FINAL DRAINAGE REPORT

for

FALCON MARKETPLACE

El Paso County, Colorado

November 4, 2019

SF-19-001

Prepared for:

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1.0 CERTIFICATION STATEMENTS

ENGINEER'S STATEMENT

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

Tim D. McConnell, P.E.
Colorado P.E. License No. 33797
For and on Behalf of Drexel, Barrell & Co.

COLORADO REGISTERED TIM D. McCONNELL 33797 12-18-19 PROFESSIONAL ENGINEER

Date

DEVELOPER'S STATEMENT

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

Business Name: LG HI Falcon, LLC.

By: _____ 12-18-19
Ben Hummel Date

Title: Owner
Address: 3953 Maple Ave, #290
Dallas, TX 75219

EL PASO COUNTY

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

For the County Engineer
CONDITIONS:

Approved
By: Elizabeth Nijkamp
Date:12/19/2019
El Paso County Planning & Community Development

FINAL DRAINAGE REPORT
for
FALCON MARKETPLACE
Falcon, Colorado

2.0 PURPOSE

This report is prepared by Drexel, Barrel & Co in support of the Falcon Marketplace project. 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 outfall facilities.

3.0 GENERAL SITE DESCRIPTION

Location

The site is located at the northwest corner of E. Woodmen Road and Meridian Road - the SE 1/4 of the SE 1/4 of Section 1, Township 13 S, Range 65 W of the 6th P.M., El Paso County, Colorado.

There is one existing home on the site, and several out buildings. The site is bounded on the north by Falcon Ranchettes single family residential, the west by Courtyards at Woodmen Hills West single family residential, the east by Meridian Road, and on the south by E. Woodmen Road.There are no existing irrigation facilities on the project site.

Existing Site Conditions

The site is approximately 35.7 acres in size and is proposed as commercial use, with one large anchor lot and several smaller outlying lots. The majority of the site is currently undeveloped and is covered with native grass and vegetation. It is gently sloping from the north to south. Offsite flows concentrate into the Unnamed Tributary to Black Squirrel Creek (UTBSC) through the center of the site, and on to a double set of triple 48" diameter culverts under E. Woodmen Road.

Proposed Site Conditions

Falcon Marketplace is a proposed commercial development, consisting of a main anchor, junior anchor and several outlying lots. Falcon Market Place bisects the project, providing access from E. Woodmen Road, Woodmen Frontage Road and Eastonville Road to the north east.

Soils

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the site is partially underlain by the Blakeland loamy sand (Soil No. 8), and predominantly by the Blakeland-Fluvaquentic Haplaquolis (Soil No. 9), and the Columbine gravelly sandy loam (Soil No. 19). All soils are type 'A' hydrologic soil group. See appendix for map.

Climate

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

Floodplain Statement

The effective floodplain, Zone A limits, for the Unnamed Tributary to Black Squirrel Creek (UTBSC), in the vicinity of the Falcon Marketplace project, are defined on the FIRM for El Paso County, Colorado and Unincorporated Areas, Map Number 8041CO553G, Effective Date December 7, 2018.

A CLOMR to modify the effective floodplain was approved by FEMA, Case No. 17-08-0074R (May 26, 2017).

Previous Drainage Studies

The site is located within the Middle Tributary Basin of the Falcon Drainage Basin, as studied in the Falcon Drainage Basin Planning Study, prepared by Matrix Design Group, September, 2015. DBPS recommendations are presented later in this report.

4.0 DBPS ANALYSIS

Existing Conditions

The Falcon DBPS completed hydrologic analysis for the Falcon Basin Watershed, using HEC-HMS v.3.5 software, for historical, existing and future land use conditions by applying a 24-hour storm event with 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals and current drainage conveyance infrastructure.

As mentioned earlier, offsite flows from two unnamed tributaries to Black Squirrel Creek (West Branch and East Branch) converge and combine with onsite flows from the Falcon Marketplace site, and travel on to a double set of triple 48" diameter culverts under E. Woodmen Road.

The following table details the HEC-HMS analysis of existing conditions across the Falcon Marketplace development.

Peak Discharges for the Existing Condition at Points of Interest in vicinity of Falcon Marketplace Development (DBPS)

Location	Existing Conditions (source: Falcon Basin, Drainage Planning Study, HEC-HMS model)								
	HEC-HMS Element	Area (sq mi)	Basin/ Design Point	Peak Flow (cfs)					
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
West Branch at North Property Line of Falcon Marketplace	RMT062	0.29	1	1	11	25	62	110	160
East Branch at North Property Line of Falcon Marketplace	RMT064	0.67	2	50	140	230	390	490	580
Local Basin	MT060	0.19	MT060	8	21	33	62	80	99
Convergence of West and East Branch at Falcon Marketplace	JMT060	1.16	3	54	160	250	450	560	670
Local Basin	MT070	0.2	MT070	10	23	34	61	77	93
E. Woodmen Road, South Property Line of Falcon Marketplace	JMT070	1.36	4	61	180	280	510	630	760

The DBPS flow rates shown in the table above were used as the basis of the existing condition analysis of the Falcon Marketplace development. Site specific basins have been allocated, and referenced on the existing conditions map in the appendix.

Future Conditions

The DBPS also studied the future condition, with the existing drainage infrastructure currently in place. To accommodate the future condition, the DBPS recommends drainage infrastructure improvements, including Sub-Regional Pond SR4 which was identified to be installed on the Falcon Marketplace property. Pond SR4 will be renamed Pond #1 for the purposes of this report, and was conceptually sized with the parameters shown below:

Falcon DBPS, Pond #1 (SR4) – Sizing Parameters

Parameter	Value
100-year storage volume	19 ac-ft
Q_{2in}	130 cfs
Q_{2out}	27 cfs
Q_{100in}	1,000 cfs
Q_{100out}	730 cfs

The DBPS model was updated to reflect the proposed site design and Pond #1's stage/storage/discharge characteristics were updated using Urban Drainage UD-Detention software. This analysis was then input into the HEC-HMS hydrologic model.

Peak Discharges for the Future Developed Conditions at Points of Interest in vicinity of Falcon Marketplace Development (DBPS) without Pond SR4

Location	Future Conditions, with existing drainage infrastructure (source: Falcon Basin, DBPS, HEC-HMS model)								
	HEC-HMS Element	Area (sq mi)	Basin/ Design Point	Peak Flow (cfs)					
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
West Branch at North Property Line of Falcon Marketplace	RMT062	0.29	1	1	11	25	62	110	160
East Branch at North Property Line of Falcon Marketplace	RMT064	0.67	2	120	270	370	590	710	850
Local Basin	MT060	0.19	MT060	30	59	83	140	170	200
Downstream of Proposed Falcon Marketplace Pond SR4	JMT060	1.16	3	130	310	430	690	840	1000
Local Basin	MT070	0.2	MT070	25	50	69	110	140	170
E. Woodmen Road, South Property Line of Falcon Marketplace	JMT070	1.36	4	150	350	490	800	980	**1200**

Peak Discharges for the Future Developed Conditions at Points of Interest in vicinity of Falcon Marketplace Development (DBPS) with Pond SR4

Location	Future Conditions, with existing drainage infrastructure and Pond SR4 (Pond #1) (source: Falcon Basin, DBPS, HEC-HMS model)								
	HEC-HMS Element	Area (sq mi)	Basin/ Design Point	Peak Flow (cfs)					
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
West Branch at North Property Line of Falcon Marketplace	RMT062	0.29	1	5	21	34	64	81	99
East Branch at North Property Line of Falcon Marketplace	RMT064	0.67	2	121	273	373	591	712	847
Local Basin	MT060	0.19	MT060	30	59	83	137	167	199
Sub Regional Pond SR4 (Pond #1) Inflow		1.16		133	310	431	697	847	1016
Sub Regional Pond SR4 (Pond #1) Outflow	JMT060	1.16	3	27	142	246	467	595	727
Local Basin	MT070	0.2	MT070	25	50	69	114	139	165
E. Woodmen Road, South Property Line of Falcon Marketplace	JMT070	1.36	4	31	162	281	535	685	**844**

As shown by the above tables, the existing 100-year discharge to E. Woodmen Road at the south property line (JMT070) is 760-cfs. Future developed conditions with no drainage improvements result in a 100-year discharge at JMT070 of 1200-cfs, hence the need for drainage improvements recommended by the DBPS.

The DBPS went on to study the placement of a sub-regional detention facility (Pond SR4) on the Falcon Marketplace property, resulting in a 100-year discharge of 844-cfs at JMT070. To be in conformance with the DBPS recommendations and current drainage criteria, the allowable 100-year discharge from the Falcon Marketplace development can be no greater than **760-cfs**. The following describes the further refining of the Pond SR4 design, and other improvements required in order for the release in conformance.

Proposed Development & CLOMR Study

On October 17, 2016 a CLOMR, prepared by Drexel, Barrell & Co., was submitted to FEMA. The CLOMR specifically details how the Falcon Marketplace development proposes filling the site and rerouting the UTBSC. This will be accomplished by intercepting the existing creek at the north property line and conveying it via a rundown into a sub-regional detention pond (SR4 - Pond #1), as recommended by the DBPS.

Pond #1 Inflow/Outflow/Stage/Storage Parameters

Recurrence Interval	Pond Inflow (cfs)	Pond Outflow (cfs)	Water Surface Elevation (ft)	Storage Volume (ac-ft)
100-year	1,016	644	6897.0	26.6
50-year	847	481	6896.4	24.5
25-year	697	338	6895.8	22.5
10-year	431	106	6894.6	18.3
5-year	310	52	6894.2	17.0
2-year	133	12	6891.8	10.0

Peak discharges resulting from proposed Pond #1 are summarized above.

Pond #1 will discharge to a new 96" RCP storm drainage system which will flow from south to east across the property and discharge to a section of grass-lined channel that parallels the south perimeter of the property.

Onsite runoff generated from the site, represented as a portion of MT070 in the HEC-HMS model, will be conveyed via curb and gutter, and storm sewer to proposed water quality basins at the south end of the site. The water quality basins will discharge into the open grass-lined channel along the south perimeter of the site.

Specific developed runoff quantities for the site were determined using the Rational Method and are discussed further in section 5.0 of this report.

The open grass-lined channel will then discharge into two sets of existing triple 48" culverts under E. Woodmen Road. Detention pond #1, 96" pipe and open channel are all designed to convey the full 100-year discharge.

No changes to the existing culverts under E. Woodmen Road are proposed. HY-8 software was used to quantify a 765-cfs total capacity of the existing culverts with the culvert headwater at the elevation of the north edge of the roadway pavement.

Specific developed runoff quantities for the site were determined using the Rational Method and are discussed further in section 5.0 of this report.

Peak Discharges at Points of Interest of Falcon Marketplace

Location	Future Conditions, with existing drainage infrastructure + Falcon Marketplace Development (Source: Falcon Marketplace, HEC-HMS model)							
	HEC-HMS Element	Area (sq mi)	Peak Flow (cfs)					
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
West branch at North Property Line of Falcon Marketplace	RMT062	0.29	5	21	34	64	81	99
East branch at North Property Line of Falcon Marketplace	RMT064	0.67	121	273	373	591	712	847
Local Basin	MT060	0.19	30	59	83	137	167	199
Sub Regional Pond SR4 Inflow	-	1.16	133	310	431	697	847	1016
Sub Regional Pond SR4 Outflow	JMT060	1.16	12	52	106	338	481	**644**
Local Basin (Falcon Marketplace)	MT070	0.20	30	57	79	129	157	186
E. Woodmen Road, South Property Line of Falcon Marketplace	JMT070	1.36	32	62	119	398	562	**757**

Per the above table, the 100-year discharge at the south property line is 757-cfs, which is less than the capacity of the existing culverts (765-cfs), and also less than the maximum allowable 100-year discharge (760-cfs) identified by the DBPS.

5.0 UPSTREAM DRAINAGE DIVERSIONS

During the drainage analysis for this Falcon Marketplace project, it came to light that upstream drainage diversions had taken place as part of the Bent Grass subdivision to the north. These diversions were not studied as part of this report, but will need to be addressed with any further development upstream.

6.0 EXISTING CONDITION HYDROLOGY SUMMARY

In addition to the DBPS, in order to confirm the "local basin (Falcon Marketplace)" flows listed above, a site specific analysis of the existing conditions was completed.

The area to the north of the Falcon Marketplace property was not specifically studied as part of this drainage analysis, rather the flows established by the DBPS were used to quantify the volume of flows entering the site from the upstream creek tributaries. See Peak Discharges for the Existing Condition at Points of Interest in vicinity of Falcon Marketplace Development (DBPS) table above.

These existing flows are listed as follows: West Branch RMT062 (Q5=11 cfs and Q100=160 cfs), East Branch RMT064 (Q_5=140 cfs and Q_{100}=580 cfs), and local basin flow to the north MT060 (Q_5=21 cfs and Q_{100}=99 cfs), resulting in a total flow of Q_5=160 cfs and Q_{100}=670 cfs entering the site from the north as part of the Unnamed Tributary of Black Squirrel Creek that runs through the center of the property.

The runoff generated by the following basins was then calculated by the rational method analysis as appropriate for basins less than 100 acres, for the Falcon Marketplace property.

Basin O1 represents 30.5 acres of 5-acre lots to the north of the Courtyards at Woodmen Hills West, northwest of the Falcon Marketplace site. A swale along the northern boundary of the Courtyards at Woodmen Hills West development is proposed to capture runoff from the north. Runoff rates of Q_5=9.6 cfs and Q_{100}=28.3 cfs discharge on to the northwest corner of the Falcon Marketplace site at **Design Point 1**. This flow is to be routed into the proposed pond SR4 in the developed condition.

Basin O2 represents the easterly boundary of the Courtyards at Woodmen Hills West and is currently graded to discharge to the east, onto the Falcon Marketplace site as overland flow. Runoff rates of Q_5=0.7 cfs and Q_{100}=4.9 cfs sheet flow on to the Falcon Marketplace site to the east at **Design Point 2.**

Basin O3 covers the westerly lanes of Meridian Road that discharge into a roadside swale. Runoff rates of Q_5=5.1 cfs and Q_{100}=9.8 cfs travel southerly towards a curb cut. The curb cut discharges into the SE corner of the Falcon Marketplace site at **Design Point 3.**

Basin O4 generates flows along E. Woodmen Road adjacent to the Falcon Marketplace project site from a high point approximately 500 ft to the west. Flows of Q_5=7.2 cfs and Q_{100}=15.8 cfs are generated by this basin and travel easterly via roadside ditch towards the existing triple 48" culverts at **Design Point 4.**

Basin E1 represents the Falcon Marketplace property. Flows of Q_5=7.7 cfs and Q_{100}=46.7 cfs are generated by this basin in its existing condition, and travel towards the center of the property and the unnamed tributary of Black Squirrel Creek, where they combine with flows from the north and continue to the south towards E. Woodmen Road towards **Design Point 5.**

Design Point 5 combines Basins O1-E1, to result in Q_5=20.0 cfs and Q_{100}=70.8 cfs, that combine with flows traveling from the north (DBPS JMT060, Q_5=160 cfs and Q_{100}=670 cfs), resulting in existing flows of Q_5=180 cfs and Q_{100}=740.8 cfs, culminating at the existing triple 48" culverts under E. Woodmen Road. The two sets of existing triple 48" RCP culverts discharge to the south across E. Woodmen Road, into an existing storm sewer system. These flows are consistent with those established by the DBPS.

Basin O5 covers the eastern side of Meridian Road between Eastonville Road and E. Woodmen Road. This area was studied as part of this report due to the proposed turn left turn lane extension required for the Falcon Marketplace development. Flows generated in Meridian Road to the north of Eastonville Road are intercepted by an existing storm system that discharges into a landscaped median/swale where it continues to the south. The flows generated by this Basin O5 (Q_5=2.9 cfs and Q_{100}=6.6 cfs) are not captured by the landscaped median/swale, but sheet flow to the east, off the shoulder and ultimately to the south towards an existing Type D area inlet at **Design Point 6**. Flows from this inlet travel to the west ultimately connecting into the eastern set of 48" culverts that runs under E. Woodmen Road.

7.0 PROPOSED HYDROLOGY (RATIONAL METHOD) & HYDRAULIC SUMMARY

For the purposes of site specific analysis, the project site has been divided into several grouped drainage basins as shown on the proposed drainage plan. In addition, Design Points have been analyzed for sizing of the drainage facilities.

The Rational Method was used to determine runoff quantities for the 5- and 100-year storm recurrence intervals. Urban Drainage UD-Detention, UD-Inlet and UD-Sewer were also used to identify pond and storm system sizing (see appendix for calculations), and below for a summary runoff table.

A-GROUP basins represent flows at the northern portion of the Falcon Marketplace site that will be intercepted by Pond #1, and the public 96" RCP outfall. Flows generated from offsite basins have already been established by the aforementioned DBPS and CLOMR study.

Basin A1 covers the very northeast corner of the Falcon Marketplace site, and the west side of Meridian Road, south of Owl Lane that will ultimately drain onto the property. Flows of Q_5 =3.4 cfs, Q_{100} =7.7 cfs are generated by this basin and travel to the south and west towards **Design Point 1** where they will be intercepted by a proposed public 10' Type R sump inlet. Flows will exit the inlet via public 24" RCP storm sewer to the southwest.

Basin A2 covers the entirety of proposed sub-regional detention facility (SR4). Flows of Q_5 =1.4 cfs, Q_{100} =10.2 cfs generated by this basin are immediately absorbed by the pond volume. **Design Point 2** represents those flows generated by the Falcon Marketplace development reaching the proposed outlet structure of pond SR4.

Basin O1/Design Point O1 covers the 10' swale along the Courtyards at Woodmen Hills West northern boundary that discharges offsite flows (Q_5=10.3 cfs and Q_{100}=30.2 cfs) onto the Falcon Marketplace site. These flows will be directed into Pond SR4 via public 24" RCP slope drain.

Rational Method Runoff Summary

BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
A1	DP1	1.81	3.4	7.7
	DP2	1.81	3.4	7.7
A2		4.82	1.4	10.2
	DP3	6.63	4.6	17.3
B4	DP4	2.35	7.5	14.6
B5		0.63	2.8	5.1
	DP5	2.99	10.0	19.3
B6	DP6	3.19	12.8	23.6
B7		0.46	2.0	3.7
	DP7	6.63	23.8	28.0
B8	DP8	1.04	3.5	6.9
B9		0.30	1.4	2.5
	DP9	1.35	4.9	9.3
B10		0.18	0.8	1.4
	DP10	8.16	29.2	38.1
B11	DP11	2.01	7.8	14.6
B12		0.18	0.8	1.5
	DP12	10.35	36.4	51.9
B13		0.20	0.9	1.6
	DP13	10.55	37.1	53.2
B14	DP14	2.49	9.1	17.0
B15	DP15	5.73	20.3	38.0
B16		0.35	1.6	2.9
	DP16	8.56	30.6	57.1
B17		0.33	1.5	2.7

BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
	DP17	8.89	31.9	59.3
	DP18	19.44	52.1	88.2
B18	DP19	2.18	7.8	15.0
B19	DP20	2.57	10.1	18.8
	DP21	24.19	67.6	117.5
B20	DP22	2.03	5.6	11.4
B21		1.62	0.5	4.0
	DP23	27.85	67.4	121.8
C1	DP24	0.35	1.3	2.6
C2		0.23	0.8	1.5
	DP25	0.59	2.0	3.8
C3		1.88	0.6	4.2
C4		2.19	6.9	13.8
	DP26	4.08	5.4	13.7
C5	DP27	0.64	0.5	1.9
C6		0.45	0.2	1.2
	DP28	5.31	7.4	18.3
C7	DP29	0.19	0.7	1.3
C8		1.14	2.5	5.5
	DP30	1.33	3.1	6.6
C9		3.43	7.3	16.2
D1		2.62	4.1	8.8
D2		0.07	0.3	0.6
D3		0.07	0.3	0.6
	DPO1	32.50	10.3	30.2

B-GROUP basins represent the bulk of the site, with flows generally travelling southwards via curb and gutter, and storm sewer towards Pond #2. Pond #2 has been designed as a 3.5 ac-ft basin, sufficient to detain and release the WQCV generated by the site.

Basin B4 covers proposed lots 3 and 4 at the northeast corner of the Falcon Marketplace site. Flows generated by this basin Q_5 =7.5 cfs, Q_{100} =14.6 cfs are intended to culminate at **Design Point 4** where a proposed private 24" RCP storm sewer stub is provided to allow for storm sewer connection as needed by the future lot developer(s). Design of the internal storm sewer/drainage configuration for lots 3 and 4 will be determined by the individual lot developer(s) at a later date.

Basin B5 covers a portion of the east side of Falcon Market Place adjacent to lots 3 and 4. Flows of Q_5 =2.8 cfs, Q_{100} =5.1 cfs are generated by this basin and will travel to the south towards a proposed public 10' Type R at-grade inlet (**Design Point 5**). Flows exit this proposed in let lB1 to the west via public 24" RCP storm sewer.

Basin B6 covers the northeast corner of lot 2. Flows generated by this basin Q_5 =12.8 cfs, Q_{100} =23.6 cfs are intended to culminate at **Design Point 6** where a proposed private 24" RCP storm sewer stub is provided to allow for storm sewer connection as needed by the

future lot developer. Design of the internal storm sewer/drainage configuration for lot 2 will be determined by the individual lot developer(s) at a later date.

Basin B7 covers a portion of the west side of Falcon Market Place adjacent to lots 3 and 4. Flows of Q_5 =2.0 cfs, Q_{100} =3.7 cfs are generated by this basin and will travel to the south towards a proposed public 10' Type R at-grade inlet IB2.

Design Point 7 represents the combining of flows from Design Points 5 and 6, and runoff captured by proposed inlet IB2. Flows at this point (Q_5 =23.8 cfs, Q_{100} =28.0 cfs) will travel to the south via proposed public 30" RCP storm sewer.

Basin B8 covers proposed lot 5 and a portion of lot 6 at the southeast corner of the Falcon Marketplace site. Flows generated by this basin Q_5=3.5 cfs, Q_{100}=6.9 cfs are intended to culminate at **Design Point 8** where a proposed private 18" RCP storm sewer stub is provided to allow for storm sewer connection as needed by the future lot developer(s). Design of the internal storm sewer/drainage configuration for lots 5 and 6 will be determined by the individual lot developer(s) at a later date.

Basin B9 covers a portion of the east side of Falcon Market Place adjacent to lots 5 and 6. Flows of Q_5 =1.4 cfs, Q_{100} =2.5 cfs are generated by this basin and will travel to the west and south towards a proposed public 10' Type R at-grade inlet IB3 (**Design Point 9**). Flows exit this inlet by public 18" storm sewer to the west.

Basin B10 covers a portion of the west side of Falcon Market Place adjacent lot 2. Flows of Q_5 =0.8 cfs, Q_{100} =1.4 cfs are generated by this basin and will travel to the south towards a proposed public 10' Type R at-grade inlet IB4.

Design Point 10 represents the combining of flows from Design Points 7 and 9, and runoff captured by proposed inlet IB4. Flows at this point (Q_5 =29.2 cfs, Q_{100} =38.1 cfs) will travel to the southwest via proposed public 36" RCP storm sewer.

Basin B11 covers the southeast corner of lot 2. Flows generated by this basin Q_5 =7.8 cfs, Q_{100} =14.6 cfs are intended to culminate at **Design Point 11** where a proposed private 30" RCP storm sewer stub is provided to allow for storm sewer connection as needed by the future lot developer. Design of the internal storm sewer/drainage configuration for lot 2 will be determined by the individual lot developer(s) at a later date.

Basin B12 covers a portion of the north side of Falcon Market Place adjacent lot 2. Flows of Q_5 =0.8 cfs, Q_{100} =1.5 cfs are generated by this basin and will travel to the west towards a proposed low point and public 10' Type R sump inlet IB5 (**Design Point 12**). Flows exiting this inlet will travel to the south via proposed public 36" RCP storm sewer.

Basin B13 covers a portion of the south side of Falcon Market Place adjacent lots 7 and 8. Flows of Q_5 =0.9 cfs, Q_{100} =1.6 cfs are generated by this basin and will travel to the west towards a proposed low point and public 10' Type R sump inlet IB6 (**Design Point 13**). Flows exiting this inlet will travel to the southwest via proposed public 42" RCP storm sewer.

Basin B14 covers the central portion of lot 1. Flows generated by this basin Q_5 =9.1 cfs,

Q_{100} =17.0 cfs are intended to culminate at **Design Point 14** where a proposed private 30" RCP storm sewer stub is provided to allow for storm sewer connection as needed by the future lot developer. Design of the internal storm sewer/drainage configuration for lot 1 will be determined by the individual lot developer at a later date.

A private 24" RCP stub has been provided into proposed manhole MA1 on the 96" outfall from pond SR4, at the northwest corner of lot 2. However, in accordance with El Paso County water quality guidelines, any flow entering this 24" stub, will need to be treated for water quality prior to entering the storm system. Alternatively all flow from this basin may travel via internal storm system to the south, as designed by this drainage report.

Basin B15 covers the western side of lot 2 and a portion of lot 1. Flows generated by this basin Q_5 =20.3 cfs, Q_{100} =38.0 cfs are intended to culminate at **Design Point 15** where a proposed private 30" RCP storm sewer stub is provided to allow for storm sewer connection as needed by the future lot developer. Design of the internal storm sewer/drainage configuration for lots 1 and 2 will be determined by the individual lot developer(s) at a later date.

Basin B16 covers a portion of the north side of Falcon Market Place adjacent lot 1. Flows of Q_5 =1.6 cfs, Q_{100} =2.9 cfs are generated by this basin and will travel to the east towards a proposed public 10' Type R at-grade inlet IB7 and further on to low point and public 10' Type R sump inlet IB8 (**Design Point 16**). Flows exiting this inlet will travel to the south via proposed public 36" RCP storm sewer.

Basin B17 covers a portion of the south side of Falcon Market Place adjacent lots 9 and 10. Flows of Q_5 =1.5 cfs, Q_{100} =2.7 cfs are generated by this basin and will travel to the east towards a proposed low point and public 10' Type R sump inlet IB9 (**Design Point 17**). Flows exiting this inlet will travel to the southeast via proposed public 36" RCP storm sewer.

Design Point 18 represents the combining of flows from Design Points 13 and 17 at proposed manhole MB1. Flows at this point (Q_5 =52.1 cfs, Q_{100} =88.2 cfs) will travel to the south via proposed public 48" RCP storm sewer.

Basin B18/Design Point 19 covers lots 9 and 10. Flows generated by this basin Q_5 =7.8 cfs, Q_{100} =15.0 cfs are intended to enter a proposed private 24" RCP storm sewer stub that has been extended through lot 9 into lot 10. This stub is provided to allow for storm sewer connection as needed by the future lot developer(s). Design of the internal storm sewer/drainage configuration for lots 9 and 10 will be determined by the individual lot developer(s) at a later date.

Basin B19/Design Point 20 covers lots 7 and 8. Flows generated by this basin Q_5 =10.1 cfs, Q_{100} =18.8 cfs are intended to enter a proposed private 24" RCP storm sewer stub that has been extended through lot 8 into lot 7. This stub is provided to allow for storm sewer connection as needed by the future lot developer(s). Design of the internal storm sewer/drainage configuration for lots 7 and 8 will be determined by the individual lot developer(s) at a later date.

Design Point 21 represents the combining of flows from Design Points 18, 19 and 20 at proposed manhole MB2. Flows at this point (Q_5 =67.6 cfs, Q_{100} =117.5 cfs) will travel to the

south towards proposed Pond 2 via proposed public 48" RCP storm sewer.

Basin B20 covers the west side of Meridian Road between Eastonville Road and E. Woodmen Road adjacent to the Falcon Marketplace site. Flows of Q_5 =5.6 cfs, Q_{100} =11.4 cfs are generated by this widening of Meridian Road and will travel to the south towards a proposed curb cut and riprap swale (**Design Point 22**). Flows will exit Meridian Road at this curb cut and travel via riprap lined swale towards the proposed water quality facility pond 2.

Basin B21 covers the entirety of proposed Water Quality Facility Pond 2. Flows of Q_5 =0.5 cfs, Q_{100} =4.0 cfs generated by this basin are immediately absorbed by the pond volume.

Design Point 23 represents those flows Q_5 =67.4 cfs, Q_{100} =121.8 cfs generated by the Falcon Marketplace development reaching the outlet structure of proposed Water Quality Facility Pond 2. See below for further discussion of the Water Quality Facilities.

C-GROUP basins cover the western and southern portions of the site that travel towards Pond #3, along with flows off E. Woodmen Road that will discharge into the open channel.

Basin C1 covers a portion of the east side of the proposed southwest roundabout. Flows of Q_5 =1.3 cfs, Q_{100} =2.6 cfs are generated by this basin and will travel to the south towards a proposed low point and public 5' Type R sump inlet (**Design Point 24**). Flows exiting this inlet will travel to the west via proposed public 18" RCP storm sewer.

Basin C2 covers a portion of the west side of the proposed southwest roundabout. Flows of Q_5 =0.8 cfs, Q_{100} =1.5 cfs are generated by this basin and will travel to the south towards a proposed low point and public 5' Type R sump inlet (**Design Point 25**). Flows exiting this inlet will travel to the west via proposed public 18" RCP storm sewer.

Basin C3 covers an offsite tract along the western boundary of the property. Flows generated by this basin Q_5 =0.6 cfs, Q_{100} =4.2 cfs travel overland to the east.

Basin C4 covers the western portion of lot 1 and lot 11. Flows generated by this basin Q_5 =6.9 cfs, Q_{100} =13.8 cfs are intended to culminate at **Design Point 26** where a proposed private 24" RCP storm sewer stub is provided to allow for storm sewer connection as needed by the future lot developer. Design of the internal storm sewer/drainage configuration for lot 1 and lot 11 will be determined by the individual lot developer at a later date.

Basin C5 covers an offsite tract along the southern boundary of the adjacent Courtyards West property. Flows generated by this basin Q_5 =0.5 cfs, Q_{100} =1.9 cfs travel overland to the east towards a proposed public 18" RCP culvert **Design Point 27,** that will discharge into Pond #3.

Basin C6 covers the entirety of proposed Water Quality Facility Pond 3 and some offsite open tract area to the east. Flows of Q_5 =0.2 cfs, Q_{100} =1.2 cfs generated by this basin are immediately absorbed by the pond volume.

Design Point 28 represents all flow reaching the proposed Water Quality Facility Pond 3.

Basin C7 covers a portion of the south side of the proposed southwest roundabout. Flows of Q_5 =0.7 cfs, Q_{100} =1.3 cfs are generated by this basin and will travel to the west towards a proposed low point and curb cut (**Design Point 29**). Flows exiting this basin will travel to the south and east via swale towards an existing open swale along E. Woodmen Road.

Basin C8 covers an offsite area along the southern boundary of the property and includes a portion of E. Woodmen Road ROW. Flows generated by this basin Q_5 =2.5 cfs, Q_{100} =5.5 cfs travel overland to the east, towards a proposed public 18" RCP storm culvert under the proposed access road (**Design Point 30**)**.**

Basin C9 covers an offsite area along the southern boundary of the property and includes a portion of E. Woodmen Road ROW, and the proposed open channel. Flows generated by this basin Q_5 =7.3 cfs, Q_{100} =16.2 cfs travel overland to the north, and are absorbed in their entirety by the proposed open channel.

D-GROUP basins cover any improvements offsite from the Falcon Marketplace property, namely Meridian Road and Eastonville Road turn lane improvements. As flow from these areas was considered in the design of Regional Pond MN downstream, the flows generated by D-group basins do not need to be treated for water quality before entering the Pond MN facility.

Basin D1 covers a portion of Meridian Road between Eastonville Road and E. Woodmen Road affected by the installation of the proposed left-turn lane access for the Falcon Marketplace development. The existing landscaped median/swale will be replaced by proposed public 24" RCP storm sewer extending between the southern terminus of the culvert at the Eastonville Rd/Meridian Rd intersection and the existing public Type D inlet approximately 600 ft to the south. This Type D inlet will be replaced by a proposed storm sewer manhole since overland flow will no longer be present. Flows generated by this basin will travel overland to the east and south towards an existing public Type D Inlet. The addition of impervious asphalt pavement in this basin results in flows of Q_5 =4.1 cfs, Q_{100} =8.8 cfs reaching the existing Type D. This, compared with the existing flow reaching this point (Q_5 =2.9 cfs, Q_{100} =6.6 cfs) is an increase of Q_5 =1.2 cfs, Q_{100} =2.2 cfs. This is within the capacity of the existing Type D inlet and as such no upgrade is required.

Basin D2 covers a portion of Eastonville Road at the intersection with Meridian Road. A right-turn lane is proposed at this location to accommodate the traffic signal for the Falcon Marketplace development to the west. This increase of 0.07 acres of asphalt pavement results in additional flows of Q_5 =0.3 cfs, Q_{100} =0.6 cfs traveling as curb and gutter flow to the east. This flow is minimal and is not anticipated to impact downstream infrastructure.

Basin D3 covers a portion of Meridian Road south of the intersection with E. Woodmen Road. A left-turn lane extension is proposed at this location to accommodate additional traffic generated by the Falcon Marketplace development to the north. This increase of 0.07 acres of asphalt pavement results in additional flows of Q_5 =0.3 cfs, Q_{100} =0.6 cfs traveling as curb and gutter flow to the south. This flow is minimal and is not anticipated to impact downstream infrastructure.

8.0 PROPOSED DETENTION/WATER QUALITY FACILITIES

As previously mentioned, three separate detention/water quality facilities are proposed with this development:

Pond #1 (DBPS – SR4), a 26.7 ac-ft sub-regional detention facility is proposed along the northern boundary of the project site, to intercept flows from the UTBSC, and release it at a reduced flow rate into the 96" pipe. In accordance with El Paso County criteria, a 12'x8' modified type D outlet structure with a permanent micropool will release the WQCV over a 40-hour period. A gravel maintenance access road will be constructed in to, and around the entire perimeter of the pond. Pond #1 will be owned and maintained by El Paso County.

Two options were considered for the construction of the drop structure into the proposed Pond SR4. A geocell product was considered for both its aesthetics and constructability, however with the consideration of both time, cost and local contractor experience, a grouted riprap structure was determined as the more appropriate option. Inspection of the placement and grouting of the riprap during construction will be required to provide for longevity and functional design.

Pond #2, a proposed 3.5 ac-ft private water-quality basin will intercept the majority of flows generated by the site, south of the proposed sub-regional pond #1. As with pond #1, in accordance with El Paso County criteria, an outlet structure with permanent micropool will release the WQCV over a 40-hour period, to the open channel along E. Woodmen Road. A gravel maintenance access road will be constructed in to, and around the southern perimeter of the pond.

Pond #3, is a small 0.21 ac-ft proposed private water-quality basin intended to intercept the flows generated by the western portion of the site. As with pond #2, in accordance with El Paso County criteria, an outlet structure with permanent micropool will release the WQCV over a 40-hour period. Flows will discharge into the 96" RCP, and ultimately reach the open channel along E. Woodmen Road.

Ponds 2 & 3 are designed as water quality basins, not full extended detention basins. Therefore release of the developed flows may be higher than the predevelopment inflow, as indicated by the UD-Detention spreadsheets in the appendix. The capacity of the open channel downstream has been designed to accommodate these flows while restricting flow discharging the overall site to no greater than historic.

The HEC-HMS study determined that allowable flow generated by the site (B & C-group basins) cannot exceed Q_{100}=113-cfs. This represents the difference between the open channel design flow and discharge from the 96" pipe (757 cfs – 644 cfs = 113 cfs).

From the UD-Detention spreadsheets in the appendix, release rates for Pond 2 (Q_5 =21.7 cfs, Q_{100} =50.2 cfs) and Pond 3 (Q_5 =3.7 cfs, Q_{100} =14.7 cfs) are within the parameters listed above. Flows combine with the 96" outflow (Q_{100} =644 cfs) and offsite contribution from basin C9 (Q_5 =7.3 cfs, Q_{100} =16.2 cfs), to generate 100-year flows of 725 cfs. This flow is within the HEC-HMS design parameters listed above, and less than the historic discharge of 760-cfs, and as such will not negatively impact the downstream facilities.

Private maintenance agreements and O&M manuals will be established for Ponds 2 and 3, prior to Final Plat recording.

9.0 EXISTING CULVERTS AT E. WOODMEN ROAD

HY-8 software was used to analyze the hydraulic performance of the existing culverts. The table below lists the discharge/headwater relationship for the two sets of culverts, and identifies the assumed maximum allowable discharge through each of the two sets of culverts assuming the maximum allowable headwater elevation is equal to the elevation of the edge of roadway asphalt along the north side of E. Woodmen Road.

E. Woodmen Road Culverts, Headwater/Discharge Data

West Set of 3-48" RCP Culverts		East Set of 3-48" RCP Culverts	
Headwater Elevation (ft)	Total Discharge (cfs)	Headwater Elevation (ft)	Total Discharge (cfs)
6871.20	0	6867.80	0
6873.04	50	6869.44	50
6873.88	100	6870.26	100
6874.60	150	6870.95	150
6875.27	200	6871.58	200
6875.96	250	6872.41	250
6876.84	300	6873.01	300
6877.87	350	6873.88	350
6877.99	355	6875.00	400
6878.0*	**355.5***	6875.12	405
6878.59	450	**6875.2***	**408.4***
6878.80	500	6875.78	500

* maximum allowable discharge through each of the two sets of culverts assuming the maximum allowable headwater elevation is equal to the elevation of the edge of roadway asphalt along the north side of E. Woodmen Road.

The proposed grass-lined channel, which parallels the south property line, contains a check dam, located immediately downstream (east) of the westerly set of 3-48" culverts under E. Woodmen Road. The check dam will help to more evenly divide flows between the westerly and easterly sets of 3-48" culverts. The check dam will be constructed of earthen material armored with riprap. The check dam was modeled as an obstruction at CLOMR XS535 with a crest elevation of 6875.9 which was chosen to maximize flow to the westerly set of culverts without exceeding the allowable headwater elevation. The HEC-RAS model results indicate that of the total 100-year discharge = 757 cfs, in the main channel, 351 cfs is diverted to the westerly set of culverts and 406 cfs remain in the main channel. See appendix for supporting information.

10.0 FOUR-STEP PROCESS

In conformance with the Four-Step Process, outlined in the DCM, Volume 2, the site development design is focused on reducing runoff volumes, treating the water quality capture volume, and creating stabilized drainage ways.

Proposed sub-regional pond SR4 (Pond #1), and both onsite water quality facilities (Ponds #2 & #3) will capture and slowly release the WQCV, aiding in water quality treatment.

Construction and stabilization of a grass-lined channel along E. Woodmen Road will also take place, allowing water quality benefits, through infiltration and vegetation pollutant uptake. A proposed grade structure will also reduce channel velocities and assist in preventing bed and bank erosion.

Source control BMP's as outline by step 4 of the four-step process will be determined by the proposed use of the individual lots at the time of development. Future individual lot owners will be required to address all steps of the four-step process, and implement further water quality features/BMPs as necessary.

Those offsite areas represented by **D-GROUP** basins, namely Meridian Road and Eastonville Road turn lane improvements, were considered in the design of Regional Pond MN downstream. As such, the flows generated by D-group basins do not need to be treated for water quality before entering the Pond MN facility.

11.0 GEOTECHNICAL HAZARDS

In accordance with geotechnical recommendations, the project design is intended to direct runoff away from structures, and into the receiving water quality basins. This will be accomplished by a variety of means, i.e. curb and gutter and storm sewer. The individual building pads will be developed by others, and further analysis will need to be addressed in the lot-specific geotechnical reports for those lots.

After consulting with the State of Colorado Dam Safety Branch, it was determined that the design of Pond #1 (SR4) allows for the structure to be considered non-jurisdictional. Given the length of the buried outlet, the downstream toe is to be used as the datum for measuring dam height. However, during construction of the embankment, settlement monitoring plates will be installed. Regular measurements will be recorded, documenting the amount of settlement in the embankment, and when it becomes negligible.

In addition, groundwater mitigation measures for Pond SR4, will consist of installation of a 12-inch thick impervious clay liner, to resolve the potential for vertical groundwater seepage. Liner specifications will be based on the Colorado Department of Natural Resources specifications.

Perimeter drain connections are available at all proposed inlets for future connection of internal perimeter drain systems on individual lots. See construction plan documents for connection details.

12.0 EXISTING ONSITE UTILITY INFRASTRUCTURE

Along the southern site boundary, a number of existing utilities are being considered as part of the final project design. Utility providers have been consulted and communication will continue as the project design progresses. Reference the construction documents for proposed utilities and relocation extents.

Mountain View Electric
An existing overhead transmission line runs along Meridian Road, and continues underground along E. Woodmen Road. These lines, both overhead and underground are proposed to be relocated through the project site, following the proposed main access road.

Woodmen Hills Metropolitan District
An existing 10" sanitary sewer line runs along E. Woodmen Road, and an existing 12" sanitary sewer line runs along Meridian Road, but both are minimally impacted by the project development.

An existing 10" water main, and 6" non-potable raw water main run along the southern boundary of the site. These lines will be relocated along the project main road through the site. Existing lines will be removed when encountered during grading of the open channel.

Nustar Energy
An existing 10" high-pressure petroleum pipeline also runs along the southern boundary of the site. This line will remain in place, and an encroachment agreement has already been filed with Nustar Energy.

13.0 CONDITIONAL LETTER OF MAP REVISION (CLOMR)

As mentioned above, a Conditional Letter of Map Revision (CLOMR) was approved by FEMA (Case No. 17-08-0074R) on May 26, 2017. The CLOMR takes a large portion of the project site out of the floodplain, by constructing the sub-regional detention pond (SR4) and open channel along E. Woodmen Road.

Referenced portions of the CLOMR are included in the appendix.

14.0 DRAINAGE/BRIDGE FEES

Drainage and Bridge Fees

The project lies within the Falcon Drainage Basin, and is previously unplatted. The following fees are required, with the percent imperviousness for this subdivision calculated as follows:

27.7 Acres Commercial	95% Impervious
8.7 Acres Open Space	0% Impervious
Weighted Average	**72.3%** Impervious

36.4 Acres at 72.3% Impervious = 26.3 Impervious Acres

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

Drainage Fees
$29,622 x 26.3 Impervious Ac = $779,058.60*
***Pond Reimbursement**

Bridge Fees
$4,069 x 26.3 Impervious Ac. = $107,014.70

Full reimbursement for construction of the sub-regional detention pond (Pond #1 – SR4) and outfall in accordance with DCM Section 3.3, is anticipated. Construction costs are listed below and the drainage fee is requested to be adjusted accordingly.

15.0 CONSTRUCTION COST ESTIMATE

Item	Qty	Unit	Unit Price	Cost
Public Reimbursable				
26.7 ac-ft Pond SR4	1	EA	$250,000.00	$250,000.00
Clay liner	3200	SY	$2.50	$8,000.00
96" RCP	1060	LF	$700.00	$742,000.00
Box Base Manholes	4	EA	$9,217.00	$36,868.00
96" Head/Wing/Cutoff wall	1	EA	$14,500.00	$14,500.00
24" RCP	623	LF	$78.00	$48,594.00
Type 2 Manholes	3	EA	$5,000.00	$15,000.00
Reimbursable Public facilities subtotal				*$1,114,962.00*
10% Contingency				*$111,496.20*
Reumbursable Public Facilities Estimate Total				**$1,226,458.20**

Public Non-Reimbursable				
5' Type R Inlet	2	EA	$6,000.00	$12,000.00
10' Type R Inlet	10	EA	$8,000.00	$80,000.00
Storm Manhole	2	EA	$5,000.00	$10,000.00
18" RCP	593	LF	$65.00	$38,545.00
24" RCP	329	LF	$78.00	$25,662.00
30" RCP	589	LF	$97.00	$57,133.00
36" RCP	274	LF	$120.00	$32,880.00
42" RCP	107	LF	$160.00	$17,120.00
48" RCP	162	LF	$195.00	$31,590.00
Non-Reimbursable Public facilities subtotal				*$304,930.00*
10% Contingency				*$30,493.00*
Non-Reimbusable Public Facilities Estimate Total				**$335,423.00**

Private Non-Reimbursable				
2.7 ac-ft EDB	1	EA	$75,000.00	$75,000.00
0.20 ac-ft SFB	1	EA	$35,000.00	$35,000.00
Storm Manhole	4	EA	$5,000.00	$20,000.00
18" RCP	258	LF	$65.00	$16,770.00
24" RCP	531	LF	$78.00	$41,418.00
30" RCP	24	LF	$97.00	$2,328.00
Private facilities subtotal				*$190,516.00*
10% Contingency				*$19,051.60*
Private Facilities Estimate Total				**$209,567.60**

Cost Estimate Total	**$1,771,448.80**

16.0 CONCLUSIONS

The Falcon Marketplace project has been designed in accordance with El Paso County criteria. The detention pond and water quality basins have been designed to limit the release of storm runoff to historic flows. This development will not negatively impact the downstream facilities.

A portion of the site will remain in the 100-year floodplain after grading is complete. A LOMR will be submitted to FEMA after construction to revise the FIRM map and remove the majority of the site from the floodplain. Future buildings will not be constructed in the floodplain, or downstream of the Pond SR4 spillway in the potential overtopping inundation area.

17.0 REFERENCES

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs/El Paso County Drainage Criteria Manual, May 2014.

2. Urban Storm Drainage Criteria Manuals, Urban Drainage and Flood Control District. June 2001, Revised April 2008.

3. Request for Conditional Letter of Map Revision, Unnamed Tributary to Black Squirrel Creek, Falcon Marketplace. Prepared by Drexel, Barrell & Co., October 17, 2016.

4. Final Drainage & Erosion Control Plan for The Courtyards at Woodmen Hills West. Prepared by JDS-Hydro, December 1, 2003.

5. Natural Resources Conservation Service (NRCS) Web Soil Survey

6. Federal Emergency Management Agency, Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Map Number 8041CO575F, Effective Date March 17, 1997.

7. EL Paso County Board Resolution No 15-042: El Paso County adoption of Chapter 6 and Section 3.2.1, Chapter 13 of the City of Colorado Springs Drainage Criteria Manual, May 2014.

8. Falcon Drainage Basin Planning Study. Prepared by Matrix Design Group, September 2015.

9. Preliminary Geotechnical Investigation. Prepared by Ground Engineering, August 25, 2015, with Addenda #1, dated March 17, 2017.

