FINAL DRAINAGE REPORT
FOR
STERLING RANCH FILING NO. 4

Prepared For:

SR Land, LLC
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August 14, 2023
Project No. 25188.11

Prepared By:

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PCD Filing No.:
SF-22-030

ENGINEER'S STATEMENT:

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

Mike Bramlett, Colorado P.E. 32314
For and On Behalf of JR Engineering, LLC

COLORADO LICENSED MIKE BRAMLETT 32314 08/14/23 PROFESSIONAL ENGINEER

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: MANAGER

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.

Approved
By: Elizabeth Nijkamp, PE
Date:08/31/2023
El Paso County Department of Public Works

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

Conditions: If any revisions are necessary due to changes or lack of construction in Filing No. 2, this report shall be revised.

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APPENDIX

PURPOSE

This document is the Final Drainage Report for Sterling Ranch Filing Number 4. The purpose of this report is to identify on-site and off-site drainage patterns, storm sewer, culvert, inlet locations, areas tributary to the site, and to safely route developed storm water to adequate outfall facilities. The proposed use is a permissible use within the residential service zoning criteria.

GENERAL SITE DESCRIPTION

GENERAL LOCATION

Sterling Filing Number 4 (hereby referred to as the "site") is a proposed development within the Sterling Ranch master planned community with a total area of approximately 57 acres and includes a replat of tracts B and J of Sterling Ranch Filing No. 2 and the regional detention pond W-5 built during Sterling Ranch Filing No. 2. The site is currently being designed to accommodate approximately 157 single-family residential lots. West of the site adjacent to the pond W-5 Marksheffel road will be extended to a planned residential subdivision.

The site is located in portion a Portion of the Southwest Quarter Of Section 33, Township 12 South, Range 65 West Of The 6th Principal Meridian & A Portion Of The Northwest Quarter Of The Northwest Quarter Of Section 4, Township 13S South, Range 65 West Of The 6th Principal Meridian County Of El Paso, State Of Colorado. The site is separated by Sterling Ranch Road into a north and south region. Barbarick Subdivision borders the northern portion of the site to the north, to the west by Sterling Ranch Filing No. 2, and to the east, the site is bounded by unplatted vacant land that is currently undeveloped. The southern portion of the site is bounded by Sterling Ranch road to the north, Sterling Ranch Filing No. 3, and Pawnee Rancheros border the site directly to the east. To the west, the southern portion of the site borders the proposed extension of Marksheffel Road, and to the south, the site borders unplatted and undeveloped land that is planned for residential use.

DESCRIPTION OF PROPERTY

The property will be primarily be single-family residential development (approximately 57 acres), Open space and drainage tracts. 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, JR Engineering, LLC is performing studies and

plans to address Sand Creek stabilization under PCD project number CDR-20-004 and is undergoing review.

There are no known irrigation facilities located on the project site.

FLOODPLAIN STATEMENT

Based on the FEMA FIRM Maps number 08041C0533G, dated December 7, 2018, the proposed development lies within Zone X. Zone X is defined as area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. FIRM Map is presented in Appendix A.

EXISTING DRAINAGE CONDITIONS

MAJOR BASIN DESCRIPTIONS

The site lies within the Sand Creek Drainage Basin based **o**n the "Sand Creek Drainage Basin Planning Study" (DBPS) completed by Kiowa Engineering Corporation in January 1993, revised March 1996. The Sand Creek Drainage Basin covers approximately 54 square miles and is divided into major sub-basins. The site is within the respective sub-basins SC3-6C, SC3-11A, and SC3-6B. Information from Sand Creek DBPS is provided in Appendix D.

The Sand Creek DBPS assumed the Sterling Ranch Filing No. 4 property to have a "large lot residential" use for the majority of the site. The Sterling Ranch MDDP assumed a mix of commercial and single family residential lots ranging in size from 0.2 to 0.3 acres for the Sterling Ranch Filing No. 4 site. The proposed Sterling Ranch master plan is a mix of; school, multi-family, single-family, and commercial land uses, resulting in higher runoff. Any additional runoff will be provided for with the extended detention basin located at the southern edge of the site. The site generally drains from north to south consisting of rolling hills. The site currently has an existing channel that was built in the Sterling Ranch Filing No. 3 that conveys the Sterling Ranch Filing 3 runoff to drainage infrastructure on the southern portion of the site that was built in Homestead Filing No. 2; this infrastructure consists of pond W-5 and existing storm pipe. Currently, the site is used as pastureland 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, JR engineering 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"; (MDDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018. The site is tributary to Pond W-5 and full-spectrum detention for the site was previously analyzed and can be found in the Final Drainage Report for Sterling Ranch Filing 2 as shown in Appendix D.

EXISTING SUB-BASIN DRAINAGE

The existing / predeveloped condition of the site was broken into four major basins: Basin A-1 A-2, A-3,and E-1, as well as several offsite basins. It is assumed Filing 2 storm structures are to be built before construction starts on Filing 4. If Filing 2 storm structures are not built, then flows will sheet flow down into the site and new calculations will be required. The basin and sub-basin delineation is shown in the existing drainage map in Appendix E and is described as follows:

Sub-basin A-1 (Q_5= 1.1cfs, Q_{100}=8.0cfs) is 5.17 acres and 0 percent impervious consists of the eastern portion of the proposed Sterling Filing No. 4 site. Runoff from this basin drains to the south west into the assumed existing storm sewer built with Filing 2 just east of Marksheffel Road located at design point 1. Collected runoff is piped south to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Sub-basin A-2 (Q_5= 3.9cfs, Q_{100}=28.6cfs) is 19.12 acres and 0 percent impervious and consists the central portion of Sterling Ranch Filing No. 4. Runoff from this basin drains south onsite into the assumed existing storm sewer built with Filing 2 located at design point 2. Collected runoff is piped south to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Sub-basin A-3 (Q_5= 5.1cfs, Q_{100}=33.3cfs) is 17.62 acres and 2 percent impervious and is located onsite in the northern part of Sterling Ranch Filing No. 4. Runoff from this basin drains to the assumed existing storm sewer built with Filing 2 just north of Sterling Ranch Road located at design point 5. Design Point 5.1 is a confluence of flows from basins A3, OS6 and OS7. Collected runoff is piped south to the existing detention pond W-5 with Filing 2 and outfalls to Sand Creek.

Basin E-1 (Q_5= 1.3 cfs, Q_{100}=9.5 cfs) is 5.15 acres and 0 percent impervious and is located on south west portion of the site. Runoff from this basin drains to design point O1. Improvements to this basin will be part of the proposed Marksheffel Road improvements. There are no current improvements to this basin.

Sub-basin OS1 (Q_5= 9.5cfs, Q_{100}=24.6 cfs) 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 W-5 in confluence with upstream flows from the eastern portion of Sub-basin A2. Runoff sheet flows south to design point 3 and joins into the existing detention pond built with Filing 2 before it outfalls to Sand Creek.

Sub-basin OS2 (Q_5= 4.3cfs, Q_{100}=9.1cfs) is 2.48 acres and 56 percent impervious and is comprised of the southern half street of Sterling Ranch Road. Runoff from this basin drains into the assumed existing storm sewer built with Filing 2 located at design point 7. Collected runoff is piped south to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Sub-basin OS3 (Q_5= 5.0cfs, Q_{100}=12.1cfs) is 3.50 acres and 42 percent impervious and is comprised of the northern half street of Sterling Ranch Road. Runoff from this basin drains into the assumed existing storm sewer built with Filing 2 located at design point 8. Collected runoff is piped south to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Sub-basin OS4 (Q_5= 1.6cfs, Q_{100}=7.9cfs) is 5.10 acres and 8 percent impervious and is located immediately north of Sterling Ranch Road and the eastern portion of the site. Runoff from this basin drains south into assumed existing storm sewer built with Filing 2 located at design point 9. Collected runoff is piped south to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Sub-basin OS5 (Q_5= 0.7cfs, Q_{100}=5.0cfs) is 3.46 acres and 0 percent impervious and is located to the west 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 and will be collected in the assumed existing storm sewer built with Filing 2 and piped to the Filing 2 detention pond w-5 located south of the site and outfalls to Sand Creek.

Sub-basin OS6 (Q_5= 25.4cfs, Q_{100}=76.8cfs) is 18.18 acres and 46 percent impervious as is located northwest of the site in the Barbarick subdivision. Historic runoff from this basins drains south onto the site at design point 10. Detained flow from this basin will be piped through the site to the detention pond W-5 and will outfall to Sand Creek.

Sub-basin OS7 (Q_5= 16.2cfs, Q_{100}=63.5cfs) is 33.07 Acres and 19 percent impervious and is located directly north of the site in the Barbarick subdivision. Historic runoff from this site drains south onto the site at design point 11. Detained flow from this basin will be piped through the site to the detention pond W-5 and will outfall to Sand Creek.

If the assumed Filing 2 storm infrastructure is not in place when construction of Filing 4 begins, runoff will continue to sheet flow as in historic condition until the storm system is in place.

PROPOSED DRAINAGE CONDITIONS

PROPOSED SUB-BASIN DRAINAGE

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

Basin A2 (Q_5= 1.7 cfs, Q_{100}=4.8 cfs) is 1.38 acres and 32 percent impervious is comprised of single-family residential lots, open space, several trails, and a local road Hazlett Drive. Runoff from this basin drains to design point 17, a 15’ type R on grade inlet on the southwest corner of the basin, in confluence

with upstream by-pass flows from the Filing 3 development of 0.2 cfs in the 5 year event and 5.2 cfs in the 100 year event. Total flow at DP 17 is 1.6 cfs for a minor storm and 7.9 cfs in a major storm. DP 17 bypasses 0 cfs in the 5 year event and 0.2 cfs in the 100 year event downstream to DP 22.

Basin A3 (Q_5= 7.0 cfs, Q_{100}=14.9 cfs) is 3.68 acres and 65 percent impervious is comprised of single-family residential lots and a local road Pennydale Drive. Runoff from this basin drains to a 15' on grade type R inlet located at design point 20 and is not capturing any upstream by-pass flows. Total flow at DP 20 is 7.0 cfs for a minor storm and 14.9 cfs in a major storm. DP 20 bypasses 0cfs in the 5 year event and 3.2 cfs in the 100 year event downstream to DP 22.

Basin A4 (Q_5= 6.3 cfs, Q_{100}=15.1 cfs) is 4.53 acres and 48 percent impervious is comprised of single-family residential lots, open space a local road Moore Drive, Pennydale Drive, Hazlette Drive, and two urban knuckles. Runoff from this basin drains to a sump 15' type R inlet located at design point 22 in confluence with upstream by-pass flows from basins A1, A2, and A3. Total flow at DP 22 is 6.3 cfs for a minor storm and 18.3 cfs in a major storm. The runoff from this basin is piped to DP 23 where the runoff confluence with the entire southern portion of the Sterling Ranch Filing No. 4 site. From here on, the runoff is then piped into an existing 42" RCP and Structure associated with design point 23. The emergency overflow for this basins drains directly to pond W-5 south of the inlet. In the event the inlet at design point 22 clogs there is an overflow path to pond W-5 south west of the inlet.

Basin A5 (Q_5= 1.4 cfs, Q_{100}=2.9 cfs) is 0.45 acres and 79 percent impervious is comprised of single-family residential lots and a local road Hazelett Drive. Runoff from this basin drains to a 10' type R on grade inlet at design point 16. Total flow at DP 16 is 1.4 cfs for a minor storm and 2.9 cfs in a major storm. DP 16 bypasses 0 cfs in the 5 year event and 0 cfs in the 100 year event downstream to DP 18.

Basin A6.1 (Q_5= 10.0 cfs, Q_{100}=20.5 cfs) is 4.73 acres and 72 percent impervious is comprised of single-family residential lots, local roads Pennydale Drive, Trago Drive, and Hazelett.Drive. Runoff from this basin drains to an on grade 15' type R inlet at design point 12 and is not capturing any upstream by-pass flows. Total flow at DP 12 is 10.0 cfs for a minor storm and 20.5 cfs in a major storm. DP 12 bypasses 1cfs in the 5 year event and 6.9 cfs in the 100 year event downstream to DP 19.

Basin A6.2 (Q_5= 5.6 cfs, Q_{100}=11.3 cfs) is 2.56 acres and 74 percent impervious is comprised of single-family residential lots, local roads Pennydale Drive, Pendroy Street, and Hazelett.Drive. Runoff from this basin drains to an on grade 15' type R inlet at design point 19 in confluence with upstream by-pass flows from DP12. Total flow at DP 19 is 6.4 cfs for a minor storm and 17.8 cfs in a major storm. DP 19 bypasses 0 cfs in the 5 year event and 4.9 cfs in the 100 year event downstream to DP 21.

Basin A7 (Q_5= 4.2 cfs, Q_{100}=8.5 cfs) is 1.76 acres and 73 percent impervious is comprised of single family residential lots and local roads Pennydale Drive, Moore Drive, and Hazelett Drive. The runoff from this basin drains to a 15' sump type R inlet located at design point 21, which receives up stream,

by pass flow from the on grade 15' type R inlet at design point 19. Total flow at DP 21 is 4.2 cfs for a minor storm and 13.4 cfs in a major storm.

Basin A8 (Q_5= 2.2 cfs, Q_{100}=9.2 cfs) 4.23 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 into a type C inlet located at design point 24.

Basin A9 (Q_5= 1.0 cfs, Q_{100}=5.0 cfs) 2.13 acres and 7 percent impervious is comprised of a single family residential lots and open space. The runoff from this basin drains to a swale on the western side of the site and into a proposed 18" flared end section and pipe located at design point 25. From there on, the flow are piped to the existing detention pond W-5.

Basin A10 (Q_5= 2.9 cfs, Q_{100}=8.8 cfs) 2.67 acres and 26 percent impervious is comprised of a single family residential lots and open space. The runoff from this basin sheet flows to the south and into existing pond W-5 at design point 27.

Basin B3 (Q_5= 3.8 cfs, Q_{100}=7.9 cfs) is 2.38 acres and 63 percent impervious is comprised of open space, Sterling Ranch road and sidewalk. Runoff from basin B3 drains to a 15' type R on grade inlet located at design point 9 in existing Sterling Ranch Road. All of the runoff is captured in the 100 year event. Runoff from this on grade inlet and is piped and outfalls into pond W-5.

Basin C1.1 (Q_5= 3.9 cfs, Q_{100}=8.3 cfs) is 1.78 acres and 66 percent impervious is comprised of single family residential lots, local roads Clancy Drive and Cordgrass Drive. Runoff from basin C1.1 drains to 5' a sump type R inlet located at design point 6.1. In the 100 year storm, the inlet receives 11.0 cfs of overflow from design point 5. Flow not captured by the 10' type R inlet will over flow to the 10' type R inlet in sump at design point 6.2. The combined runoff at DP 6.3 drains to the existing drainage structure DP 7.2.

Basin C1.2 (Q_5= 2.0 cfs, Q_{100}=4.2 cfs) is 0.81 acres and 72 percent impervious is comprised of single family residential lots, and local road School House Drive. Runoff from basin C1.2 drains to 10' a sump type R inlet located at design point 6.2. In the 100 year storm this inlet receives 10.0 cfs of bypass flow from design point 6.1. The combined runoff at DP 6.3 drains to the existing drainage structure DP 7.2.

Basin C2 (Q_5= 12.0 cfs, Q_{100}=25.9 cfs) is 6.75 acres and 63 percent impervious is comprised of local roads, Clancy Drive, School House Drive, Cordgrass Drive, single-family residential lots, open space, and paved walks. Runoff from basin C2 drains to a 15' type R sump inlet located at design point 5 and piped south west to DP6.3. In the 100 year event, runoff will overtop the crown of the road and 11.0 cfs of flow will flow to design point 6.1, a 10' type R inlet in sump. The combined runoff at DP 6.3 drains to the existing drainage structure DP 7.2.

Basin C3 (Q_5= 3.5 cfs, Q_{100}=12.8 cfs) is 4.18 acres and 19 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 a type C area inlet located at design point 7 where it is piped to existing drainage structure DP 7.2.

Basin C4 (Q_5= 6.1 cfs, Q_{100}=12.9 cfs) is 4.41 acres and 62 percent impervious is comprised of open space, roads and rear yards of single family residential lots. Runoff from basin C4 drains to an on-grade 15‘ type R inlet located at design point 8 in existing Sterling Ranch Road. In the 100 year event, 0.8 cfs is by-passed to a sump inlet adjacent to the intersection of Sterling Ranch Road and Marksheffel Road. Collected runoff is piped south into pond W-5.

Basin OS6 (Q_5= 22.3 cfs, Q_{100}=55.6 cfs) is 18.38 acres, and 45 percent impervious is located near the northwest border of the site in the Barbarick subdivision. Runoff from the Barbarick, a portion of lots 3 and 4 for 3.13 acres site, is treated in this area with a sand filter. The other portion of the site is piped with two existing 24” HDPE. A proposed manhole will connect the two existing 24” HDPE pipes to a proposed 48” RCP storm sewer main that routes flows to design point 7.1, and will outfall in detention pond W-5. In the event, the sand filter clogs in the 100-year event, the emergency overflow from the sand filter will sheet flow across an open area of land i.e. tract B at 11.6 CFS, to sheet flow onto Cordgrass Drive. The total runoff from basin OS6 will be piped throughout the Sterling Ranch Filing No. 4 site at design point 4 and will outfall in detention pond W-5 and will ultimately outfall to Sand Creek.

Basin OS7 (Q_5= 14.6 cfs, Q_{100}=52.8 cfs) is 33.07 Acres and 19 percent impervious and is located directly north of the site in the Barbarick subdivision. Runoff from the eastern portion of the basin travels overland towards design point 1. Historic runoff from this site drains south onto the site at design point 1. Detained flow from this basin will be piped via the proposed storm sewer system to design point 4.1, and then through the site to the detention pond W-5 and will outfall to Sand Creek. Emergency overflow from this basin (Q_{100}= 85.4 cfs) will be routed to the east around the lots and into the open space east of the site to vacant land via swale A-A, a concrete lined channel. Swale A-A outfalls onto a riprap pad and into basin I1.

Basin I1 (Q_5= 7.8 cfs, Q_{100}=17.9 cfs) is 5.88 Acres and 54 percent imperious is located directly east of the upper half of Sterling Ranch Filing Number Four. Runoff from this basin drains into an existing draw. The runoff is then picked up by an interim swale and conveyed away from the Filing 4 lots adjacent to Greenough Drive. The undeveloped lot that makes up basin I1 will be developed into a residential development. The runoff is conveyed in the swale and then goes to the downstream design point 2.i, captured by a 24” flared end section, where it is ultimately conveyed into pond W-5 built-in Sterling Ranch Filing No. 2, as shown in Appendix D.

Basin I2 (Q_5= 4.9 cfs, Q_{100}=9.9 cfs) is 2.18 Acres and 71 percent imperious is located directly east of the upper half of Sterling Ranch Filing Number Four. Runoff from this basin sheet drains across

existing native grass. The runoff is picked up by an interim swale, where it is collected by an interim 24" FES at design point 2.i. The runoff is ultimately conveyed into pond W-5 built-in Sterling Ranch Filing No. 2, as shown within Appendix D.

Basin I3 (Q_5= 7.1 cfs, Q_{100}=19.4 cfs) is 2.94 Acres and 68 percent imperious is located north of Sterling Ranch Road in the unplatted parcel of land directly east of the northern portion of the site. Runoff from this basin drains into an interim swale were it is collected by an interim 18" FES at design point 3.i. Flows from design point 2.i and 3.i combine at design point 3.2 were flows are ultimately conveyed into pond W-5 built in Sterling Ranch Filing No. 2, as shown within Appendix D.

Basin E1 (Q_5= 3.4 cfs, Q_{100}=6.3 cfs) is 0.90 Acres and 87 percent imperious is located directly west of Sterling Ranch Filing No. 4. Basin E1 is composed of the southwest portion of the proposed extension of Marksheffel Road. Runoff from basin E1 drains via curb and gutter in confluence with existing bypass flows, design point e10 (Q_5= 0.6 cfs, Q_{100}=4.6 cfs), from the existing portion of Marksheffel Road. The runoff from this basin is capture into the 15' type R inlet on grade at design point 1e and is then piped to pond W-5 and the remaining 1.1 cfs of runoff is then by passed to design point 3e downstream of 1e in the 100 year storm.

Basin E2 (Q_5= 3.3 cfs, Q_{100}=6.8 cfs) is 1.25 Acres and 63 percent imperious is located directly west of Sterling Ranch Filing No. 4. Basin E2 is composed of the northeast portion of the proposed extension of Marksheffel Road. Runoff from basin E2 drains via curb and gutter in confluence with existing bypass flow, design point e11 (Q_5= 0.7 cfs, Q_{100}=6.2 cfs), from the existing portion of Marksheffel Road. The runoff from this basin is captured by a 15' on grade type R inlet at design point 2e. There is 2.1 cfs of runoff from the on grade inlet in the 100 year storm that is bypassed downstream to design point 4e. The captured runoff is piped to pond W-5 built in Filing No. 2 along with upstream runoff from the Western portion of Marksheffel Road.

Basin E3 (Q_5= 1.4 cfs, Q_{100}=2.7 cfs) is 0.35 acres and 86 percent impervious is located directly west of Sterling Ranch Filing No. 4. Basin E3 is composed the southwest portion of the proposed extension of Marksheffel road. Runoff from basin E3 will drain via curb and gutter and drain into an interim sediment pond built by Aspen Meadows Subdivision. The runoff will ultimately be treated in a downstream water quality pond that is to be built the Aspen Meadows subdivision to the south and will by conveyed by corresponding improvements to Marksheffel road that will be built the Aspen Meadows subdivision developed. The Aspen Meadows subdivision will be developed prior to Sterling Rach Filing No. 4. Refer to Appendix D for excerpts from the Aspen Meadows drainage report.

Basin E4 (Q_5= 1.4 cfs, Q_{100}=2.6 cfs) is 0.36 acres and 81 percent impervious is located directly west of Sterling Ranch Filing No. 4. Basin E4 is composed the northwest portion of the proposed extension of Marksheffel road. Runoff from basin E4 will drain to an interim sediment pond. The runoff will ultimately be treated in a downstream water quality pond built with the Aspen Meadows subdivision to the south and will by conveyed by corresponding improvements to Marksheffel road that will be

built the Aspen Meadows subdivision developed. The Aspen Meadows subdivision will be developed prior to Sterling Rach Filing No. 4. Refer to Appendix D for excerpts from the Aspen Meadows drainage report.

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 1 - 1-hr Point Rainfall Data

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

HYDRAULIC CRITERIA

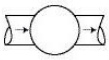
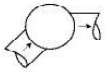
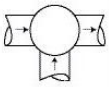
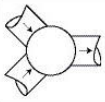
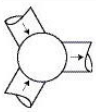
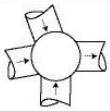
The Rational Method and USDCM's SF-2 and SF-3 forms were used to determine the runoff from the minor and major storms on the site. Sump and on-grade inlets were sized using UDFCD UD-Inlet v4.05. StormCAD was used to model the proposed storm sewer system within the interim area and to analyze the proposed HGL calculations for the Construction Drawings. Autodesk Hydraflow express was used to size the overflow channel and drainage swales. Swales were sized based on the peak 100-year flows and average swale slopes. Swales were checked for shear stress and riprap lining was added for swale with a Froude number in excess of 0.80. Urban Drainage Figure 8-22 was used to size riprap for the swales. Per criteria velocities were checked to be less than 5 ft/s in grass and soil riprap lined swales. Manhole and pipe losses for the model were obtained from the *Modeling Hydraulic and Energy Gradients in Storm Sewers: A Comparison of Computation Methods*, by AMEC Earth &

Environmental, Inc. The manhole loss coefficients used in the model can be seen in Table 2 (below), this method is accurate for pipes 42" and smaller for larger pipes the Standard head-loss coefficients as recommended by Bentley were used as shown in Table 3. StormCAD, Autodesk Hydraflow results, along with street and inlet capacities, are presented in Appendix C.

Table 2 - Storm Head-loss Coefficients

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

Table 3 - Storm Head-loss Coefficients

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

DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

The proposed stormwater conveyance system was designed to convey the developed Sterling Ranch Filing No. 4 runoff to an existing (Filing 2) full spectrum water quality and detention pond W-5 via storm sewer. The proposed pond was designed to release at less than historic rates to minimize adverse impacts downstream. Flows will be routed via overland flow, curb and gutter, swales, and storm pipes into a detention pond where it will be treated for water quality. Proposed storm structures convey flows to the existing storm pipe west of the site which leads south to the detention pond. 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 Filing No. 4 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 JR Engineering 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 (W-5). 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 –BMPs will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. The Filing No. 4 site is residential. There is no proposed commercial or industrial use for the site. The permanent erosion control BMPs include asphalt drives, storm inlets and storm pipe, the full spectrum detention pond W-5 and permanent vegetation. Maintenance responsibilities

and plans will be defined at the time of final platting.

WATER QUALITY

In accordance with Section 13.3.2.1 of the CCS/EPCDCM, full spectrum water quality and detention are provided for all developed basins. Where possible flows were routed through proposed swales to promote infiltration and reduce runoff. Flows for the site are routed through the proposed swales and the proposed and existing storm sewer system to an existing Full Spectrum Drainage Pond W-5, which was developed during the Sterling Ranch Filing No. 2 Project. There are no know existing issues with pond W-5. The outlet structure is complete, and the headwall at the pond outlet is in construction and will be completed prior to development of the site. Further details as well as all pond volume, water quality, and outfall calculations are included in the Sterling Ranch Filing 2 Final Drainage Report. Pond W-5 corresponds to pond FSD6 from the Master Development Drainage Plan for Sterling Ranch", (MMDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018 and is releasing less than the MDDP values in the proposed design. A summary of Pond W-5 has been included below for reference. From the Filing No.2 drainage report, Pond W-5 accounted for Sterling Ranch Filing 4 area to have 65% (north of Sterling Ranch Road) and 67% (south of Sterling Ranch Road) imperviousness. The total imperviousness for the Filing 4 development is 50.6% imperviousness, and the total runoff is less than what was anticipated; therefore the existing pond W-5 will function as intended.

Table 4 - Pond Volumes & Release Rates

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

EROSION CONTROL PLAN

It is the policy of the El Paso County, that a grading and erosion control plan be submitted with the drainage report. Proposed silt fence, vehicles traffic control, temporary sediment basins, seeding and mulching are proposed as erosion control measure.

OPERATION & MAINTENANCE

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. The district shall be responsible for the inspection, maintenance, rehabilitation and repair of stormwater and erosion control facilities located on the property unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. This includes swales, inlets, and storm sewer that is to be maintained by the district. Access is provided from onsite facilities and easements for proposed infrastructure located offsite. A maintenance road and O&M Manual was provided for the existing pond W-5 and information on the road can be found in the Final Drainage Report for Sterling Ranch Filing No. 2. The maintenance road access is off

Marksheffel Road and wraps around the top of the pond providing access to the inflow pipe, wingwalls and outlet structure for the pond.

DRAINAGE AND BRIDGE FEES

The site lies within the Sand Creek Drainage Basin. Anticipated drainage and bridge fees are presented below:

2023 Drainage and Bridge Fee – Sterling Ranch Filing 4				
Impervious Acres (Ac.)	Drainage Fee (Per Imp. Acre)	Bridge Fee (Per Imp. Acre)	Sterling Ranch Drainage Fee	Sterling Ranch Bridge Fee
24.217	$23,821	$9,743	$576,864.11	$235,942.53

Sterling Ranch Filing 4 Impervious Area Calculation			
Breakdown	Acres	% Impervious	Impervious Acres
ROW	6.2452	100%	6.25
Lots- minus Filing 2 replat	20.3401	60%	12.20
Tracts A-G, and J - Open space	20.403	2%	0.41
Tract H- Future Industrial / Lift Station	5.5086	50%	2.75
Tract I- Marksheffel ROW	2.6050	100%	2.61
Total	55.1019		24.22

CONSTRUCTION COST OPINION

A construction cost opinion for the public storm drainage infrastructure has been provided below. The below cost opinion is only an estimate of facility and drainage infrastructure cost and may vary.

Sterling Ranch Filing No. 4 (Public Non-Reimbursable)

Item	Description	Quantity	Unit	Unit Price	Cost
1	18" RCP	435	L.F.	$ 76	$ 33,060.00
2	24" RCP	541	L.F.	$ 91	$ 49,231.00
3	36" RCP	1896	L.F.	$ 140	$ 265,440.00
4	30" RCP	12	L.F.	$ 114	$ 1,368.00
5	42" RCP	339	L.F.	$ 187	$ 63,393.00
6	48" RCP	31	L.F.	$ 228	$ 7,068.00
7	66" RCP	20	L.F.	$ 402	$ 8,040.00
8	18" FES	2	Ea.	$ 400	$ 800.00
9	24" FES	2	Ea.	$ 500	$ 1,000.00
10	5' Curb Inlet Type R < 5 ft.	1	Ea.	$ 6,703	$ 6,703.00
11	10' Curb Inlet Type R < 5 ft.	2	Ea.	$ 9,224	$ 18,448.00
12	15' Curb Inlet Type R < 5 ft.	5	Ea.	$ 11,995	$ 59,975.00
13	15' Curb Inlet Type R < 10 ft.	3	Ea.	$ 12,858	$ 38,574.00
14	Grated Inlet CDOT TYPE C	3	Ea.	$ 5,611	$ 16,833.00
15	Storm Sewer MH, box base	14	Ea.	$ 14,061	$ 196,854.00
16	Storm Sewer MH, slab base	7	Ea.	$ 7,734	$ 54,138.00
				Sub-Total	$ 820,925.00

Per LDC section 8.5.5.C.3.b(ii) Fee Reductions, Credits or Reimbursement for Facilities, this development requests that no cash drainage or bridge fees are due at platting as the value of reimbursable DBPS improvements for the Sand Creek Tributary segment 159, 164, 169, 186, the Sand Creek Mainstem segments 170, 187 and 163 and the Briargate Bridge shown in the below table exceed the drainage and bridge fee estimate shown above.

Sterling Ranch Deferred Drainage Fees Analysis
Reimbursable Costs associated with DBPS Segment 159 and 164, Segment 169 and 186 and Main Channel Segment 159

	Reimbursable Estimate Segment 159 and 164 from SR F2 FDR (SF-2015)	$1,918,065.00
	Reimbursable Estimate Segment 169 and 186 from HN F1 FDR (SF-2213)	$611,628.00
	Reimbursable Estimate Mainstem Segment 170, 187 and 163 from SC Plans (CDR	$7,910,175.90
	Subtotal Reimb. Costs associated with DBPS Segments 159-164, 169-186 and Main Channel Segments 170, 187 and 163	$10,439,868.90
	Earlier Plats Deferred Drainage Fees (SR F1, Branding Iron F1 & Homestead F1)	$451,616.32
	SR F2 (SF-2015) Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$400,855.70
	SR F3 (SF-2132) Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$214,430.47
*	HN F1 (SF-2213) Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$541,225.00
*	HN F2 (SF-2218) Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$310,413.22
*	HN F3 (SF-2229) Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$399,632.48
	SR F4 (SF-2230) Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$576,864.11
	Subtotal Deferred Drainage Fees	$2,895,037.30
	Unused Reimb. Costs associated with DBPS Segments 159-164, 169-186 and Main Channel Segments 170, 187 and 163	$7,544,831.60

Sterling Ranch Deferred Bridge Fees Analysis
Reimbursable Costs associated with DBPS Bridge at Briargate Parkway and Sterling Ranch Rd.

	Reimbursable Estimate Briargate Parkway Bridge from CDR 2113	$1,546,676.98
	Reimbursable Estimate Sterling Ranch Road Bridge from CDR 226	$0.00
	Subtotal Reimb. Costs associated with BGP and SR Rd. Bridges	$1,546,676.98
	SR F3 (SF-2132) Bridge Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$87,709.60
*	HN F1 (SF-2213) Bridge Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$221,388.00
*	HN F2 (SF-2218) Bridge Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$126,974.29
*	HN F3 (SF-2229) Bridge Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$163,469.36
	SR F4 (SF-2230) Bridge Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$235,942.53
	Subtotal Deferred Bridge Fees	$835,483.78
	Unused Reimb. Costs associated with Briargate Parkway and SR Road Bridges	$711,193.20

* Filing is not yet platted, actual fee at time of approval may be different than shown here

SUMMARY

The proposed Sterling Ranch Filing No. 4 drainage improvements were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development will not adversely affect the offsite drainage-ways or surrounding development. The existing pond W-5 is to release less than 90% of the predeveloped runoff study associated with the subject site. The site is in continuity with the Sterling Ranch Filing No. 2 Drainage Report. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements for this site.

REFERENCES

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

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

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

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

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

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

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

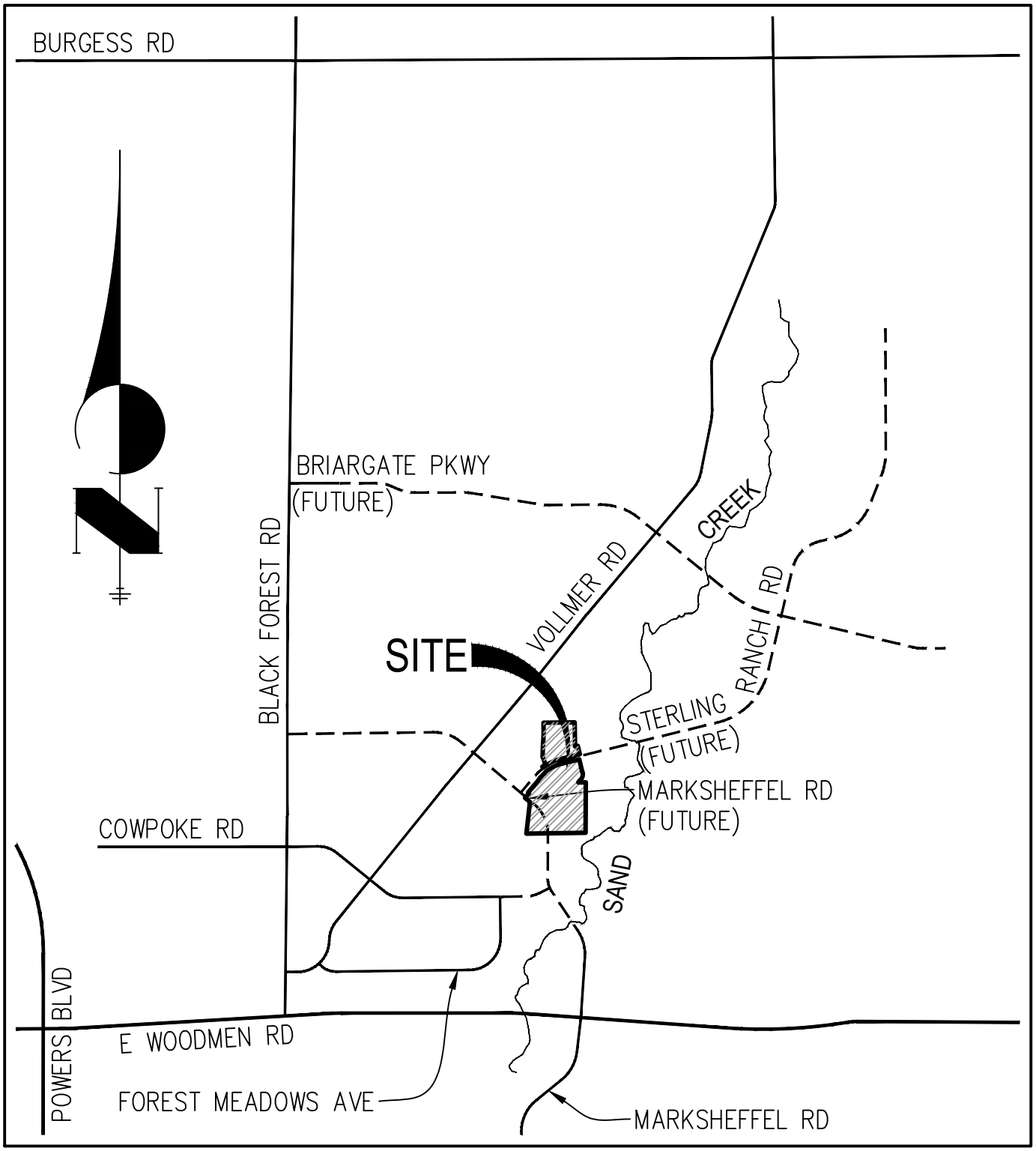
8. Final Drainage Report For Barbarick Subdivision Portion Of Lots 1,2 And Lots 3 and 4, Prepared by Matrix Design Group, June 2016

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

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

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

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map



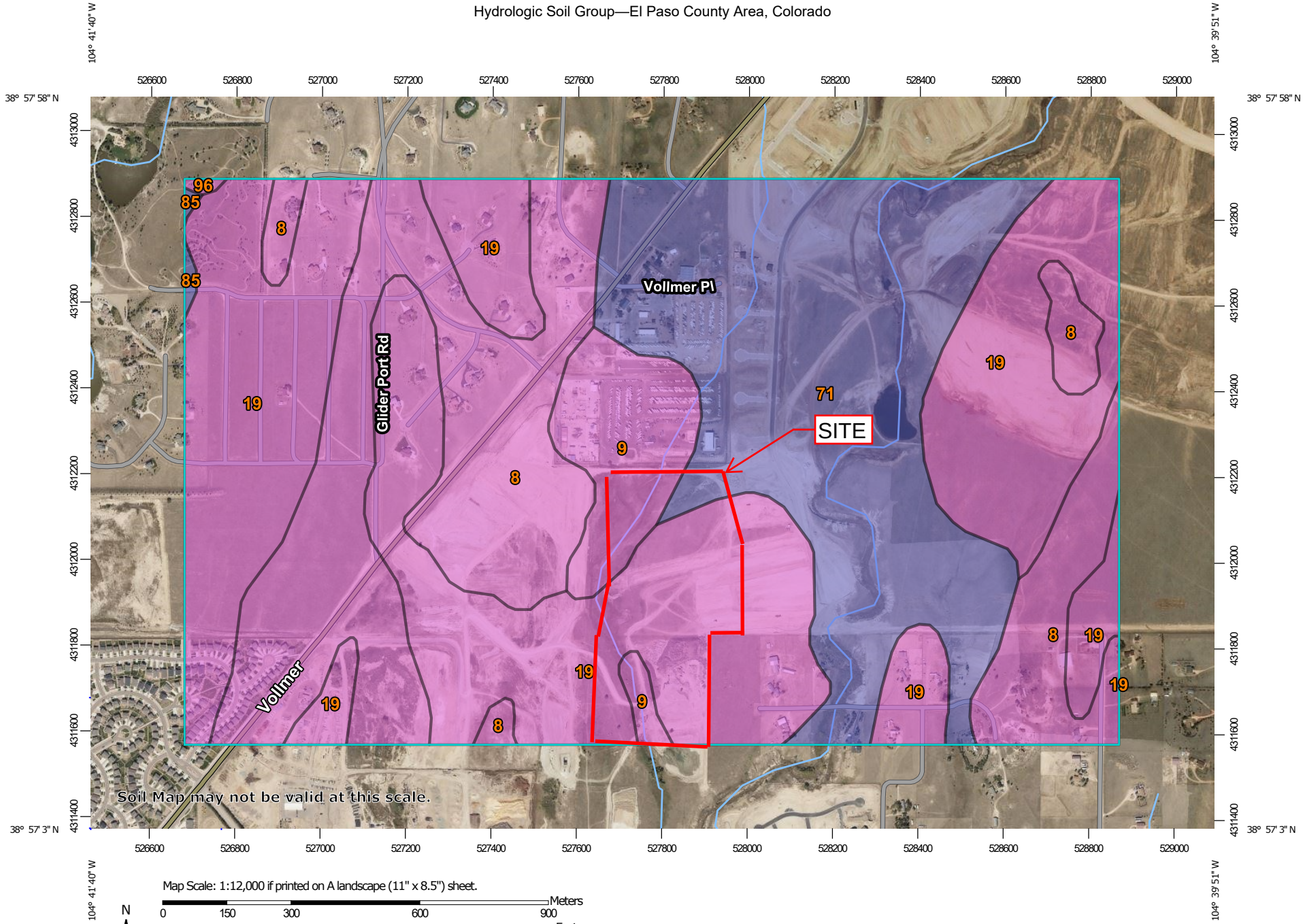
VICINITY MAP

N.T.S.

VICINITY MAP
STERLING RANCH FILING NO. 4
JOB NO. 25188.11
4/27/22
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

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



Map Scale: 1:12,000 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/.

