FINAL DRAINAGE REPORT
FOR
STERLING RANCH RECYCLING FACILITY

Prepared For:

SR Land, LLC
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(719) 491-3024

November 2022
Project No. 25188.14
PCD Filing No: PPR-22-041

Prepared By:

JR Engineering, LLC
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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 letter 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: 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.

_____

County Engineer/ ECM Administrator

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APPENDIX

PURPOSE

This document is the Drainage Report for Sterling Ranch Recycling Facility. The purpose of this report is to identify on-site and off-site drainage patterns, areas tributary to the site, compare pre-development and proposed drainage conditions.

GENERAL SITE DESCRIPTION

GENERAL LOCATION

Sterling Ranch Recycling Facility (hereby referred to as the "site") is a proposed development within the Sterling Ranch master planned community with a total area of approximately 32 acres that is presently used as a concrete and asphalt recycling facility.

The site is located in north half of Section 5, Township 13 South, Range 65 West of the Sixth Principal Meridian in El Paso County, State of Colorado. The site is bounded by Marksheffle Road to the northeast, Pioneer Sand CO to the west, and un platted land borders the site to the south and north. Refer to the vicinity map in Appendix A for additional information.

discuss pre-development condition too.

DESCRIPTION OF PROPERTY

In the existing and proposed condition, the property is used as an asphalt and concrete recycling facility with gravel drives, a staging area and some existing grasslands. The site generally slope(s) to the south at 1 to 6% towards an existing 8' berm on the southern edge of the property.

Soils for this project are classified as Blakeland Loamy Sand (8) and Columbine Gravelly Sandy Loam (19). These soils are characterized as hydrologic soil types Type A. Group A soils exhibit high infiltration rates when thoroughly wet, and consist mainly of deep, well drained to excessively drained sands or gravelly sands. Refer to the soil survey map in Appendix A for additional information.

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 entire site 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 Maps have been presented in Appendix A.

"currently" or "pre-development?" Be consistent with the use of both throughout report, since on previous page "existing" was used to describe developed condition.

EXISTING DRAINAGE CONDITIONS

MAJOR BASIN DESCRIPTIONS

The site lies within the upper 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 7 major sub-basins. The site is within the respective upper basin Sand Creek sub-basin as shown in Appendix C.

The site generally drains from north to southwest. Currently, the site is used as pasture land for cattle. Sand Creek is located west of the site running north to south. This reach of drainage conveyance is not currently improved. Currently, Kiowa is performing studies and plans to address Sand Creek stabilization adjacent to the site.

Pre-development

EXISTING SUB-BASIN DRAINAGE

The existing condition of the site was broken into five major basins. The basin and sub-basin delineation is shown in the existing drainage map in Appendix D and is described as follows:

Sub-basin EX1 (Q_5= 2.4cfs, Q_{100}=10.2cfs) is 7.45 acres and 11 percent impervious and is located offsite southeast of Vollmer Road and southwest of Marksheffel Road. Runoff from this basin sheet flows from the northwest to southeast to the ditch along Marksheffel Road at design point 1.

Sub-basin EX2 (Q_5= 14.4cfs, Q_{100}=33.2cfs) is 9.53 acres and 47 percent impervious and consists of Markshaffel Road. Runoff from this basin sheet flows southeast along the flow lines and is collected in on grade inlets in Markshaffel Road, and piped to the existing detention pond east of Marksheffel Road at design point 2.

Sub-basin EX3 (Q_5= 1.9cfs, Q_{100}=11.4cfs) is 5.06 acres and 4 percent impervious and is located offsite just east of the recycling facility and west of Markshaffel Road. Runoff from this basin sheet flows southeast to design point 3 and is piped east to the existing detention pond east of Marksheffel Road.

Specify that this is Pond W5

Sub-basin EX4 (Q_5= 7.7cfs, Q_{100}=40.6cfs) is 26.07 acres and is 6 percent impervious and is located in the central portion of the site. Runoff from this basin sheet flows south towards the existing 8' berm at design point 4.

Describe where water flows from there. Does it ever get conveyed around either side of the berm and/or overtop it? If so, how/where is it conveyed from there?

Sub-basin EX5 (Q_5= 1.1cfs, Q_{100}=5.0cfs) is 2.59 acres and is 9 percent impervious and is located on the western portion of the site. Runoff from this basin sheet flows southwest to design point 5 located just north of the existing 8' berm.

And then what?

Sub-basin EX6 (Q_5= 0.9cfs, Q_{100}=5.8cfs) is 3.77 acres and is 2 percent impervious and is located on the southwest portion of the site. Runoff from this basin sheet flows southwest to the existing stock ponds

PROPOSED DRAINAGE CONDITIONS

PROPOSED SUB-BASIN DRAINAGE

The proposed site was broken into five basins including two onsite basins and three offsite basins. The proposed basin delineation is shown on the drainage basin map within Appendix D and is described as follows.

Basin OS1 (Q_5= 2.4cfs, Q_{100}=10.2cfs) is 7.45 acres and 11 percent impervious and is located offsite southeast of Vollmer Road and southwest of Marksheffel Road. Runoff from this basin sheet flows from the northwest to southeast to the ditch along Marksheffel Road at design point 1.

Basin OS2 (Q_5= 14.4cfs, Q_{100}=33.2cfs) is 9.53 acres and 47 percent impervious and consists of Markshaffel Road. Runoff from this basin sheet flows southeast along the flow lines and is collected in on grade inlets in Markshaffel Road, and piped to the existing detention pond east of Marksheffel Road at design point 2.

Basin OS3 (Q_5= 1.9cfs, Q_{100}=11.4cfs) is 5.06 acres and 4 percent impervious and is located offsite just east of the recycling facility and west of Markshaffel Road. Runoff from this basin sheet flows southeast to design point 3 and is piped east to the existing detention pond east of Marksheffel Road.

Specify that this is Pond W5

Basin 4a (Q_5= 5.9cfs, Q_{100}=27.5cfs) is 15.20 acres and is 9 percent impervious and is located in the central portion of the site. Runoff from this basin sheet flows south towards the existing 8' berm at design point 4.

