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PHASE II DRAINAGE REPORT

FINDLAY TOYOTA

The Meadows 19, Lot 1, Filing No. 1
Castle Rock, Colorado

July 21, 2025
Revised: December 4, 2025

Owner:
Findlay Family Properties, LP
310 N. Gibson Road
Henderson, NV 89014
Contact: Tyler Corder
(702) 558-8822

Developer:
Tally CM
8715 E. Via De Commercio
Scottsdale, AZ 85258
Contact: Brent Tally

Engineer:
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O (720) 826-3965 C (720) 260-0433
Project No. 2421

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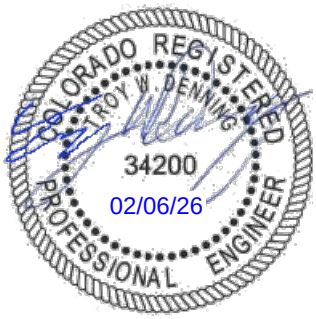
APPENDICES

Engineer Certification:

"I affirm that this report and plan for the Phase II drainage design of Findlay Toyota was prepared by me (or under my direct supervision) in accordance with the provisions of the Town of Castle Rock Drainage Design and Technical Criteria for the owners thereof. I understand that the Town of Castle Rock does not and will not assume liability for drainage facilities designed by others."



SIGNATURE: _____

Registered Professional Engineer

State Of Colorado No. 34200

(Affix Seal)

Owner Certification:

"FINDLAY FAMILY PROPERTIES LIMITED PARTNERSHIP hereby certifies that the drainage facilities for Findlay Toyota shall be constructed according to the design presented in this report. I understand that the Town of Castle Rock does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the Town of Castle Rock reviews drainage plans pursuant to the Municipal Code; but cannot, on behalf of Findlay Toyota, guarantee that final drainage design review will absolve FINDLAY FAMILY PROPERTIES LIMITED PARTNERSHIP and/or their successors and/or assigns of future liability for improper design."

Clifford J. Findlay, Manager of the General Partner

_____

Authorized Signature

GENERAL LOCATION AND DESCRIPTION

Site Location

The proposed development is in the northwest Quarter of Section 27, and the northeast Quarter of Section 28, Township 7 South, Range 67 West of the 6th Principal Meridian, Town of Castle Rock, County of Douglas, State of Colorado. The site is bordered to the north by Union Pacific Railroad (variable width Right-of-Way), to the west by North Meadows Drive, to the south by East Plum Creek and a tract of land owned by the Town of Castle Rock for a well house, and to the east by an existing commercial property used by a landscaping company. A Vicinity Map is shown in Appendix A.

Description of Property

The existing property is approximately 28.71 acres described as Lot 1 and Tract B of the Meadows 19, Lot 1, Filing. No. 1. A replat of Lot 1 will create 4 commercial properties (Lots 1-4) and Tract A1 consisting of a private road providing access to subdivided parcels. Lot 2 (Findlay Toyota) proposes development with a car dealership building, car wash building, parking lot, drive aisles, landscaped areas, and mainline utilities with service laterals. A regional water quality and detention pond is proposed on existing Tract B to provide stormwater attenuation and water quality for proposed Lots 1-4, Tract A1, and a portion of the Timber Mill Parkway bridge tributary to the regional pond. Access to the site is provided by an existing bridge located in Timber Mill Parkway spanning East Plum Creek. An average existing gradient of roughly 1.3% from southeast to northwest across the site. According to the NRCS Soil Survey the site consists of Type B and Type C soils described by the soil survey as 45 percent “Sampson loam” and 55 percent “Englewood clay loam” (Web Soil Survey Data, 7/19/2025).” A copy of the Custom Soil Resource Report is provided in Appendix A.

DRAINAGE BASINS AND SUB-BASINS

Major Drainage Basins

In the existing condition, runoff from the project site sheet flows westerly to East Plum Creek. This project proposes a regional detention and water quality pond providing stormwater attenuation and water quality for this project (Lot 2, Tract A1, Ex. Tract B, Ex. Timber Mill Parkway) and future commercial properties (Lot 1, Lot 3, and Lot 4). The table below summarizes the percent impervious used for sizing the regional pond:

MAJOR BASIN	% IMP.	Area (AC.)	DESCRIPTION	Conveyance to EDB
A	90%	7.77	Future commercial development (Lot 1)	Proposed Storm Drain System
B1-B16	89%	10.27	Lot 2, Partial Tract A1 (the Site)	Proposed Storm Drain System
B-FUT	90%	7.22	Future commercial development (Lots 3 and 4)	Proposed Storm Drain System
EX	83%	1.55	Partial Tract A1, Existing Timber Mill Parkway	Existing 30-inch RCP
C	25%	2.09	Existing Tract B (Extended detention basin parcel)	Direct or sheet flow

See Master Drainage Plan provided in Appendix E.

Minor Drainage Basins

The intent of this report is to verify that the development of the Findlay Toyota property (Lot 2) and Tract A1 storm drainage facilities meet the Town of Castle Rock's drainage design criteria and to provide a master plan for future commercial properties (Lot 1, Lot 3, and Lot 3) tributary to the proposed detention and water quality pond (EDB). The calculations provided include hydrologic computations for sizing the EDB. Specific calculations for determining the sizes and types of onsite storm sewer features will be provided in the Phase III Drainage Report.

The Site has been divided into 25 onsite sub-basins contributing flows to the proposed storm drain system discharging to the EDB, 4 existing sub-basins contributing flows to the existing 30-inch RCP discharging to the EDB, and 3 offsite sub-basins for this drainage analysis. A Proposed Drainage Plan is provided in Appendix E. All building roofs will be piped into inlets within the sub-basin with peak contributing flows being added at the time of concentration for the basin's design point. If the capacity of the roof drain is exceeded, the overflow path is to the inlet within the sub-basin.

Sub-basins tributary to proposed storm drain system:

Basin B1 (1.56 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Type 16 Double inlet at Design Point B1. The 5-year and 100-year direct runoff rates at Design Point B1 are 4.22 cfs AND 9.11 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin OS1.

Basin B1R (0.22 AC) contains a portion of the dealership roof. Runoff from this basin will be piped to the Type 16 Double inlet at Design Point B1. The 5-year and 100-year direct runoff rates at from Basin 1R are 0.73 cfs AND 1.42 cfs, respectively. If the roof drain capacity is exceeded, the overflow path is to the inlet at Basin B1.

Basin B2 (1.27 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Double Type 16 Valley inlet at Design Point B2. The 5-year and 100-year direct runoff rates at Design Point B1 are 3.92 cfs AND 7.67 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B1.

Basin B2R (0.65 AC) contains a portion of the dealership roof. Runoff from this basin will be piped to the Double Type 16 inlet at Design Point B2. The 5-year and 100-year direct runoff rates at from Basin 2R are 2.02 cfs AND 3.94 cfs, respectively. If the roof drain capacity is exceeded, the overflow path is to the inlet at Basin B2.

Basin B3 (0.88 AC) contains a portion of the site parking lot and a portion of the Tract A1 private road. Runoff from this basin will drain to a Type 16 Single inlet at Design Point B3. The 5-year and 100-year direct runoff rates at Design Point B3 are 3.12 cfs AND 6.18 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B2.

Basin B3R (0.07 AC) contains a portion of the car wash roof. Runoff from this basin will be piped to the Type 16 Single inlet at Design Point B3. The 5-year and 100-year direct runoff rates at from Basin 3R are 0.25 cfs AND 0.50 cfs, respectively. If the roof drain capacity is exceeded, the overflow path is to the inlet at Basin B3.

Basin B5 (0.14 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Single No. 16 Valley inlet at Design Point B5. The 5-year and 100-year direct runoff rates at Design Point B6 are 0.55 cfs AND 1.07 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B2.

Basin B6 (0.05 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Single No. 16 Valley inlet at Design Point B6. The 5-year and 100-year direct runoff rates at Design Point B6 are 0.20 cfs AND 0.38 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B5.

Basin B6-R1 (0.69 AC) contains a portion of the dealership roof. Runoff from this basin will be piped to the Type 16 Single inlet at Design Point B6. The 5-year and 100-year direct runoff rates at from Basin B6-R1 are 2.71 cfs AND 5.29 cfs, respectively. If the roof drain capacity is exceeded, the overflow path is to the inlet at Basin B6.

Basin B6-R2 (0.04 AC) contains a portion of the car wash roof. Runoff from this basin will be piped to the Type 16 Single inlet at Design Point B6. The 5-year and 100-year direct runoff rates at from Basin B6-R1 are 0.16 cfs AND 0.31 cfs, respectively. If the roof drain capacity is exceeded, the overflow path is to the inlet at Basin B6.

Basin B7 (0.08 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Single No. 16 Valley inlet at Design Point B7. The 5-year and 100-year direct runoff rates at Design Point B6 are 0.31 cfs AND 0.61 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B6.

Basin B8 (0.22 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Single No. 16 Valley inlet at Design Point B8. The 5-year and 100-year direct runoff rates at Design Point B6 are 0.86 cfs AND 1.19 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B7.

Basin B9 (0.18 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Single No. 16 Valley inlet at Design Point B9. The 5-year and 100-year direct runoff rates at Design Point B9 are 0.66 cfs AND 1.31 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B8.

Basin B10 (0.40 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Single No. 16 Valley inlet at Design Point B10. The 5-year and 100-year direct runoff rates at Design Point B10 are 1.30 cfs AND 2.74 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B9.

Basin B11 (0.63 AC) contains a portion of the Tract A1 private road. Runoff from this basin will drain to a Type 16-single inlet at Design Point B11. The 5-year and 100-year direct runoff rates at Design Point B11 are 2.00 cfs AND 4.10 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin OS3.

Basin B12 (0.34 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Single No. 16 Valley inlet at Design Point B12. The 5-year and 100-year direct runoff rates at Design Point B12 are 1.12 cfs AND 2.27 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B1.

Basin B13 (0.55 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Double No. 16 Valley inlet at Design Point B13. The 5-year and 100-year direct runoff rates at Design Point B5 are 1.90 cfs AND 3.86 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B12.

Basin B14 (0.44 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Single No. 16 Valley inlet at Design Point B14. The 5-year and 100-year direct runoff rates at Design Point B5 are 1.67 cfs AND 3.32 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B13.

Basin B14R (0.10 AC) contains a portion of the dealership roof. Runoff from this basin will be piped to the Single No. 16 Valley inlet at Design Point B14. The 5-year and 100-year direct runoff rates at from Basin 14R are 0.39 cfs AND 0.77 cfs, respectively. If the roof drain capacity is exceeded, the overflow path is to the inlet at Basin B14.

Basin B15 (0.45 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Single No. 16 Valley inlet at Design Point B15. The 5-year and 100-year direct runoff rates at Design Point B15 are 1.71 cfs AND 3.40 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B15.

Basin B15R (0.19 AC) contains a portion of the dealership roof. Runoff from this basin will be piped to the Single No. 16 Valley inlet at Design Point B15. The 5-year and 100-year direct runoff rates at from Basin 15R are 0.75 cfs AND 1.46 cfs, respectively. If the roof drain capacity is exceeded, the overflow path is to the inlet at Basin B15.

Basin B16 (1.10 AC) contains a portion of the site parking lot. Runoff from this basin will drain to a Single No. 16 Valley inlet at Design Point B16. The 5-year and 100-year direct runoff rates at Design Point B16 are 3.47 cfs AND 7.30 cfs, respectively. If the capacity of the inlet is exceeded, the overflow path is to Basin B16.

Basin B16R (0.04 AC) contains a portion of the dealership roof. Runoff from this basin will be piped to the Double No. 16 Valley inlet at Design Point B16. The 5-year and 100-year direct runoff rates at from Basin 16R are 0.14 cfs AND 0.28 cfs, respectively. If the roof drain capacity is exceeded, the overflow path is to the inlet at Basin B16.

Sub-basins tributary to existing 30-inch RCP:

Basin EX1 (0.41 AC) contains a portion of the Tract A1 private road and a portion of the existing Timber Mill Parkway. Runoff from this basin will drain to existing 10' Type R inlet at Design Point EX1. The 5-year and 100-year direct runoff rates at Design Point EX1 are 1.40 cfs AND 2.89 cfs, respectively. If the capacity of the existing inlet is exceeded, the overflow path is a direct discharge to East Plum Creek.

Basin EX2 (0.74 AC) contains a portion of the Tract A1 private road and a portion of the existing Timber Mill Parkway. Runoff from this basin will drain to existing 10' Type R inlet at Design Point EX2. The 5-year and 100-year direct runoff rates at Design Point EX2 are 2.06 cfs AND 4.68 cfs, respectively. If the capacity of the existing inlet is exceeded, the overflow path is a direct discharge to East Plum Creek.

Basin EX3 (0.20 AC) contains a portion of the existing Timber Mill Parkway bridge. Runoff from this basin is piped to the existing 10-foot Type R Inlet at Design Point EX1 via existing storm pipes. No changes are proposed to this basin and the basin hydraulics were not analyzed. Basin EX3 is noted in this report because it is tributary to the ex. 30-inch storm discharging to the proposed EDB.

Basin EX4 (0.20 AC) contains a portion of the existing Timber Mill Parkway bridge. Runoff from this basin is piped to the existing 10-foot Type R Inlet at Design Point EX1 via existing storm pipes. No changes are proposed to this basin and the basin hydraulics were not analyzed. Basin EX4 is noted in this report because it is tributary to the ex. 30-inch storm discharging to the proposed EDB.

Sub-basins discharging offsite:

Basin OS1 (0.05 AC) and OS2 (0.29) are undeveloped, un-detained, and un-treated basins directly tributary to East Plum Creek. These basins will maintain its historic drainage pattern.

Basin OS3 (0.20 AC) is an undeveloped, un-detained, and un-treated basins directly tributary to the existing Union Pacific Railroad ROW. This basin will maintain its historic drainage pattern.

DRAINAGE DESIGN CRITERIA

Regulations

This drainage study has been prepared to meet the requirements of the Town of Castle Rock as set forth in the "Town of Castle Rock Storm Drainage Design and Technical Criteria Manual" and the Mile High Flood District's (MHFD) "Urban Storm Drainage Criteria Manual".

Stormwater detention and water quality treatment are required for the proposed development

Drainage Studies, Master Plans, Site Constraints

Existing drainage studies and drainage plans consulted for preparation of this report include:

"Phase III Drainage Report for The Meadows Filing No. 19 Access Road", prepared by Core Consultants, January, 2020.

"Public Improvement Construction Plans for The Meadows Filing No. 19 COI Access Road", prepared by Core Consultants. Town of Castle Rock Project No. CD19-0024, approved 10/15/2021.

Hydrology

The hydrologic design for the site is based on the criteria established by the Town of Castle Rock. This report analyzes runoff anticipated during the 5- and 100-year storm events. The Rational Method was used to calculate peak runoff rates for the sub-basins. Imperviousness percentages were determined using MHFD tables 6-2 and 6-3. Runoff coefficients were determined using MHFD tables 6-8. Form SF-2 was used to determine times of concentration. Rainfall intensities were determined using 1-hour point rainfall values provided in Town figure 6-1 s and MHFD Equation 5-1. Runoff flow rates were determined using form SF-3.

See hydrologic calculations in Appendix B.

Hydraulics

Specific hydraulic calculations for determining the sizes and types of onsite storm sewer will be provided in the Phase III Drainage Report. In compliance with the Town of Castle Rock Design Criteria the storm sewer system will be sized to collect runoff from the 100-year (and smaller) events, ponding depths within sumps will not exceed 9 inches. Inlet sizing will be determined using the UD-Inlet software provided by MHFD and Type C Inlet capacity charts published by the Town of Caste Rock. Civil 3-D Storm Sewers software will be utilized to model and design the storm sewer system and will be provided in the Phase III Drainage Report.

Storage and Water Quality Enhancement

The proposed development must comply with the four-step process described in Section 14.1 of the Town's drainage manual.

1. Reduce Runoff Volume to the Maximum Extent Practicable: Due to the nature of the proposed development paved parking and building will cover approximately 90% of the property. Runoff generated in the paved areas will drain across the pavement to storm inlets which will convey flows to the offsite Extended Detention Basin (EDB). These flows will be routed through a forebay, trickle channel, micropool and outlet control structure.

2. Provide Water Quality Capture Volume and Flood Control Detention Via Full-Spectrum Detention: This step will be satisfied by the offsite EDB located on existing Tract B.

3. Utilize Stream Channel Stabilization Techniques: No stabilization is required for the banks of East Plum Creek. Bank stabilization using buried rip-rap is proposed at the proposed emergency spillway for the EDB.

4. Undertake Source Control: This step will be addressed by keeping storage and handling of all automotive-related fluids contained within the building. This includes no outside vehicle maintenance. It also includes designated snow storage in landscaped areas. Vehicle washing will be accomplished through a drive-through portion of the building with effluent being drained through the sanitary sewer system. Trash will be contained within covered dumpsters located within a walled trash enclosure.

Per town criteria, stormwater detention and the water quality capture volume must be provided for this development. The volume necessary for this function is described in Chapter 12, Volume 2, of the MHFD criteria manual. A regional extended detention basin will soon be constructed in existing Tract B. The water quality capture volume (WQCV) will be slowly released through an orifice plate on the face of the outlet control structure. The WQCV has been designed to drain in 40 hours. The orifice plate on the outlet structure will also allow the

Excess Urban Runoff Volume (EURV) to drain in 72 hours. When ponding depths exceed the EURV water surface the 100-year detention volume will be stored and drained through the outlet control structure's overflow grate and will be released at a maximum flowrate of 27.6 cfs. Flows will be piped to the existing ground surface at the edge of East Plum Creek, located immediately to the west of the EDB. An emergency overflow weir has also been designed to convey the 100-year developed flowrate in case of outlet structure failure. An emergency overflow channel consisting of buried rip-rap has been designed to convey the 100-year developed flowrate to East Plum Creek.

