826 PARK STREET EXPANSION & 200 WOLFENSBERGER ROAD

PHASE I DRAINAGE REPORT

Prepared for:

826 Park St. #200
Castle Rock, CO 80109

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Matrix Project No. 24.1310
Town Project No. PDP24-0004

I. INTRODUCTION / SITE DESCRIPTION

a. GENERAL PROJECT DESCRIPTION

The 826 Park Street building expansion and 200 Wolfensberger Road site is located between E Wolfensberger Road to the north and Eighth Street to the south. The site is east of Park Street and is made up of approximately 2.92 acres. The site is located as follows:

1. General Location: southwest ¼ of Section 2, Township 8 South, Range 67 West of the 6th P.M. in the Town of Castle Rock, County of Douglas, State of Colorado.
2. Drainageway: The proposed development is located within the East Plum Creek Drainage Basin. The site drains east and into East Plum Creek located approximately 700 feet east of the site.
3. Surrounding Developments: The site is bordered on the west by 884 Park Street and 222 Wolfensberger Road. To the north is Wolfensberger Road, to the east is 150 Wolfensberger Road, and to the south is Eighth Street.
4. Area of Disturbance: The proposed development is expected to disturb a total area of approximately 0.85 acres.
5. Existing Ground Cover: The ground cover of the site is comprised of existing buildings, driveways, parking, sidewalks, and landscaped areas which slopes to the northeast at 1.5%-8.0%.

Refer to Appendix D for the Vicinity Map.

b. SOIL CONDITIONS

Soils can be classified in four different hydrologic groups, A, B, C, or D to help predict stormwater runoff rates. Hydrologic group "A" is characterized by deep, well-drained coarse-grained soils with a rapid infiltration rate when thoroughly wet and having a low runoff potential. Group "D" typically has a clay layer at or near to the surface, or a very shallow depth to impervious bedrock and has a very slow infiltration rate and a high runoff potential. See Soils Map, Appendix A. The following soil types are present in the 826 Park Street building expansion and 200 Wolfensberger Road site:

Table 1.1 – NRCS Soil Survey for El Paso County

Soil ID Number	***Soil***	***Hydrologic Classification***	***Drainage Class***	***Percent of Site***
BrB	Bresser sandy loam, cool, 1 to 3 percent slopes	B	Well Drained	72.0%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	B	Well Drained	28.0%

II. DESIGN CRITERIA

i. This project is located within the Town of Castle Rock and is subject to the design criteria set forth in the Storm Drainage Design and Technical Criteria Manual (SDDTCM). In addition to the SDDTCM, the Urban Storm Drainage Criteria Manuals, Volumes 1 through 3, dated 2016 have been used (USDCM).

ii. UD Methods

The hydrology for this project uses the **Rational Method** as recommended by the Storm Drainage Design and Technical Criteria Manual (SDDTCM) for the minor and major storms. The Rational Method is used for drainage basins up to 160-acres in size. The Rational Method uses the following equation:

$Q=C*i*A$

Where:

Q	=	Maximum runoff rate in cubic feet per second (cfs)
C	=	Runoff coefficient
i	=	Average rainfall intensity (inches per hour)
A	=	Area of drainage sub-basin (acres)

Rational Method coefficients from table 6-7 of the SDDTCM for developed land were utilized in the Rational Method calculations. See Appendix B for more information.

Time of Concentration

The time of concentration consists of the initial time of overland flow and the travel time in a channel to the inlet or point of interest. A minimum time of concentrations of 5 minutes is utilized for urban areas. The Rational Calculation spreadsheet included in Appendix A shows an initial overland flow length, a channel or street flow length for each sub-basin, and also demonstrates the time of concentration calculations for initial (overland) and channel (or street) conditions. A maximum "True Initial" Flow Length of 300 feet will be used for pre-developed sub-basins and a maximum length of 100 feet will be used for Developed sub-basins for time of concentration calculations.

Rainfall Depths

Rainfall depths for the 1-hour storm duration were taken from the Table 6-1 of the SDDTCM, shown below.

TABLE 6-1
1-HOUR POINT RAINFALL VALUES FOR THE TOWN OF CASTLE ROCK (INCHES)

2- YR	5-YR	10-YR	50-YR	100-YR
1.06	1.43	1.66	2.26	2.60

Rainfall Intensity

Rainfall intensity curves were derived using equation RA-3 in the Rainfall section of the USDCM.

C-Factors

C-factors for the Rational Method are based on anticipated land use and are taken from Table 6-7 of the SDDTCM (Included in Appendix B). Paved areas and roofs are modeled under the Roof/Paved category. Landscaped areas are modeled under the Landscaped areas category.

III. PREVIOUS STUDIES

Previous studies relating to the developed site are not available for reference.

IV. EXISTING DRAINAGE CONDITIONS

The subject area is located within the East Plum Creek watershed. Predevelopment conditions have been analyzed using the Rational Method. Runoff generated on-site generally drains overland to the northeast to be collected in a series of existing inlets. The collected flows are conveyed to existing detention basins via existing storm sewer. There are no offsite flows that enter the site. A delineation of the basin boundaries can be found in Appendix D in drawing DR-01. Runoff calculations can be found in Appendix A. The existing runoff design points are described below:

Design Point 1 (Q_5 = 2.9 cfs, Q_{100} = 5.6 cfs) (sub-basin: EX-1; Area: 0.87 Ac.) (Slopes: 2.0 to 8.0%) This design point represents the runoff from sub-basin EX-1 that drains into the existing area inlet at Design Point 1 (DP-1). Sub-basin EX-1 contains an existing building and associated landscaping, walkways, and drives. Flows generated within sub-basin EX-1 drain overland and in curb and gutter to be collected in the existing area inlet at DP-1. Stormwater collected in the existing inlet at DP-1 receives water quality treatment in an existing underground detention facility. The underground portion of the detention facility was designed to have capacity for the minor storm event. The 100-year storm event is detained within the existing parking area surrounding DP-1 and discharges through the existing inlet at DP-1. Stormwater discharge from the existing detention facility continues downstream in existing storm infrastructure.

Design Point 2 (Q_5 = 5.0 cfs, Q_{100} = 10.0 cfs) (sub-basin: EX-2; Area: 1.69 Ac.) (Slopes: 2.0 to 8.0%) This design point represents the runoff from sub-basin EX-2 that drains into the existing Type 13 combination inlet at Design Point 2 (DP-2). Sub-basin EX-2 contains an existing building and associated landscaping, walkways, and drives. Flows generated within sub-basin EX-2 drain overland and in curb and gutter to be collected in the existing combination inlet at DP-2. Stormwater collected at DP-2 continues downstream in existing storm infrastructure.

Design Point 3 (Q_5 = 1.1 cfs, Q_{100} = 2.1 cfs) (sub-basin: EX-3; Area: 0.29 Ac.) (Slopes: 2.0 to 6.0%) This design point represents the runoff from sub-basin EX-3 that drains into the existing Type 13 combination inlet at Design Point 3 (DP-3). Sub-basin EX-3 contains existing landscaping, walkways, and drives. Flows generated within sub-basin EX-3 drain overland and in curb and gutter to be collected in the existing combination inlet at DP-3. Stormwater collected at DP-3 continues downstream in existing storm infrastructure.

Design Point 4 (Q_5 = 0.1 cfs, Q_{100} = 0.2 cfs) (sub-basin: EX-4; Area: 0.04 Ac.) (Slopes: 1.5 to 2.0%) This design point represents the runoff from sub-basin EX-4 that drains into the existing curb and gutter along the east side of Park Street. Sub-basin EX-4 contains existing landscaping, and sidewalk. Flows generated within sub-basin EX-4 drain overland to the west to be collected in the existing curb and gutter at DP-4.

Stormwater collected at DP-4 continues downstream in along historic paths.

Design Point 5 (Q_5 = 0.1 cfs, Q_{100} = 0.2 cfs) (sub-basin: EX-5; Area: 0.04 Ac.) (Slopes: 1.5 to 5.0%) This design point represents the runoff from sub-basin EX-5 that drains into the existing curb and gutter along the north side of Eighth Street. Sub-basin EX-5 contains existing landscaping, driveway, and sidewalk. Flows generated within sub-basin EX-5 drain overland to the south to be collected in the existing curb and gutter at DP-5. Stormwater collected at DP-5 continues downstream in along historic paths.

V. PROPOSED DRAINAGE CONDITIONS

Post development conditions have been analyzed using the rational routed flow. Runoff generated on-site generally drains overland to the northeast to be collected in a series of existing inlets. The collected flows are conveyed to existing detention basins via existing storm sewer. There are no offsite flows that enter the site. A delineation of the basin boundaries can be found in Appendix D in drawing DR-02. Runoff calculations can be found in Appendix A. The proposed runoff design points are described below:

Design Point 1 (Q_5 = 3.1 cfs, Q_{100} = 5.9 cfs) (sub-basin: PR-1; Area: 0.92 Ac.) (Slopes: 2.0 to 8.0%) This design point represents the runoff from sub-basin PR-1 that drains into the existing detention facility at Design Point 1 (DP-1). Sub-basin PR-1 contains an existing building with associated landscaping, walkways, and drives and is to be redeveloped to include additions to the existing building and paved parking areas. Flows generated within sub-basin PR-1 drain overland and in curb and gutter to be collected in the existing detention facility at DP-1 as in existing conditions. The existing detention facility is sized to provide detention and water quality treatment for the developed site. The underground portion of the existing detention facility is currently filled with debris making it unfunctional. To address items preventing proper function of the detention facility, removal of debris and sediment from the existing detention facility will be included as part of the site improvements. Annual inspection of the facility and removal of sediment and debris from the interior when it reaches a depth of 8 inches is recommended to promote long term function and integrity of the system. Discharge from the detention facility continues downstream in existing storm infrastructure as in existing conditions. The proposed improvements increase the stormwater runoff at DP-1 by 0.2 and 0.3 cfs during the 5 and 100-year storm events respectively. This represents a negligible impact to the overall drainage characteristics of the sub-basin tributary to this Design Point.

