MARTIN/MARTIN
CONSULTING ENGINEERS

AdventHealth Castle Rock MOB

DRAINAGE CONFORMANCE LETTER
Lot 2, Block 2, Heckendorf Ranch Filing No. 2
Castle Rock, Colorado

Martin/Martin, Inc. Project No.: 24.0241

Town of Castle Rock Project No.: 25.0001

May 14, 2025

Prepared For:	ADVENTHEALTH 2350 MEADOWS BOULEVARD CASTLE ROCK, CO 80109 ATTN: DAVID NELSON
Prepared By:	MARTIN/MARTIN, INC. 12499 WEST COLFAX AVENUE LAKEWOOD, COLORADO 80215 303.431.6100

Principal-in-Charge:	Peter S. Buckley, PE
Project Manager:	Nicole Kontour, PE
Project Engineer:	Michael Molina

CERTIFICATION STATEMENT

I affirm that this report and plan for the Phase II drainage design of the AdventHealth Castle Rock MOB 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. _____

(Affix seal)

AdventHealth hereby certifies that the drainage facilities for the AdventHealth Castle Rock MOB 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 AdventHealth Castle Rock MOB, guarantee that final drainage design review will absolve AdventHealth and/or their successors and/or assigns of future liability for improper design.

_____

Name of Developer

_____

Authorized Signature

May 14, 2025

Town of Castle Rock
Castle Rock Water/Drainage
100 N. Wilcox Street
Castle Rock, CO 80104

Re: AdventHealth Castle Rock MOB Drainage Conformance Letter
Martin/Martin, Inc. Project No.: 24.0241
PREAPP24-0032

GENERAL LOCATION AND DESCRIPTION

The intent of this letter is to address the drainage design for the AdventHealth Castle Rock MOB (herein referred to as the "project site"), located within Lot 2, Block 2, Heckendorf Filing No. 2, in the southwest quarter of Section 23, Township 8 South, Range 67 West of the 6th P.M., Town of Castle Rock, County of Douglas, State of Colorado. The site is listed as Parcel No. 2505-233-04-001. The extents of the site improvements consist of 4.74 acres of the 5.17 acre property and includes the construction of a two-story medical office building (MOB) facility, associated parking, access drives, sidewalks, site landscaping, water, sanitary, and storm infrastructure.

The project site is defined within the master drainage study titled, 'Phase III Drainage Report for Heckendorf Ranch Filing 2, Castle Rock, Colorado', prepared by EMK Consultants, Inc., dated January 9, 2006 (herein referred to as the "MASTER REPORT").

The existing site consists of roughly graded, undeveloped land. Existing vegetation density is approximately 10% with slopes ranging from 1% to 35%. The project site is zoned as planned development.

DRAINAGE BASIN AND SUB-BASINS

The project site is situated within Basin B2 of the MASTER REPORT. More specifically, the project site is within sub-basins B2.13 and B2.15. Refer to the excerpt from the MASTER REPORT titled "Final Drainage Study Rational Method Basin Map" attached to this letter for additional information. The design intent of Master Basin B2 was to direct stormwater to Design Point 85 of the MASTER REPORT located within Crystal Valley Parkway, where runoff will then be conveyed northwest and discharged to the regional water quality and detention facility, also known as Pond 1.

The project site is comprised of 16 on-site basins and 5 off-site basins consisting of 5.51 acres with a proposed composite impervious value of approximately 43.4%. A proposed Drainage Plan and associated rational calculations have been provided as an attachment for reference.

Basin B2.13 of the MASTER REPORT consists of proposed sub-basins A-1 through A-15, OS-2, OS-3, OS-4, and R-1. Based on analysis and assumptions outlined in the MASTER REPORT, basin B2.13 was anticipated to be approximately 96% impervious and generate a runoff of 16.1 cfs and 29.9 cfs in the 5-YR and 100-YR events, respectively.

Basin B2.15 of the MASTER RERPORT consists of proposed sub-basins RD-1 and TO-1. Based on analysis and assumptions outlined in the MASTER REPORT, this basin was anticipated to be approximately 65% impervious and generate a runoff of 3.3 cfs and 10.5 cfs in the 5-YR and 100-YR events, respectively.

Proposed drainage patterns will generally remain consistent with the MASTER REPORT. A majority of the runoff associated with the project site will be captured via area inlets, curb inlets, and proposed storm infrastructure and then be conveyed to existing storm infrastructure located within Crystal Valley Parkway. Roof drains will be utilized for the medical office building and route runoff to the proposed storm infrastructure. Any runoff not captured by proposed storm infrastructure will overland flow offsite and be captured by existing storm infrastructure. In summary, the proposed drainage improvements within the project site have been designed to remain in conformance with the MASTER REPORT. All stormwater runoff associated with the project site, both collected on-site or flowing offsite, will be routed to the regional water quality and detention facility, Pond 1 with the exception of the western property limits which is outside of the MASTER REPORT tributary area to Pond 1.

The sub-basins analyzed within this drainage letter are described as follows:

Basin A-1: Sub-basin A-1 is approximately 0.66 acres, located in the northern portion of the site, and consists of landscaping. Storm runoff within basin A-1 will overland flow to a drainage swale where it will then be conveyed as a concentrated flow to design point A-1, also being EX. AREA INLET. The minor and major storm event flows associated with basin A-1 were calculated to be 0.07 cfs and 1.84 cfs, respectively.

Basin A-2: Sub-basin A-2 is approximately 0.52 acres, located in the western portion of the site, and consists of landscaping, asphalt and concrete vehicular paving, sidewalks and the ambulance bay roof canopy. Storm runoff within basin A-2 will overland flow to a concrete pan and curb and gutter where it will be conveyed as a concentrated flow to design point A-2, also being ST INLET #A-1. The minor and major storm event flows associated with basin A-2 were calculated to be 1.52 cfs and 3.48 cfs, respectively.

Basin A-3: Sub-basin A-3 is approximately 0.18 acres, located south of the proposed MOB, and consists of landscaping and portions of sidewalk adjacent to the building. Storm runoff within basin A-3 will be captured by landscape area inlets, also being design point A-3. The minor and major storm event flows associated with basin A-3 were calculated to be 0.09 cfs and 0.79 cfs, respectively.

Basin A-4: Sub-basin A-4 is approximately 0.06 acres, located along a majority of the east face of the proposed MOB, and consists of landscaping. Storm runoff within basin A-4 will be collected through a landscape area inlet, also being design point A-4. The minor and major storm event flows associated with basin A-4 were calculated to be 0.01 cfs and 0.23 cfs, respectively.

Basin A-5: Sub-basin A-5 is approximately 0.32 acres, located in the southwest portion of the site, and consists of landscaping, asphalt paving, and sidewalks. Storm runoff within basin A-5 will overland flow to curb and gutter where it will then be conveyed to design point A-5, also being ST INLET #A-2. The minor and major storm event flows associated with basin A-5 were calculated to be 0.96 cfs and 2.10 cfs, respectively.

Basin A-6: Sub-basin A-6 is approximately 0.20 acres, located in the central portion of the site, and consists of landscaping, asphalt paving, and portions of sidewalk. Storm runoff within basin A-6 will overland flow to a curb and gutter where it will then be conveyed as a concentrated flow to design point A-6, also being ST INLET #A-4. The minor and major storm event flows associated with basin A-6 were calculated to be 0.63 cfs and 1.39 cfs, respectively.

Basin A-7: Sub-basin A-7 is approximately 0.10 acres, located in the central portion of the site, and consists of landscaping, asphalt and concrete paving, and small portions of sidewalk. Storm runoff within basin A-7 will overland flow to a concrete pan and then be conveyed to design point A-7, also being ST INLET #A-6. The minor and major storm event flows associated with basin A-7 were calculated to be 0.34 cfs and 0.73 cfs, respectively.

Basin A-8: Sub-basin A-8 is approximately 0.08 acres, located in the eastern portion of the site, and consists of landscaping, concrete paving, sidewalk, and the main entrance roof canopy. Storm runoff within basin A-8 will overland flow to design point A-8, also being ST INLET #A-8. The minor and major storm event flows associated with basin A-8 were calculated to be 0.26 cfs and 0.55 cfs, respectively.

Basin A-9: Sub-basin A-9 is approximately 0.10 acres, located in the northeastern portion of the site, and consists of landscaping, asphalt and concrete paving, and sidewalk. Storm runoff within basin A-9 will overland flow to curb and gutter where it will then be conveyed to design point A-9, also being ST INLET #A-11. The minor and major storm event flows associated with basin A-9 were calculated to be 0.32 cfs and 0.69 cfs, respectively.

Basin A-10: Sub-basin A-10 is approximately 0.57 acres, located in the southern portion of the site, and consists of landscaping and a small section of retaining wall. Storm runoff within basin A-10 will overland flow to a swale where it will then be conveyed as a concentrated flow to design point A-10, also being ST INLET #A-3. The minor and major storm event flows associated with basin A-10 were calculated to be 0.06 cfs and 1.50 cfs, respectively.

Basin A-11: Sub-basin A-11 is approximately 0.28 acres, located in the southern portion of the site, and consists of landscaping, a small portion of retaining wall, and asphalt surface parking. Storm runoff within basin A-11 will overland flow to a concrete pan in the parking lot where it will be conveyed as a concentrated flow to design point A-11, also being ST INLET #A-5. The minor and major storm event flows associated with basin A-11 were calculated to be 1.05 cfs and 2.11 cfs, respectively.

Basin A-12: Sub-basin A-12 is approximately 0.20 acres, located in the southeastern portion of the site, and consists of landscaping, a small portion of retaining wall, and asphalt surface parking. Storm runoff within basin A-12 will overland flow to a concrete pan where it will then be conveyed as a concentrated flow to design point A-12, also being ST INLET #A-7. The minor and major storm event flows associated with basin A-12 were calculated to be 0.76 cfs and 1.52 cfs, respectively.

Basin A-13: Sub-basin A-13 is approximately 0.24 acres, located in the southeastern portion of the site, and consists of landscaping, a small portion of retaining wall, and asphalt surface parking. Storm runoff within basin A-13 will overland flow to a concrete pan where it will then be conveyed as a concentrated flow to design point A-13, also being ST INLET #A-9. The minor and major storm event flows associated with basin A-13 were calculated to be 0.90 cfs and 1.78 cfs, respectively.

Basin A-14: Sub-basin A-14 is approximately 0.18 acres, located in the southeastern portion of the site, and consists of landscaping, retaining wall, and asphalt surface parking. Storm runoff within basin A-14 will overland flow to curb and gutter where it will then be conveyed to design point A-14, also being ST INLET #A-10. The minor and major storm event flows associated with basin A-14 were calculated to be 0.39 cfs and 1.01 cfs, respectively.

Basin A-15: Sub-basin A-15 is approximately 0.22 acres, located in the northern portion of the site, and consists of landscaping and a small portion of sidewalk. Storm runoff within basin A-15 will overland flow to a drainage swale where it will then be conveyed as a concentrated flow to design point A-15, also being EX. AREA INLET. The minor and major storm event flows associated with basin A-15 were calculated to be 0.4 cfs and 0.87 cfs, respectively.

Basin R-1: Sub-basin R-1 is approximately 0.29 acres, located in the central portion of the site, and consists of the MOB roof area. Storm runoff within basin R-1 will be collected by various roof drains depicted as design points R-1. Runoff collected by roof drain will then be routed to the proposed storm sewer via a hard pipe connection. The minor and major storm event flows associated with basin R-1 were calculated to be 1.12 cfs and 2.18 cfs, respectively.

Basin OS-1: Sub-basin OS-1 is approximately 0.77 acres, located in the western portion of the site, and consists of landscaping and undisturbed land. Storm runoff within basin OS-1 will overland flow to the design point OS-1, also being the adjacent open space which conforms to existing drainage patterns identified in the MASTER REPORT. Runoff leaving the project site will continue to follow existing drainage patterns. The minor and major storm event flows associated with basin OS-1 were calculated to be 0.11 cfs and 2.71 cfs, respectively. Basin OS-1 is excluded from meeting the water quality enhancement requirements by meeting the conditions for an exclusion outlined in Section 13.1.5 of the Castle Rock Water Department Storm Drainage Design and Technical Criteria Manual for land disturbance for land to remain undeveloped.