The Town of Castle Rock must comply with state CDPS General Permit COR080000. Therefore, the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual, revised February, 2025, states that "new development implement sub-regional Water Quality Capture Volume facilities and flood control detention at a subdivision level in lieu of onsite facilities at the time each lot is developed" (Section 14.2.1). This requires water quality enhancement for new development. The Town and CDPS requirements are met for the proposed development by draining site runoff through the extended detention basin located on existing Tract B. All proposed impervious areas in the proposed Findlay Toyota development will drain through the offsite extended detention basin.

STORMWATER MANAGEMENT FACILITY DESIGN

Stormwater Conveyance Facilities

A layout of the proposed Site storm sewer system is shown on the Proposed Drainage Plan with a continuation of the existing storm sewer system shown on the overall utility plans provided in Appendix E. The majority of the proposed development, including the building and parking lot will drain to proposed storm sewer within the development and be conveyed across Lot 1 in a 42-inch storm sewer, increasing to a 48-inch storm just upstream of the new forebay proposed with the EDB. Additional developed flows will be conveyed to the existing 30-inch RCP discharging to the EDB. Specific hydraulic calculations for determining the sizes and types of the proposed storm sewer features as well as an analysis of the existing storm sewer features will be provided in the Phase III Drainage Report

Stormwater Storage Facilities

The proposed extended detention basin will detain and release runoff to East Plum Creek at rates equal to or less than historic runoff rates. The detention facility was designed to serve the tributary portion of Lots 1-4, Tract A1, a portion of existing Timber Mill Parkway, and existing Tract B. This is a total area of 28.90 acres with an imperviousness of 84.5%. Proposed flowrates to the detention facility will be 41.6 cfs and 84.8 cfs during the 5-year and 100-year storm events, respectively. Peak release rates will be 0.4 cfs for the WQCV, 0.8 cfs for the EURV and 27.5 cfs during the 100-year storm event.

Water Quality Enhancement Best Management Practices

An extended detention basin will provide both stormwater detention and water quality capture volume for the 28.90 acres of tributary land including the proposed development (Lot 2 and Tract A1) and future commercial development (Lot 1, Lot 3 and Lot 4). This basin has been designed in compliance with MHFD criteria. As required by the Town of Castle Rock, a copy of the Permanent Water Quality Worksheet and MS4 Compliance Summary Form can be found in Appendix B. The EDB is designed to detain and treat 28.90 acres of the 29.44 acre study area at final build-out. The table below provides a summary of areas tributary to the EDB:

SUMMARY OF AREAS TRIBUTARY TO PROPOSED EDB				
	Total Area	Area Trib. to EDB	Area Not Trib. to EDB	Percent to EDB
Initial Phase (SDP25-0018 and Ex. Tract B)	14.45 AC	13.91 AC	0.54 AC	92.7%
Future Phases (Lot 1, Lot 3, Lot 4)	14.99 AC	14.99 AC	0.00 AC	100%
TOTAL	29.44 AC	28.90 AC	0.54 AC	98.2%

The 0.54 AC not tributary to the EDB in the initial phase is undeveloped land that will remain undeveloped, discharging in accordance with existing drainage patterns. It is anticipated that future build-out of Lots 1, 3, and 4 will produce similar small sub-basins that will not be conveyed to the EDBs. For planning purposes, and to ensure the EDB and conveyance pipes are adequately sized, the future phases assumed 100% capture of the site.

Floodplain Modification

No disturbance, including cut or fill, is proposed within the East Plum Creek Floodplain. This location is outside the 100-year FEMA floodplain. No floodplain modifications are including in this project. Therefore, no permitting or clearances from USFWA and USACE will be required. A copy of the FEMA Firmette is provided in Appendix A.

Geotechnical Investigation and Sub-surface Collection System Design

According to the report titled, “Geotechnical Site Development Study for The Meadows 19” prepared by A.G. Wassenaar, Inc. on March 8, 2017, groundwater was measured at depths of 16 to 31 feet, below any proposed excavation depths. Bedrock was not found in any boring depths of 14 to 34 feet. A copy of the report is provided in Appendix D.

Operation and Maintenance

The proposed storm sewer system and the detention and water quality facility will be owned and maintained by Findlay Family Properties, LP. This entity is the current owner of all lots and tracts draining to the proposed detention facility. If a portion of these lots are sold in the future a maintenance agreement for the proposed storm sewer and detention facility will be required. These drainage facilities must be maintained according to the Operations and Maintenance Guidelines provided by the Town of Castle Rock. This document can be found on the Town of Castle Rock website at Crgov.com/stormwater. Maintenance of the extended detention basin begins with a twice annual inspection and maintenance activities as more fully described in the town guidelines. Significant maintenance can be expected once every 15 to 25 years.

Additional Permitting Requirements

No additional permitting has been identified. If applicable, additional permitting requirements will be provided in the Phase III Drainage Report.

CONCLUSIONS

Compliance with Standards

The proposed drainage design is in conformance with the Town of Castle Rock Storm Drainage Design and Technical Criteria Manual and MHFD's Urban Storm Drainage Criteria Manual.

The proposed storm sewer and detention basin have been designed for developed runoff from the project site (Lot 2 and Tract A1) and future commercial developments (Lot1, Lot 3, and Lot3). EDB calculations are provided in Appendix C. Calculations for the proposed conveyance elements, including storm sewers, inlets, sidewalk chases, and channels will be provided in the Phase III Drainage Report.

The site lies downhill from Hwy 85, and all 100-year runoff from the project area continues to be fully captured and conveyed through the storm sewer system to the detention pond in Tract B, which is being upgraded as part of the project. Because runoff is contained within this established system and directed to a controlled detention facility, there is no adverse impact to downstream areas, including the CDOT Hwy 85 right-of-way.

Variances

No variances are anticipated with this project.

Drainage Concept

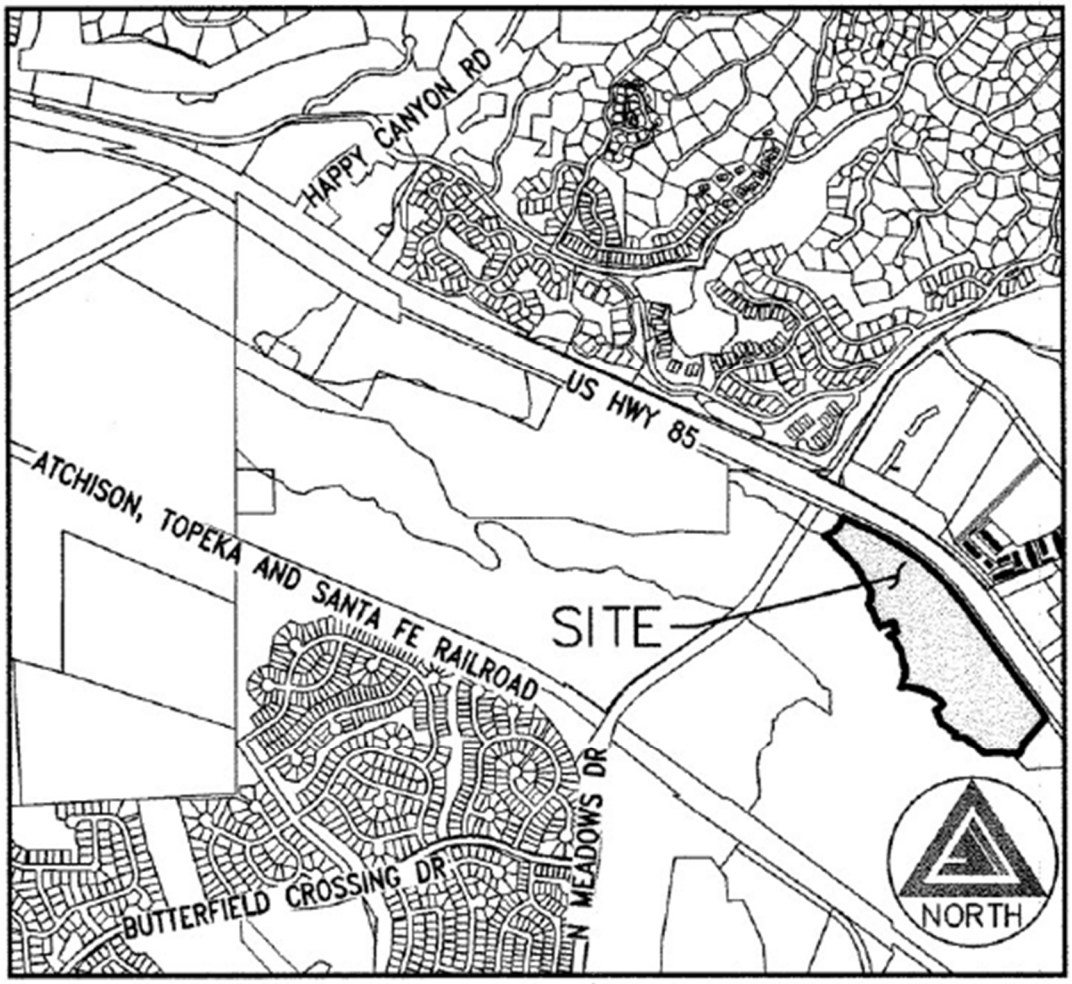
Runoff generated onsite will be directed away from the building and toward onsite storm inlets which will collect flows and convey flows to the extended detention basin to be constructed on existing Tract B. Flows will be released from the detention basin to East Plum Creek at regulated rates.

REFERENCES

1. Town of Castle Rock Storm Drainage Design and Technical Criteria Manual, February 18, 2025
2. Mile High Flood District (MHFD). *Drainage Criteria Manual, Volumes 1, 2, & 3, Urban Drainage and Flood*
3. United States Department of Agriculture – Web Soil Survey, *Custom Soil Resource Report for Castle Rock Area, Colorado,* July 19, 2025
4. Federal Emergency Management Agency (FEMA), *Flood Insurance Rate Map (FIRM), Panel 08035C0167G*, March 16, 2016
5. AGW, Geotechnical Site Development Study, *The Meadows Filing 19, Castle Rock, CO, prepared for Castle Rock Development Company,* March 8, 2017

APPENDIX A – SITE INFORMATION

VICINITY MAP
NRCS SOILS MAP
FEMA FIRM



VICINITY MAP

Scale: 1" = 2000'

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

May 27, 2025

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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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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: 1:3,320 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 45 90 180 270

Feet
0 150 300 600 900

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 17, Aug 29, 2024

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
Bo	Blakeland-Orsa association, 1 to 4 percent slopes	4.7	19.7%
En	Englewood clay loam	12.2	51.0%
Sa	Sampson loam	7.0	29.3%
Totals for Area of Interest		**23.9**	**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

Bo—Blakeland-Orsa association, 1 to 4 percent slopes

Map Unit Setting

National map unit symbol: jqy5
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 50 percent
Orsa and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Alluvial fans, hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or eolian deposits

Typical profile

H1 - 0 to 13 inches: sandy loam
H2 - 13 to 24 inches: loamy coarse sand
H3 - 24 to 60 inches: loamy coarse sand

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 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 4.9 inches)

Interpretive groups

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

Description of Orsa

Setting

Landform: Alluvial fans, hills
Landform position (three-dimensional): Base slope

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkosic sedimentary rock

Typical profile

H1 - 0 to 20 inches: coarse sandy loam
H2 - 20 to 60 inches: gravelly loamy coarse sand

Properties and qualities

Slope: 1 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 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 4.4 inches)

Interpretive groups

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

Minor Components

Bresser

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

Kassler

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

Sandy alluvial land

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

En—Englewood clay loam

Map Unit Setting

National map unit symbol: jqym
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Englewood and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Englewood

Setting

Landform: Swales, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Weathered from alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 10 inches: clay loam
H2 - 10 to 29 inches: clay
H3 - 29 to 60 inches: clay

Properties and qualities

Slope: 1 to 4 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 low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Minor Components

Sampson

Percent of map unit: 10 percent
Hydric soil rating: No

Satanta

Percent of map unit: 9 percent
Hydric soil rating: No

Fluvaquentic haplustolls

Percent of map unit: 1 percent
Landform: Terraces
Hydric soil rating: Yes

Sa—Sampson loam

Map Unit Setting

National map unit symbol: jr02
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sampson and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sampson

Setting

Landform: Stream terraces on drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Weathered alluvium derived from arkose

Typical profile

H1 - 0 to 9 inches: loam
H2 - 9 to 28 inches: clay loam
H3 - 28 to 38 inches: loam
H4 - 38 to 60 inches: silt loam

Properties and qualities

Slope: 1 to 4 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 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: B
Ecological site: R049XC202CO - Loamy Foothill Palmer Divide
Hydric soil rating: No

Minor Components

Englewood
Percent of map unit: 8 percent
Hydric soil rating: No

Bresser
Percent of map unit: 7 percent
Hydric soil rating: No

Loamy alluvial land
Percent of map unit: 4 percent
Hydric soil rating: No

Aquic haplustolls
Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission

rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

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.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group

index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Castle Rock Area, Colorado														
Map unit symbol and soil name	**Pct. of map unit**	**Hydrologic group**	**Depth**	**USDA texture**	**Classification**		**Pct Fragments**		**Percentage passing sieve number—**				**Liquid limit**	**Plasticity index**
					Unified	**AASHTO**	**>10 inches**	**3-10 inches**	**4**	**10**	**40**	**200**		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
Bo—Blakeland-Orsa association, 1 to 4 percent slopes														
Blakeland	50	A	0-13	Sandy loam	SC-SM, SC	A-2, A-4	0- 0- 0	0- 0- 0	100-100-100	95-98-100	60-65-70	30-35-40	25-28-30	5-8 -10
			13-24	Loamy coarse sand, coarse sandy loam	SC-SM, SP-SM, SM	A-1, A-2	0- 0- 0	0- 0- 0	90-95-100	80-90-100	35-53-70	10-20-30	20-23-25	NP-3 -5
			24-60	Loamy coarse sand, sand	SW-SM, SP-SM, SM	A-1, A-2, A-3	0- 0- 0	0- 0- 0	95-98-100	80-90-100	35-53-70	5-15- 25	—	NP
Orsa	35	A	0-20	Coarse sandy loam	SC-SM, SM	A-1, A-2	0- 0- 0	0- 0- 0	90-95-100	80-90-100	45-55-65	20-25-30	20-23-25	NP-3 -5
			20-60	Gravelly loamy coarse sand	SW-SM, SM	A-1	0- 0- 0	0- 0- 0	70-75-80	55-65-75	25-38-50	10-13-15	—	NP
En—Englewood clay loam														
Englewood	80	C	0-10	Clay loam	CL	A-6	0- 0- 0	0- 0- 0	85-93-100	80-90-100	75-88-100	60-70-80	30-35-40	10-15-20
			10-29	Clay, clay loam	CL	A-6, A-7	0- 0- 0	0- 0- 0	85-93-100	80-90-100	75-88-100	60-78-95	35-43-50	15-20-25
			29-60	Clay loam, clay	CL	A-6, A-7	0- 0- 0	0- 0- 0	85-93-100	80-90-100	75-88-100	60-75-90	30-38-45	10-15-20

Engineering Properties–Castle Rock Area, Colorado														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
Sa—Sampson loam														
Sampson	80	B	0-9	Loam	CL, CL-ML	A-4	0- 0- 0	0- 0- 0	100-100-100	95-98-100	75-85-95	60-68-75	25-28-30	5-8 -10
			9-28	Clay loam, sandy clay loam	CL, SC	A-2, A-6	0- 0- 0	0- 0- 0	95-98-100	80-90-100	65-83-100	30-55-80	30-33-35	10-13-15
			28-38	Loam	CL, CL-ML	A-4	0- 0- 0	0- 0- 0	95-98-100	80-90-100	70-83-95	50-63-75	25-28-30	5-8 -10
			38-60	Silt loam	ML	A-4	0- 0- 0	0- 0- 0	95-98-100	80-90-100	75-88-100	55-73-90	25-30-35	NP-5 -10

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NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

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 shown on 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 Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

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 Floodway Data table shown on this FIRM.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS 1980 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. 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, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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 by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2010.

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 **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

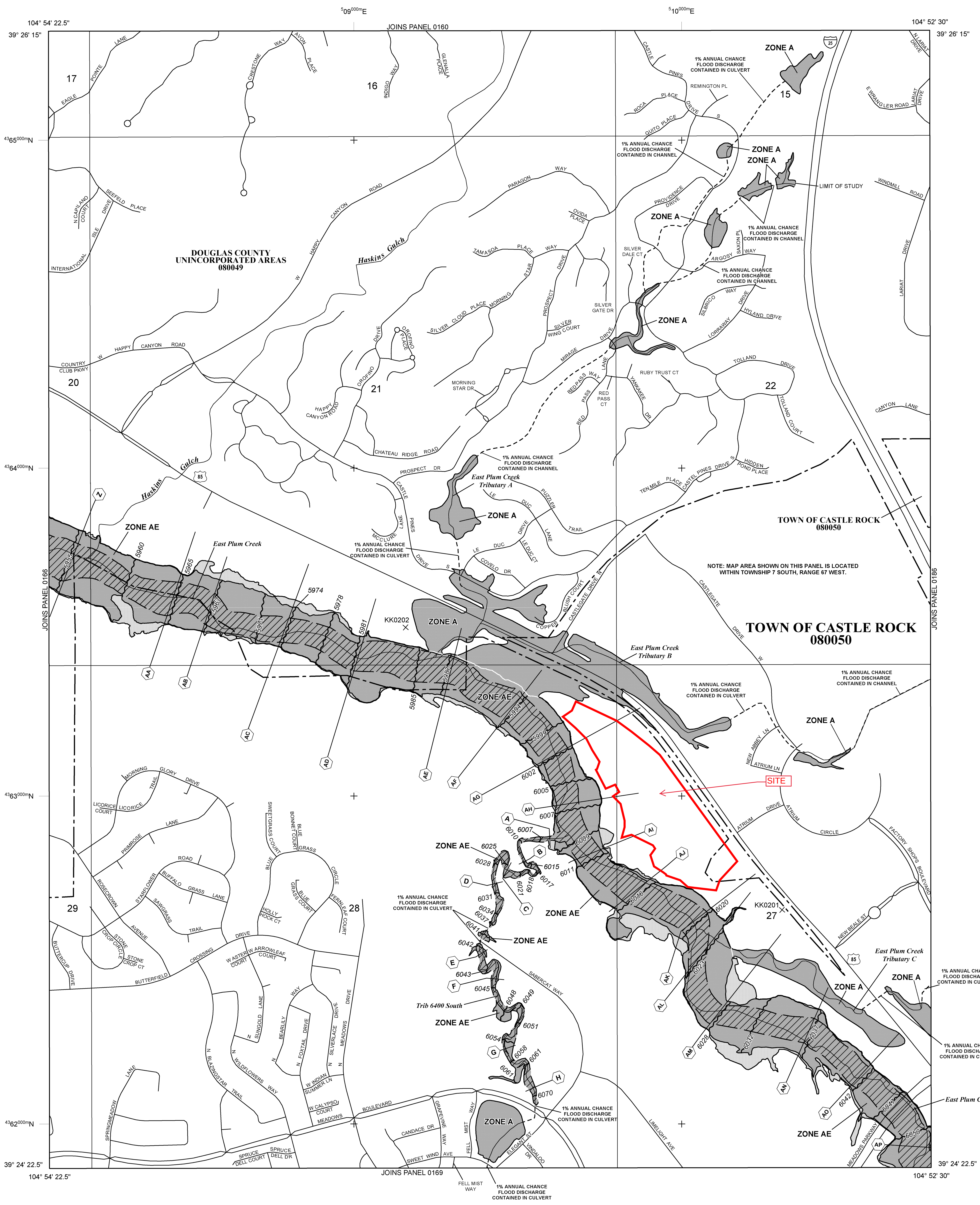
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

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 on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

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, AO, 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 ponding); Base Flood Elevations determined.
ZONE AO	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 Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. 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.

