PRELIMINARY DRAINAGE REPORT
FOR
STERLING RANCH FILING NO. 5

Prepared For:

Classic SRJ Land, LLC
2138 Flying Horse Club Drive
Colorado Springs, CO 80921
(719) 785-3270

March 2023
Project No. 25188.16

Prepared By:

JR Engineering, LLC
5475 Tech Center Drive, Suite 235
Colorado Springs, CO 80919
719-593-2593

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.

_____

Mike Bramlett, Colorado P.E. 32314
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: Classic SRJ Land, LLC

By: _____

Title: _____

Address: 2138 Flying Horse Club Drive
Colorado Springs, CO 80921

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.

_____ _____

Joshua Palmer, P.E. Date
County Engineer/ ECM Administrator

Conditions:

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APPENDIX

PURPOSE

This document is the Preliminary Drainage Report for Sterling Ranch Filing Number 5. The purpose of this report is to identify on-site and off-site drainage patterns, storm sewer, culvert, inlet locations, areas tributary to the site, and to safely route developed storm water to adequate outfall facilities.

GENERAL SITE DESCRIPTION

GENERAL LOCATION

Sterling Filing Number 5 (hereby referred to as the "site") is a proposed development within the Sterling Ranch master planned community with a total area of approximately 11.6 acres. The site is currently being designed to accommodate approximately 72 urban lots.

The site is located in a portion of the Southeast Quarter (SE ¼) Of Section 33, Township 12 South, Range 65 West of the 6th Principal Meridian County Of El Paso, State Of Colorado. The site is surrounded by Barbarick Subdivision and Branding Iron at Sterling Ranch Filing No. 1 to the north, Sterling Ranch Filing No. 4 to the west, Sterling Ranch Road to the south, and Dines Boulevard to the east.

DESCRIPTION OF PROPERTY

The property will be primarily single-family residential development (approximately 11.6 acres), open space and drainage tracts. The site is comprised of variable sloping grasslands that generally slope(s) downward to the southwest at 1 to 3% towards Sterling Ranch Road and Hazlett Dr.

Soil characteristics are comprised of Type A and B hydrologic soil groups. Refer to the soil survey map in Appendix A for additional information.

There are no major drainage ways running through the site, Sand Creek lies to the east of the site. Currently, JR Engineering, LLC is performing studies and plans to address Sand Creek stabilization. There are no known irrigation facilities located on the project site.

FLOODPLAIN STATEMENT

Based on the FEMA FIRM Maps number 08041C0533G, dated December 7, 2018, 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. FIRM Map is presented in Appendix A.

EXISTING DRAINAGE CONDITIONS

MAJOR BASIN DESCRIPTIONS

The site lies within the Sand Creek Drainage Basin based **o**n the "Sand Creek Drainage Basin Planning Study" (DBPS) completed by Kiowa Engineering Corporation in January 1993, revised March 1996. The Sand Creek Drainage Basin covers approximately 54 square miles and is divided into major sub-basins. The site is within the Upper Sand Creek sub-basin as shown in Appendix C.

The Sand Creek DBPS assumed the Sterling Ranch Filing No. 5 property to have a "large lot residential" use for the majority of the site however, the proposed Sterling Ranch master plan is a mix of; school, multi-family, single-family, and commercial land uses, resulting in higher runoff. The "Master Development Drainage Plan for Sterling Ranch"; (MDDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018 assumed a mix of a school site and single family residential lots ranging in size from 0.1 to 0.33 acres for the Sterling Ranch Filing No. 5 site.

Any additional runoff has been provided for with the extended detention basin, "Pond W-5", located at the southern edge of the Sterling Ranch boundary. The site generally drains from northeast to southwest. The site currently has drainage infrastructure built with prior Sterling Ranch subdivisions filings in the site's southwest corner that collects and conveys the Sterling Ranch Filing 5 runoff to Pond W-5. Currently, the site is undeveloped vacant land. Sand Creek is located approximately 500 feet east of the site running north to south. Currently, JR engineering is performing studies and plans to address Sand Creek stabilization adjacent to the site. Provide project number

The proposed drainage on the site closely follows the approved "Master Development Drainage Plan for Sterling Ranch"; (MDDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018. The site is tributary to Pond W-5 and full-spectrum detention for the site was previously analyzed and can be found in the Final Drainage Report for Sterling Ranch Filing 2 as shown in Appendix C.

EXISTING SUB-BASIN DRAINAGE

The existing condition of the site was broken into four onsite basins, as well as three offsite basins. The basin and sub-basin delineation is shown in the existing drainage map in Appendix D and is described as follows:

Remove assumed (same for following basin descriptions)

Basin A1 (Q_5=1.0 cfs, Q_{100}=7.6 cfs) is 5.09 acres and 0 percent impervious consists of the northern portion of the proposed Sterling Filing No. 5 site. Runoff from this basin drains via overland flow to the south west into the assumed existing storm sewer built with Filing 4 just north of Sterling Ranch Road located at DP 3. Collected runoff is piped west to the DP 5 and then piped via existing storm infrastructure south to pond W-5 built with Filing 2.

Basin A2 (Q_5=0.8 cfs, Q_{100}=5.9 cfs) is 2.89 acres and 0 percent impervious consists of the south western portion of the proposed Sterling Filing No. 5 site. Runoff from this basin drains via overland flow to the south west into the assumed existing storm sewer built with Filing 5 just north of Sterling Ranch Road located at DP 3. Collected runoff is piped west to the DP 5 and then piped via existing storm infrastructure south to pond W-5 built with Filing 2.

Basin A3 (Q_5=0.5 cfs, Q_{100}=3.7 cfs) is 1.94 acres and 0 percent impervious consists of the southern portion of the proposed Sterling Filing No. 5 site. Runoff from this basin drains via overland flow to the south west into the assumed existing storm sewer built with Filing 4 just north of Sterling Ranch Road located at DP 3. Collected runoff is piped west to the DP 5 and then piped via existing storm infrastructure south to pond W-5 built with Filing 2.

Basin A4 (Q_5=6.8 cfs, Q_{100}=16.0 cfs) is 4.83 acres and 47 percent impervious consists of the southeastern portion of the proposed Sterling Filing No. 5 site as well as the norther portion of Sterling Ranch Road. Runoff from this basin drains via overland flow to Sterling Ranch Road, then west to the existing 15' Type R inlet located at DP 5. Collected runoff is piped via existing storm infrastructure south to pond W-5 built with Filing 2.

Basin OS1 (Q_5= 1.5 cfs, Q_{100}=3.2 cfs) is 0.79 acres and 65 percent impervious, consists of the southern portion of the proposed Branding Iron at Sterling Ranch Filing No.1. Runoff from this basin drains to the south into the proposed Sterling Filing No.5 northern site sub-basin A1. Runoff is collected into the assumed existing storm sewer built with Filing 4 just north of Sterling Ranch Road located at DP3. Collected runoff is piped west to the DP 5 and then piped via existing storm infrastructure south to pond W-5 built with Filing 2.

State what pond

Indicate what project and/or report the detained flows for the pond were obtained from

Basin OS2 (Q_5=14.6 cfs, Q_{100}=52.8 cfs) is 33.07 acres and 19 percent impervious and is located directly north of the site in the Barbarick subdivision. Historic runoff from this site drains south onto the Sterling Ranch Filing 4 site at DP 2. Detained flow from this basin will be piped through the Sterling Ranch Filing 4 site to the detention pond and will outfall to Sand Creek. The emergency overflow path for this pond is routed east around the Sterling ranch Filing 4 lots and onto the northwest corner of Sterling Ranch Filing 5. The emergency overflow path is conveyed south via a concrete line swale and grass swale to DP3.

Show and label overflow path and swales on drainage map

Basin OS3 (Q_5=19.4 cfs, Q_{100}=46.3 cfs) is 13.90 acres and 49 percent impervious, consists of the Sterling Ranch Filing No.4. Runoff from this basin drains to the southwest into the storm sewer built with Sterling Ranch Filing 4 and DP 4. Collected runoff is piped south to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

PROPOSED DRAINAGE CONDITIONS

PROPOSED SUB-BASIN DRAINAGE

The proposed site was broken into ten onsite basins and one offsite basin that lead into the existing storm structures on Sterling Ranch Road and Sterling Ranch Filing 4. The proposed basin (and sub-basin) delineation is shown on the proposed drainage basin map within Appendix D and is described as follows.

Basin A1 (Q_5=0.6 cfs, Q_{100}=2.0 cfs) is 0.70 acres and 30 percent impervious, consists of single-family residential lots, open space, lawns, and part of an existing concrete channel. Runoff from this basin drains via sheet flow to the swale at DP2 where runoff is collected in an area inlet. Collected runoff is piped south to the proposed sump inlet and DP5.1. The overall runoff is piped south to Sterling Ranch Road storm structures which eventually conveys runoff to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Basin A2 (Q_5=0.8 cfs, Q_{100}=2.3 cfs) is 0.68 acres and 41 percent impervious, consists of single-family residential lots, open space, and lawns. Runoff from this basin drains via sheet flow to the swale at DP1 where it is conveyed west via swale to DP 2 and collected in an area inlet. Collected runoff is piped to DP2.1 and then south to DP5.1. The overall runoff is piped south to Sterling Ranch Road storm structures which eventually conveys runoff to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Basin A3 (Q_5=0.9 cfs, Q_{100}=2.5 cfs) is 0.75 acres and 43 percent impervious, consists of single-family residential lots, open space, and lawns. Runoff from this basin drains via sheet flow to the swale at DP3 where it is conveyed to the street and sump inlet at DP5.1. The overall runoff is piped south to Sterling Ranch Road storm structures which eventually conveys runoff to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Basin A4 (Q_5=3.1 cfs, Q_{100}=6.3 cfs) is 1.00 acres and 85 percent impervious, consists of single-family residential lots, open space, lawns, sidewalks and streets. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter to DP4, then flows to a sump inlet at DP5.1. The collected runoff is piped south to Sterling Ranch Road storm structures which eventually conveys the flow to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Basin A5 (Q_5=5.1 cfs, Q_{100}=12.3 cfs) is 2.85 acres and 62 percent impervious, consists of single-family residential lots, open space, lawns, sidewalks and streets. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter to DP5, then flows to a sump inlet at DP5.1. The collected runoff is piped south to Sterling Ranch Road storm structures which eventually conveys the flow to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Basin A6 (Q_5=1.3 cfs, Q_{100}=3.3 cfs) is 0.74 acres and 55 percent impervious, consists of single-family residential lots, open space, lawns, sidewalks and streets. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter offsite to the curb and gutter in Dines Boulevard. The flows collect in an existing sump inlet at DP6 and are piped via an existing 24" storm pipe to and existing water quality and detention pond (W-8) on the east side of Dines and eventually outfalls to Sand Creek. Pond W-8 was analyzed with the Sterling Ranch Filing 1, Branding Iron Filing 1 and Branding Iron Filing 2 subdivisions and has a total tributary area of approximately 29 acres. The addition of the Basin A6 flows are assumed to be immaterial but will be further analyzed with the Final Drainage Report for SR Filing 5 to confirm this Preliminary Drainage Report assumption.

Also include that the existing inlet will be checked for capacity with the additional flow.

Basin A7 (Q_5=3.8 cfs, Q_{100}=9.2 cfs) is 2.03 acres and 58 percent impervious, consists of single-family residential lots, open space, lawns, sidewalks and streets. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter to an on-grade inlet at DP7. The collected runoff is piped south to Sterling Ranch Road storm structures which eventually conveys the flow to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek. Runoff that is not collected by the inlet at DP7 continues west to an existing sump inlet at DP11 built with Sterling Ranch Filing 4. The collected runoff is piped south to Sterling Ranch Road storm structures which eventually conveys the flow to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Identify that the existing inlet will be checked for capacity with the by-pass flow in the FDR.

Basin A8 (Q_5=3.9 cfs, Q_{100}=8.6 cfs) is 1.55 acres and 71 percent impervious, consists of single-family residential lots, open space, lawns, sidewalks and streets. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter to an on-grade inlet at DP 8. The collected runoff is piped south to Sterling Ranch Road storm structures which eventually conveys the flow to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek. Runoff that is not collected by the inlet at DP8 continues west to an existing sump inlet at DP12 built with Sterling Ranch Filing 4. The collected runoff is piped south to Sterling Ranch Road storm structures which eventually conveys the flow to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Identify that the existing inlet will be checked for capacity with the by-pass flow in the FDR.

Basin A9 (Q_5=0.3 cfs, Q_{100}=0.8 cfs) is 0.21 acres and 50 percent impervious, consists of single-family residential lots, open space, and lawns. Runoff from this basin drains via overland and sheet flow to the curb and gutter on Dines Boulevard. The flows collect at DP9 and run along the curb and gutter along Sterling Ranch Road to an existing on-grade inlet at DP13 built with Sterling Ranch Filing 2. The overall runoff is piped south to Sterling Ranch Road storm structures which eventua the flow to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek

Identify that the existing inlet checked for capacity with the additional flow from this basi FDR.

Basin A10 (Q_5=1.9 cfs, Q_{100}=5.1 cfs) is 1.35 acres and 52 percent impervious, consists of single-family residential lots, open space, and lawns. Runoff from this basin drains via overland flow and sheet flow offsite to the curb and gutter on Sterling Ranch Road at DP10 and continues west along the curb and gutter to an existing on-grade inlet at DP13 built with Sterling Ranch Filing 2. The overall runoff is

Identify that the existing inlet (DP13) will be checked for capacity with the additional flow from this basin in the FDR and the next downstream inlet will be checked with additional bypass flow from DP13..

piped south to Sterling Ranch Road storm structures which eventually conveys the flow to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Basin OS1 (Q_5=1.5 cfs, Q_{100}=3.5 cfs) is 0.79 acres and 65 percent impervious, consists of single-family residential lots, open space, and lawns. Runoff from this basin drains via sheet flow to the swale at DP1 where it is conveyed west via swale to DP2.1 and collected in an area inlet. Collected runoff is piped south to DP5.1. The overall runoff is piped south to Sterling Ranch Road storm structures which eventually conveys runoff to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Include discussion on overall flows exiting site and indicate if there is an increase or decrease to amount of flows entering existing storm system from Filing 5

DRAINAGE DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

Storm drainage analysis and design criteria for this project were taken from the "*City of Colorado Springs/El Paso County Drainage Criteria Manual*" Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the "*Urban Storm Drainage Criteria Manual*" Volumes 1 to 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the "*Colorado Springs Drainage Criteria Manual*" (CSDCM), 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. Runoff was calculated using the Rational Method, and rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Table 6-2 of the CSDCM. One hour point rainfall data for the storm events is identified in the chart below. Runoff coefficients were determined based on proposed land use and from data in Table 6-6 from the CSDCM. Time of concentrations were developed using equations from CSDCM. All runoff calculations and applicable charts and graphs are included in the Appendices.

Table 2 - 1-hr Point Rainfall Data

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

HYDRAULIC CRITERIA

The Rational Method and USDCM's SF-2 and SF-3 forms were used to determine the runoff from the minor and major storms on the site. Sump and on-grade inlets will be sized using UDFCD UD-Inlet v5.02. StormCAD will be used to model the proposed storm sewer system within the interim area and

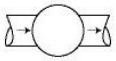
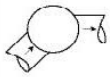
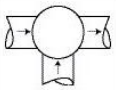
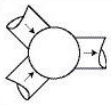
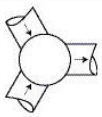
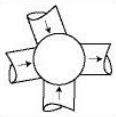
interim area? Is there phases planned?

to analyze the proposed HGL calculations for the Construction Drawings. Autodesk Hydraflow express will be used to size any channels or swales. Manhole and pipe losses for the model will be obtained from the *Modeling Hydraulic and Energy Gradients in Storm Sewers: A Comparison of Computation Methods*, by AMEC Earth & Environmental, Inc. The manhole loss coefficients used in the model can be seen in Table 3 (below) this method is accurate for pipes 42" and smaller for larger pipes the Standard head-loss coefficients as recommended by Bentley were used as shown in Table 4. All hydraulic calculations will be found in the Final Drainage Report Appendices.

Table 3 Storm Head-loss Coefficients

StormCAD Conversion Table			
Bend Loss	Bend Angle	K coefficient Conversion	
	0	0.05	
	22.5	0.1	
	45	0.4	
	60	0.64	
	90	1.32	
Lateral Loss	1 Lateral K coefficient Conversion		
	Bend Angle	Non Surcharged	Surcharged
	45	0.27	0.47
	60	0.52	0.9
	90	1.02	1.77
	2 Laterals K coefficient Conversion		
	45	0.96	
	60	1.16	
	90	1.52	

Table 4 Storm Head-loss Coefficients

Type of Manhole	Diagram	Headloss Coefficient
Trunkline only with no bend at the junction		0.5
Trunkline only with 45° bend at the junction		0.6
Trunkline only with 90° bend at the junction		0.8
Trunkline with one lateral		Small 0.6 Large 0.7
Two roughly equivalent entrance lines with angle < 90° between lines		0.8
Two roughly equivalent entrance lines with angle > 90° between lines		0.9
Three or more entrance lines		1.0

DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

The proposed stormwater conveyance system was designed to convey the developed Sterling Ranch Filing No. 5 runoff to an existing (Filing 2) full spectrum water quality and detention pond W-5 via existing and proposed storm sewer. The existing pond was designed to release at less than historic rates to minimize adverse impacts downstream. Treated water will outfall directly into the Sand Creek Drainageway, where it will eventually outfall into Fountain Creek. A proposed drainage map is presented in Appendix D showing locations of the pond.

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, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

Step 1 – Reducing Runoff Volumes: The Sterling Ranch Filing No. 5 development project consists of single-family homes with open spaces and lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. Roof drains from the structures will discharge to lawn areas, where feasible, to allow for infiltration and runoff volume reduction.