Design Point 2 (Q_5 = 5.5 cfs, Q_{100} = 10.3 cfs) (sub-basin: PR-2; Area: 1.64 Ac.) (Slopes: 2.0 to 8.0%) This design point represents the runoff from sub-basin PR-2 that drains into the existing Type 13 combination inlet at Design Point 2 (DP-2). Sub-basin PR-2 contains an existing building and associated landscaping, walkways, and drives and is to redeveloped to include additional paved parking. Flows generated within sub-basin PR-2 drain overland and in curb and gutter to be collected in the existing combination inlet at DP-2 as in existing conditions. Stormwater collected at DP-2 continues downstream in existing storm infrastructure. The proposed improvements increase the stormwater runoff at DP-2 by 0.5 and 0.3 cfs during the 5 and 100-year storm events respectively. This represents a negligible impact to the overall drainage characteristics of the sub-basin tributary to this Design Point.

Design Point 3 (Q_5 = 1.1 cfs, Q_{100} = 2.1 cfs) (sub-basin: PR-3; Area: 0.29 Ac.) (Slopes: 2.0 to 6.0%) This design point represents the runoff from sub-basin PR-3 that drains into the existing Type 13 combination inlet at Design Point 3 (DP-3). Sub-basin PR-3 maintains existing conditions containing existing landscaping, walkways, and drives. Flows generated within sub-basin PR-3 drain overland and in curb and

gutter to be collected in the existing combination inlet at DP-3. Stormwater collected at DP-3 continues downstream in existing storm infrastructure.

Design Point 4 (Q_5 = 0.1 cfs, Q_{100} = 0.2 cfs) (sub-basin: PR-4; Area: 0.04 Ac.) (Slopes: 1.5 to 2.0%) This design point represents the runoff from sub-basin PR-4 that drains into the existing curb and gutter along the east side of Park Street. Sub-basin PR-4 maintains existing conditions containing existing landscaping, and sidewalk. Flows generated within sub-basin PR-4 drain overland to the west to be collected in the existing curb and gutter at DP-4. Stormwater collected at DP-4 continues downstream in along historic paths.

Design Point 5 (Q_5 = 0.1 cfs, Q_{100} = 0.2 cfs) (sub-basin: PR-5; Area: 0.04 Ac.) (Slopes: 1.5 to 5.0%) This design point represents the runoff from sub-basin PR-5 that drains into the existing curb and gutter along the north side of Eighth Street. Sub-basin PR-5 maintains existing conditions containing existing landscaping, driveway, and sidewalk. Flows generated within sub-basin PR-5 drain overland to the south to be collected in the existing curb and gutter at DP-5. Stormwater collected at DP-5 continues downstream in along historic paths.

VI. 4 STEP PROCESS / DETENTION

Per the SDDTCM Chapter 13, Section 1.4, The Town of Castle Rock does not require projects that disturb less than 1-acre to provide detention or permanent water quality treatment facilities. This project, which is expected to disturb less than an acre, is excluded from the 4 Step Process. The Permanent Water Quality Determination Worksheet is included in Appendix B.

Detention for the site is provided by two existing detention facilities and will remain unchanged in the proposed conditions. Stormwater generated in sub-basin PR-1 drains to the existing detention facility at DP-1. Stormwater generated in sub-basin PR-2 is collected in an existing area inlet at DP-2 and conveyed via existing storm sewer downstream to an existing detention facility located to the east of the site. Both detention facilities are privately owned and maintained. Maintenance of the facilities is the responsibility of the respective parcel owners. The detention facility at DP-1 includes an underground component that provides water quality treatment for its tributary area. The underground component is currently filled with debris which is clogging the inlet at DP-1. To function properly, the accumulated debris will need to be removed at the same time as this development. It is recommended that the underground detention facility be inspected once annually and the sediment removed when it reaches a depth of 8 inches in the CMP chamber. Maintenance of any onsite inlet when blockage by leaves occurs should occur when observed or as soon as practicable.

VII. FLOODPLAIN STATEMENT

No portion of the site is located within a 100-year floodplain as determined by the Flood Insurance Rate Map (FIRM) number 08035C0188G effective date, March 16, 2016 (see Appendix C).

VIII. Summary

This phase I drainage report demonstrates that the proposed improvements associated with the 826 Park Street building expansion and 200 Wolfensberger Road site are in conformance with the Storm Drainage Design and Technical Criteria Manual (SDDTCM). These proposed improvements will not adversely affect downstream or surrounding developments and are in conformance with the pertinent studies for the area.

IX. References

1. ***Storm Drainage Design and Technical Criteria Manual***, Castle Rock Water Department, June 2019
2. ***Web Soil Survey of Castle Rock Area, Colorado. United States Department of Agriculture Soil Conservation Service***.
3. ***Flood Insurance Rate Maps for Douglas County, Colorado and Incorporated Areas, Panel 188 of 495, Federal Emergency Management Agency***, Effective Date March 16, 2016.
4. ***Urban Storm Drainage Criteria Manual, Vol. 1-3*** by Urban Drainage and Flood Control District (UDFCD), January 2016

APPENDICES

APPENDIX A

HYDROLOGIC CALCULATIONS

Rational Method - Existing Conditions

Project Name:	826 Park Street building expansion and 200 Wolfensberger Road
Project Location:	Castle Rock, CO
Designer	WCG
Notes:	EXISTING CONDITIONS

Average Channel Velocity 4.00 ft/s (If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)

Channel Flow Type Key

Heavy Meadow	2
Tillage/Field	3
Short Pasture and Lawns	4
Nearly Bare Ground	5
Grassed Waterway	6
Paved Areas	7

		Area			Rational 'C' Values									Flow Lengths										Tc	Rainfall Intensity & Rational Flow Rate					
					95%			20%																							
Sub-basin	**Comments**			Soil Group	Roof/Paved Areas (95% Impervious)			Landscaped Areas (20% Impervious)			Composite		Percent Impervious	Initial	True Initial	Channel	True Channel	Average (decimal)	Initial	Average (%)	Channel Flow Type (See Key above)	Velocity	Channel	Total	i5	Q5	i100	Q100	**Sub-basin**
		sf	acres		C5	C100		C5	C100	Area (SF)	C5	C100		ft	Length ft	ft	Length ft	Slope	Tc (min)	Slope	Ground Type	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	
EX-1		37880	0.87	B	0.81	0.87	31578	0.15	0.52	6302	0.70	0.81	82.52	100	100	212	212	0.02	5.53	2.2	7	2.97	1.19	6.72	4.73	**2.9**	7.93	**5.6**	***EX-1***
EX-2		73564	1.69	B	0.81	0.87	58153	0.15	0.52	15411	0.67	0.80	79.29	100	100	425	425	0.02	6.02	2.1	7	2.90	2.44	8.46	4.38	**5.0**	7.35	**10.0**	***EX-2***
EX-3		12562	0.29	B	0.81	0.87	11176	0.15	0.52	1386	0.74	0.83	86.73	50	50	186	186	0.03	3.07	3.4	7	3.69	0.84	5.00	5.17	**1.1**	8.68	**2.1**	***EX-3***
EX-4		1738	0.04	B	0.81	0.87	765	0.15	0.52	973	0.44	0.67	53.01	20	20	0	0	0.02	4.36	1.8	4	0.94	0.00	5.00	5.17	**0.1**	8.68	**0.2**	***EX-4***
EX-5		1537	0.04	B	0.81	0.87	990	0.15	0.52	547	0.58	0.75	68.31	15	15	0	0	0.05	2.14	5.0	4	1.57	0.00	5.00	5.17	**0.1**	8.68	**0.2**	***EX-5***
DESIGN POINTS	***Sub-basins***																												***DESIGN POINTS***
1	***EX-1***	37880	0.87	B	0.81	0.87	31578	0.15	0.52	6302	0.70	0.81	82.52	100	100	212	212	0.02	5.53	2.2	7	2.97	1.19	6.72	4.73	**2.9**	7.93	**5.6**	***1***
2	***EX-2***	73564	1.69	B	0.81	0.87	58153	0.15	0.52	15411	0.67	0.80	79.29	100	100	425	425	0.02	6.02	2.1	7	2.90	2.44	8.46	4.38	**5.0**	7.35	**10.0**	***2***
3	***EX-3***	12562	0.29	B	0.81	0.87	11176	0.15	0.52	1386	0.74	0.83	86.73	50	50	186	186	0.03	3.07	3.4	7	3.69	0.84	5.00	5.17	**1.1**	8.68	**2.1**	***3***
4	***EX-4***	1738	0.04	B	0.81	0.87	765	0.15	0.52	973	0.44	0.67	53.01	20	20	0	0	0.02	4.36	1.8	4	0.94	0.00	5.00	5.17	**0.1**	8.68	**0.2**	***4***
5	***EX-5***	1537	0.04	B	0.81	0.87	990	0.15	0.52	547	0.58	0.75	68.31	15	15	0	0	0.05	2.14	5.0	4	1.57	0.00	5.00	5.17	**0.1**	8.68	**0.2**	***5***

Rational Method - Proposed Conditions

Project Name:	826 Park Street building expansion and 200 Wolfensberger Road
Project Location:	Castle Rock, CO
Designer	WCG
Notes:	Proposed Condition

