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

Prepared For:

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Project No. 25188.00

See comment letter also

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J·R ENGINEERING

ENGINEER'S STATEMENT:

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

COLORADO LICENSED PROFESSIONAL ENGINEER
MIKE BRAMLETT
MB
32314
1/31/22

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: MANAGER

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

El Paso County:

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

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

Date

Conditions:

Table of Contents

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

The Sand Creek DBPS assumed the Homestead North at Sterling Ranch property to have a "large lot residential" use for the majority of the site. However, the proposed Sterling Ranch master plan is a mix of; school, multi-family, single-family, and commercial land uses, resulting in higher runoff. The site generally drains from north to south consisting of rolling hills. Currently, the site is used as pasture land for cattle. Sand Creek is located in the east portion of the site running north to south. This reach of drainage conveyance is not currently improved. There are a few stock ponds within the creek channel used for cattle watering. Currently, 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 14.68 Acre-ft, as shown in Tables 2.1-2.3 of this report. The total runoff released from the detention ponds is 232.3 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 (Q5 = 1.1 cfs, Q100 = 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 (Q5 = 28.1 cfs, Q100 = 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 (Q5 = 2.2 cfs, Q100 = 13.7 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 (Q5 = 9.9 cfs, Q100 = 72.3 cfs) is 70.9 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 (Q5 = 3.4 cfs, Q100 = 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 (Q5 = 17.7 cfs, Q100 = 130.0 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 (Q5 = 7.5, Q100 = 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 (Q5 = 8.9 cfs, Q100 = 61.0 cfs) is 45.2 acres of undeveloped land covered in native prairie grass at DP 1h.

Basin H2 (Q5 = 3.5 cfs, Q100 = 26.0 cfs) is 16.1 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.

Basin H3 (Q5 = 5.9 cfs, Q100 = 40.8 cfs) is 28.4 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 (Q5 = 3.6 cfs, Q100 = 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 at design point 1.

Basin C-2 (Q5 = 0.6 cfs, Q100 = 4.3 cfs) is 2% impervious and is 2.67 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 (Q5 = 13.3 cfs, Q100 = 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 (Q5 = 1.1 cfs, Q100 = 7.3 cfs) is an offsite basin that is 3.6 % impervious and 5.51 Acres. This basin diverts offsite runoff away from the lots to the Sand Creek drainage way.

O-S2 (Q5 = 28.1 cfs, Q100 = 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/ sheet drains over Vollmer Road in the existing condition and outfalls into the temporary swale that diverts the runoff around the site and into the sand creek tributary.

O-S3 (Q5 = 0.9 cfs, Q100 = 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 (Q5 = 12.4 cfs, Q100 = 91.3 cfs**)** is an offsite basin that is 2% impervious, the area is 67.77 Acres. This basin drains to a temporary 42" RCP pipe under the earth work for future Briargate Road and then this runoff ultimately goes to temporary sediment basin number 2.

O-S5 (Q5 = 1.2 cfs, Q100 = 8.9 cfs) is an offsite basin that is 2% impervious; the basin has an area of 6.18 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 (Q5 = 7.1 cfs, Q100 = 52.1 cfs) is an offsite basin that is 2% impervious; the basin has an area of 35.25 acres. The runoff drains to a temporary drainage ditch that goes to a 24” RCP in confluence with runoff from basin O-S7 and is piped under the earthwork for future Briargate Road and then the runoff goes to temporary sediment basin number 2.

OS-7 (Q5 = 3.5 cfs, Q100 = 25.5 cfs) is an offsite basin that is 2% impervious; the basin has an area of 17.36 acres**.** The runoff drains to a temporary drainage ditch that goes to a 24” RCP in confluence with runoff from basin O-S6 and is piped under the earthwork for future Briargate Road and then the runoff goes to temporary sediment basin number 2.

Basin D (Q5 =2.3 cfs, Q100 = 16.8 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 3.94 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}=16.2 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 30.26 Acres, the net percent impervious area of pond A is 46.5%. 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	6.55	2.405	33.0

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 39% 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 1.28 acres and 60% 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 2.30 acres and 55% percent impervious is comprised of single-family lots, local road and a Cul de Sac. Runoff (Q_5=5.1 cfs, Q_{100}=10.7 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 1.65 acres and 15% percent impervious is comprised of pond B. Runoff (Q_5=0.9 cfs, Q_{100}=3.7 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 27.86 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	4.34	1.701	3.4
100 Year	5.09	3.019	25.4

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% 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 59% percent impervious is comprised of a local road Texas Jack Drive and single-family lots. Runoff (Q_5=5.9 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}=1.0 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. An overflow path 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 224.42 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	3.32	1.288	0.7
5 Year	6.22	4.310	20.6
100 Year	9.94	9.263	173.9

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 1.83 acres and is 39% impervious. Basin D1 consists of the northwest portion of Vollmer road (Rural Cross Section). Runoff from basin D1 (Q_5=241 cfs, Q_{100}=6.0cfs) 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% impervious. Basin D2 consists of the northeast portion of Vollmer road (Rural Cross Section). Runoff from basin D2 (Q_5=2.5 cfs, Q_{100}=6.1 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 OS1and basin D1 into the Vollmer storm sewer system.

Basin D3 has a tributary area of 0.18 acres and is 68% impervious. Basin D3 (Q_5=0.6 cfs, Q_{100}=1.2 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 0.19 acres and is 57% 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=2.5cfs, 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 0.75 Acres and is 79% impervious. Basin D7 (Q_5=2.8 cfs, Q_{100}=5.4 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 0.72 Acres and is 69% impervious. Basin D8 (Q_5=2.4 cfs, Q_{100}=4.8 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 will the current condition.

Basin OS1 has a tributary area of 2.85 Acres and is 2% 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 D inlet at DP o1, 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% impervious. The runoff from the basin (Q_5=27.1 cfs, Q_{100}=190.9 cfs) drains into a local depression at DP 2o near the northwest portion of Vollmer road to a 6' MH w/ an overflow grate. The runoff from the basin is piped within Vollmer Road and outfalls directly into Sand Creek.

Basin OS3 has a tributary area of 11.99 Acres is 2.0 % impervious. The runoff from this basin (Q_5=1.7 cfs, Q_{100}=12.6 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 the proposed detention and water quality pond(s). Sump and on-grade inlets were sized using UDFCD UD-Inlet v2.07. Manning's equation was used to size storm pipes in the proposed condition at pipe junctions, as shown in Appendix C. "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.

Include discussion on proposed/interim swales.

The Sand Creek improvements adjacent to the Sterling Ranch Homestead North are being designed in a separate report, The Final Design Report for Sand Creek Restoration by JR Engineering, October 2021. The general concept of the channel design is to design a low maintenance, high performance channel with a meandering bankfull channel. The design will cut in a new bankfull section offset to the east from the existing thalweg, grade up to the existing thalweg so that it can remain hydraulically connected to the new thalweg, and then extend a 1% flood terrace to the east between 80 and 120 ft. depending on shear stresses and velocities. The purpose of trying to keep the existing channel hydraulically connected to the new thalweg is to maintain as many existing wetlands as possible and satisfy the ACOE. The previous design in the Kiowa DBPS made no attempt to preserve wetlands in order to satisfy the County's design criteria, and was rejected by the ACOE. While the County's criteria are certainly a determining factor, we consider the need to satisfy the ACOE the highest priority, because without their approval JR won't be granted a 404 permit. The County review of the previous design by the Kiowa DBPS states that the maximum stable longitudinal slope of the channel is 0.17%. Using this longitudinal slope will require the use of at least 10 and possibly 15 GSB drop structures. This channel slope will also ensure the destruction of more wetlands by taking the existing ones offline due to large changes in elevation. JR Engineering's intent to prove that a steeper slope can remain stable long term, thus allowing us to preserve more wetlands and appease the ACOE, a work map for The Final Design Report for Sand Creek Restoration by JR Engineering has been provided for information in Appendix E.

DRAINAGE FACILITY DESIGN

FOUR STEP PROCESS TO MINIMIZE ADVERSE IMPACTS OF URBANIZATION

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

Step 1 – Reducing Runoff Volumes: The Homestead North at Sterling Ranch development project consists single -family homes with open spaces and lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. Roof drains from the structures will discharge to lawn areas, where feasible, to allow for infiltration and runoff volume reduction.

Step 2 – Stabilize Drainageways: The site lies within the Sand Creek Drainage Basin. Basin and bridge fees will be due at time of platting. These funds will be used for the channel stabilization being designed by 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):

Do you want to state that construction of the adjacent channel and bridge is anticipated to offset fees?

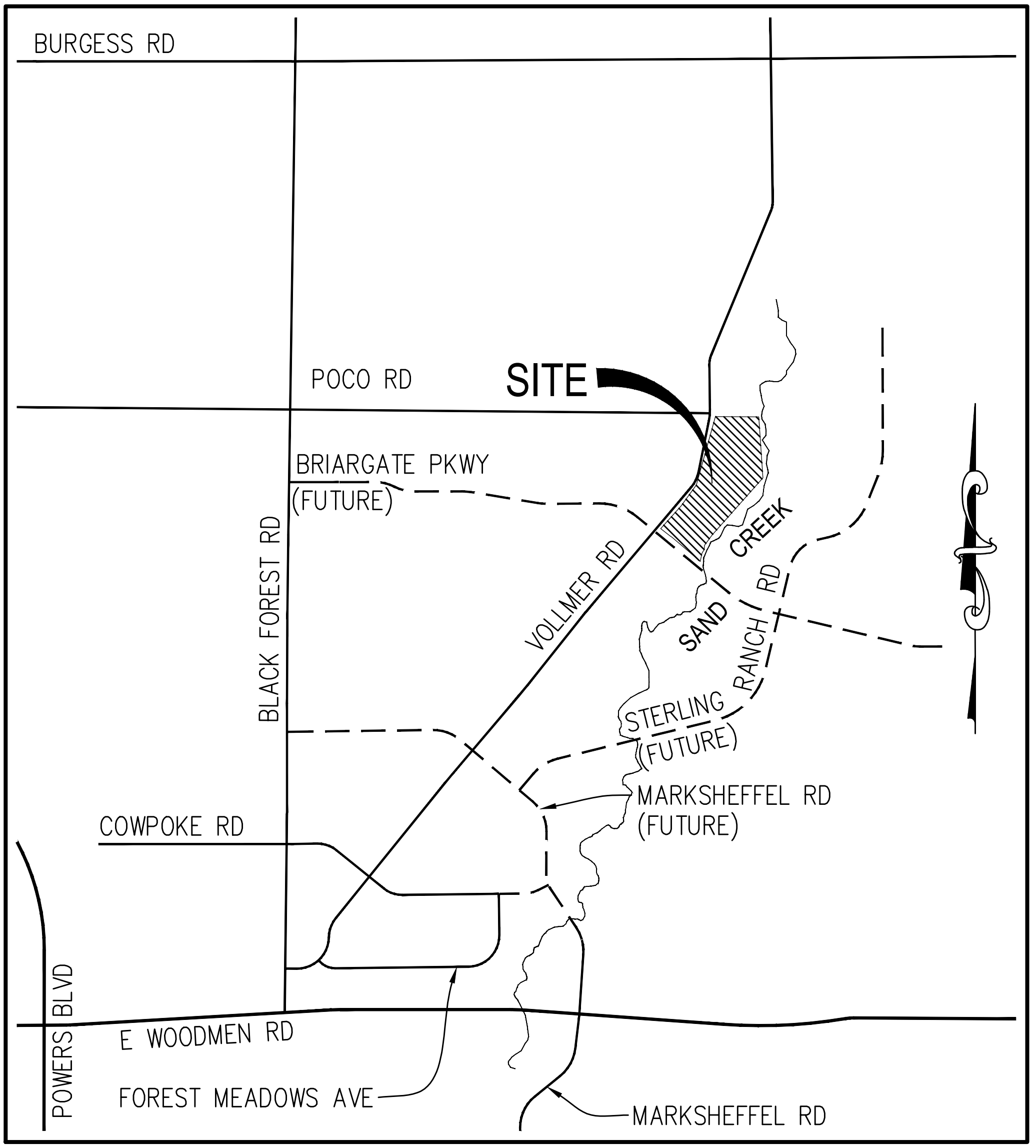
SUMMARY

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 Drainage Basin Planning Study, Stantec, January 2021
8. Sand Creek Channel Design Report JR Engineering, October 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

X:\2510000.all\2518800\Drawings\Working Dwgs\Andrew Joyce\Vicinity Map.dwg, 8.5x11 Portrait, 4/20/2020 4:54:43 PM, FC

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

Meters: 0, 50, 100, 200, 300

Feet: 0, 250, 500, 1000, 1500

N

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

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

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

Hydrologic Soil Group

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

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

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

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

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

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

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

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

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

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

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

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

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

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

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

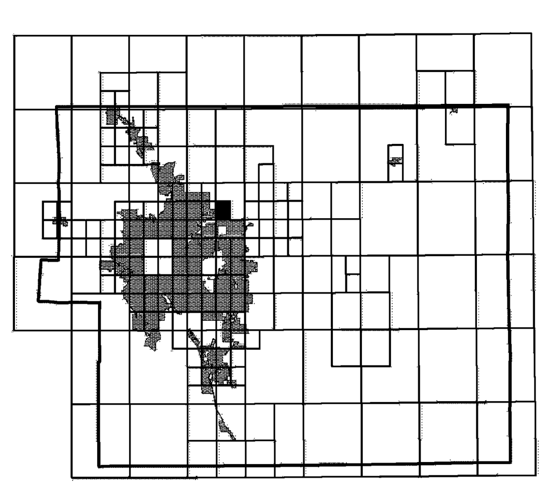
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

El Paso County Vertical Datum Offset Table

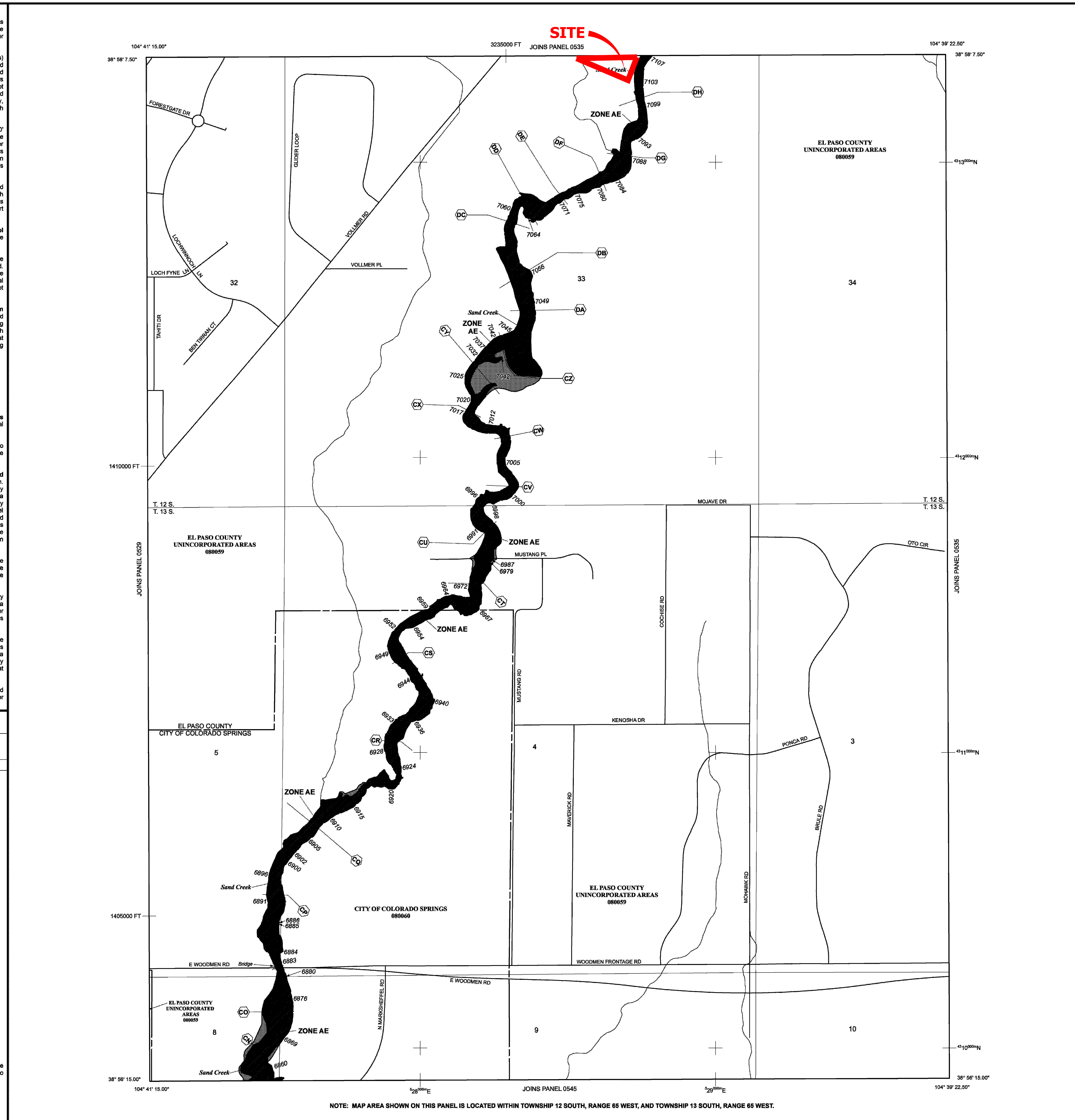
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

A — A	Cross section line
23 ------- 23	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

PANEL 0533G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 533 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

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

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

MAP NUMBER 08041C0533G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

NOTES TO USERS

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

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

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

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

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

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

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

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

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

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

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

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

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

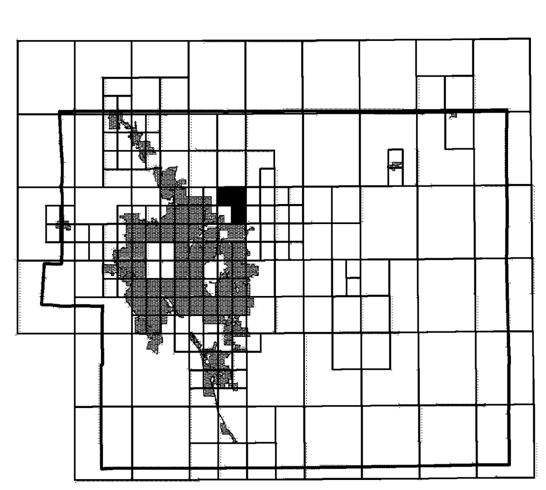
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

El Paso County Vertical Datum Offset Table

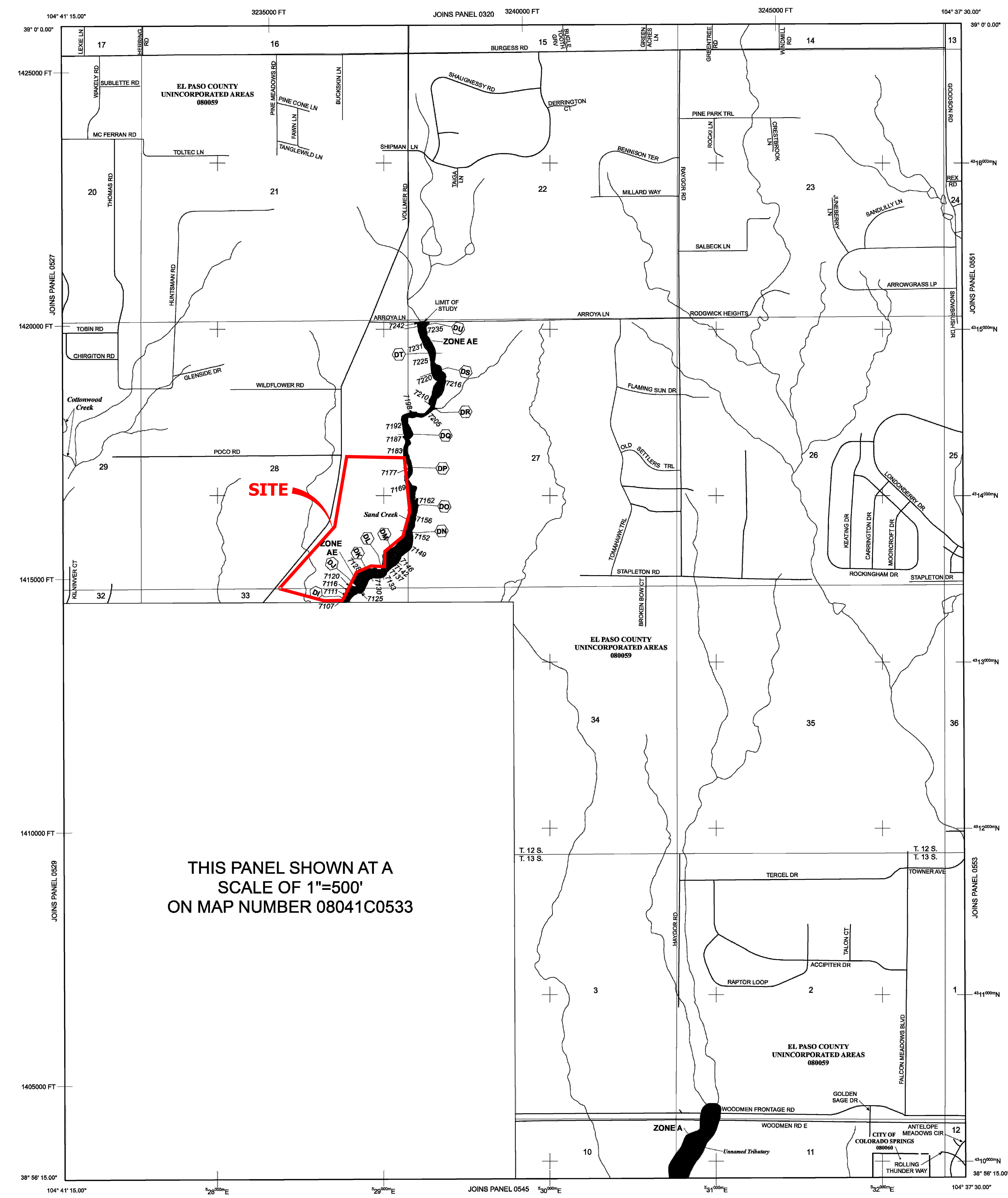
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



