



Drainage Report

8830 Mustang Place, Colorado Springs, CO 80908

PREPARED FOR: Mike Cartmell

PREPARED BY: WaterVation, PLLC

DATE: August 22nd, 2022

PCD File No. VR-224





Table of Contents

Engineer’s Statement	1
Developer’s Statement.....	1
El Paso County	1
Project Description	1
Purpose.....	3
Drainage Fee.....	3
Drainage Basin Characteristics	3
Proposed Drainage Characteristics	6
Detention & Water Quality	6
Regulatory Floodplains	7
References.....	8
Drainage Plan.....	9
Appendix A	10

Table of Tables

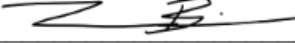
Table 1. Peak Flows for Existing Conditions	6
Table 2. Peak Flows for Proposed Conditions	6
Table 3. Peak Flow Increase at Design Point	7
Table 3. Hydrologic Calculations for Existing Conditions	10
Table 4. Hydrologic Calculations for Proposed Conditions	11

Table of Figures

Figure 1. Site Map.....	2
-------------------------	---

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.




[Name, P.E. # 42636]

8/22/2022
Date

Developer's Statement

I, the owner/developer have read and will comply with all of the requirements specified in this drainage report and plan.


Mike Cartmell (Aug 22, 2022 13:56 MDT)

Michael Cartmell, President
MASON, LLC
7702 Barnes Road #140-58
Colorado Springs, CO 80922

Aug 22, 2022
Date

El Paso County

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

Joshua Palmer, P.E.
Interim County Engineer / ECM Administrator

Conditions:

