DRAINAGE LETTER

7280 N. NEVADA LANE

AN UNPLATTED PARCEL IN THE NW1/4 NE1/4, SECTION 8, T. 13 S., R. 65 W. 6^{TH} P.M. EL PASO COUNTY, COLORADO

PCD File:

November 3, 2003

prepared for

GREENER PASTURES LLC Jeff Weisburg 4450 Mark Dabling Blvd Colorado Springs, CO 80907

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

OLIVER E. WATTS, PE-LS

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Celebrating over 44 years in business

November 3, 2023

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

ATTN: Joshua Palmer, P.E.

SUBJECT: Drainage Letter, 7280 N. Nevada Lane

Transmitted herewith for your review and approval is the drainage letter for 7280 N. Nevada Lane, to accompany the zone change submittal on subject property.

There will be no construction involved and no change in the runoff as a result of this zone change request, so this letter reflects current conditions. Please contact our office if we may provide any further information.

Oliver E. Watts, Consulting Engineer, Inc.

liver E. Watts, President
liver E. Watts, President

Encl:

Drainage Letter 2 pages
Computations 2 pages
Soils Map and Interpretation Sheet
Backup Information, 4 pages
FEMA Flood Panel 08041C0529 G, December 7, 2018
Sand Creek Drainage Basin (1977) Sheet 44
Offsite Drainage Map
Drainage Plan Dwg 23-5924-04

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, Con	nsulting Engineer, Inc.				
Oliver E. Watts	Colo. PE-LS No. 9853	 			
2. OWNERS / DEV	/ELOPER'S STATEME	NT:			
I the owner / developedrainage report and	per have read and will com plan.	nply with all	of the requirer	ments specified	in this
Greener Pastures, Ll	LC				
By:					
Colorado Springs, C (719) 291-0291					
3. EL PASO COUN	NTY:				
	with the requirements of the umes 1 and 2, and the Eng				nage
Joshua Palmer, P.E. County Engineer / E			Date	e	
Conditions:					

4. LOCATION AND DESCRIPTION:

7280 N. Nevada Lane is located south of Woodmen Road, East of Black Forest Road and West of Sand Creek, as shown on the enclosed vicinity map. It occupies 4.984 acres in the Sand Creek Drainage basin in part of the Northwest quarter of the Northeast Quarter of Section 8, Township 13 South, Range 65 West of the 6th P.M. in El Paso County. The Assessor's Parcel No. is 5308000074. It is an unplatted parcel for which a zone change is being processed, which is the reason for this drainage letter.

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. 08041C0533 G, dated December 7, 2018, a copy of which is enclosed for reference.

6. CRITERIA AND METHOD:

All computations are based on the rational method described in Volume 1 of the City – County drainage criteria. Computations are enclosed, along with pertinent criteria backup information. All soils in the area are of the Blakeland Complex, hydrologic group "A", and a soils map and interpretation sheet are enclosed.

6. DESCRIPTION OF RUNOFF:

As shown on the enclosed offsite drainage map, 1.89 acres of the adjacent northerly lot will drain into subject property. No other inflows exist. The routing across the property is delineated on the enclosed drainage plan. Basin D in the southeast corner is isolated from the remainder of the parcel by a dike and area grading and the 0.63 office parcel drains 0.1 cfs / 0.3 cfs (5-year / 100- year runoffs) in concentrated form into California Drive. The remainder of the property is graded around a number of shop buildings to drain into California Drive over the westerly 360 feet of the South boundary with no specific outfall structure, total ling 3.8 cfs/12.2 cfs. The streets in this area are unpaved or lightly graveled and further routing may be seen in a southerly direction, primarily on Wyoming Lane, some 3800 feet to the Sand Creek channel. No specific routing has been addressed in the Sand Creek study. Sheet 44 of the study in enclosed for reference.

7. FEES:

This site is unplatted and no construction is proposed in subject zone change request. Drainage fees are not applicable until the site is subdivided.

