FINAL
DRAINAGE PLAN AND REPORT

FUEL MISSIONS

A PROPOSED CHURCH AT 10695 LINDBERGH ROAD
AN UNPLATTED LOT

N1/2, N1/2 East of the Road Section 21, Township 11 South, Range 67 West 6th P.M., El Paso County

County Fil No.: PPR-20-048

December 15, 2020

Revised
July 6, 2021

Revised
January 26, 2022

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
614 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907
(719) 593-0173
fax (719) 265-9660
olliewatts@aol.com
Celebrating over 42 years in business

January 28, 2022

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 page
FEMA Panel No. 08041C0259 G
SCS Soils Map and Interpretation Sheet
Backup Information, 5 sheets
Aerial Photo
Existing Conditions Drainage Map, Dwg 20-5449-06A
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 Jim Nelson

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:

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. It is proposed that a 5,980 sf church building, along with parking lot and sidewalks be constructed on the west portion of the property. The details of the proposal are shown on the enclosed drainage plan. Parking area, driveway and sidewalks will be asphalt, and the remaining area outside the building will be landscaped. The property is in the Monument Rock drainage basin.

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. All soils in this area are of the Perrypark complex, being in hydrologic group "B".

7. DESCRIPTION OF RUNOFF:

<u>EXISTING DRAINAGE CONDITIONS</u>

Drainage Basin C is not shown on the existing drainage conditions plan. Revise accordingly.

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, B and C on the enclosed site. The total of basins A and B discharges 0.4 cfs (5-year runoff) / 3.7 cfs (100-year runoff) historically, as shown on the existing conditions drainage plan. Basin C is the basin draining to the driveway culvert location, and discharges 0.02 cfs / 0.20 cfs.

<u>PROPOSED DRAINAGE CONDITIONS</u>

Please identify the outfall of the proposed swale and indicate a design point with flows at this location. Compare the developed flows at this location with historic flows.

By providing a swale to prevent runoff to the southerly lot, the runoff has been concentrated. Please indicate how the increased flow and now concentrated flow at the ultimate outfall will be mitigated so that it does not negatively impact the downstream or surrounding properties. Please also discuss what the existing downstream conditions are.

The area will be graded to conform to the existing topography shown on the drainage plan, routing all runoff into a lot area at the southeast portion of the construction site. Very little clearing is necessary within the construction site.

All runoff will be routed to and contained within the private site, terminating at the historic outfall point. Basin A is an area partially within the forest that creates an inflow of 0.3 cfs \ 1.9 cfs that is distributed across the north line of the construction site. No concentrated point flows exist. This will combine with the 1.9 cfs /4.1 cfs from the site to total 1.0/5.0 cfs at the outfall point, distributed over the development area in a "sheet flow" condition. The total of Basins A and B is a relatively minor increase that is easily accommodated by existing conditions downstream, however the neighbor to the south has consistently apposed the project, and the owner is proposing to provide a drainage swale to a safe downstream discharge point shown on the drainage plan to divert the total runoff to that point.

The outfall point has changed now that the ditch on the southern boundary is shown.

Provide supporting documentation and/or calcs to support this statement.

It does not appear that the diverted flow from the back of the building was accounted for in Basin C. Please revise accordingly.

Basin C will continue to discharge 0.02 cfs / 0.20 cfs at the proposed 18" CMP roadway culvert. A private culvert 18" CMP minimally sloped is provided at the driveway at Lindbergh Road. The culvert is minimum in size, along with the runoff and will have substantial safety factor.

add: "...*at this time. Any future improvements on the site that will result in a cumulative soil disturbance >1ac (ie: 0.022ac) will require a water quality treatment facility for the total disturbed area."*

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

Step1 Employ Runoff Reduction Practices – The extent of impervious materials is minimized consistent with the objectives of the facility. No curb and gutter or other items that might concentrate runoff are proposed. A rock buffer along the south property line will minimize negative affects.

Step 2 Stabilize Drainageways –The development of this project does not create drainage ways and is not anticipated to have any negative effects on downstream drainage ways. Grass swales along the north side of the building are minimized and slopes are minimized, and they will outfall onto the proposed parking lot. Runoff across the asphalt pavement will not be concentrated along the south limit.

