



INNOVATIVE DESIGN. **CLASSIC RESULTS.**

**PRELIMINARY/FINAL DRAINAGE REPORT**

**MIDTOWN COLLECTION AT HANNAH RIDGE  
FILINGS 1 AND 2**

**(A Replat of Tracts AA and BB, Hannah Ridge at Feathergrass  
Subdivision Filing No. 1)**

**PUDSP-19-004**

**SF-19-006**

**SF-19-007**

**March 2019**

Prepared for:

**ELITE PROPERTIES OF AMERICA, INC.  
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COLORADO SPRINGS, CO 80919**

Prepared by:

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Job no. 1116.30

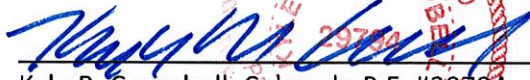


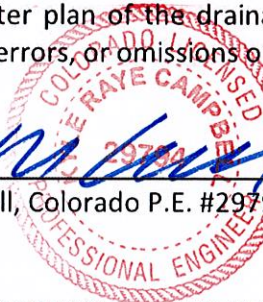
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**DRAINAGE REPORT STATEMENT**

**DESIGN 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 the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

  
\_\_\_\_\_  
Kyle R. Campbell, Colorado P.E. #29794




10.28.19  
\_\_\_\_\_  
Date

**OWNERS/DEVELOPER'S STATEMENT:**

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

Business Name: Feathergrass Investments LLC

  
\_\_\_\_\_  
Title: PIECOR

10.28.19  
\_\_\_\_\_  
Date

Address: 6385 Corporate Dr., Suite 200

Colorado Springs, CO 80919

**EL PASO COUNTY:**

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

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

Conditions:

**Approved**  
By: **Elizabeth Nijkamp**  
Date: **12/05/2019**  
El Paso County Planning & Community Development



**PRELIMINARY/FINAL DRAINAGE REPORT FOR MIDTOWN COLLECTION AT HANNAH RIDGE FILINGS 1 AND 2 (A Replat of Tracts AA and BB, Hannah Ridge at Feathergrass Subdivision Filing No. 1)**

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# **FINAL DRAINAGE REPORT FOR MIDTOWN COLLECTION AT HANNAH RIDGE FILINGS 1 AND 2 (A Replat of Tracts AA and BB, Hannah Ridge at Feathergrass Subdivision Filing No. 1)**

## **PURPOSE**

This document is the Preliminary and Final Drainage Report for Midtown Collection at Hannah Ridge Filings 1 and 2. The purpose of this report is to identify onsite and offsite drainage patterns, storm sewer, inlet locations, and areas tributary to the site, and to safely route developed storm water runoff to adequate detention and water quality facilities while releasing storm water at or below historic rates and in accordance with all applicable master drainage plans. This report will discuss the proposed storm system to be built with Filings 1 and 2 and discuss the final construction details, and more specifically, the final design details of the proposed sub-regional public detention/water quality facilities located within Filing 1 that will handle the treatment for Filings 1 and 2. Final design information for the Filings No. 1 and 2 detention/water quality facilities are included in this report.

## **GENERAL DESCRIPTION**

The Hannah Ridge at Feathergrass development is a 121.2 acre residential and commercial district within the south half of Section 32, Township 13 South, Range 65 West of the 6<sup>th</sup> Principal Meridian in El Paso County, Colorado. The site is located on the west side of Akers Drive just north of Constitution Avenue. The existing abandoned Chicago Rock Island and Pacific Railroad sits directly north and west of the site, with Akers Drive bordering the east side and Constitution adjoining the south side of the site. The development includes a total of 345 single-family residences that will be developed in seven filings, as well as one commercial parcel, Tract CC and the two previously anticipated multi-family parcels, Tracts AA and BB, that are now proposed for a small lot PUD single family development. Midtown Collection at Hannah Ridge Filing No. 1 (Tract BB) is 9.123 acres in size and contains 61 small lot, single-family lots. Midtown Collection at Hannah Ridge Filing No. 2 (Tract AA) is 3.260 acres in size and contains 28 proposed small lot, single-family lots.



The average soil condition of the entire site and tributary area to the proposed ponds reflects Hydrologic Group "A" (Blakeland, loamy sand) as determined by the "Soil Survey of El Paso County Area," prepared by the National Cooperative Soil Survey (see map in Appendix).

### **EXISTING DRAINAGE CONDITIONS**

The site is located within the Sand Creek Drainage Basin. More specifically, it is situated in the far south portion of the overall Hannah Ridge at Feathergrass development. These two proposed residential filings are comprised of Basin E9 for Filing No. 1 and Basin F5 for Filing No. 2, as shown on the developed drainage map provided by MVE, Inc. (See Appendix). The abandoned railroad bed along the west edge of the development serves as the westerly basin boundary and Hunter Jumper Drive to the north as the northerly basin boundary. The construction of Filing 2, 3 and 4 improvements included the public storm under Shawnee Drive out-falling into the existing 60" RCP storm that runs parallel to Constitution. The 84" RCP public storm from Hunter Jumper Drive to Hannah Ridge Drive was also previously constructed. The on-site pre-development drainage patterns are generally sheet flowing towards Shawnee Drive where existing inlets intercept the flows and transfer them to an existing stormwater quality only facility located on the east side of Shawnee Drive and constructed with Filing No. 4 (Filing No. 2). Filing No. 1 existing flows generally drain as sheet flow in an easterly direction towards the existing drainage channel west of Hannah Ridge Drive.

### **DEVELOPED DRAINAGE CONDITIONS**

Given some recent changes in City/County Drainage Criteria, the calculations for this development now reflects current criteria for stormwater quality and detention requirements. Proposed Pond 1 will be designed as a full spectrum facility to accommodate the developed flows from the west portion of Filing No. 1 and all of Filing No. 2. Pond 2 will accommodate the easterly portion of Filing No. 1. This will include the design of concrete forebays, concrete trickle channels, concrete micropool and an outlet structure designed to release flows based on full spectrum criteria. The attached developed conditions drainage map contains many design points related to proposed sump conditions. All public Type R inlets have been designed at these various locations to accept both the 5-yr. and 100-yr. developed flows.



All proposed storm facilities within the public Right-of-way will be public with ownership and maintenance by El Paso County. All other proposed storm facilities are within easements or tracts and the proposed Pond 1 and Pond 2 will be owned and maintained by the Hannah Ridge HOA. All existing public storm facilities are located within existing easements as reflected on the drainage map.

**Design Point 1A** ( $Q_5 = 12$  cfs and  $Q_{100} = 26$  cfs) collect developed and overland flows from Basin A & offsite Basin OSF2 shown in the Hannah Ridge at Feathergrass Filing No. 1 Final Drainage Report. At this sump condition, a 30" FES will be installed to completely collect both the 5-year and 100-year developed flows. These flows will have a maximum ponding depth of 1.0' and then be conveyed via a 30" RCP storm sewer in a southerly direction towards the existing 36" storm sewer that outfalls along Constitution Avenue. The total flow within the pipe at this location is given by **Pipe Run 11 ( $Q_5 = 12$  cfs and  $Q_{100} = 26$  cfs)**. The emergency overflow route at this location is in the easterly direction in Tract A directly into a drainage tract that will route the flows towards Constitution Avenue. Basin A contains 0.48 acres and the developed runoff will be untreated as it outfalls into the existing storm sewer system. This acreage is below the 1 acre per filing requirement for developed flows without treatment.

**Design Point 1** ( $Q_5 = 3$  cfs and  $Q_{100} = 5$  cfs) collect developed flows from Basin B. At this sump condition, a 5' Type R sump inlet will be installed to completely collect both the 5-year and 100-year developed flows. These flows will have a maximum ponding depth of 1.0' and then be conveyed via a 18" RCP storm sewer in a southerly direction towards Pond 1. The total flow within the pipe at this location is given by **Pipe Run 1 ( $Q_5 = 3$  cfs and  $Q_{100} = 5$  cfs)**. The emergency overflow route at this location is in the southerly direction in Tract A directly into a drainage tract that will route the flows towards Constitution Avenue.

**Design Point 2** ( $Q_5 = 2$  cfs and  $Q_{100} = 3$  cfs) and **Design Point 3** ( $Q_5 = 1$  cfs and  $Q_{100} = 2$  cfs) collect developed flows from Basins C & D. At this sump condition, a 5' and a 5' Type R sump inlets, respectively, will be installed to completely collect both the 5-year and 100-year developed flows. These flows will have a maximum ponding depth of 1.0' and then be conveyed via a 18" RCP storm



sewer towards Pond 1. The total flow within the pipe at this location is given by **Pipe Run 3 ( $Q_5 = 3$  cfs and  $Q_{100} = 6$  cfs)**. The emergency overflow route at this location is via Tract A directly and then to Constitution Avenue. **Pipe Run 4 ( $Q_5 = 6$  cfs and  $Q_{100} = 11$  cfs)** represents the combined pipe flows from Design Points 1-3. This 24" RCP storm sewer will route these combined developed flows directly into Pond 1. This pond inflow is designated later in this report.

**Design Point 4** ( $Q_5 = 1$  cfs and  $Q_{100} = 2$  cfs) collects developed flows from Basin F. At this sump condition, a 5' Type R sump inlet will be installed to completely collect both the 5-year and 100-year developed flows. These flows being collected have a maximum ponding depth of 1.0' and then be conveyed via a 18" RCP storm sewer towards Pond 1. The total flow within the pipe at this location is given by **Pipe Run 5 ( $Q_5 = 1$  cfs and  $Q_{100} = 2$  cfs)**. The emergency overflow route at this location is via Tract A directly and then to Shawnee Drive. **Pipe Run 6 ( $Q_5 = 7$  cfs and  $Q_{100} = 13$  cfs)** represents the combined pipe flows from Design Points 1, 2, 3 & 4. This 24" RCP storm sewer will route these combined developed flows directly into Pond 1. This pond inflow is designated later in this report.

Runoff from Basin E (0.35 Acres) and Basin G (0.32 Acres) flow directly into Hunter Jumper Drive and Shawnee Drive. The water quality treatment for Basin E and Basin G will be provided by the existing facility designed and installed within Hannah Ridge at Feathergrass Filing No. 4.

**Design Point 5** ( $Q_5 = 9$  cfs and  $Q_{100} = 19$  cfs) collect developed flows from Basins I. At this sump condition, a 15' Type R sump inlet will be installed to completely collect both the 5-year and 100-year developed flows. These flows being collected have a maximum ponding depth of 1.0' and then be conveyed via a 24" RCP storm sewer towards Pond 1. The total flow within the pipe at this location is given by **Pipe Run 7 ( $Q_5 = 9$  cfs and  $Q_{100} = 19$  cfs)**. The emergency overflow route at this location is via a Tract directly behind the inlet and then into Pond 1, based upon the proposed grading behind the inlet. As this overflow swale will only be used in an emergency situation, no reinforcement of the swale is required. **Pipe Run 8 ( $Q_5 = 15$  cfs and  $Q_{100} = 30$  cfs)** represents the combined pipe flows from Design Points 1, 2, 3, 4 & 5. This 30" RCP storm sewer will route these combined developed flows directly into Pond 1. This pond inflow is designated later in this report.



**Design Point 6** ( $Q_5 = 3$  cfs and  $Q_{100} = 6$  cfs) collects developed flows from Basin N. At this sump condition, a 5' Type R sump inlet will be installed to completely collect both the 5-year and 100-year developed flows. These flows will have a maximum ponding depth of 1.0' and be conveyed via a 18" RCP storm sewer in a southerly direction towards Pond 2. The total flow within the pipe at this location is given by **Pipe Run 9** ( $Q_5 = 3$  cfs and  $Q_{100} = 6$  cfs). The emergency overflow route at this location is via a Tract directly behind the inlet and then to an existing rip rap lined drainage channel.

**Design Point 7** ( $Q_5 = 2$  cfs and  $Q_{100} = 3$  cfs) collects developed flows from Basin O. At this sump condition, a 5' Type R sump inlet will be installed to completely collect both the 5-year and 100-year developed flows. These flows will have a maximum ponding depth of 1.0' and be conveyed via a 18" RCP storm sewer in a southerly direction towards Pond 2. The total flow within the pipe at this location is given by **Pipe Run 10** ( $Q_5 = 2$  cfs and  $Q_{100} = 3$  cfs). The emergency overflow route at this location is in the easterly direction directly into a Hannah Ridge Drive.

**Basin E** ( $Q_5 = 1.1$  cfs and  $Q_{100} = 2.1$  cfs) consists of flows from the landscaped residential front yards that will sheet flow into Shawnee Drive and be routed to the existing SWQ pond east of the intersection of Shawnee Drive and Constitution Ave.

**Basin G** ( $Q_5 = 1.1$  cfs and  $Q_{100} = 2.1$  cfs) consists of flows from the landscaped residential front yards that will sheet flow into existing Hunter Jumper Drive and then to existing Shawnee Drive and be routed to the existing SWQ pond east of the intersection of Shawnee Drive and Constitution Ave.

**Basin H** ( $Q_5 = 0.8$  cfs and  $Q_{100} = 1.9$  cfs) consists of landscaped flows from an area that contains the existing SWQ pond located at the intersection of Shawnee Drive and Constitution Ave.

**Basin J** ( $Q_5 = 2.2$  cfs and  $Q_{100} = 4.1$  cfs) consists of flows from the landscaped residential front yards that will sheet flow into existing Hunter Jumper Drive and be routed to the existing SWQ pond south of Hunter Jumper Drive in Basin K.





**Basin K** ( $Q_5 = 1.3$  cfs and  $Q_{100} = 2.9$  cfs) consists of landscaped flows from an area that contains the existing SWQ pond located south of Hunter Jumper Drive.

**Basin L** ( $Q_5 = 1.5$  cfs and  $Q_{100} = 3.4$  cfs) consists of landscaped flows from an area that contains Proposed Full Spectrum SWQ Pond 1.

**Basin P** ( $Q_5 = 0.8$  cfs and  $Q_{100} = 1.5$  cfs) consists of flows from the landscaped residential front yards that will sheet flow into existing Hunter Jumper Drive and be routed to the existing SWQ pond east of Hannah Ridge Drive.

**Basin M** ( $Q_5 = 1.9$  cfs and  $Q_{100} = 4.3$  cfs) consists of flows from the landscaped tract area that contains an existing rip rap outfall of an existing 90" RCP to an existing box culvert under Hannah Ridge Drive.

**Design Point 8 The total inflow into Pond 1 equals  $Q_5 = 16$  cfs and  $Q_{100} = 33$  cfs.** This facility will be constructed with the proposed Filing 1 development and the downstream flows will remain consistent with the previous filings. This facility will have one inflow point. The inflow ( $Q_5 = 16$  cfs and  $Q_{100} = 33$  cfs) will be from a 30" RCP into a concrete forebay with a required size of 90 CF based on 3% of the WQCV from this inflow. The forebay is designed with 12" high walls, 4.9" notch and a 30" wide concrete trickle channel routing the flows towards the pond outlet. The outlet structure consists of a 4'x4' concrete box with an integral 100 SF micropool allowing for 6" initial surcharge depth. The micropool total depth of 3.0' provides the required 0.3% of the WQCV. The outlet box will have a height of 3.50'. (See UD-BMP Spreadsheets in Appendix) The orifice plate on the front of the outlet box consists of a series of 4 – 15/16" holes, 10.50" apart. (See UD-Detention Spreadsheets in Appendix) This facility will be owned and maintained by the Hannah Ridge HOA.



**Pond 1** has the following design parameters as a full-spectrum facility:

- 0.094 Ac.-ft. WQCV required**
- 0.137 Ac.-ft. EURV required**
- 0.493 Ac.-ft. 100-yr. storage required**

<b>Total In-flow:</b>	<b>Q<sub>5</sub> = 16 cfs, Q<sub>100</sub> = 33 cfs</b>
<b>Pond Design Release:</b>	<b>Q<sub>5</sub> = 0.07 cfs, Q<sub>100</sub> = 6.7 cfs</b>
<b>Pre-development Release:</b>	<b>Q<sub>5</sub> = 0.14cfs, Q<sub>100</sub> = 8.6 cfs</b>

**Design Point 9** The total inflow into Pond 2 equals Q<sub>5</sub> = 5 cfs and Q<sub>100</sub> = 9 cfs. This facility will be constructed with the proposed Filing 1 development and the downstream flows will remain consistent with the previous filings. This facility will have two inflow points. The west inflow (Q<sub>5</sub> = 3 cfs and Q<sub>100</sub> = 6 cfs) will be from an 18" RCP into a concrete trickle channel. The north inflow (Q<sub>5</sub> = 2 cfs and Q<sub>100</sub> = 3 cfs) will be from an 18" RCP into a concrete trickle channel. Per the UD-BMP spreadsheet (see appendix) forebays are not required for this small of a facility. The trick channel will be a 30" wide concrete trickle channel routing the flows towards the pond outlet. The outlet structure consists of a 3'x3' concrete box with an integral 100 SF micropool allowing for 6" initial surcharge depth. The micropool total depth of 3.0' provides the required 0.3% of the WQCV. The outlet box will have a height of 2.35'. (See UD-BMP Spreadsheets in Appendix) The orifice plate on the front of the outlet box consists of a series of 3 holes, 9.40" apart. Two 7/16" diameter holes and 1 15/16" diameter hole. (See UD-Detention Spreadsheets in Appendix) This facility will be owned and maintained by the Hannah Ridge HOA.

**Pond 2** has the following design parameters as a full-spectrum facility:

- 0.023 Ac.-ft. WQCV required**
- 0.044 Ac.-ft. EURV required**
- 0.057 Ac.-ft. 100-yr. storage required**

<b>Total In-flow:</b>	<b>Q<sub>5</sub> = 5 cfs, Q<sub>100</sub> = 9 cfs</b>
<b>Pond Design Release:</b>	<b>Q<sub>5</sub> = 0.03 cfs, Q<sub>100</sub> = 2.4 cfs</b>
<b>Pre-development Release:</b>	<b>Q<sub>5</sub> = 0.038cfs, Q<sub>100</sub> = 2.2 cfs</b>



## HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014. Individual on-site developed basin design used for inlet sizing and storm system routing was calculated using the Rational Method. Full-Spectrum detention pond modeling developed using UD-Detention spreadsheet ver. 3.07, Urban Drainage and Flood Control District.

The City of Colorado Springs/El Paso County DCM requires the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls. The Four Step Process pertains to management of smaller, frequently occurring storm events, as opposed to larger storms for which drainage and flood control infrastructure are sized. Implementation of these four steps helps to achieve storm water permit requirements.

This site adheres to this **Four Step Process** as follows:

1. **Employ Runoff Reduction Practices:** Proposed impervious areas (roof tops, patios) will sheet flow across landscaped yards and through open space areas to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets. This will minimize directly connected impervious areas within the project site.
2. **Stabilize Drainageways:** After developed flows utilize the runoff reduction practices through the yards, these flows will travel via curb and gutter within the public streets and eventually public storm systems. These collected flows are then routed directly to the full-spectrum detention facility on-site (Pond 1 and 2).



3. **Provide Water Quality Capture Volume (WQCV):** Runoff from this development will be treated through capture and slow release of the WQCV in the proposed full-spectrum permanent Extended Detention Basin (Pond 1) designed per current El Paso County drainage criteria.
  
4. **Consider need for Industrial and Commercial BMPs:** No industrial or commercial uses are proposed within this development. However, a site-specific storm water quality and erosion control plan and narrative has been submitted along with the grading and erosion control plan. Details such as site-specific source control construction BMP's as well as permanent BMP's were detailed in this plan and narrative to protect receiving waters. BMP's will be constructed and maintained as the development has been graded and erosion control methods employed.

#### **FLOODPLAIN STATEMENT**

No portion of this site is located within a FEMA floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Number 08041C0752G, with effective dates of December 7, 2018 (See Appendix).

#### **EROSION CONTROL PLAN**

The Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate be submitted with the Final Drainage Report. We respectfully request that the Erosion Control Plan and cost estimate be submitted in conjunction with the Overlot Grading Plan and construction assurances posted prior to obtaining a grading permit. Early grading is not being requested with these applications.



**Midtown Collection at Hannah Ridge at Feathergrass Filing No. 1 and 2 Drainage Improvement Costs**

**(Non-Reimbursable)**

ITEM	DESCRIPTION	QUANTITY	UNIT COST	COST
1.	5' Type R Inlet	6 EACH	\$3,791/EA	\$ 23,400.00
2.	15' Type R Inlet	1 EACH	\$7,923/EA	\$ 4,200.00
3.	18" RCP Storm Drain	690 LF	\$69/LF	\$ 47,610.00
4.	24" RCP Storm Drain	980 LF	\$84/LF	\$ 82,320.00
5.	30" RCP Storm Drain	20 LF	\$94/LF	\$ 1,880.00
6.	Type I MH	1 EACH	\$8,592/EA	\$ 8,592.00
7.	Type II MH	8 EACH	\$4,575/EA	\$ 36,600.00
8.	Pond 1 FSD	1 EACH	\$83,000/EA	\$ 83,000.00
9.	Pond 2 FSD	1 EACH	\$53,000/EA	\$ 53,000.00
SUB-TOTAL				\$ 340,602.00
10% ENGINEERING				\$ 34,060.20
5% CONTINGENCIES				\$ 17,030.10
<b>SUB-TOTAL</b>				<b><u>\$ 391,692.30</u></b>

Classic Consulting Engineers & Surveyors cannot and does not guarantee that the construction cost will not vary from these opinions of probable construction costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular.

**DRAINAGE & BRIDGE FEES**

This site lies within the Sand Creek Drainage Basin. The fees are calculated using the following impervious acreage method approved by El Paso County. All three Filings are re-plats of previously platted tracts within Filing 1. However, these tracts were designated as future development and no fees were paid at time of original platting. Thus, the percent imperviousness for each Filing is calculated below based on the following acreages:

Filing 1: 9.123 ac.  
Filing 2: 3.260 ac.



The total development area for each Filing is broken into different residential uses:

PUD zone (1/8 acre or less SF lots – 65% Impervious)

PUD zone Open space/drainage tracts (Greenbelts – 2% Impervious).

The following calculations are based on the 2019 drainage/bridge fees for the Sand Creek Basin:

**FILING 1:**

**2158 SF avg. lots (1/8 acre or less)**

(Per El Paso County Percent Impervious Chart for 1/8 acre or less SF lots: 65%)

$$5.40 \text{ Ac.} \times 65\% = \mathbf{3.51 \text{ Impervious Ac.}}$$

**Open Space Tracts**

(Per El Paso County Percent Impervious Chart for greenbelts: 2%)

$$3.720 \text{ Ac.} \times 2\% = \mathbf{0.07 \text{ Impervious Ac.}}$$

**Total Impervious Acreage:                    3.58 Imp. Ac.**

**FILING 1 FEE TOTALS:**

**Bridge Fees**

$$\$ 5,559.00 \times 3.58 \text{ Impervious Ac.} \quad = \quad \underline{\underline{\$ 19,901.22}}$$

**Drainage Fees**

$$\$ 18,940.00 \times 3.58 \text{ Impervious Ac.} \quad = \quad \underline{\underline{\$ 67,805.20}}$$

These Drainage Fees will be paid by developer in the form of cash and/or credits.