Describe where water flows from there. Does it ever get conveyed around either side of the berm and/or overtop it? If so, how/where is it conveyed from there?

Basin 4b (Q_5= 3.8cfs, Q_{100}=19.1cfs) is 11.42 acres and is 8 percent impervious and is located on the east portion of the site. Runoff from this basin sheet flows south towards the existing 8' berm at design point 5.

Basin B (Q_5= 2.0cfs, Q_{100}=11.4cfs) is 6.36 acres and is 5 percent impervious and is located on the western portion of the site. Runoff from this basin sheet flows southwest to design point 6 located just north of the existing 8' berm.

And then what?

Discuss the paved road shown on the proposed drainage map. Paved roads are assumed to be impervious.

Show and label the berm on the proposed drainage map.

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.

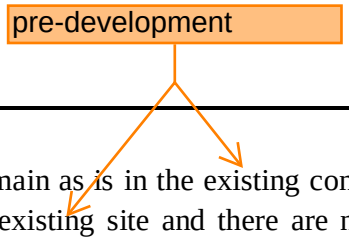
Table 2 - 1-hr Point Rainfall Data

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.

DRAINAGE FACILITY DESIGN



GENERAL CONCEPT

The proposed drainage patterns for the site will remain as is in the existing conditions. There are no proposed changes to the drainage patterns of the existing site and there are no proposed drainage facilities onsite. A proposed drainage map is presented in Appelndix D.

PBMP Applicability Form shows Runoff Reduction (RR) was selected. Revise this text and/or PBMP Form to remove discrepancies. If you do go with RR, see req's in my comment on the next page.

Per PBMP Applicability Form (and per MS4 Permit), a site specific study is needed to prove this. Attach calcs to this report to support this exclusion. If exclusion does not apply, provide WQ treatment for area disturbed to develop site (not only impervious areas). And then also show Four-Step Process too.

Revise to discuss pre-development conditions instead.

WATER QUALITY

There are no water quality features have been proposed. The site will remain as is today with a majority of the site consisting of pervious area. The drainage conditions and patterns will remain as existing conditions and do not result in concentrated stromwater fow or surface water discharge that leaves the site during an 80th percentile stormwater runoff event. The Post Construction Stormwater Management Applicability Evaluation Form is provided in Appendix C.

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):.

2022 DRAINAGE AND BRIDGE FEES – STERLING RANCH RECYCLING FACILITY				
Impervious Acres (ac)	Drainage Fee (Per Imp. Acre)	Bridge Fee (Per Imp. Acre)	Sterling Ranch Drainage Fee	Sterling Ranch Bridge Fee
1.9	$21,814	$8,923	$41,519	$16,983

SUMMARY

The proposed Sterling Ranch Recycling Facility 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. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements for this site.

Discuss the following (even if not applicable):
1) Is the whole site already fully stabilized? If not, what still needs to be done to achieve final stabilization?
2) If any soil disturbance or stabilization is proposed/needed, an ESQCP will be required (this site does not fall under an existing open ESQCPs). And if an ESQCP is required, you will need also need a FAE, GEC Plan, SWMP, and their checklists.

Discuss need or lack-thereof for SW detention.

Per ECM Chap 3.2.8.B, “The proposed project or developed land use shall not change historical runoff values, cause downstream damage, or adversely impact adjacent properties.” Increases from the historical flowrates are allowable (with or without full spectrum detention) if it is shown (via text and/or calcs) that the flow increase can be accommodated downstream (ie: show that there is a suitable outfall, per ECM, Chap 3.2.4). If applicable, reference the downstream facilities in a DBPS or MDDP.

If a WQ PBMP is necessary please complete and upload the following docs:
- MS4 Post Construction Form
- O&M Manual
- Private Detention Basin / Stormwater Quality BMP Maintenance Agreement
- SDI Form

REFERENCES

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

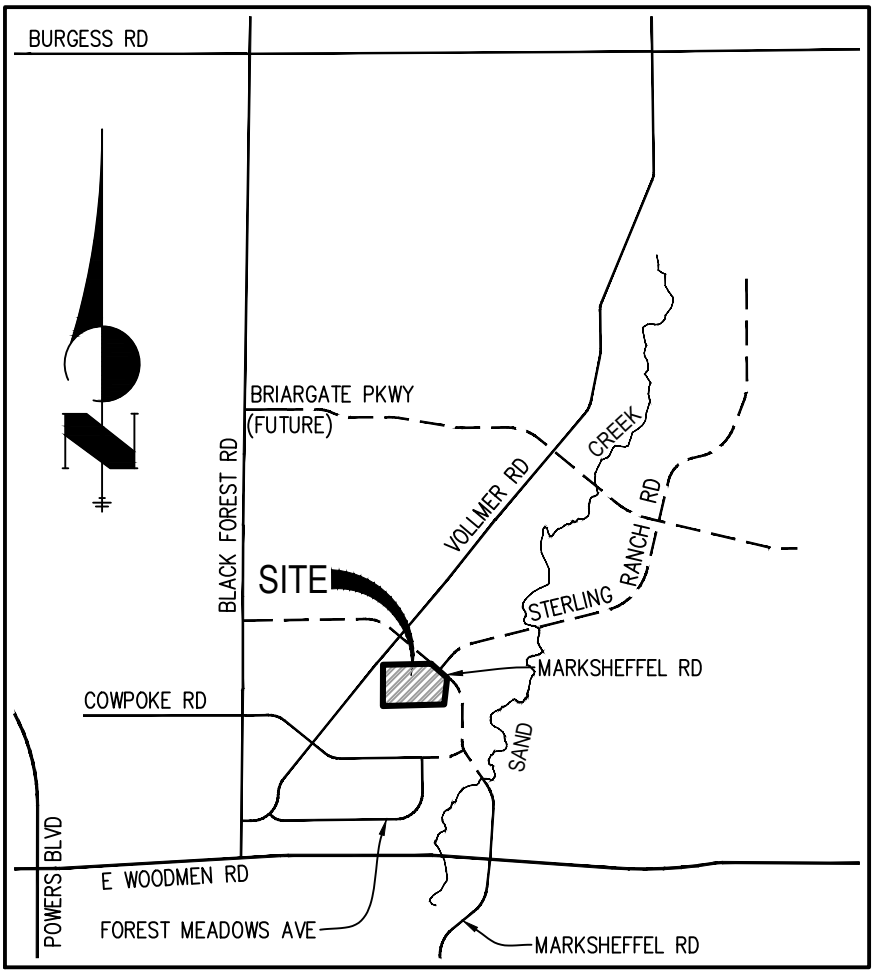
2. Sand Creek Drainage Basin Planning Study, prepared Kiowa Engineering Corporation, January 1993, revised March 1996.

