PRELIMINARY/FINAL DRAINAGE REPORT

FOR

APPALOOSA HWY 24 SUBDIVISION
FILING NO. 1A, LOTS 1, 2 & 3

Prepared For:
Platte Valley, LLC
1378 Promontory Bluff View
Colorado Springs, CO 80921
719-491-0801

Prepared By:
Associated Design Professionals, Inc.
3520 Austin Bluffs Parkway Suite 102
Colorado Springs, CO 80918
719.266-5212

This is the final drainage report for the project VR1813, which has been approved. A drainage letter must be submitted confirming that the proposed development on this lot is in conformance with the approved Final Drainage Report from the subdivision. Comments were provided on the drainage letter submitted for the AL1811 Project. The drainage letter was not required to be submitted with the special use and comments provided were for information purposes.

ADP Project No. 160504
December 12, 2018

ADP CIVIL
ENGINEERING FOR THE FUTURE

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

_____
Michael A. Bartusek, P.E. #23329

DEVELOPER'S STATEMENT:
I, the Developer, have read and will comply with all of the requirements specified in this drainage report and plan.

By: _____
Ron Waldthausen

Title: President

Address: Platte Valley, LLC
1378 Promontory Bluff View
Colorado Springs, CO 80921

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

_____ _____
Jennifer Irvine, County Engineer/ECM Administrator Date

Conditions:

PRELIMINARY/FINAL DRAINAGE REPORT
APPALOOSA HWY 24 SUBDIVISION
FILING NO. 1A, LOTS 1, 2 & 3

PROJECT DESCRIPTION

This drainage report is for the development of the Appaloosa Hwy 24 Subdivision, Filing No. 1A, Lots 1, 2 & 3. The currently vacant 4.67 acre site is located north of U.S. Hwy 24 and east of Amelia Street. It is further described as the southern portion of Section 7, Township 14 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado.

All of this lot is located in Sand Creek drainage basin and drains into the central tributary of Sand Creek. An existing 4'x4' box culvert is located at the southeast corner of U.S. Hwy 24 and Amelia St. Also an existing concrete channel is located on the east side of proposed Lot 3.

SOILS

The soil on the site can be described as having a rapid permeability, medium-surface runoff, and moderate to high hazard of erosion. The soils within the site are Truckton Sandy Loams. These soils are classified as Hydrologic Group 'B'.

FLOODPLAIN STATEMENT

A small portion of the developed site is located within a designated FEMA 100-year floodplain according to the information published in the Federal Emergency Management Agency Flood Plain Map No. 08041CO754F, dated March 17, 1997, and LOMR 05-08-0368P dated May 23, 2007. This area falls within the existing concrete channel.

METHOD OF COMPUTATION

The methodology utilized for this report is in accordance with the *El Paso County Drainage Criteria Manual, Volumes 1*, dated May 2014. The Rational Method for computation of runoff was used for determining Sub-Basin flows.

$Q = cia$

Where
- Q = maximum rate of runoff in cubic feet per second
- c = runoff coefficient representing drainage area characteristics
- i = average rainfall intensity, in inches per hour, for the duration required for the runoff to become established
- a = drainage basin size in acres

EXISTING DRAINAGE CONDITIONS

The existing site has been overlot graded and is covered with rangeland grasses. The western portion of the site drains in a southerly direction toward the existing 4' x 4' box culvert under U.S. Hwy 24. The eastern portion of the site drains westerly toward the 4' x 4' box culvert. An existing concrete channel is located on the east side of the lot, but no flows from this parcel drain to the concrete channel. A portion of the concrete channel has failed with other portions showing signs of joint failure.

The existing sub-basin AEX produces flows of 1.0 cfs for the 5-year storm and 7.9 cfs for the 100-year storm.

DEVELOPED DRAINAGE CONDITIONS

The developed site will be divided into three (3) lots. Lots 1 and 2 will encompass 1.003 acres and 1.008 acres respectively and Lot 3 will encompass 2.655 acres. The proposed land is zoned I-2 (Limited Industrial). Drainage from each lot will be self-contained with flows intercepted by swales along the property lines and directed into proposed Type C inlets and transported to a proposed extended detention basin (EDB) facility in the southwest corner of Lot 3 through a private storm sewer

Lot 1, Sub-basin A1, is located in the northern portion of the site. Sub-basin A1 will produce flows of 2.1 cfs for the 5-year storm and 4.5 cfs for the 100-year storm. These flows will continue south and be intercepted by a proposed swale located along the southerly property line. The flows will then travel west to a proposed type 'C' inlet at the southwest corner of the lot. An 18" HDPE storm sewer will transport these flows through Lot 2.

Lot 2, Sub-basin A2, is located in the center of the site. Sub-basin A2 will produce flows of 2.2 cfs for the 5-year storm and 4.5 cfs for the 100-year storm. As with Lot 1 the site flows will be intercepted by a swale located along the southerly property line. These flows will be intercepted by a type 'C' inlet at the southwest corner of the lot. These flows will combine with the flows from Sub-basin A1 at DP1 to produce flows of 4.3 cfs for the 5-year storm and 8.9 cfs for the 100-year storm. An 18" HDPE storm sewer will transport these flows into the proposed EDB in Lot 3.

Lot 3, Sub-basin A3, is located in the southern portion of the site. Sub-basin A3 will produce flows of 5.9 cfs and 10.8 cfs respectively. These flows will be intercepted by a proposed swale located along the south property line and into the proposed EDB. The combined flows into the basin at DP2 will be 9.3 cfs for the 5-year storm and 19.2 cfs for the 100-year storm.

The proposed 0.648 ac.ft. Private EDB will reduce the site flows into the existing 4' x 4' box culvert to 0.2 cfs for the 5-year storm and 5.3 cfs for the 100-year storm at DP3.

CONCRETE CHANNEL REPAIR

Approximately 120 lf of the existing concrete channel will need to be removed and replaced. The channel section is 6 feet wide and 7 feet deep. The new concrete channel section will be doweled into the concrete channel sections which remain. The channel is currently owned and maintained by the adjacent property owners as delineated on the Drainage Map. Once the repairs to the channel are made the same ownership will remain.

WATER QUALITY AND DETENTION

Water quality for the site will be achieved within by 0.118 acre-feet of storage, 1.85 ft deep within the 0.656 ac. ft. private extended detention basin (EDB) which will be maintained by the owner of Lot 3. The remainder of the basin will provide the storage volume required for detention. The facility will have an 18" RCP outlet pipe with a 12" restrictor plate located 5.8"above the pipe invert.

PRIVATE DRAINAGE FACILITIES

Item	Unit	Quantity	Unit Cost	Total Cost
18" HDPE FES	EA	1	$450	$ 450.00
18" HDPE	LF	346	$45	$ 15,570.00
Outlet Structure	EA	1	$5,000	$ 5,000.00
Emergency Spillway	EA	1	$1,500	$ 1,500.00

Type 'C' Inlet	EA	2	$3,270	$ 6,540.00
Concrete Channel	LF	120	$150	$18,000.00
Concrete Forebay	SF	102	$10	$ 1,020.00
Concrete Trickle Channel	LF	24	$25	$ 600.00
EDB	EA	1	$8,000	$8,000.00
24" RCP FES	EA	1	$500	$ 500.00
24" RCP	LF	50	$50	$ 2,500.00
			Sub-Total	$59,680.00
		15% Contingency & Engineering		$ 8,952.00
			TOTAL	**$68,632.00**

The proposed drainage improvements will be constructed at the time of plat approval. The storm sewer improvement construction and maintenance will be the responsibility of Platte Valley, LLC until such time as this property is sold. At that time the new adjacent property owners of Lots 1, 2 and 3 will assume the maintenance responsibilities, including the EDB which will be maintained by the owner of Lot 3.

