This may not be necessary if specific revisions to the MDDP are not discussed. If this report is to be approved prior to the Filing 2 report, the diversions need to be addressed.

PRELIMINARY DRAINAGE REPORT AND MDDP ADDENDUM FOR STERLING RANCH PHASE 2 PRELIMINARY PLAN

Prepared For:

SR Land, LLC
20 Boulder Crescent, Suite 200
Colorado Springs, CO 80903
(719) 491-3024

June, 2020
Project No. 25188.00

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

SP-20-003

See comment letter also.

J·R ENGINEERING

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. 38861
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: SR Land, LLC

By: _____

Title: _____

Address: 20 Boulder Crescent, Suite 200
Colorado Springs, CO 80903

El Paso County:

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

_____ _____

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

Conditions:

Table of Contents

APPENDIX

PURPOSE

This document is the Preliminary Drainage Report for Sterling Ranch Phase 2. The purpose of this report is to identify on-site and off-site drainage patterns, storm sewer, culvert and inlet locations, areas tributary to the site, and to safely route developed storm water to adequate outfall facilities.

GENERAL SITE DESCRIPTION

GENERAL LOCATION

Sterling Ranch Phase 2 (hereby referred to as the "site") is a proposed development within the Sterling Ranch master planned community with a total area of approximately 75 acres that are presently undeveloped.

The site is located in portions of Section 4, 5 & 33, Township 12 & 13 South, Range 65 West of the Sixth Principal Meridian in El Paso County, State of Colorado. The site is bounded by Un-platted land to the southwest, the Barbarick Subdivision to the north, Sterling Ranch Road cuts through the site, and Sand Creek borders the site to east. The parcels are planned to be platted after approval of the Development Plan. Refer to the vicinity map in Appendix A for additional information.

Preliminary

DESCRIPTION OF PROPERTY

The property will be primarily be single-family residential development (approximately 42 acres), Open space and drainage tracts (approximately 28 acres, and an approximate 5 acre tract in the southwest corner where the Sterling Ranch Lift Station is located. The site is comprised of variable sloping grasslands that generally slope(s) downward to the southeast at 3 to 8% towards the Sand Creek tributary basin.

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, although a tributary to the Sand Creek basin is immediately to the east of the site. Currently, Kiowa Engineering Corp. 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 far eastern portion of the project site that is adjacent to the existing drainage way lies within Zone AE. Zone AE is defined as area subject to inundation by the 1-percent-annual-chance flood event. The majority of

the proposed development lies within Zone X. Zone X is defined as area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. No grading operations are proposed within the Zone AE at this time. FIRM Maps have been 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 respective sub-basin is shown in Appendix E.

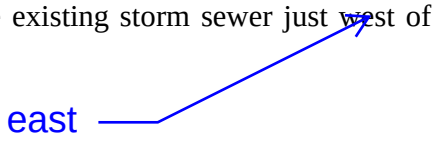
The Sand Creek DBPS assumed the Sterling Ranch Filing No. 2 property to have a "large lot residential" use for the majority of the site. However, the proposed Sterling Ranch master plan is a mix of; school, multi-family, single-family, and commercial land uses, resulting in higher runoff. The site generally drains from north to south consisting of rolling hills. Currently, the site is used as pasture land for cattle. Sand Creek is located east of the site running north to south. This reach of drainage conveyance is not currently improved. There are a few stock ponds within the creek channel used for cattle watering. Currently, Kiowa is performing studies and plans to address Sand Creek stabilization adjacent to the site.

The proposed drainage on the site closely follows the approved "Master Development Drainage Plan for Sterling Ranch", (MMDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018. The site is tributary to Pond W5 and full-spectrum detention for the site was previously analyzed and can be found in the Final Drainage Report for Sterling Ranch Filing 2.

EXISTING SUB-BASIN DRAINAGE

The existing / predeveloped condition of the site was broken into two major basins: Basin A (western portion) and Basin B (Eastern Portion), as well as several offsite basins. The basin and sub-basin delineation is shown in the existing drainage map in Appendix E and is described as follows:

Sub-basin A1 is 5.17 acres and 0 percent impervious consists of the eastern portion of Sterling Ranch phase 2 Runoff from this basin drains to the south west into the existing storm sewer just west of Marksheffel Road located at design point 1.



Is this really existing or assumed? Include reference to project under review or approved plans

Sub-basin A2 is 27.48 acres and 0 percent impervious and consists the central portion of Sterling Ranch Phase 2. Runoff from this basin drains south onsite into existing storm sewer located at design point 2.

Sub-basin A3 is 11.68 acres and 0 percent impervious and is located onsite in the northern part of Sterling Ranch Phase 2 Runoff from this basin drains to existing storm sewer just north of Sterling Ranch Road located at design point 5.1 in confluence from flows from basins OS6 and OS7.

Sub-basin B1 is 11.78 and is 0 percent impervious and is located on the eastern portion of the site portion of the site. Runoff from this basin drains to the south into Sand Creek at design point 6.

Sub-basin OS1 is 9.27 acres is 37 percent impervious and is located to the east of the site. Runoff from this basin drains into the Sterling Ranch Filing 2 detention Pond in confluence with upstream flows from the eastern portion of Subbasin A3.

A2?

Sub-basin OS2 is 5.00 acres and 100 percent impervious and is comprised of the southern half street of Sterling Ranch road. Runoff from this basin drains into existing storm sewer located at design point 7.

Sub-basin OS3 is 2.36 acres and 100 percent impervious and is comprised of the northern half street of Sterling Ranch road. Runoff from this basin drains into existing storm sewer located at design point 8.

seems low for the development in the northern portion which has ponds - split into 2 basins?

Sub-basin OS4 is 40.30 acres and 17.2 percent impervious and is located immediately north of the eastern portion of the site. Runoff from this basin drains south into existing storm sewer located at design point 9.

Sub-basin OS5 is 3.46 acres and 0 percent impervious and is located to the east of the northern portion of the site. Runoff from this basin drains to a low point just north of Sterling Ranch Road located at Design Point 4.

Sub-basin OS6 is 3.98 acres and 6.8 percent impervious as is located north of the eastern portion of the site. Historic runoff from this basins drains south onto the site at design point 10.

Sub-basin OS7 is 18.52 Acres and 39.2 percent impervious and is located directly north of the site Historic runoff from this site drains south onto the site at design point 11.

describe ponds

northwest

western

describe culverts/outfalls

Provide an "interim conditions" analysis to match proposed early grading

PROPOSED DRAINAGE CONDITIONS

(not reviewed in detail)

PROPOSED SUB-BASIN DRAINAGE

The proposed site was broken into three major basins: Basin A (lower-portion), Basin B (mid and eastern –portion) and Basin C (upper-portion) of the site. The proposed basin (and sub-basin) delineation is shown on the drainage basin map within Appendix E and is described as follows.

Basin A1 is 4.31 acres and 63 percent impervious and is comprised of single-family residential lots, and a local road. Runoff from this basin drains to design point 1, a type R on grade inlet at the southwest corner of the site.

Basin A2 is 1.37 acres and 32 percent impervious is comprised of single-family residential lots, open space, several trails, and a local road. Runoff from this basin drains to design point 2, a type R on grade inlet on the southwest corner of the site, in confluence with upstream flows from basin A1.

Basin A3 is 3.68 acres and 65 percent impervious is comprised of single-family residential lots and a local road. Runoff from this basin drains to an on grade inlet located at design point 3 in confluence with upstream flows from basin A9.

Basin A4 is 2.72 acres and 73 percent impervious is comprised of single-family residential lots, open space a local road and two urban knuckles. Runoff from this basin drains to a sump type R inlet located at design point 4 in confluence with upstream flows from basins A1, A2, A3, and A9.

Basin A5 is 0.45 acres and 78 percent impervious is comprised of single-family residential lots and a local road. Runoff from this basin drains to an on grade inlet at design point 5.

Basin A6 is 7.60 acres and 73 percent impervious is comprised of single-family residential lots, local roads. Runoff from this basin drains to an on grade type inlet at design point 6 in confluence with upstream flows from basins A5, A10, and A6.1

Basin A7 is 1.43 acres and 75 percent impervious is comprised of single family residential lots and local roads. The Runoff from this basin drains to a sump type R inlet located at design point 7 in confluence with upstream flows from basins A5, A10, A6.1 and A6.1.

Basin A8 4.22 acres and 13 percent impervious is comprised of a single family residential lots and open space The runoff from this basin drains to a swale on western side of the site and intro an area inlet located at design point 8.

Label flows for all basins and DPs

Basin B1 is 2.44 acres and 80 percent impervious is comprised of single-family residential lots, local roads, two urban knuckles, and a cul-de sac. The runoff from basin B1 drains to a type R sump inlet located at design point 1B.

Basin B2 is 4.33 acres and 73 percent impervious is comprised of single family residential lots. Runoff from basin B2 drains to a type R sump inlet located at design point 2B.

Basin C1 is 3.29 acres and 55 percent impervious is comprised of single family residential lots, local roads, and an urban knuckle Runoff from basin C1 drains to a sump type R inlet located at design point 14.