Average Channel Velocity	4.00	ft/s	(If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow	0.04	ft/ft	(If Elevations are used, this will be ignored)

Channel Flow Type Key

Heavy Meadow	2
Tillage/Field	3
Short Pasture and Lawns	4
Nearly Bare Ground	5
Grassed Waterway	6
Paved Areas	7

		Area			Rational 'C' Values (95% / 20%)									Flow Lengths										Tc	Rainfall Intensity & Rational Flow Rate					
Sub-basin	**Comments**			Soil Group	Roof/Paved Areas (95% Impervious)			Landscaped Areas (20% Impervious)			Composite		Percent Impervious	Initial	True Initial	Channel	True Channel	Average (decimal)	Initial	Average (%)	Channel Flow Type (See Key above)	Velocity	Channel	Total	i5	Q5	i100	Q100	**Sub-basin**
		sf	acres		C5	C100		C5	C100	Area (SF)	C5	C100		ft	Length ft	ft	Length ft	Slope	Tc (min)	Slope	Ground Type	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	
PR-1		39940	0.92	B	0.81	0.87	34154	0.15	0.52	5786	0.71	0.82	84.13	100	100	220	220	0.02	5.60	1.9	7	2.76	1.33	6.93	4.68	**3.1**	7.86	**5.9**	***PR-1***
PR-2		71490	1.64	B	0.81	0.87	66304	0.15	0.52	5186	0.76	0.84	89.56	100	100	540	540	0.02	5.00	1.8	7	2.68	3.35	8.35	4.40	**5.5**	7.39	**10.3**	***PR-2***
PR-3		12562	0.29	B	0.81	0.87	11180	0.15	0.52	1382	0.74	0.83	86.75	50	50	186	186	0.03	3.07	3.4	7	3.69	0.84	5.00	5.17	**1.1**	8.68	**2.1**	***PR-3***
PR-4		1738	0.04	B	0.81	0.87	767	0.15	0.52	971	0.44	0.67	53.10	20	20	0	0	0.02	4.36	1.8	4	0.94	0.00	5.00	5.17	**0.1**	8.68	**0.2**	***PR-4***
PR-5		1537	0.04	B	0.81	0.87	990	0.15	0.52	547	0.58	0.75	68.31	15	15	0	0	0.05	2.14	5.0	4	1.57	0.00	5.00	5.17	**0.1**	8.68	**0.2**	***PR-5***
DESIGN POINTS	***Sub-basins***																												***DESIGN POINTS***
1	***PR-1***	39940	0.92	B	0.81	0.87	34154	0.15	0.52	5786	0.71	0.82	84.13	100	100	220	220	0.02	5.60	1.9	7	2.76	1.33	6.93	4.68	**3.1**	7.86	**5.9**	***1***
2	***PR-2***	71490	1.64	B	0.81	0.87	66304	0.15	0.52	5186	0.76	0.84	89.56	100	100	540	540	0.02	5.00	1.8	7	2.68	3.35	8.35	4.40	**5.5**	7.39	**10.3**	***2***
3	***PR-3***	12562	0.29	B	0.81	0.87	11180	0.15	0.52	1382	0.74	0.83	86.75	50	50	186	186	0.03	3.07	3.4	7	3.69	0.84	5.00	5.17	**1.1**	8.68	**2.1**	***3***
4	***PR-4***	1738	0.04	B	0.81	0.87	767	0.15	0.52	971	0.44	0.67	53.10	20	20	0	0	0.02	4.36	1.8	4	0.94	0.00	5.00	5.17	**0.1**	8.68	**0.2**	***4***
5	***PR-5***	1537	0.04	B	0.81	0.87	990	0.15	0.52	547	0.58	0.75	68.31	15	15	0	0	0.05	2.14	5.0	4	1.57	0.00	5.00	5.17	**0.1**	8.68	**0.2**	***5***

APPENDIX B

STANDARD DESIGN CHARTS AND TABLES

Matrix

TABLE 6-2. RECOMMENDED IMPERVIOUSNESS BY LAND USE

LAND USE/DENSITY	IMPERVIOUSNESS
Residential	
Single-family Housing (SFH) – Rural (0 – 3 du/ac)	35%
SFH – Low & Medium-density (3 – 5 du/ac)	55%
SFH – High-density (5 - 20 du/ac)	65%
Manufactured Housing (>= 10 du/ac)	65%
Multi-family Housing (MFH) – Medium-density (5 – 20 du/ac)	65%
MFH – High-density MFH (>20 du/ac)	70%
Commercial	
Commercial – Low-density	65%
Commercial – Medium- to High-density	80%
Commercial – Urban Core	90%
Industrial/Institutional	
Schools	55%
Office/institutional	65%
Industrial Areas	75%
Solar Fields, Gravel Cover[1,2]	60%
Solar Fields, Grass Cover[1,2]	45%
Parks and Open Space	
Open Space, Undisturbed Native Grasses	5%
Community Parks	25%
Neighborhood Parks	15%
Golf Courses	30%
Cemeteries	25%

Note: Recommended imperviousness values shown in the table are the minimum imperviousness values for a specific land use. It is the engineer's responsibility to select imperviousness values that appropriately reflect the actual density of the proposed development.

[1] Use these values at the master planning scale or when the specific layout of panels is not known. Use values from the surface type (Table 6-3) at the site planning and design stage when panel width, panel spacing, and panel orientation relative to contours are known.

[2] Assumes 1:1 ratio of panels to aisles. See MHFD's technical memorandum regarding *Determination of Solar Panel Field Runoff Coefficients and Imperviousness Values* for additional information on procedures to reflect other impervious areas such as roads and pads that may be part of a solar field and layouts with wider inter-panel spacing.

TABLE 6-3. RECOMMENDED IMPERVIOUSNESS BY SURFACE TYPES

SURFACE TYPES		IMPERVIOUSNESS
Roadways and Paved Streets		95%
Concrete Driveways and Walks		95%
Roofs		95%
Gravel	No Traffic (Pedestrian Use)	40%
	Low-traffic Areas (Maintenance Paths and Substations)	60%
	High-traffic Areas (Roadways and Parking)	80%
Disturbed Soil (Including Lawns, Managed/Active Turf, Landscaped Areas with Water-Wise Vegetation, and Uncompacted Gravel/Mulch Planting Beds)		20%
Undisturbed or Decompacted Soil (Native Grasses and Open Space Areas)		5%
Artificial Turfs[1]	Landscape Applications (without Subgrade Drainage Layer)	25% – 45%
	Sport Fields (with Underdrain Pipe System)	60% – 80%
Water Surfaces (Lakes/Reservoirs/Irrigation Ponds)		100%
Solar Fields[2]	Grass Cover (Varies with Panel Orientation Relative to Ground Contours)	10% – 45%
	Gravel Cover (Varies with Panel Orientation Relative to Ground Contours)	50% – 75%
Historic Flow Analysis, Greenbelts, Agricultural		5%
Newly Graded Areas		65%
Stormwater Control Measures[3]	Retention Ponds & Constructed Wetland Ponds	100%
	Rooftop Systems – Blue Roofs	95%
	Rooftop Systems – Green Roofs (extensive)	65%
	Rooftop Systems – Green Roofs (intensive)	50%
	Permeable Pavement – CGP/PGP/RGP	55%
	Permeable Pavement – PICP	45%
	Extended Detention Basins	25%
	Receiving Pervious Areas (incl. Grass Buffers & Grass Swales)	20%
	Bioretention & Sand Filters	10%

[1] Consult with the manufacturer to get a recommended value.

[2] Assumes 1:1 ratio of panels to aisles. See MHFD's technical memorandum regarding *Determination of Solar Panel Field Runoff Coefficients and Imperviousness Values* for additional information on procedures for determining percent imperviousness based on panel width, panel spacing, and panel orientation relative to ground contours and how to reflect other impervious areas such as roads and pads that may be part of a solar field and layouts with wider inter-panel spacing.

[3] See MHFD's technical memorandum regarding *Evaluation of Percent Imperviousness for Stormwater Control Measures* for background information.