**FILING 2:**

**2158 SF avg. lots (1/8 acre or less)**

(Per El Paso County Percent Impervious Chart for 1/8 acre or less SF lots: 65%)

$$2.27 \text{ Ac.} \times 65\% = \mathbf{1.48 \text{ Impervious Ac.}}$$

**Open Space Tracts**

(Per El Paso County Percent Impervious Chart for greenbelts: 2%)

$$0.99 \text{ Ac.} \times 2\% = \mathbf{0.02 \text{ Impervious Ac.}}$$

**Total Impervious Acreage:                    1.50 Imp. Ac.**

**FILING 2 FEE TOTALS:**

**Bridge Fees**

$$\$ 5,559.00 \times 1.50 \text{ Impervious Ac.} \quad = \quad \underline{\underline{\$ 8,338.50}}$$

**Drainage Fees**

$$\$ 18,940.00 \times 1.50 \text{ Impervious Ac.} \quad = \quad \underline{\underline{\$ 28,410.00}}$$

These Drainage Fees will be paid by developer in the form of cash and/or credits.



## REFERENCES

1. City of Colorado Springs/County of El Paso Drainage Criteria Manual dated October 1991.
2. "Sand Creek Drainage Basin Planning Study," Kiowa Engineering Corp, dated March 1996.
3. "Master Development Drainage Plan for Hannah Ridge", prepared by MVE, Inc. November 2007
4. "Final Drainage Report for Hannah Ridge at Feathergrass Subdivision Filing No. 1", by MVE, Inc. January 2014.
5. Drainage Criteria Manual (Volume 3) latest revision April 2008, Urban Drainage and Flood Criteria District.
6. "Final Drainage Report for Hannah Ridge at Feathergrass Filing No. 3", by MVE, Inc. October 2017.
7. "Final Drainage Report for Hannah Ridge at Feathergrass Filing No. 4", by MVE, Inc. October 2017.





## SUMMARY

This proposed development remains consistent with the previously approved MDDP and Final Drainage Report for Hannah Ridge at Feathergrass Filing No. 1. The existing storm facilities continue to adequately handle both the 5-yr. and 100-yr. developed flows. All proposed detention facilities meet current criteria and provide full spectrum design. The proposed development will not adversely impact surrounding developments.



PREPARED BY:

**Classic Consulting**

Kyle R. Campbell, P.E.  
Division Manager

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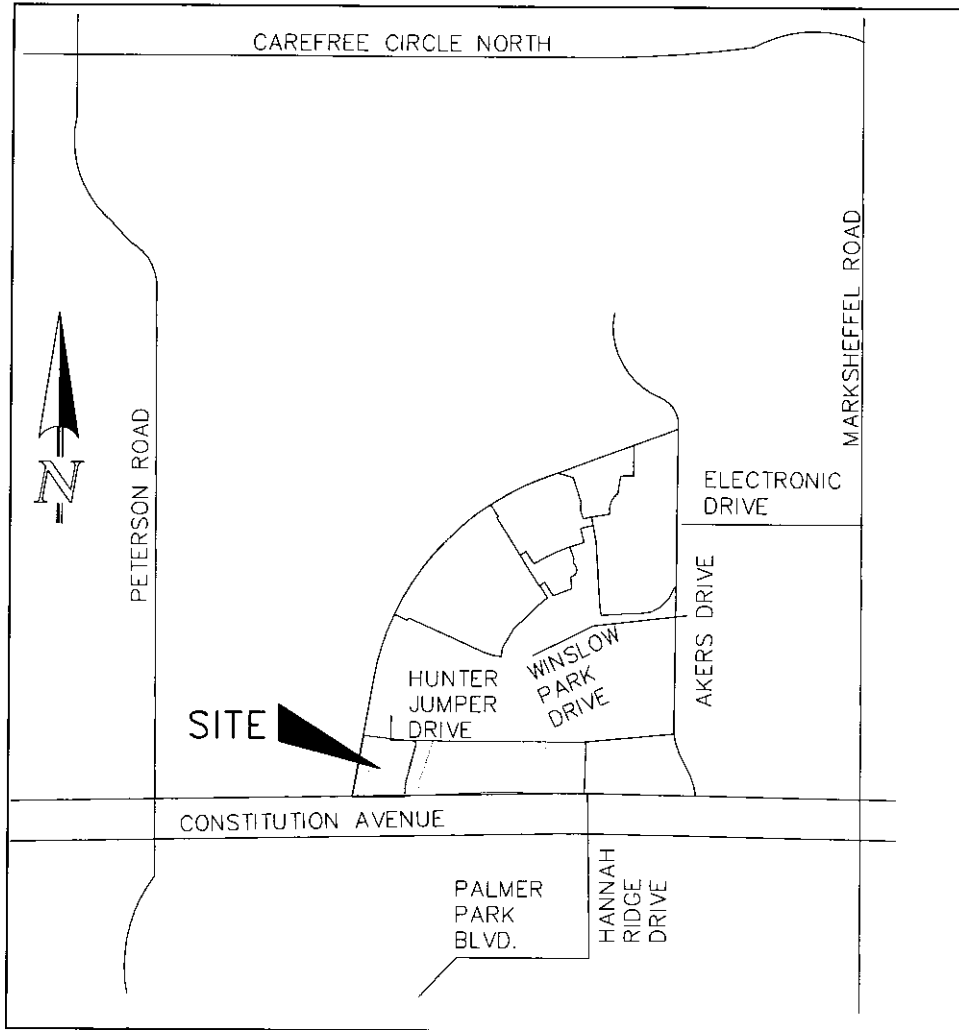


## APPENDIX



**VICINITY MAP**





VICINITY MAP  
N.T.S.

**SOILS MAP (S.C.S SURVEY)**



Hydrologic Soil Group—El Paso County Area, Colorado




































Soil Map may not be valid at this scale.

Map Scale: 1:4,130 if printed on A landscape (11" x 8.5") sheet.



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

## MAP LEGEND

 Area of Interest (AOI)	 C
 Area of Interest (AOI)	 C/D
<b>Soils</b>	 D
<b>Soil Rating Polygons</b>	 Not rated or not available
 A	<b>Water Features</b>
 A/D	 Streams and Canals
 B	<b>Transportation</b>
 B/D	 Rails
 C	 Interstate Highways
 C/D	 US Routes
 D	 Major Roads
 Not rated or not available	 Local Roads
<b>Soil Rating Lines</b>	<b>Background</b>
 A	 Aerial Photography
 A/D	
 B	
 B/D	
 C	
 C/D	
 D	
 Not rated or not available	
<b>Soil Rating Points</b>	
 A	
 A/D	
 B	
 B/D	

## MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: El Paso County Area, Colorado  
Survey Area Data: Version 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blackland loamy sand, 1 A to 9 percent slopes		57.4	100.0%
<b>Totals for Area of Interest</b>			<b>57.4</b>	<b>100.0%</b>

### Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

**Group A.** Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

**Group B.** Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

**Group C.** Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

**Group D.** Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

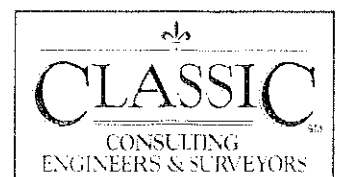
### Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified



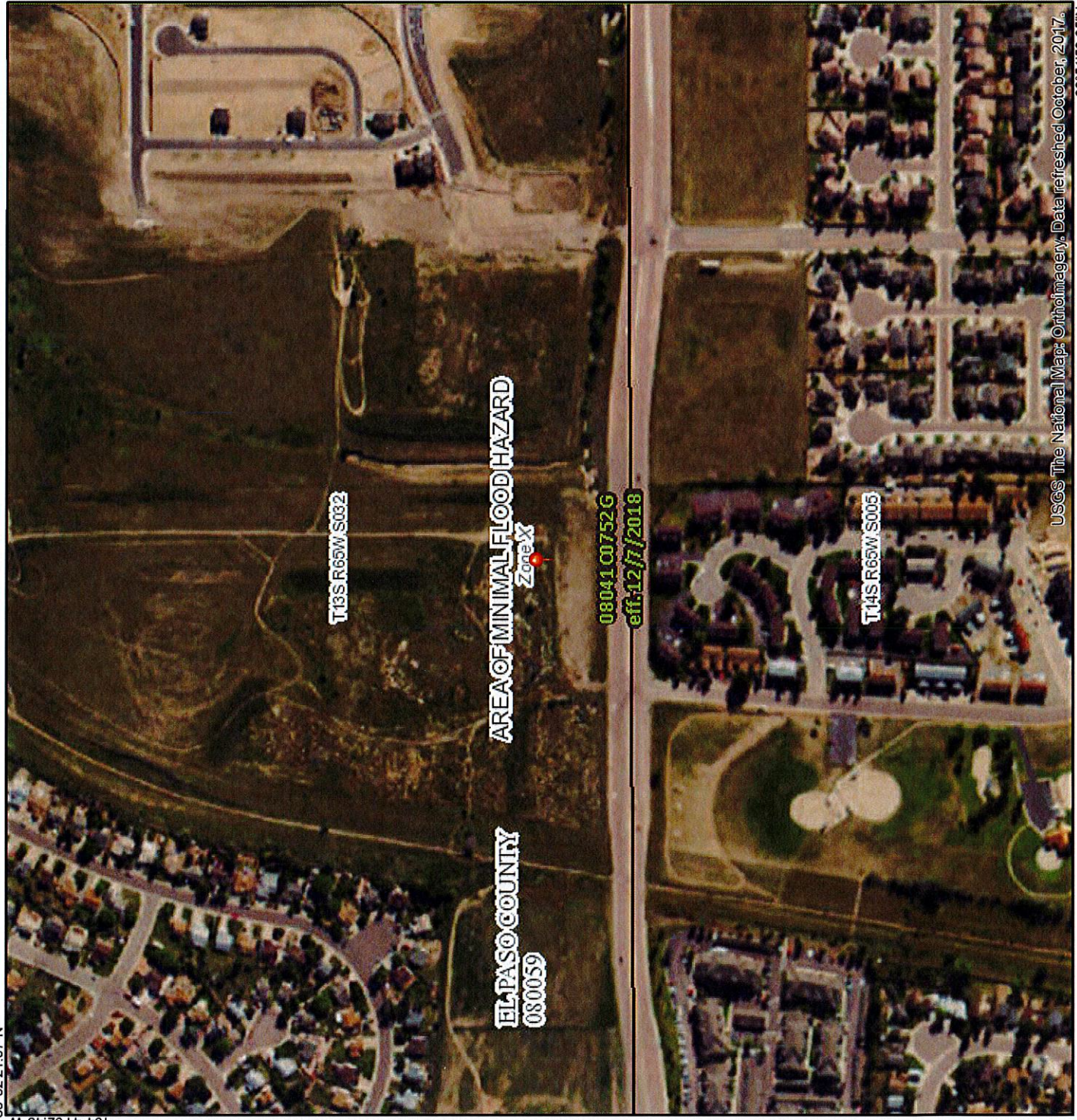
**F.E.M.A. MAP**



# National Flood Hazard Layer FIRMette



38°52'21.67"N



104°41'15.02"W

USGS The National Map: Orthoimagery, Data refreshed October, 2017, 38°51'53.65"N



## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**

- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**

- 0.2% Annual Chance Flood Hazard, Area of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile (Zone X)
- Future Conditions 1% Annual Chance Flood Hazard (Zone X)
- Area with Reduced Flood Risk due to Levee. See Notes, Zone X
- Area with Flood Risk due to Levee (Zone D)

**OTHER AREAS**

- Area of Minimal Flood Hazard (Zone X)
- Effective LOMRs
- Area of Undetermined Flood Hazard (Zone X)

**GENERAL STRUCTURES**

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**

- Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**

- Digital Data Available
- No Digital Data Available
- Unmapped

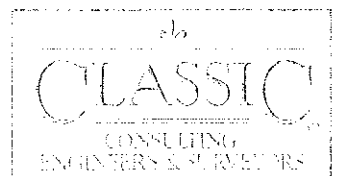
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards.

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/24/2019 at 5:51:46 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

**REFERENCE MATERIAL FROM ADJACENT STUDIES**





1903 lebray street, suite 900  
colorado springs, co 80909  
719.635.5736

# Final Drainage Report

**Hannah Ridge at  
Feathergrass  
Subdivision Filing  
No. 1**

**RECEIVED**  
APR 23 2014  
BY: Finel

**January 31, 2014**  
Copyright © MVE, Inc., 2014

# **Final Drainage Report**

for

**Hannah Ridge at Feathergrass Subdivision Filing No. 1**

**Project No. 60970**

**January 31, 2014**

prepared for

**Feathergrass Investments, LLC**  
4715 North Chestnut Street  
Colorado Springs, CO 80907  
719.593.8367

prepared by

**MVE, Inc.**  
1903 Lelaray Street, Suite 200  
Colorado Springs, CO 80909  
719.635.5736

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60970 Hannah Ridge Final Drainage Report.odt



**HYDROLOGIC / HYDRAULIC CALCULATIONS**



JOB NAME: **MIDTOWN COLLECTION AT HANNAH RIDGE FILING NO. 1 & 2**

JOB NUMBER: **1116.30**

DATE: **03/11/19**

CALCULATED BY: **K. CAMPBELL**

**FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY**

BASIN	IMPERVIOUS AREA / STREETS				LANDSCAPE/UNDEVELOPED AREAS				WEIGHTED				WEIGHTED CA			
	TOTAL AREA (AC)	AREA (AC)	C(2)	C(5)	C(100)	AREA (AC)	C(2)	C(5)	C(100)	C(2)	C(5)	C(100)	CA(2)	CA(5)	CA(100)	
OSF2	4.88	0.00	0.89	0.90	0.96	4.88	0.39	0.43	0.57	0.39	0.43	0.57	1.90	2.10	2.78	
A	0.48	0.18	0.89	0.90	0.96	0.30	0.39	0.43	0.57	0.58	0.61	0.72	0.28	0.29	0.34	
B	0.81	0.55	0.89	0.90	0.96	0.26	0.39	0.43	0.57	0.73	0.75	0.83	0.59	0.61	0.68	
C	0.51	0.31	0.89	0.90	0.96	0.20	0.39	0.43	0.57	0.69	0.72	0.81	0.35	0.37	0.41	
D	0.35	0.21	0.89	0.90	0.96	0.14	0.39	0.43	0.57	0.69	0.71	0.80	0.24	0.25	0.28	
E	0.35	0.14	0.89	0.90	0.96	0.21	0.39	0.43	0.57	0.59	0.62	0.73	0.21	0.22	0.25	
F	0.31	0.21	0.89	0.90	0.96	0.10	0.39	0.43	0.57	0.73	0.75	0.83	0.23	0.23	0.26	
G	0.32	0.20	0.89	0.90	0.96	0.12	0.39	0.43	0.57	0.70	0.72	0.81	0.22	0.23	0.26	
H	0.38	0.00	0.89	0.90	0.96	0.38	0.39	0.43	0.57	0.39	0.43	0.57	0.15	0.16	0.22	
I	4.18	1.15	0.89	0.90	0.96	3.03	0.39	0.43	0.57	0.53	0.56	0.68	2.21	2.34	2.83	
J	0.61	0.40	0.89	0.90	0.96	0.21	0.39	0.43	0.57	0.72	0.74	0.83	0.44	0.45	0.50	
K	0.59	0.00	0.89	0.90	0.96	0.59	0.39	0.43	0.57	0.39	0.43	0.57	0.23	0.25	0.34	
L	0.69	0.00	0.89	0.90	0.96	0.69	0.39	0.43	0.57	0.39	0.43	0.57	0.27	0.30	0.39	
M	0.87	0.00	0.89	0.90	0.96	0.87	0.39	0.43	0.57	0.39	0.43	0.57	0.34	0.37	0.50	
N	0.99	0.40	0.89	0.90	0.96	0.59	0.39	0.43	0.57	0.59	0.62	0.73	0.59	0.61	0.72	
O	0.48	0.30	0.89	0.90	0.96	0.18	0.39	0.43	0.57	0.70	0.72	0.81	0.34	0.35	0.39	
P	0.21	0.15	0.89	0.90	0.96	0.06	0.39	0.43	0.57	0.75	0.77	0.85	0.16	0.16	0.18	



JOB NAME: **MIDTOWN COLLECTION AT HANNAH RIDGE FILLING NO. 1 & 2**

JOB NUMBER: **1116.30**  
 DATE: **03/11/19**  
 CALCD BY: **K. CAMPBELL**

Table 6-7. Conveyance Coefficient, C<sub>v</sub>

Type of Land Surface	C <sub>v</sub>
Heavy meadow	2.5
Tillage field	5
Riprap (not buried)	$t_c = \frac{L}{180} + 10$
Short pasture and lawns	6.5
Nearly bare ground	7
Grassed waterway	10
Paved areas and shallow paved swales	15
For buried riprap, select C <sub>v</sub> value based on type of vegetative cover.	20

$$V = C_v S_w^{0.5} \quad Tc=L/V$$

$$t_c = \frac{0.395(1.1 - C_v) \sqrt{L}}{S^{0.33}}$$

**FINAL DRAINAGE REPORT ~ BASIN RUNOFF SUMMARY**

BASIN	WEIGHTED				OVERLAND			STREET / CHANNEL FLOW			INTENSITY		TOTAL FLOWS								
	CA(2)	CA(5)	CA(10)	CA(25)	CA(50)	CA(100)	C(5)	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	Tc (min)	TOTAL Q(2) (cfs)	Q(5) (cfs)	Q(100) (cfs)				
OSF2	1.90	2.10	0.00	0.00	0.00	2.78	0.43	40	0.8	6.1				6.1	3.89	4.87	8.18	7	10.2	22.8	
A	0.28	0.29	0.31	0.33	0.34	0.34	0.43	40	0.8	6.1	290	2.0%	2.8	1.7	7.8	3.59	4.50	7.56	1	1.3	2.6
B	0.59	0.61	0.63	0.65	0.67	0.68	0.43	50	1	6.8				6.8	3.75	4.71	7.90	2	2.9	5.3	
C	0.35	0.37	0.38	0.40	0.40	0.41	0.43	40	0.8	6.1				6.1	3.89	4.87	8.18	1.4	1.8	3.4	
D	0.24	0.25	0.26	0.27	0.28	0.28	0.43	40	0.8	6.1				6.1	3.89	4.87	8.18	1	1.2	2.3	
E	0.21	0.22	0.23	0.24	0.25	0.25	0.43	40	0.8	6.1				6.1	3.89	4.87	8.18	1	1.1	2.1	
F	0.23	0.23	0.24	0.25	0.25	0.26	0.43	40	0.8	6.1				6.1	3.89	4.87	8.18	0.9	1.1	2.1	
G	0.22	0.23	0.24	0.25	0.26	0.26	0.43	40	0.8	6.1				6.1	3.89	4.87	8.18	0.9	1.1	2.1	
H	0.15	0.16	0.18	0.20	0.21	0.22	0.43	40	12	2.5				5.0	4.12	5.17	8.68	1	0.8	1.9	
I	2.21	2.34	2.48	2.66	2.76	2.83	0.43	60	0.8	8.5	400	2.0%	2.8	2.4	10.9	3.19	4.00	6.72	7	9.4	19.0
J	0.44	0.45	0.47	0.49	0.50	0.50	0.43	40	0.8	6.1				6.1	3.89	4.87	8.18	2	2.2	4.1	
K	0.23	0.25	0.28	0.31	0.32	0.34	0.43	30	8	2.2				5.0	4.12	5.17	8.68	1	1.3	2.9	
L	0.27	0.30	0.32	0.36	0.38	0.39	0.43	30	8	2.2				5.0	4.12	5.17	8.68	1	1.5	3.4	
M	0.34	0.37	0.41	0.45	0.48	0.50	0.43	30	8	2.2				5.0	4.12	5.17	8.68	1	1.9	4.3	
N	0.59	0.61	0.65	0.68	0.70	0.72	0.43	40	0.8	6.1				6.1	3.89	4.87	8.18	2	3.0	5.9	
O	0.34	0.35	0.36	0.38	0.38	0.39	0.43	40	0.8	6.1				6.1	3.89	4.87	8.18	1.3	1.7	3.2	
P	0.16	0.16	0.17	0.17	0.18	0.18	0.43	40	0.8	6.1				6.1	3.89	4.87	8.18	0.6	0.8	1.5	

JOB NAME: MIDTOWN COLLECTION AT HANNAH RIDGE FILING NO. 1 & 2

JOB NUMBER: 1116.30

DATE: 03/11/19

CALCULATED BY: K. CAMPBELL

**FINAL DRAINAGE REPORT ~ SURFACE ROUTING SUMMARY**

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Inlet Size
					I(5)	I(100)	Q(5)	Q(100)	
1A	BASIN A & OSF2	2.39	3.12	6.1	4.87	8.18	12	26	30" FES
1	BASIN B	0.61	0.68	6.8	4.71	7.90	3	5	5' Type R Sump
2	BASIN C	0.37	0.41	6.1	4.87	8.18	2	3	5' Type R Sump
3	BASIN D	0.25	0.28	6.1	4.87	8.18	1	2	5' Type R Sump
4	BASIN F	0.23	0.26	6.1	4.87	8.18	1	2	5' Type R Sump
5	BASIN I	2.34	2.83	10.9	4.00	6.72	9	19	15' Type R Sump
6	BASIN N	0.61	0.72	6.1	4.87	8.18	3	6	5' Type R Sump
7	BASIN O	0.35	0.39	6.1	4.87	8.18	2	3	5' Type R Sump
8	POND 1 IN (PIPE 8 AND BASIN L)	4.09	4.85	10.9	4.00	6.72	16	33	SWQ Pond 1
9	POND 2 IN (PIPE 9 & PIPE 10 BASIN)	0.96	1.11	6.1	4.87	8.18	5	9	SWQ Pond 2

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

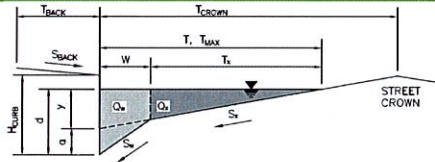
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Midtown Collection at Hannah Ridge Filing No. 1 & 2

Inlet ID:

DP-1



**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb  
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line  
 Distance from Curb Face to Street Crown  
 Gutter Width  
 Street Transverse Slope  
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)  
 Street Longitudinal Slope - Enter 0 for sump condition  
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm  
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm  
 Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is based on Depth Criterion  
 MAJOR STORM Allowable Capacity is based on Depth Criterion

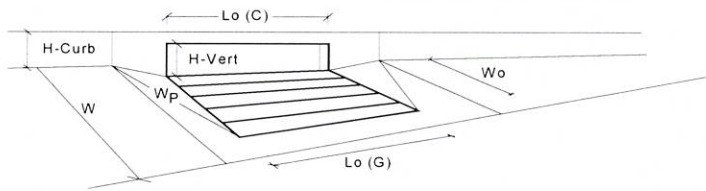
$T_{BACK}$ =	7.5	ft
$S_{BACK}$ =	0.020	ft/ft
$n_{BACK}$ =	0.013	
$H_{CURB}$ =	6.00	inches
$T_{CROWN}$ =	17.0	ft
$W$ =	2.00	ft
$S_x$ =	0.020	ft/ft
$S_w$ =	0.083	ft/ft
$S_o$ =	0.000	ft/ft
$n_{STREET}$ =	0.016	