Basin C2 is 6.74 acres and 63 percent impervious is comprised of local roads, single-family residential lots, an urban knuckle, open space, and paved walks. Runoff from basin C2 drains to a type R sump inlet located at design point 13.

Basin C3 is 3.02 acres and 11 percent impervious is comprised of single family residential lots, open space, and paved walks. Runoff from basin C3 drains to a swale on the western side of the site and into an area inlet located at design point 12.

Basin OS1 is 2.02 acres and 8 percent impervious is comprised of single family lots, open space, and paved trails. The Runoff from basin OS1 drains to an existing FES located at design point 11.

Basin OS2 is 2.18 acres and 36 percent impervious is comprised of single family lots, open space, and paved trails. Runoff from basin OS2 drains into the detention pond south of the site (see Sterling Ranch Filing 2 drainage report).

Basin OS3 is 0.95 acres and 36 percent impervious is comprised of single family lots, open space, and paved trails. The runoff from basin OS3 drains south offsite to design point 16.

Basin OS4 is 0.82 acres and 29 percent impervious is comprised of single family lots, open space, and paved trails. The runoff from basin OS4 drains south offsite to design point 17.

Basin OS5 is 5.86 acres and 21 percent impervious is comprised of the rear of single family lots, open space, and paved trails. The runoff from basin OS5 drains south offsite to design point 18.

Basin OS6 is 1.24 acres and 34 percent impervious is comprised of the rear of single family lots, walks, and landscaping. The runoff from basin OS6 drains east to design point 19.

Basin OS7 is 1.34 acres and 53 percent impervious is comprised of the rear of single family lots, walks, and landscaping. The runoff from basin OS7 drains west to design point 20.

Why are these prefixed "OS"? - usually that designates offsite areas. See comment letter regarding water quality requirements

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 v2.07. Manning's equation was used to size the proposed pipes in this report and StormCAD will be used to model the proposed storm sewer system and to analyze the proposed HGL calculations for the Construction Drawings.

DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

The proposed stormwater conveyance system was designed to convey the developed Sterling Ranch Phase 2 runoff to an existing (Filing 2) full spectrum water quality and detention pond via storm sewer. The proposed pond was designed to release at less than historic rates to minimize adverse impacts downstream. Treated water will outfall directly into the Sand Creek Drainage way, where it will eventually outfall into Fountain Creek. A proposed drainage map is presented in Appendix E 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 Phase 2 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 Drainageways: 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 Kiowa adjacent to the site and on future projects within the basin to stabilize drainageways. The site does not discharge directly into the open drainageway of Sand Creek, therefore no downstream stabilization will be accomplished with this project.

Step 3 – Treat the WQCV: Water Quality treatment for this site is provided in an existing full spectrum water quality detention pond (W5). The runoff from this site will be collected within inlets and conveyed to the proposed ponds via storm sewer. Upon entrance to the ponds, flows will be captured in a forebay designed to promote settlement of suspended solids. A trickle channel is also incorporated into the ponds to minimize the amount of standing water. The outlet structure has been designed to detain the water quality capture volume (WQCV) for 40 hours, and the extended urban runoff volume (EURV) for 72 hours. All flows released from the ponds will be reduced to less than historic rates.

Step 4 – Consider Need for Industrial and Commercial BMPs: BMPs will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. Site specific temporary source control BMPs that will be implemented include, but are not limited to, silt fencing placed around downstream areas of disturbance, construction vehicle tracking pads at the entrances, designated concrete truck washout basin, designated vehicle fueling areas, covered storage areas, spill

Do not include temporary BMPs in this discussion, address commercial and industrial areas specifically (none on site?)

containment and control, etc. The permanent erosion control BMPs include asphalt drives and parking, storm inlets and storm pipe, two full spectrum water quality and detention ponds, and permanent vegetation.

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 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.

provide summary information for the pond and provide name W-5

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.

district?

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 property owner 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. We respectfully request that the Operation & Maintenance Manual be submitted in conjunction with the construction documents, prior to obtaining a grading permit.

Address maintenance road design and locations.

DRAINAGE AND BRIDGE FEES

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

2020 DRAINAGE AND BRIDGE FEES – STERLING RANCH PHASE 2				
Impervious Acres (ac)	**Drainage Fee (Per Imp. Acre)**	**Bridge Fee (Per Imp. Acre)**	**Sterling Ranch Drainage Fee**	**Sterling Ranch Bridge Fee**
37	$19,698	$8,057	$728,826	$298,109

SUMMARY

The proposed Sterling Ranch Phase 2 drainage improvements were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development will not adversely affect the offsite drainageways or surrounding development. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements for this site.

REFERENCES

1. "Sterling Ranch Filing 2 Final Drainage Report", prepared by JR engineering, May 2020.

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

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

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

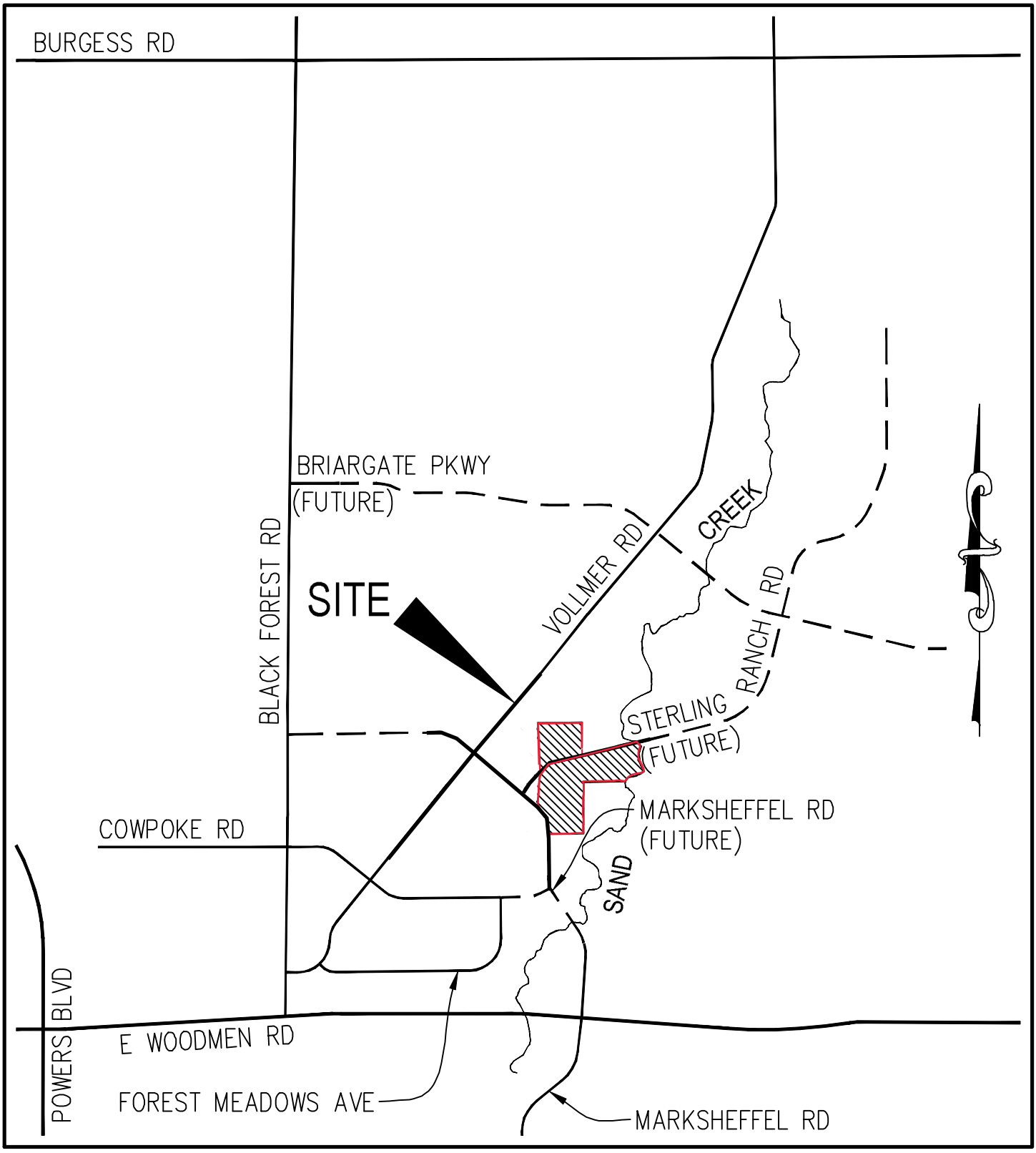
5. "Master Development Drainage Plan for Sterling Ranch", (MMDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018.

6. "Sterling Ranch Filing 2 Final Drainage Report", prepared by JR Engineering, dated May 2020 (not yet approved)

same?

