Phase I Drainage Report: YardHomes Ridge View

Parcel 1, Terra Monte

Address:
Northwest corner of Plum Creek Parkway and Ridge Road

Prepared:
November 6, 2024

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I. GENERAL LOCATION AND DESCRIPTION

A. Site Location

The YardHomes at Castle Rock Development ("Site") is located at the northwest corner of North Ridge Road and Plum Creek Parkway. More specifically, the Site is situated in the South ½ of Section 7, Township 8 South, Range 66th West of the 6th Principal Meridian, County of Douglas, State of Colorado.

The Site is bound by Plum Creek Parkway to the south, North Ridge Road to the east, two single-family residences to the west, and an existing church to the north.

A Vicinity Map can be found in Appendix A.

B. Description of Property and Land Use

The 32.3-acre development is anticipated to consist of approximately 165 dwelling units in 130 residential structures, in addition to a clubhouse and amenities such as a pool. The Site also include improvements such as paved streets, surface and garage parking, curb and gutter, hardscaping and landscaping.

Currently, the Site consists of undeveloped land with vegetation consisting of native grasses and weeds. The proposed improvements will disturb approximately 20 acres of the Site with excavation, grading, utility installation and other construction activities.

The Site generally slopes from north to south at varying grades. Rock outcroppings have been observed on the Site on the south side of the Site following Plum Creek Parkway and will not be disturbed by construction activities.

There are four soil types on the Site as identified by the Natural Resources Conservation Service (NRCS) Web Soil Survey: fondis clay loam, fondis-kutch association, and stony steep land classified as Hydrologic Soil Group C and D. Soil groups D and C tend to have lower infiltration rates which will result in higher peak runoff rates for developed sites in comparison with soils classified within hydrologic soil groups A & B. A copy of the soil survey is included in Appendix B.

There are no major or minor drainageways on or adjacent to the Site.

There are no floodplains as delineated by Town of Castle Rock or FEMA on or adjacent to the Site. Refer to the FEMA Firm map in Appendix B.

There is no known contamination on the Site. The contractor will be responsible for monitoring for contamination throughout the construction and any required remediation will occur immediately.

There are no known irrigation canals or ditches or significant geologic features on the Site.

II. DRAINAGE BASIN AND SUB-BASINS

A. Major Drainage Basins

The Site is located within the East Plum Creek watershed per the Town of Castle Rock Watershed Protection District Map, updated 2021. Per the Watershed Protection District Map and Cherry Creek Drainageway Map, a small portion of the northeast corner of the Site falls within the Cherry Creek Watershed. This area in question may be required to meet Cherry Creek Regulation 72, and a separate water quality facility may be required for the full area draining to the Cherry Creek basin. However, per the Regulation 72, an authorized exclusion can be made for "Construction of a sidewalk or driveway for disturbances less than

one acre…" Per the Map shown in Appendix E and the approximate 0.58-acre of Site area located within the Cherry Creek Watershed, an authorized exclusion will be requested.

This Site is a part of Major Basin 32 within the Plum Creek Parkway Widening Phase 2 Stormwater Improvements, Phase III Drainage Report, dated January 2022 (Town of Castle Rock Number CIP20-0020). Basin 32 follows historic drainage patterns and is routed to two extended detention basins called the "West Pond" and "East Pond" and eventually to Sellar's Gulch Unnamed Tributary No. 2.

The existing land use within the basins is agricultural and is being rezoned to Planned Development under ANX24-0008. See Appendix E for excerpts from Master Report.

There are no drainageway planning or floodplain delineation studies that are on or adjacent to the Site.

There is a proposed private access drive directly north of the Site that will be routed through the on-Site storm and treatment system.

Basins A-D will be routed to the proposed detention pond, via proposed on-site private storm sewer infrastructure, curb and gutter and drainage swales. Basin E consists of the proposed extended detention basin.

B. Minor Drainage Basins

Minor drainage basins will be delineated as the site plan progresses with the Phase II and Phase II Drainage Reports and these basins will be delineated in a way that conveys stormwater through proposed infrastructure in an efficient and economical manner.

The existing land use within the basins is agricultural and is being rezoned to Planned Development under ANX24-0008.

The shared access drive to the north of the Site is an off-Site basin that will be routed through the on-Site storm system and treated in the proposed detention system.

III. EXISTING STORMWATER CONVEYANCE OR STORAGE FACILITIES

A. Existing Stormwater Conveyance Facilities

Existing stormwater conveyance facilities consist of an existing storm main located within Plum Creek Parkway to the south of the Site. After review of the existing storm drain, it has been determined that additional, developed flows cannot be conveyed to the existing infrastructure without exceeding Town criteria or upsizing the existing infrastructure.

There is an existing on-site drainage path, located along the western portion of the Site, that surface drains towards Plum Creek Parkway, that appears to receive the majority of the historic runoff from the Site.

There are no known conveyance facilities that will be rebuilt or abandoned.

B. Existing Stormwater Storage Facilities

There are no known existing water quality and storage facilities on-Site. This Site is required to provide water quality and 100-year detention for the development of the Site. After detention, the stormwater will continue south and be routed into the existing drainage facilities located in Plum Creek Parkway and ultimately to Sellar's Gulch Unnamed Tributary No. 2, following historic drainage patterns.

IV. PROPOSED STORMWATER CONVEYANCE OR STORAGE FACILITIES

A. Proposed Stormwater Conveyance Facilities

Proposed stormwater conveyance facilities will consist of storm drainage infrastructure that will collect runoff via inlets and landscape drains, and route that runoff to the proposed storage facility. Drainage patterns will remain relatively unchanged from current conditions.

B. Proposed Stormwater Storage Facilities

The pond will be located in the southern part of the property, north of Plum Creek Parkway, within Planning Area OSP-1. The pond will include water quality capture volume (WQCV), excess urban runoff volume (EURV), 100-year + ½ WQCV detention per Town standards. A spillway will be included with the final design detailing a minimum 1-foot of freeboard.

From the outlet structure, the treated and detained runoff will be conveyed via storm pipe to the west, discharging to an existing drainage path following historic drainage patterns.

V. WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES

A. Non-structural Best Management Practices

Mile High Flood District recommends implementing the Four Step Process below, which helps to minimize adverse impacts of urbanization. Benefits of this process include reduced runoff, improved water quality, a decrease of the required storage volume, reduced burdens to downstream facilities, and improved site aesthetics. The Four Step Process is outlined below:

Step 1: Reduce runoff by disconnecting impervious areas, eliminating “unnecessary” impervious areas, and encouraging infiltration into soils that are suitable. This is accomplished by a combination of landscape islands and landscape areas adjacent to buildings and amenity areas on the Site.

Step 2: Treat and slowly release the WQCV. This is being accomplished through the proposed full spectrum detention pond where runoff will slowly flow from the forebay of the pond to the outlet structure while sediment settles to the bottom of the pond. Then the runoff is slowly released out the outlet structure.

Step 3: Stabilize drainageways. A combination of seeding and mulching and riprap around the outfall will be used on site to stabilize the land and prevent erosion. All new and re-development projects are required to construct or participate in the funding of channel stabilization measures. Drainage basin fees paid, at the time of platting, go toward channel stabilization within the drainage basin. The proposed outlet has sufficient stabilization.