Step 2 – Stabilize Drainage ways: The site lies within the Sand Creek Drainage Basin. Basin and bridge fees will be due at time of platting. These funds will be used for the channel stabilization being designed by JR Engineering adjacent to the site and on future projects within the basin to stabilize drainage ways. The site does not discharge directly into the open drainage way of Sand Creek, therefore no downstream stabilization will be accomplished with this project.

& W-8 (Basin A6 now releases into this existing pond)

Step 3 – Treat the WQCV: Water Quality treatment for this site is provided in an existing full spectrum water quality detention pond (W-5). The runoff from this site will be collected within inlets and conveyed to the proposed pond via storm sewer. Upon entrance to the pond, flows will be captured in a forebay designed to promote settlement of suspended solids. A trickle channel is also incorporated into the pond 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. All flows released from the pond will be reduced to less than historic rates.

Step 4 –BMPs will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. The Filing No. 5 site is residential. There is no proposed commercial or industrial use for the site. The permanent erosion control BMPs include asphalt drives, storm inlets and storm pipe, the full spectrum detention pond W-5 and permanent vegetation. Maintenance responsibilities and plans will be defined at the time of final platting.

WATER QUALITY

In accordance with Section 13.3.2.1 of the CCS/EPCDCM, full spectrum water quality and detention are provided for all developed basins. This site will drain into an existing Full Spectrum Drainage Pond W-5 developed during the Sterling Ranch Filing No. 2 Project. Further details as well as all pond volume, water quality, and outfall calculations are included in the Sterling Ranch Filing 2 Final Drainage Report. Pond W-5 corresponds to pond FSD6 from the Master Development Drainage Plan for Sterling Ranch", (MMDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018 and is releasing less than the MDDP values in the proposed design. A summary of Pond W-5 has been included below for reference. From the Filing No.2 drainage report, Pond W-5 accounted for Sterling Ranch Filing 5 area to have 65% imperviousness. The total imperviousness for the Filing 5 development is 59% imperviousness, and the total runoff is less than what was anticipated; therefore the existing pond W-5 will function as intended.

Table 3. Pond Volumes & Release Rates

	REQUIRED VOLUME (AC-FT)	VOLUME PROVIDED (AC-FT)	WQCV (AC-FT)	EURV (AC-FT)	5-YEAR RELEASE (CFS)	100-YEAR RELEASE (CFS)
POND W-5	18.217	18.441	3.29	11.71	2.7	137.1

Engineer must confirm in the Drainage Report that the existing offsite PBMP that the site is tributary to are functioning as intended.

EROSION CONTROL PLAN

We respectfully request that the Erosion Control Plan and Cost Estimate be submitted in conjunction with the grading and erosion control plan and construction assurances posted prior to obtaining a grading permit.

OPERATION & MAINTENANCE

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. The district shall be responsible for the inspection, maintenance, rehabilitation and repair of stormwater and erosion control facilities located on the property unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. Access is provided from onsite facilities and easements for proposed infrastructure located offsite. A maintenance road was provided for the existing pond W-5 and information on the road can be found in the Final Drainage Report for Sterling Ranch Filing No. 2. The maintenance road access is off Marksheffel Road and wraps around the top of the pond providing access to the inflow pipe wing walls and outlet structure for the pond.

As flows are now also reaching existing Pond W-8, it will also need to be included in the discussion.

DRAINAGE AND BRIDGE FEES

The site lies within the Sand Creek Drainage Basin. Anticipated drainage and bridge fees will be defined within the Final Drainage Report and will be due at time of platting (depending on date of plat submittal).

SUMMARY

The proposed Sterling Ranch Filing No. 5 drainage improvements were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development will not adversely affect the offsite drainage-ways or surrounding development. The existing pond W-5 is to release less than 90% of the predeveloped runoff study associated with the subject site. The site is in continuity with the Sterling Ranch Filing No. 2 Drainage Report. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements for this site.

Include statement that proposed site does not impact any downstream facility or property.

and Filing No. 4

REFERENCES

1. "El Paso County and City of Colorado Springs Drainage Criteria Manual, Vol I & II".

2. Sand Creek Channel Design Report, prepared by JR Engineering, May 19, 2021 (not yet approved)

3. "Master Development Drainage Plan for Sterling Ranch", (MMDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018.

4. Sand Creek Drainage Basin Planning Study, prepared Kiowa Engineering Corporation, January 1993, revised March 1996.

5. "Sterling Ranch Filing 2 Final Drainage Report", prepared by JR Engineering, dated May 2021

6. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), Urban Drainage and Flood Control District, June 2001.

7. Sand Creek Stabilization at Aspen Meadows Subdivision Filing No. 1 – 100% Design Plans, April 2020

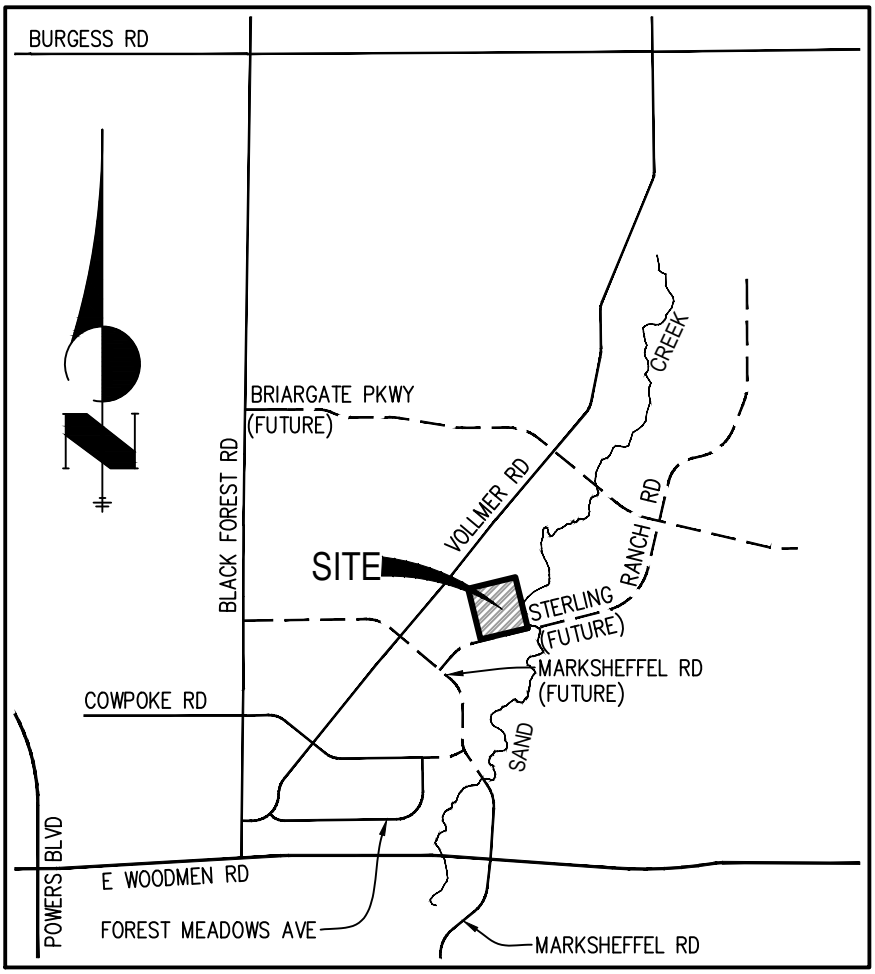
8. Final Drainage Report For Barbarick Subdivision Portion Of Lots 1,2 And Lots 3 and 4, Prepared by Matrix Design Group, June 2016

9. Preliminary Drainage Report And MDDP Addendum For Homestead North At Sterling Ranch Preliminary Plan", prepared by JR Engineering, dated January 2022

10. Sand Creek Drainage Basin Planning Study, Stantec, January 2021

12. Final Drainage Report for Aspen Meadows, Matrix Design, January 2019* pending approval

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map



VICINITY MAP

N.T.S.

VICINITY MAP
HOMESTEAD FILING NO. 5
JOB NO. 25188.16
8/26/22
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

Map Scale: 1:2,690 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

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: Aug 19, 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
9	Blakeland-Fluvaquentic Haplaquolls	A	0.8	3.3%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	12.0	49.0%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	11.7	47.7%
Totals for Area of Interest			**24.5**	**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/.

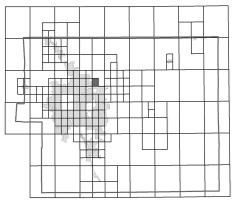
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

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)
4275000mN — 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 Calcs

COMPOSITE % IMPERVIOUS & COMPOSITE EXISTING RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Sterling Ranch Subdivision- Existing
Location: El Paso County

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: DIG
Checked By: RAB
Date: 11/21/22

Basin ID	Total Area (ac)	Streets (100% Impervious)				Residential (65% Impervious)				Light Industrial (80% Impervious)				Lawns (0% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
A1	5.09	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	5.09	0.0%	0.08	0.35	0.0%
A2	2.89	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	2.89	0.0%	0.08	0.35	0.0%
A3	1.94	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	1.94	0.0%	0.08	0.35	0.0%
A4	4.83	0.90	0.96	1.75	36.2%	0.45	0.59	0.80	10.8%	0.59	0.70	0.00	0.0%	0.08	0.35	2.28	0.0%	0.44	0.61	47.0%
OS1	0.79	0.90	0.96	0.00	0.0%	0.45	0.59	0.79	65.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.45	0.59	65.0%
OS2	33.07	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	7.91	19.1%	0.08	0.35	25.16	0.0%	0.20	0.43	19.1%
OS3	13.90	0.90	0.96	2.35	16.9%	0.45	0.59	6.86	32.1%	0.59	0.70	0.00	0.0%	0.08	0.35	4.69	0.0%	0.40	0.57	49.0%
TOTAL (A1-A4)	14.75																			0.0%
TOTAL (OS1-OS3)	47.76																			28.6%
TOTAL	62.51																			25.5%

EXISTING
STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Sterling Ranch Subdivision- Existing
Location: El Paso County

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: DIG
Checked By: RAB
Date: 11/21/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* 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)
A1	5.09	B	0%	0.08	0.35	180	1.4%	22.1	497	1.6%	10.0	1.3	6.5	28.7	677.0	33.3	28.7
A2	2.89	A	0%	0.08	0.35	125	4.6%	12.4	385	5.2%	10.0	2.3	2.8	15.3	510.0	29.1	15.3
A3	1.94	A	0%	0.08	0.35	80	1.7%	13.8	385	2.5%	10.0	1.6	4.1	17.9	465.0	30.5	17.9
A4	4.83	A	47%	0.44	0.61	100	3.0%	8.3	1466	1.5%	20.0	2.4	10.0	18.3	1566.0	30.8	18.3
OS1	0.79	A	65%	0.45	0.59	88	2.0%	8.8	122	2.0%	10.0	1.4	1.4	10.2	210.0	15.7	10.2
OS2	33.07	A	19%	0.20	0.43	298	3.0%	19.5	1664	2.7%	10.0	1.6	16.9	36.4	1962.0	37.2	36.4
OS3	13.90	A	49%	0.40	0.57	100	1.8%	10.4	796	1.7%	20.0	2.6	5.1	15.5	896.0	24.1	15.5

NOTES:

$$t_c = t_i + t_t$$ Equation 6-2

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

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

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.

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

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

Subdivision: Sterling Ranch Subdivision- Existing
Location: El Paso County
Design Storm: 5-Year

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: DIG
Checked By: RAB
Date: 11/21/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			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)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	OS1	0.79	0.45	10.2	0.36	4.10	1.5															
	2	OS2	33.07	0.20	36.4	6.68	2.19	14.6															Offsite Barbarick Pond Release Piped to DP4
	3	A1	5.09	0.08	28.7	0.41	2.55	1.0															
	3	A2	2.89	0.08	15.3	0.23	3.50	0.8															
	3	A3	1.94	0.08	17.9	0.16	3.26	0.5															
	3								28.7	1.16	2.55	3.0											Sum of basins A1-A3 and OS1, drain to Ex storm Piped west and south to Ex. Pond W-5
	4	OS3	13.90	0.40	15.5	5.58	3.47	19.4															
	5	A4	4.83	0.44	18.3	2.12	3.22	6.8															Runoff to Ex. Inlet in Sterling Ranch Road Piped south to Ex. Pond W-5

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

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

Subdivision: Sterling Ranch Subdivision- Existing
Location: El Paso County
Design Storm: 100-Year

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: DIG
Checked By: RAB
Date: 11/21/22

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			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)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	OS1	0.79	0.59	10.2	0.47	6.88	3.2															
	2	OS2	33.07	0.43	36.4	14.34	3.68	52.8															Offsite Barbarick Pond Release Piped to DP4
	3	A1	5.09	0.35	28.7	1.78	4.28	7.6															
	3	A2	2.89	0.35	15.3	1.01	5.87	5.9															
	3	A3	1.94	0.35	17.9	0.68	5.47	3.7															
	3								28.7	3.94	4.28	16.9											Sum of basins A1-A3 and OS1, drain to Ex storm Piped west and south to Ex. Pond W-5
	4	OS3	13.90	0.57	15.5	7.94	5.83	46.3															
	5	A4	4.83	0.61	18.3	2.95	5.41	16.0															Runoff to Ex. Inlet in Sterling Ranch Road Piped south to Ex. Pond W-5

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

COMPOSITE % IMPERVIOUS & COMPOSITE PROPOSED RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Sterling Ranch Subdivision -Proposed
Location: El Paso County

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: DIG
Checked By: RAB
Date: 3/20/23

% impervious is good for detached lots, but what about attached lots? Those areas would be closer to 70% impervious

Basin ID	Total Area (ac)	Paved/Streets (100% Impervious)				Residential (65% Impervious)				Light Industrial (80% Impervious)				Lawns (0% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
A1	0.70	0.90	0.96	0.01	1.4%	0.45	0.59	0.31	28.8%	0.59	0.70	0.00	0.0%	0.08	0.35	0.38	0.0%	0.26	0.47	30.2%
A2	0.68	0.90	0.96	0.00	0.0%	0.45	0.59	0.43	41.1%	0.59	0.70	0.00	0.0%	0.08	0.35	0.25	0.0%	0.31	0.50	41.1%
A3	0.75	0.90	0.96	0.00	0.0%	0.45	0.59	0.50	43.3%	0.59	0.70	0.00	0.0%	0.08	0.35	0.25	0.0%	0.33	0.51	43.3%
A4	1.00	0.90	0.96	0.64	64.0%	0.45	0.59	0.32	20.8%	0.59	0.70	0.00	0.0%	0.08	0.35	0.04	0.0%	0.72	0.82	84.8%
A5	2.85	0.90	0.96	0.74	26.0%	0.45	0.59	1.56	35.6%	0.59	0.70	0.00	0.0%	0.08	0.35	0.55	0.0%	0.50	0.64	61.5%
A6	0.74	0.90	0.96	0.10	13.5%	0.45	0.59	0.47	41.3%	0.59	0.70	0.00	0.0%	0.08	0.35	0.17	0.0%	0.43	0.58	54.8%
A7	2.03	0.90	0.96	0.69	34.0%	0.45	0.59	0.76	24.3%	0.59	0.70	0.00	0.0%	0.08	0.35	0.58	0.0%	0.50	0.65	58.3%
A8	1.55	0.90	0.96	0.76	49.0%	0.45	0.59	0.52	21.8%	0.59	0.70	0.00	0.0%	0.08	0.35	0.27	0.0%	0.61	0.73	70.8%
A9	0.21	0.90	0.96	0.00	0.0%	0.45	0.59	0.16	49.5%	0.59	0.70	0.00	0.0%	0.08	0.35	0.05	0.0%	0.36	0.53	49.5%
A10	1.35	0.90	0.96	0.00	0.0%	0.45	0.59	1.08	52.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.27	0.0%	0.38	0.54	52.0%
OS1	0.79	0.90	0.96	0.00	0.0%	0.45	0.59	0.79	65.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.45	0.59	65.0%
TOTAL (A1-A10)	11.86																			58.3%
TOTAL	12.65																			58.7%

PROPOSED
STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Sterling Ranch Subdivision -Proposed
Location: El Paso County

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: DIG
Checked By: RAB
Date: 3/20/23

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* 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)
A1	0.70	B	30%	0.26	0.47	70	2.2%	9.8	335	0.7%	7.0	0.6	9.3	19.2	405.0	25.8	19.2
A2	0.68	B	41%	0.31	0.50	70	2.0%	9.4	210	1.0%	7.0	0.7	5.0	14.4	280.0	21.4	14.4
A3	0.75	A	43%	0.33	0.51	80	3.6%	8.2	345	1.5%	7.0	0.9	6.7	14.9	425.0	21.7	14.9
A4	1.00	A	85%	0.72	0.82	30	2.0%	3.0	931	1.6%	20.0	2.5	6.2	9.2	961.0	17.6	9.2
A5	2.85	A	62%	0.50	0.64	95	2.0%	8.5	900	1.6%	20.0	2.5	5.9	14.4	995.0	22.3	14.4
A6	0.74	A	55%	0.43	0.58	93	2.6%	8.6	231	1.9%	20.0	2.8	1.4	9.9	324.0	18.3	9.9
A7	2.03	A	58%	0.50	0.65	91	2.0%	8.3	702	1.6%	20.0	2.6	4.6	12.8	793.0	21.4	12.8
A8	1.55	A	71%	0.61	0.73	38	2.0%	4.4	830	1.6%	20.0	2.5	5.5	9.8	868.0	19.7	9.8
A9	0.21	A	50%	0.36	0.53	100	3.5%	8.8	598	1.5%	20.0	2.4	4.1	12.9	698.0	22.7	12.9
A10	1.35	A	52%	0.38	0.54	100	3.5%	8.6	599	1.5%	20.0	2.4	4.1	12.7	699.0	22.2	12.7
OS1	0.79	A	65%	0.45	0.59	88	2.0%	8.8	122	2.0%	10.0	1.4	1.4	10.2	210.0	15.7	10.2

NOTES:

$$t_c = t_i + t_t$$ Equation 6-2

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

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

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.