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

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

- (A)—(A) Cross section line
- (23)----(23) Transect line
- 97° 07' 30.00" / 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275000mN 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 6000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)
- • M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

PANEL 0535G

NATIONAL FLOOD INSURANCE PROGRAM

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

PANEL 535 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

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

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

MAP NUMBER
08041C0535G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

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: 1/4/22

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}	
E-1	4.50	0.90	0.96	0.31	6.8%	0.45	0.59	0.00	0.0%	0.08	0.35	4.19	1.9%	0.14	0.39	8.7%
E-2	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%
E-3	12.39	0.90	0.96	0.31	2.5%	0.45	0.59	0.00	0.0%	0.08	0.35	12.08	2.0%	0.10	0.37	4.4%
E-4	70.90	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	70.90	2.0%	0.08	0.35	2.0%
E-5	18.80	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	18.80	2.0%	0.08	0.35	2.0%
E6.1	124.90	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	124.90	2.0%	0.08	0.35	2.0%
E6.2	49.61	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	49.61	2.0%	0.08	0.35	2.0%
H1	45.20	0.90	0.96	0.38	0.8%	0.45	0.59	0.00	0.0%	0.08	0.35	44.82	2.0%	0.09	0.36	2.8%
H2	16.10	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	16.10	2.0%	0.08	0.35	2.0%
H3	28.40	0.90	0.96	0.22	0.8%	0.45	0.59	0.00	0.0%	0.08	0.35	28.18	2.0%	0.09	0.35	2.7%

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: 1/4/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
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	70.90	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	124.90	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	45.20	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	16.10	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	28.40	B	3%	0.09	0.35	150	1.4%	20.3	645	1.9%	7.0	1.0	11.1	31.3	795.0	33.8	31.3

NOTES:

$$t_c = t_i + t_t$$

Equation 6-2

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

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

Equation 6-3

Where:

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

Table 6-2. NRCS Conveyance factors, K

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

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

Equation 6-4

Where:

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

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

Equation 6-5

Where:

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

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: 1/4/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)

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

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/4/22

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

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	*I* (in/hr)	Q (cfs)	*tc* (min)	C*A (ac)	*I* (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1o	E-1	4.50	0.14	48.7	0.61	1.76	1.1															
	1h	H1	45.20	0.09	34.7	3.92	2.26	8.9	48.7	4.53	1.76	8.0											Drains to swale H1 and E1
	2h	H2	16.10	0.08	25.1	1.29	2.75	3.5	48.7	5.82	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	28.40	0.09	31.3	2.45	2.42	5.9	47.4	18.07	1.80	32.5											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	70.90	0.08	49.0	5.67	1.75	9.9															
	5o	E-5	18.80	0.08	34.9	1.50	2.26	3.4	49.0	7.17	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	124.90	0.08	48.1	9.99	1.77	17.7	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)

Project Name: Homestead North
Subdivision: Existing Conditions Homestead Fil. 3
Project No.: 25188.00
Location: El Paso County
Calculated By: ARJ
Design Storm: 5-Year
Checked By:
Date: 1/4/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	*I* (in/hr)	Q (cfs)	*tc* (min)	C*A (ac)	*I* (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	

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)

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/4/22

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

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	*I* (in/hr)	Q (cfs)	*tc* (min)	C*A (ac)	*I* (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1o	E-1	4.50	0.39	48.7	1.76	2.94	5.2															
	1h	H1	45.20	0.36	34.7	16.05	3.80	61.0	48.7	17.81	2.94	52.4											Drains to swale H1 and E1
	2h	H2	16.10	0.35	25.1	5.64	4.61	26.0	48.7	23.45	2.94	69.0											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	28.40	0.35	31.3	10.07	4.05	40.8	47.4	74.07	3.01	223.2											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	70.90	0.35	49.0	24.82	2.93	72.7															
	5o	E-5	18.80	0.35	34.9	6.58	3.78	24.9	49.0	31.40	2.93	92.0											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	124.90	0.35	48.1	43.72	2.97	130.0	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 Condition
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/4/21

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	2.67	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	2.67	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	5.51	0.90	0.96	0.09	1.6%	0.45	0.59	0.00	0.0%	0.08	0.35	5.42	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	67.77	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	67.77	2.0%	0.08	0.35	2.0%
O-S5	6.18	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	6.18	2.0%	0.08	0.35	2.0%
O-S6	35.25	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	35.25	2.0%	0.08	0.35	2.0%
O-S7	17.36	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	17.36	2.0%	0.08	0.35	2.0%

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Homestead Fil. 3 - Interim Condition
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/4/21

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					t_c CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
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	2.0%	8.0	6925	14.0%	7.0	2.6	44.1	52.1	6955.0	58.9	52.1
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	5.51	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	67.77	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	6.18	B	2%	0.08	0.35	300	1.5%	27.9	400	2.0%	7.0	1.0	6.7	34.6	700.0	30.7	30.7
O-S6	35.25	B	2%	0.08	0.35	300	2.0%	25.4	1700	2.9%	7.0	7.2	3.9	29.3	2000.0	43.6	29.3
O-S7	17.36	B	2%	0.08	0.35	300	2.0%	25.4	2053	2.4%	7.0	8.2	4.2	29.5	2353.0	49.5	29.5

NOTES:

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

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

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

Where:

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

Table 6-2. NRCS Conveyance factors, K

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

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

Where:

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

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

Where:

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

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-2
TIME OF CONCENTRATION

Subdivision: Homestead Fil. 3 - Interim Condition
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/4/21

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)

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

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

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

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/4/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	*I* (in/hr)	Q (cfs)	*tc* (min)	C*A (ac)	*I* (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	2.1	O-S2	180.30	0.09	47.4	15.62	1.80	28.1															
	2.2	O-S3	1.16	0.21	14.0	0.25	3.63	0.9	47.4	15.87	1.80	28.5											Tributary Basins: O-S2 and O-S3 Drains to swale
	2.3	C-2	2.67	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	5.51	0.09	36.5	0.51	2.19	1.1															To sand creek
	4	O-S4	67.77	0.08	34.0	5.42	2.29	12.4															Runoff conveyed from 42" RCP under interim grading
	5	O-S5	6.18	0.08	30.7	0.49	2.44	1.2															Runoff conveyed from 24" RCP under interim grading
	6.1	O-S6	35.25	0.08	29.3	2.82	2.52	7.1															Runoff conveyed from basin OS-6
	6.2	O-S7	17.36	0.08	29.5	1.39	2.50	3.5															Runoff conveyed from 24" RCP under interim grading. Basins OS-6 and OS-7
	7	OS	124.20	0.08	64.5	9.94	1.33	13.3	64.5	20.06	1.33	26.7											Runoff from basins OS, OS-4-OS-6
	8	D	17.29	0.08	52.1	1.38	1.65	2.3															Runoff from basin D
	0								64.5	21.44	1.33	28.6											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)

Project Name: Homestead North
Subdivision: Homestead Fil. 3 - Interim Condition
Project No.: 25188.00
Location: El Paso County
Calculated By: ARJ
Design Storm: 5-Year
Checked By:
Date: 1/4/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	*I* (in/hr)	Q (cfs)	tc (min)	C*A (ac)	*I* (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/4/21

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

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	2.1	O-S2	180.30	0.35	47.4	64.00	3.01	192.9															
	2.2	O-S3	1.16	0.45	14.0	0.52	6.09	3.2	47.4	64.52	3.01	194.5											Tributary Basins: O-S2 and O-S3 Drains to swale
	2.3	C-2	2.67	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	5.51	0.36	36.5	1.98	3.67	7.3															To sand creek
	4	O-S4	67.77	0.35	34.0	23.72	3.85	91.3															Runoff conveyed from 42" RCP under interim grading
	5	O-S5	6.18	0.35	30.7	2.16	4.10	8.9															Runoff conveyed from 24" RCP under interim grading
	6.1	O-S6	35.25	0.35	29.3	12.34	4.22	52.1															Runoff conveyed from basin OS-6
	6.2	O-S7	17.36	0.35	29.5	6.08	4.20	25.5	29.5	18.42	4.20	77.4											Runoff conveyed from 24" RCP under interim grading. Basins OS-6 and OS-7
	7	OS	124.20	0.35	64.5	43.47	2.24	97.2	64.5	87.77	2.24	196.2											Runoff from basins OS, OS-4-OS-6
	8	D	17.29	0.35	52.1	6.05	2.77	16.8															Runoff from basin D
	0								64.5	95.80	2.24	214.2											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: Homestead North - Proposed Conditions
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/6/22

Basin ID	Total Area (ac)	Streets/Paved (100% Impervious)				Residential (45%-65% Impervious)				Lawns (2% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
A1	3.67	0.90	0.96	0.82	22.4%	0.45	0.59	2.41	29.5%	0.08	0.35	0.44	0.2%	0.51	0.64	52.2%
A2	3.27	0.90	0.96	0.84	25.6%	0.45	0.59	2.19	30.1%	0.08	0.35	0.24	0.1%	0.54	0.67	55.9%
A3	4.79	0.90	0.96	0.79	16.4%	0.45	0.59	3.56	33.4%	0.08	0.35	0.45	0.2%	0.49	0.63	50.0%
A4	3.95	0.90	0.96	0.77	19.6%	0.45	0.59	2.99	34.1%	0.08	0.35	0.18	0.1%	0.52	0.65	53.8%
A5	5.43	0.90	0.96	0.67	12.4%	0.45	0.59	4.47	37.0%	0.08	0.35	0.29	0.1%	0.49	0.62	49.5%
A6	3.94	0.90	0.96	0.67	17.1%	0.45	0.59	3.17	36.2%	0.08	0.35	0.09	0.0%	0.52	0.65	53.4%
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	30.26															46.5%
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	1.28	0.90	0.96	0.38	29.9%	0.45	0.59	0.84	29.5%	0.08	0.35	0.06	0.1%	0.57	0.69	59.6%
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	27.86															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	0.54	0.2%	0.49	0.63	65.4%
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	0.75	0.90	0.96	0.59	78.5%	0.45	0.59	0.00	0.0%	0.08	0.35	0.16	0.4%	0.72	0.83	78.9%
D8	0.72	0.90	0.96	0.49	68.5%	0.45	0.59	0.00	0.0%	0.08	0.35	0.23	0.6%	0.64	0.77	69.1%
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	224.42															10.3%

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Homestead North - Proposed Conditions
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/6/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
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	3.94	B	53%	0.52	0.65	230	4.5%	9.7	435	1.6%	20.0	2.6	2.8	12.5	665.0	20.4	12.5
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	1.28	B	60%	0.57	0.69	50	1.0%	6.8	315	1.5%	20.0	2.4	2.1	8.9	365.0	18.3	8.9
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 North - Proposed Conditions
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
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Date: 1/6/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
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	0.75	B	79%	0.72	0.83	15	2.0%	2.1	550	2.0%	20.0	4.2	2.2	4.3	565.0	15.8	5.0
D8	0.72	B	69%	0.64	0.77	15	2.0%	2.6	550	2.0%	20.0	5.2	1.8	4.3	565.0	17.7	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).

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

Equation 6-3

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

Where:

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

Equation 6-4

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

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).

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

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

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Homestead North - Proposed Conditions
Location: El Paso County
Design Storm: 5-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/6/22

STREET		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	*I* (in/hr)	Q (cfs)	tc (min)	C*A (ac)	*I* (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	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
	1.1								13.8	3.56	3.64	13.0							24				Piped runoff Tributary Basins A1 and A2
	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
	1.2								15.5	6.93	3.47	24.1							36				Piped runoff Tributary Basins A1, A2, A3 and A4
	6a	A6	3.94	0.52	12.5	2.04	3.79	7.7	15.5	3.08	3.47	10.7											Street Flow
	1.3								16.5	13.08	3.38	44.2							48				Piped runoff Tributary Basins A1, A2, A3 ,A4, A5 ,A6, A7
	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
	1.4								16.5	13.31	3.38	45.0							48				Piped runoff Tributary Basins A1, A2, A3 ,A4, A5 ,A6, A7 and A8
	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
	2.1								14.5	2.44	3.58	8.7							24				Piped runoff Tributary Basins B1.1 and B1.2
	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	2.4											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

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Homestead North - Proposed Conditions
Location: El Paso County
Design Storm: 5-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/6/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	*I* (in/hr)	Q (cfs)	tc (min)	C*A (ac)	*I* (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	5b	B5	1.75	0.55	7.8	0.96	4.51	4.3															Street flow
	7b	B7	1.28	0.57	8.9	0.73	4.30	3.1	8.9	1.69	4.30	7.3	0.1	0.05	1.6					340	2.5	2.2	On-grade Type R Inlet, Bypass to DP 8B
	2.2								11.3	4.13	3.94	16.3							24				Piped runoff Tributary Basins B4 and B5
	2.3								14.5	6.57	3.58	23.5							24				Piped runoff Tributary Basins B1.1, B1.2, B4 and B5
	8b	B8	2.30	0.53	9.6	1.22	4.19	5.1	11.2	1.27	3.96	5.0											Street Flow, Recives bypass flow from DP 7B
	2.4								14.5	9.94	3.58	35.6							36				Piped runoff Tributary Basins B1.1, B1.2,B3, B4, B5,B6,B7,and B9
	10b	B10	0.22	0.73	5.0	0.16	5.17	0.8	11.2	1.43	3.96	5.7											Sump inlet revices by-pass flow from 7b and runoff from 5b,8b, and 10b
	2.5								14.5	11.89	3.58	42.5							48				Piped runoff Tributary Basins B1.1, B1.2,B3, B4, B5,B6,B7,B8, B9, and B10
	11b	B11	1.65	0.16	16.7	0.26	3.36	0.9															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

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

Subdivision: Homestead North - Proposed Conditions
Location: El Paso County
Design Storm: 5-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/6/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	*I* (in/hr)	Q (cfs)	tc (min)	C*A (ac)	*I* (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	2.6								14.5	12.88	3.58	46.1											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
	3.1								12.6	1.73	3.78	6.5							18				Piped runoff Tributary Basins C4.2, and C2.1
	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
	3.2								13.1	2.12	3.72	7.9							18				Piped runoff Tributary Basins C1,C2.3 and C3.1
	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
	3.3								13.1	3.85	3.72	14.3							24				Piped runoff Tributary Basins C1, C2.3, and C3.1
	3.4								17.6	9.62	3.28	31.6							36				Piped runoff Tributary Basins C1, C2.3, C3.1, C4.2, and C2.1
	5C	C5	0.16	0.74	6.4	0.12	4.79	0.6	8.4	0.94	4.39	4.1											Sump Inlet
	3.5								17.6	10.56	3.28	34.7							36				Runoff into pond forebay
	6C	C6	2.48	0.22	6.8	0.54	4.71	2.5															Conluenced flow for Pond C
	3.6								13.1	11.13	3.72	41.4							36				Conluenced flow for Pond C for all of basin C
	1o	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							18				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
	1.2d								16.7	1.69	3.36	5.7							18				

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

Subdivision: Homestead North - Proposed Conditions
Location: El Paso County
Design Storm: 5-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/6/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	*I* (in/hr)	Q (cfs)	tc (min)	C*A (ac)	*I* (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	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							18				Tributary basin; D4 and D3 Runoff captured on on grade inlet
	1.4d								16.7	1.90	3.36	6.4							24				Tributary basins: D1-D4 and OS1 Runoff piped
	2o	OS2	179.61	0.08	47.4	15.11	1.79	27.1															Runoff captured in 6' mh w/ trash rack
	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							48				Tributary basins: 5D-6D and OS2 Runoff piped
	1.6d								47.4	18.18	1.79	32.6							60				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	0.72	0.64	5.0	0.46	5.17	2.4	47.6	1.42	1.79	2.5											Tributary basins: OS3 and D8 Runoff captured on ongrade inlet
	7d	D7	0.75	0.72	5.0	0.54	5.17	2.8															Runoff captured on ongrade inlet
	2.1d								47.6	1.96	1.79	3.5							60				Tributary basins: D7,D8 and OS1 Runoff piped
	1.7d								47.6	20.14	1.79	36.0							60				Tributary basins: 1D-4D and OS1, OS2 and OS3 Runoff piped to Pond C
	5								47.6	31.27	1.79	56.0											Total runoff into Pond C

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

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Homestead North - Proposed Conditions
Location: El Paso County
Design Storm: 100-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/6/22

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	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
	1.1								13.8	3.06	6.12	18.7							24				Piped runoff Tributary Basins A1 and A2
	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
	1.2								15.5	8.47	5.83	49.4							36				Piped runoff Tributary Basins A1, A2, A3 and A4
	6a	A6	3.94	0.65	12.5	2.55	6.37	16.2	15.5	3.17	5.83	18.5											Street Flow
	1.3								16.5	16.90	5.68	95.9							48				Piped runoff Tributary Basins A1, A2, A3 ,A4, A5 ,A6, A7
	8a	A8	0.46	0.66	5.0	0.30	8.68	2.6	16.0	3.47	5.75	19.9											Flow Confluences at sump inlet
	1.4								16.5	17.20	5.68	97.6							48				Piped runoff Tributary Basins A1, A2, A3 ,A4, A5 ,A6, A7 and A8
	9A	A9	2.78	0.43	13.4	1.20	6.20	7.4	16.5	18.40	5.68	104.4											Flows into Pond A. All of basin 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
	2.1								14.5	2.91	6.00	17.5							24				Piped runoff Tributary Basins B1.1 and B1.2
	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
																							Sump inlet Recives by-pass flows from (B1.1, B1.2 and B4)

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

Project Name: Homestead North
Subdivision: Homestead North - Proposed Conditions
Project No.: 25188.00
Location: El Paso County
Calculated By: ARJ
Design Storm: 100-Year
Checked By:
Date: 1/6/22

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	9b	B9	3.69	0.64	13.1	2.36	6.25	14.8	14.5	5.05	6.00	30.2946											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	1.28	0.69	8.9	0.88	7.22	6.4	8.9	2.06	7.22	14.9	3.2	0.44	1.6					340	2.5	2.2	On-grade Type R Inlet, Bypass to DP 8B
	2.2								11.3	4.97	6.62	32.9							24				Piped runoff Tributary Basins B4 and B5
	2.3								14.5	7.87	6.00	47.3							24				Piped runoff Tributary Basins B1.1, B1.2, B4 and B5
	8b	B8	2.30	0.66	9.6	1.52	7.03	10.7	11.2	1.96	6.65	13.1											Street Flow, Recives bypass flow from DP 7B
	2.4								14.5	12.92	6.00	77.6							36				Piped runoff Tributary Basins B1.1, B1.2,B3, B4, B5,B6,B7,and B9
	10b	B10	0.22	0.83	5.0	0.19	8.68	1.6	11.2	2.15	6.65	14.3											Sump inlet revices by-pass flow from 7b and runoff from 5b,8b, and 10b
	2.5								14.5	15.24	6.00	91.5							48				Piped runoff Tributary Basins B1.1, B1.2,B3, B4, B5,B6,B7,B8, B9, and B10
	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															
	2.6								14.5	17.09	6.00	102.6											Flow confluences into Pond B. All of Basin B
	1c	C1	2.82	0.65	13.1	1.82	6.25	11.4															
	2.3c	C2.3	0.83	0.68	10.1	0.56	6.91	3.9	13.1	2.38	6.25	14.9	3.6	0.58	1.6					185	2.5	1.2	On-Grade Type R Inlet, Street runoff from basin C1 and basin C2.3
	2.1C	C2.1	0.20	0.90	5.0	0.18	8.68	1.6					0.1	0.01	2.83					630	3.4	3.1	On-Grade Type R Inlet
	2.2C	C2.2	4.69	0.68	12.8	3.21	6.32	20.3	13.1	3.22	6.25	20.1											Runoff from basins 1c, 2.3c, 2.1c and 2.2c
	4.2c	C4.2	3.44	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
	3.1								12.6	1.85	6.35	11.7							18				Piped runoff Tributary Basins C4.2, and C2.1
	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
	3.2								13.1	2.01	6.25	12.6							18				Piped runoff Tributary Basins C1,C2.3 and C3.1
	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
	3.3								13.1	3.86	6.25	24.1							24				Piped runoff Tributary Basins C1, C2.3, and C3.1

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Homestead North - Proposed Conditions
Location: El Paso County
Design Storm: 100-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/6/22

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	3.4								17.6	11.49	5.51	63.3							36				Piped runoff Tributary Basins C1, C2.3, C3.1, C4.2, and C2.1
	5C	C5	0.16	0.84	6.4	0.13	8.04	1.0	8.4	1.20	7.37	8.8											Sump Inlet
	3.5								17.6	12.69	5.51	69.9							36				Runoff into pond forebay
	6C	C6	2.48	0.45	6.8	1.11	7.91	8.8	17.6														
	3.6								17.6	14.38	5.51	79.2											Conluenced flow for Pond C for all of basin C
	1o	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							18				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
	1.2d								16.7	3.13	5.64	17.7							18				
	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							18				Tributary basin; D4 and D3 Runoff captured on on grade inlet
	1.4d								16.7	3.40	5.64	19.2							24				Tributary basins: D1-D4 and OS1 Runoff piped
	2o	OS2	179.61	0.35	47.4	63.42	3.01	190.9															Runoff captured in 6' mh w/ trash rack
	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							48				Tributary basins: 5D-6D and OS2 Runoff piped
	1.6d								47.4	68.20	3.01	205.3							60				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	0.72	0.77	5.0	0.55	8.68	4.8	47.6	4.80	3.00	14.4	0.70	0.08	2.2								Tributary basins: OS3 and D8 Runoff captured on on grade inlet, by-pass flow goes down stream
	7d	D7	0.75	0.83	5.0	0.62	8.68	5.4	7.7	0.62	7.60	4.7											Runoff captured on ongrade inlet
	2.1d								47.6	5.37	3.00	16.1							24				Tributary basins: D7,D8 and OS1 Runoff piped
	1.7d								47.6	73.57	3.00	220.9							60				Tributary basins: 1D-4D and OS1, OS2 and OS3 Runoff piped to Pond C
	5								47.6	87.95	3.00	264.1											Total runoff into Pond C

