FINAL DRAINAGE REPORT
FOR
MC CLINTOCK STATION LOT A
(VOLLMER ROAD RV STORAGE)

Prepared For:
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Castle Rock, CO 80109

June 2022
Project No. 25251.00

Prepared By:
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719-593-2593

Revise to PPR-2245

PCD File No. SF-XX-XXXX

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 report has been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the 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.

________________________________ ____________________
Ryan Burns, Colorado P.E. # 0054412 Date
For and On Behalf of JR Engineering, LLC

DEVELOPER'S STATEMENT:
I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: Scott Belknap

By: ____________________________

Title: ____________________________
Address: 3603 First Light Drive
Castle Rock, CO 80109

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

________________________________ ____________________
Jennifer Irvine, P.E. Date
County Engineer/ ECM Administrator

Conditions:

Revise to Joshua Palmer, PE

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PURPOSE

This document is the Final Drainage Report for Mc Clintock Station Lot A herein know as “Vollmer Road RV Storage”. The purpose of this document is to identify and analyze the on and offsite drainage patterns and to ensure that post development runoff is routed through the site safely and in a manner that satisfies the requirements set forth by the El Paso County Drainage Criteria Manual. The following report is an analysis of the drainage for the site and surrounding areas.

GENERAL LOCATION AND DESCRIPTION

Location

Vollmer Road RV Storage herein known as “the site” is located in Section 34, Township 12 South, and Range 65 West of the 6th Principal Meridian. The site is bound on the northwest by existing Vollmer Road. Vollmer Road boards Wildridge Subdivision II Lot 1, Blocks 1 and 2 to the northwest of Vollmer Road. The property is bound to the east by the Sterling Ranch Filing 1 and by Lots B and C of the Mc Clintock Station Subdivision to the south. Vollmer Road RV Storage lies within the Sand Creek Drainage Basin. Flows from this site are tributary to Sand Creek. A vicinity map is presented in Appendix A.

Description of Property

Vollmer Road RV Storage consists of 4.15 acres and is presently undeveloped. Vegetation is sparse, consisting of native grasses. Existing site terrain generally slopes from north to south at grade rates that vary between 2% and 8%.

Vollmer Road RV Storage is currently zoned "I-2" for light industrial and manufacturing development. Improvements proposed for the site includes recycled asphalt drives and parking, fencing, storm drainage improvements, drainage swales, and a detention pond. A full spectrum detention pond is proposed to be constructed to provide water quality treatment and detain storm water for the development.

Soils for this project are classified as Pring Coarse Sandy Loam (71), which is characterized as Hydrologic Soil Types "B". Group B soils exhibit moderate infiltration rate when thoroughly wet, and consist primarily of deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. A soil map of the site can be found in Appendix A.

There are no major drainage ways or known irrigation facilities located on the project site. There are no known existing onsite utilities.

Floodplain Statement

Based on the FEMA FIRM Maps number 08041C0533G, dated December 7, 2018, all of the proposed development lies within Zone X. Zone X is defined as area outside the Special Flood

Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. A FIRM Map is presented in Appendix A.

DRAINAGE BASINS AND SUB-BASINS

Existing Major Basin Descriptions

The Vollmer Road RV Storage site consists of 4.15 acres and is located in the Sand Creek Drainage Basin. The site area was previously studied in the "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Stantec, January 2021.

The Sand Creek DBPS assumed the Vollmer Road RV Storage property to have an undeveloped use for the site. However, the site is zoned I-2 for light industrial and manufacturing development. The site generally drains from northwest to southeast. Currently, the site is undeveloped. Sand Creek is located east of the site running north to south.

Downstream flow patterns have been studied in “Final Drainage Report for Barbarick Subdivision, Portions of Lots 1, 2 and Lots 3 & 4,” by Matrix Design Group, June 2016, and “Woodmen Storage Final Drainage Report”, by Calibre Engineering Inc, Revised February 2010. Applicable excerpts from these reports can be found in Appendix D.

A summary of peak runoff for the basins and designated design points are depicted on the Existing Conditions Drainage Map in the appendix.

Existing Sub-basin Drainage

Basin EX-1 (Q_5=0.1 cfs, Q_{100}=1.0 cfs) is 0.48 acres of open space. Runoff from this basin drains overland flows to the south east to DP 1. Flows from Basins EX-1 and VX-7 combine at DP1.1 (Q_5=0.3 cfs, Q_{100}=1.5 cfs) where flow continues onto Lot B of the McClintock Station Subdivision.

Basin EX-2 (Q_5=0.5 cfs, Q_{100}=3.9 cfs) is 2.22 acres of open space. Runoff from this basin overland flows southeast to DP 2. Flows from Basins VX-5, VX-6 and EX-2 combine at DP2.1 (Q_5=1.2 cfs, Q_{100}=5.7 cfs) and continues onto Lot C of the McClintock Station Subdivision.

Basin EX-3 (Q_5=0.2 cfs, Q_{100}=1.5 cfs) is 0.88 acres of open space. Runoff from this basin overland flows south to DP 3 and onto Lot C of the McClintock Station Subdivision.

Basin EX-4 (Q_5=0.2 cfs, Q_{100}=1.3 cfs) is 0.56 of open space. Runoff from this basin overland flows east across the property line to DP4 and onto Homestead at Sterling Ranch Filing No. 1. Runoff is then captured by an existing swale.

Indicate whether this existing swale was designed with these flows contributing to it and are the higher or lower than assumed flows?

oen't really
ve swale.
w is directly to

Basin VX-5 (Q_5=0.7 cfs, Q_{100}=1.9 cfs) is 0.41 acres and is comprised of the existing Vollmer Road and road side swale. Runoff from this offsite basin overland flows onto the site at DP5 where flow enters Basin EX-2.

Flows and area do not match VX-5 in hydrology spreadsheet in appendix. Please revise accordingly between report and appendix

Basin VX-6 (Q_5=0.6 cfs, Q_{100}=1.5 cfs) is 0.41 acres and is comprised of the existing Vollmer Road and road side swale. Runoff from this offsite basin overland flows to the roadside ditch and then enter the site at DP6 where flow enters Basin EX-2.

Basin VX-7 (Q_5=0.3 cfs, Q_{100}=0.7 cfs) is 0.14 acres and is comprised of the existing Vollmer Road and road side swale. Runoff from this offsite basin overland flows onto the site at DP7 where flow enters Basin EX-1.

Proposed Sub-basin Drainage

The following is a description of the offsite and onsite basins for the developed condition. Calculations have been provided to show the proposed storm infrastructure will adequately convey flows. The following basins parameters and developed runoff were determined using the Rational Method. Calculation can be found in Appendix C.

Basin A (Q_5=4.6 cfs, Q_{100}=9.2 cfs) consists of approximately 1.62 acres and consists of recycled asphalt parking and drives, and landscaping. Runoff from this basin is conveyed via sheet flow across the proposed asphalt mat to DP1, where flow enters Basin C and combines with flows from Basins B and C at DP3.1 (Q_5=11.5 cfs, Q_{100}=22.6 cfs) where flow will be captured and treated in the full spectrum detention pond.

Basin B (Q_5=7.2 cfs, Q_{100}=13.0 cfs) consists of approximately 1.74 acres and consists of recycled asphalt parking and drives, and landscaping. Runoff from this basin is conveyed via sheet flow across the proposed asphalt mat and then will be captured and treated at DP2, where flow enters Basin C and combines with flows from Basins A and C at DP3.1 (Q_5=11.5 cfs, Q_{100}=22.6 cfs) where flow will be captured and treated in the full spectrum detention pond.

Basin C (Q_5=0.1 cfs, Q_{100}=0.9 cfs) consists of approximately 0.32 acres and consists the proposed full spectrum pond that includes a concrete trickle channel and outlet structure. Runoff from this basin is conveyed via sheet flow down to the bottom of the pond and through the trickle channel to the outlet structure to DP3. Runoff from Basin C combines with flows from Basins A and B at DP3.1 (Q_5=11.5 cfs, Q_{100}=22.6 cfs) where flow will be captured and treated in the full spectrum detention pond.

Basin D (Q_5=0.0 cfs, Q_{100}=0.3 cfs) is 0.10 acres of landscaping. Runoff from this basin overland flows east across the property line to DP4 and onto Homestead at Sterling Ranch Filing No. 1. Runoff is then captured by an existing swale. Indicate contributing flow to existing swale is less.

Basin E (Q_5=0.1 cfs, Q_{100}=0.5 cfs) is 0.16 acres of landscaping. Runoff from this basin drains via overland flow to the south east across the site boundary and onto Lot C of the McClintock Station Subdivision at DP 5.

Basin F (Q_5=0.1 cfs, Q_{100}=0.6 cfs) is 0.17 acres of landscaping. Runoff from this basin drains via overland flow to the south across the site boundary and onto Lot B of the McClintock Station Subdivision to DP6.

Basin G (Q_5=0.9 cfs, Q_{100}=2.5 cfs) is 0.84 acres and is comprised of the existing Vollmer Road, existing and proposed road side swale, and a portion of the access road. Runoff from this basin overland flows to the roadside ditch and then enters the proposed culvert under the access road at DP7, flow continues to DP8.1 where flows from Basins G and H combine, and continues to flow existing drainage patterns to the southwest.

Basin H (Q_5=0.1 cfs, Q_{100}=0.2 cfs) is 0.03 acres and is comprised of the existing Vollmer Road, proposed road side swale, and a portion of the access road. Runoff from this basin overland flows to the roadside ditch DP8, flow continues to DP8.1 where flows from Basins G and H combine, and continues to flow existing drainage patterns to the southwest.

DP9 (Q_5=0.5 cfs, Q_{100}=4.1 cfs) is the outfall point for the proposed full spectrum water quality and detention pond. Flow will leave the site via a proposed 18" RCP storm pipe and enter the existing ten foot public utility and drainage easement. The outlet structure for the ponds shall reduce the release rates for all storm events to less than historic rates to minimize adverse impacts to downstream stormwater facilities. Flow from DP9 will continue to follow existing drainage patterns.

DRAINAGE DESIGN CRITERIA

Development Criteria Reference

Storm drainage analysis and design criteria for the project were taken from the "*City of Colorado Spring/El Paso County Drainage Criteria Manual*" Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the "*Urban Storm Drainage Criteria Manual*" Volumes 1 - 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the "Colorado Springs Drainage Criteria Manual (CCSDCM), dated May 2014, as adopted by El Paso County.

Hydrologic Criteria

All hydrologic data was obtained from the "El Paso Drainage Criteria Manual" Volumes 1 and 2, and the "Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual" Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5 year (minor) storm event and the 100-year (major) storm event. One hour point rainfall data for the storm events is identified in the table below. Rational Method calculations were prepared, in accordance with Section 3.0 of the EPCDCM. Rational method calculations are presented in Appendix B.

Table 1: 1-hr Point Rainfall Data

Storm	Rainfall (in.)
5-year	1.50
100-year	2.52

Hydraulic Criteria

Mile High Flood District's MHFD-Detention, Version 4.05 workbook was used for pond sizing. Required detention volumes and allowable release rates were designed per USDCM and

If Final report, calculations should all be final, not preliminary

CCS/EPCDCM. Pond sizing spreadsheets are presented in Appendix C. The Manning's equation has been utilized as a preliminary sizing check for the proposed drive access culvert. Refer to Appendix C for pipe capacity calculations of the 18" RCP culvert.

DRAINAGE FACILITY DESIGN

Specific Details

Four Step Process to Minimize Adverse Impacts of Urbanization

In accordance with the El Paso County Drainage Criteria Manual Volume 2, this site has implemented the four step process to minimize adverse impacts of urbanization. The four step process includes reducing runoff volumes, stabilizing drainageways, treating the water quality capture volume (WQCV), and consider the need for Industrial Commercial BMP's.

Step 1, Reducing Runoff Volumes: The development of the project site consist of recycled asphalt parking and drives and landscaped areas. Proposed landscaped areas help disconnect impervious areas. Wherever possible runoff from the impervious areas will be routed to pervious areas to reduce runoff volumes and promote infiltration.

Flows are lower than historic because of the pond, but you are changing the flow from sheet flow to concentrated flow. please confirm the existing outfall is suitable.

Step 2, Stabilize Drainageways: Drainage fees will be paid at the time of final platting. Drainage fees go towards channel stabilization projects throughout the drainage basin. The existing outfall for the site (DP9) is believed to be stable and sufficient in today's condition. The outfall will be analyzed for stability during final design and will be upgraded if needed.

Step 3, Treat the WQCV: Water Quality treatment for the site is provided in a proposed full spectrum water quality detention ponds located in the south west corner of the site. In general, the runoff from this site will be routed via overland flow to the proposed. A trickle channel is also incorporated into the ponds to minimize the amount of standing water. The outlet structure has been designed to detain the water quality capture volume (WQCV) for 40 hours, and the extended urban runoff volume (EURV) for 72 hours. Flows released from the pond will be reduced to less than historic rates. The pond will facilitate pollutant removal for the site, while also reducing peak stormwater rates down stream.

Step 4, Consider the need for Industrial and Commercial BMP's: Temporary BMPs will be utilized during construction to minimize off-site contaminates and to protect the downstream receiving waters, Site specific temporary source control BMPs that will be implement include, but are not limited to, silt fencing, construction vehicle tracking pads, designated fueling areas, covered storage areas, spill containment and control, etc. The permanent erosion control BMPs include recycled asphalt parking and drives, permanent vegetation, a storm culvert under the access, and a full spectrum water quality and detention pond.

was this sentence cut off?

Water Quality

Water quality for the site is provided by a private full-spectrum detention and water quality pond in the southeast corner of the site. Table 2 below shows the basin parameters. The proposed pond is sized The WQCV for the pond shall be released within 40 hours and the EURV shall be released within 72 hours. Table 3 below gives the design storm results. The proposed pond will utilize a

The entire site has to receive water quality per ECM I.7.1.C.a trickle channels, and outlet structure to dissipate energy and treat flows. The outlet structure for the ponds shall reduce the release rates for all storm events to less than historic rates to minimize adverse impacts to downstream stormwater facilities. A broad crested weir will be provided as an emergency spillway and will convey emergency flows to the existing drainage easement that runs along the southern property lines.

include a forebay

Show drainage easement on GEC plan and site plan.

Table 2 - Watershed Design Parameters

Watershed Area	3.68 AC
Percent Impervious	77.0%
Watershed Slope	0.015 ft/ft

Table 3 - Design Storm Results

Design Storm Period	Volume (AC-FT)	Depth (FT)	Q_{out} 100 (CFS)
WQCV	0.096	2.25	0.0
EURV	0.315	4.01	0.2
100-YR	0.431	4.73	4.1

Include what the design volumes are in the table.

Erosion Control Plan

The El Paso County Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate must be submitted with each Final Drainage Report. The Erosion Control Plan for Vollmer RV Storage has been submitted with this report.

Operation & Maintenance

delete

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. All proposed drainage structures within the any platted County ROW will be owned and maintained by El Paso County. All proposed drainage structures within the property will be owned and maintained by Scott Belknap. An Inspection & Maintenance Plan has been submitted concurrently with this final drainage report that details the required maintenance activities and intervals to ensure proper function of all stormwater infrastructures in the future. The full spectrum detention pond will be owned & maintained by Scott Belknap.

Drainage & Bridge Fees

The site lies within the Sand Creek Drainage Basin. It is assumed that all fees were paid at the time platting for Mc Clintock Station Lot A.

SUMMARY

The Mc Clintock Station Lot A known as the Vollmer RV Storage site consists of recycled asphalt parking and drive aisles, a proposed fill spectrum water quality and detention pond, and landscaped areas. The proposed development will not adversely affect downstream drainage infrastructure as the site will provide water quality and detention for the developed flows to release below historic rates. Establishment of maintenance procedures and the implementation of temporary and permanent BMP's will insure the site has no adverse drainage impacts on adjacent properties, surrounding developments, or downstream infrastructure. This report is in conformance with the latest El Paso County Stormwater Drainage Criteria requirements for this site.

Provide cost estimate for pond and update FAE.

Calculations need to be included for:
-sizing of spillway riprap
-trickle channel
-forebays
-riprap outlet protection at pond outlet and access culvert
-roadside ditch
-rundowns into pond from DP 1 & DP2

REFERENCES:

1. City of Colorado Springs Drainage Criteria Manual, Volume 1 & 2, Colorado Springs, CO, 2014.

2. El Paso County Drainage Criteria Manual Volume 1, El Paso County, CO, 1990.

3. El Paso County Drainage Criteria Manual Update (City Chapter 6), El Paso County, CO, 2015.

4. El Paso County Engineering Criteria Manual Revision 6, El Paso County, CO, 2016.

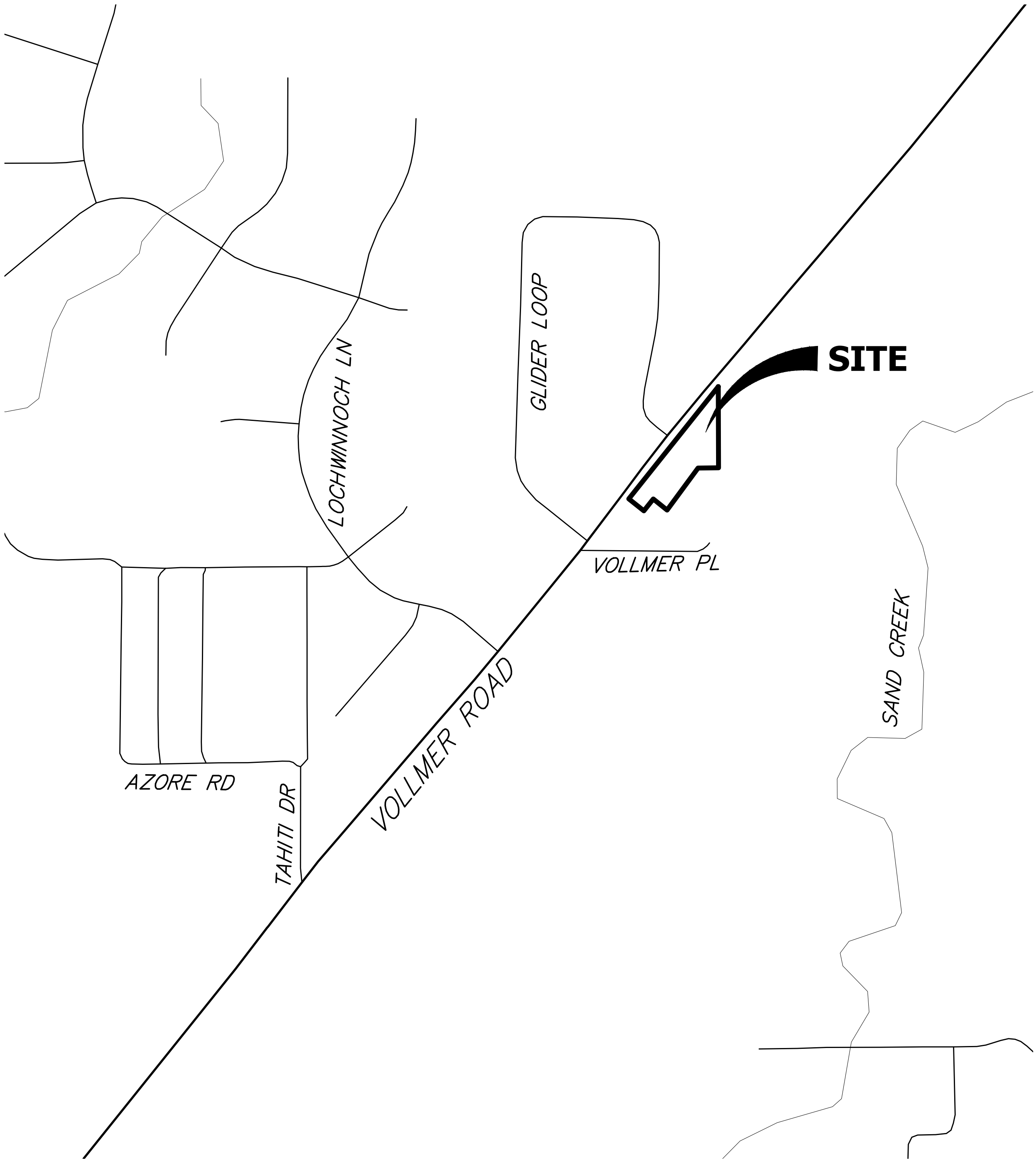
5. Final Drainage Report for Barbarick Subdivision, Portions of Lots 1, 2 and Lots 3 & 4, by Matrix Design Group, dated June 2016.

