

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

Prepared For:

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

**October, 2021
Project No. 25188.00**

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

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HOMESTEAD NORTH AT STERLING RANCH

October 2021

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.
County Engineer/ ECM Administrator

Date

Conditions:



JR ENGINEERING

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- Appendix A – Vicinity Map, Soil Descriptions, FEMA Floodplain Map
- Appendix B – Hydrologic Calculations
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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 Soils and Geology study on the site showed a potentially unstable region directly adjacent to the western bank of Sand Creek on the northeast corner of the site. At the time of final design, specifications from a Geotechnical Engineer will be implemented to ensure that the developed site is safe.

The Sand Creek is within the eastern portion of the site. Currently, JR Engineering 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 on 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, JR engineering is performing studies and plans to address Sand Creek stabilization adjacent to the site.

The proposed drainage on the site closely follows the approved "Master Development Drainage Plan for Sterling Ranch", (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 be detained within pond C, whereas the 2018 MDDP specified that this runoff outfall directly into Sand Creek. This represents a more conservative approach to attenuate and treat water

quality for the offsite runoff going into Sand Creek. The total estimated/projected detention and estimated outflows from the MDDP are shown in Table 1 on the following page.

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 deviates with MDDP and detains and treats water quality from the existing offsite runoff from basin SC3-19 of the M&S MDDP via proposed storm pipe along Vollmer road and Briargate parkway that goes into pond C and outfalls within Sand Creek. The MDDP showed the runoff going into Sand Creek undetained. The total net detention being stored onsite in the 100 year event is 14.2 Acre-ft, as shown in Tables 2.1-2.3 of this report. The total runoff released from the detention ponds is 209.3 cfs in the 100 year event for the three ponds, as shown in Tables 2.1-2.3 of this report. The drainage for Vollmer and the corresponding offsite tributary area is detained treated for water quality within pond C.

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 E-1 ($Q_5 = 1.1$ cfs, $Q_{100} = 5.2$ cfs) is 4.5 acres of undeveloped land adjacent to the northwest portion of Vollmer Road. Runoff from this basin drains to a 24” CMP pipe and outfalls on the eastern side of Vollmer Road and outfalls into Sand Creek.

Basin E-2 ($Q_5 = 28.1$ cfs, $Q_{100} = 192.9$ cfs) is 180.3 acres of undeveloped land adjacent to the northwest portion of Vollmer Road. Runoff from this basin drains to a 24” CMP pipe and outfalls on the eastern side of Vollmer Road and outfalls into Sand Creek.

Basin E-3 ($Q_5 = 2.1$ cfs, $Q_{100} = 13.6$ cfs) is 12.39 acres of undeveloped land adjacent to the western portion of Vollmer Road. Runoff from this basin drains offsite into a road side swale adjacent to Vollmer Road.

Basin E-4 ($Q_5 = 9.9$ cfs, $Q_{100} = 72.3$ cfs) is 70.5 acres of undeveloped land to the south of Retreat at Timber Ridge and on the eastern side of sand creek. Runoff from this basin drains to design point 4o.

Basin E-5 ($Q_5 = 3.4$ cfs, $Q_{100} = 24.9$ cfs) is 18.8 acres of undeveloped land adjacent to the eastern portion of Sand Creek. Runoff from this basin sheet flow to the south and ultimately drains to Sand Creek in confluence with flow from basin E-4 at Design Point 5o.

Basin E-6.1 ($Q_5 = 17.8$ cfs, $Q_{100} = 130.4$ cfs) is 124.9 acres of undeveloped land that drains to the south directly into sand creek at design point 6.1o.

Basin E-6.2 ($Q_5 = 7.5$, $Q_{100} = 55.4$ cfs) is 49.61 acres of undeveloped land that drains to a low point directly adjacent to basin E-6.1 at design point 6.2o. Runoff from this basin then drains to Sand Creek directly south of design point 6.1o in confluence with runoff from E-6.1.

Basin H1 ($Q_5 = 8.9$ cfs, $Q_{100} = 61.1$ cfs) is 45.3 acres of undeveloped land covered in native prairie grass at DP 1h.

Basin H2 ($Q_5 = 3.5$ cfs, $Q_{100} = 25.7$ 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 at DP 2h.



29.1?

Basin H3 ($Q_5 = 6.1$ cfs, $Q_{100} = 41.8$ cfs) is 21.9 acres of undeveloped land covered in native prairie grass. This basin drains directly into Sand Creek at DP 3h. The basin is to the south east of Vollmer road and North of Briargate Parkway.

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-1 ($Q_5 = 3.6$ cfs, $Q_{100} = 26.8$ cfs) is 2% impervious and 22.3 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.

1

4.3

Basin C-2 ($Q_5 = 0.6$ cfs, $Q_{100} = 4.5$ cfs) is 2% impervious and is 2.66 Acres. This basin is part of a temporary channel that diverts off site runoff in continuity with the Historic condition; directly to Sand Creek.

Basin OS ($Q_5 = 13.3$ cfs, $Q_{100} = 97.2$ cfs) is an offsite basin that is 124.2 Acres and 2% impervious. This basin is directly tributary to sediment basin number 2.

O-S1 ($Q_5 = 1.1$ cfs, $Q_{100} = 7.1$ cfs) is an offsite basin that is 3.6 % impervious and 5.40 Acres. This basin diverts offsite runoff away from the lots to the Sand Creek drainage way.

O-S2 ($Q_5 = 28.1$ cfs, $Q_{100} = 192.9$ cfs) is an offsite basin that is 2.8% impervious and 180.3 Acres. This basin drains to an existing 24" CMP pipe and outfalls into the temporary swale that diverts the runoff around the site and into the sand creek tributary.

How does this flow
fit into a 24" pipe?

O-S3 ($Q_5 = 0.9$ cfs, $Q_{100} = 3.2$ cfs) is an offsite basin that is 18.1 % impervious and is 1.16 Acres. This basin drains into the temporary swale that diverts runoff away from the site.

O-S4 ($Q_5 = 12.7$ cfs, $Q_{100} = 93.5$ cfs) is an offsite basin that is 2% impervious, the area is 69.42 Acres. This basin drains to a temporary 24" RCP pipe under the earth work for future Briargate Road and then this runoff ultimately goes to temporary sediment basin number 2.

2.6?

O-S5 ($Q_5 = 12.8$ cfs, $Q_{100} = 18.9$ cfs) is an offsite basin that is 2% impervious; the basin has an area of 8.57 acres. The runoff drains to a temporary 24" RCP that goes under the earthwork for future Briargate Road and then the runoff goes to temporary sediment basin number 2.



O-S6 ($Q_5 = 7.8$ cfs, $Q_{100} = 57.1$ cfs) is an offsite basin that is 2% impervious; the basin has an area of 51.2 acres. The runoff drains to a temporary 24" RCP that goes under the earthwork for future Briargate Road and then the runoff goes to temporary sediment basin number 2.

Basin D ($Q_5 = 2.5$ cfs, $Q_{100} = 18.6$ cfs) is 2% impervious and 17.29 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 Road are included with the drainage report for the interim condition, the roads and will be detailed and designed in the Final Drainage Report when it is time to plat the ROW.

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 0.46 acres and 52% percent impervious is comprised of a portion of a residential road Aspen Valley Road. The runoff ($Q_5=1.2$ cfs, $Q_{100}=2.6$ 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. In the event the inlet clogs in the 100 year event, runoff will overflow across the curb and gutter and spill directly into pond A.

Basin A9 2.78 acres and 16% percent impervious is comprised of pond A, grass and walk-out lots facing the detention area. Runoff ($Q_5=2.1$ cfs, $Q_{100}=7.4$ cfs) generated in Basin A9 sheet flows into Pond A where it is treated for water-quality and is detained up until the 100 year-event. The UD Detention sheet for pond A is shown in Appendix C of this report.

Pond A has a total tributary area of 30.29 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	2.81	0.498	0.2
5 Year	4.99	1.516	7.8
100 Year	7.45	2.989	32.6

Basin B1.1 3.36 acres 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.

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 basins B1.1, B1.2 and B1.3.

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 4.21 acres and 41.3% percent impervious is comprised of single-family residential lots, a local residential road Wheatland Drive and a Cul de Sac. Runoff ($Q_5=7.1$ cfs, $Q_{100}=16.8$ 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 1.30 acres and 59% percent impervious is comprised of single-family lots, local roads and a Cul de Sac Robert Allison Circle. Runoff ($Q_5=3.1$ cfs, $Q_{100}=6.4$ cfs) from basin B7 drains to design point 7B in confluence with runoff from B5.

Basin B8 1.74 acres and 55% 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 Willey Picket Drive and Wheatland Drive. Runoff ($Q_5=6.9$ cfs, $Q_{100}=14.8$ cfs) from Basin B9 drains to design point 9B in a 15' type R sump inlet. In total the runoff from the sump inlet collects runoff from basins B1, B2, B3, B4, B6 and B9.

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 ($Q_5=0.8$ cfs, $Q_{100}=1.6$ cfs) a 10' type R sump inlet. The total runoff at design point B10 collected at this site is from basins B5, B7, B8, and B10. The runoff will then ultimately go directly into the pond. In the event the inlet clogs in the 100 year event, runoff will over flow across the curb and gutter and spill directly into pond B.

Basin B11 1.77 acres and 15% 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.

Basin B12 is 2.40 Acres this basin is 40% percent impervious and is comprised of single family walk out lots facing Sand Creek. The runoff ($Q_5=1.5$ cfs, $Q_{100}=4.1$ cfs) from these lots is collected into area inlets. The runoff is then piped directly into pond B.

Pond B has a tributary area 27.87 acres and is 50.0 % 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	3.13	0.483	0.2
5 Year	4.35	1.705	3.5
100 Year	5.20	2.896	28.5

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 Drive and Harvey Logan Drive. 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 6.35 acres and 65.3% percent impervious is comprised of single-family lots, and the northwestern side of the local residential road Texas Jack Drive, a right in lane and Nat Love Drive. Runoff ($Q_5=12.1$ cfs, $Q_{100}=25.9$ 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 3.44 acres and 58.5% percent impervious is comprised of a local road Texas Jack Drive and single-family lots. Runoff ($Q_5=6$ cfs, $Q_{100}=13.3$ 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. A berm has been graded to ensure that the overflow path will go into pond C.

Basin C6 2.48 acres and 21% percent impervious is comprised of pond C and some single-family residential area. Runoff ($Q_5=2.5$ cfs, $Q_{100}=8.8$ 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 224.34 acres and is 10.3 % 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	3.38	1.288	0.6
5 Year	5.39	3.069	35.9
100 Year	9.95	8.339	148.2

The following basins are tributary to the adjacent portion of Vollmer Road being designed by JR Engineering. Runoff will be detained within pond C and the runoff will then be released into Sand Creek adjacent to the crossing of Briargate road and Sand Creek.

Basin D1 has a tributary area of 1.22 acres and is 57.1% impervious. Basin D1 consists of the northwest portion of Vollmer road (Rural Cross Section). Runoff from basin D1 ($Q_5=2.1$ cfs, $Q_{100}=4.5$ cfs) drains to an adjacent roadside swale and drains into a type C inlet at design point 1D. From here on the runoff is piped with upstream runoff from basin OS1 into the Vollmer storm sewer system.

Basin D2 has a tributary area of 1.77 acres and is 43.33% impervious. Basin D2 consists of the northeast portion of Vollmer road (Rural Cross Section). Runoff from basin D2 ($Q_5=2.6$ cfs, $Q_{100}=6.3$ cfs) drains to an adjacent roadside swale and drains into a type C inlet at design point 2D. From here on the runoff is piped with upstream runoff from basin OS1 and basin D1 into the Vollmer storm sewer system.

Basin D3 has a tributary area of 0.18 acres and is 67.6% impervious. Basin D3 ($Q_5=0.5$ cfs, $Q_{100}=1.1$ cfs) consists of the northeast portion of Vollmer road. Runoff on from this basin drains to an on grade 5' type R inlet at DP 3D.

Basin D4 has a tributary area of 0.18 acres and is 57.5% impervious. Basin D4 ($Q_5=0.5$ cfs, $Q_{100}=1.1$ cfs) consists of the northwest portion of Vollmer road. Runoff on from this basin drains to an on grade 5' type R inlet at D P4D. 0.3 cfs is by-passed down to DP 6D. Runoff is piped from basin(s) D3 and D4 to the Vollmer storm within the street's R.O.W.

Basin D5 has a tributary area of 0.91 Acres and is 77% impervious. Basin D5 ($Q_5=3.1$ cfs, $Q_{100}=6.1$ cfs) consists of the northeast portion of Vollmer road. Runoff from this basin drains to an on grade type R 10' inlet at the intersection of Vollmer and a right in right out at DP 5D, 0.7 cfs is by-passed downstream to design point D7 in the 100 year event.

Basin D6 has a tributary area of 0.83 Acres and is 69% impervious. Basin D6 ($Q_5=2.5$ cfs, $Q_{100}=5.2$ cfs) consists of the northwestern portion of Vollmer road and the runoff drains into a 10' on grade type R inlet at DP 6D. 0.4 cfs is by-passed to the downstream design point D8 in the 100 yr event.

Basin D7 has a tributary area of 0.73 Acres and is 81.4 % impervious. Basin D7 ($Q_5=2.0$ cfs, $Q_{100}=3.8$ cfs) consists of the northeast portion of Vollmer road. Runoff from this basin drains to an on grade type R 10' inlet at the intersection of Vollmer and Briargate at DP 7D. All of the runoff received by this inlet is captured within the 100 year event.

Basin D8 has a tributary area of 0.66 Acres and is 75.2% impervious. Basin D8 ($Q_5=2.4$ cfs, $Q_{100}=4.6$ cfs) consists of the northwestern portion of Vollmer road and the runoff drains into a 20' on grade type R inlet at DP 8D. 0.7 cfs is by-passed downstream and will drain into a roadside swale in continuity with the current condition.

Basin OS1 has a tributary area of 2.9 Acres and is 2.0% impervious. The runoff from basin OS1 ($Q_5=0.8$ cfs, $Q_{100}=6.0$ cfs) drains into a depression adjacent to on the northwest portion of Vollmer road. The runoff from basin OS1 is captured in a type C inlet at DP 1o, from there on runoff is piped within Vollmer road and outfalls into sand Creek.

Basin OS2 has a tributary area of 179.61 Acres and is 2.0 % impervious. The runoff from the basin ($Q_5=27.1$ cfs, $Q_{100}=179.61$ cfs) drains into a local depression at DP 2o near the northwest portion of Vollmer road. The runoff from the basin is piped within Vollmer Road and outfalls directly into Sand Creek.

Basin OS3 has a tributary area of 11.98 Acres is 2.0 % impervious. The runoff from this basin ($Q_5=2.2$ cfs, $Q_{100}=16.1$ cfs) sheet flows onto Vollmer road and is captured within a 20' type R inlet that is on grade and corresponds to design point 8D.

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.

and will be included in the Final Drainage Report.

Nothing in appendix to show any proposed pipe sizes.

Include discussion on proposed swales.

DRAINAGE FACILITY DESIGN

Include discussion on Sand Creek Improvements & how they are same or different from DBPS recommendations.

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 JR Engineering adjacent to the site and on future projects within the basin to stabilize drainageways. The Soils and Geology study on the site showed a potentially unstable region directly adjacent to the western bank of Sand Creek on the northeast corner of the site. At the time of final design, specifications from a Geotechnical Engineer will be implemented to ensure that the developed site is safe. Homestead North lots will discharge into Full Spectrum Detention Ponds, and outflows will be less than or equal to historic flows. Existing flows from the northwest of Vollmer road and runoff from the Vollmer Road improvements will be piped under Vollmer Road and then along the north side of Briargate Parkway and will be detained and treated for water quality directly on-site. The subdivision improvement agreement (SIA) for Sterling Ranch Filing 1 states that “bank stabilization of the Sand Creek channel shall be required prior to any replats of other final plats adjacent to the channel. The design and installation of said improvements shall be accomplished and guaranteed through the normal subdivision review and collateralization process.” Additionally, “Other drainage improvements in Tract D and future tracts containing the Sand Creek Channel, such as drop structures, check structures and similar stabilization or protection improvements, will be designed and constructed by the District with the final construction drawings to be approved by the



County no later than the final platting of the 700th single family lot within the boundaries of the approved Sterling Ranch Sketch Plan and the completion of all said improvements no later than the 800th single family lot with the boundaries of the approved Sterling Ranch Sketch Plan.”

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

Step 4 – Consider Need for Industrial and Commercial BMPs: There are no commercial or industrial components to this development; therefore no BMPs of this nature are required. BMPs will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. 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. Site specific temporary source control BMPs that will be implemented include, but are not limited to, silt fencing placed around downstream areas of disturbance, construction vehicle tracking pads at the entrances, designated concrete truck washout basin, designated vehicle fueling areas, covered storage areas, spill 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.

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. For this preliminary drainage report the design points, pipes and inlets are discussed in the Proposed Drainage Conditions section of this report. The corresponding design points, pipes and basin are shown within the Proposed Drainage Map within Appendix D. 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):

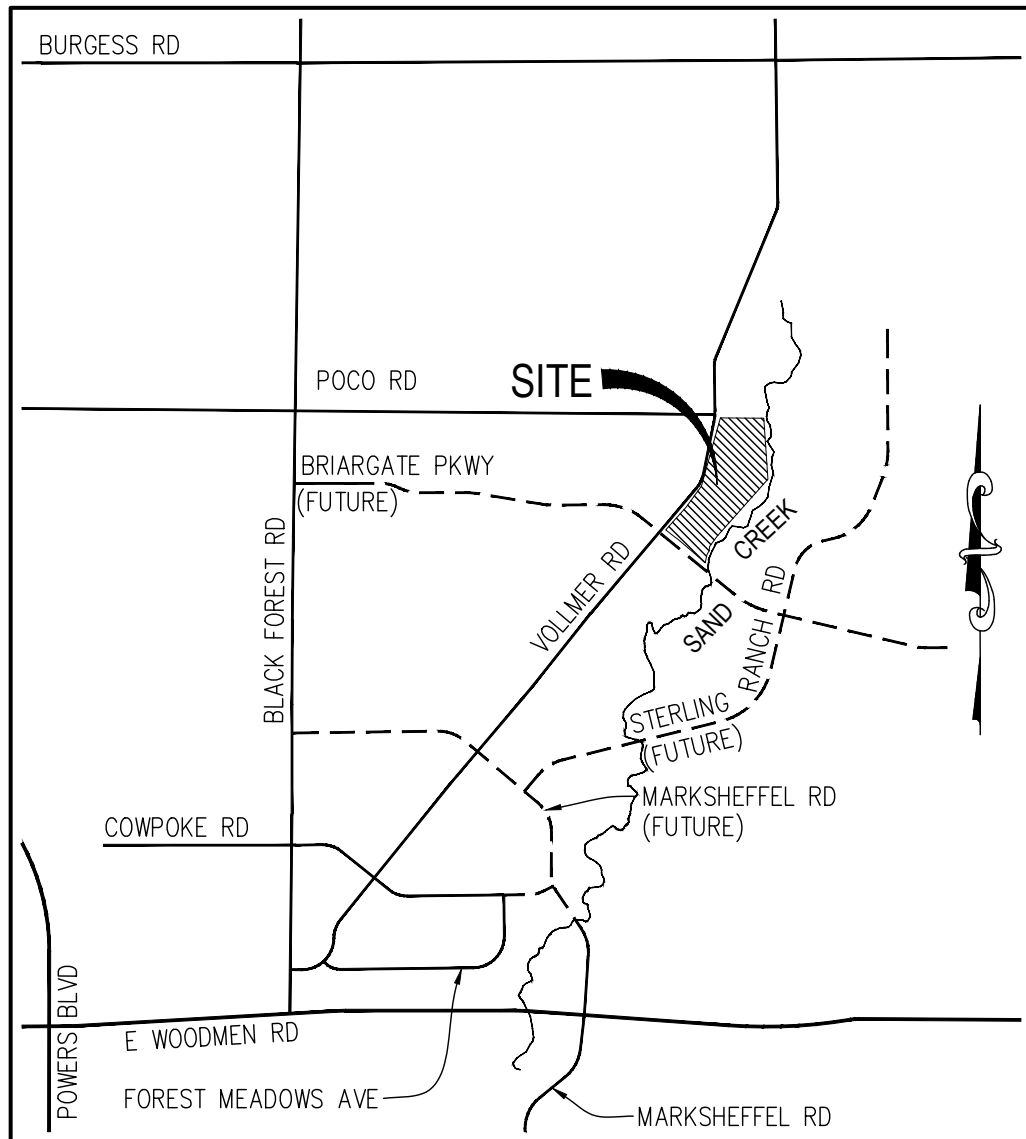
SUMMARY

The proposed Homestead North at Sterling Ranch drainage improvements were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development's ponds are designed to release less than 90% of the predeveloped runoff 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.

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 JR Engineering, 2021- Draft
-

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 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 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, NINGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

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

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

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

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

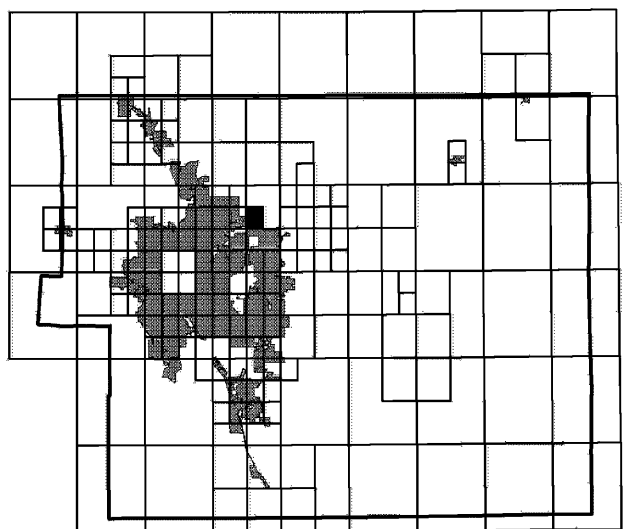
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which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

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

If you have questions about this map or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2827) or visit the FEMA website at <http://www.fema.gov/business/nfp>.

El Paso County Vertical Datum Offset Table	
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

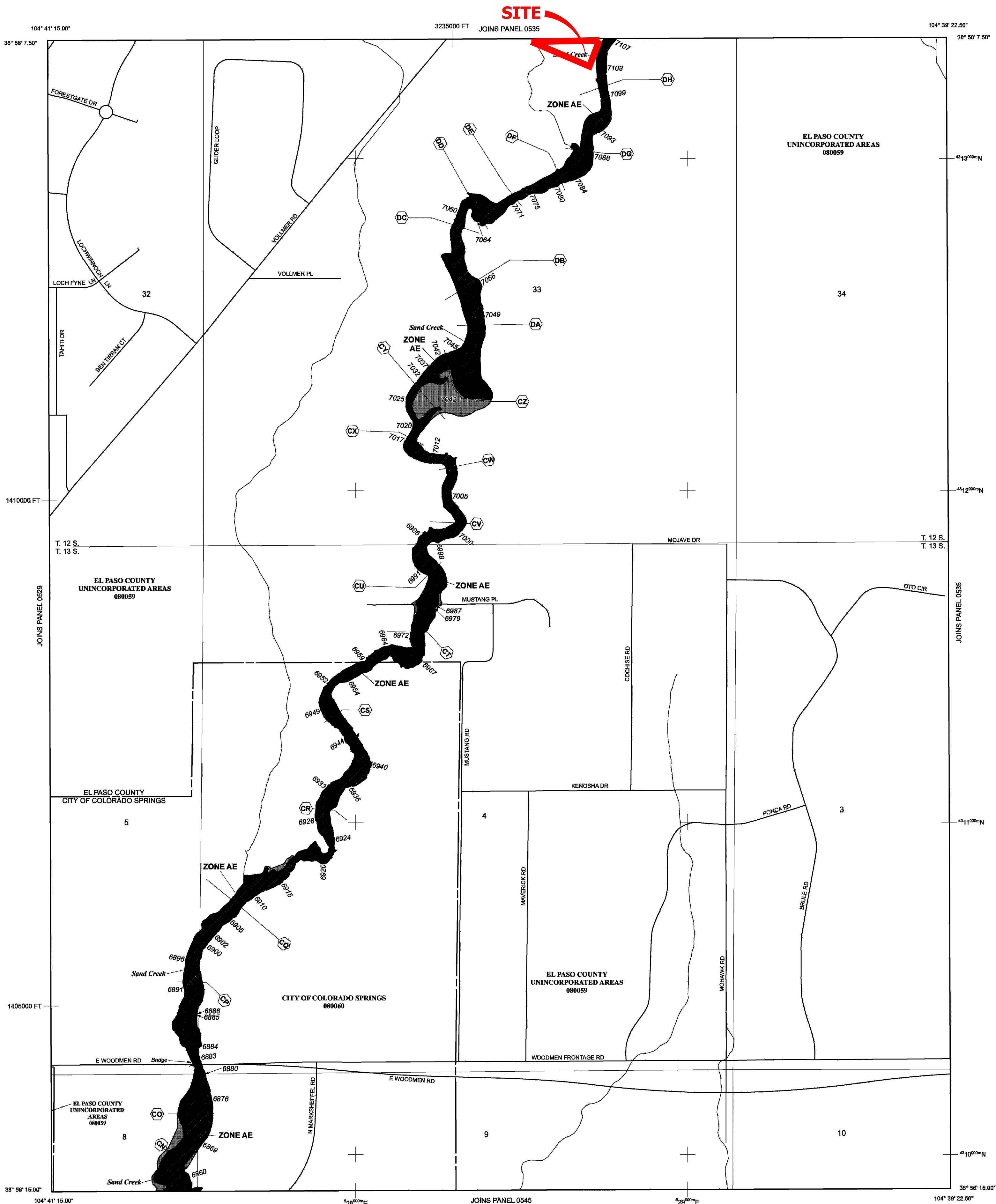
Panel Location Map



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



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



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

LEGEND

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

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

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of shallow 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 identified. 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.

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)

Cross section line

Transect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

1000-meter Universal Transverse Mercator grid ticks, zone 13

5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection

Bench mark (see explanation in Notes to Users section of this FIRM panel)

1.5 River Mile

MAP REPOSITORIES

Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

DECEMBER 7, 2018 - To update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

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

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

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 to 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, NINGS-12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

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

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

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

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

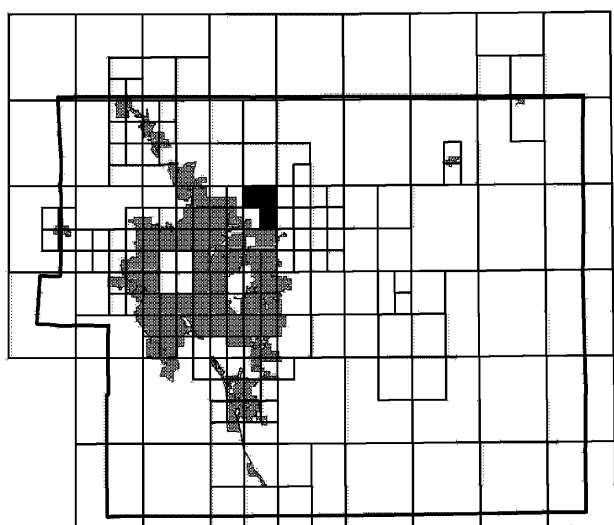
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which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

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

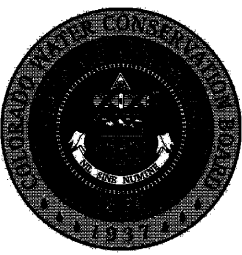
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/business/nfp>.

El Paso County Vertical Datum Offset Table	
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

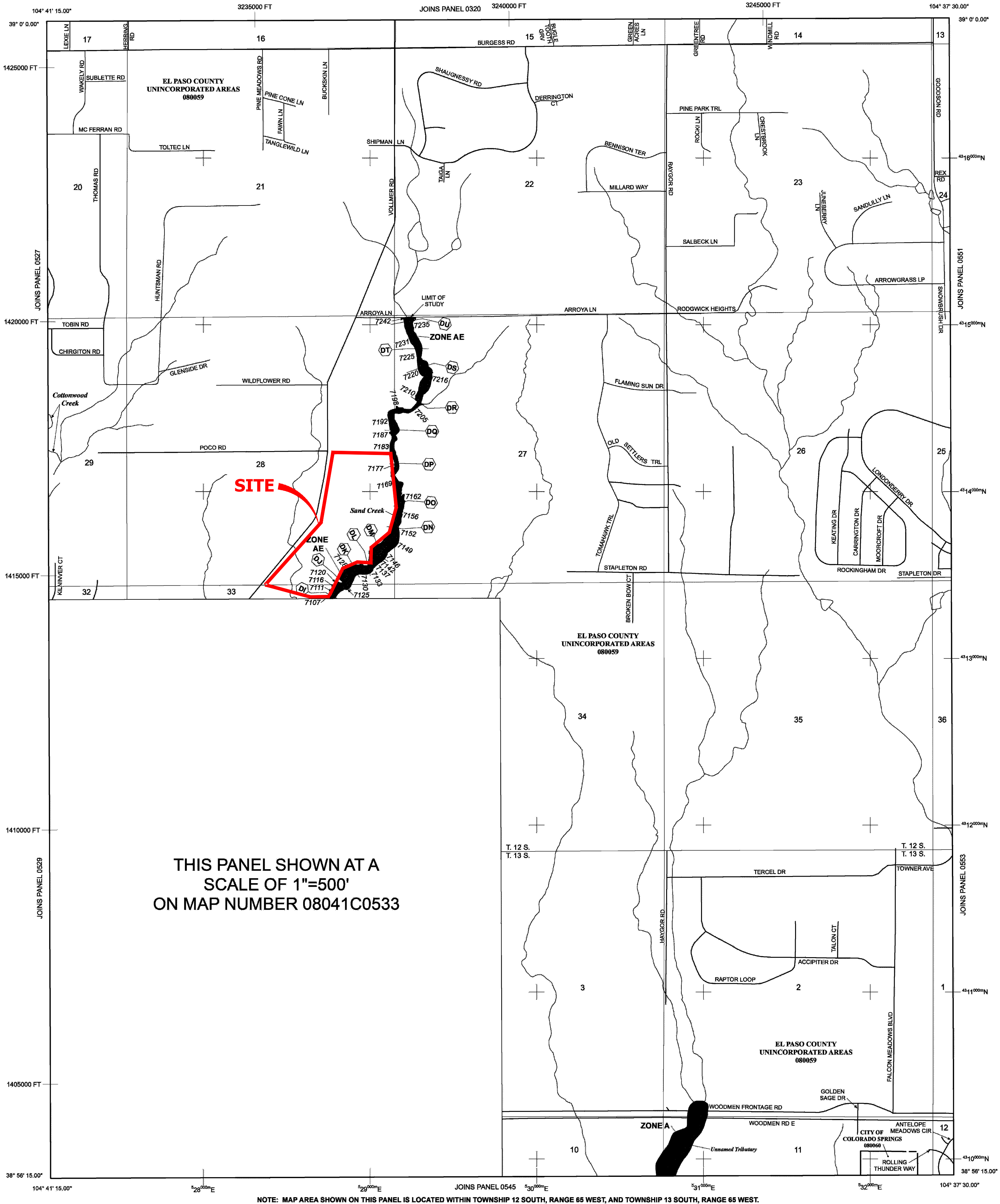
Panel Location Map



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



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



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

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

- Floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities
- 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)

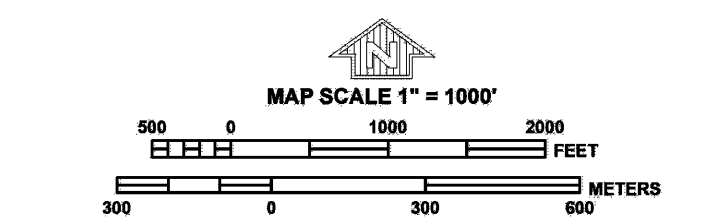
- Cross section line
- Traverse line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0902), Lambert Conformal Conic Projection
- Bench mark (see explanation in Notes to Users section of this FIRM panel)
- River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index
EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

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

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

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



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	080059	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

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: 9/15/21

[illegible]

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: 9/15/21

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t _c CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
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)
E-1	4.50	B	9%	0.14	0.39	600	1.0%	42.6	3006	4.1%	7.0	3.2	15.7	58.3	3606.0	48.7	48.7
E-2	180.30	B	3%	0.09	0.35	300	1.0%	31.7	3007	1.7%	7.0	3.2	15.7	47.4	3307.0	66.1	47.4
E-3	12.39	B	4%	0.10	0.37	300	1.0%	31.3	3008	1.8%	7.0	3.2	15.7	46.9	3308.0	64.3	46.9
E-4	70.50	B	2%	0.08	0.35	500	1.0%	41.2	2300	3.1%	7.0	4.2	9.1	50.3	2800.0	49.0	49.0
E-5	18.80	B	2%	0.08	0.35	300	1.0%	31.9	930	1.5%	7.0	5.2	3.0	34.9	1230.0	39.3	34.9
E6.1	125.30	B	2%	0.08	0.35	500	1.0%	41.2	2584	1.9%	7.0	6.2	6.9	48.1	3084.0	59.4	48.1
E6.2	49.61	B	2%	0.08	0.35	370	1.0%	35.4	3783	2.5%	7.0	7.2	8.8	44.2	4153.2	68.6	44.2
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:

$$t_c = t_i + t_t$$

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√S_o

K = NRCS conveyance factor (see Table 6-2).

Equation 6-2

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

Where:

t_i = overland (initial) flow time (minutes)

C₅ = 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

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

Where:

t_t = 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).