10. Colorado Department of Natural Resources – Pond Liner Specifications.

11. PSI Pond Liner Memo, June 23, 2017 and August 8, 2019.

Vicinity Map

Vicinity Map

NTS

FALCON MARKETPLACE
VICINITY MAP

Drexel, Barrell & Co.
Engineers • Surveyors

DATE:	DWG. NO.
8/18/16	VMAP
JOB NO:	SHEET 1 OF 1
20988-00	

Soils Map

Custom Soil Resource Report
Soil Map

MAP LEGEND

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

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

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

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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 13, Sep 22, 2015

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

Date(s) aerial images were photographed: Apr 15, 2011—Sep 22, 2011

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

Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
8	Blakeland loamy sand, 1 to 9 percent slopes	1.2	3.2%
9	Blakeland-Fluvaquentic Haplaquolls	16.3	43.9%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	19.6	52.9%
Totals for Area of Interest		**37.1**	**100.0%**

Map Unit Descriptions

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

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments

on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Blakeland

Setting

Landform: Flats, hills
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Sandy Foothill (R049BY210CO)

Minor Components

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

9—Blakeland-Fluvaquentic Haplaquolls

Map Unit Setting

National map unit symbol: 36b6
Elevation: 3,500 to 5,800 feet
Mean annual precipitation: 13 to 17 inches
Mean annual air temperature: 46 to 55 degrees F
Frost-free period: 110 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 60 percent
Fluvaquentic haplaquolls and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Flats, hills
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose and/or eolian deposits derived from arkose

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A
Ecological site: Sandy Foothill (R049BY210CO)

Description of Fluvaquentic Haplaquolls

Setting
Landform: Swales
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile
H1 - 0 to 12 inches: variable

Properties and qualities
Slope: 1 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 to 24 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)

Interpretive groups
Land capability classification (irrigated): 6w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D

Minor Components

Other soils
Percent of map unit:

Pleasant
Percent of map unit:
Landform: Depressions

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Columbine

Setting

Landform: Fans, flood plains, fan terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Gravelly Foothill (R049BY214CO)

Minor Components

Fluvaquentic haplaquolls

Percent of map unit:
Landform: Swales

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

Floodplain Map

National Flood Hazard Layer FIRMette

FEMA

0 250 500 1,000 1,500 2,000 Feet

1:6,000

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

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

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

OTHER FEATURES
- 20.2 / 17.5 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

N

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 3/20/2019 at 12:31:27 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.

Hydrology Calculations

PROJECT INFORMATION

PROJECT:	Falcon Marketplace
PROJECT NO:	20988-00CSCV
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	4/17/2019

Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
Commercial Development		0.81		0.88	95
5-acre residential		0.20		0.35	20
Open Space		0.08		0.35	0
Asphalt Roadway		[illegible]		[illegible]	100

*C-Values and Basin Imperviousness based on Table 5-1, City of Colorado Springs and El Paso County "Drainage Criteria Manual"

SUB-BASIN	SURFACE DESIGNATION	AREA	COMPOSITE RUNOFF COEFFICIENTS				% IMPERV
		ACRE	**C2**	**C5**	**C10**	**C100**	
O1	Commercial Development	*0.00*		*0.81*		*0.88*	*95*
	5-acre residential	*30.50*		*0.20*		*0.35*	*20*
	Asphalt Roadway	*0.00*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	30.50		0.20		0.35	20
O2	Commercial Development	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*2.06*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*0.00*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	2.06		0.08		0.35	0
O3	Commercial Development	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*0.51*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*1.73*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	2.24		0.71		0.82	77
O4	Commercial Development	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*2.09*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*2.37*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	4.46		0.52		0.67	53
O5	Commercial Development	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*1.13*		*0.08*		*0.35*	*0*
	As, halt Roadwa,	*1.04*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	2.17		0.47		0.64	48
E1	5-acre residential	*5.00*		*0.20*		*0.35*	*20*
	Open Space	*30.70*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*0.00*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	35.70		0.10		0.35	3

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DATE:	6/27/2019

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

EXISTING

SUB-BASIN DATA					INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)				TIME OF CONC. t_c		FINAL t_c
BASIN	DESIGN PT:	C_5	C_{100}	AREA	LENGTH	SLOPE	t_i	LENGTH	SLOPE	VEL.	t_t	COMP.	*MINIMUM*	
				Ac	Ft	%	Min	Ft	%	FPS	Min	t_c	t_c	Min
	(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)*	(11)	(12)	*(13)*	(14)
O1	DP1	0.20	0.35	30.50	1000	2.0	42.2	1800	2.0	2.1	14.3	56.5	*5.0*	56.5
O2	DP2	0.08	0.35	2.06	80	5.0	10.0	0	0.0	0.0	0.0	10.0	*5.0*	10.0
O3	DP3	0.71	0.82	2.24	50	2.0	4.1	1700	2.0	2.1	13.4	17.4	*5.0*	17.4
O4	DP4	0.52	0.67	4.46	50	2.0	6.1	1500	2.0	2.1	11.8	17.9	*5.0*	17.9
E1		0.10	0.35	35.70	200	1.0	26.5	1100	2.0	2.8	6.5	33.0	*5.0*	33.0
	DP5	0.18	0.38	74.96			56.5	1100	2.0	2.8	6.5	63.1	*5.0*	63.1
O5	DP6	0.47	0.64	2.17	50	2.0	6.6	1900	2.0	2.1	14.9	21.5	*5.0*	21.5

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Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

EXISTING RUNOFF 5 YR STORM P1= **1.50**

BASIN (S)	DIRECT RUNOFF								TOTAL RUNOFF			
	DESIGN POINT	AREA	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)	t_c (MIN)	S (C * A)	I (IN/HR)	Q (CFS)
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
DBPS OFFSITE NORTH (JMT060)								160.0				
O1	DP1		30.50	0.20	56.5	6.10	1.58	9.6				
O2	DP2		2.06	0.08	10.0	0.16	4.06	0.7				
O3	DP3		2.24	0.71	17.4	1.60	3.17	5.1				
O4	DP4		4.46	0.52	17.9	2.30	3.12	7.2				
E1			35.70	0.10	33.0	3.46	2.22	7.7				
	DP5		74.96	0.18	63.1	13.62	1.47	20.0				
O5	DP6		2.17	0.47	21.5	1.03	2.84	2.9				
JMT060+DP5 (NOT ROUTED)								180.0				

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Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

EXISTING RUNOFF 100 YR STORM P1= **2.52**

BASIN (S)	DIRECT RUNOFF								TOTAL RUNOFF			
	DESIGN POINT	AREA	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)	t_c (MIN)	S (C * A)	I (IN/HR)	Q (CFS)
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
DBPS OFFSITE NORTH (JMT060)								670.0				
O1	DP1		30.50	0.35	56.5	10.68	2.65	28.3				
O2	DP2		2.06	0.35	10.0	0.72	6.82	4.9				
O3	DP3		2.24	0.82	17.4	1.84	5.32	9.8				
O4	DP4		4.46	0.67	17.9	3.01	5.25	15.8				
E1			35.70	0.35	33.0	12.50	3.73	46.7				
	DP5		74.96	0.38	63.1	28.74	2.46	70.8				
O5	DP6		2.17	0.64	21.5	1.39	4.77	6.6				
JMT60+DP5 (NOT ROUTED)								740.8				

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Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
Commercial Development		0.81		0.88	95
Open Space		0.08		0.35	0
Asphalt Roadway		0.90		0.96	100

*C-Values and Basin Imperviousness based on Table 5-1, City of Colorado Springs and El Paso County "Drainage Criteria Manual"

SUB-BASIN	SURFACE DESIGNATION	sf	AREA ACRE	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	% IMPERV
A1	Commercial Development	0	0.00		0.81		0.88	95
	Open Space	39449	0.91		0.08		0.35	0
	Asphalt Roadway	39255	0.90		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	78704	1.81		0.49		0.65	50
A2	Commercial Development	0	0.00		0.81		0.88	95
	Open Space	210108	4.82		0.08		0.35	0
	Asphalt Roadway	0	0.00		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	210108	4.82		0.08		0.35	0
B4	Commercial Development	82558	1.90		0.81		0.88	95
	Open Space	19878	0.46		0.08		0.35	0
	Asphalt Roadway	0	0.00		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	102436	2.35		0.67		0.78	77
B5	Commercial Development	0	0.00		0.81		0.88	95
	Open Space	1202	0.03		0.08		0.35	0
	Asphalt Roadway	26452	0.61		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	27654	0.63		0.86		0.93	96
B6	Commercial Development	135219	3.10		0.81		0.88	95
	Open Space	3694	0.08		0.08		0.35	0
	Asphalt Roadway	0	0.00		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	138913	3.19		0.79		0.87	92
B7	Commercial Development	0	0.00		0.81		0.88	95
	Open Space	706	0.02		0.08		0.35	0
	Asphalt Roadway	19274	0.44		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	19980	0.46		0.87		0.94	96
B8	Commercial Development	37504	0.86		0.81		0.88	95
	Open Space	7871	0.18		0.08		0.35	0
	Asphalt Roadway	0	0.00		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	45375	1.04		0.68		0.79	79
B9	Commercial Development	0	0.00		0.81		0.88	95
	Open Space	0	0.00		0.08		0.35	0
	Asphalt Roadway	13266	0.30		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	13266	0.30		0.90		0.96	100
B10	Commercial Development	0	0.00		0.81		0.88	95
	Open Space	0	0.00		0.08		0.35	0
	Asphalt Roadway	7648	0.18		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	7648	0.18		0.90		0.96	100

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	C2*	C5*	C10*	C100*	% IMPERV
Commercial Development		0.81		0.88	95
Open Space		0.08		0.35	0
Asphalt Roadway		0.90		0.96	100

*C-Values and Basin Imperviousness based on Table 5-1, City of Colorado Springs and El Paso County "Drainage Criteria Manual"

B11	Commercial Development	82352	1.89		0.81		0.88	95
	Open Space	5276	0.12		0.08		0.35	0
	Asphalt Roadway	0	0.00		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	87628	2.01		0.77		0.85	89
B12	Commercial Development	0	0.00		0.81		0.88	95
	Open Space	0	0.00		0.08		0.35	0
	Asphalt Roadway	7868	0.18		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	7868	0.18		0.90		0.96	100
B13	Commercial Development	0	0.00		0.81		0.88	95
	Open Space	0	0.00		0.08		0.35	0
	Asphalt Roadway	8699	0.20		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	8699	0.20		0.90		0.96	100
B14	Commercial Development	100956	2.32		0.81		0.88	95
	Open Space	7304	0.17		0.08		0.35	0
	Asphalt Roadway	0	0.00		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	108260	2.49		0.76		0.84	89
B15	Commercial Development	230636	5.29		0.81		0.88	95
	Open Space	18865	0.43		0.08		0.35	0
	Asphalt Roadway	0	0.00		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	249501	5.73		0.75		0.84	88
B16	Commercial Development	0	0.00		0.81		0.88	95
	Open Space	0	0.00		0.08		0.35	0
	Asphalt Roadway	15279	0.35		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	15279	0.35		0.90		0.96	100
B17	Commercial Development	0	0.00		0.81		0.88	95
	Open Space	0	0.00		0.08		0.35	0
	Asphalt Roadway	14340	0.33		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	14340	0.33		0.90		0.96	100
B18	Commercial Development	81327	1.87		0.81		0.88	95
	Open Space	13537	0.31		0.08		0.35	0
	Asphalt Roadway	0	0.00		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	94864	2.18		0.71		0.80	81
B19	Commercial Development	106398	2.44		0.81		0.88	95
	O en S ace	5768	0.13		0.08		0.35	0
	Asphalt Roadway	0	0.00		0.90		0.96	100
TOTAL	WEIGHTED AVERAGE	112166	2.57		0.77		0.85	90
B20	Commercial Development	0	0.00		0.81		0.88	95
	Open Space	30159	0.69		0.08		0.35	0

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	C2*	C5*	C10*	C100*	% IMPERV
Commercial Development		0.81		0.88	95
Open Space		0.08		0.35	0
Asphalt Roadway		0.90		0.96	100

*C-Values and Basin Imperviousness based on Table 5-1, City of Colorado Springs and El Paso County "Drainage Criteria Manual"

	Asphalt Roadway	*58407*	*1.34*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*88566*	2.03		0.62		0.75	66
B21	Commercial Development	*0*	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*70589*	*1.62*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*0*	*0.00*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*70589*	1.62		0.08		0.35	0
C1	Commercial Development	*0*	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*2771*	*0.06*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*12632*	*0.29*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*15403*	0.35		0.75		0.85	82
C2	Commercial Development	*0*	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*1886*	*0.04*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*8276*	*0.19*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*10162*	0.23		0.75		0.85	81
C3	Commercial Development	*0*	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*82100*	*1.88*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*0*	*0.00*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*82100*	1.88		0.08		0.35	0
C4	Commercial Development	*71280*	*1.64*		*0.81*		*0.88*	*95*
	Open Space	*24284*	*0.56*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*0*	*0.00*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*95564*	2.19		0.62		0.75	71
C5	Commercial Development	*0*	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*23525*	*0.54*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*4356*	*0.10*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*27881*	*0.64*		0.21		0.45	16
C6	Commercial Development	*0*	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*19540*	*0.45*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*0*	*0.00*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*19540*	0.45		0.08		0.35	0
C7	Commercial Development	*0*	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*1346*	*0.03*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*6971*	*0.16*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*8317*	*0.19*		0.77		0.86	84
C8	Commercial Development	*0*	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*21695*	*0.50*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*27878*	*0.64*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*49573*	1.14		0.54		0.69	56

PROJECT INFORMATION

PROJECT:	Falcon Marketplace
PROJECT NO:	20988-00CSCV
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	4/17/2019

Drexel, Barrell & Co.

	C2*	C5*	C10*	C100*	% IMPERV
Commercial Development		0.81		0.88	95
Open Space		0.08		0.35	0
Asphalt Roadway		0.90		0.96	100

*C-Values and Basin Imperviousness based on Table 5-1, City of Colorado Springs and El Paso County "Drainage Criteria Manual"

C9	Commercial Development	*0*	0.00		0.81		0.88	*95*
	Open Space	*72310*	*1.66*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*77101*	*1.77*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*149411*	3.43		0.50		0.66	52
D1	Commercial Development	*0*	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*49313*	*1.13*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*64809*	*1.49*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*114122*	2.62		0.55		0.70	57
D2	Commercial Development	*0*	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*49313*	*0.00*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*64809*	*0.07*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*114122*	0.07		0.90		0.96	100
D3	Commercial Development	*0*	*0.00*		*0.81*		*0.88*	*95*
	Open Space	*49313*	*0.00*		*0.08*		*0.35*	*0*
	Asphalt Roadway	*64809*	*0.07*		*0.90*		*0.96*	*100*
TOTAL	*WEIGHTED AVERAGE*	*114122*	0.07		0.90		0.96	100

Impervious Coverage

A-group				6.63					13.6
B-group				27.85					81.2
C-group				5.75					37.1

PROJECT INFORMATION

PROJECT: Falcon Marketplace
PROJECT NO: 20988-00CSCV
DESIGN BY: KGV
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Final
DATE: 4/17/2019

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED TIME OF CONCENTRATION STANDARD FORM SF-2

SUB-BASIN DATA				INITIAL/OVERLAND TIME (t_i)							TIME OF CONC. t_c		FINAL t_c	
BASIN	DESIGN PT:	C_5	C_{100}	AREA	LENGTH	SLOPE	t_i	LENGTH	SLOPE	VEL.	t_t	COMP.	*MINIMUM*	
				Ac	Ft	%	Min	Ft	%	FPS	Min	t_c	t_c	Min
	(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)*	(11)	(12)	*(13)*	(14)
A1	DP1	0.49	0.65	1.81	100	2.0	9.1	750	2.0	5.8	2.2	11.2	*5.0*	11.2
A2		0.08	0.35	4.82	100	25.0	6.5	900	0.5	2.2	6.8	13.3	*5.0*	13.3
	DP3	0.19	0.43	6.63			13.3				0.0	13.3	*5.0*	13.3
B4	DP4	0.67	0.78	2.35	50	2.0	4.5	600	1.8	5.5	1.8	6.3	*5.0*	6.3
B5		0.86	0.93	0.63	50	2.0	2.5	650	1.5	4.8	2.3	4.7	*5.0*	5.0
	DP5	0.71	0.81	2.99			6.3	20	1.0	4.3	0.1	6.4	*5.0*	6.4
B6	DP6	0.79	0.87	3.19	100	25.0	2.0	500	1.0	4.3	1.9	3.9	*5.0*	5.0
B7		0.87	0.94	0.46	50	2.0	2.4	300	1.5	4.8	1.0	3.4	*5.0*	5.0
	DP7	0.76	0.53	6.63			6.4	52	1.9	8.4	0.1	6.5	*5.0*	6.5
B8	DP8	0.68	0.79	1.04	50	2.0	4.4	300	1.5	4.8	1.0	5.4	*5.0*	5.4
B9		0.90	0.96	0.30	20	2.0	1.3	300	1.0	4.3	1.2	2.5	*5.0*	5.0
	DP9	0.73	0.83	1.35			5.4	20	1.0	4.3	0.1	5.5	*5.0*	5.5
B10		0.90	0.96	0.18	20	2.0	1.3	210	1.5	5.3	0.7	2.0	*5.0*	5.0
	DP10	0.76	0.59	8.16			6.5	280	1.0	6.8	0.0	6.5	*5.0*	6.5
B11	DP11	0.77	0.85	2.01	20	2.0	2.2	350	2.5	5.8	1.0	3.2	*5.0*	5.0
B12		0.90	0.96	0.18	20	2.0	1.3	210	1.5	4.3	0.8	2.1	*5.0*	5.0
	DP12	0.76	0.65	10.35			6.5	219	1.0	8.4	0.4	7.0	*5.0*	7.0

B13		0.90	0.96	0.20	20	2.0	1.3	250	1.5	4.3	1.0	2.3	5.0	5.0
	DP13	0.76	0.65	10.55			7.0	50	1.0	8.4	0.1	7.1	5.0	7.1
B14	DP14	0.76	0.84	2.49	100	25.0	2.2	950	1.0	4.1	3.9	6.0	5.0	6.0
B15	DP15	0.75	0.84	5.73	100	25.0	2.2	1080	1.0	4.1	4.4	6.6	5.0	6.6
B16		0.90	0.96	0.35	20	2.0	1.3	500	1.5	5.3	1.6	2.9	5.0	5.0
	DP16	0.76	0.85	8.56			6.6	20	1.0	7.4	0.0	6.6	5.0	6.6
B17		0.90	0.96	0.33	20	2.0	1.3	480	1.5	5.3	1.5	2.8	5.0	5.0
	DP17	0.77	0.85	8.89			6.6	50	1.0	8.4	0.1	6.7	5.0	6.7
	DP18	0.58	0.58	19.44			6.7	52	1.0	8.5	0.1	6.8	5.0	6.8
B18	DP19	0.71	0.80	2.18	20	2.0	2.6	300	1.5	4.3	1.2	3.8	5.0	5.0
B19	DP20	0.77	0.85	2.57	20	2.0	2.2	420	1.5	4.3	1.6	3.8	5.0	5.0
	DP21	0.61	0.63	24.19			6.8	141	0.8	8.5	0.3	7.1	5.0	7.1
B20	DP22	0.62	0.75	2.03	50	2.0	5.0	900	2.2	5.4	2.8	7.8	5.0	7.8
B21		0.08	0.35	1.62	80	33.0	5.3	520	0.1	2.2	3.9	9.3	5.0	9.3
	DP23	0.58	0.62	27.85			9.3				0.0	9.3	5.0	9.3
C1	DP24	0.75	0.85	0.35	50	1.0	4.6	150	1.0	5.2	0.5	5.1	5.0	5.1
C2		0.75	0.85	0.23	100	1.0	6.6	170	1.0	4.3	0.7	7.2	5.0	7.2
	DP25	0.75	0.85	0.59			7.2					7.2	5.0	7.2
C3		0.08	0.35	1.88	100	4.0	12.0				0.0	12.0	5.0	12.0
C4		0.62	0.75	2.19	100	25.0	3.0	765	2.0	5.8	2.2	5.2	5.0	5.2
	DP26	0.37	0.56	4.08			12.0	550	2.0	5.8	1.6	13.6	5.0	13.6
C5	DP27	0.21	0.45	0.64	100	5.0	9.8	295	1.0	4.3	1.1	10.9	5.0	10.9
C6		0.08	0.35	0.45	50	5.0	7.9	120	5.0	8.4	0.2	8.1	5.0	8.1
	DP28	0.39	0.58	5.31			13.6	100	1.0	5.9	0.3	13.9	5.0	13.9
C7	DP29	0.77	0.86	0.19	100	1.0	6.2	150	1.0	4.3	0.6	6.8	5.0	6.8
C8		0.54	0.69	1.14	100	2.0	8.3	325	1.0	4.3	1.3	9.6	5.0	9.6
	DP30	0.57	0.72	1.33			9.6				0.0	9.6	5.0	9.6
C9		0.50	0.66	3.43	100	2.0	8.9	50	33.0	11.0	0.1	8.9	5.0	8.9
D1		0.55	0.70	2.62	50	2.0	5.8	1900	2.0	2.1	15.1	20.9	5.0	20.9
D2		0.90	0.96	0.07	20	2.0	1.3	200	2.0	2.1	1.6	2.9	5.0	5.0
D3		0.90	0.96	0.07	10	2.0	0.9	350	2.0	2.1	2.8	3.7	5.0	5.0

PROJECT INFORMATION

PROJECT:	Falcon Marketplace
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REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Final
DATE:	4/17/2019

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

DEVELOPED RUNOFF 5 YR STORM P1= **1.50**

BASIN (S)	DIRECT RUNOFF							TOTAL RUNOFF			
	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)	t_c (MIN)	S (C * A)	I (IN/HR)	Q (CFS)
	(2)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A1	DP1	1.81	0.49	11.2	0.88	3.87	3.4				
A2		4.82	0.08	13.3	0.39	3.59	1.4				
	DP3	6.63	0.19	13.3	1.27	3.59	4.6				
B4	DP4	2.35	0.67	6.3	1.57	4.75	7.5				
B5		0.63	0.86	5.0	0.55	5.09	2.8				
	DP5	2.99	0.71	6.4	2.12	4.74	10.0				
B6	DP6	3.19	0.79	5.0	2.52	5.09	12.8				
B7		0.46	0.87	5.0	0.40	5.09	2.0				
	DP7	6.63	0.76	6.5	5.04	4.71	23.8				
B8	DP8	1.04	0.68	5.4	0.71	4.98	3.5				
B9		0.30	0.90	5.0	0.27	5.09	1.4				
	DP9	1.35	0.73	5.5	0.99	4.96	4.9				
B10		0.18	0.90	5.0	0.16	5.09	0.8				
	DP10	8.16	0.76	6.5	6.19	4.71	29.2				
B11	DP11	2.01	0.77	5.0	1.54	5.09	7.8				
B12		0.18	0.90	5.0	0.16	5.09	0.8				

	DP12	10.35	0.76	7.0	7.89	4.62	36.4				
B13		0.20	0.90	5.0	0.18	5.09	0.9				
	DP13	10.55	0.76	7.1	8.07	4.60	37.1				
B14	DP14	2.49	0.76	6.0	1.89	4.83	9.1				
B15	DP15	5.73	0.75	6.6	4.32	4.70	20.3				
B16		0.35	0.90	5.0	0.32	5.09	1.6				
	DP16	8.56	0.76	6.6	6.53	4.69	30.6				
B17		0.33	0.90	5.0	0.30	5.09	1.5				
	DP17	8.89	0.77	6.7	6.83	4.67	31.9				
	DP18	19.44	0.58	6.8	11.21	4.64	52.1				
B18	DP19	2.18	0.71	5.0	1.54	5.09	7.8				
B19	DP20	2.57	0.77	5.0	1.99	5.09	10.1				
	DP21	24.19	0.61	7.1	14.73	4.59	67.6				
B20	DP22	2.03	0.62	7.8	1.26	4.45	5.6				
B21		1.62	0.08	9.3	0.13	4.18	0.5				
POND 2	DP23	27.85	0.58	9.3	16.13	4.18	67.4				
C1	DP24	0.35	0.75	5.1	0.27	5.07	1.3				
C2		0.23	0.75	7.2	0.17	4.56	0.8				
	DP25	0.59	0.75	7.2	0.44	4.56	2.0				
C3		1.88	0.08	12.0	0.15	3.76	0.6				
C4		2.19	0.62	5.2	1.37	5.02	6.9				
	DP26	4.08	0.37	13.6	1.52	3.56	5.4				
C5	DP27	0.64	0.21	10.9	0.13	3.92	0.5				
C6		0.45	0.08	8.1	0.04	4.38	0.2				
POND 3	DP28	5.31	0.39	13.9	2.09	3.53	7.4				
C7	DP29	0.19	0.77	6.8	0.15	4.65	0.7				
C8		1.14	0.54	9.6	0.62	4.13	2.5				
	DP30	1.33	0.57	9.6	0.76	4.13	3.1				
C9		3.43	0.50	8.9	1.73	4.24	7.3				
D1		2.62	0.55	20.9	1.43	2.88	4.1				
D2		0.07	0.90	5.0	0.06	5.09	0.3				
D3		0.07	0.90	5.0	0.07	5.09	0.3				

PROJECT INFORMATION

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Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

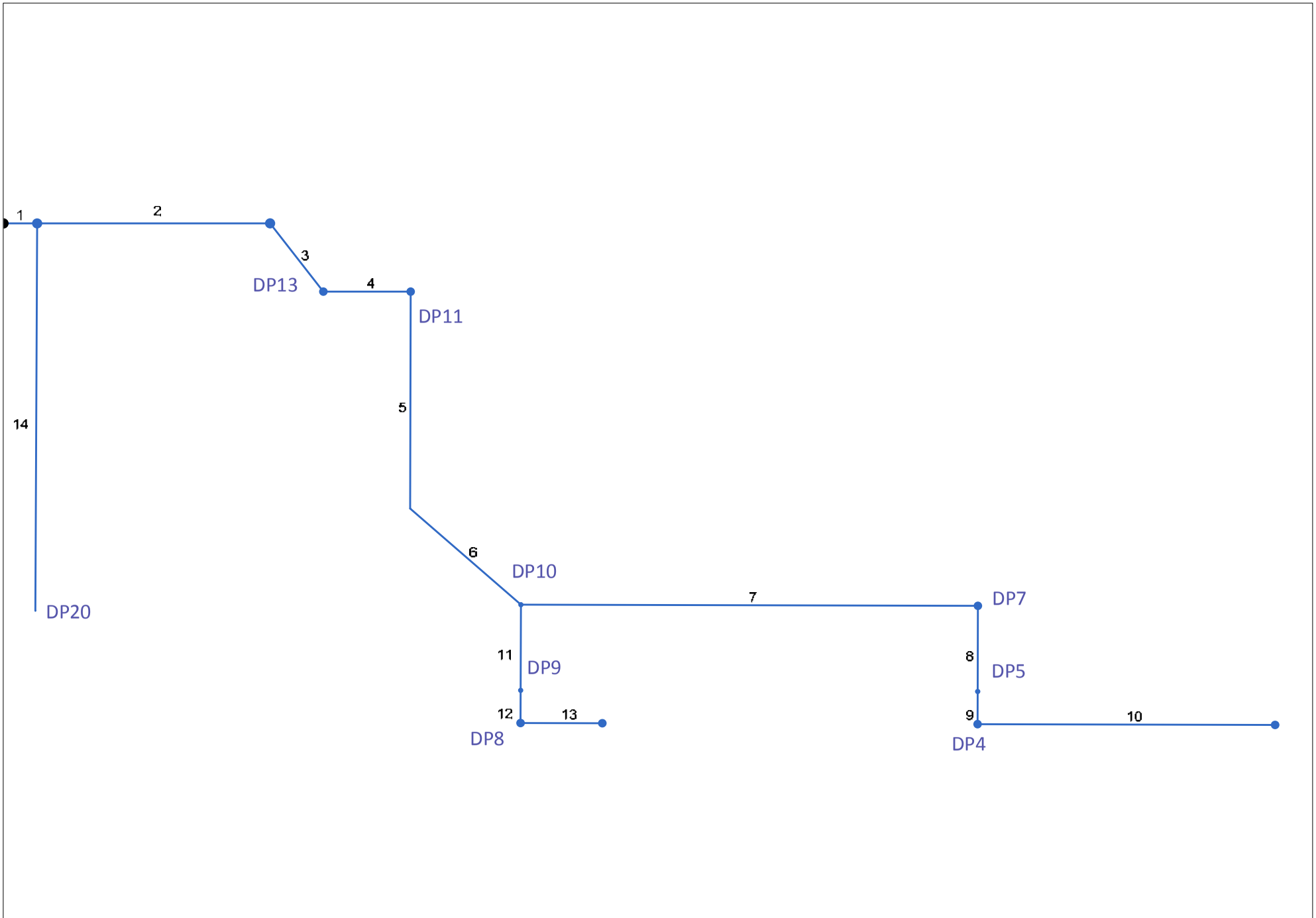
DEVELOPED RUNOFF 5 YR STORM P1= **2.52**

BASIN (S)	DIRECT RUNOFF							TOTAL RUNOFF			
	DESIGN POINT	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C * A	I (IN/HR)	Q (CFS)	t_c (MIN)	S (C * A)	I (IN/HR)	Q (CFS)
	(2)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
A1	DP1	1.81	0.65	11.2	1.18	6.51	7.7				
A2		4.82	0.35	13.3	1.69	6.04	10.2				
	DP3	6.63	0.43	13.3	2.87	6.04	17.3				
B4	DP4	2.35	0.78	6.3	1.83	7.99	14.6				
B5		0.63	0.93	5.0	0.59	8.55	5.1				
	DP5	2.99	0.81	6.4	2.42	7.96	19.3				
B6	DP6	3.19	0.87	5.0	2.76	8.55	23.6				
B7		0.46	0.94	5.0	0.43	8.55	3.7				
	DP7	6.63	0.53	6.5	3.53	7.92	28.0				
B8	DP8	1.04	0.79	5.4	0.82	8.37	6.9				
B9		0.30	0.96	5.0	0.29	8.55	2.5				
	DP9	1.35	0.83	5.5	1.11	8.33	9.3				
B10		0.18	0.96	5.0	0.17	8.55	1.4				
	DP10	8.16	0.59	6.5	4.81	7.92	38.1				
B11	DP11	2.01	0.85	5.0	1.71	8.55	14.6				
B12		0.18	0.96	5.0	0.17	8.55	1.5				

	DP12	10.35	0.65	7.0	6.69	7.76	51.9				
B13		0.20	0.96	5.0	0.19	8.55	1.6				
	DP13	10.55	0.65	7.1	6.88	7.72	53.2				
B14	DP14	2.49	0.84	6.0	2.10	8.11	17.0				
B15	DP15	5.73	0.84	6.6	4.81	7.89	38.0				
B16		0.35	0.96	5.0	0.34	8.55	2.9				
	DP16	8.56	0.85	6.6	7.25	7.88	57.1				
B17		0.33	0.96	5.0	0.32	8.55	2.7				
	DP17	8.89	0.85	6.7	7.56	7.84	59.3				
	DP18	19.44	0.58	6.8	11.30	7.80	88.2				
B18	DP19	2.18	0.80	5.0	1.75	8.55	15.0				
B19	DP20	2.57	0.85	5.0	2.20	8.55	18.8				
	DP21	24.19	0.63	7.1	15.25	7.70	117.5				
B20	DP22	2.03	0.75	7.8	1.53	7.47	11.4				
B21		1.62	0.35	9.3	0.57	7.02	4.0				
POND 2	DP23	27.85	0.62	9.3	17.34	7.02	121.8				
C1	DP24	0.35	0.85	5.1	0.30	8.51	2.6				
C2		0.23	0.85	7.2	0.20	7.66	1.5				
	DP25	0.59	0.85	7.2	0.50	7.66	3.8				
C3		1.88	0.35	12.0	0.66	6.32	4.2				
C4		2.19	0.75	5.2	1.64	8.44	13.8				
	DP26	4.08	0.56	13.6	2.29	5.99	13.7				
C5	DP27	0.64	0.45	10.9	0.29	6.59	1.9				
C6		0.45	0.35	8.1	0.16	7.37	1.2				
POND 3	DP28	5.31	0.58	13.9	3.08	5.93	18.3				
C7	DP29	0.19	0.86	6.8	0.16	7.82	1.3				
C8		1.14	0.69	9.6	0.79	6.94	5.5				
	DP30	1.33	0.72	9.6	0.95	6.94	6.6				
C9		3.43	0.66	8.9	2.28	7.12	16.2				
D1		2.62	0.70	20.9	1.82	4.84	8.8				
D2		0.07	0.96	5.0	0.07	8.55	0.6				
D3		0.07	0.96	5.0	0.07	8.55	0.6				

Hydraulic Calculations

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: 7-17-19-E.stm	Number of lines: 14	Date: 7/18/2019

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	1	117.5	48	Cir	20.392	6873.12	6873.37	1.226	6877.12	6877.31	1.37	6878.68	End	Manhole
2	2	88.20	48	Cir	141.000	6873.37	6875.05	1.191	6878.68*	6879.48*	0.63	6880.11	1	Manhole
3	3	53.20	42	Cir	52.474	6875.55	6876.21	1.258	6880.11*	6880.33*	0.39	6880.72	2	Manhole
4	4	46.10	36	Cir	52.840	6876.71	6877.40	1.306	6880.72*	6881.11*	0.66	6881.77	3	Manhole
5	5	38.10	36	Cir	131.712	6877.40	6879.11	1.298	6881.77*	6882.42*	0.36	6882.78	4	None
6	6	38.10	36	Cir	88.875	6879.11	6880.27	1.305	6882.78	6883.18	0.36	6883.54	5	Manhole
7	7	27.40	30	Cir	276.548	6880.77	6884.39	1.309	6883.54	6886.17	n/a	6886.17 j	6	Manhole
8	8	19.70	24	Cir	52.000	6884.89	6885.89	1.923	6886.21	6887.48	0.13	6887.48	7	Manhole
9	9	14.60	24	Cir	19.830	6885.89	6886.09	1.007	6887.48	6887.47	n/a	6887.47	8	Manhole
10	10	7.00	18	Cir	180.053	6886.59	6888.39	1.000	6887.62	6889.42	0.45	6889.88	9	Manhole
11	11	9.30	18	Cir	52.000	6881.80	6882.58	1.501	6883.54*	6884.16*	0.06	6884.23	6	Manhole
12	12	6.90	18	Cir	19.830	6882.58	6882.73	0.756	6884.23*	6884.36*	0.24	6884.59	11	Manhole
13	13	3.00	18	Cir	49.478	6882.73	6883.22	0.991	6884.59	6884.65	0.05	6884.69	12	Manhole
14	17	11.40	24	Cir	235.000	6875.37	6877.13	0.749	6878.68*	6879.58*	0.20	6879.79	1	None

Project File: 8-27-19-E.stm | Number of lines: 14 | Run Date: 9/11/2019

NOTES: Known Qs only ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

MyReport

Line No.	Area Dn (sqft)	Area Up (sqft)	Byp Ln No	Coeff C1 (C)	Coeff C2 (C)	Coeff C3 (C)	Capac Full (cfs)	Crit Depth (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Curb Len (ft)	Defl Ang (Deg)	Depth Dn (ft)	Depth Up (ft)	DnStm Ln No	Drng Area (ac)	Easting X (ft)	EGL Dn (ft)	EGL Up (ft)	Energy Loss (ft)
1	12.56	12.53	n/a	0.20	0.50	0.90	129.23	3.26	....	....	....	0.000	4.00	3.94	Outfall	0.00	9442.73	6878.48	6878.68	0.197
2	12.56	12.57	n/a	0.20	0.50	0.90	127.39	2.84	....	....	....	-0.010	4.00	4.00	1	0.00	9583.73	6879.44	6880.25	0.805
3	9.62	9.62	n/a	0.20	0.50	0.90	91.69	2.28	....	....	....	52.148	3.50	3.50	2	0.00	9615.94	6880.59	6880.81	0.222
4	7.07	7.07	n/a	0.20	0.50	0.90	61.92	2.21	....	....	....	-52.099	3.00	3.00	3	0.00	9668.78	6881.38	6881.77	0.383
5	7.07	7.07	n/a	0.20	0.50	0.90	61.74	2.01	....	....	....	90.107	3.00	3.00	4	0.00	9668.44	6882.22	6882.87	0.651
6	7.07	7.01	n/a	0.20	0.50	0.90	61.91	2.01	....	....	....	-49.111	3.00	2.91	5	0.00	9735.48	6883.23	6883.64	0.413
7	3.75	3.75	n/a	0.20	0.50	0.90	38.12	1.78	....	....	....	-40.889	2.50	1.78**	6	0.00	10012.03	6884.03	6887.01	2.206
8	2.20	2.68	n/a	0.20	0.50	0.90	25.48	1.59	....	....	....	89.985	1.32	1.59**	7	0.00	10011.91	6887.05	6888.32	0.000
9	2.30	2.30	n/a	0.20	0.50	0.90	18.44	1.38	....	....	....	0.004	1.59	1.38**	8	0.00	10011.86	6888.11	6888.09	0.000
10	1.30	1.30	n/a	0.20	0.50	0.90	8.53	1.02	....	....	....	-89.989	1.03	1.03	9	0.00	10191.92	6888.08	6889.88	1.800
11	1.77	1.77	n/a	0.20	0.50	0.90	10.45	1.18	....	....	....	49.125	1.50	1.50	6	0.00	9735.34	6883.97	6884.59	0.618
12	1.77	1.77	n/a	0.20	0.50	0.90	7.42	1.02	....	....	....	0.001	1.50	1.50	11	0.00	9735.28	6884.46	6884.59	0.130
13	1.77	1.74	n/a	0.20	0.50	0.90	8.49	0.66	....	....	....	-90.015	1.50	1.43	12	0.00	9784.76	6884.64	6884.69	0.057
14	3.14	3.14	n/a	0.20	0.50	0.90	15.90	1.21	....	....	....	90.257	2.00	2.00	1	0.00	9441.68	6878.88	6879.79	0.905

Project File: 8-27-19-E.stm | Number of lines: 14 | Date: 9/11/2019

NOTES: ** Critical depth

MyReport

Flow Rate (cfs)	Sf Ave (ft/ft)	Sf Dn (ft/ft)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Gutter Depth (ft)	Gutter Slope (ft/ft)	Gutter Spread (ft)	Gutter Width (ft)	HGL Dn (ft)	HGL Up (ft)	HGL Jnct (ft)	HGL Jmp Dn (ft)	HGL Jmp Up (ft)	Incr CxA	Incr Q (cfs)	Inlet Depth (ft)	Inlet Eff (%)
117.50	0.966	1.014	....	....	....	6877.12	6882.04	....	....	....	....	6877.12	6877.31	6878.68	....	....	0.00	17.90	....	....
88.20	0.571	0.571	....	....	....	6882.04	6883.69	....	....	....	....	6878.68	6879.48	6880.11	....	....	0.00	35.00	....	....
53.20	0.424	0.424	....	....	....	6883.69	6883.26	....	....	....	....	6880.11	6880.33	6880.72	....	....	0.00	7.10	....	....
46.10	0.724	0.724	....	....	....	6883.26	6883.26	....	....	....	....	6880.72	6881.11	6881.77	....	....	0.00	8.00	....	....
38.10	0.494	0.495	....	....	....	6883.26	6884.63	....	....	....	....	6881.77	6882.42	6882.78	....	....	0.00	0.00	....	....
38.10	0.465	0.495	....	....	....	6884.63	6886.46	....	....	....	....	6882.78	6883.18	6883.54	....	....	0.00	1.40	....	....
27.40	0.798	0.676	....	....	....	6886.46	6890.14	....	....	....	....	6883.54	6886.17 j	6886.17	6883.96	6883.56	0.00	7.70	....	....
19.70	0.000	0.000	....	....	....	6890.14	6890.14	....	....	....	....	6886.21	6887.48	6887.48	....	....	0.00	5.10	....	....
14.60	0.000	0.000	....	....	....	6890.14	6890.62	....	....	....	....	6887.48	6887.47	6887.47	....	....	0.00	7.60	....	....
7.00	1.000	0.999	....	....	....	6890.62	6893.43	....	....	....	....	6887.62	6889.42	6889.88	....	....	0.00	7.00	....	....
9.30	1.188	1.189	....	....	....	6886.46	6886.46	....	....	....	....	6883.54	6884.16	6884.23	....	....	0.00	2.40	....	....
6.90	0.654	0.654	....	....	....	6886.46	6886.74	....	....	....	....	6884.23	6884.36	6884.59	....	....	0.00	3.90	....	....
3.00	0.115	0.124	....	....	....	6886.74	6887.40	....	....	....	....	6884.59	6884.65	6884.69	....	....	0.00	3.00	....	....
11.40	0.385	0.385	....	....	....	6882.04	6882.04	....	....	....	....	6878.68	6879.58	6879.79	....	....	0.00	11.40	....	....

