# **FINAL DRAINAGE PLAN**

# CARRIAGE MEADOWS SOUTH AT LORSON RANCH FILING NO. 1

# SF 17-011

# AUGUST 10, 2017

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. 100.030



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#### ENGINEER'S STATEMENT

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

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

Lorson, LLC

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, Dated March 17, 1997, Revised to Reflect LOMR Effective Aug. 29, 2007. (See Appendix A, FEMA FIRM Exhibit)

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

#### EL PASO COUNTY

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

(Jennifer Irvine), County Engineer / ECM Administrator

Date

## **Conditions:**

Date

Date

## 1.0 LOCATION and DESCRIPTION

The purpose of this Final Drainage Report is to provide an overview of the overall drainage impacts/mitigation due to development in the proposed Carriage Meadows South at Lorson Ranch Filing No. 1 development located in Lorson Ranch. The study area of this report is approximately 110 acres. See *Appendix A* for vicinity map.

**Carriage Meadows South at Lorson Ranch Filing No. 1** is located southeast of the intersection of Fontaine Boulevard and Marksheffel Road in El Paso County Colorado. The site is located on approximately 106.64 acres of vacant land. A portion of this study area is occupied by an existing single family residence that is not part of this development. For purposes of this report this offsite residence has been included as existing conditions. Also included in this report and plan is the proposed layout for Carriage Meadows South at Lorson Ranch Filing No. 1 which is located southeast of the intersection of Fontaine Boulevard and Marksheffel Road. The land is currently owned by Lorson LLC or its nominees for Lorson Ranch. The first phase of development will consist of 235 single-family homes. Future development in this area will develop as commercial land uses.

The site is located in the Northeast ¼ of Section 22 and the Northwest ¼ of Section 23, Township 15 South and Range 65 West of the 6<sup>th</sup> Principal Meridian; it is currently unplatted and zoned RR3, Rural Residential District. The property is bounded on the north by the Fontaine Boulevard, on the east by the relocated Jimmy Camp Creek, a major Drainage conveyance system, on the west by Marksheffel Road, on the south by Peaceful Valley Country Club Estates, and the old Appletree Golf Course. 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 [3], adopted by El Paso County, and is referenced in this report. The only major drainage improvements for this study area according to the 1987 Wilson study was the reconstruction of the main stem of Jimmy Camp Creek. In 2006 the main stem of Jimmy Camp Creek and the FMIC relocation within Lorson Ranch was reconstructed in accordance with the 1987 study. In 2015 a new DBPS for Jimmy Camp Creek was completed by Kiowa Engineering. The Kiowa Engineering DPBS has been adopted by the City of Colorado Springs and partially adopted by El Paso County for the entire Jimmy Camp Creek Basin, including the main channel of Jimmy Camp Creek located on the east side of this site. El Paso county has not approved the drainage fees detailed in the Kiowa DBPS so current county drainage fees apply to this development. The Kiowa DBPS shows the reconstructed channel of Jimmy Camp Creek and the existing Fontaine Boulevard bridge over the main channel. According to the Kiowa DBPS all major drainage infrastructure has been constructed and there are no new requirements for channel/bridge improvements on Jimmy Camp Creek for development of Carriage Meadows South at Lorson Ranch Filing No. 1. The only major infrastructure not shown in the Kiowa DBPS is the future bridge over the main channel at Lorson Boulevard. The Lorson Boulevard bridge is not needed for this site but is included for discussion purposes.

#### Reconstruction of Jimmy Camp Creek and FMIC relocation

In 2006 Jimmy Camp Creek was re-aligned and reconstructed within Lorson Ranch from the southern boundary to the northern boundary. The construction plans were prepared by Drexel Barrell & Company (project number C-7668-2) and were approved on September 6, 2005 by El Paso County (#2801). Construction was based more or less on recommendations in the 1987 Wilson DBPS for Jimmy Camp Creek. The construction consisted of a trapezoidal channel section, armored creek banks with a sand bottom. Construction started at the south property line of Lorson Ranch and extended north 5,300 feet to the north line of Lorson Ranch. In 2006 the FMIC ditch in Lorson Ranch was also relocated in conjunction with the creek improvements. The FMIC through Lorson Ranch was relocated adjacent to the creek on the west bank and was constructed at the same time as the creek improvements. Pentacor Engineering prepared the FMIC relocation construction plans (project number 6000.0002) which were approved by El Paso County on November 22, 2005. Both the creek and FMIC

relocation were completed in 2006 from the south property line of Lorson Ranch and extended north 5,300 feet to the north line of Lorson Ranch

## 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 full spectrum pond sizing. No deviations from these published criteria are requested for this site. The proposed improvements to the Lorson Ranch Development will be in substantial compliance with the "Jimmy Camp Creek Drainage Basin Planning Study", prepared by Kiowa Engineering Corp., Colorado Springs, CO.

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

## 3.0 EXISTING HYDROLOGICAL CONDITIONS

The site is currently undeveloped with native vegetation (grass with no shrubs) and moderate slopes in a southerly direction to an existing sediment basin located at the southeast corner of the site, these flows then continue east to Jimmy Camp Creek. The soils across the site consists of the Ellicott loamy course sand, a deep somewhat excessively drained soil with 0 - 5% slopes, the Fort Collins loam and clay loam, a deep well drained soil with 0 - 3% slopes and the Manzanola clay loam, also a deep well drained soil with 1 - 3% slopes according to the Soil Survey of El Paso County Area. Other onsite soil types consist of Ustic Torrifluvents, Fluvaquentic Haploquolls, Blakeland Loamy Sand, Blendon Sandy Loam, Truckton Sandy Loam, Stoneham Sandy Loam, Keith Silt Loam, Olney Sandy Loam, Manzanola Clay Loam, Nunn Clay Loam and Sampson loam. Since the majority of this site will consist of import material, soil type C/D has been assumed for the hydrologic conditions. See Appendix A for SCS Soils Map.

Offsite drainage from the future Carriage Meadows 1, Marksheffel Road, and Fontaine Boulevard impact this development. The storm sewer system and streets accommodate the offsite flows.

The following on-site pre-development basins are briefly discussed as follows:

## <u>Basin EX-1</u>

Basin EX-1 is an on-site, undeveloped basin is located east of Marksheffel Road, south of Fontaine Boulevard and extends southerly to Peaceful Valley Country Club Estates at the SW corner of Lorson Ranch. This basin has moderate to gentle slopes and flows southerly and westerly to the existing swale on the east side of Marksheffel Road. The existing contours shown on Marksheffel Road show the reconstructed road as it is nearly completed at the time of this report. The total pre-development flow from this 15.54 acre basin is 3.0cfs for the 5-year storm event and 22.0cfs for the 100-year storm event.

## <u>Basin EX-2</u>

Basin EX-2 is primarily Marksheffel Road, flows are directed to the existing barrow ditch on the east side of the road. This small basin has moderate slopes and runoff sheet flows westerly, then southerly within the aforementioned ditch. The existing contours shown on Marksheffel Road and the barrow ditch show the reconstructed road as it is nearly completed at the time of this report. The total pre-development flow from this 4.87 acre basin is 2.5cfs for the 5-year storm event and 8.6cfs for the 100-year storm event.

#### Basin EX-3

Basin EX-3 is the main undeveloped basin and includes off-site and on-site drainage and is located east of Marksheffel Road, north and south of Fontaine Boulevard and west of the relocated of Jimmy Camp Creek. The existing conditions map show Fontaine as it has been constructed to show the basin boundaries but the runoff has been calculated based on the land being un-developed. There is no flow entering this basin from the north and east due to the relocated FMIC ditch. The contours on the east side of the basin reflect grading done in 2005 as part of the Jimmy Camp Creek CLOMR/LOMR project. The existing drainage patterns in this basin reflect historic patterns which ultimately drain to Jimmy Camp Creek in the SE corner of this site. This basin has moderate to gentle slopes and flows in a southerly and easterly direction; runoff is directed to an existing sediment basin in the SE corner of the site and then to Jimmy Camp Creek. The total pre-development flow from this 78.0 acre basin is 18.7cfs for the 5-year storm event and 125.8cfs for the 100-year storm event.

#### Basin EX-4

Basin EX-4 is an on-site, undeveloped basin is located adjacent and north of the Appletree Golf Course and approximately 800 feet east of Marksheffel Road. This basin has moderate slopes and runoff sheetflows southerly to the Appletree Golf Course. The total pre-development flow from this 5.22 acre basin is 2.6cfs for the 5-year storm event and 14.8cfs for the 100-year storm event.

#### Basin EX-5

Basin EX-5 is an on-site, undeveloped basin is located easterly of Marksheffel Road, north and adjacent to the Peaceful Valley Country Club Estates. This small basin has moderate slopes and flows southwesterly via to the Marksheffel Road east barrow ditch. The total pre-development flow from this 5.23 acre basin is 2.8cfs for the 5-year storm event and 15.4cfs for the 100-year storm event.

#### Basin EX-6

Basin EX-5 is an on-site, undeveloped basin that encompasses Jimmy Camp Creek. This basin flows south in the re-constructed channel of the creek to the Apple Tree Golf Course. The total predevelopment flow from this 23.4 acre basin is 9.9cfs for the 5-year storm event and 55.3cfs for the 100year storm event.

#### Design Point DP-1

Design Point DP-1 was included in this report to determine the existing flow in the Marksheffel Road east barrow ditch. The flow at this design point is from Basin EX-1 and EX-2. The flow is contained in a newly constructed barrow ditch as part of the Marksheffel Road reconstruction project by El Paso County DOT. The road reconstruction project constructed two-24" RCP pipe culverts in this location for an existing road crossing and have sized the new culverts for existing 100-year flow. The pre-development flows entering the culverts are 5.2cfs and 29.5cfs in the 5/100-year storm events. The pre-development 100-year flows at this design point will not be allowed to be increased when development of Carriage Meadows occurs.

## 4.0 DEVELOPED HYDROLOGICAL CONDITIONS

Hydrology for the **Carriage Meadows South at Lorson Ranch Filing No. 1** 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.

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 the City of Colorado Springs/El Paso County Drainage Criteria Manual.

The hydrology analysis necessary for sizing the storm sewer system is preliminary only and will be finalized when the construction documents are prepared.

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

## Basin G1.1

Basin G1.1 consists of future commercial development. Runoff is directed southwest to a proposed Type "D" inlet on the east side of Carriage Meadows Drive at Design Point 1. Upon development of this basin the storm sewer at the SE corner may need to be extended easterly to Rubicon Drive. The peak developed flow from this 3.09-acre basin is 11.2cfs and 20.7cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G1.2

Basin G1.2 consists of residential development. Runoff is directed north in curb/gutter in Rubicon Drive and then west overland to Design Point 1 to a proposed Type "D" inlet on the east side of Carriage Meadows Drive. When areas in Basin G1.1 develop, the storm sewer at Design Point 1 may need to be extended east to Rubicon Drive. The peak developed flow from this 2.22-acre basin is 4.3cfs and 9.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G1.3

Basin G1.3 consists of residential development. Runoff is directed north in curb/gutter in Rubicon Drive and then west overland to Design Point 1 to a proposed Type "D" inlet on the east side of Carriage Meadows Drive. When areas in Basin G1.1 develop, the storm sewer at Design Point 1 may need to be extended east to Rubicon Drive. The peak developed flow from this 0.45-acre basin is 0.8cfs and 1.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G1.4

Basin G1.4 consists of future development on Carriage Meadows Drive and residential development on Mandan Drive. Runoff is directed north to a low point and a proposed Type "R" inlet on the east side of Carriage Meadows Drive at Design Point 2. The peak developed flow from this 3.53-acre basin is 10.3cfs and 19.0cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### <u>Basin G1.5</u>

Basin G1.5 consists of residential development and Carriage Meadows Drive. Runoff is directed to a low point and a proposed Type "R" inlet on the west side of Carriage Meadows Drive at Design Point 3. Additional future commercial area in Basin G1.7 might be able to flow east to Carriage Meadows Drive but the street and inlet capacities at Design Point 3 would need to be checked. The peak developed flow from this 0.83-acre basin is 3.0cfs and 5.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

## Basin G1.6

Basin G1.6 is an offsite basin and consists of future commercial development (north of Fontaine Boulevard) and runoff from Fontaine Boulevard. Runoff is directed south to existing inlets and an existing storm sewer (42" HERCP) under Fontaine Boulevard. Runoff will then flow south overland to Interim Detention Pond G1.7 at Design Point 4. The peak developed flow from this 19.74-acre basin is 61.2cfs and 111.6cfs for the 5/100-year storm event. See the appendix for detailed calculations. Detention and Water Quality for this offsite basin is included in Pond G1/G2.

## Basin G1.7

Basin G1.7 consists of future commercial development. Runoff is directed south to Detention Pond G1.7 at Design Point 4. The peak developed flow from this 11.6-acre basin is 37.8cfs and 68.9cfs for the 5/100-year storm event. A swale in the south side of this basin will re-direct runoff east and south to Pond G1.7 so developed runoff does not flow south onto the Brownsville Subdivision No. 2. See the appendix for detailed calculations.

#### Basin G1.8a

Basin G1.8a consists of future commercial and residential areas in Lorson Ranch, Marksheffel Road, and from the Brownsville Subdivision No. 2 which is an existing single lot residential subdivision. The Brownsville Subdivision No. 2 is not part of the Lorson Ranch but we have included it in this drainage report because runoff from Lorson Ranch enters the subdivision from the north and exits back onto Lorson Ranch on the south side. Runoff is directed south to Detention Pond G1.8. For the Lorson Ranch future commercial areas the runoff has been calculated as fully developed but for the Brownsville Subdivision No. 2 we have kept runoff at existing values. If Brownsville Subdivision No. 2 should re-develop in the future and increase runoff they will have to detain runoff to pre-development amounts. Water Quality for Brownsville Subdivision No. 2 (if redevelopment occurs) is included in Pond G1/G2 but cannot be used unless an agreement is made with Lorson Ranch. The peak developed flow from this 11.6-acre basin is 37.8cfs and 68.9cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G1.8b

Basin G1.8b consists of residential areas and the east half of Marksheffel Road. Runoff is directed south to Design Point 6 in roadside barrow ditches on the east side of Marksheffel Road. A new roadside swale is proposed in the future ROW area for Marksheffel Road. If Marksheffel Road were to be widened the existing swale could be filled to make room for the additional road width and the new swale will convey runoff from the road south to Design Point 6. We have routed all the runoff from this basin to Design Point 6 which connects to Pond G1/G2. This reduces the developed runoff flowing south to Lorson Boulevard where storm facilities are very shallow shall making it impractical to construction detention ponds at Lorson Boulevard/Marksheffel Road. The peak developed flow from this 5.11-acre basin is 7.1cfs and 15.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G1.9

Basin G1.9 consists of residential development and Mandan Drive. Runoff is directed in curb/gutter in Mandan Drive to a low point at Design Point 7 on the west side of Mandan Drive. The peak developed flow from this 2.97-acre basin is 5.4cfs and 11.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### <u>Basin G1.10</u>

Basin G1.10 consists of residential development and Mandan Drive. Runoff is directed in curb/gutter in Mandan Drive to a low point at Design Point 7a on the east side of Mandan Drive. The peak developed flow from this 4.3-acre basin is 6.2cfs and 13.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

## <u>Basin G1.11</u>

Basin G1.11 consists of residential development and Pond G1/G2. Runoff is directed overland to the G1 side of Pond G1/G2. The peak developed flow from this 3.10-acre basin is 5.6cfs and 11.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

## <u>Basin G1</u>

Basin G1 consists of runoff from Basins G1.1-G1.11 that enters into Pond G1/G2 on the G1 side. The peak developed flow from this 66.69-acre basin is 132.2cfs and 273.3cfs for the 5/100-year storm event and flows to Design Point 9. This overall basin was included to design the storm sewer linking G1 side (north) to G2 side (south). See the appendix for detailed calculations.

#### Basin G2.1

Basin G2.1 consists of residential development and Rubicon Drive. Runoff is directed southwest in curb/gutter in Rubicon Drive to an on-grade inlet at Design Point 10 on the north side of Rubicon Drive. The peak developed flow from this 3.4-acre basin is 5.2cfs and 11.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G2.2

Basin G2.2 consists of residential development and Galpin Drive. Runoff is directed in curb/gutter in Galpin Drive to a low point at Design Point 14 on the east side of Galpin Drive. The peak developed flow from this 1.95-acre basin is 3.0cfs and 6.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G2.3

Basin G2.3 consists of residential development and Galpin Drive. Runoff is directed in curb/gutter in Galpin Drive to a low point at Design Point 14a on the west side of Galpin Drive. The peak developed flow from this 3.7-acre basin is 5.5cfs and 12.1cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G2.4

Basin G2.4 consists of residential development and Rubicon Drive/Lorson Blvd. Runoff is directed in curb/gutter in Rubicon Drive to a low point at Design Point 12a on the east side of Wando Drive. The peak developed flow from this 4.00-acre basin is 6.7cfs and 14.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### <u>Basin G2.5</u>

Basin G2.5 consists of residential development and Wando Drive. Runoff is directed in curb/gutter in Rubicon Drive to a low point at Design Point 12b on the west side of Wando Drive. The peak developed flow from this 0.21-acre basin is 0.4cfs and 0.9cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G2.6

Basin G2.6 consists of residential development and Rubicon Drive. Runoff is directed in curb/gutter in Rubicon Drive to a low point at Design Point 13b on the south side of Rubicon Drive at Pond G1. The peak developed flow from this 1.43-acre basin is 2.4cfs and 5.3cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G2.6a

Basin G2.6a consists of residential development and Rubicon Drive. Runoff is directed in curb/gutter in Rubicon Drive to a low point at Design Point 13 on the north side of Rubicon Drive at Pond G1. The peak developed flow from this 0.3-acre basin is 0.7cfs and 1.1cfs for the 5/100-year storm event. See the appendix for detailed calculations.

## Basin G2.7

Basin G2.7 consists of residential development and Rubicon/Clatsop Drive. Runoff is directed in curb/gutter in Rubicon Drive to a low point at Design Point 16 on the north side of Rubicon Drive. The peak developed flow from this 2.40-acre basin is 4.6cfs and 10.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

## Basin G2.8

Basin G2.8 consists of residential development and Rubicon/Wando Drive. Runoff is directed in curb/gutter in Rubicon/Wando Drive to a low point at Design Point 17 on the west side of Wando Drive. The peak developed flow from this 1.01-acre basin is 2.2cfs and 4.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G2.9

Basin G2.9 consists of residential development and Lorson Blvd/Wando Drive. Runoff is directed in curb/gutter in Lorson Blvd/Wando Drive to a low point at Design Point 17 on the west side of Wando Drive. The peak developed flow from this 0.23-acre basin is 0.4cfs and 0.9cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G2.10

Basin G2.10 consists of residential development and Rubicon/Wando Drive. Runoff is directed in curb/gutter in Rubicon/Wando Drive to a low point at Design Point 18 on the east side of Wando Drive. The peak developed flow from this 0.68-acre basin is 1.2cfs and 2.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### <u>Basin G2.11a</u>

Basin G2.11a consists of residential development and Lorson Blvd. Runoff is directed in curb/gutter in Lorson Blvd to a low point at Design Point 15 on the north side of Lorson Boulevard. The peak developed flow from this 1.61-acre basin is 2.6cfs and 5.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G2.11b

Basin G2.11b consists of residential development and Lorson Blvd. Runoff is directed in curb/gutter in Lorson Blvd to a low point at Design Point 20 on the north side of Lorson Boulevard. The peak developed flow from this 0.64-acre basin is 1.1cfs and 2.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### <u>Basin G2.12a</u>

Basin G2.12a consists of residential development and Lorson Blvd. Runoff is directed in curb/gutter in Lorson Blvd to a low point at Design Point 15a on the south side of Lorson Boulevard. The peak developed flow from this 1.14-acre basin is 2.0cfs and 4.5cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G2.12b

Basin G2.12b consists of residential development and Lorson Blvd/Wando Drive. Runoff is directed in curb/gutter in Lorson Blvd to a low point at Design Point 22 on the south side of Lorson Boulevard. The peak developed flow from this 1.16-acre basin is 2.2cfs and 4.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G2.13

Basin G2.13 consists of residential development and Simcoe Drive. Runoff is directed in curb/gutter in Simcoe Drive to a low point at Design Point 24 on the west end of Simcoe Drive. The peak developed flow from this 1.54-acre basin is 2.8cfs and 6.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

## <u>Basin G2.14</u>

Basin G2.14 consists of residential development and Pond G2. The peak developed flow from this 4.59-acre basin is 7.7cfs and 17.00cfs for the 5/100-year storm event. See the appendix for detailed calculations.

## Basin G2

Basin G2 consists of runoff from Basins G2.1-G2.14 that enters into Pond G1/G2 from the G2 side (south). The peak developed flow from this 29.34-acre basin is 42.5cfs and 93.5cfs for the 5/100-year storm event and flows to Design Point 25. This overall basin was included to design Pond G1/G2.

#### Basin G3.1

Basin G3.1 consists of residential development and Wando Drive. Runoff is directed in curb/gutter in Wando Drive to a low point at Design Point 26 on the north side of Wando Drive. The peak developed flow from this 0.69-acre basin is 1.2cfs and 2.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G3.2

Basin G3.2 consists of residential development and Wando Drive. Runoff is directed in curb/gutter in Wando Drive to a low point at Design Point 26 on the north side of Wando Drive. The peak developed flow from this 0.68-acre basin is 1.2cfs and 2.7cfs for the 5/100-year storm event. See the appendix for detailed calculations.

## Basin G3.3

Basin G3.3 consists of residential development and Wando Drive. Runoff is directed in curb/gutter in Wando Drive to a low point at Design Point 27 on the south side of Wando Drive. The peak developed flow from this 0.74-acre basin is 1.3cfs and 2.8cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G3.4

Basin G3.4 consists of residential development and Wando Drive. Runoff is directed in curb/gutter in Wando Drive to a low point at Design Point 27 on the south side of Wando Drive. The peak developed flow from this 3.46-acre basin is 5.6cfs and 12.4cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G3.5

Basin G3.5 consists of residential development and Pond G3. The peak developed flow from this 4.59acre basin is 1.0cfs and 2.2cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G3

Basin G3 consists of runoff from Basins G3.1-G3.5 that enters into Pond G3. The peak developed flow from this 6.09-acre basin is 9.9cfs and 21.8cfs for the 5/100-year storm event and flows to Design Point 29. This overall basin was included to design Pond G3.

#### Basin G4

Basin G4 consists of residential development. Runoff is from backyards and is directed south onto the Appletree Golf Course as in pre-development conditions. The peak developed flow from this 1.32-acre basin is 2.6cfs and 5.8cfs for the 5/100-year storm event which is less than the pre-development conditions in Basin EX-4. See the appendix for detailed calculations.

## <u>Basin G5</u>

Basin G5 consists of backyards and open space south of Lorson Boulevard. Runoff is from open space and is directed south onto the Appletree Golf Course and land north of Peaceful Valley Country Club estates as in pre-development conditions. The peak developed flow from this 0.89-acre basin is 1.8cfs and 4.0cfs for the 5/100-year storm event which is less than the pre-development conditions in Basin EX-5. See the appendix for detailed calculations.

## Basin G6.1

Basin G6.1 consists of backyards and Lorson Boulevard. Runoff is directed south and west in curb/gutter in Lorson Boulevard to curb chase that flows north into the Marksheffel Road east barrow ditch. This basin also includes a swale in the future ROW of Marksheffel Road that will collect runoff from backyards. All flow from this basin flows to Design Point 30 into two proposed 24" culverts under Lorson Boulevard and flows south in an existing roadside swale to two existing 24" culverts constructed in 2016 as part of El Paso County's Marksheffel Road widening project. The peak developed flow from this 5.55-acre basin is 8.7cfs and 19.1cfs for the 5/100-year storm event. Per the El Paso County's Marksheffel Road widening project the two existing 24" culverts can handle up to 28.6cfs in the 100-year storm event. See attached memo dated March 11, 2016 from HDR in Appendix E. See the appendix for detailed calculations. A portion of existing basin EX-1 (Developed basins G1.8a/b) has been diverted east into Pond G1/G2 at Design Point 6 so that runoff from Basin G6.1 can flow south to Design Point 30 and not exceed the capacity of the two existing 24" culverts in the roadside barrow ditch.

#### Basin G6.2

Basin G6.2 consists of Lorson Boulevard. Runoff is directed south and west in curb/gutter in Lorson Boulevard to a curb chase that flows south into the Marksheffel Road east barrow ditch. All flow from this basin flows to Design Point 31. The peak developed flow from this 0.77-acre basin is 3.1cfs and 5.6cfs for the 5/100-year storm event. See the appendix for detailed calculations.

#### Basin G6

Basin G6 consists of runoff from Basins G6.1-G6.2 that flows to Design Point 31. The peak developed flow from this 6.32-acre basin is 9.8cfs and 21.5cfs for the 5/100-year storm event and flows to Design Point 31. This overall basin was included and verifies that developed flows are less than the 100-year pre-development flows at existing Design Point DP-1 (5.2cfs/29.5cfs for 5/100year storm). The proposed flow is also lower than the allowable flow from the HDR drainage memo (Appendix E) for the hydraulic design of the two culverts which is 28.6cfs in the 100-year storm. There should be no downstream impacts due to our development since we have lowered the runoff to Marksheffel Road in this basin.

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".

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 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.

All storm sewer is to be part of a public system including Detention Pond G1/G2, G3, and Swale G1.8. Detention Pond G1.7 is an interim detention pond and may move in the future when the commercial areas are developed including the Brownsville Subdivision No. 2. Detention Pond G1.7 will be an interim district detention pond until

the remaining commercial areas are developed and the pond location has been finalized, then it will become public.

	Resident	tial Local	Residentia	al Collector	Principa	I 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

Table 1: Street Capacities (100-year capacity is only ½ of street)

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

Design Point 1 Design Point 1 is located east of Carriage Meadows Drive and west of Rubicon Drive.

(5-year storm) Tributary Basins: G1.1-G1.3 Upstream flowby: 0

Inlet/MH Number: Inlet 1 Total Street Flow:

Flow Intercepted:14.9 cfsFlow Bypassed:Inlet Size:CDOT Type DStreet Capacity:will need inlets when future development occurs

(100-year storm) Tributary Basins: G1.1-G1.3 Upstream flowby: 0

Flow Intercepted: 29.2 cfs

Inlet/MH Number: Inlet 1 Total Street Flow:

Flow Bypassed:

Inlet Size: CDOT Type D Street Capacity: will need inlets when future development occurs

*Comments:* The CDOT Type D is only for interim conditions. Additional inlets will be needed upstream to convey flow.

Design Point 2 and 2a

Design Point 2 is located on Carriage Meadows Drive at a low point just north of Mandan Drive and Design Point 2a is the flow in the storm sewer

(5-year storm) Tributary Basins: G1.4 Upstream flowby: 0

#### Inlet/MH Number: Inlet 2 Total Street Flow:

#### Flow Bypassed:

Flow Bypassed:

Flow Intercepted: 10.3 cfs Inlet Size: 15' Type R Inlet in sump

**Street Capacity:** The street capacity may be exceeded which will require additional inlets and storm sewer from Design Point 1 to be extended north to reduce the size of this basin. The un-developed conditions in Basin G1.4 do not exceed street capacity.

(100-year storm) Tributary Basins: G1.4 Upstream flowby: 0

Inlet/MH Number: Inlet 2 Total Street Flow:

Flow Intercepted: 19.0 cfs Inlet Size: 15' Type R Inlet in sump

**Street Capacity:** The street capacity is not exceeded in the 100-year storm event but the 5-yr storm may require additional inlets and storm sewer from Design Point 1 to be extended north to reduce the size of this basin. The un-developed conditions in Basin G1.4 do not exceed street capacity.

*Comments:* Pipe flow in culvert is 24.3cfs/46.5cfs in the 5/100-year storm events at Design Point 2a. Storm sewer size is 30" RCP

Design Point 3 and 3a

Point 3a. Storm sewer size is 30" RCP

Design Point 3 is located on Carriage Meadows Drive at a low point just north of Mandan Drive. Design Point 3a is the flow in the storm sewer into Pond G1.7

<u>(5-year storm)</u> Tributary Basins: G1.5 Upstream flowby: 0	Inlet/MH Number: Inlet 3 Total Street Flow:
Flow Intercepted: 3.0 cfs Inlet Size: 5' Type R Inlet in sump Street Capacity: 7 cfs at 0.65%street ca	Flow Bypassed: apacity okay.
(100-year storm) Tributary Basins: G1.5 Upstream flowby: 0	Inlet/MH Number: Inlet 3 Total Street Flow:
Flow Intercepted: 5.4 cfs Inlet Size: 5' Type R Inlet in sump Street Capacity: 14 cfs at 0.65%street	Flow Bypassed: capacity (1/2 of street) okay.
<b>Comments:</b> Pipe flow in culvert is 26.9cfs.	/51.2cfs in the 5/100-year storm events at Design

Design Point 4 Design Point 4 is located on the north side of Pond G1.7 and includes Basins G1.6 & G1.7

(5-year storm) Tributary Basins: G1.6 & G1.7 Upstream flowby: 0	Inlet/MH Number: Total Street Flow:	
Flow Intercepted: 83.2 cfs Inlet Size: Street Capacity:	Flow Bypassed:	
(100-year storm) Tributary Basins: G1.6 & G1.7 Upstream flowby: 0	Inlet/MH Number: Total Street Flow:	
Flow Intercepted: 151.7 cfs Inlet Size: Street Capacity:	Flow Bypassed:	
<b>Comments:</b> A swale with 5' bottom, 0.5% slope, and 3:1 side slopes will carry 100cfs. Full development of these basins will require additional storm sewer into Pond G1.7. The swale is okay for interim undeveloped conditions		

#### Design Point 5

Design Point 5 is located on the south side of Pond G1.7 and includes Basins G1.1-G1.7. The total inflow to Pond G1.7 is 106.4cfs in the 5-year storm event and 195.9cfs in the 100-year storm event. Pond G1.7 will detain runoff so the downstream storm sewer can be accommodated in a 48" storm sewer outfall. Pond G1.7 is an interim pond that could be moved depending on whether or not Brownsville Subdivision No. 2 is developed as part of Lorson Ranch in the future.

#### Design Point 6

Design Point 6 is located south of Swale G1.8 and includes Basins G1.8a, G1.8b, Detention Pond G1.7, and flow from Swale G1.8. It is our intent to divert as much runoff from Marksheffel Road as possible to the on-site detention Pond G1/G2 for detention and water quality. This will allow Lorson Ranch to drain a portion of the Southwest corner of this site to the southwest without constructing a detention/WQ pond. The resultant tributary area is significantly reduced thus maintaining offsite flow rates in the Marksheffel Road barrow ditch. By diverting the upstream Marksheffel Road areas we can also utilize the WQ facilities in the barrow ditch to treat runoff from Lorson Boulevard and backyards in the SW corner. The total flow at this design point is 47.4cfs in the 5-year storm and 96.7cfs in the 100-year storm event. All flow will be in a 48" RCP that drains to Pond G1/G2. The 48" RCP does have additional capacity should upstream areas change in land use when they are platted. This design point was modeled in hydraflow hydrographs.

<u>Design Point 7</u> Design Point 7 is located on the west side of Mandan Drive at a low point west of Pond G1.

(5-year storm) Tributary Basins: G1.9 Upstream flowby: 0	Inlet/MH Number: Inlet 7 Total Street Flow:
Flow Intercepted: 5.4 cfs Inlet Size: 10' Type R Inlet in sump	Flow Bypassed:
Street Capacity: 7.1 cfs at 0.63%street	capacity okay.
(100-year storm) Tributary Basins: G1 9	Inlet/MH Number: Inlet 7
Upstream flowby: 0	Total Street Flow:
Flow Intercepted: 11.8 cfs	Flow Bypassed:
Street Capacity: 14.8 cfs at 0.63%stree	et capacity (1/2 of street) okay.

<u>Design Point 7a</u> Design Point 7a is located on the east side of Mandan Drive at a low point west of Pond G1.

(5-year storm) Tributary Basins: G1.10 Upstream flowby: 0

Inlet/MH Number: Inlet 7a Total Street Flow:

Flow Intercepted:6.2 cfsFlow Bypassed:Inlet Size:10' Type R Inlet in sumpStreet Capacity:7.1cfs at 0.63% ---street capacity okay

(100-year storm) Tributary Basins: G1.10 Upstream flowby: 0

Inlet/MH Number: Inlet 7a Total Street Flow:

Flow Intercepted:13.6 cfsFlow Bypassed:Inlet Size:10' Type R Inlet in sumpStreet Capacity:14.8 cfs at 0.63% ---street capacity (1/2 of street) okay

Design Point 8

Design Point 8 is located west of Design Point 7a and is the total flow from Basins G1.9 and G1.10 in a storm sewer flowing into Pond G1. The total flow in the storm sewer is 12.6cfs in the 5-year storm event and 27.7cfs in the 100-year storm event.

#### Design Point 9

Design Point 9 is located on the south side of Pond G1 and includes Basins G1.1-G1.11, G2.2 & G2.3. The total inflow was calculated in Hydraflow Hydrographs and included Pond G1.7 and Swale G1.8 which detains upstream flow. The total inflow to Pond G1 is 60cfs in the 5-year storm event and 117cfs in the 100-year storm event. Pond G1 is connected directly to Pond G1/G2 and will included in the full spectrum detention calculations. This design point was added to design the interconnection pipe between Pond G1 and G2 and to determine a suitable emergency overflow for the "G1" side of the pond. The total outflow from Pond G1 to G2 into the 48" RCP interconnection pipe is 28cfs in the 5-year storm event (elev 5687.92) and 58cfs in the 100-year storm event (elev 5689.12). The 48" RCP will also function as an emergency overflow for Pond G1 to the south. The emergency overflow capacity of the 48" RCP is 120cfs at a headwater depth of 5690.60

Design Point 10

Design Point 10 is located on Rubicon Drive northeast of Galpin Drive

<u>(5-year storm)</u> Tributary Basins: G2.1 Upstream flowby: 0	Inlet/MH Number: In Total Street Flow:	let 10
Flow Intercepted: 4.9 cfs Inlet Size: 10' Type R Inlet on grade Street Capacity: 6.9 cfs at 0.6%street of	Flow Bypassed: capacity okay	0.3 cfs to DP14
<u>(100-year storm)</u> Tributary Basins: G2.1 Upstream flowby: 0	Inlet/MH Number: In Total Street Flow:	let 10
Flow Intercepted: 7.7 cfs Inlet Size: 10' Type R Inlet Street Capacity: 14.4 cfs at 0.6%street	Flow Bypassed: capacity (1/2 of street	3.7cfs to DP14 ) okay

Design Point 11

Design Point 11 is located at Manhole 11 on Rubicon Drive and is the flow in the 24" RCP storm sewer at Manhole 11. Flow at this point is from Design Point 10 and Design Point 12. The total flow in the pipe is 11.9cfs in the 5-year storm event and 23.1cfs in the 100-year storm event.

<u>Design Point 12a</u> Design Point 12a is located at a low point on Wando Drive.

<u>(5-year storm)</u> Tributary Basins: G2.4 Upstream flowby:	Inlet/MH Number: Inlet 12a Total Street Flow:	
Flow Intercepted: 6.7 cfs Inlet Size: 15' Type R Inlet in sump	Flow Bypassed:	
Street Capacity: 7.2 cfs at 0.65%street capacity okay since 1/3 of flow is from Lorson Blvd		
(100-year storm)		
Tributary Basins: G2.4	Inlet/MH Number: Inlet 12a	
Upstream flowby: 0	Total Street Flow:	
Flow Intercepted: 14.8 cfs	Flow Bypassed:	
Inlet Size: 15' Type R Inlet in sump		
Street Capacity: 15 cfs at 0.65% street of	capacity (1/2 of street) okay.	

Design Point 12b Design Point 12b is located at a low point on Wando Drive.

<u>(5-year storm)</u> Tributary Basins: G2.5 Upstream flowby:	Inlet/MH Number: Inlet 12b Total Street Flow:
Flow Intercepted: 0.4 cfs Inlet Size: 5' Type R Inlet in sump Street Capacity: 7.2 cfs at 0.65%street	Flow Bypassed: capacity okay since 1/3 of flow is from Lorson Blvd
<u>(100-year storm)</u> Tributary Basins: G2.5 Upstream flowby:	Inlet/MH Number: Inlet 12b Total Street Flow:
Flow Intercepted: 0.9 cfs Inlet Size: 5' Type R Inlet in sump Street Capacity: 15 cfs at 0.65%street	Flow Bypassed: capacity (1/2 of street).
Comments:	

## Design Point 12

Design Point 12 is located at Manhole 12 on Rubicon Drive and is the flow in the 24" RCP storm sewer at Manhole 12. Flow at this point is from Design Point 12a and Design Point 12b. The total flow in the pipe is 7.0cfs in the 5-year storm event and 15.4cfs in the 100-year storm event.

Design Point 13 Design Point 13 is located at a low point on the north side of Rubicon Drive next to Pond G1.

(5-year storm) Tributary Basins: G2.6a Upstream flowby:

Inlet/MH Number: Inlet 13 **Total Street Flow:** 

Flow Bypassed:

Flow Intercepted: 0.7 cfs Inlet Size: 10' Type R Inlet in sump Street Capacity: 6.8 cfs at 0.56% ---street capacity okay

(100-year storm) Tributary Basins: G2.6a Upstream flowby:

**Inlet/MH Number:** Inlet 13 **Total Street Flow:** 

Flow Intercepted: 1.1 cfs Flow Bypassed: Inlet Size: 10' Type R Inlet in sump Street Capacity: 13.5 cfs at 0.56% --- street capacity (1/2 of street) okay. Design Point 13a

Design Point 13a is located at Manhole 13a on Rubicon Drive and is the flow in the 48" RCP storm sewer at Manhole 13a. Flow at this point is from Design Point 13, Design Point 11, and the outflow from Pond G1 (28cfs/58cfs in the 5/100-year storm events). The total flow in the pipe is 40.6cfs in the 5-year storm event and 82.2cfs in the 100-year storm event.

<u>Design Point 13b</u> Design Point 13b is located at a low point on the south side of Rubicon Drive next to Pond G1.

<u>(5-year storm)</u> Tributary Basins: G2.6 Upstream flowby:	Inlet/MH Number: Inlet 13b Total Street Flow:
Flow Intercepted: 2.4 cfs Inlet Size: 10' Type R Inlet in sump Street Capacity: 6.8 cfs at 0.56%street	Flow Bypassed:
	supulity shay
(100-year storm)	
Tributary Basins: G2.6a	Inlet/MH Number: Inlet 13b
Upstream flowby:	Total Street Flow:
Flow Intercepted: 5.3 cfs	Flow Bypassed:
Inlet Size: 10' Type R Inlet in sump	
Street Capacity: 13.5 cfs at 0.56% street	et capacity (1/2 of street) okay.

## Design Point 13c

Design Point 13c is located downstream of Design Point 13b and is the flow in the 48" RCP storm sewer. Flow at this point is from Design Point 13b and Design Point 13a. The total flow in the pipe is 43cfs in the 5-year storm event and 87.5cfs in the 100-year storm event. The emergency overflow swale from Design Point 13c to Lorson Blvd is 12' wide, 1.2% slope, 1' deep, and has a capacity of 100cfs to handle the flow should the inlets become clogged.

Design Point 14

Design Point 14 is located at a low point on the east side Galpin Drive next to Pond G1.

(5-year storm) Tributary Basins: G2.2 Upstream flowby: 0.3cfs from Des. Pt. 10	Inlet/MH Number: Inlet 14 Total Street Flow: 3.3cfs
Flow Intercepted: 3.3cfs Inlet Size: 5' Type R Inlet in sump	Flow Bypassed:
Street Capacity: 7.3 cfs at 0.67%street	capacity okay
(100-year storm) Tributary Basins: G2.2	Inlet/MH Number: Inlet 14
Upstream flowby: 3.7cfs from Des. Pt. 10	Total Street Flow: 10.3cfs
Flow Intercepted: 9.8 cfs	Flow Bypassed: 0.5cfs to Des. Pt. 14a
Street Capacity: 15.3 cfs at 0.67% street	et capacity (1/2 of street).

Design Point 14a

Design Point 14a is located at a low point on the west side of Galpin Drive next to Pond G1.

<u>(5-year storm)</u> Tributary Basins: G2.3 Upstream flowby:	Inlet/MH Number: Inlet 14a Total Street Flow: 5.5cfs
Flow Intercepted: 5.5cfs Inlet Size: 10' Type R Inlet in sump	Flow Bypassed:
Street Capacity: 7.3 cfs at 0.67%street	capacity okay
(100-year storm) Tributary Basins: G2 3	Inlet/MH Number: Inlet 14a
<b>Upstream flowby:</b> 0.5cfs from Des. Pt. 14	Total Street Flow: 12.6cfs
Flow Intercepted: 12.6cfs	Flow Bypassed:
Street Capacity: 15.3 cfs at 0.67%street	et capacity (1/2 of street).

Design Point 14c

Design Point 14c is located on Galpin Drive where the storm sewer from Design Point 14c flows west to Pond G1. All flow is routed in a 24" RCP to Pond G1. The total flow in the pipe is 8.8cfs in the 5-year storm event and 22.4cfs in the 100-year storm event. The emergency overflow swale from Design Point 14c to Pond G1 is 8' wide, 1.2% slope, 1' deep, and has a capacity of 40cfs to handle the flow should the inlets become clogged.

Design Point 15 Design Point 15 is located at a low point on the north side of Lorson Boulevard at Pond G2

<u>(5-year storm)</u> Tributary Basins: G2.11a Upstream flowby:	Inlet/MH Number: Inlet 15 Total Street Flow:
Flow Intercepted: 2.6 cfs Inlet Size: 10' Type R Inlet in sump Street Capacity: 7.3 cfs at 0.67%street	Flow Bypassed: capacity okay
<u>(100-year storm)</u> Tributary Basins: G2.11a Upstream flowby:	Inlet/MH Number: Inlet 15 Total Street Flow:
Flow Intercepted: 5.8 cfs Inlet Size: 10' Type R Inlet in sump Street Capacity: 15.3 cfs at 0.67%stree	Flow Bypassed: et capacity (1/2 of street).

Design Point 15a Design Point 15a is located at a low point on the south side of Lorson Boulevard at Pond G2

<u>(5-year storm)</u> Tributary Basins: G2.12a Upstream flowby:	Inlet/MH Number: Inlet 15a Total Street Flow:
Flow Intercepted: 2.0 cfs Inlet Size: 10' Type R Inlet in sump	Flow Bypassed:
Street Capacity: 7.3 cfs at 0.67%street	capacity okay
(100-year storm)	
Tributary Basins: G2.12a	Inlet/MH Number: Inlet 15a
Upstream flowby:	Total Street Flow:
Flow Intercepted: 4.5 cfs	Flow Bypassed:
Inlet Size: 10' Type R Inlet in sump	
Street Capacity: 15.3 cfs at 0.67%stree	et capacity (1/2 of street).

#### Design Point 15b

*.* –

Design Point 15b is located downstream of Design Point 15a and is the flow in the 48" RCP storm sewer. Flow at this point is from Design Point 15 & 15a and Design Point 13c. The total flow in the pipe is 47.6cfs in the 5-year storm event and 97.8cfs in the 100-year storm event flowing into Pond G2

Design Point 16 Design Point 16 is located at a low point on Rubicon Drive.

(5-year storm) Tributary Basins: G2.7 Upstream flowby:

**Inlet/MH Number:** Inlet 16 **Total Street Flow:** 

Flow Intercepted: 4.6 cfs Flow Bypassed: **Inlet Size:** 10' Type R Inlet in sump Street Capacity: 7.3 cfs at 0.67% ---street capacity okay

(100-year storm) Tributary Basins: G2.7 Upstream flowby:

Inlet/MH Number: Inlet 16 **Total Street Flow:** 

Flow Intercepted: 10.2 cfs Flow Bypassed: Inlet Size: 10' Type R Inlet in sump Street Capacity: 15.3 cfs at 0.67% ---street capacity (1/2 of street). Design Point 17 Design Point 17 is located at a low point on the west side of Wando Drive north of Lorson Blvd.

<u>(5-year storm)</u> Tributary Basins: G2.8 & G2.9 Upstream flowby:	Inlet/MH Number: Inlet 17 Total Street Flow:
Flow Intercepted: 2.3 cfs Inlet Size: 5' Type R Inlet in sump Street Capacity: 7.2 cfs at 0.65%street	Flow Bypassed: capacity okay since 1/3 of flow is from Lorson Blvd
<u>(100-year storm)</u> Tributary Basins: G2.8 & G2.9 Upstream flowby:	Inlet/MH Number: Inlet 17 Total Street Flow:
Flow Intercepted: 5.0 cfs Inlet Size: 5' Type R Inlet in sump Street Capacity: 15 cfs at 0.65%street	Flow Bypassed: capacity (1/2 of street).

Design Point 18 Design Point 18 is located at a low point on the east side of Wando Drive north of Lorson Blvd.

(5-year storm) Tributary Basins: G2.10	Inlet/MH Number: Inlet 18 Total Street Flow:
Elew Intercented: 1.2 of	
Inlet Size: 5' Type R Inlet in sump	riow bypasseu.
Street Capacity: 7.2 cfs at 0.65%stree	t capacity okay since 1/3 of flow is from Lorson Blvd
(100-year storm)	
Tributary Basins: G2.10	Inlet/MH Number: Inlet 18
Upstream flowby:	Total Street Flow:
Flow Intercepted: 2.6 cfs	Flow Bypassed:
Inlet Size: 5' Type R Inlet in sump	
Street Capacity: 15 cfs at 0.65%street	capacity (1/2 of street).