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and 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*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 - - - 23	Transect line
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
$^{49}89^{000m}$ N	1000-meter Universal Transverse Mercator grid values, zone 13
DX5510 ×	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

SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, 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 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0167G

FIRM
FLOOD INSURANCE RATE MAP
DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 167 OF 495
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CASTLE ROCK, TOWN OF	080050	0167	G
DOUGLAS COUNTY	080049	0167	G

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

MAP NUMBER
08035C0167G
MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

APPENDIX B – HYDROLOGIC CALCULATIONS

LAND-USE, PERCENT IMPERVIOUS, RUNOFF COEFFICIENT TABLE
STANDARD FORM SF-2
STANDARD FORM SF-3 (5-YEAR)
STANDARD FORM SF-3 (100-YEAR)
PERMANENT WATER QUALITY DETERMINATION WORKSHEET
SUMMARY OF WATER QUALITY CONFORMANCE TO MS4 PERMIT

RUNOFF COEFFICIENTS - DEVELOPED

PROJECT NAME: Findlay Toyota
PROJECT NUMBER: 2421
CALCULATED BY: MCS
CHECKED BY: TWD

December 2, 2025

	Type C Soils				
Land Use	Paved/Roof	Landscape	EDB	Fut. Comm.	Ex. Bridge
5-YEAR Coeff.	0.81	0.20	0.24	0.77	0.86
100-YEAR Coeff.	0.87	0.57	0.59	0.85	0.89
Impervious	95%	20%	25%	90%	100%

Note: Runoff coefficients shown were obtained from UDFCD Tablea 6-2, 6-3 and 6-8

Design Basin	Design Point	Paved/Roof Area (AC)	Landscape Area (AC)	EDB Area (AC)	Fut. Comm. Area (AC)	Ex. Bridge Area (AC)	Area (AC)	CC_5	CC_{100}	% Imp.
A	A				7.77		**7.77**	0.77	0.85	90%
SUBTOTAL FOR BASIN A		**0.00**	**0.00**	**0.00**	**7.77**	**0.00**	**7.77**	0.77	0.85	90%
B1R	B1	0.22	0.00				**0.22**	0.81	0.87	95%
B1	B1	1.22	0.34				**1.56**	0.68	0.80	79%
B2R	B2	0.65	0.00				**0.65**	0.81	0.87	95%
B2	B2	1.26	0.01				**1.27**	0.81	0.87	94%
B3R	B3	0.07	0.00				**0.07**	0.81	0.87	95%
B3	B3	0.85	0.03				**0.88**	0.79	0.86	92%
B5	B5	0.14	0.00				**0.14**	0.81	0.87	95%
B6R1	B6	0.69	0.00				**0.69**	0.81	0.87	95%
B6R2	B6	0.04	0.00				**0.04**	0.81	0.87	95%
B6	B6	0.05	0.00				**0.05**	0.81	0.87	95%
B7	B7	0.08	0.00				**0.08**	0.81	0.87	95%
B8	B8	0.20	0.00				**0.20**	0.81	0.87	95%
B9	B9	0.17	0.01				**0.18**	0.78	0.85	91%
B10	B10	0.33	0.07				**0.40**	0.70	0.82	82%
B11	B11	0.56	0.07				**0.63**	0.74	0.84	87%
B12	B12	0.31	0.03				**0.34**	0.76	0.84	88%
B13	B13	0.50	0.05				**0.55**	0.75	0.84	88%
B14R	B14	0.10	0.00				**0.10**	0.81	0.87	95%
B14	B14	0.42	0.02				**0.44**	0.78	0.86	92%
B15R	B15	0.19	0.00				**0.19**	0.81	0.87	95%
B15	B15	0.43	0.02				**0.45**	0.78	0.86	92%
B16R	B16	0.04	0.00				**0.04**	0.81	0.87	95%
B16	B16	0.92	0.18				**1.10**	0.71	0.82	83%
SUBTOTAL FOR BASIN B		**9.44**	**0.83**	**0.00**	**0.00**	**0.00**	**10.27**	0.76	0.85	89%
B-FUT	B4				7.22		**7.22**	0.77	0.85	90%
SUBTOTAL FOR BASIN B-FUT		**0.00**	**0.00**	**0.00**	**7.22**	**0.00**	**7.22**	0.77	0.85	90%
EX1	EX1	0.36	0.05				**0.41**	0.74	0.83	86%
EX2	EX2	0.51	0.23				**0.74**	0.62	0.78	72%
EX3	EX3					0.20	**0.20**	0.86	0.89	100%
EX4	EX4					0.20	**0.20**	0.86	0.89	100%
SUBTOTAL FOR BASIN EX		**0.87**	**0.28**	**0.00**	**0.00**	**0.40**	**1.55**	0.71	0.82	83%
C	C			2.09			**2.09**	0.24	0.59	25%
SUBTOTAL FOR BASIN C		**0.00**	**0.00**	**2.09**	**0.00**	**0.00**	**2.09**	0.24	0.59	25%
OS-1	OS1		0.05				**0.05**	0.20	0.57	20%
OS-2	OS2		0.29				**0.29**	0.20	0.57	20%
OS-3	OS-3		0.20				**0.20**	0.20	0.57	20%
SUBTOTAL FOR BASIN OS		**0.00**	**0.54**	**0.00**	**0.00**	**0.00**	**0.54**	0.20	0.57	20%
TOTAL STUDY AREA		**10.31**	**1.65**	**2.09**	**14.99**	**0.40**	**29.44**	**0.72**	**0.82**	83.3%
TOTAL TO EDB		**10.31**	**1.11**	**2.09**	**14.99**	**0.40**	**28.90**	**0.73**	**0.83**	84.5%

STANDARD FORM SF-2 - DEVELOPED

Time of Concentration

PROJECT NAME: Findlay Toyota
PROJECT NUMBER: 2421.0
CALCULATED BY: MCS
CHECKED BY: TWD

DATE: December 2, 2025

SUB-BASIN DATA			INITIAL TIME (T_i)			TRAVEL TIME (T_t)						tc CHECK (URBANIZED BASINS)				FINAL tc
DESIGN BASIN (1)	AREA Ac (2)	C_5 (3)	LENGTH Ft (4)	SLOPE % (5)	T_i Min. (6)	LENGTH Ft. (7)	SLOPE % (8)	C_v (9)	Land Surface (10)	VEL fps (11)	T_t Min. (12)	COMP. tc (13)	Channel Flow (Lt) (14)	Imperv. i (15)	tc vs. Eq. 6-5 Min. (16)	Min.
A	7.77	0.77	300	2.0%	8.3	300	0.5%	20.0	Paved Areas	1.4	3.5	11.9	300	0.9	14.0	11.9
B1	1.56	0.68	140	1.8%	7.5	270	1.8%	20.0	Paved Areas	2.7	1.7	9.2	270	0.8	14.3	9.2
B2	1.27	0.81	90	1.5%	4.5	490	0.5%	20.0	Paved Areas	1.4	5.8	10.3	490	0.9	15.1	10.3
B3	0.88	0.79	60	2.0%	3.5	525	2.1%	20.0	Paved Areas	2.9	3.0	6.5	525	0.9	13.0	6.5
B-FUT	7.22	0.77	300	2.0%	8.3	300	0.5%	20.0	Paved Areas	1.4	3.5	11.9	300	0.9	14.0	11.9
B5	0.14	0.81	85	1.0%	4.9	0	1.0%	20.0	Paved Areas	2.0	0.0	4.9	0	1.0	9.9	5.0
B6	0.05	0.81	40	1.0%	3.4	0	1.0%	20.0	Paved Areas	2.0	0.0	3.4	0	1.0	9.9	5.0
B7	0.08	0.81	65	1.0%	4.3	0	1.0%	20.0	Paved Areas	2.0	0.0	4.3	0	1.0	9.9	5.0
B8	0.20	0.81	40	1.0%	3.4	90	0.5%	20.0	Paved Areas	1.4	1.1	4.4	90	1.0	10.8	5.0
B9	0.18	0.78	90	1.0%	5.6	0	1.0%	20.0	Paved Areas	2.0	0.0	5.6	0	0.9	10.6	5.6
B10	0.40	0.70	150	3.3%	6.0	0	3.3%	20.0	Paved Areas	3.6	0.0	6.0	0	0.8	12.1	6.0
B11	0.63	0.74	60	2.0%	4.0	570	1.8%	20.0	Paved Areas	2.7	3.5	7.6	570	0.9	14.6	7.6
B12	0.34	0.76	130	1.0%	7.2	0	1.0%	20.0	Paved Areas	2.0	0.0	7.2	0	0.9	11.0	7.2
B13	0.55	0.75	150	2.0%	6.2	0	2.0%	20.0	Paved Areas	2.8	0.0	6.2	0	0.9	11.0	6.2
B14	0.44	0.78	150	3.3%	4.8	0	3.3%	20.0	Paved Areas	3.6	0.0	4.8	0	0.9	10.4	5.0
B15	0.45	0.78	150	3.3%	4.8	0	3.3%	20.0	Paved Areas	3.6	0.0	4.8	0	0.9	10.4	5.0
B16	1.10	0.71	225	4.0%	6.8	0	4.0%	20.0	Paved Areas	4.0	0.0	6.8	0	0.8	11.9	6.8
EX1	0.41	0.74	20	2.0%	2.4	510	1.5%	20.0	Paved Areas	2.4	3.5	5.8	510	0.9	14.7	5.8
EX2	0.74	0.62	20	2.0%	3.1	510	1.5%	20.0	Paved Areas	2.4	3.5	6.6	510	0.7	17.5	6.6
EX3	0.20	0.86														5.0
EX4	0.20	0.86														5.0
C	2.09	0.24	70	2.0%	10.5	0	2.0%	7.0	Short Pasture/Lawn	1.0	0.0	10.5	0	0.3	21.8	10.5
OS-1	0.05	0.20	25	25.0%	2.8	0	25.0%	7.0	Short Pasture/Lawn	3.5	0.0	2.8	0	0.2	22.6	5.0
OS-2	0.29	0.20	116	25.0%	6.1	0	25.0%	7.0	Short Pasture/Lawn	3.5	0.0	6.1	0	0.2	22.6	6.1
OS-3	0.20	0.20	15	25.0%	2.2	0	25.0%	7.0	Short Pasture/Lawn	3.5	0.0	2.2	0	0.2	22.6	5.0

$$T_i = \frac{0.395(1.1-C)L^{1/2}}{S^{1/3}} \qquad T_t = \frac{L}{60V}$$

STANDARD FORM SF-3 - DEVELOPED
STORM DRAINAGE DESIGN - RATIONAL METHOD 5-YEAR EVENT

PROJECT NAME: Findlay Toyota
PROJECT NUMBER: 2421
CALCULATED BY: MCS
CHECKED BY: TWD

P_1 (1-Hour Rainfall) = 1.43

DATE: December 2, 2025

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				PIPE		TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C_5	tc (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(min)	∑(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(17)	(18)	(19)	(20)	(21)	(22)
B10.0	B4	B-FUT	7.22	0.20	11.9	1.44	3.61	5.21										5.21 INLET B10.0 (TEMP)
B10.0	B4	B-FUT	7.22	0.77	11.9	5.56	3.61	20.06	11.9	5.56	3.61	20.06	0.50%	30	73	1.1	1.1	20.06 FUTURE COMMERCIAL
RD EAST 3	B3	B3R	0.07	0.81	5.0	0.06	4.85	0.28										
B9.0	B3	B3	0.88	0.79	6.5	0.69	4.50	3.12	13.0	6.31	3.47	21.87	0.50%	30	127	4.5	0.5	3.12 INLET B9.1
B8.6	B10	B10	0.40	0.70	6.0	0.28	4.61	1.30	6.0	0.28	4.61	1.30	0.50%	18	39	0.7	0.9	1.30 INLET B8.6
B8.5	B9	B9	0.18	0.78	5.6	0.14	4.69	0.66	6.9	0.42	4.42	1.86	0.50%	18	50	1.1	0.8	0.66 INLET B8.5
B8.4	B8	B8	0.20	0.81	5.0	0.16	4.85	0.79	7.7	0.58	4.26	2.48	0.50%	18	51	1.4	0.6	0.79 INLET B8.4
B8.3	B7	B7	0.08	0.81	5.0	0.06	4.85	0.31	8.3	0.64	4.15	2.65	0.50%	18	49	1.5	0.5	0.31 INLET B8.3
RD EAST 1	B6	B6R1	0.69	0.81	5.0	0.56	4.85	2.71										
RD EAST 2	B6	B6R2	0.04	0.81	5.0	0.03	4.85	0.16										
B8.2	B6	B6	0.05	0.81	5.0	0.04	4.85	0.20	8.8	1.27	4.05	5.16	0.50%	18	65	2.9	0.4	0.20 INLET B8.2
B8.1	B5	B5	0.14	0.81	5.0	0.11	4.85	0.55	9.2	1.38	3.99	5.51	3.83%	18	79	3.1	0.4	0.55 INLET B8.1
B8.0	1								13.5	7.69	3.41	26.23	0.50%	42	350	2.7	2.1	
RD WEST 2	B2	B2R	0.65	0.81	5.0	0.53	4.85	2.55										
B6.0, B7.0	B2	B2	1.27	0.81	10.3	1.02	3.83	3.92	15.6	9.24	3.19	29.43	0.50%	42	181	3.1	1.0	3.92 INLET B7.1
RD WEST 1	B1	B1R	0.22	0.81	5.0	0.18	4.85	0.86										
B5.0	B1	B1	1.56	0.68	9.2	1.06	3.99	4.22	16.6	10.48	3.09	32.40	0.50%	42	84	3.4	0.4	4.22 INLET B5.1
RD NORTH 1	B16	B16R	0.04	0.81	5.0	0.03	4.85	0.16										
B4.1-5	B16	B16	1.10	0.71	6.8	0.78	4.45	3.47	6.8	0.81	4.45	3.63	0.50%	18	90	2.1	0.7	3.47 INLET B4.1-5
RD NORTH 2	B15	B15R	0.19	0.81	5.0	0.15	4.85	0.75										
B4.1-4	B15	B15	0.45	0.78	5.0	0.35	4.85	1.71	7.5	1.31	4.30	5.63	0.50%	24	100	1.8	0.9	1.71 INLET B4.1-4
RD NORTH 3	B14	B14R	0.10	0.81	5.0	0.08	4.85	0.39										
B4.1-3	B14	B14	0.44	0.78	5.0	0.34	4.85	1.67	8.4	1.73	4.12	7.14	0.50%	24	95	2.3	0.7	1.67 INLET B4.1-3
B4.1-2	B13	B13	0.55	0.75	6.2	0.42	4.57	1.90	9.1	2.15	4.01	8.59	0.50%	24	90	2.7	0.5	1.90 INLET B4.1-2
B4.1-1	B12	B12	0.34	0.76	7.2	0.26	4.36	1.12	9.6	2.41	3.93	9.47	0.50%	24	87	3.0	0.5	1.12 INLET B4.1-1
B4.2, B4.3	B11	B11	0.63	0.74	7.6	0.47	4.28	2.00				2.00	1.00%	18	164	1.1	2.4	2.00 INLET B4.3
B4.1	2								10.1	2.88	3.86	11.10	1.52%	30	369	2.3	2.7	
B2.0, B3.0, B4.0	3								17.0	13.36	3.05	40.80	0.50%	42	582	4.2	2.3	
B1.0	A	A	7.77	0.77	11.9	5.98	3.61	21.59	19.3	19.34	2.87	55.42						21.59 FUT. COMMERCIAL
	EX2	EX2	0.74	0.62	6.6	0.46	4.48	2.06										2.06 INLET EX2
	EX1	EX1	0.41	0.74	5.8	0.30	4.65	1.40										1.40 INLET EX1
	EX1	EX4	0.20	0.86	5.0	0.17	4.85	0.83										
EX. 30" RCP	EX1	EX3	0.20	0.86	5.0	0.17	4.85	0.83	6.6	1.10	4.48	4.95						
		OS-1	0.05	0.20	5.0	0.01	4.85	0.05										TO PLUM CREEK
		OS-2	0.29	0.20	6.1	0.06	4.59	0.27										TO PLUM CREEK
		OS-3	0.20	0.20	5.0	0.04	4.85	0.19										TO R.R.
		C	2.09	0.24	10.5	0.50	3.80	1.90										TO EDB