Equation 6-3

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

Equation 6-5

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

Subdivision: Existing Conditions 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: 9/15/21

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)	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)	
	1o	E-1	4.50	0.14	48.7	0.61	1.76	1.1															
	1h	H1	45.30	0.09	34.7	3.93	2.26	8.9	48.7	4.54	1.76	8.0											Drains to swale H1 and E1
	2h	H2	15.90	0.08	25.1	1.27	2.75	3.5	48.7	5.81	1.76	10.2											Accepts runoff from H1, H2 and E-1
	2o	E-2	180.30	0.09	47.4	15.62	1.80	28.1															
	3h	H3	29.10	0.09	31.3	2.51	2.42	6.1	47.4	18.13	1.80	32.6											Total Runoff; E-2 and H3
	3o	E-3	12.39	0.10	46.9	1.24	1.81	2.2															Runoff: E-3 Runoff in Vollmer rd side swale
	4o	E-4	70.50	0.08	49.0	5.64	1.75	9.9															
	5o	E-5	18.80	0.08	34.9	1.50	2.26	3.4	49.0	7.14	1.75	12.5											Total Runoff; E-4 and E-5
	6.2o	E6.2	49.61	0.08	44.2	3.97	1.90	7.5															To low point
	6.1o	E6.1	125.30	0.08	48.1	10.02	1.77	17.8	49.0	21.13	1.75	36.9											Total Runoff E-6, E-4, E-5 Runoff makes it's way into sand creek

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: 9/15/21

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)	
	1o	E-1	4.50	0.39	48.7	1.76	2.94	5.2															
	1h	H1	45.30	0.36	34.7	16.08	3.80	61.1	48.7	17.84	2.94	52.5											Drains to swale H1 and E1
	2h	H2	15.90	0.35	25.1	5.57	4.61	25.7	48.7	23.41	2.94	68.9											Accepts runoff from H1, H2 and E-1
	2o	E-2	180.30	0.35	47.4	64.00	3.01	192.9															
	3h	H3	29.10	0.35	31.3	10.32	4.05	41.8	47.4	74.32	3.01	224.0											Total Runoff: E-2 and H3
	3o	E-3	12.39	0.37	46.9	4.52	3.04	13.7															Runoff: E-3 Runoff in Vollmer rd side swale
	4o	E-4	70.50	0.35	49.0	24.68	2.93	72.3															
	5o	E-5	18.80	0.35	34.9	6.58	3.78	24.9	49.0	31.26	2.93	91.6											Total Runoff: E-4 and E-5
	6.2o	E6.2	49.61	0.35	44.2	17.36	3.19	55.4															To low point
	6.1o	E6.1	125.30	0.35	48.1	43.86	2.97	130.4	49.0	92.48	2.93	270.9											Total Runoff E-6, E-4, E-5 Runoff makes it's way into sand creek

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

COMPOSITE % IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Homestead Fil. 3 -Interim Conditons Object Name: Homestead North
 Location: El Paso County Project No.: 25188.00
 Calculated By: ARJ
 Checked By: _____
 Date: 9/15/21

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	
C-1	22.30	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	22.30	2.0%	0.08	0.35	2.0%
C-2	2.70	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	2.70	2.0%	0.08	0.35	2.0%
D	17.29	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	17.29	2.0%	0.08	0.35	2.0%
OS	124.20	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	124.20	2.0%	0.08	0.35	2.0%
O-S1	5.40	0.90	0.96	0.09	1.7%	0.45	0.59	0.00	0.0%	0.08	0.35	5.31	2.0%	0.09	0.36	3.6%
O-S2	180.30	0.90	0.96	1.46	0.8%	0.45	0.59	0.00	0.0%	0.08	0.35	178.84	2.0%	0.09	0.35	2.8%
O-S3	1.16	0.90	0.96	0.19	16.4%	0.45	0.59	0.00	0.0%	0.08	0.35	0.97	1.7%	0.21	0.45	18.1%
O-S4	69.42	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	69.42	2.0%	0.08	0.35	2.0%
O-S5	8.57	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	8.57	2.0%	0.08	0.35	2.0%
O-S6	51.20	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	51.20	2.0%	0.08	0.35	2.0%

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Homestead Fil. 3
Location: El Paso County

-Interim Condions

Project Name: Homestead North

Project No.: 25188.00

Calculated By: ARJ

Checked By:

Date: 9/15/21

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t _c CHECK			FINAL
DATA						(T _i)			(T _i)					(URBANIZED BASINS)			
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)	
C-1	22.30	B	2%	0.08	0.35	150	2.0%	17.9	1378	2.2%	7.0	1.0	22.1	40.1	1528.0	42.3	40.1
C-2	2.66	B	2%	0.08	0.35	30	2.0%	8.0	1000	2.0%	7.0	1.0	16.8	24.9	1030.0	38.4	24.9
D	17.29	B	2%	0.08	0.35	30	102.0%	2.2	6925	14.0%	7.0	2.6	44.1	46.3	6955.0	58.9	46.3
OS	124.20	B	2%	0.08	0.35	600	2.0%	35.9	2899.91	1.8%	7.0	0.9	51.5	87.4	3499.9	64.5	64.5
O-S1	5.40	B	4%	0.09	0.36	300	1.5%	27.5	999	2.5%	7.0	1.1	15.0	42.6	1299.0	36.5	36.5
O-S2	180.30	B	3%	0.09	0.35	300	1.0%	31.7	3007	1.7%	7.0	3.2	15.7	47.4	3307.0	66.1	47.4
O-S3	1.16	B	18%	0.21	0.45	30	2.0%	7.0	580	3.9%	7.0	1.4	7.0	14.0	610.0	27.2	14.0
O-S4	69.42	B	2%	0.08	0.35	500	1.0%	41.2	645	1.9%	7.0	1.0	11.1	52.3	1145.0	34.0	34.0
O-S5	8.57	B	2%	0.08	0.35	300	150.0%	6.1	400	2.0%	7.0	1.0	6.7	12.8	700.0	30.7	12.8
O-S6	51.20	B	2%	0.08	0.35	370	1.0%	35.4	3783	2.5%	7.0	7.2	8.8	44.2	4153.2	68.6	44.2

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√S_o

K = NRCS conveyance factor (see Table 6-2).

Equation 6-2

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

Where:

t_i = overland (initial) flow time (minutes)

C₅ = 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

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

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).

Equation 6-3

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

Equation 6-5

Basin D - requirements will be detailed and designed in the Final Drainage Report when its time to plat the ROW for Sterling Ranch Road and Briargate Parkway.

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

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

-Interim Conditi

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 9/15/21

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)	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)	
		O-S3	1.16	0.21	14.0	0.25	3.63	0.9															
	2	O-S2	180.30	0.09	47.4	15.62	1.80	28.1	47.4	15.87	1.80	28.5											Tributary Basins: O-S2 and O-S3 Drains to swale
	2.1	C-2	2.66	0.08	24.9	0.21	2.76	0.6	47.4	16.08	1.80	28.9											Tributary Basins: C-2, O-S2 and O-S3 To Sand Creek
	1	C-1	22.30	0.08	40.1	1.78	2.05	3.6															Tributary Basins: C-1 Pond C
	3	O-S1	5.40	0.09	36.5	0.51	2.19	1.1															To sand creek
	4	O-S4	69.42	0.08	34.0	5.55	2.29	12.7															Runoff conveyed from 24" RCP under interim grading
	5	O-S5	8.57	0.08	12.8	0.69	3.75	2.6															Runoff conveyed from 24" RCP under interim grading
	6	O-S6	51.20	0.08	44.2	4.10	1.90	7.8															Runoff conveyed from 24" RCP under interim grading
	7	OS	124.20	0.08	64.5	9.94	1.33	13.3	64.5	20.79	1.33	27.7											Runoff from basins OS, OS-4-OS-6
	8	D	17.29	0.08	46.3	1.38	1.83	2.5															Runoff from basin D
	0								64.5	21.66	1.33	28.9											Runoff from OS, OS-6,O-S5 and OS-4

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

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

Subdivision: Homestead Fil. 3
Location: El Paso County
Design Storm: T00-Year

-Interim Conditions

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 9/15/21

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)	
		O-S3	1.16	0.45	14.0	0.52	6.09	3.2															
	2	O-S2	180.30	0.35	47.4	64.00	3.01	192.9	47.4	64.52	3.01	194.5											Tributary Basins: O-S2 and O-S3 Drains to swale
	2.1	C-2	2.66	0.35	24.9	0.93	4.64	4.3	47.4	65.45	3.01	197.3											Tributary Basins: C-2, O-S2 and O-S3 To Sand Creek
	1	C-1	22.30	0.35	40.1	7.81	3.44	26.8															Tributary Basins: C-1 Pond C
	3	O-S1	5.40	0.36	36.5	1.94	3.67	7.1															To sand creek
	4	O-S4	69.42	0.35	34.0	24.30	3.85	93.5															Runoff conveyed from 24" RCP under interim grading
	5	O-S5	8.57	0.35	12.8	3.00	6.30	18.9															Runoff conveyed from 24" RCP under interim grading
	6	O-S6	51.20	0.35	44.2	17.92	3.19	57.1															Runoff conveyed from 24" RCP under interim grading
	7	OS	124.20	0.35	64.5	43.47	2.24	97.2	64.5	90.63	2.24	202.6											Runoff from basins OS, OS-4-OS-6
	8	D	17.29	0.35	46.3	6.05	3.07	18.6															Runoff from basin D
	0								64.5	96.68	2.24	216.2											Runoff from OS, OS-6,O-S5 and OS-4

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

COMPOSITE % IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision:
Location:Homestead Fil. 3
El Paso County**-Proposed Conditions**Calculated By: ARJ
Checked By:
Date: 10/8/21

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 _s	C ₁₀₀	Area (ac)	Weighted % Imp.	C _s	C ₁₀₀	Area (ac)	Weighted % Imp.	C _s	C ₁₀₀	Area (ac)	Weighted % Imp.	C _s	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	0.46	0.90	0.96	0.21	45.6%	0.45	0.59	0.05	5.4%	0.08	0.35	0.20	0.8%	0.50	0.66	51.8%
A9	2.78	0.90	0.96	0.00	0.0%	0.45	0.59	0.93	15.1%	0.08	0.35	1.85	1.3%	0.20	0.43	16.4%
Pond A	30.29															46.4%
B1.1	3.36	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	4.21	0.90	0.96	0.46	10.8%	0.45	0.59	2.63	28.1%	0.08	0.35	1.13	0.5%	0.40	0.57	39.4%
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	1.30	0.90	0.96	0.38	29.5%	0.45	0.59	0.84	29.1%	0.08	0.35	0.08	0.1%	0.56	0.69	58.7%
B8	2.30	0.90	0.96	0.53	22.9%	0.45	0.59	1.63	31.9%	0.08	0.35	0.14	0.1%	0.53	0.66	54.9%
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	1.65	61.50	0.96	0.00	0.0%	0.45	0.59	0.35	13.7%	0.08	0.35	1.30	1.6%	0.16	0.40	15.2%
B12	2.40	0.90	0.96	0.00	0.0%	0.45	0.59	1.45	39.3%	0.08	0.35	0.95	0.8%	0.30	0.50	40.1%
Pond B	27.87															50.0%
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	6.35	0.90	0.96	1.04	16.4%	0.45	0.59	4.76	48.8%	0.08	0.35	0.55	0.2%	0.49	0.63	65.3%
C4.2	3.44	0.90	0.96	0.59	17.1%	0.45	0.59	2.20	41.6%	0.08	0.35	0.65	0.4%	0.46	0.61	59.1%
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	2.48	0.90	0.96	0.27	11.0%	0.45	0.59	0.32	8.5%	0.08	0.35	1.89	1.5%	0.22	0.45	21.0%
D1	1.83	0.90	0.96	0.69	37.5%	0.45	0.59	0.00	0.0%	0.08	0.35	1.14	1.2%	0.39	0.58	38.8%
D2	1.77	0.90	0.96	0.75	42.1%	0.45	0.59	0.00	0.0%	0.08	0.35	1.02	1.2%	0.43	0.61	43.3%
D3	0.18	0.90	0.96	0.12	67.0%	0.45	0.59	0.00	0.0%	0.08	0.35	0.06	0.7%	0.63	0.76	67.6%
D4	0.19	0.90	0.96	0.11	56.6%	0.45	0.59	0.00	0.0%	0.08	0.35	0.08	0.9%	0.54	0.70	57.5%
D5	0.91	0.90	0.96	0.70	76.5%	0.45	0.59	0.00	0.0%	0.08	0.35	0.21	0.5%	0.71	0.82	77.0%
D6	0.83	0.90	0.96	0.57	68.4%	0.45	0.59	0.00	0.0%	0.08	0.35	0.26	0.6%	0.64	0.77	69.0%
D7	0.73	0.90	0.96	0.59	81.0%	0.45	0.59	0.00	0.0%	0.08	0.35	0.14	0.4%	0.74	0.84	81.4%
D8	0.66	0.90	0.96	0.49	74.7%	0.45	0.59	0.00	0.0%	0.08	0.35	0.17	0.5%	0.69	0.81	75.2%
OffSite Basins																
OS1	2.85	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	2.85	2.0%	0.08	0.35	2.0%
OS2	179.61	0.90	0.96	0.91	0.5%	0.45	0.59	0.00	0.0%	0.08	0.35	178.71	2.0%	0.08	0.35	2.5%
OS3	11.99	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	11.99	2.0%	0.08	0.35	2.0%
Pond C	224.34															10.3%

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Homestead Fil. 3

Location: El Paso County

-Proposed Conditions

Project Name: Homestead North

Project No.: 25188.00

Calculated By: ARJ

Checked By:

Date: 10/8/21

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t _c CHECK			FINAL
DATA						(T _i)			(T _i)					(URBANIZED BASINS)			
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)	
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	0.46	B	52%	0.50	0.66	9.5	2.0%	2.7	230	1.9%	20.0	2.8	1.4	4.1	239.5	18.9	5.0
A9	2.78	B	16%	0.20	0.43	30	2.0%	7.0	535	0.5%	20.0	1.4	6.3	13.4	565.0	34.4	13.4
B1.1	3.36	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	4.21	B	39%	0.40	0.57	25	2.0%	5.0	680	1.6%	20.0	2.5	4.5	9.5	705.0	25.5	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	1.30	B	59%	0.56	0.69	50	1.0%	6.9	315	1.5%	20.0	2.4	2.1	9.0	365.0	18.5	9.0
B8	2.30	B	55%	0.53	0.66	50	1.0%	7.3	280	1.0%	20.0	2.0	2.4	9.6	330.0	19.5	9.6
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	1.65	B	15%	0.16	0.40	30	2.0%	7.4	250	0.1%	20.0	0.4	9.3	16.7	280.0	40.1	16.7
B12	2.40	B	40%	0.30	0.50	30	2.0%	6.3	900	0.1%	20.0	0.4	33.5	39.8	930.0	65.1	39.8
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

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Homestead Fil. 3

Location: El Paso County

-Proposed Conditions

Project Name: Homestead North

Project No.: 25188.00

Calculated By: ARJ

Checked By:

Date: 10/8/21

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t _c CHECK			FINAL
DATA						(T _i)			(T _i)					(URBANIZED BASINS)			
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)	
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
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	6.35	B	65%	0.49	0.63	150	2.0%	10.7	366	4.8%	21.0	4.6	1.3	12.0	516.0	16.4	12.0
C4.2	3.44	B	59%	0.46	0.61	150	2.0%	11.3	367	4.6%	22.0	4.7	1.3	12.6	517.0	17.6	12.6
C5	0.16	B	81%	0.74	0.84	9.5	2.0%	1.6	368	0.3%	23.0	1.3	4.9	6.4	377.5	17.7	6.4
C6	2.48	B	21%	0.22	0.45	15	2.0%	4.9	160	0.5%	20.0	1.4	1.9	6.8	175.0	25.6	6.8
D1	1.83	B	39%	0.39	0.58	30	1.0%	7.0	1365	2.5%	15.0	2.4	9.7	16.7	1395.0	29.5	16.7
D2	1.77	B	43%	0.43	0.61	30	1.0%	6.7	1365	2.5%	15.0	2.4	9.6	16.3	1395.0	28.2	16.3
D3	0.18	B	68%	0.63	0.76	30	1.0%	4.7	150	1.7%	20.0	3.2	0.8	5.4	180.0	15.5	5.4
D4	0.19	B	57%	0.54	0.70	30	1.0%	5.5	150	1.7%	20.0	3.2	0.8	6.3	180.0	17.4	6.3
D5	0.91	B	77%	0.71	0.82	15	2.0%	2.2	740	3.4%	20.0	3.2	3.9	6.0	755.0	16.3	6.0
D6	0.83	B	69%	0.64	0.77	15	2.0%	2.6	740	3.4%	20.0	3.2	3.9	6.4	755.0	17.8	6.4
D7	0.52	B	81%	0.74	0.84	15	2.0%	2.0	550	2.0%	20.0	4.2	2.2	4.2	565.0	15.3	5.0
D8	0.66	B	75%	0.69	0.81	15	2.0%	2.3	550	2.0%	20.0	5.2	1.8	4.0	565.0	16.5	5.0
OS1	2.85	B	2%	0.08	0.35	50	1.0%	13.0	280	3.9%	7.0	3.2	1.5	14.5	330.0	28.2	14.5
OS2	179.61	B	2%	0.08	0.35	300	1.0%	31.8	3007	1.7%	7.0	3.2	15.7	47.4	3307.0	66.3	47.4
OS3	11.99	B	2%	0.08	0.35	300	1.0%	31.9	3008	1.8%	7.0	3.2	15.7	47.6	3308.0	66.2	47.6

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√S_o

K = NRCS conveyance factor (see Table 6-2).

Equation 6-2

$$t_i = \frac{0.395(1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$

Where:

t_i = overland (initial) flow time (minutes)

C₅ = 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

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

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).

Equation 6-3

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

Equation 6-5

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

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

-Proposed Conditions

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 10/8/21

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)	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)	
	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	0.46	0.50	5.0	0.23	5.17	1.2	16.0	3.31	3.42	11.3											Flow Confluences at sump inlet
	9A	A9	2.78	0.20	13.4	0.57	3.70	2.1	16.5	6.38	3.38	21.6											Flows into Pond A. All of Pond A.
	1.1b	B1.1	3.36	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	14.5	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	4.21	0.40	9.5	1.68	4.20	7.1					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	14.5	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	14.5	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	1.30	0.56	9.0	0.73	4.28	3.1	9.0	1.69	4.28	7.2	0.1	0.05	1.6					340	2.5	2.2	On-grade Type R Inlet, Bypass to DP 8B
	8b	B8	2.30	0.53	9.6	1.22	4.19	5.1	11.3	1.27	3.95	5.0											Street Flow, Recives bypass flow from DP 7B

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

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

-Proposed Conditions

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 10/8/21

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)	(in/hr)	Q (cfs)	t _c (min)	C*A (ac)	(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)	
	10b	B10	0.22	0.73	5.0	0.16	5.17	0.8	11.3	1.43	3.95	5.7											Sump Inlet recives by-pass flow from 7b and runoff from 5b,8b, and 10b
	11b	B11	1.65	0.16	16.7	0.26	3.36	0.9	14.5	5.07	3.58	18.1											Pond B
	12b	B12	2.40	0.30	39.8	0.73	2.06	1.5															Runoff Collected from walk out lots facing sand creek
	2.5								39.8	12.88	2.06	26.5											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	3.44	0.46	12.6	1.57	3.78	5.9					0.00	0	2.84					1010	3.4	5.0	On-Grade Type R Inlet, by pass to 4.2c
	4C	C4.1	6.35	0.49	12.0	3.13	3.85	12.1	17.6	5.77	3.28	18.9											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	6.4	0.12	4.79	0.6	8.4	0.94	4.39	4.1											Sump Inlet
	6C	C6	2.48	0.22	6.8	0.54	4.71	2.5															Conluenced flow for Pond C
	3.5								13.1	11.13	3.72	41.4											
	o1	OS1	2.85	0.08	14.5	0.23	3.57	0.8															offsite basin to type D inlet
	1d	D1	1.83	0.39	16.7	0.71	3.36	2.4															Tributary basin D1 NW portion of Vollmer in Swale
	1.1d								16.7	0.94	3.36	3.2											Tributary basin D1 and OS1 NW portion of Vollmer in Swale
	2d	D2	1.77	0.43	16.3	0.75	3.40	2.5															Tributary basin D2 SE portion of Vollmer in Swale

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

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

-Proposed Conditions

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 10/8/21

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)	ti (in/hr)	Q (cfs)	tc (min)	C*A (ac)	ti (in/hr)	Q (cfs)	Q _{street/swale} (cfs)	C*A (ac)	Slope (%)	Q _{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t _t (min)	
	1.2d								16.7	1.69	3.36	5.7											
	3d	D3	0.18	0.63	5.4	0.11	5.04	0.6															Tributary basin: D3 Runoff captured on on grade inlet
	4d	D4	0.19	0.54	6.3	0.10	4.83	0.5	6.3	0.21	4.83	1.0											Tributary basin: D4 Runoff captured on on grade inlet
	1.3d								6.3	0.10	4.83	0.5											Tributary basins: D4 and D3 Runoff captured on on grade inlet
	1.4d								16.7	1.90	3.36	6.4											Tributary basins: D1-D4 and OS1 Runoff piped
	2o	OS2	179.61	0.08	47.4	15.11	1.79	27.1															
	6d	D6	0.83	0.64	6.4	0.53	4.80	2.5															
	5d	D5	0.91	0.71	6.0	0.64	4.89	3.1															
	1.5d								47.4	16.28	1.79	29.2											Tributary basins: 5D-6D and OS2 Runoff piped
	1.6d								47.4	18.18	1.79	32.6											Tributary basins: 1D-6D and OS1 and OS2 Runoff piped
	3o	OS3	11.99	0.08	47.6	0.96	1.79	1.7															
	8d	D8	0.66	0.69	5.0	0.46	5.17	2.4	47.6	1.42	1.79	2.5											Tributary basins: OS3 and D8 Runoff captured on on grade inlet
	7d	D7	0.52	0.74	5.0	0.39	5.17	2.0															Runoff captured on on grade inlet
	2.1d								47.6	1.81	1.79	3.2											Tributary basins: D7,D8 and OS1 Runoff piped
	1.7d								47.6	19.99	1.79	35.8											Tributary basins: 1D-4D and OS1, OS2 and OS3 Runoff piped to Sand Creek

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

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

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

-Proposed Conditions

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 10/8/21

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 _t (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I _t (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	0.46	0.66	5.0	0.30	8.68	2.6	16.0	3.48	5.75	20.0											Flow Confluences at sump inlet
	9A	A9	2.78	0.43	13.4	1.20	6.20	7.4	16.5	8.74	5.68	49.6											Flows into Pond A. All of Pond A.
	1.1b	B1.1	3.36	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	14.5	1.13	6.00	6.80702											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	4.21	0.57	9.5	2.38	7.05	16.8					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	14.5	4.41	6.00	26.4519											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	14.5	5.05	6.00	30.2946											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
	7b	B7	1.30	0.69	9.0	0.89	7.19	6.4	9.0	2.07	7.19	14.9	3.2	0.44	1.6					340	2.5	2.2	On-grade Type R Inlet, Bypass to DP 8B

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

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

-Proposed Conditions

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 10/8/21

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 _h (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I _h (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 _c (min)	
	8b	B8	2.30	0.66	9.6	1.52	7.03	10.7	11.3	1.96	6.63	13.0											Street Flow, Recives bypass flow from DP 7B
	10b	B10	0.22	0.83	5.0	0.19	8.68	1.6	11.3	2.15	6.63	14.3											Sump inlet recives by-pass flow from 7b and runoff from 5b,8b, and 10b
	11b	B11	1.65	0.40	16.7	0.66	5.64	3.7															
	12b	B12	2.40	0.50	39.8	1.19	3.45	4.1															
	2.5								39.8	17.10	3.45	59.0											Flow confluenes 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	3.44	0.61	12.6	2.09	6.35	13.3					2.60	0.41	2.84					1010	3.4	5.0	On-Grade Type R Inlet, by pass to 4.2c
	4C	C4.1	6.35	0.63	12.0	4.00	6.47	25.9	17.6	7.63	5.51	42.0											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	6.4	0.13	8.04	1.0	8.4	1.20	7.37	8.8											Sump Inlet
	6C	C6	2.48	0.45	6.8	1.11	7.91	8.8	17.6														
	3.5								17.6	14.38	5.51	79.2											Conlueded flow for Pond C
	o1	OS1	2.85	0.35	14.5	1.00	6.00	6.0															offsite basin to type D Inlet
	1d	D1	1.83	0.58	16.7	1.06	5.64	6.0															Tributary basin D1 NW portion of Vollmer in Swale
	1.1d								16.7	2.06	5.64	11.6											Tributary basin D1 and OS1 NW portion of Vollmer in Swale
	2d	D2	1.77	0.61	16.3	1.07	5.71	6.1															Tributary basin D2 SE portion of Vollmer in Swale

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

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

-Proposed Conditions

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 10/8/21

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)	
	1.2d								16.7	3.13	5.64	17.7											
	3d	D3	0.18	0.76	5.4	0.14	8.47	1.2															Tributary basins: Runoff capture on on grade inlet
	4d	D4	0.19	0.70	6.3	0.13	8.11	1.1					0.30	0.04	2.25					750	3.0	4.2	Tributary basins: D4 Runoff captured on on-grade inlet by passed to DP 6
	1.3d								6.3	0.27	8.11	2.2											Tributary basin: D4 and D3 Runoff captured on on grade inlet
	1.4d								16.7	3.40	5.64	19.2											Tributary basins: D1-D4 and OS1 Runoff piped
	2o	OS2	179.61	0.35	47.4	63.42	3.01	190.9															
	6d	D6	0.83	0.77	6.4	0.64	8.05	5.2	10.6	0.68	6.79	4.6	0.40	0.05	3					555	3.5	2.7	Tributary basins: D6 Runoff captured on on-grade inlet by passed to DP 8
	5d	D5	0.91	0.82	6.0	0.74	8.20	6.1					0.70	0.09	3					555	3.5	2.7	
	1.5d								47.4	64.80	3.01	195.0											Tributary basins: 5D-6D and OS2 Runoff piped
	1.6d								47.4	68.20	3.01	205.3											Tributary basins: 1D-6D and OS1 and OS2 Runoff piped
	3o	OS3	11.99	0.35	47.6	4.20	3.00	12.6															
	8d	D8	0.66	0.81	5.0	0.53	8.68	4.6	47.6	4.78	3.00	14.4	0.70	0.08	2.2								Tributary basins: OS3 and D8 Runoff captured on on grade inlet, by flow goes down stream
	7d	D7	0.52	0.84	5.0	0.44	8.68	3.8	7.7	0.44	7.60	3.3											Runoff captured on on grade inlet
	2.1d								47.6	5.17	3.00	15.5											Tributary basins: D7, D8 and OS1 Runoff piped
	1.7d								47.6	73.37	3.00	220.3											Tributary basins: 1D-4D and OS1, OS2 and OS3 Runoff piped to Sand Creek

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

Appendix C

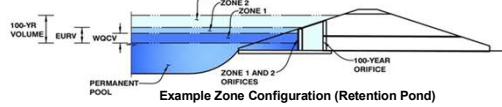
Hydraulic Calculations

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 =	30.29 acres
Watershed Length =	1,963 ft
Watershed Length to Centroid =	1,178 ft
Watershed Slope =	0.030 ft/ft
Watershed Imperviousness =	46.40% 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.

Water Quality Capture Volume (WQCV) =	0.496 acre-feet
Excess Urban Runoff Volume (EURV) =	1.494 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.435 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.081 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	2.652 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	3.437 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	4.065 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	4.868 acre-feet
500-yr Runoff Volume (P1 = 4 in.) =	8.766 acre-feet
Approximate 2-yr Detention Volume =	1.118 acre-feet
Approximate 5-yr Detention Volume =	1.542 acre-feet
Approximate 10-yr Detention Volume =	2.068 acre-feet
Approximate 25-yr Detention Volume =	2.278 acre-feet
Approximate 50-yr Detention Volume =	2.385 acre-feet
Approximate 100-yr Detention Volume =	2.685 acre-feet

Optional User Overrides

	acre-feet
	acre-feet
1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
4.00	inches

Define Zones and Basin Geometry

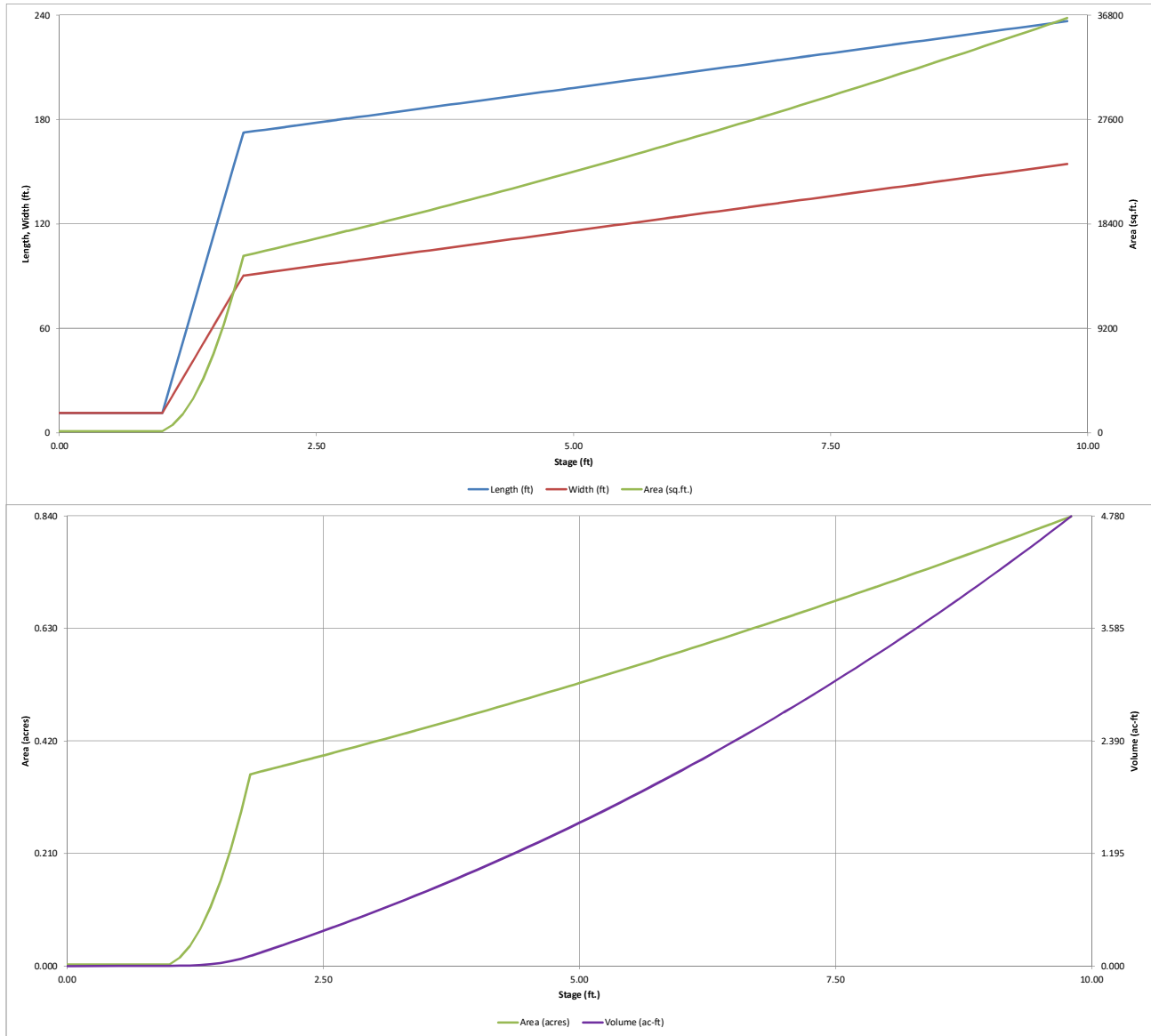
Zone 1 Volume (WQCV) =	0.496 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.997 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.192 acre-feet
Total Detention Basin Volume =	2.685 acre-feet
Initial Surcharge Volume (ISV) =	65 ft ³
Initial Surcharge Depth (ISD) =	0.50 ft
Total Available Detention Depth (H _{total}) =	7.00 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}) =	0.79 ft
Length of Basin Floor (L _{FLOOR}) =	172.5 ft
Width of Basin Floor (W _{FLOOR}) =	90.4 ft
Area of Basin Floor (A _{FLOOR}) =	15,597 ft ²
Volume of Basin Floor (V _{FLOOR}) =	4,516 ft ³
Depth of Main Basin (H _{MAIN}) =	5.21 ft
Length of Main Basin (L _{MAIN}) =	214.2 ft
Width of Main Basin (W _{MAIN}) =	132.1 ft
Area of Main Basin (A _{MAIN}) =	28,293 ft ²
Volume of Main Basin (V _{MAIN}) =	112,703 ft ³
Calculated Total Basin Volume (V _{total}) =	2.694 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	680		0.016	167	0.004
	1.20		52.2	31.4	1,638		0.038	279	0.006
	1.30		72.6	41.4	3,004		0.069	508	0.012
	1.40		93.0	51.4	4,779		0.110	894	0.021
	1.50		113.4	61.4	6,961		0.160	1,477	0.034
	1.60		133.8	71.4	9,551		0.219	2,300	0.053
	1.70		154.2	81.4	12,549		0.288	3,401	0.078
Floor	1.79		172.5	90.4	15,597		0.358	4,665	0.107
	1.80		172.6	90.5	15,618		0.359	4,821	0.111
	1.90		173.4	91.3	15,829		0.363	6,394	0.147
	2.00		174.2	92.1	16,041		0.368	7,987	0.183
	2.10		175.0	92.9	16,255		0.373	9,602	0.220
	2.20		175.8	93.7	16,470		0.378	11,238	0.258
	2.30		176.6	94.5	16,686		0.383	12,896	0.296
	2.40		177.4	95.3	16,904		0.388	14,575	0.335
	2.50		178.2	96.1	17,122		0.393	16,277	0.374
	2.60		179.0	96.9	17,342		0.398	18,000	0.413
	2.70		179.8	97.7	17,564		0.403	19,745	0.453
	2.80		180.6	98.5	17,786		0.408	21,513	0.494
Zone 1 (WQCV)	2.81		180.7	98.5	17,809		0.409	21,691	0.498
	2.90		181.4	99.3	18,010		0.413	23,303	0.535
	3.00		182.2	100.1	18,236		0.419	25,115	0.577
	3.10		183.0	100.9	18,462		0.424	26,950	0.619
	3.20		183.8	101.7	18,690		0.429	28,807	0.661
	3.30		184.6	102.5	18,919		0.434	30,688	0.704
	3.40		185.4	103.3	19,149		0.440	32,591	0.748
	3.50		186.2	104.1	19,381		0.445	34,518	0.792
	3.60		187.0	104.9	19,614		0.450	36,467	0.837
	3.70		187.8	105.7	19,848		0.456	38,440	0.882
	3.80		188.6	106.5	20,083		0.461	40,437	0.928
	3.90		189.4	107.3	20,320		0.466	42,457	0.975
	4.00		190.2	108.1	20,558		0.472	44,501	1.022
	4.10		191.0	108.9	20,797		0.477	46,569	1.069
	4.20		191.8	109.7	21,038		0.483	48,660	1.117
	4.30		192.6	110.5	21,280		0.489	50,776	1.166
	4.40		193.4	111.3	21,523		0.494	52,916	1.215
	4.50		194.2	112.1	21,767		0.500	55,081	1.264
	4.60		195.0	112.9	22,013		0.505	57,270	1.315
	4.70		195.8	113.7	22,260		0.511	59,483	1.366
	4.80		196.6	114.5	22,508		0.517	61,722	1.417
	4.90		197.4	115.3	22,758		0.522	63,985	1.469
Zone 2 (EURV)	4.95		197.8	115.7	22,883		0.525	65,126	1.495
	5.00		198.2	116.1	23,008		0.528	66,273	1.521
	5.10		199.0	116.9	23,260		0.534	68,587	1.575
	5.20		199.8	117.7	23,514		0.540	70,926	1.628
	5.30		200.6	118.5	23,768		0.546	73,290	1.682
	5.40		201.4	119.3	24,024		0.552	75,679	1.737
	5.50		202.2	120.1	24,282		0.557	78,095	1.793
	5.60		203.0	120.9	24,540		0.563	80,536	1.849
	5.70		203.8	121.7	24,800		0.569	83,003	1.905
	5.80		204.6	122.5	25,061		0.575	85,496	1.963
	5.90		205.4	123.3	25,323		0.581	88,015	2.021
	6.00		206.2	124.1	25,587		0.587	90,560	2.079
	6.10		207.0	124.9	25,852		0.593	93,132	2.138
	6.20		207.8	125.7	26,118		0.600	95,731	2.198
	6.30		208.6	126.5	26,385		0.606	98,356	2.258
	6.40		209.4	127.3	26,654		0.612	101,008	2.319
	6.50		210.2	128.1	26,924		0.618	103,687	2.380
	6.60		211.0	128.9	27,195		0.624	106,393	2.442
	6.70		211.8	129.7	27,468		0.631	109,126	2.505
	6.80		212.6	130.5	27,742		0.637	111,886	2.569
	6.90		213.4	131.3	28,017		0.643	114,674	2.633
Zone 3 (100-year)	6.99		214.1	132.0	28,265		0.649	117,207	2.691
	7.00		214.2	132.1	28,293		0.650	117,490	2.697
	7.10		215.0	132.9	28,571		0.656	120,333	2.762
	7.20		215.8	133.7	28,850		0.662	123,204	2.828
	7.30		216.6	134.5	29,130		0.669	126,103	2.895
	7.40		217.4	135.3	29,412		0.675	129,030	2.962
	7.50		218.2	136.1	29,694		0.682	131,985	3.030
	7.60		219.0	136.9	29,978		0.688	134,969	3.098
	7.70		219.8	137.7	30,264		0.695	137,981	3.168
	7.80		220.6	138.5	30,550		0.701	141,021	3.237
	7.90		221.4	139.3	30,838		0.708	144,091	3.308
	8.00		222.2	140.1	31,128		0.715	147,189	3.379
	8.10		223.0	140.9	31,418		0.721	150,316	3.451
	8.20		223.8	141.7	31,710		0.728	153,473	3.523
	8.30		224.6	142.5	32,003		0.735	156,658	3.596
	8.40		225.4	143.3	32,297		0.741	159,873	3.670
	8.50		226.2	144.1	32,593		0.748	163,118	3.745
	8.60		227.0	144.9	32,890		0.755	166,392	3.820
	8.70		227.8	145.7	33,188		0.762	169,696	3.896
	8.80		228.6	146.5	33,487		0.769	173,030	3.972
	8.90		229.4	147.3	33,788		0.776	176,393	4.049
	9.00		230.2	148.1	34,090		0.783	179,787	4.127
	9.10		231.0	148.9	34,393		0.790	183,211	4.206
	9.20		231.8	149.7	34,698		0.797	186,666	4.285
	9.30		232.6	150.5	35,004		0.804	190,151	4.365
	9.40		233.4	151.3	35,311		0.811	193,667	4.446
	9.50		234.2	152.1	35,619		0.818	197,213	4.527
	9.60		235.0	152.9	35,929		0.825	200,790	4.610
	9.70		235.8	153.7	36,240		0.832	204,399	4.692
	9.80		236.6	154.5	36,552		0.839	208,038	4.776

