DRAINAGE PLAN AND REPORT

ROCKY TOP MOTEL AND CAMPGROUND

EL PASO COUNTY

June 14, 2019

Updated
August 16, 2021

Prepared for

G & D Enterprises

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

OLIVER E. WATTS, PE-LS
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Celebrating over 40 years in business

August 16, 2021

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

ATTN: *Jennifer Irvine, P.E.*

SUBJECT: Drainage Plan and Report
Rocky Top Motel and Campground

Transmitted herewith for your review and approval is the drainage plan and report for The Rocky Top Motel and Campground in El Paso County. This report is prepared and a result of Craig Dossey's letter of May 2, 2019 regarding an alleged violation of County grading regulations. This report will accompany the submittal of other land use applications. Please contact me if I may provide any further information.

Oliver E. Watts, Consulting Engineer, Inc.

BY: ______________________________
Oliver E. Watts, President

Encl:

Drainage Report 4 pages
Computations, 2 pages
FEMA Panel No. 08041C0952 G
SCS Soils Map
Backup Information, 4 sheets
Drainage Plan, Dwg 19-5341-02

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.

G & D Enterprises, Corp.

By: __________________________________
Daniel P. Nieman, owner
10090 West Highway 24
Green Mountain Falls, CO 80819
684-9044

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 Rocky Top Motel and Campground is located at the above address, located on Highway 24, adjacent to Green Mountain Falls as shown in detail on the enclosed drainage plan. This facility has been in use at this location since 1947 as a motel and since 1950 as a camp ground. A use application for RV storage has been recently submitted to the County for this additional use. A detailed site survey is submitted as part of the enclosed drainage plan to delineate current conditions.

In reply to neighborhood complaints the County issued a notice of violation dated May 2, 2019 itemizing items that needed to be completed to reply to violations of grading in excess of one acre and the un-permitted use as RV storage.

5. FLOOD PLAIN STATEMENT:

This subdivision is not within the limits of a flood plain or flood hazard area, according to FEMA map panel number 08041C0952 G, dated December 7, 2018, a copy of which is enclosed for reference.

6. METHOD AND CRITERIA:

The method used for all computations is that specified in the City-County Drainage Criteria Manual, using the rational method for areas of the size of the development. All computations are enclosed for reference and review.

The soils in the subdivision have been mapped by the local USDA/SCS office, and a soils map and is enclosed for reference, indication that all soils in this area are of hydrologic group "A". The soils in this area are largely usable as gravel surfacing and are excellent as a construction material. Infiltration is a maximum and runoff is held to a minimum.

7. DESCRIPTION OF RUNOFF:

A. Drainage Inflows:

As shown on the enclosed drainage plan one small area (Basin O-1) will drain into the property near the northwest corner, creating 0.15 cfs / 1.1 cfs (5-year / 100-year runoffs) from a small vacant grassed site. Other inflows of a probable illegal nature have recently been addressed along the Westerly boundary in reply to diversions of runoff into the property created by improper road maintenance and construction by the adjacent property owners. A continuous concrete wall was placed to maintain the historic drainage pattern and prevent ensuing damage to the property. This runoff is now contained within Lucky 4 Road to discharge at the historic location onto Highway 24.

B. On Site Runoff:

On site runoff has existed in the current state for many years. Improvements are almost exclusively related to regrading the area for use as campground and tented areas and increases in runoff are almost negligible unless structures are involved.

The above mentioned inflow will combine with runoff from Basin A for a total of 4.0 cfs/ 10.6 cfs at a point along the entrance road. This basin is a mixture of graveled campground sites graded into the natural terrain and areas of native vegetation covering steeper boundary areas. This will combine with runoff from Basin B, consisting of the motel site, paved roads and parking, and a 0.44 acre graveled RV parking site. The total runoff at the outfall point into Highway 24 is 5.6 cfs / 17.2 cfs. This runoff is well within the capacity of existing downstream drainage facilities.