Design Point 19

Design Point 19 is flow in storm sewer located on Wando Drive just north of Lorson Boulevard Flow is routed in a 24" RCP to Design Point 21 and then to Pond G2. The total flow in the pipe is 7.4cfs in the 5-year storm event and 16.2cfs in the 100-year storm event.

<u>Design Point 20</u> Design Point 20 is located at a low point on the north side of Lorson Boulevard.

(5-year storm) Tributary Basins: G2.11b Inlet/MH Number: Inlet 20 Upstream flowby: **Total Street Flow:** Flow Intercepted: 1.1 cfs Flow Bypassed: **Inlet Size:** 5' Type R Inlet in sump Street Capacity: 7.2 cfs at 0.65% ---street capacity okay (100-year storm) Tributary Basins: G2.11b Inlet/MH Number: Inlet 20 Upstream flowby: **Total Street Flow:** Flow Intercepted: 2.5 cfs Flow Bypassed: **Inlet Size:** 5' Type R Inlet in sump Street Capacity: 15 cfs at 0.65% --- street capacity (1/2 of street).

#### Design Point 21

Design Point 21 is pipe flow in storm sewer located on Lorson Boulevard just north of Pond G2 and pipe flow from Design Point 19 and 20. Flow is routed in a 24" RCP to Design Point 22 and then to Pond G2. The total flow in the pipe is 10.4cfs in the 5-year storm event and 22.8cfs in the 100-year storm event.

<u>Design Point 22</u> Design Point 22 is located at a low point on the south side of Lorson Boulevard.

<u>(5-year storm)</u> Tributary Basins: G2.12b Upstream flowby:	Inlet/MH Number: Inlet 22 Total Street Flow:
Flow Intercepted: 2.2cfs	Flow Bypassed:
Inlet Size: 5' Type R Inlet in sump Street Capacity: 7.2 cfs at 0.65%street	capacity okay
<u>(100-year storm)</u> Tributary Basins: G2.12b	Inlet/MH Number: Inlet 22
Upstream flowby:	Total Street Flow:
Flow Intercepted: 4.8 cfs	Flow Bypassed:
Street Capacity: 15 cfs at 0.65%street of	capacity (1/2 of street).

## Design Point 23

Design Point 23 is pipe flow in storm sewer located on Lorson Boulevard draining into Pond G2 from Design Point 22. Flow is routed in a 24" RCP to Pond G2. The total flow in the pipe is 14.5cfs in the 5-year storm event and 32.0cfs in the 100-year storm event.

Design Point 24 Design Point 24 is located at a low point on the west end of Simcoe Drive

<u>(5-vear storm)</u> Tributary Basins: G2.13 Upstream flowby:	Inlet/MH Number: Inlet 24 Total Street Flow:
Flow Intercepted: 2.8cfs Inlet Size: 5' Type R Inlet in sump Street Capacity: 7.2 cfs at 0.65%street	Flow Bypassed:
<u>(100-year storm)</u> Tributary Basins: G2.13 Upstream flowby:	Inlet/MH Number: Inlet 24 Total Street Flow:
Flow Intercepted: 6.2 cfs Inlet Size: 5' Type R Inlet in sump Street Capacity: 15 cfs at 0.65%street	Flow Bypassed: capacity (1/2 of street).

#### Design Point 25

Design Point 25 is pipe flow in storm sewer draining Pond G2. This pipe was sized by the full spectrum detention pond (UD Detention) worksheets provided by Denver Urban Drainage. The pond outflow pipe is 36" RCP at a 0.4% slope. The total flow in the pipe is 4.5cfs in the 5-year storm event and 61.6cfs in the 100-year storm event per the full spectrum spreadsheets.

Design Point 26 Design Point 26 is located at a low point on the north side of Wando Drive downstream of Pond G2.

<u>(5-year storm)</u> Tributary Basins: G3.1 & G3.2 Upstream flowby:	Inlet/MH Number: Inlet 26 Total Street Flow:
Flow Intercepted: 2.4cfs Inlet Size: 5' Type R Inlet in sump	Flow Bypassed:
Street Capacity: 7.2 cfs at 0.65%street	capacity okay
(100-year storm)	
Tributary Basins: G3.1 & G3.2	Inlet/MH Number: Inlet 26
opsitean nowby.	
Flow Intercepted: 5.2 cfs	Flow Bypassed:
Inlet Size: 5' Type R Inlet in sump	
Street Capacity: 15 cfs at 0.65%street	capacity (1/2 of street).

Design Point 27

Design Point 27 is located at a low point on the south side of Wando Drive downstream of Pond G2.

<u>(5-year storm)</u> Tributary Basins: G3.3 & G3.4 Upstream flowby:	Inlet/MH Number: Inlet 27 Total Street Flow:		
Flow Intercepted: 6.8cfs Inlet Size: 10' Type R Inlet in sump	Flow Bypassed:		
Street Capacity: 7.2 cfs at 0.65%street	capacity okay		
(100-year storm) Tributary Basins: G3.3 & G3.4	Inlet/MH Number: Inlet 27		
Upstream flowby:	Total Street Flow:		
Flow Intercepted: 15.0 cfs Inlet Size: 10' Type R Inlet in sump	Flow Bypassed:		
Street Capacity: 15 cfs at 0.65%street capacity (1/2 of street).			

## Design Point 28

Design Point 28 is pipe flow in storm sewer located on Wando Drive draining into Pond G3 from Design Point 27. Flow is routed in a 24" RCP to Pond G3. The total flow in the pipe is 9.0cfs in the 5-year storm event and 19.9cfs in the 100-year storm event.

## Design Point 29

Design Point 29 is the total flow from G3 basins draining to Pond G3. This pond was sized by the full spectrum detention pond (UD Detention) worksheets provided by Denver Urban Drainage. The pond outflow pipe is 18" RCP at a 0.5% slope. The18" will connect into the 36" pipe from Pond G2 and drain east to Jimmy Camp Creek. The total flow into Pond G3 is 9.9cfs in the 5-year storm event and 21.8cfs in the 100-year storm event.

## Design Point 30

Design Point 30 is runoff from Basin G6.1 on the north side of Lorson Boulevard. Runoff in Lorson Boulevard will drain west to Marksheffel Road and then north in a curb chase to a barrow ditch on the east side of Marksheffel Road. Two proposed 24-inch RCP storm sewer pipes will be necessary to convey flow from this basin under Lorson Boulevard and will drain into the existing storm sewer system constructed as part of the Marksheffel Road improvement project consisting of two existing downstream pipes are 24" RCP pipes at 0.28% slope. The calculated flow in the proposed pipes is calculated to be 8.7cfs in the 5-year storm event and 19.1cfs in the 100-year storm event. A portion of existing basin EX-1 (Developed basins G1.8a/b) has been diverted east into Pond G1/G2 at Design Point 6 so that developed runoff from Basin G6.1 can flow south to Design Point 30 and not exceed the capacity of the two existing 24" culverts in the roadside barrow ditch.

## Design Point 31

Design Point 31 is runoff from Basins G6.1-G6.2 and is the total flow in the barrow ditch of Marksheffel Road just downstream of Lorson Boulevard. Runoff in Lorson Boulevard, backyards, and the future Marksheffel Road will drain south in a barrow ditch on the east side of Marksheffel Road to two existing 24" culverts under an access road. The total flow from all the G6 basins is 9.8cfs in the 5-year storm event and 21.5cfs in the 100-year storm event. This developed flow will not exceed the capacity of the two existing downstream 24" RCP pipes at 0.28% slope. Per the County's design of Marksheffel Road,

the two pipes have a total capacity of 28.6cfs in the 100-year storm event. See Appendix E for the drainage memo from HDR regarding design of the two 24" storm sewer culverts.

## Design Point 32

Design Point 32 is the total flow in the 36" pipe to Jimmy Camp Creek. The total flow consists of flow from Pond G1/G2 and Pond G3 and is 4.5cfs in the 5-year storm event and 65.7cfs in the 100-year storm event. All flow discharges to Jimmy Camp Creek onto a rip rap pad. The existing flow to Jimmy Camp per the UDCF pre-development flow rates are 69cfs in the 100-year storm event. The proposed runoff rate is less than the pre-development flow rate and is in conformance with the MDDP/Preliminary Drainage Report for Carriage Meadows South at Lorson Ranch prepared by Core Engineering Group [11]

## 6.0 DETENTION AND WATER QUALITY PONDS

Detention and Storm Water Quality for Carriage Meadows South at Lorson Ranch Filing No. 1 is required per El Paso County criteria. We have implemented the Full Spectrum approach for detention for Carriage Meadows South at Lorson Ranch Filing No. 1 per the Denver Urban Drainage Districts specifications. There is one interim detention pond and two permanent full spectrum ponds proposed for this development. The interim detention pond does not have full spectrum or water quality features and is strictly to slightly reduce runoff so the downstream storm sewer (48" Storm Sewer) can accommodate the increased flows from the developed conditions. The two permanent full spectrum ponds incorporate storm water quality features. The detention ponds in Carriage Meadows South at Lorson Ranch Filing No. 1 will be owned and maintained by the Lorson Ranch Metropolitan District.

#### Interim Pond G1.7 (Interim District Pond)

This is an interim detention pond located north of the residential areas and west of Carriage Meadows Drive. If the Brownsville Subdivision No. 2 develops as part of Lorson Ranch all or a portion of this pond could be moved to a more effective location to the southwest. Interim Pond G1.7 reduces the size of the downstream storm sewer to a 48" diameter that flows south to Swale G1.8. The smaller size outfall pipe is necessary to maintain cover over the pipe. This pond was modeled in Hydraflow and does <u>not</u> include water quality features. Pond G1.7's developed inflow hydrograph has a 35 minute duration and the outflow hydrograph stores and drains the pond volume in around 110 minutes. Pond G1.7 will fill and drain out in less than two hours because of the large 48" diameter storm sewer outfall pipe. Pond G1.7 does not overdetain runoff when compared to existing conditions. When development occurs upstream of this interim pond the pond must be updated to meet El Paso County requirements for full spectrum ponding.

- Incoming flows: 107cfs/196cfs in the 5-year and 100-year storm event
- Detained flows: 62.7cfs/95cfs in the 5-year and 100-year storm event
- Pipe Outlet: 48" RCP at 0.5%
- 5-yr WSEL= 5695.10, 100-yr WSEL=5696.94
- Volume: 1.22 ac-ft storage in 5-year, 2.40 acre-ft storage in 100-year

## Swale G1.8 (District Facility)

This swale is located west of the residential areas adjacent to Marksheffel Road. The swale does have some storage volume in it which is why it is included in the hydraulic calculations. If the Brownsville Subdivision No. 2 develops as part of Lorson Ranch all or a portion of this swale could be moved to a more effective location or changed into a pond. Swale G1.8 helps reduces the size of storm sewer necessary to convey drainage from Design Point 6 to Pond G1. This swale was modeled in Hydraflow and does not include water quality features.

- Incoming flows: 74cfs/120cfs in the 5-year and 100-year storm event
- Detained flows: 52.8cfs/105cfs in the 5-year and 100-year storm event
- Pipe Outlet: 42" RCP at 0.5%
- 5-yr WSEL= 5692.86, 100-yr WSEL=5694.33

• Volume: 0.9 ac-ft storage in 5-year, 1.48 acre-ft storage in 100-year

## Hydraulic Design of the "G1" portion of Pond G1/G2 (District Facility)

This analysis was added to provide a hydraulic model of the "G1" side of Pond G1/G2 to ensure the storm sewer interconnection pipes were sized adequately. See Pond G1/G2 for full spectrum calculations. The hydraulic model utilized the storage volume in Pond G1.7 and Swale G1.8 (tributary areas) and the site runoff directly entering the G1 side to determine the total flow entering the G1 side. The G1 side (north of Lorson Boulevard) was then hydraulically modeled in Hydraflow to determine the flow in the interconnect pipe flowing to the G2 side (south). The interconnection pipe will also serve as an emergency overflow with a capacity of over 120cfs. In addition, a sideyard overflow swale will also be constructed which has a capacity of 100cfs.

- Incoming flows: 56cfs/113.5cfs in the 5-year and 100-year storm event
- Outflow to "G2" side: 28cfs at elevation 5687.92 in the 5-year storm event
- Outflow to "G2" side: 58cfs at elevation 5689.12 in the 100-year storm event
- Volume: 2.25 ac-ft storage in 5-year, 3.79 acre-ft storage in 100-year
- Pipe Outlet: 48" RCP at 0.4%

## Detention Pond G1/G2 (Full Spectrum Design), (District Facility)

This is an on-site permanent full spectrum detention pond that includes water quality. Pond G1/G2 is designed as a single pond in the UDCF Full Spectrum spreadsheets. The full spectrum print outs are in the appendix of this report. See map in appendix for watershed areas. This pond is sized to provide full spectrum and water quality for the Brownsville Subdivision No. 2 should it become a part of Lorson Ranch.

- Watershed Ares: 96 acres
- Watershed Imperviousness: 79%
- Hydrologic Soils Group A, B, C/D
- Zone 1 WQCV: 2.301 ac-ft, WSEL: 5683.93
- Zone 2 EURV: 8.104 ac-ft, WSEL: 5686.29
- Zone 3 (100-yr): 12.881ac-ft, WSEL: 5687.93
- Pipe Outlet: 36" RCP at 0.4%
- 5-yr outflow = 4.2cfs, 100-yr outflow = 55.6cfs

## Detention Pond G3 (Full Spectrum Design), (District Facility)

This is an on-site permanent full spectrum detention pond that includes water quality. Pond G3 is designed per the UDCF Full Spectrum spreadsheets. The full spectrum print outs are in the appendix of this report. See map in appendix for watershed areas.

- Watershed Ares: 6.02 acres
- Watershed Imperviousness: 65%
- Hydrologic Soils Group B
- Zone 1 WQCV: 0.11 ac-ft, WSEL: 5684.94
- Zone 2 EURV: 0.39 ac-ft, WSEL: 5686.41
- Zone 3 (100-yr): 0.51 ac-ft, WSEL: 5686.98
- Pipe Outlet: 18" RCP at 0.5%
- 5-yr outflow = 0.3cfs, 100-yr outflow = 10.1cfs

Water Quality Design

Water Quality for all the G1, G2, and G3 basins is provided in the on-site full spectrum ponds. The G4 and G5 basins are from the backyards of residential lots and open space and have been reduced in area as much as possible. The WQ for the G6 basins is provided by an existing sand filter basin in the east barrow ditch of Marksheffel Road near the SW corner of this site. The sand filter basin was constructed as part of the Marksheffel Road project by El Paso County. The sand filter basin was designed for all of Marksheffel Road but we have diverted most of the northern sections of Marksheffel Road (Basins G1.8a/b) into Pond G1/G2 which will allow the flows in the G6 basins to be treated by the existing sand filter basin. The main reason for diverting runoff is that there is not enough elevation difference to construct a pond in the SW corner with a suitable outfall.

## 7.0 DRAINAGE AND BRIDGE FEES

Carriage Meadows South at Lorson Ranch Filing No. 1 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 has negotiated a development agreement with El Paso County which defines major drainage infrastructure to be constructed as part of the district.

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.

Carriage Meadows South at Lorson Ranch Filing No. 1 contains 106.64 acres. The 106.64 acres will be assessed Drainage, Bridge and Surety fees. This project consists of 34.02 acres of open space (7% impervious), 13.69 acres of commercial (95% impervious), and the remaining 58.93 acres is residential (65% impervious) for a total impervious percentage of 50.4%

The 2017 drainage fees are \$15,720, bridge fees are \$735 and Drainage Surety fees are \$7,000 per impervious acre. The fees are due at plat recordation and are calculated as follows:

Type of Land Use	Total Area (ac)	Imperviousness	Drainage Fee	Bridge Fee	Surety Fee
Residential	58.93	65%	\$602,657	\$28,177	\$268,359
Open Space	34.02	7%	\$37,435	\$1,750	\$16,669
Commercial	13.69	95%	\$204,446	\$9,559	\$91,038
		Total	\$844,538	\$39,486	\$376,066

## Table 1: Drainage/Bridge Fees

Item	Quantity	Unit	Unit Cost	Item Total
Rip Rap	60	CY	\$50/CY	\$3,000
Inlets/Manholes	27	EA	\$5000/EA	\$135,000
18" Storm	490	LF	\$35	\$17,150
24" Storm	1504	LF	\$40	\$60,160
30" Storm	80	LF	\$45	\$3,600
36" Storm	407	LF	\$55	\$22,385
42" Storm	175	LF	\$65	\$11,375
48" Storm	1228	LF	\$85	\$104,380
			Subtotal	\$357,050
			Eng/Cont (15%)	\$53,557
			Total Est. Cost	\$410,607

 Table 2: Storm Drainage Facility Costs (non-reimbursable)

#### Table 3: Lorson Ranch Metro District Drainage Facility Costs (non-reimbursable)

ltem	Quantity	Unit	Unit Cost	Item Total
Rip Rap	100	CY	\$50/CY	\$5,000
Channel Lining	1300	SY	\$5/SY	\$6,500
Full Spectrum Ponds and Outlet	2	LS	\$50,000	\$100,000
			Subtotal	\$111,500
			Eng/Cont (15%)	\$16,725
			Total Est. Cost	\$128,225

#### 8.0 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
- Jimmy Camp Creek is realigned and Marksheffel Road has been reconstructed within this study area
- Detention and water quality for this study area has been provided

## 9.0 REFERENCES

- 1. City of Colorado Springs/El Paso County Drainage Criteria Manual DCM, dated November, 1991
- 2. Chapter 6 and Section 3.2.1 Chapter 13 of the City of Colorado Springs Drainage Criteria Manual dated May 2014
- 3. Soil Survey of El Paso County Area, Colorado by USDA, SCS
- 4. Jimmy Camp Creek Drainage Basin Planning Study, 1987, Wilson & Co.
- 5. City of Colorado Springs "Drainage Criteria Manual, Volume 2
- 6. El Paso County "Engineering Criteria Manual"
- 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. Drainage Basin Planning Study, Dated March 9, 2015, by Kiowa Engineering Corporation
- 9. Drainage memo from HDR for Marksheffel Road project, dated March 11, 2016
- 10. Jimmy Camp Creek Reconstruction plans by Drexel, Barrell & Co, dated September 6, 2005, county plans #2801.
- 11. Master Development Drainage Plan and Preliminary Drainage Report for Carriage Meadows South at Lorson Ranch by Core Engineering Group, dated June, 2017 and revised March, 2017.

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







Custom Soil Resource Report

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El Paso County Area, Colorado (CO625)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	50.3	46.1%
30	Fort Collins loam, 0 to 3 percent slopes	25.0	22.9%
52	Manzanst clay loam, 0 to 3 percent slopes	33.5	30.8%
59	Nunn clay loam, 0 to 3 percent slopes	0.2	0.2%
Totals for Area of Interest		109.0	100.0%

## Map Unit Legend

## Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic
classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An association is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

## El Paso County Area, Colorado

#### 28—Ellicott loamy coarse sand, 0 to 5 percent slopes

#### Map Unit Setting

National map unit symbol: 3680 Elevation: 5,500 to 6,500 feet Mean annual precipitation: 13 to 15 inches Mean annual air temperature: 47 to 50 degrees F Frost-free period: 125 to 145 days Farmland classification: Not prime farmland

#### Map Unit Composition

Ellicott and similar soils: 85 percent Estimates are based on observations, descriptions, and transects of the mapunit.

#### **Description of Ellicott**

#### Setting

Landform: Flood plains, stream terraces Landform position (three-dimensional): Tread Down-slope shape: Linear Across-slope shape: Linear Parent material: Sandy alluvium

#### **Typical profile**

A - 0 to 4 inches: loamy coarse sand C - 4 to 60 inches: stratified coarse sand to sandy loam

#### Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

#### Interpretive groups

Land capability classification (irrigated): None specified Land capability classification (nonirrigated): 7w Hydrologic Soil Group: A Ecological site: Sandy Bottomland (R069XY031CO) Other vegetative classification: SANDY BOTTOMLAND (069AY031CO)

#### **Minor Components**

#### Fluvaquentic haplaquoll

Percent of map unit: Landform: Swales

#### Other soils

Percent of map unit:

#### Pleasant

Percent of map unit: Landform: Depressions

#### 30—Fort Collins loam, 0 to 3 percent slopes

#### Map Unit Setting

National map unit symbol: 3683 Elevation: 5,200 to 6,500 feet Mean annual precipitation: 14 to 16 inches Mean annual air temperature: 48 to 52 degrees F Frost-free period: 135 to 155 days Farmland classification: Prime farmland if irrigated

#### Map Unit Composition

Fort collins and similar soils: 85 percent Estimates are based on observations, descriptions, and transects of the mapunit.

#### **Description of Fort Collins**

#### Setting

Landform: Flats Landform position (three-dimensional): Talf Down-slope shape: Linear Across-slope shape: Linear Parent material: Loamy alluvium

#### **Typical profile**

A - 0 to 9 inches: loam Bt - 9 to 16 inches: clay loam Bk - 16 to 21 inches: clay loam Ck - 21 to 60 inches: loam

#### Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.1 inches)

#### Interpretive groups

Land capability classification (irrigated): 2e Land capability classification (nonirrigated): 4e

#### Custom Soil Resource Report

Hydrologic Soil Group: B Ecological site: Loamy Plains, LRU's A & B 10-14 Inches, P.Z. (R069XY006CO) Other vegetative classification: LOAMY PLAINS (069AY006CO)

#### **Minor Components**

#### Other soils

Percent of map unit:

#### Pleasant

Percent of map unit: Landform: Depressions

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

#### Map Unit Setting

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

#### Map Unit Composition

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

#### **Description of Manzanst**

#### Setting

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

#### **Typical profile**

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

#### Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches

#### Custom Soil Resource Report

Frequency of flooding: None Frequency of ponding: None Calcium carbonate, maximum in profile: 15 percent Gypsum, maximum in profile: 3 percent Salinity, maximum in profile: Slightly saline (4.0 to 7.0 mmhos/cm) Sodium adsorption ratio, maximum in profile: 10.0 Available water storage in profile: High (about 9.0 inches)

#### Interpretive groups

Land capability classification (irrigated): 3e Land capability classification (nonirrigated): 4c Hydrologic Soil Group: C Ecological site: Saline Overflow (R067BY037CO)

#### **Minor Components**

#### Ritoazul

Percent of map unit: 7 percent Landform: Interfluves, drainageways Landform position (three-dimensional): Rise Down-slope shape: Linear Across-slope shape: Linear Ecological site: Clayey Plains (R067BY042CO)

#### Arvada

Percent of map unit: 6 percent Landform: Drainageways, interfluves Down-slope shape: Linear Across-slope shape: Linear Ecological site: Salt Flat (R067XY033CO)

#### Wiley

Percent of map unit: 2 percent Landform: Interfluves Down-slope shape: Linear Across-slope shape: Linear Ecological site: Loamy Plains (R067BY002CO)

#### 59—Nunn clay loam, 0 to 3 percent slopes

#### Map Unit Setting

National map unit symbol: 3693 Elevation: 5,400 to 6,500 feet Mean annual precipitation: 13 to 15 inches Mean annual air temperature: 46 to 50 degrees F Frost-free period: 135 to 155 days Farmland classification: Prime farmland if irrigated

#### Map Unit Composition

Nunn and similar soils: 85 percent Estimates are based on observations, descriptions, and transects of the mapunit.

#### **Description of Nunn**

#### Setting

Landform: Terraces, fans Down-slope shape: Linear Across-slope shape: Linear Parent material: Mixed alluvium

#### Typical profile

A - 0 to 12 inches: clay loam Bt - 12 to 26 inches: clay loam BC - 26 to 30 inches: clay loam Bk - 30 to 58 inches: sandy clay loam C - 58 to 72 inches: clay

#### Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.8 inches)

#### Interpretive groups

Land capability classification (irrigated): 2e Land capability classification (nonirrigated): 3c Hydrologic Soil Group: C Ecological site: Clayey Plains (R069XY042CO) Other vegetative classification: CLAYEY PLAINS (069AY042CO)

#### **Minor Components**

#### Other soils

Percent of map unit:

#### Pleasant

Percent of map unit: Landform: Depressions



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tem De		Runoff		ļ	in/hr			ad & tch	2.41							ad & tch	4.05					
ge Sys		Total	וטומ	(A))				ting Ro	2.13							ting Ro orrow Di	7.29					
Draina				əţ	min			Exis Bo	31.4					S		Exis Bc	31.4					
. Storm	ey	×		Ø	cfs	ditions	3.0	2.5		18.7	2.6	2.8	9.9	ndition	22.0	8.6		110.1	14.8	15.4	55.3	
m SF-2	d Beas	Beasle		ļ	in/hr	ed Con	2.41	2.76		2.40	3.37	3.52	2.82	ped Co	4.05	4.63		4.03	5.66	5.91	4.73	
ard For	<u>Leonal</u> 2016	eonard		CA		aolava	1.24	0.89		7.80	0.78	0.78	3.51	Develo	5.44	1.85		27.30	2.61	2.62	11.70	
Stand	ated By May. 23	ed By: L	ברו צחו	ot	min.	t. Pre-D	31.4	24.9		31.6	16.6	15.0	24.0	nt, Pre-	31.4	24.9		31.6	16.6	15.0	24.0	
	Calcula Date: <u>I</u>	Check	ן ב	Runoff (C) .1190C		ar Even	0.08	0.18	0.10	0.10	0.15	0.15	0.15	ear Eve	0.35	0.38	0.39	0.35	0.50	0.50	0.50	
	B			(A) ธ9าA	ac.	5 - Yeá	15.54	4.87	20.41	78.00	5.22	5.23	23.40	100 - Y€	15.54	4.87	20.41	78.00	5.22	5.23	23.40	
	NG GRO			ngisəO sə	ЯA																	
ORE	INEERI		ţu	iio9 ngisə(	ו																	
	ENG			Street or Basin			Basin EX-1	Basin EX-2	DP-1	Basin EX-3	Basin EX-4	Basin EX-5	Basin EX-6		Basin EX-1	Basin EX-2	DP-1	Basin EX-3	Basin EX-4	Basin EX-5	Basin EX-6	

				Remarks																	
		S	ne	ħ	min																
		ndition	avel lin	Velocity	ft/sec																
		sed Co	_	qĵbuəJ	ft																
	outh	, Propo		əzi2 əqi9	in																
dure)	dows S	r Event	Pipe	sqol2	%																
Proce	<u>30</u> Ige Mea	<u> 5 - Үеа</u>		ngisəD Wol٦	cfs																
Method	: <u>100.03</u> : <u>Carria</u>	Storm:	eet	Street Flow	cfs																
tional	Job No. Project:	Design	Str	Slope	%																
sign (Ra		ſ		Ø	cfs				14.9		24.3		26.9			83.2	106.4			121.2	
em Des		2	Runott	ļ	in/hr				4.03		3.78		3.78			3.26	3.26			3.05	
ge Syst		- - -	I otal	(AD)					3.70		6.42		7.11			25.50	32.61			39.68	
Draina				əţ	min				10.7		12.6		12.6			17.8	17.8			20.5	
Storm	ę			Ø	cfs	11.2	4.3	0.8		10.3		3.0		61.2	37.8			14.6	7.1		5.4
n SF-2.	d Beasl	Beasley		ļ	in/hr	4.49	4.31	4.02		3.78		4.34		3.83	3.98			3.07	3.08		4.02
rd Forr	<u>Leonar</u> 2016	eonard	ott	CA		2.50	1.00	0.20		2.72		0.69		15.99	9.51			4.76	2.30		1.34
Standa	ted By: 1ay. 23,	d By: L	ect Run	ot	min.	7.9	8.8	10.7		12.6		8.7		12.2	11.1			20.3	20.2		10.7
	Calcula Date: <u>N</u>	Checke	DIL	Runoff (C)		0.81	0.45	0.45		0.77		0.83		0.81	0.82			0.52	0.45		0.45
1	B			(А) вэлА	ac.	3.09	2.22	0.45		3.53		0.83		19.74	11.60			9.16	5.11		2.97
	NG GROI			ngisəG sə	hА				5.76		9.29		10.12			31.34	41.46			55.73	
RE	INEERIF		ţı	nio9 ngisə(	]				-	2	2a	e	3а			4	S			I	7
CO	ENG			Street or Basin		G1.1	G1.2	G1.3		G1.4		G1.5		G1.6	G1.7	(G1.6 & G1.7)	(G1.1 - G1.7)	G1.8a	G1.8b	(G1.1 - G1.8)	G1.9

				Remarks																	
		S	ne	ħ	min																
		ndition	avel IIN	Velocity	ft/sec																
		sed Co	-	ұзбиәт	ft																
	outh	Propo		əzi2 əqi9	.u																
lure)	dows S	Event	ыре	Slope	%																
Procec	<u>0</u> ge Mea	5 - Year		ngisəD Flow	cfs																
<u> Method</u>	<u>100.03</u> Carria	Storm:	set	Street	cfs																
tional <b>N</b>	Job No: Project:	Design	SILE	Slope	%																
ign (Ra				Ø	cfs					5.2	i						7.0				
em Des			KUNOTT	ļ	in/hr					3.39	2						3.70				
e Syste		L 		(A))						1.53	2						1.89				
Drainag			-	ot	min					16.4	5						13.3				
Storm	Ā			Ø	cfs	6.2	50	2	5.2			3.0	5.5		6.7	0.4		2.4	i	0.7	
n SF-2.	d Beasle	Beasley		ļ	in/hr	3.18	3 74		3.38			3.44	3.29		3.73	4.12		3.71		5.17	
rd Forn	<u>Leonar</u> 2016	eonard	ОП	CA		1.94	1 49	2	1.53			0.88	1.67		1.80	0.09		0.64		0.14	
Standa	ted By: lay. 23,	d By: L	ect Kun	ot	min.	18.8	12.9	2	16.4			15.9	17.5		13.1	10.1		13.2		5.0	
	Calcula Date: <u>N</u>	Checke	הו	Runoff Coeff. (C)		0.45	0 45		0.45			0.45	0.45		0.45	0.45		0.45		0.45	
I	e.			(A) k91A	ac.	4.30	3 10	2	3.40			1.95	3.70		4.00	0.21		1.43		0.30	
	NG GROI			ngisəŪ se	ЭлĄ					3.40	2						4.21				
RE	INEERIN		μ	nio9 ngisə(	3	Та				10	2				12a	12b	12	13b		13	
	ENG			Street or Basin		G1.10	G1 11	)	G2.1			G2.2	G2.3		G2.4	G2.5	(G2.4 - G2.5)	G2.6		G2.6a	

CO	RE				Standa	rd Forn	n SF-2.	Storm	Drainac	le Syste	em Des	ign (Ra	tional <b>I</b>	<u> Method</u>	Proced	ure)					
ENGI	NEERI	NG GROI	e l	Calcula Date: N	ited By: 1av. 23.	<u>Leonar</u> 2016	d Beasle	ž				. –	Job No: Project:	<u>100.03</u> Carria	<u>0</u> Je Meac	tows Sc	outh				
				Checke	⇒d By: <u>L</u> i	eonard	Beasley						Design	Storm:	5 - Year	Event,	Propo:	sed Co	ndition	6	
	JL			Dir	ect Run	off				Total F	Runoff		Stre	set		Pipe		Tr	avel Tin	e	
Street or Basin	nio9 ngisə(	ngisəD sə	(A) Area (A)	Runoff Coeff. (C)	ot	CA	ļ	Ø	ot	(AO)	ļ	Ø	Slope	Street Flow	ngisəD Wol٦	Slope	əzi2 əqi9	цîbnəJ	Velocity	ţţ.	Remarks
	]	'nΑ	ac.		min.		in/hr	cfs	min		in/hr	cfs	%	cfs	cfs	%	i	ft	ft/sec	min	
G2.7			2.40	0.45	0.6	1.08	4.29	4.6				1									
(G2.7)	16	2.40							8.9	1.08	4.30	4.6									
G2.8			1.01	0.45	6.2	0.45	4.84	2.2													
G2.9			0.23	0.45	10.4	0.10	4.08	0.4													
(G2.8 - G2.9)	17	1.24							10.4	0.56	4.08	2.3									
G2.10			0.68	0.45	12.5	0.31	3.80	1.2													
(G2.10)	18	0.68							12.5	0.31	3.80	1.2									
(G2.7 - G2.10)	19	4.32							12.5	1.94	3.80	7.4									
G2.11a			1.61	0.45	13.7	0.72	3.66	2.6													
G2.11b			0.64	0.45	11.0	0.29	3.99	1.1													
G2.12a			1.14	0.45	11.0	0.51	3.99	2.0													
G2.12			1.16	0.45	9.6	0.52	4.19	2.2													
G2.13			1.54	0.45	10.3	0.69	4.08	2.8													
(G2.13)	24	1.54							10.3	0.69	4.08	2.8									

			s	Remark																		
		S	D	ħ	min																	
		ndition		Velocity	ft/sec																	
		sed Co		цîbuəJ	ft																	
	outh	, Propo	ə	zi2 əqi9	.Ľ																	
lure)	dows S	Event		Slope	%																	
Proced	<u>30</u> ige Mea	<u>5 - Year</u>		ngisəD Wol٦	cfs																	
Methoc	o: <u>100.00</u> t: <u>Carria</u>	Storm:	בכו	Street Flow	cfs																	
ational	Job No Project	Desigr	ถึ	sqol2	%																	
sign (R				Ø	cfs		43.4			Ċ	۲. 4			6.8	0.0		9.9					
em Des		floor		ļ	in/hr		3.22			co c	3.03 1			3.61	3.61		3.61					
ge Syst		Total I		(A)) ζ			13.50			0.60	0.0Z			1.89	2.51		2.74					
Drainag				ət	min		18.4			C C T	7.7			14.1	14.1		14.1					
Storm	ev			Q	cfs	7.7		1.2	1.2			1.3	5.6			1.0		2.6	1.8	8.7	3.1	9.8
m SF-2.	d Beasl	Beasley		ļ	in/hr	3.74		3.83	4.08			3.77	3.61			4.34		4.43	4.53	3.47	4.51	3.43
ard For	Leonal 2016	eonard		CA		2.07		0.31	0.31			0.33	1.56			0.23		0.59	0.40	2.50	0.69	2.84
Standa	ated By: Aay. 23,	ert By: L	ברו צמו	ət	min.	13.0		12.2	10.3			12.7	14.1			8.7		8.2	7.6	15.5	7.8	15.9
	Calcula Date: <u>N</u>	Checke	<u></u> (:	Runoff (C		0.45		0.45	0.45			0.45	0.45			0.45		0.45	0.45	0.45	06.0	0.45
	E.		(	Area (A)	ac.	4.59		0.69	0.68			0.74	3.46			0.52		1.32	0.89	5.55	0.77	6.32
	NG GRO		U	ıgisəŪ sə	ηA		29.99				1.37			4.20	5.57		6.09					
RE	INEERI		tnic	o9 ngisə0	ן		25			u c	97			27	28		29					
	ENG			Street or Basin		G2.14	G2	G3.1	G3.2		(63.1 - 63.2)	G3.3	G3.4	(G3.3 - G3.4)	(G3.1 - G3.4)	G3.5	G3	G4	G5	G6.1	G6.2	G6

				Remarks																	
		ons	ne	ħ	min																
		Conditi	avel III	Velocity	ft/sec																
		posed (		цîbuəJ	ft																
	outh	int, Pro		əzi2 əqi9	in																
lure)	dows S	ear Eve	Pipe	Slope	%																
Proced	<u>o</u> ge Mea	100 - Ye		ngisəD Wol <del>7</del>	cfs																
Method	: <u>100.03</u> : <u>Carria</u>	Storm:	eet	Street	cfs																
tional I	Job No: Project:	Design	NIL	Slope	%																
ign (Ra				Ø	cfs				29.2		46.5		51.2			151.7	195.9			230.8	
em Des		<del>77</del> ~ ~ ~ ~	KUNOTT	ļ	in/hr				6.76		6.35		6.35			5.48	5.48			5.13	
te Syste		T Leto T		(A))					4.33		7.33		8.07			27.70	35.77			45.01	
Drainac				ət	min				10.7		12.6		12.6			17.8	17.8			20.5	
Storm	<u>V</u>			Ø	cfs	20.7	9.5	1.8		19.0		5.4		111.6	68.9			32.1	15.6		11.8
n SF-2.	d Beasle	Beasley		ļ	in/hr	7.54	7.24	6.75		6.35		7.29		6.43	6.68			5.15	5.17		6.75
rd Forn	<u>Leonar</u> 2016	eonard	ШО	CA		2.75	1.31	0.27		3.00		0.75		17.37	10.32			6.23	3.01		1.75
Standa	ted By: 1ay. 23,	d By: L	ect Kun	ot	min.	7.9	8.8	10.7		12.6		8.7		12.2	11.1			20.3	20.2		10.7
	Calcula Date: <u>N</u>	Checke	הונ	Runoff (C) .1190C		0.89	0.59	0.59		0.85		0.90		0.88	0.89			0.68	0.59		0.59
	6			(A) Area (A)	ac.	3.09	2.22	0.45		3.53		0.83		19.74	11.60			9.16	5.11		2.97
	IG GROI			ea Design	'nΑ				5.76		9.29		10.12			31.34	41.46			55.73	
RE	INEERIN		ţı	nio9 ngisə(	ן				-	2	2a	e	За			4	5			ł	7
CO	ENG			Street or Basin		G1.1	G1.2	G1.3		G1.4		G1.5		G1.6	G1.7	(G1.6 & G1.7)	(G1.1 - G1.7)	G1.8a	G1.8b	(G1.1 - G1.8)	G1.9

				Кетагка															
		ons	Ле	ħ	min														
		Condition	avel lin	Velocity	ft/sec														
		osed (		qĵbuəJ	ft														
	uth	nt, Prop		əzi≳ əqiq	in														
ure)	ows Sc	ar Ever	Pipe	Slope	%														
Procedu	<u>)</u> Je Mead	00 - Ye		Design Wol	cfs														
lethod	<u>100.030</u> Carriac	Storm: 1	iet	Street Flow	cfs														
tional N	Job No: Project:	Design (	Stre	Slope	%														
gn (Rat				Ø	cfs					7 7 7	- - -					15.4			
m Desi		5	unott	ļ	in/hr					E EO	2.0%					6.21			
e Syste		( - -	l otal K	(AD)						500	7.01					2.48			
Drainage				əţ	min					16.1	10.1					13.3			
Storm [	75			Ø	cfs	13.6	1 1 2		11.4			6.6	12.1	14.8	0.9		5.3	1.1	10.2
n SF-2.	d Beasle	Beasley	-	ļ	in/hr	5.34	6.29		5.68			5.77	5.52	6.26	6.92		6.23	6.23	7.21
rd Forr	<u>Leonar</u> 2016	sonard	оĦ	CA		2.54	1 83		2.01			1.15	2.18	2.36	0.12		0.84	0.18	1.42
Standa	ted By: lay. 23,	d By: L	ect Kun	ət	min.	18.8	12.9		16.4			15.9	17.5	13.1	10.1		13.2	13.2	9.0
	Calcula Date: <u>N</u>	Checke	בונ	Runoff (C) .ft90C		0.59	0.59		0.59			0.59	0.59	0.59	0.59		0.59	0.59	0.59
1	<u>م</u>			(A) ธ9าA	ac.	4.30	3.10		3.40			1.95	3.70	4.00	0.21		1.43	0.30	2.40
	IG GROL			ngisəO sə	nA					3 40	0.40					4.21			
RE	INEERIN		ţı	nio9 ngisə(	]	7a				0	2	14	14a	12a	12b	12	13b	13	
CO	ENGI			Street or Basin		G1.10	G111		G2.1			G2.2	G2.3	G2.4	G2.5	(G2.4 - G2.5)	G2.6	G2.6a	G2.7

			Кетагка	_															
		ons Je	р Н	min															
		sondition avel Tin	Velocity	ft/sec															
		Desed C	цĵbuәл	ft															
	uth	it, Prop	Pipe Size	in															
ure)	ows Sc	ar <b>Ever</b> Pipe	adol2	%															
Proced	<u>)</u> Je Mead	00 - Ye	ngisəD Wol٦	cfs															
lethod	<u>100.03(</u> Carriac	storm: 1 tet	Street Flow	cfs															
tional N	Job No: Project:	Jesign ; Stre	ədol2	%															
gn (Rat	,		σ	cfs	10.2			5.0		2.6	16.2							6.2	
m Desi		unoff	!	in/hr	7.23			6.85		6.37	6.37							6.85	
e Syste		Total R	(AD) ζ		1.42			0.73		0.40	2.55							0.91	
rainage			ət	min	8.9			10.4		12.5	12.5							10.3	
Storm D	A		g	cfs		4.8	6.0		2.6			5.8	2.5	4.5	4.8		6.2		17.0
n SF-2. (	l Beasle	seasiey	ļ	in/hr		8.12	6.85		6.37			6.14	6.69	6.69	7.04		6.85		6.28
d Forn	<u>Leonarc</u> 2016	sonard t off	CA			09.0	0.14		0.40			0.95	0.38	0.67	0.68		0.91		2.71
Standa	ed By: ay. 23,	a By: Le ect Rune	tc.	min.		6.2	10.4		12.5			13.7	11.0	11.0	9.6		10.3		13.0
	Calculat Date: <u>M</u>	Dire	Runoff (C) .iteoC			0.59	0.59		0.59			0.59	0.59	0.59	0.59		0.59		0.59
1	<u>د</u>		(A) Area (A)	ac.		1.01	0.23		0.68			1.61	0.64	1.14	1.16		1.54		4.59
	g grou		ngisəO se	ыA	2.40			1.24		0.68	4.32							1.54	
RE	NEERIN		tnio9 ngise	3	16			17		18	19							24	
	ENGI		Street or Basin		(G2.7)	G2.8	G2.9	(G2.8 - G2.9)	G2.10	(G2.10)	(G2.7 - G2.10)	G2.11a	G2.11b	G2.12a	G2.12b		G2.13	(G2.13)	G2.14

3 of 4

P:\100\100.030\Drainage\100.030-PDR

				Remarks																		
		ons	ne	ħ	min																	
		Conditi	avel III	Velocity	ft/sec																	
		posed (	_	цîbuəJ	ft																	
	outh	nt,  Pro		əzi2 əqi9	.u																	
lure)	dows S	<u>ear Eve</u>	Pipe	Slope	%																	
Procec	<u>0</u> ge Mea	<u>100 - Y</u> €		Design Flow	cfs																	
Method	<u>100.03</u> Carria	Storm:	eet	Street	cfs																	
tional <b>N</b>	Job No: Project:	Design	Stre	Slope	%																	
ign (Ra				Ø	cfs	95.6			5.2				0.01	19.9		21.8						
em Des		5	Kunott	ļ	in/hr	5.40			6.43			90.9	00	6.06		6.06						
te Syste		-	I otal F	(A))		17.69			0.81			07 0	z.40	3.29		3.59						
Drainac				ət	min	18.4			12.2			7 7 7		14.1		14.14						
Storm	<u>V</u>			Ø	cfs		2.6	2.7		2.8	12.4				2.2		5.8	4.0	19.1	5.6	21.5	
n SF-2.	d Beasl	Beasley		ļ	in/hr		6.43	6.85		6.32	6.06				7.29		7.44	7.61	5.83	7.57	5.77	
rd Forr	Leonar 2016	eonard	ott	CA			0.41	0.40		0.44	2.04				0.31		0.78	0.53	3.27	0.74	3.73	
Standa	ited By: lay. 23,	<u>sd By: L</u>	ect Kun	ət	min.		12.2	10.3		12.7	14.1				8.7		8.2	7.6	15.5	7.8	15.9	
	Calcula Date: <u>N</u>	Checke	חו	Runoff (C) .1190C			0.59	0.59		0.59	0.59				0.59		0.59	0.59	0.59	0.96	0.59	
	9			(A) Area (A)	ac.		0.69	0.68		0.74	3.46				0.52		1.32	0.89	5.55	0.77	6.32	
	NG GROI			ngisəD sə	٦A	29.99			1.37				4.20	5.57		6.09						
RE	INEERI		ţu	nio9 ngisə(	ן	25			26			ľ	77	28		29						
CC	ENG			Street or Basin		G2	G3.1	G3.2	(G3.1 - G3.2)	G3.3	G3.4		(പാ.3 - പാ.4)	(G3.1 - G3.4)	G3.5	G3	G4	G5	G6.1	G6.2	G6	

	(				Standard	Form SF-	-1. Time c	of Concent	tration-Pro	oposed					
$\mathbf{\mathbf{\Theta}}$			ING GR(	OUP	Calculatec Date: <u>May</u> Checked B	1 By: <u>Leor</u> 23, 2016 3v: Leonal	<u>ard Beas</u> rd Beaslev				Job No: <u>1</u> ( Project: <u>C</u>	<u>00.030</u> arriage Me	adows Soutl	c	
	Sub-Ba	sin Data		lni	tial Overlar	Time (1	E)		Tre	avel Time (	(tt)		tc Check Ba	(urbanized eine)	Final tc
BASIN or DESIGN	C	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	% (S) %	VELOCITY (V) ft/sec	<b>T</b> i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	<b>L</b> t minutes	Computed tC Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended tc=ti+tt (min)
G1.1	0.81	3.09	20.0	44.00	18.41%	0.55	1.33	735.00	0.88%	1.88	6.53	7.86	779.00	14.33	7.86
G1.2	0.45	2.22	7.0	71.00	16.90%	0.30	3.89	143.00	1.75%	0.93	2.57				
			20.0					253.00	0.79%	1.78	2.37	8.84	467.00	12.59	8.84
G1.3	0.45	2.40	20.0	100.00	2.40%	0.19	8.82	178.00	0.60%	1.55	1.91	10.74	278.00	11.54	10.74
G1.4	0.77	3.53	7.0	100.00	4.60%	0.46	3.61	86.00	1.16%	0.75	1.90				
			20.0					800.00	0.88%	1.88	7.11	12.62	986.00	15.48	12.62
G1.5	0.83	0.83	20.0	23.00	3.04%	0.24	1.63	812.00	0.92%	1.92	7.05	8.68	835.00	14.64	8.68
G1.6	0.81	19.74	20.0	100.00	1.00%	0.32	5.24	855.00	1.53%	2.47	5.76				
			34"x53"					317.00	0.50%	4.28	1.24	12.23	1272.00	17.07	12.23
G1.7	0.82	15.02	20.0	63.00	9.52%	0.55	1.91	530.00	1.32%	2.30	3.84				
			15.0					485.00	1.03%	1.52	5.31	11.07	1078.00	15.99	11.07
DP-4	0.82	34.76	20.0	100.00	1.00%	0.33	5.06	855.00	1.53%	2.47	5.76				
			34"x53"					317.00	0.50%	4.28	1.24				
			20.0					755.00	1.19%	2.18	5.77	17.82	2027.00	21.26	17.82
G1.8a	0.52	9.16	15.0	90.06	1.67%	0.18	8.39	1157.00	1.10%	1.57	12.26				
			7.0					27.00	31.89%	3.95	0.11				
			15.0					584.00	0.40%	0.95	10.26	31.02	1858.00	20.32	20.32