MAJOR	SUB		EA	BAS	SIN	Tc		Ī.	SOIL	DEV.		7	FL	OW	RE	ΓURN
BASIN	BASIN	1"=30"				MIN	in.	hr.	GRP	TYPE			5-ry	100-yr	PE	RIOD
		PLANIM READ	ACRES	LENGTH -FT	HEIGHT -FT								qp -CFS-	qp -CFS-	- y	ears-
SAND CREEK	O-1	5.93	0.49	100	7.5	7.8			A	BARE	0.30	0.50	C=7		5	100
		1.25	0.10	+254	14.5	+1.8				R/L	0.08	0.35	C=10	V=2.4		
		TOTAL	0.59			9.6	4.2	7.0		MIX	0.265	0.475	0.65	2.0	5	100
	O-2	4.62	0.38	100	8	8.7				BARE	0.30	0.50	C=7			
		11.15	0.962	+314	22	+2.0				R/L	0.08	0.35	C=10	V=2.6		
		TOTAL	1.30			10.7	4.3	6.8		MIX	0.144	039	0.80	3.5	5	100
	A	COGO	0.018	100	6.5	8.7			A	ROOF	0.73	0.81				
			0.010	+180	11	+2.4				CONC	0.89	0.96	C=5	V=1.24		
			0.700							R/L	0.08	0.35				
			0.680							BARE	0.30	0.50				
		TOTAL	1.41			11.1	4.0	6.7		MIX	0.200	0.422				
	O-1 +A			+280	17.5	+2.7							C=7	V=1.7		
`	DP1	TOTAL	2.00			12.3	3.0	6.4		MIX	0.218	0.438	1.3	5.6	5	100
	В	COGO	0.227	100	2.5	9.7			A	ROOF	0.73	0.81				
			0.028	+290	6.5	+4.6				CONC.	0.90	0.96	C=7	V=1.05		
			1.285			14.3	3.6	6.0		BARE	0.30	0.50				
		TOTAL	1.54							MIX	0.374	0.554	2.1	5.1	5	100
	DP2		2.84	+390	9	+8.6							C=7	V=0.76		
	B+O2					19.2	3.2	5.3	A	MOX	0.318	0.588	2.8	8.5	5	100
HYDR	ROLOGICA	AL COMP	UTATION	– BASIC D	ATA										PAGE 1	
PROJ: 7280 N. NI	EVADA LA	ANE B	Y: O.E. W.	ATTS			OL.	IVER	R E. WA	TTS, CON	SULTI	NG EN	GINEEL	R. INC	(OF
RATIONAL MET	HOD	DA	ATE: 11-3-2	3				- 1		TON DRIVE CO				, 1110.		2

MAJOR	SUB	AR	REA	BAS	SIN	Tc		I	SOIL	DEV.	(FL	OW	RE	ΓURN
BASIN	BASIN					MIN	in.	/hr.	GRP	TYPE			5-ry	100-yr	PEI	RIOD
		PLANIM READ	ACRES	LENGTH -FT	HEIGHT -FT								qp -CFS-	qp -CFS-	-ye	ears-
SAND CREEK	С	COGO	0.068	100	2	12.7			A	BARE	0.30	0.50			5	100
			0.035	+100	2	+1.9				CONC	0.90	0.96	C=5	V=0.87		
			0.043							ROOF	0.73	0.81				
			1.264							R/L	0.08	0.35				
		TOTAL	1.41			14.6	3.4	6.0		MIX	0.130	0.386	0.6	3.5	5	100
01+O2+A-C	DP3			+200	5	+4.2							C=5	V=0.79		
		TOTAL	4.95			18.5	3.2	5.4			0.242	0.459	3.8	12.2	5	100
	D	COGO	0.033	100	3	13.1			A	ROOF	0.73	0.81				
			0.017	+155	4	+3.2				CONC	0.90	0.96	C=5	V=0.80		
			0.096							A.C.	0.90	0.96				
			0.058							L/S	0.08	0.35				
			0.426							BARE	0.30	0.50				
		TOTAL	0.63			16.3	3.4	5.7		MIX	0.052	0.074	0.1	0.3	5	100
																<u> </u>
			UTATION		ATA							<u> </u>				GE 2
PROJ: 7280 N N RATIONAL MET	EVADA LI HOD		O.E. WATT ATE: 11-3-2				OL	IVER		TTS, CON				R, INC.	,	OF 2