APPROVED
Engineering Review
Date 09/26/2022 11:02:44 AM

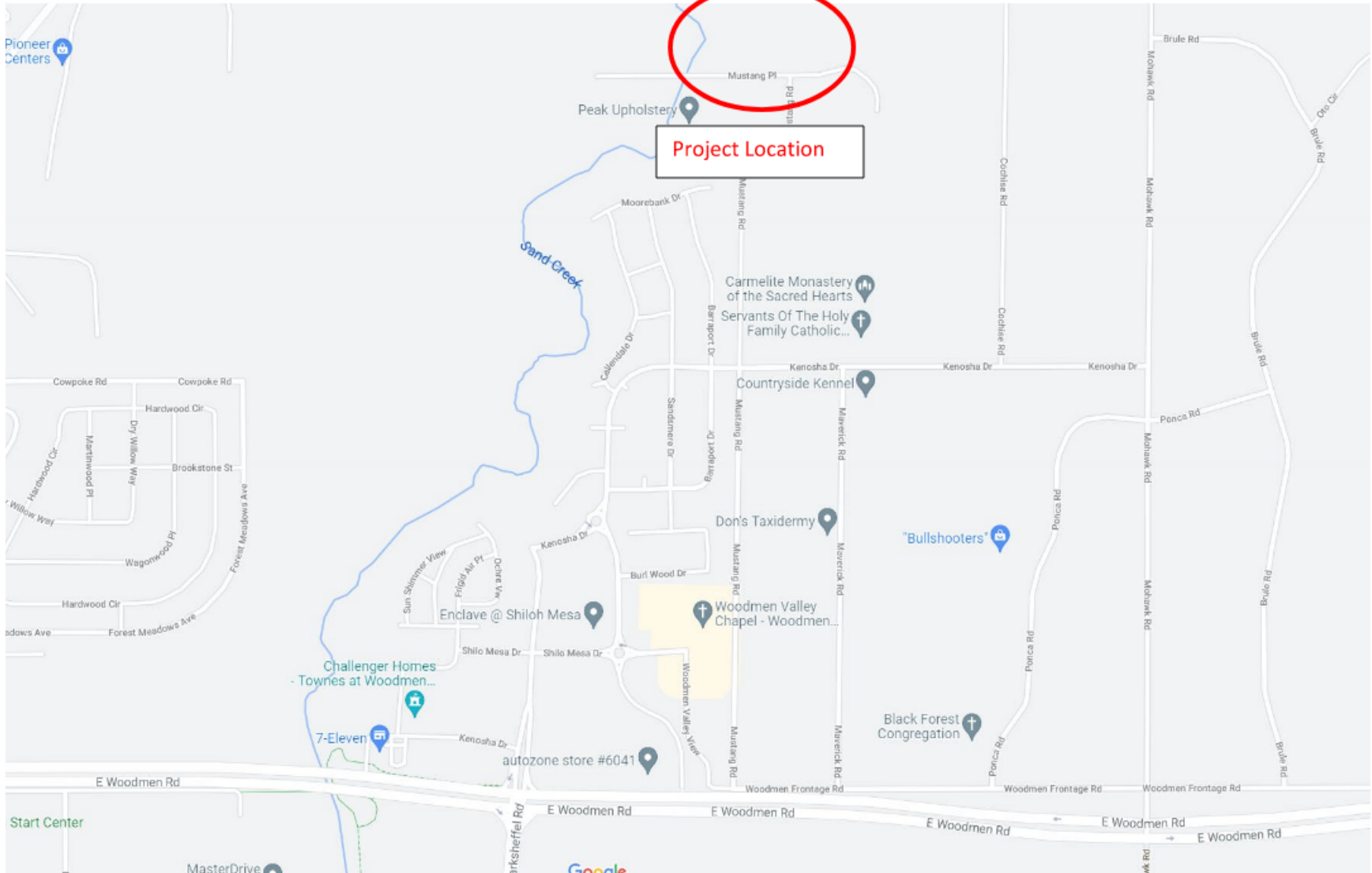

dsdrice
JeffRice@elpasoco.com
(719) 520-7877
**EPC Planning & Community
Development Department**

Project Description

This Project is located approximately 0.75 miles to the north of the intersection of East Woodmen Road and Marksheffel Road (Figure 1). The Project area is comprised of one 5.37-acre lot and is proposed to be subdivided into two lots.

8830 MUSTANG PLACE
DRAINAGE REPORT

Figure 1. Site Map



Purpose

The purpose of this drainage report is to evaluate existing and proposed drainage characteristics for the proposed subdivision of 8830 Mustang Place, Colorado Springs, CO 80908 (Project). This report was prepared on September 24th, 2021.

Drainage Fee

The property is in Sand Creek Drainage basin, which is studied and has drainage/bridge fees associated with it. Per Resolution No. 21-468 the drainage fee is \$21,814/impervious acre and bridge fee is \$8,923/impervious acre. However, per ECM 3.10.2a, a 25% reduction in drainage fees is authorized for this Project because it is a low-density lot. Therefore, the drainage fee is \$16,360.50.

Impervious Area (AC)	2022 Drainage Fee	Total Drainage Fee for Project
0.31	\$16,360.50	\$5,071.76

Impervious Area (AC)	2022 Bridge Fee	Total Bridge Fee for Project
0.31	\$8,923	\$2,766.13

Drainage Basin Characteristics

Basin A

Basin A slopes to the south and southwest at slopes ranging from 0.005 ft/ft to 0.01 ft/ft. Existing impervious area was delineated using aerial imagery flown in July 2021 and was calculated to be 0%. Proposed impervious area was established by the property owner and is 0%.

The Natural Resources Conservation Service (NRCS) Web Soil Survey was referenced to identify hydrologic soil groups within the Project area. The Project area is comprised of Hydrologic Soil Group (HSG) A and HSG B soils with dominantly sandy-loam soil. Soil conditions for all basins will remain unchanged in proposed conditions.

Existing land cover is dominantly upland grasses.

Hydrologic soil groups are based on estimates of runoff potential. HSG A soils have a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission. HSG B soils have a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission. Soil maps for the Project area are provided in Appendix A.

Peak flow rates were calculated using the Rational Method with precipitation data from Figure 6-5 of El Paso County's DCM. Runoff coefficients were calculated as a function of impervious area storm frequency using impervious area. A summary of estimated peak flows for existing conditions is provided in Table 1.

Basin B

Basin B slopes to the south and southwest at slopes ranging from 0.005 ft/ft to 0.01 ft/ft. Existing impervious area was delineated using aerial imagery flown in July 2021 and was calculated to be 7.16%. Proposed impervious area was established by the property owner and is 15.28%.

The Natural Resources Conservation Service (NRCS) Web Soil Survey was referenced to identify hydrologic soil groups within the Project area. The Project area is comprised of Hydrologic Soil Group (HSG) A and HSG B soils with dominantly sandy-loam soil. Soil conditions for all basins will remain unchanged in proposed conditions.

Existing land cover is dominantly upland grasses.

Hydrologic soil groups are based on estimates of runoff potential. HSG A soils have a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission. HSG B soils have a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission. Soil maps for the Project area are provided in Appendix A.

Peak flow rates were calculated using the Rational Method with precipitation data from Figure 6-5 of El Paso County's DCM. Runoff coefficients were calculated as a function of impervious area storm frequency using impervious area. A summary of estimated peak flows for existing conditions is provided in Table 1.

Basin C

Basin C slopes to the south and southwest at slopes ranging from 0.005 ft/ft to 0.01 ft/ft. Existing impervious area was delineated using aerial imagery flown in July 2021 and was calculated to be 3.84%. Proposed impervious area was established by the property owner and is 3.84%.

The Natural Resources Conservation Service (NRCS) Web Soil Survey was referenced to identify hydrologic soil groups within the Project area. The Project area is comprised of Hydrologic Soil Group (HSG) A and HSG B soils with dominantly sandy-loam soil. Soil conditions for all basins will remain unchanged in proposed conditions.