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

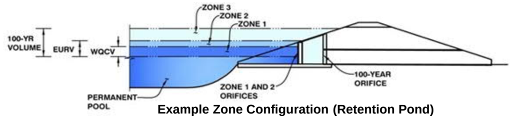
Appendix C
Hydraulic Calculations

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 =	30.26	acres		
Watershed Length =	1,963	ft		
Watershed Length to Centroid =	1,178	ft		
Watershed Slope =	0.030	ft/ft		
Watershed Imperviousness =	46.50%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths = User Input				

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.496	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.496	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.437	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.082	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.652	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.437	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	4.063	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.866	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	8.760	acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	1.120	acre-feet		
Approximate 5-yr Detention Volume =	1.544	acre-feet		
Approximate 10-yr Detention Volume =	2.070	acre-feet		
Approximate 25-yr Detention Volume =	2.280	acre-feet		
Approximate 50-yr Detention Volume =	2.386	acre-feet		
Approximate 100-yr Detention Volume =	2.687	acre-feet		

Define Zones and Basin Geometry

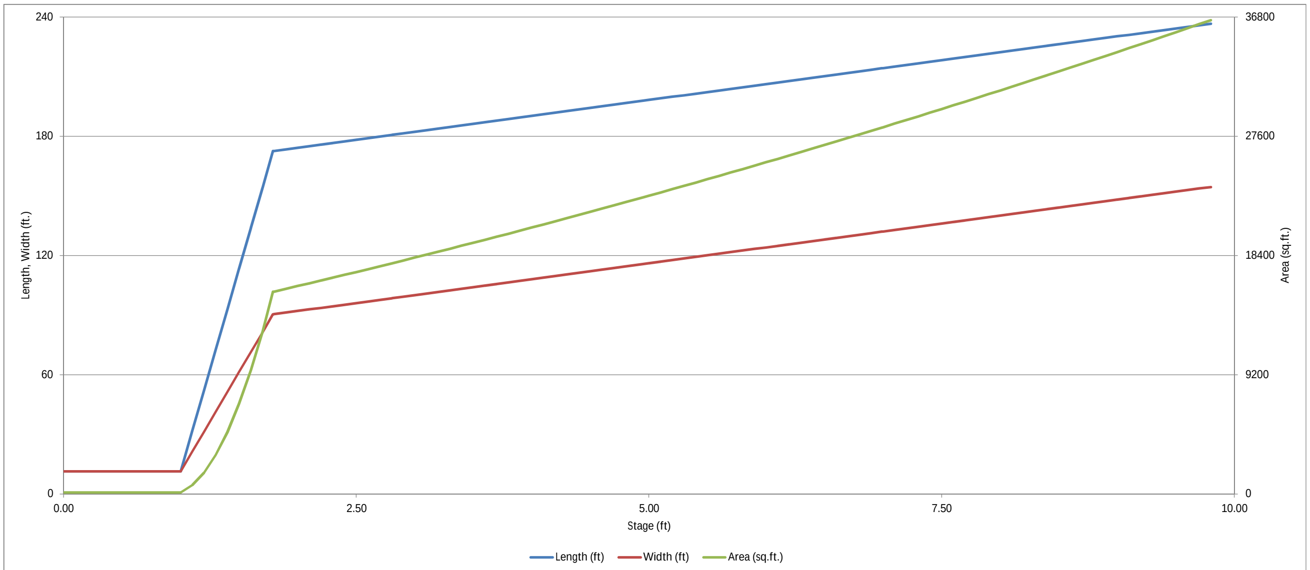
Zone 1 Volume (WQCV) =	0.496	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.999	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.191	acre-feet
Total Detention Basin Volume =	2.687	acre-feet
Initial Surcharge Volume (ISV) =	65	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (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}) =	172.6	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}) =	28,294	ft^2
Volume of Main Basin (V_{MAIN}) =	112,706	ft^3
Calculated Total Basin Volume (V_{total}) =	2.694	acre-feet

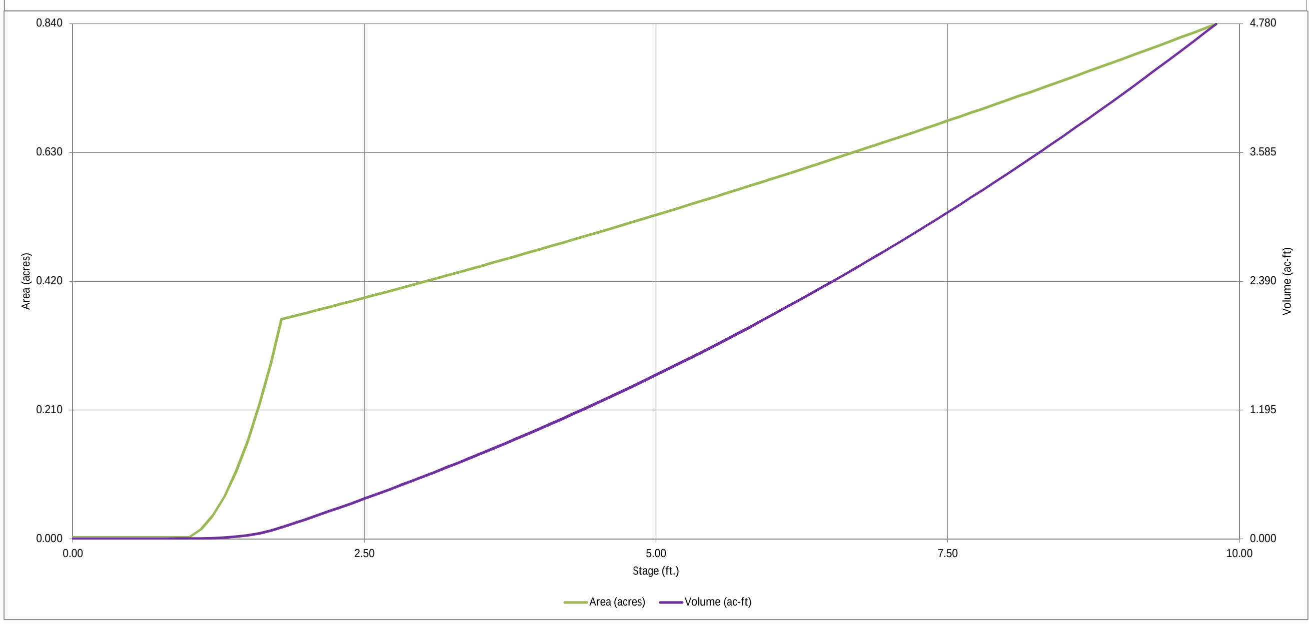
Depth Increment = 0.10 ft

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	3,005		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	1,478	0.034
	1.60		133.8	71.4	9,552		0.219	2,300	0.053
	1.70		154.2	81.4	12,550		0.288	3,401	0.078
Floor	1.79		172.6	90.4	15,597		0.358	4,666	0.107
	1.80		172.6	90.5	15,618		0.359	4,822	0.111
	1.90		173.4	91.3	15,829		0.363	6,394	0.147
	2.00		174.2	92.1	16,042		0.368	7,988	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	11,239	0.258
	2.30		176.6	94.5	16,687		0.383	12,896	0.296
	2.40		177.4	95.3	16,904		0.388	14,576	0.335
	2.50		178.2	96.1	17,123		0.393	16,277	0.374
	2.60		179.0	96.9	17,343		0.398	18,001	0.413
	2.70		179.8	97.7	17,564		0.403	19,746	0.453
	2.80		180.6	98.5	17,787		0.408	21,514	0.494
Zone 1 (WQCV)	2.81		180.7	98.6	17,809		0.409	21,692	0.498
	2.90		181.4	99.3	18,011		0.413	23,303	0.535
	3.00		182.2	100.1	18,236		0.419	25,116	0.577
	3.10		183.0	100.9	18,463		0.424	26,951	0.619
	3.20		183.8	101.7	18,690		0.429	28,808	0.661
	3.30		184.6	102.5	18,919		0.434	30,689	0.705
	3.40		185.4	103.3	19,150		0.440	32,592	0.748
	3.50		186.2	104.1	19,381		0.445	34,519	0.792
	3.60		187.0	104.9	19,614		0.450	36,469	0.837
	3.70		187.8	105.7	19,848		0.456	38,442	0.882
	3.80		188.6	106.5	20,084		0.461	40,438	0.928
	3.90		189.4	107.3	20,321		0.466	42,458	0.975
	4.00		190.2	108.1	20,559		0.472	44,502	1.022
	4.10		191.0	108.9	20,798		0.477	46,570	1.069
	4.20		191.8	109.7	21,038		0.483	48,662	1.117
	4.30		192.6	110.5	21,280		0.489	50,778	1.166
	4.40		193.4	111.3	21,523		0.494	52,918	1.215
	4.50		194.2	112.1	21,768		0.500	55,083	1.265
	4.60		195.0	112.9	22,013		0.505	57,272	1.315
	4.70		195.8	113.7	22,260		0.511	59,485	1.366
	4.80		196.6	114.5	22,509		0.517	61,724	1.417
	4.90		197.4	115.3	22,758		0.522	63,987	1.469
Zone 2 (EURV)	4.96		197.9	115.8	22,908		0.526	65,357	1.500
	5.00		198.2	116.1	23,009		0.528	66,276	1.521
	5.10		199.0	116.9	23,261		0.534	68,589	1.575
	5.20		199.8	117.7	23,514		0.540	70,928	1.628
	5.30		200.6	118.5	23,769		0.546	73,292	1.683
	5.40		201.4	119.3	24,025		0.552	75,682	1.737
	5.50		202.2	120.1	24,282		0.557	78,097	1.793
	5.60		203.0	120.9	24,541		0.563	80,538	1.849
	5.70		203.8	121.7	24,800		0.569	83,005	1.906
	5.80		204.6	122.5	25,061		0.575	85,498	1.963
	5.90		205.4	123.3	25,324		0.581	88,017	2.021
	6.00		206.2	124.1	25,587		0.587	90,563	2.079
	6.10		207.0	124.9	25,852		0.593	93,135	2.138
	6.20		207.8	125.7	26,118		0.600	95,734	2.198
	6.30		208.6	126.5	26,386		0.606	98,359	2.258
	6.40		209.4	127.3	26,655		0.612	101,011	2.319
	6.50		210.2	128.1	26,925		0.618	103,690	2.380
	6.60		211.0	128.9	27,196		0.624	106,396	2.443
	6.70		211.8	129.7	27,468		0.631	109,129	2.505
	6.80		212.6	130.5	27,742		0.637	111,889	2.569
	6.90		213.4	131.3	28,017		0.643	114,677	2.633
Zone 3 (100-year)	6.99		214.2	132.0	28,266		0.649	117,210	2.691
	7.00		214.2	132.1	28,294		0.650	117,493	2.697
	7.10		215.0	132.9	28,571		0.656	120,336	2.763
	7.20		215.8	133.7	28,850		0.662	123,207	2.828
	7.30		216.6	134.5	29,131		0.669	126,106	2.895
	7.40		217.4	135.3	29,412		0.675	129,033	2.962
	7.50		218.2	136.1	29,695		0.682	131,989	3.030
	7.60		219.0	136.9	29,979		0.688	134,973	3.099
	7.70		219.8	137.7	30,264		0.695	137,985	3.168
	7.80		220.6	138.5	30,551		0.701	141,025	3.237
	7.90		221.4	139.3	30,839		0.708	144,095	3.308
	8.00		222.2	140.1	31,128		0.715	147,193	3.379
	8.10		223.0	140.9	31,419		0.721	150,321	3.451
	8.20		223.8	141.7	31,710		0.728	153,477	3.523
	8.30		224.6	142.5	32,004		0.735	156,663	3.596
	8.40		225.4	143.3	32,298		0.741	159,878	3.670
	8.50		226.2	144.1	32,593		0.748	163,122	3.745
	8.60		227.0	144.9	32,890		0.755	166,397	3.820
	8.70		227.8	145.7	33,188		0.762	169,700	3.896
	8.80		228.6	146.5	33,488		0.769	173,034	3.972
	8.90		229.4	147.3	33,789		0.776	176,398	4.050
	9.00		230.2	148.1	34,091		0.783	179,792	4.127
	9.10		231.0	148.9	34,394		0.790	183,216	4.206
	9.20		231.8	149.7	34,698		0.797	186,671	4.285
	9.30		232.6	150.5	35,004		0.804	190,156	4.365
	9.40		233.4	151.3	35,311		0.811	193,672	4.446
	9.50		234.2	152.1	35,620		0.818	197,218	4.528
	9.60		235.0	152.9	35,930		0.825	200,796	4.610
	9.70		235.8	153.7	36,240		0.832	204,404	4.692
	9.80		236.6	154.5	36,553		0.839	208,044	4.776

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)



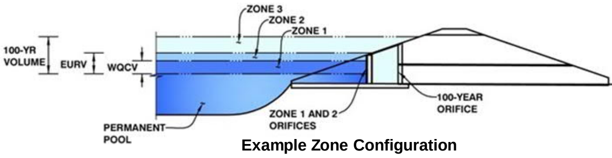


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond A



Example Zone Configuration

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
V)	2.81	0.496	
V)	4.96	0.999	
ar)	6.99	1.191	
Total (all zones)		2.687	

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

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =		ft (distance below the filtration media surface)	Underdrain Orifice Area =		ft^2
Underdrain Orifice Diameter =		inches	Underdrain Orifice Centroid =		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)

			Calculated Parameters for Plate		
Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.27	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

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)

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

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

	Not Selected	Not Selected		Calculated Parameters for Overflow Weir	Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.30	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.55	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.15	N/A	feet
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.82	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	19.33	N/A	ft^2
Overflow Grate Open Area % =	75%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	9.66	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

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

	Not Selected	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	2.83	N/A	ft^2
Circular Orifice Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.71	N/A	feet
	17.00			Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	7.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.91	feet
Spillway Crest Length =	23.00	feet	Stage at Top of Freeboard =	8.91	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.78	acres
Freeboard above Max Water Surface =	1.00	feet	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).

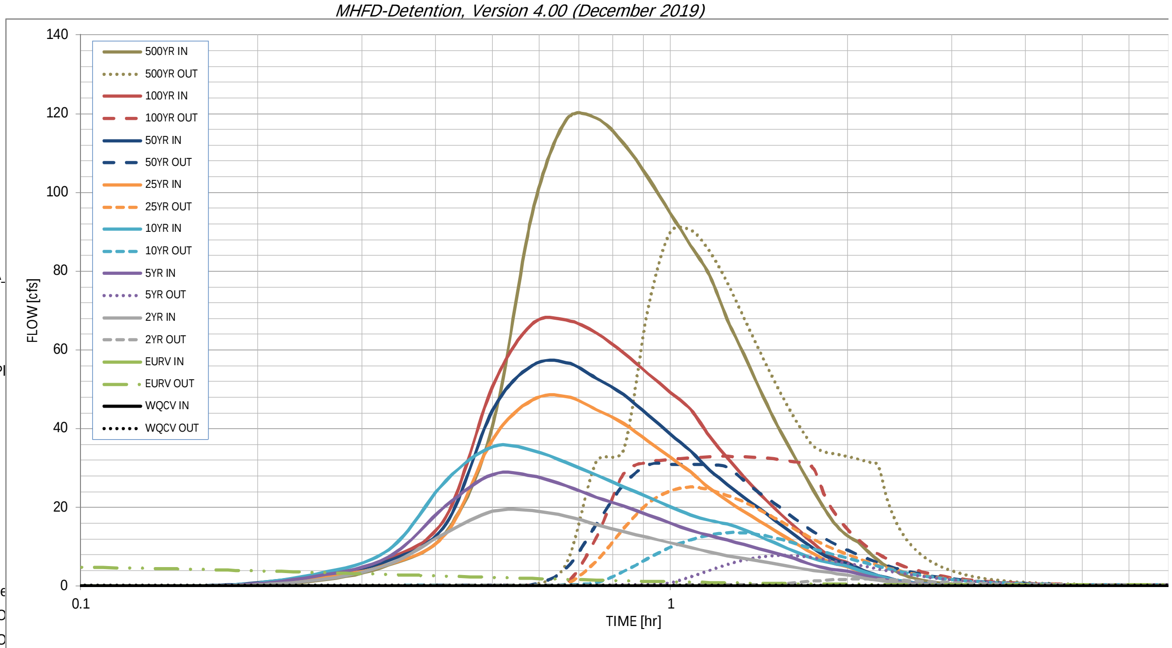
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
CUHP Runoff Volume (acre-ft) =	0.496	1.496	1.437	2.082	2.652	3.437	4.063	4.866	8.760
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.437	2.082	2.652	3.437	4.063	4.866	8.760
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	2.8	7.8	11.9	21.5	27.0	34.5	68.0
PTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.09	0.26	0.39	0.71	0.89	1.14	2.25
Peak Inflow Q (cfs) =	N/A	N/A	19.2	28.4	35.4	48.2	56.8	67.6	118.9
Peak Outflow Q (cfs) =	0.2	6.3	1.8	7.8	13.6	25.2	31.0	33.0	90.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	1.1	1.2	1.1	1.0	1.3
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.35	0.07	0.4	0.7	1.3	1.6	1.7	1.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	67	69	68	66	64	62	60	51
Time to Drain 99% of Inflow Volume (hours) =	41	71	73	73	72	71	70	69	66
Maximum Ponding Depth (ft) =	2.81	4.96	4.56	4.99	5.25	5.62	5.87	6.55	7.79
Area at Maximum Ponding Depth (acres) =	0.41	0.53	0.50	0.53	0.54	0.56	0.58	0.62	0.70
Maximum Volume Stored (acre-ft) =	0.498	1.500	1.295	1.516	1.650	1.860	2.003	2.405	3.230

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)

COUNTA_

WQ PI



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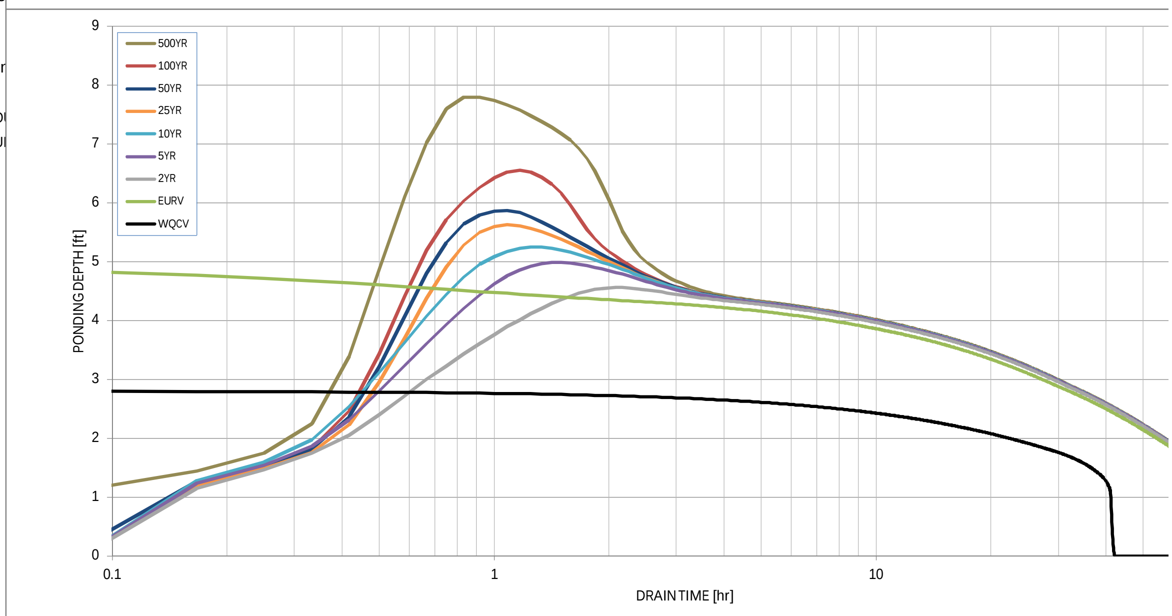
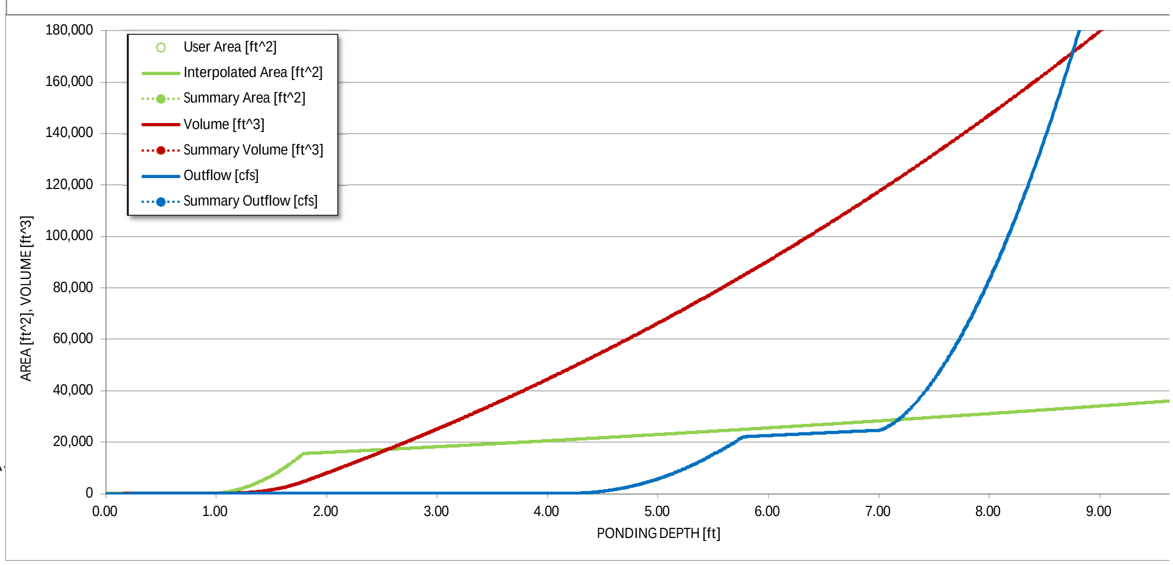