Basin OS-2: Sub-basin OS-2 is approximately 0.10 acres, located in the southern portion of the site, and consists of landscaping. Storm runoff within basin OS-2 will overland flow to an existing swale where it will be conveyed as a concentrated flow to design point OS-2 and eventually be collected by ST INLET #A-10. The minor and major storm event flows associated with basin OS-2 were calculated to be 0.01 cfs and 0.31 cfs, respectively.

Basin OS-3: Sub-basin OS-3 is approximately 0.04 acres, located in the northwestern portion of the site, and consists of asphalt paving and sidewalk. Storm runoff within basin OS-3 will overland flow to an existing inlet located within the parking lot of the adjacent property. Runoff leaving the project site will follow existing drainage patterns. The minor and major storm event flows associated with basin OS-3 were calculated to be 0.004 cfs and 0.09 cfs,

respectively. Flows within basin OS-3 were originally accounted for in basin B2.14 of the MASTER REPORT. Minor and major storm event flows associated with basin B2.14 were determined to be 8.3 cfs and 15.4 cfs, respectively. Therefore, it is not anticipated that the major storm even flow of 0.09 cfs from basin OS-3 will have an adverse impact to existing, downstream storm infrastructure in basin B2.14. Developed flows associated with basin OS-3 are tributary to the regional water quality and detention facility, Pond 1.

Basin OS-4: Sub-basin OS-4 is approximately 0.11 acres, located in the southern portion of the site, and consists of landscaping. Storm runoff within basin OS-4 will overland flow to the Plum Creek Boulevard R.O.W. where it will be conveyed to design point OS-4 and eventually be collected by existing storm infrastructure within Plum Creek Boulevard. The minor and major storm event flows associated with basin OS-4 were calculated to be 0.02 cfs and 0.42 cfs, respectively.

Basin TO-1: Sub-basin TO-1 is approximately 0.11 acres, located in the southeastern portion of the site, and consists of landscaping. Storm runoff within basin TO-1 will overland flow onto the project site into basin A-14 where it will be collected by ST INLET #A-10. The minor and major storm event flows associated with basin TO-1 were calculated to be 0.02 cfs and 0.42 cfs, respectively.

Basin RD-1: Sub-basin RD-1 is approximately 0.20 acres, located to the north of the site within the Crystal Valley Parkway right-of-way and consists of landscaping, asphalt paving, and sidewalk. Storm runoff within basin RD-1 will overland flow to curb and gutter where it will then be conveyed to design point RD-1 and eventually be collected by an existing curb inlet at Design Point 82 of the MASTER REPORT. The minor and major storm event flows associated with basin RD-1 were calculated to be 0.61 cfs and 1.37 cfs, respectively.

Basin OS-1 was not considered when calculating the composite impervious value of the site as it is not tributary to Pond 1 as identified in the Drainage Plan provided with the MASTER REPORT. It is the intent of the civil engineer to mimic the existing condition of Basin OS-1, as described by the MASTER REPORT. The resulting composite imperviousness of 49.4% remains less than anticipated developed imperviousness from the MASTER REPORT. Therefore, the existing water quality and detention facility, Pond 1, is adequately sized to serve runoff associated with the proposed site.

Existing stormwater flows to the south of the project site, within Plum Creek Blvd, are not anticipated to impact the proposed drainage improvements within the project site. A high point has been established within the westernmost access drive, just north of the intersection with Plum Creek Blvd to maintain delineation between existing stormwater flows within the right of way and developed flows within the project site.

DRAINAGE DESIGN CRITERIA

The proposed drainage design for the project site is in conformance with the Town of Castle Rock's Storm Drainage Design and Technical Criteria Manual and Mile High Flood District Criteria.

The rational method was used to complete hydrologic analysis for the 5-YR and 100-YR events in each sub-basin. Per the MASTER REPORT, existing on-grade inlets and downstream storm sewer infrastructure are

sized for the 5-YR event. The existing inlets in sump and associated downstream storm sewer infrastructure are sized for the 100-YR event. Water quality and detention for the project site will be provided by the existing regional detention pond, Pond 1, located to the northwest of the site per the MASTER REPORT. Pond 1 is adequately sized to treat and attenuate stormwater drainage from the project site, as mentioned above.

STORMWATER MANAGEMENT FACILITY DESIGN

The proposed storm infrastructure has been designed to convey runoff from the project site to existing downstream stormwater infrastructure. All proposed storm infrastructure is designed to convey the 100-YR flows. The Town of Castle Rock inlet capacity charts will be utilized to size inlets. Hydraulic analysis will be provided in a later submittal.

There are no proposed stormwater storage facilities included in this project.

WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES

Step 1 – Runoff Reduction Practices
During site layout, an effort was made to decrease the amount of pavement coverage and number of connecting impervious areas. A large portion of the project site is characterized as landscaping and runoff will be conveyed via proposed and existing storm infrastructure. Water quality is improved through these landscape areas which provides better treatment than hardscape, volume is also decreased.

Step 2 – Water Quality Capture Volume BMPs
All water quality will be provided by the regional water quality and detention pond, Pond 1, for the areas tributary to the regional facility, as described in the MASTER REPORT. See drainage basin and sub-basins section for additional detail on areas that have been excluded from water quality enhancement requirements per Section 13.1.5 of the Castle Rock Water Department Storm Drainage Design and Technical Criteria Manual. The runoff produced by the developed project site is in conformance with the MASTER REPORT, assuring that Pond 1 is adequately sized.

Step 3 – Stabilize Drainageways
The majority of the site overland flows to proposed curb and gutter, concrete pans, and landscape swales before ultimately being collected by curb inlets and landscape area inlets. The building roof is captured by roof drains. Stormwater runoff from the project site will be captured by proposed and existing storm infrastructure which will then convey flows to the regional water quality and detention facility. Small, grass lined swales will be used to convey runoff generated within landscaping areas adjacent to the proposed MOB while the remaining landscaping within the site will overland flow before being captured by existing storm infrastructure or follow existing conveyance patterns to open space. These swales may require lining with erosion control blanket or turf reinforcement until the side slopes are fully stabilized through vegetation.

Step 4 – Source Control BMP’s
Temporary best management practices will be utilized during construction including but not limited to silt fence, erosion control blankets, inlet protection, and vehicle tracking control. Proper fueling operations, storage of automotive fluids, and effective spill cleanup procedures can help reduce contamination of stormwater runoff from vehicle maintenance and fueling facilities. Source control BMP’s such as spill

prevention, containment and control, vehicle maintenance, fueling and storage, good housekeeping, and street sweeping are also recommended.

CONVEYANCE SYSTEMS

Preliminary analysis has been completed to verify that the anticipated peak flow from the proposed site in the developed condition is in conformance with the anticipated direct runoff per the MASTER REPORT. The anticipated, unrouted peak flow for the project site is 25.38 cfs which is less than the total direct runoff of 29.9 cfs for design point 79 of basin B2.13 with the MASTER REPORT. Hydraulic modeling and computation will be completed with the final utility report to verify capacity of proposed storm sewer infrastructure considering the tailwater condition at the point of connection to existing storm infrastructure. At this time, it is assumed that the proposed development will have no adverse impacts on the downstream storm sewer infrastructure or regional water quality and detention facility.

The extents of the project site are located within the FEMA Flood Insurance Rate Map (FIRM) number 08035C0303G, effective March 16, 2016. According to this map, the project site is located within FEMA unshaded Zone X. Unshaded Zone X is defined as areas determined to be outside of the 0.2% annual chance (500-year) floodplain.

There are no modifications to the floodplain proposed with this project.

There are no additional permitting requirements required for this project.

CONCLUSIONS

All hydrologic and hydraulic calculations completed can be found as an attachment to this letter.

The AdventHealth Castle Rock MOB proposed drainage and storm sewer infrastructure will provide stormwater conveyance for the minor and major storm events and will safely and efficiently route flows to the downstream receiving regional water quality and detention facility, Pond 1. Fully developed flows will be collected by roof drains and proposed inlets before ultimately being conveyed via the proposed storm sewer to the point of connection at the existing storm sewer, as described in the MASTER REPORT. As discussed herein, this letter is in accordance with the MASTER REPORT, Town of Castle Rock's Storm Drainage and Technical Criteria Manual, and Mile High Flood District criteria. There are no variances requested with this project.

All supporting calculations and documentation are attached to this letter. Should you have any questions or comments, please do not hesitate to contact me at 303.431.6100 or nkontour@martinmartin.com.

Regards,

Nicole L. Kontour, P.E.
Senior Project Engineer

Attachments:

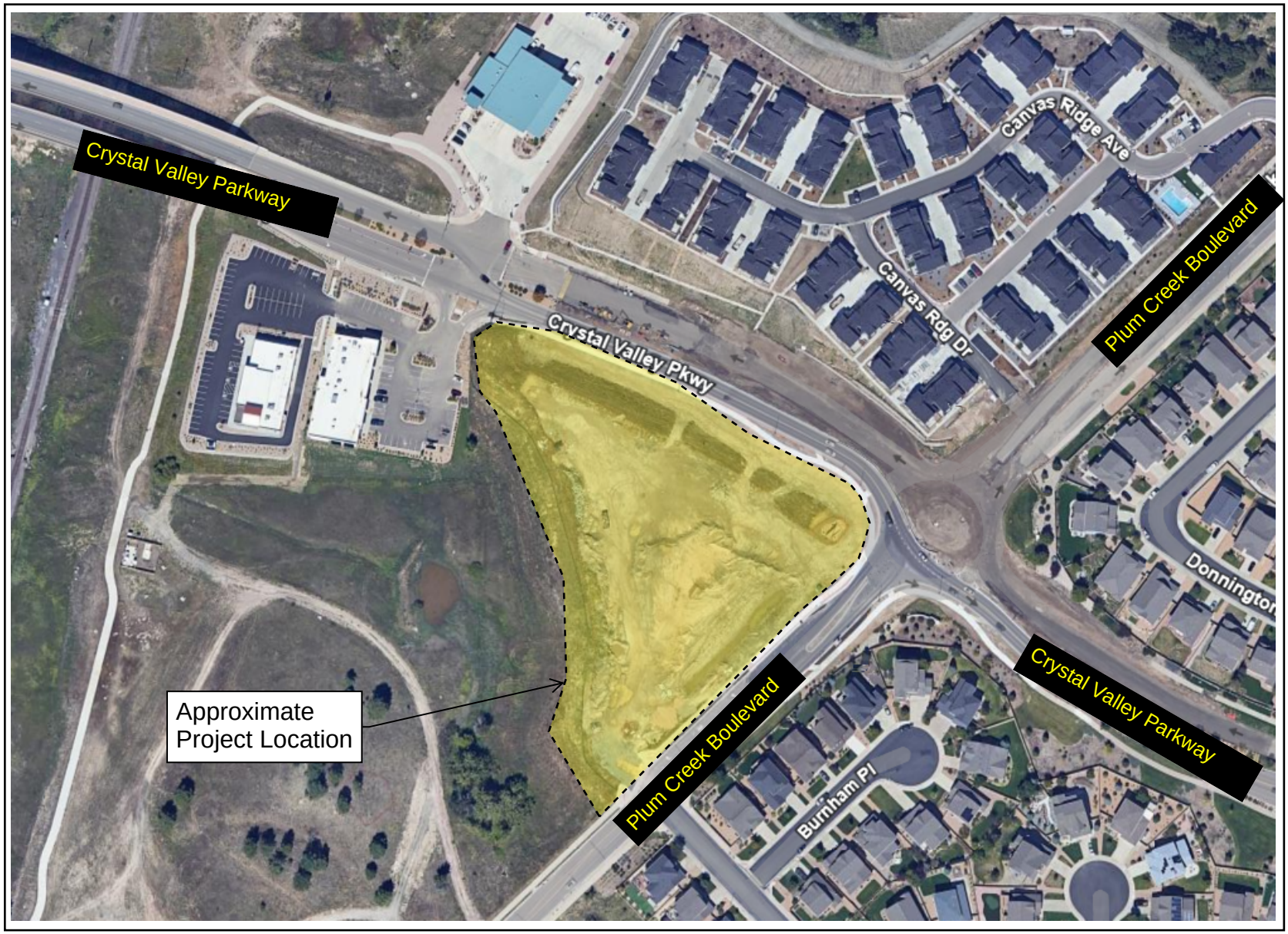
- Vicinity Map
- FIRMette Panel
- NRCS Soil Map
- Hydrologic Calculations
- Drainage Plan
- Water Quality Certification
- Permanent Water Quality Worksheets
- Excerpts from MASTER REPORT

References

A. Phase III Drainage Report for Heckendorf Ranch Filing 2, Castle Rock, Colorado, EMK Consultants, Inc. - January 9, 2006.