	Minor Storm	Major Storm	
$T_{MAX}$ =	17.0	17.0	ft
$d_{MAX}$ =	6.0	6.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

$Q_{ALLOW}$ =	Minor Storm	Major Storm	
	SUMP	SUMP	cfs

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



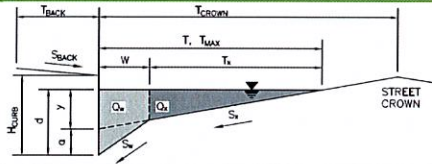
		MINOR	MAJOR	
<b>Design Information (Input)</b>				
Type of Inlet	<input type="text" value="CDOT Type R Curb Opening"/>			
Local Depression (additional to continuous gutter depression 'a' from above)				
Number of Unit Inlets (Grate or Curb Opening)				
Water Depth at Flowline (outside of local depression)				
<b>Grate Information</b>				
Length of a Unit Grate				
Width of a Unit Grate				
Area Opening Ratio for a Grate (typical values 0.15-0.90)				
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)				
Grate Weir Coefficient (typical value 2.15 - 3.60)				
Grate Orifice Coefficient (typical value 0.60 - 0.80)				
<b>Curb Opening Information</b>				
Length of a Unit Curb Opening				
Height of Vertical Curb Opening in Inches				
Height of Curb Orifice Throat in Inches				
Angle of Throat (see USDCM Figure ST-5)				
Side Width for Depression Pan (typically the gutter width of 2 feet)				
Clogging Factor for a Single Curb Opening (typical value 0.10)				
Curb Opening Weir Coefficient (typical value 2.3-3.7)				
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)				
<b>Low Head Performance Reduction (Calculated)</b>				
Depth for Grate Midwidth				
Depth for Curb Opening Weir Equation				
Combination Inlet Performance Reduction Factor for Long Inlets				
Curb Opening Performance Reduction Factor for Long Inlets				
Grated Inlet Performance Reduction Factor for Long Inlets				
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>				
<b>Inlet Capacity IS GOOD for Minor and Major Storms(&gt;Q PEAK)</b>				
		MINOR	MAJOR	
Type =		CDOT Type R Curb Opening		
$a_{local}$ =		3.00	3.00	inches
No =		1	1	
Ponding Depth =		6.0	12.0	inches
		MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
$L_3(G)$ =		N/A	N/A	feet
$W_0$ =		N/A	N/A	feet
$A_{ratio}$ =		N/A	N/A	
$C_1(G)$ =		N/A	N/A	
$C_w(G)$ =		N/A	N/A	
$C_o(G)$ =		N/A	N/A	
		MINOR	MAJOR	
$L_3(C)$ =		5.00	5.00	feet
$H_{vert}$ =		6.00	6.00	inches
$H_{throat}$ =		6.00	6.00	inches
Theta =		63.40	63.40	degrees
$W_p$ =		2.00	2.00	feet
$C_1(C)$ =		0.10	0.10	
$C_w(C)$ =		3.60	3.60	
$C_o(C)$ =		0.67	0.67	
		MINOR	MAJOR	
$d_{Grate}$ =		N/A	N/A	ft
$d_{Curb}$ =		0.33	0.83	ft
$RF_{Combination}$ =		0.77	1.00	
$RF_{Curb}$ =		1.00	1.00	
$RF_{Grate}$ =		N/A	N/A	
		MINOR	MAJOR	
$Q_0$ =		5.4	12.3	cfs
$Q_{PEAK REQUIRED}$ =		3.0	6.0	cfs

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

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

Project:  
Inlet ID:

Midtown Collection at Hannah Ridge Filing No. 1 & 2  
DP-2



**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb  
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)  
 Height of Curb at Gutter Flow Line  
 Distance from Curb Face to Street Crown  
 Gutter Width  
 Street Transverse Slope  
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)  
 Street Longitudinal Slope - Enter 0 for sump condition  
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$  = 7.5 ft  
 $S_{BACK}$  = 0.020 ft/ft  
 $n_{BACK}$  = 0.013

$H_{CURB}$  = 6.00 inches  
 $T_{CROWN}$  = 12.0 ft  
 $W$  = 2.00 ft  
 $S_x$  = 0.020 ft/ft  
 $S_w$  = 0.083 ft/ft  
 $S_o$  = 0.000 ft/ft  
 $n_{STREET}$  = 0.016

Max. Allowable Spread for Minor & Major Storm  
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm  
 Check boxes are not applicable in SUMP conditions

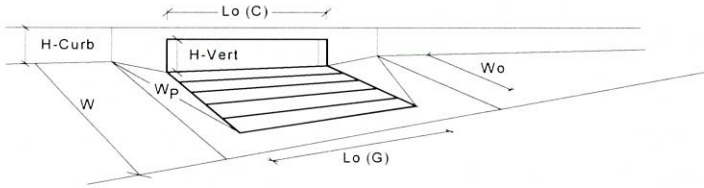
	Minor Storm	Major Storm	
$T_{MAX}$	12.0	12.0	ft
$d_{MAX}$	6.0	6.0	inches

MINOR STORM Allowable Capacity is based on Depth Criterion  
 MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow}$	SUMP	SUMP	cfs

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



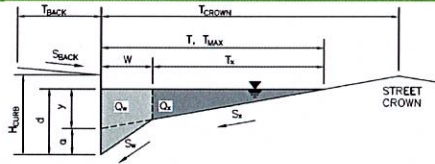
		MINOR	MAJOR	
<b>Design Information (Input)</b>				
Type of Inlet	<input type="text" value="CDOT Type R Curb Opening"/>			
Local Depression (additional to continuous gutter depression 'a' from above)				
Number of Unit Inlets (Grate or Curb Opening)				
Water Depth at Flowline (outside of local depression)				
<b>Grate Information</b>				
Length of a Unit Grate				
Width of a Unit Grate				
Area Opening Ratio for a Grate (typical values 0.15-0.90)				
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)				
Grate Weir Coefficient (typical value 2.15 - 3.60)				
Grate Orifice Coefficient (typical value 0.60 - 0.80)				
<b>Curb Opening Information</b>				
Length of a Unit Curb Opening				
Height of Vertical Curb Opening in Inches				
Height of Curb Orifice Throat in Inches				
Angle of Throat (see USDCM Figure ST-5)				
Side Width for Depression Pan (typically the gutter width of 2 feet)				
Clogging Factor for a Single Curb Opening (typical value 0.10)				
Curb Opening Weir Coefficient (typical value 2.3-3.7)				
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)				
<b>Low Head Performance Reduction (Calculated)</b>				
Depth for Grate Midwidth				
Depth for Curb Opening Weir Equation				
Combination Inlet Performance Reduction Factor for Long Inlets				
Curb Opening Performance Reduction Factor for Long Inlets				
Grated Inlet Performance Reduction Factor for Long Inlets				
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>				
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)				
		MINOR	MAJOR	
Type =		CDOT Type R Curb Opening		
$a_{local}$ =		3.00	3.00	inches
No =		1	1	
Ponding Depth =		6.0	12.0	inches
		MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
$L_o(G)$ =		N/A	N/A	feet
$W_o$ =		N/A	N/A	feet
$A_{ratio}$ =		N/A	N/A	
$C_l(G)$ =		N/A	N/A	
$C_w(G)$ =		N/A	N/A	
$C_o(G)$ =		N/A	N/A	
		MINOR	MAJOR	
$L_o(C)$ =		5.00	5.00	feet
$H_{vert}$ =		6.00	3.00	inches
$H_{throat}$ =		6.00	3.00	inches
Theta =		63.40	63.40	degrees
$W_p$ =		2.00	2.00	feet
$C_l(C)$ =		0.10	0.10	
$C_w(C)$ =		3.60	3.60	
$C_o(C)$ =		0.67	0.67	
		MINOR	MAJOR	
$d_{Grate}$ =		N/A	N/A	ft
$d_{Curb}$ =		0.33	0.83	ft
$RF_{Combination}$ =		0.77	1.00	
$RF_{Curb}$ =		1.00	1.00	
$RF_{Grate}$ =		N/A	N/A	
		MINOR	MAJOR	
$Q_s$ =		5.4	12.3	cfs
$Q_{PEAK REQUIRED}$ =		1.7	3.0	cfs

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

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

Project:  
Inlet ID:

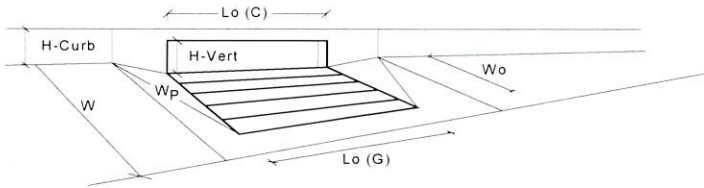
Midtown Collection at Hannah Ridge Filing No. 1 & 2  
DP-3



Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	T <sub>BACK</sub> = 7.5 ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S <sub>BACK</sub> = 0.020 ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n <sub>BACK</sub> = 0.013				
Height of Curb at Gutter Flow Line	H <sub>CURB</sub> = 6.00 inches				
Distance from Curb Face to Street Crown	T <sub>CROWN</sub> = 12.0 ft				
Gutter Width	W = 2.00 ft				
Street Transverse Slope	S <sub>x</sub> = 0.020 ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S <sub>w</sub> = 0.083 ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	S <sub>o</sub> = 0.000 ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n <sub>STREET</sub> = 0.016				
Max. Allowable Spread for Minor & Major Storm	T <sub>MAX</sub> = <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td>12.0</td><td>12.0</td></tr></table> ft	Minor Storm	Major Storm	12.0	12.0
Minor Storm	Major Storm				
12.0	12.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d <sub>MAX</sub> = <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td>6.0</td><td>6.0</td></tr></table> inches	Minor Storm	Major Storm	6.0	6.0
Minor Storm	Major Storm				
6.0	6.0				
Check boxes are not applicable in SUMP conditions	<input type="checkbox"/> <input type="checkbox"/>				
MINOR STORM Allowable Capacity is based on Depth Criterion	Q <sub>allow</sub> = <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td>SUMP</td><td>SUMP</td></tr></table> cfs	Minor Storm	Major Storm	SUMP	SUMP
Minor Storm	Major Storm				
SUMP	SUMP				
MAJOR STORM Allowable Capacity is based on Depth Criterion					

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



		MINOR	MAJOR	
<b>Design Information (Input)</b>	CDOT Type R Curb Opening			
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)	$a_{local}$ =	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 =	6.0	12.0	inches
<b>Grate Information</b>		MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate	$L_G$ (G) =	N/A	7.00	feet
Width of a Unit Grate	$W_G$ =	N/A	2.00	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	$A_{ratio}$ =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_1$ (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	$C_{w1}$ (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_{o1}$ (G) =	N/A	N/A	
<b>Curb Opening Information</b>		MINOR	MAJOR	
Length of a Unit Curb Opening	$L_C$ (C) =	5.00	3.00	feet
Height of Vertical Curb Opening in Inches	$H_{vert}$ =	6.00	3.00	inches
Height of Curb Orifice Throat in Inches	$H_{throat}$ =	6.00	3.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	$W_p$ =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_1$ (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_{w2}$ (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_{o2}$ (C) =	0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>		MINOR	MAJOR	
Depth for Grate Midwidth	$d_{grate}$ =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	$d_{curb}$ =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{combination}$ =	0.77	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	$RF_{curb}$ =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	$RF_{grate}$ =	N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>		MINOR	MAJOR	
<b>Inlet Capacity IS GOOD for Minor and Major Storms(&gt;Q PEAK)</b>	$Q_s$ =	5.4	12.3	cfs
	$Q_{PEAK REQUIRED}$ =	1.0	2.0	cfs

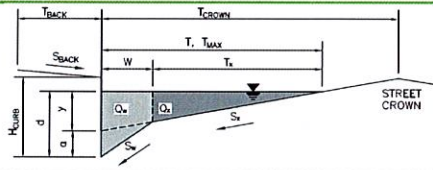


**ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)**

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

Project:  
Inlet ID:

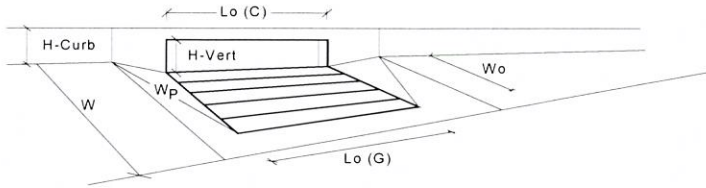
Midtown Collection at Hannah Ridge Filing No. 1 & 2  
DP-4



Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 7.5$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.013$
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 12.0$ ft
Gutter Width	$W = 2.00$ ft
Street Transverse Slope	$S_x = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_D = 0.000$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 12.0 & 12.0 \end{matrix}$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 6.0 & 6.0 \end{matrix}$ inches
Check boxes are not applicable in SUMP conditions	<input type="checkbox"/> <input type="checkbox"/>
MINOR STORM Allowable Capacity is based on Depth Criterion	$Q_{allow} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ \text{SUMP} & \text{SUMP} \end{matrix}$ cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017

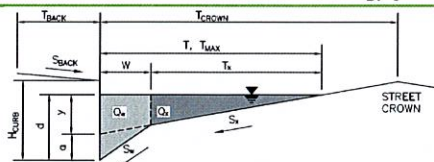


		MINOR	MAJOR	
<b>Design Information (Input)</b> <span style="float: right;">CDOT Type R Curb Opening</span>				
Type of Inlet		CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		1	1	
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
<b>Grate Information</b>				
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
<b>Curb Opening Information</b>				
Length of a Unit Curb Opening		5.00	5.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>				
Depth for Grate Midwidth		N/A	N/A	ft
Depth for Curb Opening Weir Equation		0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets		0.77	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>				
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		5.4	12.3	cfs
Q PEAK REQUIRED		1.2	2.2	cfs

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

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

Project: Midtown Collection at Hannah Ridge Filing No. 1 & 2  
 Inlet ID: DP-5



**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb  
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)  
 Height of Curb at Gutter Flow Line  
 Distance from Curb Face to Street Crown  
 Gutter Width  
 Street Transverse Slope  
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)  
 Street Longitudinal Slope - Enter 0 for sump condition  
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK}$	7.5	ft
$S_{BACK}$	0.020	ft/ft
$n_{BACK}$	0.013	
$H_{CURB}$	6.00	inches
$T_{CROWN}$	50.0	ft
$W$	2.00	ft
$S_x$	0.020	ft/ft
$S_y$	0.083	ft/ft
$S_o$	0.000	ft/ft
$n_{STREET}$	0.016	

Max. Allowable Spread for Minor & Major Storm  
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm  
 Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX}$	25.0	50.0	ft
$d_{MAX}$	6.0	12.0	inches

**Maximum Capacity for 1/2 Street based On Allowable Spread**

Water Depth without Gutter Depression (Eq. ST-2)  
 Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")  
 Gutter Depression ( $d_c - (W * S_x * 12)$ )  
 Water Depth at Gutter Flowline  
 Allowable Spread for Discharge outside the Gutter Section W (T - W)  
 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)  
 Discharge outside the Gutter Section W, carried in Section  $T_x$   
 Discharge within the Gutter Section W ( $Q_T - Q_x$ )  
 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)

	Minor Storm	Major Storm	
y	6.00	12.00	inches
$d_c$	2.0	2.0	inches
a	1.51	1.51	inches
d	7.51	13.51	inches
$T_x$	23.0	48.0	ft
$E_o$	0.235	0.113	
$Q_x$	0.0	0.0	cfs
$Q_w$	0.0	0.0	cfs
$Q_{BACK}$	0.0	0.0	cfs
$Q_T$	SUMP	SUMP	cfs
V	0.0	0.0	fps
V*d	0.0	0.0	

**Maximum Capacity for 1/2 Street based on Allowable Depth**

Theoretical Water Spread  
 Theoretical Spread for Discharge outside the Gutter Section W (T - W)  
 Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)  
 Theoretical Discharge outside the Gutter Section W, carried in Section  $T_{x,TH}$   
 Actual Discharge outside the Gutter Section W, (limited by distance  $T_{CROWN}$ )  
 Discharge within the Gutter Section W ( $Q_4 - Q_x$ )  
 Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)  
 Total Discharge for Major & Minor Storm (Pre-Safety Factor)  
 Average Flow Velocity Within the Gutter Section  
 V\*d Product: Flow Velocity Times Gutter Flowline Depth  
 Slope-Based Depth Safety Reduction Factor for Major & Minor ( $d \geq 6"$ ) Storm

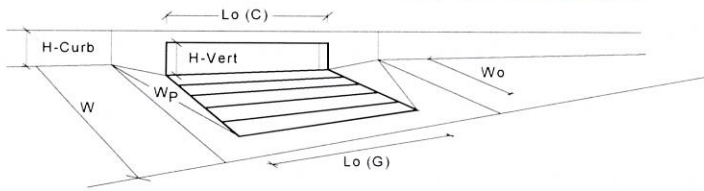
	Minor Storm	Major Storm	
$T_{TH}$	18.7	43.7	ft
$T_{x,TH}$	16.7	41.7	ft
$E_o$	0.318	0.130	
$Q_{x,TH}$	0.0	0.0	cfs
$Q_x$	0.0	0.0	cfs
$Q_w$	0.0	0.0	cfs
$Q_{BACK}$	0.0	0.0	cfs
Q	0.0	0.0	cfs
V	0.0	0.0	fps
V*d	0.0	0.0	
R	SUMP	SUMP	
$Q_4$	SUMP	SUMP	cfs
d			inches
$d_{CROWN}$			inches

MINOR STORM Allowable Capacity is based on Depth Criterion  
 MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow}$	SUMP	SUMP	cfs

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



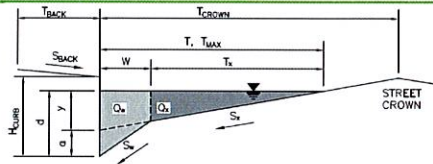
		MINOR	MAJOR	
<b>Design Information (Input)</b>				
Type of Inlet	<input type="text" value="CDOT Type R Curb Opening"/>			
Local Depression (additional to continuous gutter depression 'a' from above)				
Number of Unit Inlets (Grate or Curb Opening)				
Water Depth at Flowline (outside of local depression)				
<b>Grate Information</b>				
Length of a Unit Grate				
Width of a Unit Grate				
Area Opening Ratio for a Grate (typical values 0.15-0.90)				
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)				
Grate Weir Coefficient (typical value 2.15 - 3.60)				
Grate Orifice Coefficient (typical value 0.60 - 0.80)				
<b>Curb Opening Information</b>				
Length of a Unit Curb Opening				
Height of Vertical Curb Opening in Inches				
Height of Curb Orifice Throat in Inches				
Angle of Throat (see USDCM Figure ST-5)				
Side Width for Depression Pan (typically the gutter width of 2 feet)				
Clogging Factor for a Single Curb Opening (typical value 0.10)				
Curb Opening Weir Coefficient (typical value 2.3-3.7)				
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)				
<b>Low Head Performance Reduction (Calculated)</b>				
Depth for Grate Midwidth				
Depth for Curb Opening Weir Equation				
Combination Inlet Performance Reduction Factor for Long Inlets				
Curb Opening Performance Reduction Factor for Long Inlets				
Grated Inlet Performance Reduction Factor for Long Inlets				
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>				
WARNING: Inlet Capacity less than Q Peak for Minor Storm				
		MINOR	MAJOR	
Type =		CDOT Type R Curb Opening		
$\phi_{local}$ =		3.00	3.00	inches
No =		1	1	
Ponding Depth =		6.0	12.0	inches
		MINOR	MAJOR	<input type="checkbox"/> Override Depths
$L_o$ (G) =		N/A	N/A	feet
$W_o$ =		N/A	N/A	feet
$A_{ratio}$ =		N/A	N/A	
$C_r$ (G) =		N/A	N/A	
$C_w$ (G) =		N/A	N/A	
$C_o$ (G) =		N/A	N/A	
		MINOR	MAJOR	
$L_o$ (C) =		15.00	15.00	feet
$H_{weir}$ =		6.00	3.00	inches
$H_{throat}$ =		6.00	3.00	inches
Theta =		63.40	63.40	degrees
$W_p$ =		2.00	2.00	feet
$C_r$ (C) =		0.10	0.10	
$C_w$ (C) =		3.60	3.60	
$C_o$ (C) =		0.67	0.67	
		MINOR	MAJOR	
$d_{grate}$ =		N/A	N/A	ft
$d_{curb}$ =		0.33	0.83	ft
RF <sub>Combination</sub> =		0.57	1.00	
RF <sub>Curb</sub> =		0.79	1.00	
RF <sub>Grate</sub> =		N/A	N/A	
		MINOR	MAJOR	
$Q_a$ =		9.7	39.1	cfs
$Q_{PEAK REQUIRED}$ =		13.0	25.0	cfs

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

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

Project:  
Inlet ID:

Midtown Collection at Hannah Ridge Filing No. 1 & 2  
DP-6



**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb  $T_{BACK} = 7.5$  ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  $S_{BACK} = 0.020$  ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)  $n_{BACK} = 0.013$

Height of Curb at Gutter Flow Line  $H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown  $T_{CROWN} = 25.0$  ft

Gutter Width  $W = 2.00$  ft

Street Transverse Slope  $S_x = 0.020$  ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)  $S_w = 0.083$  ft/ft

Street Longitudinal Slope - Enter 0 for sump condition  $S_o = 0.000$  ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)  $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	25.0	25.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	6.0	6.0	inches

Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is based on Depth Criterion

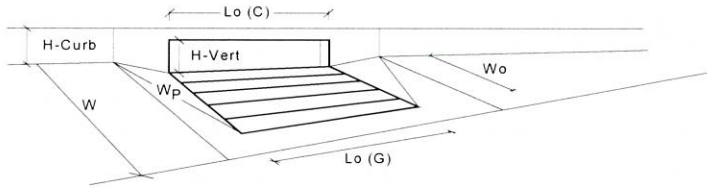
MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{ALLOW} =$

