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Final Drainage Report

Tract 5, Valley Gardens

Project No. 61195

FEBRUARY 10, 2025

PCD File No. PPR2417

Final Drainage Report

for

Tract 5, Valley Gardens

Project No. 61195

FEBRUARY 10, 2025

prepared for

Sombers Investments LLC
5565 Piedra Vista
Colorado Springs, CO 80908
719.491.0466

prepared by

MVE, Inc.
1903 Lelaray Street, Suite 200
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61195 Final Drainage Report.odt

Statements and Acknowledgments

Engineer's Statement

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage letter report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Charles C. Crum, P.E. — 02-14-25

Charles C. Crum, P.E. Colorado No. 13348 Date

For and on Behalf of MVE, Inc.

Developer's Statement

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

Jerry Sombers — 2-14-25

Date

Jerry Sombers
5565 Piedra Vista
Colorado Springs, CO 80908

El Paso County

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

Joshua Palmer, P.E., Date

County Engineer / ECM AdministratorFinal Drainage Report

Final Drainage Report

This Final Drainage Report for Tract 5, Valley Gardens has been prepared in accordance with the Drainage Report Format of the Drainage Criteria Manual for the City of Colorado Springs & El Paso County, Colorado. Said Report is in support of the proposed Site Development Plan on Tract 5 Valley Gardens, El Paso County Assessor's schedule number 64283-01-005, El Paso County, Colorado. The report will "identify specific solutions to problems on-site and off-site resulting from the proposed project. The report and included maps present results of hydrologic and drainage facilities analyses. The report will discuss the recommended drainage improvements to the site and identify drainage requirements relative to the proposed project. This report has been prepared and submitted in accordance with the requirements of the El Paso County development approval process.

A **Vicinity Map** has been included for readers reference. The site borders Janitell Road on the northwest, Tract 4, Valley Gardens on the southwest, Tract 11, Valley Gardens, on the northeast, and an unplatted Tract of land on the southeast. Said Tract 5 is located about 300' to the southwest of East Las Vegas Street and contains 5.35 acres. The property is zoned M1 (General Industrial and Manufacturing Activities) which is an obsolete Zone.

Tract 5, Valley Gardens is situate in the Spring Creek Drainage Basin. Fees are not required for a Site Development Plan.

The site generally slopes from northeast to southwest about 1 to 3 percent (%). The site area has one building (13,200 SF), entrance drives, parking & sidewalks, along with a concrete storage area slab (19,200 SF). The remainder of the site consists of sandy/gravel surface with no native grasses and is used for general industrial and manufacturing activities.

General existing drainage characteristics of the site will not change due to the construction of the 22,500 SF Office Warehouse. The minor increases in storm runoff from the site negligible and will nave no discernible effect on the property or adjacent properties. Offsite flows entering said Tract 5 are from the adjacent Tract 4. Reference is made to the Drainage Letter for Janitel RV Storage, Tract 4, Valley Gardens, dated September 17, 2014 by Oliver Watts, Consulting Engineer, Inc. M.V.E., Inc. calculated stormwater flows are a little less then than the stormwater projected flows from said Tract 4 in the 'Watts' Drainage Letter.

The current Flood Insurance Study of the region includes the Flood Insurance Rate Map (FIRM), effective December 7, 2018. The project site is included in Map Number 08041C0375 G of the FIRM for El Paso County, Colorado. According to the FIRM, the subject site is not included in a FEMA designated Special Flood Hazard Area (SFHA). A portion of the current FIRM (Flood Insurance Rate Map) with the site delineated is included with this report.

According to the Soil Survey of El Paso County Area, Colorado by the United States Natural Resource Conservation Service, the soil of the site is Ustic Torrifluvents, loamy map unit (101), which is part of hydrologic soil group B. The Ustic Torrifluvents, loamy soil is sandy, clayey, and stratified loamy and well drained. A portion of the **Soil Survey Map** is included with this report.

Hydrologic analysis for both existing and developed conditions of the site were performed according to the Rational Method. Q = CAi where:

Q = Peak runoff rate in cubic feet per second (cfs)

C = Runoff coefficient

i = average rainfall intensity in inches per hour

A = drainage area in acres

Analysis was completed in accordance with said Drainage Criteria Manual for the City of Colorado Springs & El Paso County, Colorado. Peak runoff flow rates were calculated for the 5-year and 100-year rainfall recurrence intervals for both existing and future developed conditions.

EXISTING CONDITIONS

Basin OS-A, situated in Tract 4, Valley Gardens having an area of 1.30 acres and 69% imperviousness draining southwesterly as overland flow onto the Tract 5, Valley Gardens from the northeast. Tract 4 will remain the same as existing conditions because no construction is proposed in that basin with it being a developed Industrial Tract. Runoff discharges from Basin OS-A at **Design Point 1 (DP1)** will remain unchanged at Q_5 = 3.2 cfs and Q_{100} = 6.5 cfs.

Basin EX-A, situated in the western 1/3 of said Tract 5 having an area of 2.16 acres and 84% imperviousness drains southwesterly as overland flow onto Tract 11, Valley Gardens from the northeast, with existing conditions of being developed as an Industrial use with an Office/Warehouse and paved drives & parking. The existing developed runoff is Q_5 = 6.6 cfs and Q_{100} = 12.6 cfs. Basin OS-A combines with Basin EX-A and the combined flows at existing **Design Point 2 (DP2)** will be Q_5 = 8.6 cfs and Q_{100} = 16.9 cfs.

Basin EX-B, situated in the eastern 2/3 of said Tract 5 having an area of 3.20 acres and 80.0% imperviousness drains southwesterly as overland flow onto Tract 11, Valley Gardens and to the adjacent unplatted parcel of ground (El Paso County Assessor's schedule number 64283-00-043) from the northeast, with existing conditions of being developed as an Industrial storage area use. The existing developed runoff at **Design Point 3 (DP3)** is Q_5 = 7.5 cfs and Q_{100} = 14.9 cfs. Basin OS-BC will not combine with Basin EX-B as a 1' high earthen berm will be constructed along the Tract 5 boundary for 300' northwesterly from the common corner of the Tracts 4 & 5. There is an existing concrete block (2'x2'x6') barrier along the southern boundary of Tract 5 the directs the stormwater to flow and outlet at the southern corner of said Tract 5.

Basin OS-BC, situated in Tract 5, Valley Gardens having an area of 3.84 acres and 82% imperviousness drains southwesterly as overland flow with the majority of the overland flow draining as overland flow unto the adjacent unplatted parcel of ground (El Paso County Assessor's schedule number 64283-00-043). The intent of said Drainage Letter for Janitel RV Storage, Tract 4, Valley Gardens, dated September 17, 2014 was for no storm water to enter said Tract 5 in this area. Tract 4 will remain the same as existing conditions because no construction is likely in that basin with it being a developed Industrial Tract. Runoff discharges from Basin OS-BC at **Design Point 4 (DP4)** will remain unchanged at Q_5 = 9.9 cfs and Q_{100} = 19.4 cfs.

The **Existing Drainage Map** depicts the existing topographic mapping, drainage basin delineations, drainage patterns, and runoff quantities with a data table including drainage areas and flow rates which is attached for readers reference.

DEVELOPED CONDITIONS

Basin OS-A, situated in Tract 4, Valley Gardens having an area of 1.30 acres and 69.3% imperviousness draining southwesterly as overland flow onto the Tract 5, Valley Gardens from the northeast. Tract 4 will remain the same as existing conditions because no construction is proposed in that basin with it being a developed Industrial Tract. Runoff discharges from Basin OS-A at **Design Point (DP1)** will remain unchanged at Q_5 = 3.2 cfs and Q_{100} = 6.5 cfs.

Basin PP-A, situated in the western 1/3 of said Tract 4 having an area of 2.16 acres and 84% imperviousness continues to drain southwesterly as overland flow onto Tract 11, Valley Gardens from the northeast, with existing conditions of being developed as an Industrial use with an Office/Warehouse and paved drives & parking. The existing developed runoff is Q_5 = 6.0 cfs and Q_{100} = 11.5 cfs. Basin OS-A combines with Basin PP-A and the combined flows at existing **Design Point 2 (DP2)** will be Q_5 = 8.6 cfs and Q_{100} = 16.9 cfs.

Basin PP-B, situated in the eastern 2/3 of said Tract 4 having an area of 3.20 acres and 86% imperviousness drains southwesterly into the proposed parking area drive. The flows continue as shallow channel flows in the parking area drive and continue around the northeasterly & southwesterly ends of the proposed Office/warehouse via proposed internal drives. These flows include the proposed roof top flows combining in the storage area. The storage area will have a recycled asphalt surface which has been designated as 80% impervious which is the same as gravel. A Full Spectrum Sand Filter Basin (FS-SFB) 16' wide by 270' plus long and 6' deep will be constructed along the southeastern boundary line of said Tract 5. The FS-SFB will discharge at the southern corner of said Tract 5 via a 12 “ pipe to Fountain Creek.