B. Mile High Flood District Urban Storm Drainage Criteria Manual; Volumes 1, 2 and 3, latest revision.

C. Town of Castle Rock Storm Drainage Design and Technical Criteria Manual, June 2019.



VICINITY MAP

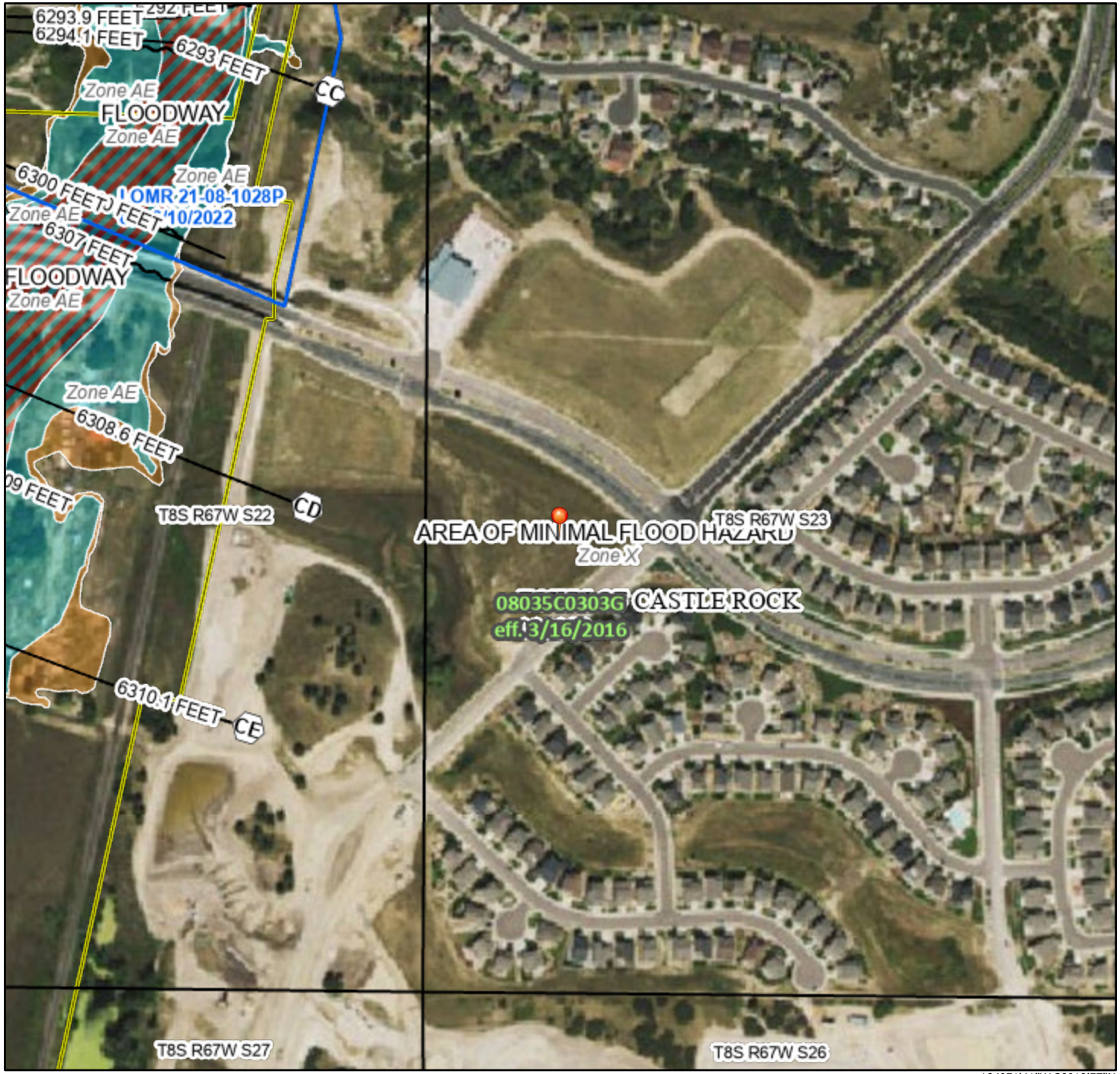
MARTIN/MARTIN
CONSULTING ENGINEERS
12499 West Colfax Avenue
Lakewood, Colorado 80215
303.431.6100
martinmartin.com

DRAWING LOCATION: Drawing1.dwg

National Flood Hazard Layer FIRMette

FEMA

104°52'18"W 39°20'25"N



104°51'41"W 39°19'57"N

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/16/2024 at 5:34 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

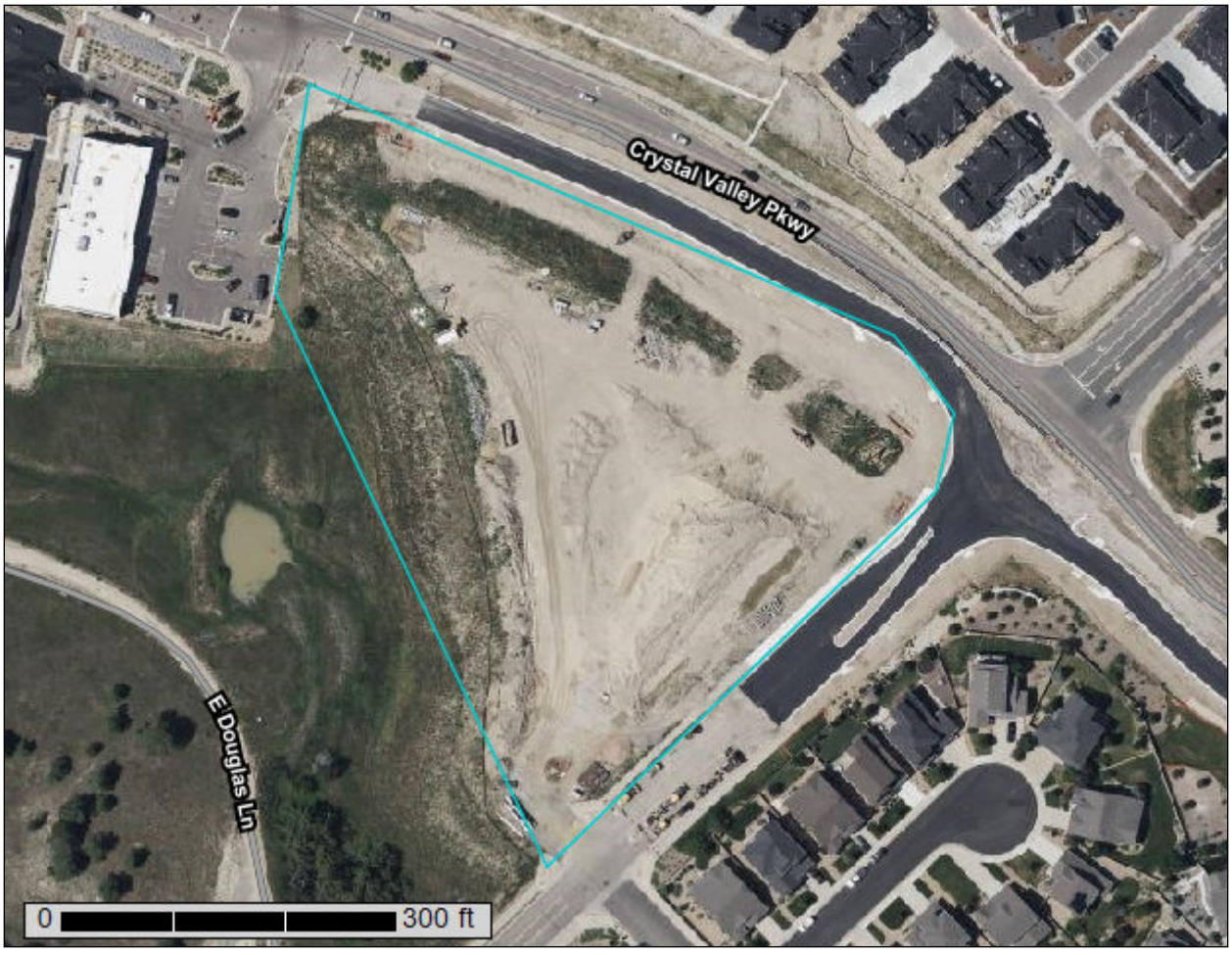
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Castle Rock Area, Colorado



October 7, 2024

Preface

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

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

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

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

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

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

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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How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,440 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 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
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	5.1	100.0%
Totals for Area of Interest		**5.1**	**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

BtE—Bresser-Truckton sandy loams, 5 to 25 percent slopes

Map Unit Setting

National map unit symbol: jqy9
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: Not prime farmland

Map Unit Composition

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

Description of Bresser

Setting

Landform: Terraces
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy eolian deposits

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 30 inches: sandy clay loam
H3 - 30 to 60 inches: loamy sand

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Description of Truckton

Setting

Landform: Terraces
Landform position (three-dimensional): Riser, tread

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

Typical profile

H1 - 0 to 4 inches: sandy loam
H2 - 4 to 19 inches: sandy loam
H3 - 19 to 60 inches: sandy loam

Properties and qualities

Slope: 10 to 25 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): 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 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Newlin

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

Blakeland

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

Stapleton

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

Aquic haplustolls

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

PROJECT INFORMATION

PROJECT NAME:	CRAH Cystal Valley MOB
PROJECT NO:	24.0241
DESIGN BY:	SK
REVIEWED BY:	NK
JURISDICTION:	Town of Castle Rock
REPORT TYPE:	Drainage
DATE:	01/09/25

MARTIN/MARTIN CONSULTING ENGINEERS

JURISDICTIONAL STANDARD	C2	C5	C10	C100	% IMPERV
LANDSCAPE	0.03	0.03	0.10	0.45	5%
ROOF	0.79	0.81	0.82	0.87	95%
PAVED	0.79	0.81	0.82	0.87	95%
GRAVEL	0.29	0.32	0.38	0.61	40%

