

FINAL
DRAINAGE PLAN AND REPORT

FUEL MISSIONS


A PROPOSED CHURCH AT 10695 LINDBERGH ROAD

AS UNPLATTED LOT

EL PASO COUNTY

December 15, 2020

Please
add PCD
File No.
PPR-2048



Prepared for
FUEL MISSIONS

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

OLIVER E. WATTS, PE-LS
OLIVER E. WATTS, CONSULTING ENGINEER, INC.
CIVIL ENGINEERING AND SURVEYING
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Celebrating over 41 years in business

December 15, 2020

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

ATTN: *Jennifer Irvine, P.E.*

SUBJECT: Final Drainage Plan and Report
Church at 10695 Lindbergh Road

Transmitted herewith for your review and approval is the drainage plan and report for the proposed Church at 10695 Lindbergh Road in El Paso County. This report will accompany the development plan submittal.

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, 1 pages
FEMA Panel No. 08041C0259 G
SCS Soils Map and Interpretation Sheet
Backup Information, 4 sheets
Drainage Plan, Dwg 20-5449-06

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 date

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.

Fuel Missions, by Dan Crosby

By: _____
P.O. Box 939
Monument, CO 80132-0939

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:

Please be sure to also address comments provided
by the stormwater engineer.

Please identify the drainage basin. Per the County GIS the drainage basin is Monument Rock (FOMO5000).

4. LOCATION AND DESCRIPTION:

The proposed church for Fuel Missions is located at 10965 Lindbergh Road, being the N1/2, N1/2 East of the Road in Section 21, Township 11 South, Range 67 west of the 6th P.M., in El Paso County. The site is 7.333 acres. The details of the proposal are shown on the enclosed drainage plan. The parking area, driveway and sidewalks will be asphalt, and the remaining area outside the building will be landscaped. The property is in an unstudied drainage basin.

Please also identify that an approximately 6000 sf building will also be proposed.

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 08041C0259 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 interpretation sheet are enclosed for reference. being in hydrologic group "B".

Please provide an existing drainage conditions plan. Also, please elaborate in your description of the existing runoff and discuss any offsite drainage. Per the drainage map it appears that only a small portion affects the development. This should be discussed in the narrative per DCMV1 ch4.

7. DESCRIPTION OF RUNOFF EXISTING DRAINAGE CONDITIONS

The site is adjacent to and south of the Forest boundary at the bottom of a will timbered side hill. The natural basin consists of basins A and B on the enclosed site that discharges 0.4 cfs (5-year runoff) / 3.2 cfs (100-year runoff) historically

It appears per the drainage plan that some of the developed flows will be conveyed to the proposed culvert. Please discuss this in your narrative. Please elaborate in your description of the developed flows.

PROPOSED DRAINAGE CONDITIONS

The area will be graded to conform to the existing topography. All runoff into a lot area at the southeast portion necessary within the construction site.

As stated it appears that the flow is leaving the site at a point source at the southeast corner of the paved parking lot where historically it appears that it sheet flowed to the southerly property. Show how this concentrated flow is mitigated to minimize the impact to the adjacent property to the south

All runoff will be routed to and contained within the site. Basin A is an area partially within the forest boundary distributed across the north line of the construction site. No concentrated point flows exist. This will combine with the 2.0 cfs /4.4 cfs from the site to total 1.0/5.2 cfs at the outfall point. This is a relatively minor increase that is easily accommodated by existing conditions downstream.

A private culvert of minimum size and slope is provided at the driveway at Lindbergh Road. No defined borrow ditch or terrain conditions exist to require separate computations.

Please identify the size and type of culvert in your narrative of the report.


FOUR STEP PROCESS

The following process has been followed to minimize adverse impacts of urbanization

Runoff Reduction: The scope of the development has been minimized consistent with zoning

See comments from the stormwater engineer regarding the 4 step process. and any other comments provided.

requirements to present the minimum footprint in providing a church in near natural setting. The undisturbed portions are to be landscaped to reduce the impervious percentage.