All flows from **Basin PP-B** are captured in said FS-SFB and no other Basins contribute to **Basin PP-B**. Basin OS-BC will not combine with Basin EX-B as a 1' high earthen berm will be constructed along the Tract 5 boundary for 300' northwesterly from the common corner of said Tracts 4 & 5. The FS-SFB will have concrete block walls on all sides just inside said Tract 5 southeastern boundary. The outlet for the FS-SFB will be located at the southwest corner of said Tract 5. Outlet flows will continue to Fountain Creek via a 12” pipe. Further description of the outlet structure is expanded in the following **Drainage Facilities** section. This portion of Tract 5, Valley Gardens will be developed as an Industrial use with an additional Office/Warehouse, landscaping, drives, paved parking, and a FS-SFB. Flows at existing **Design Point 3 (DP3)** will be Q_5 = 7.9 cfs and Q_{100} = 15.1cfs.

Basin OS-BC, situated in Tract 5, Valley Gardens having an area of 3.84 acres and 82% imperviousness drains southwesterly as overland flow with the majority of the overland flow draining as overland flow unto the adjacent unplatted parcel of ground (El Paso County Assessor's schedule number 64283-00-043). Basin OS-BC will not combine with Basin EX-B as a 1' high earthen berm will be constructed along the Tract 5 boundary for 100' northwesterly from the proposed end of the proposed block wall which is being extended northwesterly from the common corner of said Tracts 4 & 5. The intent of said Drainage Letter for Janitel RV Storage, Tract 4, Valley Gardens, dated September 17, 2014 was for no storm water to enter said Tract 5 in this area. Tract 4 will remain the same as existing conditions because no construction is likely in that basin with it being a developed Industrial Tract. Runoff discharges from Basin OS-A at **Design Point 4 (DP4)** will remain unchanged at Q_5 = 9.9 cfs and Q_{100} = 19.4 cfs.

The **Proposed Drainage Map** depicts the existing topographic mapping, proposed grading, proposed building, proposed pavement, drainage basin delineations, drainage patterns, and runoff quantities with a data table including drainage areas and flow rates which is attached for readers reference.

DRAINAGE FACILITIES

The proposed interior grading, landscaping, and paved drives and parking areas will direct the developed drainage runoff flows resulting from the proposed new development area on said Tract 5 to the proposed private FS-SFB. The FS-SFB will be a private facility, owned and maintained by the property owner. Calculations for the drainage facilities are included in the **Appendix** of this report.

The Full Spectrum Sand Filter Basin (FS-SFB) in the developed **Basin PP-B** will be constructed in accordance with El Paso Counties drainage criteria. The FS-SFB has been designed utilizing the MHFD – Detention, Version 4.06 (July 2022). The calculations for the FS-SFB are included in the **Appendix**. The contributed watershed area is 3.2 acres with the watershed imperviousness of 85.6% as determined in the runoff worksheet which is included in the **Appendix**. The total required detention volume was calculated to be 0.458 acre-feet as calculated with the Detention Basin Stage-Storage Table Builder. The total detention volume provided meets/exceeds said required volume. The outlet will be a concrete outlet box with close-mesh grate, a protective metal grate, and 12 inch outlet pipe. The Excess Urban Runoff Volume (EURV) will drain through the box by way of an orifice plate with three orifice holes. The 100-year outflows will drain through the grate top and will be limited by a restrictor plate at the 12 inch outlet pipe and flow as a point source discharge. This pipe outflow will drain to the adjacent Fountain Creek as described above and shall be dissipated through a 5' wide x 6' long type VL riprap pad. The riprap calculations for the riprap pad are included in the **Appendix**. The point source flows that have been reduced by a restrictor plate will be dissipated as the combine with Fountain Creek's channelized storm water flows. The flows leaving the site currently enter the Fountain Creek Channel via sheet flow at Q_5 = 7.5 cfs and Q_{100} = 14.9 cfs at approximately the same location of said proposed 12 inch outlet pipe. These storm water flows are being reduced to a pipe flow of Q_5 = 0.1 cfs and Q_{100} = 3.2 cfs thus there is no negative impact on Fountain Creek. These pipe flows are mitigated at Fountain Creek by the riprap apron and thereby additionally creating no negative impact to the creek. Any flows greater than the 100-year event will be dissipated by overflowing the pond embankment at a 23 foot wide riprap overflow spillway with concrete crest wall to the adjacent unplatted parcel of ground (El Paso County Assessor's schedule number 64283-01-005) with the overland flow continuing to the Fountain Creek channel. Detailed design of this drainage facility will be provided with Construction Documents for the site.

EROSION CONTROL

During future construction, control measures (CM's) for erosion control will be employed based on the previously referenced City of Colorado Springs Drainage Criteria Manual Volume 2 and the Erosion Control Plan for the site. During Construction a vehicle tracking control, concrete washout area will be in place to minimize erosion from the site. The FS-SFB permanent block walls will be placed along the northwestern, southeastern, and southwestern portions of the proposed FS-SFB with a temporary silt basin constructed at the low end of said basin in lieu of silt fence. This will inhibit suspended sediment from leaving the site during construction of the proposed new development area. Vehicle tracking control will be placed at the northwestern access point to the proposed new development area. CM's will be utilized as deemed necessary by the contractor, engineer, owner, or County inspector and are not limited to the measures described above.

WATER QUALITY ENHANSEMENT BEST MANAGEMENT PRACTICES

The Sand Filter Basin described above will provide storage for the Water Quality Capture Volume (WQCV) for the site. A Grading and Erosion Control Plan for the construction of the site has been prepared in accordance with the provisions of the DCM. Placement of construction stormwater CM's will as required by the plan will limit soil erosion and deposition by stormwater flowing over the site.

The El Paso County Engineering Criteria Manual (Appendix I, Section I.7.2) requires the consideration of a “Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long term source controls”. The Four Step Process is incorporated in this project and the elements are discussed below.

1) Runoff Reduction Practices are employed in this project. Impervious surfaces have been reduced as much as practically possible.
2) All drainage paths on the site are stabilized with appropriate treatment. The FS-SFB is intended to intercept flows from the newly developed areas. Additionally, the pond outfall will have rip rap protection.
3) The project contains no potentially hazardous uses. The newly developed area drains into a proposed a WQCV CM.
4) The site contains no storage of potentially harmful substances or use of potentially harmful substances. No Site Specific or Other Source Control CM's are required.

OPINION OF PROBABLE COST FOR DRAINAGE FACILITIES

The following cost opinion is for the construction of the required private storm water appurtenances which are non reimbursable. Labor is included in the following items. Earthwork is not included. Cost of earthwork is included in the Financial Assurances as a separate line item. There are no public storm water facilities required.

Opinion of Costs – On-Site Private Permanent CM Facilities – Non Reimbursable

• Sand Filter Concrete Block Wall	=	25,200
• Sand Filter Material 240 CY @ $46/CY	=	11,040
• Outlet Structure	=	6,500
• 12” - HDPE Pipe - 260 LF	=	8,320
• 1 - RC Flared End-section @ $210/EA	=	210
• 102 tons of VL Riprap @ $97/Ton	=	9,894
Total =		$ 61,164

DRAINAGE AND BRIDGE FEES

The site, Tract 5, Valley Gardens contains 5.35 acres and is located within the Spring Creek Drainage Basin of Fountain Creek, El Paso Basin Number FOMO4200, which was last studied in 1977.The present zone is M (Industrial). A portion of Tract 5 was conveyed to El Paso County for the Janitell Road right of way in Book 5657 at Page 231. Since this Lot was previously platted and the Final Drainage Plan is being prepared for a **Site Development Plan** no Drainage or Bridge Fees are due.

CONCLUSION

This Final Drainage Report presents existing and proposed drainage conditions for the proposed Tract 5, Valley Gardens project. The development will have negligible and inconsequential effects on the existing site drainage and drainage conditions downstream. The proposed project will not, with respect to stormwater runoff, negatively impact the adjacent properties and downstream properties.

References

NRCS Web Soil Survey. United States Department of Agriculture, Natural Resources Conservation Service ("http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx", accessed March, 2018).

NRCS Official Soil Series Descriptions. United States Department of Agriculture, Natural Resources Conservation Service ("http://soils.usda.gov/technical/classification/osd/index.html", accessed March, 2018).

Flood Insurance Rate Map. Federal Emergency Management Agency, National Flood Insurance Program (Washingon D.C.: FEMA, March 17, 1997).

NCSS Web Soil Survey. United States Department of Agriculture, Natural Resources Conservation Service ("http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx", accessed May, 2017).

Drainage Criteria Manual Volume 2, Stormwater Quality Policies, Procedures and Best Management Practices (BMPs). City of Colorado Spring Engineering Division (Colorado Springs: , May 2014).

