

DRAINAGE LETTER REPORT

for

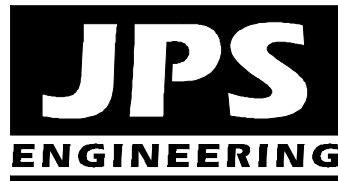
TENDER CARE VETERINARY CENTER BUILDING ADDITION LOT 3B, BENT GRASS EAST COMMERCIAL FILING NO. 2B

Prepared for:

Hammers Construction Inc.
1411 Woolsey Heights
Colorado Springs, CO 80915

August 6, 2018
Revised October 9, 2018
Revised November 20, 2018

Prepared by:



19 E. Willamette Ave.
Colorado Springs, CO 80903
(719)-477-9429
www.jpsengr.com

JPS Project No. 071403
PCD File No. PPR1839

**TENDER CARE VETERINARY CENTER – BUILDING ADDITION
LOT 3B, BENT GRASS EAST COMMERCIAL FILING NO. 2B
DRAINAGE REPORT STATEMENTS**

1. 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 for the drainage basin. I accept responsibility for liability caused by negligent acts, errors or omissions on my part in preparing this report:

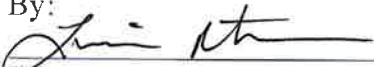


John P. Schwab Colorado P.E. No. 29891

2. Developer's Statement:

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

By:



Printed Name: Lisa Peterson
Title: Designer

12/10/18

Date

3. El Paso County Statement:

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

Approved

by Jeff Rice
El Paso County Planning and Community Development
on behalf of Elizabeth Nijkamp, Engineering Review Manager



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

01/08/2019 10:55:56 AM

Date

Conditions:

I. INTRODUCTION

A. Property Location and Description

Owners of Tender Care Veterinary Center (TCVC) are proposing to construct a building addition on the north side of the existing veterinary clinic building on Lot 3B, Bent Grass East Commercial Filing No. 2B (El Paso County Assessor's No. 53011-01-061). Following the initial phase of site development and building construction, the lot was replatted and expanded from 0.69-acres to 0.99-acres. The property is located on the west side of Meridian Park Drive, south of Bent Grass Meadows Drive. The property is zoned Planned Unit Development (PUD).

The existing veterinary clinic site is surrounded by commercial development on the north, east, and west sides, and a subdivision detention pond will adjoin the south boundary of the property. Meridian Park Drive adjoins the east boundary of Lot 3B, and Meridian Park Drive extends to a cul-de-sac located immediately southeast of Lot 3B. A subdivision detention pond is located on Tract A adjacent to the south boundary of Lot 3B. Tract B, which is planned for future commercial development, adjoins the north and west boundaries of Lot 3.

The project consists of a proposed 4,171 square foot addition on the north side of the existing 4,203 square-foot veterinary clinic building, with associated parking and site improvements. Access is currently provided by an existing driveway entrance onto Meridian Park Drive at the east boundary of Lot 3B. The proposed building addition project will include expansion of the northeast corner of the existing parking lot, including a new secondary driveway access onto Meridian Park Drive. The expanded parking areas on the northeast, south, and west sides of the building will be paved with asphalt and concrete.

B. Scope

In support of the El Paso County Site Development Plan submittal for this project, this report is intended to meet the requirements of a site-specific "Letter Type" drainage report in accordance with El Paso County drainage criteria. This report will provide a summary of site drainage issues impacting the proposed development. The report will analyze impacts from upstream drainage patterns, site-specific developed drainage patterns, and impacts on downstream facilities. This report is based on the guidelines and criteria presented in the City of Colorado Springs and El Paso County "Drainage Criteria Manual."

C. References

City of Colorado Springs & El Paso County "Drainage Criteria Manual," revised October 12, 1994, Volumes 1 and 2.

Classic Consulting Engineers & Surveyors, LLC, "Final Drainage Report for Bent Grass Commercial Filing No. 2," July, 2014.

JPS Engineering, Inc., "Drainage Letter Report for Tender Care Veterinary Clinic," September 30, 2014.

II. EXISTING / PROPOSED DRAINAGE CONDITIONS

As shown on the enclosed Drainage Plan (Figure D1), the parcel has been delineated as two on-site drainage basins flowing southerly to the detention pond on the south side of Lot 3. The subdivision detention pond outlet structure will convey detained flows easterly to the existing drainage channel along the west side of Meridian Road.