Step 4: Implement source controls. A combination of source control BMP’s will be utilized including landscape maintenance, snow and ice management, and street sweeping and cleaning utilized, one can apply for reimbursement of the parts of these fess that are unused.

The owner will be responsible for maintenance of the proposed conveyance and detention system.

VI. FLOODPLAIN MODIFICATIONS

A. Major Drainageway-Undesignated Floodplain

The Site does not appear to be near any existing undesignated floodplains and will not affect any downstream floodplains as the proposed infrastructure will detain the 100-yr + ½ WQCV and be sized to release flows at predevelopment levels.

B. Major Drainageway-Designated Floodplain

This Site does not appear to be near any existing designated floodplains and will not affect any downstream floodplains as the proposed infrastructure will detain the 100-yr + ½ WQCV and be sized to release flows at predevelopment levels.

VII. POTENTIAL PERMITTING REQUIREMENTS

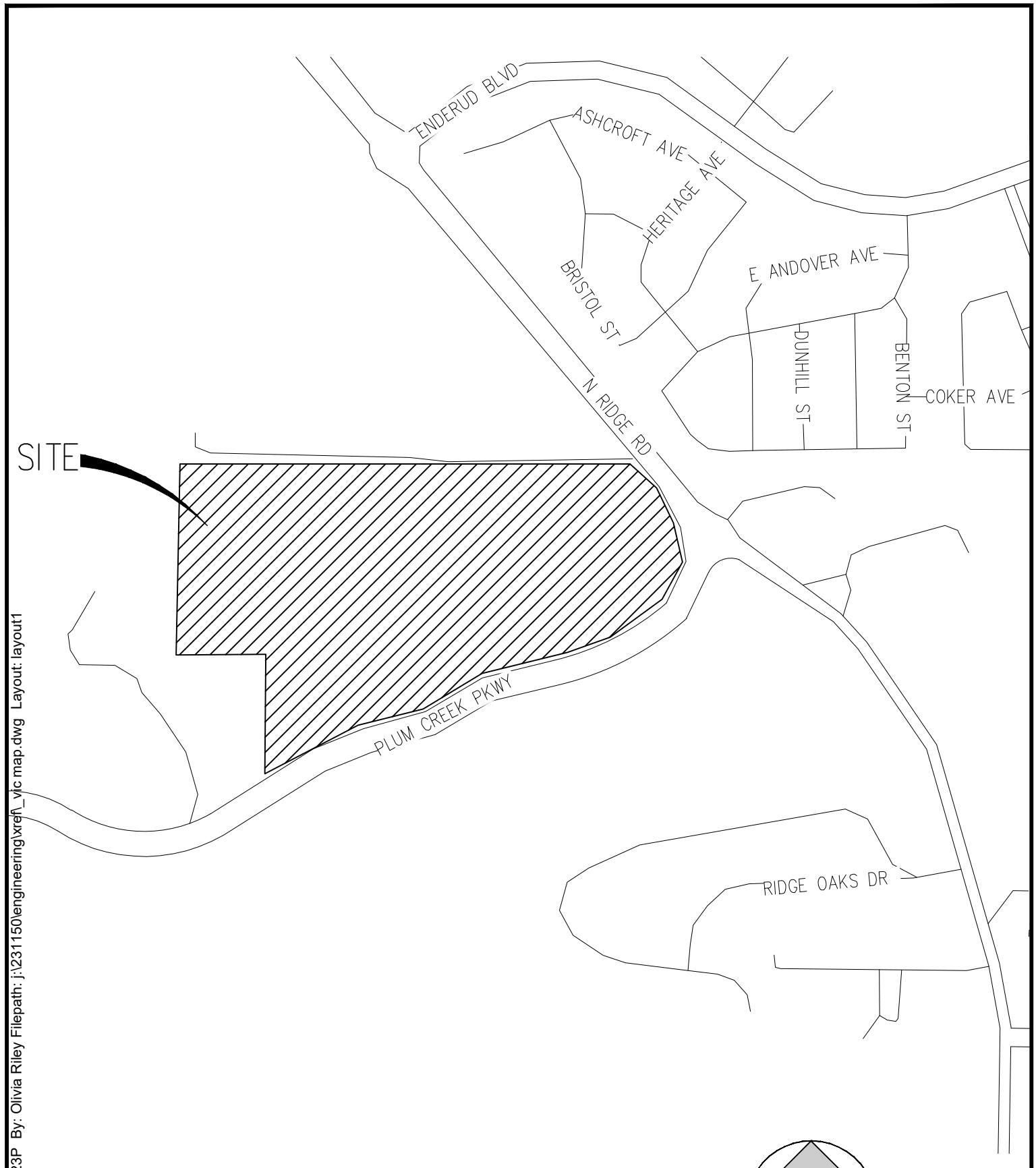
Town of Castle Rock will require a Grading, Erosion and Sediment Control permit. A Colorado Discharge System Permit (CDPS) will be required for the project.

VIII. LIST OF REFERENCES

References

1. Town of Castle Rock Storm Drainage Design and Technical Criteria Manual, Castle Rock Water Department, June 2019.
2. Urban Storm Drainage Criteria Manual, Vol. 1 and 2, Mile High Flood District, Revised January 2016
3. Urban Storm Drainage Criteria Manual, Vol. 3, Mile High Flood District, Revised November 2015
4. Custom Soil Resource Report, Natural Resources Conservation Service, United States Department of Agriculture.

APPENDIX A – VICINITY MAP



VICINITY MAP

SCALE: 1" = 600'

600 0 600 1200

SCALE: 1" = 600'

Plotted: THU 11/30/23 2:38:23P By: Olivia Riley Filepath: j:\231150\engineering\xref_vic map.dwg Layout: layout1

APPENDIX B – FEMA FIRM, NRCS SOIL REPORT

NOTES TO USERS

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

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

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

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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

Base map information shown on this FIRM was provided by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2010.