City of Colorado Springs Drainage Criterial Manual, Volume 1. City of Colorado Springs Engineering Division Staff, Matrix Desgin Group/Wright Water Engineers (Colorado Springs: , May 2014).

City of Colorado Springs/El Paso County Drainage Criteria Manual. City of Colorado Springs, Department of Public Works, Engineering Division; HDR Infrastructure, Inc.; El Paso County, Department of Public Works, Engineering Division (Colorado Springs: City of Colorado Springs, Revised November 1991).

City of Colorado Springs Drainage Criteria Manual Volume 1. City of Colorado Springs Engineering Division with Matrix Design Group and Wright Water Engineers (Colorado Springs, Colorado: , May 2014).

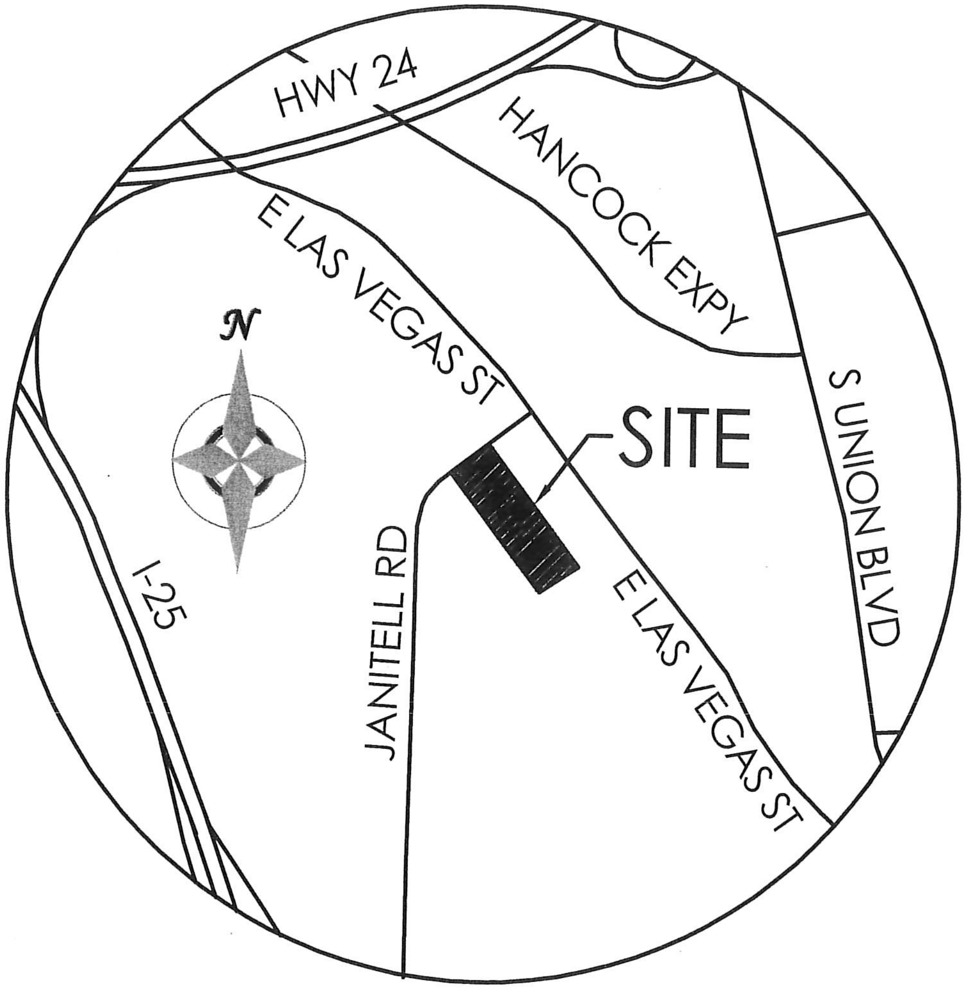
Urban Drainage Criteria Manual: Volume 3, Best Management Practices. Urban Drainage and Flood Control District (Denver, Colorado: , November 2010).

Urban Storm Drainage Criteria Manual: Volume 2, Structures, Storage, and Recreation. Urban Drainage and Flood Control District (Denver, Colorado : , January 2016).

Appendices

General Maps and Supporting Data

Vicinity Map
Portion of Flood Insurance Rate Map
Soil Type map and Tables
Official Soil Series Descriptions
Hydrologic Soil Group Map and Tables



VICINITY MAP

NOT TO SCALE

National Flood Hazard Layer FIRMette

FEMA

104°47'58"W 38°48'26"N

Feet

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

1:6,000

104°47'21"W 38°47'58"N

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 / 17.5 Cross Sections with 1% Annual Chance 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 4/4/2024 at 10:48 AM 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.

USDA 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
El Paso County Area, Colorado

April 4, 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.

Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report
Soil Map (2217 Janitell Road)

Map Scale: 1:1,730 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 25, 50, 100, 150

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 1:24,000.

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 21, 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: Aug 19, 2018—Sep 23, 2018

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

Map Unit Legend (2217 Janitell Road)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
101	Ustic Torrifluvents, loamy	5.3	100.0%
Totals for Area of Interest		**5.3**	**100.0%**

Map Unit Descriptions (2217 Janitell Road)

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.

El Paso County Area, Colorado

101—Ustic Torrifluvents, loamy

Map Unit Setting

National map unit symbol: 3673
Elevation: 5,500 to 7,000 feet
Mean annual precipitation: 13 to 16 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 125 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Ustic torrifluvents and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ustic Torrifluvents

Setting

Landform: Flood plains, stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy, clayey, stratified loamy

Typical profile

A - 0 to 6 inches: variable
C - 6 to 60 inches: stratified loamy sand to clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R069XY037CO - Saline Overflow
Other vegetative classification: OVERFLOW (069BY036CO)
Hydric soil rating: No

Minor Components

Other soils

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

Pleasant

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

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rapid, and the hazard of erosion is high. Gullies 1 foot to 3 feet deep are common.

The Bresser soil is deep and well drained. It formed in alluvium and residuum derived from arkosic sedimentary rock. Typically, the grayish brown sandy loam surface layer is very thin or has been entirely removed by erosion. The subsoil is brown sandy clay loam about 31 inches thick. The substratum is light yellowish brown loamy coarse sand to a depth of 60 inches or more.

Permeability of the Bresser soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium to rapid, and the hazard of erosion is high. Gullies 1 foot to 3 feet deep are common.

These soils are commonly used for grazing livestock and for wildlife habitat. Most areas of these soils are fields that were previously cropped but have either been abandoned or reseeded to grass.

These soils are suited to deep-rooted grasses. Native vegetation is dominantly western wheatgrass, side-oats grama, and needleandthread.

Proper range management is needed to prevent excessive removal of the plant cover from these soils. Interseeding improves the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings generally are suited to these soils. Soil blowing is the main limitation for establishing trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

These soils are suited to wildlife habitat. They are best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitation of these soils for homesites is frost-action potential, especially in areas of the Truckton soil. Special practices are needed to reduce the hazard of erosion in areas of construction where vegetation has been removed from the soils. Access roads must be designed to minimize frost-heave damage in areas of the Truckton soil. Capability subclass VIe.

101—Ustic Torrifluvents, loamy. These deep, well drained soils are on terraces and flood plains along the major drainageways. Some of the larger areas of these soils are in the Jimmy Creek Camp and Black Squirrel Creek drainageways and in the Ellicott area. Slope is 0 to 3 percent. The average annual precipitation is about 15 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is grayish brown to very dark grayish brown gravelly sandy loam to clay loam 6 to 18 inches thick. The stratified underlying material, to a depth of 60 inches, ranges from heavy clay loam to sand.

Included with these soils in mapping are small areas of Blendon sandy loam, 0 to 3 percent slopes; Bresser sandy loam, 0 to 3 percent slopes; Nunn clay loam, 0 to 3 percent slopes; and Sampson loam, 0 to 3 percent slopes.

Permeability of Ustic Torrifluvents, loamy, is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate to high. Surface runoff is slow, and the hazard of erosion is moderate to high. These soils are occasionally flooded. The hazard of soil blowing is moderate to high.

About half of the acreage of these soils is used for irrigated corn, bluegrass sod, and alfalfa and for dryfarmed wheat. The slow surface runoff reduces the need for intensive conservation measures. Most irrigated areas are in the Ellicott area and the Jimmy Camp Creek area. The rest of the acreage is used as rangeland.

These soils are suited to the production of native vegetation suitable for grazing. The soils favor tall grasses. The native vegetation is mainly big bluestem, switchgrass, junegrass, western wheatgrass, and blue grama.

To achieve needed grazing management, including periodic deferment, fences are generally arranged in such a way that access to these soils can be controlled. Reseeding on these soils is needed if the vegetation is depleted or destroyed by plowing. Water spreading is highly beneficial in suitable areas of these soils.