DRAINAGE BASIN FEES

Based on a resolution, No. 16-336, passed by the Board of County Commissioners on September 29, 2016, drainage and bridge fees will only be assessed on the two (2) smaller lots in the replat. The area of the two (2) smaller lots is 2.011 acres.

The proposed development is located within the Sand Creek drainage basin. The 2018 drainage basin fee calculation is as follows:

Impervious Coverage	=	75.7%
Area Subject to Fee	=	0.757 x 2.011 acres = 1.522 acre
Sand Creek Basin Fee	=	$17,197/acre
Drainage Basin Fee	=	$17,197 x 1.522 = $26,174
Sand Creek Bridge Fee	=	$5,210
Bridge Fee	=	$5,210 x 1.522 = $7,930

CONCLUSION

The proposed development and subsequent lot developments follow the "Four Step Process" as mandated by the EPA as follows:

Step 1: Employ runoff reduction practices

Runoff has been reduced by disconnecting impervious areas where possible, eliminating "unnecessary" impervious areas and encouraging infiltration into suitable soils.

- Impervious areas have been directed to earth swales to encourage infiltration.
- Gravel will be used in portions of the lots to reduce the impervious of the areas.

Step 2: Stabilize drainageways

All drainageways, ditches and channels have been stabilized by the following methods:

- Tributaries have been left in their relatively natural state where possible.
- New drainageways and swales have been stabilized with either riprap or erosion control fabric depending on the erosion potential.
- No new roadside ditches are proposed for the development.

Step 3: Provide water quality capture volume (WQCV)

The proposed development will disturb approximately 4.5 acres, although the initial disturbance will only be 0.6 acres.

Step 4: Consider need for industrial and commercial BMP's.

The development of this project will not affect sensitive waters.

The development of this site will have little impact on downstream properties once the EDB is constructed.

REFERENCES

1. City of Colorado Springs and El Paso County (1994). ***Drainage Criteria Manual Volume 1*** (DCM).

2. City of Colorado Springs and El Paso County (1994). ***Drainage Criteria Manual Volume II*** (DCM).

3. Soil Survey of El Paso County Area, Colorado by USDA, NRCS.

4. ***El Paso County (January 2006) Engineering Criteria Manual.***

5. Urban Drainage and Flood Control District (June 2011). ***Urban Storm Drainage Criteria Manual, Volume 1-3.***

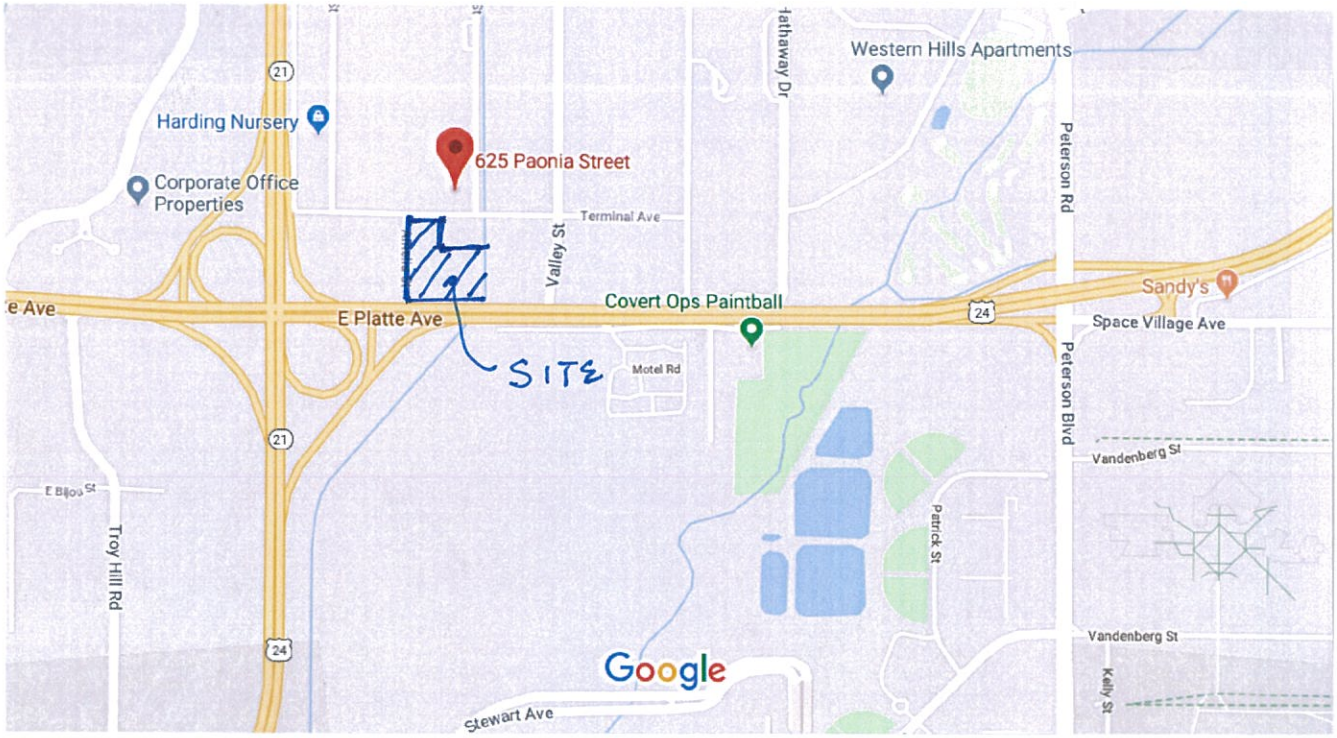
6. Sand Creek Drainage Basin Planning Study (DBPS).

7. Preliminary/Final Drainage Plan and Report for the Appaloosa Hwy 24 Subdivision by Oliver E. Watts, Consulting Engineer, dated November, 2000.

8. Resolution No. 16-336. Board of County Commissioners, County of El Paso, State of Colorado.

APPENDIX A

MAPS



VICINITY MAP

N.T.S.