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

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

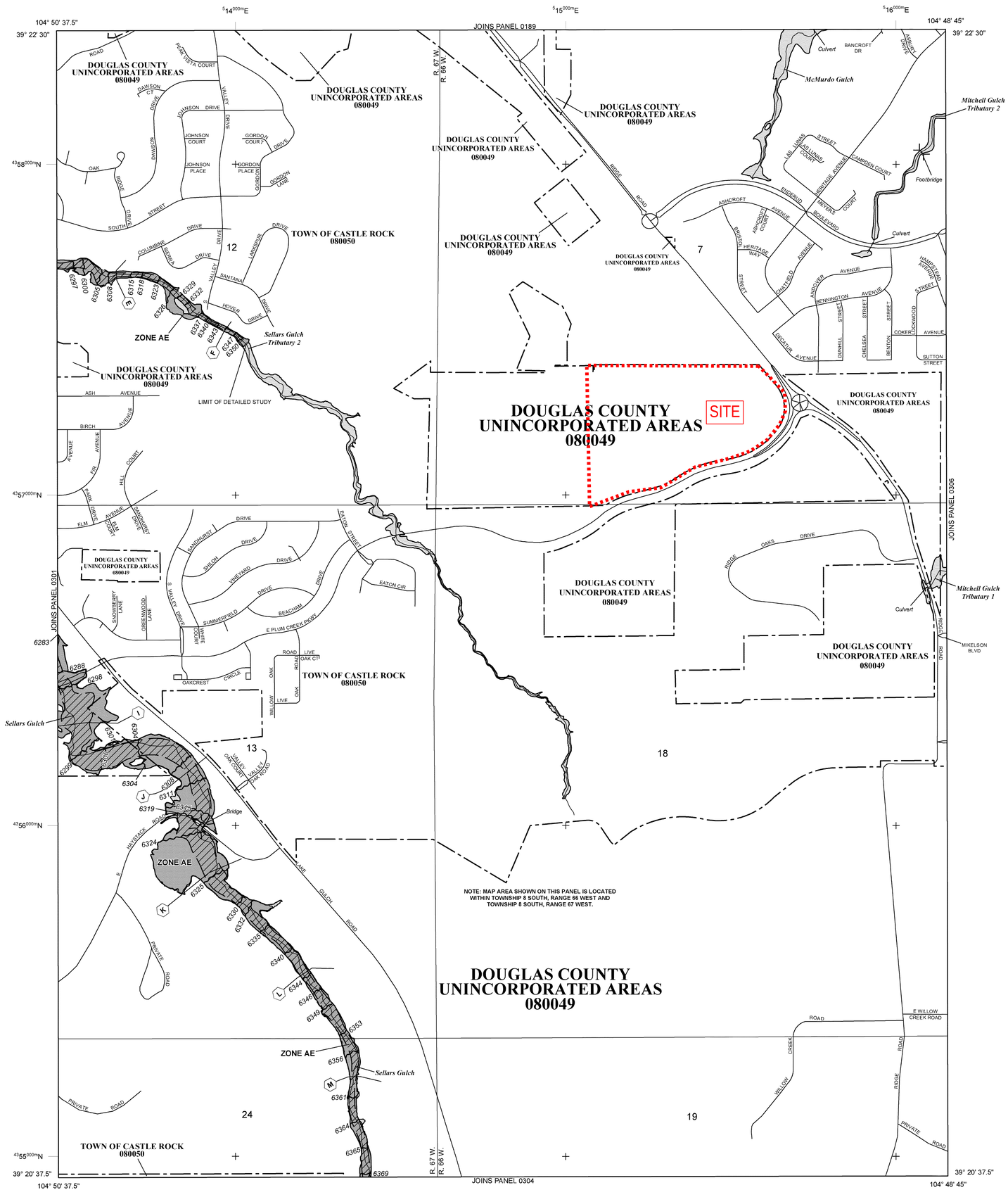
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood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

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

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

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

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



LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

	1% Annual Chance Floodplain Boundary
	0.2% Annual Chance Floodplain Boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 — 23	Transect line
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
4989000mN	1000-meter Universal Transverse Mercator grid values, zone 13
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2005

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

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision.

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

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0302G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 302 OF 495
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CASTLE ROCK, TOWN OF	080050	0302	G
DOUGLAS COUNTY	080049	0302	G

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

MAP NUMBER
08035C0302G
MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

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

April 25, 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

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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Fu—Fondis-Kutch association.....15
Sv—Stony steep land.....17
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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: 1:3,180 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 45 90 180 270

Feet
0 150 300 600 900

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FoB	Fondis clay loam, 1 to 3 percent slopes	0.6	2.2%
FoD	Fondis clay loam, 3 to 9 percent slopes	19.5	67.2%
Fu	Fondis-Kutch association	4.8	16.7%
Sv	Stony steep land	4.0	13.8%
Totals for Area of Interest		**29.0**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Castle Rock Area, Colorado

FoB—Fondis clay loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: jqyn
Elevation: 5,500 to 6,800 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Fondis

Setting

Landform: Mesas, buttes, hills, ridges
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits over sedimentary rock coarse-silty outwash derived from arkose

Typical profile

H1 - 0 to 7 inches: clay loam
H2 - 7 to 24 inches: clay
H3 - 24 to 60 inches: sandy clay loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.4 inches)

Interpretive groups

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

Minor Components

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

Buick
Percent of map unit: 6 percent
Hydric soil rating: No

Satanta
Percent of map unit: 6 percent
Hydric soil rating: No

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

FoD—Fondis clay loam, 3 to 9 percent slopes

Map Unit Setting
National map unit symbol: jqyp
Elevation: 5,500 to 6,800 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

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

Description of Fondis

Setting
Landform: Mesas, buttes, ridges
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits over coarse-silty outwash derived from arkose

Typical profile
H1 - 0 to 7 inches: clay loam
H2 - 7 to 24 inches: clay
H3 - 24 to 60 inches: sandy clay loam

Properties and qualities
Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained

Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.4 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Minor Components

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

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

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

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

Fu—Fondis-Kutch association

Map Unit Setting
National map unit symbol: jqyq
Elevation: 5,500 to 6,800 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition
Fondis and similar soils: 50 percent
Kutch and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fondis

Setting

Landform: Valley sides, draws
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits over coarse-silty outwash derived from arkose

Typical profile

H1 - 0 to 7 inches: loam
H2 - 7 to 24 inches: clay
H3 - 24 to 60 inches: sandy clay loam

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Description of Kutch

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-textured residuum weathered from calcareous shale

Typical profile

H1 - 0 to 6 inches: sandy loam
H2 - 6 to 32 inches: clay
H3 - 32 to 36 inches: weathered bedrock

Properties and qualities

Slope: 5 to 40 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent

Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Minor Components

Bresser

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

Newlin

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

Hilly gravelly land

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

Aquic haplustolls

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

Sv—Stony steep land

Map Unit Setting

National map unit symbol: jr0c
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 49 to 51 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Stony steep land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stony Steep Land

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex

Typical profile

H1 - 0 to 6 inches: cobbly sandy loam
H2 - 6 to 20 inches: cobbly sandy loam
H3 - 20 to 24 inches: unweathered bedrock

Properties and qualities

Slope: 9 to 65 percent
Depth to restrictive feature: 10 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: R049XY206CO - Stony Foothill
Hydric soil rating: No

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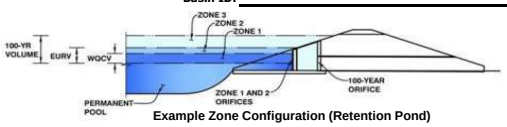
APPENDIX C – HYDROLOGIC

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Yardhomes at Castle Rock

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	16.50	acres
Watershed Length =	1,240	ft
Watershed Length to Centroid =	498	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	70.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.378	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.123	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.06 in.) =	0.993	acre-feet	1.06	inches
5-yr Runoff Volume (P1 = 1.43 in.) =	1.478	acre-feet	1.43	inches
10-yr Runoff Volume (P1 = 1.66 in.) =	1.791	acre-feet	1.66	inches
25-yr Runoff Volume (P1 = 1.69 in.) =	1.861	acre-feet		inches
50-yr Runoff Volume (P1 = 2.26 in.) =	2.659	acre-feet	2.26	inches
100-yr Runoff Volume (P1 = 2.6 in.) =	3.167	acre-feet	2.60	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	3.935	acre-feet		inches
Approximate 2-yr Detention Volume =	0.899	acre-feet		
Approximate 5-yr Detention Volume =	1.342	acre-feet		
Approximate 10-yr Detention Volume =	1.530	acre-feet		
Approximate 25-yr Detention Volume =	1.450	acre-feet		
Approximate 50-yr Detention Volume =	1.771	acre-feet		
Approximate 100-yr Detention Volume =	1.964	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.378	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.744	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	1.031	acre-feet
Total Detention Basin Volume =	2.153	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