Drainage planning for this lot has been addressed in the "Final Drainage Report for Bent Grass East Commercial Filing No. 2" by Classic Consulting Engineers & Surveyors (CCES) and the "Drainage Letter Report for Tender Care Veterinary Clinic" dated September 20, 2014 by JPS Engineering.

The subject property, Lot 3B, was identified as part of Basins L and M1 in the subdivision drainage report, and drainage from this lot has been planned to sheet flow in a southerly direction into the subdivision detention pond located on Tract A. The subdivision drainage report by CCES identified developed peak flows of $Q_5 = 18$ cfs and $Q_{100} = 35$ cfs for Basin L, and describes drainage from this future commercial area as flowing to Detention Pond #2 located at the south boundary of the subdivision. The CCES report identified peak flows of $Q_5 = 6$ cfs and $Q_{100} = 11$ cfs for Basin M-1, and describes flow from this basin as draining into adjoining public road (Meridian Park Drive).

As noted in the subdivision drainage report by CCES, on-site soils are comprised of Columbine gravelly sandy loam. These soils are classified as hydrologic soils group A.

The existing site topography slopes downward to the south with a grade of approximately 1-4 percent. For consistency with the subdivision drainage report, the west side of Lot 3B has been identified as Basin L-3 and the east side of Lot 3B has been identified as Basin M1-3. The subdivision drainage report has accounted for acceptance of fully developed flow from Lot 3 in the design of the subdivision detention pond identified as "Pond 2."

Surface runoff from the developed site will continue to follow historic drainage patterns towards the south property boundary. The proposed building pad will be graded with protective slopes to provide positive drainage away from the face of the building. A high point will be graded on the north side of the building, and drainage swales will be constructed along the north face of the building to convey developed flows around the sides of the building. Curb and gutter will be installed along the outer perimeter of the new parking areas to convey surface drainage to the proposed Detention Pond 2 immediately south of this lot.

While a protective drainage swale will be constructed to divert flow from the north side of the TCVC building and drain around the building to the detention pond on the south side of the property, the enclosed Drainage Plan includes a note stating that future development of the adjacent commercial area in Tract B to the north shall route developed flows around Lot 3B into the detention pond.

Developed peak flows at Design Point #L-3 are calculated as $Q_5 = 3.2$ cfs and $Q_{100} = 6.2$ cfs, and developed peak flows at Design Point #M1-3 are calculated as $Q_5 = 0.9$ cfs and $Q_{100} = 1.8$ cfs. Stormwater quality mitigation and detention will be provided by routing developed flows through the subdivision detention pond south of the property.

The subdivision drainage report assumed full commercial development of this site, and the proposed site development plan is entirely consistent with the approved subdivision drainage plan. The subdivision drainage report by CCES utilized runoff coefficients ($C_{100} = 0.9$) consistent with full commercial development for Basins L and M1, which correlates to an impervious percentage of 95 percent according to Table 5-1 of the El Paso County Drainage Criteria Manual. The proposed Site Development Plan for the TCVC building addition project includes landscaped areas around the perimeter of the site and remains well below the maximum impervious area anticipated in the subdivision drainage report.

The subdivision drainage report identified weighted runoff coefficients of $C_5 = 0.78$ and $C_{100} = 0.83$ for Basin L, accounting for 0.7 acres of vegetated area encompassing the detention pond in Tract A on the south side of the TCVC site. Developed flows for the TCVC site have been calculated based on standard runoff coefficients for commercial development ($C_5 = 0.81$ and $C_{100} = 0.88$). Drainage planning for future development of Tract B on the north side of Lot 2B will need to confirm that the overall impervious areas and associated runoff coefficients for Basin L remain within the assumptions in the approved subdivision drainage report.

Hydrologic calculations for the parcel are detailed in the attached spreadsheet (Appendix A), and peak flows are identified on Figure D1. The contractor will need to implement standard best management practices for erosion control during construction.

III. FLOODPLAIN IMPACTS

This site is located beyond the limits of any FEMA 100-year floodplain boundaries as shown in the FEMA floodplain map for this area, FIRM Panel No. 08041C0575F, dated March 17, 1997.

IV. DRAINAGE BASIN FEES

This site is located within the Falcon Drainage Basin. No public drainage improvements are required for development of this site. Required drainage fees have been paid during the subdivision platting process, so there are no applicable drainage fees required with the Site Development Plan.

V. SUMMARY

The developed drainage patterns associated with the proposed Tender Care Veterinary Center building addition will remain consistent with historic conditions and the overall drainage plan for this commercial subdivision. Developed flows from the site will continue to follow historic drainage patterns, flowing to the subdivision detention pond adjacent to the south boundary of this site.