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

In accordance with the MHFD, runoff reduction has vegetation requirements that have been overlooked in the past. Going forward the following will be required for runoff reduction:
- All RPA/SPA areas will need to be within a no build/drainage easement (or tract) and discussed in the maintenance agreement and O&M manual.
- RPA vegetation should be turf grass (from seed [provide appropriate seed mix] or sod).
- Turf grass vegetation should have a uniform density of at least 80%.
- Irrigation (temp or permanent) is necessary to establish sufficient vegetation and not just weeds.
- Show suitability of topsoil of RPA and steps for proper preparation of topsoil per recommendations in MHFD detail T-0 Table RR-3
- RPA/SPA limits must be shown on GEC Plans (not just FDR) so our SW inspectors and the QSM know that these areas are to remain pervious, vegetated (80%), and irrigated post-construction. Our SW inspectors do not look at drainage reports.
Other requirements that have either been done or do not pertain to this project, but I wanted to note for all future projects:
- Provide a figure showing all proposed UIA, RPA and SPA areas to be utilized for runoff reduction.
- Provide a detail for the UIA:RPA interface that shows the recommended vertical drop of 4".
- Show signage to be posted in RPAs so maintenance personnel and owners know that the area is a water quality treatment area (not just a regular grassy area and/or an SPA).

•Provide a figure showing all proposed UIA and RPA areas to be utilized for runoff reduction. All RPA areas will need to be within a no build/drainage easement and discussed in the maintenance agreement and O&M manual. Wetlands are not an acceptable RPA per the MS4 Permit and MHFD guidelines. Also make sure to show RPA limits on GEC Plans (not just FDR) so our SW inspectors and the QSM know that these areas are to remain pervious and vegetated post-construction.

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map



VICINITY MAP

N.T.S.

STERLING RECYCLING FACILITY
VICINITY MAP
JOB NO. 25188.00
6/3/22
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

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Hydrologic Soil Group—El Paso County Area, Colorado

Map Scale: 1:4,680 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

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—Sep 23, 2018

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

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	46.2	51.5%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	43.6	48.5%
Totals for Area of Interest			**89.8**	**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/.

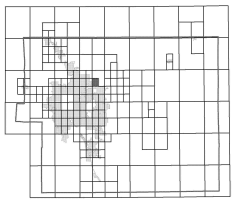
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

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)
4275000 N — 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

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

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

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
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

Appendix B
Hydrologic Calculations

COMPOSITE % IMPERVIOUS & COMPOSITE PRE-DEVELOPMENT RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Sterling Ranch Recycling Facility
Location: El Paso County

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: JSC
Checked By: RAB
Date: 11/11/22

Basin ID	Total Area (ac)	Streets (100% Impervious)				Historical Analysis (2%)				Gravel (packed) (80%)				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}	
EX1	7.45	0.90	0.96	0.67	9.0%	0.09	0.36	6.78	1.8%	0.59	0.70	0.03	0.3%	0.17	0.42	11.1%
EX2	9.53	0.90	0.96	4.39	46.1%	0.09	0.36	5.14	1.1%	0.59	0.70	0.02	0.2%	0.46	0.64	47.3%
EX3	5.06	0.90	0.96	0.08	1.6%	0.09	0.36	4.98	2.0%	0.59	0.70	0.00	0.0%	0.10	0.37	3.5%
EX4	26.07	0.90	0.96	0.76	2.9%	0.09	0.36	24.88	1.9%	0.59	0.70	0.43	1.3%	0.12	0.38	6.1%
EX5	2.59	0.90	0.96	0.18	6.8%	0.09	0.36	2.41	1.9%	0.59	0.70	0.00	0.0%	0.14	0.40	8.6%
EX6	3.77	0.90	0.96	0.00	0.0%	0.09	0.36	3.77	2.0%	0.59	0.70	0.00	0.0%	0.09	0.36	2.0%
TOTAL (EX4-EX5)	**28.66**															**6.4%**
TOTAL	**54.47**															**13.6%**

PRE-DEVELOPMENT
STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Sterling Ranch Recycling Facility
Location: El Paso County

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: JSC
Checked By: RAB
Date: 11/11/22

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)
EX1	7.45	A	11%	0.17	0.42	213	1.0%	25.1	625	0.3%	10.0	0.5	19.7	44.7	838.0	42.8	42.8
EX2	9.53	A	47%	0.46	0.64	88	9.0%	5.2	2325	2.3%	20.0	3.0	12.8	18.0	2413.0	34.3	18.0
EX3	5.06	A	4%	0.10	0.37	140	5.5%	12.2	171	2.3%	10.0	1.5	1.9	14.0	311.0	27.4	14.0
EX4	26.07	A	6%	0.12	0.38	466	5.6%	21.6	1023	3.2%	10.0	1.8	9.6	31.2	1489.0	34.7	31.2
EX5	2.59	A	9%	0.14	0.40	284	4.3%	18.0	598	3.3%	10.0	1.8	5.5	23.5	882.0	29.9	23.5
EX6	3.77	A	2%	0.09	0.36	267	2.6%	21.7	725	2.8%	10.0	1.7	7.2	28.9	992.0	33.4	28.9

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 - PRE-DEVELOPMENT

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: JSC
Checked By: RAB
Date: 11/11/22

