PRELIMINARY DRAINAGE REPORT AND MDDP ADDENDUM
FOR
HOMESTEAD NORTH AT STERLING RANCH PRELIMINARY PLAN

See comment memo also.

JR Response in red

Prepared For:

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Colorado Springs, CO 80903
(719) 491-3024

February, 2021
Project No. 25188.00

Prepared By:
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Colorado Springs, CO 80919
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PCD Filing No.:
SP-20-008

J·R ENGINEERING

ENGINEER'S STATEMENT:

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

_____

Mike Bramlett, Colorado P.E. 38861
For and On Behalf of JR Engineering, LLC

DEVELOPER'S STATEMENT:

I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: SR Land, LLC

By: _____

Title: _____

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

El Paso County:

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

_____ _____

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

Conditions:

Table of Contents

APPENDIX

PURPOSE

This document is the Preliminary Drainage Report and MDDP Addendum for Homestead North at Sterling Ranch. The purpose of this report is to identify on-site and off-site drainage patterns, storm sewer, culvert and inlet locations, areas tributary to the site, and to safely route developed storm water to adequate outfall facilities. It is important to note that Homestead North at Sterling Ranch is intended to be constructed in two phases with both phases being evaluated in this report. Assumptions have been made with regards to Phase 2 in order to size and evaluate the site drainage infrastructure. This report will be confirmed or amended in the event that the phase 2 lot configuration has significant changes.

GENERAL SITE DESCRIPTION

GENERAL LOCATION

Homestead North at Sterling Ranch and the undeveloped land to the north(hereby referred to as the "site") is a proposed development with a total area of approximately 88 acres.

The site is located in the northeast quarter of Section 33 and the southeast quarter of section 28, Township 12 South, Range 65 West of the Sixth Principal Meridian in the County of El Paso, State of Colorado. The site is located immediately east of Vollmer Road. The site is bounded by Briargate Parkway to the south, an unplatted vacant residential parcel to the north, and Sand Creek borders the site to east. The parcels are planned to be platted after approval of the Preliminary Plan. Refer to the vicinity map in Appendix A for additional information.

DESCRIPTION OF PROPERTY

The site is currently being designed to accommodate approximately 228 single-family residential lots and development is to be completed in two phases (totaling approximately 88 acres). The site is comprised of variable sloping grasslands that generally slope(s) downward to the east at 3 to 7% towards the Sand Creek tributary basin.

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

The Sand Creek is within the eastern portion of the site. Currently, Kiowa Engineering Corp. is performing studies and plans to address Sand Creek stabilization.

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

FLOODPLAIN STATEMENT

Based on the FEMA Firm Maps Number 08041C0533G and 08041C0535G revised December 7, 2018, the vast majority of the development is located within Zone X, or areas area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. The eastern property boundary will be platted to the center of Sand creek placing a portion of the site within Zone AE. The area of disturbance for site grading is located outside of the delineated floodway within Zone X. The FEMA map containing the site has been presented in Appendix A.

EXISTING DRAINAGE CONDITIONS

MAJOR BASIN DESCRIPTIONS

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

The Sand Creek DBPS assumed the Homestead North at Sterling Ranch property to have a "large lot residential" use for the majority of the site. However, the proposed Sterling Ranch master plan is a mix of; school, multi-family, single-family, and commercial land uses, resulting in higher runoff. The site generally drains from north to south consisting of rolling hills. Currently, the site is used as pasture land for cattle. Sand Creek is located in the east portion of the site running north to south. This reach of drainage conveyance is not currently improved. There are a few stock ponds within the creek channel used for cattle watering. Currently, Kiowa is performing studies and plans to address Sand Creek stabilization adjacent to the site.

The proposed drainage on the site closely follows the approved "Master Development Drainage Plan for Sterling Ranch", (MMDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018. The MMDP "Developed Hydrologic Conditions Map" as shown within Appendix E, shows the estimated detention for the site. The site is tributary to basins SC3-18, SC3-17, and a portion of basin SC-322. Full-spectrum detention in the MMDP was previously analyzed and corresponds to ponds FSD18 and FSD17 for the site. Pond FSD17 is associated with ponds A and B within this report. Pond FSD18 is associated with ponds B and C within this report. Runoff as shown in the proposed M&S conduit RT-10A will drain offsite runoff parallel to the site as shown in the MDDP within a 5' conduit. The total estimated/projected detention and estimated outflows from the MDDP are shown in Table 1 below.

Table 1.

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	67.2	86.3
MODELED RELEASE (CFS)	0.7	8.4	22.4	52	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
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

The MMDP plans for additional detention to the north of the site as shown in appendix E. No future offsite detention is necessary for the site.

In summary, the site will have three detention ponds A, B, and C. Ponds A and B associated with pond FSD17 of the M&S MDDP and Ponds B and C associated with pond FSD18. The release rates of these ponds will be below 90% of the historic drainage in continuity with the approved M&S MDDP. The report remains in continuity with MDDP and conveys the existing offsite runoff from basin SC3-19 of the MDDP to Sand Creek via proposed storm pipe along Vollmer road and Briargate parkway. The total net detention being stored onsite in the 100 year event is 7.6 Acre-ft, as shown Tables 2.1-2.3 of this report. The total runoff released from the detention ponds is 87.7 cfs in the 100 year event for the three ponds, as shown Tables 2.1-2.3 of this report. The net allowed release rate for the site is 156.2 cfs, as shown in Table 1 above.

EXISTING SUB-BASIN DRAINAGE

The existing/ predeveloped site consists of 3 onsite basins (H1, H2, and H3) and one offsite basin (2). This historic basins outfall to Sand Creek at 2 outfalls as shown in the Historic Drainage Map in Appendix D. A sub-division to the north of the site is being developed called "Retreat at Timberidge". Runoff from this sub-division will be detained and will not impact storm-water runoff on the Sterling Ranch Homestead site.

Basin 2 (Q5 = 47.7 cfs, Q100 = 188.8 cfs) is a 184 acre area of undeveloped lands covered with native prairie grasses located to the northwest of Vollmer Road. The runoff from this basin is shown in basin SC3-19 as shown in the proposed M&S Drainage Map. The runoff from this basin will be conveyed via a 5" RCP pipe along Vollmer road and Briargate parkway and outfall into Sand Creek.

Basin H1 (Q5 = 8.9 cfs, Q100 = 61.1 cfs) is 45.3 acres of undeveloped land covered in native prairie grass.

Basin H2 (Q5 = 3.5 cfs, Q100 = 25.7 cfs) is 15.9 acres of undeveloped land covered in native prairie grass. This basin drains directly into Sand Creek. The basin is to the south east of Vollmer road. This basin drains directly into Sand Creek.

JR Response: Existing basins added to drainage map.

Basin H3 (Q5 = 6.1 cfs, Q100 = 41.8 cfs) is 21.9 acres of undevelop grass. This basin drains directly into Sand Creek. The basin is to the south east of Vollmer road and North of Briargate Parkway.

Address the existing basins around proposed Sterling Ranch Road and Briargate Pkwy.

INTERIM DRAINAGE CONDITIONS

An Interim Condition Drainage map has been provided for the early grading area of Homestead, and a map is provided in Appendix D. The early grading area consists of the southern portion of Homestead as well as Briargate Parkway and Sterling Ranch Road. This area was split into 2 basins corresponding to the two proposed sediment basins and the areas tributary to them.

Basin C is 2% impervious and 24.2 Acres. This basin includes early grading from Sterling Ranch Homestead North. Runoff from this basin will drain into a temporary sediment basin at pond C.

Basin D is 2% impervious and 17.25 Acres. This basin includes Briargate Parkway and Sterling Ranch Road. Runoff from this basin will drain into a temporary sediment basin at pond D. The stormwater requirements for Briargate parkway and Sterling Ranch Ro drainage report for Sterling Ranch Phase 3, and will be detailed and desig Report when it is time to plat the ROW.

JR Response: FDR for Sterling Ranch road and Briargate will be submitted seperately

If Briargate Pkwy and Sterling Ranch Road are included in early grading, details to the FDR level will be required. See comment letter.

PROPOSED DRAINAGE CONDITIONS

PROPOSED SUB-BASIN DRAINAGE

The proposed site was broken up and delineated into three major basins: Basin A (upper-portion), Basin B (mid –portion), and Basin C (lower-portion) of the site. It should be noted that Basin A will be constructed as part of phase 2 of this development and Basins B and C will be constructed as part of Phase 1. Basin A is tributary to Pond A, Basin B is Tributary to Pond B and Basin C is tributary to Pond C. The proposed basin (and sub-basin) delineation is shown on the drainage basin map within Appendix D and is described as follows.

Basin A1 3.67 acres and 52% percent impervious is comprised of single-family residential lots, a residential road Jesse Evans Drive, and a Cul de Sac. Runoff (Q_5=6.9 cfs, Q_{100}=14.7 cfs)from this basin A1 drains to design point 1A to a 15'type R on-grade inlet. Runoff is then by-passed in the 100 year event to DP 3A.

Basin A2 3.27 acres and 56% percent impervious is comprised of single-family residential lots, a residential road Jesse Evans Drive, and a Cul de Sac. Runoff (Q_5=6.4 cfs, Q_{100}=13.3 cfs) from this basin drains to design point 2A to a 15' type R on-grade inlet. Runoff is then by-passed in the 100 year event to DP 4A.

Basin A3 4.79 acres and 50% percent impervious is comprised of single-family residential lots, a residential road David Rudabaugh Drive, and a Cul de Sac. Runoff (Q_5=8.5 cfs, Q_{100}=18.4 cfs) from this basin drains to design point 3A a 15'type R on-grade inlet in confluence with upstream by-pass flow from basin A1.

Basin A4 3.95 acres and 54% percent impervious is comprised of single-family residential lots, a residential road David Rudabaugh Drive, and a Cul de Sac. Runoff (Q_5=7.4 cfs, Q_{100}=15.6 cfs)from this basin drains to design point 4A a 15' type R on-grade inlet in confluence with upstream by-pass runoff from basin A2.

Basin A5 5.43 acres and 50% percent impervious is comprised of single-family residential lots, a residential road William Downing Drive, and an urban knuckle. Runoff (Q_5=10.5 cfs, Q_{100}=22.6 cfs)from this basin drains to design point 5A in confluence with upstream by-pass runoff from basin A3 and A1.

Basin A6 3.97 acres and 53% percent impervious is comprised of single-family residential lots, a residential road William Downing Drive, and a cul de sac. Runoff (Q_5=7.7 cfs, Q_{100}=16.3 cfs) from this basin drains to design point 6A at an on grade inlet in confluence with upstream by-pass runoff from basin A4 and A2.

Basin A7 1.97 acres and 15% percent impervious is comprised of open grass area, and a portion of a residential road Aspen Valley Road. The runoff (Q_5=1.3 cfs, Q_{100}=4.8 cfs)from this basin drains to design point 7A a 20' type R sump inlet. The runoff from the sump inlet collects tributary runoff basins A7, A5, A3, and A1.

Basin A8 0.42 acres and 57% percent impervious is comprised of a portion of a residential road Aspen Valley Road. The runoff (Q_5=1.2 cfs, Q_{100}=2.5 cfs)from this basin drains to design point 8A a 15' type R sump inlet. From here on runoff is piped for basin A1-A8 to detention pond A and detained for the water-quality event and up to the 100-year event.

address the overflow conveyance

Basin A9 2.97 acres and 16% [illegible] nd A, grass and walk-out lots facing the detention area. Run [illegible] in Basin A9 sheet flows into Pond A where it is treated f [illegible] l the 100 year-event. The UD Detention sheet for pond A is shown in Appendix C of this report.

JR Response: Addressed. Text Added. The overflow runoff will spill directly into pond A.

Pond A has a total tributary area of 30.43 Acres, the net percent impervious area of pond A is 46.3%. Pond A has been conceptually graded in to fit the design volume, as shown in Appendix C of this report. This pond will be built in phase 2 of Homestead North at Sterling Ranch. Pond A will outfall directly into the Sand Creek basin. The WQCV, 5 year and 100 year volumes, releases rates and stages for pond A are shown in Table 2.1 below. These results correspond to the Routed Hydrograph results, as shown in Appendix C of this report.

	TABLE 2.1 Pond A		
	Stage –ft	Volume (Acres)	Release Rate (cfs)
WQCV	2.58	0.503	0.2
5 Year	4.70	1.774	3.9
100 Year	6.00	2.708	32.2

Basin B1.1 3.35 acres and 45% percent impervious is comprised of single-family residential lots, a local roads Billy Claiborne Drive, Perry Owens Drive and an urban knuckle. The runoff (Q_5=5.5 cfs, Q_{100}=12.5 cfs) from basin B1.1 drains to design point 1.1B.

Basin B1.2 1.81 acres and 54% percent impervious is comprised of single-family residential lots, a local roads Claiborne Drive, Perry Owens Drive and an urban knuckle. The runoff (Q_5=3.5 cfs, Q_{100}=7.4 cfs) from basin B1.2 drains to design point 1.2B.

Basin B1.3 0.47 acres and 47% percent impervious is comprised of single-family residential lots and a local roads Aspen Valley Road and Perry Owens Drive. The runoff (Q_5=1.0 cfs, Q_{100}=2.2 cfs) from basin B1.3 drains to design point 1.3B.

JR Response: Added

Address the Vollmer Road basins, DPs and inlets

Basin B2 0.82 acres and 58% percent impervious is comprised of the northern portion of a local residential road Sam Bass Drive adjacent to the intersecting at Vollmer road. Runoff (Q_5=2.3 cfs, Q_{100}=4.9 cfs)from basin B2 drains to design point 2B and confluences with runoff from basin 1B.

Basin B3 0.24 acres and 79% percent impervious is comprised of the southern portion of a local residential road Sam Bass Drive adjacent to the intersection of Vollmer road. Runoff (Q_5=0.9 cfs, Q_{100}=1.7 cfs)from basin B3 drains to design point 3B.

Basin B4 3.98 acres and 40% percent impervious is comprised of single-family residential lots, a local residential road Wheatland Driveand a Cul de Sac. Runoff (Q_5=6.7 cfs, Q_{100}=15.9 cfs) from this basin drains to design point 4B.

Basin B5 1.75 acres and 58% percent impervious is comprised of single-family residential lots, a residential road Wheatland Drive, and a Cul de Sac. Runoff (Q_5=4.3 cfs, Q_{100}=8.9 cfs)from basin B5 drains to design point 5B.

Basin B6 3.66 acres and 57% percent impervious is comprised of single-family residential lots and a local residential roads Sam Bass Drive, Aspen Valley Road, Perry Owens Drive and Wheatland Drive. Runoff (Q_5=9.5 cfs, Q_{100}=19.9 cfs) from basin 6B drains to design point 6B. In total, the flow at design point 6B collects flow from basins B1, B2, B3, B4, and B6.

Basin B7 1.14 acres and 61% percent impervious is comprised of single-family lots, local roads and a Cul de Sac Robert Allison Circle. Runoff (Q_5=2.9 cfs, Q_{100}=5.8 cfs) from basin B7 drains to design point 7B in confluence with runoff from B5.

Basin B8 1.74 acres and 58% percent impervious is comprised of single-family lots, local road and a Cul de Sac. Runoff (Q_5=4.1 cfs, Q_{100}=8.5 cfs) from basin B8 drains to design point B8 in confluence with runoff from basins B8, B7 and B5.

Basin B9 3.69 acres and 65% percent impervious is comprised of single-family lots, and an urban knuckle, and local roads Willie Picket Drive and V[illegible]=6.9 cfs, Q_{100}=14.8 cfs)from Basin B9 drains to design point B9 in a 1[illegible] the runoff from the sump inlet collects runoff from basins B1, B2, B3, B4, B6 and B9.

JR Response: Updated

Basin B10 0.22 acres and 80% percent impervious is comprised of the southeastern side of the local road Wheatland Drive. The runoff from this basin drains to design point B10 a 10' type R sump inlet. The total runoff (Q_5=0.8 cfs, Q_{100}=1.6 cfs) is collected at this site is from basins B7, B8, and B10. Runoff will over

and B5?

JR Response: Updated

Basin B11 1.77 acres and 14% percent impervious is comprised of pond B. Runoff (Q_5=0.9 cfs, Q_{100}=3.9 cfs) generated in Basin B11 sheet flows into Pond B where it is treated for water-quality and is detained up until the 100 year-event. The UD Detention sheet for pond B is shown in Appendix C of this report.

Pond B has a tributary area 24.73 acres and is 51.1 % impervious. Pond B has been conceptually graded in to fit the design volume, as shown in Appendix C of this report. This pond will be built in phase 1 of Homestead North at Sterling Ranch. The pond B emergency overflow spillway will drain directly into Sand Creek. The WQCV, 5 year and 100 year volumes, releases rates and stages for pond B are shown in Table 2.2 below. These results correspond to the Routed Hydrograph results, as shown in Appendix C of this report.

	TABLE 2.2 Pond B		
	Stage –ft	Volume (Acres)	Release Rate (cfs)
WQCV	3.06	0.435	0.2
5 Year	4.31	1.577	2.9
100 Year	5.09	2.455	31.2

spreadsheet has different values

Basin C1 2.82 acres and 69% percent impervious is comprised of single-family lots, and the northwestern side of the local residential roads Texas Jack JR Response: Updated . Runoff (Q_5=5.4 cfs, Q_{100}=11.4 cfs) from basin C1 drains to design point 1C at Wheatland Drive.

Basin C2.1 0.20 acres and 91% percent impervious is comprised of single-family lots, and the north western side of the residential road Texas Jack Drive. Runoff (Q_5=0.8 cfs, Q_{100}=1.6 cfs) from basin C2.1 drains to design point 2.1C a 5' on grade type R inlet.

Basin C2.2 4.69 acres and 73% percent impervious is comprised of local roads, single-family lots, and the north western side of the residential road Wheatland Drive. Runoff (Q_5=9.9 cfs, Q_{100}=20.3 cfs) from basin C2.2 drains to design point 2.2C in confluence with bypass runoff from basin C2.3. The runoff ultimately drains to design point 4C a 20' type R sump inlet. The total runoff from basins C1, C2.1, C2.2, C2.3 and C4.1 is collected within the sump inlet.

Basin C2.3 0.83 acres and 67% percent impervious is comprised of local roads Tom Ketchum Drive Jack Helm Drive and Harvey Logan Drive, single-family lots, and the north western side of the residential road Wheatland Drive. Runoff (Q_5=1.9 cfs, Q_{100}=3.9 cfs) from basin C2.3 drains to design point 2.3C in confluence with runoff from basin C1 at an on grade 15' Type R inlet.

Basin C3.1 0.35 acres and 73% percent impervious is comprised of single-family lots, and the southeastern side of the residential road Wheatland Drive. Runoff (Q_5=1.2 cfs, Q_{100}=2.4 cfs) from basin C3.1 drains to design point 3.1C.

Basin C3.2 1.46 acres and 71% percent impervious is comprised of local roads, single-family lots, and the southeastern side of the residential road Wheatland Drive and Tom Ketchum Drive. Runoff (Q_5=3.6 cfs, Q_{100}=7.4 cfs) from basin C3.2 drains to design point 3.2C.

Basin C4.1 6.37 acres and 65% percent impervious is comprised of single-family lots, and the northwestern side of the local residential road Texas Jack Drive and Nat Love Drive. Runoff (Q_5=11.8 cfs, Q_{100}=25.4 cfs) from basin C4.1 drains to design point 4C a 20' type R sump inlet. The total runoff from basins C1, C2.1, C2.2, C2.3 and C4.1 is collected within the sump inlet.

Basin C4.2 3.47 acres and 55% percent impervious is comprised of a local road Texas Jack Drive and single-family lots. Runoff (Q_5=4.8 cfs, Q_{100}=11.2 cfs) from basin C4.2 drains to design point 4.2C a 15' type R on grade inlet.

Basin C5 0.16 acres and 81% percent impervious is comprised of the northwestern side of a residential road Wheatland Drive. Runoff (Q_5=0.6 cfs, Q_{100}=1.1 cfs) from basin C5 drains to design point 5C, a 5' type R sump inlet. Basin C5 collects runoff from basin C3.2 and C5. The runoff from basin C ultimately outfalls into pond C. In the event the inlet clogs at Basin C5 the runoff will overflow to pond C.

Basin C6 2.42 acres and 10% percent impervious is comprised of pond C and some single-family residential area. Runoff (Q_5=1.6 cfs, Q_{100}=8.0 cfs) generated in Basin B11 sheet flows into Pond C where it is treated for water-quality and is detained up until the 100 year-event. The MHFD Detention sheet for pond C is shown in Appendix C of this report.

Pond C has a tributary area of 22.77 acres and is 60.8 % impervious. Pond C has been conceptually graded in to fit the design volume, as shown in Appendix C of this report. This pond will be built in phase 1 of Homestead North at Sterling Ranch. The Pond C overflow emergency spillway will overflow into Sand Creek. The WQCV, 5 year and 100 year volumes, releases rates and stages for pond C are shown in Table 2.3 below. These results correspond to the Routed Hydrograph results, as shown in Appendix C of this report.

	TABLE 2.3 Pond C		
	Stage –ft	Volume (Acres)	Release Rate (cfs)
WQCV	2.39	0.455	0.2
5 Year	4.05	1.682	3.2
100 Year	4.99	2.464	24.3

DRAINAGE DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

Storm drainage analysis and design criteria for this project were taken from the "*City of Colorado Springs/El Paso County Drainage Criteria Manual*" Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the "*Urban Storm Drainage Criteria Manual*" Volumes 1 to 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the "*Colorado Springs Drainage Criteria Manual*" (CSDCM), dated May 2014, as adopted by El Paso County.

HYDROLOGIC CRITERIA

All hydrologic data was obtained from the "*El Paso Drainage Criteria Manual*" Volumes 1 and 2, and the "*Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual*" Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5 year (minor) storm event and the 100-year (major) storm event. Runoff was calculated using the Rational Method, and rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Table 6-2 of the CSDCM. One hour point rainfall data for the storm events is identified in the chart below. Runoff coefficients were determined based on proposed land use and from data in Table 6-6 from the CSDCM. Time of concentrations were developed using equations from CSDCM. All runoff calculations and applicable charts and graphs are included in the Appendices.

Table 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, and the UDFCD MHFD-Detention v4.03 spreadsheet was utilized for evaluating proposed detention and water quality pond. Sump and on-grade inlets were sized using UDFCD UD-Inlet v2.07. Manning's equation was used to size the proposed pipes in this report and StormCAD will be used to model the proposed storm sewer system and to analyze the proposed HGL calculations for Construction Drawings.

DRAINAGE FACILITY DESIGN

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 Homestead North at Sterling Ranch development project consists single -family homes with open spaces and lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. Roof drains from the structures will discharge to lawn areas, where feasible, to allow for infiltration and runoff volume reduction.

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

JR Response: Homestead North lots will discharge into a Full Spectrum Detention pond(s) and the release will be less than the Historic. Runoff from Vollmer and the area Tributary to Vollmer will be piped along side Briargate PRKY and will discharge into Sand Creek in continuity with the approved 2018 MDDP.

SIA agreement info has been added.

Step 3 – Treat the WQCV: Water Quality treatment for th
spectrum water quality detention ponds: Pond A, B, and P
collected within inlets and conveyed to the proposed pond
ponds, flows will be captured in a forebay designed to pr
trickle channel is also incorporated into the ponds to mini
outlet structure has been designed to detain the water qualit

This needs to be cla
the requirements of the Sterling Ranch Filing 1 SIA for Sand Creek channel construction.

See my comment from Review 1. And per ECM Appendix I.7.2, the heading for Step 4 still needs to be "Consider Need for Industrial and Commercial BMPs" and the following text can just state that the site is a residential subdivision (ie: not a high-risk site per Figure I-1 in ECM Appendix I), therefore specialized BMPs do not need to be considered.

and the extended urban runoff vo
be reduced to less than historic rat

Step 4 – ~~Pollution Control BMPs~~: BMPs will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. Site specific temporary
implemented include, but are not limited to, silt fencing pla
disturbance, construction vehicle tracking pads at the entrances, designated concrete truck washout basin, designated vehicle fueling areas, covered storage areas, spill containment and control, etc. The permanent erosion control BMPs include asphalt drives and parking, storm inlets and storm pipe, three full spectrum water quality and detention ponds, and permanent vegetation.

JR Response: Text updated

WATER QUALITY

The site is split into three major basins A, B, and C. Each major basin is serviced by an extended full spectrum water quality / detention pond. All the ponds have been designed per Section 13.3.2.1 of Resolution 15-042 of the El Paso County Drainage Criteria Manual. For additional information on pond storage and outlet characteristics see the MHFD sheets within appendix C.

EROSION CONTROL PLAN

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

OPERATION & MAINTENANCE

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. The property owner shall be responsible for the inspection, maintenance, rehabilitation and repair of stormwater and erosion control facilities located on the property unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. Access is provided from onsite facilities and easements for proposed infrastructure located offsite. We respectfully request that the Operation & Maintenance Manual be submitted in conjunction with the construction documents, prior to obtaining a grading permit.

DRAINAGE AND BRIDGE FEES

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

SUMMARY

The proposed Homestead North at Sterling Ranch drainage improvements were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development ponds are designed to release less than MDDP study associated with the subject site. The proposed development will not adversely affect the offsite drainageways or surrounding development. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements for this site.

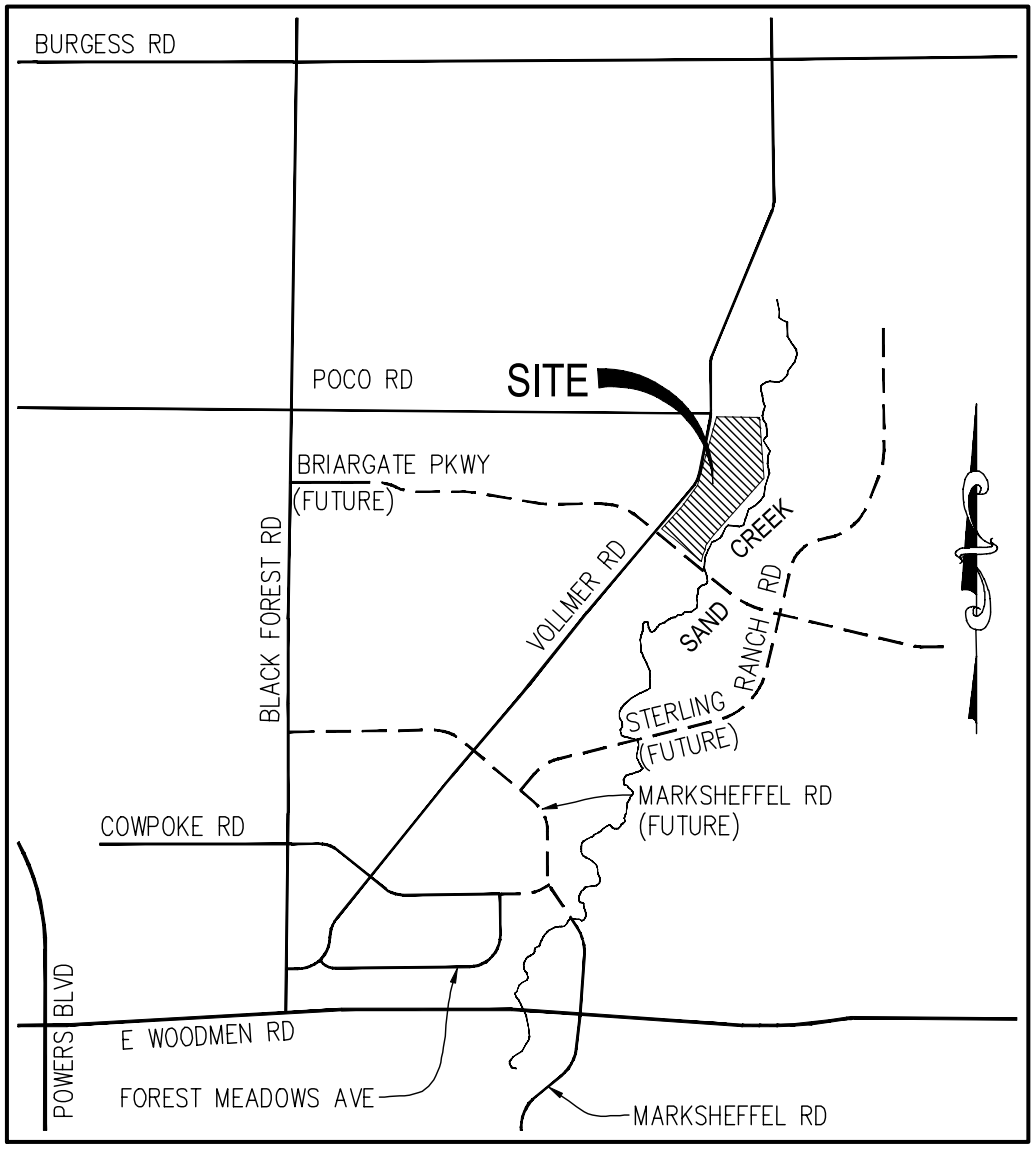
REFERENCES

1. "El Paso County and City of Colorado Springs Drainage Criteria Manual, Vol I & II".
2. El Paso County ECM, 2019
3. El Paso County DCM Vol. 1 Update, 2015
4. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), Urban Drainage and Flood Control District, June 2001.
5. Upper Sand Creek Detention Evaluation Study, Wilson and Company'
6. Final Drainage Report For Retreat at Timberridge Filing No. 1, Classic Consulting Engineers & Surveyors
7. Sand Creek Channel Design Report Kiowa, 2021

(This will be required prior to approval or conditions of approval restricting road and lot platting and construction east of Wheatland Drive will be needed.)