TOTAL SITE COMPOSITE	4.74	0.39	0.41	0.45	0.65	49.0%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA (ACRES)	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	PERCENT IMPERVIOUSNESS
A-1	LANDSCAPE	0.66	0.03	0.03	0.10	0.45	5%
	SUB-BASIN COMPOSITE	0.66	0.03	0.03	0.10	0.45	5.0%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA (ACRES)	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	PERCENT IMPERVIOUSNESS
A-2	PAVED	0.38	0.79	0.81	0.82	0.87	95%
	DISTURBED SOIL	0.01	0.13	0.15	0.22	0.52	20%
	LANDSCAPE	0.12	0.03	0.03	0.10	0.45	5%
	ROOF	0.01	0.79	0.81	0.82	0.87	95%
	SUB-BASIN COMPOSITE	0.52	0.58	0.61	0.65	0.77	73.4%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA (ACRES)	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	PERCENT IMPERVIOUSNESS
A-3	PAVED	0.02	0.79	0.81	0.82	0.87	95%
	LANDSCAPE	0.16	0.03	0.03	0.10	0.45	5%
	SUB-BASIN COMPOSITE	0.18	0.08	0.10	0.17	0.49	13.8%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA (ACRES)	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	PERCENT IMPERVIOUSNESS
A-4	LANDSCAPE	0.06	0.03	0.03	0.10	0.45	5%
	SUB-BASIN COMPOSITE	0.06	0.03	0.03	0.10	0.45	5.0%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA (ACRES)	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	PERCENT IMPERVIOUSNESS
A-5	PAVED	0.26	0.79	0.81	0.82	0.87	95%
	LANDSCAPE	0.06	0.03	0.03	0.10	0.45	5%
	SUB-BASIN COMPOSITE	0.32	0.63	0.66	0.69	0.79	78.2%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA (ACRES)	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	PERCENT IMPERVIOUSNESS
A-6	PAVED	0.16	0.79	0.81	0.82	0.87	95%
	LANDSCAPE	0.04	0.03	0.03	0.10	0.45	5%
	SUB-BASIN COMPOSITE	0.20	0.63	0.66	0.69	0.79	78.4%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA (ACRES)	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	PERCENT IMPERVIOUSNESS
A-7	PAVED	0.08	0.79	0.81	0.82	0.87	95%
	DISTURBED SOIL	0.02	0.13	0.15	0.22	0.52	20%
	SUB-BASIN COMPOSITE	0.10	0.66	0.69	0.72	0.81	81.7%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA (ACRES)	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	PERCENT IMPERVIOUSNESS
A-8	PAVED	0.05	0.79	0.81	0.82	0.87	95%
	DISTURBED SOIL	0.01	0.13	0.15	0.22	0.52	20%
	ROOF	0.01	0.79	0.81	0.82	0.87	95%
	SUB-BASIN COMPOSITE	0.08	0.69	0.72	0.74	0.82	84.9%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA (ACRES)	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	PERCENT IMPERVIOUSNESS
A-9	PAVED	0.08	0.79	0.81	0.82	0.87	95%
	LANDSCAPE	0.02	0.03	0.03	0.10	0.45	5%
	SUB-BASIN COMPOSITE	0.10	0.65	0.68	0.71	0.80	80.6%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA (ACRES)	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	PERCENT IMPERVIOUSNESS
A-10	LANDSCAPE	0.57	0.03	0.03	0.10	0.45	5%
	PAVED	0.00	0.79	0.81	0.82	0.87	95%
	SUB-BASIN COMPOSITE	0.57	0.03	0.03	0.10	0.45	5.2%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA	COMPOSITE RUNOFF COEFFICIENTS				PERCENT IMPERVIOUSNESS
		(ACRES)	C2	C5	C10	C100	
A-11	PAVED	0.27	0.79	0.81	0.82	0.87	95%
	DISTURBED SOIL	0.01	0.13	0.15	0.22	0.52	20%
	LANDSCAPE	0.00	0.03	0.03	0.10	0.45	5%
SUB-BASIN COMPOSITE		0.28	0.75	0.77	0.79	0.85	91.0%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA	COMPOSITE RUNOFF COEFFICIENTS				PERCENT IMPERVIOUSNESS
		(ACRES)	C2	C5	C10	C100	
A-12	PAVED	0.19	0.79	0.81	0.82	0.87	95%
	DISTURBED SOIL	0.01	0.13	0.15	0.22	0.52	20%
	LANDSCAPE	0.00	0.03	0.03	0.10	0.45	5%
SUB-BASIN COMPOSITE		0.20	0.75	0.78	0.80	0.85	91.6%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA	COMPOSITE RUNOFF COEFFICIENTS				PERCENT IMPERVIOUSNESS
		(ACRES)	C2	C5	C10	C100	
A-13	PAVED	0.23	0.79	0.81	0.82	0.87	95%
	DISTURBED SOIL	0.01	0.13	0.15	0.22	0.52	20%
	LANDSCAPE	0.00	0.03	0.03	0.10	0.45	5%
SUB-BASIN COMPOSITE		0.24	0.76	0.78	0.80	0.85	92.1%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA	COMPOSITE RUNOFF COEFFICIENTS				PERCENT IMPERVIOUSNESS
		(ACRES)	C2	C5	C10	C100	
A-14	PAVED	0.11	0.79	0.81	0.82	0.87	95%
	DISTURBED SOIL	0.00	0.13	0.15	0.22	0.52	20%
	LANDSCAPE	0.07	0.03	0.03	0.10	0.45	5%
SUB-BASIN COMPOSITE		0.18	0.46	0.49	0.54	0.71	60.3%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA	COMPOSITE RUNOFF COEFFICIENTS				PERCENT IMPERVIOUSNESS
		(ACRES)	C2	C5	C10	C100	
A-15	PAVED	0.00	0.79	0.81	0.82	0.87	95%
	LANDSCAPE	0.22	0.03	0.03	0.10	0.45	5%
SUB-BASIN COMPOSITE		0.22	0.03	0.04	0.10	0.45	5.6%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA	COMPOSITE RUNOFF COEFFICIENTS				PERCENT IMPERVIOUSNESS
		(ACRES)	C2	C5	C10	C100	
R-1	ROOF	0.29	0.79	0.81	0.82	0.87	95%
SUB-BASIN COMPOSITE		0.29	0.79	0.81	0.82	0.87	95.0%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA	COMPOSITE RUNOFF COEFFICIENTS				PERCENT IMPERVIOUSNESS
		(ACRES)	C2	C5	C10	C100	
OS-2	LANDSCAPE	0.10	0.03	0.03	0.10	0.45	5%
SUB-BASIN COMPOSITE		0.10	0.03	0.03	0.10	0.45	5.0%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA	COMPOSITE RUNOFF COEFFICIENTS				PERCENT IMPERVIOUSNESS
		(ACRES)	C2	C5	C10	C100	
OS-3	LANDSCAPE	0.04	0.03	0.03	0.10	0.45	5%
SUB-BASIN COMPOSITE		0.04	0.03	0.03	0.10	0.45	5.0%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA	COMPOSITE RUNOFF COEFFICIENTS				PERCENT IMPERVIOUSNESS
		(ACRES)	C2	C5	C10	C100	
OS-4	LANDSCAPE	0.11	0.03	0.03	0.10	0.45	5%
SUB-BASIN COMPOSITE		0.11	0.03	0.03	0.10	0.45	5.0%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA	COMPOSITE RUNOFF COEFFICIENTS				PERCENT IMPERVIOUSNESS
		(ACRES)	C2	C5	C10	C100	
TO-1	LANDSCAPE	0.11	0.03	0.03	0.10	0.45	5%
SUB-BASIN COMPOSITE		0.11	0.03	0.03	0.10	0.45	5.0%

SUB-BASIN	SURFACE CHARACTERISTICS	AREA	COMPOSITE RUNOFF COEFFICIENTS				PERCENT IMPERVIOUSNESS
		(ACRES)	C2	C5	C10	C100	
RD-1	PAVED	0.16	0.79	0.81	0.82	0.87	95%
	LANDSCAPE	0.05	0.03	0.03	0.10	0.45	5%
SUB-BASIN COMPOSITE		0.20	0.59	0.62	0.66	0.77	74.6%

TOTAL SITE COMPOSITE	4.74	0.39	0.41	0.45	0.65	49.0%

PROJECT: CRAH Cystal Valley MOB
JOB NO: 24.024
DATE: 01/09/25

MARTIN/MARTIN CONSULTING ENGINEERS

RUNOFF SUMMARY							
BASIN	DESIGN POINT	AREA (ACRES)	% IMP.	C_5	C_{100}	Q_5 (CFS)	Q_{100} (CFS)
A-1	A-1	0.66	5.0%	0.03	0.45	0.07	1.84
A-2	A-2	0.52	73.4%	0.61	0.77	1.52	3.48
A-3	A-3	0.18	13.8%	0.10	0.49	0.09	0.79
A-4	A-4	0.06	5.0%	0.03	0.45	0.01	0.23
A-5	A-5	0.32	78.2%	0.66	0.79	0.96	2.10
A-6	A-6	0.20	78.4%	0.66	0.79	0.63	1.39
A-7	A-7	0.10	81.7%	0.69	0.81	0.34	0.73
A-8	A-8	0.08	84.9%	0.72	0.82	0.26	0.55
A-9	A-9	0.10	80.6%	0.68	0.80	0.32	0.69
A-10	A-10	0.57	5.2%	0.03	0.45	0.06	1.50
A-11	A-11	0.28	91.0%	0.77	0.85	1.05	2.11
A-12	A-12	0.20	91.6%	0.78	0.85	0.76	1.52
A-13	A-13	0.24	92.1%	0.78	0.85	0.90	1.78
A-14	A-14	0.18	60.3%	0.49	0.71	0.39	1.01
A-15		0.22	5.6%	0.04	0.45	0.04	0.87
R-1	R-1	0.29	95.0%	0.81	0.87	1.12	2.18
OS-2	OS-2	0.10	5.0%	0.03	0.45	0.01	0.31
OS-3	OS-3	0.04	5.0%	0.03	0.45	0.004	0.09
OS-4	OS-4	0.11	5.0%	0.03	0.45	0.02	0.42
TO-1	TO-1	0.11	5.0%	0.03	0.45	0.02	0.42
SITE COMPOSITE		**4.74**	**49.0%**	**0.41**	**0.65**	**9.21**	**25.38**
						UNROUTED	UNROUTED

LEGEND

BASIN BOUNDARY

SUB-BASIN BOUNDARY

DIRECTION OF FLOW

DESIGN POINT 1

BASIN B C5 1.25 .88 .93 C100 AREA IN ACRES

N

40 20 0 40 80

SCALE: 1"=40'

ALL LINEAL DIMENSIONS ARE IN U.S. SURVEY FEET

COLORADO 811

KNOW WHAT'S BELOW. CALL BEFORE YOU DIG.

CALL 811 3-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE OR EXCAVATE FOR MARKING OF UNDERGROUND MEMBER UTILITIES

MARTIN/MARTIN ASSUMES NO RESPONSIBILITY FOR UTILITY LOCATIONS. UNLESS OTHERWISE NOTED, THE UTILITIES SHOWN ON THIS DRAWING ARE BASED ON INFORMATION PROVIDED BY OTHERS AND DEPICTED AS ASCE (38) QUALITY LEVEL D. IN ACCORDANCE WITH THE PROVISIONS OF COLORADO REVISED STATUTE, TITLE 9, IT IS THE CONTRACTORS RESPONSIBILITY TO CALL COLORADO 811 UTILITY LOCATE SERVICE FOR UTILITY LOCATES BEFORE DIGGING, AND FIELD VERIFY THE SIZE, MATERIAL, HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES (DEPICTED OR NOT DEPICTED) PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION.

TOWN APPROVAL BLOCK

TOWN OF CASTLE ROCK APPROVAL
PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM DATE OF DEVELOPMENT SERVICES APPROVAL

Approved By:

Development Services *Date*

PROFESSIONAL ENGINEER CERTIFICATION

I hearby affirm that these final construction plans were prepared under my direct supervision, in accordance with all applicable Town of Castle Rock and State of Colorado standards and statutes, respectively; and that I am fully responsible for all design and revisions relative to said plans.

(Civil Engineer signature and seal here) Date

MARTIN/MARTIN CONSULTING ENGINEERS
12499 West Colfax Avenue
Lakewood, Colorado 80215
303.431.6100
martinmartin.com

SUBJECT TO CHANGE PENDING JURISDICTIONAL APPROVAL

NOT FOR CONSTRUCTION

CASTLE ROCK NEIGHBORHOOD HEALTH CLINIC

DRAINAGE PLAN

No.	Issue / Revision	Date	Name

Job Number	24.0241
Project Manager	N.KONTOUR
Design By	KONTOUR/RICKETSON
Drawn By	J.DIAZ
Principal In Charge	P.BUCKLEY

THE DESIGNS SHOWN HEREIN INCLUDING ALL TECHNICAL DRAWINGS, GRAPHIC REPRESENTATION & MODELS THEREOF, ARE PROPRIETARY & CAN NOT BE COPIED, DUPLICATED, OR COMMERCIALLY EXPLOITED IN WHOLE OR IN PART WITHOUT THE SOLE AND EXPRESS WRITTEN PERMISSION FROM MARTIN/MARTIN, INC.