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

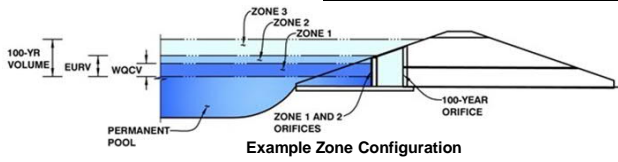


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond A



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
V)	2.81	0.496	
V)	4.95	0.997	
10)	6.99	1.192	
Total (all zones)		2.685	

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

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain
Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = feet

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

Invert of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = 4.27 ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = N/A inches
Orifice Plate: Orifice Area per Row = N/A inches

Calculated Parameters for Plate
WO Orifice Area per Row = N/A ft²
Elliptical Half-Width = N/A feet
Elliptical Slot Centroid = N/A feet
Elliptical Slot Area = N/A ft²

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.42	2.85	3.85				
Orifice Area (sq. inches)	2.00	2.00	2.00	2.00				

	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)

Invert of Vertical Orifice = Not Selected Not Selected ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = N/A N/A ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = N/A N/A inches

Calculated Parameters for Vertical Orifice
Vertical Orifice Area = Not Selected Not Selected ft²
Vertical Orifice Centroid = N/A N/A feet

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

Overflow Weir Front Edge Height, H_o = Not Selected Not Selected ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = 5.00 N/A feet
Overflow Weir Grate Slope = 4.00 N/A H:V
Horiz. Length of Weir Sides = 5.00 N/A feet
Overflow Grate Open Area % = 75% N/A %, grate open area/total area
Debris Clogging % = 50% N/A %

Calculated Parameters for Overflow Weir
Height of Grate Upper Edge, H₁ = Not Selected Not Selected feet
Overflow Weir Slope Length = 5.15 N/A feet
Grate Open Area / 100-yr Orifice Area = 23.19 N/A
Overflow Grate Open Area w/o Debris = 19.33 N/A ft²
Overflow Grate Open Area w/ Debris = 9.66 N/A ft²

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

Depth to Invert of Outlet Pipe = Not Selected Not Selected ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter = 24.00 N/A inches
 5.00

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate
Outlet Orifice Area = Not Selected Not Selected ft²
Outlet Orifice Centroid = 0.21 N/A feet
Half-Central Angle of Restrictor Plate on Pipe = N/A N/A radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 7.00 ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = 23.00 feet
Spillway End Slopes = 4.00 H:V
Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway
Spillway Design Flow Depth = 0.91 feet
Stage at Top of Freeboard = 8.91 feet
Basin Area at Top of Freeboard = 0.78 acres
Basin Volume at Top of Freeboard = 4.06 acre-ft

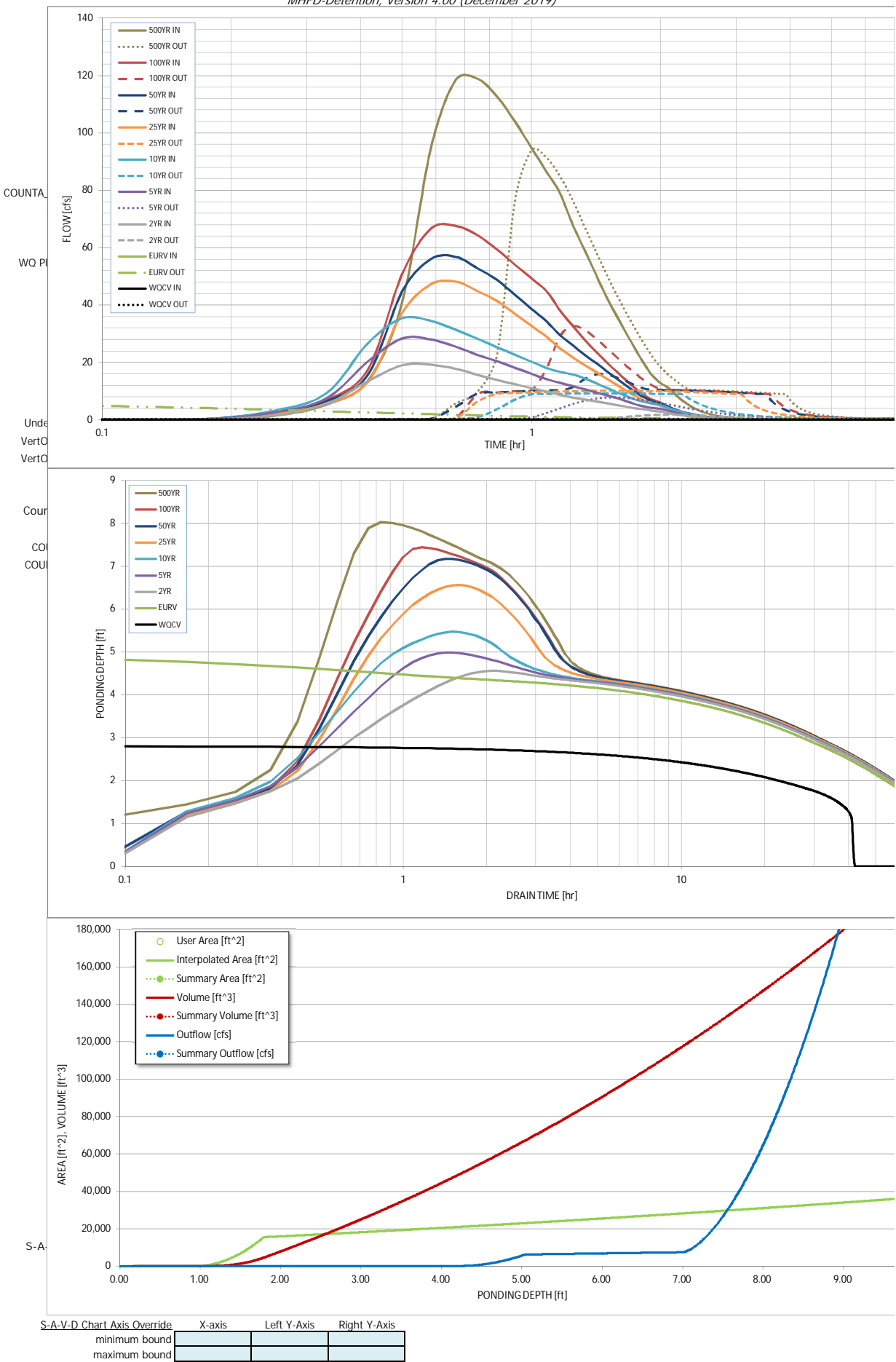
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
One-Hour Rainfall Depth (in) =	N/A	N/A	1.435	2.081	2.652	3.437	4.065	4.868	8.766
CUHP Runoff Volume (acre-ft) =	N/A	N/A	1.435	2.081	2.652	3.437	4.065	4.868	8.766
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.8	7.9	12.0	21.5	27.0	34.6	68.1
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.09	0.26	0.39	0.71	0.89	1.14	2.25
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	19.2	28.3	35.4	48.2	56.8	67.6	118.9
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	1.8	7.8	9.2	10.1	15.8	32.6	93.8
Peak Inflow Q (cfs) =	N/A	N/A	N/A	1.0	0.8	0.5	0.6	0.9	1.4
Peak Outflow Q (cfs) =	Plate	Overflow Weir	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway	Spillway	Spillway
Ratio Peak Outflow to Predevelopment Q =	N/A	0.34	0.07	0.4	0.5	0.5	0.5	0.5	0.5
Structure Controlling Flow =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 1 (fps) =	39	67	69	68	66	65	63	61	52
Max Velocity through Grate 2 (fps) =	41	71	73	73	72	72	71	71	67
Time to Drain 97% of Inflow Volume (hours) =	2.81	4.95	4.56	4.99	5.47	6.56	7.18	7.45	8.03
Time to Drain 99% of Inflow Volume (hours) =	0.41	0.53	0.50	0.53	0.56	0.62	0.66	0.68	0.72
Maximum Ponding Depth (ft) =	0.498	1.495	1.295	1.516	1.776	2.418	2.809	2.989	3.400
Area at Maximum Ponding Depth (acres) =									
Maximum Volume Stored (acre-ft) =									

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)

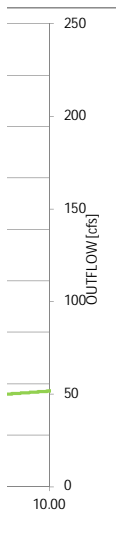
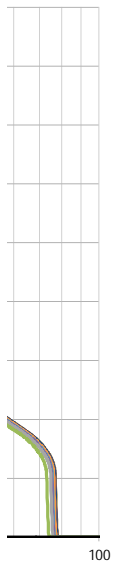


DETENTION BASIN OUTLET STRUCTURE DESIGN

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	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	1.30
0:15:00	0.00	0.00	1.51	2.47	3.06	2.06	2.59	2.52	5.32
0:20:00	0.00	0.00	5.56	7.41	9.24	5.53	6.48	6.91	13.71
0:25:00	0.00	0.00	13.50	20.37	26.75	13.30	15.79	17.62	40.65
0:30:00	0.00	0.00	18.98	28.34	35.37	37.22	44.63	50.66	94.40
0:35:00	0.00	0.00	19.16	27.99	34.48	47.21	56.00	66.54	118.45
0:40:00	0.00	0.00	17.76	25.47	31.41	48.19	56.81	67.57	118.88
0:45:00	0.00	0.00	15.65	22.58	28.22	44.83	52.80	64.29	112.59
0:50:00	0.00	0.00	13.84	20.32	25.25	41.35	48.66	59.30	103.94
0:55:00	0.00	0.00	12.37	18.13	22.65	36.90	43.53	54.01	94.88
1:00:00	0.00	0.00	11.03	16.05	20.26	32.73	38.70	49.29	86.64
1:05:00	0.00	0.00	9.85	14.18	18.12	29.02	34.37	44.93	78.97
1:10:00	0.00	0.00	8.66	12.86	16.71	24.83	29.47	38.10	67.80
1:15:00	0.00	0.00	7.76	11.74	15.77	21.75	25.90	32.63	58.95
1:20:00	0.00	0.00	7.03	10.61	14.40	18.99	22.62	27.78	50.30
1:25:00	0.00	0.00	6.37	9.54	12.70	16.62	19.76	23.58	42.60
1:30:00	0.00	0.00	5.75	8.54	11.08	14.27	16.92	19.97	35.96
1:35:00	0.00	0.00	5.13	7.58	9.56	12.10	14.30	16.66	29.91
1:40:00	0.00	0.00	4.53	6.41	8.18	10.10	11.88	13.62	24.38
1:45:00	0.00	0.00	4.00	5.35	6.98	8.25	9.65	10.86	19.36
1:50:00	0.00	0.00	3.62	4.58	6.16	6.65	7.74	8.51	15.34
1:55:00	0.00	0.00	3.18	4.14	5.60	5.59	6.50	6.96	12.79
2:00:00	0.00	0.00	2.83	3.80	5.06	4.95	5.76	6.00	11.16
2:05:00	0.00	0.00	2.31	3.11	4.14	3.95	4.58	4.68	8.75
2:10:00	0.00	0.00	1.85	2.47	3.29	3.05	3.54	3.53	6.63
2:15:00	0.00	0.00	1.47	1.95	2.60	2.37	2.74	2.65	4.99
2:20:00	0.00	0.00	1.16	1.54	2.03	1.83	2.11	1.97	3.71
2:25:00	0.00	0.00	0.91	1.21	1.58	1.41	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	0.53	0.69	0.62	0.70	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	0.03	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.

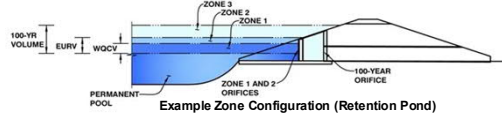
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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD- Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond B



Watershed Information

Selected BMP Type =	EDB
Watershed Area =	27.87 acres
Watershed Length =	1,290 ft
Watershed Length to Centroid =	775 ft
Watershed Slope =	0.020 ft/ft
Watershed Imperviousness =	50.00% percent
Percentage Hydrologic Soil Group A =	0.0% percent
Percentage Hydrologic Soil Group B =	100.0% percent
Percentage Hydrologic Soil Groups C/D =	0.0% percent
Target WQCV Drain Time =	40.0 hours
Location for 1-hr Rainfall Depths =	User Input

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

Water Quality Capture Volume (WQCV) =	0.479 acre-feet
Excess Urban Runoff Volume (EURV) =	1.490 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.408 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	2.013 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	2.544 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	3.257 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	3.835 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	4.568 acre-feet
500-yr Runoff Volume (P1 = 4 in.) =	8.154 acre-feet
Approximate 2-yr Detention Volume =	1.124 acre-feet
Approximate 5-yr Detention Volume =	1.541 acre-feet
Approximate 10-yr Detention Volume =	2.041 acre-feet
Approximate 25-yr Detention Volume =	2.234 acre-feet
Approximate 50-yr Detention Volume =	2.335 acre-feet
Approximate 100-yr Detention Volume =	2.607 acre-feet

Optional User Overrides

acre-feet	
acre-feet	
inches	1.19
inches	1.50
inches	1.75
inches	2.00
inches	2.25
inches	2.52
inches	4.00

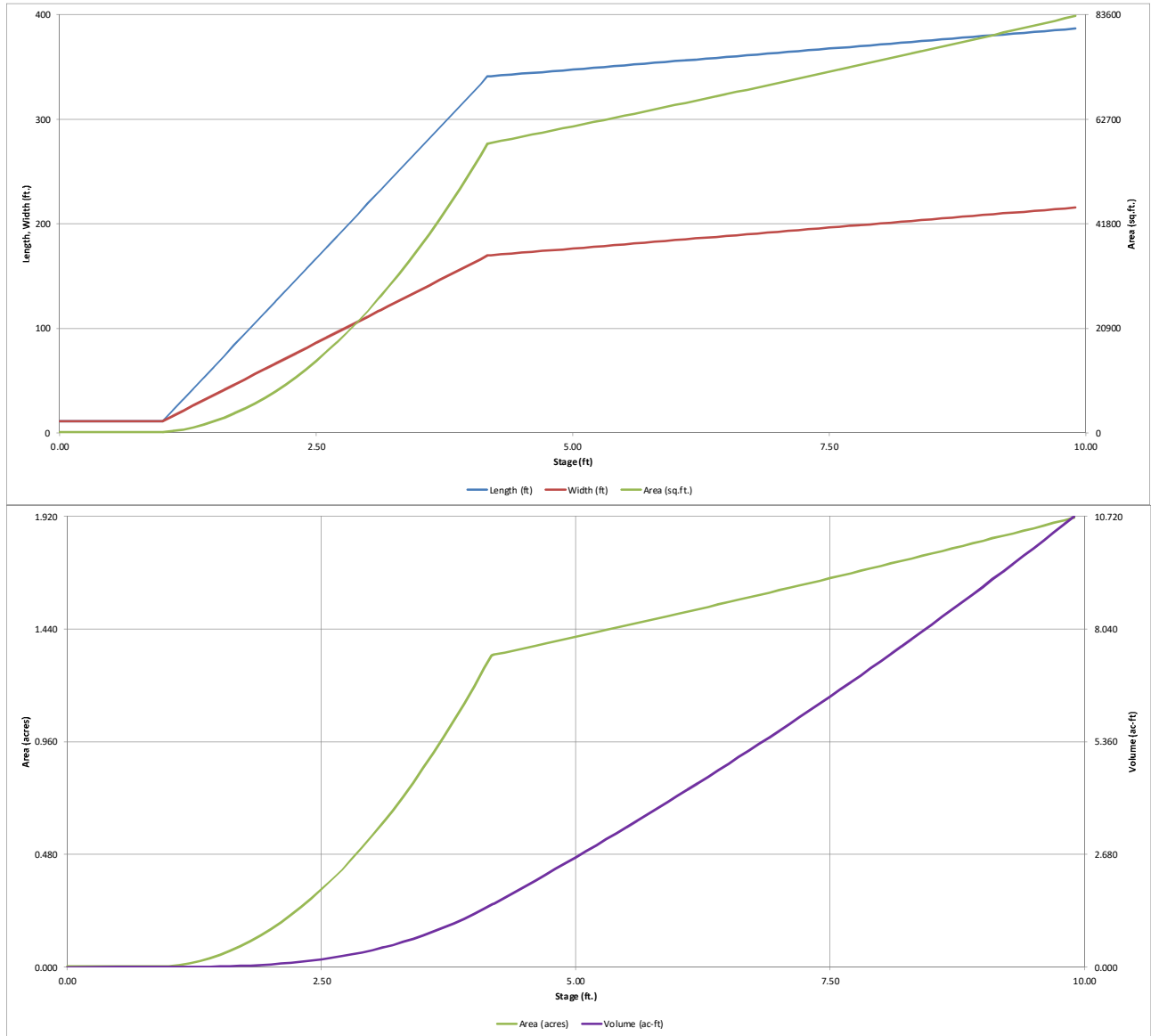
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.479 acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.011 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.117 acre-feet
Total Detention Basin Volume =	2.607 acre-feet
Initial Surge Volume (ISV) =	63 ft ³
Initial Surge 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 (L _W) =	2
Initial Surge Area (A _{ISV}) =	125 ft ²
Surcharge Volume Length (L _{SV}) =	11.2 ft
Surcharge Volume Width (W _{SV}) =	11.2 ft
Depth of Basin Floor (H _{FLOOR}) =	3.17 ft
Length of Basin Floor (L _{FLOOR}) =	340.9 ft
Width of Basin Floor (W _{FLOOR}) =	169.7 ft
Area of Basin Floor (A _{FLOOR}) =	57,842 ft ²
Volume of Basin Floor (V _{FLOOR}) =	64,095 ft ³
Depth of Main Basin (H _{MAIN}) =	0.83 ft
Length of Main Basin (L _{MAIN}) =	347.5 ft
Width of Main Basin (W _{MAIN}) =	176.3 ft
Area of Main Basin (A _{MAIN}) =	61,276 ft ²
Volume of Main Basin (V _{MAIN}) =	49,427 ft ³
Calculated Total Basin Volume (V _{total}) =	2,609 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		11.2	11.2	125		0.003		
ISV	0.50		11.2	11.2	125		0.003	63	0.001
	0.60		11.2	11.2	125		0.003	75	0.002
	0.70		11.2	11.2	125		0.003	88	0.002
	0.80		11.2	11.2	125		0.003	100	0.002
	0.90		11.2	11.2	125		0.003	113	0.003
	1.00		11.2	11.2	125		0.003	125	0.003
	1.10		21.6	16.2	350		0.008	148	0.003
	1.20		32.0	21.2	678		0.016	199	0.005
	1.30		42.4	26.2	1,110		0.025	287	0.007
	1.40		52.8	31.2	1,646		0.038	424	0.010
	1.50		63.2	36.2	2,287		0.052	620	0.014
	1.60		73.6	41.2	3,031		0.070	885	0.020
	1.70		84.0	46.2	3,879		0.089	1,230	0.028
	1.80		94.4	51.2	4,832		0.111	1,664	0.038
	1.90		104.8	56.2	5,888		0.135	2,199	0.050
	2.00		115.2	61.2	7,048		0.162	2,845	0.065
	2.10		125.6	66.2	8,313		0.191	3,612	0.083
	2.20		136.0	71.2	9,681		0.222	4,511	0.104
	2.30		146.4	76.2	11,153		0.256	5,552	0.127
	2.40		156.8	81.2	12,730		0.292	6,745	0.155
	2.50		167.2	86.2	14,410		0.331	8,101	0.186
	2.60		177.6	91.2	16,194		0.372	9,631	0.221
	2.70		188.0	96.2	18,082		0.415	11,344	0.260
	2.80		198.4	101.2	20,075		0.461	13,251	0.304
	2.90		208.8	106.2	22,171		0.509	15,362	0.353
	3.00		219.2	111.2	24,371		0.559	17,688	0.406
	3.10		229.6	116.2	26,676		0.612	20,240	0.465
Zone 1 (WQCV)	3.13		232.7	117.7	27,387		0.629	21,051	0.483
	3.20		240.0	121.2	29,084		0.668	23,027	0.529
	3.30		250.4	126.2	31,596		0.725	26,060	0.598
	3.40		260.8	131.2	34,213		0.785	29,350	0.674
	3.50		271.2	136.2	36,933		0.848	32,906	0.755
	3.60		281.6	141.2	39,757		0.913	36,740	0.843
	3.70		292.0	146.2	42,686		0.980	40,861	0.938
	3.80		302.4	151.2	45,718		1.050	45,280	1.039
	3.90		312.8	156.2	48,854		1.122	50,008	1.148
	4.00		323.2	161.2	52,095		1.196	55,055	1.264
	4.10		333.6	166.2	55,439		1.273	60,431	1.387
Floor	4.17		340.9	169.7	57,842		1.328	64,395	1.478
Zone 2 (EURV)	4.18		340.9	169.8	57,883		1.329	64,974	1.492
	4.20		341.1	169.9	57,964		1.331	66,132	1.518
	4.30		341.9	170.7	58,374		1.340	71,949	1.652
	4.40		342.7	171.5	58,785		1.350	77,807	1.786
	4.50		343.5	172.3	59,197		1.359	83,706	1.922
	4.60		344.3	173.1	59,610		1.368	89,646	2.058
	4.70		345.1	173.9	60,025		1.378	95,628	2.195
	4.80		345.9	174.7	60,440		1.388	101,651	2.334
	4.90		346.7	175.5	60,858		1.397	107,716	2.473
Zone 3 (100-year)	5.00		347.5	176.3	61,276		1.407	113,823	2.613
	5.10		348.3	177.1	61,696		1.416	119,971	2.754
	5.20		349.1	177.9	62,117		1.426	126,162	2.896
	5.30		349.9	178.7	62,539		1.436	132,395	3.039
	5.40		350.7	179.5	62,962		1.445	138,670	3.183
	5.50		351.5	180.3	63,387		1.455	144,987	3.328
	5.60		352.3	181.1	63,813		1.465	151,347	3.474
	5.70		353.1	181.9	64,241		1.475	157,750	3.621
	5.80		353.9	182.7	64,669		1.485	164,196	3.769
	5.90		354.7	183.5	65,099		1.494	170,684	3.918
	6.00		355.5	184.3	65,531		1.504	177,216	4.068
	6.10		356.3	185.1	65,963		1.514	183,790	4.219
	6.20		357.1	185.9	66,397		1.524	190,408	4.371
	6.30		357.9	186.7	66,832		1.534	197,070	4.524
	6.40		358.7	187.5	67,268		1.544	203,775	4.678
	6.50		359.5	188.3	67,706		1.554	210,523	4.833
	6.60		360.3	189.1	68,145		1.564	217,316	4.989
	6.70		361.1	189.9	68,585		1.574	224,152	5.146
	6.80		361.9	190.7	69,027		1.585	231,033	5.304
	6.90		362.7	191.5	69,469		1.595	237,958	5.463
	7.00		363.5	192.3	69,913		1.605	244,927	5.623
	7.10		364.3	193.1	70,359		1.615	251,940	5.784
	7.20		365.1	193.9	70,805		1.625	258,999	5.946
	7.30		365.9	194.7	71,253		1.636	266,102	6.109
	7.40		366.7	195.5	71,702		1.646	273,249	6.273
	7.50		367.5	196.3	72,153		1.656	280,442	6.438
	7.60		368.3	197.1	72,604		1.667	287,680	6.604
	7.70		369.1	197.9	73,057		1.677	294,963	6.771
	7.80		369.9	198.7	73,512		1.688	302,291	6.940
	7.90		370.7	199.5	73,967		1.698	309,665	7.109
	8.00		371.5	200.3	74,424		1.709	317,085	7.279
	8.10		372.3	201.1	74,882		1.719	324,550	7.451
	8.20		373.1	201.9	75,342		1.730	332,061	7.623
	8.30		373.9	202.7	75,802		1.740	339,619	7.797
	8.40		374.7	203.5	76,264		1.751	347,222	7.971
	8.50		375.5	204.3	76,727		1.761	354,871	8.147
	8.60		376.3	205.1	77,192		1.772	362,567	8.323
	8.70		377.1	205.9	77,658		1.783	370,310	8.501
	8.80		377.9	206.7	78,125		1.793	378,099	8.680
	8.90		378.7	207.5	78,593		1.804	385,935	8.860
	9.00		379.5	208.3	79,063		1.815	393,818	9.041
	9.10		380.3	209.1	79,534		1.826	401,748	9.223
	9.20		381.1	209.9	80,006		1.837	409,724	9.406
	9.30		381.9	210.7	80,479		1.848	417,749	9.590
	9.40		382.7	211.5	80,954		1.858	425,820	9.775
	9.50		383.5	212.3	81,430		1.869	433,940	9.962
	9.60		384.3	213.1	81,907		1.880	442,106	10.149
	9.70		385.1	213.9	82,386		1.891	450,321	10.338
	9.80		385.9	214.7	82,866		1.902	458,584	10.528
	9.90		386.7	215.5	83,347		1.913	466,894	10.718

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

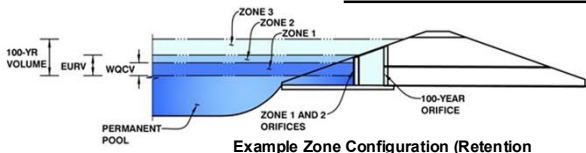


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond B



Example Zone Configuration (Retention)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
1 (WQCV)	3.13	0.479	Orifice Plate
2 (EURV)	4.18	1.011	Orifice Plate
(100-year)	5.00	1.117	Weir&Pipe (Restrict)
Total (all zones)		2.607	

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

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

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.11	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.37	2.74	3.20				
Orifice Area (sq. inches)	1.50	1.50	1.50	9.00				

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H _o =	4.11	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%
Debris Clogging % =	70%	N/A	%

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H _u =	4.11	N/A	feet
Overflow Weir Slope Length =	5.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	5.76	N/A	
Overflow Grate Open Area w/o Debris =	17.50	N/A	ft ²
Overflow Grate Open Area w/ Debris =	5.25	N/A	ft ²

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	33.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	16.80		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	3.04	N/A	ft ²
Outlet Orifice Centroid =	0.80	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.59	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	5.16	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	23.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =	0.91	feet
Stage at Top of Freeboard =	7.07	feet
Basin Area at Top of Freeboard =	1.61	acres
Basin Volume at Top of Freeboard =	5.74	acre-ft

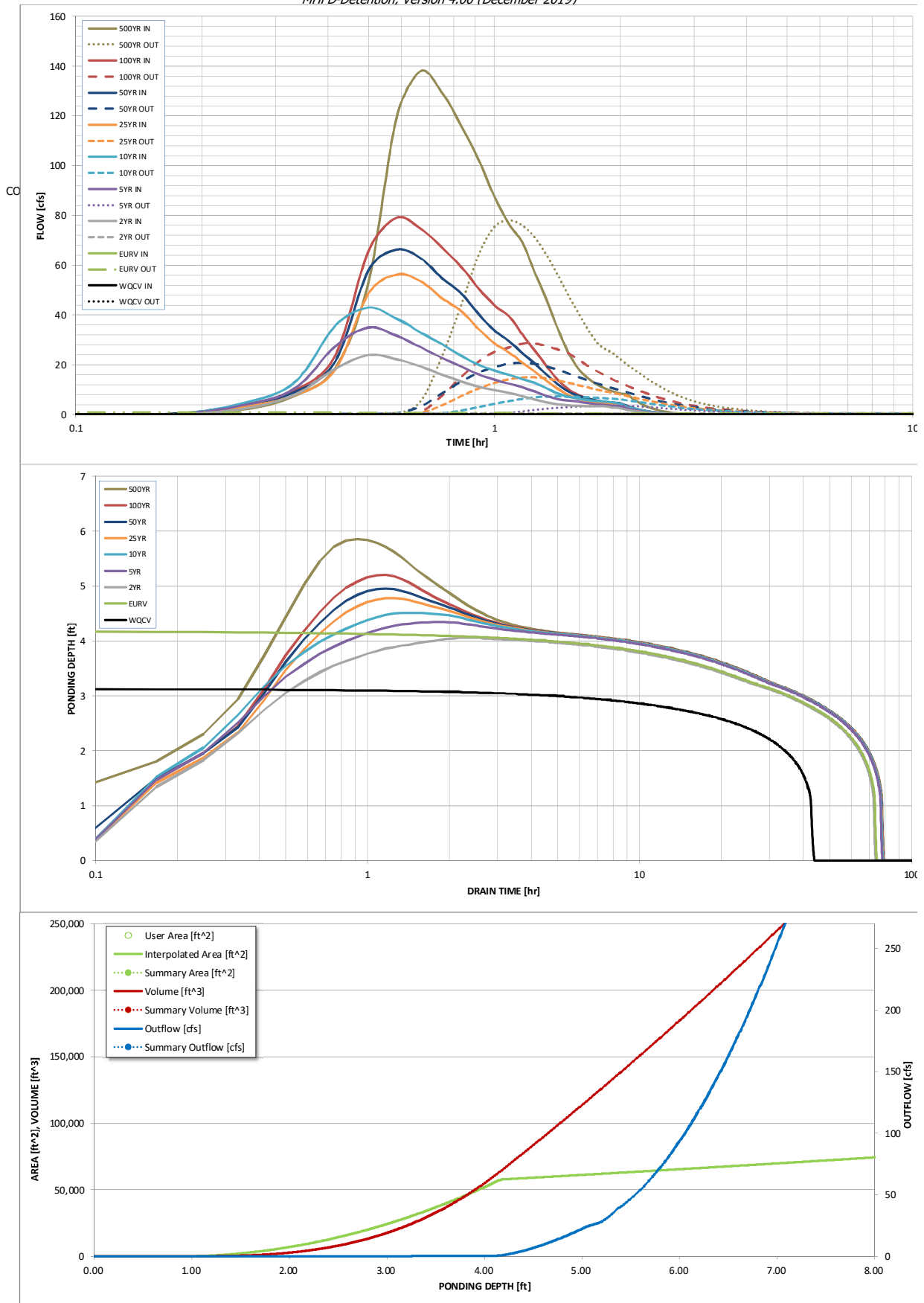
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
One-Hour Rainfall Depth (in) =	0.479	1.490	1.408	2.013	2.544	3.257	3.835	4.568	8.154
CUHP Runoff Volume (acre-ft) =	N/A	N/A	1.408	2.013	2.544	3.257	3.835	4.568	8.154
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.2	9.1	13.8	24.2	30.4	38.6	75.6
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A							
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.12	0.33	0.49	0.87	1.09	1.39	2.71
Peak Inflow Q (cfs) =	N/A	N/A	23.9	34.9	42.9	56.2	66.3	79.0	138.0
Peak Outflow Q (cfs) =	0.2	1.0	0.5	3.5	7.3	14.9	20.7	28.5	78.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.5	0.6	0.7	0.7	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	overflow Weir	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.03	N/A	0.2	0.4	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) =	41	67	67	69	68	66	64	62	53
Time to Drain 99% of Inflow Volume (hours) =	42	71	71	74	74	73	72	72	68
Maximum Ponding Depth (ft) =	3.13	4.18	4.05	4.35	4.51	4.78	4.95	5.20	5.86
Area at Maximum Ponding Depth (acres) =	0.63	1.33	1.23	1.34	1.36	1.39	1.40	1.43	1.49
Maximum Volume Stored (acre-ft) =	0.483	1.492	1.325	1.705	1.935	2.306	2.543	2.896	3.844

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	0.26	0.03	1.94
	0:15:00	0.00	0.00	2.25	3.68	4.56	3.07	3.82	3.74	7.60
	0:20:00	0.00	0.00	7.96	10.47	12.93	7.76	9.03	9.69	18.74
	0:25:00	0.00	0.00	18.42	27.42	35.63	18.08	21.37	23.78	53.17
	0:30:00	0.00	0.00	23.89	34.92	42.92	48.56	57.93	65.61	119.03
	0:35:00	0.00	0.00	22.18	31.67	38.54	56.20	66.25	79.03	138.00
	0:40:00	0.00	0.00	19.33	26.99	32.94	53.56	62.78	74.65	129.30
	0:45:00	0.00	0.00	16.02	22.73	28.27	46.71	54.73	67.10	116.09
	0:50:00	0.00	0.00	13.30	19.31	23.64	41.49	48.62	59.31	102.41
	0:55:00	0.00	0.00	11.20	16.14	20.01	34.39	40.36	50.66	87.69
	1:00:00	0.00	0.00	9.79	14.01	17.72	28.70	33.80	43.90	76.55
	1:05:00	0.00	0.00	8.75	12.42	15.96	24.95	29.48	39.53	69.13
	1:10:00	0.00	0.00	7.35	10.97	14.29	20.83	24.68	32.16	56.89
	1:15:00	0.00	0.00	6.06	9.22	12.69	17.21	20.45	25.65	46.03
	1:20:00	0.00	0.00	4.95	7.48	10.52	13.53	16.04	19.30	34.53
	1:25:00	0.00	0.00	4.15	6.23	8.46	10.42	12.31	14.00	25.12
	1:30:00	0.00	0.00	3.71	5.58	7.21	7.93	9.35	10.26	18.74
	1:35:00	0.00	0.00	3.50	5.23	6.44	6.43	7.55	8.05	14.86
	1:40:00	0.00	0.00	3.40	4.64	5.89	5.49	6.42	6.66	12.34
	1:45:00	0.00	0.00	3.33	4.18	5.51	4.88	5.67	5.69	10.58
	1:50:00	0.00	0.00	3.27	3.85	5.24	4.47	5.16	5.03	9.37
	1:55:00	0.00	0.00	2.86	3.60	4.89	4.20	4.82	4.56	8.50
	2:00:00	0.00	0.00	2.51	3.32	4.37	4.01	4.59	4.26	7.93
	2:05:00	0.00	0.00	1.89	2.48	3.24	3.00	3.42	3.16	5.86
	2:10:00	0.00	0.00	1.38	1.80	2.33	2.16	2.46	2.28	4.19
	2:15:00	0.00	0.00	1.00	1.30	1.67	1.56	1.77	1.65	3.04
	2:20:00	0.00	0.00	0.72	0.93	1.20	1.12	1.27	1.20	2.19
	2:25:00	0.00	0.00	0.51	0.64	0.84	0.79	0.89	0.84	1.54
	2:30:00	0.00	0.00	0.35	0.43	0.58	0.55	0.62	0.59	1.07
	2:35:00	0.00	0.00	0.23	0.30	0.39	0.38	0.43	0.40	0.73
	2:40:00	0.00	0.00	0.14	0.19	0.24	0.24	0.27	0.26	0.46
	2:45:00	0.00	0.00	0.07	0.10	0.13	0.14	0.15	0.14	0.25
	2:50:00	0.00	0.00	0.03	0.05	0.05	0.06	0.07	0.06	0.11
	2:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

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

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

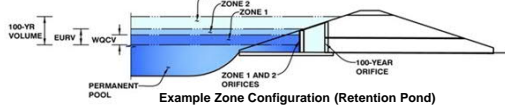
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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Pond C with offsite flow

Basin ID: _____



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB
Watershed Area =	224.34 acres
Watershed Length =	5,645 ft
Watershed Length to Centroid =	3,387 ft
Watershed Slope =	0.034 ft/ft
Watershed Imperviousness =	10.30% 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 WOCV 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.