Project File: 8-27-19-E.stm | Number of lines: 14 | Date: 9/11/2019

NOTES: ** Critical depth

MyReport

Inlet ID	Inlet Loc	(ft)	Inlet Time (min)	i Sys (in/hr)	i Inlet (in/hr)	Invert Dn (ft)	Invert Up (ft)	Jump Loc (ft)	Jump Len (ft)	Vel Hd Jmp Dn (ft)	Vel Hd Jmp Up (ft)	J-Loss Coeff	Junct Type	Known Q (cfs)	Cost RCP	Cost CMP	Cost PVC	Line ID
MB2	Sag		0.0	0.00	0.00	6873.12	6873.37	....	....	0.00	0.00	1.00	MH	17.90	1,385	1,247	1,177	1
MB1	Sag		0.0	0.00	0.00	6873.37	6875.05	....	....	0.00	0.00	0.82	MH	35.00	10,715	9,644	9,108	2
IB6	Sag		0.0	0.00	0.00	6875.55	6876.21	....	....	0.00	0.00	0.82	MH	7.10	3,406	3,065	2,895	3
IB5	Sag		0.0	0.00	0.00	6876.71	6877.40	....	....	0.00	0.00	1.00	MH	8.00	3,186	2,867	2,708	4
NB3	Sag		0.0	0.00	0.00	6877.40	6879.11	....	....	0.00	0.00	0.79	None	0.00	6,958	6,262	5,914	5
IB4	Sag		0.0	0.00	0.00	6879.11	6880.27	....	....	0.00	0.00	0.79	MH	1.40	4,932	4,439	4,192	6
IB2	Sag		0.0	0.00	0.00	6880.77	6884.39	82.96	10.51	0.60	1.11	1.00 z	MH	7.70	13,392	12,053	11,383	7
IB1	Sag		0.0	0.00	0.00	6884.89	6885.89	....	....	0.00	0.00	0.15 z	MH	5.10	2,408	2,167	2,047	8
MB3	Sag		0.0	0.00	0.00	6885.89	6886.09	....	....	0.00	0.00	1.00 z	MH	7.60	978	880	831	9
MB4	Sag		0.0	0.00	0.00	6886.59	6888.39	....	....	0.00	0.00	1.00	MH	7.00	7,320	6,588	6,222	10
IB3	Sag		0.0	0.00	0.00	6881.80	6882.58	....	....	0.00	0.00	0.15	MH	2.40	2,112	1,901	1,795	11
MB5	Sag		0.0	0.00	0.00	6882.58	6882.73	....	....	0.00	0.00	1.00	MH	3.90	756	680	643	12
MB6	Sag		0.0	0.00	0.00	6882.73	6883.22	....	....	0.00	0.00	1.00	MH	3.00	2,080	1,872	1,768	13
Null Structure	On Grade		0.0	0.00	0.00	6875.37	6877.13	....	....	0.00	0.00	1.00	None	11.40	11,172	10,055	9,496	17

Project File: 8-27-19-E.stm | Number of lines: 14 | Date: 9/11/2019

NOTES: Known Qs only. ; ** Critical depth

MyReport

Line Length (ft)	Line Size (in)	Line Slope (%)	Line Type	Local Depr (in)	n-val Gutter	n-val Pipe	Minor Loss (ft)	Northing Y (ft)	Pipe Travel (min)	Q Byp (cfs)	Q Capt (cfs)	Q Carry (cfs)	Line Rise (in)	Runoff Coeff (C)	Line Span (in)	Area A1 (ac)	Area A2 (ac)	Area A3 (ac)	Tc (min)	Throat Ht (in)	Total Area (ac)	Total CxA
20.392	48	1.23	Cir	....	....	0.016	1.37	15185.05	0.04	....	....	....	48	0.00	48	0.00	0.00	0.00	3.1	....	0.00	0.00
141.000	48	1.19	Cir	....	....	0.016	0.63	15185.08	0.33	....	....	....	48	0.00	48	0.00	0.00	0.00	2.8	....	0.00	0.00
52.474	42	1.26	Cir	....	....	0.016	0.39	15143.65	0.16	....	....	....	42	0.00	42	0.00	0.00	0.00	2.6	....	0.00	0.00
52.840	36	1.31	Cir	....	....	0.016	0.66	15143.61	0.14	....	....	....	36	0.00	36	0.00	0.00	0.00	2.5	....	0.00	0.00
131.712	36	1.30	Cir	....	....	0.016	0.36	15011.90	0.41	....	....	....	36	0.00	36	0.00	0.00	0.00	2.1	....	0.00	0.00
88.875	36	1.31	Cir	....	....	0.016	0.36	14953.55	0.27	....	....	....	36	0.00	36	0.00	0.00	0.00	1.8	....	0.00	0.00
276.548	30	1.31	Cir	....	....	0.016	n/a	14952.85	0.83	....	....	....	30	0.00	30	0.00	0.00	0.00	1.0	....	0.00	0.00
52.000	24	1.92	Cir	....	....	0.016	0.13	14900.85	0.14	....	....	....	24	0.00	24	0.00	0.00	0.00	0.8	....	0.00	0.00
19.830	24	1.01	Cir	....	....	0.016	n/a	14881.02	0.07	....	....	....	24	0.00	24	0.00	0.00	0.00	0.8	....	0.00	0.00
180.053	18	1.00	Cir	....	....	0.016	0.45	14880.57	0.76	....	....	....	18	0.00	18	0.00	0.00	0.00	0.0	....	0.00	0.00
52.000	18	1.50	Cir	....	....	0.016	0.06	14901.55	0.16	....	....	....	18	0.00	18	0.00	0.00	0.00	0.6	....	0.00	0.00
19.830	18	0.76	Cir	....	....	0.016	0.24	14881.73	0.08	....	....	....	18	0.00	18	0.00	0.00	0.00	0.5	....	0.00	0.00
49.478	18	0.99	Cir	....	....	0.016	0.05	14881.60	0.49	....	....	....	18	0.00	18	0.00	0.00	0.00	0.0	....	0.00	0.00
235.000	24	0.75	Cir	....	....	0.016	0.20	14950.06	1.08	....	....	....	24	0.00	24	0.00	0.00	0.00	0.0	....	0.00	0.00

Project File: 8-27-19-E.stm | Number of lines: 14 | Date: 9/11/2019

NOTES: ** Critical depth

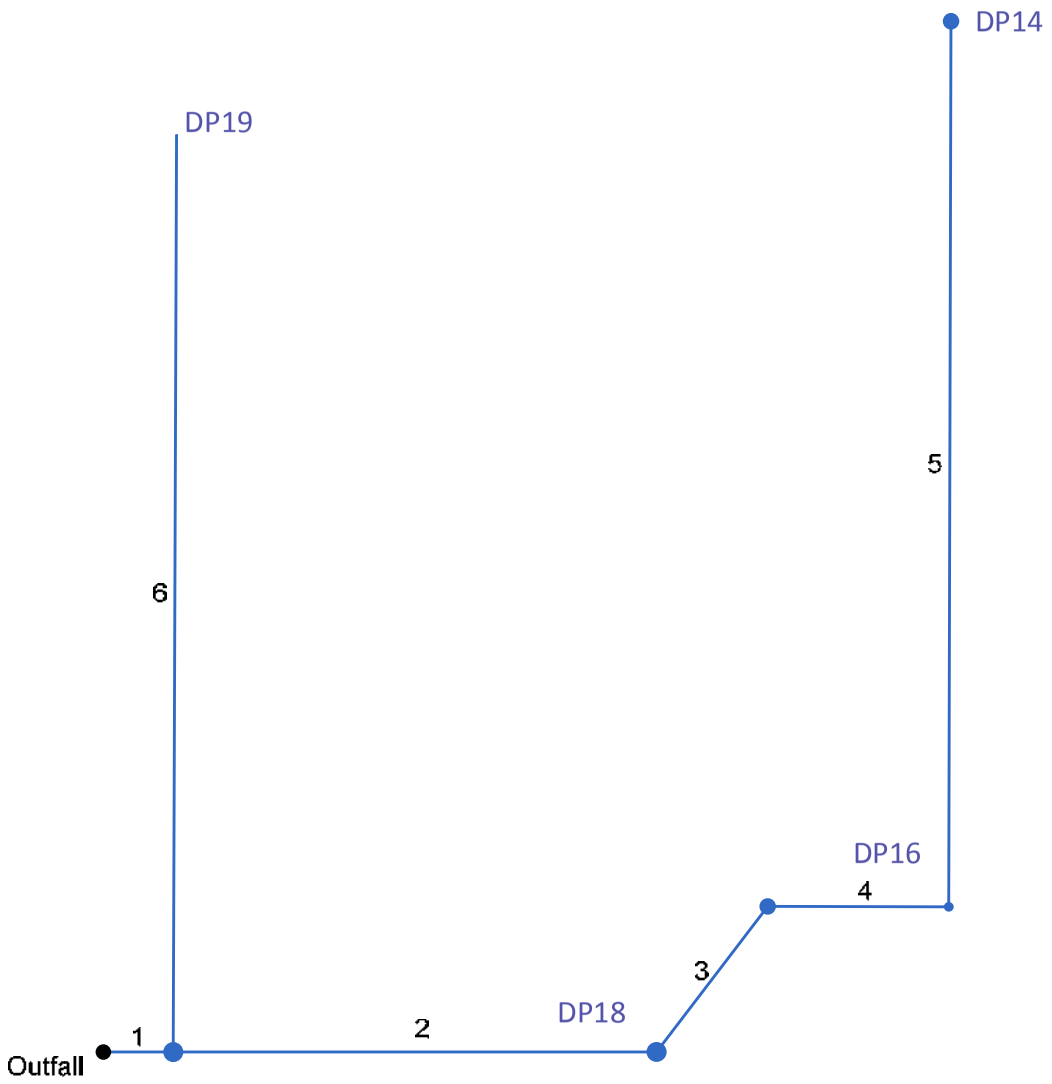
MyReport

Total Runoff (cfs)	Vel Ave (ft/s)	Vel Dn (ft/s)	Vel Hd Dn (ft)	Vel Hd Up (ft)	Vel Up (ft/s)	Cover Dn (ft)	Cover Up (ft)	Storage (cft)
0.00	9.37	9.35	1.36	1.37	9.38	0.00	4.67	255.91
0.00	7.02	7.02	0.77	0.77	7.02	4.67	4.64	1771.51
0.00	5.53	5.53	0.48	0.48	5.53	4.64	3.55	504.76
0.00	6.52	6.52	0.66	0.66	6.52	3.55	2.86	373.43
0.00	5.39	5.39	0.45	0.45	5.39	2.86	2.52	930.84
0.00	5.41	5.39	0.45	0.46	5.44	2.52	3.19	627.16
0.00	6.45	5.58	0.48	0.83	7.32	3.19	3.25	1264.08
0.00	8.15	8.95	0.84	0.84	7.34	3.25	2.25	127.33
0.00	5.89	5.44	0.62	0.62	6.34	2.25	2.53	49.54
0.00	5.39	5.39	0.45	0.45	5.39	2.53	3.54	233.86
0.00	5.26	5.26	0.43	0.43	5.26	3.16	2.38	91.87
0.00	3.90	3.91	0.24	0.24	3.90	2.38	2.51	35.04
0.00	1.71	1.70	0.04	0.05	1.73	2.51	2.68	87.16
0.00	3.63	3.63	0.20	0.20	3.63	4.67	2.91	738.13

Project File: 8-27-19-E.stm | Number of lines: 14 | Date: 9/11/2019

NOTES: ** Critical depth

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: 7-17-19-W.stm	Number of lines: 6	Date: 7/18/2019

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	1	117.5	48	Cir	20.392	6873.12	6873.37	1.226	6877.12	6877.31	1.37	6878.68	End	Manhole
2	2	88.20	48	Cir	141.000	6873.37	6875.05	1.191	6878.68*	6879.48*	0.64	6880.12	1	Manhole
3	14	59.30	42	Cir	53.559	6875.55	6876.68	2.111	6880.12*	6880.40*	0.49	6880.89	2	Manhole
4	15	32.00	36	Cir	52.840	6877.18	6877.71	1.003	6880.89*	6881.08*	0.32	6881.39	3	Manhole
5	16	17.00	30	Cir	259.404	6878.21	6880.80	0.998	6881.39	6882.24	0.52	6882.76	4	Manhole
6	18	15.00	24	Cir	268.440	6875.37	6877.38	0.749	6878.68*	6880.47*	0.35	6880.82	1	None

Project File: 8-27-19-W.stm | Number of lines: 6 | Run Date: 9/11/2019

NOTES: Known Qs only ; *Surcharged (HGL above crown).

MyReport

Line No.	Area Dn (sqft)	Area Up (sqft)	Byp Ln No	Coeff C1 (C)	Coeff C2 (C)	Coeff C3 (C)	Capac Full (cfs)	Crit Depth (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Curb Len (ft)	Defl Ang (Deg)	Depth Dn (ft)	Depth Up (ft)	DnStm Ln No	Drng Area (ac)	Easting X (ft)	EGL Dn (ft)	EGL Up (ft)	Energy Loss (ft)
1	12.56	12.53	n/a	0.20	0.50	0.90	129.23	3.26	....	....	....	0.000	4.00	3.94	Outfall	0.00	9442.73	6878.48	6878.68	0.197
2	12.56	12.57	n/a	0.20	0.50	0.90	127.39	2.84	....	....	....	-0.010	4.00	4.00	1	0.00	9583.73	6879.44	6880.25	0.805
3	9.62	9.62	n/a	0.20	0.50	0.90	118.76	2.41	....	....	....	-52.739	3.50	3.50	2	0.00	9616.15	6880.71	6880.99	0.282
4	7.07	7.07	n/a	0.20	0.50	0.90	54.26	1.83	....	....	....	52.876	3.00	3.00	3	0.00	9668.99	6881.21	6881.39	0.184
5	4.91	2.93	n/a	0.20	0.50	0.90	33.30	1.39	....	....	....	-89.984	2.50	1.44	4	0.00	9669.64	6881.58	6882.76	1.182
6	3.14	3.14	n/a	0.20	0.50	0.90	15.90	1.39	....	....	....	-89.793	2.00	2.00	1	0.00	9443.70	6879.03	6880.82	1.789

Project File: 8-27-19-W.stm | Number of lines: 6 | Date: 9/11/2019

NOTES: ** Critical depth

MyReport

Flow Rate (cfs)	Sf Ave (ft/ft)	Sf Dn (ft/ft)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Gutter Depth (ft)	Gutter Slope (ft/ft)	Gutter Spread (ft)	Gutter Width (ft)	HGL Dn (ft)	HGL Up (ft)	HGL Jnct (ft)	HGL Jmp Dn (ft)	HGL Jmp Up (ft)	Incr CxA	Incr Q (cfs)	Inlet Depth (ft)	Inlet Eff (%)
117.50	0.966	1.014	....	....	....	6877.12	6882.04	....	....	....	....	6877.12	6877.31	6878.68	....	....	0.00	14.30	....	....
88.20	0.571	0.571	....	....	....	6882.04	6883.69	....	....	....	....	6878.68	6879.48	6880.12	....	....	0.00	28.90	....	....
59.30	0.526	0.526	....	....	....	6883.69	6883.13	....	....	....	....	6880.12	6880.40	6880.89	....	....	0.00	27.30	....	....
32.00	0.349	0.349	....	....	....	6883.13	6883.11	....	....	....	....	6880.89	6881.08	6881.39	....	....	0.00	15.00	....	....
17.00	0.456	0.260	....	....	....	6883.11	6885.43	....	....	....	....	6881.39	6882.24	6882.76	....	....	0.00	17.00	....	....
15.00	0.666	0.667	....	....	....	6882.04	6882.04	....	....	....	....	6878.68	6880.47	6880.82	....	....	0.00	15.00	....	....

Project File: 8-27-19-W.stm | Number of lines: 6 | Date: 9/11/2019

NOTES: ** Critical depth

MyReport

Inlet ID	Inlet Loc	(ft)	Inlet Time (min)	i Sys (in/hr)	i Inlet (in/hr)	Invert Dn (ft)	Invert Up (ft)	Jump Loc (ft)	Jump Len (ft)	Vel Hd Jmp Dn (ft)	Vel Hd Jmp Up (ft)	J-Loss Coeff	Junct Type	Known Q (cfs)	Cost RCP	Cost CMP	Cost PVC	Line ID
MB2	Sag		0.0	0.00	0.00	6873.12	6873.37	....	....	0.00	0.00	1.00	MH	14.30	1,385	1,247	1,177	1
MB1	Sag		0.0	0.00	0.00	6873.37	6875.05	....	....	0.00	0.00	0.83	MH	28.90	10,715	9,644	9,108	2
IB9	Sag		0.0	0.00	0.00	6875.55	6876.68	....	....	0.00	0.00	0.83	MH	27.30	3,479	3,131	2,957	14
IB8	Sag		0.0	0.00	0.00	6877.18	6877.71	....	....	0.00	0.00	1.00	MH	15.00	2,850	2,565	2,423	15
IB7	Sag		0.0	0.00	0.00	6878.21	6880.80	....	....	0.00	0.00	1.00	MH	17.00	12,552	11,297	10,669	16
Null Structure	On Grade		0.0	0.00	0.00	6875.37	6877.38	....	....	0.00	0.00	1.00	None	15.00	12,624	11,362	10,730	18

Project File: 8-27-19-W.stm | Number of lines: 6 | Date: 9/11/2019

NOTES: Known Qs only. ; ** Critical depth

MyReport

Line Length (ft)	Line Size (in)	Line Slope (%)	Line Type	Local Depr (in)	n-val Gutter	n-val Pipe	Minor Loss (ft)	Northing Y (ft)	Pipe Travel (min)	Q Byp (cfs)	Q Capt (cfs)	Q Carry (cfs)	Line Rise (in)	Runoff Coeff (C)	Line Span (in)	Area A1 (ac)	Area A2 (ac)	Area A3 (ac)	Tc (min)	Throat Ht (in)	Total Area (ac)	Total CxA
20.392	48	1.23	Cir	....	....	0.016	1.37	15185.05	0.04	....	....	....	48	0.00	48	0.00	0.00	0.00	1.9	....	0.00	0.00
141.000	48	1.19	Cir	....	....	0.016	0.64	15185.08	0.33	....	....	....	48	0.00	48	0.00	0.00	0.00	1.6	....	0.00	0.00
53.559	42	2.11	Cir	....	....	0.016	0.49	15227.71	0.14	....	....	....	42	0.00	42	0.00	0.00	0.00	1.4	....	0.00	0.00
52.840	36	1.00	Cir	....	....	0.016	0.32	15227.59	0.19	....	....	....	36	0.00	36	0.00	0.00	0.00	1.2	....	0.00	0.00
259.404	30	1.00	Cir	....	....	0.016	0.52	15486.99	1.25	....	....	....	30	0.00	30	0.00	0.00	0.00	0.0	....	0.00	0.00
268.440	24	0.75	Cir	....	....	0.016	0.35	15453.49	0.94	....	....	....	24	0.00	24	0.00	0.00	0.00	0.0	....	0.00	0.00

Project File: 8-27-19-W.stm | Number of lines: 6 | Date: 9/11/2019

NOTES: ** Critical depth

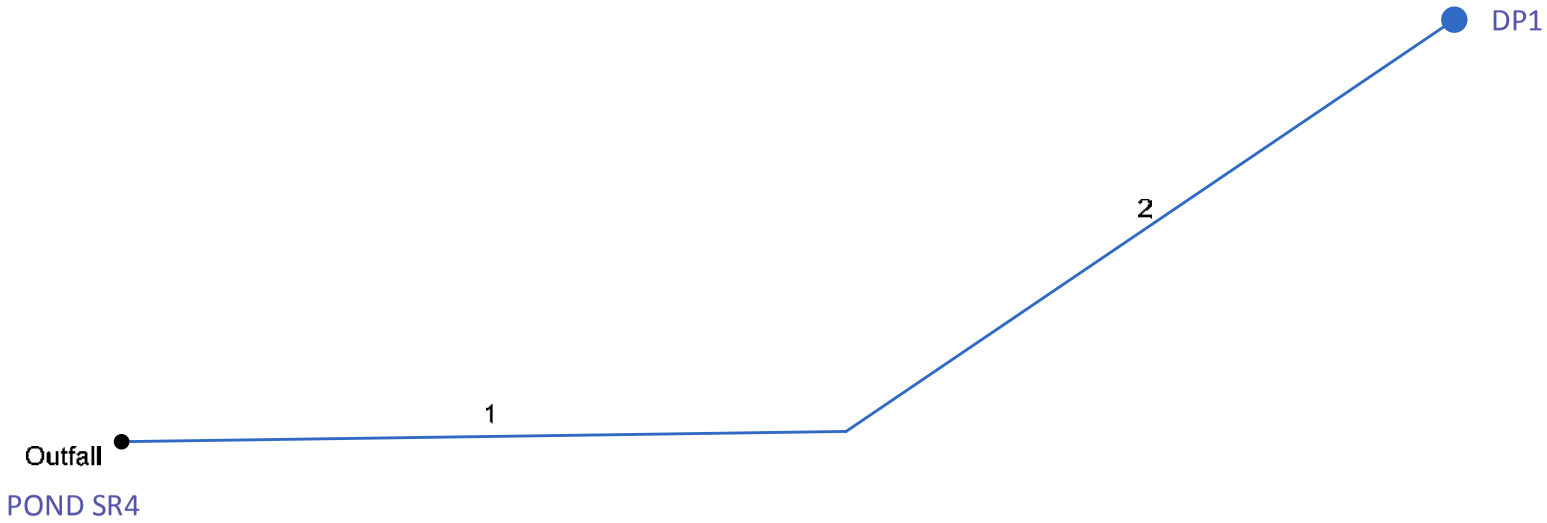
MyReport

Total Runoff (cfs)	Vel Ave (ft/s)	Vel Dn (ft/s)	Vel Hd Dn (ft)	Vel Hd Up (ft)	Vel Up (ft/s)	Cover Dn (ft)	Cover Up (ft)	Storage (cft)
0.00	9.37	9.35	1.36	1.37	9.38	0.00	4.67	255.91
0.00	7.02	7.02	0.77	0.77	7.02	4.67	4.64	1771.51
0.00	6.16	6.16	0.59	0.59	6.16	4.64	2.95	515.19
0.00	4.53	4.53	0.32	0.32	4.53	2.95	2.40	373.43
0.00	4.63	3.46	0.19	0.52	5.79	2.40	2.13	1159.06
0.00	4.78	4.78	0.35	0.35	4.77	4.67	2.66	843.16

Project File: 8-27-19-W.stm | Number of lines: 6 | Date: 9/11/2019

NOTES: ** Critical depth

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: STM-N.stm	Number of lines: 2	Date: 7/18/2019

MyReport

Line No.	Area Dn (sqft)	Area Up (sqft)	Byp Ln No	Coeff C1 (C)	Coeff C2 (C)	Coeff C3 (C)	Capac Full (cfs)	Crit Depth (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Curb Len (ft)	Defl Ang (Deg)	Depth Dn (ft)	Depth Up (ft)	DnStm Ln No	Drng Area (ac)	Easting X (ft)	EGL Dn (ft)	EGL Up (ft)	Energy Loss (ft)
1	1.24	1.35	n/a	0.20	0.50	0.90	16.08	1.07	....	....	....	-0.821	0.99	1.07**	Outfall	0.00	9700.01	6890.62	6895.08	0.000
2	1.35	1.35	n/a	0.20	0.50	0.90	9.34	1.07	....	....	....	-33.479	1.07	1.07**	1	0.00	9803.33	6895.08	6896.58	0.000

Project File: STM-N.stm | Number of lines: 2 | Date: 7/18/2019

NOTES: ** Critical depth

MyReport

Flow Rate (cfs)	Sf Ave (ft/ft)	Sf Dn (ft/ft)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Gutter Depth (ft)	Gutter Slope (ft/ft)	Gutter Spread (ft)	Gutter Width (ft)	HGL Dn (ft)	HGL Up (ft)	HGL Jnct (ft)	HGL Jmp Dn (ft)	HGL Jmp Up (ft)	Incr CxA	Incr Q (cfs)	Inlet Depth (ft)	Inlet Eff (%)
7.70	0.000	0.000	....	....	....	6892.00	6897.42	....	....	....	....	6890.12	6894.57	6894.57	....	....	0.00	0.00	....	....
7.70	0.000	0.000	....	....	....	6897.42	6899.57	....	....	....	....	6894.57	6896.07	6896.07	....	....	0.00	7.70	....	....

Project File: STM-N.stm | Number of lines: 2 | Date: 7/18/2019

NOTES: ** Critical depth

MyReport

Inlet ID	Inlet Loc	(ft)	Inlet Time (min)	i Sys (in/hr)	i Inlet (in/hr)	Invert Dn (ft)	Invert Up (ft)	Jump Loc (ft)	Jump Len (ft)	Vel Hd Jmp Dn (ft)	Vel Hd Jmp Up (ft)	J-Loss Coeff	Junct Type	Known Q (cfs)	Cost RCP	Cost CMP	Cost PVC	Line ID
Structure - (268)	Sag		0.0	0.00	0.00	6889.13	6893.50	....	....	0.00	0.00	0.61 z	MH	0.00	4,036	3,632	3,431	Pipe - (128)
IA1	Sag		0.0	0.00	0.00	6893.50	6895.00	....	....	0.00	0.00	1.00 z	MH	7.70	5,000	4,500	4,250	Pipe - (24)

Project File: STM-N.stm | Number of lines: 2 | Date: 7/18/2019

NOTES: Known Qs only. ; ** Critical depth

MyReport

Line Length (ft)	Line Size (in)	Line Slope (%)	Line Type	Local Depr (in)	n-val Gutter	n-val Pipe	Minor Loss (ft)	Northing Y (ft)	Pipe Travel (min)	Q Byp (cfs)	Q Capt (cfs)	Q Carry (cfs)	Line Rise (in)	Runoff Coeff (C)	Line Span (in)	Area A1 (ac)	Area A2 (ac)	Area A3 (ac)	Tc (min)	Throat Ht (in)	Total Area (ac)	Total CxA
123.058	18	3.55	Cir	....	....	0.016	n/a	16231.68	0.47	....	....	....	18	0.00	18	0.00	0.00	0.00	0.5	....	0.00	0.00
125.068	18	1.20	Cir	....	....	0.016	n/a	16302.16	0.48	....	....	....	18	0.00	18	0.00	0.00	0.00	0.0	....	0.00	0.00

Project File: STM-N.stm | Number of lines: 2 | Date: 7/18/2019

NOTES: ** Critical depth

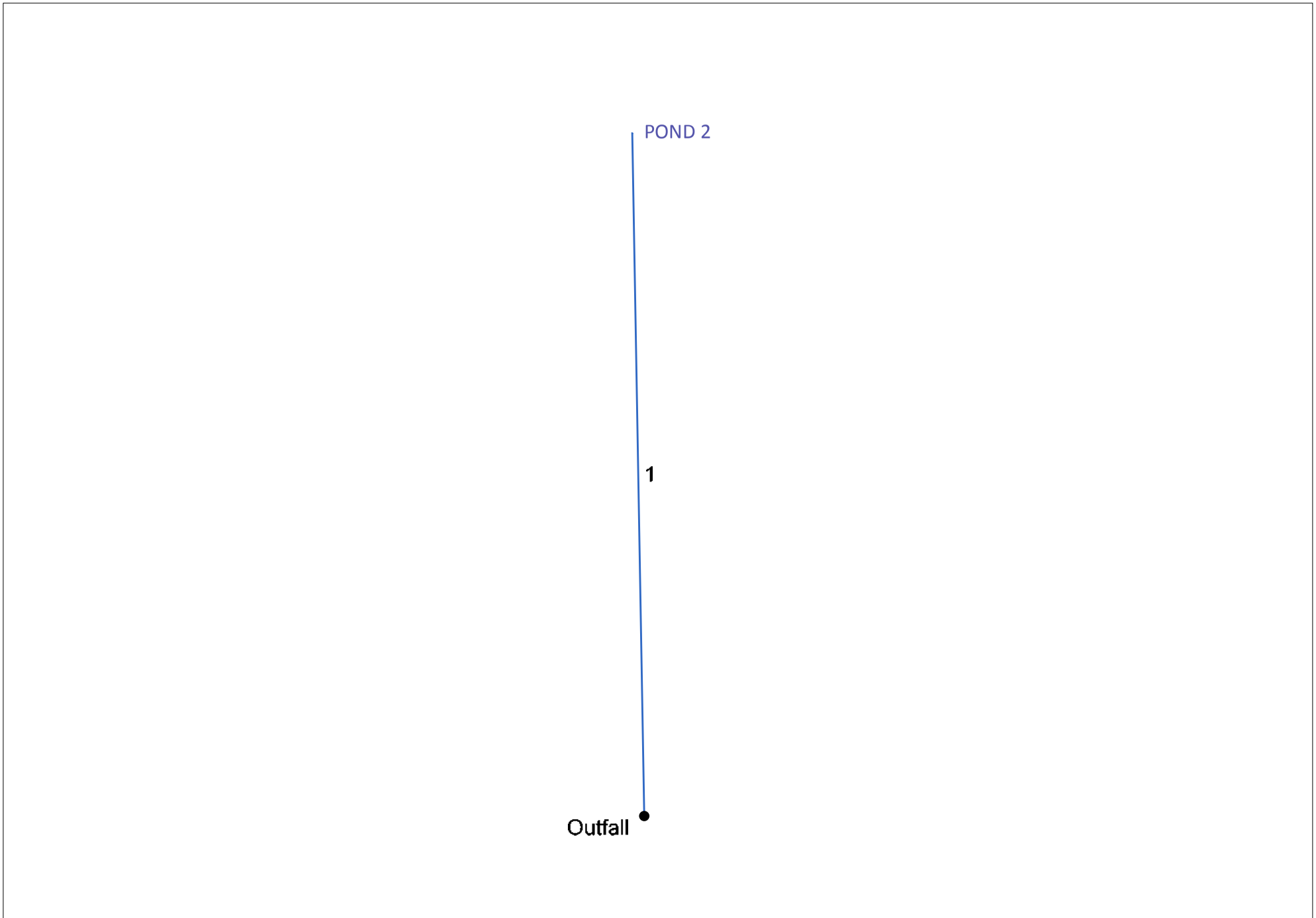
MyReport

Total Runoff (cfs)	Vel Ave (ft/s)	Vel Dn (ft/s)	Vel Hd Dn (ft)	Vel Hd Up (ft)	Vel Up (ft/s)	Cover Dn (ft)	Cover Up (ft)	Storage (cft)
0.00	5.95	6.22	0.50	0.50	5.69	1.37	2.42	159.46
0.00	5.69	5.69	0.50	0.50	5.69	2.42	3.07	169.29

Project File: STM-N.stm | Number of lines: 2 | Date: 7/18/2019

NOTES: ** Critical depth

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: P2-OUT.stm	Number of lines: 1	Date: 7/18/2019

MyReport

Line No.	Area Dn (sqft)	Area Up (sqft)	Byp Ln No	Coeff C1 (C)	Coeff C2 (C)	Coeff C3 (C)	Capac Full (cfs)	Crit Depth (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Curb Len (ft)	Defl Ang (Deg)	Depth Dn (ft)	Depth Up (ft)	DnStm Ln No	Drng Area (ac)	Easting X (ft)	EGL Dn (ft)	EGL Up (ft)	Energy Loss (ft)
1	4.73	4.72	n/a	0.20	0.50	0.90	54.66	2.30	....	....	....	-91.000	2.30	2.30**	Outfall	0.00	9616.45	6874.83	6876.05	0.000

Project File: P2-OUT.stm | Number of lines: 1 | Date: 7/18/2019

NOTES: ** Critical depth

MyReport

Flow Rate (cfs)	Sf Ave (ft/ft)	Sf Dn (ft/ft)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Gutter Depth (ft)	Gutter Slope (ft/ft)	Gutter Spread (ft)	Gutter Width (ft)	HGL Dn (ft)	HGL Up (ft)	HGL Jnct (ft)	HGL Jmp Dn (ft)	HGL Jmp Up (ft)	Incr CxA	Incr Q (cfs)	Inlet Depth (ft)	Inlet Eff (%)
50.10	0.000	0.000	....	....	....	0.00	0.00	....	....	....	....	6873.08	6874.30	6874.30	....	....	0.00	50.10	....	....

Project File: P2-OUT.stm | Number of lines: 1 | Date: 7/18/2019

NOTES: ** Critical depth

MyReport

Inlet ID	Inlet Loc	(ft)	Inlet Time (min)	i Sys (in/hr)	i Inlet (in/hr)	Invert Dn (ft)	Invert Up (ft)	Jump Loc (ft)	Jump Len (ft)	Vel Hd Jmp Dn (ft)	Vel Hd Jmp Up (ft)	J-Loss Coeff	Junct Type	Known Q (cfs)	Cost RCP	Cost CMP	Cost PVC	Line ID
Null Structure	Sag		0.0	0.00	0.00	6870.78	6872.00	....	....	0.00	0.00	1.00 z	MH	50.10	1,900	1,710	1,615	Pipe - (66)

Project File: P2-OUT.stm | Number of lines: 1 | Date: 7/18/2019

NOTES: Known Qs only. ; ** Critical depth

MyReport

Line Length (ft)	Line Size (in)	Line Slope (%)	Line Type	Local Depr (in)	n-val Gutter	n-val Pipe	Minor Loss (ft)	Northing Y (ft)	Pipe Travel (min)	Q Byp (cfs)	Q Capt (cfs)	Q Carry (cfs)	Line Rise (in)	Runoff Coeff (C)	Line Span (in)	Area A1 (ac)	Area A2 (ac)	Area A3 (ac)	Tc (min)	Throat Ht (in)	Total Area (ac)	Total CxA
45.349	30	2.69	Cir	....	....	0.016	n/a	15155.53	0.07	....	....	....	30	0.00	30	0.00	0.00	0.00	0.0	....	0.00	0.00

Project File: P2-OUT.stm | Number of lines: 1 | Date: 7/18/2019

NOTES: ** Critical depth

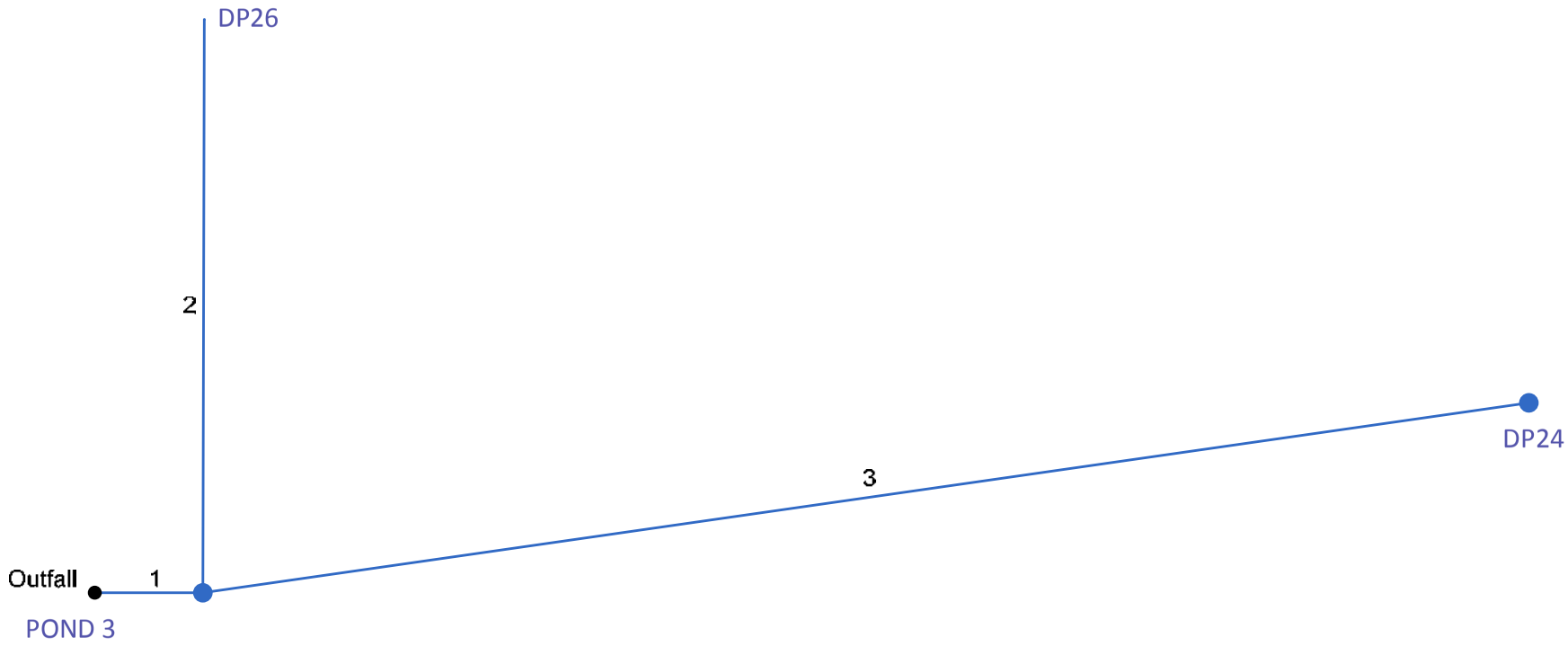
MyReport

Total Runoff (cfs)	Vel Ave (ft/s)	Vel Dn (ft/s)	Vel Hd Dn (ft)	Vel Hd Up (ft)	Vel Up (ft/s)	Cover Dn (ft)	Cover Up (ft)	Storage (cft)
0.00	10.60	10.60	1.75	1.75	10.60	n/a	n/a	214.27

Project File: P2-OUT.stm	Number of lines: 1	Date: 7/18/2019

NOTES: ** Critical depth

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: P3-IN-STM.stm	Number of lines: 3	Date: 7/18/2019

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe - (149)	20.10	24	Cir	12.760	6880.00	6880.07	0.547	6881.61	6881.93	0.68	6882.61	End	Manhole
2	Pipe - (164)	13.70	24	Cir	67.483	6880.07	6880.41	0.504	6882.61*	6882.98*	0.30	6883.28	1	None
3	Pipe - (148)	2.60	18	Cir	158.175	6880.07	6880.86	0.499	6882.61*	6882.76*	0.03	6882.79	1	Manhole

Project File: P3-IN-STM.stm | Number of lines: 3 | Run Date: 9/11/2019

NOTES: Known Qs only ; *Surcharged (HGL above crown).

MyReport

Line No.	Area Dn (sqft)	Area Up (sqft)	Byp Ln No	Coeff C1 (C)	Coeff C2 (C)	Coeff C3 (C)	Capac Full (cfs)	Crit Depth (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Curb Len (ft)	Defl Ang (Deg)	Depth Dn (ft)	Depth Up (ft)	DnStm Ln No	Drng Area (ac)	Easting X (ft)	EGL Dn (ft)	EGL Up (ft)	Energy Loss (ft)
1	2.71	3.05	n/a	0.20	0.50	0.90	13.59	1.61	....	....	....	0.053	1.61	1.86	Outfall	0.00	8729.25	6882.47	6882.61	0.145
2	3.14	3.14	n/a	0.20	0.50	0.90	13.05	1.33	....	....	....	-89.912	2.00	2.00	1	0.00	8729.42	6882.91	6883.28	0.375
3	1.77	1.77	n/a	0.20	0.50	0.90	6.03	0.61	....	....	....	-8.181	1.50	1.50	1	0.00	8885.84	6882.64	6882.79	0.147

Project File: P3-IN-STM.stm | Number of lines: 3 | Date: 9/11/2019

NOTES: ** Critical depth

MyReport

Flow Rate (cfs)	Sf Ave (ft/ft)	Sf Dn (ft/ft)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Gutter Depth (ft)	Gutter Slope (ft/ft)	Gutter Spread (ft)	Gutter Width (ft)	HGL Dn (ft)	HGL Up (ft)	HGL Jnct (ft)	HGL Jmp Dn (ft)	HGL Jmp Up (ft)	Incr CxA	Incr Q (cfs)	Inlet Depth (ft)	Inlet Eff (%)
20.10	1.136	1.237	....	....	....	6880.00	6885.17	....	....	....	....	6881.61	6881.93	6882.61	....	....	0.00	3.80	....	....
13.70	0.556	0.556	....	....	....	6885.17	6886.00	....	....	....	....	6882.61	6882.98	6883.28	....	....	0.00	13.70	....	....
2.60	0.093	0.093	....	....	....	6885.17	6884.93	....	....	....	....	6882.61	6882.76	6882.79	....	....	0.00	2.60	....	....

Project File: P3-IN-STM.stm | Number of lines: 3 | Date: 9/11/2019

NOTES: ** Critical depth

MyReport

Inlet ID	Inlet Loc	(ft)	Inlet Time (min)	i Sys (in/hr)	i Inlet (in/hr)	Invert Dn (ft)	Invert Up (ft)	Jump Loc (ft)	Jump Len (ft)	Vel Hd Jmp Dn (ft)	Vel Hd Jmp Up (ft)	J-Loss Coeff	Junct Type	Known Q (cfs)	Cost RCP	Cost CMP	Cost PVC	Line ID
IC3	Sag		0.0	0.00	0.00	6880.00	6880.07	....	....	0.00	0.00	1.00	MH	3.80	590	531	502	Pipe - (149)
Null Structure	On Grade		0.0	0.00	0.00	6880.07	6880.41	....	....	0.00	0.00	1.00	None	13.70	3,068	2,761	2,608	Pipe - (164)
IC1	Sag		0.0	0.00	0.00	6880.07	6880.86	....	....	0.00	0.00	1.00	MH	2.60	6,440	5,796	5,474	Pipe - (148)

Project File: P3-IN-STM.stm | Number of lines: 3 | Date: 9/11/2019

NOTES: Known Qs only. ; ** Critical depth

MyReport

Line Length (ft)	Line Size (in)	Line Slope (%)	Line Type	Local Depr (in)	n-val Gutter	n-val Pipe	Minor Loss (ft)	Northing Y (ft)	Pipe Travel (min)	Q Byp (cfs)	Q Capt (cfs)	Q Carry (cfs)	Line Rise (in)	Runoff Coeff (C)	Line Span (in)	Area A1 (ac)	Area A2 (ac)	Area A3 (ac)	Tc (min)	Throat Ht (in)	Total Area (ac)	Total CxA
12.760	24	0.55	Cir	....	....	0.016	0.68	15204.30	0.03	....	....	....	24	0.00	24	0.00	0.00	0.00	1.8	....	0.00	0.00
67.483	24	0.50	Cir	....	....	0.016	0.30	15271.78	0.26	....	....	....	24	0.00	24	0.00	0.00	0.00	0.0	....	0.00	0.00
158.175	18	0.50	Cir	....	....	0.016	0.03	15226.66	1.79	....	....	....	18	0.00	18	0.00	0.00	0.00	0.0	....	0.00	0.00

Project File: P3-IN-STM.stm | Number of lines: 3 | Date: 9/11/2019

NOTES: ** Critical depth

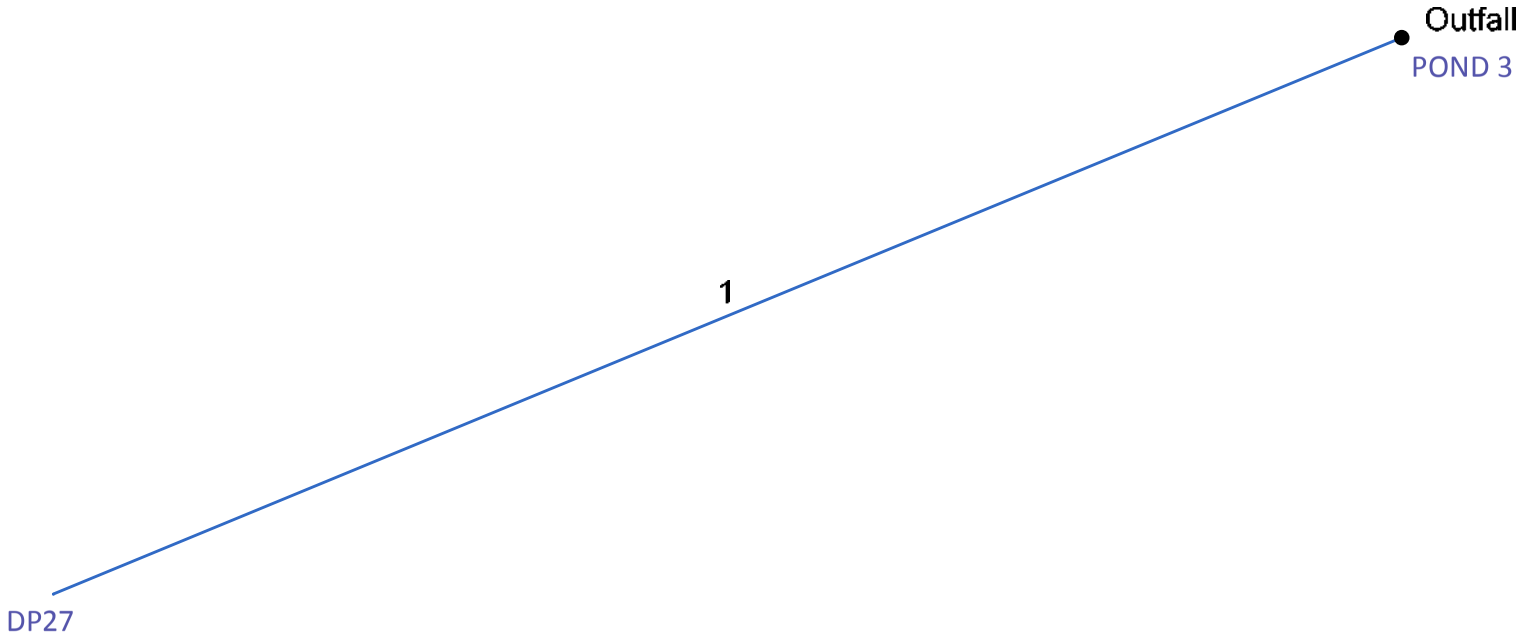
MyReport

Total Runoff (cfs)	Vel Ave (ft/s)	Vel Dn (ft/s)	Vel Hd Dn (ft)	Vel Hd Up (ft)	Vel Up (ft/s)	Cover Dn (ft)	Cover Up (ft)	Storage (cft)
0.00	7.00	7.42	0.86	0.68	6.59	-2.00	3.10	36.89
0.00	4.36	4.36	0.30	0.30	4.36	3.10	3.59	211.96
0.00	1.47	1.47	0.03	0.03	1.47	3.60	2.57	279.46

Project File: P3-IN-STM.stm | Number of lines: 3 | Date: 9/11/2019

NOTES: ** Critical depth

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: P3-STM-CULV.stm	Number of lines: 1	Date: 7/18/2019

MyReport

Line No.	Area Dn (sqft)	Area Up (sqft)	Byp Ln No	Coeff C1 (C)	Coeff C2 (C)	Coeff C3 (C)	Capac Full (cfs)	Crit Depth (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Curb Len (ft)	Defl Ang (Deg)	Depth Dn (ft)	Depth Up (ft)	DnStm Ln No	Drng Area (ac)	Easting X (ft)	EGL Dn (ft)	EGL Up (ft)	Energy Loss (ft)
1	0.78	0.78	n/a	0.20	0.50	0.90	6.46	0.97	....	....	....	157.530	0.97	0.97**	Outfall	0.00	8875.87	6877.09	6881.58	0.000

Project File: P3-STM-CULV.stm | Number of lines: 1 | Date: 7/18/2019

NOTES: ** Critical depth

MyReport

Flow Rate (cfs)	Sf Ave (ft/ft)	Sf Dn (ft/ft)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Gutter Depth (ft)	Gutter Slope (ft/ft)	Gutter Spread (ft)	Gutter Width (ft)	HGL Dn (ft)	HGL Up (ft)	HGL Jnct (ft)	HGL Jmp Dn (ft)	HGL Jmp Up (ft)	Incr CxA	Incr Q (cfs)	Inlet Depth (ft)	Inlet Eff (%)
6.60	0.000	0.000	....	....	....	6878.00	6883.00	....	....	....	....	6875.97	6880.46	6880.46	....	....	0.00	6.60	....	....

Project File: P3-STM-CULV.stm | Number of lines: 1 | Date: 7/18/2019

NOTES: ** Critical depth

MyReport

Inlet ID	Inlet Loc	(ft)	Inlet Time (min)	i Sys (in/hr)	i Inlet (in/hr)	Invert Dn (ft)	Invert Up (ft)	Jump Loc (ft)	Jump Len (ft)	Vel Hd Jmp Dn (ft)	Vel Hd Jmp Up (ft)	J-Loss Coeff	Junct Type	Known Q (cfs)	Cost RCP	Cost CMP	Cost PVC	Line ID
Null Structure	On Grade		0.0	0.00	0.00	6875.00	6879.49	....	....	0.00	0.00	1.00 z	None	6.60	2,620	2,358	2,227	Pipe - (156)

Project File: P3-STM-CULV.stm | Number of lines: 1 | Date: 7/18/2019

NOTES: Known Qs only. ; ** Critical depth

MyReport

Line Length (ft)	Line Size (in)	Line Slope (%)	Line Type	Local Depr (in)	n-val Gutter	n-val Pipe	Minor Loss (ft)	Northing Y (ft)	Pipe Travel (min)	Q Byp (cfs)	Q Capt (cfs)	Q Carry (cfs)	Line Rise (in)	Runoff Coeff (C)	Line Span (in)	Area A1 (ac)	Area A2 (ac)	Area A3 (ac)	Tc (min)	Throat Ht (in)	Total Area (ac)	Total CxA
90.117	12	4.98	Cir	....	....	0.016	1.12	15060.81	0.18	....	....	....	12	0.00	12	0.00	0.00	0.00	0.0	....	0.00	0.00

Project File: P3-STM-CULV.stm | Number of lines: 1 | Date: 7/18/2019

NOTES: ** Critical depth

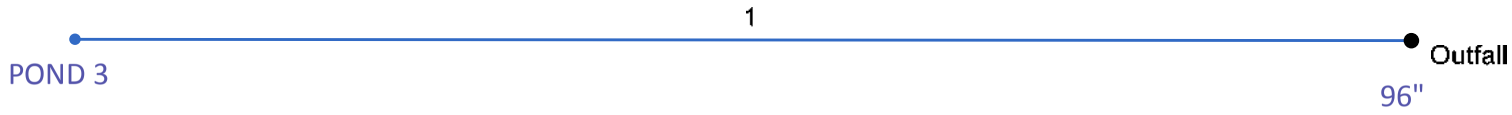
MyReport

Total Runoff (cfs)	Vel Ave (ft/s)	Vel Dn (ft/s)	Vel Hd Dn (ft)	Vel Hd Up (ft)	Vel Up (ft/s)	Cover Dn (ft)	Cover Up (ft)	Storage (cft)	
0.00	8.48	8.48	1.12	1.12	8.48	2.00	2.51	70.15	

Project File: P3-STM-CULV.stm	Number of lines: 1	Date: 7/18/2019

NOTES: ** Critical depth

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: P3-OUT-STM.stm	Number of lines: 1	Date: 7/18/2019

MyReport

Line No.	Area Dn (sqft)	Area Up (sqft)	Byp Ln No	Coeff C1 (C)	Coeff C2 (C)	Coeff C3 (C)	Capac Full (cfs)	Crit Depth (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Curb Len (ft)	Defl Ang (Deg)	Depth Dn (ft)	Depth Up (ft)	DnStm Ln No	Drng Area (ac)	Easting X (ft)	EGL Dn (ft)	EGL Up (ft)	Energy Loss (ft)
1	2.08	3.14	n/a	0.20	0.50	0.90	9.28	1.26	....	....	....	-179.943	1.26	2.00	Outfall	0.00	8708.63	6880.80	6882.08	1.279

Project File: P3-OUT-STM.stm | Number of lines: 1 | Date: 7/18/2019

NOTES: ** Critical depth

MyReport

Flow Rate (cfs)	Sf Ave (ft/ft)	Sf Dn (ft/ft)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Gutter Depth (ft)	Gutter Slope (ft/ft)	Gutter Spread (ft)	Gutter Width (ft)	HGL Dn (ft)	HGL Up (ft)	HGL Jnct (ft)	HGL Jmp Dn (ft)	HGL Jmp Up (ft)	Incr CxA	Incr Q (cfs)	Inlet Depth (ft)	Inlet Eff (%)
12.30	0.653	0.858	....	....	....	6883.00	6883.42	....	....	....	....	6880.26	6881.84	6882.08	....	....	0.00	12.30	....	....