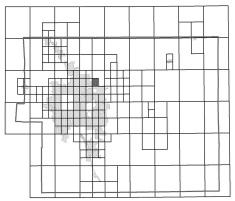
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

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)
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 EXISTING RUNOFF COEFFICIENT CALCULATIONS

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

Project Name: Sterling Ranch Filing 4
Project No.: 25188.11
Calculated By: CJD
Checked By: APL
Date: 1/18/23

Basin ID	Total Area (ac)	Streets (100% Impervious)				Residential (65% Impervious)				1 Acre lot Rersidential (20% Impervious)				Light Industrial (80% Impervious)				Lawns (0% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
A-1	5.17	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.20	0.44	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%
A-2	19.12	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.20	0.44	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	19.12	0.0%	0.08	0.35	0.0%
A-3	17.55	0.90	0.96	0.00	0.0%	0.45	0.59	0.62	2.3%	0.20	0.44	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	16.93	0.0%	0.09	0.36	2.3%
OS1	9.27	0.90	0.96	2.85	30.7%	0.45	0.59	0.00	0.0%	0.20	0.44	2.85	6.1%	0.59	0.70	0.00	0.0%	0.08	0.35	3.57	0.0%	0.37	0.57	36.9%
OS2	2.48	0.90	0.96	1.40	56.5%	0.45	0.59	0.00	0.0%	0.20	0.44	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	1.08	0.0%	0.54	0.69	56.5%
OS3	3.50	0.90	0.96	1.46	41.7%	0.45	0.59	0.00	0.0%	0.20	0.44	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	2.04	0.0%	0.42	0.60	41.7%
OS4	5.10	0.90	0.96	0.00	0.0%	0.45	0.59	0.65	8.3%	0.20	0.44	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	4.45	0.0%	0.13	0.38	8.3%
OS5	3.46	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.20	0.44	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	18.18	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.20	0.44	0.00	0.0%	0.59	0.70	10.40	45.8%	0.08	0.35	7.78	0.0%	0.37	0.55	45.8%
OS7	33.07	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.20	0.44	0.00	0.0%	0.59	0.70	7.91	19.1%	0.08	0.35	25.16	0.0%	0.20	0.43	19.1%
E-1	5.15	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.20	0.44	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	5.15	0.0%	0.08	0.35	0.0%
TOTAL (A1-A3)	**41.84**																							**1.0%**
TOTAL (OS1-OS7)	**75.06**																							**28.4%**
TOTAL	**116.90**																							**18.6%**

EXISTING
STANDARD FORM SF-2
TIME OF CONCENTRATION

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

Project Name: Sterling Ranch Filing 4
Project No.: 25188.11
Calculated By: CJD
Checked By: APL
Date: 1/18/23

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
A-1	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
A-2	19.12	A	0%	0.08	0.35	297	2.5%	23.4	500	2.4%	10.0	1.6	5.3	28.7	797.0	31.9	28.7
A-3	17.55	A	2%	0.09	0.36	121	5.4%	11.4	784	2.7%	10.0	1.7	7.9	19.4	905.0	34.1	19.4
OS1	9.27	A	37%	0.37	0.57	298	2.7%	16.4	737	2.4%	10.0	1.5	8.0	24.4	1035.0	25.4	24.4
OS2	2.48	A	56%	0.54	0.69	117	3.1%	7.5	1745	1.6%	20.0	2.5	11.5	19.0	1862.0	30.0	19.0
OS3	3.50	A	42%	0.42	0.60	41	2.5%	5.8	1681	1.8%	20.0	2.7	10.5	16.2	1722.0	33.0	16.2
OS4	5.10	A	8%	0.13	0.38	491	1.4%	35.0	940	5.6%	10.0	2.4	6.6	41.6	1431.0	31.1	31.1
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	18.18	A	46%	0.37	0.55	165	3.4%	11.2	612	2.7%	10.0	1.6	6.2	17.5	777.0	22.3	17.5
OS7	33.07	A	19%	0.20	0.43	298	3.0%	19.5	1664	2.7%	10.0	1.6	16.9	36.4	1962.0	37.2	36.4
E-1	5.15	A	0%	0.08	0.35	60	3.0%	9.9	865	2.3%	10.0	1.5	9.5	19.4	925.0	36.5	19.4

NOTES:

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

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ Equation 6-3

Where:

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

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

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

Where:

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

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

Where:

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

Table 6-2. NRCS Conveyance factors, K

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

STANDARD FORM SF-3 - EXISTING

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing 4
Project No.: 25188.11
Calculated By: CJD
Checked By: APL
Date: 1/18/23

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t_c (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	A-1	5.17	0.08	27.4	0.41	2.62	1.1															
	16.2								19.6	7.39	3.12	23.1											Runoff from Sterling Ranch Filing no. 3 see attached report in appendix D
	2	A-2	19.12	0.08	28.7	1.53	2.55	3.9	28.7	8.92	2.55	22.7											Basin A2 + runoff from Sterling Ranch Filing No. 3
	3	OS1	9.27	0.37	24.4	3.42	2.79	9.5															Basin OS1
	4	OS5	3.46	0.08	30.4	0.28	2.46	0.7															Basin A4
	7	OS2	2.48	0.54	19.0	1.35	3.16	4.3															Basin OS2
	8	OS3	3.50	0.42	16.2	1.48	3.40	5.0															Basin OS3
	9	OS4	5.10	0.13	31.1	0.65	2.43	1.6															Basin OS4
	10	OS6	18.18	0.37	17.5	6.76	3.29	22.2						6.8	3.4					998	1.8	9.1	Basin OS6 travel to design point 5.1
	11	OS7	33.07	0.20	36.4	6.68	2.19	14.6						6.68	3.2					936	1.8	8.7	Basin OS7 travel to design point 5.1
	5	A-3	17.55	0.09	19.4	1.63	3.14	5.1															Basin A3
	5.1								36.4	13.44	2.19	29.5											Design point 5.1 fed by basins A3, OS6, and OS7 (Undetained flows)
	O1	E-1	5.15	0.08	19.4	0.41	3.13	1.3															Basin E-1

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

STANDARD FORM SF-3 - EXISTING

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing 4
Project No.: 25188.11
Calculated By: CJD
Checked By: APL
Date: 1/18/23

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	A-1	5.17	0.35	27.4	1.81	4.39	8.0															
	16.2								19.3	9.33	5.28	49.2											Runoff from Sterling Ranch Filing no. 3 see attached report in appendix D
	2	A-2	19.12	0.35	28.7	6.69	4.27	28.6	28.7	16.02	4.27	68.5											Basin A2 + runoff from Sterling Ranch Filing No. 3
	3	OS1	9.27	0.57	24.4	5.24	4.69	24.6															Basin OS1
	4	OS5	3.46	0.35	30.4	1.21	4.13	5.0															Basin A4
	7	OS2	2.48	0.69	19.0	1.72	5.31	9.1															Basin OS2
	8	OS3	3.50	0.60	16.2	2.12	5.71	12.1															Basin OS3
	9	OS4	5.10	0.38	31.1	1.94	4.07	7.9															Basin OS4
	10	OS6	18.18	0.55	17.5	10.00	5.52	55.2						10.0	3.4					998	1.8	9.1	Basin OS6 travel to design point 5.1
	11	OS7	33.07	0.43	36.4	14.34	3.68	52.8						14.34	3.2					936	1.8	8.7	Basin OS7 travel to design point 5.1
	5	A-3	17.55	0.36	19.4	6.29	5.27	33.1															Basin A3
	5.1								36.4	24.34	3.68	89.6											Design point 5.1 fed by basins A3, OS6, and OS7 (Undetained)
	O1	E-1	5.15	0.35	19.4	1.80	5.26	9.5															Basin E-1

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

COMPOSITE % IMPERVIOUS & COMPOSITE PROPOSED RUNOFF COEFFICIENT CALCULATIONS

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

Project Name: Sterling Ranch Filing No. 4
Project No.: 25188.11
Calculated By: ARJ
Checked By: APL
Date: 4/4/23

Basin ID	Total Area (ac)	Paved/Streets (100% Impervious)				Residential (65% Impervious)				Light Industrial (80% Impervious)				Lawns (0% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
A2	1.38	0.90	0.96	0.22	15.9%	0.45	0.59	0.34	16.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.82	0.0%	0.30	0.51	32.0%
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	65.0%
A4	4.53	0.90	0.96	0.67	14.8%	0.45	0.59	2.35	33.7%	0.59	0.70	0.00	0.0%	0.08	0.35	1.51	0.0%	0.39	0.56	48.5%
A5	0.45	0.90	0.96	0.17	38.1%	0.45	0.59	0.28	40.8%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.63	0.73	79.0%
A6.1	4.73	0.90	0.96	1.02	21.6%	0.45	0.59	3.70	50.9%	0.59	0.70	0.00	0.0%	0.08	0.35	0.01	0.0%	0.55	0.67	72.5%
A6.2	2.56	0.90	0.96	0.66	25.7%	0.45	0.59	1.90	48.2%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.56	0.68	73.9%
A7	1.76	0.90	0.96	0.43	24.5%	0.45	0.59	1.32	48.8%	0.59	0.70	0.00	0.0%	0.08	0.35	0.01	0.0%	0.56	0.68	73.3%
A8	4.23	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	13.4%
A9	2.13	0.90	0.96	0.06	2.8%	0.45	0.59	0.15	4.6%	0.59	0.70	0.00	0.0%	0.08	0.35	1.92	0.0%	0.13	0.38	7.4%
A10	2.67	0.90	0.96	0.44	16.4%	0.45	0.59	0.40	9.8%	0.59	0.70	0.00	0.0%	0.08	0.35	1.83	0.0%	0.27	0.49	26.2%
B3	2.38	0.90	0.96	1.41	59.3%	0.45	0.59	0.12	3.3%	0.59	0.70	0.00	0.0%	0.08	0.35	0.85	0.0%	0.58	0.72	62.6%
C1.1	1.78	0.90	0.96	0.44	24.6%	0.45	0.59	1.14	41.6%	0.59	0.70	0.00	0.0%	0.08	0.35	0.20	0.0%	0.52	0.65	66.2%
C1.2	0.81	0.90	0.96	0.25	30.4%	0.45	0.59	0.52	41.6%	0.59	0.70	0.00	0.0%	0.08	0.35	0.05	0.0%	0.57	0.69	72.0%
C2	6.75	0.90	0.96	1.49	22.0%	0.45	0.59	4.21	40.5%	0.59	0.70	0.00	0.0%	0.08	0.35	1.06	0.0%	0.49	0.63	62.5%
C3	4.18	0.90	0.96	0.14	3.4%	0.45	0.59	1.00	15.5%	0.59	0.70	0.00	0.0%	0.08	0.35	3.04	0.0%	0.20	0.43	18.9%
C4	4.41	0.90	0.96	1.85	42.0%	0.45	0.59	1.35	19.9%	0.59	0.70	0.00	0.0%	0.08	0.35	1.21	0.0%	0.54	0.68	61.8%
I1	5.88	0.90	0.96	1.23	20.9%	0.45	0.59	2.98	32.9%	0.59	0.70	0.00	0.0%	0.08	0.35	1.67	0.0%	0.44	0.60	53.8%
I2	2.18	0.90	0.96	0.81	37.2%	0.45	0.59	1.13	33.7%	0.59	0.70	0.00	0.0%	0.08	0.35	0.24	0.0%	0.58	0.70	70.8%
I3	2.94	0.90	0.96	0.74	25.2%	0.45	0.59	1.94	42.9%	0.59	0.70	0.00	0.0%	0.08	0.35	2.94	0.0%	0.60	0.98	68.1%
OS6	18.38	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	10.40	45.3%	0.08	0.35	7.98	0.0%	0.37	0.55	45.3%
OS7	33.07	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	7.91	19.1%	0.08	0.35	25.16	0.0%	0.20	0.43	19.1%
E1	0.90	0.90	0.96	0.78	86.7%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.12	0.0%	0.79	0.88	86.7%
E2	1.25	0.90	0.96	0.79	63.2%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.46	0.0%	0.60	0.74	63.2%
E3	0.35	0.90	0.96	0.30	85.7%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.05	0.0%	0.78	0.87	85.7%
E4	0.36	0.90	0.96	0.29	80.6%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.07	0.0%	0.74	0.84	80.6%
TOTAL (A2-C4)	48.42																			50.4%
Total (C1-I3)	28.93																			56.0%
TOTAL (OS6 -OS7)	51.45																			28.5%
TOTAL (E1-E4)	2.86																			75.5%
TOTAL	113.73																			42.1%

PROPOSED
STANDARD FORM SF-2
TIME OF CONCENTRATION

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

Project Name: Sterling Ranch Filing No. 4
Project No.: 25188.11
Calculated By: ARJ
Checked By: APL
Date: 4/4/23

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
A2	1.38	A	32%	0.30	0.51	100	3.7%	9.4	141	1.5%	20.0	2.4	1.0	10.3	241.0	22.0	10.3
A3	3.68	A	65%	0.50	0.64	100	3.7%	7.0	1008	2.4%	20.0	3.1	5.5	12.5	1108.2	21.0	12.5
A4	4.53	A	48%	0.39	0.56	100	2.1%	10.1	814	1.9%	20.0	2.8	4.9	15.0	914.0	24.0	15.0
A5	0.45	A	79%	0.63	0.73	54	3.7%	4.1	217	3.9%	20.0	4.0	0.9	5.0	271.0	13.5	5.0
A6.1	4.73	A	72%	0.55	0.67	100	2.0%	8.0	841	2.9%	20.0	3.4	4.1	12.1	941.0	18.0	12.1
A6.2	2.56	A	74%	0.56	0.68	100	2.0%	7.7	685	1.6%	20.0	2.6	4.5	12.1	785.0	18.1	12.1
A7	1.76	A	73%	0.56	0.68	100	3.4%	6.5	367	1.2%	20.0	2.2	2.8	9.4	467.0	16.5	9.4
A8	4.23	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
C1.1	1.78	A	66%	0.52	0.65	100	4.3%	6.5	519	2.7%	20.0	3.3	2.7	9.2	619.0	17.6	9.2
C1.2	0.81	A	72%	0.57	0.69	64	2.0%	6.1	415	2.7%	20.0	3.3	2.1	8.3	479.0	16.0	8.3
C2	6.75	A	63%	0.49	0.63	99	1.8%	9.1	796	1.7%	20.0	2.6	5.1	14.2	895.0	21.1	14.2
C3	4.18	A	19%	0.20	0.43	100	9.6%	7.7	255	3.5%	15.0	2.8	1.5	9.3	355.0	24.7	9.3
A9	2.13	A	7%	0.13	0.38	100	2.4%	13.1	108	2.6%	20.0	3.2	0.6	13.7	208.0	25.9	13.7
A10	2.67	A	26%	0.27	0.49	100	2.8%	10.7	0	1.0%	20.0	2.0	0.0	10.7	100.0	21.5	10.7
B3	2.38	A	63%	0.58	0.72	37	3.4%	3.8	1595	1.5%	10.0	1.2	21.7	25.5	1632.0	27.6	25.5
C4	4.41	A	62%	0.54	0.68	100	3.0%	7.1	1664	1.5%	10.0	1.2	22.6	29.7	1764.0	28.3	28.3
OS6	18.38	A	45%	0.37	0.55	165	3.4%	11.3	612	2.7%	10.0	1.6	6.2	17.5	777.0	22.4	17.5
OS7	33.07	A	19%	0.20	0.43	298	3.0%	19.5	1664	2.7%	10.0	1.6	16.9	36.4	1962.0	37.2	36.4
I1	5.88	A	54%	0.44	0.60	180	1.4%	14.3	497	1.6%	10.0	1.3	6.5	20.9	677.0	20.8	20.8
I2	2.18	A	71%	0.58	0.70	125	1.6%	9.1	385	5.2%	10.0	2.3	2.8	11.9	510.0	15.4	11.9
I3	2.94	A	68%	0.60	0.98	80	1.7%	6.7	385	2.5%	10.0	1.6	4.1	10.8	465.0	16.6	10.8
E1	0.90	A	87%	0.79	0.88	30	2.0%	2.4	725	2.1%	20.0	2.9	4.2	6.6	755.0	15.2	6.6
E2	1.25	A	63%	0.60	0.74	30	2.0%	3.9	765	2.1%	20.0	2.9	4.4	8.3	795.0	20.2	8.3
E3	0.35	A	86%	0.78	0.87	30	2.0%	2.5	285	2.3%	20.0	3.0	1.6	4.1	315.0	12.9	5.0
E4	0.36	A	81%	0.74	0.84	30	2.0%	2.8	295	2.3%	20.0	3.0	1.6	4.4	325.0	13.9	5.0

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).

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

Where:

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

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

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ Equation 6-3

Where:

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

$$t_c = (26 - 17i) + \frac{L_c}{60(14i + 9)\sqrt{S_c}}$$ 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_c = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

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

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing No. 4
Project No.: 25188.11
Calculated By: ARJ
Checked By: APL
Date: 4/4/23

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1	OS7	33.07	0.20	36.4	6.68	2.19	14.6								14.6	6.68	1.0	36	427	7.5	0.9	Offsite Barbarick Subdivision pond release Piped to DP 4.1
	4	OS6	18.38	0.37	17.5	6.77	3.29	22.3								22.3	6.77	1.0	36	162	8.4	0.3	Offsite subdivision pond release Confluenced at DP 4.1
	4.1								37.3	13.45	2.15	29.0				29.0	13.45	1.0	36	704	9.0	1.3	Offsite undetained flow confluenced from basins OS7 and OS6 w/ bypass flows Piped to DP 7.1
	5	C2	6.75	0.49	14.2	3.32	3.61	12.0								12.0	3.32	1.0	24	63	7.3	0.1	Sump Inlet Piped to DP 6.3
	6.1	C1.1	1.78	0.52	9.2	0.92	4.26	3.9								3.9	0.92	1.0	18	9	5.5	0.0	Sump Inlet Piped to DP 6.3
	6.2	C1.2	0.81	0.57	8.3	0.46	4.42	2.0															Sump Inlet Piped to DP 6.3
	6.3								14.3	4.70	3.59	16.9				16.9	4.70	1.0	36	245	7.9	0.5	Piped to DP 7.2
	7	C3	4.18	0.20	9.3	0.82	4.24	3.5															Area Inlet Piped to DP 7.1
	7.1								38.6	14.27	2.10	30.0				30.0	14.27	1.0	36	40	9.2	0.1	Structure piped to 7.2
	7.2								38.7	18.97	2.10	39.8											Piped to existing storm sewer in Sterling Ranch Road
	8	C4	4.41	0.54	28.3	2.37	2.57	6.1															Offsite flow to existing inlet in Sterling Ranch Road Piped to existing storm sewer in Sterling Ranch Road
	9	B3	2.38	0.58	25.5	1.39	2.73	3.8															Offsite flow to existing inlet in Sterling Ranch Road Piped to existing storm sewer in Sterling Ranch Road
	1.i	I1	5.88	0.44	20.8	2.58	3.03	7.8															Runoff drains into into swale
	3.i	I3	2.94	0.60	10.8	1.77	4.01	7.1															Runoff drains into swale
	2.i	I2	2.18	0.58	11.9	1.26	3.87	4.9	20.8	3.84	3.03	11.6				11.6	3.84	2.0	24	113	9.3	0.2	
	3.2								21.0	5.61	3.02	16.9											DP2.i and DP3.i combine at DP3.2
	10								38.7	26.57	2.10	55.8											Sum of flows from DP7.2, 8, 9, and 2.1
	15							8.2					0.4	0.11	1.6	7.8							Existing runoff piped from Sterling Ranch Filing 3 subdivision by-passed to DP 17 curb and gutter flow to DP17
	15.1								19.5	6.71	3.13	21.0				21.0	6.71	1.0	24	45	8.2	0.1	On-grade Inlet from overland flow on Filing 3 subdivision Captured Flows piped to DP 16.1
	16	A5	0.45	0.63	5.0	0.28	5.17	1.4					0.0	0	2.9	1.4							Existing On-grade Inlet from Sterling Ranch Filing 3 Captured Flows piped to DP 16.1, by pass flow to DP12
	16.1								19.6	6.88	3.12	21.5				21.5	6.88	1.0	36	280	8.4	0.6	Piped to DP 18.1
	17	A2	1.38	0.30	10.3	0.42	4.08	1.7	20.1	0.53	3.08	1.6	0.0	0		1.6	0.42	1.0	18	27	4.3	0.1	On-grade Inlet, includes by pass flow from DP15/ Sterling Ranch Filing 3 Piped to DP 18.1
	17.1															1.6							Captured runoff from on Grade inlet at DP 17, FLOWS TO DP 18.1
	18.1								20.3	7.41	3.07	22.8				22.8	0.00	1.0	36	600	8.5	1.2	Piped to DP18.2
	12	A6.1	4.73	0.55	12.1	2.59	3.85	10.0					0.9	0.23	1.0	9.1	2.36	1.0	24	100	6.8	0.2	On-grade Inlet, includes by pass flow from DP16 Captured Flows piped to DP 18.2, Bypass flow to DP 19

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing No. 4
Project No.: 25188.11
Calculated By: ARJ
Checked By: APL
Date: 4/4/23

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	12.1															9.1							Captured flow into on grade inlet at DP12.1
	18.2								21.4	9.77	2.99	29.2				29.2	9.77	1.0	42	50	9.1	0.1	Piped to DP20.2
	19	A6.2	2.56	0.56	12.1	1.45	3.84	5.6	12.3	1.68	3.82	6.4	0.0	0	1.0	6.4	1.67	1.0	24	30	6.2	0.1	On-grade Inlet, includes by pass flow from DP12 Captured Flows piped to DP 20.1, Bypass flow to to DP 21
	19.1															6.4							Captured flow from on grade inlet from DP 19
	20	A3	3.68	0.50	12.5	1.84	3.79	7.0					0.0	0	1.0	7.0	1.84	1.0	18	4	6.3	0.0	On-grade Inlet Captured Flows piped to DP 20.1
	20.1															7.0							Captured flow from on grade inlet from DP 20
	20.2								21.5	13.28	2.98	39.6				39.6	13.28	1.0	42	220	9.8	0.4	Piped to DP23
	21	A7	1.76	0.56	9.4	0.99	4.23	4.2	12.2	0.99	3.83	3.8				3.8	0.99	1.0	24	60	5.3	0.2	Sump Inlet, includes by pass flow from DP19 Piped to DP21.1
	21.1								21.5	14.27	2.98	42.5				42.5	14.27	1.0	42	90	10.0	0.2	MH Piped to DP23
	22	A4	4.53	0.39	15.0	1.78	3.52	6.3	15.0	1.78	3.52	6.3											Sump Inlet, includes by pass flow from DP17 and DP20 Piped to DP22.1
	22.1								15.0	1.78	3.52	6.3				6.3	1.78	1.0	18	10	6.2	0.0	Piped to DP23
	23								21.9	16.05	2.95	47.4				47.4	16.05	1.0	42	145	10.3	0.2	Piped to DP26
	24	A8	4.23	0.16	18.9	0.69	3.17	2.2															Area Inlet Piped to EX 84" Storm Line Built w/ SR Filing 2 First Phase
	25	A9	2.13	0.13	13.7	0.28	3.66	1.0								1.0	0.28	4.0	18	60	6.0	0.2	Prop. 18" FES Piped to EX 84" Storm Line Built w/ SR Filing 2 First Phase
	25.1															5.0							Captured and Piped runoff from 15 ' type R inlet
	27	A10	2.67	0.27	10.7	0.72	4.03	2.9															Pervious area sheet flows into EX Pond W5
	e10												0.6										By pass runoff from up stream existing 15' type R inlet built in Sterling Ranch Filing No. 2
	1e	E1	0.90	0.79	6.6	0.71	4.75	3.4				4.0	0.0										Runoff from up stream + runoff from by pass flow
	1.1e															4.0							Captured and Piped runoff from 15 ' type R inlet
	e11												0.7										By pass runoff from upstream existing 15' type R inlet built in Sterling Ranch Filing No. 2
	2e	E2	1.25	0.60	8.3	0.75	4.40	3.3				4.0											Total Runoff from up stream + runoff from by pass flow
	2.1e															4.0							Total runoff piped from basin E2 + runoff from upstream bypass
	2.2e															8.0							Total runoff piped from basin E1 + upstream bypass and runoff from basin E2 + runoff from upstream bypass
	3e	E3	0.35	0.78	5.0	0.27	5.17	1.4	6.6	0.27	4.75	1.3	0.0										Total runoff from basin E3 and bypass runoff from basin E1
	4e	E4	0.36	0.74	5.0	0.27	5.17	1.4	8.3	0.27	4.40	1.2											Total runoff from basin E4 and bypass runoff from basin E2

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

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing No. 4
Project No.: 25188.11
Calculated By: ARJ
Checked By: APL
Date: 4/4/23

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
Description	Design Point	Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	t_C (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	OS7	33.07	0.43	36.4	14.34	3.68	52.8								52.8	14.34	1.0	36	427	10.5	0.7	Offsite Barbarick Subdivision pond release Piped to DP 4.1
	4	OS6	18.38	0.55	17.5	10.07	5.52	55.6								55.6	10.07	1.0	36	162	10.6	0.3	Offsite subdivision pond release Confluenced at DP 4.1
	4.1								37.0	24.41	3.63	88.7				88.7	24.41	1.0	36	704	12.6	0.9	Offsite undetained flow confluenced from basins OS7 and OS6 w/ bypass flows Piped to DP 7.1
	5	C2	6.75	0.63	14.2	4.28	6.06	25.9					12.4	2.05	2.0	13.5	2.23	1.0	24	42 63	2.8 7.5	0.2 0.1	Sump Inlet, Over flows 12.4 cfs to DP 6.1 Piped to DP 6.3
	6.1	C1.1	1.78	0.65	9.2	1.16	7.16	8.3	14.4	3.21	6.01	19.3	3.1	0.52	0.1	16.2	0.97	1.0	18	16 9	0.6 9.2	0.4 0.0	Sump Inlet, Overflows 3.1 cfs to DP6.2 Piped to DP 6.3
	6.2	C1.2	0.81	0.69	8.3	0.56	7.41	4.2	14.8	1.08	5.94	6.4											Sump Inlet Piped to DP 6.3
	6.3								14.8	6.00	5.94	35.6				35.6	6.00	1.0	36	245	9.6	0.4	Piped to DP 7.2
	7	C3	4.18	0.43	9.3	1.79	7.12	12.8															Area Inlet Piped to DP 7.1
	7.1								38.0	26.20	3.57	93.5				93.5	26.20	1.0	36	40	13.2	0.1	Structure piped to 7.2
	7.2								38.0	32.20	3.57	114.9											Piped to existing storm sewer in Sterling Ranch Road
	8	C4	4.41	0.68	28.3	3.00	4.31	12.9															Offsite flow to existing inlet in Sterling Ranch Road Piped to existing storm sewer in Sterling Ranch Road
	9	B3	2.38	0.72	25.5	1.72	4.58	7.9															Offsite flow to existing inlet in Sterling Ranch Road Piped to existing storm sewer in Sterling Ranch Road
	1.i	I1	5.88	0.60	20.8	3.52	5.09	17.9															Runoff drains into into swale
	3.i	I3	2.94	0.98	10.8	2.88	6.74	19.4															Runoff drains into swale
	2.i	I2	2.18	0.70	11.9	1.53	6.50	9.9	20.8	5.05	5.09	25.7				25.7	5.05	2.0	24	113	11.3	0.2	
	3.2								21.0	7.93	5.07	40.2											Flows from DP2.i and DP3.1 combine in proposed storm sewer
	10								38.0	41.97	3.57	149.7											Sum of flows from DP7.2, 8, 9, and 2.1
	15							17.7					4.7	0.817	1.5	12.5							Existing runoff piped from Sterling Ranch Filing 3 subdivision by-passed to DP 17 curb and gutter flow to DP17
	15.1								19.2	8.18	5.28	43.2				43.2	8.18	1.0	24	45	13.8	0.1	On-grade Inlet from overland flow on Filing 3 subdivision Captured Flows piped to DP 16.1
	16	A5	0.45	0.73	5.0	0.33	8.68	2.9					0.0	0	2.9	2.9							Existing On-grade Inlet from Sterling Ranch Filing 3 Captured Flows piped to DP 16.1, by pass flow to DP12
	16.1								19.3	8.51	5.28	44.9				44.9	8.51	1.0	36	280	10.1	0.5	Piped to DP 18.1
	17	A2	1.38	0.51	10.3	0.70	6.85	4.8	19.8	1.52	5.22	7.9	0.2	0.029	1.5	7.7	1.49	1.0	18	27	6.5	0.1	On-grade Inlet, includes by pass flow from DP15/ Sterling Ranch Filing 3 Piped to DP 18.1
	17.1															7.7							Captured runoff from on Grade inlet at DP 17, FLOWS TO DP 18.1
	18.1								19.8	10.03	5.21	52.2				52.2	10.03	1.0	36	600	10.4	1.0	Piped to DP18.2
	12	A6.1	4.73	0.67	12.1	3.17	6.46	20.5					6.6	1.022	1.0	13.9	2.15	1.0	24	100	7.6	0.2	On-grade Inlet, includes by pass flow from DP16 Captured Flows piped to DP 18.2, Bypass flow to DP 19
	12.1															13.9							Captured flow into on grade inlet at DP12.1

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing No. 4
Project No.: 25188.11
Calculated By: ARJ
Checked By: APL
Date: 4/4/23

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	t_C (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)	
	18.2								20.8	12.18	5.09	62.0				62.0	12.18	1.0	42	50	11.0	0.1	Piped to DP20.2
	19	A6.2	2.56	0.68	12.1	1.75	6.44	11.3	12.3	2.77	6.41	17.8	4.9	0.761	1.0								On-grade Inlet, includes by pass flow from DP12
	19.1															12.9	2.00	1.0	24	30	7.4	0.1	Captured Flows piped to DP 20.1, Bypass flow to DP 21 Captured flow from on grade inlet from DP 19
	20	A3	3.68	0.64	12.5	2.34	6.37	14.9					3.2	0.502	1.0	11.7	1.84	1.0	18	4	6.6	0.0	On-grade Inlet Captured Flows piped to DP 20.1
	20.1															11.7							Captured flow from on grade inlet from DP 20
	20.2								20.9	16.01	5.08	81.4				81.4	16.01	1.0	42	220	11.6	0.3	Piped to DP23
	21	A7	1.76	0.68	9.4	1.20	7.10	8.5	12.2	1.96	6.43	12.6				12.6	1.96	1.0	24	60	7.4	0.1	Sump Inlet, includes by pass flow from DP19 Piped to DP21.1
	21.1								20.9	17.97	5.08	91.3				91.3	17.97	1.0	42	90	11.9	0.1	MH Piped to DP23
	22	A4	4.53	0.56	15.0	2.56	5.91	15.1	15.0	3.09	5.91	18.3											Sump Inlet, includes by pass flow from DP17 and DP20 Piped to DP22.1
	22.1								15.0	3.09	5.91	18.3				18.3	3.09	1.0	18	10	10.4	0.0	Piped to DP23
	23								21.2	21.07	5.04	106.2				106.2	21.07	1.0	42	145	11.9	0.2	Piped to DP26
	24	A8	4.23	0.41	18.9	1.72	5.32	9.2															Area Inlet Piped to EX 84" Storm Line Built w/ SR Filing 2 First Phase
	25	A9	2.13	0.38	13.7	0.82	6.14	5.0								5.0	0.82	4.0	18	60	9.8	0.1	Prop. 18" FES Piped to EX 84" Storm Line Built w/ SR Filing 2 First Phase
	25.1															14.8							1.1e + dp25
	27	A10	2.67	0.49	10.7	1.30	6.77	8.8															Pervious area sheet flows into EX Pond W5
	e10												4.6										By pass runoff from up stream existing 15' type R inlet built in Sterling Ranch Filing No. 2
	1e	E1	0.90	0.88	6.6	0.79	7.98	6.3				10.9	1.1	0.138	3.4	9.8							Runoff from up stream + runoff from by pass flow
	1.1e															9.8							Captured and Piped runoff from 15 ' type R inlet
	e11												6.2										By pass runoff from upstream existing 15' type R inlet built in Sterling Ranch Filing No. 2
	2e	E2	1.25	0.74	8.3	0.92	7.39	6.8				13.0	2.1	0.284	3.4	10.9							Total Runoff from up stream + runoff from by pass flow
	2.1e															10.9							Total runoff piped from basin E2 + runoff from upstream bypass
	2.2e															20.7							Total runoff piped from basin E1 + upstream bypass and runoff from basin E2 + runoff from upstream bypass
	3e	E3	0.35	0.87	5.0	0.31	8.68	2.7	6.6	0.45	7.98	3.6											Total runoff from basin E3 and bypass runoff from basin E1
	4e	E4	0.36	0.84	5.0	0.30	8.68	2.6	8.3	0.58	7.39	4.3											Total runoff from basin E4 and bypass runoff from basin E2

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

Appendix C
Hydraulic Calculations

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet DP5	Inlet DP6.1	Inlet DP6.2
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	In Sump	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	12.0	3.9	2.0
Major Q_{Known} (cfs)	25.9	8.3	4.2

Bypass (Carry-Over) Flow from Upstream Inlets must be organized from upstream (left) to downstream (right) in order for bypass flows to be linked.

Receive Bypass Flow from:	No Bypass Flow Received	User-Defined	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	11.0	3.1

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**12.0**	**3.9**	**2.0**
Major Total Design Peak Flow, Q (cfs)	**25.9**	**19.3**	**7.3**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	N/A

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet DP7	Ex Inlet DP8	Ex Inlet DP9
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	STREET	STREET
Hydraulic Condition	Swale	On Grade	On Grade
Inlet Type	CDOT Type C	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	3.5	6.1	3.8
Major Q_{Known} (cfs)	12.8	13.0	7.9

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**3.5**	**6.1**	**3.8**
Major Total Design Peak Flow, Q (cfs)	**12.8**	**13.0**	**7.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	2.2	0.2

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Ex Inlet DP15	Ex Inlet DP16	Inlet DP12
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	8.2	1.4	10.0
Major Q_{Known} (cfs)	17.7	2.9	20.5

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**8.2**	**1.4**	**10.0**
Major Total Design Peak Flow, Q (cfs)	**17.7**	**2.9**	**20.5**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.2	0.0	0.9
Major Flow Bypassed Downstream, Q_b (cfs)	4.7	0.0	6.6

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet DP17	Inlet DP19	Inlet DP20
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.6	6.4	7.0
Major Q_{Known} (cfs)	7.9	17.8	14.9

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.6**	**6.4**	**7.0**
Major Total Design Peak Flow, Q (cfs)	**7.9**	**17.8**	**14.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.2	4.9	3.2

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet DP21	Inlet DP22	Inlet DP24
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	AREA
Hydraulic Condition	In Sump	In Sump	Swale
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type C

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	3.8	6.3	2.2
Major Q_{Known} (cfs)	12.6	18.3	9.2

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**3.8**	**6.3**	**2.2**
Major Total Design Peak Flow, Q (cfs)	**12.6**	**18.3**	**9.2**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A	0.0

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Ex Inlet DPe10	Ex Inlet DPe11	Inlet DP1e
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	9.2	9.5	4.0
Major Q_{Known} (cfs)	17.3	19.9	10.9

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	9.2	9.5	4.0
Major Total Design Peak Flow, Q (cfs)	17.3	19.9	10.9
Minor Flow Bypassed Downstream, Q_b (cfs)	0.6	0.7	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	4.6	6.2	1.1

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet DP2e	Inlet DP25
Site Type (Urban or Rural)	URBAN	URBAN
Inlet Application (Street or Area)	STREET	AREA
Hydraulic Condition	On Grade	Swale
Inlet Type	CDOT Type R Curb Opening	CDOT Type C

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	4.0	1.0
Major Q_{Known} (cfs)	13.0	4.8

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)		
Percent Impervious		
NRCS Soil Type		

Watershed Profile

Overland Slope (ft/ft)		
Overland Length (ft)		
Channel Slope (ft/ft)		
Channel Length (ft)		

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	4.0	1.0
Major Total Design Peak Flow, Q (cfs)	13.0	4.8
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	2.1	0.0

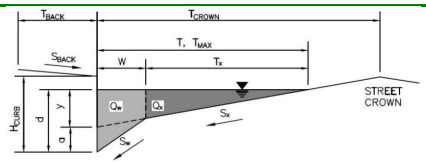
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Inlet DP5



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

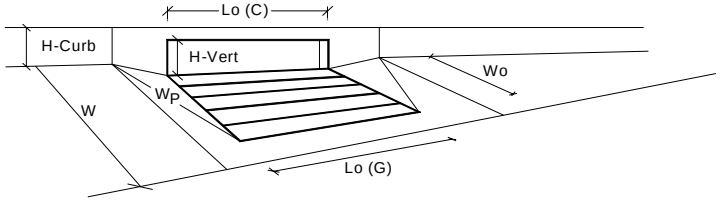
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

		Minor Storm	Major Storm	
	Q_{allow} =	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)

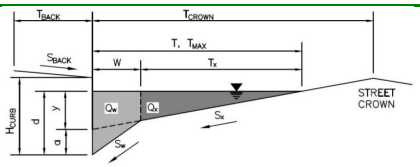


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	7.1	7.4	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.43	0.45	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.85	0.86	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	12.2	13.5	cfs
WARNING: Inlet Capacity < Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	12.0	25.9	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Sterling Ranch Filing 4**
Inlet ID: **Inlet DP6.1**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

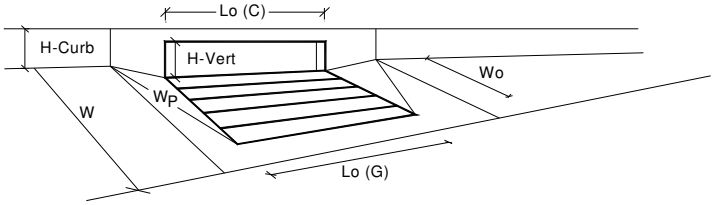
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

MINOR STORM Allowable Capacity is not applicable to Sump Condition
MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	8.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.50	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.91	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.9**	**16.2**	**cfs**
WARNING: Inlet Capacity < Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	3.9	19.3	cfs

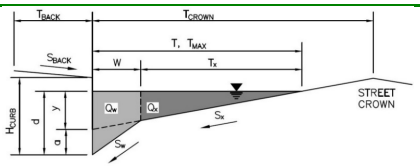
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: **Sterling Ranch Filing 4**

Inlet ID: **Inlet DP6.2**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

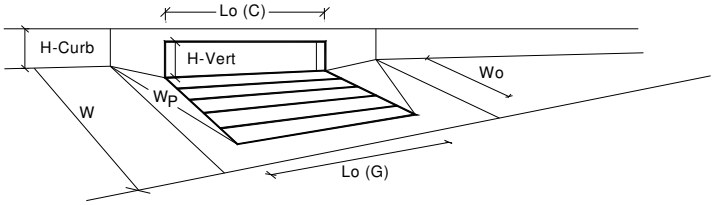
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)

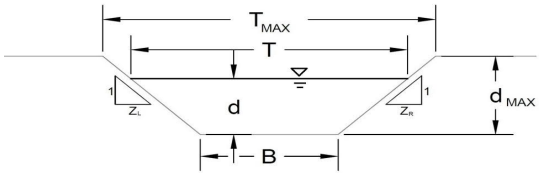


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	8.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.50	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.91	1.00	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.9**	**16.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.0	7.3	cfs

AREA INLET IN A SWALE

Sterling Ranch Filing 4

Inlet DP7



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =	D	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0280	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	4.00	ft/ft
Right Side Sloe	Z2 =	4.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	8.00	12.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	2.00	3.00	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	12.3	49.0	cfs
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	1.00	1.50	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	3.5	12.8	cfs
Water Depth	d =	0.72	1.01	ft

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

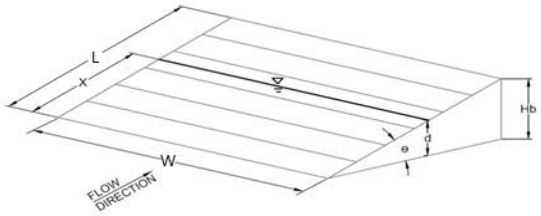
AREA INLET IN A SWALE

Sterling Ranch Filing 4

Inlet DP7

Inlet Design Information (Input)

Type of Inlet: CDOT Type C — Inlet Type = CDOT Type C



Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	ft
Length of Grate	L =	3.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.72	1.01	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	11.3	16.3	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

Warning 03: Velocity exceeds USDCM Volume I recommendation.
Warning 04: Froude No. exceeds USDCM Volume I recommendation.

