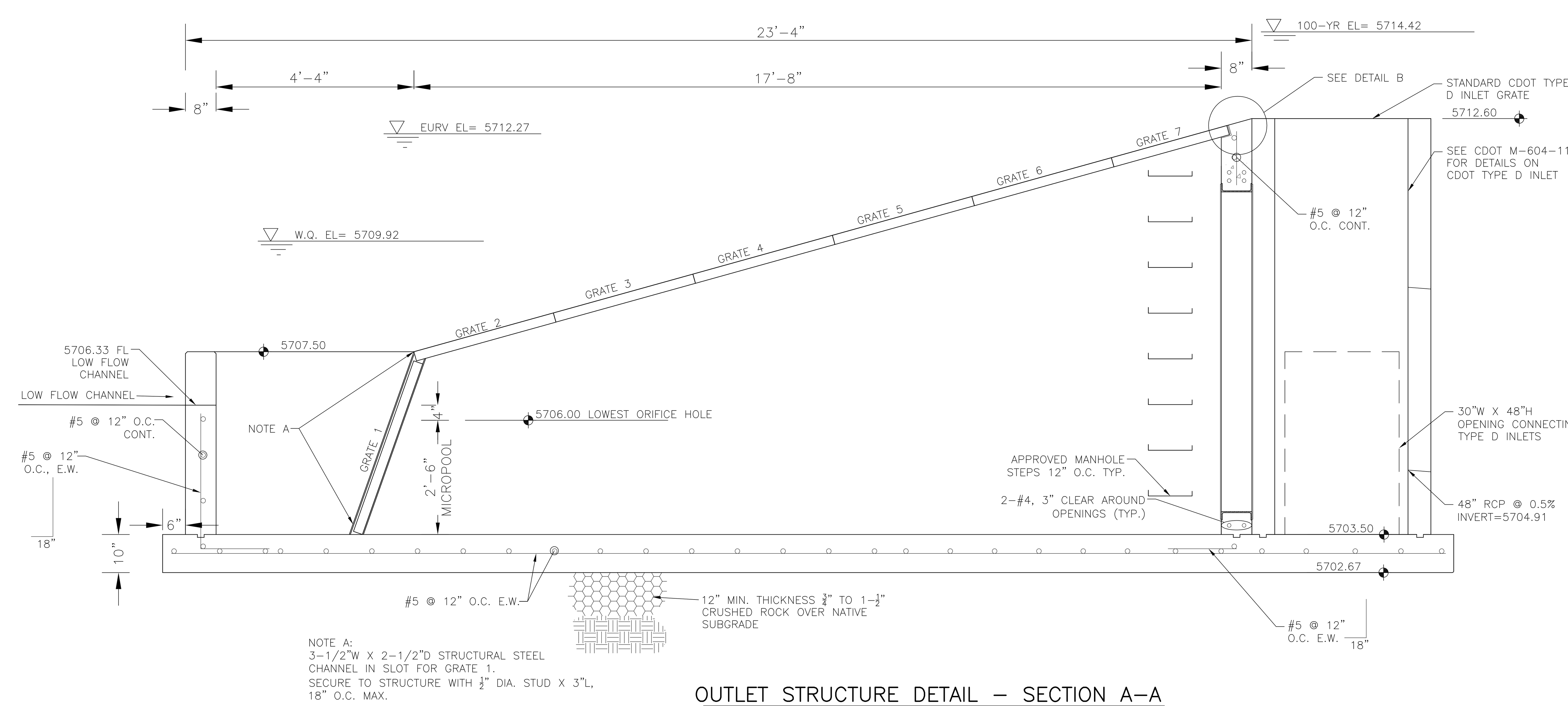
1. PRIOR TO CONSTRUCTION, CONTRACTOR SHALL PROVIDE SHOP DRAWINGS FOR ALL COMPONENTS OF THE OUTLET STRUCTURE.
2. GRADE 60 REINFORCING STEEL REQUIRED. SEE TABLE FOR THE MINIMUM LAP SPLICE LENGTH FOR REINFORCING BARS. ALL REINFORCING STEEL SHALL HAVE A TWO-INCH MINIMUM CLEARANCE FROM EDGE OF CONCRETE, UNLESS OTHERWISE NOTED.