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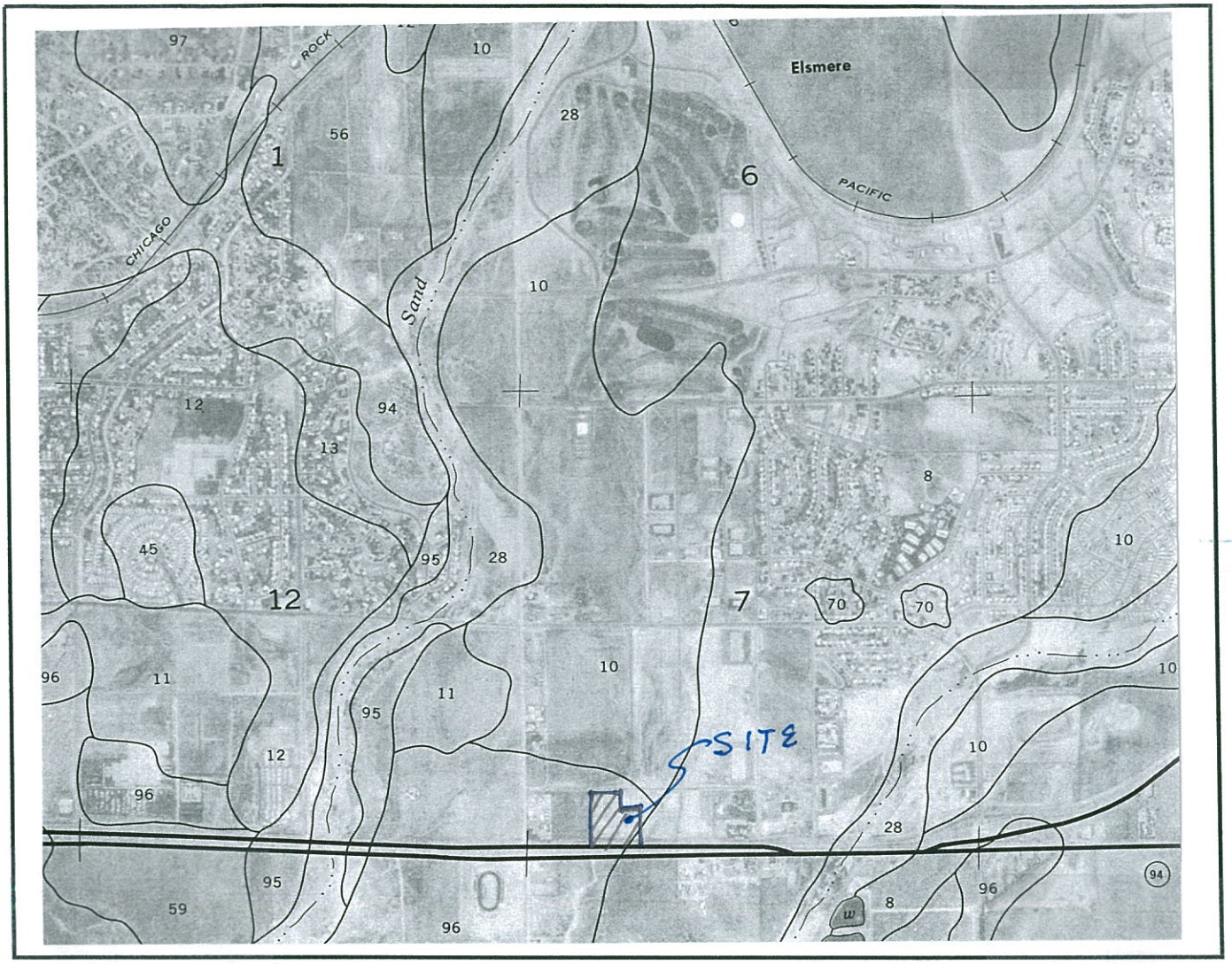

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SOILS MAP

N.T.S.

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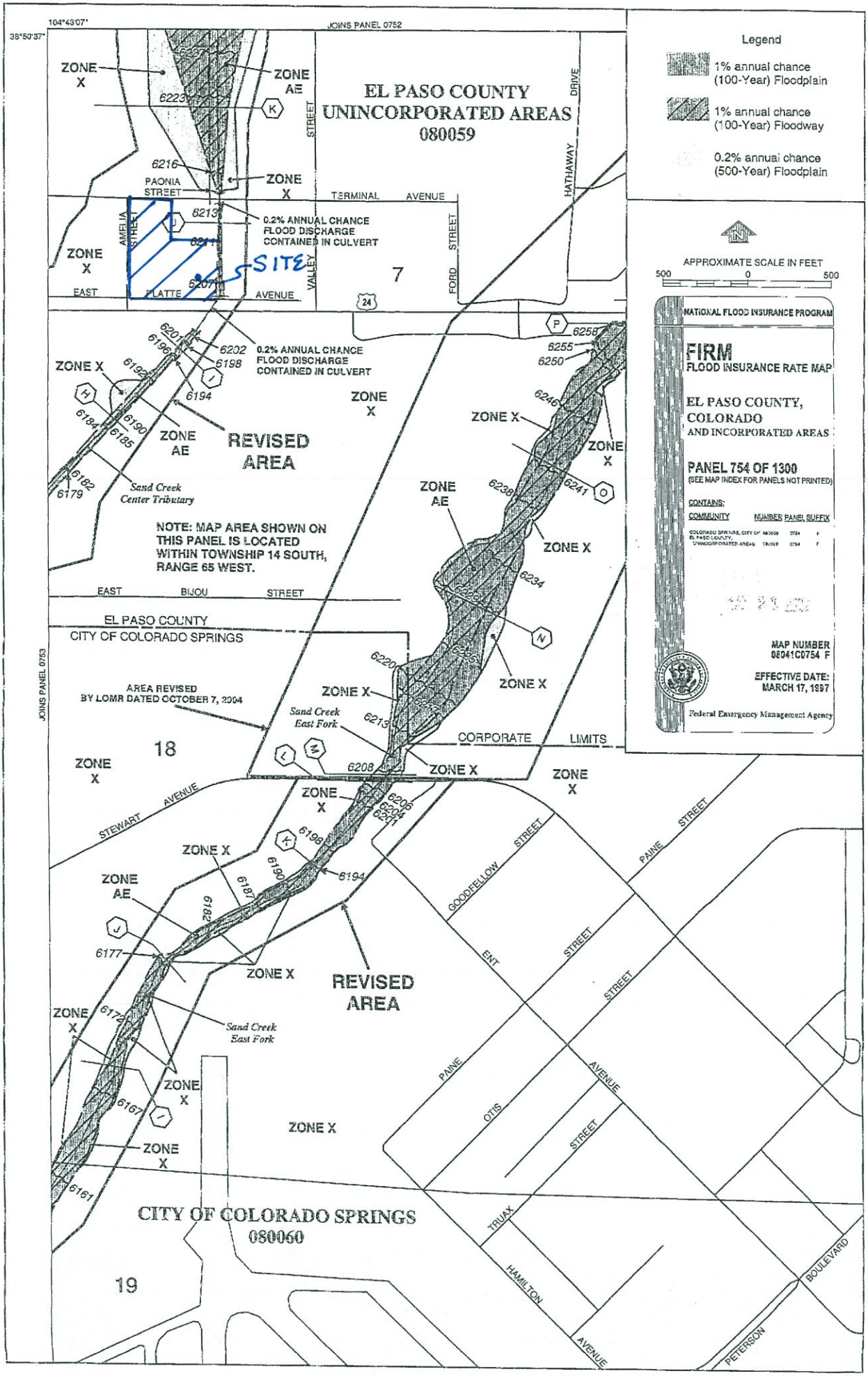

104°43'07"
38°50'37"
JOINS PANEL 0752
JOINS PANEL 0753
EL PASO COUNTY
UNINCORPORATED AREAS
080059
CITY OF COLORADO SPRINGS
080060
ZONE X
ZONE AE
REVISED AREA
0.2% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT
SITE
PAONIA STREET
AMELIA STREET
TERMINAL AVENUE
EAST PLATTE AVENUE
VALLEY STREET
FORD STREET
HATHAWAY DRIVE
Sand Creek Center Tributary
Sand Creek East Fork
NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 14 SOUTH, RANGE 65 WEST.
EAST BIJOU STREET
EL PASO COUNTY
CITY OF COLORADO SPRINGS
AREA REVISED BY LOMR DATED OCTOBER 7, 2004
CORPORATE LIMITS
STEWART AVENUE
GOODFELLOW STREET
PAINE STREET
ENT STREET
OTIS AVENUE
TRUAX
HAMILTON
BOULEVARD
PETERSON
AVENUE
7
18
19
Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
APPROXIMATE SCALE IN FEET
500 0 500
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS
PANEL 754 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
COLORADO SPRINGS, CITY OF 080060 0754 F
EL PASO COUNTY, UNINCORPORATED AREAS 080059 0754 F
MAP NUMBER 08041C0754 F
EFFECTIVE DATE: MARCH 17, 1997
Federal Emergency Management Agency