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	EX1	7.45	0.17	42.8	1.23	1.95	2.4															
	2	EX2	9.53	0.46	18.0	4.43	3.25	14.4															
	3	EX3	5.06	0.10	14.0	0.52	3.62	1.9															
	4	EX4	26.07	0.12	31.2	3.18	2.42	7.7															
	5	EX5	2.59	0.14	23.5	0.37	2.85	1.1															
	6	EX6	3.77	0.09	28.9	0.34	2.54	0.9															

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 - PRE-DEVELOPMENT

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: JSC
Checked By: RAB
Date: 11/11/22

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	EX1	7.45	0.42	42.8	3.11	3.27	10.2															
	2	EX2	9.53	0.64	18.0	6.08	5.45	33.2															
	3	EX3	5.06	0.37	14.0	1.87	6.08	11.4															
	4	EX4	26.07	0.38	31.2	9.99	4.06	40.6															
	5	EX5	2.59	0.40	23.5	1.04	4.78	5.0															
	6	EX6	3.77	0.36	28.9	1.36	4.26	5.8															

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 Recycling Facility
Location: El Paso County

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: JSC
Checked By: RAB
Date: 11/11/22

Basin ID	Total Area (ac)	Streets (100% Impervious)				Historical Analysis (2%)				Gravel (packed) (80%)				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}	
OS1	7.45	0.90	0.96	0.67	9.0%	0.09	0.36	6.78	1.8%	0.59	0.70	0.03	0.3%	0.17	0.42	11.1%
OS2	9.53	0.90	0.96	4.39	46.1%	0.09	0.36	5.14	1.1%	0.59	0.70	0.02	0.2%	0.46	0.64	47.3%
OS3	5.06	0.90	0.96	0.08	1.6%	0.09	0.36	4.98	2.0%	0.59	0.70	0.00	0.0%	0.10	0.37	3.5%
4a	15.20	0.90	0.96	0.86	5.7%	0.09	0.36	14.05	1.8%	0.59	0.70	0.29	1.5%	0.15	0.40	9.0%
4b	11.42	0.90	0.96	0.00	0.0%	0.09	0.36	10.51	1.8%	0.59	0.70	0.91	6.4%	0.13	0.39	8.2%
B	6.36	0.90	0.96	0.18	2.8%	0.09	0.36	6.01	1.9%	0.59	0.70	0.00	0.0%	0.11	0.37	4.7%
TOTAL (EX4-EX5)	**26.62**															**8.7%**
TOTAL	**55.02**															**14.8%**

PROPOSED
STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Sterling Ranch Recycling Facility
Location: El Paso County

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: JSC
Checked By: RAB
Date: 11/11/22

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)
OS1	7.45	A	11%	0.17	0.42	213	1.0%	25.1	625	0.3%	10.0	0.5	19.7	44.7	838.0	42.8	42.8
OS2	9.53	A	47%	0.46	0.64	88	9.0%	5.2	2325	2.3%	20.0	3.0	12.8	18.0	2413.0	34.3	18.0
OS3	5.06	A	4%	0.10	0.37	140	5.5%	12.2	171	2.3%	10.0	1.5	1.9	14.0	311.0	27.4	14.0
4a	15.20	A	9%	0.15	0.40	148	6.0%	11.6	1020	1.4%	10.0	1.2	14.5	26.1	1168.0	38.6	26.1
4b	11.42	A	8%	0.13	0.39	301	2.6%	22.2	477	1.7%	10.0	1.3	6.1	28.3	778.0	30.6	28.3
B	6.36	A	5%	0.11	0.37	245	4.3%	17.3	591	3.3%	10.0	1.8	5.4	22.7	836.0	30.8	22.7

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 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: JSC
Checked By: RAB
Date: 11/11/22

		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
	1	OS1	7.45	0.17	42.8	1.23	1.95	2.4															
	2	OS2	9.53	0.46	18.0	4.43	3.25	14.4															
	3	OS3	5.06	0.10	14.0	0.52	3.62	1.9															
	4	4a	15.20	0.15	26.1	2.21	2.69	5.9															
	5	4b	11.42	0.13	28.3	1.48	2.57	3.8															
	6	B	6.36	0.11	22.7	0.70	2.90	2.0															

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 Recycling Facility
Location: El Paso County
Design Storm: 100-Year

Project Name: Sterling Ranch
Project No.: 25188.14
Calculated By: JSC
Checked By: RAB
Date: 11/11/22

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	7.45	0.42	42.8	3.11	3.27	10.2															
	2	OS2	9.53	0.64	18.0	6.08	5.45	33.2															
	3	OS3	5.06	0.37	14.0	1.87	6.08	11.4															
	4	4a	15.20	0.40	26.1	6.09	4.51	27.5															
	5	4b	11.42	0.39	28.3	4.42	4.31	19.1															
	6	B	6.36	0.37	22.7	2.34	4.87	11.4															

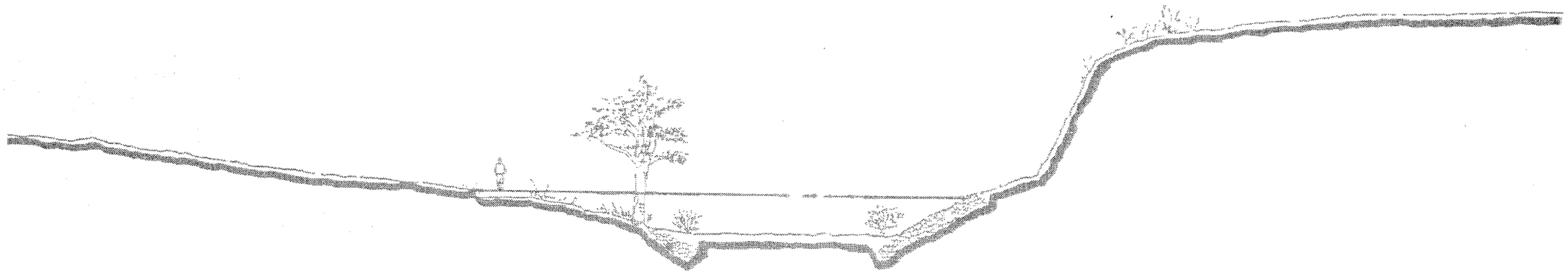
Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