Treat and Slowly Release: The total construction site is less than one acre in size.  During construction, the developer will be required to address stormwater quality per ECM appendix I.

Channel Stabilizing: The site will be graded to route the runoff over improved driveway installations to provide stabilizing in the natural erosive material over the site. Discharge from the site will be into and across a private driveway to the historic discharge point. Runoff is relatively minor and there will be no adverse affect on downstream developments as a result of this development

Source Controls: This is a church site, so source control problems will be a minimum. During construction, standard site specific state of the art BMP's will be employed to minimize and mitigate erosive problems.

8. COST ESTIMATE:

No drainage structures are required, other that the normal private driveway culvert into the site.

9. FEES:

No subdivision is required, therefore fees are not due.

10. SUMMARY

The proposed church site at this address provides a minimum encroachment in an attractive natural setting in order to aid in a meaningful worship experience.

The drainage analysis has been prepared in accordance with the current City of Colorado Springs Drainage Criteria Manuel. Supporting information and calculations are included in this report.

This report and findings is in general conformance with the MDDP or Preliminary Drainage Report or other pertinent studies

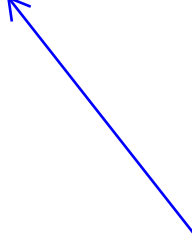
Please reiterate in your summary that there will be no adverse affects on downstream or surrounding developments.

Please revise to El Paso County

Which other reports? Please be sure to state/list any existing MDDP, drainage reports or other studies that are relevant to this development.

References

1. City of Colorado Springs Drainage Criteria Manual, Volumes 1 and 2, May, 2014



Please reference the County criteria manual and any updates/adoptions to the criteria manual such as the adoption of chapter 6 (hydrology) and Section 3.2.1 of Chapter 13 (full spectrum detention) of the City of Colorado Springs DCMV1