APPENDIX B

DESIGN CALCULATIONS

APPALOOSA SUBDIVISION

PROJ. #160504

DRAINAGE CALCULATION SHEET

file:appaloosa dr

12/18/18

							Initial Tci			Travel Time								length	vel.		
AREA DESIG.	AREA (acre)	C5 (5 yr)	C100 (100 yr)	C5 X A	C100 X A	L (ft)	Slope (%)	ti (min)	L (ft)	Slope (%)	V (fps)	Tt (min)	TC (min)	I5 (in/hr)	I100 (in/hr)	Q5 (cfs)	Q100 (cfs)	L (feet)	V (fps)	^t (min)	AREA DESIG.
EXISTING CONDITIONS																					
Aex	4.58	0.08	0.35	0.37	1.60	100	2.50	14.10	520	1.30	1.20	7.22	21.32	2.82	4.92	1.03	7.88				Aex
DEVELOPED CONDITIONS																					
A1	1.00	0.59	0.70	0.59	0.70	100	2.00	7.59	300	1.00	1.00	5.00	12.59	3.66	6.40	2.16	4.48	150	10.00	0.25	A1
A2	1.01	0.59	0.70	0.60	0.71	100	2.00	7.59	300	1.00	1.00	5.00	12.59	3.66	6.40	2.18	4.52				A2
DP1	2.01			1.19	1.41								12.84	3.63	6.34	4.31	8.92	175	10.00	0.29	DP1
A3	2.57	0.59	0.70	1.52	1.80	100	1.20	8.98	400	1.30	1.20	5.56	14.54	3.42	5.98	5.19	10.76				A3
DP2	4.58			2.70	3.21								14.54	3.42	5.98	9.25	19.18				DP2
DP3	4.58			1.14	0.89	Adjusted C Factor for Detention Basin A							14.54	3.42	5.98	3.90	5.30				DP3

IMPERVIOUS AREA CALC

Description	Imperv %
UNDEV	0
LOOSE GRAVEL	80
PAVED PARKING	100
BUILDINGS	100

				Imperious Area Description		
Subasin	Area	Landscape	Building	Paved Parking	Loose Gravel	Total Imperv
A1	1.00	0.2	0.18	0.36	0.26	74.8
A2	1.01	0.19	0.25	0.42	0.15	78.2
A3	2.57	0.35	0.25	0.40	1.60	75.1
Total	4.58					75.7

SPILLWAY CALCULATIONS

b = 15'

d = 0.43'

C = 3.2

Q = d^1.5xbxC

Q = 20.8 cfs

PIPE CAPACITY

D = 24"

S = 0.6%

n = 0.012

Q max = 20.4 cfs

Swale Location	Q5 cfs	Q100cfs	S %	B ft	Z	d100 ft	V fps	Froude #	Riprap Size	
Spillway	9.30	19.20	1.00	15.00	4:1	0.43	2.20	0.57	0.03	Use 6" Rock

FOREBAY CALCULATIONS

2% OF WQV

0.02 X 0.116 = 0.002 AF = 101 CF

FOREBAY NOTCH CALCULATIONS

2% OF 100YR FLOW

0.02 X 19.2 = 0.38 CFS

W =Q/(D^1.5XC)

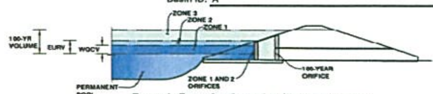
W=0.38/(1X3.0)=0.13 FT

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Appaloosa Hwy 24 Sub Fil 1A

Basin ID: A



Example Zone Configuration (Retention Pond)

Required Volume Calculation

			Optional User Override 1-hr Precipitation	
Selected BMP Type =	EDB			
Watershed Area =	4.58	acres		
Watershed Length =	550	ft		
Watershed Slope =	0.012	ft/ft		
Watershed Imperviousness =	75.70%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	Denver - Capitol Building			
Water Quality Capture Volume (WQCV) =	0.116	acre-feet		
Excess Urban Runoff Volume (EURV) =	0.383	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.322	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.425	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.532	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.657	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.751	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.875	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.01 in.) =	1.093	acre-feet	3.01	inches
Approximate 2-yr Detention Volume =	0.302	acre-feet		
Approximate 5-yr Detention Volume =	0.400	acre-feet		
Approximate 10-yr Detention Volume =	0.499	acre-feet		
Approximate 25-yr Detention Volume =	0.536	acre-feet		
Approximate 50-yr Detention Volume =	0.557	acre-feet		
Approximate 100-yr Detention Volume =	0.591	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.116	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.267	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	0.265	acre-feet
Total Detention Basin Volume =	0.648	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	--	--	--	30	0.001		
	--	0.25	--	--	--	2,206	0.051	258	0.006
	--	0.50	--	--	--	2,436	0.056	835	0.019
	--	0.75	--	--	--	2,666	0.061	1,471	0.034
	--	1.00	--	--	--	2,895	0.066	2,164	0.050
	--	1.25	--	--	--	3,124	0.072	2,914	0.067
	--	1.50	--	--	--	3,354	0.077	3,721	0.085
	--	1.75	--	--	--	3,583	0.082	4,586	0.105
Zone 1	--	2.00	--	--	--	3,812	0.088	5,508	0.126
	--	2.25	--	--	--	4,042	0.093	6,528	0.150
	--	2.50	--	--	--	4,270	0.098	7,567	0.174
	--	2.75	--	--	--	4,500	0.103	8,663	0.199
	--	3.00	--	--	--	4,730	0.109	9,817	0.225
	--	3.25	--	--	--	4,959	0.114	11,028	0.253
	--	3.50	--	--	--	5,188	0.119	12,296	0.282
	--	3.75	--	--	--	5,418	0.124	13,622	0.313
	--	4.00	--	--	--	5,647	0.130	15,005	0.344
Zone 2	--	4.25	--	--	--	5,876	0.135	16,446	0.378
	--	4.50	--	--	--	6,106	0.140	17,943	0.412
	--	4.75	--	--	--	6,335	0.145	19,498	0.448
	--	5.00	--	--	--	6,564	0.151	21,111	0.485
	--	5.25	--	--	--	6,794	0.156	22,781	0.523
	--	5.50	--	--	--	7,023	0.161	24,508	0.563
	--	5.75	--	--	--	7,252	0.166	26,292	0.604
Zone 3	--	6.00	--	--	--	7,482	0.172	28,134	0.646
	--	6.25	--	--	--	7,711	0.177	30,033	0.689
	--	6.50	--	--	--	7,940	0.182	31,989	0.734
	--	6.75	--	--	--	8,170	0.188	34,003	0.781
	--	7.00	--	--	--	8,400	0.193	36,074	0.828
	--	7.25	--	--	--	8,640	0.198	38,204	0.877
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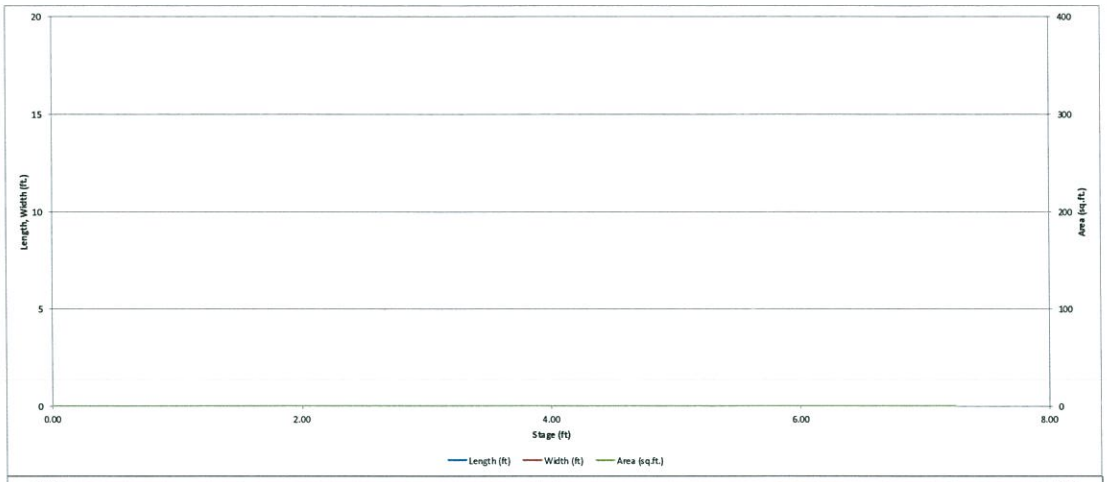
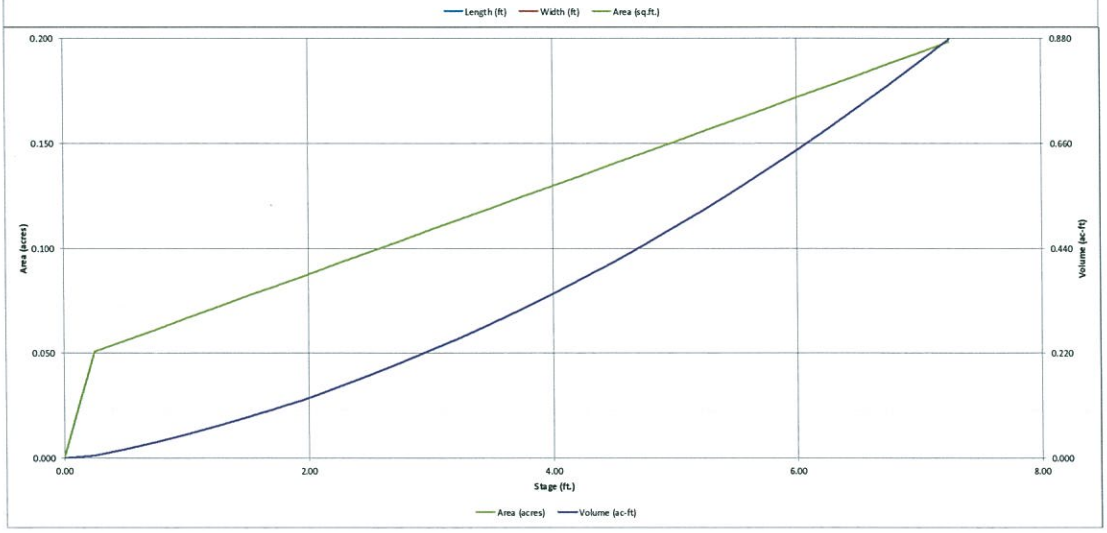
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



