

Design Point H4 ($Q_5 = 0.3$ cfs and $Q_{100} = 1.9$ cfs) consists of pre-development flows from Basin EX-4 within the Kettle Creek Basin. These historic sheet flows travel in a southwesterly direction towards the southwest corner of the property. No development is proposed within this small basin.

Design Point H5 ($Q_5 = 8$ cfs and $Q_{100} = 43$ cfs) consists of pre-development flows from Basins OS-2, OS-3, OS-4, EX-5 and EX-7 within the Upper Black Squirrel Basin. These historic flows sheet flow in a southeasterly direction towards multiple stock ponds at the southeast corner of the property. These historic flows travel to the existing stock pond facilities with an ultimate release point at an existing 18" CMP crossing Vollmer Road.

Design Point H6 ($Q_5 = 2$ cfs and $Q_{100} = 10$ cfs) consists of pre-development flows from Basin EX-8 within the Upper Black Squirrel Basin. These historic sheet flows travel in a easterly direction towards Vollmer Road where an existing 24" CMP conveys the flows under Vollmer Road.

As mentioned earlier, this site was previously studied as part of the Walker Place Subdivision, prepared by ADP, Inc., approved January 2010. This report generally described the drainage characteristics for the majority of the west half of the property. Along with this Walker Place Final Plat, drainage fees in the amount of \$1,904.76 were previously paid within the Kettle Creek Basin for the two lots currently platted.

**DEVELOPED DRAINAGE CONDITIONS
(KETTLE CREEK BASIN)**

The attached developed conditions drainage map contains several design points related to proposed culvert crossings and BMP facilities. All proposed culverts have been designed for the 100-yr. developed flows. All proposed storm facilities within the public Right-of-way (roadside ditches and culverts) will be public with ownership and maintenance by El Paso County. All proposed BMP facilities within easements will be owned and maintained by the individual lot owner.

or HOA 



proposed ROW or future 40' ROW easement. Therefore, no further improvements within this basin are proposed at this time.

How Addressed

Design Point D9 ($Q_5 = 1$ cfs and $Q_{100} = 4$ cfs) consists of developed flows from Basin I. These on-site developed flows travel as sideroad ditch flows in an easterly direction towards Vollmer Road. At this location an 18" RCP culvert is proposed to convey these flows under the roadway. (See Appendix for Culvert Design) Sediment control will be provided with on-site grading operations and remain until site development is complete and vegetation within sideroad ditch is at 75% growth.

The previous comment was made "Address sediment control" Please provide information in the report that calls out where velocities exceed criteria (5fps) in roadside ditches and call out where permanent rip rap checks will be installed in these high velocity areas

Design Point D10 ($Q_5 = 2$ cfs and $Q_{100} = 29$ cfs) consists of developed flows from Basins I, J and K and the proposed outflow from Pond 2. With the construction of Sanctuary Pine Drive to divert the majority of the developed flows within this existing drainage corridor into the proposed Pond 2, the developed flows at Design Point 10 will be significantly lower than the pre-developed condition. These developed sheet flows continue to travel in an easterly direction towards Vollmer Road and the existing 24" CMP under Vollmer Road. With a significant reduction in the flows seen at this location, this existing culvert will continue to adequately convey the developed flows under Vollmer Road. The necessary ponding at this culvert location is all contained within the proposed ROW or future 40' ROW easement. Therefore, no further improvements within this basin are proposed at this time.

HYDROLOGIC CALCULATIONS

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

The City of Colorado Springs/El Paso County DCM requires the Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume



FLOODPLAIN STATEMENT

No portion of this site is located within a FEMA floodplain as determined by the Flood Insurance Rate Maps (F.I.R.M.) Map Numbers 08041C 0325F, with effective date of March 17, 1997 (See Appendix).

EROSION CONTROL PLAN

The Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate be submitted with the Final Drainage Report. We respectfully request that the Erosion Control Plan and cost estimate be submitted in conjunction with the Grading and Erosion Control Plan and construction assurances posted prior to obtaining a grading permit.