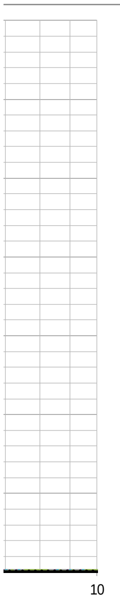
S-A-

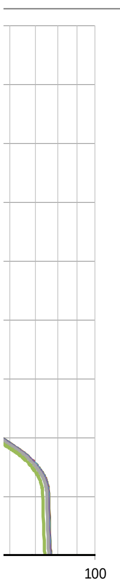


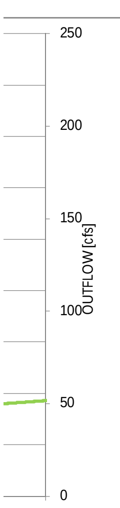
S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:







nflow Hydrographs

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

SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.02	1.31
0:15:00	0.00	0.00	1.51	2.48	3.07	2.06	2.60	2.52	5.34
0:20:00	0.00	0.00	5.58	7.43	9.27	5.55	6.50	6.93	13.75
0:25:00	0.00	0.00	13.53	20.41	26.80	13.34	15.83	17.66	40.70
0:30:00	0.00	0.00	19.02	28.37	35.40	37.26	44.67	50.71	94.45
0:35:00	0.00	0.00	19.19	28.01	34.50	47.24	56.03	66.57	118.47
0:40:00	0.00	0.00	17.78	25.48	31.43	48.20	56.82	67.57	118.86
0:45:00	0.00	0.00	15.66	22.59	28.23	44.84	52.80	64.29	112.55
0:50:00	0.00	0.00	13.86	20.33	25.25	41.35	48.65	59.28	103.88
0:55:00	0.00	0.00	12.38	18.13	22.65	36.89	43.52	53.99	94.82
1:00:00	0.00	0.00	11.03	16.05	20.26	32.72	38.68	49.26	86.57
1:05:00	0.00	0.00	9.85	14.18	18.11	29.00	34.35	44.90	78.88
1:10:00	0.00	0.00	8.67	12.86	16.71	24.81	29.44	38.06	67.71
1:15:00	0.00	0.00	7.76	11.75	15.77	21.73	25.88	32.60	58.88
1:20:00	0.00	0.00	7.03	10.61	14.40	18.98	22.60	27.75	50.23
1:25:00	0.00	0.00	6.38	9.54	12.69	16.60	19.74	23.55	42.53
1:30:00	0.00	0.00	5.75	8.54	11.07	14.26	16.90	19.94	35.89
1:35:00	0.00	0.00	5.13	7.57	9.55	12.09	14.27	16.63	29.84
1:40:00	0.00	0.00	4.53	6.41	8.17	10.08	11.85	13.59	24.30
1:45:00	0.00	0.00	4.00	5.34	6.97	8.23	9.63	10.82	19.29
1:50:00	0.00	0.00	3.63	4.58	6.16	6.63	7.72	8.48	15.28
1:55:00	0.00	0.00	3.18	4.14	5.60	5.58	6.49	6.94	12.75
2:00:00	0.00	0.00	2.83	3.80	5.07	4.95	5.75	5.99	11.14
2:05:00	0.00	0.00	2.31	3.11	4.14	3.95	4.58	4.67	8.74
2:10:00	0.00	0.00	1.85	2.47	3.29	3.05	3.54	3.52	6.62
2:15:00	0.00	0.00	1.47	1.95	2.60	2.37	2.74	2.65	4.98
2:20:00	0.00	0.00	1.16	1.54	2.03	1.83	2.11	1.97	3.70
2:25:00	0.00	0.00	0.91	1.20	1.57	1.41	1.62	1.47	2.76
2:30:00	0.00	0.00	0.71	0.93	1.20	1.08	1.23	1.12	2.09
2:35:00	0.00	0.00	0.56	0.71	0.90	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	0.40	0.53	0.48	0.54	0.51	0.94
2:50:00	0.00	0.00	0.24	0.30	0.39	0.36	0.41	0.38	0.71
2:55:00	0.00	0.00	0.17	0.21	0.28	0.26	0.30	0.28	0.51
3:00:00	0.00	0.00	0.11	0.14	0.19	0.18	0.20	0.19	0.34
3:05:00	0.00	0.00	0.07	0.09	0.11	0.11	0.13	0.12	0.21
3:10:00	0.00	0.00	0.03	0.05	0.06	0.06	0.07	0.06	0.11
3:15:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.02	0.04
3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

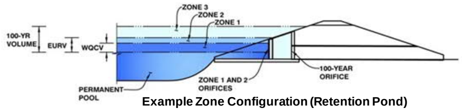
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond B



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	27.86	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.

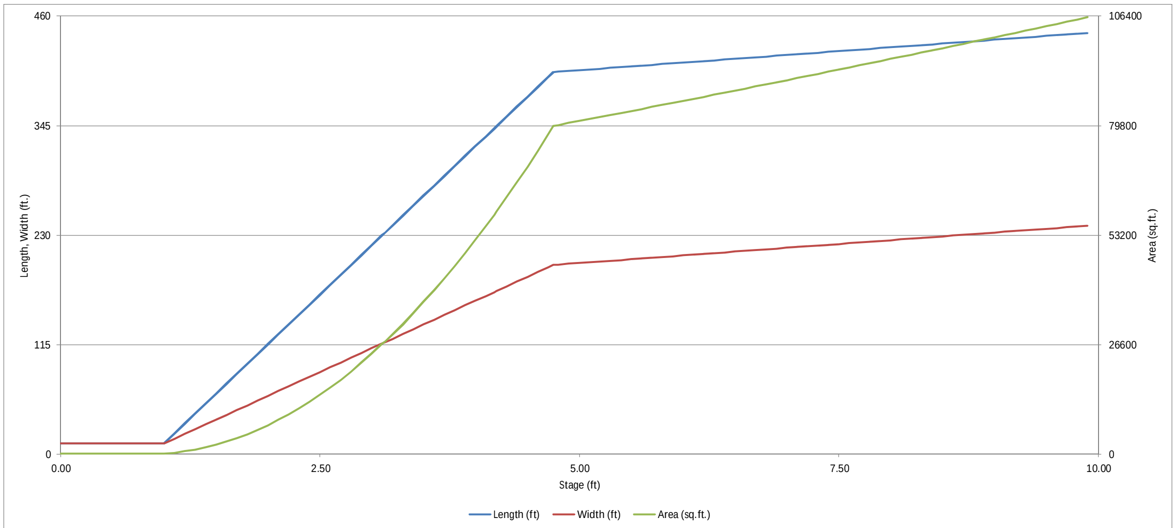
			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.479	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.489	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.408	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.012	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.543	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.255	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.834	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.566	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	8.151	acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	1.124	acre-feet		
Approximate 5-yr Detention Volume =	1.540	acre-feet		
Approximate 10-yr Detention Volume =	2.040	acre-feet		
Approximate 25-yr Detention Volume =	2.233	acre-feet		
Approximate 50-yr Detention Volume =	2.335	acre-feet		
Approximate 100-yr Detention Volume =	2.606	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.479	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.010	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	1.356	acre-feet
Total Detention Basin Volume =	2.845	acre-feet
Initial Surcharge Volume (ISV) =	63	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H_{total}) =	5.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.010	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	2	
Initial Surcharge Area (A_{ISV}) =	125	ft^2
Surcharge Volume Length (L_{ISV}) =	11.2	ft
Surcharge Volume Width (W_{ISV}) =	11.2	ft
Depth of Basin Floor (H_{FLOOR}) =	3.75	ft
Length of Basin Floor (L_{FLOOR}) =	401.2	ft
Width of Basin Floor (W_{FLOOR}) =	198.7	ft
Area of Basin Floor (A_{FLOOR}) =	79,711	ft^2
Volume of Basin Floor (V_{FLOOR}) =	103,743	ft^3
Depth of Main Basin (H_{MAIN}) =	0.25	ft
Length of Main Basin (L_{MAIN}) =	403.2	ft
Width of Main Basin (W_{MAIN}) =	200.7	ft
Area of Main Basin (A_{MAIN}) =	80,914	ft^2
Volume of Main Basin (V_{MAIN}) =	20,078	ft^3
Calculated Total Basin Volume (V_{total}) =	2.845	acre-feet

Depth Increement = 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	349		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	1,229	0.028
	1.80		94.4	51.2	4,831		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	8,312		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	12,729		0.292	6,745	0.155
	2.50		167.2	86.2	14,409		0.331	8,101	0.186
	2.60		177.6	91.2	16,194		0.372	9,630	0.221
	2.70		188.0	96.2	18,082		0.415	11,343	0.260
	2.80		198.4	101.2	20,074		0.461	13,250	0.304
	2.90		208.8	106.2	22,170		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	26,675		0.612	20,239	0.465
Zone 1 (WQCV)	3.13		232.7	117.7	27,387		0.629	21,050	0.483
	3.20		240.0	121.2	29,083		0.668	23,026	0.529
	3.30		250.4	126.2	31,596		0.725	26,059	0.598
	3.40		260.8	131.2	34,212		0.785	29,349	0.674
	3.50		271.2	136.2	36,932		0.848	32,905	0.755
	3.60		281.6	141.2	39,756		0.913	36,739	0.843
	3.70		292.0	146.2	42,685		0.980	40,860	0.938
	3.80		302.4	151.2	45,717		1.050	45,279	1.039
	3.90		312.8	156.2	48,853		1.122	50,007	1.148
	4.00		323.2	161.2	52,094		1.196	55,053	1.264
	4.10		333.6	166.2	55,438		1.273	60,429	1.387
Zone 2 (EURV)	4.18		341.9	170.2	58,188		1.336	64,974	1.492
	4.20		344.0	171.2	58,886		1.352	66,144	1.518
	4.30		354.4	176.2	62,438		1.433	72,210	1.658
	4.40		364.8	181.2	66,095		1.517	78,635	1.805
	4.50		375.2	186.2	69,855		1.604	85,432	1.961
	4.60		385.6	191.2	73,719		1.692	92,610	2.126
	4.70		396.0	196.2	77,688		1.783	100,179	2.300
Floor	4.75		401.2	198.7	79,711		1.830	104,114	2.390
	4.80		401.6	199.1	79,951		1.835	108,106	2.482
	4.90		402.4	199.9	80,432		1.846	116,125	2.666
Z3 (100+1/2WQCV	5.00		403.2	200.7	80,914		1.858	124,192	2.851
	5.10		404.0	201.5	81,398		1.869	132,308	3.037
	5.20		404.8	202.3	81,883		1.880	140,472	3.225
	5.30		405.6	203.1	82,369		1.891	148,684	3.413
	5.40		406.4	203.9	82,857		1.902	156,946	3.603
	5.50		407.2	204.7	83,346		1.913	165,256	3.794
	5.60		408.0	205.5	83,836		1.925	173,615	3.986
	5.70		408.8	206.3	84,327		1.936	182,023	4.179
	5.80		409.6	207.1	84,820		1.947	190,481	4.373
	5.90		410.4	207.9	85,314		1.959	198,987	4.568
	6.00		411.2	208.7	85,809		1.970	207,543	4.765
	6.10		412.0	209.5	86,306		1.981	216,149	4.962
	6.20		412.8	210.3	86,804		1.993	224,805	5.161
	6.30		413.6	211.1	87,303		2.004	233,510	5.361
	6.40		414.4	211.9	87,803		2.016	242,265	5.562
	6.50		415.2	212.7	88,305		2.027	251,071	5.764
	6.60		416.0	213.5	88,808		2.039	259,926	5.967
	6.70		416.8	214.3	89,312		2.050	268,832	6.172
	6.80		417.6	215.1	89,818		2.062	277,789	6.377
	6.90		418.4	215.9	90,324		2.074	286,796	6.584
	7.00		419.2	216.7	90,832		2.085	295,854	6.792
	7.10		420.0	217.5	91,342		2.097	304,962	7.001
	7.20		420.8	218.3	91,852		2.109	314,122	7.211
	7.30		421.6	219.1	92,364		2.120	323,333	7.423
	7.40		422.4	219.9	92,877		2.132	332,595	7.635
	7.50		423.2	220.7	93,392		2.144	341,908	7.849
	7.60		424.0	221.5	93,908		2.156	351,273	8.064
	7.70		424.8	222.3	94,425		2.168	360,690	8.280
	7.80		425.6	223.1	94,943		2.180	370,158	8.498
	7.90		426.4	223.9	95,463		2.192	379,679	8.716
	8.00		427.2	224.7	95,983		2.203	389,251	8.936
	8.10		428.0	225.5	96,506		2.215	398,875	9.157
	8.20		428.8	226.3	97,029		2.227	408,552	9.379
	8.30		429.6	227.1	97,554		2.240	418,281	9.602
	8.40		430.4	227.9	98,080		2.252	428,063	9.827
	8.50		431.2	228.7	98,607		2.264	437,897	10.053
	8.60		432.0	229.5	99,135		2.276	447,784	10.280
	8.70		432.8	230.3	99,665		2.288	457,724	10.508
	8.80		433.6	231.1	100,196		2.300	467,717	10.737
	8.90		434.4	231.9	100,729		2.312	477,764	10.968
	9.00		435.2	232.7	101,262		2.325	487,863	11.200
	9.10		436.0	233.5	101,797		2.337	498,016	11.433
	9.20		436.8	234.3	102,334		2.349	508,223	11.667
	9.30		437.6	235.1	102,871		2.362	518,483	11.903
	9.40		438.4	235.9	103,410		2.374	528,797	12.140
	9.50		439.2	236.7	103,950		2.386	539,165	12.378
	9.60		440.0	237.5	104,491		2.399	549,587	12.617
	9.70		440.8	238.3	105,034		2.411	560,063	12.857
	9.80		441.6	239.1	105,578		2.424	570,594	13.099
	9.90		442.4	239.9	106,123		2.436	581,179	13.342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Stage (ft)
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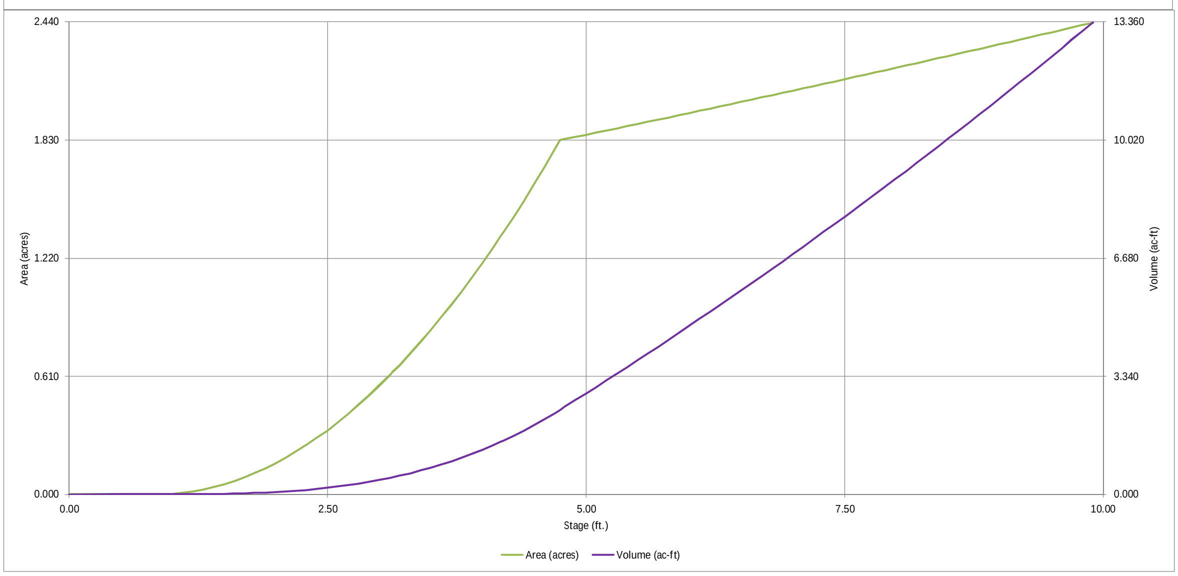
Width (ft)
Area (sq.ft.)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Volume (ac-ft)
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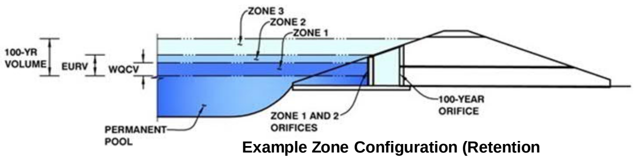
2.50
5.00
7.50
10.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Homestead North at Sterling Ranch

Basin ID: Pond B



Example Zone Configuration (Retention

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
e 1 (WQCV)	3.13	0.479	Orifice Plate
e 2 (EURV)	4.18	1.010	Orifice Plate
-1/2WQCV)	5.00	1.356	Weir&Pipe (Restrict)
Total (all zones)		2.845	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Calculated Parameters for Plate

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	4.11	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	ow 4 (optional	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	ow 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.37	2.74	3.20				
Orifice Area (sq. inches)	1.60	1.60	1.60	9.00				

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

User Input: Vertical Orifice (Circular or Rectangular)

Calculated Parameters for Vertical Orifice

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

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

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.11	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.11	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	5.76	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	17.50	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	5.25	N/A	ft^2
Debris Clogging % =	70%	N/A	%				

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

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

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage=	5.16	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.91	feet
Spillway Crest Length =	23.00	feet	Stage at Top of Freeboard =	7.07	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	2.09	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	6.94	acre-ft

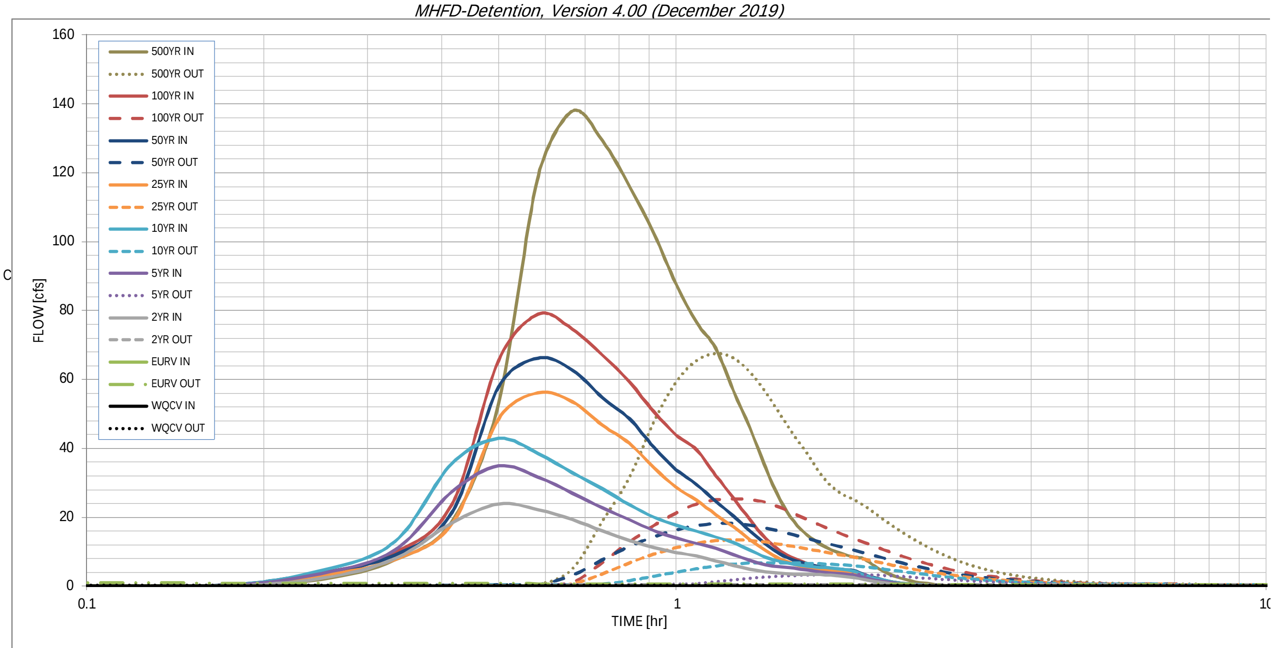
Routed Hydrograph Results

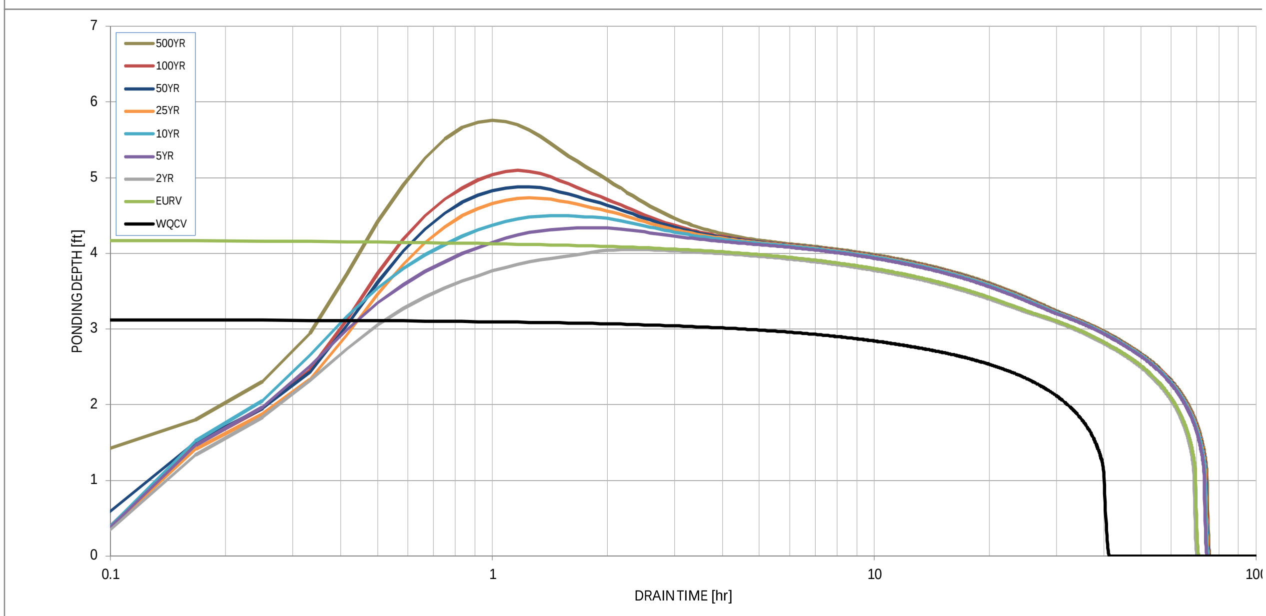
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