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					Standard	Form SF-	1. Time c	of Concent	tration-Pro	oposed					
$\Theta$		INEER	ING GR	OUP	Calculated Date: <u>May</u> Checked B	l By: <u>Leon</u> 23, 2016 y: Leonar	ard Beasl d Beasley				Job No: <u>1</u> ( Project: <u>C</u>	<u> 20.030</u> 2arriage Me	adows South	c	
	Sub-Ba:	sin Data		Ini	tial Overlan	d Time (t	(1.		Tre	avel Time (	tı)		tc Check Ba	(urbanized sins)	Final tc
BASIN or DESIGN	C	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	% (S) %	VELOCITY (V) ft/sec	<b>T</b> i minutes	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	<b>L</b> t minutes	Computed tC Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended tc=ti+tt (min)
G1.8b	0.45	5.11	20.0	68.00	1.78%	0.14	8.03	127.00	3.15%	3.55	0.60				
			15.0					1633.00	1.41%	1.78	15.28	23.91	1828.00	20.16	20.16
DP-6	0.82	34.76	20.0	100.00	1.00%	0.33	5.06	855.00	1.53%	2.47	5.76				
			34"x53"					317.00	0.50%	4.28	1.23				
			20.0					883.00	2.50%	3.16	4.65				
			48"					508.00	0.68%	9.41	06.0				
			Chnl					847.00	0.30%	4.92	2.87	20.47	3510.00	29.50	20.47
G1.9	0.45	2.97	20.0	45.00	2.43%	0.13	5.89	1317.00	0.62%	1.57	13.94	19.83	1362.00	17.57	17.57
G1.10	0.45	5.04	20.0	100.00	2.30%	0.19	8.95	1483.00	0.68%	1.65	14.99	23.94	1583.00	18.79	18.79
G1.11	0.45	3.10	7.0	67.00	1.49%	0.13	8.42	458.00	2.62%	1.13	6.74	15.16	525.00	12.92	12.92
G1	0.72	69.69	20.0	100.00	1.00%	0.24	6.86	3081.00	3.80%	3.90	13.17	20.03	3181.00	27.67	20.03
G2.1	0.45	3.95	7.0	81.00	1.73%	0.15	8.81	56.00	2.14%	1.02	0.91				
			20.0					1020.00	0.76%	1.74	9.75	19.48	1157.00	16.43	16.43
G2.2	0.45	1.40	20.0	42.00	1.33%	0.10	6.92	1015.00	0.83%	1.82	9.28	16.21	1057.00	15.87	15.87
G2.3	0.45	3.04	20.0	97.00	2.47%	0.19	8.58	1254.00	0.73%	1.71	12.23	20.81	1351.00	17.51	17.51
G2.4	0.45	4.00	7.0	71.00	15.49%	0.30	4.00	141.00	1.49%	0.85	2.75				
			20.0					687.00	0.82%	1.81	6.32	13.08	899.00	14.99	13.08

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		Final t <sub>c</sub>	USDCM tecommended c=ti+tt (min)	10.06	13.21	8.97	6.63	10.35	12.48	13.51	10.94	11.02	9.65		10.33		12.95	12.19	10.34	12.74
		rbanized	Regional tc c=(L/180)+10 minutes t	10.74	13.21	12.57	10.34	11.23	12.48	13.51	10.94	13.25	12.39		11.02		12.95	12.69	13.40	12.74
	adows South	tc Check (u Basir	TOTAL LENGTH ti (L) feet	134.00	577.00	462.00	60.95	222.00	446.00	631.00	170.00	585.00	430.00		184.00		531.00	485.00	612.00	494.00
	<u>00.030</u> arriage Mea		Computed tC Minutes	10.06	13.43	8.97	6.63	10.35	12.84	13.74	7.89	11.02	9.65		10.33		21.28	12.19	10.34	16.57
	Job No: <u>1(</u> Project: <u>C</u>	tt)	<b>T</b> t minutes	0.61	5.51	3.22	0.05	1.34	3.77	5.96	1.29	6.35	4.54	3.59	0.35	0.25	13.06	3.48	5.23	3.80
posed		avel Time (	VELOCITY (V) ft/sec	1.55	1.52	2.16	1.92	1.71	1.66	1.55	1.55	1.47	1.47	1.60	8.76	3.01	0.49	1.92	1.85	1.87
tration-Pro		Tra	SLOPE (S) %	0.60%	0.58%	1.17%	0.92%	0.73%	0.69%	0.60%	0.60%	0.54%	0.54%	0.64%	2.17%	18.48%	0.50%	0.92%	0.86%	0.87%
of Concent	ev ev		LENGTH (L) feet	57.00	504.00	418.00	5.95	137.00	376.00	554.00	120.00	560.00	400.00	345.00	184.00	46.00	388.00	401.00	582.00	425.00
-1. Time c	nard Beasl rrd Beasley	ti)	<b>T</b> i minutes	9.44	7.91	5.75	6.58	9.01	9.07	7.78	6.60	4.67	5.11	6.39		7.97		8.70	5.11	12.78
Form SF	d By: <u>Leor</u> <u>v 23, 2016</u> By: <u>Leona</u>	nd Time (	VELOCITY (V) ft/sec	0.14	0.15	0.13	0.14	0.16	0.13	0.16	0.13	0.09	0.10	0.11		0.20		0.16	0.10	0.09
Standard	Calculate Date: <u>Ma</u> Checked	tial Overla	% (S) %	1.30%	2.05%	2.50%	2.36%	1.76%	1.29%	2.34%	2.00%	2.00%	2.00%	1.82%		3.09%		1.90%	2.00%	2.17%
	OUP		LENGTH (L) feet	77.00	73.00	44.00	55.00	85.00	70.00	77.00	50.00	25.00	30.00	44.00		97.00		84.00	30.00	69.00
	ING GR		NRCS Convey.	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	18"	7.0	7.0	20.0	20.0	20.0
3 a c	SINEER	asin Data	AREA (A) acres	0.21	1.43	2.40	1.01	0.23	0.68	1.61	0.64	1.14	1.16	1.54		4.59		0.69	0.68	0.74
Č	ENC	Sub-Bá	C	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45		0.45		0.45	0.45	0.00
	9		BASIN or DESIGN	G2.5	G2.6	G2.7	G2.8	G2.9	G2.10	G2.11a	G2.11b	G2.12a	G2.12b	G2.13		G2.14		G3.1	G3.2	G3.3

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					Standard	Form SF-	1. Time o	of Concent	ration-Pro	oposed					
$\Theta$		<b>INEER</b>	ING GR	ano	Calculated	4 By: Leon	ard Beasl	νθ			Job No: 10	030			
			)		Date: <u>May</u>	, 23, 2016		5			Project: C	arriage Me	adows South		
					Checked I	By: <u>Leona</u> l	<u>'d Beasley</u>	7				I			
	Sub-Bas	sin Data		ici	tial Overla	nd Time (t	(i:		Tre	avel Time (	tı)		tc Check Ba	(urbanized sins)	Final tc
BASIN or DESIGN	C	AREA (A) acres	NRCS Convey.	LENGTH (L) feet	SLOPE (S) %	VELOCITY (V) ft/sec	<b>t</b> i minutes	LENGTH (L) feet	% (S) %	VELOCITY (V) ft/sec	<b>t</b> t minutes	Computed tC Minutes	TOTAL LENGTH (L) feet	Regional tc tc=(L/180)+10 minutes	USDCM Recommended tc=ti+tt (min)
G3.4	0.45	3.46	7.0	36.00	16.67%	0.22	2.78	318.00	3.77%	1.36	3.90				
			20.0					796.00	0.79%	1.78	7.46	14.14	1150.00	16.39	14.14
G3.5	0.45	0.52	7.0	85.00	8.47%	0.27	5.35	106.00	0.57%	0.53	3.34	8.69	191.00	11.06	8.69
G4	0.45	1.32	7.0	86.00	2.56%	0.18	7.98	33.00	15.15%	2.72	0.20	8.18	119.00	10.66	8.18
G5	0.45	0.89	7.0	45.00	3.33%	0.14	5.29	143.00	2.10%	1.01	2.35	7.64	188.00	11.04	7.64
G6.1	0.45	5.55	15.0	86.00	3.26%	0.19	7.37	900.006	0.70%	1.25	11.95	19.32	986.00	15.48	15.48
G6.2	0.90	0.77	20.0	30.00	1.67%	0.30	1.67	696.00	0.90%	1.90	6.11	7.78	726.00	14.03	7.78
GG	0.45	6.32	15.0	86.00	3.26%	0.19	7.37	975.00	0.70%	1.25	12.95	20.32	1061.00	15.89	15.89

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CORE ENGINEERING GROUP

15004 1st Avenue South Burnsville, MN 55306

PROJECT NAME: Carriage Meadows South PROJECT NUMBER: 100.030 ENGINEER: LAB DATE: February 18, 2016

Preliminary Drainage Plan PROPOSED CONDITIONS COEFFICIENT "C" CALCULATIONS

BASIN	Soil No.	Hydro Group	Area	Cover (%)	C5	Wtd. C5	C100	Wtd. C100	Impervious	Type of Cover
G1.4		A/B	2.53	71.67%	0.81	0.58	0.88	0.63	95.0%	Commercial
		C/D	0.60	17.00%	0.82	0.14	0.89	0.15	95.0%	Commercial
		A/B	0.40	11.33%	0.45	0.05	0.59	0.07	65.0%	Proposed Residential
			3.53	100.00%		0.77		0.85		
G1.5		A-D	0.71	85.54%	0.90	0.77	0.95	0.81	95.0%	Carriage Meadows Dr.
		В	0.12	14.46%	0.45	0.07	0.59	0.09	65.0%	Proposed Residential
			0.83	100.00%		0.83		0.90		
G1.6		A	15.35	77.76%	0.81	0.63	0.88	0.68	95.0%	Commercial
		С	4.39	22.24%	0.82	0.18	0.89	0.20	95.0%	Commercial
			19.74	100.00%		0.81		0.88		
G1.7		С	10.46	90.17%	0.82	0.74	0.89	0.80	95.0%	Commercial
		В	1.14	9.83%	0.81	0.08	0.88	0.09	95.0%	Commercial
			11.60	100.00%		0.82		0.89		
G1.8a		С	1.35	14.74%	0.82	0.12	0.89	0.13	95.0%	Commercial
		В	1.17	12.77%	0.81	0.10	0.88	0.11	95.0%	Commercial
		С	1.57	17.14%	0.90	0.15	0.96	0.16	100.0%	Pavement
		С	1.57	17.14%	0.15	0.03	0.50	0.09	0.0%	Roadside Swale
		В	0.17	1.86%	0.90	0.02	0.96	0.02	100.0%	Pavement
		В	0.16	1.75%	0.08	0.01	0.35	0.01	0.0%	Roadside Swale
		В	1.67	18.23%	0.08	0.01	0.35	0.06	0.0%	Lawn
		В	1.50	16.38%	0.45	0.07	0.59	0.10	65.0%	Proposed Residential
			9.16	100.00%		0.52		0.68		

Land Use or Surface	Percent						Runoff Co	oefficients					
Characteristics	Impervious	2-1	ear	5-y	ear	10-1	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	0.45	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	0.57	0.47	0.50
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.45	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	0.40	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	0.45	0.35	0.51
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	45												
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

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

## 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.



# **Culvert Report**

Hydraflow Express by Intelisolve

## G1 side 48-inch Interconnection Emergency Overflow

Invert Elev Dn (ft)	= 5684.00	Calculations	
Pipe Length (ft)	= 320.00	Qmin (cfs)	= 50.00
Slope (%)	= 0.40	Qmax (cfs)	= 120.00
Invert Elev Up (ft)	= 5685.28	Tailwater Elev (ft)	= (dc+D)/2
Rise (in)	= 48.0		
Shape	= Cir	Highlighted	
Span (in)	= 48.0	Qtotal (cfs)	= 113.00
No. Barrels	= 1	Qpipe (cfs)	= 113.00
n-Value	= 0.013	Qovertop (cfs)	= 0.00
Inlet Edge	= Projecting	Veloc Dn (ft/s)	= 10.03
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.5	Veloc Up (ft/s)	= 9.55
		HGL Dn (ft)	= 5687.57
Embankment		HGL Up (ft)	= 5689.60
Top Elevation (ft)	= 5692.00	Hw Elev (ft)	= 5690.60

Hw/D (ft)

Flow Regime

Top Elevation (ft) Top Width (ft) Crest Width (ft)

Elev (ft)

= 5692.00= 100.00= 50.00



= Inlet Control

= 1.33



# 4FT WIDE CURB CHASE AT LORSON BLVD AND MARKSHEFFEL

Rectangular		Highlighted	
Botom Width (ft)	= 4.00	Depth (ft)	= 0.50
Total Depth (ft)	= 0.50	Q (cfs)	= 15.20
• • • •		Area (sqft)	= 2.00
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 7.60
Slope (%)	= 1.50	Wetted Perim (ft)	= 5.00
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.50
		Top Width (ft)	= 4.00
Calculations		EĠL (ft)	= 1.40
Compute by:	Known Depth		
Known Depth (ft)	= 0.50		



Monday, Feb 20 2017, 10:6 AM

# Galpin Emergency Overflow to Lorson Blvd.

Trapezoidal		Highlighted	
Botom Width (ft)	= 8.00	Depth (ft)	= 0.77
Side Slope (z:1)	= 4.00	Q (cfs)	= 40.00
Total Depth (ft)	= 1.00	Area (sqft)	= 8.53
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 4.69
Slope (%)	= 1.20	Wetted Perim (ft)	= 14.35
N-Value	= 0.024	Crit Depth, Yc (ft)	= 0.80
		Top Width (ft)	= 14.16
Calculations		EGL (ft)	= 1.11
Compute by:	Known Q		
Known Q (cfs)	= 40.00		



Saturday, Feb 18 2017, 7:31 AM

# Rubicon Emergency Overflow to Lorson Blvd.

Trapezoidal		Highlighted	
Botom Width (ft)	= 12.00	Depth (ft)	= 1.00
Side Slope (z:1)	= 4.00	Q (cfs)	= 111.31
Total Depth (ft)	= 1.00	Area (sqft)	= 16.00
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 6.96
Slope (%)	= 1.20	Wetted Perim (ft)	= 20.25
N-Value	= 0.020	Crit Depth, Yc (ft)	= 1.00
		Top Width (ft)	= 20.00
Calculations		EGL (ft)	= 1.75
Compute by:	Known Depth		
Known Depth (ft)	= 1.00		



# Interim Swale at Interim Pond G1.7

Trapezoidal		Highlighted	
Botom Width (ft)	= 5.00	Depth (ft)	= 2.36
Side Slope (z:1)	= 3.00	Q (cfs)	= 152.00
Total Depth (ft)	= 3.00	Area (sqft)	= 28.51
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 5.33
Slope (%)	= 0.50	Wetted Perim (ft)	= 19.93
N-Value	= 0.025	Crit Depth, Yc (ft)	= 2.08
		Top Width (ft)	= 19.16
Calculations		EGL (ft)	= 2.80
Compute by:	Known Q		
Known Q (cfs)	= 152.00		



Wednesday, Feb 22 2017, 8:6 AM

# Simcoe Emergency Overflow to Pond G2

Triangular		Highlighted	
Side Slope (z:1)	= 6.00	Depth (ft)	= 0.73
Total Depth (ft)	= 1.00	Q (cfs)	= 10.00
		Area (sqft)	= 3.20
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 3.13
Slope (%)	= 1.00	Wetted Perim (ft)	= 8.88
N-Value	= 0.024	Crit Depth, Yc (ft)	= 0.71
		Top Width (ft)	= 8.76
Calculations		EGL (ft)	= 0.88
Compute by:	Known Q		
Known Q (cfs)	= 10.00		



Project = Iniet ID =

# Carriage Meadows South #100.030 Inlet DP-2 (G1.4) Lo (C) H-Curb H-Vert Wp Lo (G)

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 <sub>local</sub> =	3.00	1.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.1	8.0	inches
Grate Information		MINOR	MAJOR	[] Override Depths
Length of a Unit Grate	L <sub>o</sub> (G) =	N/A	1659	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	DUNK	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	1920A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>1</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	Set Ac	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	147.9	1
Curb Opening Information		MINOR	MAJOR	-
Length of a Unit Curb Opening	L <sub>6</sub> (C) =	15.00	15/00	feet
Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	0.00	inches
Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	0.03	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	82.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	3.01	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C <sub>1</sub> (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	1.80	
Curb Opening Onfice Coefficient (typical value 0.60 - 0.70)	C <sub>0</sub> (C) =	0.67	0.82	-
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	7
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 <sub>wi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>eep</sub> =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>oe</sub> =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	7
Clogging Factor for Multiple Units	Clog =	0.04	0.04	1
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	-
Interception without Clogging	Q <sub>wi</sub> =	10.83	21.18	cfs
Interception with Clogging	Q <sub>via</sub> =	10.36	20.25	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q <sub>oi</sub> =	29.58	33.57	cfs
Interception with Clogging	Q <sub>os</sub> =	28.29	32.11	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q <sub>mi</sub> =	16.65	24.80	cfs
Interception with Clogging	Q <sub>ma</sub> =	15.92	23.72	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	10.36	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 =	19.3	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.5	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> = [	10.4	20.3	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q PEAK REQUIRED =	10.3	19.0	cfs

Project = Inlet ID =

Carriage Meadows South #100.030



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type	R Curb Opening	7
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a <sub>koal</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1		
Nater Depth at Flowline (outside of local depression)	Ponding Depth =	6.1	8.0	inches
Grate Information	2 A L	MINOR	MAJOR	<ul> <li>Override Depth</li> </ul>
ength of a Unit Grate	L <sub>o</sub> (G) =	N/A	N/IA	feet
Nidth of a Unit Grate	W <sub>0</sub> =	N/A	100	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratic</sub> =	N/A		
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>r</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	100	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	Patrice .	-
Curb Opening Information		MINOR	MAJOR	_
ength of a Unit Curb Opening	L <sub>0</sub> (C) =	5.00	1.00	feet
leight of Vertical Curb Opening in Inches	H <sub>watt</sub> =	6.00	5.00	inches
Height of Curb Orifice Throat in Inches	Hataran =	6.00	6.03	inches
Angle of Throat (see LISDCM Figure ST-5)	Thata -	63.40	20.00	degreen
Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>-</sub> =	2.00	1000	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_{r}(C) =$	0.10	0.10	
Surb Opening Weir Coefficient (typical value 2.3-3.7)	$G_{-}(C) =$	3.60	0.10	-
Curb Opening Ordice Coefficient (bridal value 0.60 - 0.70)	C, (C) =	0.67	0.00	-
Grate Flow Analysis (Calculated)	0000	MINOR	MAIOR	
Contine Conficient for Multiple Unite	Conta	NINOR	NUA	7
Nogen Coefficient for Multiple Units	Clear =	N/A	N/A	-
Grate Canacity as a Weir (based on LIDECD - CSU 2010 Study)	Ciug -	MINOR	MALOR	
ntercention without Clogging	0.=[	NINOR	NAJOR	Tata
nterception with Cleaning	Q	NIA	N/A	crs
Proto Canacity as a Orifice /based on UDECD _ CSU 2010 Study)	Q <sub>wa</sub> - [	N/A	N/A	CTS
state capacity as a Office (based on ODFCD - CSO 2010 Study)	o -F	MINOR	MAJOR	
nterception with Cleaning	Q <sub>0</sub> -	N/A	N/A	CTS
Interception with Clogging	Cu <sub>cia</sub> =	N/A	N/A	cts
Grate Capacity as Mixed Flow		MINOR	MAJOR	7
nterception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
nterception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	7
Jogging 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	
nterception without Clogging	Q <sub>vit</sub> =	6.29	10.97	cfs
nterception with Clogging	Q <sub>vm</sub> =	5.66	9.87	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	-
nterception without Clogging	Q <sub>ci</sub> =	9.86	11.19	cfs
nterception with Clogging	Q <sub>os</sub> =	8.87	10.07	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	-
nterception without Clogging	Q <sub>mi</sub> =	7.33	10.30	cfs
nterception with Clogging	Q <sub>ma</sub> =	6.59	9.27	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	5.66	9.27	cfs
Resultant Street Conditions		MINOR	MAJOR	-
otal Inlet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on sheet Q-Allow geometry)	T =	19.3	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.5	2.4	inches
		MINOR	MAJOR	
fotal Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	5.7	9.3	cfs
nlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q PEAK REQUIRED =	3.0	5.4	cfs

Project = Inlet ID =

# Carriage Meadows South #100.030

Lo (C) H-Curb W W Lo (G)

Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type F	Curb Opening	
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a <sub>local</sub> =	3.00	12.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.5	8.0	inches
Grate Information		MINOR	MAJOR	<ul> <li>Override Depths</li> </ul>
Length of a Unit Grate	L <sub>0</sub> (G) =	N/A	7654	feet
Width of a Unit Grate	W <sub>0</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	1015	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	1
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	1974	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	1019	1
Curb Opening Information		MINOR	MAJOR	-
Length of a Unit Curb Opening	L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H <sub>ment</sub> =	6.00	8.00	inches
Height of Curb Orifice Throat in Inches	Harrow =	6.00	16.60	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	82.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>e</sub> =	2 00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C <sub>r</sub> (C) =	0.10	0.10	liber
Curb Opening Weir Coefficient (whice) value 2 3-3 7)	$C_{(C)} =$	3.60	0.10	-
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{\rm w}(0) =$	0.67		-
Grate Flow Analysis (Calculated)	0,00	MINOR	MAIOR	
Clonging Coefficient for Multiple Units	Conf	MINOR	MAJOR N/A	1
Clogging Coshidan for Multiple Units	Clear =	NIA	N/A	-
Grate Capacity as a Weir (based on LIDECD - CSU 2010 Study)	Clog -	MINOR	MAIOR	1
Intercention without Clogging	0[	MINOR	MAJOR	
Interception with Clogging	0 -	NA	N/A	cis
Grete Capacity as a Orifice (based on LIDECD CSII 2010 Study)	Given -	NA	N/A	cis
Grate Capacity as a Ornice (based on ODPCD - CSO 2010 Study)	0 -1	MINOR	MAJOR	٦.
Interception with Clogging	Q <sub>oi</sub> =	N/A	N/A	cis
Interception with Clogging	Q <sub>os</sub> =	N/A	N/A	cts
Grate Capacity as Mixed Flow	0 -	MINOR	MAJOR	1.
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cts
Resulting Crate Consolity (assumes classed condition)	Q <sub>ma</sub> =	N/A	N/A	cfs
	Grate -	NIA	N/A	cts
Curb Opening Flow Analysis (Calculated)	2 A 1	MINOR	MAJOR	1
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)	0	MINOR	MAJOR	1
Interception without Clogging	Q <sub>wi</sub> =	6.99	17.34	cfs
Interception with Clogging	Q <sub>we</sub> =	6.56	16.26	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q <sub>oi</sub> =	18.72	22.38	CTS
Interception with Clogging	Q <sub>css</sub> =	17.55	20.98	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	-
Interception without Clogging	Q <sub>mi</sub> =	10.64	18.32	cfs
Interception with Clogging	Q <sub>ma</sub> =	9.98	17.18	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	6.56	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 =	16.6	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.0	2.4	inches
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	$Q_a =$	6.6	16.3	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q PEAK REQUIRED =	5.4	11.8	cfs

Project =

#### Carriage Meadows South #100.030 Inlet DP-7a (G1.10) Lo (C) H-Curb H-Vert Wo WF W Lo (G) Design Information (Input) MINOR MAJOR CDOT Type R Curb Opening Type of Inlet Inlet Type : Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow') 3.00 ama inches Number of Unit Inlets (Grate or Curb Opening) No Water Depth at Flowline (outside of local depression) inches Override Depths Ponding Depth = 6.5 8.0 Grate Information MINOR MAJOR Length of a Unit Grate L<sub>0</sub> (G) = N/A ef Width of a Unit Grate W. N/A ini Area Opening Ratio for a Grate (typical values 0.15-0.90) Auto N/A Clogging Factor for a Single Grate (typical value 0.50 - 0.70) C, (G) = N/A N/A Grate Weir Coefficient (typical value 2.15 - 3.60) C<sub>w</sub> (G) N/A Grate Orifice Coefficient (typical value 0.60 - 0.80) $C_{0}(G) =$ N/A Curb Opening Information MINOR MAJOR Length of a Unit Curb Opening L (C) : 10.00 eet leight of Vertical Curb Opening in Inches 6.00 inches Hunt leight of Curb Orifice Throat in Inches Henry 6.00 inches Angle of Throat (see USDCM Figure ST-5) Theta 63.40 degrees Side Width for Depression Pan (typically the gutter width of 2 feet) W<sub>n</sub> 2.00 feet Clogging Factor for a Single Curb Opening (typical value 0.10) Cr (C) 0.10 0.10 Curb Opening Weir Coefficient (typical value 2.3-3.7) C, (C) 3.60 Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) C. (C) = 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 nterception without Clogging Que N/A N/A cfs Interception with Clogging Q\_\_\_\_ N/A N/A cfs Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study) MINOR MAJOR Interception without Clogging Qoi N/A N/A cfs Interception with Clogging 0 N/A N/A cfs Grate Capacity as Mixed Flow MINOR MAJOR Interception without Clogging Qmi N/A N/A cfs nterception with Clogging Qma N/A N/A cfs Resulting Grate Capacity (assumes clogged condition) Queste 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 Qui 10.72 17.34 cfs Interception with Clogging Q 10.05 16.26 cfs Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study) MINOR MAJOR Interception without Clogging Qai 20.22 22.38 cfs Interception with Clogging Q .... 18.96 20.98 cfs Curb Opening Capacity as Mixed Flow MINOR MAJOR Interception without Clogging Qmi 13.69 18.32 cfs Interception with Clogging Qms 12.84 17.18 cfs Resulting Curb Opening Capacity (assumes clogged condition) Quet cfs 10.05 16.26 **Resultant Street Conditions** MINOR MAJOR Total Inlet Length 1.4 10.00 10.00 feet Resultant Street Flow Spread (based on sheet Q-Allow geometry) ft.>T-Crown Т 20.7 27.0 Resultant Flow Depth at Street Crown d<sub>CROWN</sub> 3 0.9 2.4 inches MINOR MAJOR Total Inlet Interception Capacity (assumes clogged condition) Q<sub>a</sub> = 10.1 16.3 cfs

Q PEAK REQUIRED

72

15.9

cfs

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

#### INLET ON A CONTINUOUS GRADE

Carriage Meadows South #100.030 Inlet DP-10 (G2.1)

Project: Inlet ID:



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 <sub>LOCAL</sub> =	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 <sub>o</sub> =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W <sub>o</sub> =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C <sub>f</sub> -G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C <sub>f</sub> -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)	<b>Q</b> <sub>o</sub> =	5.2	11.4	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 <sub>MAX</sub> )	d <sub>CROWN</sub> =	0.0	0.8	inches
Ratio of Gutter Flow to Design Flow	E <sub>o</sub> =	0.406	0.296	
Discharge outside the Gutter Section W, carried in Section T <sub>x</sub>	Q <sub>x</sub> =	3.1	8.0	cfs
Discharge within the Gutter Section W	Q <sub>w</sub> =	2.1	3.4	cfs
Discharge Behind the Curb Face	Q <sub>BACK</sub> =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A <sub>W</sub> =	2.28	4.10	sq ft
Velocity within the Gutter Section W	V <sub>W</sub> =	2.3	2.8	fps
Water Depth for Design Condition	d <sub>LOCAL</sub> =	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 <sub>o-GRATE</sub> =	N/A	N/A	1
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V., =	N/A	N/A	fps
Interception Rate of Frontal Flow	R <sub>f</sub> =	N/A	N/A	1
Interception Rate of Side Flow	R <sub>x</sub> =	N/A	N/A	1
Interception Capacity	Q <sub>i</sub> =	N/A	N/A	cfs
Under Clogging Condition	· •	MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	٦
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	-
Effective (uncloaged) Length of Multiple-unit Grate Inlet	L. =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V <sub>o</sub> =	N/A	N/A	fps
Interception Rate of Frontal Flow	R <sub>f</sub> =	N/A	N/A	-1
Interception Rate of Side Flow	R. =	N/A	N/A	-
Actual Interception Capacity	Q. =	N/A	N/A	cfs
<b>Carry-Over Flow</b> = $\mathbf{Q}_{0}$ - $\mathbf{Q}_{a}$ (to be applied to curb opening or next d/s inlet)	Q <sub>b</sub> =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)	U.	MINOR	MAJOR	
Equivalent Slope S <sub>e</sub> (based on grate carry-over)	S. =	0.096	0.076	ft/ft
Required Length $L_T$ to Have 100% Interception	 L - =	12.19	20.33	ft
Under No-Clogging Condition	· •	MINOR	MAJOR	_
Effective Length of Curb Opening or Slotted Inlet (minimum of L. L <sub>T</sub> )	L =	10.00	10.00	ft
Interception Capacity	Q: =	5.0	8.0	cfs
Under Clogging Condition	-4	MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	٦
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	1
Effective (Uncloaded) Length	L. =	8.75	8.75	ft
Actual Interception Capacity	 Q_ =	4.9	77	cfs
Carry-Over Flow = $Q_{h/gRATE}$ -Q		0.3	3.7	cfs
Summary	-0-	MINOR	MAJOR	1
Total Interception Capacity	٦- ٥	4.86	7.72	cfs
Total Inlet Carry-Over Flow (flow hynassing inlet)	o, _	0.3	37	cfs
Capture Percentage = $Q_{-}/Q_{-}$ =	C% _	0.0	5.7 69	%
	<b>0</b> % =	30	00	/0
Project = Inlet ID =

# Carriage Meadows South #100.030

Inlet DP-12a (G2.4)



Jesign information (input)		MINOR	MAJOR	
ype of Inlet	Inlet Type =	CDOT Type	R Curb Opening	
ocal Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a <sub>koal</sub> =	3.00	0.00	inches
lumber of Unit Inlets (Grate or Curb Opening)	No =	1		
Vater Depth at Flowline (outside of local depression)	Ponding Depth =	5.5	8.5	inches
Srate Information	130 A 🛌	MINOR	MAJOR	Override Depths
ength of a Unit Grate	L <sub>o</sub> (G) =	N/A	1979-	feet
Nidth of a Unit Grate	W <sub>o</sub> =	N/A	Things.	feet
rea Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	100 M	
logging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>1</sub> (G) ≃	N/A	N/A	1
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	SWA.	
arate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	5476	1
Curb Opening Information		MINOR	MAJOR	-
ength of a Unit Curb Opening	L <sub>0</sub> (C) =	15.00	15.00	feet
leight of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	0.02	inches
leight of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	10.00	inches
ingle of Throat (see USDCM Figure ST-5)	Theta =	63.40	52.40	degrees
side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	4.01	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_{t}(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	3.80	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>0</sub> (C) =	0.67	0.87	
irate Flow Analysis (Calculated)		MINOR	MAJOR	
logging Coefficient for Multiple Units	Coef =	N/A	N/A	7
logging Factor for Multiple Units	Clog =	N/A	N/A	1
rate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	-
nterception without Clogging	Q <sub>ut</sub> =	N/A	N/A	cfs
terception with Clogging	Q <sub>we</sub> =	N/A	N/A	cfs
rate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	(COR)
terception without Clogging	Q., =	N/A	N/A	cfs
terception with Clogging	Q., =	N/A	N/A	cfs
rate Capacity as Mixed Flow		MINOR	MAJOR	
terception without Clogging	0	N/A	N/A	cfs
	Colori =			-
nterception with Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
terception with Clogging esulting Grate Capacity (assumes clogged condition)		N/A N/A	N/A	cfs
nterception with Clogging tesulting Grate Capacity (assumes clogged condition) urb Opening Flow Analysis (Calculated)	Q <sub>rmi</sub> = Q <sub>rms</sub> = Q <sub>Grate</sub> =	N/A N/A MINOR	N/A N/A MAJOR	cfs cfs
terception with Clogging tesulting Grate Capacity (assumes clogged condition) urb Opening Flow Analysis (Calculated) Jogoing Coefficient for Multiple Units	Q <sub>ma</sub> = Q <sub>ma</sub> = Q <sub>Grate</sub> =	N/A N/A MINOR	N/A N/A MAJOR	cfs cfs
terception with Clogging tesulting Grate Capacity (assumes clogged condition) urb Opening Flow Analysis (Calculated) logging Coefficient for Multiple Units logging Factor for Multiple Units	Q <sub>ma</sub> = Q <sub>ma</sub> = Q <sub>Grate</sub> = Coef = Clos =	N/A N/A MINOR 1.31	N/A N/A MAJOR 1.31	cfs cfs
Interception with Clogging Resulting Grate Capacity (assumes clogged condition) Surb Opening Flow Analysis (Calculated) Slogging Coefficient for Multiple Units Slogging Factor for Multiple Units Surb Opening as a Weir (based on UDFCD - CSU 2010 Study)	 Q <sub>mat</sub> = Q <sub>Grate</sub> = Coef =  Clog =	N/A N/A MINOR 1.31 0.04 MINOR	N/A N/A MAJOR 1.31 0.04 MAJOR	cfs cfs
Interception with Clogging Resulting Grate Capacity (assumes clogged condition) 2urb Opening Flow Analysis (Calculated) 2logging Coefficient for Multiple Units 2logging Factor for Multiple Units 2urb Opening as a Weir (based on UDFCD - CSU 2010 Study) terception without Clogging	 Q <sub>ma</sub> = Q <sub>Grate</sub> = Coef = Clog = Q <sub>cr</sub> =	N/A N/A MINOR 1.31 0.04 MINOR 7.99	N/A N/A MAJOR 1.31 0.04 MAJOR 24.46	cfs cfs
terception with Clogging tesulting Grate Capacity (assumes clogged condition) <u>aurb Opening Flow Analysis (Calculated)</u> logging Coefficient for Multiple Units logging Factor for Multiple Units <b>aurb Opening as a Weir (based on UDFCD - CSU 2010 Study)</b> terception with Clogging terception with Clogging	Q <sub>mi</sub> = Q <sub>mu</sub> = Q <sub>Grate</sub> = Coef = Clog = Q <sub>mi</sub> = Q <sub>mi</sub> =	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64	N/A N/A MAJOR 1.31 0.04 MAJOR 24.46 23.39	efs efs efs
terception with Clogging tesulting Grate Capacity (assumes clogged condition) turb Opening Flow Analysis (Calculated) test of the second se	Q <sub>mi</sub> = Q <sub>mu</sub> = Q <sub>Grate</sub> = Coef = Clog = Q <sub>ves</sub> = Q <sub>ves</sub> =	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64 MINOR	N/A N/A MAJOR 1.31 0.04 MAJOR 24.46 23.39 MAJOP	cfs cfs cfs cfs
terception with Clogging tesulting Grate Capacity (assumes clogged condition) aurb Opening Flow Analysis (Calculated) alogging Coefficient for Multiple Units alogging Factor for Multiple Units aurb Opening as a Weir (based on UDFCD - CSU 2010 Study) terception without Clogging aurb Opening as an Orifice (based on UDFCD - CSU 2010 Study) terception without Clogging aurb Opening as an Orifice (based on UDFCD - CSU 2010 Study) terception without Clogging	Q <sub>rmi</sub> = Q <sub>mu</sub> = Q <sub>Qrate</sub> = Coef = Clog = Q <sub>res</sub> = Q <sub>res</sub> =	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64 MINOR 28.08	N/A N/A MAJOR 1.31 0.04 MAJOR 24.46 23.39 MAJOR 34.57	cfs cfs cfs cfs
hterception with Clogging Resulting Grate Capacity (assumes clogged condition) Purb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on UDFCD - CSU 2010 Study) hterception without Clogging hterception with Clogging iterception with Clogging therception with Clogging therception with Clogging therception with Clogging therception with Clogging therception with Clogging	Q <sub>mi</sub> = Q <sub>mu</sub> = Q <sub>qrats</sub> = Coof = Ciog = Q <sub>rss</sub> = Q <sub>rss</sub> = Q <sub>rss</sub> = Q <sub>rss</sub> = Q <sub>rss</sub> =	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64 MINOR 28.08 26.85	N/A N/A MAJOR 1.31 0.04 MAJOR 24.46 23.39 MAJOR 34.57 33.06	cfs cfs cfs cfs cfs cfs
Interception with Clogging Resulting Grate Capacity (assumes clogged condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on UDFCD - CSU 2010 Study) Interception without Clogging Interception with Clogging Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study) Interception without Clogging Interception with With Clogging Interception with With Clogging Interception with With Cloggin	$\begin{array}{c} \mathbf{Q}_{mi} = \\ \mathbf{Q}_{ma} = \\ \mathbf{Q}_{orats} = \end{array}$ $\begin{array}{c} \mathbf{Coef} = \\ \mathbf{Clog} = \\ \mathbf{Q}_{res} = \\ \mathbf{Q}_{res} = \\ \mathbf{Q}_{res} = \\ \mathbf{Q}_{ou} = \\ \mathbf{Q}_{ou} = \\ \mathbf{Q}_{ou} = \end{array}$	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64 MINOR 28.08 26.85 MINOP	N/A           N/A           MAJOR           1.31           0.04           MAJOR           24.46           23.39           MAJOR           34.57           33.06           MAIOR	cfs cfs cfs cfs cfs cfs cfs
Interception with Clogging Resulting Grate Capacity (assumes clogged condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on UDFCD - CSU 2010 Study) Interception without Clogging Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study) Interception without Clogging Interception without Clogging Interception without Clogging Interception without Clogging Interception with Clogging Interception without Clogging Interception without Clogging Interception without Clogging Interception without Clogging Interception without Clogging	Q <sub>mi</sub> = Q <sub>ma</sub> = Q <sub>Grats</sub> = Coof = Clog = Q <sub>os</sub> = Q <sub>os</sub> = Q <sub>os</sub> = Q <sub>os</sub> =	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64 MINOR 28.08 26.85 MINOR 13.93	N/A           N/A           MAJOR           1.31           0.04           MAJOR           24.46           23.39           MAJOR           34.57           33.06           MAJOR           27.04	ers ers cfs ofs ofs ofs ofs ofs
hterception with Clogging Resulting Grate Capacity (assumes clogged condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on UDFCD - CSU 2010 Study) therception without Clogging therception with Clogging therception without Clogging therception without Clogging therception without Clogging therception with Clogging	$Q_{mi} = $ $Q_{ma} =$ $Q_{orate} =$ $Q_{orate} =$ $Q_{orat} =$ $Q_{orat} =$ $Q_{orat} =$ $Q_{orat} =$ $Q_{orat} =$ $Q_{orat} =$ $Q_{orat} =$ $Q_{orat} =$ $Q_{orat} =$	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64 MINOR 28.08 26.85 MINOR 13.93 13.32	N/A           N/A           MAJOR           1.31           0.04           MAJOR           24.46           23.39           MAJOR           34.57           33.06           MAJOR           27.04           25.86	ers ers ers ers ers ers ers ers ers ers
Interception with Clogging Resulting Grate Capacity (assumes clogged condition) Surb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on UDFCD - CSU 2010 Study) Interception with Clogging Surb Opening as an Orifice (based on UDFCD - CSU 2010 Study) Interception with Clogging Surb Opening Capacity as Mixed Flow Interception with Clogging Surb Opening Capacity as Mixed Flow Interception with Clogging Surb Opening Capacity (assumes clonged condition)	$Q_{mi} = Q_{ma} = Q$	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64 MINOR 28.08 26.85 MINOR 13.93 13.32 7.64	N/A N/A N/A N/A 1.31 0.04 MAJOR 24.46 23.39 MAJOR 34.57 33.06 MAJOR 27.04 27.04 25.86 23.39	efs efs efs efs efs efs efs efs efs efs
terception with Clogging tesulting Grate Capacity (assumes clogged condition) Surb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Coefficient for Multiple Units Surb Opening as a Weir (based on UDFCD - CSU 2010 Study) terception without Clogging Urb Opening as an Orfice (based on UDFCD - CSU 2010 Study) terception without Clogging terception without Clogging terception with Clogging terception with Clogging urb Opening Capacity as Mixed Flow terception without Clogging terception with clogging terception wi	$\begin{array}{c} \mathbf{U}_{mi} = \\ \mathbf{Q}_{ma} = \\ \mathbf{Q}_{crate} = \end{array} \\ \begin{array}{c} \mathbf{Coef} = \\ \mathbf{Clog} = \\ \mathbf{Clog} = \\ \mathbf{Q}_{res} = \\ \mathbf{Q}_{res} = \\ \mathbf{Q}_{res} = \\ \mathbf{Q}_{ca} = \\ \mathbf{Q}_{ca} = \\ \mathbf{Q}_{ca} = \\ \mathbf{Q}_{ma} = \\ \mathbf{Q}_{ma} = \\ \mathbf{Q}_{cub} = \end{array} \\ \end{array}$	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64 MINOR 28.08 26.85 MINOR 13.93 13.32 7.64 MINOR	N/A           N/A           MAJOR           1.31           0.04           MAJOR           24.46           23.39           MAJOR           34.57           33.06           MAJOR           27.04           25.86           23.39           MAJOR	cfs cfs cfs cfs cfs cfs cfs cfs cfs cfs
Interception with Clogging Resulting Grate Capacity (assumes clogged condition) Surb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Coefficient for Multiple Units Curb Opening as a Weir (based on UDFCD - CSU 2010 Study) Interception without Clogging Urb Opening as an Orifice (based on UDFCD - CSU 2010 Study) Interception without Clogging Urb Opening Capacity (based on UDFCD - CSU 2010 Study) Interception without Clogging Interception without Cl	Q <sub>mi</sub> = Q <sub>mu</sub> = Q <sub>artis</sub> = Coef = Clog = Q <sub>est</sub> =	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64 MINOR 28.08 26.85 MINOR 13.93 13.32 7.64 MINOR	N/A           N/A           MAJOR           1.31           0.04           MAJOR           24.46           23.39           MAJOR           34.57           33.06           MAJOR           27.04           25.86           23.39           MAJOR           15.00	cfs cfs cfs cfs cfs cfs cfs cfs cfs cfs
Interception with Clogging Resulting Grate Capacity (assumes clogged condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on UDFCD - CSU 2010 Study) Interception without Clogging Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study) Interception without Clogging Curb Opening Capacity as Mixed Flow Interception without Clogging Esulting Curb Opening Capacity (assumes clogged condition) Esultant Street Conditions Otal Inlet Length Condition Con	$Q_{mi} = Q_{mi} = Q$	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64 MINOR 28.08 26.85 MINOR 13.93 13.32 7.64 MINOR 15.00	N/A           N/A           MAJOR           1.31           0.04           MAJOR           24.46           23.39           MAJOR           34.57           33.06           MAJOR           27.04           25.86           23.39           MAJOR           25.86           23.39           MAJOR           25.86           23.39           MAJOR	cfs cfs cfs cfs cfs cfs cfs cfs cfs cfs
Interception with Clogging Resulting Grate Capacity (assumes clogged condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study) Iterception with Clogging Urb Opening Capacity as Mixed Flow Iterception with Clogging Iterception with Clogging Iterception with Clogging Iterception with Clogging Curb Opening Capacity as Mixed Flow Iterception with Clogging Iterception with Cloggi	$\begin{array}{c} \mathbf{U}_{mi} = \\ \mathbf{Q}_{mu} = \\ \mathbf{Q}_{mu} = \\ \mathbf{Q}_{ortis} = \end{array}$ $\begin{array}{c} \mathbf{Coef} = \\ \mathbf{Ciog} = \\ \mathbf{Q}_{res} = \\ \mathbf{Q}_{res} = \\ \mathbf{Q}_{res} = \\ \mathbf{Q}_{ors} = \\ \mathbf{Q}_{ortis} = \\ $	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64 MINOR 28.08 26.85 MINOR 13.93 13.32 7.64 MINOR 15.00 16.6	N/A           N/A           MAJOR           1.31           0.04           MAJOR           24.46           23.39           MAJOR           34.57           33.06           MAJOR           27.04           25.86           23.39           MAJOR           15.00           29.1           2.0	cfs cfs cfs cfs cfs cfs cfs cfs
Interception with Clogging Resulting Grate Capacity (assumes clogged condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Curb Opening as a Weir (based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Curb Opening Capacity (assumes clogged condition) Essultant Street Conditions Otal Inlet Length Essultant Street Flow Spread (based on sheet Q-Allow geometry) Essultant Flow Depth at Street Crown	$\begin{array}{c} \mathbf{U}_{mi} = \\ \mathbf{Q}_{mu} = \\ \mathbf{Q}_{onu} = \\ \mathbf{Q}_{ortals} = \\ \hline \\ \mathbf{Coof} = \\ \hline \\ \mathbf{Ciog} = \\ \\ \mathbf{Q}_{vis} = \\ \hline \\ \mathbf{Q}_{vis} = \\ \hline \\ \mathbf{Q}_{ois} = \\ \hline \\ \mathbf{Q}_{$	N/A N/A MINOR 1.31 0.04 MINOR 7.99 7.64 MINOR 28.08 26.85 MINOR 13.93 13.32 7.64 MINOR 15.00 16.6 0.0	N/A           N/A           MAJOR           1.31           0.04           MAJOR           24.46           23.39           MAJOR           34.57           33.06           MAJOR           27.04           25.86           23.39           MAJOR           27.04           25.86           23.39           MAJOR           25.86           23.39           MAJOR           15.00           29.1           2.9           MAJOR	cfs cfs cfs cfs cfs cfs cfs cfs cfs cfs
Interception with Clogging Resulting Grate Capacity (assumes clogged condition) Curb Opening Flow Analysis (Calculated) Clogging Coefficient for Multiple Units Clogging Coefficient for Multiple Units Curb Opening as a Weir (based on UDFCD - CSU 2010 Study) Interception without Clogging Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study) Interception without Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Int	$\begin{array}{c} \mathbf{U}_{mi} = \\ \mathbf{Q}_{mu} = \\ \mathbf{Q}_{cras} = \\ \mathbf{Q}_{cras} = \\ \mathbf{Coof} = \\ \mathbf{Clog} = \\ \mathbf{Q}_{res} = \\ \mathbf{Q}_$	N/A N/A N/A MINOR 7.99 7.64 MINOR 28.08 26.85 MINOR 13.93 13.32 7.64 MINOR 15.00 16.6 0.0 MINOR 7.6	N/A           N/A           MAJOR           1.31           0.04           MAJOR           24.46           23.39           MAJOR           34.57           33.06           MAJOR           27.04           25.86           23.39           MAJOR           15.00           29.1           2.9           MAJOR           23.4	cfs cfs cfs cfs cfs cfs cfs cfs