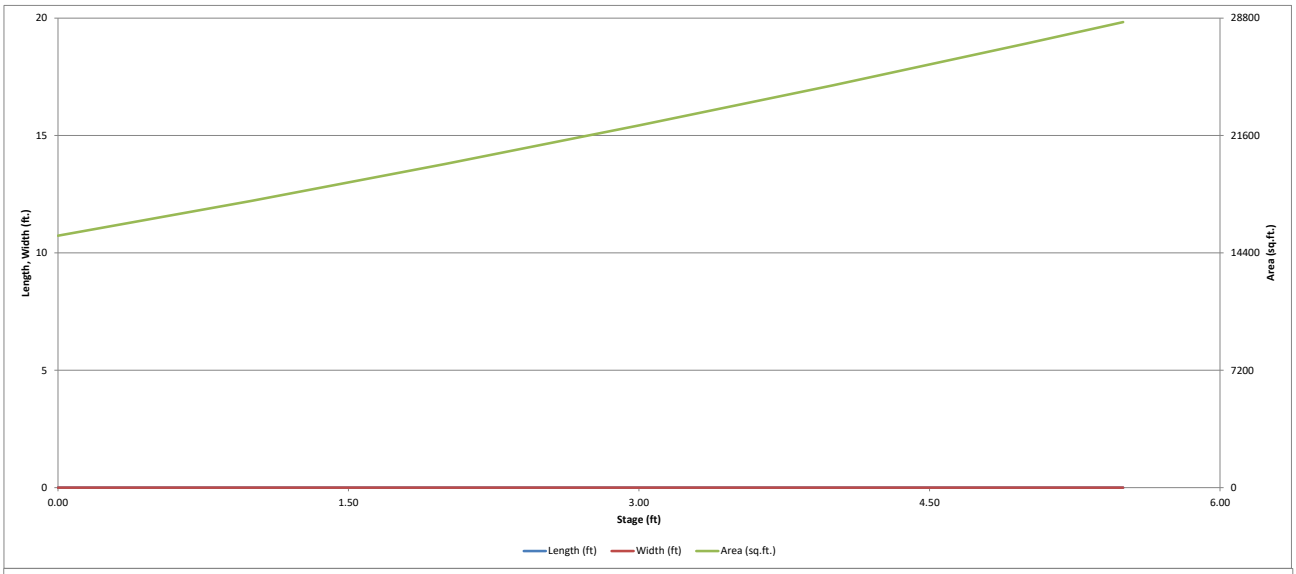
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user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

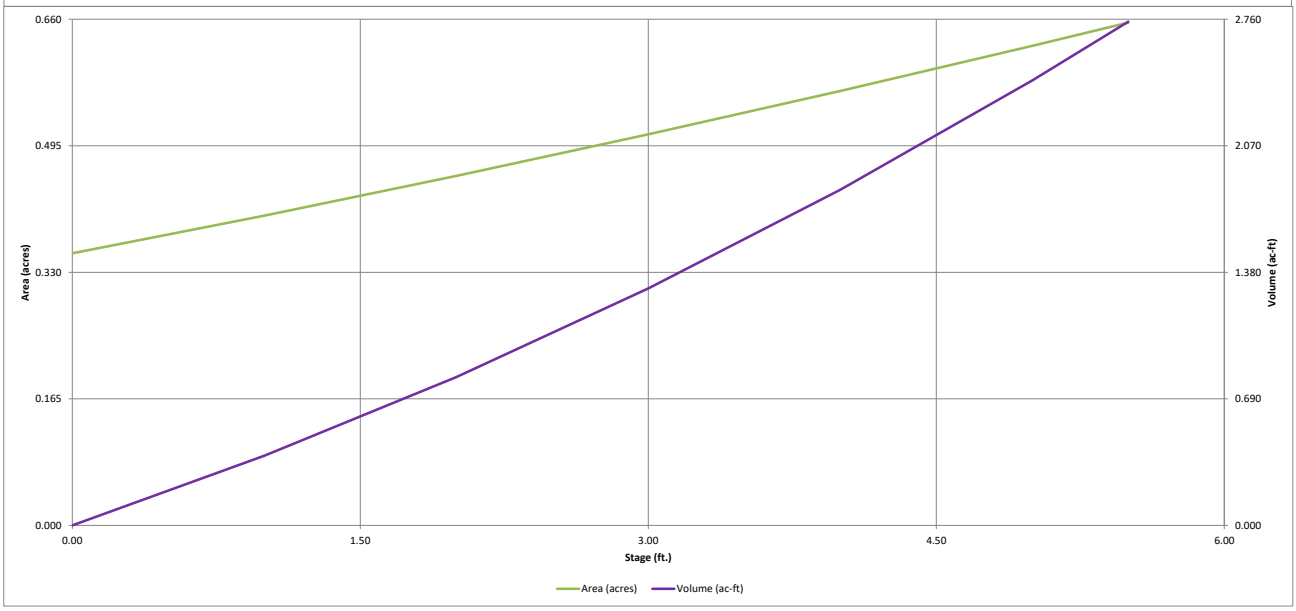
Depth Increment = 0.20 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	15,456	0.355		
6611	--	1.00	--	--	--	17,594	0.404	16,525	0.379
6612	--	2.00	--	--	--	19,855	0.456	35,250	0.809
6613	--	3.00	--	--	--	22,216	0.510	56,285	1.292
6614	--	4.00	--	--	--	24,677	0.567	79,732	1.830
6615	--	5.00	--	--	--	27,240	0.625	105,691	2.426
6615.5	--	5.50	--	--	--	28,558	0.656	119,640	2.747

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



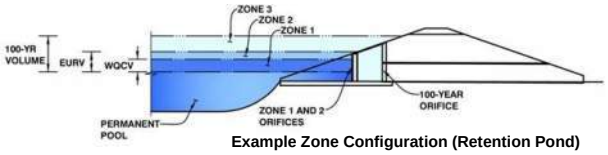


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Yardhomes at Castle Rock**

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.00	0.378	Orifice Plate
Zone 2 (EURV)	2.67	0.744	Rectangular Orifice
Zone 3 (100+1/2WQCV)	4.56	1.031	Weir&Pipe (Restrict)
Total (all zones)		2.153	

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

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

Calculated Parameters for Underdrain

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	3.333E-02	ft^2
Depth at top of Zone using Orifice Plate =	1.00	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	6.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	4.80	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50						
Orifice Area (sq. inches)	4.80	4.80						

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected			Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	1.00	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.04	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	2.67	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.08	N/A	feet
Vertical Orifice Height =	2.00	N/A	inches				
Vertical Orifice Width =	3.00		inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.75	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.73	N/A	feet
Overflow Weir Front Edge Length =	6.67	N/A	feet	Overflow Weir Slope Length =	4.04	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	28.09	N/A	
Horiz. Length of Weir Sides =	3.92	N/A	feet	Overflow Grate Open Area w/o Debris =	21.32	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	10.66	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.76	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.39	N/A	feet
Restrictor Plate Height Above Pipe Invert =	8.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.46	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.89	feet
Spillway Crest Length =	20.00	feet	Stage at Top of Freeboard =	7.39	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.66	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	2.75	acre-ft