Water Quality Capture Volume (WOCV) =	1.285 acre-feet
Excess Urban Runoff Volume (EURV) =	2.177 acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	3.053 acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	6.690 acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	10.314 acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	16.752 acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	21.154 acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	27.479 acre-feet
500-yr Runoff Volume (P1 = 4 in.) =	55.481 acre-feet
Approximate 2-yr Detention Volume =	1.394 acre-feet
Approximate 5-yr Detention Volume =	2.181 acre-feet
Approximate 10-yr Detention Volume =	4.470 acre-feet
Approximate 25-yr Detention Volume =	6.213 acre-feet
Approximate 50-yr Detention Volume =	6.504 acre-feet
Approximate 100-yr Detention Volume =	8.393 acre-feet

Optional User Overrides

	acre-feet
	acre-feet
1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
4.00	inches

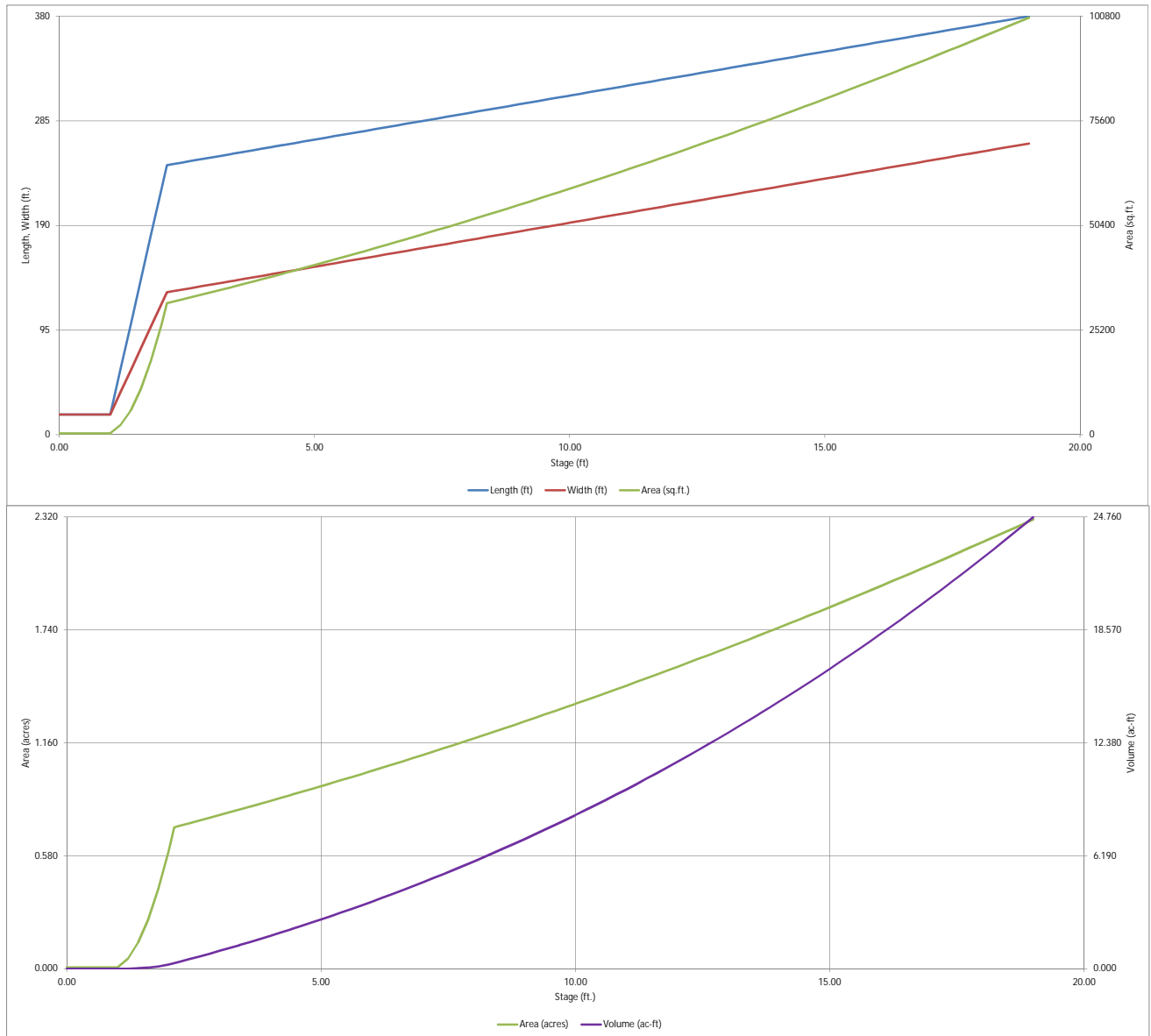
Define Zones and Basin Geometry

Zone 1 Volume (WOCV) =	1.285 acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.892 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	6.216 acre-feet
Total Detention Basin Volume =	8.393 acre-feet
Initial Surge Volume (ISV) =	168 ft ³
Initial Surge Depth (ISD) =	0.50 ft
Total Available Detention Depth (H _{total}) =	9.99 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 Surge Area (A _{ISV}) =	336 ft ²
Surge Volume Length (L _{ISV}) =	18.3 ft
Surge Volume Width (W _{ISV}) =	18.3 ft
Depth of Basin Floor (H _{FLOOR}) =	1.11 ft
Length of Basin Floor (L _{FLOOR}) =	244.8 ft
Width of Basin Floor (W _{FLOOR}) =	129.3 ft
Area of Basin Floor (A _{FLOOR}) =	31,653 ft ²
Volume of Basin Floor (V _{FLOOR}) =	13,042 ft ³
Depth of Main Basin (H _{MAIN}) =	7.88 ft
Length of Main Basin (L _{MAIN}) =	307.8 ft
Width of Main Basin (W _{MAIN}) =	192.4 ft
Area of Main Basin (A _{MAIN}) =	59,210 ft ²
Volume of Main Basin (V _{MAIN}) =	352,381 ft ³
Calculated Total Basin Volume (V _{total}) =	8.397 acre-feet

Depth Increment =	0.20	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		18.3	18.3	336		0.008		
ISV	0.50		18.3	18.3	336		0.008	168	0.004
	0.60		18.3	18.3	336		0.008	201	0.005
	0.80		18.3	18.3	336		0.008	269	0.006
	1.00		18.3	18.3	336		0.008	336	0.008
	1.20		59.1	38.3	2,266		0.052	569	0.013
	1.40		99.9	58.3	5,828		0.134	1,351	0.031
	1.60		140.7	78.3	11,022		0.253	3,009	0.069
	1.80		181.5	98.3	17,848		0.410	5,868	0.135
	2.00		222.3	118.3	26,306		0.604	10,257	0.235
Floor	2.11		244.8	129.3	31,653		0.727	13,440	0.309
	2.20		245.5	130.0	31,923		0.733	16,301	0.374
	2.40		247.1	131.6	32,527		0.747	22,746	0.522
	2.60		248.7	133.2	33,135		0.761	29,312	0.673
	2.80		250.3	134.8	33,749		0.775	36,000	0.826
	3.00		251.9	136.4	34,368		0.789	42,812	0.983
Zone 1 (WOCV)	3.20		253.5	138.0	34,991		0.803	49,747	1.142
	3.38		254.9	139.5	35,557		0.816	56,097	1.288
	3.40		255.1	139.6	35,620		0.818	56,808	1.304
	3.60		256.7	141.2	36,255		0.832	63,996	1.469
	3.80		258.3	142.8	36,894		0.847	71,311	1.637
	4.00		259.9	144.4	37,538		0.862	78,754	1.808
	4.20		261.5	146.0	38,188		0.877	86,326	1.982
	4.40		263.1	147.6	38,842		0.892	94,029	2.159
Zone 2 (EURV)	4.43		263.3	147.9	38,941		0.894	95,196	2.185
	4.60		264.7	149.2	39,502		0.907	101,864	2.338
	4.80		266.3	150.8	40,167		0.922	109,830	2.521
	5.00		267.9	152.4	40,837		0.937	117,931	2.707
	5.20		269.5	154.0	41,512		0.953	126,165	2.896
	5.40		271.1	155.6	42,192		0.969	134,536	3.089
	5.60		272.7	157.2	42,877		0.984	143,043	3.284
	5.80		274.3	158.8	43,568		1.000	151,687	3.482
	6.00		275.9	160.4	44,263		1.016	160,470	3.684
	6.20		277.5	162.0	44,964		1.032	169,393	3.889
	6.40		279.1	163.6	45,670		1.048	178,456	4.097
	6.60		280.7	165.2	46,381		1.065	187,661	4.308
	6.80		282.3	166.8	47,097		1.081	197,009	4.523
	7.00		283.9	168.4	47,818		1.098	206,500	4.741
	7.20		285.5	170.0	48,544		1.114	216,136	4.962
	7.40		287.1	171.6	49,276		1.131	225,918	5.186
	7.60		288.7	173.2	50,012		1.148	235,847	5.414
	7.80		290.3	174.8	50,754		1.165	245,923	5.646
	8.00		291.9	176.4	51,501		1.182	256,149	5.880
	8.20		293.5	178.0	52,252		1.200	266,524	6.119
	8.40		295.1	179.6	53,009		1.217	277,050	6.360
	8.60		296.7	181.2	53,772		1.234	287,728	6.605
	8.80		298.3	182.8	54,539		1.252	298,559	6.854
	9.00		299.9	184.4	55,311		1.270	309,544	7.106
	9.20		301.5	186.0	56,089		1.288	320,684	7.362
	9.40		303.1	187.6	56,871		1.306	331,980	7.621
	9.60		304.7	189.2	57,659		1.324	343,433	7.884
	9.80		306.3	190.8	58,452		1.342	355,044	8.151
Zone 3 (100-year)	9.98		307.7	192.3	59,170		1.358	365,630	8.394
	10.00		307.9	192.4	59,250		1.360	366,814	8.421
	10.20		309.5	194.0	60,053		1.379	378,744	8.695
	10.40		311.1	195.6	60,861		1.397	390,835	8.972
	10.60		312.7	197.2	61,674		1.416	403,089	9.254
	10.80		314.3	198.8	62,493		1.435	415,505	9.539
	11.00		315.9	200.4	63,316		1.454	428,086	9.828
	11.20		317.5	202.0	64,145		1.473	440,832	10.120
	11.40		319.1	203.6	64,979		1.492	453,745	10.417
	11.60		320.7	205.2	65,818		1.511	466,824	10.717
	11.80		322.3	206.8	66,662		1.530	480,072	11.021
	12.00		323.9	208.4	67,511		1.550	493,489	11.329
	12.20		325.5	210.0	68,365		1.569	507,077	11.641
	12.40		327.1	211.6	69,225		1.589	520,836	11.957
	12.60		328.7	213.2	70,089		1.609	534,767	12.277
	12.80		330.3	214.8	70,959		1.629	548,872	12.600
	13.00		331.9	216.4	71,834		1.649	563,151	12.928
	13.20		333.5	218.0	72,714		1.669	577,606	13.260
	13.40		335.1	219.6	73,599		1.690	592,237	13.596
	13.60		336.7	221.2	74,489		1.710	607,045	13.936
	13.80		338.3	222.8	75,384		1.731	622,032	14.280
	14.00		339.9	224.4	76,284		1.751	637,199	14.628
	14.20		341.5	226.0	77,190		1.772	652,547	14.980
	14.40		343.1	227.6	78,100		1.793	668,075	15.337
	14.60		344.7	229.2	79,016		1.814	683,787	15.698
	14.80		346.3	230.8	79,937		1.835	699,682	16.062
	15.00		347.9	232.4	80,863		1.856	715,762	16.432
	15.20		349.5	234.0	81,794		1.878	732,028	16.805
	15.40		351.1	235.6	82,730		1.899	748,480	17.183
	15.60		352.7	237.2	83,671		1.921	765,120	17.565
	15.80		354.3	238.8	84,618		1.943	781,949	17.951
	16.00		355.9	240.4	85,569		1.964	798,968	18.342
	16.20		357.5	242.0	86,526		1.986	816,177	18.737
	16.40		359.1	243.6	87,488		2.008	833,578	19.136
	16.60		360.7	245.2	88,455		2.031	851,173	19.540
	16.80		362.3	246.8	89,427		2.053	868,961	19.949
	17.00		363.9	248.4	90,404		2.075	886,944	20.361
	17.20		365.5	250.0	91,386		2.098	905,123	20.779
	17.40		367.1	251.6	92,374		2.121	923,499	21.201
	17.60		368.7	253.2	93,366		2.143	942,072	21.627
	17.80		370.3	254.8	94,364		2.166	960,845	22.058
	18.00		371.9	256.4	95,367		2.189	979,818	22.494
	18.20		373.5	258.0	96,375		2.212	998,992	22.934
	18.40		375.1	259.6	97,388		2.236	1,018,368	23.379
	18.60		376.7	261.2	98,406		2.259	1,037,948	23.828
	18.80		378.3	262.8	99,429		2.283	1,057,731	24.282
	19.00		379.9	264.4	100,457		2.306	1,077,720	24.741

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

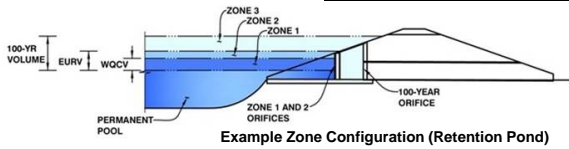


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-DETENTION, Version 4.04 (February 2021)

Project: **Pond C with offsite flow**

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.38	1.285	Orifice Plate
Zone 2 (EURV)	4.43	0.892	Orifice Plate
Zone 3 (100-year)	9.98	6.216	Weir&Pipe (Restrict)
Total (all zones)		8.393	

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.43	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	17.72	inches
Orifice Plate: Orifice Area per Row =	4.62	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	3.208E-02	ft ²
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft ²

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.50	3.00					
Orifice Area (sq. inches)	4.62	4.62	4.62					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, H _o =	4.39	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	15.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	75%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H _g =	4.39	N/A	feet
Overflow Weir Slope Length =	6.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	7.25	N/A	
Overflow Grate Open Area w/o Debris =	71.19	N/A	ft ²
Overflow Grate Open Area w/ Debris =	17.80	N/A	ft ²

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.50	0.00	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	48.00		inches
Restrictor Plate Height Above Pipe Invert =	35.00		inches
Outlet Orifice Area =	9.82		ft ²
Outlet Orifice Centroid =	1.62		feet
Half-Central Angle of Restrictor Plate on Pipe =	2.05		radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage =	10.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	81.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet
Spillway Design Flow Depth =	0.97	feet
Stage at Top of Freeboard =	11.97	feet
Basin Area at Top of Freeboard =	1.55	acres
Basin Volume at Top of Freeboard =	11.28	acre-ft

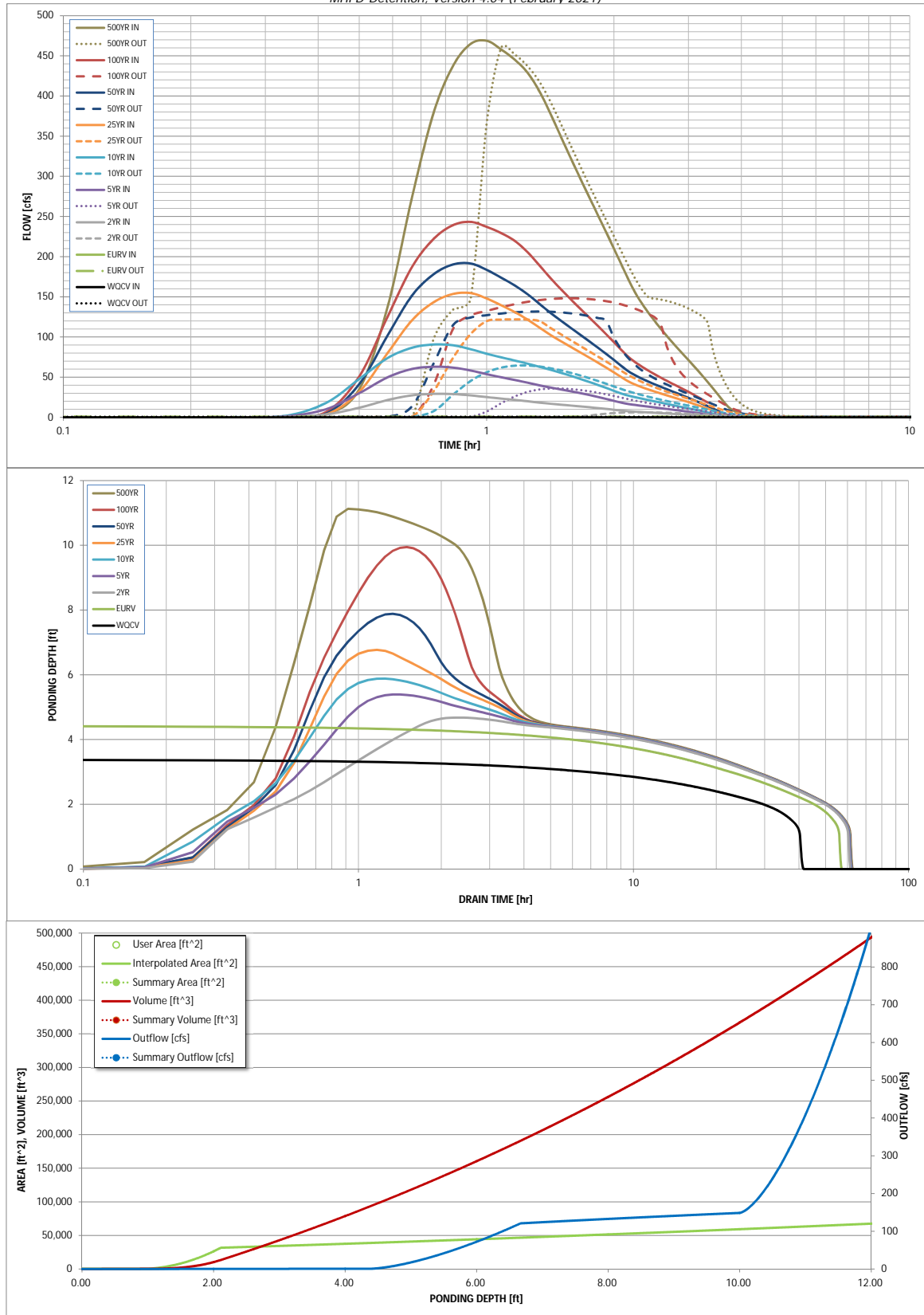
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =			1.19	1.50	1.75	2.00	2.25	2.52	4.00
One-Hour Rainfall Depth (in) =	N/A	N/A	3.053	6.690	10.314	16.752	21.154	27.479	55.481
CUHP Runoff Volume (acre-ft) =	1.285	2.177	3.053	6.690	10.314	16.752	21.154	27.479	55.481
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.053	6.690	10.314	16.752	21.154	27.479	55.481
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	17.6	49.5	77.1	142.3	179.0	229.8	455.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.08	0.22	0.34	0.63	0.80	1.02	2.03
Peak Inflow Q (cfs) =	N/A	N/A	29.2	62.9	90.7	154.6	191.5	243.2	468.8
Peak Outflow Q (cfs) =	0.6	0.9	6.2	35.9	64.5	121.9	131.7	148.2	460.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.7	0.8	0.9	0.7	0.6	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.00	0.08	0.5	0.9	1.7	1.8	2.1	2.2
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	53	56	51	48	41	37	32	14
Time to Drain 99% of Inflow Volume (hours) =	40	55	59	57	56	53	52	49	40
Maximum Ponding Depth (ft) =	3.38	4.43	4.68	5.39	5.88	6.77	7.89	9.95	11.13
Area at Maximum Ponding Depth (acres) =	0.82	0.89	0.91	0.97	1.01	1.08	1.17	1.35	1.46
Maximum Volume Stored (acre-ft) =	1.288	2.185	2.402	3.079	3.563	4.490	5.739	8.339	10.003

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)



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	0.01	0.00	0.08
	0:15:00	0.00	0.00	0.09	0.15	0.19	0.13	0.17	0.16	0.44
	0:20:00	0.00	0.00	0.46	1.05	1.75	0.51	0.62	0.65	3.37
	0:25:00	0.00	0.00	3.52	9.98	17.68	3.45	4.47	6.28	34.88
	0:30:00	0.00	0.00	11.92	30.04	47.68	31.82	41.26	50.74	137.01
	0:35:00	0.00	0.00	21.51	49.75	73.74	79.89	101.79	125.03	274.15
	0:40:00	0.00	0.00	27.37	60.19	86.63	120.85	151.63	187.24	379.49
	0:45:00	0.00	0.00	29.24	62.95	90.68	143.30	178.16	222.16	437.55
	0:50:00	0.00	0.00	28.90	61.88	89.65	153.54	190.25	239.24	464.73
	0:55:00	0.00	0.00	27.30	58.28	84.80	154.61	191.49	243.24	468.76
	1:00:00	0.00	0.00	25.17	53.74	79.17	147.99	183.59	237.12	457.76
	1:05:00	0.00	0.00	23.29	49.81	74.62	139.41	173.77	229.21	445.04
	1:10:00	0.00	0.00	21.66	46.44	70.63	130.89	164.01	219.46	428.91
	1:15:00	0.00	0.00	19.99	43.11	66.77	121.59	153.14	205.51	405.76
	1:20:00	0.00	0.00	18.32	39.84	62.89	111.70	141.25	189.08	377.53
	1:25:00	0.00	0.00	16.88	37.04	59.15	102.45	129.91	173.15	348.76
	1:30:00	0.00	0.00	15.70	34.68	55.36	94.62	120.15	159.22	321.92
	1:35:00	0.00	0.00	14.61	32.41	51.51	87.41	111.09	146.56	296.87
	1:40:00	0.00	0.00	13.57	30.11	47.69	80.68	102.59	135.01	273.59
	1:45:00	0.00	0.00	12.53	27.72	43.93	74.24	94.46	124.14	251.54
	1:50:00	0.00	0.00	11.50	25.30	40.26	68.02	86.61	113.65	230.41
	1:55:00	0.00	0.00	10.47	22.89	36.63	61.89	78.90	103.44	209.92
	2:00:00	0.00	0.00	9.42	20.49	32.97	55.86	71.34	93.51	190.03
	2:05:00	0.00	0.00	8.40	18.24	29.53	49.92	63.86	83.78	170.94
	2:10:00	0.00	0.00	7.56	16.53	26.95	44.49	57.05	74.95	154.24
	2:15:00	0.00	0.00	6.99	15.32	24.94	40.52	52.06	68.28	140.98
	2:20:00	0.00	0.00	6.50	14.25	23.11	37.29	47.92	62.75	129.60
	2:25:00	0.00	0.00	6.05	13.24	21.39	34.50	44.30	57.84	119.33
	2:30:00	0.00	0.00	5.61	12.26	19.77	31.95	40.97	53.38	109.93
	2:35:00	0.00	0.00	5.19	11.33	18.20	29.60	37.91	49.27	101.22
	2:40:00	0.00	0.00	4.78	10.42	16.69	27.34	34.98	45.41	93.06
	2:45:00	0.00	0.00	4.38	9.53	15.23	25.17	32.17	41.81	85.44
	2:50:00	0.00	0.00	3.99	8.66	13.83	23.06	29.47	38.40	78.24
	2:55:00	0.00	0.00	3.60	7.80	12.48	20.98	26.81	35.01	71.22
	3:00:00	0.00	0.00	3.22	6.96	11.17	18.93	24.19	31.65	64.33
	3:05:00	0.00	0.00	2.84	6.13	9.88	16.88	21.59	28.30	57.45
	3:10:00	0.00	0.00	2.46	5.30	8.60	14.84	19.00	24.94	50.60
	3:15:00	0.00	0.00	2.09	4.48	7.32	12.80	16.41	21.60	43.76
	3:20:00	0.00	0.00	1.72	3.67	6.05	10.77	13.83	18.26	36.95
	3:25:00	0.00	0.00	1.34	2.86	4.79	8.74	11.26	14.92	30.16
	3:30:00	0.00	0.00	0.98	2.05	3.55	6.72	8.69	11.60	23.41
	3:35:00	0.00	0.00	0.62	1.28	2.37	4.71	6.16	8.31	16.94
	3:40:00	0.00	0.00	0.36	0.78	1.68	2.85	3.84	5.33	11.65
	3:45:00	0.00	0.00	0.24	0.58	1.32	1.82	2.56	3.56	8.31
	3:50:00	0.00	0.00	0.19	0.45	1.05	1.19	1.76	2.42	6.00
	3:55:00	0.00	0.00	0.15	0.37	0.84	0.80	1.23	1.61	4.27
	4:00:00	0.00	0.00	0.12	0.29	0.67	0.52	0.84	1.04	2.97
	4:05:00	0.00	0.00	0.10	0.23	0.52	0.36	0.60	0.63	2.00
	4:10:00	0.00	0.00	0.08	0.18	0.39	0.24	0.41	0.35	1.29
	4:15:00	0.00	0.00	0.06	0.13	0.28	0.16	0.28	0.20	0.83
	4:20:00	0.00	0.00	0.05	0.10	0.20	0.12	0.20	0.15	0.60
	4:25:00	0.00	0.00	0.04	0.07	0.14	0.08	0.15	0.12	0.44
	4:30:00	0.00	0.00	0.03	0.05	0.11	0.06	0.12	0.09	0.35
	4:35:00	0.00	0.00	0.02	0.04	0.08	0.05	0.09	0.07	0.27
	4:40:00	0.00	0.00	0.02	0.02	0.06	0.03	0.06	0.05	0.20
	4:45:00	0.00	0.00	0.01	0.01	0.04	0.02	0.05	0.04	0.14
	4:50:00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.09
	4:55:00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.01	0.06
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	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 4.04 (February 2021)

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.

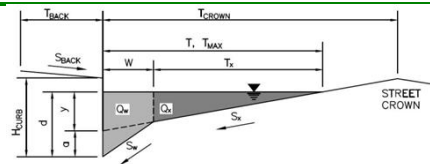
Stage - Storage	Stage	Area	Area	Volume	Volume	Total Outflow
-----------------	-------	------	------	--------	--------	------------------

[illegible]

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

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.013$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 2.00$ ft
 $S_x = 0.002$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.028$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.3	inches
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM Allowable Capacity is based on Depth Criterion**

	Minor Storm	Major Storm	
$Q_{allow} =$	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'

Provide 2nd page?

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

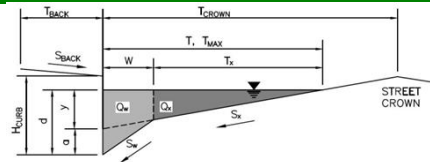
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet 1A

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} =$ 9.5 ft
 $S_{BACK} =$ 0.020 ft/ft
 $n_{BACK} =$ 0.013

$H_{CURB} =$ 6.00 inches
 $T_{CROWN} =$ 18.0 ft
 $W =$ 2.00 ft
 $S_x =$ 0.020 ft/ft
 $S_w =$ 0.083 ft/ft
 $S_o =$ 0.028 ft/ft
 $n_{STREET} =$ 0.016

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Spread Criterion

$Q_{allow} =$

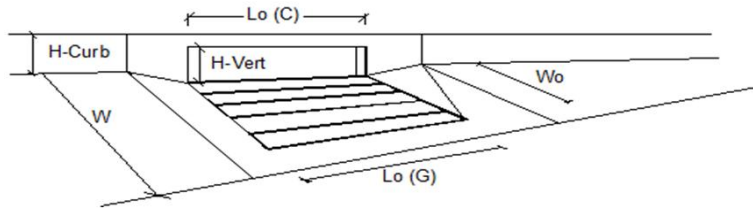
Minor Storm	Major Storm	
18.1	21.1	cfs

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)	CDOT Type R Curb Opening	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 _i /Q _o =		C% =	100 81 %

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

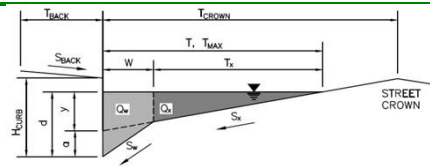
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet 3A

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.013$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 2.00$ ft
 $S_X = 0.020$ ft/ft
 $S_W = 0.083$ ft/ft
 $S_O = 0.028$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Spread Criterion

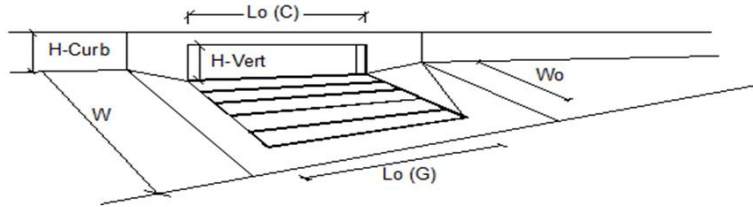
	Minor Storm	Major Storm	
$Q_{allow} =$	18.1	21.1	cfs

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 _i /Q _o =		C% =	98	70	%

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

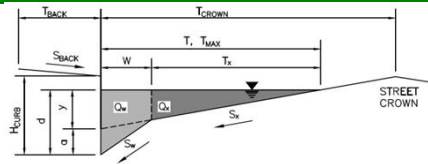
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Street at DP 5A



DP5A was already included on first sheet of this section. Please remove one of the two.

Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.013$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 2.00$ ft
 $S_x = 0.002$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.028$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.3	inches
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	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'

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

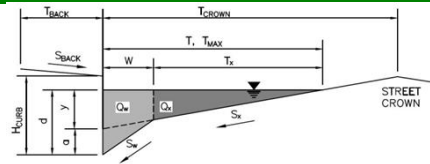
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet 7A

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.016$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.000$ ft/ft
 $n_{STREET} = 0.016$

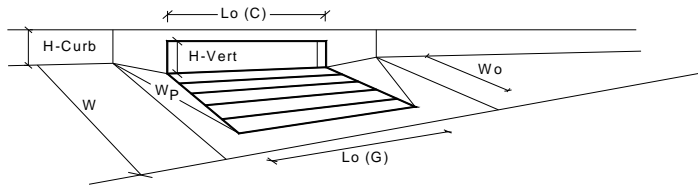
	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

$Q_{allow} =$

Minor Storm	Major Storm	
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 =	4	4	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	8.3	inches
Grate Information			MINOR	MAJOR	<input checked="" type="checkbox"/> 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 _l (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 _l (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	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
		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

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

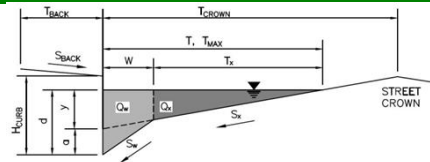
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet 2A

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.016$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.284$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

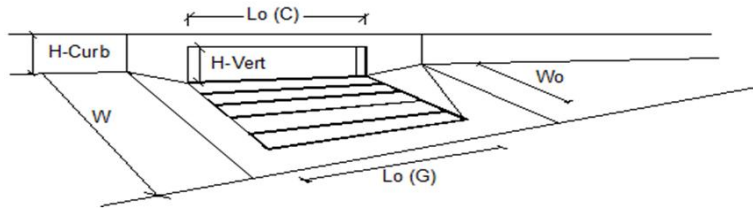
	Minor Storm	Major Storm	
$Q_{allow} =$	9.0	18.6	cfs

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 _i /Q _o =		C% =	100	87	%

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

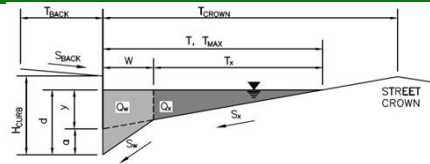
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet 4A

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.013$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 2.00$ ft
 $S_X = 0.020$ ft/ft
 $S_W = 0.083$ ft/ft
 $S_O = 0.028$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Spread Criterion

$Q_{allow} =$

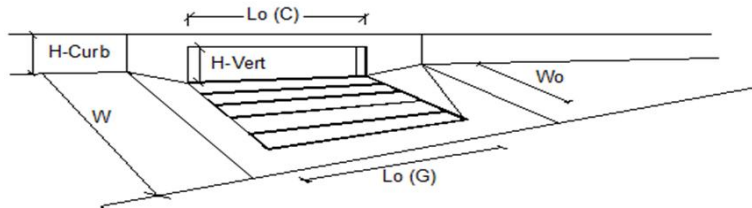
Minor Storm	Major Storm	
18.1	21.0	cfs

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

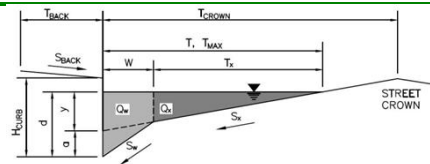


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening
Local Depression (additional to continuous gutter depression 'a')		a _{LOCAL} =	3.0 3.0 inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3 3
Length 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 _i /Q _o =		C% =	100 78 %

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

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.013$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 2.00$ ft
 $S_x = 0.002$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.028$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM Allowable Capacity is based on Depth Criterion**

	Minor Storm	Major Storm	
$Q_{allow} =$	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'

Provide 2nd page?

