FINAL DRAINAGE REPORT
FOR
STERLING RANCH FILING NO. 5

Prepared For:

Classic SRJ Land, LLC
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April 2024
Project No. 25188.16
PCD Filing No: SF-241

Prepared By:

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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.

Bryan T. Law, Colorado P.E. 25043
For and On Behalf of JR Engineering, LLC

COLORADO REGISTERED
BRYAN T. LAW
B.T.L.
25043
4/26/24
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: Classic SRJ Land, LLC

By:

Title: VICE PRESIDENT

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

El Paso County:

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

Gilbert LaForce, P.E.

Digitally signed by Gilbert LaForce, P.E.
Reason: On Behalf of the County Engineer
Date: 2024.05.14 15:35:48-06'00'

05/14/2024

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

Date

Conditions:

Table of Contents

Purpose 1
General Site Description 1
General Location 1
Description of Property 1
Floodplain Statement 1
Existing Drainage Conditions 2
Major Basin Descriptions 2
Existing Sub-basin Drainage 3
Proposed Drainage Conditions 4
Proposed Sub-basin Drainage 4
Comparison of Flows 7
Proposed Emergency Overflow 8
Drainage Design Criteria 9
Development Criteria Reference 9
Hydrologic Criteria 10
Hydraulic Criteria 10
Drainage Facility Design 11
General Concept 11
Four Step Process to Minimize Adverse Impacts of Urbanization 11
Water Quality 12
Erosion Control Plan 13
Operation & Maintenance 13
Drainage and Bridge Fees 14
Construction Cost Opinion 14
Summary 16
References 17

APPENDIX

Appendix A – Vicinity Map, Soil Descriptions, FEMA Floodplain Map
Appendix B – Hydrologic Calcs
Appendix C – Hydraulic Calcs
Appendix D – Reference Material
Appendix E – Drainage Maps

PURPOSE

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

GENERAL SITE DESCRIPTION

GENERAL LOCATION

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

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

DESCRIPTION OF PROPERTY

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

Soil characteristics are comprised of Group A and B hydrologic soil groups. Group A soils have a high infiltration rate and high rate of water transmission. Group B soils have a moderate infiltration rate and moderate rate of water transmission. Refer to the soil survey map in Appendix A for additional information.

There are no major drainage ways running through the site. A tributary of Sand Creek lies 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 Upper Sand Creek sub-basin as shown in Appendix D.

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

Additional runoff has been provided for with the extended detention basin, "Pond W-5", located at the southern edge of the Sterling Ranch boundary. The site generally drains from northeast to southwest. The site currently has drainage infrastructure built with prior Sterling Ranch Filing 4 and in the site's southwest corner that collects and conveys the Sterling Ranch Filing 5 runoff to Pond W-5. A portion of the site will drain to the extended detention basin, "Pond W-8", located to the northeast of the site. Currently, the site is undeveloped vacant land. Sand Creek is located approximately 500 feet east of the site running north to south. Currently, JR engineering is performing studies and plans to address Sand Creek stabilization adjacent to the site under PCD project number CDR-20-004 and is undergoing review.

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 excerpts shown in Appendix D. The site is also tributary to Pond W-8, which was built with a portion of the Sterling Ranch Filing 1 improvements. Refer to the approved "Final Drainage Report for Branding Iron at Sterling Ranch Filing No. 2" prepared by M&S Civil Consultants, Inc., dated January 2020. Excerpts are shown in Appendix D for updates to original Pond W-8 design. An updated analysis for both was performed to show they still function appropriately with revised development from this area.

EXISTING SUB-BASIN DRAINAGE

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

Basin A1 (Q_5=1.0 cfs, Q_{100}=7.6 cfs) is 5.09 acres and 0 percent impervious consists of the northern portion of the proposed Sterling Filing No. 5 site. Runoff from this basin drains via overland flow to the south west into the existing storm sewer built with Filing 4 just north of Sterling Ranch Road located at DP3 (Q_5=3.1 cfs, Q_{100}=18.7 cfs). Collected runoff is piped west to the DP5 and then piped via existing storm infrastructure south to Pond W-5 built with Filing 2.

Basin A2 (Q_5=0.8 cfs, Q_{100}=5.9 cfs) is 2.89 acres and 0 percent impervious consists of the south western portion of the proposed Sterling Filing No. 5 site. Runoff from this basin drains via overland flow to the south west into the existing storm sewer built with Filing 5 just north of Sterling Ranch Road located at DP3 (Q_5=3.1 cfs, Q_{100}=18.7 cfs). Collected runoff is piped west to the DP5 and then piped via existing storm infrastructure south to Pond W-5 built with Filing 2.

Basin A3 (Q_5=0.5 cfs, Q_{100}=3.7 cfs) is 1.94 acres and 0 percent impervious consists of the southern portion of the proposed Sterling Filing No. 5 site. Runoff from this basin drains via overland flow to the south west into the existing storm sewer built with Filing 4 just north of Sterling Ranch Road located at DP3 (Q_5=3.1 cfs, Q_{100}=18.7 cfs). Collected runoff is piped west to the DP5 and then piped via existing storm infrastructure south to Pond W-5 built with Filing 2.

Basin A4 (Q_5=6.8 cfs, Q_{100}=16.0 cfs) is 4.83 acres and 47 percent impervious consists of the southeastern portion of the proposed Sterling Filing No. 5 site as well as the norther portion of Sterling Ranch Road. Runoff from this basin drains via overland flow to Sterling Ranch Road, then west to the existing 15’ Type R inlet located at DP5 (Q_5=6.8 cfs, Q_{100}=16.0 cfs). Collected runoff is piped via existing storm infrastructure south to Pond W-5 built with Filing 2.

Basin OS1 (Q_5= 1.7 cfs, Q_{100}=6.4 cfs) is 2.17 acres and 19 percent impervious, consists of the southern portion of the proposed Branding Iron at Sterling Ranch Filing No.1. Runoff from this basin drains to the south into the proposed Sterling Filing No. 5 northern site Basin A1. Runoff is collected into the existing storm sewer built with Filing 4 just north of Sterling Ranch Road located at DP3 (Q_5=3.1 cfs, Q_{100}=18.7 cfs). Collected runoff is piped west to the DP5 and then piped via existing storm infrastructure south to Pond W-5 built with Filing 2.

Basin OS2 (Q_5=14.4 cfs, Q_{100}=51.0 cfs) is 31.70 acres and 20 percent impervious and is located directly north of the site in the Barbarick subdivision per the “Final Drainage Report for Barbarick Subdivision, Portions of Lots 1, 2 and Lots 3&4” prepared by Matrix Design Group dated June 6, 2016. Historic runoff from this site drains south onto the Sterling Ranch Filing 4 site at DP2. Detained flow from this basin will be piped through the Sterling Ranch Filing 4 site to the detention Pond W-5 and

will outfall to Sand Creek. The emergency overflow path for this pond is routed east around the Sterling ranch Filing 4 lots and onto the northwest corner of Sterling Ranch Filing 5. The emergency overflow path is conveyed south via a concrete line swale and grass swale to DP3.

Basin OS3 (Q_5=19.4 cfs, Q_{100}=46.3 cfs) is 13.90 acres and 49 percent impervious, consists of the Sterling Ranch Filing No.4. Runoff from this basin drains to the southwest into the storm sewer built with Sterling Ranch Filing 4 at DP4. Collected runoff is piped south to the existing detention pond W-5 built with Filing 2 and outfalls to Sand Creek.

Table 1: Existing Condition Basin Summary Table

BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	5.09	0%	0.08	0.35	28.7	1.0	7.6
A2	2.89	0%	0.08	0.35	15.3	0.8	5.9
A3	1.94	0%	0.08	0.35	17.9	0.5	3.7
A4	4.83	47%	0.44	0.61	18.3	6.8	16.0
OS1	2.17	19%	0.19	0.42	9.6	1.7	6.4
OS2	31.70	20%	0.21	0.44	36.3	14.4	51.0
OS3	13.90	49%	0.40	0.57	15.5	19.4	46.3

PROPOSED DRAINAGE CONDITIONS

PROPOSED SUB-BASIN DRAINAGE

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

Basin OS1 (Q_5=1.6 cfs, Q_{100}=6.7 cfs) is 2.05 acres and 20% impervious, consists of single-family residential lots, open space, and lawns part of the Branding Iron at Sterling Ranch Filing No. 1 development. Runoff from this basin drains via sheet flow to the proposed swale which conveys flows to the Type C sump inlet at DP1 within Basin A1. Collected runoff is piped south to the proposed manhole at DP2.1.

Basin A1 (Q_5=0.2 cfs, Q_{100}=0.8 cfs) is 0.22 acres and 27% impervious, consists of a portion of single-family residential lots, open space, lawns, and a proposed swale. Runoff from this basin sheet flows to the swale and is conveyed to the Type C sump inlet at DP1 (Q_5=1.8 cfs, Q_{100}=7.3 cfs), where flows from Basin OS1 and A1 combine. This inlet was sized to capture all flow in the 5 and 100-year storm. In the event that the inlet at DP1 is clogged, the flow will overtop the proposed sidewalk and flow through Tract A to Manor House Way. See the separate emergency overflow analysis at the end of the

Proposed Drainage Conditions for information on the sump inlet emergency overflow path. Collected runoff is piped south to the proposed manhole at DP2.1 (Q_5=2.1 cfs, Q_{100}=8.3 cfs).

Basin OS2 (Q_5=0.3 cfs, Q_{100}=1.0 cfs) is 0.25 acres and 28% impervious, consists of tie-back slopes from the existing Barbarick full-spectrum detention pond and an existing concrete channel from the existing pond spillway. Runoff from this basin drains via sheet flow to the existing channel to the proposed Type D inlet at DP2. In the event that the inlet at DP2 is clogged, the flow will continue along the proposed swale within Tract A. See the separate emergency overflow analysis at the end of the Proposed Drainage Conditions for information on the sump inlet emergency overflow path. Collected runoff is piped east to the manhole at DP2.1 (Q_5=2.1 cfs, Q_{100}=8.3 cfs), which combines flow of DP1 and DP2. All captured flow from DP2.1 is piped to the proposed manhole at DP4.1. See the separate emergency overflow analysis at the end of the Proposed Drainage Conditions for information on the pond spillway and overflow path.

Basin A2 (Q_5=1.0 cfs, Q_{100}=3.1 cfs) is 0.99 acres and 38% impervious, consists of single-family residential lots, open space, lawns, and a proposed swale. Runoff from this basin drains via sheet flow to the proposed swale which conveys flows to the proposed triple Type C sump inlet at DP3. This inlet was sized to capture all flow in the 5 and 100-year storm. In the event that the inlet at DP3 is clogged, the flow will overtop the existing sidewalk and flow through School House Drive to Hazlett Drive. See the separate emergency overflow analysis at the end of the Proposed Drainage Conditions for information on the sump inlet emergency overflow path. Collected runoff is piped to the existing manhole at DP5.2.

Basin A3 (Q_5=3.4 cfs, Q_{100}=7.9 cfs) is 1.72 acres and 66% impervious, consists of single-family residential lots, open space, lawns, sidewalks and a portion of Manor House Way. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter to the proposed 15’ Type R on-grade inlet at DP4. This inlet was sized to capture Q_5=1.1 cfs & Q_{100}=7.7 cfs and bypass Q_5=0.0 cfs & Q_{100}=0.2 cfs to the 10’ Type R sump inlet at DP5. Collected runoff is piped to the proposed manhole at DP4.1 (Q_5=5.3 cfs, Q_{100}=15.3 cfs) and then to the proposed 10’ Type R sump inlet at DP5.1.

Basin A4 (Q_5=5.5 cfs, Q_{100}=13.1 cfs) is 3.02 acres and 63% impervious, consists of single-family residential lots, open space, lawns, sidewalks and portions of Manor House Way, School House Drive, and Abby House Lane. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter to the proposed 10’ Type R sump inlet at DP5 (Q_5=5.5 cfs, Q_{100}=13.2 cfs). This inlet was sized to capture all flow in the 5 and 100-year storm. In the event that the inlet at DP5 is clogged, the flow will overtop the proposed and existing sidewalk and flow through School House Drive to Hazlett Drive. See the separate emergency overflow analysis at the end of the Proposed Drainage Conditions for information on the sump inlet emergency overflow path. Collected flows from DP4.1 and DP5 combine at DP5.1 (Q_5=10.5 cfs, Q_{100}=27.7 cfs) which is then piped to the existing manhole at DP5.2 (Q_5=10.9 cfs, Q_{100}=29.9 cfs). Flows are then piped to the existing manhole at DP7.2.

Basin A5 (Q_5=3.9 cfs, Q_{100}=9.3 cfs) is 2.04 acres and 60% impervious, consists of single-family residential lots, open space, lawns, sidewalks and portions of School House Drive and Abby House Lane. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter to the proposed 15' Type R on-grade inlet at DP6. This inlet was sized to capture Q_5=3.9 cfs & Q_{100}=8.8 cfs and bypass Q_5=0.0 cfs & Q_{100}=0.5 cfs to the series of existing Filing 4 sump inlets located at School House Drive which have the capacity for the additional flow. See the Ex. Inlet Bypass Exhibit in Appendix E for more information. Collected runoff is piped to the proposed manhole at DP7.1.

Basin A6 (Q_5=2.8 cfs, Q_{100}=5.9 cfs) is 1.00 acres and 78% impervious, consists of single-family residential lots, open space, lawns, sidewalks and a portion of School House Drive. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter to the proposed 15' Type R on-grade inlet at DP7. This inlet was sized to capture all flow in the 5 and 100-year storm. Collected runoff is piped to the proposed manhole at DP7.1 (Q_5=6.3 cfs, Q_{100}=14.0 cfs) and then to the existing manhole at DP7.2 (Q_5=16.5 cfs, Q_{100}=42.7 cfs). Flows from DP7.2 are then piped to the existing manhole at DP8.1.

Basin C4.1 (Q_5=1.1 cfs, Q_{100}=2.3 cfs) is 0.31 acres and 79% impervious, consists of a portion of School House Drive, a portion of Hazlett Drive, a portion of Filing 4 and 5 single-family residential lots, open space, and lawns. Runoff from this basin drains via sheet flow to the existing curb and gutter where it is conveyed west and then south to the proposed 5' Type R on-grade inlet at DP8. This inlet was sized to capture Q_5=1.1 cfs & Q_{100}=1.9 cfs and bypass Q_5=0.0 cfs & Q_{100}=0.4 cfs to the series of existing Filing 2 and 4 inlets located along Sterling Ranch Road and Marksheffel Road, which have the capacity for the additional flow. See the Ex. Inlet Bypass Exhibit in Appendix E for more information. Collected runoff is piped to the existing manhole at DP8.1 (Q_5=17.1 cfs, Q_{100}=43.8 cfs) and then to the existing manhole at DP9.1.

Basin A7 (Q_5=1.6 cfs, Q_{100}=4.5 cfs) is 1.34 acres and 53% impervious, consists of single-family residential lots, open space, and lawns. Runoff from this basin drains via overland flow and sheet flow to the proposed swale and continues west to the proposed Type C sump inlet at DP9. This inlet was sized to capture all flow in the 5 and 100-year storm. In the event that the inlet at DP9 is clogged, the flow will overtop the existing sidewalk and flow through Hazlett Drive to Sterling Ranch Road. See the separate emergency overflow analysis at the end of the Proposed Drainage Conditions for information on the sump inlet emergency overflow path. Collected runoff is piped to the existing manhole at DP9.1 (Q_5=18.2 cfs, Q_{100}=47.3 cfs) and then is piped south within the storm infrastructure along Sterling Ranch Road storm infrastructure which eventually conveys the flow to the existing manhole at DP16.1.

Basin A8 (Q_5=0.4 cfs, Q_{100}=1.2 cfs) is 0.29 acres and 54% impervious, consists of single-family residential lots, open space, and lawns. Runoff from this basin drains via overland and sheet flow to the existing curb and gutter along Dines Boulevard and then flows to the existing 15' Type R on-grade inlet at DP10 within Basin C4.2.

Basin C4.2 (Q_5=5.8 cfs, Q_{100}=14.0 cfs) is 3.35 acres and 61% impervious, consists of a portion of Sterling Ranch Road, a portion of Dines Blvd, Filing 4 single-family residential lots, open space, and lawns. Runoff from this basin drains via sheet flow to the existing curb and gutter west along Sterling Ranch Road to an existing on-grade inlet at DP10 built with Sterling Ranch Filing 2. This existing inlet was designed to capture Q_5=6.1 cfs & Q_{100}=12.9 cfs and bypass Q_5=0.0 cfs & Q_{100}=2.5 cfs to the series of existing Filing 2 and 4 inlets located along Sterling Ranch Road and Marksheffel Road, which have the capacity for the additional flow. See the Ex. Inlet Bypass Exhibit in Appendix E for more information. Collected runoff from the existing inlet conveys the flow to the existing manhole at DP16.1 (Q_5=75.0 cfs, Q_{100}=197.5 cfs). DP16.1 represents the total flow to the existing detention Pond W-5 build within Filing 2 and combines the collected runoff from DP9.1, DP10, DP11, DP14.1, and DP15.1. Existing Pond W-5 outfalls to Sand Creek as designed with Filing 2.

Basin A9 (Q_5=1.5 cfs, Q_{100}=3.8 cfs) is 0.79 acres and 54% impervious, consists of single-family residential lots, open space, lawns, sidewalks and a portion of Manor House Way. Runoff from this basin drains via overland flow, sheet flow, and curb and gutter offsite to the existing curb and gutter along Dines Boulevard. The flows collect in an existing 10' Type R sump inlet at DP17 which was calculated to have capacity to capture all of the additional flow. Captured flows are piped via an existing storm pipe to existing water quality and detention Pond W-8 on the east side of Dines and eventually outfalls to Sand Creek.

Table 2: Proposed Condition Basin Summary Table

BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	0.22	27%	0.28	0.49	10.4	0.2	0.8
A2	0.99	38%	0.30	0.50	17.1	1.0	3.1
A3	1.72	66%	0.53	0.66	13.4	3.4	7.9
A4	3.02	63%	0.51	0.65	15.0	5.5	13.1
A5	2.04	60%	0.51	0.66	13.2	3.9	9.3
A6	1.00	78%	0.65	0.76	9.0	2.8	5.9
A7	1.34	53%	0.38	0.55	18.5	1.6	4.5
A8	0.29	54%	0.39	0.55	10.7	0.4	1.2
A9	0.79	54%	0.42	0.58	7.2	1.5	3.8
OS1	2.05	20%	0.19	0.42	9.6	1.6	6.7
OS2	0.25	28%	0.31	0.52	8.6	0.3	1.0
C4.1	0.31	79%	0.69	0.80	5.0	1.1	2.3
C4.2	3.35	61%	0.54	0.69	19.0	5.8	14.0

COMPARISON OF FLOWS

There are several locations where proposed Filing 5 storm sewer connects to existing storm sewer built with previous Sterling Ranch Filings 2 and 4.

- The proposed Filing 5 flows at DP5.1 (Q_5=10.5 cfs, Q_{100}=27.7 cfs) are located at the same location as Filing 4 DP2.i (Q_5=11.6 cfs, Q_{100}=25.7 cfs) and have a 2 cfs increase to the anticipated 100-year flow at the existing 24" RCP.
- The proposed Filing 5 flows at DP7.1 (Q_5=6.3 cfs, Q_{100}=14.0 cfs) are located at the same location as Filing 4 DP3.i (Q_5=7.1 cfs, Q_{100}=19.4 cfs) and have less than the anticipated flow at the existing 18" RCP.
- The proposed Filing 5 flows at DP7.2 (Q_5=16.5 cfs, Q_{100}=42.7 cfs) are located at the same location as Filing 4 DP3.2 (Q_5=16.9 cfs, Q_{100}=40.2 cfs) and have a 2.5 cfs increase to the anticipated 100-year flow at the existing storm manhole.
- The proposed Filing 5 flows at DP9.1 (Q_5=18.2 cfs, Q_{100}=47.3 cfs) are located at the same location as Filing 2 DP2.2 (Q_5=56.9 cfs, Q_{100}=138.7 cfs) and have less than the anticipated flow at the existing storm manhole.
- The proposed Filing 5 flows at DP11, DP12, DP13, DP14, and DP15.1 are the same flows the inlets at Filing 4 DP9, DP5, DP6.1, DP6.2, and DP7.1 capture.
- The proposed Filing 5 flows at DP14.1 have increased by 0.5 cfs due to the bypass flow from DP6 and are increased by 0.5 cfs from the flows at the inlet at Filing 4 DP6.2.
- The proposed Filing 5 flows at DP16.1 (Q_5=75.0 cfs, Q_{100}=197.5 cfs) is located at the same location as Filing 4 DP10 (Q_5=55.8 cfs, Q_{100}=149.7 cfs) and Filing 2 DP2.5 (Q_5=96.6 cfs, Q_{100}=250.7 cfs). The downstream storm infrastructure from this design point was built in Filing 2 and the proposed flows are less than was anticipated in the existing storm manhole.

Based on these comparisons, there are no negative impacts anticipated to existing downstream storm infrastructure.

PROPOSED EMERGENCY OVERFLOW

The Barbarick Subdivision to the northwest of the site has a full-spectrum detention pond emergency spillway that connects to an existing concrete channel along the northern side of Sterling Ranch Filing 4. See Appendix C for the Emergency Pond Overflow Exhibit and calculation sheets. The emergency overflow of the existing pond is 85.4 cfs, but for design purposes that value was rounded to 85.5 cfs. The existing concrete channel directs flows to a proposed Type D inlet (DP2) within the site that will collect 23.5 cfs and connect to the proposed 24" RCP. The remaining 62 cfs will continue south within a proposed TRM-lined channel to a proposed triple Type C inlet (DP3). If the DP2 inlet is clogged, the DP3 swale has the capacity to convey the full 85.5 cfs to the DP3 inlet. The proposed DP3 swale has the capacity and erosive protection for the anticipated flow depth and velocities. The proposed inlet will collect 50 cfs and connect to the proposed 36" RCP. The flows then combine within the downstream manhole for a total piped flow of 73.5 cfs within the existing storm system. The remaining 12 cfs will then overtop the existing sidewalk flow south overtopping the School House Dr. crown continuing south along Hazlett Drive. Hazlett Drive has a capacity of 60 cfs in the emergency condition and the calculated flow (12 cfs) will not have any adverse effects. The flows will then enter Sterling Ranch Road and continue flowing west to a series of inlets along Sterling Ranch Road. Sterling Ranch

Road has a capacity of 140 cfs in the emergency condition and the calculated flow (12 cfs) will not have any adverse effects. Of the 85.5 cfs total emergency overflow from the existing Barbarick FSD pond, 73.5 cfs will be captured within the storm sewer system and 12 cfs will flow along proposed roadways. See Appendix C for the applicable emergency pond overflow calculations.

There are several sump inlets located throughout the site which each have unique emergency overflow paths in the case where they are clogged. See Appendix C for the Sump Inlet Emergency Overflow Exhibit and calculation sheets. In the case where the Type C sump inlet at DP1 (Q_{100}=7.3 cfs) is clogged, flows would travel over the sidewalk and south through Tract A to Manor House Way. Flows would then combine with DP4 (Q_{100}=7.9 cfs) within Manor House Way for a rounded flow of Q_{100}=15.5 cfs. Manor House Way has a capacity of 80 cfs in the emergency condition and the calculated flow (15.5 cfs) will not have any adverse effects. In the case where the Type D inlet at DP2 (Q_{100}=1.0 cfs) is clogged, flows would travel south along the proposed DP3 swale. Flows would combine with DP3 (Q_{100}=3.1 cfs) within the proposed DP3 swale for a rounded flow of Q_{100}=4.5 cfs. The proposed DP3 swale has the capacity and erosive protection for the anticipated flow depth and velocities. In the case where the triple Type C sump inlet at DP3 (Q_{100}=3.1 cfs) is clogged, the flow will overtop the existing sidewalk and flow through School House Drive south to Hazlett Drive. In the case where the 15' Type R sump inlet at DP5 (Q_{100}=13.2 cfs) is clogged, the flow will overtop the proposed and existing sidewalk and flow through School House Drive south to Hazlett Drive. In the case where the Type C sump inlet at DP9 (Q_{100}=4.5 cfs) is clogged, the flow will overtop the existing sidewalk and flow through Hazlett Drive to Sterling Ranch Road. DP3, DP5, and DP9 flows would combine with DP8 (Q_{100}=2.3 cfs) flows within Hazlett Drive for a rounded flow of 23.5 cfs. Hazlett Drive has a capacity of 60 cfs in the emergency condition and the calculated flow (23.5 cfs) will not have any adverse effects. The flows will then enter Sterling Ranch Road and continue flowing west to a series of inlets along Sterling Ranch Road. Sterling Ranch Road has a capacity of 140 cfs in the emergency condition and the calculated flow (23.5 cfs) will not have any adverse effects. Overall, the sump inlet emergency overflow paths are designed to direct flow to desired infrastructure for safe conveyance. See Appendix C for the applicable emergency inlet overflow calculations.

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. On-site 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 3: 1-hr Point Rainfall Data

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

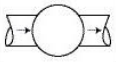
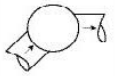
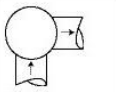
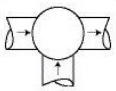
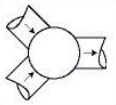
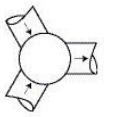
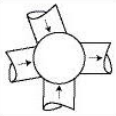
HYDRAULIC CRITERIA

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 MHFD UD-Inlet v5.02. StormCAD was used to model the proposed storm sewer system within the site to analyze the proposed HGL calculations for the Construction Drawings. Autodesk Hydraflow express was used to size any proposed channels or swales. Swales were sized based on the peak 100-year flows with the minimum and maximum swale slopes. Swales were checked for shear stress and turf reinforcement mat (TRM) was added for swales with a Froude number in excess of 0.80. Per criteria velocities were checked to be less than 5 ft/s in the proposed swales otherwise TRM was proposed. 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 4 (below) this method is accurate for pipes 42" and smaller. For pipes larger than 42", the Standard head-loss coefficients as recommended by Bentley were used as shown in Table 5. All hydraulic calculations are presented in Appendix C.

Table 4: 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 5: Storm Head-loss Coefficients

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

DRAINAGE FACILITY DESIGN

GENERAL CONCEPT

The proposed stormwater conveyance system was designed to convey the developed Sterling Ranch Filing No. 5 runoff to an existing (Filing 2) full-spectrum water quality and detention Pond W-5 and an existing full-spectrum water quality and detention Pond W-8 via existing and proposed storm sewer. The existing ponds were designed to release at less than historic rates to minimize adverse impacts downstream. Treated water will outfall directly into the Sand Creek Drainageway, where it will eventually outfall into Fountain Creek. A proposed drainage map is presented in Appendix E showing locations of the ponds.

FOUR STEP PROCESS TO MINIMIZE ADVERSE IMPACTS OF URBANIZATION

In accordance with the El Paso County Drainage Criteria Manual Volume 2, this site has implemented the four-step process to minimize adverse impacts of urbanization. The four-step process includes reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

Step 1 – Reducing Runoff Volumes: The Sterling Ranch Filing No. 5 development project consists of single-family homes with open spaces and lawn areas interspersed within the development which helps

disconnect impervious areas and reduce runoff volumes. Roof drains from the structures will discharge to lawn areas, where feasible, to allow for infiltration and runoff volume reduction.

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

Step 3 – Treat the WQCV: Water Quality treatment for this site is provided in the existing full spectrum water quality detention Pond W-5 and Pond W-8. 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 structures have been designed to detain the water quality capture volume (WQCV) for 40 hours, and the extended urban runoff volume (EURV) for 72 hours. All flows released from the pond will be reduced to less than historic rates.

Step 4 –BMPs will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. The Filing No. 5 site is residential. There is no proposed commercial or industrial use for the site. The permanent erosion control BMPs include asphalt drives, storm inlets and storm pipe, permanent vegetation, the full spectrum detention Pond W-5 and Pond W-8. Maintenance responsibilities and plans will be defined at the time of final platting.

WATER QUALITY

In accordance with Section 13.3.2.1 of the CCS/EPCDCM, full-spectrum water quality and detention are provided for all developed basins. This site will drain into two existing full-spectrum detention ponds (Pond W-5 and Pond W-8) developed during the Sterling Ranch Filing 1 (Pond W-8) and Filing 2 (Pond W-5) projects. Further details as well as all pond volume, water quality, and outfall calculations are included in the Sterling Ranch Filing 2 Final Drainage Report for Pond W-5. Further details are included in the Sterling Ranch Filing No. 1 Storm Sewer Plans for Pond W-8. Per a visual inspection, both ponds are functioning as intended.

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. The pond was designed in Filing No. 2 drainage report with the A14 basin (11.76 acres @ 55%) representing the Filing 5 development. The total imperviousness for the Filing 5 development is 59.4% imperviousness, which is higher than anticipated. The total area of the existing Pond W-5 had 173.97 acres @ 57.6% impervious. The increase in impervious area from the Filing 5 development results in the Pond W-5 now having 173.97 acres @ 57.9% impervious. To ensure that the existing

Pond W-5 will function as intended, a UD-Detention spreadsheet is provided in Appendix C. The spreadsheet shows that the pond still functions as was originally designed. See Table 6 for the Pond W-5 summary.

Table 6: Pond W-5 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	18.2	18.4	3.3	11.9	3.4	140.6

Pond W-8 corresponds to pond FSD13 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. Pond W-8 was analyzed with the "Final Drainage Report for Branding Iron at Sterling Ranch Filing No. 2" prepared by M&S Civil Consultants, Inc., dated January 2020. Per the excerpts shown in Appendix D, the existing Pond W-8 has a total tributary area of 35.20 acres @ 53% impervious. The addition of Basin A9 developed flows part of the site are an additional 0.79 acres @ 54% impervious. To ensure that the existing Pond W-8 will function as intended, a UD-Detention spreadsheet is provided in Appendix C. The spreadsheet shows that the pond still functions as was originally designed. See Table 7 for the Pond W-5 summary.

Table 7: Pond W-8 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-8	3.3	3.4	0.6	2.1	6.3	43.2

EROSION CONTROL PLAN

It is the policy of El Paso County that a Final Grading and Erosion Control Plan be submitted with the Final Drainage Report, construction drawings, and plat prior to obtaining a grading permit.

OPERATION & MAINTENANCE

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. The metro district shall be responsible for the inspection, maintenance, rehabilitation and repair of stormwater and erosion control facilities located on the property unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. Access is provided from onsite facilities and easements for proposed infrastructure located offsite. A maintenance road was provided for the existing Pond W-5 and information on the road can be found in the Final Drainage Report for Sterling Ranch Filing No. 2. The maintenance road access is off Marksheffel Road and wraps around the top of the pond providing access to the inflow pipe wing walls and outlet structure for the pond. A maintenance road was provided for the existing Pond W-8 and information on the road can be found in the approved Sterling Ranch Filing No. 1 Storm Sewer Plans.

The maintenance road access is off Dines Boulevard and provides access to the inflow pipe forebay 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.

Sterling Ranch Filing 5 - Impervious Area Calculation			
Breakdown	Area (acres)	% Impervious	Impervious Acres
R.O.W.	2.9283	100%	2.93
Lots	6.3193	65%	4.11
Tracts A-C - Open Space	2.4158	2%	0.05
Total	11.6634		7.08

2024 Drainage and Bridge Fee – Sterling Ranch Filing 5				
Impervious Acres (ac.)	Drainage Fee (Per Imp. Acre)	Bridge Fee (Per Imp. Acre)	Sterling Ranch Filing 5 Drainage Fee	Sterling Ranch Filing 5 Bridge Fee
7.08	$25,632	$10,484	$181,474.56	$74,226.72

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. 5 (Public Non-Reimbursable)					
Item	Description	Quantity	Unit	Unit Price	Cost
1	18" RCP	212	L.F.	$ 82	$ 17,384.00
2	24" RCP	626	L.F.	$ 98	$ 61,348.00
3	36" RCP	24	L.F.	$ 151	$ 3,624.00
4	5' Curb Inlet Type R < 10 ft.	1	Ea.	$ 9,377	$ 9,377.00
5	10' Curb Inlet Type R < 10 ft.	1	Ea.	$ 10,230	$ 10,230.00
6	15' Curb Inlet Type R < 5 ft.	2	Ea.	$ 12,907	$ 25,814.00
7	15' Curb Inlet Type R < 10 ft.	1	Ea.	$ 13,835	$ 13,835.00
8	Storm Sewer MH, slab base	6	Ea.	$ 8,322	$ 49,932.00
9	Grated Inlet CDOT Type C	2	Ea.	$ 6,037	$ 12,074.00
10	Grated Inlet CDOT Type D	1	Ea.	$ 7,458	$ 7,458.00
11	Grated Inlet CDOT Type C-Triple	1	Ea.	$ 16,833	$ 16,833.00
				Sub-Total	$ 227,909.00

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 20-04)	$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
SR F5 (SF-241) Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$181,474.56
Subtotal Deferred Drainage Fees	$3,076,511.86

Unused Reimb. Costs associated with DBPS Segments 159-164, 169-186 and Main Channel Segments 170, 187 and 163	$7,363,357.04

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	$990,016.80
Subtotal Reimb. Costs associated with BGP and SR Rd. Bridges	$2,536,693.78

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
SR F5 (SF-241) Bridge Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$74,226.72
Subtotal Deferred Bridge Fees	$909,710.50

Unused Reimb. Costs associated with Briargate Parkway and SR Road Bridges	$1,626,983.28

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

SUMMARY

The proposed Sterling Ranch Filing No. 5 drainage improvements were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development will not adversely affect the offsite drainage-ways or surrounding development. The existing Ponds W-5 and W-8 are 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 and the Sterling Ranch Filing No. 4 Drainage Report. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements for this site. The proposed site does not impact any downstream facility or property.

REFERENCES

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

2. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), prepared by Mile High Flood District, Revised August 2018, September 2017, and January 2021.

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.

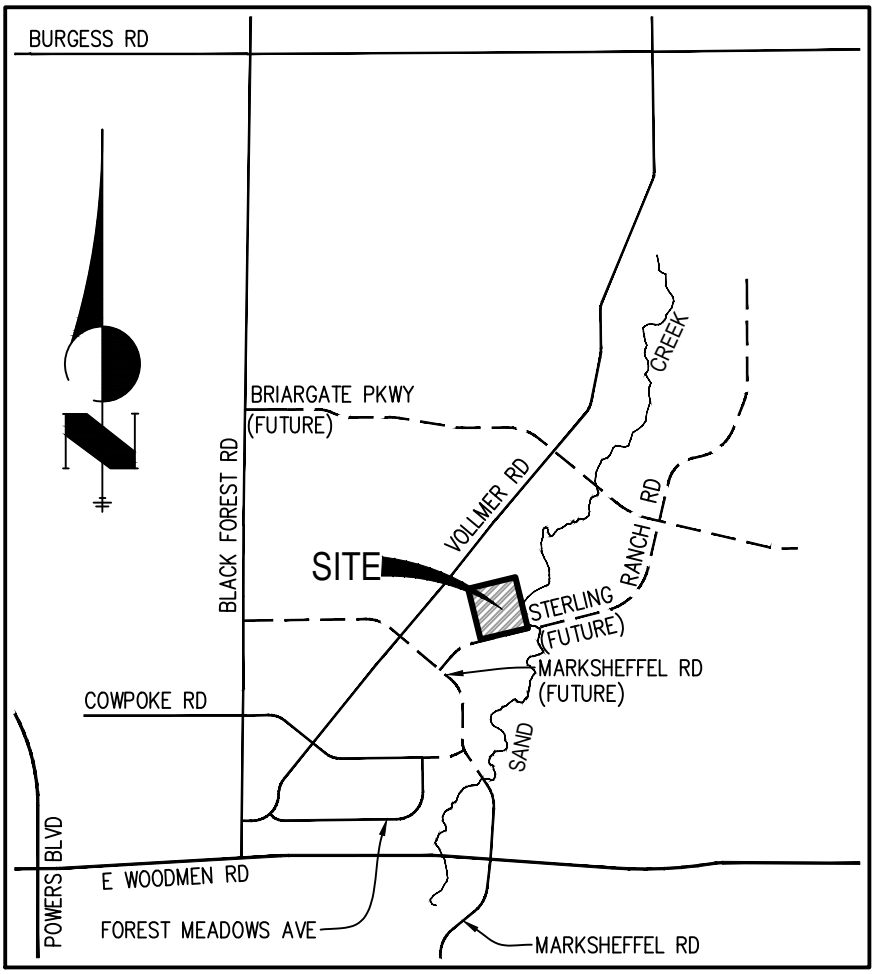
5. Final Drainage Report For Barbarick Subdivision Portion Of Lots 1,2 And Lots 3 and 4, prepared by Matrix Design Group, dated June 2016

6. “Final Drainage Report for Sterling Ranch Filing No. 2”, prepared by JR Engineering, dated August 2021

7. “Final Drainage Report for Sterling Ranch Filing No. 4”, prepared by JR Engineering, dated August 14, 2023

8. “Final Drainage Report for Branding Iron at Sterling Ranch Filing No. 2”, prepared by M&S Civil Consultants, Inc., dated January 2020

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map



VICINITY MAP

N.T.S.

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

J·R ENGINEERING
A Westrian Company

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

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

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Aug 19, 2018—Oct 20, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
9	Blakeland-Fluvaquentic Haplaquolls	A	0.8	3.3%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	12.0	49.0%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	11.7	47.7%
Totals for Area of Interest			**24.5**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

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

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

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

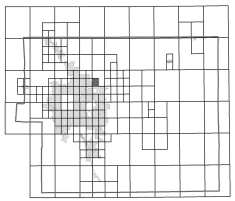
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

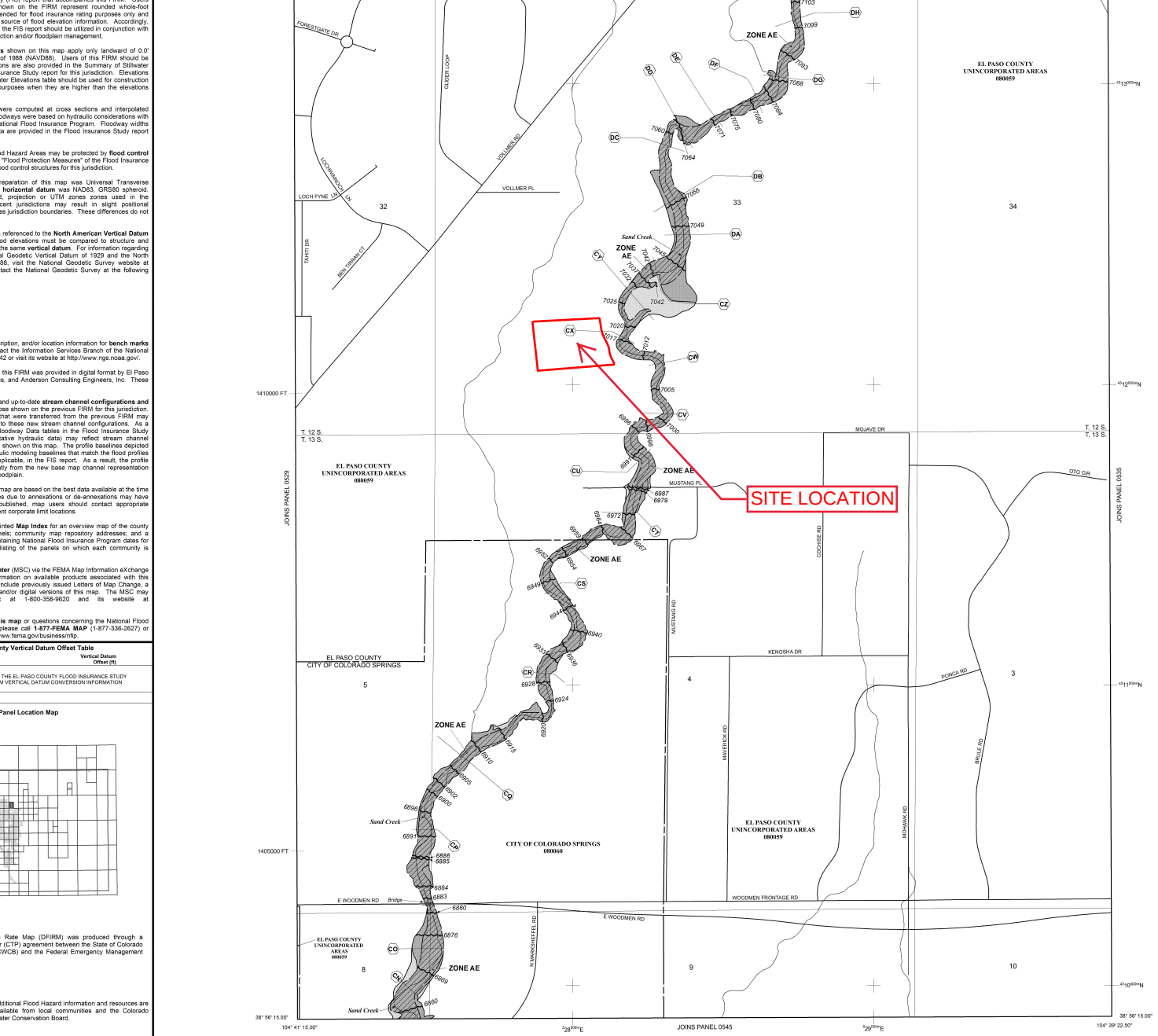
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



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

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



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

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary
Floodway boundary
Zone D Boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513 — Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A — A — Cross section line
23 — 23 — Transect line
97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
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 Calcs

COMPOSITE % IMPERVIOUS & COMPOSITE EXISTING RUNOFF COEFFICIENT CALCULATIONS

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

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: DIG
Checked By: RAB
Date: 11/3/23

Basin ID	Total Area (ac)	Streets (100% Impervious)				Residential (65% Impervious)				Light Industrial (80% Impervious)				Lawns (0% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
A1	5.09	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	5.09	0.0%	0.08	0.35	0.0%
A2	2.89	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	2.89	0.0%	0.08	0.35	0.0%
A3	1.94	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	1.94	0.0%	0.08	0.35	0.0%
A4	4.83	0.90	0.96	1.75	36.2%	0.45	0.59	0.80	10.8%	0.59	0.70	0.00	0.0%	0.08	0.35	2.28	0.0%	0.44	0.61	47.0%
OS1	2.17	0.90	0.96	0.00	0.0%	0.45	0.59	0.62	18.6%	0.59	0.70	0.00	0.0%	0.08	0.35	1.55	0.0%	0.19	0.42	18.6%
OS2	31.70	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.59	0.70	7.91	20.0%	0.08	0.35	23.79	0.0%	0.21	0.44	20.0%
OS3	13.90	0.90	0.96	2.35	16.9%	0.45	0.59	6.86	32.1%	0.59	0.70	0.00	0.0%	0.08	0.35	4.69	0.0%	0.40	0.57	49.0%
TOTAL (A1-A4)	14.75																			0.0%
TOTAL (OS1-OS3)	47.77																			28.3%
TOTAL	62.52																			25.3%

EXISTING
STANDARD FORM SF-2
TIME OF CONCENTRATION

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

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: DIG
Checked By: RAB
Date: 11/3/23

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
A1	5.09	B	0%	0.08	0.35	180	1.4%	22.1	500	1.6%	10.0	1.3	6.6	28.7	680.0	33.3	28.7
A2	2.89	A	0%	0.08	0.35	125	4.6%	12.4	385	5.2%	10.0	2.3	2.8	15.3	510.0	29.1	15.3
A3	1.94	A	0%	0.08	0.35	80	1.7%	13.8	385	2.5%	10.0	1.6	4.1	17.9	465.0	30.5	17.9
A4	4.83	A	47%	0.44	0.61	100	3.0%	8.3	1465	1.5%	20.0	2.4	10.0	18.3	1565.0	30.8	18.3
OS1	2.17	A	19%	0.19	0.42	30	25.0%	3.1	660	2.9%	10.0	1.7	6.5	9.6	690.0	28.4	9.6
OS2	31.70	A	20%	0.21	0.44	300	3.0%	19.4	1665	2.7%	10.0	1.6	16.9	36.3	1965.0	36.9	36.3
OS3	13.90	A	49%	0.40	0.57	100	1.8%	10.4	800	1.7%	20.0	2.6	5.1	15.5	900.0	24.1	15.5

NOTES:

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

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

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

Where:

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

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

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

Where:

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

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

Where:

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

Table 6-2. NRCS Conveyance factors, K

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

STANDARD FORM SF-3 - EXISTING

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: DIG
Checked By: RAB
Date: 11/3/23

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	OS1	2.17	0.19	9.6	0.40	4.19	1.7															
	2	OS2	31.70	0.21	36.3	6.57	2.19	14.4															Offsite Barbarick Pond Release Piped to DP4
		A1	5.09	0.08	28.7	0.41	2.55	1.0															
		A2	2.89	0.08	15.3	0.23	3.50	0.8															
		A3	1.94	0.08	17.9	0.16	3.26	0.5															
	3								28.7	1.20	2.55	3.1											Sum of basins A1-A3 and OS1, drain to Ex storm Piped west and south to Ex. Pond W-5
	4	OS3	13.90	0.40	15.5	5.58	3.47	19.4															
	5	A4	4.83	0.44	18.3	2.12	3.22	6.8															Runoff to Ex. Inlet in Sterling Ranch Road Piped south to Ex. Pond W-5

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

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

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

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: DIG
Checked By: RAB
Date: 11/3/23

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	OS1	2.17	0.42	9.6	0.91	7.04	6.4															
	2	OS2	31.70	0.44	36.3	13.86	3.68	51.0															Offsite Barbarick Pond Release Piped to DP4
		A1	5.09	0.35	28.7	1.78	4.28	7.6															
		A2	2.89	0.35	15.3	1.01	5.87	5.9															
		A3	1.94	0.35	17.9	0.68	5.47	3.7															
	3								28.7	4.38	4.28	18.7											Sum of basins A1-A3 and OS1, drain to Ex storm Piped west and south to Ex. Pond W-5
	4	OS3	13.90	0.57	15.5	7.94	5.83	46.3															
	5	A4	4.83	0.61	18.3	2.95	5.41	16.0															Runoff to Ex. Inlet in Sterling Ranch Road Piped south to Ex. Pond W-5

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

COMPOSITE % IMPERVIOUS & COMPOSITE PROPOSED RUNOFF COEFFICIENT CALCULATIONS

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

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: GAG
Checked By:
Date: 4/29/24

Basin ID	Total Area (ac)	Paved/Streets (100% Impervious)				Residential (65% 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}	
A1	0.22	0.90	0.96	0.04	18.2%	0.45	0.59	0.03	8.9%	0.08	0.35	0.15	0.0%	0.28	0.49	27.0%
A2	0.99	0.90	0.96	0.04	4.0%	0.45	0.59	0.51	33.5%	0.08	0.35	0.44	0.0%	0.30	0.50	37.5%
A3	1.72	0.90	0.96	0.49	28.5%	0.45	0.59	1.00	37.8%	0.08	0.35	0.23	0.0%	0.53	0.66	66.3%
A4	3.02	0.90	0.96	0.89	29.5%	0.45	0.59	1.57	33.8%	0.08	0.35	0.56	0.0%	0.51	0.65	63.3%
A5	2.04	0.90	0.96	0.71	34.8%	0.45	0.59	0.79	25.2%	0.08	0.35	0.54	0.0%	0.51	0.66	60.0%
A6	1.00	0.90	0.96	0.51	51.0%	0.45	0.59	0.42	27.3%	0.08	0.35	0.07	0.0%	0.65	0.76	78.3%
A7	1.34	0.90	0.96	0.01	0.7%	0.45	0.59	1.07	51.9%	0.08	0.35	0.26	0.0%	0.38	0.55	52.6%
A8	0.29	0.90	0.96	0.00	0.0%	0.45	0.59	0.24	53.8%	0.08	0.35	0.05	0.0%	0.39	0.55	53.8%
A9	0.79	0.90	0.96	0.10	12.7%	0.45	0.59	0.50	41.1%	0.08	0.35	0.19	0.0%	0.42	0.58	53.8%
OS1	2.05	0.90	0.96	0.00	0.0%	0.45	0.59	0.62	19.7%	0.08	0.35	1.43	0.0%	0.19	0.42	19.7%
OS2	0.25	0.90	0.96	0.07	28.0%	0.45	0.59	0.00	0.0%	0.08	0.35	0.18	0.0%	0.31	0.52	28.0%
C4.1	0.31	0.90	0.96	0.20	64.5%	0.45	0.59	0.07	14.7%	0.08	0.35	0.04	0.0%	0.69	0.80	79.2%
C4.2	3.35	0.90	0.96	1.55	46.3%	0.45	0.59	0.75	14.6%	0.08	0.35	1.05	0.0%	0.54	0.69	60.8%
TOTAL (A1-A9)	11.41															59.4%
TOTAL	17.37															54.9%

PROPOSED
STANDARD FORM SF-2
TIME OF CONCENTRATION

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

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: GAG
Checked By:
Date: 4/29/24

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
A1	0.22	B	27%	0.28	0.49	18	2.0%	5.0	455	2.0%	10.0	1.4	5.4	10.4	473.0	25.6	10.4
A2	0.99	A	38%	0.30	0.50	95	2.0%	11.1	440	1.5%	10.0	1.2	6.0	17.1	535.0	23.8	17.1
A3	1.72	A	66%	0.53	0.66	95	2.0%	8.0	795	1.5%	20.0	2.4	5.4	13.4	890.0	20.7	13.4
A4	3.02	A	63%	0.51	0.65	90	2.0%	8.0	1035	1.5%	20.0	2.4	7.0	15.0	1125.0	23.1	15.0
A5	2.04	A	60%	0.51	0.66	95	2.0%	8.3	750	1.6%	20.0	2.6	4.9	13.2	845.0	21.4	13.2
A6	1.00	A	78%	0.65	0.76	30	2.0%	3.5	830	1.6%	20.0	2.5	5.5	9.0	860.0	18.2	9.0
A7	1.34	A	53%	0.38	0.55	75	3.5%	7.4	665	1.0%	10.0	1.0	11.1	18.5	740.0	23.8	18.5
A8	0.29	A	54%	0.39	0.55	95	2.3%	9.5	170	1.5%	20.0	2.4	1.2	10.7	265.0	18.3	10.7
A9	0.79	A	54%	0.42	0.58	30	2.0%	5.4	300	1.9%	20.0	2.8	1.8	7.2	330.0	19.0	7.2
OS1	2.05	B	20%	0.19	0.42	30	25.0%	3.1	660	2.9%	10.0	1.7	6.5	9.6	690.0	28.2	9.6
OS2	0.25	A	28%	0.31	0.52	40	8.0%	4.5	204	0.7%	10.0	0.8	4.1	8.6	244.0	24.4	8.6
C4.1	0.31	A	79%	0.69	0.80	17	2.0%	2.4	220	1.0%	20.0	2.0	1.8	4.2	237.0	14.4	5.0
C4.2	3.35	A	61%	0.54	0.69	20	2.0%	3.6	1855	1.0%	20.0	2.0	15.5	19.0	1875.0	33.3	19.0

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).