Windbreaks and environmental plantings generally are suited to these soils. Soil blowing is the main limitation for the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

These soils are suited to wildlife habitat. They are best suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. This is especially true in areas of intensive farming. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitation of these soils for urban use is the hazard of flooding. Buildings and roads should not be built along drainageways and on flood plains. Access roads must be designed to minimize frost-heave damage. Capability subclasses IIIe, nonirrigated, and IIe, irrigated.

102—Valent sand, 1 to 9 percent slopes. This deep, nearly level to gently rolling, excessively drained soil formed in sandy eolian material on uplands. Elevation ranges from 5,100 to 5,600 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is light brownish gray sand about 6 inches thick. The next layer is brown sand about 6 inches thick. The substratum is pale brown sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Bijou loamy sand, 1 to 8 percent slopes, and Wigton loamy sand, 1 to 8 percent slopes.

Permeability of this Valent soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Surface runoff is slow, and the hazards of erosion and soil blowing are high.

This soil is used as rangeland and for wildlife habitat.

The native vegetation is mainly sand reedgrass, sand bluestem, blue grama, little bluestem, and needleandthread. Sand sagebrush is in the stand, but it makes up only a small part of the total ground cover. Large amounts of yucca are present in some places.

Mechanical and chemical control of sagebrush may be needed in overgrazed areas of this soil. The soil is highly susceptible to soil blowing, and water erosion occurs when the plant cover is inadequate. Interseeding is a good practice in overgrazed areas. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand and low available water capacity are the main limitations for the establishment of trees and shrubs. The soil is so loose that trees need to be planted in shallow furrows and plant cover needs to be maintained between the rows. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitation of this soil for homesites is the sandy nature of the soil, which makes excavation difficult. Special erosion control practices are needed during construction. Because of the rapid permeability of this soil, there is a hazard of pollution if it is used for septic tank absorption fields. Capability subclass VIe.

103—Valent sand, 9 to 20 percent slopes. This deep, excessively drained, rolling to hilly soil formed in sandy eolian material on uplands. Elevation ranges from 5,100 to 5,600 feet. The average annual precipitation is about 13 inches, the average annual air temperature is about 49 degrees F, and the average frost-free period is about 145 days.

Typically, the surface layer is light brownish gray sand about 6 inches thick. The next layer is brown sand about 6 inches thick. The underlying material is pale brown sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Bijou loamy sand, 1 to 8 percent slopes; Wigton loamy sand, 1 to 8 percent slopes; and Valent sand, 1 to 9 percent slopes.

Permeability of this Valent soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Surface runoff is slow, and the hazard of erosion is high. Blowouts are common in all areas of this soil.

This soil is used as rangeland and for wildlife habitat.

The native vegetation is mainly prairie sandreed, sand bluestem, needleandthread, and sand dropseed.

Careful grazing management is essential on this soil to prevent overgrazing, because the hazard of soil blowing is high when the protective plant cover is destroyed. Livestock watering facilities should not be located on this soil, because they cause concentrations of animals that deplete the rangeland cover. No mechanical type of conservation treatment is practical on this soil.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand and low available water capacity are the main limitations for the establishment of trees and shrubs. The soil is so loose that trees need to be planted in shallow furrows and the plant cover should be maintained between the rows. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitations of this soil for urban use are slope and the sandy texture of the soil. Special designs are needed for buildings and roads to overcome these limitations. The sandy texture of the soil causes excavation problems, mostly the caving in of cut banks. Practices are needed to control soil blowing. Because of the rapid permeability of this soil, there is a hazard of pollution if it is used for septic tank absoption fields. Capability subclass VIe.

104—Vona sandy loam, 1 to 3 percent slopes. This deep, well drained soil formed in sandy, calcareous eolian

Hydrologic Calculations

City of Colorado Springs DCM Runoff Coefficients – Table 6-6
Colorado Springs DCM Rainfall Intensity Duration Frequency – Figure 6-5
Sub-Basin Time of Concentration – Form SF-1
5-yr Sub-Basin and Combined Flows – Form SF-2
100-yr Sub-Basin and Combined Flows – Form SF-2
Sub-Basin Calculations

Sub-Basin OS-A Runoff Calculations (DP-1)

Job No.:	**61195**	Date:	**7/17/2024 09:13**
Project:	**High County Crane**	Calcs by:	**CCC**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
Paved	23,958	0.55	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	18,731	0.43	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	13,939	0.32	0.03	0.09	0.17	0.26	0.31	0.36	2%
Combined	**56,628**	**1.30**	**0.57**	**0.60**	**0.64**	**0.68**	**0.70**	**0.73**	**69.3%**
	56628								

Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ 100 ft C_v 7

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	300	7	-	-	-	-	
Initial Time	100	2	0.020	-	7.2	11.7	DCM Eq. 6-8
Shallow Channel	200	5	0.025	1.1	3.0	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**10.2**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.27	4.10	4.78	5.46	6.15	6.88
Runoff (cfs)	2.4	**3.2**	4.0	4.8	5.6	**6.5**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	2.4	**3.2**	4.0	4.8	5.6	**6.5**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin OS-BC Runoff Calculations (DP-4)

Job No.:	**61195**	Date:	**7/17/2024 09:13**
Project:	**High County Crane**	Calcs by:	**CCC**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
Paved	17,585	0.40	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	130,244	2.99	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	3,049	0.07	0.03	0.09	0.17	0.26	0.31	0.36	2%
Roofs	16,352	0.38	0.71	0.73	0.75	0.78	0.8	0.81	90%
Combined	**167,230**	**3.84**	**0.61**	**0.63**	**0.66**	**0.69**	**0.71**	**0.73**	**81.7%**
	167270								

Basin Travel Time

Shallow Channel Ground Cover: Paved areas/shallow paved swales

$L_{max,Overland}$ 100 ft C_v 20

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	820	16	-	-	-	-	
Initial Time	100	4	0.040	-	5.4	14.6	DCM Eq. 6-8
Shallow Channel	720	12	0.017	2.6	4.6	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**10.1**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.29	4.12	4.81	5.50	6.18	6.92
Runoff (cfs)	7.7	**9.9**	12.3	14.6	16.9	**19.4**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	7.7	**9.9**	12.3	14.6	16.9	**19.4**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin EX-A Runoff Calculations

Job No.:	**61195**	Date:	**7/17/2024 09:13**
Project:	**High County Crane**	Calcs by:	**CCC**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

Surface	Area (SF)	Area (Acres)	Runoff Coefficient C2	C5	C10	C25	C50	C100	% Imperv.
Roofs	13,348	0.31	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	34,737	0.80	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	39,801	0.91	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	6,375	0.15	0.03	0.09	0.17	0.26	0.31	0.36	2%
Combined	**94,261**	**2.16**	**0.67**	**0.69**	**0.72**	**0.75**	**0.77**	**0.79**	**83.5%**
	175385								

Basin Travel Time

Shallow Channel Ground Cover: Paved areas/shallow paved swales

$L_{max,Overland}$ 100 ft; C_v 20

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	522	9	-	-	-	-	
Initial Time	100	3	0.025	-	5.5	12.9	DCM Eq. 6-8
Shallow Channel	422	7	0.015	2.5	2.8	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**8.3**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.52	4.41	5.14	5.88	6.61	7.40
Runoff (cfs)	5.1	**6.6**	8.0	9.6	11.0	**12.6**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	5.1	**6.6**	8.0	9.6	11.0	**12.6**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin EX-B Runoff Calculations (EX-DP-3)

Job No.:	**61195**	Date:	**7/17/2024 09:13**
Project:	**High County Crane**	Calcs by:	**CCC**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs			0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved			0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	139,540	3.20	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	-	0.00	0.03	0.09	0.17	0.26	0.31	0.36	2%
Combined	**139,540**	**3.20**	**0.57**	**0.59**	**0.63**	**0.66**	**0.68**	**0.70**	**80.0%**

58417

Basin Travel Time

Shallow Channel Ground Cover: Paved areas/shallow paved swales

$L_{max,Overland}$ 100 ft C_v 20

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	653	8	-	-	-	-	
Initial Time	100	4	0.040	-	5.8	13.6	DCM Eq. 6-8
Shallow Channel	553	4	0.007	1.7	5.4	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**11.2**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	**5-Yr**	**10-Yr**	**25-Yr**	**50-Yr**	**100-Yr**
Intensity (in/hr)	3.16	3.95	4.61	5.27	5.93	6.64
Runoff (cfs)	5.8	**7.5**	9.3	11.1	12.9	**14.9**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	5.8	**7.5**	9.3	11.1	12.9	**14.9**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin PP-A Runoff Calculations

Job No.:	**61195**	Date:	**7/17/2024 09:13**
Project:	**High County Crane**	Calcs by:	**CCC**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	13,348	0.31	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	34,737	0.80	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	39,801	0.91	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	6,375	0.15	0.03	0.09	0.17	0.26	0.31	0.36	2%
Combined	**94,261**	**2.16**	**0.67**	**0.69**	**0.72**	**0.75**	**0.77**	**0.79**	**83.5%**
	94261								