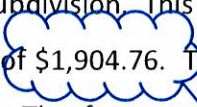
DRAINAGE & BRIDGE FEES

This site lies within two major drainage basins: Kettle Creek and Upper Black Squirrel. The total acreage for the property is 67.9 acres. The acreage within each drainage basin equals:

Kettle Creek Basin – 32.17 Ac. (Basin Fees as calculated below)

Upper Black Squirrel Basin – 35.69 Ac. (No current Basin Fees)

As mentioned previously, a portion of this site within the Kettle Creek Drainage Basin was platted as Lots 1 and 2 or Walker Subdivision. This previously platted acreage equals 19.91 ac. Fees were paid at that time in the amount of \$1,904.76. This acreage will be removed from the total fee acreage within the Kettle Creek Basin. The fees are calculated using the following impervious acreage method approved by El Paso County with current zoning of RR-5 (5-ac. residential land use). Thus, the percent imperviousness for this subdivision is calculated as follows:



This amount was in error (EPC Staff report) and should have been \$2,857 per the approved drainage report. Add the difference to the fees owed.

RR-5 Zone Area

(Per El Paso County Percent Impervious Chart for 5.0 ac. lots: 7%)

$32.17 - 19.91 \text{ Ac.} \times 7\% = 0.86 \text{ Impervious Ac.}$

Revised

**Only subtract the area of two lots in the previously platted area (5.037+5.093).
22 x 7% = 1.54**



The following calculations are based on the 2018 drainage/bridge fees for the Kettle Creek Drainage Basin:

FEE TOTALS (prior to reduction):

Bridge Fees - None

1.54

Drainage Fees (Kettle Creek)

\$14,302

\$ 9,287.00 x 0.86 Impervious Ac.

=

\$ 7,986.82

Per the ECM 3.10.2a, this development requests a 25% reduction of drainage fees based on the low density lots proposed (5 ac. min lot size). This reduction is as follows:

Low Density Lot Reduction (25%) \$ 7,986.82 x 25% = \$ 1,996.71

\$3,575.50

FEE TOTALS (with reduction):

Bridge Fees - None

Drainage Fees (Kettle Creek)

\$ 7,986.82 - 1,976.71

=

\$ 5,990.11

+ \$ 952 (prev. error)
= ~~\$11,678.50~~

Revised

Upper Black Squirrel currently has no bridge or drainage fees.

SUMMARY

This proposed development remains consistent with pre-development drainage conditions with the construction of the proposed on-site Sand Filter Basins. These proposed facilities meet current criteria and provide full spectrum design. The proposed development will not adversely impact surrounding developments.



Description

A sand filter is a filtering or infiltrating BMP that consists of a surcharge zone underlain by a sand bed with an underdrain system. During a storm, accumulated runoff collects in the surcharge zone and gradually infiltrates into the underlying sand bed, filling the void spaces of the sand. The underdrain gradually dewateres the sand bed and discharges the runoff to a nearby channel, swale, or storm drain. It is similar to a BMP designed for bioretention in that it utilizes filtering, but differs in that it is not specifically designed for vegetative growth. The absence of vegetation in a sand filter allows for active maintenance at the surface of the filter, (i.e., raking for removing a layer of sediment). For this reason, sand filter criteria allows for a larger contributing area and greater depth of storage. A sand filter is also a dry basin, which can be designed to include the flood control volume above the WQCV or EURV. Sand filters can also be placed in a vault. Underground sand filters have additional requirements. See Fact Sheet T-11 for additional discussion on underground BMPs.



Photograph SF-1. This sand filter, constructed on two sides of a parking garage, is accessible for maintenance, yet screened from public view by a landscape buffer.

Site Selection

Sand filters require a stable watershed. When the watershed includes phased construction, sparsely vegetated areas, or steep slopes in sandy soils, consider another BMP or provide pretreatment before runoff from these areas reach the rain garden.

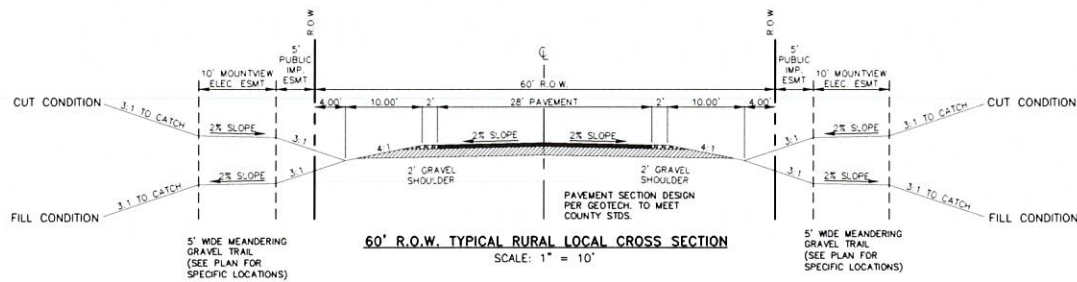
When sand filters (and other BMPs used for infiltration) are located adjacent to buildings or pavement areas, protective measures should be implemented to avoid adverse impacts to these structures. Oversaturated subgrade soil underlying a structure can cause the structure to settle or result in moisture-related problems. Wetting of expansive soils or bedrock can cause swelling, resulting in structural movements. A geotechnical engineer should evaluate the potential impact of the BMP on adjacent structures based on an evaluation of the subgrade soil, groundwater, and bedrock conditions at the site.