6. Sand Creek Drainage Basin Planning Study, by Stantec, dated January 2021.

7. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, Latest Revision.

APPENDIX A

Vicinity Map, Soils, FEMA



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1000 500 0 1000

ORIGINAL SCALE: 1" = 1000'

VICINITY MAP
VOLLMER RV STORAGE
JOB NO. 25251.00
02/22/2022
SHEET 1 OF 1

J·R ENGINEERING
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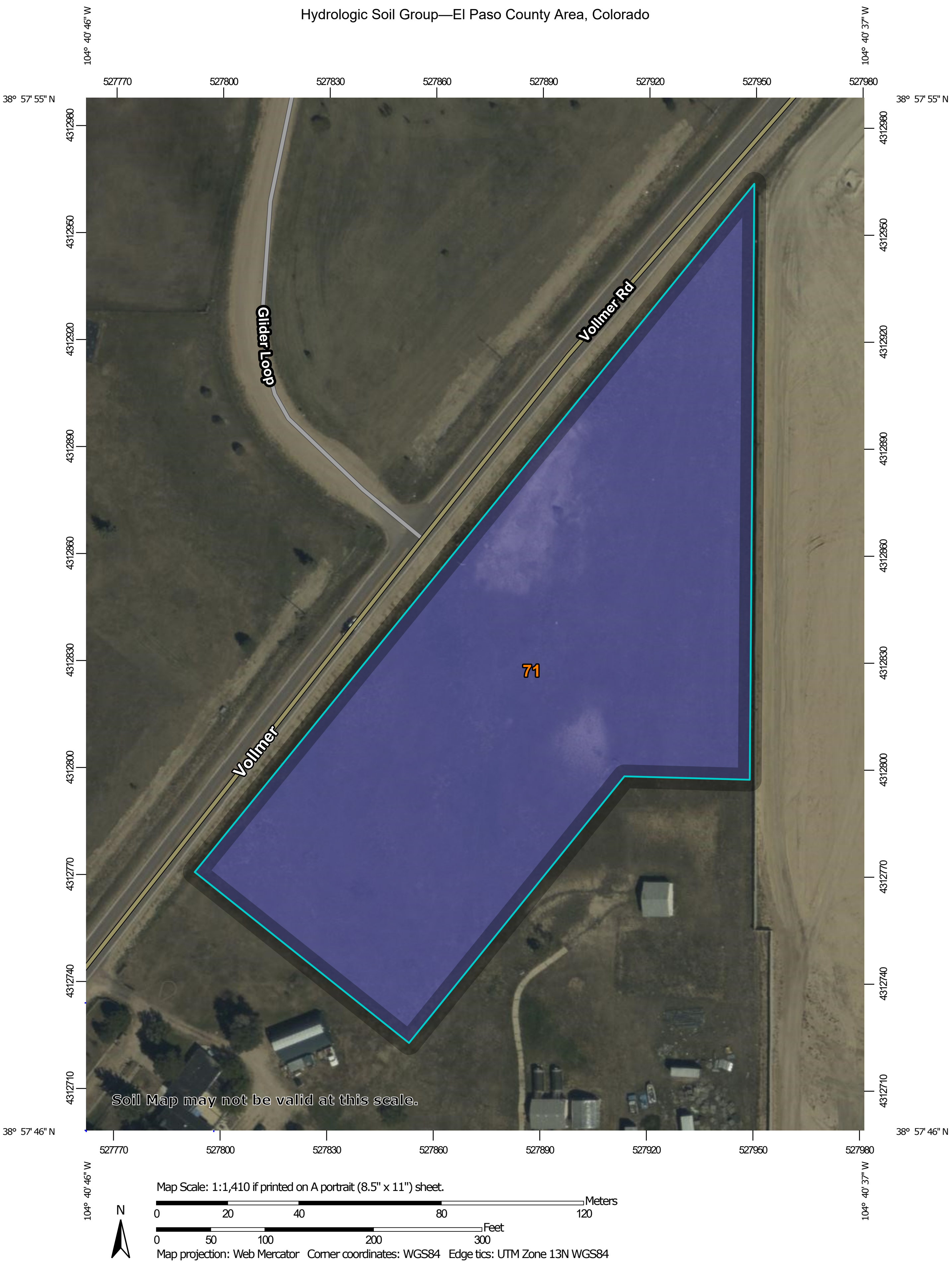
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104° 40' 37" W
38° 57' 55" N
38° 57' 46" N
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Glider Loop
Vollmer Rd
Vollmer
71
Soil Map may not be valid at this scale.
Map Scale: 1:1,410 if printed on A portrait (8.5" x 11") sheet.
Meters
0 20 40 80 120
Feet
0 50 100 200 300
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	4.0	100.0%
Totals for Area of Interest			**4.0**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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 contained within the Flood Insurance Study (FIS) report that accompanies 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 FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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 Flood Insurance Study report for this jurisdiction.

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 **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones 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 (NAVD88)**. 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, MD 20910-3282

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 in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

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.

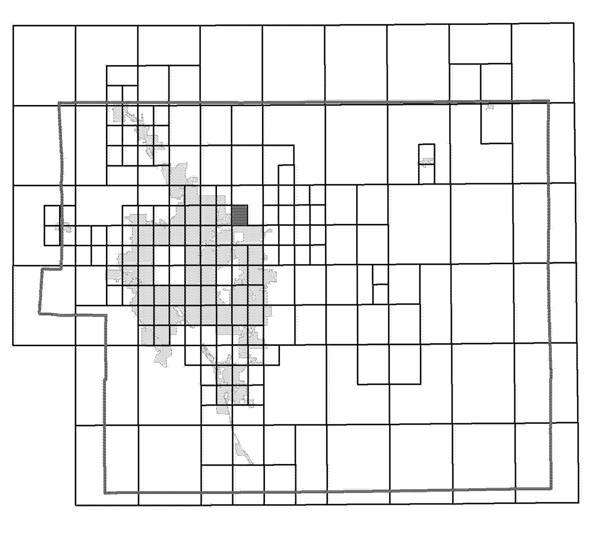
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

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

El Paso County Vertical Datum Offset Table

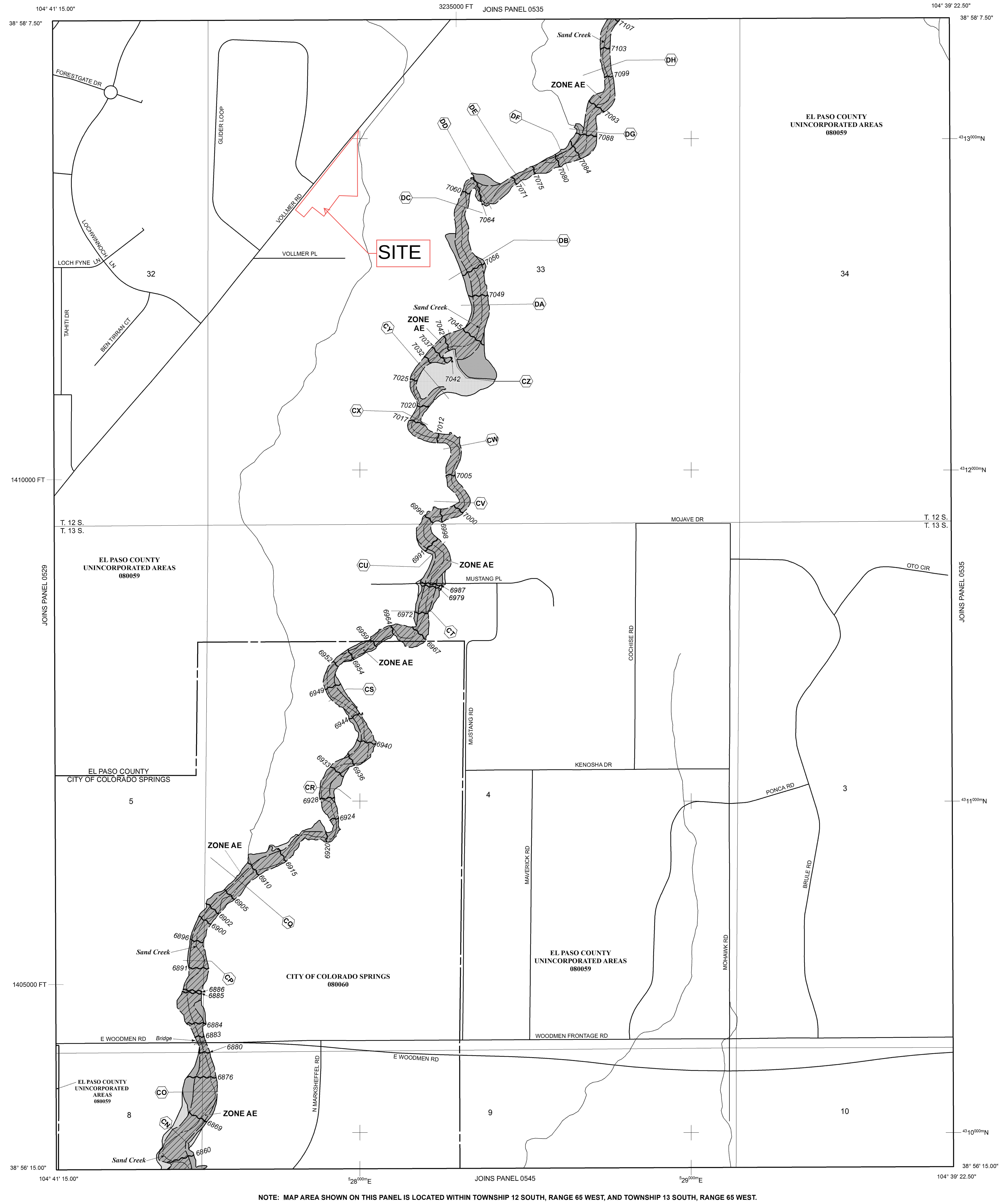
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

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 Area 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.

	Floodplain boundary
	Floodway boundary
	Zone D Boundary
	CBRS and OPA boundary
	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 (NAVD 88)

A —— A	Cross section line
23 -------- 23	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
$^{42}75^{000m}$N	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
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
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and 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 0533G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 533 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0533	G
EL PASO COUNTY	080059	0533	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
08041C0533G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

APPENDIX B

HYDROLOGIC CALCULATIONS

COMPOSITE % IMPERVIOUS CALCULATIONS - EXISTING CONDITIONS

Subdivision: MC CLINTOCK STATION
Location: Colorado Springs

Vollmer Road RV Storage
25251.00
APL
REB
6/23/22

Basin ID	Total Area (ac)	Drives/Walks (100% Imp.) C_5	Drives/Walks (100% Imp.) C_{100}	Drives/Walks (100% Imp.) Area (ac)	Drives/Walks (100% Imp.) Weighted % Imp.	Pasture/Meadow (2% Imp.) C_5	Pasture/Meadow (2% Imp.) C_{100}	Pasture/Meadow (2% Imp.) Area (ac)	Pasture/Meadow (2% Imp.) Weighted % Imp.	Basins Total Weighted C C_5	Basins Total Weighted C C_{100}	Basins Total Weighted % Imp.
EX-1	0.48	0.90	0.96	0.00	0.0%	0.08	0.35	0.48	2.0%	0.08	0.35	2.0%
EX-2	2.22	0.90	0.96	0.00	0.0%	0.08	0.35	2.22	2.0%	0.08	0.35	2.0%
EX-3	0.88	0.90	0.96	0.00	0.0%	0.08	0.35	0.88	2.0%	0.08	0.35	2.0%
EX-4	0.56	0.90	0.96	0.00	0.0%	0.08	0.35	0.56	2.0%	0.08	0.35	2.0%
VX-5	0.27	0.90	0.96	0.08	28.1%	0.08	0.35	0.19	1.4%	0.31	0.52	29.5%
VX-6	0.41	0.90	0.96	0.12	30.4%	0.08	0.35	0.29	1.4%	0.33	0.54	31.8%
VX-7	0.14	0.90	0.96	0.05	34.3%	0.08	0.35	0.09	1.3%	0.36	0.56	35.6%
TOTAL	**4.96**											**6.9%**

Per COS DCM Table 6-6 C-Values for 2% impervious are 0.09 & 0.36. Please update values

STANDARD FORM SF-2 - EXISTING CONDITIONS
TIME OF CONCENTRATION

Subdivision: MC CLINTOCK STATION
Location: El Paso County

Project Name: Vollmer Road RV Storage
Project No.: 25251.00
Calculated By: APL
Checked By: REB
Date: 6/23/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					t_c CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
EX-1	0.48	B	2%	0.08	0.35	136	2.8%	15.4	0	0.0%	7.0	0.0	0.0	15.4	136.0	25.7	15.4
EX-2	2.22	B	2%	0.08	0.35	226	4.2%	17.2	296	2.6%	7.0	1.1	4.4	21.6	522.0	29.0	21.6
EX-3	0.88	B	2%	0.08	0.35	300	3.7%	20.7	78	2.2%	7.0	1.0	1.2	21.9	377.6	26.6	21.9
EX-4	0.56	B	2%	0.08	0.35	122	5.6%	11.5	0	0.0%	7.0	0.0	0.0	11.5	121.7	25.7	11.5
VX-5	0.27	B	30%	0.31	0.52	40	5.7%	5.1	0	0.0%	7.0	0.0	0.0	5.1	39.5	21.0	5.1
VX-6	0.41	B	32%	0.33	0.54	22	9.0%	3.2	455	2.5%	7.0	1.1	6.9	10.0	476.9	24.2	10.0
VX-7	0.14	B	36%	0.36	0.56	40	5.7%	4.7	0	0.0%	7.0	0.0	0.0	4.7	39.5	19.9	5.0

NOTES:

$$t_c = t_i + t_t$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

Equation 6-2

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$

Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Equation 6-5

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

STANDARD FORM SF-3 - EXISTING CONDITIONS
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Project Name: Vollmer Road RV Storage
Subdivision: MC CLINTOCK STATION
Project No.: 25251.00
Location: El Paso County
Calculated By: APL
Design Storm: 5-Year
Checked By: REB
Date: 6/23/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	EX-1	0.48	0.08	15.4	0.04	3.48	0.1															Runoff from Basin EX-1, overland flows southeast, across the property line to Lot B at DP1.
	1.1								15.4	0.09	3.48	0.3											Runoff from Basins EX-1 and VX-7 combine at DP1.1 and continue onto Lot B
	2	EX-2	2.22	0.08	21.6	0.18	2.98	0.5															Runoff from Basin EX-2, overland flows southeast, across the property line to Lot C at DP2.
	2.1								21.6	0.40	2.98	1.2											Runoff from Basins EX-2, VX-6, and VX-5 combine at DP2.1 and continue onto Lot C
	3	EX-3	0.88	0.08	21.9	0.07	2.95	0.2															Runoff from Basin EX-3, overland flows southeast, across the property line to Lot C at DP3.
	4	EX-4	0.56	0.08	11.5	0.04	3.92	0.2															Runoff from Basin EX-4, overland flows east, across the property line to an exisitng swale in the Homestead at Stearling Ranch Development
	5	VX-5	0.27	0.31	5.1	0.08	5.15	0.4															Runoff from Basin VX-5, overland flows southeast, across Vollmer Road and into the Site at DP5.
	6	VX-6	0.41	0.33	10.0	0.13	4.12	0.6															Runoff from Basin VX-6, overland flows southeast, across Vollmer Road and into a road side swale, flow from the swale enters the Site at DP6.
	7	VX-7	0.14	0.36	5.0	0.05	5.17	0.3															Runoff from Basin VX-7, overland flows southeast, across Vollmer Road and into the Site at DP7.

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

STANDARD FORM SF-3 - EXISTING CONDITIONS

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Project Name: Vollmer Road RV Storage
Subdivision: MC CLINTOCK STATION
Project No.: 25251.00
Location: El Paso County
Calculated By: APL
Design Storm: 100-Year
Checked By: REB
Date: 6/23/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	EX-1	0.48	0.35	15.4	0.17	5.85	1.0															Runoff from Basin EX-1, overland flows southeast, across the property line to Lot B at DP1.
	1.1								15.4	0.25	5.85	1.5											Runoff from Basins EX-1 and VX-7 combine at DP1.1 and continue onto Lot B
	2	EX-2	2.22	0.35	21.6	0.78	4.99	3.9															Runoff from Basin EX-2, overland flows southeast, across the property line to Lot C at DP2.
	2.1								21.6	1.14	4.99	5.7											Runoff from Basins EX-2, VX-6, and VX-5 combine at DP2.1 and continue onto Lot C
	3	EX-3	0.88	0.35	21.9	0.31	4.95	1.5															Runoff from Basin EX-3, overland flows southeast, across the property line to Lot C at DP3.
	4	EX-4	0.56	0.35	11.5	0.20	6.58	1.3															Runoff from Basin EX-4, overland flows east, across the property line to an exisitng swale in the Homestead at Stearling Ranch Development
	5	VX-5	0.27	0.52	5.1	0.14	8.65	1.2															Runoff from Basin VX-5, overland flows southeast, across Vollmer Road and into the Site at DP5.
	6	VX-6	0.41	0.54	10.0	0.22	6.92	1.5															Runoff from Basin VX-6, overland flows southeast, across Vollmer Road and into a road side swale, flow from the swale enters the Site at DP6.
	7	VX-7	0.14	0.56	5.0	0.08	8.68	0.7															Runoff from Basin VX-7, overland flows southeast, across Vollmer Road and into the Site at DP7.