TABLE 6-7. RUNOFF COEFFICIENTS, *C*, NRCS HSG B

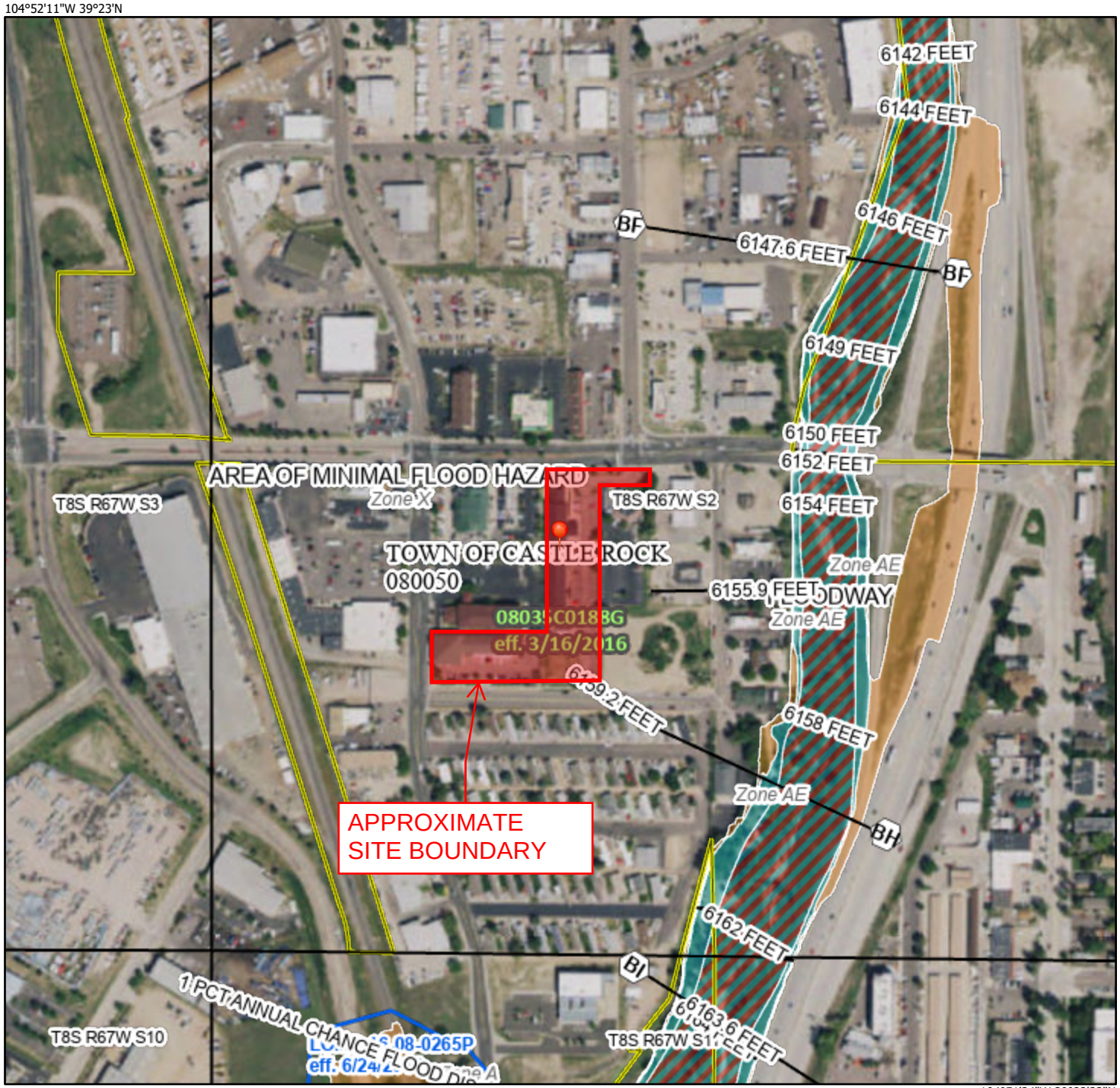
TOTAL OR EFFECTIVE % IMPERVIOUS	NRCS HSG B						
	WQE & 2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.01	0.07	0.26	0.34	0.44	0.54
5%	0.03	0.03	0.10	0.28	0.36	0.45	0.55
10%	0.06	0.07	0.14	0.31	0.38	0.47	0.57
15%	0.09	0.11	0.18	0.34	0.41	0.50	0.59
20%	0.13	0.15	0.22	0.37	0.44	0.52	0.61
25%	0.17	0.19	0.26	0.41	0.47	0.54	0.63
30%	0.20	0.23	0.30	0.44	0.50	0.57	0.65
35%	0.24	0.27	0.34	0.47	0.52	0.59	0.66
40%	0.29	0.32	0.38	0.50	0.55	0.61	0.68
45%	0.33	0.36	0.42	0.53	0.58	0.64	0.70
50%	0.37	0.40	0.46	0.56	0.61	0.66	0.72
55%	0.42	0.45	0.50	0.59	0.63	0.68	0.74
60%	0.46	0.49	0.54	0.63	0.66	0.71	0.76
65%	0.50	0.54	0.58	0.66	0.69	0.73	0.77
70%	0.55	0.58	0.62	0.69	0.72	0.75	0.79
75%	0.60	0.63	0.66	0.72	0.75	0.77	0.81
80%	0.64	0.67	0.70	0.75	0.77	0.80	0.83
85%	0.69	0.72	0.74	0.78	0.80	0.82	0.85
90%	0.74	0.76	0.78	0.81	0.83	0.84	0.87
95%	0.79	0.81	0.82	0.85	0.86	0.87	0.88
100%	0.84	0.86	0.86	0.88	0.89	0.89	0.90

APPENDIX C

REPORT REFERENCES

National Flood Hazard Layer FIRMette

FEMA



Basemap Imagery Source: USGS National Map 2023

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 Cross Sections with 1% Annual Chance
- 17.5 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 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 6/12/2024 at 5:06 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.

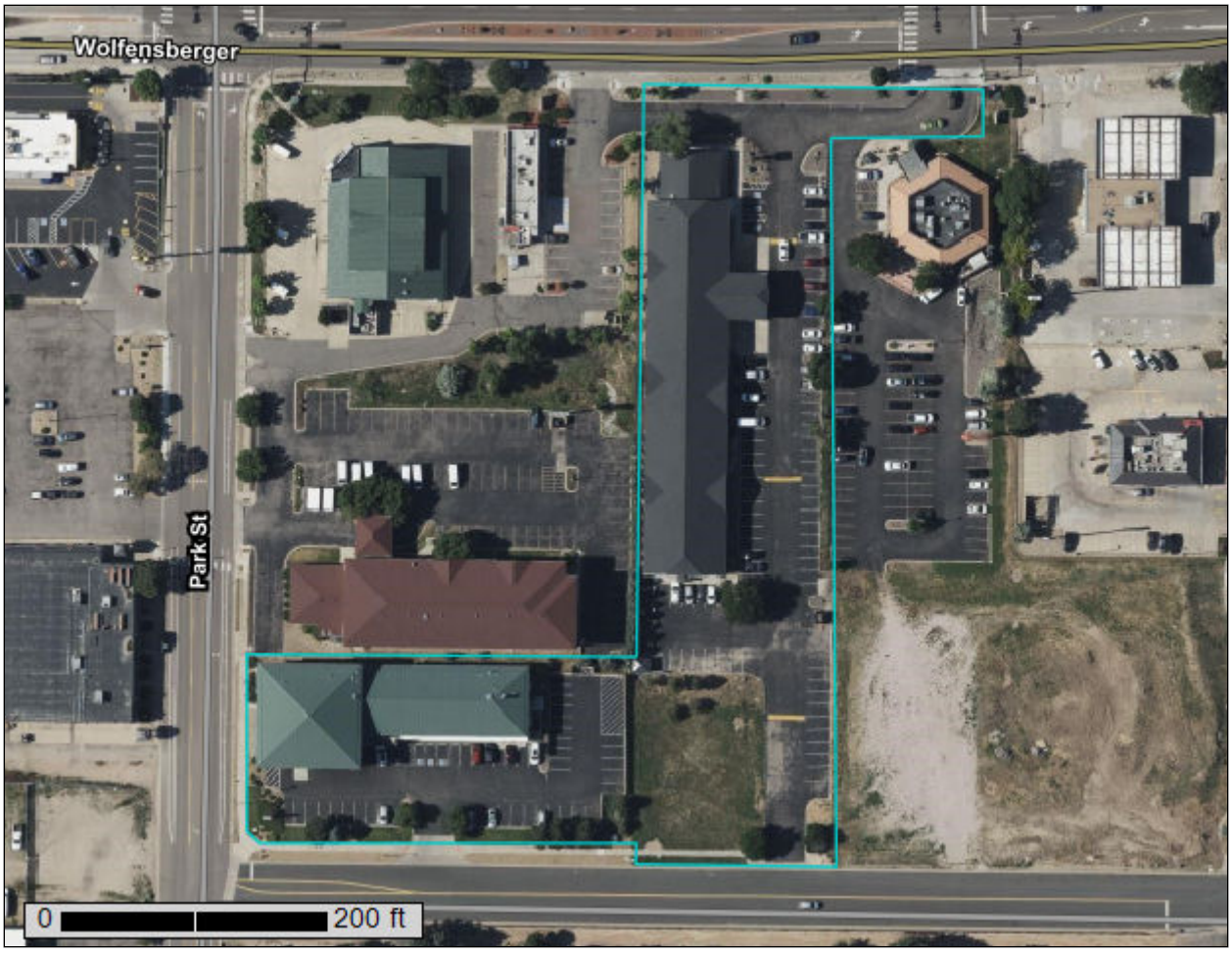
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Castle Rock Area, Colorado