1.4 CFS TOPS CROWN É FLOWIS TO INLET CÓ DP-IZD (MAJOR STORM)

Project = Inlet ID =

 Carriage Meadows South
 #100.030

 Inlet DP-12b (G2.5)
 Inlet DP-12b (G2.5)

 H-Curb
 H-Vert
 Wo

 W
 Wp
 Lo (G)

Type of Inited         Inited Types         CDCD Type R Cut-Openang         Invester Types         CDCD Types Cut-Openang         Invester Types           Number of Unit Inities (Crate or Cut-Openang)         Nove         1         Invester         Invester           Water Depth al Flowing (outside of local depression)         Permide Depth S         5.5         5.5         1.5           Graits Information         Nove         Number of Local Content (Special Value 3.0.5.0.80)         Nove	Design Information (Input)		MINOR	MAJOR	
Lacel Depresents (additional to continuous guiter depression 'a from 'Q-Allow') Namer of Unit Rice (trains or Lar Gorennon) Namer of Unit Rice (trains or Lar Gorennon) Namer Deprint (Grains of Lar Gorennon) Pending Deprint Carls of the Unit Grains Large for a Carls (typical values 0.15-0.50) A.a., NAA Carls Carls of the Carls (Large for the Single Carls of units 0.15-0.50) A.a., NAA Carls Carls of the Carls (Large for the Carls (typical values 0.15-0.50) A.a., NAA Carls Carls of the Carls (Large for the Carls (typical values 0.15-0.50) A.a., NAA Carls Carls Of the Carls (Large for the Carls (typical values 0.0-070) Carls (Grain Mac) Carls Carls (Large for the Carls (typical values 0.0-070) Carls Carls (Large for the Carls (Large for the Carls (typical values 0.0-070) Carls Carls (Large for the Ca	Type of Inlet	Inlet Type =	CDOT Type R	Curb Opening	
Number (Dath Intels (Catal Could Opening)         No         1	Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a <sub>local</sub> =	3.00	.11.30	inches
Water Depth at Flowine (outside focal depression)         Pending Depth at Flowine (Statis of Call Depth at Flowing Call Depth Call D	Number of Unit Inlets (Grate or Curb Opening)	No =	1		
Graits information         MNOR         MALOR         C           Unigh of 2 Junk Graie         IL(G) =         N/A         Image: Comparing Field Fi	Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.5	8.5	inches
Lingh of Juni Graie L, (G) NA Server (Server (	Grate Information		MINOR	MAJOR	Override Depths
With of 2 unit Grate         With         NA         Image: Second Seco	Length of a Unit Grate	L <sub>o</sub> (G) =	N/A	No.	feet
Area Opening Tatio for a Circle (typical value 50 - 0.50)       Amage Text (typical value 2.5 - 3.80)       C (10)       NA       NA         Craft Own Coefficient (typical value 2.5 - 3.80)       C (10)       NA       NA       NA         Craft Own Coefficient (typical value 2.5 - 3.80)       C (10)       NA       NA       NA         Craft Own Coefficient (typical value 2.5 - 3.80)       C (10)       NA       NA       NA         Craft Own Coefficient (typical value 2.5 - 3.80)       C (10)       NA       MAUOR       MAUOR         Langth of Luth Cuth Opening Intones       Haige 3.600       IIII on the set of the se	Width of a Unit Grate	VV <sub>o</sub> =	N/A	MON.	feet
Clogping Factor for a Single Grate (piped value 0.50 - 0.70) C, (G) = NA NA NA C, (G) = NA NA	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	3(0)	
Grate Weir Coefficient (typical value 0.60 - 0.80)       C <sub>1</sub> (0) =       NA       Image: Coefficient (typical value 0.60 - 0.80)         Cuto Dopaning Information       MIXOR       MAUOR         Langth of J Unit Cuto Opening in Inches       H <sub>10</sub> =       5.00       Image: Coefficient (typical value 0.60 - 0.80)         Angel of Throat (cuto Opening in Inches       H <sub>10</sub> =       6.00       Image: Coefficient (typical value 0.75)       C(c) =       0.10       0.10         Cuto Dopening Ortho: Coefficient (typical value 0.75)       C <sub>1</sub> (C) =       0.70       C(c) =       C(c) =       C(c) =       C(c) =       C(c) =       C(c) =	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	1
Grate Orinic Coefficient (price) value 0.00 - 0.80)       C_4(0) =       NA       MINOR         Length of a Unit Cutb Opening       L_4(0) =       5.500       Interview         Haight of Unit Chore Treat in Inches       H <sub>au</sub> =       6.00       Interview         Angie of Threat (see USDCM Figure ST-5)       Theta =       6.30       Interview         Side Wath for Coefficient (typical value 0.10)       C_4(0) =       0.10       0.10         Curb Opening Detect for a Single Curb Opening (hypical value 0.10)       C_4(0) =       3.80       Interview         Curb Opening Orifice Coefficient (typical value 0.0-070)       C_6(0) =       3.60       Interview         Curb Opening Orifice Coefficient (typical value 0.0-070)       C_6(0) =       3.60       Interview         Cogging Ontifice Coefficient (typical value 0.0-070)       C_6(0) =       3.60       Interview         Cogging Ontifice Coefficient (typical value 0.0-070)       C_6(0) =       NA       NA         Cogging Ontifice Coefficient (typical value 0.0-070)       C_6(0) =       NA       NA         Cogging Factor for Multiple Units       Code =       NA       NA       NA         Cogging Factor for Multiple Units       Code =       NA       NA       Afs         Corte Cogging A so Office Costa on UDFCD - CSU 2010 Study)       MIN	Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	3676	
Curb Opening Information         MINOR         MAUOR           Length of Unit Curb Opening in Inches         Haget of Verifical Curb Opening in Inches         Haget of Verifical Curb Opening in Inches         Haget of Verifical Curb Opening in Inches         modes           Angle of Thoratic USDCK Figure 51-5)         Thotas         60.40         inches         modes           Side Width for Depression Pain (typical value 2.3-3.7)         Curb Opening Ontice Coefficient (typical value 2.3-3.7)         Curb Opening Ont	Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	1044	1
Length of Vartical Curb Opening in Inches $H_{uar} = \begin{cases} 5.00 & 100$	Curb Opening Information		MINOR	MAJOR	-
Height of Curb Onifice Troat in Inches         H <sub>um</sub> =         6 00         Inches           Height of Curb Onifice Troat in Inches         H <sub>um</sub> =         6 00         Inches           Angle of Throat (see USPCAF Figure S1-5)         Thetal =         6 3.40         Inches           Side Wildh for Depression Pain (typically the guiter with of 2 feet)         W <sub>p</sub> =         2 0.0         Inches           Capping Patch for a Single Curb Opening (typical value 0.3-07)         C <sub>q</sub> (C) =         3 8.0         Inches           Carb Opening Onifice Coefficient (typical value 0.80 - 070)         C <sub>q</sub> (C) =         0 8.7         Inches           Clogging Patch for Mulpile Units         Coder =         MN/A         N/A           Clogging Coefficient for Mulpile Units         Coder =         N/A         N/A           Clogging Coefficient for Mulpile Units         Coder =         N/A         N/A           Interception with Clogging         Q <sub>a</sub> =         MINOR         MA/A           Interception with Clogging         Q <sub>a</sub> =         MINOR         MA/A           Interception with Clogging         Q <sub>a</sub> =         MINA         N/A           Interception with Clogging         Q <sub>a</sub> =         MINA         N/A           Interception with Clogging         Q <sub>a</sub> =         MINA         MA/A	Length of a Unit Curb Opening	L <sub>o</sub> (C) =	5.00	16.00	feet
hight Outb Outbo Entrol in Inches         H <sub>max</sub> =         6.00         inches           Angle of Throat (see USDCM Figure ST-5)         Theta =         63.40         inches           Side Width for Depression Pan (typically the gutter width of 2 feet)         V/r, a         2.00         inches           Chooping Patch for a Single Curb Opening (typical value 0.10)         Cr (C) =         0.10         0.10           Curb Opening Wint Coefficien (typical value 0.60 - 0.70)         C <sub>0</sub> (C) =         0.67         inches           Cargain Coefficient for Multiple Units         Coeff =         NNA         NNA           Clogging Office Loaded to UDFCD - CSU 2010 Study)         MINOR         MAJOR           Interception with Clogging         Q <sub>m</sub> =         NNA         NNA           Carste Capacity as a Orffice Loaded on UDFCD - CSU 2010 Study)         MINOR         MAIA         RA           Interception with Clogging         Q <sub>m</sub> =         NNA         NNA         dfs           Carste Capacity as a Orffice Loaded on UDFCD - CSU 2010 Study)         MINOR         MAIA         RA           Interception with Clogging         Q <sub>m</sub> =         NNA         NNA         dfs           Carste Capacity as Nixed Flow         MINOR         MAIA         RA         RA           Interception without Clogging	Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	8.00	inches
Angle of Threat (see USDCM Figure ST-5)Theta bit is the gutter with of 2 feet)Theta bit is the gutter g	Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
Side Wildh for Depression Pan (typically the gutter wildh of 2 feet)       W <sub>1</sub> = 2.00       Image: Control Contrel Control Control Control Control Control C	Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	83.44	degrees
Cloging Factor for a Single Curb Opening (kpical value 0.10)       C, (C) =       0.10       0.10         Curb Opening Weir Coefficient (kpical value 2.3-37)       C, (C) =       0.67       0.00         Cloging Orfice Coefficient (kpical value 2.3-37)       C, (C) =       0.67       0.00         Cloging Orfice Coefficient (kpical value 0.60 - 0.70)       C, (C) =       0.67       0.00         Cloging Coefficient for Multiple Units       Coef =       N/A       N/A         Cloging Coefficient for Multiple Units       Coef =       N/A       N/A         Grate Capacity as a Veir (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception with Clogging       Q <sub>a</sub> =       N/A       N/A       dfs         Interception with Clogging       Q <sub>a</sub> =       N/A       N/A       dfs         Interception with Clogging       Q <sub>a</sub> =       N/A       N/A       dfs         Interception with Clogging       Q <sub>a</sub> =       N/A       N/A       dfs         Interception with Clogging       Q <sub>a</sub> =       N/A       N/A       dfs         Curb Opening Coefficient for Multiple Units       Coef =       1.00       1.00       1.00         Clogging Coefficient for Multiple Units       Coef =       1.00       1.00       1.00       1.00	Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	1.02	feet
Curb Opening Weir Coefficient (typical value 2.3-3.7) $C_{u}$ ( $C_{p} = 3.60$ 0.67         Curb Opening Office Coefficient (typical value 0.60 - 0.70) $C_{c}$ ( $C_{p} = 0.67$ 0.67         Clogging Coefficient for Multiple Units       Coef =       N/A       N/A         Clogging Coefficient for Multiple Units       Coef =       N/A       N/A         Clogging Coefficient for Multiple Units       Coef =       N/A       N/A         Clogging Coefficient for Multiple Units       Coef =       N/A       N/A         Crate CopeCing as Vier (Cosed on UDFCD - CSU 2010 Study)       MINOR       M/A/OR         Interception without Clogging $Q_{ae} =$ N/A       N/A         Crate CopeCing Stitude (Cosed on UDFCD - CSU 2010 Study)       MINOR       M/A/OR         Interception without Clogging $Q_{ae} =$ N/A       N/A         Crate CopeCing Stitude (Cosed on UDFCD - CSU 2010 Study)       MINOR       M/A/OR         Interception without Clogging $Q_{ae} =$ N/A       N/A         Clogging Coefficient for Multiple Units       Coef =       1.00       1.00         Clogging Coefficient for Multiple Units       Coef =       1.00       1.00         Clogging Coefficient for Multiple Units       Coef =       1.00       1.00	Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_{t}(C) =$	0.10	0.10	1
Curb Opening Onfice Coefficient (typical value 0.60 - 0.70)       C. (C)       0.67         Grate Trow Analysis (Calculated)       MINOR       MAJOR         Clogging Coefficient for Multiple Units       Coef =       N/A       N/A         Clogging Coefficient for Multiple Units       Coef =       N/A       N/A         Grate Capacity as a Veir (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception with Clogging       Q <sub>a</sub> =       N/A       N/A         Grate Capacity as a Office (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception with Clogging       Q <sub>a</sub> =       N/A       N/A         Grate Capacity as Mixed Flow       MINOR       MAJOR         Interception with Clogging       Q <sub>a</sub> =       N/A       N/A         Curb Opening East Via (Saculated)       Coof =       I.0.0       I.0.0         Clogging Coefficient for Multiple Units       Coef =       I.0.0       I.0.0         Clogging	Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	0.00	
Grate Flow Analysis (Calculated)       MINOR       MAJOR         Clogging Coefficient for Multiple Units       Coef a       N/A       N/A         Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception without Clogging       Quare       N/A       N/A         Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception without Clogging       Quare       N/A       N/A         Interception without Clogging       Quare       N/A       N/A         Interception without Clogging       Quare       N/A       N/A         Interception without Clogging       Quare       N/A       N/A       N/A         Clogging Cartifice (transmitter for Withighe Units       Codef a       N/A       N/A         Clogging Cartifice (transmitter for Withighe Units       Codef a       N/A       N/A         Clogging Cartifice (transmitter for Withighe Units       Codef a       N/A       N/A         C	Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>o</sub> (C) =	0.67	11.61	1
Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Clogging Factor for Multiple Units Clogging Factor for Multiple Units Crate Capacity as a Work (Dased on UDFCD - CSU 2010 Study) Interception without Clogging Crate Capacity as Orffice (based on UDFCD - CSU 2010 Study) Interception without Clogging Crate Capacity as Orffice (based on UDFCD - CSU 2010 Study) Interception with Clogging Crate Capacity as Mixed Flow Interception with Clogging Crate Capacity as Mixed Flow Interception with Clogging Crate Capacity (assumes clogged condition) Clogging Coefficient for Multiple Units Clogging Factor for Multiple Units Cloud Depending as an Orffice (based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening as an Orffice (based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening Capacity (assumes clogged condition) Curb Opening as an Orffice (based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening Capacity (assumes clogged condition) Curb Opening Capacity as Mixed Flow Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Curb Opening Capacity (assumes clogged condition) Curb Opening	Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Factor for Multiple Units       Clog =       N/A       N/A         Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)       MINOR       MA/OR         Interception without Clogging       Q <sub>m</sub> =       N/A       N/A       cfs         Grate Capacity as A Office (based on UDFCD - CSU 2010 Study)       MINOR       MA/OR       cfs         Interception with Clogging       Q <sub>m</sub> =       N/A       N/A       cfs         Grate Capacity as Mixed Flow       MINOR       MALOR       cfs         Interception with Clogging       Q <sub>m</sub> =       N/A       N/A       cfs         Interception with Clogging       Q <sub>m</sub> =       N/A       N/A       cfs         Interception with Clogging       Q <sub>m</sub> =       N/A       N/A       cfs         Interception with Clogging       Q <sub>m</sub> =       N/A       N/A       cfs         Cub Opening Flow Analysis (Calculated)       MINOR       MA/OR       cfs         Clogging Coefficient for Multiple Units       Clog =       1.00       1.00       cfs         Cub Opening as a Weir (based on UDFCD - CSU 2010 Study)       MINOR       MA/OR       cfs         Interception without Clogging       Q <sub>m</sub> =       4.40       11.13       cfs         Curb Opening Capacity as Mixed Flow	Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	1
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception without Clogging $Q_{ee} = N/A$ N/A       N/A         Grate Capacity as a Orffice (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception without Clogging $Q_{ee} = N/A$ N/A       N/A         Grate Capacity as Mixed Flow       MINOR       MAJOR         Interception without Clogging $Q_{ee} = N/A$ N/A       N/A         Resulting Grate Capacity (assumes clogged condition) $Q_{corre} = N/A$ N/A       Resulting Grate Capacity (assumes clogged condition)         Curb Opening Flow Analysis (Calculated)       MINOR       MAJOR       Resulting Grate Capacity (assumes clogged condition) $Q_{corre} = 0.10$ 0.010       0.010       0.010       0.010       0.010       0.010       0.010       0.010       0.010       0.010       0.010       0.010       0.010       0.010       0.010	Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Interception without Clogging Interception with Clogging Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study) Interception with Clogging Carte Capacity as Mixed Flow Interception with Clogging Grate Capacity as Mixed Flow Interception with Clogging Carte Capacity as Mixed Flow Interception with Clogging Carte Capacity as Mixed Flow Curb Opening Flow Analysis (Calculated) Clogging Control (Calculated) Clogging Carte (based on UDFCD - CSU 2010 Study) Interception with Clogging Carte Capacity (assumes clogged condition) Clogging Carte (based on UDFCD - CSU 2010 Study) Interception with Clogging Factor for Multiple Units Curb Opening as a Weir (based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening as a Weir (based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening as a Wire (based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening as a Wire (based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening as a Wire (Clogging Curb Opening as a Wire (based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening Capacity (assumes clogged condition) Curb Openi	Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	-
Interception with Clogging Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study) Interception with Clogging Interception with Clogging Grate Capacity as Mixed Flow Interception with Clogging Interception with Clogging Resulting Grate Capacity (assumes clogged condition) Curb Opening Flow Analysis (Catculated) Curb Opening as a Weir (Based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening as a Weir (Based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening as a Weir (Based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening as a Weir (Based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening as a Weir (Based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening as a Weir (Based on UDFCD - CSU 2010 Study) Interception with Clogging Curb Opening Capacity as Mixed Flow Interception with Clogging Curb Opening Capacity (assumes clogged condition) Queue = 4.40 Subset Chore Subset Conditions Total Inter Length Resultant Street Conditions Total Inter Length Total Inter Length Chapter Chore Major Storms ( <q peak)<br="">Queue = 0.0 Curb Opening Capacity (assumes clogged condition) Queue = 0.0 Curb Opening Capacity (assumes clogged condition) Curb Opening Capacity (assumes clogged condition) Curb Opening Capacity (assumes clogged condition) Curb Opening Capacity (assumes clogged</q>	Interception without Clogging	Q <sub>ut</sub> =	N/A	N/A	cfs
Grate Capacity as a Office (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception without Clogging       Qa =       N/A       N/A       cfs         Grate Capacity as Mixed Flow       MINOR       MAJOR       dfs         Interception with Clogging       Qa =       N/A       N/A       cfs         Grate Capacity as Mixed Flow       MINOR       MAJOR       dfs         Interception with Clogging       Qa =       N/A       N/A       cfs         Curb Opening Flow Analysis (Calculated)       Qa =       N/A       N/A       cfs         Clogging Coefficient for Multiple Units       Clog =       0.10       0.10       0.00         Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR       MINOR       MAJOR         Interception with Clogging       Qa =       4.40       11.13       cfs         Curb Opening as a Office (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR       MINOR       MAJOR         Interception with Clogging       Qa =       8.42       10.37       cfs       cfs         Interception with Clogging       Qa =       8.42       10.37       cfs       cfs         Interception with Clogging       Qa =       8.42       10.37	Interception with Clogging	Q <sub>een</sub> =	N/A	N/A	cfs
Interception without Clogging $Q_{es} =$ N/A       N/A       cfs         Interception with Clogging $Q_{ess} =$ N/A       N/A       rds         Grate Capacity as Mixed Flow       MINOR       MAJOR         Interception with Clogging $Q_{ess} =$ N/A       N/A       rds         Interception with Clogging $Q_{ess} =$ N/A       N/A       rds         Resulting Grate Capacity (assumes clogged condition) $Q_{outes} =$ N/A       N/A       rds         Clogging Coefficient for Multiple Units       Code =       1.00       1.00       Clog =       0.10       0.10         Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR       MAJOR         Interception without Clogging $Q_{ess} =$ 4.40       11.13       cfs         Curb Opening as an Office (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR       rds         Interception without Clogging $Q_{ess} =$ 9.36       11.52       cfs         Curb Opening as an Office (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR       rds         Interception without Clogging $Q_{ess} =$ 6.29       11.10       rds         Interception without Clogging	Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception with Clogging Grate Capacity as Mixed Flow MAJOR Interception with Clogging Cafficient for Multiple Units Coord and Major Storms (Section With Clogging Coefficient for Multiple Units Coord and Major Storms (Section With Clogging Factor for Multiple Units Coord and Major Storms (Section With Clogging Sector for Multiple Units Coord and Major Storms (Section With Clogging Sector for Multiple Units Coord and Major Storms (Section With Clogging Sector for Multiple Units Coord and Major Storms (Section With Clogging Sector for Multiple Units Coord and Major Storms (Section With Clogging Sector for Multiple Units Coord and Major Storms (Section With Clogging Sector for Multiple Units Coord and Major Storms (Section With Clogging Sector for Multiple Units Coord and Major Storms (Section With Clogging Sector for Multiple Units Coord and Major Storms (Section With Clogging Sector for Multiple Units Coord and Major Storms (Section With Clogging Sector for Multiple Units Coord and Major Storms (Section With Clogging Generation Without Clogging Generation Witho	Interception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
Grate Capacity as Mixed Flow       MINOR       MAJOR         Interception without Clogging       Qmm =       N/A       N/A       cfs         Resulting Grate Capacity (assumes clogged condition)       Qcmm =       N/A       N/A       cfs         Curb Opening Flow Analysis (Calculated)       MINOR       MAJOR       Clogging Coefficient for Multiple Units       Clog =       1.00       1.00         Clogging Factor for Multiple Units       Clog =       0.10       0.10       0.10         Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception with Clogging       Qmm =       4.89       12.37       cfs         Curb Opening as a Norflice (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR       MAJOR         Interception without Clogging       Qmm =       9.36       11.52       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR       minore       dfs         Interception without Clogging       Qmm =       5.86       9.99       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR       minore         Interception without Clogging       Qmm =       5.86       9.99       cfs         Resultant Street Conditions       MINOR       M	Interception with Clogging	Q <sub>oa</sub> =	N/A	N/A	cfs
Interception without Clogging       Qmm       NNA       NNA       cfs         Interception with Clogging       Qmm       NNA       NNA       cfs         Resulting Grate Capacity (assumes clogged condition)       Qmm       NNA       NNA       cfs         Curb Opening Flow Analysis (Calculated)       MINOR       MAJOR       NA       NA       cfs         Clogging Coefficient for Multiple Units       Coef       1.00       1.00       0.10         Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR       MAJOR         Interception without Clogging       Qmm       4.89       12.37       cfs         Interception with Clogging       Qmm       4.40       11.13       cfs         Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception with Clogging       Qmm       4.40       11.13       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR       MAJOR         Interception with Clogging       Qmm       6.29       11.10       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR       fs         Interception with Clogging       Qmm       5.56       9.99       cfs	Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception with Clogging       Qmm =       N/A       N/A       N/A       cfs         Resulting Grate Capacity (assumes clogged condition)       Qmm =       N/A       N/A       N/A       cfs         Curb Opening Flow Analysis (Calculated)       MINOR       MAJOR       1.00       1.00       1.00         Clogging Coefficient for Multiple Units       Code =       1.00       1.00       1.00       1.00         Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR       MAJOR       6fs         Interception with Clogging       Qmm =       4.40       11.13       cfs         Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception with Clogging       Qmm =       9.36       11.52       cfs         Interception with Clogging       Qmm =       8.42       10.37       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR       MINOR       MAJOR         Interception with Clogging       Qmm =       6.29       11.10       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR       dfs         Interception with Clogging       Qmm =       6.66       9.99       cfs         Curb Opening Capa	Interception without Clogging	Q <sub>mi</sub> =	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       Clog =       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 with Clogging       Q <sub>eff</sub> =       4.40       11.13       cfs         Curb Opening as an Orffice (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR       MAJOR         Interception with Clogging       Q <sub>eff</sub> =       9.36       11.52       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR       MINOR       MAJOR         Interception with Clogging       Q <sub>eff</sub> =       6.29       11.10       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR       dfs         Interception with Clogging       Q <sub>eff</sub> =       5.66       9.99       cfs         Resulting Curb Opening Capacity (assumes clogged condition)       Q <sub>eff</sub> =       5.00       5.00       fest         Resultant Street Conditions       MINOR       MAJOR       0.0       2.9       inches<	Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
Curb Opening Flow Analysis (Calculated)       MINOR       MAJOR         Clogging Coefficient for Multiple Units       Coeff =       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 with Clogging       Q <sub>eff</sub> =       4.89       12.37         Interception with Clogging       Q <sub>eff</sub> =       4.40       11.13       cfs         Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception with Clogging       Q <sub>eff</sub> =       9.36       11.52       cfs         Interception with Clogging       Q <sub>eff</sub> =       9.36       11.52       cfs         Interception with Clogging       Q <sub>eff</sub> =       6.29       11.10       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR       MINOR       MAJOR         Interception with Clogging       Q <sub>eff</sub> =       5.66       9.99       cfs         Resulting Curb Opening Capacity (assumes clogged condition)       Q <sub>curb</sub> =       4.40       9.99       cfs         Resultant Street Conditions       MINOR       MAJOR       Eeff       0.0       2.9       inches	Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
Clogging Coefficient for Multiple UnitsCoeff1.001.00Clogging Factor for Multiple UnitsClog0.100.10Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)MINORMAJORInterception without Clogging $Q_{est} =$ 4.8912.37Interception with Clogging $Q_{est} =$ 4.4011.13Curb Opening as an Orffice (based on UDFCD - CSU 2010 Study)MINORMAJORInterception without Clogging $Q_{est} =$ 9.3611.52Interception without Clogging $Q_{as} =$ 9.3611.52Interception without Clogging $Q_{as} =$ 8.4210.37Interception without Clogging $Q_{as} =$ 6.2911.10Interception without Clogging $Q_{mas} =$ 5.669.99Interception with Clogging $Q_{mas} =$ 5.005.00Interception with Clogging $Q_{mas} =$ 5.005.00Interception with Clogging $Q_{as} =$ 4.409.99cfsInterception with Clogging $Q_{as} =$ 4.409.99cfsInterception With Clogging $Q_{as} =$ 4.409.99cfsResultant Street Conditions $Q_{as} =$ 4.409.99cfsResultant Street Flow Spread (based on sheet Q-Allow geometry) $T =$ 16.629.1ft.5-T-	Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
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 $Q_{esc} =$ 4.49       12.37       cfs         Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study) $Q_{esc} =$ 4.40       11.13       cfs         Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study) $MINOR$ MAJOR       MAJOR         Interception without Clogging $Q_{ac} =$ 9.36       11.52       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR       MINOR       MAJOR         Interception without Clogging $Q_{esc} =$ 5.66       9.99       cfs         Interception with Clogging $Q_{esc} =$ 5.66       9.99       cfs         Interception with Clogging $Q_{esc} =$ 5.00       5.00       feet         Interception with Clogging $Q_{esc} =$ 5.00       5.00       feet         Resultant Street Conditions       T       feet       5.00       5.00       feet         Resultant Street Flow Spread (based on sheet Q-Allow geometry)       T       fis       6.6       29.1       ft.7-Crown         Resul	Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	1
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception without Clogging $Q_{esc} =$ 4.49       12.37       cfs         Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR       11.13       cfs         Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR       11.13       cfs         Interception with Clogging $Q_{esc} =$ 9.36       11.52       cfs         Interception with Clogging $Q_{esc} =$ 8.42       10.37       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR       MINOR       MAJOR         Interception with Clogging $Q_{esc} =$ 6.29       11.10       cfs         Interception with Clogging $Q_{mei} =$ 5.66       9.99       cfs         Interception with Clogging $Q_{mei} =$ 5.66       9.99       cfs         Resultant Street Conditions       MINOR       MAJOR       9.99       cfs         Resultant Street Flow Spread (based on sheet Q-Allow geometry)       T =       16.6       29.1       ft.>T-Crown         Resultant Flow Depth at Street Crown $d_{cincwris} =$ 0.0       2.9       inches	Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Interception without Clogging $Q_{ac} =$ 4.89       12.37       cfs         Interception with Clogging $Q_{ac} =$ 4.40       11.13       cfs         Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception without Clogging $Q_{ac} =$ 9.36       11.52       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR       MINOR       MAJOR         Interception with Clogging $Q_{ac} =$ 6.29       11.10       cfs         Interception with Clogging $Q_{mar} =$ 6.29       11.10       cfs         Interception with Clogging $Q_{mar} =$ 6.29       ofs       0.4000       0.9.99       cfs         Interception with Clogging $Q_{mar} =$ 5.66       9.99       cfs       0.500       feet       0.0000       0.00000       0.00000       0.00000       0.000000       0.000000       0.00000000       0.00000000000       0.00000000000000000000000000000000000	Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	-
Interception with Clogging $Q_{eee} =$ 4.40       11.13       cfs         Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study) $Q_{eee} =$ 9.36       11.52       cfs         Interception without Clogging $Q_{oee} =$ 8.42       10.37       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR         Interception without Clogging $Q_{me} =$ 6.29       11.10       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR         Interception without Clogging $Q_{me} =$ 6.29       11.10       cfs         Interception with Clogging $Q_{me} =$ 5.66       9.99       cfs         Resultant Street Conditions       Queue       4.40       9.99       cfs         Total Inlet Length       L =       5.00       5.00       feet         Resultant Street Conditions       T =       16.6       29.1       ft.>T-Crown         Resultant Street Conditions $Q_{ercown} =$ 0.0       2.9       inches         Total Inlet Interception Capacity (assumes clogged condition) $Q_{ercown} =$ 0.4       2.3       cfs         Interception Vibror and Major Storms (>Q PEAK) $Q_{exax recoursepti} =$ 0.4<	Interception without Clogging	Q <sub>eel</sub> =	4.89	12.37	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)       MINOR       MAJOR         Interception without Clogging $Q_{cu} =$ 9.36       11.52       cfs         Interception with Clogging $Q_{cu} =$ 8.42       10.37       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR         Interception without Clogging $Q_{min} =$ 6.29       11.10       cfs         Interception with Clogging $Q_{ma} =$ 5.66       9.99       cfs         Resulting Curb Opening Capacity (assumes clogged condition) $Q_{curb} =$ 4.40       9.99       cfs         Resultant Street Conditions       MINOR       MAJOR       Its T-Crown       Total Inlet Length       L =       5.00       5.00       feet         Resultant Street Conditions       T =       16.6       29.1       ft.>T-Crown       0.0       2.9       inches         MINOR       MAJOR       MINOR       MAJOR       0.0       2.9       inches         Total Inlet Interception Capacity (assumes clogged condition)       Q resure requere =       0.4       2.3       cfs         Interception Kinor and Major Storms (>Q PEAK)       Q resure requere =       0.4       2.3       cfs <td>Interception with Clogging</td> <td>Q<sub>var</sub> =</td> <td>4.40</td> <td>11.13</td> <td>cfs</td>	Interception with Clogging	Q <sub>var</sub> =	4.40	11.13	cfs
Interception without Clogging $Q_{ui} =$ $9.36$ $11.52$ cfs         Interception with Clogging $Q_{ui} =$ $8.42$ $10.37$ cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR         Interception without Clogging $Q_{mi} =$ $6.29$ $11.10$ cfs         Interception with Clogging $Q_{mi} =$ $6.29$ $11.10$ cfs         Interception with Clogging $Q_{max} =$ $5.66$ $9.99$ cfs         Resultant Street Conditions       MINOR       MAJOR         Total Inlet Length       L = $5.00$ $5.00$ feet         Resultant Street Conditions       T = $16.6$ $29.1$ ft.>T-Crown         Resultant Street Flow Spread (based on sheet Q-Allow geometry)       T = $16.6$ $29.1$ ft.>T-Crown         Resultant Flow Depth at Street Crown $d_{CROWN} =$ $0.0$ $2.9$ inches         MINOR       MAJOR       MINOR       MAJOR $0.0$ $2.9$ inches         Total Inlet Interception Capacity (assumes clogged condition) $Q_{PEAK REQUEED} =$ $0.4$ $2.3$ cfs         Inlet Capacity IS GOOD for Minor and M	Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
Interception with Clogging $Q_{osc} =$ 8.42       10.37       cfs         Curb Opening Capacity as Mixed Flow       MINOR       MAJOR         Interception without Clogging $Q_{me} =$ 6.29       11.10       cfs         Interception with Clogging $Q_{me} =$ 5.66       9.99       cfs         Resulting Curb Opening Capacity (assumes clogged condition) $Q_{curb} =$ 4.40       9.99       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 =       16.6       29.1       ft.>T-Crown         Resultant Flow Depth at Street Crown $d_{cnowh} =$ 0.0       2.9       inches         MINOR       MAJOR       MINOR       MAJOR       10.0       cfs         Total Inlet Interception Capacity (assumes clogged condition) $Q_{pEXK REQUEED} =$ 0.4       2.3       cfs	Interception without Clogging	Q <sub>ci</sub> =	9.36	11.52	cfs
Curb Opening Capacity as Mixed Flow       MINOR       MAJOR         Interception without Clogging $Q_{mi} = 62.9$ 11.10       cfs         Interception with Clogging $Q_{mi} = 5.66$ 9.99       cfs         Resulting Curb Opening Capacity (assumes clogged condition) $Q_{curb} = 4.40$ 9.99       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 = 16.6       29.1       ft.>T-Crown         Resultant Flow Depth at Street Crown       d_crown = 0.0       2.9       inches         MINOR       MAJOR       Total Inlet Interception Capacity (assumes clogged condition)       Qa = 4.4       10.0       cfs         Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)       Q PEAK REQUEED = 0.4       2.3       cfs	Interception with Clogging	Q <sub>cas</sub> =	8.42	10.37	cfs
Interception without Clogging $Q_{mi} =$ $6.29$ $11.10$ cfs         Interception with Clogging $Q_{ma} =$ $5.66$ $9.99$ cfs         Resulting Curb Opening Capacity (assumes clogged condition) $Q_{curb} =$ $4.40$ $9.99$ 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 = $16.6$ $29.1$ $ft. > T-Crown$ Resultant Flow Depth at Street Crown $d_{circowin} =$ $0.0$ $2.9$ inches         Total Inlet Interception Capacity (assumes clogged condition) $Q_a =$ $4.4$ $10.0$ cfs         Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK) $Q_{PEAK REQUEED} =$ $0.4$ $2.3$ cfs	Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception with Clogging     Qmm =     5.66     9.99     cfs       Resulting Curb Opening Capacity (assumes clogged condition)     Qcurb =     4.40     9.99     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 =     16.6     29.1     ft.>T-Crown       Resultant Flow Depth at Street Crown     dcsicowie     0.0     2.9     inches       Total Inlet Interception Capacity (assumes clogged condition)     Qa =     4.4     10.0     cfs       Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)     Q PEAK REQUEED =     0.4     2.3     cfs	Interception without Clogging	Q <sub>mi</sub> =	6.29	11.10	cfs
Resulting Curb Opening Capacity (assumes clogged condition)     Q <sub>curb</sub> 4.40     9.99     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 =     16.6     29.1     ft.>T-Crown       Resultant Flow Depth at Street Crown     d <sub>GROWN</sub> 0.0     2.9     inches       Total Inlet Interception Capacity (assumes clogged condition)     Q <sub>a</sub> =     4.4     10.0     cfs       Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)     Q <sub>PEAK REQUIRED</sub> 0.4     2.3     cfs	Interception with Clogging	Q <sub>ma</sub> =	5.66	9.99	cfs
Minor     Major       Total Inlet Length     L = 5.00     5.00     feet       Resultant Street Flow Spread (based on sheet Q-Allow geometry)     T = 16.6     29.1     ft.>T-Crown       Resultant Flow Depth at Street Crown     dcRown = 0.0     2.9     inches       Total Inlet Interception Capacity (assumes clogged condition)     Qa = 4.4     10.0     cfs       Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)     Q PEAK REQUIRED = 0.4     0.4     2.3	Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>curb</sub> =	4.40	9.99	cfs
Total Inlet Length       L =       5.00       5.00       feet         Resultant Street Flow Spread (based on sheet Q-Allow geometry)       T =       16.6       29.1       ft.>T-Crown         Resultant Flow Depth at Street Crown $d_{CRCWH} =$ 0.0       2.9       inches         Total Inlet Interception Capacity (assumes clogged condition) $Q_a =$ 4.4       10.0       cfs         Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK) $Q_{PEAK REQUIRED} =$ 0.4       2.3       cfs	Resultant Street Conditions		MINOR	MAJOR	
Resultant Street Flow Spread (based on sheet Q-Al/ow geometry)     T =     16.6     29.1     ft.>T-Crown       Resultant Flow Depth at Street Crown     d <sub>GROWN</sub> =     0.0     2.9     inches       Total Inlet Interception Capacity (assumes clogged condition)     Qa =     4.4     10.0     cfs       Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)     Q PEAK REQUIRED =     0.4     2.3     cfs	Total Inlet Length	L =	5.00	5.00	feet
Resultant Flow Depth at Street Crown     d <sub>CROWN</sub> =     0.0     2.9     inches       Total Inlet Interception Capacity (assumes clogged condition)     Qa =     4.4     10.0     cfs       Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)     Q PEAK REQUIRED =     0.4     2.3     cfs	Resultant Street Flow Spread (based on sheet Q-Allow geometry)	T =	16.6	29.1	ft.>T-Crown
MINOR     MAJOR       Total Inlet Interception Capacity (assumes clogged condition)     Qa = 4.4     10.0     cfs       Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)     Q PEAK REQUIRED = 0.4     2.3     cfs	Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.0	2.9	inches
Control Intel Interception Capacity (assumes clogged condition)     Qa =     4.4     10.0     cfs       Intel Capacity IS GOOD for Minor and Major Storms (>Q PEAK)     Q PEAK REQUIRED =     0.4     2.3     cfs			MINOR	MAJOR	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK) Q PEAK REQUIRED = 0.4 2.3 cfs	Total Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	4.4	10.0	cfs
	Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q PEAK REQUIRED =	0.4	2.3	cfs

Project = Inlet ID = Carriage Meadows South 100.030

Inlet DP-13



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 <sub>local</sub> =	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
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	-4
Length of a Unit Curb Opening	L <sub>o</sub> (C) =	25.00	25.00	feet
Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat (see LISDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_f(C) =$	0.10	0.10	1
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w(C) =$	3.60	3.60	1
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>2</sub> (C) =	0.67	0.67	
Grate Flow Analysis (Calculated)	- 0 ( - 7	MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	7
Clogging Eactor for Multiple Units	Clog -	N/A	N/A	
Grate Canacity as a Weir (based on LIDECD - CSU 2010 Study)	olog =	MINOR	MAIOR	
Interception without Clogging	Q =	N/A	N/A	ofe
Interception with Clogging	Q., =	N/A	N/A	cfs
Grate Canacity as a Griffice (based on LIDECD CSLI 2010 Study)	∽wa –	MINOR		013
Interception without Clogging	0	NI/A	N/A	ofo
Interception with Clogging	a₀ = 0 -	N/A	N/A	ofo
marcepadri war Clogging	a <sub>oa</sub> –	IN/A	IN/A	CIS
Grate Capacity as Mixed Flow	0	MINOR	MAJOR	ata
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	crs
	Q <sub>ma</sub> –	N/A	N/A	cis
	Grate =	N/A	N/A	CIS
Curb Opening Flow Analysis (Calculated)	[	MINOR	MAJOR	7
	Coet =	1.33	1.33	-
	Clog =	0.03	0.03	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)	o _ <b>「</b>	MINUR	MAJOR 22.57	ofo
Interception without Clogging	Q <sub>wi</sub> =	19.14	32.57	uisi afa
	Q <sub>wa</sub> =	18.63	31.70	cis
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)	o _	MINUK	MAJOR	-ta
Interception without Clogging	Q <sub>oi</sub> =	50.55	55.95	cis 
	Q <sub>oa</sub> =	49.20	54.47	CIS
Curb Opening Capacity as Mixed Flow	~	MINOR	MAJOR	٦.,.
Interception without Clogging	Q <sub>mi</sub> =	28.92	39.70	crs
Interception with Clogging	Q <sub>ma</sub> =	28.16	38.64	cts
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	18.63	31.70	cts
Resultant Street Conditions	. r	MINOR	MAJOR	п
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 <sub>CROWN</sub> =	0.9	2.4	inches
	<b>•</b> •	MINOR	MAJOR	7. 6.
Total Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	18.6	31.7	CTS
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q PEAK REQUIRED =	0.7	1.1	cfs



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 <sub>local</sub> =	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
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (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 <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	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 <sub>n</sub> =	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)	$C_{x}(C) =$	0.67	0.67	
Grate Flow Analysis (Calculated)	-0(-)	MINOR	MAIOR	
Clogging Coefficient for Multiple Units	Coef -	N/A	N/A	1
Clogging Eactor for Multiple Units	Clog =	N/A	N/A	
Croto Canacity as a Weir (based on LIDECD CSLI 2010 Study)	Clog -	MINOR	MALOR	1
State Capacity as a weir (based on ODFCD - CSO 2010 Study)	0		NI/A	ata
Interception without Clogging	Q <sub>wi</sub> =	N/A	N/A	cis
	Q <sub>wa</sub> =	N/A	N/A	crs
Grate Capacity as a Ornice (based on ODFCD - CSO 2010 Study)	0	MINOR	MAJOR	٦.
Interception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cts
Interception with Clogging	Q <sub>oa</sub> =	N/A	N/A	cts
Grate Capacity as Mixed Flow		MINOR	MAJOR	٦.
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cts
Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cts
Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	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	٦.
Interception without Clogging	Q <sub>wi</sub> =	19.14	32.57	cfs
Interception with Clogging	Q <sub>wa</sub> =	18.63	31.70	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	-
Interception without Clogging	Q <sub>oi</sub> =	50.55	55.95	cfs
Interception with Clogging	Q <sub>oa</sub> =	49.20	54.47	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	-
Interception without Clogging	Q <sub>mi</sub> =	28.92	39.70	cfs
Interception with Clogging	Q <sub>ma</sub> =	28.16	38.64	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	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 <sub>CROWN</sub> =	0.9	2.4	inches
	-	MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	<b>Q</b> <sub>a</sub> =	18.6	31.7	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q PEAK REQUIRED =	2.4	5.3	cfs



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 <sub>local</sub> =	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	8.4	inches
Grate Information		MINOR	MAJOR	<ul> <li>Override Depths</li> </ul>
Length of a Unit Grate	L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	1
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	1
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	N/A	1
Curb Opening Information		MINOR	MAJOR	-
Length of a Unit Curb Opening	L <sub>o</sub> (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	dearees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_{f}(C) =$	0.10	0.10	1
Curb Opening Weir Coefficient (typical value 2,3-3,7)	C <sub>w</sub> (C) =	3.60	3.60	-
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>0</sub> (C) =	0.67	0.67	4
Grate Flow Analysis (Calculated)	0(1)	MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	7
Clogging Eactor for Multiple Units	Clog =	N/A	N/A	4
Grate Capacity as a Weir (based on UDECD - CSU 2010 Study)	0.0g -	MINOR	MAJOR	4
Intercention without Clogging	Q <sub>uri</sub> =	N/A	N/A	cfs
Interception with Clogging	Q =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on LIDECD - CSU 2010 Study)	-wa	MINOR	MAJOR	
Interception without Clogging	Q.; =	N/A	N/A	cfe
Interception with Clogging	Q., =	N/A	N/A	cfe
Crete Connectivity of Mixed Flow	~ <sub>08</sub> –	MINOR		613
Interception without Clogging	0		N/A	ofo
Interception with Clogging	Qmi =	N/A	N/A	cfe
Reception with Cogging	∽ma –	N/A	N/A	ofo
Curk Oneming Flow Analysis (Calculated)	Grate -	N/A MINOD	N/A	CIS
Cleaning Coefficient for Multiple Units	Conf	1.00	MAJOR	7
Clogging Coemcient for Multiple Units	Coel =	1.00	0.10	4
Curb Oneming as a Mair (based on UDECD CELL 2010 Study)	Ciug =	MINOR	0.10	4
Curb Opening as a weir (based on ODFCD - CSO 2010 Study)	0.=	7.08	12.08	cfe
Interception with Clogging	~~~ 0 -	6.27	10.97	ofo
Curb Opening as an Orifice (based on LIDECD CSLI 2010 Study)	Swa –	MINOR	MAIOP	013
Intercention without Clogging	0	10.12		cfs
Interception with Clogging		0.12	10.24	ofe
Curb Opening Conseitures Mixed Flow	G <sup>08</sup> -	MINOD	MA IOD	015
Curb Opening Capacity as Mixed Flow	0	7.97		cfe
Interception with Clogging	Q <sub>mi</sub> =	7.07	0.94	ofo
nancepaon with Clogging	⊲ <sub>ma</sub> =	6.27	9.00 0.95	ofo
resulting ours opening capacity (assumes clogged condition)	⊂Curb =	0.37	9.00	615
	. г	MINUR	MAJOR	feet
	L = 	5.00	5.00	ieet
Resultant Street Flow Spread (based on sneet Q-Allow geometry)	f = d	20.7	28.7	IL>I-CrOWN
Resultant Flow Depth at Street Crown	u <sub>CROWN</sub> =	0.9	2.8	Inches
Total Inlat Intercontion Consolity (accurate all and a set of the	0 -1		MAJUR	ofe
Total met merception Capacity (assumes clogged condition)	⊶a -	0.4	9.0	
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	✓ PEAK REQUIRED =	3.3	10.3	CIS