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

Where:

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

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

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

Where:

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

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

Where:

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

Table 6-2. NRCS Conveyance factors, K

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

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

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

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: GAG
Checked By:
Date: 4/29/24

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
		OS1	2.05	0.19	9.6	0.39	4.20	1.6															Off-site flows overland into Basin A1 Combines flow at Type C sump inlet at DP1
		A1	0.22	0.28	10.4	0.06	4.08	0.2															Flows overland into swale to DP1 Combines flow at Type C sump inlet at DP1
	1								10.4	0.45	4.08	1.8				1.8	0.45	1.0	18	48	4.4	0.2	Combined flow of Basin OS1 and Basin A1 within Type C sump inlet Flows are piped to manhole at DP2.1
	2	OS2	0.25	0.31	8.6	0.08	4.35	0.3								0.3	0.08	1.0	24	144	2.5	1.0	Flows overland to existing swale to Double Type C sump inlet at DP2 Flows are piped to manhole at DP2.1
	2.1								10.5	0.53	4.05	2.1				2.1	0.53	1.2	18	321	5.0	1.1	Combined flow of DP1 and DP2 within manhole Flows are piped to manhole at DP4.1
	3	A2	0.99	0.30	17.1	0.30	3.32	1.0								1.0	0.30	1.1	36	24	3.5	0.1	Flows overland into swale to Triple Type C sump inlet at DP3 Flows are piped to manhole at DP5.2
	4	A3	1.72	0.53	13.4	0.91	3.69	3.4								3.4	0.91	2.0	24	7	6.6	0.0	Flows along c&g to 15' Type R inlet at DP4. Bypass flows to DP5 Captured flows are piped to manhole at DP4.1
	4.1								13.4	1.44	3.69	5.3				5.3	1.44	2.0	24	161	7.4	0.4	Combined flow of DP2.1 and DP4 within manhole Flows are piped to 10' Type R inlet at DP5.1
	5	A4	3.02	0.51	15.0	1.55	3.52	5.5															Flows along c&g to 10' Type R inlet at DP5 Combines flow at 10' Type R inlet at DP5.1
	5.1								15.0	2.99	3.52	10.5				10.5	2.99	2.0	24	65	9.1	0.1	Combined flow of DP4.1 and DP5 within 10' Type R inlet Flows are piped to manhole at DP5.2
	5.2								17.2	3.29	3.31	10.9				10.9	3.29	2.0	36	44	8.9	0.1	Combined flow of DP3 and DP5.1 within manhole Flows are piped to manhole at DP7.2
	6	A5	2.04	0.51	13.2	1.04	3.72	3.9								3.9	1.04	2.9	18	33	7.9	0.1	Flows along c&g to 15' Type R inlet at DP6. Bypass flows to inlet within SR F4 Captured flows are piped to manhole at DP7.1
	7	A6	1.00	0.65	9.0	0.65	4.29	2.8								2.8	0.65	2.8	18	56	7.1	0.1	Flows along c&g to 15' Type R inlet at DP7. Captured flows are piped to manhole at DP7.1
	7.1								13.2	1.69	3.71	6.3				6.3	1.69	5.2	18	70	11.2	0.1	Combined flow of DP6 and DP7 within manhole Flows are piped to manhole at DP7.2
	7.2								17.3	4.98	3.30	16.5				16.5	4.98	1.8	36	119	9.5	0.2	Combined flow of DP5.2 and DP7.1 within manhole Flows are piped to manhole at DP8.1
	8	C4.1	0.31	0.69	5.0	0.21	5.17	1.1								1.1	0.21	16.4	18	9	9.8	0.0	Flows along c&g to 5' Type R inlet at DP8. Bypass flows to inlet within SR F4 Captured flows are piped to manhole at DP8.1
	8.1								17.5	5.19	3.29	17.1				17.1	5.19	2.0	36	10	10.0	0.0	Combined flow of DP7.1 and DP8 within manhole Flows are piped to manhole at DP9.1
	9	A7	1.34	0.38	18.5	0.51	3.21	1.6								1.6	0.51	4.0	18	60	6.8	0.1	Flows overland into swale to Type C inlet at DP9 Flows are piped to manhole at DP9.1
	9.1								18.7	5.70	3.19	18.2											Combined flow of DP8.1 and DP9 within manhole Flows are piped to manhole at DP7.2

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

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

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: GAG
Checked By:
Date: 4/29/24

		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
		A8	0.29	0.39	10.7	0.11	4.03	0.4															Flows off-site along ex. Dines Blvd. c&g to ex. Sterling Ranch Road c&g Flows to ex. inlet at DP10
		C4.2	3.35	0.54	19.0	1.82	3.16	5.8															Flows off-site along ex. Dines Blvd. c&g to ex. Sterling Ranch Road c&g Flows to ex. inlet at DP10
	10								19.0	1.93	3.16	6.1											Combined flow of Basin A8 and Basin C4.2 to ex. inlet at DP10 Captured flows are piped to manhole at DP16.1
	11	EX F4 DP9						3.8								3.8							Total runoff to ex. sump inlet at Filing 4 DP9 Piped to manhole at DP16.1
	12	EX F4 DP5						12.0								12.0							Total runoff to ex. sump inlet at Filing 4 DP5 Piped to sump inlet at DP14.1
	13	EX F4 DP6.1						3.9								3.9							Total runoff to ex. sump inlet at Filing 4 DP6.1 Piped to sump inlet at DP14.1
	14	EX F4 DP6.2						2.0								2.0							Total runoff to ex. sump inlet at Filing 4 DP6.2 Piped to sump inlet at DP14.1
	14.1	EX F4 DP6.3						16.9															Combined captured flow DP12, DP13, and DP14 and bypass from DP6. Piped to manhole at DP16.1
	15.1	EX F4 DP7.1						30.0															Total runoff to ex. manhole at Filing 4 DP7.1 Piped to manhole at DP15.1
	16.1											75.0											Combined flow of DP9.1, DP10, DP11, DP14.1, and DP15.1. Same as Filing 4 DP10. Total runoff piped to ex. Pond W-5
		EX Branding Iron F1 DP8						1.4															Runoff to ex. 10' Type R inlet at Branding Iron at Sterling Ranch F1 DP8 Flows piped to ex. FSD Pond 8
	17	A9	0.79	0.42	7.2	0.33	4.63	1.5				2.9											Flows off-site along ex. Dines Blvd. c&g to ex. sump inlet at DP17 Flows piped to ex. Pond W-8

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
Values in BLUE indicate they are from the approved "Final Drainage Report for Sterling Ranch Filing No. 4" dated August 14, 2023 by JR Engineering.
Values in RED indicate they are from the approved "Final Drainage Report for Branding Iron at Sterling Ranch Filing No. 1" dated October 2018 by M&S Civil Consultants, Inc.

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: GAG
Checked By:
Date: 4/29/24

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
		OS1	2.05	0.42	9.6	0.87	7.65	6.7															Off-site flows overland into Basin A1 Combines flow at Type C sump inlet at DP1
		A1	0.22	0.49	10.4	0.11	7.47	0.8															Flows overland into swale to DP1 Combines flow at Type C sump inlet at DP1
	1								10.4	0.98	7.47	7.3				7.3	0.98	1.0	18	48	6.4	0.1	Combined flow of Basin OS1 and Basin A1 within Type C sump inlet Flows are piped to manhole at DP2.1
	2	OS2	0.25	0.52	8.6	0.13	7.89	1.0								1.0	0.13	1.0	24	144	3.7	0.7	Flows overland to existing swale to Double Type C sump inlet at DP2 Flows are piped to manhole at DP2.1
	2.1								10.5	1.11	7.45	8.3				8.3	1.11	1.2	18	321	7.1	0.8	Combined flow of DP1 and DP2 within manhole Flows are piped to manhole at DP4.1
	3	A2	0.99	0.50	17.1	0.49	6.34	3.1								3.1	0.49	1.1	36	24	4.8	0.1	Flows overland into swale to Triple Type C sump inlet at DP3 Flows are piped to manhole at DP5.2
	4	A3	1.72	0.66	13.4	1.14	6.89	7.9					0.2	0.03	2.2	7.7	1.11	2.0	24	169 7	3.0 8.3	0.9 0.0	Flows along c&g to 15' Type R inlet at DP4. Bypass flows to DP5 Captured flows are piped to manhole at DP4.1
	4.1								13.4	2.22	6.89	15.3				15.3	2.22	2.0	24	161	10.0	0.3	Combined flow of DP2.1 and DP4 within manhole Flows are piped to 10' Type R inlet at DP5.1
	5	A4	3.02	0.65	15.0	1.98	6.64	13.1	15.6	2.01	6.55	13.2											Flows along c&g to 10' Type R inlet at DP5, bypass from DP4 Combines flow at 10' Type R inlet at DP5.1
	5.1								15.6	4.23	6.55	27.7				27.7	4.23	2.0	24	65	11.5	0.1	Combined flow of bypass from DP4, DP4.1, and DP5 within 10' Type R inlet. Flows are piped to manhole at DP5.2
	5.2								17.2	4.72	6.33	29.9				29.9	4.72	2.0	36	44	11.8	0.1	Combined flow of DP3 and DP5.1 within manhole Flows are piped to manhole at DP7.2
	6	A5	2.04	0.66	13.2	1.34	6.93	9.3					0.5	0.07	2.5	8.8	1.27	2.9	18	462 33	3.2 10.0	2.4 0.1	Flows along c&g to 15' Type R inlet at DP6. Bypass flows to DP14.1 inlet within SR F4 Captured flows are piped to manhole at DP7.1
	7	A6	1.00	0.76	9.0	0.76	7.80	5.9								5.9	0.76	2.8	18	56	9.0	0.1	Flows along c&g to 15' Type R inlet at DP7. Captured flows are piped to manhole at DP7.1
	7.1								13.2	2.03	6.92	14.0				14.0	2.03	5.2	18	70	14.0	0.1	Combined flow of DP6 and DP7 within manhole Flows are piped to manhole at DP7.2
	7.2								17.3	6.75	6.32	42.7				42.7	6.75	1.8	36	119	12.5	0.2	Combined flow of DP5.2 and DP7.1 within manhole Flows are piped to manhole at DP8.1
	8	C4.1	0.31	0.80	5.0	0.25	9.11	2.3					0.4	0.04	1.5	1.9	0.21	16.4	18	660 9	2.4 11.7	4.5 0.0	Flows along c&g to 5' Type R inlet at DP8. Bypass flows to DP14.1 inlet within SR F4 Captured flows are piped to manhole at DP8.1
	8.1								17.4	6.95	6.30	43.8				43.8	6.95	2.0	36	10	13.1	0.0	Combined flow of DP7.1 and DP8 within manhole Flows are piped to manhole at DP9.1
	9	A7	1.34	0.55	18.5	0.73	6.17	4.5								4.5	0.73	4.0	18	60	9.2	0.1	Flows overland into swale to Type C inlet at DP9 Flows are piped to manhole at DP9.1
	9.1								18.6	7.68	6.16	47.3											Combined flow of DP8.1 and DP9 within manhole Flows are piped to manhole at DP7.2

STANDARD FORM SF-3 - PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

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

Project Name: Sterling Ranch Filing 5
Project No.: 25188.16
Calculated By: GAG
Checked By:
Date: 4/29/24

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)	
		A8	0.29	0.55	10.7	0.16	7.40	1.2															Flows off-site along ex. Dines Blvd. c&g to ex. Sterling Ranch Road c&g Flows to ex. inlet at DP10
		C4.2	3.35	0.69	19.0	2.30	6.11	14.0															Flows off-site along ex. Dines Blvd. c&g to ex. Sterling Ranch Road c&g Flows to ex. inlet at DP10
	10								19.0	2.50	6.11	15.3	2.4	0.39	3.0	12.9	2.11	1.0	24	1745 26	3.5 7.4	8.4 0.1	Combined flow of Basin A8 and Basin C4.2 to ex. inlet at DP10 Captured flows are piped to manhole at DP16.1
	11	EX F4 DP9						7.9								7.7							Total runoff to ex. sump inlet at Filing 4 DP9 Piped to manhole at DP16.1
	12	EX F4 DP5						25.9								13.5							Total runoff to ex. sump inlet at Filing 4 DP5 Piped to sump inlet at DP14.1
	13	EX F4 DP6.1						19.3								16.2							Total runoff to ex. sump inlet at Filing 4 DP6.1 Piped to sump inlet at DP14.1
	14	EX F4 DP6.2						7.3								7.3							Total runoff to ex. sump inlet at Filing 4 DP6.2 Piped to sump inlet at DP14.1
	14.1	EX F4 DP6.3						36.1															Combined captured flow DP12, DP13, and DP14 and bypass from DP6. Piped to manhole at DP16.1
	15.1	EX F4 DP7.1						93.5															Total runoff to ex. manhole at Filing 4 DP7.1 Piped to manhole at DP15.1
	16.1											197.5											Combined flow of DP9.1, DP10, DP11, DP14.1, and DP15.1. Same as Filing 4 DP10. Total runoff piped to ex. Pond W-5
		EX Branding Iron F1 DP8						13.2															Runoff to ex. 10' Type R inlet at Branding Iron at Sterling Ranch F1 DP8 Flows piped to ex. FSD Pond 8
	17	A9	0.79	0.58	7.2	0.46	8.30	3.8				17.0											Flows off-site along ex. Dines Blvd. c&g to ex. sump inlet at DP17 Flows piped to ex. Pond W-8

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
Values in BLUE indicate they are from the approved "Final Drainage Report for Sterling Ranch Filing No. 4" dated August 14, 2023 by JR Engineering
Values in RED indicate they are from the approved "Final Drainage Report for Branding Iron at Sterling Ranch Filing No. 1" dated October 2018 by M&S Civil Consultants, Inc.

Appendix C
Hydraulic Calcs

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Dec 20 2023

DP1 Swale-Capacity

User-defined

Invert Elev (ft)	= 7025.19
Slope (%)	= 0.75
N-Value	= 0.030

Calculations

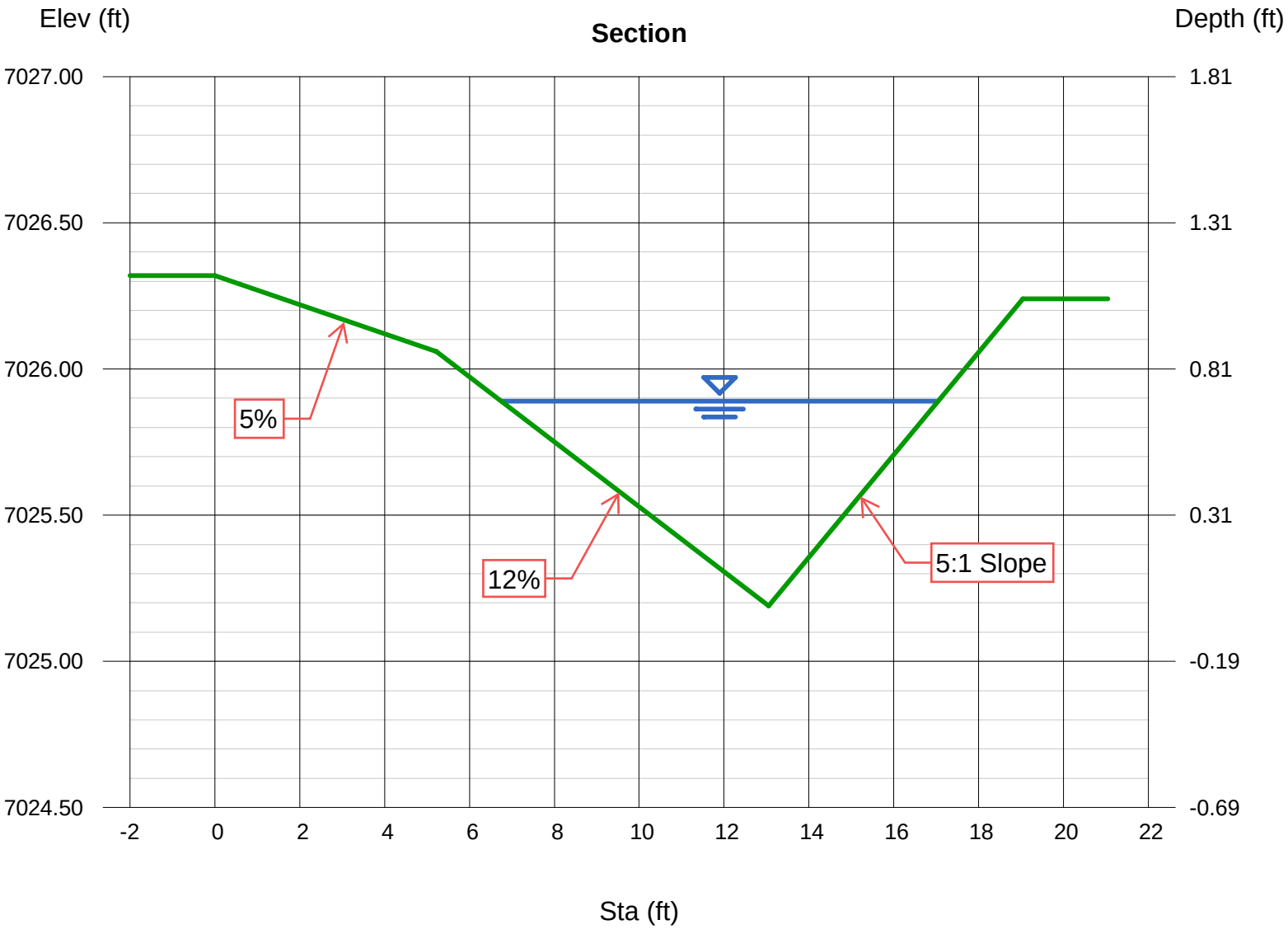
Compute by:	Known Q
Known Q (cfs)	= 7.50

Highlighted

Depth (ft)	= 0.70
Q (cfs)	= 7.500
Area (sqft)	= 3.61
Velocity (ft/s)	= 2.08
Wetted Perim (ft)	= 10.40
Crit Depth, Yc (ft)	= 0.58
Top Width (ft)	= 10.30
EGL (ft)	= 0.77

(Sta, El, n)-(Sta, El, n)...

(0.00, 7026.32) -(5.22, 7026.06, 0.030) -(13.05, 7025.19, 0.030) -(19.05, 7026.24, 0.030)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Dec 20 2023

DP1 Swale-Velocity

User-defined

Invert Elev (ft)	= 7019.08
Slope (%)	= 5.00
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 7.50

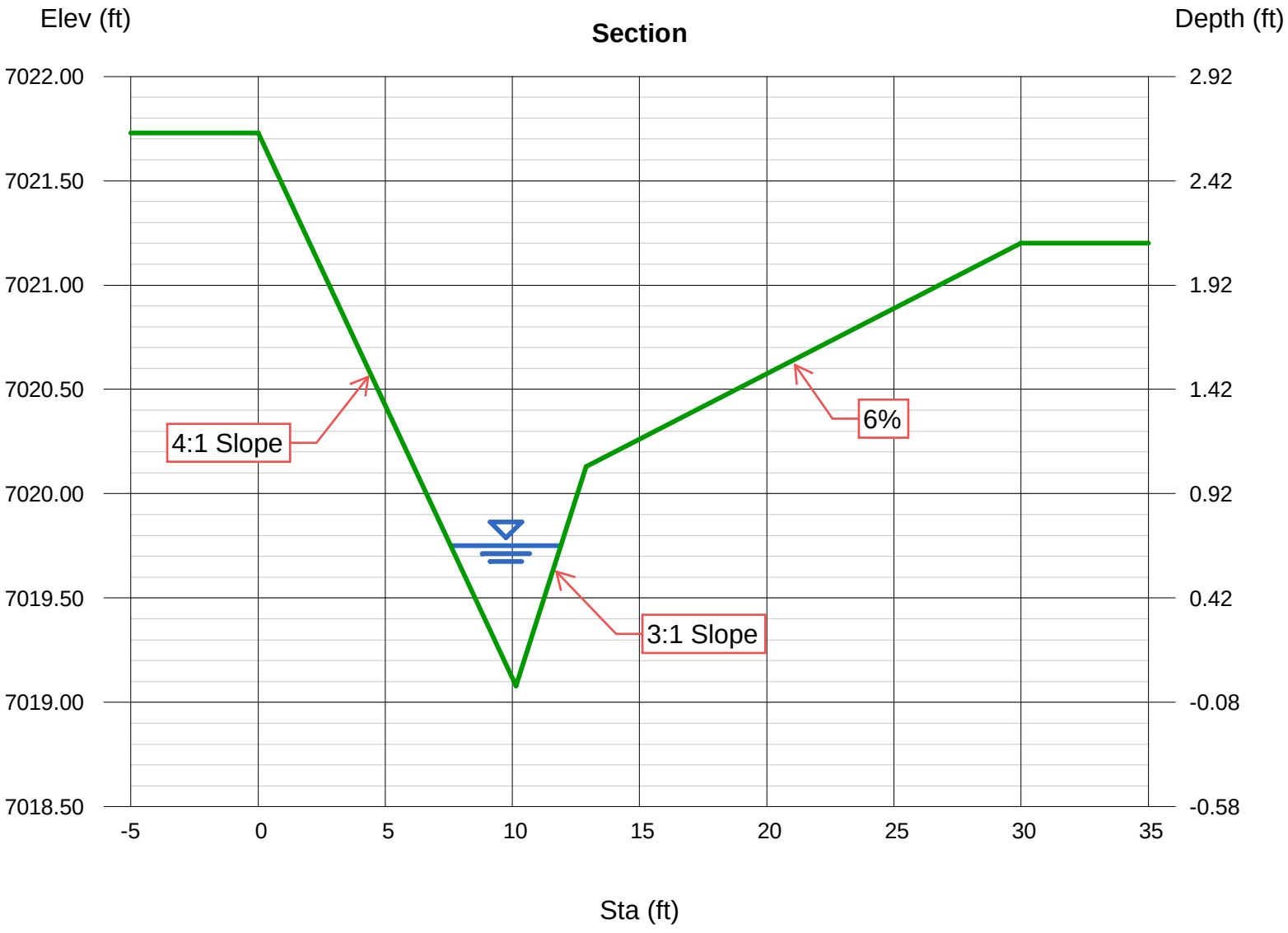
(Sta, El, n)-(Sta, El, n)...

(0.00, 7021.73) -(10.15, 7019.08, 0.030) -(12.90, 7020.13, 0.030) -(30.00, 7021.20, 0.030)

Highlighted

Depth (ft)	= 0.67
Q (cfs)	= 7.500
Area (sqft)	= 1.45
Velocity (ft/s)	= 5.18
Wetted Perim (ft)	= 4.53
Crit Depth, Yc (ft)	= 0.81
Top Width (ft)	= 4.32
EGL (ft)	= 1.09

TRM will be used for this steep slope due to velocity.



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Apr 23 2024

DP2-Capacity & Velocity

Trapezoidal

Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7019.18
Slope (%)	= 0.50
N-Value	= 0.012

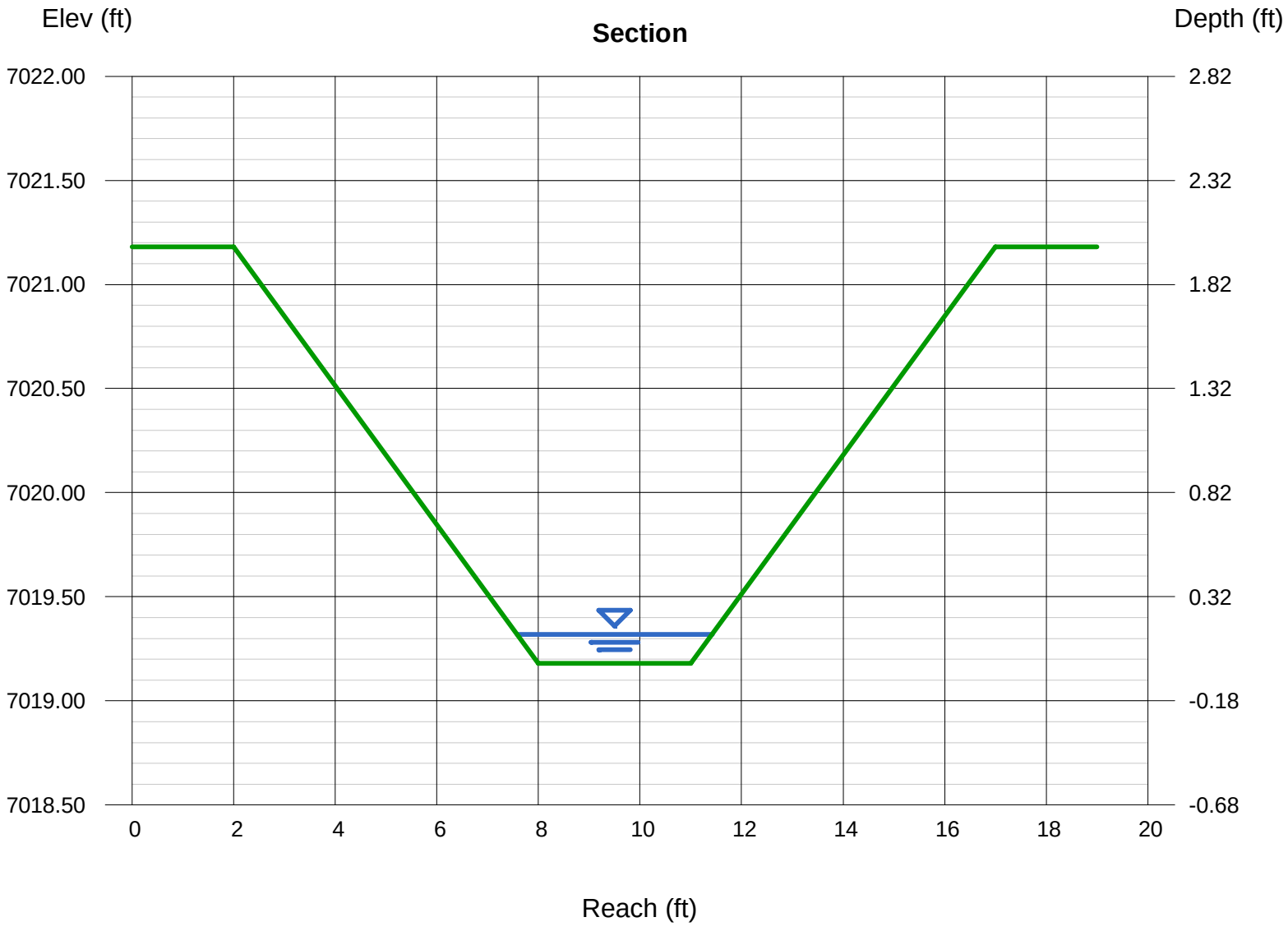
Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.00

Highlighted

Depth (ft)	= 0.14
Q (cfs)	= 1.000
Area (sqft)	= 0.48
Velocity (ft/s)	= 2.09
Wetted Perim (ft)	= 3.89
Crit Depth, Yc (ft)	= 0.15
Top Width (ft)	= 3.84
EGL (ft)	= 0.21

Design flows for basin
See separate overflow analysis



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 24 2024

DP3 Swale-Capacity

Trapezoidal

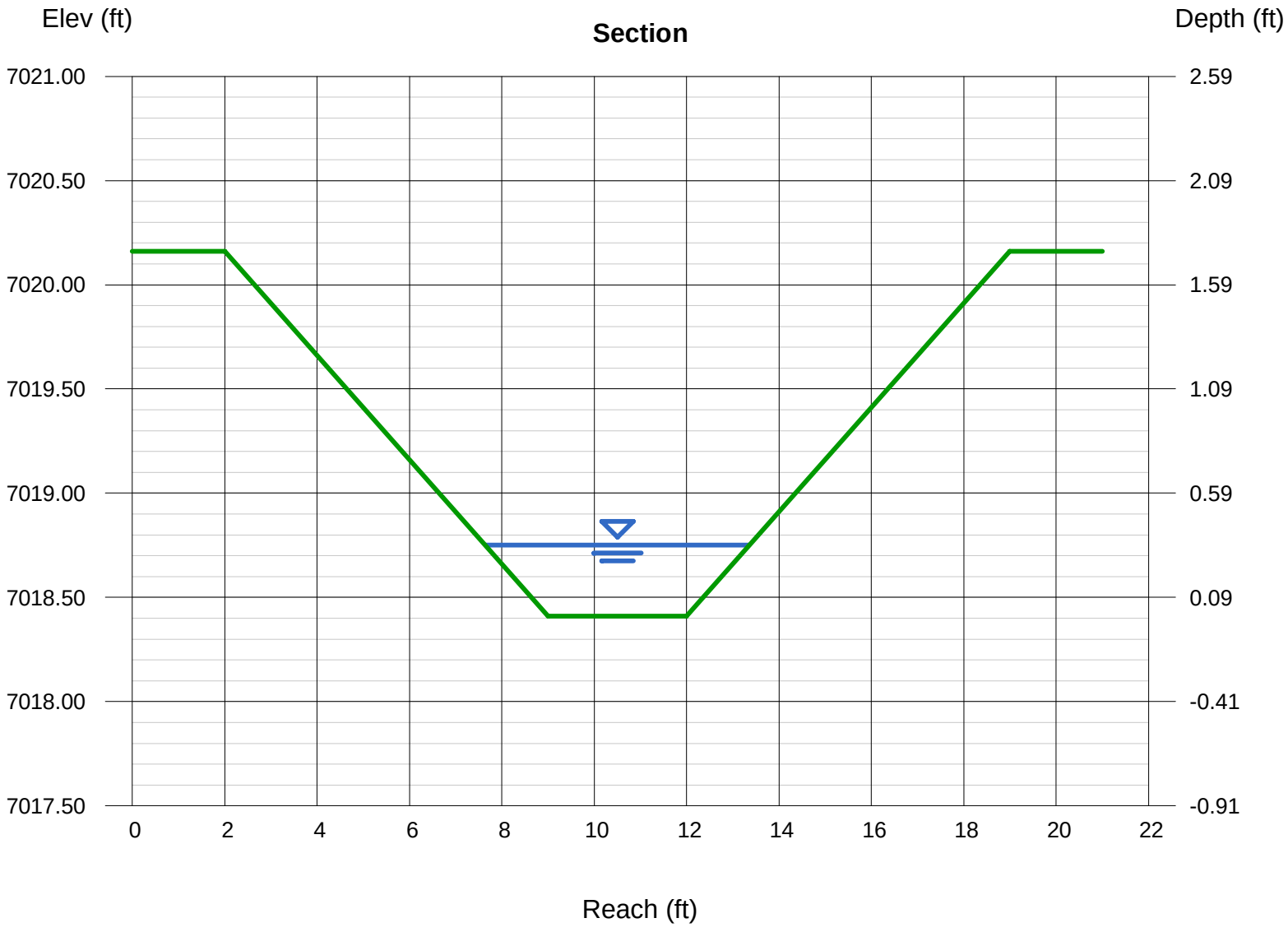
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.75
Invert Elev (ft)	= 7018.41
Slope (%)	= 1.50
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3.50

Highlighted

Depth (ft)	= 0.34
Q (cfs)	= 3.500
Area (sqft)	= 1.48
Velocity (ft/s)	= 2.36
Wetted Perim (ft)	= 5.80
Crit Depth, Yc (ft)	= 0.31
Top Width (ft)	= 5.72
EGL (ft)	= 0.43



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 24 2024

DP3 Swale-Velocity

Trapezoidal

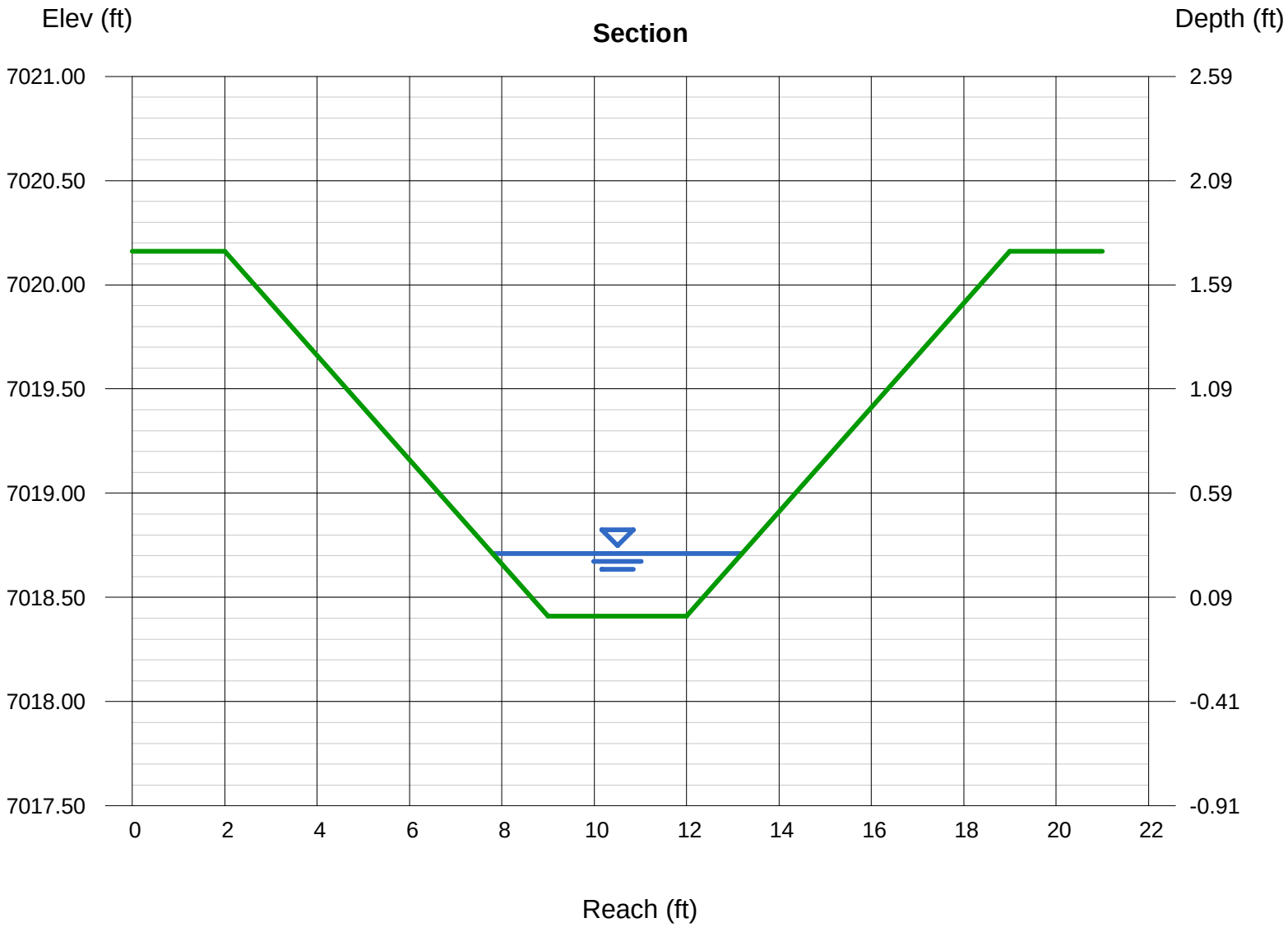
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.75
Invert Elev (ft)	= 7018.41
Slope (%)	= 2.50
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3.50

Highlighted

Depth (ft)	= 0.30
Q (cfs)	= 3.500
Area (sqft)	= 1.26
Velocity (ft/s)	= 2.78
Wetted Perim (ft)	= 5.47
Crit Depth, Yc (ft)	= 0.31
Top Width (ft)	= 5.40
EGL (ft)	= 0.42



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Dec 6 2023

DP9 Swale-Capacity

User-defined

Invert Elev (ft)	= 7019.25
Slope (%)	= 0.90
N-Value	= 0.030

Calculations

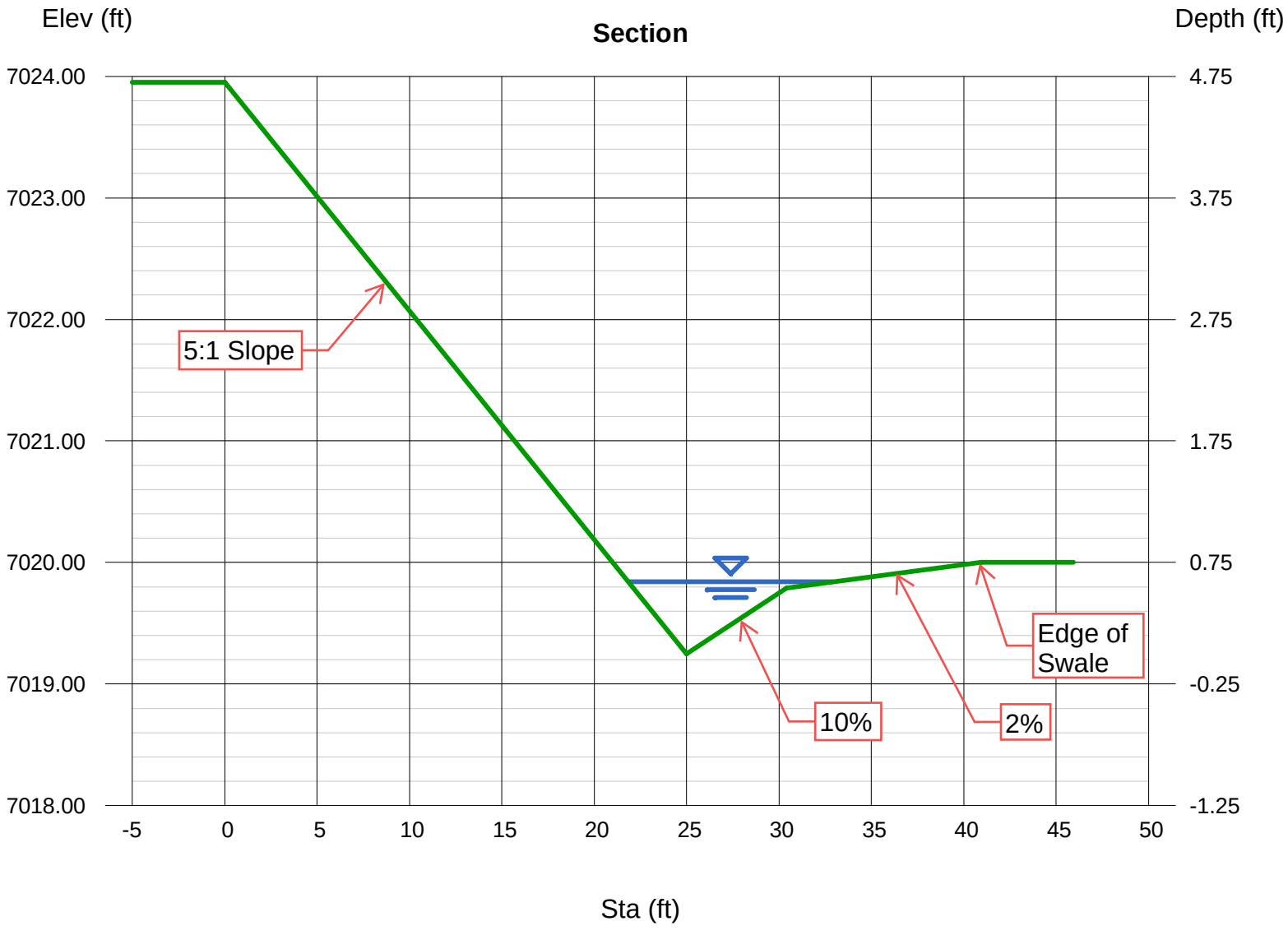
Compute by:	Known Q
Known Q (cfs)	= 5.00

Highlighted

Depth (ft)	= 0.59
Q (cfs)	= 5.000
Area (sqft)	= 2.72
Velocity (ft/s)	= 1.84
Wetted Perim (ft)	= 11.14
Crit Depth, Yc (ft)	= 0.49
Top Width (ft)	= 11.06
EGL (ft)	= 0.64

(Sta, El, n)-(Sta, El, n)...

(0.00, 7023.95) -(25.00, 7019.25, 0.030) -(30.42, 7019.79, 0.030) -(40.95, 7020.00, 0.030)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Dec 6 2023

DP9 Swale-Velocity

User-defined

Invert Elev (ft)	= 7012.27
Slope (%)	= 3.40
N-Value	= 0.030

Calculations

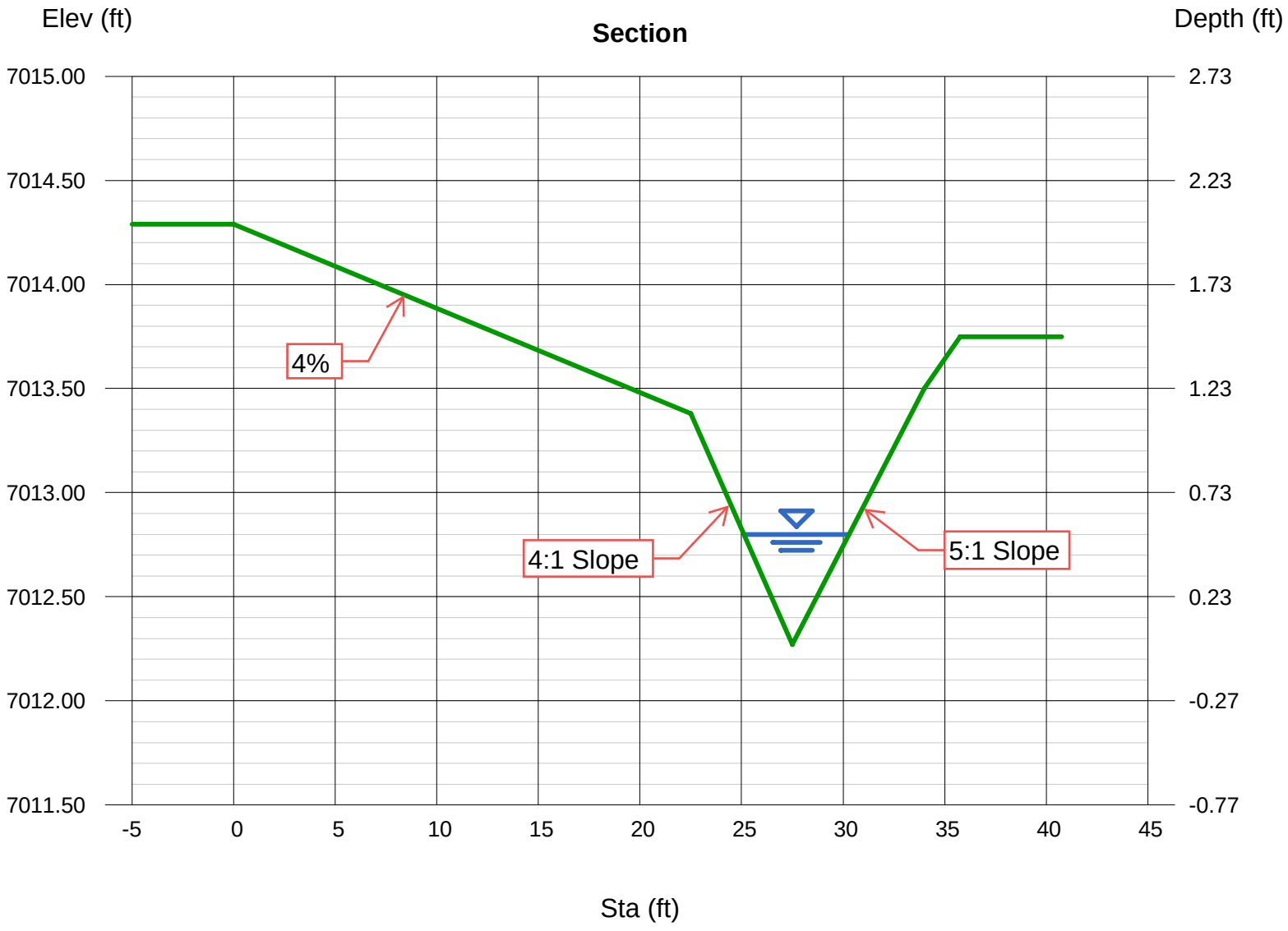
Compute by:	Known Q
Known Q (cfs)	= 5.00

Highlighted

Depth (ft)	= 0.53
Q (cfs)	= 5.000
Area (sqft)	= 1.37
Velocity (ft/s)	= 3.64
Wetted Perim (ft)	= 5.29
Crit Depth, Yc (ft)	= 0.58
Top Width (ft)	= 5.19
EGL (ft)	= 0.74

(Sta, El, n)-(Sta, El, n)...

(0.00, 7014.29) -(22.50, 7013.38, 0.030) -(27.50, 7012.27, 0.030) -(34.00, 7013.50, 0.030) -(35.75, 7013.75, 0.030)



Froude Number Calculations

Sterling Ranch Filing No. 5

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 DP1 Swale (Flat) Calculations:

Parameters: S= 0.75%, A= 3.61 ft^2, T= 10.40 ft, v= 2.08 ft/s

Therefore: $h_m = \frac{3.61}{10.40} = 0.35\ ft$

$$Fr = \frac{2.08}{(32.2*0.35)^{1/2}} = 0.62$$

For cohesive soils maximum Froude Number is 0.80.

Inlet DP1 Swale (Steep) Calculations:

Parameters: S= 5.0%, A= 1.45 ft^2, T= 4.53 ft, v= 5.18 ft/s

Therefore: $h_m = \frac{1.45}{4.53} = 0.32\ ft$

$$Fr = \frac{5.18}{(32.2*0.32)^{1/2}} = 1.61$$

For cohesive soils maximum Froude Number is 0.80.

Turf Reinforcement Mat (TRM) used for steep portion of the swale.

Inlet DP2 Swale Calculations:

Parameters: A= 0.33 ft^2, T= 3.63 ft, v= 3.03 ft/s

Therefore: $h_m = \frac{0.33}{3.63} = 0.09\ ft$

$$Fr = \frac{3.03}{(32.2*0.09)^{1/2}} = 1.78$$

For cohesive soils maximum Froude Number is 0.80.

Concrete is used for the DP2 swale.

Inlet DP3 Swale (Flat) Calculations:

Parameters: S= 1.5%, A= 1.48 ft^2, T= 5.80 ft, v= 2.36 ft/s

Therefore: $h_m = \frac{1.48}{5.80} = 0.26\ ft$

$$Fr = \frac{2.36}{(32.2*0.26)^{1/2}} = 0.82$$

For cohesive soils maximum Froude Number is 0.80.

Turf Reinforcement Mat (TRM) used for this swale.

Inlet DP3 Swale (Steep) Calculations:

Parameters: S= 2.5%, A= 1.26 ft^2, T= 5.47 ft, v= 2.78 ft/s

Therefore: $h_m = \frac{1.26}{5.47} = 0.23\ ft$

$$Fr = \frac{2.78}{(32.2*0.23)^{1/2}} = 1.02$$

For cohesive soils maximum Froude Number is 0.80.

Turf Reinforcement Mat (TRM) used for this swale.

Inlet DP9 Swale (Flat) Calculations:

Parameters: S= 0.9%, A= 2.72 ft^2, T= 11.14 ft, v= 1.84 ft/s

Therefore: $h_m = \frac{2.72}{11.14} = 0.24\ ft$

$$Fr = \frac{1.84}{(32.2*0.24)^{1/2}} = 0.66$$

For cohesive soils maximum Froude Number is 0.80.

Inlet DP9 Swale (Steep) Calculations:

Parameters: S= 3.4%, A= 1.37 ft^2, T= 5.29 ft, v= 3.64 ft/s

Therefore: $$h_m = \frac{1.37}{5.29} = 0.26\ ft$$

$$Fr = \frac{3.64}{(32.2*0.26)^{1/2}} = 1.26$$

For cohesive soils maximum Froude Number is 0.80.

Turf Reinforcement Mat (TRM) used for steep portion of the swale.

VMax® TRMs

ROLLMAX™
ROLLED EROSION CONTROL

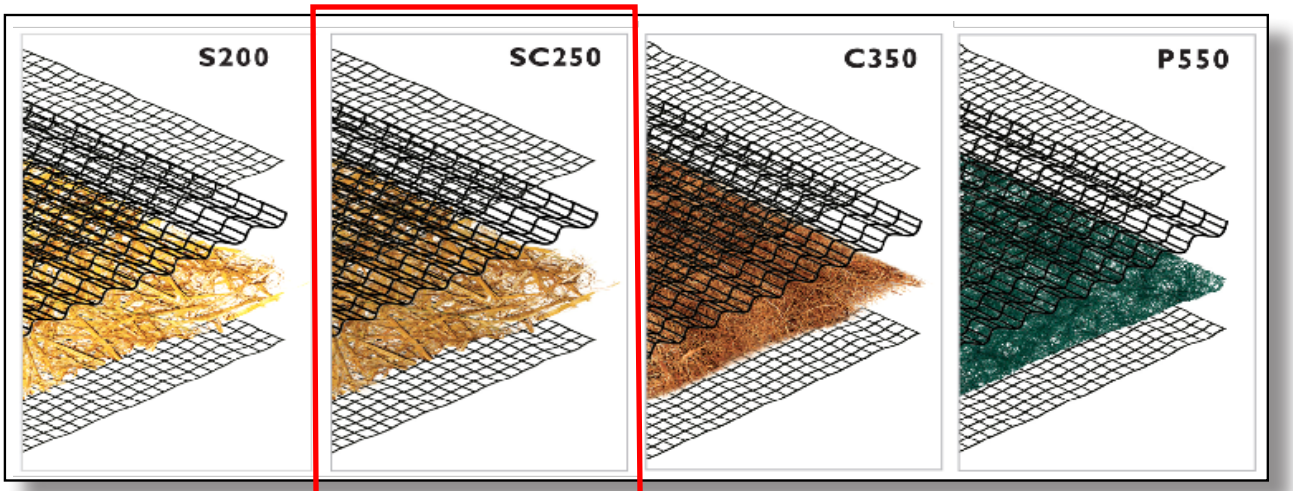
A Permanent Turf Reinforcement Mat Solution for Every Design

The VMax system of permanent TRMs are ideal for high-flow channels, streambanks, shorelines, and other areas needing permanent vegetation reinforcement and protection from water and wind. Our VMax TRMs combine a three-dimensional matting and a fiber matrix material for all-out erosion protection, vegetation establishment and reinforcement. The VMax TRMs are available with various performance capabilities and support reinforced vegetative lining development from germination to maturity.

VMax® Unique Three-Dimensional Design

North American Green VMax TRMs are each designed to maximize performance through all development phases of a reinforced vegetative lining. The corrugated matting structure lends a true reinforcement zone for vegetation entanglement, especially compared to flat net mats. The unique design of the corrugated matting also helps to create a shear plane that deflects flowing water away from the soil surface. And the incorporation of a fiber matrix supplements the 3-D structure by creating a ground cover that blocks soil movement and aids in vegetation establishment.

Four VMax Turf Reinforcement Mats Designed for Every Level of Performance



	S200	SC250	C350	P550
Matrix Fiber	100% Straw	70% Straw / 30% Coconut	100% Coconut	100% Polypropylene
Netting Types	Top and Bottom light-weight UV-stabilized PP, Crimped PP center net	Top and Bottom UV-stabilized PP, Crimped PP center net	Top and Bottom heavy-weight UV-stabilized PP, Crimped PP center net	Top and Bottom ultra heavy-weight UV-stabilized PP, Crimped PP center net
Typical Slope Applications (H:V)	1:1 and greater	1:1 and greater	1:1 and greater	1:1 and greater
Channel Shear Stress Threshold	Unvegetated: 2.3 psf Vegetated: 10.0 psf	Unvegetated: 3.0 psf Vegetated: 10.0 psf	Unvegetated: 3.2 psf Vegetated: 12.0 psf	Unvegetated: 4.0 psf Vegetated: 14.0 psf
Channel Velocity Threshold	Unvegetated: 8.5 fps Vegetated: 18 fps	Unvegetated: 9.5 fps Vegetated: 15 fps	Unvegetated: 10.5 fps Vegetated: 20 fps	Unvegetated: 12.5 fps Vegetated: 25 fps

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Selected product that will work for all swales above 5 ft/s. Has maximum of 15 ft/s.

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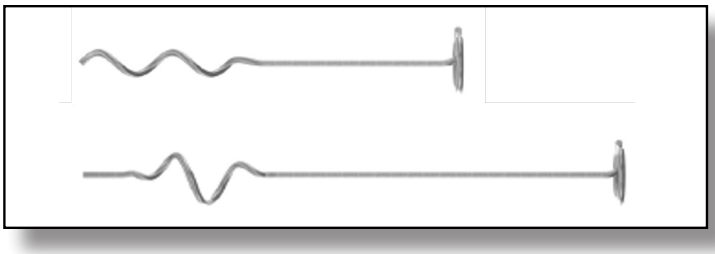
VMax® TRMs cont.