The existing subdivision detention pond will mitigate developed drainage impacts and meet the County's stormwater quality requirements for this site. Proper maintenance of the subdivision detention pond, in conjunction with proper erosion control practices, will ensure that this developed site has no significant adverse impact on downstream or surrounding areas.

APPENDIX A

DRAINAGE CALCULATIONS & FIGURES

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	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	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

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_r) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_r) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

$$t_c = t_i + t_t \quad (\text{Eq. 6-7})$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i , may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad (\text{Eq. 6-8})$$

Where:

t_i = overland (initial) flow time (min)

C_5 = runoff coefficient for 5-year frequency (see Table 6-6)

L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)

S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t , which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t , can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad (\text{Eq. 6-9})$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \quad (\text{Eq. 6-10})$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional “calibration” of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

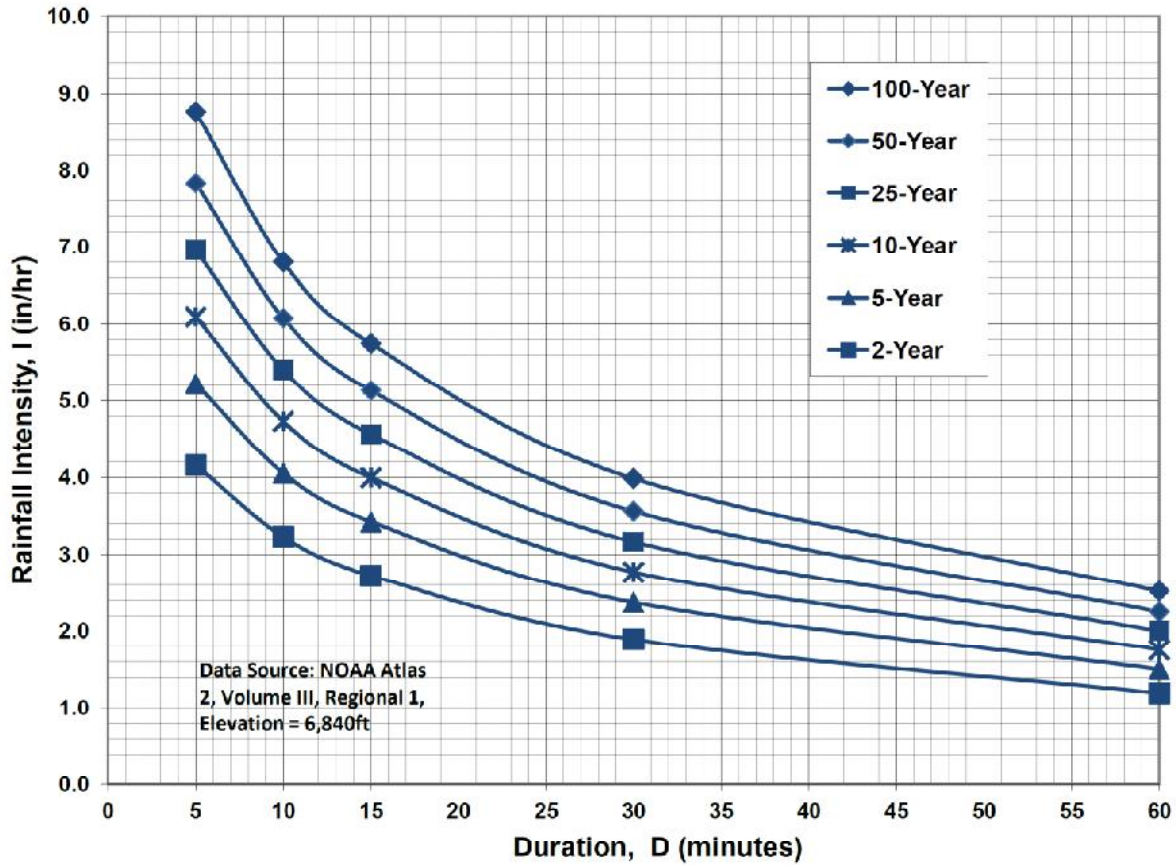
3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

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.