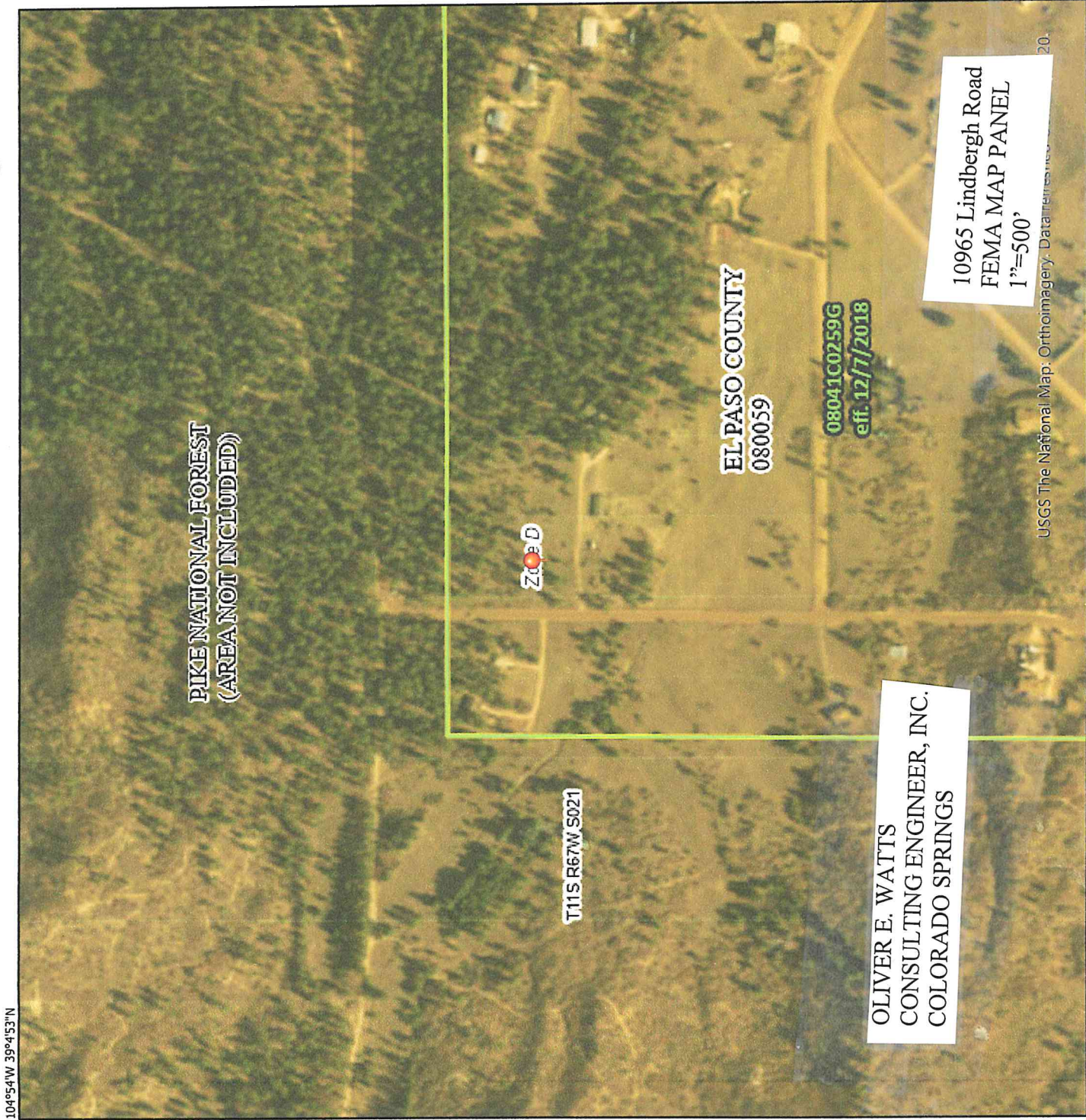
MAJOR BASIN	SUB BASIN	AREA		BASIN		Tc MIN	I in./hr.	SOIL GRP	DEV. TYPE	C	FLOW		RETURN PERIOD -years-		
		PLANIM READ	ACRES	LENGTH -FT.-	HEIGHT -FT.-						5-yr qp -CFS-	100-yr qp -CFS-			
UNSTUDIED HISTORIC	A	COGO	1.105	300	14.4	19.0	3.0	5.1	FOREST	0.08	0.35	0.3	2.0	5	100
	B	COGO	1.183	+180	10.5	+1.8									
		TOTAL		2.288	V=1.64		21	2.3	4.8	FOREST	0.08	0.35	0.4	3.2	5
DEVELOPED	A	AS	ABOVE												
	B	COGO	1.183	300	18	11.1			66%*	0.458	0.596				
			V=2.82	+138	2%	+0.8									
		TOTAL				11.9	8.7	6.5				2.0	4.4	5	100
	A+B	COGO	2.288	+438	17	+2.6									
			V+2.82			21.6	2.9	4.8	MIX	0.275	0.477	1.0	5.2	5	100
* % IMP	BUILDG		0.583												
	PARKG.		0.157												
	S/W		0.040												
	IMP		0.782						66%						
	TOTAL		1.183						100%						
HYDROLOGICAL COMPUTATION – BASIC DATA														PAGE 1 OF 1	
PROJ:	BY:	OLIVER E. WATTS, CONSULTING ENGINEER, INC. 614 ELKTON DRIVE COLORADO SPRINGS, CO 80907													
RATIONAL METHOD		DATE: December 11, 2020													

It appears that this should be labeled parking and the cell below should be building.