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

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

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

Subdivision: Sterling Ranch Subdivision -Proposed
Location: El Paso County
Design Storm: 5-Year

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: DIG
Checked By: RAB
Date: 3/20/23

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
STREET	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)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
		OS1	0.79	0.45	10.2	0.36	4.10	1.5															FLOWS IN SWALE TO DP 1 CONVEY VIA SWALE TO DP2.1
		A2	0.68	0.31	14.4	0.21	3.58	0.8															FLOWS IN SWALE TO DP 1 CONVEY VIA SWALE TO DP2.1
	1								14.4	0.57	3.58	2.0											TOTAL FLOW AT DP1 BASINS OS1 AND A2
	2	A1	0.70	0.26	19.2	0.18	3.15	0.6															FLOWS IN SWALE TO DP 2 CAPTURED IN AREA INLET
	2.1								19.2	0.75	3.15	2.4											AREA INLET PIPED TO DP 5.1
	3	A3	0.75	0.33	14.9	0.25	3.53	0.9															FLOWS IN SWALE TO DP 3 CONVEYED TO DP5
	4	A4	1.00	0.72	9.2	0.72	4.25	3.1															FLOWS IN SWALE TO DP 2 THEN FLOWS TO CURB AND GUTTER TO INLET AT DP 5
									14.9	0.97	3.53	3.4											BASINS A3 AND A4 CONVEYED TO INLET DP5
	5	A5	2.85	0.50	14.4	1.41	3.58	5.1															FLOWS IN CURB AND GUTTER TO DP 5
									14.9	2.38	3.53	8.4											INLET AT DP5 BASINS A3-A5
	5.1								19.2	3.13	3.15	9.9											PIPED FROM INLET AT DP 5 TO EX STORM BASINS A1-A5 AND OS1
	6	A6	0.74	0.43	9.9	0.32	4.14	1.3															FLOWS INTO DINES BLVD CURB AND GUTTER TO EXISTING INLET
	7	A7	2.03	0.50	12.8	1.01	3.75	3.8															FLOWS IN CURB AND GUTTER TO ON-GRADE INLET AT DP 7 ON SCHOOLHOUSE ROAD COLLECTED RUNOFF PIPED TO DP8.1, BYPASS RUNOFF TO EX. INLET AT DP11
	8	A8	1.55	0.61	9.8	0.94	4.15	3.9															FLOWS IN CURB AND GUTTER TO ON-GRADE INLET AT DP 8 ON SCHOOLHOUSE ROAD COLLECTED RUNOFF PIPED TO DP8.1, BYPASS RUNOFF TO EX. INLET AT DP12
	8.1								12.8	1.95	3.75	7.3											TOTAL RUNOFF PIPED TO EXISTING STORM SEWER FROM FILING 4
	9	A9	0.21	0.36	12.9	0.08	3.75	0.3															FLOWS INTO DINES BLVD AND STERLING RANCH ROAD ULTIMATELY TO EX. ON-GRADE INLET AT DP 13
	10	A10	1.35	0.38	12.7	0.51	3.77	1.9															FLOWS INTO STERLING RANCH ROAD ULTIMATELY TO EX. ON-GRADE INLET AT DP 13
									12.9	0.59	3.75	2.2											BASINS A9-A10 CONVEYED TO EX. INLET AT DP13
	11	RUNOFF FROM FILING 4 DP5						12.0				12.0											TOTAL RUNOFF TO EX. 15' TYPE R INLET PIPED TO DP 14
	12	RUNOFF FROM FILING 4 DP6.2						2.0				2.0											TOTAL RUNOFF TO EX. 10' TYPE R INLET PIPED TO DP 14
	13	RUNOFF FROM FILING 4 DP8						6.1				8.3											TOTAL RUNOFF TO EX. 15' TYPE R INLET PIPED TO DP 14
	14											29.6											TOTAL RUNOFF PIPED TO EX. POND W-5

pe C*A values are determined by Q/i using t

Should this be labeled as DP5, since it's collecting flow from other basins at the inlet & DP5.1 is the pipe/intercepted flow?

Doesn't match

List all DP's/Basins contributing

Should this be labeled as DP10, since it's collecting flow from other basins at the inlet?

Show total flow to DP13, indicate in report if there is an increase or decrease from Filing No. 4 report

Include a DP that corresponds to DP10 from the Filing No. 4 report. Indicate in report if there is an increase/decrease in flows

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Sterling Ranch Subdivision -Proposed
Location: El Paso County
Design Storm: 100-Year

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: DIG
Checked By: RAB
Date: 3/20/23

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			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)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
		OS1	0.79	0.59	10.2	0.47	7.51	3.5															FLOWS IN SWALE TO DP 1 CONVEY VIA SWALE TO DP2.1
		A2	0.68	0.50	14.4	0.34	6.73	2.3															FLOWS IN SWALE TO DP 1 CONVEY VIA SWALE TO DP2.1
	1								14.4	0.81	6.73	5.4											TOTAL FLOW AT DP1 BASINS OS1 AND A2
	2	A1	0.70	0.47	19.2	0.33	6.09	2.0															FLOWS IN SWALE TO DP 2 CAPTURED IN AREA INLET
	2.1								19.2	1.14	6.09	6.9											AREA INLET PIPED TO DP 5.1
	3	A3	0.75	0.51	14.9	0.38	6.66	2.5															FLOWS IN SWALE TO DP 3 CONVEYED TO DP5
	4	A4	1.00	0.82	9.2	0.82	7.74	6.3															FLOWS IN SWALE TO DP 2 THEN FLOWS TO CURB AND GUTTER TO INLET AT DP 5
									14.9	1.20	6.66	8.0											BASINS A3 AND A4 CONVEYED TO INLET DP5
	5	A5	2.85	0.64	14.4	1.82	6.73	12.3															FLOWS IN CURB AND GUTTER TO DP 5
									14.9	3.02	6.66	20.1											INLET AT DP5 BASINS A3-A5
	5.1								19.2	4.16	6.09	25.3											PIPED FROM INLET AT DP 5 TO EX STORM BASINS A1-A5 AND OS1
	6	A6	0.74	0.58	9.9	0.43	7.57	3.3															FLOWS INTO DINES BLVD CURB AND GUTTER TO EXISTING INLET
	7	A7	2.03	0.65	12.8	1.31	6.99	9.2															FLOWS IN CURB AND GUTTER TO ON-GRADE INLET AT DP 7 ON SCHOOLHOUSE ROAD COLLECTED RUNOFF PIPED TO DP8.1, BYPASS RUNOFF TO EX. INLET AT DP11
	8	A8	1.55	0.73	9.8	1.13	7.59	8.6															FLOWS IN CURB AND GUTTER TO ON-GRADE INLET AT DP 8 ON SCHOOLHOUSE ROAD COLLECTED RUNOFF PIPED TO DP8.1, BYPASS RUNOFF TO EX. INLET AT DP12
	8.1								12.8	2.44	6.99	17.1											TOTAL RUNOFF PIPED TO EXISTING STORM SEWER FROM FILING 4
	9	A9	0.21	0.53	12.9	0.11	6.98	0.8															FLOWS INTO DINES BLVD AND STERLING RANCH ROAD ULTIMATELY TO EX. ON-GRADE INLET AT DP 13
	10	A10	1.35	0.54	12.7	0.73	7.01	5.1															FLOWS INTO STERLING RANCH ROAD ULTIMATELY TO EX. ON-GRADE INLET AT DP 13
									12.9	0.84	6.98	5.9											BASINS A9-A10 CONVEYED TO EX. INLET AT DP13
	11	RUNOFF FROM FILING 4 DP5						25.9				25.9											TOTAL RUNOFF TO EX. 15' TYPE R INLET PIPED TO DP 14
	12	RUNOFF FROM FILING 4 DP6.2						6.4				6.4											TOTAL RUNOFF TO EX. 10' TYPE R INLET PIPED TO DP 14
	13	RUNOFF FROM FILING 4 DP8						12.9				18.8											TOTAL RUNOFF TO EX. 15' TYPE R INLET PIPED TO DP 14
	14											68.1											TOTAL RUNOFF PIPED TO EX. POND W-5

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

Flows do not match with Filing No. 4 report

Appendix C
Reference Material

MASTER DEVELOPMENT DRAINAGE PLAN FOR STERLING RANCH

OCTOBER 2018

Prepared for:

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Project #09-002
SKP-18-003
SF-17-024

HW/D ratio of ~1.3. The peak detained volume has been estimated at 78.2 ac-ft. A low point in Sterling Ranch Road will be designed adjacent to the facility to provide a safe overflow route. An exhibit showing the concept design and its various elements is included in the appendix of this report.

As previously discussed a Condition Letter of Map Revision and Letter of Map Revision (CLOMR/LOMR) will need to be processed through the Federal Emergency Management Agency (FEMA) to revise the hydrology to the Sand Creek Channel and allow for the remapping of the revised floodplains. It should be noted that the DBPS flow rates for Reach SC-8 (Reach 163) adjacent to this location were estimate to be 2,630 cfs and that the effective FEMA 100 year flow rate is 2,600cfs. A comparison table of the various flow rates is provided later in this text and on the accompanying drainage maps.

The final design of the culvert crossing and final determination of approved rates as well as the final pond design will be discussed within the future Sterling Ranch Channel Design Report and Sand Creek CLOMR/LOMR documents. No deviations for this pond and accompanying outlet structure are anticipated at this time.

It is important to note that the planned discharge outlet pipe for the FSD pond located to the west of the pond W3 will need to be extended to the downstream outlet side of the culvert to ensure that the 100 year water surface elevation with W3 does not affect the functionality of the adjacent FSD and its storm sewer systems.

In regards to timing, the need to construction this facility can be tied to the Sand Creek Channel improvements which is discussed within this report and also within the Subdivision Improvements Agreement. In no case should runoff from the East Fork of Sand Creek be diverted to the Main Branch of the Sand Creek Channel prior to the construction and of this facility.

Basin SC3-11A (Q5 = 7.8 cfs, Q100 = 24.3 cfs) consists of a 10.7 acre area located within of Sterling. Ranch, that is south of Sterling Ranch Road, west of Sand Creek. This portion of Sterling Ranch consists of single family residential for lots ranging in size from 0.2 to 0.3 acres in size and open space associated with the Sand Creek Channel. Runoff from the developed portion of the basin shall be collected and conveyed within street and storm sewer systems to a full spectrum detention pond FSD11A. The treated detained flows from the pond will discharge into Sand Creek at peak flow rates of 0.9 cfs and 12.3 cfs in the 5 and 100 year events respectively just upstream of DP-63. It should be noted that this detention facility may not be necessary if grading can be oriented to force surface runoff to the west.

Basin SC3-11B (Q5 = 81.3 cfs, Q100 = 213.7 cfs) consists of a 76.6 acre area located within of Sterling. Ranch, that is south of Sterling Ranch Road, east of Sand Creek. This portion of Sterling Ranch consists of single family residential planned for lots ranging in size from 0.2 to 0.3 acres in size and a portion of a park site and collector roadways. Runoff from the developed portion of the basin shall be collected and conveyed within street and storm sewer systems westward to a full spectrum detention pond FSD11B. The treated detained flows from the pond will discharge into Sand Creek at peak flow rates of 4.5 cfs and 69.5 cfs in the 5 and 100 year events respectively. The runoff from DP68 and from FSD ponds 11A and 11B combine at DP63 at peak flow rates of Q5 = 201.0 cfs, Q100 = 1385.1, which is less than the anticipated existing modeled flow rates of Q5 = 430.7 cfs, Q100 = 1911.5 at DP63. Runoff from DP63 continues south within the Sand Creek Channel toward DP61.

Basin SC3-7 (Q5 = 69.9 cfs, Q100 = 157.2 cfs) consists of a 45.7 acre industrial zoned area, referred to as the Barbarick Subdivision, located outside of Sterling Ranch. Per the Final Drainage Report for Barbarick Subdivision, Portions of Lots 1, 2 and Lots 3and 4 the filing consists of four lots which upon which development will be constructed which will include adding a proposed Extended Detention Basin within Lot 4. This detention basin will provide water quality treatment for portions of Lots 1 & 2, and Lots 3 & 4. The EBD will structure will outfall at the south end of Lot 4 at the Barbarick Subdivision/Sterling Ranch property line. Per the report the proposed total outflow from the EDB pond will be Q5 = 0.3 cfs, Q100 = 45.9** cfs(**which includes pass through flows of 29.4 cfs). A second Sand Filter Basin water quality detention catchment will be provided at the southeast/downstream end of Lot 2. The SFB will outfall at the southeast corner of the Lot 2 at the Barbarick Subdivision/Sterling Ranch property line. Per the report the proposed total outflow the SFB pond will be Q5 = 0.1 cfs, Q100 = 3.6 cfs. At the initial writing of this report, neither EDB nor SFB structure has been fully constructed, and thus the assumption was made to utilize the full un-detained untreated runoff from the offsite development for onsite drainage planning purposes. Thus the downstream facilities planned within Sterling Ranch will account for the total un-detained runoff from the parcel of Q5 = 69.9 cfs, Q100 = 157.2 cfs and will plan to treat the total runoff onsite facilities. This provides a conservative approach for master planning. Runoff discharged from the property will be collected by proposed storm sewer within Sterling Ranch and routed to DP64. These facilities and their effects on drainage will be re-reviewed with subsequent drainage report and shall be implemented into final design and construction.

Basin SC3-6B (Q5=43.4 cfs, Q100=102.7 cfs) consists of a 30.9 acre area located within of Sterling Ranch, that is north of Sterling

Ranch Road and west of Sand Creek. This portion of Sterling Ranch will consist of single family residential planned for lots ranging in size from 0.1 to 0.33 acres in size, a school site and portion of the local collector roadways. Runoff from the developed portion of the basin shall be collected and conveyed within street and storm sewer systems where it combines with flows from Basin SC3-7 at DP64 (Q5 = 112.1 cfs, Q100 = 258.0 cfs). The combined runoff continues south toward Pond FSD6.

Basin SC3-6A (Q5=79.3 cfs, Q100=177.1 cfs) consists of a 49.3 acre area located within of Sterling Ranch, that is north and east of Marksheffel Road and of Sterling Ranch Road and west of Sand Creek. This portion of Sterling Ranch is planned for a commercial site and single family residential lots ranging in size from 0.2 to 0.3 acres lots as well as portions of major and local collector roadways. Developed runoff from the basin shall be conveyed within street sections and storm sewer systems and directed to FSD Pond 6.

Basin SC3-6C (Q5=72.5 cfs, Q100=181.5 cfs) consists of a 58.0 acre area located mostly within the confines of Sterling Ranch, near the south boundary of the site, west of the Sand Creek Channel. This portion of Sterling Ranch is planned for a commercial site and single family residential lots ranging in size from 0.2 to 0.3 acres lots as well as portions of major and local collector roadways. A small segment of the existing Pawnee Rancheros subdivision (5 acres lots) also falls within the basin. Where not sheet flowing into the creek, the developed runoff from the basin shall be conveyed within street sections and storm sewer systems and directed to FSD Pond 6. Runoff from DP64 and from Basins SC3-6B and 6C will combine in FSD6. The treated detained flows from the pond will discharge into Sand Creek at peak flow rates of 7.5 cfs and 149.6 cfs in the 5 and 100 year events respectively. Flows from FSD6 outfall into the Sand Creek Channel at DP61.

Basin SC3-8 (Q5 = 42.1 cfs, Q100 = 166.2 cfs) consists of 143.4 acres located outside of Sterling Ranch and to the west of Basin SC3-15A. In the developed condition, it is assumed that the remaining large parcel are fully developed into 5 acres lots. Runoff from the basin is conveyed as surface flows to Basin SC3-9.