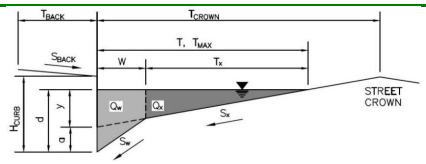
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Ex Inlet DP8



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

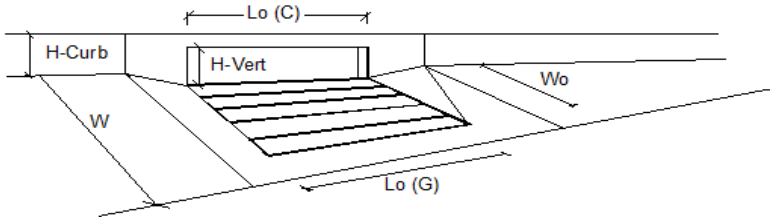
		Minor Storm	Major Storm	
	Q_{allow} =	9.8	16.9	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 6.10 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 13.00 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	6.1	10.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	2.2	cfs
Capture Percentage = Q_a/Q_o	C% =	100	83	%

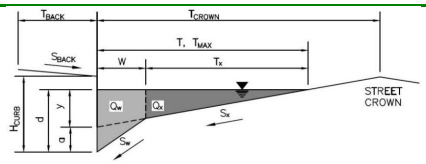
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Ex Inlet DP9



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.015	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

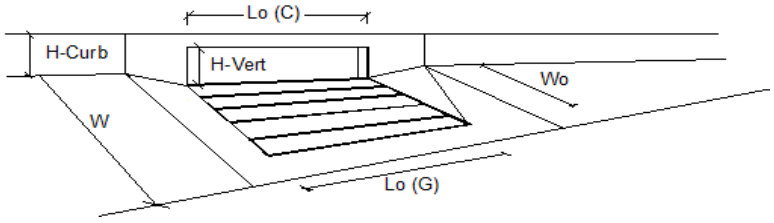
		Minor Storm	Major Storm	
	Q_{allow} =	9.8	16.9	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.80 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.90 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	3.8	7.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	0.2	cfs
Capture Percentage = Q_a/Q_o	C% =	100	98	%

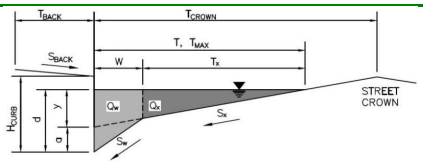
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Ex Inlet DP15



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.033	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

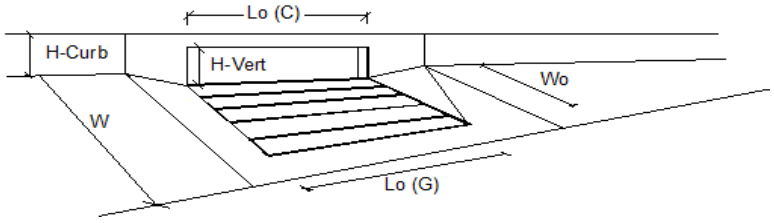
		Minor Storm	Major Storm	
	Q_{allow} =	17.2	19.7	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 8.20 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 17.70 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	8.0	13.0	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.2	4.7	cfs
Capture Percentage = Q_a/Q_o	C% =	97	73	%

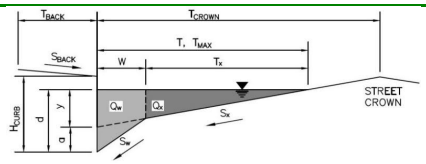
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Ex Inlet DP16



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.033	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

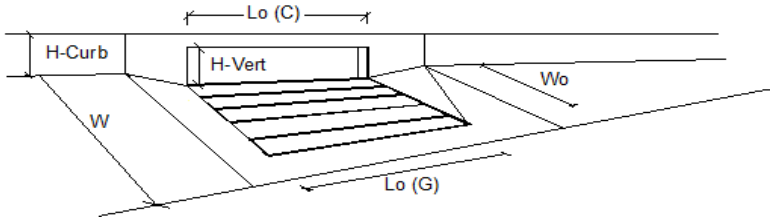
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	17.2	17.2	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.40 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.90 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	1.4	2.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	0.0	cfs
Capture Percentage = Q_a/Q_o	C% =	100	100	%

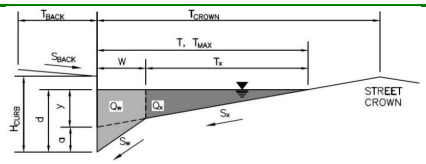
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Inlet DP12



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

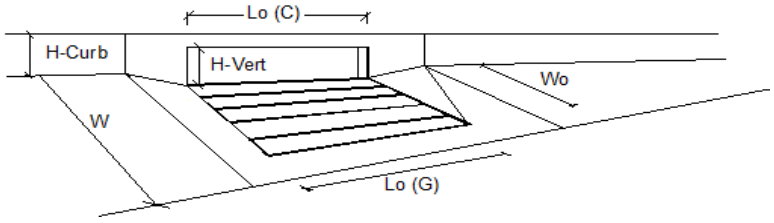
		Minor Storm	Major Storm	
	Q_{allow} =	10.9	22.6	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 10.00 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 20.50 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	9.1	13.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.9	6.6	cfs
Capture Percentage = Q_a/Q_o	C% =	91	68	%

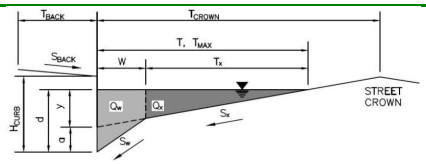
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Inlet DP17



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.026	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

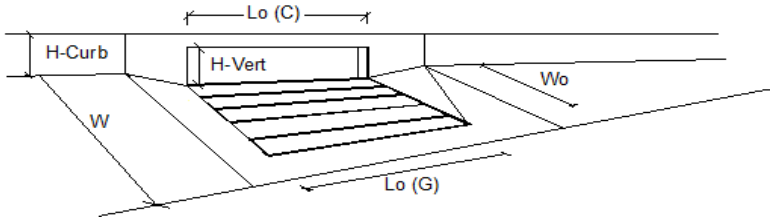
		Minor Storm	Major Storm	
	Q_{allow} =	17.5	17.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.60 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 7.90 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	1.6	7.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	0.2	cfs
Capture Percentage = Q_a/Q_o	C% =	100	98	%

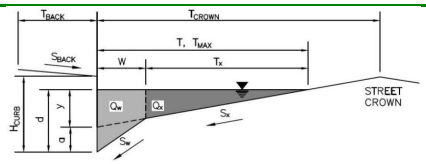
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Inlet DP19



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

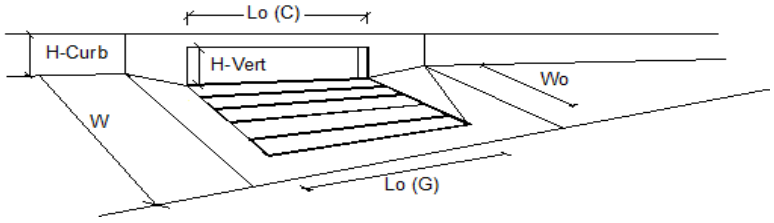
		Minor Storm	Major Storm	
	Q_{allow} =	10.9	22.6	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 6.40 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 17.80 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	6.4	12.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	4.9	cfs
Capture Percentage = Q_a/Q_o	C% =	100	72	%

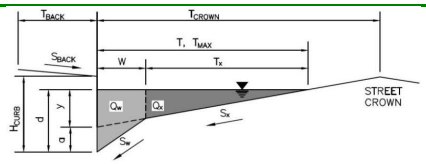
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Inlet DP20



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☑	

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

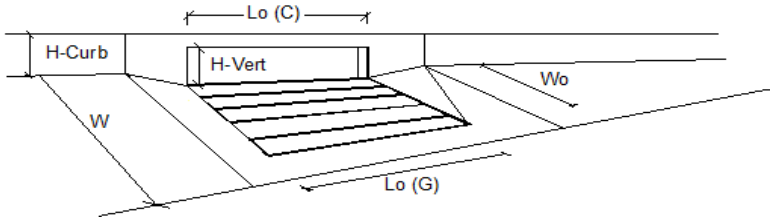
		Minor Storm	Major Storm	
	Q_{allow} =	10.9	22.6	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 7.00 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 14.90 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	7.0	11.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	3.2	cfs
Capture Percentage = Q_a/Q_o	C% =	99	78	%

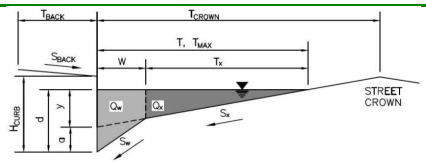
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Inlet DP21



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

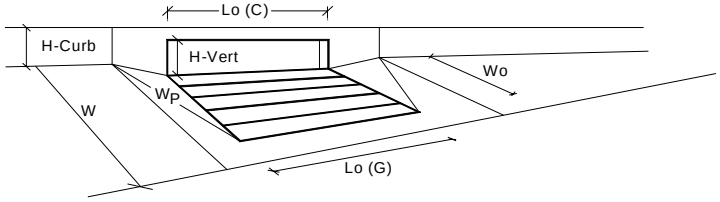
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	7.3	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.44	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.76	0.86	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	6.5	13.1	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.8	12.6	cfs

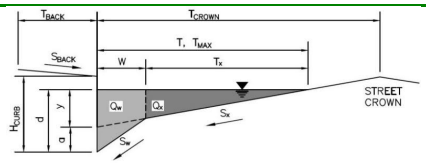
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Inlet DP22



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

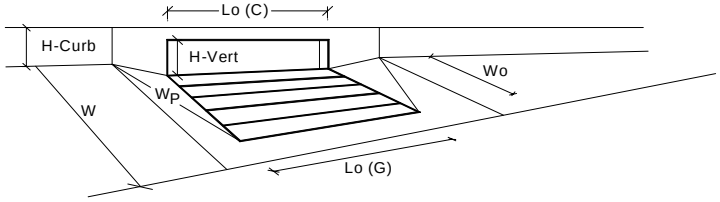
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

		Minor Storm	Major Storm	
	Q_{allow} =	SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)

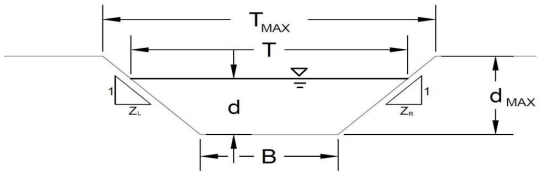


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	8.5	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.54	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.76	0.91	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	6.5	18.9	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	6.3	18.3	cfs

AREA INLET IN A SWALE

Sterling Ranch Filing 4

Inlet DP24



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =	D	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0158	ft/ft
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	5.00	ft/ft
Right Side Sloe	Z2 =	5.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	24.00	24.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	2.00	2.00	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	136.9	136.9	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	2.00	2.00	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	2.2	9.2	cfs
Water Depth	d =	0.55	0.81	ft

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

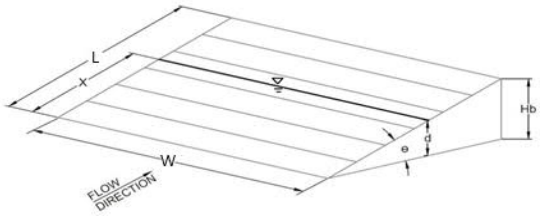
AREA INLET IN A SWALE

Sterling Ranch Filing 4

Inlet DP24

Inlet Design Information (Input)

Type of Inlet: CDOT Type C — Inlet Type = CDOT Type C



Angle of Inclined Grade (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	ft
Length of Grate	L =	3.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.55	0.81	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	7.6	13.5	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

Warning 03: Velocity exceeds USDCM Volume I recommendation.
Warning 04: Froude No. exceeds USDCM Volume I recommendation.

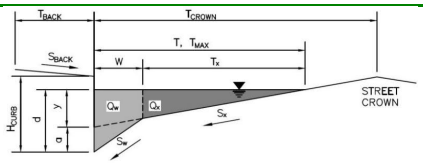
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Ex Inlet DPe10



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.014	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

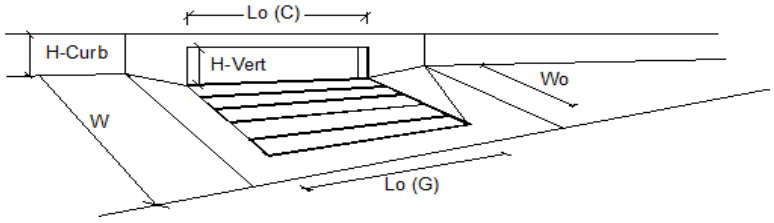
		Minor Storm	Major Storm	
	Q_{allow} =	16.3	27.4	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 9.20 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 17.30 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	8.6	12.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.6	4.6	cfs
Capture Percentage = Q_a/Q_o	C% =	94	74	%

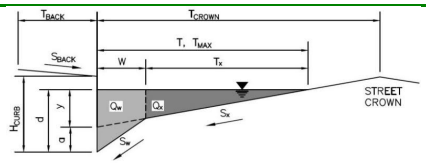
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Ex Inlet DPe11



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.014	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

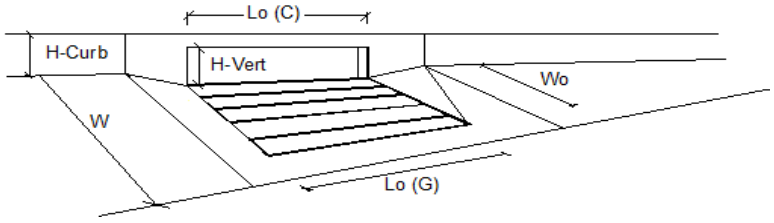
	Minor Storm	Major Storm	
Q_{allow} =	16.3	16.3	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 9.50 cfs on sheet 'Inlet Management'

WARNING: MAJOR STORM max. allowable capacity is less than the design peak flow of 19.90 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	
Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	8.8	13.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.7	6.2	cfs
Capture Percentage = Q_a/Q_o	C% =	93	69	%

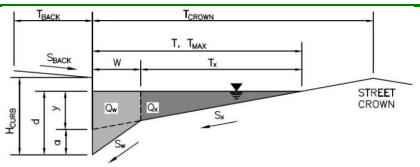
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Inlet DP1e



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.041	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

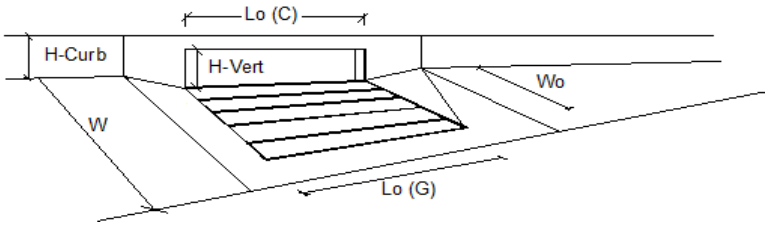
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	16.2	16.2	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.00 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 10.90 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	4.0	9.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	1.1	cfs
Capture Percentage = Q_a/Q_o	C% =	100	90	%

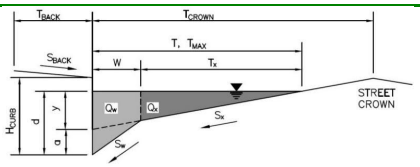
MHFD-Inlet, Version 5.02 (August 2022)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Sterling Ranch Filing 4

Inlet ID: Inlet DP2e



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.037	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

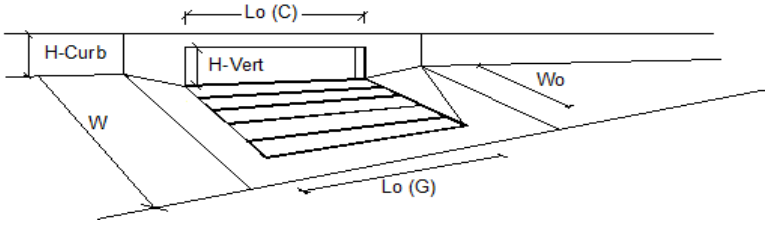
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	16.7	16.7	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 4.00 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 13.00 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



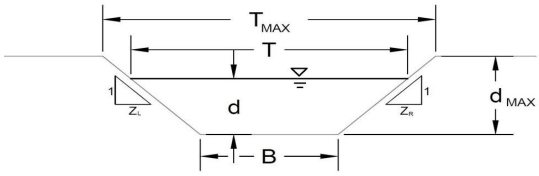
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	4.0	10.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	2.1	cfs
Capture Percentage = Q_a/Q_o	C% =	100	84	%

AREA INLET IN A SWALE

Sterling Ranch Filing 4

Inlet DP25



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =	D	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0080	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	10.00	ft/ft
Right Side Sloe	Z2 =	20.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- ○ **Non-Cohesive**
- ◉ **Cohesive**
- ○ **Paved**

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	24.00	24.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	2.00	2.00	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	5.8	5.8	cfs
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	0.80	0.80	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	1.0	4.8	cfs
Water Depth	d =	0.50	0.76	ft

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

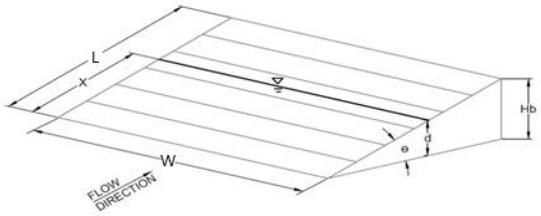
AREA INLET IN A SWALE

Sterling Ranch Filing 4

Inlet DP25

Inlet Design Information (Input)

Type of Inlet: CDOT Type C — Inlet Type = CDOT Type C



Angle of Inclined Grade (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grade	W =	3.00	ft
Length of Grade	L =	3.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grade	H_B =	0.00	ft
Clogging Factor	C_f =	0.50	
Grade Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.50	0.76	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	6.6	12.3	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

Warning 03: Velocity exceeds USDCM Volume I recommendation.
Warning 04: Froude No. exceeds USDCM Volume I recommendation.

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jan 19 2023

Barbrarick FSD Overflow Channel Section A-A

Trapezoidal

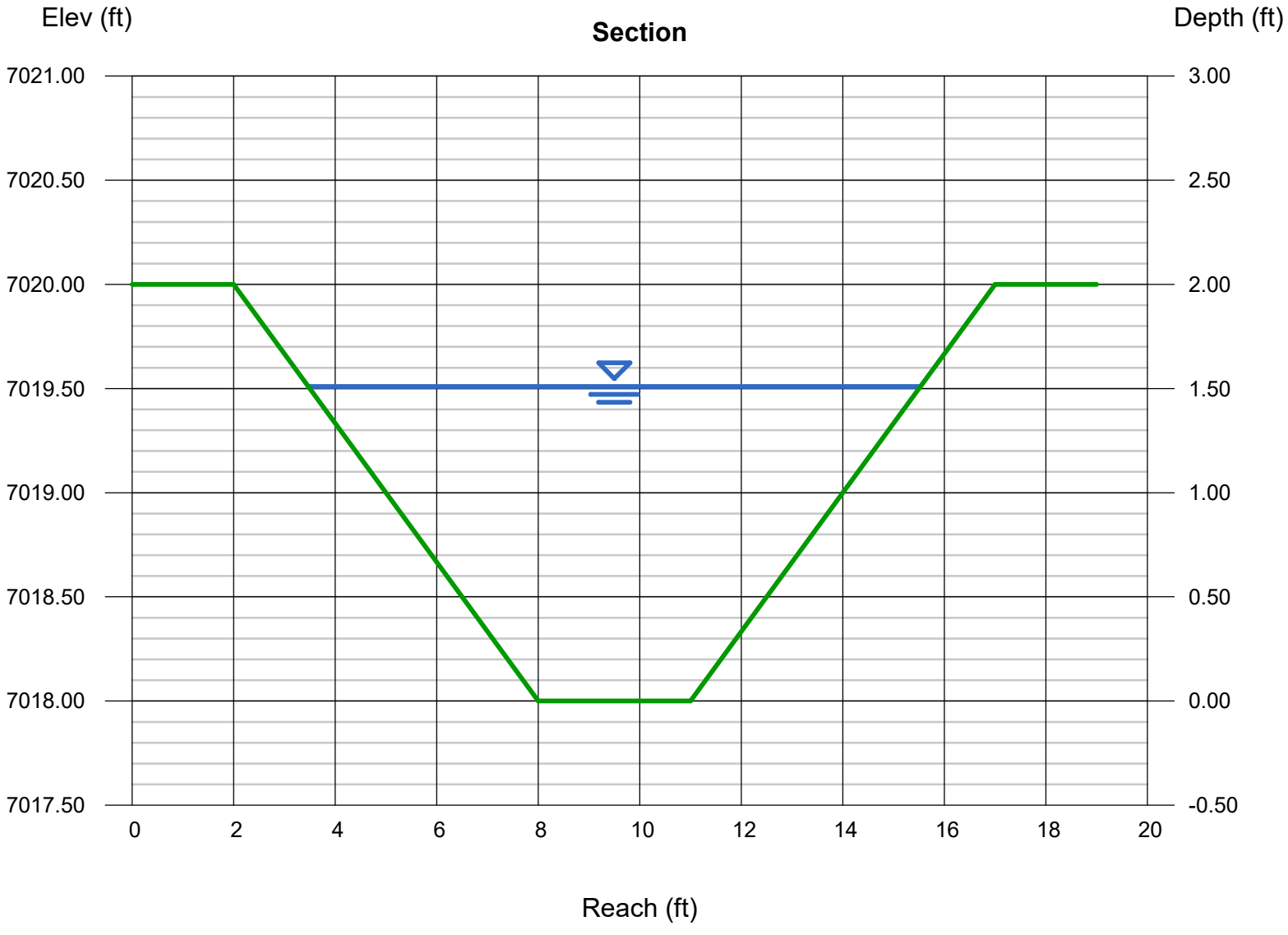
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7018.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 85.40

Highlighted

Depth (ft)	= 1.51
Q (cfs)	= 85.40
Area (sqft)	= 11.37
Velocity (ft/s)	= 7.51
Wetted Perim (ft)	= 12.55
Crit Depth, Yc (ft)	= 1.76
Top Width (ft)	= 12.06
EGL (ft)	= 2.39



PIPE OUTFALL RIPRAP SIZING CALCULATIONS

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

Project Name: Sterling Ranch Filing No. 4
Project No.: 25188.11
Calculated By: ARJ
Checked By: APL
Date: 4/4/23

	STORM DRAIN SYSTEM			
	Barbarick Overflow		DESIGN POINT	Notes
Q_{100} (cfs):	85.4			Flows are the greater of proposed vs. future (Detained)
Conduit	Box Culvert			
D_c, Pipe Diameter (in):	N/A			
W, Box Width (ft):	3			
H, Box Height (ft):	3			
Y_t, Tailwater Depth (ft):	1.51			If unknown, use Y_t/D_c (or H)=0.4
Y_t/Dc or Y_t/H	0.50			
$Q/D^{2.5}$ or $Q/(WH^{3/2})$	5.48			
Supercritical?	Yes			
Y_n, Normal Depth (ft) [Supercritical]:	1.00			
D_a, H_a (in) [Supercritical]:	2.00			$D_a=(D_c+Y_n)/2$
Riprap d_{50} (in) [Supercritical]:	4.48			
Riprap d_{50} (in) [Subcritical]:	N/A			
Required Riprap Size:	L			Fig. 9-38 or Fig. 9-36
d_{50} (in):	9			
Expansion Factor, $1/(2\tan\theta)$:	6.00			Read from Fig. 9-35 or 9-36
θ:	0.08			
Erosive Soils?	No			
Area of Flow, A_t (ft^2):	12.20			$A_t=Q/V$
Length of Protection, L_p (ft):	30.5			L=(1/(2 tan θ))(At/Yt - D)
Min Length (ft)	9.0			Min L=3D or 3H
Max Length (ft)	30.0			Max L=10D or 10H
Min Bottom Width, T (ft):	8.1			$T=2*(L_p*\tan\theta)+W$
Design Length (ft)	30.0			
Design Width (ft)	8.1			
Riprap Depth (in)	18			Depth=2(d_{50})
Type II Bedding Depth (in)*	6			*Not used if Soil Riprap
Cutoff Wall	Yes			
Cutoff Wall Depth (ft)	24.0			Depth of Riprap and Base
Cutoff Wall Width (ft)	#N/A			

Note: No Type II Base to be used if Soil Riprap is specified within the plans

* For use when the flow in the culvert is supercritical (and less than full).

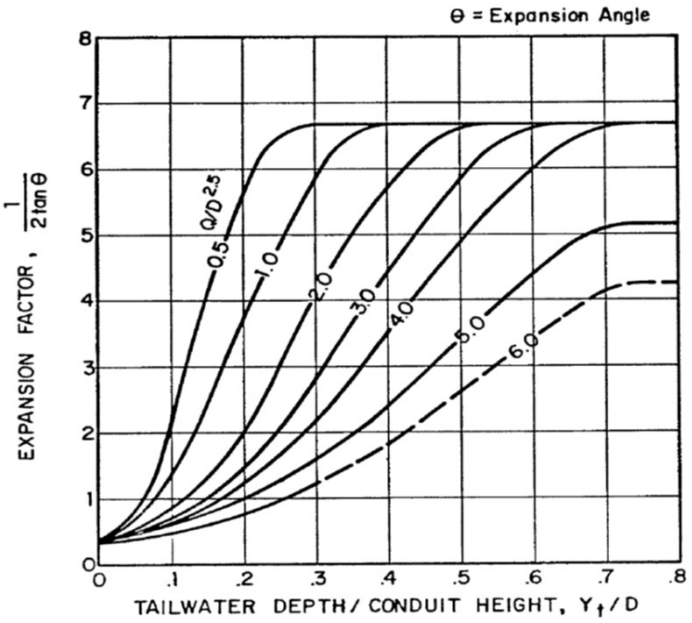


Figure 9-35. Expansion factor for circular conduits

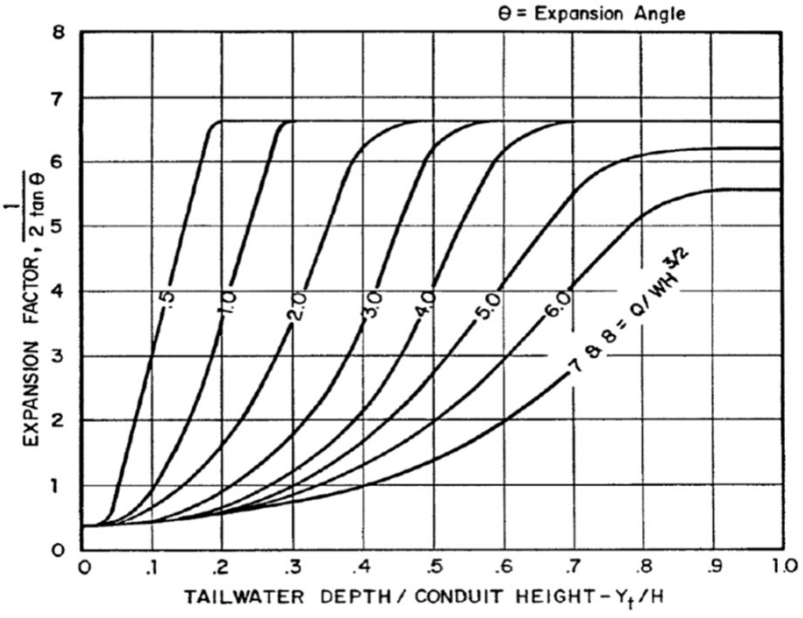


Figure 9-36. Expansion factor for rectangular conduits

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jan 20 2023

Swale Section Point 2.i -Section BB

Trapezoidal

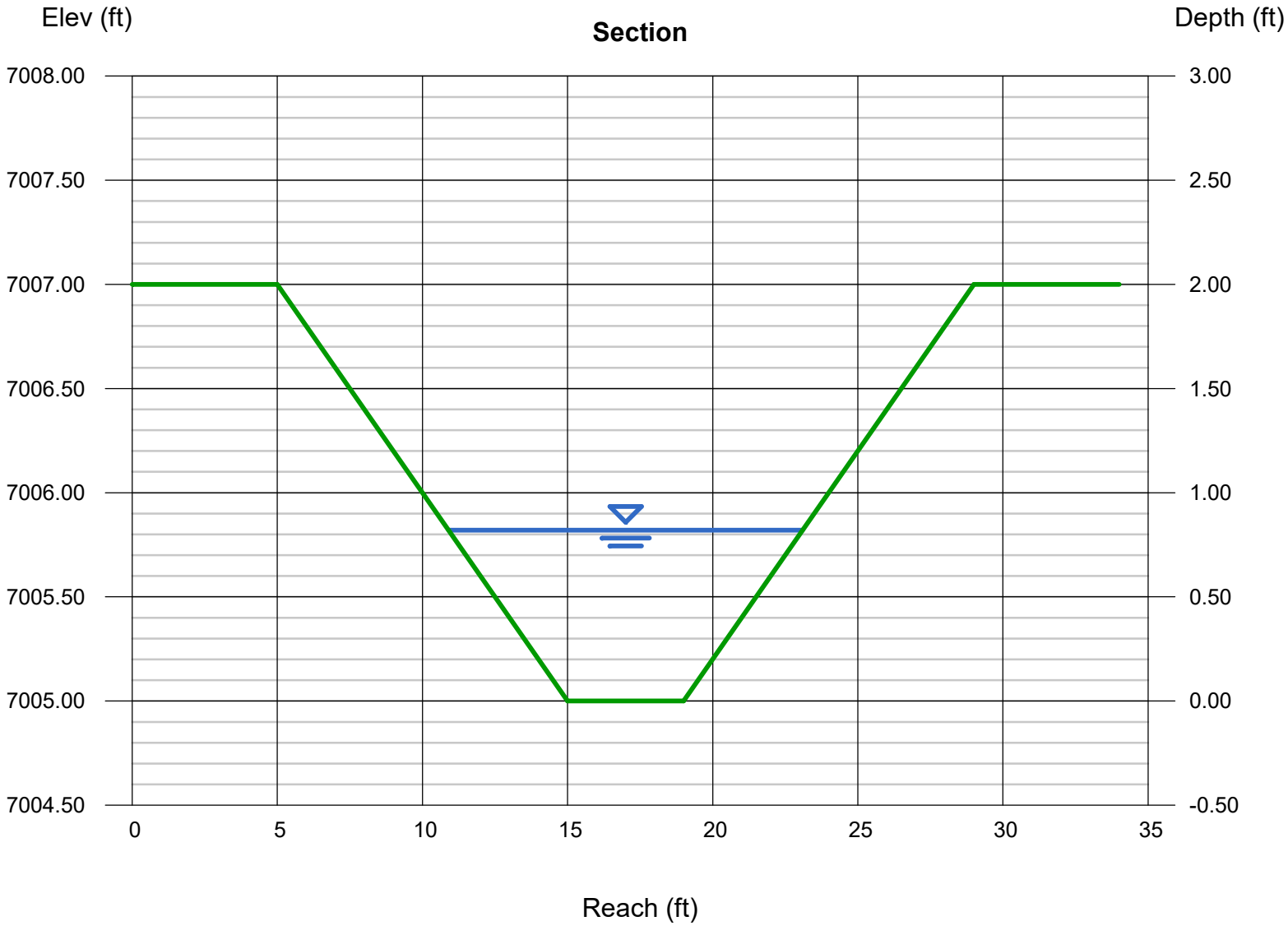
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 5.00, 5.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7005.00
Slope (%)	= 2.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 25.70

Highlighted

Depth (ft)	= 0.82
Q (cfs)	= 25.70
Area (sqft)	= 6.64
Velocity (ft/s)	= 3.87
Wetted Perim (ft)	= 12.36
Crit Depth, Yc (ft)	= 0.79
Top Width (ft)	= 12.20
EGL (ft)	= 1.05



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Apr 27 2023

Swale Section Point 7- Section CC

Triangular

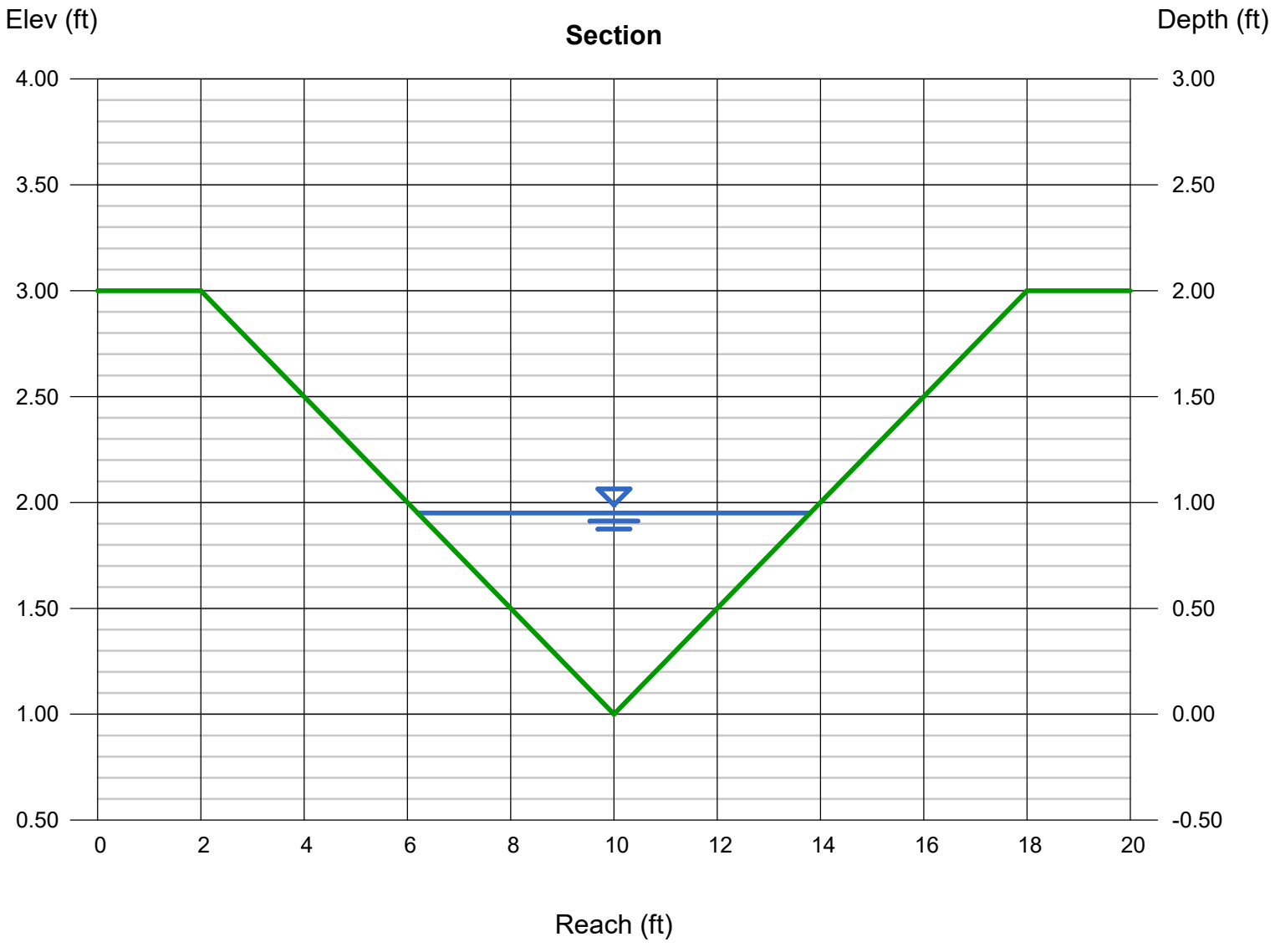
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 2.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 12.80

Highlighted

Depth (ft)	= 0.95
Q (cfs)	= 12.80
Area (sqft)	= 3.61
Velocity (ft/s)	= 3.55
Wetted Perim (ft)	= 7.83
Crit Depth, Yc (ft)	= 0.92
Top Width (ft)	= 7.60
EGL (ft)	= 1.15



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Nov 16 2022

Swale Section Point 24 -Section DD

Trapezoidal

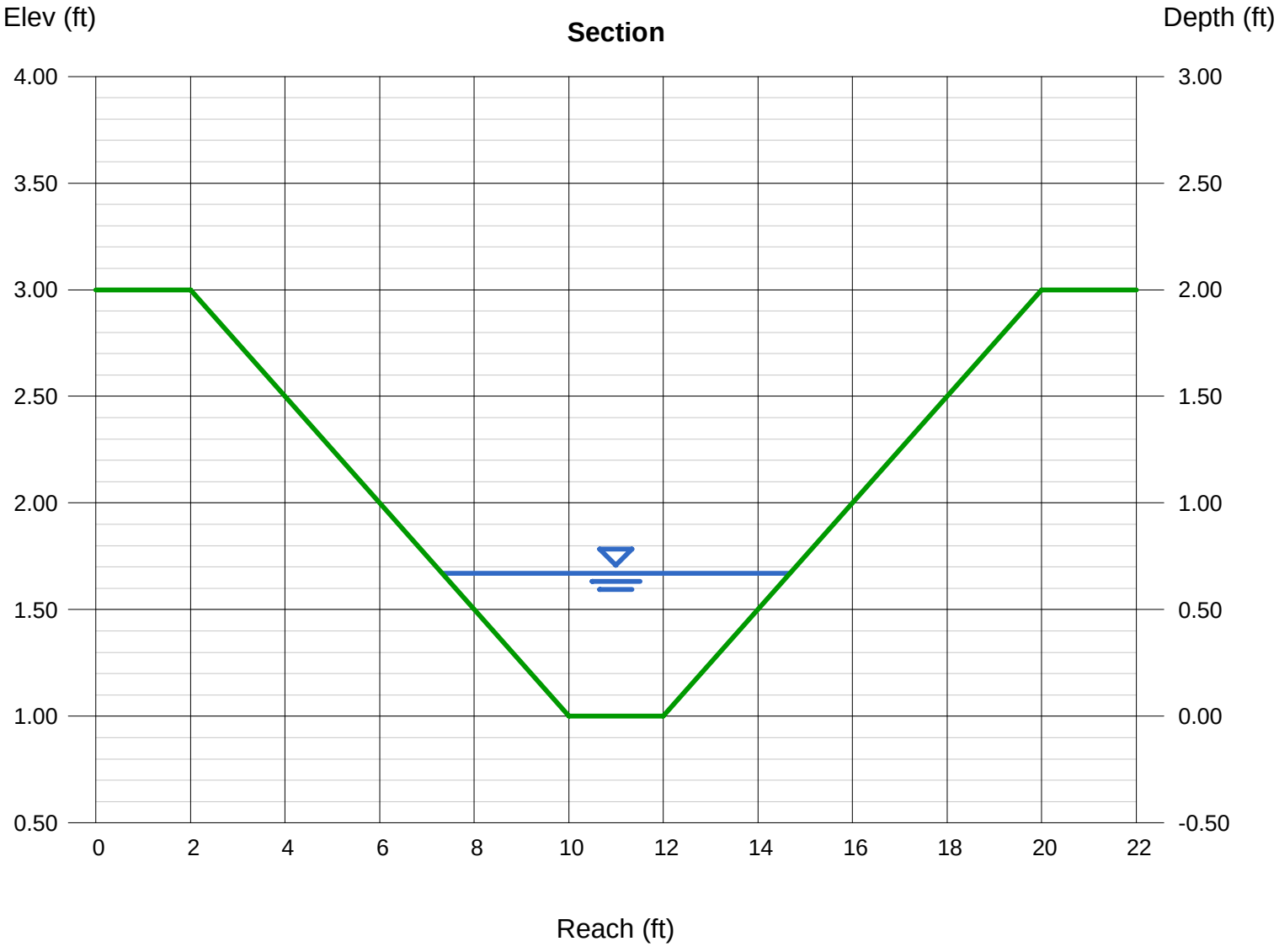
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 1.00
Slope (%)	= 1.59
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 9.20

Highlighted

Depth (ft)	= 0.67
Q (cfs)	= 9.200
Area (sqft)	= 3.14
Velocity (ft/s)	= 2.93
Wetted Perim (ft)	= 7.52
Crit Depth, Yc (ft)	= 0.60
Top Width (ft)	= 7.36
EGL (ft)	= 0.80



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 17 2022

Swale Section Point 3.i -Section EE

Trapezoidal

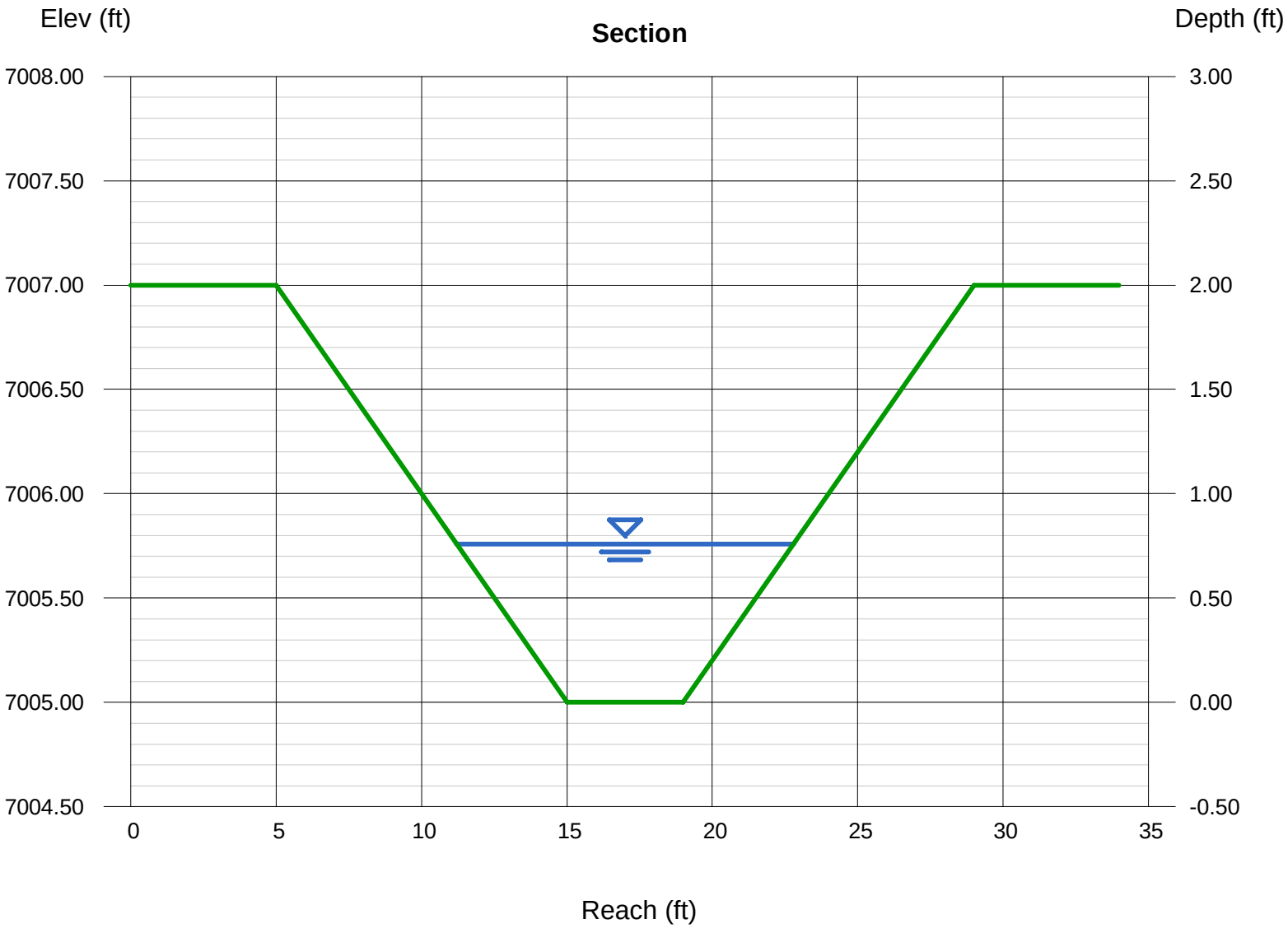
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 5.00, 5.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7005.00
Slope (%)	= 1.50
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 19.40

Highlighted

Depth (ft)	= 0.76
Q (cfs)	= 19.40
Area (sqft)	= 5.93
Velocity (ft/s)	= 3.27
Wetted Perim (ft)	= 11.75
Crit Depth, Yc (ft)	= 0.68
Top Width (ft)	= 11.60
EGL (ft)	= 0.93



Froude Number Calculation's

Sterling Ranch Filing No.4

Froude Number Equation:

$$Fr = \frac{v}{(gh_m)^{1/2}}$$

Where: v= velocity (ft/s)

g= acceleration of gravity (32.2ft/s^2)

h_m=hydraulic mean depth (ft)

Hydraulic Mean Depth Equation:

$$h_m = \frac{A}{T}$$

Where: A= cross sectional area of filled flow in channel (ft^2)

T= width of channel open to surface (ft)

Inlet DP2.i Swale Section BB Calculations:

Parameters: A= 6.64 ft^2 , T= 12.20 ft, v= 3.87ft/s

There for: $h_m = \frac{6.64}{12.2} = 0.54\ ft$

$$Fr = \frac{3.87}{(32.2*0.54)^{1/2}} = 0.92$$

For cohesive soils maximum Froude Number is 0.80.