JOB NAME: BENT GRASS EAST COMMERCIAL FIL. 2
 JOB NUMBER: 2177.53
 DATE: 07/01/14
 CALCULATED BY: MAW

FINAL DRAINAGE REPORT ~ BASIN RUNOFF COEFFICIENT SUMMARY

BASIN	IMPERVIOUS AREA / STREETS			LANDSCAPE/UNDEVELOPED AREAS			WEIGHTED		WEIGHTED CA	
	TOTAL AREA (AC)	AREA (AC)	C(5)	AREA (AC)	C(5)	C(100)	C(5)	C(100)	CA(5)	CA(100)
OS-1	24.20	0.00	0.27	24.20	0.25	0.35	0.25	0.35	6.05	8.47
OS-2	1.60	1.50	0.90	0.10	0.25	0.35	0.86	0.91	1.38	1.46
OS-3	1.70	1.40	0.90	0.30	0.25	0.35	0.79	0.84	1.34	1.44
H3	1.54	1.54	0.55	0.00	0.25	0.35	0.55	0.65	0.85	1.00
H4	0.42	0.42	0.55	0.00	0.25	0.35	0.55	0.65	0.23	0.27
I1	3.00	3.00	0.55	0.00	0.25	0.35	0.55	0.65	1.65	1.95
I2	1.70	1.70	0.55	0.00	0.25	0.35	0.55	0.65	0.94	1.11
J	1.64	1.64	0.40	0.00	0.25	0.35	0.40	0.55	0.66	0.90
K	1.00	1.00	0.40	0.00	0.25	0.35	0.40	0.55	0.40	0.55
L	5.90	5.20	0.65	0.70	0.25	0.35	0.78	0.83	4.60	4.93
M1	1.56	1.56	0.85	0.00	0.25	0.35	0.85	0.90	1.33	1.40
M2	0.44	0.44	0.85	0.00	0.25	0.35	0.85	0.90	0.37	0.40
N	1.32	1.32	0.85	0.00	0.25	0.35	0.85	0.90	1.12	1.19
O	0.58	0.00	0.85	0.58	0.25	0.35	0.25	0.35	0.15	0.20



TENDER CARE VETERINARY CENTER - BUILDING ADDITION
RATIONAL METHOD

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	C		Overland Flow			Channel flow				TOTAL		TOTAL		INTENSITY ⁽⁷⁾		PEAK FLOW	
			5-YEAR ⁽²⁾	100-YEAR ⁽²⁾	LENGTH (FT)	SLOPE (FT/FT)	T _{co} ⁽³⁾ (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE VELOCITY (FT/S)	T _t ⁽⁵⁾ (MIN)	T _c ⁽⁶⁾ (MIN)	T _c ⁽⁶⁾ (MIN)	5-YR (IN/HR)	100-YR (IN/HR)	Q5 ⁽¹⁾ (CFS)	Q100 ⁽¹⁾ (CFS)		
L-3	L-3	0.77	0.810	0.880	10	0.01	1.7	290	20.00	0.01	2.00	2.4	4.1	5.0	5.10	9.09	3.18	6.16	
M1-3	M1-3	0.22	0.810	0.880	10	0.01	1.7	180	20.00	0.01	2.00	1.5	3.2	5.0	5.10	9.09	0.91	1.76	

1) RATIONAL METHOD: Q (FLOW, CFS) = C (RUNOFF COEFFICIENT) * I (INTENSITY, IN/HR) * A (TRIBUTARY AREA, AC)

2) WEIGHTED AVERAGE C VALUES FOR COMBINED BASINS

3) OVERLAND FLOW T_{co} = (0.395⁽¹⁾ / (1 - RUNOFF COEFFICIENT)) * (OVERLAND FLOW LENGTH^(0.5) / (SLOPE^(0.333)))

4) SCS VELOCITY = C * (SLOPE/FT)^(0.5)

C = 2.5 FOR HEAVY MEADOW

C = 5 FOR TILLAGE/FIELD

C = 7 FOR SHORT PASTURE AND LAWNS

C = 10 FOR NEARLY BARE GROUND

C = 15 FOR GRASSED WATERWAY

C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES

5) CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)

6) T_c = T_{co} + T_t

*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED

7) INTENSITY BASED ON I-D-F CURVE IN EL PASO COUNTY DRAINAGE CRITERIA MANUAL, REVISED BY CITY OF COLORADO SPRINGS 1/1/03

$$I = (A * P) / (B + T_d)^C$$

5-YEAR VALUES: A = 26.65; P1 = 1.5 IN (1-HOUR DEPTH); B = 10.0; C = 0.76

100-YEAR VALUES: A = 26.65; P = 2.67 IN (1-HOUR DEPTH); B = 10.0; C = 0.76