Existing land cover is dominantly upland grasses.

Hydrologic soil groups are based on estimates of runoff potential. HSG A soils have a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission. HSG B soils have a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission. Soil maps for the Project area are provided in Appendix A.

Peak flow rates were calculated using the Rational Method with precipitation data from Figure 6-5 of El Paso County's DCM. Runoff coefficients were calculated as a function of impervious area storm frequency using impervious area. A summary of estimated peak flows for existing conditions is provided in Table 1.

Basin D

Basin D slopes to the south and southwest at slopes ranging from 0.005 ft/ft to 0.01 ft/ft. Existing impervious area was delineated using aerial imagery flown in July 2021 and was calculated to be 1.14%. Proposed impervious area was established by the property owner and is 1.14%.

The Natural Resources Conservation Service (NRCS) Web Soil Survey was referenced to identify hydrologic soil groups within the Project area. The Project area is comprised of Hydrologic Soil Group (HSG) A and HSG B soils with dominantly sandy-loam soil. Soil conditions for all basins will remain unchanged in proposed conditions.

Existing land cover is dominantly upland grasses.

Hydrologic soil groups are based on estimates of runoff potential. HSG A soils have a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission. HSG B soils have a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission. Soil maps for the Project area are provided in Appendix A.

Peak flow rates were calculated using the Rational Method with precipitation data from Figure 6-5 of El Paso County's DCM. Runoff coefficients were calculated as a function of impervious area storm frequency using impervious area. A summary of estimated peak flows for existing conditions is provided in Table 1.

Basin E

Basin E slopes to the south and southwest at slopes ranging from 0.005 ft/ft to 0.01 ft/ft. Existing impervious area was delineated using aerial imagery flown in July 2021 and was calculated to be 1.39%. Proposed impervious area was established by the property owner and is 1.39%.

The Natural Resources Conservation Service (NRCS) Web Soil Survey was referenced to identify hydrologic soil groups within the Project area. The Project area is comprised of Hydrologic Soil Group (HSG) A and HSG B soils with dominantly sandy-loam soil. Soil conditions for all basins will remain unchanged in proposed conditions.

Existing land cover is dominantly upland grasses.

Hydrologic soil groups are based on estimates of runoff potential. HSG A soils have a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission. HSG B soils have a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission. Soil maps for the Project area are provided in Appendix A.

Peak flow rates were calculated using the Rational Method with precipitation data from Figure 6-5 of El Paso County's DCM. Runoff coefficients were calculated as a function of impervious area storm frequency using impervious area. A summary of estimated peak flows for existing conditions is provided in Table 1.

Table 1. Peak Flows for Existing Conditions

EXISTING SUBBASIN CHARACTERISTICS				EXISTING PEAK FLOW (CFS)			
SUBBASIN	AREA (AC)	NRCS HYDROLOGIC SOIL GROUP	PERCENT IMPERVIOUS	2-YR	5-YR	25-YR	100-YR
A	0.36	B	0.00%	0.00	0.00	0.40	0.90
B	0.96	B	7.16%	0.09	0.15	1.21	2.46
C	3.60	B	3.84%	0.15	0.24	3.59	7.59
D	1.49	B	1.14%	0.02	0.03	1.74	3.81
E	0.55	B	1.39%	0.01	0.01	0.56	1.23

Proposed Drainage Characteristics

The only alteration to proposed conditions is the addition of 3,000 square-feet of impervious area in Subbasin B. A summary of estimated peak flows for proposed conditions is provided in Table 2.

Table 2. Peak Flows for Proposed Conditions

PROPOSED SUBBASIN CHARACTERISTICS				PROPOSED PEAK FLOW (CFS)			
SUBBASIN	AREA (AC)	NRCS HYDROLOGIC SOIL GROUP	PERCENT IMPERVIOUS	2-YR	5-YR	25-YR	100-YR
A	0.36	B	0.00%	0.00	0.00	0.40	0.90
B	0.96	B	15.28%	0.24	0.34	1.46	2.73
C	3.60	B	3.84%	0.15	0.24	3.59	7.59
D	1.49	B	1.14%	0.02	0.03	1.74	3.81
E	0.55	B	1.39%	0.01	0.01	0.56	1.23

Design Points

Design Point 1

Design Point 1 captures flow from Basin A. As shown in Table 3, there is no increase in flow between existing and proposed conditions at this design point during either the 5-year or 100-year storm.

Design Point 2

Design Point 1 captures flow from Basin B and C. As shown in Table 3, there is an increase in flow of 0.15 cfs and 0.22 cfs between existing and proposed conditions at this design point during either the 5-year or 100-year storm, respectively.