Basin Travel Time

Shallow Channel Ground Cover: Paved areas/shallow paved swales

$L_{max,Overland}$ 100 ft C_v 20

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	850	14	-	-	-	-	
Initial Time	100	8	0.080	-	3.7	14.7	DCM Eq. 6-8
Shallow Channel	750	6	0.008	1.8	7.0	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**10.7**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	**5-Yr**	**10-Yr**	**25-Yr**	**50-Yr**	**100-Yr**
Intensity (in/hr)	3.21	4.03	4.70	5.37	6.04	6.76
Runoff (cfs)	4.7	**6.0**	7.3	8.7	10.1	**11.5**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	4.7	**6.0**	7.3	8.7	10.1	**11.5**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Sub-Basin PP-B Runoff Calculations (PP-DP-3)

Job No.:	**61195**	Date:	**7/17/2024 09:13**
Project:	**High County Crane**	Calcs by:	**CCC**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	22,500	0.52	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	29,398	0.67	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	87,236	2.00	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	406	0.01	0.03	0.09	0.17	0.26	0.31	0.36	2%
Combined	**139,540**	**3.20**	**0.66**	**0.68**	**0.71**	**0.74**	**0.76**	**0.77**	**85.6%**
	64806								

Basin Travel Time

Shallow Channel Ground Cover: Paved areas/shallow paved swales

$L_{max,Overland}$ 100 ft C_v 20

	L (ft)	ΔZ_0 (ft)	S_0 (ft/ft)	v (ft/s)	t (min)	t_{Alt} (min)	
Total	850	10	-	-	-	-	
Initial Time	100	7	0.070	-	4.0	14.7	DCM Eq. 6-8
Shallow Channel	750	3	0.004	1.3	9.9	-	DCM Eq. 6-9
Channelized			0.000	0.0	0.0	-	V-Ditch
				t_c	**13.9**	**min.**	

Rainfall Intensity & Runoff

	2-Yr	**5-Yr**	**10-Yr**	**25-Yr**	**50-Yr**	**100-Yr**
Intensity (in/hr)	2.90	3.63	4.24	4.85	5.45	6.10
Runoff (cfs)	6.1	**7.9**	9.6	11.4	13.2	**15.1**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	6.1	**7.9**	9.6	11.4	13.2	**15.1**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Combined Sub-Basin Runoff Calculations (PP-DP-2)

Includes Basins OS-A PP-A

Job No.:	**61195**	Date:	**7/17/2024 09:13**
Project:	**High County Crane**	Calcs by:	**CCC**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	13,348	0.31	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	58,695	1.35	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	58,532	1.34	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	20,314	0.47	0.03	0.09	0.17	0.26	0.31	0.36	2%
Combined	**150,889**	**3.46**	**0.63**	**0.66**	**0.69**	**0.73**	**0.75**	**0.77**	**78.2%**

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ΔZ_0 (ft)	Q_i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	OS-A	-	300	7	-	-	-	-	10.2
Channelized-1	V-Ditch	1	522	9	6	0	2	4.0	2.2
Channelized-2									
Channelized-3									
Total			822	16					

1 = Man-made, Smooth, Straight

t_c (min) **12.4**

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} (cfs) - 5-year Storm

Q_{Major} (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.04	3.81	4.44	5.07	5.71	6.39
Site Runoff (cfs)	6.67	**8.64**	10.63	12.75	14.75	**16.93**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**8.6**	-	-	-	**16.9**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

Combined Sub-Basin Runoff Calculations (EX-DP-2)

Includes Basins OS-A EX-A

Job No.:	**61195**	Date:	**7/17/2024 09:13**
Project:	**High County Crane**	Calcs by:	**CCC**
		Checked by:	
Jurisdiction	**DCM**	Soil Type	**B**
Runoff Coefficient	**Surface Type**	Urbanization	**Urban**

Basin Land Use Characteristics

	Area		Runoff Coefficient						%
Surface	**(SF)**	**(Acres)**	**C2**	**C5**	**C10**	**C25**	**C50**	**C100**	**Imperv.**
Roofs	13,348	0.31	0.71	0.73	0.75	0.78	0.8	0.81	90%
Paved	58,695	1.35	0.89	0.9	0.92	0.94	0.95	0.96	100%
Gravel	58,532	1.34	0.57	0.59	0.63	0.66	0.68	0.7	80%
Landscaping	20,314	0.47	0.03	0.09	0.17	0.26	0.31	0.36	2%
Combined	**150,889**	**3.46**	**0.63**	**0.66**	**0.69**	**0.73**	**0.75**	**0.77**	**78.2%**

Basin Travel Time

	Sub-basin or Channel Type	Material Type	L (ft)	Elev. ΔZ_0 (ft)	Q_i (cfs)	Base or Dia (ft)	Sides z:1 (ft/ft)	v (ft/s)	t (min)
Furthest Reach	OS-A	-	300	7	-	-	-	-	10.2
Channelized-1	V-Ditch	1	522	9	6	0	2	4.0	2.2
Channelized-2									
Channelized-3									
Total			822	16					

1 = Man-made, Smooth, Straight

t_c (min) **12.4**

Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

Q_{Minor} (cfs) - 5-year Storm

Q_{Major} (cfs) - 100-year Storm

Rainfall Intensity & Runoff

	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Intensity (in/hr)	3.04	3.81	4.44	5.07	5.71	6.39
Site Runoff (cfs)	6.67	**8.64**	10.63	12.75	14.75	**16.93**
OffSite Runoff (cfs)	-	**0.00**	-	-	-	**0.00**
Release Rates (cfs/ac)	-	-	-	-	-	-
Allowed Release (cfs)	-	**8.6**	-	-	-	**16.9**

DCM: I = C1 * ln (tc) + C2

C1	1.19	1.5	1.75	2	2.25	2.52
C2	6.035	7.583	8.847	10.111	11.375	12.735

Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

Job No.: **61195**

Project: **High County Crane**

Date: **7/17/2024 09:13**

Calcs By: **CCC**

Checked By:

Time of Concentration (Modified from Standard Form SF-1)

Sub-Basin	Sub-Basin Data				Overland			Shallow Channel				Channelized				t_c Check		
	Area (Acres)	C_5	C_{100}/CN	% Imp.	L_0 (ft)	S_0 (%)	t_i (min)	L_{0t} (ft)	S_{0t} (ft/ft)	v_{0sc} (ft/s)	t_t (min)	L_{0c} (ft)	S_{0c} (ft/ft)	v_{0c} (ft/s)	t_c (min)	L (min)	$t_{c,alt}$ (min)	t_c (min)
OS-A	1.30	0.60	0.73	69%	100	2%	7.2	200	0.025	1.1	3.0	0	0.000	0.0	0.0	300	11.7	10.2
OS-BC	3.84	0.63	0.73	82%	100	4%	5.4	720	0.017	2.6	4.6	0	0.000	0.0	0.0	820	14.6	10.1
EX-A	2.16	0.69	0.79	84%	100	3%	5.5	422	0.015	2.5	2.8	0	0.000	0.0	0.0	522	12.9	8.3
EX-B	3.20	0.59	0.70	80%	100	4%	5.8	553	0.007	1.7	5.4	0	0.000	0.0	0.0	653	13.6	11.2
PP-A	2.16	0.69	0.79	84%	100	8%	3.7	750	0.008	1.8	7.0	0	0.000	0.0	0.0	850	14.7	10.7
PP-B	3.20	0.68	0.77	86%	100	7%	4.0	750	0.004	1.3	9.9	0	0.000	0.0	0.0	850	14.7	13.9

Job No.: **61195**
Project: **High County Crane**
Design Storm: **5-Year Storm** *(20% Probability)*
Jurisdiction: **DCM**

Date: **7/17/2024 09:13**
Calcs By: **CCC**
Checked By:

Sub-Basin and Combined Flows (Modified from Standard Form SF-2)

				Direct Runoff				Combined Runoff				Streetflow			Pipe Flow					Travel Time		
DP	Sub-Basin	Area (Acres)	C5	t_c (min)	CA (Acres)	I5 (in/hr)	Q5 (cfs)	t_c (min)	CA (Acres)	I5 (in/hr)	Q5 (cfs)	Slope (%)	Length (ft)	Q (cfs)	Q (cfs)	Slope (%)	Mnngs n	Length (ft)	D_{Pipe} (in)	Length (ft)	v_{0sc} (ft/s)	t_t (min)
DP-1	OS-A	1.30	0.60	10.2	0.78	4.10	3.2															
	EX-A	2.16	0.69	8.3	1.49	4.41	6.6															
EX-DP-2	OS-A, EX-A	3.46	0.66					12.4	2.27	3.81	8.6											
EX-DP-3	EX-B	3.20	0.59	11.2	1.89	3.95	7.5															
EX-DP-4	OS-BC	3.84	0.63	10.1	2.41	4.12	9.9															
DP-1	OS-A	1.30	0.60	10.2	0.78	4.10	3.2															
	PP-A	2.16	0.69	10.7	1.49	4.03	6.0															
PP-DP-2	AS-A, PP-A	3.46	0.66					12.4	2.27	3.81	8.6											
DP-3	PP-B	3.20	0.68	13.9	2.17	3.63	7.9															
PP-DP-4	OS-BC	3.84	0.63	10.1	2.41	4.12	9.9															