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 <sub>local</sub> =	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 =	5.5	8.0	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	-
Length of a Unit Curb Opening	L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	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 <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C <sub>f</sub> (C) =	0.10	0.10	1
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C <sub>o</sub> (C) =	0.67	0.67	1
Grate Flow Analysis (Calculated)		MINOR	MAJOR	•
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	1
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 <sub>wi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>wa</sub> =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	-
Interception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>oa</sub> =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	-
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cfs
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	1
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 <sub>wi</sub> =	6.99	17.34	cfs
Interception with Clogging	Q <sub>wa</sub> =	6.56	16.26	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	-
Interception without Clogging	Q <sub>oi</sub> =	18.72	22.38	cfs
Interception with Clogging	Q <sub>oa</sub> =	17.55	20.98	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q <sub>mi</sub> =	10.64	18.32	cfs
Interception with Clogging	Q <sub>ma</sub> =	9.98	17.18	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	6.56	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 =	16.6	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.0	2.4	inches
	•	MINOR	MAIOR	—
		minton	101/10/01	_
Total Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	6.6	16.3	cfs





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 <sub>local</sub> =	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	8.4	inche <u>s</u>
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	1
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	1
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	1
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (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 <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat (see LISDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_{f}(C) =$	0.10	0.10	1
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (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)	-0(-7	MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	٦
Clogging Eactor for Multiple Units	Clog =	N/A	N/A	-
Grate Canacity as a Weir (based on LIDECD - CSU 2010 Study)	olog –	MINOR	MAIOR	_
Interception without Clogging	Q <sub>uri</sub> =	N/A	N/A	cfs
Interception with Clogging	Q =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on LIDECD - CSU 2010 Study)	∽wa –	MINOR		013
Interception without Clogging	Q.; =	N/A	N/A	ofe
Interception with Clogging	Q., =	N/A	N/A	cfe
Grate Consolity as Mixed Flow		MINOR		013
Interception without Clogging	0	N/A	N/A	ofo
Interception with Clogging	Q=	N/A	N/A	cfe
Recuting Grate Conseity (accumes alonged condition)	с <sub>ma</sub> –	N/A	N/A	ofe
	Grate -	MINOR	MAJOR	013
Classing Coefficient for Multiple Lipite	Cast	MINOR 1 25	MAJOR	7
Clogging Coencient for Multiple Units	Coel =	1.25	1.25	-
Ciudgung Factor for Multiple Onits	Ciby =	MINOR	0.00	_
Interception without Clogging	Q . =	10.76	10.11	ofe
Interception with Clogging	⊂w =	10.70	17.01	ofo
	∽wa –	MINOR	MA IOD	013
Carb Opening as an Office (based on ODFCD - CSO 2010 Study)	0	20.23	1VIAJUK 22 01	cfs
	a₀ - 0 -	18.07	22.31	cfe
Curb Opening Connectivity of Mixed Flow	× <sub>08</sub> –	MINOR	MA IOP	
Intercention without Clogging	0	13.72	19.46	cfs
	Qmi -	12.87	18.24	cfe
Resulting Curb Opening Canacity (assumes clogged condition)	• ma =	10.00	17 01	cfs
	≪Curb =	MINOD	17.31 MA 100	613
nesuran Sueer Conditions	. г	10.00		Tract
Pasultant Street Flow Spread (based on sheet O Allow accomption)		20.7	10.00	ft a T Crower
Resultant Street Flow Optedu (Dased Off Sileet Granow geoffietry)	= 1 =acb	20.7	20.7	inchos
	GCROWN =	U.9	2.0 MA IOP	in iones
Total Inlet Intercention Canacity (accumes closed condition)	Q. =[	10 1	17 Q	Tefs
Inter the condition capacity (assumes clogged condition)	~a -	2.6	11.3	
Inter Capacity IS GOOD for Millior and Major Storms (>Q PEAK)	✓ PEAK REQUIRED =	∠.២	5.8	us

Project = Inlet ID =

### Carriage Meadows South #100.030 Inlet DP-15a (G2.12a )



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 <sub>local</sub> =	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	8.4	inches
Grate Information		MINOR	MAJOR	<ul> <li>Override Depths</li> </ul>
Length of a Unit Grate	L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	1
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	1
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	N/A	1
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 <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat (see LISDCM Figure ST-5)	Theta =	63.40	63 40	dearees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>n</sub> =	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)	$C_{w}(C) =$	0.67	0.67	-
Grate Elow Analysis (Calculated)	-0(-)	MINOR	MAIOR	
Clogging Coefficient for Multiple Units	Coef -	N/A	N/A	7
	Clog =	N/A	N/A	4
Grote Consolity as a Weir (based on LIDECD CSLI 2010 Study)	Ciby -	MINOR		4
State Capacity as a weir (based on ODFCD - CSO 2010 Study)	o	NI/A	INIAJOK	
Interception with Clossing	Q <sub>m</sub> =	N/A	N/A	cis
	Q <sub>wa</sub> –	IN/A	IN/A	cis
Grate Capacity as a Ornice (based on ODFCD - CSO 2010 Study)	o _ <b>[</b>	MINOR	MAJOR	7.4
Interception without Clogging		N/A	N/A	CIS
	Q <sub>oa</sub> =	N/A	N/A	cis
Grate Capacity as Mixed Flow	o <b>Г</b>	MINOR	MAJOR	٦.
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cts
Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cts
Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	N/A	N/A	cts
Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	7
Clogging Coefficient for Multiple Units	Coef =	1.25	1.25	4
Clogging Factor for Multiple Units	Clog =	0.06	0.06	
Curb Opening as a Weir (based on UDFCD - CSU 2010 Study)	~ <b>F</b>	MINOR	MAJOR	٦.
Interception without Clogging	Q <sub>wi</sub> =	10.76	19.11	cts
Interception with Clogging	Q <sub>wa</sub> =	10.09	17.91	cts
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)	~ -	MINOR	MAJOR	٦.
Interception without Clogging	Q <sub>oi</sub> =	20.23	22.91	cts
Interception with Clogging	Q <sub>oa</sub> =	18.97	21.48	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	-
Interception without Clogging	Q <sub>mi</sub> =	13.72	19.46	cfs
Interception with Clogging	Q <sub>ma</sub> =	12.87	18.24	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	10.09	17.91	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	28.7	ft.>T-Crown
Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.9	2.8	inches
		MINOR	MAJOR	<b>-</b> .
Total Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	10.1	17.9	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q PEAK REQUIRED =	2.0	4.5	cfs

Project = Inlet ID =

 Carriage Meadows South
 #100.030

 Inlet DP-16 (G2.7)
 Inlet DP-16 (G2.7)

 H-Curb
 H-Vert
 Wo

 Wp
 Lo (G)
 Lo (G)

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 <sub>local</sub> =	3.00	1.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1		
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.0	inches
Grate Information		MINOR	MAJOR	<ul> <li>Override Depths</li> </ul>
Length of a Unit Grate	L <sub>0</sub> (G) =	N/A	RIA.	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	- 192A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	NUL	1
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	1
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	1004	-
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>0</sub> (G) =	N/A	2615	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L <sub>o</sub> (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H <sub>eert</sub> =	6.00	6.60	inches
Height of Curb Orifice Throat in Inches	H <sub>menut</sub> =	6.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	11.00	degraes
Side Width for Depression Pan (typically the gutter width of 2 feet)	W. =	2.00	5.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_{r}(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2 3-3 7)	C. (C) =	3.60	0.10	-
Curb Opening Ordine Coefficient (Aprical Value 0.60 - 0.70)	C, (C) =	0.67	10.00	-
Grate Flow Analysis (Calculated)	0,0)	MINOR	MAIOR	
Clonging Coefficient for Multiple Units	Coef	N/A	NIA	7
Clogging Coshident for Multiple Units	Clear =	NIA	N/A	-
Grate Capacity as a Weir (based on UDECD _ CSU 2010 Study)	Clog =	MINIOR	N/A	_
Intercention without Cleaning	0 -[	MINOR	MAJOR	-te
Interception with Closeling	Quei -	NVA	N/A	cis
Crete Casesity as a Orifice (based on UDECD, CSU 2010 Study)	Give -	N/A	N/A	CIS
Grate Capacity as a Onnice (based on ODFCD - CSO 2010 Study)	0 -	MINOR	MAJOR	٦.
Interception with Ologging		N/A	N/A	cts
Interception with clogging	Q <sub>os</sub> =	N/A	N/A	cts
Grate Capacity as Mixed Flow	0 -	MINOR	MAJOR	1.
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cts
Resulting Crete Constitution	ame a	N/A	N/A	cts
Resulting Grate Capacity (assumes clogged condition)	Grate =	N/A	N/A	cts
Curb Opening Flow Analysis (Calculated)	T	MINOR	MAJOR	7
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)	<b>a</b> - [	MINOR	MAJOR	
Interception without Clogging	Q <sub>vit</sub> =	10.72	17.34	cfs
Interception with Clogging	Q <sub>eep</sub> =	10.05	16.26	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)	F	MINOR	MAJOR	1
Interception without Clogging	Q <sub>oi</sub> =	20.22	22.38	cfs
Interception with Clogging	Q <sub>cs</sub> =	18.96	20.98	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	-
Interception without Clogging	Q <sub>mi</sub> =	13.69	18.32	cfs
Interception with Clogging	Q <sub>ms</sub> =	12.84	17.18	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	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 <sub>CROWN</sub> =	0.9	2.4	inches
		MINOR	MAJOR	-
Total Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	10.1	16.3	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q PEAK REQUIRED =	4.6	10.2	cfs



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type F	R Curb Opening	
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a <sub>local</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1		
Nater Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.0	inches
Grate Information		MINOR	MAJOR	<ul> <li>Override Depth</li> </ul>
ength of a Unit Grate	L <sub>o</sub> (G) =	N/A	ihuw:	feet
Nidth of a Unit Grate	W <sub>o</sub> =	N/A	104	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	1105	-
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>1</sub> (G) =	N/A	N/A	1
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	Serv.	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_{o}(G) =$	N/A	The	-
Curb Opening Information		MINOR	MAJOR	
ength of a Unit Curb Opening	L <sub>o</sub> (C) =	5.00	3.00	feet
leight of Vertical Curb Opening in Inches	H <sub>unt</sub> =	6.00	8.00	inches
eight of Curb Orifice Throat in Inches	Henry =	6.00	1000	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	80.45	degrees
Side Width for Depression Pan (typically the putter width of 2 feet)	W_=	2.00	3.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C, (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2 3-3 7)	C. (C) =	3.60	0.10	-
Surb Opening Orifice Coefficient (spicel value 0.60 - 0.70)	C, (C) =	0.67	0.52	-
Crate Flow Analysis (Calculated)	0,00	MINOR	MAIOR	
Conting Coefficient for Multiple Units	Conf	NIA	NIA	
Consister For Multiple Linits	Clos =	NZA	NIA	-
and the second of the second of the second of the second	ciog -	MINOR	MAJOR	
state Capacity as a weir (based on ODFCD - CSO 2010 Study)	0 -	MINOR	MAJOR	1
nterception without Clogging	Q <sub>wi</sub> =	N/A	N/A	cts
Interception with Clogging		N/A	N/A	cts
srate Capacity as a Ornice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
nterception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
nterception with Clogging	Q <sub>ou</sub> =	N/A	N/A	cfs
Srate Capacity as Mixed Flow		MINOR	MAJOR	-
nterception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
nterception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	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	_
nterception without Clogging	Q <sub>wi</sub> =	7.06	10.97	cfs
nterception with Clogging	Q <sub>via</sub> =	6.35	9.87	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)	-	MINOR	MAJOR	-
nterception without Clogging	Q <sub>oi</sub> =	10.11	11.19	cfs
nterception with Clogging	Q <sub>ce</sub> =	9.10	10.07	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	-
nterception without Clogging	Q <sub>mi</sub> =	7.86	10.30	cfs
nterception with Clogging	Q <sub>ma</sub> =	7.07	9.27	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	6.35	9.27	cfs
lesultant Street Conditions		MINOR	MAJOR	_
otal 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 <sub>CROWN</sub> =	0.9	2.4	inches
		MINOR	MAJOR	_
Fotal Inlet Interception Capacity (assumes clogged condition)	$Q_a = $	6.4	9.3	cfs
nlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q DEAK DECKEDER	23	5.0	cfs

Project = Inlet ID =

 Carriage Meadows South #100.030

 Inlet DP-18 (G2.10)

 Lo (C)

 H-Curb

 H-Vert

 Wp

 Lo (G)

Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type F	Curb Opening	
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a <sub>local</sub> =	3.00	0.00	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
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L <sub>0</sub> (G) =	N/A	Provi	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	DOP 1	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	3674	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>r</sub> (G) =	N/A	N/A	1
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	(min)	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C, (G) =	N/A	inazoli	-
Curb Opening Information		MINOR	MAJOR	-
Length of a Unit Curb Opening	L. (C) =	5.00		feet
Height of Vertical Curb Opening in Inches	H <sub>unt</sub> =	6.00	25-031	inches
Height of Curb Orifice Throat in Inches	Hauna =	6.00	2.60	inches
Angle of Throat (see LISDCM Figure ST-5)	Thota =	63.40	122.42	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W. =	2.00	6.00	feet
Clogging Eactor for a Single Curb Opening (typical value 0.10)	C. (C) =	0.10	0.10	- leet
Curch Opening Weir Coefficient (bring) value 2 3-3 7)	C (C) =	3.60	0.10	-
Curb Opening Orifice Coefficient (typical value 2.3-5.7)	C (C) =	3.60	0.00	-
Crate Eleve Analysis (Calculated)	$C_0(0) =$	0.67		
Cleaning Coefficient for Multiple Units	Court I	MINOR	MAJOR	
Closeles Easter for Multiple Units	Coer =	N/A	N/A	-
Crogging Factor for Multiple Onits	Clog =	N/A	N/A	_
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)	0.1	MINOR	MAJOR	1.
Interception without Clogging	Q <sub>wi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>960</sub> =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)	T	MINOR	MAJOR	
Interception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>os</sub> =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	-
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	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 <sub>wi</sub> =	7.06	10.97	cfs
Interception with Clogging	Q <sub>vve</sub> =	6.35	9.87	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)	_	MINOR	MAJOR	
Interception without Clogging	Q <sub>oi</sub> =	10.11	11.19	cfs
Interception with Clogging	Q <sub>oe</sub> =	9.10	10.07	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q <sub>mi</sub> =	7.86	10.30	cfs
Interception with Clogging	Q <sub>ma</sub> =	7.07	9.27	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>curb</sub> =	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)	τ=	20.7	27.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.9	2.4	inches
		MINOR	MAJOR	-
Total Inlet Interception Capacity (assumes clogged condition)	Q <sub>a</sub> =	6.4	9.3	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q PEAK REQUIRED =	1.2	2.6	cfs





Design Information (Input)		MINOR	MAJOR	_
Type of Inlet	Inlet Type =	CDOT Type R	R Curb Opening	
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a <sub>local</sub> =	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
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	1
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	N/A	1
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 <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	dearees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>p</sub> =	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 <sub>w</sub> (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{0}(C) =$	0.67	0.67	1
Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	٦
Clogging Factor for Multiple Units	Clog =	N/A	N/A	4
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	-
Interception without Clogging	Q <sub>wi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>wa</sub> =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on LIDECD - CSU 2010 Study)		MINOR	MAJOR	
Interception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>00</sub> =	N/A	N/A	cfs
Grate Capacity as Mixed Flow	<u>u</u>	MINOR	MAIOR	
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grato</sub> =	N/A	N/A	cfs
Curb Opening Flow Analysis (Calculated)	Horate	MINOR	MAIOR	0.0
Clogging Coefficient for Multiple Unite	Coef -	1.00	1.00	7
Clogging Eactor for Multiple Units	Clog -	0.10	0.10	4
Curb Opening as a Weir (based on LIDECD - CSU 2010 Study)	olog –	MINOR	MAIOR	4
Interception without Clogging	Q <sub>uri</sub> =	7.06	10.97	cfs
Interception with Clogging	Q =	6.35	9.87	cfs
Curb Opening as an Orifice (based on LIDECD - CSU 2010 Study)	·wa	MINOR	MAIOR	0.0
Interception without Clogging	Q <sub>ci</sub> =	10.11	11 19	cfs
Interception with Clogging	Q <sub>0-</sub> =	9,10	10.07	cfs
Curb Opening Canacity as Mixed Flow	- Jua	MINOP	MAIOR	0.0
Interception without Clogging	Q <sub>mi</sub> =	7.86	10.30	cfs
Interception with Clogging	Q =	7.07	9.27	cfs
Resulting Curb Opening Capacity (assumes clogged condition)		6.35	9.27	cfs
	scurb -	MINOR	MAIOR	0.0
Total Inlet Length	ı _ <b>I</b>	5.00	5.00	feet
Resultant Street Flow Spread (based on sheet Q-4//ow geometry)	L= τ_	20.7	27.0	ft >T-Crown
Resultant Flow Denth at Street Crown		20.7	21.0	inches
	CROWN -	MINOP		
Total Inlet Intercention Canacity (assumes closed condition)	Q. =	6.4	9.3	cfs
Inlet Canacity IS GOOD for Minor and Major Storms (>O PEAK)		11	2.5	cfs
miler oupdoidy to ocode for million and major otornis (24 r EAR)	- PEAK REQUIRED =	1.1	2.0	010

Project = Inlet ID =

### Carriage Meadows South #100.030 Inlet DP-22 (G2.12b)



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 <sub>local</sub> =	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	8.1	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L <sub>o</sub> (G) =	N/A	N/A	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>0</sub> (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	$L_{0}(C) =$	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	Hthroat =	6.00	6.00	inches
Angle of Throat (see LISDCM Figure ST-5)	Theta -	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_ =	2 00	2.00	feet
Clogging Eactor for a Single Curb Opening (typical value 0.10)	$C_{t}(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2 3-3 7)	C <sub>11</sub> (C) =	3.60	3.60	1
Curb Opening Orifice Coofficient (typical value 2.5-5.7)	C (C) =	0.67	0.67	4
Cristo Opening Office Coleviated)	0,00	0.07	0.07	
Grate Flow Analysis (Calculated)	Cast	IVIINOR	IVIAJOR	7
Clogging Coefficient for Multiple Units	Coel =	N/A	N/A	-
	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on UDFCD - CSU 2010 Study)	~ <b>[</b>	MINOR	MAJOR	٦.
Interception without Clogging	Q <sub>wi</sub> =	N/A	N/A	cts
Interception with Clogging	Q <sub>wa</sub> =	N/A	N/A	cts
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)	- <b>1</b>	MINOR	MAJOR	٦.
Interception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>oa</sub> =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	-
Interception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	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 <sub>wi</sub> =	7.06	11.24	cfs
Interception with Clogging	Q <sub>wa</sub> =	6.35	10.12	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)	_	MINOR	MAJOR	-
Interception without Clogging	Q <sub>oi</sub> =	10.11	11.26	cfs
Interception with Clogging	Q <sub>oa</sub> =	9.10	10.13	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	_
Interception without Clogging	Q <sub>mi</sub> =	7.86	10.46	cfs
Interception with Clogging	Q <sub>ma</sub> =	7.07	9.42	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	6.35	9.42	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)	Τ=	20.7	27.5	ft.>T-Crown
Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.9	2.5	inches
	L.	MINOR	MAJOR	-
Total Inlet Interception Capacity (assumes clogged condition)	<b>Q</b> <sub>a</sub> =	6.4	9.4	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q PEAK REQUIRED =	2.2	4.8	cfs

Project = Inlet ID =

# Carriage Meadows South #100.030

Inlet DP-24 (G2.13)

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 <sub>local</sub> =	3.00	5.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1		
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.1	inches
Grate Information		MINOR	MAJOR	<ul> <li>Override Depths</li> </ul>
Length of a Unit Grate	L <sub>0</sub> (G) =	N/A	1975	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	12114	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	1464	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	1
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	1996	-
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>0</sub> (G) =	N/A	7400	
Curb Opening Information		MINOR	MAJOR	-
Length of a Unit Curb Opening	L <sub>o</sub> (C) =	5.00	3.00	feet
Height of Vertical Curb Opening in Inches	H <sub>unt</sub> =	6.00	8.02	inches
Height of Curb Orifice Throat in Inches	H <sub>threat</sub> =	6.00	8,007	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	N.L.ab	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W., =	2.00	3.01	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_{r}(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2 3-3 7)	$G_{-}(C) =$	3.60	0.10	-
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C. (C) =	0.67	19.47	-
Grate Flow Analysis (Calculated)	-01-7	MINOR	MAIOR	1
Clagging Coefficient for Multiple Units	Coef =	N/A	N/A	1
Clogging Eactor for Multiple Units	Clog =	N/A	N/A	-
Grate Capacity as a Weir (based on UDECD - CSU 2010 Study)	ciog -	MINOR	MAIOR	_
Intercention without Clogging	0.=	N/A	N/A	cle
Interception with Clogging	0 =	N/A	N/A	cis
Grate Capacity as a Orifice (based on LIDECD - CSU 2010 Study)	Came -	MINOR	MALOR	CIS
Intercention without Cloppins	0.=[	MINOR	MAJOR	Inte
Interception with Clogging	0 =	NIA	N/A	cis
Grate Capacity as Mixed Flow	G208 -	NA	N/A	CIS
Interception without Clonging	0[	MINOR	MAJOR	7-6-
Interception with Clogging	Q <sub>mi</sub> =	N/A	N/A	crs
Resulting Grate Capacity (assumes clonged condition)	Q	N/A	N/A	cis
Curb Opening Flow Applyris (Colouleted)	Grate -	NIA	N/A	CTS
Classics Coofficient for Multiple Units		MINOR	MAJOR	1
	Coef =	1.00	1.00	-
Clogging Pactor for Multiple Units	Clog =	0.10	0.10	1
Curb Opening as a Weir (based on ODFCD - CSO 2010 Study)	01	MINOR	MAJOR	
Interception with Oligonia	0 -	7.06	11.24	CIS
	Q.ve -	6.35	10.12	cis
Interpretion without Clonging	0	MINOR	MAJOR	
Interception with Clogging	0 -	10.11	11.20	cis
Curb Opening Considered Mined Flow	Q <sub>08</sub> -	9.10	10.13	cis
Curb Opening Capacity as Mixed Flow	o - [	MINOR	MAJOR	1.
Interception without Clogging	Q <sub>mi</sub> =	7.86	10.46	cts
Interception with Clogging	Q <sub>ms</sub> =	7.07	9.42	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	6.35	9.42	cfs
Resultant Street Conditions		MINOR	MAJOR	1
Constant (Rest Figure Constant Constant Constant Constant)	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on sheet Q-Allow geometry)	Τ=	20.7	27.5	ft.>T-Crown
Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.9	2.5	inches
	0 -5	MINOR	MAJOR	Tete .
Total Interception Capacity (assumes clogged condition)	u <sub>a</sub> =	6.4	9.4	CIS
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q PEAK REQUIRED =	2.8	6.2	cfs

Project = Inlet ID =

# Carriage Meadows South #100.030

Inlet DP-26 (G3.1 & G3.2)

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 <sub>koal</sub> =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1		
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.1	inches
Grate Information		MINOR	MAJOR	[J] Override Depths
Length of a Unit Grate	L <sub>0</sub> (G) =	N/A	THEM	feet
Width of a Unit Grate	W <sub>0</sub> =	N/A	LIGHT	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	100	1
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>f</sub> (G) =	N/A	N/A	1
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	1995	1
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>o</sub> (G) =	N/A	190vili	1
Curb Opening Information		MINOR	MAJOR	-
Length of a Unit Curb Opening	L <sub>o</sub> (C) =	5.00	IE po	feet
Height of Vertical Curb Opening in Inches	H <sub>vert</sub> =	6.00	0.00	inches
Height of Curb Orifice Throat in Inches	H <sub>throat</sub> =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	83.46	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W <sub>n</sub> =	2.00	5.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_t(C) =$	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60	11 19 1	-
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{n}(C) =$	0.67	20.87	-
Grate Flow Analysis (Calculated)	-01-7	MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	1
Clogging Factor for Multiple Units	Clog =	N/A	N/A	-
Grate Capacity as a Weir (based on UDECD - CSU 2010 Study)	olog	MINOR	MAIOR	_
Interception without Clogging	0=	N/A	N/A	efe
Interception with Clonging	0=	N/A	N/A	cia
Grate Canacity as a Orifice (based on LIDECD - CSU 2010 Study)	- via	MINOR	MAIOR	CIS
Interception without Clogging	Q., =	N/A	N/A	cfs
Interception with Clonging	0 =	N/A	N/A	cfe
Grate Capacity as Mixed Flow	unda -	MINOR	MALOR	013
Intercention without Clonging	o. =[	MINOR	NIAJOR	afe
Interception with Clonging	0 =	N/A	NIA	cfs
Resulting Grate Capacity (assumes clogged condition)	0 =	NIA	NIA	cia
Curb Opening Elew Analysis (Calculated)	Grate	MINOR	MALIOR	CIS
Clossing Coefficient for Multiple Units	Cont -	MINOR	MAJOR	1
Clogging Coefficient for Multiple Units	Coer =	1.00	1.00	-
Crogging Pactor for Multiple Units	Clog =	0.10	0.10	1
Interpenting as a weir (based on ODFCD - CSO 2010 Study)	0 -	MINOR	MAJOR	1
Interception with Olegging	Q <sub>w</sub> =	7.06	11.24	cts
	Give -	0.35	10.12	CIS
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)	o - [	MINOR	MAJOR	٦.
Interception without Clogging		10.11	11.26	cts
Interception with Clogging	Close =	9.10	10.13	cts
Curb Opening Capacity as Mixed Flow	o . [	MINOR	MAJOR	1.
Interception without Clogging	Q <sub>mi</sub> =	7.86	10.46	cfs
Interception with Clogging	Q <sub>me</sub> =	7.07	9.42	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	6.35	9.42	cfs
Resultant Street Conditions		MINOR	MAJOR	1
I otal iniet Length	L =	5.00	5.00	feet
Resultant Street Flow Spread (based on sheet Q-Allow geometry)	T =	20.7	27.5	ft.>T-Crown
Resultant Flow Depth at Street Crown	d <sub>CROWN</sub> =	0.9	2.5	inches
	C	MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	$Q_a =$	6.4	9.4	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	Q PEAK REQUIRED =	2.4	5.2	cfs



Design Information (Input)	-	MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type F	R Curb Opening	
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a <sub>kocal</sub> =	3.00	31.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1		
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.5	8.1	inches
Grate Information		MINOR	MAJOR	<ul> <li>Override Depth</li> </ul>
Length of a Unit Grate	L <sub>0</sub> (G) =	N/A	think	feet
Width of a Unit Grate	W <sub>o</sub> =	N/A	1004	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A <sub>ratio</sub> =	N/A	1906	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C <sub>1</sub> (G) =	N/A	N/A	-
Grate Weir Coefficient (typical value 2.15 - 3.60)	C <sub>w</sub> (G) =	N/A	1005	-
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C <sub>0</sub> (G) =	N/A	North	-
Curb Opening Information		MINOR	MAJOR	
enoth of a Unit Curb Opening	L. (C) =	10.00	MP BOIL	feet
Height of Vertical Curb Opening in Inches	H =	6.00	16,193	inches
Height of Curb Orifice Throat in Inches	Hanna =	6.00	10.00	inches
Angle of Throat (see LISDOM Figure ST.5)	Their -	62.40	100.00	deamor
Side Width for Decression Pan (typically the outler width of 2 feet)	W =	2.00	5.00	feet
Clogging Earlor for a Single Curb Opening the guildt width of 2 (661)	C. (C) =	0.10	0.10	1301
Curb Opening Weir Coefficient (Innicel value 2.2.2.7)	G (C) -	3.60	0.10	-
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C <sub>w</sub> (C) =	3.60		-
Curb Opening Onnice Coemclent (typical value 0.60 - 0.70)	C <sub>0</sub> (C) =	0.67	144.105	
State 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	
Srate Capacity as a Weir (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	-
nterception without Clogging	Q <sub>vd</sub> =	N/A	N/A	cfs
nterception with Clogging	Q <sub>ves</sub> =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on UDFCD - CSU 2010 Study)	-	MINOR	MAJOR	_
nterception without Clogging	Q <sub>oi</sub> =	N/A	N/A	cfs
nterception with Clogging	Q <sub>os</sub> =	N/A	N/A	cfs
Grate Capacity as Mixed Flow	-	MINOR	MAJOR	-
nterception without Clogging	Q <sub>mi</sub> =	N/A	N/A	cfs
Interception with Clogging	Q <sub>ma</sub> =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q <sub>Grate</sub> =	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	
nterception without Clogging	Q <sub>wi</sub> =	10.72	17.78	cfs
nterception with Clogging	Q <sub>ww</sub> =	10.05	16.67	cfs
Curb Opening as an Orifice (based on UDFCD - CSU 2010 Study)		MINOR	MAJOR	
nterception without Clogging	Q <sub>ci</sub> =	20.22	22.52	cfs
nterception with Clogging	Q <sub>os</sub> =	18.96	21.11	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
nterception without Clogging	Q <sub>mi</sub> =	13.69	18.61	cfs
nterception with Clogging	Q <sub>ma</sub> =	12.84	17.44	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q <sub>Curb</sub> =	10.05	16.67	cfs
Resultant Street Conditions	- and	MINOR	MAJOR	
Fotal Inlet Length	1=	10.00	10.00	feet
Resultant Street Flow Spread (based on sheet Q-Allow geometry)	T =	20.7	27.5	ft >T-Crown
Resultant Flow Depth at Street Crown	dopose =	0.9	25	inches
contents, terr and an an another another	-CHOWN L	MINOR	MAIOP	
Total Inlet Interception Capacity (assumes clonged condition)	Q. =[	10.1	16.7	cfs
Injet Canacity IS GOOD for Minor and Major Storms (50 DEAK)	0	6.9	16.0	cfe
A REAL PROPERTY AND A REAL PROPERTY AND A REAL PROPERTY AND A REAL PROPERTY.	Not Little All Little and Little	12.12	· · · · · · · · · · · · · · · · · · ·	Theter 1

**RESIDENTIAL STREET (34' Flowline to flowline)** 



Interim Release October 12, 1994 City of Colorado Springs

Use this graph to determine the allowable street capacity per side, initial storm, for the typical street section using a 2% crown.





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 - 30" RCP	26.90	30 c	37.0	5692.80	5693.10	0.812	5694.53	5694.83	n/a	5694.83	End
2	L2 - 30" RCP	24.30	30 c	36.0	5693.60	5693.89	0.806	5695.31	5695.54	n/a	5695.54	1
3	L3 - 24" RCP	14.90	24 c	18.0	5694.39	5694.53	0.776	5695.97	5695.92	0.00	5695.92	2
Projec	t File: 100.030 DP-3b S	torm Drain	-5yr.stm				Num	nber of line	s: 3	Run I	Date: 06-21	-2016

Station	Lei	Drr	ng Area	Rnof	¥.	rea x C		ц	Rain	Total	Cap	Vel	Ρi	be	Invert	Elev	НСГ	Elev	Grnd / Ri	m Elev	Line ID	
Line To	0	Incr	· Total		Incr	Tota	I Inlet	Syst					Size	Slope	dŊ	Dn	dŊ	Dn	dŊ	Dn		
3	(tt)	(ac)	) (ac)	Û			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(ii)	(%)	(tt)	(ft)	(ft)	(ft)	(ft)	(ft)		
- E	ld 37.0	0.00	0.00	0.00	0.00	0.00	0.0	0.2	0.0	26.90	36.95	7.41	30	0.81	5693.10	5692.80	5694.83	5694.53	5700.00	5697.00	L1 - 30" RCP	
2	36.0	0.00	0.00	0.00	0.00	00.0	0.0	0.1	0.0	24.30	36.81	6.95	30	0.81	5693.89	5693.60	5695.54	5695.31	5700.00	5700.00	L2 - 30" RCP	
3	18.0	0.00	0.00	0.00	00.0	00.00	0.0	0.0	0.0	14.90	19.92	6.01	24	0.78	5694.53	5694.39	5695.92	5695.97	5698.00	5700.00	L3 - 24" RCP	
Project	: File: 10	0.030 DF	3b Stori	m Drain-	-5yr.stm										Number	of lines: 3			Run Dat	e: 06-21-2	016	
NOTES:	Intensity	= 68.28	/ (Inlet tin	le + 13.1	10) ^ 0.6	39; Retu	Irn perioc	1 = 5 Yrs														

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**Storm Sewer Tabulation** 

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 - 30" RCP	51.20	30 c	37.0	5692.80	5693.10	0.812	5695.30*	5695.88*	0.00	5695.88	End
2	L2 - 30" RCP	46.50	30 c	36.0	5693.60	5693.89	0.806	5696.17*	5696.64*	0.00	5696.64	1
3	L3 - 24" RCP	29.20	24 c	18.0	5694.39	5694.53	0.776	5696.69*	5696.99*	0.00	5696.99	2
3	L3 - 24" RCP	29.20	24 c	18.0	5694.39	5694.53	0.776	5696.69*	5696.99*	0.00	5696.99	2
Projec	t File: 100.030 DP-3b S	torm Drain	-100yr.stm				Num	nber of line:	5:3	Run I	Date: 06-21	-2016

Stat	ion	Len	Drng	Area	Rnoff	Are	axC	Ч	~	Rain	Total	Cap	Vel	Pip	e	Invert	Elev	HGL	Elev	Grnd / Ri	m Elev	Line ID	
Line	To a		Incr	Total		Incr	Total	Inlet	Syst	2				Size	Slope	Чp	Dn	dD	Dn	Чр	Dn		
		(ft)	(ac)	(ac)	(C			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)		
~	End	37.0	0.00	0.00	0.00	0.00	0.00	0.0	0.1	0.0	51.20	36.95	10.43	30	0.81	5693.10	5692.80	5695.88	5695.30	5700.00	5697.00	L1 - 30" RCP	
N	<del></del>	36.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	46.50	36.81	9.47	30	0.81	5693.89	5693.60	5696.64	5696.17	5700.00	5700.00	L2 - 30" RCP	
ო	7	18.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	29.20	19.92	9.30	24	0.78	5694.53	5694.39	5696.99	5696.69	5698.00	5700.00	L3 - 24" RCP	
Proj	ect File	: 100.0	30 DP-3	b Storm	Drain-10	J0yr.stm										Number	of lines: 3			Run Dat	e: 06-21-2	016	
NOTE	S: Inte	nsity = 5	58.48 / (	nlet time	+ 7.70)	^ 0.75;	Return p	veriod =	100 Yrs.														

Hydraflow Storm Sewers 2005

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# **Storm Sewer Tabulation**





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	P1 - 48" RCP	120.0	48 c	198.0	5685.86	5686.85	0.500	5689.28	5690.83	0.00	5690.83	End
Projec	t File: 100.030 DP-6 St	orm Drain-	100yr.stm				Num	nber of line:	s: 1	Run [	Date: 06-21	-2016

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs.

Line ID			48" RCP	
_			2	
m Elev	Dn	(ft)	5693.00 5693.00	e: 00-21-2
Grnd / Ri	dŊ	(ft)	5693.00 5693.00	
Elev	Dn	(ft)	2689.28	
HGL	dŊ	(ft)	2690.83	
Elev	Dn	(ft)	5685.86 5685.86	
Invert	dŊ	(ft)	5686.85 Minor	
be	Slope	(%)	0.50	
Ē	Size	(ui)	84	
Vel		(ft/s)	10.02	
Cap	5	(cfs)	101.6	
Total		(cfs)	120.0	
Rain		(in/hr)	0.0	
0	Syst	(min)	0. ō	100 Yrs
Ĕ	Inlet	(min)	0. 0	period =
a x C	Total		8. 6	Return
Are	Incr		0.00	0.75;
Rnoff		ΰ	0.00	9 + 7.70)
Area	Total	(ac)	0.00	o storm
Drng	Incr	(ac)	0.00	58.48 / (
Len		(ft)	20 20 20 20	e: 100.0 9nsity = {
ation	To		E U Q E U D E U D	oject rii ES: Inte
St	Line			TON TON

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**Storm Sewer Tabulation** 



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 - 24" RCP	12.60	24 c	50.0	5685.80	5686.80	2.000	5687.14	5688.06	n/a	5688.06 j	End
2	L2 - 18" RCP	5.40	18 c	35.0	5687.30	5688.00	2.001	5688.48	5688.89	n/a	5688.89 j	1
Proiec	t File: 100.030 DP-7 Stu	orm Drain-	ōyr.stm				Nun	hber of line	s: 2	Run I	Date: 06-21	-2016
.,			•									-

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

### 5686.80 5685.80 5688.06 5687.14 5692.63 5689.00 L1 - 24" RCP 5692.63 L2 - 18" RCP Line ID Run Date: 06-21-2016 Grnd / Rim Elev (£ Б 5692.63 ď (£ 5688.48 ŧ Б HGL Elev 5687.30 5688.89 ď (£ Number of lines: 2 D ŧ Invert Elev 5688.00 ď (t Slope 2.00 2.00 (%) Pipe Size (in) 18 24 4.29 (ft/s) 5.84 Vel 14.85 31.99 (cfs) Cap full 12.60 Total flow (cfs) 5.40 (in/hr) Rain (I) 0.0 0.0 (min) NOTES: Intensity = 68.28 / (Inlet time + 13.10) ^ 0.89; Return period = 5 Yrs. Syst 0.2 0.0 ۲ Inlet (min) 0.0 0.0 Total 0.00 0.00 Area x C Incr 0.00 0.00 Project File: 100.030 DP-7 Storm Drain-5yr.stm Rnoff coeff 0.00 0.00 ΰ (ac) Total 0.00 0.00 Drng Area Incr (ac) 0.00 0.00 Len 50.0 35.0 ŧ End To Line Station ~ Line ~ 2

Hydraflow Storm Sewers 2005

**Storm Sewer Tabulation** 

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 - 24" RCP	27.70	24 c	50.0	5685.80	5686.80	2.000	5687.62	5688.62	n/a	5688.62	End
2	L2 - 18" RCP	11.80	18 c	35.0	5687.30	5688.00	2.001	5689.25*	5689.69*	0.00	5689.69	1
Projec	t File: 100.030 DP-7 Sto	orm Drain-	100yr.stm				Nun	hber of lines	s: 2	Run [	Date: 06-21	-2016

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; \*Surcharged (HGL above crown).

### 5689.00 L1 - 24" RCP 5692.63 L2 - 18" RCP Line ID Run Date: 06-21-2016 Grnd / Rim Elev (£ Б 5687.62 5692.63 5692.63 ď (£ 5689.25 ŧ Б HGL Elev 5685.80 5688.62 5687.30 5689.69 ď (£ Number of lines: 2 D ŧ Invert Elev 5686.80 5688.00 ď (t Slope 2.00 2.00 (%) Pipe Size (in) 18 24 6.68 (ft/s) 9.21 Vel 31.99 14.85 (cfs) Cap full 27.70 11.80 Total flow (cfs) (in/hr) Rain (I) 0.0 0.0 NOTES: Intensity = 58.48 / (Inlet time + 7.70) $^{\circ}$ 0.75; Return period = 100 Yrs. (min) Syst 0.0 0.1 ۲ Inlet (min) 0.0 0.0 Total 0.00 0.00 Area x C Incr Project File: 100.030 DP-7 Storm Drain-100yr.stm 0.00 0.00 Rnoff coeff 0.00 0.00 ΰ (ac) Total 0.00 0.00 Drng Area Incr (ac) 0.00 0.00 Len 50.0 35.0 ŧ End To Line Station ~ Line ~ 2

Hydraflow Storm Sewers 2005

# Storm Sewer Tabulation





Hydraflow Storm Sewers 2005

02-20-2017

No. Lines: 10

Project File: 100.030 G2.1-G2.6 Storm Drain-100yr.stm

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	47.60	48 c	51.0	5683.54	5683.74	0.393	5685.61	5685.80	0.00	5685.80	End
2	L2	45.60	48 c	47.0	5683.74	5683.93	0.404	5686.42	5686.44	0.00	5686.44	1
3	L3	43.00	48 c	146.0	5683.93	5684.51	0.397	5686.73	5686.80	0.00	5686.80	2
4	L4	40.60	48 c	7.0	5684.51	5684.54	0.432	5686.86	5686.86	0.00	5686.86	3
5	L5	28.70	48 c	27.0	5684.54	5684.65	0.407	5687.11	5687.11	0.00	5687.11	4
6	L6	11.90	24 c	215.0	5687.24	5688.53	0.600	5688.45	5689.76	0.00	5689.76	4
7	L7	4.90	18 c	27.0	5689.03	5689.30	1.000	5690.18	5690.15	0.00	5690.15	6
8	L8	7.00	24 c	361.0	5688.73	5690.90	0.601	5690.22	5691.84	n/a	5691.84 j	6
9	L9	7.00	24 c	28.0	5691.20	5691.37	0.607	5692.13	5692.31	0.00	5692.31	8
10	L10	6.70	18 c	34.0	5691.87	5692.07	0.587	5692.92	5693.11	0.00	5693.11	9
Projec	t File: 100.030 G2.1-G2	2.6 Storm D	prain-5yr.stm				Num	nber of line:	s: 10	Run I	Date: 02-21	-2017
Projec	t File: 100.030 G2.1-G2	2.6 Storm D	orain-5yr.stm				Num	nber of line	s: 10	Run [	Date: 02-21	-2017

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

**Storm Sewer Tabulation** 

Stat	ion	Len	Drng /	Area	Rnoff	Area	a x c	۲ ۲		Rain	Total	Cap	Vel	Pig	)e	Invert	Elev	HGL	Elev	Grnd / Ri	im Elev	Line ID
Line	P		Incr	Total	coeff	Incr	Total	Inlet	Syst	Ξ	flow	full		Size	Slope	dD	Dn	ď	ď	dD	Ð	
	Line	(ft)	(ac)	(ac)	(C			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(tt)	(ft)	(ft)	
-	End	51.0	0.00	0.00	0.00	00.0	0.00	0.0	5.0	0.0	47.60	90.00	7.27	48	0.39	5683.74	5683.54	5685.80	5685.61	5690.50	5688.00	2
5	-	47.0	0.00	0.00	00.0	0.00	0.00	0.0	4.8	0.0	45.60	91.32	5.29	48	0.40	5683.93	5683.74	5686.44	5686.42	5690.50	5690.50	12
ю	2	146.0	0.00	0.00	0.00	0.00	0.00	0.0	4.0	0.0	43.00	90.51	5.18	48	0.40	5684.51	5683.93	5686.80	5686.73	5692.06	5690.50	L3
4	ю	7.0	0.00	0.00	0.00	00.0	00.0	0.0	4.0	0.0	40.60	94.47	5.32	48	0.43	5684.54	5684.51	5686.86	5686.86	5691.82	5692.06	L4
5	4	27.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	28.70	91.63	3.46	48	0.41	5684.65	5684.54	5687.11	5687.11	5692.06	5691.82	L5
9	4	215.0	0.00	0.00	0.00	0.00	0.00	0.0	3.1	0.0	11.90	17.52	5.94	24	0.60	5688.53	5687.24	5689.76	5688.45	5693.72	5691.82	LG
7	9	27.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	4.90	10.50	4.07	18	1.00	5689.30	5689.03	5690.15	5690.18	5694.24	5693.72	٢٦
8	9	361.0	0.00	0.00	0.00	0.00	0.00	0.0	0.4	0.0	7.00	17.54	3.82	24	0.60	5690.90	5688.73	5691.84	5690.22	5696.00	5693.72	L8
6	ø	28.0	0.00	0.00	0.00	00.0	00.0	0.0	0.1	0.0	7.00	17.62	4.87	24	0.61	5691.37	5691.20	5692.31	5692.13	5695.71	5696.00	67
10	6	34.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	6.70	8.05	5.10	18	0.59	5692.07	5691.87	5693.11	5692.92	5695.71	5695.71	L10
Pro	ect File	: 100.0	30 G2.1	-G2.6 St	orm Dra	in-5yr.str	۶									Number	of lines: 1(			Run Dat	e: 02-21-2	017
NOTE	S: Inter	nsity = 6	8.28 / (h	let time	+ 13.10	) ^ 0.89;	Return	period =	5 Yrs.						1							

Hydraflow Storm Sewers 2005

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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	97.80	48 c	51.0	5683.54	5683.74	0.393	5687.54	5687.74	0.00	5687.74	End	
2	L2	93.30	48 c	47.0	5683.74	5683.93	0.404	5687.80*	5688.00*	0.00	5688.00	1	
3	L3	87.50	48 c	146.0	5683.93	5684.51	0.397	5688.10*	5688.64*	0.00	5688.64	2	
4	L4	82.20	48 c	7.0	5684.51	5684.54	0.432	5688.73*	5688.76*	0.00	5688.76	3	
5	L5	59.10	48 c	27.0	5684.54	5684.65	0.407	5689.08*	5689.12*	0.00	5689.12	4	
6	L6	23.10	24 c	215.0	5686.99	5688.29	0.605	5688.99*	5691.23*	0.00	5691.23	4	
7	L7	7.70	18 c	27.0	5689.03	5689.30	1.000	5691.78*	5691.93*	0.00	5691.93	6	
8	L8	15.40	24 c	361.0	5688.73	5690.90	0.601	5691.70*	5693.38*	0.00	5693.38	6	
9	L9	15.40	24 c	28.0	5691.20	5691.37	0.607	5693.38*	5693.51*	0.00	5693.51	8	
10	L10	14.80	18 c	34.0	5691.87	5692.07	0.587	5693.51*	5694.18*	0.00	5694.18	9	
Projec	t File: 100.030 G2.1-G2	2.6 Storm D	orain-100yr.st	m			Num	Number of lines: 10 Run Date: 02-20-201					

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; \*Surcharged (HGL above crown).