Calculated Parameters for Spillway

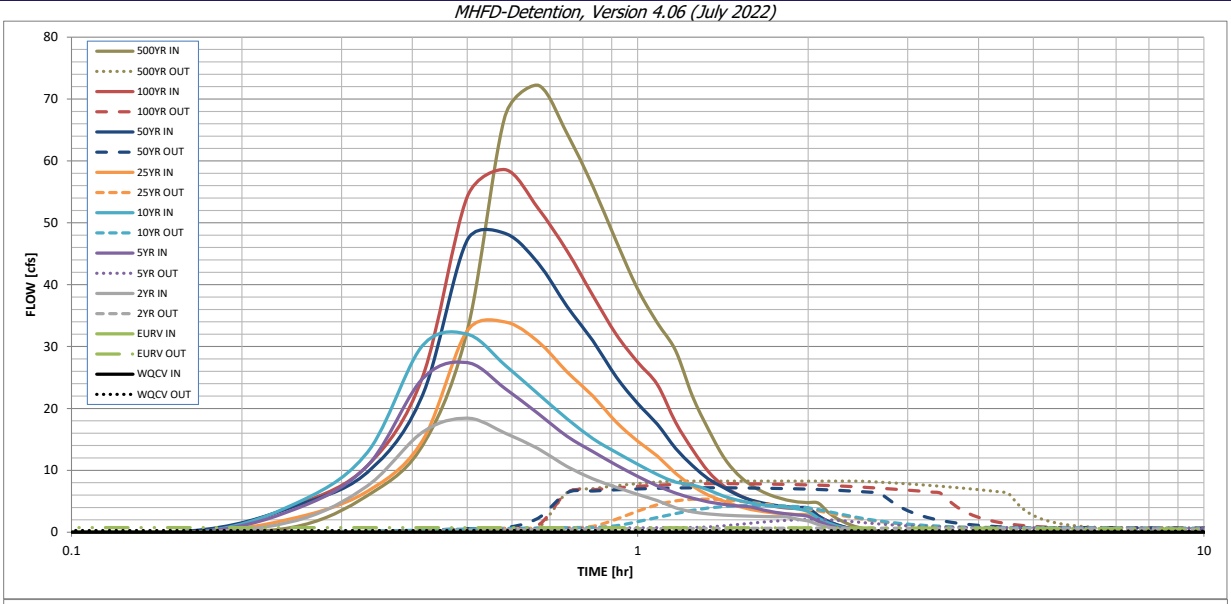
Routed Hydrograph Results

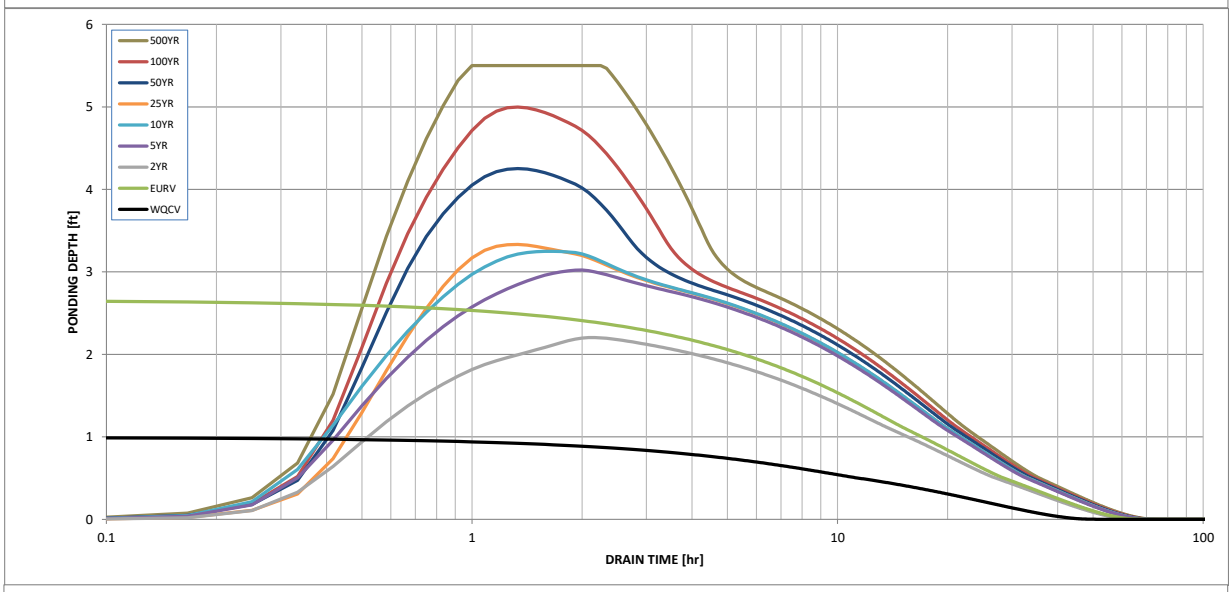
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

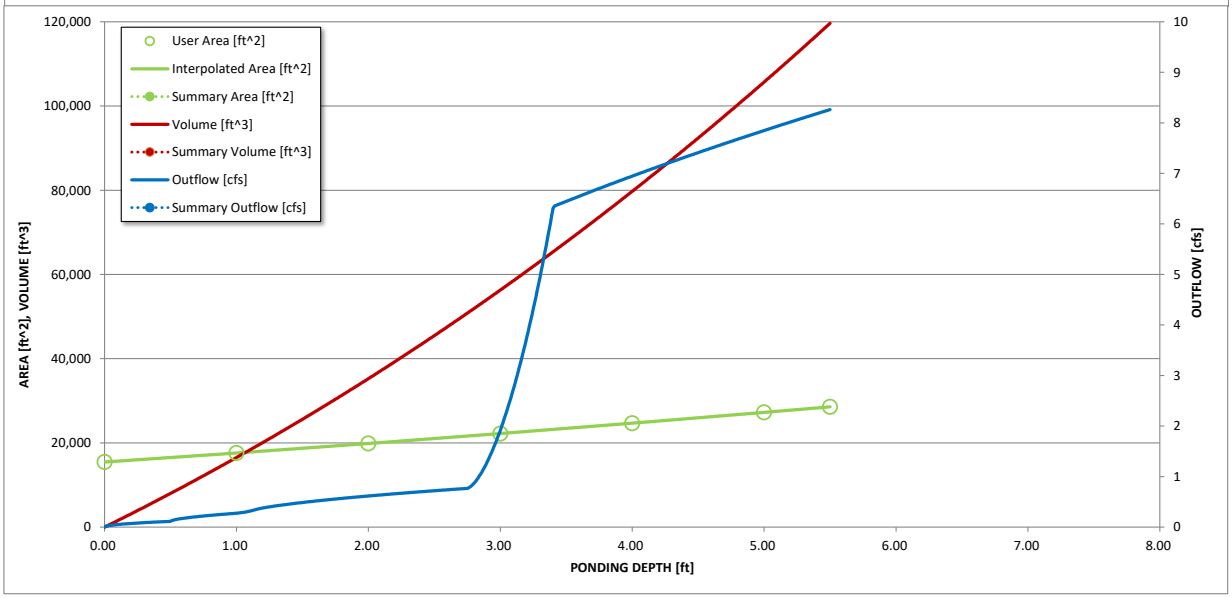
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.06	1.43	1.66	1.69	2.26	2.60	3.14
CUHP Runoff Volume (acre-ft) =	0.378	1.123	0.993	1.478	1.791	1.861	2.659	3.167	3.935
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.993	1.478	1.791	1.861	2.659	3.167	3.935
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.8	6.5	9.2	11.5	20.0	25.7	33.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.11	0.40	0.56	0.70	1.21	1.56	2.05
Peak Inflow Q (cfs) =	N/A	N/A	18.4	27.4	32.0	34.0	48.3	58.6	72.2
Peak Outflow Q (cfs) =	0.3	0.7	0.7	2.1	4.3	5.4	7.2	7.8	8.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	0.5	0.5	0.4	0.3	0.2
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.2	0.2	0.3	0.3	0.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	41	51	50	53	51	51	47	46	43
Time to Drain 99% of Inflow Volume (hours) =	**45**	58	57	61	60	60	58	57	57
Maximum Ponding Depth (ft) =	1.00	2.67	2.20	3.02	3.25	3.33	4.25	5.00	5.50
Area at Maximum Ponding Depth (acres) =	0.40	0.49	0.47	0.51	0.52	0.53	0.58	0.62	0.66
Maximum Volume Stored (acre-ft) =	0.379	1.127	0.901	1.302	1.416	1.464	1.974	2.420	2.747