DCM: I = C1 * ln (tc) + C2
C1: 1.5
C1: 7.583

Z:\61195\Documents\Drainage\Calcs\Hydrology\61195-Runoff Spreadsheet.xlsm
Form SF-2 (Minor)

Job No.: **61195**
Project: **High County Crane**
Design Storm: **100-Year Storm** *(1% Probability)*
Jurisdiction: **DCM**

Date: **7/17/2024 09:13**
Calcs By: **CCC**
Checked By:

Sub-Basin and Combined Flows (Modified from Standard Form SF-2)

				Direct Runoff				Combined Runoff				Streetflow			Pipe Flow					Travel Time		
DP	Sub-Basin	Area (Acres)	C100	t_c (min)	CA (Acres)	I100 (in/hr)	Q100 (cfs)	t_c (min)	CA (Acres)	I100 (in/hr)	Q100 (cfs)	Slope (%)	Length (ft)	Q (cfs)	Q (cfs)	Slope (%)	Mnngs n	Length (ft)	D_{Pipe} (in)	Length (ft)	v_{0sc} (ft/s)	t_t (min)
DP-1	OS-A	1.30	0.73	10.2	0.94	6.88	6.5															
	EX-A	2.16	0.79	8.3	1.71	7.40	12.6															
EX-DP-2	OS-A, EX-A	3.46	0.77					12.4	2.65	6.39	16.9											
EX-DP-3	EX-B	3.20	0.70	11.2	2.24	6.64	14.9															
EX-DP-4	OS-BC	3.84	0.73	10.1	2.81	6.92	19.4															
DP-1	OS-A	1.30	0.73	10.2	0.94	6.88	6.5															
	PP-A	2.16	0.79	10.7	1.71	6.76	11.5															
PP-DP-2	AS-A, PP-A	3.46	0.77					12.4	2.65	6.39	16.9											
DP-3	PP-B	3.20	0.77	13.9	2.47	6.10	15.1															
PP-DP-4	OS-BC	3.84	0.73	10.1	2.81	6.92	19.4															

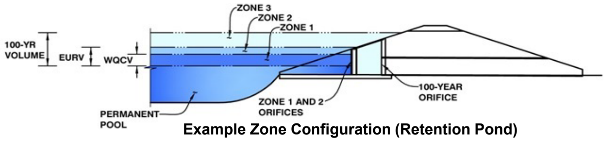
DCM: I = C1 * ln (tc) + C2
C1: 2.52
C1: 12.735

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **61195 - 2217 Janitell Rd**

Basin ID: **Basin PP-B**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**SF**			
Watershed Area =	3.20	acres		
Watershed Length =	654	ft		
Watershed Length to Centroid =	325	ft		
Watershed Slope =	0.018	ft/ft		
Watershed Imperviousness =	85.60%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	12.0	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) =	0.078	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.306	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.261	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.342	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.408	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.479	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.547	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.623	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.25 in.) =	0.823	acre-feet	3.25	inches
Approximate 2-yr Detention Volume =	0.244	acre-feet		
Approximate 5-yr Detention Volume =	0.320	acre-feet		
Approximate 10-yr Detention Volume =	0.394	acre-feet		
Approximate 25-yr Detention Volume =	0.422	acre-feet		
Approximate 50-yr Detention Volume =	0.438	acre-feet		
Approximate 100-yr Detention Volume =	0.458	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.078	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.228	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.152	acre-feet
Total Detention Basin Volume =	0.458	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface	--	0.00	--	--	--	4,005	0.092		
Btm=35.4'	--	0.60	--	--	--	4,032	0.093	2,411	0.055
	--	1.60	--	--	--	4,060	0.093	6,457	0.148
Top Box=38.9'	--	2.60	--	--	--	4,111	0.094	10,543	0.242
	--	3.60	--	--	--	4,198	0.096	14,697	0.337
Spillway=40.5'	--	4.60	--	--	--	4,303	0.099	18,948	0.435
	--	5.60	--	--	--	4,360	0.100	23,279	0.534
Top Wall=41.9'	--	6.50	--	--	--	4,360	0.100	27,203	0.624
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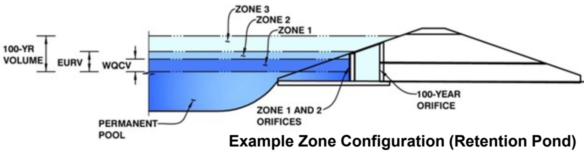
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **61195 - 2217 Janitell Rd**

Basin ID: **Basin PP-B**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.85	0.078	Filtration Media
Zone 2 (EURV)	3.27	0.228	Orifice Plate
Zone 3 (100-year)	4.83	0.152	Weir&Pipe (Restrict)
Total (all zones)		0.458	

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

Underdrain Orifice Invert Depth =	2.83	ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Diameter =	1.25	inches	Underdrain Orifice Centroid =	0.05	feet

Calculated Parameters for Underdrain (right columns above)

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)

Calculated Parameters for Plate (right columns below)

Centroid of Lowest Orifice =	0.85	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	8.333E-04	ft^2
Depth at top of Zone using Orifice Plate =	3.28	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.12	sq. inches (diameter = 3/8 inch)	Elliptical Slot Area =	N/A	ft^2

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)	0.85	1.66	2.46					
Orifice Area (sq. inches)	0.12	0.12	0.12					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

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	
Overflow Weir Front Edge Height, Ho =	4.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	2.92	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.92	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.00	N/A	feet
Overflow Weir Slope Length =	2.92	N/A	feet
Grate Open Area / 100-yr Orifice Area =	23.84	N/A	
Overflow Grate Open Area w/o Debris =	5.93	N/A	ft^2
Overflow Grate Open Area w/ Debris =	2.97	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.90	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	12.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	4.25		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.25	N/A	ft^2
Outlet Orifice Centroid =	0.21	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.27	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.10	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.28	feet
Spillway Crest Length =	23.00	feet	Stage at Top of Freeboard =	6.38	feet
Spillway End Slopes =	0.00	H:V	Basin Area at Top of Freeboard =	0.10	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.61	acre-ft

Calculated Parameters for Spillway (right columns above)

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	1.19	1.50	1.75	2.00	2.25	2.52	3.25
CUHP Runoff Volume (acre-ft) =	0.078	0.306	0.261	0.342	0.408	0.479	0.547	0.623	0.823
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.261	0.342	0.408	0.479	0.547	0.623	0.823
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.3	0.8	1.3	2.2	2.8	3.6	5.3
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.26	0.39	0.70	0.88	1.13	1.67
Peak Inflow Q (cfs) =	N/A	N/A	4.3	5.6	6.4	7.8	8.9	10.3	13.5
Peak Outflow Q (cfs) =	0.1	0.1	0.1	0.1	0.4	1.4	2.8	3.2	7.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	0.3	0.6	1.0	0.9	1.3
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.2	0.4	0.5	0.5
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) =	13	40	36	44	49	49	49	48	47
Time to Drain 99% of Inflow Volume (hours) =	**13**	41	37	45	51	51	51	50	50
Maximum Ponding Depth (ft) =	0.85	3.28	2.60	3.43	4.06	4.17	4.27	4.59	5.24
Area at Maximum Ponding Depth (acres) =	0.09	0.10	0.09	0.10	0.10	0.10	0.10	0.10	0.10
Maximum Volume Stored (acre-ft) =	0.079	0.307	0.242	0.321	0.381	0.392	0.403	0.433	0.497

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.07, March 2018)

Designer: Thomas Wendland
Company: MVE Inc.
Date: February 14, 2025
Project: 61195 - 2217 Janitell Road
Location: Basin PP-B

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter)	I_a = 85.6 %
B) Tributary Area's Imperviousness Ratio ($i = I_a/100$)	i = 0.856
C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time WQCV= 0.8 * (0.91* i^3 - 1.19 * i^2 + 0.78 * i)	WQCV = 0.29 watershed inches
D) Contributing Watershed Area (including sand filter area)	Area = 139,392 sq ft
E) Water Quality Capture Volume (WQCV) Design Volume V_{WQCV} = WQCV / 12 * Area	V_{WQCV} = cu ft
F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume	$V_{WQCV\ OTHER}$ = 3,327 cu ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$ = cu ft
2. Basin Geometry	
A) WQCV Depth	D_{WQCV} = 0.9 ft
B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.	Z = 0.00 ft / ft
C) Minimum Filter Area (Flat Surface Area)	A_{Min} = 1491 sq ft
D) Actual Filter Area	A_{Actual} = 3916 sq ft
E) Volume Provided	V_T = 17710 cu ft
3. Filter Material	Choose One ◉ 18" CDOT Class B or C Filter Material ○ Other (Explain):
4. Underdrain System	
A) Are underdrains provided?	Choose One ◉ YES ○ NO
B) Underdrain system orifice diameter for 12 hour drain time	
i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = 2.8 ft
ii) Volume to Drain in 12 Hours	Vol_{12} = 3,327 cu ft
iii) Orifice Diameter, 3/8" Minimum	D_O = 1 1/4 in

Design Procedure Form: Sand Filter (SF)

Designer: Thomas Wendland
Company: MVE Inc.
Date: February 14, 2025
Project: 61195 - 2217 Janitell Road
Location: Basin PP-B

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric

   A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?