	Minor Storm	Major Storm	
	SUMP	SUMP	cfs

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017

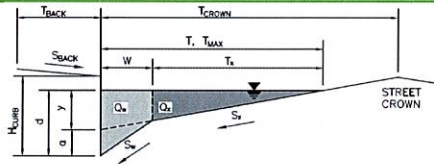


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)			
Number of Unit Inlets (Grate or Curb Opening)	1		
Water Depth at Flowline (outside of local depression)			
<b>Grate Information</b>			
Length of a Unit Grate			
Width of a Unit Grate			
Area Opening Ratio for a Grate (typical values 0.15-0.90)			
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)			
Grate Weir Coefficient (typical value 2.15 - 3.60)			
Grate Orifice Coefficient (typical value 0.60 - 0.80)			
<b>Curb Opening Information</b>			
Length of a Unit Curb Opening			
Height of Vertical Curb Opening in Inches			
Height of Curb Orifice Throat in Inches			
Angle of Throat (see USDCM Figure ST-5)			
Side Width for Depression Pan (typically the gutter width of 2 feet)			
Clogging Factor for a Single Curb Opening (typical value 0.10)			
Curb Opening Weir Coefficient (typical value 2.3-3.7)			
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)			
<b>Low Head Performance Reduction (Calculated)</b>			
Depth for Grate Midwidth			
Depth for Curb Opening Weir Equation			
Combination Inlet Performance Reduction Factor for Long Inlets			
Curb Opening Performance Reduction Factor for Long Inlets			
Grated Inlet Performance Reduction Factor for Long Inlets			
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>			
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)			
	MINOR		MAJOR
Type =	CDOT Type R Curb Opening		
a <sub>local</sub> =	3.00	3.00	inches
No =	1		
Ponding Depth =	6.0	12.0	inches
	MINOR		MAJOR
L <sub>3</sub> (G) =	N/A	N/A	feet
W <sub>3</sub> =	N/A	N/A	feet
A <sub>ratio</sub> =	N/A	N/A	
C <sub>1</sub> (G) =	N/A	N/A	
C <sub>w</sub> (G) =	N/A	N/A	
C <sub>o</sub> (G) =	N/A	N/A	
	MINOR		MAJOR
L <sub>3</sub> (C) =	5.00	5.00	feet
H <sub>vert</sub> =	6.00	6.00	inches
H <sub>throat</sub> =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W <sub>p</sub> =	2.00	2.00	feet
C <sub>1</sub> (C) =	0.10	0.10	
C <sub>w</sub> (C) =	3.60	3.60	
C <sub>o</sub> (C) =	0.67	0.67	
	MINOR		MAJOR
d <sub>Grate</sub> =	N/A	N/A	ft
d <sub>Curb</sub> =	0.33	0.83	ft
RF <sub>Combination</sub> =	0.77	1.00	
RF <sub>Curb</sub> =	1.00	1.00	
RF <sub>Grate</sub> =	N/A	N/A	
	MINOR		MAJOR
Q <sub>3</sub> =	5.4	12.3	cfs
Q <sub>PEAK REQUIRED</sub> =	3.0	6.0	cfs

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

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

Project: Midtown Collection at Hannah Ridge Filing No. 1 & 2  
 Inlet ID: DP-7



**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb  $T_{BACK} = 7.5$  ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  $S_{BACK} = 0.020$  ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)  $n_{BACK} = 0.013$

Height of Curb at Gutter Flow Line  $H_{CURB} = 6.00$  inches

Distance from Curb Face to Street Crown  $T_{CROWN} = 12.0$  ft

Gutter Width  $W = 2.00$  ft

Street Transverse Slope  $S_X = 0.020$  ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)  $S_W = 0.083$  ft/ft

Street Longitudinal Slope - Enter 0 for sump condition  $S_D = 0.000$  ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)  $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm
$T_{MAX} =$	12.0	12.0
$d_{MAX} =$	6.0	12.0
	<input type="checkbox"/>	<input type="checkbox"/>

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is based on Depth Criterion

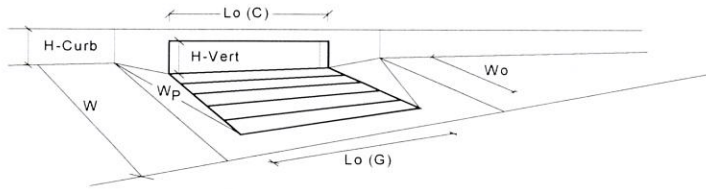
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm
$Q_{allow} =$	SUMP	SUMP

cfs

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



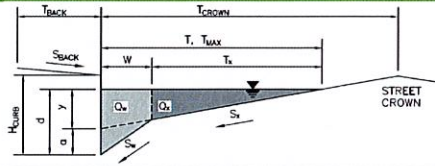
		MINOR	MAJOR	
<b>Design Information (Input)</b>	CDOT Type R Curb Opening			
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1			
Water Depth at Flowline (outside of local depression)		6.0	12.0	inches
<b>Grate Information</b>		<input checked="" type="checkbox"/> Override Depths		
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
<b>Curb Opening Information</b>				
Length of a Unit Curb Opening		5.00	5.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
<b>Low Head Performance Reduction (Calculated)</b>				
Depth for Grate Midwidth		N/A	N/A	ft
Depth for Curb Opening Weir Equation		0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets		0.77	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		N/A	N/A	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>				
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		5.4	12.3	cfs
Q <sub>PEAK</sub> REQUIRED =		2.0	3.0	cfs



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

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

Project: Midtown Collection at Hannah Ridge Filing No. 1 & 2  
 Inlet ID: DP-8

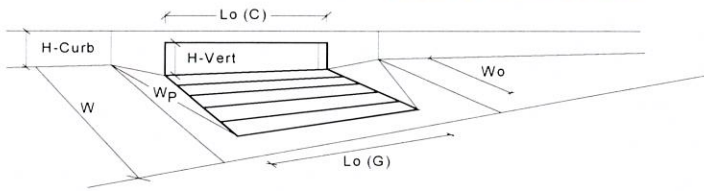


**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb	$T_{BACK} =$ <input type="text" value="7.5"/> ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} =$ <input type="text" value="0.020"/> ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} =$ <input type="text" value="0.013"/>				
Height of Curb at Gutter Flow Line	$H_{CURB} =$ <input type="text" value="6.00"/> inches				
Distance from Curb Face to Street Crown	$T_{CROWN} =$ <input type="text" value="17.0"/> ft				
Gutter Width	$W =$ <input type="text" value="2.00"/> ft				
Street Transverse Slope	$S_x =$ <input type="text" value="0.020"/> ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w =$ <input type="text" value="0.083"/> ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 =$ <input type="text" value="0.000"/> ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} =$ <input type="text" value="0.016"/>				
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} =$ <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td><input type="text" value="17.0"/></td><td><input type="text" value="17.0"/></td></tr></table> ft	Minor Storm	Major Storm	<input type="text" value="17.0"/>	<input type="text" value="17.0"/>
Minor Storm	Major Storm				
<input type="text" value="17.0"/>	<input type="text" value="17.0"/>				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} =$ <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td><input type="text" value="6.0"/></td><td><input type="text" value="8.0"/></td></tr></table> inches	Minor Storm	Major Storm	<input type="text" value="6.0"/>	<input type="text" value="8.0"/>
Minor Storm	Major Storm				
<input type="text" value="6.0"/>	<input type="text" value="8.0"/>				
Check boxes are not applicable in SUMP conditions	<input type="checkbox"/> <input type="checkbox"/>				
<b>MINOR STORM Allowable Capacity is based on Depth Criterion</b>					
<b>MAJOR STORM Allowable Capacity is based on Depth Criterion</b>					
	$Q_{allow} =$ <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td><input type="text" value="SUMP"/></td><td><input type="text" value="SUMP"/></td></tr></table> cfs	Minor Storm	Major Storm	<input type="text" value="SUMP"/>	<input type="text" value="SUMP"/>
Minor Storm	Major Storm				
<input type="text" value="SUMP"/>	<input type="text" value="SUMP"/>				

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017

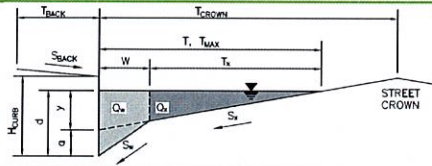


		MINOR	MAJOR	
<b>Design Information (Input)</b>				
Type of Inlet	<input type="text" value="CDOT Type R Curb Opening"/>			
Local Depression (additional to continuous gutter depression 'a' from above)				
Number of Unit Inlets (Grate or Curb Opening)				
Water Depth at Flowline (outside of local depression)				
<b>Grate Information</b>				
Length of a Unit Grate				
Width of a Unit Grate				
Area Opening Ratio for a Grate (typical values 0.15-0.90)				
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)				
Grate Weir Coefficient (typical value 2.15 - 3.60)				
Grate Orifice Coefficient (typical value 0.60 - 0.80)				
<b>Curb Opening Information</b>				
Length of a Unit Curb Opening				
Height of Vertical Curb Opening in Inches				
Height of Curb Orifice Throat in Inches				
Angle of Throat (see USDCM Figure ST-5)				
Side Width for Depression Pan (typically the gutter width of 2 feet)				
Clogging Factor for a Single Curb Opening (typical value 0.10)				
Curb Opening Weir Coefficient (typical value 2.3-3.7)				
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)				
<b>Low Head Performance Reduction (Calculated)</b>				
Depth for Grate Midwidth				
Depth for Curb Opening Weir Equation				
Combination Inlet Performance Reduction Factor for Long Inlets				
Curb Opening Performance Reduction Factor for Long Inlets				
Grated Inlet Performance Reduction Factor for Long Inlets				
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>				
WARNING: Inlet Capacity less than Q Peak for Minor and Major Storms				
		MINOR	MAJOR	
Type =	CDOT Type R Curb Opening			
$a_{local}$ =	3.00	3.00	inches	
No =	1			
Ponding Depth =	6.0	6.0	inches	
		MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
$L_y(G)$ =	N/A	N/A	feet	
$W_o$ =	N/A	N/A	feet	
$A_{ratio}$ =	N/A	N/A		
$C_r(G)$ =	N/A	N/A		
$C_w(G)$ =	N/A	N/A		
$C_o(G)$ =	N/A	N/A		
		MINOR	MAJOR	
$L_y(C)$ =	10.00	10.00	feet	
$H_{vert}$ =	6.00	6.00	inches	
$H_{throat}$ =	6.00	6.00	inches	
Theta =	63.40	63.40	degrees	
$W_p$ =	2.00	2.00	feet	
$C_r(C)$ =	0.10	0.10		
$C_w(C)$ =	3.60	3.60		
$C_o(C)$ =	0.67	0.67		
		MINOR	MAJOR	
$d_{Grate}$ =	N/A	N/A	ft	
$d_{Curb}$ =	0.33	0.33	ft	
$RF_{Combination}$ =	0.57	0.57		
$RF_{Curb}$ =	0.93	0.93		
$RF_{Grate}$ =	N/A	N/A		
		MINOR	MAJOR	
$Q_s$ =	8.3	8.3	cfs	
$Q_{PEAK REQUIRED}$ =	13.0	25.0	cfs	

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

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

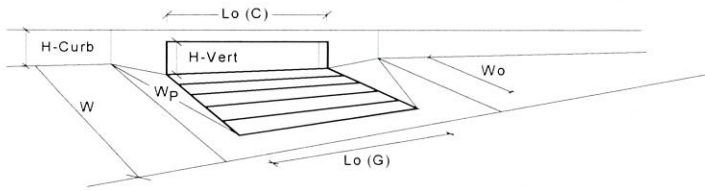
Project: Midtown Collection at Hannah Ridge Filing No. 1 & 2  
 Inlet ID: DP-9



Gutter Geometry (Enter data in the blue cells)					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 7.5$ ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.013$				
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft				
Gutter Width	$W = 2.00$ ft				
Street Transverse Slope	$S_x = 0.020$ ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_G = 0.083$ ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	$S_L = 0.000$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> </tr> <tr> <td><math>T_{MAX} = 17.0</math></td> <td><math>T_{MAX} = 17.0</math></td> </tr> </table> ft	Minor Storm	Major Storm	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$
Minor Storm	Major Storm				
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> </tr> <tr> <td><math>d_{MAX} = 6.0</math></td> <td><math>d_{MAX} = 12.0</math></td> </tr> </table> inches	Minor Storm	Major Storm	$d_{MAX} = 6.0$	$d_{MAX} = 12.0$
Minor Storm	Major Storm				
$d_{MAX} = 6.0$	$d_{MAX} = 12.0$				
Check boxes are not applicable in SUMP conditions	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table>	Minor Storm	Major Storm	<input type="checkbox"/>	<input type="checkbox"/>
Minor Storm	Major Storm				
<input type="checkbox"/>	<input type="checkbox"/>				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Q <sub>allow</sub>	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> </tr> <tr> <td>SUMP</td> <td>SUMP</td> </tr> </table> cfs	Minor Storm	Major Storm	SUMP	SUMP
Minor Storm	Major Storm				
SUMP	SUMP				

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



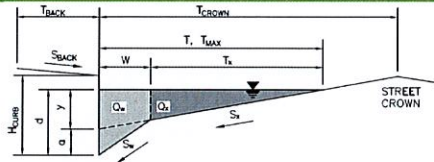
		MINOR	MAJOR	
<b>Design Information (Input)</b>				
Type of Inlet	<input type="text" value="CDOT Type R Curb Opening"/>			
Local Depression (additional to continuous gutter depression 'a' from above)				
Number of Unit Inlets (Grate or Curb Opening)				
Water Depth at Flowline (outside of local depression)				
<b>Grate Information</b>				
Length of a Unit Grate				
Width of a Unit Grate				
Area Opening Ratio for a Grate (typical values 0.15-0.90)				
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)				
Grate Weir Coefficient (typical value 2.15 - 3.60)				
Grate Orifice Coefficient (typical value 0.60 - 0.80)				
<b>Curb Opening Information</b>				
Length of a Unit Curb Opening				
Height of Vertical Curb Opening in Inches				
Height of Curb Orifice Throat in Inches				
Angle of Throat (see USDCM Figure ST-5)				
Side Width for Depression Pan (typically the gutter width of 2 feet)				
Clogging Factor for a Single Curb Opening (typical value 0.10)				
Curb Opening Weir Coefficient (typical value 2.3-3.7)				
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)				
<b>Low Head Performance Reduction (Calculated)</b>				
Depth for Grate Midwidth				
Depth for Curb Opening Weir Equation				
Combination Inlet Performance Reduction Factor for Long Inlets				
Curb Opening Performance Reduction Factor for Long Inlets				
Grated Inlet Performance Reduction Factor for Long Inlets				
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>				
WARNING: Inlet Capacity less than Q Peak for Minor Storm				
		MINOR	MAJOR	
Type =		CDOT Type R Curb Opening		
$a_{local}$ =		3.00	3.00	inches
No =		1		
Ponding Depth =		6.0	12.0	inches
		MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
$L_g (G)$ =		N/A	N/A	feet
$W_p$ =		N/A	N/A	feet
$A_{ratio}$ =		N/A	N/A	
$C_l (G)$ =		N/A	N/A	
$C_w (G)$ =		N/A	N/A	
$C_o (G)$ =		N/A	N/A	
		MINOR	MAJOR	
$L_c (C)$ =		10.00	8.00	feet
$H_{weir}$ =		6.00	6.00	inches
$H_{throat}$ =		6.00	6.00	inches
Theta =		63.40	63.40	degrees
$W_p$ =		2.00	2.00	feet
$C_l (C)$ =		0.10	0.10	
$C_w (C)$ =		3.60	3.60	
$C_o (C)$ =		0.67	0.67	
		MINOR	MAJOR	
$d_{grate}$ =		N/A	N/A	ft
$d_{curb}$ =		0.33	0.83	ft
$RF_{Combination}$ =		0.57	1.00	
$RF_{curb}$ =		0.93	1.00	
$RF_{grate}$ =		N/A	N/A	
		MINOR	MAJOR	
$Q_a$ =		8.3	25.5	cfs
$Q_{PEAK REQUIRED}$ =		9.0	19.0	cfs

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

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

Project:  
Inlet ID:

Midtown Collection at Hannah Ridge Filing No. 1 & 2  
DP-10



**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb  
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)  
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK} = 8.5$  ft  
 $S_{BACK} = 0.020$  ft/ft  
 $n_{BACK} = 0.013$

Height of Curb at Gutter Flow Line  
Distance from Curb Face to Street Crown

$H_{CURB} = 6.00$  inches  
 $T_{CROWN} = 17.0$  ft

Gutter Width  
Street Transverse Slope

$W = 2.00$  ft  
 $S_x = 0.020$  ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)  
Street Longitudinal Slope - Enter 0 for sump condition

$S_w = 0.083$  ft/ft  
 $S_o = 0.000$  ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	17.0	17.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	6.0	12.0	inches

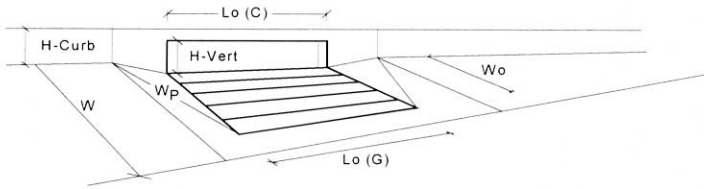
Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is based on Depth Criterion  
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	SUMP	SUMP	cfs

## INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)			
Number of Unit Inlets (Grate or Curb Opening)	1		
Water Depth at Flowline (outside of local depression)			
<b>Grate Information</b>			
Length of a Unit Grate			
Width of a Unit Grate			
Area Opening Ratio for a Grate (typical values 0.15-0.90)			
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)			
Grate Weir Coefficient (typical value 2.15 - 3.60)			
Grate Orifice Coefficient (typical value 0.60 - 0.80)			
<b>Curb Opening Information</b>			<input checked="" type="checkbox"/> Override Depths
Length of a Unit Curb Opening			
Height of Vertical Curb Opening in Inches			
Height of Curb Orifice Throat in Inches			
Angle of Throat (see USDCM Figure ST-5)			
Side Width for Depression Pan (typically the gutter width of 2 feet)			
Clogging Factor for a Single Curb Opening (typical value 0.10)			
Curb Opening Weir Coefficient (typical value 2.3-3.7)			
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)			
<b>Low Head Performance Reduction (Calculated)</b>			
Depth for Grate Midwidth			
Depth for Curb Opening Weir Equation			
Combination Inlet Performance Reduction Factor for Long Inlets			
Curb Opening Performance Reduction Factor for Long Inlets			
Grated Inlet Performance Reduction Factor for Long Inlets			
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>			
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)			

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a <sub>local</sub> =	3.00	3.00	inches
No =	1		
Ponding Depth =	6.0	12.0	inches
L <sub>g</sub> (G) =	N/A	N/A	feet
W <sub>g</sub> =	N/A	N/A	feet
A <sub>ratio</sub> =	N/A	N/A	
C <sub>g</sub> (G) =	N/A	N/A	
C <sub>w</sub> (G) =	N/A	N/A	
C <sub>o</sub> (G) =	N/A	N/A	
L <sub>g</sub> (C) =	5.00	5.00	feet
H <sub>weir</sub> =	6.00	6.00	inches
H <sub>throat</sub> =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W <sub>p</sub> =	2.00	2.00	feet
C <sub>g</sub> (C) =	0.10	0.10	
C <sub>w</sub> (C) =	3.60	3.60	
C <sub>o</sub> (C) =	0.67	0.67	
d <sub>grate</sub> =	N/A	N/A	ft
d <sub>curb</sub> =	0.33	0.83	ft
RF <sub>Combination</sub> =	0.77	1.00	
RF <sub>Curb</sub> =	1.00	1.00	
RF <sub>Grate</sub> =	N/A	N/A	
Q <sub>g</sub> =	5.4	12.3	cfs
Q <sub>PEAK REQUIRED</sub> =	2.0	5.0	cfs

JOB NAME: **MIDTOWN COLLECTION AT HANNAH RIDGE FILING NO. 1 & 2**

JOB NUMBER: **1116.30**

DATE: **03/11/19**

CALCULATED BY: **K. CAMPBELL**

\* PIPES ARE LISTED AT MAXIMUM SIZE REQUIRED TO ACCOMMODATE Q100 FLOWS AT MINIMUM GRADE. REFER TO INDIVIDUAL PIPE SHEETS FOR HYDRAULIC INFORMATION.

**FINAL DRAINAGE REPORT ~ PIPE ROUTING SUMMARY**

Pipe Run	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity		Flow		Pipe Size*
					I(5)	I(100)	Q(5)	Q(100)	
1	DP-1	0.90	1.02	7.8	4.50	7.56	4	8	18" RCP
2	DP 2	0.37	0.41	6.1	4.87	8.18	2	3	18" RCP
3	PIPE 2 & DP-3	0.61	0.69	6.1	4.87	8.18	3	6	18" RCP
4	PIPE 1 & PIPE 3	1.51	1.71	7.8	4.50	7.56	7	13	18" RCP
5	DP 4	0.23	0.26	6.1	4.87	8.18	1	2	18" RCP
6	PIPE 4 & PIPE 5	1.74	1.97	7.8	4.50	7.56	8	15	24" RCP
7	DP 5	2.34	2.83	10.9	4.00	6.72	9	19	24" RCP
8	PIPE 6 & PIPE 7	4.08	4.80	10.9	4.00	6.72	16	32	30" RCP
9	DP 6	0.61	0.72	6.1	4.87	8.18	3	6	18" RCP
10	DP 7	0.35	0.39	6.1	4.87	8.18	2	3	18" RCP

---

## Worksheet for PIPE RUN 1

---

### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

Roughness Coefficient                      0.013  
Channel Slope                                0.07190 ft/ft  
Diameter                                        1.50 ft  
Discharge                                      5.00 ft<sup>3</sup>/s

### Results

Normal Depth                                0.43 ft  
Flow Area                                      0.42 ft<sup>2</sup>  
Wetted Perimeter                            1.69 ft  
Hydraulic Radius                            0.25 ft  
Top Width                                      1.35 ft  
Critical Depth                                0.86 ft  
Percent Full                                  28.5 %  
Critical Slope                                0.00577 ft/ft  
Velocity                                        12.02 ft/s  
Velocity Head                                2.25 ft  
Specific Energy                              2.67 ft  
Froude Number                                3.83  
Maximum Discharge                        30.30 ft<sup>3</sup>/s  
Discharge Full                                28.16 ft<sup>3</sup>/s  
Slope Full                                      0.00227 ft/ft  
Flow Type                                      SuperCritical

### 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  
Average End Depth Over Rise            0.00 %  
Normal Depth Over Rise                28.53 %  
Downstream Velocity                      Infinity ft/s



---

## Worksheet for PIPE RUN 1

---

### GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.43	ft
Critical Depth	0.86	ft
Channel Slope	0.07190	ft/ft
Critical Slope	0.00577	ft/ft

---

## Worksheet for PIPE RUN 2

---

### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

Roughness Coefficient                      0.013  
Channel Slope                                0.00500    ft/ft  
Diameter                                        1.50    ft  
Discharge                                      3.00    ft<sup>3</sup>/s

### Results

Normal Depth                                0.66    ft  
Flow Area                                      0.75    ft<sup>2</sup>  
Wetted Perimeter                            2.18    ft  
Hydraulic Radius                            0.35    ft  
Top Width                                      1.49    ft  
Critical Depth                                0.66    ft  
Percent Full                                  44.2    %  
Critical Slope                                0.00513    ft/ft  
Velocity                                        3.98    ft/s  
Velocity Head                                0.25    ft  
Specific Energy                              0.91    ft  
Froude Number                                0.99  
Maximum Discharge                        7.99    ft<sup>3</sup>/s  
Discharge Full                                7.43    ft<sup>3</sup>/s  
Slope Full                                      0.00082    ft/ft  
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  
Average End Depth Over Rise            0.00    %  
Normal Depth Over Rise                   44.23    %  
Downstream Velocity                        Infinity    ft/s

---

## Worksheet for PIPE RUN 2

---

### GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.66	ft
Critical Depth	0.66	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00513	ft/ft

---

## Worksheet for PIPE RUN 3

---

### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

Roughness Coefficient                      0.013  
Channel Slope                                0.00500    ft/ft  
Diameter                                        1.50    ft  
Discharge                                      6.00    ft<sup>3</sup>/s