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

COMPOSITE % IMPERVIOUS CALCULATIONS - PROPOSED CONDITIONS

Subdivision:	MC CLINTOCK STATION		Vollmer Road RV Storage
Location:	El Paso County		25251.00
			APL
			REB
			6/14/22

Basin ID	Total Area (ac)	Drives/Walks (100% Imp.)				Pasture/Meadow (2% Imp.)				Basins Total Weighted C		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
A	1.62	0.90	0.96	1.11	68.5%	0.08	0.35	0.51	0.6%	0.64	0.77	69.1%
B	1.74	0.90	0.96	1.70	97.7%	0.08	0.35	0.04	0.0%	0.88	0.95	97.7%
C	0.32	0.90	0.96	0.01	2.4%	0.08	0.35	0.31	2.0%	0.10	0.36	4.3%
D	0.10	0.90	0.96	0.00	0.0%	0.08	0.35	0.10	2.0%	0.08	0.35	2.0%
E	0.16	0.90	0.96	0.00	0.0%	0.08	0.35	0.16	2.0%	0.08	0.35	2.0%
F	0.17	0.90	0.96	0.01	8.2%	0.08	0.35	0.16	1.8%	0.15	0.40	10.0%
G	0.84	0.90	0.96	0.25	30.2%	0.08	0.35	0.59	1.4%	0.33	0.53	31.6%
H	0.03	0.90	0.96	0.02	58.0%	0.08	0.35	0.01	0.8%	0.56	0.70	58.8%
TOTAL	**4.98**											**63.1%**
Pond Total	3.68											77%

Per COS DCM Table 6-6 C-Values for 2% impervious are 0.09 & 0.36. Please update values

Did not see any area in Basin B that would not be "paved". Please verify this area

STANDARD FORM SF-2 - PROPOSED CONDITIONS
TIME OF CONCENTRATION

Subdivision: MC CLINTOCK STATION
Location: El Paso County

Project Name: Vollmer Road RV Storage
Project No.: 25251.00
Calculated By: APL
Checked By: REB
Date: 6/14/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					t_c CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
A	1.62	B	69%	0.64	0.77	45.0	10.0%	2.6	722.2	1.1%	20.0	2.1	5.7	8.3	767.2	20.4	8.3
B	1.74	B	98%	0.88	0.95	78.9	3.0%	2.5	556.9	1.1%	20.0	2.1	4.4	6.8	635.7	13.2	6.8
C	0.32	B	4%	0.10	0.36	27.9	21.0%	3.5	305.6	0.5%	20.0	1.4	3.6	7.1	333.5	32.8	7.1
D	0.10	B	2%	0.08	0.35	39.7	1.0%	11.8	0.0	0.0%	7.0	0.0	0.0	11.8	39.7	25.7	11.8
E	0.16	B	2%	0.08	0.35	22.5	5.5%	5.0	0.0	0.0%	7.0	0.0	0.0	5.0	22.5	25.7	5.0
F	0.17	B	10%	0.15	0.40	24.6	19.1%	3.2	0.0	0.0%	7.0	0.0	0.0	3.2	24.6	24.3	5.0
G	0.84	B	32%	0.33	0.53	22.0	9.4%	3.1	871.1	2.1%	7.0	1.0	14.2	17.4	893.1	28.1	17.4
H	0.03	B	59%	0.56	0.70	19.5	15.6%	1.8	14.5	0.6%	7.0	0.5	0.4	2.2	34.0	16.2	5.0

This length seems long, since basin is just the pond. Please verify

NOTES:

$$t_c = t_i + t_t$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

Equation 6-2 $$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$ Equation 6-5

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

STANDARD FORM SF-3 - PROPOSED CONDITIONS

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Project Name: Vollmer Road RV Storage
Subdivision: MC CLINTOCK STATION
Project No.: 25251.00
Location: El Paso County
Calculated By: APL
Design Storm: 5-Year
Checked By: REB
Date: 6/23/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	A	1.62	0.64	8.3	1.04	4.41	4.6															Runoff from Basin A, overland flows southeast & becomes channalized and flows south west to DP1 where flow enters the proposed pond.
	2	B	1.74	0.88	6.8	1.53	4.70	7.2															Runoff from Basin B, overland flows & becomes channalized, runoff flows south west to DP2 where flow enters the proposed pond.
	3	C	0.32	0.10	7.1	0.03	4.64	0.1															Runoff from Basin C, flows down the sides of the pond and becomes channelized in the trickel channel that flows to DP3.
	3.1								8.3	2.60	4.41	11.5											Flows from Basins A,B, and C combine at DP3.1 in the proposed EDB pond.
	4	D	0.10	0.08	11.8	0.01	3.88	0.0															Runoff from Basin D, overland flows east, across the property line to an exisitng swale in the Homestead at Stearling Ranch Development
	5	E	0.16	0.08	5.0	0.01	5.17	0.1															Runoff from Basin E, overland flows southeast, across the propery line and into the neighboring Parcel, Mc Clintock Station Lot C.
	6	F	0.17	0.15	5.0	0.02	5.17	0.1															Runoff from Basin F, overland flows southeast, across the propery line and into the neighboring Parcel, Mc Clintock Station Lot B.
	7	G	0.84	0.33	17.4	0.28	3.30	0.9															Runoff from Basin G, overland flows southeast, across Vollmer Road &into a road side swale, flow enters the proposed 18" culvert at DP7.
	8	H	0.03	0.56	5.0	0.02	5.17	0.1															Runoff from Basin H, overland flows across Vollmer Road & proposed access & into a road side swale to DP 8.
	8.1								17.4	0.29	3.30	1.0											Flows from Basins G & H combine at DP8.1 and contiune to flow southwest along Vollmer Road.

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

STANDARD FORM SF-3 - PROPOSED CONDITIONS
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Project Name: Vollmer Road RV Storage
Subdivision: MC CLINTOCK STATION
Project No.: 25251.00
Location: El Paso County
Calculated By: APL
Design Storm: 100-Year
Checked By: REB
Date: 6/23/22

STREET		DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			
	Design Point	Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1	A	1.62	0.77	8.3	1.24	7.40	9.2															Runoff from Basin A, overland flows southeast & becomes channalized and flows south west to DP1 where flow enters the proposed pond.
	2	B	1.74	0.95	6.8	1.65	7.90	13.0															Runoff from Basin B, overland flows & becomes channalized, runoff flows south west to DP2 where flow enters the proposed pond.
	3	C	0.32	0.36	7.1	0.12	7.80	0.9															Runoff from Basin C, flows down the sides of the pond and becomes channelized in the trickel channel that flows to DP3.
	3.1								8.3	3.01	7.40	22.3											Flows from Basins A,B, and C combine at DP3.1 in the proposed EDB pond.
	4	D	0.10	0.35	11.8	0.04	6.51	0.3															Runoff from Basin D, overland flows east, across the property line to an exisitng swale in the Homestead at Stearling Ranch Development
	5	E	0.16	0.35	5.0	0.06	8.68	0.5															Runoff from Basin E, overland flows southeast, across the propery line and into the neighboring Parcel, Mc Clintock Station Lot C.
	6	F	0.17	0.40	5.0	0.07	8.68	0.6															Runoff from Basin F, overland flows southeast, across the propery line and into the neighboring Parcel, Mc Clintock Station Lot B.
	7	G	0.84	0.53	17.4	0.45	5.54	2.5															Runoff from Basin G, overland flows southeast, across Vollmer Road &into a road side swale, flow enters the proposed 18" culvert at DP7.
	8	H	0.03	0.70	5.0	0.02	8.68	0.2															Runoff from Basin H, overland flows across Vollmer Road & proposed access & into a road side swale to DP 8.
	8.1								17.4	0.47	5.54	2.6											Flows from Basins G & H combine at DP8.1 and contiune to flow southwest along Vollmer Road.

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

APPENDIX C

HYDRAULIC CALCULATIONS

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jun 23 2022

Drive Access Culvert

Invert Elev Dn (ft)	=	7067.17
Pipe Length (ft)	=	44.48
Slope (%)	=	0.50
Invert Elev Up (ft)	=	7067.39
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

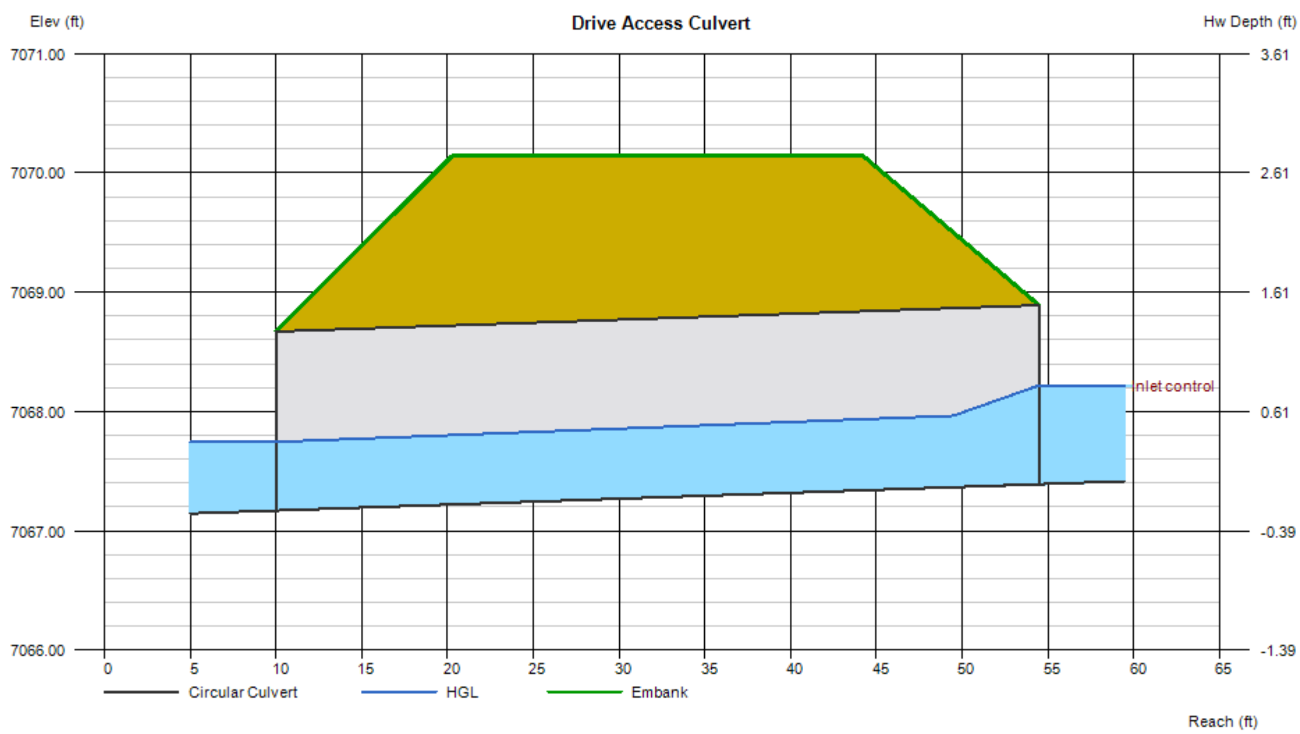
Top Elevation (ft)	=	7070.14
Top Width (ft)	=	24.00
Crest Width (ft)	=	15.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	2.50
Tailwater Elev (ft)	=	0.00

Highlighted

Qtotal (cfs)	=	2.50
Qpipe (cfs)	=	2.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.01
Veloc Up (ft/s)	=	3.77
HGL Dn (ft)	=	7067.75
HGL Up (ft)	=	7067.99
Hw Elev (ft)	=	7068.22
Hw/D (ft)	=	0.55
Flow Regime	=	Inlet Control

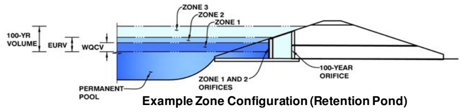


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **Vollmer RVStorage**

Basin ID: **Pond**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	3.68	acres		
Watershed Length =	600	ft		
Watershed Length to Centroid =	300	ft		
Watershed Slope =	0.015	ft/ft		
Watershed Imperviousness =	77.00%	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 =	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) =	0.095	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.314	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.270	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.359	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.433	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.517	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.593	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.682	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	1.146	acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	0.247	acre-feet		
Approximate 5-yr Detention Volume =	0.327	acre-feet		
Approximate 10-yr Detention Volume =	0.408	acre-feet		
Approximate 25-yr Detention Volume =	0.437	acre-feet		
Approximate 50-yr Detention Volume =	0.455	acre-feet		
Approximate 100-yr Detention Volume =	0.481	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.095	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.218	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.168	acre-feet
Total Detention Basin Volume =	0.481	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

63.06

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	--	--	--	10	0.000		
63.29	--	0.23	--	--	--	49	0.001	7	0.000
64	--	0.94	--	--	--	968	0.022	368	0.008
65	--	1.94	--	--	--	4,031	0.093	2,867	0.066
66	--	2.94	--	--	--	5,172	0.119	7,468	0.171
67	--	3.94	--	--	--	6,421	0.147	13,265	0.305
68	--	4.94	--	--	--	7,779	0.179	20,365	0.468
69	--	5.94	--	--	--	9,244	0.212	28,877	0.663
69.5	--	6.44	--	--	--	10,095	0.232	33,711	0.774
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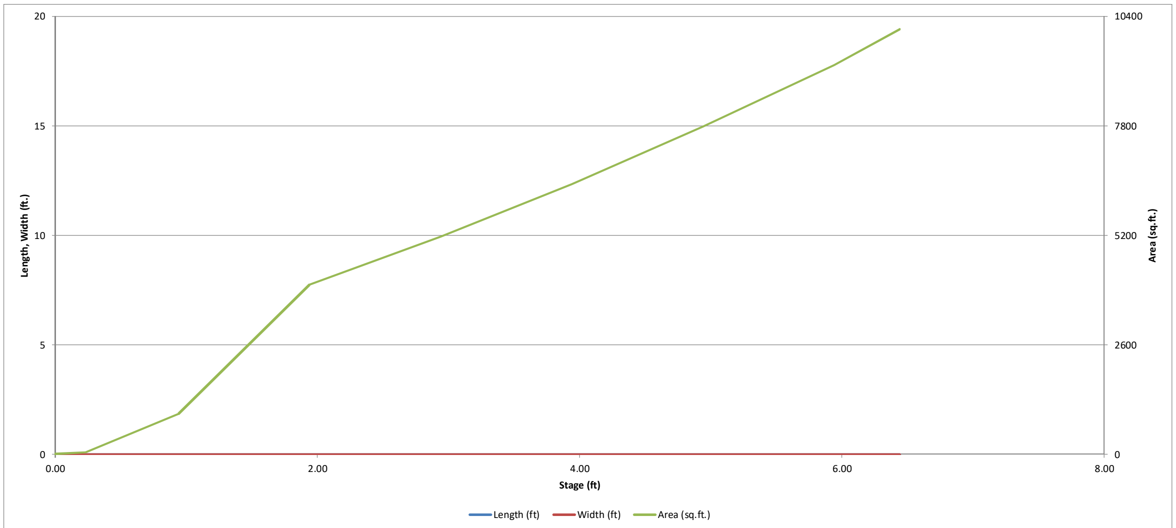
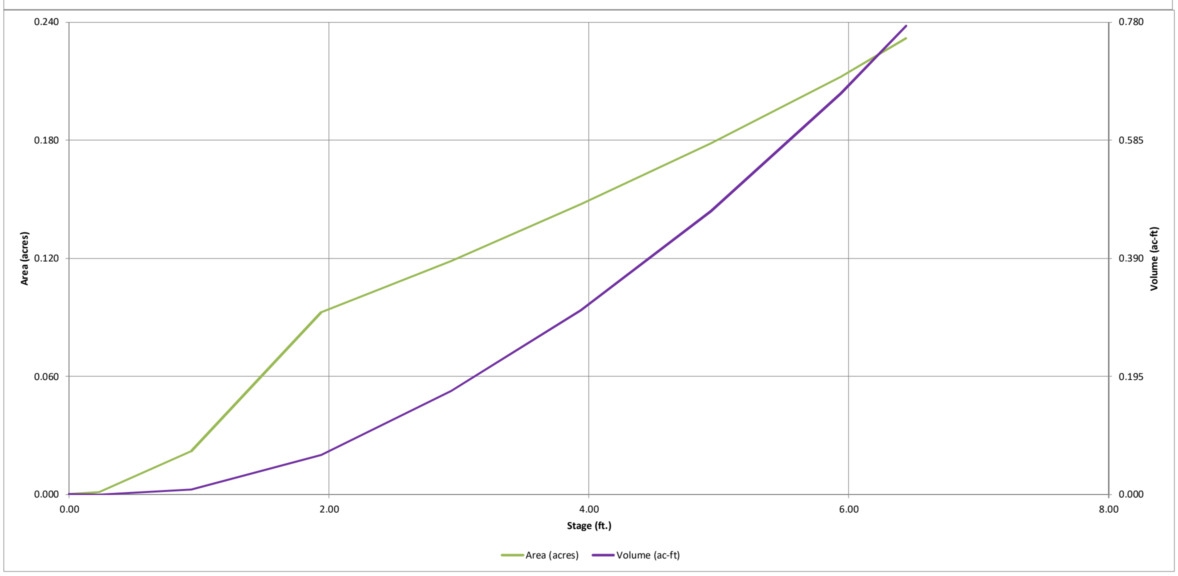
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



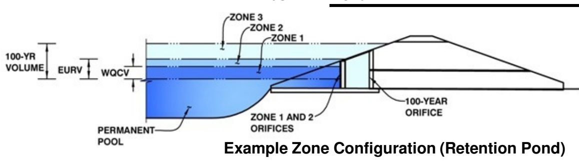


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: Vollmer RVStorage

Basin ID: Pond



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.25	0.095	Orifice Plate
Zone 2 (EURV)	4.01	0.218	Orifice Plate
Zone 3 (100-year)	5.02	0.168	Weir&Pipe (Restrict)
Total (all zones)		0.481	