STANDARD FORM SF-3 - DEVELOPED
STORM DRAINAGE DESIGN - RATIONAL METHOD 100-YEAR EVENT

PROJECT NAME: Findlay Toyota
PROJECT NUMBER: 2421
CALCULATED BY: MCS
CHECKED BY: TWD

P_1 (1-Hour Rainfall) = 2.60

DATE: December 2, 2025

STORM LINE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				PIPE		TRAVEL TIME			REMARKS
		DESIGN BASIN	AREA (AC)	RUNOFF COEFF C_{100}	tc (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(min)	∑(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(17)	(18)	(19)	(20)	(21)	(22)
B10.0	B4	B-FUT	7.22	0.57	11.9	4.12	6.56	27.00										27.00 INLET B10.0 (TEMP)
B10.0	B4	B-FUT	7.22	0.85	11.9	6.14	6.56	40.26	11.9	6.14	6.56	40.26	0.50%	30	73	5.5	0.2	40.26 FUTURE COMMERCIAL
RD EAST 3	B3	B3R	0.07	0.87	5.0	0.06	8.82	0.54										
B9.0	B3	B3	0.88	0.86	6.5	0.76	8.17	6.18	12.1	6.96	6.51	45.30	0.50%	30	127	9.2	0.2	6.18 INLET B9.1
B8.6	B10	B10	0.40	0.82	6.0	0.33	8.39	2.74	6.0	0.33	8.39	2.74	0.50%	18	39	1.6	0.4	2.74 INLET B8.6
B8.5	B9	B9	0.18	0.85	5.6	0.15	8.54	1.31	6.4	0.48	8.22	3.95	0.50%	18	50	2.2	0.4	1.31 INLET B8.5
B8.4	B8	B8	0.20	0.87	5.0	0.17	8.82	1.53	6.8	0.65	8.08	5.29	0.50%	18	51	3.0	0.3	1.53 INLET B8.4
B8.3	B7	B7	0.08	0.87	5.0	0.07	8.82	0.61	7.1	0.72	7.97	5.77	0.50%	18	49	3.3	0.2	0.61 INLET B8.3
RD EAST 1	B6	B6R1	0.69	0.87	5.0	0.60	8.82	5.29										
RD EAST 2	B6	B6R2	0.04	0.87	5.0	0.03	8.82	0.31										
B8.2	B6	B6	0.05	0.87	5.0	0.04	8.82	0.38	7.3	1.39	7.88	10.95	0.50%	18	65	6.2	0.2	0.38 INLET B8.2
B8.1	B5	B5	0.14	0.87	5.0	0.12	8.82	1.07	7.5	1.51	7.82	11.82	3.83%	18	79	6.7	0.2	1.07 INLET B8.1
B8.0	1								12.3	8.47	6.46	54.70	0.50%	42	350	5.7	1.0	
RD WEST 2	B2	B2R	0.65	0.87	5.0	0.57	8.82	4.99										
B6.0, B7.0	B2	B2	1.27	0.87	10.3	1.10	6.96	7.67	13.3	10.14	6.23	63.19	0.50%	42	181	6.6	0.5	7.67 INLET B7.1
RD WEST 1	B1	B1R	0.22	0.87	5.0	0.19	8.82	1.69										
B5.0	B1	B1	1.56	0.80	9.2	1.26	7.26	9.11	13.8	11.59	6.14	71.10	0.50%	42	84	7.4	0.2	9.11 INLET B5.1
RD NORTH 1	B16	B16R	0.04	0.87	5.0	0.03	8.82	0.31										
B4.1-5	B16	B16	1.10	0.82	6.8	0.90	8.08	7.30	6.8	0.93	8.08	7.52	0.50%	18	90	4.3	0.4	7.30 INLET B4.1-5
RD NORTH 2	B15	B15R	0.19	0.87	5.0	0.17	8.82	1.46										
B4.1-4	B15	B15	0.45	0.86	5.0	0.39	8.82	3.40	7.2	1.49	7.92	11.80	0.50%	24	100	3.8	0.4	3.40 INLET B4.1-4
RD NORTH 3	B14	B14R	0.10	0.87	5.0	0.09	8.82	0.77										
B4.1-3	B14	B14	0.44	0.86	5.0	0.38	8.82	3.32	7.6	1.96	7.76	15.21	0.50%	24	95	4.8	0.3	3.32 INLET B4.1-3
B4.1-2	B13	B13	0.55	0.84	6.2	0.46	8.32	3.86	7.9	2.42	7.67	18.60	0.50%	24	90	5.9	0.3	3.86 INLET B4.1-2
B4.1-1	B12	B12	0.34	0.84	7.2	0.29	7.92	2.27	8.2	2.71	7.59	20.57	0.50%	24	87	6.5	0.2	2.27 INLET B4.1-1
B4.2, B4.3	B11	B11	0.63	0.84	7.6	0.53	7.79	4.10				4.10	1.00%	18	164	2.3	1.2	4.10 INLET B4.3
B4.1	2								8.4	3.24	7.52	24.34	1.52%	30	369	5.0	1.2	
B2.0, B3.0, B4.0	3								14.0	14.83	6.10	90.45	0.50%	42	582	9.4	1.0	
B1.0	A	A	7.77	0.85	11.9	6.60	6.56	43.33	15.0	21.43	5.90	126.47						43.33 FUT. COMMERCIAL
	EX2	EX2	0.74	0.78	6.6	0.57	8.15	4.68										4.68 INLET EX2
	EX1	EX1	0.41	0.83	5.8	0.34	8.45	2.89										2.89 INLET EX1
	EX1	EX4	0.20	0.89	5.0	0.18	8.82	1.57										
EX. 30" RCP	EX1	EX3	0.20	0.89	5.0	0.18	8.82	1.57	6.6	1.27	8.15	10.37						
		OS-1	0.05	0.57	5.0	0.03	8.82	0.25										TO PLUM CREEK
		OS-2	0.29	0.57	6.1	0.17	8.35	1.38										TO PLUM CREEK
		OS-3	0.20	0.57	5.0	0.11	8.82	1.01										TO R.R.
		C	2.09	0.59	10.5	1.23	6.90	8.51										TO EDB

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

Project: FINDLAY TOYOTA **Project #:** SDP25-0018 **Applicant:** Action Civil Engineering

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.

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 Findlay Toyota

Project Owner Findlay Family Properties Limited Partnership

Project Location Lot 1 and Tract B of the Meadows 19, Lot 1, Filing 1, as recorded at reception no. 2023006012 of the records of Douglas County., Colorado.

ToCR Project Number SDP25-0018

Total Site Area 29.40 **acres**

Total Size of Common Plan of Development 12.37 **acres**

Check all that apply:

- ☑ **Project within Plum Creek Basin**
- ☐ **Project within Cherry Creek Basin**

Estimated construction completion date 7/2026

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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: 0.54 acres

   Total Site area: 29.44 acres, 1.83 % 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

APPENDIX C – HYDRAULIC CALCULATIONS

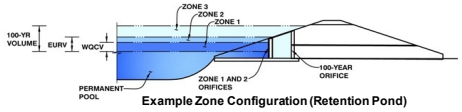
INLET CALCULATIONS (TO BE INCLUDED IN PH III REPORT)
STORM SEWER MODEL AND HGL CALCULATIONS – PROPOSED (TO BE INCLUDED IN PH III REPORT)
STORM SEWER MODEL AND HGL CALCULATIONS – EXISTING (TO BE INCLUDED IN PH III REPORT)
MHFD-DETENTION SPREADSHEET CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)

Project: _____

Basin ID: _____



Example Zone Configuration (Retention Pond)

Watershed Information

Selected SCM Type =	**EDB**	
Watershed Area =	28.90	acres
Watershed Length =	2,280	ft
Watershed Length to Centroid =	1,140	ft
Watershed Slope =	0.013	ft/ft
Watershed Imperviousness =	84.50%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	45.0%	percent
Percentage Hydrologic Soil Groups C/D =	55.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.863	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	2.550	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.06 in.) =	2.143	acre-feet	1.06 inches
5-yr Runoff Volume (P1 = 1.43 in.) =	3.061	acre-feet	1.43 inches
10-yr Runoff Volume (P1 = 1.66 in.) =	3.644	acre-feet	1.66 inches
25-yr Runoff Volume (P1 = 2 in.) =	4.546	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.26 in.) =	5.218	acre-feet	2.26 inches
100-yr Runoff Volume (P1 = 2.6 in.) =	6.126	acre-feet	2.60 inches
500-yr Runoff Volume (P1 = 3 in.) =	7.167	acre-feet	3.00 inches
Approximate 2-yr Detention Volume =	1.941	acre-feet	
Approximate 5-yr Detention Volume =	2.768	acre-feet	
Approximate 10-yr Detention Volume =	3.276	acre-feet	
Approximate 25-yr Detention Volume =	3.676	acre-feet	
Approximate 50-yr Detention Volume =	3.803	acre-feet	
Approximate 100-yr Detention Volume =	4.090	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.863	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.687	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	1.972	acre-feet
Total Detention Basin Volume =	4.522	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

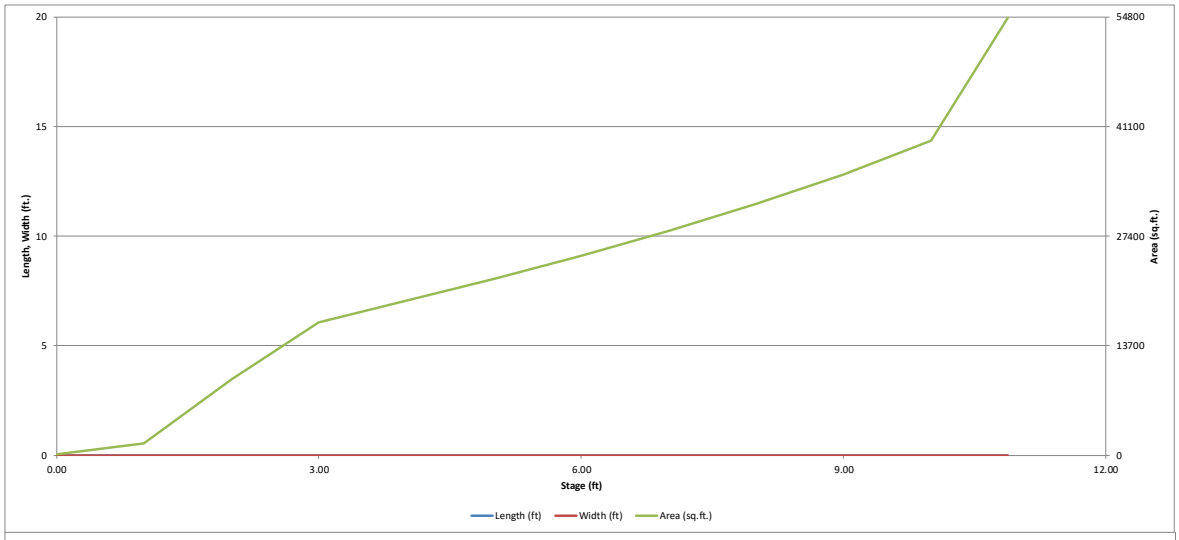
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

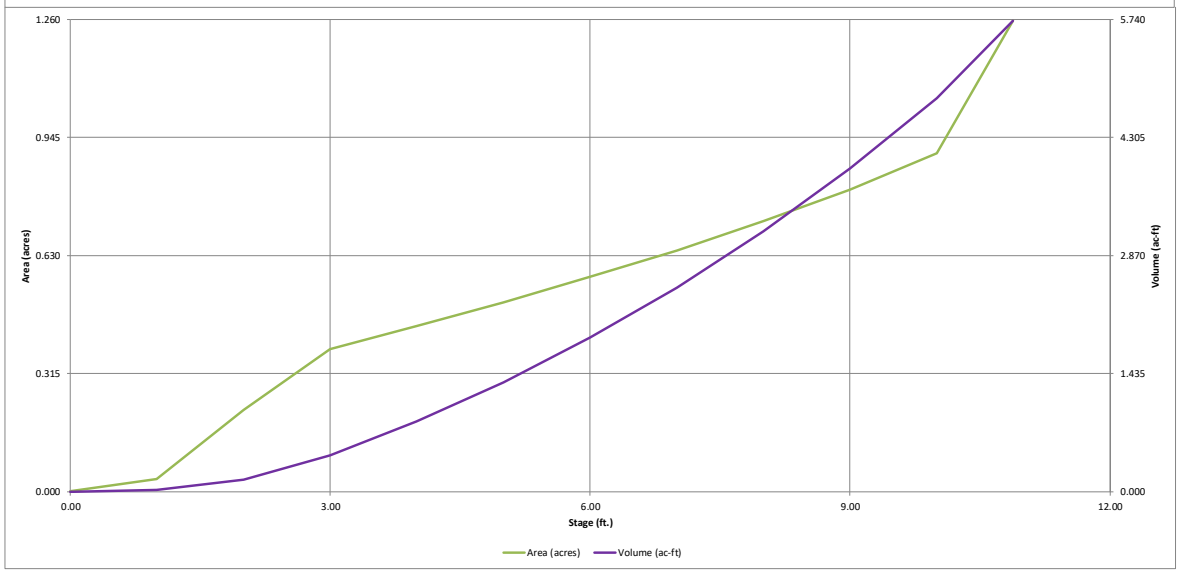
Depth Increment = _____ ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	108	0.002		
6009	--	1.00	--	--	--	1,502	0.034	805	0.018
6010	--	2.00	--	--	--	9,501	0.218	6,306	0.145
6011	--	3.00	--	--	--	16,597	0.381	19,355	0.444
6012	--	4.00	--	--	--	19,281	0.443	37,294	0.856
6013	--	5.00	--	--	--	22,031	0.506	57,950	1.330
6014	--	6.00	--	--	--	24,943	0.573	81,437	1.870
6015	--	7.00	--	--	--	28,057	0.644	107,937	2.478
6016	--	8.00	--	--	--	31,413	0.721	137,672	3.161
6017	--	9.00	--	--	--	35,069	0.805	170,913	3.924
6018	--	10.00	--	--	--	39,350	0.903	208,123	4.778
6018.28	--	10.88	--	--	--	54,756	1.257	249,530	5.728

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.07 (June 2025)



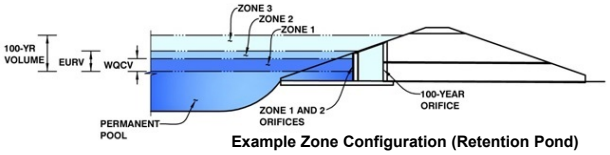


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.02	0.863	Orifice Plate
Zone 2 (EURV)	7.12	1.687	Orifice Plate
Zone 3 (100+1/2WQCV)	9.72	1.972	Weir&Pipe (Restrict)
Total (all zones)		4.522	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration SCM)

Underdrain Orifice Invert Depth =		ft (distance below the filtration media surface)	Underdrain Orifice Area =		ft^2
Underdrain Orifice Diameter =		inches	Underdrain Orifice Centroid =		feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation SCM)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	7.13	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.38	4.76					
Orifice Area (sq. inches)	3.75	3.75	4.25					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	7.13	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	8.13	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	4.12	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	7.38	N/A	
Horiz. Length of Weir Sides =	4.00	N/A	feet	Overflow Grate Open Area w/o Debris =	13.05	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	6.52	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.77	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.75	N/A	feet
Restrictor Plate Height Above Pipe Invert =	18.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	9.23	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.65	feet
Spillway Crest Length =	48.00	feet	Stage at Top of Freeboard =	10.88	feet
Spillway End Slopes =	10.00	H:V	Basin Area at Top of Freeboard =	1.26	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	5.73	acre-ft