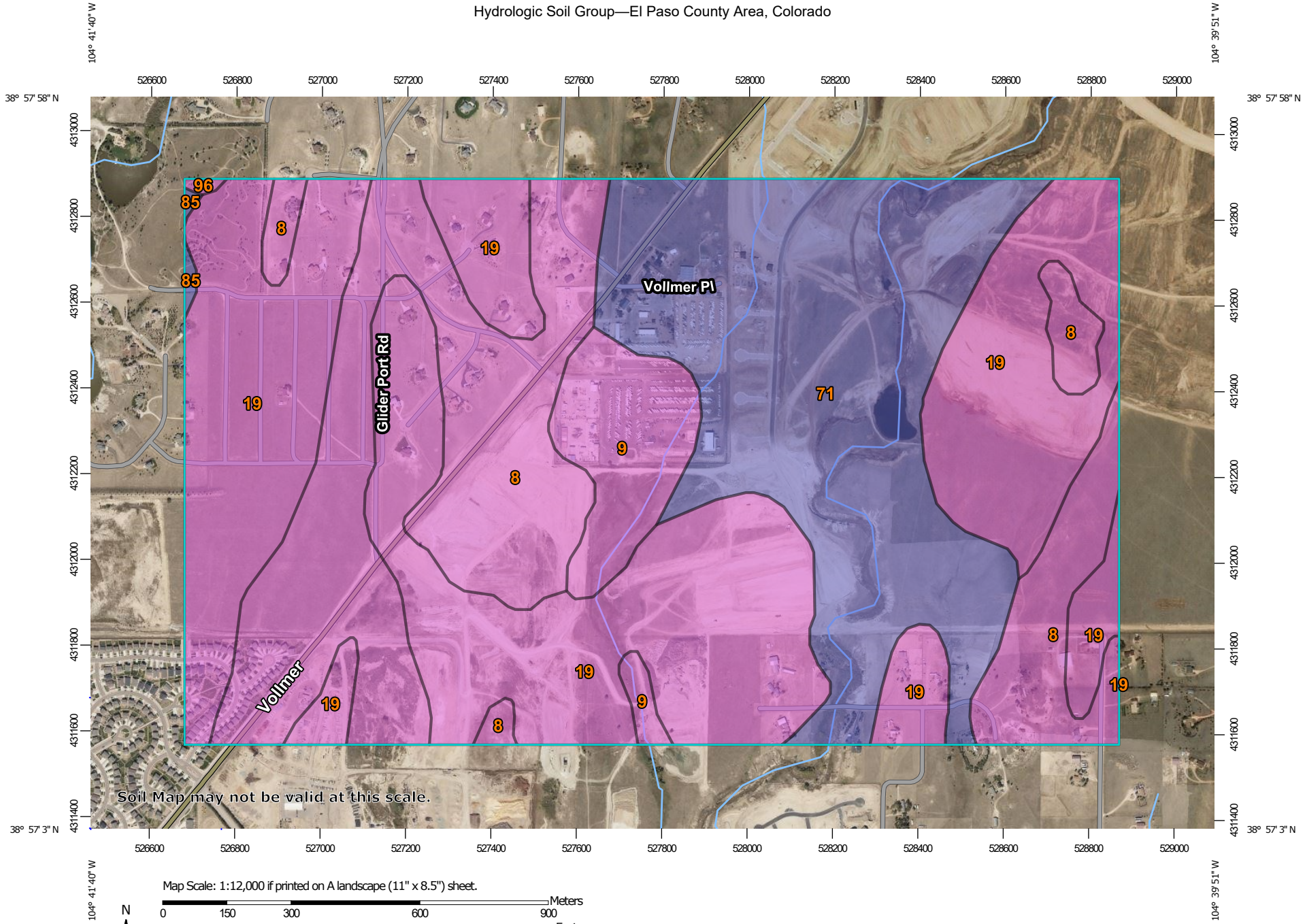
Add Kiowa Sand Creek Channel design report

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map



VICINITY MAP

N.T.S.



Map Scale: 1:12,000 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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 17, Sep 13, 2019

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—May 26, 2019

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
8	Blakeland loamy sand, 1 to 9 percent slopes	A	182.3	25.4%
9	Blakeland-Fluvaquentic Haplaquolls	A	36.8	5.1%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	307.5	42.9%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	188.4	26.3%
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	B	1.2	0.2%
96	Truckton sandy loam, 0 to 3 percent slopes	A	0.6	0.1%
Totals for Area of Interest			**716.9**	**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/.

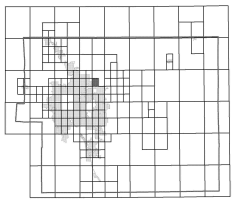
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

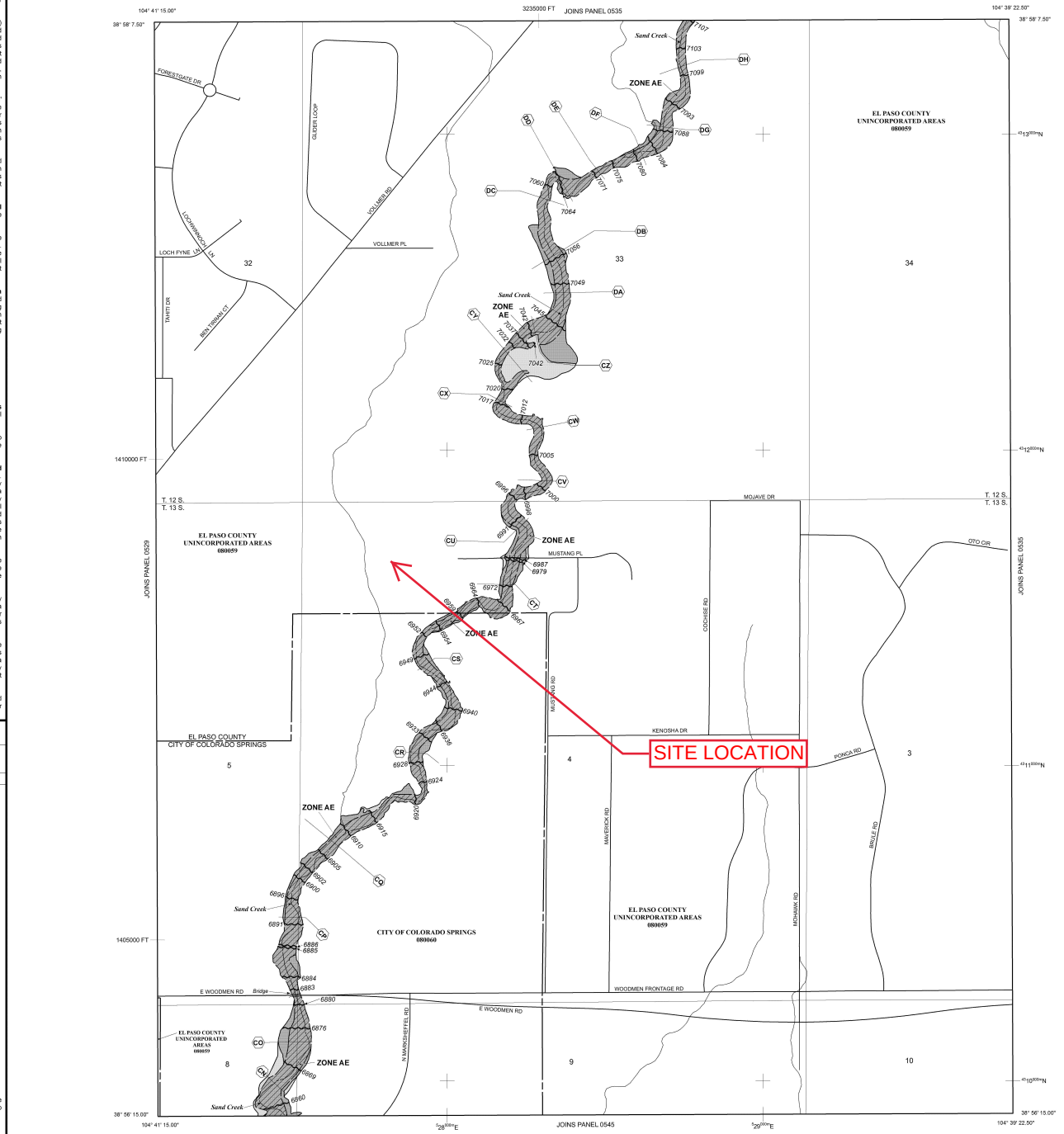
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

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
PANEL 0533G

NATIONAL FLOOD INSURANCE PROGRAM

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

(Review stopped here)

Appendix B
Hydrologic and Hydraulic Calculations

COMPOSITE % IMPERVIOUS & COMPOSITE EXISTING RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Sterling Ranch Subdivision
Location: El Paso County

Project Name: Sterling Ranch Phase 2
Project No.: 25188.02
Calculated By: CJD
Checked By:
Date: 6/1/20