BAR SIZE	#4	#5	#6
MIN. SPLICE LENGTH	1'-3"	1'-7"	2'-0"

3. CONCRETE FOR THE OUTLET STRUCTURE AND FOREBAY SHALL BE CDOT CLASS D CONCRETE.
4. CONCRETE FOR DRAIN CHANNELS SHALL BE CDOT CLASS B CONCRETE
5. EXPANSION JOINT MATERIAL SHALL MEET AASHTO SPECIFICATION M-213. EXPANSION JOINT MATERIAL SHALL BE 1/2" THICK, SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE AND THE JOINT SHALL BE SEALED, REFER TO DETAILS.
6. ALL EXPOSED CONCRETE CORNERS SHALL HAVE A 3/4" CHAMFER UNLESS OTHERWISE NOTED.
7. SUBGRADE TO BE 12" THICK CLEAN FILL COMPACTED TO 95% STANDARD PROCTOR DENSITY PER ASTM M698 UNDER STRUCTURE.
8. REFER TO SHEET C9.2 FOR PRESEDIMENTATION/FOREBAY DESIGN.
9. ENGINEER SHALL BE NOTIFIED PRIOR TO BEGINNING CONSTRUCITON OF OUTLET STRUCTURE TO SCHEDULE OBSERVATION VISITS FOR STRUCTURES.







CORE ENGINEERING GROUP
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BURNSVILLE, MN 55306
PH: 719.570.1100
CONTACT: RICHARD L. SCHINDLER, P.E.
EMAIL: Rich@ceg1.com

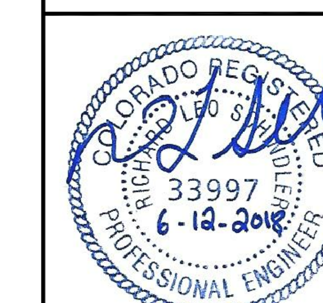
PREPARED FOR:
LORSON, LLC
212 N. WAHSATCH AVE, SUITE 301
COLORADO SPRINGS, COLORADO 80903
(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
LORSON RANCH EAST FILING NO. 1
FONTAINE BLVD.-OLD GLORY DR
COLORADO SPRINGS, COLORADO