June 7, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

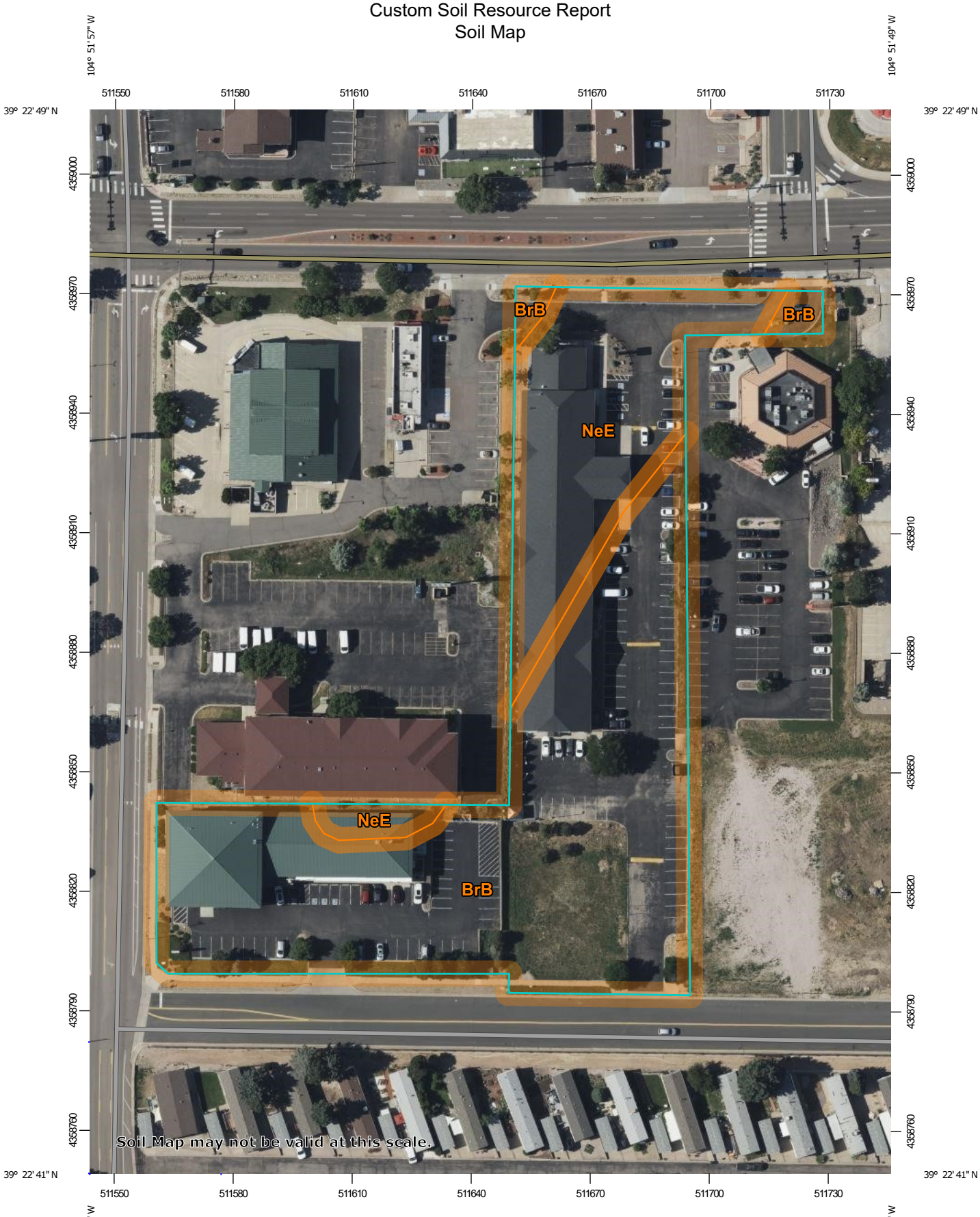
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,300 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 1:20,000.

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: Castle Rock Area, Colorado
Survey Area Data: Version 16, Aug 24, 2023

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BrB	Bresser sandy loam, cool, 1 to 3 percent slopes	2.1	72.0%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	0.8	28.0%
Totals for Area of Interest		**3.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Castle Rock Area, Colorado

BrB—Bresser sandy loam, cool, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tlpj
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 100 to 130 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Bresser, cool, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bresser, Cool

Setting

Landform: Hillslopes, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Tertiary aged alluvium derived from arkose

Typical profile

Ap - 0 to 5 inches: sandy loam
Bt1 - 5 to 8 inches: sandy loam
Bt2 - 8 to 27 inches: sandy clay loam
Bt3 - 27 to 36 inches: sandy loam
C - 36 to 80 inches: loamy coarse sand

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Truckton

Percent of map unit: 5 percent
Landform: Hillslopes, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Sampson

Percent of map unit: 5 percent
Landform: Terraces, alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XC202CO - Loamy Foothill 14-19 PZ
Hydric soil rating: No

NeE—Newlin gravelly sandy loam, 8 to 30 percent slopes

Map Unit Setting

National map unit symbol: jqzg
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 49 to 51 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Newlin and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Newlin

Setting

Landform: Terraces, mesas, plateaus
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Unconformable sandy and gravelly and/or mixed source alluvium

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam
H2 - 8 to 17 inches: gravelly sandy clay loam
H3 - 17 to 22 inches: gravelly sandy loam

H4 - 22 to 60 inches: very gravelly sand

Properties and qualities

Slope: 8 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Bresser

Percent of map unit: 5 percent
Hydric soil rating: No

Stapleton

Percent of map unit: 4 percent
Hydric soil rating: No

Satanta

Percent of map unit: 4 percent
Hydric soil rating: No

Aquic haplustolls

Percent of map unit: 2 percent
Landform: Swales
Hydric soil rating: Yes

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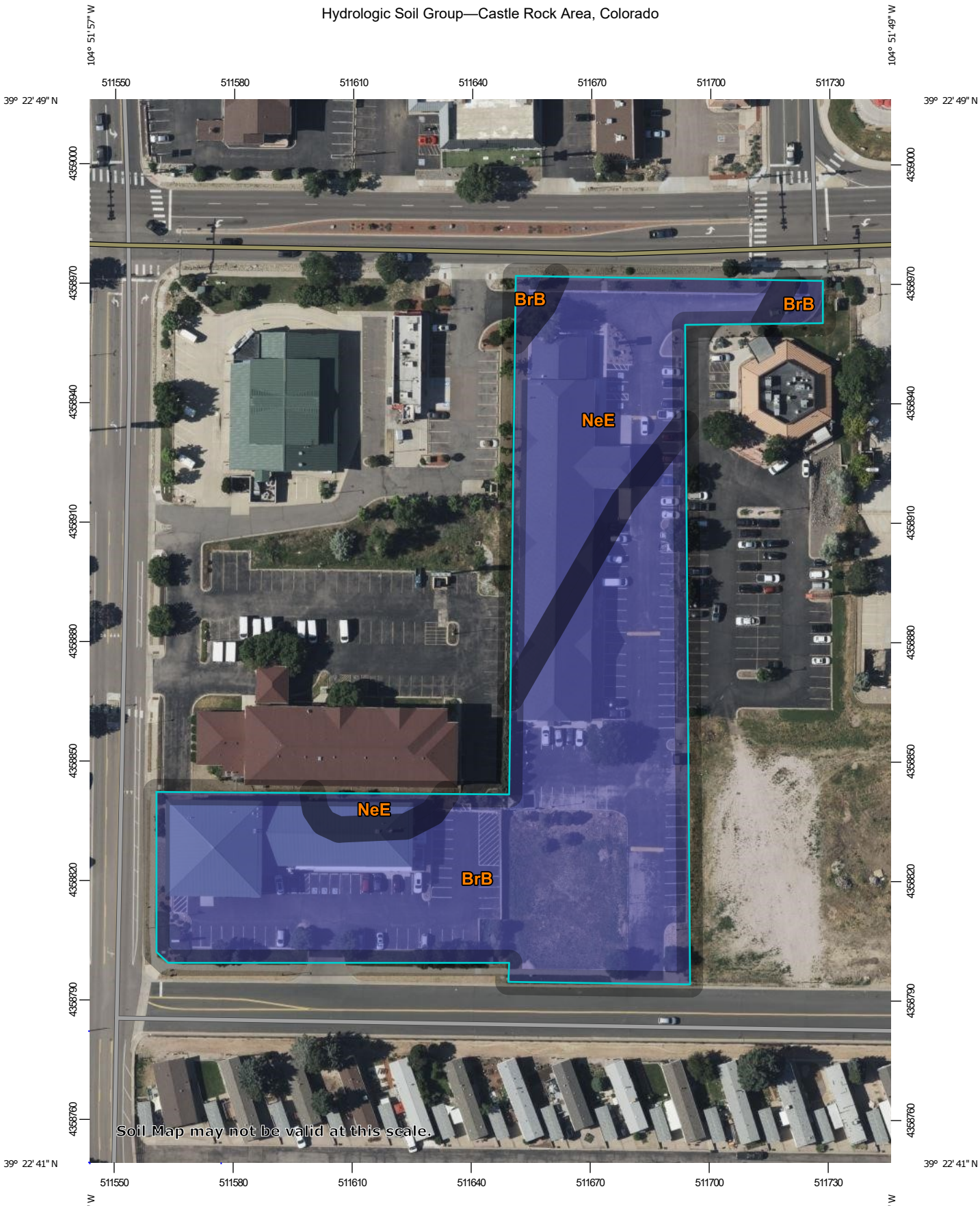


Map Scale: 1:1,300 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

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 1:20,000.

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: Castle Rock Area, Colorado
Survey Area Data: Version 16, Aug 24, 2023

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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
BrB	Bresser sandy loam, cool, 1 to 3 percent slopes	B	2.1	72.0%
NeE	Newlin gravelly sandy loam, 8 to 30 percent slopes	B	0.8	28.0%
Totals for Area of Interest			**3.0**	**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

Summary of Water Quality Conformance to MS4 Permit

The purpose of this worksheet is to document conformance with the Town of Castle Rock's MS4 permit with regard to permanent water quality on land disturbance projects.

Project Name 826 Park Street building expansion and 200 Wolfensberger Road

Project Owner Castle Oaks Evangelical Covenant Church Inc

Project Location 200 E Wolfensberger Road & 826 Park Street

ToCR Project Number _____

Total Site Area 2.92 **acres**

Total Size of Common Plan of Development 2.92 **acres**

Check all that apply:

☐ **Project within Plum Creek Basin**

☐ **Project within Cherry Creek Basin**

Estimated construction completion date _____

---

1. The water quality control measure(s) for applicable development sites shall meet one of the following base design standards as per the SDDTCM Section 14.4. Please select all design standards that were applied to meet conformance with the MS4 on this site.