JR Response: Noted

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map



VICINITY MAP

N.T.S.

VICINITY MAP
HOMESTEAD FIL. 3
JOB NO. 25188.00
04/20/20
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

Hydrologic Soil Group—El Paso County Area, Colorado

Map Scale: 1:5,730 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	90.2	100.0%
Totals for Area of Interest			**90.2**	**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.

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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.

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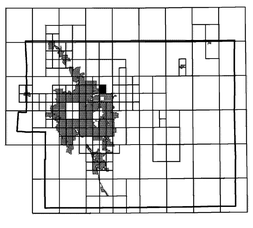
El Paso County Vertical Datum Offset Table

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



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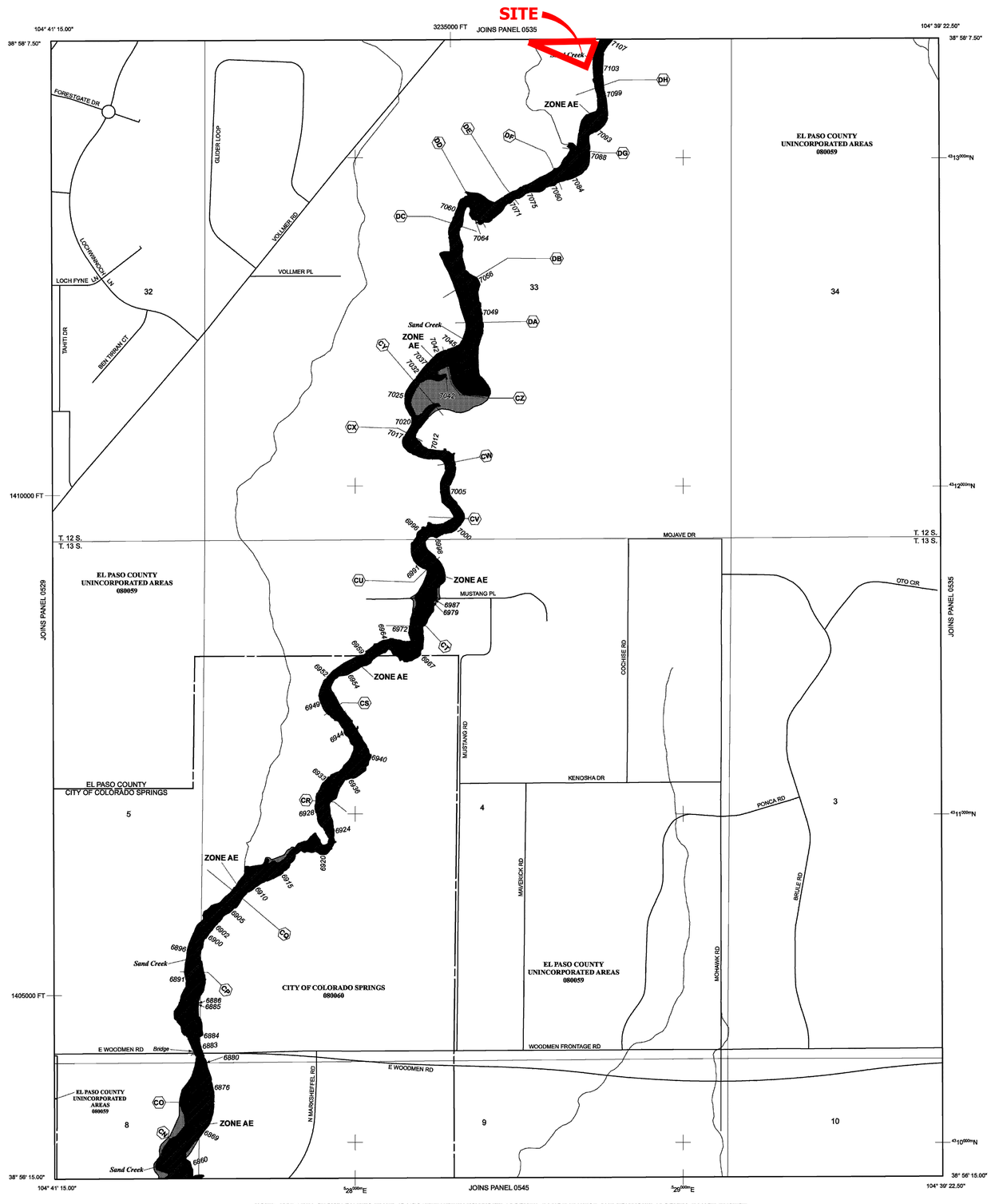

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

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)

4779000mN 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
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MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0533G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 533 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0533	G
EL PASO COUNTY	080059	0533	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0533G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

X:\2510000.all\82518800\Drawings\Working Dwgs\Andrew.Joyce\2518800 FIRM MAP.dwg, Sheet 1, 4/20/2020 4:23:28 PM, FC

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

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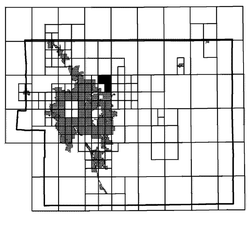

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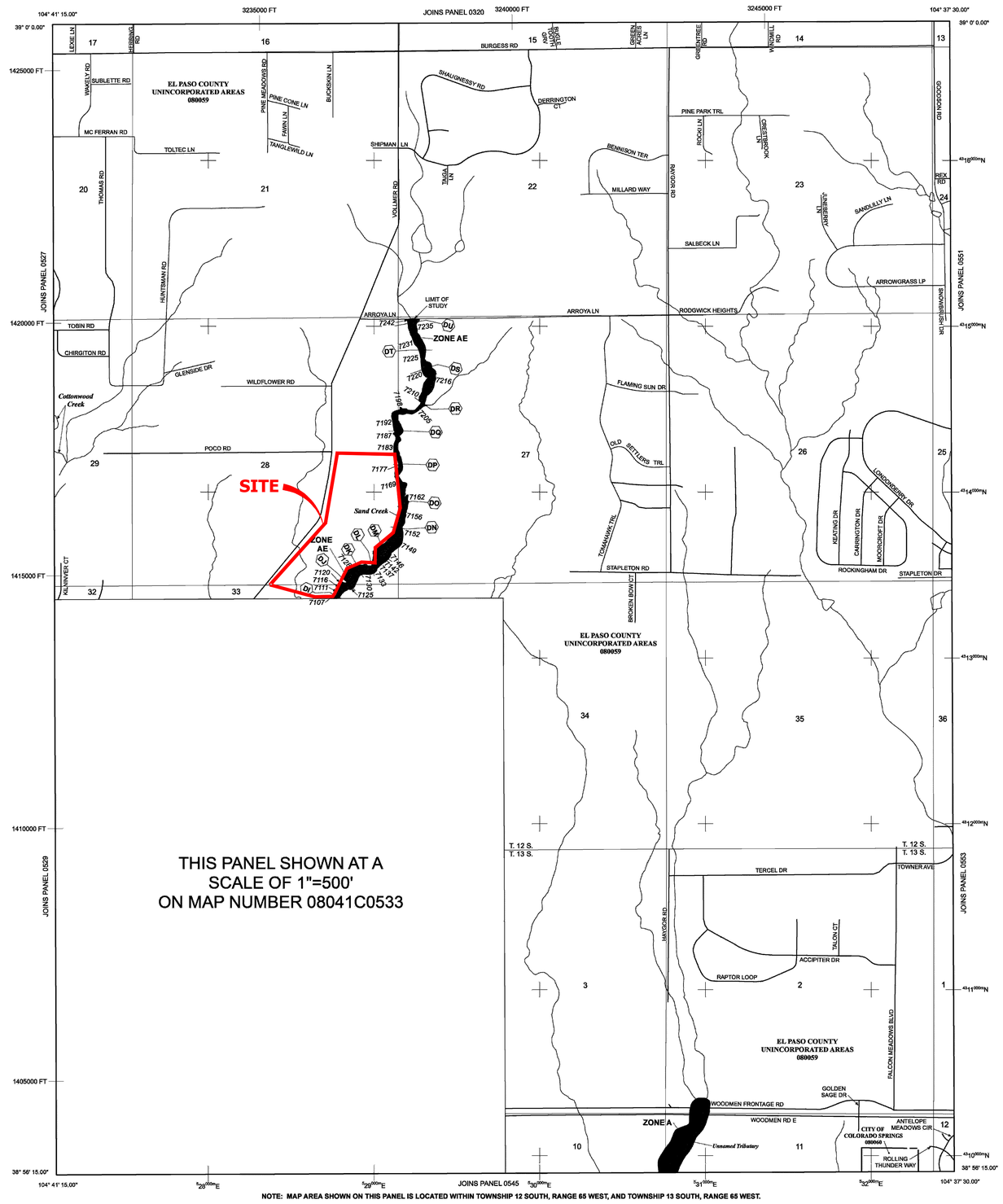

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

LEGEND

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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.
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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 (EL 987)	Base Flood Elevation line and value; elevation in feet* / 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)
4779000mN	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.

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MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0535G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 535 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0535	G
EL PASO COUNTY	080059	0535	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
08041C0535G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

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Appendix B
Hydrologic Calculations

COMPOSITE % IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Existing Conditions Homestead Fil. 3
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 2/12/20

Basin ID	Total Area (ac)	Streets/Paved (100% Impervious)				Residential (45%-65% Impervious)				Lawns (2% 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}	
H1	45.30	0.90	0.96	0.38	0.8%	0.45	0.59	0.00	0.0%	0.08	0.35	44.92	2.0%	0.09	0.36	2.8%
H2	15.90	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	15.90	2.0%	0.08	0.35	2.0%
H3	29.10	0.90	0.96	0.22	0.7%	0.45	0.59	0.00	0.0%	0.08	0.35	28.88	2.0%	0.09	0.35	2.7%

Provide for the area east of Sand Creek that the proposed roads are in. JR Response: Updated

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Existing Conditions Homestead Fil. 3
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 2/12/20

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
H1	45.30	B	3%	0.09	0.36	150	2.0%	17.8	1074	2.3%	7.0	1.1	16.9	34.7	1224.0	38.1	34.7
H2	15.90	B	2%	0.08	0.35	150	2.0%	17.9	425	2.0%	7.0	1.0	7.2	25.1	575.0	31.1	25.1
H3	29.10	B	3%	0.09	0.35	150	1.4%	20.3	645	1.9%	7.0	1.0	11.1	31.3	795.0	33.8	31.3

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).

Table 6-2. NRCS Conveyance factors, K

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

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

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).

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.

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Existing Conditions Homestead Fil. 3
Location: El Paso County
Design Storm: 100-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 2/12/21

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
		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
	1h	H1	45.30	0.36	34.7	16.08	3.80	61.1															Drains to swale
	2h	H2	15.90	0.35	25.1	5.57	4.61	25.7	34.7	21.65	3.80	82.2											Accepts runoff from H1 and H2
	3h	H3	29.10	0.35	31.3	10.32	4.05	41.8															Does not include upstream runoff

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

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Existing Conditions Homestead Fil. 3
Location: El Paso County
Design Storm: 100-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 2/12/21

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
		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
	1h	H1	45.30	0.36	34.7	16.08	3.80	61.1															Drains to swale
	2h	H2	15.90	0.35	25.1	5.57	4.61	25.7	34.7	21.65	3.80	82.2											Accepts runoff from H1 and H2
	3h	H3	29.10	0.35	31.3	10.32	4.05	41.8															Does not include upstream runoff

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

COMPOSITE % IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Homestead Fil. 3
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 2/12/21

Basin ID	Total Area (ac)	Streets/Paved (100% Impervious)				Residential (45%-65% Impervious)				Lawns (2% 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	3.67	0.90	0.96	0.82	22.4%	0.45	0.59	2.41	29.5%	0.08	0.35	0.44	0.2%	0.51	0.64	52.2%
A2	3.27	0.90	0.96	0.84	25.6%	0.45	0.59	2.19	30.1%	0.08	0.35	0.24	0.1%	0.54	0.67	55.9%
A3	4.79	0.90	0.96	0.79	16.4%	0.45	0.59	3.56	33.4%	0.08	0.35	0.45	0.2%	0.49	0.63	50.0%
A4	3.95	0.90	0.96	0.77	19.6%	0.45	0.59	2.99	34.1%	0.08	0.35	0.18	0.1%	0.52	0.65	53.8%
A5	5.43	0.90	0.96	0.67	12.4%	0.45	0.59	4.47	37.0%	0.08	0.35	0.29	0.1%	0.49	0.62	49.5%
A6	3.97	0.90	0.96	0.67	17.0%	0.45	0.59	3.17	36.0%	0.08	0.35	0.12	0.1%	0.51	0.65	53.0%
A7	1.97	0.90	0.96	0.22	11.0%	0.45	0.59	0.12	2.7%	0.08	0.35	1.63	1.7%	0.19	0.43	15.4%
A8	0.42	0.90	0.96	0.21	50.4%	0.45	0.59	0.05	5.9%	0.08	0.35	0.15	0.7%	0.54	0.69	57.1%
A9	2.97	0.90	0.96	0.00	0.0%	0.45	0.59	0.99	14.9%	0.08	0.35	1.99	1.3%	0.20	0.43	16.3%
Pond A	30.44															46.3%
B1.1	3.35	0.90	0.96	0.48	14.2%	0.45	0.59	2.29	30.7%	0.08	0.35	0.59	0.4%	0.45	0.60	45.2%
B1.2	1.81	0.90	0.96	0.32	17.9%	0.45	0.59	1.43	35.5%	0.08	0.35	0.06	0.1%	0.52	0.65	53.5%
B1.3	0.47	0.90	0.96	0.20	41.4%	0.45	0.59	0.05	5.0%	0.08	0.35	0.22	0.9%	0.46	0.63	47.4%
B2	0.82	0.90	0.96	0.33	40.2%	0.45	0.59	0.32	17.3%	0.08	0.35	0.17	0.4%	0.55	0.69	57.9%
B3	0.24	0.90	0.96	0.19	78.7%	0.45	0.59	0.00	0.0%	0.08	0.35	0.05	0.4%	0.73	0.83	79.1%
B4	3.98	0.90	0.96	0.46	11.4%	0.45	0.59	2.47	27.9%	0.08	0.35	1.06	0.5%	0.40	0.57	39.9%
B5	1.75	0.90	0.96	0.44	25.1%	0.45	0.59	1.26	32.4%	0.08	0.35	0.05	0.1%	0.55	0.68	57.5%
B6	3.66	0.90	0.96	1.25	34.2%	0.45	0.59	1.85	22.8%	0.08	0.35	0.55	0.3%	0.55	0.68	57.3%
B7	1.14	0.90	0.96	0.38	33.7%	0.45	0.59	0.69	27.4%	0.08	0.35	0.06	0.1%	0.58	0.70	61.2%
B8	1.74	0.90	0.96	0.53	30.2%	0.45	0.59	1.07	27.7%	0.08	0.35	0.14	0.2%	0.56	0.68	58.1%
B9	3.69	0.90	0.96	0.80	21.7%	0.45	0.59	2.43	42.7%	0.08	0.35	0.47	0.3%	0.50	0.64	64.6%
B10	0.22	0.90	0.96	0.18	79.1%	0.45	0.59	0.00	0.0%	0.08	0.35	0.05	0.4%	0.73	0.83	79.5%
B11	1.77	0.90	0.96	0.00	0.0%	0.45	0.59	0.35	12.7%	0.08	0.35	1.42	1.6%	0.15	0.40	14.3%
Pond B	24.64															51.1%
C1	2.82	0.90	0.96	0.49	17.2%	0.45	0.59	2.25	51.7%	0.08	0.35	0.09	0.1%	0.52	0.65	69.0%
C2.1	0.20	0.90	0.96	0.18	90.5%	0.45	0.59	0.00	0.0%	0.08	0.35	0.02	0.2%	0.82	0.90	90.7%
C2.2	4.69	0.90	0.96	1.26	26.9%	0.45	0.59	3.33	46.1%	0.08	0.35	0.10	0.0%	0.56	0.68	73.0%
C2.3	0.83	0.90	0.96	0.28	34.1%	0.45	0.59	0.41	32.4%	0.08	0.35	0.13	0.3%	0.54	0.68	66.9%
C3.1	0.35	0.90	0.96	0.25	72.8%	0.45	0.59	0.00	0.0%	0.08	0.35	0.09	0.5%	0.68	0.79	73.3%
C3.2	1.46	0.90	0.96	0.42	28.4%	0.45	0.59	0.96	42.8%	0.08	0.35	0.08	0.1%	0.56	0.68	71.3%
C4.1	6.37	0.90	0.96	1.04	16.4%	0.45	0.59	4.76	48.6%	0.08	0.35	0.57	0.2%	0.49	0.63	65.1%
C4.2	3.47	0.90	0.96	0.45	13.1%	0.45	0.59	2.20	41.2%	0.08	0.35	0.81	0.5%	0.42	0.58	54.8%
C5	0.16	0.90	0.96	0.13	80.9%	0.45	0.59	0.00	0.0%	0.08	0.35	0.03	0.4%	0.74	0.84	81.3%
C6	2.42	0.90	0.96	0.00	0.0%	0.45	0.59	0.32	8.7%	0.08	0.35	2.10	1.7%	0.13	0.38	10.4%
Pond C	22.77															60.8%

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Homestead Fil. 3
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 2/12/21

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	3.67	B	52%	0.51	0.64	150	2.0%	10.4	589	3.0%	20.0	3.5	2.8	13.3	739.0	20.6	13.3
A2	3.27	B	56%	0.54	0.67	150	2.0%	9.9	595	1.6%	20.0	2.5	3.9	13.8	745.0	21.2	13.8
A3	4.79	B	50%	0.49	0.63	150	2.0%	10.7	645	2.9%	20.0	3.4	3.2	13.9	795.0	21.5	13.9
A4	3.95	B	54%	0.52	0.65	150	2.0%	10.2	653	1.9%	20.0	2.7	4.0	14.2	803.0	21.7	14.2
A5	5.43	B	50%	0.49	0.62	187	7.0%	8.0	531	2.1%	20.0	2.9	3.1	11.1	718.0	21.5	11.1
A6	3.97	B	53%	0.51	0.65	230	4.5%	9.8	435	1.6%	20.0	2.6	2.8	12.6	665.0	20.4	12.6
A7	1.97	B	15%	0.19	0.43	240	4.9%	15.1	125	0.6%	20.0	1.5	1.4	16.5	365.0	25.9	16.5
A8	0.42	B	57%	0.54	0.69	9.5	2.0%	2.5	230	1.9%	20.0	2.8	1.4	3.9	239.5	17.9	5.0
A9	2.97	B	16%	0.20	0.43	30	2.0%	7.1	535	0.5%	20.0	1.4	6.3	13.4	565.0	34.4	13.4
B1.1	3.35	B	45%	0.45	0.60	125	2.0%	10.5	610	3.1%	20.0	3.5	2.9	13.4	735.0	22.1	13.4
B1.2	1.81	B	54%	0.52	0.65	150	2.0%	10.2	577	3.4%	20.0	3.7	2.6	12.8	727.0	20.1	12.8
B1.3	0.47	B	47%	0.46	0.63	50	2.0%	6.5	270	2.0%	20.0	2.8	1.6	8.1	320.0	20.0	8.1
B2	0.82	B	58%	0.55	0.69	9.5	2.0%	2.4	368	3.4%	20.0	3.7	1.7	4.1	377.5	18.1	5.0
B3	0.24	B	79%	0.73	0.83	9.5	2.0%	1.7	360	3.7%	20.0	3.9	1.6	3.2	369.5	14.1	5.0
B4	3.98	B	40%	0.40	0.57	25	2.0%	5.0	680	1.6%	20.0	2.5	4.5	9.5	705.0	25.4	9.5
B5	1.75	B	58%	0.55	0.68	25	2.0%	3.9	590	1.6%	20.0	2.6	3.8	7.8	615.0	20.7	7.8
B6	3.66	B	57%	0.55	0.68	9.5	2.0%	2.4	855	3.0%	20.0	3.5	4.1	6.6	864.5	21.1	6.6
B7	1.14	B	61%	0.58	0.70	50	1.0%	6.6	315	1.5%	20.0	2.4	2.1	8.8	365.0	18.0	8.8
B8	1.74	B	58%	0.56	0.68	50	1.0%	6.9	280	1.0%	20.0	2.0	2.4	9.3	330.0	18.9	9.3
B9	3.69	B	65%	0.50	0.64	140	2.0%	10.2	600	2.9%	20.0	3.4	2.9	13.1	740.0	18.3	13.1
B10	0.22	B	80%	0.73	0.83	9.5	2.0%	1.6	200	0.5%	20.0	1.4	2.4	4.1	209.5	14.9	5.0
B11	1.77	B	14%	0.15	0.40	30	2.0%	7.5	250	0.1%	20.0	0.4	9.3	16.8	280.0	40.5	16.8
C1	2.82	B	69%	0.52	0.65	130	2.0%	9.6	690	2.6%	20.0	3.2	3.6	13.1	820.0	18.1	13.1
C2.1	0.20	B	91%	0.82	0.90	7.5	2.0%	1.1	300	1.0%	20.0	2.0	2.5	3.6	307.5	12.9	5.0
C2.2	4.69	B	73%	0.56	0.68	150	2.0%	9.5	630	2.5%	20.0	3.2	3.3	12.8	780.0	17.0	12.8
C2.3	0.83	B	67%	0.54	0.68	100	2.0%	8.0	462	3.3%	20.0	3.6	2.1	10.1	562.0	16.9	10.1
C3.1	0.35	B	73%	0.68	0.79	9.5	2.0%	1.9	460	2.6%	20.0	3.2	2.4	4.2	469.5	16.0	5.0

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Homestead Fil. 3
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 2/12/21

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)
C3.2	1.46	B	71%	0.56	0.68	50	2.0%	5.5	365	1.1%	20.0	2.1	2.9	8.4	415.0	16.9	8.4
C4.1	6.37	B	65%	0.49	0.63	150	2.0%	9.6	633	2.8%	20.0	3.3	3.2	12.7	783.0	17.2	12.7
C4.2	3.47	B	55%	0.42	0.58	150	2.0%	10.7	1010	1.7%	20.0	2.6	6.5	17.2	1160.0	22.1	17.2
C5	0.16	B	81%	0.74	0.84	9.5	2.0%	2.7	200	0.6%	20.0	1.5	2.2	4.9	209.5	17.4	5.0
C6	2.42	B	10%	0.13	0.38	15	2.0%	2.0	160	0.5%	20.0	1.4	1.9	3.9	175.0	14.0	5.0

NOTES:

$$t_c = t_i + t_t$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

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

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).

Equation 6-2

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

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).

Equation 6-4

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

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

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.

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Homestead Fil. 3
Location: El Paso County
Design Storm: 5-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 2/12/21

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)	
	1a	A1	3.67	0.51	13.3	1.86	3.70	6.9					0.00	0	2.84					335	3.4	1.7	On-grade Type R Inlet, Bypass to DP 3a
	3a	A3	4.79	0.49	13.9	2.34	3.63	8.5	14.9	2.34	3.53	8.3	0.20	0.06	2.8					110	3.3	0.5	On-grade Type R Inlet, Bypass to DP 5a
	5a	A5	5.43	0.49	11.1	2.64	3.98	10.5	14.9	2.70	3.53	9.5											Street Flow
	7a	A7	1.97	0.19	16.5	0.38	3.38	1.3	16.5	3.08	3.38	10.4											Flow Confluences at sump inlet
	2a	A2	3.27	0.54	13.8	1.76	3.64	6.4					0.00	0	2.84					335	3.4	1.7	On-grade Type R Inlet, Bypass to DP 4a
	4a	A4	3.95	0.52	14.2	2.06	3.61	7.4	15.5	2.06	3.47	7.2	3.60	1.04	2.8					110	3.3	0.5	On-grade Type R Inlet, Bypass to DP 6a
	6a	A6	3.97	0.51	12.6	2.04	3.79	7.7	15.5	3.08	3.47	10.7											Street Flow
	8a	A8	0.42	0.54	5.0	0.23	5.17	1.2	16.0	3.31	3.42	11.3											Flow Confluences at sump inlet
	9A	A9	2.97	0.20	13.4	0.60	3.69	2.2	16.5	6.38	3.38	21.6											Flows into Pond A. All of Pond A.
	1.1b	B1.1	3.35	0.45	13.4	1.50	3.69	5.5					0.00	0	2.6					210	3.2	1.1	On-grade Type R Inlet, Bypass to DP 2B
	1.2b	B1.2	1.81	0.52	12.8	0.94	3.75	3.5					0.00	0	2.6					235	3.2	1.2	On-grade Type R Inlet, Bypass to DP 2B
	1.3b	B1.3	0.47	0.46	8.1	0.22	4.45	1.0															Street flow
	2b	B2	0.82	0.55	5.0	0.45	5.17	2.3	14.4	0.67	3.58	2.40											Street flow
	3b	B3	0.24	0.73	5.0	0.18	5.17	0.9															Street flow
	4b	B4	3.98	0.40	9.5	1.60	4.20	6.7					0.1	0.02	2.5					340	3.2	1.8	Type R Inlet, Bypass to DP 6B
	6b	B6	3.66	0.55	6.6	2.00	4.76	9.5	14.4	2.87	3.58	10.28											Recives by-pass flows from Basins (B1.1, B1.2 and B4), Direct Runoff from B1.3,B2,B3, and B6
	9b	B9	3.69	0.50	13.1	1.85	3.72	6.9	14.4	3.37	3.58	12.07											Sump inlet Recives by-pass flows from (B1.1, B1.2 and B4) Direct Runoff from B1.3,B2,B3, B6 and B9
	5b	B5	1.75	0.55	7.8	0.96	4.51	4.3															Street flow
	7b	B7	1.14	0.58	8.8	0.66	4.33	2.9	8.8	1.62	4.33	7.0	0.1	0.06	1.6					340	2.5	2.2	On-grade Type R Inlet, Bypass to DP 8B
	8b	B8	1.74	0.56	9.3	0.97	4.24	4.1	11.0	1.03	3.99	4.1											Street Flow, Recives bypass flow from DP 7B
	10b	B10	0.22	0.73	5.0	0.16	5.17	0.8	11.0	1.19	3.99	4.7											Sump inlet revices by-pass flow from 7b and runoff from 5b,8b, and 10b

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Homestead Fil. 3
Location: El Paso County
Design Storm: 5-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 2/12/21

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)	
	11b	B11	1.77	0.15	16.8	0.27	3.35	0.9	14.4	4.83	3.58	17.3											Flow confluences into Pond B. All of Basin B
	1c	C1	2.82	0.52	13.1	1.46	3.72	5.4															
	2.3c	C2.3	0.83	0.54	10.1	0.45	4.11	1.9	13.1	1.91	3.72	7.1	0.1	0.03	1.6					185	2.5	1.2	On-Grade Type R Inlet, Street runoff from basin C1 and basin C2.3
	2.1C	C2.1	0.20	0.82	5.0	0.16	5.17	0.8					0.0	0	2.83					630	3.4	3.1	On-Grade Type R Inlet
	2.2C	C2.2	4.69	0.56	12.8	2.64	3.76	9.9	13.1	2.64	3.72	9.8											Runoff from basins 1c, 2.3c, 2.1c and 2.2c
	4.2c	C4.2	3.47	0.42	17.2	1.46	3.31	4.8					0.00	0	2.84					1010	3.4	5.0	On-Grade Type R Inlet, by pass to 4.2c
	4C	C4.1	6.37	0.49	12.7	3.13	3.77	11.8	22.2	5.77	2.93	16.9											Sump Inlet
	3.1c	C3.1	0.35	0.68	5.0	0.24	5.17	1.2					0.00	0	2.84					200	3.4	1.0	On-Grade Type R inlet, By pass flow to DP 3.2c
	3.2c	C3.2	1.46	0.56	8.4	0.82	4.39	3.6	8.4	0.82	4.39	3.6											Recives by-pass flow from DP 3.1c
	5C	C5	0.16	0.74	5.0	0.12	5.17	0.6	8.4	0.94	4.39	4.1											Sump Inlet
	6C	C6	2.42	0.13	5.0	0.31	5.17	1.6	22.2	7.02	2.93	20.6											Conluenced flow for Pond C

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

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Homestead Fil. 3
Location: El Paso County
Design Storm: 100-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 2/12/21

