DRAINAGE LETTER

ROLLING THUNDER BUSINESS PARK FILLING NO. 2

A REPLAT OF LOTS 2 AND 3, ROLLING THUNDER BUSINESS PARK

January 22, 2020

prepared for

2C Construction and Consulting, Inc.

Oliver E. Watts, Consulting Engineer, Inc.
Colorado Springs, Colorado

OLIVER E. WATTS, PE-LS
OLIVER E. WATTS, CONSULTING ENGINEER, INC.
CIVIL ENGINEERING AND SURVEYING
614 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907
(719) 593-0173
fax (719) 265-9660
olliewatts@aol.com
Celebrating over 40 years in business

January 22, 2020

El Paso County Planning and Community Development
2880 International Circle
Colorado Springs, CO 80910

ATTN: *Jennifer Irvine, P.E.*

SUBJECT: Drainage Letter
Rolling Thunder Business Park, Filing No. 2

Gentlemen

Transmitted herewith for your review and approval is the drainage letter for the Rolling Thunder Business Park, Filing No. 2, which is a replat of Lots 2 and 3, Rolling Thunder Business Park.

There will be no change in the approved runoff as a result of this subdivision. Please contact our office if we may provide any further information.

Oliver E. Watts, Consulting Engineer, Inc.

BY: ______________________________
Oliver E. Watts, President

Encl:

- Drainage Letter 2 pages
- Computations, 1 sheet
- FEMA Flood Panel 08041C0752 G, December 7, 2018
- Soils Map and Interpretation Sheet
- Backup Information, 4 pages
- Drainage Plan, Dwg No. 19-5348-07

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 applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Oliver E. Watts, Consulting Engineer, Inc.

____

Oliver E. Watts Colo. PE-LS No. 9853

2. OWNERS / DEVELOPER'S STATEMENT:

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

2C Construction and Consulting, Inc.

By: ______________________________________
3430 Sloan Peak Heights
Colorado Springs, CO 80922
499-2377

3. EL PASO COUNTY:

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

____ _______________

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

Conditions:

4. LOCATION AND DESCRIPTION:
The Rolling Thunder Business Park, Filing No. 2 is located on the South side of Woodmen Road just West of Falcon Meadows Boulevard, as shown on the enclosed drainage plan. It is a replat of Lot 2 and 3, Rolling Thunder Business Park and lies in the NE1/4 of Section 11, Township 13 South, Range 65 West of the 6th P.M. in El Paso County, Colorado. The total size of the subdivision is 1.02 acres. The purpose of the subdivision is to combine the two existing lots and construct a commercial building as shown on the enclosed drainage plan.

5. FLOOD PLAIN STATEMENT:
This subdivision is not within the limits of a designated flood plain or flood hazard area, as identified on FEMA panel no. 08041C0752 G, dated December 7, 2018, a copy of which is enclosed for reference.

6. CRITERIA:
Runoff is computed as prescribed by the City/County Drainage Criteria Manual, using the rational method for areas the size of this subdivision. Computations are enclosed for reference and review.

The area has bee mapped by the USDA/SCS, and soils type in this are is the Blakeland Series, having hydrologic group “A”. A soils map and interpretation sheet are enclosed for reference.

7. DESCRIPTION OF RUNOFF:
As stated above, this Site was previously platted as the Rolling Thunder Business Park. At that time a drainage report was submitted and approved by El Paso County, Colorado. This lot has been zoned for industrial or commercial uses since that time, and runoff was computed on that basis. The subdivision lays South of Woodmen on the North side of Maltese Drive. Runoff is divided by a high point in the existing curb and gutter where shown on the drainage plan.

Basins O-1 and O-2 are the inflows to the subdivision from adjacent Woodmen Road, south of the centerline of the pavement. 0.5 cfs / 0.9 cfs (5-year / 100-year runoffs) will flow into the subdivision in each basin. This will combine with the runoff from each half of the development and exit to the West and East long the north curb line of Maltese Drive. The combined runoff exiting the subdivision is 1.6/3.3 cfs westerly and 1.9/4.0 cfs easterly, well within the capacity of the roadway. The runoff is unchanged from that developed by the existing zoning at the time of the original subdivision, and no harm will be incurred to downstream facilities.