Calculated Parameters for Spillway

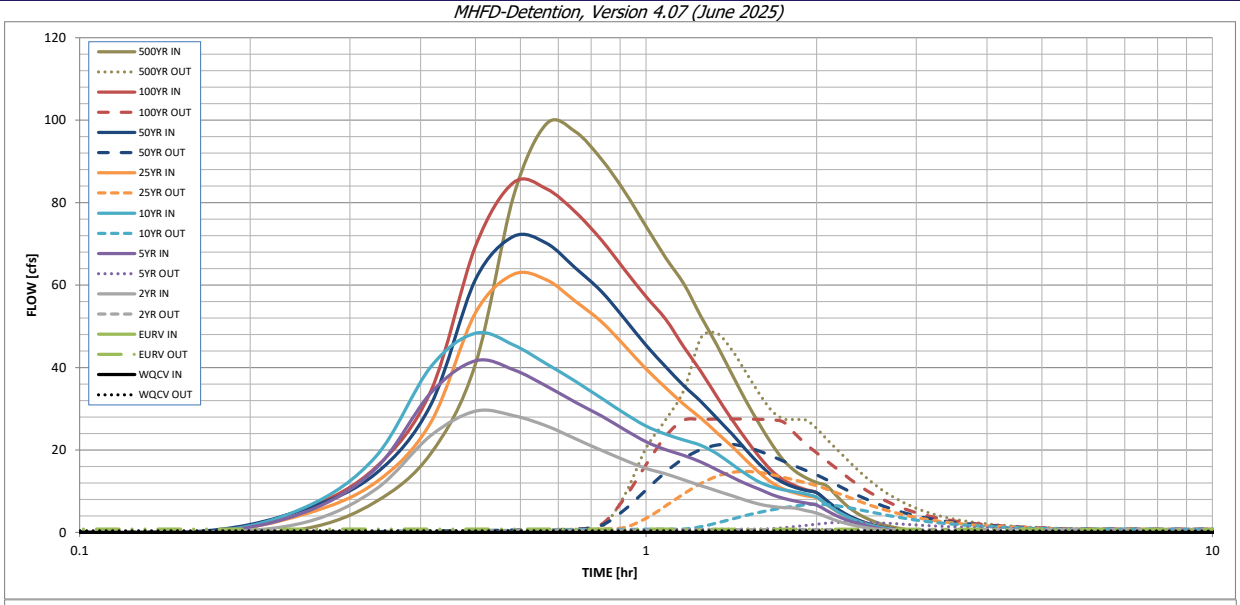
Routed Hydrograph Results

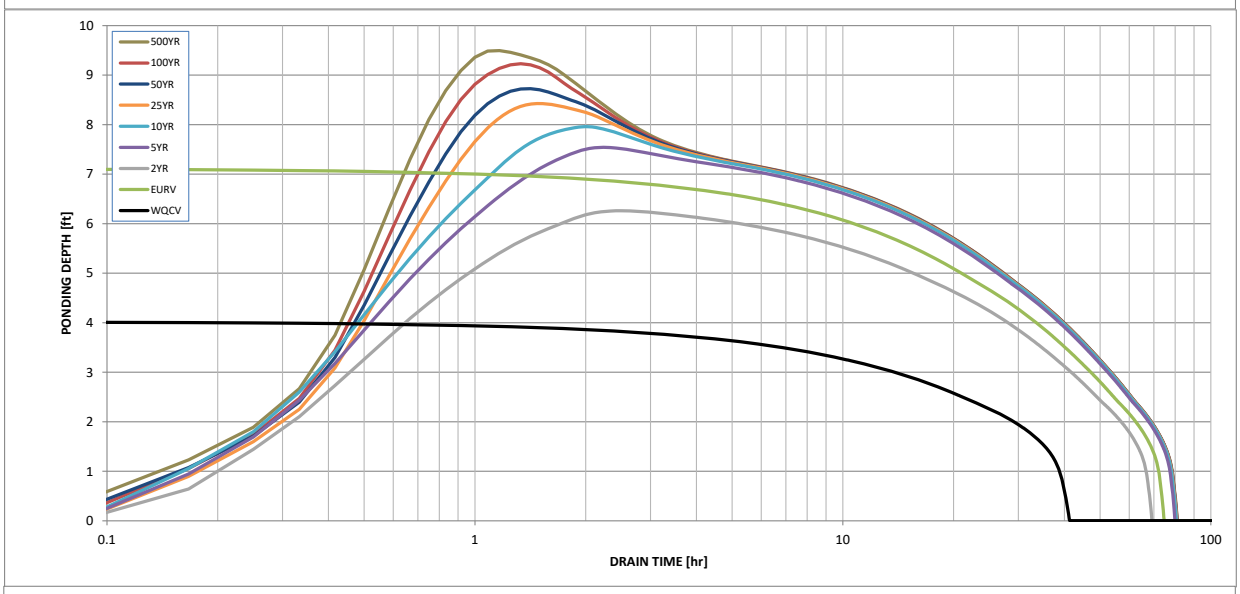
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

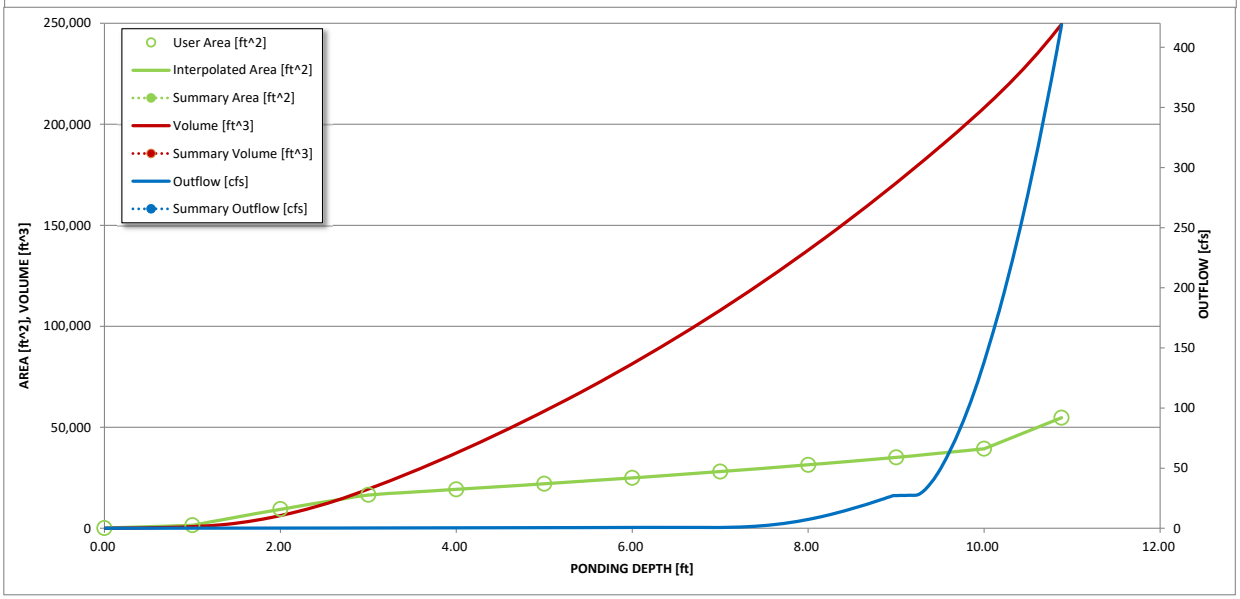
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.06	1.43	1.66	2.00	2.26	2.60	3.00
CUHP Runoff Volume (acre-ft) =	0.863	2.550	2.143	3.061	3.644	4.546	5.218	6.126	7.167
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.143	3.061	3.644	4.546	5.218	6.126	7.167
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.5	6.5	9.6	18.3	22.7	29.8	37.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.05	0.22	0.33	0.63	0.78	1.03	1.28
Peak Inflow Q (cfs) =	N/A	N/A	29.4	41.6	48.3	62.6	71.8	84.8	99.1
Peak Outflow Q (cfs) =	0.4	0.8	0.7	2.5	6.8	14.8	21.3	27.5	48.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.7	0.8	0.9	0.9	1.3
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.5	1.1	1.6	2.0	2.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	68	63	72	71	69	68	66	64
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	67	76	77	76	76	75	74
Maximum Ponding Depth (ft) =	4.02	7.12	6.26	7.54	7.96	8.43	8.72	9.23	9.49
Area at Maximum Ponding Depth (acres) =	0.44	0.65	0.59	0.69	0.72	0.76	0.78	0.83	0.85
Maximum Volume Stored (acre-ft) =	0.865	2.556	2.021	2.837	3.125	3.471	3.702	4.103	4.330

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.07 (June 2025)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0	0.00	0.00	0.00	0.00	0.00	0.40	0.19	0.94
	0:15:00	0	0.00	2.46	4.95	6.12	4.50	5.71	5.80	7.45
	0:20:00	0	0.00	10.48	15.51	18.42	12.17	14.30	15.81	19.11
	0:25:00	0	0.00	23.48	33.80	40.15	26.63	30.89	34.22	40.88
	0:30:00	0	0.00	29.43	41.64	48.32	53.30	61.36	69.42	81.47
	0:35:00	0	0.00	28.35	39.49	45.49	62.58	71.78	84.84	99.07
	0:40:00	0	0.00	25.87	35.51	40.92	61.29	70.17	83.36	97.20
	0:45:00	0	0.00	22.74	31.59	36.69	56.09	64.17	77.75	90.59
	0:50:00	0	0.00	19.95	28.29	32.59	51.16	58.50	70.96	82.67
	0:55:00	0	0.00	17.55	24.94	28.89	45.28	51.80	63.74	74.26
	1:00:00	0	0.00	15.55	22.01	25.81	39.68	45.40	57.19	66.62
	1:05:00	0	0.00	14.22	20.07	23.84	35.10	40.17	51.69	60.22
	1:10:00	0	0.00	12.74	18.69	22.42	31.06	35.57	44.95	52.40
	1:15:00	0	0.00	11.34	17.07	21.12	27.71	31.75	39.04	45.54
	1:20:00	0	0.00	10.11	15.23	19.14	24.23	27.74	33.00	38.48
	1:25:00	0	0.00	8.93	13.44	16.57	20.92	23.94	27.47	32.02
	1:30:00	0	0.00	7.81	11.84	14.20	17.60	20.13	22.67	26.42
	1:35:00	0	0.00	6.89	10.53	12.29	14.58	16.67	18.44	21.50
	1:40:00	0	0.00	6.32	9.22	11.07	12.12	13.86	14.98	17.48
	1:45:00	0	0.00	6.05	8.27	10.34	10.54	12.06	12.75	14.88
	1:50:00	0	0.00	5.90	7.63	9.84	9.55	10.93	11.33	13.24
	1:55:00	0	0.00	5.30	7.15	9.32	8.89	10.18	10.38	12.13
	2:00:00	0	0.00	4.72	6.64	8.56	8.43	9.65	9.69	11.33
	2:05:00	0	0.00	3.78	5.33	6.87	6.79	7.78	7.69	8.99
	2:10:00	0	0.00	2.91	4.09	5.27	5.18	5.93	5.78	6.76
	2:15:00	0	0.00	2.24	3.14	4.04	3.96	4.53	4.35	5.09
	2:20:00	0	0.00	1.71	2.39	3.06	3.00	3.44	3.30	3.86
	2:25:00	0	0.00	1.30	1.80	2.29	2.27	2.59	2.50	2.92
	2:30:00	0	0.00	0.98	1.33	1.70	1.68	1.92	1.87	2.19
	2:35:00	0	0.00	0.72	0.97	1.26	1.24	1.42	1.39	1.62
	2:40:00	0	0.00	0.53	0.71	0.94	0.93	1.06	1.05	1.22
	2:45:00	0	0.00	0.37	0.50	0.67	0.68	0.77	0.76	0.89
	2:50:00	0	0.00	0.24	0.33	0.45	0.46	0.53	0.52	0.60
	2:55:00	0	0.00	0.13	0.21	0.27	0.29	0.33	0.32	0.38
	3:00:00	0	0.00	0.06	0.11	0.14	0.16	0.18	0.17	0.20
	3:05:00	0	0.00	0.02	0.04	0.05	0.06	0.07	0.07	0.08
	3:10:00	0	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX D – REFERENCE MATERIAL

MHFD TABLES 6-2, 6-3, 6-8
GEOTECHICAL SITE DEVELOPMENT STUDY

Site-specific conditions may vary from the representative values presented in this chapter. The engineer is responsible for assuring that the selected imperviousness values represent the imperviousness of the catchment or the proposed development. During master planning or in early stages of design, select imperviousness values that are unlikely to be exceeded as final design plans are developed to avoid the need to increase the size of infrastructure during later design stages.

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.

To design the storm drain pipes and extended detention basin (EDB), a 90% impervious was selected for Basins A and B-Fut. (future commercial Lots 1, 3, and 4) as a conservative approach to ensure proposed infrastructure can adequately convey, treat, and detain developed flows at final build-out.

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 6-8. RUNOFF COEFFICIENTS, *C*, NRCS HSG C/D

TOTAL OR EFFECTIVE % IMPERVIOUS	NRCS HSG C/D						
	WQE & 2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.05	0.15	0.33	0.40	0.49	0.59
5%	0.03	0.08	0.17	0.35	0.42	0.50	0.60
10%	0.06	0.12	0.21	0.38	0.44	0.52	0.62
15%	0.10	0.16	0.24	0.40	0.47	0.55	0.64
20%	0.14	0.20	0.28	0.43	0.49	0.57	0.65
25%	0.18	0.24	0.32	0.46	0.52	0.59	0.67
30%	0.22	0.28	0.35	0.49	0.54	0.61	0.68
35%	0.26	0.32	0.39	0.52	0.57	0.63	0.70
40%	0.30	0.36	0.43	0.54	0.59	0.65	0.71
45%	0.34	0.40	0.46	0.57	0.62	0.67	0.73
50%	0.38	0.44	0.50	0.60	0.64	0.69	0.75
55%	0.43	0.48	0.54	0.63	0.66	0.71	0.76
60%	0.47	0.52	0.57	0.66	0.69	0.73	0.78
65%	0.51	0.56	0.61	0.68	0.71	0.75	0.79
70%	0.56	0.61	0.65	0.71	0.74	0.77	0.81
75%	0.60	0.65	0.68	0.74	0.76	0.79	0.82
80%	0.65	0.69	0.72	0.77	0.79	0.81	0.84
85%	0.69	0.73	0.76	0.80	0.81	0.83	0.86
90%	0.74	0.77	0.79	0.82	0.84	0.85	0.87
95%	0.79	0.81	0.83	0.85	0.86	0.87	0.89
100%	0.84	0.86	0.87	0.88	0.89	0.89	0.90

Sub-basins EX3 AND EX4 were modeled using 100% impervious per approved Phase III Drainage Report for the Meadows Filing No. 19 Access Road (CD19-0024). See highlighted Sub-basins O and Q from above referenced report on next page.

RUNOFF SUMMARY TABLE

DESIGN POINT	BASIN	AREA (AC)	5-YEAR RUNOFF (CFS)	100-YEAR RUNOFF (CFS)
A	A	9.61	24.9	50.1
B	B	2.24	6.5	13.0
C	C	1.23	3.9	7.9
D	D	0.55	1.9	4.0
E	E	0.73	2.4	4.7
F	F	1.30	4.8	9.7
G	G	0.82	0.0	2.8
H	H	0.92	3.4	6.9
I	I	0.56	2.0	4.1
J	J	0.33	1.4	2.6
K	K	4.51	14.2	28.4
L	L	4.52	13.4	26.9
M	M	0.78	0.2	3.4
N	N	0.20	0.8	1.6
O	O	0.20	0.8	1.6
P	P	0.20	0.8	1.6
Q	Q	0.20	0.8	1.6
O1	OS1	0.23	0.1	1.0
O2	OS2	0.13	0.0	0.6
O3	OS3	4.20	0.1	6.3

POND 1
POND 2
SANTA FE DR.
N. MEADOWS DR.
MEADOWS DR.
EX. TYPE D INLET
EX. 5' TYPE R INLET
EX. 10' TYPE R INLET
5' TYPE R INLET
10' TYPE R INLET
TYPE 16 COMBO INLETS
EX. 18" SANITARY
EX. 12" WATER LINE
EX. OVERHEAD UTILITY
EX. EASEMENT (WIDTH VARIES)
100 YR FLOODPLAIN
HABITAT CONSERVATION PLAN

0 100' 200'
1 inch = 100 ft.

LEGEND:

- PROPERTY BOUNDARY LINE
- PROPOSED EASEMENT

GRADING
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR

STORM DRAIN
- MANHOLE and PIPE
- INLET
- FLARED END SECTION

DRAINAGE
- EX BASIN DESIGNATION FROM REFERENCED REPORT
- BASIN DESIGNATION
- BASIN AREA / 5 YEAR COEFFICIENTS / 100 YEAR COEFFICIENTS
- BASIN BOUNDARY
- DIRECTIONAL FLOW ARROW
- EMERGENCY OVERFLOW PATH
- DESIGN POINT

CIVIL ENGINEERING
DEVELOPMENT CONSULTING
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LAND SURVEYING
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CORE CONSULTANTS

#	REVISION DESCRIPTION	DATE	BY

THE MEADOWS
CASTLE ROCK, COLORADO

FILING 19 ACCESS ROAD
DRAINAGE PLAN

DESIGNED BY: NW
DRAWN BY: NW
CHECKED BY: MM

JOB NO. 14-003

SHEET 1 OF 1

A.G. Wassenaar Inc.
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GEOTECHNICAL SITE DEVELOPMENT STUDY FOR

THE MEADOWS, FILING 19
SOUTH OF SANTE FE DRIVE AT NORTH MEADOWS DRIVE
CASTLE ROCK, COLORADO

165963S_R2017-03-08
The Meadows F19 SD

CASTLE ROCK DEVELOPMENT COMPANY
3033 EAST 1ST AVENUE, SUITE 305
DENVER, COLORADO 80206

MARCH 8, 2017
PROJECT NUMBER 165963

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

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March 8, 2017

Castle Rock Development Company
3033 East 1st Avenue, Suite 305
Denver, Colorado 80206

Attention: Mr. Malcolm Mulroney

Subject: Geotechnical Site Development Study
The Meadows, Filing 19
South of Sante Fe Drive at North Meadows Drive
Castle Rock, Colorado
Project Number 165963

Dear Mr. Mulroney:

We have conducted the geotechnical site development study for the proposed mixed-use development at the subject site. Our summary of the data collected during our field and laboratory work and our analysis, opinions, and conclusions are presented in the attached report. The purpose of our study is to provide design criteria for planning, site development, and preliminary design concepts for foundation systems, interior floor support, and streets for the proposed development.

In general, the subsurface materials encountered consist of fill, topsoil, clay, and sand overlying sedimentary bedrock. Claystone and/or sandstone bedrock were encountered at depths of 14 to 34 feet in 15 of the 32 test borings. Ground water was measured at depths of 16 to 31 feet in 12 of the 32 test borings during this study.

Site development considerations should include provisions for the presence of existing fill, expansive soils, and deep bedrock.

Based upon the results of this preliminary study, we expect that most of the structures will likely be founded on spread or pad-type footings or a post-tensioned slab type foundation bearing on properly placed and compacted fill. We expect that a significant number of the structure pads will require the expansive clays to be modified prior to construction of shallow foundations. In limited areas, drilled pier foundations may be feasible. Preliminary foundation design concepts are presented in the report

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ATTACHMENTS

GEOTECHNICAL SITE DEVELOPMENT STUDY

The Meadows, Filing 19
South of Sante Fe Drive at North Meadows Drive
Castle Rock, Colorado

PURPOSE

This report presents results of a geotechnical site development study for a proposed mixed-use development to be located south of Sante Fe Drive at North Meadows Drive in Castle Rock, Colorado (see Figure 1). The study was made to assist in determining preliminary design criteria for planning, site development, foundation systems, slabs-on-grade, and drainage. Preliminary geotechnical design concepts are also presented for street construction. Factual data gathered during the field and laboratory work is summarized on Figures 1 through 9 and on Table I. Our opinions and recommendations presented in this report are based on the data generated during this field exploration, laboratory testing, our experience with similar type projects, and our understanding of the proposed project.