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)	
	1a	A1	3.67	0.64	13.3	2.36	6.22	14.7					2.80	0.45	2.84					335	3.4	1.7	On-grade Type R Inlet, Bypass to DP 3a
	3a	A3	4.79	0.63	13.9	3.01	6.10	18.4	14.9	3.46	5.92	20.5	6.10	1.03	2.8					110	3.3	0.5	On-grade Type R Inlet, Bypass to DP 5a
	5a	A5	5.43	0.62	11.1	3.38	6.67	22.6	14.9	4.41	5.92	26.1											Street Flow
	7a	A7	1.97	0.43	16.5	0.85	5.68	4.8	16.5	5.26	5.68	29.9											Flow Confluences at sump inlet
	2a	A2	3.27	0.67	13.8	2.18	6.12	13.3					1.60	0.26	2.84					335	3.4	1.7	On-grade Type R Inlet, Bypass to DP 4a
	4a	A4	3.95	0.65	14.2	2.57	6.05	15.6	15.5	2.83	5.83	16.5	3.60	0.62	2.8					110	3.3	0.5	On-grade Type R Inlet, Bypass to DP 6a
	6a	A6	3.97	0.65	12.6	2.56	6.35	16.3	15.5	3.18	5.83	18.5											Street Flow
	8a	A8	0.42	0.69	5.0	0.29	8.68	2.5	16.0	3.47	5.75	19.9											Flow Confluences at sump inlet
	9A	A9	2.97	0.43	13.4	1.28	6.20	7.9	16.5	8.73	5.68	49.5											Flows into Pond A. All of Pond A.
	1.1b	B1.1	3.35	0.60	13.4	2.01	6.20	12.5					1.50	0.24	2.6					210	3.2	1.1	On-grade Type R Inlet, Bypass to DP 2B
	1.2b	B1.2	1.81	0.65	12.8	1.17	6.30	7.4					0.20	0.03	2.6					235	3.2	1.2	On-grade Type R Inlet, Bypass to DP 2B
	1.3b	B1.3	0.47	0.63	8.1	0.30	7.47	2.2															Street flow
	2b	B2	0.82	0.69	5.0	0.56	8.68	4.9	14.4	1.13	6.01	6.81											Street flow, Recives bypass flow from 1.1b,1.2b and direct runoff from basin 1.3b
	3b	B3	0.24	0.83	5.0	0.20	8.68	1.7															Street flow
	4b	B4	3.98	0.57	9.5	2.26	7.06	15.9					4.1	0.58	2.5					340	3.2	1.8	Type R Inlet, Bypass to DP 6B
	6b	B6	3.66	0.68	6.6	2.49	8.00	19.9	14.4	4.40	6.01	26.5											Recives by-pass flows from Basins (B1.1, B1.2 and B4), Direct Runoff from B1.3,B2,B3, and B6
	9b	B9	3.69	0.64	13.1	2.36	6.25	14.8	14.4	5.04	6.01	30.3											Sump inlet Recives by-pass flows from (B1.1, B1.2 and B4) Direct Runoff from B1.3,B2,B3, B6 and B9
	5b	B5	1.75	0.68	7.8	1.18	7.57	8.9															Street flow

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Homestead Fil. 3
Location: El Paso County
Design Storm: 100-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 2/12/21

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	*i* (in/hr)	Q (cfs)	t_c (min)	C*A (ac)	*i* (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	7b	B7	1.14	0.70	8.8	0.80	7.27	5.8	8.8	1.98	7.27	14.4	3.2	0.44	1.6					340	2.5	2.2	On-grade Type R Inlet, Bypass to DP 8B
	8b	B8	1.74	0.68	9.3	1.19	7.12	8.5	11.0	1.63	6.69	10.9											Street Flow, Recives bypass flow from DP 7B
	10b	B10	0.22	0.83	5.0	0.19	8.68	1.6	11.0	1.82	6.69	12.2											Sump inlet revices by-pass flow from 7b and runoff from 5b,8b, and 10b
	11b	B11	1.77	0.40	16.8	0.70	5.63	3.9	14.4	7.56	6.01	45.4											Flow confluences into Pond B. All of Basin B
	1c	C1	2.82	0.65	13.1	1.82	6.25	11.4															
	2.3c	C2.3	0.83	0.68	10.1	0.56	6.91	3.9	13.1	2.38	6.25	14.9	3.6	0.58	1.6					185	2.5	1.2	On-Grade Type R Inlet, Street runoff from basin C1 and basin C2.3
	2.1C	C2.1	0.20	0.90	5.0	0.18	8.68	1.6					0.1	0.01	2.83					630	3.4	3.1	On-Grade Type R Inlet
	2.2C	C2.2	4.69	0.68	12.8	3.21	6.32	20.3	13.1	3.22	6.25	20.1											Runoff from basins 1c, 2.3c, 2.1c and 2.2c
	4.2c	C4.2	3.47	0.58	17.2	2.02	5.56	11.2					0.70	0.13	2.84					1010	3.4	5.0	On-Grade Type R Inlet, by pass to 4.2c
	4C	C4.1	6.37	0.63	12.7	4.01	6.32	25.4	22.2	7.36	4.92	36.2											Sump Inlet
	3.1c	C3.1	0.35	0.79	5.0	0.28	8.68	2.4					0.60	0.07	2.84					200	3.4	1.0	On-Grade Type R inlet, By pass flow to DP 3.2c
	3.2c	C3.2	1.46	0.68	8.4	1.00	7.37	7.4	8.4	1.07	7.37	7.9											Recives by-pass flow from DP 3.1c
	5C	C5	0.16	0.84	5.0	0.13	8.68	1.1	8.4	1.20	7.37	8.8											Sump Inlet
	6C	C6	2.42	0.38	5.0	0.92	8.68	8.0	22.2	9.48	4.92	46.6											Conluenced flow for Pond C

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

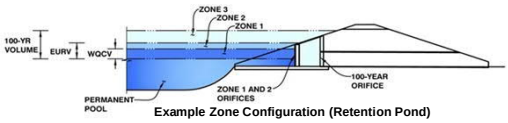
Appendix C
Hydraulic Calculations

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond A



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	30.44	acres
Watershed Length =	1,963	ft
Watershed Length to Centroid =	1,178	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	46.30%	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.

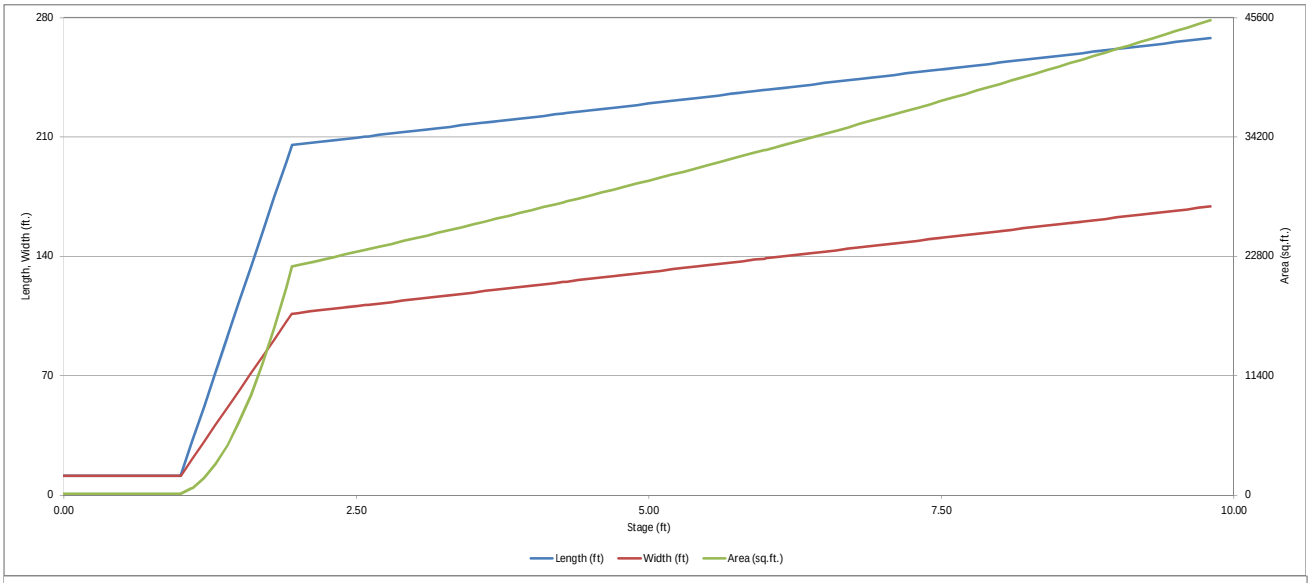
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.498	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.497	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.440	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.088	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.661	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.451	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	4.081	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.888	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	8.806	acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	1.121	acre-feet		
Approximate 5-yr Detention Volume =	1.546	acre-feet		
Approximate 10-yr Detention Volume =	2.074	acre-feet		
Approximate 25-yr Detention Volume =	2.285	acre-feet		
Approximate 50-yr Detention Volume =	2.392	acre-feet		
Approximate 100-yr Detention Volume =	2.695	acre-feet		

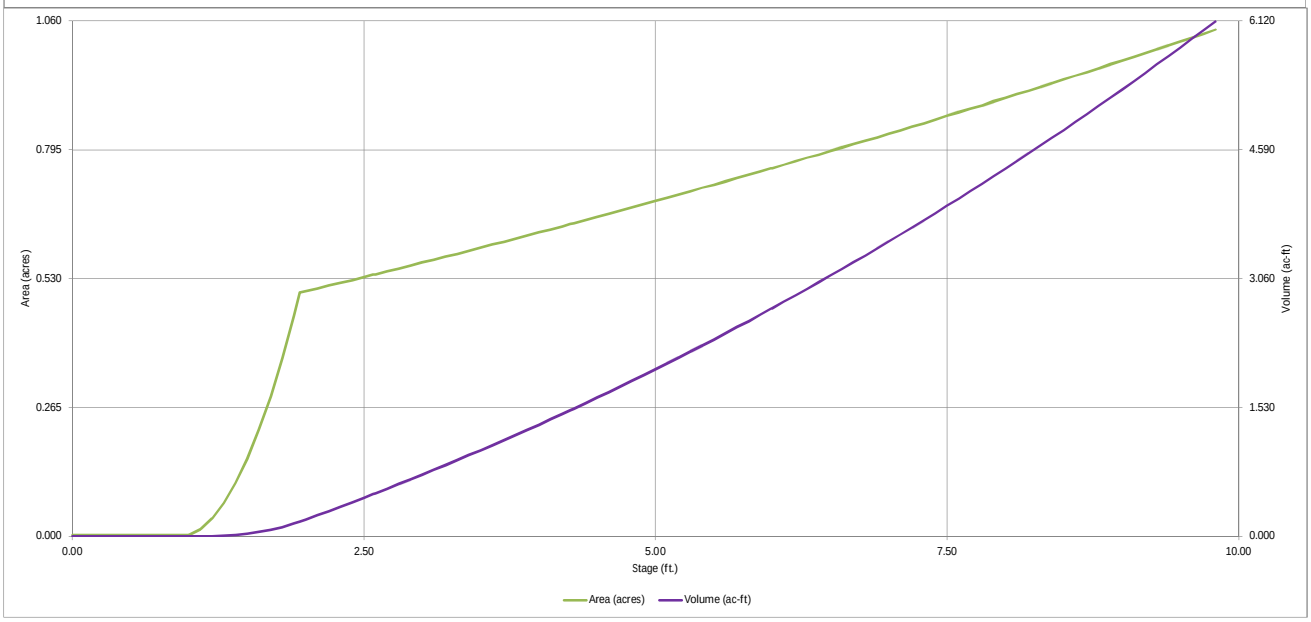
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.498	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.999	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.197	acre-feet
Total Detention Basin Volume =	2.695	acre-feet
Initial Surcharge Volume (ISV) =	65	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H_{total}) =	6.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	130	ft^2
Surcharge Volume Length (L_{ISV}) =	11.4	ft
Surcharge Volume Width (W_{ISV}) =	11.4	ft
Depth of Basin Floor (H_{FLOOR}) =	0.95	ft
Length of Basin Floor (L_{FLOOR}) =	205.2	ft
Width of Basin Floor (W_{FLOOR}) =	106.4	ft
Area of Basin Floor (A_{FLOOR}) =	21,836	ft^2
Volume of Basin Floor (V_{FLOOR}) =	7,490	ft^3
Depth of Main Basin (H_{MAIN}) =	4.05	ft
Length of Main Basin (L_{MAIN}) =	237.6	ft
Width of Main Basin (W_{MAIN}) =	138.8	ft
Area of Main Basin (A_{MAIN}) =	32,983	ft^2
Volume of Main Basin (V_{MAIN}) =	110,235	ft^3
Calculated Total Basin Volume (V_{total}) =	2.706	acre-feet

Depth Increment = 0.10 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		11.4	11.4	130		0.003		
ISV	0.50		11.4	11.4	130		0.003	65	0.001
	0.60		11.4	11.4	130		0.003	78	0.002
	0.70		11.4	11.4	130		0.003	91	0.002
	0.80		11.4	11.4	130		0.003	104	0.002
	0.90		11.4	11.4	130		0.003	117	0.003
	1.00		11.4	11.4	130		0.003	130	0.003
	1.10		31.8	21.4	681		0.016	167	0.004
	1.20		52.2	31.4	1,640		0.038	280	0.006
	1.30		72.6	41.4	3,007		0.069	509	0.012
	1.40		93.0	51.4	4,782		0.110	895	0.021
	1.50		113.4	61.4	6,964		0.160	1,479	0.034
	1.60		133.8	71.4	9,555		0.219	2,301	0.053
	1.70		154.2	81.4	12,554		0.288	3,404	0.078
	1.80		174.6	91.4	15,961		0.366	4,826	0.111
	1.90		195.0	101.4	19,776		0.454	6,609	0.152
Floor	1.95		205.2	106.4	21,836		0.501	7,649	0.176
	2.00		205.6	106.8	21,961		0.504	8,744	0.201
	2.10		206.4	107.6	22,212		0.510	10,953	0.251
	2.20		207.2	108.4	22,464		0.516	13,187	0.303
	2.30		208.0	109.2	22,717		0.522	15,446	0.355
	2.40		208.8	110.0	22,971		0.527	17,730	0.407
	2.50		209.6	110.8	23,227		0.533	20,040	0.460
Zone 1 (WQCV)	2.58		210.2	111.4	23,432		0.538	21,906	0.503
	2.60		210.4	111.6	23,484		0.539	22,375	0.514
	2.70		211.2	112.4	23,742		0.545	24,737	0.568
	2.80		212.0	113.2	24,002		0.551	27,124	0.623
	2.90		212.8	114.0	24,262		0.557	29,537	0.678
	3.00		213.6	114.8	24,525		0.563	31,976	0.734
	3.10		214.4	115.6	24,788		0.569	34,442	0.791
	3.20		215.2	116.4	25,053		0.575	36,934	0.848
	3.30		216.0	117.2	25,318		0.581	39,452	0.906
	3.40		216.8	118.0	25,586		0.587	41,998	0.964
	3.50		217.6	118.8	25,854		0.594	44,570	1.023
	3.60		218.4	119.6	26,124		0.600	47,169	1.083
	3.70		219.2	120.4	26,395		0.606	49,794	1.143
	3.80		220.0	121.2	26,667		0.612	52,448	1.204
	3.90		220.8	122.0	26,941		0.618	55,128	1.266
	4.00		221.6	122.8	27,216		0.625	57,836	1.328
	4.10		222.4	123.6	27,492		0.631	60,571	1.391
	4.20		223.2	124.4	27,769		0.637	63,334	1.454
Zone 2 (EURV)	4.27		223.8	125.0	27,964		0.642	65,285	1.499
	4.30		224.0	125.2	28,048		0.644	66,125	1.518
	4.40		224.8	126.0	28,328		0.650	68,944	1.583
	4.50		225.6	126.8	28,610		0.657	71,791	1.648
	4.60		226.4	127.6	28,892		0.663	74,666	1.714
	4.70		227.2	128.4	29,176		0.670	77,569	1.781
	4.80		228.0	129.2	29,461		0.676	80,501	1.848
	4.90		228.8	130.0	29,748		0.683	83,462	1.916
	5.00		229.6	130.8	30,035		0.690	86,451	1.985
	5.10		230.4	131.6	30,324		0.696	89,469	2.054
	5.20		231.2	132.4	30,614		0.703	92,516	2.124
	5.30		232.0	133.2	30,906		0.710	95,592	2.194
	5.40		232.8	134.0	31,199		0.716	98,697	2.266
	5.50		233.6	134.8	31,493		0.723	101,831	2.338
	5.60		234.4	135.6	31,788		0.730	104,995	2.410
	5.70		235.2	136.4	32,085		0.737	108,189	2.484
	5.80		236.0	137.2	32,383		0.743	111,412	2.558
	5.90		236.8	138.0	32,682		0.750	114,666	2.632
Zone 3 (100-year)	5.99		237.5	138.7	32,952		0.756	117,619	2.700
	6.00		237.6	138.8	32,983		0.757	117,949	2.708
	6.10		238.4	139.6	33,284		0.764	121,262	2.784
	6.20		239.2	140.4	33,587		0.771	124,606	2.861
	6.30		240.0	141.2	33,892		0.778	127,980	2.938
	6.40		240.8	142.0	34,197		0.785	131,384	3.016
	6.50		241.6	142.8	34,504		0.792	134,819	3.095
	6.60		242.4	143.6	34,812		0.799	138,285	3.175
	6.70		243.2	144.4	35,122		0.806	141,782	3.255
	6.80		244.0	145.2	35,433		0.813	145,310	3.336
	6.90		244.8	146.0	35,745		0.821	148,868	3.418
	7.00		245.6	146.8	36,058		0.828	152,459	3.500
	7.10		246.4	147.6	36,373		0.835	156,080	3.583
	7.20		247.2	148.4	36,688		0.842	159,733	3.667
	7.30		248.0	149.2	37,006		0.850	163,418	3.752
	7.40		248.8	150.0	37,324		0.857	167,134	3.837
	7.50		249.6	150.8	37,644		0.864	170,883	3.923
	7.60		250.4	151.6	37,965		0.872	174,663	4.010
	7.70		251.2	152.4	38,287		0.879	178,476	4.097
	7.80		252.0	153.2	38,610		0.886	182,320	4.185
	7.90		252.8	154.0	38,935		0.894	186,198	4.275
	8.00		253.6	154.8	39,261		0.901	190,107	4.364
	8.10		254.4	155.6	39,589		0.909	194,050	4.455
	8.20		255.2	156.4	39,917		0.916	198,025	4.546
	8.30		256.0	157.2	40,247		0.924	202,033	4.638
	8.40		256.8	158.0	40,578		0.932	206,075	4.731
	8.50		257.6	158.8	40,911		0.939	210,149	4.824
	8.60		258.4	159.6	41,245		0.947	214,257	4.919
	8.70		259.2	160.4	41,580		0.955	218,398	5.014
	8.80		260.0	161.2	41,916		0.962	222,573	5.110
	8.90		260.8	162.0	42,254		0.970	226,781	5.206
	9.00		261.6	162.8	42,593		0.978	231,024	5.304
	9.10		262.4	163.6	42,933		0.986	235,300	5.402
	9.20		263.2	164.4	43,274		0.993	239,610	5.501
	9.30		264.0	165.2	43,617		1.001	243,955	5.600
	9.40		264.8	166.0	43,961		1.009	248,334	5.701
	9.50		265.6	166.8	44,306		1.017	252,747	5.802
	9.60		266.4	167.6	44,653		1.025	257,195	5.904
	9.70		267.2	168.4	45,001		1.033	261,678	6.007
	9.80		268.0	169.2	45,350		1.041	266,195	6.111


280
210
140
70
0
Length, Width (ft.)
45600
34200
22800
11400
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

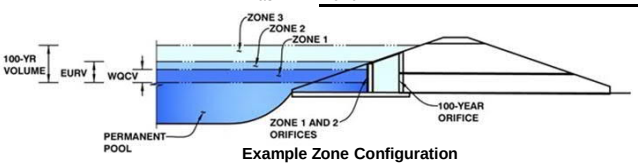

1.060
0.795
0.530
0.265
0.000
Area (acres)
6.120
4.590
3.060
1.530
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond A



Example Zone Configuration

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
V)	2.58	0.498	Orifice Plate
V)	4.27	0.999	Orifice Plate
ır)	5.99	1.197	Weir&Pipe (Restrict)
Total (all zones)		2.695	

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

Underdrain Orifice Invert Depth =		ft (distance below the filtration media surface)	Underdrain Orifice Area =		ft^2
Underdrain Orifice Diameter =		inches	Underdrain Orifice Centroid =		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	ft^2
Depth at top of Zone using Orifice Plate =	4.27	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	ft^2

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	1.42	2.85	3.85				
Orifice Area (sq. inches)	2.11	2.11	2.11	24.00				

	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)

	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	ft^2
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 =	4.30	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.55	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.15	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	7.74	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	19.33	N/A	ft^2
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	9.66	N/A	ft^2
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 =	2.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	2.50	N/A	ft^2
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.82	N/A	feet
Restrictor Plate Height Above Pipe Invert =	17.80		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.08	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.10	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.91	feet
Spillway Crest Length =	23.00	feet	Stage at Top of Freeboard =	8.01	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.90	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	4.37	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	4.00
CUHP Runoff Volume (acre-ft) =	0.498	1.497	1.440	2.088	2.661	3.451	4.081	4.888	8.806
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.440	2.088	2.661	3.451	4.081	4.888	8.806
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.8	7.9	12.0	21.6	27.2	34.8	68.5
PTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.26	0.40	0.71	0.89	1.14	2.25
Peak Inflow Q (cfs) =	N/A	N/A	19.2	28.5	35.5	48.4	57.1	67.9	119.5
Peak Outflow Q (cfs) =	0.2	0.9	0.7	3.9	9.0	18.4	25.7	32.2	89.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.7	0.8	0.9	0.9	1.3
Structure Controlling Flow =	Plate	Plate	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	N/A	N/A	0.1	0.4	0.9	1.2	1.6	1.7
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	75	76	78	76	74	73	71	62
Time to Drain 99% of Inflow Volume (hours) =	40	79	79	82	82	81	80	80	76
Maximum Ponding Depth (ft) =	2.58	4.27	4.04	4.70	5.01	5.38	5.61	6.00	6.91
Area at Maximum Ponding Depth (acres) =	0.54	0.64	0.63	0.67	0.69	0.71	0.73	0.76	0.82
Maximum Volume Stored (acre-ft) =	0.503	1.499	1.353	1.774	1.985	2.251	2.418	2.708	3.418

These need to be 72 or less

JR Response: Updated

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)

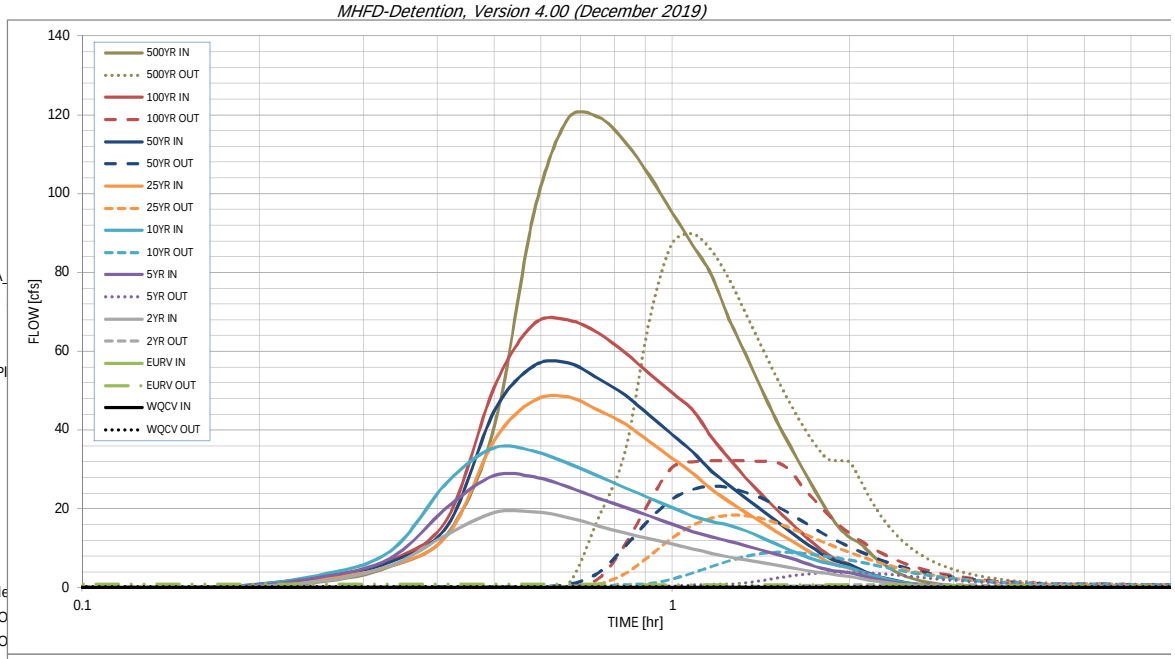
COUNTA_

WQ Pl

Unde

VertO

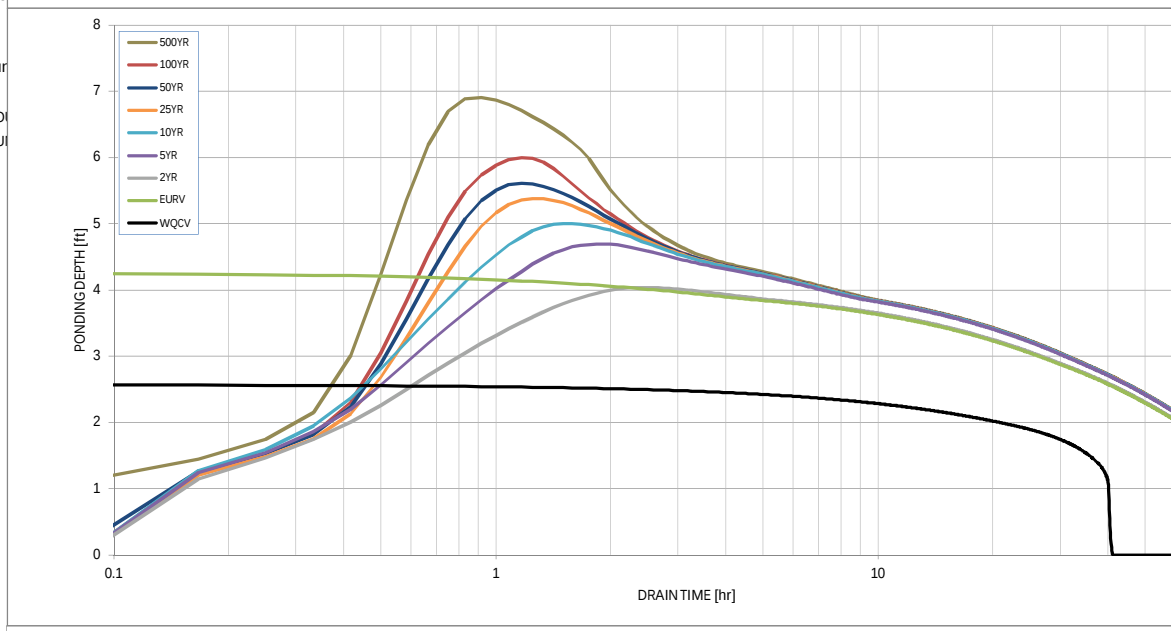
VertO



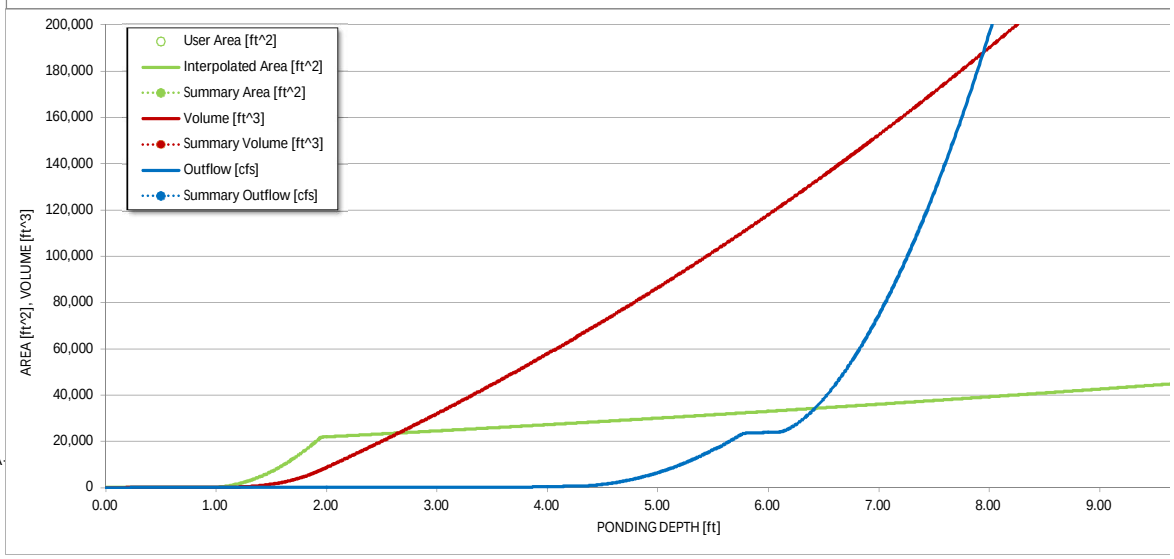
Cour

CO

COU



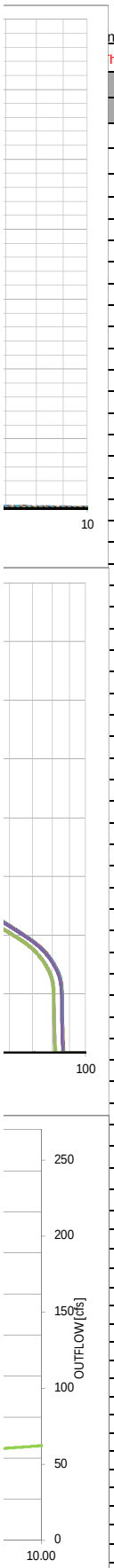
S-A-



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:



nflow Hydrographs

he 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	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.02	1.31
0:15:00	0.00	0.00	1.51	2.47	3.07	2.06	2.60	2.52	5.34
0:20:00	0.00	0.00	5.58	7.43	9.27	5.55	6.50	6.93	13.75
0:25:00	0.00	0.00	13.54	20.45	26.86	13.34	15.84	17.68	40.83
0:30:00	0.00	0.00	19.05	28.45	35.52	37.38	44.83	50.89	94.87
0:35:00	0.00	0.00	19.23	28.10	34.63	47.43	56.27	66.87	119.06
0:40:00	0.00	0.00	17.82	25.57	31.54	48.41	57.08	67.89	119.48
0:45:00	0.00	0.00	15.70	22.67	28.33	45.04	53.05	64.60	113.15
0:50:00	0.00	0.00	13.89	20.40	25.35	41.53	48.88	59.57	104.45
0:55:00	0.00	0.00	12.41	18.19	22.73	37.06	43.72	54.26	95.34
1:00:00	0.00	0.00	11.06	16.10	20.33	32.87	38.87	49.52	87.05
1:05:00	0.00	0.00	9.87	14.23	18.18	29.14	34.52	45.13	79.33
1:10:00	0.00	0.00	8.69	12.90	16.77	24.93	29.58	38.26	68.10
1:15:00	0.00	0.00	7.78	11.78	15.82	21.83	26.00	32.76	59.21
1:20:00	0.00	0.00	7.05	10.64	14.45	19.06	22.70	27.89	50.52
1:25:00	0.00	0.00	6.39	9.57	12.74	16.67	19.83	23.67	42.77
1:30:00	0.00	0.00	5.76	8.56	11.11	14.32	16.98	20.04	36.10
1:35:00	0.00	0.00	5.14	7.59	9.59	12.14	14.34	16.72	30.02
1:40:00	0.00	0.00	4.54	6.43	8.20	10.12	11.91	13.66	24.45
1:45:00	0.00	0.00	4.01	5.36	6.99	8.27	9.68	10.88	19.41
1:50:00	0.00	0.00	3.63	4.59	6.17	6.66	7.75	8.53	15.37
1:55:00	0.00	0.00	3.18	4.15	5.61	5.60	6.52	6.97	12.82
2:00:00	0.00	0.00	2.83	3.81	5.07	4.96	5.77	6.01	11.19
2:05:00	0.00	0.00	2.32	3.12	4.15	3.95	4.59	4.68	8.77
2:10:00	0.00	0.00	1.85	2.47	3.30	3.06	3.55	3.54	6.64
2:15:00	0.00	0.00	1.47	1.95	2.61	2.38	2.75	2.66	5.00
2:20:00	0.00	0.00	1.16	1.54	2.04	1.84	2.11	1.97	3.72
2:25:00	0.00	0.00	0.91	1.21	1.58	1.42	1.62	1.47	2.77
2:30:00	0.00	0.00	0.71	0.93	1.20	1.08	1.24	1.12	2.10
2:35:00	0.00	0.00	0.56	0.71	0.91	0.82	0.93	0.85	1.58
2:40:00	0.00	0.00	0.43	0.54	0.69	0.62	0.71	0.65	1.21
2:45:00	0.00	0.00	0.33	0.41	0.53	0.48	0.54	0.51	0.94
2:50:00	0.00	0.00	0.24	0.30	0.40	0.36	0.41	0.39	0.71
2:55:00	0.00	0.00	0.17	0.21	0.28	0.26	0.30	0.28	0.51
3:00:00	0.00	0.00	0.11	0.14	0.19	0.18	0.20	0.19	0.34
3:05:00	0.00	0.00	0.07	0.09	0.11	0.11	0.13	0.12	0.21
3:10:00	0.00	0.00	0.03	0.05	0.06	0.06	0.07	0.06	0.11
3:15:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.02	0.04
3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft ^{2}]	Area [acres]	Volume [ft ^{3}]	Volume [ac-ft]	Total Outflow [cfs]

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

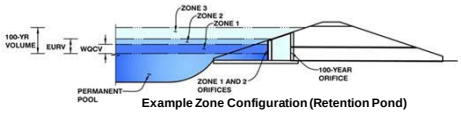
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond B



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	24.73	acres
Watershed Length =	1,290	ft
Watershed Length to Centroid =	775	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	51.10%	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.

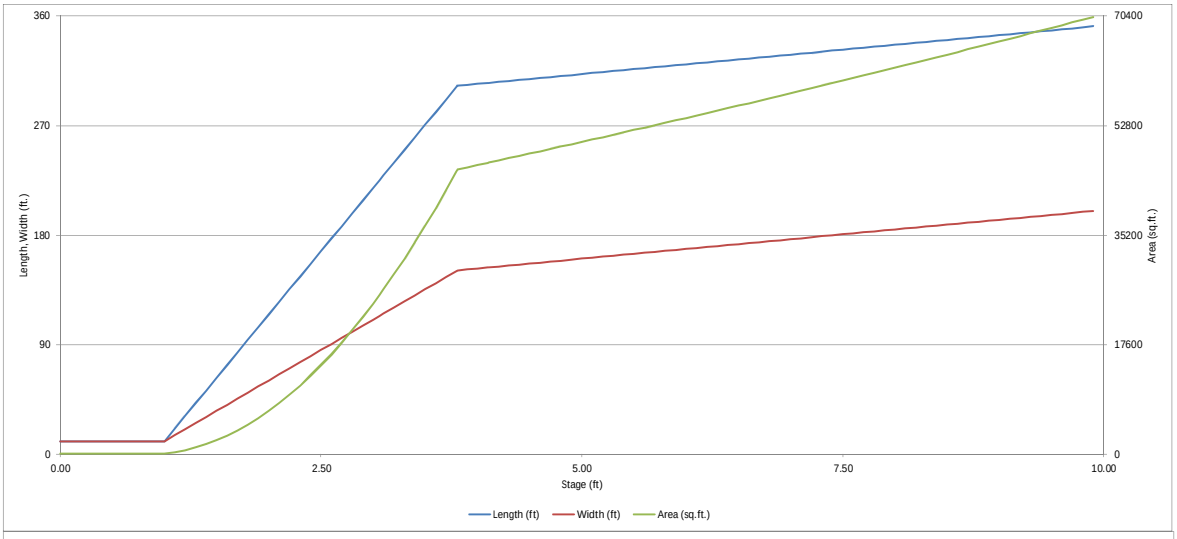
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.431	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.353	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.273	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.812	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.284	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.915	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.428	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.078	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	7.262	acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	1.023	acre-feet		
Approximate 5-yr Detention Volume =	1.400	acre-feet		
Approximate 10-yr Detention Volume =	1.848	acre-feet		
Approximate 25-yr Detention Volume =	2.020	acre-feet		
Approximate 50-yr Detention Volume =	2.111	acre-feet		
Approximate 100-yr Detention Volume =	2.350	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.431	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.922	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.997	acre-feet
Total Detention Basin Volume =	2.350	acre-feet
Initial Surcharge Volume (ISV) =	56	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H_{total}) =	5.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.010	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	113	ft^2
Surcharge Volume Length (L_{ISV}) =	10.6	ft
Surcharge Volume Width (W_{ISV}) =	10.6	ft
Depth of Basin Floor (H_{FLOOR}) =	2.81	ft
Length of Basin Floor (L_{FLOOR}) =	302.9	ft
Width of Basin Floor (W_{FLOOR}) =	151.1	ft
Area of Basin Floor (A_{FLOOR}) =	45,767	ft^2
Volume of Basin Floor (V_{FLOOR}) =	45,101	ft^3
Depth of Main Basin (H_{MAIN}) =	1.19	ft
Length of Main Basin (L_{MAIN}) =	312.4	ft
Width of Main Basin (W_{MAIN}) =	160.6	ft
Area of Main Basin (A_{MAIN}) =	50,179	ft^2
Volume of Main Basin (V_{MAIN}) =	57,068	ft^3
Calculated Total Basin Volume (V_{total}) =	2.348	acre-feet

Depth Increment = 0.10 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		10.6	10.6	113		0.003		
ISV	0.50		10.6	10.6	113		0.003	56	0.001
	0.60		10.6	10.6	113		0.003	68	0.002
	0.70		10.6	10.6	113		0.003	79	0.002
	0.80		10.6	10.6	113		0.003	90	0.002
	0.90		10.6	10.6	113		0.003	101	0.002
	1.00		10.6	10.6	113		0.003	113	0.003
	1.10		21.0	15.6	328		0.008	134	0.003
	1.20		31.4	20.6	648		0.015	182	0.004
	1.30		41.8	25.6	1,071		0.025	267	0.006
	1.40		52.2	30.6	1,599		0.037	400	0.009
	1.50		62.6	35.6	2,230		0.051	590	0.014
	1.60		73.0	40.6	2,966		0.068	849	0.019
	1.70		83.4	45.6	3,805		0.087	1,187	0.027
	1.80		93.8	50.6	4,749		0.109	1,614	0.037
	1.90		104.2	55.6	5,796		0.133	2,140	0.049
	2.00		114.6	60.6	6,948		0.159	2,776	0.064
	2.10		125.0	65.6	8,203		0.188	3,533	0.081
	2.20		135.4	70.6	9,563		0.220	4,420	0.101
	2.30		145.8	75.6	11,026		0.253	5,449	0.125
	2.40		156.2	80.6	12,594		0.289	6,629	0.152
	2.50		166.6	85.6	14,265		0.327	7,971	0.183
	2.60		177.0	90.6	16,041		0.368	9,486	0.218
	2.70		187.4	95.6	17,920		0.411	11,183	0.257
	2.80		197.8	100.6	19,904		0.457	13,073	0.300
	2.90		208.2	105.6	21,991		0.505	15,167	0.348
	3.00		218.6	110.6	24,183		0.555	17,475	0.401
Zone 1 (WQCV)	3.06		224.9	113.6	25,548		0.586	18,967	0.435
	3.10		229.0	115.6	26,478		0.608	20,007	0.459
	3.20		239.4	120.6	28,878		0.663	22,774	0.523
	3.30		249.8	125.6	31,381		0.720	25,786	0.592
	3.40		260.2	130.6	33,989		0.780	29,054	0.667
	3.50		270.6	135.6	36,700		0.843	32,587	0.748
	3.60		281.0	140.6	39,516		0.907	36,397	0.836
	3.70		291.4	145.6	42,435		0.974	40,494	0.930
	3.80		301.8	150.6	45,459		1.044	44,888	1.030
Floor	3.81		302.9	151.1	45,767		1.051	45,344	1.041
	3.90		303.6	151.8	46,094		1.058	49,477	1.136
	4.00		304.4	152.6	46,459		1.067	54,105	1.242
	4.10		305.2	153.4	46,825		1.075	58,769	1.349
Zone 2 (EURV)	4.11		305.3	153.5	46,862		1.076	59,238	1.360
	4.20		306.0	154.2	47,193		1.083	63,470	1.457
	4.30		306.8	155.0	47,562		1.092	68,208	1.566
	4.40		307.6	155.8	47,932		1.100	72,983	1.675
	4.50		308.4	156.6	48,303		1.109	77,794	1.786
	4.60		309.2	157.4	48,676		1.117	82,643	1.897
	4.70		310.0	158.2	49,050		1.126	87,530	2.009
	4.80		310.8	159.0	49,425		1.135	92,453	2.122
	4.90		311.6	159.8	49,801		1.143	97,415	2.236
Zone 3 (100-year)	5.00		312.4	160.6	50,179		1.152	102,414	2.351
	5.10		313.2	161.4	50,558		1.161	107,450	2.467
	5.20		314.0	162.2	50,939		1.169	112,525	2.583
	5.30		314.8	163.0	51,320		1.178	117,638	2.701
	5.40		315.6	163.8	51,703		1.187	122,789	2.819
	5.50		316.4	164.6	52,087		1.196	127,979	2.938
	5.60		317.2	165.4	52,473		1.205	133,207	3.058
	5.70		318.0	166.2	52,859		1.213	138,473	3.179
	5.80		318.8	167.0	53,247		1.222	143,779	3.301
	5.90		319.6	167.8	53,637		1.231	149,123	3.423
	6.00		320.4	168.6	54,027		1.240	154,506	3.547
	6.10		321.2	169.4	54,419		1.249	159,929	3.671
	6.20		322.0	170.2	54,812		1.258	165,390	3.797
	6.30		322.8	171.0	55,207		1.267	170,891	3.923
	6.40		323.6	171.8	55,602		1.276	176,431	4.050
	6.50		324.4	172.6	55,999		1.286	182,012	4.178
	6.60		325.2	173.4	56,398		1.295	187,631	4.307
	6.70		326.0	174.2	56,797		1.304	193,291	4.437
	6.80		326.8	175.0	57,198		1.313	198,991	4.568
	6.90		327.6	175.8	57,600		1.322	204,731	4.700
	7.00		328.4	176.6	58,003		1.332	210,511	4.833
	7.10		329.2	177.4	58,408		1.341	216,332	4.966
	7.20		330.0	178.2	58,814		1.350	222,193	5.101
	7.30		330.8	179.0	59,221		1.360	228,094	5.236
	7.40		331.6	179.8	59,630		1.369	234,037	5.373
	7.50		332.4	180.6	60,039		1.378	240,020	5.510
	7.60		333.2	181.4	60,451		1.388	246,045	5.648
	7.70		334.0	182.2	60,863		1.397	252,110	5.788
	7.80		334.8	183.0	61,276		1.407	258,217	5.928
	7.90		335.6	183.8	61,691		1.416	264,366	6.069
	8.00		336.4	184.6	62,108		1.426	270,556	6.211
	8.10		337.2	185.4	62,525		1.435	276,787	6.354
	8.20		338.0	186.2	62,944		1.445	283,061	6.498
	8.30		338.8	187.0	63,364		1.455	289,376	6.643
	8.40		339.6	187.8	63,785		1.464	295,734	6.789
	8.50		340.4	188.6	64,208		1.474	302,133	6.936
	8.60		341.2	189.4	64,631		1.484	308,575	7.084
	8.70		342.0	190.2	65,057		1.493	315,060	7.233
	8.80		342.8	191.0	65,483		1.503	321,587	7.383
	8.90		343.6	191.8	65,911		1.513	328,156	7.533
	9.00		344.4	192.6	66,340		1.523	334,769	7.685
	9.10		345.2	193.4	66,770		1.533	341,424	7.838
	9.20		346.0	194.2	67,201		1.543	348,123	7.992
	9.30		346.8	195.0	67,634		1.553	354,864	8.147
	9.40		347.6	195.8	68,068		1.563	361,650	8.302
	9.50		348.4	196.6	68,504		1.573	368,478	8.459
	9.60		349.2	197.4	68,940		1.583	375,350	8.617
	9.70		350.0	198.2	69,378		1.593	382,266	8.776
	9.80		350.8	199.0	69,818		1.603	389,226	8.935
	9.90		351.6	199.8	70,258		1.613	396,230	9.096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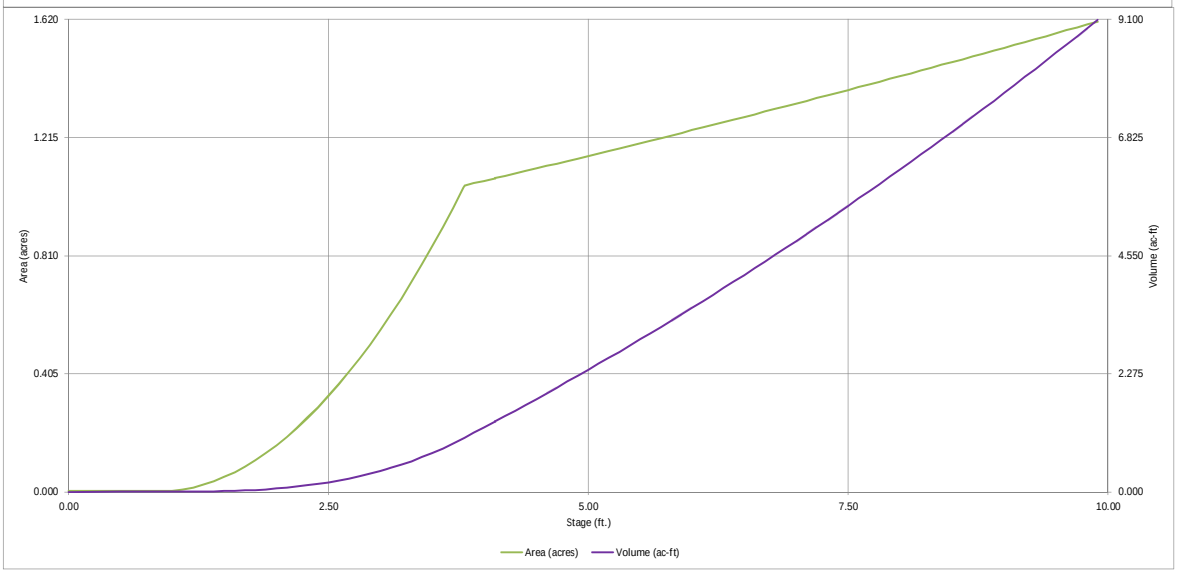
Area (sq.ft.)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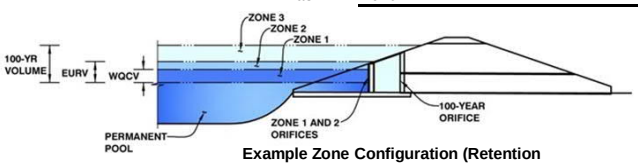
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond B



Example Zone Configuration (Retention

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
1 (WQCV)	3.06	0.431	Orifice Plate
e 2 (EURV)	4.11	0.922	Orifice Plate
(100-year)	5.00	0.997	Weir&Pipe (Restrict)
Total (all zones)		2.350	

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	ft^2
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	ft^2
Depth at top of Zone using Orifice Plate =	4.11	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	ft^2

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)	ow 4 (optiona	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	ow 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.37	2.74	3.20				
Orifice Area (sq. inches)	1.40	1.40	1.40	9.00				

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	ow 12 (optiona	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	ow 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	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =		N/A	ft^2
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	feet
Vertical Orifice Diameter =		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 =	4.11	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.11	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	5.76	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	17.50	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	5.25	N/A	ft^2
Debris Clogging % =	70%	N/A	%				

Calculated Parameters for Overflow Weir

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

	one 3 Restrictc	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.04	N/A	ft^2
Outlet Pipe Diameter =	33.00	N/A	inches	Outlet Orifice Centroid =	0.80	N/A	feet
Restrictor Plate Height Above Pipe Invert =	16.80		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.59	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.16	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.91	feet
Spillway Crest Length =	23.00	feet	Stage at Top of Freeboard =	7.07	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.34	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	4.93	acre-ft

Calculated Parameters for Spillway

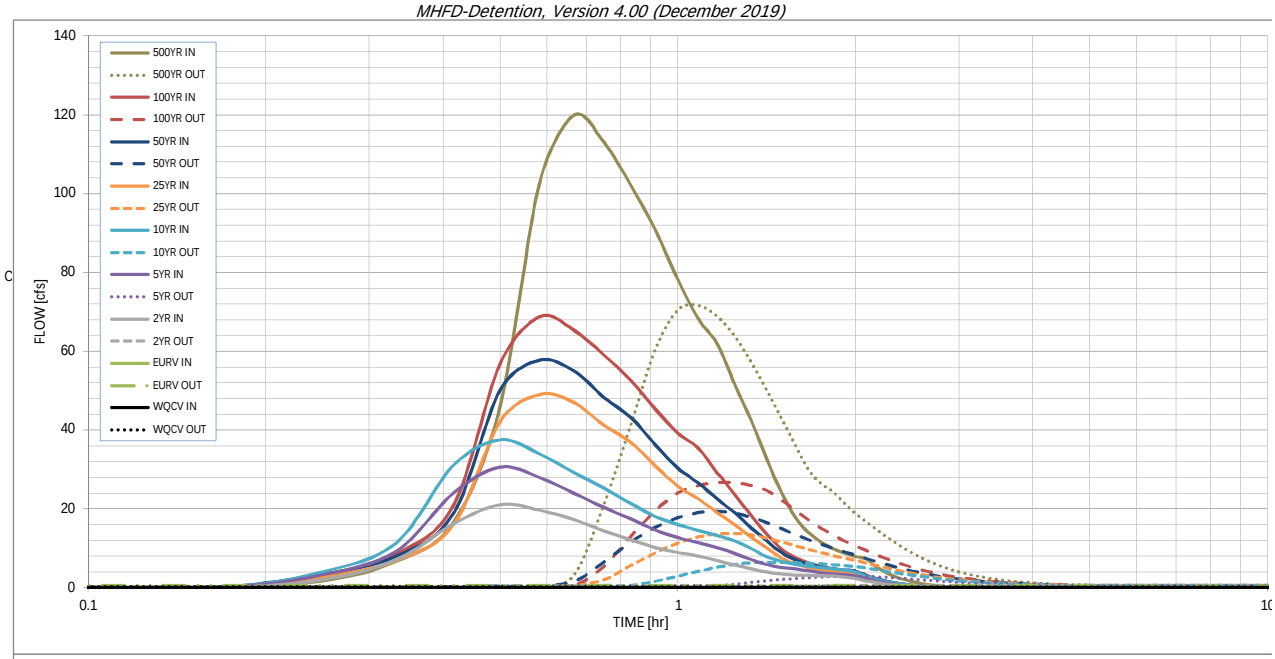
Routed Hydrograph Results

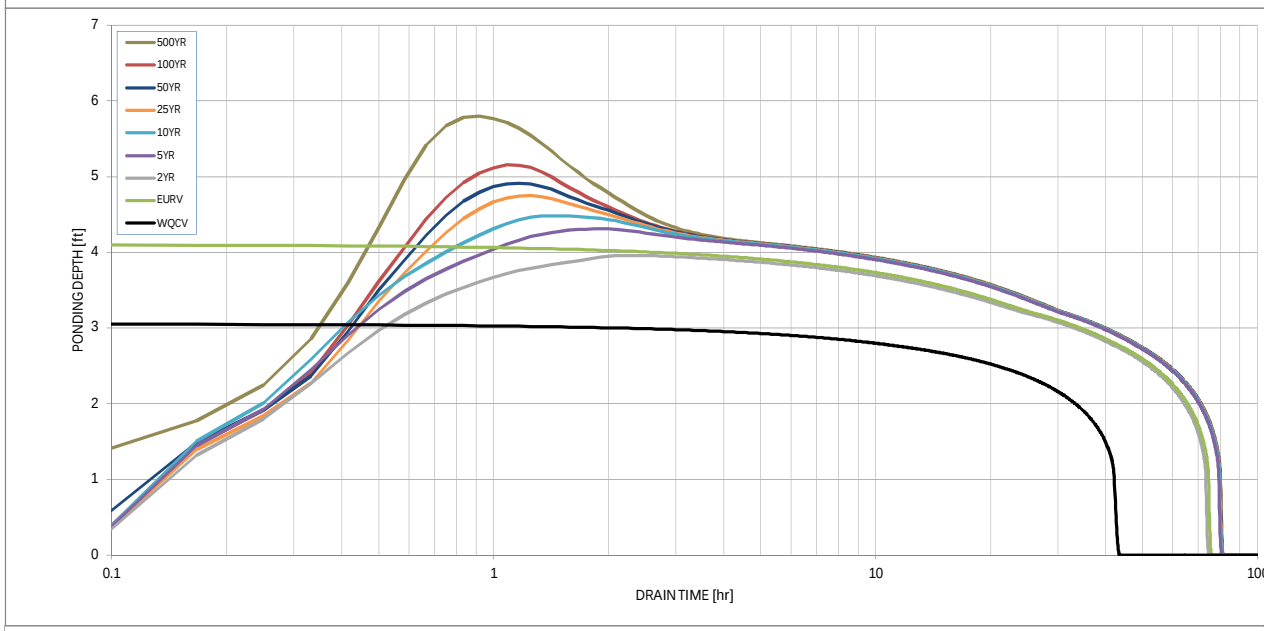
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

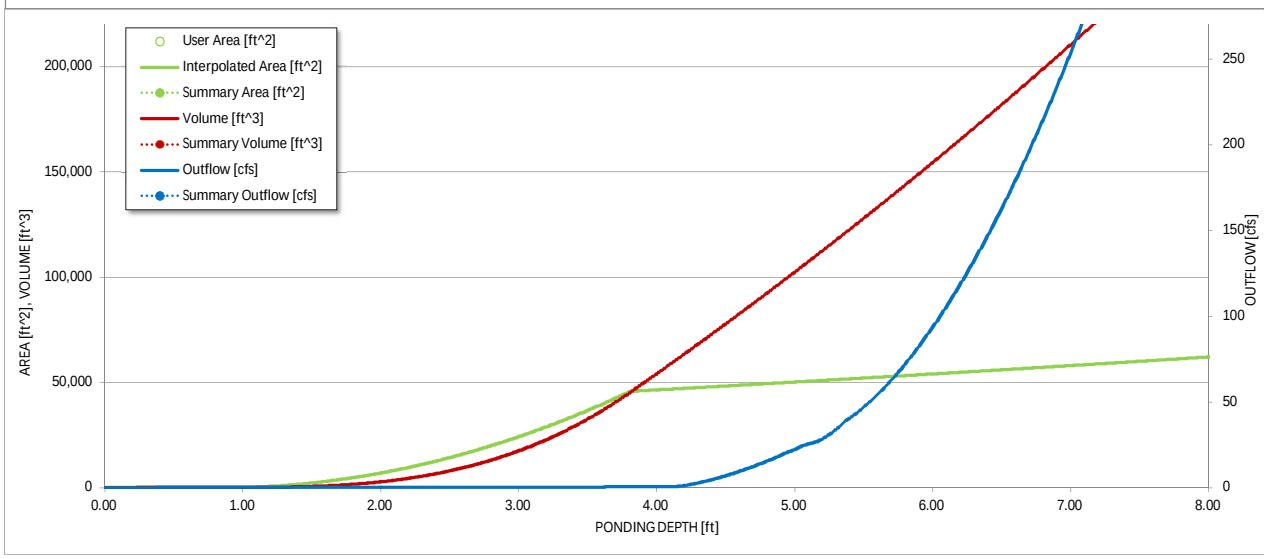
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
CUHP Runoff Volume (acre-ft) =	0.431	1.353	1.273	1.812	2.284	2.915	3.428	4.078	7.262
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.273	1.812	2.284	2.915	3.428	4.078	7.262
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.7	7.7	11.6	20.6	25.8	33.0	64.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.11	0.31	0.47	0.83	1.04	1.34	2.62
Peak Inflow Q (cfs) =	N/A	N/A	21.0	30.6	37.5	49.0	57.7	68.7	119.9
Peak Outflow Q (cfs) =	0.2	0.5	0.5	2.9	6.5	13.8	19.3	26.7	71.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.7	0.7	0.8	1.1
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	verflow Weir	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	verflow Weir	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.3	0.8	1.1	1.5	1.9
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) =	40	68	68	72	70	68	67	65	55
Time to Drain 99% of Inflow Volume (hours) =	42	72	71	76	76	75	75	74	70
Maximum Ponding Depth (ft) =	3.06	4.11	3.96	4.31	4.48	4.75	4.91	5.15	5.80
Area at Maximum Ponding Depth (acres) =	0.59	1.08	1.06	1.09	1.11	1.13	1.14	1.17	1.22
Maximum Volume Stored (acre-ft) =	0.435	1.360	1.189	1.577	1.764	2.055	2.248	2.525	3.288

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.