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

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

Calculated Parameters for Underdrain

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

Calculated Parameters for Plate

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.01	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

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	1.34	2.67	3.00				
Orifice Area (sq. inches)	0.53	0.53	0.53	2.00				

	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)

Calculated Parameters for Vertical Orifice

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

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

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.01	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.01	N/A	feet
Overflow Weir Front Edge Length =	2.00	N/A	feet	Overflow Weir Slope Length =	2.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.95	N/A	
Horiz. Length of Weir Sides =	2.00	N/A	feet	Overflow Grate Open Area w/o Debris =	2.78	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	1.39	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	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 =	0.40	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.25	N/A	feet
Restrictor Plate Height Above Pipe Invert =	5.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.11	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage=	4.94	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.28	feet
Spillway Crest Length =	25.00	feet	Stage at Top of Freeboard =	6.22	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.22	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.72	acre-ft

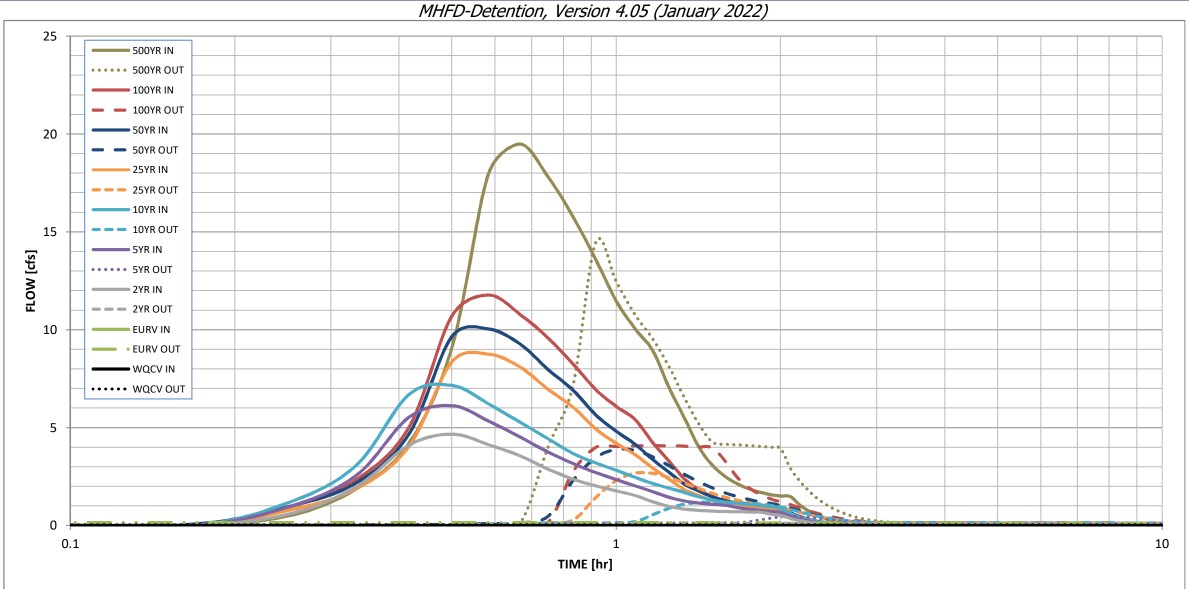
Routed Hydrograph Results

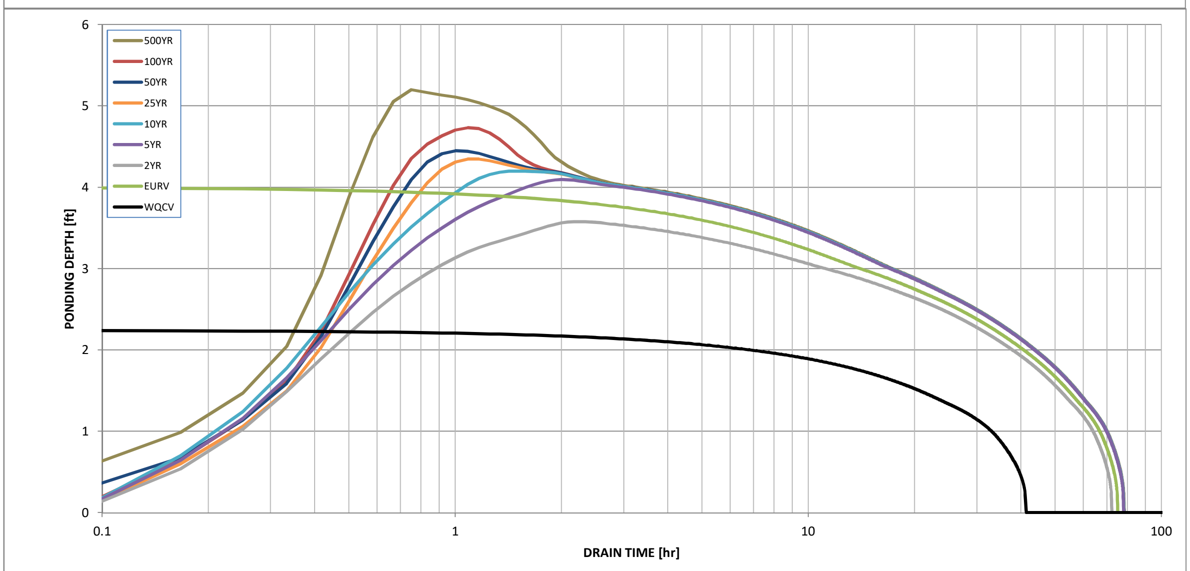
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

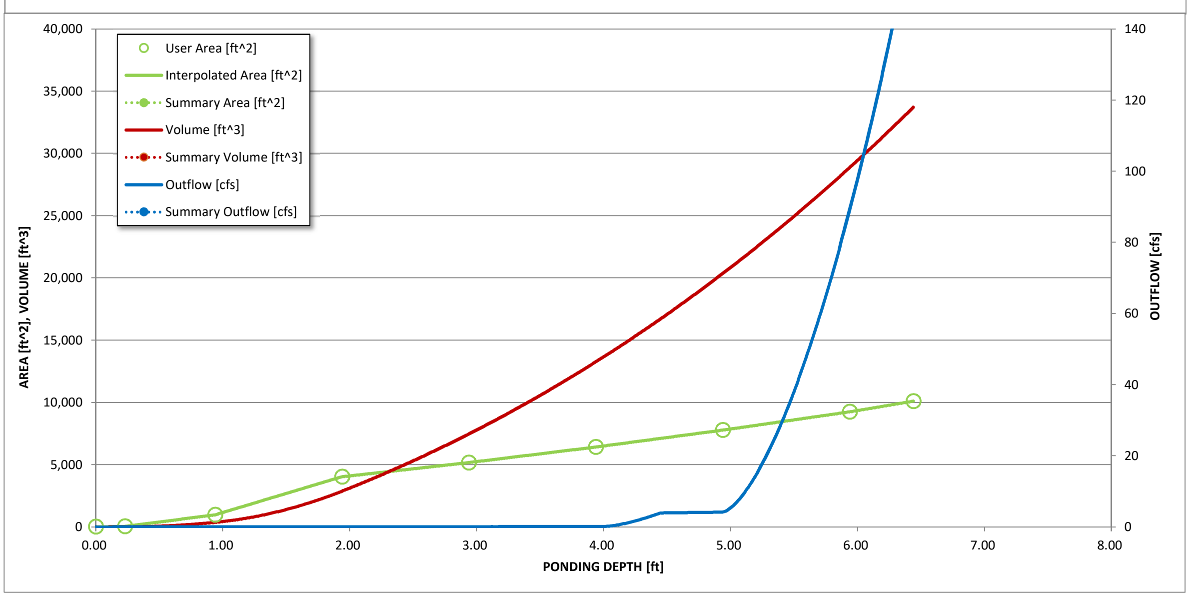
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
CUHP Runoff Volume (acre-ft) =	0.095	0.314	0.270	0.359	0.433	0.517	0.593	0.682	1.146
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.270	0.359	0.433	0.517	0.593	0.682	1.146
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.4	1.0	1.6	2.8	3.5	4.5	8.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.28	0.43	0.76	0.95	1.22	2.39
Peak Inflow Q (cfs) =	N/A	N/A	4.7	6.1	7.2	8.8	10.0	11.8	19.5
Peak Outflow Q (cfs) =	0.0	0.2	0.1	0.5	1.2	2.7	3.9	4.1	14.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.8	1.0	1.1	0.9	1.6
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.4	0.9	1.4	1.4	1.5
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) =	38	67	65	69	68	66	65	63	57
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	70	75	74	73	73	72	69
Maximum Ponding Depth (ft) =	2.25	4.01	3.58	4.10	4.20	4.35	4.45	4.73	5.20
Area at Maximum Ponding Depth (acres) =	0.10	0.15	0.14	0.15	0.16	0.16	0.16	0.17	0.19
Maximum Volume Stored (acre-ft) =	0.096	0.315	0.252	0.327	0.342	0.366	0.382	0.431	0.513

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 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
5.00 min	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]
	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	0.06	0.01	0.49
	0:15:00	0.00	0.00	0.58	0.94	1.16	0.78	0.96	0.95	1.86
	0:20:00	0.00	0.00	1.97	2.55	3.06	1.87	2.17	2.34	4.19
	0:25:00	0.00	0.00	4.11	5.53	6.69	4.04	4.67	5.02	9.12
	0:30:00	0.00	0.00	4.67	6.13	7.16	8.37	9.66	10.72	17.99
	0:35:00	0.00	0.00	4.13	5.34	6.22	8.76	10.05	11.78	19.49
	0:40:00	0.00	0.00	3.56	4.52	5.27	8.10	9.27	10.79	17.81
	0:45:00	0.00	0.00	2.88	3.75	4.44	6.96	7.97	9.58	15.78
	0:50:00	0.00	0.00	2.37	3.17	3.68	6.05	6.92	8.26	13.59
	0:55:00	0.00	0.00	2.03	2.71	3.20	4.94	5.66	6.95	11.47
	1:00:00	0.00	0.00	1.77	2.35	2.82	4.20	4.82	6.09	10.05
	1:05:00	0.00	0.00	1.53	2.02	2.46	3.62	4.15	5.41	8.93
	1:10:00	0.00	0.00	1.22	1.73	2.15	2.94	3.37	4.23	7.03
	1:15:00	0.00	0.00	0.98	1.44	1.91	2.37	2.72	3.28	5.49
	1:20:00	0.00	0.00	0.85	1.26	1.69	1.84	2.11	2.38	4.01
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	1:30:00	0.00	0.00	0.74	1.09	1.32	1.28	1.47	1.48	2.51
	1:35:00	0.00	0.00	0.72	1.04	1.21	1.12	1.28	1.26	2.13
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	1:45:00	0.00	0.00	0.70	0.84	1.08	0.93	1.06	1.00	1.70
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	1:55:00	0.00	0.00	0.59	0.73	0.97	0.84	0.96	0.89	1.51
	2:00:00	0.00	0.00	0.52	0.67	0.87	0.83	0.94	0.88	1.48
	2:05:00	0.00	0.00	0.37	0.48	0.62	0.59	0.66	0.62	1.06
	2:10:00	0.00	0.00	0.26	0.34	0.43	0.41	0.47	0.44	0.75
	2:15:00	0.00	0.00	0.18	0.23	0.30	0.29	0.33	0.31	0.52
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	2:25:00	0.00	0.00	0.08	0.10	0.13	0.13	0.15	0.14	0.23
	2:30:00	0.00	0.00	0.05	0.07	0.09	0.09	0.10	0.09	0.15
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	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 4.05 (January 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]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

APPENDIX D

REFERENCE MATERIALS

SAND CREEK DRAINAGE BASIN PLANNING STUDY

FINAL REPORT
JANUARY 2021

Prepared for:

COLORADO SPRINGS
OLYMPIC CITY USA

STORMWATER ENTERPRISE

Prepared by:

Stantec

HDR

Dewberry®

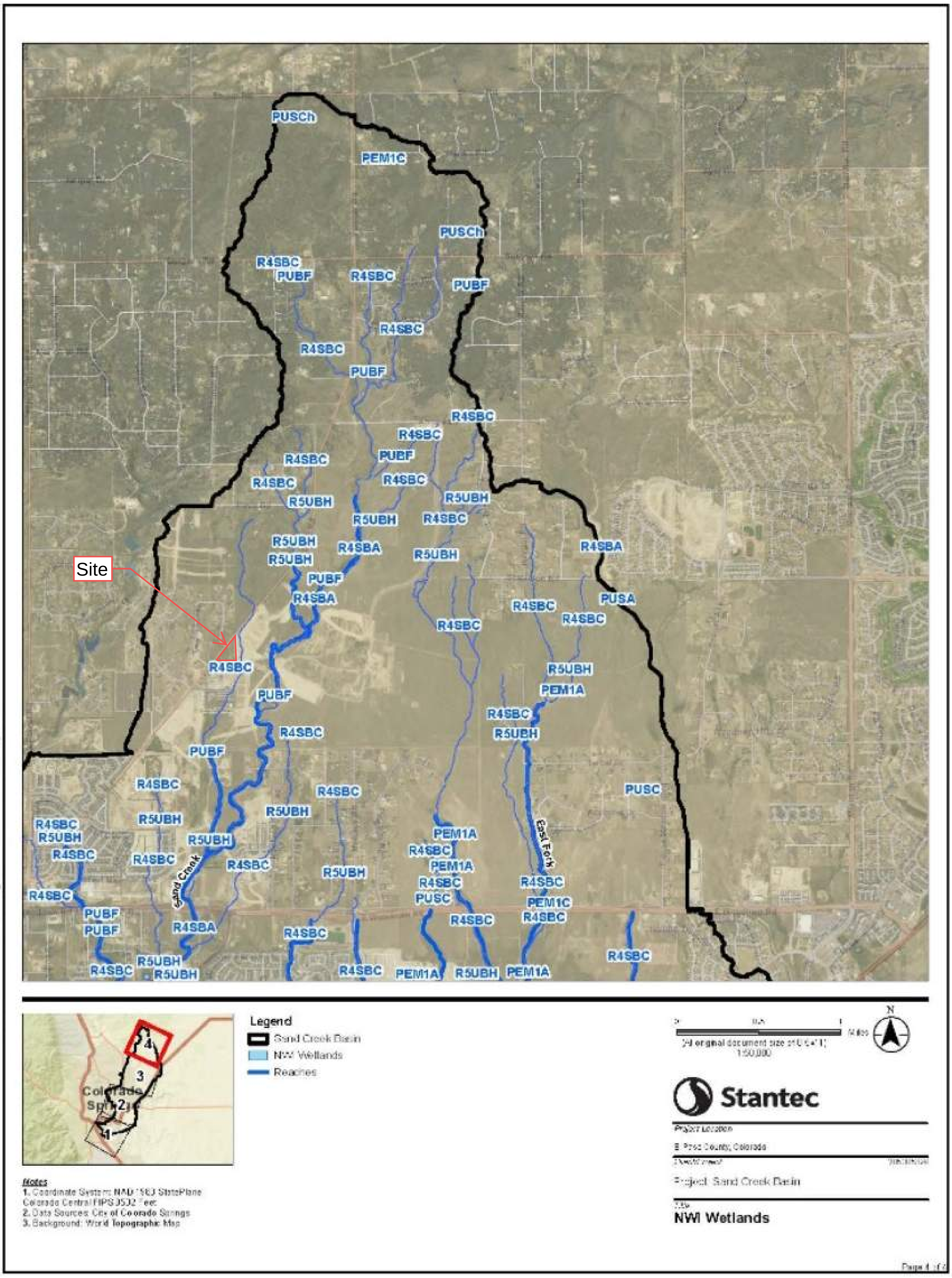


Figure 2-7: NWI Wetlands Located in Sand Creek Drainage Basin (Page 4)

