OCTOBER 19, 2020

DRAINAGE REPORT 3rd/M/Crestone

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Project #20013



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1: INTRODUCTION

The proposed project is a residential development in the City of Salida which will consist of 5 units and one additional accessory dwelling unit. The site consists of two parcels currently owned by the City of Salida, and the recently vacated Crestone Avenue right of way adjacent to the city-owned parcels.

2: EXISTING CONDITIONS

The subject site contains an asphalt street in the vacated Crestone Ave right of way, and sparse vegetation outside the asphalt. No major off-site drainage basins route through the site.

Photos of existing conditions at the site:



3: Soils

Information for the on-site soils was obtained from the USDA Web Soil Survey (U.S. Department of Agriculture, n.d.). The soils consist of Dominson and St. Elmo gravelly sandy loams, which are assigned to Hydrologic Soils Group A. Web Soil Survey data is included in Appendix A.

4: PRECIPITATION

Precipitation amounts for the Design Storms was obtained from the NOAA precipitation frequency estimates for the subject area. The Design Storms utilized in the analysis are summarized in 1 below.

TABLE 1	
Storm	24-hour
Return Period	Rainfall
(yr)	Amount (in.)
2	1.34
5	1.64
10	1.89
25	2.26
50	2.55
100	2.85

5: RUNOFF ANALYSIS

The runoff Analysis was performed utilizing the methods described in the Natural Resources Conservation Service (NRCS) Technical Release #55 (TR-55), with a Type II storm distribution. Curve number in the developed condition will be lower than the predeveloped condition due to the removal of Crestone Avenue pavement, and improvement of site landscaping. The development will not cause an increase in runoff generated on the subject site. No stormwater detention is required.

APPENDIX A: SOILS REPORT



USDA Natural Resources Conservation Service Web Soil Survey National Cooperative Soil Survey 10/19/2020 Page 1 of 3





Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DoD	Dominson gravelly sandy loam, 1 to 9 percent slopes	1.6	41.2%
SeB	St. Elmo gravelly sandy loam, 1 to 3 percent slopes	0.7	17.3%
SeF	St. Elmo gravelly sandy loam, 3 to 9 percent slopes	1.6	41.6%
Totals for Area of Interest		3.8	100.0%