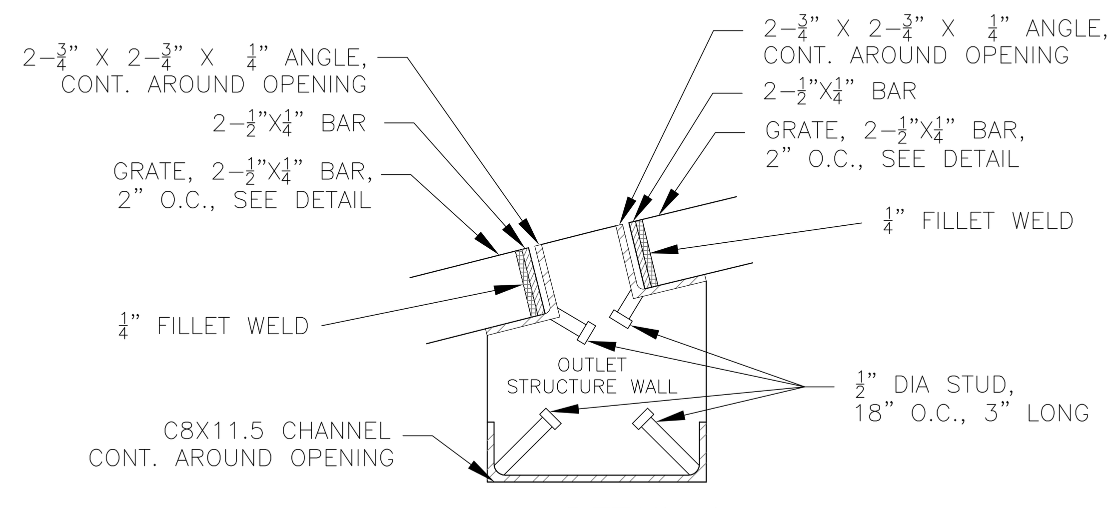
NO.	DESCRIPTION	DATE

DRAWN: RLS
DESIGNED: RLS
CHECKED: RLS

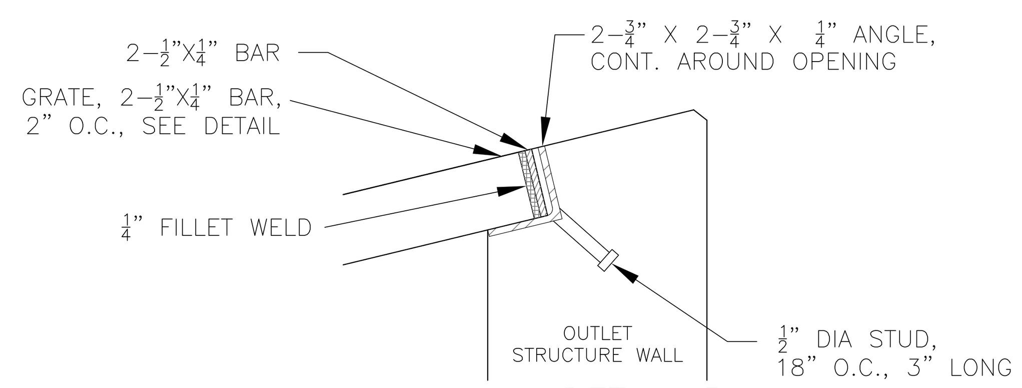
LORSON RANCH EAST FILING NO. 1
FULL SPECTRUM POND C5
OUTLET STRUCTURE



DATE: JUNE 12, 2018
PROJECT NO. 100.042
SHEET NUMBER C9.3
TOTAL SHEETS: 45

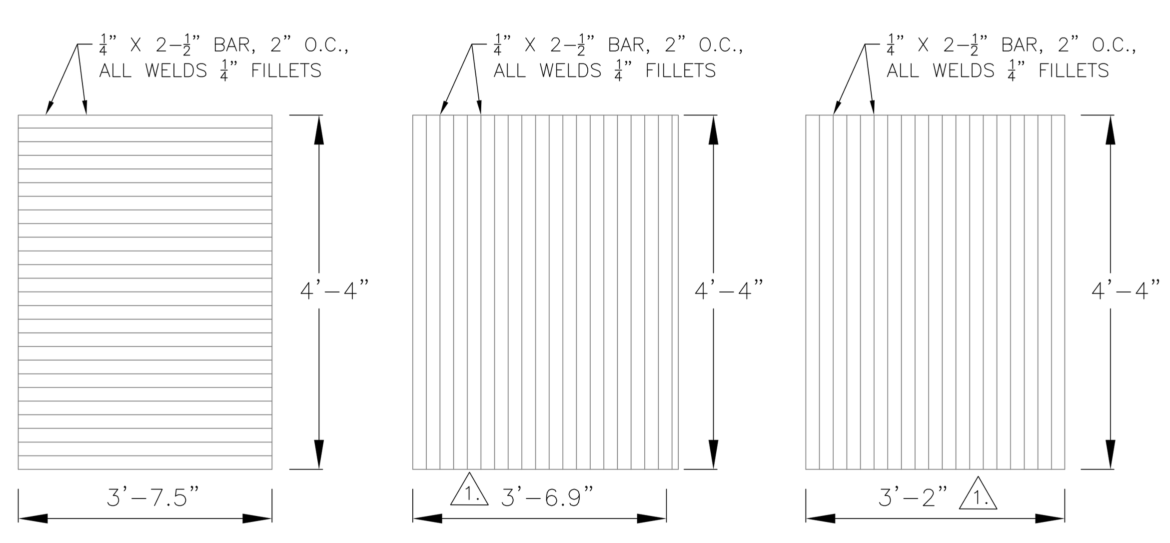