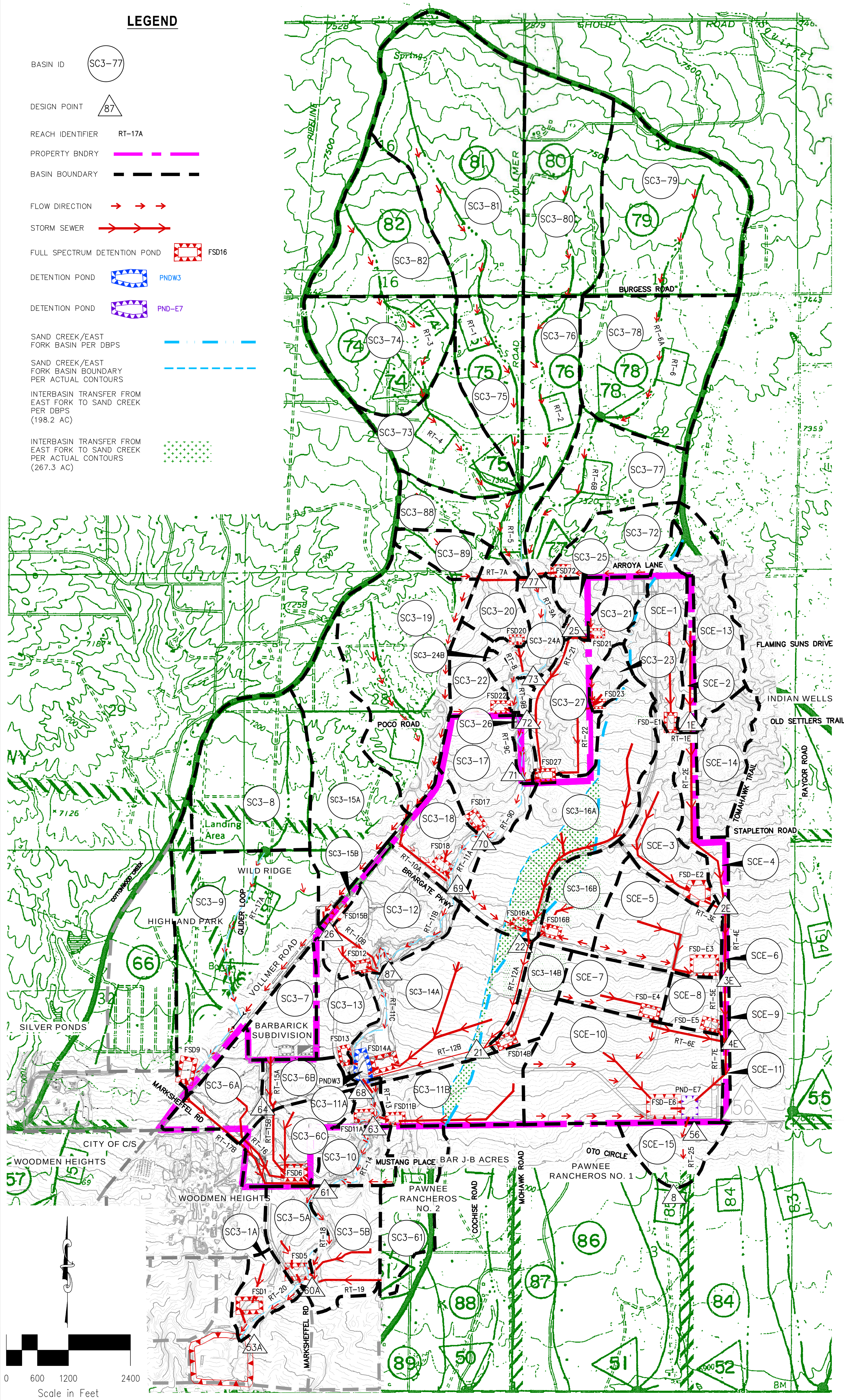
Basin SC3-9 (Q5 = 71.5 cfs, Q100 = 254.0 cfs) consists of 217.4 acres located to northwest of Vollmer Road and south of Basin SC3-8. In the current condition, much of the large parcel has been developed into 2.5-5 acres lots. The calculated runoff will assume that that Vollmer Road is widened as a part of this project. Runoff from Basins SC3-8 and SC3-9 combine within the roadside ditches and natural drainage ways within the development before combining within an upgraded roadside swale located along the west side of Vollmer Road which discharges into a full spectrum detention pond (FSD9) located at the south end of the basin. The treated detained flows from the pond are conveyed under Vollmer and along Marksheffel Road within a storm drain or stabilized channel to Sand Creek at peak flow rates of 24.9 cfs and 289.9 cfs in the 5 and 100 year events respectively just downstream of DP-61.

Basin SC3-10 (Q5 = 12.3 cfs, Q100 = 47.7 cfs) consists of 36.0 acres (located outside of Sterling Ranch), of the existing Pawnee Rancheros Filing No 2 (5 acre lots), that is located to the east of Basin SC3-6. Runoff from the basin is conveyed as surface drainage to the Sand Creek Channel, where it combines with flows discharged from FSD Ponds 6 and 9 and from DP 63 at the County/City Boundary (DP-61) at peak flow rates of 223.9 cfs and 1620.1 cfs in the 5 and 100 year events respectively. It is anticipated that easements from the owner of the property located to the south of the Sterling Ranch will be required to outfall the storm sewer from FSD6 and FSD9 as well as provide an emergency overflow route. Runoff from DP61 continues south within the Sand Creek Channel toward DP60A.

Basin SC3-5A (Q5 = 53.7 cfs, Q100 = 129.1 cfs) is a 39.1 acres offsite area located to the south of Sterling Ranch, west of the Sand Creek Channel. In the developed condition, it is assumed that this area will be developed into 0.1 acre residential lots, portions of Marksheffel Road and stabilized segments of the Sand Creek Channel. Runoff produced from within the basin shall be directed to a proposed full spectrum detention facility (FSD5) located at the southeast corner of the basin upstream of DP-60A. Released flows from the pond will discharge into Sand Creek at peak flow rates of 1.4 cfs and 30.1 cfs in the 5 and 100 year events.

Basin SC3-61 (Q5 = 22.0 cfs, Q100 = 84.8 cfs) is a 65.5 acres offsite area located to the south of Sterling Ranch east of Basin SC3-5B, that is made up of 5 acre lots. With the development of filing SC3-5B, a storm sewer bypass line will be constructed to safely convey the upstream runoff thru the development to the channel just upstream of DP-60A.

Basin SC3-5B (Q5 = 73.0 cfs, Q100 = 187.0 cfs) is a 63.0 acres offsite area located to the south of Sterling Ranch east of Basin SC3-5A. In the developed condition, it is assumed that the majority of the area will be subdivided into 0.1 acre residential lots. Water quality treatment only is anticipated for this area and thus a FSD pond has not been included in the modeling. Runoff produced from within the basin shall be directed to Sand Creek just upstream of DP-60A. The runoff from DP61, FSD5 and from Basins SC3-5B and SC3-61 combine at DP60A at peak flow rates of Q5 = 224.8 cfs, Q100 = 1661.8, which is less than the anticipated existing modeled flow rates of Q5 = 430.2 cfs, Q100 = 1913.5 at DP60A. Runoff from DP60A continues south within the Sand Creek Channel toward



BASIN SUMMARY

BASIN	CN	AREA (ACRES)	AREA (SQ MI)	Q_2 (CFS)	Q_5 (CFS)	Q_{10} (CFS)	Q_{25} (CFS)	Q_{50} (CFS)	Q_{100} (CFS)
SC3-1A	73	27.8	0.044	16.3	23.3	33.0	45.8	57.1	68.9
SC3-5A	84	39.1	0.061	40.6	53.7	71.0	92.4	110.6	129.1
SC3-5B	81	63.0	0.098	53.8	73.0	98.5	130.8	158.6	187.0
SC3-6A	88	49.3	0.077	61.4	79.3	102.2	130.1	153.6	177.1
SC3-6B	85	30.9	0.048	32.9	43.4	57.0	73.9	88.2	102.7
SC3-6C	82	58.0	0.091	53.9	72.5	97.1	128.0	154.5	181.5
SC3-7	88	45.7	0.071	54.0	69.9	90.3	115.2	136.2	157.2
SC3-8	62	143.4	0.224	25.4	42.1	66.7	100.7	132.3	166.2
SC3-9	66	217.4	0.340	45.8	71.5	108.6	158.9	204.9	254.0
SC3-10	63	36.0	0.056	7.6	12.3	19.4	29.1	38.0	47.7
SC3-11A	70	10.7	0.017	5.3	7.8	11.3	15.9	20.0	24.3
SC3-11B	80	76.6	0.120	59.4	81.3	110.8	148.1	180.5	213.7
SC3-12	81	88.2	0.138	77.8	105.6	142.5	189.1	229.1	270.0
SC3-13	85	41.0	0.064	43.9	57.8	76.0	98.5	117.6	136.9
SC3-14A	79	164.9	0.258	127.6	175.4	239.8	321.9	393.2	466.3
SC3-14B	77	34.7	0.054	24.6	34.3	47.4	64.2	79.0	94.1
SC3-15A	62	139.7	0.218	21.3	35.5	56.3	85.3	112.1	141.0
SC3-15B	87	7.9	0.012	10.8	14.0	18.2	23.3	27.6	31.9
SC3-16A	74	168.1	0.263	84.4	120.4	170.0	234.8	292.2	351.8
SC3-16B	78	50.7	0.079	39.0	53.7	73.6	99.0	121.1	143.8
SC3-17	73	70.6	0.110	41.8	59.6	85.2	119.0	149.1	180.6
SC3-18	81	53.8	0.084	49.3	67.1	91.0	121.2	147.3	174.0
SC3-19	62	184.0	0.287	28.8	47.7	75.7	114.4	150.2	188.8
SC3-20	65	34.2	0.053	9.9	15.5	23.8	35.1	45.5	56.6
SC3-21	66	23.3	0.036	7.0	10.8	16.3	23.7	30.4	37.5
SC3-22	65	33.9	0.053	9.4	14.8	22.5	32.9	42.5	52.6
SC3-23	67	14.5	0.023	5.5	8.3	12.4	18.0	23.0	28.4
SC3-24A	65	35.7	0.056	13.0	20.4	31.1	45.7	59.0	73.2
SC3-24B	65	12.2	0.019	3.4	5.3	8.1	11.8	15.2	18.9
SC3-25	66	19.0	0.030	5.8	8.9	13.4	19.5	25.1	31.0
SC3-26	63	10.0	0.016	2.5	4.0	6.2	9.2	12.1	15.1
SC3-27	71	70.0	0.109	35.1	51.2	73.8	103.7	130.3	158.3
SC3-61	63	65.5	0.102	13.7	22.0	34.4	51.6	67.6	84.8
SC3-72	64	56.2	0.088	12.8	20.2	31.4	46.7	60.9	76.0
SC3-73	63	90.0	0.141	16.4	26.4	41.3	62.1	81.3	102.0
SC3-74	63	119.7	0.187	22.3	36.5	57.3	85.9	112.3	140.7
SC3-75	63	79.3	0.124	13.1	21.5	33.7	50.5	66.1	82.8
SC3-76	63	86.4	0.135	14.2	23.1	36.4	54.6	71.4	89.6
SC3-77	62	106.9	0.167	16.6	27.6	43.8	66.2	87.0	109.4
SC3-78	63	155.6	0.243	28.1	45.3	70.6	106.2	139.1	174.5
SC3-79	63	189.0	0.295	34.9	57.0	89.5	134.3	175.6	220.1
SC3-80	63	147.7	0.231	27.3	44.3	69.6	104.5	136.8	171.4
SC3-81	62	262.9	0.411	42.6	70.2	111.0	167.4	219.6	275.7
SC3-82	62	117.8	0.184	20.0	33.2	52.8	80.0	105.1	132.3
SC3-88	62	60.2	0.094	10.5	17.4	27.6	41.8	54.9	69.0
SC3-89	62	27.5	0.043	6.1	10	15.7	23.6	30.8	38.6
SCE-1	65	64.4	0.101	23.3	35.9	53.8	79.1	102.4	127.4
SCE-2	64	15.0	0.023	4.4	7.0	10.8	15.9	20.7	25.7
SCE-3	70	67.5	0.105	30.6	45.2	65.9	93.3	118.0	143.9
SCE-4	70	29.5	0.046	13.3	19.6	28.6	40.6	257.8	62.6
SCE-5	87	85.5	0.134	100.4	130.6	169.6	217.4	257.8	298.4
SCE-6	64	3.8	0.006	1.6	2.5	3.7	5.4	7.0	8.6
SCE-7	89	44.9	0.070	58.9	75.5	96.6	122.2	143.7	165.2
SCE-8	92	25.5	0.040	38.6	48.4	60.7	75.4	87.7	99.9
SCE-9	64	4.0	0.006	1.5	2.4	3.6	5.3	6.8	8.5
SCE-10	83	174.3	0.272	7.6	189.4	19.4	29.1	398.9	467.5
SCE-11	64	5.8	0.009	2.3	3.6	5.5	8.0	10.3	12.8
SCE-13	63	78.6	0.123	19.6	31.3	48.7	73.1	95.7	120.0
SCE-14	63	52.5	0.082	13.2	21.2	33.3	49.9	65.2	81.7
SCE-15	51	39.7	0.062	2.2	5.1	10.1	17.7	25.1	33.4

DESIGN POINT SUMMARY

DESIGN POINT	AREA (SQ MI)	Q_2 (CFS)	Q_5 (CFS)	Q_{10} (CFS)	Q_{25} (CFS)	Q_{50} (CFS)	Q_{100} (CFS)	LOCATION
DP-74	0.371	39.3	65.3	104.8	158.9	209.1	262.8	
DP-75	1.413	141.2	235.1	376.6	566.6	750.9	950.5	
DP-77	2.343	209.9	351.9	580.6	886.6	1168.4	1467.7	ARROYA LANE X-ING
DP-78	0.538	59.7	98.4	154.0	232.6	306.2	385.3	
DP-73	2.471	207.5	354.3	588.5	897.1	1187.2	1506.7	
DP-72	2.543	206.2	352.5	586.7	897.2	1195.3	1518.6	POCO ROAD X-ING
DP-71	2.757	205.9	349.3	610.5	932.4	1226.9	1612.2	STERLING RANCH NORTHERN BNDRY
DP-70	2.867	205.3	349.8	614.0	940.1	1260.6	1636.7	
DP-69	3.238	212.7	366.6	653.7	1010.6	1364.1	1775.7	BRIARGATE PARKWAY X-ING
DP-87	3.594	216.9	374.6	681.9	1072.1	1471.5	1905.9	
DP-68	4.312	214.6	374.5	714.9	1187.6	1674.9	2204.1	UPSTREAM OF POND W3
DP-64	0.119	85.9	112.1	145.9	187.5	222.6	258.0	
DP-63	4.449	154.4	201.0	375.7	815.9	1112.1	1385.1	STERLING RANCH SOUTHERN BNDRY
DP-61	5.356	156.6	223.9	428.0	928.2	1287.3	1620.1	COLORADO SPRINGS/EL PASO BNDRY
DP-60A	5.617	161.6	224.8	439.1	950.4	1320.5	1661.8	MARKSHEFFEL X-ING
DP-53A	5.661	161.6	225.7	441.8	951.1	1326.0	1668.9	SAND CREEK AND POND 3
DP-1E	0.247	23.9	38.3	70.1	132.8	173.0	220.9	
DP-2E	0.486	48.9	76.8	123.0	228.7	319.7	419.4	
DP-3E	0.626	48.5	75.7	122.2	271.1	387.1	500.1	
DP-4E	0.745	48.1	76.2	122.4	286.9	407.3	534.8	
DP-56	1.017	23.1	35.3	71.5	108.3	152.1	196.4	NEAR SE PROP CORNER
DP-8	1.079	24.1	37.2	73.5	111.3	155.4	200.7	BELOW SE PROP CORNER
DP-21	0.396	0.6	8.8	17.8	57.1	116.8	174.9	
DP-22	0.342	0.6	8.8	17.6	56.8	105.1	156.4	
DP-25	0.066	5.9	9.1	16.3	35.1	46.4	58.2	
DP-26	0.012	0.1	1.1	3.2	7.3	9.5	12.0	

DESIGN POINT SUMMARY (VOLUME)

DESIGN POINT	AREA (SQ MI)	V_2 (AC-FT)	V_5 (AC-FT)	V_{10} (AC-FT)	V_{25} (AC-FT)	V_{50} (AC-FT)	V_{100} (AC-FT)	LOCATION
DP-74	0.371	5.9	9.0	13.6	19.8	25.5	31.6	
DP-75	1.413	22.7	34.5	51.7	75.4	97.1	120.5	
DP-77	2.343	37.7	57.4	85.9	125.1	161.1	199.9	ARROYA LANE X-ING
DP-78	0.538	8.9	13.5	20.1	29.3	37.7	46.7	
DP-73	2.471	40.0	60.8	91.0	132.5	170.7	211.7	
DP-72	2.543	41.3	62.9	94.0	136.8	176.2	218.5	POCO ROAD X-ING
DP-71	2.757	46.3	70.0	104.3	151.3	194.5	240.8	STERLING RANCH NORTHERN BNDRY
DP-70	2.867	49.5	74.5	110.6	160.1	205.4	254.0	
DP-69	3.238	57.5	86.1	127.4	183.8	235.3	290.6	BRIARGATE PARKWAY X-ING
DP-87	3.594	66.5	98.9	145.6	209.1	267.1	329.1	
DP-68	4.312	81.8	123.7	183.9	264.9	338.0	415.8	UPSTREAM OF POND W3
DP-64	0.119	7.0	9.1	11.8	15.2	18.1	21.1	
DP-63	4.449	85.6	129.5	192.3	276.7	352.8	433.5	STERLING RANCH SOUTHERN BNDRY
DP-61	5.356	103.7	157.8	235.1	338.4	431.3	529.8	COLORADO SPRINGS/EL PASO BNDRY
DP-60A	5.617	111.0	168.6	250.4	359.5	457.7	561.5	MARKSHEFFEL X-ING
DP-53A	5.661	112.0	170.0	252.6	362.6	461.7	566.5	SAND CREEK AND POND 3
DP-1E	0.247	3.1	5.2	8.4	12.7	16.6	20.9	
DP-2E	0.480	6.1	10.4	16.9	25.7	33.7	42.2	
DP-3E	0.620	7.0	13.7	23.4	36.1	47.4	59.3	
DP-4E	0.736	7.6	15.6	27.2	43.0	57.2	72.0	
DP-56	1.017	7.7	16.1	28.6	51.3	71.7	92.9	NEAR SE PROP CORNER
DP-8	1.079	8.0	16.7	26.6	53.0	74.0	95.9	BELOW SE PROP CORNER
DP-21	0.396	6.3	11.3	18.3	27.5	35.6	44.0	
DP-22	0.736	6.3	10.7	16.7	24.6	31.5	38.7	
DP-25	1.017	1.3	1.9	2.8	4.1	5.2	6.4	
DP-26	1.079	0.7	0.9	1.2	1.5	1.8	2.1	

WATER QUALITY & DETENTION POND SUMMARY

FSD1						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	16.3	23.3	33.0	45.8	57.1	68.9
ALLOWABLE RELEASE (CFS)	0.1	1.7	3.3	10.9	17.5	25.5
MODELED RELEASE (CFS)	0.1	1.6	3.2	10.9	17.4	25.4
STORED VOLUME (AC-FT)	2.4	2.6	3.0	3.6	1.9	2.2