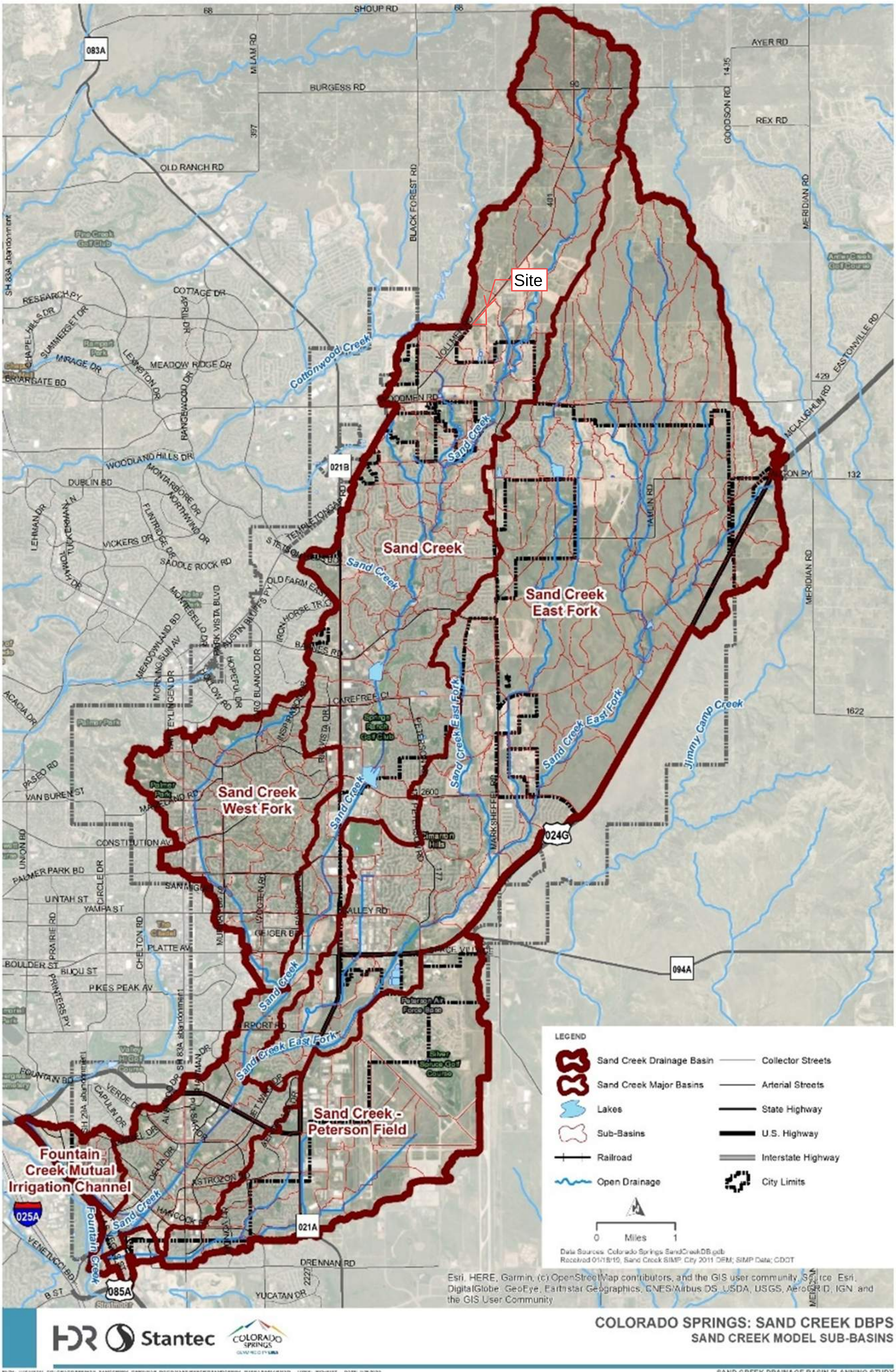


Figure 3-1. Major Sub-basin Map

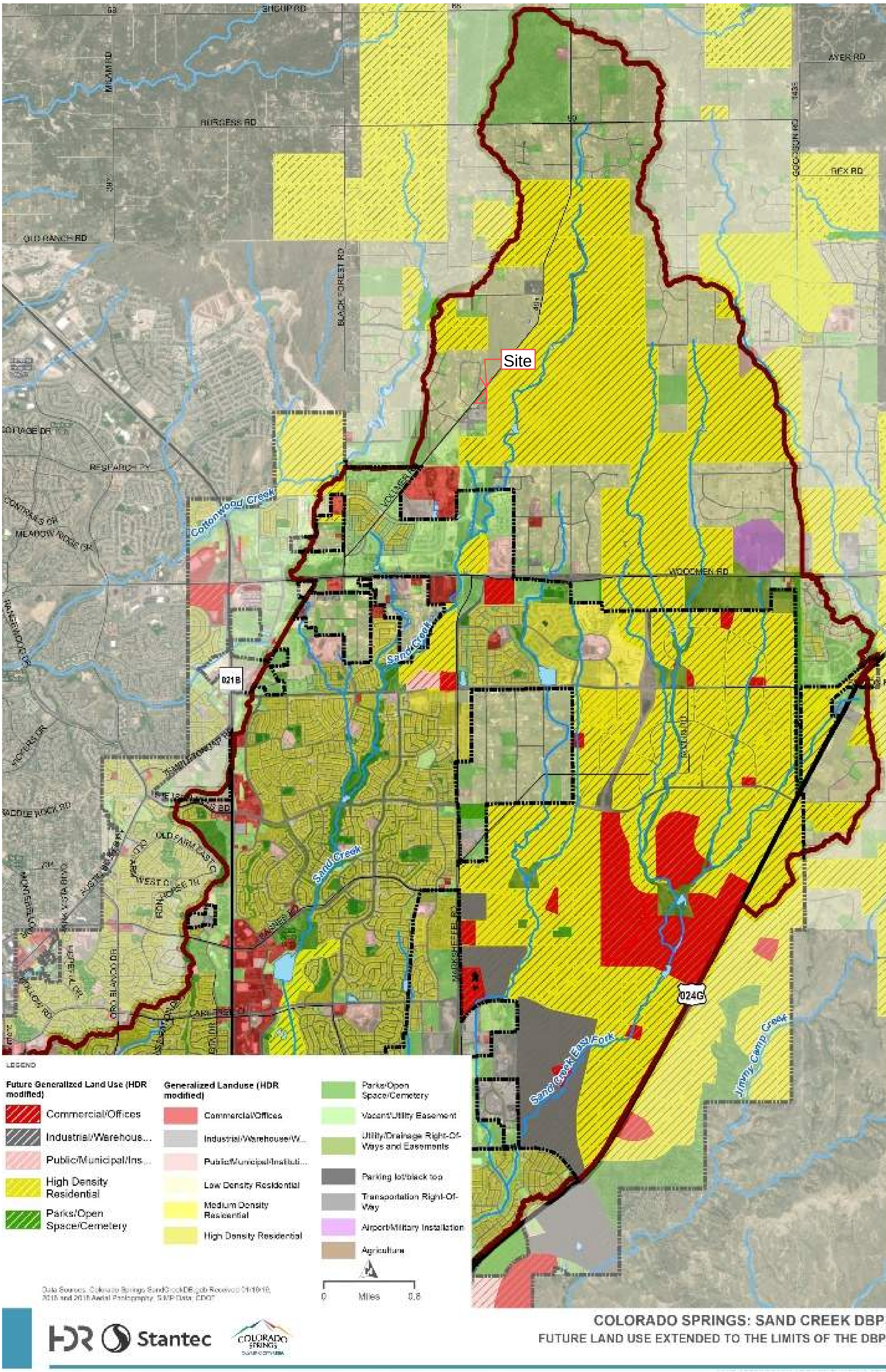


Figure 3-15. **Future Land Use MapFuture Condition Model Results**

NEW DOC

FINAL DRAINAGE REPORT
For

BARBARICK SUBDIVISION, PORTIONS OF LOTS 1, 2 and LOTS 3 & 4
El Paso County, Colorado

Sand Creek Drainage Basin

RECEIVED
JUN 08 2016
BY: my 730

Prepared for:
El Paso County Development Services
Engineering Division

On Behalf of:
Wykota Construction
430 Beacon Light Road, Suite 130
Monument, CO 80132

Prepared by:

Matrix DESIGN GROUP
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
(719) 575-0100
Fax (719) 572-0208

June 6, 2016

15.789.001

plus the time of travel (t_t) in concentrated form, such as a swale or drainageway. A minimum T_c of 5 minutes and 10 minutes were used for the final calculations in developed and undeveloped conditions, respectively.

Storm Drain Systems
All proposed storm drain infrastructure will be located within private property and will be owned and maintained by the property owner.

The storm drain hydraulics is analyzed using *Bentley's* FlowMaster, CulvertMaster & StormCAD design software. Colorado Department of Transportation (CDOT) type inlets will be used where necessary.

The designated outfall locations for the proposed on-site storm drains are the natural drainage ways at the south end of the property. The proposed storm drain infrastructure will be discussed in more detail below.

EXISTING DRAINAGE REPORT DISCUSSION

The approved Barbarick Subdivision Final Drainage Report (BS-FDR) and the approved Woodmen Storage Final Drainage Report (WS-FDR) both apply to the existing general drainage conditions for this site. The off-site basins and general flow patterns in the BS-FDR and WS-FDR still apply. Excerpts from these reports are provided below for reference.

On-site and Off-Site Basin Descriptions from the BS-FDR and WS-FDR:

The following summary is taken from the Barbarick Subdivision Final Drainage Report (BS-FDR):

Off-site:

Off-site Basin O3 This basin encompasses approximately 7.03 acres and represents the area north and northwest of Lot 1. This basin drains into Lot 1 through a series of (2) 24" CMP pipes which control the flow of 14/36 cfs in the 5/100 year storm events.

Lots 1 & 2 – these lots are considered fully developed lots and drain north to south collecting at the existing concrete settling pond on Lot 2. This developed flow (20.8 cfs /57.2 cfs) combines with Off-site Basin O3 to total 30.5 cfs / 80.8 cfs in the greenbelt offsite south of Lot 2. At the time of development permit for these developed lots, a detention pond for water quality will be required, probably in the area of the existing concrete settling pond, that will accommodate Lots 1 and 2 west of the gas easement and flood plain area.

On-site:

On-site Basins A1 and B1 (for portions of Lots 1 and 2, and Lots 3 & 4)
These basins encompass approximately 5.3 & 3.8 acres and represent the buildable portions of the property as described in the BS-FDR (see Basin Map from BS-FDR below). These basins were slated (in the BS-FDR) to drain into small detention ponds that would release to historic rates. These discharge rates were calculated to be 2.9/7.3 and 2.2/5.4 cfs (5/100 year). The BS-FDR does not include the drainage ways in any hydrology calculations due to the fact that this no-build drainage area was not planed on being developed. This drainage way allowed off-site flows from O1+O2 to pass-through Lots 3 & 4. The drainage way to the west of A1 passes through flows from offsite O3. Since the approval of this report, offsite tributary basins O1+O2 have been changed, and the development of the property encompasses the whole property, including the previously determined no-build area.

The following summary is taken from the Woodmen Storage Final Drainage Report (WS-FDR):

Off-site:

Design Point 5 - This design point encompasses approximately 19.69 acres and represents the tributary area north of the project site. This basin drains into a proposed detention pond near the northeast corner of the property and generates 57.4/92.7 cfs in the 10/100 year storm events, historic flows are 16.7/30.3 cfs. The releases rates from this pond are lower than historic 16.1 cfs/29.4 cfs in the 10/100-year storm events. These flows are conveyed along the east property line of the site and into the eastern natural drainage way that leaves the property to the south.

Review of the Sterling Ranch Preliminary Drainage Report (SR-PDR):

The Barbarick Subdivision is surrounded on three sides by the planned Sterling Ranch Development. The approved Sterling Ranch PDR was prepared by M&S Civil Consultants in May of 2015. This Sterling Ranch PDR re-analyzes runoff from Barbarick Subdivision and plans for storm drain improvements to convey this runoff to a full spectrum detention and water quality pond to be located down stream of Barbarick Subdivision as part of Sterling Ranch Phase One.

In summary; the Sterling Ranch PDR is planning on receiving 73.3/139.2 cfs (5/100 year) from Basin OS3. A 54" RCP is planned to convey this flow through Sterling Ranch. The Sterling Ranch PDR is planning on receiving 45/86 cfs (5/100 year) from OS2, encompasses Lots 1 & 2 and OS3 encompasses Lots 3 & 4 and the Basin north of Lot 3. A 48" RCP is planned to convey this flow through Sterling Ranch. The cumulative runoff from the northerly property and Lots 1 through 4 does not exceed the anticipated rates in the SR-PDR.

condition rangeland and generates 0.3/2.7 cfs in the 5/100 year storm events. This basin sheet flows offsite where it is captured in a small swale between the site and existing roadway and conveyed westerly to the low point south of the outfall of Basin H1.

These existing basins encompass the previously unmodelled drainage area from the BS-FDR. The total historic flow from the site is 3.8/34.6 cfs in the 5/100 year storm events. The following design point table is for combined allowable discharge rates from the property at respective locations including historic flows from the tributary upstream basins:

Design Point	5/100 Release	Comments
DP H1	16.7*/30.3 cfs	DP H5 WS-FDR - * is 10year
DP H2	13.7/35.5 cfs	O3 BS-FDR
DP H3	56.7 cfs	DPH1+H1+H3 (100-year)
DP H4	14.6/43.7 cfs	DPH2 + H2

Design Point H3 will release a flow lower than previously anticipated within the BS-FDR (52.9/170 cfs). It is the introduction of development within the Sterling Ranch site that has eliminated offsite flows from BS-FDR Basin O1 that significantly changed the drainage pattern. The historic release is now contained solely to the historic flows from WS-FDR design point H5 and the proposed onsite historic flows.

Design Point H4 will combine with the western half of Lots 1&2. Per the BS-FDR the combined portions of Lots 1&2 and O3 to release a combined flow of 30.5/80.8 cfs downstream. The flow anticipated in the BS-FDR appears consistent with the smaller basin analysis of this report and should be used for downstream analysis.

PROPOSED DRAINAGE DISCUSSION

Introduction

The proposed site will be developed differently than anticipated in the previous BS-FDR. The previous plan for this site maintained the existing native drainage way down the middle of Lots 1 & 2 and 3 & 4, thereby splitting the buildable area into the outer thirds of these lots. The native drainage way and "Drainage Boundary – No Build Area" (as shown on the Plat & FDR) will be eliminated with the proposed development. The proposed site and proposed drainage improvements will allow this native drainage way to be eliminated while maintaining the pass through of major flows. These modifications to the site and to the drainage patterns will allow a larger buildable area.

The existing retention pond, located just north of Lot 3, will be modified by others to become a water quality/detention pond pursuant to the WS-FDR. A new outlet works and a storm drain pipe will convey runoff from this detention pond (16.1/29.4 cfs in the 10/100 year storm events) discharging at the property line. This development is proposing a CDOT Type D inlet to capture the discharged flow and pipe it downstream along the east side of Lots 3 & 4 to discharge into the proposed Full Spectrum Extended

Detention Basin (EDB) in Lot 4. The EDB is designed to pass through, and not treat or detain, these offsite flows.

A new EDB will be provided in Lot 4. This detention basin will provide water quality treatment for portions of Lots 1 & 2, and Lots 3 & 4. In the approved Barbarick FDR there were to be two separate ponds. The new site development has been planned for a single pond to treat the developed flows. Tributary water sheet flow across the site to shallow swales that will direct runoff to the proposed EDB. The EDB will have a forebay at the confluence of the two pipe outfalls, a concrete trickle channel that terminates at a micropool structure, and is designed to treat the WQCV, EURV and 100-year detention.

A second SFB water quality with detention catchment basin will be provided at the south east/downstream end of Lot 2. This SFB will not have an outlet structure to release flows due to requirements from the gas main utility ownership of no structure to be built within the existing easements. There will be a small spillway to allow the release of large storm events. Runoff will be directed to the proposed SFB where possible.

Flow from the area north of Lot 1 (Basin O3) will pass through the site via two 24" culverts and will be discharged at the southern boundary of Lot 2, as historically done. An earthen channel will run north-south along the east side of the existing Lot 1 and Lot 2 developments. The channel is approximately 1-ft deep with 4:1 side slopes and will capture and convey any westerly flowing nuisance runoff from the proposed improvements to the sand filter detention pond as discussed in the original Barbarick Subdivision FDR, instead of the existing Lot 1 and 2 improved areas.

Runoff from the property is at historic flows and will not exceed the anticipated runoff as determined in the Sterling Ranch PDR. This is described in more detail below. The Sterling Ranch PDR includes an analysis of future drainage conditions and includes recommended infrastructure to convey this runoff. Since the Sterling Ranch surrounds the Barbarick Subdivision, it is appropriate to include the recommendations from the SR-PDR in this Proposed Drainage Discussion.

Proposed On-Site Basin Descriptions: (See Basin Map in the pocket)

On-site Basin D1 (D for Developed condition) - This developed basin encompasses approximately 11.4 acres - the majority of Lots 3 & 4 and small portions of Lots 1 & 2. This basin generates 19.7/56.0 cfs in the 5/100 year storm events and sheet flows into shallow swales that direct the runoff into the proposed EDB to be located in Lot 4. Lot 3 is based on Owner provided information for a gravel parking/vehicle storage area, and Lot 4 has been based on proposed building site improvements as identified in the rezoning application. Any changes to the land use will require an update to the Final Drainage Report; much like the original Barbarick Subdivision Final Drainage Report is being updated with the grading and Lot 4 development application.

On-site Basin D2 This undeveloped basin encompasses 1.2 acres and represents the south portion of Lot 4, below and south of the two detention ponds. This basin is historic in nature and generates 0.8/3.0 cfs and drains directly into a road side ditch within the Sterling Ranch development.

On-site Basin D3 This developed basin encompasses approximately 3.13 acres - the remaining proposed infill portions of Lots 1 and 2 (east of the currently built out Lots 1&2). As discussed in the original Barbarick Subdivision FDR, development of these areas will require a detention water quality pond. This basin generates 4.1/11.6 cfs in the 5/100 year storm events and sheet flows southerly to the proposed SFB located at the southern-most portion of Lot 2.

The following design point table is for combined allowable discharge rates from the property at respective locations including historic flows from the tributary upstream basins:

Design Point	5/100 Year	Comments
DP D1	85.4 cfs (100)	D1+O2 Pass Through
DP D2	48.9 cfs (100)	Pond Release+D2
DP D3	4.1/11.6 cfs	D3
DP D4	13.8/39.1 cfs	Pond Release +03 Pass Through

All release flows downstream are at or below historic levels.

RECOMMENDED DESIGN

Off-site Detention Facility:

This shallow pond will be modified for the proposed development to the north as part of the WS-FDR. This will eliminate the retention properties in this pond, will provide detention for off-site flows, will provide a suitable outlet structure, and will remove accumulated sediment. The modified pond will store up to 1.52 acft (66,211 cuft) to the principal spillway (elevation = 7048.05). A summary of flows into and out of this pond:

Off-site Pond Flow Summary (cfs)	5 year	100 year
Proposed Flow into offsite pond (Basin G/DP 5)	**57.4**	**92.7**
Increase in peak flow due to development	46.2	51.3
Proposed flow out of modified pond	**16.1**	**29.4**
Reduction in peak flow	41.3	63.3

For complete pond design, refer to the WS-FDR.

Proposed 30" HDPE Storm Drain from Modified Off-site Detention Pond:

This storm drain will capture flows from the discharged offsite pond and route them along the perimeter of the property daylighting into the EDB in Lot 4. 4' precast concrete manholes will be used for maintenance access at all bends and grade breaks. A grouted riprap forebay will help dissipate energy at the outlet of the pipe, and allow for settling prior to entering the pond. See the Appendix for the hydraulic analysis of this storm drain (StormCAD).

In the event of an emergency and the offsite pond fails, developed flow (Q100=93.0 cfs) will overtop the pond and be collected between the proposed roadway and pond berm.. Flow not captured by the proposed inlet will bypass easterly to the proposed offsite swale between this property and the Sterling Ranch property and conveyed southerly.

Proposed 18" HDPE Storm Drain Culvert:

A 18" HDPE culvert will convey collected runoff from Lot 3 (Developed Q100 = 15.90cfs) through Lot 4 to the FSD Pond and join sheet flow from Lot 4 and the 30" piped bypass flow from basin O2. This culvert will be privately owned and maintained by the property owners. See the Appendix for open channel calculations.

On-site FSD - EDB Pond in Lot 4 (Basin D1):

This On-site Full Spectrum Extended Detention Basin Pond provides water quality, EURV and 100-year detention. Onsite flows will combine with the 30-inch bypass flows from the north and pass through the EDB. The pond has been sized for the release of historic flows from Basin D1, as well as provides capacity for pass through conveyance of historic flows from the north.

The following table outlines the onsite existing and developed flow, required detention, and modifications to required detention utilizing the upstream over detention.