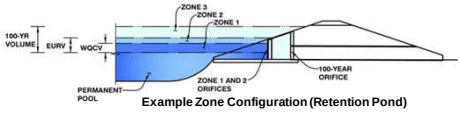
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
me Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.02	1.70
	0:15:00	0.00	0.00	1.98	3.24	4.02	2.70	3.37	3.29	6.71
	0:20:00	0.00	0.00	7.03	9.26	11.39	6.86	7.99	8.56	16.49
	0:25:00	0.00	0.00	16.22	23.99	31.04	15.92	18.80	20.87	46.11
	0:30:00	0.00	0.00	21.04	30.58	37.52	42.14	50.19	56.78	102.80
	0:35:00	0.00	0.00	19.65	27.93	33.93	49.02	57.73	68.74	119.90
	0:40:00	0.00	0.00	17.24	23.97	29.19	46.99	55.03	65.36	113.04
	0:45:00	0.00	0.00	14.41	20.36	25.26	41.20	48.24	59.02	102.02
	0:50:00	0.00	0.00	12.07	17.45	21.34	36.87	43.17	52.57	90.73
	0:55:00	0.00	0.00	10.18	14.61	18.05	30.88	36.21	45.31	78.28
	1:00:00	0.00	0.00	8.92	12.71	16.03	25.78	30.32	39.24	68.31
	1:05:00	0.00	0.00	8.04	11.38	14.57	22.52	26.59	35.44	61.90
	1:10:00	0.00	0.00	6.85	10.17	13.19	19.04	22.51	29.22	51.57
	1:15:00	0.00	0.00	5.75	8.68	11.82	15.96	18.93	23.67	42.36
	1:20:00	0.00	0.00	4.75	7.12	9.91	12.79	15.14	18.24	32.54
	1:25:00	0.00	0.00	3.94	5.85	7.86	10.05	11.86	13.58	24.18
	1:30:00	0.00	0.00	3.45	5.14	6.63	7.51	8.85	9.83	17.81
	1:35:00	0.00	0.00	3.23	4.79	5.92	6.04	7.09	7.62	13.97
	1:40:00	0.00	0.00	3.11	4.26	5.41	5.13	5.99	6.29	11.58
	1:45:00	0.00	0.00	3.05	3.84	5.05	4.54	5.27	5.36	9.90
	1:50:00	0.00	0.00	3.00	3.54	4.80	4.14	4.78	4.72	8.75
	1:55:00	0.00	0.00	2.63	3.31	4.49	3.88	4.45	4.27	7.92
	2:00:00	0.00	0.00	2.31	3.05	4.03	3.70	4.22	3.96	7.34
	2:05:00	0.00	0.00	1.75	2.30	3.02	2.78	3.17	2.93	5.42
	2:10:00	0.00	0.00	1.30	1.69	2.19	2.03	2.30	2.13	3.92
	2:15:00	0.00	0.00	0.95	1.23	1.58	1.48	1.67	1.56	2.85
	2:20:00	0.00	0.00	0.69	0.89	1.15	1.08	1.22	1.15	2.09
	2:25:00	0.00	0.00	0.50	0.63	0.82	0.76	0.86	0.82	1.49
	2:30:00	0.00	0.00	0.35	0.43	0.58	0.54	0.61	0.58	1.05
	2:35:00	0.00	0.00	0.24	0.30	0.40	0.38	0.43	0.41	0.74
	2:40:00	0.00	0.00	0.15	0.20	0.26	0.25	0.29	0.27	0.49
	2:45:00	0.00	0.00	0.08	0.12	0.15	0.15	0.17	0.16	0.29
	2:50:00	0.00	0.00	0.04	0.06	0.07	0.07	0.08	0.08	0.14
	2:55:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.03	0.04
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond C



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	22.77	acres
Watershed Length =	1,580	ft
Watershed Length to Centroid =	948	ft
Watershed Slope =	0.021	ft/ft
Watershed Imperviousness =	60.80%	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.

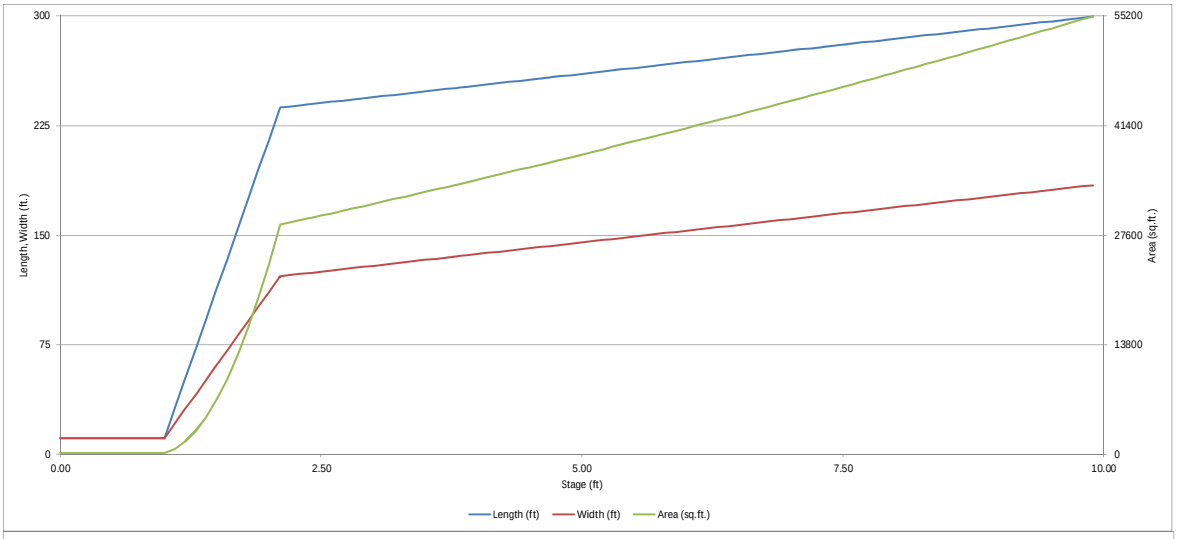
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.453	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.503	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.395	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.923	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.376	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	2.946	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.429	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.022	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	6.989	acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	1.158	acre-feet		
Approximate 5-yr Detention Volume =	1.561	acre-feet		
Approximate 10-yr Detention Volume =	2.008	acre-feet		
Approximate 25-yr Detention Volume =	2.170	acre-feet		
Approximate 50-yr Detention Volume =	2.262	acre-feet		
Approximate 100-yr Detention Volume =	2.465	acre-feet		

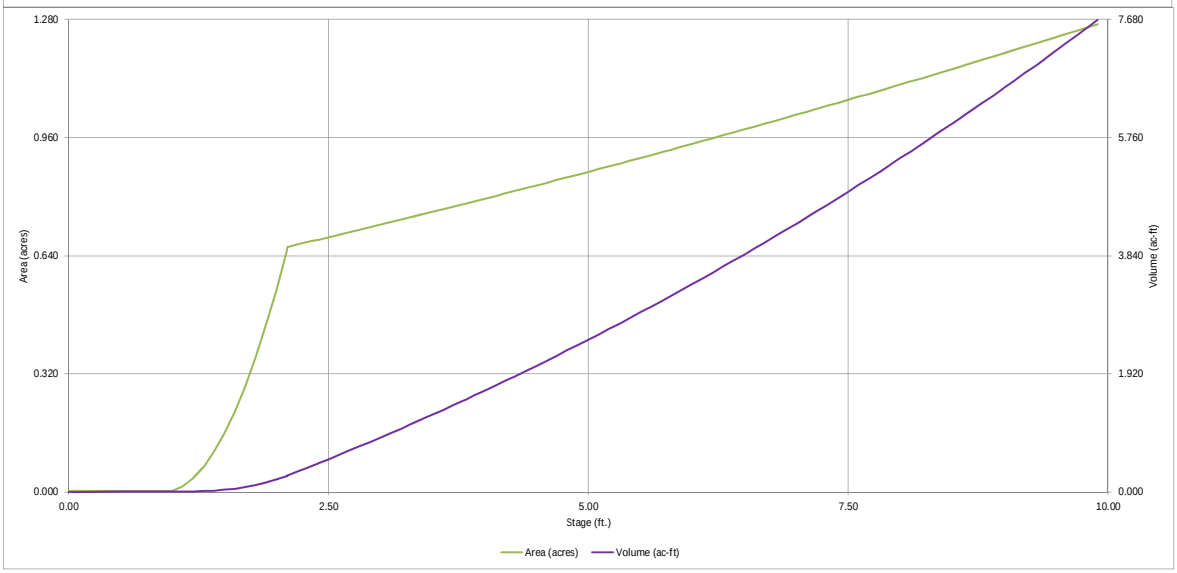
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.453	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.050	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.962	acre-feet
Total Detention Basin Volume =	2.465	acre-feet
Initial Surcharge Volume (ISV) =	59	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H_{total}) =	5.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.005	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	118	ft^2
Surcharge Volume Length (L_{ISV}) =	10.9	ft
Surcharge Volume Width (W_{ISV}) =	10.9	ft
Depth of Basin Floor (H_{FLOOR}) =	1.11	ft
Length of Basin Floor (L_{FLOOR}) =	237.3	ft
Width of Basin Floor (W_{FLOOR}) =	121.9	ft
Area of Basin Floor (A_{FLOOR}) =	28,926	ft^2
Volume of Basin Floor (V_{FLOOR}) =	11,431	ft^3
Depth of Main Basin (H_{MAIN}) =	2.89	ft
Length of Main Basin (L_{MAIN}) =	260.4	ft
Width of Main Basin (W_{MAIN}) =	145.0	ft
Area of Main Basin (A_{MAIN}) =	37,765	ft^2
Volume of Main Basin (V_{MAIN}) =	96,086	ft^3
Calculated Total Basin Volume (V_{total}) =	2.471	acre-feet

Depth Increment = 0.10 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		10.9	10.9	118		0.003		
ISV	0.50		10.9	10.9	118		0.003	59	0.001
	0.60		10.9	10.9	118		0.003	71	0.002
	0.70		10.9	10.9	118		0.003	83	0.002
	0.80		10.9	10.9	118		0.003	95	0.002
	0.90		10.9	10.9	118		0.003	107	0.002
	1.00		10.9	10.9	118		0.003	118	0.003
	1.10		31.3	20.9	653		0.015	154	0.004
	1.20		51.7	30.9	1,596		0.037	263	0.006
	1.30		72.1	40.9	2,947		0.068	486	0.011
	1.40		92.5	50.9	4,706		0.108	866	0.020
	1.50		112.9	60.9	6,873		0.158	1,441	0.033
	1.60		133.3	70.9	9,448		0.217	2,254	0.052
	1.70		153.7	80.9	12,431		0.285	3,344	0.077
	1.80		174.1	90.9	15,821		0.363	4,754	0.109
	1.90		194.5	100.9	19,620		0.450	6,522	0.150
	2.00		214.9	110.9	23,827		0.547	8,691	0.200
	2.10		235.3	120.9	28,442		0.653	11,301	0.259
Floor	2.11		237.3	121.9	28,926		0.664	11,588	0.266
	2.20		238.0	122.6	29,185		0.670	14,203	0.326
	2.30		238.8	123.4	29,474		0.677	17,136	0.393
Zone 1 (WQCV)	2.39		239.6	124.1	29,736		0.683	19,801	0.455
	2.40		239.6	124.2	29,765		0.683	20,098	0.461
	2.50		240.4	125.0	30,056		0.690	23,089	0.530
	2.60		241.2	125.8	30,349		0.697	26,109	0.599
	2.70		242.0	126.6	30,644		0.703	29,159	0.669
	2.80		242.8	127.4	30,939		0.710	32,238	0.740
	2.90		243.6	128.2	31,236		0.717	35,347	0.811
	3.00		244.4	129.0	31,534		0.724	38,485	0.884
	3.10		245.2	129.8	31,834		0.731	41,654	0.956
	3.20		246.0	130.6	32,134		0.738	44,852	1.030
	3.30		246.8	131.4	32,436		0.745	48,081	1.104
	3.40		247.6	132.2	32,740		0.752	51,340	1.179
	3.50		248.4	133.0	33,044		0.759	54,629	1.254
	3.60		249.2	133.8	33,350		0.766	57,948	1.330
	3.70		250.0	134.6	33,657		0.773	61,299	1.407
	3.80		250.8	135.4	33,965		0.780	64,680	1.485
Zone 2 (EURV)	3.83		251.1	135.6	34,058		0.782	65,700	1.508
	3.90		251.6	136.2	34,275		0.787	68,092	1.563
	4.00		252.4	137.0	34,586		0.794	71,535	1.642
	4.10		253.2	137.8	34,898		0.801	75,009	1.722
	4.20		254.0	138.6	35,212		0.808	78,515	1.802
	4.30		254.8	139.4	35,526		0.816	82,051	1.884
	4.40		255.6	140.2	35,842		0.823	85,620	1.966
	4.50		256.4	141.0	36,160		0.830	89,220	2.048
	4.60		257.2	141.8	36,478		0.837	92,852	2.132
	4.70		258.0	142.6	36,798		0.845	96,516	2.216
	4.80		258.8	143.4	37,119		0.852	100,211	2.301
	4.90		259.6	144.2	37,442		0.860	103,939	2.386
Zone 3 (100-year)	5.00		260.4	145.0	37,765		0.867	107,700	2.472
	5.10		261.2	145.8	38,090		0.874	111,493	2.560
	5.20		262.0	146.6	38,417		0.882	115,318	2.647
	5.30		262.8	147.4	38,744		0.889	119,176	2.736
	5.40		263.6	148.2	39,073		0.897	123,067	2.825
	5.50		264.4	149.0	39,403		0.905	126,991	2.915
	5.60		265.2	149.8	39,735		0.912	130,948	3.006
	5.70		266.0	150.6	40,067		0.920	134,938	3.098
	5.80		266.8	151.4	40,401		0.927	138,961	3.190
	5.90		267.6	152.2	40,736		0.935	143,018	3.283
	6.00		268.4	153.0	41,073		0.943	147,108	3.377
	6.10		269.2	153.8	41,411		0.951	151,233	3.472
	6.20		270.0	154.6	41,750		0.958	155,391	3.567
	6.30		270.8	155.4	42,090		0.966	159,583	3.664
	6.40		271.6	156.2	42,432		0.974	163,809	3.761
	6.50		272.4	157.0	42,775		0.982	168,069	3.858
	6.60		273.2	157.8	43,119		0.990	172,364	3.957
	6.70		274.0	158.6	43,464		0.998	176,693	4.056
	6.80		274.8	159.4	43,811		1.006	181,057	4.156
	6.90		275.6	160.2	44,159		1.014	185,455	4.257
	7.00		276.4	161.0	44,509		1.022	189,889	4.359
	7.10		277.2	161.8	44,859		1.030	194,357	4.462
	7.20		278.0	162.6	45,211		1.038	198,860	4.565
	7.30		278.8	163.4	45,564		1.046	203,399	4.669
	7.40		279.6	164.2	45,919		1.054	207,973	4.774
	7.50		280.4	165.0	46,274		1.062	212,583	4.880
	7.60		281.2	165.8	46,631		1.071	217,228	4.987
	7.70		282.0	166.6	46,990		1.079	221,909	5.094
	7.80		282.8	167.4	47,349		1.087	226,626	5.203
	7.90		283.6	168.2	47,710		1.095	231,379	5.312
	8.00		284.4	169.0	48,072		1.104	236,168	5.422
	8.10		285.2	169.8	48,436		1.112	240,994	5.532
	8.20		286.0	170.6	48,800		1.120	245,855	5.644
	8.30		286.8	171.4	49,166		1.129	250,754	5.757
	8.40		287.6	172.2	49,533		1.137	255,689	5.870
	8.50		288.4	173.0	49,902		1.146	260,660	5.984
	8.60		289.2	173.8	50,272		1.154	265,669	6.099
	8.70		290.0	174.6	50,643		1.163	270,715	6.215
	8.80		290.8	175.4	51,015		1.171	275,798	6.331
	8.90		291.6	176.2	51,389		1.180	280,918	6.449
	9.00		292.4	177.0	51,764		1.188	286,076	6.567
	9.10		293.2	177.8	52,140		1.197	291,271	6.687
	9.20		294.0	178.6	52,517		1.206	296,504	6.807
	9.30		294.8	179.4	52,896		1.214	301,774	6.928
	9.40		295.6	180.2	53,276		1.223	307,083	7.050
	9.50		296.4	181.0	53,658		1.232	312,430	7.172
	9.60		297.2	181.8	54,040		1.241	317,814	7.296
	9.70		298.0	182.6	54,424		1.249	323,238	7.421
	9.80		298.8	183.4	54,809		1.258	328,699	7.546
	9.90		299.6	184.2	55,196		1.267	334,200	7.672


300
225
150
75
0
Length, Width (ft.)
55200
41400
27600
13800
0
Area (sq.ft.)
0.00
2.50
5.00
7.50
10.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

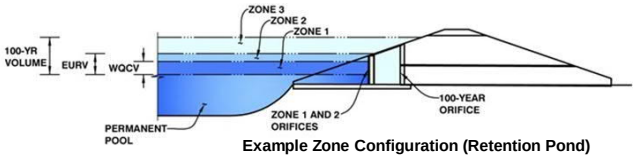

1.280
0.960
0.640
0.320
0.000
Area (acres)
7.680
5.760
3.840
1.920
0.000
Volume (ac-ft)
0.00
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond C



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.39	0.453	Orifice Plate
Zone 2 (EURV)	3.83	1.050	Orifice Plate
Zone 3 (100-year)	5.00	0.962	Weir&Pipe (Restrict)
Total (all zones)		2.465	

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	ft^2
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	ft^2
Depth at top of Zone using Orifice Plate =	3.83	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	ft^2

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)	ow 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.30	2.00	3.00				
Orifice Area (sq. inches)	0.75	3.10	3.50	10.00				

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	w 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	ft^2
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 =	3.83	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.83	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	7.91	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	18.75	N/A	ft^2
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	4.69	N/A	ft^2
Debris Clogging % =	75%	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 =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	2.37	N/A	ft^2
Outlet Pipe Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	0.70	N/A	feet
Restrictor Plate Height Above Pipe Invert =	14.60		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.54	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.90	feet
Spillway Crest Length =	21.00	feet	Stage at Top of Freeboard =	6.90	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.01	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	4.26	acre-ft

Calculated Parameters for Spillway

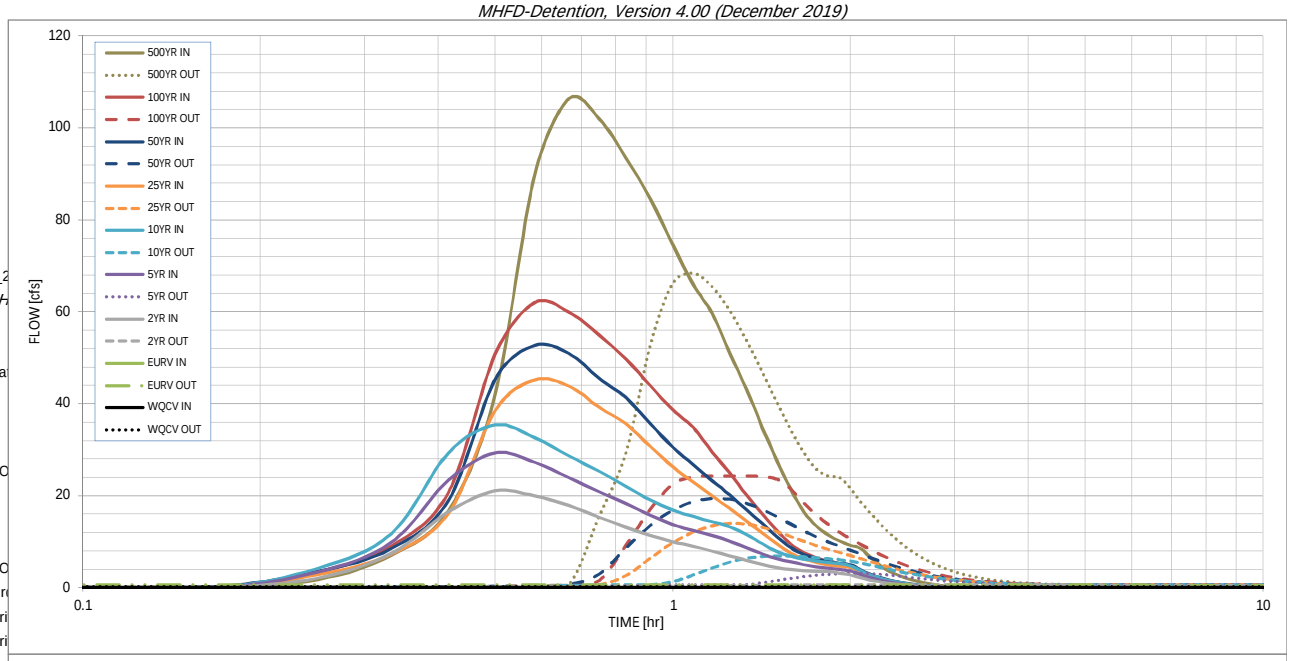
Routed Hydrograph Results

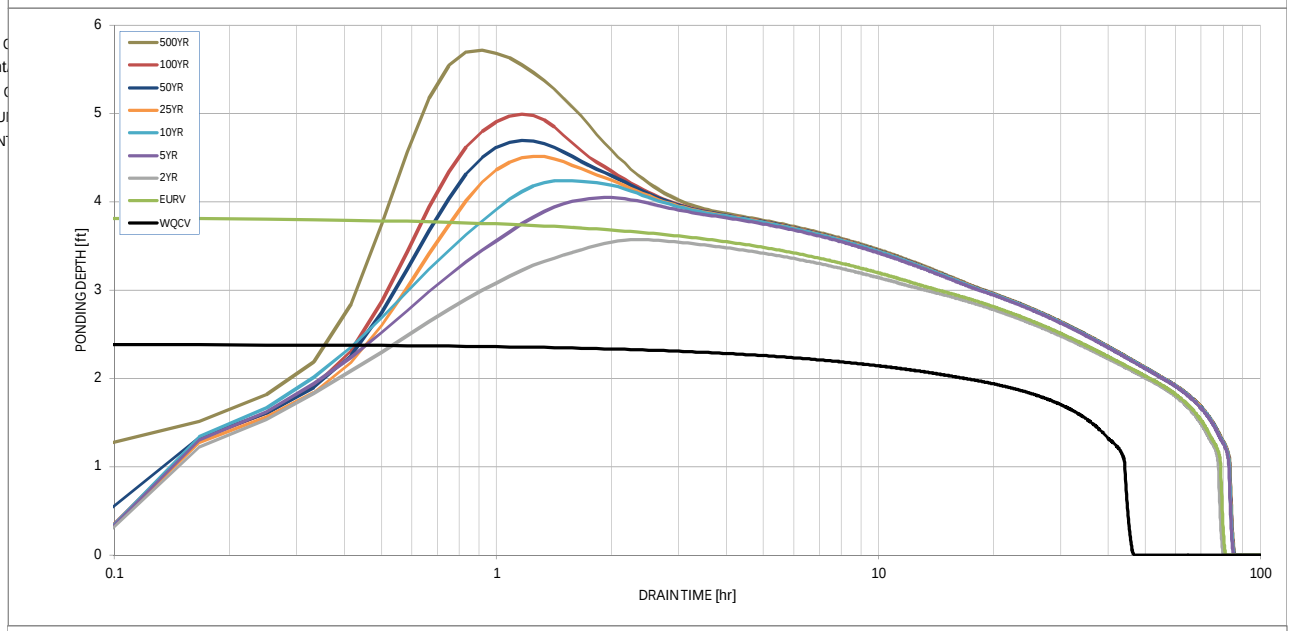
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

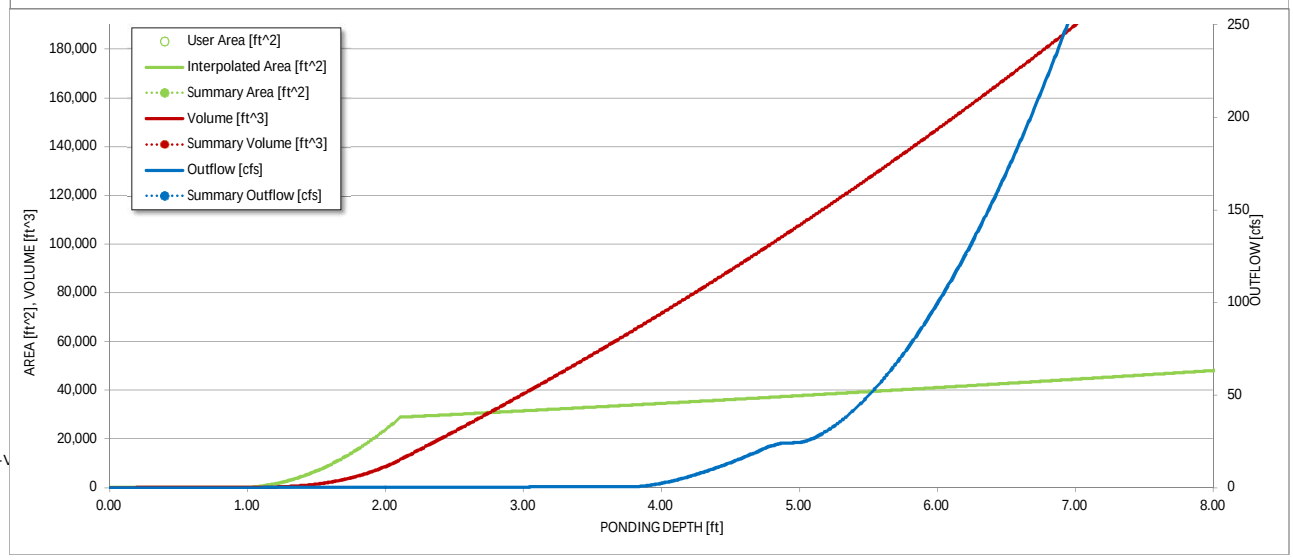
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
CUHP Runoff Volume (acre-ft) =	0.453	1.503	1.395	1.923	2.376	2.946	3.429	4.022	6.989
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.395	1.923	2.376	2.946	3.429	4.022	6.989
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.1	5.9	8.9	16.0	20.1	25.7	50.8
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	0.70	0.88	1.13	2.23
Peak Inflow Q (cfs) =	N/A	N/A	21.1	29.3	35.4	45.2	52.7	62.0	106.3
Peak Outflow Q (cfs) =	0.2	0.7	0.6	3.2	6.9	14.0	19.4	24.3	68.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.8	0.9	1.0	0.9	1.3
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	utlet Plate	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.3	0.7	1.0	1.2	1.3
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) =	40	69	68	71	70	68	66	64	55
Time to Drain 99% of Inflow Volume (hours) =	43	74	73	77	77	76	75	74	70
Maximum Ponding Depth (ft) =	2.39	3.83	3.57	4.05	4.24	4.52	4.69	4.99	5.71
Area at Maximum Ponding Depth (acres) =	0.68	0.78	0.76	0.80	0.81	0.83	0.84	0.87	0.92
Maximum Volume Stored (acre-ft) =	0.455	1.508	1.307	1.682	1.835	2.057	2.207	2.464	3.107

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	0.23	0.02	1.76
	0:15:00	0.00	0.00	2.07	3.38	4.18	2.80	3.51	3.42	7.04
	0:20:00	0.00	0.00	7.44	9.81	11.74	7.28	8.48	9.07	16.75
	0:25:00	0.00	0.00	16.50	23.35	29.31	16.19	18.96	20.73	41.98
	0:30:00	0.00	0.00	21.06	29.32	35.40	38.54	45.30	50.76	89.72
	0:35:00	0.00	0.00	19.96	27.28	32.63	45.18	52.70	62.01	106.34
	0:40:00	0.00	0.00	17.86	23.95	28.68	43.85	50.93	59.93	102.03
	0:45:00	0.00	0.00	15.32	20.84	25.31	39.25	45.55	55.00	93.50
	0:50:00	0.00	0.00	13.15	18.30	21.97	35.57	41.28	49.72	84.52
	0:55:00	0.00	0.00	11.34	15.74	19.04	30.68	35.65	43.89	74.61
	1:00:00	0.00	0.00	9.96	13.74	16.87	26.25	30.55	38.70	65.94
	1:05:00	0.00	0.00	9.02	12.40	15.46	22.96	26.77	34.84	59.61
	1:10:00	0.00	0.00	7.92	11.36	14.33	19.88	23.21	29.50	50.89
	1:15:00	0.00	0.00	6.90	10.08	13.22	17.25	20.17	24.83	43.18
	1:20:00	0.00	0.00	5.96	8.65	11.54	14.49	16.93	20.14	34.99
	1:25:00	0.00	0.00	5.09	7.36	9.55	12.02	14.02	16.04	27.76
	1:30:00	0.00	0.00	4.37	6.30	7.88	9.59	11.14	12.47	21.51
	1:35:00	0.00	0.00	3.92	5.64	6.85	7.54	8.71	9.51	16.50
	1:40:00	0.00	0.00	3.69	5.00	6.24	6.27	7.23	7.67	13.42
	1:45:00	0.00	0.00	3.58	4.52	5.82	5.49	6.31	6.54	11.48
	1:50:00	0.00	0.00	3.52	4.18	5.52	4.99	5.71	5.77	10.14
	1:55:00	0.00	0.00	3.12	3.92	5.20	4.64	5.28	5.23	9.19
	2:00:00	0.00	0.00	2.77	3.63	4.73	4.41	5.00	4.84	8.50
	2:05:00	0.00	0.00	2.15	2.83	3.67	3.42	3.88	3.68	6.45
	2:10:00	0.00	0.00	1.63	2.12	2.75	2.55	2.88	2.69	4.71
	2:15:00	0.00	0.00	1.23	1.60	2.05	1.91	2.16	2.01	3.51
	2:20:00	0.00	0.00	0.93	1.20	1.52	1.43	1.61	1.51	2.62
	2:25:00	0.00	0.00	0.69	0.88	1.11	1.05	1.18	1.12	1.94
	2:30:00	0.00	0.00	0.50	0.63	0.81	0.76	0.85	0.82	1.42
	2:35:00	0.00	0.00	0.36	0.45	0.59	0.56	0.62	0.60	1.03
	2:40:00	0.00	0.00	0.25	0.31	0.42	0.40	0.45	0.43	0.74
	2:45:00	0.00	0.00	0.16	0.21	0.28	0.27	0.30	0.29	0.50
	2:50:00	0.00	0.00	0.09	0.13	0.16	0.17	0.19	0.18	0.30
	2:55:00	0.00	0.00	0.04	0.07	0.08	0.09	0.10	0.09	0.16
	3:00:00	0.00	0.00	0.02	0.03	0.03	0.03	0.04	0.03	0.06
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