Type L Soil Riprap used for this swale.

Inlet DP7 Swale Section CC Calculations:

Parameters: A= 3.048 ft^2 , T= 7.04 ft, v= 4.13 ft/s

There for: $h_m = \frac{3.08}{7.04} = 0.44\ ft$

$$Fr = \frac{4.13}{(32.2*0.44)^{1/2}} = 1.09$$

For cohesive soils maximum Froude Number is 0.80.

Type VL Soil Riprap used for this swale

Inlet DP 24 Swale Section DD Calculations:

Parameters: A= 3.14 ft^2 , T= 7.36 ft, v= 2.93 ft/s

There for: $$h_m = \frac{3.14}{7.36} = 0.42\ ft$$

$$Fr = \frac{2.93}{(32.2*0.42)^{1/2}} = 0.79$$

For cohesive soils maximum Froude Number is 0.80.

Inlet DP 3.i Swale Section EE Calculations:

Parameters: A= 5.92 ft^2 , T= 11.60 ft, v= 3.27 ft/s

There for: $$h_m = \frac{5.92}{11.60} = 0.51\ ft$$

$$Fr = \frac{3.27}{(32.2*0.51)^{1/2}} = 0.80$$

For cohesive soils maximum Froude Number is 0.80.

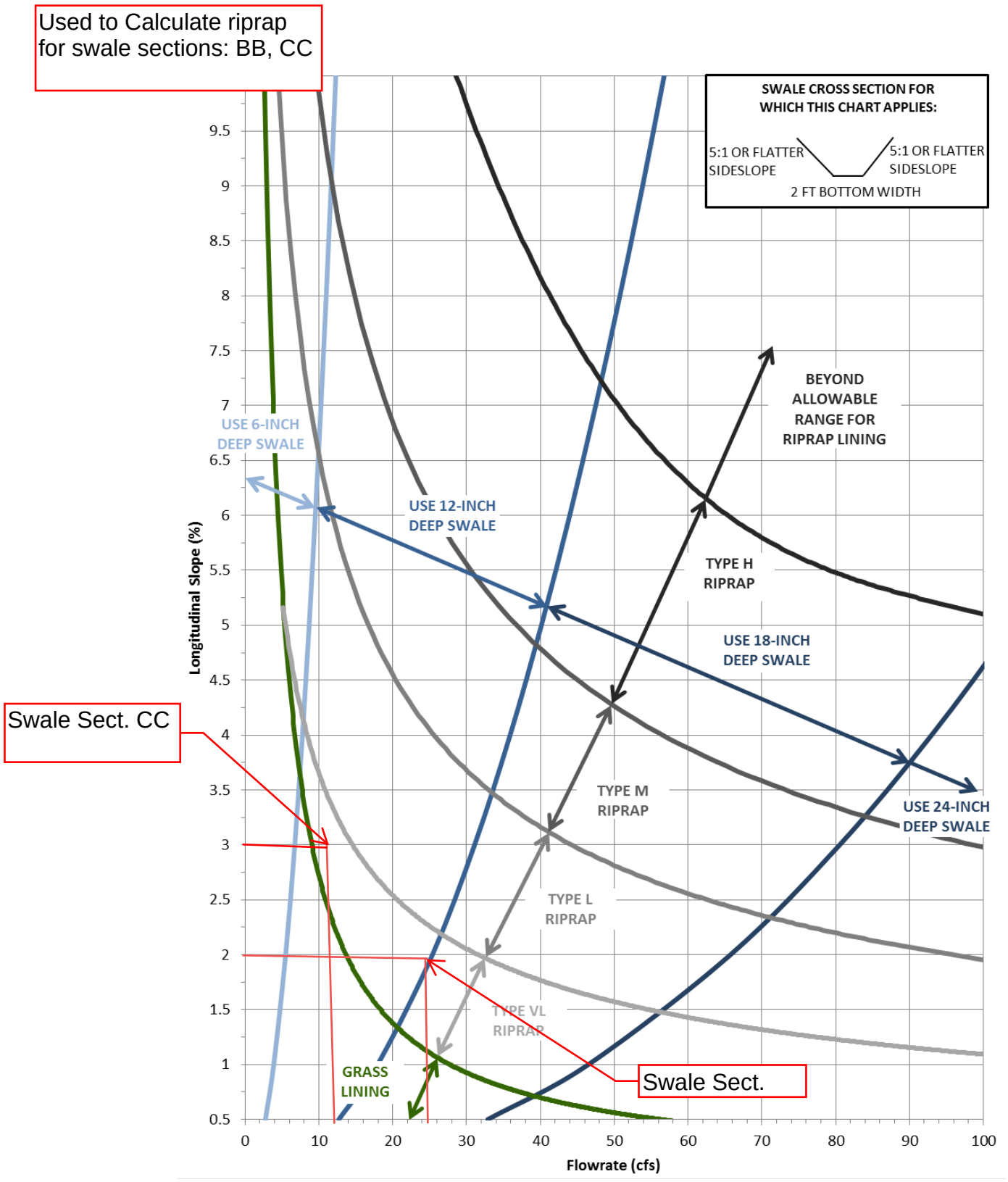
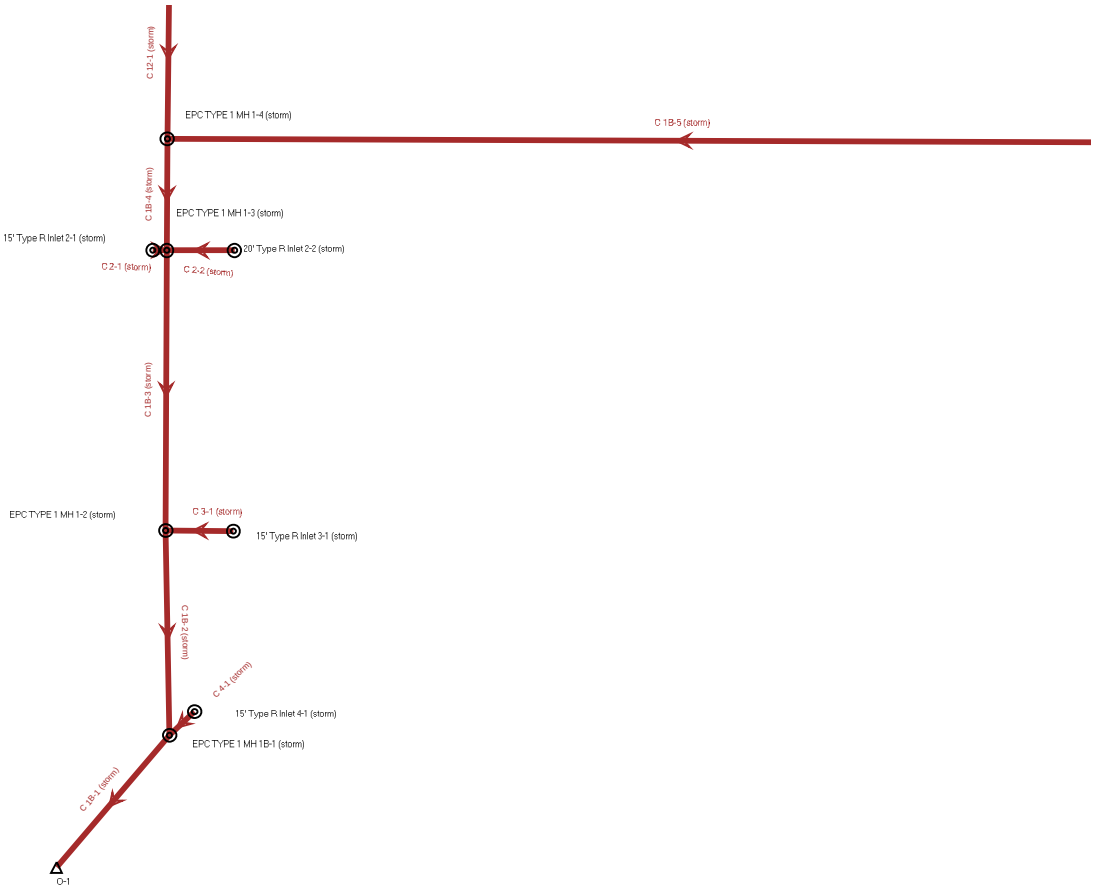
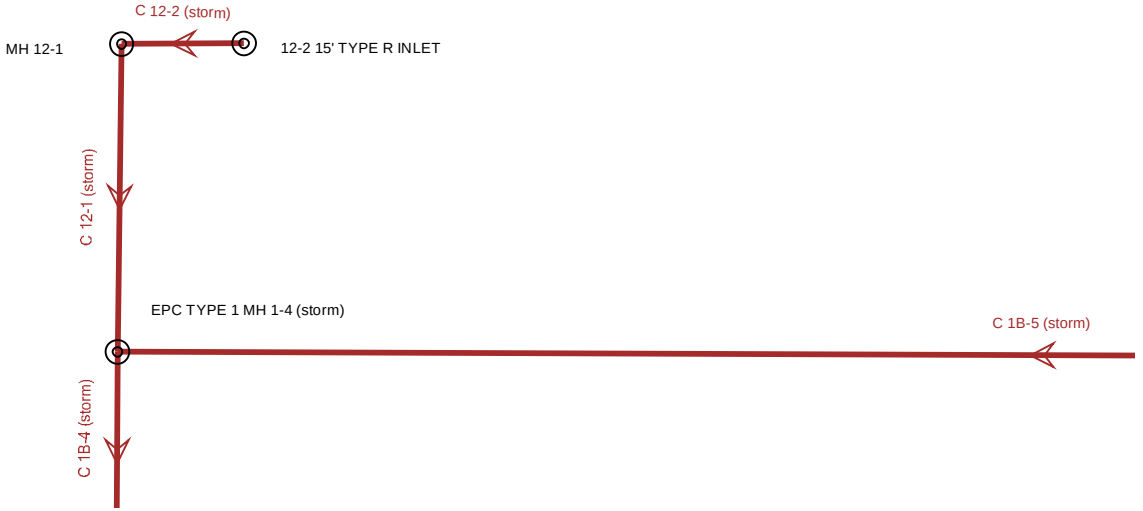


Figure 8-22. Swale stability chart; 2- to 4-foot bottom width and side slopes between 5:1 and 10:1 (Note: Riprap classifications refer to gradation for riprap used in soil riprap or void-filled riprap. See Figure 8-34 for gradations.) (Source: Muller Engineering Company)

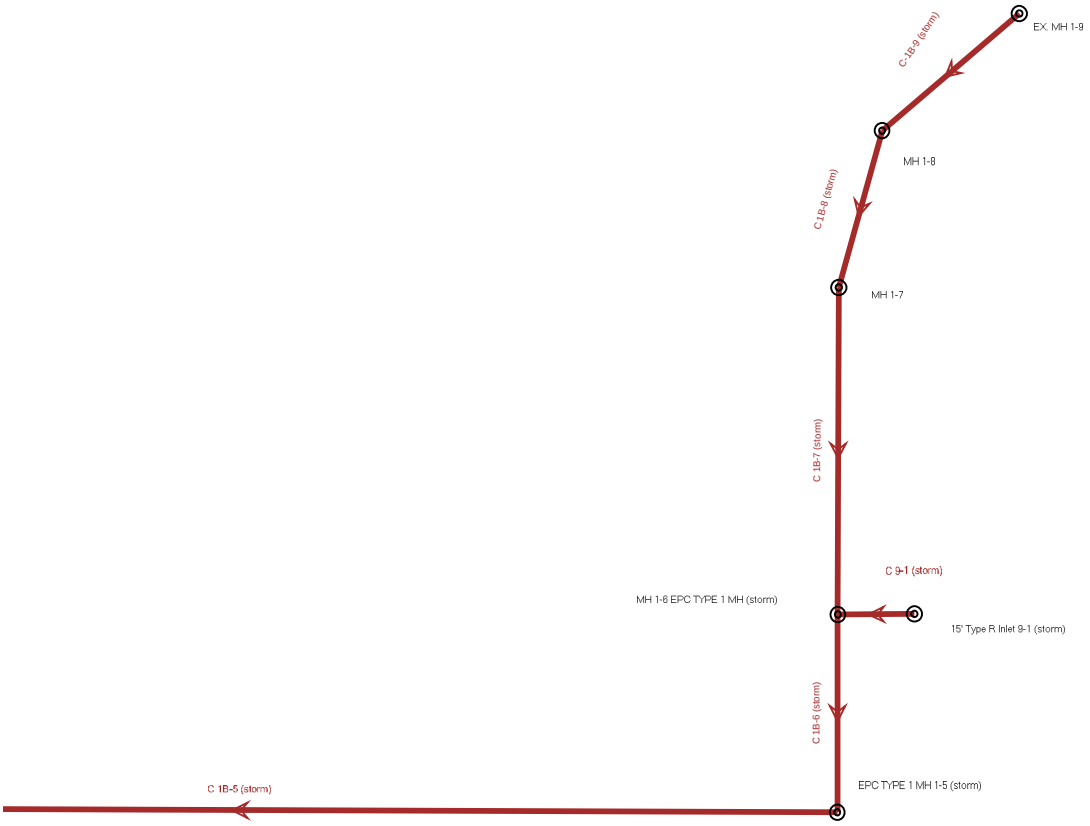
Scenario: Sterling Ranch Fil. No. 4 -100 Year



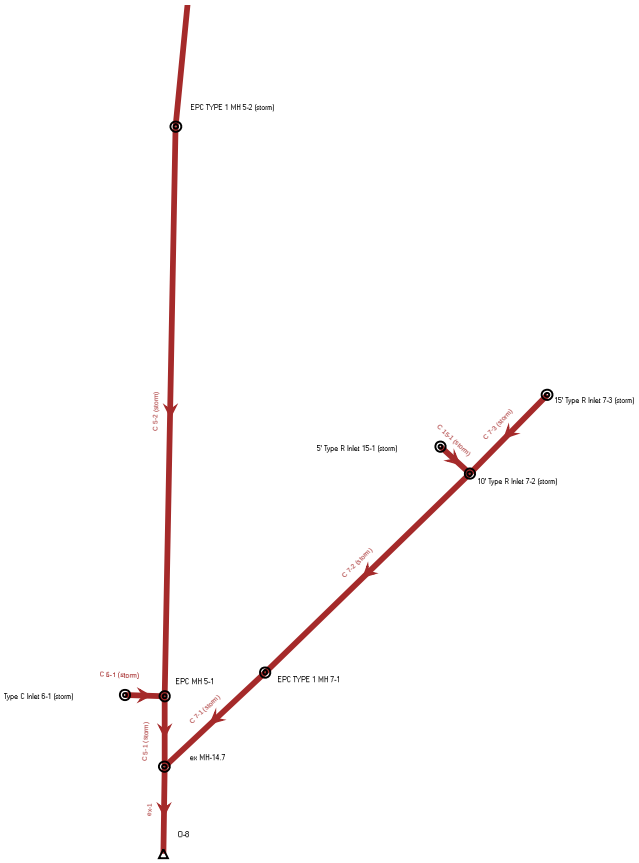
Scenario: Sterling Ranch Fil. No. 4 -100 Year



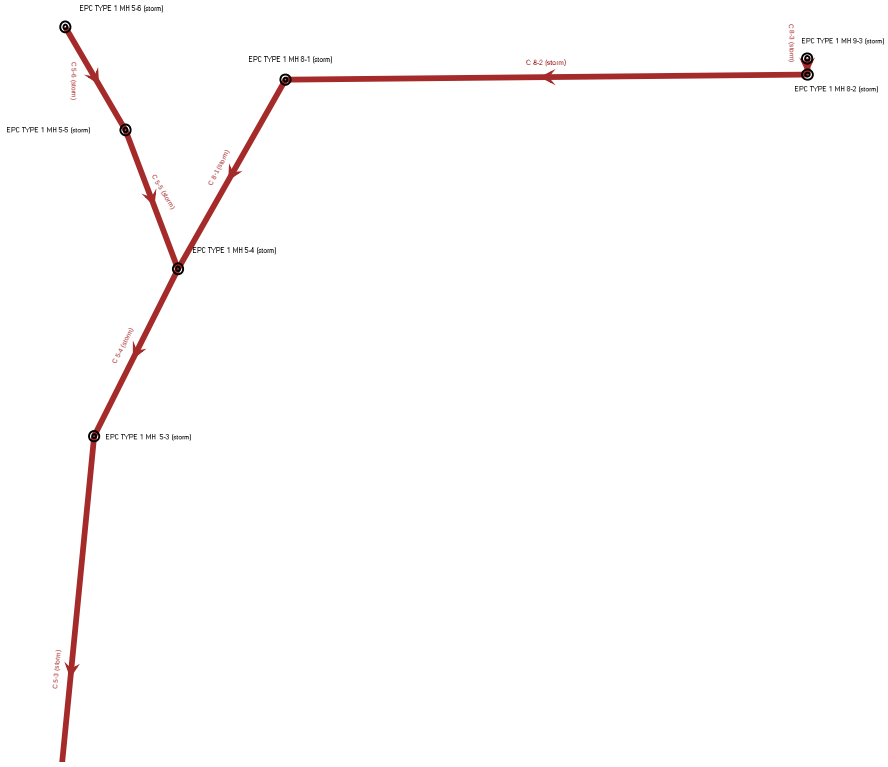
Scenario: Sterling Ranch Fil. No. 4 -5 Year



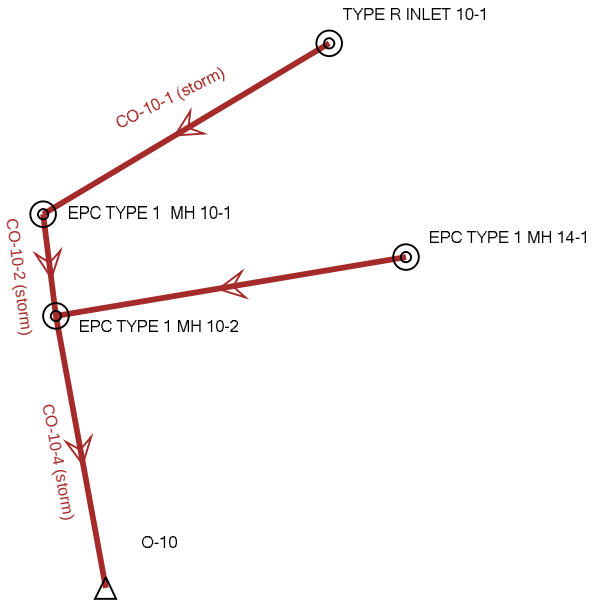
Scenario: Sterling Ranch Fil. No. 4 -100 Year



Scenario: Sterling Ranch Fil. No. 4 -100 Year

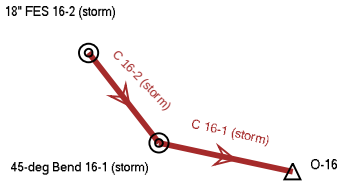


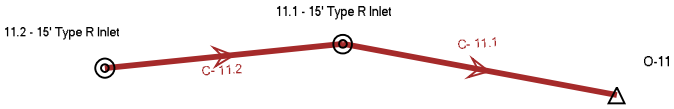
Scenario: Sterling Ranch Fil. No. 4 -100 Year



Scenario: Sterling Ranch Fil. No. 4 -100 Year

Scenario: Sterling Ranch Fil. No. 4 -5 Year





Scenario: Sterling Ranch Fil. No. 4 -5 Year
Current Time Step: 0.000 h
Conduit FlexTable: Combined Pipe/Node Report

Upstream Structure	Label	Flow (cfs)	Capacity (Full Flow) (cfs)	Diameter (in)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	HGL (In) (ft)	HGL (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Velocity (ft/s)	Manning's n	Upstream Structure Headloss Coefficient
EPC TYPE 1 MH 1B-1 (storm)	C 1B-1 (storm)	47.40	64.87	42.0	74.8	0.004	6,970.28	6,969.97	6,979.57	6,973.84	6,972.50	6,972.12	6,973.34	6,973.03	7.36	0.013	0.400
EPC TYPE 1 MH 1-2 (storm)	C 1B-2 (storm)	42.50	71.03	42.0	92.3	0.005	6,971.04	6,970.58	6,979.46	6,979.57	6,973.07	6,972.84	6,973.91	6,973.49	7.71	0.013	0.400
EPC TYPE 1 MH 1-3 (storm)	C 1B-3 (storm)	39.60	71.06	42.0	124.3	0.005	6,971.96	6,971.34	6,980.54	6,979.46	6,973.92	6,973.41	6,974.71	6,974.10	7.59	0.013	0.400
EPC TYPE 1 MH 1-4 (storm)	C 1B-4 (storm)	29.20	70.49	42.0	46.8	0.005	6,972.49	6,972.26	6,981.10	6,980.54	6,974.16	6,974.24	6,974.81	6,974.66	6.98	0.013	0.500
EPC TYPE 1 MH 1-5 (storm)	C 1B-5 (storm)	22.80	84.88	36.0	470.1	0.016	6,981.88	6,974.27	6,988.70	6,981.10	6,983.42	6,975.33	6,984.03	6,976.94	10.18	0.013	1.320
MH 1-6 EPC TYPE 1 MH (storm)	C 1B-6 (storm)	22.80	78.19	36.0	76.1	0.014	6,983.13	6,982.08	6,989.81	6,988.70	6,984.67	6,984.22	6,985.27	6,984.50	9.59	0.013	1.020
MH 1-7	C 1B-7 (storm)	21.50	66.66	36.0	110.1	0.010	6,984.53	6,983.43	6,991.32	6,989.81	6,986.02	6,985.29	6,986.60	6,985.63	8.41	0.013	0.400
MH 1-8	C 1B-8 (storm)	21.50	66.65	36.0	72.1	0.010	6,985.55	6,984.83	6,992.17	6,991.32	6,987.04	6,986.03	6,987.63	6,987.06	8.41	0.013	0.400
15' Type R Inlet 2-1 (storm)	C 2-1 (storm)	7.00	24.57	18.0	4.8	0.055	6,976.04	6,975.78	6,980.90	6,980.54	6,977.06	6,976.55	6,977.52	6,977.47	11.98	0.013	0.050
15' Type R Inlet 2-2 (storm)	C 2-2 (storm)	6.40	41.10	24.0	27.0	0.033	6,976.17	6,975.28	6,980.82	6,980.54	6,977.07	6,975.86	6,977.41	6,976.97	9.51	0.013	0.050
15' Type R Inlet 3-1 (storm)	C 3-1 (storm)	3.80	14.48	18.0	28.4	0.019	6,975.13	6,974.59	6,979.81	6,979.46	6,975.88	6,975.14	6,976.17	6,975.80	6.90	0.013	0.050
15' Type R Inlet 4-1 (storm)	C 4-1 (storm)	6.30	14.68	18.0	9.2	0.020	6,972.76	6,972.58	6,979.58	6,979.57	6,973.73	6,973.37	6,974.15	6,974.06	7.99	0.013	0.050
EPC MH 5-1	C 5-1 (storm)	30.00	211.73	48.0	39.7	0.022	6,988.34	6,987.48	6,996.65	6,997.00	6,989.97	6,989.73	6,990.58	6,989.99	11.92	0.013	1.020
EPC TYPE 1 MH 5-2 (storm)	C 5-2 (storm)	29.00	108.21	36.0	321.4	0.026	6,997.80	6,989.34	7,008.13	6,996.65	6,999.54	6,990.40	7,000.26	6,993.02	12.97	0.013	0.500
EPC TYPE 1 MH 5-3 (storm)	C 5-3 (storm)	29.00	92.98	36.0	287.1	0.019	7,003.68	6,998.10	7,016.92	7,008.13	7,005.42	6,999.90	7,006.14	7,000.57	11.62	0.013	0.250
EPC TYPE 1 MH 5-4 (storm)	C 5-4 (storm)	29.00	83.06	36.0	92.2	0.016	7,005.41	7,003.98	7,017.77	7,016.92	7,007.15	7,005.25	7,007.87	7,006.87	10.70	0.013	0.520
EPC TYPE 1 MH 5-5 (storm)	C 5-5 (storm)	22.30	77.85	36.0	102.0	0.014	7,007.10	7,005.71	7,020.52	7,017.77	7,008.62	7,007.53	7,009.22	7,007.91	9.51	0.013	0.050
EPC TYPE 1 MH 5-6 (storm)	C 5-6 (storm)	22.30	185.04	36.0	61.5	0.077	7,012.13	7,007.40	7,022.78	7,020.52	7,013.65	7,008.16	7,014.25	7,012.09	17.68	0.013	0.500
Type C Inlet 6-1 (storm)	C 6-1 (storm)	3.50	10.26	18.0	18.9	0.010	6,990.97	6,990.79	6,995.95	6,996.65	6,991.68	6,991.41	6,991.96	6,991.81	5.26	0.013	0.050
EPC TYPE 1 MH 7-1	C 7-1 (storm)	16.90	81.12	36.0	73.0	0.015	6,989.56	6,988.48	6,999.05	6,997.00	6,990.87	6,989.44	6,991.37	6,990.62	9.07	0.013	0.050
10' Type R Inlet 7-2 (storm)	C 7-2 (storm)	16.90	44.37	36.0	171.7	0.004	6,990.62	6,989.86	7,000.82	6,999.05	6,991.93	6,991.14	6,992.43	6,991.68	5.85	0.013	1.020
15' Type R Inlet 7-3 (storm)	C 7-3 (storm)	12.00	16.19	24.0	60.5	0.005	6,991.93	6,991.62	7,001.62	7,000.82	6,993.21	6,992.86	6,993.71	6,993.39	5.64	0.013	0.050
EPC TYPE 1 MH 8-1 (storm)	C 8-1 (storm)	14.60	103.26	36.0	131.4	0.024	7,008.86	7,005.71	7,021.55	7,017.77	7,010.08	7,007.53	7,010.53	7,007.69	10.33	0.013	0.640
EPC TYPE 1 MH 8-2 (storm)	C 8-2 (storm)	14.60	104.55	36.0	285.7	0.025	7,016.18	7,009.16	7,022.25	7,021.55	7,017.40	7,009.92	7,017.85	7,011.60	10.42	0.013	1.320
EPC TYPE 1 MH 9-3 (storm)	C 8-3 (storm)	14.60	41.01	30.0	12.0	0.010	7,017.30	7,017.18	7,022.41	7,022.25	7,018.59	7,018.31	7,019.10	7,019.02	7.65	0.013	0.500
15' Type R Inlet 9-1 (storm)	C 9-1 (storm)	1.60	14.34	18.0	27.9	0.019	6,985.15	6,984.63	6,990.17	6,989.81	6,985.63	6,985.29	6,985.80	6,985.36	5.36	0.013	0.050
MH 12-1	C 12-1 (storm)	9.10	32.76	24.0	73.9	0.021	6,976.82	6,975.27	6,981.92	6,981.10	6,977.90	6,976.00	6,978.33	6,977.20	8.92	0.013	1.020
12-2 15' TYPE R INLET	C 12-2 (storm)	9.10	26.30	24.0	29.6	0.014	6,977.52	6,977.12	6,982.28	6,981.92	6,978.60	6,978.34	6,979.03	6,978.66	7.61	0.013	1.020
Type C-13-2	C 13-1)Storm)	2.20	9.87	24.0	63.0	0.002	6,972.05	6,971.93	6,980.26	6,976.65	6,972.68	6,972.45	6,972.78	6,972.63	2.53	0.013	0.050
5' Type R Inlet 15-1 (storm)	C 15-1 (storm)	3.90	10.86	18.0	12.2	0.011	6,992.25	6,992.12	7,000.89	7,000.82	6,993.01	6,992.77	6,993.30	6,993.21	5.64	0.013	0.050
45-deg Bend 16-1 (storm)	C 16-1 (storm)	1.00	21.54	18.0	25.7	0.042	6,972.62	6,971.54	6,978.69	6,979.03	6,972.99	6,971.76	6,973.13	6,972.36	6.21	0.013	0.400
18" FES 16-2 (storm)	C 16-2 (storm)	1.00	21.75	18.0	35.9	0.043	6,974.16	6,972.62	6,974.16	6,978.69	6,974.53	6,973.05	6,974.67	6,973.14	6.26	0.013	0.050
11.1 - 15' Type R Inlet	C- 11.1	8.00	34.75	24.0	91.1	0.024	6,967.49	6,965.34	6,973.29	6,969.71	6,968.50	6,968.27	6,968.89	6,968.37	8.99	0.013	0.250
11.2 - 15' Type R Inlet	C- 11.2	4.00	8.71	18.0	75.7	0.007	6,968.51	6,967.99	6,973.29	6,973.29	6,969.28	6,968.70	6,969.58	6,969.07	4.82	0.013	1.000
EX. MH 1-9	C-1B-9 (storm)	21.50	100.93	36.0	96.5	0.023	6,988.06	6,985.85	6,994.07	6,992.17	6,989.55	6,986.82	6,990.13	6,988.67	11.35	0.013	0.400
TYPE R INLET 10-1	CO-10-1 (storm)	11.60	31.77	24.0	64.9	0.020	7,005.73	7,004.45	7,005.77	7,011.29	7,006.95	7,005.87	7,007.47	7,006.24	9.32	0.013	0.050
EPC TYPE 1 MH 10-1	CO-10-2 (storm)	11.60	32.06	24.0	43.8	0.020	7,004.13	7,003.25	7,011.29	7,010.44	7,005.35	7,004.13	7,005.87	7,005.31	9.38	0.013	1.000
EPC TYPE 1 MH 14-1	CO-10-3 (storm)	7.10	23.94	18.0	82.0	0.052	7,008.01	7,003.75	7,008.00	7,010.44	7,009.04	7,004.31	7,009.51	7,006.48	11.81	0.013	0.050
EPC TYPE 1 MH 10-2	CO-10-4 (storm)	16.90	94.22	36.0	121.8	0.020	7,002.25	6,999.82	7,010.44	7,010.00	7,003.56	7,000.68	7,004.06	7,002.26	10.09	0.013	1.320
ex MH-14.7	ex-1	39.80	190.20	48.0	57.6	0.018	6,987.48	6,986.47	6,997.00	6,990.00	6,989.36	6,987.83	6,990.09	6,989.56	11.97	0.013	0.500

Scenario: Sterling Ranch Fil. No. 4 -100 Year
Current Time Step: 0.000 h
Conduit FlexTable: Combined Pipe/Node Report

Upstream Structure	Label	Flow (cfs)	Capacity (Full Flow) (cfs)	Diameter (in)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	HGL (In) (ft)	HGL (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Velocity (ft/s)	Manning's n	Upstream Structure Headloss Coefficient
EPC TYPE 1 MH 1B-1 (storm)	C 1B-1 (storm)	106.20	64.87	42.0	74.8	0.004	6,970.28	6,969.97	6,979.57	6,973.84	6,976.10	6,975.27	6,978.00	6,977.16	11.04	0.013	0.400
EPC TYPE 1 MH 1-2 (storm)	C 1B-2 (storm)	91.30	71.03	42.0	92.3	0.005	6,971.04	6,970.58	6,979.46	6,979.57	6,977.62	6,976.86	6,979.02	6,978.26	9.49	0.013	0.400
EPC TYPE 1 MH 1-3 (storm)	C 1B-3 (storm)	81.40	71.06	42.0	124.3	0.005	6,971.96	6,971.34	6,980.54	6,979.46	6,978.99	6,978.18	6,980.11	6,979.29	8.46	0.013	0.400
EPC TYPE 1 MH 1-4 (storm)	C 1B-4 (storm)	62.00	70.49	42.0	46.8	0.005	6,972.49	6,972.26	6,981.10	6,980.54	6,979.62	6,979.44	6,980.26	6,980.08	6.44	0.013	0.500
EPC TYPE 1 MH 1-5 (storm)	C 1B-5 (storm)	52.20	84.88	36.0	470.1	0.016	6,981.88	6,974.27	6,988.70	6,981.10	6,984.23	6,979.94	6,985.43	6,980.79	12.62	0.013	1.320
MH 1-6 EPC TYPE 1 MH (storm)	C 1B-6 (storm)	52.20	78.19	36.0	76.1	0.014	6,983.13	6,982.08	6,989.81	6,988.70	6,986.29	6,985.82	6,987.13	6,986.67	7.38	0.013	1.020
MH 1-7	C 1B-7 (storm)	44.90	66.66	36.0	110.1	0.010	6,984.53	6,983.43	6,991.32	6,989.81	6,987.65	6,987.15	6,988.28	6,987.78	6.35	0.013	0.400
MH 1-8	C 1B-8 (storm)	44.90	66.65	36.0	72.1	0.010	6,985.55	6,984.83	6,992.17	6,991.32	6,988.03	6,987.90	6,988.83	6,988.53	10.12	0.013	0.400
15' Type R Inlet 2-1 (storm)	C 2-1 (storm)	11.70	24.57	18.0	4.8	0.055	6,976.04	6,975.78	6,980.90	6,980.54	6,979.50	6,979.44	6,980.18	6,980.12	6.62	0.013	0.050
15' Type R Inlet 2-2 (storm)	C 2-2 (storm)	12.90	41.10	24.0	27.0	0.033	6,976.17	6,975.28	6,980.82	6,980.54	6,979.53	6,979.44	6,979.79	6,979.70	4.11	0.013	0.050
15' Type R Inlet 3-1 (storm)	C 3-1 (storm)	12.60	14.48	18.0	28.4	0.019	6,975.13	6,974.59	6,979.81	6,979.46	6,978.59	6,978.18	6,979.38	6,978.97	7.13	0.013	0.050
15' Type R Inlet 4-1 (storm)	C 4-1 (storm)	18.30	14.68	18.0	9.2	0.020	6,972.76	6,972.58	6,979.58	6,979.57	6,977.14	6,976.86	6,978.81	6,978.53	10.36	0.013	0.050
EPC MH 5-1	C 5-1 (storm)	93.50	211.73	48.0	39.7	0.022	6,988.34	6,987.48	6,996.65	6,997.00	6,991.27	6,991.58	6,992.67	6,992.44	16.32	0.013	0.600
EPC TYPE 1 MH 5-2 (storm)	C 5-2 (storm)	88.70	108.21	36.0	321.4	0.026	6,997.80	6,989.34	7,008.13	6,996.65	7,000.64	6,991.41	7,003.19	6,995.94	17.08	0.013	0.500
EPC TYPE 1 MH 5-3 (storm)	C 5-3 (storm)	88.70	92.98	36.0	287.1	0.019	7,003.68	6,998.10	7,016.92	7,008.13	7,006.99	7,001.91	7,009.44	7,004.36	12.55	0.013	0.250
EPC TYPE 1 MH 5-4 (storm)	C 5-4 (storm)	88.70	83.06	36.0	92.2	0.016	7,005.41	7,003.98	7,017.77	7,016.92	7,009.23	7,007.60	7,011.68	7,010.05	12.55	0.013	0.900
EPC TYPE 1 MH 5-5 (storm)	C 5-5 (storm)	55.60	77.85	36.0	102.0	0.014	7,007.10	7,005.71	7,020.52	7,017.77	7,012.15	7,011.44	7,013.11	7,012.40	7.87	0.013	0.050
EPC TYPE 1 MH 5-6 (storm)	C 5-6 (storm)	55.60	185.04	36.0	61.5	0.077	7,012.13	7,007.40	7,022.78	7,020.52	7,014.55	7,012.19	7,015.84	7,013.16	22.89	0.013	0.500
Type C Inlet 6-1 (storm)	C 6-1 (storm)	12.80	10.26	18.0	18.9	0.010	6,990.97	6,990.79	6,995.95	6,996.65	6,992.49	6,992.13	6,993.30	6,993.05	7.24	0.013	0.500
EPC TYPE 1 MH 7-1	C 7-1 (storm)	35.60	81.12	36.0	73.0	0.015	6,989.56	6,988.48	6,999.05	6,997.00	6,991.50	6,991.58	6,992.34	6,991.97	11.10	0.013	0.050
10' Type R Inlet 7-2 (storm)	C 7-2 (storm)	35.60	44.37	36.0	171.7	0.004	6,990.62	6,989.86	7,000.82	6,999.05	6,992.65	6,991.80	6,993.41	6,992.64	6.98	0.013	0.050
15' Type R Inlet 7-3 (storm)	C 7-3 (storm)	13.50	16.19	24.0	60.5	0.005	6,991.93	6,991.62	7,001.62	7,000.82	6,993.33	6,992.94	6,993.84	6,993.53	5.77	0.013	0.050
EPC TYPE 1 MH 8-1 (storm)	C 8-1 (storm)	52.80	103.26	36.0	131.4	0.024	7,008.86	7,005.71	7,021.55	7,017.77	7,012.26	7,011.44	7,013.13	7,012.30	7.47	0.013	0.640
EPC TYPE 1 MH 8-2 (storm)	C 8-2 (storm)	52.80	104.55	36.0	285.7	0.025	7,016.18	7,009.16	7,022.25	7,021.55	7,018.54	7,012.82	7,019.76	7,013.68	14.83	0.013	1.320
EPC TYPE 1 MH 9-3 (storm)	C 8-3 (storm)	52.80	41.01	30.0	12.0	0.010	7,017.30	7,017.18	7,022.41	7,022.25	7,020.35	7,020.15	7,022.14	7,021.94	10.76	0.013	0.500
15' Type R Inlet 9-1 (storm)	C 9-1 (storm)	7.70	14.34	18.0	27.9	0.019	6,985.15	6,984.63	6,990.17	6,989.81	6,987.30	6,987.15	6,987.59	6,987.44	4.36	0.013	0.050
MH 12-1	C 12-1 (storm)	13.90	32.76	24.0	73.9	0.021	6,976.82	6,975.27	6,981.92	6,981.10	6,980.22	6,979.94	6,980.52	6,980.24	4.42	0.013	1.020
12-2 15' TYPE R INLET	C 12-2 (storm)	13.90	26.30	24.0	29.6	0.014	6,977.52	6,977.12	6,982.28	6,981.92	6,980.64	6,980.53	6,980.95	6,980.83	4.42	0.013	1.020
Type C-13-2	C 13-1)Storm)	9.10	9.87	24.0	63.0	0.002	6,972.05	6,971.93	6,980.26	6,976.65	6,977.20	6,977.10	6,977.33	6,977.23	2.90	0.013	0.050
5' Type R Inlet 15-1 (storm)	C 15-1 (storm)	9.30	10.86	18.0	12.2	0.011	6,992.25	6,992.12	7,000.89	7,000.82	6,993.43	6,993.22	6,994.03	6,993.92	6.91	0.013	0.050
45-deg Bend 16-1 (storm)	C 16-1 (storm)	5.00	21.54	18.0	25.7	0.042	6,972.62	6,971.54	6,978.69	6,979.03	6,974.85	6,974.79	6,974.97	6,974.91	2.83	0.013	0.400
18" FES 16-2 (storm)	C 16-2 (storm)	5.00	21.75	18.0	35.9	0.043	6,974.16	6,972.62	6,974.16	6,978.69	6,975.02	6,974.90	6,975.37	6,975.02	10.00	0.013	0.050
11.1 - 15' Type R Inlet	C- 11.1	20.70	34.75	24.0	91.1	0.024	6,967.49	6,965.34	6,973.29	6,969.71	6,970.71	6,969.95	6,971.39	6,970.62	6.59	0.013	0.080
11.2 - 15' Type R Inlet	C- 11.2	9.80	8.71	18.0	75.7	0.007	6,968.51	6,967.99	6,973.29	6,973.29	6,971.43	6,970.77	6,971.90	6,971.24	5.55	0.013	0.050
EX. MH 1-9	C-1B-9 (storm)	44.90	100.93	36.0	96.5	0.023	6,988.06	6,985.85	6,994.07	6,992.17	6,990.24	6,988.35	6,991.27	6,989.14	13.86	0.013	0.400
TYPE R INLET 10-1	CO-10-1 (storm)	25.70	31.77	24.0	64.9	0.020	7,005.73	7,004.45	7,005.77	7,011.29	7,007.99	7,007.15	7,009.03	7,008.19	8.18	0.013	0.050
EPC TYPE 1 MH 10-1	CO-10-2 (storm)	25.70	32.06	24.0	43.8	0.020	7,004.13	7,003.25	7,011.29	7,010.44	7,006.11	7,005.55	7,007.15	7,006.59	11.34	0.013	1.000
EPC TYPE 1 MH 14-1	CO-10-3 (storm)	19.40	23.94	18.0	82.0	0.052	7,008.01	7,003.75	7,008.00	7,010.44	7,009.47	7,005.55	7,011.37	7,007.42	15.09	0.013	0.050
EPC TYPE 1 MH 10-2	CO-10-4 (storm)	40.20	94.22	36.0	121.8	0.020	7,002.25	6,999.82	7,010.44	7,010.00	7,004.31	7,002.98	7,005.25	7,003.48	12.80	0.013	1.320
ex MH-14.7	ex-1	114.90	190.20	48.0	57.6	0.018	6,987.48	6,986.47	6,997.00	6,990.00	6,990.71	6,989.03	6,992.45	6,991.88	15.85	0.013	0.500