Design Point 3

Design Point 1 captures flow from Basin D. As shown in Table 3, there is no increase in flow between existing and proposed conditions at this design point during either the 5-year or 100-year storm.

Design Point 4

Design Point 1 captures flow from Basin D. As shown in Table 3, there is no increase in flow between existing and proposed conditions at this design point during either the 5-year or 100-year storm.

Table 3. Peak Flow Increase at Design Point

DESIGN POINT SUMMARY												
DESIGN POINT	EXISTING PEAK FLOW (CFS)				PROPOSED PEAK FLOW (CFS)				DIFFERENCE (CFS)			
	2-YR	5-YR	25-YR	100-YR	2-YR	5-YR	25-YR	100-YR	2-YR	5-YR	25-YR	100-YR
1	0.00	0.00	0.40	0.90	0.00	0.00	0.40	0.90	0.00	0.00	0.00	0.00
2	0.22	0.36	4.63	9.69	0.33	0.51	4.83	9.91	0.11	0.15	0.20	0.22
3	0.02	0.03	1.74	3.81	0.02	0.03	1.74	3.81	0.00	0.00	0.00	0.00
4	0.01	0.01	0.56	1.23	0.01	0.01	0.56	1.23	0.00	0.00	0.00	0.00

Detention & Water Quality

The only design point that experiences an increase in peak flow rate is Design Point 2 (Table 3). The increase in peak flow, compared to existing conditions, ranges between 0.11 cfs (2-year) to 0.22 cfs (100-year). Water quality for the increase in runoff will be provided by the large grass swale that exists in Basin C, which has a bottom width of approximately 150 feet.

Regulatory Floodplains

No regulatory floodplains exist on-site. The FEMA FIRM is 08041C0533G.

Conclusion

The project area is already developed. The proposed project contemplates adding one house. The impacts on stormwater runoff are negligible as shown in this report. Flow leaving the site does not exceed 15 cfs at any design point, therefore drainage easements are not required.

References

City of Colorado Springs, Drainage Criteria Manual Volume 1, May 2014.

El Paso Engineering Criteria Manual, 2018

Mile High Flood Control District, UD Rational 2.00

Natural Resources Conservation Service (NRCS) Web Soil Survey

8830 MUSTANG PLACE
DRAINAGE REPORT

Drainage Plan

PROPOSED SUBBASIN CHARACTERISTICS				PROPOSED PEAK FLOW (CFS)			
SUBBASIN	AREA (AC)	NRCS HYDROLOGIC SOIL GROUP	PERCENT IMPERVIOUS	2-YR	5-YR	25-YR	100-YR
A	0.36	B	0.00%	0.00	0.00	0.40	0.90
B	0.96	B	15.28%	0.24	0.34	1.46	2.73
C	3.60	B	3.84%	0.15	0.24	3.59	7.59
D	1.49	B	1.14%	0.02	0.03	1.74	3.81
E	0.55	B	1.39%	0.01	0.01	0.56	1.23

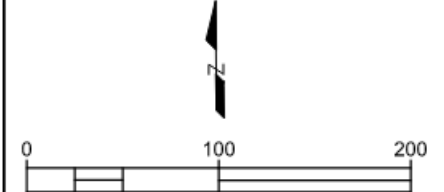


DESIGN POINT SUMMARY												
DESIGN POINT	EXISTING PEAK FLOW (CFS)				PROPOSED PEAK FLOW (CFS)				DIFFERENCE (CFS)			
	2-YR	5-YR	25-YR	100-YR	2-YR	5-YR	25-YR	100-YR	2-YR	5-YR	25-YR	100-YR
1	0.00	0.00	0.40	0.90	0.00	0.00	0.40	0.90	0.00	0.00	0.00	0.00
2	0.22	0.36	4.63	9.69	0.33	0.51	4.83	9.91	0.11	0.15	0.20	0.22
3	0.02	0.03	1.74	3.81	0.02	0.03	1.74	3.81	0.00	0.00	0.00	0.00
4	0.01	0.01	0.56	1.23	0.01	0.01	0.56	1.23	0.00	0.00	0.00	0.00

Copyright Reserved
The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to WaterVation without delay.
The Copyrights to all designs and drawings are the property of WaterVation. Reproduction or use for any purpose other than that authorized by WaterVation is forbidden.

Sub-Consultants

Horizontal Scale & Orientation



Legend

Revision	By	Appd.	YY.MM.DD	
Issued	By	Appd.	YY.MM.DD	
File Name:	LTB	---	LTB	21.09.20
Permit Seal	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Client/Project

MUSTANG PL. & CHAPARRAL LP. DRAINAGE

EL PASO COUNTY, CO

Project Milestone

Sheet Name
PR DRAINAGE PLAN-MUSTANG PLACE

2021006027 1" = 100'
Project No. Horizontal Scale

Appendix A

A summary of the hydrologic calculations for this Project are provided in Table 3 and Table 4. Rational calculations were performed using the UD-RATIONAL 2.00 software.