Selecting the Right VMax TRM

Choosing the right VMax TRM can be made easy by utilizing our Erosion Control Materials Design Software (www.ecmds.com), which allows users to input project specific parameters for channels, slopes, spillways, and more and ensures proper evaluation, design, and product selection in return. Our four VMax TRMs offer varying performance values, fiber matrix longevities, and price points, to help you meet your project specific goals.

Twist Pin + VMax TRM - an Ideal Installation

Utilizing the VMax TRMs in conjunction with Twist Pin fastener technology can result in an installed system that pushes TRM performance with increased factors of safety. The combined system has been shown to have superior pullout strength performance up to 200 lbs when compared to installation with traditional wire staples and pins. This is up to 10x the pullout resistance of wire staples and pins. Additionally, the use of the twist pins provides intimate contact between the TRM and the soil, and have been shown to be effective in a wide range of soil types. With a quick and easy installation using an electric drill and custom chuck, the TRM+Twist Pin system can eliminate time and labor costs from day 1 through project release.



VMax turf reinforcement mat being installed on a channel application (top right), twist pins installed with TRMs can have increased system performance and pullout resistance (middle right), twist pins are available in 8" and 12" lengths and two coil configurations designed for hard or soft soil types (lower right).

Comparison of common TRM fasteners based on pullout performance and typical application (below).

Fastener	Pullout Resistance (lb)	Comment
6" Round Top Pin	14	Best for hardened soils where other fasteners are damaged during installation.
6" Regular U-staple	42	Standard fastener that develops additional pullout as legs may deflect and add friction during installation.
12" Pin with Washer	35	Standard fastener good for soils where staples can be bent frequently and are too difficult to install.
18" Pin with Washer	27	Standard fastener good for soils where staples are frequently bent and 12" straight pins fail to provide sufficient pullout because surface soil is wet or loose.
Twist Pin	170	Upgraded fastener that provides high pullout and ideal for loose or soft soils.

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MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP1	DP2	DP3
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	AREA	AREA
Hydraulic Condition	Swale	Swale	Swale
Inlet Type	CDOT Type C	CDOT TYPE D (Parallel)	User-Defined

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.8	0.3	1.0
Major Q_{Known} (cfs)	7.3	1.0	3.1

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	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)	1.8	0.3	1.0
Major Total Design Peak Flow, Q (cfs)	7.3	1.0	3.1
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP4	DP5	DP6
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	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)	3.4	5.5	3.9
Major Q_{Known} (cfs)	7.9	13.1	9.3

Bypass (Carry-Over) Flow from Upstream

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	0.2	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)	3.4	5.5	3.9
Major Total Design Peak Flow, Q (cfs)	7.9	13.3	9.3
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.2	N/A	0.5

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP7	DP8	DP9
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	AREA
Hydraulic Condition	On Grade	On Grade	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)	2.8	1.1	1.6
Major Q_{Known} (cfs)	5.9	2.3	4.5

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)	2.8	1.1	1.6
Major Total Design Peak Flow, Q (cfs)	5.9	2.3	4.5
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	0.4	0.0

MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP17
Site Type (Urban or Rural)	URBAN
Inlet Application (Street or Area)	STREET
Hydraulic Condition	In Sump
Inlet Type	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	2.9
Major Q_{Known} (cfs)	17.0

Bypass (Carry-Over) Flow from Upstream

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

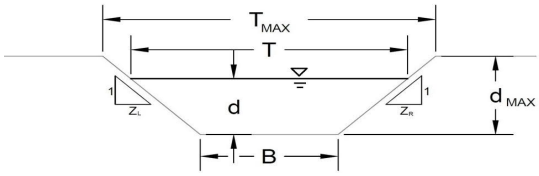
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	2.9
Major Total Design Peak Flow, Q (cfs)	17.0
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A

AREA INLET IN A SWALE

STERLING RANCH FILING 5

DP1



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 =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0300	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	8.00	ft/ft
Right Side Sloe	Z2 =	3.00	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} =	10.00	10.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.50	1.50	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	22.8	22.8	cfs
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	0.91	0.91	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	1.8	7.3	cfs
Water Depth	d =	0.35	0.59	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'

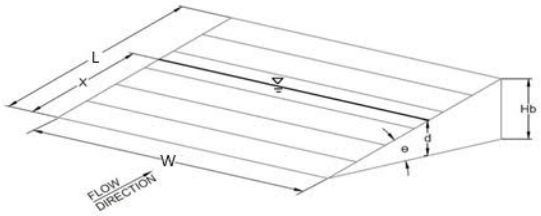
AREA INLET IN A SWALE

STERLING RANCH FILING 5

DP1

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	



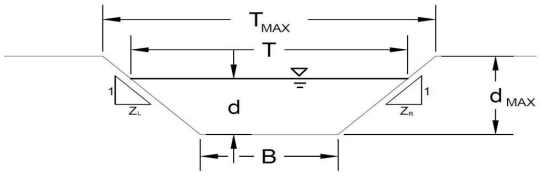
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.35	0.59	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	3.8	8.4	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

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

AREA INLET IN A SWALE

STERLING RANCH FILING 5

DP2



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 =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0100	ft/ft
Bottom Width	B =	3.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Sloe	Z2 =	3.00	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} =	15.00	15.00	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} =	98.1	98.1	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 =	0.3	1.0	cfs
Water Depth	d =	0.09	0.19	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'

MHFD-Inlet, Version 5.02 (August 2022)

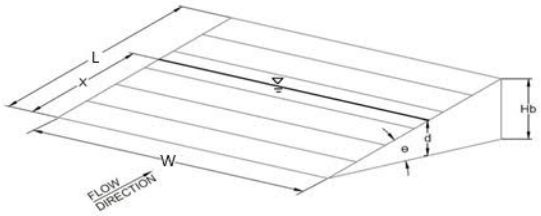
AREA INLET IN A SWALE

STERLING RANCH FILING 5

DP2

Inlet Design Information (Input)

Type of Inlet	CDOT TYPE D (Parallel)	Inlet Type =	CDOT TYPE D (Parallel)	
Angle of Inclined Grate (must be <= 30 degrees)		θ =	0.00	degrees
Width of Grate		W =	6.00	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 =	0.38	
Grate Discharge Coefficient		C_d =	0.76	
Orifice Coefficient		C_o =	0.50	
Weir Coefficient		C_w =	1.62	



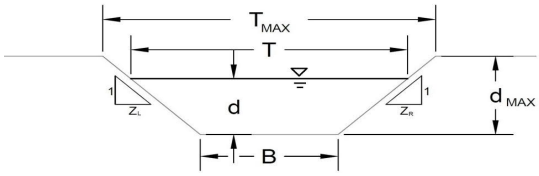
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.09	0.19	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	0.7	2.1	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

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

AREA INLET IN A SWALE

STERLING RANCH FILING 5

DP3



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 =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0100	ft/ft
Bottom Width	B =	3.00	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} =	15.00	17.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.00	1.75	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	25.3	87.1	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.00	1.75	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	1.0	3.1	cfs
Water Depth	d =	0.19	0.35	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'

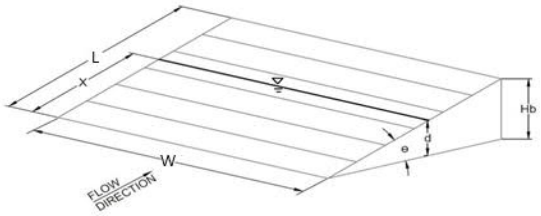
AREA INLET IN A SWALE

STERLING RANCH FILING 5

DP3

Inlet Design Information (Input)

Type of Inlet	User-Defined	Inlet Type =	User-Defined	
Angle of Inclined Grate (must be <= 30 degrees)		θ =	0.00	degrees
Width of Grate		W =	2.92	ft
Length of Grate		L =	8.76	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 =	N/A	
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 =	0.19	0.35	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	3.1	8.0	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

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

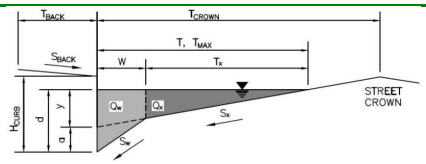
MHFD-Inlet, Version 5.02 (August 2022)

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 5

Inlet ID: DP4



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	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} =	16.0	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 =	0.022	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} =	10.0	13.0	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)		☐	☐	

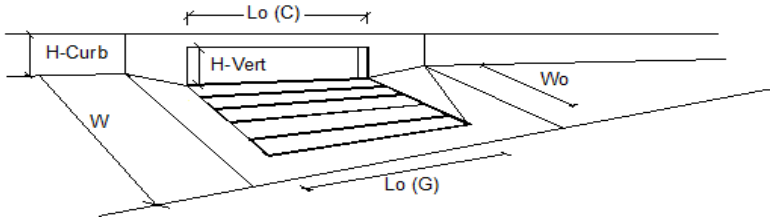
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	4.6	8.4	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.40 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 =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	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 =	3.4	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	%

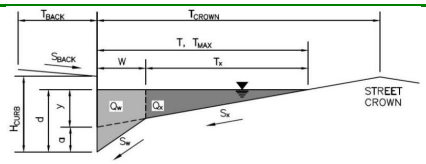
MHFD-Inlet, Version 5.02 (August 2022)

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 5

Inlet ID: DP5



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	45.0	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} =	40.0	45.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

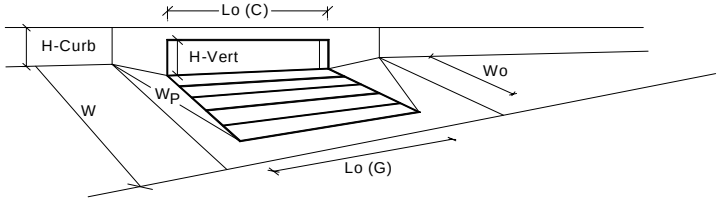
MINOR STORM Allowable Capacity is not applicable to Sump Condition

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 =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	7.5	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) =	5.00	5.00	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} =	0.33	0.46	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} =	0.93	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 =	8.3	14.3	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	5.5	13.3	cfs

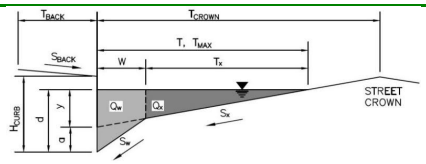
MHFD-Inlet, Version 5.02 (August 2022)

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 5

Inlet ID: DP6



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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 =	0.034	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} =	10.5	14.0	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)		☐	☐	

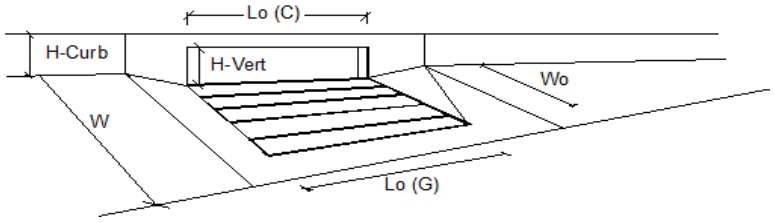
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	6.4	12.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 3.90 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 9.30 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 =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	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 =	3.9	8.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	0.5	cfs
Capture Percentage = Q_a/Q_o	C% =	100	94	%

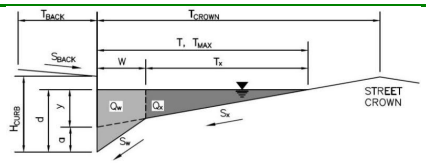
MHFD-Inlet, Version 5.02 (August 2022)

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 5

Inlet ID: DP7



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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 =	0.034	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} =	10.5	14.0	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)		☐	☐	

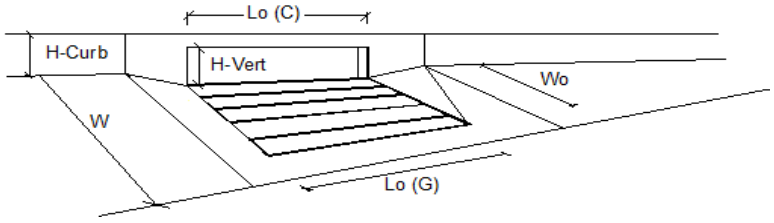
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	6.4	12.5	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.80 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.90 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 =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	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 =	2.8	5.9	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	%

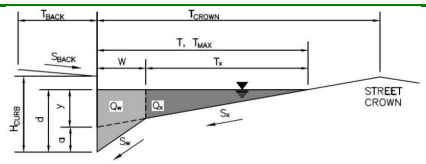
MHFD-Inlet, Version 5.02 (August 2022)

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 5

Inlet ID: DP8



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	40.0	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} =	12.0	16.0	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)		☐	☐	

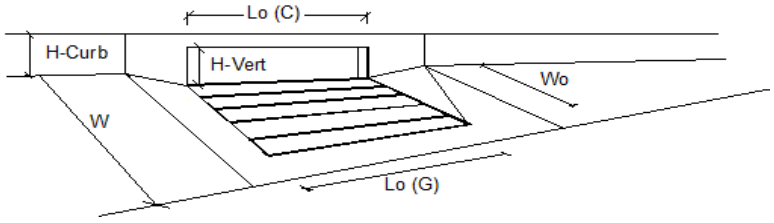
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	4.7	9.4	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.10 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.30 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



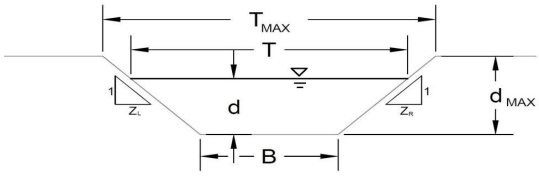
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	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 =	1.1	1.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	0.4	cfs
Capture Percentage = Q_a/Q_o	C% =	100	82	%

AREA INLET IN A SWALE

STERLING RANCH FILING 5

DP9



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 =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0100	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} =	10.00	10.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.25	1.25	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	22.2	22.2	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.25	1.25	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	1.6	4.5	cfs
Water Depth	d =	0.47	0.69	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'

MHFD-Inlet, Version 5.02 (August 2022)

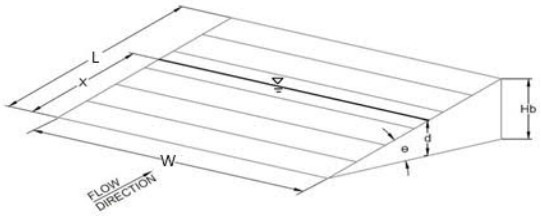
AREA INLET IN A SWALE

STERLING RANCH FILING 5

DP9

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 =	0.47	0.69	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	5.9	10.5	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

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

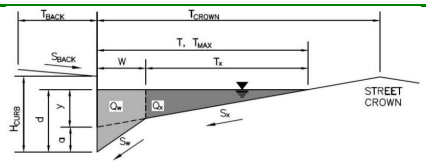
MHFD-Inlet, Version 5.02 (August 2022)

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 5

Inlet ID: DP17



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	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} =	20.0	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} =	15.0	20.0	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		☐	☐	

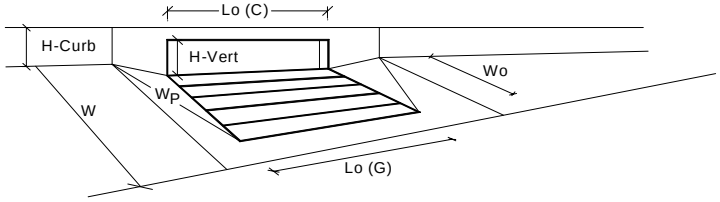
MINOR STORM Allowable Capacity is not applicable to Sump Condition

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 =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	9.0	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) =	5.00	5.00	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} =	0.33	0.58	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} =	0.93	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 =	8.3	19.8	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	2.9	17.0	cfs

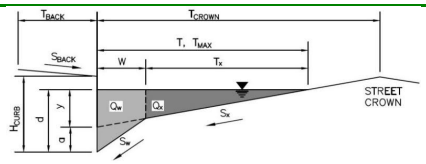
MHFD-Inlet, Version 5.02 (August 2022)

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 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		☐	☐	

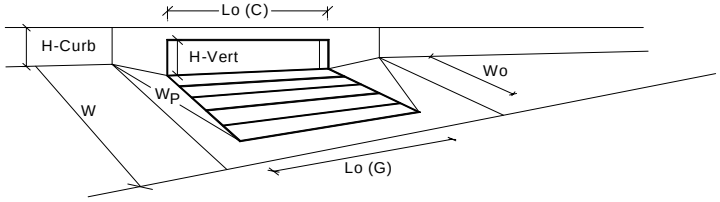
MINOR STORM Allowable Capacity is not applicable to Sump Condition

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)

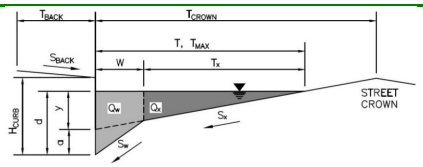


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	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	**14.0**	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	

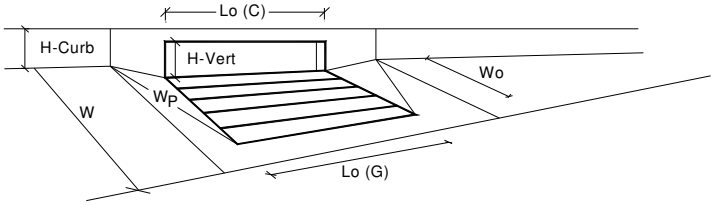
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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)

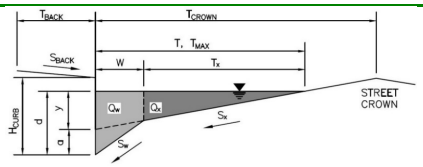


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	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**	**16.7**	**cfs**
WARNING: Inlet Capacity < Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	3.9	19.3	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 DP6.2**



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	

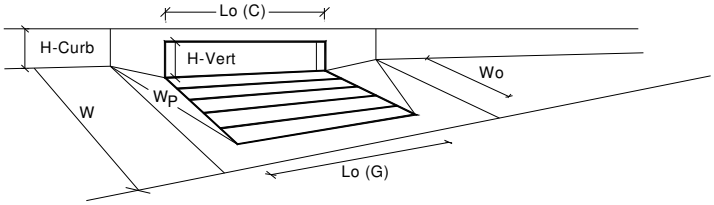
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

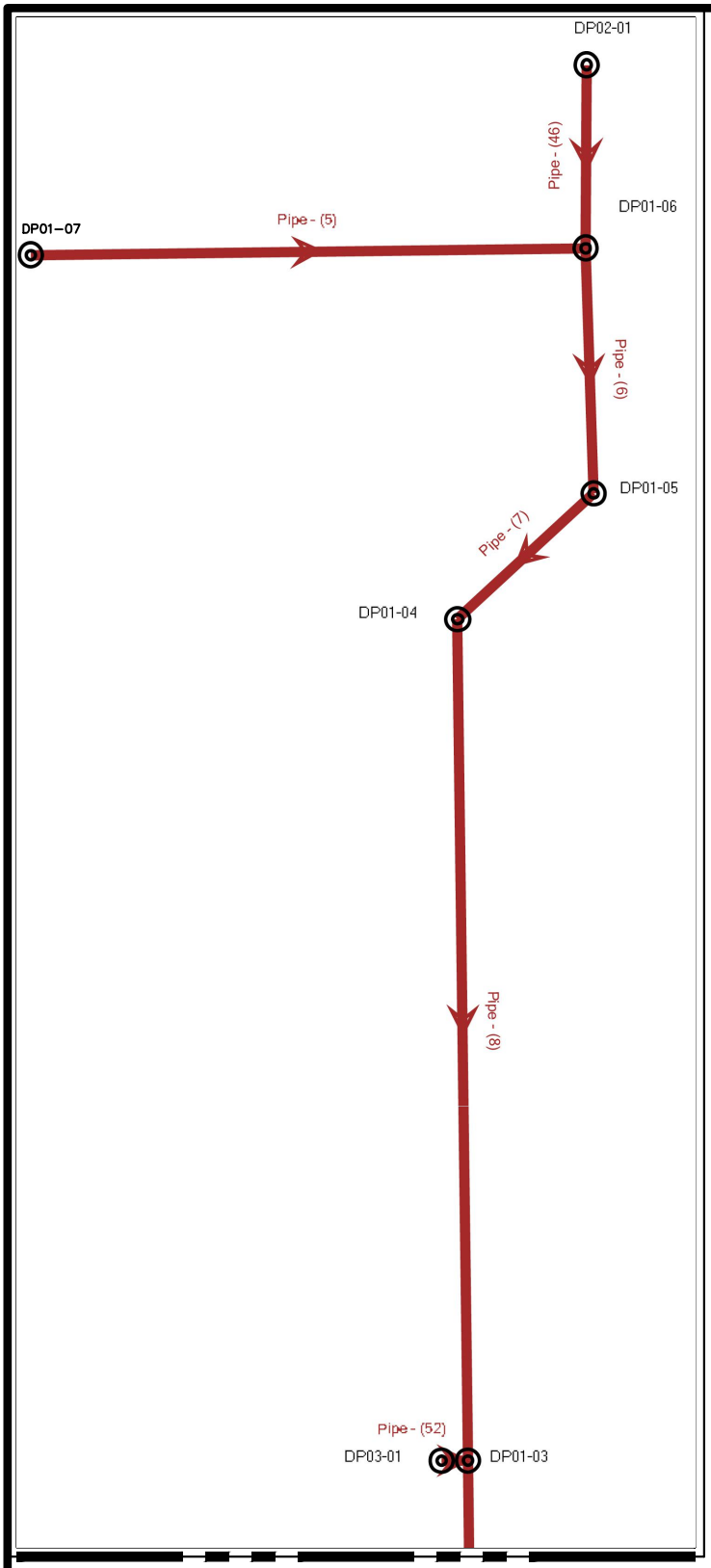
	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)

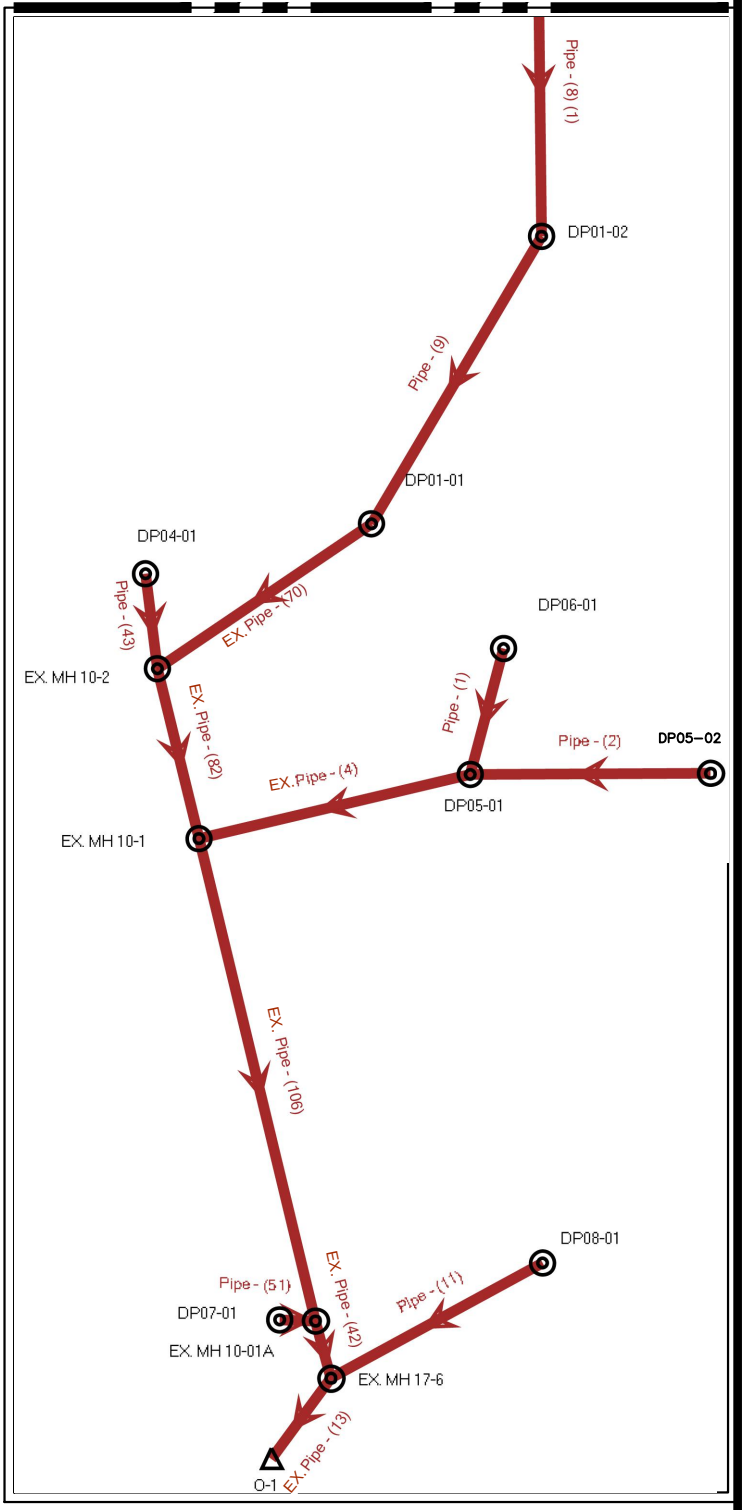


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	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	7.8	cfs



SEE RIGHT

SEE LEFT



STORMCAD MAP
STERLING RANCH FILING NO. 5
JOB NO. 25188.16
12/06/23
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

Scenario: 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
DP01-06	Pipe - (6)	2.20	16.12	24.0	63.8	0.005	7,014.21	7,013.89	7,021.23	7,020.18	7,014.73	7,014.39	7,014.91	7,014.59	3.59	0.013	1.020
DP01-05	Pipe - (7)	2.20	15.99	24.0	48.0	0.005	7,013.59	7,013.35	7,020.18	7,019.42	7,014.11	7,013.85	7,014.29	7,014.05	3.57	0.013	0.400
DP01-04	Pipe - (8)	2.20	27.33	24.0	209.0	0.015	7,013.05	7,010.00	7,019.42	7,015.08	7,013.57	7,010.82	7,013.75	7,010.87	5.22	0.013	0.400
DP01-07	Pipe - (5)	0.30	22.62	24.0	143.9	0.010	7,015.95	7,014.51	7,019.20	7,021.23	7,016.14	7,014.92	7,016.20	7,014.92	2.52	0.013	0.050
DP02-01	Pipe - (46)	1.80	10.50	18.0	47.6	0.010	7,015.19	7,014.71	7,018.72	7,021.23	7,015.69	7,015.13	7,015.88	7,015.44	4.44	0.013	0.050
DP03-01	Pipe - (52)	3.40	13.67	18.0	7.7	0.017	7,010.33	7,010.20	7,015.37	7,015.08	7,011.03	7,010.77	7,011.30	7,011.24	6.42	0.013	0.050
DP01-03	Pipe - (8) (1)	5.30	32.81	24.0	77.0	0.021	7,009.70	7,008.08	7,015.08	7,013.35	7,010.51	7,008.62	7,010.82	7,009.54	7.67	0.013	1.020
DP05-02	Pipe - (2)	2.80	16.76	18.0	60.4	0.025	7,009.21	7,007.67	7,013.86	7,012.20	7,009.85	7,008.57	7,010.09	7,008.67	7.04	0.013	0.050
DP01-02	Pipe - (9)	5.30	32.54	24.0	84.4	0.021	7,007.78	7,006.03	7,013.35	7,011.20	7,008.59	7,007.19	7,008.90	7,007.31	7.63	0.013	0.250
DP06-01	Pipe - (1)	3.90	17.73	18.0	32.6	0.028	7,008.60	7,007.67	7,012.74	7,012.20	7,009.36	7,008.57	7,009.66	7,008.76	8.05	0.013	0.050
DP05-01	Ex. Pipe - (4)	6.30	23.91	18.0	69.9	0.052	7,007.38	7,003.75	7,012.20	7,010.40	7,008.35	7,004.28	7,008.77	7,006.30	11.41	0.013	0.520
DP01-01	Ex. Pipe - (70)	10.50	32.00	24.0	65.0	0.020	7,005.72	7,004.42	7,011.20	7,011.21	7,006.88	7,005.23	7,007.36	7,006.44	9.12	0.013	0.640
DP04-01	Pipe - (43)	1.00	69.38	36.0	23.8	0.011	7,003.99	7,003.73	7,009.76	7,011.21	7,004.74	7,004.74	7,004.75	7,004.74	3.52	0.013	0.050
DP08-01	Pipe - (11)	1.60	21.00	18.0	59.8	0.040	7,003.52	7,001.12	7,009.38	7,009.02	7,003.99	7,001.40	7,004.16	7,002.17	7.02	0.013	0.050
DP07-01	Pipe - (51)	1.10	42.51	18.0	8.7	0.164	7,002.75	7,001.32	7,009.53	7,009.23	7,003.14	7,001.50	7,003.28	7,002.74	10.29	0.013	0.050
EX. MH 17-6	Ex. Pipe - (13)	18.20	200.97	48.0	23.0	0.020	6,998.62	6,998.17	7,009.02	7,008.52	7,000.87	7,000.90	7,000.97	7,000.96	9.93	0.013	0.270
EX. MH 10-2	Ex. Pipe - (82)	10.90	94.51	36.0	43.8	0.020	7,003.43	7,002.55	7,011.21	7,010.40	7,004.48	7,004.05	7,004.86	7,004.20	8.91	0.013	0.690
EX. MH 10-1	Ex. Pipe - (106)	16.50	89.37	36.0	118.6	0.018	7,002.25	7,000.12	7,010.40	7,009.23	7,003.55	7,001.66	7,004.04	7,001.98	9.65	0.013	1.020
EX. MH 10-01A	Ex. Pipe - (42)	17.10	95.49	36.0	9.8	0.021	6,999.82	6,999.62	7,009.23	7,009.02	7,001.15	7,000.69	7,001.65	7,001.58	10.22	0.013	1.020

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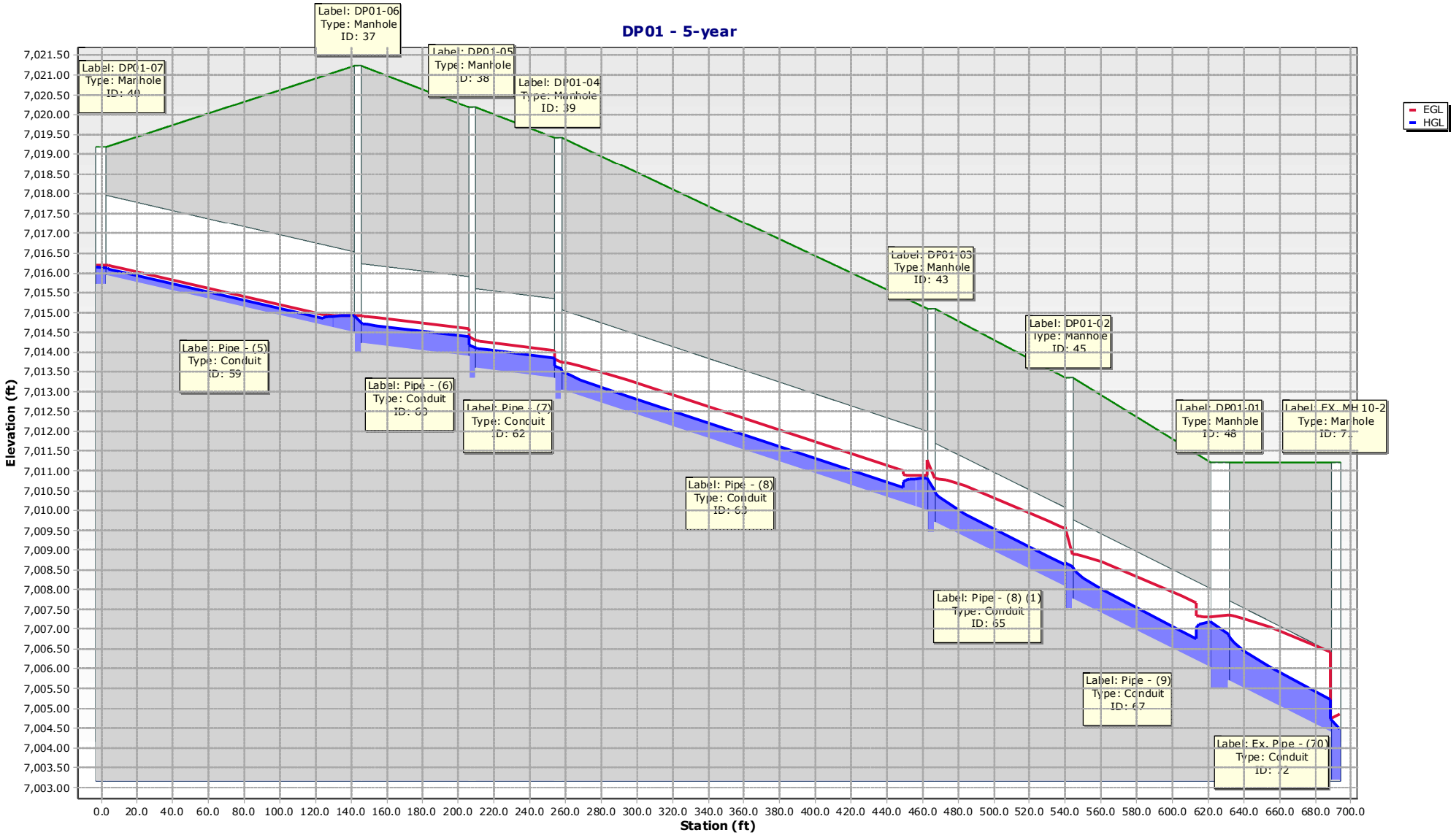
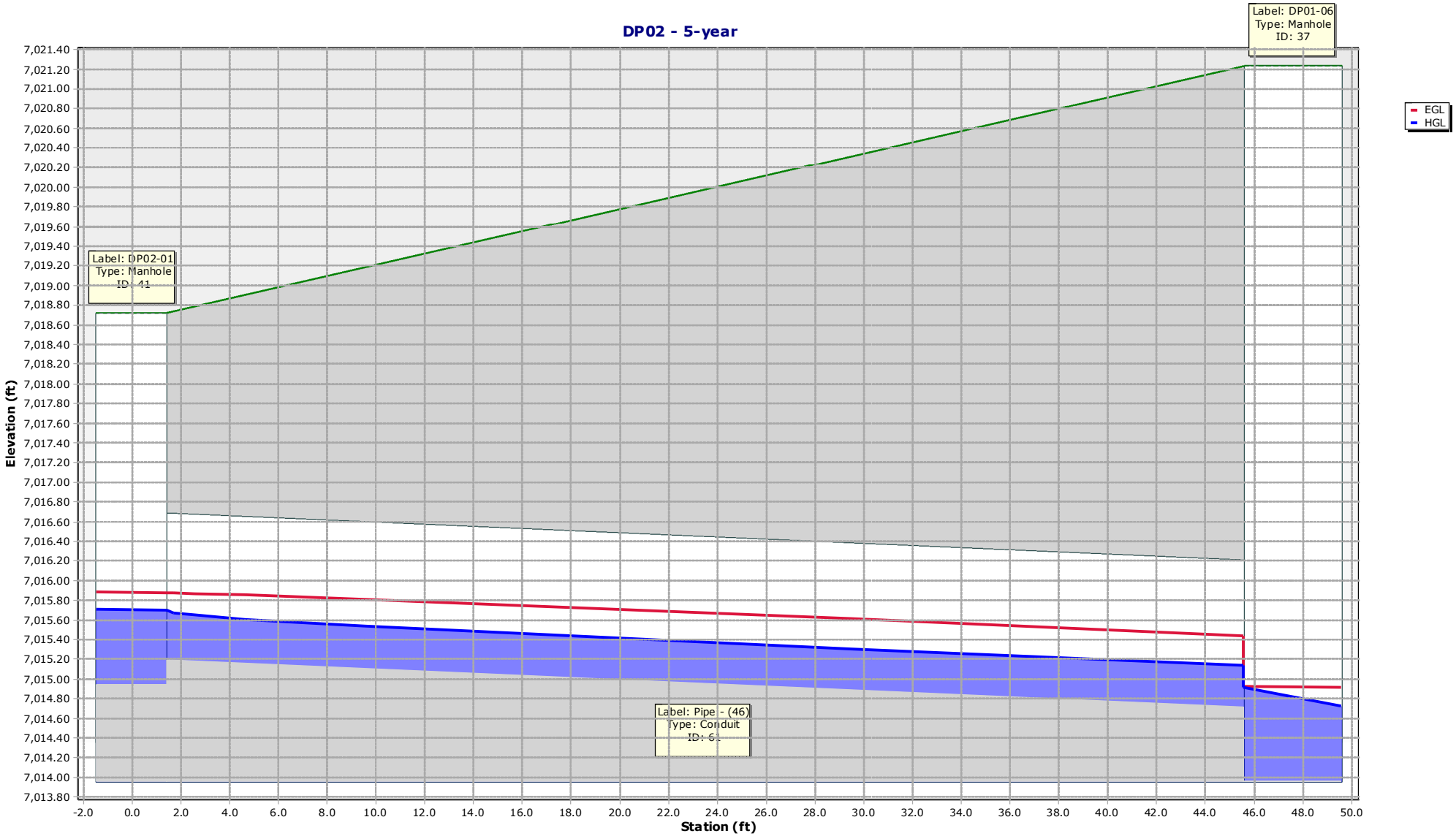

DP01 - 5-year
Label: DP01-06
Type: Manhole
ID: 37
Label: DP01-05
Type: Manhole
ID: 38
Label: DP01-04
Type: Manhole
ID: 39
Label: DP01-07
Type: Manhole
ID: 40
Label: DP01-03
Type: Manhole
ID: 43
Label: DP01-02
Type: Manhole
ID: 45
Label: DP01-01
Type: Manhole
ID: 48
Label: EX_MH 10-2
Type: Manhole
Label: Pipe - (5)
Type: Conduit
ID: 59
Label: Pipe - (6)
Type: Conduit
ID: 60
Label: Pipe - (7)
Type: Conduit
ID: 62
Label: Pipe - (8)
Type: Conduit
ID: 63
Label: Pipe - (8) (1)
Type: Conduit
ID: 65
Label: Pipe - (9)
Type: Conduit
ID: 67
Label: Ex. Pipe - (70)
Type: Conduit
ID: 72
EGL
HGL
Elevation (ft)
7,021.50
7,021.00
7,020.50
7,020.00
7,019.50
7,019.00
7,018.50
7,018.00
7,017.50
7,017.00
7,016.50
7,016.00
7,015.50
7,015.00
7,014.50
7,014.00
7,013.50
7,013.00
7,012.50
7,012.00
7,011.50
7,011.00
7,010.50
7,010.00
7,009.50
7,009.00
7,008.50
7,008.00
7,007.50
7,007.00
7,006.50
7,006.00
7,005.50
7,005.00
7,004.50
7,004.00
7,003.50
7,003.00
0.0 20.0 40.0 60.0 80.0 100.0 120.0 140.0 160.0 180.0 200.0 220.0 240.0 260.0 280.0 300.0 320.0 340.0 360.0 380.0 400.0 420.0 440.0 460.0 480.0 500.0 520.0 540.0 560.0 580.0 600.0 620.0 640.0 660.0 680.0 700.0
Station (ft)


DP02 - 5-year
Label: DP01-06
Type: Manhole
ID: 37
Label: DP02-01
Type: Manhole
ID: 41
Label: Pipe - (46)
Type: Conduit
ID: 6
EGL
HGL
Elevation (ft)
Station (ft)
7,021.40
7,021.20
7,021.00
7,020.80
7,020.60
7,020.40
7,020.20
7,020.00
7,019.80
7,019.60
7,019.40
7,019.20
7,019.00
7,018.80
7,018.60
7,018.40
7,018.20
7,018.00
7,017.80
7,017.60
7,017.40
7,017.20
7,017.00
7,016.80
7,016.60
7,016.40
7,016.20
7,016.00
7,015.80
7,015.60
7,015.40
7,015.20
7,015.00
7,014.80
7,014.60
7,014.40
7,014.20
7,014.00
7,013.80
-2.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
24.0
26.0
28.0
30.0
32.0
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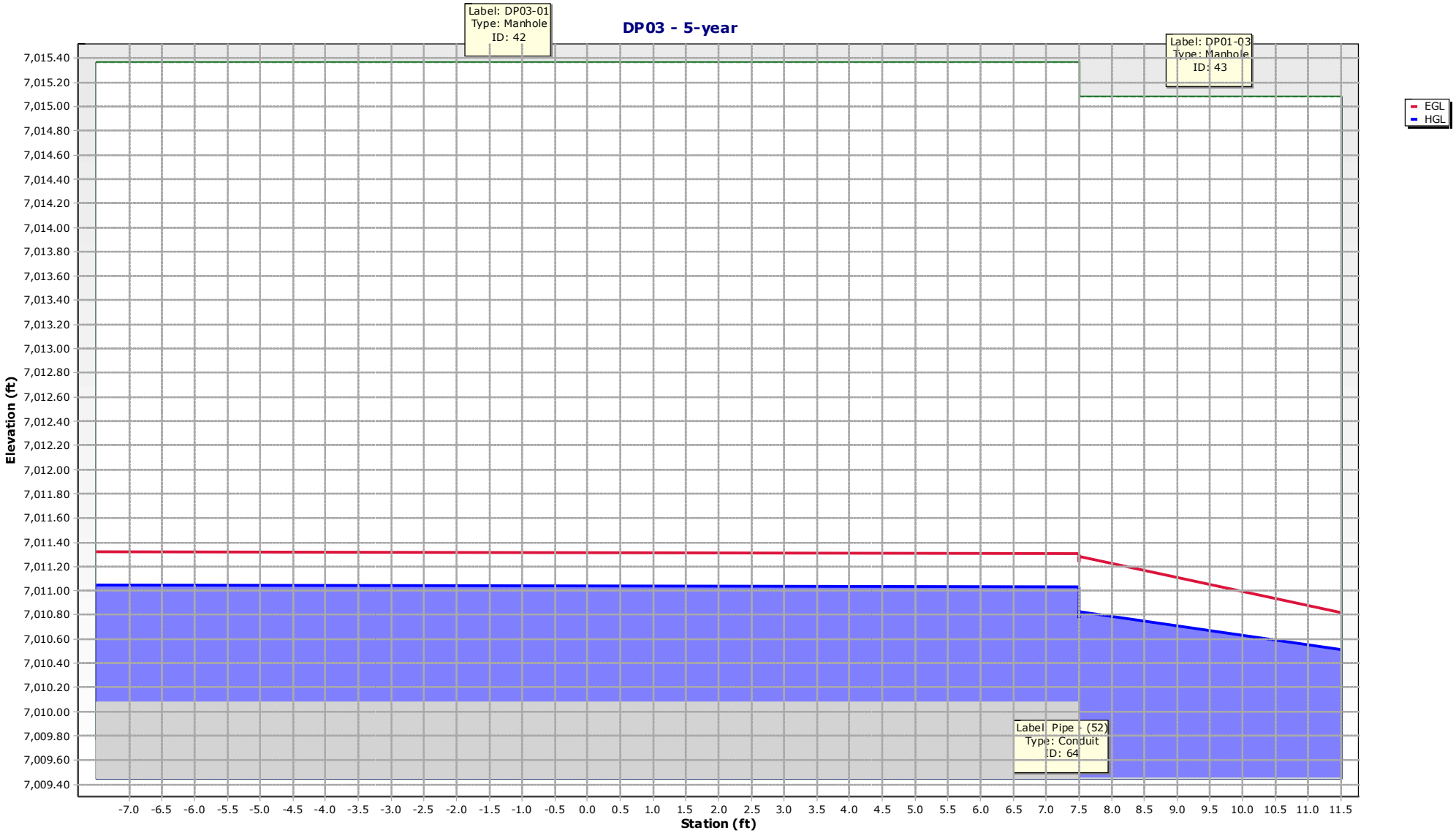
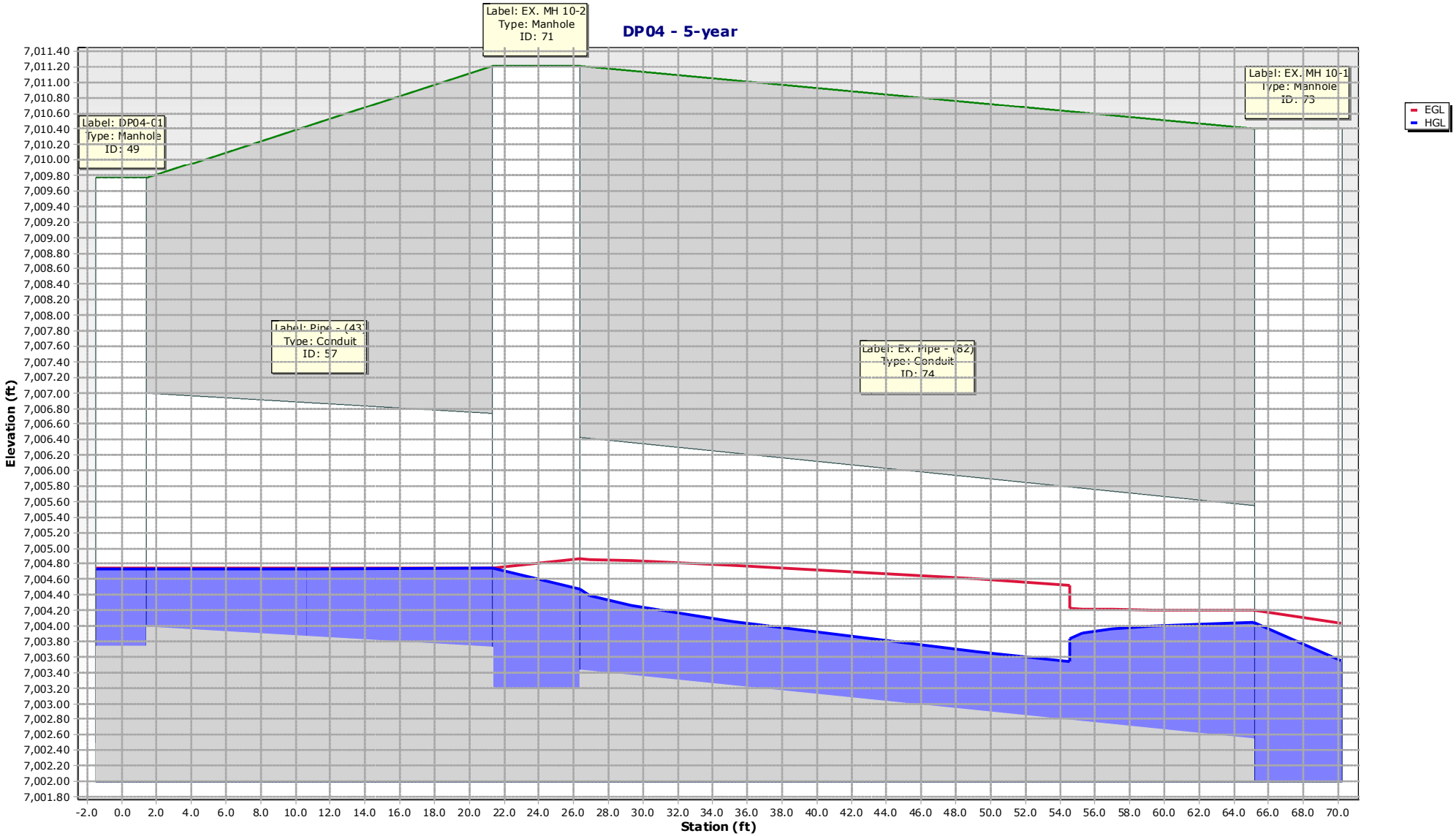
36.0
38.0
40.0
42.0
44.0
46.0
48.0
50.0


DP03 - 5-year
Label: DP03-01
Type: Manhole
ID: 42
Label: DP01-03
Type: Manhole
ID: 43
Label: Pipe : (52)
Type: Conduit
ID: 64
EGL
HGL
Elevation (ft)
Station (ft)
7,015.40
7,015.20
7,015.00
7,014.80
7,014.60
7,014.40
7,014.20
7,014.00
7,013.80
7,013.60
7,013.40
7,013.20
7,013.00
7,012.80
7,012.60
7,012.40
7,012.20
7,012.00
7,011.80
7,011.60
7,011.40
7,011.20
7,011.00
7,010.80
7,010.60
7,010.40
7,010.20
7,010.00
7,009.80
7,009.60
7,009.40
-7.0 -6.5 -6.0 -5.5 -5.0 -4.5 -4.0 -3.5 -3.0 -2.5 -2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5