Basin ID	Total Area (ac)	Streets (100% Impervious)				Residential (65% Impervious) Neighborhood Area (70% Impervious)				1 Acre lot Residential (20% Impervious) Light Commercial (80% Impervious)				Lawns (0% Impervious) School (55% 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	5.17	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	5.17	0.0%	0.08	0.35	0.0%
A2	27.48	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	27.48	0.0%	0.08	0.35	0.0%
A3	11.68	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	11.68	0.0%	0.08	0.35	0.0%
B1	11.78	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	11.78	0.0%	0.08	0.35	0.0%
OS1	9.27	0.90	0.96	2.85	30.7%	0.45	0.59	0.00	0.0%	0.59	0.70	2.85	6.1%	0.08	0.35	3.57	0.0%	0.49	0.65	36.9%
OS2	1.94	0.90	0.96	1.94	100.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.90	0.96	100.0%
OS3	2.36	0.90	0.96	2.36	100.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.90	0.96	100.0%
OS4	40.30	0.90	0.96	0.00	0.0%	0.45	0.59	0.90	1.5%	0.59	0.70	7.91	15.7%	0.08	0.35	31.49	0.0%	0.19	0.42	17.2%
OS5	3.46	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	3.46	0.0%	0.08	0.35	0.0%
OS6	3.98	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	1.35	6.8%	0.08	0.35	2.63	0.0%	0.25	0.47	6.8%
OS7	18.52	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	9.07	39.2%	0.08	0.35	9.45	0.0%	0.33	0.52	39.2%
TOTAL (A1-B1)	56.11																			0.0%
TOTAL (OS1-OS7)	79.83																			27.8%
TOTAL	135.94																			16.3%

EXISTING
STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Sterling Ranch Subdivision
Location: El Paso County

Project Name: Sterling Ranch Phase 2
Project No.: 25188.02
Calculated By: CJD
Checked By:
Date: 6/1/20

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	5.17	A	0%	0.08	0.35	212	2.0%	21.4	517	2.1%	10.0	1.4	6.0	27.4	729.0	32.6	27.4
A2	27.48	A	0%	0.08	0.35	297	2.5%	23.4	1475	2.4%	10.0	1.6	15.7	39.1	1772.0	43.5	39.1
A3	11.68	A	0%	0.08	0.35	121	5.4%	11.6	784	2.7%	10.0	1.7	7.9	19.5	905.0	34.8	19.5
B1	11.78	A	0%	0.08	0.35	297	2.9%	22.4	380	5.2%	10.0	2.3	2.8	25.2	677.0	29.1	25.2
OS1	9.27	A	37%	0.49	0.65	298	2.7%	13.7	737	2.4%	10.0	1.5	8.0	21.7	1035.0	25.4	21.7
OS2	1.94	A	100%	0.90	0.96	117	3.1%	2.7	1745	1.6%	20.0	2.5	11.5	14.2	1862.0	19.0	14.2
OS3	2.36	A	100%	0.90	0.96	41	2.5%	1.7	1681	1.8%	20.0	2.7	10.5	12.2	1722.0	18.1	12.2
OS4	40.30	A	17%	0.19	0.42	290	1.4%	25.2	2421	2.5%	10.0	1.6	25.5	50.7	2711.0	45.4	45.4
OS5	3.46	A	0%	0.08	0.35	298	3.0%	22.1	784	2.4%	10.0	1.6	8.4	30.4	1082.0	35.3	30.4
OS6	3.98	A	7%	0.25	0.47	165	3.4%	13.1	612	2.7%	10.0	1.6	6.2	19.3	777.0	31.1	19.3
OS7	18.52	A	39%	0.33	0.52	191	2.1%	15.1	1262	3.1%	10.0	1.7	12.0	27.2	1453.0	27.7	27.2

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).

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ 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
Location: El Paso County
Design Storm: 5-Year

Project Name: Sterling Ranch Phase 2
Project No.: 25188.02
Calculated By: CJD
Checked By:
Date: 6/1/20

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	A1	5.17	0.08	27.4	0.41	2.62	1.1															
	2	A2	27.48	0.08	39.1	2.20	2.08	4.6															Basin A2
	3	OS1	9.27	0.49	21.7	4.53	2.97	13.4															Basin A1
	4	OS5	3.46	0.08	30.4	0.28	2.46	0.7															Basin A4
	6	B1	11.78	0.08	25.2	0.94	2.74	2.6															Basin OS1
	7	OS2	1.94	0.90	14.2	1.75	3.60	6.3															Basin OS2
	8	OS3	2.36	0.90	12.2	2.12	3.83	8.1															Basin OS3
	9	OS4	40.30	0.19	45.4	7.59	1.86	14.1															Basin OS4
	10	OS6	3.98	0.25	19.3	1.01	3.14	3.2						1.0	3.4					998	1.8	9.1	Basin OS6 travel to design point 5.1
	11	OS7	18.52	0.33	27.2	6.11	2.63	16.1						6.11	3.2					936	1.8	8.7	Basin OS7 travel to design point 5.1
	5	A3	11.68	0.08	19.5	0.93	3.13	2.9															Basin A3
	5.1								19.5	8.05	3.13	25.2											Design point 5.1 fed by basins A3, OS6, and OS7

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

STANDARD FORM SF-3 - EXISTING

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Phase 2
Project No.: 25188.02
Calculated By: CJD
Checked By:
Date: 6/1/20

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	A1	5.17	0.35	27.4	1.81	4.39	8.0															
	2	A2	27.48	0.35	39.1	9.62	3.49	33.6															Basin A2
	3	OS1	9.27	0.65	21.7	5.98	4.98	29.8															Basin A1
	4	OS5	3.46	0.35	30.4	1.21	4.13	5.0															Basin A4
	6	B1	11.78	0.35	25.2	4.12	4.60	19.0															Basin OS1
	7	OS2	1.94	0.96	14.2	1.86	6.04	11.2															Basin OS2
	8	OS3	2.36	0.96	12.2	2.27	6.44	14.6															Basin OS3
	9	OS4	40.30	0.42	45.4	17.09	3.12	53.3															Basin OS4
	10	OS6	3.98	0.47	19.3	1.87	5.27	9.9						1.9	3.4					998	1.8	9.1	Basin OS6 travel to design point 5.1
	11	OS7	18.52	0.52	27.2	9.66	4.41	42.6						9.66	3.2					936	1.8	8.7	Basin OS7 travel to design point 5.1
	5	A3	11.68	0.35	19.5	4.09	5.25	21.5															Basin A3
	5.1								19.5	15.62	5.25	82.0											Design point 5.1 fed by basins A3, OS6, and OS7

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

COMPOSITE % IMPERVIOUS & COMPOSITE PROPOSED RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Sterling Ranch Subdivision
Location: El Paso County

Project Name: Sterling Ranch Phase 2
Project No.: 25188.02
Calculated By: CJD
Checked By:
Date: 6/1/20

Basin ID	Total Area (ac)	Streets (100% Impervious)				Residential (65% Impervious) Neighborhood Area (70% Impervious)				Light Industrial (80% Impervious) Commercial (95% Impervious)				Lawns (0% Impervious) School (55% 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	4.31	0.90	0.96	0.92	21.3%	0.45	0.59	2.79	42.1%	0.59	0.70	0.00	0.0%	0.08	0.35	0.60	0.0%	0.49	0.64	63.4%
A2	1.37	0.90	0.96	0.22	16.1%	0.45	0.59	0.34	16.1%	0.59	0.70	0.00	0.0%	0.08	0.35	0.81	0.0%	0.30	0.51	32.2%
A3	3.68	0.90	0.96	0.71	19.3%	0.45	0.59	2.59	45.7%	0.59	0.70	0.00	0.0%	0.08	0.35	0.38	0.0%	0.50	0.64	65.1%
A4	2.72	0.90	0.96	0.59	21.8%	0.45	0.59	2.13	50.9%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.55	0.67	72.7%
A5	0.45	0.90	0.96	0.17	37.8%	0.45	0.59	0.28	40.4%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.62	0.73	78.2%
A6	7.60	0.90	0.96	1.76	23.2%	0.45	0.59	5.84	49.9%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.55	0.68	73.1%
A7	1.43	0.90	0.96	0.43	29.8%	0.45	0.59	1.00	45.5%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.58	0.70	75.3%
A8	4.22	0.90	0.96	0.12	2.8%	0.45	0.59	0.68	10.5%	0.59	0.70	0.00	0.0%	0.08	0.35	3.42	0.0%	0.16	0.41	13.3%
B1	2.44	0.90	0.96	1.04	42.6%	0.45	0.59	1.40	37.3%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.64	0.75	79.9%
B2	4.33	0.90	0.96	0.94	21.7%	0.45	0.59	3.39	50.9%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.55	0.67	72.6%
C1	3.29	0.90	0.96	0.72	21.9%	0.45	0.59	1.66	32.8%	0.59	0.70	0.00	0.0%	0.08	0.35	0.91	0.0%	0.45	0.60	54.7%
C2	6.74	0.90	0.96	1.49	22.1%	0.45	0.59	4.21	40.6%	0.59	0.70	0.00	0.0%	0.08	0.35	1.04	0.0%	0.49	0.63	62.7%
C3	3.11	0.90	0.96	0.10	3.2%	0.45	0.59	0.37	7.7%	0.59	0.70	0.00	0.0%	0.08	0.35	2.64	0.0%	0.15	0.40	10.9%
OS1	2.02	0.90	0.96	0.06	3.0%	0.45	0.59	0.15	4.8%	0.59	0.70	0.00	0.0%	0.09	0.35	1.81	0.0%	0.14	0.39	7.8%
OS2	2.18	0.90	0.96	0.14	6.4%	0.45	0.59	0.98	29.2%	0.59	0.70	0.00	0.0%	0.09	0.35	1.06	0.0%	0.30	0.50	35.6%
OS3	0.95	0.90	0.96	0.04	4.2%	0.45	0.59	0.46	31.5%	0.59	0.70	0.00	0.0%	0.09	0.35	0.45	0.0%	0.30	0.49	35.7%
OS4	0.82	0.90	0.96	0.05	6.6%	0.45	0.59	0.28	22.2%	0.59	0.70	0.00	0.0%	0.09	0.35	0.49	0.0%	0.27	0.47	28.8%
OS5	5.86	0.90	0.96	0.24	4.1%	0.45	0.59	1.49	16.5%	0.59	0.70	0.00	0.0%	0.09	0.35	4.13	0.0%	0.21	0.44	20.6%
OS6	1.24	0.90	0.96	0.34	27.4%	0.45	0.59	0.12	6.3%	0.59	0.70	0.00	0.0%	0.09	0.35	0.78	0.0%	0.35	0.54	33.7%
OS7	1.34	0.90	0.96	0.19	14.2%	0.45	0.59	0.80	38.8%	0.59	0.70	0.00	0.0%	0.09	0.35	0.35	0.0%	0.42	0.58	53.0%
TOTAL (A1-B7)	45.69																			58.1%
TOTAL (OS1-OS3)	14.41																			26.7%
TOTAL	60.10																			50.6%