### Results

Normal Depth                                1.02    ft  
Flow Area                                      1.28    ft<sup>2</sup>  
Wetted Perimeter                            2.91    ft  
Hydraulic Radius                            0.44    ft  
Top Width                                      1.40    ft  
Critical Depth                                0.95    ft  
Percent Full                                  68.1    %  
Critical Slope                                0.00622    ft/ft  
Velocity                                        4.68    ft/s  
Velocity Head                                0.34    ft  
Specific Energy                              1.36    ft  
Froude Number                                0.86  
Maximum Discharge                        7.99    ft<sup>3</sup>/s  
Discharge Full                                7.43    ft<sup>3</sup>/s  
Slope Full                                      0.00326    ft/ft  
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  
Average End Depth Over Rise            0.00    %  
Normal Depth Over Rise                   68.14    %  
Downstream Velocity                        Infinity    ft/s

---

## Worksheet for PIPE RUN 3

---

### GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.02	ft
Critical Depth	0.95	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00622	ft/ft

---

## Worksheet for PIPE RUN 4

---

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.013
Channel Slope	0.00500 ft/ft
Diameter	2.00 ft
Discharge	11.00 ft <sup>3</sup> /s

### Results

Normal Depth	1.22 ft
Flow Area	2.00 ft <sup>2</sup>
Wetted Perimeter	3.58 ft
Hydraulic Radius	0.56 ft
Top Width	1.95 ft
Critical Depth	1.19 ft
Percent Full	60.9 %
Critical Slope	0.00538 ft/ft
Velocity	5.49 ft/s
Velocity Head	0.47 ft
Specific Energy	1.69 ft
Froude Number	0.95
Maximum Discharge	17.21 ft <sup>3</sup> /s
Discharge Full	16.00 ft <sup>3</sup> /s
Slope Full	0.00236 ft/ft
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
Average End Depth Over Rise	0.00 %
Normal Depth Over Rise	60.93 %
Downstream Velocity	Infinity ft/s

---

---

## Worksheet for PIPE RUN 4

---

### GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.22	ft
Critical Depth	1.19	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00538	ft/ft

---

## Worksheet for PIPE RUN 5

---

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.013	
Channel Slope	0.03250	ft/ft
Diameter	1.50	ft
Discharge	2.00	ft <sup>3</sup> /s

### Results

Normal Depth	0.33	ft
Flow Area	0.29	ft <sup>2</sup>
Wetted Perimeter	1.46	ft
Hydraulic Radius	0.20	ft
Top Width	1.24	ft
Critical Depth	0.53	ft
Percent Full	21.9	%
Critical Slope	0.00494	ft/ft
Velocity	6.96	ft/s
Velocity Head	0.75	ft
Specific Energy	1.08	ft
Froude Number	2.55	
Maximum Discharge	20.37	ft <sup>3</sup> /s
Discharge Full	18.94	ft <sup>3</sup> /s
Slope Full	0.00036	ft/ft
Flow Type	SuperCritical	

### 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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	21.94	%
Downstream Velocity	Infinity	ft/s



---

## Worksheet for PIPE RUN 5

---

### GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.33	ft
Critical Depth	0.53	ft
Channel Slope	0.03250	ft/ft
Critical Slope	0.00494	ft/ft

---

## Worksheet for PIPE RUN 6

---

### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Diameter	2.00	ft
Discharge	13.00	ft <sup>3</sup> /s

### Results

Normal Depth	1.37	ft
Flow Area	2.29	ft <sup>2</sup>
Wetted Perimeter	3.90	ft
Hydraulic Radius	0.59	ft
Top Width	1.86	ft
Critical Depth	1.30	ft
Percent Full	68.5	%
Critical Slope	0.00581	ft/ft
Velocity	5.67	ft/s
Velocity Head	0.50	ft
Specific Energy	1.87	ft
Froude Number	0.90	
Maximum Discharge	17.21	ft <sup>3</sup> /s
Discharge Full	16.00	ft <sup>3</sup> /s
Slope Full	0.00330	ft/ft
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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	68.45	%
Downstream Velocity	Infinity	ft/s

---

## Worksheet for PIPE RUN 6

---

### GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.37	ft
Critical Depth	1.30	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00581	ft/ft

---

## Worksheet for PIPE RUN 7

---

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00700	ft/ft
Diameter	2.00	ft
Discharge	19.00	ft <sup>3</sup> /s

### Results

Normal Depth	1.65	ft
Flow Area	2.77	ft <sup>2</sup>
Wetted Perimeter	4.55	ft
Hydraulic Radius	0.61	ft
Top Width	1.53	ft
Critical Depth	1.57	ft
Percent Full	82.3	%
Critical Slope	0.00769	ft/ft
Velocity	6.87	ft/s
Velocity Head	0.73	ft
Specific Energy	2.38	ft
Froude Number	0.90	
Maximum Discharge	20.36	ft <sup>3</sup> /s
Discharge Full	18.93	ft <sup>3</sup> /s
Slope Full	0.00705	ft/ft
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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	82.32	%
Downstream Velocity	Infinity	ft/s

---

---

## Worksheet for PIPE RUN 7

---

### GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.65	ft
Critical Depth	1.57	ft
Channel Slope	0.00700	ft/ft
Critical Slope	0.00769	ft/ft

---

## Worksheet for PIPE RUN 8

---

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00600	ft/ft
Diameter	2.50	ft
Discharge	30.00	ft <sup>3</sup> /s

### Results

Normal Depth	1.93	ft
Flow Area	4.08	ft <sup>2</sup>
Wetted Perimeter	5.38	ft
Hydraulic Radius	0.76	ft
Top Width	2.09	ft
Critical Depth	1.87	ft
Percent Full	77.4	%
Critical Slope	0.00650	ft/ft
Velocity	7.36	ft/s
Velocity Head	0.84	ft
Specific Energy	2.78	ft
Froude Number	0.93	
Maximum Discharge	34.18	ft <sup>3</sup> /s
Discharge Full	31.77	ft <sup>3</sup> /s
Slope Full	0.00535	ft/ft
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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	77.37	%
Downstream Velocity	Infinity	ft/s

---

## Worksheet for PIPE RUN 8

---

### GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.93	ft
Critical Depth	1.87	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00650	ft/ft

---

## Worksheet for PIPE RUN 9

---

### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

Roughness Coefficient                      0.013  
Channel Slope                                0.00500    ft/ft  
Diameter                                      1.50        ft  
Discharge                                    6.00        ft<sup>3</sup>/s

### Results

Normal Depth                                1.02        ft  
Flow Area                                    1.28        ft<sup>2</sup>  
Wetted Perimeter                          2.91        ft  
Hydraulic Radius                          0.44        ft  
Top Width                                    1.40        ft  
Critical Depth                               0.95        ft  
Percent Full                                68.1        %  
Critical Slope                                0.00622    ft/ft  
Velocity                                      4.68        ft/s  
Velocity Head                                0.34        ft  
Specific Energy                              1.36        ft  
Froude Number                              0.86  
Maximum Discharge                        7.99        ft<sup>3</sup>/s  
Discharge Full                               7.43        ft<sup>3</sup>/s  
Slope Full                                    0.00326    ft/ft  
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  
Average End Depth Over Rise            0.00        %  
Normal Depth Over Rise                   68.14       %  
Downstream Velocity                      Infinity     ft/s

---



---

## Worksheet for PIPE RUN 9

---

### GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.02	ft
Critical Depth	0.95	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00622	ft/ft

---

## Worksheet for PIPE RUN 10

---

### Project Description

Friction Method                      Manning Formula  
Solve For                                Normal Depth

### Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Diameter	1.50	ft
Discharge	3.00	ft <sup>3</sup> /s

### Results

Normal Depth	0.66	ft
Flow Area	0.75	ft <sup>2</sup>
Wetted Perimeter	2.18	ft
Hydraulic Radius	0.35	ft
Top Width	1.49	ft
Critical Depth	0.66	ft
Percent Full	44.2	%
Critical Slope	0.00513	ft/ft
Velocity	3.98	ft/s
Velocity Head	0.25	ft
Specific Energy	0.91	ft
Froude Number	0.99	
Maximum Discharge	7.99	ft <sup>3</sup> /s
Discharge Full	7.43	ft <sup>3</sup> /s
Slope Full	0.00082	ft/ft
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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	44.23	%
Downstream Velocity	Infinity	ft/s

---

## Worksheet for PIPE RUN 10

---

### GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.66	ft
Critical Depth	0.66	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00513	ft/ft

---

## Worksheet for PIPE RUN 11

---

### Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

### Input Data

Roughness Coefficient	0.013
Channel Slope	0.01000 ft/ft
Diameter	2.50 ft
Discharge	26.00 ft <sup>3</sup> /s

### Results

Normal Depth	1.44 ft
Flow Area	2.94 ft <sup>2</sup>
Wetted Perimeter	4.32 ft
Hydraulic Radius	0.68 ft
Top Width	2.47 ft
Critical Depth	1.74 ft
Percent Full	57.8 %
Critical Slope	0.00584 ft/ft
Velocity	8.84 ft/s
Velocity Head	1.22 ft
Specific Energy	2.66 ft
Froude Number	1.43
Maximum Discharge	44.12 ft <sup>3</sup> /s
Discharge Full	41.01 ft <sup>3</sup> /s
Slope Full	0.00402 ft/ft
Flow Type	SuperCritical

### 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
Average End Depth Over Rise	0.00 %
Normal Depth Over Rise	57.80 %
Downstream Velocity	Infinity ft/s

---

## Worksheet for PIPE RUN 11

---

### GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.44	ft
Critical Depth	1.74	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00584	ft/ft

**SWQ / DETENTION CALCULATIONS**

## Site-Level Low Impact Development (LID) Design Effective Impervious Calculator LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1 Hour Rain Depth	WQCV Event	0.53	inches
***Minor Storm: 1 Hour Rain Depth	5-Year Event	1.50	inches
***Major Storm: 1 Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event	2.52	

Max Intensity for Optional User Defined Storm: 2.51496

Designer: \_\_\_\_\_  
 Company: Classic Consulting Engineers  
 Date: MARCH 26 2019  
 Project: MIDTOWN AT HANNAH RIDGE  
 Location: POND 1

### SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	Basin A	Basin B	Basin C	Basin D	Basin F	Basin I	Basin L								
Receiving Pervious Area Soil Type	Sand	Sand	Sand	Sand	Sand	Sand	Sand								
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	0.480	0.810	0.510	0.350	0.310	4.180	0.690								
Directly Connected Impervious Area (DCIA, acres)	0.000	0.210	0.150	0.080	0.100	1.150	0.000								
Unconnected Impervious Area (UIA, acres)	0.050	0.050	0.040	0.030	0.030	0.350	0.000								
Receiving Pervious Area (RPA, acres)	0.170	0.200	0.080	0.170	0.140	2.580	0.000								
Separate Pervious Area (SPA, acres)	0.260	0.350	0.240	0.070	0.040	0.100	0.690								
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	C	C	C	C								

### CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	0.480	0.810	0.510	0.350	0.310	4.180	0.690								
Directly Connected Impervious Area (DCIA, %)	0.0%	25.9%	29.4%	22.9%	32.3%	27.5%	0.0%								
Unconnected Impervious Area (UIA, %)	10.4%	6.2%	7.8%	8.6%	9.7%	8.4%	0.0%								
Receiving Pervious Area (RPA, %)	35.4%	24.7%	15.7%	48.6%	45.2%	61.7%	0.0%								
Separate Pervious Area (SPA, %)	54.2%	43.2%	47.1%	20.0%	12.9%	2.4%	100.0%								
A <sub>s</sub> (RPA / UIA)	3.400	4.000	2.000	5.667	4.667	7.371	0.000								
I <sub>s</sub> Check	0.230	0.200	0.330	0.150	0.180	0.120	1.000								
f / I for WQCV Event:	11.0	11.0	11.0	11.0	11.0	11.0	11.0								
f / I for 5-Year Event:	0.6	0.6	0.6	0.6	0.6	0.6	0.6								
f / I for 100-Year Event:	0.6	0.6	0.6	0.6	0.6	0.6	0.6								
<b>f / I for Optional User Defined Storm CUHP:</b>	<b>0.57</b>	<b>0.57</b>	<b>0.57</b>	<b>0.57</b>	<b>0.57</b>	<b>0.57</b>	<b>0.57</b>								
IRF for WQCV Event:	0.45	0.43	0.51	0.32	0.39	0.26	1.00								
IRF for 5-Year Event:	0.80	0.80	0.82	0.60	0.72	0.48	1.00								
IRF for 100-Year Event:	0.82	0.82	0.84	0.61	0.73	0.49	1.00								
<b>IRF for Optional User Defined Storm CUHP:</b>	<b>0.82</b>	<b>0.82</b>	<b>0.84</b>	<b>0.61</b>	<b>0.73</b>	<b>0.49</b>	<b>1.00</b>								
Total Site Imperviousness: I <sub>total</sub>	10.4%	32.1%	37.3%	31.4%	41.9%	35.9%	0.0%								
Effective Imperviousness for WQCV Event:	4.7%	28.6%	33.4%	25.6%	36.0%	29.7%	0.0%								
Effective Imperviousness for 5-Year Event:	8.4%	30.9%	35.9%	28.0%	39.2%	31.5%	0.0%								
Effective Imperviousness for 100-Year Event:	8.6%	31.0%	36.0%	28.1%	39.4%	31.6%	0.0%								
<b>Effective Imperviousness for Optional User Defined Storm CUHP:</b>	<b>8.6%</b>	<b>31.0%</b>	<b>36.0%</b>	<b>28.1%</b>	<b>39.4%</b>	<b>31.6%</b>	<b>0.0%</b>								

### LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	50.7%	6.9%	6.3%	12.1%	8.6%	10.8%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT*: Reduce Detention By:	22.0%	3.8%	3.6%	11.3%	6.4%	12.2%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>User Defined CUHP CREDIT: Reduce Detention By:</b>	<b>10.7%</b>	<b>2.6%</b>	<b>2.6%</b>	<b>7.6%</b>	<b>5.0%</b>	<b>9.0%</b>	<b>0.0%</b>								

<b>Total Site Imperviousness:</b>	<b>30.6%</b>
<b>Total Site Effective Imperviousness for WQCV Event:</b>	<b>25.5%</b>
<b>Total Site Effective Imperviousness for 5-Year Event:</b>	<b>27.4%</b>
<b>Total Site Effective Imperviousness for 100-Year Event:</b>	<b>27.5%</b>
<b>Total Site Effective Imperviousness for Optional User Defined Storm CUHP:</b>	<b>27.5%</b>

Notes:  
 \* Use Green Ampt average infiltration rate values from Table 3-3.  
 \*\* Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.  
 \*\*\* Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposes

**Design Procedure Form: Extended Detention Basin (EDB)**

UD-BMP (Version 3.06, November 2016)

Sheet 1 of 4

**Designer:** \_\_\_\_\_  
**Company:** Classic Consulting Engineers  
**Date:** March 28, 2019  
**Project:** Midtown at Hannah Ridge Fil. 1  
**Location:** Pond 1

<p>1. Basin Storage Volume</p> <p>A) Effective Imperviousness of Tributary Area, <math>I_a</math></p> <p>B) Tributary Area's Imperviousness Ratio (<math>i = I_a / 100</math>)</p> <p>C) Contributing Watershed Area</p> <p>D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm</p> <p>E) Design Concept (Select EURV when also designing for flood control)</p> <p>F) Design Volume (WQCV) Based on 40-hour Drain Time (<math>V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)</math>)</p> <p>G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume (<math>V_{WQCV\ OTHER} = (d_5 * (V_{DESIGN} / 0.43))</math>)</p> <p>H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)</p> <p>I) Predominant Watershed NRCS Soil Group</p> <p>J) Excess Urban Runoff Volume (EURV) Design Volume                  For HSG A: <math>EURV_A = 1.68 * i^{1.28}</math>                  For HSG B: <math>EURV_B = 1.36 * i^{1.08}</math>                  For HSG C/D: <math>EURV_{C/D} = 1.20 * i^{1.08}</math> </p>	<p><math>I_a =</math> <u>30.6</u> %</p> <p><math>i =</math> <u>0.306</u></p> <p>Area = <u>7.330</u> ac</p> <p><math>d_5 =</math> <u>0.42</u> in</p> <p>Choose One  <input type="radio"/> Water Quality Capture Volume (WQCV)  <input checked="" type="radio"/> Excess Urban Runoff Volume (EURV)             </p> <p><math>V_{DESIGN} =</math> <u>0.094</u> ac-ft</p> <p><math>V_{DESIGN\ OTHER} =</math> <u>0.091</u> ac-ft</p> <p><math>V_{DESIGN\ USER} =</math> _____ ac-ft</p> <p>Choose One  <input type="radio"/> A  <input checked="" type="radio"/> B  <input type="radio"/> C / D             </p> <p>EURV = <u>0.231</u> ac-ft</p>
<p>2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)</p>	<p>L : W = <u>2.0</u> : 1</p>
<p>3. Basin Side Slopes</p> <p>A) Basin Maximum Side Slopes (Horizontal distance per unit vertical. 4:1 or flatter preferred)</p>	<p>Z = <u>3.00</u> ft / ft  <b>DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE</b></p>
<p>4. Inlet</p> <p>A) Describe means of providing energy dissipation at concentrated inflow locations:</p>	<p>_____</p> <p>_____</p> <p>_____</p>



**Design Procedure Form: Extended Detention Basin (EDB)**

Sheet 2 of 4

**Designer:** \_\_\_\_\_  
**Company:** Classic Consulting Engineers  
**Date:** March 28, 2019  
**Project:** Midtown at Hannah Ridge Fil. 1  
**Location:** Pond 1

<p>5. Forebay</p> <p>A) Minimum Forebay Volume (<math>V_{FMIN} = 2\%</math> of the WQCV)</p> <p>B) Actual Forebay Volume</p> <p>C) Forebay Depth (<math>D_F = 18</math> inch maximum)</p> <p>D) Forebay Discharge</p> <p style="margin-left: 20px;">i) Undetained 100-year Peak Discharge</p> <p style="margin-left: 20px;">ii) Forebay Discharge Design Flow (<math>Q_F = 0.02 * Q_{100}</math>)</p> <p>E) Forebay Discharge Design</p> <p style="margin-left: 20px;">* Discharge Pipe Size minimum 3 inches</p> <p>G) Rectangular Notch Width</p>	<p><math>V_{FMIN} = 0.002</math> ac-ft</p> <p><math>V_F = 0.002</math> ac-ft</p> <p><math>D_F = 12.0</math> in</p> <p><math>Q_{100} = 35.00</math> cfs</p> <p><math>Q_F = 0.70</math> cfs</p> <p>Choose One  <input type="radio"/> Berm With Pipe  <input checked="" type="radio"/> Wall with Rect. Notch  <input type="radio"/> Wall with V-Notch Weir  <span style="color: blue;">(flow too small for berm w/ pipe)</span></p> <p>Calculated <math>W_N = 4.9</math> in</p>
<p>6. Trickle Channel</p> <p>A) Type of Trickle Channel</p> <p>F) Slope of Trickle Channel</p>	<p>Choose One  <input checked="" type="radio"/> Concrete  <input type="radio"/> Soft Bottom</p> <p><math>S = 0.0100</math> ft / ft</p>
<p>7. Micropool and Outlet Structure</p> <p>A) Depth of Micropool (2.5-foot minimum)</p> <p>B) Surface Area of Microooool (10 ft<sup>2</sup> minimum)</p> <p>C) Outlet Type</p> <p>D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)</p> <p>E) Total Outlet Area</p>	<p><math>D_M = 2.5</math> ft</p> <p><math>A_M = 100</math> sq ft</p> <p>Choose One  <input checked="" type="radio"/> Orifice Plate  <input type="radio"/> Other (Describe):          _____          _____</p> <p><math>D_{orifice} = 1.00</math> inches</p> <p><math>A_{ot} = 3.00</math> square inches</p>

**Design Procedure Form: Extended Detention Basin (EDB)**

Sheet 3 of 4

**Designer:** \_\_\_\_\_  
**Company:** Classic Consulting Engineers  
**Date:** March 28, 2019  
**Project:** Midtown at Hannah Ridge Fil. 1  
**Location:** Pond 1

<p><b>8. Initial Surcharge Volume</b></p> <p>A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)</p> <p>B) Minimum Initial Surcharge Volume (Minimum volume of 1.3% of the WQCV)</p> <p>C) Initial Surcharge Provided Above Micropool</p>	<p><math>D_{IS} =</math> <u>6</u> in</p> <p><math>V_s =</math> <u>50.0</u> cu ft</p>
<p><b>9. Trash Rack</b></p> <p>A) Water Quality Screen Open Area: <math>A_t = A_{tot} * 38.5 * (e^{-0.095D})</math></p> <p>B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open area to the total screen area for the material specified.)</p> <p style="padding-left: 40px;">Other (Y/N): <u>N</u></p> <p>C) Ratio of Total Open Area to Total Area (only for type "Other")</p> <p>D) Total Water Quality Screen Area (based on screen type)</p> <p>E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)</p> <p>F) Height of Water Quality Screen (<math>H_{TR}</math>)</p> <p>G) Width of Water Quality Screen Opening (<math>W_{opening}</math>) (Minimum of 12 inches is recommended)</p>	<p><math>A_t =</math> <u>105</u> square inches</p> <p><u>S.S. Well Screen with 60% Open Area</u></p> <hr/> <hr/> <hr/> <p><math>A_{total} =</math> <u>175</u> sq. in.</p> <p><math>H =</math> <u>3.5</u> feet</p> <p><math>H_{TR} =</math> <u>70</u> inches</p> <p><math>W_{opening} =</math> <u>12.0</u> inches</p>

Design Procedure Form: Extended Detention Basin (EDB)

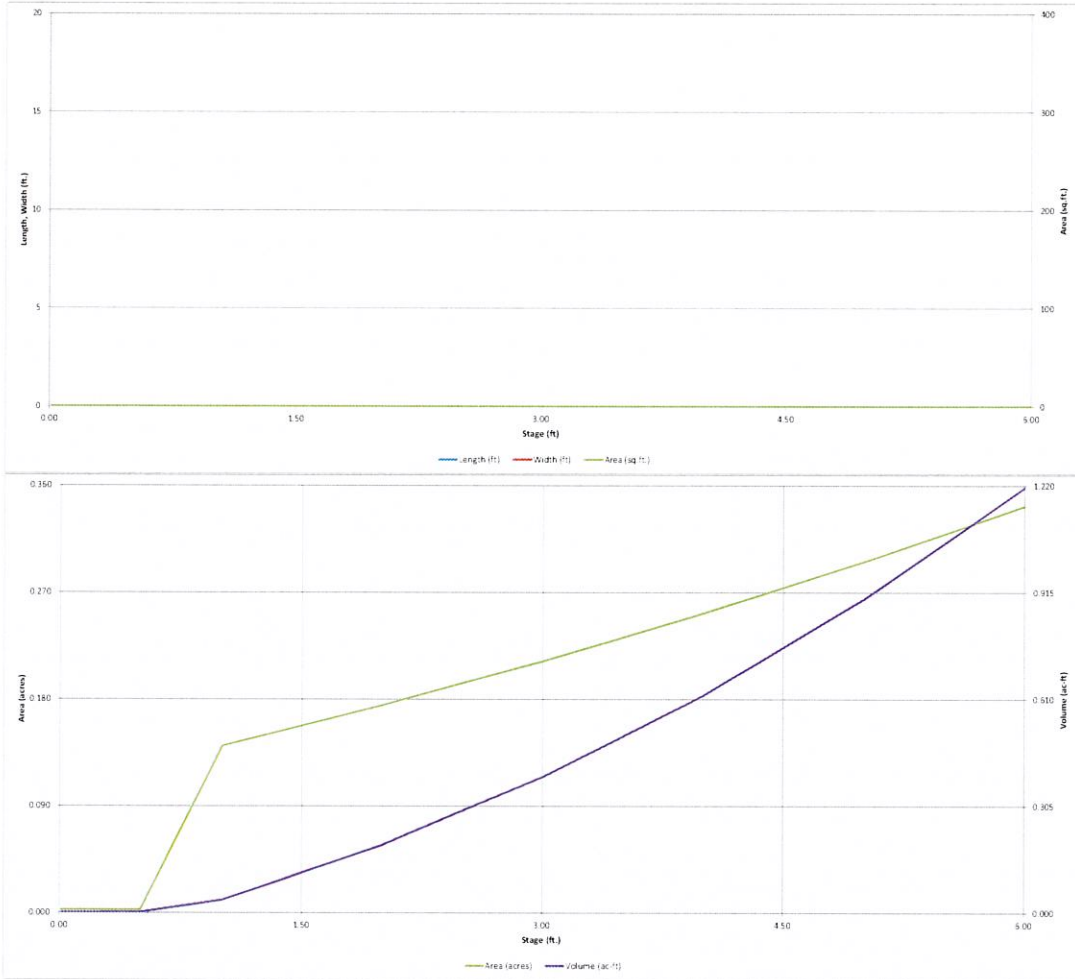
Designer: \_\_\_\_\_  
Company: Classic Consulting Engineers  
Date: March 28, 2019  
Project: Midtown at Hannah Ridge Fil. 1  
Location: Pond 1