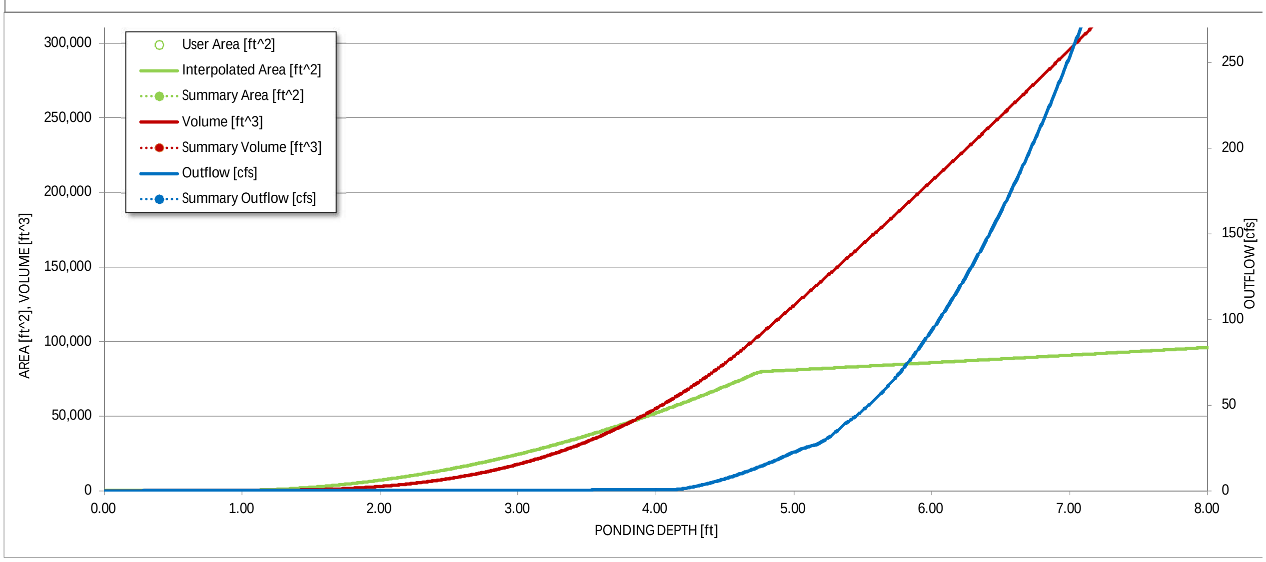
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
CUHP Runoff Volume (acre-ft) =	0.479	1.489	1.408	2.012	2.543	3.255	3.834	4.566	8.151
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.408	2.012	2.543	3.255	3.834	4.566	8.151
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.2	9.1	13.8	24.2	30.4	38.6	75.6
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	66.2	79.0	137.9
Peak Outflow Q (cfs) =	0.2	1.0	0.5	3.4	6.8	13.4	18.2	25.4	67.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.5	0.6	0.6	0.7	0.9
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	verflow Weir	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	verflow Weir	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.03	N/A	0.2	0.4	0.7	1.0	1.4	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) =	38	64	63	66	65	63	61	59	51
Time to Drain 99% of Inflow Volume (hours) =	40	67	67	70	70	70	69	68	65
Maximum Ponding Depth (ft) =	3.13	4.18	4.05	4.34	4.50	4.73	4.88	5.09	5.75
Area at Maximum Ponding Depth (acres) =	0.63	1.34	1.23	1.46	1.59	1.81	1.84	1.87	1.94
Maximum Volume Stored (acre-ft) =	0.483	1.492	1.312	1.701	1.945	2.354	2.629	3.019	4.276

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
me Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	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	7.75	9.02	9.68	18.73
	0:25:00	0.00	0.00	18.41	27.41	35.61	18.07	21.36	23.77	53.14
	0:30:00	0.00	0.00	23.88	34.90	42.90	48.54	57.90	65.58	118.97
	0:35:00	0.00	0.00	22.17	31.65	38.52	56.18	66.22	79.00	137.93
	0:40:00	0.00	0.00	19.33	26.98	32.92	53.54	62.76	74.62	129.24
	0:45:00	0.00	0.00	16.01	22.72	28.26	46.69	54.71	67.07	116.05
	0:50:00	0.00	0.00	13.29	19.30	23.63	41.48	48.60	59.29	102.37
	0:55:00	0.00	0.00	11.19	16.14	20.00	34.37	40.35	50.64	87.66
	1:00:00	0.00	0.00	9.79	14.00	17.71	28.69	33.79	43.89	76.53
	1:05:00	0.00	0.00	8.75	12.42	15.96	24.94	29.48	39.51	69.11
	1:10:00	0.00	0.00	7.35	10.96	14.29	20.83	24.67	32.15	56.88
	1:15:00	0.00	0.00	6.06	9.22	12.69	17.21	20.44	25.64	46.02
	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	8.45	10.42	12.31	14.00	25.12
	1:30:00	0.00	0.00	3.71	5.57	7.21	7.92	9.35	10.26	18.74
	1:35:00	0.00	0.00	3.50	5.22	6.44	6.42	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	12.33
	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	3.31	4.37	4.01	4.58	4.26	7.93
	2:05:00	0.00	0.00	1.89	2.48	3.24	3.00	3.42	3.16	5.85
	2:10:00	0.00	0.00	1.38	1.80	2.32	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.

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

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

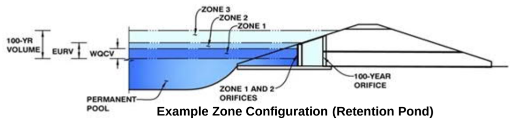
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Pond C with offsite flow

Basin ID:



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB			
Watershed Area =	224.42	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 WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.285	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.178	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	3.054	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	6.693	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	10.318	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	16.758	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	21.161	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	27.489	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	55.501	acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	1.394	acre-feet		
Approximate 5-yr Detention Volume =	2.182	acre-feet		
Approximate 10-yr Detention Volume =	4.471	acre-feet		
Approximate 25-yr Detention Volume =	6.215	acre-feet		
Approximate 50-yr Detention Volume =	6.507	acre-feet		
Approximate 100-yr Detention Volume =	8.396	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.285	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.893	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	6.861	acre-feet
Total Detention Basin Volume =	9.038	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

Depth Increment = 1.00 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	--	--	--	90	0.002		
7107	--	0.24	--	--	--	331	0.008	51	0.001
7108	--	1.24	--	--	--	7,689	0.177	4,061	0.093
7109	--	2.24	--	--	--	26,604	0.611	21,207	0.487
7110	--	3.24	--	--	--	37,234	0.855	53,126	1.220
7111	--	4.24	--	--	--	43,658	1.002	93,573	2.148
7112	--	5.24	--	--	--	47,762	1.096	139,282	3.197
7113	--	6.24	--	--	--	51,250	1.177	188,788	4.334
7114	--	7.24	--	--	--	54,827	1.259	241,827	5.552
7115	--	8.24	--	--	--	58,544	1.344	298,513	6.853
7116	--	9.24	--	--	--	62,316	1.431	358,943	8.240
7116.75* Spillway	--	9.99	--	--	--	65,152	1.496	406,744	9.338
7117	--	10.24	--	--	--	66,643	1.530	423,218	9.716
7118	--	11.24	--	--	--	70,696	1.623	491,888	11.292
7119	--	12.24	--	--	--	74,859	1.719	564,665	12.963
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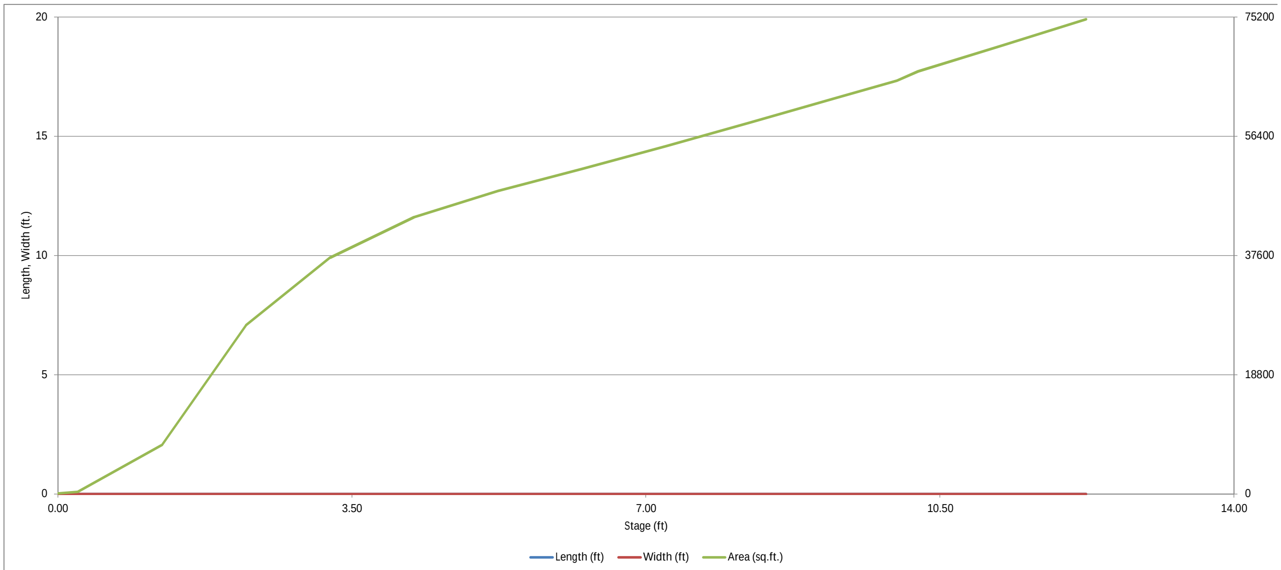
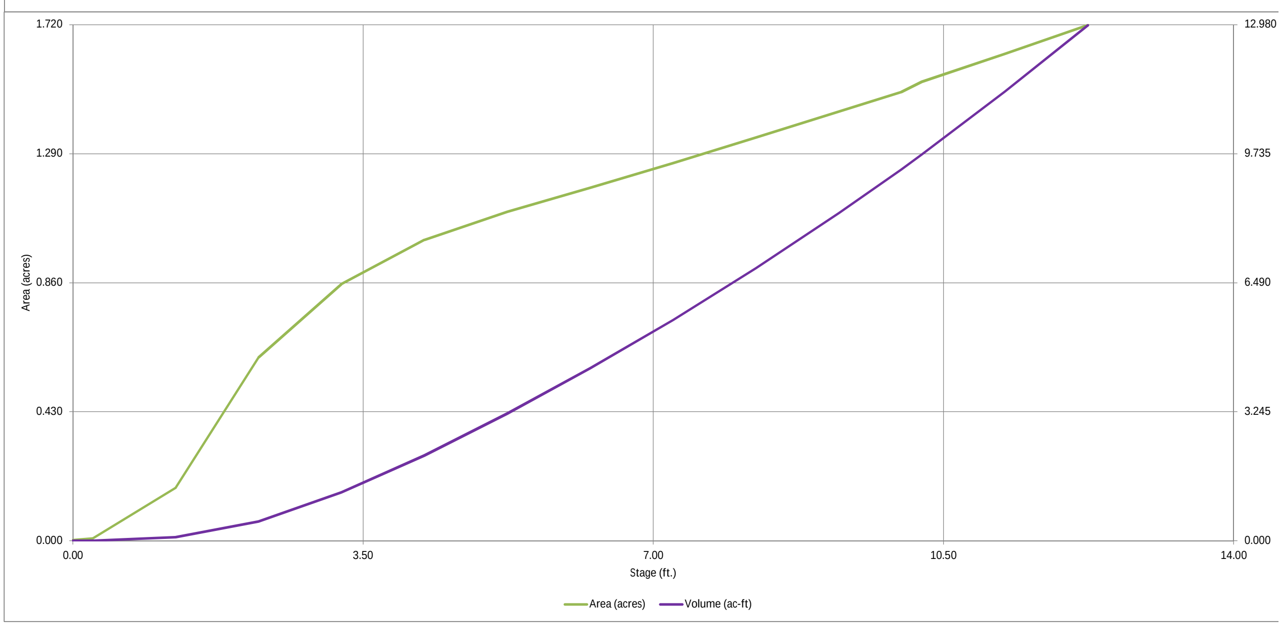
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



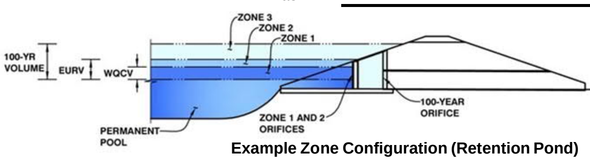


DETENTION BASIN OUTLET STRUCTURE DESIGN

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)	3.32	1.285	Orifice Plate
Zone 2 (EURV)	4.27	0.893	Orifice Plate
:3 (100+1/2WQCV)	9.79	6.861	Weir&Pipe (Restrict)
Total (all zones)	9.038		

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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

Calculated Parameters for Plate

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	3.660E-02	ft^2
Depth at top of Zone using Orifice Plate =	4.27	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	17.72	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	5.27	sq. inches (use rectangular openings)	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)	5.27	5.27	5.27					

	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)

Calculated Parameters for Vertical Orif

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

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

Calculated Parameters for Overflow W

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	4.36	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.47	N/A
Overflow Weir Front Edge Length =	7.00	N/A	feet	Overflow Weir Slope Length =	12.80	N/A
Overflow Weir Grate Slope =	4.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	7.22	N/A
Horiz. Length of Weir Sides =	12.42	N/A	feet	Overflow Grate Open Area w/o Debris =	70.89	N/A
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	17.72	N/A
Debris Clogging % =	75%	N/A	%			

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

Calculated Parameters for Outlet Pipe w/ Flow Restriction Pla

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected
Depth to Invert of Outlet Pipe =	6.29	0.00	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	9.82	
Outlet Pipe Diameter =	48.00		inches	Outlet Orifice Centroid =	1.62	
Restrictor Plate Height Above Pipe Invert =	35.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.05	

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage=	9.99	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.74	feet
Spillway Crest Length =	123.00	feet	Stage at Top of Freeboard =	11.73	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.67	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	12.10	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

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	1.285	2.178	3.054	6.693	10.318	16.758	21.161	27.489
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.054	6.693	10.318	16.758	21.161	27.489
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	17.6	49.5	77.1	142.4	179.0	229.9
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
Peak Inflow Q (cfs) =	N/A	N/A	29.3	63.0	90.7	154.7	191.6	243.4
Peak Outflow Q (cfs) =	0.7	0.9	2.4	20.6	43.8	91.6	124.1	173.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.6	0.6	0.7	0.8
Structure Controlling Flow =	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	0.02	0.3	0.6	1.3	1.7	2.4
Max Velocity through Grate 2 (fps) =	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	50	57	54	50	45	41	36
Time to Drain 99% of Inflow Volume (hours) =	40	53	62	61	59	56	54	52
Maximum Ponding Depth (ft) =	3.32	4.27	4.80	6.22	7.10	8.35	9.02	9.94
Area at Maximum Ponding Depth (acres) =	0.87	1.01	1.05	1.17	1.25	1.35	1.41	1.49
Maximum Volume Stored (acre-ft) =	1.288	2.178	2.714	4.310	5.376	6.988	7.928	9.263

ice

ft^2
feet

eir

feet
feet

ft^2
ft^2

ate

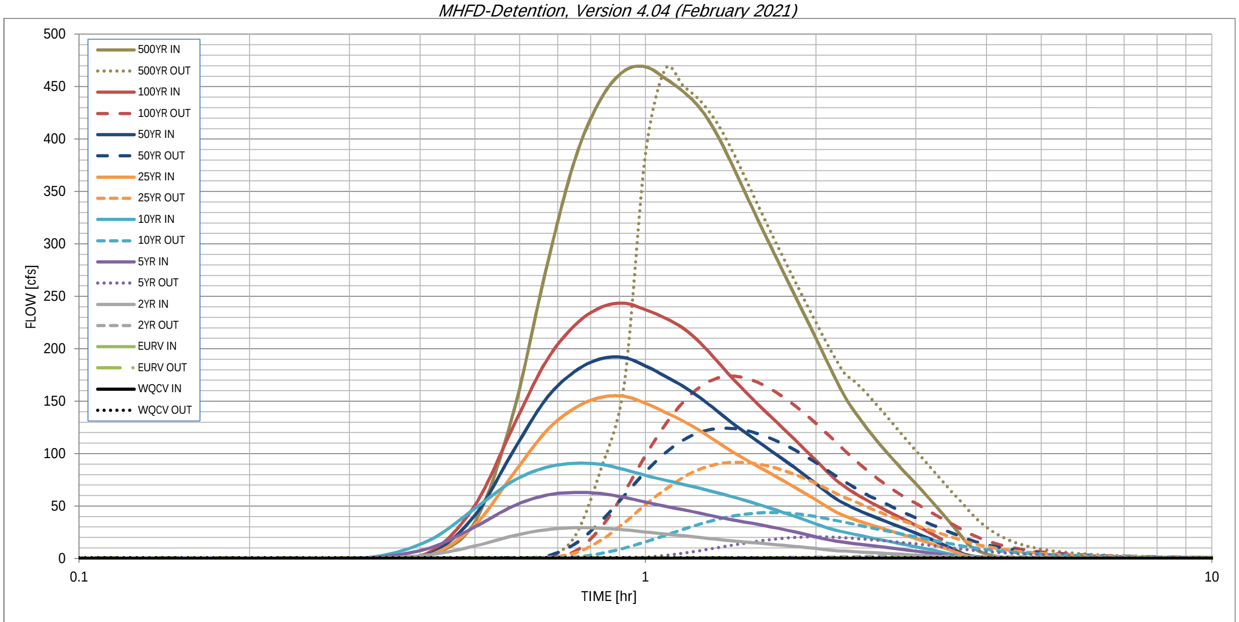
ft^2
feet
radians

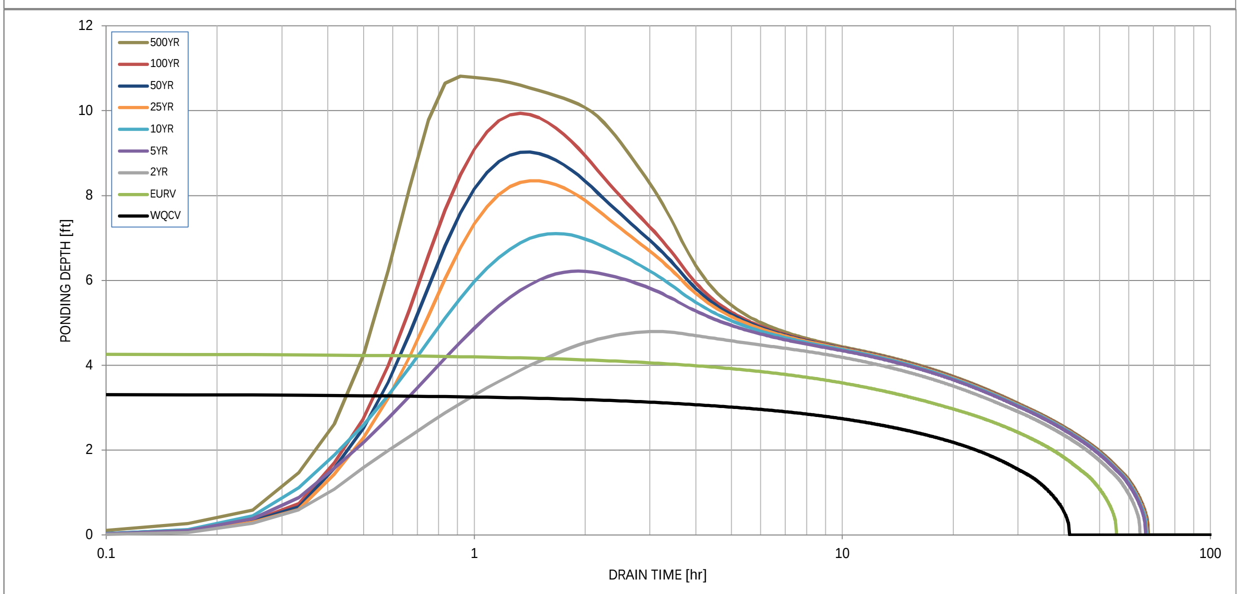
).