PROPOSED
STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Sterling Ranch Subdivision
Location: El Paso County

Project Name: Sterling Ranch Phase 2
Project No.: 25188.02
Calculated By: CJD
Checked By:
Date: 6/1/20

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	4.31	A	63%	0.49	0.64	79	1.7%	8.2	1007	3.7%	20.0	3.8	4.4	12.5	1086.0	20.1	12.5
A2	1.37	A	32%	0.30	0.51	266	3.7%	15.2	141	1.5%	20.0	2.4	1.0	16.2	407.0	21.9	16.2
A3	3.68	A	65%	0.50	0.64	120	3.7%	7.7	1008	2.4%	20.0	3.1	5.5	13.2	1128.2	21.0	13.2
A4	2.72	A	73%	0.55	0.67	118	2.1%	8.5	814	1.9%	20.0	2.8	4.9	13.4	932.0	18.8	13.4
A5	0.45	A	78%	0.62	0.73	54	3.7%	4.1	217	3.9%	20.0	4.0	0.9	5.0	271.0	13.6	5.0
A6	7.60	A	73%	0.55	0.68	212	4.3%	8.9	723	1.4%	20.0	2.4	5.0	13.9	934.9	18.8	13.9
A7	1.43	A	75%	0.58	0.70	303	3.4%	10.9	367	1.2%	20.0	2.2	2.8	13.7	670.0	16.1	13.7
A8	4.22	A	13%	0.16	0.41	233	4.9%	15.3	307	0.9%	15.0	1.4	3.6	18.9	540.0	28.7	18.9
B1	2.44	A	80%	0.64	0.75	50	2.5%	4.3	1066	1.6%	20.0	2.5	7.1	11.4	1116.0	19.4	11.4
B2	4.33	A	73%	0.55	0.67	226	4.9%	8.8	346	0.7%	20.0	1.7	3.4	12.2	572.0	17.2	12.2
C1	3.29	A	55%	0.45	0.60	228	4.3%	11.0	393	1.8%	20.0	2.7	2.5	13.5	621.0	19.7	13.5
C2	6.74	A	63%	0.49	0.63	99	1.8%	9.0	796	1.7%	20.0	2.6	5.1	14.1	895.0	21.1	14.1
C3	3.11	A	11%	0.15	0.40	144	9.6%	9.8	255	3.5%	15.0	2.8	1.5	11.3	399.0	26.3	11.3
OS1	2.02	A	8%	0.14	0.39	452	2.4%	27.5	108	2.6%	20.0	3.2	0.6	28.1	560.0	25.8	25.8
OS2	2.18	A	36%	0.30	0.50	248	2.8%	16.1	0	1.0%	20.0	2.0	0.0	16.1	248.0	19.9	16.1
OS3	0.95	A	36%	0.30	0.49	246	1.5%	19.9	0	1.0%	20.0	2.0	0.0	19.9	246.0	19.9	19.9
OS4	0.82	A	29%	0.27	0.47	129	5.0%	10.1	0	1.0%	20.0	2.0	0.0	10.1	129.0	21.1	10.1
OS5	5.86	B	21%	0.21	0.44	222	11.0%	10.8	914	1.1%	20.0	2.1	7.4	18.2	1136.0	34.9	18.2
OS6	1.24	A	34%	0.35	0.54	73.12	2.9%	8.1	0	1.0%	20.0	2.0	0.0	8.1	73.1	20.3	8.1
OS7	1.34	A	53%	0.42	0.58	160	3.9%	9.9	0	1.0%	20.0	2.0	0.0	9.9	160.0	17.0	9.9

PROPOSED
STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Sterling Ranch Subdivision
Location: El Paso County

Project Name: Sterling Ranch Phase 2
Project No.: 25188.02
Calculated By: CJD
Checked By:
Date: 6/1/20

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					tc CHECK			FINAL
DATA						(T_i)			(T_t)					(URBANIZED BASINS)			
BASIN	D.A.	Hydrologic	Impervious	C_5	C_{100}	L	S_o	t_i	L_t	S_t	K	VEL.	t_t	COMP. t_c	TOTAL	Urbanized t_c	t_c

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).

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

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

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Phase 2
Project No.: 25188.02
Calculated By: CJD
Checked By:
Date: 6/1/20

		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
	2B	B2	4.33	0.55	12.2	2.37	3.83	9.1															Sump inlet Drains to DP 1.1
	1B	B1	2.44	0.64	11.4	1.57	3.93	6.2															Sump inlet Drains to DP 1.1
	1.1B								12.2	3.94	3.83	15.1											Sum of inlets 1B and 2B
	1	A1	4.31	0.49	12.5	2.13	3.79	8.1															On-grade inlet, carryover flow to A2 (assume inlets capture 100% for now) Drains to DP 1.2
	1.1								12.5	6.07	3.79	23.0											DP 1.1 merge with inlet 1
	5	A5	0.45	0.62	5.0	0.28	5.16	1.4															On-grade inlet, carryover flow to DP 5 Drains to DP 1.3
	5.1								12.5	6.35	3.79	24.1											inlet 5 merge with DP1.2
	2	A2	1.37	0.30	16.2	0.42	3.41	1.4															On-grade inlet, carryover flow to A4
	2.1								16.2	6.77	3.41	23.1											DP 1.3 merge with inlet 2
	6	A6	7.60	0.55	13.9	4.21	3.64	15.3															on grade inlet, carryover flow to A7
	3	A3	3.68	0.50	13.2	1.84	3.72	6.8															on grade inlet, carryover flow to A4
	6.1								16.2	12.82	3.41	43.7											Merge of DP 1.4, inlet 6, and inlet 3
	7	A7	1.43	0.58	13.7	0.83	3.66	3.0															Sump inlet Drains to DP1.6
	4	A4	2.72	0.55	13.4	1.49	3.68	5.5															Sump Inlet Drains to to DP 1.7
	4.1								16.2	15.14	3.41	51.6											Mh connection to DP1.7
	8	A8	4.22	0.16	18.9	0.69	3.17	2.2															Area inlet east of site
	11	OS1	2.02	0.14	25.8	0.28	2.71	0.8															FES southeast of site
	13	C2	6.74	0.49	14.1	3.32	3.61	12.0															Sump inlet Drains to DP 2.0
	14	C1	3.29	0.45	13.5	1.47	3.68	5.4															Sump inlet Drains to DP 2.1
	14.1								14.1	4.79	3.61	17.3											MH connection to DP 2.1
	12	C3	3.11	0.15	11.3	0.47	3.95	1.9															Area Inlet
	15	OS2	2.18	0.30	16.1	0.66	3.42	2.3															Drains directly to detention pond
	16	OS3	0.95	0.30	19.9	0.28	3.10	0.9															Drains offsite
	17	OS4	0.82	0.27	10.1	0.22	4.12	0.9															Drains offsite
	18	OS5	5.86	0.21	18.2	1.26	3.23	4.1															Drains offsite
	19	OS6	1.24	0.35	8.1	0.43	4.44	1.9															Drains offsite
	20	OS7	1.34	0.42	9.9	0.56	4.14	2.3															Drains offsite

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

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

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

Project Name: Sterling Ranch Phase 2
Project No.: 25188.02
Calculated By: CJD
Checked By:
Date: 6/1/20