Basin C is the Southwesterly third of the site, containing graveled campground sites, tent sites, a gravel road and a 0.38 acre RV storage site. The total runoff at the historic outfall point into Highway 24 is 3.2 cfs / 9.1 cfs. A few culverts exist within the site and below the outfall point, all of which have the computed capacity to safely accommodate this total runoff

8. WATER QUALITY REQUIREMENTS:

The proposed development work comprises a small (less that one acre) portion of the total campground, which has existed in its current state for many years. The proposed construction is held to that minimum and should not require water quality provisions.

The proposed grading is represented on the enclosed drainage plan and the grading plan that accompanies the total submittal. The work is minimal and necessary erosion BMP's are proposed.

9. COST ESTIMATE:

All facilities are private. No additional facilities are required or proposed.

MAJOR BASIN	SUB BASIN	AREA		BASIN		Tc MIN	I		SOIL GRP	DEV. TYPE	C		FLOW		RETURN PERIOD	
		PLANIM READ	ACRES	LENGTH	HEIGHT								qp	qp		
FOUNTAIN CR	O-1	COGO	0.66	100	4	20			A	MDW	0.08	0.35			5	100
				+200	6	+1										
						21	2.9	4.8					0.15	1.1	5	100
	+A	COGO	3.12	+420	34	+1.2			A	MDW	0.08	0.35	15%			
				V=5.7						GRAVEL	0.50	0.70	85%			
										MIX	0.437	0.648				
	TOTAL	COGO	3.78			22.2	2.8	4.7	A	MIX	0.375	0.596	4.0	10.6	5	100
	+B	COGO	3.13	+360	34	+1.0			A	ROOF	0.73	0.81	2%			
				V=6.1						GRAVEL	0.50	0.70	20%			
										MDW	0.08	0.35	70%			
										MIX	0.215	0.478				
	TOTAL	COGO	6.91			23.2	2.7	4.6	A	MIX	0.302	0.542	5.6	17.2	5	100
	C	COGO	2.97	100	2	14.7			A	GRAVEL	0.50	0.70	60%			
			V=5.4	+640	46	+2.0				MDW	0.08	0.35	40%			
						16.7	3.3	5.5	A	MIX	0.332	0.560	3.2	9.1	5	100

HYDROLOGICAL COMPUTATION – BASIC DATA

PROJ: ROCKY TOP MOTEL & CAMPGROUND BY: O.E. WATTS

RATIONAL METHOD DATE: 6-14-19, 8-16-21

OLIVER E. WATTS, CONSULTING ENGINEER, INC.

614 ELKTON DRIVE COLORADO SPRINGS, CO 80907

STREET AND STORM SEWER CALCULATIONS

STREET	LOCATION	DISTANCE	ELEVATION & SLOPE	TOTAL RUNOFF	STREET FLOW / CAPACITY	PIPE FLOW	TYPE PIPE, CATCH BASIN & SLOPE %
PRIVATE	B OUTFALL			5.6/172		17.2	24"CMP hi=0.62' S=0.60% MIN
	C OUTFALL			3.7/9.1		9.1	24"CMP hi=0.24' S=0.20% MIN.

National Flood Hazard Layer FIRMette

FEMA

38°56'20.49"N

105°05.81"W

38°55'52.50"N

Feet 0 250 500 1,000 1,500 2,000

1:6,000

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, Area of 1% annual chance flood with average depth less than one foot or with drainag areas of less than one square mile *Zone)*
- 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*

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
- 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