Table 4. Hydrologic Calculations for Existing Conditions

Calculation of Peak Runoff using Rational Method																																																															
Designer: L. Babbitt		Version 2.00 released May 20		Clear Worksheet		$t_i = \frac{0.395(1.1 - C_s)\sqrt{L_i}}{S_i^{0.33}}$		Computed $t_c = t_i + t_e$		$t_{\text{minimum}} = 5$ (urban) $t_{\text{minimum}} = 10$ (non-urban)		Link for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website																																																			
Company: WaterVation		Date: 5/10/2022		Project: 8330 Mustang Place		Location: El Paso County, CO		Cells of this color are for required user-input		Cells of this color are for optional override		Cells of this color are for calculated result		$t_i = \frac{L_i}{60K\sqrt{S_i}} = \frac{L_i}{60V_i}$		Regional $t_c = (26 - 17i) + \frac{L_i}{60(14i + 9)\sqrt{S_i}}$		Selected $t_c = \max\{t_{\text{minimum}}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$		1-hour rainfall depth, P1 (in) = <table border="1"><tr><th>2-yr</th><th>5-yr</th><th>10-yr</th><th>25-yr</th><th>50-yr</th><th>100-yr</th><th>500-yr</th></tr><tr><td>1.20</td><td>1.45</td><td>1.80</td><td>2.00</td><td>2.45</td><td>2.60</td><td></td></tr></table>						2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	1.20	1.45	1.80	2.00	2.45	2.60		Rainfall Intensity Equation Coefficients = <table border="1"><tr><th>a</th><th>b</th><th>c</th></tr><tr><td>28.50</td><td>10.00</td><td>0.786</td></tr></table>						a	b	c	28.50	10.00	0.786	$I(\text{in/hr}) = \frac{a}{(b + i)^c}$ Use Denver Area Intensity						Q(cfs) = CIA					
2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr																																																									
1.20	1.45	1.80	2.00	2.45	2.60																																																										
a	b	c																																																													
28.50	10.00	0.786																																																													
Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time				Channelized (Travel) Flow Time						Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)																																
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L _i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S _i (ft/ft)	Overland Flow Time t _i (min)	Channelized Flow Length L _i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S _i (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V _i (ft/sec)	Channelized Flow Time t _i (min)	Computed t _c (min)	Regional t _c (min)	Selected t _c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr																								
A (EX)	0.36	B	0.00	0.00	0.00	0.06	0.25	0.33	0.43	0.54	126.00	7012.00	7006.00	0.048	13.32	236.00	7006.00	6986.00	0.085	7	2.04	1.93	15.25	27.50	15.25	2.70	3.27	4.05	4.50	5.52	5.86	0.00	0.00	0.08	0.40	0.65	0.90																										
B (EX)	0.96	B	7.16	0.04	0.05	0.11	0.29	0.37	0.46	0.56	141.00	7012.00	7005.00	0.050	13.28	369.00	7005.00	6994.00	0.030	10	1.73	3.56	16.85	28.34	16.85	2.58	3.11	3.86	4.29	5.26	5.58	0.09	0.15	0.43	1.21	1.86	2.46																										
C (EX)	3.60	B	3.84	0.02	0.02	0.09	0.27	0.35	0.44	0.55	71.00	7012.00	7011.00	0.014	14.61	627.00	7011.00	6991.00	0.032	7	1.25	8.36	22.97	31.48	22.97	2.19	2.65	3.29	3.65	4.47	4.75	0.15	0.24	1.04	3.59	5.63	7.59																										
D (EX)	1.49	B	1.14	0.00	0.01	0.07	0.26	0.33	0.43	0.54	36.00	7012.00	7011.00	0.028	8.45	560.00	7011.00	6999.00	0.021	10	1.46	6.38	14.83	32.77	14.83	2.74	3.31	4.11	4.56	5.59	5.93	0.02	0.03	0.41	1.74	2.79	3.81																										
E (EX)	0.55	B	1.39	0.01	0.01	0.07	0.26	0.34	0.43	0.54	86.00	7012.00	7010.00	0.023	13.84	506.00	7010.00	6999.00	0.022	10	1.47	5.72	19.56	31.98	19.56	2.39	2.89	3.58	3.98	4.88	5.17	0.01	0.01	0.13	0.56	0.90	1.23																										
DP 1 (EX)	0.36	B	0.00	0.00	0.00	0.06	0.25	0.33	0.43	0.54	126.00	7012.00	7006.00	0.048	13.32	236.00	7006.00	6986.00	0.08	7	2.04	1.93	15.25	27.50	15.25	2.70	3.27	4.05	4.50	5.52	5.86	0.00	0.00	0.08	0.40	0.65	0.90																										
DP 2 (EX)	4.56	B	4.50	0.02	0.03	0.09	0.28	0.35	0.45	0.55	71.00	7012.00	7011.00	0.014	14.55	627.00	7011.00	6991.00	0.032	7	1.25	8.36	22.91	31.31	22.91	2.20	2.65	3.29	3.66	4.48	4.76	0.22	0.36	1.40	4.63	7.22	9.69																										
DP 3 (EX)	1.49	B	1.14	0.00	0.01	0.07	0.26	0.33	0.43	0.54	36.00	7012.00	7011.00	0.028	8.45	560.00	7011.00	6999.00	0.021	10	1.46	6.38	14.83	32.77	14.83	2.74	3.31	4.11	4.56	5.59	5.93	0.02	0.03	0.41	1.74	2.79	3.81																										
DP 4 (EX)	0.55	B	1.39	0.01	0.01	0.07	0.26	0.34	0.43	0.54	86.00	7012.00	7010.00	0.023	13.84	506.00	7010.00	6999.00	0.022	10	1.47	5.72	19.56	31.98	19.56	2.39	2.89	3.58	3.98	4.88	5.17	0.01	0.01	0.13	0.56	0.90	1.23																										