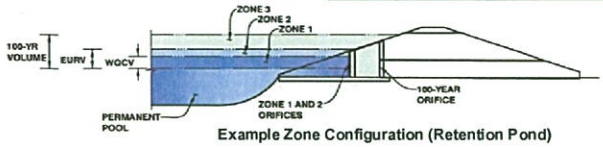


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Appaloosa Hwy 24 Sub Fil 1A

Basin ID: A



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.87	0.116	Orifice Plate
Zone 2 (EURV)	4.30	0.267	Orifice Plate
I (100+1/2WQCV)	6.02	0.265	Weir&Pipe (Restrict)
		0.648	Total

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.30	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	16.80	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.43	2.87					
Orifice Area (sq. inches)	1.07	1.07	1.50					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.30	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	1.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	4.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.30	N/A	feet
Over Flow Weir Slope Length =	4.12	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.65	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	2.89	N/A	ft^2
Overflow Grate Open Area w/ Debris =	1.44	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	4.70		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.43	N/A	ft^2
Outlet Orifice Centroid =	0.23	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.92	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.02	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	15.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

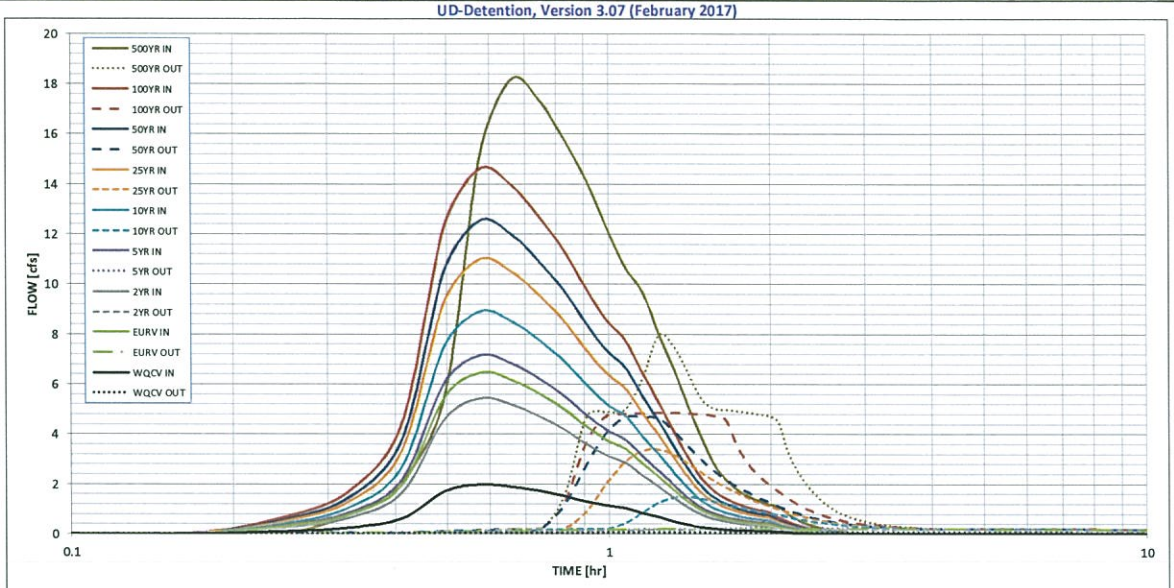
Spillway Design Flow Depth=	0.44	feet
Stage at Top of Freeboard =	7.46	feet
Basin Area at Top of Freeboard =	0.20	acres