DP04 - 5-year
Label: EX. MH 10-2
Type: Manhole
ID: 71
Label: DP04-01
Type: Manhole
ID: 49
Label: EX. MH 10-1
Type: Manhole
ID: 73
Label: Pipe - (43)
Type: Conduit
ID: 57
Label: Ex. Pipe - (82)
Type: Conduit
ID: 74
EGL
HGL
Elevation (ft)
Station (ft)
7,011.40
7,011.20
7,011.00
7,010.80
7,010.60
7,010.40
7,010.20
7,010.00
7,009.80
7,009.60
7,009.40
7,009.20
7,009.00
7,008.80
7,008.60
7,008.40
7,008.20
7,008.00
7,007.80
7,007.60
7,007.40
7,007.20
7,007.00
7,006.80
7,006.60
7,006.40
7,006.20
7,006.00
7,005.80
7,005.60
7,005.40
7,005.20
7,005.00
7,004.80
7,004.60
7,004.40
7,004.20
7,004.00
7,003.80
7,003.60
7,003.40
7,003.20
7,003.00
7,002.80
7,002.60
7,002.40
7,002.20
7,002.00
7,001.80
-2.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
24.0
26.0
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44.0
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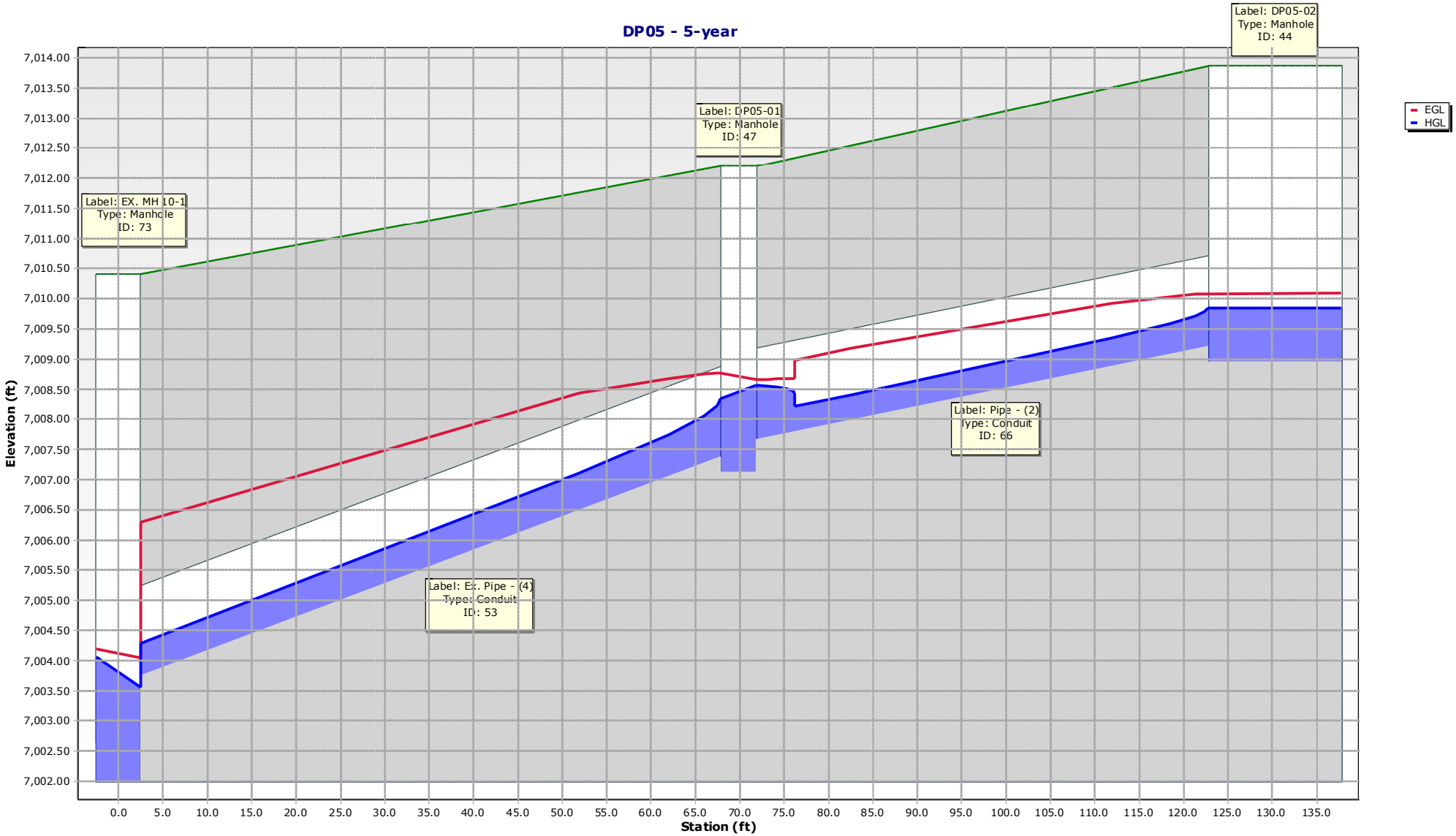
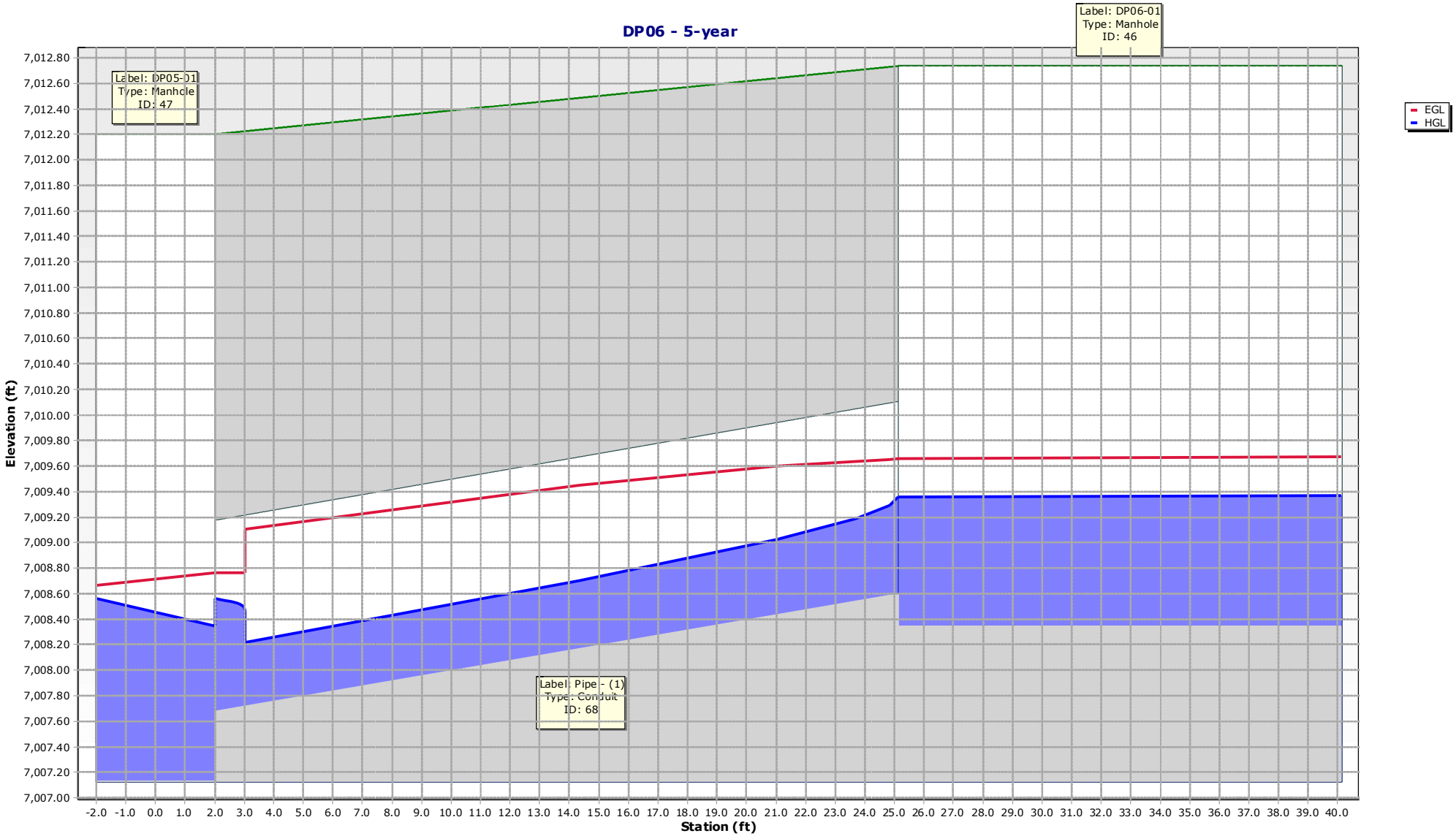
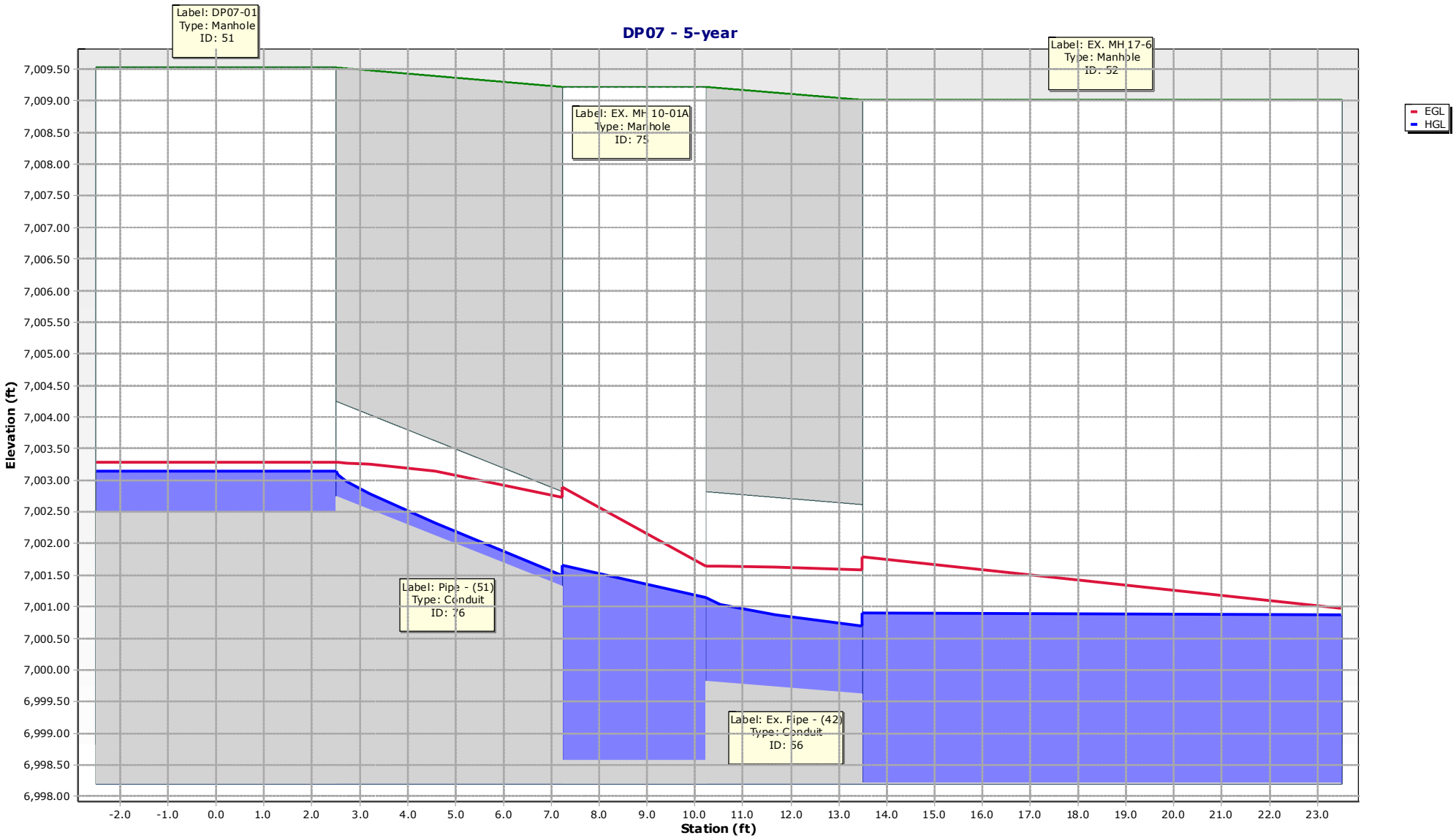

DP05 - 5-year
Label: DP05-02
Type: Manhole
ID: 44
Label: DP05-01
Type: Manhole
ID: 47
Label: EX. MH 10-1
Type: Manhole
ID: 73
Label: Pipe - (2)
Type: Conduit
ID: 66
Label: Ex. Pipe - (4)
Type: Conduit
ID: 53
EGL
HGL
Elevation (ft)
Station (ft)
7,014.00
7,013.50
7,013.00
7,012.50
7,012.00
7,011.50
7,011.00
7,010.50
7,010.00
7,009.50
7,009.00
7,008.50
7,008.00
7,007.50
7,007.00
7,006.50
7,006.00
7,005.50
7,005.00
7,004.50
7,004.00
7,003.50
7,003.00
7,002.50
7,002.00
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
105.0
110.0
115.0
120.0
125.0
130.0
135.0


DP06 - 5-year
Label: DP06-01
Type: Manhole
ID: 46
Label: DP05-01
Type: Manhole
ID: 47
Label: Pipe - (1)
Type: Conduit
ID: 68
EGL
HGL
Elevation (ft)
Station (ft)
7,012.80
7,012.60
7,012.40
7,012.20
7,012.00
7,011.80
7,011.60
7,011.40
7,011.20
7,011.00
7,010.80
7,010.60
7,010.40
7,010.20
7,010.00
7,009.80
7,009.60
7,009.40
7,009.20
7,009.00
7,008.80
7,008.60
7,008.40
7,008.20
7,008.00
7,007.80
7,007.60
7,007.40
7,007.20
7,007.00
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0 40.0


DP07 - 5-year
Label: DP07-01
Type: Manhole
ID: 51
Label: EX. MH 10-01A
Type: Manhole
ID: 75
Label: EX. MH 17-6
Type: Manhole
ID: 52
Label: Pipe - (51)
Type: Conduit
ID: 76
Label: Ex. Pipe - (42)
Type: Conduit
ID: 56
EGL
HGL
Elevation (ft)
Station (ft)
7,009.50
7,009.00
7,008.50
7,008.00
7,007.50
7,007.00
7,006.50
7,006.00
7,005.50
7,005.00
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7,001.00
7,000.50
7,000.00
6,999.50
6,999.00
6,998.50
6,998.00
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
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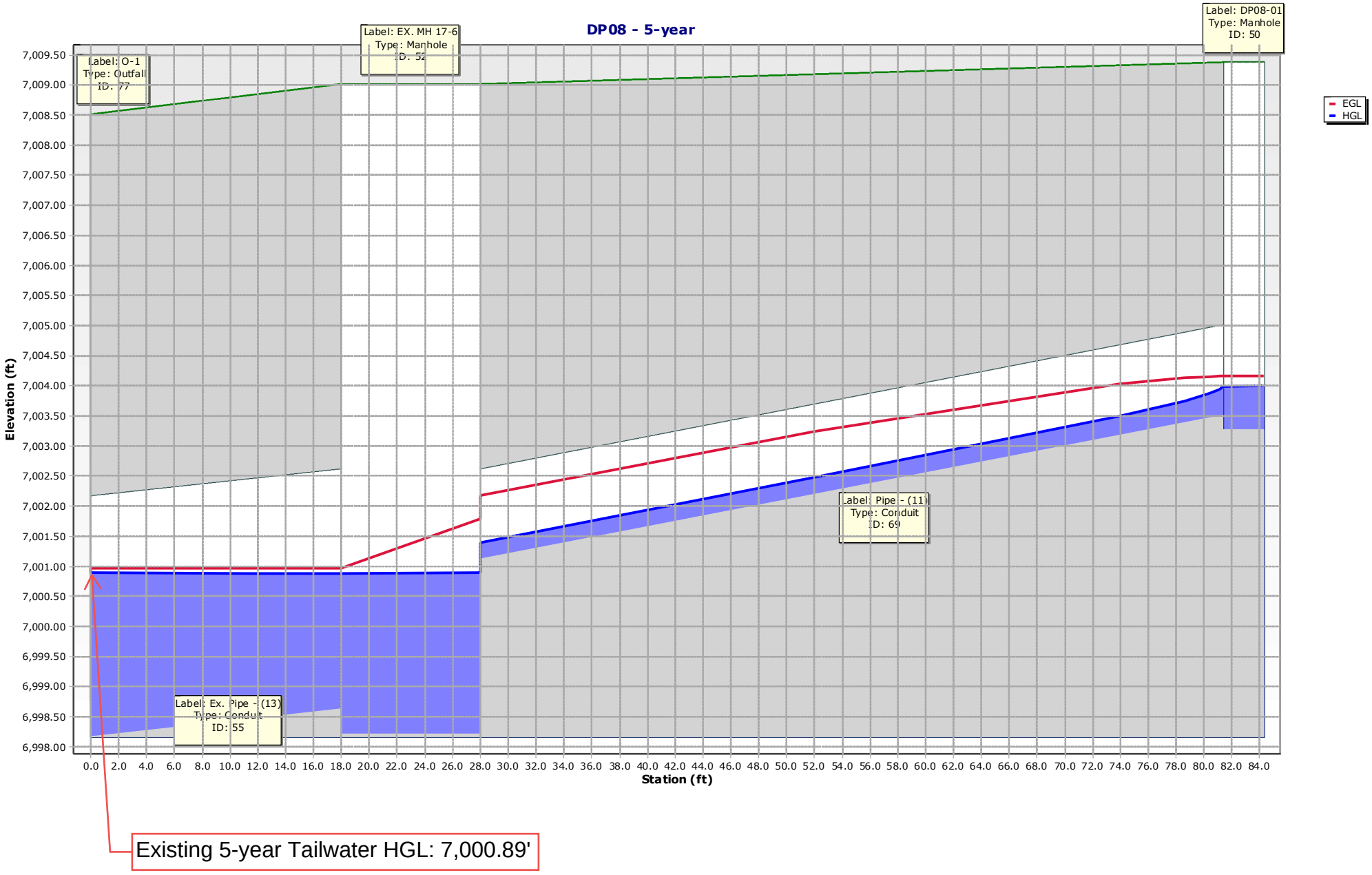
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0


DP08 - 5-year
Label: O-1
Type: Outfall
ID: 77
Label: EX. MH 17-6
Type: Manhole
ID: 52
Label: DP08-01
Type: Manhole
ID: 50
Label: Pipe - (11)
Type: Conduit
ID: 69
Label: Ex. Pipe - (13)
Type: Conduit
ID: 55
EGL
HGL
Elevation (ft)
Station (ft)
7,009.50
7,009.00
7,008.50
7,008.00
7,007.50
7,007.00
7,006.50
7,006.00
7,005.50
7,005.00
7,004.50
7,004.00
7,003.50
7,003.00
7,002.50
7,002.00
7,001.50
7,001.00
7,000.50
7,000.00
6,999.50
6,999.00
6,998.50
6,998.00
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0 42.0 44.0 46.0 48.0 50.0 52.0 54.0 56.0 58.0 60.0 62.0 64.0 66.0 68.0 70.0 72.0 74.0 76.0 78.0 80.0 82.0 84.0
Existing 5-year Tailwater HGL: 7,000.89'

Scenario: 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
DP01-06	Pipe - (6)	8.30	16.12	24.0	63.8	0.005	7,014.21	7,013.89	7,021.23	7,020.18	7,015.24	7,014.91	7,015.65	7,015.32	5.17	0.013	1.020
DP01-05	Pipe - (7)	8.30	15.99	24.0	48.0	0.005	7,013.59	7,013.35	7,020.18	7,019.42	7,014.62	7,014.37	7,015.02	7,014.78	5.14	0.013	0.400
DP01-04	Pipe - (8)	8.30	27.33	24.0	209.0	0.015	7,013.05	7,010.00	7,019.42	7,015.08	7,014.08	7,011.77	7,014.48	7,011.90	7.63	0.013	0.400
DP01-07	Pipe - (5)	1.00	22.62	24.0	143.9	0.010	7,015.95	7,014.51	7,019.20	7,021.23	7,016.29	7,015.65	7,016.41	7,015.66	3.62	0.013	0.050
DP02-01	Pipe - (46)	7.30	10.50	18.0	47.6	0.010	7,015.19	7,014.71	7,018.72	7,021.23	7,016.24	7,015.64	7,016.71	7,016.27	6.42	0.013	0.050
DP03-01	Pipe - (52)	7.70	13.67	18.0	7.7	0.017	7,010.33	7,010.20	7,015.37	7,015.08	7,011.81	7,011.77	7,012.11	7,012.07	7.97	0.013	0.050
DP01-03	Pipe - (8) (1)	15.30	32.81	24.0	77.0	0.021	7,009.70	7,008.08	7,015.08	7,013.35	7,011.11	7,009.07	7,011.76	7,010.59	10.27	0.013	1.020
DP05-02	Pipe - (2)	5.90	16.76	18.0	60.4	0.025	7,009.21	7,007.67	7,013.86	7,012.20	7,010.15	7,009.30	7,010.55	7,009.48	8.66	0.013	0.050
DP01-02	Pipe - (9)	15.30	32.54	24.0	84.4	0.021	7,007.78	7,006.03	7,013.35	7,011.20	7,009.19	7,008.39	7,009.84	7,008.76	10.19	0.013	0.250
DP06-01	Pipe - (1)	8.80	17.73	18.0	32.6	0.028	7,008.60	7,007.67	7,012.74	7,012.20	7,009.75	7,009.30	7,010.32	7,009.69	10.02	0.013	0.050
DP05-01	Ex. Pipe - (4)	14.00	23.91	18.0	69.9	0.052	7,007.38	7,003.75	7,012.20	7,010.40	7,008.76	7,005.38	7,009.81	7,006.36	14.06	0.013	0.520
DP01-01	Ex. Pipe - (70)	27.70	32.00	24.0	65.0	0.020	7,005.72	7,004.42	7,011.20	7,011.21	7,007.54	7,005.91	7,008.86	7,007.80	11.47	0.013	0.640
DP04-01	Pipe - (43)	3.10	69.38	36.0	23.8	0.011	7,003.99	7,003.73	7,009.76	7,011.21	7,005.71	7,005.71	7,005.72	7,005.72	4.95	0.013	0.050
DP08-01	Pipe - (11)	4.50	21.00	18.0	59.8	0.040	7,003.52	7,001.12	7,009.38	7,009.02	7,004.33	7,002.90	7,004.66	7,003.00	9.46	0.013	0.050
DP07-01	Pipe - (51)	1.90	42.51	18.0	8.7	0.164	7,002.75	7,001.32	7,009.53	7,009.23	7,003.99	7,004.00	7,004.02	7,004.01	12.12	0.013	0.050
EX. MH 17-6	Ex. Pipe - (13)	47.30	200.97	48.0	23.0	0.020	6,998.62	6,998.17	7,009.02	7,008.52	7,002.79	7,002.77	7,003.02	7,002.99	3.76	0.013	0.470
EX. MH 10-2	Ex. Pipe - (82)	29.90	94.51	36.0	43.8	0.020	7,003.43	7,002.55	7,011.21	7,010.40	7,005.20	7,005.38	7,005.94	7,005.67	11.86	0.013	0.690
EX. MH 10-1	Ex. Pipe - (106)	42.70	89.37	36.0	118.6	0.018	7,002.25	7,000.12	7,010.40	7,009.23	7,004.38	7,004.00	7,005.36	7,004.56	12.50	0.013	1.020
EX. MH 10-01A	Ex. Pipe - (42)	43.80	95.49	36.0	9.8	0.021	6,999.82	6,999.62	7,009.23	7,009.02	7,002.94	7,002.90	7,003.54	7,003.50	6.20	0.013	1.770

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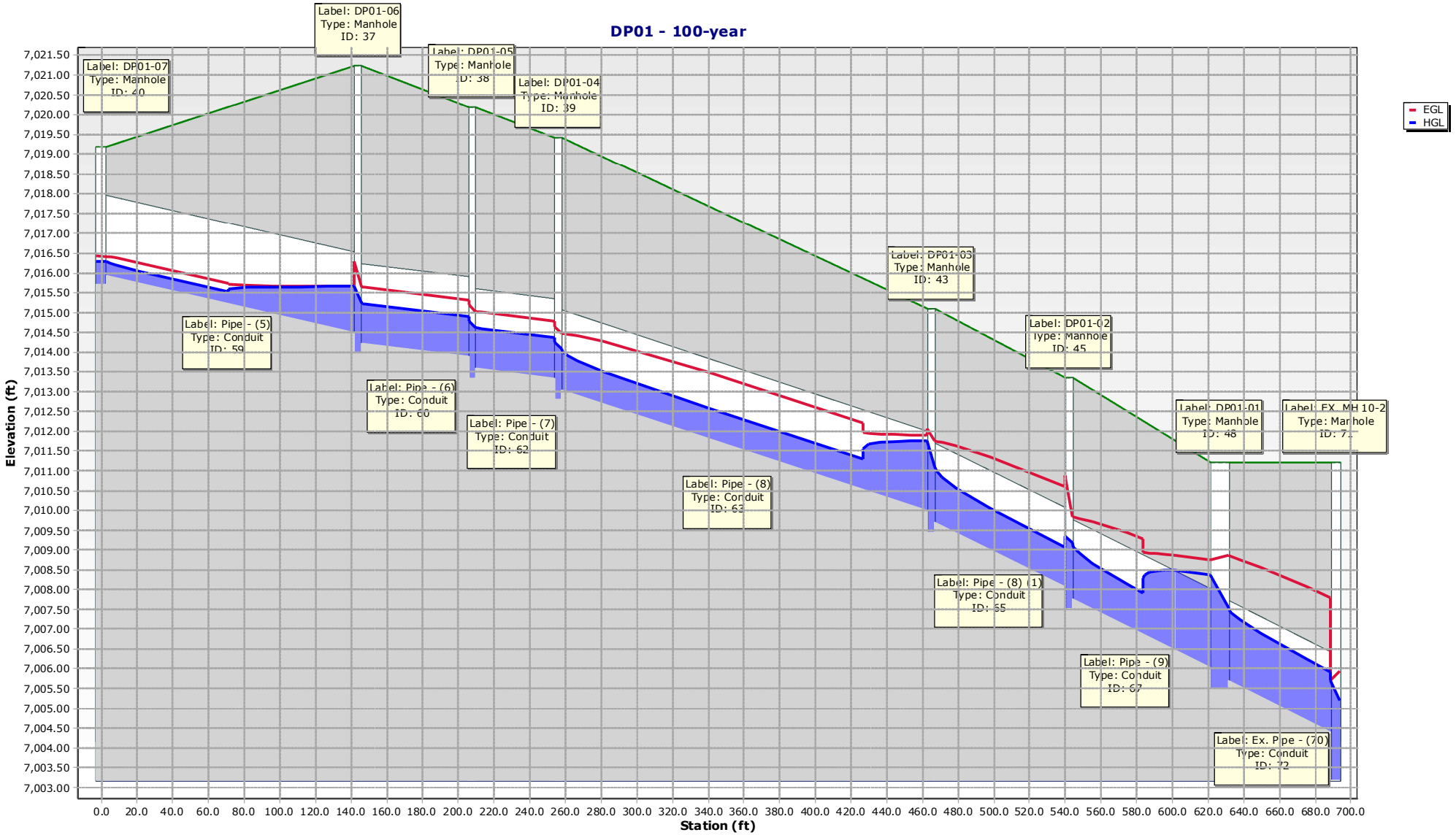
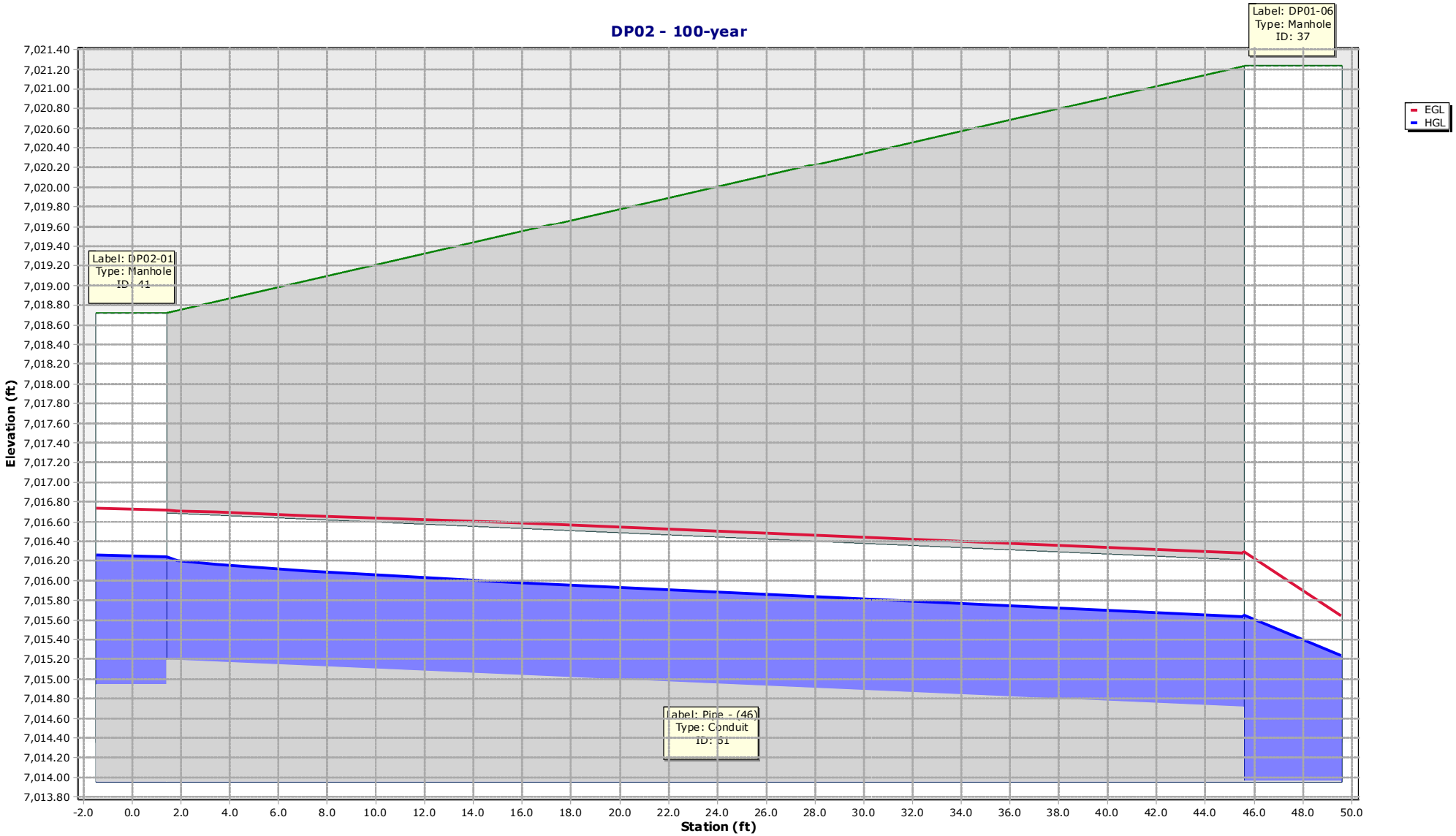
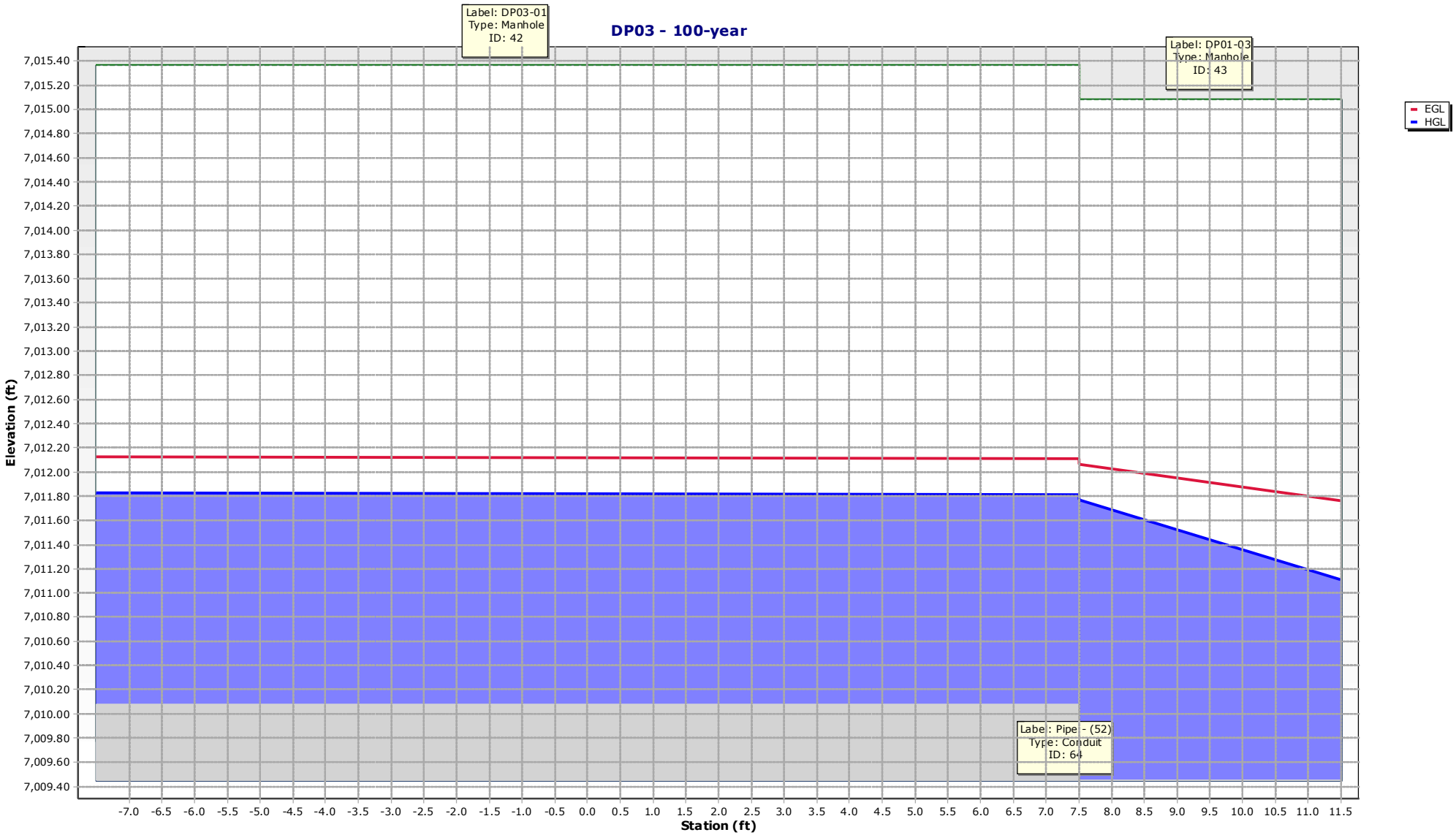

DP01 - 100-year
Label: DP01-06
Type: Manhole
ID: 37
Label: DP01-07
Type: Manhole
ID: 40
Label: DP01-05
Type: Manhole
ID: 38
Label: DP01-04
Type: Manhole
ID: 39
Label: DP01-03
Type: Manhole
ID: 43
Label: DP01-02
Type: Manhole
ID: 45
Label: DP01-01
Type: Manhole
ID: 48
Label: EX_MH 10-2
Type: Manhole
ID: 7
Label: Pipe - (5)
Type: Conduit
ID: 59
Label: Pipe - (6)
Type: Conduit
ID: 60
Label: Pipe - (7)
Type: Conduit
ID: 62
Label: Pipe - (8)
Type: Conduit
ID: 63
Label: Pipe - (8) (1)
Type: Conduit
ID: 65
Label: Pipe - (9)
Type: Conduit
ID: 67
Label: Ex. Pipe - (70)
Type: Conduit
ID: 72
EGL
HGL
Elevation (ft)
7,021.50
7,021.00
7,020.50
7,020.00
7,019.50
7,019.00
7,018.50
7,018.00
7,017.50
7,017.00
7,016.50
7,016.00
7,015.50
7,015.00
7,014.50
7,014.00
7,013.50
7,013.00
7,012.50
7,012.00
7,011.50
7,011.00
7,010.50
7,010.00
7,009.50
7,009.00
7,008.50
7,008.00
7,007.50
7,007.00
7,006.50
7,006.00
7,005.50
7,005.00
7,004.50
7,004.00
7,003.50
7,003.00
0.0 20.0 40.0 60.0 80.0 100.0 120.0 140.0 160.0 180.0 200.0 220.0 240.0 260.0 280.0 300.0 320.0 340.0 360.0 380.0 400.0 420.0 440.0 460.0 480.0 500.0 520.0 540.0 560.0 580.0 600.0 620.0 640.0 660.0 680.0 700.0
Station (ft)


DP02 - 100-year
Label: DP01-06
Type: Manhole
ID: 37
Label: DP02-01
Type: Manhole
ID: 41
Label: Pipe - (46)
Type: Conduit
ID: 51
EGL
HGL
Elevation (ft)
Station (ft)
7,021.40
7,021.20
7,021.00
7,020.80
7,020.60
7,020.40
7,020.20
7,020.00
7,019.80
7,019.60
7,019.40
7,019.20
7,019.00
7,018.80
7,018.60
7,018.40
7,018.20
7,018.00
7,017.80
7,017.60
7,017.40
7,017.20
7,017.00
7,016.80
7,016.60
7,016.40
7,016.20
7,016.00
7,015.80
7,015.60
7,015.40
7,015.20
7,015.00
7,014.80
7,014.60
7,014.40
7,014.20
7,014.00
7,013.80
-2.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
24.0
26.0
28.0
30.0
32.0
34.0
36.0
38.0
40.0
42.0
44.0
46.0
48.0
50.0


DP03 - 100-year
Label: DP03-01
Type: Manhole
ID: 42
Label: DP01-03
Type: Manhole
ID: 43
Label: Pipe - (52)
Type: Conduit
ID: 64
EGL
HGL
Elevation (ft)
Station (ft)
7,015.40
7,015.20
7,015.00
7,014.80
7,014.60
7,014.40
7,014.20
7,014.00
7,013.80
7,013.60
7,013.40
7,013.20
7,013.00
7,012.80
7,012.60
7,012.40
7,012.20
7,012.00
7,011.80
7,011.60
7,011.40
7,011.20
7,011.00
7,010.80
7,010.60
7,010.40
7,010.20
7,010.00
7,009.80
7,009.60
7,009.40
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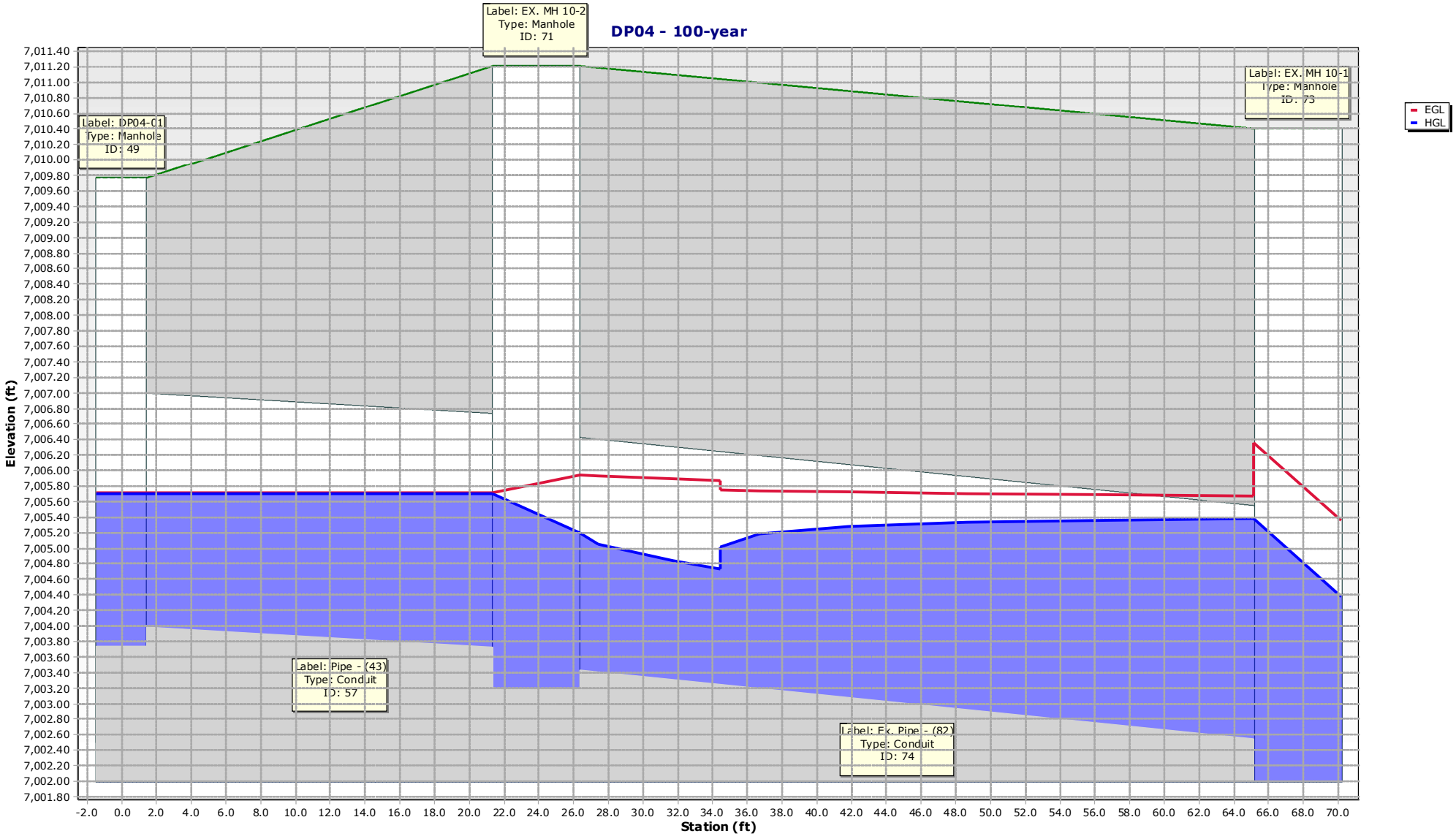
DP04 - 100-year
Label: EX. MH 10-2
Type: Manhole
ID: 71
Label: DP04-01
Type: Manhole
ID: 49
Label: EX. MH 10-1
Type: Manhole
ID: 73
Label: Pipe - (43)
Type: Conduit
ID: 57
Label: Ex. Pipe - (82)
Type: Conduit
ID: 74
EGL
HGL
Elevation (ft)
Station (ft)
7,011.40
7,011.20
7,011.00
7,010.80
7,010.60
7,010.40
7,010.20
7,010.00
7,009.80
7,009.60
7,009.40
7,009.20
7,009.00
7,008.80
7,008.60
7,008.40
7,008.20
7,008.00
7,007.80
7,007.60
7,007.40
7,007.20
7,007.00
7,006.80
7,006.60
7,006.40
7,006.20
7,006.00
7,005.80
7,005.60
7,005.40
7,005.20
7,005.00
7,004.80
7,004.60
7,004.40
7,004.20
7,004.00
7,003.80
7,003.60
7,003.40
7,003.20
7,003.00
7,002.80
7,002.60
7,002.40
7,002.20
7,002.00
7,001.80
-2.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
24.0
26.0
28.0
30.0
32.0
34.0
36.0
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40.0
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44.0
46.0
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50.0
52.0
54.0
56.0
58.0
60.0
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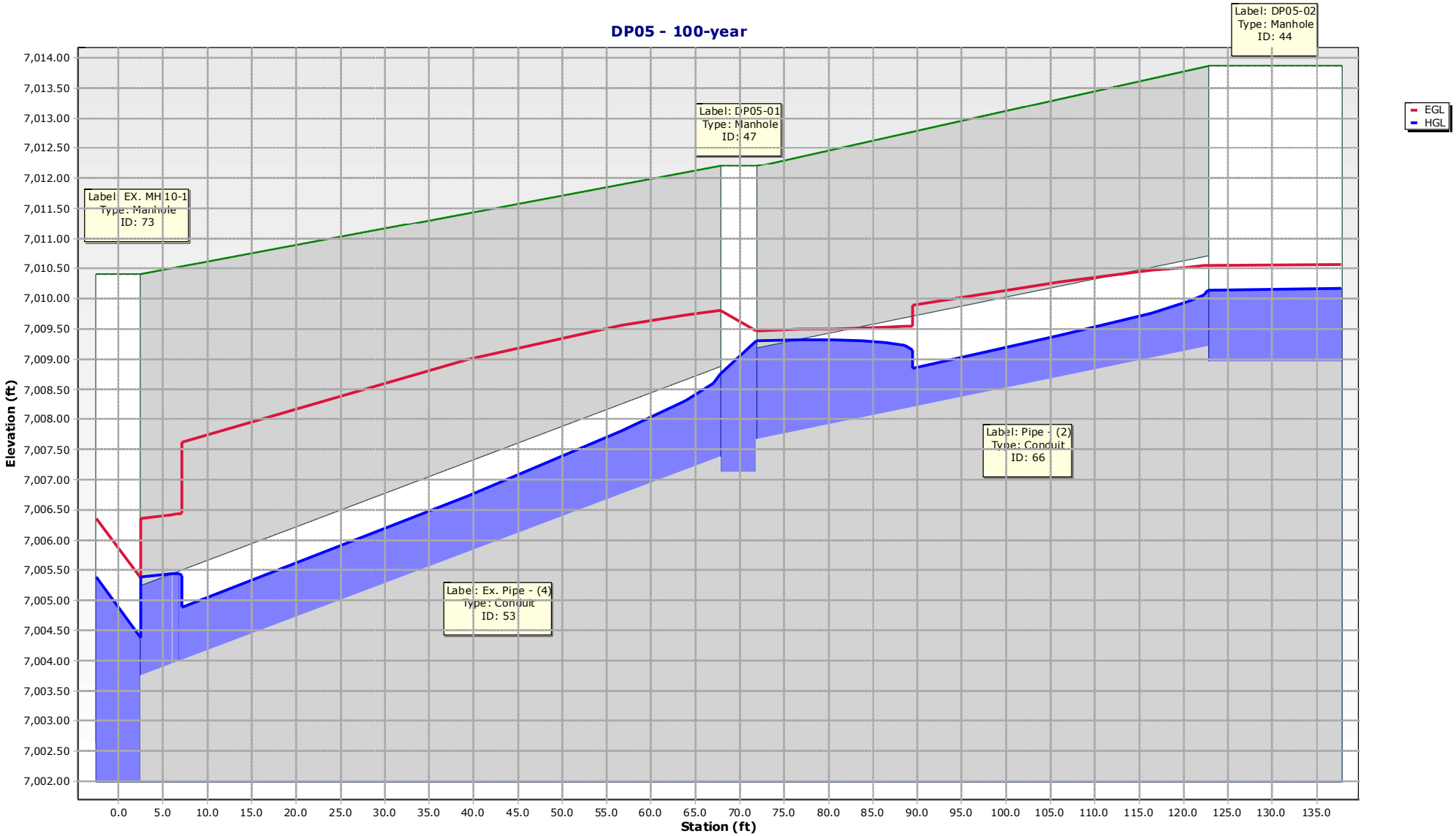
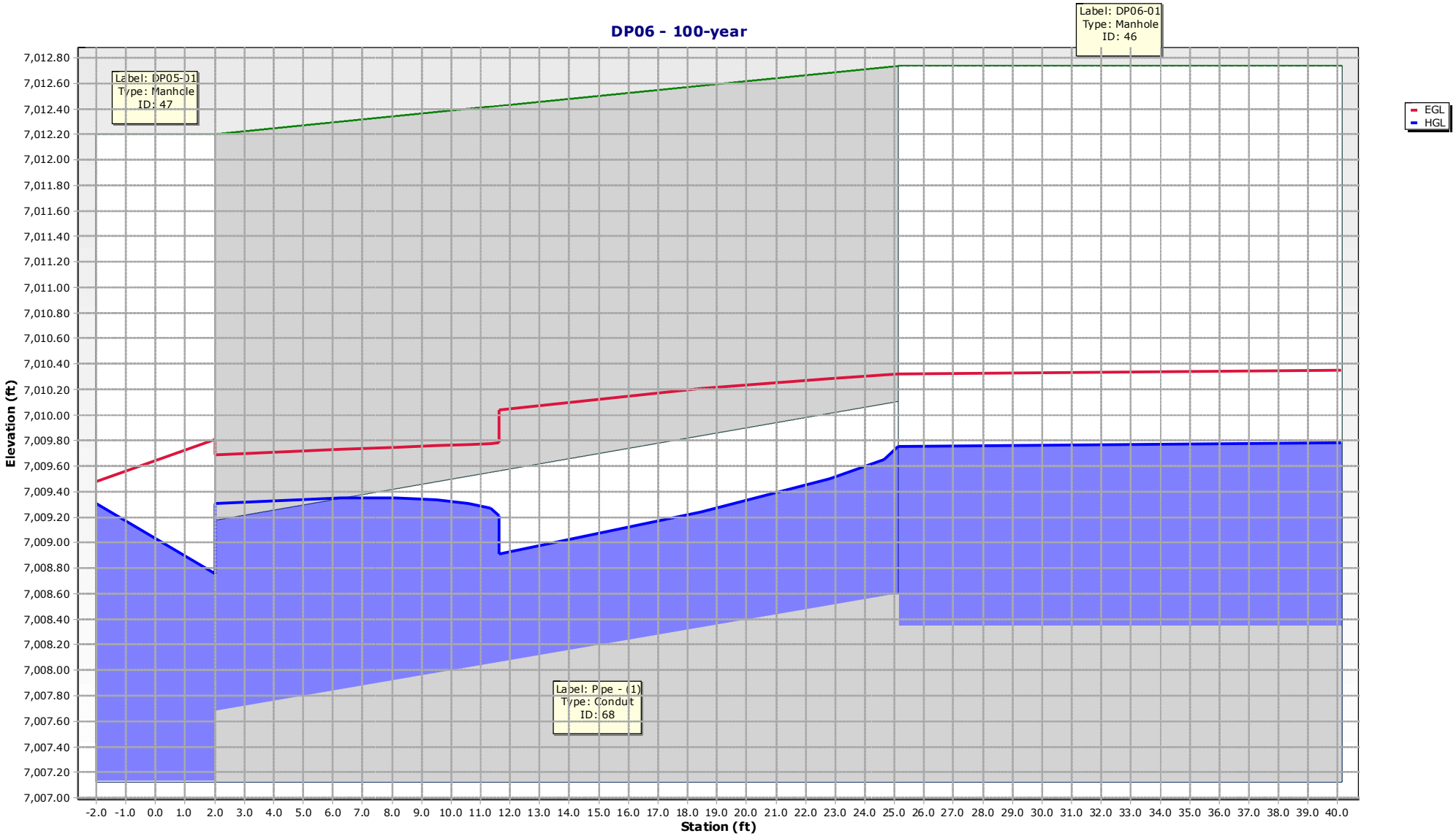
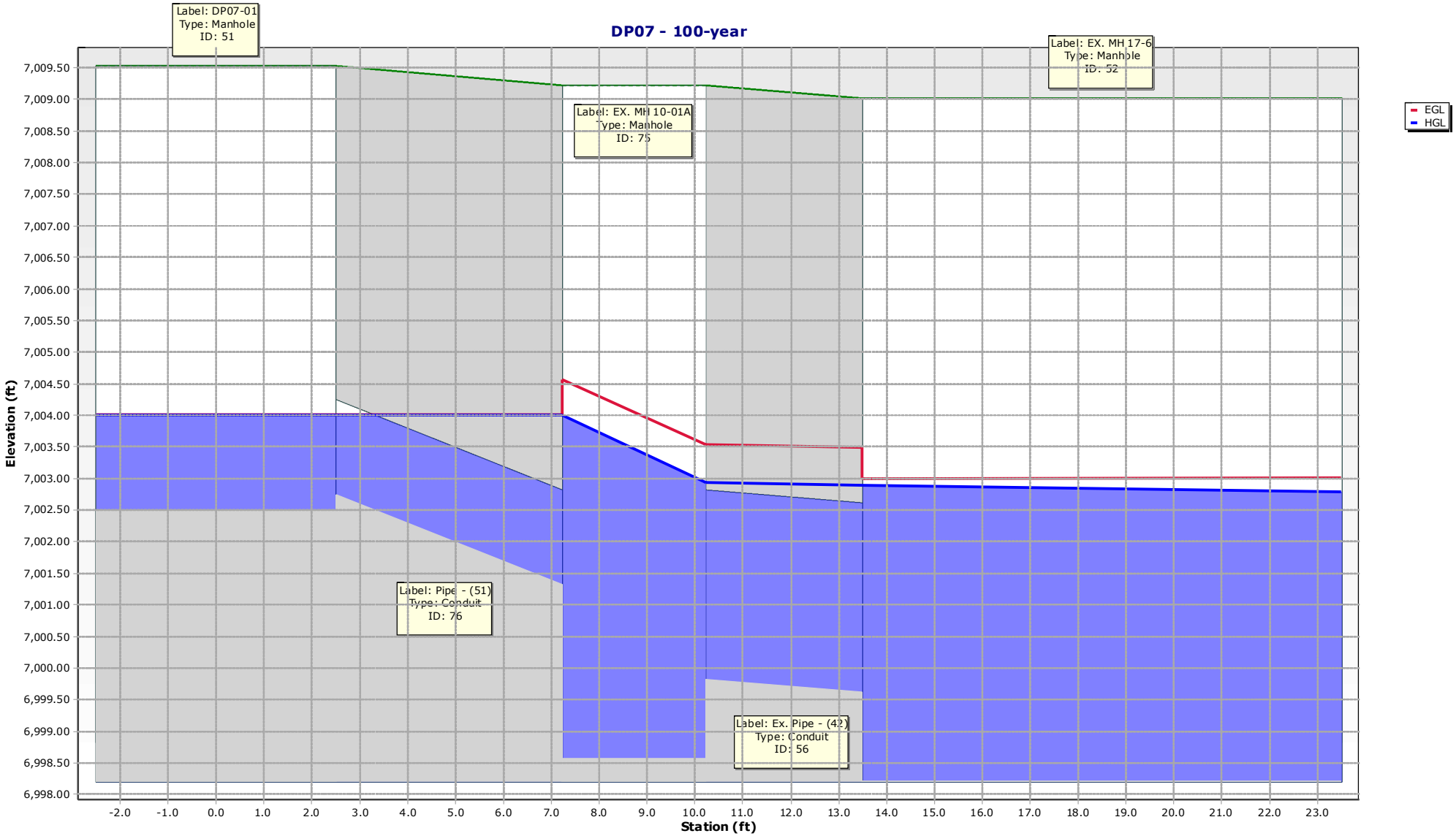
66.0
68.0
70.0