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)	
	2B	B2	4.33	0.67	12.2	2.90	6.43	18.7															Sump inlet Drains to DP 1.1
	1B	B1	2.44	0.75	11.4	1.82	6.60	12.0															Sump inlet Drains to DP 1.1
	1.1B								12.2	4.72	6.43	30.4											Sum of inlets 1B and 2B
	1	A1	4.31	0.64	12.5	2.74	6.37	17.4															On-grade inlet, carryover flow to A2 (assume inlets capture 100% for now) Drains to DP 1.2
	1.1								12.5	7.46	6.37	47.5											DP 1.1 merge with inlet 1
	5	A5	0.45	0.73	5.0	0.33	8.66	2.9															On-grade inlet, carryover flow to DP 5 Drains to DP 1.3
	5.1								12.5	7.79	6.37	49.6											inlet 5 merge with DP1.2
	2	A2	1.37	0.51	16.2	0.70	5.72	4.0															On-grade inlet, carryover flow to A4
	2.1								16.2	8.49	5.72	48.5											DP 1.3 merge with inlet 2
	6	A6	7.60	0.68	13.9	5.14	6.11	31.4															on grade inlet, carryover flow to A7
	3	A3	3.68	0.64	13.2	2.34	6.24	14.6															on grade inlet, carryover flow to A4
	6.1								16.2	15.97	5.72	91.3											Merge of DP 1.4, inlet 6, and inlet 3
	7	A7	1.43	0.70	13.7	1.00	6.14	6.1															Sump inlet Drains to DP1.6
	4	A4	2.72	0.67	13.4	1.82	6.19	11.3															Sump Inlet Drains to to DP 1.7
	4.1								16.2	18.79	5.72	107.4											Mh connection to DP1.7
	8	A8	4.22	0.41	18.9	1.71	5.32	9.1															Drains to swale Area inlet east of site
	11	OS1	2.02	0.39	25.8	0.78	4.55	3.5															FES southeast of site
	13	C2	6.74	0.63	14.1	4.28	6.06	25.9															Sump inlet Drains to DP 2.0
	14	C1	3.29	0.60	13.5	1.99	6.18	12.3															Sump inlet Drains to DP 2.1
	14.1								14.1	6.27	6.06	38.0											MH connection to DP 2.1
	12	C3	3.11	0.40	11.3	1.24	6.63	8.2															Drains to Swale Area Inlet
	15	OS2	2.18	0.50	16.1	1.08	5.73	6.2															Drains directly to detention pond
	16	OS3	0.95	0.49	19.9	0.47	5.20	2.4															Drains offsite
	17	OS4	0.82	0.47	10.1	0.39	6.92	2.7															Drains offsite
	18	OS5	5.86	0.44	18.2	2.56	5.42	13.9															Drains offsite
	19	OS6	1.24	0.54	8.1	0.67	7.45	5.0															Drians offsite
	20	OS7	1.34	0.58	9.9	0.78	6.96	5.4															Drians offsite

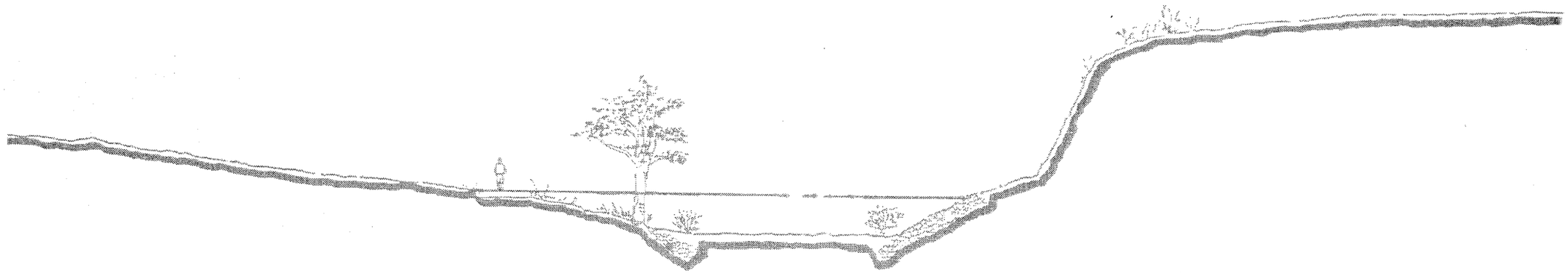
Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

Appendix C
Reference Material

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

II. STUDY AREA DESCRIPTION

The Sand Creek drainage basin is a left-bank tributary to the Fountain Creek lying in the west-central portions of El Paso County. Sand Creek's drainage area at Fountain Creek is approximately 54 square miles of which approximately 18.8 square miles are inside the City of Colorado Springs corporate limits. The basin is divided into five major sub-basins, the Sand Creek mainstem, the East Fork Sand Creek, the Central Tributary to East Fork, the West Fork, and the East Fork Subtributary. Figure II-1 shows the location of the Sand Creek basin.

Basin Description

The Sand Creek basin covers a total of 54 square miles in unincorporated El Paso County and Colorado Springs, Colorado. Of this total, approximately 28 square miles is encompassed by the Sand Creek basin, and 26 square miles for the East Fork Sand Creek basin. The basin trends in generally a south to southwesterly direction, entering the Fountain Creek approximately two miles upstream of the Academy Boulevard bridge over Fountain Creek. Two main tributaries drain the basin, those being the mainstem of Sand Creek and East Fork Sand Creek. Development presence in most evident along the mainstream. At this time, approximately 25 percent of the basin is developed. This alternative evaluation focuses upon the Sand Creek basin only.

The maximum basin elevation is approximately 7,620 feet above mean sea level, and falls to approximately 5,790 feet at the confluence with Fountain Creek. The headwaters of the basin originate in the conifer covered areas of The Black Forest. The middle eastern portions of the basin are typified by rolling range land with fair to good vegetative cover associated with semi-arid climates.

Climate

This area of El Paso County can be described, in general as high plains, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry. Precipitation ranges from 14 to 16 inches per year, with the majority of this precipitation occurring in spring and summer in the form of rainfall. Thunderstorms are common during the summer months, and are typified by quick-moving low pressure cells which draw moisture from the Gulf of Mexico into the region. Average temperatures range from about 30^{O}F in the winter to 75^{O} in the summer. The relative humidity ranges from about 25 percent in the summer to 45 percent in the winter.

Soils and Geology

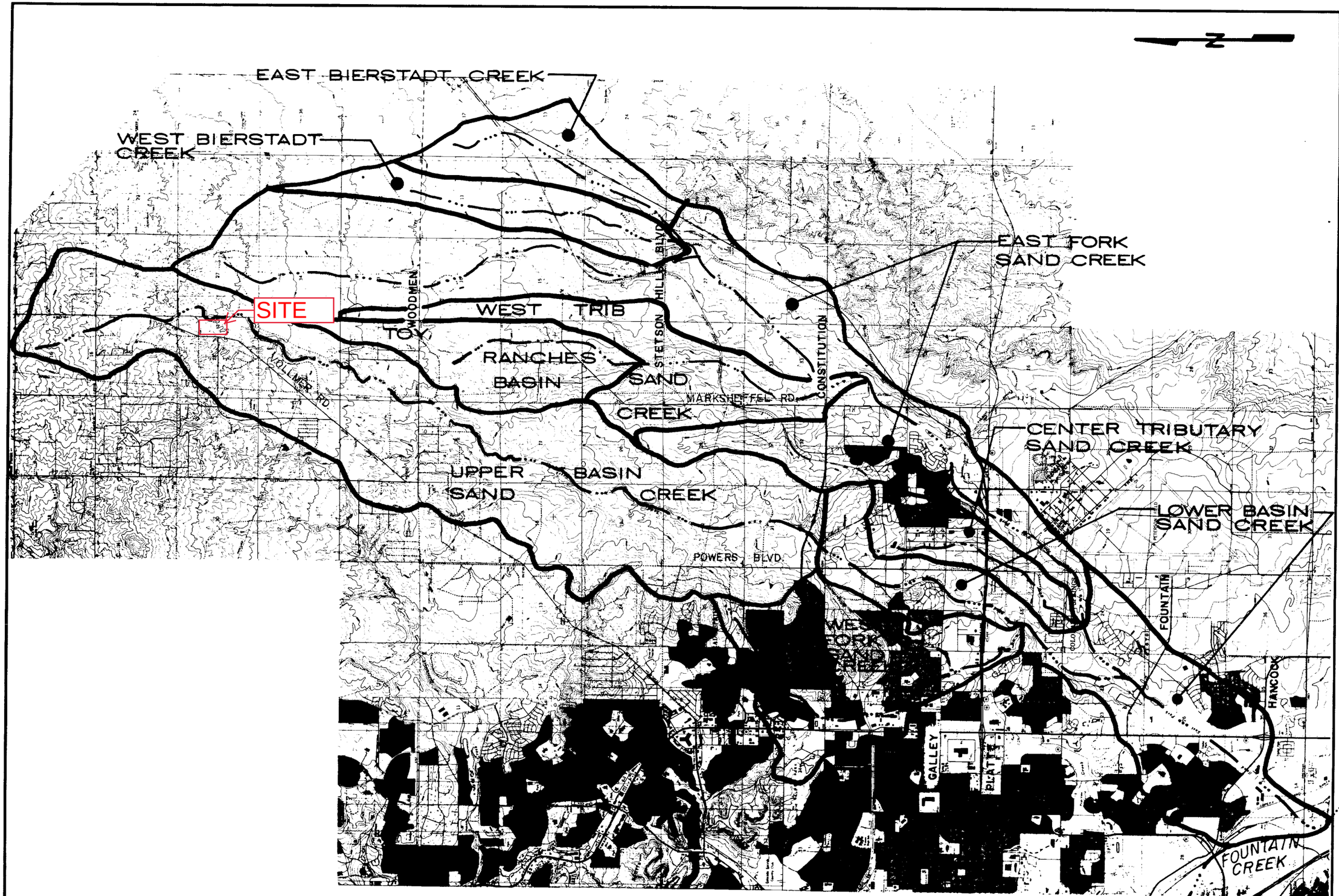
Soils within the Sand Creek basin vary between soil types A through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant soil groupings are in the Truckton and Bresser soil associations. The soils consist of deep, well drained soils that formed in alluvium and residium, derived from sedimentary rock. The soils have high to moderate infiltration rates, and are extremely susceptible to wind and water erosion where poor vegetation cover exists. In undeveloped areas, the predominance of Type A and B soils give this basin a lower runoff per unit area as compared to basins with soils dominated by Types C and D. Presented on Figure II-2 is the Hydrologic Soil distribution map for the Sand Creek basin.