7. FEES:
This Site has been previously platted; therefore fees are not due at this time.

MAJOR BASIN	SUB BASIN	AREA		BASIN		Tc MIN	I		SOIL GRP	DEV. TYPE	C		FLOW		RETURN PERIOD -years-	
		PLANIM READ	ACRES	LENGTH -FT.-	HEIGHT -FT.-		in./hr.						qp -CFS-	qp -CFS-		
FALCON	O-1	COGO	0.098	38	1	0.8			A	A/C	0.90	0.96			5	100
		30%	0.030	+10	3	+0.1				R/L	0.09	0.36				
			0.128			0.87	5.1	9.0		MIX	0.710	0.819	0.5	0.9		
	A		0.112	25	5	3.0				L/S						
	V=2.72	1.86%	0.338	+215	4	+2.7				IMP						
			0.450			5.7	5.0	8.5		75%	0.554	0.672	1.2	2.6		
	O-1 + A		0.578			6.6	4.8	8.1		MIX	0.588	0.705	1.6	3.3		
	O-2		0.098	38	1	0.8			A	A/C	0.90	0.96				
			0.030							R/L	0.096	0.36				
			0.128			0.9	5.1	9.0		MIX	0.710	0.819	0.5	0.9		
	B		0.151	25	5	3.0				L/S						
	V=2.64	1.74%	0.414	+235	4	+1.5				IMP						
			0.565			4.5				73%	0.528	0.651	1.5	3.3		
	O-2 + B		0.693			5.4	5.0	8.5		MIX	0.561	0.682	1.9	4.0		

HYDROLOGICAL COMPUTATION – BASIC DATA
PROJ: ROLLING THUNDER BUS PK F#2 BY: O.E. WATTS
RATIONAL METHOD DATE: 1/22/20

OLIVER E. WATTS, CONSULTING ENGINEER, INC.
614 ELKTON DRIVE COLORADO SPRINGS, CO 80907

National Flood Hazard Layer FIRMette

FEMA

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
- 513 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 represen 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 1/22/2020 at 12:00:29 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.

OLIVER E. WATTS
CONSULTING ENGINEER, INC.
COLORADO SPRINGS

ROLLING THUDER BUSINESS PARK
FILING NO. 2
SOILS MAP
1"=2000'