DP05 - 100-year
Label: DP05-02
Type: Manhole
ID: 44
Label: DP05-01
Type: Manhole
ID: 47
Label: EX. MH 10-1
Type: Manhole
ID: 73
Label: Pipe - (2)
Type: Conduit
ID: 66
Label: Ex. Pipe - (4)
Type: Conduit
ID: 53
EGL
HGL
Elevation (ft)
Station (ft)
7,014.00
7,013.50
7,013.00
7,012.50
7,012.00
7,011.50
7,011.00
7,010.50
7,010.00
7,009.50
7,009.00
7,008.50
7,008.00
7,007.50
7,007.00
7,006.50
7,006.00
7,005.50
7,005.00
7,004.50
7,004.00
7,003.50
7,003.00
7,002.50
7,002.00
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
105.0
110.0
115.0
120.0
125.0
130.0
135.0


DP06 - 100-year
Label: DP06-01
Type: Manhole
ID: 46
Label: DP05-01
Type: Manhole
ID: 47
Label: Pipe - (1)
Type: Conduit
ID: 68
EGL
HGL
Elevation (ft)
Station (ft)
7,012.80
7,012.60
7,012.40
7,012.20
7,012.00
7,011.80
7,011.60
7,011.40
7,011.20
7,011.00
7,010.80
7,010.60
7,010.40
7,010.20
7,010.00
7,009.80
7,009.60
7,009.40
7,009.20
7,009.00
7,008.80
7,008.60
7,008.40
7,008.20
7,008.00
7,007.80
7,007.60
7,007.40
7,007.20
7,007.00
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0 40.0


DP07 - 100-year
Label: DP07-01
Type: Manhole
ID: 51
Label: EX. MH 10-01A
Type: Manhole
ID: 75
Label: EX. MH 17-6
Type: Manhole
ID: 52
Label: Pipe - (51)
Type: Conduit
ID: 76
Label: Ex. Pipe - (42)
Type: Conduit
ID: 56
EGL
HGL
Elevation (ft)
Station (ft)
7,009.50
7,009.00
7,008.50
7,008.00
7,007.50
7,007.00
7,006.50
7,006.00
7,005.50
7,005.00
7,004.50
7,004.00
7,003.50
7,003.00
7,002.50
7,002.00
7,001.50
7,001.00
7,000.50
7,000.00
6,999.50
6,999.00
6,998.50
6,998.00
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
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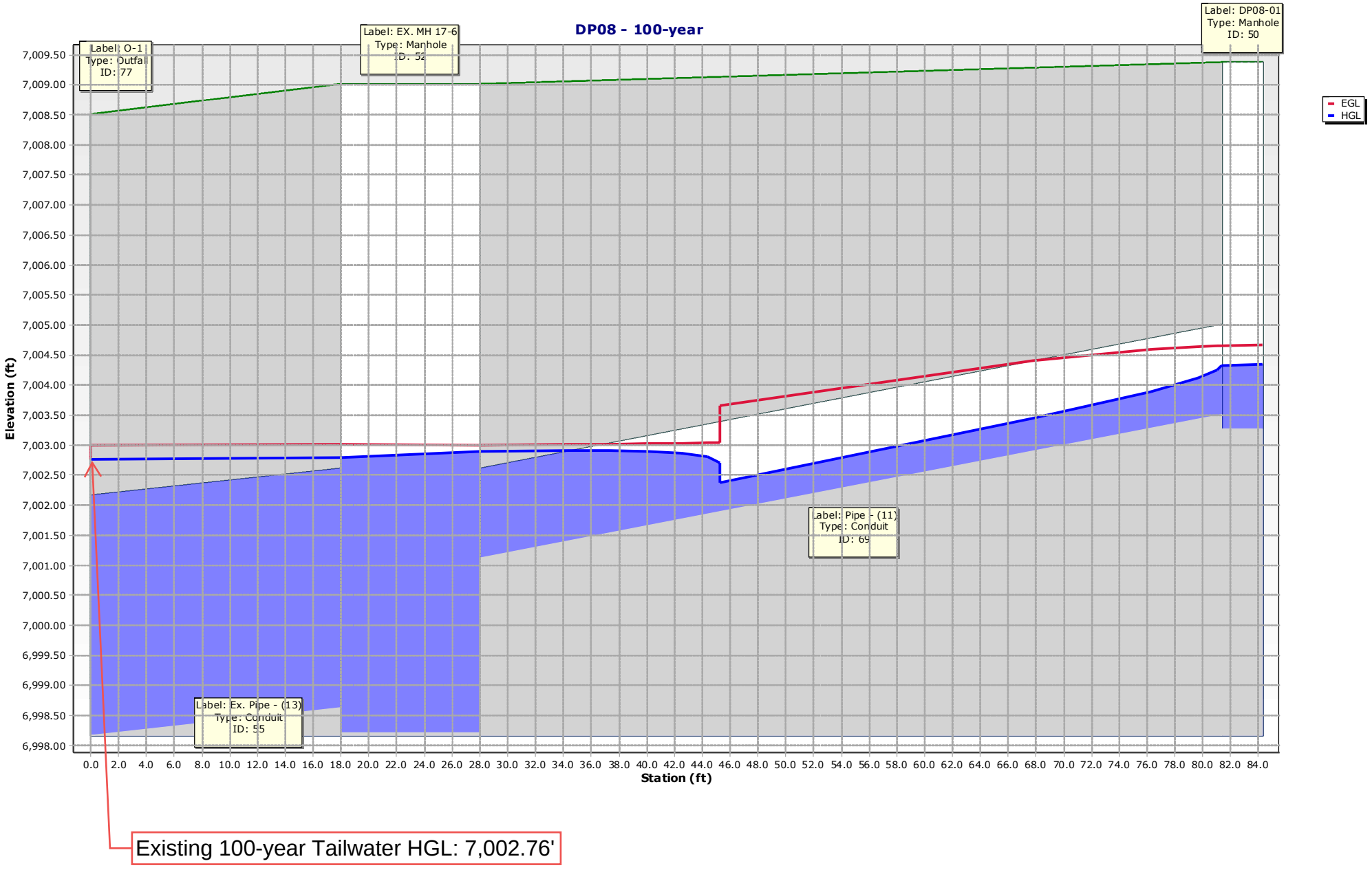
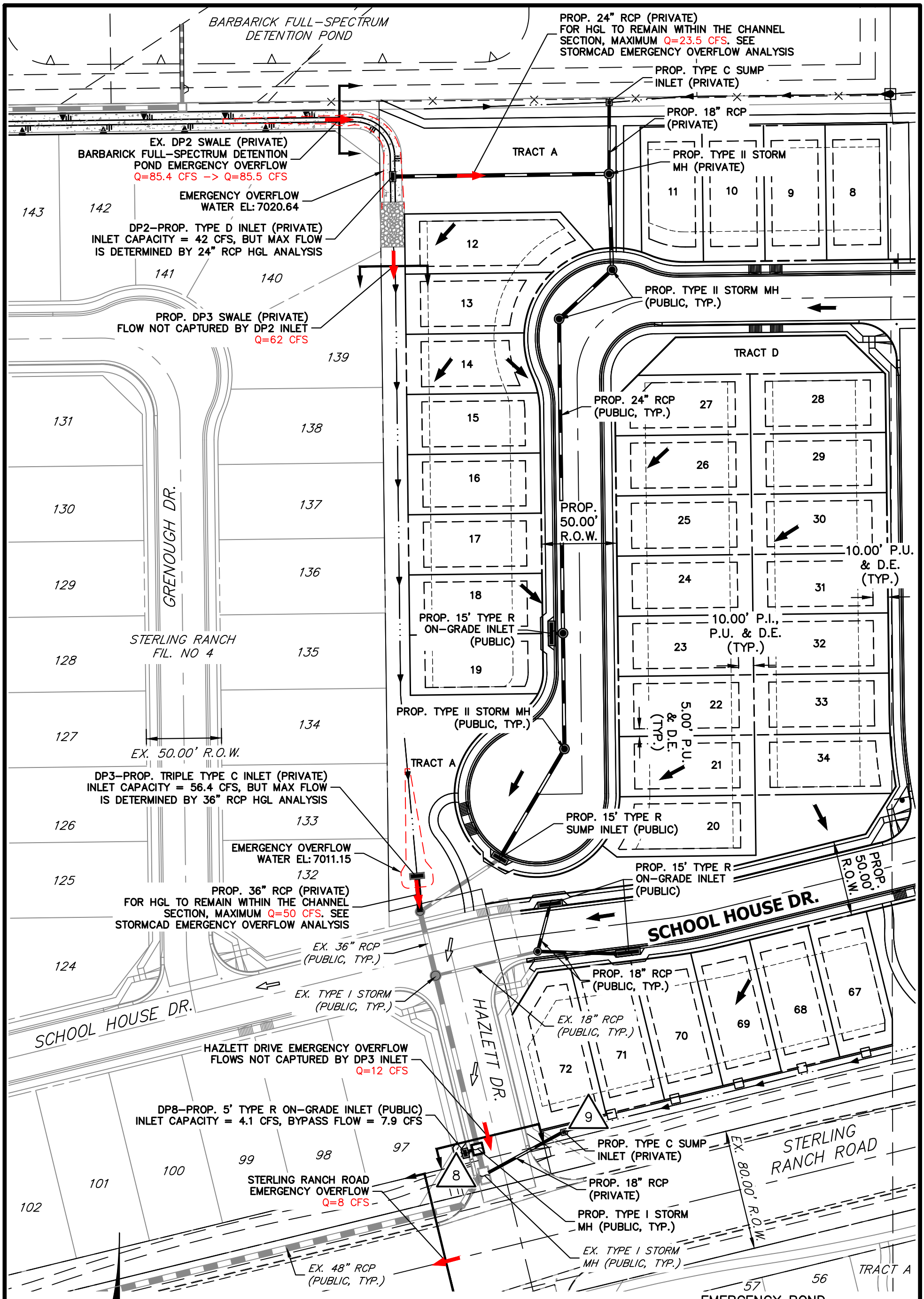

DP08 - 100-year
Label: O-1
Type: Outfall
ID: 77
Label: EX. MH 17-6
Type: Manhole
D: 52
Label: DP08-01
Type: Manhole
ID: 50
Label: Pipe - (11)
Type: Conduit
ID: 69
Label: Ex. Pipe - (13)
Type: Conduit
ID: 55
EGL
HGL
Elevation (ft)
Station (ft)
7,009.50
7,009.00
7,008.50
7,008.00
7,007.50
7,007.00
7,006.50
7,006.00
7,005.50
7,005.00
7,004.50
7,004.00
7,003.50
7,003.00
7,002.50
7,002.00
7,001.50
7,001.00
7,000.50
7,000.00
6,999.50
6,999.00
6,998.50
6,998.00
0.0 2.0 4.0 6.0 8.0 10.0 12.0 14.0 16.0 18.0 20.0 22.0 24.0 26.0 28.0 30.0 32.0 34.0 36.0 38.0 40.0 42.0 44.0 46.0 48.0 50.0 52.0 54.0 56.0 58.0 60.0 62.0 64.0 66.0 68.0 70.0 72.0 74.0 76.0 78.0 80.0 82.0 84.0
Existing 100-year Tailwater HGL: 7,002.76'



LEGEND

- PROPOSED DRAINAGE PATH
- POND OVERFLOW PATH
- EXISTING DRAINAGE PATH

NOTES

1. SEE THE CALCULATION SHEETS FOLLOWING THIS EXHIBIT TO SEE MORE DETAILED HYDRAULIC INFORMATION.
2. SEE SEPARATE INLET OVERFLOW ANALYSIS FOR CALCULATIONS SHOWING CLOGGED INLET FLOWS ARE SAFELY ROUTED.

60 30 0 60

ORIGINAL SCALE: 1" = 60'

EMERGENCY POND OVERFLOW EXHIBIT
STERLING RANCH FILING NO. 5
JOB NO. 25188.16
04/25/24
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

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Apr 25 2024

DP2 Existing Swale Emergency Pond Overflow

Trapezoidal

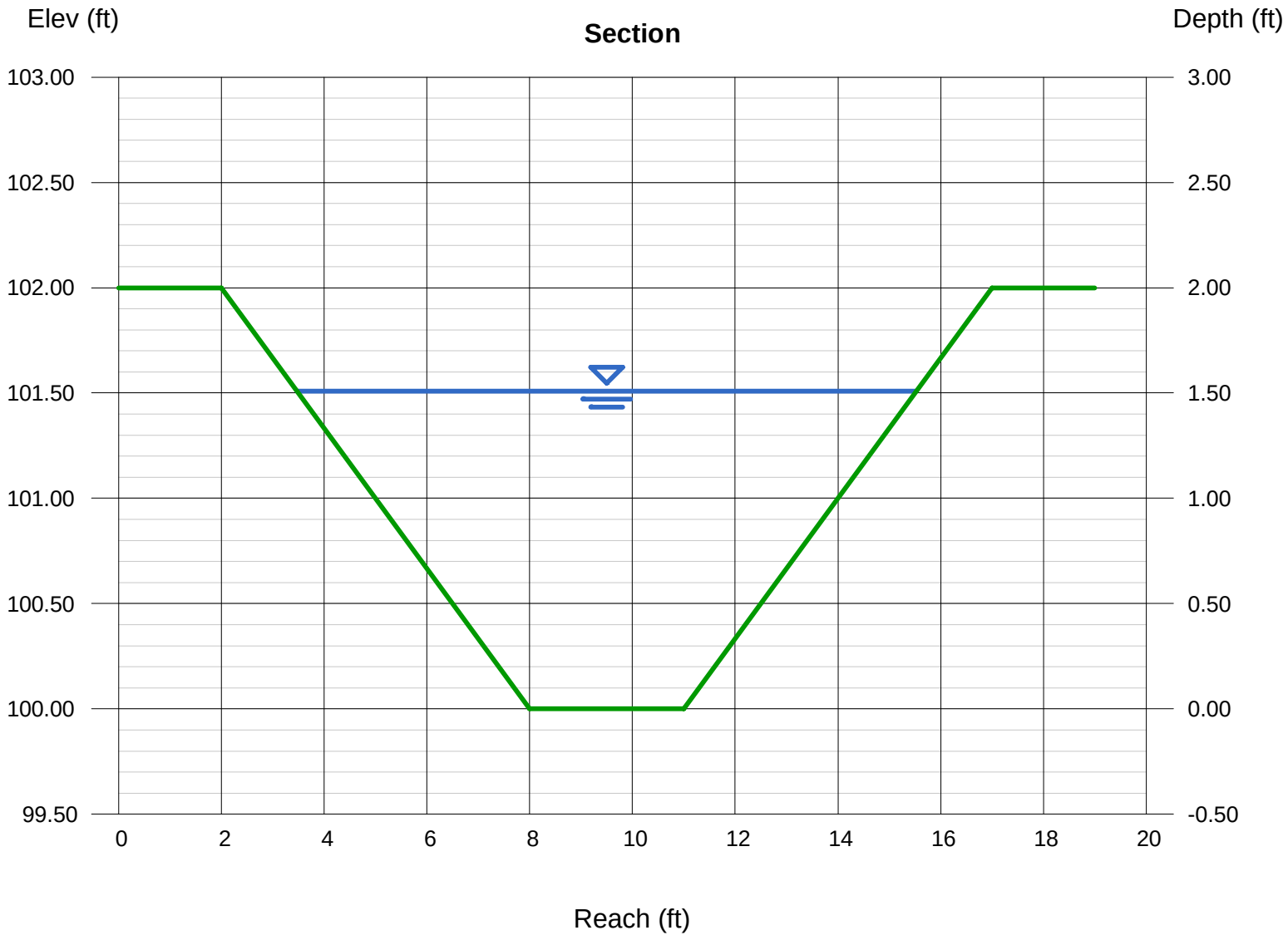
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.013

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



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 24 2024

DP3 Swale Emergency Pond Overflow-Capacity

Trapezoidal

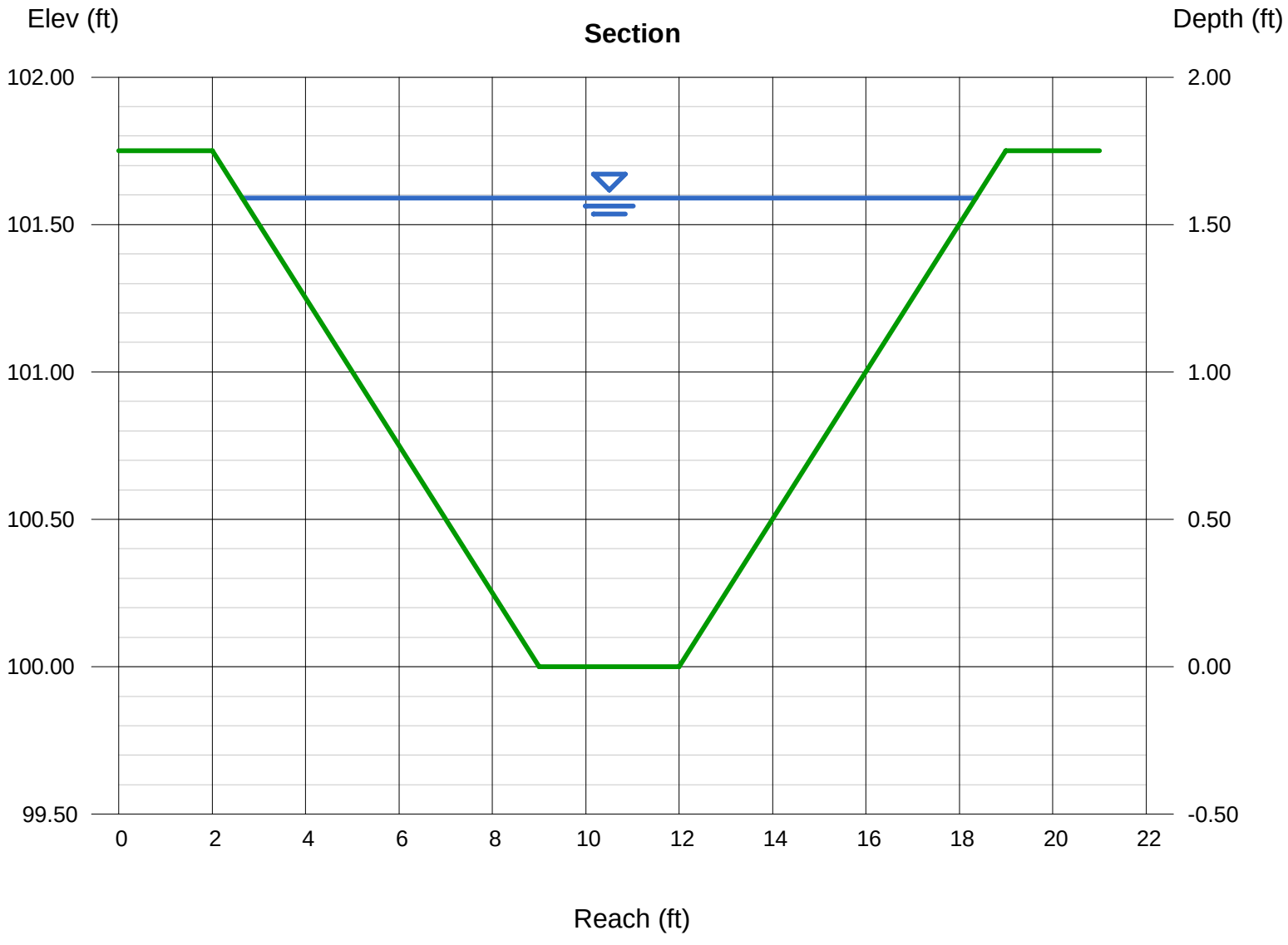
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.75
Invert Elev (ft)	= 100.00
Slope (%)	= 1.50
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 85.50

Highlighted

Depth (ft)	= 1.59
Q (cfs)	= 85.50
Area (sqft)	= 14.88
Velocity (ft/s)	= 5.75
Wetted Perim (ft)	= 16.11
Crit Depth, Yc (ft)	= 1.63
Top Width (ft)	= 15.72
EGL (ft)	= 2.10



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Apr 24 2024

DP3 Swale Emergency Pond Overflow-Velocity

Trapezoidal

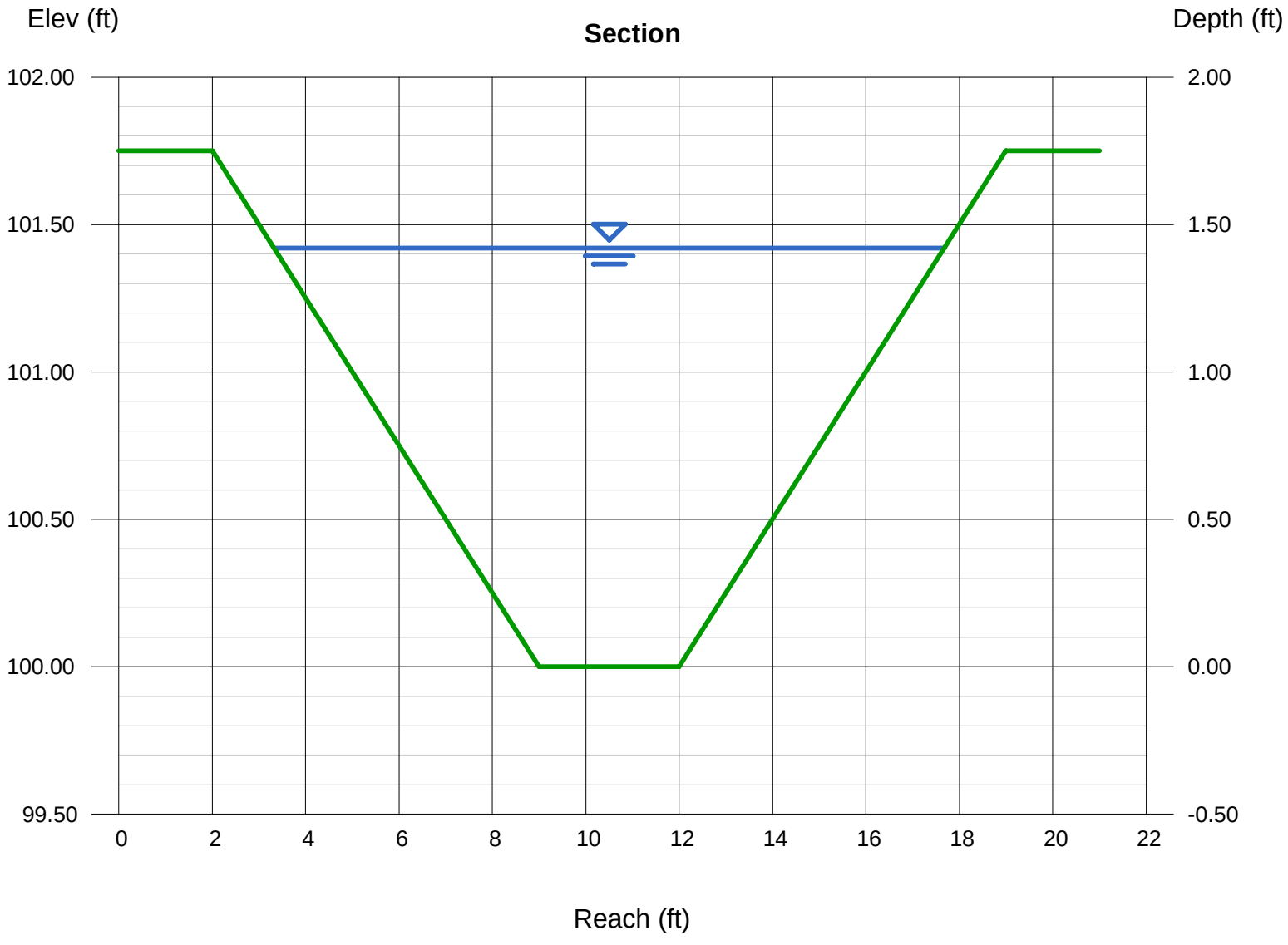
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.75
Invert Elev (ft)	= 100.00
Slope (%)	= 2.50
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 85.50

Highlighted

Depth (ft)	= 1.42
Q (cfs)	= 85.50
Area (sqft)	= 12.33
Velocity (ft/s)	= 6.94
Wetted Perim (ft)	= 14.71
Crit Depth, Yc (ft)	= 1.63
Top Width (ft)	= 14.36
EGL (ft)	= 2.17



MHFD-Inlet, Version 5.02 (August 2022)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP2-Emergency	DP3-Emergency	DP8-Emergency
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	AREA	STREET
Hydraulic Condition	Swale	Swale	On Grade
Inlet Type	User-Defined	User-Defined	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.0	0.0	0.0
Major Q_{Known} (cfs)	85.5	62.0	12.0

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	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)			

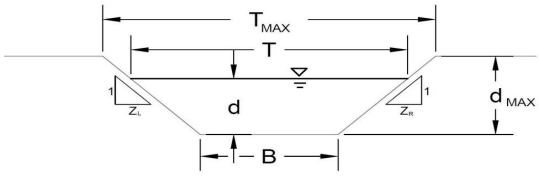
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	0.0	0.0	0.0
Major Total Design Peak Flow, Q (cfs)	85.5	62.0	12.0
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	43.5	5.6	7.9

AREA INLET IN A SWALE

STERLING RANCH FILING 5

DP2-Emergency



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 =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0100	ft/ft
Bottom Width	B =	3.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Sloe	Z2 =	3.00	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} =	15.00	15.00	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} =	98.1	98.1	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 =	0.0	85.5	cfs
Water Depth	d =	0.00	1.88	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'

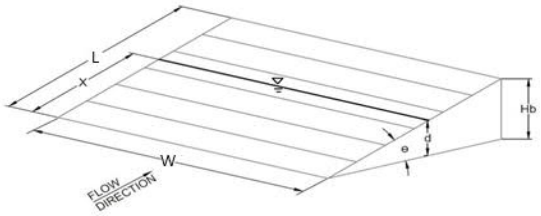
AREA INLET IN A SWALE

STERLING RANCH FILING 5

DP2-Emergency

Inlet Design Information (Input)

Type of Inlet	User-Defined	Inlet Type =	User-Defined	
Angle of Inclined Grate (must be <= 30 degrees)		θ =	0.00	degrees
Width of Grate		W =	2.92	ft
Length of Grate		L =	5.84	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 =	N/A	
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 =	0.00	1.88	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	0.0	42.0	cfs
Bypassed Flow	Q_b =	0.0	43.5	cfs
Capture Percentage = Qa/Qo	C% =	100	49	%

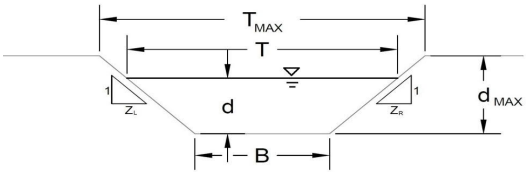
Warning 03: Velocity exceeds USDCM Volume I recommendation.
Warning 04: Froude No. exceeds USDCM Volume I recommendation.

Inlet capacity is greater than the controlling 24" RCP in order to keep the HGL within the swale section. See StormCAD analysis sheet for HGL information.

AREA INLET IN A SWALE

STERLING RANCH FILING 5

DP3-Emergency



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 =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0100	ft/ft
Bottom Width	B =	3.00	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} =	15.00	17.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.00	1.75	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	25.3	87.1	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.00	1.75	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	0.0	62.0	cfs
Water Depth	d =	0.00	1.51	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'

MHFD-Inlet, Version 5.02 (August 2022)

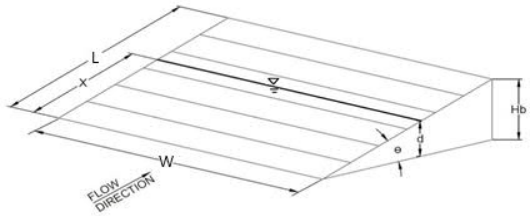
AREA INLET IN A SWALE

STERLING RANCH FILING 5

DP3-Emergency

Inlet Design Information (Input)

Type of Inlet	User-Defined	Inlet Type =	User-Defined	
Angle of Inclined Grade (must be <= 30 degrees)		θ =	0.00	degrees
Width of Grate		W =	2.92	ft
Length of Grate		L =	8.76	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 =	N/A	
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 =	0.00	1.51	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	0.0	56.4	cfs
Bypassed Flow	Q_b =	0.0	5.6	cfs
Capture Percentage = Qa/Qo	C% =	100	91	%

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

Inlet capacity is greater than the controlling 36" RCP in order to keep the HGL within the swale section. See StormCAD analysis sheet for HGL information.

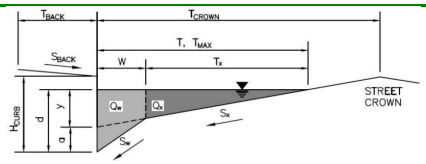
MHFD-Inlet, Version 5.02 (August 2022)

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 5

Inlet ID: DP8-Emergency



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	40.0	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} =	12.0	16.0	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

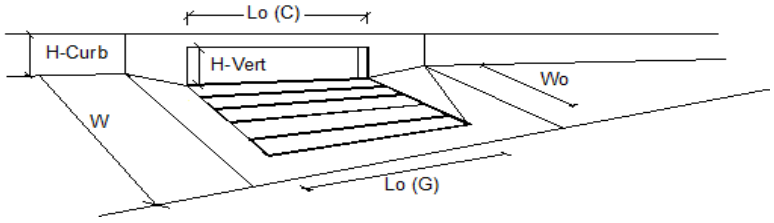
		Minor Storm	Major Storm	
	Q_{allow} =	4.7	9.4	cfs

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.00 cfs on sheet 'Inlet Management'

WARNING: MAJOR STORM max. allowable capacity is less than the design peak flow of 12.00 cfs on sheet 'Inlet Management'

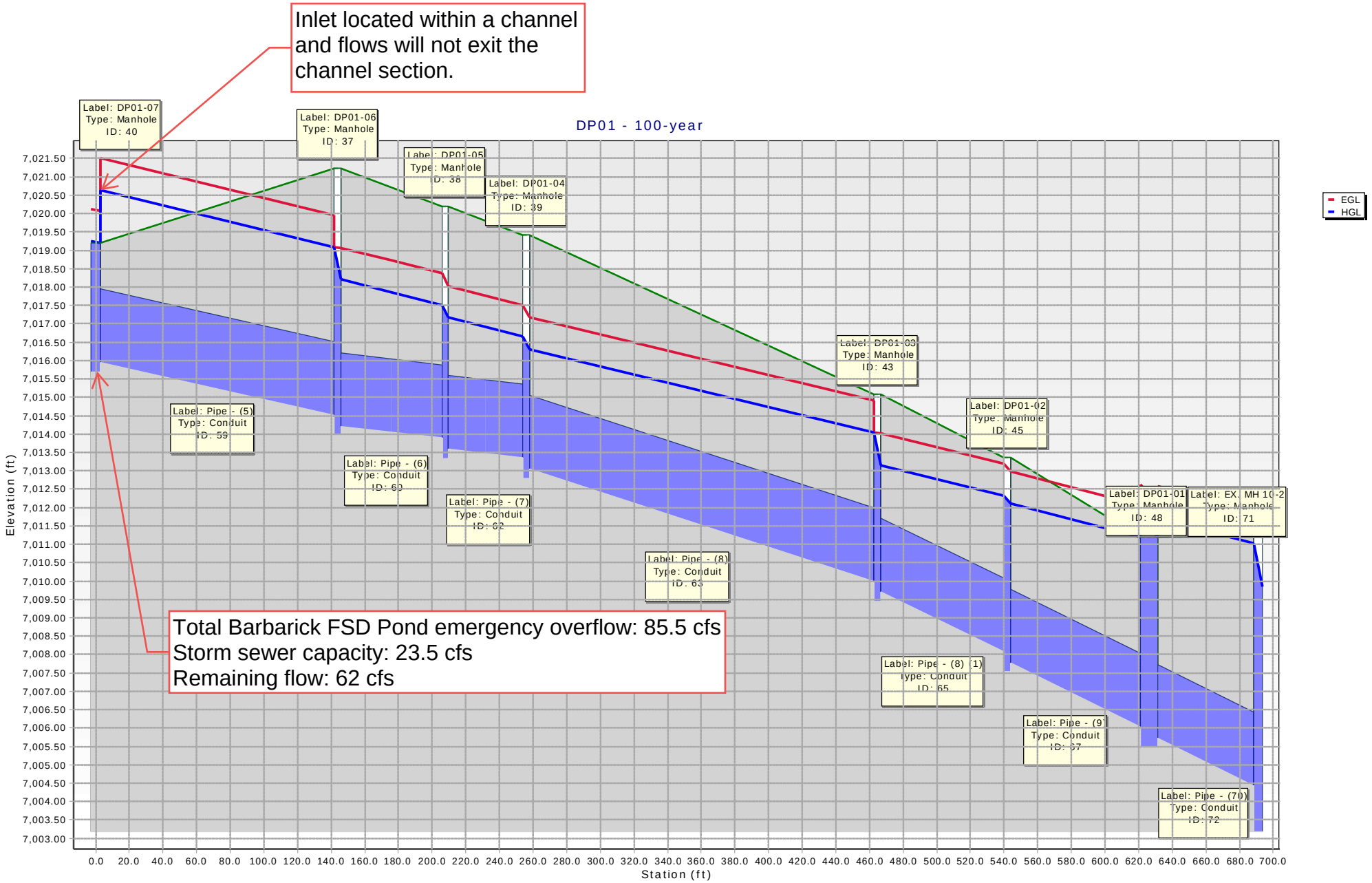
INLET ON A CONTINUOUS GRADE

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 =	5.00	5.00	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 =	0.0	4.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	7.9	cfs
Capture Percentage = Q_a/Q_o	C% =	0	34	%


Inlet located within a channel and flows will not exit the channel section.
DP01 - 100-year
Label: DP01-07
Type: Manhole
ID: 40
Label: DP01-06
Type: Manhole
ID: 37
Label: DP01-05
Type: Manhole
ID: 38
Label: DP01-04
Type: Manhole
ID: 39
Label: DP01-03
Type: Manhole
ID: 43
Label: DP01-02
Type: Manhole
ID: 45
Label: DP01-01
Type: Manhole
ID: 48
Label: EX. MH 10-2
Type: Manhole
ID: 71
Label: Pipe - (5)
Type: Conduit
ID: 59
Label: Pipe - (6)
Type: Conduit
ID: 60
Label: Pipe - (7)
Type: Conduit
ID: 62
Label: Pipe - (8)
Type: Conduit
ID: 63
Label: Pipe - (8) (1)
Type: Conduit
ID: 65
Label: Pipe - (9)
Type: Conduit
ID: 67
Label: Pipe - (70)
Type: Conduit
ID: 72
Total Barbarick FSD Pond emergency overflow: 85.5 cfs
Storm sewer capacity: 23.5 cfs
Remaining flow: 62 cfs
EGL
HGL
Elevation (ft)
7,021.50
7,021.00
7,020.50
7,020.00
7,019.50
7,019.00
7,018.50
7,018.00
7,017.50
7,017.00
7,016.50
7,016.00
7,015.50
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7,014.50
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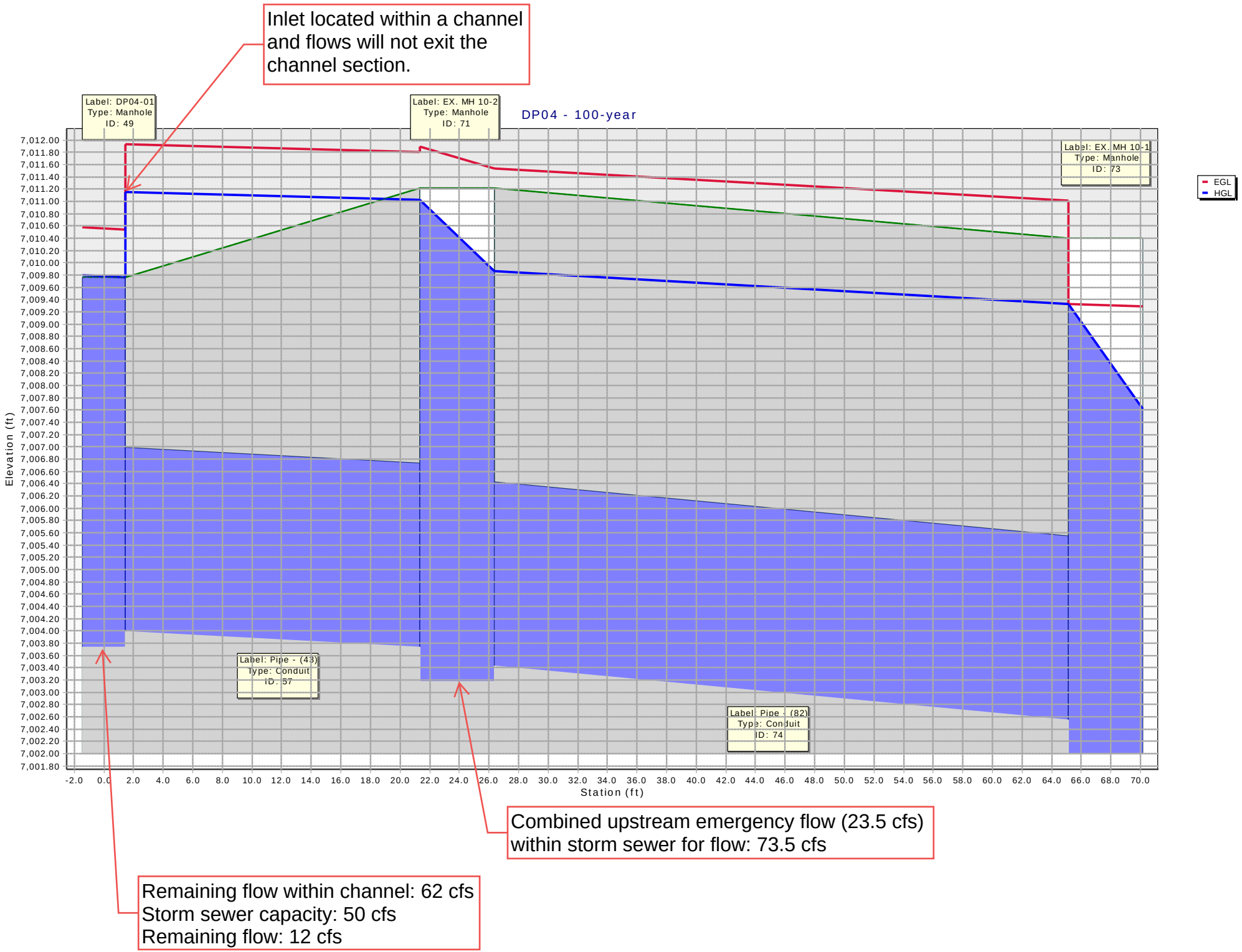
7,006.50
7,006.00
7,005.50
7,005.00
7,004.50
7,004.00
7,003.50
7,003.00
0.0 20.0 40.0 60.0 80.0 100.0 120.0 140.0 160.0 180.0 200.0 220.0 240.0 260.0 280.0 300.0 320.0 340.0 360.0 380.0 400.0 420.0 440.0 460.0 480.0 500.0 520.0 540.0 560.0 580.0 600.0 620.0 640.0 660.0 680.0 700.0
Station (ft)


Inlet located within a channel and flows will not exit the channel section.
Label: DP04-01
Type: Manhole
ID: 49
Label: EX. MH 10-2
Type: Manhole
ID: 71
DP04 - 100-year
Label: EX. MH 10-1
Type: Manhole
ID: 73
EGL
HGL
Elevation (ft)
Station (ft)
Label: Pipe - (43)
Type: Conduit
ID: 57
Label: Pipe - (82)
Type: Conduit
ID: 74
Combined upstream emergency flow (23.5 cfs) within storm sewer for flow: 73.5 cfs
Remaining flow within channel: 62 cfs
Storm sewer capacity: 50 cfs
Remaining flow: 12 cfs

DP01 and DP04 StormCAD Analysis-Emergency Overflow																		
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
DP01-07	Pipe - (5)	23.5	22.62	24	143.9	0.01	7,015.95	7,014.51	7,019.20	7,021.23	7,020.64	7,019.09	7,021.51	7,019.96	7.48	0.013	0.05
DP01-06	Pipe - (6)	23.5	16.12	24	63.8	0.005	7,014.21	7,013.89	7,021.23	7,020.18	7,018.20	7,017.51	7,019.07	7,018.38	7.48	0.013	1.02
DP01-05	Pipe - (7)	23.5	15.99	24	48	0.005	7,013.59	7,013.35	7,020.18	7,019.42	7,017.17	7,016.65	7,018.03	7,017.52	7.48	0.013	0.4
DP01-04	Pipe - (8)	23.5	27.33	24	209	0.015	7,013.05	7,010.00	7,019.42	7,015.08	7,016.30	7,014.04	7,017.17	7,014.91	7.48	0.013	0.4
DP01-03	Pipe - (8) (1)	23.5	32.81	24	77	0.021	7,009.70	7,008.08	7,015.08	7,013.35	7,013.16	7,012.33	7,014.03	7,013.20	7.48	0.013	1.02
DP01-02	Pipe - (9)	23.5	32.54	24	84.4	0.021	7,007.78	7,006.03	7,013.35	7,011.20	7,012.11	7,011.20	7,012.98	7,012.07	7.48	0.013	0.25
DP01-01	Pipe - (70)	23.5	32	24	65	0.02	7,005.72	7,004.42	7,011.20	7,011.21	7,011.72	7,011.02	7,012.59	7,011.89	7.48	0.013	0.64
DP04-01	Pipe - (43)	50	69.38	36	23.8	0.011	7,003.99	7,003.73	7,009.76	7,011.21	7,011.15	7,011.02	7,011.93	7,011.80	7.07	0.013	0.05
EX. MH 10-2	Pipe - (82)	73.5	94.51	36	43.8	0.02	7,003.43	7,002.55	7,011.21	7,010.40	7,009.86	7,009.33	7,011.54	7,011.01	10.4	0.013	0.69

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 11 2024

Hazlett Drive-Emergency Overflow Capacity

User-defined

Invert Elev (ft)	= 7009.31
Slope (%)	= 0.65
N-Value	= 0.018

Calculations

Compute by:	Known Q
Known Q (cfs)	= 60.00

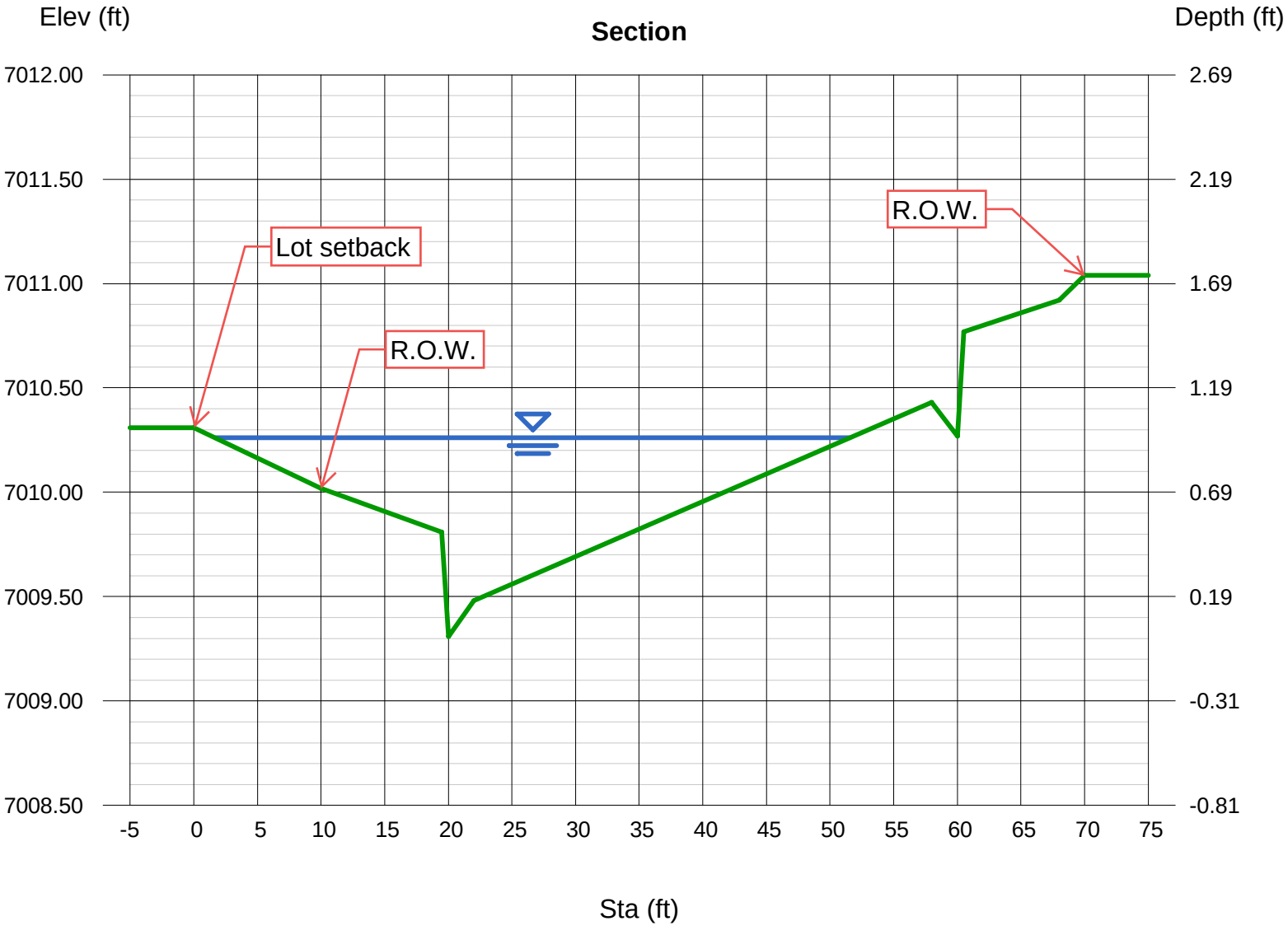
Highlighted

Depth (ft)	= 0.95
Q (cfs)	= 60.00
Area (sqft)	= 17.89
Velocity (ft/s)	= 3.35
Wetted Perim (ft)	= 50.08
Crit Depth, Yc (ft)	= 0.95
Top Width (ft)	= 49.85
EGL (ft)	= 1.12

(Sta, El, n)-(Sta, El, n)...

(0.00, 7010.31) -(10.00, 7010.02, 0.030) -(19.50, 7009.81, 0.013) -(20.00, 7009.31, 0.013) -(22.00, 7009.48, 0.013) -(58.00, 7010.43, 0.016) -(60.00, 7010.27, 0.013) -(60.50, 7010.77, 0.013) -(68.00, 7010.92, 0.013) -(70.00, 7011.04, 0.030)

Uncaptured remaining flow is 12 cfs (see exhibit), which is less than maximum capacity



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 11 2024

Sterling Ranch Road-Emergency Overflow Capacity

User-defined

Invert Elev (ft)	= 7006.33
Slope (%)	= 1.80
N-Value	= 0.020

Calculations

Compute by:	Known Q
Known Q (cfs)	= 140.00

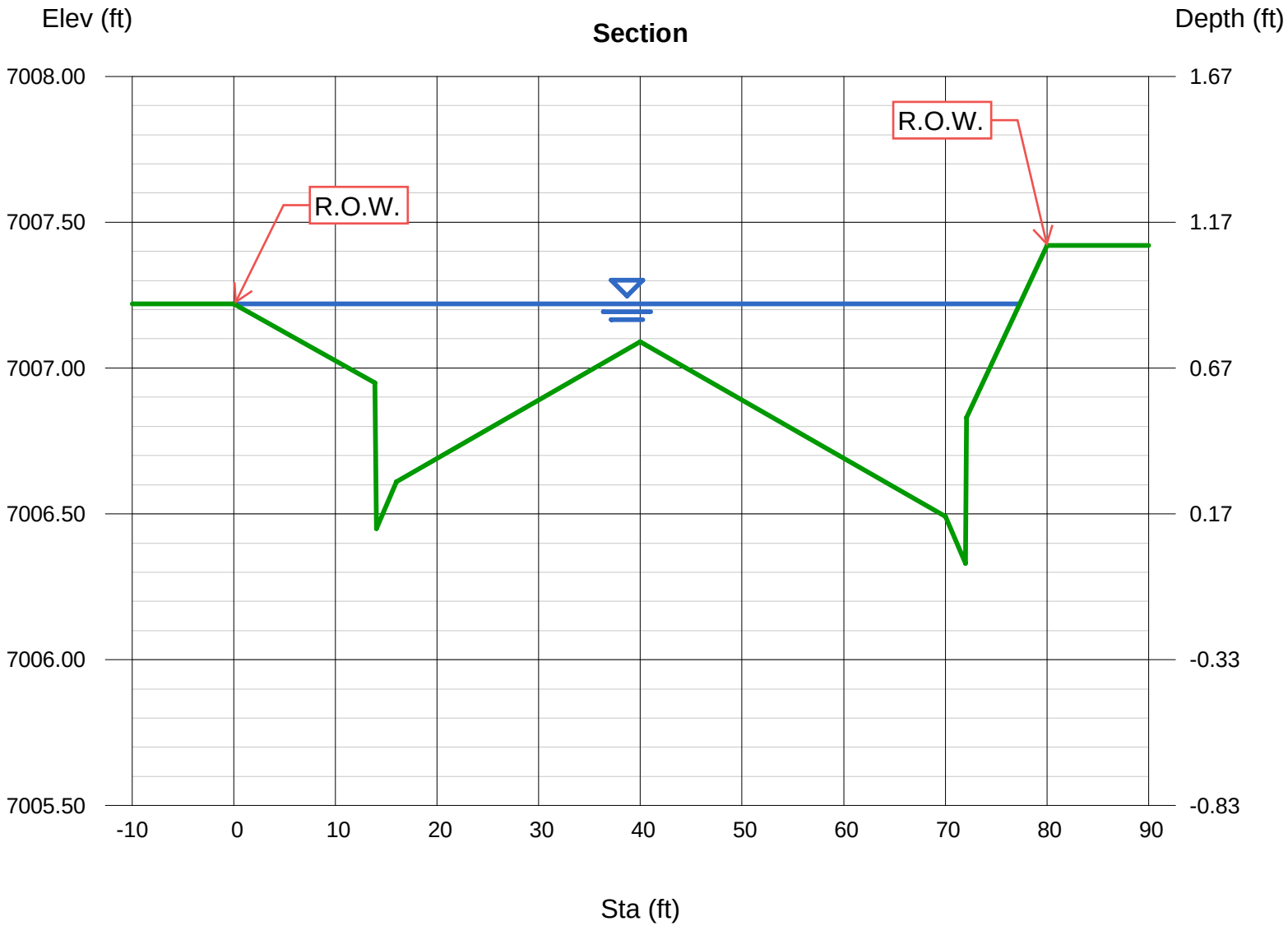
Highlighted

Depth (ft)	= 0.89
Q (cfs)	= 140.00
Area (sqft)	= 27.83
Velocity (ft/s)	= 5.03
Wetted Perim (ft)	= 78.15
Crit Depth, Yc (ft)	= 1.00
Top Width (ft)	= 77.33
EGL (ft)	= 1.28

(Sta, El, n)-(Sta, El, n)...