FSD5						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	40.6	53.7	71.0	92.4	110.6	129.1
ALLOWABLE RELEASE (CFS)	0.1	1.4	2.6	11.3	19.8	30.2
MODELED RELEASE (CFS)	0.1	1.4	2.6	11.2	19.7	30.1
STORED VOLUME (AC-FT)	3.0	3.2	3.8	4.1	4.7	5.2

FSD6						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	196.5	258.5	339.1	438.7	523.3	608.6
ALLOWABLE RELEASE (CFS)	0.5	7.6	14.6	58.4	99.6	149.7
MODELED RELEASE (CFS)	0.5	7.5	14.5	58.2	99.6	149.6
STORED VOLUME (AC-FT)	15.5	16.4	18.7	20.8	23.3	26.0

FSD9						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	64.6	105.6	169.5	252.3	327.1	410.1
ALLOWABLE RELEASE (CFS)	1.7	24.9	49.8	141.1	207.2	290.0
MODELED RELEASE (CFS)	1.7	24.9	49.8	141.1	207.0	289.9
STORED VOLUME (AC-FT)	8.7	8.7	9.6	10.8	12.3	13.8

FSD11A						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	5.3	7.8	11.3	15.9	20.0	24.3
ALLOWABLE RELEASE (CFS)	0.1	1.6	3.2	7.5	9.7	12.4
MODELED RELEASE (CFS)	0.2	0.9	3.0	7.5	9.7	12.3
STORED VOLUME (AC-FT)	0.3	0.3	0.4	0.4	0.5	0.6

FSD11B						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	59.4	81.3	110.8	148.1	180.5	213.7
ALLOWABLE RELEASE (CFS)	0.3	4.5	8.7	29.6	47.7	69.6
MODELED RELEASE (CFS)	0.3	4.5	8.6	29.5	47.7	69.5
STORED VOLUME (AC-FT)	4.8	4.9	5.5	6.4	7.3	8.2

FSD12						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	77.8	105.6	142.5	189.1	229.1	270.0
ALLOWABLE RELEASE (CFS)	0.9	13.2	26.7	62.0	80.2	103.2
MODELED RELEASE (CFS)	0.9	9.0	26.7	61.9	80.1	103.1
STORED VOLUME (AC-FT)	5.2	5.5	5.8	6.7	7.8	8.9

FSD13						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	43.9	57.8	76.0	98.5	117.6	136.9
ALLOWABLE RELEASE (CFS)	0.4	6.1	12.3	28.6	37.0	47.6
MODELED RELEASE (CFS)	0.4	4.2	12.3	28.6	36.9	47.2
STORED VOLUME (AC-FT)	3.1	3.1	3.3	3.8	4.4	5.0

FSD14A						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	127.6	175.4	239.8	321.9	393.2	466.3
ALLOWABLE RELEASE (CFS)	0.5	7.5	14.4	56.2	95.2	142.4
MODELED RELEASE (CFS)	0.5	7.5	14.4	56.2	95.1	142.2
STORED VOLUME (AC-FT)	9.9	10.6	11.9	13.5	15.3	17.3

FSD14B						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	24.6	34.3	47.4	64.2	79.0	94.1
ALLOWABLE RELEASE (CFS)	0.0	0.3	0.5	5.7	11.8	19.3
MODELED RELEASE (CFS)	0.0	0.3	0.5	4.5	11.8	19.3
STORED VOLUME (AC-FT)	1.9	2.5	3.3	3.5	3.5	3.8

FSD15B						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	10.8	14.0	18.2	23.3	27.6	31.9
ALLOWABLE RELEASE (CFS)	0.1	1.6	3.2	7.3	9.5	12.0
MODELED RELEASE (CFS)	0.1	1.1	3.2	7.3	9.5	12.0
STORED VOLUME (AC-FT)	0.6	0.6	0.7	0.8	0.9	1.0

FSD16A						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	84.4	120.4	170.0	234.8	292.2	351.8
ALLOWABLE RELEASE (CFS)	0.6	8.8	17.3	56.2	88.4	128.3
MODELED RELEASE (CFS)	0.6	8.8	17.3	56.2	88.3	128.3
STORED VOLUME (AC-FT)	7.6	7.7	8.9	10.4	12.1	13.8

SAND CREEK FLOW COMPARISON CHART

DESIGN POINT	AREA (SQ MI)	Q_{100} (CFS)	DESCRIPTION
DP-77	2.343	1468	PROPOSED CONDITION
	2.91	2262	SAND CREEK DBPS
		2600	FEMA
DP-71	2.757	1612	PROPOSED CONDITION
		2260	SAND CREEK DBPS
DP-63	4.449	1385	PROPOSED CONDITION
	4.33	2630	SAND CREEK DBPS
		2600	FEMA
DP-60A	5.661	1662	PROPOSED CONDITION
	5.38	3295	SAND CREEK DBPS

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)

DBPS DESIGN POINT	AREA (SQ MI)	Q_{10} (CFS) (EXIST)	Q_{100} (CFS) (EXIST)	AREA (SQ MI)	Q_{10} (CFS) (PROP)	Q_{100} (CFS) (PROP)
DP-50	0.32	47.0	195.7	0.32	146.7	370.3
DP-51 (BASIN 86)	0.33	17.7	74.1	0.33	110.0	233.5
DP-52	1.67	80.5	456.5	1.67	1207.9	2123.0
DP-56	0.79	63.6	265.0	0.79	513.0	908.2

Values reported from SCDBPS, (DP 50, 51, 52 Not analyzed as a part of this study)
DBPS Reach 85(Basin91)=Q10=28.8cfs Q100=115.2cfs (EXISTING) / Q10=345.7cfs Q100=588.9cfs (PROPOSED)

WATER QUALITY & DETENTION POND SUMMARY

FSD16B						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	39.0	53.7	73.6	99.0	121.1	143.8
ALLOWABLE RELEASE (CFS)	0.0	0.4	0.7	8.3	17.2	28.2
MODELED RELEASE (CFS)	0.0	0.4	0.7	7.9	17.2	28.1
STORED VOLUME (AC-FT)	3.0	3.9	5.1	5.1	5.3	5.8

FSD17						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	41.8	59.6	85.2	119.0	149.1	180.6
ALLOWABLE RELEASE (CFS)	0.7	11.1	22.5	52.0	67.2	86.3
MODELED RELEASE (CFS)	0.7	8.4	22.4	52.0	67.2	86.1
STORED VOLUME (AC-FT)	2.6	2.6	2.8	3.4	4.0	4.7

FSD18						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	49.3	67.1	91.0	121.2	147.3	174.0
ALLOWABLE RELEASE (CFS)	0.6	9.2	18.4	42.2	54.6	69.9
MODELED RELEASE (CFS)	0.6	6.3	18.4	42.2	54.6	69.6
STORED VOLUME (AC-FT)	3.2	3.2	3.4	4.0	4.7	5.3

FSD20						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	9.9	15.5	23.8	35.1	45.5	56.6
ALLOWABLE RELEASE (CFS)	0.4	5.5	11.1	25.7	33.2	42.5
MODELED RELEASE (CFS)	0.4	2.8	10.9	25.7	33.0	42.4
STORED VOLUME (AC-FT)	0.7	0.8	0.8	0.9	1.0	1.2

FSD21						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	7.0	10.8	16.3	23.7	30.4	37.5
ALLOWABLE RELEASE (CFS)	0.3	4.0	8.0	18.3	23.7	30.3
MODELED RELEASE (CFS)	0.3	3.3	8.0	18.3	23.7	30.1
STORED VOLUME (AC-FT)	0.5	0.5	0.5	0.6	0.7	0.8

FSD22						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	9.4	14.8	22.5	32.9	42.5	52.6
ALLOWABLE RELEASE (CFS)	0.4	5.8	11.5	26.5	34.3	43.9
MODELED RELEASE (CFS)	0.4	5.8	11.4	26.5	34.3	43.8
STORED VOLUME (AC-FT)	0.6	0.6	0.7	0.8	0.9	1.0

FSD23						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	5.5	8.3	12.4	18.0	23.0	28.4
ALLOWABLE RELEASE (CFS)	0.2	2.4	4.9	11.2	14.5	18.6
MODELED RELEASE (CFS)	0.2	2.0	4.9	11.2	14.5	18.6
STORED VOLUME (AC-FT)	0.3	0.3	0.4	0.4	0.5	0.6

FSD27						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	38.8	57.6	84.1	119.7	159.2	206.3
ALLOWABLE RELEASE (CFS)	1.4	21.1	42.4	97.8	126.4	161.9
MODELED RELEASE (CFS)	1.4	18.4	42.3	97.7	126.2	161.9
STORED VOLUME (AC-FT)	2.7	2.8	2.9	3.2	3.7	4.2

FSD72						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	12.8	20.2	31.4	46.7	60.9	76.0
ALLOWABLE RELEASE (CFS)	0.6	9.6	19.3	44.4	57.4	73.4
MODELED RELEASE (CFS)	0.6	9.3	19.2	44.4	57.4	73.4
STORED VOLUME (AC-FT)	1.0	1.0	1.1	1.1	1.2	1.3

PNDW3						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	214.6	374.5	714.9	1187.6	1674.9	2204.1
MODELED RELEASE (CFS)	154.3	200.3	366.8	799.9	1085.6	1350.6
STORED VOLUME (AC-FT)	2.8	9.5	26.3	41.2	57.2	78.2

FSD-E1						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	23.3	35.9	53.8	79.1	102.4	127.4
ALLOWABLE RELEASE (CFS)	0.7	11.0	22.1	50.9	65.7	84.1
MODELED RELEASE (CFS)	0.7	5.4	19.9	48.9	62.8	84.0
STORED VOLUME (AC-FT)	1.3	1.3	1.5	1.8	2.1	2.5

FSD-E2						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	30.6	45.2	65.9	93.3	118.0	143.9
ALLOWABLE RELEASE (CFS)	0.6	9.5	19.2	45.5	59.8	77.6
MODELED RELEASE (CFS)	0.6	3.2	18.5	41.3	58.5	74.7
STORED VOLUME (AC-FT)	2.1	2.3	2.4	2.8	3.3	3.8

FSD-E3						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	100.4	130.6	169.6	217.4	257.8	298.4
ALLOWABLE RELEASE (CFS)	0.9	13.2	26.5	61.6	79.8	102.6
MODELED RELEASE (CFS)	1.0	6.8	25.7	56.0	79.8	101.3
STORED VOLUME (AC-FT)	7.0	7.2	7.7	8.9	10.1	11.4

FSD-E4						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	58.9	75.5	96.6	122.2	143.7	165.2
ALLOWABLE RELEASE (CFS)	0.3	4.4	8.8	23.0	32.2	43.7
MODELED RELEASE (CFS)	0.9	2.8	8.7	21.9	32.2	43.6
STORED VOLUME (AC-FT)	4.2	4.3	4.7	5.4	6.2	6.9

FSD-E5						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	38.6	48.4	60.7	75.4	87.7	99.9
ALLOWABLE RELEASE (CFS)	0.0	0.2	0.4	4.2	8.7	14.3
MODELED RELEASE (CFS)	0.0	0.2	0.5	2.2	5.1	10.0
STORED VOLUME (AC-FT)	3.0	3.7	4.4	4.8	5.0	5.3

FSD-E6						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	141.6	189.4	252.5	331.4	398.9	467.5
ALLOWABLE RELEASE (CFS)	0.2	1.9	3.2	37.4	77.3	125.6
MODELED RELEASE (CFS)	0.2	0.9	3.2	18.3	64.1	123.3
STORED VOLUME (AC-FT)	13.0	17.0	21.9	22.2	22.6	23.7

PND-E7						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	46.5	75.4	121.2	285.2	402.4	548.0
MODELED RELEASE (CFS)	23.1	35.3	71.5	108.3	152.1	196.4
STORED VOLUME (AC-FT)	1.0	1.8	4.6	10.5	17.9	28.0

M&S CIVIL CONSULTANTS, INC.
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

2018 STERLING RANCH MDDP

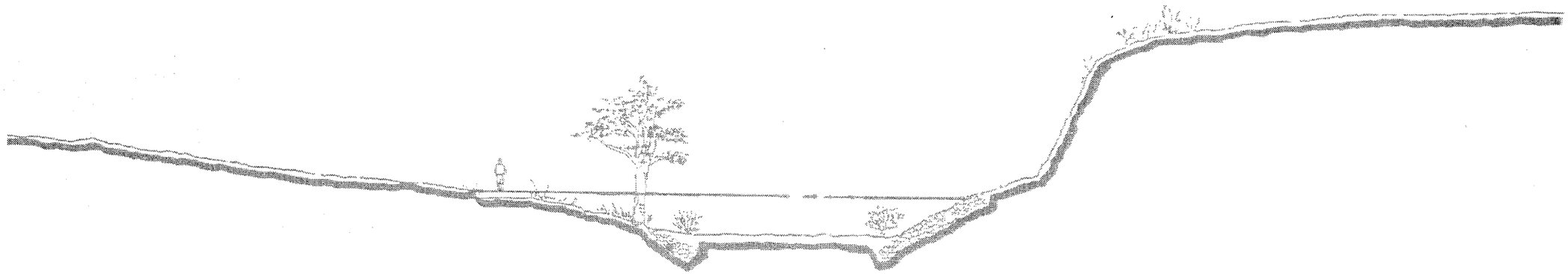
DEVELOPED HYDROLOGIC CONDITIONS MAP

PROJECT NO. 09-002
FILE: \dwg\Eng Exhibits\2018-MDDP-PROPCOND.dwg
DESIGNED BY: JD
DRAWN BY: JD
CHECKED BY: VAS
SCALE
HORIZ: 1"=2400'
VERT: 1"=2400'
DATE: 10-21-2018
DM2

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN REPORT

CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO

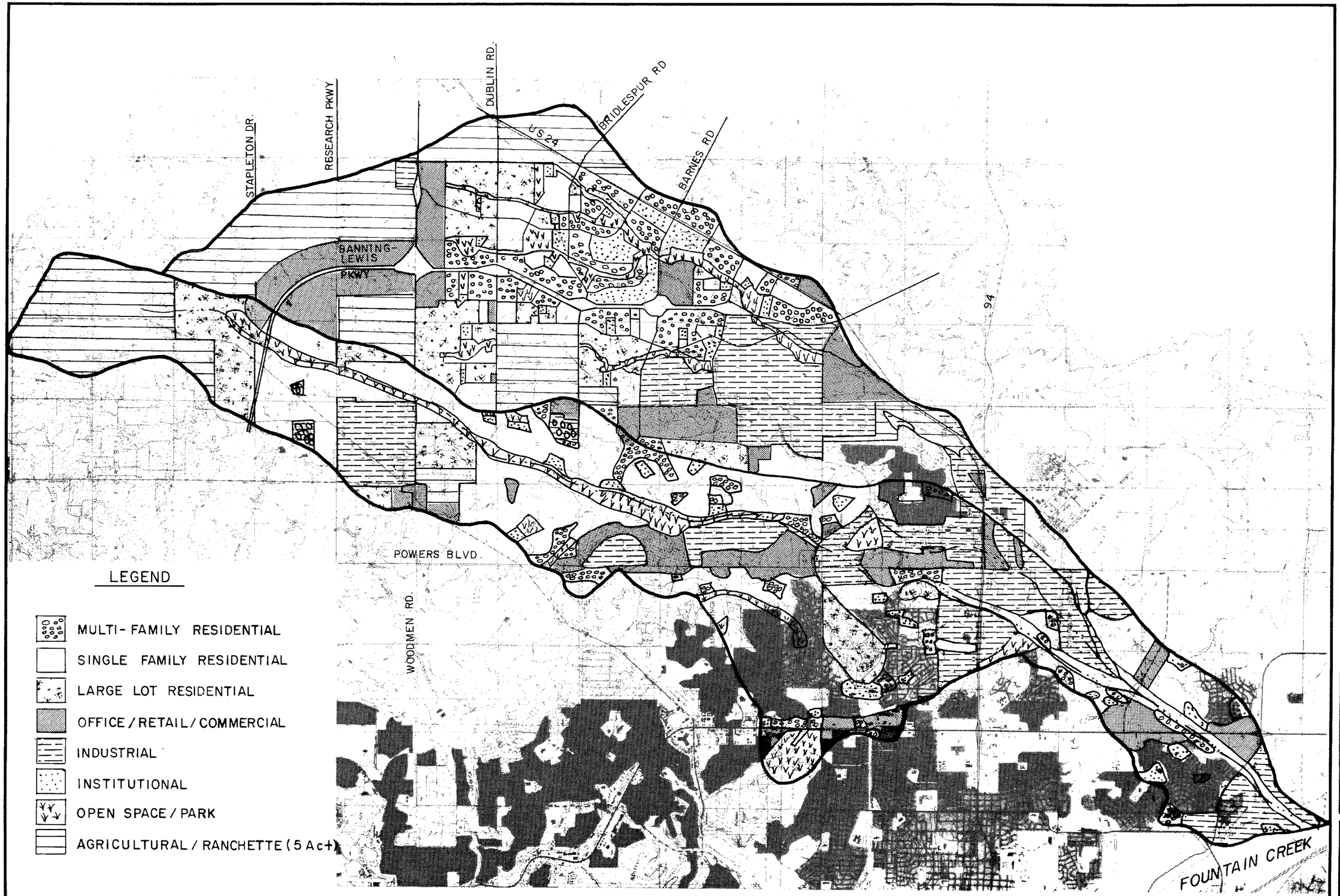


PREPARED FOR:

City of Colorado Springs
Department of Comprehensive Planning, Development and Finance
Engineering Division
30 S. Nevada
Colorado Springs, Colorado 80903

PREPARED BY:

Kiowa Engineering Corporation
1011 North Weber
Colorado Springs, CO 80903



Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PROPOSED LAND USE

Project No.	90-04-09
Date:	9/90
Design:	
Drawn:	EAK
Check:	
Revisions:	

7

FIG. II-3

Table III-1. Percent Impervious Values.