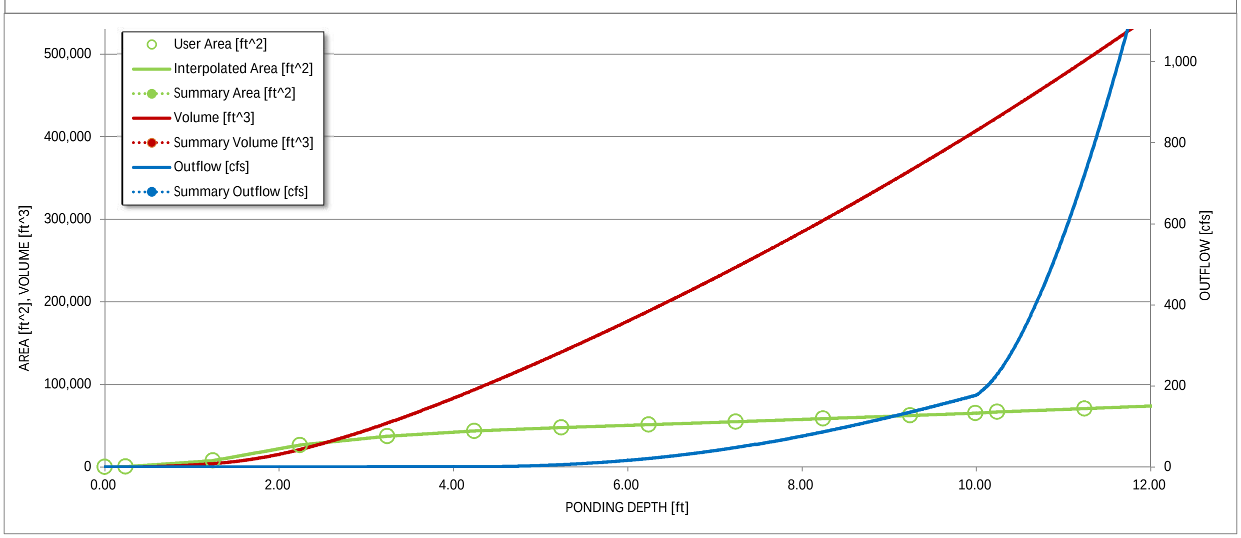
500 Year
4.00
55.501
55.501
455.8
2.03
469.0
466.7
1.0
Spillway
2.6
N/A
20
44
10.81
1.58
10.603

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	1.76	0.51	0.62	0.65	3.37
	0:25:00	0.00	0.00	3.52	9.98	17.69	3.45	4.47	6.28	34.90
	0:30:00	0.00	0.00	11.93	30.05	47.70	31.84	41.28	50.76	137.07
	0:35:00	0.00	0.00	21.52	49.78	73.78	79.92	101.83	125.08	274.28
	0:40:00	0.00	0.00	27.38	60.22	86.67	120.91	151.70	187.33	379.67
	0:45:00	0.00	0.00	29.25	62.98	90.72	143.37	178.24	222.26	437.75
	0:50:00	0.00	0.00	28.91	61.90	89.69	153.61	190.33	239.35	464.94
	0:55:00	0.00	0.00	27.31	58.31	84.83	154.68	191.57	243.35	468.96
	1:00:00	0.00	0.00	25.18	53.76	79.20	148.05	183.67	237.22	457.96
	1:05:00	0.00	0.00	23.30	49.83	74.65	139.47	173.85	229.30	445.23
	1:10:00	0.00	0.00	21.67	46.46	70.66	130.94	164.08	219.55	429.09
	1:15:00	0.00	0.00	20.00	43.13	66.79	121.64	153.20	205.59	405.92
	1:20:00	0.00	0.00	18.33	39.85	62.92	111.74	141.31	189.15	377.68
	1:25:00	0.00	0.00	16.89	37.05	59.18	102.49	129.96	173.22	348.90
	1:30:00	0.00	0.00	15.71	34.69	55.38	94.65	120.20	159.28	322.04
	1:35:00	0.00	0.00	14.62	32.42	51.53	87.45	111.13	146.62	296.98
	1:40:00	0.00	0.00	13.57	30.12	47.70	80.71	102.63	135.06	273.69
	1:45:00	0.00	0.00	12.54	27.73	43.94	74.27	94.49	124.18	251.62
	1:50:00	0.00	0.00	11.51	25.31	40.27	68.04	86.63	113.68	230.48
	1:55:00	0.00	0.00	10.47	22.89	36.64	61.91	78.93	103.47	209.98
	2:00:00	0.00	0.00	9.42	20.50	32.98	55.88	71.36	93.53	190.08
	2:05:00	0.00	0.00	8.40	18.24	29.54	49.93	63.88	83.80	170.99
	2:10:00	0.00	0.00	7.56	16.54	26.96	44.50	57.07	74.97	154.29
	2:15:00	0.00	0.00	6.99	15.33	24.95	40.53	52.07	68.30	141.02
	2:20:00	0.00	0.00	6.50	14.25	23.11	37.31	47.94	62.76	129.64
	2:25:00	0.00	0.00	6.05	13.24	21.40	34.51	44.31	57.85	119.36
	2:30:00	0.00	0.00	5.61	12.27	19.77	31.96	40.98	53.40	109.96
	2:35:00	0.00	0.00	5.19	11.33	18.21	29.61	37.92	49.28	101.24
	2:40:00	0.00	0.00	4.78	10.42	16.69	27.35	34.98	45.43	93.08
	2:45:00	0.00	0.00	4.38	9.53	15.24	25.17	32.18	41.82	85.46
	2:50:00	0.00	0.00	3.99	8.66	13.83	23.07	29.47	38.41	78.26
	2:55:00	0.00	0.00	3.61	7.80	12.48	20.99	26.82	35.02	71.23
	3:00:00	0.00	0.00	3.22	6.96	11.18	18.93	24.20	31.66	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	1.71	3.67	6.05	10.77	13.83	18.25	36.94
	3:25:00	0.00	0.00	1.34	2.85	4.79	8.74	11.25	14.92	30.15
	3:30:00	0.00	0.00	0.98	2.05	3.54	6.71	8.69	11.59	23.40
	3:35:00	0.00	0.00	0.62	1.27	2.37	4.71	6.15	8.30	16.92
	3:40:00	0.00	0.00	0.35	0.78	1.68	2.85	3.83	5.32	11.64
	3:45:00	0.00	0.00	0.24	0.58	1.32	1.82	2.56	3.55	8.30
	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	1.03	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)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

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

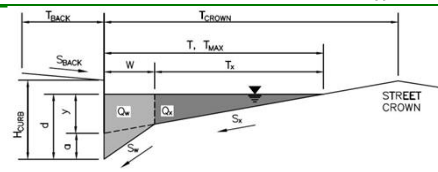
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet 1A



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.028	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

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

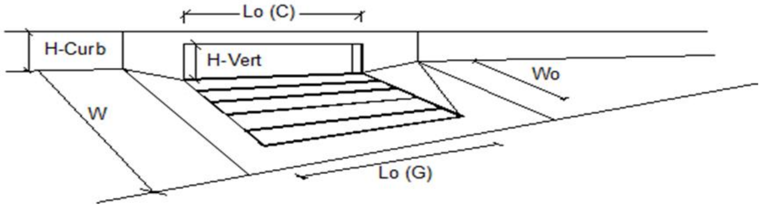
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**18.1**	**21.1**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.1**	**12.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**2.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**81**	**%**

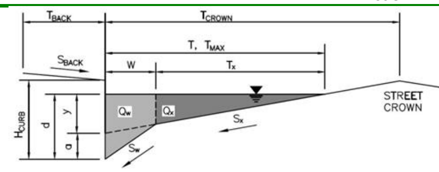
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet 3A



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.028	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

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

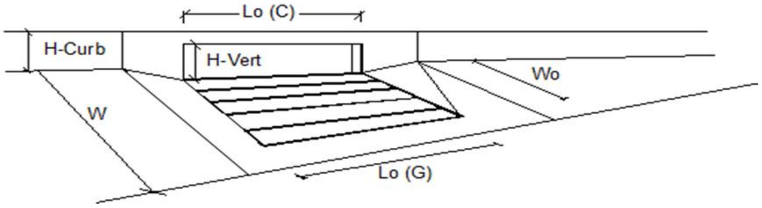
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**18.1**	**21.1**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**8.2**	**14.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.2**	**6.1**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**98**	**70**	**%**

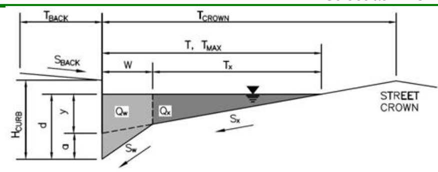
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Street at DP 5A



STREET FLOW

Gutter Geometry (Enter data in the blue cells)				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.002		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.028		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.3	inches
Allow Flow Depth at Street Crown (leave blank for no)		☑	☑	check = yes
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**34.9**	**63.3**	**cfs**

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

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

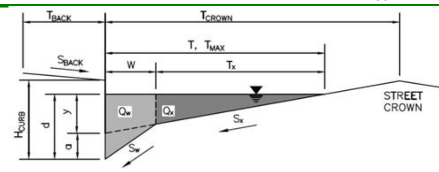
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet 7A**



Gutter Geometry (Enter data in the blue cells)

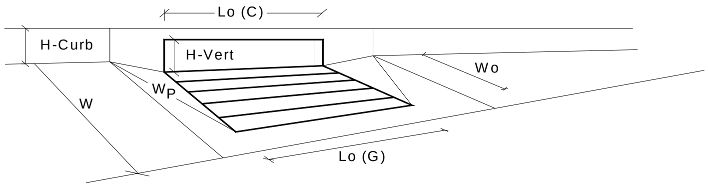
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	4	4	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	8.3	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.78	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

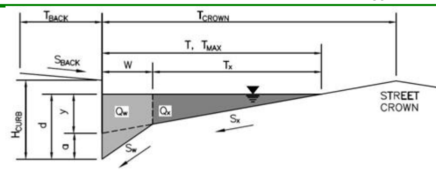
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**18.2**	**39.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	10.5	29.7	cfs

Version 4.05 Released March 2017

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

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

Project: **Homestead North**
Inlet ID: **Inlet 2A**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.284	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

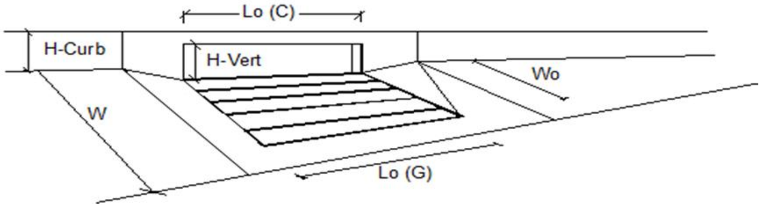
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.4**	**11.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**87**	**%**

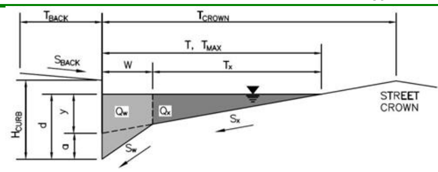
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet 4A**



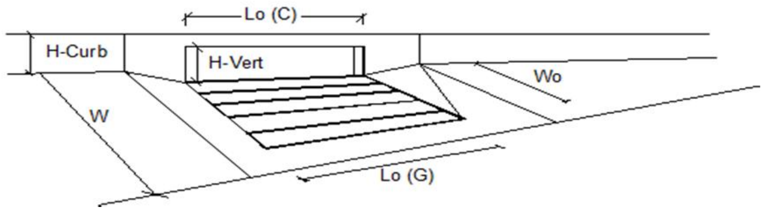
Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.028		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**18.1**	**21.0**	**cfs**

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.0**	**12.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**3.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**78**	**%**

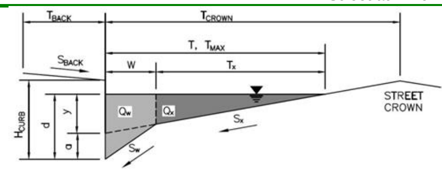
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

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



STREET FLOW

Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.002	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.028	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

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

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

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

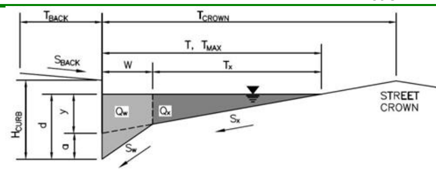
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet 8A**



Gutter Geometry (Enter data in the blue cells)

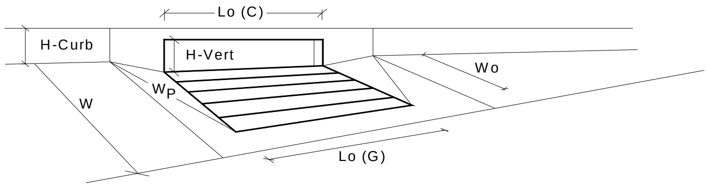
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.8	8.3	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.32	0.53	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	0.55	0.78	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.78	0.91	
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		Q_a =	**12.5**	**29.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK\ REQUIRED}$ =	11.3	19.9	cfs

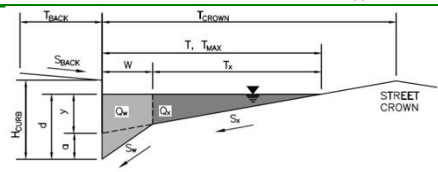
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 1.1B



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.026	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

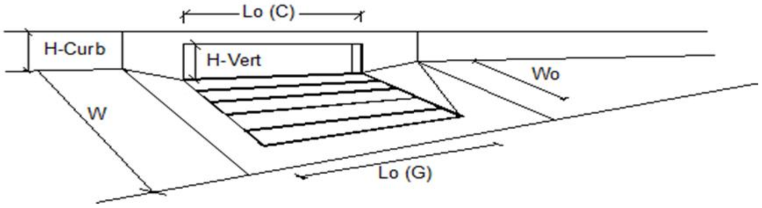
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.3**	**9.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**87**	**%**

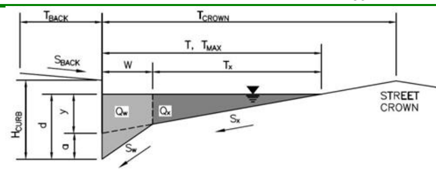
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 1.2B



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.026	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

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

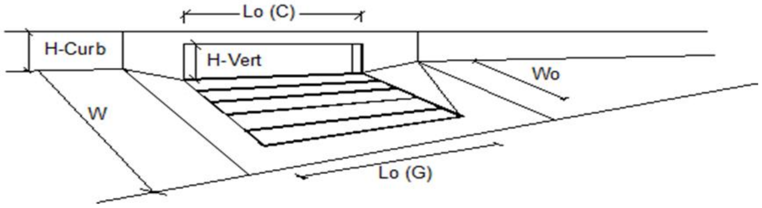
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**3.7**	**19.1**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**3.6**	**7.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.2**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**97**	**%**

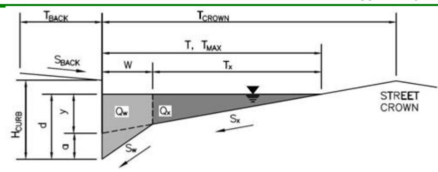
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 4b



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.016	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

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

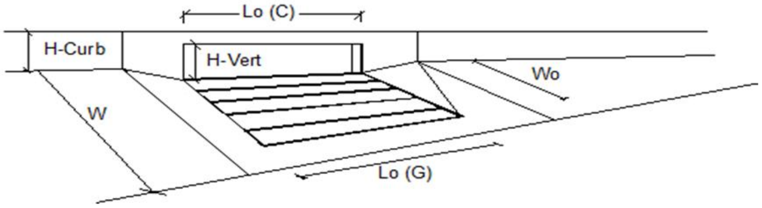
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**15.0**	**52.4**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



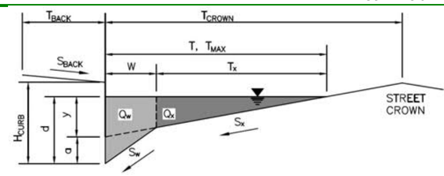
Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.7**	**11.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**4.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**99**	**74**	**%**

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

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

Project: Homestead North
Inlet ID: Inlet DP 9b

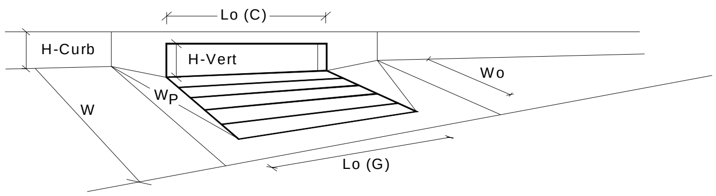


Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	12.0	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	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	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		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

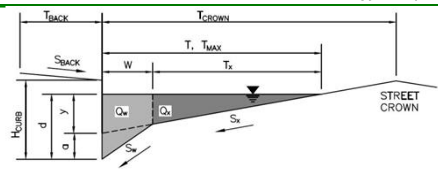
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 7b**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.016	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

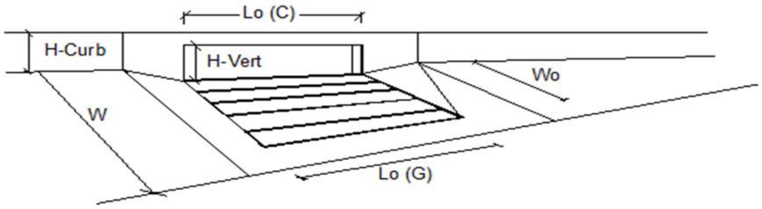
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**7.0**	**11.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.1**	**3.2**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**98**	**78**	**%**

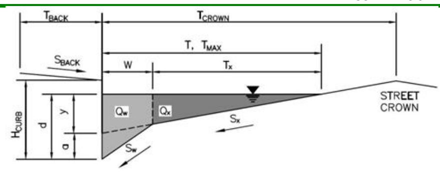
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 10b

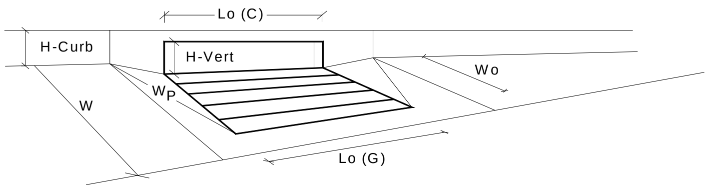


Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.8	8.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.32	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	0.75	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.78	0.89	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

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

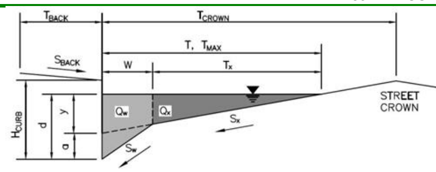
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 2.3C**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.027	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

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

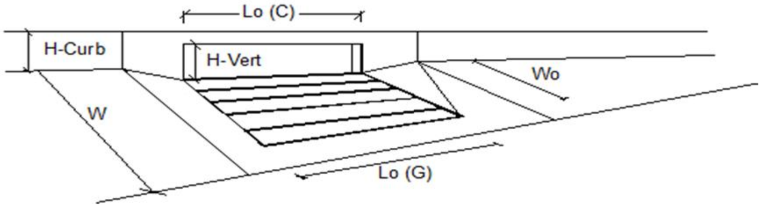
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**24.2**	**44.5**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.2**	**11.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**3.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**98**	**76**	**%**

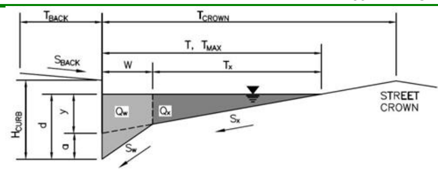
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 2.1C**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

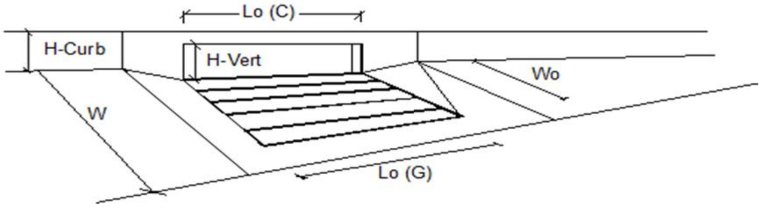
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



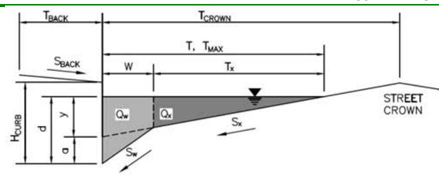
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.8**	**1.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**91**	**%**

Version 4.05 Released March 2017

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

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

Project: Homestead North
Inlet ID: Inlet DP 4.2C



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

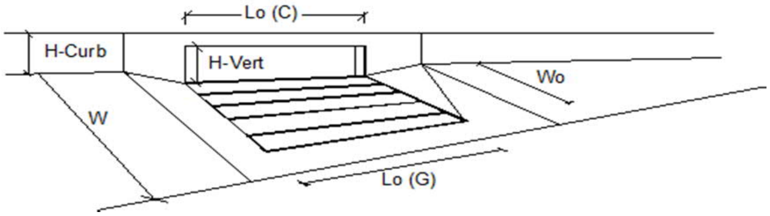
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**5.9**	**10.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**2.6**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**81**	**%**

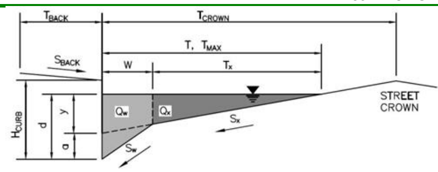
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 3.1C**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	2.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

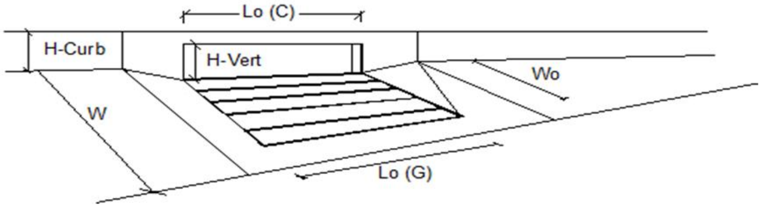
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



			MINOR	MAJOR	
Design Information (Input)					
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.3**	**2.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.6**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**97**	**79**	**%**

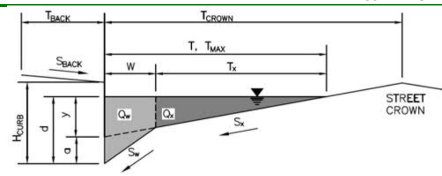
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 4C

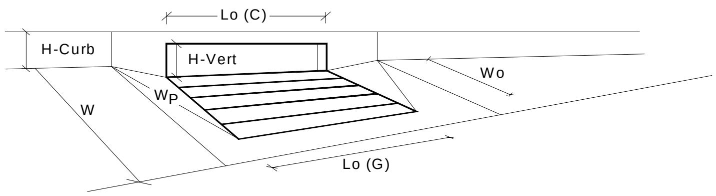


Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.3	inches
Check boxes are not applicable in SUMP conditions		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



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	12.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	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	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**18.2**	**52.7**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Minor Storm	$Q_{PEAK\ REQUIRED}$ =	18.9	42.0	cfs

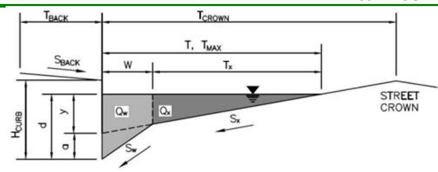
Version 4.05 Released March 2017

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

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

Project: **Homestead North**

Inlet ID: **Inlet DP 5C**



Gutter Geometry (Enter data in the blue cells)