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: GAG
Company: JR ENGINEERING
Date: April 5, 2023
Project: Sterling Ranch Filing No.4 - Forebay #2
Location: EL PASO COUNTY

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 73.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.730

C) Contributing Watershed Area — Area = 2.150 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.43 in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- (●) Water Quality Capture Volume (WQCV)
- ( ) Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)
V_{DESIGN} = ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$
$V_{DESIGN\ OTHER}$ = 0.052 ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)
$V_{DESIGN\ USER}$ = ac-ft

I) NRCS Hydrologic Soil Groups of Tributary Watershed
i) Percentage of Watershed consisting of Type A Soils — HSG_A = %
ii) Percentage of Watershed consisting of Type B Soils — HSG_B = %
iii) Percentage of Watershed consisting of Type C/D Soils — $HSG_{C/D}$ = %

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
$EURV_{DESIGN}$ = ac-f t

K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)
$EURV_{DESIGN\ USER}$ = ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)
L : W = 2.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)
Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 1% of the WQCV)
V_{FMIN} = 0.001 ac-ft

B) Actual Forebay Volume
V_F = 0.002 ac-ft

C) Forebay Depth (D_F = 12 inch maximum)
D_F = 12.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge
Q_{100} = 20.70 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)
Q_F = 0.41 cfs

E) Forebay Discharge Design

Choose One
- ( ) Berm With Pipe
- (●) Wall with Rect. Notch
- ( ) Wall with V-Notch Weir

Flow too small for berm w/ pipe

F) Discharge Pipe Size (minimum 8-inches)
Calculated D_P = in

G) Rectangular Notch Width
Calculated W_N = 3.9 in

Weir Report

Forebay #2 Release

Compound Weir

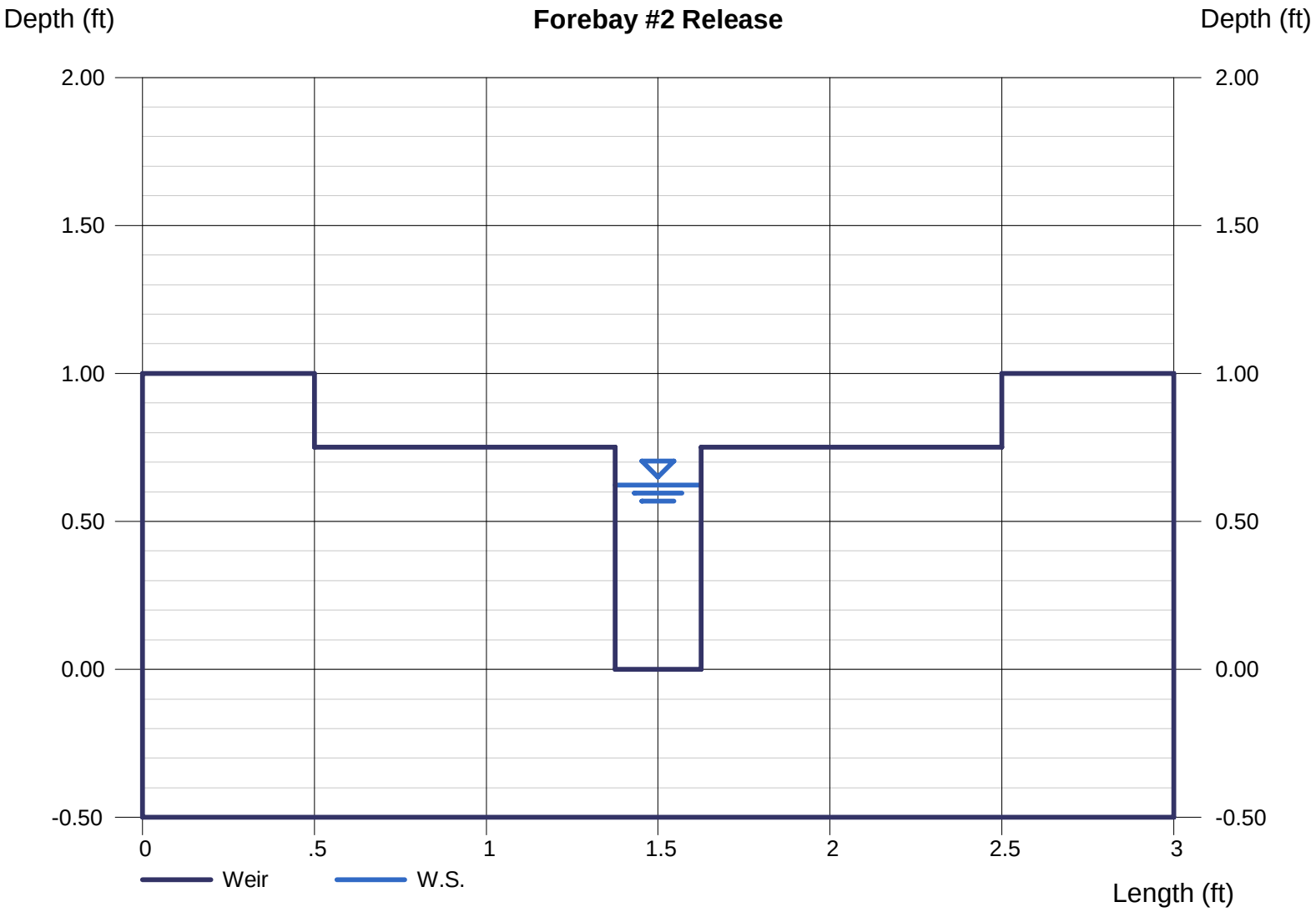
Crest	= Sharp
Bottom Length (ft)	= 2.00
Total Depth (ft)	= 1.00
Length, x (ft)	= 0.25
Depth, a (ft)	= 0.75

Highlighted

Depth (ft)	= 0.62
Q (cfs)	= 0.410
Area (sqft)	= 0.16
Velocity (ft/s)	= 2.63
Top Width (ft)	= 0.25

Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 0.41



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 5 2023

Forebay #2 Trickle Channel Capacity

Rectangular

Bottom Width (ft)	= 2.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.013

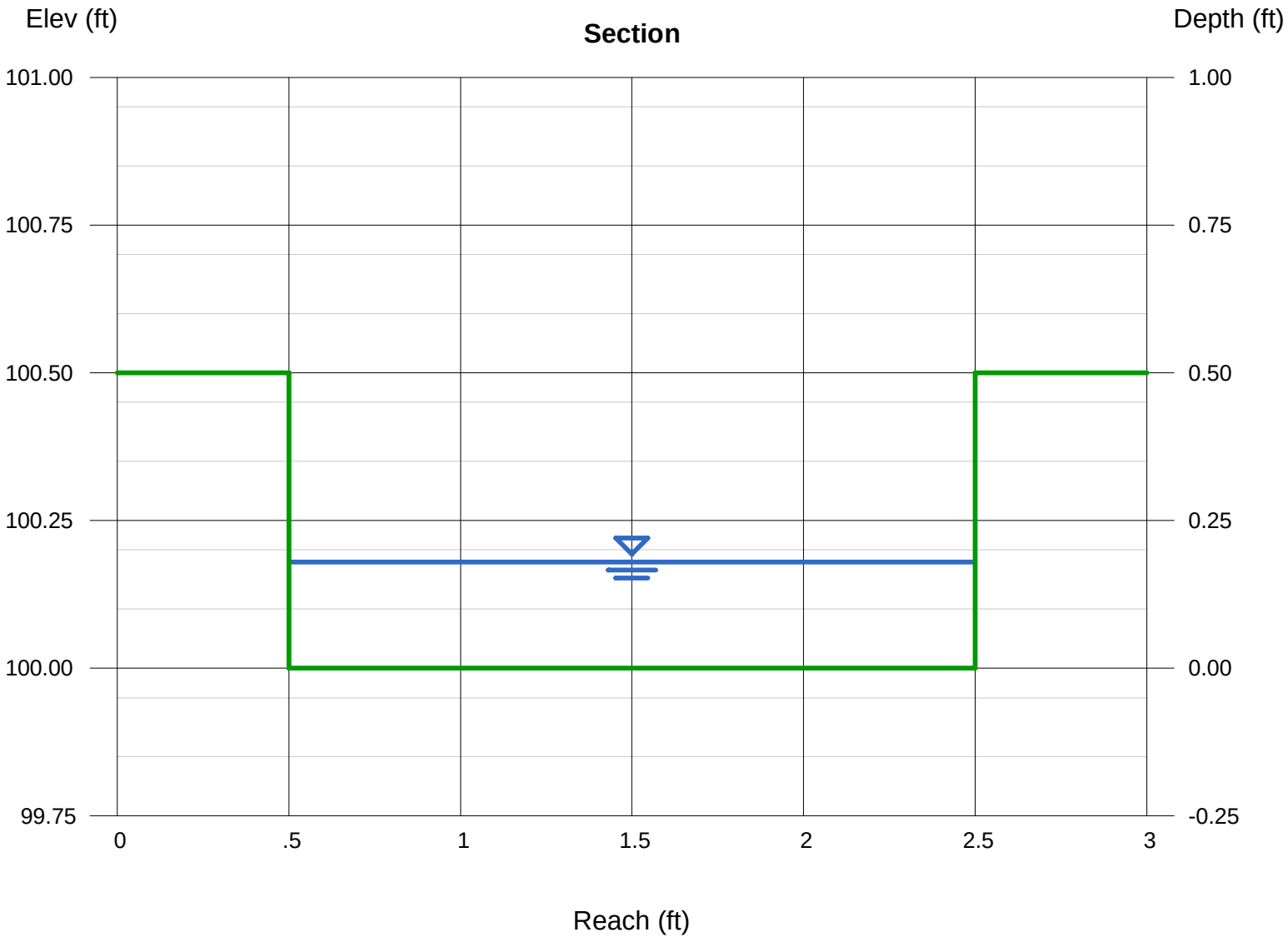
Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.82

Highlighted

Depth (ft)	= 0.18
Q (cfs)	= 0.820
Area (sqft)	= 0.36
Velocity (ft/s)	= 2.28
Wetted Perim (ft)	= 2.36
Crit Depth, Yc (ft)	= 0.18
Top Width (ft)	= 2.00
EGL (ft)	= 0.26

Forebay Release Q_{100}=0.41 cfs
Double Flow = 0.41 cfs * 2 = 0.82 cfs

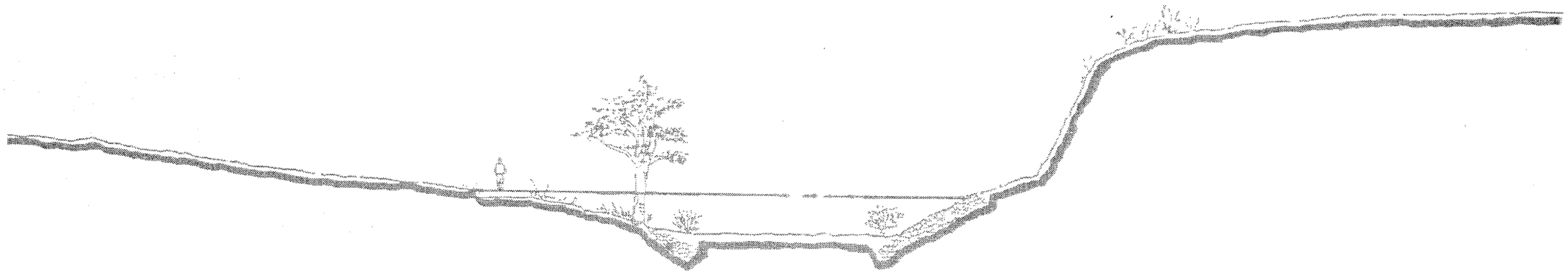


Appendix D
Reference Material

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

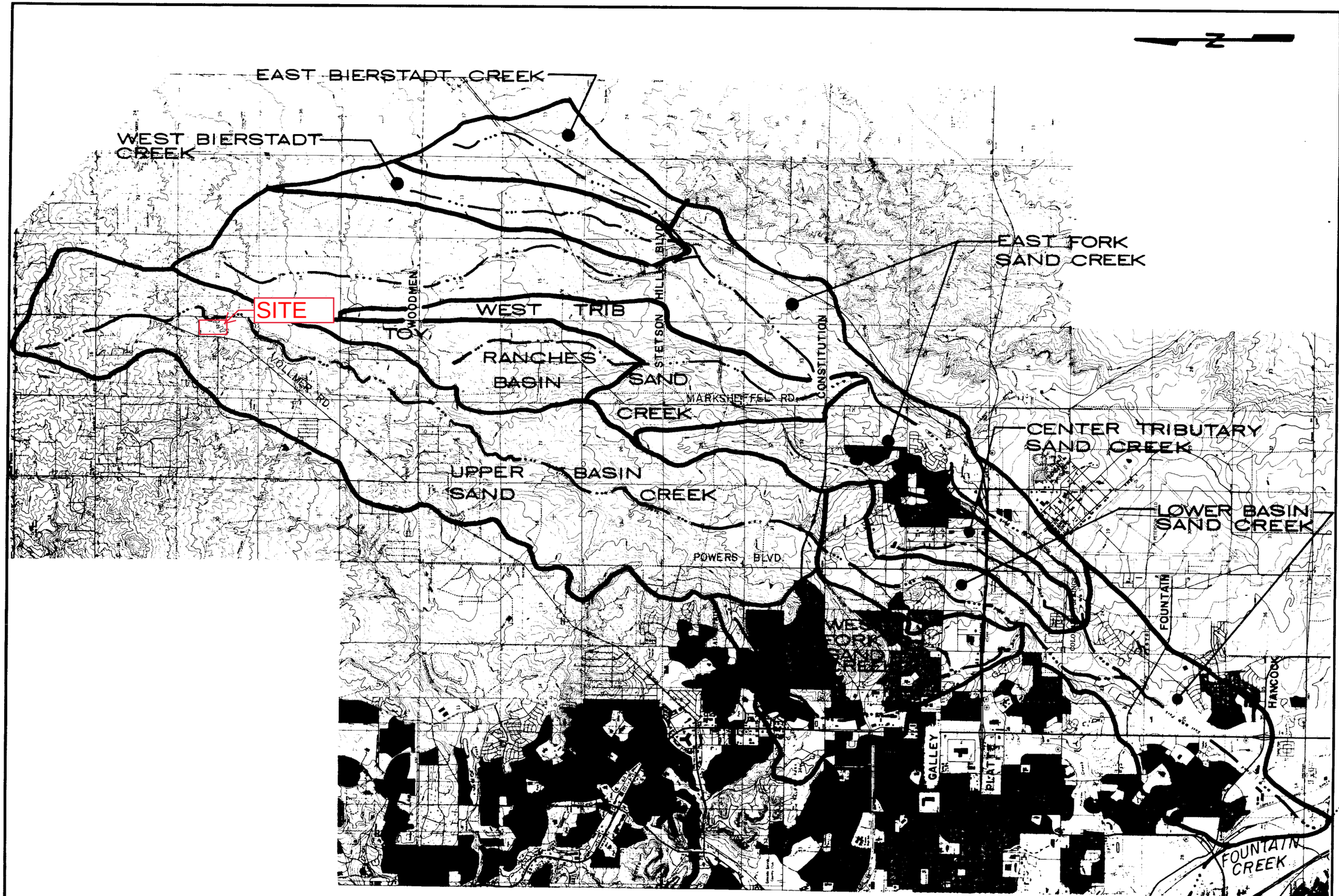
Soils within the Sand Creek basin vary between soil types A through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant soil groupings are in the Truckton and Bresser soil associations. The soils consist of deep, well drained soils that formed in alluvium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

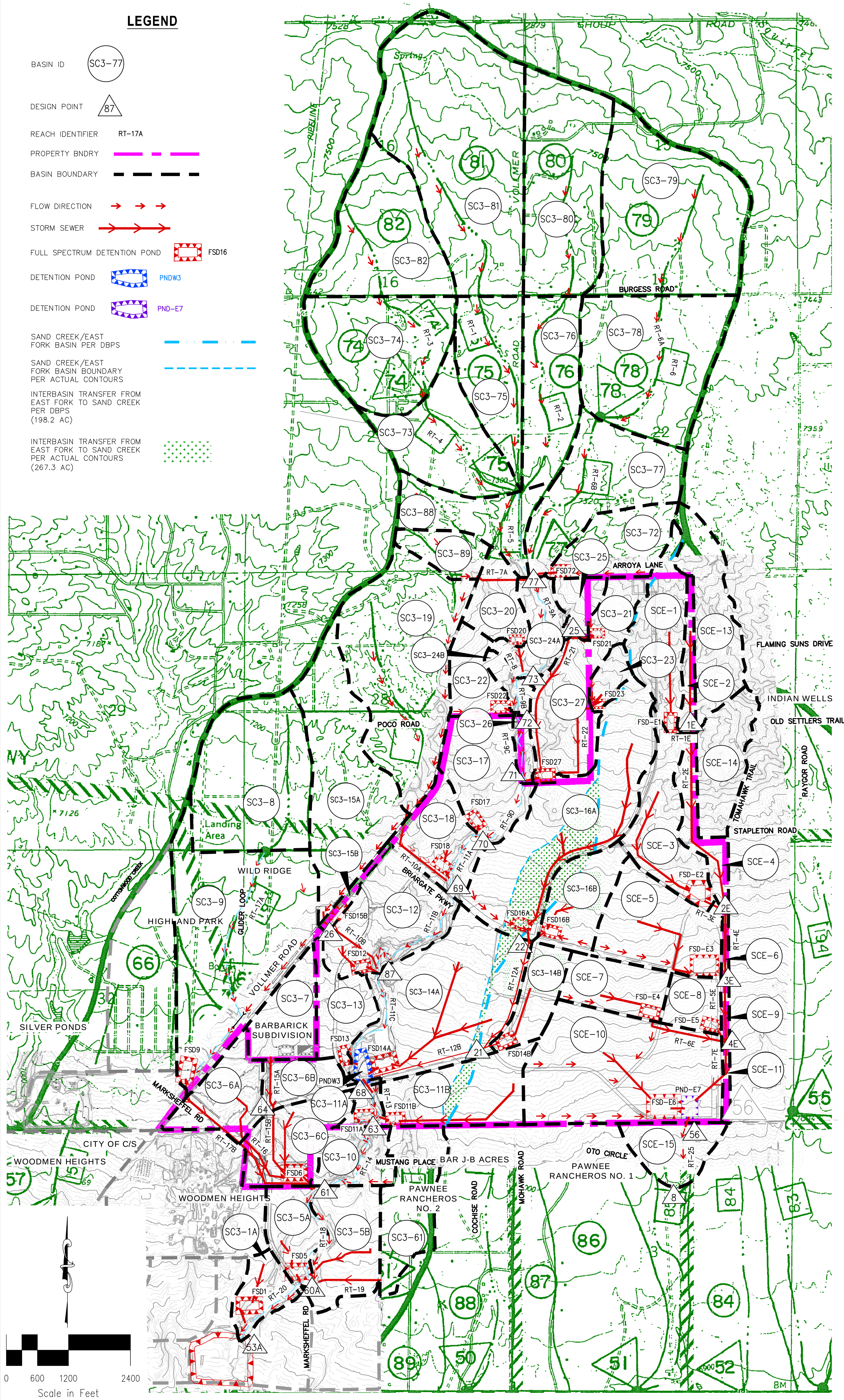
SAND CREEK DRAINAGE BASIN PLANNING STUDY

REGIONAL SUB-BASINS

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

11

FIG. III-1



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BASIN SUMMARY

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

DESIGN POINT SUMMARY

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

DESIGN POINT SUMMARY (VOLUME)

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

WATER QUALITY & DETENTION POND SUMMARY

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

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

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

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

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

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

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

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

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

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

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

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

SAND CREEK FLOW COMPARISON CHART

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

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)

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

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

WATER QUALITY & DETENTION POND SUMMARY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2018 STERLING RANCH MDDP

DEVELOPED HYDROLOGIC CONDITIONS MAP

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

NEW DOC

FINAL DRAINAGE REPORT
For

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

Sand Creek Drainage Basin

Prepared for:
El Paso County Development Services
Engineering Division

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

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

June 6, 2016

15.789.001

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

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

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

Proposed 18" HDPE Storm Drain Culvert:

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

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

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

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

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

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

Emergency Overflow:

56.0+29.4= 85.40

Summary results include:

- WQCV Volume =0.039 ac-ft depth 0.37-ft (12 hour release)
- EURV Volume Stored = 0.181 ac-ft at depth 1.52 ft (42 hour release)
- 5 Year Volume Stored = 0.181 ac-ft at depth 1.52 ft (42 hour release)
- 100 Year Volume Stored = 0.394 ac-ft depth 2.83-ft (68 hour release)

Proposed (2) 24" HDPE Storm Drain Culvert:

Two 24" pipes will convey offsite flows through Lots 1 and 2 discharging to the south. The culverts will connect to a pair of existing 24" culverts entering the property and will discharge to a riprap settling basing prior to the released downstream. These culverts will be privately owned and maintained by the property owners. See the Appendix for the hydraulic analysis of this storm drain (CulvertMaster). Flow from these pipes will join the flow from the Sand Filter and discharge at Design Point 4 (combined 39.4 cfs in the 100-year event). Per the BS-FDR this flow combines with the westerly portions of Lots 1 & 2 offsite for a total release of 30.5/80.8 cfs in the 5/100 year events.

As stated above in the summary from the Sterling Ranch PDR, the anticipated runoff from this proposed discharge point (aka: SR-PDR Basin H4) is 30.5/80.8 cfs (5/100 year) due to the large pass through flow. A 42" RCP is planned to convey this flow through Sterling Ranch.

DRAINAGE, BRIDGE, AND POND FEES

This subdivision has already been platted. No additional Drainage, Bridge or Pond fees are required.

MAINTENANCE

All proposed storm drain infrastructure will be located within private property and will be owned and maintained by the property owner. The detention pond will be owned and maintained by the property owner and will require maintenance consisting of routine inspections, removal of debris from the detention area, and bi-annual inspections for hydraulic performance of the basin. Refer to the DCM for exact maintenance criteria and for other Best Management Practices (BMP).

EROSION CONTROL

Best Management Practices (BMPs) will be utilized to minimize erosion during construction and will be shown on the construction drawings. These will be in accordance with will be utilized as deemed necessary by the contractor and/or engineer. The contractor shall minimize the amount of area disturbed during all construction activities.

In general, the following shall be applied in developing the sequence of major activities;

Pond FDS - Barbarack Subdivision Restrictor plate

Worksheet for FSD Outlet Orifice Plate

Project Description

Solve For	Diameter

Input Data

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

Results

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

Pond FDS - Barbarack Subdivision Restrictor plate

Worksheet for FSD Overflow - Pass

Project Description

Solve For	Discharge

Input Data

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

Results

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

(55 DU + 29.4 pass = 84.4 cfs)

Pond FDS Barbarack Subdivision Overflow Weir

Worksheet for FSD Overflow - Pass

Project Description

Solve For	Discharge		

Input Data

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

Results

Discharge		86.22	ft³/s (55 bul + 29.4 pass = 84.4 cfs)
Headwater Height Above Crest		0.90	ft
Tailwater Height Above Crest		0.00	ft
Weir Coefficient		2.80	US
Submergence Factor		1.00	
Adjusted Weir Coefficient		2.80	US
Flow Area		32.40	ft²
Velocity		2.66	ft/s
Wetted Perimeter		37.80	ft
Top Width		36.00	ft

Pond SFB Barbarack Subdivision Overflow Weir

Worksheet for SFB Overflow Developed

Project Description

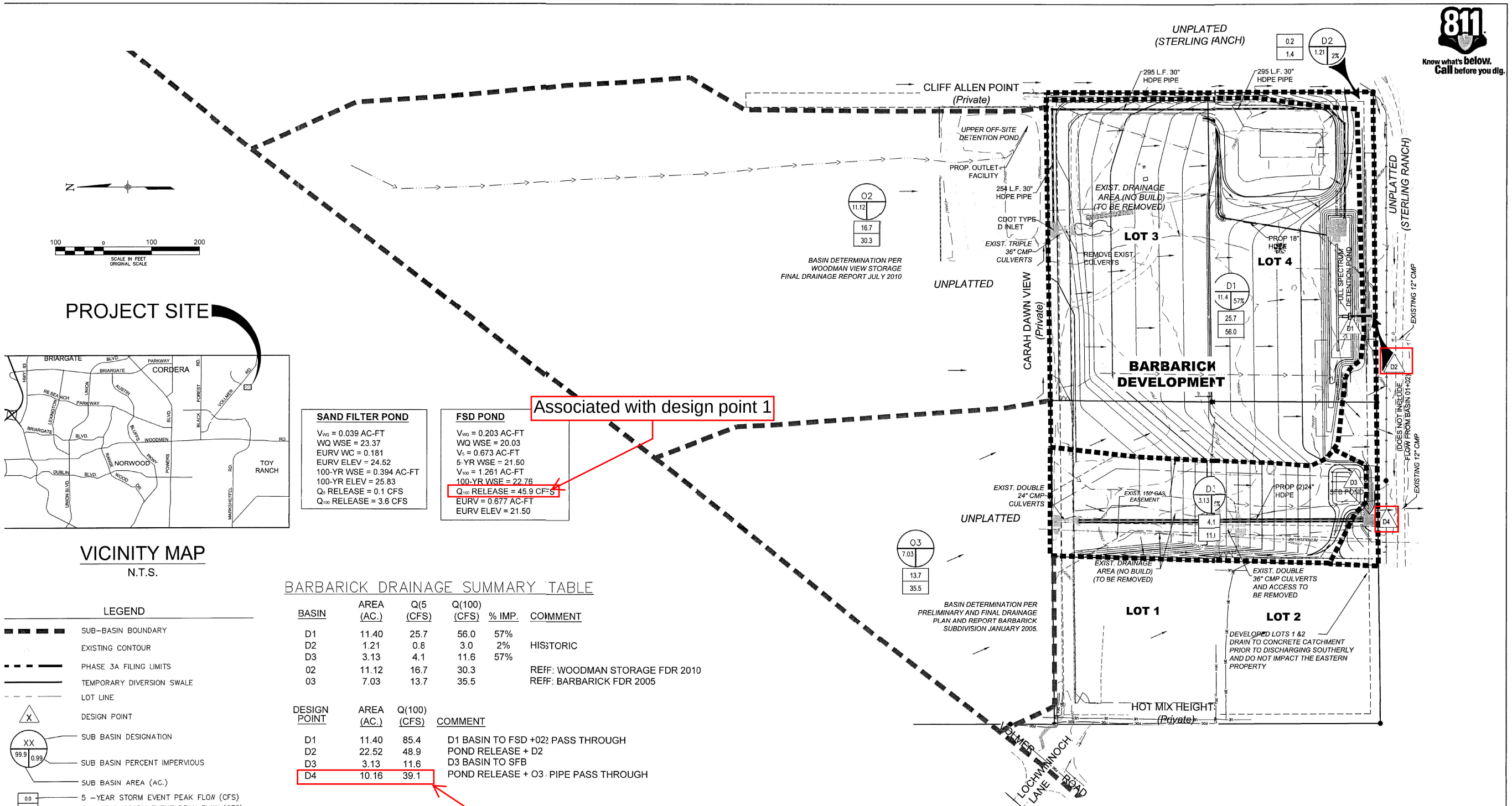
Solve For	Discharge

Input Data

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

Results

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



PROJECT SITE

VICINITY MAP

N.T.S.

SAND FILTER POND

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

FSD POND

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

Associated with design point 1

LEGEND

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

BARBARICK DRAINAGE SUMMARY TABLE

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

DESIGN POINT	AREA (AC.)	Q(100) (CFS)	COMMENT
D1	11.40	85.4	D1 BASIN TO FSD +022 PASS THROUGH
D2	22.52	48.9	POND RELEASE + D2
D3	3.13	11.6	D3 BASIN TO SFB
D4	10.16	39.1	POND RELEASE + O3 PIPE PASS THROUGH

Associated with design point 4

NO.	DATE	DESCRIPTION	BY

REVISIONS

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

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

VERTICAL BENCHMARK:

THE VERTICAL INFORMATION ON THIS MAP IS BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 AND THE 1960 SUPPLEMENTARY ADJUSTMENT BEING A FOUND 3.25" ALUMINUM CAP IN A ROAD BOX DESIGNATED AS FACILITIES INFORMATION MANAGEMENT SYSTEM (FIMS) MONUMENT "F_69" AND HAVING PUBLISHED ELEVATION OF 6975.62 FEET WAS USED TO REFERENCE THIS VERTICAL DATUM. THE BENCHMARK IS LOCATED ON THE WEST SIDE OF BLACK FOREST ROAD, ABOUT 1.95 MILES SOUTH OF OLD RANCH ROAD, JUST SOUTH OF THE SCHMIDT CONSTRUCTION COMPANY DRIVEWAY. A CORNER FENCE POST IS 28.1 FEET TO THE SOUTHWEST, AND THE MOST SOUTHERLY GUARD RAIL POST IS 25.7 FEET TO THE NORTH.

BASIS OF BEARING:

THE BASIS OF BEARINGS FOR THIS MAP IS THE NORTH LINE OF BARBARICK SUBDIVISION ACCORDING TO THE OFFICIAL MAP THEREOF RECORDED FEBRUARY 12, 2008 IN THE OFFICE OF THE EL PASO COUNTY CLERK AND RECORDER UNDER RECEPTION NUMBER 208712754, SAID LINE MONUMENTED ON THE WEST END BY A FOUND 5/8" REBAR AND ON THE EAST BY A FOUND 4/8" REBAR WITH 1" ALUMINUM CAP STAMPED "LS 2154" BEING A POINT ON THE NORTH LINE BEARING NORTH 89°12'41 EAST 1287.35 FEET FROM THE WEST END THEREOF

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

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

BARBARICK SUBDIVISION LOTS 1-4

PROPOSED DRAINAGE PLAN

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

FINAL DRAINAGE REPORT
FOR
STERLING RANCH FILING NO. 2

Prepared For:
SR Land, LLC
20 Boulder Crescent, Suite 210
Colorado Springs, CO 80903

August 2021
Project No. 25188.01

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

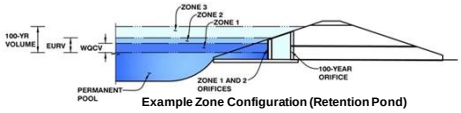
PCD File No. SF-20-015

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: STERLING RANCH FILING NO. 2

Basin ID: POND W5



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	173.97	acres
Watershed Length =	3,888	ft
Watershed Length to Centroid =	1,814	ft
Watershed Slope =	0.025	ft/ft
Watershed Imperviousness =	57.10%	percent
Percentage Hydrologic Soil Group A =	85.0%	percent
Percentage Hydrologic Soil Group B =	15.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	3.288	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	11.714	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	9.031	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	11.873	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	14.194	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	18.106	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	21.364	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	25.580	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	34.562	acre-feet		inches
Approximate 2-yr Detention Volume =	7.768	acre-feet		
Approximate 5-yr Detention Volume =	10.244	acre-feet		
Approximate 10-yr Detention Volume =	12.566	acre-feet		
Approximate 25-yr Detention Volume =	14.965	acre-feet		
Approximate 50-yr Detention Volume =	16.434	acre-feet		
Approximate 100-yr Detention Volume =	18.217	acre-feet		

Define Zones and Basin Geometry

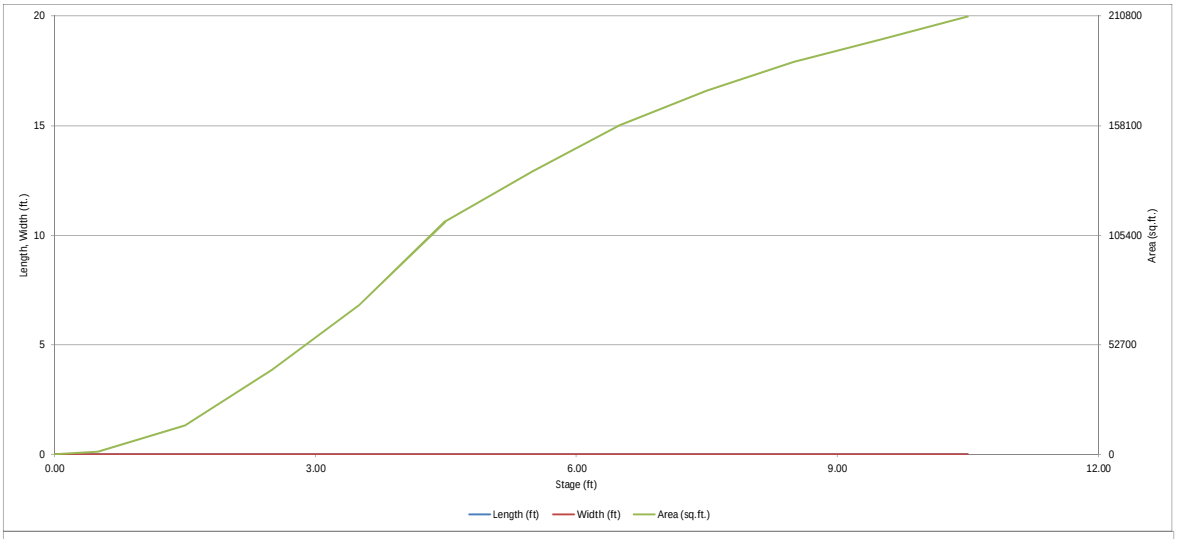
Zone 1 Volume (WQCV) =	3.288	acre-feet
Zone 2 Volume (EURV - Zone 1) =	8.426	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	6.502	acre-feet
Total Detention Basin Volume =	18.217	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio (R_{LW}) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

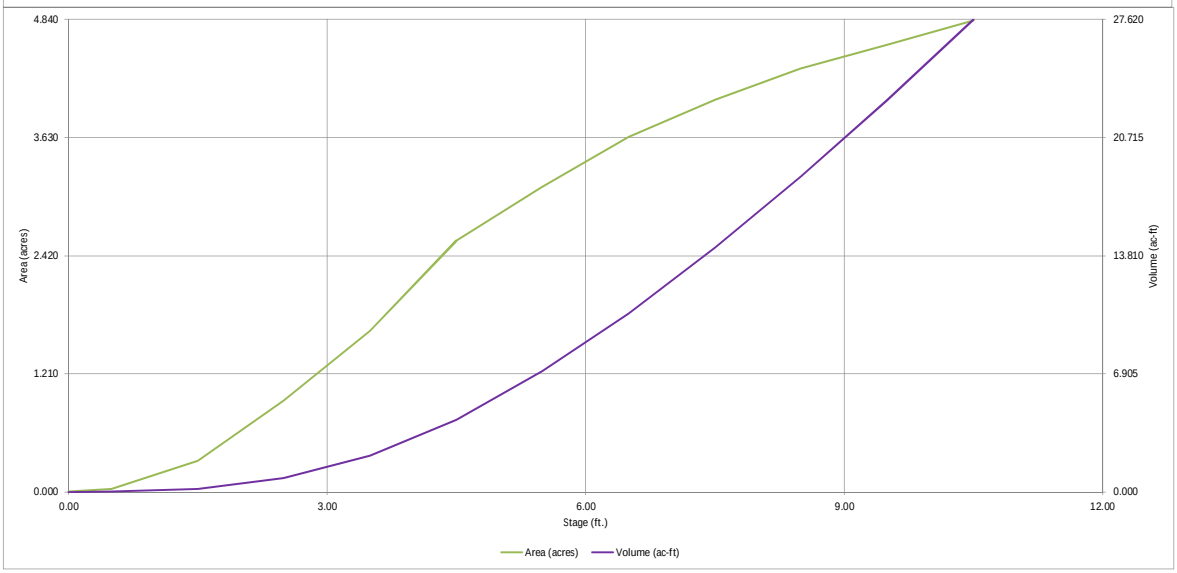
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	20	0.000		
ELEV:6962	--	0.50	--	--	--	1,328	0.030	337	0.008
ELEV:6963	--	1.50	--	--	--	13,823	0.317	7,912	0.182
ELEV:6964	--	2.50	--	--	--	40,724	0.935	35,186	0.808
ELEV:6965	--	3.50	--	--	--	71,720	1.646	91,408	2.098
ELEV:6966	--	4.50	--	--	--	112,095	2.573	183,315	4.208
ELEV:6967	--	5.50	--	--	--	136,106	3.125	307,416	7.057
ELEV:6968	--	6.50	--	--	--	158,377	3.636	454,657	10.437
ELEV:6969	--	7.50	--	--	--	174,976	4.017	621,334	14.264
ELEV:6970	--	8.50	--	--	--	188,903	4.337	803,273	18.441
ELEV:6971	--	9.50	--	--	--	199,637	4.583	997,543	22.900
ELEV:6972	--	10.50	--	--	--	210,510	4.833	1,202,617	27.608