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

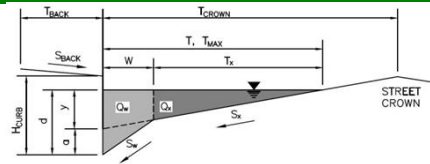
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet 8A

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

$T_{BACK} =$ 9.5 ft
 $S_{BACK} =$ 0.020 ft/ft
 $n_{BACK} =$ 0.016

$H_{CURB} =$ 6.00 inches
 $T_{CROWN} =$ 18.0 ft
 $W =$ 2.00 ft
 $S_x =$ 0.020 ft/ft
 $S_w =$ 0.083 ft/ft
 $S_o =$ 0.000 ft/ft
 $n_{STREET} =$ 0.016

	Minor Storm	Major Storm
$T_{MAX} =$	18.0	18.0
$d_{MAX} =$	6.0	12.0

☐ ☐

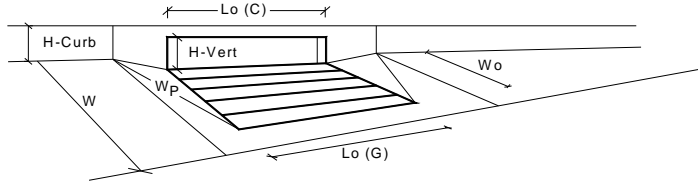
$Q_{allow} =$

Minor Storm	Major Storm
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	<input checked="" type="checkbox"/> 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 _l (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 _l (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	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
		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

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

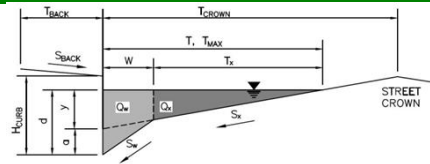
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 1.1B

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.17$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.026$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

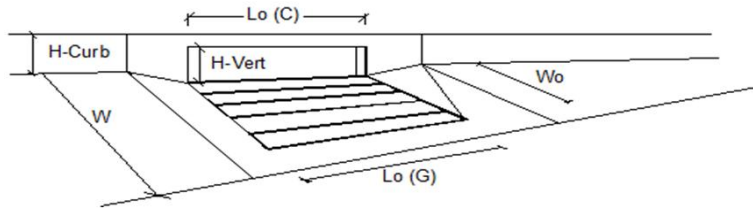
	Minor Storm	Major Storm	
$Q_{allow} =$	19.1	19.1	cfs

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 _i /Q _o =		C% =	100	87	%

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

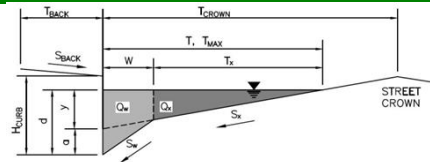
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 1.2B

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.17$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.026$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	9.5	18.0	ft
$d_{MAX} =$	6.0	8.3	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Spread Criterion

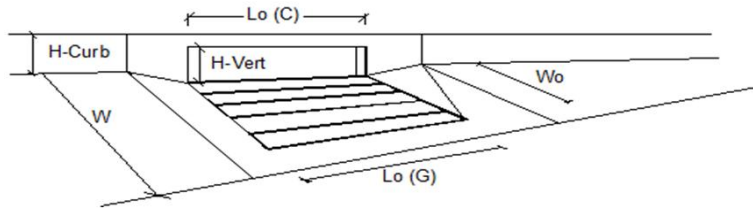
	Minor Storm	Major Storm	
$Q_{allow} =$	3.7	19.1	cfs

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	
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0
Total Number of Units in the Inlet (Grate or Curb Opening)	3	3
Length of a Single Unit Inlet (Grate or Curb Opening)	5.00	5.00
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10
Street Hydraulics: OK - Q < Allowable Street Capacity		
Total Inlet Interception Capacity	3.6	7.4
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.2
Capture Percentage = Q_i/Q_o =	100	97

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

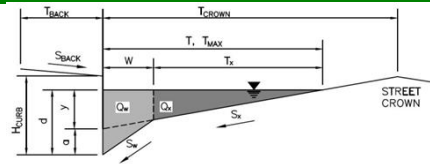
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 4b

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.17$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.016$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

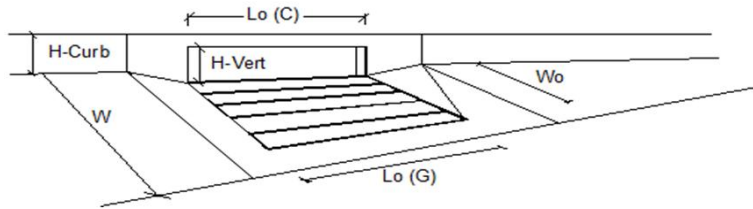
	Minor Storm	Major Storm	
$Q_{allow} =$	15.0	52.4	cfs

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

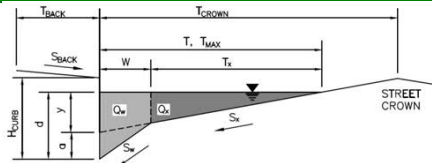


Design Information (Input)		MINOR	MAJOR
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening
Local Depression (additional to continuous gutter depression 'a')		a _{LOCAL} =	3.0 3.0 inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3 3
Length of a Single Unit Inlet (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 _i /Q _o =		C% =	99 74 %

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

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

Project: _____
 Inlet ID: _____ Homestead North
 Inlet DP 9b

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $T_{BACK} = 9.5$ ft $S_{BACK} = 0.020$ ft/ft $n_{BACK} = 0.020$ $H_{CURB} = 6.00$ inches $T_{CROWN} = 18.0$ ft $W = 2.00$ ft $S_X = 0.020$ ft/ft $S_W = 0.083$ ft/ft $S_O = 0.000$ ft/ft $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

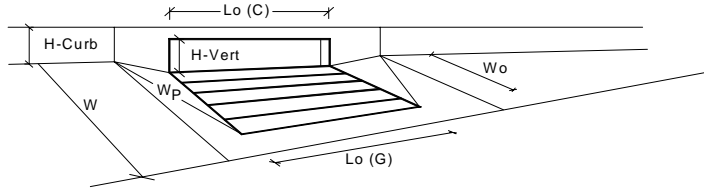
	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches

**MINOR STORM Allowable Capacity is based on Depth Criterion****MAJOR STORM Allowable Capacity is based on Depth Criterion**

	Minor Storm	Major Storm	
$Q_{allow} =$	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	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 =	6.0	12.0	inches
Grate Information		MINOR		MAJOR	
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)		$C_r (G) =$	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)		$C_r (C) =$	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	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination} =$	0.57	1.00	
Curb Opening Performance Reduction Factor for Long Inlets		$RF_{Curb} =$	0.79	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets		$RF_{Grate} =$	N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
		$Q_a =$	13.5	39.1	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK REQUIRED} =$	12.5	30.9	cfs

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

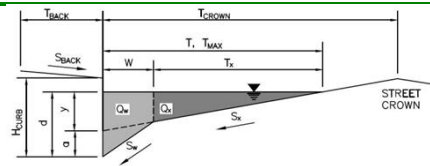
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 7b

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.17$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.016$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

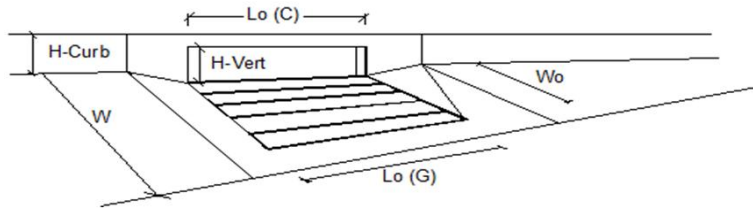
	Minor Storm	Major Storm	
$Q_{allow} =$	15.0	52.3	cfs

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 _i /Q _o =		C% =	98	78	%

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

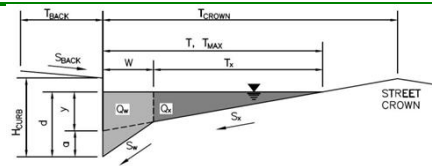
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 10b

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

$T_{BACK} =$ 9.5 ft
 $S_{BACK} =$ 0.020 ft/ft
 $n_{BACK} =$ 0.020

$H_{CURB} =$ 6.00 inches
 $T_{CROWN} =$ 18.0 ft
 $W =$ 2.00 ft
 $S_x =$ 0.020 ft/ft
 $S_w =$ 0.083 ft/ft
 $S_o =$ 0.000 ft/ft
 $n_{STREET} =$ 0.016

	Minor Storm	Major Storm
$T_{MAX} =$	18.0	18.0
$d_{MAX} =$	6.0	8.0

☐ ☐

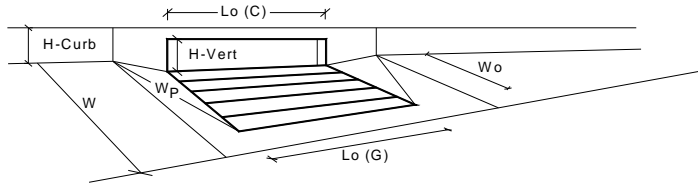
$Q_{allow} =$

Minor Storm	Major Storm
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	<input checked="" type="checkbox"/> 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 _l (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 _l (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	
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR	
		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

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

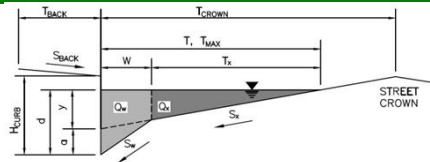
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 2.3C

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.17$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.027$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM Allowable Capacity is based on Depth Criterion**

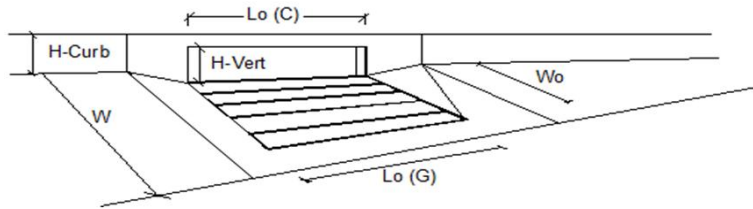
	Minor Storm	Major Storm	
$Q_{allow} =$	24.2	44.5	cfs

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 _i /Q _o =		C% =	98	76	%

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

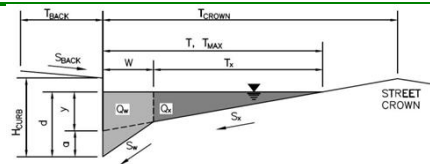
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 2.1C

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 7.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.17$ ft
 $S_X = 0.020$ ft/ft
 $S_W = 0.083$ ft/ft
 $S_O = 0.020$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion**MAJOR STORM** Allowable Capacity is based on Spread Criterion

$Q_{allow} =$

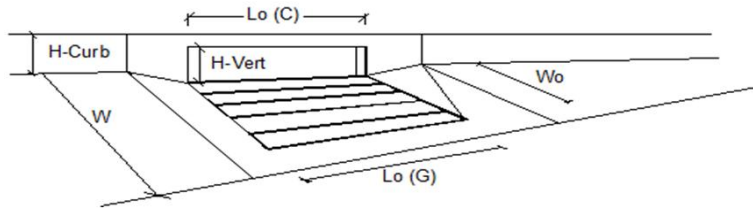
Minor Storm	Major Storm	
16.7	16.7	cfs

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

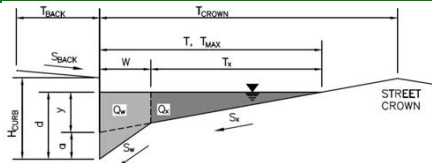


Design Information (Input)	MINOR	MAJOR
Type of Inlet	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1
Length of a Single Unit Inlet (Grate or Curb Opening)	5.00	5.00
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10
Street Hydraulics: OK - Q < Allowable Street Capacity		
Total Inlet Interception Capacity	0.8	1.5
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.1
Capture Percentage = Q_i/Q_o =	100	91

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
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK} = 7.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.17$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.020$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

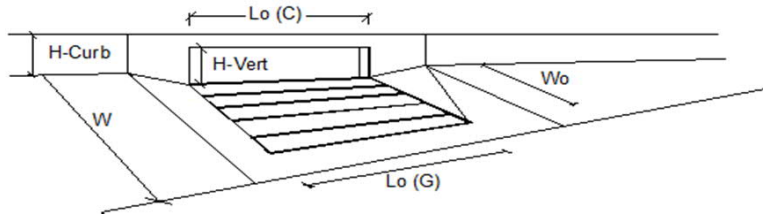
MINOR STORM Allowable Capacity is based on Spread Criterion
MAJOR STORM Allowable Capacity is based on Spread Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	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)		N_o =	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)		$C_r \cdot G$ =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_r \cdot C$ =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity		MINOR		MAJOR	
Total Inlet Interception Capacity		Q =	5.9	10.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_b =	0.0	2.6	cfs
Capture Percentage = Q_i/Q_o =		C% =	100	81	%

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

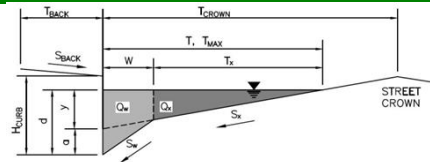
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 3.1C

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 1.17$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 2.000$ ft/ft
 $n_{STREET} = 0.016$

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM Allowable Capacity is based on Depth Criterion**

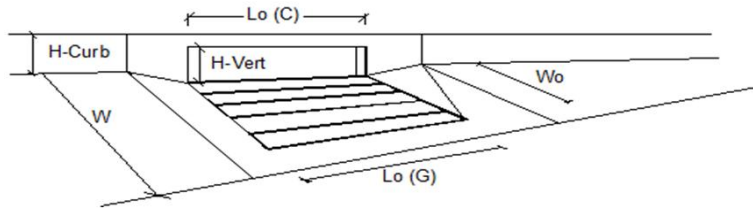
	Minor Storm	Major Storm	
$Q_{allow} =$	6.7	12.3	cfs

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

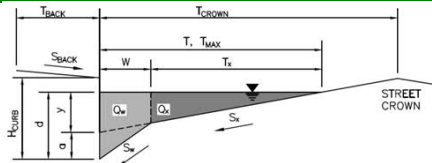


Design Information (Input)	MINOR	MAJOR
Type of Inlet	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1
Length of a Single Unit Inlet (Grate or Curb Opening)	5.00	5.00
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10
Street Hydraulics: OK - Q < Allowable Street Capacity		
Total Inlet Interception Capacity	1.3	2.0
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.6
Capture Percentage = Q_i/Q_o =	97	79

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

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

Project: _____
 Inlet ID: _____ Homestead North
 Inlet DP 4C

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK} = 9.5$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.020$

Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 18.0$ ft
 $W = 2.00$ ft
 $S_X = 0.020$ ft/ft
 $S_W = 0.083$ ft/ft
 $S_O = 0.000$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	18.0	18.0	ft
$d_{MAX} =$	6.0	8.3	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

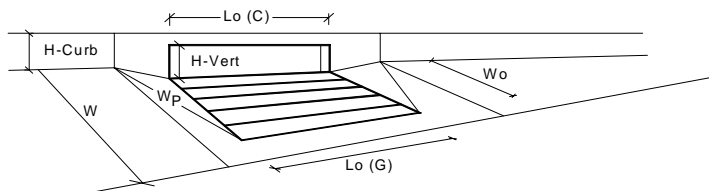
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

$Q_{allow} =$

Minor Storm	Major Storm	
SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)

Type of Inlet CDOT Type R Curb Opening

Local Depression (additional to continuous gutter depression 'a' from above)

Number of Unit Inlets (Grate or Curb Opening)

Water Depth at Flowline (outside of local depression)

Grate Information

Length of a Unit Grate

Width of a Unit Grate

Area Opening Ratio for a Grate (typical values 0.15-0.90)

Clogging Factor for a Single Grate (typical value 0.50 - 0.70)

Grate Weir Coefficient (typical value 2.15 - 3.60)

Grate Orifice Coefficient (typical value 0.60 - 0.80)

Curb Opening Information

Length of a Unit Curb Opening

Height of Vertical Curb Opening in Inches

Height of Curb Orifice Throat in Inches

Angle of Throat (see USDCM Figure ST-5)

Side Width for Depression Pan (typically the gutter width of 2 feet)

Clogging Factor for a Single Curb Opening (typical value 0.10)

Curb Opening Weir Coefficient (typical value 2.3-3.7)

Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)

Low Head Performance Reduction (Calculated)

Depth for Grate Midwidth

Depth for Curb Opening Weir Equation

Combination Inlet Performance Reduction Factor for Long Inlets

Curb Opening Performance Reduction Factor for Long Inlets

Grated Inlet Performance Reduction Factor for Long Inlets

Total Inlet Interception Capacity (assumes clogged condition)

WARNING: Inlet Capacity less than Q Peak for Minor Storm

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a_{local} =	3.00	3.00	inches
No =	4	4	
Ponding Depth =	6.0	12.0	inches
	MINOR	MAJOR	<input checked="" type="checkbox"/> Override Depths
L_o (G) =	N/A	N/A	feet
W_o =	N/A	N/A	feet
A_{ratio} =	N/A	N/A	
C_r (G) =	N/A	N/A	
C_w (G) =	N/A	N/A	
C_o (G) =	N/A	N/A	
	MINOR	MAJOR	
L_o (C) =	5.00	5.00	feet
H_{vert} =	6.00	6.00	inches
H_{throat} =	6.00	6.00	inches
Theta =	63.40	63.40	degrees
W_p =	2.00	2.00	feet
C_r (C) =	0.10	0.10	
C_w (C) =	3.60	3.60	
C_o (C) =	0.67	0.67	
	MINOR	MAJOR	
d_{Grate} =	N/A	N/A	ft
d_{Curb} =	0.33	0.83	ft
$RF_{Combination}$ =	0.57	1.00	
RF_{Curb} =	0.79	1.00	
RF_{Grate} =	N/A	N/A	
	MINOR	MAJOR	
Q_a =	18.2	52.7	cfs
$Q_{PEAK REQUIRED}$ =	18.9	42.0	cfs

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

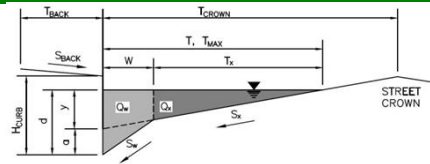
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 5C

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line

Distance from Curb Face to Street Crown

Gutter Width

Street Transverse Slope

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

Street Longitudinal Slope - Enter 0 for sump condition

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

Max. Allowable Spread for Minor & Major Storm

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is based on Depth Criterion**MAJOR STORM** Allowable Capacity is based on Depth Criterion

$T_{BACK} =$ 9.5 ft
 $S_{BACK} =$ 0.020 ft/ft
 $n_{BACK} =$ 0.020

$H_{CURB} =$ 6.00 inches
 $T_{CROWN} =$ 18.0 ft
 $W =$ 2.00 ft
 $S_x =$ 0.020 ft/ft
 $S_w =$ 0.083 ft/ft
 $S_o =$ 0.000 ft/ft
 $n_{STREET} =$ 0.016

	Minor Storm	Major Storm
$T_{MAX} =$	18.0	18.0
$d_{MAX} =$	6.0	8.3

☐ ☐

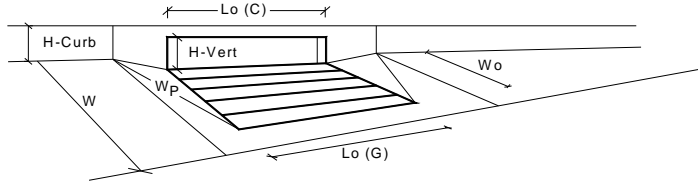
$Q_{allow} =$

Minor Storm	Major Storm
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		<input type="checkbox"/> 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 _l (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 _l (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		
Total Inlet Interception Capacity (assumes clogged condition)			MINOR	MAJOR		
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		Q _a =	9.7	9.7	cfs	
		Q _{PEAK REQUIRED} =	4.2	9.0	cfs	

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

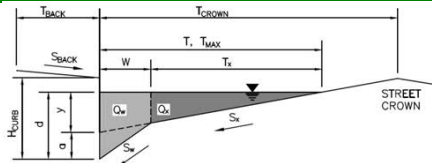
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 3D

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 25.0$ ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$ ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 26.5$ ft

Gutter Width

 $W = 2.00$ ft

Street Transverse Slope

 $S_x = 0.020$ ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

 $S_w = 0.083$ ft/ft

Street Longitudinal Slope - Enter 0 for sump condition

 $S_o = 0.023$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	15.0	25.0	ft
$d_{MAX} =$	6.0	8.0	inches

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes
MINOR STORM Allowable Capacity is based on Spread Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	12.0	41.9	cfs

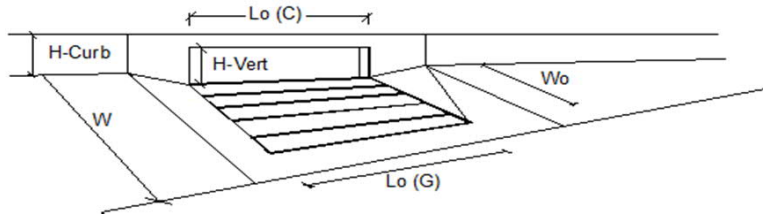
MAJOR STORM Allowable Capacity is based on Depth Criterion

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)		$N_o =$	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)		$C_r-G =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_r-C =$	0.10	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$		MINOR		MAJOR	
Total Inlet Interception Capacity		$Q =$	0.5	1.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b =$	0.0	0.0	cfs
Capture Percentage = $Q_i/Q_o =$		$C\% =$	100	100	%

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

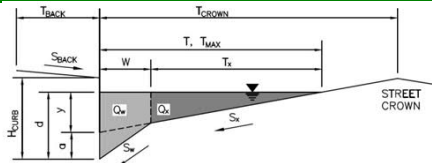
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 4D

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 15.0$ ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$ ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 36.0$ ft

Gutter Width

 $W = 2.00$ ft

Street Transverse Slope

 $S_x = 0.020$ ft/ft

Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)

 $S_w = 0.083$ ft/ft

Street Longitudinal Slope - Enter 0 for sump condition

 $S_o = 0.023$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	15.0	25.0	ft
$d_{MAX} =$	6.0	6.0	inches

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes
MINOR STORM Allowable Capacity is based on Spread Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	12.0	19.4	cfs

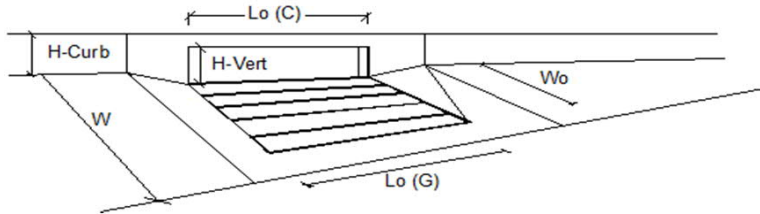
MAJOR STORM Allowable Capacity is based on Depth Criterion

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		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			
Total Inlet Interception Capacity	1.1	1.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.3	cfs
Capture Percentage = Q_i/Q_o =	100	86	%

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

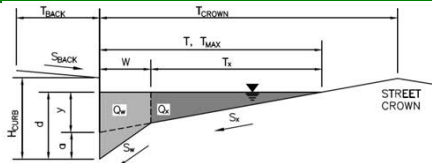
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 5D

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 15.0$ ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$ ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 33.0$ 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

 $S_O = 0.030$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	33.0	33.0	ft
$d_{MAX} =$	6.0	6.0	inches

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	17.8	17.8	cfs

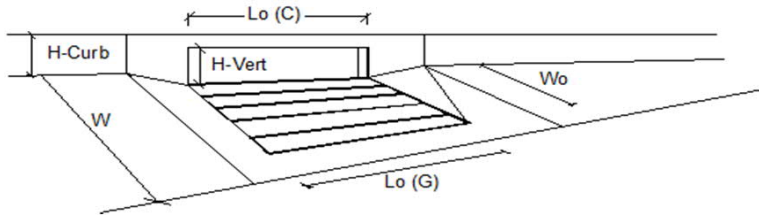
MAJOR STORM Allowable Capacity is based on Depth Criterion

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		
Local Depression (additional to continuous gutter depression 'a')	$a_{LOCAL} = 3.0$	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$No = 1$	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o = 10.00$	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	$W_o = N/A$	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	$C_r-G = N/A$	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C = 0.10$	0.10	
Street Hydraulics: OK - $Q < \text{Allowable Street Capacity}$			
Total Inlet Interception Capacity	$Q = 3.1$	5.4	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	0.7	cfs
Capture Percentage = $Q_i/Q_o =$	$C\% = 100$	88	%

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

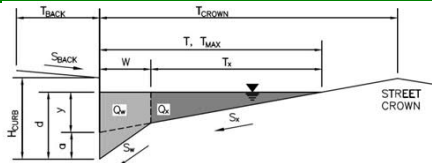
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 6D

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 20.0$ ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$ ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 33.0$ 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

 $S_o = 0.030$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	33.0	33.0	ft

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

	Minor Storm	Major Storm	
$d_{MAX} =$	6.0	6.0	inches

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	17.8	17.8	cfs

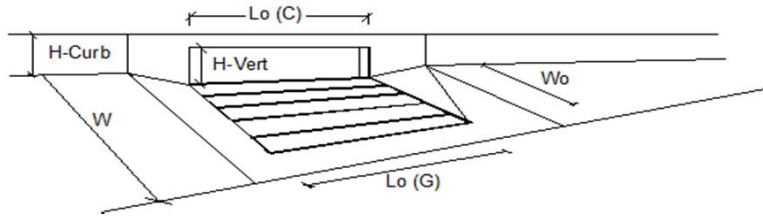
MAJOR STORM Allowable Capacity is based on Depth Criterion

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		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity*			
Total Inlet Interception Capacity	2.5	4.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.4	cfs
Capture Percentage = Q_i/Q_o =	100	93	%

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

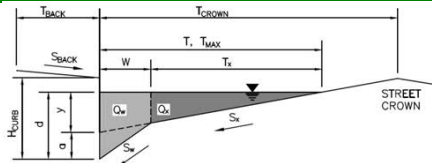
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 7D

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 15.0$ ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$ ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 33.0$ 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

 $S_o = 0.020$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	33.0	33.0	ft
$d_{MAX} =$	6.0	6.0	inches

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	19.5	19.5	cfs

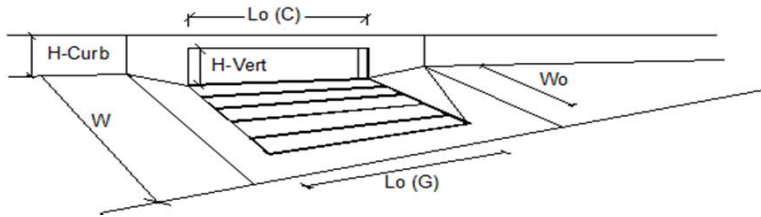
MAJOR STORM Allowable Capacity is based on Depth Criterion

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		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity*			
Total Inlet Interception Capacity	2.0	3.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.0	cfs
Capture Percentage = Q_i/Q_o =	100	100	%

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

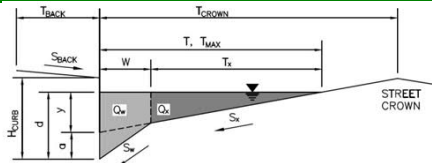
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Homestead North

Inlet ID:

Inlet DP 8D

**Gutter Geometry (Enter data in the blue cells)**

Maximum Allowable Width for Spread Behind Curb

 $T_{BACK} = 15.0$ ft

Side Slope Behind Curb (leave blank for no conveyance credit behind curb)

 $S_{BACK} = 0.020$ ft/ft

Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

 $n_{BACK} = 0.013$

Height of Curb at Gutter Flow Line

 $H_{CURB} = 6.00$ inches

Distance from Curb Face to Street Crown

 $T_{CROWN} = 33.0$ 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

 $S_O = 0.020$ ft/ft

Manning's Roughness for Street Section (typically between 0.012 and 0.020)

 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm

	Minor Storm	Major Storm	
$T_{MAX} =$	33.0	33.0	ft
$d_{MAX} =$	6.0	6.0	inches

Max. Allowable Depth at Gutter Flowline for Minor & Major Storm

Allow Flow Depth at Street Crown (leave blank for no)

☐ ☐ check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	19.5	19.5	cfs

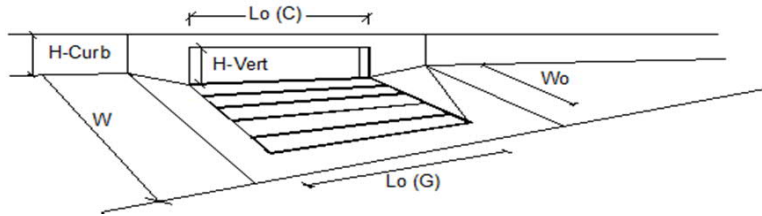
MAJOR STORM Allowable Capacity is based on Depth Criterion

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		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	20.00	20.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity*			
Total Inlet Interception Capacity	2.5	13.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.7	cfs
Capture Percentage = Q_i/Q_o =	100	95	%

Channel Report

Interim Channel Section - AA

Trapezoidal

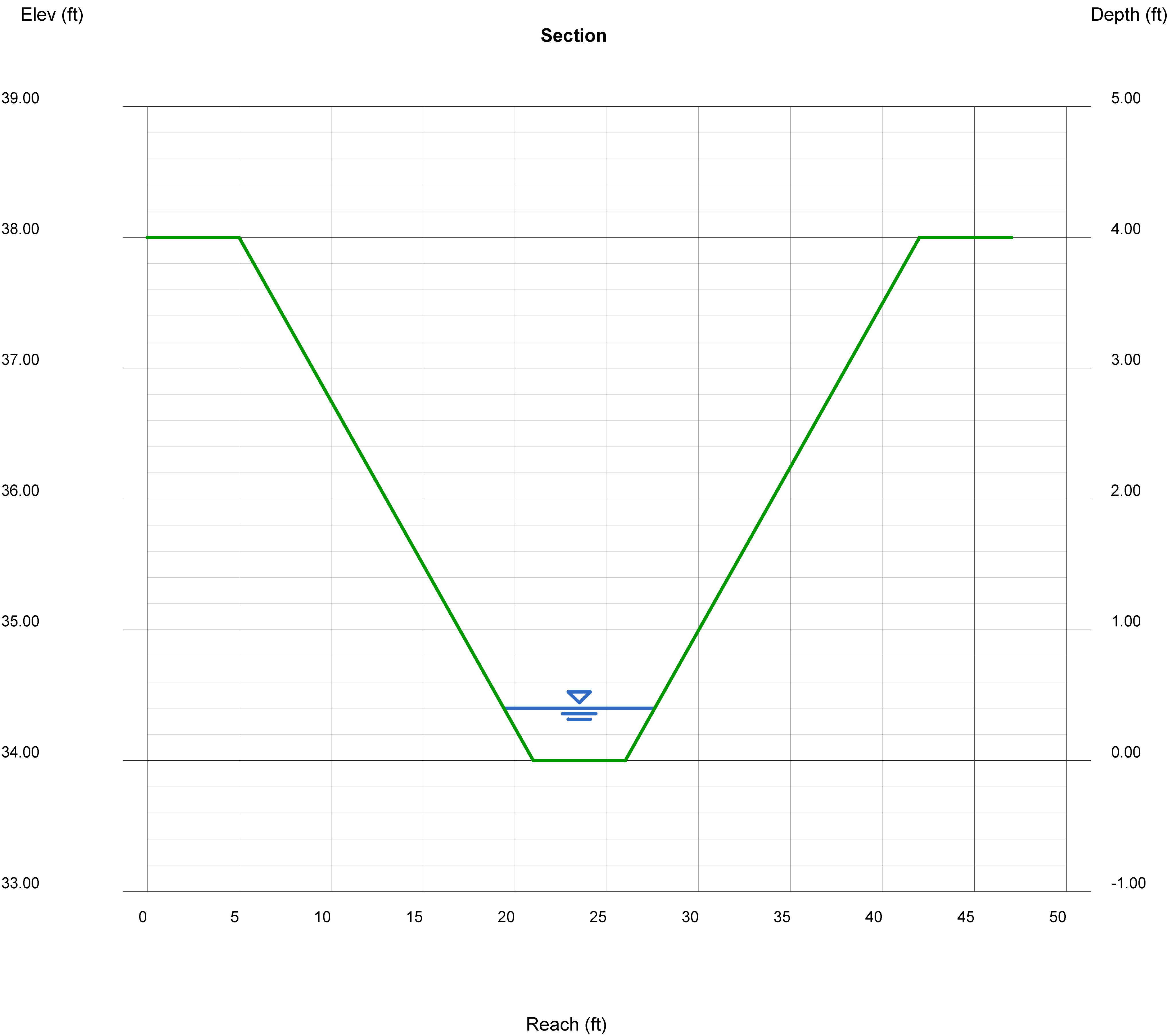
Bottom Width (ft)	= 5.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 7134.00
Slope (%)	= 2.62
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 7.10

Highlighted

Depth (ft)	= 0.40
Q (cfs)	= 7.100
Area (sqft)	= 2.64
Velocity (ft/s)	= 2.69
Wetted Perim (ft)	= 8.30
Crit Depth, Yc (ft)	= 0.36
Top Width (ft)	= 8.20
EGL (ft)	= 0.51



Channel Report

Interim Channel Section - BB

Trapezoidal

Bottom Width (ft) = 5.00
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 4.00
Invert Elev (ft) = 7098.00
Slope (%) = 2.00
N-Value = 0.040

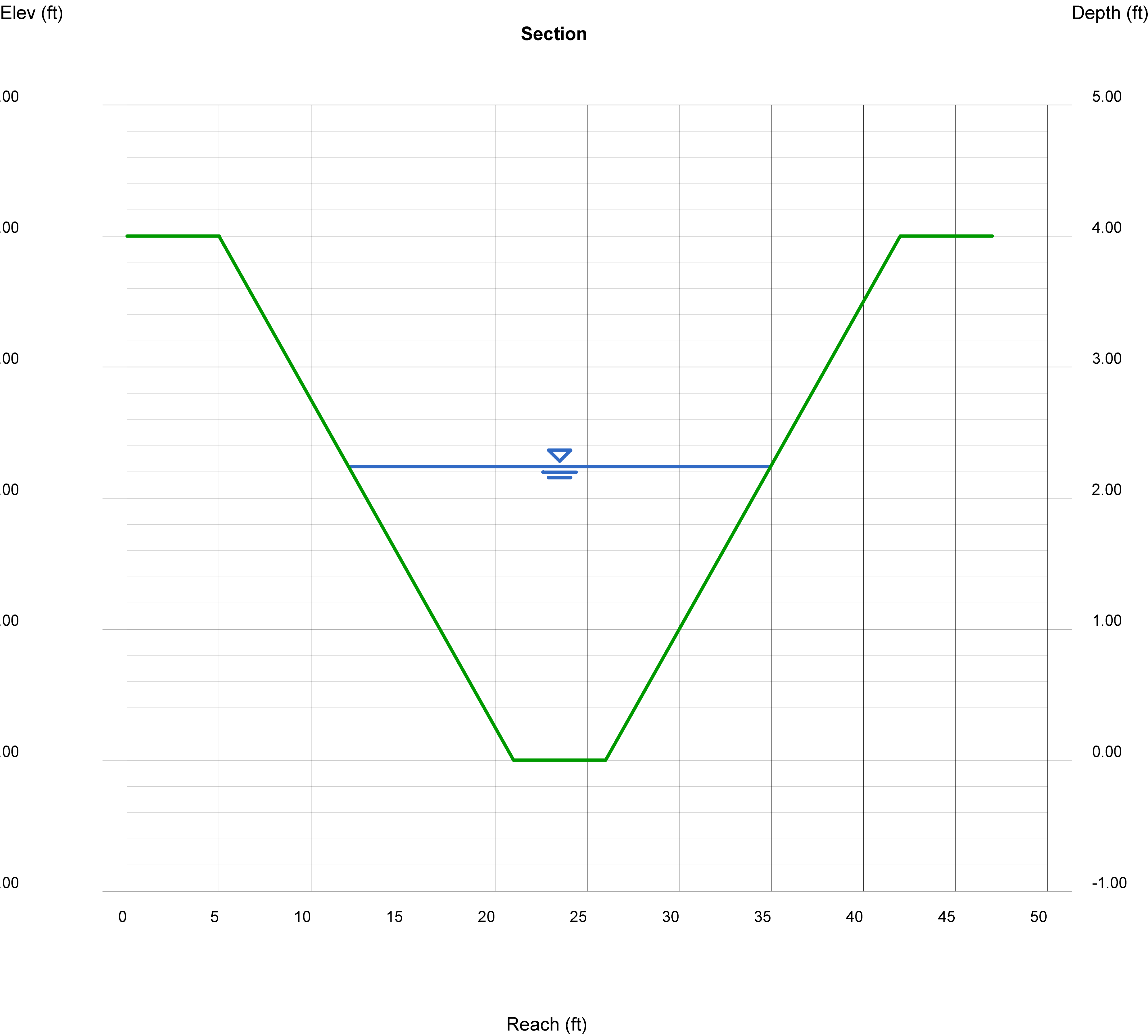
Calculations

Compute by: Known Q
Known Q (cfs) = 197.30

Highlighted

Depth (ft) = 2.24
Q (cfs) = 197.30
Area (sqft) = 31.27
Velocity (ft/s) = 6.31
Wetted Perim (ft) = 23.47
Crit Depth, Yc (ft) = 2.19
Top Width (ft) = 22.92
EGL (ft) = 2.86

State what lining is proposed



Channel Report

Interim Channel Section - CC

Trapezoidal

Bottom Width (ft) = 5.00
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 4.00
Invert Elev (ft) = 7010.00
Slope (%) = 2.18
N-Value = 0.040