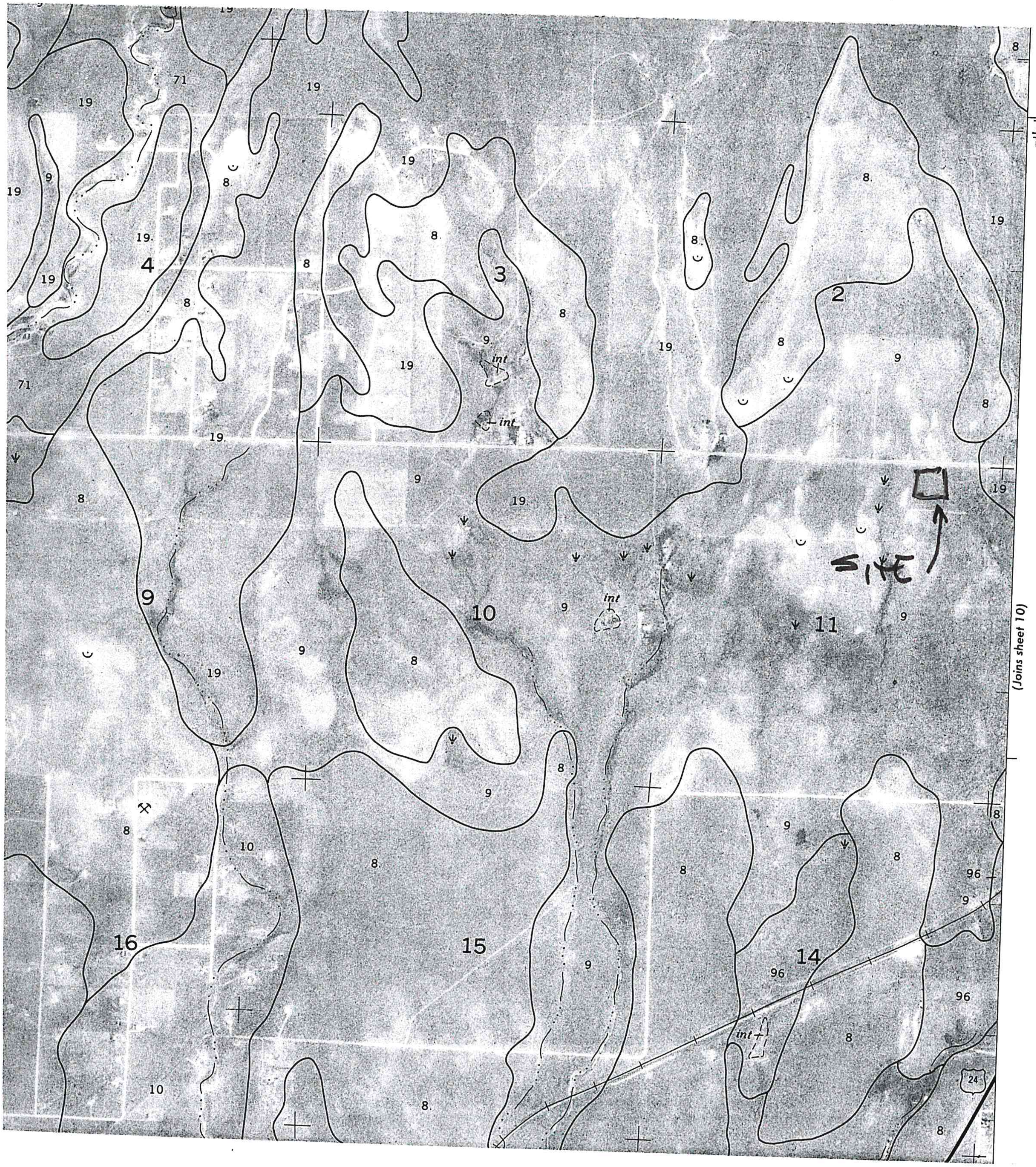


TABLE 16.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See "flooding" in Glossary for definition of terms as "rare," "brief," and "very brief." The symbol > means greater than]

Soil name and map symbol	Hydro-logic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Alamosa: 1	C	Frequent	Brief	May-Jun	>60	---	High.
Ascalon: 2, 3	B	None	---	---	>60	---	Moderate.
Badland: 4	D	---	---	---	---	---	---
Bijou: 5, 6, 7	B	None	---	---	>60	---	Low.
Blakeland: 8	A	None	---	---	>60	---	Low.
[1]9: Blakeland part	A	None	---	---	>60	---	Low.
Fluvaquentic Haplaquolls part	D	Common	Very brief	Mar-Aug	>60	---	High.
Blendon: 10	B	None	---	---	>60	---	Moderate.
Bresser: 11, 12, 13	B	None	---	---	>60	---	Low.
Brussett: 14, 15	B	None	---	---	>60	---	Moderate.
Chaseville: 16, 17	A	None	---	---	>60	---	Low.
[1]18: Chaseville part	A	None	---	---	>60	---	Low.
Midway part	D	None	---	---	10-20	Rippable	Moderate.
Columbine: 19	A	None to rare	---	---	>60	---	Low.
Connerton: [1]20: Connerton part	B	None	---	---	>60	---	High.
Rock outcrop part	D	---	---	---	---	---	---
Cruckton: 21	B	None	---	---	>60	---	Moderate.
Cushman: 22, 23	C	None	---	---	20-40	Rippable	Moderate.
[1]24: Cushman part	C	None	---	---	20-40	Rippable	Moderate.
Kutch part	C	None	---	---	20-40	Rippable	Moderate.
Elbeth: 25, 26	B	None	---	---	>60	---	Moderate.
[1]27: Elbeth part	B	None	---	---	>60	---	Moderate.