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.15	0.93
	0:15:00	0.00	0.00	1.90	3.83	4.74	2.38	4.32	4.45	5.92
	0:20:00	0.00	0.00	7.50	10.76	12.91	6.62	9.68	10.76	13.96
	0:25:00	0.00	0.00	16.15	24.79	30.14	14.75	22.08	25.01	32.50
	0:30:00	0.00	0.00	18.44	27.42	32.02	32.56	47.21	54.19	67.29
	0:35:00	0.00	0.00	16.01	23.21	26.99	33.97	48.29	58.59	72.24
	0:40:00	0.00	0.00	13.52	19.20	22.37	30.83	43.52	52.37	64.47
	0:45:00	0.00	0.00	10.63	15.51	18.34	25.91	36.51	45.49	55.91
	0:50:00	0.00	0.00	8.63	13.03	15.12	22.03	30.96	38.26	47.03
	0:55:00	0.00	0.00	7.26	10.86	12.90	17.79	25.09	31.95	39.30
	1:00:00	0.00	0.00	6.11	9.03	10.99	14.72	20.81	27.48	33.83
	1:05:00	0.00	0.00	5.11	7.49	9.32	12.31	17.46	23.86	29.36
	1:10:00	0.00	0.00	3.94	6.32	8.10	9.51	13.55	17.77	21.95
	1:15:00	0.00	0.00	3.29	5.49	7.63	7.47	10.76	13.34	16.60
	1:20:00	0.00	0.00	2.96	4.89	6.83	5.98	8.60	9.80	12.22
	1:25:00	0.00	0.00	2.76	4.51	5.85	5.05	7.24	7.53	9.40
	1:30:00	0.00	0.00	2.66	4.26	5.18	4.23	6.03	6.13	7.65
	1:35:00	0.00	0.00	2.59	4.09	4.72	3.67	5.20	5.19	6.48
	1:40:00	0.00	0.00	2.54	3.58	4.40	3.33	4.70	4.57	5.71
	1:45:00	0.00	0.00	2.50	3.21	4.19	3.09	4.34	4.16	5.19
	1:50:00	0.00	0.00	2.48	2.96	4.03	2.94	4.11	3.92	4.89
	1:55:00	0.00	0.00	2.10	2.78	3.77	2.86	3.98	3.83	4.78
	2:00:00	0.00	0.00	1.82	2.58	3.34	2.80	3.90	3.79	4.73
	2:05:00	0.00	0.00	1.25	1.76	2.29	1.92	2.68	2.62	3.26
	2:10:00	0.00	0.00	0.83	1.17	1.54	1.29	1.80	1.77	2.20
	2:15:00	0.00	0.00	0.55	0.77	1.02	0.87	1.21	1.18	1.47
	2:20:00	0.00	0.00	0.35	0.48	0.65	0.56	0.77	0.76	0.94
	2:25:00	0.00	0.00	0.21	0.30	0.40	0.35	0.49	0.48	0.60
	2:30:00	0.00	0.00	0.11	0.18	0.23	0.21	0.29	0.28	0.35
	2:35:00	0.00	0.00	0.05	0.08	0.10	0.10	0.14	0.14	0.17
	2:40:00	0.00	0.00	0.02	0.03	0.03	0.03	0.04	0.04	0.05
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

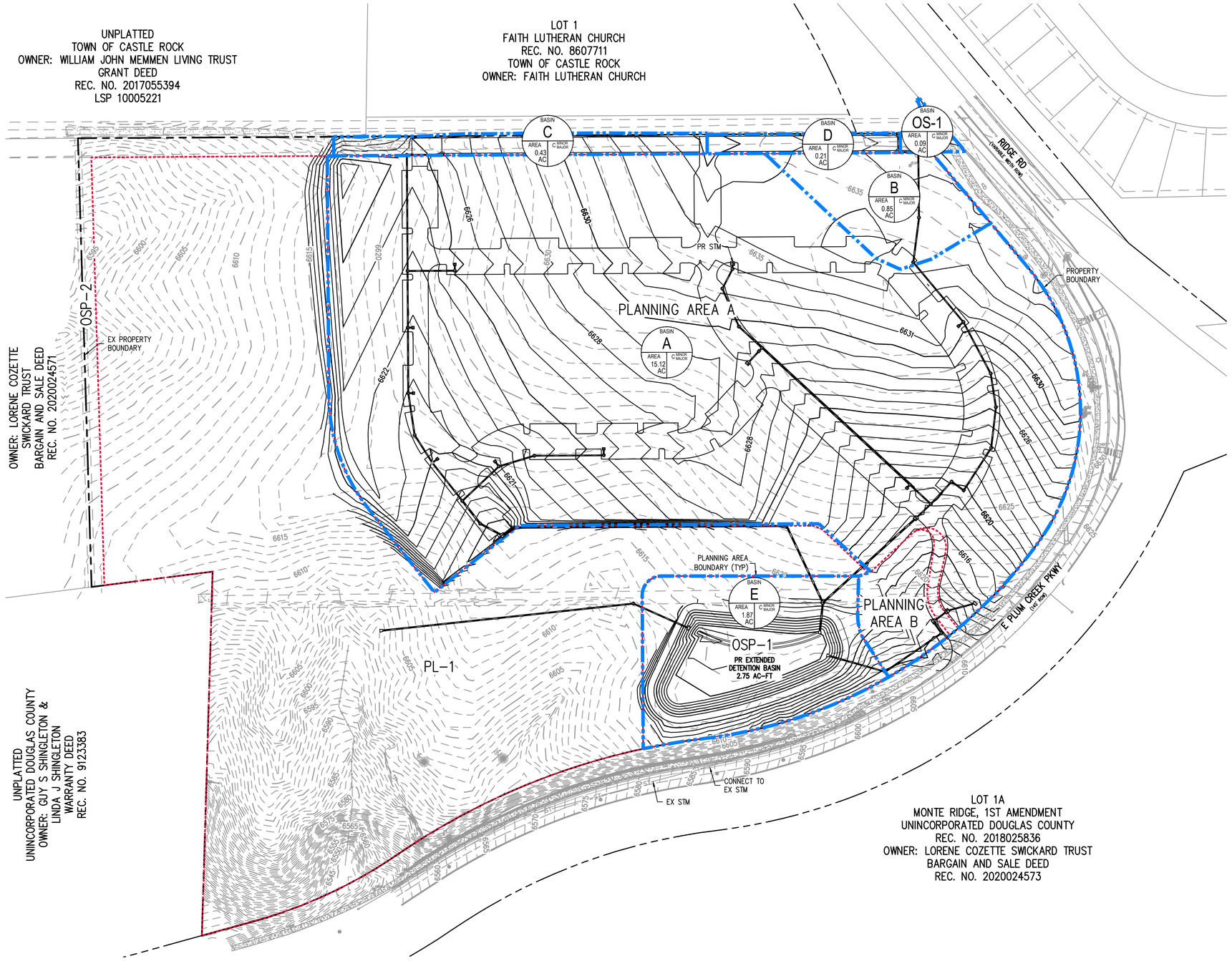
MHFD-Detention, Version 4.06 (July 2022)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