Appendix C
Reference Materials

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

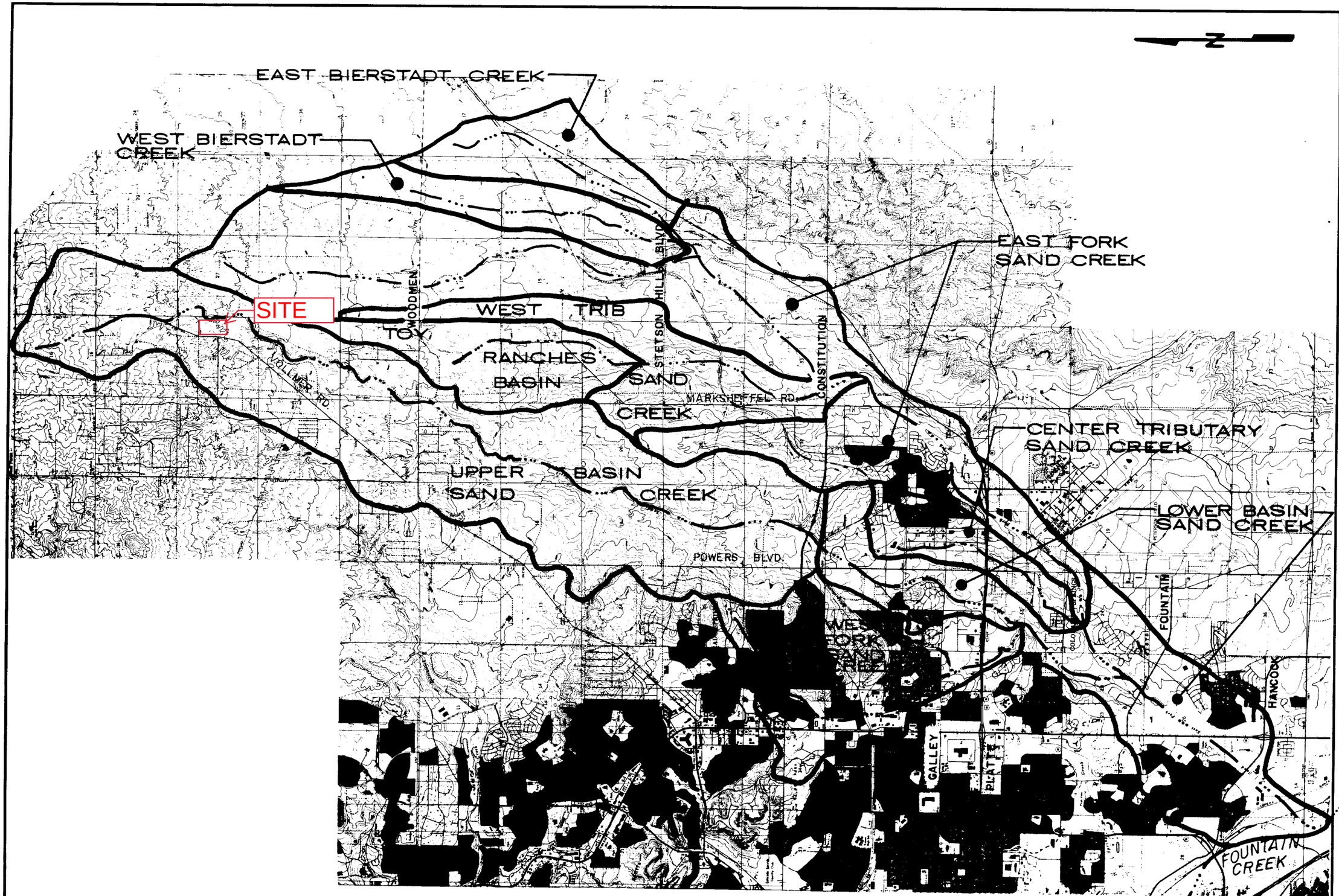
Soils within the Sand Creek basin vary between soil types A through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant soil groupings are in the Truckton and Bresser soil associations. The soils consist of deep, well drained soils that formed in alluvium 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:	