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



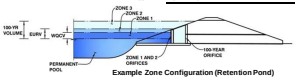


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: STERLING RANCH FILING NO. 2

Basin ID: POND W5



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.13	3.311	Orifice Plate
Zone 2 (EURV)	6.88	8.532	Rectangular Orifice
Zone 3 (100-year)	8.49	6.532	Weir&Pipe (Restrict)
Total (all zones)		18.376	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft²
Depth at top of Zone using Orifice Plate =	6.88	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.15	4.00					
Orifice Area (sq. inches)	12.55	12.55	25.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected				
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft²
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Height =	N/A	N/A	inches				
Vertical Orifice Width =			inches				

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected

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

	Zone 3 Weir	Not Selected				
Overflow Weir Front Edge Height, Ho =	7.30	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.30	N/A	feet
Overflow Weir Front Edge Length =	20.00	N/A	feet	Overflow Weir Slope Length =	6.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	7.35	N/A	
Horiz. Length of Weir Sides =	6.00	N/A	feet	Overflow Grate Open Area w/o Debris =	84.00	N/A	ft²
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	42.00	N/A	ft²
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected

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

	Zone 3 Restrictor	Not Selected				
Depth to Invert of Outlet Pipe =	0.83	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	11.43	N/A	ft²
Outlet Pipe Diameter =	48.00	N/A	inches	Outlet Orifice Centroid =	1.84	N/A	feet
Restrictor Plate Height Above Pipe Invert =	41.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.36	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.74	feet
Spillway Crest Length =	48.00	feet	Stage at Top of Freeboard =	12.24	feet
Spillway End Slopes =	10.00	H:V	Basin Area at Top of Freeboard =	4.83	acres
Freeboard above Max Water Surface =	2.00	feet	Basin Volume at Top of Freeboard =	27.61	acre-ft

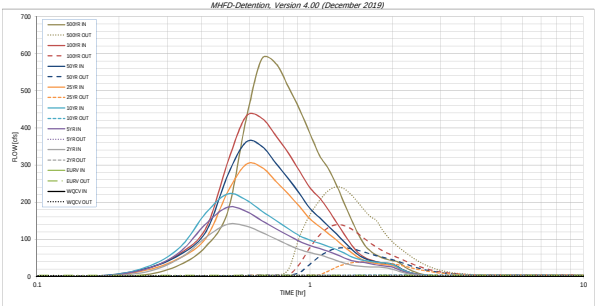
Calculated Parameters for Spillway

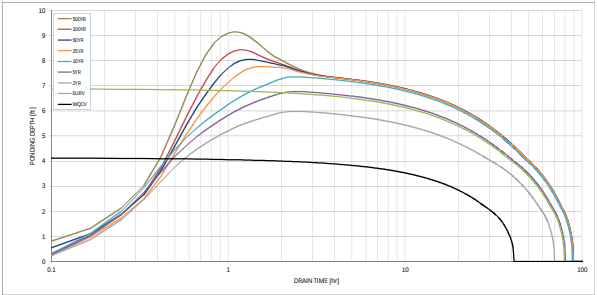
Routed Hydrograph Results *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

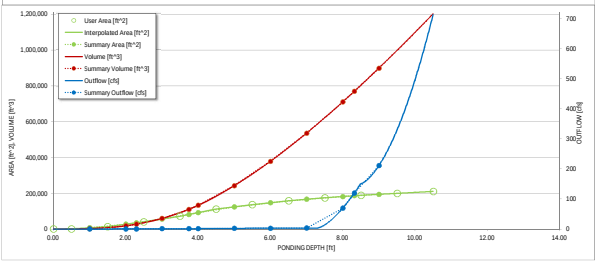
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	3.311	11.843	9.121	11.991	14.334	18.244	21.510	25.732	34.734
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	9.121	11.991	14.334	18.244	21.510	25.732	34.734
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.6	2.9	5.1	54.6	85.6	128.5	217.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.31	0.49	0.74	1.25
Peak Inflow Q (cfs) =	N/A	N/A	140.5	186.5	222.1	301.6	361.5	431.2	586.0
Peak Outflow Q (cfs) =	1.7	3.4	3.0	3.4	5.1	38.8	77.3	139.3	241.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.2	1.0	0.7	0.9	1.1	1.1
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.4	0.9	1.6	1.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	70	63	71	78	76	75	73	70
Time to Drain 99% of Inflow Volume (hours) =	40	76	67	77	84	84	83	82	81
Maximum Ponding Depth (ft) =	4.13	6.88	5.98	6.77	7.35	7.76	8.05	8.43	9.15
Area at Maximum Ponding Depth (acres) =	2.23	3.78	3.37	3.73	3.96	4.10	4.19	4.31	4.50
Maximum Volume Stored (acre-ft) =	3.320	11.847	8.616	11.396	13.666	15.319	16.522	18.138	21.311

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
5.00 min	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	1.37	0.14	4.42
	0:15:00	0.00	0.00	12.01	19.62	24.38	16.41	21.13	20.11	30.88
	0:20:00	0.00	0.00	48.30	65.33	77.56	49.45	58.16	61.60	81.16
	0:25:00	0.00	0.00	105.72	142.54	171.74	104.07	121.39	131.21	174.25
	0:30:00	0.00	0.00	140.48	186.46	222.13	227.64	272.80	308.13	422.01
	0:35:00	0.00	0.00	135.46	175.22	206.03	301.61	361.54	431.24	585.96
	0:40:00	0.00	0.00	118.36	150.07	175.68	293.61	350.26	425.82	573.28
	0:45:00	0.00	0.00	100.92	128.44	150.65	256.40	304.92	378.98	510.45
	0:50:00	0.00	0.00	84.87	110.40	128.43	222.14	263.81	332.30	449.36
	0:55:00	0.00	0.00	72.36	94.33	109.32	187.66	222.42	282.99	384.40
	1:00:00	0.00	0.00	64.06	83.13	97.59	154.96	182.98	238.59	325.88
	1:05:00	0.00	0.00	58.14	75.08	88.94	134.19	158.26	211.50	290.49
	1:10:00	0.00	0.00	50.72	67.68	80.67	115.60	135.72	179.70	246.12
	1:15:00	0.00	0.00	42.71	59.08	72.46	97.95	114.30	145.50	197.99
	1:20:00	0.00	0.00	35.76	50.04	63.10	80.42	93.20	113.95	153.88
	1:25:00	0.00	0.00	30.54	42.87	53.10	64.63	74.31	85.95	114.90
	1:30:00	0.00	0.00	27.71	39.21	46.68	51.11	58.33	64.24	85.13
	1:35:00	0.00	0.00	26.36	37.32	42.89	42.74	48.57	51.51	67.73
	1:40:00	0.00	0.00	25.60	34.28	40.22	37.77	42.78	44.23	57.57
	1:45:00	0.00	0.00	25.13	31.06	38.26	34.61	39.11	39.26	50.51
	1:50:00	0.00	0.00	24.76	28.74	36.93	32.45	36.59	35.99	45.78
	1:55:00	0.00	0.00	22.48	27.05	35.35	31.03	34.94	33.68	42.43
	2:00:00	0.00	0.00	19.58	25.23	32.57	30.03	33.77	32.06	40.11
	2:05:00	0.00	0.00	15.52	20.27	25.90	24.54	27.57	25.96	32.36
	2:10:00	0.00	0.00	11.36	14.69	18.66	17.66	19.83	18.68	23.23
	2:15:00	0.00	0.00	8.25	10.65	13.46	12.75	14.30	13.52	16.79
	2:20:00	0.00	0.00	5.94	7.66	9.70	9.23	10.34	9.85	12.22
	2:25:00	0.00	0.00	4.23	5.34	6.86	6.50	7.28	6.96	8.63
	2:30:00	0.00	0.00	2.91	3.63	4.77	4.51	5.04	4.82	5.97
	2:35:00	0.00	0.00	1.96	2.50	3.30	3.19	3.57	3.40	4.20
	2:40:00	0.00	0.00	1.21	1.65	2.12	2.10	2.34	2.23	2.75
	2:45:00	0.00	0.00	0.65	0.97	1.20	1.24	1.38	1.31	1.60
	2:50:00	0.00	0.00	0.28	0.47	0.55	0.60	0.66	0.63	0.76
	2:55:00	0.00	0.00	0.09	0.15	0.16	0.19	0.20	0.19	0.22
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft²]	Area [acres]	Volume [ft³]	Volume [ac-ft]	Total Outflow [cfs]
	1.00	7,576	0.174	2,563	0.059	0.42
	2.00	27,274	0.626	18,186	0.418	0.59
WQCV	2.29	35,075	0.805	27,227	0.625	0.79
	3.00	56,222	1.291	59,422	1.364	1.11
EURV	3.74	81,410	1.869	109,783	2.520	1.34
	4.00	91,907	2.110	132,314	3.038	1.41
	5.00	124,100	2.849	242,364	5.564	2.48
	6.00	147,241	3.380	378,252	8.683	3.03
	7.00	166,676	3.826	535,920	12.303	3.48
	8.00	181,939	4.177	710,562	16.312	69.54
100-YR	8.32	186,396	4.279	769,496	17.665	119.49
	9.00	194,270	4.460	899,066	20.640	210.78

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

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

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

BASIN SUMMARY TABLE

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

NOTE

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

LEGEND:

- PROPOSED STORM SEWER
- 5000 FUTURE RD MAJOR CONTOUR
- FUTURE RD MINOR CONTOUR
- 5000 PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 5000 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN
- A = BASIN DESIGNATION; B = AREA IN ACRES; C = 5-YR RUNOFF COEFFICIENT; D = 100-YR RUNOFF COEFFICIENT
- DESIGN POINT
- HP HIGH POINT
- LP LOW POINT
- DRAINAGE ARROW
- EXISTING DRAINAGE ARROW
- PROPOSED DRAINAGE SWALE

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

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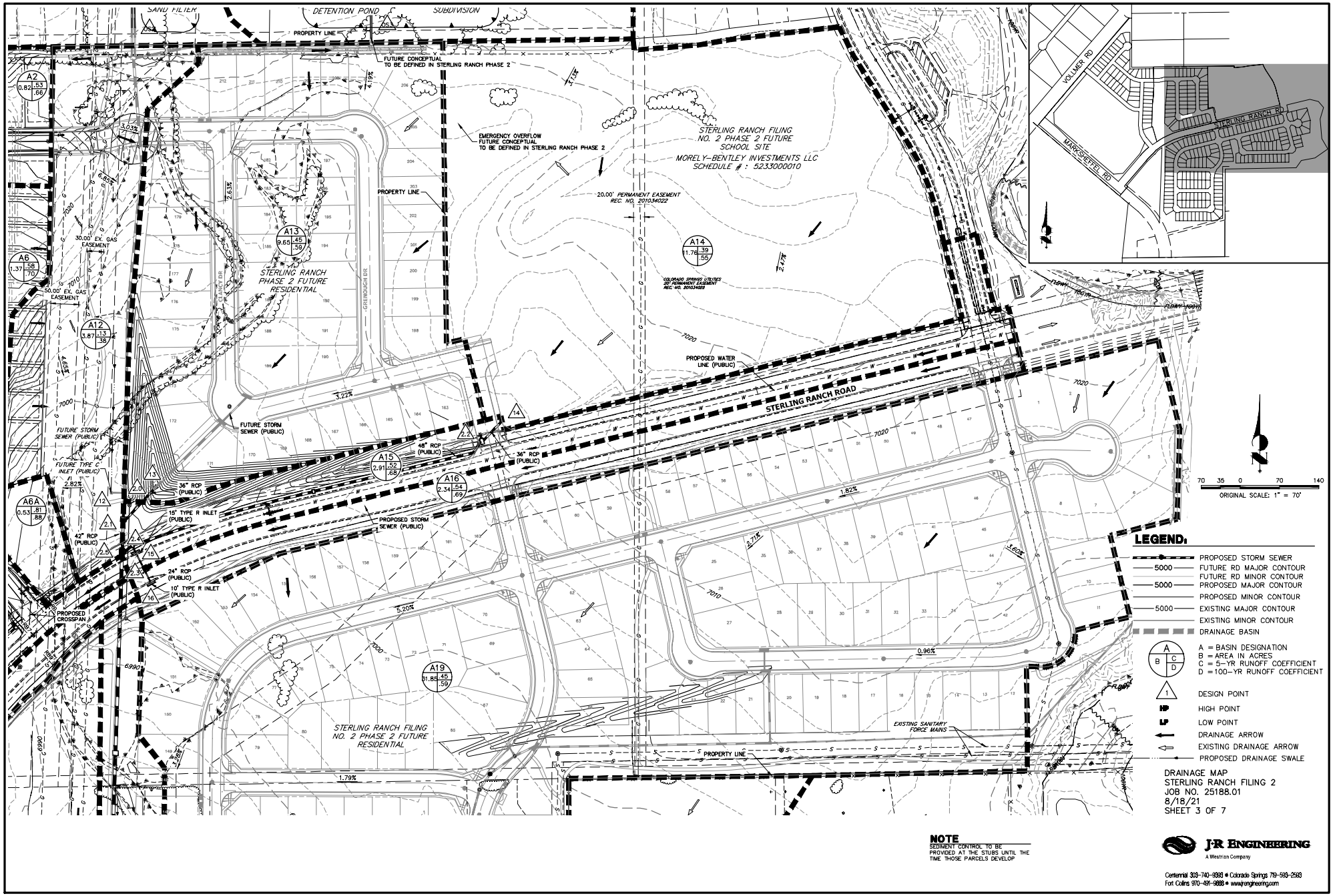

DRAINAGE MAP
STERLING RANCH FILING 2
JOB NO. 25188.01
8/18/21
SHEET 3 OF 7

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

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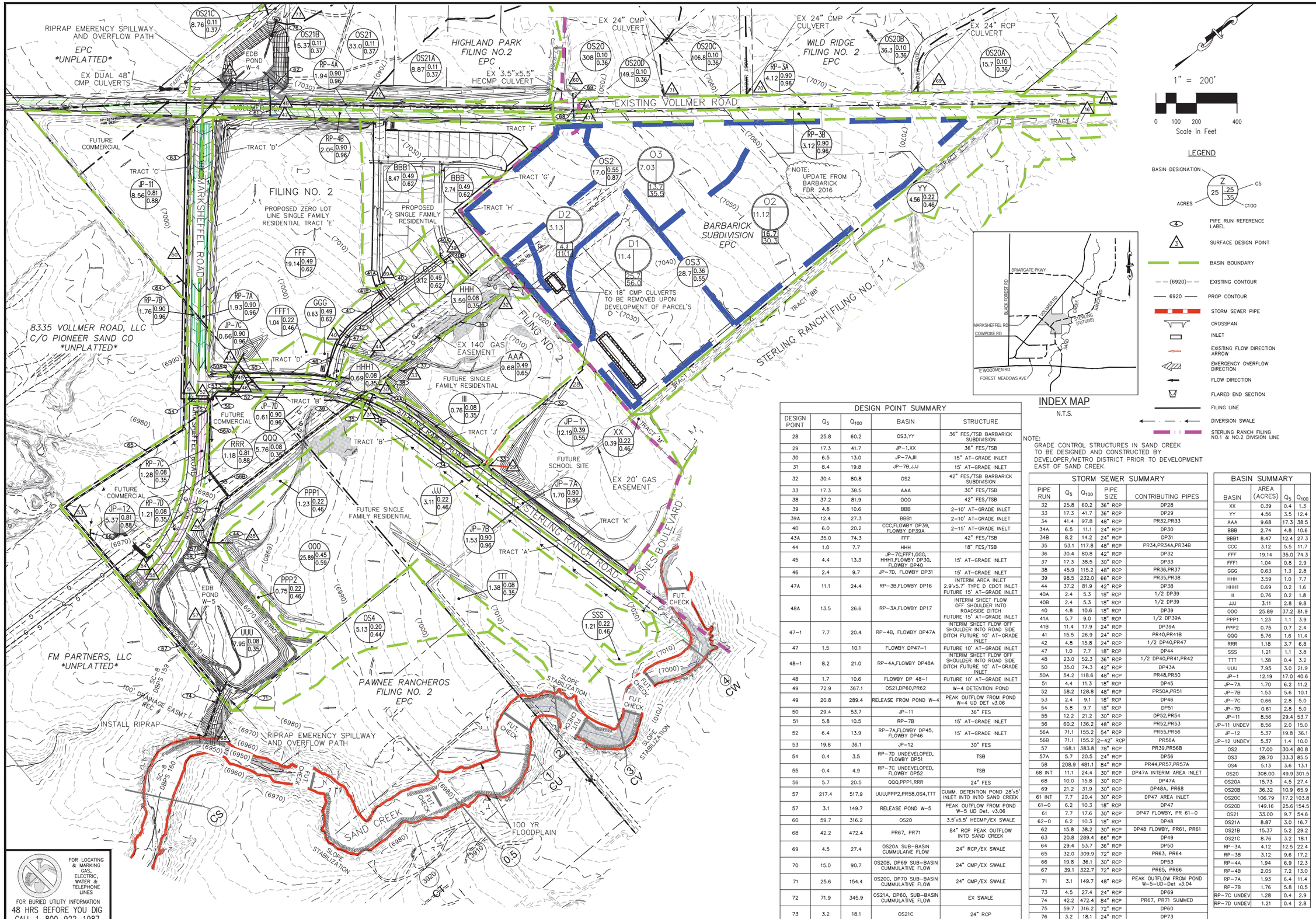

INDEX MAP
N.T.S.

1" = 200'
0 100 200 400
Scale in Feet

LEGEND
BASIN DESIGNATION
Z 25 .25 .35 C5 C100
ACRES
4 PIPE RUN REFERENCE LABEL
3 SURFACE DESIGN POINT
BASIN BOUNDARY
(6920) EXISTING CONTOUR
6920 PROP CONTOUR
STORM SEWER PIPE
CROSSPAN
INLET
EXISTING FLOW DIRECTION ARROW
EMERGENCY OVERFLOW DIRECTION
FLOW DIRECTION
FLARED END SECTION
FILING LINE
DIVERSION SWALE
STERLING RANCH FILING NO.1 & NO.2 DIVISION LINE

NOTE:
GRADE CONTROL STRUCTURES IN SAND CREEK TO BE DESIGNED AND CONSTRUCTED BY DEVELOPER/METRO DISTRICT PRIOR TO DEVELOPMENT EAST OF SAND CREEK.

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
28	25.8	60.2	OS3,YY	36" FES/TSB BARBARICK SUBDIVISION
29	17.3	41.7	JP-1,XX	36" FES/TSB
30	6.5	13.0	JP-7A,III	15" AT-GRADE INLET
31	8.4	19.8	JP-7B,JJJ	15' AT-GRADE INLET
32	30.4	80.8	OS2	42" FES/TSB BARBARICK SUBDIVISION
33	17.3	38.5	AAA	30" FES/TSB
38	37.2	81.9	OOO	42" FES/TSB
39	4.8	10.6	BBB	2-10' AT-GRADE INLET
39A	12.4	27.3	BBB1	2-10' AT-GRADE INLET
40	6.0	20.2	CCC,FLOWBY DP39, FLOWBY DP39A	2-15' AT-GRADE INELT
43A	35.0	74.3	FFF	42" FES/TSB
44	1.0	7.7	HHH	18" FES/TSB
45	4.4	13.3	JP-7C,FFF1,GGG, HHH1,FLOWBY DP30, FLOWBY DP40	15' AT-GRADE INLET
46	2.4	9.7	JP-7D, FLOWBY DP31	15' AT-GRADE INLET
47A	11.1	24.4	RP-3B,FLOWBY DP16	INTERIM AREA INLET 2.9'x5.7' TYPE D CDOT INLET FUTURE 15' AT-GRADE INLET
48A	13.5	26.6	RP-3A,FLOWBY DP17	INTERIM SHEET FLOW OFF SHOULDER INTO ROADSIDE DITCH FUTURE 15' AT-GRADE INLET
47-1	7.7	20.4	RP-4B, FLOWBY DP47A	INTERIM SHEET FLOW OFF SHOULDER INTO ROAD SIDE DITCH FUTURE 10' AT-GRADE INLET
47	1.5	10.1	FLOWBY DP47-1	FUTURE 10' AT-GRADE INLET
48-1	8.2	21.0	RP-4A,FLOWBY DP48A	INTERIM SHEET FLOW OFF SHOULDER INTO ROAD SIDE DITCH FUTURE 10' AT-GRADE INLET
48	1.7	10.6	FLOWBY DP 48-1	FUTURE 10' AT-GRADE INLET
49	72.9	367.1	OS21,DP60,PR62	W-4 DETENTION POND
49	20.8	289.4	RELEASE FROM POND W-4	PEAK OUTFLOW FROM POND W-4 UD DET v3.06
50	29.4	53.7	JP-11	36" FES
51	5.8	10.5	RP-7B	15' AT-GRADE INLET
52	6.4	13.9	RP-7A,FLOWBY DP45, FLOWBY DP46	15' AT-GRADE INLET
53	19.8	36.1	JP-12	30" FES
54	0.4	3.5	RP-7D UNDEVELOPED, FLOWBY DP51	TSB
55	0.4	4.9	RP-7C UNDEVELOPED, FLOWBY DP52	TSB
56	5.7	20.5	QQQ,PPP1,RRR	24" FES
57	217.4	517.9	UUU,PPP2,PR58,OS4,TTT	CUMM. DETENTION POND 28'x5' INLET INTO INTO SAND CREEK
57	3.1	149.7	RELEASE POND W-5	PEAK OUTFLOW FROM POND W-5 UD Det. v3.06
60	59.7	316.2	OS20	3.5'x5.5' HECMP/EX SWALE
68	42.2	472.4	PR67, PR71	84" RCP PEAK OUTFLOW INTO SAND CREEK
69	4.5	27.4	OS20A SUB-BASIN CUMMULAIVE FLOW	24" RCP/EX SWALE
70	15.0	90.7	OS20B, DP69 SUB-BASIN CUMMULATIVE FLOW	24" CMP/EX SWALE
71	25.6	154.4	OS20C, DP70 SUB-BASIN CUMMULATIVE FLOW	24" CMP/EX SWALE
72	71.9	345.9	OS21A, DP60, SUB-BASIN CUMMULATIVE FLOW	EX SWALE
73	3.2	18.1	OS21C	24" RCP

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES
32	25.8	60.2	36" RCP	DP28
33	17.3	41.7	36" RCP	DP29
34	41.4	97.8	48" RCP	PR32,PR33
34A	6.5	11.1	24" RCP	DP30
34B	8.2	14.2	24" RCP	DP31
35	53.1	117.8	48" RCP	PR34,PR34A,PR34B
36	30.4	80.8	42" RCP	DP32
37	17.3	38.5	30" RCP	DP33
38	45.9	115.2	48" RCP	PR36,PR37
39	98.5	232.0	66" RCP	PR35,PR38
44	37.2	81.9	42" RCP	DP38
40A	2.4	5.3	18" RCP	1/2 DP39
40B	2.4	5.3	18" RCP	1/2 DP39
40	4.8	10.6	18" RCP	DP39
41A	5.7	9.0	18" RCP	1/2 DP39A
41B	11.4	17.9	24" RCP	DP39A
41	15.5	26.9	24" RCP	PR40,PR41B
42	4.8	15.8	24" RCP	1/2 DP40,PR47
47	1.0	7.7	18" RCP	DP44
48	23.0	52.3	36" RCP	1/2 DP40,PR41,PR42
50	35.0	74.3	42" RCP	DP43A
50A	54.2	118.6	48" RCP	PR48,PR50
51	4.4	11.3	18" RCP	DP45
52	58.2	128.8	48" RCP	PR50A,PR51
53	2.4	9.1	18" RCP	DP46
54	5.8	9.7	18" RCP	DP51
55	12.2	21.2	30" RCP	DP52,PR54
56	60.2	136.2	48" RCP	PR52,PR53
56A	71.1	155.2	54" RCP	PR55,PR56
56B	71.1	155.2	2-42" RCP	PR56A
57	168.1	383.8	78" RCP	PR39,PR56B
57A	5.7	20.5	24" RCP	DP56
58	208.9	481.1	84" RCP	PR44,PR57,PR57A
68 INT	11.1	24.4	30" RCP	DP47A INTERIM AREA INLET
68	10.0	15.8	30" RCP	DP47A
69	21.2	31.9	30" RCP	DP48A, PR68
61 INT	7.7	20.4	30" RCP	DP47 AREA INLET
61-0	6.2	10.3	18" RCP	DP47
61	7.7	17.6	30" RCP	DP47 FLOWBY, PR 61-0
62-0	6.2	10.3	18" RCP	DP48
62	15.8	38.2	30" RCP	DP48 FLOWBY, PR61, PR61
63	20.8	289.4	66" RCP	DP49
64	29.4	53.7	36" RCP	DP50
65	32.0	309.9	72" RCP	PR63, PR64
66	19.8	36.1	30" RCP	DP53
67	39.1	322.7	72" RCP	PR65, PR66
71	3.1	149.7	48" RCP	PEAK OUTFLOW FROM POND W-5-UD-Det v3.04
73	4.5	27.4	24" RCP	DP69
74	42.2	472.4	84" RCP	PR67, PR71 SUMMED
75	59.7	316.2	72" RCP	DP60
76	3.2	18.1	24" RCP	DP73

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
XX	0.39	0.4	1.3
YY	4.56	3.5	12.4
AAA	9.68	17.3	38.5
BBB	2.74	4.8	10.6
BBB1	8.47	12.4	27.3
CCC	3.12	5.5	11.7
FFF	19.14	35.0	74.3
FFF1	1.04	0.8	2.9
GGG	0.63	1.3	2.8
HHH	3.59	1.0	7.7
HHH1	0.69	0.2	1.6
III	0.76	0.2	1.8
JJJ	3.11	2.8	9.8
OOO	25.89	37.2	81.9
PPP1	1.23	1.1	3.9
PPP2	0.75	0.7	2.4
QQQ	5.76	1.6	11.4
RRR	1.18	3.7	6.8
SSS	1.21	1.1	3.8
TTT	1.38	0.4	3.2
UUU	7.95	3.0	21.9
JP-1	12.19	17.0	40.6
JP-7A	1.70	6.2	11.2
JP-7B	1.53	5.6	10.1
JP-7C	0.66	2.8	5.0
JP-7D	0.61	2.8	5.0
JP-11	8.56	29.4	53.7
JP-11 UNDEV	8.56	2.0	15.0
JP-12	5.37	19.8	36.1
JP-12 UNDEV	5.37	1.4	10.0
OS2	17.00	30.4	80.8
OS3	28.70	33.3	85.5
OS4	5.13	3.6	13.1
OS20	308.00	49.9	301.5
OS20A	15.73	4.5	27.4
OS20B	36.32	10.9	65.9
OS20C	106.79	17.2	103.8
OS20D	149.16	25.6	154.5
OS21	33.00	9.7	54.6
OS21A	8.87	3.0	16.7
OS21B	15.37	5.2	29.2
OS21C	8.76	3.2	18.1
RP-3A	4.12	12.5	22.4
RP-3B	3.12	9.6	17.2
RP-4A	1.94	6.9	12.3
RP-4B	2.05	7.2	13.0
RP-7A	1.93	6.4	11.4
RP-7B	1.76	5.8	10.5
RP-7C UNDEV	1.28	0.4	2.9
RP-7D UNDEV	1.21	0.4	2.8

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STERLING RANCH FILING NO. 2
PROPOSED DRAINAGE MAP

PROJECT NO. 09-002 | SCALE: HORIZONTAL: 1"=200' VERTICAL: N/A | DATE: 12/20/2017 | SHEET 1 OF 1 | SHEET 1
DESIGNED BY: GT
DRAWN BY: BB
CHECKED BY: GT

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

FOR AND ON BEHALF OF M&S CIVIL CONSULTANTS, INC.
VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160

REVISIONS:
NO. | DATE: | BY: | DESCRIPTION: | APPR'D. BY: | DATE:

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

CAUTION

File: C:\09002A\Sterling Ranch District - Filing 2\dwg\Eng Exhibits\FDP\SR Filing 2-Proposed Drainage Map Filing 2.dwg Plotstamp: 1/24/2018 3:27 PM

Project Name:	Aspen Meadows
Project Location:	NE Colorado Springs
Designer	JTS
Notes:	Proposed Conditions

Average Channel Velocity 5 ft/s (If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow 0.04 ft/ft (If Elevations are used, this will be ignored)

	Area		Rational 'C' Values														Flow Lengths				Initial Flow				Channel Flow					Tc	Rainfall Intensity & Rational Flow Rate													
Basin			Surface Type 1 (Meadow)			Surface Type 2 (Pavement)			Surface Type 3 Acre Lots)		(1/4 Area	Surface Type 4 (0.147 Acre Lots) (Interpolated between 1/8 & 1/4 Acre lots)			Composite		Initial	True Initial	Channel	rue Chann	High Point	Low Point	Average	Initial	High Point	Low Point	Average	Velocity	Channel	Total	i2	Q2	i5	Q5	i10	Q10	i25	Q25	i50	Q50	i100	Q100
	sf	acres	C5	C100	Area (SF)	C5	C100	Area (SF)	C5	C100	Area	C10	C100	Area	C5	C100	ft	Length ft	ft	Length ft	Elevation	Elevation	Slope	Tc (min)	Elevation	Elevation	Slope	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	in/hr	cfs	in/hr	cfs	in/hr	cfs	in/hr	cfs
RP-7C	55757	1.28	0.08	0.36	0	0.90	0.96	55,757	0.30	0.50		0.42	0.57		0.90	0.96	25	25	2111	2111			0.040	1.2	0		0.000		7.0	8.2	1.9	**2.2**	2.5	**2.8**	3.0	**3.5**	3.8	**4.7**	4.4	**5.5**	5.2	**6.4**
RP-7D	52707	1.21	0.08	0.36	0	0.90	0.96	52,707	0.30	0.50		0.42	0.57		0.90	0.96	25	25	1927	1927			0.040	1.2	0		0.000		6.4	7.6	2.0	**2.2**	2.6	**2.9**	3.2	**3.5**	4.0	**4.7**	4.7	**5.5**	5.5	**6.5**
A1	183953	4.22	0.08	0.36	0	0.90	0.96	0	0.30	0.50	0	0.42	0.57	183953	0.42	0.57	129	129	1165	1165	6968	6962	0.047	8.7	6962	6951	0.010		3.9	12.5	2.3	**4.2**	3.0	**5.4**	3.7	**6.6**	4.6	**11.3**	5.5	**13.3**	6.4	**15.5**
A2	171980	3.95	0.08	0.36		0.90	0.96		0.30	0.50		0.42	0.57	171980	0.42	0.57	155	155	785	785	6962	6959	0.019	12.7	6959	6951	0.010		2.6	15.3	2.1	**3.6**	2.8	**4.6**	3.4	**5.6**	4.3	**9.6**	5.0	**11.4**	5.8	**13.2**
A3	40333	0.93	0.08	0.36		0.90	0.96		0.30	0.50		0.42	0.57	40333	0.42	0.57	60	60	429	429	6958	6955	0.050	5.8	6955	6951	0.010		1.4	7.2	2.9	**1.1**	3.7	**1.5**	4.5	**1.8**	5.7	**3.0**	6.7	**3.6**	7.8	**4.2**
A4	16521	0.38	0.08	0.36		0.90	0.96		0.30	0.50		0.42	0.57	16521	0.42	0.57	84	84	168	168	6954	6952	0.020	9.2	6952	6951	0.006		0.6	9.8	2.6	**0.4**	3.3	**0.5**	4.1	**0.7**	5.1	**1.1**	6.0	**1.3**	7.0	**1.5**
A5	87091	2.00	0.08	0.36		0.90	0.96		0.30	0.50		0.42	0.57	87091	0.42	0.57	84	84	281	281	6954	6952	0.020	9.2	6952	6949	0.010		0.9	10.2	2.5	**2.1**	3.3	**2.8**	4.0	**3.4**	5.1	**5.8**	6.0	**6.8**	6.9	**8.0**
A6	170648	3.92	0.08	0.36	46,932	0.90	0.96		0.30	0.50		0.42	0.57	123716	0.33	0.52	331	300	672	703	6975	6962	0.039	15.8	6962	6953	0.014		2.3	18.2	2.0	**2.6**	2.6	**3.3**	3.1	**4.0**	3.9	**8.1**	4.6	**9.5**	5.4	**11.0**
A7	50796	1.17	0.08	0.36		0.90	0.96		0.30	0.50		0.42	0.57	50796	0.42	0.57	60	60	624	624	6963	6961	0.027	7.0	6961	6953	0.013		2.1	9.1	2.6	**1.3**	3.4	**1.7**	4.2	**2.1**	5.3	**3.5**	6.2	**4.2**	7.2	**4.8**
A8	18695	0.43	0.08	0.36		0.90	0.96		0.30	0.50		0.42	0.57	18695	0.42	0.57	50	50	130	130	6953	6951	0.023	6.8	6951	6950	0.008		0.4	7.2	2.9	**0.5**	3.7	**0.7**	4.5	**0.8**	5.7	**1.4**	6.7	**1.7**	7.8	**1.9**
A9	48530	1.11	0.08	0.36		0.90	0.96		0.30	0.50		0.42	0.57	48530	0.42	0.57	66	66	400	400	6959	6958	0.023	7.8	6958	6950	0.019		1.3	9.1	2.6	**1.2**	3.4	**1.6**	4.2	**2.0**	5.3	**3.4**	6.2	**4.0**	7.2	**4.6**
A10	145660	3.34	0.08	0.36	91,851	0.90	0.96		0.30	0.50		0.42	0.57	53809	0.21	0.44	133	133	409	409	6959	6945	0.105	8.8	6945	6942	0.007		1.4	10.1	2.5	**1.8**	3.3	**2.3**	4.0	**2.8**	5.1	**7.5**	6.0	**8.8**	6.9	**10.3**
A11	38513	0.88	0.08	0.36	38,513	0.90	0.96		0.30	0.50		0.42	0.57		0.08	0.36	15	15	74	74	6950	6949	0.067	3.9	6949	6940	0.122		0.2	5.0	3.2	**0.2**	4.1	**0.3**	5.0	**0.4**	6.3	**2.0**	7.5	**2.4**	8.7	**2.8**
A12	29078	0.67	0.08	0.36		0.90	0.96	29,078	0.30	0.50		0.42	0.57		0.90	0.96	13	13	512	512	6965	6964	0.077	0.7	6964	6959	0.009		1.7	5.0	3.2	**1.9**	4.1	**2.5**	5.0	**3.0**	6.3	**4.1**	7.5	**4.8**	8.7	**5.6**
A13	28956	0.66	0.08	0.36		0.90	0.96	28,956	0.30	0.50		0.42	0.57		0.90	0.96	13	13	512	512	6964	6964	0.020	1.1	6964	6959	0.009		1.7	5.0	3.2	**1.9**	4.1	**2.5**	5.0	**3.0**	6.3	**4.1**	7.5	**4.8**	8.7	**5.6**
A14	31058	0.71	0.08	0.36		0.90	0.96	31,058	0.30	0.50		0.42	0.57		0.90	0.96	96	96	547	547	6956	6954	0.021	2.9	6954	6953	0.002		1.8	5.0	3.2	**2.0**	4.1	**2.7**	5.0	**3.2**	6.3	**4.4**	7.5	**5.1**	8.7	**6.0**
A15	30826	0.71	0.08	0.36		0.90	0.96	30,826	0.30	0.50		0.42	0.57		0.90	0.96	13	13	547	547	6958	6958	0.020	1.1	6958	6953	0.009		1.8	5.0	3.2	**2.0**	4.1	**2.6**	5.0	**3.2**	6.3	**4.3**	7.5	**5.1**	8.7	**5.9**
A16	82931	1.90	0.08	0.36		0.90	0.96	43,788	0.30	0.50		0.42	0.57	39143	0.68	0.78	100	100	553	553	6954	6951	0.027	5.6	6951	6940	0.019		1.8	7.5	2.8	**3.7**	3.7	**4.8**	4.5	**5.8**	5.6	**8.4**	6.6	**9.9**	7.7	**11.6**
A17	40961	0.94	0.08	0.36		0.90	0.96	40,961	0.30	0.50		0.42	0.57		0.90	0.96	13	13	553	553	6954	6953	0.077	0.7	6953	6940	0.023		1.8	5.0	3.2	**2.7**	4.1	**3.5**	5.0	**4.3**	6.3	**5.8**	7.5	**6.8**	8.7	**7.9**
Total Onsite Area =	**1216531**	**27.93**																																								
DP1 (A2)		3.95																														**4.6**										**13.2**
DP2 (A1+A2)		8.17																														**10.0**										**28.7**
DP3 (A3)		0.93																														**1.5**										**4.2**
DP4 (A3+A4)		1.31																														**2.0**										**5.7**
DP5 (D2+D4)		9.48																														**12.0**										**34.4**
DP6 (A6)		3.92																														**3.3**										**11.0**
DP7 (A6+A7)		5.08																														**5.0**										**15.9**
DP8 (A8)		0.43																														**0.7**										**1.9**
DP9 (DP5+DP7+DP8+A9)		16.10																														**19.3**										**56.8**
DP 10 (A5)		2.00																														**2.8**										**8.0**
DP Pond (A1-A10)		21.45																														**24.4**										**75.1**
DP Pond (Discharge)		21.45																														**0.4**										**3.7**
DP11 (RP-7D+A12)		1.88																														**5.4**										**12.1**
DP12 (DP11+RP-7C+A13)		3.82																														**10.7**										**24.0**
DP13 (A14)		0.71																														**2.7**										**6.0**
DP14 (DP12+DP13+A15)		5.24																														**16.0**										**36.0**
DP15 (A16)		1.90																														**4.8**										**11.6**
DP16 (DP14+DP15+A17)		8.09																														**24.3**										**55.4**
Total Area =	**1324995**	**30.42**																																								

Runoff captured in offsite runoff from basins RP-7D and RP-7C

NOTES:
1. Spot elevations subject to change with final grading design and construction.

ASPEN MEADOWS

COLORADO SPRINGS, CO

PROPOSED STORM SEWER EXHIBIT MAP

Know what's below. Call before you dig.