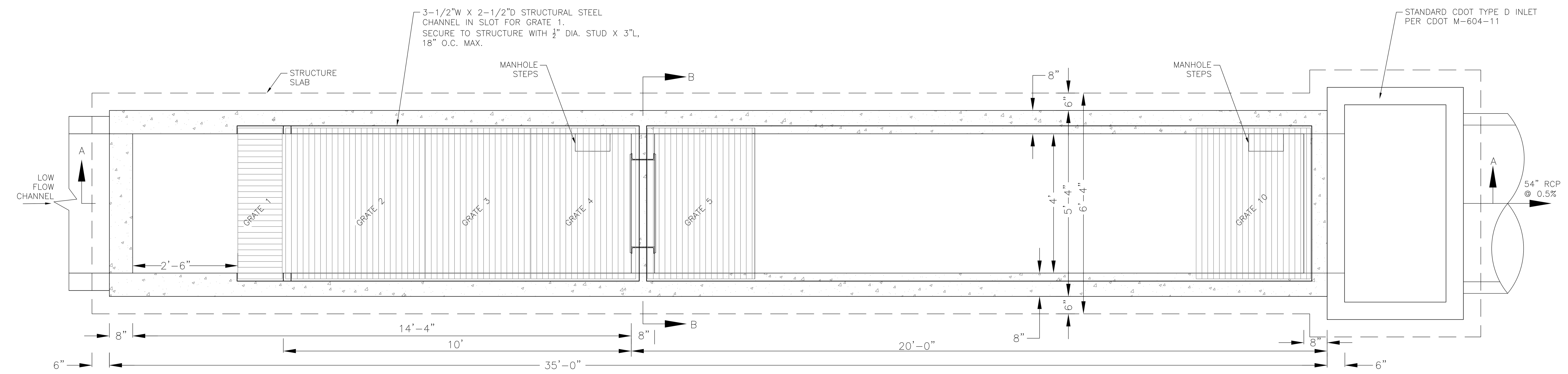
DETAIL A
NO SCALE



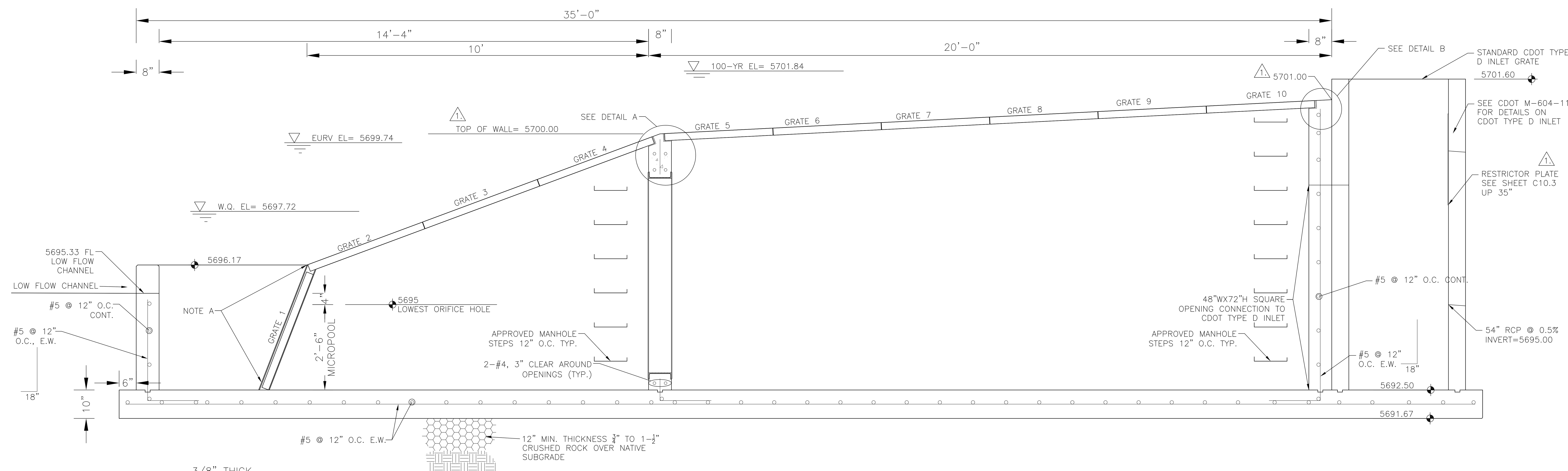
DETAIL B
NO SCALE

NOTE:
AFTER CONCRETE STRUCTURE HAS BEEN POURED ALL GRATE DIMENSIONS SHALL BE FIELD VERIFIED PRIOR TO GRATE CONSTRUCTION



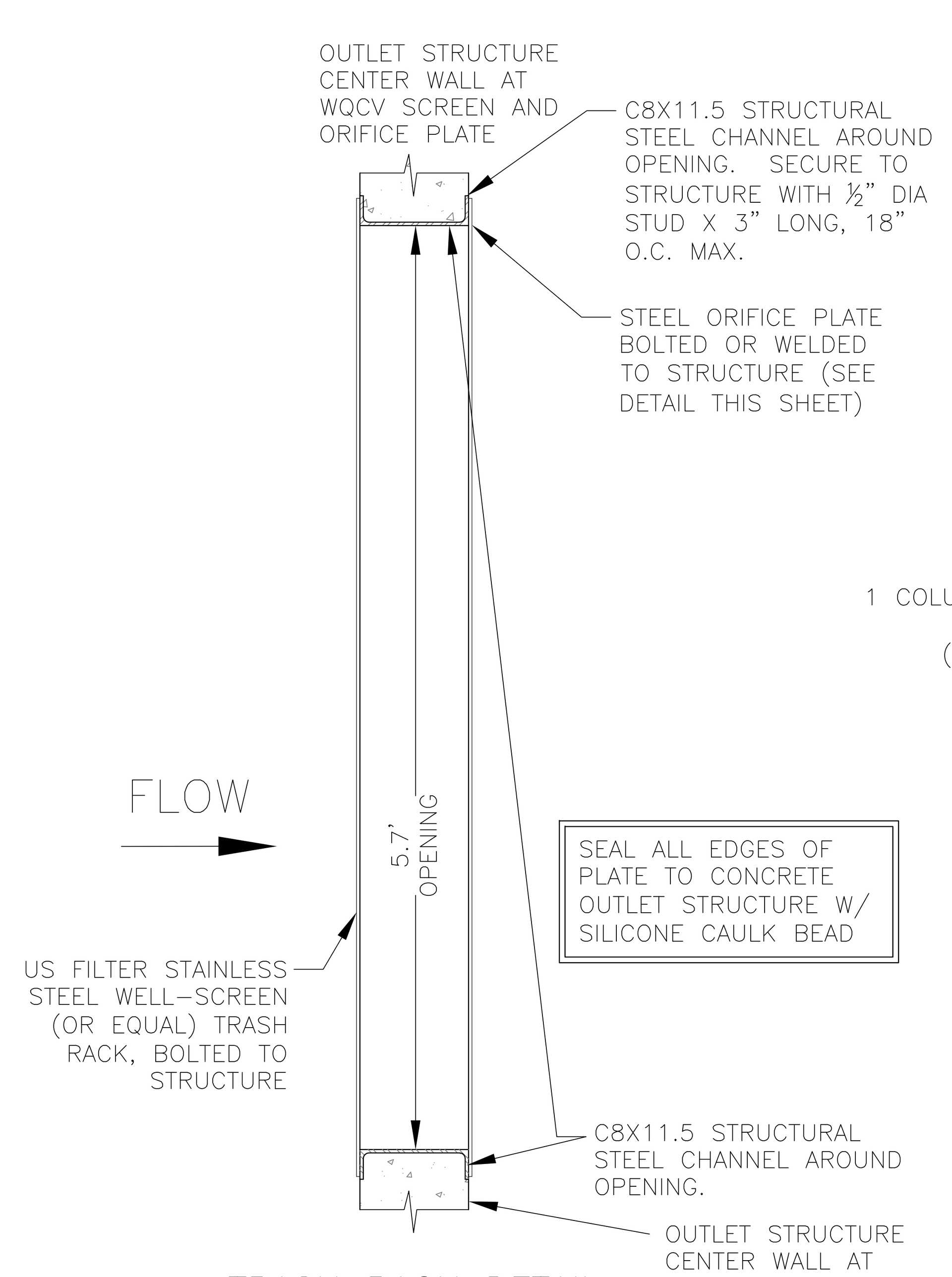


OUTLET STRUCTURE DETAIL – PLAN VIEW
NO SCALE