Step 3 Provide Water Quality Capture Volume – The limit of disturbance for the proposed construction is 0.978 acre, less than one acre County stipulation, so no water quality provisions are required or necessary.

Step4 Consider Need for Industrial and Commercial BMP's – This submittal provides a final grading and erosion control plans with BMP's in place. The proposed project will use silt fence, a vehicle tracking control pad, and concrete washout area, reseeding and landscaping to mitigate the potential for erosion across the site. The proposed BMP's are considered fully adequate.

Revise per addition of swale area.

Per the narrative the runoff will be conveyed to a swale where the runoff will concentrate and be conveyed to the east. Revise accordingly.

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. There will be no adverse effects on downstream or surrounding properties.

The drainage analysis has been prepared in accordance with the current El Paso County Drainage Criteria Manual. Supporting information and calculations are included in this report.

References

1. El Paso County Engineering Criteria Manual, December 13, 2016

2. City/County Drainage Criteria Manual, Volumes 1 and 2, May, 2014

MAJOR BASIN	SUB BASIN	AREA		BASIN		Tc MIN	I in./hr.		SOIL GRP	DEV. TYPE	C		FLOW 5-ry	FLOW 100-yr	RETURN PERIOD -years-	
		PLANIM READ	ACRES	LENGTH -FT.-	HEIGHT -FT.-								qp -CFS-	qp -CFS-		
UNSTUDIED	A	COGO	1.079	300	14.4	19.0	3.0	5.1	B	FOREST	0.08	0.35	0.3	1.9	5	100
HISTORIC	B	COGO	1.098	+180	10.5	+1.8										
		TOTAL	2.177	V=1.64		21	2.3	4.8	B	FOREST	0.08	0.35	0.4	3.7	5	100
	C	COGO	0.111	215	8	21	2.3	4.8	B	FOREST	0.08	0.35	0.02	0.2	5	100
DEVELOPED	A	AS	ABOVE													
	B	COGO	1.098	300	18	11.1			B	66%*	0.458	0.596				
			V=2.82	+138	2%	+0.8										
		TOTAL				11.9	3.7	6.3					1.9	4.1	5	100
	A+B	COGO	2.288	+438	17	+2.6										
			V+2.82			21.6	2.9	4.8	B	MIX	0.271	0.474	1.0	5.0	5	100
	C	AS	ABOVE													
* % IMP	PARKG.		0.583													
	BUILDG.		0.157													
	S/W		0.040													
	IMP		0.782							66%						
	TOTAL		1.183							100%						