APPENDIX D – DRAINAGE PLAN



LEGEND

- PROPERTY BOUNDARY
- EXISTING RIGHT-OF-WAY
- EXISTING CONTOURS (5173, 5170)
- PROPOSED CONTOURS (5173, 5170)
- PROPOSED DRAINAGE BASIN

PROPOSED BASIN

BASIN DESIGNATION — BASIN OS 1 — 5-YR RATIONAL C COEFFICIENT

BASIN SIZE IN ACRES — AREA 1.23 AC — MINOR C MAJOR 0.45 / 0.67 — 100-YR RATIONAL C COEFFICIENT

1 BASIN DESIGN POINT

NOTES:

1. THE FULL SITE IS 32.29 ACRES BUT WILL BE SUBDIVIDED AND APPROXIMATELY 19-ACRES WILL BE DEVELOPED. THE REMAINING WILL BE UNTOUCHED AND FOLLOW HISTORIC DRAINAGE PATTERNS.
2. DRAINAGE BASINS AND STORM SEWER LAYOUT ARE CONCEPTUAL AND SUBJECT TO CHANGE AT SITE DEVELOPMENT PLAN.

NO CHANGES ARE TO BE MADE TO THIS DRAWING WITHOUT WRITTEN PERMISSION OF HARRIS KOCHER SMITH.

FILEPATH: P:\2023\231150\ENGINEERING\DRAINAGE\PH 1 DRAINAGE PLAN.DWG LAYOUT: LAYOUT1
7 XREFs: e-base-byot, e-legal-byot, e-util-byot, p-base, p-drng, p-legal[U], pdp-bndy
PLOTTED: THU 11/07/24 10:53:14A BY: RACHEL PATTON

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

80 0 80 160
SCALE: 1" = 80'

DESIGNED BY: ORR
CHECKED BY: RCP
DRAWN BY: ORR

ISSUE DATE: 07-03-2024

DATE	REVISION COMMENTS
11-06-2024	PER TOWN COMMENTS

HARRIS KOCHER SMITH
1120 Lincoln Street, Suite 1000
Denver, Colorado 80203
P: 303.623.6300 F: 303.623.6311
HarrisKocherSmith.com

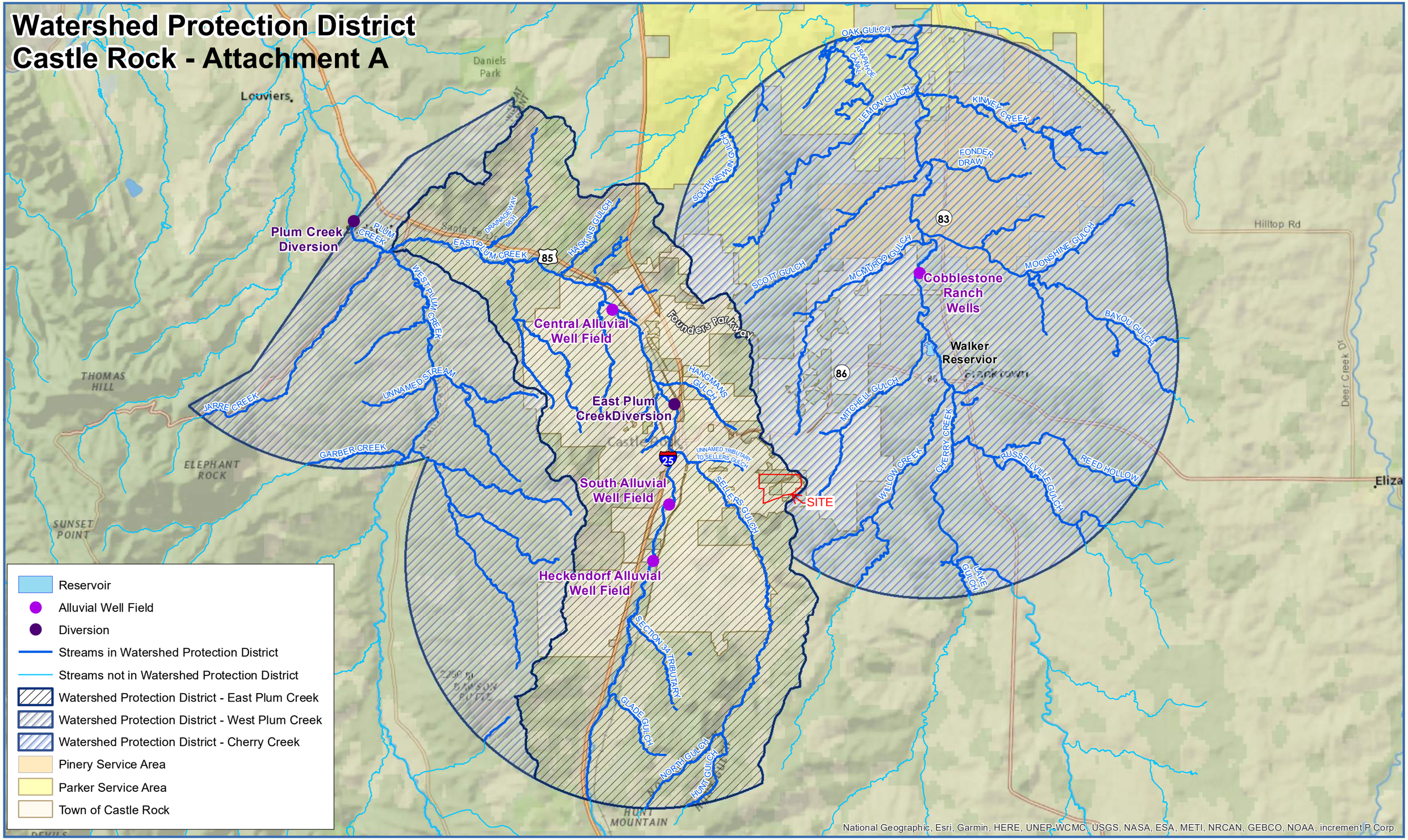
URBAN MOMENT

YARDHOMES RIDGE VIEW
PHASE 1 DRAINAGE PLAN

PROJECT #: 231150
SHEET NUMBER
1
1 OF 1

APPENDIX E – EXCERPTS FROM MASTER REPORT

Watershed Protection District
Castle Rock - Attachment A



CASTLE ROCK Qwater
Securing our future drop by drop

0 3 6 Miles

1 in = 2 miles

Date: 9/16/2021 Document Path: J:\GIS\Map Requests\2021\Internal_Requests\Watershed_Protection_2021\CastleRock_WaterProtectionDistrict_2021Landscape.mxd

Disclaimer: The data presented has been compiled from various sources, each of which introduces varying degrees of inaccuracies or inconsistencies. Such discrepancies in data are inherent and in supplying this product the Town of Castle Rock assumes no liability for it's use or accuracy. Questions or comments regarding the cartographic composition of this map including, but not limited to, errors, omissions, corrections, and/or updates, should be directed to the Utilities Department, Town of Castle Rock, (720) 733-6056. Copyright 2020, Town of Castle Rock Utilities Mapping.