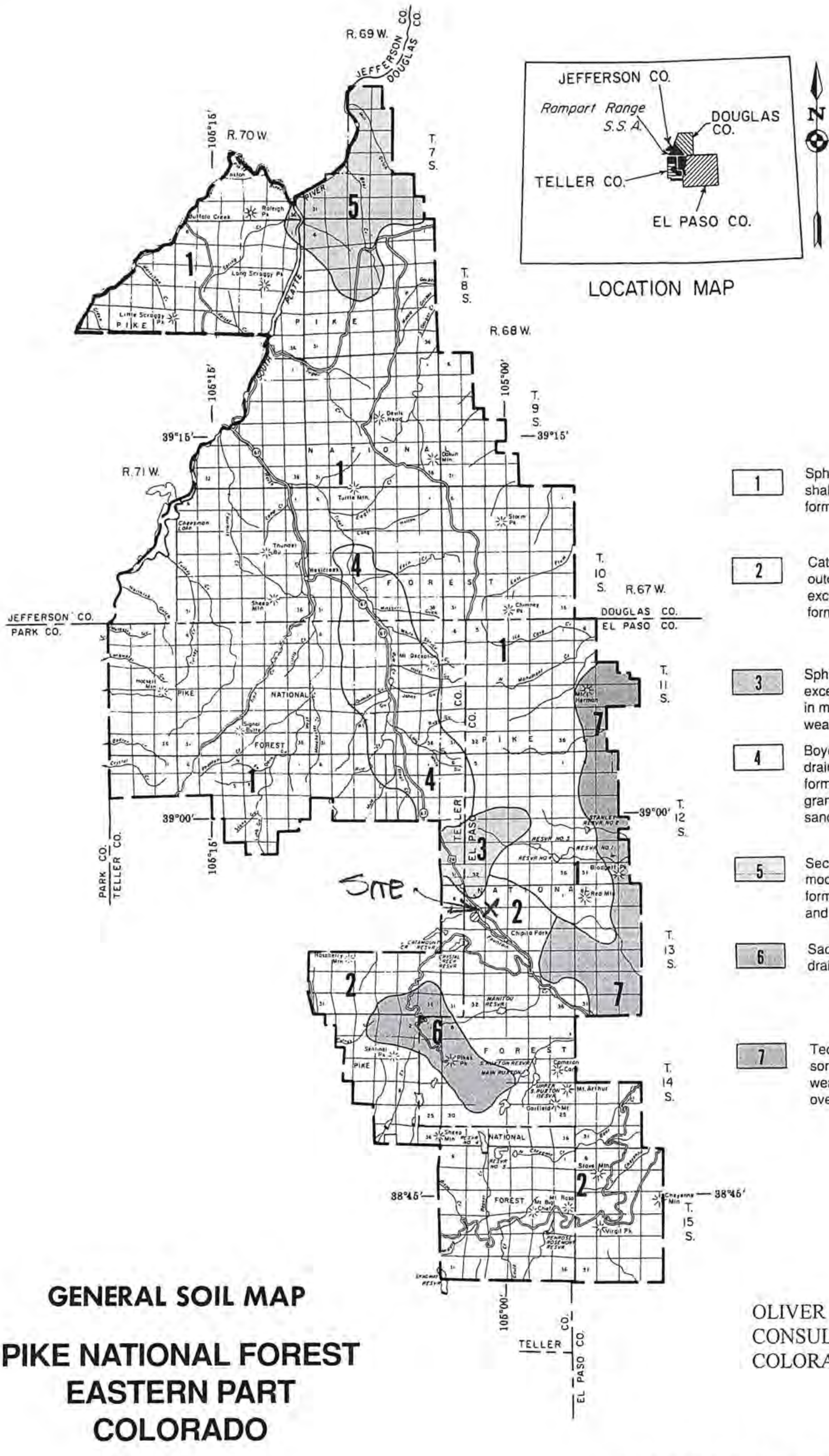
N

The pin displayed on the map is an approximate point selected by the user and does not represe 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 6/14/2019 at 10:34:12 AM 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.