Project File: P3-OUT-STM.stm | Number of lines: 1 | Date: 7/18/2019

NOTES: ** Critical depth

MyReport

Inlet ID	Inlet Loc	(ft)	Inlet Time (min)	i Sys (in/hr)	i Inlet (in/hr)	Invert Dn (ft)	Invert Up (ft)	Jump Loc (ft)	Jump Len (ft)	Vel Hd Jmp Dn (ft)	Vel Hd Jmp Up (ft)	J-Loss Coeff	Junct Type	Known Q (cfs)	Cost RCP	Cost CMP	Cost PVC	Line ID
IC4	Sag		0.0	0.00	0.00	6879.00	6879.50	....	....	0.00	0.00	1.00	MH	12.30	7,138	6,424	6,067	Pipe - (150)

Project File: P3-OUT-STM.stm | Number of lines: 1 | Date: 7/18/2019

NOTES: Known Qs only. ; ** Critical depth

MyReport

Line Length (ft)	Line Size (in)	Line Slope (%)	Line Type	Local Depr (in)	n-val Gutter	n-val Pipe	Minor Loss (ft)	Northing Y (ft)	Pipe Travel (min)	Q Byp (cfs)	Q Capt (cfs)	Q Carry (cfs)	Line Rise (in)	Runoff Coeff (C)	Line Span (in)	Area A1 (ac)	Area A2 (ac)	Area A3 (ac)	Tc (min)	Throat Ht (in)	Total Area (ac)	Total CxA
195.965	24	0.26	Cir	....	....	0.016	0.24	15177.38	0.83	....	....	....	24	0.00	24	0.00	0.00	0.00	0.0	....	0.00	0.00

Project File: P3-OUT-STM.stm | Number of lines: 1 | Date: 7/18/2019

NOTES: ** Critical depth

MyReport

Total Runoff (cfs)	Vel Ave (ft/s)	Vel Dn (ft/s)	Vel Hd Dn (ft)	Vel Hd Up (ft)	Vel Up (ft/s)	Cover Dn (ft)	Cover Up (ft)	Storage (cft)	
0.00	4.91	5.90	0.54	0.24	3.92	2.00	1.92	559.85	

Project File: P3-OUT-STM.stm	Number of lines: 1	Date: 7/18/2019

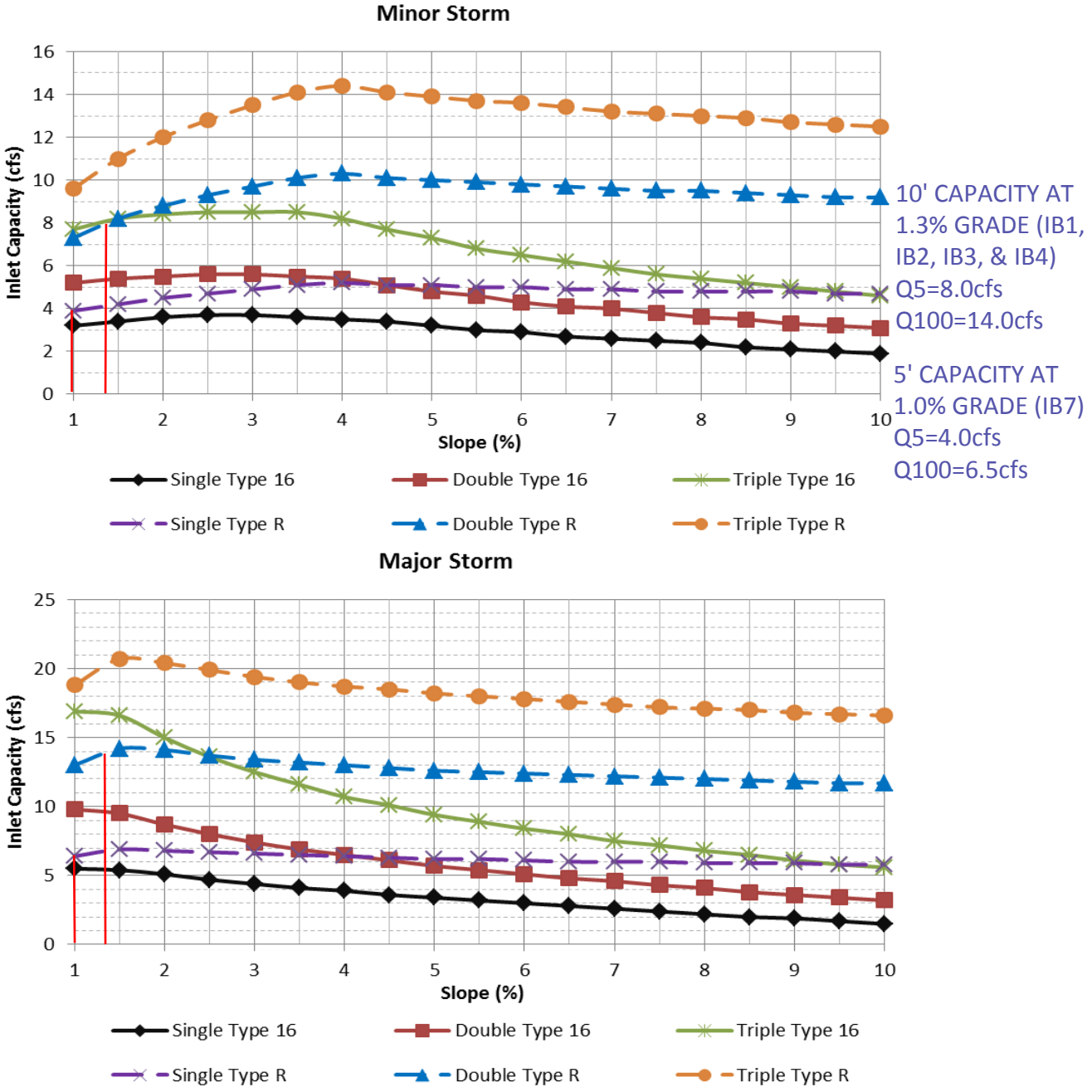
NOTES: ** Critical depth

Inlet Summary (see figures 8-7, 8-10 & 8-11)

			Flow		Capacity	
Inlet	**Type**		**Q5 (cfs)**	**Q100 (cfs)**	**Q5 (cfs)**	**Q100 (cfs)**
IA1	10' Type R	sump	3.4	7.7		
IB1	10' Type R	at-grade	2.8	5.1	8.0	14.0
IB2	10' Type R	at-grade	2.0	3.7	8.0	14.0
IB3	10' Type R	at-grade	1.4	2.5	8.0	14.0
IB4	10' Type R	at-grade	0.8	1.4	8.0	14.0
IB5	10' Type R	sump	0.8	1.5	10.5	10.5
IB6	10' Type R	sump	0.9	1.6	10.5	10.5
IB7	5' Type R	at-grade	1.6	2.9	4.0	6.5
IB8	10' Type R	sump	1.6	2.9	10.5	10.5
IB9	10' Type R	sump	1.5	2.7	10.5	10.5
IC1	5' Type R	sump	1.3	2.6	6.5	6.5
IC3	5' Type R	sump	0.8	1.5	6.5	6.5

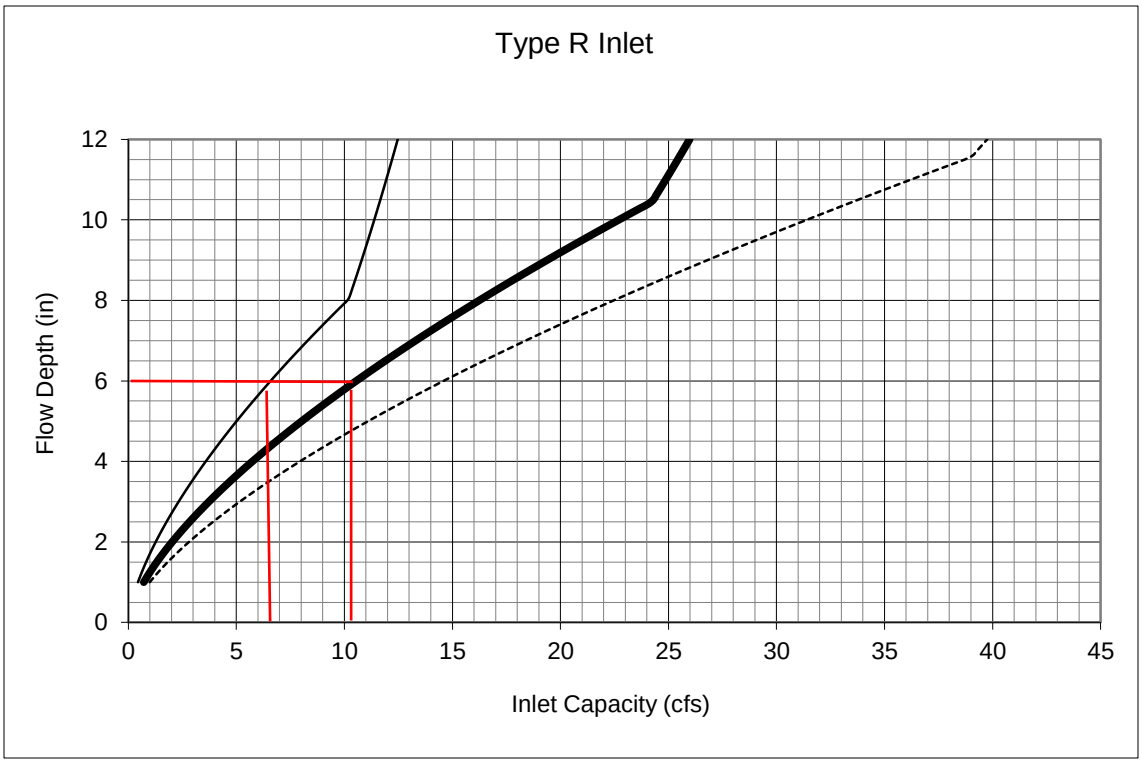
Figure 8-7. Inlet Capacity Chart Continuous Grade Conditions, Residential (Local)
(Attached and Detached Sidewalk)

Street Section Data: Street Width Flowline to Flowline = 34'
Type of Curb and Gutter: D-10-R = 8" vertical
Type 16 = 6" vertical



The standard street section parameters as defined in Chapter 7 must apply to use these charts. For non-standard sections, the inlet capacity shall be calculated using the UDFCD spreadsheets. The maximum spread width is limited by the curb height based on no curb overtopping during a minor storm and flow being contained within the public right-of-way during the major storm. Calculations were done using UD-Inlet 3.00.xls, Mar., 2011 with the default clogging factors.

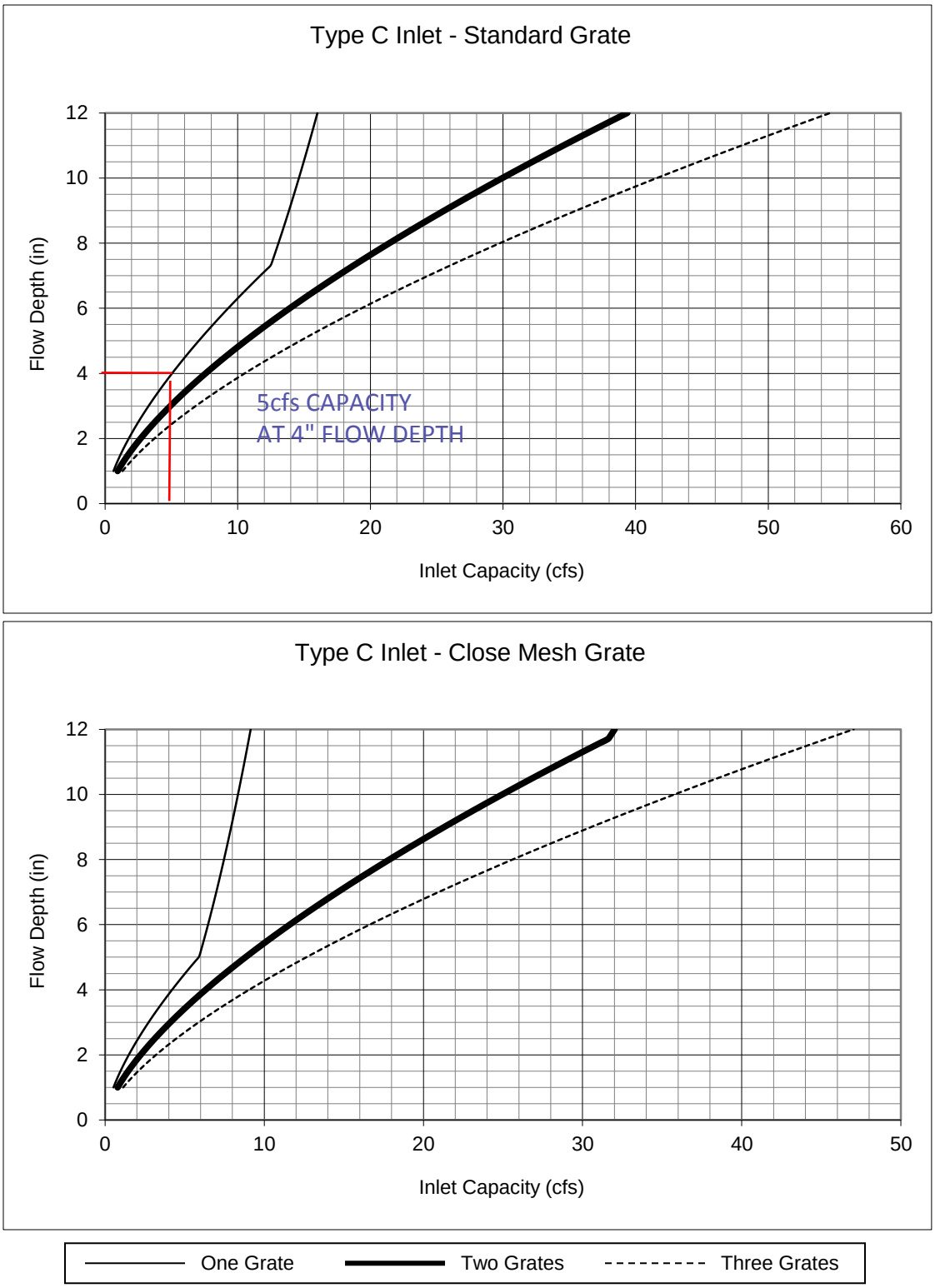
Figure 8-11. Inlet Capacity Chart Sump Conditions , Curb Opening (Type R) Inlet



Notes:

1. The standard inlet parameters must apply to use this chart.

Figure 8-10. Inlet Capacity Chart Sump Conditions, Area (Type C) Inlet



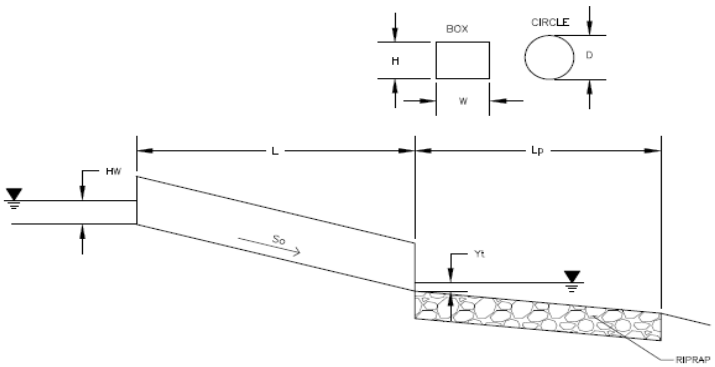
INLET IA2
Q5=0.0cfs
Q100= 0.2cfs

INLET IC2
Q5=0.0cfs
Q100=0.3cfs

Notes:
1. The standard inlet parameters must apply to use these charts.

Determination of Culvert Headwater and Outlet Protection

Project: Falcon Marketplace
Basin ID: DP27



Soil Type:
Choose One:
(•) Sandy
( ) Non-Sandy

Supercritical Flow! Using Da to calculate protection type

Design Information (Input):

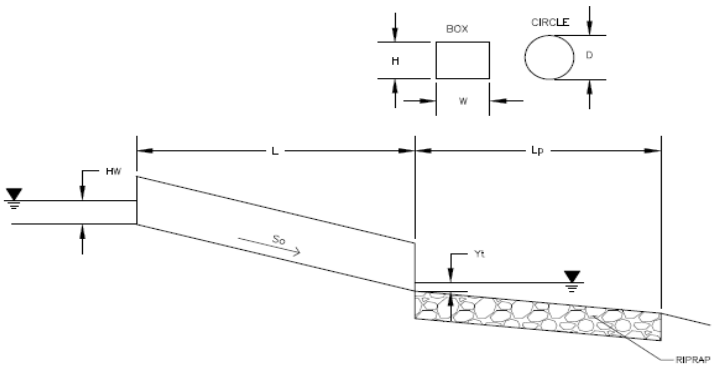
	Design Discharge	Q =	1.9	cfs
Circular Culvert:				
	Barrel Diameter in Inches	D =	18	inches
	Inlet Edge Type (Choose from pull-down list)		Square End with Headwall	
Box Culvert:			**OR**	
	Barrel Height (Rise) in Feet	Height (Rise) =		ft
	Barrel Width (Span) in Feet	Width (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	No =	1	
	Inlet Elevation	Elev IN =	6885.5	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6885	ft
	Culvert Length	L =	24	ft
	Manning's Roughness	n =	0.012	
	Bend Loss Coefficient	k_b =	0	
	Exit Loss Coefficient	k_x =	1	
	Tailwater Surface Elevation	Elev Y_t =		ft
	Max Allowable Channel Velocity	V =	5	ft/s

Required Protection (Output):

	Tailwater Surface Height	Y_t =	0.60	ft
	Flow Area at Max Channel Velocity	A_t =	0.38	ft^2
	Culvert Cross Sectional Area Available	A =	1.77	ft^2
	Entrance Loss Coefficient	k_e =	0.50	
	Friction Loss Coefficient	k_f =	0.37	
	Sum of All Losses Coefficients	k_s =	1.87	ft
	Culvert Normal Depth	Y_n =	0.34	ft
	Culvert Critical Depth	Y_c =	0.52	ft
	Tailwater Depth for Design	d =	1.01	ft
	Adjusted Diameter **OR** Adjusted Rise	D_a =	0.92	ft
	Expansion Factor	1/(2*tan(Θ)) =	6.70	
	Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	0.69	$ft^{0.5}/s$
	Froude Number	Fr =	2.22	**Supercritical!**
	Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.65	
	Inlet Control Headwater	HW_I =	0.71	ft
	Outlet Control Headwater	HW_O =	0.54	
	Design Headwater Elevation	**HW =**	**6,886.21**	**ft**
	Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**0.47**	
	Minimum Theoretical Riprap Size	d_{50} =	1	in
	Nominal Riprap Size	d_{50} =	6	in
	UDFCD Riprap Type	**Type =**	**VL**	
	Length of Protection	**L_p =**	**5**	**ft**
	Width of Protection	**T =**	**3**	**ft**

Determination of Culvert Headwater and Outlet Protection

Project: Falcon Marketplace
Basin ID: DP30



Soil Type:
Choose One:
(●) Sandy
( ) Non-Sandy

Supercritical Flow! Using Da to calculate protection type

Design Information (Input):

	Design Discharge	Q =	6.6	cfs
Circular Culvert:				
	Barrel Diameter in Inches	D =	18	inches
	Inlet Edge Type (Choose from pull-down list)		Square End with Headwall	
Box Culvert:			**OR**	
	Barrel Height (Rise) in Feet	Height (Rise) =		ft
	Barrel Width (Span) in Feet	Width (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	No =	1	
	Inlet Elevation	Elev IN =	6879.49	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6875	ft
	Culvert Length	L =	90.1	ft
	Manning's Roughness	n =	0.012	
	Bend Loss Coefficient	k_b =	0	
	Exit Loss Coefficient	k_x =	1	
	Tailwater Surface Elevation	Elev Y_t =		ft
	Max Allowable Channel Velocity	V =	5	ft/s

Required Protection (Output):

	Tailwater Surface Height	Y_t =	0.60	ft
	Flow Area at Max Channel Velocity	A_t =	1.32	ft^2
	Culvert Cross Sectional Area Available	A =	1.77	ft^2
	Entrance Loss Coefficient	k_e =	0.50	
	Friction Loss Coefficient	k_f =	1.39	
	Sum of All Losses Coefficients	k_s =	2.89	ft
	Culvert Normal Depth	Y_n =	0.52	ft
	Culvert Critical Depth	Y_c =	0.99	ft
	Tailwater Depth for Design	d =	1.25	ft
	Adjusted Diameter **OR** Adjusted Rise	D_a =	1.01	ft
	Expansion Factor	1/(2*tan(Θ)) =	6.66	
	Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$)	Q/D^2.5 =	2.40	$ft^{0.5}/s$
	Froude Number	Fr =	3.45	**Supercritical!**
	Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise	Yt/D =	0.59	
	Inlet Control Headwater	HW_I =	1.53	ft
	Outlet Control Headwater	HW_O =	-2.62	
	Design Headwater Elevation	**HW =**	**6,881.02**	**ft**
	Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**1.02**	
	Minimum Theoretical Riprap Size	d_{50} =	3	in
	Nominal Riprap Size	d_{50} =	6	in
	UDFCD Riprap Type	**Type =**	**VL**	
	Length of Protection	**L_p =**	**5**	**ft**
	Width of Protection	**T =**	**3**	**ft**

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: _____

Basin ID: _____

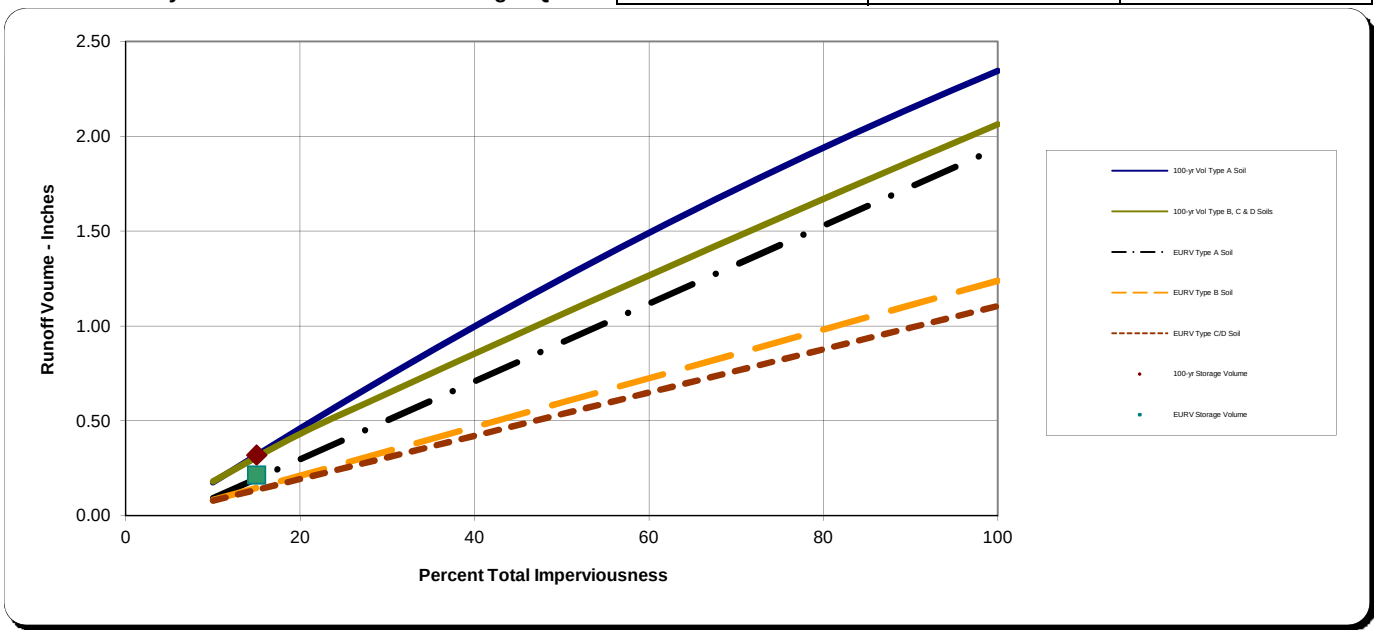
* User input data shown in blue.

Area of Watershed (acres)	740.00	
Subwatershed Imperviousness	15.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	15.0%	

Hydrologic Soil Type	**Percentage of Area**	**Area (acres)**
Type A	100.0%	740.0
Type B		0.0
Type C or D		0.0

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		**Decay Coefficient--α**
Initial--f_i	**Final--f_o**	
5	1.0	0.0007

	Detention Volumes [2,5]		
	(watershed inches)	**(acre-feet)**	**Maximum Allowable Release Rate, cfs**[3]
Excess Urban Runoff Volume[4]	0.22	13.30	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.32	19.72	370.00



Notes:

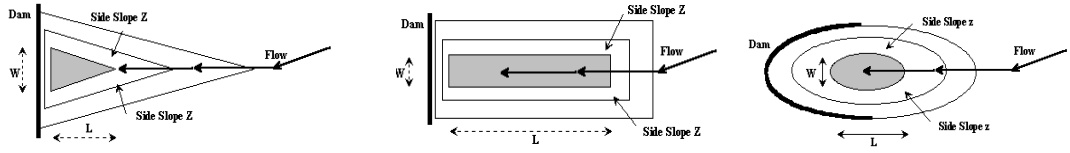
1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV



STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1

Design Information (Input):

Width of Basin Bottom, W = ☐ ft
Length of Basin Bottom, L = ☐ ft
Dam Side-slope (H:V), Z_d = ☐ ft/ft

Check Basin Shape

Right Triangle ☐ OR…
Isosceles Triangle ☐ OR…
Rectangle ☐ OR…
Circle / Ellipse ☐ OR…
Irregular ☐ (Use Overide values in cells G32:G52)

Stage-Storage Relationship:

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':			acre-ft.
Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':	13.30	19.72	acre-ft.

Labels for WQCV, Minor, & Major Storage Stages (input)	Water Surface Elevation ft (input)	Side Slope (H:V) ft/ft Below El.	Basin Width at Stage ft (output)	Basin Length at Stage ft (output)	Surface Area at Stage ft^2 (output)	Surface Area at Stage ft^2 User Overide	Volume Below Stage ft^3 (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage Volumes (for goal seek)
	6882.00	(input)				531		0.012	0.000	
	6883.00		0.00	0.00		531	531	0.012	0.012	
	6884.00		0.00	0.00		531	1,062	0.012	0.024	
	6885.00		0.00	0.00		886	1,771	0.020	0.041	
	6886.00		0.00	0.00		9,189	6,808	0.211	0.156	
	6887.00		0.00	0.00		27,880	25,343	0.640	0.582	
	6888.00		0.00	0.00		60,263	69,414	1.383	1.594	
	6889.00		0.00	0.00		85,329	142,210	1.959	3.265	
	6890.00		0.00	0.00		103,874	236,812	2.385	5.436	
	6891.00		0.00	0.00		111,922	344,710	2.569	7.913	
	6892.00		0.00	0.00		116,616	458,979	2.677	10.537	
WQCV	6893.00		0.00	0.00		128,472	581,523	2.949	13.350	
	6894.00		0.00	0.00		136,926	714,222	3.143	16.396	
	6895.00		0.00	0.00		145,498	855,434	3.340	19.638	
	6896.00		0.00	0.00		154,188	1,005,277	3.540	23.078	
	6896.50		0.00	0.00		158,590	1,083,471	3.641	24.873	
100-YR	6897.00		0.00	0.00		162,992	1,163,867	3.742	26.719	
	6897.50		0.00	0.00		167,639	1,246,524	3.848	28.616	
	6898.00		0.00	0.00		172,286	1,331,506	3.955	30.567	
	6899.00		0.00	0.00		181,155	1,508,226	4.159	34.624	
	6900.00		0.00	0.00		190,124	1,693,866	4.365	38.886	
	6901.00		0.00	0.00		199,194	1,888,525	4.573	43.355	
							#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	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
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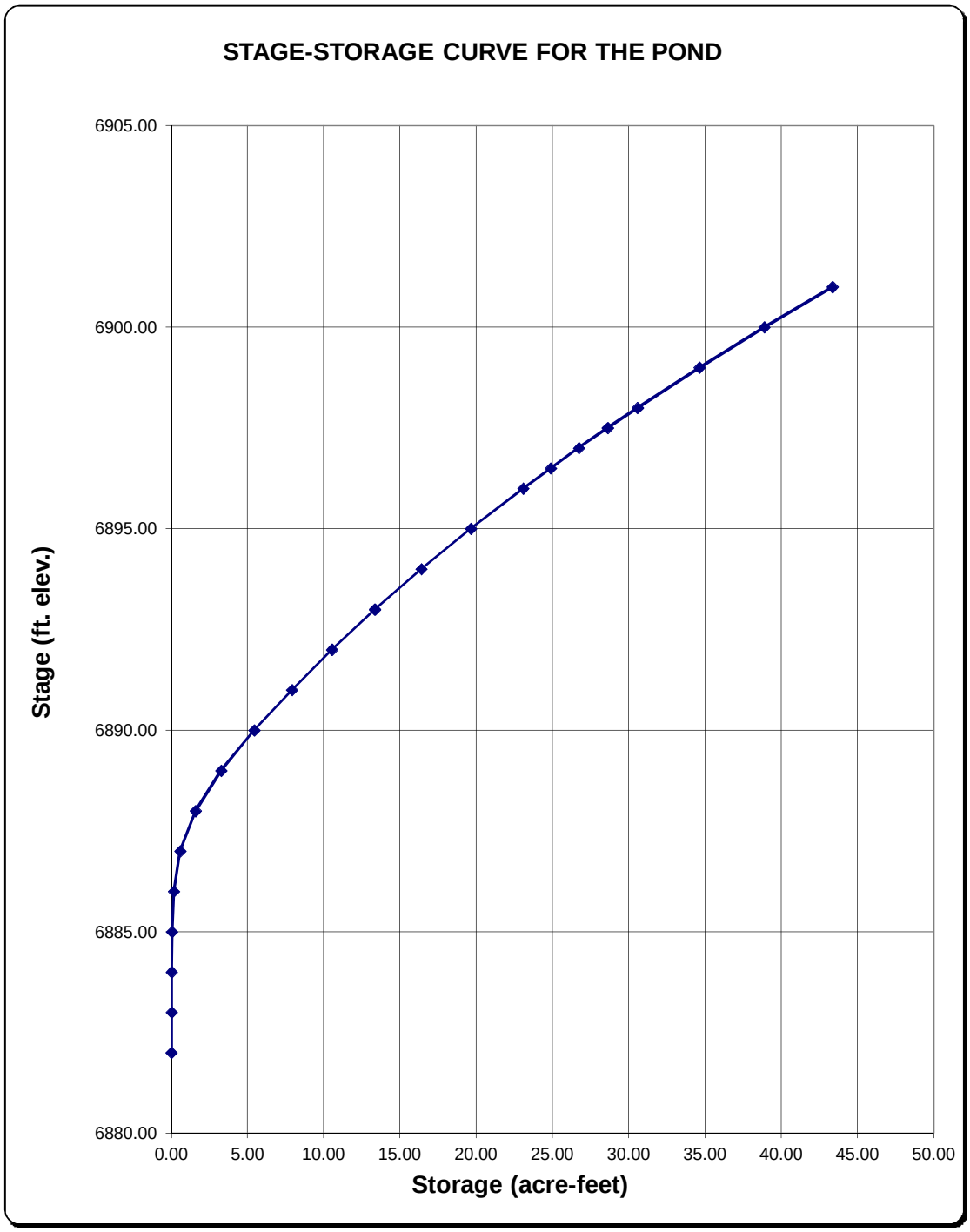
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	
							#N/A		#N/A	

STAGE-STORAGE SIZING FOR DETENTION BASINS

Project: _____

Basin ID: _____



STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: FALCON MARKETPLACE

Basin ID: NORTH POND #1

WQCV Design Volume (Input):

Catchment Imperviousness, I_a = 15.0 percent
Catchment Area, A = 740.00 acres
Depth at WQCV outlet above lowest perforation, H = 8 feet
Vertical distance between rows, h = 30.00 inches
Number of rows, NL = 3.00
Orifice discharge coefficient, C_o = 0.50
Slope of Basin Trickle Channel, S = 0.005 ft / ft
Time to Drain the Pond = 40 hours

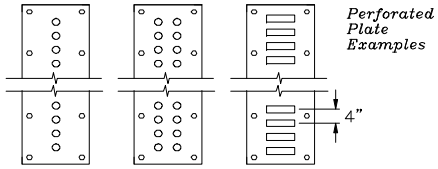
Diameter of holes, D = 5.000 inches
Number of holes per row, N = 1

OR

Height of slot, H = inches
Width of slot, W = inches

Watershed Design Information (Input):

Percent Soil Type A = 100 %
Percent Soil Type B = %
Percent Soil Type C/D = %



Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') 0.216 watershed inches
N/A
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') 13.300 acre-feet
Outlet area per row, Ao = 69.21 square inches
Total opening area at each row based on user-input above, Ao = 19.63 square inches
Total opening area at each row based on user-input above, Ao = 0.136 square feet

3

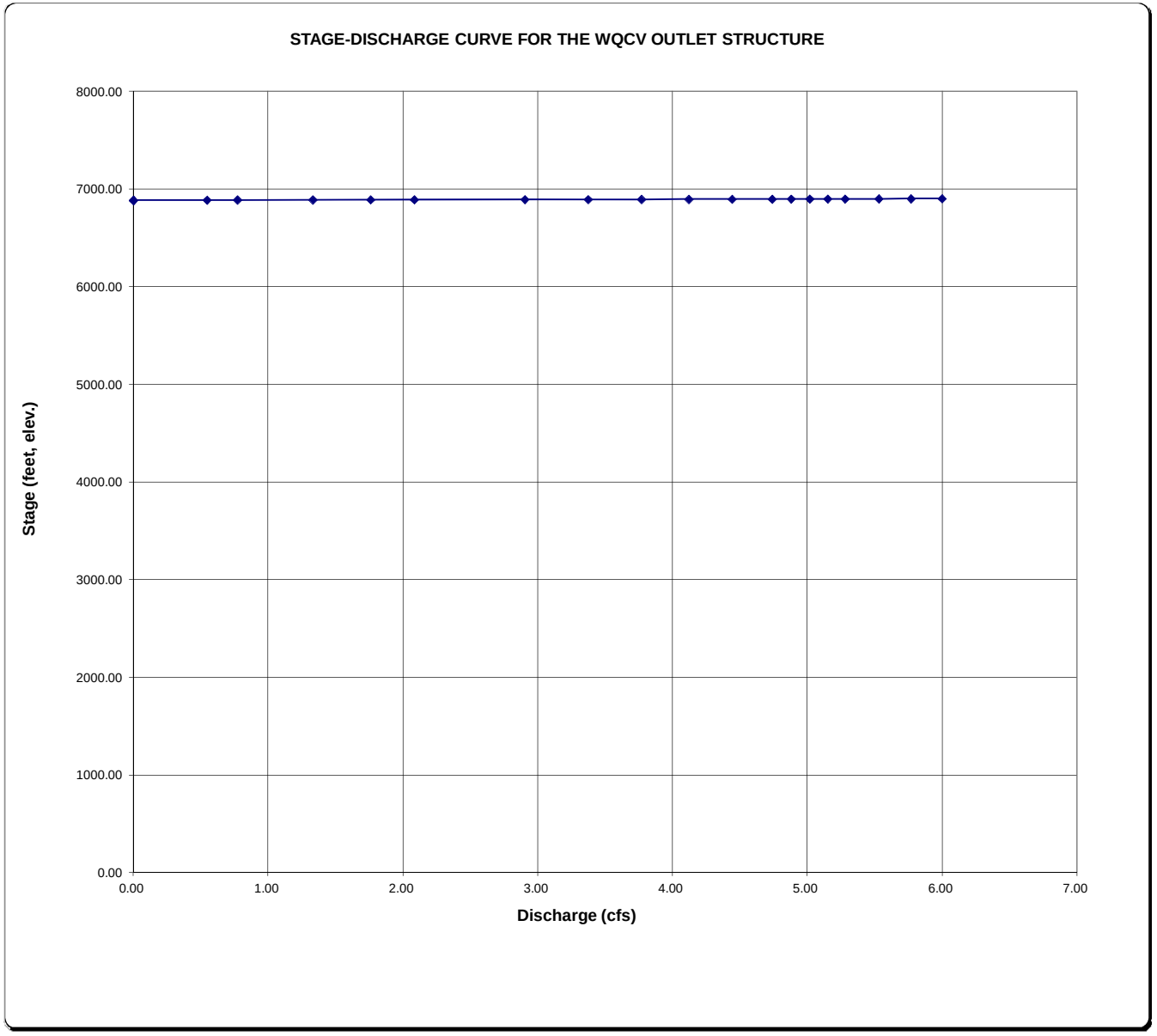
	Central Elevations of Rows of Holes in feet																								Σ Flow
	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Row 23	
	6885.00	6887.50	6890.00																						
	Collection Capacity for Each Row of Holes in cfs																								
6882.00	0.0000	0.0000	0.0000																						**0.00**
6883.00	0.0000	0.0000	0.0000																						**0.00**
6884.00	0.0000	0.0000	0.0000																						**0.00**
6885.00	0.0000	0.0000	0.0000																						**0.00**
6886.00	0.5457	0.0000	0.0000																						**0.55**
6887.00	0.7717	0.0000	0.0000																						**0.77**
6888.00	0.9452	0.3859	0.0000																						**1.33**
6889.00	1.0914	0.6683	0.0000																						**1.76**
6890.00	1.2202	0.8628	0.0000																						**2.08**
6891.00	1.3367	1.0209	0.5457																						**2.90**
6892.00	1.4438	1.1576	0.7717																						**3.37**
6893.00	1.5435	1.2798	0.9452																						**3.77**
6894.00	1.6371	1.3913	1.0914																						**4.12**
6895.00	1.7256	1.4945	1.2202																						**4.44**
6896.00	1.8099	1.5910	1.3367																						**4.74**
6896.50	1.8505	1.6371	1.3913																						**4.88**
6897.00	1.8904	1.6820	1.4438																						**5.02**
6897.50	1.9293	1.7256	1.4945																						**5.15**
6898.00	1.9675	1.7683	1.5435																						**5.28**
6899.00	2.0418	1.8505	1.6371																						**5.53**
6900.00	2.1135	1.9293	1.7256																						**5.77**
6901.00	2.1828	2.0050	1.8099																						**6.00**
	#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**
	#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**
	#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**
	#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**
	#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**
	#N/A	#N/A	#N/A																						**#N/A**
	#N/A	#N/A	#N/A																						**#N/A**
	Override Area Row 1	Override Area Row 2	Override Area Row 3	Override Area Row 4	Override Area Row 5	Override Area Row 6	Override Area Row 7	Override Area Row 8	Override Area Row 9	Override Area Row 10	Override Area Row 11	Override Area Row 12	Override Area Row 13	Override Area Row 14	Override Area Row 15	Override Area Row 16	Override Area Row 17	Override Area Row 18	Override Area Row 19	Override Area Row 20	Override Area Row 21	Override Area Row 22	Override Area Row 23	Override Area Row 24	
	0.14	0.14	0.14																						

STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

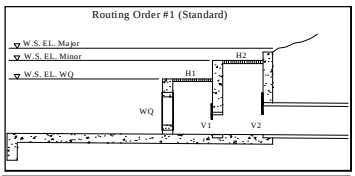
Project: FALCON MARKETPLACE

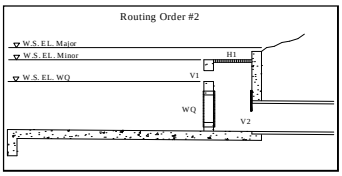
Basin ID: NORTH POND #1

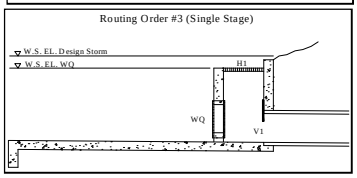


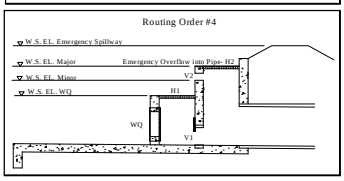
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: **Falcon Marketplace #1**
Basin ID: **NORTH POND #1**









Current Routing Order is #3

Design Information (Input):

			#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Circular Opening:	Diameter in Inches	Dia. =			96.00		inches
OR							
Rectangular Opening:	Width in Feet	W =	8.00				ft.
	Length (Height for Vertical)	L or H =	12.00				ft.
	Percentage of Open Area After Trash Rack Reduction	% open =	80		100		%
	Orifice Coefficient	C_o =	0.75		0.75		
	Weir Coefficient	C_w =	3.00				
	Orifice Elevation (Bottom for Vertical)	E_o =	6893.80		6,881.97		ft.

Calculation of Collection Capacity:

		#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Net Opening Area (after Trash Rack Reduction)	A_o =	76.80		50.27		sq. ft.
OPTIONAL: User-Overide Net Opening Area	A_o =					sq. ft.
Perimeter as Weir Length	L_w =	36.80	ft.			
OPTIONAL: User-Overide Weir Length	L_w =		ft.			

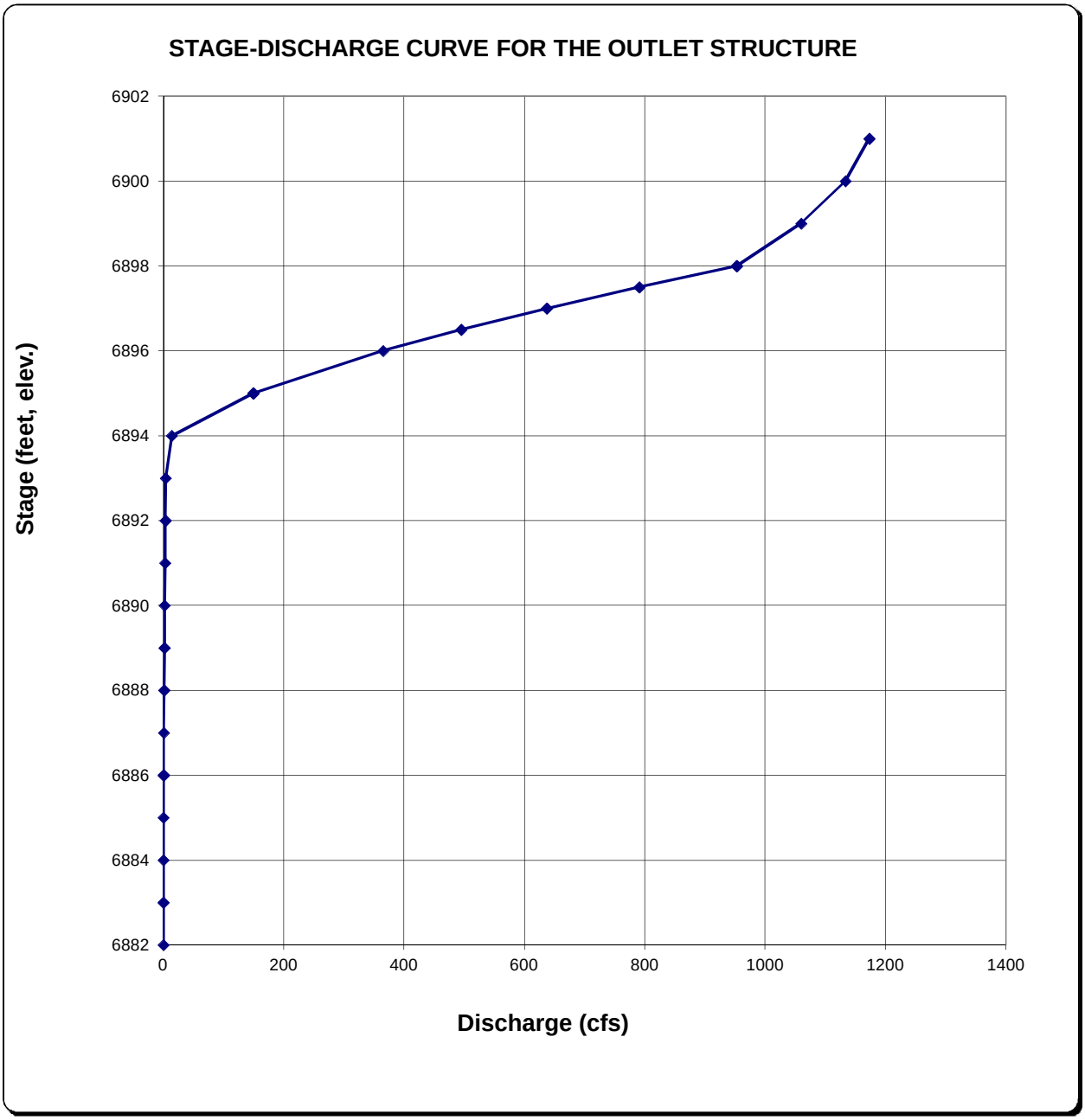
Top Elevation of Vertical Orifice Opening, Top = 6889.97 ft.
Center Elevation of Vertical Orifice Opening, Cen = 6885.97 ft.

Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).