**Storm Sewer Tabulation** 

Hydraflow Storm Sewers 2005

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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	14.50	24 c	55.0	5684.06	5684.34	0.509	5685.41	5685.87	0.00	5685.87	End
2	L2	10.40	24 c	35.0	5684.84	5685.02	0.515	5686.19	5686.24	0.00	5686.24	1
3	L3	3.50	18 c	9.0	5685.52	5685.61	0.998	5686.48	5686.45	0.00	5686.45	2
4	L4	7.40	24 c	166.0	5685.22	5686.05	0.500	5686.57	5687.01	n/a	5687.01 j	2
5	L5	7.40	24 c	62.0	5686.25	5686.56	0.500	5687.31	5687.53	n/a	5687.53 j	4
6	L6	1.20	18 c	27.0	5687.06	5687.20	0.519	5687.85	5687.85	0.00	5687.85	5
7	L7	2.30	18 c	7.0	5687.06	5687.13	0.997	5687.88	5687.86	0.00	5687.86	5
8	L8	4.60	18 c	129.0	5687.06	5687.71	0.504	5687.91	5688.56	0.00	5688.56	5
Proiec	t File: 100.030 G2.7-G2	2.12 Storm	Drain-5vr.stm				Nun	nber of line	5: 8	Run I	Date: 06-21	-2016
Projec	t File: 100.030 G2.7-G2	2.12 Storm	Drain-5yr.stm	1			Nun	nber of line	s: 8	Run I	Date: 06-21	-2016

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

# **Storm Sewer Tabulation**

Stat	ion	Len	Drng ,	Area	Rnoff	Area	с ×	۲ ۲		Rain	Total	Cap	Vel	Pip	۵	Invert	Elev	HGL	Elev	Grnd / Ri	im Elev	Line ID	
ine	To		Incr	Total	соещ	Incr	Total	Inlet	Syst	E	MOIL			Size	Slope	dŊ	P	ď	D	dŊ	D		
		(ft)	(ac)	(ac)	(C)			(min)	(min)	in/hr) (	(cfs)	cfs) (	ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)		
-	End	55.0	0.00	0.00	0.00	0.00	0.00	0.0	2.6	0.0	14.50	6.13	6.03	24	0.51	5684.34	5684.06	5685.87	5685.41	5690.66	5688.00	L I	
7	<del>.</del>	35.0	0.00	0.00	0.00	00.0	00.0	0.0	2.4	0.0	10.40	6.23	4.91	24	0.51	5685.02	5684.84	5686.24	5686.19	5690.66	5690.66	12	
e	2	9.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	3.50 1	0.49	3.19	18	1.00	5685.61	5685.52	5686.45	5686.48	5690.66	5690.66	L3	
4	N	166.0	0.00	0.00	0.00	0.00	0.00	0.0	1.3	0.0	7.40	5.99	4.11	24	0.50	5686.05	5685.22	5687.01	5686.57	5691.56	5690.66	۲4	
5	4	62.0	0.00	0.00	0.00	0.00	0.00	0.0	0.8	0.0	7.40	5.99	4.65	24	0.50	5686.56	5686.25	5687.53	5687.31	5690.51	5691.56	L5	
9	5	27.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.20	.57	1.44	18	0.52	5687.20	5687.06	5687.85	5687.85	5690.75	5690.51	ГG	
7	5	7.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.30	0.49	2.51	18	1.00	5687.13	5687.06	5687.86	5687.88	5690.75	5690.51	L7	
80	5	129.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	4.60 7	.45	4.44	18	0.50	5687.71	5687.06	5688.56	5687.91	5691.82	5690.51	L8	
Proj	iect File	: 100.0	30 G2.7	-G2.12 S	torm Dr	ain-5yr.st	E									Number	of lines: 8			Run Dat	e: 06-21-2	016	
NOTE	S: Intel	nsity = 6	8.28 / (1	nlet time	+ 13.10)	^ 0.89;	Return p	period =	5 Yrs.														

Hydraflow Storm Sewers 2005

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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 Ioss (ft)	HGL Junct (ft)	Dns line No.
1	L1	32.00	24 c	55.0	5684.06	5684.34	0.509	5686.06*	5687.16*	0.00	5687.16	End
2	L2	22.80	24 c	35.0	5684.84	5685.02	0.515	5687.96*	5688.31*	0.00	5688.31	1
3	L3	7.60	18 c	9.0	5685.52	5685.61	0.998	5688.84*	5688.89*	0.00	5688.89	2
4	L4	16.20	24 c	166.0	5685.22	5686.05	0.500	5688.72*	5689.57*	0.00	5689.57	2
5	L5	16.20	24 c	62.0	5686.25	5686.56	0.500	5689.57*	5689.89*	0.00	5689.89	4
6	L6	2.60	18 c	27.0	5687.06	5687.20	0.519	5690.27*	5690.28*	0.00	5690.28	5
7	L7	5.00	18 c	7.0	5687.06	5687.13	0.997	5690.18*	5690.19*	0.00	5690.19	5
8	L8	10.20	18 c	129.0	5687.06	5687.71	0.504	5689.89*	5691.11*	0.00	5691.11	5
Project	t File: 100.030 G2.7-G2	2.12 Storm	Drain-100yr.s	stm			Nun	ber of line	s: 8	Run I	Date: 06-21	-2016
Fiojec	GET INC. 100.030 G2.7-G2		Diani-100yf.8	ou II			INUN		3. 0	Kunt	Jaie. 00-21	-2010

Hydraflow Storm Sewers 2005

# **Storm Sewer Tabulation**

Rim Elev Line ID	D	(ft)	5688.00 L1	5690.66 L2	5690.66 L3	5690.66 L4	5691.56 L5	5690.51 L6	5690.51 L7	: 5690.51 L8	ate: 06-21-2016	
Grnd / F	ď	(ft)	5690.66	5690.66	5690.66	5691.56	5690.51	5690.75	5690.75	5691.82	Run Da	
. Elev	D	(ft)	5686.06	5687.96	5688.84	5688.72	5689.57	5690.27	5690.18	5689.89		
HGL	đ	(ft)	5687.16	5688.31	5688.89	5689.57	5689.89	5690.28	5690.19	5691.11		
Elev	Dn	(ft)	5684.06	5684.84	5685.52	5685.22	5686.25	5687.06	5687.06	5687.06	of lines: 8	
Invert	ď	(tt)	5684.34	5685.02	5685.61	5686.05	5686.56	5687.20	5687.13	5687.71	Number	
be	Slope	(%)	0.51	0.51	1.00	0.50	0.50	0.52	1.00	0.50		
Ē	Size	(in)	24	24	18	24	24	18	18	18		
Vel		(ft/s)	10.19	7.26	4.30	5.16	5.16	1.47	2.83	5.77		
Cap		(cfs)	16.13	16.23	10.49	15.99	15.99	7.57	10.49	7.45		
Total	TIOW	(cfs)	32.00	22.80	7.60	16.20	16.20	2.60	5.00	10.20		
Rain	E	(in/hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	Syst	(mim)	1.2	1.1	0.0	0.6	0.4	0.0	0.0	0.0		
Ĕ	Inlet	(min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
axC	Total		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	yr.stm	
Are	Incr		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	rain-100	
Rnoff	соец	<u>(</u> )	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Storm D	
Area	Total	(ac)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7-G2.12	
Drng	Incr	(ac)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	030 G2.	
Len		(tt)	55.0	35.0	9.0	166.0	62.0	27.0	7.0	129.0	le: 100.	
tation	To I		End	~	2	2	4	5	5	5	roject Fi	
Š	Line		-	2	ю	4	2	9	2	ø	Д.	

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Hydraflow Storm Sewers 2005

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	2.80	18 c	26.0	5684.10	5684.57	1.807	5684.74	5685.21	n/a	5685.21 j	End
2	L2	2.80	18 c	148.0	5684.57	5687.23	1.797	5685.41	5687.87	n/a	5687.87 j	1
Projec	t File: 100.030 G2.13 S	torm Drain	-5yr.stm				Num	nber of line:	s: 2	Run [	Date: 06-21	-2016

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Line ID			L	ප ප	.016	
im Elev	D	(ft)	5686.00	5692.00 20 20	te: 06-21-2	
Grnd / R	đ	(ft)	5692.00	2000	Run Da	
Elev	D	(ft)	5684.74	5685.41		
НӨГ	ď	(ft)	5685.21	5687.87		
t Elev	D	(ft)	5684.10	5684.57	of lines: 2	
Inver	đ	(ft)	5684.57	5687.23	Number	
ipe	Slope	(%)	1.81	1.80		
	Size	(ii)	18	8		
Vel		(ft/s)	3.90			
Cap	3	(cfs)	14.11	4 0.		
Total		(cfs)	2.80	5.80		
Rain	5	(in/hr)	0.0	0 0 0		
.u	Syst	(min)	1.6	0.0		= 5 Yrs
	Inlet	(min)	0.0	0. 0		n period
ea x C	Total		0.00	0000		9; Retur
f Ar	Incr		0.00	0000	5yr.stm	10) ^ 0.8
Rnoft		<u>(</u> )	00.0	00.00	n Drain-	ne + 13.1
g Area	Total	(ac)	0.00	0000	.13 Stori	(Inlet tin
Dru	Incr	(ac)	00.0	00.00	0.030 G2	= 68.28 /
Len	_ 4	(£)	d 26.0		File: 10(	ntensity
Station	l To		EDC	←	Project	OTES: I
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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	6.20	18 c	26.0	5684.10	5684.57	1.807	5685.05	5685.52	n/a	5685.52	End
2	L2	6.20	18 c	148.0	5684.57	5687.23	1.797	5685.76	5688.18	n/a	5688.18 j	1
Projec	t File: 100.030 G2.13 S	torm Drain	-100yr.stm				Num	hber of line	s: 2	Run [	Date: 06-21	-2016

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; j - Line contains hyd. jump.

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Line ID			L	<u>ප</u>	2016	
im Elev	D	(ft)	5686.00	2692.00	te: 06-21-2	
Grnd / R	ď	(ft)	5692.00	2692.20	Run Dai	
Elev	Б	(ft)	5685.05	2685.76		
HGL	ď	(ft)	5685.52	5688.28		
t Elev	Dn	(tt)	5684.10	5684.57	of lines: 2	
Invert	ď	(ft)	5684.57	5687.23	Number	
ipe	Slope	(%)	1.81			
<b>_</b>	Size	(in)	18	∞		
Vel		(ft/s)	5.25	4.69		
Cap	3	(cfs)	14.11	4.08		
Total	<b>8</b> 01	(cfs)	6.20	ê.20		
Rain	5	(in/hr)	0.0	0.0		ú
0	Syst	(min)	0.7	0.0		100 Yr
	Inlet	(min)	0.0	0;		period =
ea x C	Total		0.00	0.0	c	Return
Are	Incr		0.00	000	00yr.stm	) ^ 0.75;
Rnoff		<u>(</u> )	00.00	0.00	ר-Drain	e + 7.70
) Area	Total	(ac)	0.00	8 0	13 Storn	(Inlet tim
Drnç	Incr	(ac)	0.00	0.00	.030 G2.	: 58.48 /
Len		(ft)	26.0	148.0	ile: 100.	tensity =
tation	ب Line		End	-	Project F	TES: In
Ň	Line		~	8	ш	8

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Hydraflow Storm Sewers 2005

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	L1-24"RCP	9.00	24 c	25.0	5685.00	5685.15	0.600	5686.06	5686.22	0.00	5686.22	End
2	L2 - 18"RCP	2.40	18 c	35.0	5685.65	5685.86	0.600	5686.62	5686.62	0.00	5686.62	1
Projec	t File: 100.030 G3.1-G3	3.4 Storm D	rain-5yr.stm				Num	nber of lines	s: 2	Run [	Date: 06-21	-2016

#### 5689.89 | L2 - 18"RCP Line ID 5686.06 5689.89 5688.00 L1-24"RCP Run Date: 06-21-2016 Grnd / Rim Elev ŧ Б 5689.89 ď (£ 5686.62 ŧ Б HGL Elev 5685.00 5686.22 5685.65 5686.62 ď (£ Number of lines: 2 D ŧ Invert Elev 5685.15 5685.86 ď (t Slope 0.60 0.60 (%) Pipe Size (in) 18 24 5.29 2.32 (ft/s) Vel (cfs) 17.51 Cap full 8.13 Total flow (cfs) 9.00 2.40 (in/hr) Rain (I) 0.0 0.0 (min) NOTES: Intensity = 68.28 / (Inlet time + 13.10) ^ 0.89; Return period = 5 Yrs. Syst 0.4 0.0 ۲ Inlet (min) 0.0 0.0 Total 0.00 0.00 Area x C Project File: 100.030 G3.1-G3.4 Storm Drain-5yr.stm Incr 0.00 0.00 Rnoff coeff 0.00 0.00 ΰ (ac) Total 0.00 0.00 Drng Area Incr (ac) 0.00 0.00 Len 25.0 35.0 ŧ End To Line Station ~ Line ~ 2

**Storm Sewer Tabulation** 

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	L1-24"RCP	19.90	24 c	25.0	5685.00	5685.15	0.600	5687.00	5687.15	0.00	5687.15	End
2	L2 - 18"RCP	5.20	18 c	35.0	5685.65	5685.86	0.600	5687.64*	5687.72*	0.00	5687.72	1
Desis												0040
Projec	т не: 100.030 G3.1-G3	5.4 Storm L	vrain-100yr.st	П			Nur	ider of lines	5. Z	Kun L	Jate: 06-21	-2016

NOTES: c = cir; e = ellip; b = box; Return period = 100 Yrs. ; \*Surcharged (HGL above crown).

#### 5689.89 | L2 - 18"RCP Line ID 5685.15 5685.00 5687.15 5687.00 5689.89 5688.00 L1-24"RCP Run Date: 06-21-2016 Grnd / Rim Elev ŧ Б 5689.89 ď (£ 5687.64 ŧ Б HGL Elev 5685.65 5687.72 ď (£ Number of lines: 2 D ŧ Invert Elev 5685.86 ď (t Slope 0.60 0.60 (%) Pipe Size (in) 18 24 2.94 (ft/s) 6.34 Vel 17.51 (cfs) Cap full 8.13 19.90 Total flow (cfs) 5.20 (in/hr) Rain (I) 0.0 0.0 NOTES: Intensity = 58.48 / (Inlet time + 7.70) $^{\circ}$ 0.75; Return period = 100 Yrs. (min) Syst 0.2 0.0 ۲ Inlet (min) 0.0 0.0 Total 0.00 0.00 Area x C Project File: 100.030 G3.1-G3.4 Storm Drain-100yr.stm Incr 0.00 0.00 Rnoff coeff 0.00 0.00 ΰ (ac) Total 0.00 0.00 Drng Area Incr (ac) 0.00 0.00 Len 25.0 35.0 ŧ End To Line Station ~ Line ~ 2

**Storm Sewer Tabulation** 

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Hydraflow Storm Sewers 2005

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 - 24" RCP	8.80	24 c	155.0	5686.00	5687.55	1.000	5687.05	5688.60	0.00	5688.60	End
2	L2 - 18" RCP	3.30	18 c	34.0	5688.05	5688.39	1.001	5688.98	5689.08	n/a	5689.08 j	1
Projec	t File: 100.030 DP-14 S	storm Drain	-5yr.stm				Num	nber of lines	s: 2	Run [	Date: 02-21	-2017

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

#### 5686.00 5688.60 5687.05 5692.45 5688.00 L1 - 24" RCP 5692.45 | L2 - 18" RCP Line ID Run Date: 02-21-2017 Grnd / Rim Elev (£ Б 5692.45 ď (£ 5688.98 ŧ Б HGL Elev 5688.05 5689.08 ď (£ Number of lines: 2 D ŧ Invert Elev 5687.55 5688.39 ď (t Slope 1.00 1.00 (%) Pipe Size (in) 18 24 3.50 5.26 (ft/s) Vel 22.62 10.51 (cfs) Cap full Total flow (cfs) 3.30 8.80 (in/hr) Rain (I) 0.0 0.0 (min) NOTES: Intensity = 68.28 / (Inlet time + 13.10) ^ 0.89; Return period = 5 Yrs. Syst 0.3 0.0 ۲ Inlet (min) 0.0 0.0 Total 0.00 0.00 Area x C Incr 0.00 0.00 Project File: 100.030 DP-14 Storm Drain-5yr.stm Rnoff coeff 0.00 0.00 ΰ (ac) Total 0.00 0.00 Drng Area Incr (ac) 0.00 0.00 155.0 Len 34.0 ŧ End To Line Station ~ Line ~ 2

Hydraflow Storm Sewers 2005

# **Storm Sewer Tabulation**

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 - 24" RCP	22.40	24 c	155.0	5686.00	5687.55	1.000	5687.68	5689.23	n/a	5689.23 j	End
2	L2 - 18" RCP	9.80	18 c	34.0	5688.05	5688.39	1.001	5689.73*	5690.03*	0.00	5690.03	1
Projec	t File: 100.030 DP-14 S	torm Drain	-100yr.stm				Num	ber of line	s: 2	Run [	Date: 02-21	-2017

#### 5687.68 5692.45 5688.00 L1 - 24" RCP 5692.45 | L2 - 18" RCP Line ID Run Date: 02-21-2017 Grnd / Rim Elev (£ Б 5692.45 ď (£ 5689.73 ŧ Б HGL Elev 5686.00 5689.23 5688.05 5690.03 ď (£ Number of lines: 2 D ŧ Invert Elev 5687.55 5688.39 ď (t Slope 1.00 1.00 (%) Pipe Size (in) 18 24 5.55 7.96 (ft/s) Vel 22.62 10.51 (cfs) Cap full 22.40 Total flow (cfs) 9.80 (in/hr) Rain (I) 0.0 0.0 NOTES: Intensity = 58.48 / (Inlet time + 7.70) $^{\circ}$ 0.75; Return period = 100 Yrs. (min) Syst 0.0 0.1 ۲ Inlet (min) 0.0 0.0 Total 0.00 0.00 Area x C Project File: 100.030 DP-14 Storm Drain-100yr.stm Incr 0.00 0.00 Rnoff coeff 0.00 0.00 ΰ (ac) Total 0.00 0.00 Drng Area Incr (ac) 0.00 0.00 155.0 Len 34.0 ŧ End To Line Station ~ Line ~ 2

Hydraflow Storm Sewers 2005

**Storm Sewer Tabulation** 

## APPENDIX D – POND AND HYDRAFLOW CALCULATIONS

	cription	mercial (G1.1 to G1.7)	d G1.7	Basin G1.8a	w to Pond G1.8	d G1.8	te flow to des. pt. 6	n G1.8b	at Des. Pt. 6	n G1.9-G1.10-G1.11	I Detained Flow into Pond G1	
	Descriptior	Commercia	Pond G1.7	Sub-Basin (	inflow to Po	Pond G1.8	Route flow t	Basin G1.8t	Flow at Des	Basin G1.9-	Total Detain	Pond G1
<u>agend</u>	<u>d. Origin</u>	Rational	Reservoir	Rational	Combine	Reservoir	Reach	Rational	Combine	Rational	Combine	Reservoir
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Tuesday, Jun 21 2016, 6:06 AM

Project: 100.030 G1.7 Ponds G1 & G2-5yr.gpw

Hydraflow Hydrographs Model

# Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description		
1	Rational	106.94	1	18	115,493				Commercial (G1.1 to G1.7)		
2	Reservoir	62.65	1	25	115,483	1	5695.10	53,518	Pond G1.7		
3	Rational	14.66	1	20	17,588				Sub-Basin G1.8a		
4	Combine	73.96	1	24	133,070	2, 3			inflow to Swale G1.8		
5	Reservoir	52.83	1	34	133,065	4	5692.86	39,288	Swale G1.8		
6	Reach	52.64	1	36	132,976	5			Route flow to des. pt. 6		
7	Rational	7.126	1	19	8,124				Basin G1.8b		
8	Combine	53.71	1	35	141,100	6, 7			Flow at Des. Pt. 6		
9	Rational	26.41	1	17	26,940				Basin G1.9-G1.10-G1.11, G2.2, G2.3		
10	Combine	59.98	1	24	168,040	8, 9			Total Detained Flow into Pond G1		
11	Reservoir	28.06	1	58	167,438	10	5687.92	97,961	Pond G1		
100.	.030 G1.7 F	onds G	1 & G2	-5yr.gpw	Return	Period: 5	Year	Monday, Feb 20 2017, 2:27 PM			

# 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	196.13	1	18	211,821				Commercial (G1.1 to G1.7)
2	Reservoir	95.15	1	27	211,811	1	5696.94	104,641	Pond G1.7
3	Rational	32.37	1	20	38,846				Sub-Basin G1.8a
4	Combine	119.53	1	23	250,657	2, 3			inflow to Swale G1.8
5	Reservoir	105.09	1	32	250,651	4	5694.33	64,525	Swale G1.8
6	Reach	104.64	1	33	250,563	5			Route flow to Des.Pt.6
7	Rational	16.56	1	19	18,879				Basin G1.8b
8	Combine	109.00	1	33	269,442	6, 7			Total Flow at Des. Pt. 6
9	Rational	58.42	1	17	59,593				Basins G1.9-G1.11, G2.2, G2.3
10	Combine	117.04	1	31	329,035	8, 9			Total Flow into Pond G1
11	Reservoir	57.96	1	54	328,418	10	5689.12	165,167	Pond G1 to G2 flow
100	030 C1 7 5	Donde (	1 & C2	-100vr a	WRoturn	Period: 1	00 Vear	Monday	

## **Pond Report**

Hydraflow Hydrographs by Intelisolve

#### Pond No. 2 - Pond G1.7

#### **Pond Data**

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

#### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)	
0.00	5692.00	300	0	0	
1.00	5693.00	18,612	9,456	9,456	
2.00	5694.00	20,476	19,544	29,000	
3.00	5695.00	23,445	21,961	50,961	
4.00	5696.00	27.847	25.646	76.607	
5.00	5697.00	31,984	29.916	106.522	
6.00	5698.00	34,000	32,992	139,514	
Culvert / Or	ifice Structures		Weir Structure	25	

#### **Culvert / Orifice Structures**

	[A]	[B]	[C]	[D]		[A]	[B]	[C]	[D]
Rise (in)	= 48.00	0.00	0.00	0.00	Crest Len (ft)	= 50.00	0.00	0.00	0.00
Span (in)	= 48.00	0.00	0.00	0.00	Crest El. (ft)	= 5697.50	0.00	0.00	0.00
No. Barrels	= 1	0	0	0	Weir Coeff.	= 2.60	0.00	0.00	0.00
Invert El. (ft)	= 5692.00	0.00	0.00	0.00	Weir Type	= Broad			
Length (ft)	= 426.00	0.00	0.00	0.00	Multi-Stage	= No	No	No	No
Slope (%)	= 0.53	0.00	0.00	0.00					
N-Value	= .013	.000	.000	.000					
Orif. Coeff.	= 0.60	0.00	0.00	0.00					
Multi-Stage	= n/a	No	No	No	Exfiltration = 0.	.000 in/hr (Conto	our) Tailw	ater Elev. =	= 0.00 ft

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



## **Pond Report**

Hydraflow Hydrographs by Intelisolve

#### Pond No. 1 - Swale G1.8

#### Pond Data

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

#### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5689.00	706	0	0
1.00	5690.00	8,766	4,736	4,736
2.00	5691.00	11,018	9,892	14,628
3.00	5692.00	13,306	12,162	26,790
4.00	5693.00	15,646	14,476	41,266
5.00	5694.00	18.041	16.844	58.110
6.00	5695.00	21.000	19.521	77.630
7.00	5696.00	24.000	22,500	100.130

#### **Culvert / Orifice Structures**

	[A]	[B]	[C]	[D]		[A]	[B]	[C]	[D]
Rise (in)	= 42.00	0.00	0.00	0.00	Crest Len (ft)	= 50.00	0.00	0.00	0.00
Span (in)	= 42.00	0.00	0.00	0.00	Crest El. (ft)	= 5694.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0	Weir Coeff.	= 2.60	0.00	0.00	0.00
Invert El. (ft)	= 5689.00	0.00	0.00	0.00	Weir Type	= Broad			
Length (ft)	= 150.00	0.00	0.00	0.00	Multi-Stage	= No	No	No	No
Slope (%)	= 0.50	0.00	0.00	0.00					
N-Value	= .013	.000	.000	.000					
Orif. Coeff.	= 0.60	0.00	0.00	0.00					
Multi-Stage	= n/a	No	No	No	Exfiltration = 0	.000 in/hr (Conte	our) Tailw	ater Elev. =	= 0.00 ft

#### Stage / Storage / Discharge Table

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

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	5689.00	0.00				0.00					0.00
1.00	4,736	5690.00	7.75				0.00					7.75
2.00	14,628	5691.00	26.13				0.00					26.13
3.00	26,790	5692.00	41.32				0.00					41.32
4.00	41,266	5693.00	55.97				0.00					55.97
5.00	58,110	5694.00	75.09				0.00					75.09
6.00	77.630	5695.00	90.25				130.00					220.25
7.00	100,130	5696.00	103.20				367.70					470.90

**Weir Structures** 

## **Pond Report**

Hydraflow Hydrographs by Intelisolve

#### Pond No. 3 - Pond G1

#### Pond Data

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

#### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	5686.00	48,284	0	0
1.00	5687.00	51,208	49,746	49,746
2.00	5688.00	54,210	52,709	102,455
3.00	5689.00	57,244	55,727	158,182
4.00	5690.00	60,334	58,789	216,971
5.00	5691.00	63,481	61,908	278,879
6.00	5692.00	66,687	65,084	343,963
7.00	5693.00	69.994	68.341	412,303

#### **Culvert / Orifice Structures**

	[A]	[B]	[C]	[D]		[A]	[B]	[C]	[D]
Rise (in)	= 0.00	48.00	0.00	0.00	Crest Len (ft)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	48.00	0.00	0.00	Crest El. (ft)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	1	0	0	Weir Coeff.	= 0.00	3.33	0.00	0.00
Invert El. (ft)	= 0.00	5686.00	0.00	0.00	Weir Type	=			
Length (ft)	= 0.00	320.00	0.00	0.00	Multi-Stage	= No	No	No	No
Slope (%)	= 0.00	0.40	0.00	0.00					
N-Value	= .013	.013	.000	.000					
Orif. Coeff.	= 0.60	0.60	0.00	0.00					
Multi-Stage	= n/a	No	No	No	Exfiltration = 0	.000 in/hr (Cor	tour) Tailw	ater Elev. =	= 0.00 ft

#### Stage / Storage / Discharge Table

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

elage,	eterage,	eleena ge										
Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	5686.00		0.00								0.00
1.00	49,746	5687.00		8.38								8.38
2.00	102,455	5688.00		30.31								30.31
3.00	158,182	5689.00		55.67								55.67
4.00	216,971	5690.00		65.12								65.12
5.00	278,879	5691.00		86.91								86.91
6.00	343,963	5692.00		104.24								104.24
7.00	412,303	5693.00		119.08								119.08

**Weir Structures** 

Hydraflow Hydrographs by Intelisolve

## Hyd. No. 1

Commercial (G1.1 to G1.7)

Hydrograph type	= Rational	Peak discharge	= 106.94 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Drainage area	= 41.460 ac	Runoff coeff.	= 0.81
Intensity	= 3.184 in/hr	Tc by User	= 18.00 min
IDF Curve	= Colorado Springs-El Paso County-Table.	DAsc/Rec limb fact	= 1/1

Hydrograph Volume = 115,493 cuft



Sunday, Oct 2 2016, 8:28 AM

1

Hydraflow Hydrographs by Intelisolve

## Hyd. No. 2

Pond G1.7

Hydrograph type	= Reservoir	Peak discharge	= 62.65 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Inflow hyd. No.	= 1	Max. Elevation	= 5695.10 ft
Reservoir name	= Pond G1.7	Max. Storage	= 53,518 cuft

Storage Indication method used.

Hydrograph Volume = 115,483 cuft



Hydraflow Hydrographs by Intelisolve

## Hyd. No. 3

Sub-Basin G1.8a

Hydrograph type	= Rational	Peak discharge	= 14.66 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Drainage area	= 9.160 ac	Runoff coeff.	= 0.53
Intensity	= 3.019 in/hr	Tc by User	= 20.00 min
IDF Curve	= Colorado Springs-El Paso County-Table.I	DAsc/Rec limb fact	= 1/1

Hydrograph Volume = 17,588 cuft



Hydraflow Hydrographs by Intelisolve

### Hyd. No. 4

inflow to Swale G1.8

Hydrograph type	= Combine
Storm frequency	= 5 yrs
Inflow hyds.	= 2, 3

Wednesday, Jan 25 2017, 8:1 AM

Peak discharge = 73.96 cfs Time interval = 1 min

Hydrograph Volume = 133,070 cuft



Hydraflow Hydrographs by Intelisolve

## Hyd. No. 5

Swale G1.8

Hydrograph type	= Reservoir	Peak discharge	= 52.83 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Inflow hyd. No.	= 4	Max. Elevation	= 5692.86 ft
Reservoir name	= Pond G1.8	Max. Storage	= 39,288 cuft

Storage Indication method used.

Hydrograph Volume = 133,065 cuft



Hydraflow Hydrographs by Intelisolve

## Hyd. No. 6

Route flow to des. pt. 6

Hydrograph type	= Reach	Peak discharge	= 52.64 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Inflow hyd. No.	= 5	Section type	<ul> <li>Trapezoidal</li> </ul>
Reach length	= 256.0 ft	Channel slope	= 0.3 %
Manning's n	= 0.024	Bottom width	= 5.0 ft
Side slope	= 3.0:1	Max. depth	= 4.0 ft
Rating curve x	= 1.162	Rating curve m	= 1.334
Ave. velocity	= 3.02 ft/s	Routing coeff.	= 0.6417

Modified Att-Kin routing method used.

Hydrograph Volume = 132,976 cuft



Hydraflow Hydrographs by Intelisolve

## Hyd. No. 7

Basin G1.8b

Hydrograph type	= Rational	Peak discharge	= 7.126 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Drainage area	= 5.110 ac	Runoff coeff.	= 0.45
Intensity	= 3.099 in/hr	Tc by User	= 19.00 min
IDF Curve	= Colorado Springs-El Paso County-Table.	DAFsc/Rec limb fact	= 1/1

Hydrograph Volume = 8,124 cuft



7

Hydraflow Hydrographs by Intelisolve

## Hyd. No. 8

Flow at Des. Pt. 6

Hydrograph type Storm frequency	= Combine = 5 yrs = 6 7	Peak discharge Time interval	= 53.71 cfs = 1 min
Inflow hyds.	= 6, 7		

Hydrograph Volume = 141,100 cuft



Hydraflow Hydrographs by Intelisolve

## Hyd. No. 9

Basin G1.9-G1.10-G1.11, G2.2, G2.3

Hydrograph type	= Rational	Peak discharge	= 26.41 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Drainage area	= 16.800 ac	Runoff coeff.	= 0.48
Intensity	= 3.275 in/hr	Tc by User	= 17.00 min
IDF Curve	= Colorado Springs-El Paso County-Table.	DAsc/Rec limb fact	= 1/1

Hydrograph Volume = 26,940 cuft



Monday, Feb 20 2017, 2:25 PM

Hydraflow Hydrographs by Intelisolve

### Hyd. No. 10

Total Detained Flow into Pond G1

Hydrograph type	= Combine
Storm frequency	= 5 yrs
Inflow hyds.	= 8, 9

Peak discharge = 59.98 cfs Time interval = 1 min

Hydrograph Volume = 168,040 cuft



Monday, Feb 20 2017, 2:26 PM
Hydraflow Hydrographs by Intelisolve

## Hyd. No. 11

Pond G1

Hydrograph type	= Reservoir	Peak discharge	= 28.06 cfs
Storm frequency	= 5 yrs	Time interval	= 1 min
Inflow hyd. No.	= 10	Max. Elevation	= 5687.92 ft
Reservoir name	= Pond G1	Max. Storage	= 97,961 cuft

Storage Indication method used.

Hydrograph Volume = 167,438 cuft



Monday, Feb 20 2017, 2:26 PM

Hydraflow Hydrographs by Intelisolve

## Hyd. No. 1

Commercial (G1.1 to G1.7)

Hydrograph type	= Rational	Peak discharge	= 196.13 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 41.400 ac	Runoff coeff.	= 0.84
Intensity	= 5.640 in/hr	Tc by User	= 18.00 min
IDF Curve	= Colorado Springs-El Paso County-Table.	DAFsc/Rec limb fact	= 1/1

Hydrograph Volume = 211,821 cuft



Hydraflow Hydrographs by Intelisolve

## Hyd. No. 2

Pond G1.7

Hydrograph type	= Reservoir	Peak discharge	= 95.15 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 1	Max. Elevation	= 5696.94 ft
Reservoir name	= Pond G1.7	Max. Storage	= 104,641 cuft

Storage Indication method used.

Hydrograph Volume = 211,811 cuft



Hydraflow Hydrographs by Intelisolve

## Hyd. No. 3

Sub-Basin G1.8a

Hydrograph type	= Rational	Peak discharge	= 32.37 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 9.160 ac	Runoff coeff.	= 0.66
Intensity	= 5.355 in/hr	Tc by User	= 20.00 min
IDF Curve	= Colorado Springs-El Paso County-Table.I	DAsc/Rec limb fact	= 1/1

Hydrograph Volume = 38,846 cuft



Hydraflow Hydrographs by Intelisolve

#### Hyd. No. 4

inflow to Swale G1.8

Hydrograph type	= Combine
Storm frequency	= 100 yrs
Inflow hyds.	= 2, 3

Wednesday, Jan 25 2017, 7:58 AM

Peak discharge = 119.53 cfs Time interval = 1 min

Hydrograph Volume = 250,657 cuft



Hydraflow Hydrographs by Intelisolve

## Hyd. No. 5

Swale G1.8

Hydrograph type	= Reservoir	Peak discharge	= 105.09 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 4	Max. Elevation	= 5694.33 ft
Reservoir name	= Swale G1.8	Max. Storage	= 64,525 cuft

Storage Indication method used.

Hydrograph Volume = 250,651 cuft



Wednesday, Jan 25 2017, 7:59 AM

Hydraflow Hydrographs by Intelisolve

## Hyd. No. 6

Route flow to Des.Pt.6

Hydrograph type	= Reach	Peak discharge	= 104.64 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 5	Section type	<ul> <li>Trapezoidal</li> </ul>
Reach length	= 256.0 ft	Channel slope	= 0.3 %
Manning's n	= 0.024	Bottom width	= 5.0 ft
Side slope	= 3.0:1	Max. depth	= 4.0 ft
Rating curve x	= 1.162	Rating curve m	= 1.334
Ave. velocity	= 3.59 ft/s	Routing coeff.	= 0.7189

Modified Att-Kin routing method used.

Hydrograph Volume = 250,563 cuft



Hydraflow Hydrographs by Intelisolve

## Hyd. No. 7

Basin G1.8b

Hydrograph type	= Rational	Peak discharge	= 16.56 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 5.110 ac	Runoff coeff.	= 0.59
Intensity	= 5.493 in/hr	Tc by User	= 19.00 min
IDF Curve	= Colorado Springs-El Paso County-Table.I	DÆsc/Rec limb fact	= 1/1

Hydrograph Volume = 18,879 cuft



Hydraflow Hydrographs by Intelisolve

## Hyd. No. 8

Total Flow at Des. Pt. 6

Hydrograph type	= Combine
Storm frequency	= 100 yrs
Inflow hyds.	= 6, 7

Sunday, Oct 2 2016, 8:6 AM

Peak discharge = 109.00 cfs Time interval = 1 min

Hydrograph Volume = 269,442 cuft



Hydraflow Hydrographs by Intelisolve

## Hyd. No. 9

Basins G1.9-G1.11, G2.2, G2.3

Hydrograph type	= Rational	Peak discharge	= 58.42 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Drainage area	= 16.800 ac	Runoff coeff.	= 0.6
Intensity	= 5.796 in/hr	Tc by User	= 17.00 min
IDF Curve	= Colorado Springs-El Paso County-Table.	DAsc/Rec limb fact	= 1/1

Hydrograph Volume = 59,593 cuft



Monday, Feb 20 2017, 2:30 PM

Hydraflow Hydrographs by Intelisolve

#### Hyd. No. 10

Total Flow into Pond G1

Hydrograph type	= Combine
Storm frequency	= 100 yrs
Inflow hyds.	= 8, 9

Monday, Feb 20 2017, 2:30 PM

Peak discharge = 117.04 cfs Time interval = 1 min

Hydrograph Volume = 329,035 cuft



Hydraflow Hydrographs by Intelisolve

#### Hyd. No. 11

Pond G1 to G2 flow

Hydrograph type	= Reservoir	Peak discharge	= 57.96 cfs
Storm frequency	= 100 yrs	Time interval	= 1 min
Inflow hyd. No.	= 10	Max. Elevation	= 5689.12 ft
Reservoir name	= Pond G1	Max. Storage	= 165,167 cuft

Storage Indication method used.

Hydrograph Volume = 328,418 cuft



Monday, Feb 20 2017, 2:31 PM

#### DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Depth Increment =

#### Project: Carriage Meadows South at Lorson Ranch Basin ID: Pond G1/G2 Full Spectrum Detention (v3.07)

ZONE 3 ZONE 2 ZONE 1 -100-YEAR

PERMANENT	1	20NE 1 ORIFICE	AND 2	CHARGE	
POOL	Example	Zone	Configuration	(Retention	Pond

Example zone	Configurat		don i ond)	
Required Volume Calculation				
Selected BMP Type =	EDB	]		
Watershed Area =	96.00	acres		
Watershed Length =	3,730	ft		
Watershed Slope =	0.008	ft/ft		
Watershed Imperviousness =	79.00%	percent		
Percentage Hydrologic Soil Group A =	46.0%	percent		
Percentage Hydrologic Soil Group B =	23.0%	percent		
Percentage Hydrologic Soil Groups C/D =	31.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	2.577	acre-feet	Optional Use	r Overrid
Excess Urban Runoff Volume (EURV) =	8.814	acre-feet	1-hr Precipita	ation
2-yr Runoff Volume (P1 = 1.16 in.) =	6.842	acre-feet	1.16	inches
5-yr Runoff Volume (P1 = 1.44 in.) =	8.912	acre-feet	1.44	inches
10-yr Runoff Volume (P1 = 1.68 in.) =	10.804	acre-feet	1.68	inches
25-yr Runoff Volume (P1 = 1.92 in.) =	13.017	acre-feet	1.92	inches
50-yr Runoff Volume (P1 = 2.16 in.) =	14.962	acre-feet	2.16	inches
100-yr Runoff Volume (P1 = 2.42 in.) =	17.363	acre-feet	2.42	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	6.451	acre-feet		
Approximate 5-yr Detention Volume =	8.419	acre-feet		
Approximate 10-yr Detention Volume =	10.033	acre-feet		
Approximate 25-yr Detention Volume =	11.239	acre-feet		
Annual for the Part of the Market State	44.040			

Excess Urban Runoff Volume (EURV) =	8.814	acre-feet	
2-yr Runoff Volume (P1 = 1.16 in.) =	6.842	acre-feet	
5-yr Runoff Volume (P1 = 1.44 in.) =	8.912	acre-feet	
10-yr Runoff Volume (P1 = 1.68 in.) =	10.804	acre-feet	
25-yr Runoff Volume (P1 = 1.92 in.) =	13.017	acre-feet	
50-yr Runoff Volume (P1 = 2.16 in.) =	14.962	acre-feet	
100-yr Runoff Volume (P1 = 2.42 in.) =	17.363	acre-feet	
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	
Approximate 2-yr Detention Volume =	6.451	acre-feet	
Approximate 5-yr Detention Volume =	8.419	acre-feet	
Approximate 10-yr Detention Volume =	10.033	acre-feet	
Approximate 25-yr Detention Volume =	11.239	acre-feet	
Approximate 50-yr Detention Volume =	11.916	acre-feet	
Approximate 100-yr Detention Volume =	12.731	acre-feet	
e-Storage Calculation			
Zone 1 Volume (WQCV) =	2.577	acre-feet	
		1	

Stage-Storage Ca	lculation
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(		acie-icei
Zone 2 Volume (EURV - Zone 1) =	6.236	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.918	acre-feet
Total Detention Basin Volume =	12.731	acre-feet
Initial Surcharge Volume (ISV) =	user	ft/3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H <sub>total</sub> ) =	user	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	user	ft
Slope of Trickle Channel (STC) =	user	ft/ft
Slopes of Main Basin Sides (Smain) =	user	Η:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	user	

 $\begin{array}{l} \mbox{lnitial Surcharge Area} (A_{\rm SV}) = \\ \mbox{Surcharge Volume Length} (L_{\rm SV}) = \\ \mbox{Surcharge Volume Width} (W_{\rm SV}) = \\ \mbox{Depth of Basin Floor} (H_{\rm FLOOR}) = \\ \end{array}$ 
 Depth of Basin Floor (H<sub>1000</sub>)
 user

 Length of Basin Floor (M<sub>1000</sub>)
 user

 Width of Basin Floor (M<sub>1000</sub>)
 user

 Area of Basin Floor (M<sub>1000</sub>)
 user

 Depth of Main Basin (H<sub>2000</sub>)
 user

 Length of Main Basin (H<sub>2000</sub>)
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 Vidth of Main Basin (H<sub>2000</sub>)
 user

 User of Main Basin (H<sub>2000</sub>)
 user

 User of Main Basin (H<sub>2000</sub>)
 user

 user Other Basin Strump
 user

 User of Main Basin (H<sub>2000</sub>)
 user

ft^2

t/9 acre-feet

	Description	(ft)	Stage (ft)	(ft)	(ft)	(ft/2)	Area (ft/2)	(acre)	(ft/3)	(ac-ft)
	Top of Micropool		0.00				561	0.013		
	5682.33		0.33				43 673	1 003	6.866	0.158
	5692		4.00				47 700	4.000	27.427	0.050
	5065		1.00				47,723	1.096	31,437	9,009
	5684		2.00				91,223	2.094	106,477	2.444
	5685		3.00	-		-	108,717	2.496	207,357	4.760
	5686		4.00	-		-	116,519	2.675	319,975	7.346
	5-yr=5686.69		4.69				123,570	2.837	402,805	9.247
	5687		5.00				126,736	2.909	441,603	10.138
	5688		6.00			-	133,533	3.065	571,737	13.125
	100-yr=5688.48		6.48				138,115	3.171	636,933	14.622
	5689		7.00				142.697	3.276	709.944	16.298
6	5690		8.00				146,770	3.369	854.678	19.621
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Width (ft)

Area (ft/2)

Area (acre) 0.013 1.003 1.096

Volume (ac-ft)

Volume (ft/3)