   Choose One
   - ○ YES
   - ◉ NO

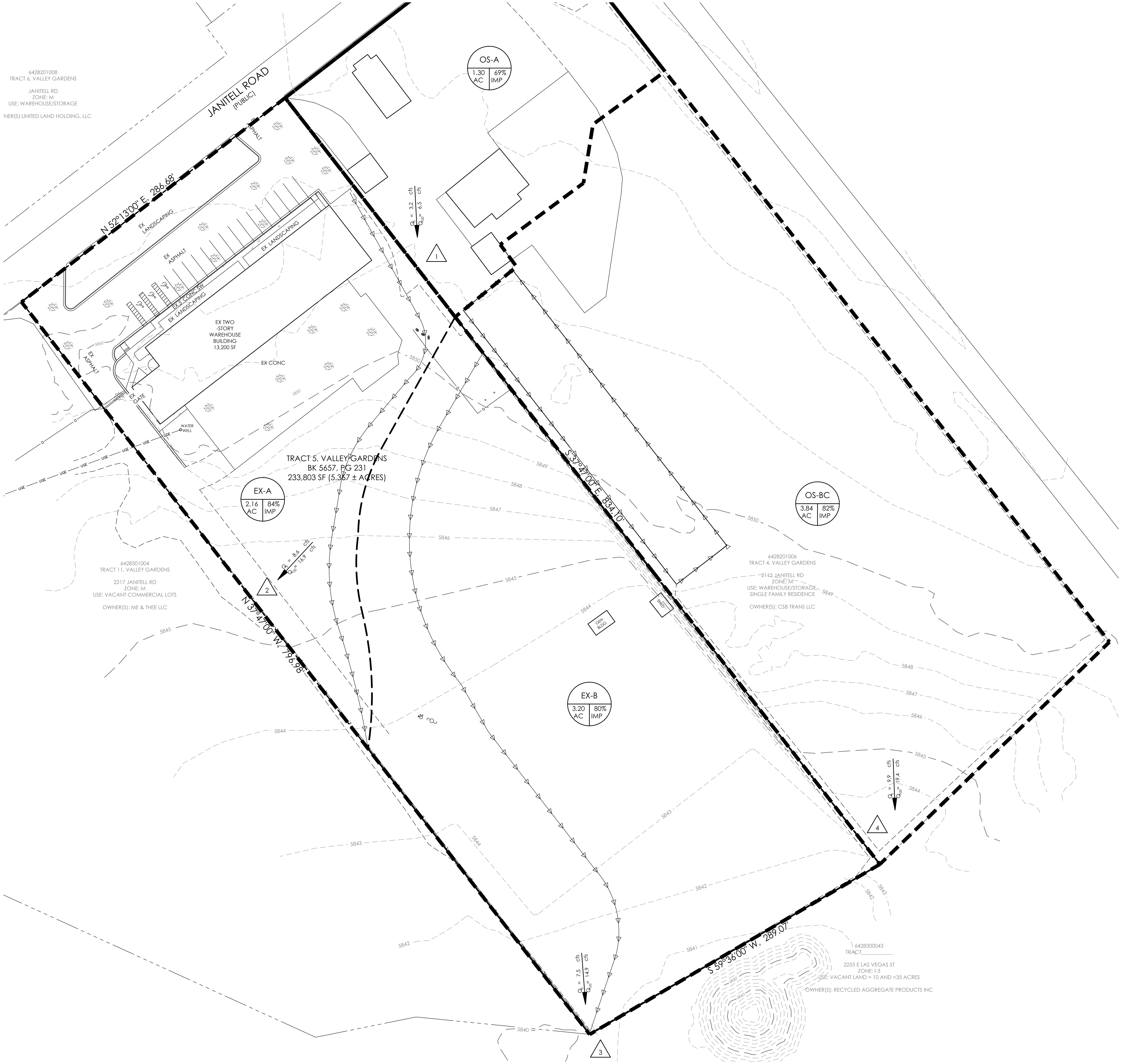
6. Inlet / Outlet Works

   A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet

   Flow Sheet into pond over the retaining wall. No concentrated points of inflow.

   Block wall notched for emergency overflow and riprap downstream.

Notes:



LEGEND

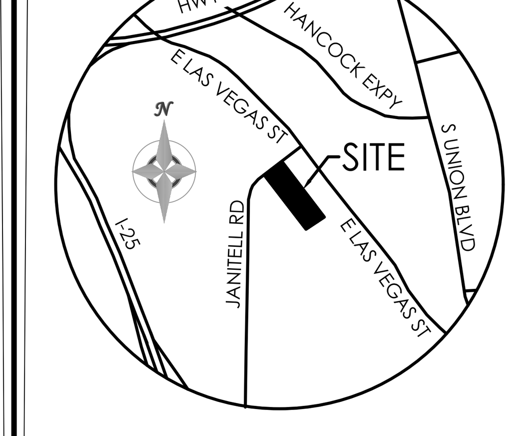
- PROPERTY LINE
- EASEMENT LINE
- LOT LINE

EXISTING

- 5985 INDEX CONTOUR
- 84 INTERMEDIATE CONTOUR

PROPOSED

- 5985 INDEX CONTOUR
- 84 INTERMEDIATE CONTOUR
- CURB INLET
- STORM DRAINAGE (SD)
- AREA INLET
- STORM DRAIN PIPE/ FLARED END SECTION (FES)
- SDMH-1 STORM DRAIN MANHOLE
- RIPRAP
- BASIN BOUNDARY
- Q_5 = 6.4 cfs, Q_{100} = 21.3 cfs GENERAL FLOW DIRECTION
- 1.50% SLOPE DIRECTION AND GRADE
- BASIN LABEL (A1, 1.0 AC, 50% IMP): AREA IN ACRES, PERCENT IMPERVIOUS
- DESIGN POINT
- 1.50% SWALE WITH GRADE



VICINITY MAP

NOT TO SCALE

BENCHMARK

10 0 20 40 80

1" = 40' 1:480

MVE INC. ENGINEERS, SURVEYORS

1903 lelaray street, suite 200 colorado springs co 80909 719.635.5736

REVISIONS

EXISTING DRAINAGE SUMMARY TABLE					
DESIGN POINT	INCLUDED BASIN(S)	AREA (AC)	Tc (MIN.)	RUNOFF	
				Q5 (CFS)	Q100 (CFS)
DP1	OS-A	1.30	10.2	3.2	6.5
	EX-A	2.16	8.3	6.6	12.6
EX-DP-2	OS-A, EX-A	3.46	12.4	8.6	16.9
EX-DP-3	EX-B	3.20	11.2	7.5	14.9
EX-DP-4	OS-BC	3.84	10.1	9.9	19.4