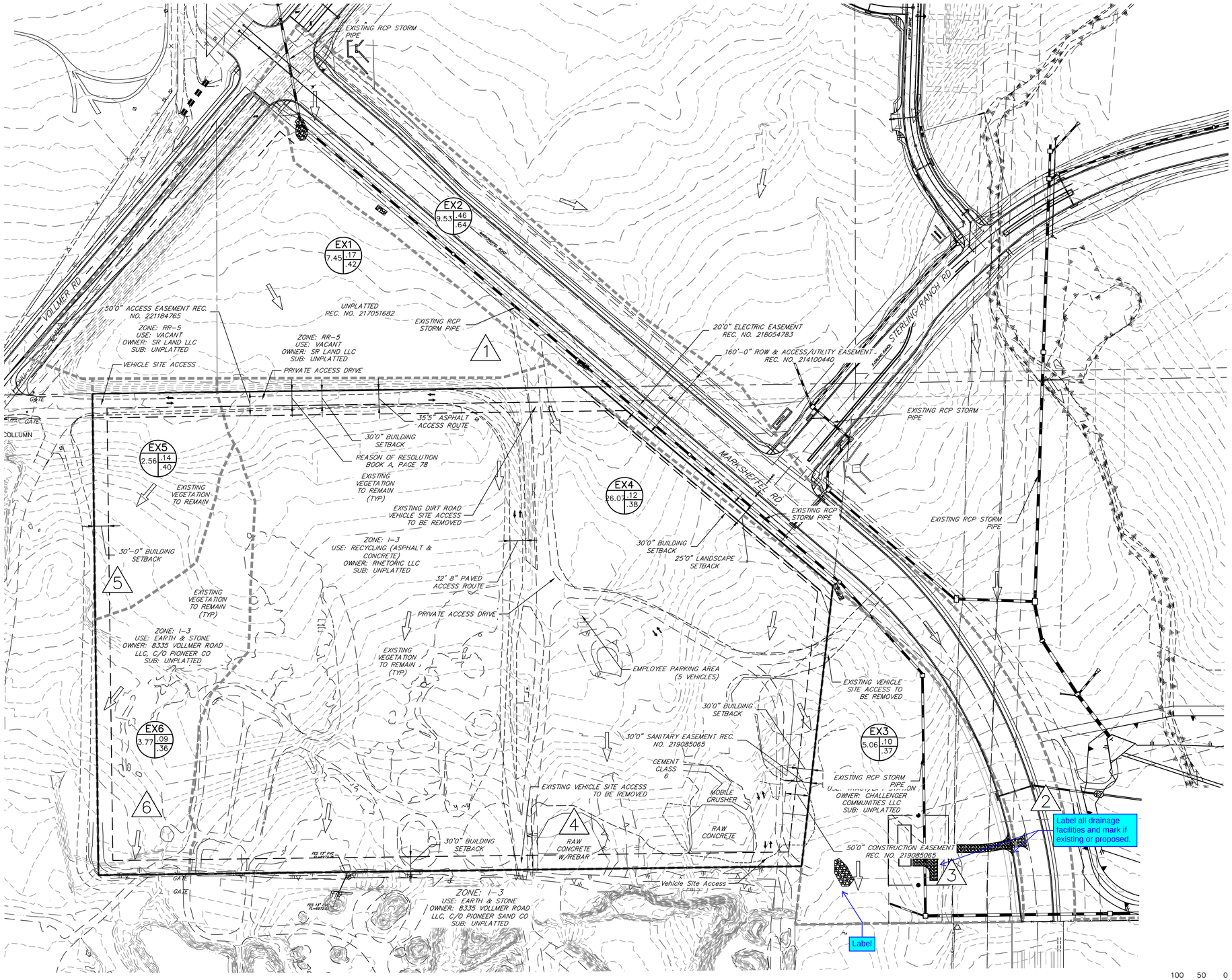
11

FIG. III-1

Appendix D
Drainage Maps

STERLING RANCH RECYCLING FACILITY

PRE-DEVELOPMENT 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 CONTOURS — 6100

SITE BOUNDARY
EXISTING PROPERTY LINE
ROW EXISTING
FL EXISTING
SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

DESIGN POINT		
DP	Q5 Total	Q100 Total
1	2.4	10.2
2	14.4	33.2
3	1.9	11.4
4	7.7	40.6
5	1.1	5.0
6	0.9	5.8

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX1	7.45	11%	0.17	0.42	42.8	2.4	10.2
EX2	9.53	47%	0.46	0.64	18.0	14.4	33.2
EX3	5.06	4%	0.10	0.37	14.0	1.9	11.4
EX4	26.07	6%	0.12	0.38	31.2	7.7	40.6
EX5	2.59	9%	0.14	0.40	23.5	1.1	5.0
EX6	3.77	2%	0.09	0.36	28.9	0.9	5.8

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

PCD FILE NO. PPR-22-041
STERLING RANCH RECYCLING FACILITY
PRE-DEVELOPED DRAINAGE MAP
JOB NO. 25188.14
12/07/2022
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

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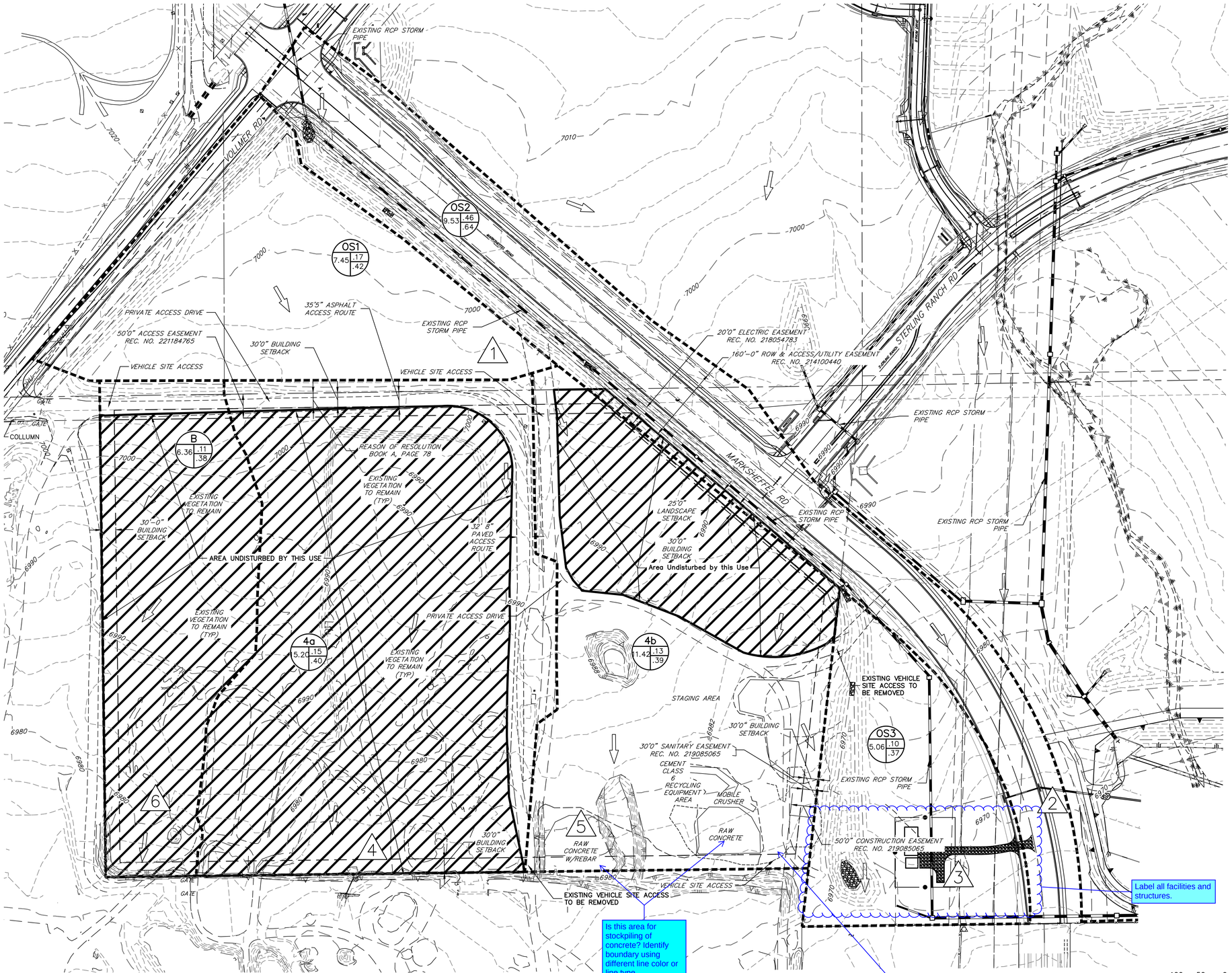
Fort Collins 970-491-9888 • www.jrengineering.com