Calculation of Peak Runoff using Rational Method																																																							
Designer: L. Babbitt		Version 2.00 released May 20		Clear Worksheet		$t_i = \frac{0.395(1.1 - C_s)\sqrt{L_i}}{S_i^{0.33}}$		Computed $t_c = t_1 + t_t$		$t_{\text{minimum}} = 5$ (urban) $t_{\text{minimum}} = 10$ (non-urban)		Link for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA v																																											
Company: WaterVation		Date: 5/10/2022		Cells of this color are for required user-input		$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$		Regional $t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$		Selected $t_c = \max\{t_{\text{minimum}}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$		1-hour rainfall depth, P1 (in) = <table border="1"><tr><td>2-yr</td><td>5-yr</td><td>10-yr</td><td>25-yr</td><td>50-yr</td><td>100-yr</td><td>500-yr</td></tr><tr><td>1.20</td><td>1.45</td><td>1.80</td><td>2.00</td><td>2.45</td><td>2.60</td><td></td></tr></table>						2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	1.20	1.45	1.80	2.00	2.45	2.60		All Intensity Equation Coefficients = <table border="1"><tr><td>a</td><td>b</td><td>c</td></tr><tr><td>28.50</td><td>10.00</td><td>0.786</td></tr></table>						a	b	c	28.50	10.00	0.786	$I(\text{in/hr}) = \frac{a \cdot I_a}{(b + I_a)}$ Use Denver Area Intensity						Q(cfs) = CIA					
2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr																																																	
1.20	1.45	1.80	2.00	2.45	2.60																																																		
a	b	c																																																					
28.50	10.00	0.786																																																					
Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time				Channelized (Travel) Flow Time						Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)																								
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L _i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S _i (ft/ft)	Overland Flow Time t _i (min)	Channelized Flow Length L _i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S _i (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V _i (ft/sec)	Channelized Flow Time t _i (min)	Computed t _c (min)	Regional t _c (min)	Selected t _c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr																
A (PR)	0.36	B	0.00	0.00	0.00	0.06	0.25	0.33	0.43	0.54	126.00	7012.00	7006.00	0.048	13.32	236.00	7006.00	6986.00	0.085	7	2.04	1.93	15.25	27.50	15.25	2.70	3.27	4.05	4.50	5.52	5.86	0.00	0.00	0.08	0.40	0.65	0.90																		
B (PR)	0.96	B	15.28	0.09	0.11	0.18	0.34	0.41	0.50	0.59	141.00	7012.00	7005.00	0.050	12.50	369.00	7005.00	6994.00	0.030	10	1.73	3.56	16.06	26.60	16.06	2.64	3.19	3.96	4.39	5.38	5.71	0.24	0.34	0.68	1.46	2.14	2.73																		
C (PR)	3.60	B	3.84	0.02	0.02	0.09	0.27	0.35	0.44	0.55	71.00	7012.00	7011.00	0.014	14.61	627.00	7011.00	6991.00	0.032	7	1.25	8.36	22.97	31.48	22.97	2.19	2.65	3.29	3.65	4.47	4.75	0.15	0.24	1.04	3.59	5.63	7.59																		
D (PR)	1.49	B	1.14	0.00	0.01	0.07	0.26	0.33	0.43	0.54	36.00	7012.00	7011.00	0.028	8.45	560.00	7011.00	6999.00	0.021	10	1.46	6.38	14.83	32.77	14.83	2.74	3.31	4.11	4.56	5.59	5.93	0.02	0.03	0.41	1.74	2.79	3.81																		
E (PR)	0.55	B	1.39	0.01	0.01	0.07	0.26	0.34	0.43	0.54	86.00	7012.00	7010.00	0.023	13.84	506.00	7010.00	6999.00	0.022	10	1.47	5.72	19.56	31.98	19.56	2.39	2.89	3.58	3.98	4.88	5.17	0.01	0.01	0.13	0.56	0.90	1.23																		
DP 1 (PR)	0.36	B	0.00	0.00	0.06	0.25	0.33	0.43	0.54	126.00	7012.00	7006.00	0.048	13.32	236.00	7006.00	6986.00	0.08	7	2.04	1.93	15.25	27.50	15.25	2.70	3.27	4.05	4.50	5.52	5.86	0.00	0.00	0.08	0.40	0.65	0.90																			
DP 2 (PR)	4.56	B	6.25	0.03	0.04	0.11	0.29	0.36	0.46	0.56	71.00	7012.00	7011.00	0.014	14.38	627.00	7011.00	6991.00	0.032	7	1.25	8.36	22.73	30.86	22.73	2.20	2.66	3.31	3.67	4.50	4.78	0.33	0.51	1.62	4.83	7.45	9.91																		
DP 3 (PR)	1.49	B	1.14	0.00	0.01	0.07	0.26	0.33	0.43	0.54	36.00	7012.00	7011.00	0.028	8.45	560.00	7011.00	6999.00	0.021	10	1.46	6.38	14.83	32.77	14.83	2.74	3.31	4.11	4.56	5.59	5.93	0.02	0.03	0.41	1.74	2.79	3.81																		
DP 4 (PR)	0.55	B	1.39	0.01	0.01	0.07	0.26	0.34	0.43	0.54	86.00	7012.00	7010.00	0.023	13.84	506.00	7010.00	6999.00	0.022	10	1.47	5.72	19.56	31.98	19.56	2.39	2.89	3.58	3.98	4.88	5.17	0.01	0.01	0.13	0.56	0.90	1.23																		