In locations where potentially expansive soils or bedrock exist, placement of a sand filter adjacent to a structure should only be considered if the BMP includes a drainage layer (with underdrain)

Sand/Media Filter	
Functions	
LID/Volume Red.	Yes
WQCV Capture	Yes
WQCV+Flood Control	Yes
Fact Sheet Includes EURV Guidance	No
Typical Effectiveness for Targeted Pollutants³	
Sediment/Solids	Very Good ⁴
Nutrients	Good
Total Metals	Good
Bacteria	Moderate
Other Considerations	
Life-cycle Costs ⁴	Moderate
¹ Not recommended for watersheds with high sediment yields (unless pretreatment is provided).	
³ Based primarily on data from the International Stormwater BMP Database (www.bmpdatabase.org).	
⁴ Based primarily on BMP-REALCOST available at www.udfed.org . Analysis based on a single installation (not based on the maximum recommended watershed tributary to each BMP).	

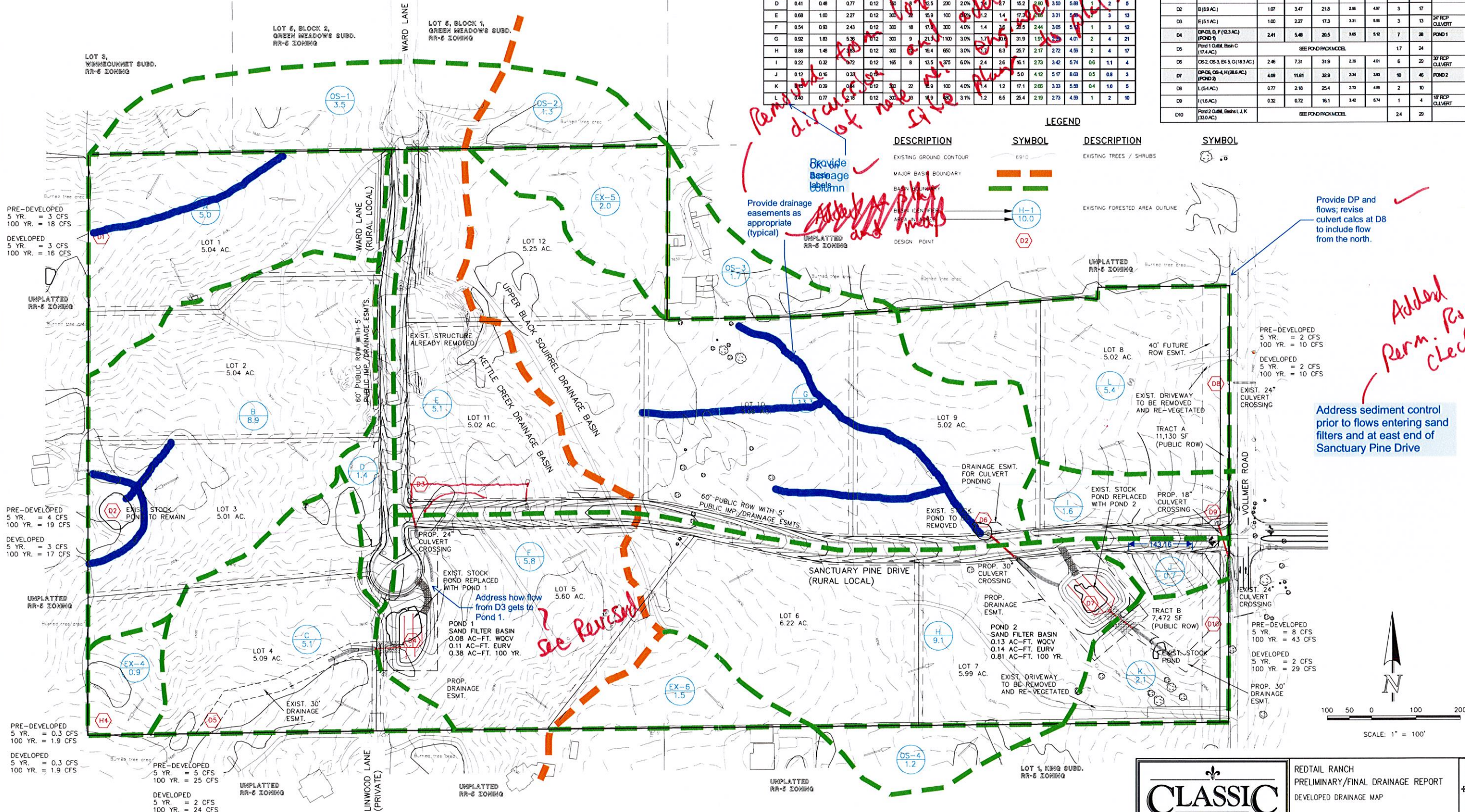
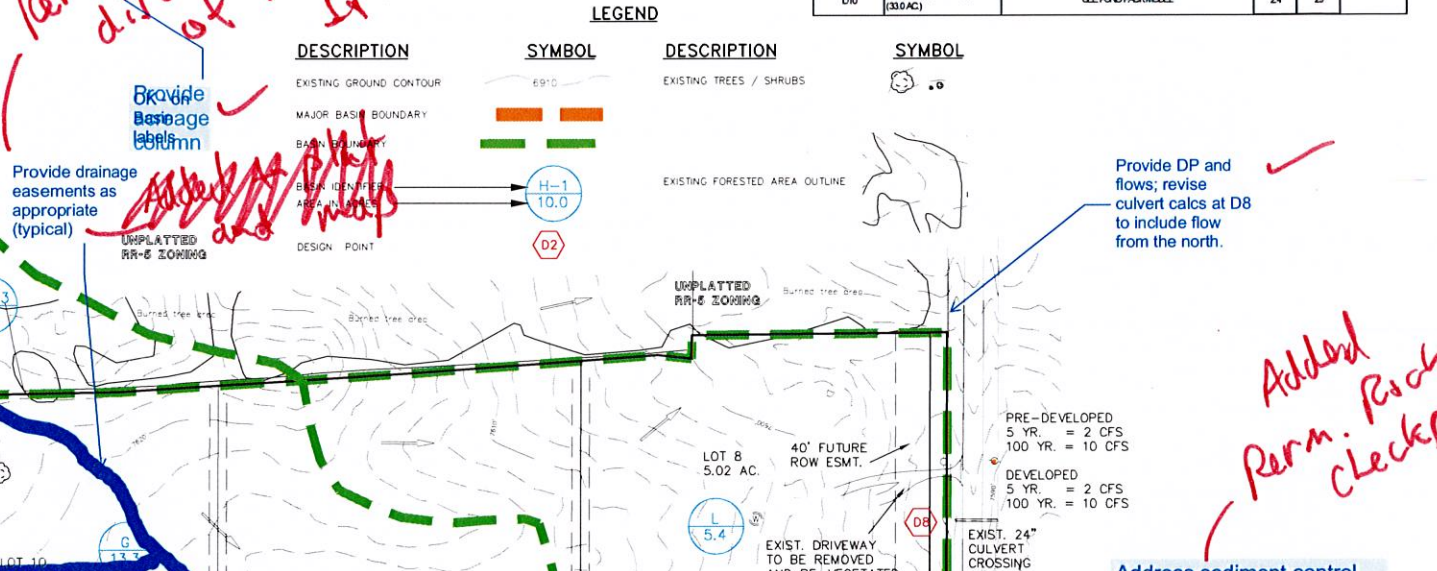
provide