See footnote at end of table.

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_t) 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_t) 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.

$$t_c = t_i + t_t$$ (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.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}}$$ (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).

$$V = C_v S_w^{0.5}$$ (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.

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

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.

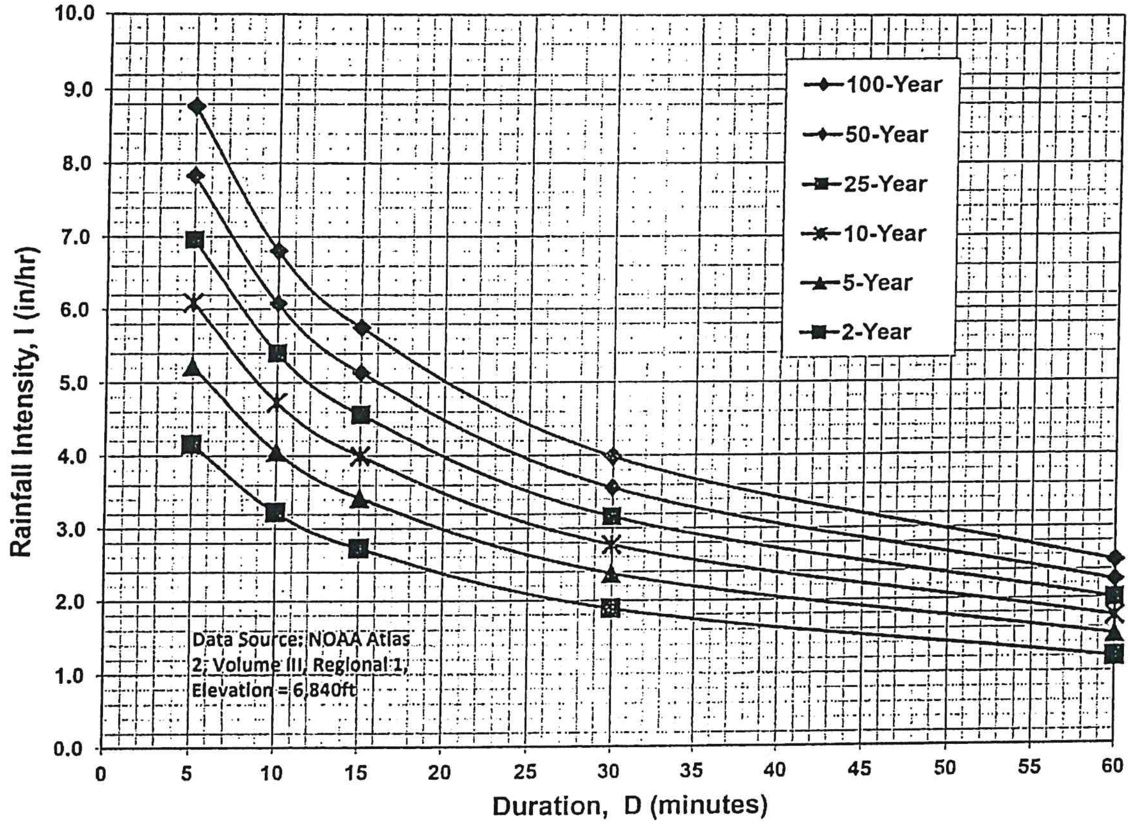
3.2.4 Minimum Time of Concentration

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.

DRAWN BY: O.E. WATTS DATE: 1-21-20 DWG. NO.: 19-5348-07 SURVEYED BY: OEW, ESW, 6-26-19	APPROVED BY: PROJ. NO. DWG.	REVISIONS	OLIVER E. WATTS CONSULTING ENGINEER COLORADO SPRINGS	PROJECT 10634 & 10658 MALTESE POINT LOTS 2 & 3, ROLLING THUNDER BUSINESS PARK EL PASO COUNTY	SHT. NAME DRAINAGE PLAN	SHT. NO. 1 OF 1