2021 Update

K:\DEN_PublicSector\096533007_Plum Creek Pkwy\CADD\SHEETS - PHASE II\PROP-DRNMAP-PH2.dwg Otten, Heidi 1/7/2022
THIS DOCUMENT, TOGETHER WITH THE CONCEPTS AND DESIGNS PRESENTED HEREIN, AS AN INSTRUMENT OF SERVICE, IS INTENDED ONLY FOR THE SPECIFIC PURPOSE AND CLIENT FOR WHICH IT WAS PREPARED. REUSE OF AND IMPROPER RELIANCE ON THIS DOCUMENT WITHOUT WRITTEN AUTHORIZATION AND ADAPTATION BY KIMLEY-HORN AND ASSOCIATES, INC. SHALL BE WITHOUT LIABILITY TO KIMLEY-HORN AND ASSOCIATES, INC.

LEGEND

A = BASIN DESIGNATION
B = AREA (AC)
C = 5 YR FLOW (CFS)
D = 100 YR FLOW (CFS)
# = DESIGN POINT
BASIN BOUNDARY
EXISTING MAJOR CONTOURS
EXISTING MINOR CONTOURS
PROPOSED MAJOR CONTOURS
PROPOSED MINOR CONTOURS
FLOW ARROW

RIDGE SOUTH A: 0.46 | 1.42 | 3.14
RIDGE NORTH: 0.67 | 1.48 | 3.32
RIDGE ROAD: 2.04 | 1.1 | 6.04
WALL LEFT: 8.37 | 2.19 | 26.52
WALL RIGHT: 0.81 | 0.3 | 3.62
WL
WR
32: 20.28 | 3.75 | 45.32
34: 7.6 | 1.71 | 20.74
34C: 16.8 | 3.74 | 45.32
31: 25.27 | 36.65 | 189.80
33: 72.87 | 30.46 | 159.62
36: 29.48 | 68.29 | 287.42

NORTH

GRAPHIC SCALE IN FEET
0 125 250 500

Print Date: January 7, 2022
Drawing File Name: prop-drnmap-ph2.dwg
Horizontal Scale: Vertical Scale:

Kimley»Horn
KIMLEY-HORN AND ASSOCIATES, INC.
4582 SOUTH ULSTER STREET, SUITE 1500
DENVER, COLORADO 80237
(303) 228-2300

	Date:	Comments:	Init.
(R-X)			
(R-X)			
(R-X)			
(R-X)			

Town of Castle Rock COLORADO

DEPARTMENT OF PUBLIC WORKS
4175 N CASTLETON COURT
CASTLE ROCK, CO 80104
PHONE: (720) 733-2462
FAX: (303) 660-1025

AS CONSTRUCTED
No Revisions:
Revised:
Void:

PLUM CREEK PKWY WIDENING IMPROVEMENTS &
PLUM CREEK PKWY/ GILBERT ST ROUNDABOUT
OVERALL DRAINAGE MAP

DESIGN BY: | CHECKED BY: | SHEET SUBSET:
DRAWN BY: | DATE: | SUBSET SHEET: of

PRELIMINARY
FOR REVIEW ONLY
NOT FOR CONSTRUCTION
Kimley»Horn
Kimley-Horn and Associates, Inc.

PROJECT NO./CODE
096667001
SHEET NUMBER
DR-1

Table 5. Summary of Offsite Basins Tributary to the Major Drainageway

SEACR Basin ID	Proposed Basin ID	Area (acres)	Imperviousness	SEACR 100-Yr Flow (CFS)	Proposed 100-Yr Flow (CFS)
31	--	98.07	27.43%	171.58	--
	31A	90.95			179.63
	31B	0.69			2.53
	31C	4.70			16.83
	31D	0.71			2.95
	31E	2.62			10.39
	31F	1.72			6.92
	31G	1.78			7.57
	31H	1.12			4.93
	31I	0.57			2.58
	31J	1.06			4.35
32	--	30.22	5.00%	70.50	70.50*
33	--	73.53	19.74%	161.38	--
	33A	66.00			144.63
	33B	3.13			10.17
	33C	3.75			11.37
34	--	23.48	5.00%	65.99	65.99*
	Total	354.78	22%	469.45	541.34

*Flow not re-calculated with the Project, SEACR value used.

The total flow shown in Table 5 above is a sum of the basin flows and does not account for routing through the pipe system. The total flow out of the pipe system, when routing is taken into consideration is calculated to be 347.38 CFS by StormCAD. This is equivalent to flows from sub-basins 31 and 33. When flows from basins 32 and 34 are added to this flow, the total proposed flow in the Offsite Drainageway is 483.87. As shown in the Summary of Ditch Analysis Table, on page 132 of the SEACR Report PDF, the maximum flow rate utilized by SEACR to design the original Offsite Drainageway was 444.95 CFS. Therefore, utilizing the 483.87 CFS as the flow rate for this report is considerable conservative from the original design. The difference in flow rates between the SEACR Report and this Report can be attributed

3 DRAINAGE BASINS AND SUB-BASINS

3.1 EXISTING MAJOR DRAINAGE BASINS

The SEACR Report delineated five major basins associated with this project, as shown in Figure 2 in the SEACR Report. These basins and the relevant data provided by the SEACR Report are included in Table 6. This project will not make any modifications to these major basins.

Table 6. The Major Sub-Basins Delineated by the SEACR Report.

Major Sub-Basin	Area (AC)	Imperviousness (%)	5-Year Flow (CFS0	100-Year Flow (CFS)
31	98.07	27.43%	61.10	171.58
32	30.22	5.00%	13.73	70.50
33	73.53	19.74%	41.66	161.38
34	23.48	5.00%	12.93	65.99
36*	129.40	27.27%	80.43	281.61

*This sub-basin is not tributary to the Offsite Drainageway.

3.2 MINOR SUB-BASINS

3.2.1 ONSITE SUB-BASINS

The SEACR Report includes delineation of onsite roadway basins for the full build out condition of the roadway. Due to slight changes in the proposed roadway geometry on the south side of the road and median, this project re-evaluated the onsite minor sub-basins, utilizing SEACR's delineations as a starting point.

Onsite sub-basins are mainly comprised of proposed roadway; proposed landscaping adjacent to the roadway; and concrete sidewalk adjacent to the roadway.

Sub-basins on the north side of the road, that have been previously analyzed with the SEACR Report, contributing to existing inlets were only evaluated for updated areas. Imperviousness values calculated by the SEACR Report were utilized. Rational Method calculations for these basins are included to account for any updates to criteria since the SEACR Report was written.

Sub-basins on the south side of the road, contributing to proposed inlets, were completely re-evaluated with this report. The below section describes each of the proposed sub-basins.