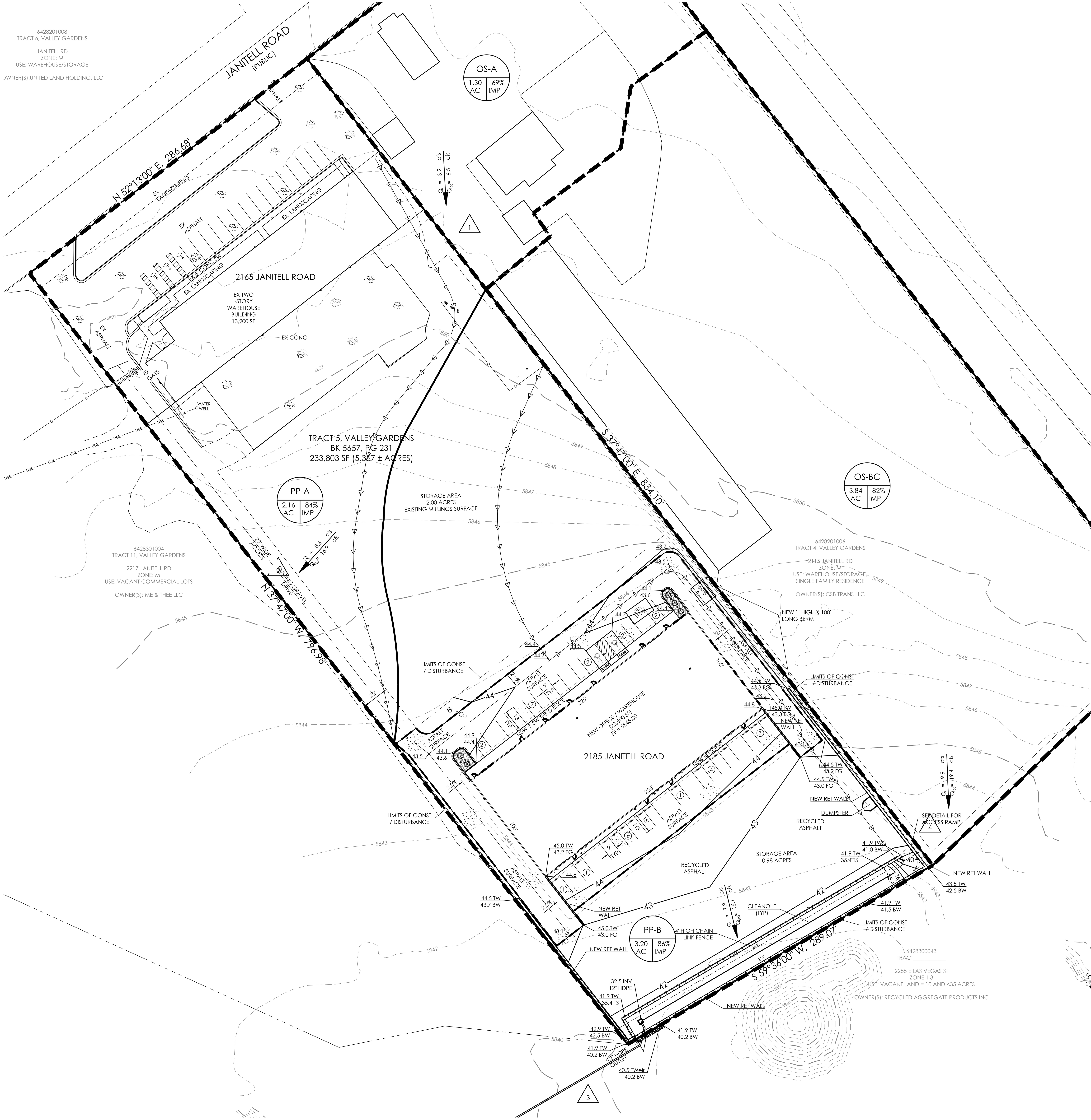
DESIGNED BY CCC
DRAWN BY CCC
CHECKED BY
AS-BUILTS BY
CHECKED BY

2185 JANTELL RD

EXISTING DRAINAGE

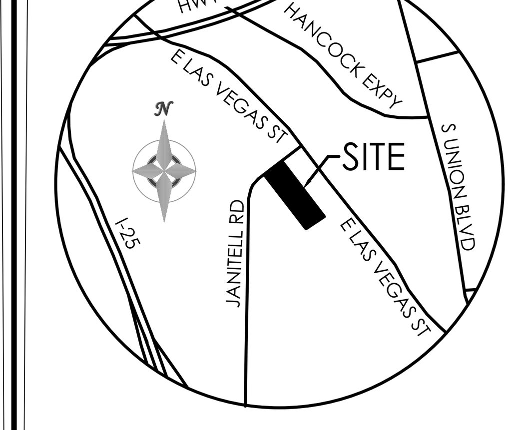
MVE PROJECT **61195**
MVE DRAWING **DRAIN-EX**

JANUARY 20, 2025
SHEET 1 OF 1



LEGEND

	PROPERTY LINE
	EASEMENT LINE
	LOT LINE
EXISTING	
5985	INDEX CONTOUR
84	INTERMEDIATE CONTOUR
PROPOSED	
5985	INDEX CONTOUR
84	INTERMEDIATE CONTOUR
	CURB INLET
	STORM DRAINAGE (SD)
	AREA INLET
	STORM DRAIN PIPE/ FLARED END SECTION (FES)
SDMH-1	STORM DRAIN MANHOLE
	RIPRAP
	BASIN BOUNDARY
Q_5 = 6.4 cfs, Q_{100} = 21.3 cfs	GENERAL FLOW DIRECTION
1.50%	SLOPE DIRECTION AND GRADE
A1 / 1.0 AC / 50% IMP	BASIN LABEL AREA IN ACRES PERCENT IMPERVIOUS
1	DESIGN POINT
1.50%	SWALE WITH GRADE



VICINITY MAP
NOT TO SCALE

BENCHMARK

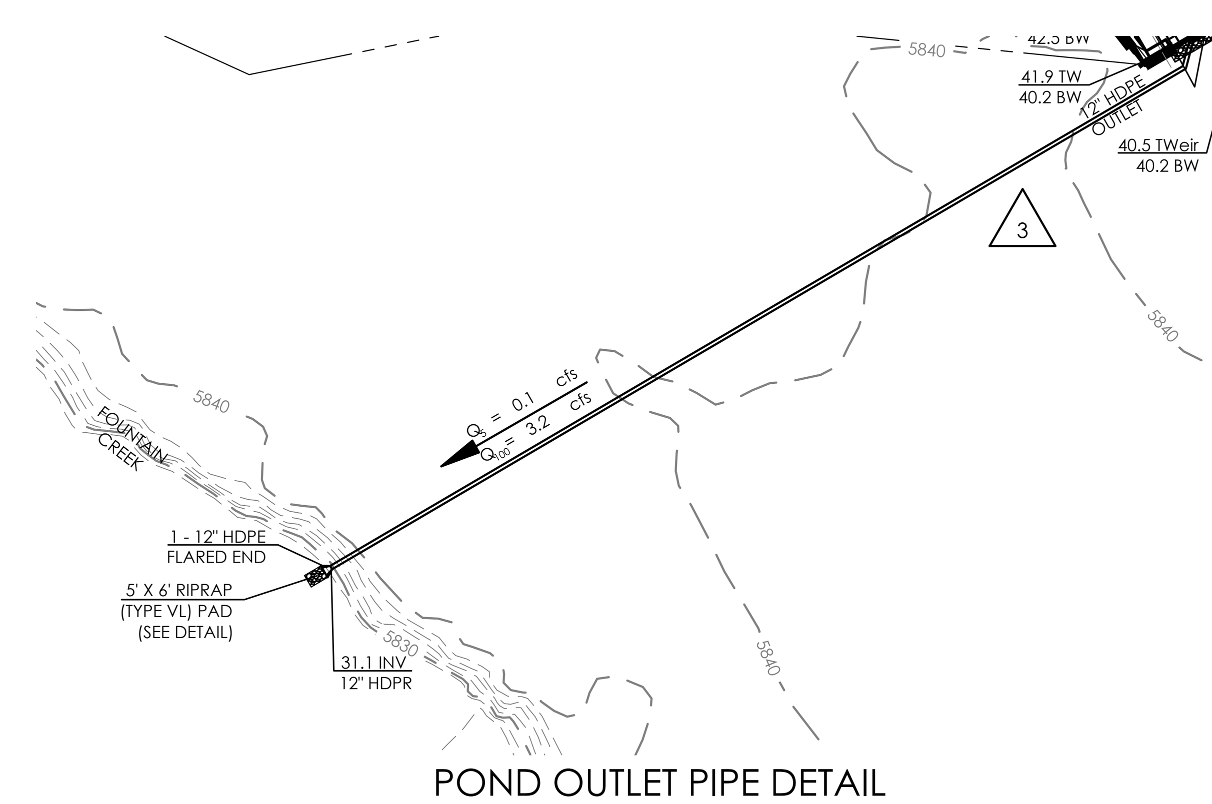
1" = 40' 1:480

DEVEVELOPED DRAINAGE SUMMARY TABLE

DESIGN POINT	INCLUDED BASIN(S)	AREA (AC)	Tc (MIN.)	RUNOFF Q5 (CFS)	RUNOFF Q100 (CFS)
DP1	OS-A	1.30	10.2	3.2	6.5
	PP-A	2.16	10.7	6.0	11.5
PP-DP-2	OS-A, PP-A	3.46	12.4	8.6	16.9
PP-DP-3	PP-B	3.20	13.9	7.9	15.1
PP-DP-4	OS-BC	3.84	10.1	9.9	19.4

MVE, INC.
ENGINEERS, SURVEYORS
1903 lelaray street, suite 200 colorado springs co 80909 719.635.5736

REVISIONS



POND OUTLET PIPE DETAIL
SCALE: 1" = 40'

DESIGNED BY
DRAWN BY
CHECKED BY
AS-BUILTS BY
CHECKED BY

2185 JANTELL ROAD

DEVELOPED DRAINAGE

MVE PROJECT **61195**
MVE DRAWING **DRAIN-PP**

JANUARY 20, 2025
SHEET 1 OF 1