STERLING RANCH RECYCLING FACILITY

PROPOSED 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 CONTOURS

SITE BOUNDARY
EXISTING PROPERTY LINE
ROW EXISTING
FL EXISTING
SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

DESIGN POINT		
DP	Q5 Total	Q100 Total
1	2.4	10.2
2	14.4	33.2
3	1.9	11.4
4	5.9	27.5
5	3.8	19.1
6	2.0	11.4

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
OS1	7.45	11%	0.17	0.42	42.8	2.4	10.2
OS2	9.53	47%	0.46	0.64	18.0	14.4	33.2
OS3	5.06	4%	0.10	0.37	14.0	1.9	11.4
4a	15.20	9%	0.15	0.40	26.1	5.9	27.5
4b	11.42	8%	0.13	0.39	28.3	3.8	19.1
B	6.36	5%	0.11	0.37	22.7	2.0	11.4

Is this area for stockpiling of concrete? Identify boundary using different line color or line type.

Label all facilities and structures.

Clearly show where water quality facilities are provided or adequate conveyance to those facilities, and describe them (Pond W5 FSD?).

If runoff reduction is proposed, the stabilized vegetated area with easement needs to be identified.

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

PCD FILE NO. PPR-22-041
STERLING RANCH RECYCLING FACILITY
PROPOSED DRAINAGE MAP
JOB NO. 25188.14
12/07/22
SHEET 1 OF 1

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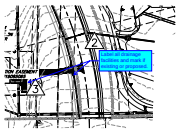
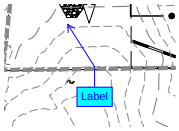
V2_Drainage Report.pdf Markup Summary

Callout (5)



Subject: Callout
Page Label: 31
Author: Carlos
Date: 2/28/2023 1:06:22 PM

Label all drainage facilities and mark if existing or proposed.

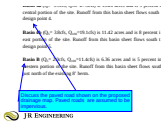


Subject: Callout
Page Label: 31
Author: Carlos
Date: 2/28/2023 1:05:56 PM

Label

Subject: Callout
Page Label: 32
Author: Carlos
Date: 2/28/2023 1:10:08 PM

Is this area for stockpiling of concrete? Identify boundary using different line color or line type.



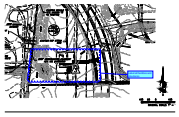
Subject: Callout
Page Label: 6
Author: Carlos
Date: 2/28/2023 1:16:10 PM

Discuss the paved road shown on the proposed drainage map. Paved roads are assumed to be impervious.

Subject: Callout
Page Label: 32
Author: dsdrice
Date: 2/28/2023 2:40:04 PM

Clearly show where water quality facilities are provided or adequate conveyance to those facilities, and describe them (Pond W5 FSD?).

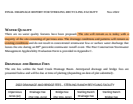
Cloud+ (1)



Subject: Cloud+
Page Label: 32
Author: Carlos
Date: 2/28/2023 1:07:50 PM

Label all facilities and structures.

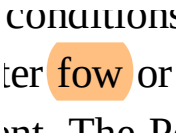
Engineer (1)



Subject: Engineer
Page Label: 8
Author: Mikayla Hartford
Date: 2/27/2023 10:42:36 AM

The site will remain as is today with a majority of the site consisting of pervious area. The drainage conditions and patterns will remain as existing conditions

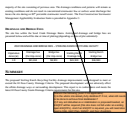
SW - Highlight (1)



Subject: SW - Highlight
Page Label: 8
Author: Glenn Reese - EPC Stormwater
Date: 2/27/2023 4:07:12 PM

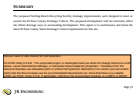
fow

SW - Textbox (4)



Subject: SW - Textbox
Page Label: 8
Author: Mikayla Hartford
Date: 2/27/2023 10:45:30 AM

Discuss the following (even if not applicable):
1) Is the whole site already fully stabilized? If not, what still needs to be done to achieve final stabilization?
2) If any soil disturbance or stabilization is proposed/needed, an ESQCP will be required (this site does not fall under an existing open ESQCPs). And if an ESQCP is required, you will need also need a FAE, GEC Plan, SWMP, and their checklists.



Subject: SW - Textbox
Page Label: 8
Author: Mikayla Hartford
Date: 2/27/2023 10:45:27 AM

Discuss need or lack-thereof for SW detention.

Per ECM Chap 3.2.8.B, “The proposed project or developed land use shall not change historical runoff values, cause downstream damage, or adversely impact adjacent properties.” Increases from the historical flowrates are allowable (with or without full spectrum detention) if it is shown (via text and/or calcs) that the flow increase can be accommodated downstream (ie: show that there is a suitable outfall, per ECM, Chap 3.2.4). If applicable, reference the downstream facilities in a DBPS or MDDP.