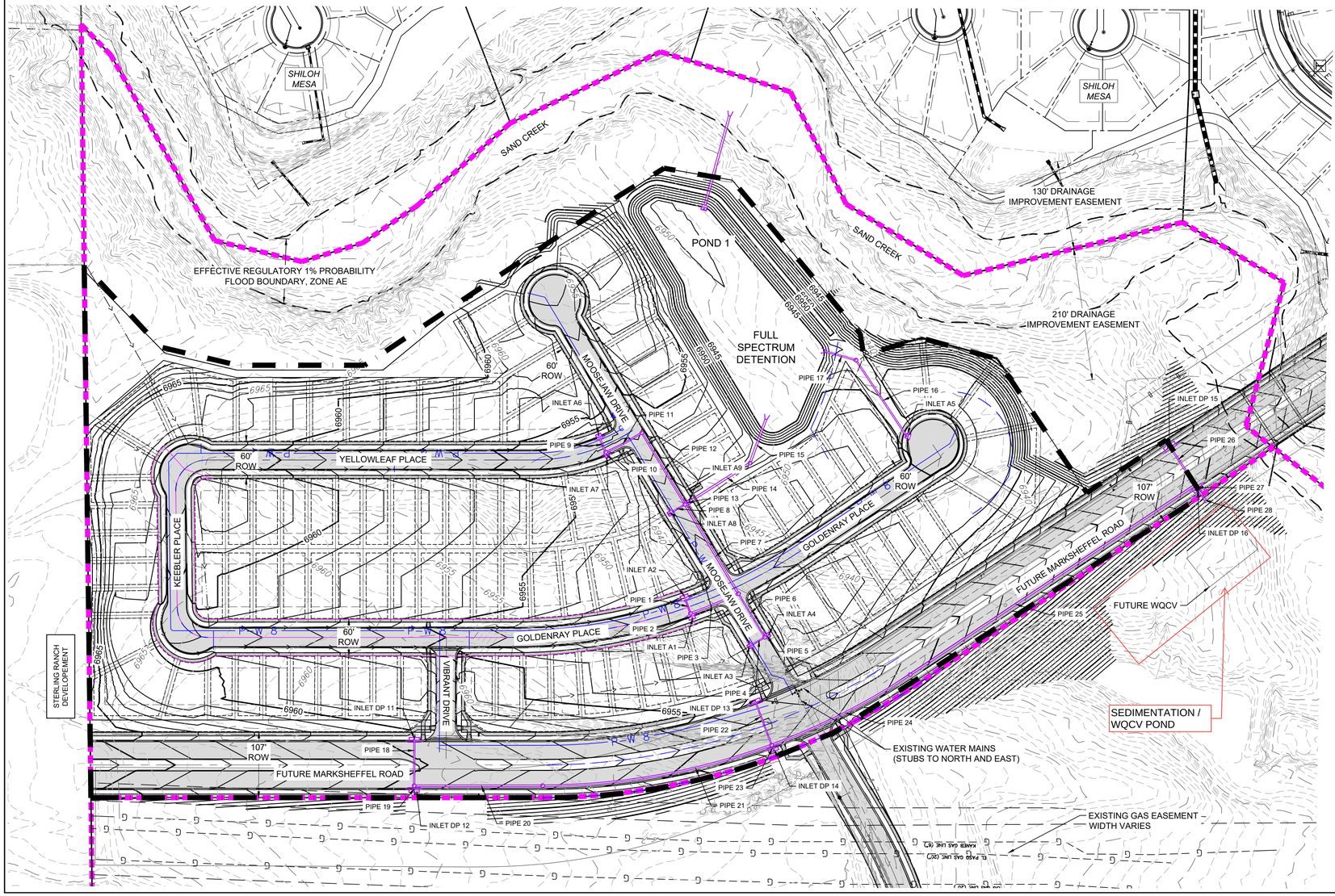
LEGEND

- SUB-BASIN BOUNDARY
- EXISTING CONTOUR (4900)
- PROPOSED CONTOUR (6970)
- FLOW DIRECTION (XXX)
- LOW POINT AND ELEVATION (LP XX)
- HIGH POINT AND ELEVATION (HP XX)
- SPOT ELEVATION (95.71)
- SWALE
- DESIGN POINT
- SUB BASIN DESIGNATION (XX)
- SUB BASIN RUNOFF COEFFICIENT (xx x.xx)
- SUB BASIN AREA (AC.)
- 5-YEAR STORM EVENT PEAK FLOW (CFS) (0.0)
- 100-YEAR STORM EVENT PEAK FLOW (CFS) (0.0)
- PROPERTY LINE
- STORM PIPE

GRAPHIC SCALE

100' 0' 100' 200'

(IN FEET)
1 inch = 100 ft.



STORM PIPE SUMMARY TABLE

PIPE LABEL	PIPE DIAMETER (IN)	PIPE LENGTH (FT)	PIPE FLOW (cfs)
PIPE 1	24"	28	13.2
PIPE 2	24"	6	15.5
PIPE 3	30"	88	28.7
PIPE 4	18"	28	4.2
PIPE 5	18"	6	1.5
PIPE 6	18"	83	5.7
PIPE 7	30"	170	34.4
PIPE 8	18"	28	1.9
PIPE 9	24"	28	11.6
PIPE 10	18"	6	4.8
PIPE 11	24"	68	16.4
PIPE 12	24"	137	16.4
PIPE 13	36"	6	52.7
PIPE 14	36"	117	57.3
PIPE 15	36"	77	57.3
PIPE 16	24"	148	7.9
PIPE 17	24"	52	7.9
PIPE 18	24"	75	10.5
PIPE 19	24"	7	10.4
PIPE 20	30"	210	20.9
PIPE 21	30"	382	20.9
PIPE 22	18"	75	7.5
PIPE 23	18"	7	7.3
PIPE 24	30"	255	35.7
PIPE 25	30"	560	35.7
PIPE 26	24"	75	11.4
PIPE 27	36"	7	47.1
PIPE 28	36"	24	54.9

STORM SUMMARY TABLE

INLET LABEL	INLET OPENING (FT)	FLOW TO INLET (CFS)	FLOW CAPTURED (CFS)
INLET A1 (D10R)	12'	15.5	15.5
INLET A2 (D10R)	10'	13.2	13.2
INLET A3 (D10R)	6'	4.2	4.2
INLET A4 (D10R)	6'	1.5	1.5
INLET A5 (D10R)	6'	8.0	8.0
INLET A6 (D10R)	8'	11.0	11.0
INLET A7 (D10R)	6'	4.8	4.8
INLET A8 (D10R)	6'	1.9	1.9
INLET A9 (D10R)	6'	4.6	4.6
INLET DP11 (D10R)	16'	12.1	10.5
INLET DP12 (D10R)	16'	12.0	10.4
INLET DP13 (D10R)	16'	7.6	7.5
INLET DP14 (D10R)	16'	7.4	7.3
INLET DP15 (D10R)	20'	11.7	11.4
INLET DP16 (D10R)	16'	8.0	7.8

ASPEN MEADOWS
FILING NO. 1
COLORADO SPRINGS, CO
DEVELOPMENT PLAN

CONSULTANT:

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

LANDSCAPE ARCHITECT:
Thomas & Thomas Planning-Urban
614 N. Tejon Street
Colorado Springs, CO 80903
Phone (719)578-8777

PROJECT:
ASPEN MEADOWS
FILING NO.1
DEVELOPMENT PLAN
CITY OF COLORADO SPRINGS
JANUARY 2019

OWNER:
COLA, LLC
555 MIDDLE PARKWAY
COLORADO SPRINGS, CO 80921
(719)459-0807

DEVELOPER:
COLA, LLC
555 MIDDLE PARKWAY
COLORADO SPRINGS, CO 80921
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CITY PLANNING FILE NO: AR DP XXXXXXXXX

ISSUE: JANUARY, 2019

DRAWING INFORMATION:	
PROJECT NO:	17.886.004.000
DRAWN BY:	CRAIG DOLD
CHECKED BY:	JEFF ODOR
APPROVED BY:	JEFF ODOR
SHEET TITLE:	

DRAINAGE REPORT EXHIBIT

DR03

SHEET 3 OF 3

Pond Design Report

Aspen Meadows Addendum

Aspen Meadows - Sand Creek Drainage Basin

June 2020

Prepared for:
City of Colorado Springs, Colorado
Engineering Development Review Division Team
30 South Nevada Avenue, Suite 401
Colorado Springs, CO 80903

COLA, LLC.
555 Middle Parkway
Colorado Springs, CO 80921

Prepared by:
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
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fax (719) 572-0208

MDG Project No. 17.886.004

Detention Calculations

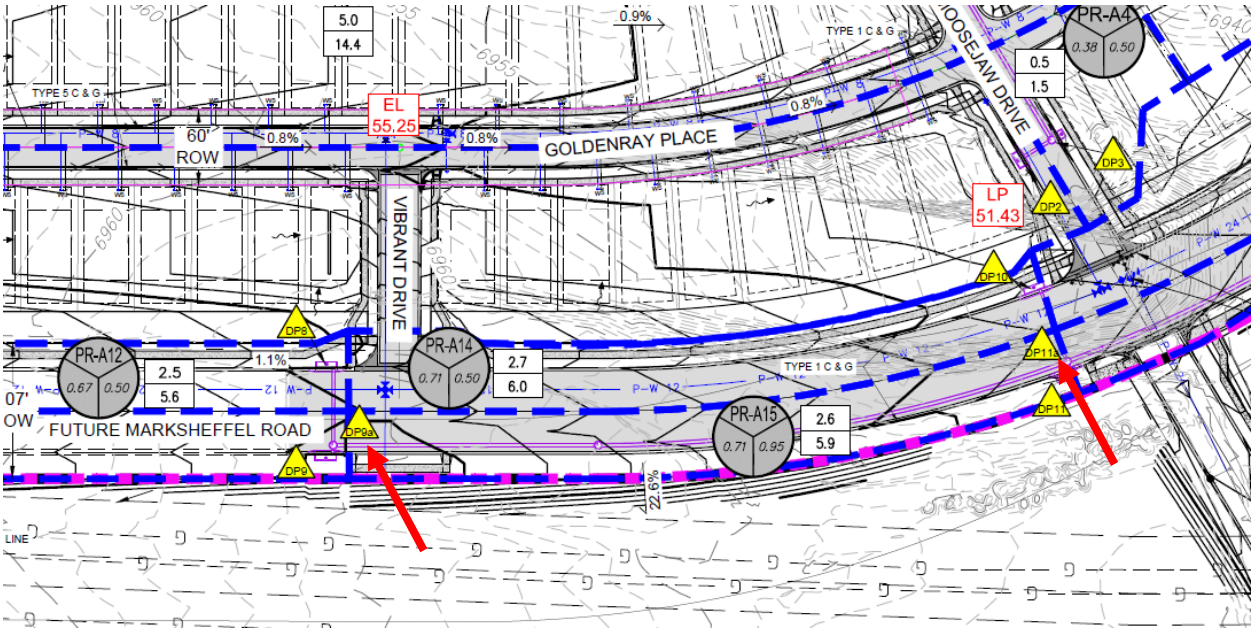
Along with design grading for the proposed single-family full spectrum detention pond (**FDR**: Pond 1), the UD-Detention model was updated to reflect the updated contours as part of the construction documents for Pond 1. Please see the attached UD-Detention sheets for reference.

Calculations

The StormCAD modeling has been completed for the proposed storm sewer as described above. Please see the attached pipe and inlet reports. Spillway and outfall protection calculations were completed in compliance with DCM criteria and are attached as well. Also included are the northern boundary area inlet and swale capacity calculations.

Marksheffel Storm Calculations

Because the layout of the proposed storm alignment has been modified since the previous submittal, the rational calculations for this site were updated and are included in the appendix. Two additional design points were added, DP9a and DP11a, and are placed along Marksheffel Road at the manhole junctions shown below. An updated proposed conditions drainage map can also be found in the Appendix.



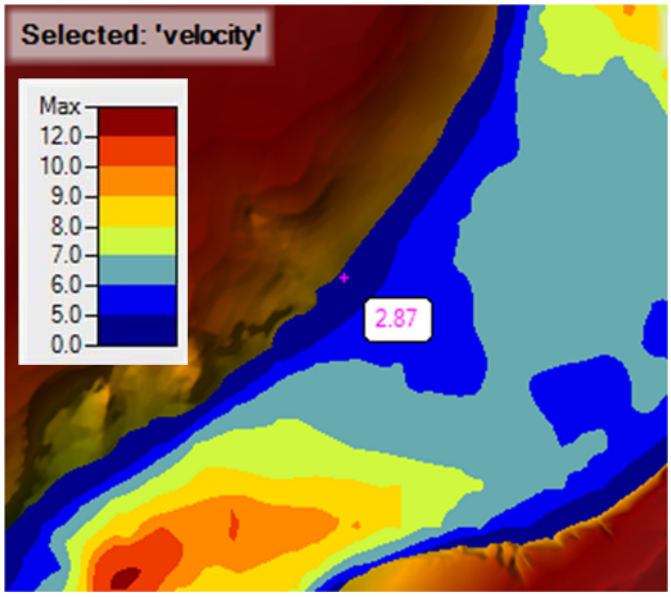
Sterling Ranch Interim Conditions

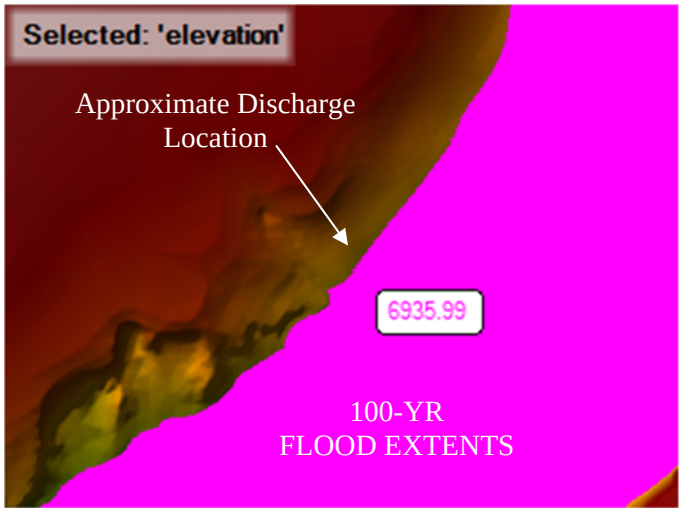
It appears that the proposed Aspen Meadows Filing 1 development will be constructed prior to completion of the proposed detention in Sterling Ranch to the north. The0 result of this is that the runoff from approximately 2.3 acres of undeveloped area immediately north of the proposed Aspen Meadows development. This flow is estimated to be approximately 3 cfs.

Pond Outfalls to Sand Creek

Pond 1

The outfall for Pond 1 at Aspen Meadows Filing 1 discharges near the 100-year highwater for Sand Creek, therefore, additional analysis of the outfall spill pad has been performed. According to the 2D model of Sand Creek the velocity at the spill pad location is just under 3 ft/s. This corresponds with an elevation of 6935.99. Please see excerpted screen captures from the 2D model.

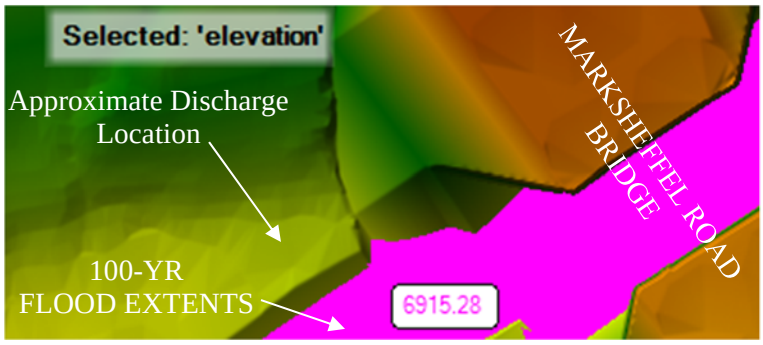




The above indicates that the Pond 1 Discharge pipe (Flout = 6936.22) will discharge just above the 100-year flood event. The spill pad will likely be just inside the 100-year floodplain; however, the modeled flow velocity is below the 3.5 ft/s velocity deemed acceptable in the DCM channel guidelines for the minor storm through erosive soils. This suggests that the Type L (9-inch D50) Rip Rap outfall protection will not be disturbed by the flows within Sand Creek and that the outfall design calculations included in the appendix determine the required outlet protection.

Marksheffel WQ Pond

The modeled Water Surface Elevation adjacent to discharge location is 6915.28. The design discharge flow line is 6920.2. This comparison indicates that the proposed discharge is above the 100-year Base Flood Elevation and that Sand Creek flows do not affect the pipe outfall. Therefore, the outfall protection indicated in this addendum for the Marksheffel WQ Pond discharge flow determines the required outlet protection.

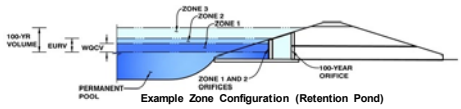


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Aspen Meadows

Basin ID: Marksheffel WQCV



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	SF	
Watershed Area =	8.08	acres
Watershed Length =	1,612	ft
Watershed Slope =	0.023	ft/ft
Watershed Imperviousness =	91.20%	percent
Percentage Hydrologic Soil Group A =	95.3%	percent
Percentage Hydrologic Soil Group B =	4.7%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	12.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.222	acre-feet
Excess Urban Runoff Volume (EURV) =	0.997	acre-feet
2-yr Runoff Volume (P1 = 0.95 in.) =	0.558	acre-feet
5-yr Runoff Volume (P1 = 1.23 in.) =	0.742	acre-feet
10-yr Runoff Volume (P1 = 1.49 in.) =	0.925	acre-feet
25-yr Runoff Volume (P1 = 1.88 in.) =	1.193	acre-feet
50-yr Runoff Volume (P1 = 2.21 in.) =	1.406	acre-feet
100-yr Runoff Volume (P1 = 2.57 in.) =	1.669	acre-feet
500-yr Runoff Volume (P1 = 3.52 in.) =	2.346	acre-feet
Approximate 2-yr Detention Volume =	0.530	acre-feet
Approximate 5-yr Detention Volume =	0.706	acre-feet
Approximate 10-yr Detention Volume =	0.871	acre-feet
Approximate 25-yr Detention Volume =	1.127	acre-feet
Approximate 50-yr Detention Volume =	1.278	acre-feet
Approximate 100-yr Detention Volume =	1.417	acre-feet

Optional User Override 1-hr Precipitation

0.95	inches
1.23	inches
1.49	inches
1.88	inches
2.21	inches
2.57	inches
3.52	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.222	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.222	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

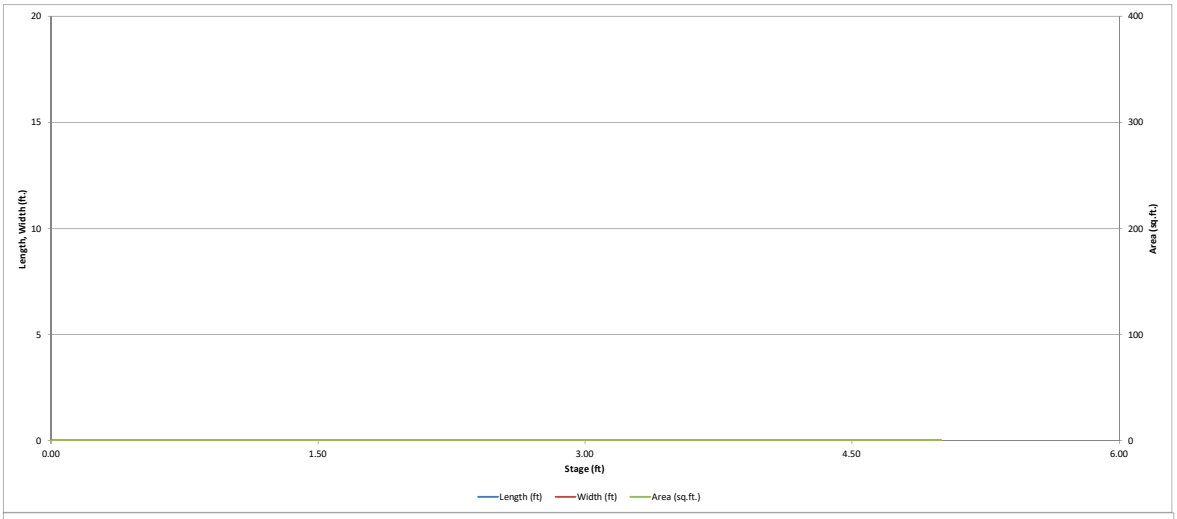
Total detention volume is less than 100-year volume.

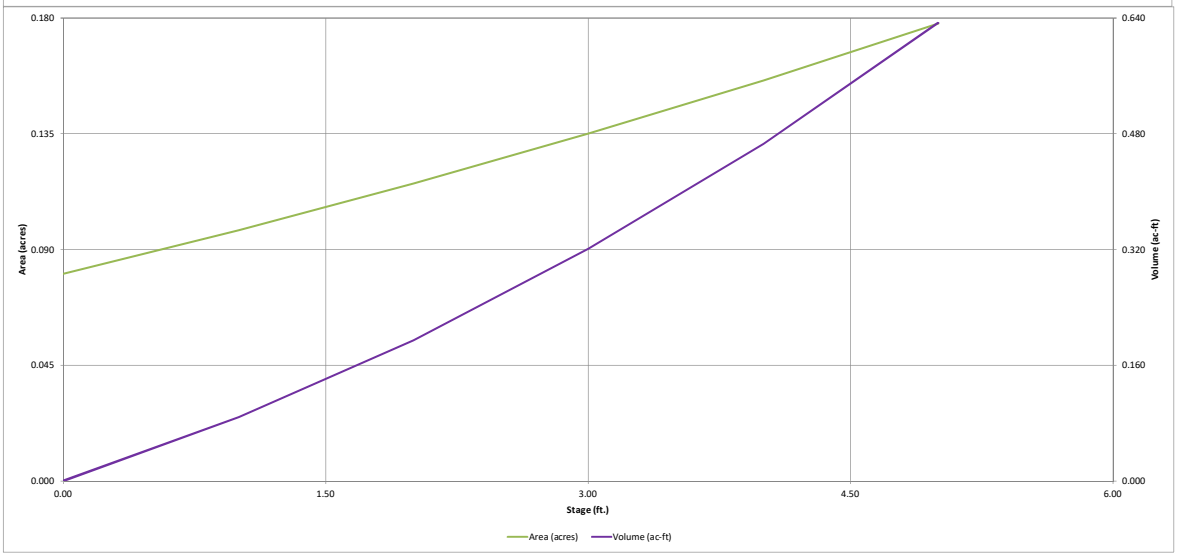
Depth Increment = 1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface	--	0.00	--	--	--	3,508	0.081		
	--	1.00	--	--	--	4,242	0.097	3,833	0.088
	--	2.00	--	--	--	5,035	0.116	8,463	0.194
	--	3.00	--	--	--	5,883	0.135	13,972	0.321
	--	4.00	--	--	--	6,788	0.156	20,307	0.466
	--	5.00	--	--	--	7,750	0.178	27,576	0.633

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)





Matrix DESIGN GROUP
AN EMPLOYEE-OWNED COMPANY

Job. No. 17.886.004
Date JULY / 30 / 2019
Sheet 1 of 1
By BAS

Project ASPEN MEADOWS
Subject UNDERDRAIN ORIFICE SIZING

$$D_{12\,HR} = \sqrt{\frac{V}{1414\,y^{0.41}}}$$

WHERE $V = 0.222$ AC-FT $= 9{,}670.32$ FT^3

$y = 1.825$ FT

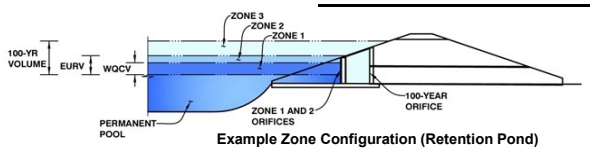
$$= \sqrt{\frac{9670.32}{1414\,(1.825)^{0.41}}} = 2.31 \text{ in}$$

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Aspen Meadows

Basin ID: Marksheffel WQCV



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.23	0.222	
Zone 2			
Zone 3			
		0.222	Total

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

Underdrain Orifice Invert Depth =	1.83	ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Diameter =	2.31	inches	Underdrain Orifice Centroid =	0.10	feet

Calculated Parameters for Underdrain

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

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

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Not Selected	Not Selected			Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =			ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =			feet
Overflow Weir Front Edge Length =			feet	Over Flow Weir Slope Length =			feet
Overflow Weir Slope =			H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =			should be ≥ 4
Horiz. Length of Weir Sides =			feet	Overflow Grate Open Area w/o Debris =			ft^2
Overflow Grate Open Area % =			%, grate open area/total area	Overflow Grate Open Area w/ Debris =			ft^2
Debris Clogging % =			%				

Calculated Parameters for Overflow Weir

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =			ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =			ft^2
Circular Orifice Diameter =			inches	Outlet Orifice Centroid =			feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.48	feet
Spillway Crest Length =	17.00	feet	Stage at Top of Freeboard =	4.48	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.17	acres
Freeboard above Max Water Surface =	1.00	feet			

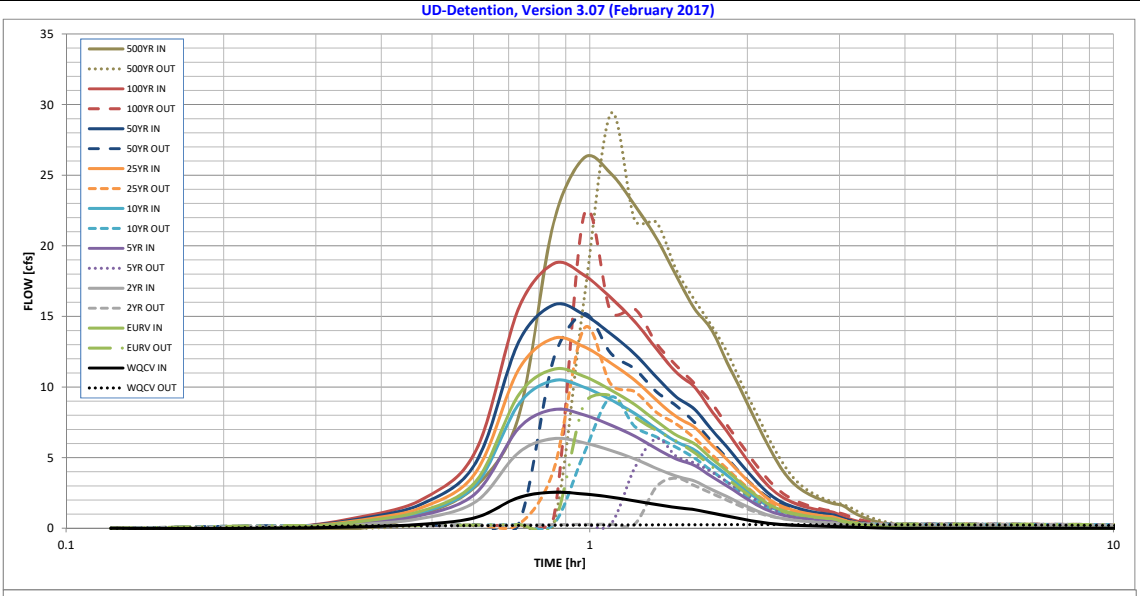
Calculated Parameters for Spillway

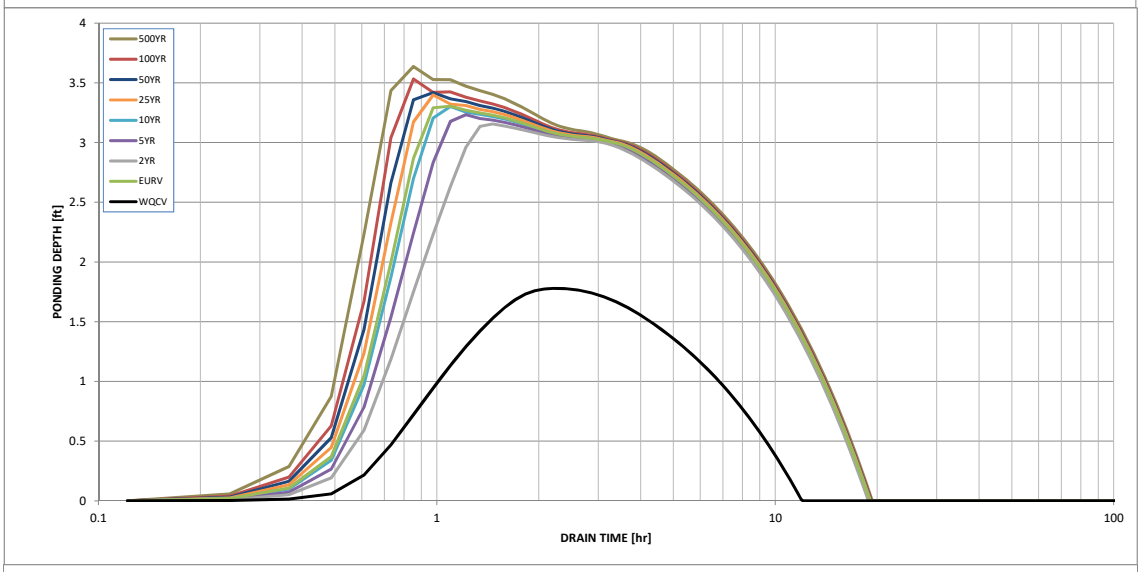
Routed Hydrograph Results

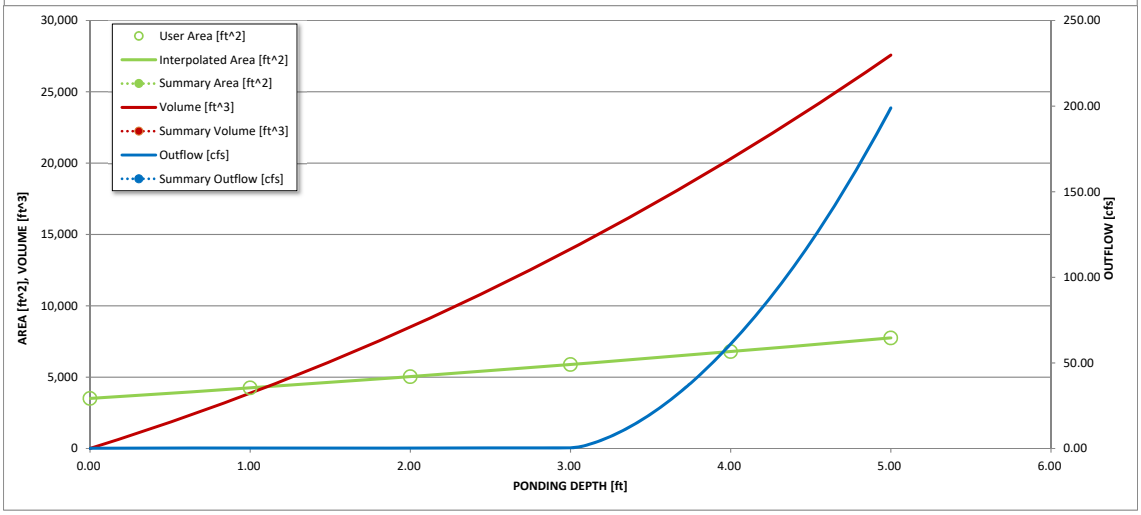
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.95	1.23	1.49	1.88	2.21	2.57	3.52
Calculated Runoff Volume (acre-ft) =	0.222	0.997	0.558	0.742	0.925	1.193	1.406	1.669	2.346
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.222	0.997	0.558	0.742	0.925	1.193	1.406	1.669	2.346
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.04	0.15	0.34	0.84
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.1	0.3	1.2	2.7	6.7
Peak Inflow Q (cfs) =	2.6	11.3	6.4	8.4	10.5	13.5	15.8	18.7	26.2
Peak Outflow Q (cfs) =	0.3	9.4	3.6	6.4	9.3	14.1	15.2	22.2	29.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	256.7	102.9	49.8	12.9	8.1	4.3
Structure Controlling Flow =	Filtration Media	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	12	17	18	18	17	17	17	16	15
Time to Drain 99% of Inflow Volume (hours) =	**12**	19	19	19	19	18	18	18	18
Maximum Ponding Depth (ft) =	1.78	3.31	3.16	3.23	3.30	3.40	3.42	3.53	3.64
Area at Maximum Ponding Depth (acres) =	0.11	0.14	0.14	0.14	0.14	0.14	0.14	0.15	0.15
Maximum Volume Stored (acre-ft) =	0.169	0.362	0.341	0.352	0.362	0.375	0.378	0.395	0.410

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
7.31 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:07:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:14:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:21:56	0.12	0.49	0.28	0.37	0.46	0.59	0.69	0.81	1.12
0.684	0:29:14	0.31	1.34	0.76	1.00	1.24	1.59	1.87	2.21	3.07
	0:36:33	0.79	3.43	1.95	2.57	3.19	4.09	4.80	5.67	7.89
	0:43:52	2.18	9.43	5.36	7.07	8.77	11.23	13.18	15.56	21.65
	0:51:10	2.55	11.26	6.35	8.41	10.46	13.45	15.82	18.74	26.23
	0:58:29	2.43	10.76	6.06	8.03	10.00	12.86	15.13	17.94	25.14
	1:05:47	2.21	9.80	5.51	7.31	9.10	11.71	13.78	16.33	22.88
	1:13:06	1.96	8.77	4.92	6.53	8.14	10.49	12.35	14.65	20.56
	1:20:25	1.68	7.59	4.24	5.65	7.05	9.09	10.71	12.72	17.90
	1:27:43	1.47	6.61	3.70	4.92	6.13	7.91	9.31	11.05	15.57
	1:35:02	1.33	5.99	3.35	4.46	5.56	7.17	8.44	10.02	14.10
	1:42:20	1.08	4.96	2.76	3.68	4.60	5.95	7.02	8.34	11.77
	1:49:39	0.88	4.07	2.25	3.01	3.77	4.89	5.77	6.87	9.72
	1:56:58	0.66	3.15	1.73	2.32	2.92	3.80	4.50	5.37	7.64
	2:04:16	0.48	2.37	1.29	1.73	2.19	2.86	3.41	4.08	5.84
	2:11:35	0.35	1.71	0.93	1.25	1.58	2.08	2.49	2.99	4.31
	2:18:53	0.28	1.32	0.72	0.97	1.22	1.60	1.90	2.28	3.26
	2:26:12	0.23	1.08	0.60	0.80	1.00	1.31	1.55	1.86	2.65
	2:33:31	0.20	0.92	0.51	0.68	0.85	1.11	1.31	1.57	2.23
	2:40:49	0.17	0.80	0.44	0.59	0.75	0.97	1.15	1.37	1.95
	2:48:08	0.16	0.72	0.40	0.54	0.67	0.87	1.03	1.23	1.75
	2:55:26	0.14	0.67	0.37	0.49	0.62	0.80	0.95	1.13	1.60
	3:02:45	0.11	0.49	0.27	0.36	0.45	0.59	0.70	0.83	1.19
	3:10:04	0.08	0.36	0.20	0.27	0.33	0.43	0.51	0.61	0.86
	3:17:22	0.06	0.26	0.15	0.19	0.24	0.32	0.38	0.45	0.64
	3:24:41	0.04	0.19	0.11	0.14	0.18	0.23	0.28	0.33	0.47
	3:31:59	0.03	0.14	0.08	0.10	0.13	0.17	0.20	0.24	0.34
	3:39:18	0.02	0.10	0.05	0.07	0.09	0.12	0.14	0.17	0.24
	3:46:37	0.01	0.07	0.04	0.05	0.07	0.09	0.10	0.12	0.18
	3:53:55	0.01	0.05	0.03	0.03	0.04	0.06	0.07	0.08	0.12
	4:01:14	0.01	0.03	0.01	0.02	0.03	0.04	0.04	0.05	0.08
	4:08:32	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04
	4:15:51	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.02
	4:23:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:37:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:52:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:59:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:07:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:14:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:21:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:28:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:36:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:43:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:58:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:05:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:12:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:20:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:27:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:34:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:42:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:49:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:56:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:03:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:11:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:18:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:25:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:33:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:40:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:47:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:55:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:02:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:09:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:17:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:24:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:31:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:39:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8:46:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

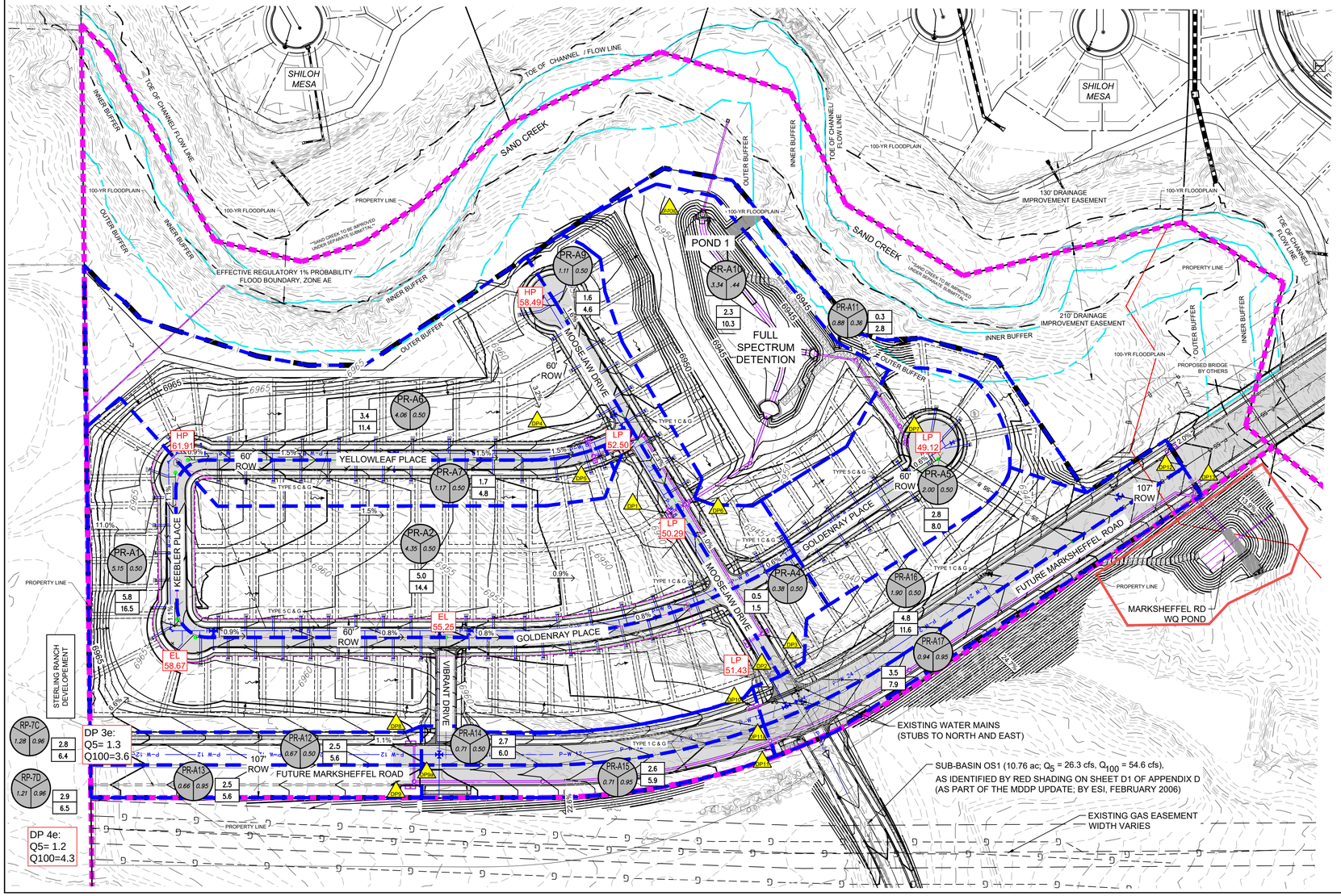
ASPEN MEADOWS

COLORADO SPRINGS, CO

PROPOSED CONDITIONS MAP

Design Point Summary Table

Design Point	Upstream Area (Acres)	Q5 (cfs)	Q100 (cfs)	Subbasins Included	Inlet Name	Inlet Type	Inlet Size (ft)	Outlet Pipe Size/Type	Downstream Design Point	Receiving Emergency Overflow
DP1	4.35	5.0	14.4	A2	A2	D 10 R	12	24" RCP/HP	DP6	DP6 / Street Overtop
DP2	5.15	5.8	16.5	A1	A1	D 10 R	10	24" RCP/HP	DP3	DP3 / Street Overtop
DP3	5.53	6.2	17.7	DP2,A4	A4	D 10 R	6	18" RCP/HP	DP6	DP6 / C & G, Street Overtop
DP4	4.06	3.4	11.4	A6	D4	D 10 R	8	36" RCP/HP	DP5	DP5 / Street Overtop
DP5	5.23	4.8	15.2	DP5, A7	D5	MH	6	36" RCP/HP	DP6	DP1 / C & G
DP6	16.22	16.7	49.3	DP1,DP3,DP5,A9	D6	D 10 R	6	42" RCP/HP	DP POND	DP POND / Overtop Curb, Swale
DP7	2.00	2.8	8.0	A5	A5	D 10 R	6	24" RCP/HP	DP POND	DP POND / Overtop Curb, Swale
DP Pond Detention Discharge	21.57 -	19.9 0.4	61.2 3.7	A1,A2,A4,A5, A6,A7,A9, A10	A9	Detention Outlet Structure		Orifice Plate: 1.02 Sq. In. (Stage 0', .9' & 1.06') Overflow Weir/Grate: L=2', W=2' w/ slope: 0 Overflow Weir/Grate: (Stage: 4' to 6') Structure Outlet Pipe: 18" RCP/HP (10.5" Orifice Plate.	- Sand Creek	- Sand Creek
DP8	1.95	5.9	13.2	RP-7C,A12	A12	D 10 R	16	24" RCP/HP	DP9	DP10 / C & G
DP9	1.87	5.8	13.0	DP8,RP-7D,A13	A13	D 10 R	16	24" RCP/HP	DP11	DP11 / C & G
DP10	0.71	2.7	6.0	A14	A14	D 10 R	16	18" RCP/HP	DP11	DP12 / C & G
DP11	0.71	2.6	5.9	DP9,DP10,A15	A15	D 10 R	16	30" RCP/HP	DP13	DP13 / C & G
DP12	1.90	4.8	11.6	A16	A16	D 10 R	20	24" RCP/HP	DP13	Sand Creek Bridge
DP13	3.55	8.6	20.3	DP11,DP12,A17	A17	D 10 R	16	42" RCP/HP	WQ POND/ Sand Creek	Sand Creek Bridge



Basin Summary Table
Aspen Meadows

Area ID	Area (Acres)	Q5 (cfs)	Q100 (cfs)	Runoff Source	Runoff Type
RP-7C	1.28	2.8	6.4	Road	Concentrated
RP-7D	1.21	2.9	6.5	Road	Concentrated
A1	5.15	5.8	16.5	Lots/Road	Sheet/Conc
A2	4.35	5.0	14.4	Lots/Road	Sheet/Conc
A4	0.38	0.5	1.5	Lots/Road	Sheet/Conc
A5	2.00	2.8	8.0	Lots/Road	Sheet/Conc
A6	4.06	3.4	11.4	Lots/Road	Sheet/Conc
A7	1.17	1.7	4.8	Lots/Road	Sheet/Conc
A9	1.11	1.6	4.6	Lots/Road	Sheet/Conc
A10	3.34	2.3	10.3	Pond	Sheet
A11	0.88	0.3	2.8	Channel	Concentrated
A12	0.67	2.5	5.6	Road	Concentrated
A13	0.66	2.5	5.6	Road	Concentrated
A14	0.71	2.7	6.0	Road	Concentrated
A15	0.71	2.6	5.9	Road	Concentrated
A16	1.90	4.8	11.6	Lots/Road	Sheet/Conc
A17	0.94	3.5	7.9	Road	Concentrated

NOTE: BASIN A3 & A8 OMITTED.