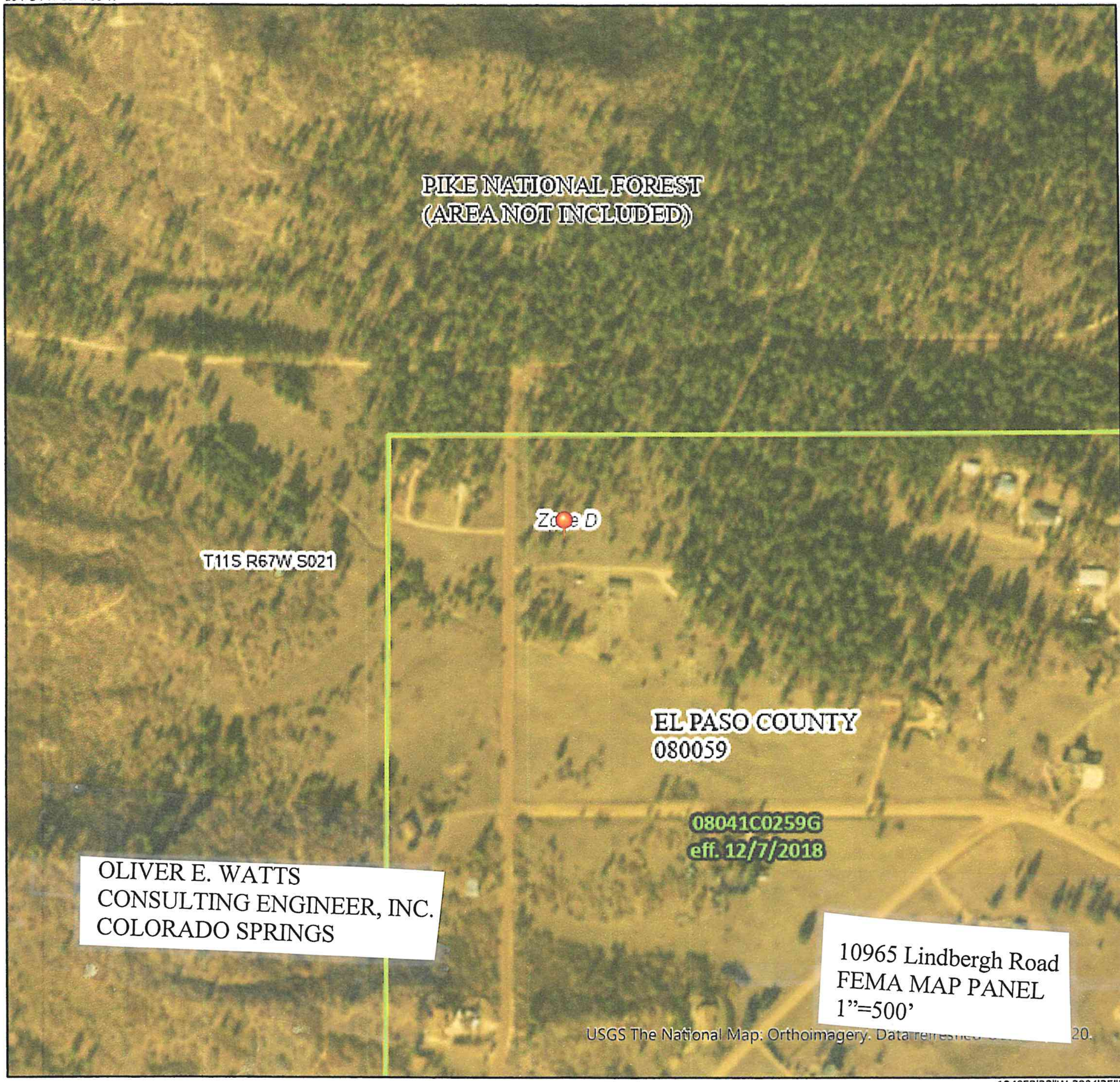
HYDROLOGICAL COMPUTATION – BASIC DATA
PROJ: FUEL MSSIONS BY: O.E. WATTS
RATIONAL METHOD DATE: 7/6/21 1/26/22

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

National Flood Hazard Layer FIRMette

FEMA

104°54'W 39°4'53"N



104°53'22"W 39°4'25"N

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

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, 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 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.