This report is not intended to provide design criteria for individual foundations or street construction. Additional geotechnical studies will be required to develop these types of final design criteria and construction recommendations.

PROPOSED CONSTRUCTION

We understand the proposed 121-acre development will consist of commercial, industrial, and residential structures and the associated utility and roadway infrastructure. The approximate locations of our test borings are shown on Figure 1. Based on the conceptual overlot grading plans provided by Core Consultants on March 8, 2017, cut depths at our test boring locations range from approximately 1 to 10 feet and fill depths at our test boring locations range from 1 to 12 feet.

The plans indicate that the site is to be rough graded to provide a working platform for future construction. If the grading plans change from what has been provided, the recommendations in this report should be reviewed by this office.

SITE CONDITIONS

The site is bounded by a residential subdivision, Castle View High School, and railroad tracks to the south and a wastewater treatment plant and Santa Fe Drive to the north. A portion of the site is periodically used to graze horses. Plum Creek traverses the site from the northwest to the southeast. Overall, the site slopes gently downward towards Plum Creek. North Meadows Drive bisects the site. Site vegetation includes native grasses, yucca, cactus, and ponderosa pine. No bedrock outcrops were observed.

FIELD EXPLORATION

Subsurface conditions were explored by drilling 32 test borings at the approximate locations indicated on Figure 1. The test borings were advanced using a 4-inch diameter, continuous flight auger powered by a truck-mounted drill rig. At frequent intervals, samples of the subsurface materials were obtained using a Modified California sampler and a split spoon sampler which were driven into the soil by dropping a 140-pound hammer through a free fall of 30 inches. The Modified California sampler is a 2.5-inch outside diameter device. The split spoon sampler is a 2.0-inch outside diameter by 1.5-inch inside diameter device. The number of blows required for the sampler to penetrate 12 inches and/or the number of inches that the sampler is driven by 50 blows gives and indication of the consistency or relative density of the soils encountered. Results of the penetration tests and locations of sampling are presented on the "Test Boring Logs", Figures 2 through 9. Ground water measurements were made at the time of drilling and between 3 to 10 days after drilling.

LABORATORY TESTING

The samples obtained during drilling were returned to the laboratory where they were visually classified by a geotechnical engineer. Laboratory testing was then assigned to specific samples to evaluate their engineering properties. The laboratory tests included 63 swell-consolidation tests to evaluate the effect of wetting and loading on the selected samples. The results of the swell-consolidation tests are presented on Figures 10 through 41. Thirty-four gradation analyses and Atterberg limits tests were conducted to evaluate grain size distribution and plasticity. These results are presented on Figures 42 through 58. Moisture-density testing was performed on one sample. In addition, four representative samples were tested for pH, resistivity, chlorides, and water soluble sulfates. The test results are summarized on Figures 2 through 9 and on Table I.

SUBSURFACE CONDITIONS

Our test borings indicate the subsurface materials encountered consist of fill, topsoil, clay, and sand overlying sedimentary bedrock. Claystone and/or sandstone bedrock was encountered at depths ranging from 14 to 34 feet in 15 of the 32 test borings. Ground water was measured at depths ranging from 16 to 31 feet in 12 of the 32 test borings during this study. A more complete description of the subsurface conditions is shown on Figures 2 through 9.

FILL

Fill was encountered in one of the 32 test borings and was 4½ feet thick. The fill consisted of clayey sand. It was medium dense, silty, slightly moist, and mottled brown. It is not known whether the existing fill encountered during this study was placed as fill capable of supporting a structure or other structural elements. The fill should be removed prior to placement of new fill, structures, flatwork, or other structural appurtenances.

3. All topsoil and vegetation beneath planned fill areas should be thoroughly stripped and removed prior to fill placement. The organic soils or topsoil should be wasted from the site or stockpiled for future use in revegetating exposed slopes. In no case should these materials be used in new fills or where the stability of slopes will be affected by their low shear strength.
4. Any existing fill in structural areas should be entirely removed. The excavated fill must be observed for quality at the time of excavation. Material containing organic soils, debris, etc. should not be used as new fill on the site. The existing structures and driveways should also be entirely removed from the site.
5. The stripped foundation areas should be observed by this office prior to fill placement. Any soft soils found in these areas must be removed or stabilized as necessary prior to fill placement.
6. Where the natural slopes are steeper than a 5:1 (horizontal to vertical), benching will be required for structural integrity of any fills (see Figure 59).
7. After the fill areas have been cleared, the exposed soils should be scarified to a minimum depth of 6 inches, brought to the proper moisture content, and then compacted according to the Appendix.
8. Particular attention should be paid to compaction of the exterior faces of slopes.
9. Other specifications outlined in the Appendix should be followed.

OVEREXCAVATION AND PLACEMENT OF MOISTURE TREATED FILL

An option to reduce the amount of swell of the expansive soils would be to remove them from beneath foundation and pavement areas and to place the excavated material as a moisture

to 3,000 psf. The parameters provided below should be used for design of the foundation system. These parameters were developed using practices established by our firm, as well as our evaluation of published information and experience in working with these types of foundations.

Center Lift

Edge Moisture Variation Distance (e_m) = 7 to 9 feet

Differential Movement (y_m) = 1 to 3 inches

Edge Lift

Edge Moisture Variation Distance (e_m) = 4 to 6 feet

Differential Movement (y_m) = 1 to 3 inches

We suggest that the structural engineer consider the information contained in "Design and Construction of Post-Tensioned Slabs-on-Grade" by the Post-Tensioning Institute (Third Edition) for design of the slab. All portions of the structure should be supported on the post-tensioned slab. If this recommendation is not followed, cracking between the post-tensioned slab and the sections supported on other foundation systems may occur.

DRILLED PIERS

A suitable foundation system for structures where moderately to highly expansive soils are encountered would be straight shaft piers drilled into bedrock. This will also be the case if the foundation loads are high. We anticipate allowable end bearing pressures on the order of 20,000 to 40,000 psf, a minimum dead load pressure between 10,000 and 15,000 psf, and a side shear between 1,600 and 3,200 psf. The side shear would be applied for that portion of the pier in undisturbed bedrock. Minimum dead load based on pier end area on each pier of 10,000 to 15,000 psf should be anticipated. Horizontal modulus of subgrade reactions on the order of 300 to 500

tcf can be anticipated in the bedrock. Pier lengths on the order of 30 to 45 feet can be anticipated. Water may be encountered in some of the piers and casing may be necessary.

SEISMIC EVALUATION

Based on the subsurface soil profile encountered in the upper 35 feet, our knowledge of the local geotechnical conditions, and averaging the soil properties, this site is classified as Seismic Site Class D in accordance with Section 1613 of the International Building Code. Shear wave velocity testing may be used to modify the Seismic Site Class. We are available to discuss this with you.

LATERAL EARTH PRESSURES

Foundation walls with fill on only one side will need to be designed for lateral earth pressures. For this site, lateral earth pressures calculated based upon equivalent fluid densities on the order of 50 to 80 pcf should be anticipated. The preliminary estimates are for properly placed and compacted fill at foundation walls. They should not be used for site retaining walls. These values should be evaluated during the design-level geotechnical study.

INTERIOR FLOOR CONSTRUCTION

Where footing foundations are recommended, it is likely that most of the sites will be assessed with a low or moderate slab risk performance evaluation. If the risk tolerance for slab movement is zero, structural floors should be constructed in all areas. Post-tensioned slabs are structural and would not be subject to these types of movements.

DRAIN SYSTEMS

Due to the nature of the soils encountered on the site, drain systems will be required around the lowest excavation level for each structure. Either interior or exterior drains may be used. Extensive

interior drains will be necessary where ground water approaches foundation elevation. The drains must consist of rigid perforated pipe encased in gravel and sloped to a positive gravity outfall or sump.

BACKFILL AND SURFACE DRAINAGE

Backfill should be moistened and compacted to reduce potential future settlement. Site grading should consider a slope of 10% away from the foundations at the completion of construction. All other drainage swales in landscaped areas on the lots should slope at a minimum of 2%.

FILL PLACEMENT

Where fill soils are necessary beneath structural elements such as interior slabs, foundations, exterior flatwork, pavements, etc. the on-site, inorganic materials may be used. The soil must be placed in maximum 8-inch loose lifts, within 0 to +4% of optimum moisture content, and compacted to a minimum of 95% of Standard Proctor maximum dry density, according to ASTM D698 for A-6 to A-7-6 soils. For all other soil types, the soils should be placed within -2 to +2% of optimum moisture content and compacted to a minimum of 95 percent of Modified Proctor maximum dry density according to ASTM D1557. Where backfill is necessary around the exterior of the structure in landscaped areas, the material should be placed within -3 to +3% of optimum moisture content and compacted to a minimum of 90% of the appropriate Proctor maximum dry density for the material type. As a minimum, the structural designer should be consulted regarding the need for bracing and the timing of backfill. All topsoil, existing fill, and soil containing organic material should be removed prior to placement of new fill. Off-site material considered for fill beneath structural elements should be of similar or better quality as the on-site soils and must be evaluated by this office prior to importation. Fill quality specifications are presented in the

Appendix. A guide specification for proper placement and compaction of fill is presented in the Appendix.

PRELIMINARY STREET PAVEMENT DESIGN

Pavement design procedures are based on strength properties of the subgrade and pavement materials, the assumed design traffic conditions, and the Town of Castle Rock pavement regulations. The subgrade materials encountered on this site are potentially expansive and require additional precautions be taken to provide for adequate pavement performance. The pavement design procedures outlined address expansive subgrade materials primarily by modifying the subgrade materials in such a manner as to reduce the swell potential and then by attempting to minimize subgrade wetting after construction.

Based upon our preliminary analysis, it appears the proposed pavement subgrade materials will be a mixture of sandy clays and clayey sands. Their AASHTO soil classification will likely be A-1-b, A-2-4, A-2-6, A-6, and A-7-6. From this classification, we have estimated strength values in order to determine the preliminary pavement thicknesses.

The Town of Castle Rock requires moisture treatment and chemical or mechanical stabilization based upon the materials encountered on this site. The depth of moisture treatment is based on the average swell of the samples tested. Moisture treatment consists of "removing the soil, adding moisture until the soil moisture content is between 1 and 3% above optimum as determined by AASHTO T99 (ASTM D698), and compacted to at least 95% of maximum Standard Proctor density". The moisture treatment must extend to the back of curb at a minimum. Per the "Town of Castle Rock Transportation Design Criteria Manual", a stabilized subgrade is also required. A

minimum of the top 12 inches of the moisture treated fill must be stabilized by chemical (lime, etc.) or mechanical (Geogrid) methods.

Table 14.4 of the "Town of Castle Rock Transportation Design Criteria Manual" provides ESAL (Equivalent Single Axle Loadings – 18 kip equivalent) default values. The table indicates a default value of 1,000,000 for a 20-year life design for a "Industrial Street/Commercial Frontage" classification. The manual states: "This is a one-directional and per lane ESAL value which may not be reduced for directional travel or lane distribution."

Based on this information and utilizing structural numbers as determined from the Town of Castle Rock design nomograph, the alternatives presented below were calculated. Alternate B is only recommended if mechanical stabilization of the subgrade is selected. It should be emphasized that the design alternatives provided are preliminary. The final design thicknesses could be more or less than indicated.

Pavement Thickness Recommendations

Alternate	ACS (in.)	ABC (in.)	CTS (in.)	Moisture Treated Fill
A	4 to 5	—	12	18 to 36
B	4 to 5	8 to 14	—	18 to 36

ACS = Asphaltic Concrete Surface ABC = Aggregate Base Course CTS = Chemically Treated Subgrade

Proper surface and subsurface drainage is essential for adequate performance of pavements constructed on these types of subgrade materials. It has been our experience that water from landscaped areas can infiltrate pavement subgrade soils and result in loss of subgrade integrity followed by pavement damage. Therefore, provisions should be made to maintain adequate drainage and/or contain runoff from such areas. This is especially important since composite pavement sections which include base course tend to promote further subgrade moisture

infiltration and damage. In addition, water and irrigation lines should be thoroughly pressure tested for leaks prior to placement of pavement materials.

It must be reiterated that the information contained in this section is preliminary in nature. More detailed information will be required by the Town of Castle Rock prior to issuance of a paving permit. Therefore, when overlot grading is complete at the site, a final pavement evaluation must be performed.

FINAL DESIGN CONSULTATION AND CONSTRUCTION OBSERVATION

This report has been prepared for the exclusive use of Castle Rock Development Company for the purpose of providing geotechnical criteria for the proposed project. The data gathered and the conclusions and recommendations presented herein are based upon the consideration of many factors including, but not limited to, the type of structures proposed, the configuration of the structures, the proposed usage of the site, the configuration of surrounding structures, the geologic setting, the materials encountered, and our understanding of the level of risk acceptable to the Client. Therefore, the conclusions and recommendations contained in this report shall not be considered valid for use by others unless accompanied by written authorization from A. G. Wassenaar, Inc.

It is recommended that A. G. Wassenaar, Inc. be retained to provide general review of the final design and specifications in order that the recommendations presented may be properly interpreted and implemented. Our firm should also be retained to provide geotechnical engineering and material testing services during construction of the site grading, utilities, and structures. The purpose is to observe the construction with respect to the geotechnical design concepts,

specifications or recommendations, and to facilitate design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

GEOTECHNICAL RISK

The concept of risk is an important aspect of any geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools which geotechnical engineers use are generally empirical and must be tempered by engineering judgment and experience. Therefore, the solutions or recommendations presented in any geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as desired or intended. What the engineering recommendations presented in the preceding sections do constitute is our best estimate, based on the information generated during this evaluation and our experience in working with these conditions, of those measures that are necessary to help the development perform in a satisfactory manner. The Owner must understand this concept of risk, as it is they who must decide what is an acceptable level of risk for the proposed development of the site.

LIMITATIONS

We believe the professional judgments expressed in this report are consistent with that degree of skill and care ordinarily exercised by practicing design professionals performing similar design services in the same locality, at the same time, at the same site and under the same or similar circumstances and conditions. No other warranty, express or implied, is made. In the event that any changes in the nature, design or location of the facility are made, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are modified or verified in writing. Because of the

constantly changing state of the practice in geotechnical engineering, and the potential for site changes after our field exploration, this report should not be relied upon after a period of three years without our firm being given the opportunity to review and, if necessary, revise our findings.

The test borings drilled for this study were spaced to obtain a reasonably accurate picture of underground conditions for design purposes. Variations frequently occur from these conditions which are not indicated by the test borings. These variations are sometimes sufficient to necessitate modifications in the designs. If unexpected subsurface conditions are observed by any party during site development, we should be notified to review our recommendations.

Our scope of services for this project did not include, either specifically or by implication, any research, identification, testing, or assessment relative to past or present contamination of the site by any source, including biological (i.e., mold, fungi, bacteria, etc.). If such contamination were present, it is likely that the exploration and testing conducted for this report would not reveal its existence. If the Owner is concerned about the potential for such contamination or pollution, additional studies should be undertaken. We are available to discuss the scope of such studies with you.

Our scope of services for this project did not include a local or global geological risk assessment. Therefore, issues such as mine subsidence, slope stability, active faults, etc. were not researched or addressed as part of this study. If the Owner is concerned about these issues, we are available to discuss the scope of such studies upon your request.

APPENDIX E – DRAINAGE MAPS AND PLANS

MASTER DRAINAGE MAP
PROPOSED DRAINAGE MAP
OVERALL UTILITY PLAN
OVERALL GRADING PLAN
STORM SEWER PLAN AND PROFILE (TO BE INLCUDED IN PH III REPORT)

DRAINAGE LEGEND

BASIN — BASIN NAME
AREA — BASIN ACREAGE
5 yr — 5 yr C VALUE
100 yr — 100 yr C VALUE

1 — DESIGN POINT
BASIN BOUNDARY LINE
6025 — EX. MAJOR CONTOUR
EX. MINOR CONTOUR
6025 — PR. MAJOR CONTOUR
PR. MINOR CONTOUR
SURFACE FLOW DIRECTION

TRACT A - PRIVATE ROAD
MEADOWS 19, LOT 1, FILING No. 1, FIRST AMENDMENT
OWNER: FINDLAY FAMILY PROPERTIES, LP
ZONING: PLANNED DEVELOPMENT
MEADOWS FOURTH AMENDMENT

% IMP: 20%
OS3 | 0.20 | .20 | .57

LOT 3 - FUTURE COMMERCIAL DEVELOPMENT
MEADOWS 19, LOT 1, FILING No. 1, FIRST AMENDMENT
OWNER: FINDLAY FAMILY PROPERTIES, LP
ZONING: PLANNED DEVELOPMENT
MEADOWS FOURTH AMENDMENT

LOT 4 - FUTURE COMMERCIAL DEVELOPMENT
MEADOWS 19, LOT 1, FILING No. 1, FIRST AMENDMENT
OWNER: FINDLAY FAMILY PROPERTIES, LP
ZONING: PLANNED DEVELOPMENT
MEADOWS FOURTH AMENDMENT

OWNER: UNION PACIFIC RAILROAD
(VARIABLE WIDTH R.O.W.)