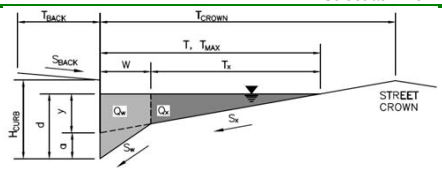
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Street at DP 5A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.002	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 =	0.028	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.3	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} =**	**34.9**	**63.3**	**cfs**

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

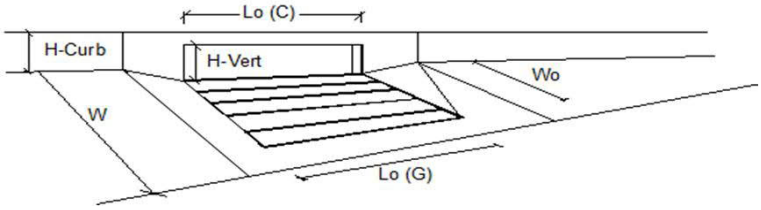
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

(Only the sump inlets were checked)

JR Response: Noted

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



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

		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**			**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**			**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**			**%**

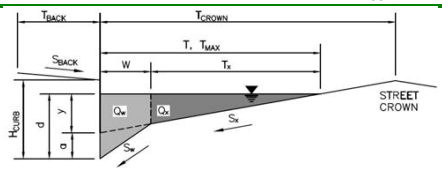
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet 1A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	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 =	0.028	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

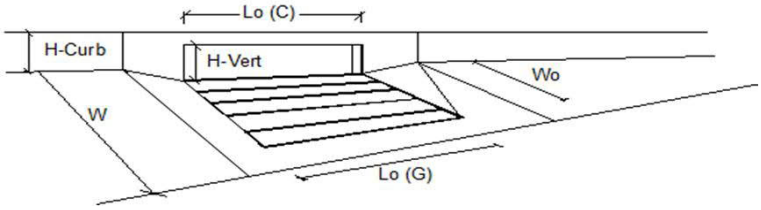
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**18.1**	**21.1**	**cfs**

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 (CDOT Type R Curb Opening)	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 =**	**7.1**	**12.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**81**	**%**

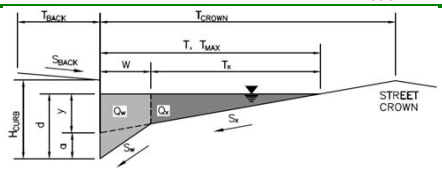
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet 3A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	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 =	0.028	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

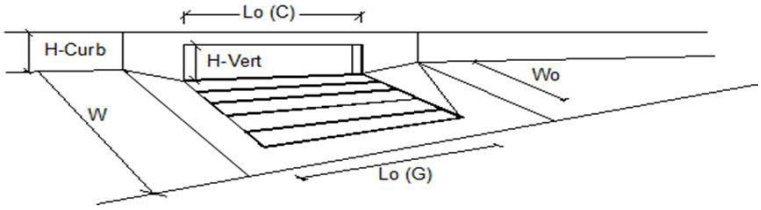
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**18.1**	**21.1**	**cfs**

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 (CDOT Type R Curb Opening)	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 =**	**8.2**	**14.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.2**	**6.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**98**	**70**	**%**

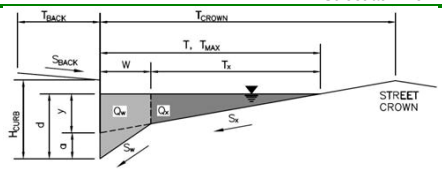
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Street at DP 5A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.002	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 =	0.028	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.3	inches
Allow Flow Depth at Street Crown (leave blank for no)		☑	☑	check = yes

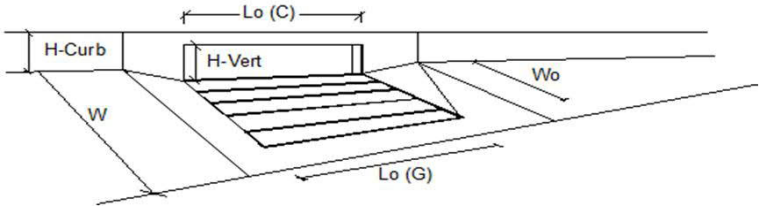
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**34.9**	**63.3**	**cfs**

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 =			
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =			inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =			
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =			ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =			ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =			
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =			

		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**			**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**			**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**			**%**

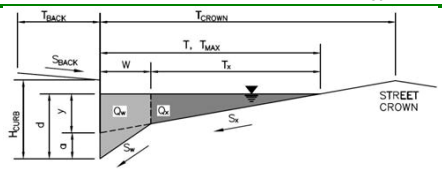
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet 7A**



Gutter Geometry (Enter data in the blue cells)

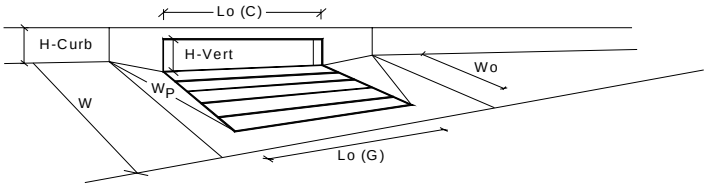
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



		MINOR	MAJOR	
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	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 =	4	4	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	8.3	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening 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	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.78	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**18.2**	**39.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	10.5	29.7	cfs

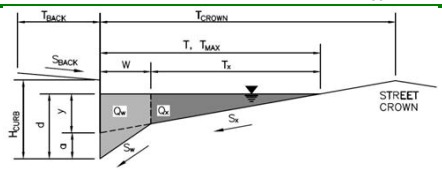
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet 2A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	18.0	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 =	0.284	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

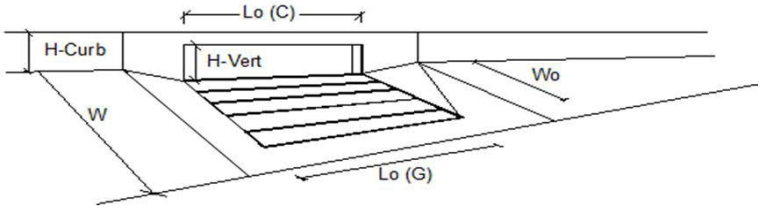
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**9.0**	**18.6**	**cfs**

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 (CDOT Type R Curb Opening)	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 =**	**6.4**	**11.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**87**	**%**

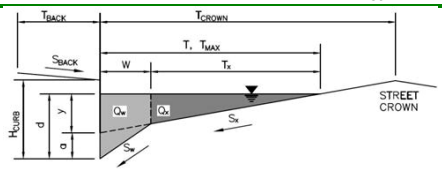
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet 4A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	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 =	0.028	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

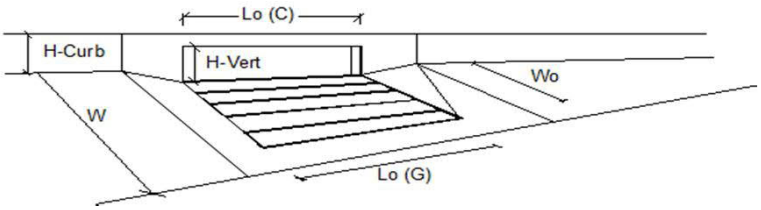
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**18.1**	**21.0**	**cfs**

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 (CDOT Type R Curb Opening)	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 =**	**7.0**	**12.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**3.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**78**	**%**

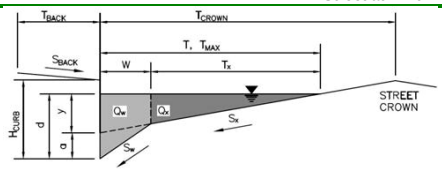
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Street at DP 6A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.002	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 =	0.028	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☑	☑	check = yes

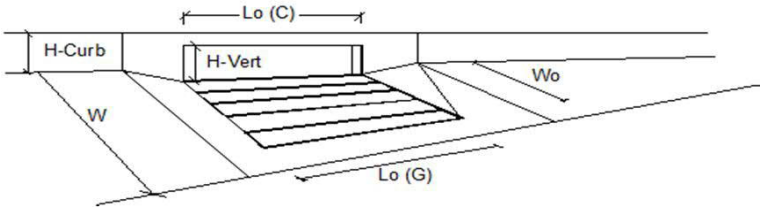
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**34.9**	**57.7**	**cfs**

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 =			
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =			inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =			
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =			ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =			ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =			
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =			

		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**			**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**			**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**			**%**

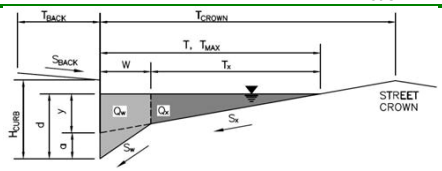
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet 8A**



Gutter Geometry (Enter data in the blue cells)

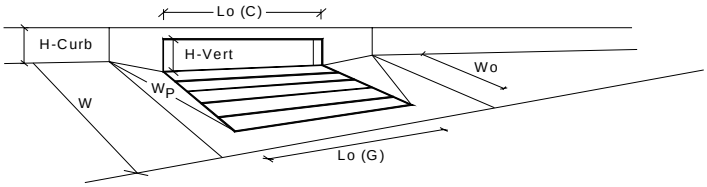
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	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 =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.8	8.3	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening 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} =	0.32	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	0.78	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.78	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**12.5**	**29.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	11.3	19.9	cfs

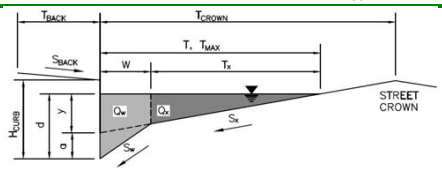
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 1.1B**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.026	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

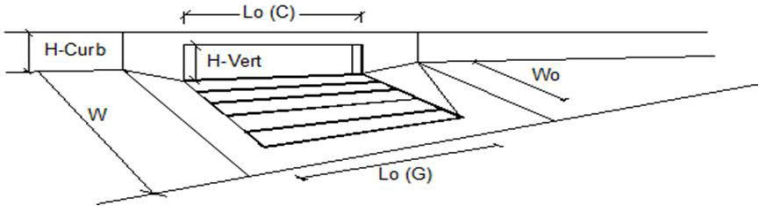
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**19.1**	**19.1**	**cfs**

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 (CDOT Type R Curb Opening)	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 =**	**5.3**	**9.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**87**	**%**

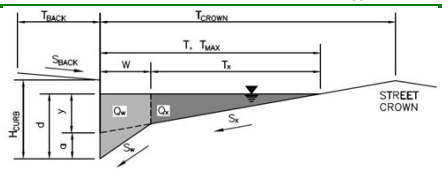
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 1.2B**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.026	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	9.5	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.3	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

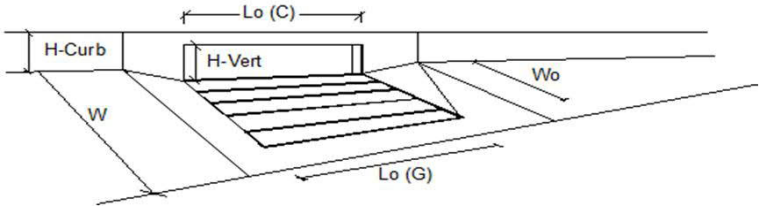
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**3.7**	**19.1**	**cfs**

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 (CDOT Type R Curb Opening)	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 =**	**3.6**	**7.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**97**	**%**

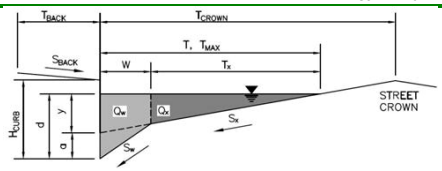
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 4b**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	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 =	0.016	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

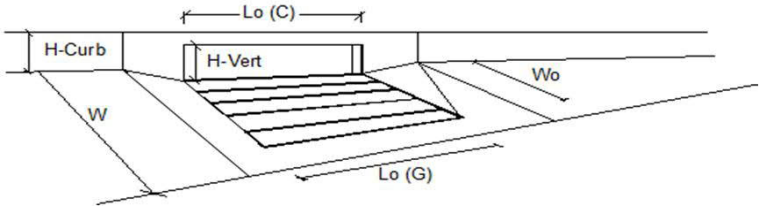
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**15.0**	**52.4**	**cfs**

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 (CDOT Type R Curb Opening)	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 =**	**6.7**	**11.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**4.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**99**	**74**	**%**

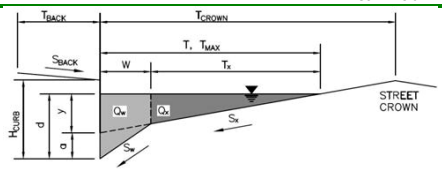
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 9b**



Gutter Geometry (Enter data in the blue cells)

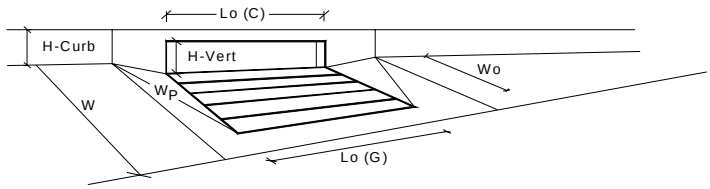
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



		MINOR	MAJOR	
Design Information (Input)				
Type of Inlet (CDOT Type R Curb Opening)	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 =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.8	12.0	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
Area Opening 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} =	0.32	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.78	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**12.5**	**39.1**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Minor Storm	$Q_{PEAK\ REQUIRED}$ =	12.5	30.9	cfs

JR Response: Updated

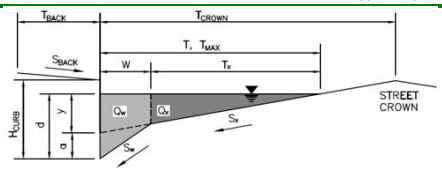
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 7b**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	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 =	0.016	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

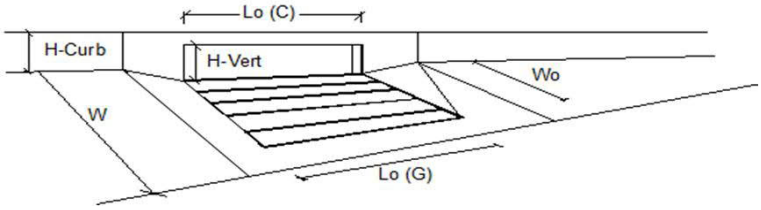
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**15.0**	**52.3**	**cfs**

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 (CDOT Type R Curb Opening)	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 =**	**7.0**	**11.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**3.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**98**	**78**	**%**

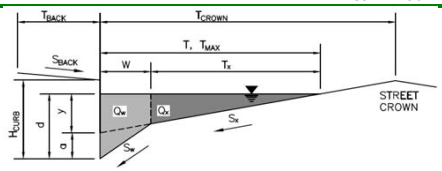
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 10b**



Gutter Geometry (Enter data in the blue cells)

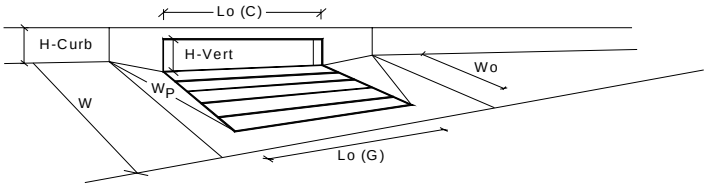
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	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 =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.8	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
Area Opening 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} =	0.32	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	0.75	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.78	0.89	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**12.5**	**27.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.0	12.5	cfs

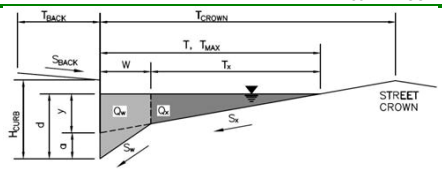
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 2.3C**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	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 =	0.027	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☑	☑	check = yes

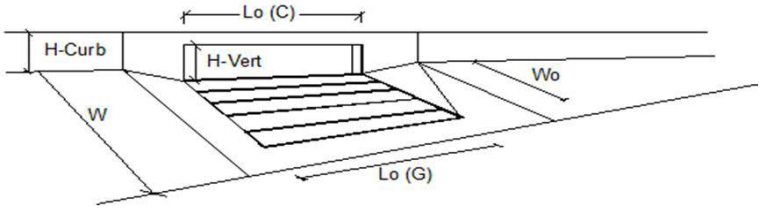
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**24.2**	**44.5**	**cfs**

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 (CDOT Type R Curb Opening)	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 =**	**7.2**	**11.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**3.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**98**	**76**	**%**

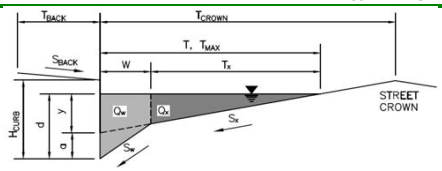
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 2.1C



Gutter Geometry (Enter data in the blue cells)

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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	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 =	0.020	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

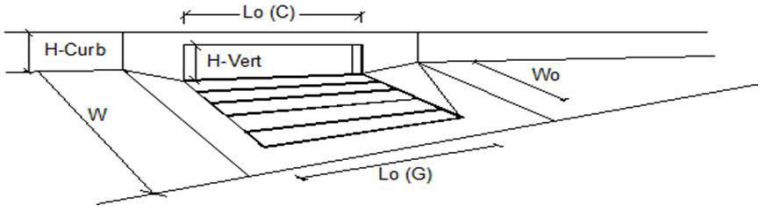
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**16.7**	**16.7**	**cfs**

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 (CDOT Type R Curb Opening)	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 =**	**0.8**	**1.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**91**	**%**

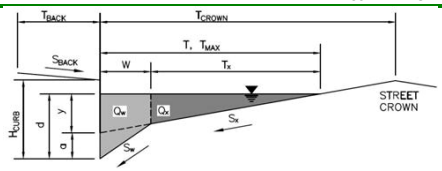
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 4.2C**



Gutter Geometry (Enter data in the blue cells)

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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	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 =	0.020	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

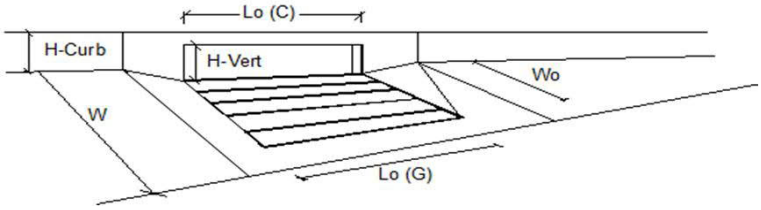
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**16.7**	**16.7**	**cfs**

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 (CDOT Type R Curb Opening)	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 =**	**4.4**	**8.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**92**	**%**

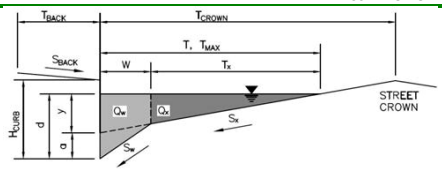
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 3.1C**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	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 =	2.000	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

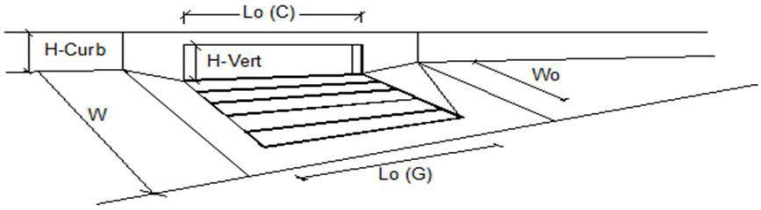
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**6.7**	**12.3**	**cfs**

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 (CDOT Type R Curb Opening)	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 =**	**1.3**	**2.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**97**	**79**	**%**

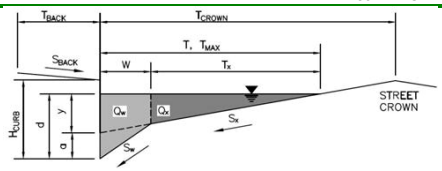
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 4C**



Gutter Geometry (Enter data in the blue cells)

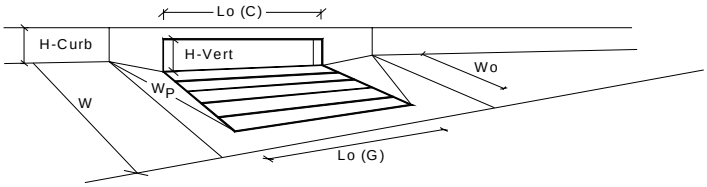
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.3	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



		MINOR	MAJOR	
Design Information (Input)				
Type of Inlet (CDOT Type R Curb Opening)	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 =	4	4	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	8.3	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening 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	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.78	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**18.2**	**39.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	16.9	35.5	cfs

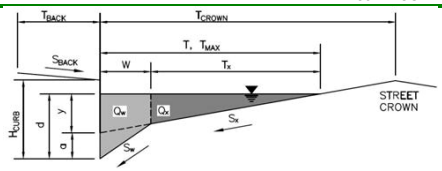
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 5C**



Gutter Geometry (Enter data in the blue cells)

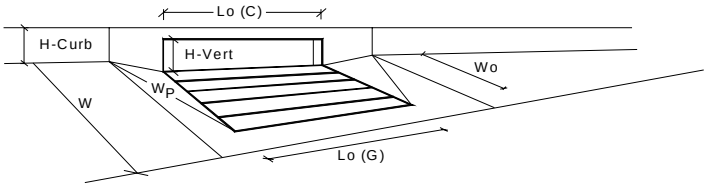
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	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} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.3	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



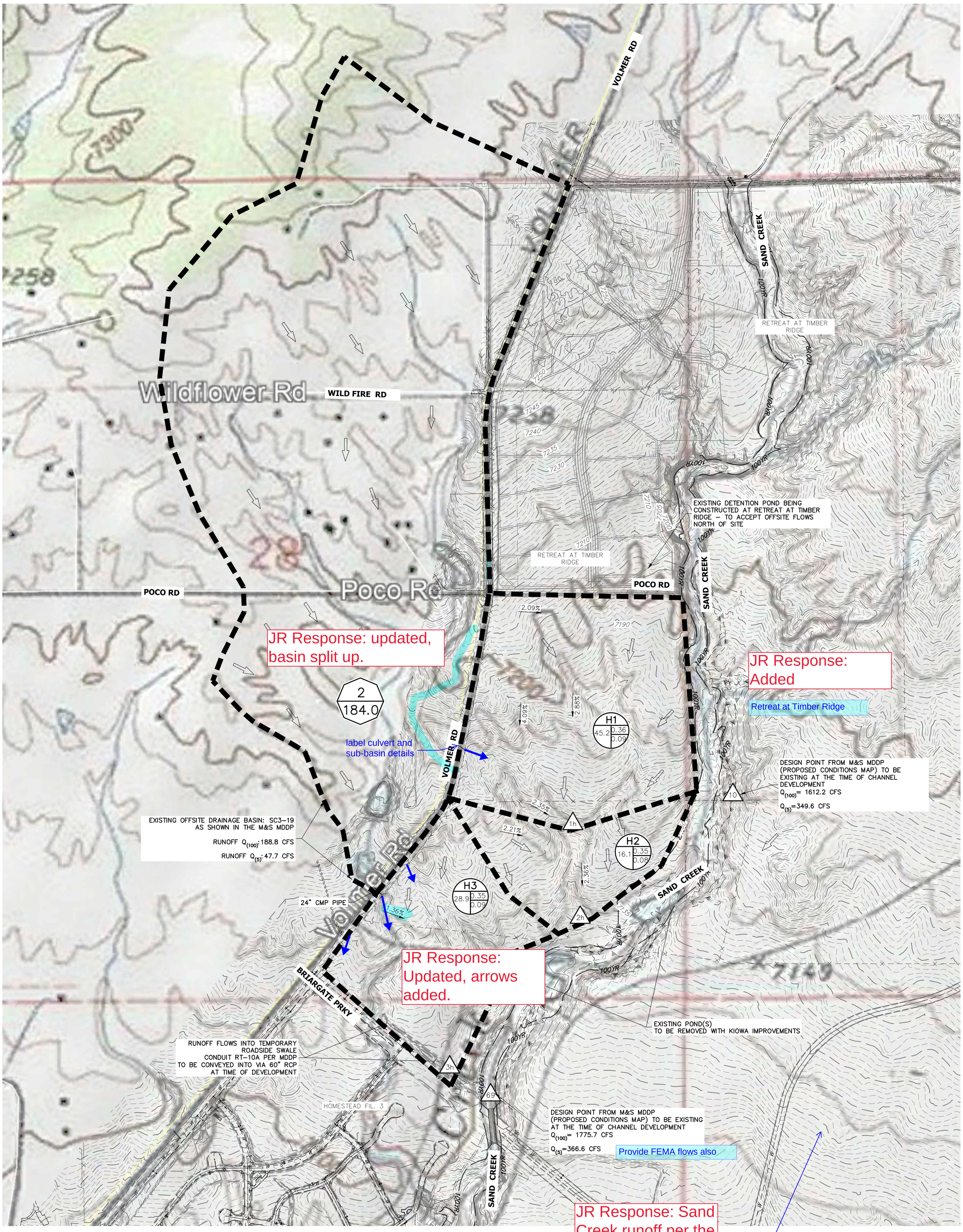
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.8	5.8	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
Area Opening 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} =	0.32	0.32	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	0.55	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.92	0.92	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**9.7**	**9.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	4.2	9.0	cfs

Appendix D
Drainage Maps

EXISTING DRAINAGE MAP
HOMESTEAD NORTH



BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
H1	45.30	3%	0.09	0.36	34.7	8.9	61.1
H2	15.90	2%	0.08	0.35	25.1	3.5	25.7
H3	29.10	3%	0.09	0.35	31.3	6.1	41.8

DESIGN POINT

DP	Q5 Total	Q100 Total
1h	8.9	61.1
2h	11.8	82.2
3h	41.8	41.8

LEGEND

BASIN ID
A: BASIN LABEL
B: AREA

DESIGN POINT

EXISTING FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING

6100

300 150 0 300 600

ORIGINAL SCALE: 1" = 300'