National Flood Hazard Layer FIRMette



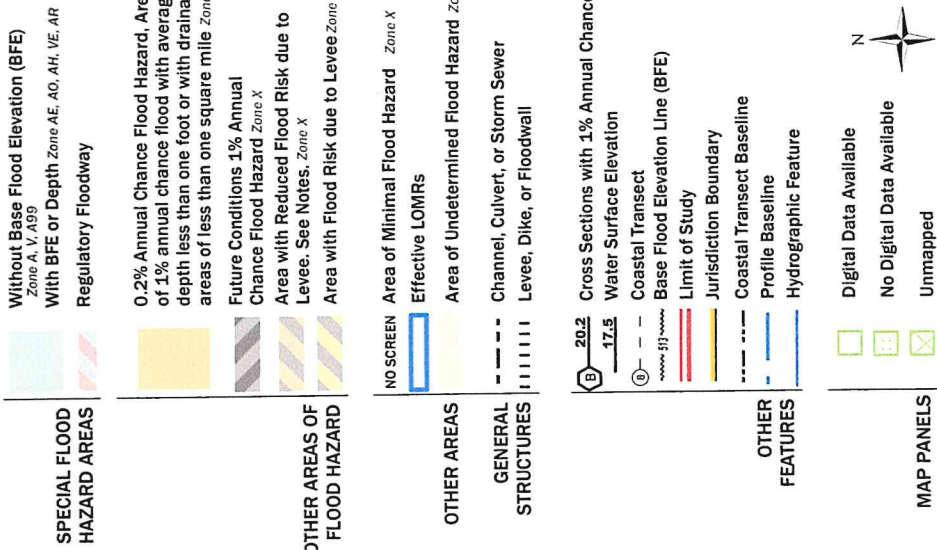
104°54'W 39°4'53"N



104°53'22"W 39°4'25"N

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT



The pin displayed on the map is an approximate point selected by the user and does not represent 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 12/11/2020 at 4:27 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.

An aerial photograph of a landscape, likely a wetland or marsh area, with topographic contour lines overlaid. The contours are labeled with numbers such as 2, 3, 50, and 48. A specific area in the lower right is marked with a circle and the number 32, and is labeled "SITE 2" with an arrow. The image includes a scale bar at the top indicating 55', 508, 2170 000 FEET, 509, 510, and 104° 52' 30". The right side of the image shows a vertical scale from 430 to 4329. A text box in the upper left identifies the project as "OLIVER E. WATTS CONSULTING ENGINEER, INC. COLORADO SPRINGS". Another text box in the upper right provides the address "10965 Lindbergh Road" and the map title "SCS SOILS MAP 1\"=2000'".

10965 Lindbergh Road
SCS SOILS MAP
1"=2000'

TABLE 11.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro- logic group	Bedrock		Risk of corrosion	
		Depth	Hard- ness	Uncoated steel	Concrete
		<u>In</u>			
22----- Kassler	A	>60	---	Moderate	Low.
23----- Kutch	C	20-40	Soft	High----	Moderate.
24, 25----- Legault	D	5-20	Soft	Moderate	Moderate.
26: Legault-----	D	5-20	Soft	Moderate	Moderate.
Rock outcrop----	D	0	Hard	---	---
27, 28: Palboone-----	B	>60	---	Moderate	Moderate.
Security-----	C	20-40	Soft	Moderate	Moderate.
29, 30----- Pendant	D	7-20	Hard	Moderate	Low.
31: Pendant-----	D	7-20	Hard	Moderate	Low.
Rock outcrop----	D	0	Hard	---	---
32----- Perrypark	B	>60	---	Moderate	Low.
33: Rock outcrop----	D	0	Hard	---	---
Catamount-----	D	10-20	Soft	Moderate	Moderate.
34: Rock outcrop----	D	0	Hard	---	---
Security-----	C	20-40	Soft	Moderate	Moderate.
Cathedral-----	D	10-20	Hard	Moderate	Moderate.
35, 36: Rock outcrop----	D	0	Hard	---	---
Sphinx-----	D	8-20	Soft	Moderate	Low.
37: Sachett-----	C	10-20	Soft	High----	High.
Rock outcrop----	D	0	Hard	---	---
38, 39----- Security	C	20-40	Soft	Moderate	Moderate.
40: Security-----	C	20-40	Soft	Moderate	Moderate.
Cathedral-----	D	10-20	Hard	Moderate	Moderate.