NOTES:
1. Spot elevations subject to change with final grading design and construction.

LEGEND

- SUB-BASIN BOUNDARY
- 4900 EXISTING CONTOUR
- 6970 PROPOSED CONTOUR
- XXX FLOW DIRECTION
- LP XX LOW POINT AND ELEVATION
- HP XX HIGH POINT AND ELEVATION
- 95.71 SPOT ELEVATION
- FLOW ARROW
- SWALE
- x DESIGN POINT
- XX SUB BASIN DESIGNATION
- XX X.XX SUB BASIN RUNOFF COEFFICIENT
- SUB BASIN AREA (AC.)
- 0.0 5-YEAR STORM EVENT PEAK FLOW (CFS)
- 0.0 100-YEAR STORM EVENT PEAK FLOW (CFS)
- PROPERTY LINE
- STORM PIPE

GRAPHIC SCALE
100' 0' 100' 200'
(IN FEET)
1 inch = 100 ft.

Know what's below. Call before you dig.

CONSULTANT:

CIVIL ENGINEER/ LANDSCAPE ARCHITECT:
Matrix
Excellence by Design
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
Contact: Greg Shaner, Civil Engineer
Contact: Jason Alwine, Landscape Architect
Phone (719) 575-0100
Fax (719) 575-0208

PROJECT:
ASPEN MEADOWS
FILING NO.1
PUD DEVELOPMENT PLAN
CITY OF COLORADO SPRINGS
JANUARY 2020

OWNER:
COLA, LLC
555 MIDDLE PARKWAY
COLORADO SPRINGS, CO 80921
(719)459-0807

DEVELOPER:
COLA, LLC
555 MIDDLE PARKWAY
COLORADO SPRINGS, CO 80921
(719)459-0807

CITY PLANNING FILE NO: AR PUD 19-00053

ISSUE: MARCH, 2020

DRAWING INFORMATION:

PROJECT NO:	17.886.004.000
DRAWN BY:	CRAIG DOLD
CHECKED BY:	JEFF ODOR
APPROVED BY:	JEFF ODOR
SHEET TITLE:	

DRAINAGE REPORT MAP

DR02

Project Name:	Aspen Meadows Filing No. 1 Addendum
Project Location:	NE Colorado Springs
Designer	JTS
Notes:	Proposed Conditions

Average Channel Velocity	5	ft/s	(If specific channel vel is used, this will be ignored)
Average Slope for Initial Flow	0.04	ft/ft	(If Elevations are used, this will be ignored)

	Area		Rational 'C' Values														Flow Lengths				Initial Flow				Channel Flow					Tc	Rainfall Intensity & Rational Flow Rate													
Basin			Surface Type 1 (Meadow)			Surface Type 2 (Pavement)			Surface Type 3 Acre Lots)			(1/4 Surface Type 4 (0.147 Acre Lots) (Interpolated between 1/8 & 1/4 Acre lots)			Composite		Initial	True Initial	Channel	rue Chann	High Point	Low Point	Average	Initial	High Point	Low Point	Average	Velocity	Channel	Total	i2	Q2	i5	Q5	i10	Q10	i25	Q25	i50	Q50	i100	Q100
	sf	acres	C5	C100	Area (SF)	C5	C100	Area (SF)	C5	C100	Area	C10	C100	Area	C5	C100	ft	Length ft	ft	Length ft	Elevation	Elevation	Slope	Tc (min)	Elevation	Elevation	Slope	(ft/s)	Tc (min)	(min)	in/hr	cfs	in/hr	cfs	in/hr	cfs	in/hr	cfs	in/hr	cfs	in/hr	cfs
Sterling Ranch Interim Flows	101795	2.34	0.08	0.36	101,795	0.90	0.96		0.30	0.50		0.42	0.57		0.08	0.36	273	273	315	315	6971	6968	0.011	30.5	6968	6966	0.006		1.1	31.6	1.5	**0.3**	1.9	**0.4**	2.3	**0.4**	2.9	**2.5**	3.4	**2.9**	4.0	**3.4**

FINAL DRAINAGE REPORT
FOR
STERLING RANCH FILING 3

Prepared For:

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Colorado Springs, CO 80903
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April 2022
Project No. 25188.02
SF-2132

Prepared By:

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719-593-2593

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 Filing 3
Project No.: 25188.02
Calculated By: CJD
Checked By:
Date: 4/12/22

		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)	t_c (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
	9	B3	0.59	0.55	14.7	0.33	3.55	1.2															Offsite flow to existing inlet in Sterling Ranch Road Piped to existing storm sewer in Sterling Ranch Road
	10	B4	1.59	0.40	16.0	0.63	3.43	2.2								2.2	0.63	1.0	12	380	4.7	1.4	Rear lot and area inlets Piped to DP 11.1
	11	B5	0.45	0.37	8.8	0.17	4.31	0.7															Area Inlet Piped to DP 14.1
	11.1								17.3	0.80	3.30	2.6				2.6	0.80	1.0	18	357	4.9	1.2	Piped to DP 14.1
	12	B2	4.33	0.55	12.2	2.37	3.83	9.1								9.1	2.37	1.0	18	38	6.7	0.1	Sump Inlet Piped to DP 13.1
	13	B1	2.44	0.62	11.6	1.52	3.91	5.9															Sump Inlet Piped to DP 13.1
	13.1								12.3	3.89	3.82	14.9				14.9	3.89	1.0	24	125	7.6	0.3	Piped to DP 14.1
	14	B6	0.79	0.33	18.6	0.26	3.20	0.8															Area Inlet Piped to DP 14.1
	14.1								18.6	4.95	3.20	15.8				15.8	4.95	1.0	24	415	7.7	0.9	Piped to DP 15.1
	15	A1	4.37	0.49	12.5	2.16	3.79	8.2					0.8	0.21	1.6	7.4				230	2.5	1.5	On-grade Inlet Captured Flows piped to DP 15.1, Bypass flow to DP 17
	15.1								19.5	7.11	3.13	22.2				22.2	7.11	1.0	24	45	8.2	0.1	On-grade Inlet Captured Flows piped to DP 16.1
	16	A5	0.45	0.62	5.0	0.28	5.16	1.4															On-grade Inlet Captured Flows piped to DP 16.1
	16.1								19.6	7.39	3.12	23.1				23.1	7.39	1.0	24	125	8.2	0.3	FES release to drainage channel
	I1	I1	24.50	0.09	31.8	2.17	2.40	5.2															FES
	I1.1								31.8	9.56	2.40	22.9				22.9	9.56	0.4	42	62	6.1	0.2	Combined flow from DPI1 & DP16.1 Piped to Existing 84" RCP
	I2	I2	3.47	0.08	31.1	0.28	2.43	0.7															Piped to Existing 84" RCP
	28	D1	0.38	0.22	8.9	0.09	4.30	0.4															Sheet flow to Sand Creek
	29	D2	3.92	0.14	7.6	0.56	4.53	2.5															Sheet flow to Sand Creek

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)

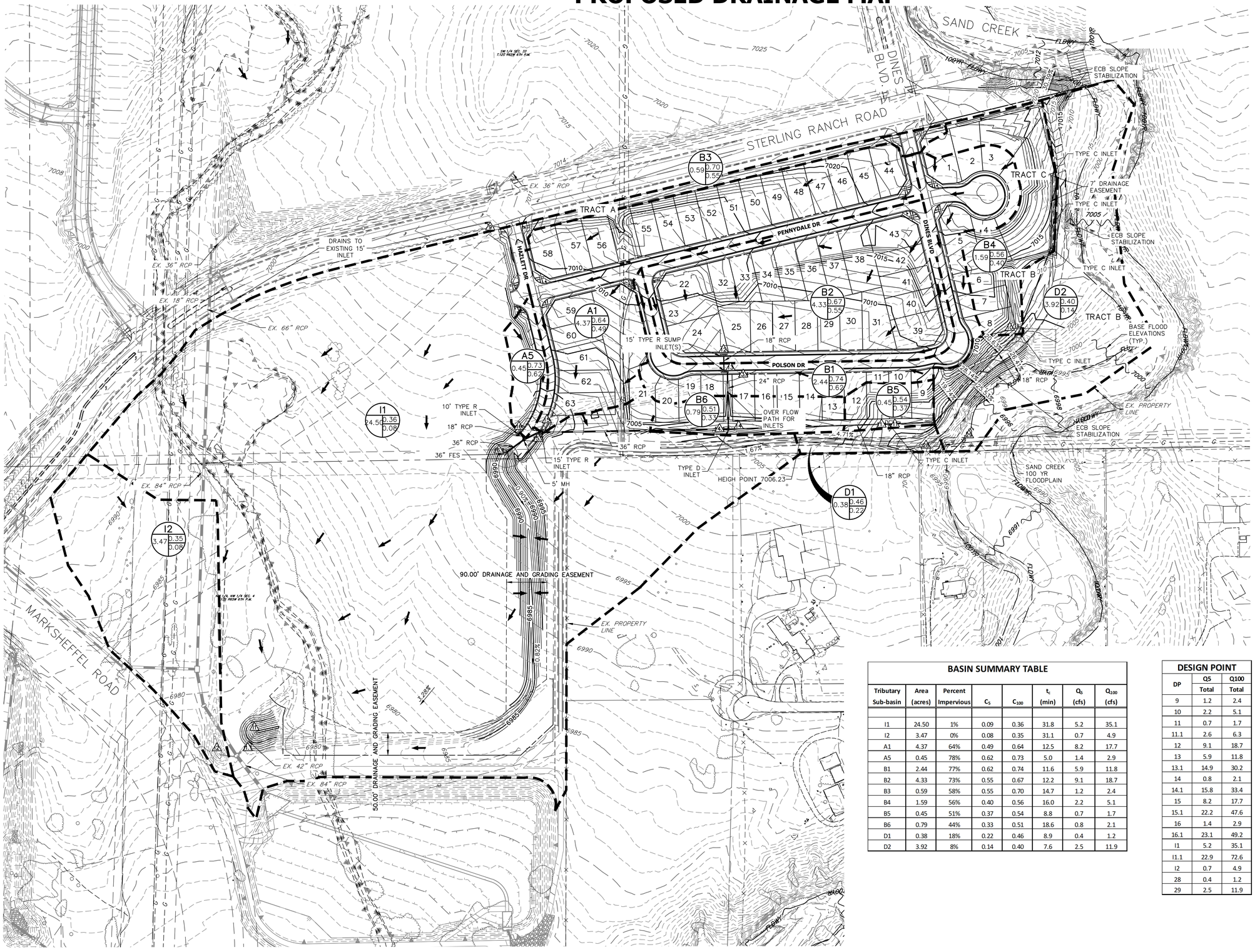
Subdivision: Sterling Ranch Subdivision
Location: El Paso County
Design Storm: 100-Year

Project Name: Sterling Ranch Filing 3
Project No.: 25188.02
Calculated By: CJD
Checked By:
Date: 4/12/22

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)	t_c (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)	
	9	B3	0.59	0.70	14.7	0.41	5.96	2.4															Offsite flow to existing inlet in Sterling Ranch Road Piped to existing storm sewer in Sterling Ranch Road
	10	B4	1.59	0.56	16.0	0.88	5.75	5.1								5.1	0.88	1.0	12	380	6.5	1.0	Rear lot and area inlets Piped to DP 11.1
	11	B5	0.45	0.54	8.8	0.24	7.24	1.7															Area Inlet Piped to DP 14.1
	11.1								17.0	1.12	5.60	6.3				6.3	1.12	1.0	18	357	6.2	1.0	Piped to DP 14.1
	12	B2	4.33	0.67	12.2	2.90	6.43	18.7								18.7	2.90	1.0	18	38	10.6	0.1	Sump Inlet Piped to DP 13.1
	13	B1	2.44	0.74	11.6	1.80	6.56	11.8															Sump Inlet Piped to DP 13.1
	13.1								12.3	4.70	6.42	30.2				30.2	4.70	1.0	24	125	9.6	0.2	Piped to DP 14.1
	14	B6	0.79	0.51	18.6	0.40	5.37	2.1															Area Inlet Piped to DP 14.1
	14.1								18.6	6.22	5.37	33.4				33.4	6.22	1.0	24	415	10.6	0.7	Piped to DP 15.1
	15	A1	4.37	0.64	12.5	2.78	6.37	17.7					10.3	1.618	1.6	7.4				230	2.5	1.5	On-grade Inlet Captured Flows piped to DP 15.1, Bypass flow to DP 17
	15.1								19.2	9.00	5.28	47.6				47.6	9.00	1.0	24	45	15.2	0.0	On-grade Inlet Captured Flows piped to DP 16.1
	16	A5	0.45	0.73	5.0	0.33	8.66	2.9															On-grade Inlet Captured Flows piped to DP 16.1
	16.1								19.3	9.33	5.28	49.2				49.2	9.33	1.0	24	125	15.7	0.1	FES release to drainage channel
	I1	I1	24.50	0.36	31.8	8.73	4.02	35.1															FES
	I1.1								31.8	18.06	4.02	72.6				72.6	18.06	0.4	42	62	7.6	0.1	Combined flow from DPI1 & DP16.1 Piped to Existing 84" RCP
	I2	I2	3.47	0.35	31.1	1.21	4.07	4.9															Piped to Existing 84" RCP
	28	D1	0.38	0.46	8.9	0.17	7.22	1.2															Sheet flow to Sand Creek
	29	D2	3.92	0.40	7.6	1.56	7.61	11.9															Sheet flow to Sand Creek

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.

STERLING RANCH FILING 3
PROPOSED DRAINAGE MAP



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

EXISTING 6100 PROPOSED 6100

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
I1	24.50	1%	0.09	0.36	31.8	5.2	35.1
I2	3.47	0%	0.08	0.35	31.1	0.7	4.9
A1	4.37	64%	0.49	0.64	12.5	8.2	17.7
A5	0.45	78%	0.62	0.73	5.0	1.4	2.9
B1	2.44	77%	0.62	0.74	11.6	5.9	11.8
B2	4.33	73%	0.55	0.67	12.2	9.1	18.7
B3	0.59	58%	0.55	0.70	14.7	1.2	2.4
B4	1.59	56%	0.40	0.56	16.0	2.2	5.1
B5	0.45	51%	0.37	0.54	8.8	0.7	1.7
B6	0.79	44%	0.33	0.51	18.6	0.8	2.1
D1	0.38	18%	0.22	0.46	8.9	0.4	1.2
D2	3.92	8%	0.14	0.40	7.6	2.5	11.9

DESIGN POINT

DP	Q_5 Total	Q_{100} Total
9	1.2	2.4
10	2.2	5.1
11	0.7	1.7
11.1	2.6	6.3
12	9.1	18.7
13	5.9	11.8
13.1	14.9	30.2
14	0.8	2.1
14.1	15.8	33.4
15	8.2	17.7
15.1	22.2	47.6
16	1.4	2.9
16.1	23.1	49.2
I1	5.2	35.1
I1.1	22.9	72.6
I2	0.7	4.9
28	0.4	1.2
29	2.5	11.9

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

STERLING RANCH FILING 3
PROPOSED CONDITION DRAINAGE MAP
JOB NO. 25188.02
04/12/22
SHEET 1 OF 1

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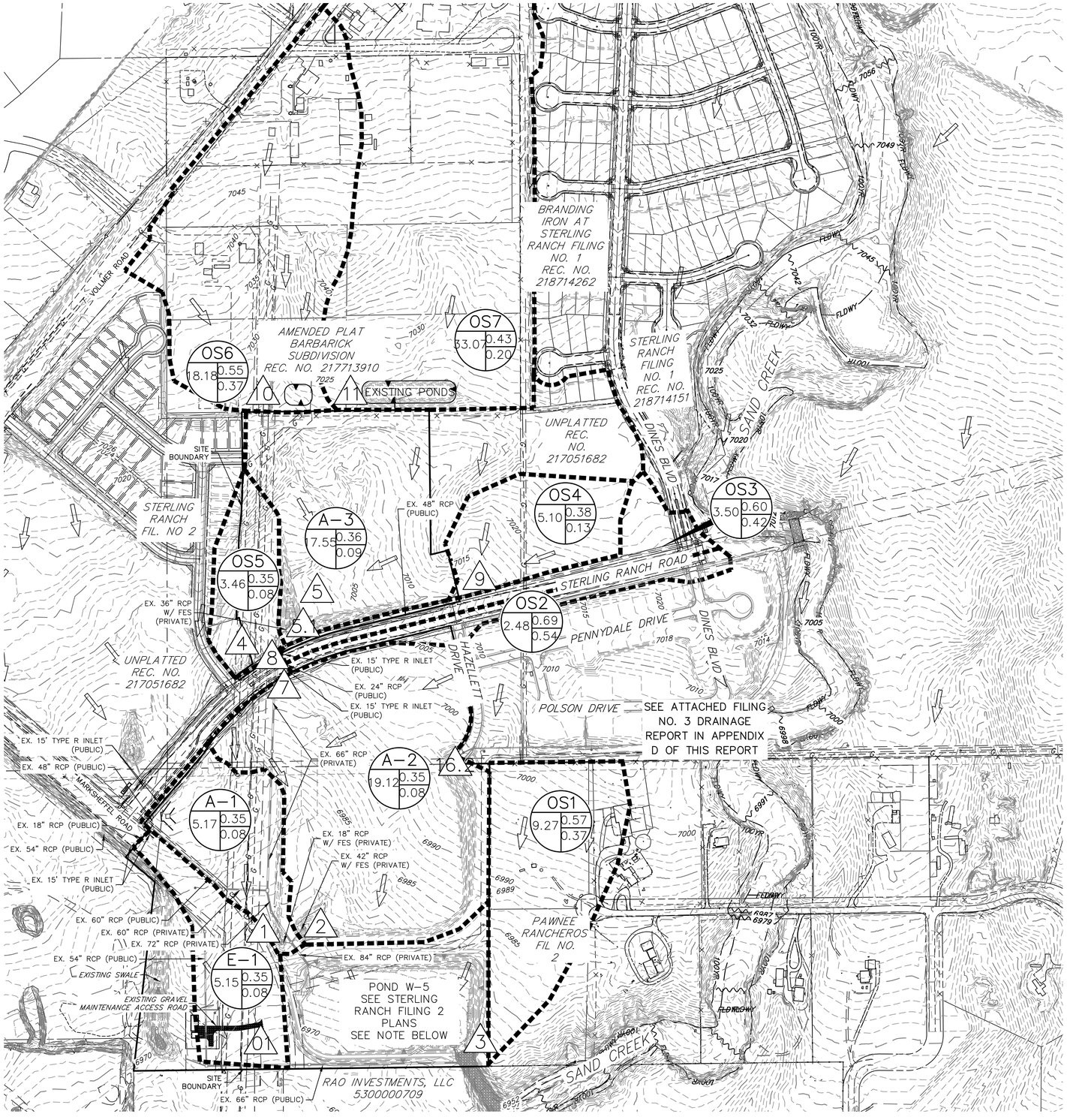
Appendix E
Drainage Maps

STERLING RANCH FILING NO. 4

EXISTING DRAINAGE MAP



LEGEND

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

DESIGN POINT

EXISTING FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

SITE BOUNDARY
EXISTING PROPERTY LINE
ROW EXISTING
FL EXISTING
SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING

6100

DESIGN POINT		
DP	Q5 Total	Q100 Total
1	1.1	8.0
16.2	23.1	49.2
2	22.7	68.5
3	9.5	24.6
4	0.7	5.0
7	4.3	9.1
8	5.0	12.1
9	1.6	7.9
10	22.2	55.2
11	14.6	52.8
5	5.1	33.1
5.1	29.5	89.6
O1	1.3	9.5

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A-1	5.17	0%	0.08	0.35	27.4	1.1	8.0
A-2	19.12	0%	0.08	0.35	28.7	3.9	28.6
A-3	17.55	2%	0.09	0.36	19.4	5.1	33.1
OS1	9.27	37%	0.37	0.57	24.4	9.5	24.6
OS2	2.48	56%	0.54	0.69	19.0	4.3	9.1
OS3	3.50	42%	0.42	0.60	16.2	5.0	12.1
OS4	5.10	8%	0.13	0.38	31.1	1.6	7.9
OS5	3.46	0%	0.08	0.35	30.4	0.7	5.0
OS6	18.18	46%	0.37	0.55	17.5	22.2	55.2
OS7	33.07	19%	0.20	0.43	36.4	14.6	52.8
E-1	5.15	0%	0.08	0.35	19.4	1.3	9.5

NOTE:

EXISTING GRADING ASSUMES FILING 2, STERLING RANCH ROAD, & MARKSHEFFEL ROAD ARE BUILT.

300 150 0 300 600

ORIGINAL SCALE: 1" = 300'

STERLING RANCH FILING NO. 4
EXISTING DRAINAGE MAP
JOB NO. 25188.11
01/18/23
SHEET 1 OF 1

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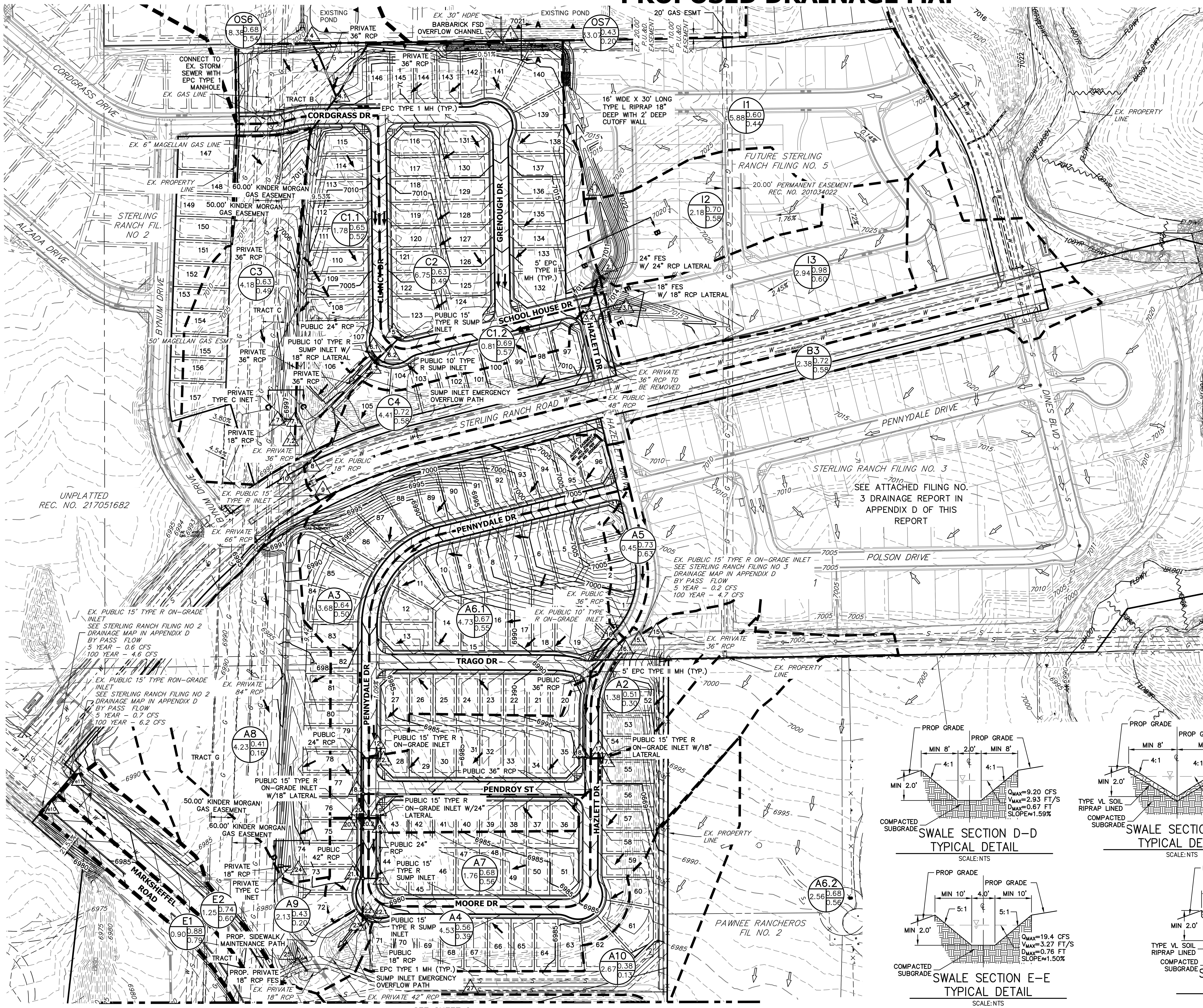
STERLING RANCH FILING NO. 4
PROPOSED DRAINAGE MAP



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

LEGEND

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

DESIGN POINT
PROPOSED FLOW DIRECTION
EXISTING FLOW DIRECTION
BASIN DRAINAGE AREA
EXISTING STORM SEWER
STORM SEWER PROPOSED
PROPOSED R.O.W
PROPOSED PROPERTY LINES
PROPOSED SIDEWALK
EXISTING PROPERTY LINE
ROW EXISTING
FL EXISTING
SIDEWALK EXISTING
DRAINAGE ACCESS & MAINTENANCE EASEMENT

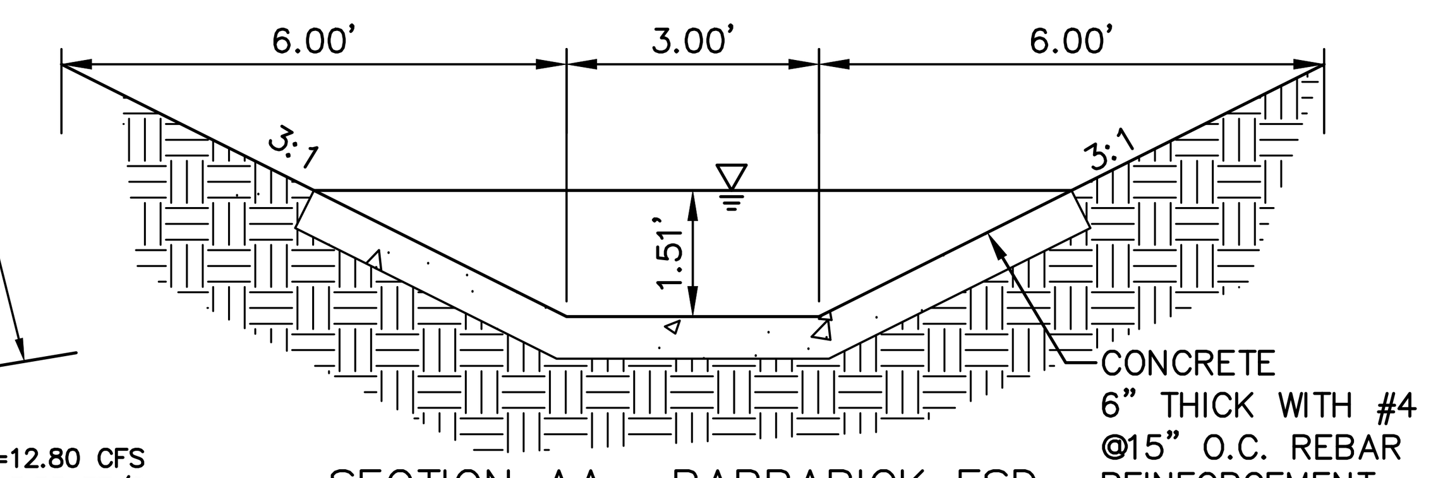
EXISTING 6100
PROPOSED 6100

DESIGN POINT

DP	Q5 Total	Q100 Total
1	14.6	52.8
4	22.3	55.6
4.1	29.0	88.7
5	12.0	25.9
6.1	3.9	19.3
6.2	2.0	13.2
6.3	16.9	35.6
7	3.5	12.8
7.1	30.0	93.5
7.2	39.8	114.9
8	6.1	12.9
9	3.8	7.9
15	8.2	17.7
15.1	21.0	43.2
16	1.4	2.9
16.1	21.5	44.9
17	1.6	7.9
17.1	1.6	7.7
18.1	22.8	52.2
12	10.0	20.5
12.1	9.1	13.9
18.2	29.2	62.0
19	6.4	17.8
19.1	6.4	12.9
20	7.0	14.9
20.1	7.0	11.7
20.2	39.6	81.4
21	3.8	12.6
21.1	42.5	91.3
22	6.3	18.3
22.1	6.3	18.3
23	47.4	106.2
24	2.2	9.2
25	1.0	5.0
27	2.9	8.8
1.i	7.8	17.9
3.i	7.1	19.4
2.i	11.6	25.7
3.2	16.9	40.2
e11	0.7	6.2
1e	4.0	10.9
1.1e	4.0	9.8
e10	0.6	4.6
2e	4.0	13.0
2.1e	4.0	10.9
2.2e	8.0	20.7
3e	1.3	3.6
4e	1.2	4.3

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A2	1.38	32%	0.30	0.51	10.3	1.7	4.8
A3	3.68	65%	0.50	0.64	12.5	7.0	14.9
A4	4.53	48%	0.39	0.56	15.0	6.3	15.1
A5	0.45	79%	0.63	0.73	5.0	1.4	2.9
A6.1	4.73	72%	0.55	0.67	12.1	10.0	20.5
A6.2	2.56	74%	0.56	0.68	12.1	5.6	11.3
A7	1.76	73%	0.56	0.68	9.4	4.2	8.5
A8	4.23	13%	0.16	0.41	18.9	2.2	9.2
C1.1	1.78	66%	0.52	0.65	9.2	3.9	8.3
C1.2	0.81	72%	0.57	0.69	8.3	2.0	4.2
C2	6.75	63%	0.49	0.63	14.2	12.0	25.9
C3	4.18	19%	0.20	0.43	9.3	3.5	12.8
A9	2.13	7%	0.13	0.38	13.7	1.0	5.0
A10	2.67	26%	0.27	0.49	10.7	2.9	8.8
B3	2.38	63%	0.58	0.72	25.5	3.8	7.9
C4	4.41	62%	0.54	0.68	28.3	6.1	12.9
OS6	18.38	45%	0.37	0.55	17.5	22.3	55.6
OS7	33.07	19%	0.20	0.43	36.4	14.6	52.8
I1	5.88	54%	0.44	0.60	20.8	7.8	17.9
I2	2.18	71%	0.58	0.70	11.9	4.9	9.9
I3	2.94	68%	0.60	0.98	10.8	7.1	19.4
E1	0.90	87%	0.79	0.88	6.6	3.4	6.3
E2	1.25	63%	0.60	0.74	8.3	3.3	6.8
E3	0.35	86%	0.78	0.87	5.0	1.4	2.7
E4	0.36	81%	0.74	0.84	5.0	1.4	2.6



SECTION AA- BARBARICK FSD OVERFLOW DITCH CROSS SECTION

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

STERLING RANCH FILING NO.4
PROPOSED DRAINAGE MAP
JOB NO. 25188.11
08/10/2023
SHEET 1 OF 2

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STERLING RANCH FILING NO. 4
PROPOSED DRAINAGE MAP

DESIGN POINT		
DP	Q5 Total	Q100 Total
1	14.6	52.8
4	22.3	55.6
4.1	29.0	88.7
5	12.0	25.9
6.1	3.9	19.3
6.2	2.0	13.2
6.3	16.9	35.6
7	3.5	12.8
7.1	30.0	93.5
7.2	39.8	114.9
8	6.1	12.9
9	3.8	7.9
15	8.2	17.7
15.1	21.0	43.2
16	1.4	2.9
16.1	21.5	44.9
17	1.6	7.9
17.1	1.6	7.7
18.1	22.8	52.2
12	10.0	20.5
12.1	9.1	13.9
18.2	29.2	62.0
19	6.4	17.8
19.1	6.4	12.9
20	7.0	14.9
20.1	7.0	11.7
20.2	39.6	81.4
21	3.8	12.6
21.1	42.5	91.3
22	6.3	18.3
22.1	6.3	18.3
23	47.4	106.2
24	2.2	9.2
25	1.0	5.0
27	2.9	8.8
1.i	7.8	17.9
3.i	7.1	19.4
2.i	11.6	25.7
3.2	16.9	40.2
e11	0.7	6.2
1e	4.0	10.9
1.1e	4.0	9.8
e10	0.6	4.6
2e	4.0	13.0
2.1e	4.0	10.9
2.2e	8.0	20.7
3e	1.3	3.6
4e	1.2	4.3

LEGEND

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

DESIGN POINT
PROPOSED FLOW DIRECTION
EXISTING FLOW DIRECTION
BASIN DRAINAGE AREA
EXISTING STORM SEWER
STORM SEWER PROPOSED
PROPOSED R.O.W
PROPOSED PROPERTY LINES
PROPOSED SIDEWALK
EXISTING PROPERTY LINE
ROW EXISTING
FL EXISTING
SIDEWALK EXISTING
DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100 PROPOSED 6100

BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A2	1.38	32%	0.30	0.51	10.3	1.7	4.8
A3	3.68	65%	0.50	0.64	12.5	7.0	14.9
A4	4.53	48%	0.39	0.56	15.0	6.3	15.1
A5	0.45	79%	0.63	0.73	5.0	1.4	2.9
A6.1	4.73	72%	0.55	0.67	12.1	10.0	20.5
A6.2	2.56	74%	0.56	0.68	12.1	5.6	11.3
A7	1.76	73%	0.56	0.68	9.4	4.2	8.5
A8	4.23	13%	0.16	0.41	18.9	2.2	9.2
C1.1	1.78	66%	0.52	0.65	9.2	3.9	8.3
C1.2	0.81	72%	0.57	0.69	8.3	2.0	4.2
C2	6.75	63%	0.49	0.63	14.2	12.0	25.9
C3	4.18	19%	0.20	0.43	9.3	3.5	12.8
A9	2.13	7%	0.13	0.38	13.7	1.0	5.0
A10	2.67	26%	0.27	0.49	10.7	2.9	8.8
B3	2.38	63%	0.58	0.72	25.5	3.8	7.9
C4	4.41	62%	0.54	0.68	28.3	6.1	12.9
OS6	18.38	45%	0.37	0.55	17.5	22.3	55.6
OS7	33.07	19%	0.20	0.43	36.4	14.6	52.8
I1	5.88	54%	0.44	0.60	20.8	7.8	17.9
I2	2.18	71%	0.58	0.70	11.9	4.9	9.9
I3	2.94	68%	0.60	0.98	10.8	7.1	19.4
E1	0.90	87%	0.79	0.88	6.6	3.4	6.3
E2	1.25	63%	0.60	0.74	8.3	3.3	6.8
E3	0.35	86%	0.78	0.87	5.0	1.4	2.7
E4	0.36	81%	0.74	0.84	5.0	1.4	2.6

NOTE:
FOR ADDITIONAL INFORMATION REGARDING DESIGN POINTS, ROUTING, AND RUNOFF VALUES ASSOCIATED WITH POND W-5. REFER TO THE FILING 2 DRAINAGE MAP, AS SHOWN IN APPENDIX D OF THIS REPORT.

STERLING RANCH FILING NO. 4
PROPOSED DRAINAGE MAP
JOB NO. 25188.11
08/10/2023
SHEET 2 OF 2

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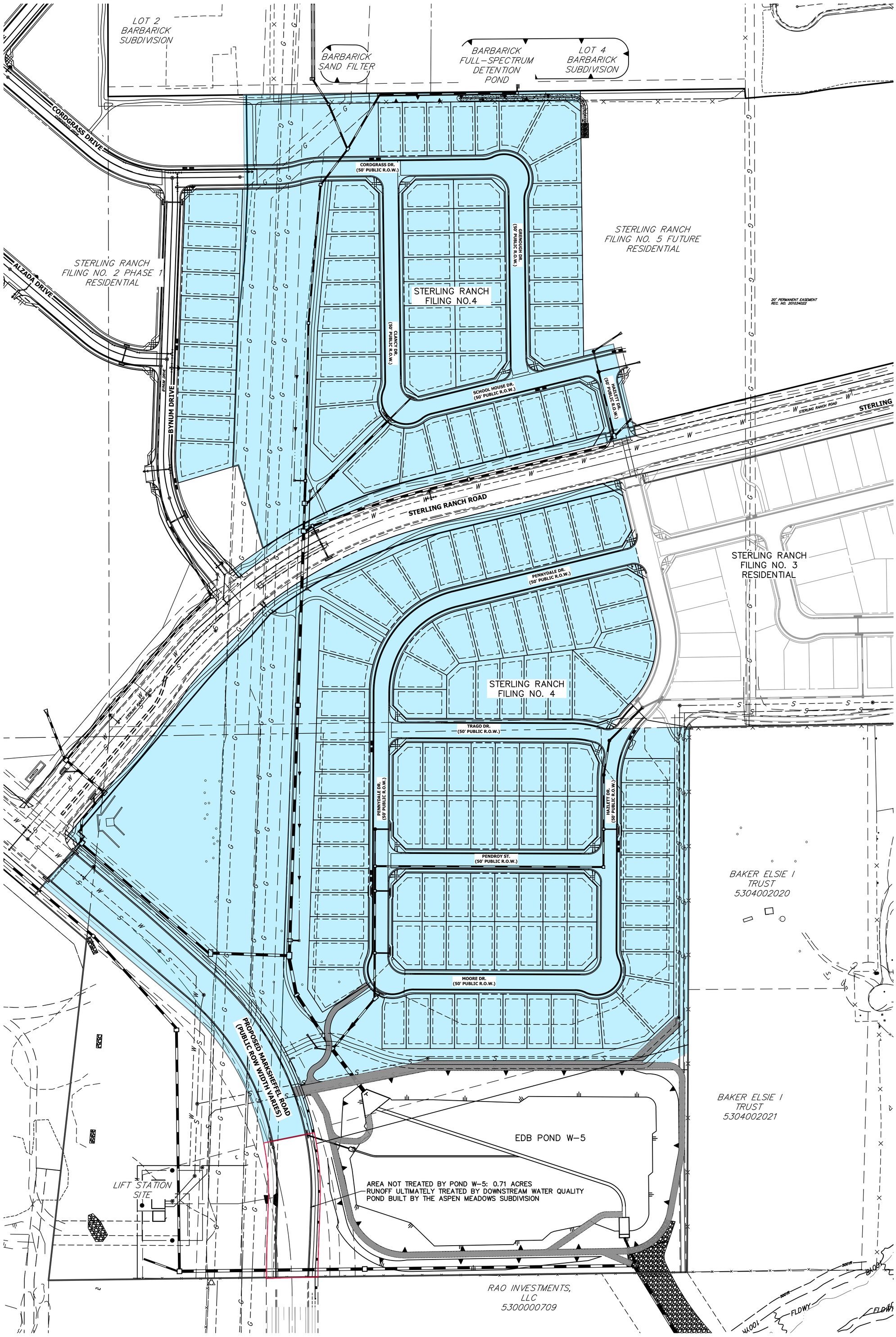
WATER QUALITY CAPTURE PLAN
STERLING RANCH FILING 4



100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

STERLING RANCH FILING 4
RUNOFF AREA TREATED BY POND W-5

WATER QUALITY MAP
STERLING RANCH FILING 4
JOB NO. 25188.11
08/10/2023
SHEET 1 OF 1

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