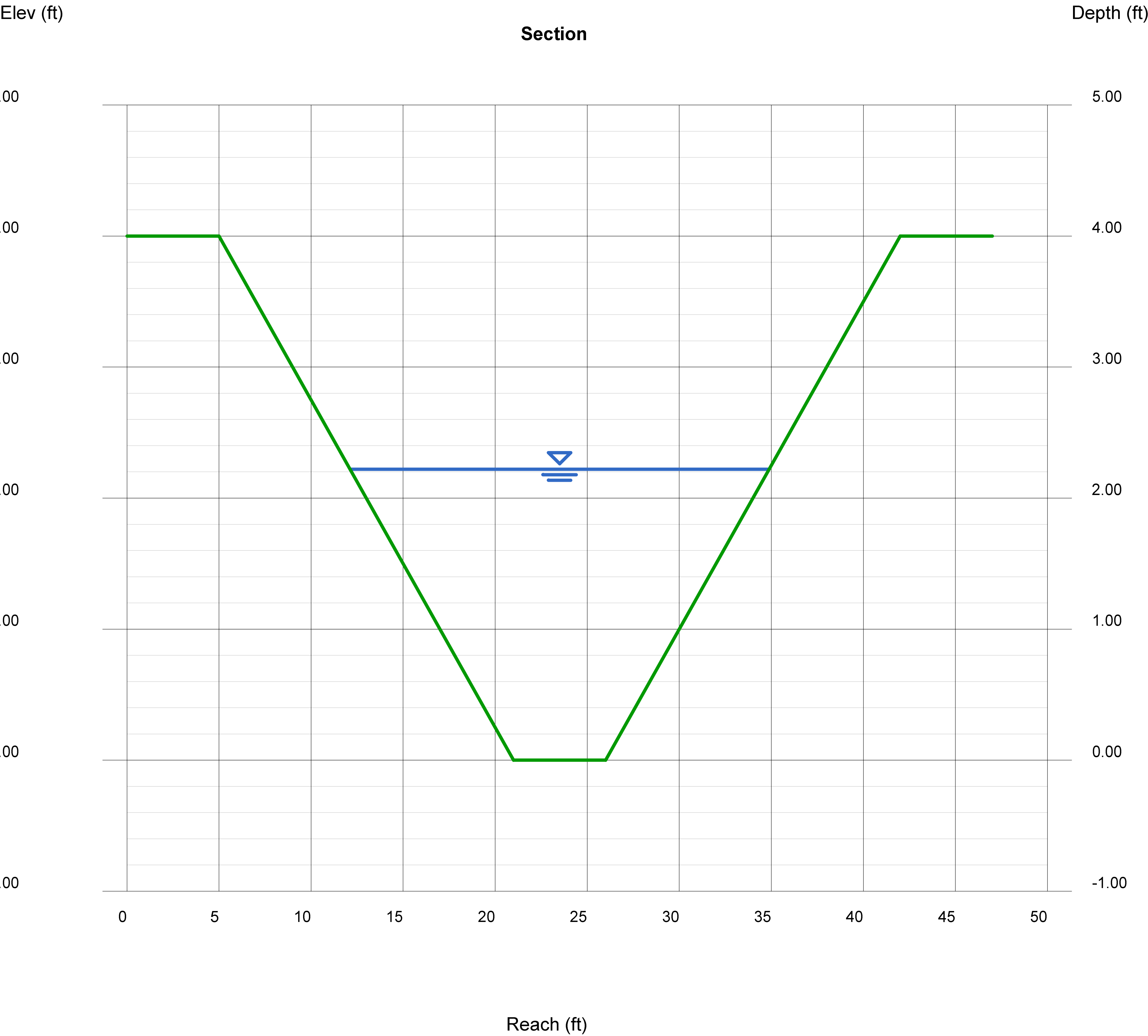
Calculations

Compute by: Known Q
Known Q (cfs) = 202.60

Highlighted

Depth (ft) = 2.22
Q (cfs) = 202.60
Area (sqft) = 30.81
Velocity (ft/s) = 6.58
Wetted Perim (ft) = 23.31
Crit Depth, Yc (ft) = 2.22
Top Width (ft) = 22.76
EGL (ft) = 2.89

State what lining is proposed



Channel Report

Interim Channel Section - DD

Trapezoidal

Bottom Width (ft) = 5.00
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 4.00
Invert Elev (ft) = 7057.00
Slope (%) = 3.65
N-Value = 0.040

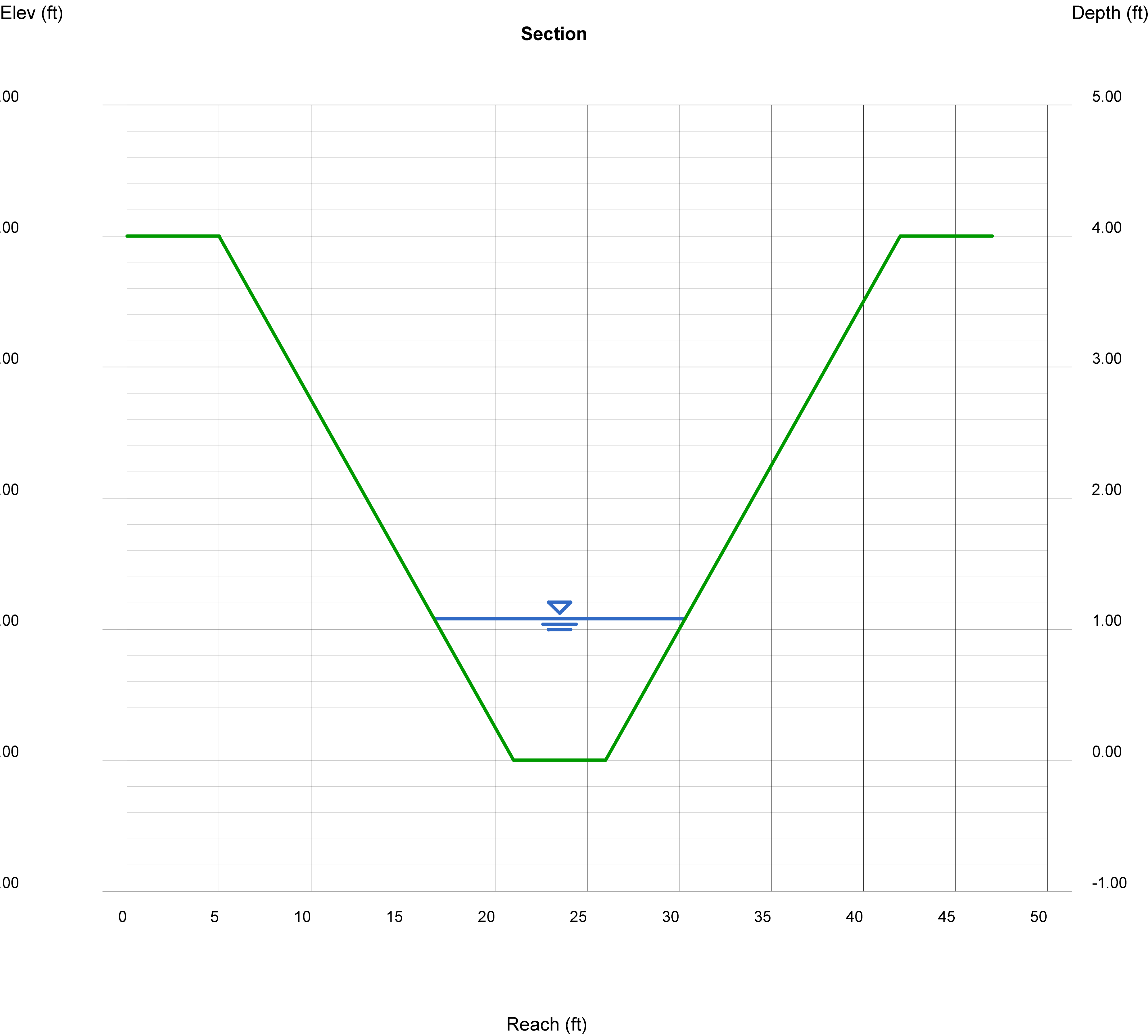
Calculations

Compute by: Known Q
Known Q (cfs) = 57.10

Highlighted

Depth (ft) = 1.08
Q (cfs) = 57.10
Area (sqft) = 10.07
Velocity (ft/s) = 5.67
Wetted Perim (ft) = 13.91
Crit Depth, Yc (ft) = 1.18
Top Width (ft) = 13.64
EGL (ft) = 1.58

State what lining is proposed



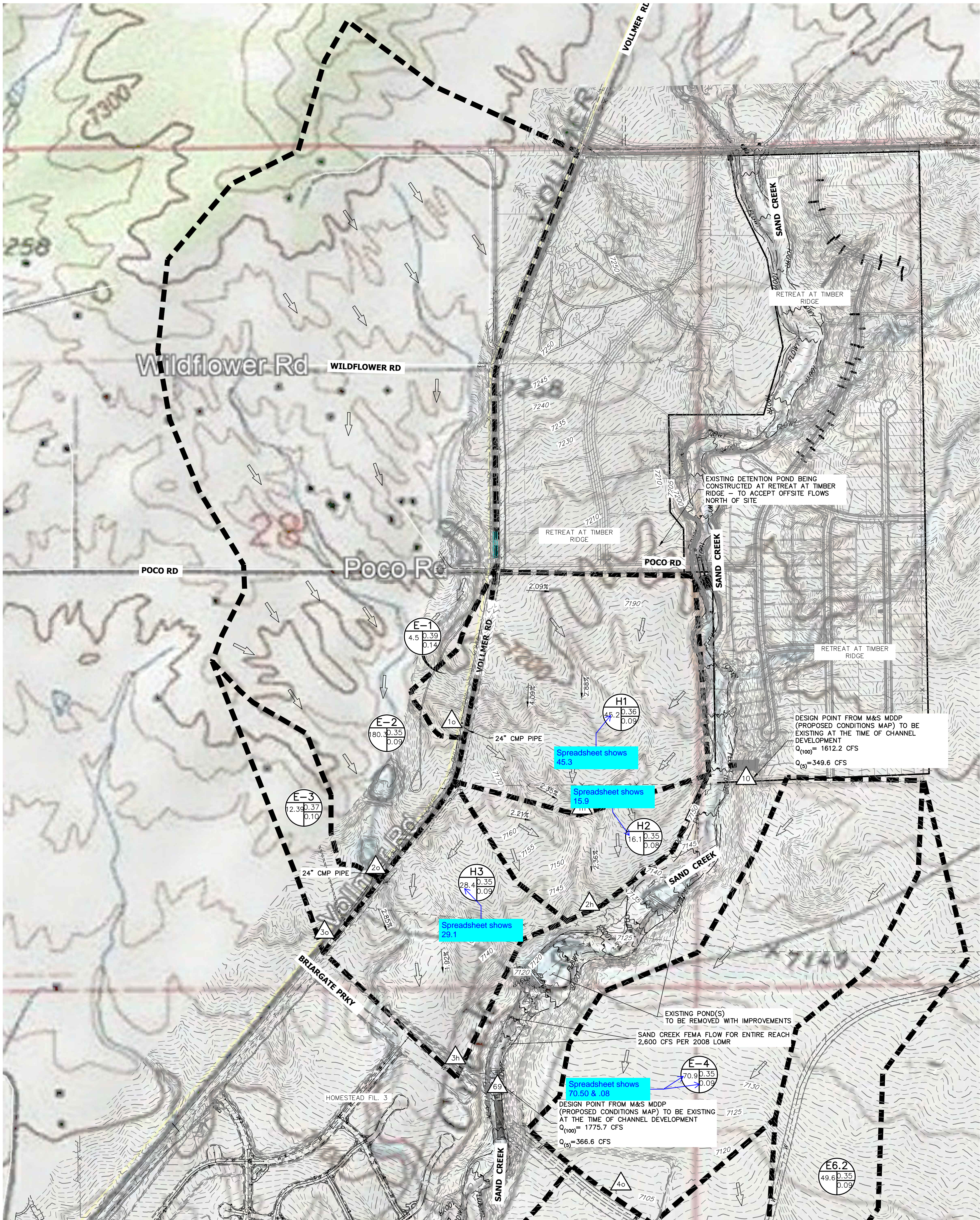
Appendix D

Drainage Maps



EXISTING DRAINAGE MAP

HOMESTEAD NORTH



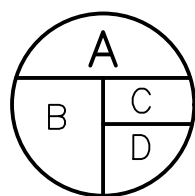
SEE SHEET 2

BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
E-1	4.50	9%	0.14	0.39	48.7	1.1	5.2
E-2	180.30	3%	0.09	0.35	47.4	28.1	192.9
E-3	12.39	4%	0.10	0.37	46.9	2.2	13.7
E-4	70.50	2%	0.08	0.35	49.0	9.9	72.3
E-5	18.80	2%	0.08	0.35	34.9	3.4	24.9
E6.1	125.30	2%	0.08	0.35	48.1	17.8	130.4
E6.2	49.61	2%	0.08	0.35	44.2	7.5	55.4
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	Q ₅ Total	Q ₁₀₀ Total
1h	8.0	52.5
2h	10.2	68.9
3h	32.6	224.0
1o	1.1	5.2
2o	28.1	192.9
3o	2.2	13.7
4o	9.9	72.3
5o	12.5	91.6
6.2o	7.5	55.4
6.1o	36.9	270.9

LEGEND

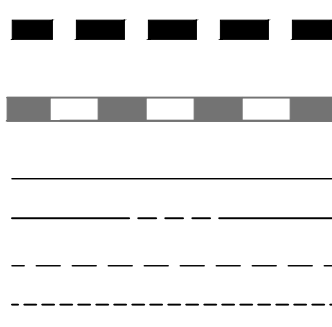
BASIN ID
A: BASIN LABEL
B: AREA
C: C - 100 YR
D: C - 5 YR



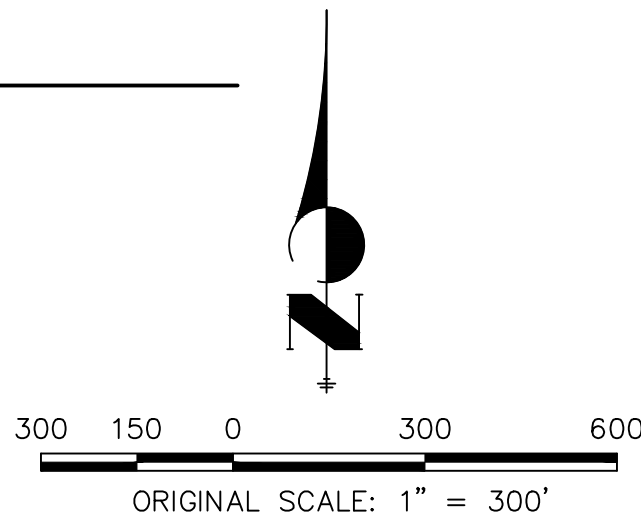
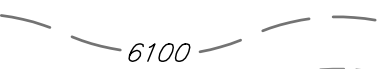
DESIGN POINT
EXISTING FLOW DIRECTION



BASIN DRAINAGE AREA
EXISTING STORM SEWER
EXISTING PROPERTY LINE
ROW EXISTING
FL EXISTING
SIDEWALK EXISTING
DRAINAGE ACCESS & MAINTENANCE EASEMENT



EXISTING



EX DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
9-25-2021
SHEET 1 OF 2

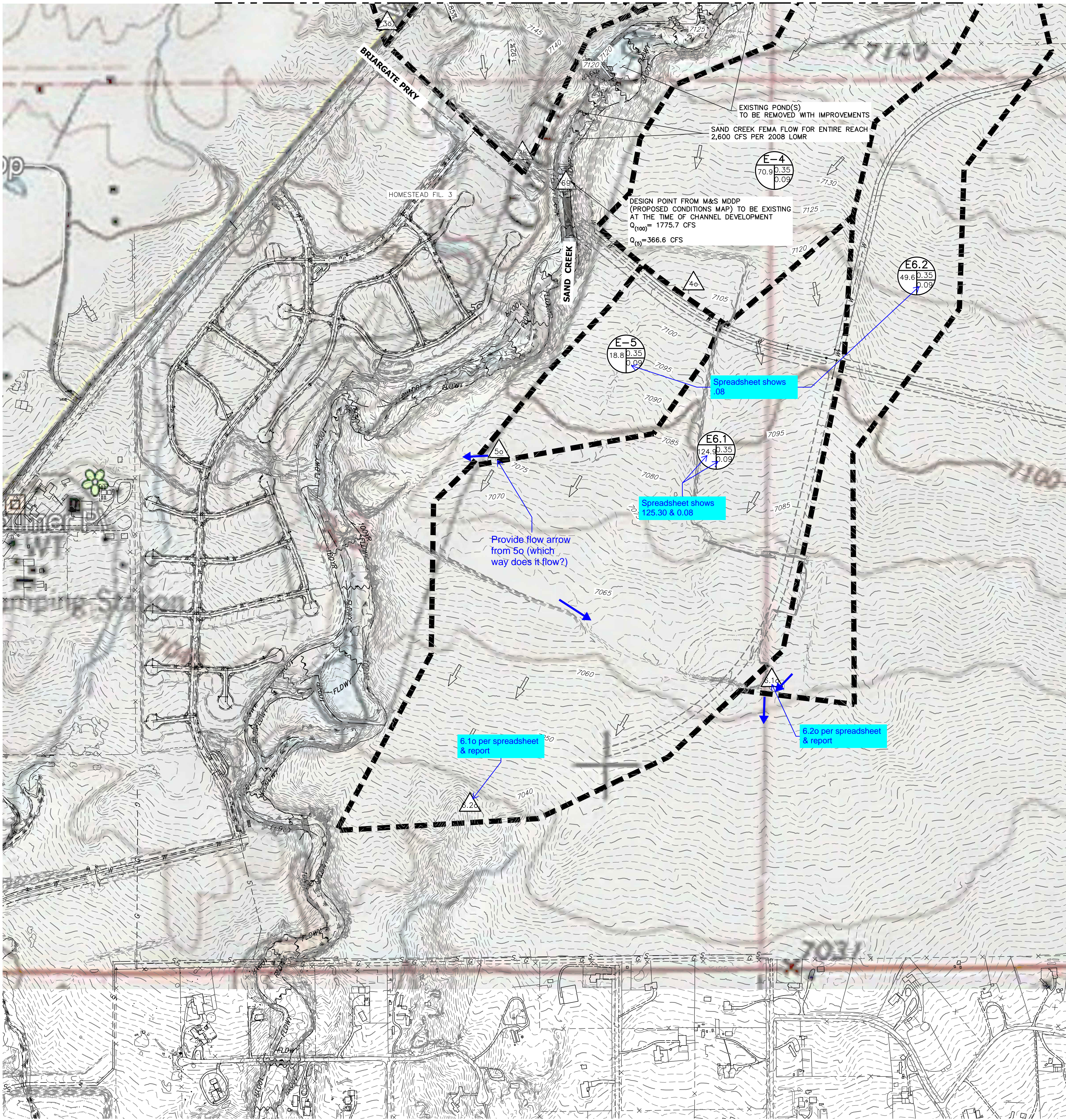
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EXISTING DRAINAGE MAP

HOMESTEAD NORTH

SEE SHEET 1

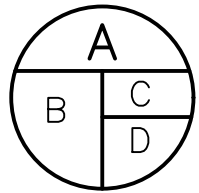


BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
E-1	4.50	9%	0.14	0.39	48.7	1.1	5.2
E-2	180.30	3%	0.09	0.35	47.4	28.1	192.9
E-3	12.39	4%	0.10	0.37	46.9	2.2	13.7
E-4	70.50	2%	0.08	0.35	49.0	9.9	72.3
E-5	18.80	2%	0.08	0.35	34.9	3.4	24.9
E6.1	125.30	2%	0.08	0.35	48.1	17.8	130.4
E6.2	49.61	2%	0.08	0.35	44.2	7.5	55.4
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	Q100
	Total	Total
1h	8.0	52.5
2h	10.2	68.9
3h	32.6	224.0
1a	1.1	5.2
2a	28.1	192.9
3a	2.2	13.7
4a	9.9	72.3
5a	12.5	91.6
6.2a	7.5	55.4
6.1a	36.9	270.9

LEGEND

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



DESIGN POINT
EXISTING FLOW DIRECTION



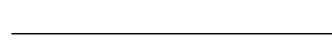
BASIN DRAINAGE AREA



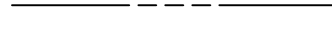
EXISTING STORM SEWER



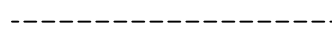
EXISTING PROPERTY LINE



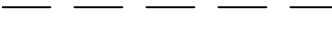
ROW EXISTING



FL EXISTING



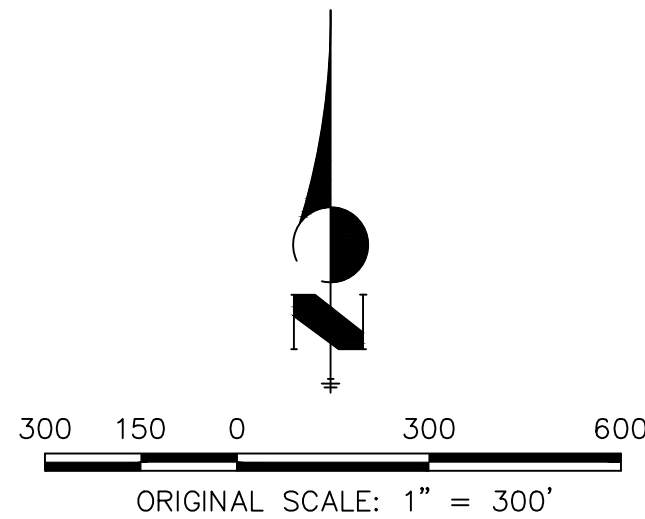
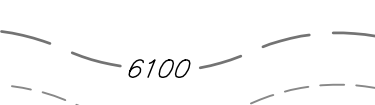
SIDEWALK EXISTING



DRAINAGE ACCESS & MAINTENANCE EASEMENT



EXISTING



EX DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
9-15-2021
SHEET 2 OF 2

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EARLY GRADING - DRAINAGE MAP

5.40 in spreadsheet

0.21 & 0.45 per spreadsheet

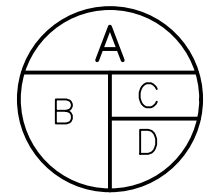
Not shown in spreadsheet

Overlapping text

Do not show curb and gutter on grading

LEGEND

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



DESIGN POINT



PROPOSED FLOW DIRECTION



BASIN DRAINAGE AREA



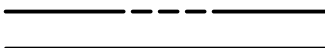
EXISTING STORM SEWER



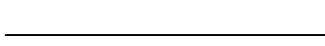
STORM SEWER PROPOSED



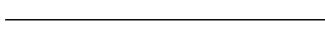
PROPOSED R.O.W



PROPOSED PROPERTY LINES



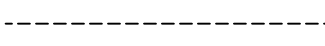
PROPOSED SIDEWALK



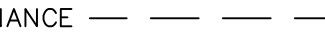
EXISTING PROPERTY LINE



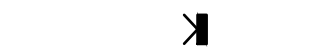
ROW EXISTING



FL EXISTING



SIDEWALK EXISTING



DRAINAGE ACCESS & MAINTENANCE



EASEMENT



CHECK DAM



EXISTING

PROPOSED



SEDIMENT 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-1	22.30	2%				80,280	108,900
2	D	17.29	2%	OS, O-S4, O-S5, OS-6	253.39	2%	188,939	201,393

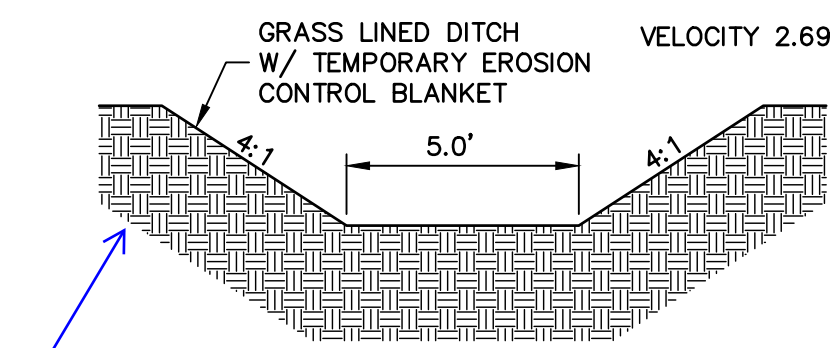
BASIN - SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
C-1	22.30	2%	0.08	0.35	40.1	3.6	26.8
C-2	2.66	2%	0.08	0.35	24.9	0.6	4.3
D	17.29	2%	0.08	0.35	46.3	2.5	18.6
OS	124.20	2%	0.08	0.35	64.5	13.3	97.2
O-S1	5.40	4%	0.09	0.36	36.5	1.1	7.1
O-S2	180.30	3%	0.09	0.35	47.4	28.1	192.9
O-S3	1.16	18%	0.21	0.45	14.0	0.9	3.2
O-S4	69.42	2%	0.08	0.35	34.0	12.7	93.5
O-S5	8.57	2%	0.08	0.35	12.8	2.6	18.9
O-S6	51.20	2%	0.08	0.35	44.2	7.8	57.1

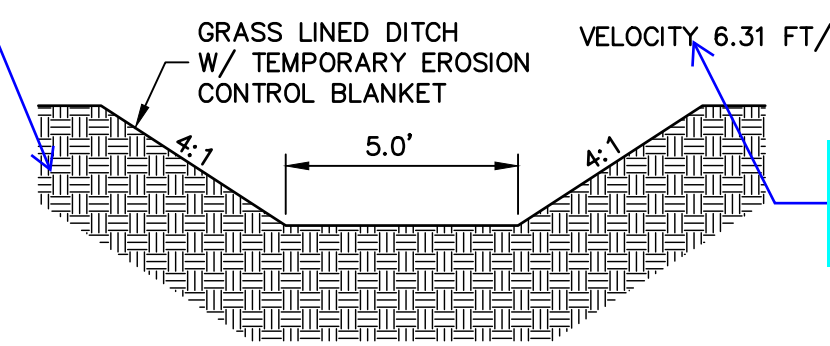
DESIGN POINT

DP	Q ₅ Total	Q ₁₀₀ Total
0	28.9	216.2
1	3.6	26.8
2	28.5	194.5
2.1	28.9	197.3
3	1.1	7.1
4	12.7	93.5
5	2.6	18.9
6	7.8	57.1
7	27.7	202.6
8	2.5	18.6

Include a minimum depth on all swale details



TYPICAL DITCH CROSS SECTION A-A



TYPICAL DITCH CROSS SECTION B-B

With this velocity, need a permanent lining, not temporary



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

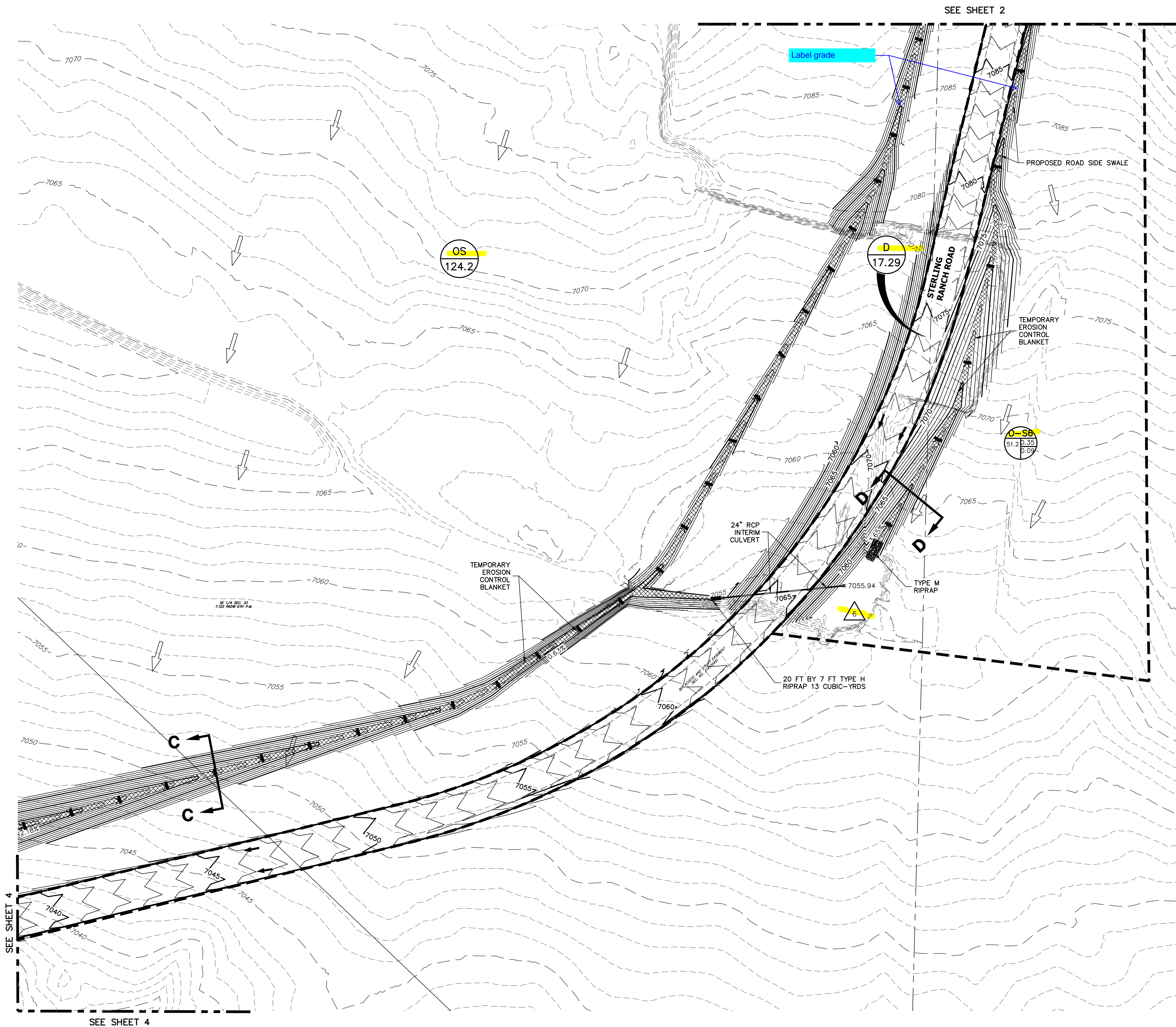
SEE SHEET 2

EARLY GRADING - DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
09/16/21
SHEET 1 OF 4

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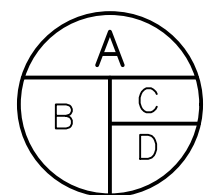
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EARLY GRADING - DRAINAGE MAP



LEGEND

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



DESIGN POINT

PROPOSED FLOW DIRECTION



BASIN DRAINAGE AREA



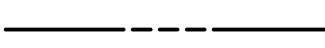
EXISTING STORM SEWER



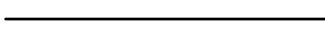
STORM SEWER PROPOSED



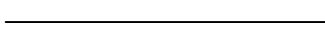
PROPOSED R.O.W



PROPOSED PROPERTY LINES



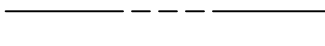
PROPOSED SIDEWALK



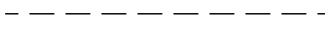
EXISTING PROPERTY LINE



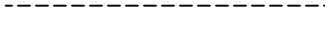
ROW EXISTING



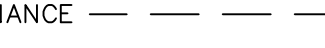
FL EXISTING



SIDEWALK EXISTING



DRAINAGE ACCESS & MAINTENANCE



EASEMENT



CHECK DAM



EXISTING

PROPOSED

6100

6100

SEDIMENT BASIN - SUMMARY TABLE

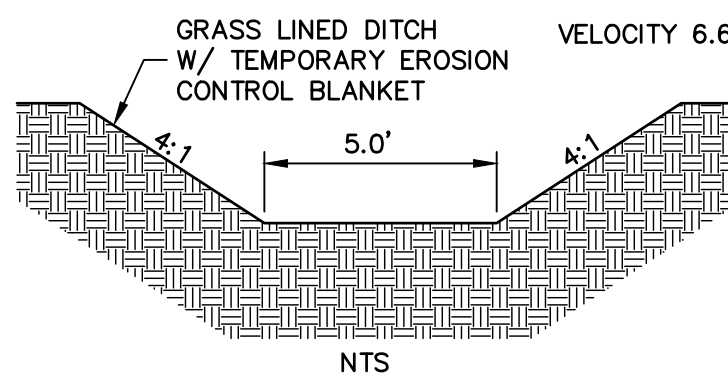
Temporary Sediment Basin	Contributing On-site Basin	Area (acres)	Percent Impervious	Contributing Off-site Basin	Area (acres)	Percent Impervious	Required Volume (cf)	Provided Volume (cf)
1	C-1	22.30	2%				80,280	108,900
2	D	17.29	2%	OS, O-S4, O-S5, O-S6	253.39	2%	188,939	201,393

BASIN - SUMMARY TABLE

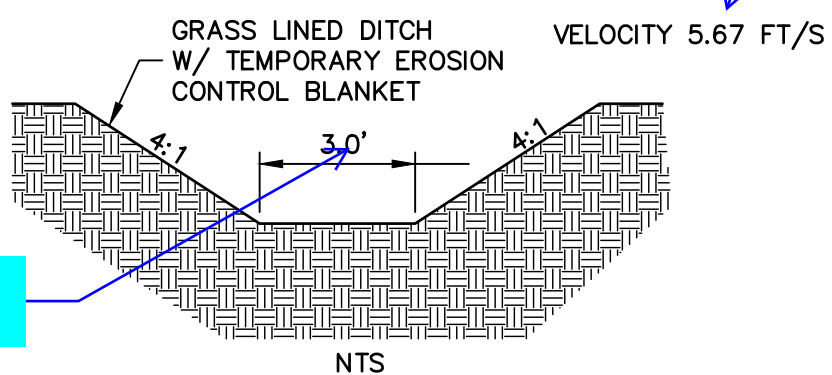
Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
C-1	22.30	2%	0.08	0.35	40.1	3.6	26.8
C-2	2.66	2%	0.08	0.35	24.9	0.6	4.3
D	17.29	2%	0.08	0.35	46.3	2.5	18.6
OS	124.20	2%	0.08	0.35	64.5	13.3	97.2
O-S1	5.40	4%	0.09	0.36	36.5	1.1	7.1
O-S2	180.30	3%	0.09	0.35	47.4	28.1	192.9
O-S3	1.16	18%	0.21	0.45	14.0	0.9	3.2
O-S4	69.42	2%	0.08	0.35	34.0	12.7	93.5
O-S5	8.57	2%	0.08	0.35	12.8	2.6	18.9
O-S6	51.20	2%	0.08	0.35	44.2	7.8	57.1

DESIGN POINT

DP	Q _S Total	Q ₁₀₀ Total
0	28.9	216.2
1	3.6	26.8
2	28.5	194.5
2.1	28.9	197.3
3	1.1	7.1
4	12.7	93.5
5	2.6	18.9
6	7.8	57.1
7	27.7	202.6
8	2.5	18.6