Sheet Number:

D1

5/14/2025 11:22:59 AM
g:\BUCKLEY\24.0241-castle rock - neighborhood health clinic\PLANS\CDs\D1 - DRAINAGE PLAN.dwg
PLOT DATE: Wednesday, May 14, 2025 11:22 AM LAST SAVED BY: KRICKETSON
DRAWING LOCATION: g:\BUCKLEY\24.0241-castle rock - neighborhood health clinic\PLANS\CDs\D1 - DRAINAGE PLAN.dwg

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 AdventHealth Castle Rock MOB

Project Owner AdventHealth

Project Location West Corner of Crystal Valley Parkway and Plum Creek Boulevard

ToCR Project Number 25.0001

Total Site Area 5.17 **acres**

Total Size of Common Plan of Development 5.17 **acres**

Check all that apply:

- [x] **Project within Plum Creek Basin**
- [ ] **Project within Cherry Creek Basin**

Estimated construction completion date TBD

---

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.

   - [x] WQCV standard
   - [ ] Pollutant removal standard
   - [ ] Runoff reduction standard
   - [x] 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: 0.77 acres
- ☐ Stream Stabilization Sites
  Excluded impervious area: _____ acres
- ☐ Trails
  Excluded impervious area: _____ acres
- ☐ Oil and Gas Exploration

Area excluded entirely landscape or undisturbed land to remain undeveloped.

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: 0.77 acres

   Total Site area: 5.17 acres, 14.89 % site excluded

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

   If yes, complete the following:

   Excluded area: _____ acres

   Excluded impervious area: _____ acres

   Total Site area: _____ acres, _____ % site excluded

   Total Impervious area: _____ acres, _____ % impervious excluded

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

Project: AdventHealth Castle Rock MOB **Project #:** 25.0001 **Applicant:** AdventHealth

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 ● No	Proceed to next line. Proceed to 3.3.2.
	Is the project site greater than 10% impervious?	○ No ○ Yes	Project is excluded. Submit **variance** for Large Lot Single Family Sites Excluded from Permanent Water Quality Requirements. Proceed to next line.
	Is the project site greater than 20% impervious?	○ Yes ○ No	This exclusion does not apply. Permanent water quality is required. Proceed to next line.
	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 Large Lot Single Family Sites Excluded from Permanent Water Quality Requirements. 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 ● No	This exclusion does not apply. Permanent water quality is required. Proceed to next line.
	Is all or a portion of the site undeveloped or will it remain undeveloped after construction?	○ Yes ● No	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. Proceed to next line.
	Is the remaining untreated impervious area greater than 20% of the site?	○ Yes ● No	This exclusion does not apply. Permanent water quality is required. Proceed to next line.
	Is the remaining untreated impervious area greater than one acre?	○ Yes ● No	This exclusion does not apply. Permanent water quality is required. Proceed to next line.
	Is it practicable to capture runoff from portions of the site that will not drain to a control measure?	● No ○ Yes	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. This exclusion does not apply. Permanent water quality is required.

PHASE III DRAINAGE STUDY
FOR
HECKENDORF RANCH FILING 2

VOLUME 1
Drainage Report

Castle Rock, Colorado

January 9, 2006

Job. No. 12145.01

PREPARED FOR

CASTLE STAR DEVELOPMENT CO., LLC

7600 East Orchard Road, Suite 270N
Englewood, Colorado 80111
(303) 771-7400
Attn: Clarence Hughes

PREPARED BY

EMK CONSULTANTS, INC.
7006 S. Alton Way, Building F
Centennial, Colorado 80112
(303) 694-1520
Fax (303) 694-1617

B. SPECIFIC DETAILS (see Plan Sheets for Rational Method Drainage Plans for design points and basin identification)

Basins A

Developed flows from Basins OS1.1-OS1.4 and A1.1 - A1.9 are routed via overland, curb, gutter, and street system into Pond 2. Basins OS1.1-OS1.4 are tributary basins from The Lanterns subdivision. Basin OS1.1 consists mainly of undetained residential flows to design point 9. Basins OS1.2 and OS1.3 are developed flows to be routed to a future pond within The Lanterns, prior to discharging into Pond 2. Basin OS1.4 is undetained overland residential flows into Pond 2. Basins A.1.1 - A1.5 are residential runoffs to design point 7 and are routed to Pond 2 via curb, gutter and street system. Basins A1.6-A1.8 and including OS1.1 are residential runoff to sump location along Ranch Road at design point 11 and are routed to Pond 2 via curb, gutter, and street system. Discharge from Pond 2 is conveyed into a wide grass lined channel to design point 23 and piped into Pond 3.

Basins OS2.1-OS2.2 and A2.1-A2.12 are routed via overland, curb, gutter, and street system into Pond 3. Basins OS2.12 and A2.1-A2.2 are routed via overland, inlets, and street system to design point 22 and piped into Pond 3. Basins A2.3-A2.5 are routed via overland, inlets, and street system to design point 22 and piped into Pond 3. Basins OS2.2, A2.2, and A2.6-A2.7 are routed via overland, inlets, and street system to design point 31 and piped into Pond 3. Basins A2.8 and A2.9 are routed via street and sump inlets to design point 33 and piped into Pond 3. Basins A2.10 and A2.11 are routed via street and sump inlets to design point 35 and piped into Pond 3. The discharge to pond 3 is piped and conveyed into an existing channel, located within both Heckendorf Ranch and Lanterns subdivision, and ultimately to East Plum Creek.

Basins B

Undetained runoff from Basins B1.1-B1.7, 17(See Ref. 10), and 18(See Ref. 11) are routed via overland flow, curb, gutter, and street system to design point 49. Design point 49 has an existing pipe connected to an existing twin 72" culvert that discharges into the unnamed gulch that outfalls into Pond 1. Basin 17's contribution also includes flows from Detention Pond B(See Ref. 10) which is located in Crystal Valley Ranch Filing 6. Basin 18 is located east of Design Point 46 and its' runoff is mainly generated by the southern portion of Crystal Valley Parkway.

Basins B2.1 - B2.17 consists of residential, commercial, and Crystal Valley Parkway runoff. The runoffs are conveyed via overland flow and existing/proposed curb, gutter, and street system to design point 85. Flows to design point 85 are routed into an existing twin 42" rcp that are extended

into Pond 1 (Regional Pond)

Basins B3.1-B3.5 and B3.10-B3.11 are routed via overland flow, curb, gutter, and street system to design point 110 and piped into the riprap area of an existing twin 72" culvert.within the unnamed gulch and outfalls into Pond 1.

Pond 1 (Regional Pond)

Pond 1 is a regional, on-stream pond serving Major Basin B. Major Basin B includes Heckendorf Ranch Filing 1, which currently has an existing temporary detention and water quality pond. This existing pond will be filled-in and all runoff from Heckendorf Ranch Filing 1 will discharge into Pond 1. Pond 1 is a detention and water quality pond that will release at historic rates into East Plum Creek. The pond is designed to accommodate 21.1 ac-ft of detention storage, which includes 3.7 ac-ft of water quality storage (see Appendix D for calculations).

Ponds 2 and 3

Water quality storage is provided by "Pond 3" for Major Basin A and detention by ponds 2 and 3 together. Ponds 2 and 3 together will detain runoff from Major Basin A and will release well below historic rates. Pond 2 is designed to detain the 10 year and 100 year storm without water quality. Pond 2 will accommodate 7.6 ac-ft of detention storage (see Appendix D for calculations). Pond 3 is designed to accommodate 3.9 ac-ft of detention storage, which includes 1.1 ac-ft of water quality storage (see Appendix D for calculations).

Unnamed Gulch

The unnamed gulch, which is tributary to East Plum Creek, does not have a base flow and has not been mapped previously. The HEC-RAS analysis done for the Phase III Draiange Study For Heckendorf Ranch Filing 1 (Reference 6) provides an approximate mapping of the 100-year water surface elevation (Non-regulatory floodplain) for the unnamed gulch. The HEC-RAS analysis of the unnamed gulch for this Phase III Drainage Study in Appendix C provides an approximate comparison of Historic versus Developed flows tributary to the unnamed gulch. This analysis indicates that the historic flows in the unnamed gulch had velocities exceeding 5 fps and froude numbers greater than 0.8. In comparison, the developed flows in the unnamed gulch had minimal differences to the existing velocities and froude numbers of the historic analysis.

In regards to the longitudinal slope, cross-section, and flows within the unnamed gulch, general field observations for the past two years indicate no severe erosion has occurred within the channel (see photos in Appendix C). Recent site visits this past summer indicate severe erosions in areas other

TABLE 3-1 (42)

RECOMMENDED RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY 2	5	10	100
Business:					
Commercial Areas	95	.87	.87	.88	.89
Neighborhood Areas	70	.60	.65	.70	.80
Residential:					
Single-Family	*	.40	.45	.50	.60
Multi-Unit (detached)	50	.45	.50	.60	.70
Multi-Unit (attached)	70	.60	.65	.70	.80
1/2 Acre Lot or Larger	*	.30	.35	.40	.60
Apartments	70	.65	.70	.70	.80
Industrial:					
Light Areas	80	.71	.72	.76	.82
Heavy Acres	90	.80	.80	.85	.90
Parks, Cemetaries:	7	.10	.18	.25	.45
Playgrounds:	13	.15	.20	.30	.50
Schools:	50	.45	.50	.60	.70
Railroad Yard Areas	20	.20	.25	.35	.45
Undeveloped Areas:					
Historic Flow Analysis- Greenbelts, Agricultural	2	(See "Lawns")			
Offsite Flow Analysis (when land use not defined)	45	.43	.47	.55	.65
Streets:					
Paved	100	.87	.88	.90	.93
Gravel (Packed)	40	.40	.45	.50	.60
Drive and Walks:	96	.87	.87	.88	.89
Roofs:	90	.80	.85	.90	.90
Lawns, Sandy Soil	0	.00	.01	.05	.20
Lawns, Clayey Soil	0	.05	.15	.25	.50

NOTE: These Rational Formula coefficients may not be valid for large basins.

*See Figure 2-1 for percent impervious.

Figure 6

COMPOSITE "C" VALUES (DEVELOPED CONDITION) - BASIN B2

HECKENDORF RANCH FILING 2

Job No:	12145.00		
CALC. BY:	BCG		
CHKED BY:	BCG		
JOB DESC.:	Phase III drainage study		

Basin B2.1 — 5 YEAR

AREA	Area	"C"	
Res	0.5	0.45	0.225
	0.5 ac		0.225
	WEIGHTED BASIN "C" VALUE =		0.45

Basin B2.2 — 5 YEAR

AREA	Area	"C"	
Res	0.1	0.45	0.045
	0.1 ac		0.045
	WEIGHTED BASIN "C" VALUE =		0.45

Basin B2.3 — 5 YEAR

AREA	Area	"C"	
Res	1.6	0.45	0.72
	1.6 ac		0.72
	WEIGHTED BASIN "C" VALUE =		0.45

Basin B2.4 — 5 YEAR

AREA	Area	"C"	
Res	1.1	0.45	0.495
	1.1 ac		0.495
	WEIGHTED BASIN "C" VALUE =		0.45

Basin B2.5 — 5 YEAR

AREA	Area	"C"	
Res	0.4	0.45	0.18
	0.4 ac		0.18
	WEIGHTED BASIN "C" VALUE =		0.45

Basin B2.1 — 100 YEAR

AREA	Area	"C	
Res	0.5	0.6	0.3
	0.5 ac		0.3
	WEIGHTED BASIN "C" VALUE =		0.60

Basin B2.2 — 100 YEAR

AREA	Area	"C	
Res	0.1	0.6	0.06
	0.1 ac		0.1
	WEIGHTED BASIN "C" VALUE =		0.60

Basin B2.3 — 100 YEAR

AREA	Area	"C	
Res	1.6	0.6	0.96
	1.6 ac		0.96
	WEIGHTED BASIN "C" VALUE =		0.60

Basin B2.4 — 100 YEAR

AREA	Area	"C	
Res	1.1	0.6	0.66
	1.1 ac		0.66
	WEIGHTED BASIN "C" VALUE =		0.60

Basin B2.5 — 100 YEAR

AREA	Area	"C	
Res	0.4	0.6	0.24
	0.4 ac		0.24
	WEIGHTED BASIN "C" VALUE =		0.60

Basin B2.6 — 5 YEAR

AREA	Area	"C"	
Res	2.5	0.45	1.125
	2.5 ac		1.125
	WEIGHTED BASIN "C" VALUE =		0.45