<p>10. Overflow Embankment</p> <p>A) Describe embankment protection for 100-year and greater overtopping:</p> <p>B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>11. Vegetation</p>	<p>Choose One</p> <p><input type="radio"/> Irrigated</p> <p><input type="radio"/> Not Irrigated</p>
<p>12. Access</p> <p>A) Describe Sediment Removal Procedures</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Notes: _____</p> <p>_____</p> <p>_____</p>	



# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

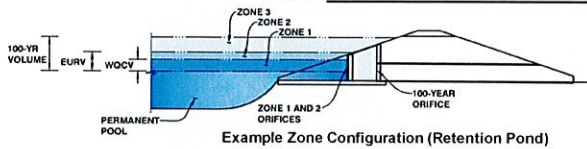


# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: MIDTOWN AT HANNAH RIDGE FIL. NO. 1

Basin ID: POND 1



	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.39	0.094	Orifice Plate
Zone 2 (EURV)	2.21	0.137	Orifice Plate
Zone 3 (100-year)	3.48	0.262	Weir&Pipe (Restrict)
		0.493	<b>Total</b>

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

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

**Calculated Parameters for Underdrain**

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.50	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	10.50	inches
Orifice Plate: Orifice Area per Row =	0.67	sq. inches (diameter = 15/16 inch)

**Calculated Parameters for Plate**

WQ Orifice Area per Row =	4.653E-03	ft <sup>2</sup>
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft <sup>2</sup>

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.90	1.80	2.70				
Orifice Area (sq. inches)	0.67	0.67	0.67	0.67				

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

**User Input: Vertical Orifice (Circular or Rectangular)**

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

**Calculated Parameters for Vertical Orifice**

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

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

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

**Calculated Parameters for Overflow Weir**

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>g</sub> =	4.50	N/A	feet
Over Flow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.53	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	11.54	N/A	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	5.77	N/A	ft <sup>2</sup>

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	18.00		inches

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

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.77	N/A	ft <sup>2</sup>
Outlet Orifice Centroid =	0.75	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

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

Spillway Invert Stage =	4.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	25.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

**Calculated Parameters for Spillway**

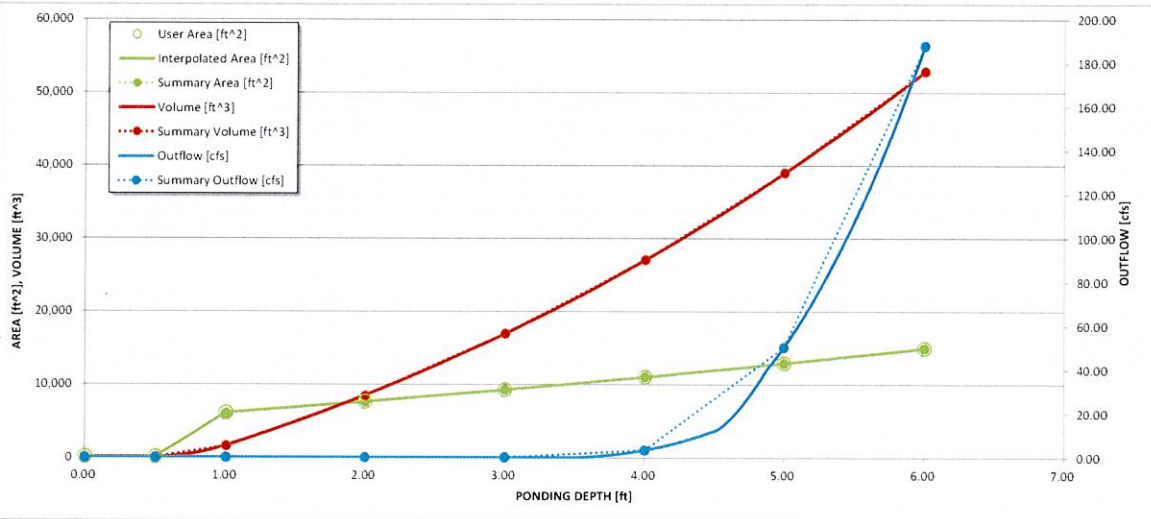
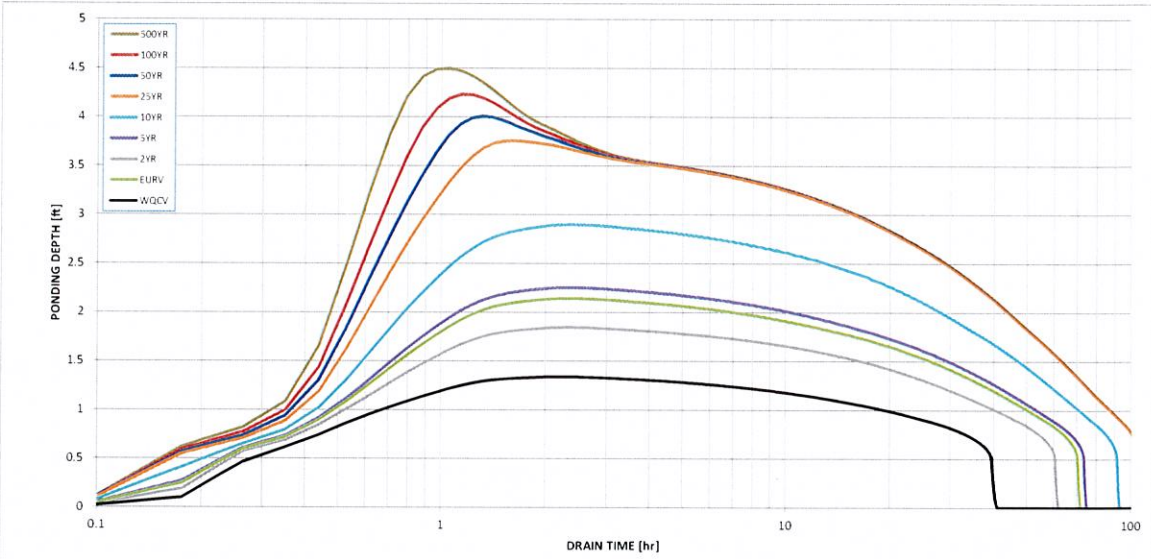
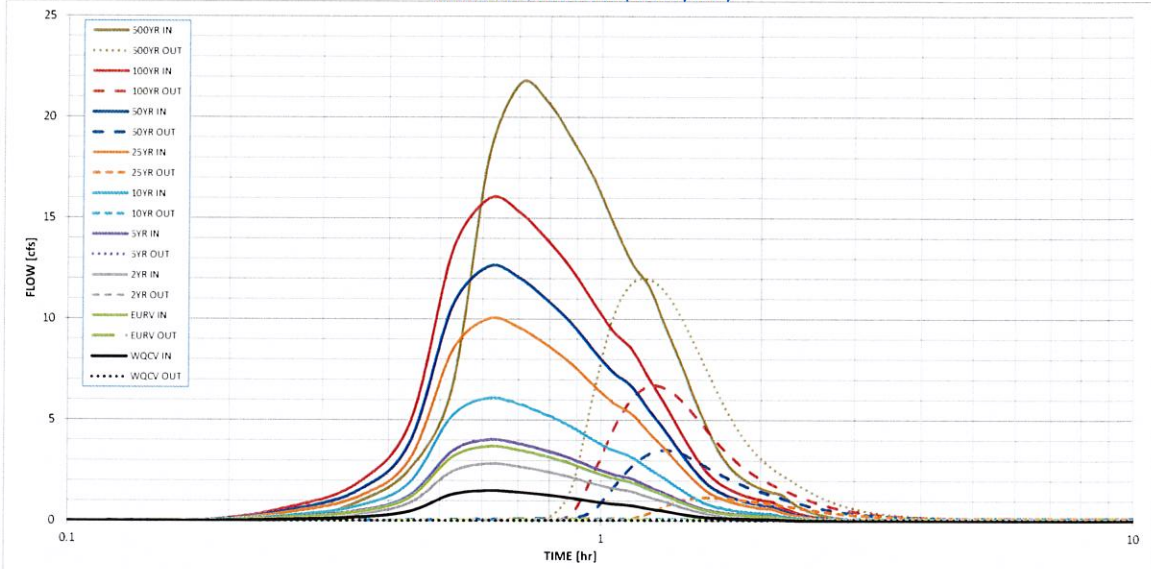
Spillway Design Flow Depth =	0.23	feet
Stage at Top of Freeboard =	5.73	feet
Basin Area at Top of Freeboard =	0.33	acres

**Routed Hydrograph Results**

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.00
Calculated Runoff Volume (acre-ft) =	0.094	0.231	0.177	0.252	0.382	0.634	0.800	1.017	1.386
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.093	0.230	0.177	0.251	0.382	0.634	0.800	1.017	1.386
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.19	0.63	0.87	1.17	1.65
Predevelopment Peak Q (cfs) =	0.0	0.0	0.1	0.143	1.4	4.6	6.3	8.6	12.1
Peak Inflow Q (cfs) =	1.5	3.7	2.8	4.0	6.1	10.0	12.6	16.0	21.7
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.075	0.1	1.2	3.5	6.7	12.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.1	0.3	0.6	0.8	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.1	0.3	0.6	1.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	66	58	69	85	96	93	90	86
Time to Drain 99% of Inflow Volume (hours) =	40	70	60	73	90	104	103	101	99
Maximum Ponding Depth (ft) =	1.34	2.14	1.84	2.25	2.90	3.75	4.01	4.23	4.49
Area at Maximum Ponding Depth (acres) =	0.15	0.18	0.17	0.18	0.21	0.24	0.25	0.26	0.27
Maximum Volume Stored (acre-ft) =	0.085	0.217	0.167	0.239	0.365	0.558	0.620	0.677	0.749

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



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







## Site-Level Low Impact Development (LID) Design Effective Impervious Calculator LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

---Design Storm: 1-Hour Rain Depth	WQCV Event	0.53	inches
---Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
---Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1-Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event	2.52	

Max Intensity for Optional User Defined Storm: 2.51496

Designer: \_\_\_\_\_  
 Company: CLASSIC CONSULTING ENGINEERS  
 Date: March 26, 2019  
 Project: MIDTOWN AT HANNAH RIDGE  
 Location: POND 2

### SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	Basin N	Basin 0													
Receiving Pervious Area Soil Type:	Sand	Sandy Loam													
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	0.990	0.480													
Directly Connected Impervious Area (DCIA, acres)	0.400	0.150													
Unconnected Impervious Area (UIA, acres)	0.040	0.040													
Receiving Pervious Area (RPA, acres)	0.250	0.150													
Separate Pervious Area (SPA, acres)	0.300	0.140													
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C													

### CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	0.990	0.480													
Directly Connected Impervious Area (DCIA, %)	40.4%	31.3%													
Unconnected Impervious Area (UIA, %)	4.0%	8.3%													
Receiving Pervious Area (RPA, %)	25.3%	31.3%													
Separate Pervious Area (SPA, %)	30.3%	29.2%													
A <sub>i</sub> (RPA / UIA)	6.250	3.750													
I <sub>s</sub> Check	0.140	0.210													
f / I for WQCV Event:	11.0	2.0													
f / I for 5-Year Event:	0.6	0.5													
f / I for 100-Year Event:	0.6	0.3													
<b>f / I for Optional User Defined Storm CUHP:</b>	<b>0.57</b>	<b>0.31</b>													
IRF for WQCV Event:	0.30	0.45													
IRF for 5-Year Event:	0.56	0.85													
IRF for 100-Year Event:	0.57	0.89													
<b>IRF for Optional User Defined Storm CUHP:</b>	<b>0.57</b>	<b>0.89</b>													
Total Site Imperviousness: i <sub>area</sub>	44.4%	39.6%													
Effective Imperviousness for WQCV Event:	41.6%	35.0%													
Effective Imperviousness for 5-Year Event:	42.7%	38.3%													
Effective Imperviousness for 100-Year Event:	42.7%	38.7%													
<b>Effective Imperviousness for Optional User Defined Storm CUHP:</b>	<b>42.7%</b>	<b>38.7%</b>													

### LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	3.9%	6.9%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	3.9%	2.4%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>User Defined CUHP CREDIT: Reduce Detention By:</b>	<b>3.3%</b>	<b>1.8%</b>														

Total Site Imperviousness:	42.9%
Total Site Effective Imperviousness for WQCV Event:	39.5%
Total Site Effective Imperviousness for 5-Year Event:	41.2%
Total Site Effective Imperviousness for 100-Year Event:	41.4%
<b>Total Site Effective Imperviousness for Optional User Defined Storm CUHP:</b>	<b>41.4%</b>

Notes:  
 \* Use Green-Ampt average infiltration rate values from Table 3-3.  
 \*\* Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.  
 \*\*\* Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposes

## Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Sheet 1 of 4

**Designer:** \_\_\_\_\_  
**Company:** \_\_\_\_\_  
**Date:** March 28, 2019  
**Project:** \_\_\_\_\_  
**Location:** \_\_\_\_\_

<p>1. Basin Storage Volume</p> <p>A) Effective Imperviousness of Tributary Area, <math>I_a</math></p> <p>B) Tributary Area's Imperviousness Ratio (<math>i = I_a / 100</math>)</p> <p>C) Contributing Watershed Area</p> <p>D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm</p> <p>E) Design Concept (Select EURV when also designing for flood control)</p> <p>F) Design Volume (WQCV) Based on 40-hour Drain Time (<math>V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)</math>)</p> <p>G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume (<math>V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43))</math>)</p> <p>H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)</p> <p>I) Predominant Watershed NRCS Soil Group</p> <p>J) Excess Urban Runoff Volume (EURV) Design Volume                      For HSG A: <math>EURV_A = 1.68 * i^{1.28}</math>                      For HSG B: <math>EURV_B = 1.36 * i^{1.08}</math>                      For HSG C/D: <math>EURV_{C/D} = 1.20 * i^{1.08}</math> </p>	<p><math>I_a =</math> <u>42.9</u> %</p> <p><math>i =</math> <u>0.429</u></p> <p>Area = <u>1.470</u> ac</p> <p><math>d_6 =</math> <u>0.42</u> in</p> <p>Choose One</p> <p><input type="radio"/> Water Quality Capture Volume (WQCV)</p> <p><input checked="" type="radio"/> Excess Urban Runoff Volume (EURV)</p> <p><math>V_{DESIGN} =</math> <u>0.023</u> ac-ft</p> <p><math>V_{DESIGN\ OTHER} =</math> <u>0.022</u> ac-ft</p> <p><math>V_{DESIGN\ USER} =</math> _____ ac-ft</p> <p>Choose One</p> <p><input type="radio"/> A</p> <p><input checked="" type="radio"/> B</p> <p><input type="radio"/> C / D</p> <p>EURV = <u>0.067</u> ac-ft</p>
<p>2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)</p>	<p>L : W = <u>2.0</u> : 1</p>
<p>3. Basin Side Slopes</p> <p>A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)</p>	<p>Z = <u>3.00</u> ft / ft</p> <p style="color: red; font-weight: bold;">DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE</p>
<p>4. Inlet</p> <p>A) Describe means of providing energy dissipation at concentrated inflow locations:</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>

**Design Procedure Form: Extended Detention Basin (EDB)**

**Designer:** \_\_\_\_\_  
**Company:** \_\_\_\_\_  
**Date:** March 28, 2019  
**Project:** \_\_\_\_\_  
**Location:** \_\_\_\_\_

<p>5. Forebay</p> <p>A) Minimum Forebay Volume (<math>V_{FMIN} =</math> <u>0%</u> of the WQCV)</p> <p>B) Actual Forebay Volume</p> <p>C) Forebay Depth (<math>D_F =</math> <u>12</u> inch maximum)</p> <p>D) Forebay Discharge</p> <p style="margin-left: 20px;">i) Undetained 100-year Peak Discharge</p> <p style="margin-left: 20px;">ii) Forebay Discharge Design Flow (<math>Q_F = 0.02 * Q_{100}</math>)</p> <p>E) Forebay Discharge Design</p> <p>F) Discharge Pipe Size (minimum 8-inches)</p> <p>G) Rectangular Notch Width</p>	<p><math>V_{FMIN} =</math> <u>0.000</u> ac-ft <span style="color: red; font-weight: bold;">A FOREBAY MAY NOT BE NECESSARY FOR THIS SIZE SITE</span></p> <p><math>V_F =</math> <u>0.000</u> ac-ft</p> <p><math>D_F =</math> _____ in</p> <p><math>Q_{100} =</math> _____ cfs</p> <p><math>Q_F =</math> <u>          </u> cfs</p> <p>Choose One _____  <input type="radio"/> Berm With Pipe <span style="color: blue;">(flow too small for berm w/ pipe)</span>  <input type="radio"/> Wall with Rect. Notch  <input type="radio"/> Wall with V-Notch Weir</p> <p>Calculated <math>D_p =</math> <u>          </u> in</p> <p>Calculated <math>W_N =</math> <u>          </u> in</p>
<p>6. Trickle Channel</p> <p>A) Type of Trickle Channel</p> <p>F) Slope of Trickle Channel</p>	<p>Choose One _____  <input checked="" type="radio"/> Concrete  <input type="radio"/> Soft Bottom</p> <p><math>S =</math> <u>0.0100</u> ft / ft</p>
<p>7. Micropool and Outlet Structure</p> <p>A) Depth of Micropool (2.5-feet minimum)</p> <p>B) Surface Area of Micropool (10 ft<sup>2</sup> minimum)</p> <p>C) Outlet Type</p> <p>D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)</p> <p>E) Total Outlet Area</p>	<p><math>D_M =</math> <u>2.5</u> ft</p> <p><math>A_M =</math> <u>100</u> sq ft</p> <p>Choose One _____  <input checked="" type="radio"/> Orifice Plate  <input type="radio"/> Other (Describe):          _____          _____          _____</p> <p><math>D_{orifice} =</math> _____ inches</p> <p><math>A_{ot} =</math> _____ square inches</p>

**Design Procedure Form: Extended Detention Basin (EDB)**

**Designer:** \_\_\_\_\_  
**Company:** \_\_\_\_\_  
**Date:** March 28, 2019  
**Project:** \_\_\_\_\_  
**Location:** \_\_\_\_\_

<p>8. Initial Surcharge Volume</p> <p>A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)</p> <p>B) Minimum Initial Surcharge Volume (Design Volume of 1.5% Storm + QCV)</p> <p>C) Initial Surcharge Provided Above Micropool</p>	<p><math>D_{IS} = </math> <u>6</u> in</p> <p><math>V_s = </math> <u>50.0</u> cu ft</p>
<p>9. Trash Rack</p> <p>A) Water Quality Screen Open Area: <math>A_t = A_{st} * 38.5 * (e^{-0.095D})</math></p> <p>B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)</p> <p style="padding-left: 40px;">Other (Y/N): <u>N</u></p> <p>C) Ratio of Total Open Area to Total Area for Type "Other"</p> <p>D) Total Water Quality Screen Area (based on screen type)</p> <p>E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)</p> <p>F) Height of Water Quality Screen (<math>H_{TR}</math>)</p> <p>G) Width of Water Quality Screen Opening (<math>W_{opening}</math>) (Minimum of 12 inches is recommended)</p>	<p><math>A_t = </math> <u>                    </u> square inches</p> <p><math>A_{total} = </math> <u>                    </u> sq. in.</p> <p><math>H = </math> <u>                    </u> feet</p> <p><math>H_{TR} = </math> <u>                    </u> inches</p> <p><math>W_{opening} = </math> <u>                    </u> inches</p>

Design Procedure Form: Extended Detention Basin (EDB)

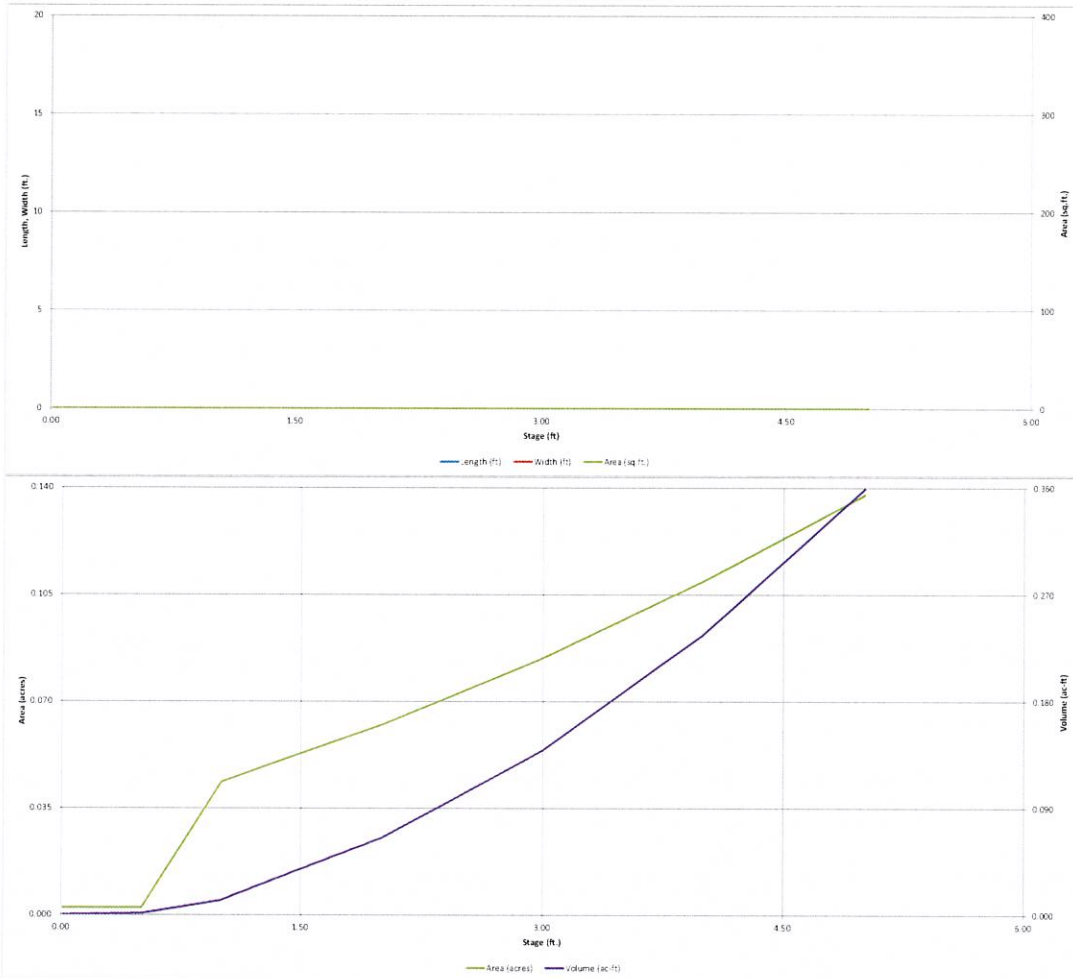
Designer: \_\_\_\_\_  
Company: \_\_\_\_\_  
Date: March 28, 2019  
Project: \_\_\_\_\_  
Location: \_\_\_\_\_