❒ WQCV standard

❒ Pollutant removal standard

❒ Runoff reduction standard

❒ Applicable site draining to regional WQVC control measure (accepts drainage prior to discharging to WOTS)

❒ Applicable site draining to regional WQVC control facility (with receiving pervious area control measure upstream of WOTS)

❒ Constrained redevelopment sites standard

- Imperviousness of existing site _____/_____(Imp. Ac/Site Ac) =____%
- Variance required TCV No. _____

❒ Existing control measure with WQCV per previous criteria standards

- Reference Construction Permit No. _____

❒ Cherry Creek Basin only, choose one: ☐ Tier 1 ☐ Tier 2 ☐ Tier 3

☑ No control measures provided (See Permanent WQ Worksheet for applicability)

Summary of Water Quality Conformance to MS4 Permit

2. Was an exclusion to water quality applied as per SDDTCM Section 13.1.5? ☐ Yes ☐ No

   i. If yes, please select all that apply, provide total excluded impervious area(s) and submit variance, as applicable: TCV No. _____

   ❒ Pavement management site

   Excluded impervious area: _____ acres

   ❒ Excluded roadway redevelopment

   Excluded impervious area: _____ acres

   ❒ Excluded existing roadway areas

   Excluded impervious area: _____ acres

   ❒ Above ground and below ground utilities

   ❒ Large lot single family home

   ❒ Non-residential and non-commercial infiltration

   Excluded impervious area: _____ acres

   ❒ Land disturbance for land to remain undeveloped

   Excluded impervious area: _____ acres

   ❒ Stream Stabilization Sites

   Excluded impervious area: _____ acres

   ❒ Trails

   Excluded impervious area: _____ acres

   ❒ Oil and Gas Exploration

3. For Development and Redevelopment sites, following any exclusions claimed above, was any portion of the site excluded up to 20% of the site and not to exceed one acre? ☐ Yes ☐ No

   If yes, complete the following:

   Excluded area: _____ acres

   Total Site area: _____ acres, _____ % site excluded

4. For Constrained sites, was any portion of the site excluded up to 50% of the site and not to exceed 50% of the impervious area? ☐ Yes ☐ No

   If yes, complete the following:

   Excluded area: _____ acres

   Excluded impervious area: _____ acres

   Total Site area: _____ acres, _____ % site excluded

   Total Impervious area: _____ acres, _____ % impervious excluded

Permanent Water Quality Determination Worksheet (Taken from 2019 SDDTCM Sections 13.1.4 and 13.1.5)

Project: 826 Park Street building expansion and Unity **Project #:** **Applicant:**

Section	Question	Response	Instructions
1	**Non-applicable Sites**		
1.1	Will the project result in a temporary disturbance of greater than one acre?	◉ No ○ Yes	Proceed to section 1.2. Proceed to section 2.
1.2	Is the project part of a larger common plan of development or sale where multiple separate and distinct construction activities may be taking place at different times on different schedules, but remain related and are within 1/4 mile of each other? (A common plan of development will generally be documented on a site development plan, master plan, or equivalent, for the property/project)	◉ No ○ Yes	Proceed to section 1.3. Proceed to section 2.
1.3	Is the project within the Cherry Creek Watershed?	○ Yes ◉ No	Permanent water quality control measures may be required. Refer to Water Qualtiy Control Regulation 72.7 for details and allowable exclusions. Permanent water quality control measures are not required.

Section	Question	Response	Instructions
2	**Applicable Site Types and Exclusions by Variance**		
2.1	Does the project have more than 35% impervious area on the existing site?	○ No ○ Yes	Project is an applicable Development Site. Proceed to section 3. Proceed to 2.2.
2.2	Does the project have greater than 75% impervious area on the existing site?	○ No ○ Yes	Project is an applicable Redevelopment Site. Proceed to section 3. Project is an applicable Constrainted Redevelopment Site. Proceed to 2.3.
2.3	Will 100% of the runoff from the existing and proposed site be captured and treated using one or more of the allowable design standards for permanent water quality?	○ Yes ○ No	No further action required. Proceed to 2.4.
2.4	Do any other water quality exclusions apply to the site?	○ No ○ Yes	Portions of the project are excluded. Proceed with design in accordance with Constrained Redevelopment standards and apply for **variance** for Constrained Redevelopment Sites. Proceed to section 3. Following approval of other exclusions, design remaining site in accordance with Constrained Redevelopment standards and apply for **variance** for Constrained Redevelopment Sites.

Section	Question	Response	Instructions
3	**Applicable Sites with Other Exclusions by Variance**		
3.1	**Category 1: Roadways, bridges and trails only**		
3.1.1	Is the project a bike or pedestrian trail?	○ Yes ○ No	Proceed to next line. Proceed to 3.1.2.
	Is the trail for a roadway?	○ Yes ○ No	Proceed to 3.1.2. Project is excluded. Submit **variance** for Trails Excluded from Permanent Water Quality Requirements.
3.1.2	Is the project primarily used for parking or access to parking?	○ Yes ○ No	This exclusion does not apply. Permanent water quality is required. Proceed to 3.1.3.
3.1.3	Does the project add impervious area?	○ No ○ Yes	Project is excluded. Submit **variance** for Pavement Management Sites Excluded from Permanent Water Quality Requirements. Proceed to 3.1.4.
3.1.4	Does the project add more than 8.25 feet of paved width at any location to the existing roadway?	○ No ○ Yes	Project is excluded. Submit **variance** for Roadway Redevelopment Sites Excluded from Permanent Water Quality Requirements. Proceed to next line.
	Does the project add more than one acre of paved area per mile to an existing roadway?	○ No ○ Yes	Project is excluded. Submit **variance** for Roadway Redevelopment Sites Excluded from Permanent Water Quality Requirements. Proceed to next line.
	Does the project increase the width by two times or more, on average, of the original roadway area?	○ No ○ Yes	Existing areas of site are excluded only. Submit **variance** for Existing Roadway Surfaces Only Excluded from Permanent Water Quality Requirements. This exclusion does not apply. Permanent water quality is required.
3.2	**Category 2: Non-residential and non-commercial projects only**		
3.2.1	Is the project associated with oil and gas exploration, production, processing, or treatment operations or transmission facilities, including activities necessary to prepare a site for drilling and the movement and placement of drilling equipment?	○ Yes ○ No	Project is excluded. Submit **variance** for Oil and Gas Exploration Sites Excluded from Permanent Water Quality Requirements. Proceed to 3.2.2.
3.2.2	Is the project for stream stabilization?	○ Yes ○ No	Project is excluded. Submit **variance** for Stream Stabilization Sites Excluded from Permanent Water Quality Requirements. Proceed to 3.2.3.
3.2.3	Is the project for installation or maintenance of aboveground or underground utilities or infrastructure that does not permanently alter the terrain, ground cover, or drainage patterns from those present prior to the construction activity including activities to install, replace or maintain utilities under roadways or other paved areas that return the surface to the same condition?	○ Yes ○ No	Project is excluded. Submit **variance** for Aboveground and Underground Utilities Excluded from Permanent Water Quality Requirements. Proceed to 3.2.4.
3.2.4	Is the project on undeveloped land (land with no human-made structures such as buildings or pavement) that will remain undeveloped after the project?	○ Yes ○ No	Project is excluded. Submit **variance** for Sites with Land Disturbances to Undeveloped Land that will Remain Undeveloped Excluded from Permanent Water Quality Requirements. Proceed to 3.2.5.
3.2.5	Will the post-project condition result in surface water discharge during the 80th percentile storm runoff event?	○ No ○ Yes	Project is excluded. Submit **study** along with **variance** for Non-residential and Non-commercial Infiltration Conditions Excluded from Permanent Water Quality Requirements. This exclusion does not apply. Permanent water quality is required.

Section	Question	Response	Instructions
3.3	**Category 3: Residential, Agricultural and Commercial projects**		
3.3.1	Is the project a single-family residential lot, or agricultural zoned lands, greater than or equal to 2.5 acres in size per dwelling unit?	◯ Yes	Proceed to next line.
		◯ No	Proceed to 3.3.2.
	Is the project site greater than 10% impervious?	◯ No	Project is excluded. Submit **variance** for Large Lot Single Family Sites Excluded from Permanent Water Quality Requirements.
		◯ Yes	Proceed to next line.
	Is the project site greater than 20% impervious?	◯ Yes	This exclusion does not apply. Permanent water quality is required.
		◯ No	Proceed to next line.
	Will the post-project condition result in surface water discharge during the 80th percentile storm runoff event?	◯ No	Project is excluded. Submit **study** along with **variance** for Large Lot Single Family Sites Excluded from Permanent Water Quality Requirements.
		◯ Yes	This exclusion does not apply. Permanent water quality is required.
3.3.2	Will 100% of the runoff from the residential or commercial site be captured?	◯ Yes	This exclusion does not apply. Permanent water quality is required.
		◯ No	Proceed to next line.
	Is all or a portion of the site undeveloped or will it remain undeveloped after construction?	◯ Yes	This portion of the project is excluded. Submit **variance** for Sites with Land Disturbance to Undeveloped Land that will Remain Undeveloped Excluded from Permanent Water Quality Requirements. Proceed to next line.
		◯ No	Proceed to next line.
	Is the remaining untreated impervious area greater than 20% of the site?	◯ Yes	This exclusion does not apply. Permanent water quality is required.
		◯ No	Proceed to next line.
	Is the remaining untreated impervious area greater than one acre?	◯ Yes	This exclusion does not apply. Permanent water quality is required.
		◯ No	Proceed to next line.
	Is it practicable to capture runoff from portions of the site that will not drain to a control measure?	◯ No	Document justification demonstrating that it is not practicable to capture runoff from this portion of the site in the **drainage report**. No further action is needed.
		◯ Yes	This exclusion does not apply. Permanent water quality is required.

Castle Rock Water
175 Kellogg Court
Castle Rock, CO 80109
720-733-6000

Phase I Drainage Report Checklist

The Phase I Drainage Report must be in conformance with the latest Town of Castle Rock Storm Drainage Design and Technical Criteria Manual available on the Town's website.