EX DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1–27–2021
SHEET 1 OF 1

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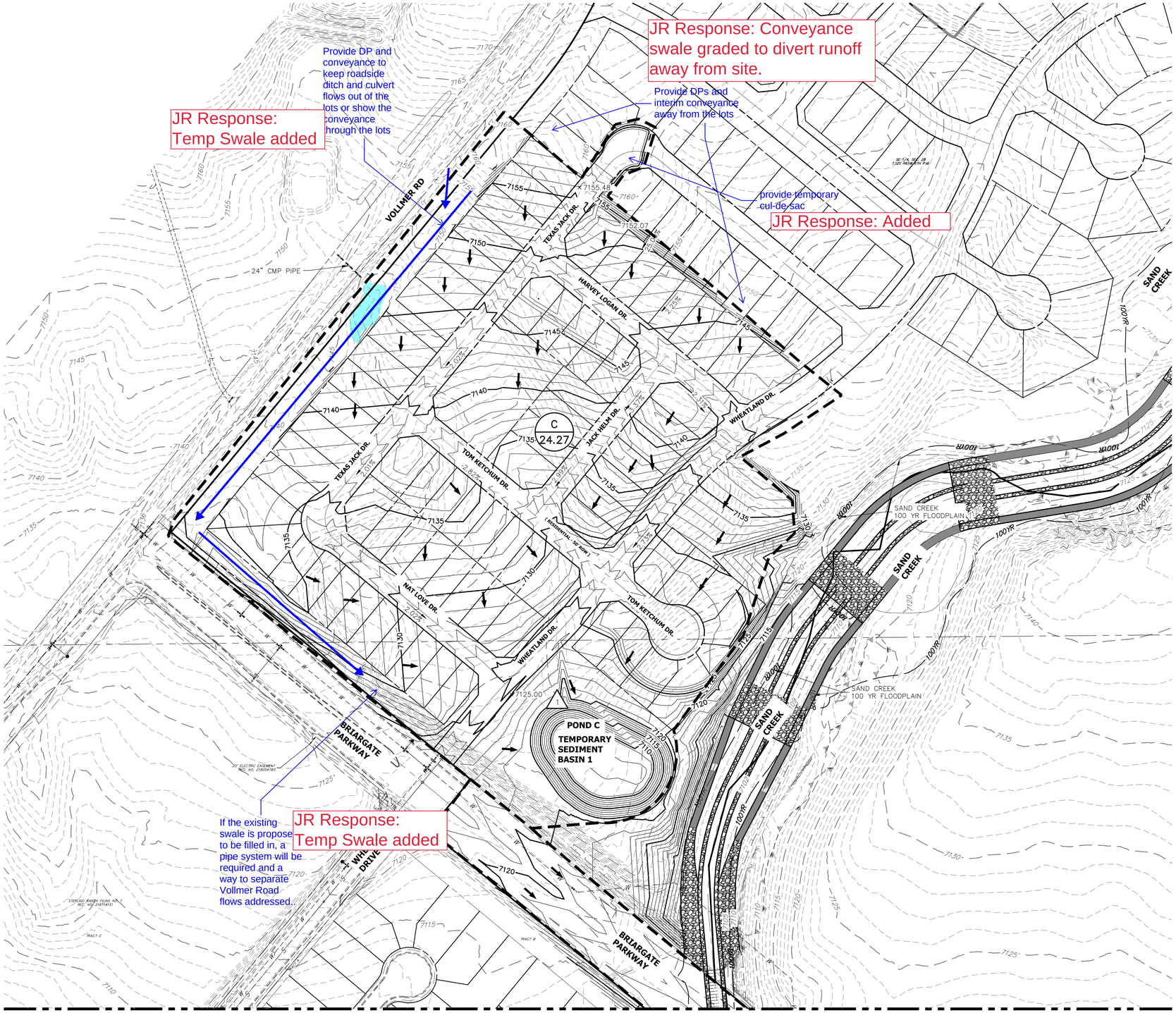
EARLY GRADING - DRAINAGE MAP



LEGEND

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

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

PROPOSED 6100

BASIN SUMMARY TABLE

Temporary Sediment Basin	Contributing On-site Basin	Area (acres)	Percent Impervious	Contributing Off-site Basin	Area (acres)	Percent Impervious	Required Volume (cf)	Provided Volume (cf)
1	C	24.27	2%				87,372	108,900
2	D	17.29	2%	OS	160.00	2%	142,244	196,020

JR Response: Updated

Provide basin and DP summary tables

JR Response: Added

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

EARLY GRADING – DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
02/12/21
SHEET 1 OF 1

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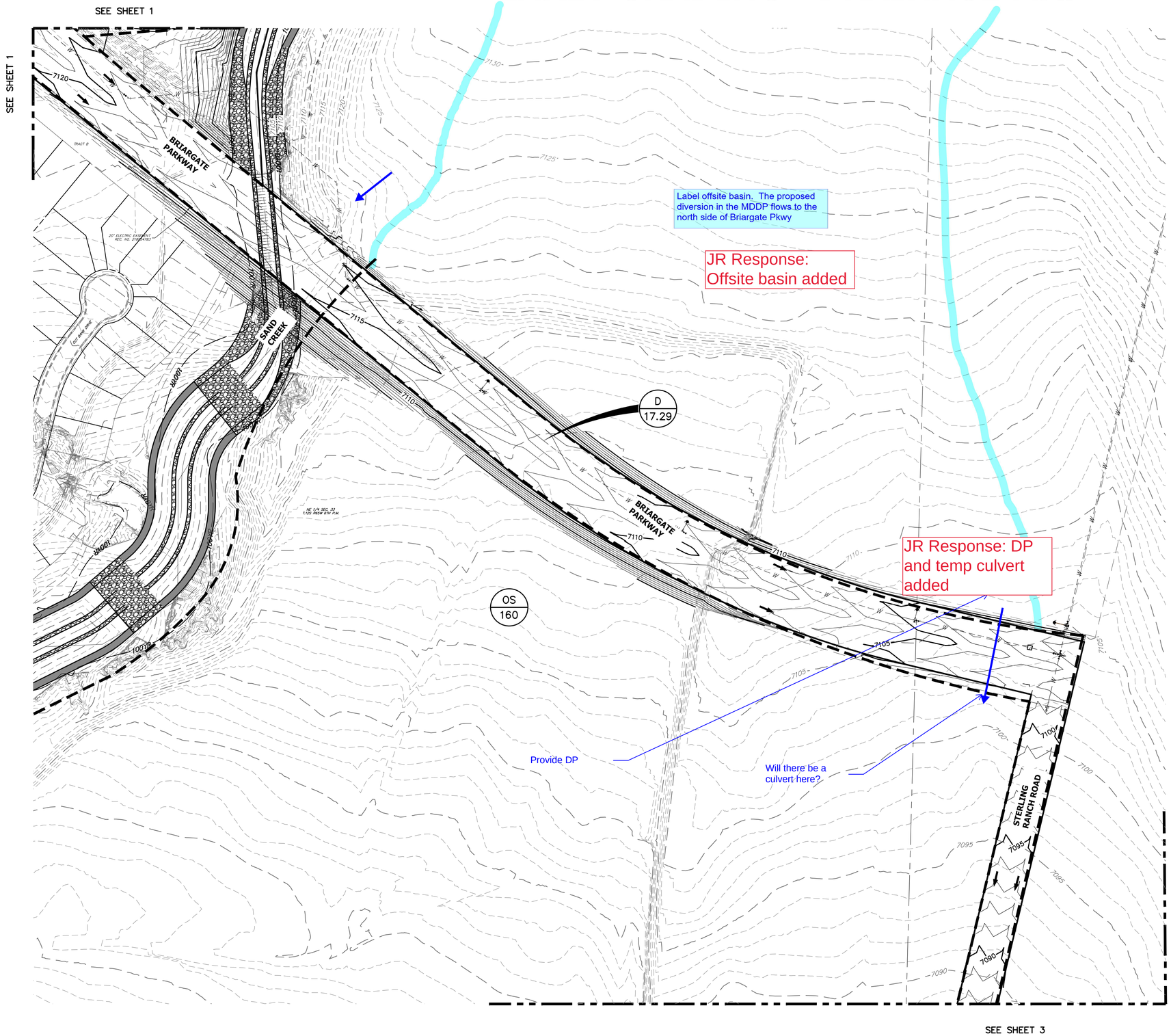
EARLY GRADING - DRAINAGE MAP



LEGEND

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

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

PROPOSED 6100

Provide basin and DP summary tables

JR Response: Added

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

EARLY GRADING – DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
02/12/21
SHEET 2 OF 4

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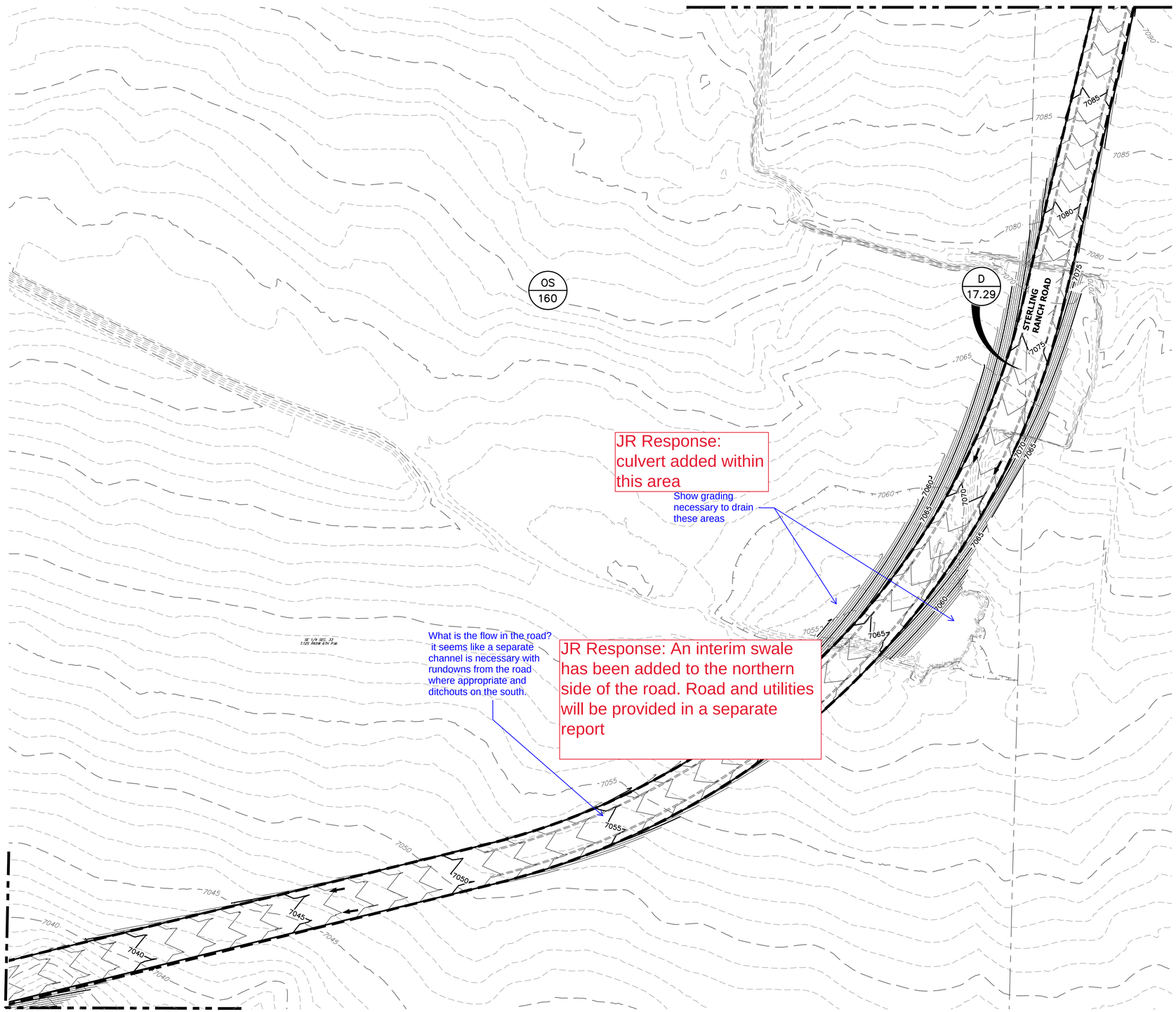
EARLY GRADING - DRAINAGE MAP

SEE SHEET 2



JR Response: culvert added within this area

Show grading necessary to drain these areas

What is the flow in the road? it seems like a separate channel is necessary with rundowns from the road where appropriate and ditchouts on the south.

JR Response: An interim swale has been added to the northern side of the road. Road and utilities will be provided in a separate report

SEE SHEET 4

SEE SHEET 4

LEGEND

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

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

PROPOSED 6100

Provide basin and DP summary tables

JR Response: Added

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

EARLY GRADING – DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
02/12/21
SHEET 3 OF 4

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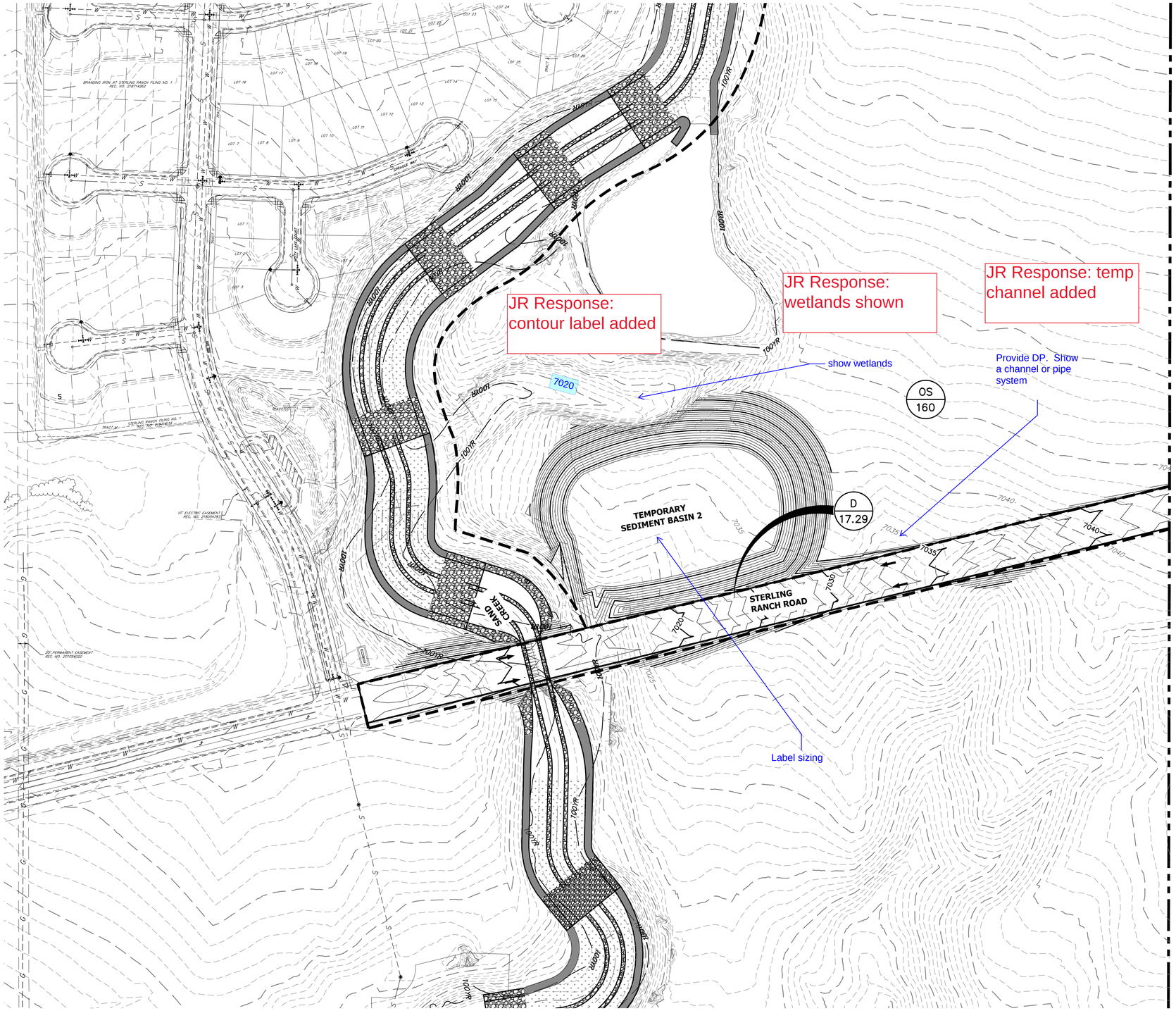
EARLY GRADING - DRAINAGE MAP



LEGEND

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

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

PROPOSED 6100

Provide basin and DP summary tables

JR Response: Added

BASIN SUMMARY TABLE

Temporary Sediment Basin	Contributing On-site Basin	Area (acres)	Percent Impervious	Contributing Off-site Basin	Area (acres)	Percent Impervious	Required Volume (cf)	Provided Volume (cf)
1	C	24.27	2%				87,372	108,900
2	D	17.29	2%	OS	160.00	2%	142,244	196,020

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

EARLY GRADING – DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
02/12/21
SHEET 4 OF 4

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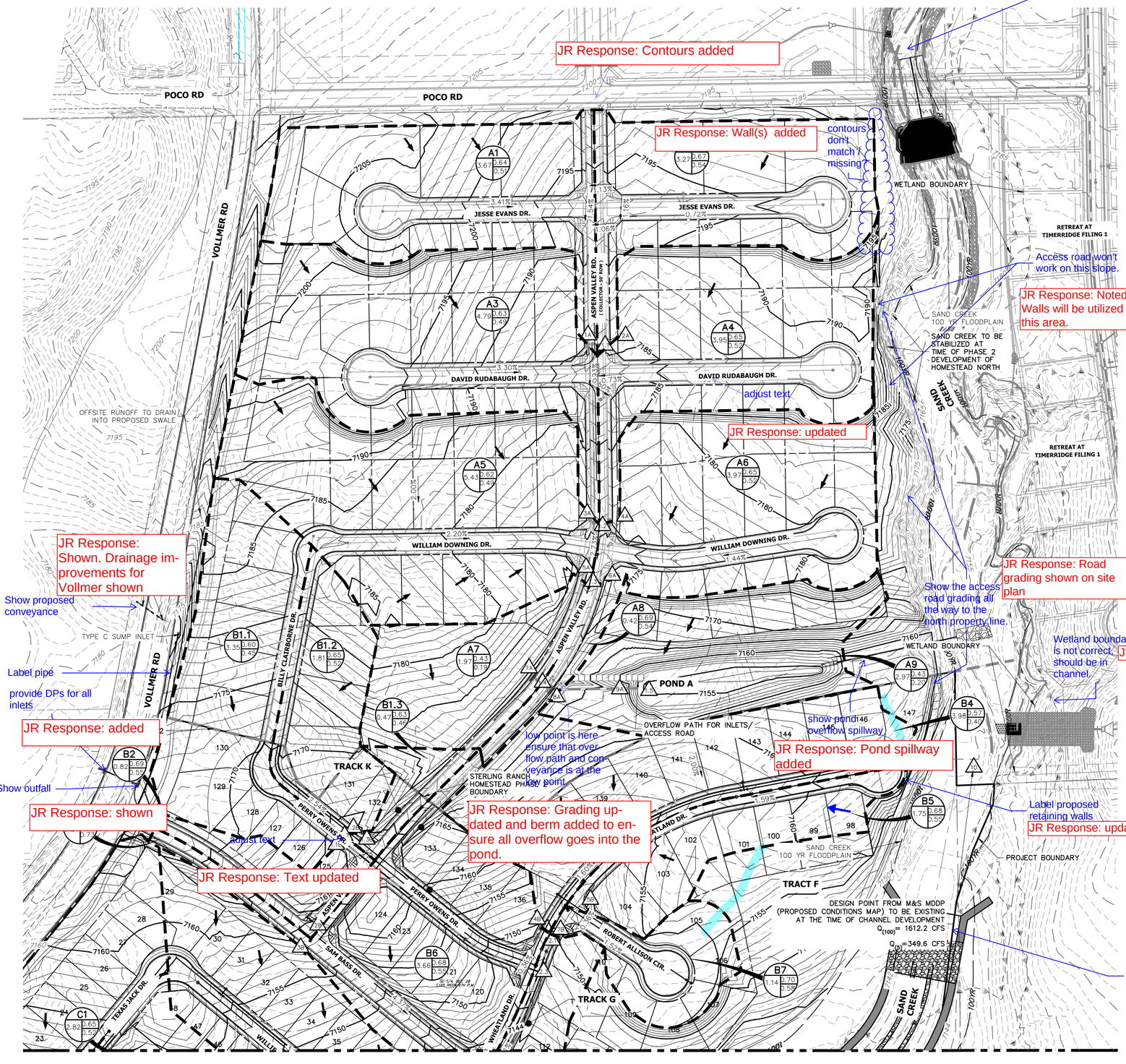
DRAINAGE MAP

Show proposed contours for Poco Road (under construction) https://epcdevplanreview.com/Public/ProjectDetails/111186

Label channel flows - MDDP/DPBS/FEMA

JR Response: added and called out



SEE SHEET 2

LEGEND

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

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

PROPOSED 6100

DESIGN POINT SUMMARY TABLE

DP	Q5 Total	Q100 Total
1a	6.9	14.6
2a	6.5	13.4
3a	8.2	20.4
4a	7.2	16.6
5a	9.5	26.1
6a	10.7	18.6
7a	10.4	29.9
8a	11.4	20.0
9a	21.6	49.5
1.1b	5.5	12.5
1.2b	3.5	7.4
1.3b	1.0	2.2
2b	2.4	6.8
3b	0.9	1.7
4b	7.5	15.9
5b	4.3	8.9
6b	10.4	26.5
7b	7.0	14.4
8b	4.1	10.9
9b	12.1	30.4
10b	4.7	12.2
11b	17.4	45.5
1c	5.4	11.4
2.1c	0.8	1.6
2.2c	9.8	20.1
2.3c	7.1	14.9
3.1c	1.2	2.4
3.2c	3.6	7.9
4c	16.9	36.2
4.2c	4.8	11.2
5c	4.1	8.8
6c	20.6	46.6

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C5	C100	tc (min)	Q5 (cfs)	Q100 (cfs)
A1	3.67	52%	0.51	0.64	13.4	6.9	14.6
A2	3.27	56%	0.54	0.67	13.6	6.5	13.4
A3	4.79	50%	0.49	0.63	13.9	8.5	18.4
A4	3.95	54%	0.52	0.65	14.1	7.4	15.6
A5	5.43	50%	0.49	0.62	11.1	10.5	22.6
A6	3.96	53%	0.52	0.65	12.6	7.7	16.3
A7	1.97	15%	0.19	0.43	16.5	1.3	4.8
A8	0.42	57%	0.54	0.69	5.0	1.2	2.5
A9	2.97	16%	0.20	0.43	13.4	2.2	7.9
B1.1	3.35	45%	0.45	0.60	13.4	5.5	12.5
B1.2	1.81	54%	0.52	0.65	12.8	3.5	7.4
B1.3	0.47	47%	0.46	0.63	8.1	1.0	2.2
B2	0.82	58%	0.55	0.69	5.0	2.3	4.9
B3	0.24	79%	0.73	0.83	5.0	0.9	1.7
B4	3.98	40%	0.40	0.57	9.5	6.7	15.9
B5	1.75	58%	0.55	0.68	7.8	4.3	8.9
B6	3.66	58%	0.55	0.68	6.5	9.6	20.0
B7	1.14	61%	0.58	0.70	8.8	2.9	5.8
B8	1.74	58%	0.56	0.68	9.3	4.1	8.5
B9	3.69	65%	0.50	0.64	13.1	6.9	14.8
B10	0.22	80%	0.73	0.83	5.0	0.8	1.6
B11	1.77	14%	0.15	0.40	16.8	0.9	3.9
C1	2.82	69%	0.52	0.65	13.1	5.4	11.4
C2.1	0.20	91%	0.82	0.90	5.0	0.8	1.6
C2.2	4.69	73%	0.56	0.68	12.8	9.9	20.3
C2.3	0.83	67%	0.54	0.68	10.1	1.9	3.9
C3.1	0.35	73%	0.68	0.79	5.0	1.2	2.4
C3.2	1.46	71%	0.56	0.68	8.4	3.6	7.4
C4.1	6.37	65%	0.49	0.63	12.7	11.8	25.4
C4.2	3.47	55%	0.42	0.58	17.2	4.8	11.2
C5	0.16	81%	0.74	0.84	5.0	0.6	1.1
C6	2.42	10%	0.13	0.38	5.0	1.6	8.0

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

DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
2/15/21
SHEET 1 OF 2

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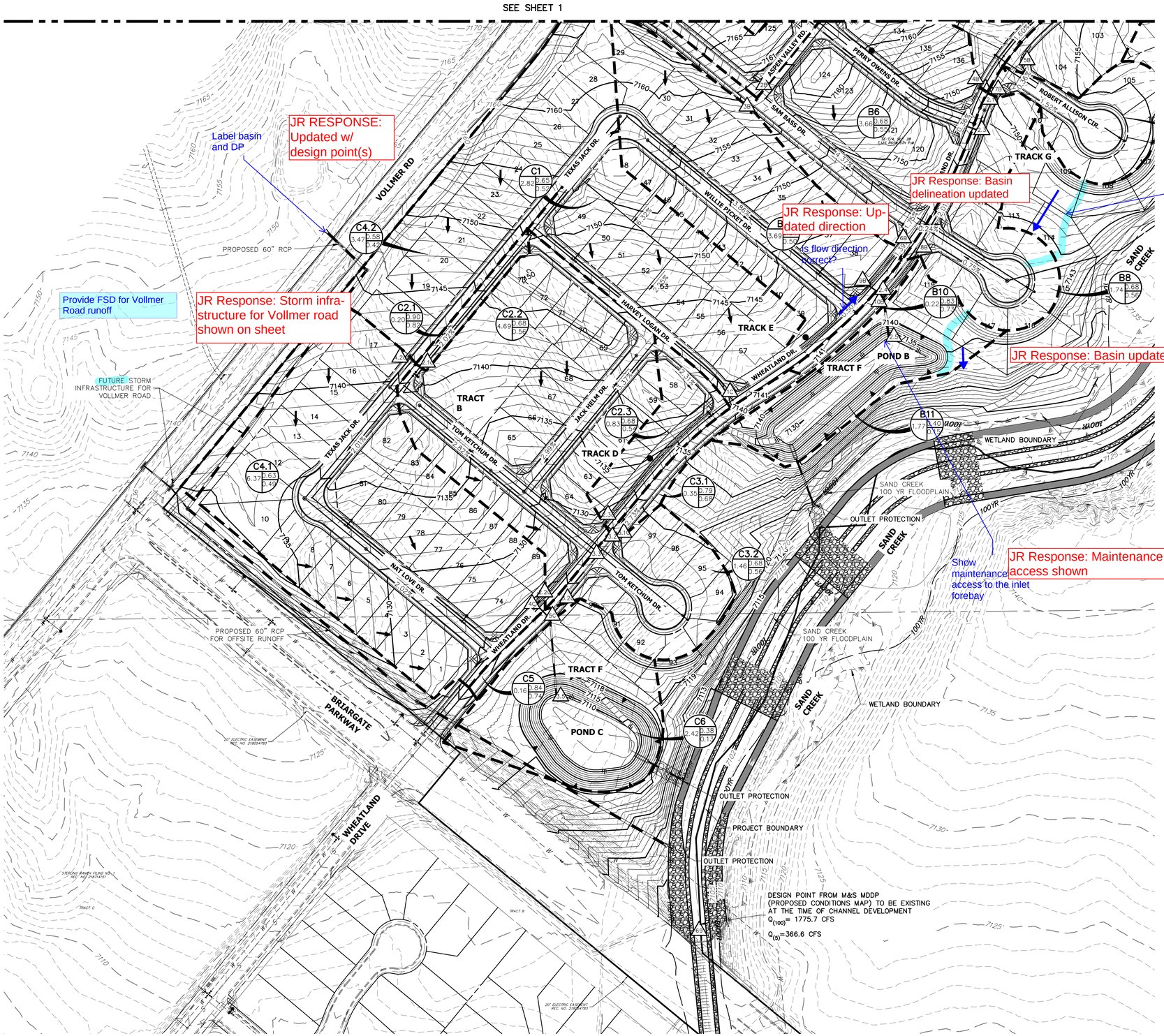
DRAINAGE MAP



LEGEND

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

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100 PROPOSED 6100

DESIGN POINT SUMMARY TABLE

DP	Q5 Total	Q100 Total
1a	6.9	14.6
2a	6.5	13.4
3a	8.2	20.4
4a	7.2	16.6
5a	9.5	26.1
6a	10.7	18.6
7a	10.4	29.9
8a	11.4	20.0
9a	21.6	49.5
1.1b	5.5	12.5
1.2b	3.5	7.4
1.3b	1.0	2.2
2b	2.4	6.8
3b	0.9	1.7
4b	6.7	15.9
5b	4.3	8.9
6b	10.4	26.5
7b	7.0	14.4
8b	4.1	10.9
9b	12.1	30.4
10b	4.7	12.2
11b	17.4	45.5
1c	5.4	11.4
2.1c	0.8	1.6
2.2c	9.8	20.1
2.3c	7.1	14.9
3.1c	1.2	2.4
3.2c	3.6	7.9
4c	16.9	36.2
4.2c	4.8	11.2
5c	4.1	8.8
6c	20.6	46.6

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C5	C100	tc (min)	Q5 (cfs)	Q100 (cfs)
A1	3.67	52%	0.51	0.64	13.4	6.9	14.6
A2	3.27	56%	0.54	0.67	13.6	6.5	13.4
A3	4.79	50%	0.49	0.63	13.9	8.5	18.4
A4	3.95	54%	0.52	0.65	14.1	7.4	15.6
A5	5.43	50%	0.49	0.62	11.1	10.5	22.6
A6	3.96	53%	0.52	0.65	12.6	7.7	16.3
A7	1.97	15%	0.19	0.43	16.5	1.3	4.8
A8	0.42	57%	0.54	0.69	5.0	1.2	2.5
A9	2.97	16%	0.20	0.43	13.4	2.2	7.9
B1.1	3.35	45%	0.45	0.60	13.4	5.5	12.5
B1.2	1.81	54%	0.52	0.65	12.8	3.5	7.4
B1.3	0.47	47%	0.46	0.63	8.1	1.0	2.2
B2	0.82	58%	0.55	0.69	5.0	2.3	4.9
B3	0.24	79%	0.73	0.83	5.0	0.9	1.7
B4	3.98	40%	0.40	0.57	9.5	6.7	15.9
B5	1.75	58%	0.55	0.68	7.8	4.3	8.9
B6	3.66	58%	0.55	0.68	6.5	9.6	20.0
B7	1.14	61%	0.58	0.70	8.8	2.9	5.8
B8	1.74	58%	0.56	0.68	9.3	4.1	8.5
B9	3.69	65%	0.50	0.64	13.1	6.9	14.8
B10	0.22	80%	0.73	0.83	5.0	0.8	1.6
B11	1.77	14%	0.15	0.40	16.8	0.9	3.9
C1	2.82	69%	0.52	0.65	13.1	5.4	11.4
C2.1	0.20	91%	0.82	0.90	5.0	0.8	1.6
C2.2	4.69	73%	0.56	0.68	12.8	9.9	20.3
C2.3	0.83	67%	0.54	0.68	10.1	1.9	3.9
C3.1	0.35	73%	0.68	0.79	5.0	1.2	2.4
C3.2	1.46	71%	0.56	0.68	8.4	3.6	7.4
C4.1	6.37	65%	0.49	0.63	12.7	11.8	25.4
C4.2	3.47	55%	0.42	0.58	17.2	4.8	11.2
C5	0.16	81%	0.74	0.84	5.0	0.6	1.1
C6	2.42	10%	0.13	0.38	5.0	1.6	8.0