Land Use Classification	Percent Impervious	Land Use Density
Multi-Family Residential	65-80	10-24 DU/AC
Single-Family Residential	45-65	6-10 DU/AC
Low Density Residential	30-45	1-6 DU/AC
Large Lot Residential/ Agricultural	5-20	1 DU/AC
Office/Commercial	80-90	
Industrial	85-95	
Institutional	50-75	
Dedicated Open Space/Park	5-10	
Rangeland - Poor to Good Condition	5- 20	

NOTE: The above data was used in the preparation of the hydrologic analysis for the Sand Creek Drainage Basin Planning Study. These data are not intended to reflect future land use planning within the City or the County.

Table III-2: Summary of Peak Discharges
24-hour Duration Storm, AMC-II
Baseline Hydrologic Conditions

Design Point	Location	Area s.m.	100-year (cfs) Existing	100-year (cfs) Future	10-year (cfs) Existing	10-year (cfs) Future
	SAND CREEK (1)					
1	@ Fountain Creek	54.1	16900	25800	7470	11800
12	Hancock Blvd.	53.1	16100	25000	7250	11600
19	Fountain Blvd.	50.7	13600	22100	6230	10800
27	West Fork Sand Creek	23.0	11300	18900	5920	8790
99	C.R.I. & P. RR	16.0	5820	14530	2360	7400
20	North Carefree	13.5	4030	10260	1520	4810
37	Stetson Hills Blvd.	10.0	3230	6690	840	3060
60	Woodmen Road	5.4	2630	3300	760	950
75	Black Forest Road	1.4	1000	1030	320	350
	WEST FORK SAND CREEK					
27	@ Sand Creek	5.0	6840	6840	3200	3200
52	U. S. 24	4.8	6860	6860	3230	3230
59	Constitution Ave.	2.1	3450	3450	1680	1680
69	South Carefree	1.0	1630	1630	810	810
	CENTER TRIBUTARY SAND CREEK					
42	Airport Road	1.6	1530	2010	650	1200
43	Powers Blvd.	1.3	1300	1710	590	980
44	U. S. 24	1.1	1200	1680	580	960
45	Galley Road	0.8	1180	1340	530	650
	EAST FORK SAND CREEK					
1	@ Center Tributary	24.3	3970	15600	700	6530
9	@ East Fork Sub. Tributary	19.8	3730	13990	650	6050
29	@ W. Bierstadt Creek	10.6	2080	7460	400	3330
40	@ Tamlin Road	4.6	950	3570	210	1820
52	@ Woodmen Road	1.7	460	2120	80	1210
	EAST FORK SUB-TRIBUTARY SAND CREEK					
11	@ Constitution Avenue	5.9	1330	4100	240	1630
15	@ Chicago & Rock Island RR	5.2	1250	3540	230	1370
26	@ Confluence w/Toy Ranch	1.0	220	820	50	370
47	@ Proposed Dublin Blvd.	0.4	100	300	20	140
	WEST BIERSTADT CREEK					
31	@ Confluence w/ East Fork	1.8	480	1590	80	600
39	@ Tamlin Road	0.8	270	680	50	290
54	@ Woodmen Road	0.5	230	420	55	150
	EAST BIERSTADT CREEK					
32	@ Conf. w/W Bierstadt	2.4	520	1520	90	580
38	@ Chicago & Rock Island RR	0.4	120	350	15	130

(1) Future baseline condition discharges for Sand Creek compiled with the assumption that the discharges from the East Fork Sand Creek basin are maintained at existing rates as shown on this Table.

EAST BIERSTADT CREEK

WEST BIERSTADT CREEK

EAST FORK SAND CREEK

WEST TRIB TO RANCHES BASIN SAND CREEK

CENTER TRIBUTARY SAND CREEK

LOWER BASIN SAND CREEK

UPPER BASIN SAND CREEK

WEST FORK SAND CREEK

FOUNTAIN CREEK

WOODMEN

HILLTOP BLVD

STETSON

CONSTITUTION

VOLLMER RD

MARKSHEFFEL RD

POWERS BLVD

FOUNTAIN

GALLEY

PLATTE

HANCOCK

Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY

REGIONAL SUB-BASINS

Project No	90-04-09
Date:	11/90
Design:	
Drawn:	EAK
Check:	
Revisions:	

11

FIG. III-1

Pond FDS - Barbarack Subdivision Restrictor plate

Worksheet for FSD Outlet Orifice Plate

Project Description

Solve For	Diameter

Input Data

Discharge	45.90	ft³/s (16.5 Ha + 29.4 Pac)
Headwater Elevation	4.70	ft
Centroid Elevation	0.00	ft
Tailwater Elevation	0.00	ft
Discharge Coefficient	0.60	

Results

Diameter	2.37	ft
Headwater Height Above Centroid	4.70	ft
Tailwater Height Above Centroid	0.00	ft
Flow Area	4.40	ft²
Velocity	10.43	ft/s

Pond FDS - Barbarack Subdivision Restrictor plate

Worksheet for FSD Overflow - Pass

Project Description

Solve For	Discharge

Input Data

Headwater Elevation	0.90	ft
Crest Elevation	0.00	ft
Tailwater Elevation	0.00	ft
Crest Surface Type	Gravel	
Crest Breadth	12.00	ft
Crest Length	36.00	ft

Results

Discharge	86.22	ft³/s
Headwater Height Above Crest	0.90	ft
Tailwater Height Above Crest	0.00	ft
Weir Coefficient	2.80	US
Submergence Factor	1.00	
Adjusted Weir Coefficient	2.80	US
Flow Area	32.40	ft²
Velocity	2.66	ft/s
Wetted Perimeter	37.80	ft
Top Width	36.00	ft

(55 DU + 29.4 pass = 84.4 cfs)

Pond FDS Barbarack Subdivision Overflow Weir

Worksheet for FSD Overflow - Pass

Project Description

Solve For	Discharge

Input Data

Headwater Elevation	0.90	ft
Crest Elevation	0.00	ft
Tailwater Elevation	0.00	ft
Crest Surface Type	Gravel	
Crest Breadth	12.00	ft
Crest Length	36.00	ft

Results

Discharge	86.22	ft³/s
Headwater Height Above Crest	0.90	ft
Tailwater Height Above Crest	0.00	ft
Weir Coefficient	2.80	US
Submergence Factor	1.00	
Adjusted Weir Coefficient	2.80	US
Flow Area	32.40	ft²
Velocity	2.66	ft/s
Wetted Perimeter	37.80	ft
Top Width	36.00	ft

(55DVI + 29.4 pass = 44.4 L/s)

Pond SFB Barbarack Subdivision Overflow Weir

Worksheet for SFB Overflow Developed

Project Description

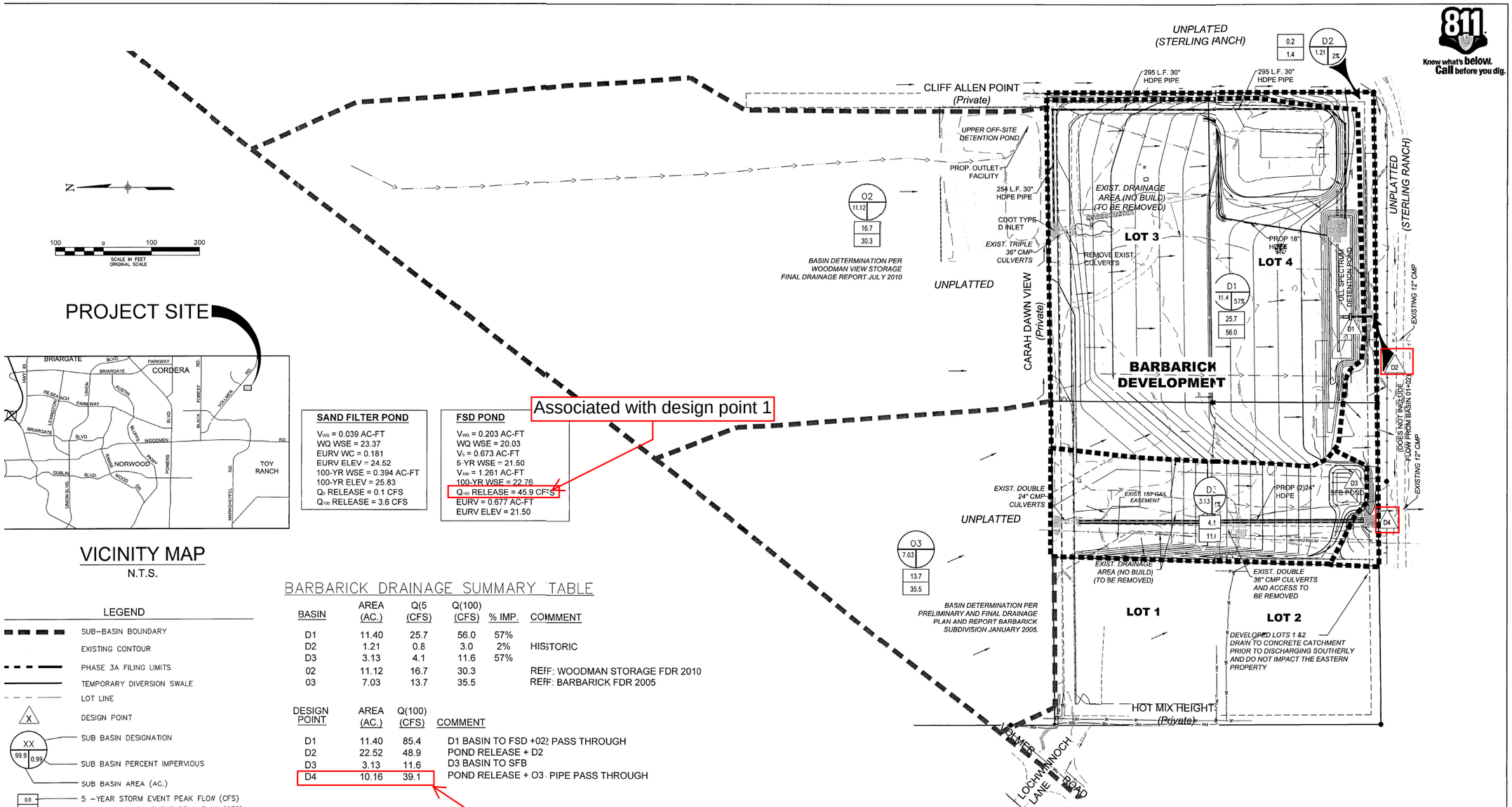
Solve For	Discharge

Input Data

Headwater Elevation		0.45	ft
Crest Elevation		0.00	ft
Tailwater Elevation		0.00	ft
Crest Surface Type	Gravel		
Crest Breadth		6.00	ft
Crest Length		10.00	ft

Results

Discharge	8.08	ft^3/s
Headwater Height Above Crest	0.45	ft
Tailwater Height Above Crest	0.00	ft
Weir Coefficient	2.68	US
Submergence Factor	1.00	
Adjusted Weir Coefficient	2.68	US
Flow Area	4.50	ft^2
Velocity	1.80	ft/s
Wetted Perimeter	10.90	ft
Top Width	10.00	ft



PROJECT SITE

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

Associated with design point 1

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 +022 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

Associated with design point 4

LEGEND

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

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 BOX DESIGNATED AS FACILITIES INFORMATION MANAGEMENT SYSTEM (FIMS) MONUMENT "F_69" 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 1287.35 FEET FROM THE WEST END THEREOF

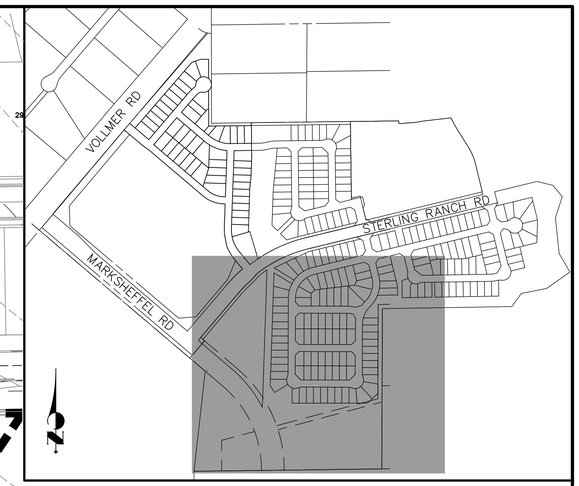
PREPARED UNDER MY DIRECT SUPERVISION, FOR AND ON BEHALF OF MATRIX DESIGN GROUP, INC.

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

PROPOSED DRAINAGE PLAN

DESIGNED B'	BJH	SCALE		DATE ISSUED:	April 2016
DRAWN BY:	BJH	HORIZ:	1"=100'	SHEET NO. 1 OF 2 SHEETS	DP02
CHECKED BY	ES	VERT:	N/A		



DESIGN POINT		
DP	Q5 Total	Q100 Total
1	4.4	9.4
2	1.9	3.9
3	11.1	24.7
4	3.7	7.4
5	4.1	19.6
6	3.3	6.7
6A	2.2	4.1
7	27.5	60.6
8	3.0	12.5
9	1.9	4.8
10	9.2	17.3
11	9.5	19.9
12	1.9	9.5
13	15.7	34.6
14	16.0	37.9
15	5.4	11.7
16	4.4	9.6
17	1.4	4.7
18	4.3	14.0
19	38.8	85.4
20	7.1	13.4
21	7.4	15.2
22	2.7	15.4
23	8.8	15.8
24	11.5	20.6
25	61.0	310.0
26	4.3	22.4
27	6.3	11.7
28	6.9	14.4
29	3.1	16.3
30	0.9	6.4
31	2.0	15.0
32	1.4	10.0
1.0	6.0	10.3
1.1	12.6	19.7
1.2	17.6	28.2
1.3	25.9	46.9
1.3A	5.0	8.7
1.4	52.5	105.9
1.5	55.1	103.9
1.6	56.4	107.7
1.7	17.3	25.3
1.8	68.8	125.0
2.0	23.2	74.5
2.1	38.1	106.6
2.2	56.9	138.7
2.3	9.6	17.2
2.4	63.7	151.9
2.5	96.6	250.7
2.6	97.8	250.4
2.7	162.0	336.8
2.8	189.8	424.4
2.9	14.2	22.5
3.0	189.8	424.4
3.1	14.2	22.5
3.2	187.5	428.2
4.0	18.4	26.1
4.1	56.2	264.7
4.2	12.7	26.0
4.3	49.1	291.2
4.4	3.1	3.1
4.5	51.1	51.1
4.6	56.5	245.8
4.7	58.4	248.6
4.8	59.8	320.3
OS2	13.8	39.1
OS3	17.6	48.9
OS4	2.6	8.5
D1	3.31	8.20
D2	1.63	2.97

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	2.06	66%	0.51	0.65	9.7	4.4	9.4
A2	0.82	69%	0.53	0.66	9.1	1.9	3.9
A3	6.76	60%	0.47	0.62	15.0	11.1	24.7
A4	1.51	77%	0.60	0.71	10.2	3.7	7.4
A5	1.70	76%	0.59	0.70	9.9	4.1	8.3
A6	1.37	75%	0.58	0.70	10.0	3.3	6.6
A6A	0.53	95%	0.81	0.88	5.0	2.2	4.1
A7	19.00	65%	0.45	0.59	18.3	27.5	60.6
A8	1.48	63%	0.56	0.70	13.9	3.0	6.3
A9	0.61	79%	0.73	0.83	8.7	1.9	3.7
A10	2.61	86%	0.79	0.88	7.9	9.2	17.3
A11	2.89	83%	0.76	0.86	8.7	9.5	18.1
A12	3.87	8%	0.13	0.38	11.9	1.9	9.5
A13	9.65	65%	0.45	0.59	14.0	15.7	34.6
A14	11.76	55%	0.39	0.55	15.3	16.0	37.9
A15	2.91	54%	0.52	0.68	14.9	5.4	11.7
A16	2.34	56%	0.54	0.69	14.7	4.4	9.6
A17	1.76	24%	0.21	0.44	13.7	1.4	4.7
A18	5.27	21%	0.24	0.47	16.4	4.3	14.0
A19	31.85	67%	0.45	0.59	25.8	38.8	85.4
A20	1.83	89%	0.81	0.89	8.0	6.6	12.2
A21	1.93	90%	0.82	0.90	8.7	6.8	12.6
A22	8.68	5%	0.11	0.37	23.3	2.7	15.4
B1	2.98	100%	0.90	0.96	17.6	8.8	15.8
B2	3.89	100%	0.90	0.96	17.6	11.5	20.6
B3	1.53	100%	0.90	0.96	9.4	5.8	10.4
B4	1.50	100%	0.90	0.96	9.4	5.7	10.2
B5	2.91	0%	0.08	0.35	13.1	0.9	6.4
C1	8.01	95%	0.81	0.88	9.9	2.0	15.0
C2	5.06	95%	0.81	0.88	7.9	1.4	10.0
OS20	308.00	6%	0.13	0.40	68.9	61.0	310.0
OS21A	20.26	14%	0.13	0.40	52.3	4.3	22.4
OS21B	8.71	9%	0.13	0.40	24.5	3.1	16.3
OS2	17.00	70%	0.49	0.62	36.0	13.8	39.1
OS3	28.70	70%	0.49	0.62	52.6	17.6	48.9
OS4	5.08	15%	0.20	0.40	29.5	2.6	8.5
D1	0.45	95%	0.81	0.88	7.0	1.7	3.1
D2	0.43	95%	0.81	0.88	7.0	1.6	3.0

Highlight basins and design points being referenced within report.