#### Stage - Storage Description Top of Micropoo Stage (ft) Length (ft) Stage (ft) 0.00 0.33 1.00 2.00 3.00 4.00 5682.33

Detention Basin Outlet Structure Design									
Project:			UD-Detention, Ve	rsion 3.07 (Februar	y 2017)				
Basin ID:									
ZONE 3 ZONE 2 ZONE 1									
				Stage (ft)	Zone Volume (ac-ft)	Outlet Type	1		
VOLUME EURV WOCV			Zone 1 (WQCV)	2.06	2.577	Orifice Plate			
ZONE 1 AND 2	100-YEA	R	Zone 2 (EURV)	4.54	6.236	Orifice Plate			
PERMANENT ORIFICES	Configuration (Da	tantion Dand)	'one 3 (100-year)	5.88	3.918	Weir&Pipe (Restrict)			
Example 2016	Configuration (Re	elention Pond)			12.731	Total			
User Input: Orifice at Underdrain Outlet (typically us	sed to drain WQCV in	a Filtration BMP)	Ch	( )		Calculate	ed Parameters for Un	derdrain	
Underdrain Orifice Invert Depth =	N/A	ft (distance below th	e filtration media sur	tace)	Unde	erdrain Orifice Area =	N/A	ft <sup>-</sup>	
	N/A	inches			Underura	an onne centrola -	N/A	leet	
User Input: Orifice Plate with one or more orifices of	r Elliptical Slot Weir	(typically used to dra	in WQCV and/or EUF	RV in a sedimentation	n BMP)	Calcu	lated Parameters for	Plate	
Invert of Lowest Orifice =	0.00	ft (relative to basin b	ottom at Stage = 0 ft	)	WQO	rifice Area per Row =	1.536E-01	ft <sup>2</sup>	
Depth at top of Zone using Orifice Plate =	4.54	ft (relative to basin b	ottom at Stage = 0 ft	)	E	lliptical Half-Width =	N/A	feet	
Orifice Plate: Orifice Vertical Spacing =	18.20	inches			Elli	ptical Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	22.12	sq. inches (use recta	ngular openings)			Elliptical Slot Area =	N/A	ft <sup>2</sup>	
User Input: Stage and Total Area of Each Orifice	Row (numbered from	m 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	1.51	3.03						
Orifice Area (sq. inches)	22.12	22.12	22.12						l
									1
	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)	1
Stage of Orifice Centroid (ft)									
Office Area (sq. inches)									1
User Input: Vertical Orifice (Circ	cular or Rectangular)					Calculated	Parameters for Vert	ical Orifice	
	Not Selected	Not Selected	]				Not Selected	Not Selected	]
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin b	oottom at Stage = 0 ft]	v	ertical Orifice Area =	N/A	N/A	ft <sup>2</sup>
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin b	oottom at Stage = 0 ft	Verti	cal Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches						
			-						
								<i>a</i>	
User Input: Overflow Weir (Dropbox) and G	Grate (Flat or Sloped)	Not Colostad	1			Calculated	Parameters for Ove	rflow Weir	1
User Input: Overflow Weir (Dropbox) and C	Grate (Flat or Sloped) Zone 3 Weir	Not Selected	ft (relative to basin bo	ttom at Stage - 0 ft)	Height of Gr	Calculated	Parameters for Ove	rflow Weir Not Selected	feet
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length =	Trate (Flat or Sloped) Zone 3 Weir 4.15	Not Selected	ft (relative to basin bo	ttom at Stage = 0 ft)	Height of Gr Over Flow	Calculated	Parameters for Ove Zone 3 Weir 5.82	rflow Weir Not Selected N/A	feet
User Input: Overflow Weir (Dropbox) and O Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slove =	irate (Flat or Sloped) Zone 3 Weir 4.15 4.00 6.00	Not Selected N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for fl	ttom at Stage = 0 ft) at grate)	Height of Gr Over Flow Grate Open Area /	Calculated rate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-vr Orifice Area =	Parameters for Ove Zone 3 Weir 5.82 10.14 4.02	rflow Weir Not Selected N/A N/A N/A	feet feet should be > 4
User Input: Overflow Weir (Dropbox) and O Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Slobe =	irate (Flat or Sloped) Zone 3 Weir 4.15 4.00 6.00 10.00	Not Selected N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for fl feet	ttom at Stage = 0 ft) at grate)	Height of Gr Over Flow Grate Open Area / Overflow Grate Ope	Calculated rate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris =	Zone 3 Weir           5.82           10.14           4.02           28.39	rflow Weir Not Selected N/A N/A N/A N/A	feet feet should be ≥ 4 ft <sup>2</sup>
User Input: Overflow Weir (Dropbox) and O Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % =	irate (Flat or Sloped) Zone 3 Weir 4.15 4.00 6.00 10.00 70%	Not Selected N/A N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for fl feet %, grate open area/t	ttom at Stage = 0 ft) at grate) total area	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op	Calculated rate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = pen Area w/ Debris =	Parameters for Ove Zone 3 Weir 5.82 10.14 4.02 28.39 14.19	rflow Weir N/A Selected N/A N/A N/A N/A N/A	feet feet should be≥4 ft <sup>2</sup>
User Input: Overflow Weir (Dropbox) and C Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % =	rate (Flat or Sloped) Zone 3 Weir 4.15 4.00 6.00 10.00 70% 50%	Not Selected N/A N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for fl feet %	ttom at Stage = 0 ft) at grate) otal area	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op	Calculated rate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = pen Area w/ Debris =	Zone 3 Weir           5.82           10.14           4.02           28.39           14.19	rflow Weir N/A N/A N/A N/A N/A N/A	feet feet should be ≥ 4 $ft^2$
User Input: Overflow Weir (Dropbox) and C Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % =	rate (Flat or Sloped) Zone 3 Weir 4.15 4.00 6.00 10.00 70% 50%	Not Selected N/A N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for fl feet %, grate open area/t %	ttom at Stage = 0 ft) at grate) otal area	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op	Calculated rate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = pen Area w/ Debris =	Parameters for Ove           Zone 3 Weir           5.82           10.14           4.02           28.39           14.19	rflow Weir N/A N/A N/A N/A N/A N/A	feet feet should be ≥ 4 $ft^2$
User Input: Overflow Weir (Dropbox) and C Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (Cit	irate (Flat or Sloped) Zone 3 Weir 4.15 4.00 6.00 10.00 70% 50% rcular Orifice, Restrict	Not Selected N/A N/A N/A N/A N/A N/A tor Plate, or Rectang	ft (relative to basin bo feet H:V (enter zero for fl feet %, grate open area/t % <b>ular Orifice)</b>	ttom at Stage = 0 ft) at grate) otal area	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op	Calculated rate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = pen Area w/ Debris = Calculated Parameter	Parameters for Ove           Zone 3 Weir           5.82           10.14           4.02           28.39           14.19	rflow Weir N/A N/A N/A N/A N/A N/A Flow Restriction Plat	feet feet should be≥4 ft <sup>2</sup> €
User Input: Overflow Weir (Dropbox) and C Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (Cl	rate (Flat or Sloped) Zone 3 Weir 4.15 4.00 6.00 10.00 70% 50% rcular Orifice, Restric Zone 3 Restrictor	Not Selected N/A N/A N/A N/A N/A tor Plate, or Rectang Not Selected	ft (relative to basin bo feet H:V (enter zero for fi feet %, grate open area/t % <b>ular Orifice)</b>	ttom at Stage = 0 ft) at grate) iotal area	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op	Calculated rate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = pen Area w/ Debris = Calculated Parameter	Parameters for Ove           Zone 3 Weir           5.82           10.14           4.02           28.39           14.19           rs for Outlet Pipe w/           Zone 3 Restrictor	rflow Weir N/A N/A N/A N/A N/A Flow Restriction Plat Not Selected	feet feet should be ≥ 4 ft <sup>2</sup> e
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User Input: Overflow Weir (Dropbox) and C Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Stope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (Ci Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectan Spillway Crest Length = Spillway Crest Length = Spillway Crest Length = Spillway Eds Stope Restored above Max Water Surface = Restrictor Plate Height Above Pipe Invert = Depth to Invert of Outlet Pipe Invert = Depth to Invert of Outlet Pipe Invert = Spillway Crest Length = Spillway Crest Length = Spillway Eds Stope Stope Storm Return Period = One-Hour Rainfall Depth (in) = Calculated Runoff Volume (acre-ft) = OPTIONAL Override Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Unit Peak Flow, q (cf/sacre) = Predevelopment Q (cfs) = Peak Untflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) =	rate (Flat or Sloped) Zone 3 Weir 4.15 4.00 6.00 10.00 70% 50% rcular Orifice, Restrice Zone 3 Restrictor 0.20 36.00 36.00 36.00 36.00 36.00 2.07 2.577 0.00 0.0 31.0 1.5 N/A Plate N/A	Not Selected           N/A           It (relative to basin b feet           H:V           feet           H:V           6et           N.07           8.814           8.814           8.806           0.00           103.1           4.0           N/A	ft (relative to basin bo feet H:V (enter zero for fl feet %, grate open area/t % ular Orifice) ft (distance below bas inches inches bottom at Stage = 0 ft <u>2 Year</u> 1.16 6.842 6.841 0.01 0.5 80.7 3.0 N/A Plate N/A	ttom at Stage = 0 ft) at grate) otal area in bottom at Stage = 0 1 Half-1 ) 5 Year 1.44 8.912 8.905 0.03 2.9 104.3 4.2 1.4 Overflow Grate 1 0.0	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate Op Overflow Grate Op t) Out Central Angle of Rest Spillway Stage a Basin Area a 10 Year 1.68 10.804 10.803 0.11 10.2 125.7 10.4 1.0 Overflow Grate 1 0.2	Calculated rate Upper Edge, H, = 'Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = pen Area w/o Debris = Calculated Parameter Calculated Parameter Calcula	Parameters for Ove           Zone 3 Weir           5.82           10.14           4.02           28.39           14.19           rs for Outlet Pipe w/           Zone 3 Restrictor           7.07           1.50           3.14           ted Parameters for S           1.15           10.15           3.37           50 Year           2.16           14.962           14.953           0.44           42.0           171.9           36.7           0.9           Overflow Grate 1           1.1	rflow Weir N/A N/A N/A N/A N/A N/A N/A Flow Restriction Plat Not Selected N/A N/A N/A N/A N/A N/A N/A N/A	feet feet should be ≥ 4 ft <sup>2</sup> ft <sup>2</sup> fee feet radians
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User Input: Overflow Weir (Dropbox) and C Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length - Overflow Weir Slope = Horiz. Length of Weir Slodes = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (Ci Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectan Spillway Crest Length = Spillway Crest Length = Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Routed Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = Calculated Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Unit Peak Flow, q (cfs/acre) = Predevelopment Paek Q(cfs) = Peak Untflow Q (cfs) = Peak Outflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Time to Drain 97% of Inflow Volume (hours) =	rate (Flat or Sloped) Zone 3 Weir 4.15 4.00 6.00 10.00 70% 50% rcular Orifice, Restrict Zone 3 Restrictor 0.20 36.00 36.00 36.00 20 36.00 36.00 20 36.00 36.00 20 36.00 36.00 36.00 20 36.00 36.00 36.00 31.00 1.5 N/A Plate N/A N/A 38 60 36 00 36 00 31.0 1.5 N/A Plate N/A N/A 38 60 36 00 36 00 31.0 1.5 N/A N/A 1.5 N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A	Not Selected           N/A           It (relative to basin b feet           H:V           feet           B.806           0.00           0.01           103.1           4.0           N/A           Overflow Grate 1           0.01           N/A	ft (relative to basin bo feet H:V (enter zero for ff feet %, grate open area/t % ular Orifice) ft (distance below bas inches inches inches obtom at Stage = 0 ft <u>2 Year</u> <u>1.16</u> 6.841 0.01 0.5 80.7 3.0 N/A Plate N/A N/A 57 6-1	ttom at Stage = 0 ft) at grate) otal area in bottom at Stage = 0 ft Half-f half	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate Op Overflow Grate Op t) Out Central Angle of Rest Spillway Stage a Basin Area a Basin Area a 10 Year 1.68 10.803 0.11 10.2 125.7 10.4 1.0 0.2 125.7 10.4 1.0 0.2 1.0 0.4 1.0 0.2 1.0 0.4 1.0 0.2 1.0 0.4 0.1 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4	Calculated rate Upper Edge, H, = 'Weir Slope Length = 100-yr Orifice Area = pen Area w/ Debris = calculated Parameter Calculated Parameter Calculat	2 Parameters for Ove Zone 3 Weir 5.82 10.14 4.02 28.39 14.19 rs for Outlet Pipe w/ Zone 3 Restrictor 7.07 1.50 3.14 ted Parameters for S 1.15 10.15 3.37 50 Year 2.16 14.962 14.953 0.44 42.0 171.9 36.7 0.9 Overflow Grate 1 1.1 N/A 61 67	rflow Weir N/A N/A N/A N/A N/A N/A N/A Plow Restriction Plat Not Selected N/A N/A N/A N/A N/A Pillway feet feet feet acres 100 Year 2.42 17.363 0.65 62.5 199.4 55.6 0.9 Overflow Grate 1 1.8 N/A 60 60 67	feet feet should be $\geq$ 4 ft <sup>2</sup> ft <sup>2</sup> fee feet radians $\frac{500 \text{ Year}}{100000000000000000000000000000000000$
User Input: Overflow Weir (Dropbox) and C Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Stope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectant Spillway Crest Length = Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Neuted Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = Calculated Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Unit Peak Flow, q (cfs/acre) = Peak Inflow Q (cfs) = Peak Inflow Q (cfs) = Ratio Peak Outflow to Predevelopment Q Max Velocity through Grate 1 (fps) = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 1 (fps) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 97% of Inflow Volume (hours) =	rate (Flat or Sloped) Zone 3 Weir 4.15 4.00 6.00 10.00 70% 50% rcular Orifice, Restric Zone 3 Restrictor 0.20 36.00 36.00 36.00 30.00 4.00 1.00 WQCV 0.53 2.577 0.00 0.00 3.1.0 1.5 N/A Plate N/A Plate N/A 1.03	Not Selected           N/A           It (relative to basin b           feet           H:V           feet           B.806           0.00           0.01           N/A           Overflow Grate 1           0.01           N/A           62           67           4.20	ft (relative to basin bo feet H:V (enter zero for ff feet %, grate open area/t % ular Orifice) ft (distance below bas inches inches inches obtom at Stage = 0 ft 1.16 6.841 0.01 0.5 80.7 3.0 N/A Plate N/A Plate N/A S7 61 3.0	ttom at Stage = 0 ft) at grate) otal area in bottom at Stage = 0 1 Half-1 ) 5 Year 1.44 8.912 9 0.03 2.9 104.3 4.2 1.4 0.03 4.2 1.4 0.03 62 67 67 62 67 67 4.32	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate Op Overflow Grate Op t) Out Central Angle of Rest Spillway Stage a Basin Area a Basin Area a 10.804 10.804 10.803 0.11 10.2 125.7 10.4 1.0 0.2 10.4 1.0 0.2 10.4 1.0 0.2 10.4 1.0 0.2 10.4 1.0 0.2 10.4 1.0 0.2 10.4 1.0 0.2 10.4 1.0 0.2 10.4 1.0 0.2 10.4 1.0 0.2 10.4 1.0 0.2 10.4 1.0 0.2 10.4 1.0 0.2 1.0 0.2 1.0 0.4 1.0 0.2 1.0 0.4 1.0 0.2 1.0 0.4 1.0 0.2 1.0 0.4 1.0 0.2 1.0 0.4 1.0 0.2 1.0 0.4 1.0 0.2 1.0 0.4 1.0 0.2 0.2 0 0.4 1.0 0.2 0.2 0 0.4 1.0 0.2 0.2 0 0.4 1.0 0.2 0.2 0 0.4 1.0 0.2 0.2 0 0.4 1.0 0 0.2 0 0.2 0 0.2 0 0 0 0 0 0 0 0 0 0	Calculated rate Upper Edge, H, = 'Weir Slope Length = 100-yr Orifice Area = pen Area w/ Debris = pen Area w/ Debris = Calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula v Design Flow Depth= t Top of Freeboard = t Top of Freeboard = 1.92 1.3.017 	Parameters for Ove           Zone 3 Weir           5.82           10.14           4.02           28.39           14.19           rs for Outlet Pipe w/           Zone 3 Restrictor           7.07           1.50           3.14           ted Parameters for S           1.15           10.15           3.37           SO Year           2.16           14.952           0.44           42.0           171.9           36.7           0.9           Overflow Grate 1           1.1           N/A           61           69           5 <	rflow Weir Not Selected N/A N/A N/A N/A N/A N/A N/A Flow Restriction Plat Not Selected N/A N/A N/A N/A N/A Pillway feet feet feet acres 100 Year 2.42 17.363 100 Year 2.42 17.363 0.65 62.5 199.4 1.8 0.9 Overflow Grate 1 1.8 N/A 60 68 5.03	feet feet should be $\geq$ 4 ft <sup>2</sup> ft <sup>2</sup> fee feet radians 0.00 0.00 0.000 0.000 0.000 0.00
User Input: Overflow Weir (Dropbox) and C Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Derflow Weir Stope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectan Spillway Invert Stage Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = Nouted Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = Calculated Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Unit Peak Flow, g (cfs/acre) Peak Inflow Q (cfs) = Peak Outflow to Predevelopment Q Structure Controlling Flow = Max Velocity through Grate 1 (fts) = Max Velocity through Grate 2 (fts) = Time to Drain 97% of Inflow Volume (hours) = Time to Drain 97% of Inflow Volume (hours) = Maximum Ponding Depth (rt) =	rate (Flat or Sloped) Zone 3 Weir 4.15 4.00 6.00 10.00 70% 50% rcular Orifice, Restric Zone 3 Restrictor 0.20 36.00 36.00 36.00 36.00 4.00 1.00 4.00 1.00 VQCV 0.53 2.577 2.577 0.00 0.00 1.5 N/A Plate N/A Plate N/A 38 40 1.93 2.01	Not Selected           N/A           ft (relative to basin b feet           H:V           feet           H:V           feet           0.07           8.814           8.806           0.00           0.01           N/A           Overflow Grate 1           0.01           N/A           62           67           4.29           2.74	ft (relative to basin bo feet H:V (enter zero for fl feet %, grate open area/t % ular Orifice) ft (distance below bas inches inches inches inches obttom at Stage = 0 ft 1.16 6.842 0.01 0.5 80.7 3.0 N/A Plate N/A Plate N/A 57 61 3.60	ttom at Stage = 0 ft) at grate) iotal area in bottom at Stage = 0 l Half-4 ) 5 Year 1.44 8.912 8.905 0.03 2.9 104.3 4.2 1.4 Overflow Grate 1 0.0 N/A 62 67 4.32 2.75	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate Op t) Courter Spillway Stage a Basin Area a 10 Year 1.68 10.804 10.803 0.11 10.2 125.7 10.4 1.0 00verflow Grate 1 0.2 10.2 10.2 125.7 10.4 1.0 00verflow Grate 1 0.2 10.2 1.0 0.2 10.2 1.0 0.2 1.0 0.2 1.0 0.2 1.0 0.2 1.0 0.2 1.0 0.2 1.0 0.2 1.0 0.2 1.0 0.2 1.0 0.2 1.0 0.2 1.0 0.2 1.0 0.2 1.0 0.2 1.0 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0	Calculated Tate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area = pen Area w/ Debris = pen Area w/ Debris = Calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = 1.92 1.3.017 1.3.008 0.29 2.7.6 150.4 22.8 0.8 Overflow Grate 1 0.7 N/A 62 69 5.25 2.95	Parameters for Ove           Zone 3 Weir           5.82           10.14           4.02           28.39           14.19           rs for Outlet Pipe w/           Zone 3 Restrictor           7.07           1.50           3.14           ted Parameters for S           1.15           10.15           3.37           50 Year           2.16           14.952           0.44           42.0           171.9           36.7           0.9           Overflow Grate 1           1.1           N/A           61           69           5.58           3.00	rflow Weir Not Selected N/A N/A N/A N/A N/A N/A N/A N/A	feet feet should be ≥ 4 ft <sup>2</sup> ft <sup>2</sup> fee radians



#### **Detention Basin Outlet Structure Design**

Outflow Hydrograph Workbook Filename:

	Storm Inflow H	ydrographs	UD-Det	ention, Versio	n 3.07 (Februa	ry 2017)				
	The user can o	verride the calcu	ulated inflow hyd	drographs from	this workbook w	ith inflow hydrog	graphs develope	d in a separate p	rogram.	
	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
6.79 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:06:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:13:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:20:22	1.32	3.88	3.16	3.92	4.55	5.22	5.77	6.39	#N/A
0.736	0:27:10	3.62	11.31	9.03	11.42	13.51	15.83	17.79	20.12	#N/A
	0:33:57	9.30	29.04	23.20	29.33	34.71	40.70	45.77	51.81	#N/A #N/A
	0:47:32	30.98	103.13	80.70	104.26	125.73	150.37	171.89	198.14	#N/A
	0:54:19	29.70	100.96	78.43	102.10	123.94	149.31	171.71	199.37	#N/A
	1:01:07	27.03	92.59	71.73	93.65	113.94	137.60	158.55	184.52	#N/A
	1:07:54	24.30	83.53	64.68	84.49	102.84	124.24	143.20	166.69	#N/A
	1:14:41	21.17	73.49	56.79	74.34	90.61	109.63	126.50	147.43	#N/A
	1:21:29	18.43	64.33 57.71	49.68	65.08 58.37	79.37	96.06	08 01	129.25	#N/A #N/A
	1:35:04	13.93	48.87	37.68	49.44	60.39	73.21	84.59	98.73	#N/A
	1:41:51	11.51	40.64	31.30	41.12	50.26	60.97	70.49	82.33	#N/A
	1:48:38	9.06	32.58	24.99	32.97	40.43	49.19	57.01	66.74	#N/A
	1:55:26	6.94	25.41	19.43	25.72	31.60	38.52	44.71	52.43	#N/A
	2:02:13	5.13	19.22	14.64	19.45	23.96	29.30	34.11	40.12	#N/A
	2:09:01	3.88	14.23	10.89	14.40	17.68	21.63	25.24	29.76	#N/A #N/A
	2:22:35	2.65	9.48	7.29	9.59	11.72	14.25	16.52	19.33	#N/A
	2:29:23	2.31	8.20	6.32	8.30	10.13	12.29	14.23	16.63	#N/A
	2:36:10	2.07	7.31	5.64	7.40	9.02	10.93	12.64	14.75	#N/A
	2:42:58	1.90	6.67	5.16	6.75	8.23	9.96	11.50	13.41	#N/A
	2:49:45	1.41	5.10	3.90	5.16	6.35	5.58	9.02	10.60	#N/A #N/A
	3:03:20	0.75	2.73	2.82	2.76	3.39	4.14	4.82	5.66	#N/A
	3:10:07	0.56	2.03	1.55	2.05	2.52	3.07	3.57	4.20	#N/A
	3:16:55	0.41	1.50	1.14	1.52	1.86	2.28	2.65	3.11	#N/A
	3:23:42	0.29	1.08	0.82	1.10	1.35	1.65	1.92	2.26	#N/A
	3:30:29	0.21	0.78	0.60	0.79	0.98	1.19	1.39	1.63	#N/A
	3:44:04	0.15	0.56	0.42	0.56	0.70	0.85	0.67	0.80	#N/A #N/Δ
	3:50:52	0.05	0.22	0.16	0.22	0.28	0.34	0.41	0.49	#N/A
	3:57:39	0.02	0.11	0.08	0.11	0.14	0.17	0.21	0.26	#N/A
	4:04:26	0.00	0.03	0.02	0.03	0.05	0.06	0.08	0.10	#N/A
	4:11:14	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	#N/A
	4:18:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A #N/Δ
	4:31:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:38:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:45:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:51:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:58:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A #N/A
	5:12:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:19:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:25:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:32:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:39:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A #N/Δ
	5:53:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:59:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:06:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:20:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A #N/A
	6:27:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:33:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:47:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:54:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:00:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:14:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A #N/A
	7:21:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:28:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:34:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A #N/A
	7:48:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	7:55:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	8:02:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A #N/A

#### DETENTION BASIN STAGE-STORAGE TABLE BUILDER

0.1

#### UD-Detention, Version 3.07 (February 2017)

Depth Increment =

#### Project: Carriage Meadows South at Lorson Ranch Basin ID: Full Spectrum Pond G3

## 

#### ONFICE Example Zone Configuration (Retention Pond) PERM

ZONE 2

uired Volume Calculation				
Selected BMP Type =	EDB	]		
Watershed Area =	6.02	acres		
Watershed Length =	790	ft		
Watershed Slope =	0.016	ft/ft		
Watershed Imperviousness =	65.00%	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) =	0.127	acre-feet	Optional Use	r Overric
Excess Urban Runoff Volume (EURV) =	0.427	acre-feet	1-hr Precipita	tion
2-yr Runoff Volume (P1 = 1.16 in.) =	0.345	acre-feet	1.16	inches
5-yr Runoff Volume (P1 = 1.44 in.) =	0.454	acre-feet	1.44	inches
10-yr Runoff Volume (P1 = 1.68 in.) =	0.583	acre-feet	1.68	inches
25-yr Runoff Volume (P1 = 1.92 in.) =	0.751	acre-feet	1.92	inches
50-yr Runoff Volume (P1 = 2.16 in.) =	0.873	acre-feet	2.16	inches
100-yr Runoff Volume (P1 = 2.42 in.) =	1.033	acre-feet	2.42	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.323	acre-feet		
Approximate 5-yr Detention Volume =	0.426	acre-feet		
Approximate 10-yr Detention Volume =	0.543	acre-feet		
Approximate 25-yr Detention Volume =	0.586	acre-feet		
Approximate 50-yr Detention Volume =	0.610	acre-feet		
Approximate 100-yr Detention Volume =	0.659	acre-feet		

#### Stage-Storage Calculation

Rec

Zone 1 Volume (WQCV) =	0.127	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.300	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.232	acre-feet
Total Detention Basin Volume =	0.659	acre-feet
Initial Surcharge Volume (ISV) =	user	ft/B
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H <sub>total</sub> ) =	user	ft
Depth of Trickle Channel (H <sub>TC</sub> ) =	user	ft
Slope of Trickle Channel (STC) =	user	ft/ft
Slopes of Main Basin Sides (Smain) =	user	Η:V
Basin Length-to-Width Ratio (R <sub>L/W</sub> ) =	user	

# $\begin{array}{l} \mbox{lnitial Surcharge Area} (A_{\rm SV}) = \\ \mbox{Surcharge Volume Length} (L_{\rm SV}) = \\ \mbox{Surcharge Volume Width} (W_{\rm SV}) = \\ \mbox{Depth of Basin Floor} (H_{\rm FLOOR}) = \\ \end{array}$ Depth of Basin Floor (H<sub>1000</sub>) user Length of Basin Floor (M<sub>1000</sub>) user Width of Basin Floor (M<sub>1000</sub>) user Area of Basin Floor (M<sub>1000</sub>) user Depth of Main Basin (H<sub>2000</sub>) user Length of Main Basin (H<sub>2000</sub>) user Vidth of Main Basin (H<sub>2000</sub>) user User of Main Basin (H<sub>2000</sub>) user User of Main Basin (H<sub>2000</sub>) user user Other Basin Strump user User of Main Basin (H<sub>2000</sub>) user

ft^2

Pond)		Stage - Storage	Stage	Optional Override	Length	Width	Area	Optional Override	Area	Volume	Volume
		Description Top of Micropool	(tt)	Stage (tt)	(ft)	(tt)	(tt/2)	Area (tt/2)	(acre)	(ft/3)	(ac-tt)
				0.00	-		-	10	0.000		
		5684		1.00			-	2,000	0.046	985	0.023
		5685		2.00			-	7,055	0.162	5,462	0.125
		5686		3.00	-		-	8,627	0.198	13,373	0.307
		5687		4.00			-	10,260	0.236	22,817	0.524
		5yr=5687.22		4.22				10,632	0.244	25,115	0.577
		100yr=5687.81		4.81			-	11,628	0.267	31,682	0.727
		5688		5.00			-	11,949	0.274	33,922	0.779
		5689		6.00				14,318	0.329	47,055	1.080
nal Use	or Override										
Tecipic											
. 10	inches										
.44	inches										
.00	inches										
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2.10	inches										
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t/9 acre-feet

Detention Basin Outlet Structure Design									
Project:	Carriage Meadows	South at Lorson Rar	UD-Detention, Ve nch	ersion 3.07 (Februar	ry 2017)				
Basin ID:	Full Spectrum Pone	d G3							
ZONE 3 ZONE 2 ZONE 1									
				Stage (ft)	Zone Volume (ac-ft)	Outlet Type	1		
VOLUME EURV WQCV			Zone 1 (WQCV)	2.01	0.127	Orifice Plate			
ZONE 1 AND 2	100-YEA ORIFICE	R	Zone 2 (EURV)	3.58	0.300	Rectangular Orifice			
PERMANENT ORIFICES	Configuration (Pr	tontion Bond)	'one 3 (100-year)	4.56	0.232	Weir&Pipe (Restrict)			
Example 201e	Configuration (Re	elention Fond)			0.659	Total			
User Input: Orifice at Underdrain Outlet (typically us	sed to drain WQCV in	n a Filtration BMP)		-f)	Lada	Calculate	ed Parameters for Ur	derdrain	
Underdrain Orlice Invert Depth =	N/A N/A	inches	le mitration media sur	nace)	Underdra	in Orifice Centroid =	N/A N/A	π feet	
	1975	Inches			onacian		14/15		
User Input: Orifice Plate with one or more orifices of	or Elliptical Slot Weir	(typically used to dra	ain WQCV and/or EU	IRV in a sedimentatio	n BMP)	Calcu	lated Parameters for	Plate	
Invert of Lowest Orifice =	0.00	ft (relative to basin b	oottom at Stage = 0 ft	t)	WQ O	rifice Area per Row =	4.236E-03	ft²	
Depth at top of Zone using Orifice Plate =	2.01	ft (relative to basin b	oottom at Stage = 0 ft	t)	E	lliptical Half-Width =	N/A	feet	
Orifice Plate: Orifice Vertical Spacing =	8.00	inches	7/0:		Elli	ptical Slot Centroid =	N/A	feet	
Orifice Plate: Orifice Area per Row =	0.61	sq. inches (diameter	= //8 inch)			Elliptical Slot Area =	N/A	ft*	
User Input: Stage and Total Area of Each Orifice F	Row (numbered fron	n lowest to highest)							
	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)	
Stage of Orifice Centroid (ft)	0.00	0.70	1.40						
Orifice Area (sq. inches)	0.61	0.61	0.61						
	Row 0 (fi"	Pow 10 (antian i)	Pow 11 /	Bow 12 /antians "	Pour 12 /	Pour 14 /	Pow 15 /orthogy "	Pour 16 (	l
Stage of Orifice Centroid (#)	Row 9 (optional)	Row TO (optional)	NOW 11 (Optional)	Row i∠ (optional)	ROW 13 (Optional)	ROW 14 (Optional)	Row 15 (optional)	NUW 10 (Optional)	
Orifice Area (sq. inches)									
User Input: Vertical Orifice (Circ	ular or Rectangular)					Calculated	Parameters for Vert	ical Orifice	
	Zone 2 Rectangular	Not Selected					Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.20	N/A	ft (relative to basin b	pottom at Stage = 0 ft	:) V	ertical Orifice Area =	0.03	N/A	ft <sup>2</sup>
Depth at top of Zone using Vertical Orifice =	3.58	N/A	ft (relative to basin b	oottom at Stage = 0 ft	) Verti	cal Orifice Centroid =	0.08	N/A	feet
Vertical Orifice Height =	2.00	N/A	inches						
vertical Office Width =	2.00		inches						
		-							
User Input: Overflow Weir (Dropbox) and G	irate (Flat or Sloped)	-				Calculated	Parameters for Ove	rflow Weir	
User Input: Overflow Weir (Dropbox) and G	irate (Flat or Sloped) Zone 3 Weir	Not Selected	]			Calculated	Parameters for Ove Zone 3 Weir	rflow Weir Not Selected	
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho =	rate (Flat or Sloped) Zone 3 Weir 3.58	Not Selected	ft (relative to basin bo	ttom at Stage = 0 ft)	Height of Gr	<b>Calculated</b> ate Upper Edge, H <sub>t</sub> =	Parameters for Ove Zone 3 Weir 3.58	rflow Weir Not Selected N/A	feet
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length =	irate (Flat or Sloped) Zone 3 Weir 3.58 4.00	Not Selected N/A N/A	ft (relative to basin bo	ttom at Stage = 0 ft)	Height of Gr Over Flow	Calculated ate Upper Edge, H <sub>t</sub> = Weir Slope Length =	Parameters for Ove Zone 3 Weir 3.58 5.00	rflow Weir Not Selected N/A N/A	feet
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope =	rate (Flat or Sloped) Zone 3 Weir 3.58 4.00 0.00	Not Selected N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for fl	ttom at Stage = 0 ft) lat grate)	Height of Gr Over Flow Grate Open Area /	Calculated ate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area =	Parameters for Ove Zone 3 Weir 3.58 5.00	rflow Weir Not Selected N/A N/A N/A	feet feet should be ≥ 4
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Slotes = Overflow Grate Open 4ras % =	rate (Flat or Sloped) Zone 3 Weir 3.58 4.00 0.00 5.00 70%	Not Selected N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for fl feet % grate open area/t	ttom at Stage = 0 ft) lat grate) total area	Height of Gr Over Flow Grate Open Area / Overflow Grate Ope Overflow Grate Ope	Calculated ate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = an Area w/ Debris =	Parameters for Ove Zone 3 Weir 3.58 5.00 14.00 7.00	rflow Weir Not Selected N/A N/A N/A N/A	feet feet should be $\geq$ 4 $ft^2$
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Slotes = Overflow Grate Open Area % = Debris Clogging % =	rate (Flat or Sloped) Zone 3 Weir 3.58 4.00 0.00 5.00 70% 50%	Not Selected N/A N/A N/A N/A N/A	ft (relative to basin bo' feet H:V (enter zero for fl feet %, grate open area/t %	ttom at Stage = 0 ft) lat grate) total area	Height of Gr Over Flow Grate Open Area / Overflow Grate Ope Overflow Grate Op	Calculated ate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = ben Area w/ Debris =	Parameters for Ove Zone 3 Weir 3.58 5.00 14.00 7.00	rflow Weir N/A N/A N/A N/A N/A N/A	feet feet should be $\geq 4$ ft <sup>2</sup> ft <sup>2</sup>
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % =	rate (Flat or Sloped) Zone 3 Weir 3.58 4.00 0.00 5.00 70% 50%	Not Selected N/A N/A N/A N/A N/A N/A	ft (relative to basin bo feet H:V (enter zero for fl feet %, grate open area/t %	ttom at Stage = 0 ft) lat grate) total area	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op	Calculated ate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = pen Area w/ Debris =	Parameters for Ove Zone 3 Weir 3.58 5.00 14.00 7.00	rflow Weir N/A N/A N/A N/A N/A N/A	feet feet should be ≥ 4 $ft^2$
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (Ci	rate (Flat or Sloped) Zone 3 Weir 3.58 4.00 0.00 5.00 70% 50% rcular Orifice, Restri	Not Selected N/A N/A N/A N/A N/A N/A ctor Plate, or Rectan	ft (relative to basin bo feet H:V (enter zero for fl feet %, grate open area/t % gular Orifice)	ttom at Stage = 0 ft) lat grate) total area	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op	Calculated ate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area = an Area w/o Debris = ben Area w/ Debris = calculated Parameter	Parameters for Ove Zone 3 Weir 3.58 5.00 14.00 7.00 s for Outlet Pipe w/	rflow Weir N/A N/A N/A N/A N/A N/A Flow Restriction Plat	feet feet should be ≥ 4 ft <sup>2</sup> ft <sup>2</sup>
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User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Slope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Dianeter = Outlet Pipe Dianeter =	rate (Flat or Sloped) Zone 3 Weir 3.58 4.00 0.00 5.00 70% 50% ircular Orifice, Restri Zone 3 Restrictor	Not Selected N/A N/A N/A N/A N/A N/A Ctor Plate, or Rectan Not Selected N/A N/A	ft (relative to basin bo' feet H:V (enter zero for fl feet %, grate open area/t % gular Orifice) ft (distance below basi jaches	ttom at Stage = 0 ft) lat grate) total area in bottom at Stage = 0 f	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate Op t) Outt	Calculated ate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = en Area w/ Debris = <b>Calculated Parameter</b> Outlet Orifice Area = let Orifice Centroid =	Parameters for Ove Zone 3 Weir 3.58 5.00 14.00 7.00 *s for Outlet Pipe w/ Zone 3 Restrictor	rflow Weir N/A N/A N/A N/A N/A Flow Restriction Plat Not Selected N/A N/A N/A	feet feet should be $\geq 4$ ft <sup>2</sup> ft <sup>2</sup> e ft <sup>2</sup> feet readians
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User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Front Edge Length = Overflow Weir Stope = Horiz. Length of Weir Stdes = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = User Input: Emergency Spillway (Rectand Spillway Crest Length = Spillway Enst Stage Spillway Enst Stage Spillway Enst Stage Spillway Enst Stage Spillway Enst Stage Spillway Enst Length = Spillway Enst Stage Preeboard above Max Water Surface = Spillway Enst Stage OPTIONAL Override Runoff Volume (acre-ft) = OPTIONAL Override Runoff Volume (acre-ft) = Predevelopment Unit Peak Flow, q (cfs/acre) = Predevelopment Unit Peak Flow, q (cfs/acre) = Predevelopment Q = Ratio Peak Outflow to Predevelopment Q = Structure Controlling Flow Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (houre) = Time to Drain 97% of Inflow Volume (houre) =	rate (Flat or Sloped) Zone 3 Weir 3.58 4.00 0.00 5.00 70% 50% frcular Orifice, Restri Zone 3 Restrictor 2010 3 Restrictor 2010 3 Restrictor 2010 3 Restrictor 2010 0 127 0.12	Not Selected           N/A           It (relative to basin to feet           H:V           feet           H:V           0.427           0.00           0.02           N/A           Vertical Orifice 1           N/A           N/A           S5           62	ft (relative to basin bo' feet H:V (enter zero for ff feet %, grate open area/t % gular Orifice) ft (distance below basis inches inches bottom at Stage = 0 ft 2 Year 1.16 0.345 0.01 0.1 5.3 0.2 N/A Vertical Orifice 1 N/A N/A 53 5.8	ttom at Stage = 0 ft) lat grate) total area in bottom at Stage = 0 f Half-0 total 5 Year 1.44 0.454 0.454 0.454 0.02 0.1 6.9 0.3 2.3 Vertical Orifice 1 N/A N/A 56 63	Height of Gr Over Flow Grate Open Area / Overflow Grate Ope Overflow Grate Op Overflow Grate Op Overflow Grate Op Overflow Grate Ope Spillway Stage a Basin Area a Basin Area a 0.583 0.17 1.0 0.583 0.17 1.0 8.9 2.6 2.5 Overflow Grate 1 0.0 N/A 55 62	Calculated ate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = ben Area w/o Debris = calculated Parameter Outlet Orifice Area = let Orifice Centroid = irictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = t Top of Freeboard = 1.92 0.751 0.751 0.751 0.57 3.5 11.4 5.5 1.6 Overflow Grate 1 0.0 N/A 5.3 61	Parameters for Ove Zone 3 Weir 3.58 5.00 14.00 7.00 s for Outlet Pipe w/ Zone 3 Restrictor 	rflow Weir N/A N/A N/A N/A N/A N/A N/A N/A	feet feet should be $\geq$ 4 ft <sup>2</sup> ft <sup>2</sup> feet radians $\frac{500 \text{ Year}}{0.00}$ 0.00 0.000 #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Stope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Outlet Pipe Diameter = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = Spillway Crest Length = Spillway Crest Length = Spillway Erd Stopes = Freeboard above Max Water Surface = Nouted Hydrograph Results Design Storm Return Period = One-Hour Rainfall Depth (in) = Calculate Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Unit Peak Flow, q (cfs/acre) = Predevelopment Peak Q (cfs) = Peak Inflow Q (cfs) = Peak Cutflow to Predevelopment Q = Structure Controlling Flow = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 1 (fps) = Max Velocity through Grate 1 (fps) = Time to Drain 97% of Inflow Volume (hours) =	rate (Flat or Sloped) Zone 3 Weir 3.58 4.00 0.00 5.00 70% 50% frcular Orifice, Restri Zone 3 Restrictor 2008 3 Restrictor 2009 3 Restrictor 2009 3 Restrictor 2009 2.50 30.00 4.00 1.00 WQCV 0.53 0.127 0.00 0.02 0.127 0.00 0.0 2.0 0.1 N/A Plate N/A N/A N/A 37 40 1.94	Not Selected           N/A           Selected           N/A           N/A           It (relative to basin to feet           H:V           feet           H:V           feet           0.427           0.00           0.6.5           0.2           N/A           Vertical Orifice 1           N/A           N/A           S5           62           3.41	ft (relative to basin bo' feet H:V (enter zero for ff feet %, grate open area/t % gular Orifice) ft (distance below basi inches inches bottom at Stage = 0 ft 2 Year 1.16 0.345 0.01 0.345 0.01 0.1 5.3 0.2 N/A Vertical Orifice 1 N/A N/A 53 58 3.05	ttom at Stage = 0 ft) lat grate) total area in bottom at Stage = 0 f Half-0 t) 5 Year 1.44 0.454 0.454 0.454 0.454 0.02 0.1 6.9 0.3 2.3 Vertical Orifice 1 N/A N/A 56 63 3.53	Height of Gr Over Flow Grate Open Area / Overflow Grate Ope Overflow Grate Ope Overflow Grate Ope Overflow Grate Ope Comparison Spillway Stage a Basin Area a Basin Area a 0.583 0.17 1.0 8.9 2.6 2.5 Overflow Grate 1 0.0 N/A 55 62 3.73	Calculated ate Upper Edge, H, = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = ben Area w/o Debris = calculated Parameter Outlet Orifice Area = let Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = t Top of Freeboard = 1.92 0.751 0.751 0.57 3.5 11.4 5.5 1.6 Overflow Grate 1 0.0 N/A 53 61 3.84	Parameters for Ove Zone 3 Weir 3.58 5.00 14.00 7.00 s for Outlet Pipe w/ Zone 3 Restrictor 	rflow Weir N/A N/A N/A N/A N/A N/A N/A N/A	feet feet should be $\geq 4$ ft <sup>2</sup> ft <sup>2</sup> feet radians $\frac{500 Year}{0.00}$ 0.00 0.000 #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A
User Input: Overflow Weir (Dropbox) and G Overflow Weir Front Edge Height, Ho = Overflow Weir Front Edge Length = Overflow Weir Stope = Horiz. Length of Weir Sides = Overflow Grate Open Area % = Debris Clogging % = User Input: Outlet Pipe w/ Flow Restriction Plate (C Depth to Invert of Outlet Pipe = Outlet Pipe Diameter = Restrictor Plate Height Above Pipe Invert = Spillway (rest Length = Spillway (rest Length = Spillway Crest Length = Spillway Crest Length = Spillway End Slopes = Freeboard above Max Water Surface = One-Hour Rainfall Depth (in) = Calculate Runoff Volume (acre-ft) = Inflow Hydrograph Volume (acre-ft) = Predevelopment Unit Peak Flow, q (cfs/acre) = Predevelopment Peak Q (cfs) = Ratio Peak Outflow to Predevelopment Q Max Velocity through Grate 1 (fps) = Max Velocity through Grate 2 (fps) = Time to Drain 97% of Inflow Volume (hours) = Calculate Rate Q (cfs) = Calculate Rate (fps) = Maximum Ponding Depth (acres) =	rate (Flat or Sloped) Zone 3 Weir 3.58 4.00 0.00 5.00 70% 50% rcular Orifice, Restri Zone 3 Restrictor 200 3 Restrictor 200 0.127 0.127 0.00 0.0 2.0 0.1 N/A Plate N/A 1.94 0.15 200 200 200 200 200 200 200 20	Not Selected           N/A           N/A           N/A           N/A           N/A           N/A           N/A           Intervention           Not Selected           N/A           N/A           Intervention           <	ft (relative to basin bo' feet H:V (enter zero for ff feet %, grate open area/t % gular Orifice) ft (distance below basi inches inches inches ottom at Stage = 0 ft 2 Year 1.16 0.345 0.01 0.1 5.3 0.2 N/A Vertical Orifice 1 N/A Vertical Orifice 1 N/A 53 58 3.05 0.20	ttom at Stage = 0 ft) lat grate) total area in bottom at Stage = 0 f Half-0 total area 1.44 0.454 0.454 0.02 0.1 6.9 0.3 2.3 Vertical Orifice 1 N/A 56 63 3.53 0.22	Height of Gr Over Flow Grate Open Area / Overflow Grate Op Overflow Grate Op Overflow Grate Op Overflow Grate Op C Coverflow Grate Op Spillway Stage a Basin Area a Basin Area a 0.583 0.17 1.0 8.9 2.6 2.5 Overflow Grate 1 0.0 8.9 2.6 2.5 Overflow Grate 1 0.0 8.9 2.6 2.5 Overflow Grate 1 0.0 8.9 2.6 2.5 Overflow Grate 1 0.0 8.7 3.73 0.23	Calculated ate Upper Edge, H <sub>t</sub> = Weir Slope Length = 100-yr Orifice Area = en Area w/o Debris = ben Area w/ o Debris = calculated Parameter Outlet Orifice Centroid = rictor Plate on Pipe = Calcula Design Flow Depth= t Top of Freeboard = t Top of Freeboard = t Top of Freeboard = t Top of Freeboard = 0.751 0.751 0.57 3.5 1.1.4 5.5 1.6 Overflow Grate 1 0.0 N/A 53 61 3.84 0.23	Parameters for Ove Zone 3 Weir 3.58 5.00 14.00 7.00 s for Outlet Pipe w/ Zone 3 Restrictor 	rflow Weir N/A N/A N/A N/A N/A N/A N/A N/A	feet feet should be ≥ 4 ft <sup>2</sup> ft <sup>2</sup> fee ft <sup>2</sup> feet radians #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A #N/A



#### **Detention Basin Outlet Structure Design**

Outflow Hydrograph Workbook Filename:

	Storm Inflow H	ydrographs	UD-Dete	ention, Versio	n <b>3.07 (Febru</b> a	ry 2017)				
	The user can or	verride the calcu	lated inflow hyd	rographs from th	nis workbook wit	h inflow hydrogr	aphs developed	in a separate pro	gram.	
	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.47 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0.11 1111	0:05:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:10:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:16:25	0.00	0.29	0.24	0.31	0.39	0.50	0.58	0.68	#N/A
0.915	0:21:53	0.24	0.78	0.63	0.83	1.06	1.35	1.57	1.85	#N/A
	0:27:21	0.62	2.01	1.63	2.13	2.72	3.48	4.03	4.75	#N/A
	0:32:49	1.69	5.51	4.48	5.85	7.47	9.56	11.07	13.05	#N/A
	0:38:17	1.97	6.51	5.27	6.92	8.85	11.37	13.20	15.60	#N/A
	0:43:46	1.87	6.20	5.02	6.59	8.45	10.86	12.61	14.90	#N/A
	0:49:14	1.70	5.65	4.57	6.00	7.69	9.89	11.48	13.57	#N/A
	0:54:42	1.51	5.03	4.07	5.35	6.86	8.84	10.27	12.15	#N/A
	1:00:10	1.29	4.33	3.50	4.61	5.92	7.64	8.88	10.52	#N/A
	1:05:38	1.12	3.78	3.05	4.02	5.16	6.65	7.73	9.15	#N/A
	1:11:07	1.02	3.42	2.76	3.64	4.67	6.03	7.01	8.30	#N/A
	1.10.55	0.82	2.81	2.27	2.99	3.85	4.98	5.80	6.88	#N/A
	1.22.03	0.66	1.75	1.64	2.44	2.14	3.14	4.75	5.64 4.38	#N/A
	1:32:59	0.36	1.75	1.40	1.87	1.80	2 35	2 75	3 29	#N/A
	1:38:28	0.26	0.94	0.75	1.00	1.30	1.70	1.98	2.38	#N/A
	1:43:56	0.21	0.73	0.59	0.78	1.01	1.31	1.53	1.83	#N/A
	1:49:24	0.17	0.60	0.48	0.64	0.83	1.08	1.26	1.50	#N/A
	1:54:52	0.15	0.51	0.41	0.55	0.71	0.92	1.07	1.27	#N/A
	2:00:20	0.13	0.45	0.36	0.48	0.62	0.80	0.94	1.12	#N/A
	2:05:49	0.12	0.41	0.33	0.43	0.56	0.72	0.84	1.00	#N/A
	2:11:17	0.11	0.38	0.30	0.40	0.52	0.67	0.78	0.92	#N/A
	2:16:45	0.08	0.28	0.22	0.29	0.38	0.49	0.57	0.68	#N/A
	2:22:13	0.06	0.20	0.16	0.22	0.28	0.36	0.42	0.50	#N/A
	2:27:41	0.04	0.15	0.12	0.16	0.20	0.26	0.31	0.37	#N/A
	2:33:10	0.03	0.11	0.09	0.12	0.15	0.19	0.23	0.27	#N/A
	2:38:38	0.02	0.08	0.06	0.08	0.11	0.14	0.16	0.19	#N/A
	2:44.00	0.02	0.05	0.04	0.06	0.08	0.10	0.12	0.14	#N/A
	2:55:02	0.01	0.04	0.03	0.04	0.03	0.07	0.05	0.07	#N/A
	3:00:31	0.00	0.03	0.01	0.02	0.02	0.03	0.03	0.04	#N/A
	3:05:59	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	#N/A
	3:11:27	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	#N/A
	3:16:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:22:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:27:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:33:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:38:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:44:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:49:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:00:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:06:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:11:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:17:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:22:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:28:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:33:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:38:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:44:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	4:55:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A #N/A
	5:00:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:06:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:11:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:17:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A #N/A
	5:28:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:33:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:39:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:44:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	5:50:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A #N/A
	6:01:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:06:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:11:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:17:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	6:22:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A #N/A
	6:33:50	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)

			Sheet 1 of 4
Designer:	Richard Schindler		
Company:	Core Engineering Group		
Date:	January 30, 2017		
Project:	Carriage Meadows South		
Location:	Pond G1/G2 Full Spectrum Forebay and WQ Outlet Design		
1. Basin Storage \	/olume		
A) Effective Imp	perviousness of Tributary Area, I <sub>a</sub>	l <sub>a</sub> =%	
B) Tributary Area	a's Imperviousness Ratio (i = $I_a / 100$ )	i =	
C) Contributing	Watershed Area	Area = <u>96.000</u> ac	
D) For Watersh Runoff Prod	neds Outside of the Denver Region, Depth of Average lucing Storm	d <sub>6</sub> = in	
E) Design Cond	cept	Choose One	
(Select EUR)	V when also designing for flood control)	Water Quality Capture Volume (WQCV)	
		O Excess Urban Runoff Volume (EURV)	
F) Design Volur (V <sub>DESIGN</sub> = (*	me (WQCV) Based on 40-hour Drain Time 1.0 * (0.91 * i <sup>3</sup> - 1.19 * i <sup>2</sup> + 0.78 * i) / 12 * Area )	V <sub>DESIGN</sub> = 2.577 ac-ft	
G) For Watersh Water Quali (V <sub>WQCV OTHE</sub>	neds Outside of the Denver Region, ty Capture Volume (WQCV) Design Volume $_{R} = (d_{6}^{*}(V_{DESIGN}/0.43))$	V <sub>DESIGN OTHER</sub> = ac-ft	
H) User Input o (Only if a dif	of Water Quality Capture Volume (WQCV) Design Volume ferent WQCV Design Volume is desired)	V <sub>DESIGN USER</sub> = ac-ft	
I) Predominant	Watershed NRCS Soil Group	Choose One Q A Q B Q C / D WQCV selected. Soil group not required.	
J) Excess Urba For HSG A: For HSG B For HSG C	in Runoff Volume (EURV) Design Volume : EURV <sub>A</sub> = 1.68 * i <sup>1.28</sup> : EURV <sub>B</sub> = 1.36 * i <sup>1.08</sup> /D: EURV <sub>C/D</sub> = 1.20 * i <sup>1.08</sup>	EURV = ac-f t	
2. Basin Shape: Le (A basin length	ength to Width Ratio to width ratio of at least 2:1 will improve TSS reduction.)	L : W = <u>2.0</u> : 1	
3. Basin Side Slop	les		
A) Basin Maxim (Horizontal c	num Side Slopes distance per unit vertical, 4:1 or flatter preferred)	Z = ft / ft	
4. Inlet			
A) Describe me	eans of providing energy dissipation at concentrated		
innow locate	015.		