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	0.39	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.

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

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.

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

Where:

t_i = overland (initial) flow time (min)

C_s = 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_t) and the travel time (t_l) 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.

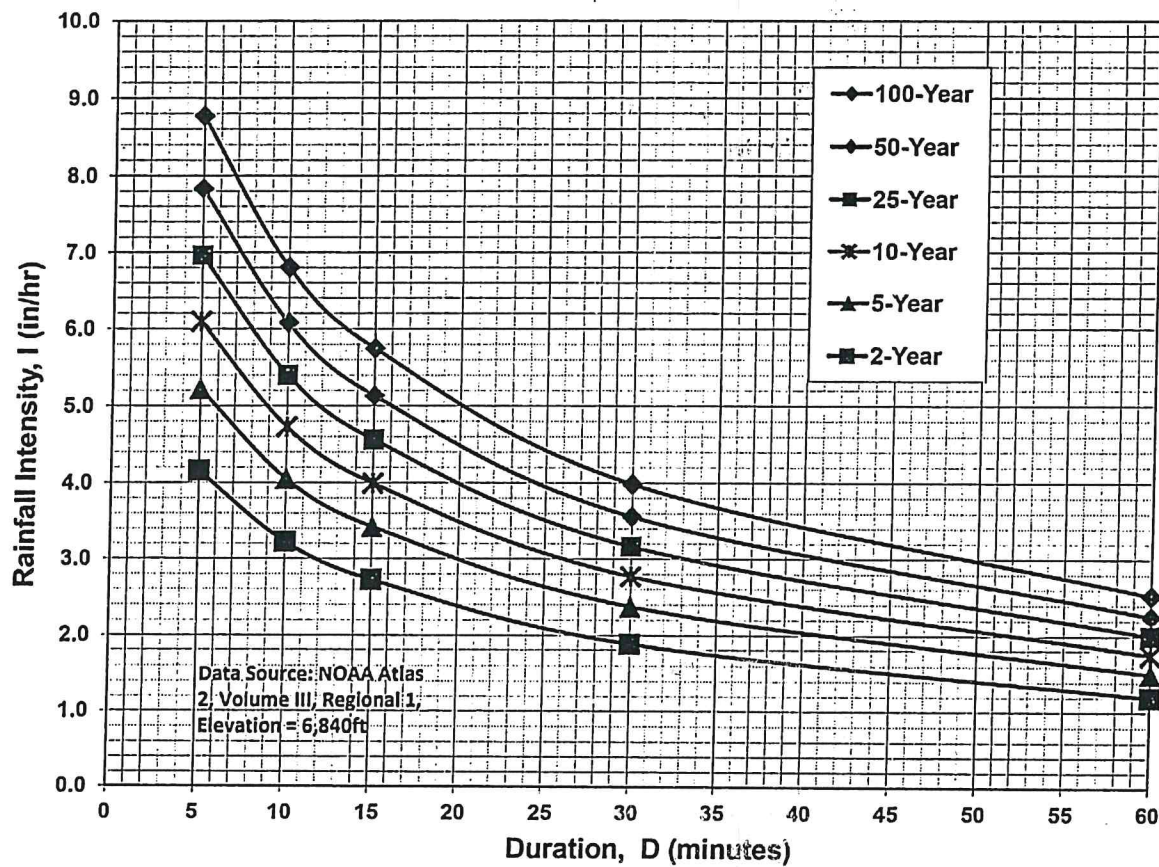
3.2.4 Minimum Time of Concentration

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

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

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