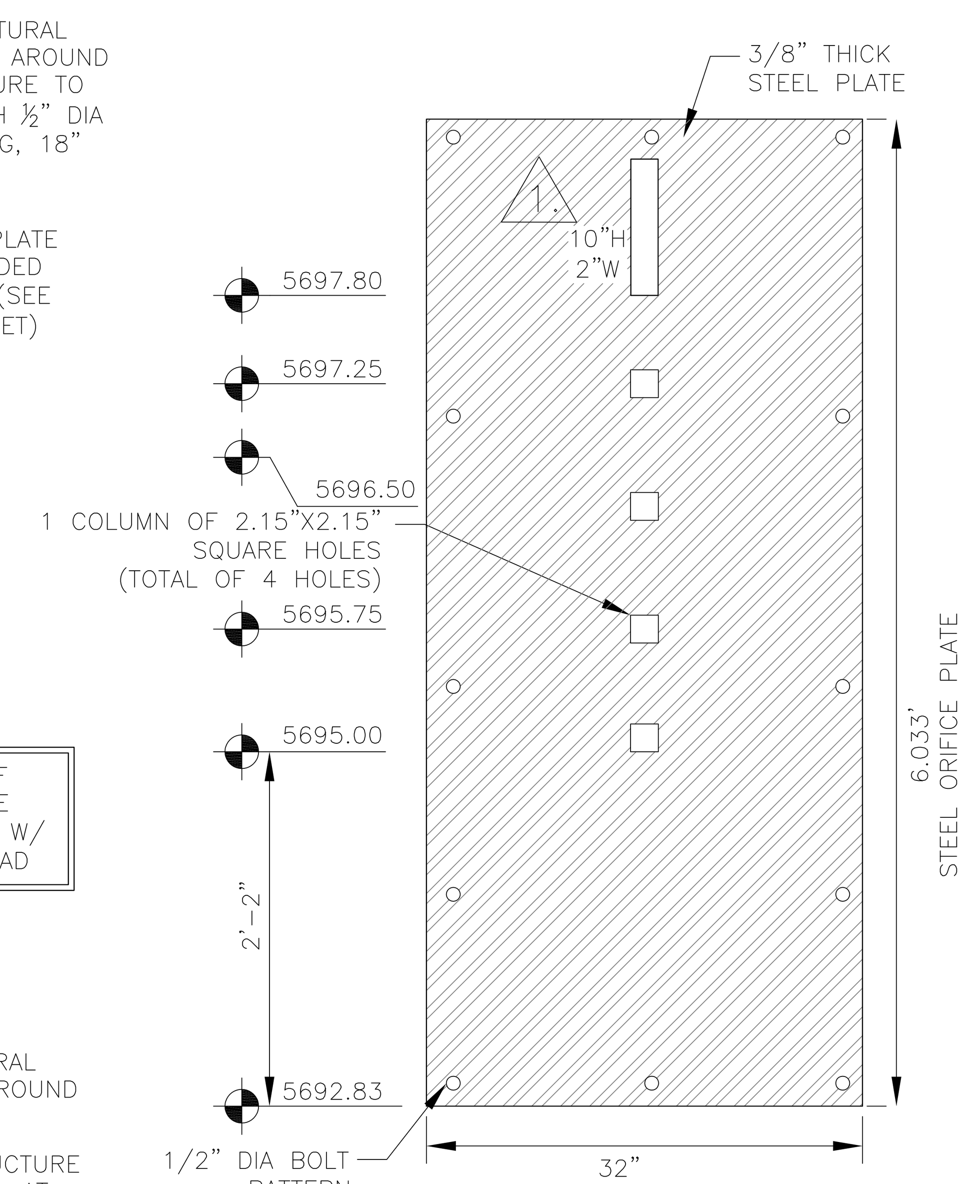


NOTE A:
3-1/2"W X 2-1/2"D STRUCTURAL STEEL CHANNEL IN SLOT FOR GRATE 1. SECURE TO STRUCTURE WITH 1/2" DIA. STUD X 3"L, 18" O.C. MAX.

OUTLET STRUCTURE DETAIL – SECTION A-A
NO SCALE



TRASH RACK DETAIL
NO SCALE



ORIFICE PLATE DETAIL
NO SCALE

OUTLET STRUCTURE, FOREBAY, AND DRAIN CHANNEL NOTES:

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2. GRADE 60 REINFORCING STEEL REQUIRED. SEE TABLE FOR THE MINIMUM LAP SPLICE LENGTH FOR REINFORCING BARS. ALL REINFORCING STEEL SHALL HAVE A TWO-INCH MINIMUM CLEARANCE FROM EDGE OF CONCRETE, UNLESS OTHERWISE NOTED.

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MIN. SPLICE LENGTH	1'-3"	1'-7"	2'-0"