LOT 1 - FUTURE COMMERCIAL DEVELOPMENT
MEADOWS 19, LOT 1, FILING No. 1, FIRST AMENDMENT
OWNER: FINDLAY FAMILY PROPERTIES, LP
ZONING: PLANNED DEVELOPMENT
MEADOWS FOURTH AMENDMENT

LOT 2 - CAR DEALERSHIP
MEADOWS 19, LOT 1, FILING No. 1, FIRST AMENDMENT
OWNER: FINDLAY FAMILY PROPERTIES, LP
ZONING: PLANNED DEVELOPMENT
MEADOWS FOURTH AMENDMENT

NOT PLATTED
REC. 2007060666
OWNER: J & M INVESTMENTS LLC
ZONING: PLANNED DEVELOPMENT - MEADOWS FOURTH AMENDMENT

C | 2.09 | .24 | .59
% IMP: 25%

A | 7.77 | .77 | .85
% IMP: 90%

EX | 1.55 | .71 | .82
% IMP: 83%

B1-B16 | 10.27 | .76 | .85
% IMP:89%
(SEE PROPOSED DRAINAGE PLAN)

B-FUT | 7.22 | .77 | .85
% IMP: 90%

48" RCP
A
5' MH
42" RCP
5' MH
42" RCP
EX. 5' MH
30" RCP
3
EX1
B4

OS1 | 0.05 | .20 | .57
% IMP: 20%

OS2 | 0.29 | .20 | .57
% IMP: 20%

TRACT B (EDB PARCEL)
MEADOWS 19, LOT 1, FILING No. 1
REC: 2023006012
OWNER: FINDLAY FAMILY PROPERTIES, LP
ZONING: PLANNED DEVELOPMENT
MEADOWS FOURTH AMENDMENT

TRACT A
MEADOWS 19, LOT 1, FILING No. 1
REC: 2023006012
OWNER: TOWN OF CASTLE ROCK
ZONING: PLANNED DEVELOPMENT
MEADOWS FOURTH AMENDMENT
(NOT A PART)

NOT PLATTED
REC. 2018064530
OWNER: CASTLE ROCK DEVELOPMENT COMPANY
ZONING: PLANNED DEVELOPMENT - MEADOWS FOURTH AMENDMENT

EAST PLUM CREEK CONSERVATION EASEMENT
NOT PLATTED
REC. 2018064530
OWNER: CASTLE ROCK DEVELOPMENT COMPANY
ZONING: PLANNED DEVELOPMENT - MEADOWS FOURTH AMENDMENT

ZONE X FLOODPLAIN
FIRM PANEL 08035C0167G
EFFECTIVE DATE: 03/16/2016

ZONE AE FLOODPLAIN
FIRM PANEL 08035C0167G
EFFECTIVE DATE: 03/16/2016

EAST PLUM CREEK

TIMBER MILL PARKWAY
(VARIABLE WIDTH R.O.W.)
REC. 2021047414

EAST PLUM CREEK

EAST PLUM CREEK FLOODWAY
FIRM PANEL 08035C0167G
EFFECTIVE DATE: 03/16/2016

Know what's below.
Call before you dig.

0 100 200 Feet

SDP25-0018

#	DATE	REVISION DESCRIPTION

DRN TWD
CHK
DSG TWD

COLORADO REGISTERED 34200 PROFESSIONAL ENGINEER
12/5/25

FINDLAY TOYOTA
SITE DEVELOPMENT PLAN

MASTER DRAINAGE PLAN

ACTION CIVIL ENGINEERING
9777 PYRAMID CT, SUITE 150
ENGLEWOOD, CO 80112 720.826.3965
tdenning@actioncivileng.com

JOB NO. 2421
SCALE ---
DATE 12/2/2025
SHEETS 2
SHEET 01

DRAINAGE LEGEND

BASIN — BASIN NAME
AREA — BASIN ACREAGE
5 yr — 5 yr C VALUE
100 yr — 100 yr C VALUE
DESIGN POINT
BASIN BOUNDARY LINE
EX. MAJOR CONTOUR
EX. MINOR CONTOUR
PR. MAJOR CONTOUR
PR. MINOR CONTOUR
SURFACE FLOW DIRECTION

OS3 | 0.20 | .20 | .57
EX. 15' IREA EASEMENT REC. 2020048709
EX. 24' ACCESS EASEMENT REC. 2023006014
UNION PACIFIC RAILROAD (VARIABLE WIDTH R.O.W.)
EX. 40' WATER EASEMENT REC. 2020032100
TRACT A1
TYPE 16 SINGLE
B11 | 0.63 | .74 | .84
ACCESS EMENT 230006012
B12 | 0.34 | .76 | .84
B13 | 0.55 | .75 | .84
B14 | 0.44 | .78 | .86
B15 | 0.45 | .78 | .86
B16 | 1.10 | .71 | .82
4' MH
18" RCP
LOT 1
MEADOWS 19, LOT 1, FILING No. 1, FIRST AMENDMENT
(FUTURE COMMERCIAL DEVELOPMENT)
OWNER: FINDLAY FAMILY PROPERTIES, LP
ZONING: PLANNED DEVELOPMENT - MEADOWS FOURTH AMENDMENT
AMENDMENT
DOUBLE No. 16 VALLEY
SINGLE No. 16 VALLEY
20' UTILITY EASEMENT
24" RCP
18" RCP
EX. 20' WATER EASEMENT REC. 20200111106
4' MH
DRAINAGE SWALE
B-TEMP | 2.77 | .20 | .57
LOT 3
MEADOWS 19, LOT 1, FILING No. 1, FIRST AMENDMENT
(FUTURE COMMERCIAL DEVELOPMENT)
OWNER: FINDLAY FAMILY PROPERTIES, LP
ZONING: PLANNED DEVELOPMENT - MEADOWS FOURTH AMENDMENT
B9 | 0.18 | .78 | .85
B10 | 0.40 | .70 | .82
TYPE 13 INLET SINGLE
EX2 | 0.74 | .62 | .78
B14R | 0.10 | .81 | .87
B15R | 0.19 | .81 | .87
B1R | 0.22 | .81 | .87
B16R | 0.04 | .81 | .87
B8 | 0.20 | .81 | .87
B3R | 0.07 | .81 | .87
LOT 2
OWNER: FINDLAY FAMILY PROPERTIES, LP
ZONING: PLANNED DEVELOPMENT - MEADOWS FOURTH AMENDMENT
20' UTILITY EASEMENT
CAR DEALERSHIP BUILDING
FF: 6030.0
B2R | 0.65 | .81 | .87
B6-R1 | 0.69 | .81 | .87
B7 | 0.08 | .81 | .87
B6 | 0.05 | .81 | .87
CAR WASH BUILDING
FF: 6030.0
B3 | 0.88 | .79 | .86
EX1 | 0.41 | .74 | .83
EX. 20' WATER EASEMENT REC. 20200111106
EX. 46' ACCESS EASEMENT REC. 2023006012
B1 | 1.56 | .68 | .80
EX. 24' ACCESS EASEMENT TO BE RELINQUISHED REC. 20230006012
B5 | 0.14 | .81 | .87
B6-R2 | 0.04 | .81 | .87
24' ACCESS EASEMENT
40' DRAINAGE & UTILITY EASEMENT
30' DRAINAGE & UTILITY EASEMENT
5' MH
42" RCP
30" RCP
TYPE C INLET
TYPE 16 INLET SINGLE
EX. 30" RCP
EX. 18" RCP
EX. 10' TYPE R INLET
TYPE 13 INLET DOUBLE
OS1 | 0.05 | .20 | .57
EX. 10' PERMANENT UTILITY EASEMENT REC. 2021046155
B2 | 1.27 | .81 | .87
DOUBLE TYPE 16 VALLEY INLET
TRACT A
THE MEADOWS 19, LOT 1, FILING No. 1
REC. 2023006012
OWNER: TOWN OF CASTLE ROCK
ZONING: PLANNED DEVELOPMENT - MEADOWS FOURTH AMENDMENT
OS2 | 0.29 | .20 | .57
EX3 | 0.20 | .86 | .89
EX4 | 0.20 | .86 | .89
ZONE X FLOODPLAIN
FIRM PANEL 08035C0167G
EFFECTIVE DATE: 03/16/2016
ZONE AE FLOODPLAIN
FIRM PANEL 08035C0167G
EFFECTIVE DATE: 03/16/2016
EAST PLUM CREEK
EAST PLUM CREEK CONSERVATION EASEMENT
NOT PLATTED
REC. 2018064530
OWNER: CASTLE ROCK DEVELOPMENT COMPANY
ZONING: PLANNED DEVELOPMENT - MEADOWS FOURTH AMENDMENT
TIMBER MILL PARKWAY (VARIABLE WIDTH R.O.W.) REC. 2021046374

Know what's below. Call before you dig.

0 40 80 Feet

SDP25-0018

#	DATE	REVISION DESCRIPTION

DRN TWD
CHK
DSG TWD

FINDLAY TOYOTA
SITE DEVELOPMENT PLAN

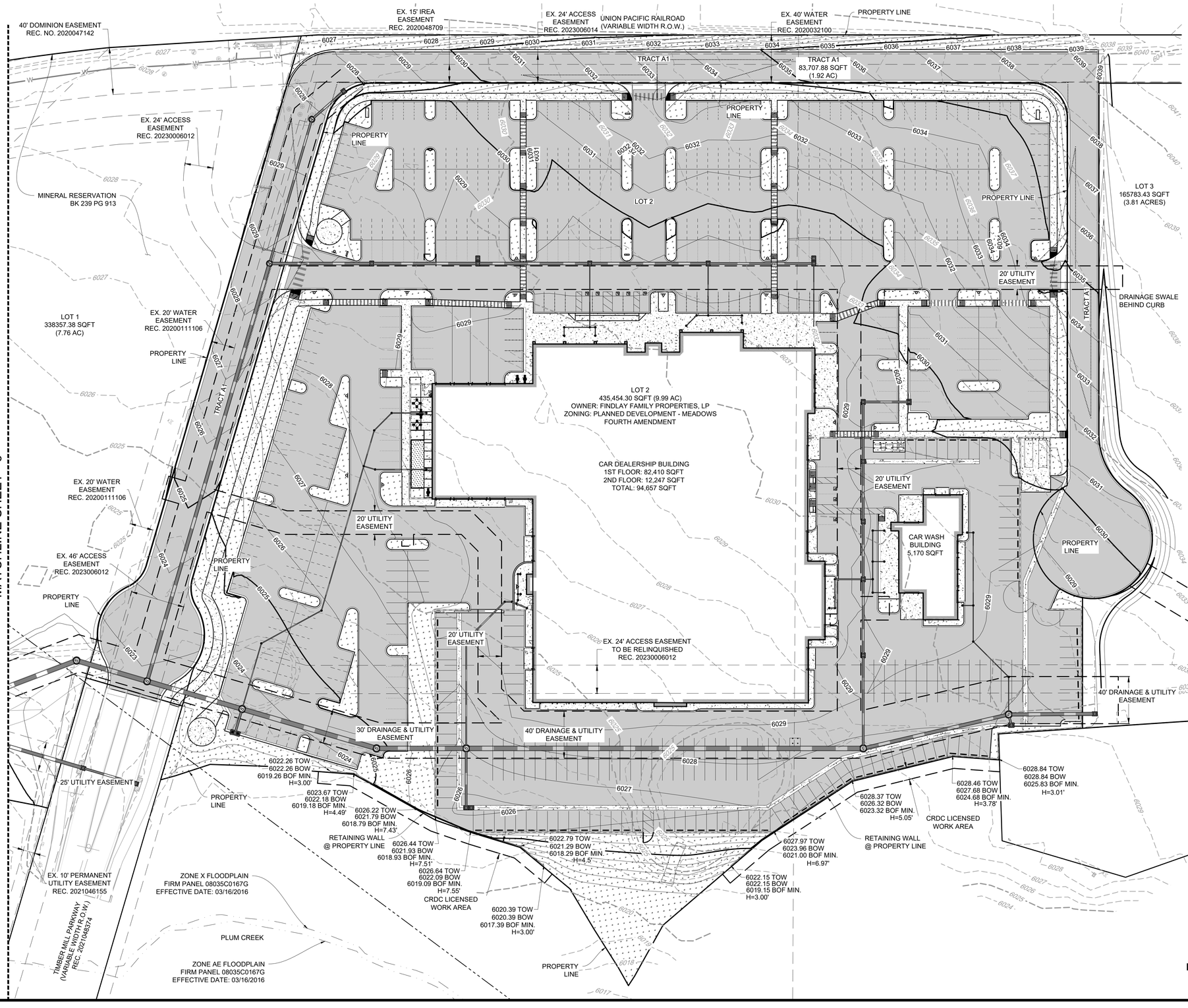
PROPOSED DRAINAGE PLAN

ACTION CIVIL ENGINEERING
9777 PYRAMID CT, SUITE 150
ENGLEWOOD, CO 80112 720.826.3965
tdenning@actioncivileng.com

JOB NO. 2421
SCALE ---
DATE 2/6/2026
SHEETS
SHEET 02

SITE DEVELOPMENT PLAN

LOT 2 AND TRACT A1 OF THE MEADOWS 19, LOT 1, FILING No. 1, 1ST AMENDMENT
NORTHWEST 1/4 OF SECTION 27 AND THE NORTHEAST QUARTER OF SECTION 28 TOWNSHIP 7 SOUTH, RANGE 67 WEST OF THE 6TH P.M.,
TOWN OF CASTLE ROCK, COUNTY OF DOUGLAS, STATE OF COLORADO



LEGEND:

- PROPERTY LINE
- EXISTING EASEMENT
- EXISTING FLOODPLAIN LIMITS
- EXISTING CONTOUR
- EXISTING FENCE LINE
- EXISTING ELECTRIC LINE
- EXISTING GAS LINE
- EXISTING SANITARY LINE W/ MH
- EXISTING STORM LINE W/ MH
- EXISTING WATER LINE
- EXISTING STREET LIGHT
- EXISTING STORM INLETS
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
- STORM WATER FLOW DIRECTION
- EXISTING CONCRETE
- EXISTING ASPHALT
- PROPOSED ASPHALT
- PROPOSED CONCRETE
- PROPOSED LANDSCAPE
- PROPOSED CONTOUR
- PROPOSED SANITARY SEWER W/ MH
- PROPOSED PRIVACY WALL
- PROPOSED RETAINING WALL
- PROPOSED WATER LINE
- PROPOSED STORM SEWER W/ MH
- PROPOSED EASEMENT LINE
- PROPOSED ACCESSIBLE ROUTE
- SERVICE PARKING
- EMPLOYEE PARKING
- INVENTORY PARKING
- DISPLAY PARKING
- CUSTOMER PARKING
- PROPOSED TYPE 'R' INLET
- PROPOSED STREET LIGHT
- PROPOSED SIGN
- PROPOSED TRANSFORMER
- MH MANHOLE
- EX. EXISTING
- PR. PROPOSED
- FG FINISHED GRADE
- RD ROOF DRAIN
- FL FLOWLINE
- T.O.W. TOP OF WALL
- B.O.W. BOTTOM OF WALL
- R.O.W./ROW RIGHT-OF-WAY
- PARKING SPACE COUNT
- PROPOSED FIRE HYDRANT
- REMOTE FIRE DEPARTMENT CONNECTION
- FIRE LANE SIGN BOTH DIRECTIONS
- BOF MIN BOTTOM OF FOOTING MINIMUM

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

0 40 80 Feet

SDP25-0018

#	DATE	REVISION DESCRIPTION
1	07/21/25	SUBMITTED TO CASTLE ROCK
2	12/05/25	SUBMITTED TO CASTLE ROCK
3	2/6/26	SUBMITTED TO CASTLE ROCK

DRN TWD
CHK
DSG TWD

FINDLAY TOYOTA
SITE DEVELOPMENT PLAN

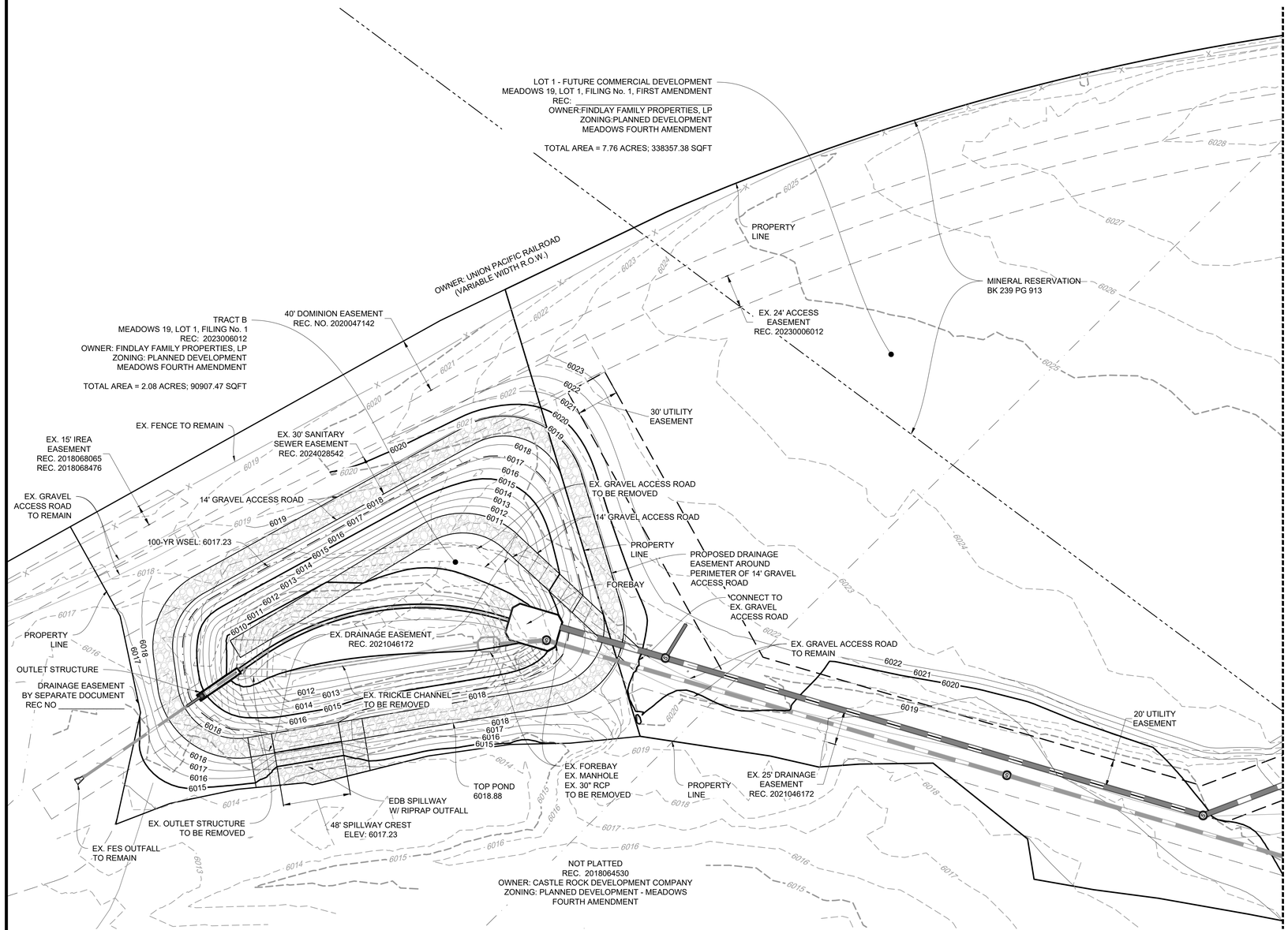
OVERALL GRADING PLAN - ONSITE

ACTION CIVIL ENGINEERING
9777 PYRAMID CT, SUITE 150
ENGLEWOOD, CO 80112 720.826.3965
tdenning@actioncivileng.com