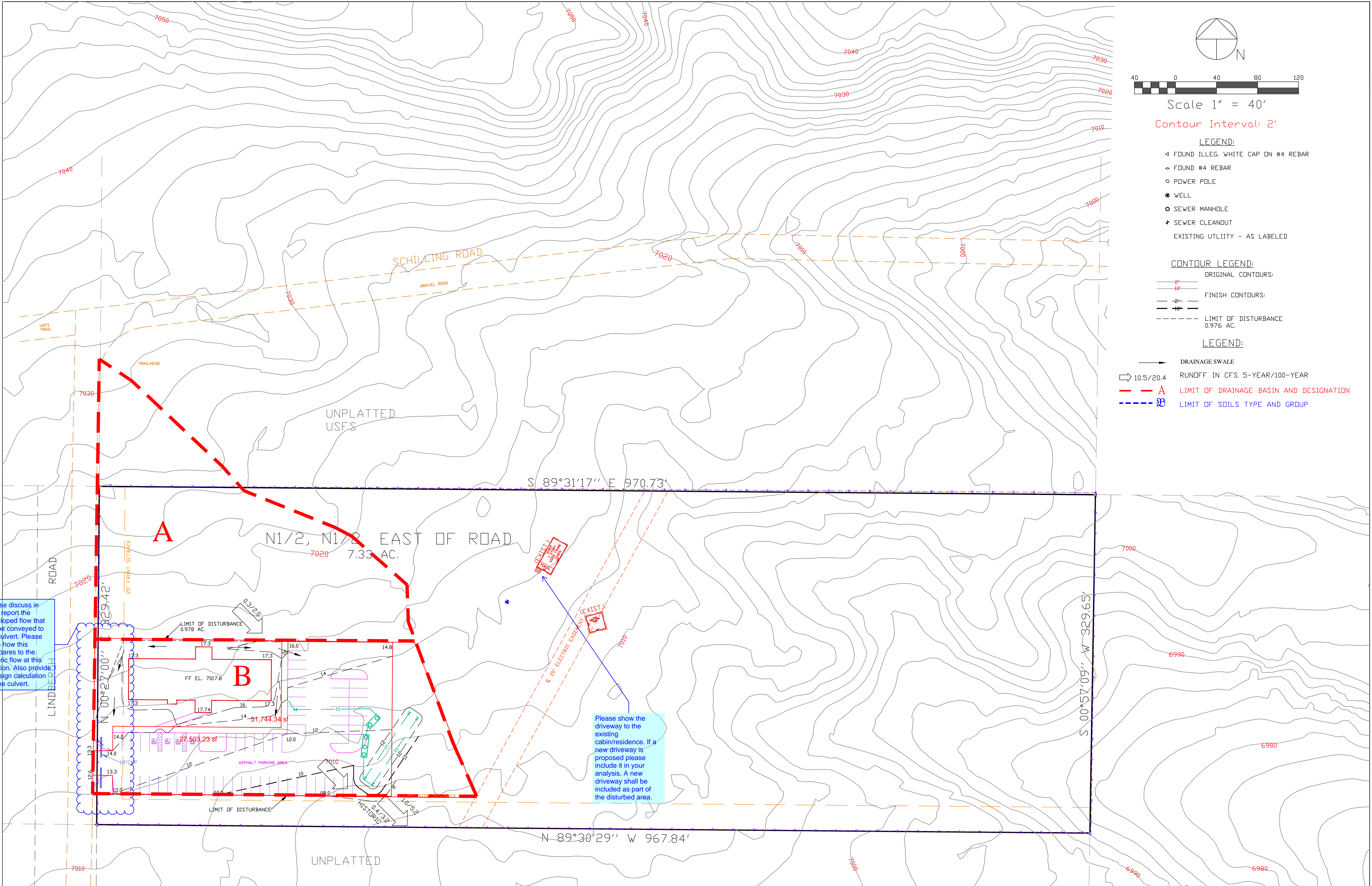
$$I_{25} = -2.00 \ln(D) + 10.111$$

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

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

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

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



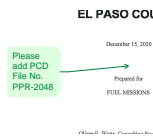
Please discuss in your report the developed flow that will be conveyed to the culvert. Please state how this compares to the historic flow at this location. Also provide a design calculation for the culvert.

Please show the driveway to the existing cabin/residence. If a new driveway is proposed please include it in your analysis. A new driveway shall be included as part of the disturbed area.