PIKE NATIONAL FOREST—EASTERN PART, COLORADO
SOIL SURVEY AREA
SHEET NO. 14

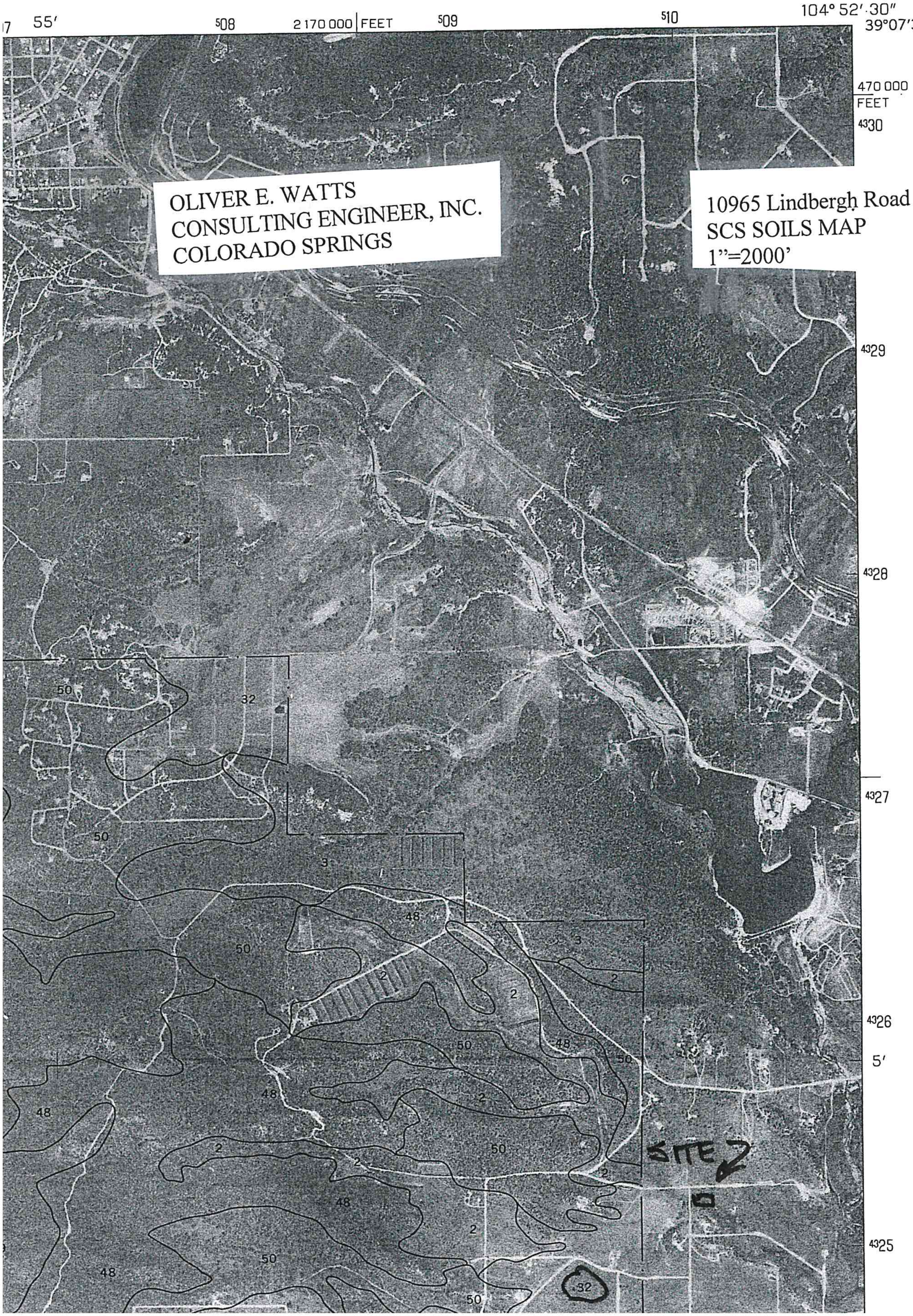


TABLE 11.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Bedrock		Risk of corrosion	
		Depth	Hardness	Uncoated steel	Concrete
		In			
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.

$$t_c = t_i + t_t$$ (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.