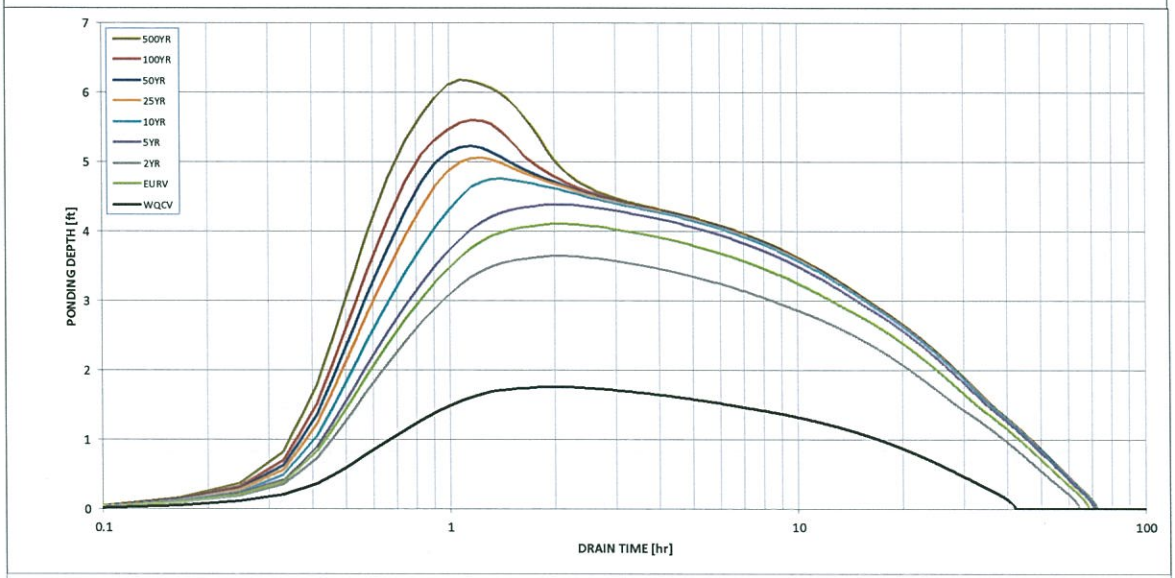
Routed Hydrograph Results

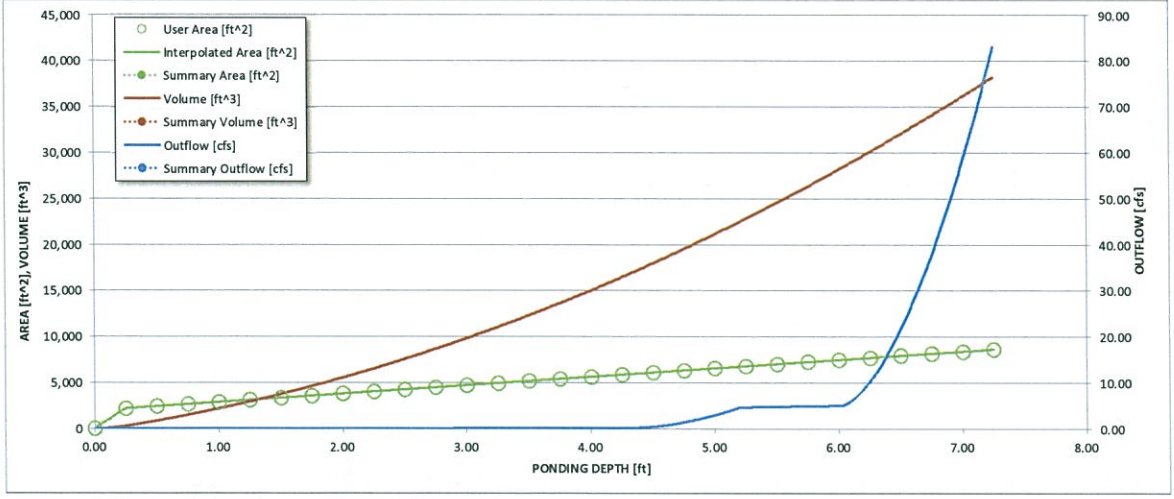
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.01
Calculated Runoff Volume (acre-ft) =	0.116	0.383	0.322	0.425	0.532	0.657	0.751	0.875	1.093
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.116	0.383	0.321	0.424	0.531	0.656	0.750	0.875	1.092
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.20	0.67	0.93	1.25	1.77
Predevelopment Peak Q (cfs) =	0.0	0.0	0.1	0.1	0.9	3.1	4.3	5.7	8.1
Peak Inflow Q (cfs) =	2.0	6.4	5.4	7.1	8.9	11.0	12.5	14.6	18.2
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.3	1.5	3.4	4.7	4.8	8.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.6	1.6	1.1	1.1	0.8	1.0
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.4	1.1	1.5	1.6	1.7
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	60	57	61	60	59	57	56	53
Time to Drain 99% of Inflow Volume (hours) =	41	65	61	67	67	66	65	65	64
Maximum Ponding Depth (ft) =	1.76	4.10	3.64	4.39	4.76	5.05	5.22	5.59	6.18
Area at Maximum Ponding Depth (acres) =	0.08	0.13	0.12	0.14	0.15	0.15	0.16	0.16	0.18
Maximum Volume Stored (acre-ft) =	0.106	0.358	0.299	0.395	0.448	0.492	0.518	0.577	0.675

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]
4.96 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:04:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:09:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:14:53	0.09	0.29	0.24	0.32	0.40	0.49	0.55	0.64	0.79
1.008	0:19:50	0.24	0.77	0.65	0.86	1.06	1.31	1.49	1.73	2.15
	0:24:48	0.62	1.99	1.68	2.20	2.74	3.36	3.83	4.46	5.53
	0:29:46	1.70	5.47	4.61	6.05	7.52	9.24	10.54	12.24	15.19
	0:34:43	1.98	6.45	5.42	7.14	8.90	10.97	12.53	14.59	18.17
	0:39:41	1.88	6.15	5.17	6.80	8.49	10.47	11.97	13.94	17.36
	0:44:38	1.71	5.59	4.70	6.19	7.73	9.53	10.89	12.69	15.81
	0:49:36	1.51	4.98	4.18	5.52	6.90	8.52	9.74	11.35	14.16
	0:54:34	1.29	4.29	3.59	4.75	5.95	7.35	8.41	9.82	12.26
	0:59:31	1.13	3.74	3.14	4.15	5.18	6.41	7.33	8.55	10.67
	1:04:29	1.02	3.39	2.84	3.75	4.70	5.80	6.64	7.75	9.67
	1:09:26	0.83	2.78	2.33	3.08	3.87	4.79	5.49	6.41	8.02
	1:14:24	0.66	2.26	1.89	2.51	3.15	3.91	4.49	5.25	6.58
	1:19:22	0.49	1.73	1.44	1.92	2.42	3.01	3.46	4.06	5.11
	1:24:19	0.36	1.27	1.06	1.42	1.80	2.25	2.59	3.04	3.84
	1:29:17	0.26	0.93	0.77	1.03	1.30	1.63	1.87	2.19	2.79
	1:34:14	0.21	0.72	0.60	0.80	1.01	1.26	1.45	1.69	2.14
	1:39:12	0.17	0.59	0.50	0.66	0.83	1.04	1.19	1.39	1.76
	1:44:10	0.15	0.51	0.42	0.56	0.71	0.88	1.01	1.18	1.49
	1:49:07	0.13	0.44	0.37	0.49	0.62	0.77	0.89	1.04	1.30
	1:54:05	0.12	0.40	0.34	0.45	0.56	0.70	0.80	0.93	1.17
	1:59:02	0.11	0.37	0.31	0.41	0.52	0.64	0.74	0.86	1.08
	2:04:00	0.08	0.27	0.23	0.30	0.38	0.47	0.54	0.63	0.79
	2:08:58	0.06	0.20	0.17	0.22	0.28	0.35	0.40	0.46	0.58
	2:13:55	0.04	0.15	0.12	0.16	0.20	0.25	0.29	0.34	0.43
	2:18:53	0.03	0.11	0.09	0.12	0.15	0.19	0.21	0.25	0.32
	2:23:50	0.02	0.08	0.06	0.08	0.11	0.13	0.15	0.18	0.23
	2:28:48	0.02	0.05	0.04	0.06	0.08	0.09	0.11	0.13	0.16
	2:33:46	0.01	0.04	0.03	0.04	0.05	0.07	0.08	0.09	0.12
	2:38:43	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.08
	2:43:41	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05
	2:48:38	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
	2:53:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
	2:58:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:03:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:08:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:13:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:18:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:23:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:28:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:33:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:38:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:43:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:48:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:53:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:58:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:03:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:08:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:12:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:17:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:22:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:27:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:32:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:37:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:42:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:47:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:52:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:57:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:02:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:07:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:12:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:17:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:22:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:27:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:32:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:37:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:42:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:47:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:52:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:57:07	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).