EL PASO COUNTY AREA, COLORADO

TABLE 16. -- SOIL AND WATER FEATURES

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

THE TOTAL STATE OF THE STATE OF	NOT TO \$1.50		Flooding		Bed	rock	
Soil name and map symbol	Hydro- logic group	Frequency	Duration	Months	Depth	Hardness	Potential Frost action
Alamosa:	С	Frequent	Brief	May-Jun	<u>In</u> >60		High.
Ascalon: 2, 3	В	None			>60		Moderate:
Badland:	D						
Bijou: 5, 6, 7	В	None		700	>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	1-4-1	High.
Blendon: 10	В	None	1		>60		Moderate.
Bresser: 11, 12, 13	В	None	224	222	>60		Low.
Brussett: 14, 15	В	None		425	>60	544	Moderate.
Chaseville: 16, 17	A	None		114	>60	4	Low.
¹ 18: Chaseville part	A	 None			>60		Low.
Midway part	D	None	122		10-20	Rippable	Moderate.
Columbine:	A	None to rare		3.3	>60		Low.
Connerton: 120: Connerton part-	В	None		7770	>60		High.
Rock outcrop	D						
Cruckton: 21	В	None		444	>60		Moderate.
Cushman: 22, 23	С	None		-	20-40	Rippable	Moderate.
124: Cushman part	С	None			20-40	Rippable	Moderate.
Kutch part	c	None		144	20-40	Rippable	Moderate.
Elbeth: 25, 26	В	None		446	>60	777	Moderate.
127: Elbeth part	В	None	255	177	>60		Moderate.

See footnote at end of table.