(0.00, 7007.22) -(13.87, 7006.95, 0.030) -(14.00, 7006.45, 0.013) -(16.00, 7006.61, 0.013) -(40.00, 7007.09, 0.016) -(70.00, 7006.49, 0.016) -(72.00, 7006.33, 0.013) -(72.12, 7006.83, 0.013) -(80.00, 7007.42, 0.030)

Uncaptured remaining flow is 8 cfs (see exhibit), which is less than maximum capacity



BARBARICK FULL-SPECTRUM DETENTION POND

DP1-PROP. TYPE C SUMP INLET (PRIVATE) OVERFLOWS SOUTH TO MANOR HOUSE WAY

PROP. 18" RCP (PRIVATE)

PROP. TYPE II STORM MH (PRIVATE)

SEE SEPARATE EXHIBIT FOR POND EMERGENCY OVERFLOW ANALYSIS

TRACT A

DP2-PROP. TYPE D INLET (PRIVATE) OVERFLOWS SOUTH TO PROP. SWALE

PROP. DP3 SWALE (PRIVATE)
DP2 FLOW = 1.0 CFS
DP3 FLOW = 3.1 CFS
TOTAL SWALE EMERGENCY
Q=4.1 CFS -> Q=4.5 CFS

PROP. TYPE II STORM MH (PUBLIC, TYP.)

TRACT D

PROP. 24" RCP (PUBLIC, TYP.)

MANOR HOUSE WAY EMERGENCY OVERFLOW
DP1 FLOW = 7.3 CFS
DP4 FLOW = 7.9 CFS
TOTAL MANOR HOUSE WAY EMERGENCY
Q=15.2 CFS -> Q=15.5 CFS

PROP. 50.00' R.O.W.

10.00' P.U. & D.E. (TYP.)

10.00' P.I., P.U. & D.E. (TYP.)

5.00' P.U. & D.E. (TYP.)

MANOR HOUSE WAY

PROP. 15' TYPE R ON-GRADE INLET (PUBLIC)

PROP. TYPE II STORM MH (PUBLIC, TYP.)

TRACT A

DP5-PROP. 15' TYPE R SUMP INLET (PUBLIC), OVERFLOWS SOUTH TO SCHOOL HOUSE DR. AND THEN TO HAZLETT DR.

DP3-PROP. TRIPLE TYPE C INLET (PRIVATE) OVERFLOWS SOUTH TO HAZLETT DR.

PROP. 15' TYPE R ON-GRADE INLET (PUBLIC)

SCHOOL HOUSE DR.

EX. 36" RCP (PUBLIC, TYP.)

EX. TYPE I STORM (PUBLIC, TYP.)

PROP. 18" RCP (PUBLIC, TYP.)

EX. 18" RCP (PUBLIC, TYP.)

HAZLETT DRIVE EMERGENCY OVERFLOW
DP3 FLOW = 3.1 CFS
DP5 FLOW = 13.2 CFS
DP8 FLOW = 2.3 CFS
DP9 FLOW = 4.5 CFS
TOTAL HAZLETT DR. EMERGENCY
Q=23.1 CFS -> Q=23.5 CFS

DP8-PROP. 5' TYPE R ON-GRADE INLET (PUBLIC)

DP9-PROP. TYPE C SUMP INLET (PRIVATE) OVERFLOWS WEST TO HAZLETT DR. AND THEN TO STERLING RANCH ROAD

STERLING RANCH ROAD EMERGENCY OVERFLOW
Q=23.5 CFS

PROP. 18" RCP (PRIVATE)

PROP. TYPE I STORM MH (PUBLIC, TYP.)

EX. TYPE I STORM MH (PUBLIC, TYP.)

EX. 48" RCP (PUBLIC, TYP.)

EX. 80.00' R.O.W.

STERLING RANCH ROAD

GRENOUGH DR.

STERLING RANCH FIL. NO 4

EX. 50.00' R.O.W.

HAZLETT DR.

143 142 141 140 139 138 137 136 135 134 133 132 131 130 129 128 127 126 125 124 101 100 99 98 97 72 71 70 69 68 67 57 56

1 2 3 5 8 9 11 10 9 8 12 13 14 15 16 17 18 19 27 28 26 29 25 30 24 31 23 32 22 33 21 34

60 30 0 60

ORIGINAL SCALE: 1" = 60'

LEGEND

- PROPOSED DRAINAGE PATH
- INLET OVERFLOW PATH
- EXISTING DRAINAGE PATH

NOTES

1. SEE THE CALCULATION SHEETS FOLLOWING THIS EXHIBIT TO SEE MORE DETAILED HYDRAULIC INFORMATION.
2. SEE SEPARATE POND OVERFLOW ANALYSIS FOR CALCULATIONS SHOWING POND FLOWS ARE SAFELY ROUTED.

SUMP INLET EMERGENCY OVERFLOW EXHIBIT
STERLING RANCH FILING NO. 5
JOB NO. 25188.16
04/25/24
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

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 11 2024

Manor House Way-Emergency Inlet Overflow Capacity

User-defined

Invert Elev (ft)	= 7015.26
Slope (%)	= 2.20
N-Value	= 0.020

Calculations

Compute by:	Known Q
Known Q (cfs)	= 80.00

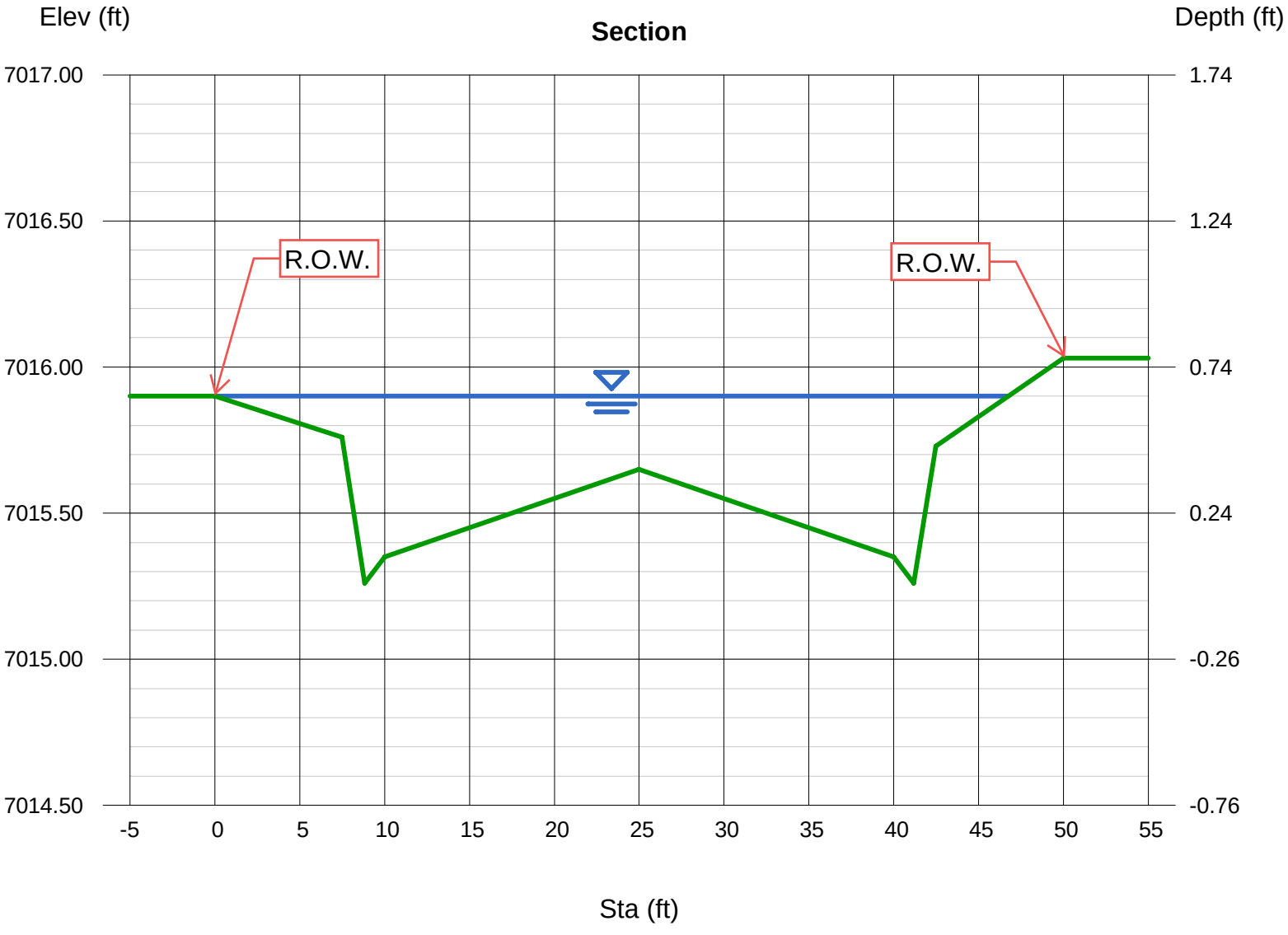
Highlighted

Depth (ft)	= 0.64
Q (cfs)	= 80.00
Area (sqft)	= 15.33
Velocity (ft/s)	= 5.22
Wetted Perim (ft)	= 46.94
Crit Depth, Yc (ft)	= 0.77
Top Width (ft)	= 46.75
EGL (ft)	= 1.06

(Sta, El, n)-(Sta, El, n)...

(0.00, 7015.90) -(7.50, 7015.76, 0.030) -(8.83, 7015.26, 0.013) -(10.00, 7015.35, 0.013) -(25.00, 7015.65, 0.016) -(40.00, 7015.35, 0.016) -(41.17, 7015.26, 0.013) -(42.50, 7015.73, 0.013) -(50.00, 7016.03, 0.030)

DP1 and DP4 total flow is 15.5 cfs (see exhibit), which is less than maximum capacity



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Apr 25 2024

DP3 Swale Emergency Inlet Overflow-Capacity

Trapezoidal

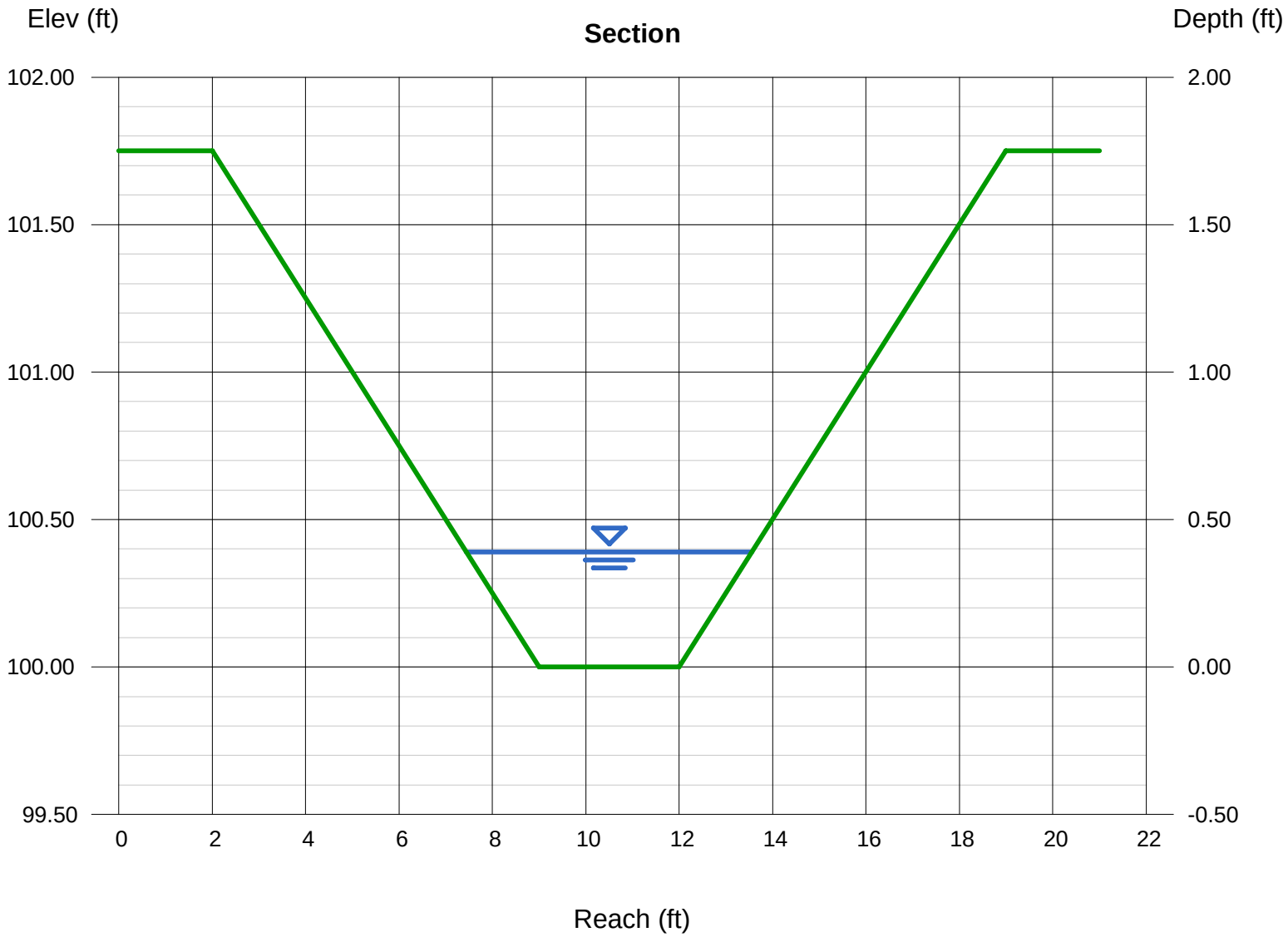
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.75
Invert Elev (ft)	= 100.00
Slope (%)	= 1.50
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.50

Highlighted

Depth (ft)	= 0.39
Q (cfs)	= 4.500
Area (sqft)	= 1.78
Velocity (ft/s)	= 2.53
Wetted Perim (ft)	= 6.22
Crit Depth, Yc (ft)	= 0.35
Top Width (ft)	= 6.12
EGL (ft)	= 0.49



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Apr 25 2024

DP3 Swale Emergency Inlet Overflow-Velocity

Trapezoidal

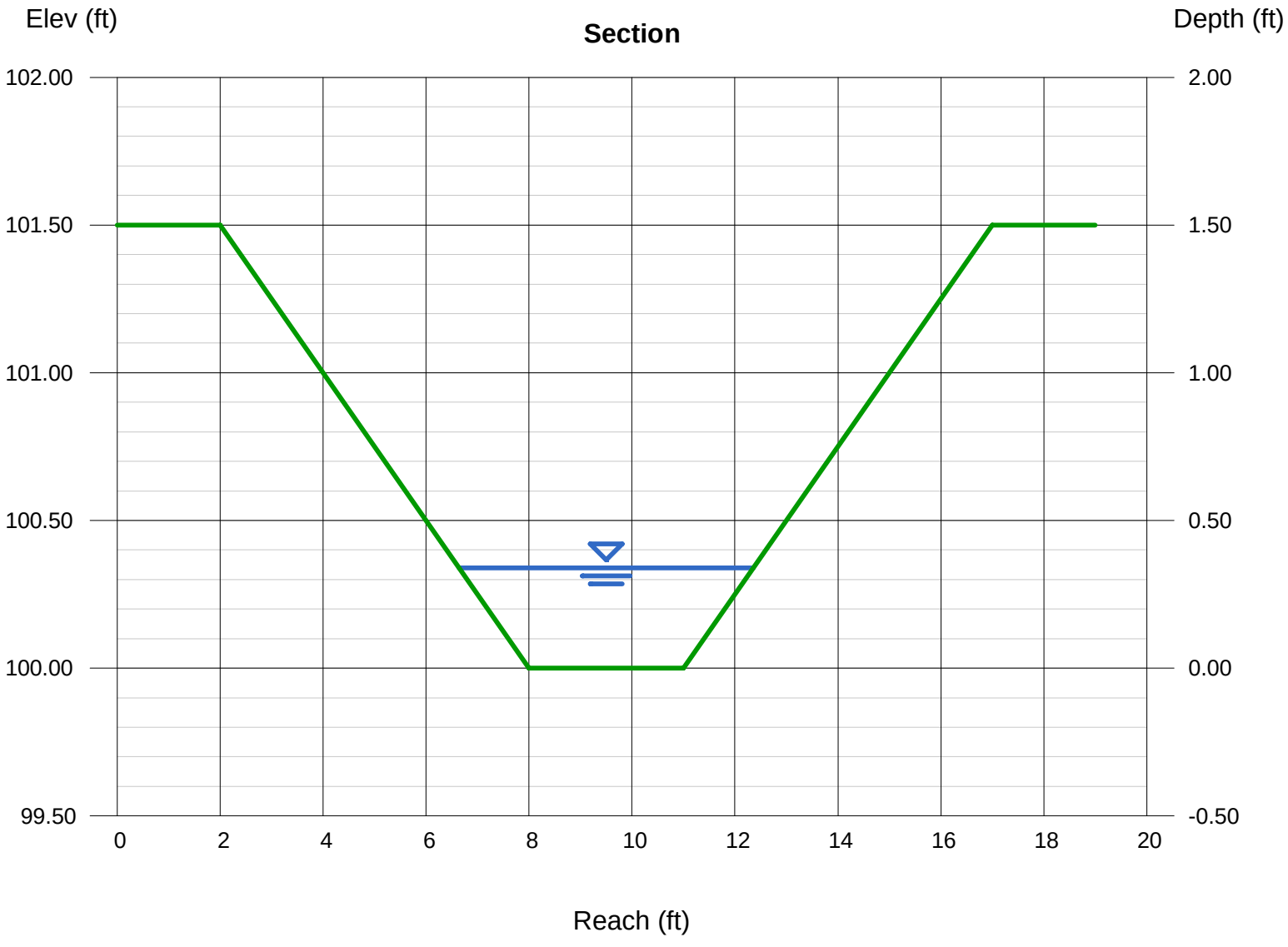
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 100.00
Slope (%)	= 2.50
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.50

Highlighted

Depth (ft)	= 0.34
Q (cfs)	= 4.500
Area (sqft)	= 1.48
Velocity (ft/s)	= 3.04
Wetted Perim (ft)	= 5.80
Crit Depth, Yc (ft)	= 0.35
Top Width (ft)	= 5.72
EGL (ft)	= 0.48



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 11 2024

Hazlett Drive-Emergency Overflow Capacity

User-defined

Invert Elev (ft)	= 7009.31
Slope (%)	= 0.65
N-Value	= 0.018

Calculations

Compute by:	Known Q
Known Q (cfs)	= 60.00

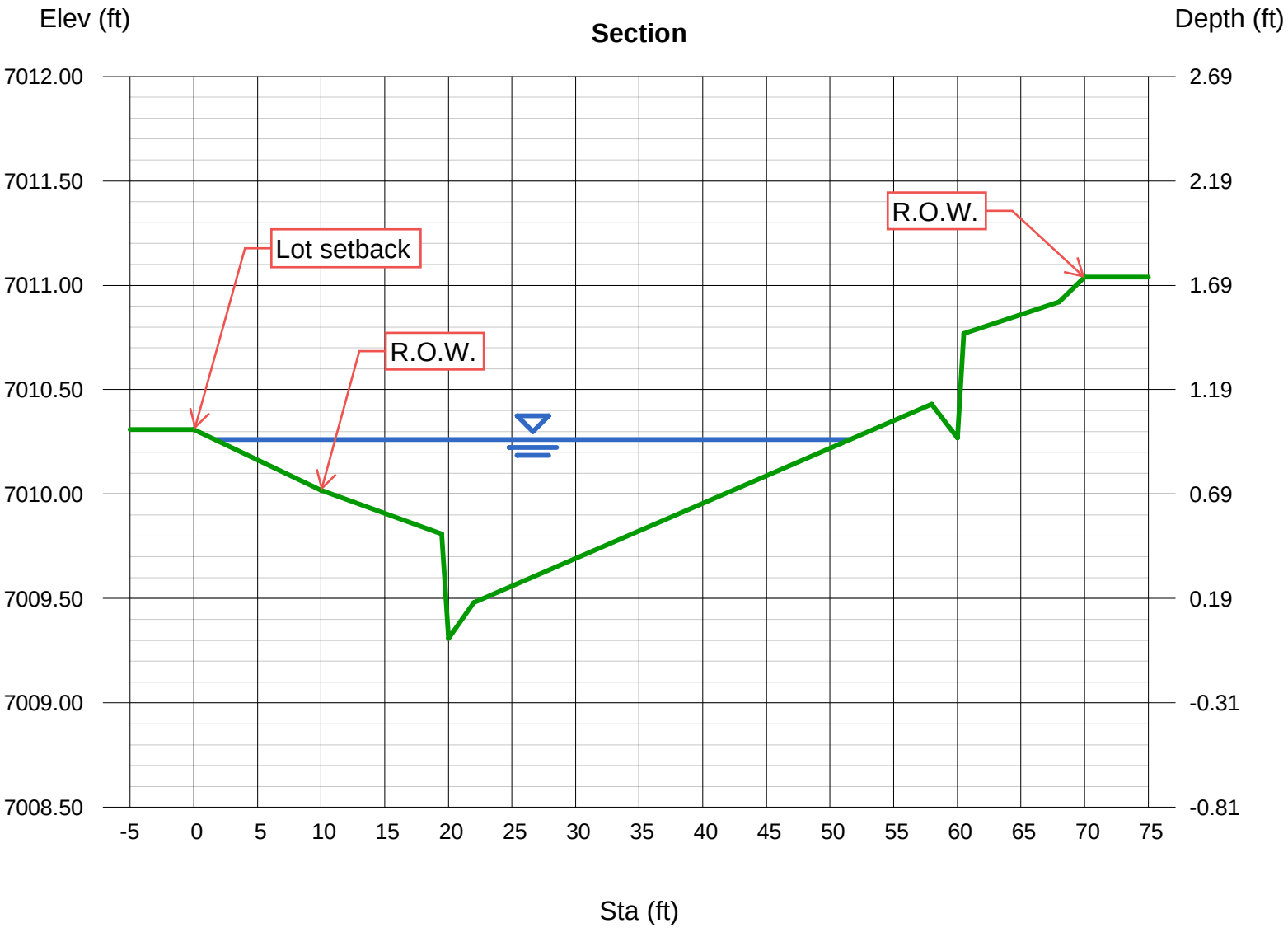
Highlighted

Depth (ft)	= 0.95
Q (cfs)	= 60.00
Area (sqft)	= 17.89
Velocity (ft/s)	= 3.35
Wetted Perim (ft)	= 50.08
Crit Depth, Yc (ft)	= 0.95
Top Width (ft)	= 49.85
EGL (ft)	= 1.12

(Sta, El, n)-(Sta, El, n)...

(0.00, 7010.31) -(10.00, 7010.02, 0.030) -(19.50, 7009.81, 0.013) -(20.00, 7009.31, 0.013) -(22.00, 7009.48, 0.013) -(58.00, 7010.43, 0.016) -(60.00, 7010.27, 0.013) -(60.50, 7010.77, 0.013) -(68.00, 7010.92, 0.013) -(70.00, 7011.04, 0.030)

DP3, DP5, DP8, and DP9 total flow is 23.5 cfs (see exhibit), which is less than maximum capacity



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 11 2024

Sterling Ranch Road-Emergency Overflow Capacity

User-defined

Invert Elev (ft)	= 7006.33
Slope (%)	= 1.80
N-Value	= 0.020

Calculations

Compute by:	Known Q
Known Q (cfs)	= 140.00

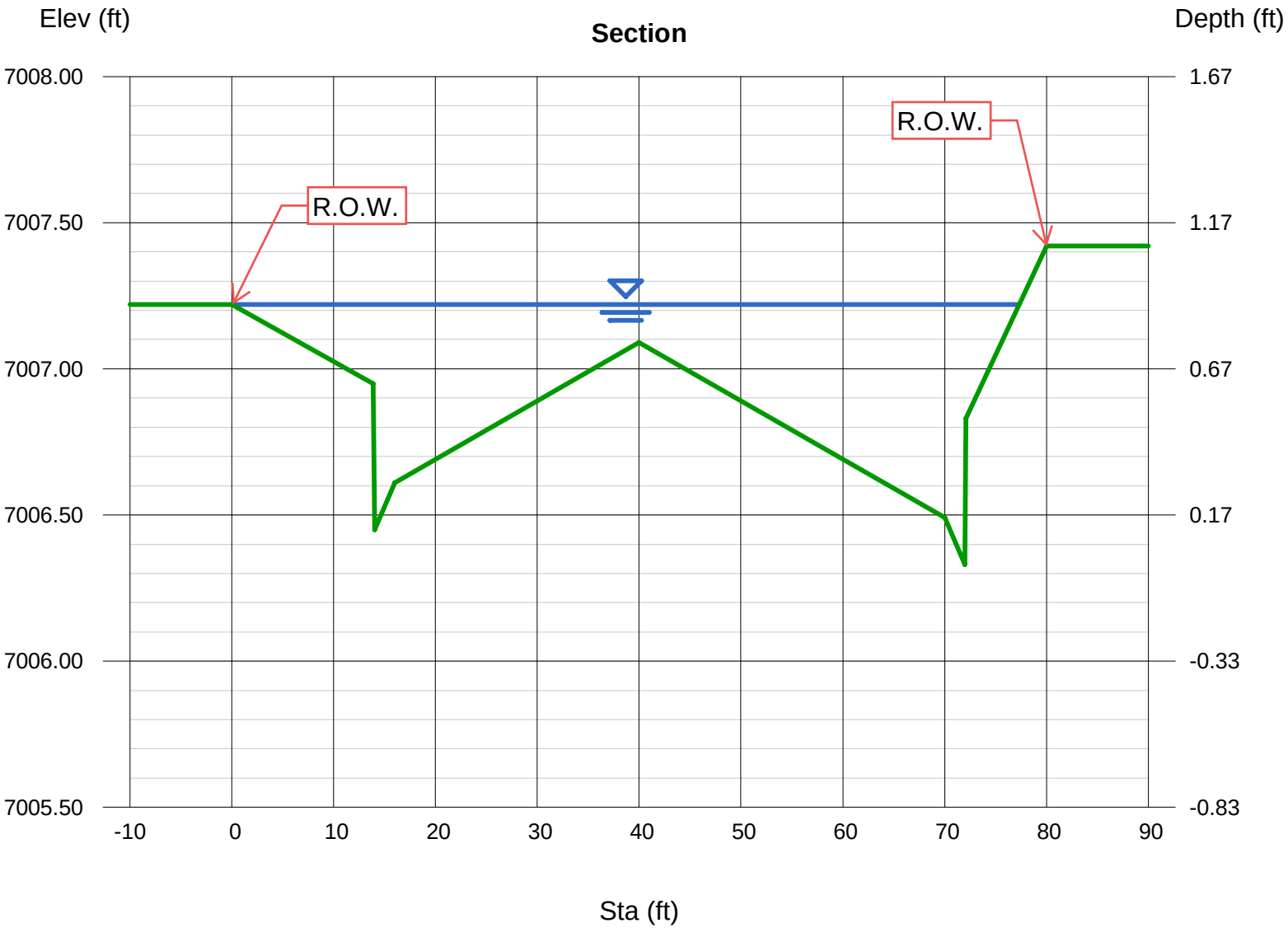
Highlighted

Depth (ft)	= 0.89
Q (cfs)	= 140.00
Area (sqft)	= 27.83
Velocity (ft/s)	= 5.03
Wetted Perim (ft)	= 78.15
Crit Depth, Yc (ft)	= 1.00
Top Width (ft)	= 77.33
EGL (ft)	= 1.28

(Sta, El, n)-(Sta, El, n)...

(0.00, 7007.22) -(13.87, 7006.95, 0.030) -(14.00, 7006.45, 0.013) -(16.00, 7006.61, 0.013) -(40.00, 7007.09, 0.016) -(70.00, 7006.49, 0.016) -(72.00, 7006.33, 0.013) -(72.12, 7006.83, 0.013) -(80.00, 7007.42, 0.030)

DP3, DP5, DP8, and DP9 total flow is 23.5 cfs (see exhibit), which is less than maximum capacity

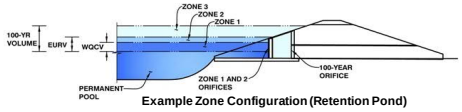


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Sterling Ranch Filing No. 5

Basin ID: Ex. Pond W-5



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 =	57.90%	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) =	3.325	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	11.920	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	9.179	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	12.064	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	14.418	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	18.329	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	21.605	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	25.828	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	34.837	acre-feet	inches
Approximate 2-yr Detention Volume =	7.910	acre-feet	
Approximate 5-yr Detention Volume =	10.426	acre-feet	
Approximate 10-yr Detention Volume =	12.777	acre-feet	
Approximate 25-yr Detention Volume =	15.205	acre-feet	
Approximate 50-yr Detention Volume =	16.688	acre-feet	
Approximate 100-yr Detention Volume =	18.471	acre-feet	

Define Zones and Basin Geometry

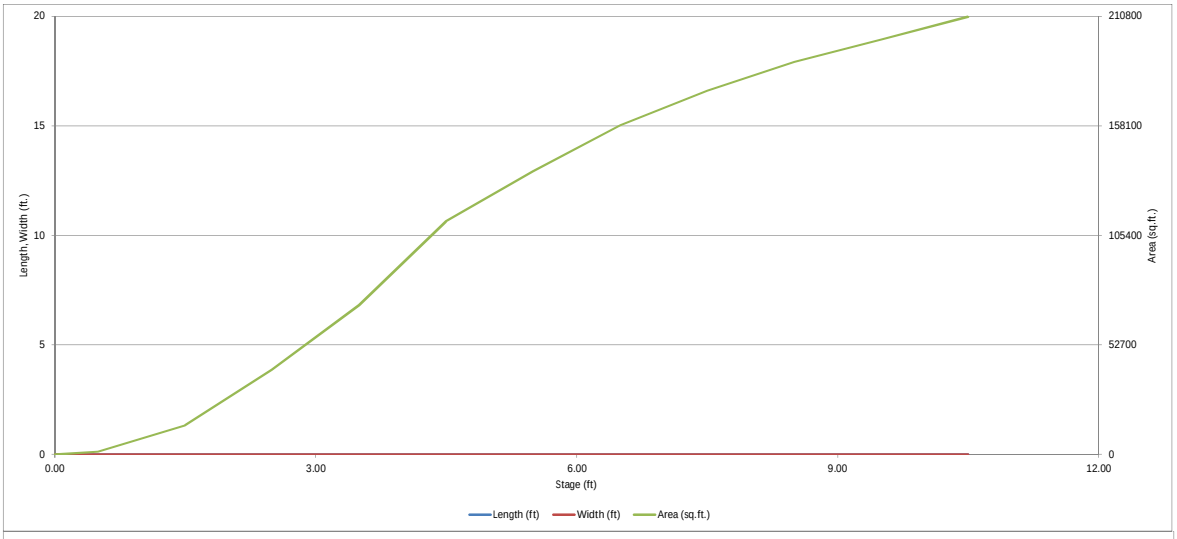
Zone 1 Volume (WQCV) =	3.325	acre-feet
Zone 2 Volume (EURV - Zone 1) =	8.596	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	6.550	acre-feet
Total Detention Basin Volume =	18.471	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention 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

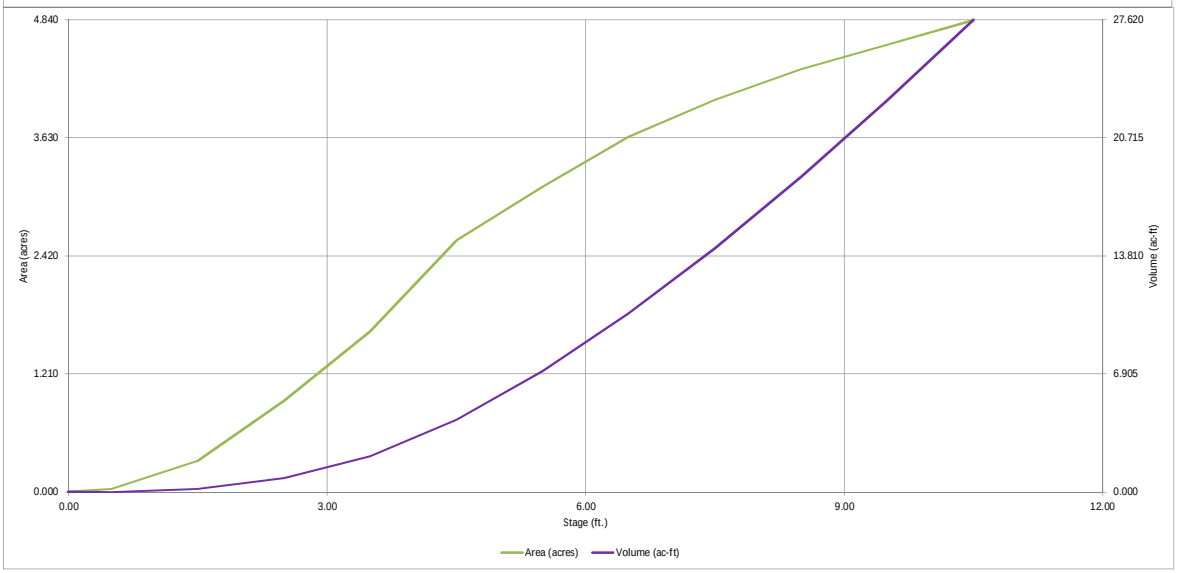
Depth Increment = ft

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)



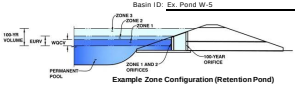


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Sterling Ranch Filing No. 5

Basin ID: Ex. Pond W-5



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.14	3.325	Orifice Plate
Zone 2 (EURV)	6.90	8.596	Rectangular Orifice
Zone 3 (100-year)	8.51	6.550	Weir&Pipe (Restrict)
Total (all zones)		18.471	

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			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

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			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

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

	Zone 3 Restrictor	Not Selected			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

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

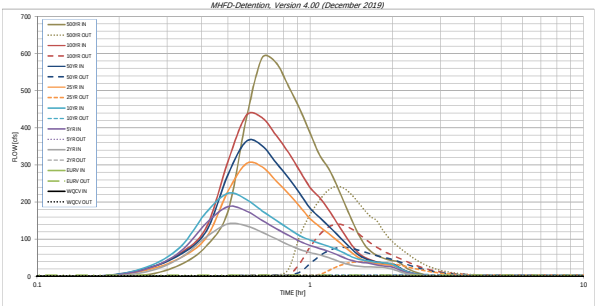
Routed Hydrograph Results

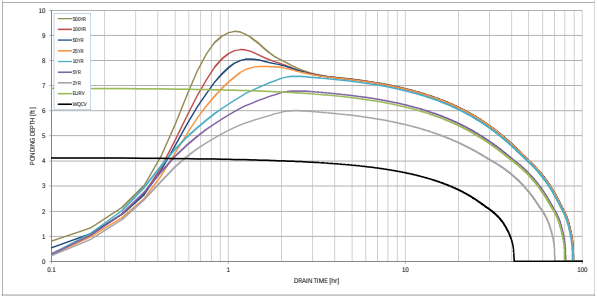
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

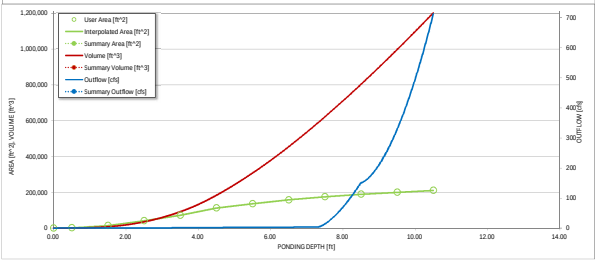
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	3.325	11.920	9.179	12.064	14.418	18.329	21.605	25.828	34.837
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	9.179	12.064	14.418	18.329	21.605	25.828	34.837
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	141.8	188.1	224.0	303.6	363.8	433.7	588.8
Peak Outflow Q (cfs) =	1.7	3.4	3.0	3.4	5.7	39.6	78.3	140.6	242.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.2	1.1	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	71	63	72	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) =	4.14	6.90	6.00	6.79	7.37	7.77	8.06	8.44	9.16
Area at Maximum Ponding Depth (acres) =	2.24	3.79	3.38	3.74	3.97	4.10	4.20	4.32	4.50
Maximum Volume Stored (acre-ft) =	3.342	11.922	8.650	11.470	13.745	15.319	16.563	18.181	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.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
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]
5.00 min	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	1.39	0.14	4.47
	0:15:00	0.00	0.00	12.16	19.85	24.67	16.60	21.38	20.35	31.24
	0:20:00	0.00	0.00	48.86	66.08	78.44	50.01	58.81	62.29	82.05
	0:25:00	0.00	0.00	106.83	143.97	173.41	105.20	122.61	132.51	175.91
	0:30:00	0.00	0.00	141.77	188.08	223.98	229.57	274.91	310.41	424.77
	0:35:00	0.00	0.00	136.54	176.53	207.49	303.63	363.77	433.71	588.85
	0:40:00	0.00	0.00	119.18	151.03	176.72	295.20	351.96	427.71	575.40
	0:45:00	0.00	0.00	101.52	129.15	151.44	257.50	306.09	380.26	511.80
	0:50:00	0.00	0.00	85.29	110.92	128.98	223.00	264.75	333.29	450.35
	0:55:00	0.00	0.00	72.66	94.70	109.71	188.25	223.08	283.68	385.02
	1:00:00	0.00	0.00	64.36	83.50	98.01	155.37	183.58	239.24	326.50
	1:05:00	0.00	0.00	58.39	75.40	89.30	134.57	158.72	212.07	290.99
	1:10:00	0.00	0.00	50.88	67.89	80.92	115.86	136.02	180.00	246.30
	1:15:00	0.00	0.00	42.79	59.21	72.62	98.07	114.42	145.56	197.86
	1:20:00	0.00	0.00	35.82	50.14	63.25	80.41	93.18	113.79	153.49
	1:25:00	0.00	0.00	30.65	43.05	53.33	64.58	74.22	85.69	114.42
	1:30:00	0.00	0.00	27.86	39.43	46.92	51.20	58.43	64.20	84.99
	1:35:00	0.00	0.00	26.51	37.54	43.12	42.88	48.74	51.60	67.78
	1:40:00	0.00	0.00	25.76	34.48	40.44	37.93	42.98	44.36	57.67
	1:45:00	0.00	0.00	25.29	31.23	38.48	34.78	39.31	39.41	50.65
	1:50:00	0.00	0.00	24.92	28.90	37.14	32.63	36.80	36.16	45.95
	1:55:00	0.00	0.00	22.61	27.21	35.56	31.21	35.14	33.85	42.62
	2:00:00	0.00	0.00	19.69	25.37	32.75	30.21	33.98	32.24	40.33
	2:05:00	0.00	0.00	15.59	20.36	26.02	24.67	27.72	26.11	32.54
	2:10:00	0.00	0.00	11.39	14.73	18.72	17.73	19.91	18.75	23.33
	2:15:00	0.00	0.00	8.26	10.67	13.48	12.78	14.34	13.56	16.84
	2:20:00	0.00	0.00	5.94	7.66	9.70	9.24	10.36	9.87	12.24
	2:25:00	0.00	0.00	4.22	5.33	6.85	6.50	7.28	6.97	8.63
	2:30:00	0.00	0.00	2.89	3.62	4.75	4.50	5.04	4.82	5.96
	2:35:00	0.00	0.00	1.95	2.49	3.29	3.18	3.55	3.39	4.19
	2:40:00	0.00	0.00	1.20	1.63	2.10	2.09	2.33	2.22	2.72
	2:45:00	0.00	0.00	0.64	0.95	1.18	1.22	1.36	1.29	1.57
	2:50:00	0.00	0.00	0.27	0.46	0.54	0.59	0.65	0.61	0.74
	2:55:00	0.00	0.00	0.09	0.14	0.15	0.18	0.19	0.18	0.21
	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
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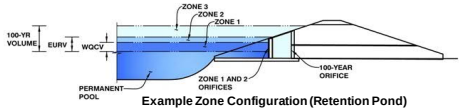
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Sterling Ranch Filing No. 5

Basin ID: Ex. Pond W-8



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	35.99	acres
Watershed Length =	2,151	ft
Watershed Length to Centroid =	1,076	ft
Watershed Slope =	0.021	ft/ft
Watershed Imperviousness =	53.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.644	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	2.049	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.933	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.732	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	3.430	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	4.349	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	5.103	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	6.054	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 6.53 in.) =	19.063	acre-feet	6.53 inches
Approximate 2-yr Detention Volume =	1.555	acre-feet	
Approximate 5-yr Detention Volume =	2.121	acre-feet	
Approximate 10-yr Detention Volume =	2.784	acre-feet	
Approximate 25-yr Detention Volume =	3.035	acre-feet	
Approximate 50-yr Detention Volume =	3.169	acre-feet	
Approximate 100-yr Detention Volume =	3.513	acre-feet	

Define Zones and Basin Geometry

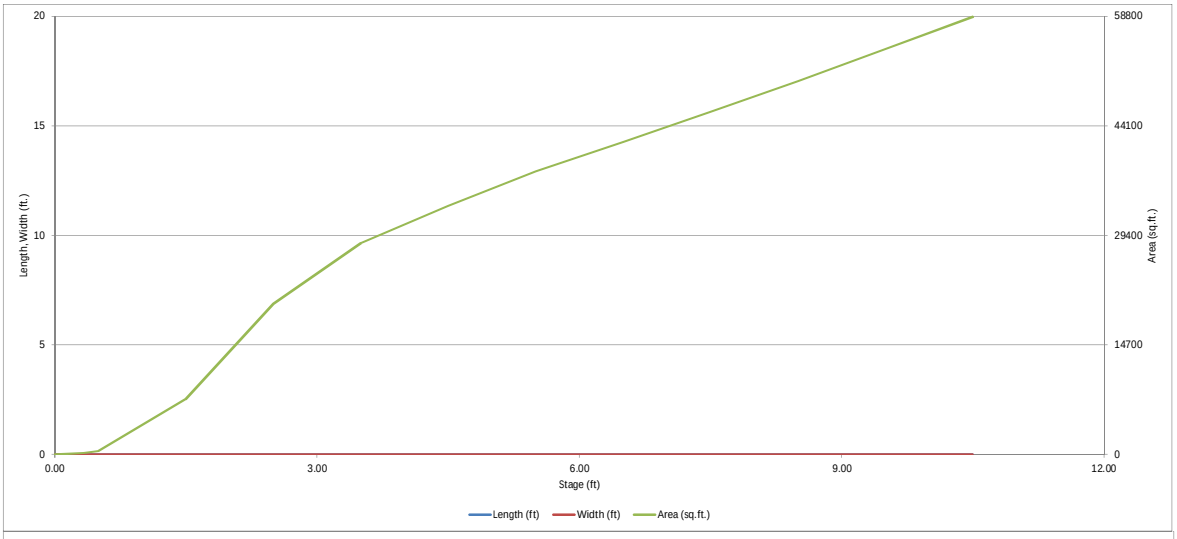
Zone 1 Volume (WQCV) =	0.644	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.405	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.464	acre-feet
Total Detention Basin Volume =	3.513	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

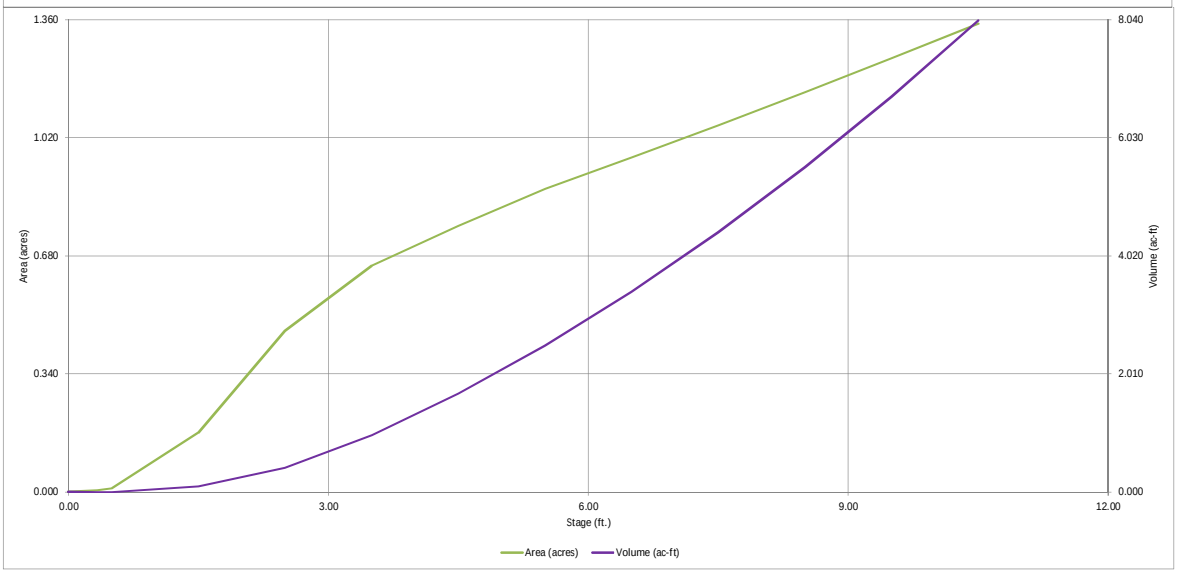
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	10	0.000		
	--	0.33	--	--	--	228	0.005	39	0.001
	--	0.50	--	--	--	457	0.010	97	0.002
7016	--	1.50	--	--	--	7,423	0.170	4,037	0.093
7017	--	2.50	--	--	--	20,206	0.464	17,852	0.410
7018	--	3.50	--	--	--	28,371	0.651	42,140	0.967
7019	--	4.50	--	--	--	33,351	0.766	73,001	1.676
7020	--	5.50	--	--	--	37,998	0.872	108,676	2.495
7021	--	6.50	--	--	--	41,980	0.964	148,665	3.413
7022	--	7.50	--	--	--	46,012	1.056	192,661	4.423
7023	--	8.50	--	--	--	50,147	1.151	240,740	5.527
7024	--	9.50	--	--	--	54,386	1.249	293,007	6.727
7025	--	10.50	--	--	--	58,728	1.348	349,564	8.025

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



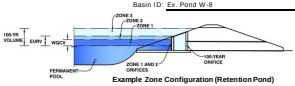


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Sterling Ranch Filing No. 5

Basin ID: Ex. Pond W-8



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.97	0.644	Orifice Plate
Zone 2 (EURV)	4.98	1.405	Orifice Plate
Zone 3 (100-year)	6.61	1.464	Weir&Pipe (Restrict)
	Total (all zones)	3.513	

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 =	4.92	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	1.60	3.20	4.80				
Orifice Area (sq. inches)	2.87	2.90	4.38	2.88				

	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 =	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 Diameter =	N/A	N/A	inches				

Calculated Parameters for Vertical Orifice

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			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.74	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.47	N/A	feet
Overflow Weir Front Edge Length =	9.00	N/A	feet	Overflow Weir Slope Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	4.90	N/A	
Horiz. Length of Weir Sides =	2.91	N/A	feet	Overflow Grate Open Area w/o Debris =	18.90	N/A	ft²
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	9.45	N/A	ft²
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.86	N/A	ft²
Outlet Pipe Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	1.02	N/A	feet
Restrictor Plate Height Above Pipe Invert =	22.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.06	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.65	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.82 feet
Spillway Crest Length =	35.00	feet	Stage at Top of Freeboard =	8.47 feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.15 acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	5.49 acre-ft

Calculated Parameters for Spillway

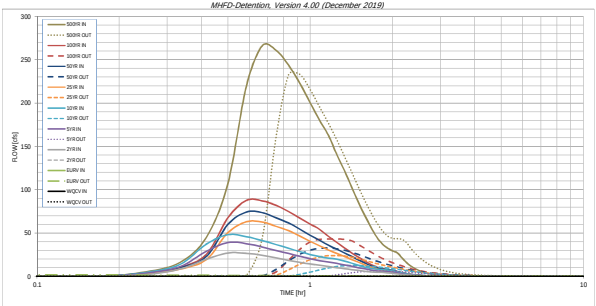
Routed Hydrograph Results

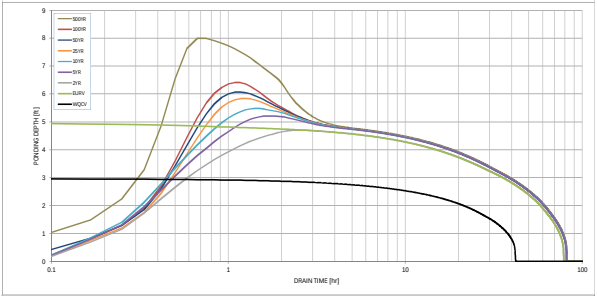
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

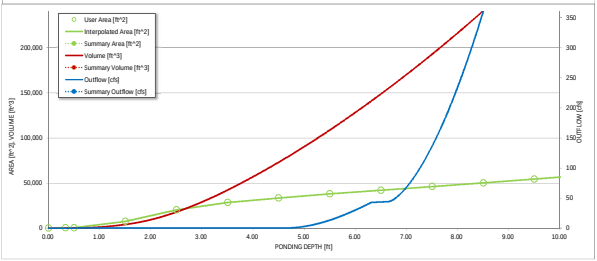
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	6.53
CUHP Runoff Volume (acre-ft) =	0.644	2.049	1.933	2.732	3.430	4.349	5.103	6.054	19.063
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.933	2.732	3.430	4.349	5.103	6.054	19.063
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.3	9.3	14.1	25.5	32.0	41.0	148.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.26	0.39	0.71	0.89	1.14	4.14
Peak Inflow Q (cfs) =	N/A	N/A	27.2	39.3	48.3	63.1	74.3	87.7	266.1
Peak Outflow Q (cfs) =	0.3	2.3	0.6	6.3	12.8	24.2	32.9	43.2	233.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.9	1.0	1.0	1.1	1.6
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.10	N/A	0.3	0.6	1.2	1.7	2.2	2.5
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	71	71	71	69	67	65	63	43
Time to Drain 99% of Inflow Volume (hours) =	41	76	76	78	77	76	75	74	63
Maximum Ponding Depth (ft) =	2.97	4.98	4.71	5.21	5.49	5.94	6.07	6.41	8.00
Area at Maximum Ponding Depth (acres) =	0.55	0.82	0.79	0.84	0.87	0.90	0.92	0.96	1.10
Maximum Volume Stored (acre-ft) =	0.649	2.056	1.831	2.238	2.477	2.797	3.007	3.327	4.952

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	CUHP
	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]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.03	5.36
	0:15:00	0.00	0.00	2.31	3.78	4.68	3.15	3.97	3.84	16.23
	0:20:00	0.00	0.00	8.55	11.38	13.92	8.49	9.93	10.58	45.37
	0:25:00	0.00	0.00	20.00	29.15	37.39	19.66	23.19	25.59	107.89
	0:30:00	0.00	0.00	27.19	39.26	48.28	50.67	60.17	67.85	219.06
	0:35:00	0.00	0.00	26.83	37.93	46.05	63.14	74.32	87.75	266.09
	0:40:00	0.00	0.00	24.50	34.02	41.38	63.02	73.78	87.36	261.15
	0:45:00	0.00	0.00	21.36	29.94	36.88	57.89	67.70	82.00	243.72
	0:50:00	0.00	0.00	18.66	26.64	32.57	52.85	61.80	74.94	222.84
	0:55:00	0.00	0.00	16.39	23.37	28.72	46.59	54.57	67.36	200.37
	1:00:00	0.00	0.00	14.40	20.37	25.32	40.57	47.60	60.42	179.90
	1:05:00	0.00	0.00	12.90	18.14	22.90	35.43	41.63	54.30	162.68
	1:10:00	0.00	0.00	11.43	16.65	21.32	30.57	36.01	46.25	141.02
	1:15:00	0.00	0.00	10.17	15.11	20.00	26.78	31.63	39.46	122.41
	1:20:00	0.00	0.00	9.06	13.40	17.98	23.14	27.30	33.07	103.26
	1:25:00	0.00	0.00	8.02	11.76	15.44	19.79	23.31	27.35	85.82
	1:30:00	0.00	0.00	7.00	10.22	13.03	16.49	19.36	22.35	70.64
	1:35:00	0.00	0.00	6.07	8.85	10.95	13.44	15.70	17.84	57.07
	1:40:00	0.00	0.00	5.34	7.41	9.34	10.75	12.50	13.89	45.75
	1:45:00	0.00	0.00	4.94	6.45	8.42	8.70	10.08	10.93	37.83
	1:50:00	0.00	0.00	4.77	5.88	7.86	7.51	8.68	9.16	32.92
	1:55:00	0.00	0.00	4.28	5.47	7.33	6.76	7.78	8.01	29.67
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	2:45:00	0.00	0.00	0.33	0.42	0.55	0.52	0.58	0.56	2.16
	2:50:00	0.00	0.00	0.23	0.29	0.38	0.37	0.41	0.39	1.50
	2:55:00	0.00	0.00	0.14	0.19	0.24	0.24	0.27	0.25	0.96
	3:00:00	0.00	0.00	0.07	0.11	0.13	0.14	0.15	0.15	0.54
	3:05:00	0.00	0.00	0.03	0.05	0.06	0.07	0.07	0.07	0.24
	3:10:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.06
	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
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	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	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
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	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix D
Reference Material