On-site Basin Flow Summary (cfs)	5 year	100 year
Existing On-site Flow at Pond	2.2	16.5
Developed On-site Flow (Basin D1)	19.7	56.0
Increase in peak flow due to development	17.5	39.5
Proposed Pass Through Flow from Off-Site Pond	16.1*	29.4
Proposed total flow out of EDB pond	0.3	45.9**

*Includes 10 year from WS-FDR
**Includes Pass Through flow of 29.4 cfs

Matrix DESIGN GROUP

Final Design for Full Spectrum Detention Basins

Project: Barbarick Subdivision

Basin ID: Lot 3 FSD Pond

See Outlet Structure Figure on Initial Design Worksheet

User Input: Watershed Parameters

Watershed Area =	11.40	acres
Watershed Length =	668	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	57.0%	percent
Percentage Hydrologic Soil Group A =	5%	percent
Percentage Hydrologic Soil Group B =	95%	percent
Percentage Hydrologic Soil Groups C/D =	0%	percent
Location for 1-hr Rainfall Depths =	User Input	

User Input: Detention Basin Parameters

Depth of Initial Surcharge Volume =	0.33	ft
Depth of Trickle Channel =	0.50	ft
Trickle Channel Slope =	0.005	ft/ft
Available EURV Ponding Depth =	3.00	ft (2.99 ft recommended)
Desired WQCV Drain Time =	40	hours

User Input: Outlet Structure Parameters

Overflow Weir Front Edge Height, H_o =	3.3	ft (relative to lowest WQ orifice)
Overflow Weir Front Edge Length =	6.0	ft
Overflow Weir Slope =	0	H:V (enter zero for flat grate)
Horizontal Length of the Overflow Weir Sides =	3.5	ft
Overflow Grate Open Area % =	70%	%, grate open area / total area
Debris Clogging % =	50%	%

Calculated Outlet Discharge Parameters

Height of Grate Upper Edge H_t =	3.3	ft
Over Flow Weir Slope Length =	3.5	ft
Grate Open Area /100-yr Orifice Area =	9.3	should be ≥ 4
Overflow Grate Area w/o Debris =	14.7	ft^2

User Input: Water Quality Orifices (numbered from lowest to highest)

	Row 1	Row 2	Row 3	Row 4	Row 5
Area (sq inch)	1.55	1.55	3.80		
Stage (ft)	0.00	1.00	2.00		

	Row 6	Row 7	Row 8	Row 9	Row 10
Area (sq inch)					
Stage (ft)					

User Input: 100-Year Orifice Parameters

100-yr Restrictor Plate Type =	Circular Orifice	
100-Year Orifice Invert Depth =	1.2	ft (below the lowest WQ orifice)
100-Year Orifice Diameter =	17.0	in

Calculated 100-yr Orifice Parameters

100-Year Orifice Area =	1.6	ft^2
100-Year Orifice Centroid =	0.71	ft
Half-Central Angle of Plate on Pipe =		radians

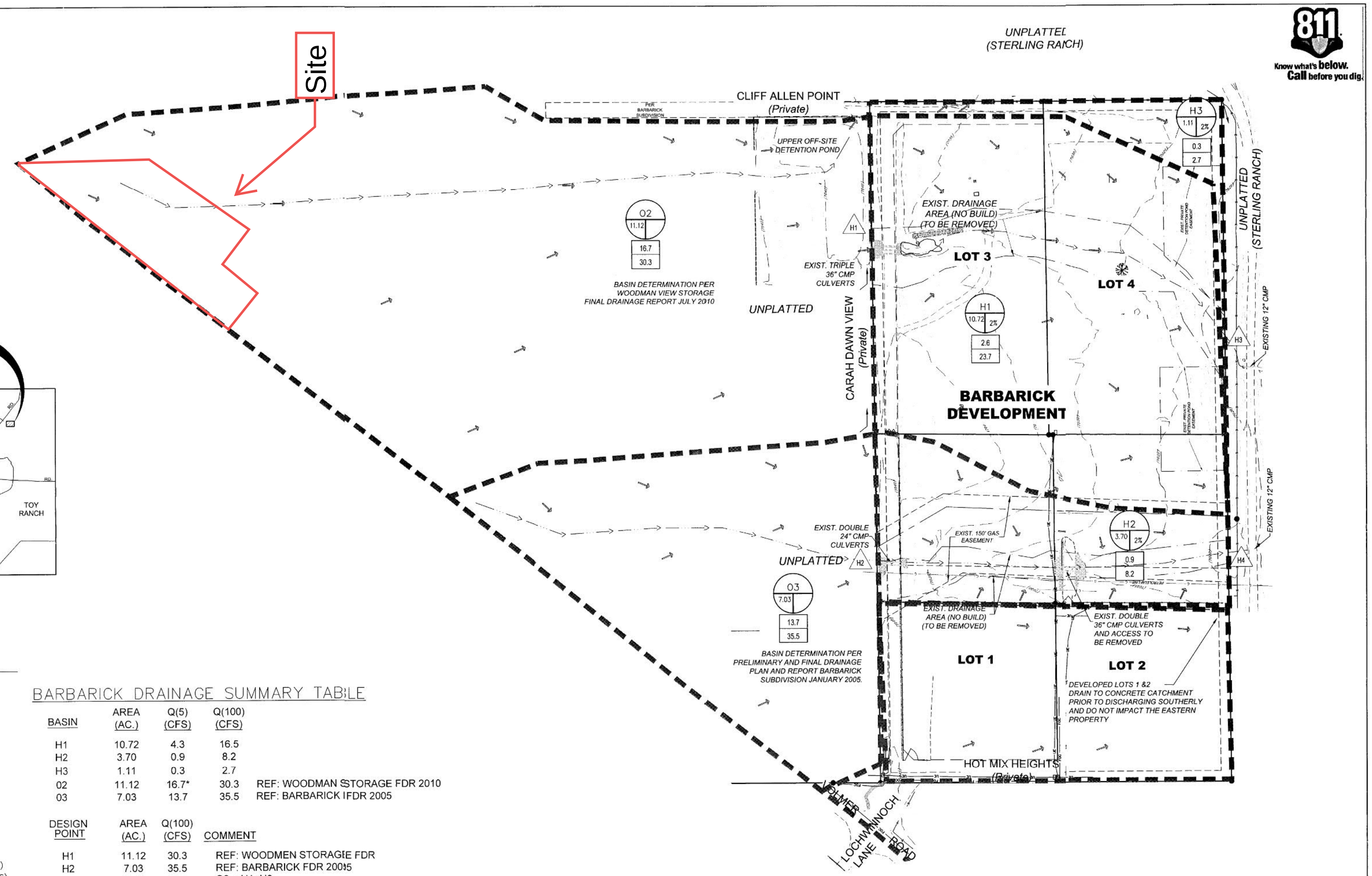
User Input: Emergency Spillway Parameters

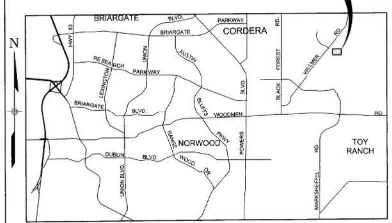
Spillway Invert Stage=	4.7	ft (relative to lowest WQ orifice)
Spillway Crest Length =	23	ft
Spillway End Slopes =	4.0	H:V
Freeboard above Spillway =	1.0	ft

Calculated Spillway Parameters

Spillway Design Flow Depth=	0.8	ft
Stage at Top of Freeboard =	6.5	ft
Basin Area at Top of Freeboard =	0.63	acres

User Defined Stage (ft)	User Defined Area (ft^2)	User Defined Volume (ac-ft)
0.00	1,250	0.00
0.50	4,076	0.03
1.50	10,413	0.19
2.50	15,584	0.49
3.00	17,528	0.68
3.50	19,472	0.89
4.50	23,488	1.38
4.70	24,472	1.49
5.50	27,426	1.97
6.50	31,603	2.64





VICINITY MAP

N.T.S.

LEGEND

- SUB-BASIN BOUNDARY
- EXISTING CONTOUR
- PHASE 3A FILING LIMITS
- TEMPORARY DIVERSION SWALE
- LOT LINE
- X — DESIGN POINT
- XX — SUB BASIN DESIGNATION
- 99.9 — SUB BASIN PERCENT IMPERVIOUS
- 0.99 — SUB BASIN AREA (AC.)
- 0.0 — 5-YEAR STORM EVENT PEAK FLOW (CFS)
- 0.0 — 100-YEAR STORM EVENT PEAK FLOW (CFS)
- PROPOSED FLOW DIRECTION
- EXISTING FLOW DIRECTION

BARBARICK DRAINAGE SUMMARY TABLE

BASIN	AREA (AC.)	Q(5) (CFS)	Q(100) (CFS)	
H1	10.72	4.3	16.5	
H2	3.70	0.9	8.2	
H3	1.11	0.3	2.7	
O2	11.12	16.7*	30.3	REF: WOODMAN STORAGE FDR 2010
O3	7.03	13.7	35.5	REF: BARBARICK IFDR 2005

DESIGN POINT	AREA (AC.)	Q(100) (CFS)	COMMENT
H1	11.12	30.3	REF: WOODMEN STORAGE FDR
H2	7.03	35.5	REF: BARBARICK FDR 2005
H3	22.95	56.7	O2 + H1+H3
H4	10.73	43.7	O3 + H2

REFERENCE DRAWINGS
EX-TOPO
EX-PROP-BDRY
EX-FEATURES
X-Title(Drainage)
pr-site
EX-UTIL

NO.	DATE	DESCRIPTION	BY

REVISIONS

NAME: S:\15.789.001 Tri Lakes\Dwg\CD\Drainage\20160605-DP01.dwg
PCP: Matrix.ctb
PLOT DATE: Tue Jun 07, 2016 12:49pm

BENCHMARK DATA(ELEV.) ____
(DATUM) ____
(DESCRIPTION/LOCATION) ____

VERTICAL BENCHMARK:
THE VERTICAL INFORMATION ON THIS MAP IS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 AND THE 1960 SUPPLEMENTARY ADJUSTMENT BEING A FOUND 3.25" ALUMINUM CAP IN A ROAD BBOX DESIGNATED AS FACILITIES INFORMATION MANAGEMENT SYSTEM (FIMS) MONUMENT "F_E69" AND HAVING PUBLISHED ELEVATION OF 6975.62 FEET WAS USED TO REFERENCE THIS VERTICAL DATUM. THE BENCHMARK IS LOCATED ON THE WEST SIDE OF BLACK FOREST ROAD, ABOUT 1.95 MILES SOUTH OF OLD RANCH ROAD, JUST SOUTH OF THE SCHMIDT CONSTRUCTION COMPANY DRIVEWAY. A CORNER FENCE POST IS 28.1 FEET TO THE SOUTHWEST, AND THE MOST SOUTHERLY GUARD RAIL POST IS 25.7 FEET TO THE NORTH.

BASIS OF BEARING:
THE BASIS OF BEARINGS FOR THIS MAP IS THE NORTH LINE OF BARBARICK SUBDIVISION ACCORDING TO THE OFFICIAL MAP THEREOF RECORDED FEBRUARY 12, 2008 IN THE OFFICE OF THE EL PASO COUNTY CLERK AND RECORDER UNDER RECEPTION NUMBER 208712754,SAID LINE MONUMENTED ON THE WEST END BY A FOUND 5/8" REBAR AND ON THE EAST BY A FOUND 4/8" REBAR WITH 1" ALUMINUM CAP STAMPED "LS 2154" BEING A POINT ON THE NORTH LINE BEARING NORTH 89°12'41 EAST 12287.35 FEET FROM THE WEST END THEREOF.

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

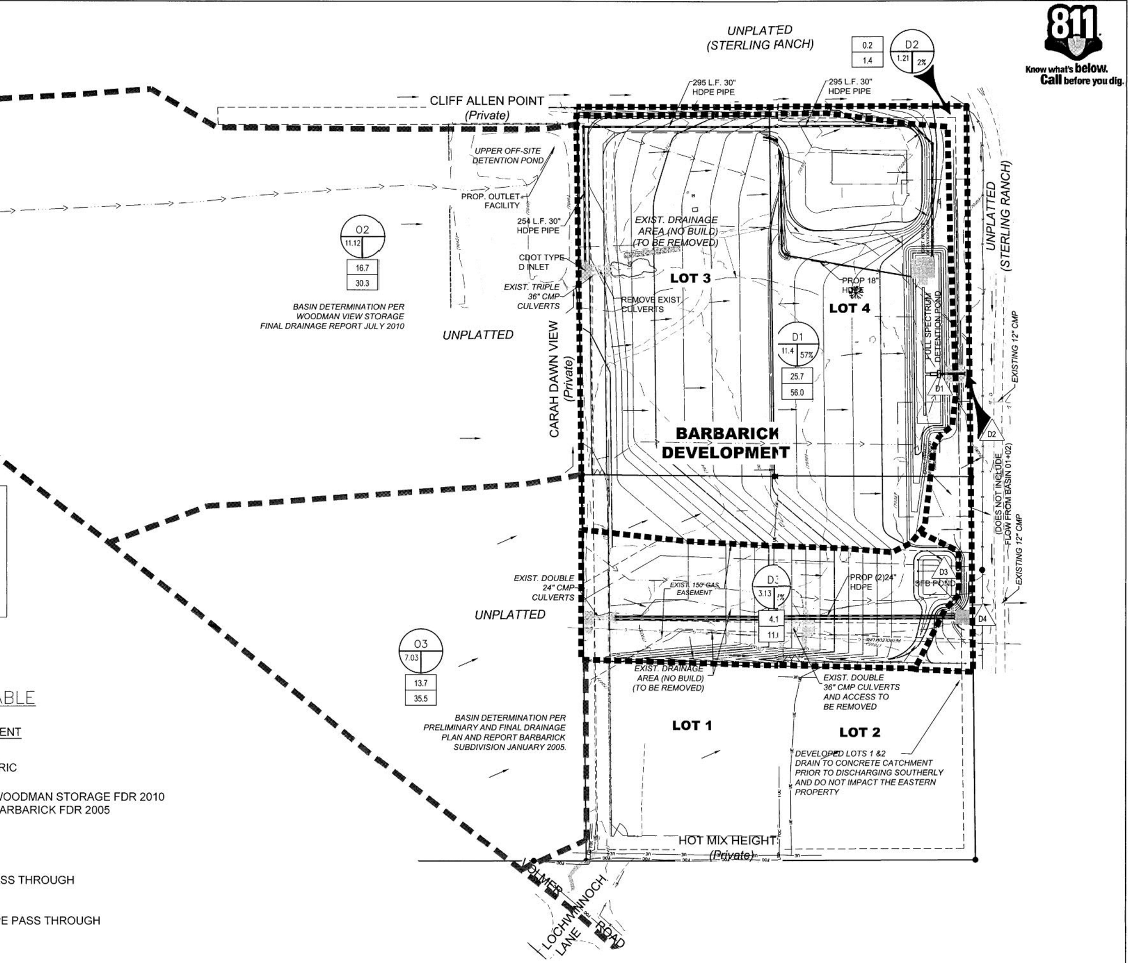
Matrix DESIGN GROUP
2435 Research Parkway, Suite 300 Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

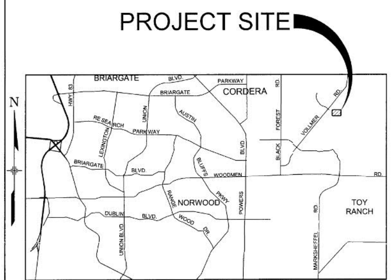
BARBARICK SUBDIVISION LOTS 1-4

EXISTING CONDITIONS DRAINAGE PLAN

DESIGNED BY: BJH	SCALE	DATE ISSUED: April 2016
DRAWN BY: BJH	HORIZ: 1"=50'	
CHECKED BY: ES	VERT: N/A	SHEET NO. 1 OF 2 SHEETS

DP01





VICINITY MAP

N.T.S.

SAND FILTER POND
V_{WQ} = 0.039 AC-FT
WQ WSE = 23.37
EURV WC = 0.181
EURV ELEV = 24.52
100-YR WSE = 0.394 AC-FT
100-YR ELEV = 25.83
Q_5 RELEASE = 0.1 CFS
Q_{100} RELEASE = 3.6 CFS

FSD POND
V_{WQ} = 0.203 AC-FT
WQ WSE = 20.03
V_5 = 0.673 AC-FT
5-YR WSE = 21.50
V_{100} = 1.261 AC-FT
100-YR WSE = 22.76
Q_{100} RELEASE = 45.9 CFS
EURV = 0.677 AC-FT
EURV ELEV = 21.50

BARBARICK DRAINAGE SUMMARY TABLE

BASIN	AREA (AC.)	Q(5 (CFS)	Q(100) (CFS)	% IMP.	COMMENT
D1	11.40	25.7	56.0	57%	
D2	1.21	0.8	3.0	2%	HISTORIC
D3	3.13	4.1	11.6	57%	
02	11.12	16.7	30.3		REFF: WOODMAN STORAGE FDR 2010
03	7.03	13.7	35.5		REFF: BARBARICK FDR 2005

DESIGN POINT	AREA (AC.)	Q(100) (CFS)	COMMENT
D1	11.40	85.4	D1 BASIN TO FSD +02 PASS THROUGH
D2	22.52	48.9	POND RELEASE + D2
D3	3.13	11.6	D3 BASIN TO SFB
D4	10.16	39.1	POND RELEASE + O3 PIPE PASS THROUGH

LEGEND

- SUB-BASIN BOUNDARY
- EXISTING CONTOUR
- PHASE 3A FILING LIMITS
- TEMPORARY DIVERSION SWALE
- LOT LINE
- DESIGN POINT
- SUB BASIN DESIGNATION
- SUB BASIN PERCENT IMPERVIOUS
- SUB BASIN AREA (AC.)
- 5 -YEAR STORM EVENT PEAK FLOW (CFS)
- 100-YEAR STORM EVENT PEAK FLOW (CFS)
- PROPOSED FLOW DIRECTION
- EXISTING FLOW DIRECTION

REFERENCE DRAWINGS
EX-TOPO
EX-PROP-BDRY
EX-FEATURES
X-Title(Drainage)
pr-site
EX-UTIL

NO.	DATE	DESCRIPTION	BY

REVISIONS

NAME: S:\15.789.001 Tri Lakes\Dwg\CD\Drainage\20160605-DP01.dwg
PCP: Matrix.ctb
PLOT DATE: Tue Jun 07, 2016 12:49pm

BENCHMARK DATA(ELEV.) ____________
(DATUM) ____________
(DESCRIPTION/LOCATION) ____________

VERTICAL BENCHMARK:

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PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

Matrix DESIGN GROUP
2435 Research Parkway, Suite 300 Colorado Springs, CO 80920
Phone 719-575-0100
Fax 719-575-0208

BARBARICK SUBDIVISION LOTS 1-4

PROPOSED DRAINAGE PLAN

DESIGNED BY	BJH	SCALE		DATE ISSUED:	April 2016
DRAWN BY:	BJH	HORIZ	1"=100'	SHEET NO.	1 OF 2 SHEETS
CHECKED BY	ES	VERT:	N/A		

DP02

Calibre

WOODMAN VIEW STORAGE
FINAL DRAINAGE REPORT

JULY 2004
REVISED FEBRUARY 2010
REVISED MAY 2010
REVISED JULY 2010

For:

Woodmen View Storage
2720 Meridian Road
Peyton, CO 80831

2.2 Sub-Basin Description

- Historically, the runoff sheet-flows across the site to the south where it enters one of two draws to Sand Creek.
- A large upstream basin sheet-flows across the site.
- The offsite basin will continue to sheet-flow through the site in the developed conditions and is routed through the onsite detention pond.
- A swale is provided along the west property line to covey the discharge from the existing culvert under Vollmer Place.