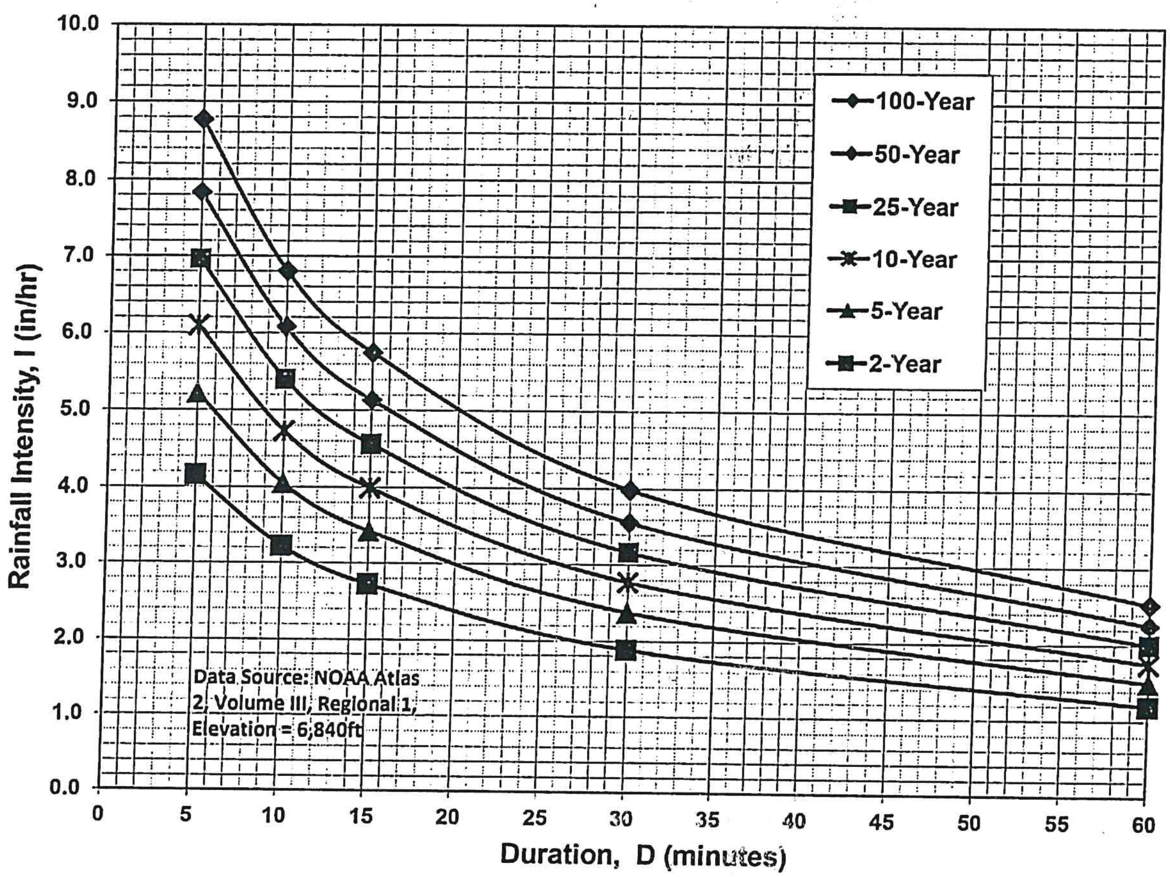
3.2.4 Minimum Time of Concentration

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

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

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

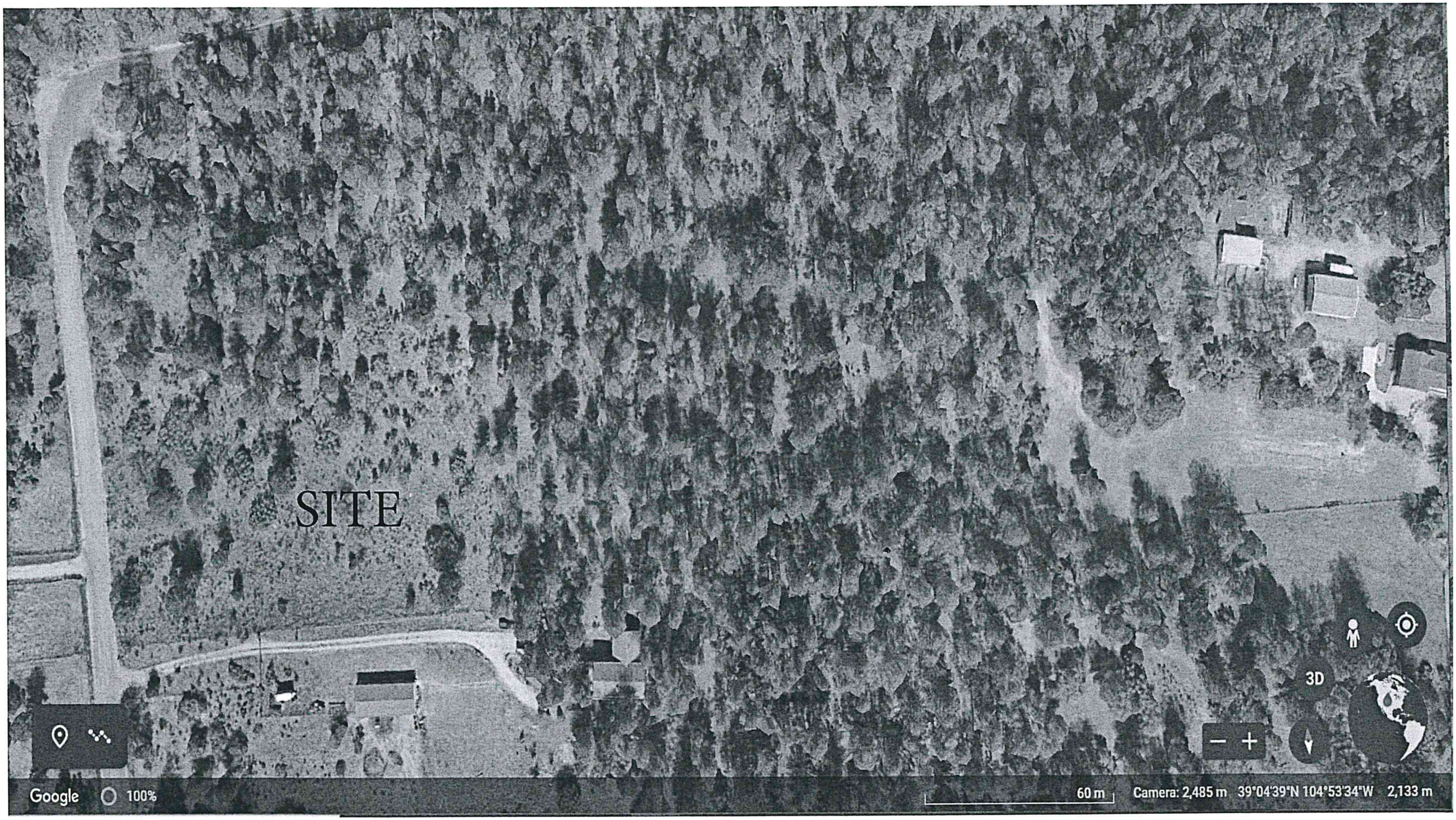
$$I_{25} = -2.00 \ln(D) + 10.111$$

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

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

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

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


SITE
3D
Google
100%
60 m
Camera: 2,485 m 39°04'39"N 104°53'34"W 2,133 m

DRAWN BY: O.E. WATTS DATE: 12-9-20 DWG. NO.: 20-5449 01 A TOPOGRAPHY BY: COUNTY LIDAR SURVEYED BY: OEW, ESW, 4-29-20,12-4-20	APPROVED BY: PROJ. NO. DWG.	