Hydrologic Soil Group—El Paso County Area, Colorado



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Lines

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available

Soil Rating Points

-  A
-  A/D
-  B
-  B/D

-  C
-  C/D
-  D
-  Not rated or not available

Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 18, Jun 5, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	4.8	58.5%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	3.4	41.5%
Totals for Area of Interest			8.2	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The projection used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The horizontal datum was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov/> or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, NINGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at <http://www.ngs.noaa.gov/>.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

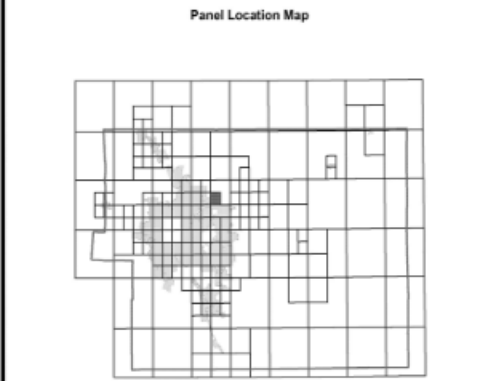
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels in which each community is located.

Contact **FEMA Map Service Center (MSC)** via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at <http://www.msc.fema.gov/>.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP (1-877-336-2627)** or visit the FEMA website at <http://www.fema.gov/business/nfp>.