3.0 DRAINAGE DESIGN CRITERIA

3.1 Development Criteria Reference and Constraints

- Previous studies for the proposed site or the surrounding areas are not available.
- The *Sand Creek Drainage Basin Planning Study* does not affect the proposed site.
- This study is in compliance with the following Standards except where stated herein:
    - *City of Colorado Springs and El Paso County Drainage Criteria Manual Volume 1 & 2*
- The simplicity and proposed use of the site do not create any drainage constraints.
- The proposed detention pond and outlet works must be constructed within the proposed site.

3.2 Hydrological Criteria

- Design rainfall is from the City/County's Criteria.
- The rational method was used to calculate peak runoff rates for the development.
- The 10-year storm was used as the minor event.
- The 100-year storm was used as the major event.
- Detention storage requirements were calculated using the Rational Stored Rate Method.

- The Water Quality Capture Volume was calculated using the City/County's criteria.
- The combined runoff from the detention pond and developed undetained basins will be less than or equal to the total historic runoff rate from the site.

4.0 DRAINAGE FACILITY DESIGN

4.1 General Concepts

The following are concepts and typical drainage patterns of the proposed drainage system:

- Runoff generated in both the minor and major storm events will sheet-flow overland to the onsite detention pond.
- A swale is graded along the west property line to convey runoff from the north side of Vollmer Place and to keep onsite runoff from leaving the site.
- The proposed development is divided into seven basins (A, B, C, D, E, F, and G).
- Basins A-D are offsite basins. The offsite basins will continue to flow through the site and will be routed through the onsite detention pond.
- Basins E-G are made up entirely of the proposed development.
- Basin E will sheet-flow to the onsite detention pond.
- Basins F and G will be released from the site undetained.

Offsite runoff will be handled in the following ways:

- Offsite flows entering the site are conveyed through the site and proposed detention pond.

The following tables, charts, and figures are presented in the appendix of this report:

- Vicinity Map and Soils Map
- [1]FIRM Map
- Runoff computation sheets
- Detention Pond calculations
- Water Quality Capture Volume calculations
- [1]Pond Outfall Sizing spreadsheet
- [1]Restrictor Plate Sizing
- [1]Weir Design Spreadsheet
- [2]Culvert Calculations

- [2]Riprap Sizing Calculations
- Tables and charts from *City of Colorado Springs and El Paso County Drainage Criteria Manual*

4.2 Specific Details

- It is anticipated the site will be developed in two phases.
- The detention facility must be constructed with the first phase.
- [2]The flows released from the detention pond (16.1 cfs and 29.4 cfs) during the 10-year and 100-year events respectively, are equal to the historic flow rates at Design Point H5 (16.7 cfs and 30.3 cfs) less the developed flows released from the site undetained at Design Point 7 (0.6 cfs and 0.9 cfs).
- The detention volume was calculated using the City/County's Criteria.
- The WQCV was calculated using the City/County's Criteria.
- [1] The outlet structure for the detention pond consists of a Modified Type D inlet. The rim of the inlet is set at the water quality water surface elevation and will collect the 10-year flow.
- [1] The 100-year flow will outfall over a weir directly to one of the draws that drain to Sand Creek.
- An 18" HDPE culvert is provided at DP3 to convey the 100-year flow, 12.5cfs, from the onsite swale along the west property line to the onsite detention pond.
- Maintenance access to the detention pond will be provided via proposed drive aisles within the development and a gentle slope to the bottom of the pond per the City/Counties criteria.
- It is the responsibility of the property owner to maintain all drainage facilities.
- There are no immediate adverse impacts on downstream properties. The flows released from the site are equal to the historic flow rates through the site.

Calibre

DETENTION POND CALCULATIONS

Woodman View Storage
El Paso County, CO

DETENTION POND CRITERIA

Peak release rate for the developed 10-yr and 100-yr events shall not exceed the historic rate for the drainage area

Criteria References:
El Paso County/City of Colorado Springs Drainage Criteria Manual
Urban Drainage and Flood Control District Criteria Manual

DETENTION POND RELEASE RATE CALCULATION

10-yr Historic Runoff (cfs)
Design Point H5 = 16.7
Design Point H7 = 15.3

10-yr Developed Runoff (cfs)
Design Point 5 = 57.4
Design Point 6 = 2.3
Design Point 7 = 0.6

100-yr Historic Runoff (cfs)
Design Point H5 = 30.3
Design Point H7 = 30.0

100-yr Developed Runoff (cfs)
Design Point 5 = 92.7
Design Point 6 = 3.7
Design Point 7 = 0.9

Allowable Release Rate at DP 5 (cfs)
10-yr = 16.1 (DP H5 - DP 7)
100-yr = 29.4 (DP H5 - DP 7)

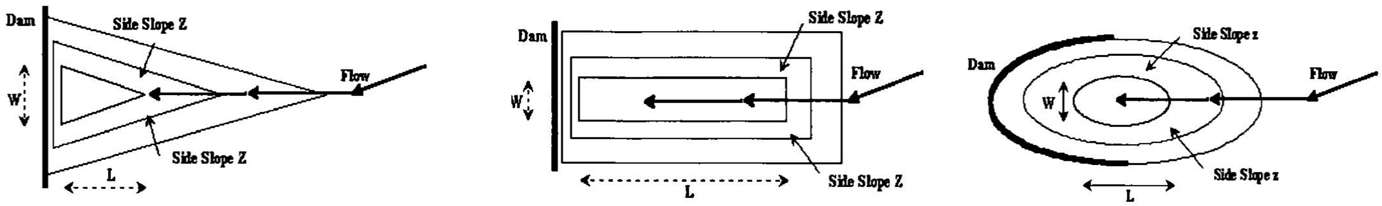
Allowable Release Rate at DP 6 (cfs)
10-yr = 15.3 (Developed < Historic therefore no detention
100-yr = 30.0 at this location)

DETENTION POND VOLUME CALCULATION

Water Quality Capture Volume (VQCV) = 0.30	**AC-FT**	UDFCD WQCV Calculation	7045.74
10-yr Volume = 0.85	AC-FT	Rational Storage Rate Method	
10-yr Volume + WQVC = 1.15	**AC-FT**		7047.47
100-yr Volume = 1.37	AC-FT	Rational Storage Rate Method	
100-yr Volume + WQVC/2 = 1.52	**AC-FT**		7048.05

STAGE-STORAGE SIZING FOR POLYGONAL, ELLIPTICAL, OR IRREGULAR PONDS

Project: Woodman View Storage Final Drainage
Basin ID:



Design Information (Input):

Width of Pond Bottom, W =		ft
Length of Pond Bottom, L =		ft
Dam Side-slope (H:V), Z_d =		ft/ft

Check Pond Shape

Right Triangle		OR...
Isosceles Triangle		OR...
Rectangle		OR...
Circle / Ellipse		OR...
Irregular	X	(Use Overide values in cells G32:G52)

Stage-Storage Relationship:

	MINOR	MAJOR	
Storage Requirement from Sheet 'Modified FAA':			acre-ft.
Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Storage Requirement from Sheet 'Full-Spectrum':			acre-ft.

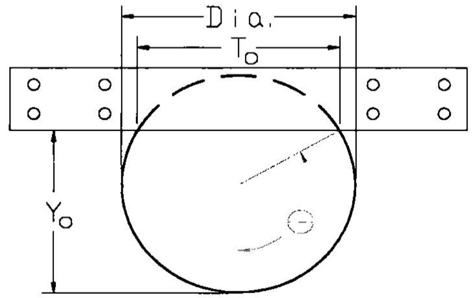
Labels for WQCV, Minor, & Major Storage Stages (input)	Stage ft (input)	Side Slope (H:V) ft/ft Below El. (input)	Pond Width at Stage ft (output)	Pond Length at Stage ft (output)	Surface Area at Stage ft^2 (output)	Surface Area at Stage ft^2 User Overide	Volume Below Stage ft^3 (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage Volumes (for goal seek)
	7043.00					0		0.000	0.000	
	7043.20		0.00	0.00		85	8	0.002	0.000	
	7043.40		0.00	0.00		541	71	0.012	0.002	
	7043.60		0.00	0.00		1,206	246	0.028	0.006	
	7043.80		0.00	0.00		1,802	547	0.041	0.013	
	7044.00		0.00	0.00		2,468	974	0.057	0.022	
	7044.20		0.00	0.00		3,221	1,542	0.074	0.035	
	7044.40		0.00	0.00		4,074	2,272	0.094	0.052	
	7044.60		0.00	0.00		5,029	3,182	0.115	0.073	
	7044.80		0.00	0.00		6,067	4,292	0.139	0.099	
	7045.00		0.00	0.00		7,256	5,624	0.167	0.129	
	7045.20		0.00	0.00		8,604	7,210	0.198	0.166	
	7045.40		0.00	0.00		10,126	9,083	0.232	0.209	
	7045.60		0.00	0.00		11,774	11,273	0.270	0.259	
WQCV	7045.80		0.00	0.00		13,756	13,826	0.316	0.317	0.30 REQUIRED
	7046.00		0.00	0.00		16,086	16,810	0.369	0.386	
	7046.20		0.00	0.00		18,669	20,286	0.429	0.466	
	7046.40		0.00	0.00		21,153	24,268	0.486	0.557	
	7046.60		0.00	0.00		22,506	28,634	0.517	0.657	
	7046.80		0.00	0.00		23,692	33,254	0.544	0.763	
	7047.00		0.00	0.00		24,730	38,096	0.568	0.875	
	7047.20		0.00	0.00		25,577	43,127	0.587	0.990	
	7047.40		0.00	0.00		26,259	48,310	0.603	1.109	
10-YR WSEL	7047.60		0.00	0.00		26,971	53,633	0.619	1.231	1.15 REQUIRED
	7047.80		0.00	0.00		27,873	59,118	0.640	1.357	
	7048.00		0.00	0.00		28,982	64,803	0.665	1.488	
100-YR WSEL	7048.20		0.00	0.00		30,276	70,729	0.695	1.624	1.52 REQUIRED
	7048.40		0.00	0.00		31,774	76,934	0.729	1.766	

RESTRICTOR PLATE SIZING FOR CIRCULAR VERTICAL ORIFICES

Project: **Woodman View Storage Final Drainage**

Basin ID:

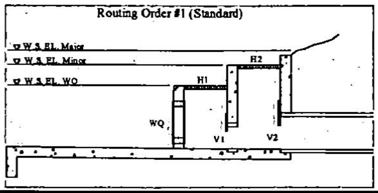
X

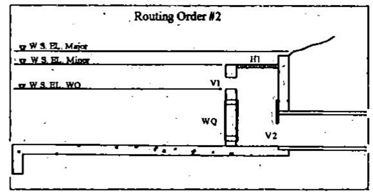


		#1 Vertical Orifice	#2 Vertical Orifice	
Sizing the Restrictor Plate for Circular Vertical Orifices or Pipes (Input)				
Water Surface Elevation at Design Depth	Elev: WS =	7,047.74		feet
Pipe/Vertical Orifice Entrance Invert Elevation	Elev: Invert =	7,042.67		feet
Required Peak Flow through Orifice at Design Depth	Q =	8.05		cfs
Pipe/Vertical Orifice Diameter (inches)	Dia =	18.0		inches
Orifice Coefficient	C_o =	0.65		
Full-flow Capacity (Calculated)				
Full-flow area	Af =	1.77		sq ft
Half Central Angle in Radians	Theta =	3.14		rad
Full-flow capacity	Qf =	19.2		cfs
	Percent of Design Flow =	238%		
Calculation of Orifice Flow Condition				
Half Central Angle (0<Theta<3.1416)	Theta =	1.42		rad
Flow area	A_o =	0.71		sq ft
Top width of Orifice (inches)	T_o =	17.78		inches
Height from Invert of Orifice to Bottom of Plate (feet)	Y_o =	0.63		feet
Elevation of Bottom of Plate	Elev Plate Bottom Edge =	7,043.30		feet
Resultant Peak Flow Through Orifice at Design Depth	Q_o =	8.1		cfs
Width of Equivalent Rectangular Vertical Orifice	**Equivalent Width =**	**1.13**		**feet**
Centroid Elevation of Equivalent Rectangular Vertical Orifice	**Equiv. Centroid El. =**	**7,042.99**		**feet**

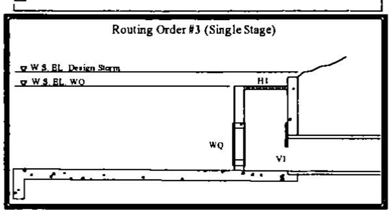
STAGE-DISCHARGE SIZING OF THE WEIRS AND ORIFICES (INLET CONTROL)

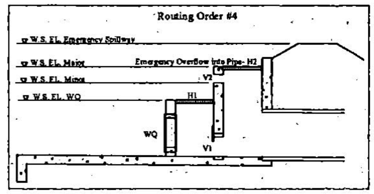
Project: Woodman View Storage Final Drainage
Basin ID:





Current Routing Order is #3





Design Information (Input):

			#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Circular Opening:	Diameter in Inches	Dia. =					inches
OR							
Rectangular Opening:	Width in Feet	W =	2.92		1.55		ft.
	Length (Height for Vertical)	L or H =	5.67		0.93		ft.
	Percentage of Open Area After Trash Rack Reduction	% open =	38		100		%
	Orifice Coefficient	C_o =	0.65		0.65		
	Weir Coefficient	C_w =	2.55				
	Orifice Elevation (Bottom for Vertical)	E_o =	7045.74		7,042.67		ft.

Calculation of Collection Capacity:

		#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Net Opening Area (after Trash Rack Reduction)	A_o =	6.21		1.44		sq. ft.
OPTIONAL: User-Overide Net Opening Area	A_o =					sq. ft.
Perimeter as Weir Length	L_w =	13.53	ft.			
OPTIONAL: User-Overide Weir Length	L_w =		ft.			
Top Elevation of Vertical Orifice Opening, Top =				7043.60		ft.
Center Elevation of Vertical Orifice Opening, Cen =				7043.14		ft.

Routing 3: Single Stage - Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow will be applied to culvert sheet (#2 vertical & horizontal openings is not used).

			Horizontal Orifices				Vertical Orifices			
Labels for WQCV, Minor, & Major Storage W.S. Elevations (input)	Water Surface Elevation ft (linked)	WQCV Plate/Riser Flow cfs (User-linked)	#1 Horiz. Weir Flow cfs (output)	#1 Horiz. Orifice Flow cfs (output)	#2 Horiz. Weir Flow cfs (output)	#2 Horiz. Orifice Flow cfs (output)	#1 Vert. Collection Capacity cfs (output)	#2 Vert. Collection Capacity cfs (output)	**Total Collection Capacity cfs (output)**	Target Volumes for WQCV, Minor, & Major Storage Volumes (link for goal seek)
	7043.00	0.00	0.00	0.00	0.00	0.00	1.08	0.00	**0.00**	
	7043.20	0.01	0.00	0.00	0.00	0.00	2.20	0.00	**0.01**	
	7043.40	0.02	0.00	0.00	0.00	0.00	3.56	0.00	**0.02**	
	7043.60	0.03	0.00	0.00	0.00	0.00	5.12	0.00	**0.03**	
	7043.80	0.04	0.00	0.00	0.00	0.00	6.13	0.00	**0.04**	
	7044.00	0.05	0.00	0.00	0.00	0.00	6.99	0.00	**0.05**	
	7044.20	0.07	0.00	0.00	0.00	0.00	7.75	0.00	**0.07**	
	7044.40	0.09	0.00	0.00	0.00	0.00	8.45	0.00	**0.09**	
	7044.60	0.11	0.00	0.00	0.00	0.00	9.09	0.00	**0.11**	
	7044.80	0.13	0.00	0.00	0.00	0.00	9.69	0.00	**0.13**	
	7045.00	0.14	0.00	0.00	0.00	0.00	10.26	0.00	**0.14**	
	7045.20	0.17	0.00	0.00	0.00	0.00	10.79	0.00	**0.17**	
	7045.40	0.19	0.00	0.00	0.00	0.00	11.30	0.00	**0.19**	
	7045.60	0.21	0.00	0.00	0.00	0.00	11.79	0.00	**0.21**	
WQCV	7045.80	0.23	0.51	7.93	0.00	0.00	12.26	0.00	**0.74**	.30 REQUIRED
	7046.00	0.24	4.57	16.51	0.00	0.00	12.71	0.00	**4.81**	
	7046.20	0.25	10.76	21.97	0.00	0.00	13.15	0.00	**11.01**	
	7046.40	0.27	18.50	26.31	0.00	0.00	13.57	0.00	**13.57**	
	7046.60	0.28	27.52	30.03	0.00	0.00	13.98	0.00	**13.98**	
	7046.80	0.29	37.65	33.34	0.00	0.00	14.38	0.00	**14.38**	
	7047.00	0.30	48.80	36.35	0.00	0.00	14.77	0.00	**14.77**	
	7047.20	0.31	60.86	39.13	0.00	0.00	15.14	0.00	**15.14**	
	7047.40	0.33	73.79	41.73	0.00	0.00	15.51	0.00	**15.51**	
	7047.60	0.34	87.52	44.17	0.00	0.00	15.87	0.00	**15.87**	
10-YR WSEL	7047.80	0.35	102.01	46.48	0.00	0.00	16.22	0.00	**16.22**	1.15 REQUIRED
	7048.00	0.35	117.22	48.69	0.00	0.00	16.57	0.00	**16.57**	
100-YR	7048.20	0.36	133.12	50.80	0.00	0.00	16.90	0.00	**16.90**	1.52 REQUIRED
	7048.40	0.37	149.68	52.82	0.00	0.00	17.24	0.00	**17.24**	