APPENDIX C

DESIGN CHARTS

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

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

Figure 6-25. Estimate of Average Concentrated Shallow Flow

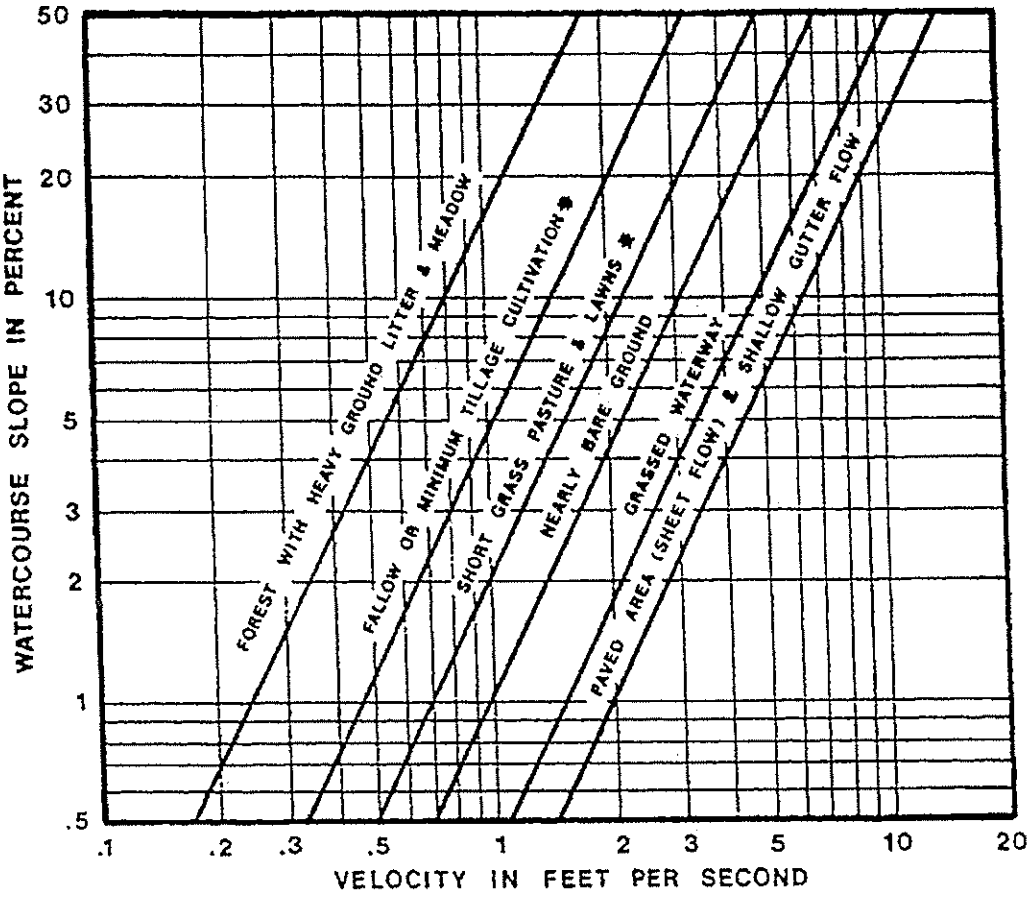
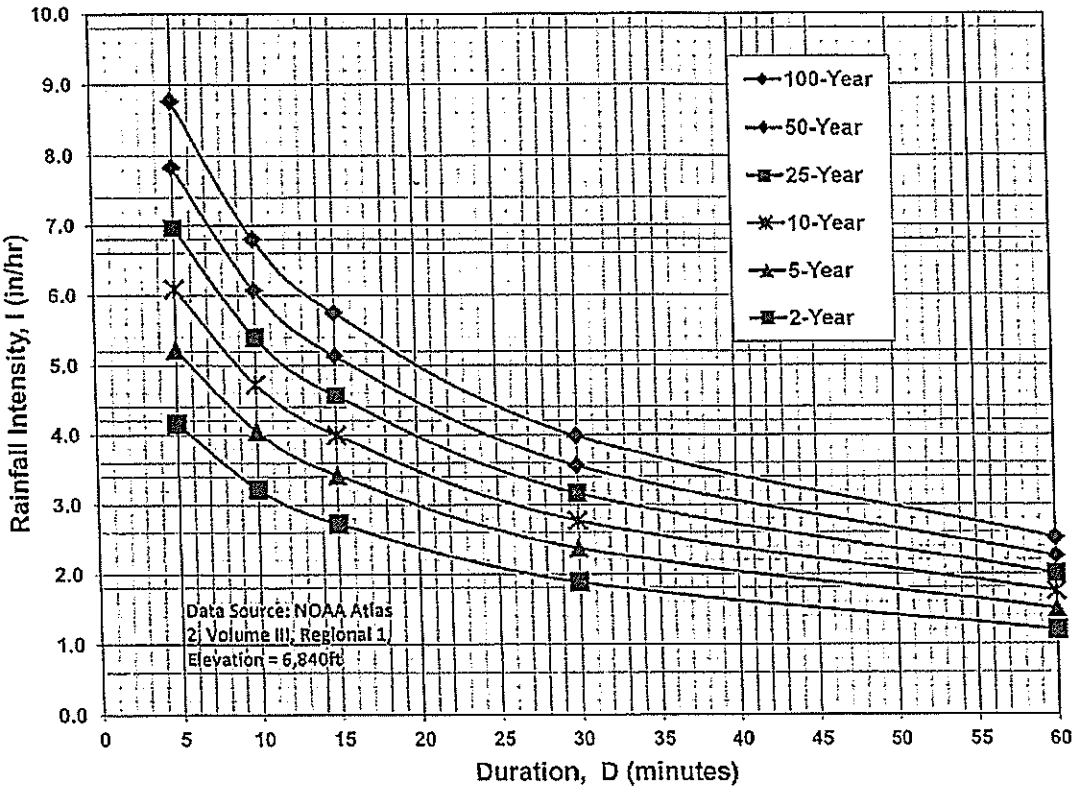


Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

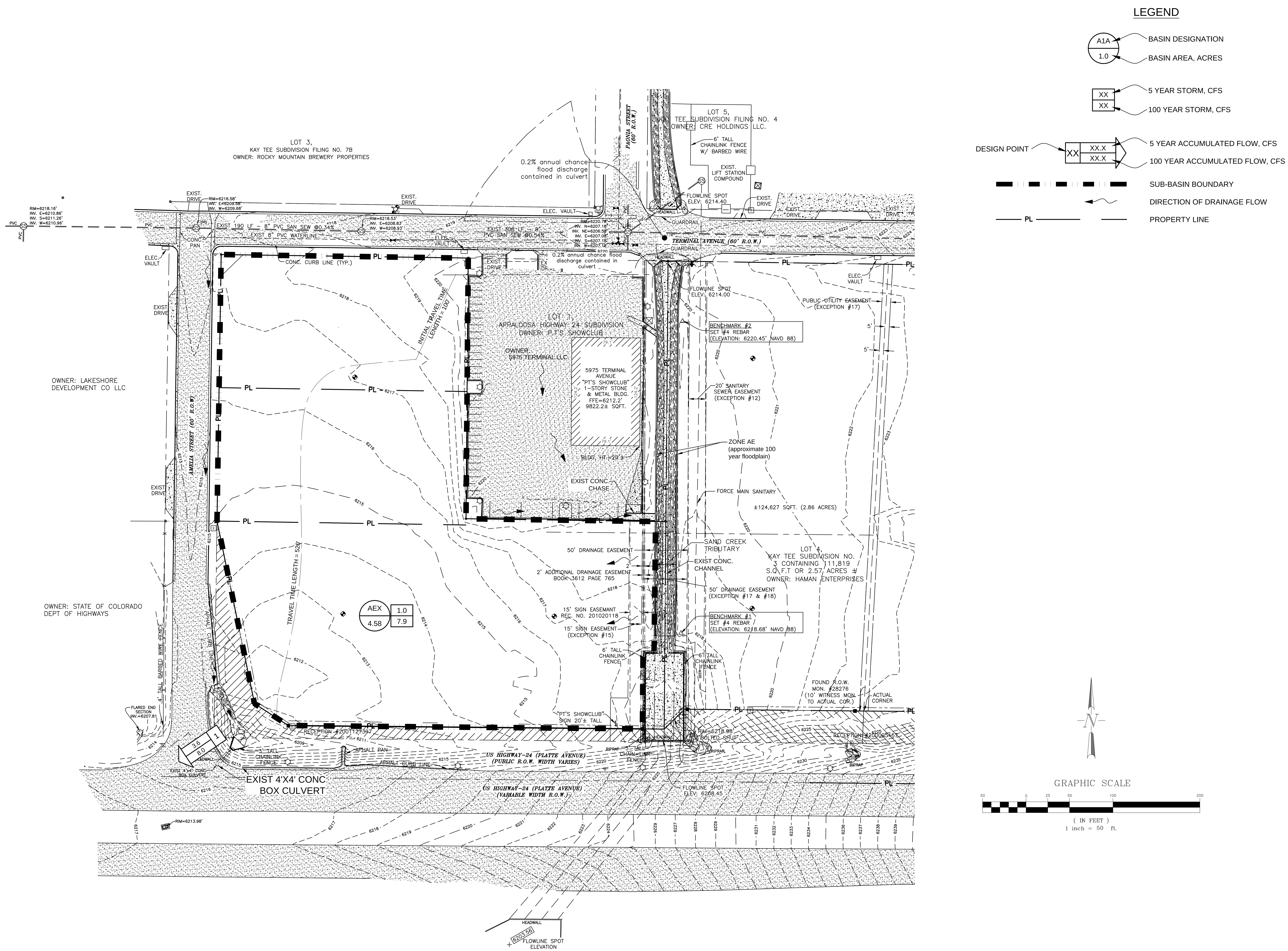
$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_5 = -1.50 \ln(D) + 7.583$