The Phase I Drainage Report must be signed and sealed by a Professional Engineer licensed in the State of Colorado. The purpose of the Phase I Drainage Report is to describe, at a conceptual level, the feasibility and design characteristics of stormwater management facilities within the proposed development.

The preparer should contact and work with the Town Stormwater Engineering Staff regarding any design, master planning and existing system questions (720-733-6000). The following outline sets forth the **required minimum** content to be provided in the Phase I Drainage Report that shall be submitted with the Planned Development Plan or Straight Zoning documents. A copy of this checklist must be submitted with the Phase I Drainage Report.

Please see Chapter 4 of the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual for additional details and information. Please check off the following items to assure your report is complete. Appropriate notations shall be provided with the checklist. For example, if a specific item is not addressed or not applicable, an explanation needs to be provided.

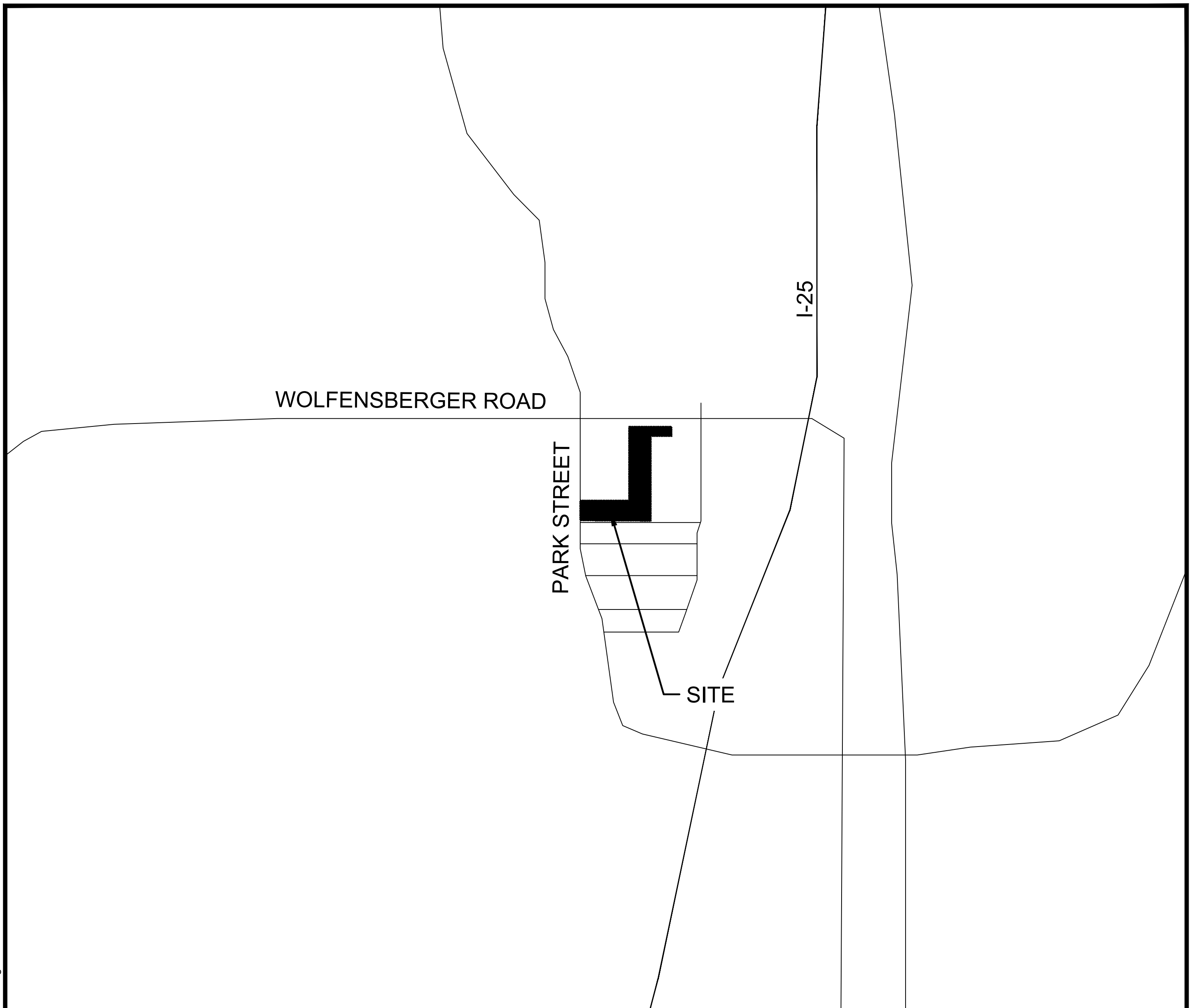
Included	N/A	
		I. COVER SHEET
✓		A. Name of Project, including legal name of development
✓		B. Address
✓		C. Owner
✓		D. Developer
✓		E. Engineer
✓		F. Submittal date and revision dates as applicable
		II. GENERAL LOCATION AND DESCRIPTION
✓		A. Site Location
✓		B. Description of Property and Land Use
		III. DRAINAGE BASIN AND SUB-BASINS
✓		A. Major Drainage Basins
✓		B. Minor Drainage Basins
		IV. EXISTING STORMWATER CONVEYANCE OR STORAGE FACILITIES
✓		A. Existing Stormwater Conveyance Facilities
✓		B. Existing Stormwater Storage Facilities
		V. PROPOSED STORMWAER CONVEYANCE OR STORAGE FACILITIES
	✓	A. Proposed Stormwater Conveyance Facilities
	✓	B. Proposed Stormwater Storage Facilities

Included	N/A	
		VI. WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES
	✓	A. Non-structural Best Management Practices
	✓	B. Structural Best Management Practices
		VII. FLOODPLAIN MODIFICATIONS
	✓	A. Major Drainageway—Undesignated Floodplain
	✓	B. Major Drainageway—Designated Floodplain
	✓	**VIII. POTENTIAL PERMITTING REQUIREMENTS**
✓		**IX. REFERENCES**
✓		**X. APPENDICES**
✓		**OVERALL DRAINAGE PLAN (IN POCKET)**
✓		**DETAILED DRAINAGE PLANS (IN POCKET)**

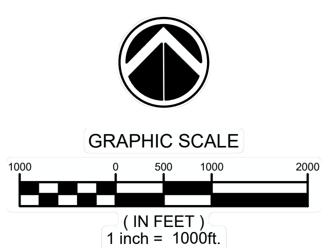
Notes/Comments:

APPENDIX D

MAPS



VICINITY MAP



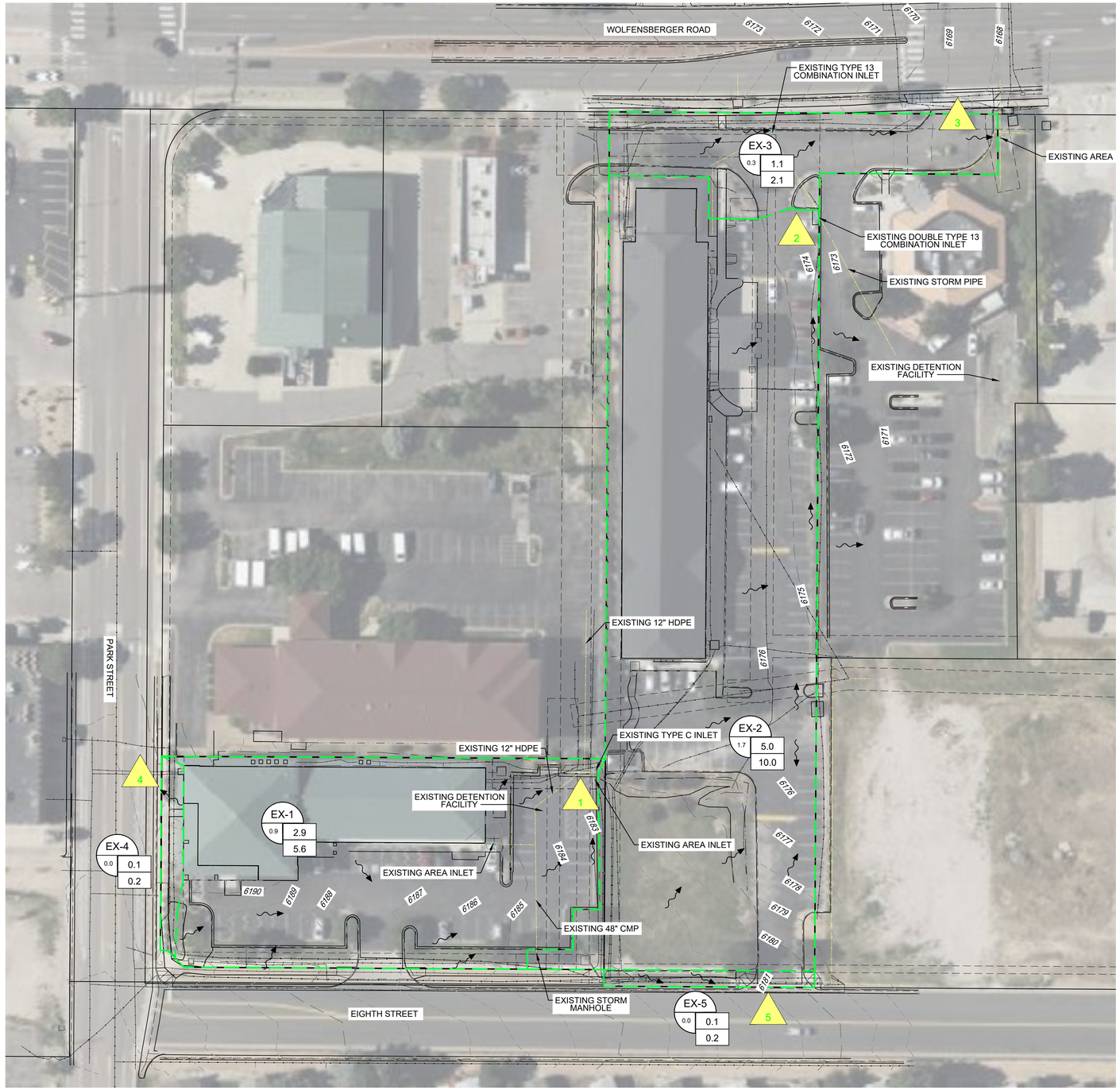
PREPARED BY:

Matrix

Excellence by Design

826 PARK STREET & 200 WOLFENSBERGER ROAD VICINITY MAP

DESIGNED BY:	SCALE	DATE ISSUED: JUNE 2024	DRAWING No.
DRAWN BY:	HORIZ. 1"=1000'		VM
CHECKED BY:	VERT.	SHEET 1 OF 1	



LEGEND

- BASIN BOUNDARY
- 5975 — EXISTING CONTOUR
- FLOW PATH
- 2 — DESIGN POINT
- EX-2 — SUB BASIN DESIGNATION
- #### — 5-YEAR STORM EVENT PEAK FLOW (CFS)
- x.x — 100-YEAR STORM EVENT PEAK FLOW (CFS)
- x.x — SUB BASIN AREA (AC.)

Know what's **below.** **Call** before you dig.

Unity 2

Existing Conditions
Sub-basin Summary

Basin	Area	Q5	Q100
	acres	cfs	cfs
EX-1	0.87	2.9	5.6
EX-2	1.69	5.0	10.0
EX-3	0.29	1.1	2.1
EX-4	0.04	0.1	0.2
EX-5	0.04	0.1	0.2

Existing Design Point Summary

Unity 2

Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
1	EX-1	0.87	2.9	5.6
2	EX-2	1.69	5.0	10.0
3	EX-3	0.29	1.1	2.1
4	EX-4	0.04	0.1	0.2
5	EX-5	0.04	0.1	0.2

N

GRAPHIC SCALE

40' 0' 40' 80'

(IN FEET)
1 inch = 40 ft.

REFERENCE DRAWINGS

1310.004-EX-SITE
X-MDG22x34
1310.004-EX-MAP
1310.004-EX-UTIL

No.	DATE	DESCRIPTION	BY

REVISIONS

COMPUTER FILE MANAGEMENT

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THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE.

SHEET KEY

PREPARED BY:
Matrix
Excellence by Design

SEAL

PRELIMINARY
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FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.
PROJECT No. 24.1310.005

826 PARK STREET EXPANSION AND 200 WOLFENSBERGER ROAD

TOWN OF CASTLE ROCK
PHASE I DRAINAGE PLAN

EXISTING CONDITIONS DRAINAGE MAP

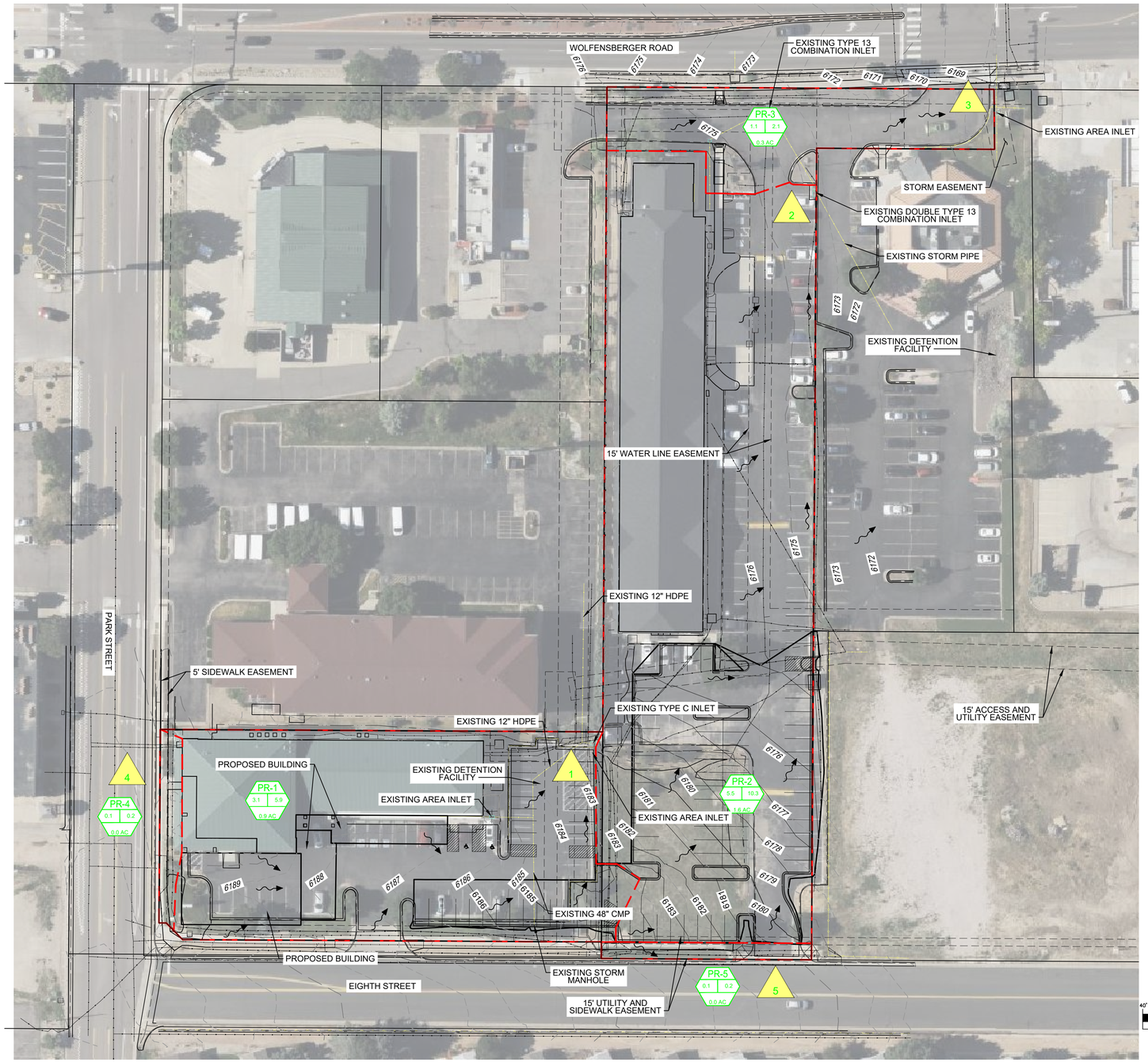
DESIGNED BY:
DRAWN BY: WCG
CHECKED BY: JTS

SCALE
HORIZ. 1" = 40'
VERT. N/A

DATE ISSUED: JULY 2024

SHEET 1 OF 2

DRAWING No. DR01



LEGEND

- PR BASIN BOUNDARY
- 5975 — EXISTING CONTOUR
- 7050 — PROPOSED CONTOUR
- EXISTING EDGE OF ROAD
- PROPOSED PROPERTY LINE
- PROPOSED FLOW DIRECTION
- 2 — DESIGN POINT
- BASIN (Q5 | Q100 | AREA) — SUB BASIN DESIGNATION; 5-YEAR STORM EVENT PEAK FLOW (CFS); 100-YEAR STORM EVENT PEAK FLOW (CFS); SUB BASIN AREA (AC.)

Know what's **below.** **Call** before you dig.

Unity 2

Proposed Conditions
Sub-basin Summary

Basin	Area	Q5	Q100
	acres	cfs	cfs
PR-1	0.92	3.1	5.9
PR-2	1.64	5.5	10.3
PR-3	0.29	1.1	2.1
PR-4	0.04	0.1	0.2
PR-5	0.04	0.1	0.2

Proposed Design Point Summary

Unity 2

Design Point	Sub-Basins	Total Area (ac.)	Q(5) (cfs)	Q(100) (cfs)
1	PR-1	0.92	3.1	5.9
2	PR-2	1.64	5.5	10.3
3	PR-3	0.29	1.1	2.1
4	PR-4	0.04	0.1	0.2
5	PR-5	0.04	0.1	0.2

N

GRAPHIC SCALE

40' 0' 40' 80'

(IN FEET)
1 inch = 40 ft.

REFERENCE DRAWINGS

1310.004-EX-SITE
X-MDG22x34
1310.004-EX-MAP
1310.004-EX-UTIL
X-1310-PR SITE

No.	DATE	DESCRIPTION	BY

REVISIONS

COMPUTER FILE MANAGEMENT

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THIS DRAWING IS CURRENT AS OF PLOT DATE AND MAY BE SUBJECT TO CHANGE.

SHEET KEY

PREPARED BY: Matrix Excellence by Design

SEAL

PRELIMINARY
THIS DRAWING HAS NOT BEEN APPROVED BY GOVERNING AGENCIES AND IS SUBJECT TO CHANGE

FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.
PROJECT No. 24.1310.005

826 PARK STREET EXPANSION AND 200 WOLFENSBERGER ROAD

TOWN OF CASTLE ROCK
PHASE I DRAINAGE PLAN

PROPOSED CONDITIONS DRAINAGE MAP

DESIGNED BY:		SCALE	
DRAWN BY:	WCG	HORIZ.	1" = 40'
CHECKED BY:	JTS	VERT.	N/A
DATE ISSUED:	JULY 2024		
SHEET	2 OF 2		
DRAWING No.	DR02		