Property Ownership and Impervious Land Densities

Property ownership along the major drainageway within the Sand Creek basin vary from public to private. Along the developed reaches, drainage right-of-ways and greenbelts have been dedicated during the development of the adjacent residential and commercial land. Where development has not occurred, the drainageways remain under private ownership with no delineated drainage right-of-way or easements. There are several public parks which abut the mainstem of Sand Creek. Roadway and utility easements abutting or crossing the major drainageways occur most frequently in the developed portions of the basin.

Land use information for the existing and future conditions were reviewed as part of the planning effort. This information is used in the hydrologic analysis to predict runoff rates and volumes for the purposes of facility evaluation. The identification of land uses abutting the drainageways is also useful in the identification of feasible plans for stabilization and aesthetic treatment of the creek. Presented on Figure II-3 is the proposed land use map used in the evaluation of impervious land densities discussed in the hydrologic section of this report. Figure II-3 is not intended to reflect the future zoning or land use policies of the City or the County.

The land use information within the Banning-Lewis Ranch property was obtained from Aries Properties during the time the draft East Fork Sand Creek Drainage Basin Planning Study was being prepared. The land use information was again reviewed with the City of Colorado Springs Department of Planning and was found to be appropriate for use in the estimation of hydrology for the East Fork Basin. The location of future arterial streets and roadways within



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

SAND CREEK DRAINAGE BASIN PLANNING STUDY

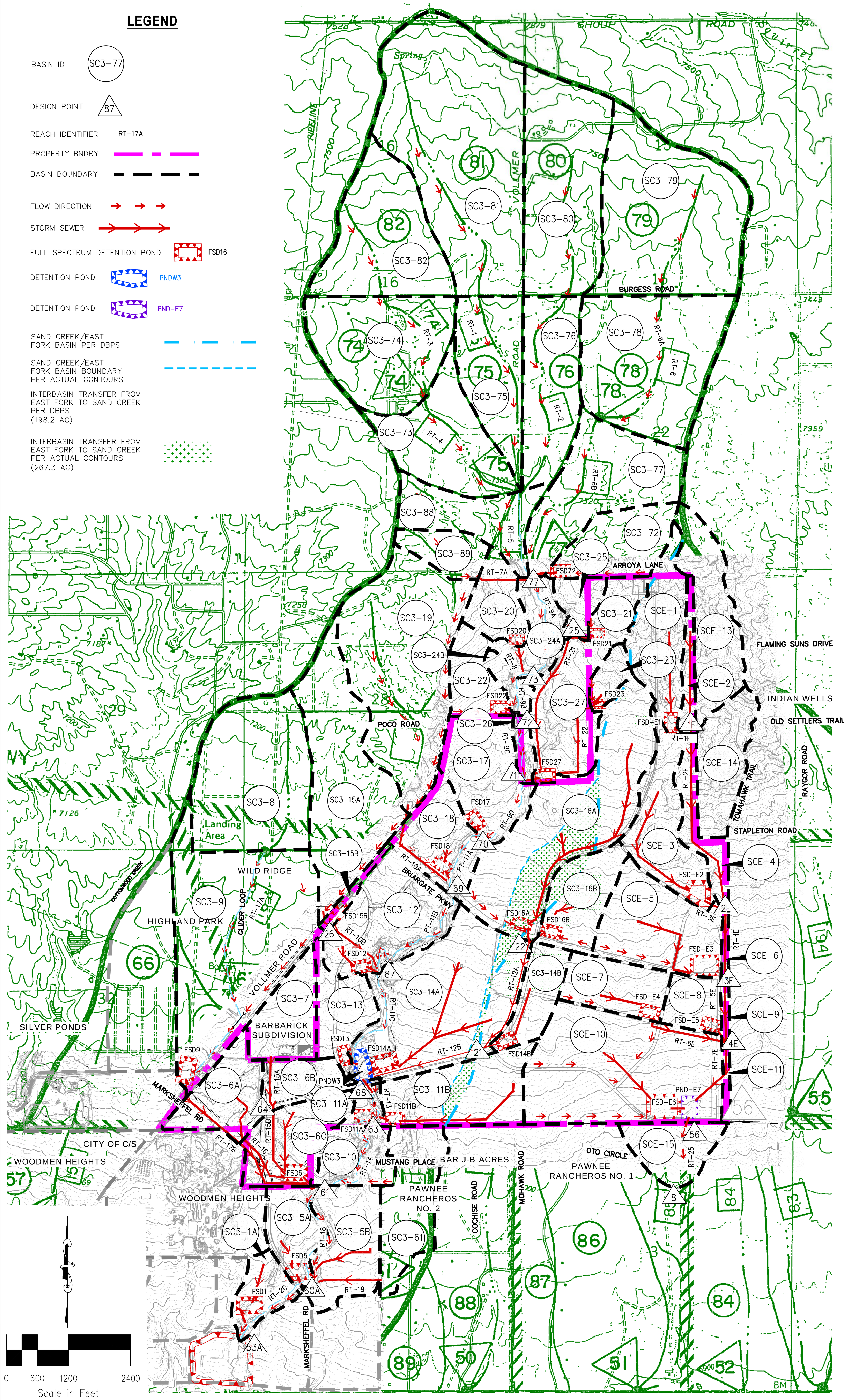
REGIONAL SUB-BASINS

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

11

FIG. III-1

File: O:\09002A\Sterling Ranch District\dwg\Eng Exhibits\2018 MDDP\2018-MDDP-eInterimCondWSWrkMap.dwg Plotstamp: 10/24/2018 3:21 PM



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 / Q10=345.7cfs Q100=588.9cfs
(EXISTING) (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.
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COLORADO SPRINGS, CO 80903
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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