NOTE

SEDIMENT CONTROL TO BE PROVIDED AT THE STUBS UNTIL THE TIME THOSE PARCELS DEVELOP

LEGEND:

- PROPOSED STORM SEWER
- 5000 FUTURE RD MAJOR CONTOUR
- FUTURE RD MINOR CONTOUR
- 5000 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 5000 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
- 1 DESIGN POINT
- HP HIGH POINT
- LP LOW POINT
- DRAINAGE ARROW
- EXISTING DRAINAGE ARROW
- PROPOSED DRAINAGE SWALE

DRAINAGE MAP
STERLING RANCH FILING 2
JOB NO. 25188.01
8/18/21
SHEET 1 OF 7

ORIGINAL SCALE: 1" = 70'

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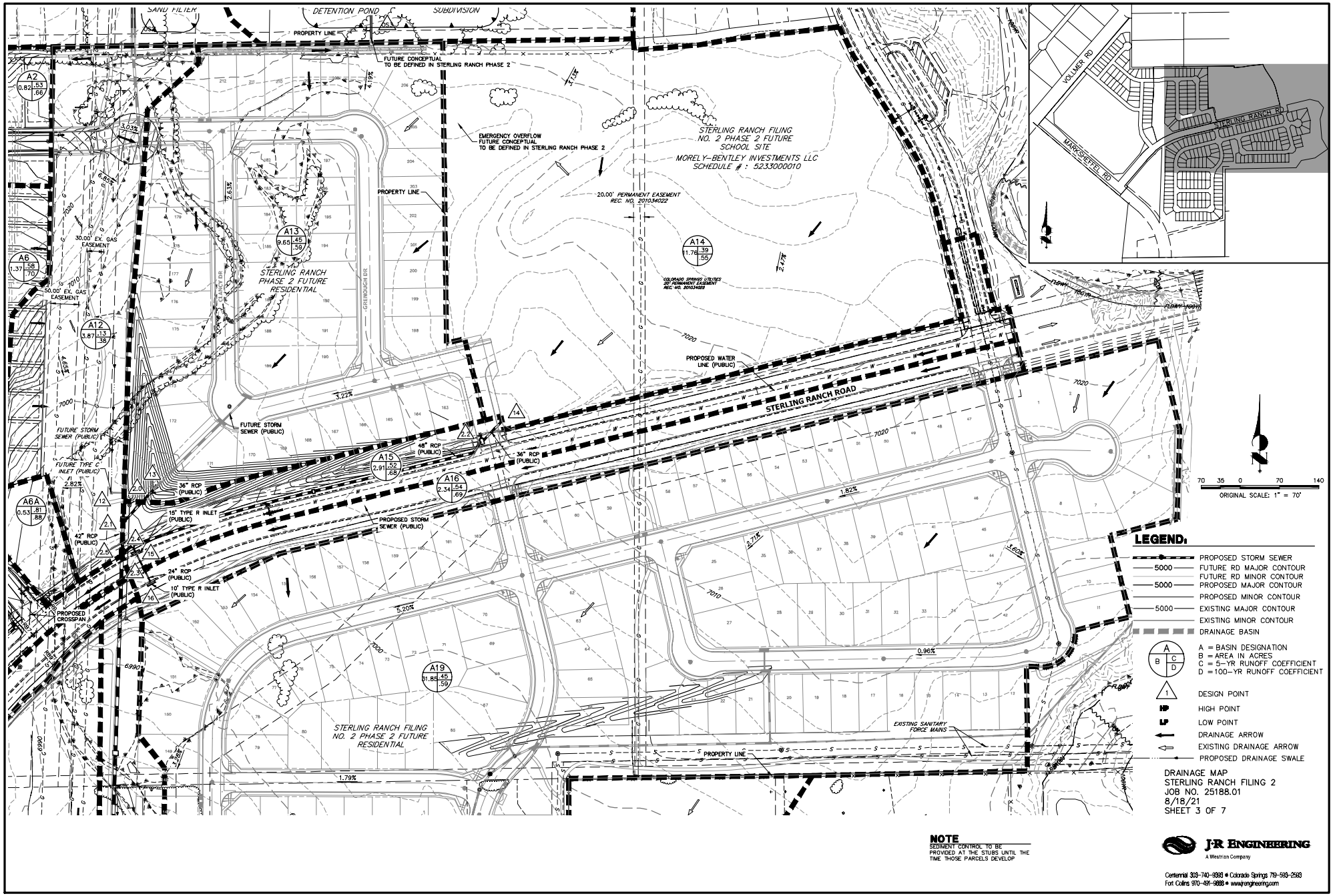
X:\25\10000_all\25188\01\Drawings\Sheet Dwgs\Drainage Maps\Proposed Map.dwg, 24x36 Title Landscape, 8/18/2021 11:20:55 AM, FC



DRAINAGE MAP
STERLING RANCH FILING 2
JOB NO. 25188.01
8/18/21
SHEET 3 OF 7

NOTE
SEDIMENT CONTROL TO BE PROVIDED AT THE STUBS UNTIL THE TIME THOSE PARCELS DEVELOP

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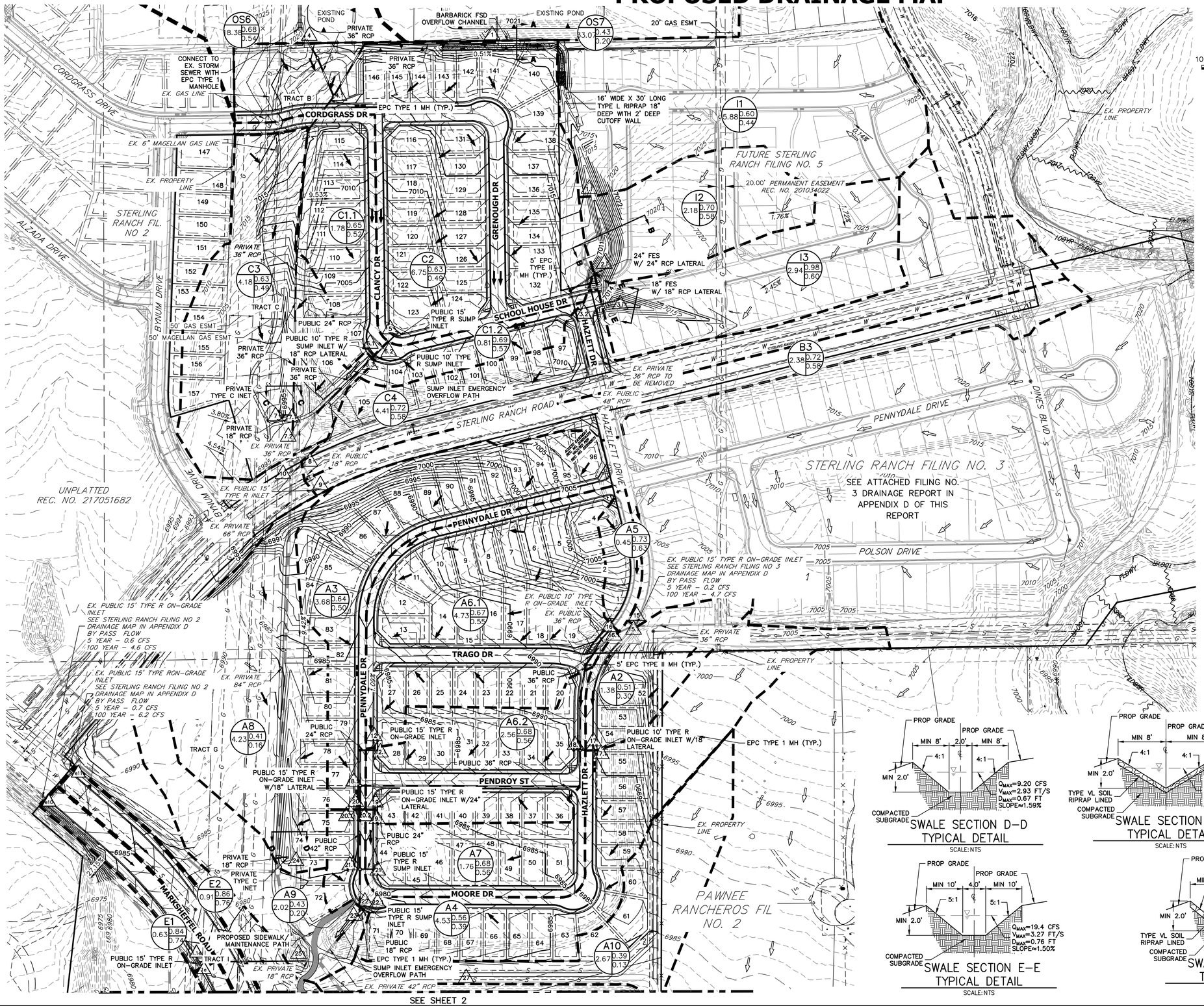
STERLING RANCH FILING NO. 4
PROPOSED DRAINAGE MAP



LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C –100 YR
D: C–5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

EXISTING FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100 PROPOSED 6100

DESIGN POINT

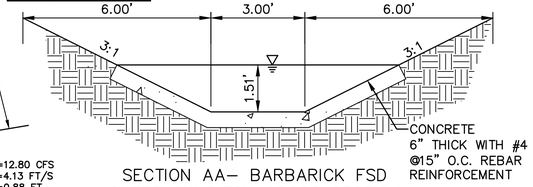
DP	Q5 Total	Q100 Total
1	14.6	52.8
4	22.3	55.6
4.1	29.0	88.7
5	12.0	25.9
6.1	3.9	19.3
6.2	2.0	6.4
6.3	16.9	35.6
7	3.5	12.8
7.1	30.0	93.5
7.2	39.8	114.9
8	6.1	12.9
9	3.8	7.9
15	8.2	17.7
15.1	21.0	43.2
16	1.4	2.9
16.1	21.5	44.9
17	1.6	7.9
17.1	1.6	7.7
18.1	22.8	52.2
12	10.0	20.5
12.1	9.1	13.9
18.2	29.2	62.0
19	6.4	17.8
19.1	6.4	12.9
20	7.0	14.9
20.1	7.0	11.7
20.2	39.6	81.4
21	3.8	12.6
21.1	42.5	91.3
22	6.3	18.3
22.1	6.3	18.3
23	47.4	106.2
24	2.2	9.2
25	1.0	4.8
27	2.9	8.8
1.i	7.8	17.9
3.i	7.1	19.4
2.i	11.6	25.7
3.2	16.9	40.2
e11	0.7	6.2
1e	2.8	8.9
1.1e	2.8	8.5
e10	0.6	4.6
2e	4.1	12.6
2.1e	4.1	10.7
3e	2.2	4.6
4e	1.3	5.0

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A2	1.38	32%	0.30	0.51	10.3	1.7	4.8
A3	3.68	65%	0.50	0.64	12.5	7.0	14.9
A4	4.53	48%	0.39	0.56	15.0	6.3	15.1
A5	0.45	79%	0.63	0.73	5.0	1.4	2.9
A6.1	4.73	72%	0.55	0.67	12.1	10.0	20.5
A6.2	2.56	74%	0.56	0.68	12.1	5.6	11.3
A7	1.76	73%	0.56	0.68	9.4	4.2	8.5
A8	4.23	13%	0.16	0.41	18.9	2.2	9.2
C1.1	1.78	66%	0.52	0.65	9.2	3.9	8.3
C1.2	0.81	72%	0.57	0.69	8.3	2.0	4.2
C2	6.75	63%	0.49	0.63	14.2	12.0	25.9
C3	4.18	19%	0.20	0.43	9.3	3.5	12.8
A9	2.02	8%	0.13	0.39	13.6	1.0	4.8
A10	2.67	26%	0.27	0.49	10.7	2.9	8.8
B3	2.38	63%	0.58	0.72	25.5	3.8	7.9
C4	4.41	62%	0.54	0.68	28.3	6.1	12.9
OS6	18.38	45%	0.37	0.55	17.5	22.3	55.6
OS7	33.07	19%	0.20	0.43	36.4	14.6	52.8
I1	5.88	54%	0.44	0.60	20.8	7.8	17.9
I2	2.18	71%	0.58	0.70	11.9	4.9	9.9
I3	2.94	68%	0.60	0.98	10.8	7.1	19.4
E1	0.63	80%	0.74	0.84	6.1	2.2	4.3
E2	0.91	83%	0.76	0.86	6.0	3.4	6.4
E3	0.60	83%	0.76	0.85	5.1	2.3	4.4
E4	0.61	47%	0.46	0.64	6.6	1.3	3.1

SWALE SECTION D–D TYPICAL DETAIL
SCALE: NTS

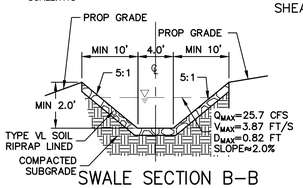
SWALE SECTION C–C TYPICAL DETAIL
SCALE: NTS



SECTION AA– BARBARICK FSD OVERFLOW DITCH CROSS SECTION

OVERFLOW = 85.4 CFS
FLOW DEPTH = 1.51 FT
VELOCITY = 7.51 FT/S
SLOPE = 0.50%
SHEAR STRESS =0.549 LB/FT^2

SWALE SECTION E–E TYPICAL DETAIL
SCALE: NTS



SWALE SECTION B–B TYPICAL DETAIL
SCALE: NTS

STERLING RANCH FILING NO.4
PROPOSED DRAINAGE MAP
JOB NO. 25188.11
02/07/2023
SHEET 1 OF 2

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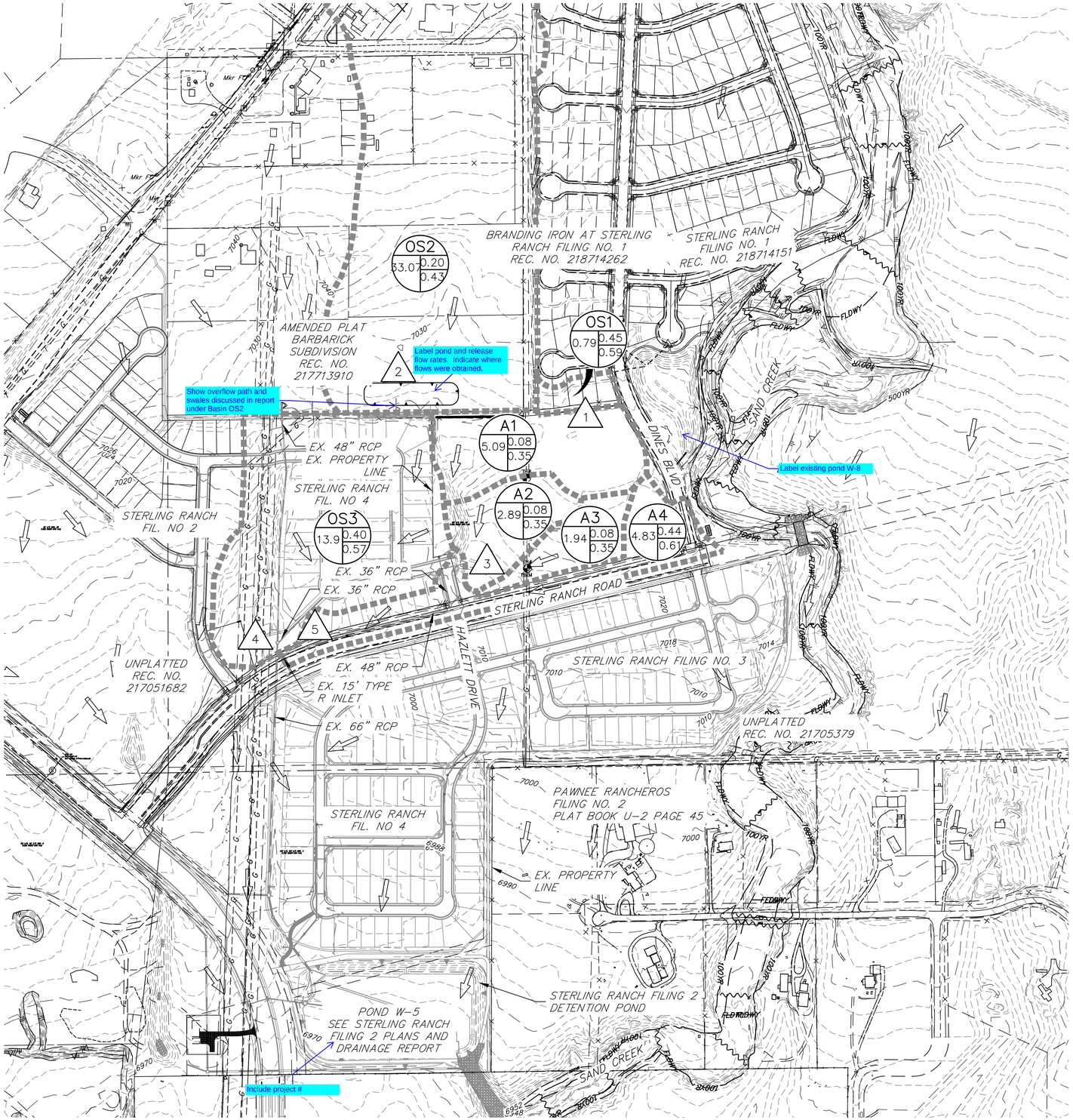
Appendix D
Drainage Maps

STERLING RANCH FILING 5
EXISTING DRAINAGE MAP



LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C –100 YR
D: C–5 YR

DESIGN POINT

EXISTING FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

SITE BOUNDARY
EXISTING PROPERTY LINE
ROW EXISTING
FL EXISTING
SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING

6100

DESIGN POINT		
DP	Q5 Total	Q100 Total
1	1.5	3.2
2	14.6	52.8
3	1.0	7.6
4	19.4	46.3
5	6.8	16.0