APPENDIX B: NOAA PRECIPITATION ESTIMATES

Precipitation Frequency Data Server

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NOAA Atlas 14, Volume 8, Version 2 Location name: Salida, Colorado, USA* Latitude: 38.5395°, Longitude: -105.9994° Elevation: 7085.8 ft** * source: ESRI Maps ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS	-based po	oint precip	itation fre	quency es	stimates v	vith 90% c	onfidenc	e interva	ls (in inc	hes) ¹
Duration				Average	recurrence	interval (yea	ars)			
Duration	1	2	5	10	25	50	100	200	500	1000
5-min	0.174	0.207	0.277	0.350	0.472	0.584	0.711	0.855	1.07	1.25
	(0.137-0.227)	(0.163-0.270)	(0.217-0.362)	(0.272-0.460)	(0.365-0.674)	(0.435-0.837)	(0.510-1.04)	(0.586-1.29)	(0.703-1.66)	(0.791-1.94)
10-min	0.255	0.304	0.406	0.513	0.692	0.855	1.04	1.25	1.57	1.83
	(0.200-0.332)	(0.238-0.395)	(0.317-0.530)	(0.398-0.673)	(0.534-0.987)	(0.637-1.23)	(0.746-1.53)	(0.859-1.89)	(1.03-2.43)	(1.16-2.84)
15-min	0.311	0.370	0.495	0.625	0.844	1.04	1.27	1.53	1.91	2.23
	(0.244-0.405)	(0.291-0.482)	(0.387-0.647)	(0.486-0.821)	(0.652-1.20)	(0.777-1.49)	(0.910-1.87)	(1.05-2.31)	(1.25-2.96)	(1.41-3.46)
30-min	0.394	0.494	0.685	0.867	1.15	1.40	1.68	1.98	2.42	2.78
	(0.309-0.512)	(0.388-0.643)	(0.535-0.894)	(0.673-1.14)	(0.881-1.62)	(1.04-1.99)	(1.20-2.44)	(1.35-2.97)	(1.58-3.73)	(1.76-4.31)
60-min	0.458	0.600	0.851	1.08	1.41	1.69	1.98	2.30	2.75	3.11
	(0.359-0.595)	(0.471-0.781)	(0.665-1.11)	(0.836-1.41)	(1.07-1.96)	(1.24-2.37)	(1.41-2.87)	(1.56-3.43)	(1.79-4.22)	(1.97-4.82)
2-hr	0.522	0.706	1.02	1.29	1.67	1.98	2.29	2.62	3.08	3.43
	(0.415-0.669)	(0.561-0.906)	(0.805-1.31)	(1.01-1.66)	(1.27-2.26)	(1.47-2.72)	(1.64-3.24)	(1.80-3.83)	(2.03-4.63)	(2.20-5.24)
3-hr	0.572	0.765	1.09	1.36	1.75	2.06	2.38	2.71	3.16	3.50
	(0.458-0.728)	(0.612-0.974)	(0.867-1.39)	(1.08-1.75)	(1.34-2.35)	(1.54-2.81)	(1.72-3.33)	(1.87-3.91)	(2.09-4.70)	(2.26-5.30)
6-hr	0.713	0.903	1.22	1.49	1.88	2.19	2.50	2.83	3.27	3.61
	(0.579-0.895)	(0.732-1.14)	(0.987-1.54)	(1.20-1.89)	(1.46-2.48)	(1.65-2.93)	(1.83-3.45)	(1.98-4.01)	(2.19-4.79)	(2.36-5.38)
12-hr	0.928	1.11	1.40	1.66	2.03	2.32	2.63	2.95	3.38	3.72
	(0.763-1.15)	(0.907-1.37)	(1.15-1.75)	(1.35-2.08)	(1.60-2.64)	(1.78-3.07)	(1.95-3.57)	(2.09-4.12)	(2.30-4.88)	(2.46-5.45)
24-hr	1.16	1.34	1.64	1.89	2.26	2.55	2.85	3.16	3.59	3.92
	(0.966-1.42)	(1.11-1.63)	(1.36-2.01)	(1.56-2.33)	(1.80-2.89)	(1.98-3.31)	(2.14-3.80)	(2.27-4.35)	(2.47-5.09)	(2.63-5.65)
2-day	1.35	1.57	1.92	2.21	2.61	2.92	3.23	3.54	3.96	4.27
	(1.14-1.63)	(1.32-1.89)	(1.61-2.31)	(1.84-2.68)	(2.10-3.27)	(2.29-3.72)	(2.45-4.22)	(2.57-4.78)	(2.76-5.50)	(2.90-6.05)
3-day	1.46	1.70	2.09	2.41	2.84	3.18	3.51	3.84	4.28	4.61
	(1.24-1.74)	(1.44-2.03)	(1.77-2.50)	(2.02-2.89)	(2.30-3.53)	(2.51-4.01)	(2.68-4.55)	(2.81-5.13)	(3.01-5.90)	(3.16-6.47)
4-day	1.55	1.80	2.21	2.54	3.00	3.35	3.70	4.06	4.52	4.87
	(1.33-1.84)	(1.54-2.14)	(1.88-2.63)	(2.15-3.04)	(2.44-3.70)	(2.67-4.20)	(2.84-4.77)	(2.98-5.38)	(3.19-6.18)	(3.35-6.78)
7-day	1.77	2.03	2.46	2.82	3.31	3.68	4.06	4.44	4.95	5.34
	(1.53-2.07)	(1.75-2.38)	(2.12-2.89)	(2.41-3.33)	(2.73-4.03)	(2.97-4.56)	(3.16-5.16)	(3.31-5.82)	(3.54-6.68)	(3.71-7.33)
10-day	1.97	2.25	2.70	3.08	3.60	4.00	4.41	4.81	5.35	5.76
	(1.71-2.29)	(1.95-2.62)	(2.34-3.15)	(2.65-3.61)	(2.99-4.35)	(3.25-4.92)	(3.45-5.55)	(3.61-6.25)	(3.85-7.16)	(4.04-7.85)
20-day	2.55	2.92	3.51	3.99	4.64	5.13	5.61	6.08	6.70	7.16
	(2.25-2.92)	(2.57-3.34)	(3.08-4.03)	(3.48-4.60)	(3.90-5.50)	(4.21-6.18)	(4.44-6.93)	(4.61-7.74)	(4.88-8.79)	(5.08-9.57)
30-day	3.03	3.47	4.18	4.74	5.49	6.04	6.57	7.09	7.74	8.20
	(2.69-3.43)	(3.09-3.94)	(3.70-4.75)	(4.17-5.42)	(4.64-6.43)	(4.99-7.19)	(5.24-8.03)	(5.41-8.91)	(5.67-10.0)	(5.87-10.9)
45-day	3.62	4.15	4.98	5.63	6.47	7.08	7.65	8.20	8.86	9.31
	(3.25-4.07)	(3.72-4.67)	(4.44-5.61)	(4.99-6.38)	(5.51-7.49)	(5.90-8.34)	(6.15-9.24)	(6.30-10.2)	(6.54-11.3)	(6.72-12.2)
60-day	4.11 (3.71-4.59)	4.70 (4.24-5.26)	5.62 (5.05-6.30)	6.33 (5.65-7.13)	7.24 (6.19-8.30)	7.88 (6.59-9.19)	8.47 (6.84-10.1)	9.01 (6.97-11.1)	9.66 (7.17-12.2)	10.1 (7.32-13.1)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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PF graphical







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Maps & aerials

Small scale terrain

Precipitation Frequency Data Server



Large scale terrain





Large scale aerial

Precipitation Frequency Data Server



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US Department of Commerce National Oceanic and Atmospheric Administration National Weather Service National Water Center 1325 East West Highway Silver Spring, MD 20910 Questions?: <u>HDSC.Questions@noaa.gov</u>