MASTER DEVELOPMENT DRAINAGE PLAN FOR STERLING RANCH

OCTOBER 2018

Prepared for:

Morley-Bentley Investments, LLC
20 Boulder Crescent, 2nd Floor
Colorado Springs, CO 80903
(719) 471-1742

Prepared by:

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20 Boulder Crescent, Suite 110
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Project #09-002
SKP-18-003
SF-17-024

LEGEND

BASIN ID — SC3-77

DESIGN POINT — 87

REACH IDENTIFIER — RT-17A

PROPERTY BNDRY

BASIN BOUNDARY

FLOW DIRECTION

STORM SEWER

FULL SPECTRUM DETENTION POND — FSD16

DETENTION POND — PNDW3

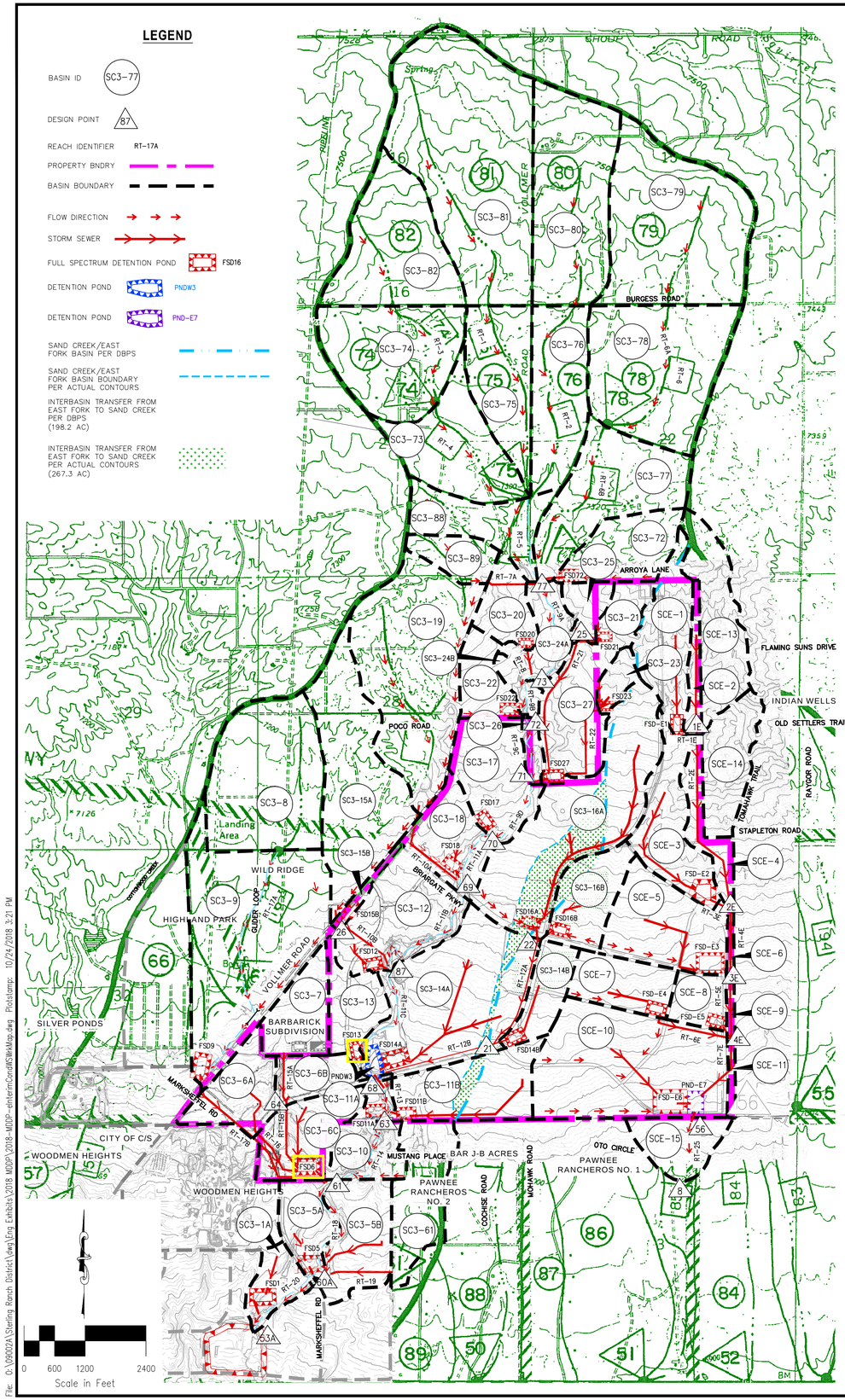
DETENTION POND — PND-E7

SAND CREEK/EAST FORK BASIN PER DBPS

SAND CREEK/EAST FORK BASIN BOUNDARY PER ACTUAL CONTOURS

INTERBASIN TRANSFER FROM EAST FORK TO SAND CREEK PER DBPS (198.2 AC)

INTERBASIN TRANSFER FROM EAST FORK TO SAND CREEK PER ACTUAL CONTOURS (267.3 AC)



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	132.1
SC3-88	62	60.2	0.094	10.5	17.4	27.6	41.8	54.9	69.0
SC3-89	62	27.5	0.043	6.1	10	15.7	23.6	30.8	38.6
SCE-1	65	64.4	0.101	23.3	35.9	53.8	79.1	102.4	127.4
SCE-2	64	15.0	0.023	4.4	7.0	10.8	15.9	20.7	25.7
SCE-3	70	67.5	0.105	30.6	45.2	65.9	93.3	118.0	143.9
SCE-4	70	29.5	0.046	13.3	19.6	28.6	40.6	257.8	62.6
SCE-5	87	85.5	0.134	100.4	130.6	169.6	217.4	257.8	298.4
SCE-6	64	3.8	0.006	1.6	2.5	3.7	5.4	7.0	8.6
SCE-7	89	44.9	0.070	58.9	75.5	96.6	122.2	143.7	165.2
SCE-8	92	25.5	0.040	38.6	48.4	60.7	75.4	87.7	99.9
SCE-9	64	4.0	0.006	1.5	2.4	3.6	5.3	6.8	8.5
SCE-10	83	174.3	0.272	7.6	189.4	19.4	29.1	398.9	467.5
SCE-11	64	5.8	0.009	2.3	3.6	5.5	8.0	10.3	12.8
SCE-13	63	78.6	0.123	19.6	31.3	48.7	73.1	95.7	120.0
SCE-14	63	52.5	0.082	13.2	21.2	33.3	49.9	65.2	81.7
SCE-15	51	39.7	0.062	2.2	5.1	10.1	17.7	25.1	33.4

DESIGN POINT SUMMARY

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

DESIGN POINT SUMMARY (VOLUME)

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

WATER QUALITY & DETENTION POND SUMMARY

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

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

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

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

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

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

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

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

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

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

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

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

SAND CREEK FLOW COMPARISON CHART

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

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)

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

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

WATER QUALITY & DETENTION POND SUMMARY

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

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

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

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

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

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

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

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

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

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

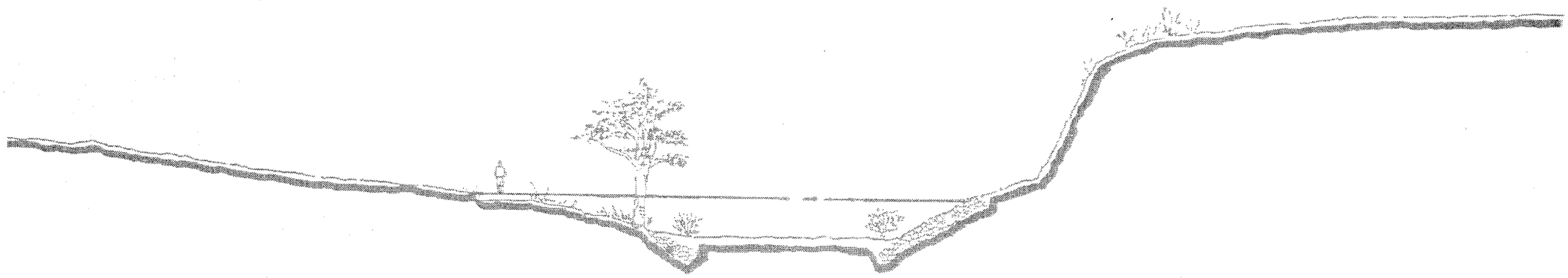
FSD-E1						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	23.3	35.9	53.8	79.1	102.4	127.4
ALLOWABLE RELEASE (CFS)	0.7	11.0	22.1	50.9	65.7	84.1
MODELED RELEASE (CFS)	0.7	5.4	19.9	48.9	62.8	84.0
STORED VOLUME (AC-FT)	1.3	1.3	1.5	1.8	2.1	2.5

FSD-E2						

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN REPORT

CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO



PREPARED FOR:

City of Colorado Springs
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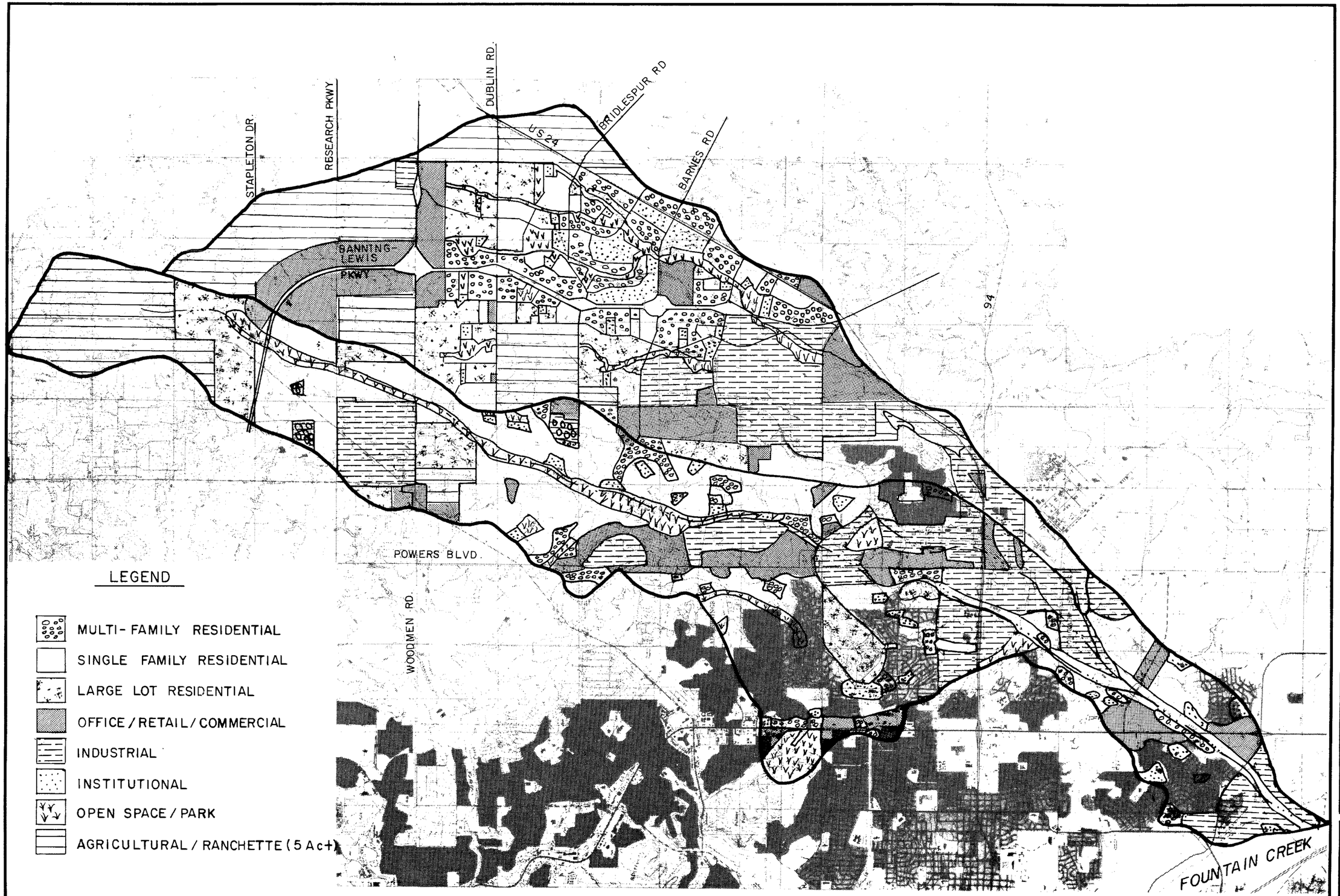


Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PROPOSED LAND USE

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

7

FIG. II-3

Table III-1. Percent Impervious Values.

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

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

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

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

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

EAST BIERSTADT CREEK

WEST BIERSTADT CREEK

EAST FORK SAND CREEK

WOODMEN

HILLS BLVD

STETSON

CONSTITUTION

WEST TRIB TO RANCHES BASIN SAND CREEK

VOLLMER RD

MARKSHEFFEL RD

CENTER TRIBUTARY SAND CREEK

UPPER BASIN SAND CREEK

LOWER BASIN SAND CREEK

POWERS BLVD

WEST FORK SAND CREEK

FOUNTAIN

HANCOCK

GALLEY

PLATTE

FOUNTAIN CREEK

N

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

NEW DOC

FINAL DRAINAGE REPORT
For

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

Sand Creek Drainage Basin

RECEIVED
JUN 08 2016
BY: MY 730

Prepared for:
El Paso County Development Services
Engineering Division

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

Prepared by:

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

June 6, 2016

15.789.001

STERLING RANCH FILING NO. 1
PRELIMINARY DRAINAGE REPORT
(CDOT Type R Inlet Calculations - Sump Condition)

Urban Local Roadway-50' ROW-30' Pavement-6" Vertical Curb
Maximum allowable depth for MINOR (0.43') & MAJOR (0.66') storm

Inlet Length	Storm	Depth	Eqn. 7-31	Eqn. 7-32	Eqn. 7-28
			Qw=CwNwLeD^3/2	Qo=CoNo(LeHc)(2g(D-0.5Hc))^1/2	Qm=Cm(QwQo)^1/2
5	Q_5	0.43	5.1	5.7	5.0
5	Q_{100}	0.66	9.7	8.6	8.5
6	Q_5	0.43	6.1	6.8	6.0
6	Q_{100}	0.66	11.6	10.3	10.2
8	Q_5	0.43	8.1	9.1	8.0
8	Q_{100}	0.66	15.4	13.8	13.6
10	Q_5	0.43	10.2	11.4	10.0
10	Q_{100}	0.66	19.3	17.2	17.0
12	Q_5	0.43	12.2	13.7	12.0
12	Q_{100}	0.66	23.2	20.7	20.3
14	Q_5	0.43	14.2	16.0	14.0
14	Q_{100}	0.66	27.0	24.1	23.7
15	Q_5	0.43	15.2	17.1	15.0
15	Q_{100}	0.66	29.0	25.8	25.4
16	Q_5	0.43	16.2	18.2	16.0
16	Q_{100}	0.66	30.9	27.5	27.1

Table 7-7. Coefficients for various inlets in sumps

Inlet Type	Nw	Cw	No	Co	Cm
CDOT Type 13 Grate	0.7	3.3	0.43	0.6	0.93
Denver No. 16 Grate	0.73	3.6	0.31	0.6	0.9
Curb Opening for Type 13/No. 16 Combination	1	3.7	1	0.66	0.86
CDOT Type R Curb Opening	1	3.6	1	0.67	0.93

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 (55 Dul + 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

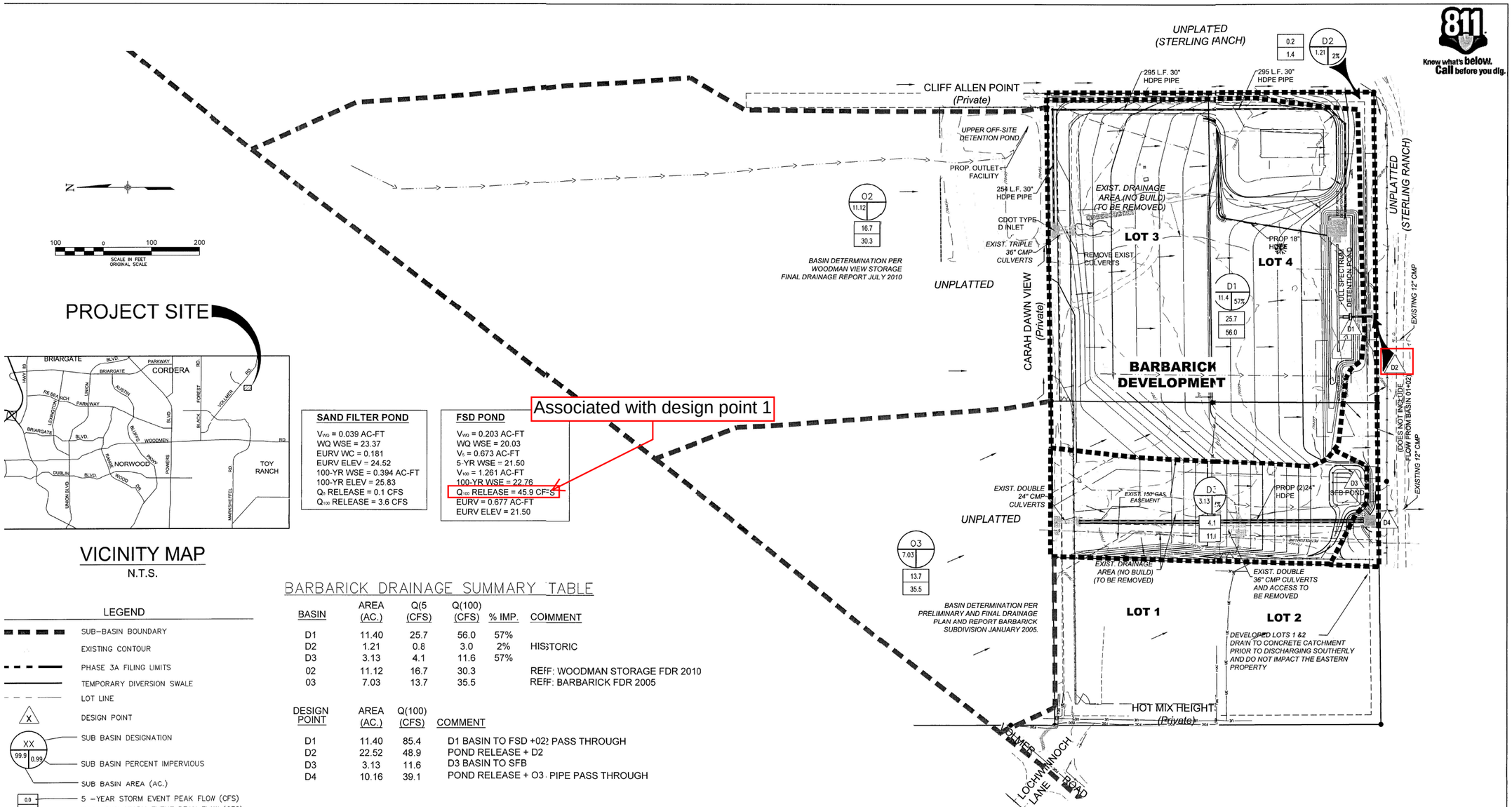
Solve For	Discharge

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.

Associated with design point 1

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_S = 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

LEGEND

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

BARBARICK DRAINAGE SUMMARY TABLE

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

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

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 BEARINGS:

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

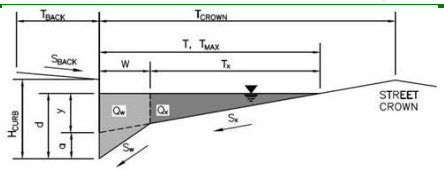
Version 4.05 Released March 2017

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 No. 2

Inlet ID: A8



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.0	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} =	26.0	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 =	0.007	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} =	19.3	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.7	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

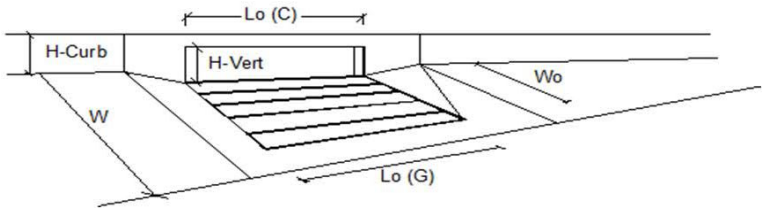
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.5**	**26.7**	**cfs**

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'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



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 =**	**3.0**	**10.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.9**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**85**	**%**

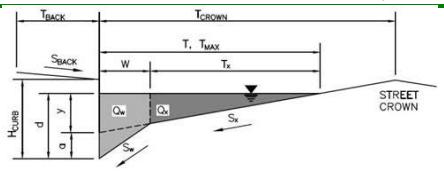
Version 4.05 Released March 2017

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 No. 2

Inlet ID: A9



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.0	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} =	26.0	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 =	0.007	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} =	19.3	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.7	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

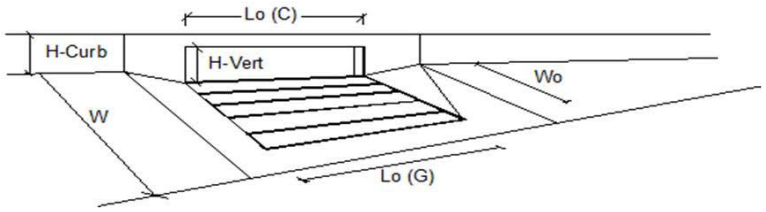
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**11.5**	**26.9**	**cfs**

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'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



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 =**	**2.1**	**4.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**94**	**%**

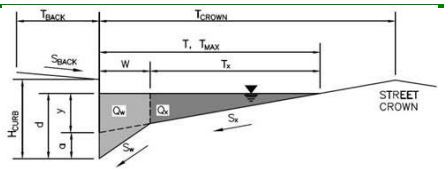
Version 4.05 Released March 2017

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 No. 2

Inlet ID: A11



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0	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} =	38.0	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 =	0.012	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} =	33.0	38.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.1	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

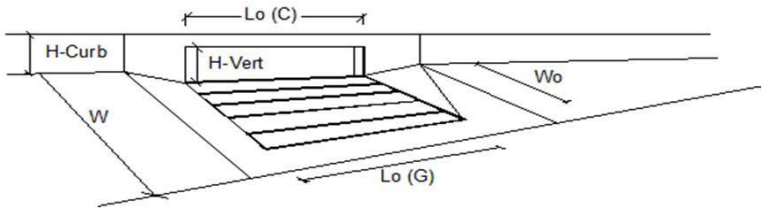
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**15.1**	**63.3**	**cfs**

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'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



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 =**	**8.9**	**13.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.6**	**6.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**93**	**69**	**%**

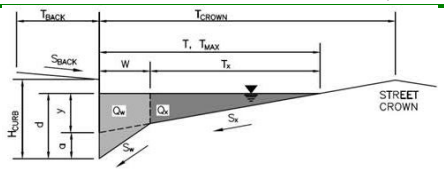
Version 4.05 Released March 2017

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 No. 2

Inlet ID: A15



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.0	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} =	26.0	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 =	0.023	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} =	19.3	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.7	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

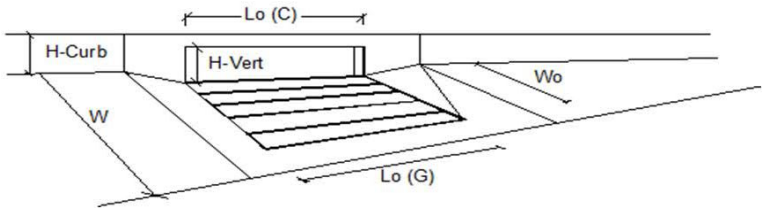
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**19.2**	**36.4**	**cfs**

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'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



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 =**	**5.4**	**10.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**88**	**%**

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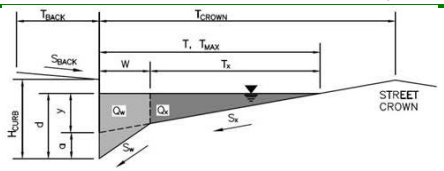
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: Sterling Ranch Filing No. 2

Inlet ID: A16



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.0	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} =	26.0	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 =	0.023	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} =	19.3	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.7	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**19.2**	**36.4**	**cfs**

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'

INLET ON A CONTINUOUS GRADE

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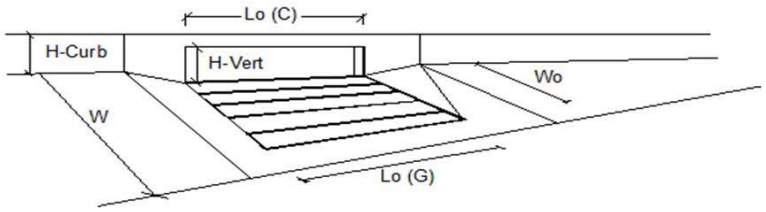
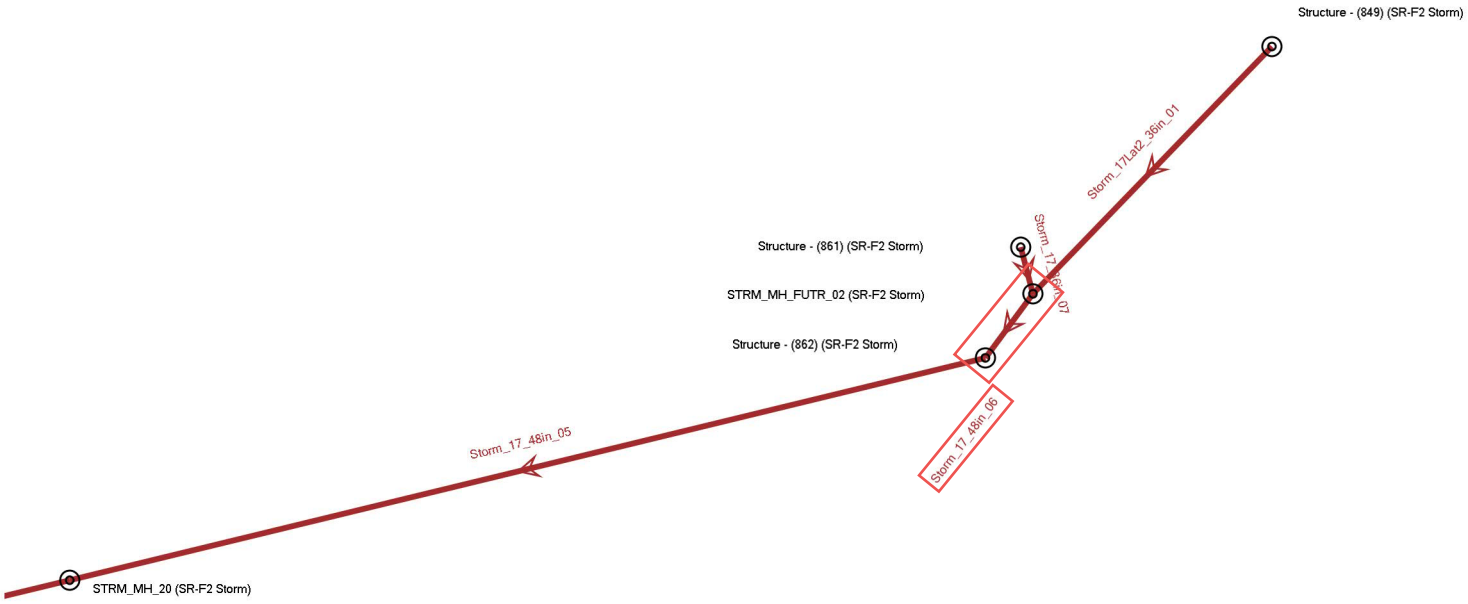


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	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 =**	**4.3**	**7.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**2.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**97**	**73**	**%**

Sterling Ranch 5yr

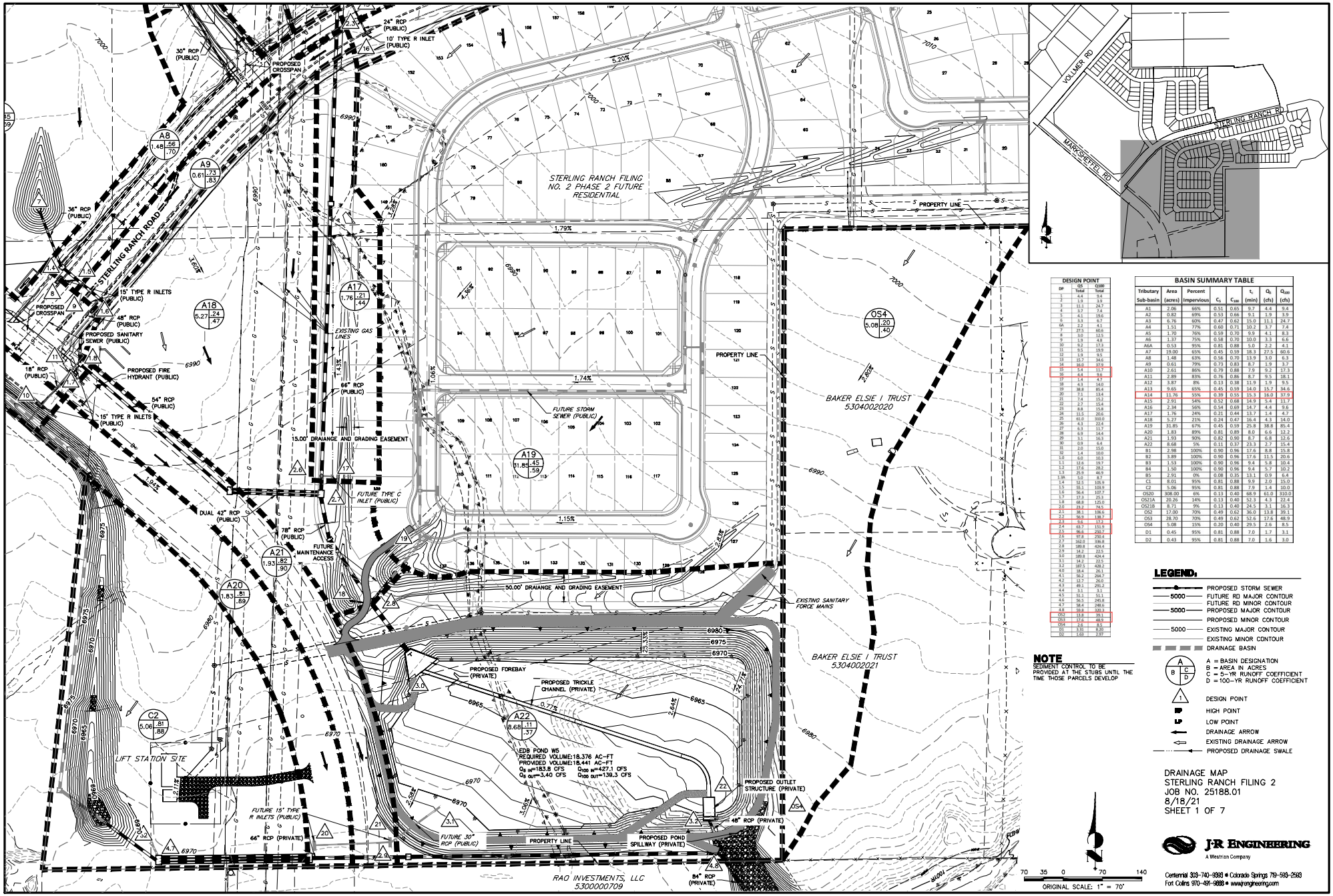


Scenario: 5-YEAR
Current Time Step: 0.000 h
FlexTable: Conduit Table

Label	Flow (cfs)	Diameter (in)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
Storm_21_48in_01	55.10	48.0	57.3	-0.030	0.013	15.91	248.76	6,984.23	6,981.75
Storm_21_48in_02	52.50	48.0	25.8	-0.030	0.013	15.69	248.66	6,984.95	6,984.69
Storm_16_48in_02	68.80	48.0	348.6	-0.024	0.013	15.49	220.31	6,979.03	6,972.39
Storm_17_48in_01	63.70	48.0	15.6	-0.020	0.013	14.28	202.74	6,989.18	6,988.44
Storm_17_48in_05	56.90	48.0	292.3	-0.020	0.013	13.87	203.11	7,000.43	6,994.63
Storm_16_48in_03	56.40	48.0	50.4	-0.020	0.013	13.85	203.42	6,980.18	6,979.56
Storm_16_48in_04	56.40	48.0	42.5	-0.020	0.013	13.83	203.12	6,981.03	6,980.64
Storm_17_48in_06	56.90	48.0	22.6	-0.020	0.013	13.82	202.28	7,000.88	7,000.89
Storm_14_66in_05	96.60	66.0	354.4	-0.014	0.013	13.79	397.24	6,984.12	6,978.30
Storm_16_48in_05	55.10	48.0	26.8	-0.020	0.013	13.74	203.11	6,981.54	6,981.49
Storm_19_Lat 2_18in_01	12.60	18.0	76.7	-0.049	0.013	13.39	23.16	7,006.61	7,002.92
Storm_14_66in_04	96.60	66.0	512.4	-0.012	0.013	13.02	366.67	6,976.96	6,972.10
Storm_17Lat2_36in_01	16.00	36.0	110.1	-0.040	0.013	12.71	133.20	7,005.28	7,001.34
Storm_19_30in_03	25.90	30.0	165.0	-0.024	0.013	12.37	64.17	6,992.63	6,988.66
Storm_18_18in_02	8.70	18.0	82.7	-0.050	0.013	12.29	23.47	6,985.92	6,983.18
Storm_17_48in_04	56.90	48.0	82.9	-0.014	0.013	12.29	172.06	6,994.40	6,993.44
Storm_17_48in_03	56.90	48.0	150.3	-0.014	0.013	12.28	171.79	6,993.21	6,991.28
Storm_17_48in_02	56.90	48.0	102.0	-0.014	0.013	12.19	170.08	6,991.05	6,989.03
Storm_19_24in_05	17.60	24.0	177.0	-0.030	0.013	12.14	39.18	7,002.55	6,996.67
Storm_14_48in_06	38.10	48.0	59.3	-0.017	0.013	11.72	187.87	6,989.32	6,987.79
Storm_14_84in_01	189.80	84.0	107.3	-0.005	0.013	11.25	453.09	6,970.13	6,969.23
Storm_14_72in_03	162.00	72.0	74.5	-0.005	0.013	10.99	306.40	6,971.03	6,971.00
CO-6	23.20	48.0	9.5	-0.021	0.013	10.94	208.41	6,989.62	6,989.67
Storm_14_72in_02	162.00	72.0	127.9	-0.005	0.013	10.80	299.58	6,970.64	6,970.48
Storm_23 54in_05	30.70	54.0	120.0	-0.015	0.013	10.39	240.88	6,957.68	6,955.40
Storm_23 54in_09	30.70	54.0	402.5	-0.015	0.013	10.39	240.88	6,978.16	6,971.61
Storm_23 54in_08	30.70	54.0	567.0	-0.015	0.013	10.39	240.76	6,969.87	6,960.87
Storm_23 54in_06	30.70	54.0	93.0	-0.015	0.013	10.38	240.46	6,959.07	6,957.97
Storm_19_18in_06	6.00	18.0	339.5	-0.040	0.013	10.23	20.95	7,016.00	7,002.92
Storm_17_36in_07	17.60	36.0	9.8	-0.020	0.013	10.21	94.31	7,001.15	7,001.34
Storm_23 54in_10	30.70	54.0	298.5	-0.014	0.013	10.14	232.69	6,982.73	6,978.06
Storm_23 54in_11	30.70	54.0	333.6	-0.014	0.013	10.14	232.65	6,993.98	6,988.82
Storm_23 54in_12	30.70	54.0	412.3	-0.014	0.013	10.14	232.63	7,002.09	6,995.83
Storm_15_18in_02-W	4.30	18.0	25.5	-0.049	0.013	10.08	23.36	6,973.60	6,972.01
Storm_14_36in_07	15.70	36.0	76.3	-0.020	0.013	9.89	94.31	6,991.27	6,989.33
Storm_18_18in_01	17.30	18.0	22.4	-0.059	0.013	9.79	25.59	6,982.43	6,981.79
Storm_19_Lat 1_18in_01	5.00	18.0	36.4	-0.030	0.013	8.78	18.18	6,993.84	6,993.02
Storm_19_Lat 2_18in_02	9.50	18.0	35.3	-0.015	0.013	7.97	12.86	7,007.49	7,007.05
Storm_19_36in_02	25.90	36.0	144.5	-0.006	0.013	7.26	51.15	6,987.99	6,987.48
Storm_19_36in_01	25.90	36.0	302.2	-0.006	0.013	7.25	51.04	6,987.14	6,985.83
Storm_19_Lat 3_18in_01	4.20	18.0	6.0	-0.020	0.013	7.22	14.84	7,016.37	7,016.40
Storm_15_42in_01-E	38.80	42.0	63.9	-0.004	0.013	7.09	65.41	6,971.94	6,971.67
Storm_23 54in_13	30.70	54.0	265.9	-0.005	0.013	6.98	138.03	7,010.66	7,009.20
Storm_21_42in_03	27.50	42.0	101.2	-0.005	0.013	6.92	71.15	6,985.78	6,985.83
Storm_23 54in_14	27.40	54.0	43.7	-0.005	0.013	6.70	136.36	7,011.10	7,011.18
Storm_22_30in_02	8.30	30.0	79.4	-0.009	0.013	6.22	38.24	7,016.69	7,016.15
Storm 23 three 42in_04	32.10	42.0	258.8	-0.008	0.013	6.19	264.00	6,954.49	6,952.34
STRM_29_02	1.60	18.0	79.6	-0.027	0.013	6.11	17.27	7,015.72	7,013.40
Storm_20_48in_01	3.40	48.0	57.9	-0.020	0.013	6.07	203.30	6,961.20	6,959.87
Storm_22_30in_01	16.00	30.0	113.0	-0.005	0.013	6.06	29.03	7,016.09	7,015.50
Storm_16_Lat_1_18in_01	2.10	18.0	13.2	-0.020	0.013	5.99	15.01	6,982.08	6,981.67
Storm_23_84in_02	35.50	84.0	27.0	-0.003	0.013	5.81	347.91	6,947.59	6,947.51
Storm_28 30in_01	8.40	30.0	90.0	-0.007	0.013	5.81	34.60	7,044.20	7,044.15
Storm_19_Lat 3_18in_02	1.90	18.0	29.3	-0.020	0.013	5.79	14.90	7,016.36	7,016.40
Storm_28 30in_01	18.40	30.0	35.4	-0.004	0.013	5.71	25.78	7,044.15	7,043.91
Storm_17_Lat_1_24in_01	9.60	24.0	8.8	-0.006	0.013	5.58	17.03	6,989.73	6,989.65
Storm_23_84in_01	35.50	84.0	200.4	-0.003	0.013	5.55	325.38	6,948.26	6,947.85
STRM_29_01	3.30	18.0	66.2	-0.008	0.013	4.85	9.40	7,013.34	7,012.73
Storm_23_66in_03	32.10	66.0	167.7	-0.002	0.013	4.77	139.63	6,951.31	6,951.02
Storm_17_Lat_1_24in_02	4.30	24.0	53.4	-0.007	0.013	4.76	18.29	6,989.80	6,989.84
Storm_23_66in_02	32.10	66.0	549.0	-0.002	0.013	4.75	138.58	6,950.94	6,949.73
Storm_26 24in_01	2.10	24.0	80.7	-0.010	0.013	4.51	22.68	7,017.31	7,016.41
Storm_19_24in_04	0.50	24.0	144.7	-0.030	0.013	4.31	39.18	6,995.97	6,993.02
Storm_21_Lat_1_18in_01	3.00	18.0	19.4	-0.005	0.013	3.87	7.16	6,985.26	6,985.15
Storm_16_42in_01	68.80	42.0	158.3	-0.002	0.013	3.58	90.47	6,972.29	6,972.10
Storm_25 30in_01	1.40	30.0	28.2	0.005	0.013	3.11	29.93	6,955.70	6,955.54

Scenario: 100-YEAR
Current Time Step: 0.000 h
FlexTable: Conduit Table

Label	Flow (cfs)	Diameter (in)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
Storm_17_48in_01	151.90	48.0	15.6	-0.020	0.013	17.70	202.74	6,990.38	6,989.68
Storm_14_66in_05	250.70	66.0	354.4	-0.014	0.013	17.68	397.24	6,985.83	6,982.04
Storm_20_48in_01	139.30	48.0	57.9	-0.020	0.013	17.42	203.30	6,964.17	6,962.31
Storm_17_48in_05	138.70	48.0	292.3	-0.020	0.013	17.39	203.11	7,001.66	6,996.18
Storm_23 54in_11	233.40	54.0	333.6	-0.014	0.013	16.67	232.65	6,996.60	6,991.45
Storm_23 54in_12	233.40	54.0	412.3	-0.014	0.013	16.67	232.63	7,004.71	6,998.44
Storm_17Lat2_36in_01	37.90	36.0	110.1	-0.040	0.013	16.24	133.20	7,006.00	7,003.91
Storm_14_48in_06	106.60	48.0	59.3	-0.017	0.013	15.42	187.87	6,990.60	6,988.91
Storm_17_48in_04	138.70	48.0	82.9	-0.014	0.013	15.23	172.06	6,995.63	6,994.99
Storm_17_48in_03	138.70	48.0	150.3	-0.014	0.013	15.21	171.79	6,994.44	6,992.83
CO-6	74.50	48.0	9.5	-0.021	0.013	15.20	208.41	6,991.39	6,991.40
Storm_17_48in_02	138.70	48.0	102.0	-0.014	0.013	15.09	170.08	6,992.28	6,991.01
Storm_19_Lat 2_18in_01	19.70	18.0	76.7	-0.049	0.013	14.72	23.16	7,006.74	7,003.66
Storm_23 54in_10	233.40	54.0	298.5	-0.014	0.013	14.68	232.69	6,986.54	6,982.33
Storm_23 54in_09	233.40	54.0	402.5	-0.015	0.013	14.68	240.88	6,981.49	6,975.82
Storm_23 54in_08	233.40	54.0	567.0	-0.015	0.013	14.68	240.76	6,974.99	6,967.00
Storm_23 54in_05	233.40	54.0	120.0	-0.015	0.013	14.68	240.88	6,962.34	6,960.65
Storm_23 54in_13	233.40	54.0	265.9	-0.005	0.013	14.68	138.03	7,015.89	7,011.98
Storm_23 54in_06	233.40	54.0	93.0	-0.015	0.013	14.68	240.46	6,965.32	6,964.01
Storm_18_18in_01	25.30	18.0	22.4	-0.059	0.013	14.32	25.59	6,984.40	6,983.10
Storm_23 54in_14	221.60	54.0	43.7	-0.005	0.013	13.93	136.36	7,019.46	7,018.90
Storm_19_24in_05	30.00	24.0	177.0	-0.030	0.013	13.74	39.18	7,002.90	6,997.04
Storm_19_24in_04	30.00	24.0	144.7	-0.030	0.013	13.74	39.18	6,997.59	6,994.14
Storm_14_36in_07	34.60	36.0	76.3	-0.020	0.013	12.31	94.31	6,991.91	6,991.40
Storm_14_72in_03	336.80	72.0	74.5	-0.005	0.013	11.91	306.40	6,977.10	6,976.63
Storm_14_72in_02	336.80	72.0	127.9	-0.005	0.013	11.91	299.58	6,976.08	6,975.27
Storm_19_18in_06	10.30	18.0	339.5	-0.040	0.013	11.81	20.95	7,016.29	7,003.66
Storm_17_48in_06	138.70	48.0	22.6	-0.020	0.013	11.04	202.28	7,002.97	7,002.76
Storm_14_84in_01	424.40	84.0	107.3	-0.005	0.013	11.03	453.09	6,974.79	6,974.32
Storm_14_66in_04	250.70	66.0	512.4	-0.012	0.013	10.55	366.67	6,981.61	6,978.75
Storm_23_66in_02	243.40	66.0	549.0	-0.002	0.013	10.24	138.58	6,957.00	6,954.11
Storm_23_66in_03	243.40	66.0	167.7	-0.002	0.013	10.24	139.63	6,958.28	6,957.40
Storm_19_Lat 1_ 18in_01	8.70	18.0	36.4	-0.030	0.013	10.18	18.18	6,994.36	6,994.14
Storm_16_48in_02	125.00	48.0	348.6	-0.024	0.013	9.95	220.31	6,982.33	6,979.69
Storm_23_84in_02	382.70	84.0	27.0	-0.003	0.013	9.94	347.91	6,951.54	6,951.16
Storm_23_84in_01	382.70	84.0	200.4	-0.003	0.013	9.94	325.38	6,953.31	6,952.64
Storm_19_30in_03	46.90	30.0	165.0	-0.024	0.013	9.55	64.17	6,993.43	6,991.28
Storm_15_42in_01-E	85.40	42.0	63.9	-0.004	0.013	8.88	65.41	6,975.73	6,975.27
Storm_16_48in_03	107.70	48.0	50.4	-0.020	0.013	8.57	203.42	6,983.38	6,983.10
Storm_16_48in_04	107.70	48.0	42.5	-0.020	0.013	8.57	203.12	6,984.19	6,983.95
Storm 23 three 42in_ 04	243.40	42.0	258.8	-0.008	0.013	8.43	264.00	6,960.38	6,958.69
Storm_21_48in_02	105.90	48.0	25.8	-0.030	0.013	8.43	248.66	6,986.94	6,986.80
Storm_19_Lat 2_18in_02	14.70	18.0	35.3	-0.015	0.013	8.32	12.86	7,008.40	7,007.71
Storm_21_48in_01	103.90	48.0	57.3	-0.030	0.013	8.27	248.76	6,986.27	6,985.97
Storm_16_48in_05	103.90	48.0	26.8	-0.020	0.013	8.27	203.11	6,984.90	6,984.76
Storm_15_18in_02-W	14.00	18.0	25.5	-0.049	0.013	7.92	23.36	6,975.72	6,975.27
Storm_18_18in_02	12.80	18.0	82.7	-0.050	0.013	7.24	23.47	6,987.22	6,985.99
Storm_19_Lat 3_18in_02	3.80	18.0	29.3	-0.020	0.013	7.05	14.90	7,016.96	7,016.97
Storm_17_36in_07	48.90	36.0	9.8	-0.020	0.013	6.92	94.31	7,003.97	7,003.91
STRM_ 29_01	11.80	18.0	66.2	-0.008	0.013	6.68	9.40	7,019.74	7,018.90
Storm_19_36in_02	46.90	36.0	144.5	-0.006	0.013	6.63	51.15	6,990.59	6,989.88
Storm_19_36in_01	46.90	36.0	302.2	-0.006	0.013	6.63	51.04	6,989.53	6,988.04
Storm_16_42in_01	125.00	42.0	158.3	-0.002	0.013	6.50	90.47	6,979.36	6,978.75
Storm_28 30in_01	12.20	30.0	90.0	-0.007	0.013	6.44	34.60	7,044.41	7,044.53
Storm_21_42in_03	60.60	42.0	101.2	-0.005	0.013	6.30	71.15	6,988.41	6,988.04
Storm_21_Lat_1_18in_01	10.60	18.0	19.4	-0.005	0.013	6.00	7.16	6,986.99	6,986.80
Storm_28 30in_01	26.10	30.0	35.4	-0.004	0.013	5.99	25.78	7,044.53	7,044.20
Storm_22_30in_01	29.10	30.0	113.0	-0.005	0.013	5.93	29.03	7,022.08	7,021.51
Storm_17_Lat_1_24in_01	17.20	24.0	8.8	-0.006	0.013	5.47	17.03	6,991.06	6,991.01
Storm_26 24in_01	14.50	24.0	80.7	-0.010	0.013	4.62	22.68	7,022.43	7,022.10
Storm_19_Lat 3_18in_01	6.60	18.0	6.0	-0.020	0.013	3.73	14.84	7,016.99	7,016.97
Storm_22_30in_02	13.70	30.0	79.4	-0.009	0.013	2.79	38.24	7,022.22	7,022.13
Storm_16_Lat_1_18in_01	4.50	18.0	13.2	-0.020	0.013	2.55	15.01	6,984.79	6,984.76
STRM_ 29_02	4.10	18.0	79.6	-0.027	0.013	2.32	17.27	7,020.00	7,019.88
Storm_17_Lat_1_24in_02	7.00	24.0	53.4	-0.007	0.013	2.23	18.29	6,991.23	6,991.18
Storm_25 30in_01	10.00	30.0	28.2	0.005	0.013	2.04	29.93	6,960.67	6,960.65



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	15.6
24	11.5	20.6
25	61.0	310.0
26	4.3	22.6
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	109.7
1.6	56.4	107.7
1.7	17.3	25.3
1.8	68.9	125.0
2.0	33.2	74.5
2.1	38.1	106.6
2.2	56.9	138.7
2.3	9.6	17.9
2.4	69.7	133.9
2.5	96.6	230.7
2.6	97.8	230.4
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	187.1	428.7
4.0	18.4	26.1
4.1	56.2	204.1
4.2	12.7	26.0
4.3	49.1	291.2
4.4	3.1	3.1
4.5	53.1	53.1
4.6	56.5	245.8
4.7	58.4	248.0
4.8	59.8	330.1
OS2	13.8	39.1
OS3	17.6	48.9
OS4	2.6	8.5
D1	1.31	8.39
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	0.76	60%	0.47	0.62	15.0	1.1	2.4
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