LOCATION MAP

SOIL LEGEND

1	Sphinx-Legault-Rock outcrop: Rock outcrop and shallow, somewhat excessively drained soils that formed in material weathered from granite
2	Catamount-Ivywild-Legault-Rock outcrop: Rock outcrop and shallow and moderately deep, somewhat excessively drained, and excessively drained soils that formed in material weathered from granite
3	Sphinx-Tecolote-Condie: Shallow and deep, somewhat excessively drained and well drained soils that formed in material weathered from granite or in colluvium over weathered granite
4	Boyett-Frenchcreek-Pendant: Deep and shallow, well drained and somewhat excessively drained soils that formed in material weathered from limestone and granite, and in alluvium derived from mixed red arkosic sandstone
5	Security-Cathedral-Rock outcrop: Rock outcrop and moderately deep and shallow, well drained soils that formed in material weathered from mixed schist, gneiss, and granite
6	Sachett-Cirque land: Cirque land and shallow, excessively drained soils that formed in material weathered from granite
7	Tecolote-Pendant: Deep and shallow, well drained and somewhat excessively drained soils that formed in material weathered from limestone and in cobbly or stony colluvium over weathered granite

Compiled 1986

GENERAL SOIL MAP

PIKE NATIONAL FOREST EASTERN PART COLORADO

JULY 1992

5 0 5 10 MILES

Scale 1:362,057

1 inch equals approximately 5.7 miles

PARTS OF DOUGLAS, EL PASO, JEFFERSON, AND TELLER COUNTIES, COLORADO

OLIVER E. WATTS
CONSULTING ENGINEER, INC.
COLORADO SPRINGS

ROCKY TOP MOTEL AND CAMPGROUND
SCS SOILS MAP

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SOIL CONSERVATION SERVICE
COLORADO AGRICULTURAL EXPERIMENT STATION

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

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.

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

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).

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

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-6. 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.

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.