DRAWN BY: D.E. WATTS		APPROVED BY:		REVISIONS		PROJECT		SHT. NAME		SHT. NO.	
DATE: 12-9-20		PROJ. NO.				16965 LINDBERGH ROAD		DRAINAGE PLAN		1	
DWG. NO.: 20-5449 01		DWG.				N1/2, N1/2, NW1/4, SE1/4, SEC. 22, T.11S., R.67W.				OF	
SURVEYED BY: DEV. ES. 4-29-20 12-4-20						EL PASO COUNTY				1	

Drainage Report Final_V1.pdf Markup Summary

1 (1)



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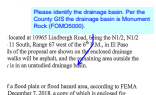
Please be sure to also address comments provided by the stormwater engineer.

4 (6)



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See comments from the stormwater engineer regarding the 4 step process. and any other comments provided.



Subject: Callout
Page Label: 4
Author: Daniel Torres
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Please identify the drainage basin. Per the County GIS the drainage basin is Monument Rock (FOMO5000).



Subject: Callout
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Please also identify that an approximately 6000 sf building will also be proposed.



Subject: Callout
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Please provide an existing drainage conditions plan. Also, please elaborate in your description of the existing runoff and discuss any offsite drainage. Per the drainage map it appears that only a small portion affects the development. This should be discussed in the narrative per DCMV1 ch4.

It appears per the drainage plan that some of the developed flows will be conveyed to the proposed culvert. Please discuss this in your narrative. Please elaborate in your description of the developed flows. As stated it appears that the flow is leaving the site at a point source at the southeast corner of the paved parking lot where historically it appears that it sheet flowed to the southerly property. Show how this concentrated flow is mitigated to minimize the impact to the adjacent property to the south

Please identify the size and type of culvert in your narrative of the report.

Please revise to El Paso County

Which other reports? Please be sure to state/list any existing MDDP, drainage reports or other studies that are relevant to this development.

Please reiterate in your summary that there will be no adverse affects on downstream or surrounding developments.

Please state the proposed disturbance area.
Please be aware that should 1 acre or more of the site be disturbed during construction, the developer will be required to address stormwater quality per ECM appendix I.

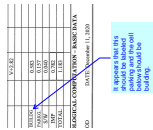
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Please reference the County criteria manual and any updates/adoptions to the criteria manual such as the adoption of chapter 6 (hydrology) and Section 3.2.1 of Chapter 13 (full spectrum detention) of the City of Colorado Springs DCMV1

7 (1)



Subject: Callout
Page Label: 7
Author: Daniel Torres
Date: 1/26/2021 6:14:24 PM
Status:
Color: ■
Layer:
Space:

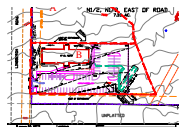
It appears that this should be labeled parking and the cell below should be building.

15 (4)



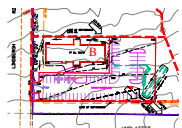
Subject: Callout
Page Label: 15
Author: Daniel Torres
Date: 1/26/2021 5:39:02 PM
Status:
Color: ■
Layer:
Space:

Please show the driveway to the existing cabin/residence. If a new driveway is proposed please include it in your analysis. A new driveway shall be included as part of the disturbed area.



Subject: Area Measurement
Page Label: 15
Author: Daniel Torres
Date: 1/26/2021 6:11:47 PM
Status:
Color: ■
Layer:
Space:

51,744.34 sf



Subject: Area Measurement
Page Label: 15
Author: Daniel Torres
Date: 1/26/2021 6:12:39 PM
Status:
Color: ■
Layer:
Space:

27,503.23 sf



Subject: Cloud+
Page Label: 15
Author: Daniel Torres
Date: 1/26/2021 6:16:17 PM
Status:
Color: ■
Layer:
Space:

Please discuss in your report the developed flow that will be conveyed to the culvert. Please state how this compares to the historic flow at this location. Also provide a design calculation for the culvert.