			Horizontal Orifices				**Vertical Orifices**			
Labels for WQCV, Minor, & Major Storage W.S. Elevations (input)	Water Surface Elevation ft (linked)	WQCV Plate/Riser Flow cfs (User-linked)	#1 Horiz. Weir Flow cfs (output)	#1 Horiz. Orifice Flow cfs (output)	#2 Horiz. Weir Flow cfs (output)	#2 Horiz. Orifice Flow cfs (output)	#1 Vert. Collection Capacity cfs (output)	#2 Vert. Collection Capacity cfs (output)	**Total Collection Capacity cfs (output)**	Target Volumes for WQCV, Minor, & Major Storage Volumes (link for goal seek)
	6882.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	**0.00**	
	6883.00	0.00	0.00	0.00	0.00	0.00	27.95	0.00	**0.00**	
	6884.00	0.00	0.00	0.00	0.00	0.00	77.34	0.00	**0.00**	
	6885.00	0.00	0.00	0.00	0.00	0.00	141.04	0.00	**0.00**	
	6886.00	0.55	0.00	0.00	0.00	0.00	216.33	0.00	**0.55**	
	6887.00	0.77	0.00	0.00	0.00	0.00	301.66	0.00	**0.77**	
	6888.00	1.33	0.00	0.00	0.00	0.00	395.95	0.00	**1.33**	
	6889.00	1.76	0.00	0.00	0.00	0.00	498.43	0.00	**1.76**	
	6890.00	2.08	0.00	0.00	0.00	0.00	607.33	0.00	**2.08**	
	6891.00	2.90	0.00	0.00	0.00	0.00	678.51	0.00	**2.90**	
	6892.00	3.37	0.00	0.00	0.00	0.00	742.90	0.00	**3.37**	
WQCV	6893.00	3.77	0.00	0.00	0.00	0.00	802.14	0.00	**3.77**	
	6894.00	4.12	9.87	206.72	0.00	0.00	857.30	0.00	**13.99**	
	6895.00	4.44	145.12	506.36	0.00	0.00	909.11	0.00	**149.56**	
	6896.00	4.74	360.25	685.61	0.00	0.00	958.13	0.00	**364.99**	
	6896.50	4.88	489.80	759.53	0.00	0.00	981.72	0.00	**494.67**	
100-YR	6897.00	5.02	631.97	826.88	0.00	0.00	1004.76	0.00	**636.98**	
	6897.50	5.15	785.73	889.13	0.00	0.00	1027.28	0.00	**790.88**	
	6898.00	5.28	950.26	947.31	0.00	0.00	1049.32	0.00	**952.58**	
	6899.00	5.53	1309.10	1054.06	0.00	0.00	1092.06	0.00	**1059.59**	
	6900.00	5.77	1704.34	1150.96	0.00	0.00	1133.19	0.00	**1133.19**	
	6901.00	6.00	2132.89	1240.31	0.00	0.00	1172.88	0.00	**1172.88**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.00	**#N/A**	

STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

Project: Falcon Marketplace #1
Basin ID: NORTH POND #1

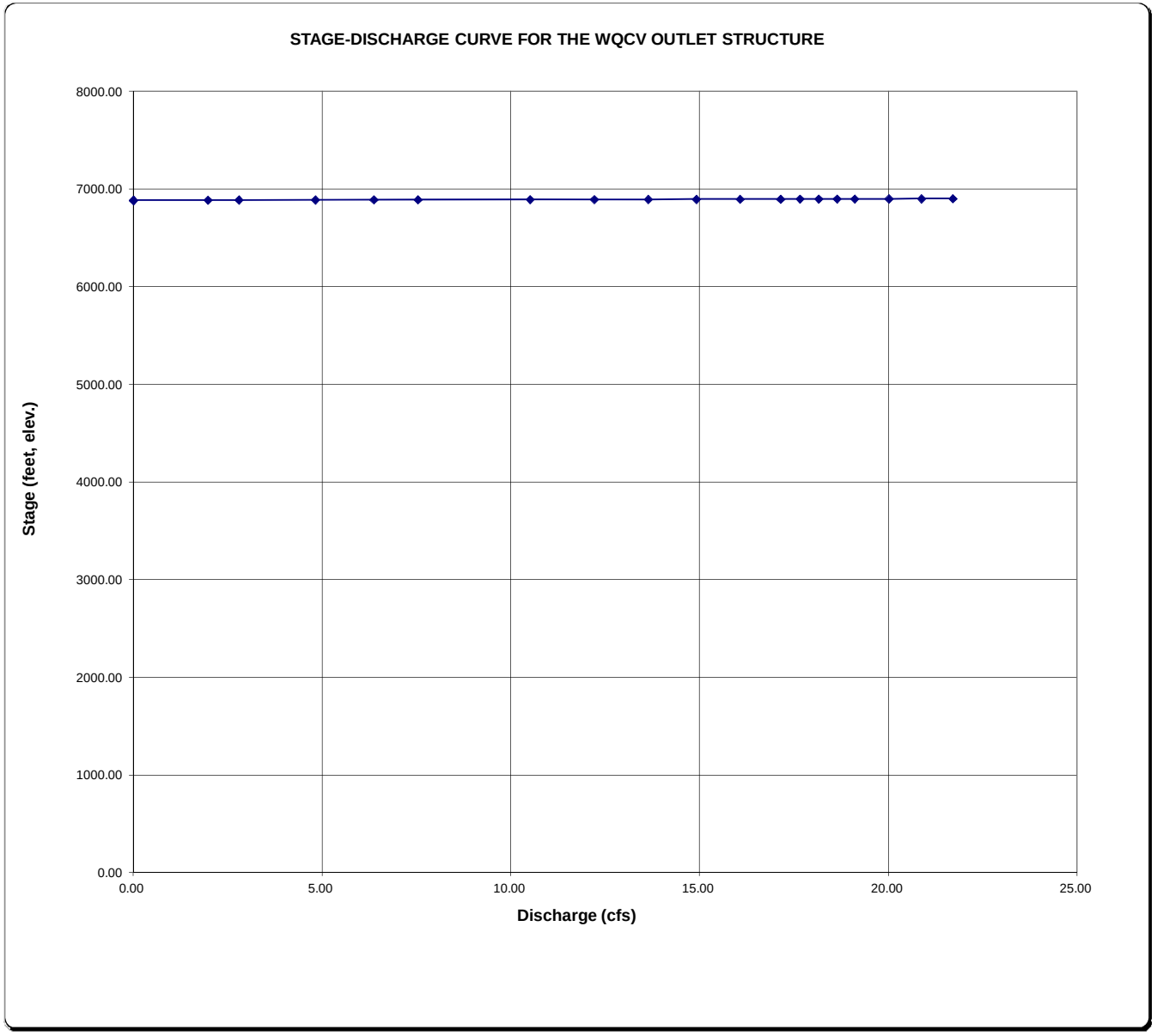


STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Worksheet Protected

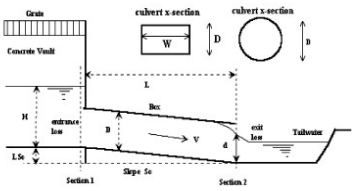
Project: FALCON MARKETPLACE

Basin ID: NORTH POND #1



STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: **FALCON MARKETPLACE**
Basin ID: **NORTH POND #1**



Status: Culvert Data is valid!

Design Information (Input):

Circular Culvert: Barrel Diameter in Inches	D =	96	in.
Circular Culvert: Inlet Edge Type (choose from pull-down list)		Grooved End with Headwall	
OR:			
Box Culvert: Barrel Height (Rise) in Feet	Height (Rise) =		ft.
Box Culvert: Barrel Width (Span) in Feet	Width (Span) =		ft.
Box Culvert: Inlet Edge Type (choose from pull-down list)		Square Edge w/ 90-15 deg. Flared Wingwall	
Number of Barrels	No =	1	
Inlet Elevation at Culvert Invert	I_{elev} =	6881.97	ft. elev.
Outlet Elevation at Culvert Invert	O_{elev} =	6880.85	ft. elev.
Culvert Length in Feet	L =	78.0	ft.
Manning's Roughness	n =	0.0120	
Bend Loss Coefficient	K_b =	0.00	
Exit Loss Coefficient	K_x =	1.00	

Design Information (calculated):

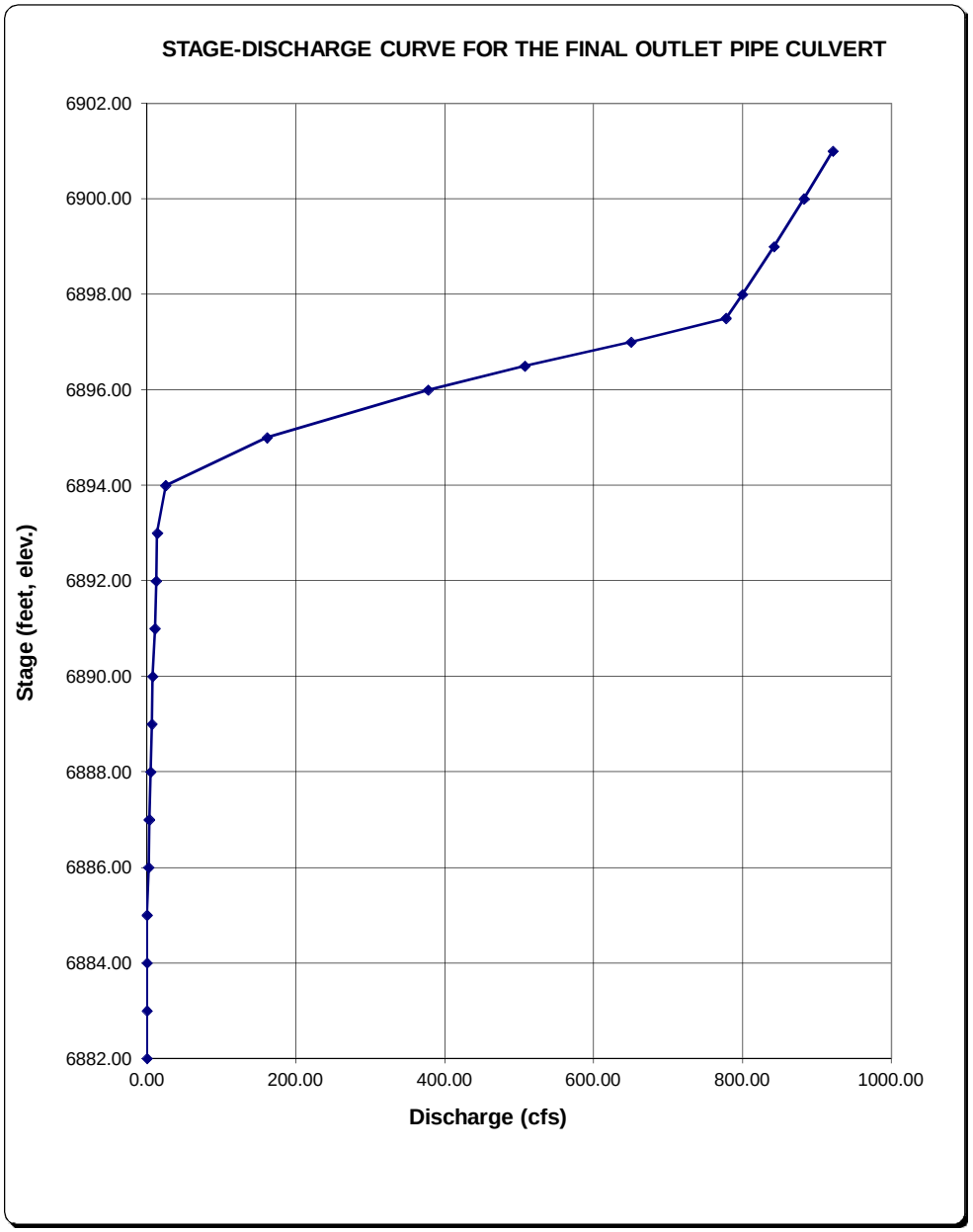
Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.13
Sum of All Loss Coefficients	K_s =	1.33
Orifice Inlet Condition Coefficient	C_d =	0.99
Minimum Energy Condition Coefficient	KE_{low} =	-0.04

Calculations of Culvert Capacity (output):

Water Surface Elevation From Sheet "Basin" (ft., linked)	Tailwater Surface Elevation ft (input if known)	Culvert Inlet-Control Flowrate cfs (output)	Culvert Outlet-Control Flowrate cfs (output)	Flowrate Into Culvert From Sheet "Outlet" (cfs, linked)	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used (output)
6882.00	0.00	0.10	73.88	**0.00**	**0.00**	Min. Energy. Eqn.
6883.00	0.00	8.20	127.58	**0.00**	**0.00**	Min. Energy. Eqn.
6884.00	0.00	38.80	179.44	**0.00**	**0.00**	Min. Energy. Eqn.
6885.00	0.00	83.70	227.39	**0.00**	**0.00**	Min. Energy. Eqn.
6886.00	0.00	142.70	253.50	**1.98**	**1.98**	Regression Eqn.
6887.00	0.00	207.40	260.30	**2.79**	**2.79**	Regression Eqn.
6888.00	0.00	284.50	274.34	**4.82**	**4.82**	Regression Eqn.
6889.00	0.00	370.40	296.59	**6.37**	**6.37**	Regression Eqn.
6890.00	0.00	456.70	327.85	**7.54**	**7.54**	Regression Eqn.
6891.00	0.00	537.00	401.74	**10.51**	**10.51**	Regression Eqn.
6892.00	0.00	609.70	475.03	**12.21**	**12.21**	Regression Eqn.
6893.00	0.00	675.30	541.57	**13.64**	**13.64**	Regression Eqn.
6894.00	0.00	735.40	601.48	**24.79**	**24.79**	Regression Eqn.
6895.00	0.00	790.90	656.53	**161.20**	**161.20**	Regression Eqn.
6896.00	0.00	843.00	707.57	**377.40**	**377.40**	Regression Eqn.
6896.50	0.00	867.90	731.66	**507.45**	**507.45**	Regression Eqn.
6897.00	0.00	892.20	755.10	**650.12**	**650.12**	Regression Eqn.
6897.50	0.00	915.90	777.72	**804.36**	**777.72**	Regression Eqn.
6898.00	0.00	939.10	799.86	**966.41**	**799.86**	Regression Eqn.
6899.00	0.00	984.10	842.42	**1074.08**	**842.42**	Regression Eqn.
6900.00	0.00	1027.50	882.74	**1133.19**	**882.74**	Regression Eqn.
6901.00	0.00	1069.50	921.46	**1172.88**	**921.46**	Regression Eqn.
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)
0.00	0.00	0.00	0.00	**#N/A**	**#N/A**	No Flow (WS < inlet)

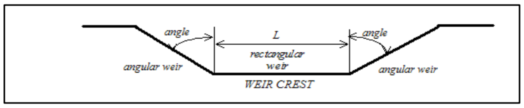
STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



Design Information (input):

Bottom Length of Weir	L =	160.00	feet
Angle of Side Slope Weir	Angle =	75.96	degrees
Elev. for Weir Crest	EL. Crest =	6,898.00	feet
Coef. for Rectangular Weir	C_w =		
Coef. for Trapezoidal Weir	C_t =	3.50	

Calculation of Spillway Capacity (output):

Water Surface Elevation ft. (linked)	Rect. Weir Flowrate cfs (output)	Triangle Weir Flowrate cfs (output)	Total Spillway Release cfs (output)	Total Pond Release cfs (output)
6882.00	0.00	0.00	0.00	0.00
6883.00	0.00	0.00	0.00	0.00
6884.00	0.00	0.00	0.00	0.00
6885.00	0.00	0.00	0.00	0.00
6886.00	0.00	0.00	0.00	1.98
6887.00	0.00	0.00	0.00	2.79
6888.00	0.00	0.00	0.00	4.82
6889.00	0.00	0.00	0.00	6.37
6890.00	0.00	0.00	0.00	7.54
6891.00	0.00	0.00	0.00	10.51
6892.00	0.00	0.00	0.00	12.21
6893.00	0.00	0.00	0.00	13.64
6894.00	0.00	0.00	0.00	24.79
6895.00	0.00	0.00	0.00	161.20
6896.00	0.00	0.00	0.00	377.40
6896.50	0.00	0.00	0.00	507.45
6897.00	0.00	0.00	0.00	650.12
6897.50	0.00	0.00	0.00	777.72
6898.00	0.00	0.00	0.00	799.86
6899.00	0.00	14.00	14.00	856.42
6900.00	0.00	79.17	79.17	961.91
6901.00	0.00	218.18	218.18	1,139.63
#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	#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	#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	#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	#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
#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	#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

PROJECT INFORMATION

PROJECT:	Falcon Marketplace
PROJECT NO:	20988-00CSCV
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Preliminary
DATE:	6/19/2017

Drexel, Barrell & Co.

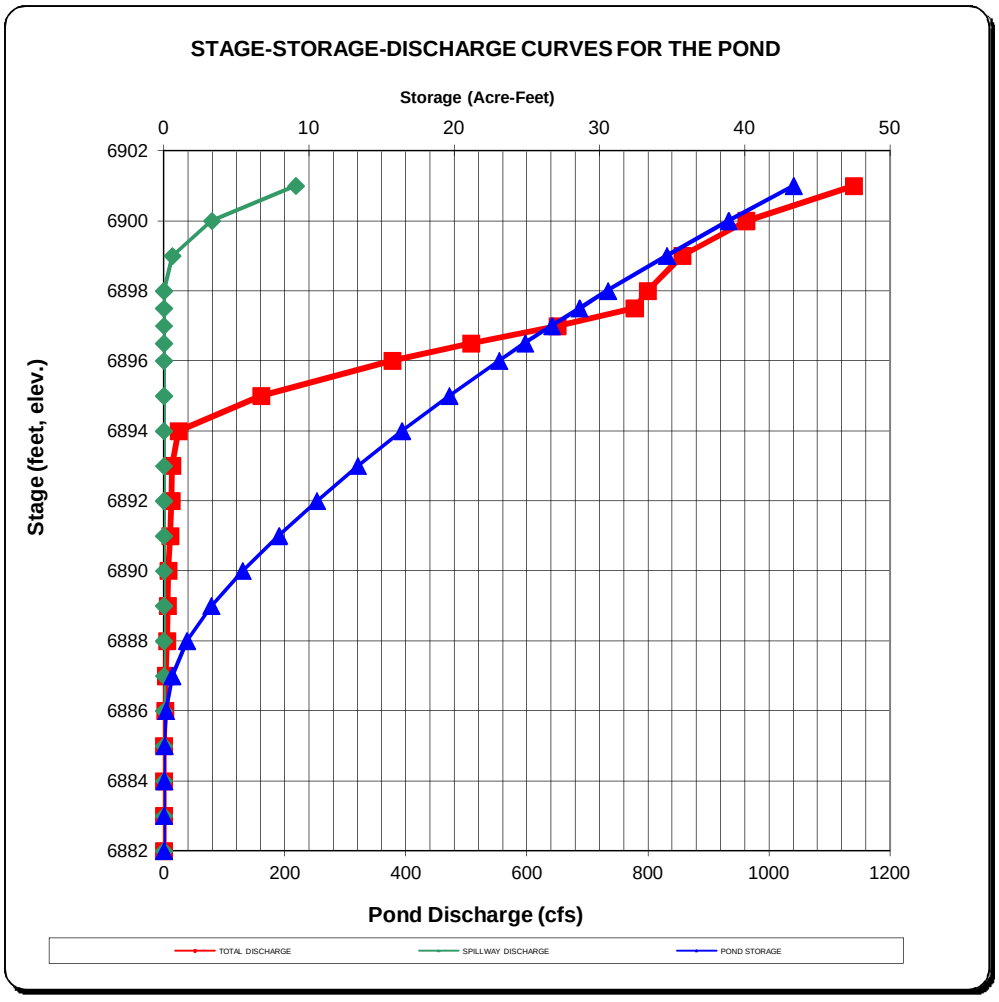
SPILLWAY CALCULATIONS

Q=CL(H^(2/3))

Weir coefficient C:	3.5
Depth H, ft:	1.5
Flowrate Q. cfs:	1016
Required L, ft:	**158.01**

STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: FALCON MARKETPLACE
Basin ID: NORTH POND #1



Aluminum Bar Grating

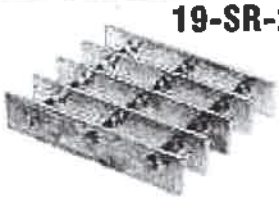
TRASH RACK GRATE
AT FRONT OF BOX

RECTANGULAR BAR SWAGE-LOCKED 1-3/16" C/C Bearing Bars

19-SR-4

Cross Rods 4" C/C

19-SR-2



Cross Rods 2" C/C

NON-SERRATED & SERRATED

PRESS-LOCKED 1-3/16" C/C Bearing Bars

19-AP-4

Cross Bars 4" C/C

19-AP-2

Cross Bars 2" C/C

LOAD & DEFLECTION TABLE

Bar Size	Symbol	Approx. Weight psf	Sec. Mod Per Ft. Of Width		SPAN (Direction of Bearing Bar) 24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"	96"	108"
3/4" x 1/8"	19-SR-4	1.4	0.118	U	237	152	105	77									
	19-SR-2	1.6		D	0.192	0.300	0.432	0.588									
	19-AP-4	1.5		C	237	169	158	135									
	19-AP-2	1.8		D	0.154	0.240	0.346	0.470									
3/4" x 3/16"	19-SR-4	1.9	0.178	U	355	227	158	116									
	19-SR-2	2.1		D	0.192	0.300	0.432	0.588									
	19-AP-4	2.2		C	355	284	237	203									
	19-AP-2	2.7		D	0.154	0.240	0.346	0.470									
1" x 1/8"	19-SR-4	1.7	0.211	U	421	269	187	137	105								
	19-SR-2	1.9		D	0.144	0.225	0.324	0.441	0.576								
	19-AP-4	1.8		C	421	337	281	241	211								
	19-AP-2	2.2		D	0.115	0.180	0.259	0.353	0.461								
1" x 3/16"	19-SR-4	2.5	0.316	U	632	404	281	206	158	125							
	19-SR-2	2.7		D	0.144	0.225	0.324	0.441	0.576	0.729							
	19-AP-4	2.8		C	632	505	421	361	316	281							
	19-AP-2	3.3		D	0.115	0.180	0.259	0.353	0.461	0.583							
1-1/4" x 1/8"	19-SR-4	2.1	0.329	U	658	421	292	215	164	130							
	19-SR-2	2.3		D	0.115	0.180	0.259	0.353	0.461	0.583							
	19-AP-4	2.4		C	658	526	439	376	329	292							
	19-AP-2	2.8		D	0.092	0.144	0.207	0.282	0.369	0.467							
1-1/4" x 3/16"	19-SR-4	3.1	0.493	U	987	632	439	322	247	195	158						
	19-SR-2	3.3		D	0.115	0.180	0.259	0.353	0.461	0.583	0.720						
	19-AP-4	3.5		C	987	789	658	564	493	439	395						
	19-AP-2	4.2		D	0.092	0.144	0.207	0.282	0.369	0.467	0.576						
1-1/2" x 1/8"	19-SR-4	2.5	0.474	U	947	606	421	309	237	187	152						
	19-SR-2	2.7		D	0.096	0.150	0.216	0.294	0.384	0.486	0.600						
	19-AP-4	2.8		C	947	758	632	541	474	421	379						
	19-AP-2	3.2		D	0.077	0.120	0.173	0.235	0.307	0.389	0.480						
1-1/2" x 3/16"	19-SR-4	3.7	0.711	U	1421	909	632	464	355	281	227	188					
	19-SR-2	3.9		D	0.096	0.150	0.216	0.294	0.384	0.486	0.600	0.726					
	19-AP-4	4.1		C	1421	1137	947	812	711	632	568	517					
	19-AP-2	4.8		D	0.077	0.120	0.173	0.235	0.307	0.389	0.480	0.581					
1-3/4" x 3/16"	19-SR-4	4.2	0.967	U	1934	1238	860	632	484	382	309	256	215	183			
	19-SR-2	4.4		D	0.082	0.129	0.185	0.252	0.329	0.417	0.514	0.622	0.741	0.869			
	19-AP-4	4.7		C	1934	1547	1289	1105	967	860	774	703	645	595			
	19-AP-2	5.3		D	0.066	0.103	0.148	0.202	0.263	0.333	0.411	0.498	0.592	0.695			
2" x 3/16"	19-SR-4	4.8	1.263	U	2526	1617	1123	825	632	499	404	334	281	239	206		
	19-SR-2	5.0		D	0.072	0.113	0.162	0.221	0.288	0.365	0.450	0.545	0.648	0.761	0.882		
	19-AP-4	5.3		C	2526	2021	1684	1444	1263	1123	1011	919	842	777	722		
	19-AP-2	5.9		D	0.058	0.090	0.130	0.176	0.230	0.292	0.360	0.436	0.518	0.608	0.706		
2-1/4" x 3/16"	19-SR-4	5.4	1.599	U	3197	2046	1421	1044	799	632	512	423	355	303	261	200	
	19-SR-2	5.6		D	0.064	0.100	0.144	0.196	0.256	0.324	0.400	0.484	0.576	0.676	0.784	1.024	
	19-AP-4	5.8		C	3197	2558	2132	1827	1599	1421	1279	1163	1066	984	914	799	
	19-AP-2	6.5		D	0.051	0.080	0.115	0.157	0.205	0.259	0.320	0.387	0.461	0.541	0.627	0.819	
2-1/2" x 3/16"	19-SR-4	5.9	1.974	U	3947	2526	1754	1289	987	780	632	522	439	374	322	247	195
	19-SR-2	6.1		D	0.058	0.090	0.130	0.176	0.230	0.292	0.360	0.436	0.518	0.608	0.706	0.922	1.166
	19-AP-4	6.4		C	3947	3158	2632	2256	1974	1754	1579	1435	1316	1215	1128	987	877
	19-AP-2	7.1		D	0.046	0.072	0.104	0.141	0.184	0.233	0.288	0.348	0.415	0.487	0.564	0.737	0.933

U = safe uniform load, psf (page 93)
C = safe concentrated load, psf (page 93)
D = deflection, inches
E = modulus of elasticity, 10,000,000 psi
F = fiber stress, 12,000 psi
Material: ASTM B-221, 6063 or 6061
Deflection: Spans and loads to the right of the bold line exceed 1/4" deflection for uniform load of 100 psf which provides safe pedestrian comfort. These can be exceeded for other types of loads with engineer's approval.
Serrated Bars: For serrated grating, the depth of grating required for a specified load is 1/4" deeper than that shown in the table.
General: Loads and deflections are theoretical and based on static loading.
Finish: Mill finish unless otherwise specified.

FALCON MARKETPLACE
15-FT Head x 62.4 = 936 psf

SR/AP-19 PANEL WIDTH (inches)

Note: Includes 1/4" (1/8" each side) for extended cross rods on swage-locked (SR) and extended cross bars on press-locked (AP).

No. of Bars	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1/8" Bar	1 9/16	2 3/4	3 15/16	5 1/8	6 5/16	7 1/2	8 11/16	9 7/8	11 1/16	12 1/4	13 7/16	14 5/8	15 13/16	17	18 3/16
3/16" Bar	1 5/8	2 13/16	4	5 3/16	6 3/8	7 9/16	8 3/4	9 15/16	11 1/8	12 5/16	13 1/2	14 11/16	15 7/8	17 1/16	18 1/4
No. of Bars	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
1/8" Bar	19 3/8	20 9/16	21 3/4	22 15/16	24 1/8	25 5/16	26 1/2	27 11/16	28 7/8	30 1/16	31 1/4	32 7/16	33 5/8	34 13/16	36
3/16" Bar	19 7/16	20 5/8	21 13/16	23	24 3/16	25 3/8	26 9/16	27 3/4	28 15/16	30 1/8	31 5/16	32 1/2	33 11/16	34 7/8	36 1/16

Flow depths entering Pond SR4

CLOMR

Min Ch El	6895.98	
WS Elev	6898.75	
Max flow depth (north)	***2.8***	ft

NORTHWEST SWALE

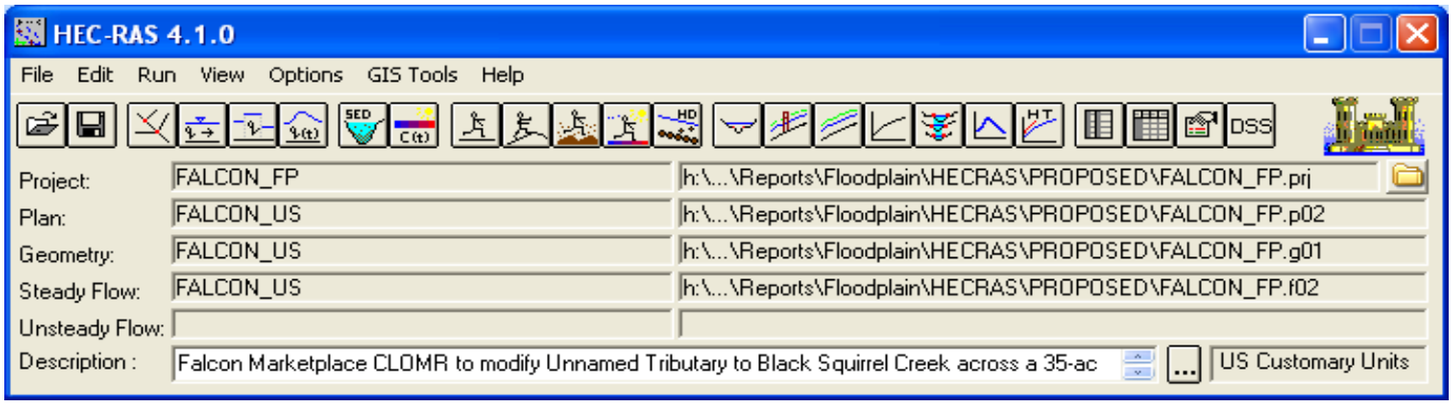
Assuming trapezoidal channelized flow at riprap entry

Q100	30.2	cfs
Width	8	ft
Side Slopes	5	:1
Slope	1.6	%
n	0.020	

Calculated flow depth	***0.5***	ft

Project: Falcon Marketplace
Project No.: 20988-00

HEC-RAS Data Output
Proposed Conditions Model, North (Drexel Barrell Model)
File: H:\20988-00CSCV\Reports\Floodplain\HECRAS\PROPOSED\FALCON_FP.prj
Plan: FALCON_US



Date: 10/17/16
100-year Output, Standard Tabel 1
Cross Sections: 2926-2842

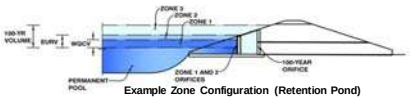
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
FALCON_US	2926	100-YR	1016	6895.98	6898.75	6898.75	6899.12	0.025538	6.71	306.22	403.31	0.91
FALCON_US	2842	100-YR	1016	6888.58	6897	6889.37	6897	0.000001	0.15	6775.42	897.89	0.01

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: FALCON MARKETPLACE

Basin ID: POND 2



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	27.80	acres	
Watershed Length =	1,500	ft	
Watershed Slope =	0.020	ft/ft	
Watershed Imperviousness =	86.80%	percent	
Percentage Hydrologic Soil Group A =	100.0%	percent	
Percentage Hydrologic Soil Group B =	0.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	User Input		
Water Quality Capture Volume (WQCV) =	0.870	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	3.247	acre-feet	
2-yr Runoff Volume (P1 = 0.95 in.) =	1.799	acre-feet	0.95 inches
5-yr Runoff Volume (P1 = 1.22 in.) =	2.375	acre-feet	1.22 inches
10-yr Runoff Volume (P1 = 1.48 in.) =	2.968	acre-feet	1.48 inches
25-yr Runoff Volume (P1 = 1.86 in.) =	3.832	acre-feet	1.86 inches
50-yr Runoff Volume (P1 = 2.19 in.) =	4.561	acre-feet	2.19 inches
100-yr Runoff Volume (P1 = 2.54 in.) =	5.426	acre-feet	2.54 inches
500-yr Runoff Volume (P1 = 3.46 in.) =	7.652	acre-feet	3.46 inches
Approximate 2-yr Detention Volume =	1.708	acre-feet	
Approximate 5-yr Detention Volume =	2.258	acre-feet	
Approximate 10-yr Detention Volume =	2.792	acre-feet	
Approximate 25-yr Detention Volume =	3.627	acre-feet	
Approximate 50-yr Detention Volume =	4.136	acre-feet	
Approximate 100-yr Detention Volume =	4.593	acre-feet	

Stage-Storage Calculation

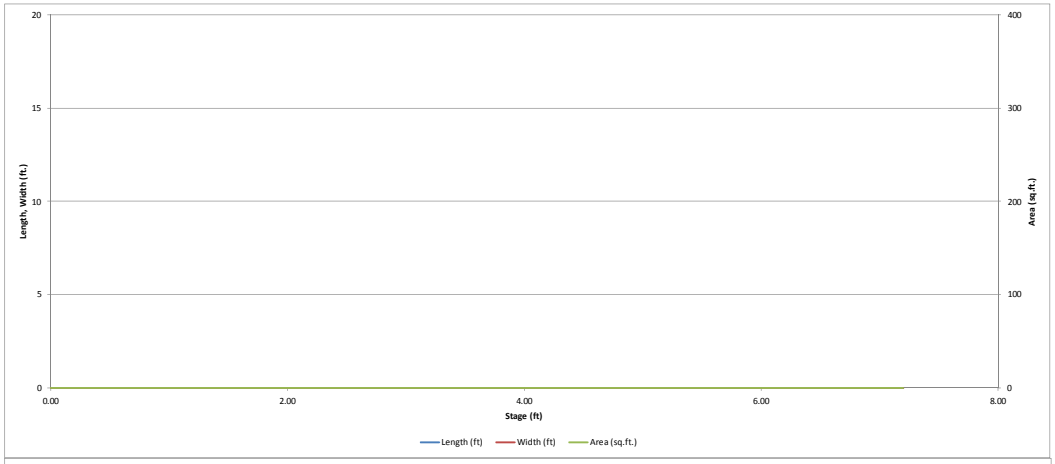
Zone 1 Volume (WQCV) =	0.870	acre-feet	
Zone 2 Volume (User Defined - Zone 1) =	0.400	acre-feet	**Total detention volume is less than 100-year volume.**
Select Zone 3 Storage Volume (Optional) =		acre-feet	
Total Detention Basin Volume =	1.270	acre-feet	
Initial Surcharge Volume (ISV) =	user	ft^3	
Initial Surcharge Depth (ISD) =	user	ft	
Total Available Detention Depth (H_{total}) =	user	ft	
Depth of Trickle Channel (H_{TC}) =	user	ft	
Slope of Trickle Channel (S_{TC}) =	user	ft/ft	
Slopes of Main Basin Sides (S_{main}) =	user	H:V	
Basin Length-to-Width Ratio ($R_{L/W}$) =	user		
Initial Surcharge Area (A_{ISV}) =	user	ft^2	
Surcharge Volume Length (L_{ISV}) =	user	ft	
Surcharge Volume Width (W_{ISV}) =	user	ft	
Depth of Basin Floor (H_{FLOOR}) =	user	ft	
Length of Basin Floor (L_{FLOOR}) =	user	ft	
Width of Basin Floor (W_{FLOOR}) =	user	ft	
Area of Basin Floor (A_{FLOOR}) =	user	ft^2	
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3	
Depth of Main Basin (H_{MAIN}) =	user	ft	
Length of Main Basin (L_{MAIN}) =	user	ft	
Width of Main Basin (W_{MAIN}) =	user	ft	
Area of Main Basin (A_{MAIN}) =	user	ft^2	
Volume of Main Basin (V_{MAIN}) =	user	ft^3	
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet	

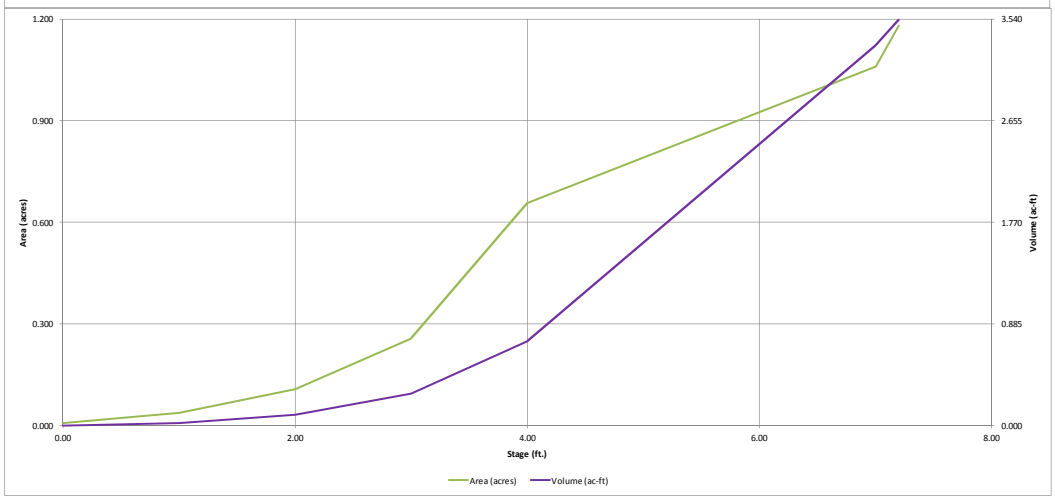
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	300	0.007		
6873	--	1.00	--	--	--	1,659	0.038	963	0.022
6874	--	2.00	--	--	--	4,721	0.108	4,122	0.095
6875	--	3.00	--	--	--	11,225	0.258	12,142	0.279
6876	--	4.00	--	--	--	28,592	0.656	32,051	0.736
6879	--	7.00	--	--	--	46,125	1.059	144,126	3.309
6879.2	--	7.20	--	--	--	51,425	1.181	153,881	3.533

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



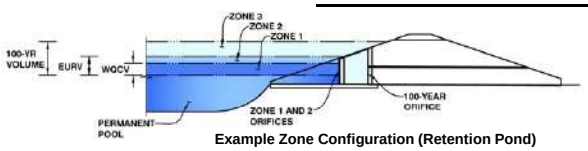


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: FALCON MARKETPLACE

Basin ID: POND 2



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.21	0.870	Orifice Plate
Zone 2 (User)	4.76	0.400	Weir&Pipe (Circular)
Zone 3			
		1.270	Total

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.21	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	14.70	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.40	2.81					
Orifice Area (sq. inches)	2.46	2.46	2.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =			ft^2
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =			feet
Vertical Orifice Diameter =			inches				

Calculated Parameters for Vertical Orifice

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

	Zone 2 Weir	Not Selected			Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.21		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.21		feet
Overflow Weir Front Edge Length =	6.00		feet	Over Flow Weir Slope Length =	6.00		feet
Overflow Weir Slope =	0.00		H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	5.13		should be ≥ 4
Horiz. Length of Weir Sides =	6.00		feet	Overflow Grate Open Area w/o Debris =	25.20		ft^2
Overflow Grate Open Area % =	70%		%, grate open area/total area	Overflow Grate Open Area w/ Debris =	12.60		ft^2
Debris Clogging % =	50%		%				

Calculated Parameters for Overflow Weir

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

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.80	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.39	feet
Spillway Crest Length =	120.00	feet	Stage at Top of Freeboard =	7.19	feet
Spillway End Slopes =	5.00	H:V	Basin Area at Top of Freeboard =	1.17	acres
Freeboard above Max Water Surface =	1.00	feet			

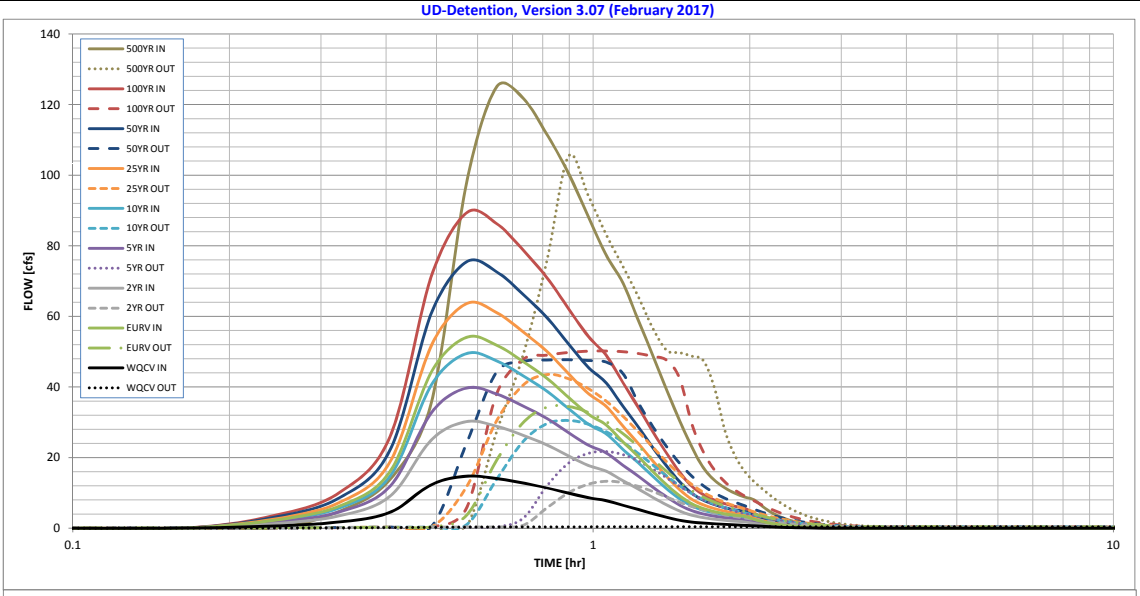
Calculated Parameters for Spillway

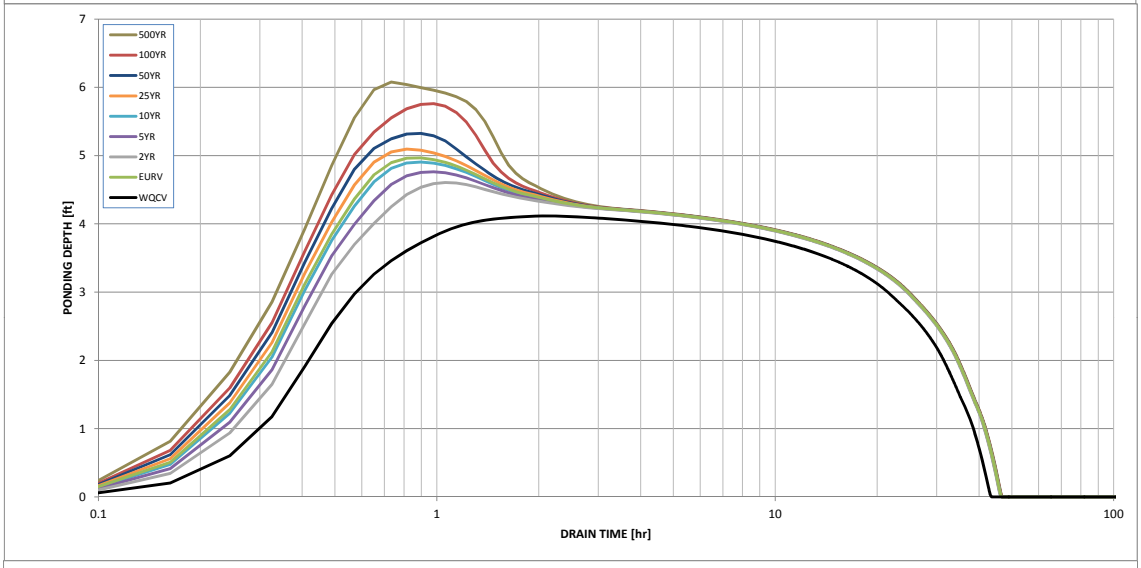
Routed Hydrograph Results

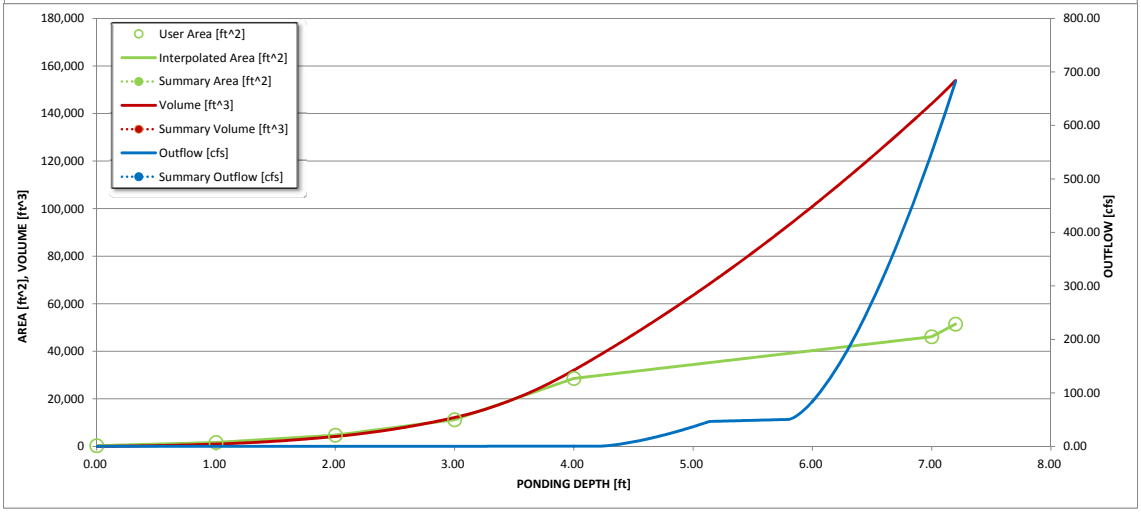
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.95	1.22	1.48	1.86	2.19	2.54	3.46
Calculated Runoff Volume (acre-ft) =	0.870	3.247	1.799	2.375	2.968	3.832	4.561	5.426	7.652
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.870	3.247	1.799	2.375	2.969	3.832	4.561	5.422	7.651
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.03	0.20	0.50	1.22
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.1	0.3	0.7	5.5	13.8	34.0
Peak Inflow Q (cfs) =	14.7	54.0	30.2	39.7	49.5	63.6	75.4	89.3	124.9
Peak Outflow Q (cfs) =	0.4	34.4	13.3	21.7	30.5	43.5	47.7	50.2	105.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	181.6	105.6	61.3	8.7	3.6	3.1
Structure Controlling Flow =	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	1.36	0.52	0.8	1.2	1.7	1.9	2.0	2.0
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	35	38	36	35	33	32	31	27
Time to Drain 99% of Inflow Volume (hours) =	**41**	40	42	41	41	40	39	38	36
Maximum Ponding Depth (ft) =	4.12	4.97	4.61	4.76	4.91	5.09	5.33	5.76	6.08
Area at Maximum Ponding Depth (acres) =	0.67	0.79	0.74	0.76	0.78	0.80	0.83	0.89	0.93
Maximum Volume Stored (acre-ft) =	0.809	1.428	1.154	1.273	1.381	1.531	1.719	2.099	2.382