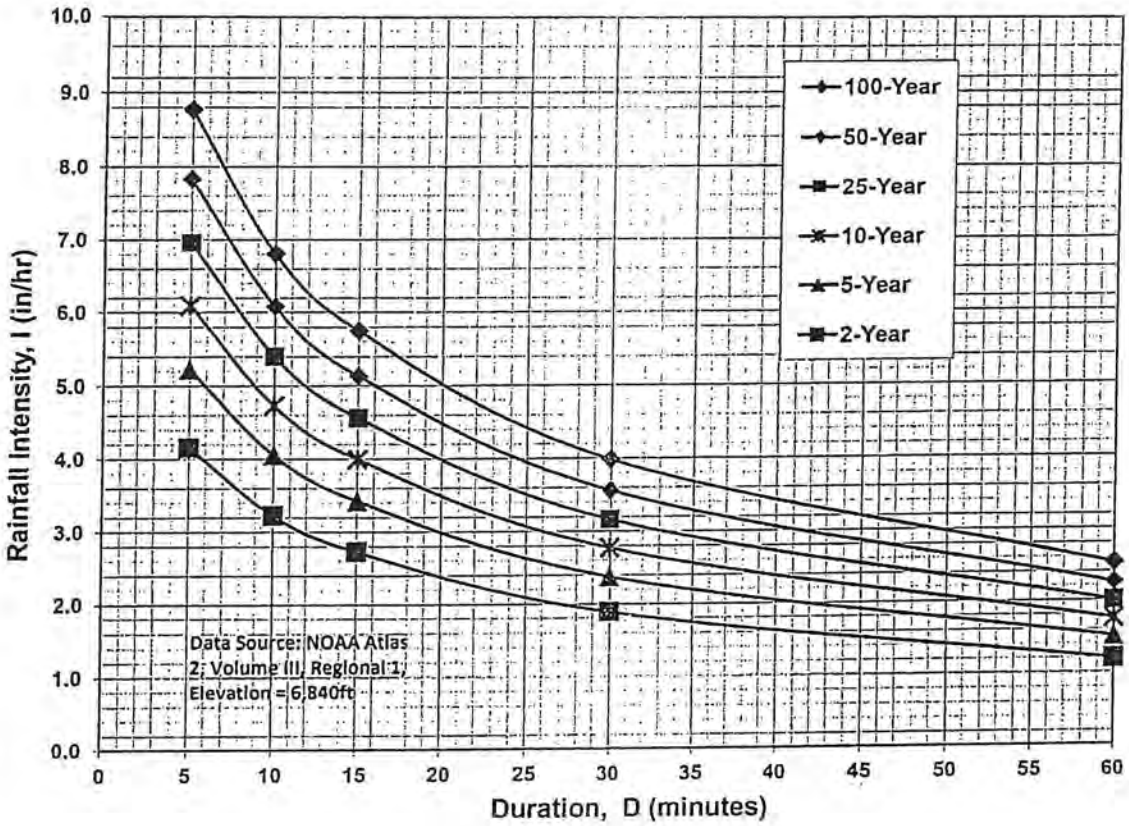
3.2.4 Minimum Time of Concentration

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

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

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

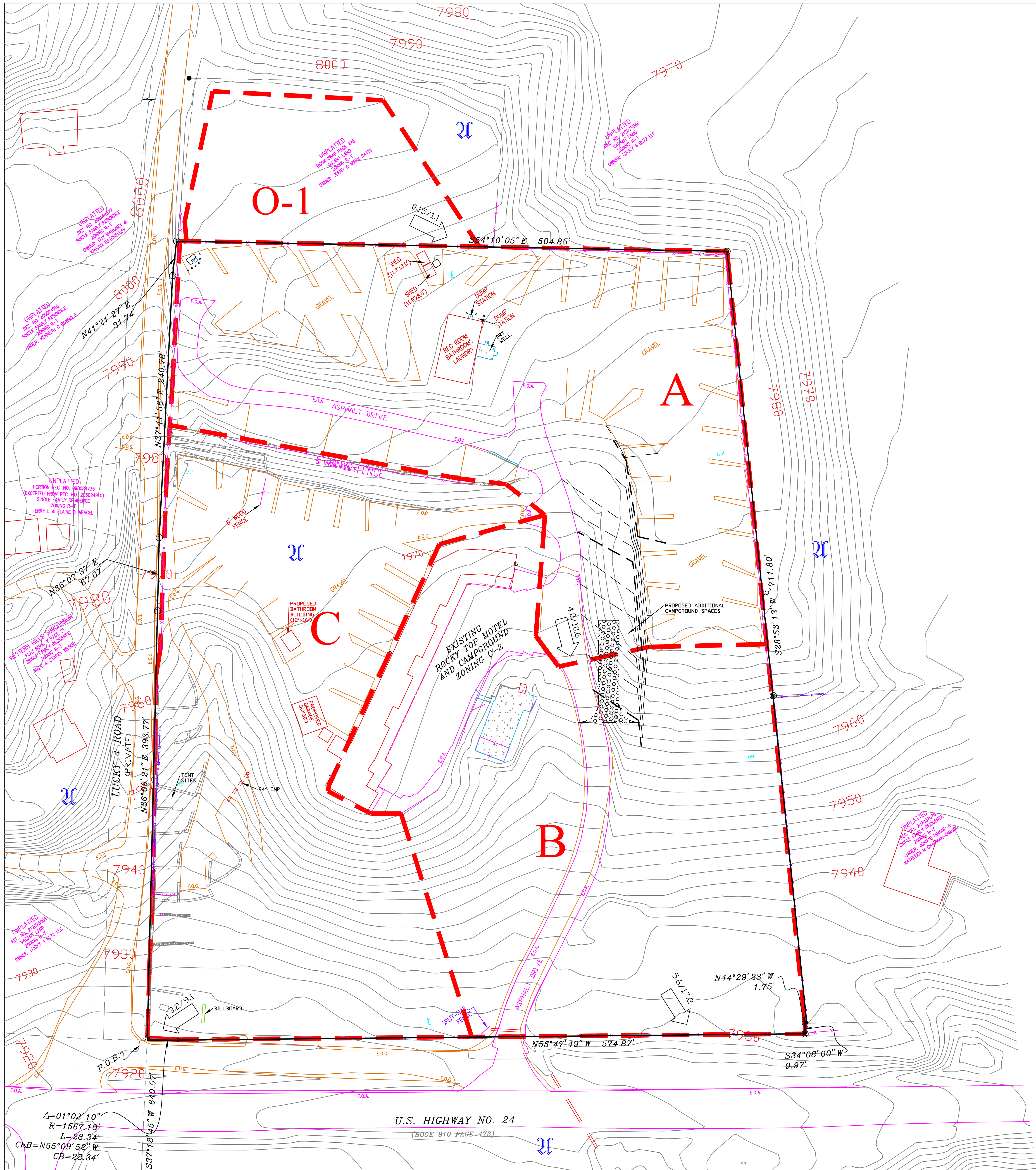
$I_{25} = -2.00 \ln(D) + 10.111$

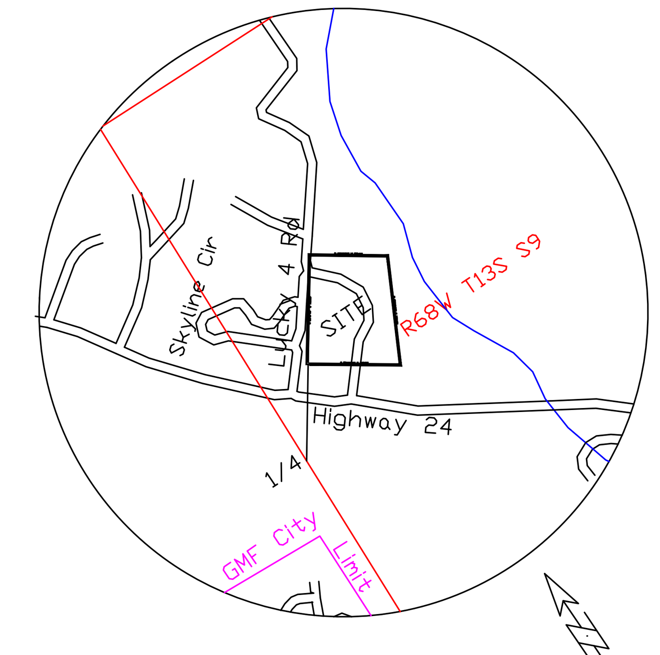
$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

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





VICINITY MAP

1"=1000'

Scale 1" = 50'

50 0 50 100 150

Contour Interval: 2'

NGVD, 1929 ADJUSTMENT

CONTOUR LEGEND:

ORIGINAL CONTOURS:
1'
5'
FINISH CONTOURS:
1'
5'

LEGEND:

10.5/20.4	RUNOFF IN CFS 5-YEAR/100-YEAR
A	LIMIT OF DRAINAGE BASIN AND DESIGNATION
	EXISTING STORM SEWER AS LABELED
B	LIMIT OF SOILS TYPE AND GROUP

Prepared by the office of:
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Celebrating 42 years in Business

DRAWN BY: O.E. WATTS DATE: DWG. NO.: 19-5341-02 TOPOGRAPHY BY: CITY FIMS 6-12-19 SURVEY INFORMATION BY: RAMPART JOB NO. 18384	APPROVED BY: PROJ. NO. DWG.	REVISIONS 8-16-21 UPDATED OEW	OLIVER E. WATTS CONSULTING ENGINEER COLORADO SPRINGS	PROJECT ROCKY TOP MOTEL & CAMPGROUND PART NW1/4 SECTION 9, T.13S., R.68W., 6TH P.M. EL PASO COUNTY	SHT. NAME DRAINAGE PLAN	SHT. NO. 1 OF 1