JOB NO.	2421
SCALE	---
DATE	2/6/2026
SHEETS	25
SHEET	5

SITE DEVELOPMENT PLAN

LOT 2 AND TRACT A1 OF THE MEADOWS 19, LOT 1, FILING No. 1, 1ST AMENDMENT
NORTHWEST 1/4 OF SECTION 27 AND THE NORTHEAST QUARTER OF SECTION 28 TOWNSHIP 7 SOUTH, RANGE 67 WEST OF THE 6TH P.M.,
TOWN OF CASTLE ROCK, COUNTY OF DOUGLAS, STATE OF COLORADO



MATCHLINE SEE SHEET - 5

LEGEND:

- PROPERTY LINE
- EXISTING EASEMENT
- EXISTING FLOODPLAIN LIMITS
- EXISTING CONTOUR
- EXISTING FENCE LINE
- EXISTING ELECTRIC LINE
- EXISTING GAS LINE
- EXISTING SANITARY LINE W/ MH
- EXISTING STORM LINE W/ MH
- EXISTING WATER LINE
- EXISTING STREET LIGHT
- EXISTING STORM INLETS
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
- STORM WATER FLOW DIRECTION
- EXISTING CONCRETE
- EXISTING ASPHALT
- PROPOSED ASPHALT
- PROPOSED CONCRETE
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- CUSTOMER PARKING
- PROPOSED TYPE 'R' INLET
- PROPOSED STREET LIGHT
- PROPOSED SIGN
- PROPOSED TRANSFORMER
- MH MANHOLE
- EX. EXISTING
- PR. PROPOSED
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- RD ROOF DRAIN
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- R.O.W./ROW RIGHT-OF-WAY
- PARKING SPACE COUNT
- PROPOSED FIRE HYDRANT
- REMOTE FIRE DEPARTMENT CONNECTION
- FIRE LANE SIGN BOTH DIRECTIONS

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

0 40 80 Feet

SDP25-0018

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3	2/6/26	SUBMITTED TO CASTLE ROCK

DRN TWD
CHK
DSG TWD

FINDLAY TOYOTA
SITE DEVELOPMENT PLAN

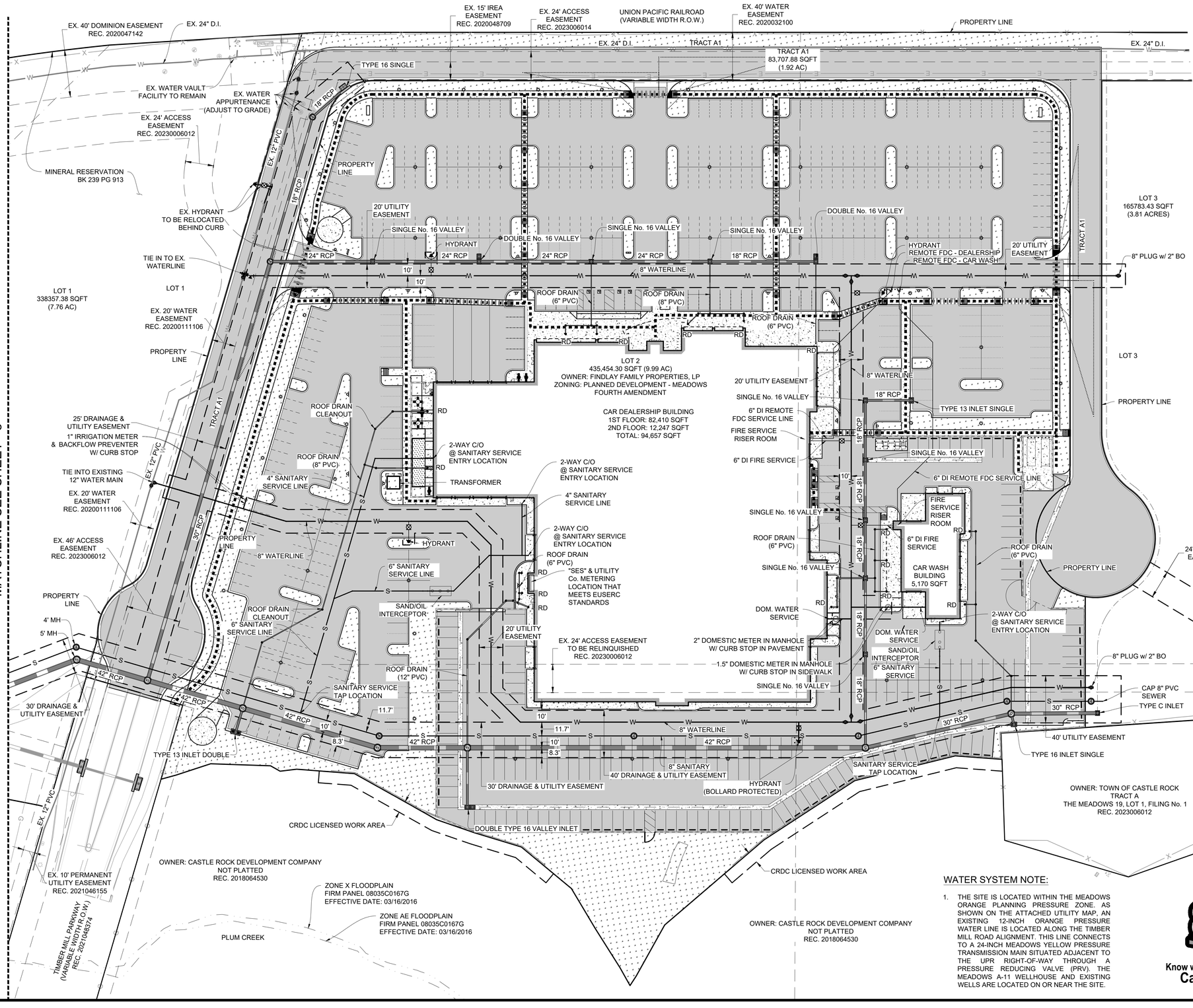
OVERALL GRADING PLAN - OFFSITE

ACTION CIVIL ENGINEERING
9777 PYRAMID CT, SUITE 150
ENGLEWOOD, CO 80112 720.826.3965
tdenning@actioncivileng.com

JOB NO. 2421
SCALE ---
DATE 2/6/2026
SHEETS 25
SHEET 6

SITE DEVELOPMENT PLAN

LOT 2 AND TRACT A1 OF THE MEADOWS 19, LOT 1, FILING No. 1, 1ST AMENDMENT
NORTHWEST 1/4 OF SECTION 27 AND THE NORTHEAST QUARTER OF SECTION 28 TOWNSHIP 7 SOUTH, RANGE 67 WEST OF THE 6TH P.M.,
TOWN OF CASTLE ROCK, COUNTY OF DOUGLAS, STATE OF COLORADO



LEGEND:

- PROPERTY LINE
- EXISTING EASEMENT
- EXISTING FLOODPLAIN LIMITS
- EXISTING CONTOUR
- EXISTING FENCE LINE
- EXISTING ELECTRIC LINE
- EXISTING GAS LINE
- EXISTING SANITARY LINE W/ MH
- EXISTING STORM LINE W/ MH
- EXISTING WATER LINE
- EXISTING STREET LIGHT
- EXISTING STORM INLETS
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
- STORM WATER FLOW DIRECTION
- EXISTING CONCRETE
- EXISTING ASPHALT
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- PROPOSED TYPE 'R' INLET
- PROPOSED STREET LIGHT
- PROPOSED SIGN
- PROPOSED TRANSFORMER
- MH MANHOLE
- EX. EXISTING
- PR. PROPOSED
- FG FINISHED GRADE
- RD ROOF DRAIN
- FL FLOWLINE
- T.O.W. TOP OF WALL
- B.O.W. BOTTOM OF WALL
- R.O.W./ROW RIGHT-OF-WAY
- PARKING SPACE COUNT
- PROPOSED FIRE HYDRANT
- REMOTE FIRE DEPARTMENT CONNECTION
- FIRE LANE SIGN BOTH DIRECTIONS

UTILITY NOTES:

1. THIS SITE IS LOCATED WITHIN THE TOWN OF CASTLE ROCK ORANGE PLANNING WATER PRESSURE ZONE.
2. ALL PROPOSED EASEMENTS MUST BE RECORDED PRIOR TO ISSUANCE OF CONSTRUCTION PERMITS.
3. ALL UTILITY EASEMENTS FOR WATER AND WASTEWATER LINES SHALL BE FOR THE EXCLUSIVE USE OF THE TOWN SO THAT ACCESS AND MAINTENANCE MAY BE PERFORMED.
4. THE MINIMUM SEPARATION BETWEEN WATERLINES, SANITARY SEWER AND STORM SEWER LINES IS 10 FEET.
5. THE MINIMUM SEPARATION BETWEEN WATER SERVICE LINES IS 5 FEET.
6. ANY TIE-IN, CROSSING OR LOWERING OF TOWN CRITICAL INFRASTRUCTURE WILL REQUIRE A TIME AND MATERIALS PERMIT (TMU) WITH FEES REQUIRED PRIOR TO CONSTRUCTION.

WATER SYSTEM NOTE:

1. THE SITE IS LOCATED WITHIN THE MEADOWS ORANGE PLANNING PRESSURE ZONE. AS SHOWN ON THE ATTACHED UTILITY MAP, AN EXISTING 12-INCH ORANGE PRESSURE WATER LINE IS LOCATED ALONG THE TIMBER MILL ROAD ALIGNMENT. THIS LINE CONNECTS TO A 24-INCH MEADOWS YELLOW PRESSURE TRANSMISSION MAIN SITUATED ADJACENT TO THE UPR RIGHT-OF-WAY THROUGH A PRESSURE REDUCING VALVE (PRV). THE MEADOWS A-11 WELLHOUSE AND EXISTING WELLS ARE LOCATED ON OR NEAR THE SITE.

Know what's below. Call before you dig.

0 40 80 Feet

SDP25-0018

#	DATE	REVISION DESCRIPTION
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2	12/05/25	SUBMITTED TO CASTLE ROCK
3	2/6/26	SUBMITTED TO CASTLE ROCK

DRN TWD
CHK
DSG TWD

FINDLAY TOYOTA
SITE DEVELOPMENT PLAN

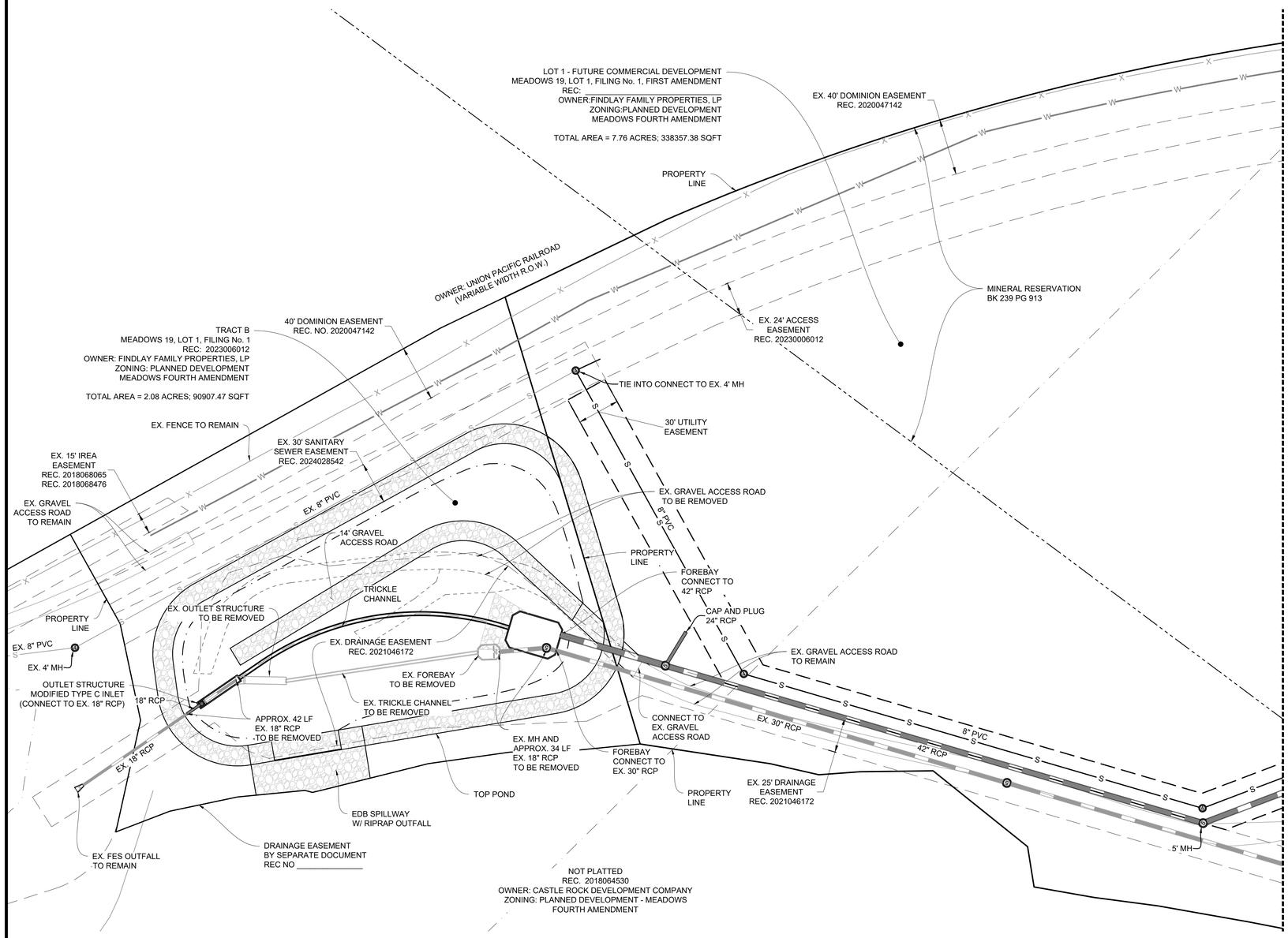
OVERALL UTILITY PLAN - ONSITE

ACTION CIVIL ENGINEERING
9777 PYRAMID CT, SUITE 150
ENGLEWOOD, CO 80112 720.826.3965
tdenning@actioncivileng.com

JOB NO. 2421
SCALE ---
DATE 2/6/2026
SHEETS 25 SHEET 7

SITE DEVELOPMENT PLAN

LOT 2 AND TRACT A1 OF THE MEADOWS 19, LOT 1, FILING No. 1, 1ST AMENDMENT
NORTHWEST 1/4 OF SECTION 27 AND THE NORTHEAST QUARTER OF SECTION 28 TOWNSHIP 7 SOUTH, RANGE 67 WEST OF THE 6TH P.M.,
TOWN OF CASTLE ROCK, COUNTY OF DOUGLAS, STATE OF COLORADO



MATCHLINE SEE SHEET - 7

LEGEND:

- PROPERTY LINE
- EXISTING EASEMENT
- EXISTING FLOODPLAIN LIMITS
- EXISTING CONTOUR
- EXISTING FENCE LINE
- EXISTING ELECTRIC LINE
- EXISTING GAS LINE
- EXISTING SANITARY LINE W/ MH
- EXISTING STORM LINE W/ MH
- EXISTING WATER LINE
- EXISTING STREET LIGHT
- EXISTING STORM INLETS
- EXISTING FIRE HYDRANT
- EXISTING WATER VALVE
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- CUSTOMER PARKING
- PROPOSED TYPE 'R' INLET
- PROPOSED STREET LIGHT
- PROPOSED SIGN
- PROPOSED TRANSFORMER
- MH MANHOLE
- EX. EXISTING
- PR. PROPOSED
- FG FINISHED GRADE
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- T.O.W. TOP OF WALL
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- R.O.W./ROW RIGHT-OF-WAY
- PARKING SPACE COUNT
- PROPOSED FIRE HYDRANT
- REMOTE FIRE DEPARTMENT CONNECTION
- FIRE LANE SIGN BOTH DIRECTIONS

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

0 40 80 Feet

SDP25-0018

#	DATE	REVISION DESCRIPTION
1	07/21/25	SUBMITTED TO CASTLE ROCK
2	12/05/25	SUBMITTED TO CASTLE ROCK
3	2/6/26	SUBMITTED TO CASTLE ROCK

DRN TWD
CHK
DSG TWD

FINDLAY TOYOTA
SITE DEVELOPMENT PLAN

OVERALL UTILITY PLAN - OFFSITE

ACTION CIVIL ENGINEERING
9777 PYRAMID CT, SUITE 150
ENGLEWOOD, CO 80112 720.826.3965
tdenning@actioncivileng.com

JOB NO. 2421
SCALE ---
DATE 2/6/2026
SHEETS 25
SHEET 8