see revised text and plans



BASIN	WEIGHTED			OVERLAND			STREET / CHANNEL FLOW			TOTAL	INTENSITY			TOTAL FLOWS				
	CA(2)	CA(5)	CA(100)	Q(5)	Length (ft)	Height (ft)	Length (ft)	Slope (%)	Velocity (fps)		Tc (min)	I(5)	I(100)	I(2)	Q(2)	Q(5)	Q(100)	
OS-1	0.33	0.56	1.46	0.12	300	14	18.4				18.4	2.57	3.21	5.39	0.8	2	8	
OS-2	0.12	0.20	0.54	0.12	300	16	17.6				17.6	2.62	3.28	5.50	0.3	0.7	3	
OS-3	0.14	0.25	0.69	0.12	300	12	19.4				19.4	2.51	3.14	5.25	0.3	0.8	4	
OS-4	0.06	0.14	0.47	0.12	270	12	17.8				17.8	2.61	3.27	5.46	0.2	0.5	3	
A	0.25	0.60	1.95	0.12	300	18	17.0	250	3.0	1.3	3.1	2.8	3.08	5.17	1	2	10	
B	0.45	1.07	3.47	0.12	300	14	18.4	300	4.0	1.4	2.8	2.37	2.96	4.97	1	3	17	
C	0.26	0.61	1.99	0.12	300	15	18.0	350	3.6	1.1	2.4	3.24	3.33	5.50	1	2	10	
D	0.41	0.48	0.77	0.12	300	15	18.5	200	2.0	1.2	2.7	1.52	1.60	3.50	0.8	1	5	
E	0.68	1.00	2.27	0.12	300	15	18.5	150	1.0	1.2	1.4	17.3	2.69	3.31	5.46	1	3	13
F	0.54	0.93	2.43	0.12	300	18	17.0	300	4.0	1.4	3.0	2.5	2.44	3.05	5.1	1	3	12
G	0.92	1.83	5.33	0.12	300	11	21.3	1100	3.0	1.1	2.0	31.9	1.97	2.59	4.01	2	4	21
H	0.88	1.48	4.33	0.12	300	8	19.4	650	3.0	1.4	6.3	25.7	2.17	2.72	4.35	2	4	17
I	0.22	0.32	0.72	0.12	165	8	13.5	375	6.0	2.4	2.6	16.1	2.73	3.42	5.74	0.6	1.1	4
J	0.12	0.16	0.33	0.12	300	12	17.6	100	1.0	1.4	1.4	5.0	4.12	5.17	8.68	0.5	0.8	3
K	0.29	0.47	1.12	0.12	300	22	16.5	100	4.0	1.4	12	2.69	3.33	5.38	0.4	1.0	5	
L	0.40	0.77	2.13	0.12	300	13	18.9	80	3.1	1.2	6.5	25.4	2.19	2.73	4.59	1	2	10

Design Point(s)	Contributing Basins	Equivalent CA(5)	Equivalent CA(100)	Maximum Tc	Intensity			Flow		
					I(5)	I(100)	Q(5)	Q(100)	Outfall / Inlet Size	
H1	OS-1, EX-1 (96 AC)	1.17	3.69	21.9	2.6	4.96	3	16		
H2	EX-2 (10 AC)	1.41	3.98	24.3	2.6	4.70	4	16		
H3	EX-3 (148 AC)	1.93	5.74	27.8	2.6	4.36	5	25		
H4	EX-4 (89 AC)	0.68	0.32	15.9	3.40	5.76	0.3	1.9		
H5	OS-2, OS-3, OS-4, EX-5, EX-7 (32.6 AC)	3.70	12.30	39.3	2.6	3.48	8	43		
H6	EX-8 (61 AC)	0.60	2.23	26.0	2.70	4.53	2	10		
D1	A, OS-1 (8.5 AC)	1.05	3.12	20.1	3.08	5.17	3	16		
D2	B (8.9 AC)	1.07	3.47	21.8	2.6	4.97	3	17		
D3	E (51 AC)	1.00	2.27	17.3	3.31	5.56	3	13	3" RCP CULVERT	
D4	DR-DL, D, F (23 AC) (POND 1)	2.41	5.48	28.5	3.08	5.12	7	28	POND 1	
D5	Prop 1 QMB Basin C (17.4 AC)						1.7	24		
D6	OS-2, OS-3, EX-5, G (18.3 AC)	2.46	7.31	31.9	2.38	4.01	6	29	3" RCP CULVERT	
D7	DR-DL, OS-4, H (28.4 AC) (POND 2)	4.09	11.61	32.9	2.34	3.80	10	46	POND 2	
D8	L (5.4 AC)	0.77	2.16	25.4	2.70	4.59	2	10		
D9	I (1.6 AC)	0.32	0.72	16.1	3.42	5.74	1	4	1" RCP CULVERT	
D10	Prop 2 QMB Basins J, K (30.6 AC)						2.4	29		



CLASSIC CONSULTING ENGINEERS & SURVEYORS

RETAIL RANCH
PRELIMINARY/FINAL DRAINAGE REPORT
DEVELOPED DRAINAGE MAP

DESIGNED BY: MAW SCALE: DATE: 7-3-18
DRAWN BY: MAW (H) 1" = 100' SHEET 2 OF 2
CHECKED BY: (V) 1" = N/A JOB NO. 2525.00

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