Label project boundary

Label all existing easements

Include another map with larger scale of project area

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	5.09	0%	0.08	0.35	28.7	1.0	7.6
A2	2.89	0%	0.08	0.35	15.3	0.8	5.9
A3	1.94	0%	0.08	0.35	17.9	0.5	3.7
A4	4.83	47%	0.44	0.61	18.3	6.8	16.0
OS1	0.79	65%	0.45	0.59	10.2	1.5	3.2
OS2	33.07	19%	0.20	0.43	36.4	14.6	52.8
OS3	13.90	49%	0.40	0.57	15.5	19.4	46.3

300 150 0 300 600

ORIGINAL SCALE: 1" = 300'

STERLING RANCH FILING 5
EXISTING DRAINAGE MAP
JOB NO. 25188.16
11/27/22
SHEET 1 OF 1

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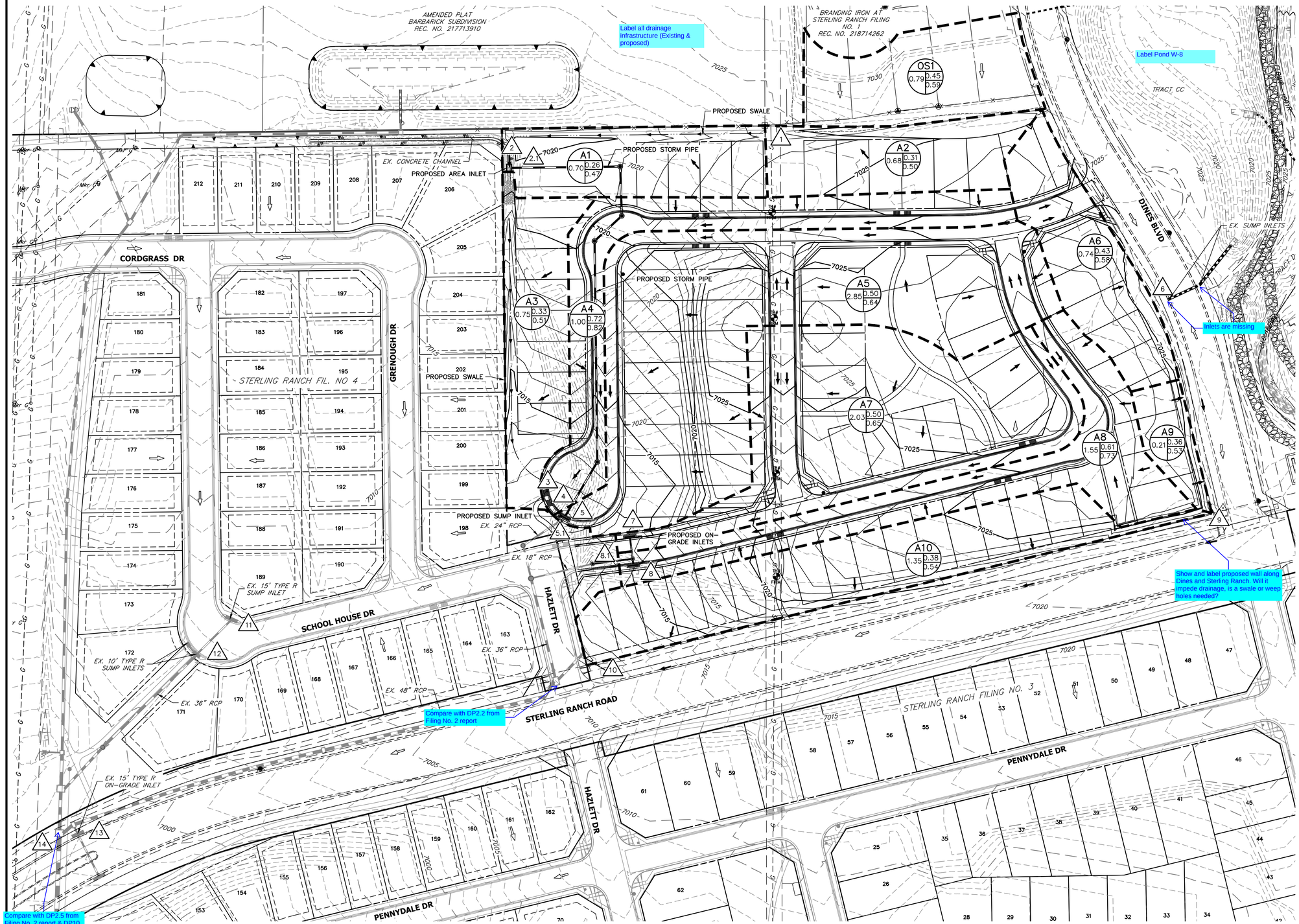
HOMESTEAD FILING 5
PROPOSED DRAINAGE MAP



LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C –100 YR
D: C–5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

EXISTING FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100 PROPOSED 6100

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	0.70	30%	0.26	0.47	19.2	0.6	2.0
A2	0.68	41%	0.31	0.50	14.4	0.8	2.3
A3	0.75	43%	0.33	0.51	14.9	0.9	2.5
A4	1.00	85%	0.72	0.82	9.2	3.1	6.3
A5	2.85	62%	0.50	0.64	14.4	5.1	12.3
A6	0.74	55%	0.43	0.58	9.9	1.3	3.3
A7	2.03	58%	0.50	0.65	12.8	3.8	9.2
A8	1.55	71%	0.61	0.73	9.8	3.9	8.6
A9	0.21	50%	0.36	0.53	12.9	0.3	0.8
A10	1.35	52%	0.38	0.54	12.7	1.9	5.1
OS1	0.79	65%	0.45	0.59	10.2	1.5	3.5

DESIGN POINT

DP	Q5 Total	Q100 Total
1	2.0	5.4
2	0.6	2.0
2.1	2.4	6.9
3	0.9	2.5
4	3.1	6.3
5	5.1	12.3
5.1	9.9	25.3
6	1.3	3.3
7	3.8	9.2
8	3.9	8.6
8.1	7.3	17.1
9	0.3	0.8
10	1.9	5.1
11	12.0	25.9
12	2.0	6.4
13	8.3	18.8
14	29.6	68.1

Label all easements

Label all storm as public or private

Label Streets, lots and tracts

60 30 0 60 120
ORIGINAL SCALE: 1" = 60'

HOMESTEAD FILING 5
PROPOSED DRAINAGE MAP
JOB NO. 25188.16
08/08/23
SHEET 1 OF 1

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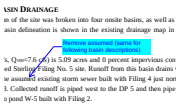
V1_ drainage.pdf Markup Summary

Callout (20)



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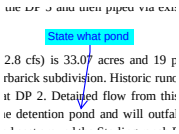
Remove assumed (same for following basin descriptions)



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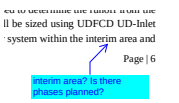
State what pond



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Date: 10/2/2023 3:39:28 PM
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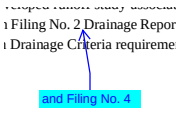
interim area? Is there phases planned?



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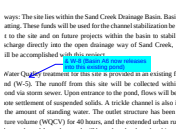
Layer:
Space:

and Filing No. 4



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Page Label: 12
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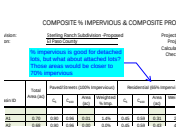
Space:

& W-8 (Basin A6 now releases into this existing pond)



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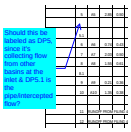
Layer:
Space:

% impervious is good for detached lots, but what about attached lots? Those areas would be closer to 70% impervious



Subject: Callout
Page Label: 1
Author: CDurham
Date: 10/2/2023 4:07:45 PM
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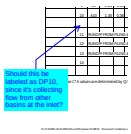
Color:
Layer:
Space:

Should this be labeled as DP5, since it's collecting flow from other basins at the inlet & DP5.1 is the pipe/intercepted flow?



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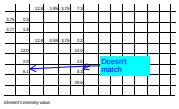
Should this be labeled as DP10, since it's collecting flow from other basins at the inlet?



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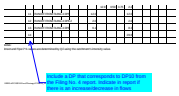
Doesn't match



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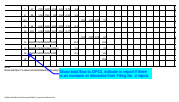
Include a DP that corresponds to DP10 from the Filing No. 4 report. Indicate in report if there is an increase/decrease in flows

---



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Page Label: 1
Author: CDurham
Date: 10/2/2023 4:11:25 PM
Status:
Color:
Layer:
Space:

Show total flow to DP13, indicate in report if there is an increase or decrease from Filing No. 4 report

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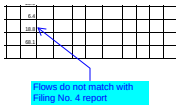
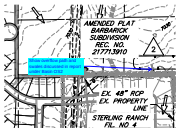


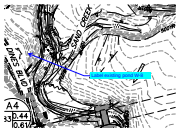
Subject: Callout
Page Label: 1
Author: CDurham
Date: 10/2/2023 4:12:40 PM
Status:
Color:
Layer:
Space:

Flows do not match with Filing No. 4 report



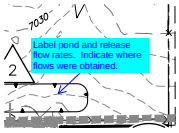
Subject: Callout
Page Label: 46
Author: CDurham
Date: 10/2/2023 4:14:38 PM
Status:
Color:
Layer:
Space:

Show overflow path and swales discussed in report under Basin OS2



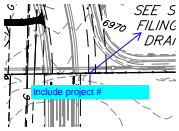
Subject: Callout
Page Label: 46
Author: CDurham
Date: 10/2/2023 4:14:57 PM
Status:
Color:
Layer:
Space:

Label existing pond W-8



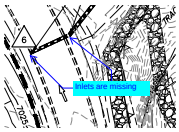
Subject: Callout
Page Label: 46
Author: CDurham
Date: 10/2/2023 4:15:33 PM
Status:
Color:
Layer:
Space:

Label pond and release flow rates. Indicate where flows were obtained.



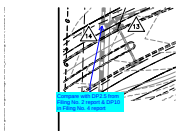
Subject: Callout
Page Label: 46
Author: CDurham
Date: 10/2/2023 4:16:42 PM
Status:
Color:
Layer:
Space:

Include project #



Subject: Callout
Page Label: [1] DRO1
Author: CDurham
Date: 10/2/2023 4:18:24 PM
Status:
Color:
Layer:
Space:

Inlets are missing

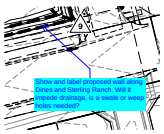


Subject: Callout
Page Label: [1] DRO1
Author: CDurham
Date: 10/2/2023 4:21:25 PM
Status:
Color:
Layer:
Space:

Compare with DP2.5 from Filing No. 2 report & DP10 in Filing No. 4 report

Subject: Callout
Page Label: [1] DRO1
Author: CDurham
Date: 10/2/2023 4:20:30 PM
Status:
Color:
Layer:
Space:

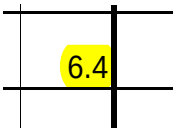
Compare with DP2.2 from Filing No. 2 report



Subject: Callout
Page Label: [1] DRO1
Author: CDurham
Date: 10/2/2023 4:22:45 PM
Status:
Color:
Layer:
Space:

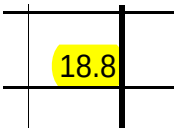
Show and label proposed wall along Dines and Sterling Ranch. Will it impede drainage, is a swale or weep holes needed?

Highlight (3)



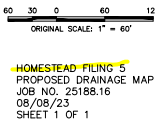
Subject: Highlight
Page Label: 1
Author: CDurham
Date: 10/2/2023 4:12:23 PM
Status:
Color:
Layer:
Space:

6.4



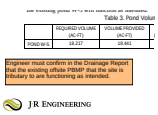
Subject: Highlight
Page Label: 1
Author: CDurham
Date: 10/2/2023 4:12:24 PM
Status:
Color:
Layer:
Space:

18.8



Subject: Highlight
Page Label: [1] DRO1
Author: CDurham
Date: 10/2/2023 4:23:23 PM
Status:
Color:
Layer:
Space:

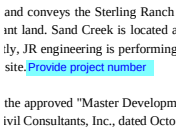
SW - Textbox (1)



Subject: SW - Textbox
Page Label: 12
Author: Glenn Reese - EPC Stormwater
Date: 9/22/2023 8:55:14 AM
Status:
Color:
Layer:
Space:

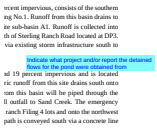
Engineer must confirm in the Drainage Report that the existing offsite PBMP that the site is tributary to are functioning as intended.

Text Box (21)



Subject: Text Box
Page Label: 5
Author: CDurham
Date: 10/2/2023 3:12:27 PM
Status:
Color:
Layer:
Space:

Provide project number



Subject: Text Box
Page Label: 6
Author: CDurham
Date: 10/2/2023 3:22:19 PM
Status:
Color:
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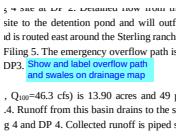
Space:

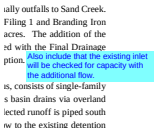
Indicate what project and/or report the detained flows for the pond were obtained from

---



Subject: Text Box
Page Label: 6
Author: CDurham
Date: 10/2/2023 3:22:57 PM
Status:
Color:
Layer:
Space:

Show and label overflow path and swales on drainage map



Subject: Text Box
Page Label: 8
Author: CDurham
Date: 10/2/2023 3:32:24 PM
Status:
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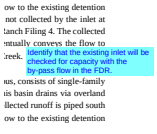
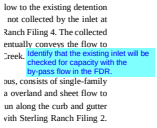
Space:

Also include that the existing inlet will be checked for capacity with the additional flow.



Subject: Text Box
Page Label: 8
Author: CDurham
Date: 10/2/2023 3:33:35 PM
Status:
Color:
Layer:
Space:

Identify that the existing inlet will be checked for capacity with the by-pass flow in the FDR.



Subject: Text Box
Page Label: 8
Author: CDurham
Date: 10/2/2023 3:34:01 PM
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Color:
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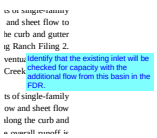
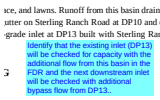
Identify that the existing inlet will be checked for capacity with the by-pass flow in the FDR.



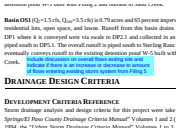
Subject: Text Box
Page Label: 8
Author: CDurham
Date: 10/2/2023 3:37:30 PM
Status:
Color:
Layer:
Space:

Identify that the existing inlet will be checked for capacity with the additional flow from this basin in the FDR.



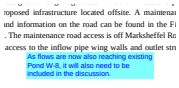
Subject: Text Box
Page Label: 8
Author: CDurham
Date: 10/2/2023 3:38:29 PM
Status:
Color:
Layer:
Space:

Identify that the existing inlet (DP13) will be checked for capacity with the additional flow from this basin in the FDR and the next downstream inlet will be checked with additional bypass flow from DP13..



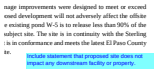
Subject: Text Box
Page Label: 9
Author: CDurham
Date: 10/2/2023 3:43:55 PM
Status:
Color:
Layer:
Space:

Include discussion on overall flows exiting site and indicate if there is an increase or decrease to amount of flows entering existing storm system from Filing 5



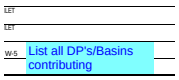
Subject: Text Box
Page Label: 13
Author: CDurham
Date: 10/2/2023 3:45:36 PM
Status:
Color:
Layer:
Space:

As flows are now also reaching existing Pond W-8, it will also need to be included in the discussion.



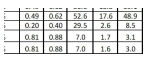
Subject: Text Box
Page Label: 13
Author: CDurham
Date: 10/2/2023 3:51:57 PM
Status:
Color:
Layer:
Space:

Include statement that proposed site does not impact any downstream facility or property.



Subject: Text Box
Page Label: 1
Author: CDurham
Date: 10/2/2023 4:09:36 PM
Status:
Color:
Layer:
Space:

List all DP's/Basins contributing



Highlight basins and design points being referenced within report.

Subject: Text Box
Page Label: 22
Author: CDurham
Date: 10/2/2023 4:13:47 PM
Status:
Color:
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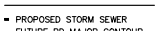
Space:

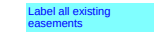
Highlight basins and design points being referenced within report.



Label project boundary

Subject: Text Box
Page Label: 46
Author: CDurham
Date: 10/2/2023 4:15:54 PM
Status:
Color:
Layer:
Space:

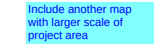
Label project boundary



Label all existing easements

Subject: Text Box
Page Label: 46
Author: CDurham
Date: 10/2/2023 4:16:06 PM
Status:
Color:
Layer:
Space:

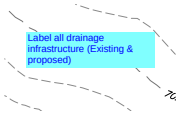
Label all existing easements



Include another map with larger scale of project area

Subject: Text Box
Page Label: 46
Author: CDurham
Date: 10/2/2023 4:16:24 PM
Status:
Color:
Layer:
Space:

Include another map with larger scale of project area



Label all drainage infrastructure (Existing & proposed)

Subject: Text Box
Page Label: [1] DRO1
Author: CDurham
Date: 10/2/2023 4:17:14 PM
Status:
Color:
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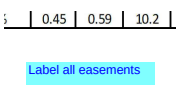
Space:

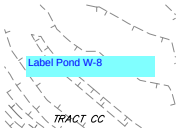
Label all drainage infrastructure (Existing & proposed)



Label all easements

Subject: Text Box
Page Label: [1] DRO1
Author: CDurham
Date: 10/2/2023 4:17:53 PM
Status:
Color:
Layer:
Space:

Label all easements



Subject: Text Box
Page Label: [1] DRO1
Author: CDurham
Date: 10/2/2023 4:18:04 PM
Status:
Color:
Layer:
Space:

Label Pond W-8

Label all storm as public or private

Subject: Text Box
Page Label: [1] DRO1
Author: CDurham
Date: 10/2/2023 4:21:46 PM
Status:
Color:
Layer:
Space:

Label all storm as public or private

Label Streets, lots and tracts

Subject: Text Box
Page Label: [1] DRO1
Author: CDurham
Date: 10/2/2023 4:23:15 PM
Status:
Color:
Layer:
Space:

Label Streets, lots and tracts