Subject: SW - Textbox
Page Label: 8
Author: Mikayla Hartford
Date: 2/27/2023 10:45:19 AM

If a WQ PBMP is necessary please complete and upload the following docs:
- MS4 Post Construction Form
- O&M Manual
- Private Detention Basin / Stormwater Quality BMP Maintenance Agreement
- SDI Form

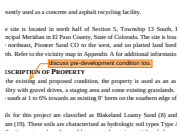
Subject: SW - Textbox
Page Label: 9
Author: Glenn Reese - EPC Stormwater
Date: 2/27/2023 4:19:51 PM

In accordance with the MHFD, runoff reduction has vegetation requirements that have been overlooked in the past. Going forward the following will be required for runoff reduction:
- All RPA/SPA areas will need to be within a no build/drainage easement (or tract) and discussed in the maintenance agreement and O&M manual.
- RPA vegetation should be turf grass (from seed [provide appropriate seed mix] or sod).
- Turf grass vegetation should have a uniform density of at least 80%.
- Irrigation (temp or permanent) is necessary to establish sufficient vegetation and not just weeds.
- Show suitability of topsoil of RPA and steps for proper preparation of topsoil per recommendations in MHFD detail T-0 Table RR-3
- RPA/SPA limits must be shown on GEC Plans (not just FDR) so our SW inspectors and the QSM know that these areas are to remain pervious, vegetated (80%), and irrigated post-construction. Our SW inspectors do not look at drainage reports.

Other requirements that have either been done or do not pertain to this project, but I wanted to note for all future projects:
- Provide a figure showing all proposed UIA, RPA and SPA areas to be utilized for runoff reduction.
- Provide a detail for the UIA:RPA interface that shows the recommended vertical drop of 4".
- Show signage to be posted in RPAs so maintenance personnel and owners know that the area is a water quality treatment area (not just a regular grassy area and/or an SPA).

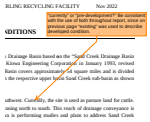
•Provide a figure showing all proposed UIA and RPA areas to be utilized for runoff reduction. All RPA areas will need to be within a no build/drainage easement and discussed in the maintenance agreement and O&M manual. Wetlands are not an acceptable RPA per the MS4 Permit and MHFD guidelines. Also make sure to show RPA limits on GEC Plans (not just FDR) so our SW inspectors and the QSM know that these areas are to remain pervious and vegetated post-construction.

SW - Textbox with Arrow (13)



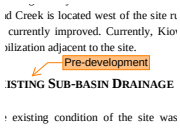
Subject: SW - Textbox with Arrow
Page Label: 4
Author: Mikayla Hartford
Date: 2/27/2023 9:54:16 AM

discuss pre-development condition too.



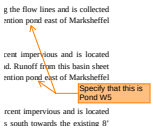
Subject: SW - Textbox with Arrow
Page Label: 5
Author: Mikayla Hartford
Date: 2/27/2023 10:17:51 AM

"currently" or "pre-development?" Be consistent with the use of both throughout report, since on previous page "existing" was used to describe developed condition.



Subject: SW - Textbox with Arrow
Page Label: 5
Author: Mikayla Hartford
Date: 2/27/2023 10:05:14 AM

Pre-development

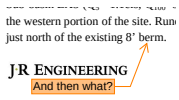


Subject: SW - Textbox with Arrow
Page Label: 5
Author: Mikayla Hartford
Date: 2/27/2023 10:06:06 AM

Specify that this is Pond W5

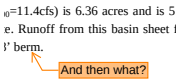
Subject: SW - Textbox with Arrow
Page Label: 5
Author: Mikayla Hartford
Date: 2/27/2023 10:06:39 AM

Describe where water flows from there. Does it ever get conveyed around either side of the berm and/or overtop it? If so, how/where is it conveyed from there?



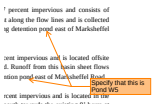
Subject: SW - Textbox with Arrow
Page Label: 5
Author: Mikayla Hartford
Date: 2/27/2023 10:18:54 AM

And then what?



Subject: SW - Textbox with Arrow
Page Label: 6
Author: Mikayla Hartford
Date: 2/27/2023 10:27:00 AM

And then what?

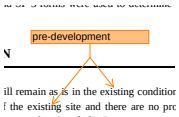


Subject: SW - Textbox with Arrow
Page Label: 6
Author: Mikayla Hartford
Date: 2/27/2023 10:29:24 AM

Specify that this is Pond W5

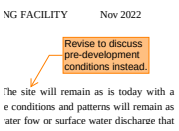
Subject: SW - Textbox with Arrow
Page Label: 6
Author: Mikayla Hartford
Date: 2/27/2023 10:31:02 AM

Describe where water flows from there. Does it ever get conveyed around either side of the berm and/or overtop it? If so, how/where is it conveyed from there?



Subject: SW - Textbox with Arrow
Page Label: 7
Author: Mikayla Hartford
Date: 2/27/2023 10:32:03 AM

pre-development



Subject: SW - Textbox with Arrow
Page Label: 8
Author: Mikayla Hartford
Date: 2/27/2023 10:43:23 AM

Revise to discuss pre-development conditions instead.

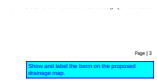
Subject: SW - Textbox with Arrow
Page Label: 8
Author: Mikayla Hartford
Date: 2/27/2023 10:43:06 AM

Per PBMP Applicability Form (and per MS4 Permit), a site specific study is needed to prove this. Attach calcs to this report to support this exclusion. If exclusion does not apply, provide WQ treatment for area disturbed to develop site (not only impervious areas). And then also show Four-Step Process too.

Subject: SW - Textbox with Arrow
Page Label: 8
Author: Glenn Reese - EPC Stormwater
Date: 2/27/2023 4:14:50 PM

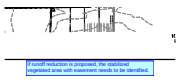
PBMP Applicability Form shows Runoff Reduction (RR) was selected. Revise this text and/or PBMP Form to remove discrepancies. If you do go with RR, see req's in my comment on the next page.

Text Box (2)



Subject: Text Box
Page Label: 6
Author: Carlos
Date: 2/28/2023 1:16:00 PM

Show and label the berm on the proposed drainage map.



Subject: Text Box
Page Label: 32
Author: dsdrice
Date: 2/28/2023 2:54:03 PM

If runoff reduction is proposed, the stabilized vegetated area with easement needs to be identified.