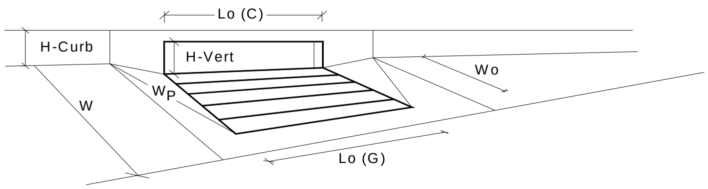
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	18.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	18.0	18.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.3	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet: CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.8	5.8	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.32	0.32	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.55	0.55	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.92	0.92	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

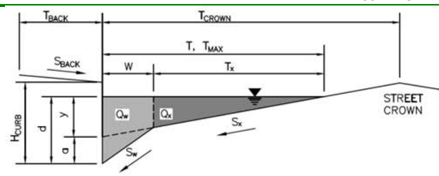
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**9.7**	**9.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	4.2	9.0	cfs

Version 4.05 Released March 2017

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

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

Project: Homestead North
Inlet ID: Inlet DP 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	

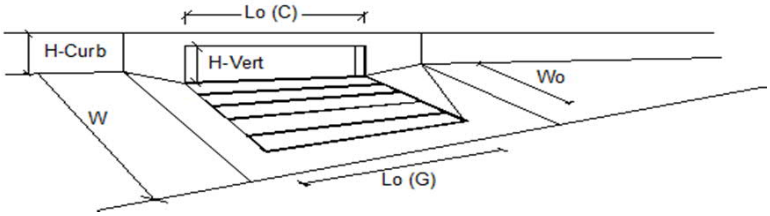
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.0	25.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**12.0**	**41.9**	**cfs**

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.5**	**1.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

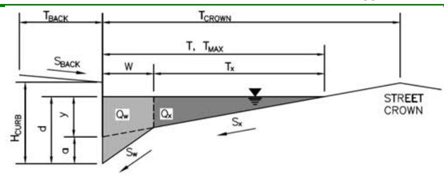
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 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	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.0	25.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

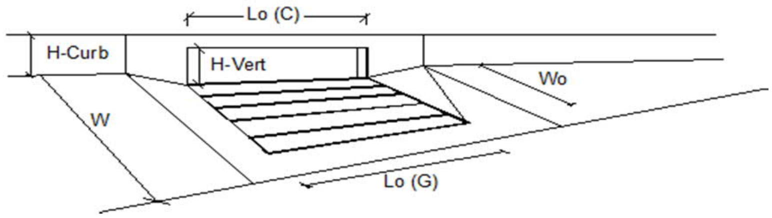
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**12.0**	**19.4**	**cfs**

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 =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.1**	**1.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**86**	**%**

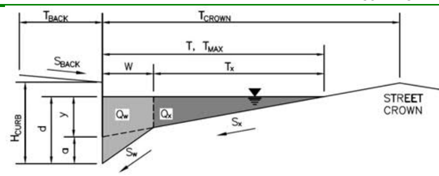
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 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	

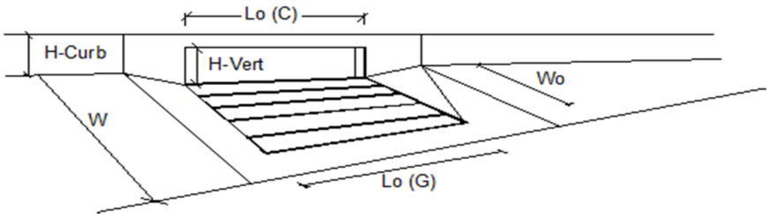
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	33.0	33.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**17.8**	**17.8**	**cfs**

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



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

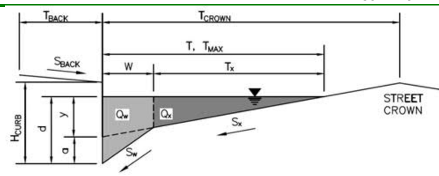
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 6D



Gutter Geometry (Enter data in the blue cells)

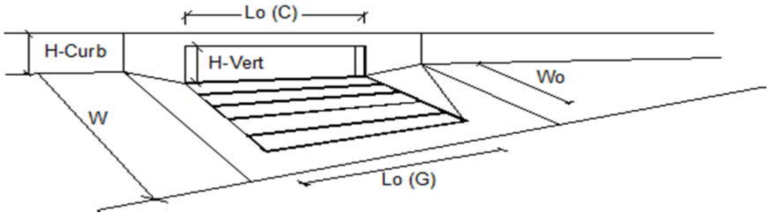
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	20.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		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		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	33.0	33.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**17.8**	**17.8**	**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		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**2.5**	**4.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.4**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**93**	**%**

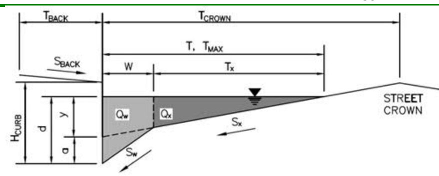
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 7D



Gutter Geometry (Enter data in the blue cells)

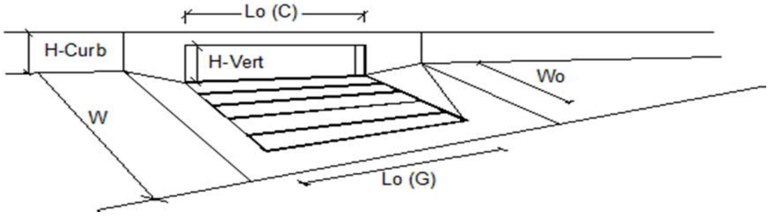
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		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		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	33.0	33.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**19.5**	**19.5**	**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 =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.0**	**3.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

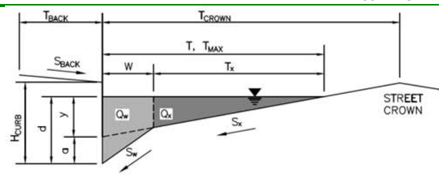
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 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	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	33.0	33.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

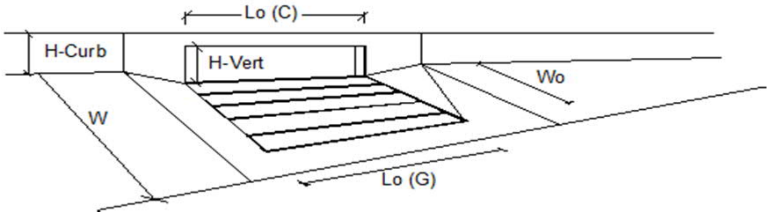
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**19.5**	**19.5**	**cfs**

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



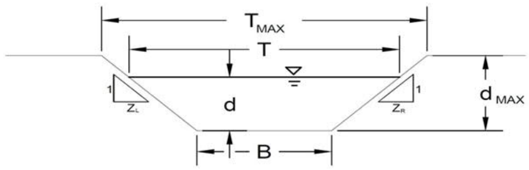
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	20.00	20.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.5**	**13.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**95**	**%**

Version 4.05 Released March 2017

AREA INLET IN A SWALE

Homestead North

DP 1o



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

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E	B	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0200	ft/ft
Bottom Width	B =	5.00	ft
Left Side Slope	Z1 =	4.00	ft/ft
Right Side Slope	Z2 =	4.00	ft/ft

Check one of the following soil types:

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

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

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**20.00**	**20.00**	**feet**
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**2.00**	**2.00**	**feet**

Allowable Channel Capacity Based On Channel Geometry		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**74.5**	**74.5**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**1.88**	**1.88**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**0.8**	**6.0**	**cfs**
Water Depth	d =	**0.40**	**1.07**	**feet**

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'

Version 4.05 Released March 2017

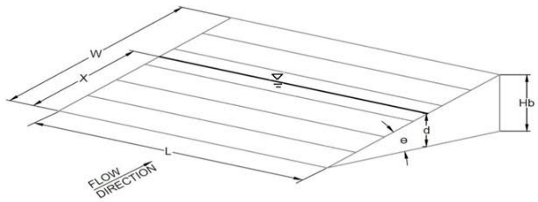
AREA INLET IN A SWALE

Homestead North

DP 1o

Inlet Design Information (Input)

Type of Inlet	CDOT TYPE D (Parallel)	Inlet Type =	CDOT TYPE D (Parallel)	
Angle of Inclined Grate (must be <= 30 degrees)		θ =	0.00	degrees
Width of Grate		W =	6.00	feet
Length of Grate		L =	3.00	feet
Open Area Ratio		A_{RATIO} =	0.70	
Height of Inclined Grate		H_B =	0.00	feet
Clogging Factor		C_f =	0.38	
Grate Discharge Coefficient		C_d =	0.76	
Orifice Coefficient		C_o =	0.50	
Weir Coefficient		C_w =	1.62	

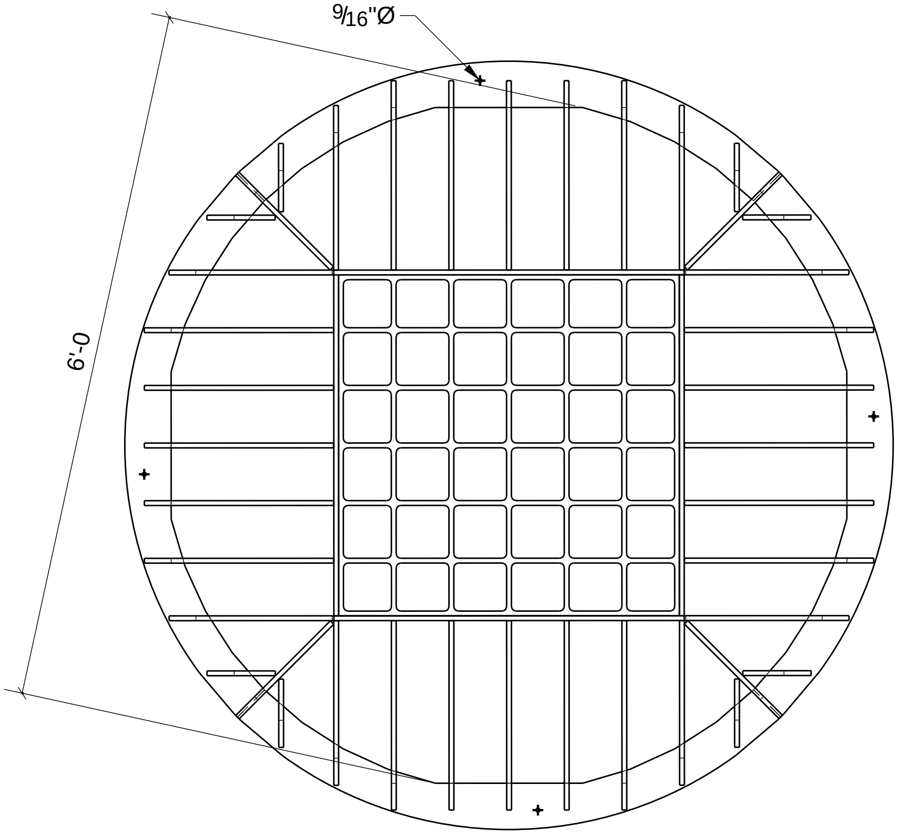


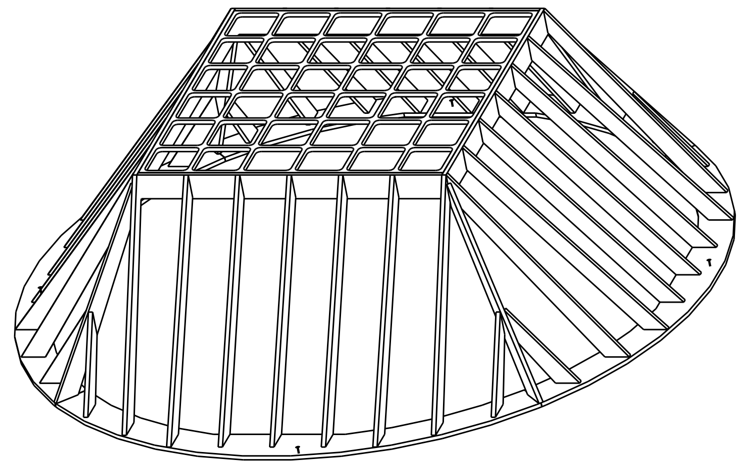
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.40	1.07	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**6.5**	**28.4**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

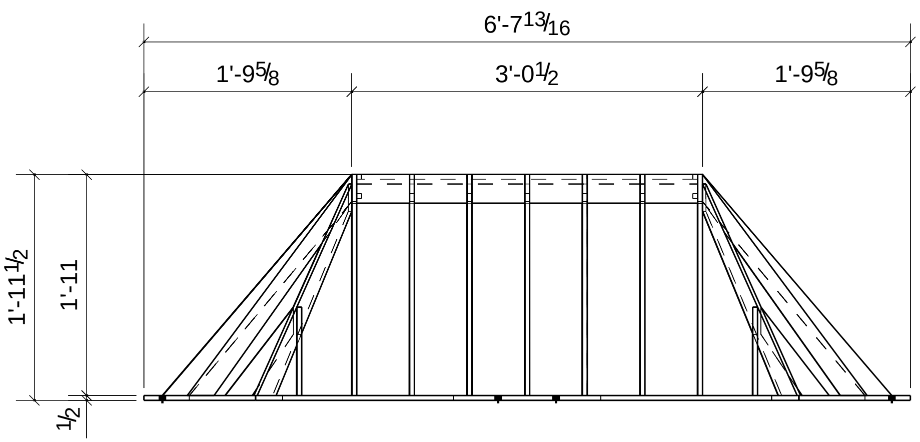
Subdivision: Homestead North - Proposed Conditions
Location: El Paso County
Project Name: Homestead North
Project Number: 25188.00
Calculated By: MAB
Checked By:
Date: 1/12/2022

Design Point - 2o (6 ft. Dia Manhole w/ Trash Rack)
Design flow 190.9 cfs
Orifice Flow Calculation
Q = C*A* square root (2gH)
C = 0.6 A = 28.274 sq ft g = 32.2

Head (ft)	CA	(2GH)	Sqrt (2GH)	Capacity
1	16.9644	64.40	8.025	136.1
2	16.9644	128.80	11.349	192.5
3	16.9644	193.20	13.900	235.8
4	16.9644	257.60	16.050	272.3
5	16.9644	322.00	17.944	304.4
6	16.9644	386.40	19.657	333.5







MADE IN THE U.S.A.

AVAILABLE MATERIALS:
MILD STEEL (NO FINISH) - WGT: 496.7 lbs.
MILD STEEL (GALVANIZED) - WGT: 496.7 lbs.
STAINLESS STEEL - WGT: 496.7 lbs.
ALUMINUM - WGT: 167.8 lbs.

CUSTOM SIZES AVAILABLE

AVAILABLE UPON REQUEST WITH:
ACCESS PORT
ANTI-VORTEX PLATE

TRASHRACKS.com
A DIVISION OF J.R. HOE
101 IRONWOOD ROAD
MIDDLESBORO, KY 40965
PH: (606) 248-5560
FAX: (606) 248-6308
JRHOE.COM

TITLE:
LDR-72
72" ROUND TOP-MOUNT TRASH RACK

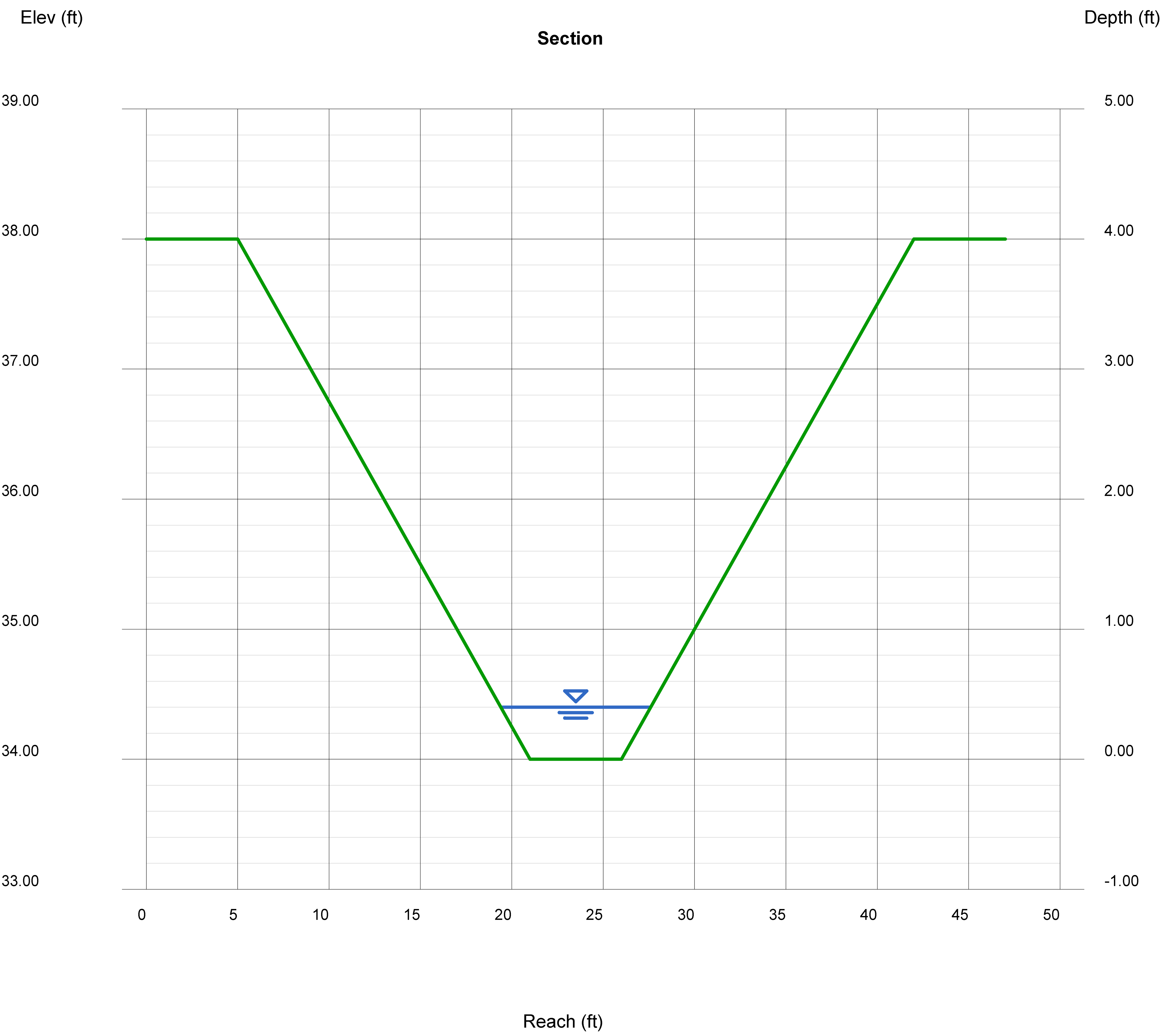
SIZE	DWG. NO.	REV. 0
A	118839	SHEET 1 / 1

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Sep 17 2021

Interim Channel Section - AA

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 5.00	Depth (ft)	= 0.40
Side Slopes (z:1)	= 4.00, 4.00	Q (cfs)	= 7.100
Total Depth (ft)	= 4.00	Area (sqft)	= 2.64
Invert Elev (ft)	= 7134.00	Velocity (ft/s)	= 2.69
Slope (%)	= 2.62	Wetted Perim (ft)	= 8.30
N-Value	= 0.040	Crit Depth, Yc (ft)	= 0.36
		Top Width (ft)	= 8.20
Calculations		EGL (ft)	= 0.51
Compute by:	Known Q		
Known Q (cfs)	= 7.10		