Basin B2.7 — 5 YEAR

AREA	Area	"C"	
Res	2.1	0.45	0.945
	2.1 ac		0.945
	WEIGHTED BASIN "C" VALUE =		0.45

Basin B2.8 — 5 YEAR

AREA	Area	"C"	
Res	0.2	0.45	0.09
	0.2 ac		0.09
	WEIGHTED BASIN "C" VALUE =		0.45

Basin B2.9 — 5 YEAR

AREA	Area	"C"	
Res	0.3	0.45	0.135
	0.3 ac		0.135
	WEIGHTED BASIN "C" VALUE =		0.45

Basin B2.10 — 5 YEAR

AREA	Area	"C"	
Res	0.2	0.45	0.09
	0.2 ac		0.09
	WEIGHTED BASIN "C" VALUE =		0.45

Basin B2.6 — 100 YEAR

AREA	Area	"C	
Res	2.5	0.6	1.5
	2.5 ac		1.5
	WEIGHTED BASIN "C" VALUE =		0.60

Basin B2.7 — 100 YEAR

AREA	Area	"C	
Res	2.1	0.6	1.26
	2.1 ac		1.26
	WEIGHTED BASIN "C" VALUE =		0.60

Basin B2.8 — 100 YEAR

AREA	Area	"C	
Res	0.2	0.6	0.12
	0.2 ac		0.12
	WEIGHTED BASIN "C" VALUE =		0.60

Basin B2.9 — 100 YEAR

AREA	Area	"C	
Res	0.3	0.6	0.18
	0.3 ac		0.18
	WEIGHTED BASIN "C" VALUE =		0.60

Basin B2.10 — 100 YEAR

AREA	Area	"C	
Res	0.2	0.6	0.12
	0.2 ac		0.12
	WEIGHTED BASIN "C" VALUE =		0.60

Basin B2.11 — 5 YEAR

AREA	Area	"C"	
Res	0.8	0.45	0.36
	0.8 ac		0.36
	WEIGHTED BASIN "C" VALUE =		0.45

Basin B2.12 — 5 YEAR

AREA	Area	"C"	
Res	0.7	0.45	0.315
	0.7 ac		0.315
	WEIGHTED BASIN "C" VALUE =		0.45

Basin B2.13 — 5 YEAR

AREA	Area	"C"	
Commer.	4.0	0.87	3.48
	4.0 ac		3.48
	WEIGHTED BASIN "C" VALUE =		0.87

Basin B2.14 — 5 YEAR

AREA	Area	"C"	
Commer.	2.1	0.87	1.827
	2.1 ac		1.827
	WEIGHTED BASIN "C" VALUE =		0.87

Basin B2.15 — 5 YEAR

AREA	Area	"C"	
Pav't	1.6	0.88	1.408
Res	0.4	0.45	0.18
OS	0.3	0.2	0.06
	2.3 ac		1.648
	WEIGHTED BASIN "C" VALUE =		0.72

Basin B2.11 — 100 YEAR

AREA	Area	"C	
Res	0.8	0.6	0.48
	0.8 ac		0.48
	WEIGHTED BASIN "C" VALUE =		0.60

Basin B2.12 — 100 YEAR

AREA	Area	"C	
Res	0.7	0.6	0.42
	0.7 ac		0.42
	WEIGHTED BASIN "C" VALUE =		0.60

Basin B2.13 — 100 YEAR

AREA	Area	"C	
Commer.	4.0	0.89	3.56
	4.0 ac		3.56
	WEIGHTED BASIN "C" VALUE =		0.89

Basin B2.14 — 100 YEAR

AREA	Area	"C	
Commer.	2.1	0.89	1.869
	2.1 ac		1.869
	WEIGHTED BASIN "C" VALUE =		0.89

Basin B2.15 — 100 YEAR

AREA	Area	"C	
Pav't	1.6	0.93	1.488
Res	0.4	0.6	0.24
OS	0.3	0.2	0.06
	2.3 ac		1.788
	WEIGHTED BASIN "C" VALUE =		0.78

Basin B2.16 — 5 YEAR

AREA	Area	"C"	
Pav't	1.72	0.88	1.514
OS	1	0.2	0.2
	2.7 ac		1.714
	WEIGHTED BASIN "C" VALUE =		0.63

Basin B2.17 — 5 YEAR

AREA	Area	"C"	
Pav't	0.8	0.88	0.704
OS	0.1	0.2	0.02
	0.9 ac		0.724
	WEIGHTED BASIN "C" VALUE =		0.80

Basin B2.18 — 5 YEAR

AREA	Area	"C"	
Pav't	0.75	0.88	0.66
OS	0.8	0.2	0.16
	1.6 ac		0.82
	WEIGHTED BASIN "C" VALUE =		0.53

Basin B2.19 — 5 YEAR

AREA	Area	"C"	
Commer.	8.4	0.87	7.308
	8.4 ac		7.308
	WEIGHTED BASIN "C" VALUE =		0.87

Basin B2.16 — 100 YEAR

AREA	Area	"C	
Pav't	1.72	0.93	1.6
OS	1	0.2	0.2
	2.7 ac		1.8
	WEIGHTED BASIN "C" VALUE =		0.66

Basin B2.17 — 100 YEAR

AREA	Area	"C	
Pav't	0.8	0.93	0.744
OS	0.1	0.6	0.06
		0.2	
	0.9 ac		0.804
	WEIGHTED BASIN "C" VALUE =		0.89

Basin B2.18 — 100 YEAR

AREA	Area	"C	
Pav't	0.75	0.93	0.6975
OS	0.8	0.2	0.16
	1.6 ac		0.8575
	WEIGHTED BASIN "C" VALUE =		0.55

Basin B2.19 — 100 YEAR

AREA	Area	"C	
Commer.	8.4	0.89	7.476
	8.4 ac		7.476
	WEIGHTED BASIN "C" VALUE =		0.89

NOTE: See Fig. 6 for 'c' value information. Off-site and open space/ undeveloped areas in Basin A have 'c' values for a clayey loam soil (see Soil Survey for Castle Rock). Off-site and open space/ undeveloped areas in Basin B have 'c' values for a sandy loam soil.

JOB NO: 12145.00

PROJECT: HECKENDORF RANCH FILING 2
DSIN STRM: 5 year
CALC. BY: BCG
CHCKD BY BCG

RATIONAL METHOD
(5-YEAR DEVELOPED CONDITION)

I=28.5*P1/(10+T)^0.789

1 HR STORM= 1.43

Design Point	Basin	Area	C	DIRECT RUNOFF Tc	C*A	I	Q	TOTAL RUNOFF Tc	C*A	I	Q	STREET FLOW Design Q C*A	Design Q CFS	INLET TYPE	Intercept C*A	Intercept CFS	Carryover C*A	Carryover CFS	PIPE Design Q C*A	PIPE Design Q CFS	Downstream Design Pt. TRAVEL TIME Length	Vel.	Time	Notes
		Ac				IN/HR	CFS			IN/HR	CFS										ft	fps	min	
60	B2.1	0.5	0.45	6.8	0.23	4.4	1.0					0.2	1.0	5' CURB-G	0.2	0.7	0.1	0.3	0.2	0.7	46	3.09	0.2	DIRECT FLOW (TT 60-61)
61	B2.2	0.1	0.45	5.0	0.05	4.8	0.2					0.0	0.2	5' CURB-G	0.0	0.2								DIRECT FLOW
61	B2.1,B2.2	0.6	0.45					7.1	0.27	4.3	1.2								0.2	0.9	12	3.16	0.1	COMBINED FLOW (TT 61-62)
62	B2.3	1.6	0.45	8.5	0.72	4.1	2.9					0.7	2.9	5' CURB-G	0.4	1.5	0.3	1.4			86	3.20	0.4	DIRECT FLOW (TT 62-66)
62	B2.1-B2.3	2.2	0.45					8.5	0.99	4.1	4.0								0.6	2.3				COMBINED FLOW
62																					872	4.88	3.0	(TT 62-69)
63	B2.4	1.1	0.45	8.8	0.50	4.0	2.0					0.5	2.0	5' CURB-G	0.3	1.2	0.2	0.8	0.3	1.2	27	3.22	0.1	DIRECT FLOW (TT 63-65)
63																					860	4.70	3.1	(TT 63-67)
64	B2.5	0.4	0.45	5.0	0.18	4.8	0.9					0.2	0.9	5' CURB-G	0.1	0.7	0.0	0.2	0.1	0.7	18	3.33	0.1	DIRECT FLOW (TT 64-65)
64																					853	4.71	3.0	(TT 64-67)
65	B2.4,B2.5	1.5	0.45					8.9	0.68	4.0	2.7			MH					0.4	1.8	63	3.19	0.3	COMBINED FLOW (TT 65-66)
66	B2.1-B2.5	3.7	0.45					9.3	1.67	4.0	6.6			MH					1.0	4.0	798	3.17	4.2	COMBINED FLOW (TT 66-68)
67	B2.6	2.5	0.45	11.1	1.13	3.7	4.1																	DIRECT FLOW
67	B2.4-B2.6	4.0	0.45					11.1	1.80	3.7	6.6	1.4	5.0	5' CURB-G	0.5	1.9	0.8	3.1			1050	3.74	4.7	COMBINED FLOW (TT 67-82)
67	B2.4-B2.6, B2.8	4.2	0.45					11.1	1.89	3.7	6.9								0.6	2.2	180	3.46	0.9	COMBINED FLOW (TT 67-78)
68	DP66, DP67	7.9	0.45					13.5	3.56	3.4	12.0								1.6	5.4	165	3.48	0.8	COMBINED PIPE FLOW (TT68-78)
69	B2.7	2.1	0.45	9.3	0.95	4.0	3.7																	DIRECT FLOW
69	B2.1-B2.3,B2.7	4.3	0.45					11.5	1.94	3.6	7.0	1.4	4.9	10' CURB-G	0.8	3.0	0.5	1.9	0.8	3.0	144	3.46	0.7	COMBINED FLOW (TT 69-75)
69																					1037	3.61	4.8	(TT 69-83)
70	B2.8	0.2	0.45	5.0	0.09	4.8	0.4					0.1	0.4	5' CURB-S	0.1	0.4			0.1	0.4	11	3.44	0.1	DIRECT FLOW (TT 70-67)
72	B2.9	0.3	0.45	5.9	0.14	4.6	0.6					0.1	0.6	5' CURB-G	0.1	0.6			0.1	0.6	73	3.14	0.4	DIRECT FLOW (TT 72-74)
72																					984	3.32	4.9	(TT 72-82)
73	B2.10	0.2	0.45	5.0	0.09	4.8	0.4					0.1	0.4	5' CURB-G	0.1	0.4			0.1	0.4	30	3.27	0.2	DIRECT FLOW (TT 73-74)
73																					856	3.51	4.1	(TT 73-82)
74	B2.9,B2.10	0.5	0.45					6.3	0.23	4.5	1.0			MH					0.2	1.0	60	3.16	0.3	COMBINED FLOW (TT 74-78)
75	B2.11	0.8	0.45	6.7	0.36	4.4	1.6					0.4	1.6	5' CURB-G	0.2	1.0	0.1	0.6			37	3.12	0.2	DIRECT FLOW (TT 75-77)
75	DP69, B2.11	5.1	0.45					12.1	2.30	3.5	8.1								1.1	3.7	1029	3.41	5.0	(TT 75-83)
78	B2.12	0.7	0.45	5.0	0.32	4.8	1.5					0.3	1.5	5' CURB-G	0.2	1.0	0.1	0.5	0.2	1.0	35	3.21	0.2	DIRECT FLOW (TT 75-77)
76																					960	3.48	4.6	(TT 75-83)
77	DP75, DP76	5.8	0.45					12.3	2.61	3.5	9.2			MH					1.3	4.4	160	3.16	0.8	COMBINED FLOW (TT 77-78)
78	DP68, DP74, DP77	14.2	0.45					14.2	6.39	3.3	21.0			MH					3.1	10.2	773	3.16	4.1	COMBINED FLOW (TT 78-88)
79	B2.13	4.0	0.87	5.8	3.48	4.6	16.1														167	1.62	1.7	DIRECT FLOW (TT 79-81)
80	B2.14	2.1	0.87	6.1	1.83	4.5	8.3														127	2.02	1.0	DIRECT FLOW (TT 80-81)
81	B2.13,B2.14	6.1	0.87					7.2	5.31	4.3	22.9			MH					5.3	22.9	87	3.46	0.3	COMBINED FLOW (TT81-87)
82	B2.15	2.3	0.45	14.9	1.04	3.2	3.3														78	3.47	0.4	DIRECT FLOW (TT82-87)
82	DP67, DP72, DP73, B2.15	6.8	0.45					12.0	3.06	3.6	10.9	1.9	6.7	5' ON-GRADE	0.7	2.6	1.2	4.1	0.7	2.6	115	2.04	0.9	COMBINED FLOW (TT 82-84)
83	B2.16	2.7	0.63	12.2	1.71	3.5	6.1														74	3.45	0.4	DIRECT FLOW (TT83-89)
83	DP69, DP75, DP76, B2.16	8.5	0.51					16.2	4.32	3.1	13.4	2.5	7.7	5' ON-GRADE	0.9	2.7	1.6	5.0	0.9	2.7	168	1.95	1.4	DIRECT FLOW (TT83-85)
84	B2.17	0.9	0.80	5.0	0.72	4.8	3.5														25	3.46	0.1	DIRECT FLOW (TT 84-86)
84	DP82, B2.17	7.7	0.49					12.9	3.78	3.4	13.0	1.9	6.5	15' SUMP	1.9	6.5			1.9	6.5				COMBINED FLOW
85	B2.18	1.6	0.53	6.2	0.82	4.5	3.7														87	3.46	0.4	DIRECT FLOW (TT85-86)
85	DP83, B2.18	10.1	0.51					17.7	5.14	3.0	15.3	2.4	7.2	15' SUMP	2.4	7.2			2.4	7.2				COMBINED FLOW
85	DP84, DP85	17.8	0.50					17.7	8.93	3.0	26.5	4.3	12.8											COMBINED FLOW
86	DP84, DP85	17.8	0.50					17.7	8.93	3.0	26.5			MH					4.3	12.8	48	3.48	0.2	COMBINED PIPE FLOW (TT86-87)
87	DP81, DP82, DP86	30.7	0.56					17.9	17.29	2.9	51.0			MH					10.3	30.5	12	3.42	0.1	CONBINED PIPE FLOW (TT87-88)
88	DP78, DP87	44.9	0.53					18.0	23.68	2.9	69.7			MH					13.4	39.5	84	3.45	0.4	COMBINED PIPE FLOW (TT88-89)
89	DP83, DP88	53.4	0.52					18.4	28.01	2.9	81.5			MH					14.3	41.6	65	3.51	0.3	COMBINED PIPE FLOW (TT89-90)
90	B2.19	8.4	0.87	10.5	7.31	3.8	27.5																	DIRECT FLOW
90	DP89, B2.19	61.8	0.57					18.7	35.32	2.9	101.9			MH					21.6	62.4				COMBINED PIPE FLOW