Calibre

STORM DRAINAGE SYSTEM DESIGN

WEIR DESIGN SPREADSHEET

PROJECT: Woodman View Storage
CITY/COUNTY: Colorado Springs/El Paso

DATE: 7-May-10
DESIGNER: JLT
REVIEWER: TAJ

100 Year Weir must pass:	12.5	cfs	Q = 100 year flow (29.4) - 100 year inlet capacity (16.9*)
Emergency Weir must pass:	93.0	cfs	Q = 100 year flow

Bottom of weir elevation =	7047.74	100-yr Available head =	0.31	feet
100 Year water elev. =	7048.05	Emergency Overflow Available head=	1.26	feet
Top of pond =	7049.00	Weir Coefficient =	3.1	

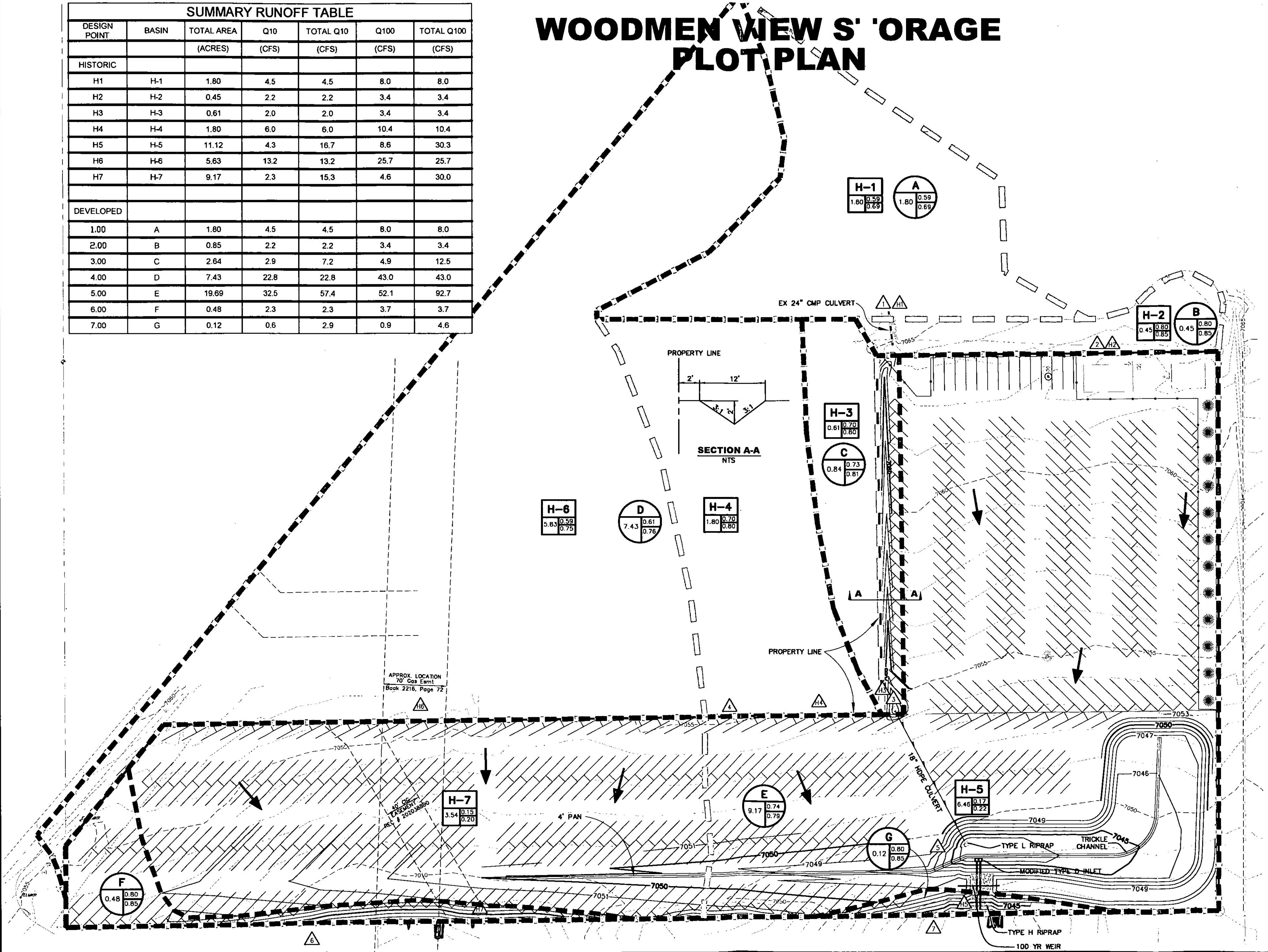
Length of Rectangular Weir			22.8	FEET
Side Slope 1	25%	Angle 1	75.96	DEGREES
Side Slope 2	25%	Angle 2	75.96	DEGREES
		Total Angle For V-notch Weir	151.93	

WSE	head (ft.)	Freeboard (ft.)	Rect weir (cfs)	v-notch (cfs)	total Q (cfs)	
7048.05	0.3	0.9	12.2	0.3	12.5	<----Q(100) Flow
7049.00	1.3	0.0	100.0	9.8	109.8	<----Q(Emergency) Flow

*Total Collection Capacity at 100-yr WSEL (see inlet control spreadsheet)

WOODMEN VIEW S' 'ORAGE
PLOT PLAN

SUMMARY RUNOFF TABLE						
DESIGN POINT	BASIN	TOTAL AREA	Q10	TOTAL Q10	Q100	TOTAL Q100
		(ACRES)	(CFS)	(CFS)	(CFS)	(CFS)
HISTORIC						
H1	H-1	1.80	4.5	4.5	8.0	8.0
H2	H-2	0.45	2.2	2.2	3.4	3.4
H3	H-3	0.61	2.0	2.0	3.4	3.4
H4	H-4	1.80	6.0	6.0	10.4	10.4
H5	H-5	11.12	4.3	16.7	8.6	30.3
H6	H-6	5.63	13.2	13.2	25.7	25.7
H7	H-7	9.17	2.3	15.3	4.6	30.0
DEVELOPED						
1.00	A	1.80	4.5	4.5	8.0	8.0
2.00	B	0.85	2.2	2.2	3.4	3.4
3.00	C	2.64	2.9	7.2	4.9	12.5
4.00	D	7.43	22.8	22.8	43.0	43.0
5.00	E	19.69	32.5	57.4	52.1	92.7
6.00	F	0.48	2.3	2.3	3.7	3.7
7.00	G	0.12	0.6	2.9	0.9	4.6



LEGEND

AREA (AC) | A | 2.00 | 0.02 | 0.91 — DEVELOPED BASIN DESIGNATION; 10-YR RUNOFF COEFICIENT; 100-YR RUNOFF COEFICIENT

AREA (AC) | A | 2.25 | 0.02 | 0.90 — HISTORIC BASIN DESIGNATION; 10-YR RUNOFF COEFICIENT; 100-YR RUNOFF COEFICIENT

HISTORIC BASIN BOUNDARY

DEVELOPED BASIN BOUNDARY

DRAINAGE ARROW

DESIGN POINT

EXISTING MAJOR CONTOUR (5') ——5525——

EXISTING MINOR CONTOUR (1')

PROPOSED MAJOR CONTOUR (5')

PROPOSED MINOR CONTOUR (1')

DETENTION POND

V_{WQ} =0.30 AC-FT
WQ WSE=7045.74
V_{10} =1.15 AC-FT
10 YR WSE=7047.47
V_{100}=1.52 AC-FT
100 YR WSE=7048.05
Q_{10} RELEASE=16.1 cfs
Q_{100} RELEASE=29.4 cfs

	5	
	4	
	3	
	2	
	1	
DATE		REVISION DESCRIPTION

COLORADO REGISTERED PROFESSIONAL ENGINEER 37660 07-01-10

Calibre
Construction Management · Civil Engineering · Surveying
WOODMEN VIEW STORAGE

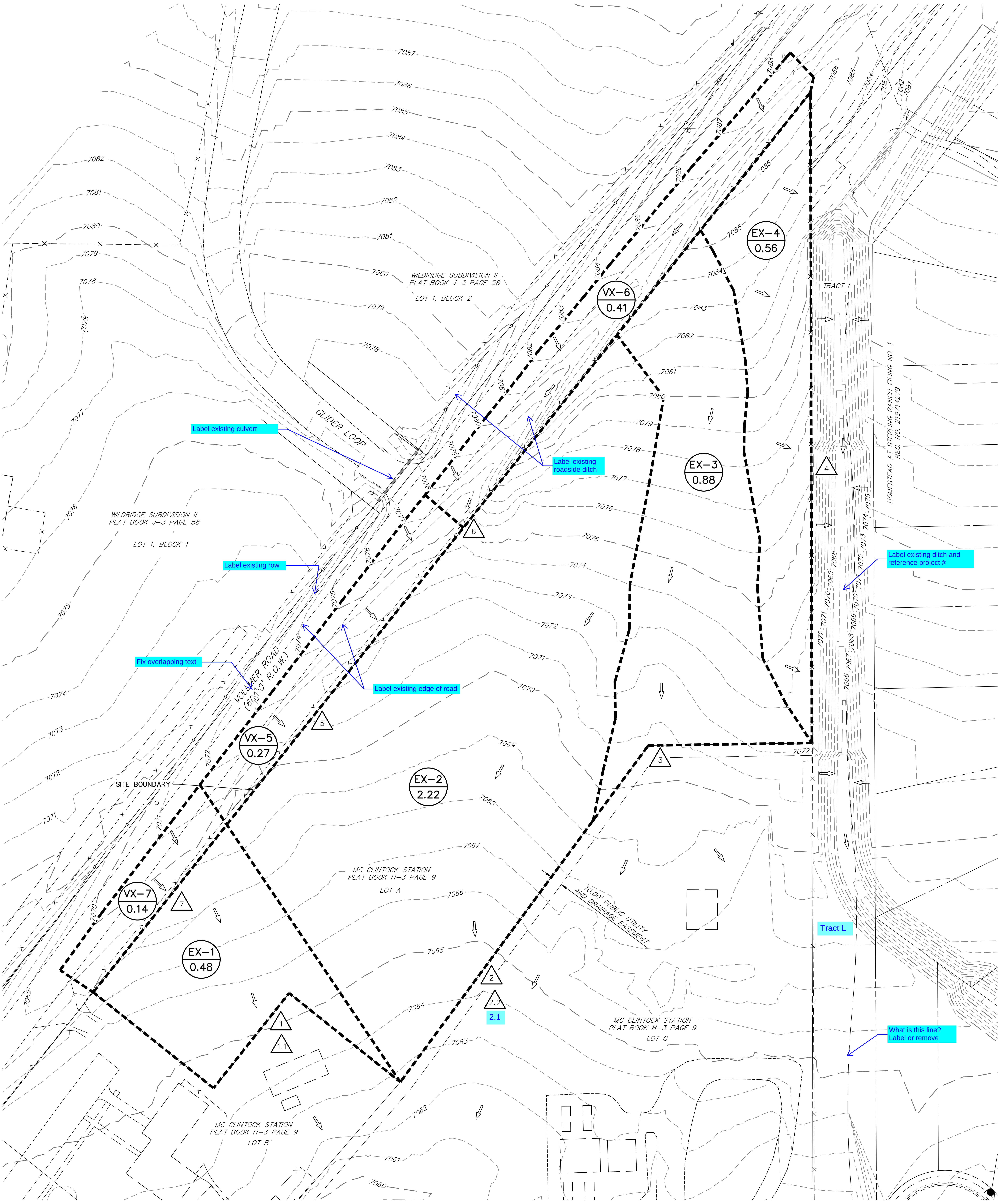
WOODMEN VIEW STORAGE
PLOT PLAN
FINAL DRAINAGE REPORT
JULY 1, 2010

DR1
of 1 Sheets
TAJ EMB GVM
1DR.dwg

APPENDIX E

DRAINAGE MAPS & PLANS

VOLLMER RV STORAGE
EXISTING DRAINAGE MAP



Show and label all existing utilities

BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX-1	0.48	2%	0.08	0.35	15.4	0.1	1.0
EX-2	2.22	2%	0.08	0.35	21.6	0.5	3.9
EX-3	0.88	2%	0.08	0.35	21.9	0.2	1.5
EX-4	0.56	2%	0.08	0.35	11.5	0.2	1.3
VX-5	0.27	30%	0.31	0.52	5.1	0.4	1.2
VX-6	0.41	32%	0.33	0.54	10.0	0.6	1.5
VX-7	0.14	36%	0.36	0.56	5.0	0.3	0.7

DESIGN POINT SUMMARY TABLE		
DP#	Q_{5-YR}	Q_{100-YR}
1	0.1	1.0
1.1	0.3	1.5
2	0.5	3.9
2.1	1.2	5.7
3	0.2	1.5
4	0.2	1.3
5	0.4	1.2
6	0.6	1.5
7	0.3	0.7

LEGEND:

6000 EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
DRAINAGE BASIN
A = BASIN DESIGNATION
B = AREA IN ACRES
DESIGN POINT
EXISTING DRAINAGE ARROW

40 20 0 40 80
ORIGINAL SCALE: 1" = 40'

N

EXISTING DRAINAGE MAP
VOLLMER RV STORAGE
JOB NO. 25251.00
06/23/2022
SHEET 1 OF 1

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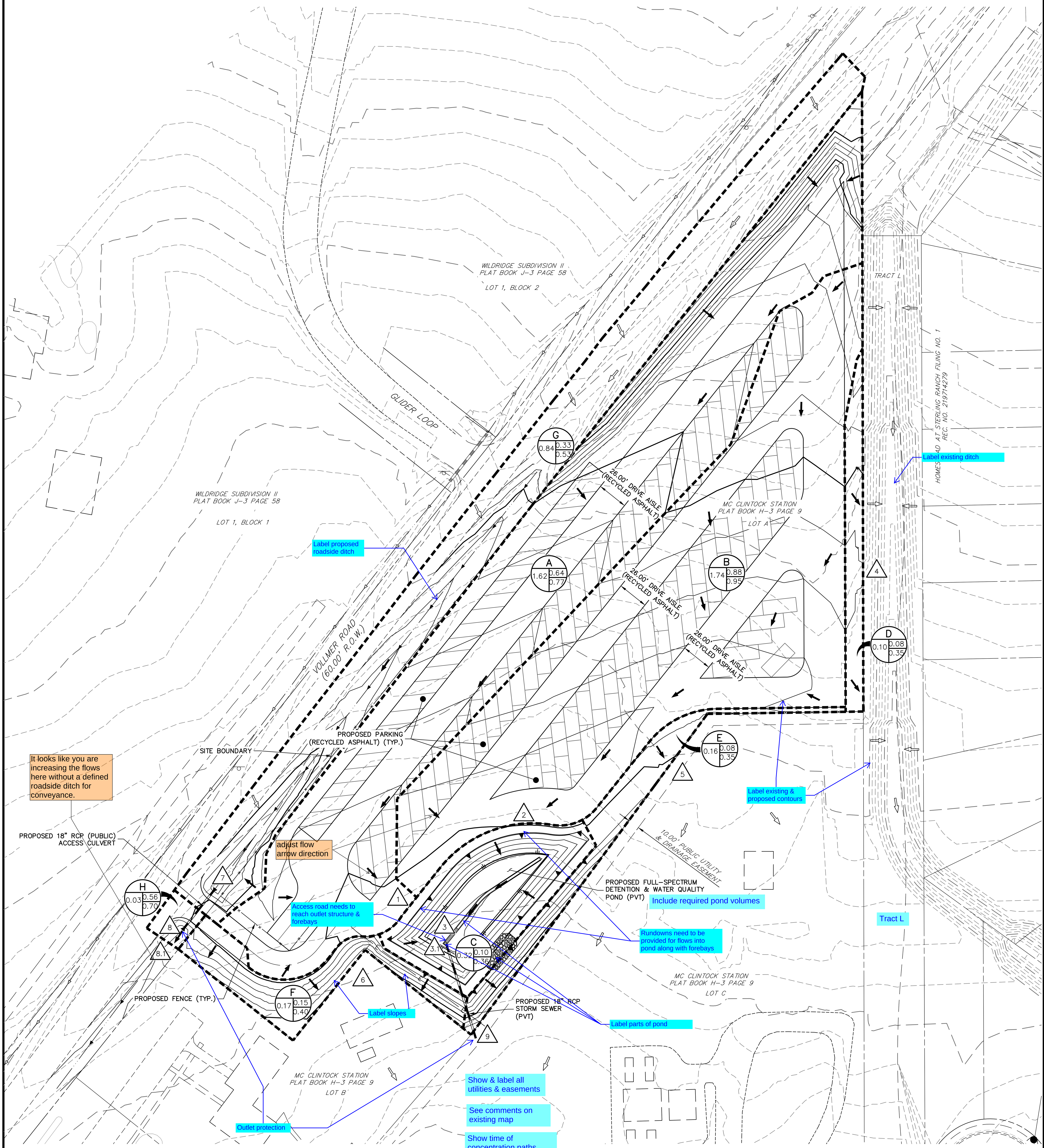
Fort Collins 970-491-9888 • www.jrengineering.com

VOLLMER RV STORAGE
PROPOSED DRAINAGE MAP



Include water quality exhibit showing what areas are treated by ponds and what is not treated

BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A	1.62	69%	0.64	0.77	8.3	4.6	9.2
B	1.74	98%	0.88	0.95	6.8	7.2	13.0
C	0.32	4%	0.10	0.36	7.1	0.1	0.9
D	0.10	2%	0.08	0.35	11.8	0.0	0.3
E	0.16	2%	0.08	0.35	5.0	0.1	0.5
F	0.17	10%	0.15	0.40	5.0	0.1	0.6
G	0.84	32%	0.33	0.53	17.4	0.9	2.5
H	0.03	59%	0.56	0.70	5.0	0.1	0.2

DESIGN POINT SUMMARY TABLE		
DP#	$Q_{5\text{-YR}}$	$Q_{100\text{-YR}}$
1	4.6	9.2
2	7.2	13.0
3	0.1	0.9
3.1	11.5	22.3
4 *	0.0	0.3
5 *	0.1	0.5
6 *	0.1	0.6
7	0.9	2.5
8	0.1	0.2
8.1 *	1.0	2.6
9 *	0.5	4.1

Pond release rates

*-DP's release flows offsite

40 20 0 40 80
ORIGINAL SCALE: 1" = 40'

LEGEND:

6000 PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
6000 EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
DRAINAGE BASIN

A = BASIN DESIGNATION
B = AREA IN ACRES
C = 5-YR RUNOFF COEFFICIENT
D = 100-YR RUNOFF COEFFICIENT
DESIGN POINT
DRAINAGE ARROW
EXISTING DRAINAGE ARROW

PROPOSED DRAINAGE MAP
VOLLMER RV STORAGE
JOB NO. 25251.00
06/23/2022
SHEET 1 OF 1

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