<p>10. Overflow Embankment</p> <p>A) Describe embankment protection for 100-year and greater overtopping:</p> <p>B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)</p>	<p>_____</p> <p>_____</p> <p>_____</p>
<p>11. Vegetation</p>	<p>Choose One</p> <p><input type="radio"/> Irrigated</p> <p><input type="radio"/> Not Irrigated</p>
<p>12. Access</p> <p>A) Describe Sediment Removal Procedures</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Notes: _____</p> <p>_____</p> <p>_____</p>	



# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



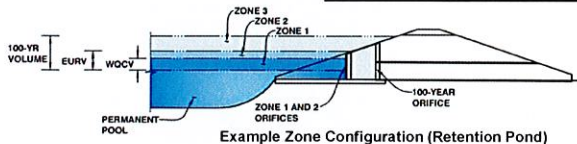


## Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: MIDTOWN AT HANNAH RIDGE FIL. 1

Basin ID: POND 1



	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.23	0.023	Orifice Plate
Zone 2 (EURV)	2.02	0.044	Orifice Plate
Zone 3 (100-year)	2.82	0.057	Weir&Pipe (Restrict)
		0.123	<b>Total</b>

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

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

**Calculated Parameters for Underdrain**

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

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

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

**Calculated Parameters for Plate**

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.80	1.60					
Orifice Area (sq. inches)	0.17	0.17	0.69					

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

**User Input: Vertical Orifice (Circular or Rectangular)**

	Not Selected	Not Selected	
Invert of Vertical Orifice =	<input type="text" value="N/A"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	<input type="text" value="N/A"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	<input type="text" value="N/A"/>	<input type="text" value="N/A"/>	inches

**Calculated Parameters for Vertical Orifice**

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	<input type="text" value="2.35"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	<input type="text" value="3.00"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Slope =	<input type="text" value="4.00"/>	<input type="text" value="N/A"/>	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	<input type="text" value="3.00"/>	<input type="text" value="N/A"/>	feet
Overflow Grate Open Area % =	<input type="text" value="50%"/>	<input type="text" value="N/A"/>	% grate open area/total area
Debris Clogging % =	<input type="text" value="50%"/>	<input type="text" value="N/A"/>	%

**Calculated Parameters for Overflow Weir**

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>g</sub> =	<input type="text" value="3.10"/>	<input type="text" value="N/A"/>	feet
Over Flow Weir Slope Length =	<input type="text" value="3.09"/>	<input type="text" value="N/A"/>	feet
Grate Open Area / 100-yr Orifice Area =	<input type="text" value="2.62"/>	<input type="text" value="N/A"/>	should be ≥ 4
Overflow Grate Open Area w/o Debris =	<input type="text" value="4.64"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	<input type="text" value="2.32"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	<input type="text" value="2.50"/>	<input type="text" value="N/A"/>	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	<input type="text" value="18.00"/>	<input type="text" value="N/A"/>	inches
Restrictor Plate Height Above Pipe Invert =	<input type="text" value="18.00"/>	<input type="text" value="N/A"/>	inches

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

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	<input type="text" value="1.77"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Outlet Orifice Centroid =	<input type="text" value="0.75"/>	<input type="text" value="N/A"/>	feet
Half-Central Angle of Restrictor Plate on Pipe =	<input type="text" value="3.14"/>	<input type="text" value="N/A"/>	radians

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

Spillway Invert Stage =	<input type="text" value="3.50"/>	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	<input type="text" value="25.00"/>	feet
Spillway End Slopes =	<input type="text" value="4.00"/>	H:V
Freeboard above Max Water Surface =	<input type="text" value="1.00"/>	feet

**Calculated Parameters for Spillway**

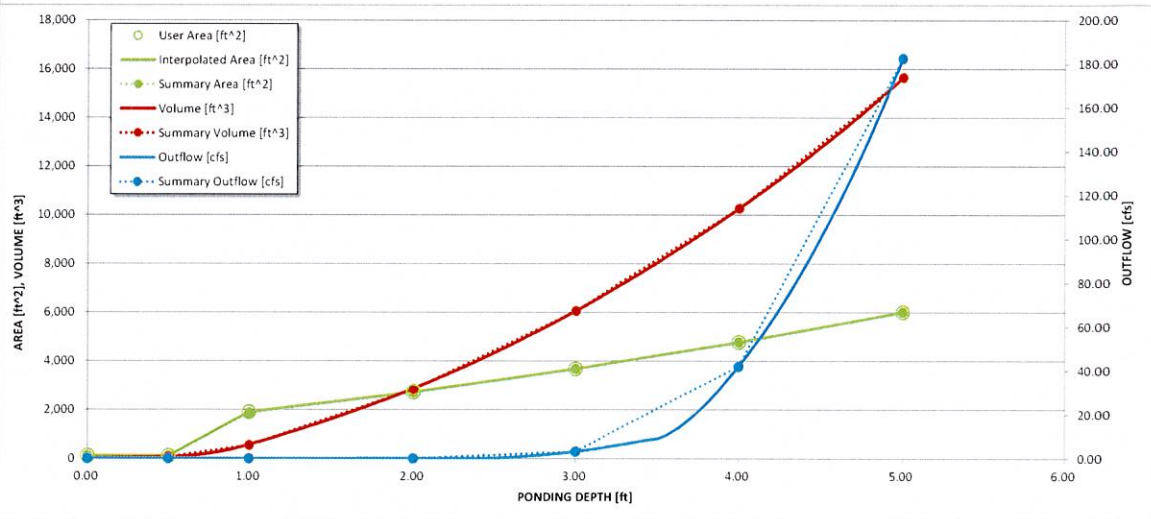
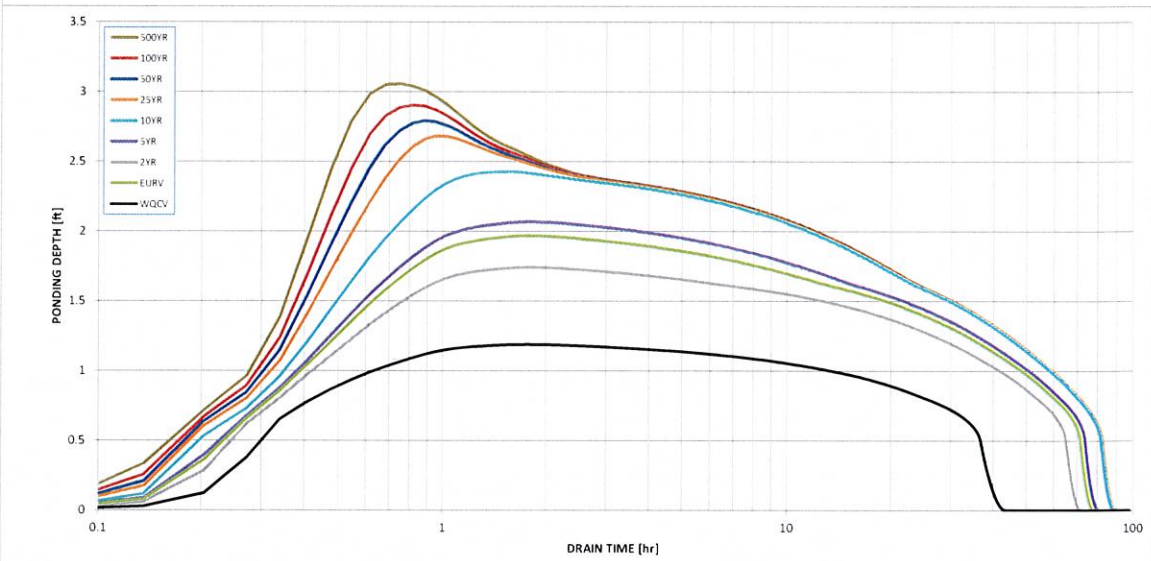
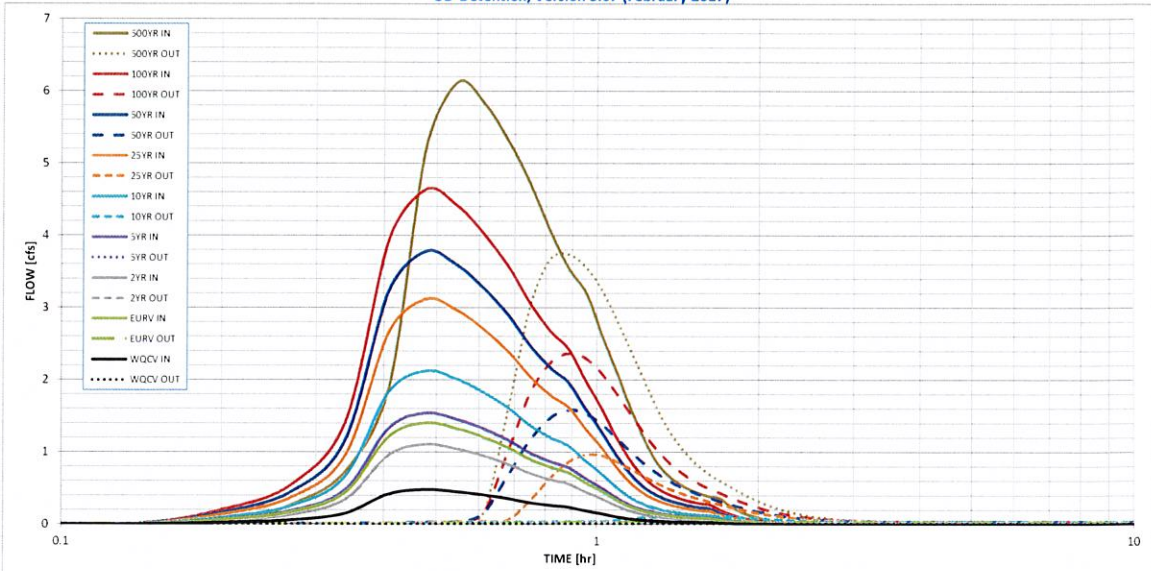
Spillway Design Flow Depth =	<input type="text" value="0.23"/>	feet
Stage at Top of Freeboard =	<input type="text" value="4.73"/>	feet
Basin Area at Top of Freeboard =	<input type="text" value="0.13"/>	acres

**Routed Hydrograph Results**

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =									
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.00
Calculated Runoff Volume (acre-ft) =	0.023	0.067	0.053	0.073	0.102	0.150	0.182	0.225	0.297
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.022	0.066	0.052	0.073	0.102	0.150	0.183	0.225	0.298
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.03	0.25	0.81	1.11	1.49	2.09
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.038	0.4	1.2	1.6	2.2	3.1
Peak Inflow Q (cfs) =	0.5	1.4	1.1	1.5	2.1	3.1	3.8	4.6	6.1
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.030	0.1	1.0	1.6	2.4	3.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.3	0.8	1.0	1.1	1.2
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.2	0.3	0.5	0.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	69	64	71	77	74	71	69	65
Time to Drain 99% of Inflow Volume (hours) =	41	73	67	76	82	81	80	79	78
Maximum Ponding Depth (ft) =	1.19	1.97	1.74	2.07	2.43	2.68	2.79	2.90	3.05
Area at Maximum Ponding Depth (acres) =	0.05	0.06	0.06	0.06	0.07	0.08	0.08	0.08	0.09
Maximum Volume Stored (acre-ft) =	0.021	0.063	0.050	0.069	0.094	0.113	0.122	0.130	0.143

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



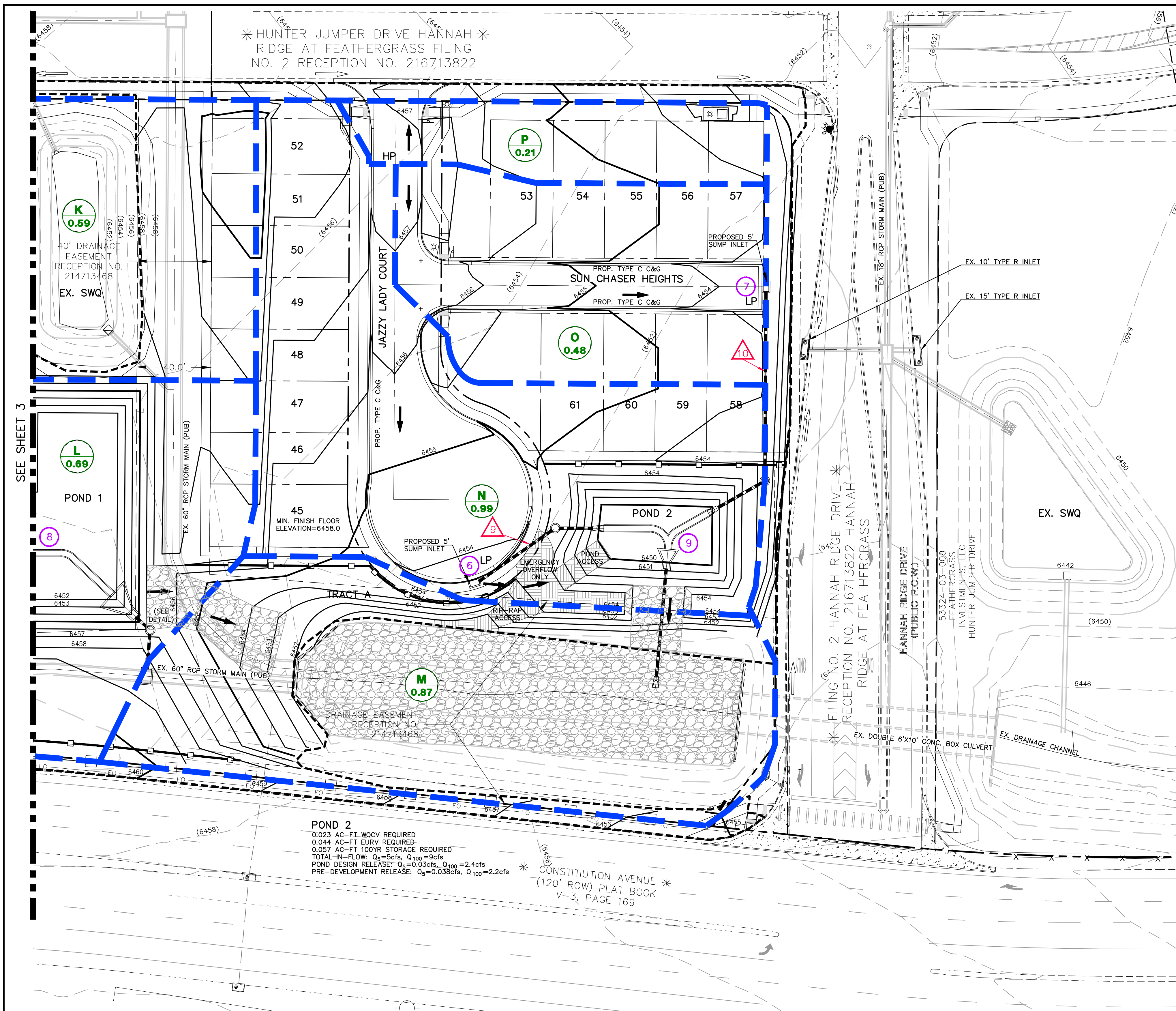
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			





## DRAINAGE MAPS



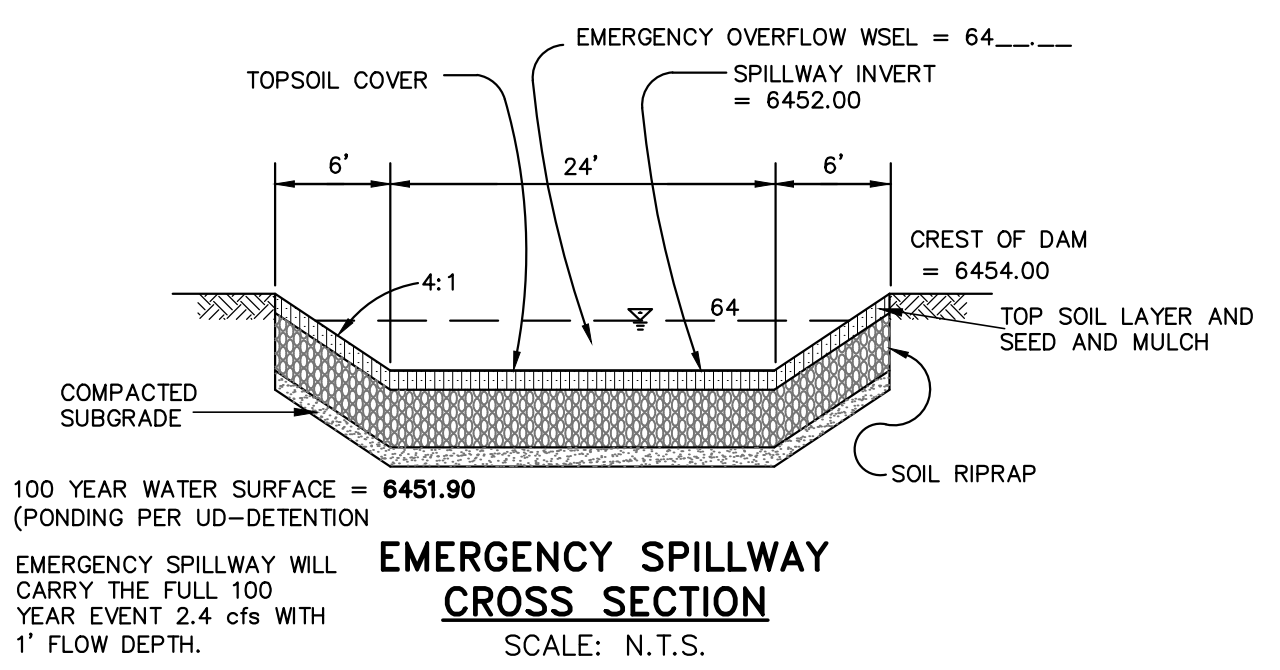


BASIN RUNOFF SUMMARY		
BASIN	Q5 (CFS)	Q100 (CFS)
K	1.3	2.9
L	1.5	3.4
M	1.9	4.3
N	3.0	5.9
O	1.7	3.2
P	0.8	1.5

DESIGN POINT SUMMARY			
DESIGN POINT	Q5 (CFS)	Q100 (CFS)	INLET SIZE
6	3	6	5' TYPE R SUMP
7	2	3	5' TYPE R SUMP
8	16	33	POND 1
9	5	9	POND 2

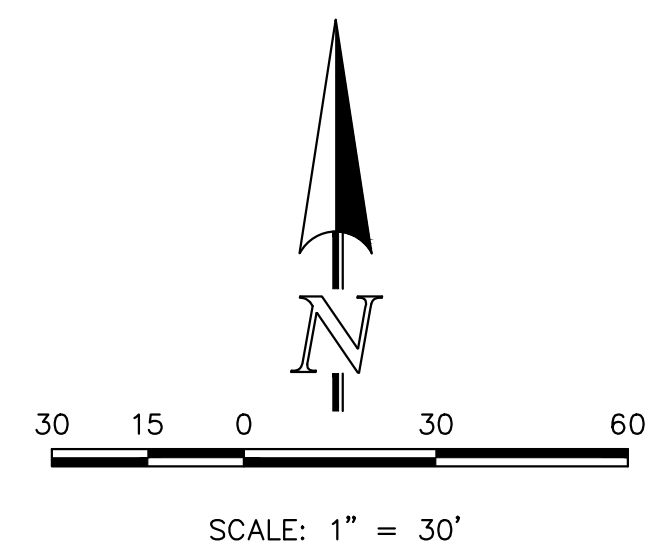
BASIN SWQ TREATMENT		
BASIN	ACRES	SWQ FACILITY
K	0.59	HANNAH FILING 3
L	0.69	MIDTOWN FILING 1
M	0.87	NOT TREATED (<1 Ac)
N	0.99	MIDTOWN FILING 1
O	0.48	MIDTOWN FILING 1
P	0.21	HANNAH FILING 3

PIPE ROUTING SUMMARY			
PIPE RUN	Q5 (CFS)	Q100 (CFS)	PIPE SIZE
9	3	6	18" RCP
10	2	3	18" RCP



**LEGEND**

- (6770) EXISTING CONTOUR
- 6770 PROPOSED CONTOUR
- FILING LINE
- BOUNDARY/R.O.W. LINE
- EXISTING FLOW DIRECTION
- PROPOSED FLOW
- "A" A LOT
- "B" B LOT
- "W/O" WALKOUT LOT
- "T" TRANSITION LOT
- "G" GARDEN LOT
- PROPOSED INLET
- PROPOSED STORM SEWER PIPE
- HP PROPOSED HIGH POINT
- LP PROPOSED LOW POINT
- (D) BASIN IDENTIFIER AREA IN ACRES
- △ PIPE RUN
- ① DESIGN POINT



**POND 2**  
 0.023 AC-FT. WOCV REQUIRED  
 0.044 AC-FT. EURV REQUIRED  
 0.057 AC-FT. 100YR STORAGE REQUIRED  
 TOTAL IN-FLOW: Q<sub>5</sub>=5cfs, Q<sub>100</sub>=9cfs  
 POND DESIGN RELEASE: Q<sub>5</sub>=0.03cfs, Q<sub>100</sub>=2.4cfs  
 PRE-DEVELOPMENT RELEASE: Q<sub>5</sub>=0.038cfs, Q<sub>100</sub>=2.2cfs

48 HOURS BEFORE YOU DIG,  
 CALL UTILITY LOCATORS  
**811**  
 UTILITY NOTIFICATION CENTER OF COLORADO  
 IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE

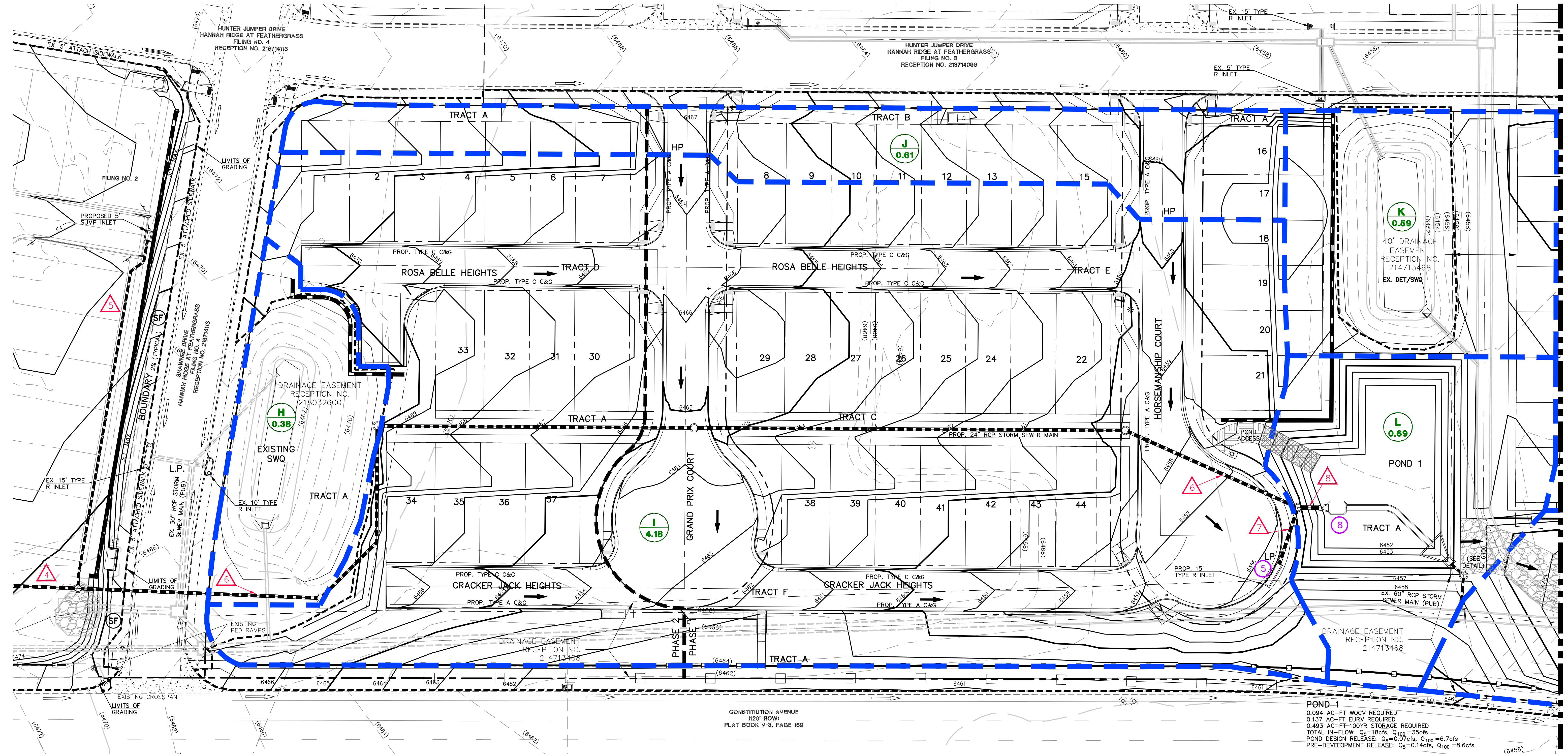
REVIEW:  
 PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

KYLE R. CAMPBELL, COLORADO P.E. #29794 DATE

MIDTOWN COLLECTION AT HANNAH RIDGE FILING NO. 1 DEVELOPED CONDITIONS DRAINAGE MAP			
DESIGNED BY	KRC	SCALE	DATE 03/22/19
DRAWN BY	LDB	(H) 1" = 30'	SHEET 1 OF 3
CHECKED BY		(V) 1" = NA	JOB NO. 1116.30

PUD SP-19-004  
 SF-19-006  
 SF-19-007

N:\11630\DRAWINGS\DEVELOPMENT\11630-FDR-MAP-01.dwg, 10/1/2019, 3:06:55 PM, 1:1



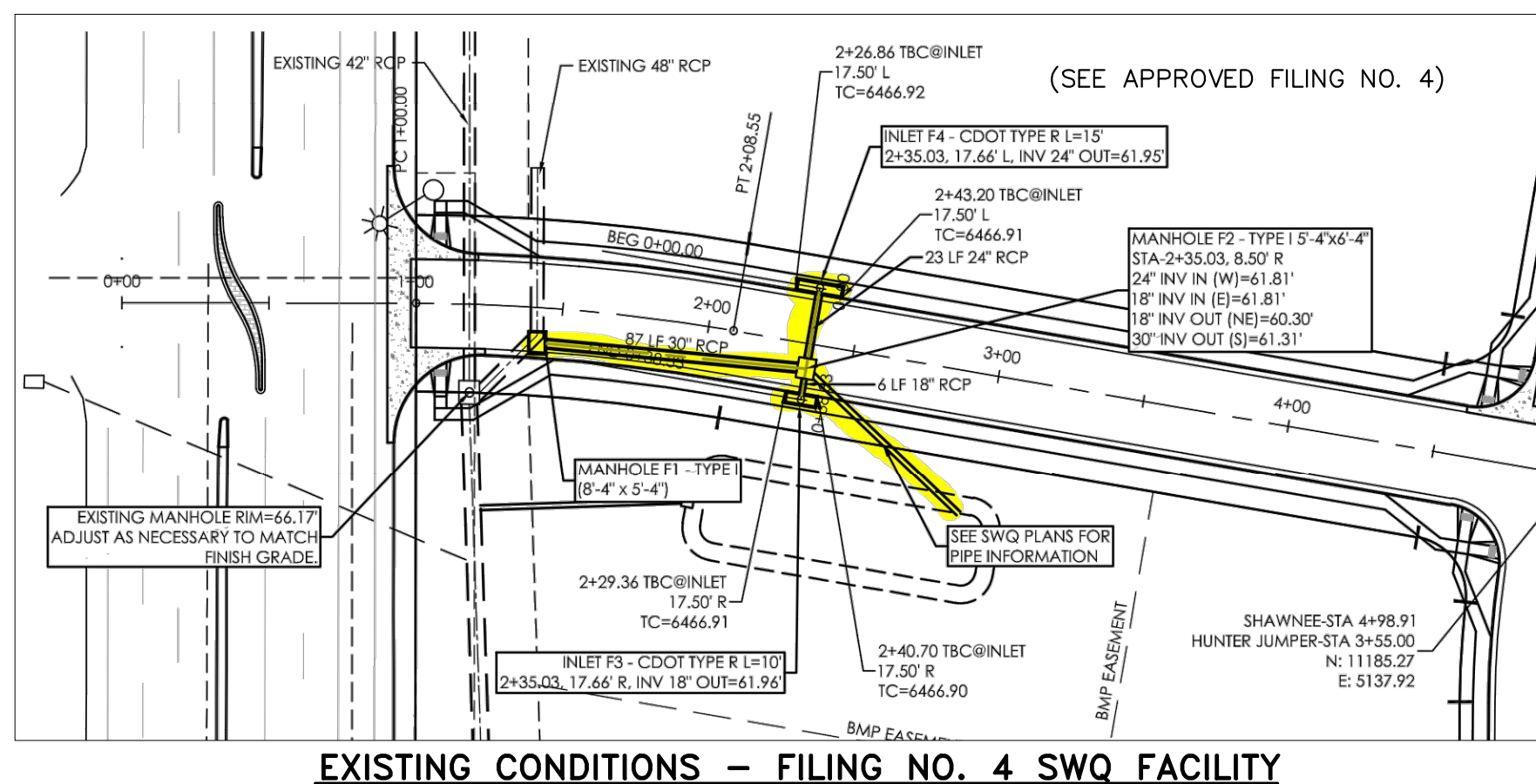
SEE SHEET 2

**POND 1**  
 0.094 AC-FT WQV REQUIRED  
 0.137 AC-FT EURV REQUIRED  
 0.493 AC-FT 100YR STORAGE REQUIRED  
 TOTAL IN-FLOW: Q<sub>5</sub>=18cfs, Q<sub>100</sub>=35cfs  
 POND DESIGN RELEASE: Q<sub>5</sub>=0.07cfs, Q<sub>100</sub>=6.7cfs  
 PRE-DEVELOPMENT RELEASE: Q<sub>5</sub>=0.14cfs, Q<sub>100</sub>=8.6cfs

CONSTITUTION AVENUE  
 (120' ROW)  
 PLAT BOOK V-9, PAGE 189

**LEGEND**

- (6770) --- EXISTING CONTOUR
- 6770 --- PROPOSED CONTOUR
- FILING LINE
- BOUNDARY/R.O.W. LINE
- EXISTING FLOW DIRECTION
- PROPOSED FLOW
- "A" --- A LOT
- "B" --- B LOT
- "W/O" --- WALKOUT LOT
- "T" --- TRANSITION LOT
- "G" --- GARDEN LOT
- --- PROPOSED INLET
- PROPOSED STORM SEWER PIPE
- HP --- PROPOSED HIGH POINT
- LP --- PROPOSED LOW POINT
- (D) 1.41 --- BASIN IDENTIFIER AREA IN ACRES
- △ --- PIPE RUN
- ① --- DESIGN POINT



EXISTING CONDITIONS - FILING NO. 4 SWQ FACILITY

**BASIN RUNOFF SUMMARY**

BASIN	Q5 (CFS)	Q100 (CFS)
H	0.8	1.9
I	9.4	19.0
J	2.2	4.1
K	1.3	2.9
L	1.5	3.4

**DESIGN POINT SUMMARY**

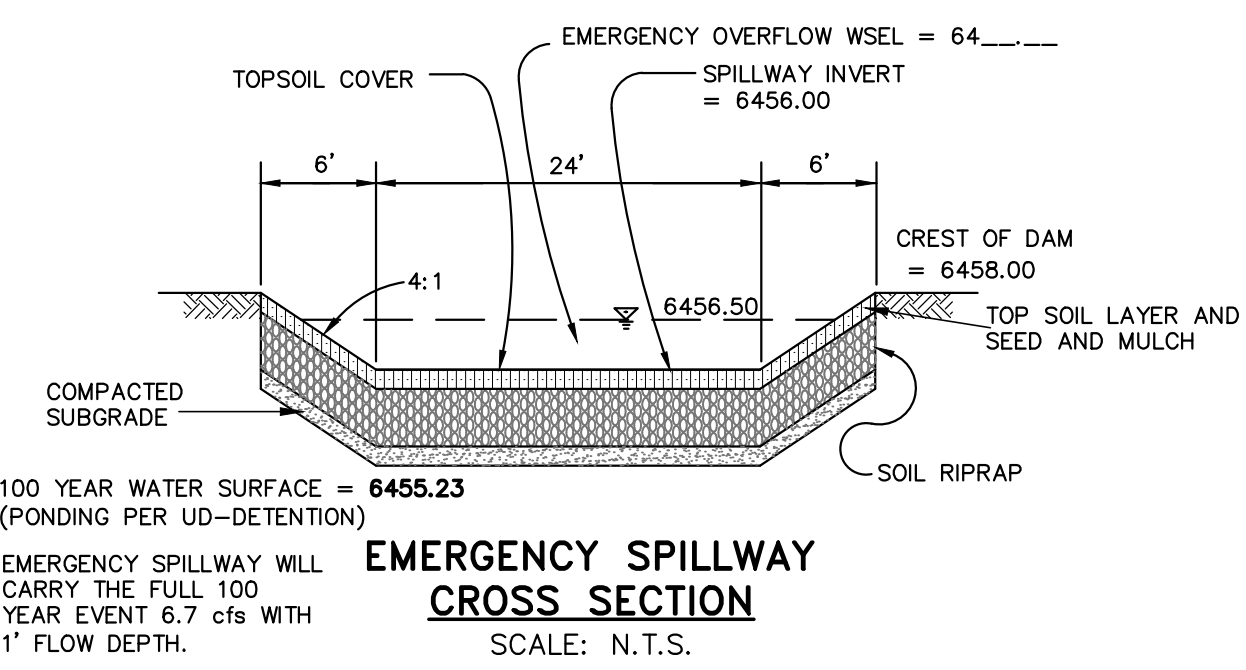
DESIGN POINT	Q5 (CFS)	Q100 (CFS)	INLET SIZE
5	9	19	15" TYPE R SUMP
8	16	33	POND 1

**PIPE ROUTING SUMMARY**

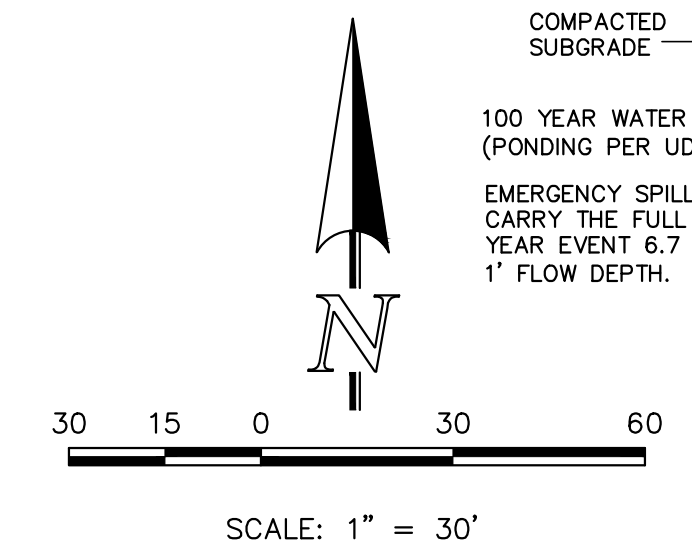
PIPE RUN	Q5 (CFS)	Q100 (CFS)	PIPE SIZE
4	6	11	18" RCP
5	1	2	18" RCP
6	7	13	24" RCP
7	9	19	24" RCP
8	15	30	30" RCP

**BASIN SWQ TREATMENT**

BASIN	ACRES	SWQ FACILITY
H	0.38	HANNAH FILING 4
I	4.18	MIDTOWN FILING 1
J	0.61	HANNAH FILING 3
K	0.59	HANNAH FILING 3
L	0.69	MIDTOWN FILING 1



EMERGENCY SPILLWAY CROSS SECTION  
 SCALE: N.T.S.



48 HOURS BEFORE YOU DIG,  
 CALL UTILITY LOCATORS  
**811**  
 UTILITY NOTIFICATION CENTER OF COLORADO  
 IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE	REVIEW:

REVIEW:  
 PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

KYLE R. CAMPBELL, COLORADO P.E. #29794 DATE

**CLASSIC**  
 CONSULTING ENGINEERS & SURVEYORS

618 N. Cascade Avenue, Suite 200  
 Colorado Springs, Colorado 80903  
 (719) 785-0790  
 (719) 785-0799 (Fax)

MIDTOWN COLLECTION AT HANNAH RIDGE  
 FILING NO. 1  
 DEVELOPED CONDITIONS DRAINAGE MAP

DESIGNED BY	KRC	SCALE	DATE	03/22/19
DRAWN BY	KC	(H) 1" = 30'	SHEET	2 OF 3
CHECKED BY	(V) 1" = NA	JOB NO.	1116.30	

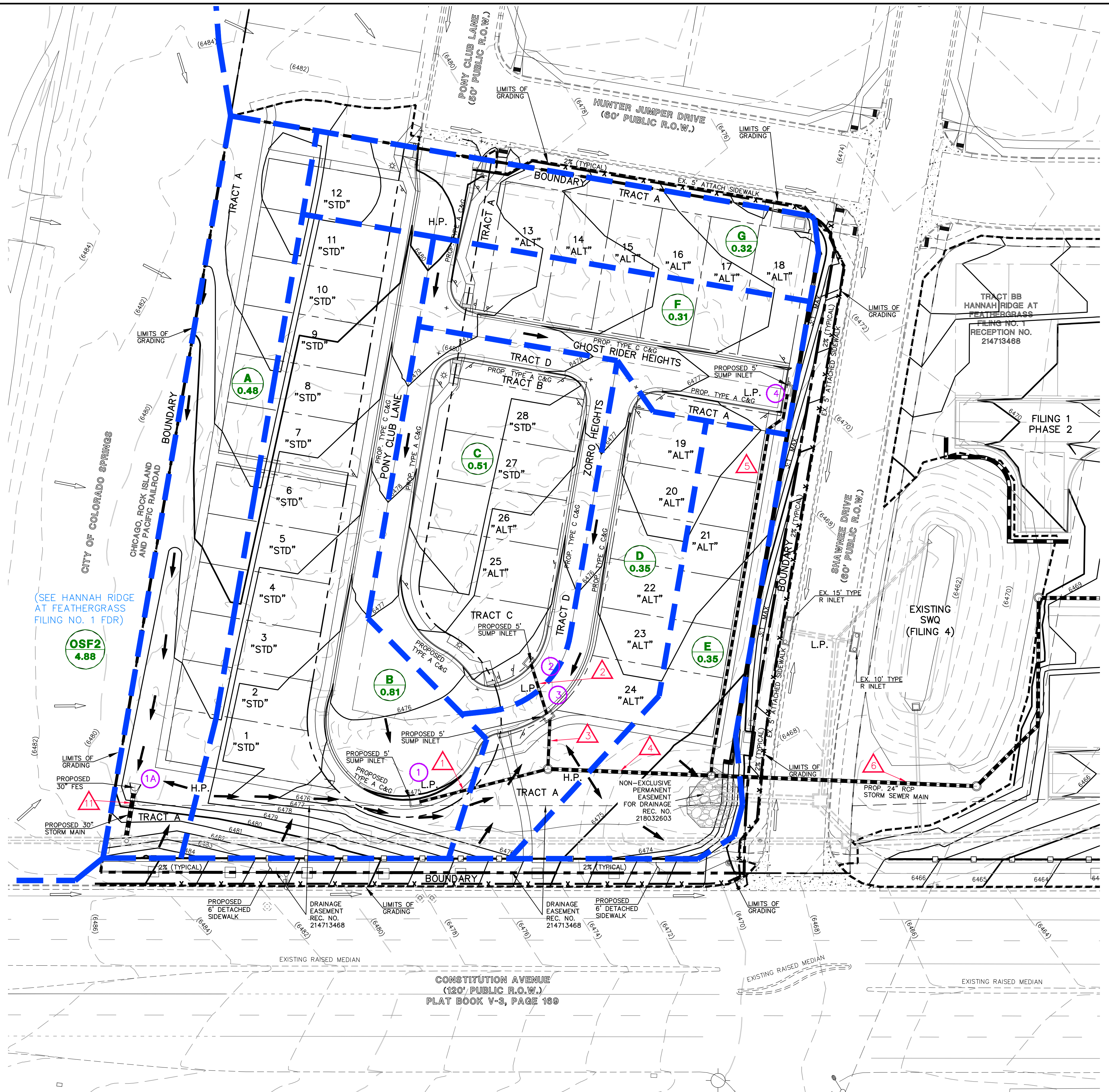
PUD SP-19-004  
 SF-19-006  
 SF-19-007

BASIN RUNOFF SUMMARY		
BASIN	Q5 (CFS)	Q100 (CFS)
OSF2	10.2	22.8
A	1.3	2.6
B	2.9	5.3
C	1.8	3.4
D	1.2	2.3
E	1.1	2.1
F	1.1	2.1
G	1.1	2.1

DESIGN POINT SUMMARY			
DESIGN POINT	Q5 (CFS)	Q100 (CFS)	INLET SIZE
1A	12	26	30" FES
1	3	5	5' TYPE R SUMP
2	2	3	5' TYPE R SUMP
3	1	2	5' TYPE R SUMP
4	1	2	5' TYPE R SUMP

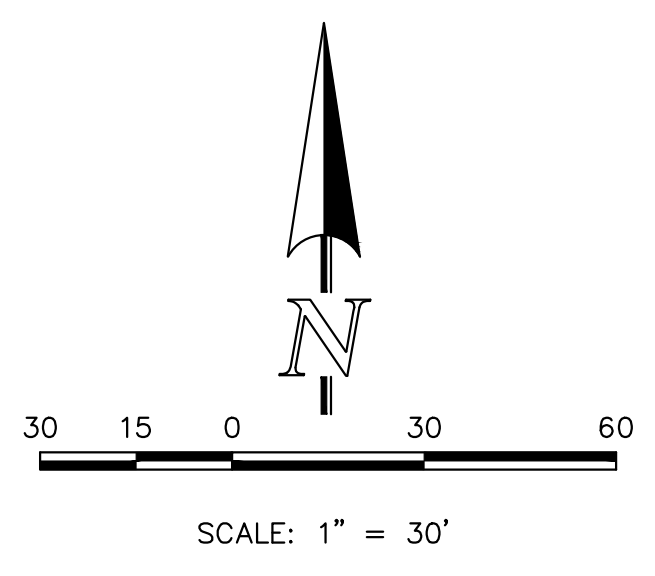
BASIN SWQ TREATMENT		
BASIN	ACRES	SWQ FACILITY
A	0.48	NOT TREATED (<1 Ac)
B	0.81	MIDTOWN FILING 1
C	0.51	MIDTOWN FILING 1
D	0.35	MIDTOWN FILING 1
E	0.35	HANNAH FILING 4
F	0.31	MIDTOWN FILING 1
G	0.32	HANNAH FILING 4

PIPE ROUTING SUMMARY			
PIPE RUN	Q5 (CFS)	Q100 (CFS)	PIPE SIZE
1	3	5	18" RCP
2	2	3	18" RCP
3	3	6	18" RCP
4	6	11	18" RCP
5	1	2	18" RCP
6	7	13	24" RCP
11	12	26	30" RCP



(SEE HANNAH RIDGE AT FEATHERGRASS FILING NO. 1 FDR)

- LEGEND**
- (6770) --- EXISTING CONTOUR
  - 6770 --- PROPOSED CONTOUR
  - FILING LINE
  - BOUNDARY/R.O.W. LINE
  - EXISTING FLOW DIRECTION
  - PROPOSED FLOW
  - "A" --- A LOT
  - "B" --- B LOT
  - "W/O" --- WALKOUT LOT
  - "T" --- TRANSITION LOT
  - "G" --- GARDEN LOT
  - --- PROPOSED INLET
  - PROPOSED STORM SEWER PIPE
  - HP --- PROPOSED HIGH POINT
  - LP --- PROPOSED LOW POINT
  - D --- BASIN IDENTIFIER
  - 1.41 --- AREA IN ACRES
  - ▲ --- PIPE RUN
  - ① --- DESIGN POINT



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NO.	REVISION	DATE

REVIEW:

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

KYLE R. CAMPBELL, COLORADO P.E. #29794      DATE

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Colorado Springs, Colorado 80903  
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(719) 785-0799 (Fax)

PUD SP-19-004  
SF-19-006  
SF-19-007

MIDTOWN COLLECTION AT HANNAH RIDGE  
FILING NO. 2  
DEVELOPED CONDITIONS DRAINAGE MAP

DESIGNED BY	KRC	SCALE	DATE	03/22/19
DRAWN BY	LDB	(H) 1" = 30'	SHEET	3 OF 3
CHECKED BY		(V) 1" = NA	JOB NO.	1116.30

N:\11630\DRAWINGS\DEVELOPMENT\11630-FDR-MAP-03.dwg, 10/17/2019 1:55:40 PM, 1:1