JOB NO: 12145.00

PROJECT: HECKENDORF RANCH FILING 2
DSIN STRM: 100 year
CALC. BY: BCG
CHCKD BY: BCG

RATIONAL METHOD
(100-YEAR DEVELOPED CONDITION)

I=28.5*P1/(10+T)^0.789

1 HR STORM= 2.60

Design Point	Basin	Area	C	DIRECT RUNOFF Tc	C*A	I	Q	TOTAL RUNOFF Tc	C*A	I	Q	STREET FLOW C*A	Q	INLET TYPE	Intercept C*A	Intercept CFS	Carryover C*A	Carryover CFS	PIPE Design Q C*A	PIPE Design Q CFS	Downstream Design Pt. TRAVEL TIME Length	Vel.	Time	Notes
		Ac				IN/HR	CFS			IN/HR	CFS		CFS								ft	fps	min	
60	B2.1	0.5	0.60	6.8	0.30	8.0	2.4					0.3	2.4	5' CURB-G	0.1	1.1	0.2	1.3	0.1	1.1	46	3.09	0.2	DIRECT FLOW (TT 60-61)
61	B2.2	0.1	0.60	5.0	0.06	8.7	0.5					0.1	0.5	5' CURB-G	0.1	0.4	0.0	0.1						
61	B2.1,B2.2	0.6	0.60					7.1	0.36	7.9	2.8								0.2	1.6	12	3.16	0.1	DIRECT FLOW
62	B2.3	1.6	0.60	8.5	0.96	7.4	7.1					1.0	7.1	5' CURB-G	0.3	2.3	0.6	4.8			86	3.20	0.4	COMBINED FLOW (TT 61-62)
62	B2.1-B2.3	2.2	0.60					8.5	1.32	7.4	9.8								0.5	3.8				DIRECT FLOW (TT 62-66)
62																					872	4.88	3.0	COMBINED FLOW
63	B2.4	1.1	0.60	8.8	0.66	7.3	4.8					0.7	4.8	5' CURB-G	0.2	1.8	0.4	3.0	0.2	1.8	27	3.22	0.1	(TT 62-69)
63																					860	4.70	3.1	DIRECT FLOW (TT 63-65)
64	B2.5	0.4	0.60	5.0	0.24	8.7	2.1					0.2	2.1	5' CURB-G	0.1	1.2	0.1	0.9	0.1	1.2	18	3.33	0.1	(TT 63-67)
64																					853	4.71	3.0	DIRECT FLOW (TT 64-65)
85	B2.4,B2.5	1.5	0.60					8.9	0.90	7.3	6.6			MH					0.4	2.8	63	3.19	0.3	(TT 64-67)
66	B2.1-B2.5	3.7	0.60					9.3	2.22	7.2	15.9			MH					0.9	6.4	798	3.17	4.2	COMBINED FLOW (TT 65-66)
67	B2.6	2.5	0.60	11.1	1.50	6.7	10.0																	COMBINED FLOW (TT 66-68)
67	B2.4-B2.6	4.0	0.60					11.1	2.40	6.7	16.0	2.0	13.5	5' CURB-G	0.4	2.9	1.6	10.6			1050	3.74	4.7	DIRECT FLOW
67	B2.4-B2.6, B2.8	4.2	0.60					11.1	2.52	6.7	16.8								0.6	3.7	180	3.46	0.9	COMBINED FLOW (TT 67-82)
68	DP66, DP67	7.9	0.60					13.5	4.74	6.1	29.1								1.4	8.9	165	3.48	0.8	COMBINED FLOW (TT 67-78)
69	B2.7	2.1	0.60	9.3	1.26	7.2	9.0																	COMBINED PIPE FLOW (TT68-78)
69	B2.1-B2.3,B2.7	4.3	0.60					11.5	2.58	6.6	17.0	2.1	13.6	10' CURB-G	0.7	4.9	1.3	8.7	0.7	4.9	144	3.46	0.7	DIRECT FLOW
69																					1037	3.61	4.8	COMBINED FLOW (TT 69-75)
70	B2.8	0.2	0.60	5.0	0.12	8.7	1.0					0.1	1.0	5' CURB-S	0.1	1.0			0.1	1.0	11	3.44	0.1	(TT 69-83)
72	B2.9	0.3	0.60	5.9	0.18	8.3	1.5					0.2	1.5	5' CURB-G	0.1	1.1	0.0	0.4	0.1	1.1	73	3.14	0.4	DIRECT FLOW (TT 70-67)
72																					984	3.32	4.9	DIRECT FLOW (TT 72-74)
73	B2.10	0.2	0.60	5.0	0.12	8.7	1.0					0.1	1.0	5' CURB-G	0.1	0.8	0.0	0.2	0.1	0.8	30	3.27	0.2	(TT 72-82)
73																					856	3.51	4.1	DIRECT FLOW (TT 73-74)
74	B2.9,B2.10	0.5	0.60					6.3	0.30	8.2	2.5			MH					0.2	1.8	60	3.16	0.3	(TT 73-82)
75	B2.11	0.8	0.60	6.7	0.48	8.0	3.9					0.5	3.9	5' CURB-G	0.2	2.0	0.2	1.9			37	3.12	0.2	COMBINED FLOW (TT 74-78)
75	DP69, B2.11	5.1	0.6					12.1	3.06	6.4	19.7								1.0	6.4	1029	3.41	5.0	DIRECT FLOW (TT 75-77)
76	B2.12	0.7	0.60	5.0	0.42	8.7	3.7					0.4	3.7	5' CURB-G	0.2	1.6	0.2	2.1	0.2	1.6	35	3.21	0.2	(TT 77-83)
76																					960	3.48	4.6	DIRECT FLOW (TT 75-77)
77	DP75, DP76	5.8	0.60					12.3	3.48	6.4	22.2			MH					1.2	7.5	160	3.16	0.8	(TT 75-83)
78	DP68, DP74, DP77	14.2	0.60					14.2	8.52	6.0	51.0			MH					2.8	17.0	773	3.16	4.1	COMBINED FLOW (TT 77-78)
79	B2.13	4.0	0.89	5.8	3.56	8.4	29.9														167	1.62	1.7	COMBINED FLOW (TT 78-88)
80	B2.14	2.1	0.89	6.1	1.87	8.3	15.4														127	2.02	1.0	DIRECT FLOW (TT 79-81)
81	B2.13,B2.14	6.1	0.89					7.2	5.43	7.9	42.7			MH					5.4	42.7	67	3.46	0.3	DIRECT FLOW (TT 80-81)
82	B2.15	2.3	0.78	14.9	1.79	5.9	10.5														78	3.47	0.4	COMBINED FLOW (TT81-87)
82	DP67, DP72, DP73, B2.15	6.8	0.66					12.0	4.49	6.5	29.1	3.4	22.3	5' ON-GRADE	0.7	4.8	2.7	17.5	0.7	4.8	115	2.04	0.9	DIRECT FLOW (TT82-87)
83	B2.16	2.7	0.66	12.2	1.80	6.4	11.6														74	3.45	0.4	COMBINED FLOW (TT 82-84)
83	DP69, DP75, DP76, B2.16	8.5	0.62					16.2	5.28	5.6	29.7	3.6	20.2	5' ON-GRADE	0.8	4.6	2.8	15.6	0.8	4.6	168	1.95	1.4	DIRECT FLOW (TT83-89)
84	B2.17	0.9	0.89	5.0	0.80	8.7	7.0														25	3.46	0.1	DIRECT FLOW (TT83-85)
84	DP82, B2.17	7.7	0.69					12.9	5.29	6.3	33.2	3.6	19.3	15' SUMP	3.6	19.3			3.6	19.3				DIRECT FLOW (TT 84-86)
85	B2.18	1.6	0.55	6.2	0.86	8.2	7.1																	COMBINED FLOW
85	DP83, B2.18	10.1	0.61					17.7	6.14	5.4	33.1	3.6	19.3	15' SUMP	3.6	19.3			3.6	19.3	87	3.46	0.4	DIRECT FLOW (TT85-86)
85	DP84, DP85	17.8	0.64					17.7	11.43	5.4	61.7	7.1	38.5											COMBINED FLOW
86	DP84, DP85	17.8	0.64					17.7	11.43	5.4	61.7			MH					7.1	38.5	48	3.48	0.2	COMBINED FLOW
87	DP81, DP82, DP86	30.7	0.70					17.9	21.35	5.4	114.4			MH					13.3	71.3	12	3.42	0.1	COMBINED PIPE FLOW (TT86
88	DP78, DP87	44.9	0.67					18.0	29.87	5.4	159.8			MH					16.1	86.4	84	3.45	0.4	CONBINED PIPE FLOW (TT87
89	DP83, DP88	53.4	0.66					18.4	35.15	5.3	186.0			MH					17.0	89.8	65	3.51	0.3	COMBINED PIPE FLOW (TT88
90	B2.19	8.4	0.89	10.5	7.48	6.8	51.1																	COMBINED PIPE FLOW (TT89
90	DP89, B2.19	61.8	0.69					18.7	42.62	5.2	223.6			MH					24.4	128.2				DIRECT FLOW
																								COMBINED PIPE FLOW