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4. CONCRETE FOR DRAIN CHANNELS SHALL BE CDOT CLASS B CONCRETE

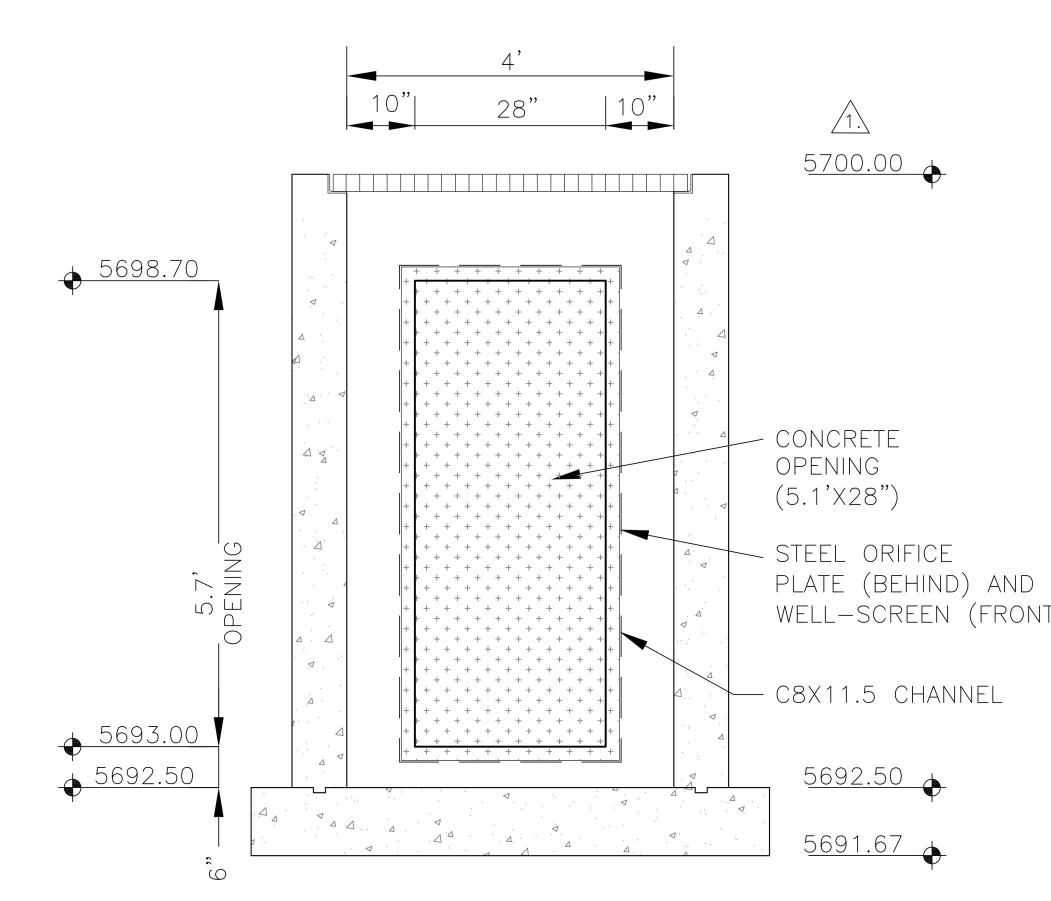
5. EXPANSION JOINT MATERIAL SHALL MEET AASHTO SPECIFICATION M-213. EXPANSION JOINT MATERIAL SHALL BE 1/2" THICK, SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE AND THE JOINT SHALL BE SEALED, REFER TO DETAILS.
6. ALL EXPOSED CONCRETE CORNERS SHALL HAVE A 3/4" CHAMFER UNLESS OTHERWISE NOTED.

7. SUBGRADE TO BE 12" THICK CLEAN FILL COMPACTED TO 95% STANDARD PROCTOR DENSITY PER ASTM M698 UNDER STRUCTURE.

8. REFER TO SHEET C9.5 FOR PRESEDIMENTATION/FOREBAY DESIGN.

9. ENGINEER SHALL BE NOTIFIED PRIOR TO BEGINNING CONSTRUCITON OF OUTLET STRUCTURE TO SCHEDULE OBSERVATION VISITS FOR STRUCTURES.

10. SEE SHEET C9.3 FOR WELL-SCREEN DESIGN NOTES



OUTLET STRUCTURE DETAIL – SECTION B-B
NO SCALE

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NO.	DESCRIPTION	DATE
1.	MODIFY OUTLET, CHANGE GRATE SIZES	7-2-2018

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212 N. WAHSATCH AVE, SUITE 301
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(719) 635-3200
CONTACT: JEFF MARK