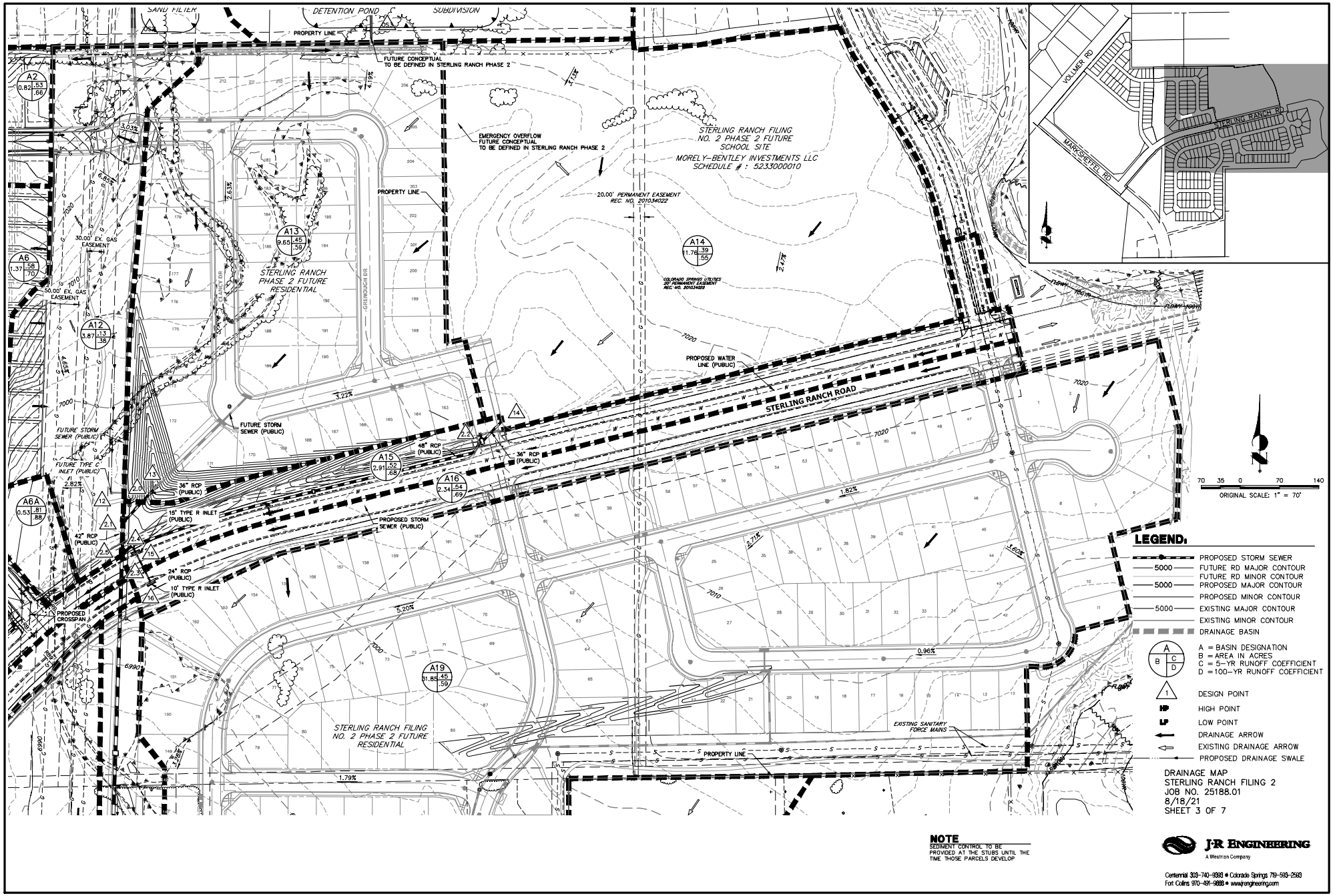
NOTE
SEDIMENT CONTROL TO BE PROVIDED AT THE STUBS UNTIL THE TIME THOSE PARCELS DEVELOP

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

ORIGINAL SCALE: 1" = 70'

J-R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com



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

FINAL DRAINAGE REPORT
FOR
STERLING RANCH FILING NO. 4

Prepared For:

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

August 14, 2023
Project No. 25188.11

Prepared By:

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

PCD Filing No.:
SF-22-030

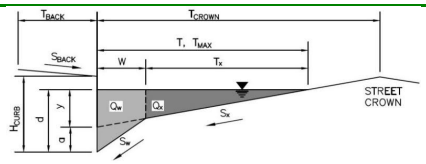
MHFD-Inlet, Version 5.02 (August 2022)

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		☐	☐	

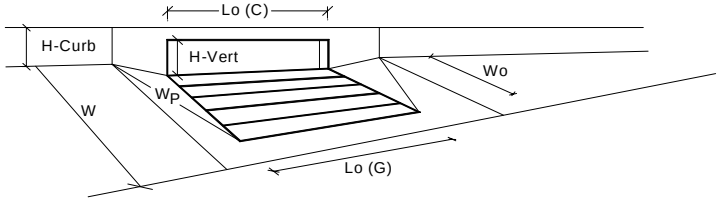
MINOR STORM Allowable Capacity is not applicable to Sump Condition

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)

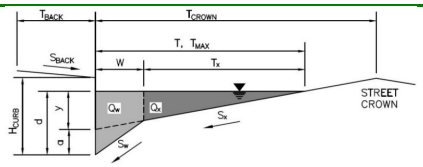


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	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	

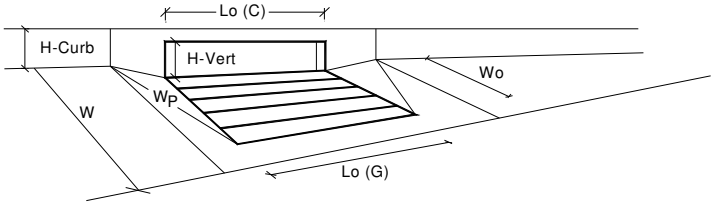
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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)

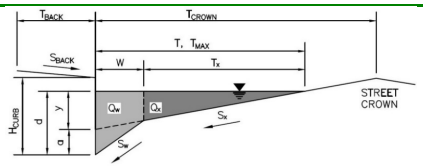


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	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

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	

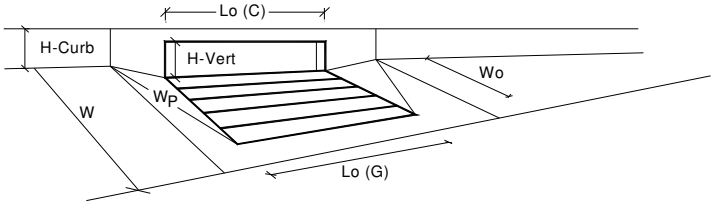
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

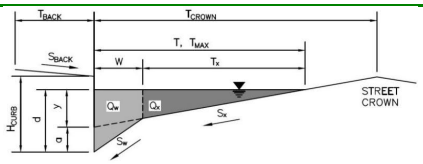
MHFD-Inlet, Version 5.02 (August 2022)

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

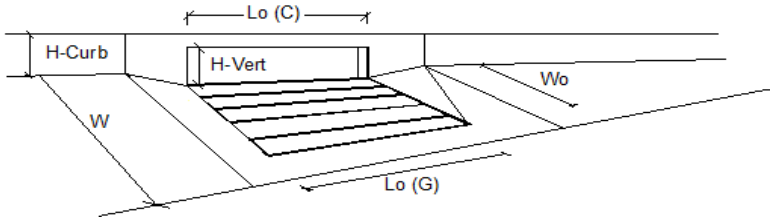
		Minor Storm	Major Storm	
	Q_{allow} =	9.8	16.9	cfs

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	%

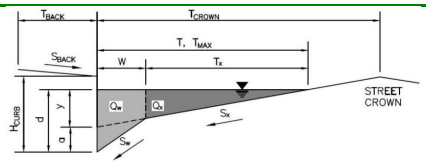
MHFD-Inlet, Version 5.02 (August 2022)

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

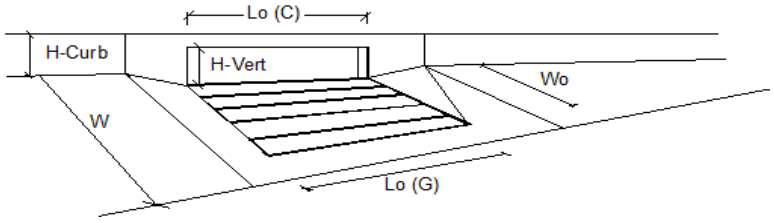
		Minor Storm	Major Storm	
	Q_{allow} =	9.8	16.9	cfs

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	%

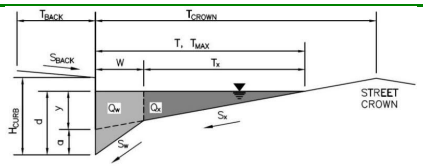
MHFD-Inlet, Version 5.02 (August 2022)

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: 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)		☐	☐	

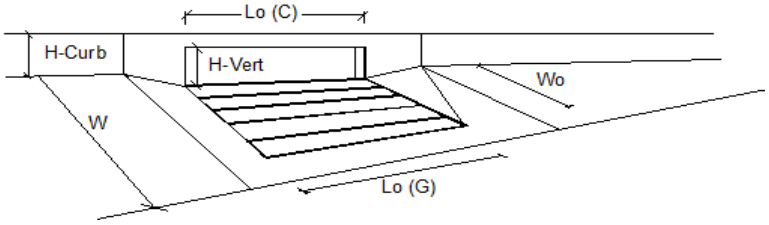
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	16.7	16.7	cfs

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	%

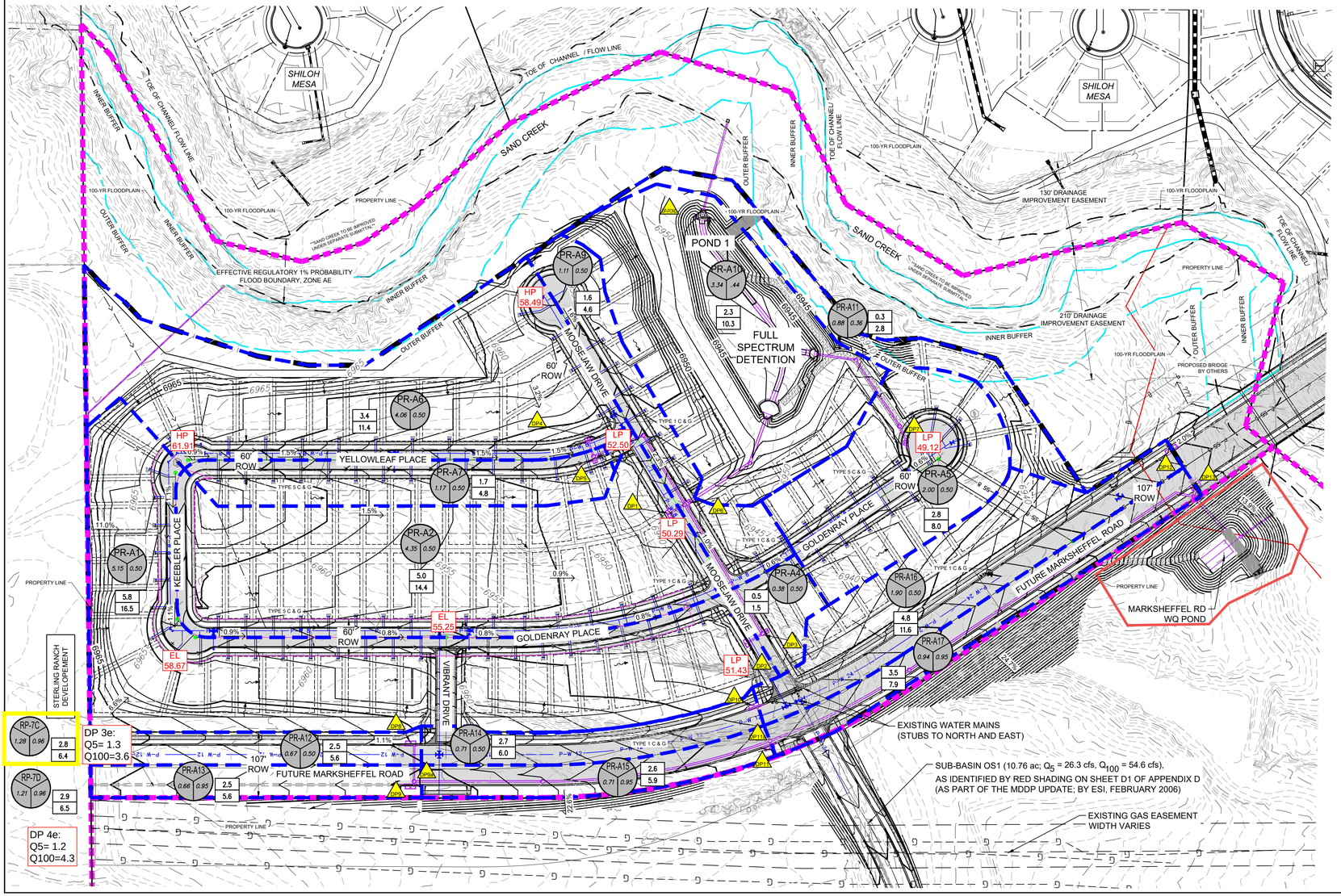
ASPEN MEADOWS

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	21.57	19.9	61.2	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.	-	-
Detention Discharge	-	0.4	3.7						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:

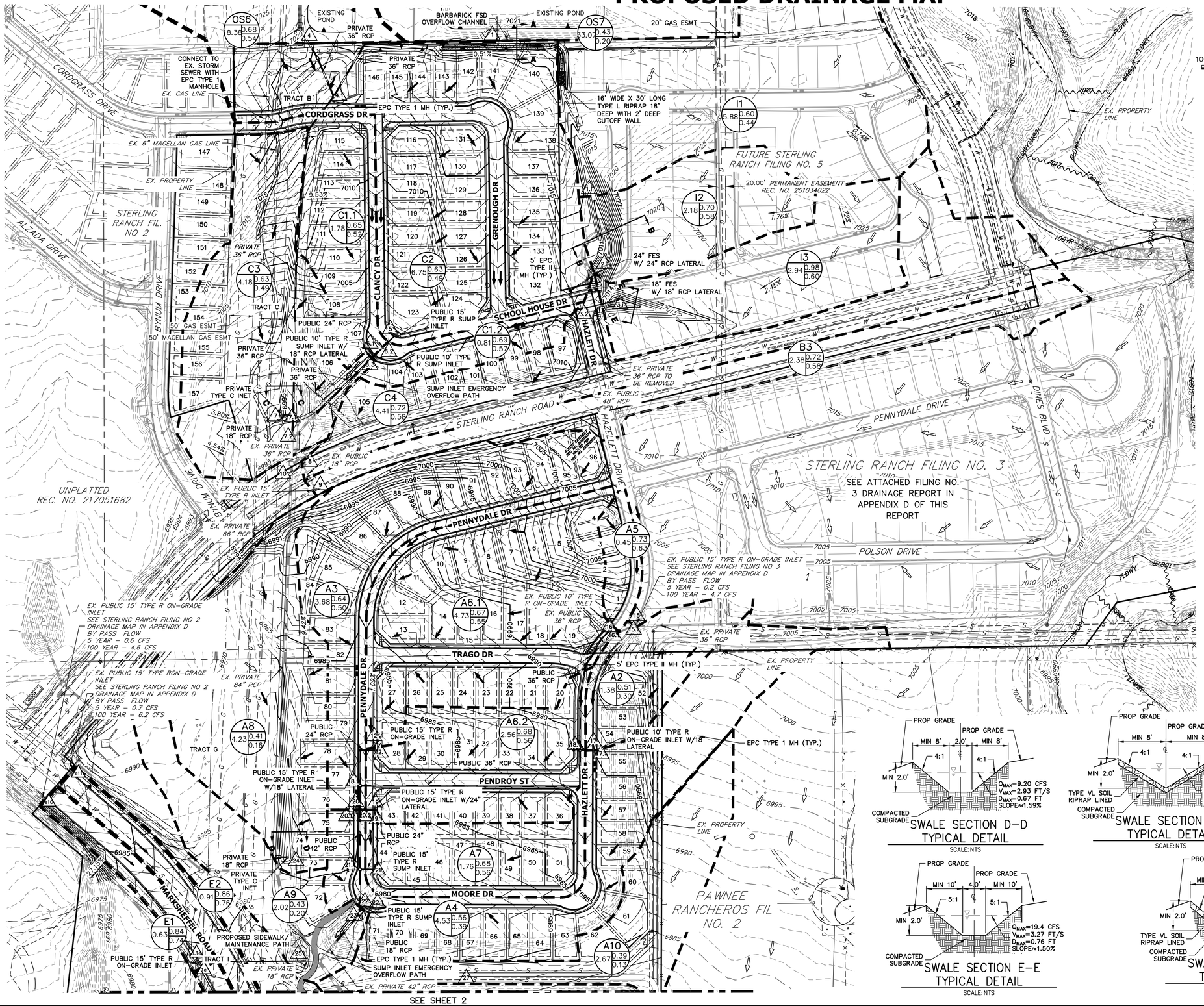
PROJECT NO:	17.886.004.000
DRAWN BY:	CRAIG DOLD
CHECKED BY:	JEFF ODOR
APPROVED BY:	JEFF ODOR
SHEET TITLE:	

DRAINAGE REPORT MAP

DR02

SHEET 2 OF 3

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

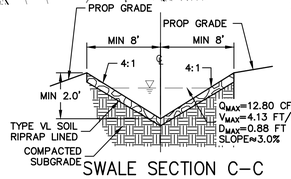
PROPOSED 6100

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

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

SWALE SECTION D–D TYPICAL DETAIL

SCALE: NTS

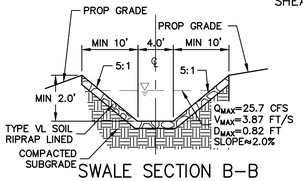


SWALE SECTION C–C TYPICAL DETAIL

SCALE: NTS

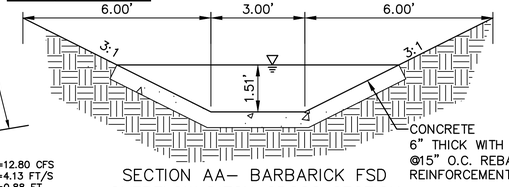
SWALE SECTION E–E TYPICAL DETAIL

SCALE: NTS



SWALE SECTION B–B TYPICAL DETAIL

SCALE: NTS



SECTION AA– BARBARICK FSD OVERFLOW DITCH CROSS SECTION

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

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

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STERLING RANCH FILING NO. 4
PROPOSED DRAINAGE MAP

SEE SHEET 1
MARKSHEFFEL ROAD
MOORE DR
PRIVATE 18" RCP
PRIVATE TYPE C INLET
PUBLIC 15' TYPE R SUMP INLET
PUBLIC 15' TYPE R SUMP INLET
PUBLIC 18" RCP
EPC TYPE 1 MH (TYP.)
SUMP INLET EMERGENCY OVERFLOW PATH
PROP. SIDEWALK/ MAINTENANCE PATH
TRACT I
PROP. PRIVATE 18" RCP FES
EX. PRIVATE 18" RCP
EX. PRIVATE 42" RCP
EX. PRIVATE 84" RCP
PUBLIC 15' TYPE R ON-GRADE INLET
PUBLIC 15' TYPE R ON-GRADE INLET
24" CONCRETE FOREBAY (PRIVATE)
POND W-5
SEE STERLING RANCH FILING 2 PLANS
SEE NOTE BELOW
TRACH H
18" RCP PUBLIC
50.00' GAS ESMT.
24" RCP PUBLIC
PROP. 2' TRICKLE CHANNEL
TRACT J
EX. LIFT STATION
PAWNEE RANCHEROS FIL NO. 2
BAKER ELSIE I TRUST 5304002021
RAO INVESTMENTS, LLC 5300000709
SAND CREEK
FLDWY
100YR
FLDWY
100YR
FLDWY
100YR

FINAL DRAINAGE REPORT FOR BRANDING IRON AT STERLING RANCH FILING NO. 2

EL PASO COUNTY, COLORADO

January 2020

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

Prepared by:

CIVIL CONSULTANTS, INC.
102 E. Pikes Peak, Suite 500
Colorado Springs, CO 80903
(719) 955-5485

Project #09-012
EPC Project # SF-19-018

DP27, 33.84 acres, consists of Pond 8 an existing full spectrum detention pond. Runoff tributary to Pond 8 consists of Basin UU* with runoff coefficients of 0.08 for the 5-year and 0.35 for the 100-year, existing pipe runs PR20*, PR23*, PR26* and proposed pipe run PR2. Developed runoff of Q5=50.0 cfs and Q100=132.0 cfs has been calculated for DP27. A 2.91' X 9' outlet structure is designed to detain and treat all flows reaching DP27. Refer to the Hydraulic Calculations section of the appendix for more information.

Detailed Drainage Discussion (Drainage Basins)

Basins VV and WW, 1.00 acres, consists of proposed residential backyard lots located along the east and south boundaries of the site, with runoff coefficients of 0.22 for the 5-year and 0.46 for the 100-year. Developed combined runoff of Q5=0.9 cfs and Q100=3.0 cfs has been calculated for these basins. Sheet flow produced within the residential backyard lots of Basins VV and WW travels east and south via backyard lot grading towards Sand Creek. Since the total area draining into Sand Creek is less than One acre, no permanent water quality facilities are necessary. No deviation to the EPC code is required or requested.

IMPROVEMENTS TO POND 8

An additional watershed area of 6.22 acres was added to existing Pond 8 from proposed Basin RR and Basin SS. Runoff produced within these basins is collected at Design Point 24 by a proposed 15' CDOT Type R sump inlet and routed to existing Pond 8 via a proposed 24" and existing 30" RCP pipe (Pipe Run 1). The increased volume and hydraulic affects for Pond 8 were analyzed and are summarized in the table below. Adjustments were performed to the design of Pond 8 to accommodate for the increase in tributary impervious area and runoff volume. Refer to the Hydraulic Calculations section of the appendix for more information. A forebay calculation sheet has been included in the appendix. A copy of the draft CD/pond modifications have been included with this report.

Description	MDDP	Branding Iron Fil. No. 2
Watershed Area	28.98 Acres	35.20 Acres
100 yr WSE	7020.59	7021.13
Emergency Spillway Crest EL	7020.60	7021.15
100 yr Volume	2.988 Ac-ft	3.490 Ac-ft
North Forebay Volume Required	643 CF	732 CF
North Forebay Volume Provided	855 CF	855 CF

EROSION CONTROL

It is the policy of the El Paso County that a grading and erosion control plan be submitted with the drainage report. EPC approved "Early Grading Plan for Sterling Ranch Phase I Onsite Grading & Erosion Control", November 18, 2015. And "Early Grading Plan for Sterling Ranch Phase I Offsite Grading & Erosion Control", December 3, 2015. Grading and Erosion control operations are currently underway (August 2016). Grading and Erosion Control will cease with the final development of the site in the next 12-36 months.

CHANNEL IMPROVEMENTS

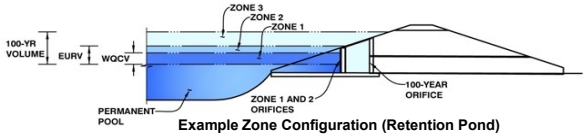
Slope grading and intermittent channel bank lining has been proposed for portions of the developable areas adjacent to Sand Creek to protect the developed lots and prevent excessive erosion until the DBPS recommended Sand Creek Channel improvements are installed. The proposed slope grading is intended to reduce outer bank grades and bring uniformity to areas where significant riling and destabilization has

BRANDING IRON AT STERLING RANCH FIL. NO.2

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: STERLING RANCH FILING NO. 1

Basin ID: POND 8



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Top of MP=7014.54

Selected BMP Type =	EDB	
Watershed Area =	35.20	acres
Watershed Length =	2,151	ft
Watershed Slope =	0.021	ft/ft
Watershed Imperviousness =	53.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	
Water Quality Capture Volume (WQCV) =	0.630	acre-feet
Excess Urban Runoff Volume (EURV) =	2.004	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.671	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.524	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	3.238	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	4.235	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	5.066	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	6.013	acre-feet
500-yr Runoff Volume (P1 = 6.53 in.) =	16.565	acre-feet
Approximate 2-yr Detention Volume =	1.581	acre-feet
Approximate 5-yr Detention Volume =	2.320	acre-feet
Approximate 10-yr Detention Volume =	2.537	acre-feet
Approximate 25-yr Detention Volume =	2.653	acre-feet
Approximate 50-yr Detention Volume =	2.952	acre-feet
Approximate 100-yr Detention Volume =	3.543	acre-feet

Optional User Input 1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
6.53	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.630	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.374	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.540	acre-feet
Total Detention Basin Volume =	3.543	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

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)
Micropool	--	0.00	--	--	--	10	0.000		
	--	0.33	--	--	--	228	0.005	37	0.001
	--	0.50	--	--	--	457	0.010	93	0.002
7016	--	1.50	--	--	--	7,423	0.170	3,964	0.091
7017	--	2.50	--	--	--	20,206	0.464	17,852	0.410
7018	--	3.50	--	--	--	28,371	0.651	42,140	0.967
7019	--	4.50	--	--	--	33,351	0.766	73,001	1.676
7020	--	5.50	--	--	--	37,998	0.872	108,676	2.495
7021	--	6.50	--	--	--	41,980	0.964	148,665	3.413
7022	--	7.50	--	--	--	46,012	1.056	192,661	4.423
7023	--	8.50	--	--	--	50,147	1.151	240,740	5.527
7024	--	9.50	--	--	--	54,386	1.249	293,007	6.727
7025	--	10.50	--	--	--	58,728	1.348	349,564	8.025
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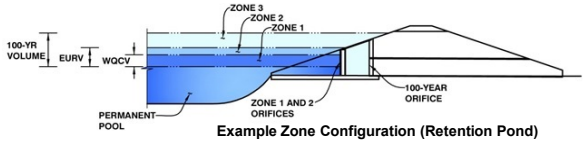
BRANDING IRON AT STERLING RANCH FIL. NO.2

Detention Basin Outlet Structure Design

Project: STERLING RANCH FILING NO. 1

Basin ID: POND 8



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.94	0.630	Orifice Plate
Zone 2 (EURV)	4.92	1.374	Orifice Plate
Zone 3 (100-year)	6.64	1.540	Weir&Pipe (Restrict)
		3.543	Total

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 Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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)
Depth at top of Zone using Orifice Plate =	4.92	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	19.48	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.60	3.20	4.80				
Orifice Area (sq. inches)	2.87	2.90	4.38	2.88				

	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	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.74	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	9.00	N/A	feet
Overflow Weir Slope =	4.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	2.91	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.47	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	4.90	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	18.90	N/A	ft^2
Overflow Grate Open Area w/ Debris =	9.45	N/A	ft^2

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 =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	22.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	3.86	N/A	ft^2
Outlet Orifice Centroid =	1.02	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.06	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.65	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	35.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

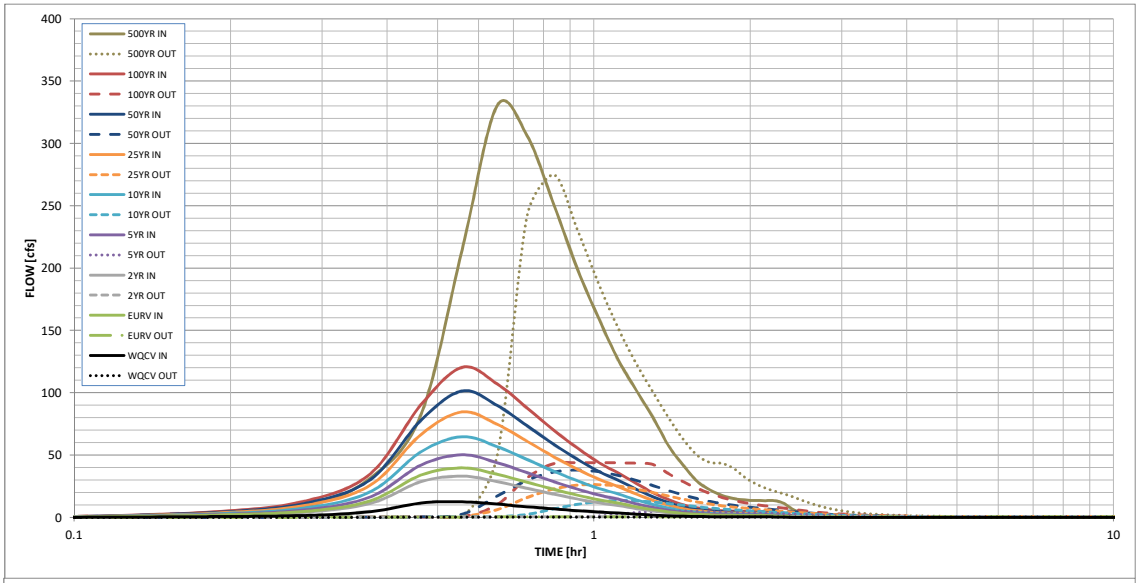
Calculated Parameters for Spillway

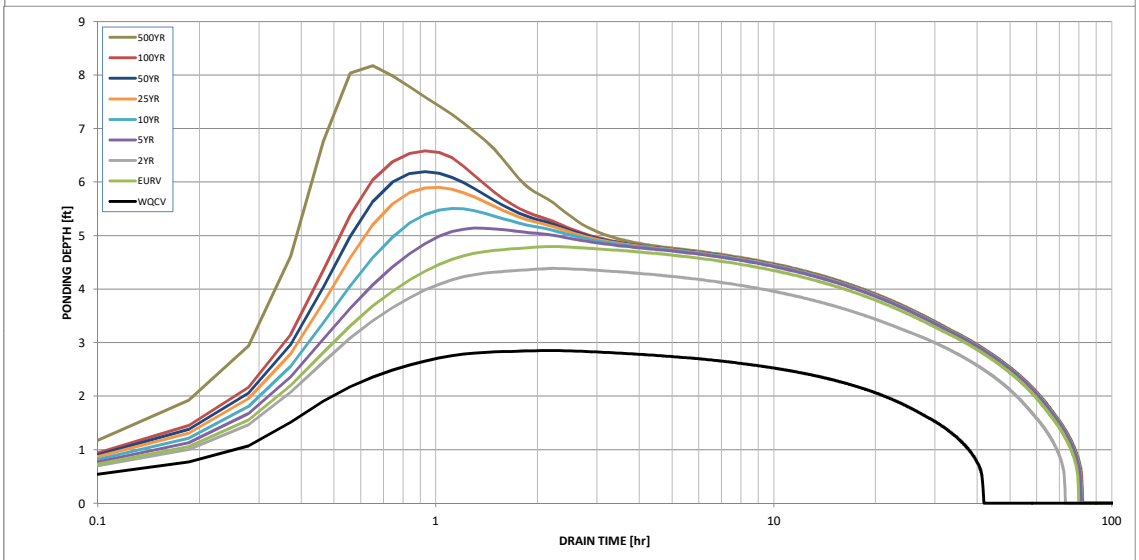
Spillway Design Flow Depth=	1.07	feet
Stage at Top of Freeboard =	8.72	feet
Basin Area at Top of Freeboard =	1.17	acres

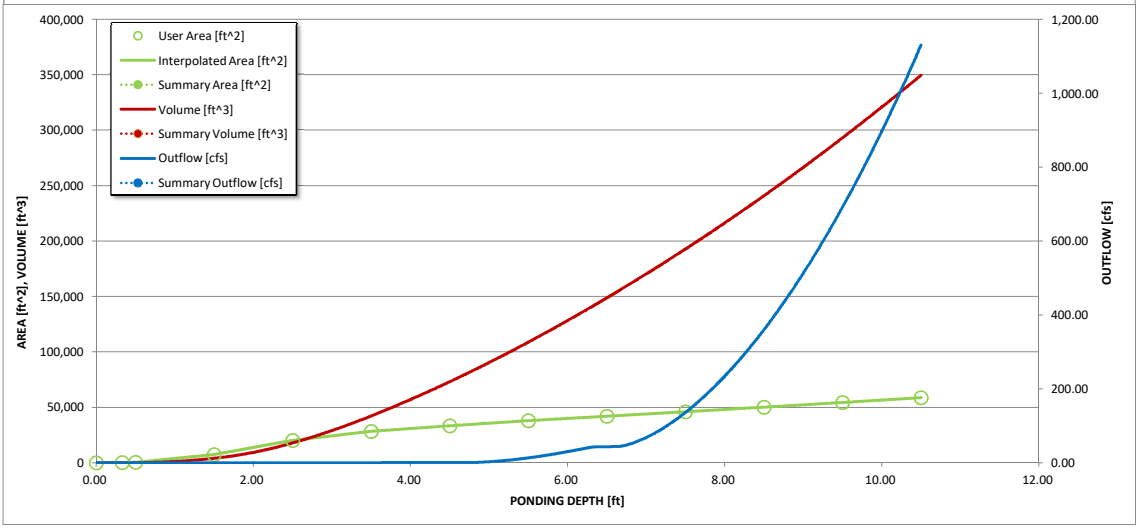
Routed Hydrograph Results

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	1.19	1.50	1.75	2.00	2.25	2.52	6.53
Calculated Runoff Volume (acre-ft) =	0.630	2.004	1.671	2.524	3.238	4.235	5.066	6.013	16.565
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.629	2.003	1.670	2.523	3.237	4.233	5.062	6.008	16.555
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.17	0.34	0.78	1.01	1.29	1.83
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	6.0	12.0	27.5	35.6	45.6	64.5
Peak Inflow Q (cfs) =	12.5	39.7	33.2	50.2	64.6	84.7	101.4	120.4	329.9
Peak Outflow Q (cfs) =	0.3	0.8	0.5	5.0	13.4	26.3	37.8	43.8	274.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	1.1	1.0	1.1	1.0	4.3
Structure Controlling Flow =	Plate	Overflow Grate 1	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.01	N/A	0.2	0.7	1.3	1.9	2.3	2.6
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) =	39	72	66	72	70	67	65	63	47
Time to Drain 99% of Inflow Volume (hours) =	**41**	77	70	77	77	76	75	74	65
Maximum Ponding Depth (ft) =	2.85	4.80	4.39	5.14	5.51	5.90	6.19	6.59	8.17
Area at Maximum Ponding Depth (acres) =	0.53	0.80	0.75	0.83	0.87	0.91	0.94	0.97	1.12
Maximum Volume Stored (acre-ft) =	0.584	1.902	1.585	2.179	2.495	2.851	3.119	3.490	5.152

Detention Basin Outlet Structure Design



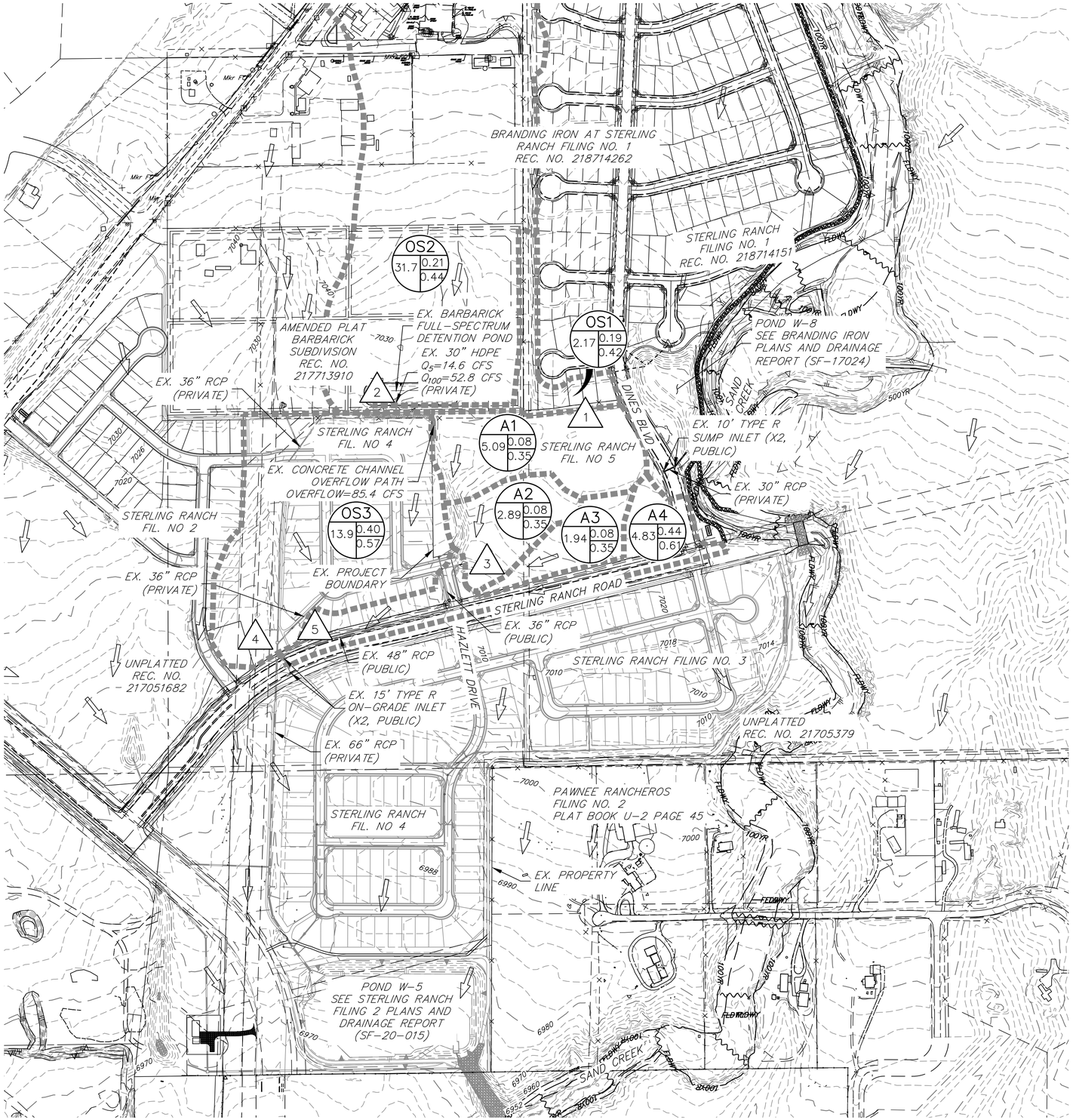




S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Appendix E
Drainage Maps

STERLING RANCH FILING 5
EXISTING DRAINAGE MAP



LEGEND

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

DESIGN POINT

EXISTING FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

SITE BOUNDARY
EXISTING PROPERTY LINE
ROW EXISTING
FL EXISTING
SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING

6100

DESIGN POINT		
DP	Q5 Total	Q100 Total
1	1.7	6.4
2	14.4	51.0
3	3.1	18.7
4	19.4	46.3
5	6.8	16.0

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	5.09	0%	0.08	0.35	28.7	1.0	7.6
A2	2.89	0%	0.08	0.35	15.3	0.8	5.9
A3	1.94	0%	0.08	0.35	17.9	0.5	3.7
A4	4.83	47%	0.44	0.61	18.3	6.8	16.0
OS1	2.17	19%	0.19	0.42	9.6	1.7	6.4
OS2	31.70	20%	0.21	0.44	36.3	14.4	51.0
OS3	13.90	49%	0.40	0.57	15.5	19.4	46.3

300 150 0 300 600

ORIGINAL SCALE: 1" = 300'

STERLING RANCH FILING 5
EXISTING DRAINAGE MAP
JOB NO. 25188.16
03/12/2024
SHEET 1 OF 1

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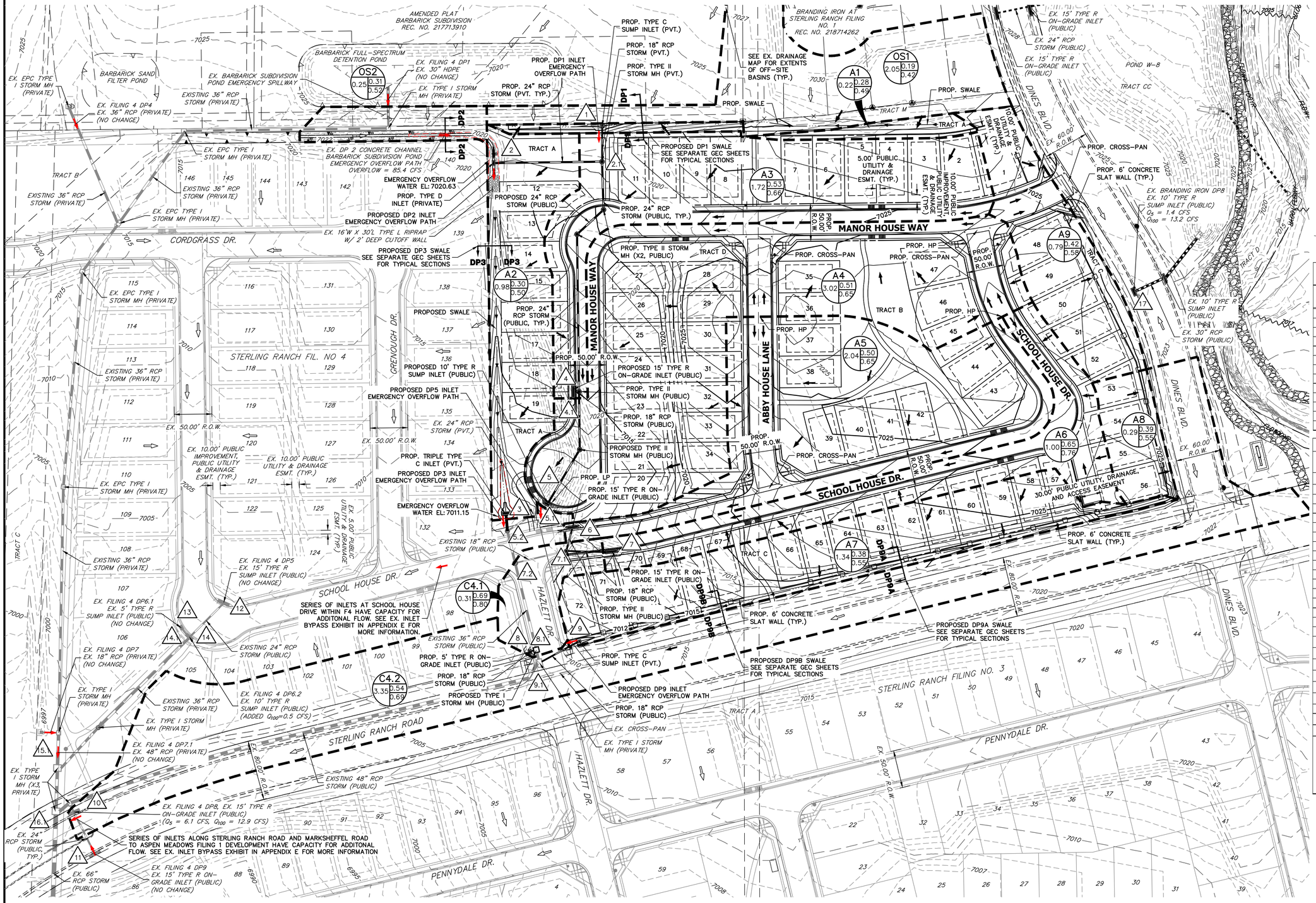
STERLING RANCH FILING NO. 5
PROPOSED DRAINAGE MAP



LEGEND

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

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

EXISTING 6100 PROPOSED 6100

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	0.22	27%	0.28	0.49	10.4	0.2	0.8
A2	0.99	38%	0.30	0.50	17.1	1.0	3.1
A3	1.72	66%	0.53	0.66	13.4	3.4	7.9
A4	3.02	63%	0.51	0.65	15.0	5.5	13.1
A5	2.04	60%	0.51	0.66	13.2	3.9	9.3
A6	1.00	78%	0.65	0.76	9.0	2.8	5.9
A7	1.34	53%	0.38	0.55	18.5	1.6	4.5
A8	0.29	54%	0.39	0.55	10.7	0.4	1.2
A9	0.79	54%	0.42	0.58	7.2	1.5	3.8
OS1	2.05	20%	0.19	0.42	9.6	1.6	6.7
OS2	0.25	28%	0.31	0.52	8.6	0.3	1.0
C4.1	0.31	79%	0.69	0.80	5.0	1.1	2.3
C4.2	3.35	61%	0.54	0.69	19.0	5.8	14.0

DESIGN POINT

DP	Q5 Total	Q100 Total
1	1.8	7.3
2	0.3	1.0
2.1	2.1	8.3
3	1.0	3.1
4	3.4	7.9
4.1	5.3	15.3
5	5.5	13.2
5.1	10.5	27.7
5.2	10.9	29.9
6	3.9	9.3
7	2.8	5.9
7.1	6.3	14.0
7.2	16.5	42.7
8	1.1	2.3
8.1	17.1	43.8
9	1.6	4.5
9.1	18.2	47.3
10	6.1	15.3
11	3.8	7.9
12	12.0	25.9
13	3.9	19.3
14	2.0	7.3
14.1	16.9	36.1
15.1	30.0	93.5
16.1	75.0	197.5
17	2.9	17.0

Values in BLUE indicate they are from the approved "Final Drainage Report for Sterling Ranch Filing No. 4" dated August 14, 2023 by JR Engineering.

NOTES

1. SEE EXISTING DRAINAGE MAP FOR FULL EXTENTS OF OFF–SITE BASINS.
2. SEE SEPARATE POND AND INLET OVERFLOW EXHIBITS FOR CALCULATIONS SHOWING POND OVERFLOW AND CLOGGED INLET FLOWS ARE SAFELY ROUTED.

60 30 0 60 120

ORIGINAL SCALE: 1" = 60'

STERLING RANCH FILING NO. 5
PROPOSED DRAINAGE MAP
JOB NO. 25188.16
04/29/24
SHEET 1 OF 1

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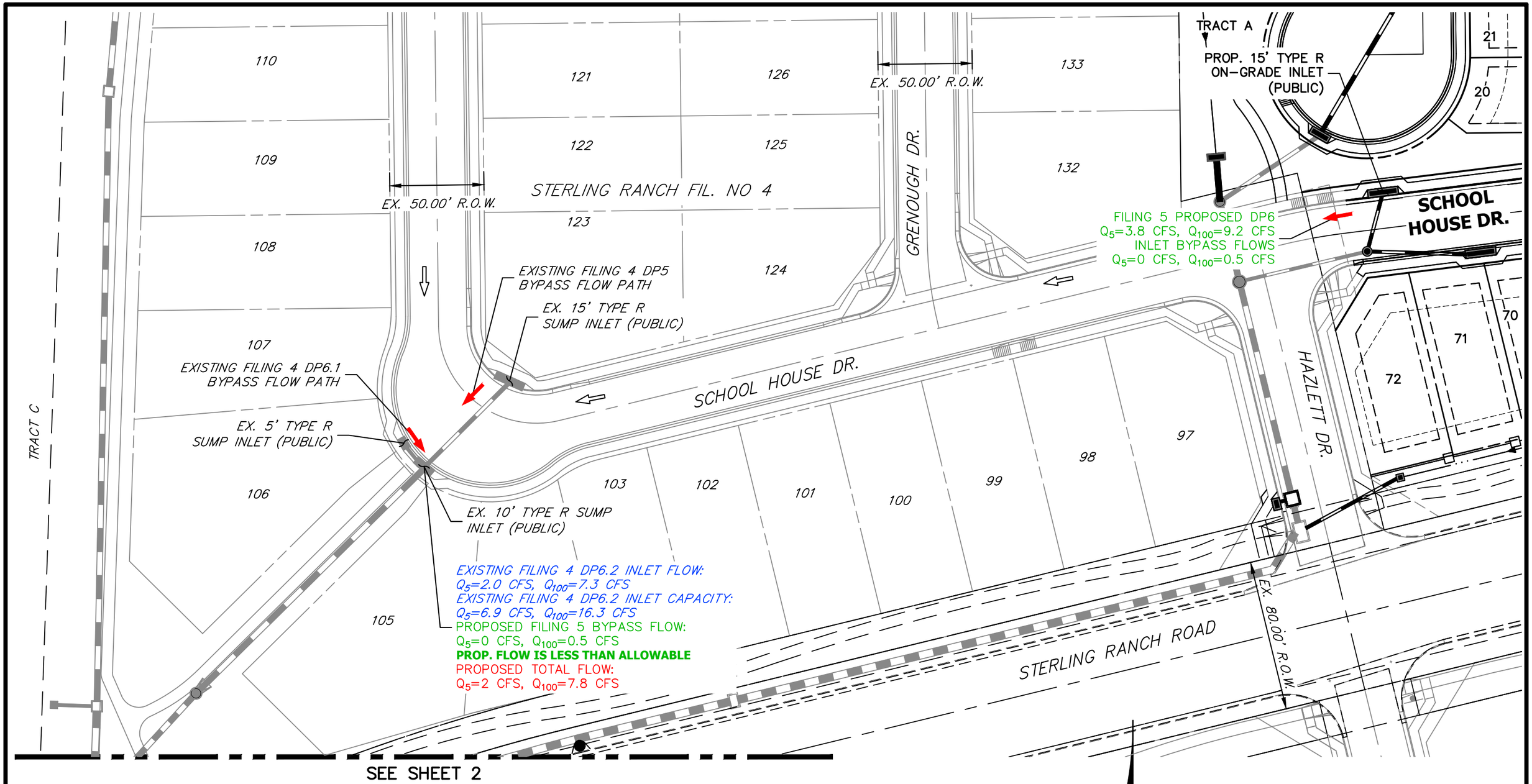

LEGEND

- INLET BYPASS FLOW PATH
- EXISTING DRAINAGE PATH

NOTES

1. FOR DETAILED EXISTING INLET AND BYPASS FLOW INFORMATION, SEE "FINAL DRAINAGE REPORT FOR STERLING RANCH FILING NO. 4" BY JR ENGINEERING, DATED AUGUST 14, 2023.

50 25 0 50

ORIGINAL SCALE: 1" = 50'

EX. INLET BYPASS EXHIBIT
STERLING RANCH FILING NO. 5
JOB NO. 25188.16
04/25/24
SHEET 1 OF 2

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SEE SHEET 1

FILING 5 PROPOSED DP10
Q_5=6.1 CFS, Q_{100}=15.3 CFS
FILING 4 EXISTING DP8
Q_5=6.1 CFS, Q_{100}=12.9 CFS
INCREASE IN FLOWS
FOR BYPASS ROUTING
Q_5=0 CFS, Q_{100}=2.4 CFS

EX. 80.00' R.O.W.

EX. 15' TYPE R ON-GRADE INLET (PUBLIC)

UNPLATTED
REC. NO.
217051682

STERLING RANCH ROAD

EX. 15' TYPE R ON-GRADE INLET (PUBLIC)

EXISTING FILING 2 DP8
BYPASS FLOW PATH

EX. 15' TYPE R ON-GRADE INLET (PUBLIC)

EXISTING FILING 4 DP11
BYPASS FLOW PATH

MARKSHEFFEL ROAD

TRACT G

TRACT I

TRACH H

EXISTING FILING 4 DP2e
EX. 15' TYPE R ON-GRADE INLET (PUBLIC)

EXISTING FILING 4 BYPASS FLOW:
Q_5=1.5 CFS, Q_{100}=3.6 CFS
PROP. FILING 5 TOTAL BYPASS FLOW:
Q_5=1.5 CFS, Q_{100}=6.0 CFS
ALLOWABLE ASPEN MEADOWS
FILING 1 FLOW (BASIN RP-7C):
Q_5=2.8 CFS, Q_{100}=6.4 CFS
PROP. FLOW IS LESS THAN ALLOWABLE

TRAGO DR.

PENNYDALE DR.

PENDROY ST.

STERLING RANCH
FIL. NO 4

EX. POND W-5
BUILT W/ STERLING
RANCH FILING NO. 2
(SF-20-015)

TRACT J

91 90 89 88 87 86 85 84 83 82 81 80 79 78 77 76 75 74 73 72 71 70 69 68 67

27 26 25 24 28 29 30 31 43 42 41 40 44 45 46 47 10 9 11 12 14 15 13

100 50 0 100

ORIGINAL SCALE: 1" = 100'

LEGEND

INLET BYPASS FLOW PATH
EXISTING DRAINAGE PATH

NOTES

1. FOR DETAILED EXISTING INLET AND BYPASS FLOW INFORMATION, SEE "FINAL DRAINAGE REPORT FOR STERLING RANCH FILING NO. 2" BY JR ENGINEERING, DATED AUGUST 2021 AND "FINAL DRAINAGE REPORT FOR STERLING RANCH FILING NO. 4" BY JR ENGINEERING, DATED AUGUST 14, 2023.

EX. INLET BYPASS EXHIBIT
STERLING RANCH FILING NO. 5
JOB NO. 25188.16
04/25/24
SHEET 2 OF 2

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