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
4.89 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:04:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:09:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:14:40	0.65	2.28	1.30	1.70	2.10	2.66	3.10	3.61	4.82
1.023	0:19:34	1.75	6.28	3.55	4.65	5.77	7.36	8.66	10.16	13.86
	0:24:27	4.50	16.14	9.12	11.93	14.80	18.89	22.23	26.08	35.61
	0:29:20	12.35	44.26	25.03	32.75	40.62	51.80	60.94	71.47	97.44
	0:34:14	14.72	54.02	30.18	39.70	49.45	63.59	75.41	89.32	124.94
	0:39:07	14.06	51.84	28.89	38.04	47.43	61.11	72.66	86.34	121.79
	0:44:01	12.80	47.18	26.29	34.62	43.17	55.63	66.23	78.80	111.52
	0:48:54	11.45	42.46	23.60	31.11	38.83	50.11	59.67	71.02	100.59
	0:53:47	9.91	37.07	20.50	27.09	33.88	43.81	52.23	62.25	88.39
	0:58:41	8.62	32.32	17.80	23.57	29.52	38.23	45.62	54.41	77.35
	1:03:34	7.82	29.22	16.15	21.35	26.70	34.53	41.15	49.01	69.48
	1:08:28	6.47	24.44	13.45	17.82	22.32	28.92	34.53	41.21	58.70
	1:13:21	5.30	20.22	11.09	14.71	18.46	23.95	28.62	34.19	48.79
	1:18:14	4.10	15.96	8.68	11.56	14.55	18.95	22.71	27.20	39.03
	1:23:08	3.07	12.28	6.60	8.84	11.18	14.62	17.57	21.09	30.39
	1:28:01	2.21	9.13	4.84	6.53	8.29	10.90	13.14	15.83	22.93
	1:32:55	1.71	6.87	3.68	4.94	6.25	8.19	9.84	11.82	17.02
	1:37:48	1.41	5.55	3.00	4.01	5.05	6.59	7.90	9.46	13.56
	1:42:41	1.19	4.67	2.54	3.38	4.26	5.55	6.65	7.95	11.37
	1:47:35	1.05	4.07	2.22	2.95	3.71	4.83	5.78	6.91	9.85
	1:52:28	0.94	3.65	1.99	2.65	3.33	4.32	5.17	6.17	8.79
	1:57:22	0.87	3.34	1.83	2.43	3.05	3.96	4.73	5.65	8.03
	2:02:15	0.64	2.48	1.35	1.80	2.26	2.95	3.53	4.24	6.10
	2:07:08	0.47	1.80	0.98	1.31	1.64	2.13	2.56	3.06	4.40
	2:12:02	0.34	1.33	0.72	0.96	1.21	1.58	1.89	2.27	3.26
	2:16:55	0.25	0.99	0.54	0.71	0.90	1.17	1.41	1.69	2.43
	2:21:49	0.18	0.72	0.39	0.52	0.66	0.86	1.03	1.24	1.79
	2:26:42	0.13	0.52	0.28	0.37	0.47	0.62	0.74	0.89	1.29
	2:31:35	0.09	0.37	0.20	0.27	0.34	0.45	0.54	0.65	0.94
	2:36:29	0.06	0.26	0.14	0.19	0.24	0.31	0.38	0.45	0.66
	2:41:22	0.04	0.17	0.09	0.12	0.15	0.20	0.24	0.30	0.44
	2:46:16	0.02	0.09	0.05	0.06	0.08	0.11	0.14	0.17	0.26
	2:51:09	0.01	0.04	0.02	0.03	0.04	0.05	0.06	0.08	0.12
	2:56:02	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.02	0.04
	3:00:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:44:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:49:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:54:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:59:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:04:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:09:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:14:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:19:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:24:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:28:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:33:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:38:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:43:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:48:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:53:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:58:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:03:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:08:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:12:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:17:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:22:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:27:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:32:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:37:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:42:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:47:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:52:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

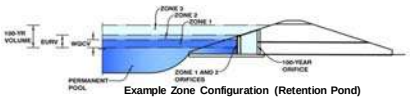
For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

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

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: FALCON MARKETPLACE

Basin ID: POND #3



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	5.31	acres	
Watershed Length =	1,000	ft	
Watershed Slope =	0.020	ft/ft	
Watershed Imperviousness =	48.20%	percent	
Percentage Hydrologic Soil Group A =	100.0%	percent	
Percentage Hydrologic Soil Group B =	0.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Desired WQCV Drain Time =	40.0	hours	
Location for 1-hr Rainfall Depths =	UDFCD Default		
Water Quality Capture Volume (WQCV) =	0.089	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.292	acre-feet	
2-yr Runoff Volume (P1 = 0.95 in.) =	0.148	acre-feet	0.95 inches
5-yr Runoff Volume (P1 = 1.22 in.) =	0.203	acre-feet	1.22 inches
10-yr Runoff Volume (P1 = 1.48 in.) =	0.274	acre-feet	1.48 inches
25-yr Runoff Volume (P1 = 1.86 in.) =	0.430	acre-feet	1.86 inches
50-yr Runoff Volume (P1 = 2.19 in.) =	0.542	acre-feet	2.19 inches
100-yr Runoff Volume (P1 = 2.54 in.) =	0.677	acre-feet	2.54 inches
500-yr Runoff Volume (P1 = 3.46 in.) =	1.026	acre-feet	3.46 inches
Approximate 2-yr Detention Volume =	0.141	acre-feet	
Approximate 5-yr Detention Volume =	0.193	acre-feet	
Approximate 10-yr Detention Volume =	0.261	acre-feet	
Approximate 25-yr Detention Volume =	0.331	acre-feet	
Approximate 50-yr Detention Volume =	0.379	acre-feet	
Approximate 100-yr Detention Volume =	0.463	acre-feet	

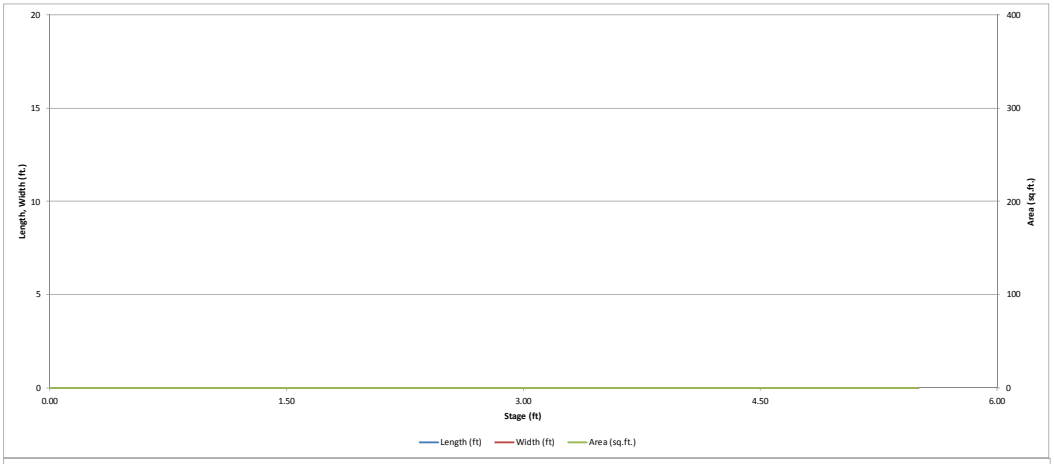
Stage-Storage Calculation

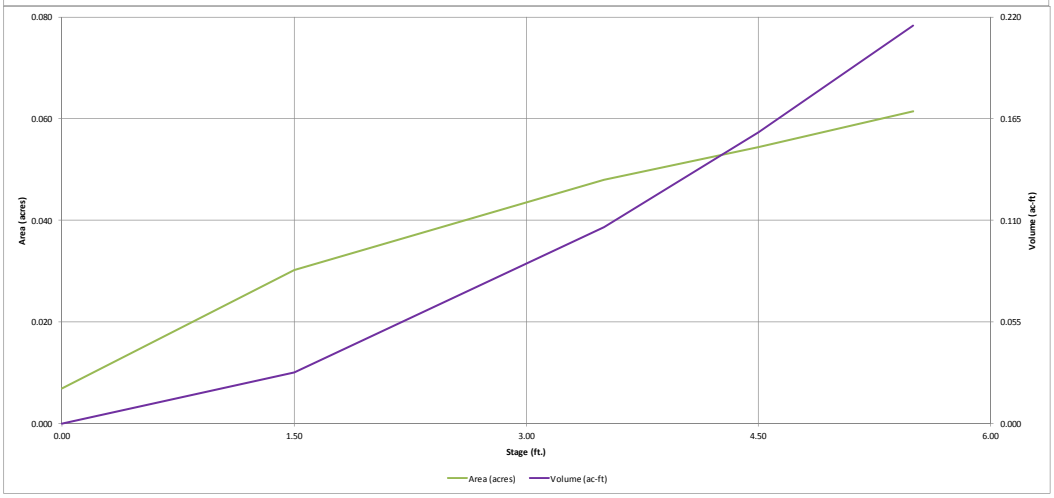
Zone 1 Volume (WQCV) =	0.089	acre-feet	
Zone 2 Volume (User Defined - Zone 1) =	0.126	acre-feet	**Total detention volume is less than 100-year volume.**
Select Zone 3 Storage Volume (Optional) =		acre-feet	
Total Detention Basin Volume =	0.215	acre-feet	
Initial Surcharge Volume (ISV) =	user	ft^3	
Initial Surcharge Depth (ISD) =	user	ft	
Total Available Detention Depth (H_{total}) =	user	ft	
Depth of Trickle Channel (H_{TC}) =	user	ft	
Slope of Trickle Channel (S_{TC}) =	user	ft/ft	
Slopes of Main Basin Sides (S_{main}) =	user	H:V	
Basin Length-to-Width Ratio ($R_{L/W}$) =	user		
Initial Surcharge Area (A_{ISV}) =	user	ft^2	
Surcharge Volume Length (L_{ISV}) =	user	ft	
Surcharge Volume Width (W_{ISV}) =	user	ft	
Depth of Basin Floor (H_{FLOOR}) =	user	ft	
Length of Basin Floor (L_{FLOOR}) =	user	ft	
Width of Basin Floor (W_{FLOOR}) =	user	ft	
Area of Basin Floor (A_{FLOOR}) =	user	ft^2	
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3	
Depth of Main Basin (H_{MAIN}) =	user	ft	
Length of Main Basin (L_{MAIN}) =	user	ft	
Width of Main Basin (W_{MAIN}) =	user	ft	
Area of Main Basin (A_{MAIN}) =	user	ft^2	
Volume of Main Basin (V_{MAIN}) =	user	ft^3	
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet	

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Micropool	--	0.00	--	--	--	303	0.007		
6881	--	1.50	--	--	--	1,319	0.030	1,203	0.028
6883	--	3.50	--	--	--	2,092	0.048	4,627	0.106
6884	--	4.50	--	--	--	2,370	0.054	6,858	0.157
6885	--	5.50	--	--	--	2,675	0.061	9,381	0.215

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

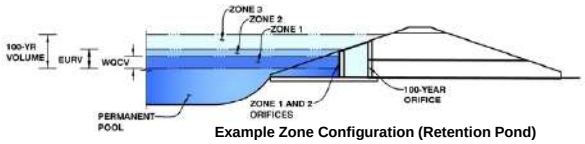




Detention Basin Outlet Structure Design

Project: FALCON MARKETPLACE

Basin ID: POND #3



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.14	0.089	Orifice Plate
Zone 2 (User)	5.50	0.126	Weir&Pipe (Restrict)
Zone 3			
		0.215	Total

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.14	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	13.50	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.05	2.09					
Orifice Area (sq. inches)	0.45	0.40	0.30					

	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			Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =			ft^2
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =			feet
Vertical Orifice Diameter =			inches				

Calculated Parameters for Vertical Orifice

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

	Zone 2 Weir	Not Selected			Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.38		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.38		feet
Overflow Weir Front Edge Length =	4.00		feet	Over Flow Weir Slope Length =	3.00		feet
Overflow Weir Slope =	0.00		H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	5.35		should be ≥ 4
Horiz. Length of Weir Sides =	3.00		feet	Overflow Grate Open Area w/o Debris =	8.40		ft^2
Overflow Grate Open Area % =	70%		%, grate open area/total area	Overflow Grate Open Area w/ Debris =	4.20		ft^2
Debris Clogging % =	50%		%				

Calculated Parameters for Overflow Weir

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

	Zone 2 Restrictor	Not Selected			Zone 2 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.57		ft^2
Outlet Pipe Diameter =	24.00		inches	Outlet Orifice Centroid =	0.58		feet
Restrictor Plate Height Above Pipe Invert =	12.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.57	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

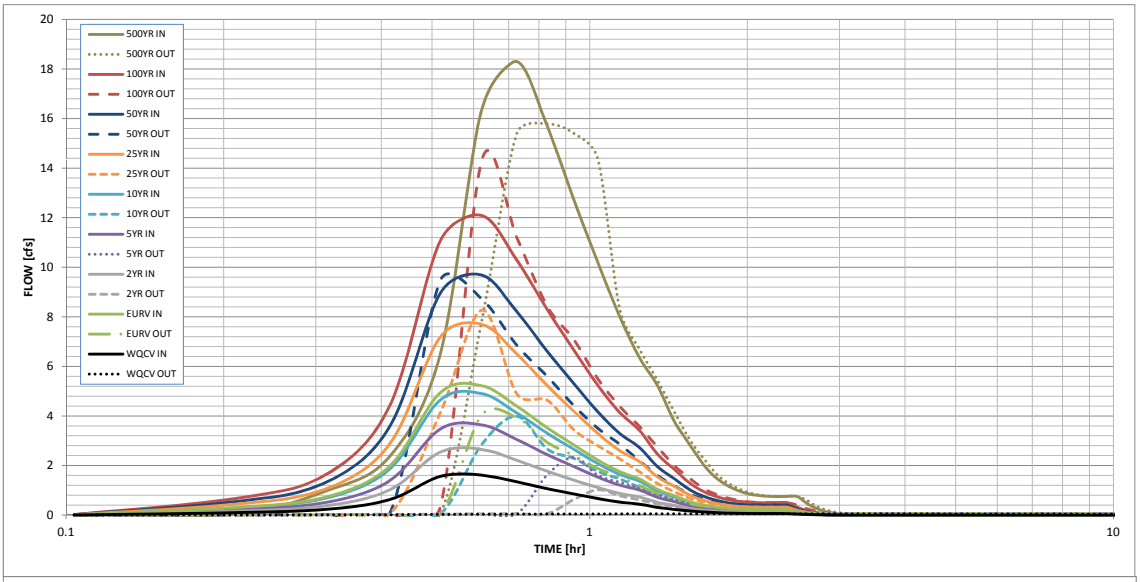
Spillway Invert Stage=		ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=		feet
Spillway Crest Length =		feet	Stage at Top of Freeboard =		feet
Spillway End Slopes =		H:V	Basin Area at Top of Freeboard =		acres
Freeboard above Max Water Surface =		feet			

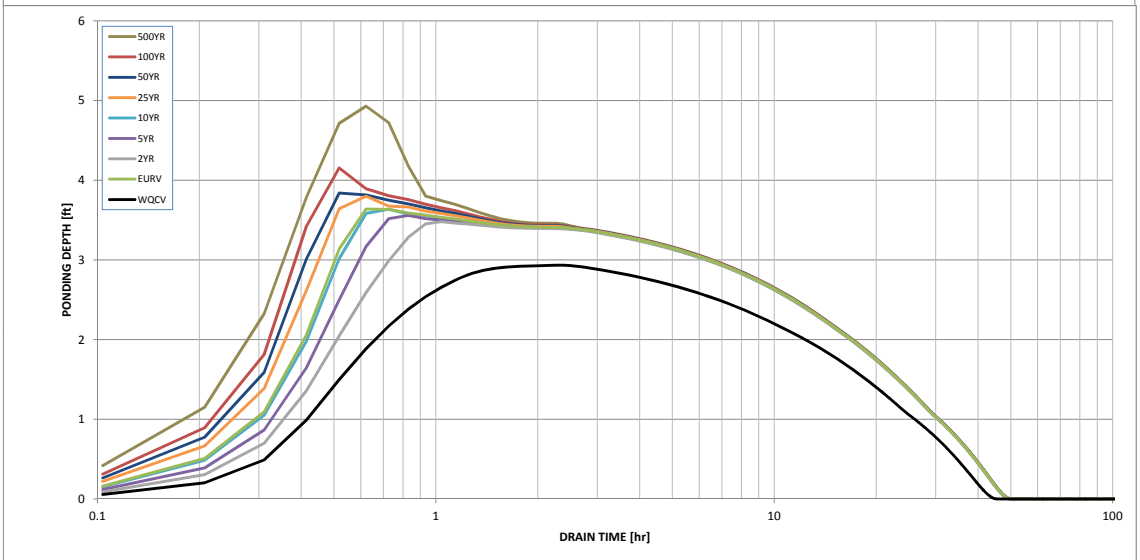
Calculated Parameters for Spillway

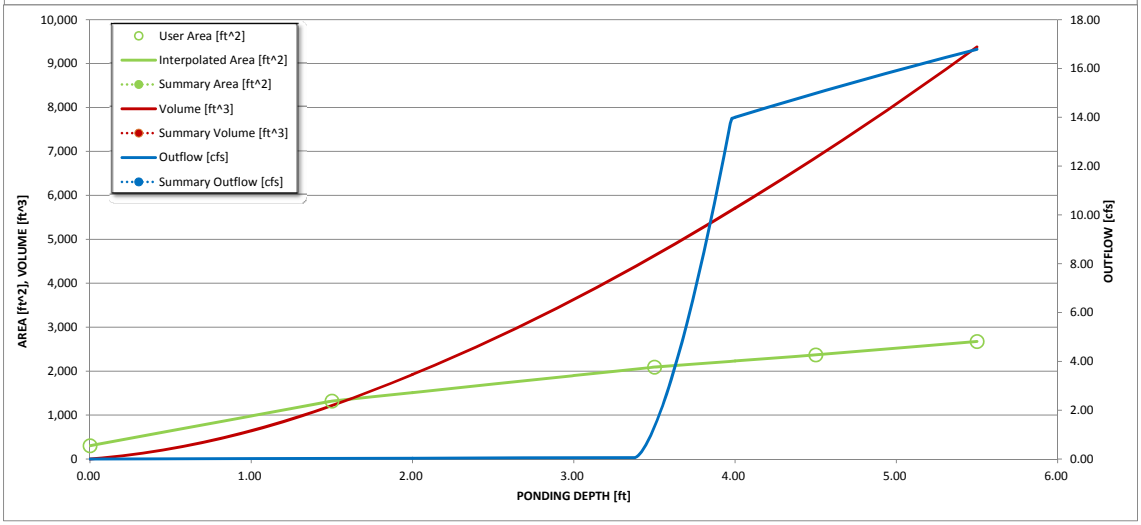
Routed Hydrograph Results

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.95	1.22	1.48	1.86	2.19	2.54	3.46
Calculated Runoff Volume (acre-ft) =	0.089	0.292	0.148	0.203	0.274	0.430	0.542	0.677	1.026
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.089	0.291	0.147	0.202	0.273	0.429	0.541	0.676	1.025
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.01	0.01	0.16	0.33	0.54	0.99
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.1	0.8	1.7	2.8	5.3
Peak Inflow Q (cfs) =	1.6	5.2	2.6	3.6	4.9	7.7	9.7	12.1	18.3
Peak Outflow Q (cfs) =	0.1	4.0	1.0	2.3	4.0	8.3	9.5	14.3	15.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	54.9	56.7	9.9	5.5	5.0	3.0
Structure Controlling Flow =	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	0.48	0.11	0.3	0.5	1.0	1.1	1.7	1.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	36	40	39	36	32	30	27	22
Time to Drain 99% of Inflow Volume (hours) =	**42**	43	45	44	43	41	39	38	35
Maximum Ponding Depth (ft) =	2.93	3.64	3.48	3.56	3.64	3.80	3.84	4.15	4.93
Area at Maximum Ponding Depth (acres) =	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06
Maximum Volume Stored (acre-ft) =	0.080	0.113	0.105	0.109	0.113	0.120	0.122	0.139	0.181

Detention Basin Outlet Structure Design







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

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs

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

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
6.22 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:06:13	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03
Hydrograph	0:12:26	0.10	0.30	0.15	0.21	0.28	0.43	0.53	0.65	0.95
Constant	0:18:40	0.22	0.71	0.37	0.50	0.67	1.03	1.29	1.59	2.36
0.803	0:24:53	0.62	1.97	1.02	1.38	1.85	2.86	3.56	4.39	6.49
	0:31:06	1.56	4.94	2.55	3.47	4.65	7.18	8.95	11.06	16.38
	0:37:19	1.61	5.22	2.65	3.64	4.90	7.70	9.69	12.09	18.30
	0:43:32	1.34	4.39	2.21	3.05	4.12	6.50	8.21	10.29	15.70
	0:49:46	1.06	3.52	1.77	2.44	3.30	5.22	6.61	8.30	12.72
	0:55:59	0.85	2.83	1.42	1.96	2.65	4.19	5.30	6.66	10.19
	1:02:12	0.66	2.21	1.11	1.53	2.08	3.29	4.16	5.23	8.02
	1:08:25	0.52	1.75	0.87	1.21	1.64	2.60	3.30	4.15	6.36
	1:14:38	0.44	1.46	0.73	1.01	1.37	2.16	2.73	3.42	5.22
	1:20:52	0.31	1.03	0.52	0.71	0.97	1.54	1.95	2.45	3.77
	1:27:05	0.23	0.78	0.39	0.54	0.73	1.16	1.47	1.84	2.83
	1:33:18	0.16	0.53	0.27	0.37	0.50	0.80	1.01	1.28	1.97
	1:39:31	0.12	0.39	0.20	0.27	0.37	0.58	0.74	0.93	1.43
	1:45:44	0.09	0.30	0.15	0.21	0.29	0.45	0.57	0.72	1.11
	1:51:58	0.08	0.25	0.13	0.17	0.24	0.37	0.47	0.59	0.91
	1:58:11	0.07	0.23	0.11	0.16	0.21	0.33	0.42	0.53	0.80
	2:04:24	0.07	0.22	0.11	0.15	0.20	0.32	0.40	0.51	0.77
	2:10:37	0.07	0.21	0.11	0.15	0.20	0.31	0.40	0.50	0.75
	2:16:50	0.07	0.21	0.11	0.15	0.20	0.31	0.40	0.50	0.75
	2:23:04	0.07	0.21	0.11	0.15	0.20	0.31	0.40	0.50	0.75
	2:29:17	0.04	0.13	0.07	0.09	0.12	0.20	0.25	0.32	0.49
	2:35:30	0.02	0.08	0.04	0.05	0.07	0.12	0.15	0.19	0.29
	2:41:43	0.01	0.04	0.02	0.03	0.04	0.06	0.08	0.10	0.16
	2:47:56	0.01	0.02	0.01	0.02	0.02	0.04	0.05	0.06	0.09
	2:54:10	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04
	3:00:23	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
	3:06:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:12:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:19:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:31:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:37:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:43:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:56:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:02:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:08:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:21:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:27:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:33:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:39:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:46:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:52:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:58:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:04:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:23:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:29:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:42:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:48:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:54:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:06:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:13:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:19:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:25:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:31:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:38:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:44:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:50:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:56:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:02:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:09:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:15:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:21:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:27:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Detention Basin Outlet Structure Design

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

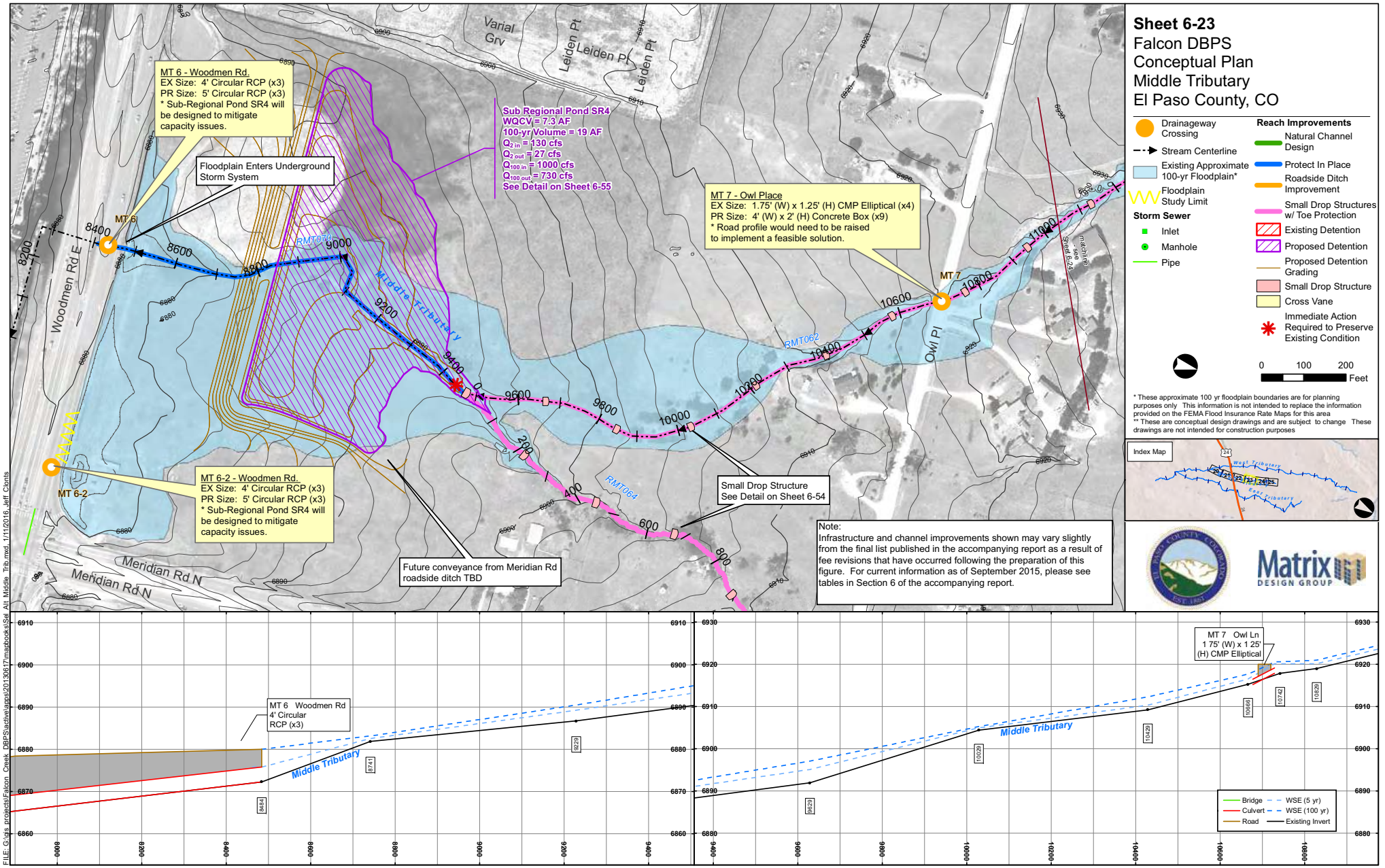
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

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

Falcon DBPS Excerpts



Sheet 6-23
Falcon DBPS
Conceptual Plan
Middle Tributary
El Paso County, CO

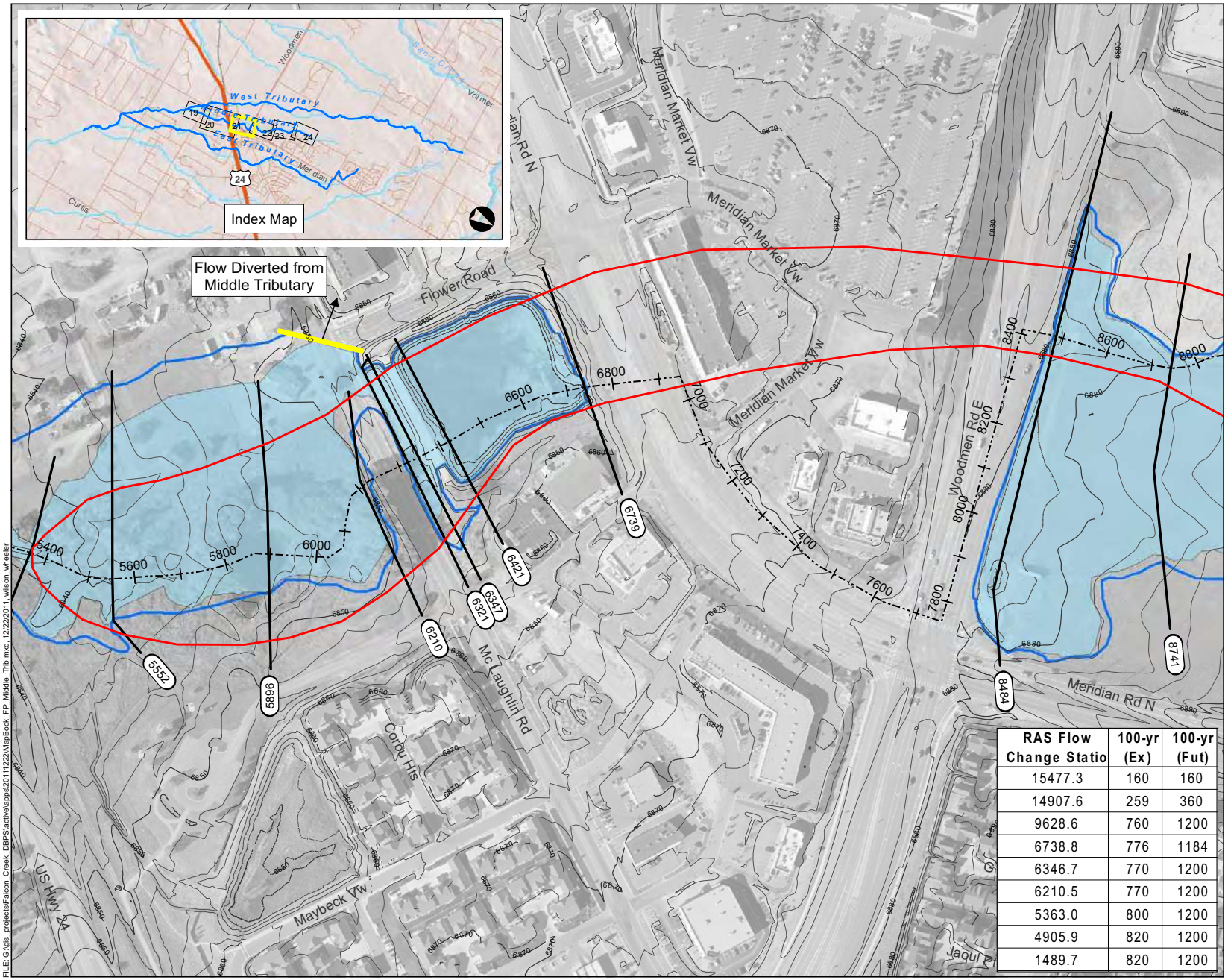
- Drainageway Crossing
- Stream Centerline
- Existing Approximate 100-yr Floodplain*
- Floodplain Study Limit

Storm Sewer
- Inlet
- Manhole
- Pipe

Reach Improvements
- Natural Channel Design
- Protect In Place
- Roadside Ditch Improvement
- Small Drop Structures w/ Toe Protection
- Existing Detention
- Proposed Detention
- Proposed Detention Grading
- Small Drop Structure
- Cross Vane
- Immediate Action Required to Preserve Existing Condition

0 100 200 Feet

* These approximate 100 yr floodplain boundaries are for planning purposes only This information is not intended to replace the information provided on the FEMA Flood Insurance Rate Maps for this area
** These are conceptual design drawings and are subject to change These drawings are not intended for construction purposes



RAS Flow Change Statio	100-yr (Ex)	100-yr (Fut)
15477.3	160	160
14907.6	259	360
9628.6	760	1200
6738.8	776	1184
6346.7	770	1200
6210.5	770	1200
5363.0	800	1200
4905.9	820	1200
1489.7	820	1200

Sheet 4-21

Middle Tributary Floodplain
Falcon DBPS
El Paso County, CO

Legend

- Approximate 100-yr Floodplain Existing
- Approximate 100-yr Floodplain Existing (Based on Assumed Split Flow Condition)
- Approximate 100-yr Floodplain Future
- Approximate 100-yr Floodplain Future (Based on Assumed Split Flow Condition)
- Shallow Flooding
- HEC-RAS Centerline
- XSCutLines (Middle Trib)
- FEMA Regulatory Floodplain (Effective as of 1999)*
- Study Limit

*Letters of Map Change completed after 1999 are not shown

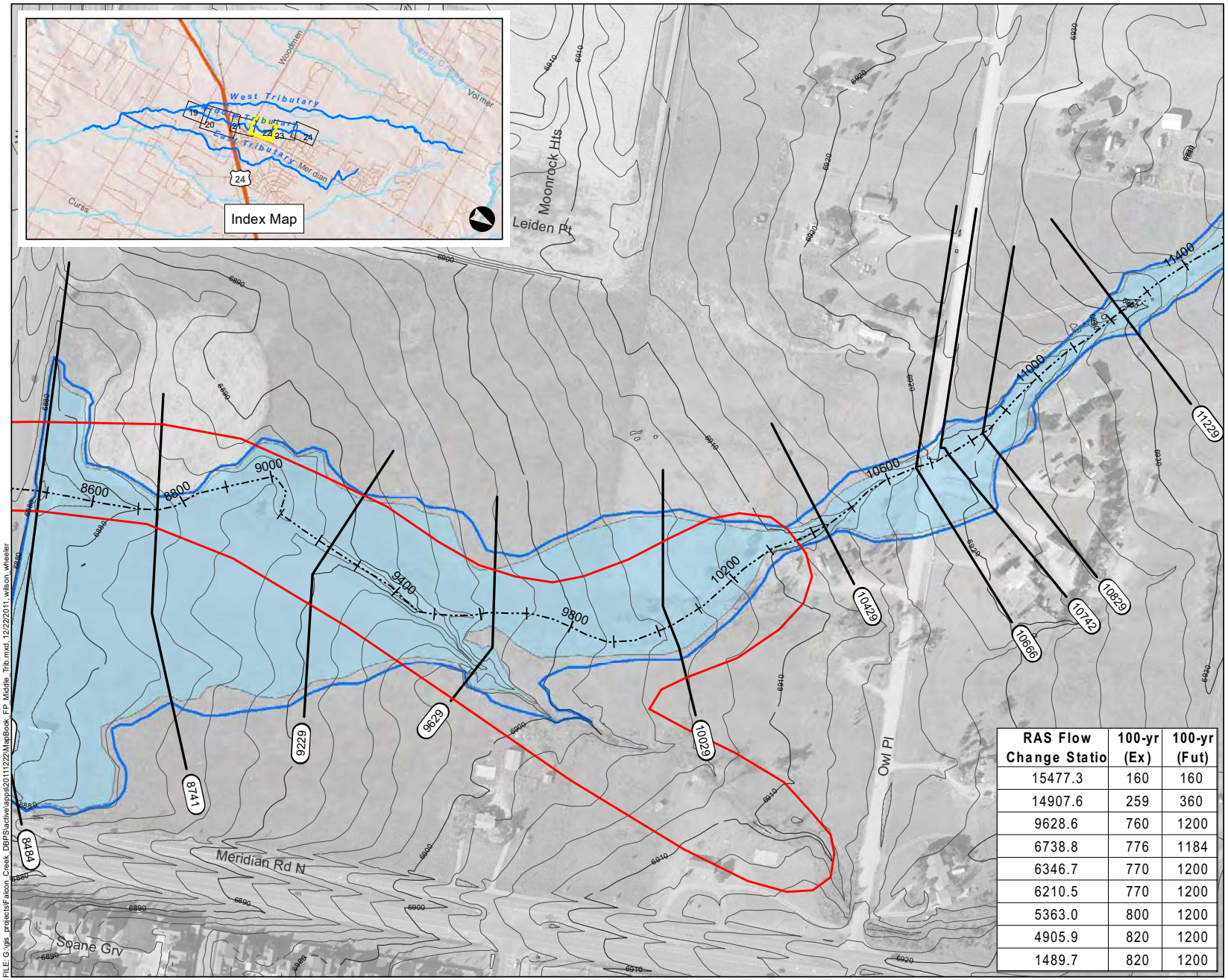
N

0 100 200 400

Feet

Matrix DESIGN GROUP

FILE:G:\gis_projects\Falcon_Creek_DBPS\active\apps\20111222\MapBook_FP_Middle_Trib.mxd, 12/22/2011, wilson_wheeler



RAS Flow Change Statio	100-yr (Ex)	100-yr (Fut)
15477.3	160	160
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6346.7	770	1200
6210.5	770	1200
5363.0	800	1200
4905.9	820	1200
1489.7	820	1200

Sheet 4-22

Middle Tributary Floodplain
Falcon DBPS
El Paso County, CO

Legend

- Approximate 100-yr Floodplain Existing
- Approximate 100-yr Floodplain Existing (Based on Assumed Split Flow Condition)
- Approximate 100-yr Floodplain Future
- Approximate 100-yr Floodplain Future (Based on Assumed Split Flow Condition)
- Shallow Flooding
- HEC-RAS Centerline
- XSCutLines (Middle Trib)
- FEMA Regulatory Floodplain (Effective as of 1999)*
- Study Limit

*Letters of Map Change completed after 1999 are not shown

N

0 100 200 400

Feet

Matrix DESIGN GROUP

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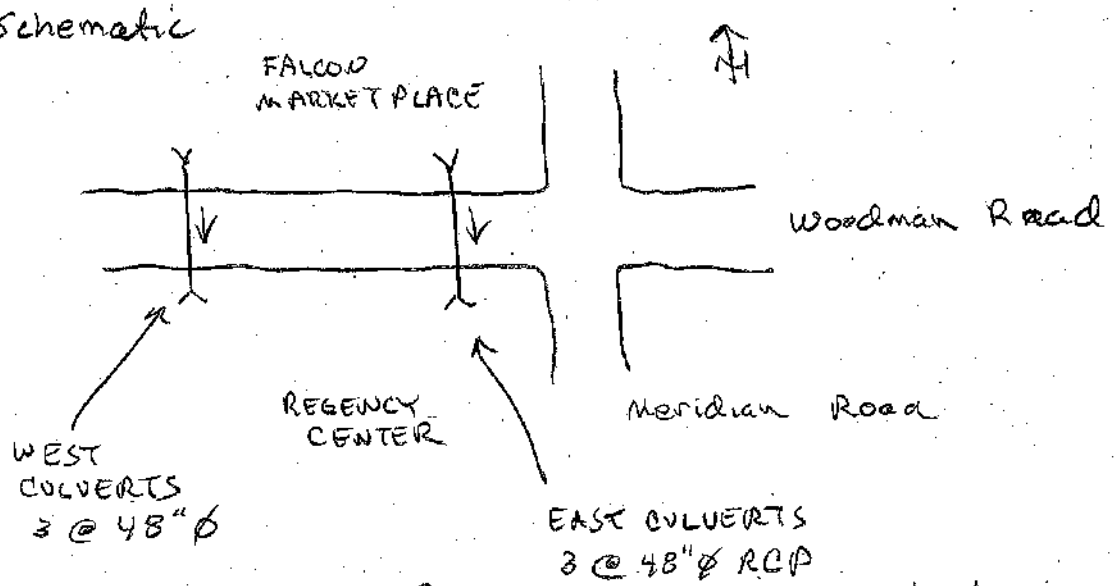
CLOMR Excerpts

① Schematic



② Use FHWA HY-8 software to check culvert capacity

③ Model input based on 3 sources of information

a) project surveys by DBC for Falcon Marketplace email 9/26/16

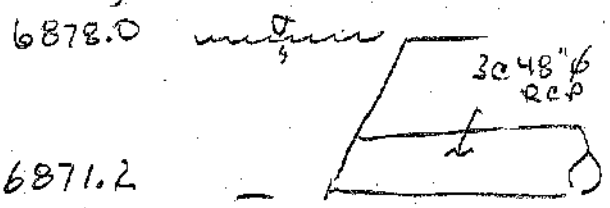
b) Design drawing from Regency Center URS 8/24/04

c) Design drawing for culvert extension on north side of woodman DMJM Harris/AECOM 9/11/2007

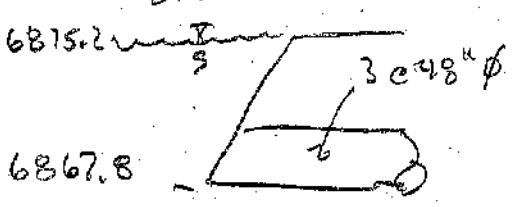
d) see HY8 model output files file: HY-8-Woodman Culverts.hy8

e) Design flow rate varied until allowable headwater elevation reached. Allowable headwater elevation = to north edge of Woodman Road Asphalt.

f) West Culvert:



EAST CULVERT:



g) The Woodman Road culverts discharge to large 84" culvert & 8'x8' culvert on the Regency Center property that are @ a significantly lower elevation.

than the invert of the 48"Ø pipes; therefore inlet control conditions are anticipate w/ no backwater from downstream

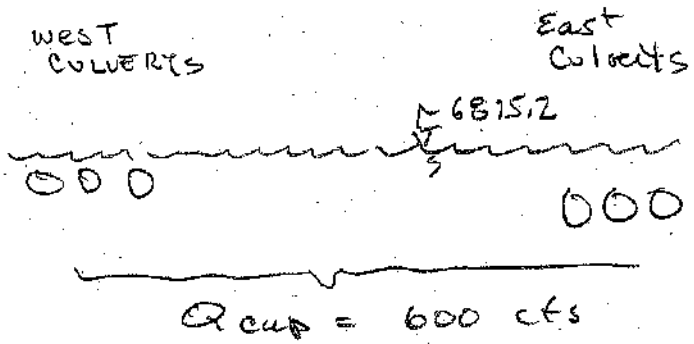
④ See HY-8 output

a) West Culvert: Q_{cap} = 355 cfs w/ HW @ 6877.99 ≈ 6878

b) East Culverts: Q_{cap} = 405 cfs w/ HW @ 6875.12 ≈ 6875.2

c) Total Capacity 760 cfs

d) Also looked @ capacity of both culverts with the lower allowable headwater elevation



Q_{cap} = 600 cfs

HY-8 Culvert Analysis Report

Project Notes

Project Title:

Designer:

Project Date: Wednesday, September 28, 2016

Notes:

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

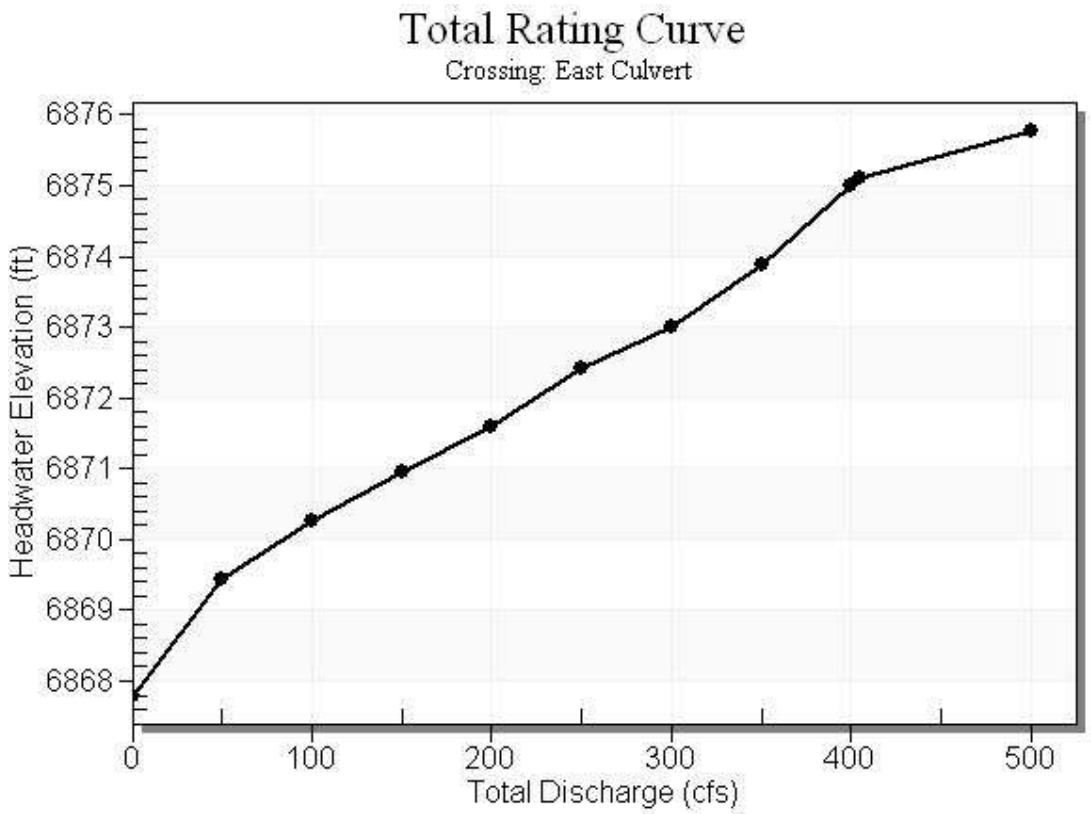
Exit Loss Option: Standard Method

Crossing Notes: East Culvert

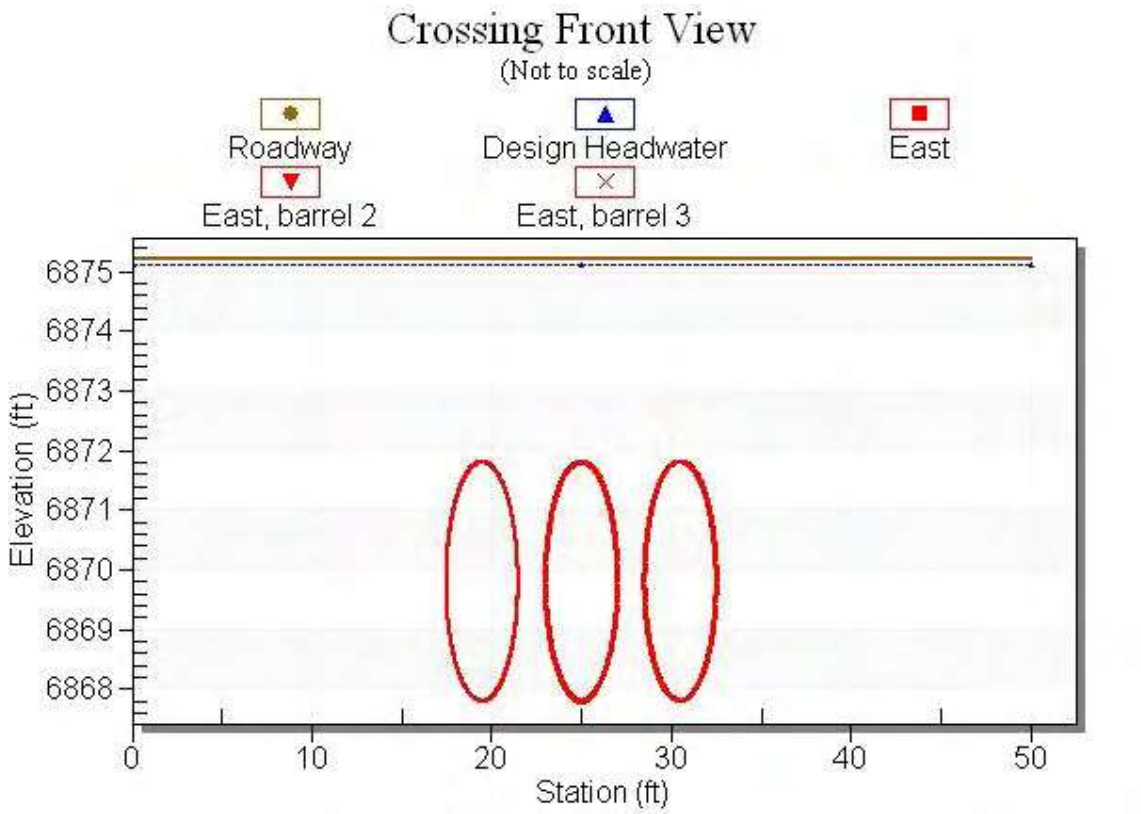
Table 1 - Summary of Culvert Flows at Crossing: East Culvert

Headwater Elevation (ft)	Total Discharge (cfs)	East Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6867.80	0.00	0.00	0.00	1
6869.44	50.00	50.00	0.00	1
6870.26	100.00	100.00	0.00	1
6870.95	150.00	150.00	0.00	1
6871.58	200.00	200.00	0.00	1
6872.41	250.00	250.00	0.00	1
6873.01	300.00	300.00	0.00	1
6873.88	350.00	350.00	0.00	1
6875.00	400.00	400.00	0.00	1
6875.12	405.00	405.00	0.00	1
6875.78	500.00	432.38	67.60	5
6875.20	408.39	408.39	0.00	Overtopping

Rating Curve Plot for Crossing: East Culvert



Crossing Front View (Roadway Profile): East Culvert



Culvert Notes: East

Table 2 - Culvert Summary Table: East

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	6867.80	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
50.00	50.00	6869.44	1.645	0.0*	1-S2n	1.114	1.197	1.117	0.745	5.778	8.385
100.00	100.00	6870.26	2.457	0.0*	1-S2n	1.620	1.708	1.622	1.169	6.978	10.692
150.00	150.00	6870.95	3.153	0.0*	1-S2n	2.042	2.114	2.043	1.532	7.747	12.238
200.00	200.00	6871.58	3.785	0.0*	1-S2n	2.445	2.461	2.445	1.864	8.280	13.414
250.00	250.00	6872.41	4.445	4.610	2-M2c	2.874	2.763	2.766	2.175	8.989	14.366
300.00	300.00	6873.01	5.196	5.208	2-M2c	3.464	3.018	3.030	2.473	9.792	15.165
350.00	350.00	6873.88	6.077	6.001	2-M2c	4.000	3.246	3.258	2.760	10.663	15.852
400.00	400.00	6875.00	7.109	7.200	7-M2c	4.000	3.420	3.447	3.039	11.579	16.454
405.00	405.00	6875.12	7.221	7.318	7-M2c	4.000	3.437	3.464	3.066	11.676	16.509
500.00	432.38	6875.78	7.861	7.984	7-M2c	4.000	3.533	3.544	3.578	12.241	17.466

* theoretical depth is impractical. Depth reported is corrected.