PROJECT:
LORSON RANCH EAST FILING NO. 1
FONTAINE BLVD.-OLD GLORY DR
COLORADO SPRINGS, COLORADO

DRAWN: RLS
DESIGNED: RLS
CHECKED: RLS

LORSON RANCH EAST FILING NO. 1
FULL SPECTRUM POND D2
OUTLET STRUCTURE

COLORADO RICHARD L. SCHINDLER 33997 7-2-2018 PROFESSIONAL ENGINEER

DATE:
JUNE 12, 2018

PROJECT NO.
100.042

SHEET NUMBER
C9.6

TOTAL SHEETS: 45

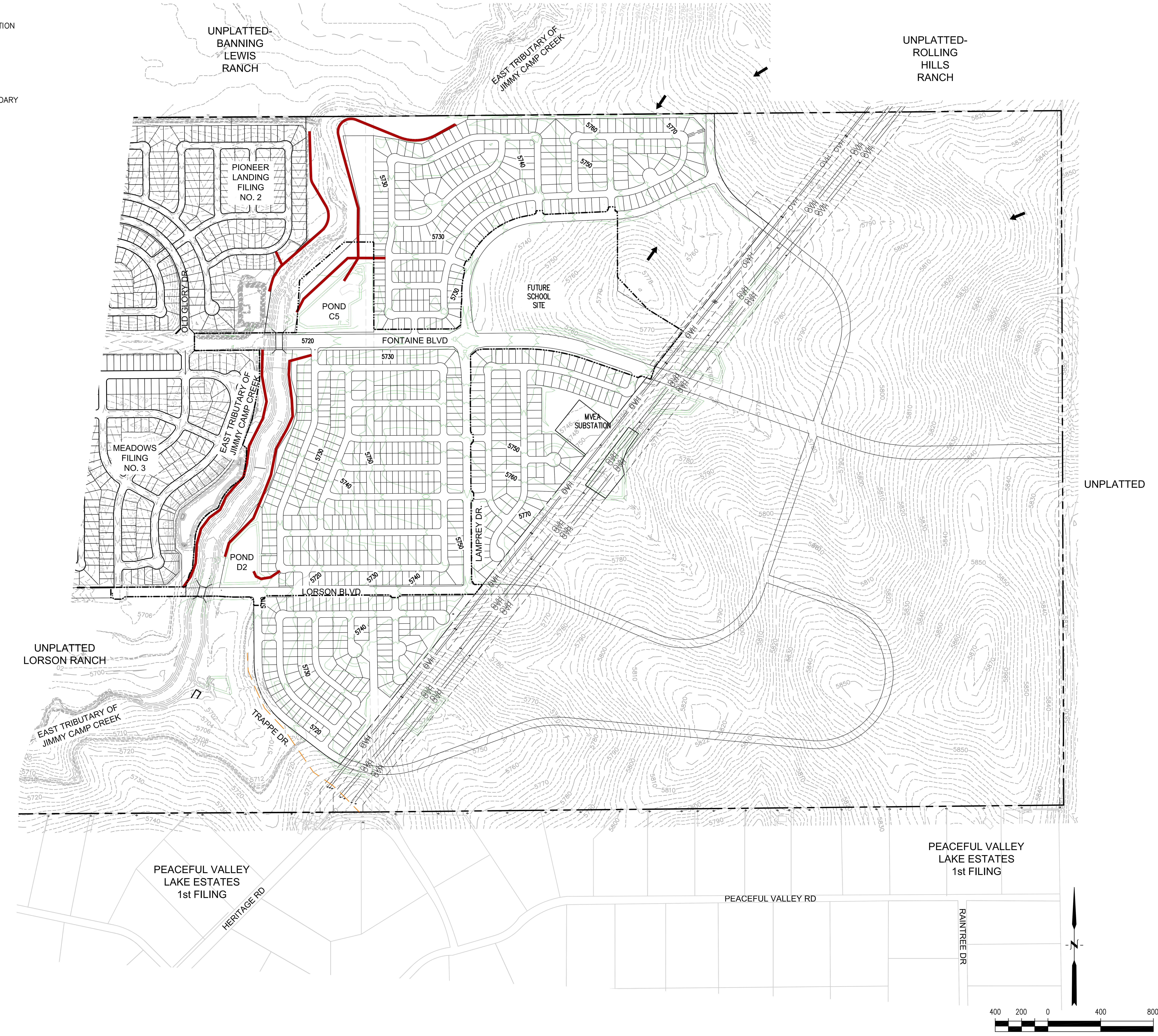
LEGEND

ETRIB, POND C5, AND POND D2 ACCESS ROAD LOCATION

6690 EXISTING CONTOUR

6690 PROPOSED CONTOUR

LORSON RANCH EAST FILING NO. 1 FINAL PLAT BOUNDARY



CORE ENGINEERING GROUP

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NO.	DESCRIPTION	DATE

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

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

DRAWN: RLS
DESIGNED: RLS
CHECKED: RLS

ETRIB AND POND ACCESS LOCATIONS
LORSON RANCH EAST FILING NO. 1

DATE:
JULY 2, 2018

PROJECT NO.
100.042

SHEET NUMBER
1

TOTAL SHEETS: 1