TYPICAL DITCH CROSS SECTION C-C



TYPICAL DITCH CROSS SECTION D-D

With this velocity, need a permanent lining, not temporary

5' per Hydrflow spreadsheet



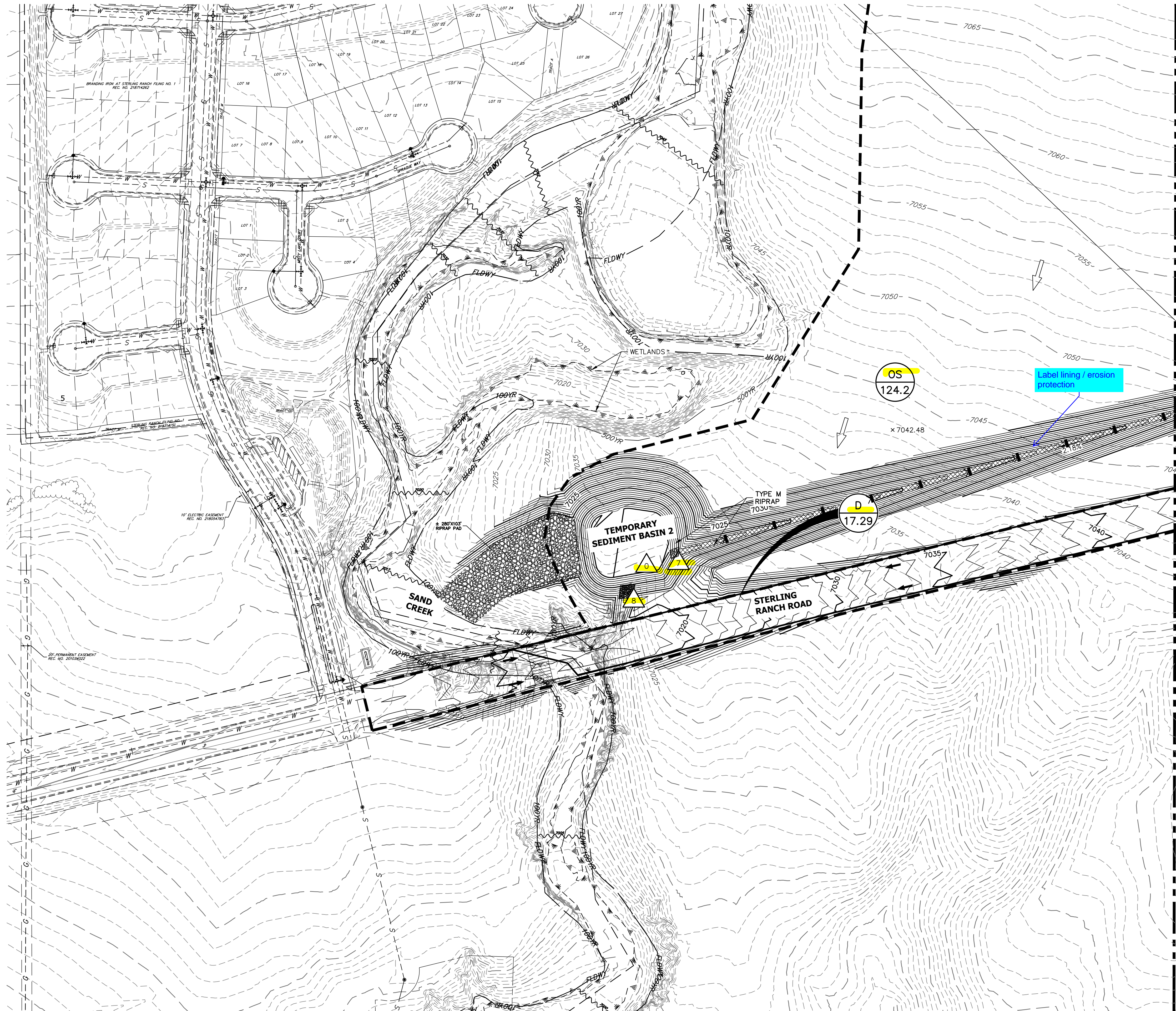
100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

EARLY GRADING - DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
09/16/21
SHEET 3 OF 4

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EARLY GRADING - DRAINAGE MAP



SEE SHEET 3

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
CHECK DAM
- EXISTING
PROPOSED

SEDIMENT BASIN - SUMMARY TABLE

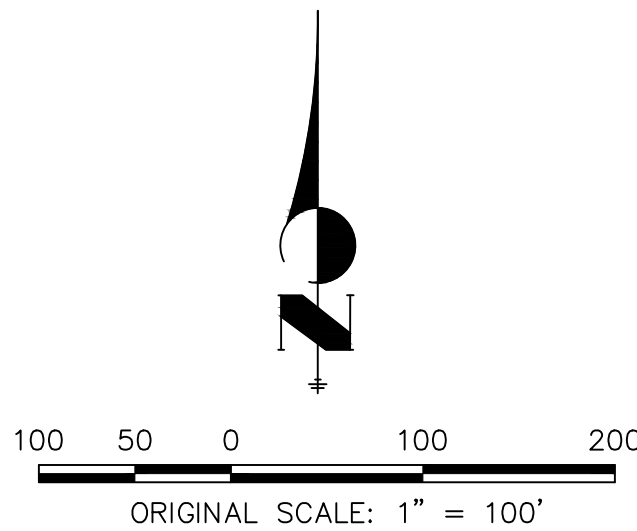
Temporary Sediment Basin	Contributing On-site Basin	Area (acres)	Percent Impervious	Contributing Off-site Basin	Area (acres)	Percent Impervious	Required Volume (cf)	Provided Volume (cf)
1	C-1	22.30	2%			2%	80,280	108,900
2	D	17.29	2%	OS, O-S4, O-S5, OS-6	253.39	2%	188,939	201,393

BASIN - SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C _s	C ₁₀₀	t _c (min)	Q _s (cfs)	Q ₁₀₀ (cfs)
C-1	22.30	2%	0.08	0.35	40.1	3.6	26.8
C-2	2.66	2%	0.08	0.35	24.9	0.6	4.3
D	17.29	2%	0.08	0.35	46.3	2.5	18.6
OS	124.20	2%	0.08	0.35	64.5	13.3	97.2
O-S1	5.40	4%	0.09	0.36	36.5	1.1	7.1
O-S2	180.30	3%	0.09	0.35	47.4	28.1	192.9
O-S3	1.16	18%	0.21	0.45	14.0	0.9	3.2
O-S4	69.42	2%	0.08	0.35	34.0	12.7	93.5
O-S5	8.57	2%	0.08	0.35	12.8	2.6	18.9
O-S6	51.20	2%	0.08	0.35	44.2	7.8	57.1

DESIGN POINT

DP	Q5 Total	Q100 Total
0	28.9	216.2
1	3.6	26.8
2	28.5	194.5
2.1	28.9	197.3
3	1.1	7.1
4	12.7	93.5
5	2.6	18.9
6	7.8	57.1
7	27.7	202.6
8	2.5	18.6



EARLY GRADING - DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
09/16/21
SHEET 4 OF 4

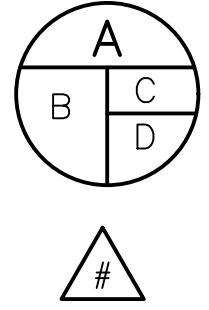


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DRAINAGE MAP

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
PROPOSED

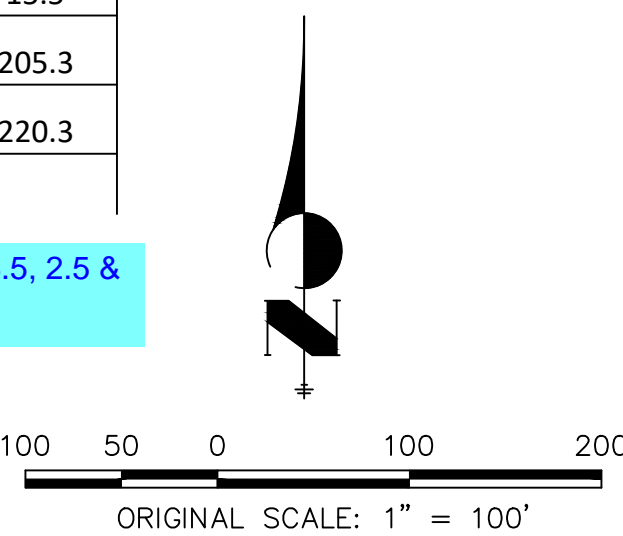
DESIGN POINT SUMMARY TABLE

DP	Q5		Q100	
	Total	Q5	Total	Q5
1a	6.9	14.7		
2a	6.4	13.3		
3a	8.3	20.5		
4a	7.2	16.5		
5a	9.5	26.1		
6a	10.7	18.5		
7a	10.4	29.9		
8a	11.3	20.0		
9a	21.6	49.6		
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	7.1	16.8		
5b	4.3	8.9		
6b	10.3	26.5		
7b	7.2	14.9		
8b	5.0	13.0		
9b	12.1	30.3		
10b	5.7	14.3		
11b	18.1	3.7		
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	18.9	42.0		
4.2c	5.9	13.3		
5c	4.1	8.8		
6c	2.5	8.8		
o1	0.8	6.0		
1d	2.4	6.0		
1.1d	3.2	11.6		
2d	2.5	6.1		
1.2d	5.7	17.7		
4d	1.0	1.1		
3d	0.6	1.2		
1.3d	0.5	2.2		
2o	27.1	190.9		
5d	3.1	6.1		
6d	2.5	4.6		
1.4d	6.4	19.2		
1.5d	29.2	195.0		
3o	1.7	12.6		
7d	2.0	3.3		
8d	2.5	14.4		
2.1d	3.2	15.5		
1.6d	32.6	205.3		
1.7d	35.8	220.3		

BASIN SUMMARY TABLE

Tributary	Area	Percent			tc	Q5	Q100
Sub-basin	(acres)	Impervious	C5	C100	(min)	(cfs)	(cfs)
A1	3.67	52%	0.51	0.64	13.3	6.9	14.7
A2	3.27	56%	0.54	0.67	13.8	6.4	13.3
A3	4.79	50%	0.49	0.63	13.9	8.5	18.4
A4	3.95	54%	0.52	0.65	14.2	7.4	15.6
A5	5.43	50%	0.49	0.62	11.1	10.5	22.6
A6	3.97	53%	0.51	0.65	12.6	7.7	16.3
A7	1.97	15%	0.19	0.43	16.5	1.3	4.8
A8	0.46	52%	0.50	0.66	5.0	1.2	2.6
A9	2.78	16%	0.20	0.43	13.4	2.1	7.4
B1.1	3.36	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	4.21	39%	0.40	0.57	9.5	7.1	16.8
B5	1.75	58%	0.55	0.68	7.8	4.3	8.9
B6	3.66	57%	0.55	0.68	6.6	9.5	19.9
B7	1.30	59%	0.56	0.69	9.0	3.1	6.4
B8	2.30	55%	0.53	0.66	9.6	5.1	10.7
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	1.65	15%	0.16	0.40	16.7	0.9	3.7
B12	2.40	40%	0.30	0.50	39.8	1.5	4.1
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	6.35	65%	0.49	0.63	12.0	12.1	25.9
C4.2	3.44	59%	0.46	0.61	12.6	5.9	13.3
C5	0.16	81%	0.74	0.84	6.4	0.6	1.0
C6	2.48	21%	0.22	0.45	6.8	2.5	8.8
D1	1.83	39%	0.39	0.58	16.7	2.4	6.0
D2	1.77	43%	0.43	0.61	16.3	2.5	6.1
D3	0.18	68%	0.63	0.76	5.4	0.6	1.2
D4	0.19	57%	0.54	0.70	6.3	0.5	1.1
D5	0.91	77%	0.71	0.82	6.0	3.1	6.1
D6	0.83	69%	0.64	0.77	6.4	2.5	5.2
D7	0.52	81%	0.74	0.84	5.0	2.0	3.8
D8	0.66	75%	0.69	0.81	5.0	2.4	4.6
OS1	2.85	2%	0.08	0.35	14.5	0.8	6.0
OS2	179.61	2%	0.08	0.35	47.4	27.1	190.9
OS3	11.99	2%	0.08	0.35	47.6	1.7	12.6

Missing design points 3.5, 2.5 & 12b in table.



DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
10/08/21
SHEET 1 OF 2

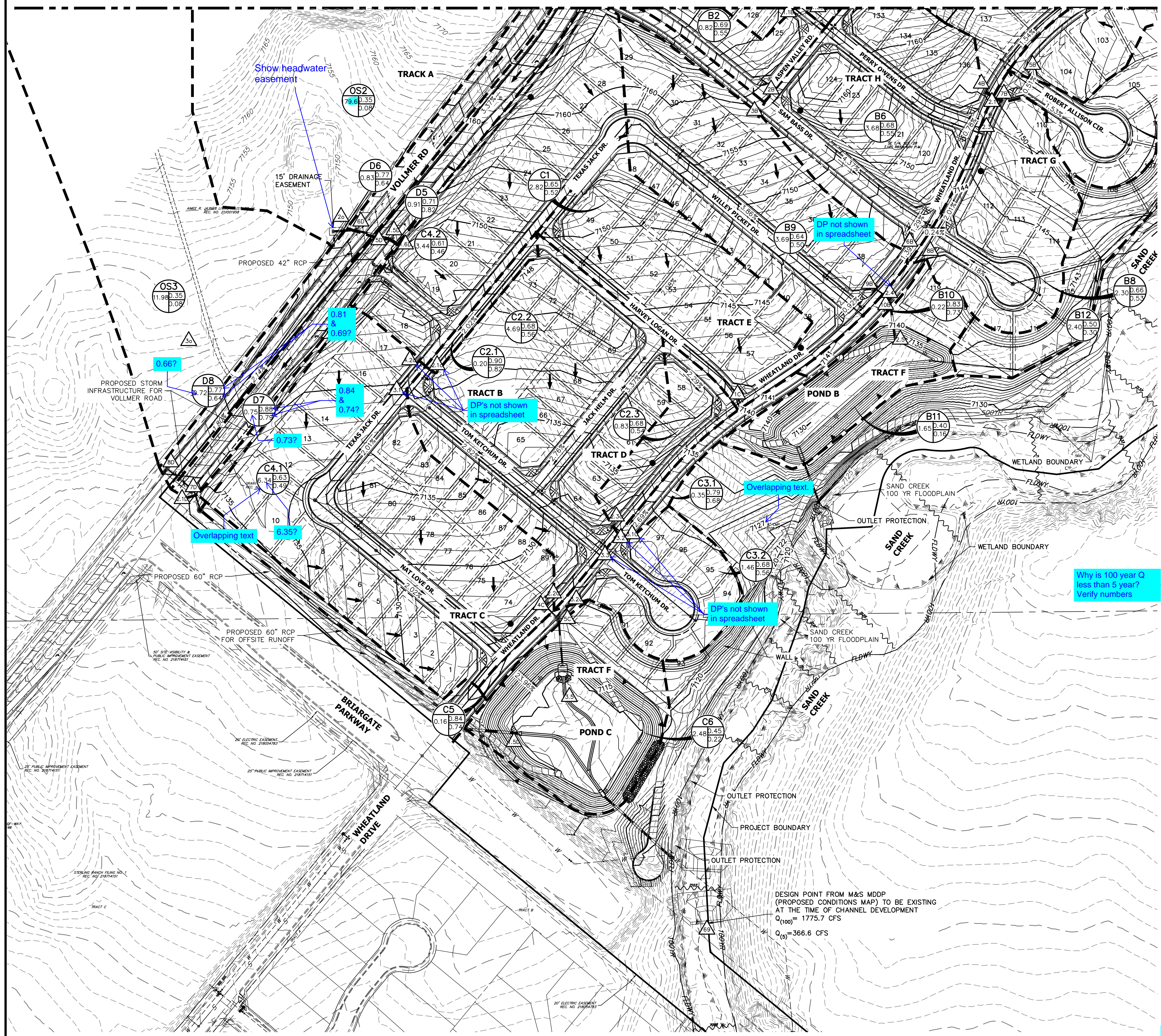
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SEE SHEET 2

DRAINAGE MAP

SEE SHEET 1



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
PROPOSED

Missing DP's 11b, 12b, 4.2c, 3.1c, 6c & 1.7d on Drainage Plan

Label proposed inlets & storm pipes

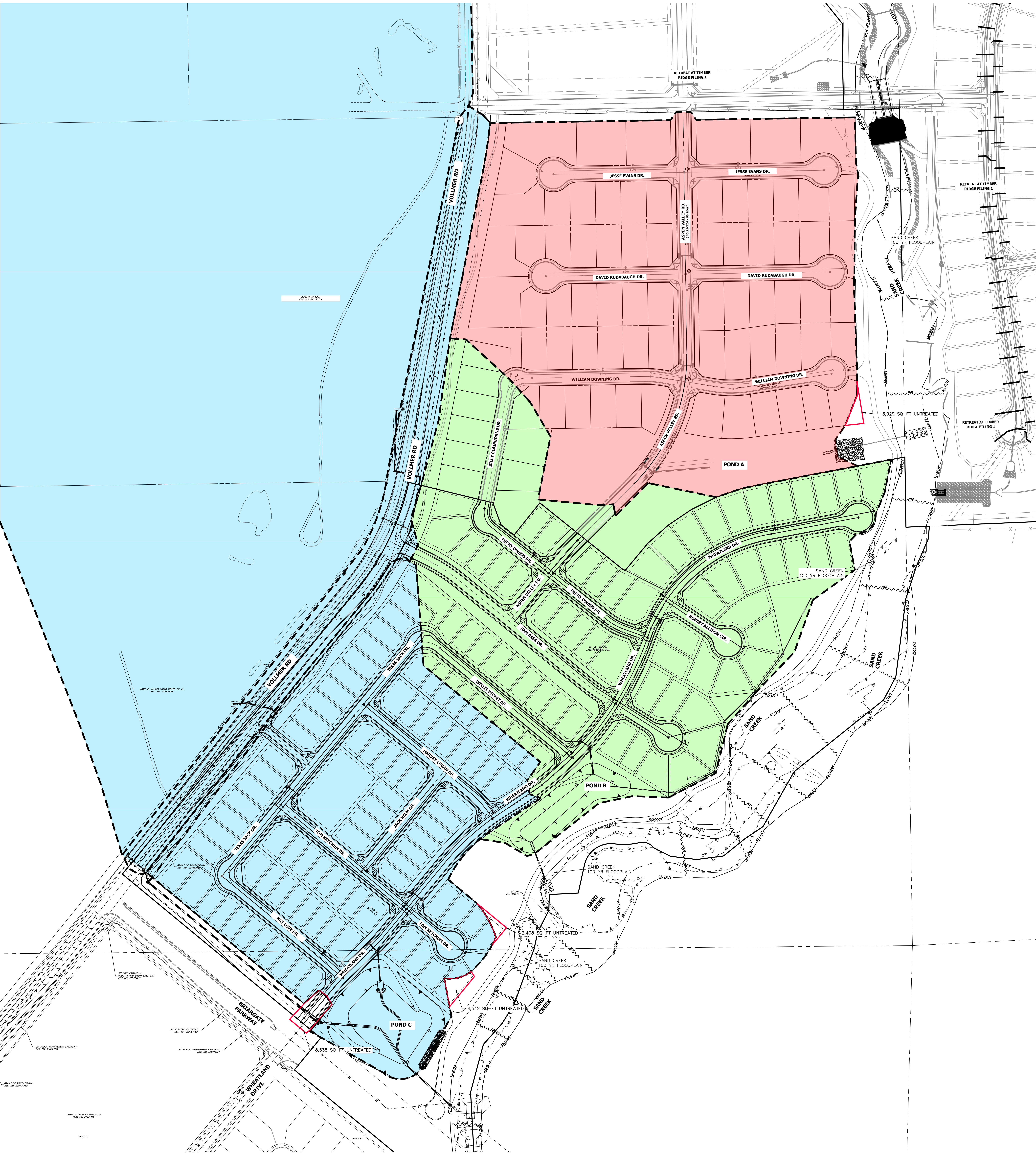
DESIGN POINT SUMMARY TABLE				BASIN SUMMARY TABLE							
DP	Q5	Q100		Tributary	Area	Percent			tc	Q5	Q100
	Total	Total		Sub-basin	(acres)	Impervious				(cfs)	(cfs)
1a	6.9	14.7									
2a	6.4	13.3		A1	3.67	52%	0.51	0.64	13.3	6.9	14.7
3a	8.3	20.5		A2	3.27	56%	0.54	0.67	13.8	6.4	13.3
4a	7.2	16.5		A3	4.79	50%	0.49	0.63	13.9	8.5	18.4
5a	9.5	26.1		A4	3.95	54%	0.52	0.65	14.2	7.4	15.6
6a	10.7	18.5		A5	5.43	50%	0.49	0.62	11.1	10.5	22.6
7a	10.4	29.9		A6	3.97	53%	0.51	0.65	12.6	7.7	16.3
8a	11.3	20.0		A7	1.97	15%	0.19	0.43	16.5	1.3	4.8
9a	21.6	49.6		A8	0.46	52%	0.50	0.66	5.0	1.2	2.6
1.1b	5.5	12.5		A9	2.78	16%	0.20	0.43	13.4	2.1	7.4
1.2b	3.5	7.4		B1.1	3.36	45%	0.45	0.60	13.4	5.5	12.5
1.3b	1.0	2.2		B1.2	1.81	54%	0.52	0.65	12.8	3.5	7.4
2b	2.4	6.8		B1.3	0.47	47%	0.46	0.63	8.1	1.0	2.2
3b	0.9	1.7		B2	0.82	58%	0.55	0.69	5.0	2.3	4.9
4b	7.1	16.8		B3	0.24	79%	0.73	0.83	5.0	0.9	1.7
5b	4.3	8.9		B4	4.21	39%	0.40	0.57	9.5	7.1	16.8
6b	10.3	26.5		B5	1.75	58%	0.55	0.68	7.8	4.3	8.9
7b	7.2	14.9		B6	3.66	57%	0.55	0.68	6.6	9.5	19.9
8b	5.0	13.0		B7	1.30	59%	0.56	0.69	9.0	3.1	6.4
9b	12.1	30.3		B8	2.30	55%	0.53	0.66	9.6	5.1	10.7
10b	5.7	14.3		B9	3.69	65%	0.50	0.64	13.1	6.9	14.8
11b	18.1	3.7		B10	0.22	80%	0.73	0.83	5.0	0.8	1.6
1c	5.4	11.4		B11	1.65	15%	0.16	0.40	16.7	0.9	3.7
2.1c	0.8	1.6		B12	2.40	40%	0.30	0.50	39.8	1.5	4.1
2.2c	9.8	20.1		C1	2.82	69%	0.52	0.65	13.1	5.4	11.4
2.3c	7.1	14.9		C2.1	0.20	91%	0.82	0.90	5.0	0.8	1.6
3.1c	1.2	2.4		C2.2	4.69	73%	0.56	0.68	12.8	9.9	20.3
3.2c	3.6	7.9		C2.3	0.83	67%	0.54	0.68	10.1	1.9	3.9
4c	18.9	42.0		C3.1	0.35	73%	0.68	0.79	5.0	1.2	2.4
4.2c	5.9	13.3		C3.2	1.46	71%	0.56	0.68	8.4	3.6	7.4
5c	4.1	8.8		C4.1	6.35	65%	0.49	0.63	12.0	12.1	25.9
6c	2.5	8.8		C4.2	3.44	59%	0.46	0.61	12.6	5.9	13.3
o1	0.8	6.0		C5	0.16	81%	0.74	0.84	6.4	0.6	1.0
1d	2.4	6.0		C6	2.48	21%	0.22	0.45	6.8	2.5	8.8
1.1d	3.2	11.6		D1	1.83	39%	0.39	0.58	16.7	2.4	6.0
2d	2.5	6.1		D2	1.77	43%	0.43	0.61	16.3	2.5	6.1
1.2d	5.7	17.7		D3	0.18	68%	0.63	0.76	5.4	0.6	1.2
4d	1.0	1.1		D4	0.19	57%	0.54	0.70	6.3	0.5	1.1
3d	0.6	1.2		D5	0.91	77%	0.71	0.82	6.0	3.1	6.1
1.3d	0.5	2.2		D6	0.83	69%	0.64	0.77	6.4	2.5	5.2
2o	27.1	190.9		D7	0.52	81%	0.74	0.84	5.0	2.0	3.8
5d	3.1	6.1		D8	0.66	75%	0.69	0.81	5.0	2.4	4.6
6d	2.5	4.6		OS1	2.85	2%	0.08	0.35	14.5	0.8	6.0
1.4d	6.4	19.2		OS2	179.61	2%	0.08	0.35	47.4	27.1	190.9
1.5d	29.2	195.0		OS3	11.99	2%	0.08	0.35	47.6	1.7	12.6
3o	1.7	12.6									
7d	2.0	3.3									
8d	2.5	14.4									
2.1d	3.2	15.5									
1.6d	32.6	205.3									
1.7d	35.8	220.3									

Missing design points 3.5, 2.5 & 12b in table.



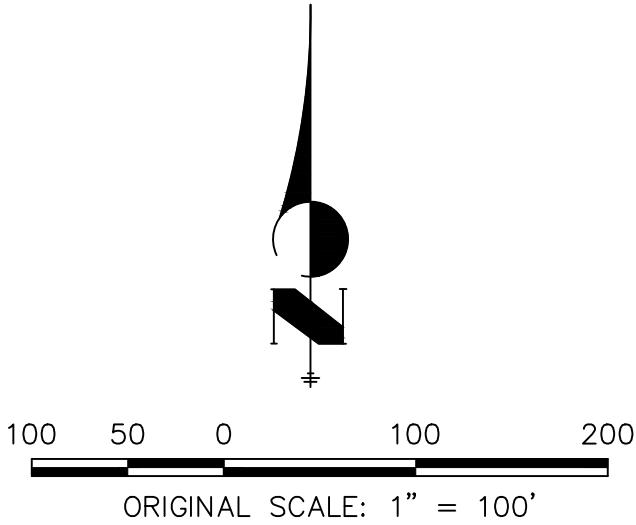
WATER QUALITY CAPTURE PLAN

HOMESTEAD NORTH



- POND A 30.29 ACRES, 46.4% IMPERVIOUS
- POND B 27.87 ACRES, 50.0% IMPERVIOUS
- POND C 224.34 ACRES, 10.3% IMPERVIOUS

- NOTE:**
- A SEPARATE PLAN FOR STERLING RANCH ROAD AND BRIARGATE PKWY WILL BE PROVIDED IN A THE SEPARATE FDR REQUIRED FOR CONSTRUCTION OF THESE ROADWAYS.
 - A TOTAL OF 13,517 SQ-FT ON SITE IS LEFT UNTREATED.
 - POND C TREATS THE IMPROVEMENTS TO VOLLMER ROAD AND THE OFFSITE TRIBUTARY AREA



WQ -PONDS
HOMESTEAD NORTH
JOB NO. 25188.00
6-29-2021
SHEET 1 OF 1

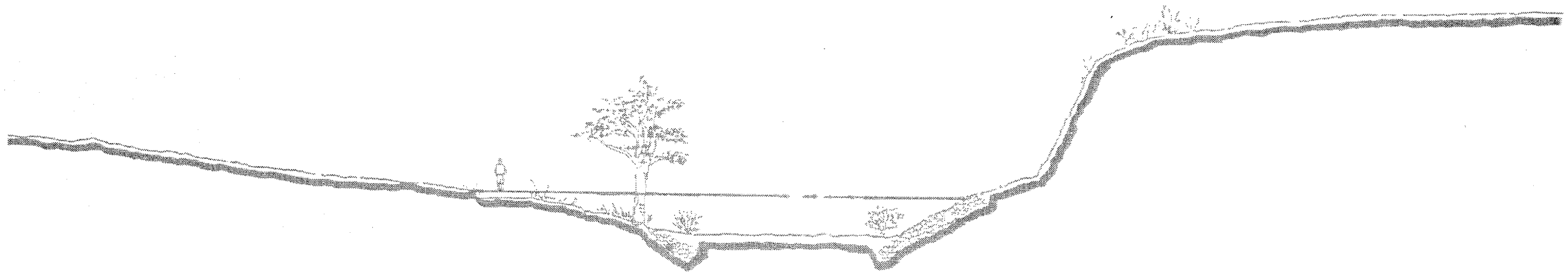
Appendix E

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 is 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

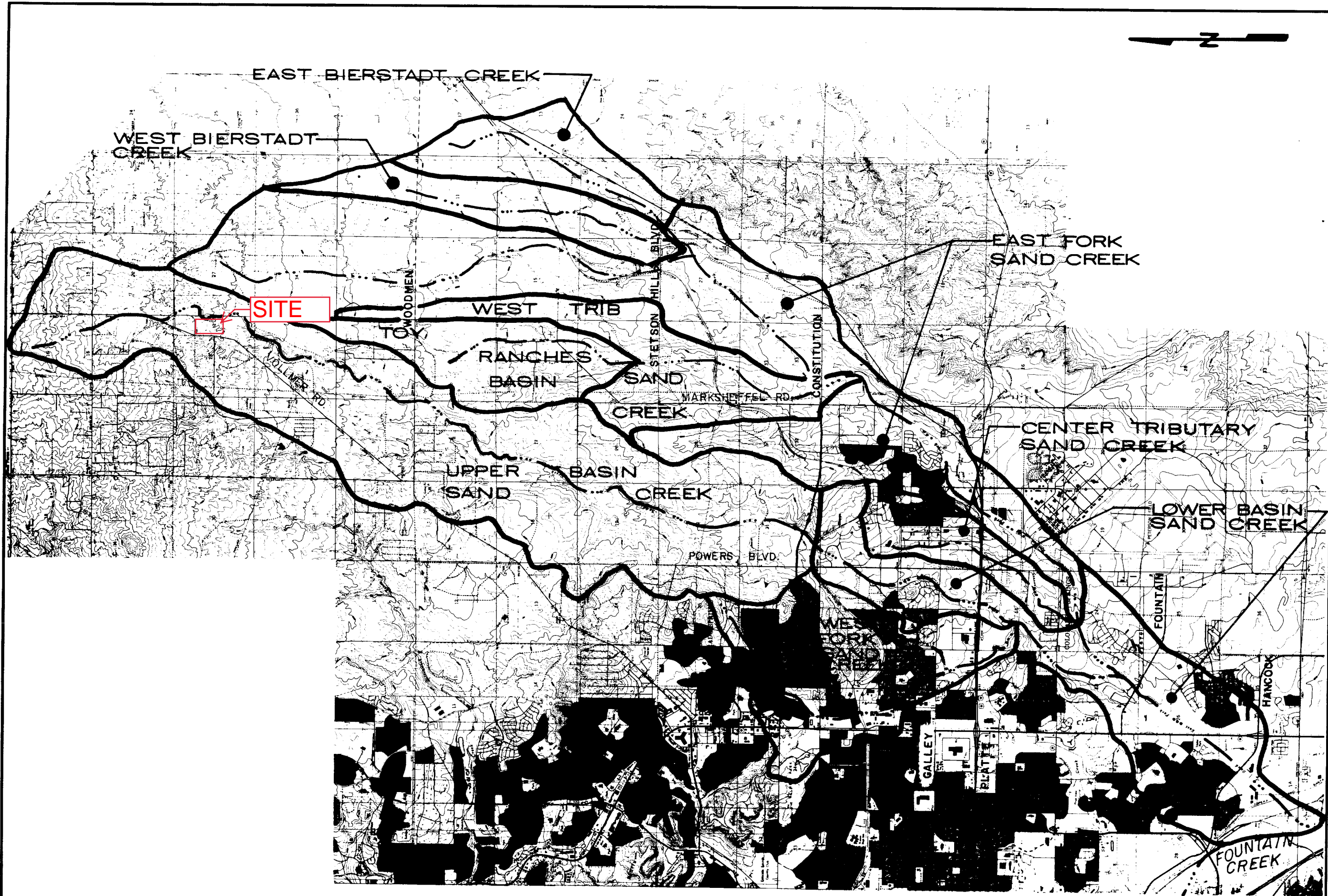
Soils within the Sand Creek basin vary between soil types A through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant soil groupings are in the Truckton and Bresser soil associations. The soils consist of deep, well drained soils that formed in alluvium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

Fee Development *For Information Only

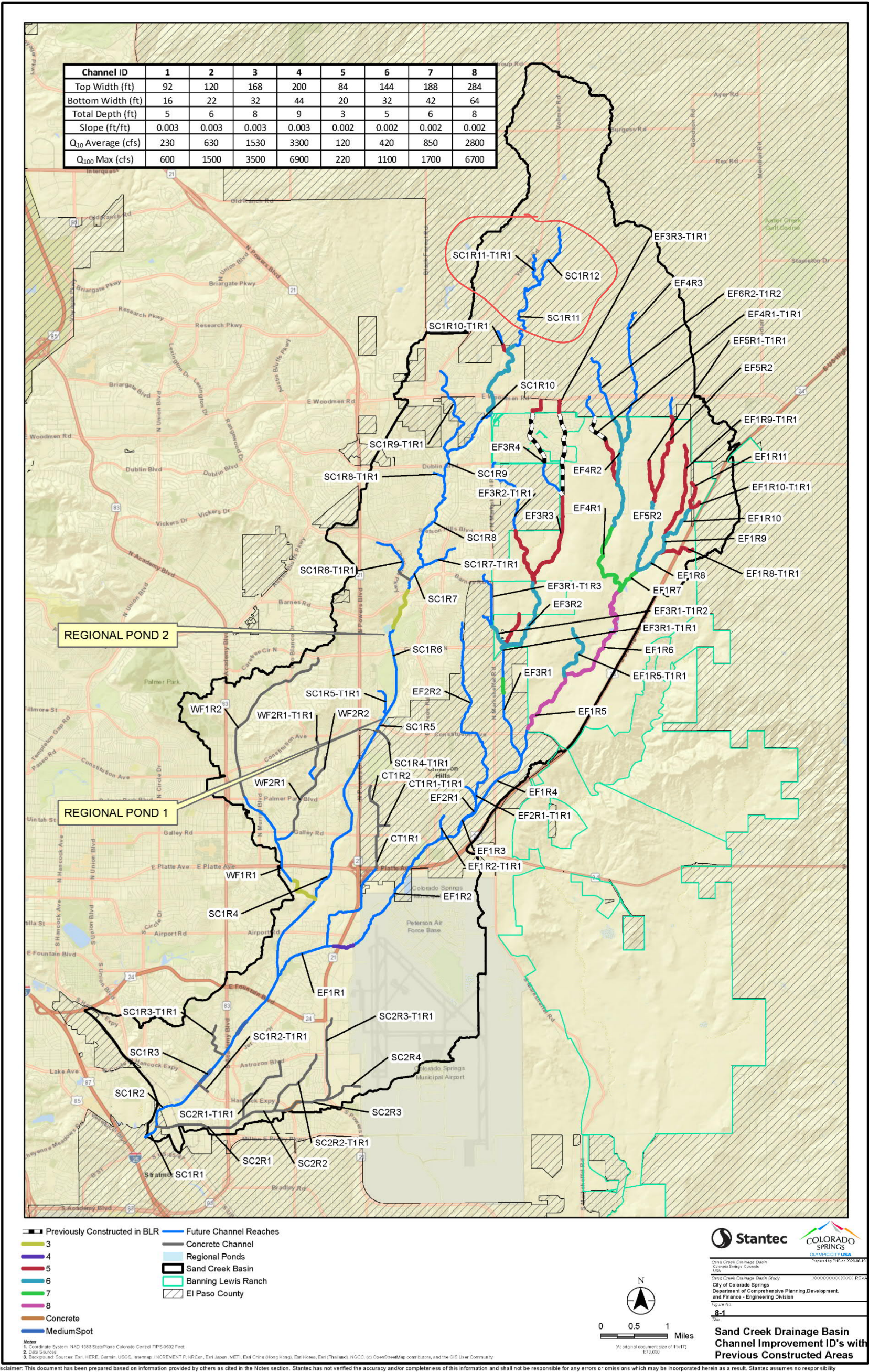


Figure 8-1. Sand Creek Drainage Basin Chanel Improvement IDs with Previous Constructed Areas

HISTORIC CONDITION

BASIN SUMMARY			
BASIN	AREA (acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
EX-1	24	3	40
EX-2	31	3	45
EX-3	310	49	341
EX-4	359	71	553
EX-5	1692	118	209
EX-6	165	12	97
EX-7	42	11	84
EX-8	132	11	84
EX-9	45	48	49
EX-10	209	19	261
EX-11	40	5	63
EX-12	89	8	113
EX-13	318	61	310
OS-20	33	8	38
OS-21	88	18	91
OS-22	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