N

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

DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
2/15/21
SHEET 2 OF 2

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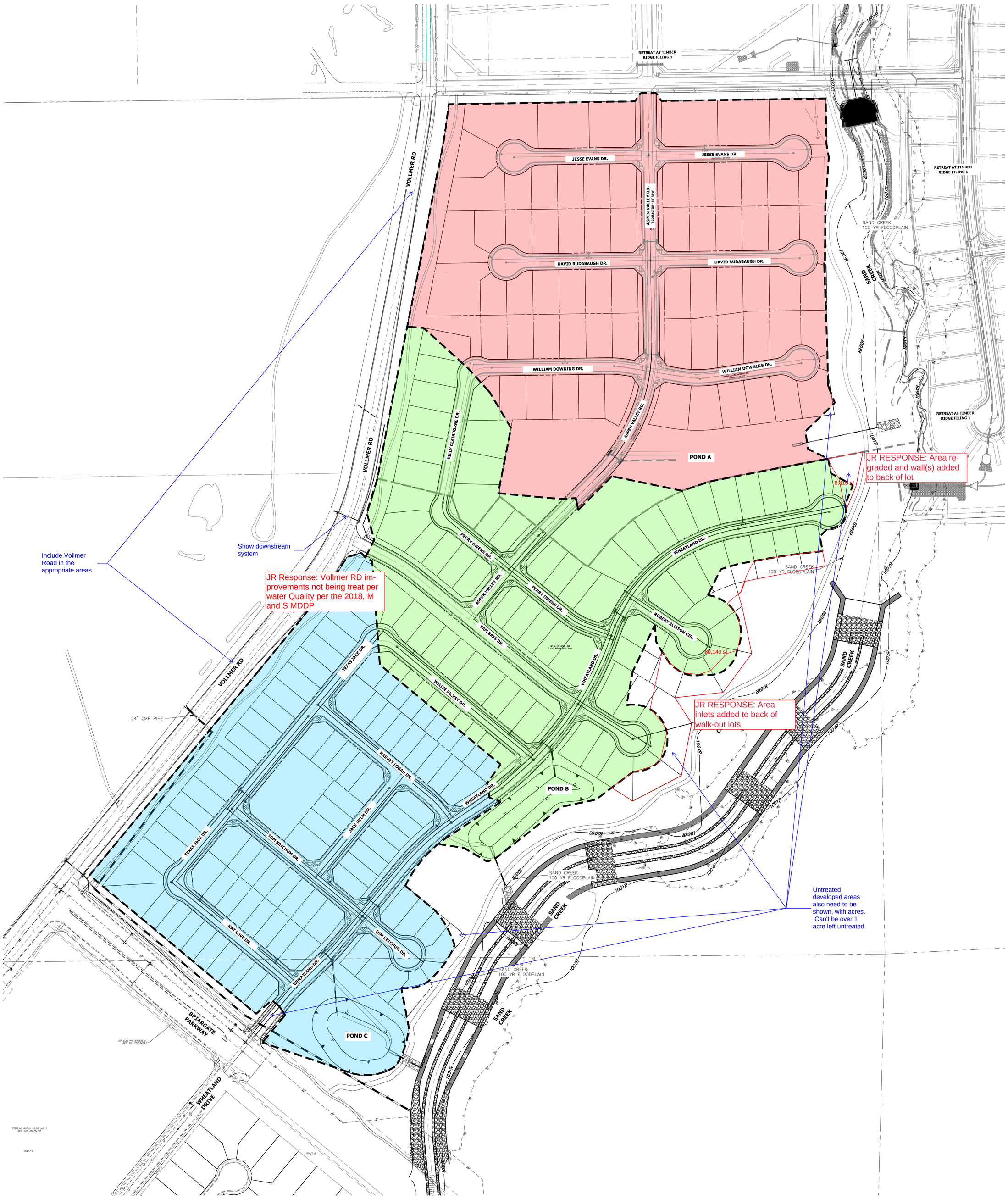
WATER QUALITY CAPTURE PLAN

HOMESTEAD NORTH



POND A 30.43 ACRES, 46.3% IMPERVIOUS

POND B 24.64 ACRES, 51.1% IMPERVIOUS

POND C 22.77 ACRES, 60.8% IMPERVIOUS

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

WQ –PONDS
HOMESTEAD NORTH
JOB NO. 25188.00
2–13–2021
SHEET 1 OF 1

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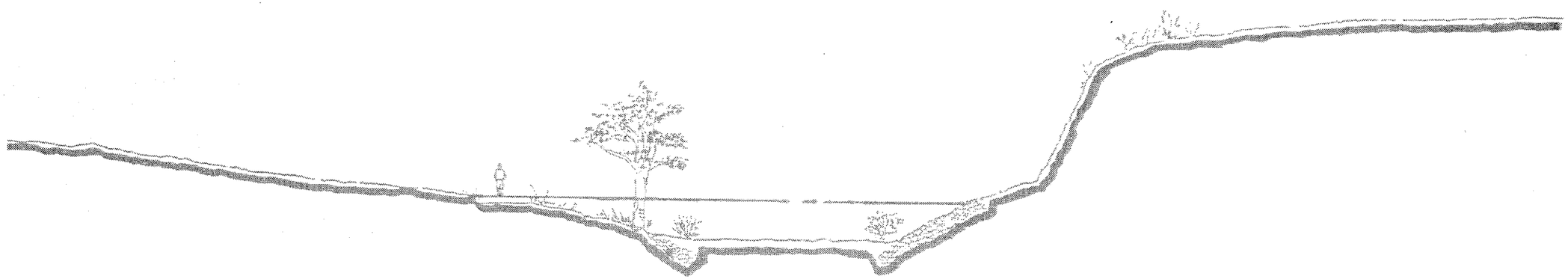
Appendix E
Reference Material

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN REPORT

CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO



PREPARED FOR:

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

PREPARED BY:

Kiowa Engineering Corporation
1011 North Weber
Colorado Springs, CO 80903

II. STUDY AREA DESCRIPTION

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

Basin Description

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

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

Climate

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

Soils and Geology

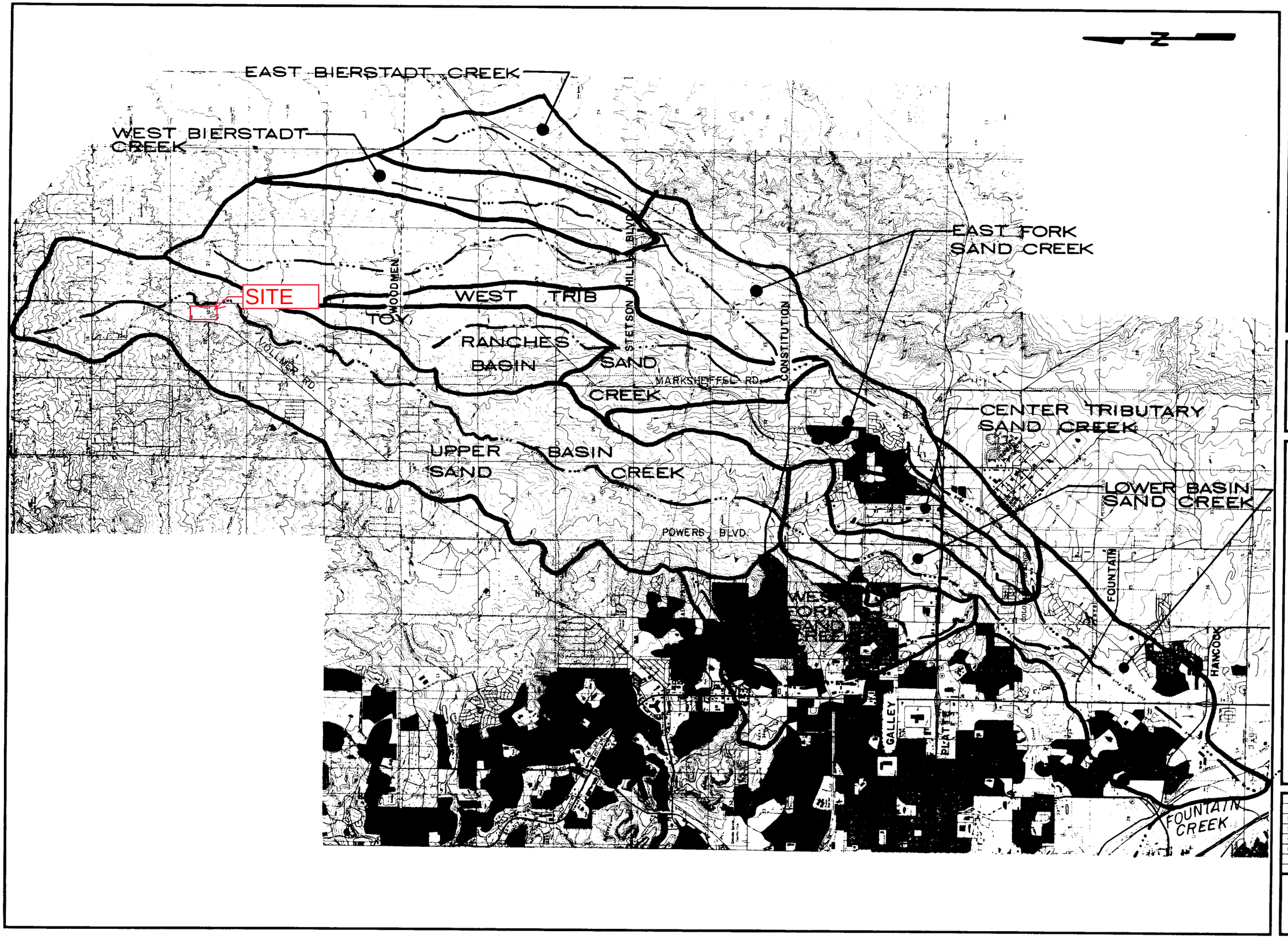
Soils within the Sand Creek basin vary between soil types A through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant soil groupings are in the Truckton and Bresser soil associations. The soils consist of deep, well drained soils that formed in alluvium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

Property Ownership and Impervious Land Densities

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

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

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



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

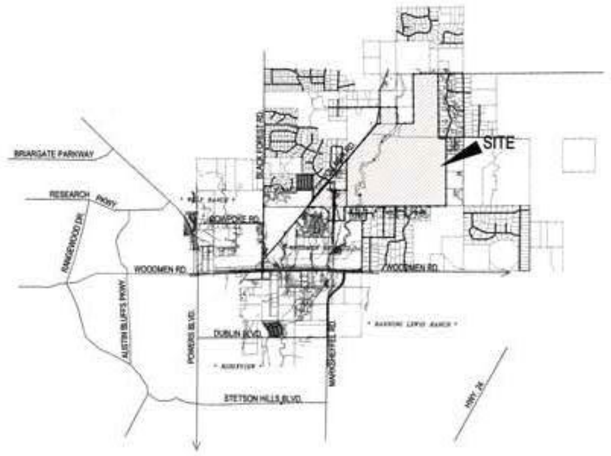
SAND CREEK DRAINAGE BASIN PLANNING STUDY

REGIONAL SUB-BASINS

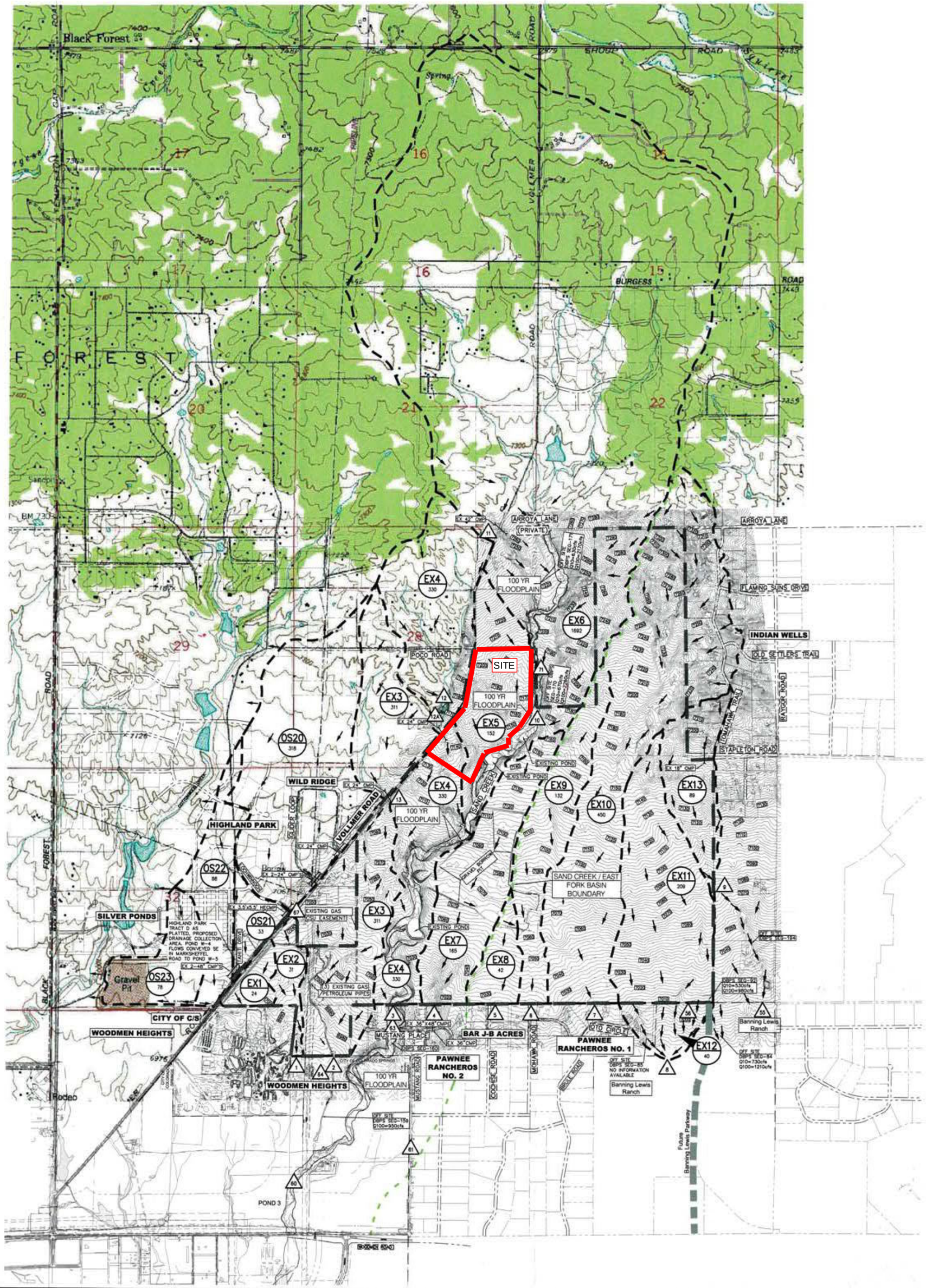
Project No	90-04-09
Date:	11/90
Design:	
Drawn:	EAK
Check:	
Revisions:	

11

FIG. III-1



STERLING RANCH
N.T.S.



HISTORIC CONDITION

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5 (CFS)	Q_{100} (CFS)
EX-1	24	3	40
EX-2	31	3	45
EX-3	311	49	341
EX-4	330	71	353
EX-5	152	14	209
EX-6	1692	118	2168
EX-7	165	12	197
EX-8	42	4	64
EX-9	132	11	149
EX-10	450	48	474
EX-11	209	17	261
EX-12	40	5	65
EX-13	89	6	114
OS-20	318	61	310
OS-21	33	8	38
OS-22	88	18	91
OS-23	78	34	84

* NOTE: BASINS OS-22 & OS-23 NOT PART OF THIS REPORT. FLOWS FOLLOW HISTORIC PATTERNS ON THE WESTSIDE OF VOLLMER ROAD.

HISTORIC CONDITION

DESIGN POINTS						
DESIGN POINT	SQ. MI.	Q_5 (CFS)	Q_{100} (CFS)	SQ. MI.	DBPS Q_{100}	DBPS DP/ID
1	0.09	5	84			
2	0.49	55	465	0.74	465	64
3	0.52	139	2610	4.33	2552	63
4	0.26	12	197			
5	0.07	4	64			
6	0.21	11	149			
7	0.70	48	474			
8	0.39	18	305			
9	0.14	6	114			
10	2.64	122	2245	3.27	2245	71
11	0.09	5	83			
12A	0.01	3	16			
12	0.27	10	200			
13	0.17	6	126			
				0.48	#	55
				0.53	1210	56
				5.38	2629	60
				0.38	76	61
				0.49	115	67

* NOTE: SQ. MI. ARE NOT CONSISTANT AT EACH DESIGN POINT DP-DBPS

* NOTE: DBPS FLOWS ARE FOR THE EXISTING CONDITION

NO DATA GIVEN IN DBPS

Runoff in attenuated in an existing pond. The existing release rate across the site is 16 cfs

1" = 1000'

0 250 500 1000 2000
Scale in Feet

LEGEND

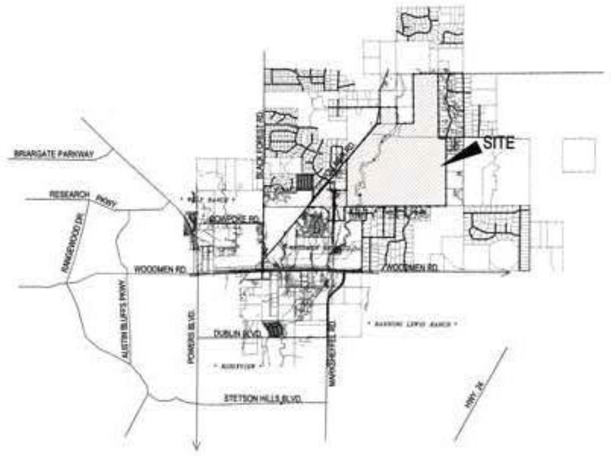
- EX1 / 23.2 — EXISTING MDDP BASIN / ACREAGE
- E1 — EXISTING FLOW RELEASE POINT
- FLOW DIRECTION
- BASIN BOUNDARY
- PROPERTY BOUNDARY
- 6920 — EXISTING CONTOUR
- CULVERT PIPE

MS CIVIL CONSULTANTS, INC.
102 E. PIKES PEAK AVE. STE 306
COLORADO SPRINGS, CO 80903
(719) 955-5485, FAX (719) 444-8427

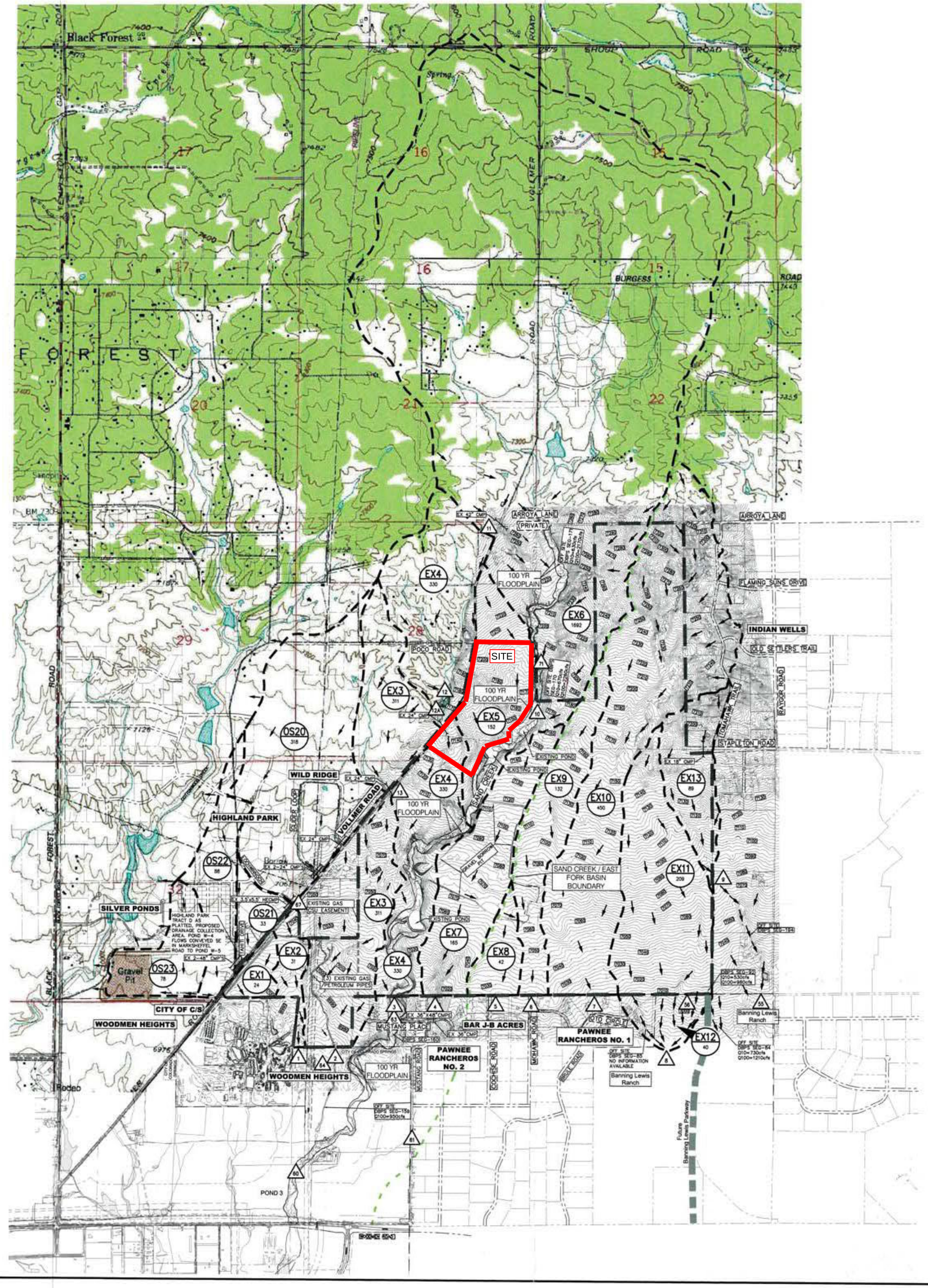
STERLING RANCH MDDP

HISTORIC – DRAINAGE MAP

PROJECT NO. 09-001		FILE: *\dwg\Dev Plan\09001-MDDP HISTORIC	
DESIGNED BY: VAS	SCALE	DATE: 03/16/15	
DRAWN BY: VAS	HORIZ: 1"=500'	SHEET 1 OF 1	D1
CHECKED BY: VAS	VERT: N/A		



STERLING RANCH
N.T.S.



HISTORIC CONDITION

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5 (CFS)	Q_{100} (CFS)
EX-1	24	3	40
EX-2	31	3	45
EX-3	311	49	341
EX-4	330	71	353
EX-5	152	14	209
EX-6	1692	118	2168
EX-7	165	12	197
EX-8	42	4	64
EX-9	132	11	149
EX-10	450	48	474
EX-11	209	17	261
EX-12	40	5	65
EX-13	89	6	114
OS-20	318	61	310
OS-21	33	8	38
OS-22	88	18	91
OS-23	78	34	84

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				5.38	2629	60
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1" = 1000'

0 250 500 1000 2000
Scale in Feet

LEGEND

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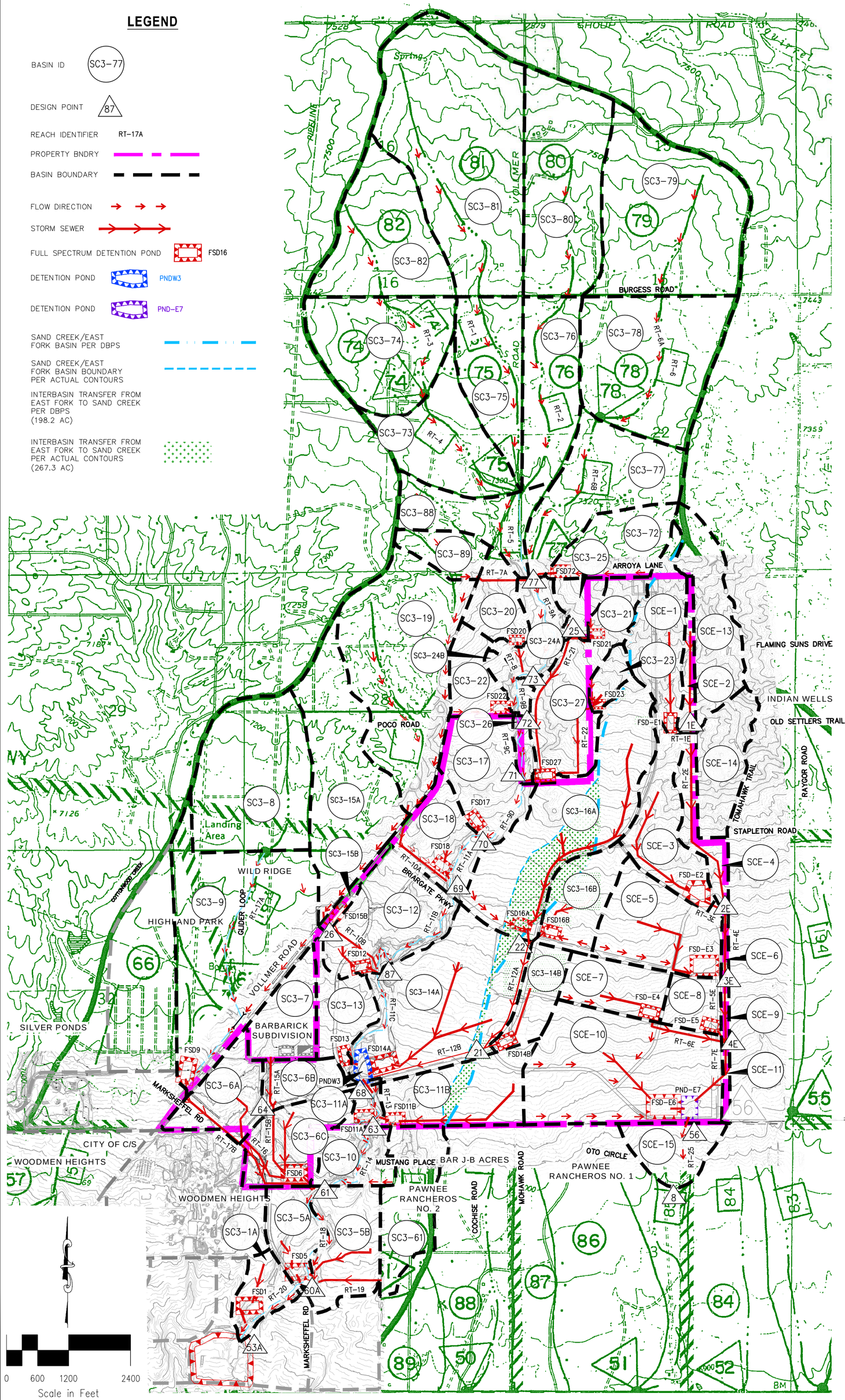
DESIGNED BY: VAS	SCALE	DATE: 03/16/15	
DRAWN BY: VAS	HORIZ: 1"=500'	SHEET 1 OF 1	D1
CHECKED BY: VAS	VERT: N/A		

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



BASIN SUMMARY

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

DESIGN POINT SUMMARY

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

DESIGN POINT SUMMARY (VOLUME)

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

WATER QUALITY & DETENTION POND SUMMARY

FSD1

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

FSD5

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

FSD6

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

FSD9

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

FSD11A

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

FSD11B

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

FSD12

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

FSD13

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

FSD14A

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

FSD14B

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

FSD15B

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

FSD16A

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

SAND CREEK FLOW COMPARISON CHART

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

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)

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

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

WATER QUALITY & DETENTION POND SUMMARY

FSD16B

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

FSD17

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

FSD18

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

FSD20

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

FSD21

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

FSD22

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

FSD23

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

FSD27

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

FSD72

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

PNDW3

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

FSD-E1

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

FSD-E2

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

FSD-E3

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

FSD-E4

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

FSD-E5

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

FSD-E6

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

PND-E7

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

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2018 STERLING RANCH MDDP

DEVELOPED HYDROLOGIC CONDITIONS MAP

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