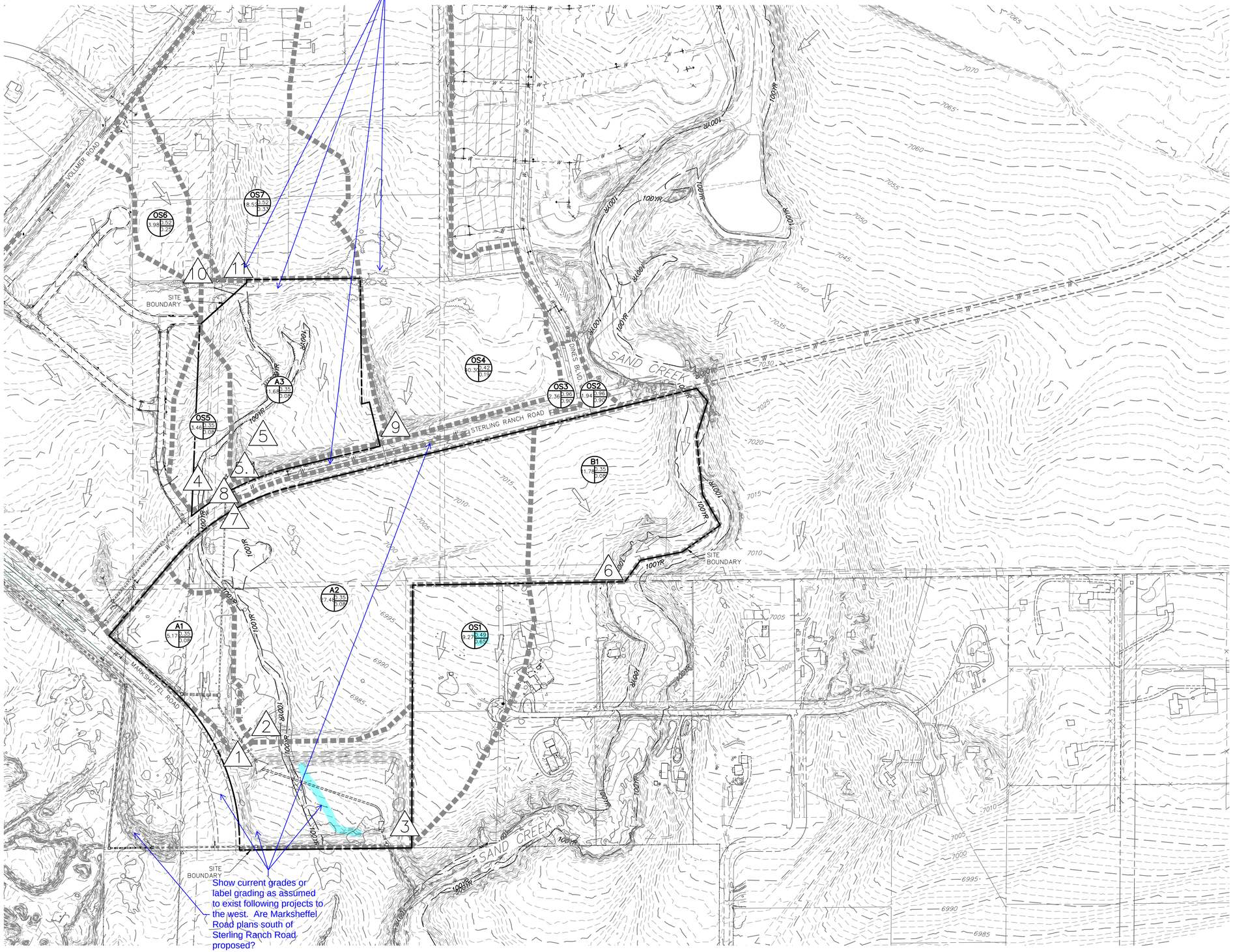
Appendix D
Drainage Maps

Also provide the Existing Drainage Plan from SF20015 showing a larger area (with comments addressed) down to existing confluence

STERLING RANCH PHASE 2

EXISTING DRAINAGE MAP

Show the existing upstream facilities, access roads and culverts



Show current grades or label grading as assumed to exist following projects to the west. Are Marksheffel Road plans south of Sterling Ranch Road proposed?

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

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	5.17	0%	0.08	0.35	27.4	1.1	8.0
A2	27.48	0%	0.08	0.35	39.1	4.6	33.6
A3	11.68	0%	0.08	0.35	19.5	2.9	21.5
B1	11.78	0%	0.08	0.35	25.2	2.6	19.0
OS1	9.27	37%	0.49	0.65	21.7	13.4	29.8
OS2	5.00	100%	0.90	0.96	14.2	6.3	11.2
OS3	2.36	100%	0.90	0.96	12.2	8.1	14.6
OS4	40.30	17%	0.19	0.42	45.4	14.1	53.3
OS5	3.46	0%	0.08	0.35	30.4	0.7	5.0
OS6	3.98	7%	0.25	0.47	19.3	3.2	9.9
OS7	18.52	39%	0.33	0.52	27.2	16.1	42.6

N

300 150 0 300 600

ORIGINAL SCALE: 1" = 300'

STERLING RANCH PHASE 2
EXISTING DRAINAGE MAP
JOB NO. 25188.00
06/01/20
SHEET 1 OF 1

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Provide the interim drainage plan proposed for early grading (to match GEC plan)

STERLING RANCH PHASE 2
PROPOSED DRAINAGE MAP

Show the existing upstream facilities and culverts. Show how flows will be intercepted. Provide design points and basins

label pipes and easements

label basin

label DP

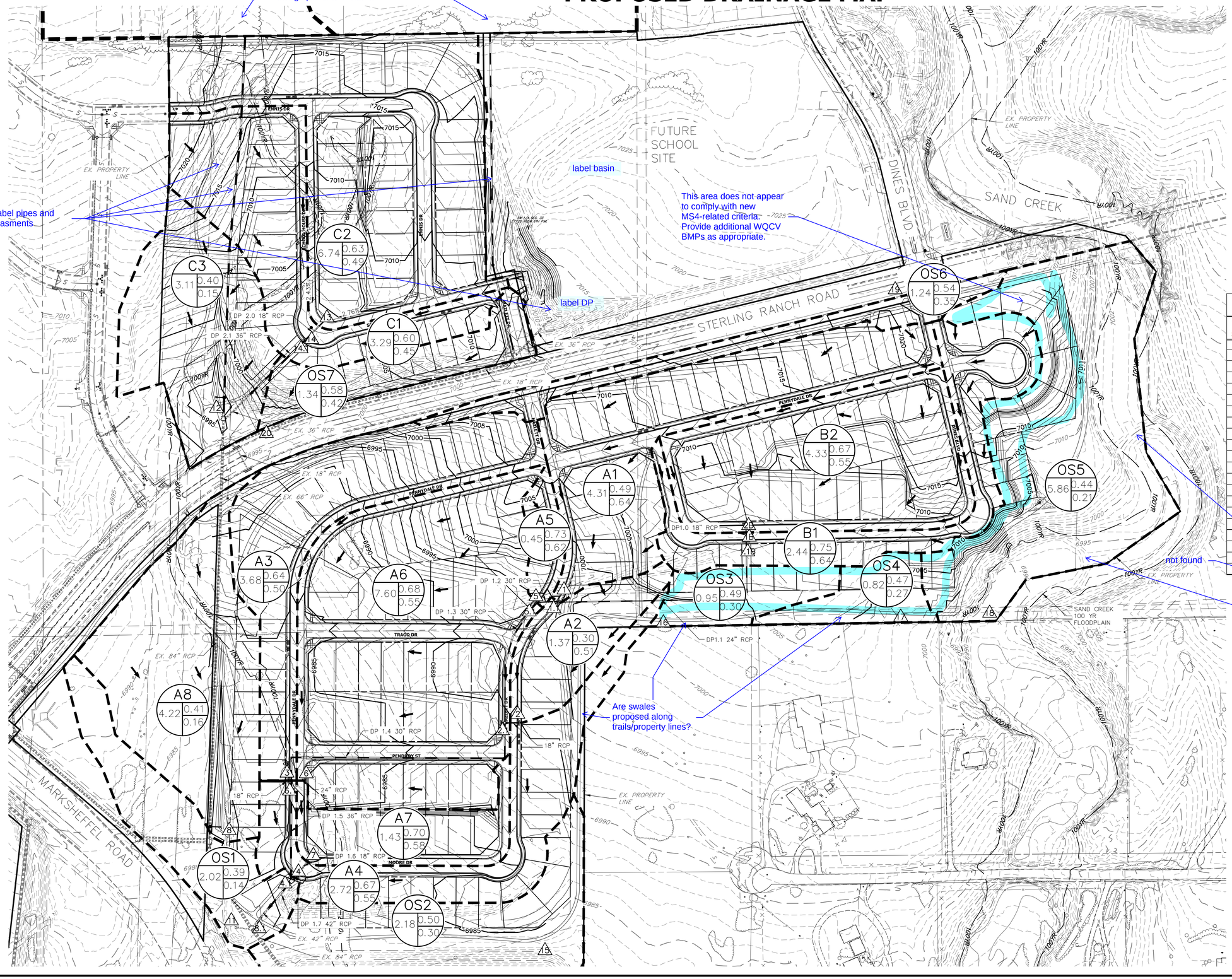
This area does not appear to comply with new MS4-related criteria. Provide additional WQCV BMPs as appropriate.

Are swales proposed along trails/property lines?

not found

Show and label conceptual channel improvements

Cursory review - Basins and DPs not reviewed or cross-checked against calculations



LEGEND

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

DESIGN POINT

PROPOSED 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

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	4.31	63%	0.49	0.64	12.5	8.1	17.4
A2	1.37	32%	0.30	0.51	16.2	1.4	4.0
A3	3.68	65%	0.50	0.64	13.2	6.8	14.6
A4	2.72	73%	0.55	0.67	13.4	5.5	11.3
A5	0.45	78%	0.62	0.73	5.0	1.4	2.9
A6	7.60	73%	0.55	0.68	13.9	15.3	31.4
A7	1.43	75%	0.58	0.70	13.7	3.0	6.1
A8	4.22	13%	0.16	0.41	18.9	2.2	9.1
B1	2.44	80%	0.64	0.75	11.4	6.2	12.0
B2	4.33	73%	0.55	0.67	12.2	9.1	18.7
C1	3.29	55%	0.45	0.60	13.5	5.4	12.3
C2	6.74	63%	0.49	0.63	14.1	12.0	25.9
C3	3.11	11%	0.15	0.40	11.3	1.9	8.2
OS1	2.02	8%	0.14	0.39	25.8	0.8	3.5
OS2	2.18	36%	0.30	0.50	16.1	2.3	6.2
OS3	0.95	36%	0.30	0.49	19.9	0.9	2.4
OS4	0.82	29%	0.27	0.47	10.1	0.9	2.7
OS5	5.86	21%	0.21	0.44	18.2	4.1	13.9
OS6	1.24	34%	0.35	0.54	8.1	1.9	5.0
OS7	1.34	53%	0.42	0.58	9.9	2.3	5.4

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

STERLING RANCH PHASE 2
PROPOSED DRAINAGE MAP
JOB NO. 25188.00
06/01/20
SHEET 1 OF 1

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Provide a sheet showing Lift station tract, Marksheffel Road, Pond W5, all contributing flows to it and outfall improvements (including channel)