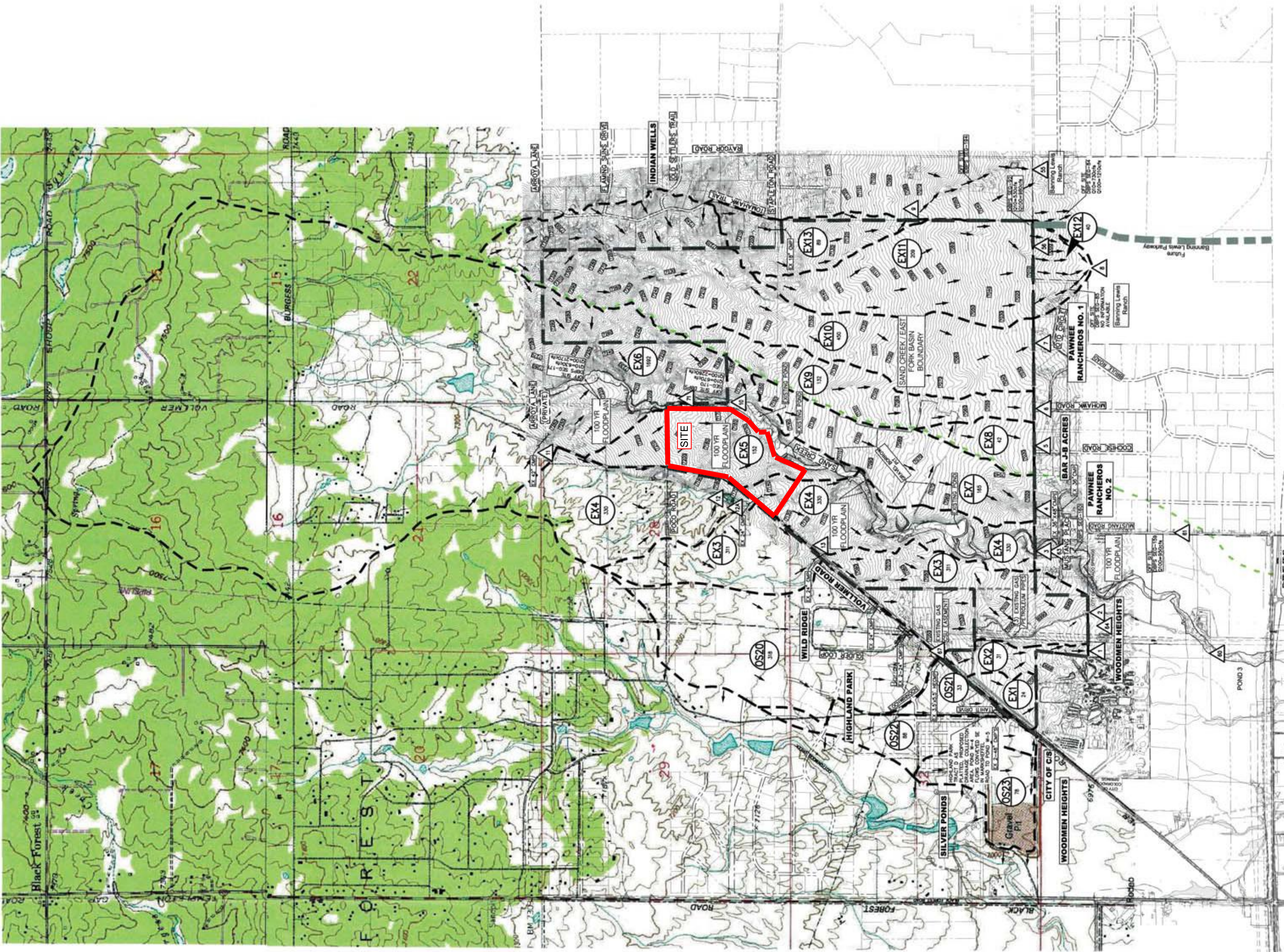
DESIGN POINTS			
DESIGN POINT	SQ. MI.	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
1	0.09	5	84
2	0.49	55	465
3	0.52	139	2610
4	0.26	12	197
5	0.07	4	64
6	0.21	11	149
7	0.10	48	474
8	0.39	18	305
9	0.74	6	114
10	2.64	122	2245
11	0.09	5	83
12A	0.09	3	65
12	0.17	10	200
13	0.17	6	130

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

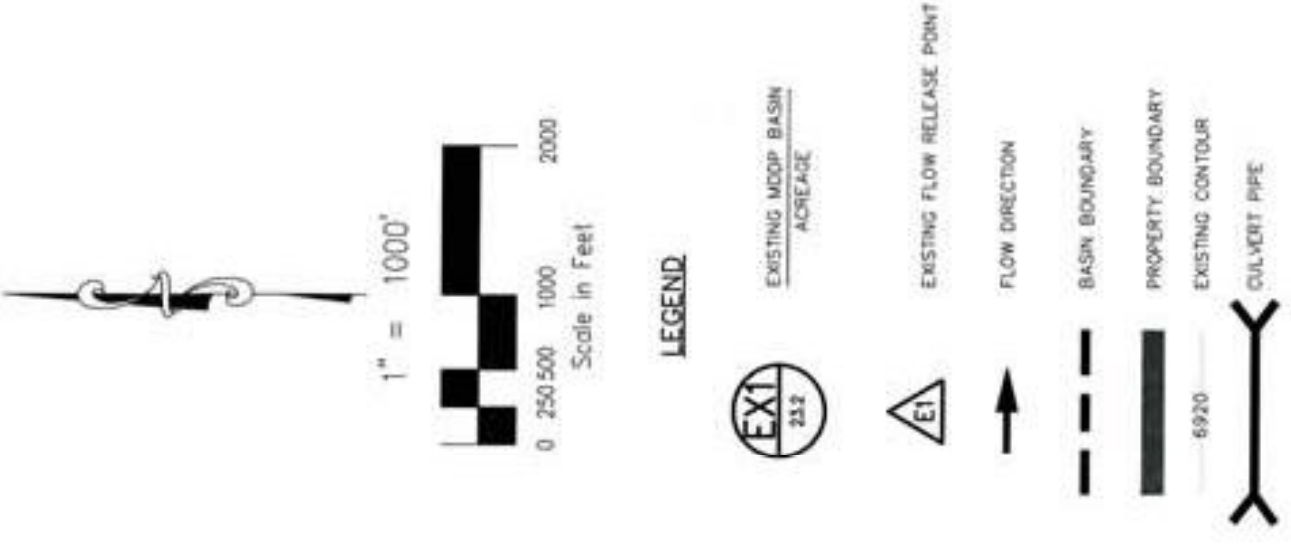
* NOTE: DBPS FLOWS ARE FOR THE EXISTING CONDITION

NO DATA GIVEN IN DBPS

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



STERLING RANCH
N.T.S.



CIVIL CONSULTANTS, INC.
102 E. Pikes Peak Ave. Ste. 306
Colorado Springs, CO 80903
(719) 555-5465, FAX (719) 444-8427

STERLING RANCH MDDP

HISTORIC - DRAINAGE MAP

PROJECT NO. 09-001 FILE: \\dwp\09-001-MDDP HISTORIC

DESIGNED BY: VAS SCALE: 1"=500'

DRAWN BY: VAS HORIZ: 1"=500'

CHECKED BY: VAS VERT: N/A

SHEET 1 OF 1

D1

HISTORIC CONDITION

BASIN SUMMARY			
BASIN	AREA (acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
EX-1	24	3	40
EX-2	31	3	45
EX-3	310	49	341
EX-4	359	71	553
EX-5	1692	118	209
EX-6	165	12	97
EX-7	42	11	84
EX-8	132	11	49
EX-9	45	48	474
EX-10	209	19	261
EX-11	40	5	63
EX-12	89	8	113
EX-13	318	61	310
OS-20	33	8	38
OS-21	88	18	91
OS-22	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

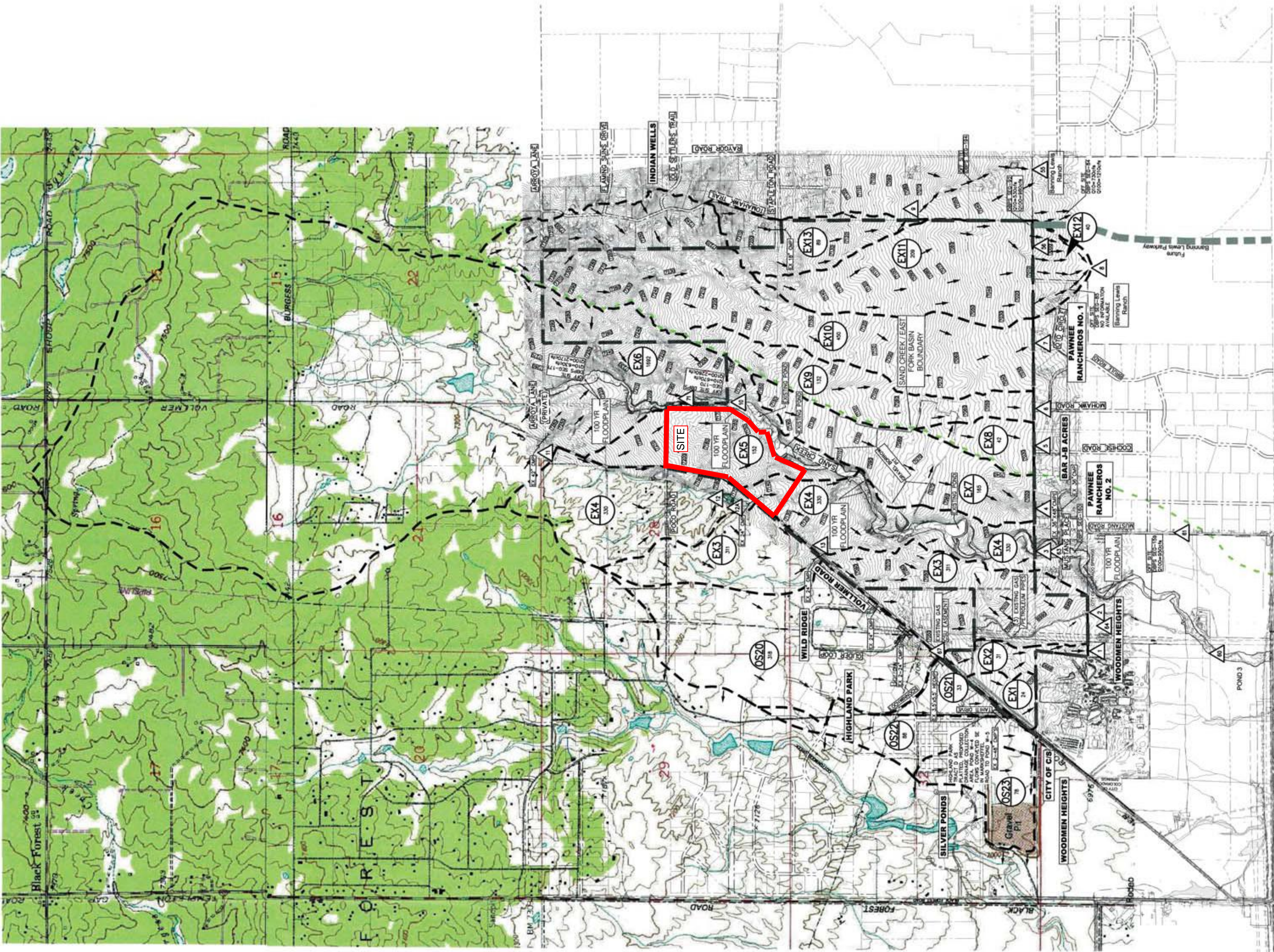
DESIGN POINTS			
DESIGN POINT	SQ. MI.	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
1	0.09	5	84
2	0.49	55	465
3	0.52	139	2610
4	0.26	12	197
5	0.07	4	64
6	0.21	11	149
7	0.10	48	474
8	0.39	18	305
9	0.74	6	114
10	2.64	122	2245
11	0.09	5	83
12A	0.09	3	65
12	0.17	10	200
13	0.17	6	130

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

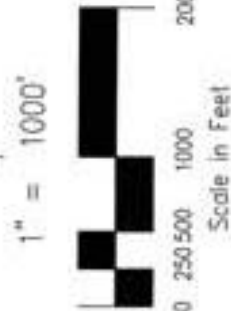
* NOTE: DBPS FLOWS ARE
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Runoff in attenuated
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STERLING RANCH
N.T.S.



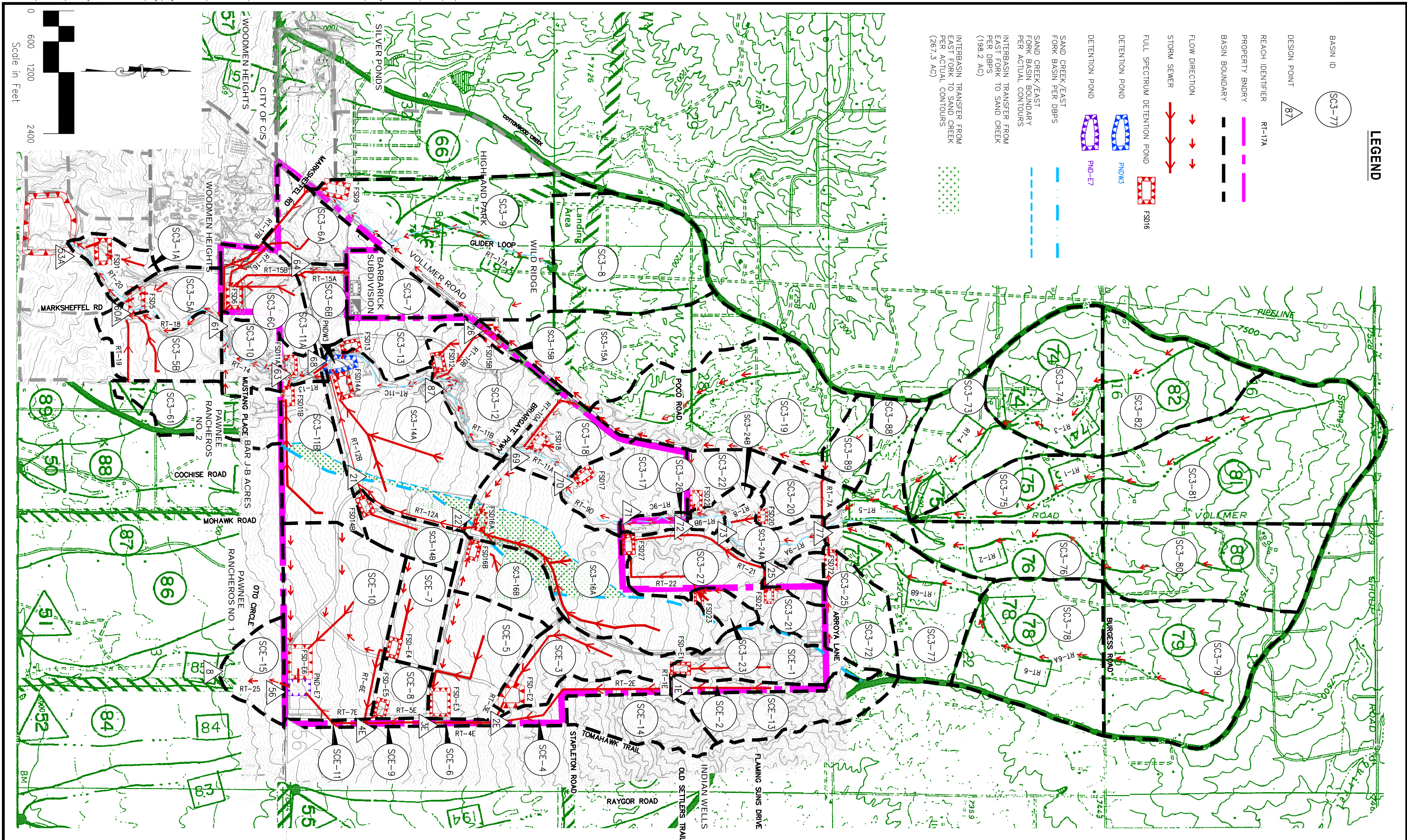
LEGEND

- EXISTING MDDP BASIN
- EXISTING FLOW RELEASE POINT
- FLOW DIRECTION
- BASIN BOUNDARY
- PROPERTY BOUNDARY
- EXISTING CONTOUR
- CULVERT PIPE

ABS
CIVIL CONSULTANTS, INC.
102 E. PIKES PEAK AVE. STE 306
COLORADO SPRINGS, CO 80903
(719) 955-5465, FAX (719) 444-8427

STERLING RANCH MDDP
HISTORIC - DRAINAGE MAP

PROJECT NO. 09-001	FILE: *dwg\09mddp-historic
DESIGNED BY: VAS	SCALE: HORIZ. 1"=500'
DRAWN BY: VAS	CHECKED BY: VAS
DATE: 03/16/15	SHEET 1 OF 1
	D1



BASIN SUMMARY												
BASIN	CN	AREA km ²	AREA % of total			POP % of total			POP % of total			POP % of total
			Area	Pop	Pop	Area	Pop	Pop				
SC3-1A	73	27.8	0.044	16.3	23.3	33.0	45.8	57.1	68.9			
SC3-2A	84	39.1	0.061	50.6	53.7	71.0	92.4	110.6	129.1			
SC3-3A	81	63.0	0.098	53.6	63.0	98.5	130.8	158.6	187.0			
SC3-4A	88	49.3	0.077	61.4	79.3	102.2	130.1	153.6	177.1			
SC3-5A	88	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	119.7	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	24.9	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	78.6	0.120	59.4	81.3	106.8	142.5	188.1	180.5	213.7		
SC3-12	81	88.2	0.138	77.8	106.6	142.5	188.1	229.1	270.0			
SC3-13	85	40.1	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	94.0		
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	8.8	14.0	18.2	23.3	27.6	31.9			
SC3-16A	74	168.1	0.263	81.4	120.4	170.0	234.6	293.2	351.8			
SC3-16B	73	70.6	0.110	41.8	59.6	85.2	119.0	143.1	180.6			
SC3-18	81	53.8	0.084	49.3	67.1	91.0	112.2	147.3	174.0			
SC3-19	62	184.0	0.287	24.8	47.7	75.7	114.2	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	23.5	28.4			
SC3-24B	65	35.7	0.056	13.0	20.4	31.1	48.7	59.0	73.2			
SC3-24C	63	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	101.2	120.1	150.3			
SC3-28	63	63.5	0.102	13.7	22.0	34.4	51.6	67.6	84.8			
SC3-32	64	38.2	0.068	12.6	20.2	31.4	46.1	60.9	76.0			
SC3-33	63	90.0	0.141	26.4	28.4	51.3	66.1	81.3	102.0			
SC3-34	63	70.7	0.117	22.3	36.5	53.3	72.7	93.6	112.3			
SC3-35	63	86.3	0.135	13.1	21.3	32.7	50.6	66.1	82.8			
SC3-36	63	105.9	0.167	16.6	27.6	43.5	66.2	87.6	109.4			
SC3-37	63	158.0	0.253	92.3	28.8	45.3	70.6	98.2	130.1			
SC3-38	63	147.7	0.235	34.9	57.0	89.5	134.3	175.8	174.0			
SC3-39	63	147.7	0.231	27.3	44.3	69.6	104.5	136.6	171.4			
SC3-40	62	262.9	0.411	42.6	73.2	111.0	167.4	219.6	275.5			
SC3-41	62	117.8	0.184	20.0	30.2	52.8	80.1	105.1	132.3			
SC3-48	62	60.2	0.094	10.5	17.4	27.6	41.8	54.9	69.0			
SC3-49	62	27.5	0.043	6.1	10	15.7	23.6	30.8	38.6			
SC3-51	65	64.4	0.101	23.3	35.9	53.8	79.1	102.4	127.4			
SC3-52	64	15.0	0.023	4.4	7.0	10.8	15.9	20.7	25.7			
SC3-53	70	67.5	0.095	33.6	45.2	65.9	93.3	118.0	143.9			
SC3-54	70	29.5	0.046	13.3	19.6	28.6	40.6	257.8	62.6			
SC3-55	87	85.8	0.134	100.4	130.6	169.6	217.4	257.8	298.4			
SC3-56	64	3.8	0.006	1.6	2.5	3.7	5.4	7.0	8.6			
SC3-57	89	44.9	0.070	58.9	75.5	96.7	122.2	143.7	165.2			
SC3-58	92	25.5	0.040	38.6	48.4	60.6	74.4	87.7	99.9			
SC3-59	64	174.3	0.276	1.5	2.4	3.6	5.5	6.8	8.5			
SC3-10	83	174.3	0.272	7.6	18.4	19.4	29.1	39.9	467.5			
SC3-11	64	5.8	0.009	2.3	3.6	5.5	8.0	10.3	12.8			
SC3-13	63	78.6	0.123	19.6	31.3	48.7	73.5	90.7	120.0			
SC3-14	63	53.5	0.082	13.2	21.2	33.3	49.9	65.2	81.7			
SC3-15	51	33.7	0.062	2.2	5.1	10.1	17.9	25.1	33.4			

DESIGN POINT SUMMARY											LOCATION
DESIGN POINT	AREA (sq. ft.)	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇	Q ₈	Q ₉	
DP-74	0.371	39.3	65.3	104.8	158.9	209.1	262.8				
DP-77	2.343	200.9	351.9	576.6	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	2.553	206.2	352.5	586.7	892.8	1195.3	1518.6				POCO ROAD X-ING
DP-71	2.757	205.3	349.3	610.5	932.4	1265.9	1612.2				STERLING RANCH NORTHERN BUDGET
DP-69	2.867	205.3	349.8	610.0	940.1	1280.6	1636.7				
DP-67	3.283	212.7	366.6	653.7	1010.6	1340.1	1725.7				BROADGATE PARKWAY X-ING
DP-68	3.594	216.9	374.6	681.9	1027.1	1351.5	1760.9				
DP-65	4.312	216.9	374.6	714.9	1187.6	1674.9	2204.1				UPSTREAM OF POND W3
DP-64	0.119	55.9	112.1	145.9	187.5	222.6	258.0				
DP-63	4.449	153.4	201.0	375.7	615.9	815.9	1088.1				STERLING RANCH SOUTHERN BUDGET
DP-60	5.611	161.6	225.9	439.0	682.2	919.2	1230.0				COLUMBIAN RIVER L-ING
DP-60A	5.611	161.6	225.7	441.8	951.1	1376.0	1861.9				MARSHFIELD L-ING BUDGET
DP-53A	0.247	23.9	38.3	70.1	132.8	173.0	220.9				SAND CREEK AND POND 3
DP-52	0.486	44.9	76.8	123.0	228.7	319.7	419.4				
DP-51	0.626	48.5	75.7	122.2	271.1	387.1	500.1				
DP-46	0.745	48.1	76.2	122.4	286.9	407.3	534.8				
DP-56	1.079	24.1	37.2	71.5	108.3	155.1	196.4				NEAR SE PROP CORNER
DP-8	1.079	24.1	37.2	73.5	111.3	152.4	200.7				
DP-21	0.396	0.6	8.8	17.8	57.1	116.8	174.9				BELOW SE PROP CORNER
DP-22	0.342	0.6	8.8	17.6	56.8	105.1	156.4				
DP-25	0.068	5.9	9.1	16.3	3.3	48.4	58.2				
DP-26	0.012	0.1	1.1	3.2	7.1	9.5	12.0				

DESIGN POINT SUMMARY (VOLUME)										
DESIGN	AREA	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	LOCATION		
POINT	(sq. mi.)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)	(ac-ft)			
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	120.9			
DP-77	2.343	37.7	57.4	85.9	125.1	161.1	199.5	ARROYA LANE X-RING		
DP-78	0.538	8.9	13.5	20.1	29.3	37.2	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	216.5	POCO ROAD X-RING		
DP-71	2.757	46.3	70.0	104.3	151.3	194.5	240.8	STERLING RANCH NORTHERN BUDRY		
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	BRARGATE PARKWAY X-RING		
DP-87	3.594	66.5	98.9	145.6	209.1	267.1	329.1			
DP-68	4.312	61.8	93.7	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	83.5	129.3	192.3	278.7	352.8	433.3	STERLING RANCH SOUTHERN BUDRY		
DP-61	5.256	113.7	168.8	255.1	373.1	475.5	584.5	COLORADO SPRINGS/EL PASO BUDRY		
DP-52A	5.651	112.0	170.0	252.6	359.6	461.7	566.5	SHULE CREEK		
DP-15C	0.247	3.1	5.2	8.4	12.7	16.6	20.9	SAND CREEK AND POND 3		
DP-12	0.480	6.1	10.4	16.9	25.7	33.7	42.2			
DP-15	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	16.7	26.1	28.6	51.3	71.7	92.9	NEAR SE PROP. CORNER		
DP-8	1.079	8.0	16.7	28.6	53.0	74.0	95.9	BELOW SE PROP. CORNER		
DP-21	0.366	6.3	11.3	16.3	24.5	35.6	44.0			
DP-22	0.736	6.3	10.7	16.7	26.7	36.7	47.0			
DP-25	1.017	1.3	1.9	2.8	4.1	5.8	6.4			
DP-26	1.079	0.7	0.9	1.2	1.5	1.8	2.1			

WATER QUALITY & DETENTION POND SUMMARY						
FSOI	STORM EVENT (CFS)		PEAK INFLOW (CFS)			
	2	5	10	25	50	100
	16.3	23.3	33.0	45.8	57.1	68.9
	0.1	1.7	3.3	10.9	17.5	23.5
	0.1	1.6	3.2	10.9	17.4	23.4
	2.4	2.6	3.0	3.6	1.9	2.2
	STORED VOLUME (AC-FIT)					

F505	STORM EVENT (YR)	2	5	10	25	50	100
	PEAK INFLOW (CFS)	40.6	53.7	71.0	92.4	108.6	129.1
	ALLOWABLE RELEASE (CFS)	0.1	1.4	2.6	11.2	19.7	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
F506							

FSD9	STRAIN EVENT (°F)	2	5	10	25	50	100
	PEAK IN/OUT (°F)	64.6	105.6	165.5	252.3	327.1	410.1
	ALLOWABLE RELEASE (°F)	0.5	7.6	14.6	51.8	99.6	149.7
	MODELED RELEASE (°F)	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

	5	10	25	50	100
STOCK LIGHT (AE)	2				
STOCK RELEASE (GCS)	5.3	7.8	11.2	18.0	24.4
ALLOWED RELEASE (GCS)	10	1.6	3.2	7.5	9.7
MODELED RELEASE (GCS)	0.2	0.9	3.0	7.5	9.7
MODELED RELEASE (AC-F)	0.3	0.3	0.4	0.4	0.6
STORDED VOLUME (AC-F)	8.7	6.7	9.6	10.6	12.3
MODELED VOLUME (GCS)	1.7	2.9	4.9	14.1	20.0
MODELED VOLUME (AC-F)	1.7	2.4	4.8	14.1	20.0

F50118	2	5	10	25	50	100
STORM EVENT (YR)						
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
STORAGE RELEASE (CFS)	0.3	8.6	8.6	29.3	47.7	69.5
STORED VOLUME (AC-FT)	4.8	4.9		5.5	7.3	8.2

STOCK VOLUME (AC-F)	5.2	5.5	5.8	6.7	7.8	8.9
ALLOWED RELEASE (CRS)	0.9	9.0	26.7	61.9	80.1	103.2
PEAK INFLOW (GR5)	77.8	105.6	142.5	189.1	229.1	270.0
STOCK EVENT (CR)	2	5	10	25	50	100
STOCK EVENT (GR)	43.9	57.4	76.0	98.5	117.6	136.9

FSD#4A						
	STORM EVENT (YR)	2	5	10	50	100
PEAK INFLOW (CFS)		121.6	175.4	239.8	321.9	466.3
PEAK FLOW (MGD)		0.6	0.7	0.9	1.3	1.9
WATER RELEASE (CFS)		0.6	0.7	0.9	1.3	1.9
MODIFIED RELEASE (CFS)		0.4	0.4	0.5	0.7	1.0
STORAGE VOLUME (AC-FT)		3.1	3.1	3.3	3.8	4.4
						5.0

STORAGE VOLUME (AC-FT)	9.9	0.6	11.9	13.5	15.3	17.3
FSD4	2	5	10	25	50	100
STORAGE EVENT (YR)	24.6	34.3	47.4	64.2	79.0	94.3
PEAK INFLOW (CFS)	0.0	0.3	0.5	5.7	11.8	19.3
ALLOWED RELEASE (CFS)	0.0	0.5	0.5	4.5	11.8	19.3
MODELED RELEASE (CFS)	0.0	0.3	0.5	4.5	11.8	19.3
STORAGE VOLUME (AC-FT)	1.9	2.9	3.3	3.5	3.9	3.6

	5	10	25	50	100
FSD 58	2	5	10	25	50
STORM EVENT (CR)					
ALLOWABLE RELEASE (CRFS)	10.8	14.0	18.2	23.3	31.9
MODELED RELEASE (CRFS)	0.1	1.6	3.2	7.3	12.0
MODELED VOLUME (AC-FT)	0.1	1.1	3.2	7.3	12.0
STORED VOLUME (AC-FT)	0.6	0.6	0.7	0.8	0.9
FSD 6A					
STORM EVENT (CR)	5	10	25	50	100

SAND CREEK FLOW COMPARISON CHART									
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			

POINT	USE WAY	TYPE	DESCRIPTION
DP-77	1.468	PROPOSED CONDITION	
	2.91	2.262	SAID GREEK DBPS
	2.600		FEMA
DP-71	2.757	61.2	PROPOSED CONDITION
		2.289	SAID GREEK DBPS
DP-63	4.449	1.395	PROPOSED CONDITION
	4.33	26.30	SAID GREEK DBPS

EFSO DBPS DESIGN POINT SUMMARY (PEAK FLOW)					
DBPS DESIGN	AREA	$\frac{Q_{98}}{Q_{95}}$	$\frac{Q_{98}}{Q_{90}}$	AREA	$\frac{Q_{98}}{Q_{95}}$
DP-60A	5,661	1,662		FEMA PROPOSED CONDITION SAND CREEK DBPS	
	5.36	32.95			

	DP-50	DP-51	DP-52	DP-56
Values reported from SCQPRS (DP-50, 52 Not marked as part of the study)	0.32	47.0	195.7	0.32
DP-51 (B/SIN 86)	0.33	17.7	74.1	0.33
DP-52	0.33	17.7	74.1	0.33
DP-56	0.79	63.6	265.0	0.79

FSD06B	2	5	10	25	50	100
PEAK INFLOW (CFS)	36.0	55.7	73.6	99.0	121.1	143.8
ALLOWABLE RELEASE (CFS)	0.0	0.4	0.7	8.3	17.2	28.1
MODELED RELEASE (CFS)	0.0	0.4	0.7	7.9	17.2	28.2
STORED VOLUME (AC-FT)	3.0	3.9	5.1	5.1	5.3	5.8

STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	41.8	59.6	88.2	119.0	149.3	180.6
ALLOWABLE RELEASE (CFS)	0.7	11.1	22.5	52.0	67.2	86.3
MODEL RELEASE (CFS)	0.7	8.4	22.4	52.0	67.2	86.3
STORED VOLUME (AC-FT)	2.6	2.6	2.8	3.4	4.0	4.7

FS202									
STORM EVENT (YR)	2	5	10	25	50	100			
PEAK INFLOW (GFS)	9.5	23.8	35.1	42.5	56.6	66.9			
ALLOWABLE RELEASE (GFS)	0.4	5.5	11.1	25.7	33.3	42.5			
STORGE VOLUME (M ³ -FT)	32	32	3.4	4.0	4.7	5.3			

ES021										
STORAGE EVENT (YR)	2	5	10	25	50	100				
PEAK INFLOW (CMS)	7.0	10.8	16.3	23.7	32.5	37.5				
ALLOWABLE RELEASE (CMS)	3	4.0	6.0	8.3	20.4	30.3				
MODEL RELEASE (CMS)	0.3	3.5	8.0	18.3	23.7	30.1				
STORGE VOLUME (AC-FT)	0	0.5	0.5	0.6	0.7	0.8				
MODELED RELEASE (AC-FT)	0.4	2.8	10.9	25.7	3.0	42.4				
STORGE VOLUME (AC-FT)	0.7	0.8	0.8	0.9	1.0	1.2				

[illegible]

ES927					
STORM EVENT (YR)	2	5	10	25	50
STORM EVENT (GTS)	98.8	62.6	84.1	113.7	159.2
PEAK INFL. (CM)	2.5	5	10	25	50
PEAK INFL. (GTS)	98.8	62.6	84.1	113.7	159.2
ALLOWABLE RELEASE (GTS)	0.2	2.0	4.9	11.2	14.5
MODELED RELEASE (GTS)	0.2	2.0	4.9	11.2	14.5
STOR. VOLUME (AC-F)	0.3	0.3	0.4	0.4	0.5
					0.6

FS072						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	12.8	31.4	46.7	60.3	76.0	93.0
ALLOWABLE RELEASE (CFS)	0.6	9.6	19.3	44.4	57.4	73.0
MODIFIED RELEASE (CFS)	1.4	21.1	42.4	97.7	126.2	161.9
STORED VOLUME (AC-FT)	2.7	2.8	2.9	3.2	3.7	4.2

STOR'D VOLUME (AC-F)	1.0	1.0	1.1	1.1	1.2	1.3
PHONO3						
STOR'D EVENT (YR)	2	5	10	25	50	100
PEAK INLQW (G/S)	214.6	374.5	714.9	1187.6	1674.9	2001
MODED RELEASE (G/S)	154.3	200.3	366.8	799.9	1085.6	1350.6
MODED VOLUME (AC-F)	2.8	9.5	26.3	41.2	57.2	78.2
FSD-1						
STOR'D EVENT (YR)	2	5	10	25	50	100

	2	5	10	25	50	100
STORM EVENT (YR)						
PEAK IN-LOW (CFS)	23.3	35.9	53.8	79.1	102.4	127.4
PEAK IN-HIGH (CFS)	23.3	35.9	53.8	79.1	102.4	127.4
ATWIDE RELEASE (CFS)	0.7	1.0	2.21	50.9	65.5	84.1
MODED RELEASE (CFS)	0.7	1.5	19.9	48.9	62.8	84.0
STORDED VOLUME (AC-FT)	1.3	1.5	1.5	1.8	2.1	2.5

STORDED VOLUME (AC-FI)	2.1	2.3	2.4	2.8	3.3	3.8
STORDED VOLUME (AC-FI)	2.1	2.3	2.4	2.8	3.3	3.8

STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	58.9	75.5	96.6	122.2	143.7	165.2
ALL DOWRUE RELEASE (CFS)	2.4	4.4	8.8	23.0	32.3	43.7
MODELED RELEASE (CFS)	0.9	2.8	8.7	21.9	32.2	43.6
STORIED VOLUME (AC-FT)	4.2	4.3	4.7	5.4	6.2	6.9

FSD-65						
STORM EVENT (YR)	2	5	10	25	50	100
PEAK INFLOW (CFS)	38.6	48.4	60.7	75.4	87.7	99.9

	FSD-65				
	1	2	3	4	5
ALUMINUM RELEASE (PPS)	0.0	0.2	0.4	4.2	8.7
MODERED RELEASE (PPS)	0.0	0.2	0.5	2.2	5.1
STORING VOLUME (AC-FI)	3.0	3.7	4.4	4.8	5.3
PEAK INLET (G/S)	141.6	189.4	252.5	351.4	467.5
STEADY-STATE (G/S)	0.2	1.9	3.2	57.3	72.6
ALUMINUM RELEASE (PPS)	0.2	1.9	3.2	38.4	47.5
MODERED RELEASE (PPS)	0.2	0.9	3.2	17.3	22.3
STORING VOLUME (AC-FI)	0.2	0.9	3.2	6.7	7.3

PNO-ET	2	5	10	25	50	100
STORM EVENT (YR)	46	75.4	121.2	266.2	492.4	548.0
PEAK INFL. (MGD)	2.5	35.3	71.5	108.3	152.1	196.4
MODELED RELEASE (CS)	1.0	1.8	4.6	10.5	17.9	28.0
STOR'D VOLUME (AC-FT)						

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

October 2021