$I_2 = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.



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DESIGNED BY MAB
PROJECT ENGINEER MAB
PROJECT MANAGER MAB
SCALE: HORZ. 1" = 50' VERT. N/A
DATE: 09/19/18
JOB NO. 160504
CAD FILE NO. 160504-Const
DRAWN BY HJG

PREPARED BY:

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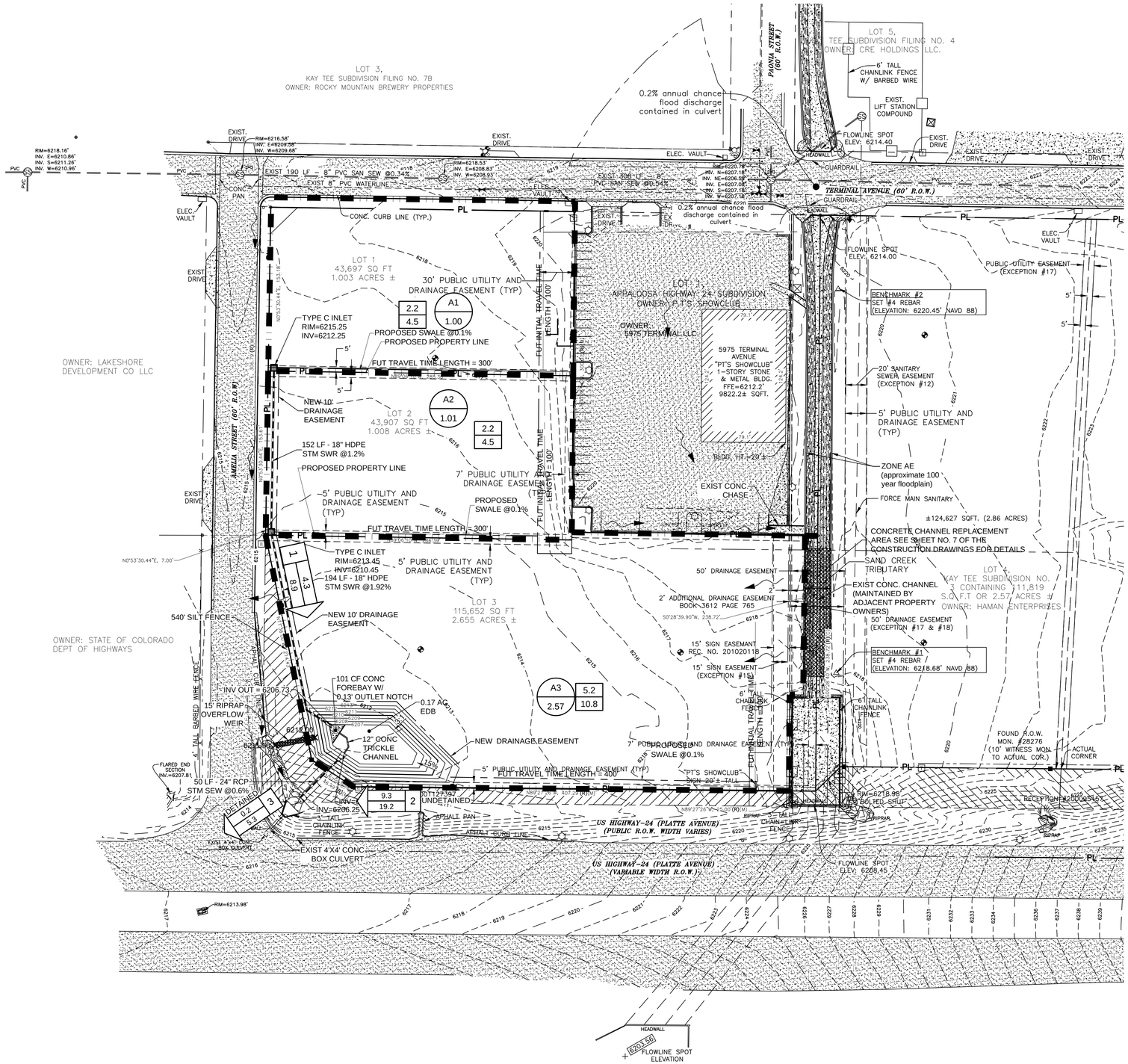
NO.	DATE	REVISION	BY

APPALOOSA HIGHWAY 24 SUBDIVISION FILING NO. 1A COLORADO SPRINGS, COLORADO

EXISTING DRAINAGE PLAN

SHEET 1 of 2



LEGEND

- A1A / 1.0 — BASIN DESIGNATION; BASIN AREA, ACRES
- XX / XX — 5 YEAR STORM, CFS; 100 YEAR STORM, CFS
- DESIGN POINT — XX — XX.X / XX.X — 5 YEAR ACCUMULATED FLOW, CFS; 100 YEAR ACCUMULATED FLOW, CFS
- SUB-BASIN BOUNDARY
- DIRECTION OF DRAINAGE FLOW
- PL — PROPERTY LINE

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

DESIGNED BY MAB | PROJECT ENGINEER MAB | PROJECT MANAGER MAB | SCALE: HORZ. 1"= 50' VERT. N/A
DATE: 09/19/18 | JOB NO. 160504 | CAD FILE NO. 160504-Const | DRAWN BY HJG

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NO.	REVISION	BY	DATE

APPALOOSA HIGHWAY 24 SUBDIVISION FILING NO. 1A COLORADO SPRINGS, COLORADO

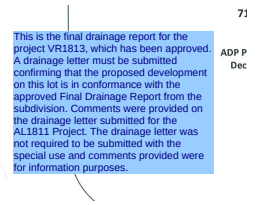
PROPOSED DRAINAGE PLAN

SHEET 2 of 2

M:\LAND PROJECTS\2016\160504-Appaloosa Sub\DWG\160504-Const.dwg Mike Tue, 12/18/18 9:30 AM

Markup Summary

This is the final drainage report for the project VR1813, which has been approved. A drainage letter must be submitted confirming t



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ADP P
Dec

Subject: Engineer
Page Label: 1
Lock: Unlocked
Author: dsdgrimm
Date: 5/1/2019 11:15:24 AM
Color:

This is the final drainage report for the project VR1813, which has been approved. A drainage letter must be submitted confirming that the proposed development on this lot is in conformance with the approved Final Drainage Report from the subdivision. Comments were provided on the drainage letter submitted for the AL1811 Project. The drainage letter was not required to be submitted with the special use and comments provided were for information purposes.