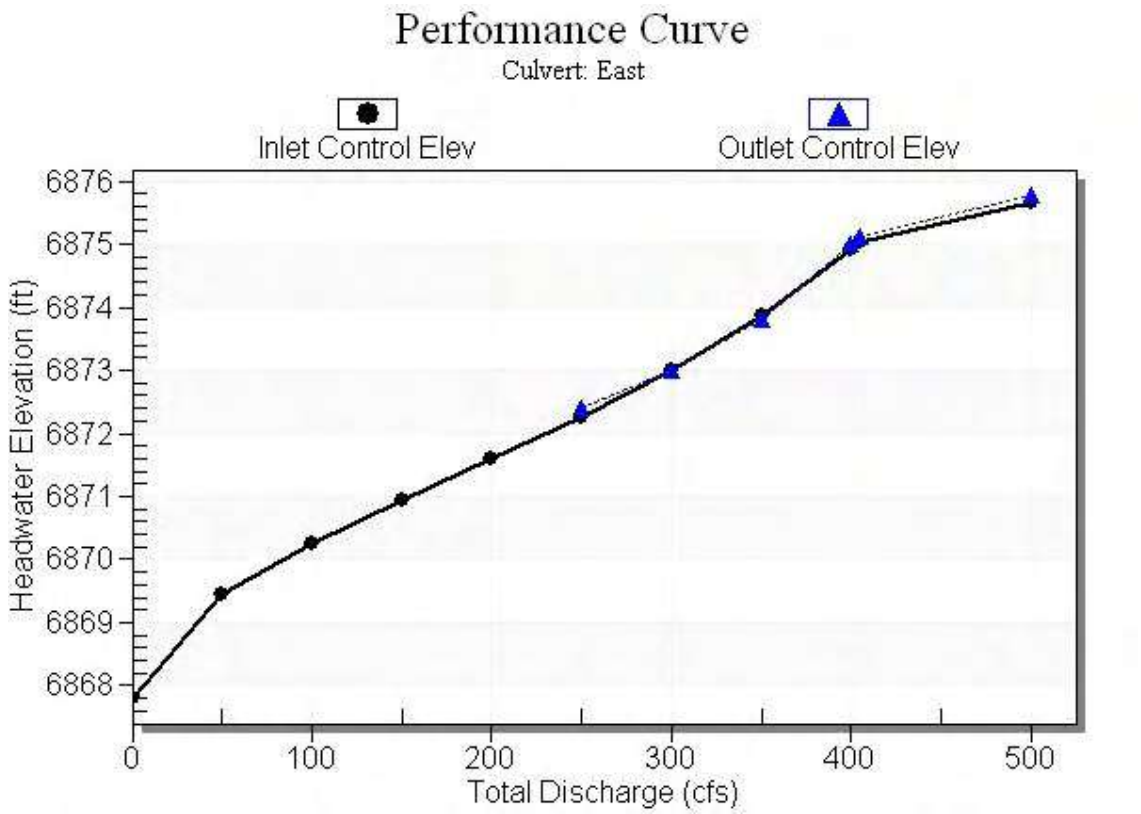
****

Inlet Elevation (invert): 6867.80 ft, Outlet Elevation (invert): 6866.90 ft

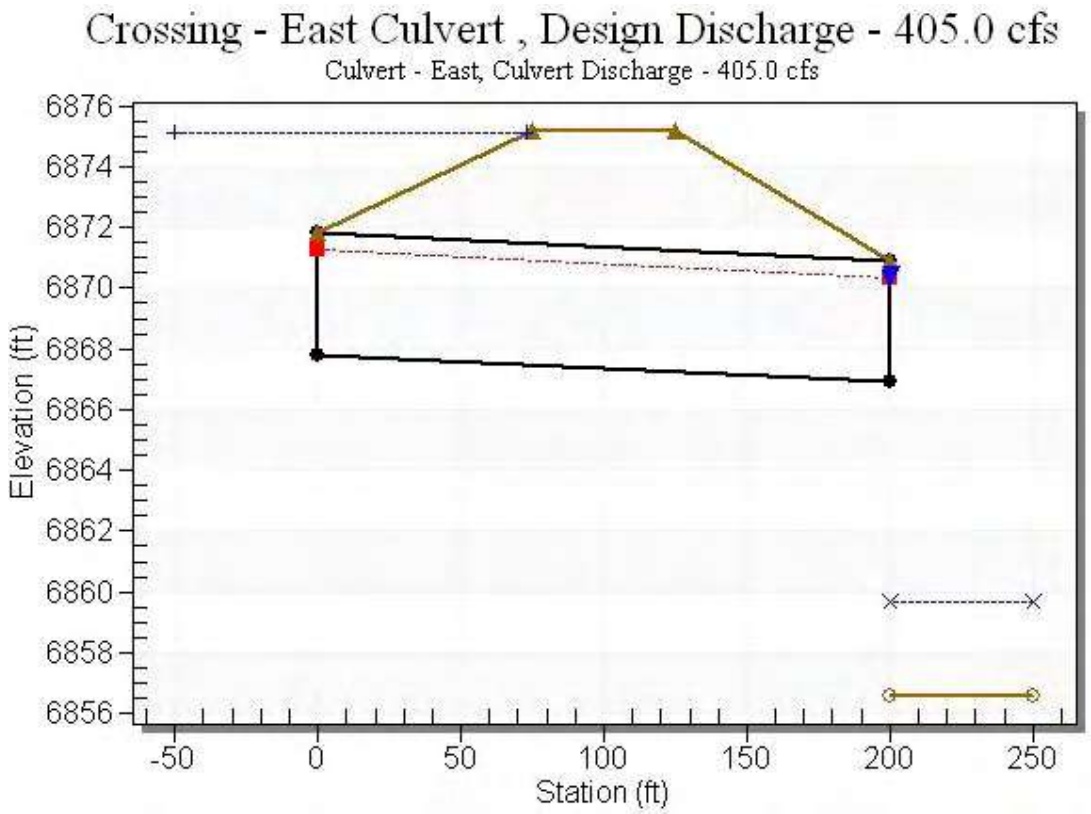
Culvert Length: 200.00 ft, Culvert Slope: 0.0045

****

Culvert Performance Curve Plot: East



Water Surface Profile Plot for Culvert: East



Site Data - East

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6867.80 ft

Outlet Station: 200.00 ft

Outlet Elevation: 6866.90 ft

Number of Barrels: 3

Culvert Data Summary - East

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: East Culvert)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	6856.60	0.00	0.00	0.00	0.00
50.00	6857.35	0.75	8.39	0.47	1.71
100.00	6857.77	1.17	10.69	0.73	1.74
150.00	6858.13	1.53	12.24	0.96	1.74
200.00	6858.46	1.86	13.41	1.16	1.73
250.00	6858.78	2.18	14.37	1.36	1.72
300.00	6859.07	2.47	15.17	1.54	1.70
350.00	6859.36	2.76	15.85	1.72	1.68
400.00	6859.64	3.04	16.45	1.90	1.66
405.00	6859.67	3.07	16.51	1.91	1.66
500.00	6860.18	3.58	17.47	2.23	1.63

Tailwater Channel Data - East Culvert

Tailwater Channel Option: Rectangular Channel

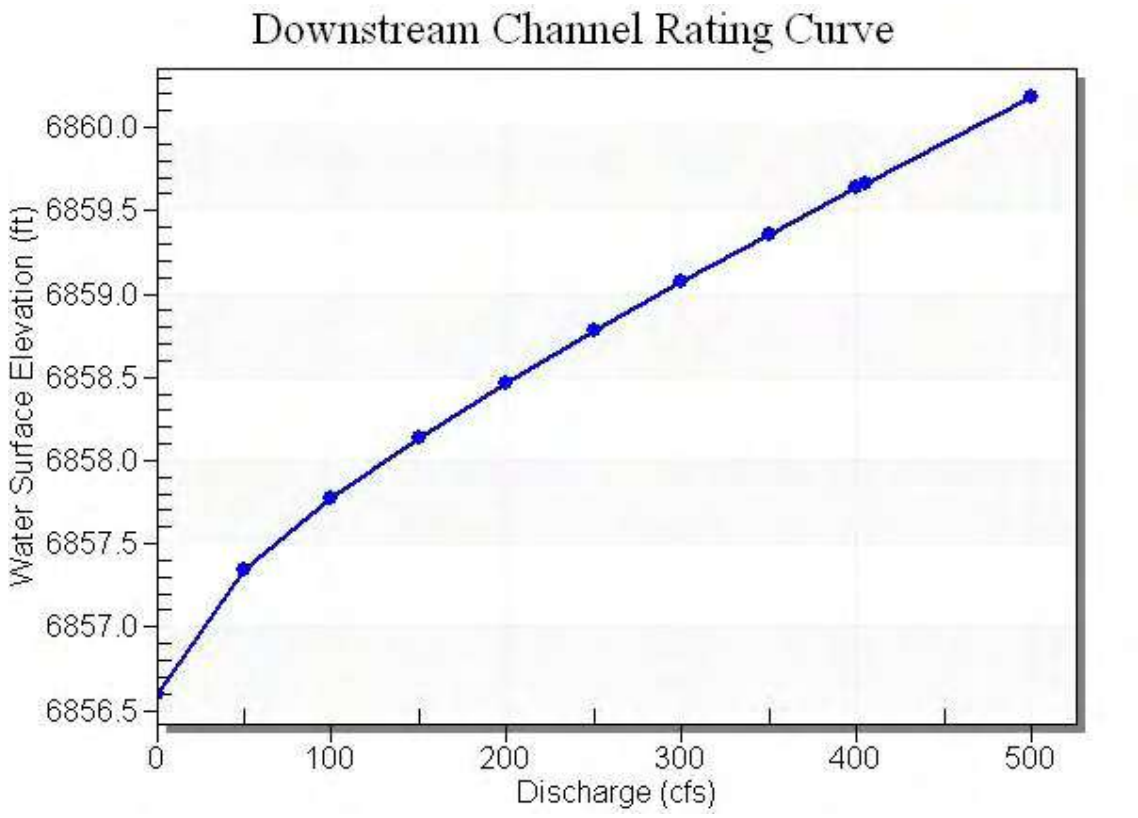
Bottom Width: 8.00 ft

Channel Slope: 0.0100

Channel Manning's n: 0.0130

Channel Invert Elevation: 6856.60 ft

Tailwater Rating Curve Plot for Crossing: East Culvert



Roadway Data for Crossing: East Culvert

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	6875.20
1	25.00	6875.20
2	50.00	6875.20

Roadway Surface: Paved

Roadway Top Width: 50.00 ft

HY-8 Culvert Analysis Report

Project Notes

Project Title:

Designer:

Project Date: Wednesday, September 28, 2016

Notes:

Project Units: U.S. Customary Units

Outlet Control Option: Profiles

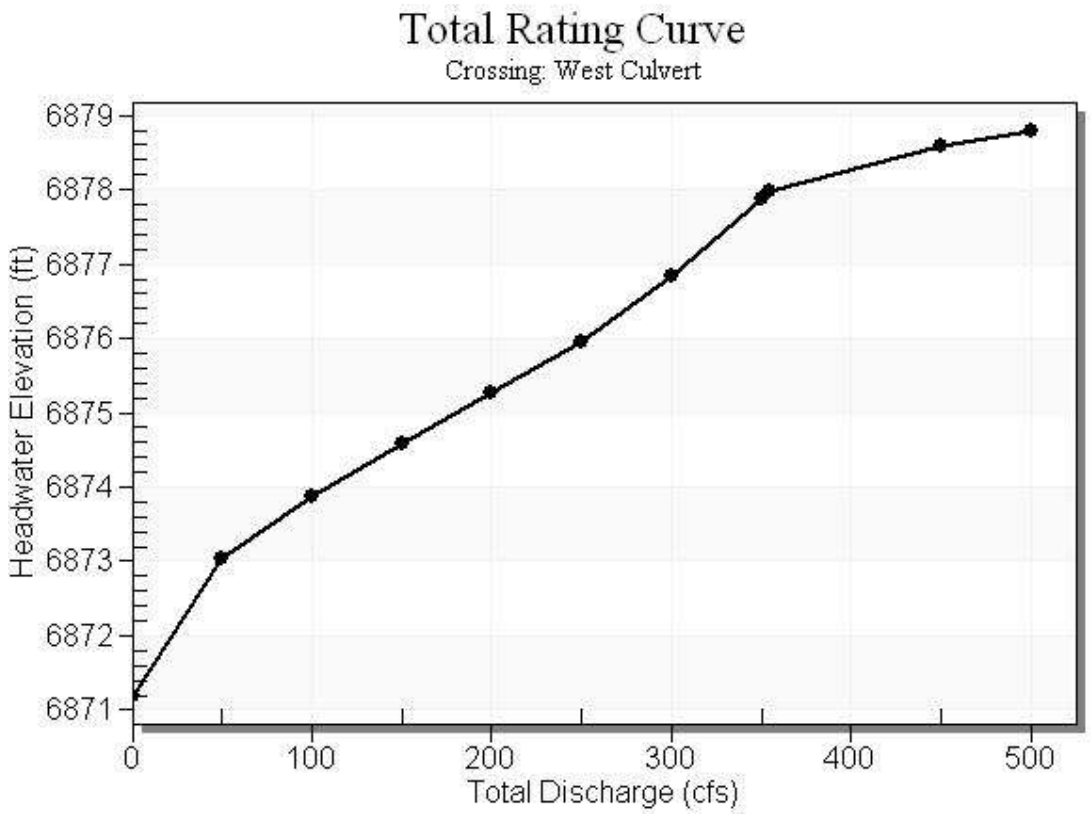
Exit Loss Option: Standard Method

Crossing Notes: West Culvert

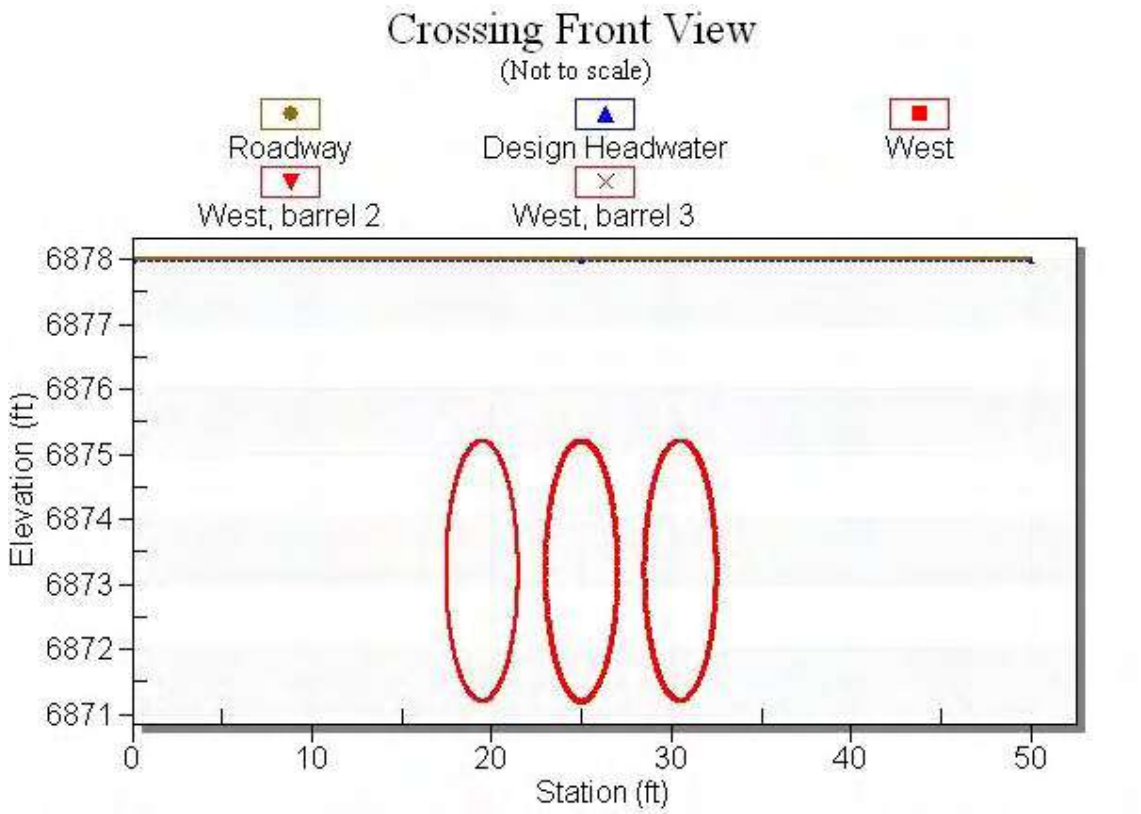
Table 1 - Summary of Culvert Flows at Crossing: West Culvert

Headwater Elevation (ft)	Total Discharge (cfs)	West Discharge (cfs)	Roadway Discharge (cfs)	Iterations
6871.20	0.00	0.00	0.00	1
6873.04	50.00	50.00	0.00	1
6873.88	100.00	100.00	0.00	1
6874.60	150.00	150.00	0.00	1
6875.27	200.00	200.00	0.00	1
6875.96	250.00	250.00	0.00	1
6876.84	300.00	300.00	0.00	1
6877.87	350.00	350.00	0.00	1
6877.99	355.00	355.00	0.00	1
6878.59	450.00	381.65	68.32	5
6878.80	500.00	390.91	108.90	4
6878.00	355.54	355.54	0.00	Overtopping

Rating Curve Plot for Crossing: West Culvert



Crossing Front View (Roadway Profile): West Culvert



Culvert Notes: West

Table 2 - Culvert Summary Table: West

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	6871.20	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
50.00	50.00	6873.04	1.649	1.836	2-M2c	1.492	1.197	1.197	0.821	5.273	8.705
100.00	100.00	6873.88	2.463	2.685	2-M2c	2.228	1.708	1.716	1.297	6.473	11.017
150.00	150.00	6874.60	3.159	3.396	2-M2c	2.970	2.114	2.121	1.709	7.390	12.536
200.00	200.00	6875.27	3.791	4.071	2-M2c	4.000	2.461	2.465	2.090	8.203	13.674
250.00	250.00	6875.96	4.451	4.755	2-M2c	4.000	2.763	2.766	2.449	8.989	14.582
300.00	300.00	6876.84	5.202	5.642	7-M2c	4.000	3.018	3.030	2.795	9.792	15.335
350.00	350.00	6877.87	6.083	6.665	7-M2c	4.000	3.246	3.258	3.130	10.646	15.976
355.00	355.00	6877.99	6.179	6.787	7-M2c	4.000	3.264	3.278	3.163	10.735	16.035
450.00	381.65	6878.59	6.718	7.388	7-M2c	4.000	3.356	3.380	3.777	11.230	17.019
500.00	390.91	6878.80	6.916	7.602	7-M2c	4.000	3.388	3.413	4.093	11.410	17.453

* theoretical depth is impractical. Depth reported is corrected.

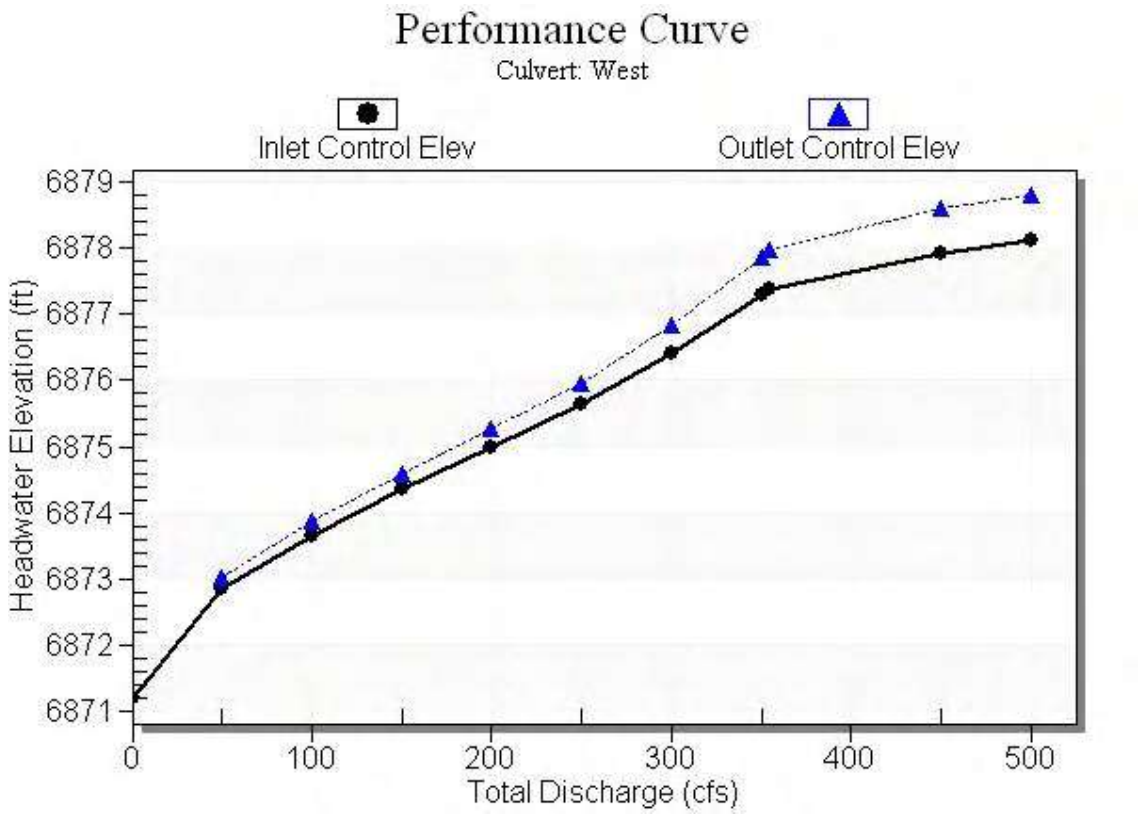
****

Inlet Elevation (invert): 6871.20 ft, Outlet Elevation (invert): 6870.90 ft

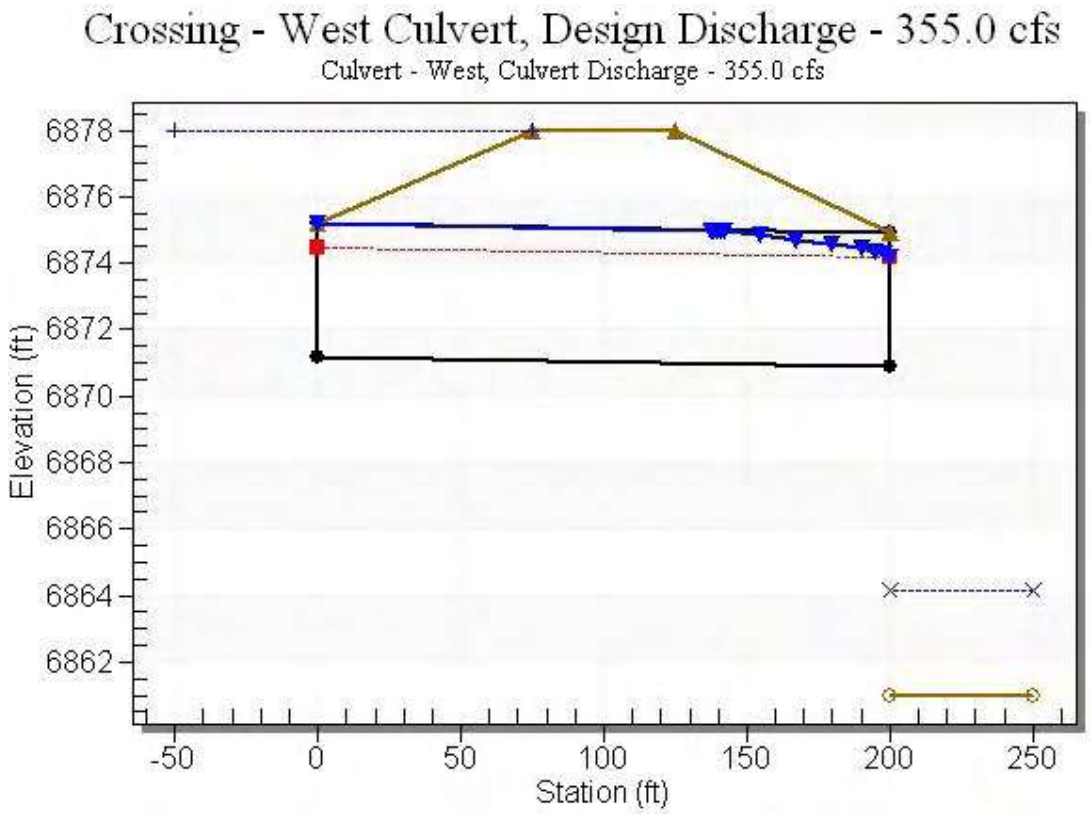
Culvert Length: 200.00 ft, Culvert Slope: 0.0015

****

Culvert Performance Curve Plot: West



Water Surface Profile Plot for Culvert: West



Site Data - West

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 6871.20 ft

Outlet Station: 200.00 ft

Outlet Elevation: 6870.90 ft

Number of Barrels: 3

Culvert Data Summary - West

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: West Culvert)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	6861.00	0.00	0.00	0.00	0.00
50.00	6861.82	0.82	8.71	0.51	1.69
100.00	6862.30	1.30	11.02	0.81	1.71
150.00	6862.71	1.71	12.54	1.07	1.69
200.00	6863.09	2.09	13.67	1.30	1.67
250.00	6863.45	2.45	14.58	1.53	1.64
300.00	6863.79	2.79	15.34	1.74	1.62
350.00	6864.13	3.13	15.98	1.95	1.59
355.00	6864.16	3.16	16.03	1.97	1.59
450.00	6864.78	3.78	17.02	2.36	1.54
500.00	6865.09	4.09	17.45	2.55	1.52

Tailwater Channel Data - West Culvert

Tailwater Channel Option: Rectangular Channel

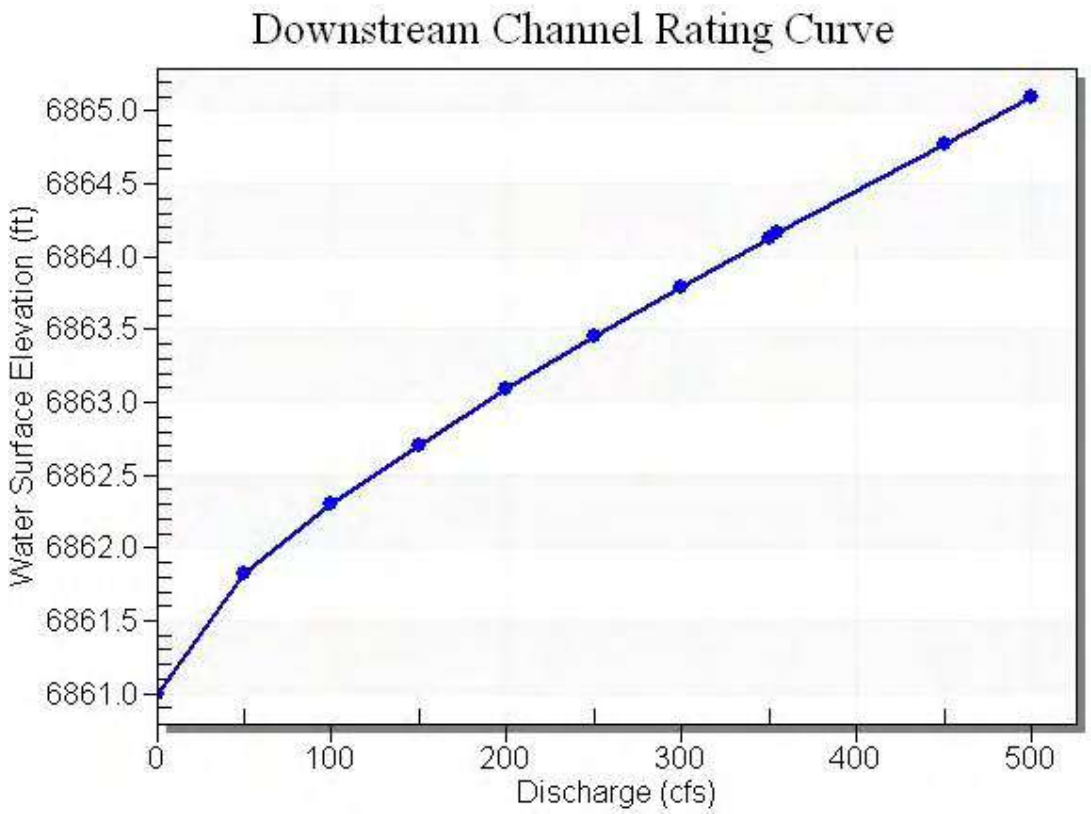
Bottom Width: 7.00 ft

Channel Slope: 0.0100

Channel Manning's n: 0.0130

Channel Invert Elevation: 6861.00 ft

Tailwater Rating Curve Plot for Crossing: West Culvert



Roadway Data for Crossing: West Culvert

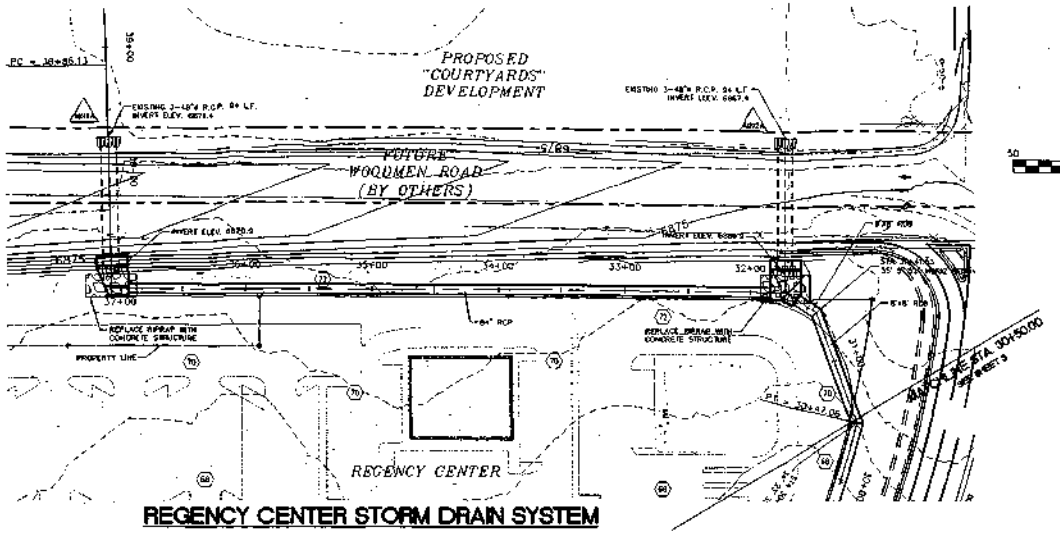
Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

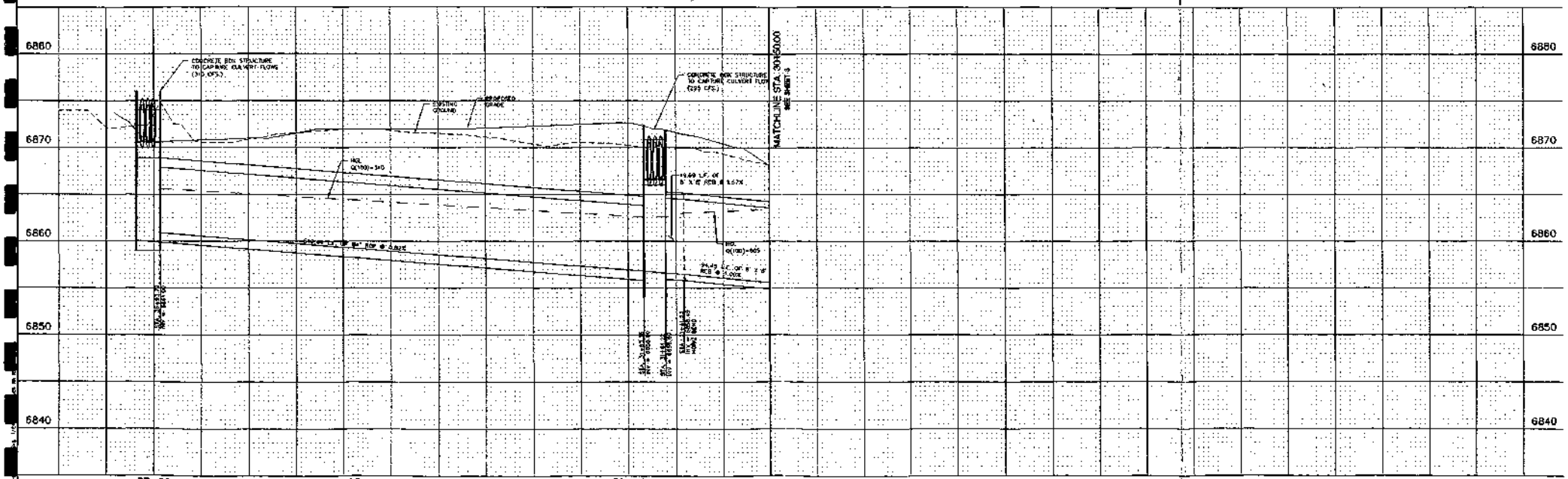
Coord No.	Station (ft)	Elevation (ft)
0	0.00	6878.00
1	25.00	6878.00
2	50.00	6878.00

Roadway Surface: Paved

Roadway Top Width: 50.00 ft



REGENCY CENTER STORM DRAIN SYSTEM



STATEMENT:
EL PASO COUNTY RECOGNIZES THE DESIGN ENGINEER AS HAVING RESPONSIBILITY FOR THE DESIGN; THE COUNTY HAS LIMITED ITS SCOPE OF REVIEW ACCORDINGLY. RESUBMITAL REQUIRED IF CONSTRUCTION HAS NOT COMMENCED WITHIN 180 DAYS AFTER REVIEW DATE.

REVIEW
STREET DESIGN
CURB & GUTTER REVIEW _____ DATE _____
FINAL REVIEW _____ DATE _____
DRAINAGE DESIGN, ORIGINAL BASIN _____

DESIGN DATA
SIDEWALKS: WIDTH 4'
LOCATION: ATTACHED ☐ DETACHED: 5' FROM P/L ☒
CURB TYPE 10 20 30 40 50
CRCD SPCD
R/W WIDTH 80' F/O-F/O 44'
STREET TYPE COLLECTOR
OTHER

ASPHALT THICKNESS:
AC SURFACE
AC BASE
AGGREGATE BASE THICKNESS:
CLASS 6
CLASS 5
CLASS 2

SCALE: HORIZONTAL 1" = 50' VERTICAL 1" = 5'
BENCH MARK:
(SEE COVER SHEET)

REVISIONS:

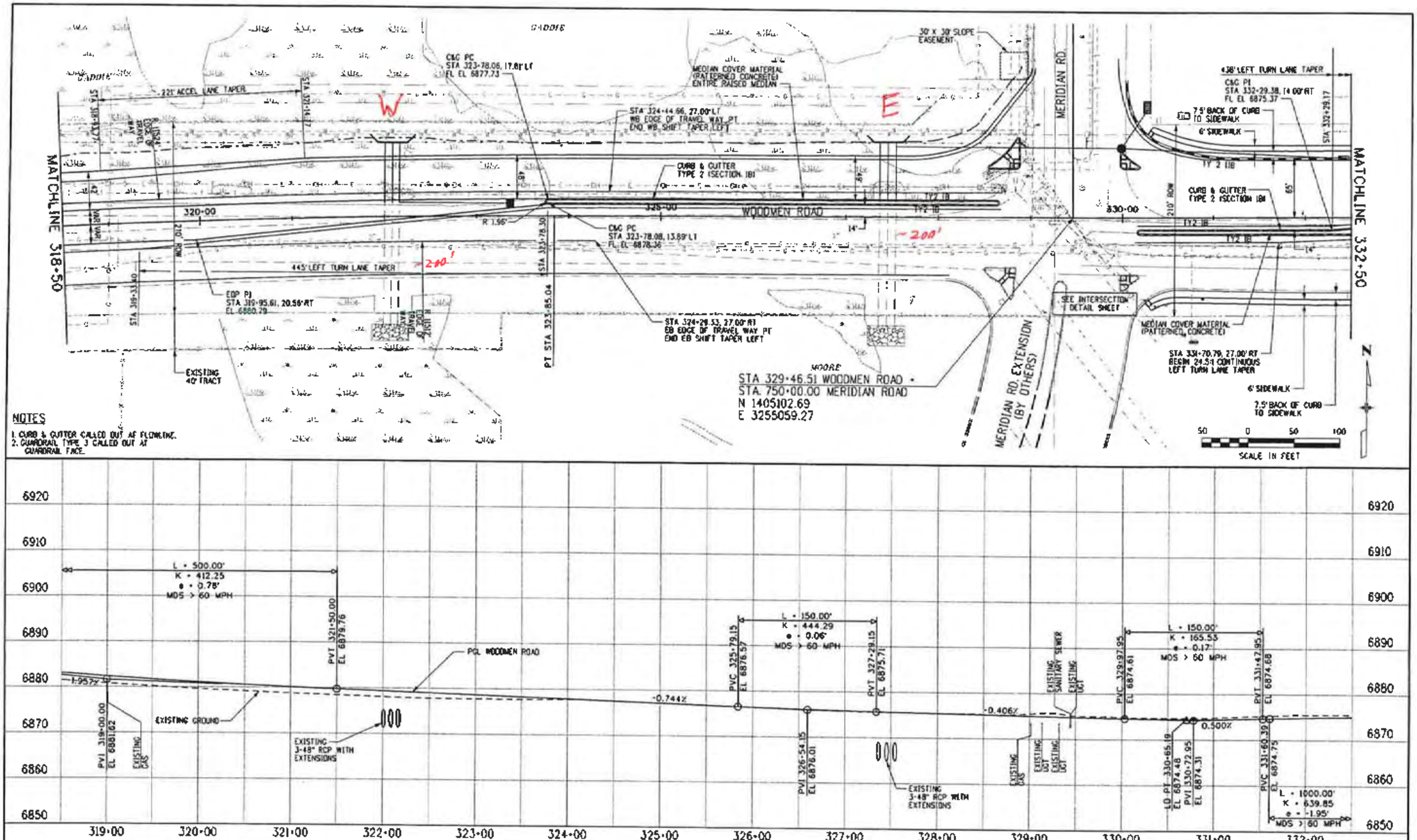
NO.	DESCRIPTION	DATE

ENGINEER
DESIGNED BY JDR DATE 8/24/04
DRAWN BY JDR DATE 8/24/04
CHECKED BY DATE

48 HOURS BEFORE YOU DIG.
CALL UTILITY LOCATORS
1-800-922-1987
(SEE BOOKLET FOR LIST OF UTILITY COMPANIES)

URS
8860 FEDERAL DRIVE #200
COLORADO SPRINGS, COLORADO 80921
PHONE: (719) 531-0001
FAX: (719) 534-0007

PROJECT REGENCY CENTER
SHEET TITLE PLAN & PROFILE CHANNEL
FROM STA. 30+50 TO STA. 37+00
JOB NO 21710844 SHEET 2 OF 4



NOTES

1. CURB & GUTTER CALLED OUT AT FLOWLINE.
2. GUARDRAIL TYPE 3 CALLED OUT AT GUARDRAIL FACE.

Computer File Information			
Creation Date: 02/07/06	Initials: LPS		
Last Modification Date: 9/11/2007	Initials: LPS		
Full Path:c:\4954\4954_0604\cadd\roadway\54RDPP24.dgn			
Drawing Scale: 1"=50'			
V8 Ver. 08.00.01.19	Units: ENGLISH		

Sheet Revisions

DMJM HARRIS | AECOM
2850 Professional Place
Colorado Springs, Colorado 80904
Phone: (719) 385-8300 Fax: (719) 385-8308

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

As Constructed

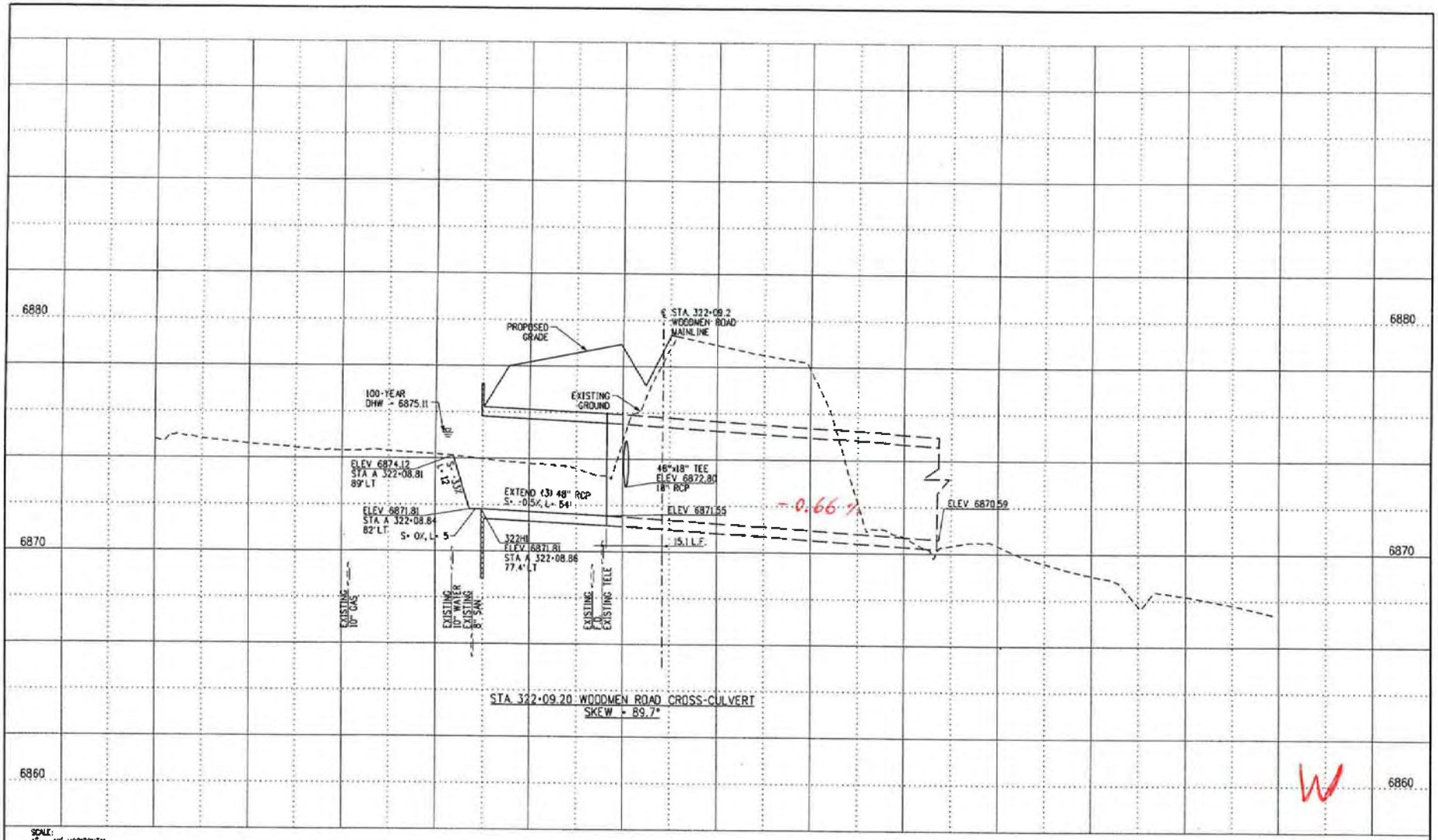
No Revisions:
Revised:
Void:

WOODMEN ROAD
PLAN & PROFILE-WOODMEN ROAD

Designer:	MES	Structure Numbers	
Detailer:	LPS		
Sheet Subset:	ROADWAY	Subset Sheets:	RDPP23 of 38

Project No./Code
STU M240-062
13263
Sheet Number 91

10/10/2007 8:00:43 AM



SCALE:
1" = 40' HORIZONTAL
1" = 4' VERTICAL

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Last Modification Date:	9/17/2007	Initials:	LPS
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Drawing Scale:	1=20		
V8 Ver.	08.00.01.19	Units:	ENGLISH

Sheet Revisions		

DMJM HARRIS | AECOM
2350 Professional Place
Colorado Springs, Colorado 80904
Phone: (719) 386-6380 Fax: (719) 386-6338

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

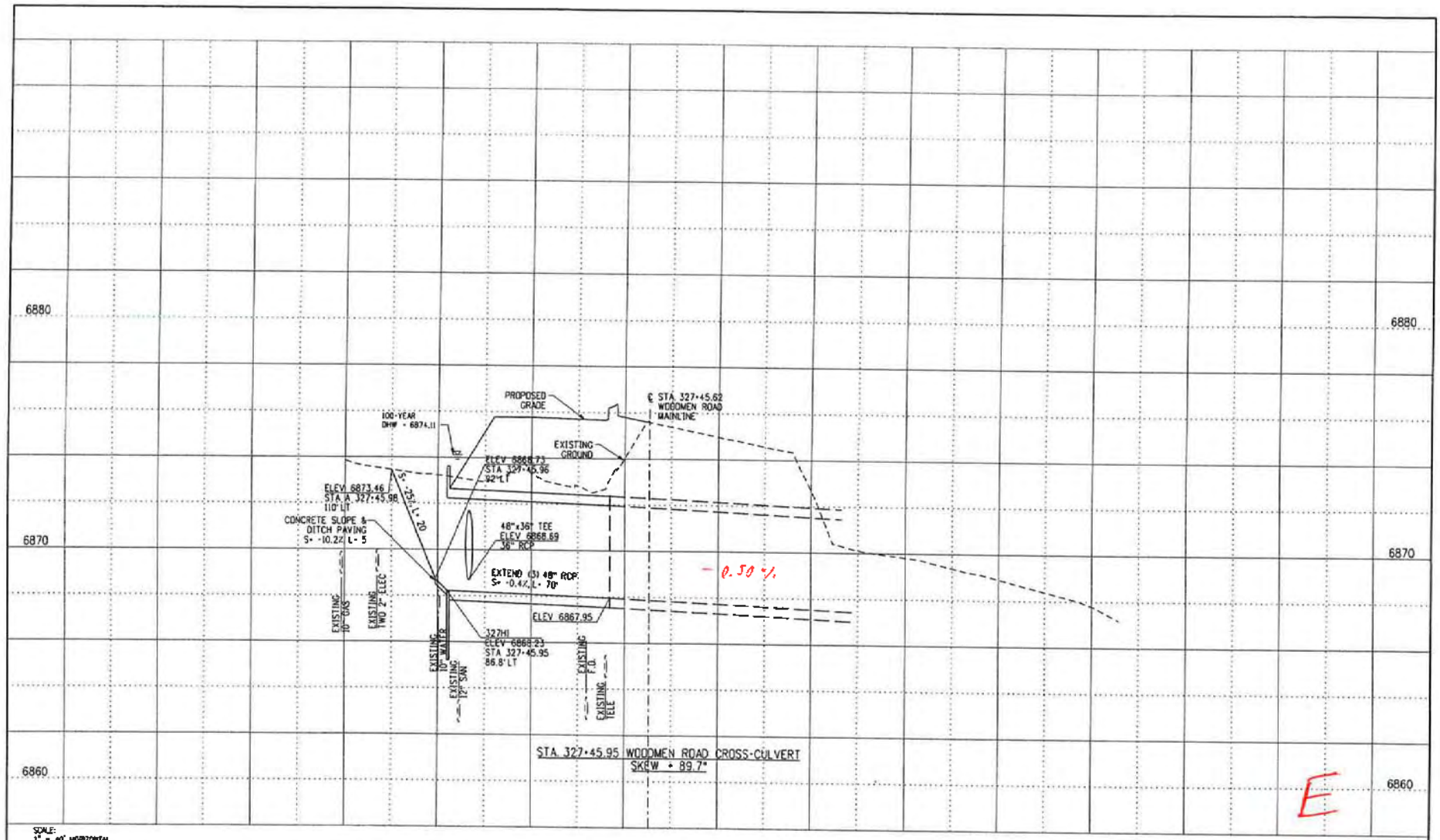
As Constructed	
No Revisions:	-
Revised:	-
Void:	-

WOODMEN ROAD
STORM SEWER PROFILE -
WOODMEN RD. STA. 322+09.20

Designer:	CLK	Structure Numbers	
Detailer:	LPS		
Sheet Subset:	DRAINAGE	Subset Sheets:	DR45 of 50

Project No./Code	
STU M240-062	
13263	
Sheet Number	193

10/10/2007 8:00:56 AM



SCALE:
1" = 40' HORIZONTAL
1" = 4' VERTICAL

Computer File Information			
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Drawing Scale:	1=20		
V8 Ver.	08.00.01.19	Units:	ENGLISH

Sheet Revisions			

DMJM HARRIS | AECOM
2850 Professional Place
Colorado Springs, Colorado 80904
Phone: (719) 386-8300 Fax: (719) 386-8338

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

As Constructed	
No Revisions:	-
Revised:	-
Void:	-

WOODMEN ROAD
STORM SEWER PROFILE -
WOODMEN RD. STA. 327+45.95

Designer:	CLK	Structure Numbers	
Detailer:	LPS		
Sheet Subset:	DRAINAGE	Subset Sheets:	DR47 of 50

Project No./Code	
STU M240-062	
13263	
Sheet Number	195

CLOMR Approval

Federal Emergency Management Agency

Washington, D.C. 20472

May 26, 2017

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 17-08-0074R
Community Name: El Paso County, CO
Community No.: 080059

The Honorable Darryl Glenn
Chairman, El Paso County
Board of Commissioners
200 South Cascade Avenue, Suite 100
Colorado Springs, CO 80903

Dear Mr. Glenn:

The Flood Insurance Study Report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed that provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Denver, Colorado, at (303) 235-4830, or the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/national-flood-insurance-program.

Sincerely,

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

List of Enclosures:

Letter of Map Revision Determination Document
Annotated Flood Insurance Rate Map
Annotated Flood Insurance Study Report

cc: Mr. Keith Curtis, P.E., CFM
Floodplain Administrator
El Paso County

Mr. Steven Leslie, P.E., CFM
Project Engineer
Drexell, Barrell & CO

Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT

COMMUNITY INFORMATION		PROPOSED PROJECT DESCRIPTION	BASIS OF CONDITIONAL REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	CHANNELIZATION BRIDGE	HYDRAULIC ANALYSIS UPDATED TOPOGRAPHIC DATA HYDROLOGIC ANALYSIS
	COMMUNITY NO.: 080059		
IDENTIFIER	Falcon Marketplace	APPROXIMATE LATITUDE & LONGITUDE: 38.9426, -104.610 SOURCE: USGS QUADRANGLE DATUM: NAD 83	

AFFECTED MAP PANELS	
TYPE: FIRM* NO.: 08041C0575F DATE: March 17, 1997	* FIRM - Flood Insurance Rate Map

FLOODING SOURCE(S) AND REACH DESCRIPTION

Unnamed Tributary to Black Squirrel Creek- from Woodmen Road to approximately 2,280 feet upstream of Woodmen Road

PROPOSED PROJECT DESCRIPTION

Flooding Source	Proposed Project	Location of Proposed Project
Unnamed Tributary to Black Squirrel Creek	Channelization	From Woodmen Road to approximately 2,820 feet upstream of Woodmen Road
	Bridge Modification	At Woodmen Road

SUMMARY OF IMPACTS TO FLOOD HAZARD DATA

Flooding Source	Effective Flooding	Proposed Flooding	Increases	Decreases
Unnamed Tributary to Black Squirrel Creek	Zone A	Zone AE	Yes	Yes
	No BFEs	BFEs	Yes	None

* BFEs - Base (1-percent-annual-chance) Flood Elevations

COMMENT

This document provides the Federal Emergency Management Agency's (FEMA's) comment regarding a request for a CLOMR for the project described above. This document is not a final determination; it only provides our comment on the proposed project in relation to the flood hazard information shown on the effective National Flood Insurance Program (NFIP) map. We reviewed the submitted data and the data used to prepare the effective flood hazard information for your community and determined that the proposed project meets the minimum floodplain management criteria of the NFIP. Your community is responsible for approving all floodplain development and for ensuring that all permits required by Federal or State/Commonwealth law have been received. State/Commonwealth, county, and community officials, based on their knowledge of local conditions and in the interest of safety, may set higher standards for construction in the Special Flood Hazard Area (SFHA), the area subject to inundation by the base flood). If the State/Commonwealth, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at http://www.fema.gov/national-flood-insurance-program.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

USE PARAGRAPH BELOW WHEN REQUEST IS FOR ZONE A ONLY

To determine the changes in flood hazards that will be caused by the proposed project, we compared the hydraulic modeling reflecting the proposed project (referred to as the proposed conditions model) to the hydraulic modeling reflecting the existing conditions.

The table below shows the changes in the base flood water-surface elevations (WSELs).

Base Flood WSEL Comparison Table

Flooding Source: Unnamed Tributary to Black Squirrel Creek		Base Flood WSEL Change (feet)	Location of maximum change
Proposed vs. Existing	Maximum increase	None	N/A
	Maximum decrease	7.3	Approximately 880 feet upstream of Woodmen Road

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activites necessary to ensure this requirement.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at http://www.fema.gov/national-flood-insurance-program.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

DATA REQUIRED FOR FOLLOW-UP LOMR

Upon completion of the project, your community must submit the data listed below and request that we make a final determination on revising the effective FIRM. If the project is built as proposed and the data below are received, a revision to the FIRM would be warranted.

• Detailed application and certification forms must be used for requesting final revisions to the maps. Therefore, when the map revision request for the area covered by this letter is submitted, Form 1, entitled "Overview and Concurrence Form," must be included. A copy of this form may be accessed at http://www.fema.gov/plan/prevent/fhm/dl_mt-2.shtm.

• The detailed application and certification forms listed below may be required if as-built conditions differ from the proposed plans. If required, please submit new forms, which may be accessed at http://www.fema.gov/plan/prevent/fhm/dl_mt-2.shtm, or annotated copies of the previously submitted forms showing the revised information.

Form 2, entitled "Riverine Hydrology and Hydraulics Form." Hydraulic analyses for as-built conditions of the base flood must be submitted with Form 2.

Form 3, entitled "Riverine Structures Form."

• A certified topographic work map showing the revised and effective base floodplain boundaries. Please ensure that the revised information ties-in with the current effective information at the downstream and upstream ends of the revised reach.

• An annotated copy of the FIRM, at the scale of the effective FIRM, that shows the revised base floodplain boundary delineations shown on the submitted work map and how they tie-in to the base floodplain boundary delineations shown on the current effective FIRM at the downstream and upstream ends of the revised reach.

• As-built plans, certified by a registered Professional Engineer, of all proposed project elements.

• Documentation of the individual legal notices sent to property owners who will be affected by any widening or shifting of the base floodplain and/or any BFE increases along the Unnamed Tributary to Black Squirrel Creek.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at http://www.fema.gov/national-flood-insurance-program.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION
COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

COMMUNITY REMINDERS

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Jeanine P. Petterson
Director, Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

WHEN PRELIMINARY STUDY HAS BEEN SUBMITTED TO COMMUNITY FOR REVIEW

A preliminary study is being conducted for El Paso County. Preliminary copies of the revised FIRM and FIS report were submitted to your community for review on July 29, 2015, and may become effective before the revision request following this CLOMR is submitted. Please ensure that the data submitted for the revision ties into the data effective at the time of the submittal.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at http://www.fema.gov/national-flood-insurance-program.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Drainage Map

LEGEND

PROPERTY LINE

EX. MINOR CONTOUR

EX. MAJOR CONTOUR 6800

BASIN BOUNDARY

FLOW DIRECTION

DESIGN POINT

BASIN DESCRIPTION ..... BASIN / IMPERVIOUS COVERAGE PERCENTAGE

BASIN AREA (ACRES)

N

100 0 100 200

SCALE: 1"=100'

RUNOFF SUMMARY

BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
JMT060			160	670
O1	DP1	30.50	9.6	28.3
O2	DP2	2.06	0.7	4.9
O3	DP3	2.24	5.1	9.8
O4	DP4	4.46	7.2	15.8
E1		35.70	7.7	46.7
	DP5	74.96	20.0	70.8
O5	DP6	2.17	2.9	6.6
JMT070			180.0	740.8

PREPARED BY:

DREXEL, BARRELL & CO.
Engineers • Surveyors
3 SOUTH 7TH STREET
COLORADO SPGS, COLORADO 80905
CONTACT: TIM D. McCONNELL, P.E.
(719)260-0887
BOULDER • COLORADO SPRINGS

CLIENT:

HUMMEL INVESTMENTS, LLC
8117 PRESTON ROAD, SUITE 120
DALLAS, TEXAS 75225
(214) 416-9820

DRAINAGE PLAN FOR
FALCON MARKETPLACE
FALCON, COLORADO

ISSUE	DATE
INITIAL ISSUE	3-23-17
REVISION	7-19-19

DESIGNED BY:	TDM
DRAWN BY:	KGV
CHECKED BY:	TDM
FILE NAME:	

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1"=100'
VERTICAL: N/A

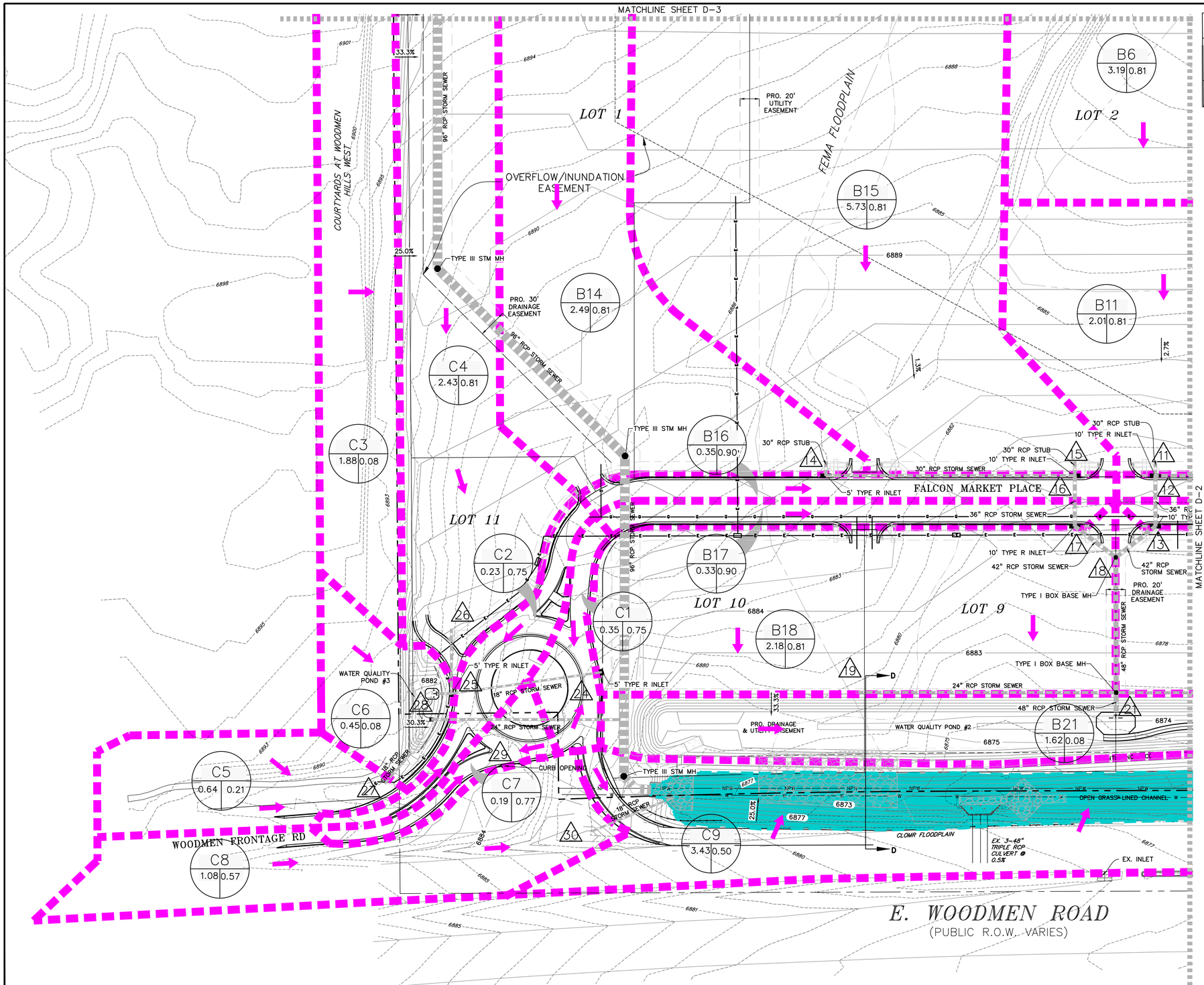
EXISTING DRAINAGE CONDITIONS

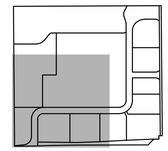
PROJECT NO. 20988-00CSCV

DRAWING NO.

ED-1

SHEET: 1 OF 1





KEY MAP
NTS

N

50 0 50 100
SCALE: 1"=50'

RUNOFF SUMMARY

BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
A1	DP1	1.81	3.4	7.7
	DP2	1.81	3.4	7.7
A2		4.82	1.4	10.2
	DP3	6.63	4.6	17.3
B4	DP4	2.35	7.5	14.6
B5		0.63	2.8	5.1
	DP5	2.99	10.0	19.3
B6	DP6	3.19	12.8	23.6
B7		0.46	2.0	3.7
	DP7	6.63	23.8	28.0
B8	DP8	1.04	3.5	6.9
B9		0.30	1.4	2.5
	DP9	1.35	4.9	9.3
B10		0.18	0.8	1.4
	DP10	8.16	29.2	38.1
B11	DP11	2.01	7.8	14.6
B12		0.18	0.8	1.5
	DP12	10.35	36.4	51.9
B13		0.20	0.9	1.6
	DP13	10.55	37.1	53.2
B14	DP14	2.49	9.1	17.0
B15	DP15	5.73	20.3	38.0
B16		0.35	1.6	2.9
	DP16	8.56	30.6	57.1
B17		0.33	1.5	2.7

BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
	DP17	8.89	31.9	59.3
	DP18	19.44	52.1	88.2
B18	DP19	2.18	7.8	15.0
B19	DP20	2.57	10.1	18.8
	DP21	24.19	67.6	117.5
B20	DP22	2.03	5.6	11.4
B21		1.62	0.5	4.0
	DP23	27.85	67.4	121.8
C1	DP24	0.35	1.3	2.6
C2		0.23	0.8	1.5
	DP25	0.59	2.0	3.8
C3		1.88	0.6	4.2
C4		2.19	6.9	13.8
	DP26	4.08	5.4	13.7
C5	DP27	0.64	0.5	1.9
C6		0.45	0.2	1.2
	DP28	5.31	7.4	18.3
C7	DP29	0.19	0.7	1.3
C8		1.14	2.5	5.5
	DP30	1.33	3.1	6.6
C9		3.43	7.3	16.2
D1		2.62	4.1	8.8
D2		0.07	0.3	0.6
D3		0.07	0.3	0.6
	DP01	32.50	10.3	30.2

PREPARED BY:

DREXEL, BARRELL & CO.
Engineers • Surveyors
3 SOUTH 7TH STREET
COLORADO SPGS, COLORADO 80905
CONTACT: TIM D. McCONNELL, P.E.
(719)260-0887
BOULDER • COLORADO SPRINGS

CLIENT:

HUMMEL INVESTMENTS, LLC
8117 PRESTON ROAD, SUITE 120
DALLAS, TEXAS 75225
(214) 416-9820

DRAINAGE PLAN FOR FALCON MARKETPLACE

FALCON, COLORADO

ISSUE	DATE
INITIAL ISSUE	6-28-19
REVISED	7-19-19

DESIGNED BY:	TDM
DRAWN BY:	KGV
CHECKED BY:	TDM
FILE NAME:	

COLORADO REGISTERED T.D. McCONNELL 23707 12-18-19 PROFESSIONAL ENGINEER

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1"=50'
VERTICAL: N/A

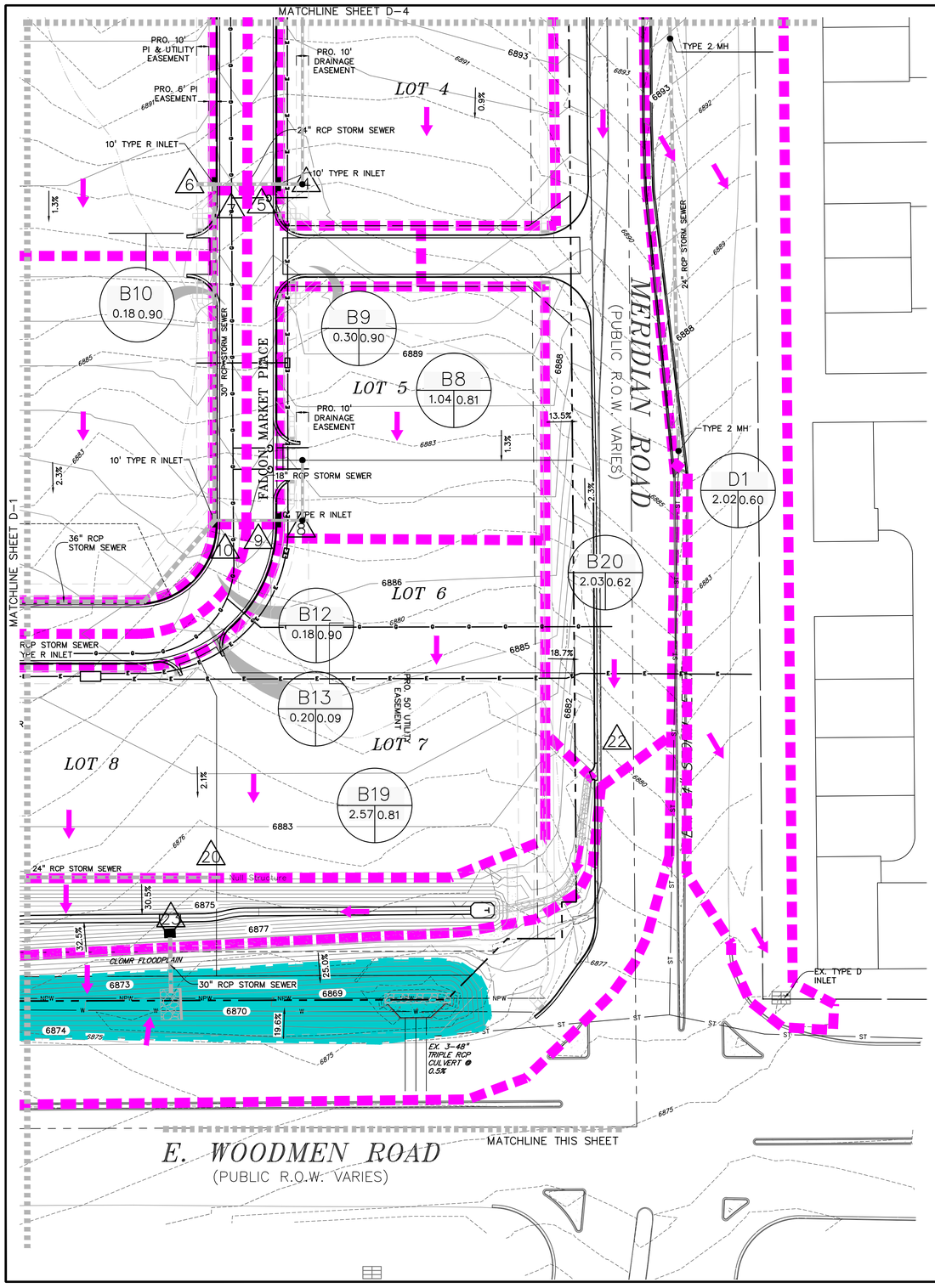
PROPOSED DRAINAGE CONDITIONS

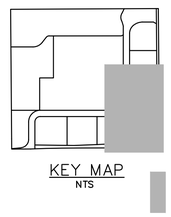
PROJECT NO. 20988-00CSCV

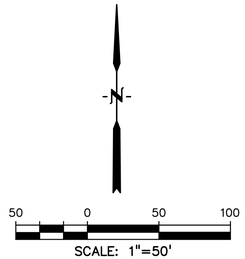
DRAWING NO.

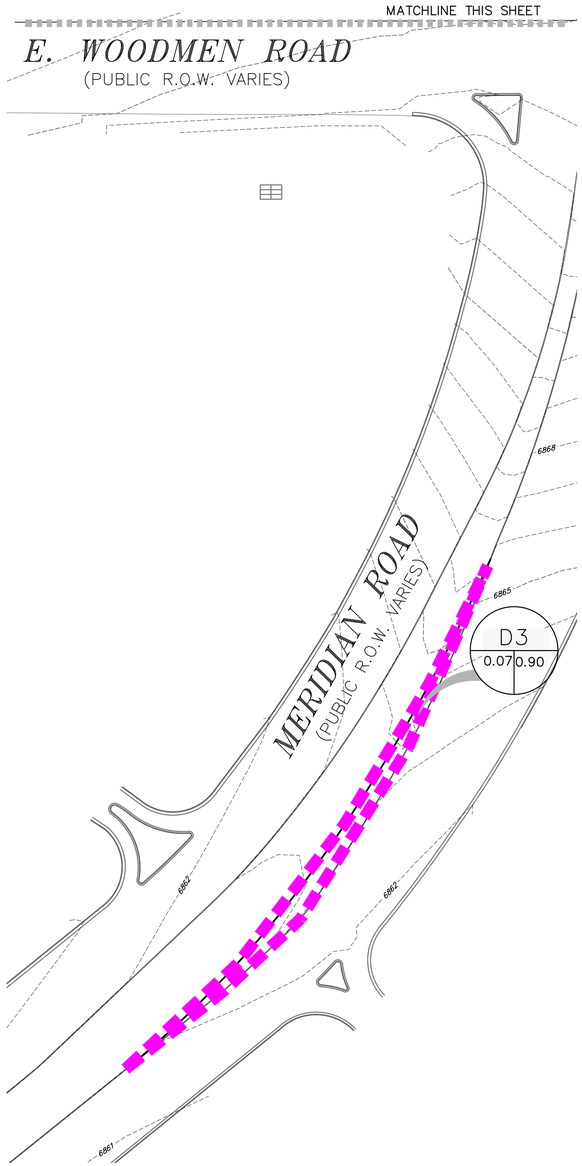
D-1

SHEET: 1 OF 5









RUNOFF SUMMARY

BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
A1	DP1	1.81	3.4	7.7
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	DP5	2.99	10.0	19.3
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	DP7	6.63	23.8	28.0
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	DP16	8.56	30.6	57.1
B17		0.33	1.5	2.7

BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
	DP17	8.89	31.9	59.3
	DP18	19.44	52.1	88.2
B18	DP19	2.18	7.8	15.0
B19	DP20	2.57	10.1	18.8
	DP21	24.19	67.6	117.5
B20	DP22	2.03	5.6	11.4
B21		1.62	0.5	4.0
	DP23	27.85	67.4	121.8
C1	DP24	0.35	1.3	2.6
C2		0.23	0.8	1.5
	DP25	0.59	2.0	3.8
C3		1.88	0.6	4.2
C4		2.19	6.9	13.8
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	DP28	5.31	7.4	18.3
C7	DP29	0.19	0.7	1.3
C8		1.14	2.5	5.5
	DP30	1.33	3.1	6.6
C9		3.43	7.3	16.2
D1		2.62	4.1	8.8
D2		0.07	0.3	0.6
D3		0.07	0.3	0.6
	DP01	32.50	10.3	30.2

PREPARED BY:

DREXEL, BARRELL & CO.
Engineers • Surveyors
3 SOUTH 7TH STREET
COLORADO SPGS, COLORADO 80905
CONTACT: TIM D. McCONNELL, P.E.
(719)260-0887
BOULDER • COLORADO SPRINGS

CLIENT:

HUMMEL INVESTMENTS, LLC
8117 PRESTON ROAD, SUITE 120
DALLAS, TEXAS 75225
(214) 416-9820

DRAINAGE PLAN FOR
FALCON MARKETPLACE
FALCON, COLORADO

ISSUE	DATE
INITIAL ISSUE	6-28-19
REVISED	7-19-19

DESIGNED BY:	TDM
DRAWN BY:	KGV
CHECKED BY:	TDM
FILE NAME:	

COLORADO REGISTERED PROFESSIONAL ENGINEER
TIMOTHY D. McCONNELL
37907
7-12-19
PROFESSIONAL ENGINEER

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1"=50'
VERTICAL: N/A

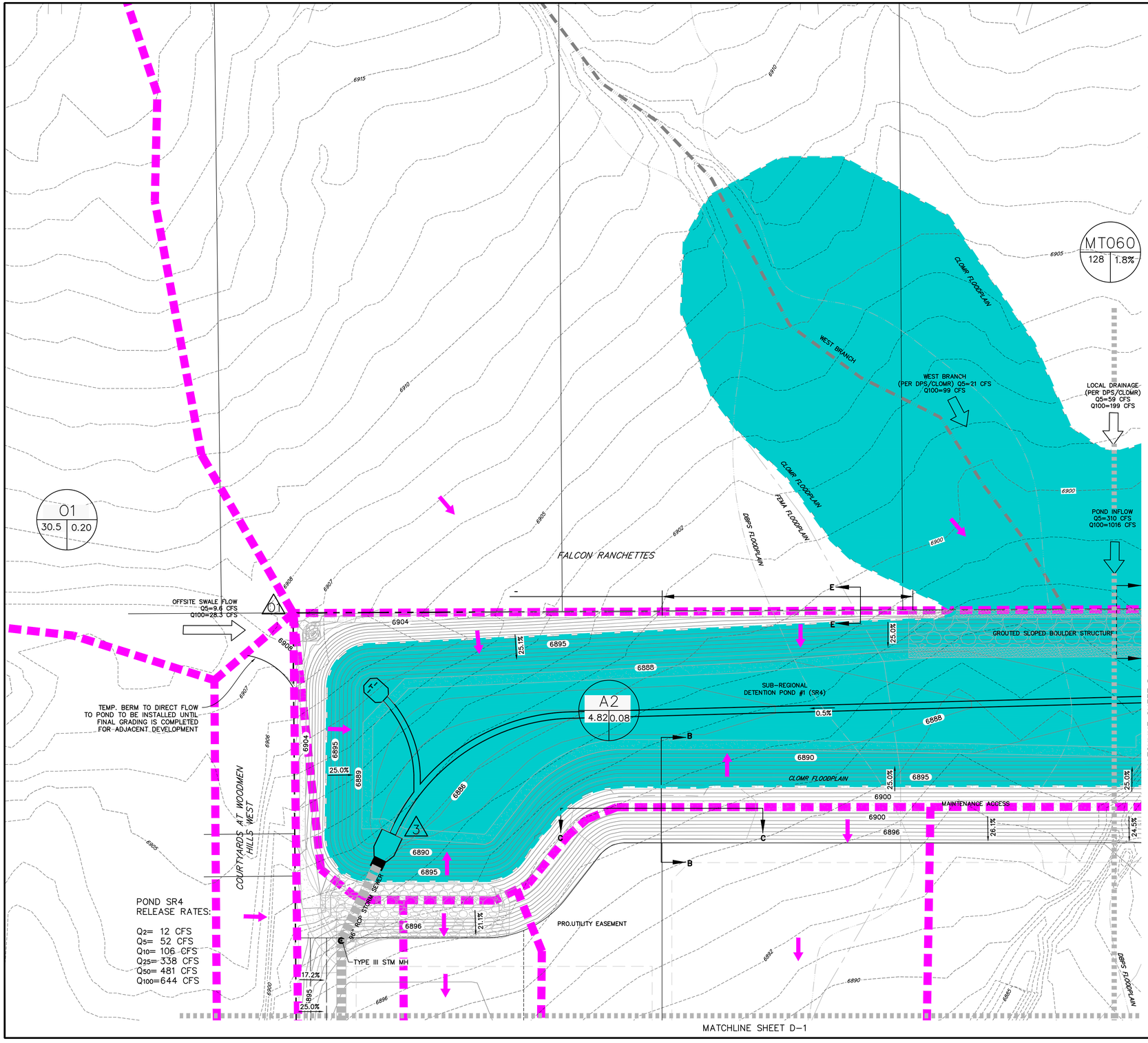
PROPOSED DRAINAGE CONDITIONS

PROJECT NO. 20988-00CSCV

DRAWING NO.

D-2

SHEET: 2 OF 5



N

50 0 50 100

SCALE: 1"=50'

KEY MAP
NTS

RUNOFF SUMMARY

BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
A1	DP1	1.81	3.4	7.7
	DP2	1.81	3.4	7.7
A2		4.82	1.4	10.2
	DP3	6.63	4.6	17.3
B4	DP4	2.35	7.5	14.6
B5		0.63	2.8	5.1
	DP5	2.99	10.0	19.3
B6	DP6	3.19	12.8	23.6
B7		0.46	2.0	3.7
	DP7	6.63	23.8	28.0
B8	DP8	1.04	3.5	6.9
B9		0.30	1.4	2.5
	DP9	1.35	4.9	9.3
B10		0.18	0.8	1.4
	DP10	8.16	29.2	38.1
B11	DP11	2.01	7.8	14.6
B12		0.18	0.8	1.5
	DP12	10.35	36.4	51.9
B13		0.20	0.9	1.6
	DP13	10.55	37.1	53.2
B14	DP14	2.49	9.1	17.0
B15	DP15	5.73	20.3	38.0
B16		0.35	1.6	2.9
	DP16	8.56	30.6	57.1
B17		0.33	1.5	2.7

BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
	DP17	8.89	31.9	59.3
	DP18	19.44	52.1	88.2
B18	DP19	2.18	7.8	15.0
B19	DP20	2.57	10.1	18.8
	DP21	24.19	67.6	117.5
B20	DP22	2.03	5.6	11.4
B21		1.62	0.5	4.0
	DP23	27.85	67.4	121.8
C1	DP24	0.35	1.3	2.6
C2		0.23	0.8	1.5
	DP25	0.59	2.0	3.8
C3		1.88	0.6	4.2
C4		2.19	6.9	13.8
	DP26	4.08	5.4	13.7
C5	DP27	0.64	0.5	1.9
C6		0.45	0.2	1.2
	DP28	5.31	7.4	18.3
C7	DP29	0.19	0.7	1.3
C8		1.14	2.5	5.5
	DP30	1.33	3.1	6.6
C9		3.43	7.3	16.2
D1		2.62	4.1	8.8
D2		0.07	0.3	0.6
D3		0.07	0.3	0.6
	DPO1	32.50	10.3	30.2

PREPARED BY:

DREXEL, BARRELL & CO.
Engineers • Surveyors
3 SOUTH 7TH STREET
COLORADO SPGS, COLORADO 80905
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DRAINAGE PLAN FOR
FALCON MARKETPLACE
FALCON, COLORADO

ISSUE	DATE
INITIAL ISSUE	6-28-19
REVISED	7-19-19

DESIGNED BY:	TDM
DRAWN BY:	KGV
CHECKED BY:	TDM
FILE NAME:	

COLORADO REGISTERED PROFESSIONAL ENGINEER
TIMOTHY D. McCONNELL
33707
12-18-19

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1"=50'
VERTICAL: N/A

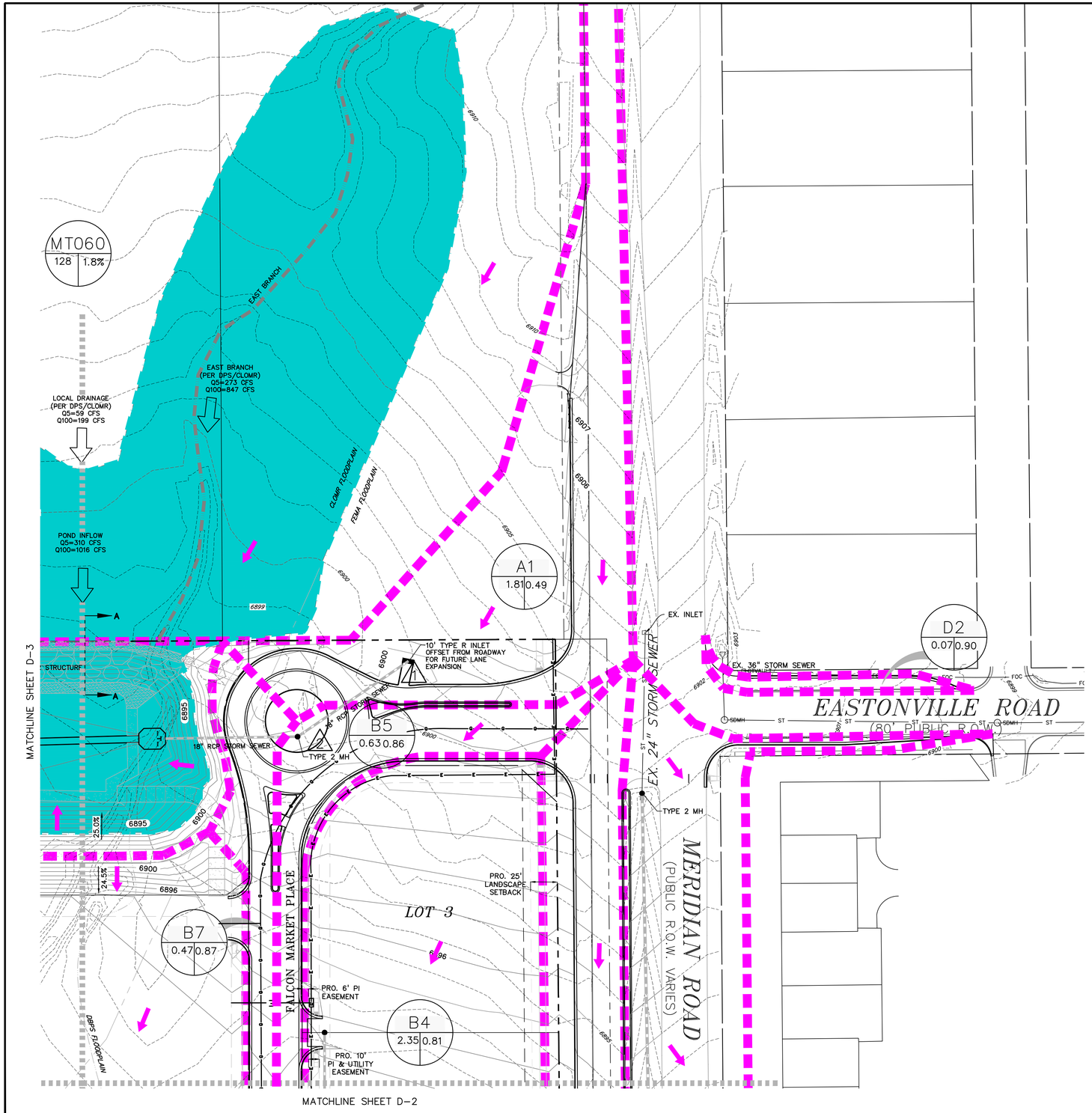
PROPOSED DRAINAGE CONDITIONS

PROJECT NO. 20988-00CSCV

DRAWING NO.

D-3

SHEET: 3 OF 5



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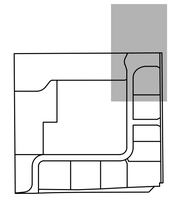
SCALE: 1"=50'



KEY MAP
NTS

LEGEND

- PROPERTY LINE
- LOT LINE
- PROPOSED STORM SEWER
- EX. MINOR CONTOUR
- EX. MAJOR CONTOUR — 6800 —
- PR. MINOR CONTOUR
- PR. MAJOR CONTOUR — 6800 —
- BASIN BOUNDARY
- FLOW DIRECTION
- PROPOSED (CLOMR/LOMR) FLOODPLAIN
- DESIGN POINT
- BASIN DESCRIPTION — BASIN; IMPERVIOUS COVERAGE
- BASIN AREA (ACRES)

RUNOFF SUMMARY

BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
A1	DP1	1.81	3.4	7.7
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	DP3	6.63	4.6	17.3
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B7		0.46	2.0	3.7
	DP7	6.63	23.8	28.0
B8	DP8	1.04	3.5	6.9
B9		0.30	1.4	2.5
	DP9	1.35	4.9	9.3
B10		0.18	0.8	1.4
	DP10	8.16	29.2	38.1
B11	DP11	2.01	7.8	14.6
B12		0.18	0.8	1.5
	DP12	10.35	36.4	51.9
B13		0.20	0.9	1.6
	DP13	10.55	37.1	53.2
B14	DP14	2.49	9.1	17.0
B15	DP15	5.73	20.3	38.0
B16		0.35	1.6	2.9
	DP16	8.56	30.6	57.1
B17		0.33	1.5	2.7

BASIN	DP	Area (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
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C3		1.88	0.6	4.2
C4		2.19	6.9	13.8
	DP26	4.08	5.4	13.7
C5	DP27	0.64	0.5	1.9
C6		0.45	0.2	1.2
	DP28	5.31	7.4	18.3
C7	DP29	0.19	0.7	1.3
C8		1.14	2.5	5.5
	DP30	1.33	3.1	6.6
C9		3.43	7.3	16.2
D1		2.62	4.1	8.8
D2		0.07	0.3	0.6
D3		0.07	0.3	0.6
	DPO1	32.50	10.3	30.2

PREPARED BY:

DREXEL, BARRELL & CO.
Engineers • Surveyors
3 SOUTH 7TH STREET
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CLIENT:

HUMMEL INVESTMENTS, LLC
8117 PRESTON ROAD, SUITE 120
DALLAS, TEXAS 75225
(214) 416-9820

DRAINAGE PLAN FOR
FALCON MARKETPLACE
FALCON, COLORADO

ISSUE	DATE
INITIAL ISSUE	6-28-19
REVISED	7-19-19

DESIGNED BY:	TDM
DRAWN BY:	KGV
CHECKED BY:	TDM
FILE NAME:	

COLORADO REGISTERED P.E. TIMOTHY D. McCONNELL 23707 12-18-19 PROFESSIONAL ENGINEER

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1"=50'
VERTICAL: N/A

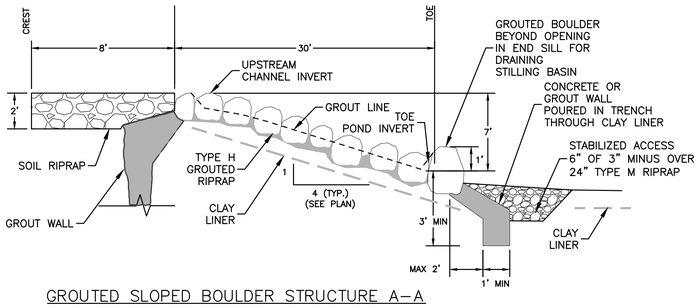
PROPOSED DRAINAGE CONDITIONS

PROJECT NO. 20988-00CSCV

DRAWING NO.

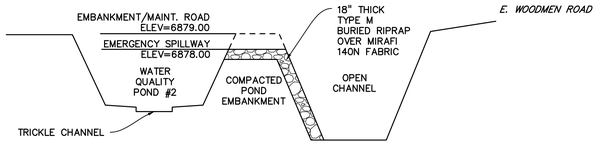
D-4

SHEET: 4 OF 5



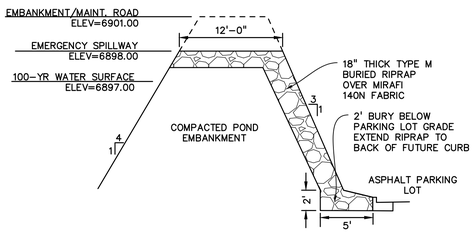
GROUTED SLOPED BOULDER STRUCTURE A–A

NO SCALE



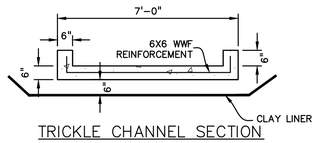
POND #2 & OPEN CHANNEL SECTION D–D

NO SCALE



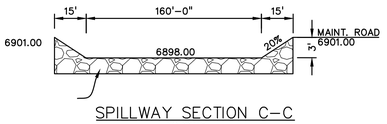
SPILLWAY SECTION B–B

NO SCALE



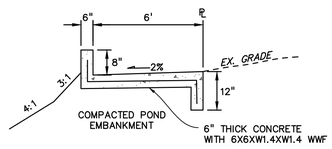
TRICKLE CHANNEL SECTION

NO SCALE



SPILLWAY SECTION C–C

NO SCALE



THIS SECTION REFERS TO A PORTION OF MAINTENANCE ROAD BEGINNING AT THE EAST EDGE OF THE GROUTED RIPRAP FOR A LENGTH OF 250–LF EAST ALONG THE NORTH PROPERTY LINE

MAINTENANCE ROAD SECTION E–E

NO SCALE

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DRAINAGE PLAN FOR
FALCON MARKETPLACE
FALCON, COLORADO

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CHECKED BY:	TDM
FILE NAME:	

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: N/A
VERTICAL: N/A

PROPOSED DRAINAGE DETAILS

PROJECT NO. 20988–00CSCV

DRAWING NO.

D-5

SHEET: 5 OF 5