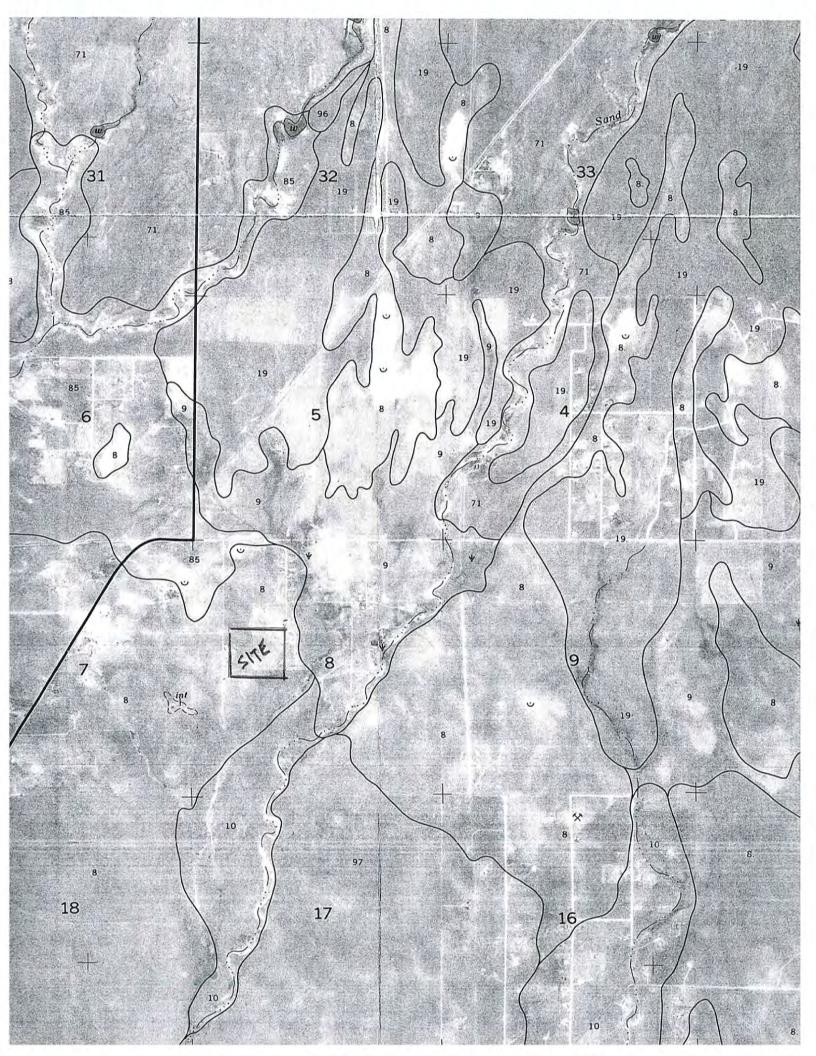


Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

Land Use or Surface	Percent						Runoff Co	efficients	1				
Characteristics	Impervious	2-y	ear	5-9	ear	10-	year	25-	year	50-1	ear	100-	year
		HSG A&B	HSG C&D	HSG A&B	HSG CAD	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											1.0%		
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	0.45	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
Rallroad 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	80,0	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_i) 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_i) 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.

$$t_c = t_i + t_t \tag{Eq. 6-7}$$

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.

$$t_{t} = \frac{0.395(1.1 - C_{5})\sqrt{L}}{S^{0.33}}$$
 (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 <u>maximum</u> for non-urban land uses, 100 ft <u>maximum</u> 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_i , which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_i , can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_{y}S_{yy}^{0.5}$$
 (Eq. 6-9)

 $\mathcal{A}_{A}^{\prime}=0$

Where:

V = velocity (ft/s)

 $C_v = \text{conveyance coefficient (from Table 6-7)}$

 S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C,

Type of Land Surface	C,
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, 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_i) 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.

$$t_c = \frac{L}{180} + 10 \tag{Eq. 6-10}$$

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

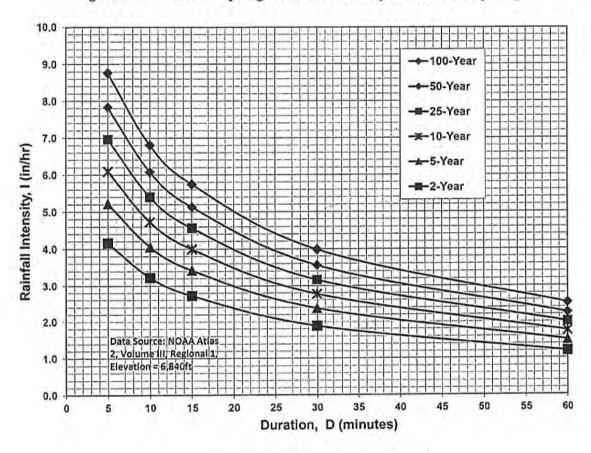


Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency

IDF Equations

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

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

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

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

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

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

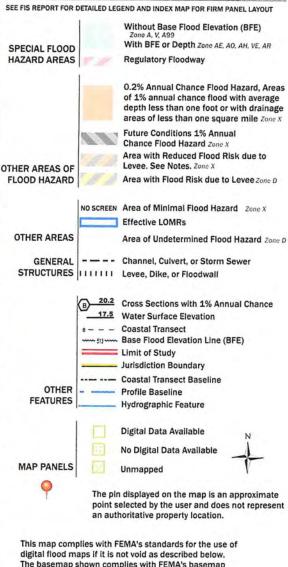
Note: Values calculated by equations may not precisely duplicate values read from figure,

National Flood Hazard Layer FIRMette



Basemap: USGS National Map: Ortholmagery: Data refreshed October, 2020

Legend



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 3/30/2023 at 4:55 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.