		Shee	t 2 of 4
Designer:	Richard Schindler		
Company:	Core Engineering Group		
Project	Carriage Meadows South		
Location:	Pond G1/G2 Full Spectrum Forebay and WQ Outlet Design		
5. Forebay			
A) Minimum Fo (V <sub>FMIN</sub>	orebay Volume = <u>3%</u> of the WQCV)	V <sub>FMIN</sub> = ac-ft	
B) Actual Fore	bay Volume	V <sub>F</sub> = ac-ft	
C) Forebay Dep (D <sub>F</sub>	oth = <u>30</u> inch maximum)	D <sub>F</sub> = in	
D) Forebay Dise	charge		
	i) Undetained 100-year Peak Discharge	Q <sub>100</sub> = <u>301.00</u> cfs	
	ii) Forebay Discharge Design Flow $(Q_F = 0.02 * Q_{100})$	$Q_F = 6.02$ cfs	
E) Forebay Disc	sharge Design	Choose One Berm With Pipe Wall with Rect. Notch Wall with V-Notch Weir	
F) Discharge Pi	pe Size (minimum 8-inches)	Calculated $D_P =$ in	
G) Rectangular	Notch Width	Calculated $W_N = 11.9$ in	
6. Trickle Channel		Choose One	
A) Type of Tric	kle Channel	O Soft Bottom	
F) Slope of Trie	ckle Channel	S = 0.0040 ft / ft	
7. Micropool and 0	Dutlet Structure		
A) Depth of Mi	cropool (2.5-feet minimum)	D <sub>M</sub> = ft	
B) Surface Are	a of Micropool (10 ft <sup>2</sup> minimum)	A <sub>M</sub> = sq ft	
C) Outlet Type		Choose One Orifice Plate Other (Describe):	
D) Smallest Dir (Use UD-Detr	nension of Orifice Opening Based on Hydrograph Routing ntion)	D <sub>oiffce</sub> = <u>4.70</u> inches	
E) Total Outlet	Area	A <sub>ot</sub> = <u>66.36</u> square inches	

	Design Procedure Form	: Extended Det	ention Basi	n (EDB)	
Designer: Company: Date: Project: Location:	Richard Schindler Core Engineering Group January 30, 2017 Carriage Meadows South Pond G1/G2 Full Spectrum Forebay and WQ Outlet Design				Sheet 3 of 4
8. Initial Surcharge	9 Volume				
A) Depth of Initi (Minimum red	ial Surcharge Volume commended depth is 4 inches)	D <sub>IS</sub> =	4	in	
B) Minimum Initi (Minimum vol	ial Surcharge Volume ume of 0.3% of the WQCV)	V <sub>IS</sub> =	336.8	cu ft	
C) Initial Surcha	rge Provided Above Micropool	V <sub>s</sub> =	50.0	cu ft	
9. Trash Rack					
A) Water Qualit	ty Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A <sub>t</sub> =	1,635	square inches	
B) Type of Screet in the USDCM, in total screen are	en (If specifying an alternative to the materials recommended indicate "other" and enter the ratio of the total open are to the for the material specified.)	Aluminum Ar	nico-Klemp SR Se	ries with Cross Rods 4" O.C.	
	Other (Y/N): N				-
C) Ratio of Tota	I Open Area to Total Area (only for type 'Other')	User Ratio =			
D) Total Water (	Quality Screen Area (based on screen type)	A <sub>total</sub> =	2123	sq. in.	
E) Depth of Des (Based on des	ign Volume (EURV or WQCV) sign concept chosen under 1E)	H=_	3.54	feet	
F) Height of Wa	ter Quality Screen (H <sub>TR</sub> )	H <sub>TR</sub> =	70.48	inches	
G) Width of Wat (Minimum of 1	ter Quality Screen Opening (W <sub>opening</sub> ) 2 inches is recommended)	W <sub>opening</sub> =	30.1	inches	

Design Procedure Form: Extended Detention Basin (ED)	Desian	Procedure	Form:	Extended	Detention	Basin (	(EDB
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		Sheet 4 of 4
Designer:	Richard Schindler	
Company:	Core Engineering Group	
Date:	January 30, 2017	
Project:	Carriage Meadows South	
Location:	Pond G1/G2 Full Spectrum Forebay and WQ Outlet Design	
10. Overflow Err	bankment	
A) Describe	embankment protection for 100-year and greater overtopping:	
D) Olympic (		
<ul> <li>B) Slope of (Horizon)</li> </ul>	Overflow Embankment tal distance per unit vertical, 4:1 or flatter preferred)	
(		
		- oh
11. Vegetation		
-		
		U Not Irrigated
12. Access		
A) Describe	Sediment Removal Procedures	
.,		
Notoo		
Notes:		
-		

Design Procedure Form: Extended Detention Basin (EDB)

		Sheet 1 of 4
Designer:	Richard Schindler	
Company:	Core Engineering Group	
Date:	February 21, 2017	
Project:	Carriage Meadows South	
Location:	Full Spectrum Pond G3	
1. Basin Storage \	/olume	
A) Effective Imp	perviousness of Tributary Area, I <sub>a</sub>	l <sub>a</sub> =65.0 %
B) Tributary Are	a's Imperviousness Ratio (i = $I_a / 100$ )	i =0.650
C) Contributing	Watershed Area	Area = <u>6.020</u> ac
D) For Watersh Runoff Proc	neds Outside of the Denver Region, Depth of Average lucing Storm	d <sub>6</sub> = in
E) Design Con	cept	Choose One
(Select EUR	V when also designing for flood control)	Water Quality Capture Volume (WQCV)
		O Excess Urban Runoff Volume (EURV)
F) Design Volu (V <sub>DESIGN</sub> = (	me (WQCV) Based on 40-hour Drain Time 1.0 * (0.91 * i <sup>3</sup> - 1.19 * i <sup>2</sup> + 0.78 * i) / 12 * Area )	V <sub>DESIGN</sub> = 0.127 ac-ft
G) For Watersh Water Quali (V <sub>WQCV OTHE</sub>	neds Outside of the Denver Region, try Capture Volume (WQCV) Design Volume $_{\rm R}$ = (de $^{\rm r}(V_{\rm DESIGN}/0.43))$	V <sub>DESIGN OTHER</sub> = ac-ft
H) User Input o (Only if a dif	of Water Quality Capture Volume (WQCV) Design Volume ferent WQCV Design Volume is desired)	V <sub>DESIGN USER</sub> = ac-ft
I) Predominant	Watershed NRCS Soil Group	Choose One A B C C / D WQCV selected. Soil group not required.
J) Excess Urba For HSG A For HSG B For HSG C	in Runoff Volume (EURV) Design Volume : EURV <sub>A</sub> = 1.68 * i <sup>1.28</sup> : EURV <sub>B</sub> = 1.36 * i <sup>1.08</sup> /D: EURV <sub>C/D</sub> = 1.20 * i <sup>1.08</sup>	EURV = ac-f t
2. Basin Shape: Li (A basin length	ength to Width Ratio to width ratio of at least 2:1 will improve TSS reduction.)	L : W = : 1
3. Basin Side Slop	es	
A) Basin Maxin (Horizontal	num Side Slopes distance per unit vertical, 4:1 or flatter preferred)	Z = <u>3.00</u> ft / ft DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE
4. Inlet		
A) Describe me	eans of providing energy dissipation at concentrated	
inflow locati	ons:	



	Design Procedure Form	Extended Detention Basin (EDB)
Designer: Company: Date: Project: Location:	Richard Schindler Core Engineering Group February 21, 2017 Carriage Meadows South Full Spectrum Pond G3	Sheet 3 of 4
8. Initial Surcharge	e Volume	
A) Depth of Init (Minimum re	tial Surcharge Volume commended depth is 4 inches)	$D_{IS} = $ in
B) Minimum Init (Minimum vo	ial Surcharge Volume lume of 0.3% of the WQCV)	$V_{IS} =$
C) Initial Surcha	arge Provided Above Micropool	V <sub>s</sub> = <u>16.0</u> cu ft
9. Trash Rack		
A) Water Quali	ty Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A <sub>t</sub> = <u>69</u> square inches
B) Type of Scre in the USDCM, total screen are	een (If specifying an alternative to the materials recommended indicate "other" and enter the ratio of the total open are to the for the material specified.)	S.S. Well Screen with 60% Open Area
	Other (Y/N): N	
C) Ratio of Tota	al Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water	Quality Screen Area (based on screen type)	$A_{total} = $ 115 sq. in.
E) Depth of Des (Based on de	sign Volume (EURV or WQCV) sign concept chosen under 1E)	H= <u>2.2</u> feet
F) Height of Wa	ater Quality Screen ( $H_{TR}$ )	H <sub>TR</sub> = 54.4 inches
G) Width of Wa (Minimum of <sup>-</sup>	ter Quality Screen Opening (W <sub>opening</sub> ) 12 inches is recommended)	W <sub>opening</sub> = <u>12.0</u> inches

	Design Procedure Form	: Extended Detention Basin (EDB)	
Designer: Company: Date: Project: Location:	Richard Schindler Core Engineering Group February 21, 2017 Carriage Meadows South Full Spectrum Pond G3		Sheet 4 of 4
<ol> <li>Overflow Emb</li> <li>A) Describe e</li> <li>B) Slope of O (Horizonta)</li> </ol>	ankment mbankment protection for 100-year and greater overtopping: verflow Embankment I distance per unit vertical, 4:1 or flatter preferred)		
11. Vegetation		Choose One O Irrigated O Not Irrigated	
12. Access A) Describe S	Sediment Removal Procedures		
Notes:			

## Pond G2 forebay 24-inch RCP with 5-inch wide drain notch

<b>Rectangular Weir</b>		Highlighted	
Crest	= Sharp	Depth (ft) =	2.25
Bottom Length (ft)	= 0.42	Q (cfs) =	4.720
Total Depth (ft)	= 2.25	Area (sqft) =	0.95
		Velocity (ft/s) =	5.00
Calculations		Top Width (ft) =	0.42
Weir Coeff. Cw	= 3.33		
Compute by:	Known Depth		
Known Depth (ft)	= 2.25		



## Pond G2 low flow channel from 24-inch RCP

Rectangular		Highlighted	
Botom Width (ft)	= 4.00	Depth (ft)	= 0.50
Total Depth (ft)	= 0.50	Q (cfs)	= 7.847
,		Area (sqft)	= 2.00
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 3.92
Slope (%)	= 0.40	Wetted Perim (ft)	= 5.00
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.45
		Top Width (ft)	= 4.00
Calculations		EGL (ft)	= 0.74
Compute by:	Q vs Depth		
No. Increments	= 10		



Reach (ft)

Highlighted

## Pond G2 low flow channel from 48-inch RCP

Rectangular	•
-------------	---

Botom Width (ft)	= 6.00	Depth (ft)	= 0.50
Total Depth (ft)	= 0.50	Q (cfs)	= 12.32
		Area (sqft)	= 3.00
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 4.11
Slope (%)	= 0.40	Wetted Perim (ft)	= 7.00
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.50
		Top Width (ft)	= 6.00
Calculations		EGL (ft)	= 0.76
Compute by:	Known Depth		
Known Depth (ft)	= 0.50		



Reach (ft)

## Pond G2 low flow channel

#### Rectangular

Rectangular		Highlighted	
Botom Width (ft)	= 8.00	Depth (ft)	= 0.50
Total Depth (ft)	= 0.50	Q (cfs)	= 16.84
		Area (sqft)	= 4.00
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 4.21
Slope (%)	= 0.40	Wetted Perim (ft)	= 9.00
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.50
		Top Width (ft)	= 8.00
Calculations		EGL (ft)	= 0.78
Compute by:	Known Depth		
Known Depth (ft)	= 0.50		



Reach (ft)

# FC

# Memo

Date:	Friday, March 11, 2016
Project:	Marksheffel Road South
To:	Dennis Barron, El Paso County
From:	Matthew Johnson, HDR Elizabeth Staten, HDR
Subject:	3/11/16 Marksheffel Road South Revisions

This memo serves as a supplement to the August 2015 Marksheffel Road South Final Drainage Report, stamped 8/26/2015, to document changes to the hydraulic design and supporting calculations from the 3/11/16 revisions.

The following plan sheets are affected as part of the revisions:

- D-10a
- D-14
- D-16
- D-18
- D-43
- D-50
- D-58
- D-59

For all revisions see attached calculations.

The changes to the design include the addition of three approach culverts used to convey ditch flow underneath roadway bump outs. The roadway bump outs were added to provide utility manhole access. The approach culverts are all 24" RCP with riprap outlet protection.

Two sand filters are shifted to accommodate access road changes. The affected sand filters are SF 125L and SF 178R. These sand filters are moved downstream so they will still have the ability to treat the required tributary area. Since the shift is downstream there are no required changes to the sand filter's water quality capture volume. Any excess runoff will bypass the sand filters and treatment will still be provided for at the downstream sand filters.

The driveway at station 150+00 LT is shifted to the north and the culvert at the driveway is shifted as well. The shift causes the culvert length to increase and the slope to increase. This culvert has conveyance capacity and significant downstream erosion protection so hydraulics were not performed for these minor changes.

The driveways from station 177+00 LT to 178+50 LT are shifted to the south. Both culverts used to convey runoff under these driveways are shifted and lengths and widths adjusted as appropriate.

The culvert under the access road at station 177+00 RT is upsized from a single 24" RCP to a double 24" RCP. This change is taking place due to updated basin delineation provided by an adjacent developer that estimates a 100-year peak flow of 28.6 cfs at this location. The double 24" RCP will accommodate this flow. Similarly the culvert at 168+00 RT is upsized to a double 24" RCP to accommodate the additional expected runoff.

The culvert CV618 is extended 6 feet at the previous slope of 0.50%. This shift removes the conditions where the toe wall is above a water utility. There is more than 3 feet of vertical clearance from the bottom of culvert to the top of the water utility. Hydraulic calculations are not computed for the change in length since the friction loss for the additional 6 feet of culvert is considered negligible.

The ditch just north of the future Mesa Ridge is changed from a trapezoidal ditch section to a triangular ditch section. This occurs from approximately station 130+00 LT to 140+00 LT. This ditch section is part of basin 103L and is evaluated with the full flow from that basin. The new ditch section has 2:1 side-slopes and a depth of 1.50 feet.

The ditch just south of Fontaine Boulevard on the east is changed from a trapezoidal ditch section to a triangular ditch section. This occurs from approximately station 200+00 RT to 205+00 RT. This ditch section is part of basin 178R and is evaluated with the full flow from that basin. The new ditch section has 2:1 side-slopes and a depth of 1.50 feet.

Pipe ID	<b>Previous Size</b>	Previous Length (LF)	Updated Size	Updated Length (LF)
CV117	-	-	24"	88
CV121	-	-	24"	103
CV125	-	-	24"	125
CV150	6x2 CBC	35	-	38
CV168	18"	66	2-24"	55
CV177R	24"	39	2-24"	-
CV177	2-36"	77	-	100
CV178L	2-36"	26	-	-
CV618	5x2 CBC	112	-	118

See the Table below for a summary of changes to pipe quantities.

#### **Runoff Coefficients**

Corridor / Design Package: Marksheffel	Computed:	MAJ	Date:	3/5/2016
System Name: South Approach Pipes	Checked:	EVS	Date:	

	Sub-Basin Data		Composite C		Sub Area (Pavement)			Sub Area (Pervious)		
		ισται					_			_
		Area					Area			Area
Basin ID	Description	(ac)	C₅	C <sub>100</sub>	C₅	<b>C</b> <sub>100</sub>	(ac)	C₅	C <sub>100</sub>	(ac)
ZONE3										
CV233	Onsite flow from 233+00 to 246+00	2.37	0.90	0.95	0.90	0.95	2.37	0.25	0.35	0.00
P205	Onsite flow from 207+60 to 212+00	0.44	0.90	0.95	0.90	0.95	0.44	0.25	0.35	0.00
CV205	Onsite flow from 205+00 to 212+00	0.84	0.90	0.95	0.90	0.95	0.84	0.25	0.35	0.00
CV195	Onsite flow from 195+00 to 205+00	1.68	0.90	0.95	0.90	0.95	1.68	0.25	0.35	0.00
CV194	Onsite flow from 194+00 to 205+00	1.79	0.90	0.95	0.90	0.95	1.79	0.25	0.35	0.00
CV192	Onsite flow from 192+00 to 205+00	1.99	0.90	0.95	0.90	0.95	1.99	0.25	0.35	0.00
CV177R	Onsite & Offisite flow from 177+00 to 205+00	5.51	0.64	0.71	0.90	0.95	3.32	0.25	0.35	2.19
CV168	Onsite flow from 168+00 to 179+00	0.95	0.90	0.95	0.90	0.95	0.95	0.25	0.35	0.00
CV152	Onsite flow from 152+00 to 177+00	2.49	0.90	0.95	0.90	0.95	2.49	0.25	0.35	0.00
ZONE 4										
CV125	Onsite flow from 125+00 to 148+00	2.95	0.90	0.95	0.90	0.95	2.95	0.25	0.35	0.00
CV121	Onsite flow from 121+00 to 148+00	3.31	0.90	0.95	0.90	0.95	3.31	0.25	0.35	0.00
CV117	Onsite flow from 117+00 to 148+00	3.85	0.90	0.95	0.90	0.95	3.85	0.25	0.35	0.00
CV112	Onsite flow from 112+00 to 114+00	0.18	0.90	0.95	0.90	0.95	0.18	0.25	0.35	0.00
CV109	Onsite flow from 109+00 to 114+00	0.27	0.90	0.95	0.90	0.95	0.27	0.25	0.35	0.00
CV106	Onsite flow from 106+00 to 114+00	0.40	0.90	0.95	0.90	0.95	0.40	0.25	0.35	0.00
CV99	Onsite flow from 99+00 to 103+00	0.20	0.90	0.95	0.90	0.95	0.20	0.25	0.35	0.00
#### Standard Form SF-1 . Time of Concentration

Corridor / Design Package:	Marksheffel

System Name: South Approach Pipes

	SUB-BASIN DATA			INITIAL/	OVERLAN	D FLOW				TRAVEL TIME				Total
					(t <sub>i</sub> )					(t <sub>t</sub> )				
										Type of Land Surface				
													Travel	
			Area	Length	Slope	t <sub>i</sub>	Length	Sw			Convey	Velocity	Time	$\mathbf{t}_{c} = \mathbf{t}_{i} + \mathbf{t}_{t}$
Basin ID	Description	C <sub>5</sub>	(ac)	(ft)	(ft/ft)	(min)	(ft)	(ft/ft)	Code	Description	Coef (C <sub>v</sub> )	(ft/s)	(min)	(min)
ZONE 3														
CV233	Onsite flow from 233+00 to 246+00	0.90	2.37	96	0.05208	2.13	1180	0.0288	5	Grassed waterway	15.00	2.55	7.72	9.85
P205	Onsite flow from 207+60 to 212+00	0.90	0.44	57	0.07018	1.48	453	0.01044	5	Grassed waterway	15.00	1.53	4.93	6.41
CV205	Onsite flow from 205+00 to 212+00	0.90	0.84	61	0.06557	1.57	660	0.01045	5	Grassed waterway	15.00	1.53	7.17	8.74
CV195	Onsite flow from 195+00 to 205+00	0.90	1.68	70	0.05714	1.75	1170	0.0120	5	Grassed waterway	15.00	1.64	11.88	13.63
CV194	Onsite flow from 194+00 to 205+00	0.90	1.79	70	0.05714	1.76	1280	0.01172	5	Grassed waterway	15.00	1.62	13.14	14.90
CV192	Onsite flow from 192+00 to 205+00	0.90	1.99	70	0.05714	1.76	1490	0.01208	5	Grassed waterway	15.00	1.65	15.06	16.82
CV177R	Onsite & Offisite flow from 177+00 to 205+00	0.64	5.51	54	0.07407	3.25	2865	0.00999	5	Grassed waterway	15.00	1.50	31.86	35.11
CV168	Onsite flow from 168+00 to 179+00	0.90	0.95	58	0.05172	1.66	978	0.00511	5	Grassed waterway	15.00	1.07	15.20	16.85
CV152	Onsite flow from 152+00 to 177+00	0.90	2.49	53	0.0566	1.54	2600	0.00527	5	Grassed waterway	15.00	1.09	39.80	41.33
ZONE 4														
CV125	Onsite flow from 125+00 to 148+00	0.90	2.95	100	0.06	2.07	4386	0.00876	5	Grassed waterway	15.00	1.40	52.06	54.13
CV121	Onsite flow from 121+00 to 148+00	0.90	3.31	100	0.06	2.07	4386	0.00876	5	Grassed waterway	15.00	1.40	52.06	54.13
CV117	Onsite flow from 117+00 to 148+00	0.90	3.85	100	0.06	2.07	4386	0.00876	5	Grassed waterway	15.00	1.40	52.06	54.13
CV112	Onsite flow from 112+00 to 114+00	0.90	0.18	39	0.07692	1.19	262	0.01145	5	Grassed waterway	15.00	1.61	2.72	5.00
CV109	Onsite flow from 109+00 to 114+00	0.90	0.27	39	0.07692	1.19	492	0.01016	5	Grassed waterway	15.00	1.51	5.42	6.61
CV106	Onsite flow from 106+00 to 114+00	0.90	0.40	37	0.08108	1.14	677	0.01034	5	Grassed waterway	15.00	1.53	7.40	8.54
CV99	Onsite flow from 99+00 to 103+00	0.90	0.20	39	0.10256	1.08	330	0.00909	5	Grassed waterway	15.00	1.43	3.85	5.00

Notes:

 $t_i = (1.87^*(1.1-C_5)^*(L^{0.5}))/(S^{0.33})$ , from COS DCM page 5-11

Velocity from V = C\_\*^s\_w^0.5, from UDFCD Eqn RO-4, C\_ from Table R0-2 (See Sheet Design Info)  $t_t{=}L/60V$ 

Computed: MAJ Checked: EVS 3/5/2016

Date:

Date:

# Standard Form SF-2 . Storm Drainage System Design (Rational Method Procedure) Corridor / Design Package: <u>Marksheffel</u> System Name: <u>South Approach Pipes</u>

Computed:	MAJ	Date:	3/5/2016
Checked:	EVS	Date:	

Design Storm: 5-yr

		F			DIRE	CT RUN	OFF				TOTAL I	RUNOFF		STR	EET		PIPE		Т	RAVEL .	TIME	
		ż																				
	LOCATION	DESIGN PO	AREA DESIGN (name)	AREA (AC)	RUNOFF COEFF	t <sub>c</sub> (MIN)	C.A. (AC)	I IN/HR	a (CFS)	t <sub>c</sub> (MIN)	SUM (C*A) (AC)	I (IN / HR)	Q (CFS)	(%) SLOPE	STREET FLOW (CFS)	DESIGN FLOW (CFS)	(%) SLOPE	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t, (MIN)	REMARKS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
zoi	NE 3																					
1	Onsite flow from 233+00 to 246+00		CV233	2.37	0.90	9.85	2.13	2.79	5.95													
2	Onsite flow from 207+60 to 212+00		P205	0.44	0.90	6.41	0.40	3.36	1.33													
3	Onsite flow from 205+00 to 212+00		CV205	0.84	0.90	8.74	0.76	2.98	2.25													
4	Onsite flow from 195+00 to 205+00		CV195	1.68	0.90	13.63	1.51	2.31	3.49													
5	Onsite flow from 194+00 to 205+00		CV194	1.79	0.90	14.90	1.61	2.22	3.58													
6	Onsite flow from 192+00 to 205+00		CV192	1.99	0.90	16.82	1.79	2.08	3.73													
7	Onsite & Offisite flow from 177+00 to 205+00		CV177R	5.51	0.64	35.11	3.54	1.48	5.23													
8	Onsite flow from 168+00 to 179+00		CV168	0.95	0.90	16.85	0.86	2.08	1.78													
9	Onsite flow from 152+00 to 177+00		CV152	2.49	0.90	41.33	2.24	1.36	3.05													
zoi	NE 4																					
10	Onsite flow from 112+00 to 114+00		CV112	0.18	0.90	5.00	0.17	3.55	0.59													
11	Onsite flow from 109+00 to 114+00		CV109	0.27	0.90	6.61	0.24	3.36	0.82													
12	Onsite flow from 106+00 to 114+00		CV106	0.40	0.90	8.54	0.36	2.98	1.07													
13	Onsite flow from 99+00 to 103+00		CV99	0.20	0.90	5.00	0.18	3.55	0.62													

#### Design Storm: 100-yr

				DIRE	CT RUN	OFF				TOTAL	RUNOFF		STR	REET		PIPE		Т	RAVEL	TIME	REMARKS
LOCATION	DESIGN	AREA DESIGN	AREA (AC)	RUNOFF COEFF	t <sub>c</sub> (MIN)	C.A. (AC)	I IN / HR	Q (CFS)	t <sub>c</sub> (MIN)	SUM (C*A) (AC)	I / HR)	Q (CFS)	(%) SLOPE	STREET FLOW (CFS)	DESIGN FLOW (CFS)	(%) SLOPE	3ZIS Balpe	LENGTH (FT)	VELOCITY (FPS)	t <sub>r</sub> (MIN)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
ZONE 3																					
1 Onsite flow from 233+00 to 246+00		CV233	2.37	0.95	9.85	2.25	7.49	16.87													
2 Onsite flow from 207+60 to 212+00		P205	0.44	0.95	6.41	0.42	9.02	3.77													
3 Onsite flow from 205+00 to 212+00		CV205	0.84	0.95	8.74	0.80	8.00	6.38													
4 Onsite flow from 195+00 to 205+00		CV195	1.68	0.95	13.63	1.59	6.19	9.87													
5 Onsite flow from 194+00 to 205+00		CV194	1.79	0.95	14.90	1.70	5.93	10.08													See TR-55 Peak Flow
6 Onsite flow from 192+00 to 205+00		CV192	1.99	0.95	16.82	1.89	5.57	10.53													
7 Onsite & Offisite flow from 177+00 to 205+00		CV177R	5.51	0.71	35.11	3.92	3.96	15.53													
8 Onsite flow from 168+00 to 179+00		CV168	0.95	0.95	16.85	0.90	5.57	5.03													
9 Onsite flow from 152+00 to 177+00		CV152	2.49	0.95	41.33	2.37	3.67	8.68													
ZONE 4						-															
Onsite flow from 125+00 to 148+00		CV125	2.95	0.95	54.13	2.80	3.05	8.55													
Onsite flow from 121+00 to 148+00		CV121	3.31	0.95	54.13	3.14	3.05	9.59													
Onsite flow from 117+00 to 148+00		CV117	3.85	0.95	54.13	3.66	3.05	11.16													
10 Onsite flow from 112+00 to 114+00		CV112	0.18	0.95	5.00	0.18	9.53	1.67													See TR-55 Peak Flow
11 Onsite flow from 109+00 to 114+00		CV109	0.27	0.95	6.61	0.26	9.02	2.31													
12 Onsite flow from 106+00 to 114+00		CV106	0.40	0.95	8.54	0.38	8.00	3.04													
13 Onsite flow from 99+00 to 103+00		CV99	0.20	0.95	5.00	0.19	9.53	1.77													

(7) =Column 4 x Column 5
(8) =28.5\*P/(10+Column 6)^0.786
(9) =Column 7 x Column 8
(10) =Column 6 + Column 21
(11) Add the Basin Areas (7) to get the combined basin AC
(12) =28.5\*P/(10+Column 10)^0.786

(13) Sum of Qs
(14) Additonal Street Overland Flow
(15) Additonal Street Overland Flow
(16) Design Pipe Flow
(17) Pipe Slope
(18) Pipe Size

(19) Additional Flow Length (20) Velocity (21) =Column 19 / Column 20 / 60

- Basin Description linked to C-Value Sheet
   Basin Design Point
   Enter the Basin Name from C Value Sheet
   Basin Area linked to C-Value Sheet
   Composite C linked to C-Value Sheet
   Time of Concentration linked to C-Value Sheet

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	5,647.78	ft	Headwater Depth/Height	0.90	
Computed Headwater Elevation	5,646.58	ft	Discharge	11.16	cfs
Inlet Control HW Elev.	5,646.51	ft	Tailwater Elevation	5,644.14	ft
Outlet Control HW Elev.	5,646.58	ft	Control Type	Entrance Control	
Grades					
	E 644 79	#	Downotroom Invort	E 644 14	f+
Length	5,644.78 88.00	ft	Constructed Slope	0.007273	ft/ft
Hydraulic Profile					
Profile	S2		Depth, Downstream	1.09	ft
Slope Type	Steep		Normal Depth	1.09	ft
Flow Regime	Supercritical		Critical Depth	1.20	ft
Velocity Downstream	6.36	ft/s	Critical Slope	0.005417	ft/ft
Section					
	0			0.010	
Section Snape	Circular			0.013	"
Section Material	Concrete		Span	2.00	11 f+
Number Sections	24 111011		nise	2.00	п
	1				
Outlet Control Properties					
Outlet Control HW Elev.	5,646.58	ft	Upstream Velocity Head	0.50	ft
Ke	0.20		Entrance Loss	0.10	ft
Inlet Control Properties					
Inlet Control HW Elev.	5,646.51	ft	Flow Control	N/A	
Inlet Type Beveled ri	ng, 33.7° bevels		Area Full	3.1	ft²
К	0.00180		HDS 5 Chart	3	
M	2.50000		HDS 5 Scale	В	
C	0.02430		Equation Form	1	
Y	0.83000				

Project Engineer: mattjohn

Culvert Summary					
Allowable HW Elevation	5,650.77	ft	Headwater Depth/Height	0.82	
Computed Headwater Elevation	5,649.44	ft	Discharge	9.59	cfs
Inlet Control HW Elev.	5,649.36	ft	Tailwater Elevation	5,647.01	ft
Outlet Control HW Elev.	5,649.44	ft	Control Type	Entrance Control	
Grades					
Upstream Invert	5,647,79	ft	Downstream Invert	5.647.01	ft
Length	103.00	ft	Constructed Slope	0.007573	ft/ft
Hydraulic Profile					
Profile	S2		Depth, Downstream	0.98	ft
Slope Type	Steep		Normal Depth	0.98	ft
Flow Regime	Supercritical		Critical Depth	1.11	ft
Velocity Downstream	6.23	ft/s	Critical Slope	0.005132	ft/ft
Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				
Outlet Control Properties					
Outlet Control HW Elev.	5,649.44	ft	Upstream Velocity Head	0.45	ft
Ке	0.20		Entrance Loss	0.09	ft
Inlet Control Properties					
Inlet Control HW Elev.	5,649.36	ft	Flow Control	N/A	
Inlet Type Beveled rin	ng, 33.7° bevels	-	Area Full	3.1	ft²
K	0.00180		HDS 5 Chart	3	
М	2.50000		HDS 5 Scale	В	
С	0.02430		Equation Form	1	
Υ	0.83000				

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	5,654.11	ft	Headwater Depth/Height	0.77	
Computed Headwater Elevation	5,652.54	ft	Discharge	8.55	cfs
Inlet Control HW Elev.	5,652.47	ft	Tailwater Elevation	5,650.07	ft
Outlet Control HW Elev.	5,652.54	ft	Control Type	Entrance Control	
Grades					
Upstream Invert	5.651.00	ft	Downstream Invert	5.650.07	ft
Length	125.00	ft	Constructed Slope	0.007440	ft/ft
Hydraulic Profile					
Profile	S2		Depth, Downstream	0.93	ft
Slope Type	Steep		Normal Depth	0.93	ft
Flow Regime	Supercritical		Critical Depth	1.04	ft
Velocity Downstream	6.01	ft/s	Critical Slope	0.004968	ft/ft
Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				
Outlet Control Properties					
Outlet Control HW Elev.	5,652.54	ft	Upstream Velocity Head	0.41	ft
Ке	0.20		Entrance Loss	0.08	ft
Inlet Control Properties					
Inlet Control HW Elev.	5,652.47	ft	Flow Control	N/A	
Inlet Type Beveled rir	ng, 33.7° bevels		Area Full	3.1	ft²
К	0.00180		HDS 5 Chart	3	
М	2.50000		HDS 5 Scale	В	
С	0.02430		Equation Form	1	
Y	0.83000				

Project Engineer: mattjohn

Culvert Summary					
Allowable HW Elevation	5,683.94	ft	Headwater Depth/Height	1.19	
Computed Headwater Elevation	5,683.18	ft	Discharge	33.60	cfs
Inlet Control HW Elev.	5,683.11	ft	Tailwater Elevation	5,680.54	ft
Outlet Control HW Elev.	5,683.18	ft	Control Type	Outlet Control	
Grades					
	- <u> </u>	0		E 000 E 4	0
Upstream Invert	5,680.80	π #	Downstream Invert	5,680.54	TT f+/f+
Length	66.00	IL	Constructed Stope	0.003939	IVIL
Hydraulic Profile					
Profile	M2		Depth, Downstream	1.48	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	1.48	ft
Velocity Downstream	6.75	ft/s	Critical Slope	0.006871	ft/ft
Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	2				
Outlet Control Properties					
Outlet Control HW Elev.	5,683.18	ft	Upstream Velocity Head	0.51	ft
Ке	0.20		Entrance Loss	0.10	ft
Inlet Control Properties					
Inlet Control HW Fley	5,683 11	ft	Flow Control	Transition	
Inlet Type Beveled rine	a. 33.7° bevels		Area Full	6.3	ft²
K	0.00180		HDS 5 Chart	3	-
М	2.50000		HDS 5 Scale	В	
С	0.02430		Equation Form	1	
Υ	0.83000				

Culvert Summary					
Allowable HW Elevation	5,688.70	ft	Headwater Depth/Height	1.12	
Computed Headwater Elevation	5,688.43	ft	Discharge	87.06	cfs
Inlet Control HW Elev.	5,688.36	ft	Tailwater Elevation	5,684.52	ft
Outlet Control HW Elev.	5,688.43	ft	Control Type	Entrance Control	
Grades					
Upstream Invert	5,685.08	ft	Downstream Invert	5,684.40	ft
Length	100.00	ft	Constructed Slope	0.006800	ft/ft
Hydraulic Profile					
Profile	60		Denth Downstream	2.01	ft
Slone Type	Steen		Normal Depth	2.01	ft
Elow Begime	Supercritical		Critical Depth	2.01	ft
Velocity Downstream	8.63	ft/s	Critical Slope	0.005723	ft/ft
Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	2				
Outlet Control Properties					
Outlet Control HW Elev.	5,688.43	ft	Upstream Velocity Head	1.00	ft
Ke	0.20		Entrance Loss	0.20	ft
Inlet Control Properties					
Inlet Control HW Elev.	5,688.36	ft	Flow Control	Transition	
Inlet Type Beveled rir	ng, 33.7° bevels		Area Full	14.1	ft²
К	0.00180		HDS 5 Chart	3	
Μ	2.50000		HDS 5 Scale	В	
С	0.02430		Equation Form	1	
Y	0.83000				

Culvert Summary					
Allowable HW Elevation	5,689.14	ft	Headwater Depth/Height	1.07	
Computed Headwater Elevation	5,687.56	ft	Discharge	28.60	cfs
Inlet Control HW Elev.	5,687.47	ft	Tailwater Elevation	5,685.32	ft
Outlet Control HW Elev.	5,687.56	ft	Control Type	Outlet Control	
Grades					
Linstream Invert	5 685 43	ft	Downstream Invert	5 685 32	ft
Length	39.00	ft	Constructed Slope	0.002821	ft/ft
Hydraulic Profile					
Profile	M2		Depth, Downstream	1.36	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	1.36	ft
Velocity Downstream	6.27	ft/s	Critical Slope	0.006130	ft/ft
Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	2				
Outlet Control Properties					
Outlet Control HW Elev.	5,687.56	ft	Upstream Velocity Head	0.43	ft
Ке	0.20		Entrance Loss	0.09	ft
Inlet Control Properties					
Inlet Control HW Elev.	5.687.47	ft	Flow Control	Unsubmerged	
Inlet Type Beveled rin	g, 33.7° bevels		Area Full	6.3	ft²
K	0.00180		HDS 5 Chart	3	
Μ	2.50000		HDS 5 Scale	В	
С	0.02430		Equation Form	1	
Υ	0.83000				

Culvert Summary					
Allowable HW Elevation	5,690.19	ft	Headwater Depth/Height	1.12	
Computed Headwater Elevation	5,688.90	ft	Discharge	87.06	cfs
Inlet Control HW Elev.	5,688.83	ft	Tailwater Elevation	5,685.38	ft
Outlet Control HW Elev.	5,688.90	ft	Control Type	Outlet Control	
Grades					
Upstream Invert	5.685.55	ft	Downstream Invert	5.685.45	ft
Length	26.00	ft	Constructed Slope	0.003846	ft/ft
Hydraulic Profile					
Profile	M2		Depth, Downstream	2.15	ft
Slope Type	Mild		Normal Depth	2.63	ft
Flow Regime	Subcritical		Critical Depth	2.15	ft
Velocity Downstream	8.03	ft/s	Critical Slope	0.005723	ft/ft
Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	2				
Outlet Control Properties					
Outlet Control HW Elev.	5,688.90	ft	Upstream Velocity Head	0.84	ft
Ке	0.20		Entrance Loss	0.17	ft
Inlet Control Properties					
Inlet Control HW Elev.	5,688.83	ft	Flow Control	Transition	
Inlet Type Beveled rin	g, 33.7° bevels		Area Full	14.1	ft²
К	0.00180		HDS 5 Chart	3	
М	2.50000		HDS 5 Scale	В	
С	0.02430		Equation Form	1	
Y	0.83000				

#### **Ditch Worksheet for 103L**

Project Description		
Friction Method	Manning Formula	
Solve For	Normal Depth	
Input Data		
Roughness Coefficient	0.030	
Channel Slope	0.00750	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	0.00	ft
Discharge	13.47	ft³/s
Results		
Normal Depth	1.45	ft
Flow Area	4.19	ft²
Wetted Perimeter	6.48	ft
Hydraulic Radius	0.65	ft
Top Width	5.79	ft
Critical Depth	1.23	ft
Critical Slope	0.01789	ft/ft
Velocity	3.21	ft/s
Velocity Head	0.16	ft
Specific Energy	1.61	ft
	0.67	
Flow Type	Subchildar	
GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	
GVF Output Data		
Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.45	ft
Critical Depth	1.23	ft
Channel Slope	0.00750	ft/ft
Critical Slope	0.01789	ft/ft

#### Messages

Notes

## Worksheet for 178R

Project Description		
Friction Method	Manning Formula	
Solve For	Normal Depth	
Input Data		
Roughness Coefficient	0.030	
Channel Slope	0.01000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Discharge	12.81	ft³/s
Results		
Normal Depth	1.35	ft
Flow Area	3.63	ft²
Wetted Perimeter	6.02	ft
Hydraulic Radius	0.60	ft
Top Width	5.39	ft
Critical Depth	1.21	ft
Critical Slope	0.01801	ft/ft
Velocity	3.53	ft/s
Velocity Head	0.19	ft
Specific Energy	1.54	ft
Froude Number	0.76	
Flow Type	Subcritical	
GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	
GVF Output Data		
Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.35	ft
Critical Depth	1.21	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.01801	ft/ft

Riprap Design	MAJ
Marksheffel - South	3/5/2016
CV117	



(1) Obtain Velocity from Section 3.4.3.1 of Vol 2 in the UD Manual or program such as FlowMaster or StormCad

Riprap Design	MAJ
Marksheffel - South	3/5/2016
CV121	
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(1) Obtain Velocity from Section 3.4.3.1 of Vol 2 in the UD Manual or program such as FlowMaster or StormCad

Riprap Design	MAJ
Marksheffel - South	3/5/2016
CV125	
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(1) Obtain Velocity from Section 3.4.3.1 of Vol 2 in the UD Manual or program such as FlowMaster or StormCad

Riprap Design	MAJ
Marksheffel - South	3/7/2016
CV168	



(1) Obtain Velocity from Section 3.4.3.1 of Vol 2 in the UD Manual or program such as FlowMaster or StormCad

Riprap Design	MAJ
Marksheffel - South	3/7/2016
CV177	



(1) Obtain Velocity from Section 3.4.3.1 of Vol 2 in the UD Manual or program such as FlowMaster or StormCad

Riprap Design	MAJ
Marksheffel - South	3/7/2016
CV177R	



(1) Obtain Velocity from Section 3.4.3.1 of Vol 2 in the UD Manual or program such as FlowMaster or StormCad