RATIONAL METHOD DISCHARGE SUMMARY

JOB NO:	12145.00
PROJECT:	HECKENDORF RANCH FILING 2
DESIGN STORM:	5 and 100 year
CALCULATED BY:	EMK/BCG
CHECKED BY:	EMK/

BASIN B2

Design Point	Basin	Area	DIRECT RUNOFF 5 Year	DIRECT RUNOFF 100 Year	Notes
		Ac	cfs	cfs	
60	B2.1	0.5	1.0	2.4	DIRECT FLOW (TT 60-61)
61	B2.2	0.1	0.2	0.5	DIRECT FLOW
61	B2.1,B2.2	0.6	1.2	2.8	COMBINED FLOW (TT 61-62)
62	B2.3	1.6	2.9	7.1	DIRECT FLOW (TT 62-66)
62	B2.1-B2.3	2.2	4.0	9.8	COMBINED FLOW
62	0	0	0.0	0.0	(TT 62-69)
63	B2.4	1.1	2.0	4.8	DIRECT FLOW (TT 63-65)
63	0	0	0.0	0.0	(TT 63-67)
64	B2.5	0.4	0.9	2.1	DIRECT FLOW (TT 64-65)
64	0	0	0.0	0.0	(TT 64-67)
65	B2.4,B2.5	1.5	2.7	6.6	COMBINED FLOW (TT 65-66)
66	B2.1-B2.5	3.7	6.6	15.9	COMBINED FLOW (TT 66-68)
67	B2.6	2.5	4.1	10.0	DIRECT FLOW
67	B2.4-B2.6	4	6.6	16.0	COMBINED FLOW (TT 67-82)
67	B2.4-B2.6, B2.8	4.2	6.9	16.8	COMBINED FLOW (TT 67-78)
69	B2.7	2.1	3.7	9.0	DIRECT FLOW
69	B2.1-B2.3,B2.7	4.3	7.0	17.0	COMBINED FLOW (TT 69-75)
69	0	0	0.0	0.0	(TT 69-83)
70	B2.8	0.2	0.4	1.0	DIRECT FLOW (TT 70-67)
72	B2.9	0.3	0.6	1.5	DIRECT FLOW (TT 72-74)
72	0	0	0.0	0.0	(TT 72-82)
73	B2.10	0.2	0.4	1.0	DIRECT FLOW (TT 73-74)
73	0	0	0.0	0.0	(TT 73-82)
74	B2.9,B2.10	0.5	1.0	2.5	COMBINED FLOW (TT 74-78)
75	B2.11	0.8	1.6	3.9	DIRECT FLOW (TT 75-77)
75	DP69, B2.11	5.1	8.1	19.7	(TT 75-83)
76	B2.12	0.7	1.5	3.7	DIRECT FLOW (TT 75-77)
76	0	0	0.0	0.0	(TT 75-83)
77	DP75, DP76	5.8	9.2	22.2	COMBINED FLOW (TT 77-78)
78	DP67, DP74, DP77	10.5	16.1	39.1	COMBINED FLOW (TT 78-88)
79	B2.13	4	16.1	29.9	DIRECT FLOW (TT 79-81)
80	B2.14	2.1	8.3	15.4	DIRECT FLOW (TT 80-81)
81	B2.13,B2.14	6.1	22.9	42.7	COMBINED FLOW (TT81-87)
82	B2.15	2.3	3.3	10.5	DIRECT FLOW (TT82-87)
82	DP67, DP72, DP73, B2.15	6.8	10.9	29.1	COMBINED FLOW (TT 82-84)
83	B2.16	2.72	6.1	11.6	DIRECT FLOW (TT83-89)
83	DP69, DP75, DP76, B2.16	8.52	13.4	29.7	DIRECT FLOW (TT83-85)
84	B2.17	0.9	3.5	7.0	DIRECT FLOW (TT 84-86)
84	DP82, B2.17	7.7	13.0	33.2	COMBINED FLOW
85	B2.18	1.55	3.7	7.1	DIRECT FLOW (TT85-86)
85	DP83, B2.18	10.07	15.3	33.1	COMBINED FLOW
85	DP84, DP85	17.77	26.5	61.7	COMBINED FLOW
86	DP84, DP85	17.77	26.5	61.7	COMBINED PIPE FLOW (TT86-87)
87	DP81, DP82, DP86	30.67	51.0	114.4	CONBINED PIPE FLOW (TT87-88)
88	DP78, DP87	41.17	64.8	147.9	COMBINED PIPE FLOW (TT88-89)
89	DP83, DP88	49.69	76.7	174.2	COMBINED PIPE FLOW (TT89-90)
90	B2.19	8.4	27.5	51.1	DIRECT FLOW
90	DP89, B2.19	58.09	97.1	211.9	COMBINED PIPE FLOW

HECKENDORF RANCH FILING NO. 2

Pond 1 (Regional Pond) Volume Calculation
(Prismoidal Method)

Elevation	Area	Volume	(Available Volume) Cumulative Volume
ft	sf	ac-ft	ac-ft
6308.5	165450.13	1.9	25.9
6308.0	162219.86	7.0	24.0
6306.0	142802.36	6.2	17.0
6304.0	129026.42	5.3	10.8
6302.0	100821.48	3.6	5.5
6300.0	57243.41	1.8	2.0
6298.0	21883.85	0.2	0.2
6297.5	15264.22	0.0	0.0

Pond 1 (WQCV)

Tributary Basin	Area Acres	Impervious %, I	A*I	
3	294	2	588.0	
11	13.9	40	556.0	
12	42.1	16	673.6	
13	21.9	43	941.7	
14	42.1	59	2483.9	
15	24.1	24	578.4	
Total	438.1		5821.6	
Weighted, I	13.3	%		
WQCV	0.085	inch		
Required Storage	3.7	Acre-ft		<====

WQCV=a*(0.91*I^3-1.19*I^2+0.78*I)
a=1.0 for 40-hour drain time
I=I/100
Required Storage=(WQCV/12)*(Area)*1.2

Frequency	Volume	Elevation	Release Rate	*Allowable Release Rate
yr	ac-ft	ft	cfs	cfs
100 Year	15.4	6305.5	596	596
10 Year	10.3	6303.8	159	159
WQ	3.7	6300.5	(Per UDFCD)	(Per UDFCD)

* ALLOWABLE RELEASE RATE TAKEN FROM EXISTING CUHP/UDSWMM ANALYSIS LOCATED IN APPENDIX B AND C.

REGIONAL WATER QUALITY AND DETENTION POND 1

	Volume Required		Volume Provided			
	Cubic Ft. ac-ft	Acre-Ft. ft	Cubic Ft. cfs	Acre-Ft. cfs	Elevation (ft)	Release Rate (cfs)
Water Quality	161172.0	3.7	161172.0	3.7	6300.5	(Per UDFCD)
10 year	287496.0	6.6	287496.0	6.6	6302.4	159
10 year + WQ	448668.0	10.3	448668.0	10.3	6303.8	159
100 year	670824.0	15.4	670824.0	15.4	6305.5	596
100 year + WQ	670824.0	15.4	670824.0	15.4	6305.5	596.0

* 100 year volume is inclusive of water quality volume per Town of Castle Rock Regulations.

DESIGN POINT 4, REFERENCED FROM PHASE III DRAINAGE STUDY FOR HECKENDORF RANCH FILING 1, DECEMBER 2002, PREPARED BY EMK CONSULTANTS, INC.

KEY MAP

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

HECKENDORF RANCH FILING NO. 1

TRACT A
TRACT B
TRACT C
TRACT E
TRACT F
TRACT H

CROSSHAVEN PLACE
CROSSHAVEN COURT
BOULEVARD
CASTLEMAINE
COURT
DOWNINGTON WAY
DOWNINGTON COURT
DOUGLAS LANE (UNRECORDED)
DRIVEWAY

RECORDED 1-28-2005 AT RECEPTION NO. 2005008723

PLUM CREEK

DENVER AND RIO GRANDE WESTERN RAILROAD

POND 1
100 YR WSE= 6305.5

POND 3

APPROXIMATE 100 YR FLOODPLAIN AT PLUM CREEK BASED UPON FEMA FLOOD INSURANCE RATE MAP, DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS, MAP REVISED: DECEMBER 17, 2002
NOTE: ELEVATIONS ARE NGVD29 DATUM. ADD 3.53' TO CONVERT TO NAVD88 DATUM

APPROXIMATE 100 YR. W.S.E. (NON-REGULATORY FLOODPLAIN)

VERTICAL DATUM IS NGVD29 (PLUM CREEK)

VERTICAL DATUM IS NAVD88 (CRYSTAL VALLEY PARKWAY)

THE LANTERNS P.D.
PREMISE REAL ESTATE, LLC

BLOCK 1 OF 3
BLOCK 1 LOT 1
BLOCK 2 LOT 1
BLOCK 2 LOT 2

B2.19	8.4	0.87
B2.17	0.9	0.80
B2.16	2.7	0.67
B2.14	2.1	0.87
B2.15	2.3	0.72
B2.13	4.0	0.87
B2.10	0.2	0.45
B2.9	0.3	0.45
B2.7	2.1	0.45
B2.8	0.2	0.45
B2.6	2.5	0.45
B2.5		
B2.4		
B2.12	0.7	0.45
B2.11	0.8	0.45
B2.1	0.5	0.45
B2.2	0.1	0.45
B2.3	1.6	0.45
B3.11	0.7	0.45
B3.10	2.2	0.45
B3.5	0.1	0.45
B3.2	0.3	0.45
B3.1	4.1	0.45
B3.4	3.5	0.45
B3.3	3.1	0.45
B3.6	5.2	0.45
B1.7	0.2	0.45
B1.6	0.19	0.45
B1.5	0.33	0.45
B1.4	0.91	0.45
B1.3	4.2	0.45
B1.2	2.3	0.45
A2.11	1.9	0.45
A2.10	0.5	0.45
A2.6	3.3	0.45
A2.4	3.4	0.45
A1.3		
17*	0.4	0.80
18**	1.84	0.77

* PHASE III DRAINAGE STUDY FOR CRYSTAL VALLEY RANCH FILING 6 PREPARED BY LEGACY ENGINEERING , INC. 07/01/2005
** PHASE III DRAINAGE STUDY FOR CRYSTAL VALLEY PARKWAY PREPARED BY MANHARD CONSULTING, LTD 10/09/2003

EMK CONSULTANTS, INC.
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(303) 694-1520

FOR BOARD OF COUNTY COMMISSIONERS APPROVED UTILITY INFORMATION
48 HOURS BEFORE YOU DIG
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BAR IS 1 INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

SCALE VERIFICATION

REUSE OF DOCUMENT

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REVISIONS

NO.	DATE	BY

DESIGNED BY DMD
DRAWN BY DSN
CHECKED BY BCG
APPROVED BY MJE

HECKENDORF RANCH FILING NO. 2

FINAL DRAINAGE STUDY RATIONAL METHOD BASIN MAP

DATE: 4.22.05
JOB NO: 12145.01
SCALE
1" = 100'

J:\12145 Heckl\Ranch #II 2\Drainage\Rational Method\01-1002-DRH.dwg, 1/25/2006 1:37:34 PM, hpierrales, 1:100