REVISIONS 7-6-21 REVISED PER COUNTY REVIEW OEW	OLIVER E. WATTS CONSULTING ENGINEER COLORADO SPRINGS	PROJECT 16965 LINDBERGH ROAD N1/2, N1/2, NW1/4, SE1/4, SEC. 22, T.11S., R.67W. EL PASO COUNTY	SHT. NAME EXISTING CONDITIONS DRAINAGE PLAN	SHT. NO. 1 OF 1

Prepared by the office of:
Oliver E. Watts, Consulting Engineer, Inc.
614 Elkton Drive
Colorado Springs, CO 80907
(719) 593-0173
Olliewatts@aol.com
Celebrating 42 years in business

County File No. PPR2048

DRAWN BY: O.E. WATTS	APPROVED BY:	REVISIONS 7-6-21 REVISED PER COUNTY REVIEW OEW
DATE: 12-9-20	PROJ. NO.	1-26-22 REVISED PER COUNTY REVIEW OEW
DWG. NO.: 20-5449 01	DWG.	
TOPOGRAPHY BY: COUNTY LIDAR; SURVEYED BY: OEW, ESW, 4-29-20,12-4-20		

OLIVER E. WATTS
CONSULTING ENGINEER
COLORADO SPRINGS

PROJECT
16965 LINDBERGH ROAD
N1/2, N1/2, NW1/4, SE1/4, SEC. 22, T.11S., R.67W.
EL PASO COUNTY

SHT. NAME
DRAINAGE PLAN

SHT. NO. 1 OF 1