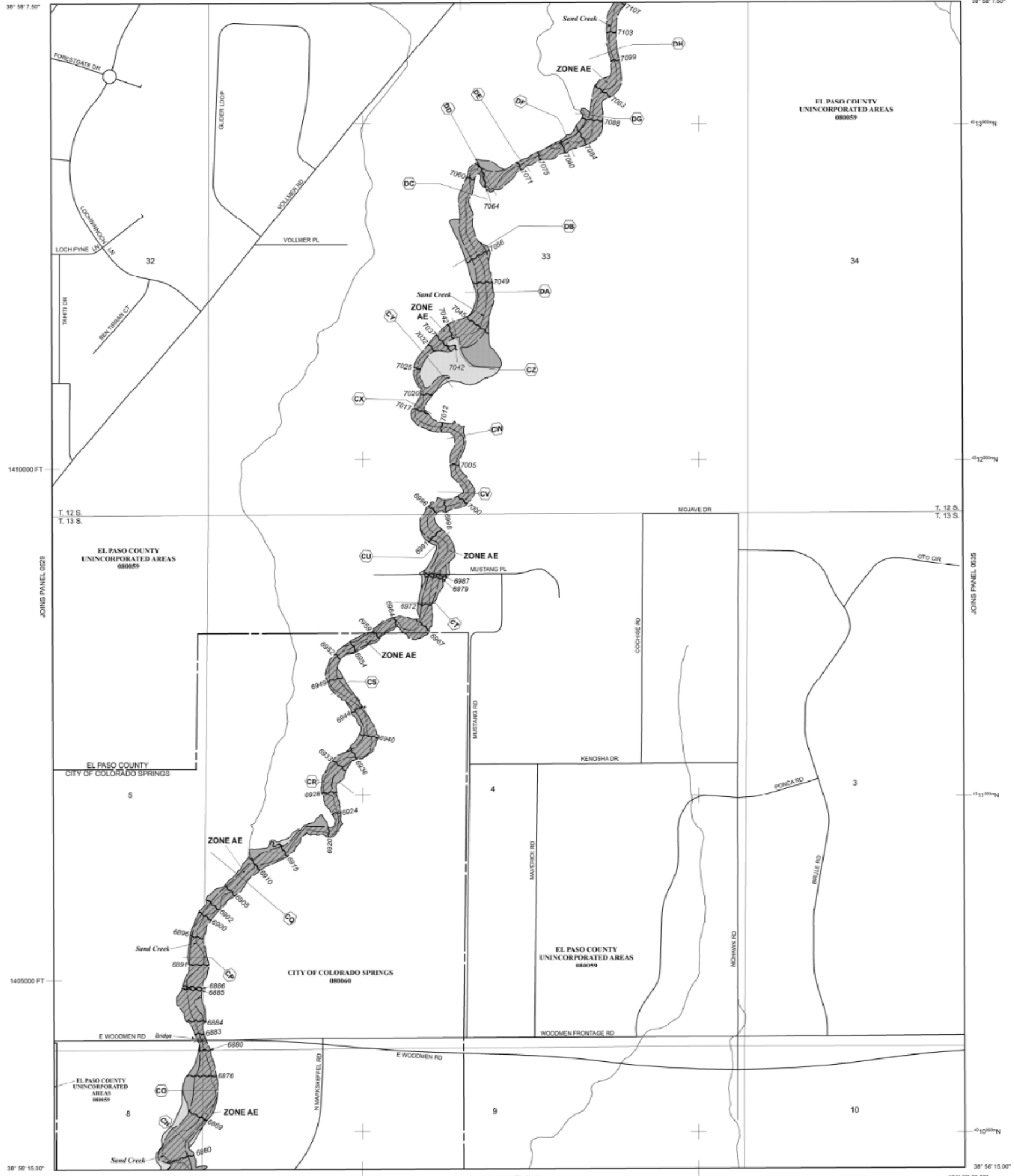
El Paso County Vertical Datum Offset Table	
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



The 1% annual chance flood (100-year flood), also known as the **base flood**, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AD, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of parking); Base Flood Elevations determined.
- ZONE AD** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently deteriorated. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE
The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS
ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS
ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS
OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513 Base Flood Elevation line and value; elevation in feet*
Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A—A Cross section line
23—23 Transsect line

67° 38.00' 32' 22.30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
32° 22' 30.00" 75° 00' 00" 1000-meter Universal Transverse Mercator grid ticks, zone 13

600000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPS/ZONE 5002), Lambert Conformal Conic Projection

DX5510, X Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 River Mile

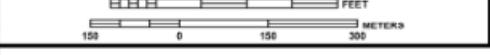
MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6626.



NFP **PANEL 0533G**

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 533 OF 1300
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
COLORADO SPRING CITY OF 08060 503 0
EL PASO COUNTY 08059 503 6

Notice to User: The Map Number shown above should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0533G

MAP REVISED








8830 Mustang Place_Drainage Report_FINAL

Final Audit Report

2022-08-22

Created:	2022-08-22
By:	Lucas Babbitt (lucas.babbitt@water-vation.com)
Status:	Signed
Transaction ID:	CBJCHBCAABAAzNWZBFLpoZ_9y78apxIjISDliaFISOrW

"8830 Mustang Place_Drainage Report_FINAL" History

-  Document created by Lucas Babbitt (lucas.babbitt@water-vation.com)
2022-08-22 - 7:37:03 PM GMT- IP address: 216.147.124.20
-  Document emailed to Mike Cartmell (cartmell.michael@gmail.com) for signature
2022-08-22 - 7:37:34 PM GMT
-  Email viewed by Mike Cartmell (cartmell.michael@gmail.com)
2022-08-22 - 7:55:59 PM GMT- IP address: 66.102.6.131
-  Document e-signed by Mike Cartmell (cartmell.michael@gmail.com)
Signature Date: 2022-08-22 - 7:56:25 PM GMT - Time Source: server- IP address: 71.34.147.244
-  Agreement completed.
2022-08-22 - 7:56:25 PM GMT