Disclaimer

APPENDIX C: HYDROLOGIC ANALYSIS

10/19/2020



325 D Street

DRAINAGE CALCULATIONS

Project Name:	3rd/M/Crestone		
Project #:	20013		
Location:	Salida, CO		
Client Name	Chaffee Housing Truct		
Chent Name:	Chance Housing Trust		
Client Address:			
Client Phone #:			
Prepared By:	WBH	Date:	10/19/2020
Checked by:	WBH	Date:	10/19/2020

Area Name:

Storm Return Period (yr)	24-hour Rainfall Amount (in.)
2	1.34
5	1.64
10	1.89
25	2.26
50	2.55
100	2.85
Source:	NOAA ATLAS 14

Rainfall Distribution: 11



3rd/M/Crestone

PRE-DEVELOPMENT RUNOFF CALCULATIONS

Pre-Developed Curve Number

Land Use Description	HSG	Curve No.	Area (acres)	Area (%)
Open space (grass cover <50%)	A	68	0.27	75%
Impervious	A	98	0.09	25%
		Totals	0.36	100%

Weighted Curve Number

76

Time to Concentration

Sheet Flow

Surface Cover	Length (ft)	Slope (^{ft} / _{ft})	Manning's n	T _t (hrs)
Cultivated soils: Residue cover < 20%	50	0.120	0.060	0.034

Shallow Flow

Surface Cover	Length (ft)	Slope (^{ft} / _{ft})	Velocity Coefficient	T _t (hrs)
Unpaved	40	0.120	16.135	0.002

Channel Flow

Length (ft.)	Slope (^{ft} / _{ft})	n-Value	Flow Area (ft ²)	Wetted Perimeter (ft)	Tt (hrs)

Total Travel Time

0.083

Peak Discharge

Storm	2-yr	10-yr	25-yr	50-yr	100-yr
24-hr Precipitation (P)	1.34	1.89	2.26	2.55	2.85
Initial Abstraction (I _a)	0.632	0.632	0.632	0.632	0.632
I _a /P	0.471	0.334	0.279	0.248	0.222
Unit Peak Discharge (q _u)	658	922	900	927	950
Runoff (Q)	0.13	0.36	0.55	0.73	0.92
Peak Discharge (q _p)	0.048	0.186	0.281	0.378	0.489

TR55 Analysis CHT 3rd Crestone2 10/19/2020



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POST-DEVELOPMENT RUNOFF CALCULATIONS

Post-Developed Curve Number

Land Use Description	HSG	Curve No.	Area (acres)	Area (%)
Open space (grass cover 50% to 75%)	A	49	0.21	58%
Gravel Road/Parking Lot	A	76	0.05	14%
Impervious	A	98	0.10	28%
		Totals	0.36	100%

Weighted Curve Number

66

Time to Concentration

Surface Cover	Length (ft)	Slope (^{ft} / _{ft})	Manning's n	T _t (hrs)
Grass: Bermuda grass	50	0.120	0.410	0.158

Shallow Flow

Surface Cover	Length (ft)	Slope (^{ft} / _{ft})	Velocity Coefficient	T _t (hrs)

Channel Flow

Length (ft.)	Slope (^{ft} / _{ft})	n-Value	Flow Area (ft ²)	Wetted Perimeter (ft)	Tt (hrs)

Total Travel Time (hrs)

0.158

Peak Discharge

Storm	2-yr	10-yr	25-yr	50-yr	100-yr
24-hr Precipitation (P)	1.34	1.89	2.26	2.55	2.85
Initial Abstraction (I _a)	1.030	1.030	1.030	1.030	1.030
I _a /P	0.769	0.545	0.456	0.404	0.361
Unit Peak Discharge (q _u)	405	405	524	631	692
Runoff (Q)	0.02	0.12	0.24	0.35	0.47
Peak Discharge (q _p)	0.004	0.028	0.070	0.123	0.185



3rd/M/Crestone

MINIMUM DETENTION CALCULATIONS

1. Data:						Г		
Drainage area	A _m =	0.0006		6.	$V_{s}/V_{r} = C_{0} + C_{1}(q_{0}/q_{1}) + C_{1}(q_{0}/q_{1})$	(a/a) ² +Ca	-30.82	-6.51
	' <u> '' </u>		-	-		2(40/41) * • • 3	(40, 41))	
		1st Stage	2nd Stage					
		25	100] _	Dupoff O	Г	0 24	0.47
2. Frequency	yı	25	100] /.	(from Post-Developed	worksheet)	0.24	0.47
3. Peak Inflow				_				
discharge q _i	cfs	0.070	0.185	8.	Runoff Vol. V _r	cu-ft	310	621
(from Post-Developed v	worksheet)			-	(V _r =QA _m 53.33)	_		
4. Peak outflow	Г		1	1		Г		
discharge q _p	cfe	0.281	0.489	9.		ou ft	0	
(from Pre-Developed w	orksheet)	0.202	1]	Storage vol, V _s	cu-n	0	0
(from Pre-Developed w	orksheet)	4.02	2.65] 10	Storage vol, V _s	• F	0	0
(from Pre-Developed w 5. Compute q _p /q _i	orksheet)	4.02	2.65] 10.	Storage vol, V _s Maximum storage (from plot)	E _{max}	0	0