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jan 5 2022

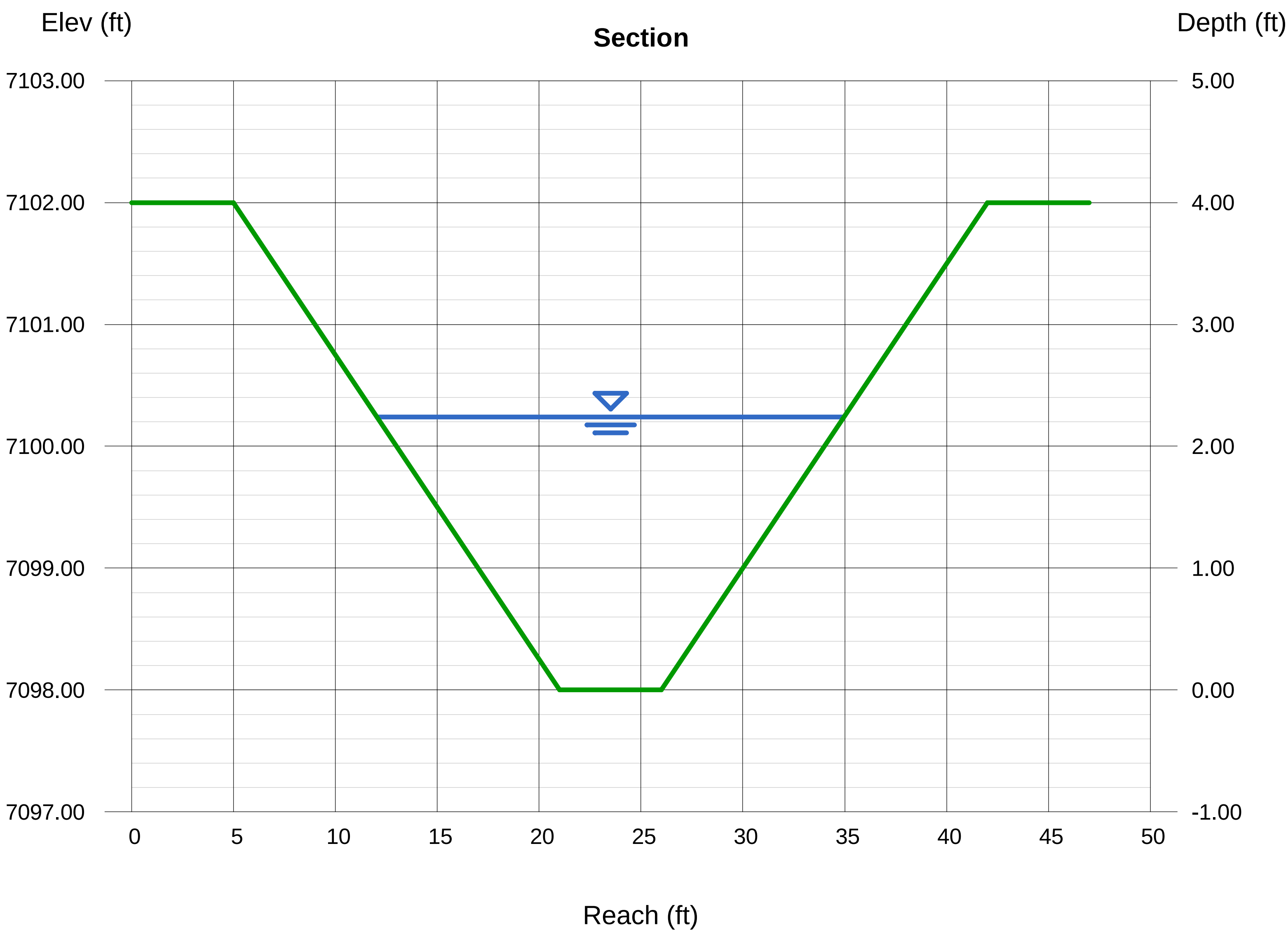
Interim Channel Section - BB

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

USE PERMANENT EROSION
CONTROL BLANKET
V MAX SC250
OR EQUIVALENT



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Jan 5 2022

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

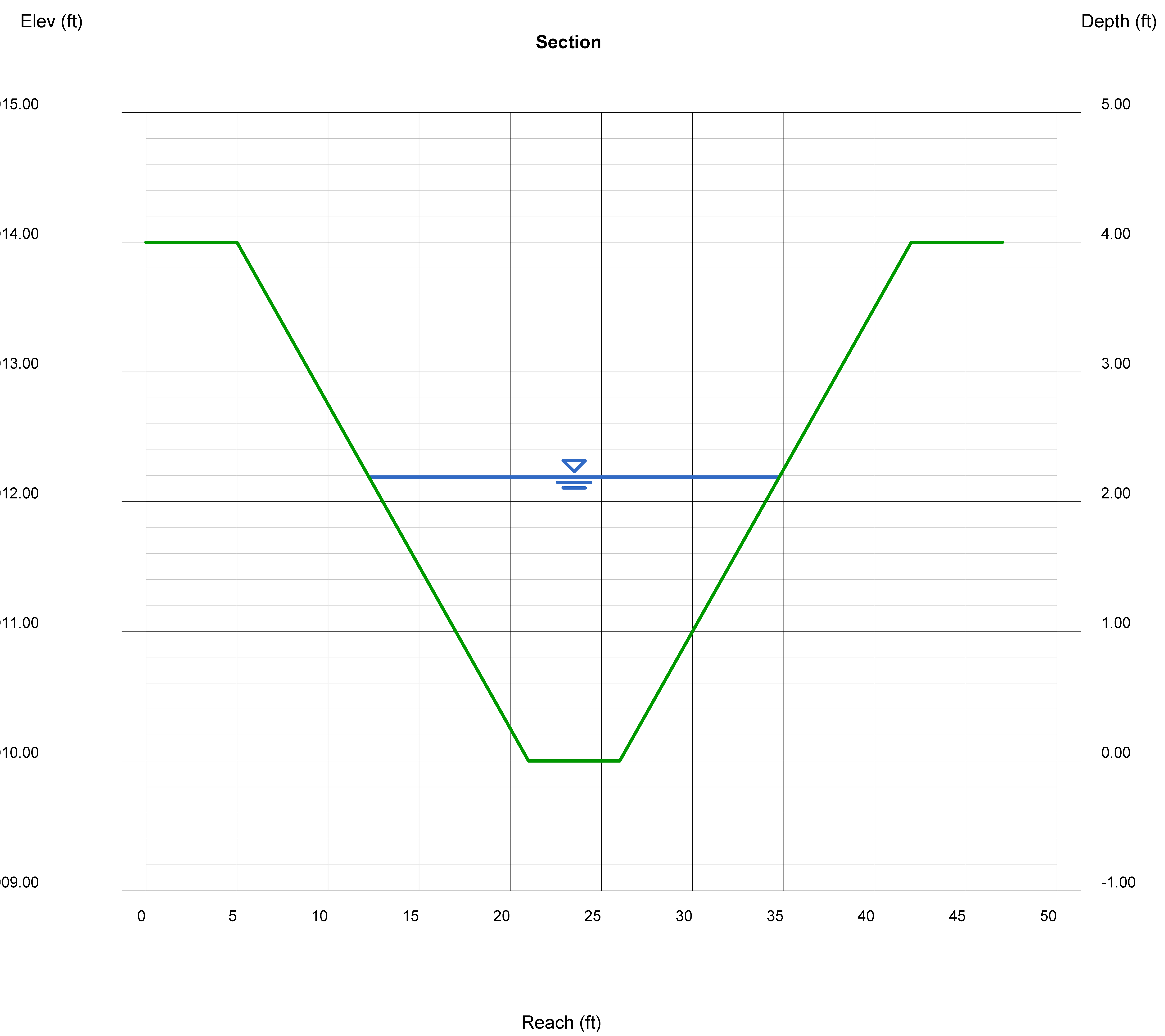
Calculations

Compute by:	Known Q
Known Q (cfs)	= 196.20

Highlighted

Depth (ft)	= 2.19
Q (cfs)	= 196.20
Area (sqft)	= 30.13
Velocity (ft/s)	= 6.51
Wetted Perim (ft)	= 23.06
Crit Depth, Yc (ft)	= 2.19
Top Width (ft)	= 22.52
EGL (ft)	= 2.85

USE PERMANENT EROSION
CONTROL BLANKET
V MAX SC250
OR EQUIVALENT

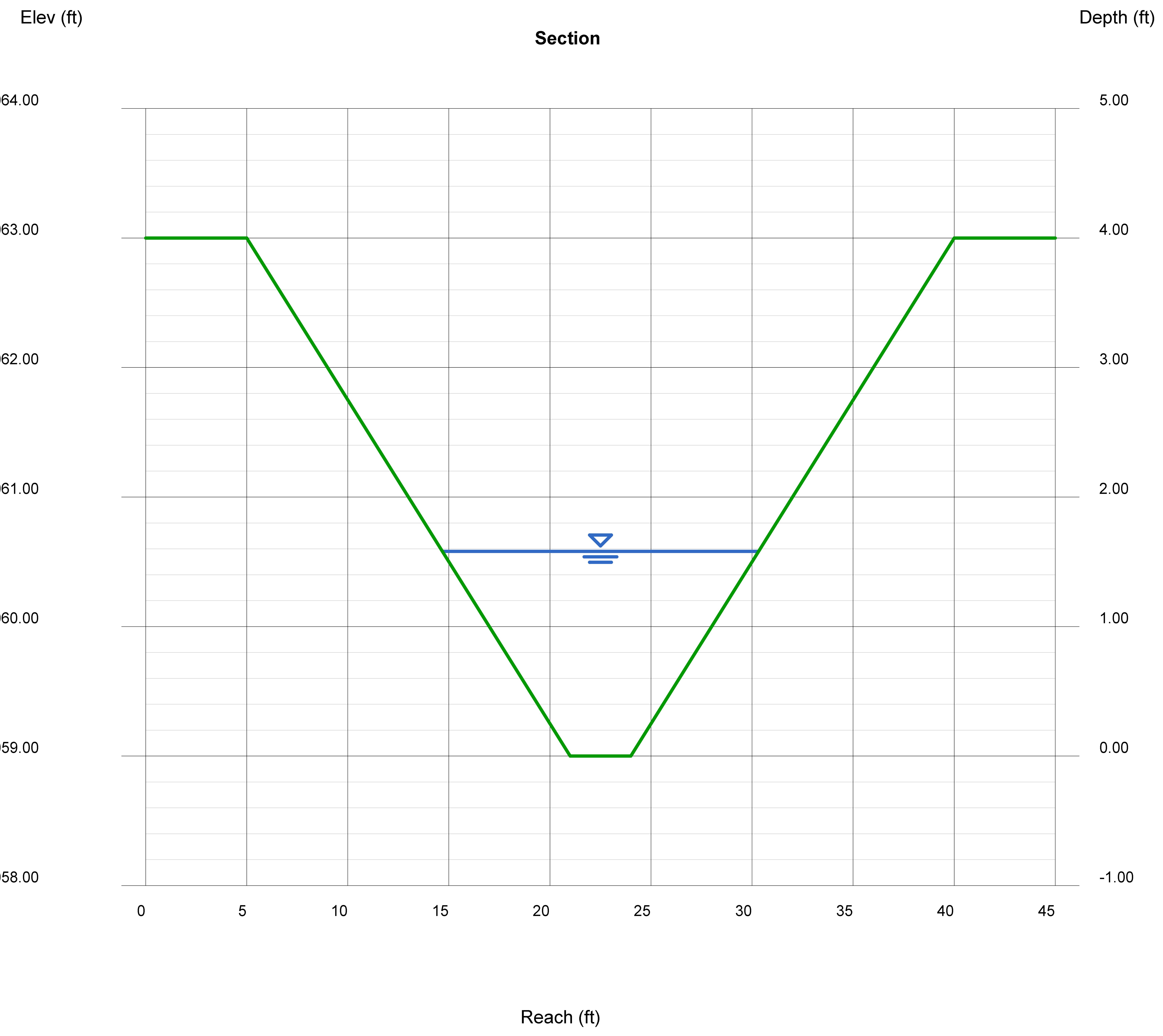


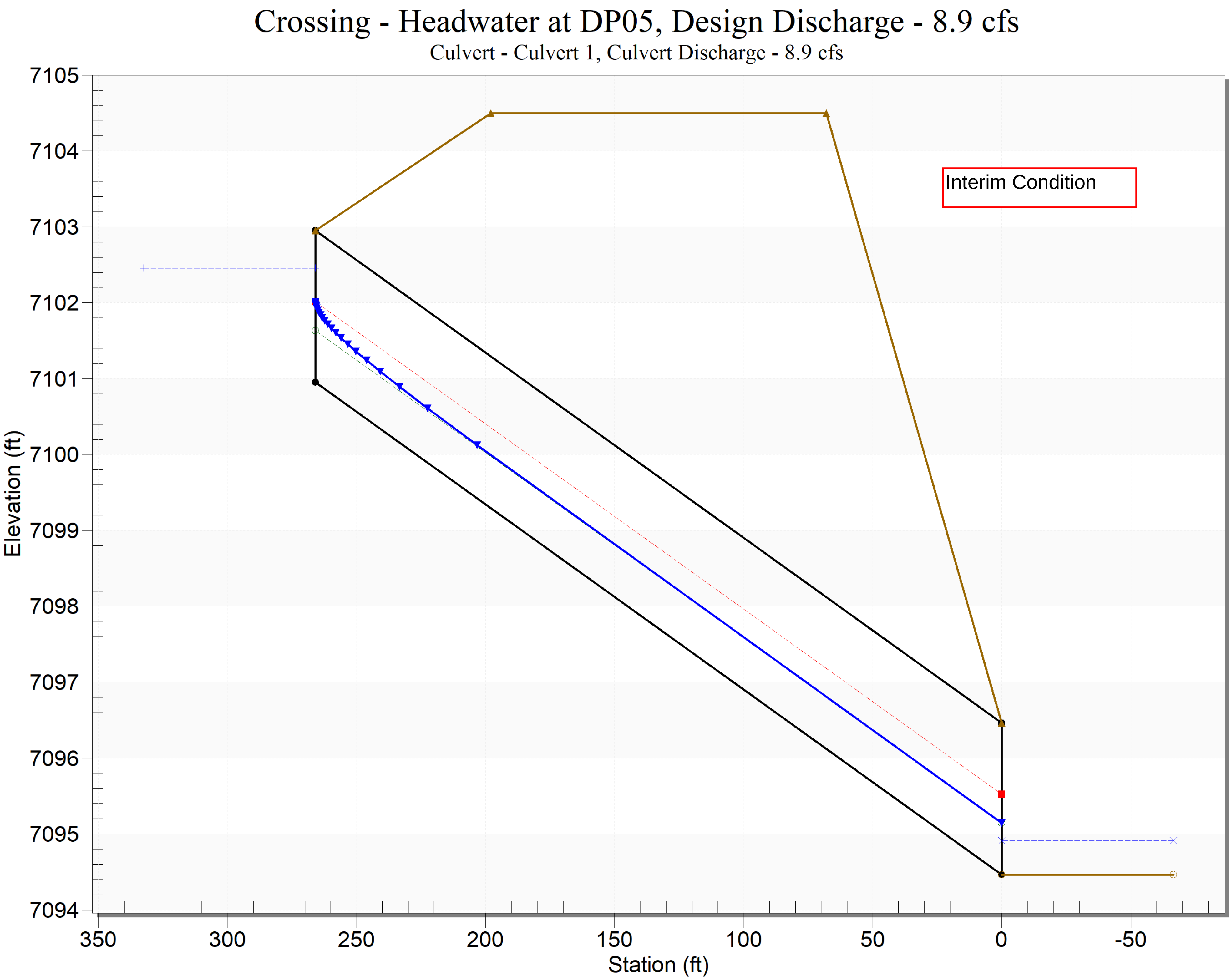
Channel Report

Interim Channel Section - DD

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 3.00	Depth (ft)	= 1.58
Side Slopes (z:1)	= 4.00, 4.00	Q (cfs)	= 77.40
Total Depth (ft)	= 4.00	Area (sqft)	= 14.73
Invert Elev (ft)	= 7059.00	Velocity (ft/s)	= 5.26
Slope (%)	= 2.25	Wetted Perim (ft)	= 16.03
N-Value	= 0.040	Crit Depth, Yc (ft)	= 1.55
		Top Width (ft)	= 15.64
Calculations		EGL (ft)	= 2.01
Compute by:	Known Q		
Known Q (cfs)	= 77.40		

USE PERMANENT EROSION
CONTROL BLANKET
V MAX SC250
OR EQUIVALENT





Crossing - Headwater at DP05, Design Discharge - 8.9 cfs
Culvert - Culvert 1, Culvert Discharge - 8.9 cfs
Interim Condition
Elevation (ft)
7105
7104
7103
7102
7101
7100
7099
7098
7097
7096
7095
7094
Station (ft)
350
300
250
200
150
100
50
0
-50

HY-8 Analysis Results

Crossing Summary Table

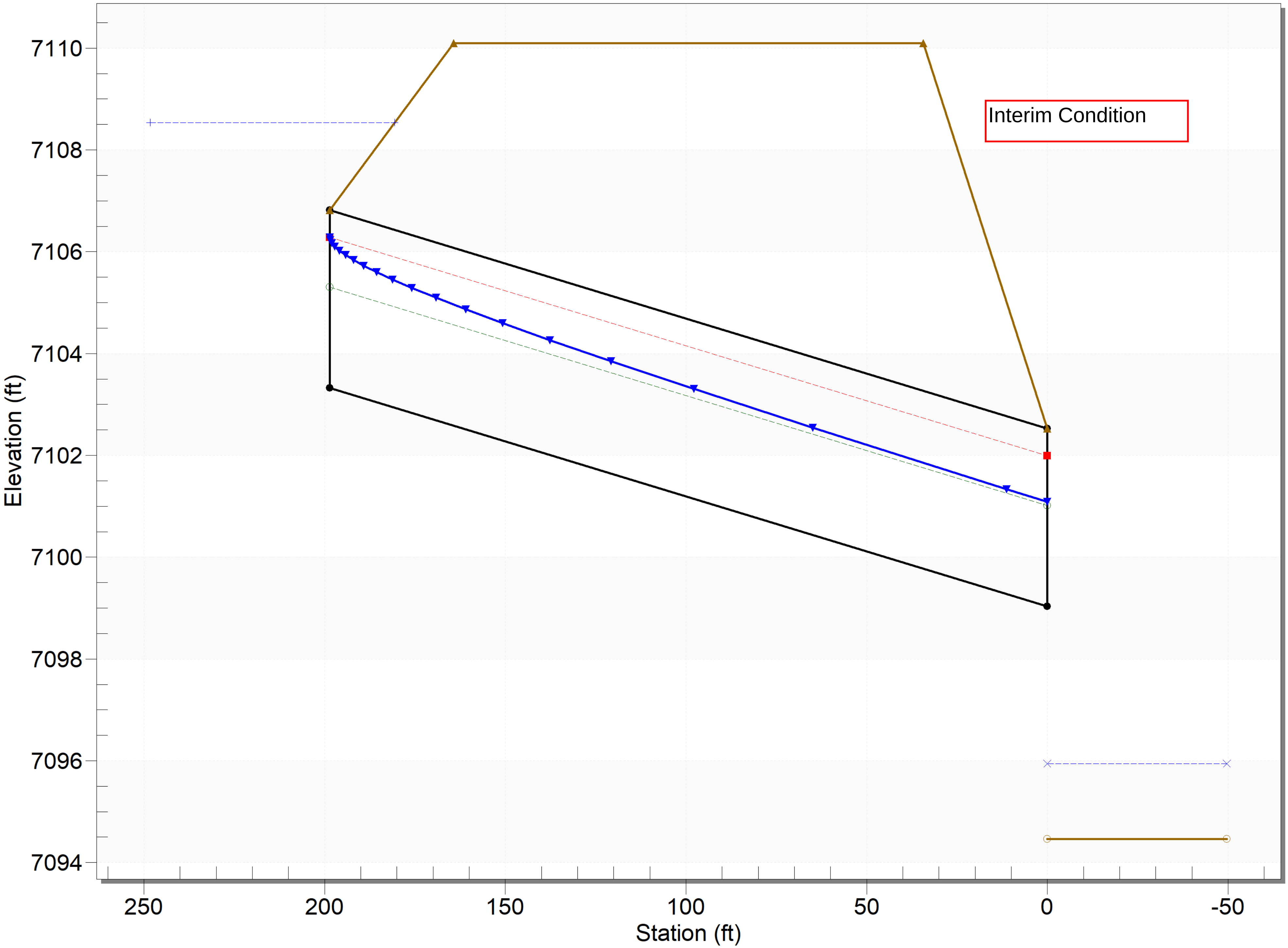
Culvert Crossing: Headwater at DP05

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7102.46	8.90	8.90	0.00	1
7102.46	8.90	8.90	0.00	1
7102.46	8.90	8.90	0.00	1
7102.46	8.90	8.90	0.00	1
7102.46	8.90	8.90	0.00	1
7102.46	8.90	8.90	0.00	1
7102.46	8.90	8.90	0.00	1
7102.46	8.90	8.90	0.00	1
7102.46	8.90	8.90	0.00	1
7102.46	8.90	8.90	0.00	1
7102.46	8.90	8.90	0.00	1
7104.50	26.18	26.18	0.00	Overtopping

Interim Condition

Crossing - Headwater at DP04, Design Discharge - 91.3 cfs

Culvert - Culvert 1, Culvert Discharge - 91.3 cfs



HY-8 Analysis Results

Interim Condition

Crossing Summary Table

Culvert Crossing: Headwater at DP04

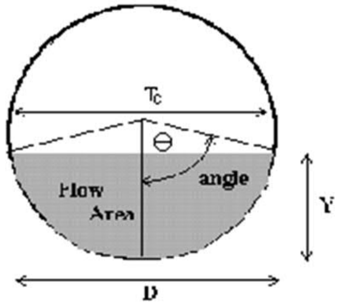
Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
7108.54	91.30	91.30	0.00	1
7108.54	91.30	91.30	0.00	1
7108.54	91.30	91.30	0.00	1
7108.54	91.30	91.30	0.00	1
7108.54	91.30	91.30	0.00	1
7108.54	91.30	91.30	0.00	1
7108.54	91.30	91.30	0.00	1
7108.54	91.30	91.30	0.00	1
7108.54	91.30	91.30	0.00	1
7108.54	91.30	91.30	0.00	1
7108.54	91.30	91.30	0.00	1
7110.10	113.42	113.42	0.00	Overtopping

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 1.1



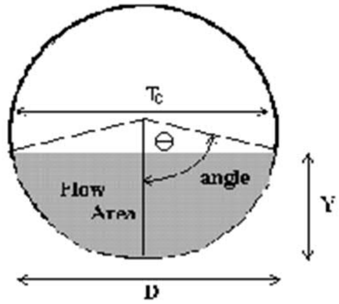
Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	Q =	18.7	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	32.08	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.67	radians
Flow area	An =	1.76	sq ft
Top width	Tn =	1.99	ft
Wetted perimeter	Pn =	3.34	ft
Flow depth	Yn =	1.10	ft
Flow velocity	Vn =	10.60	fps
Discharge	Qn =	18.70	cfs
Percent of Full Flow	Flow =	58.3%	of full flow
Normal Depth Froude Number	Fr_n =	1.98	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.16	radians
Critical flow area	Ac =	2.62	sq ft
Critical top width	Tc =	1.66	ft
Critical flow depth	Yc =	1.56	ft
Critical flow velocity	Vc =	7.13	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 1.2



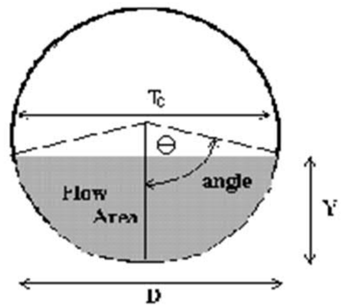
Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	36.00	inches
Design discharge	Q =	49.4	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	7.07	sq ft
Full-flow wetted perimeter	Pf =	9.42	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	94.58	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.60	radians
Flow area	An =	3.65	sq ft
Top width	Tn =	3.00	ft
Wetted perimeter	Pn =	4.79	ft
Flow depth	Yn =	1.54	ft
Flow velocity	Vn =	13.53	fps
Discharge	Qn =	49.40	cfs
Percent of Full Flow	Flow =	52.2%	of full flow
Normal Depth Froude Number	Fr_n =	2.16	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.12	radians
Critical flow area	Ac =	5.78	sq ft
Critical top width	Tc =	2.55	ft
Critical flow depth	Yc =	2.29	ft
Critical flow velocity	Vc =	8.54	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 1.3



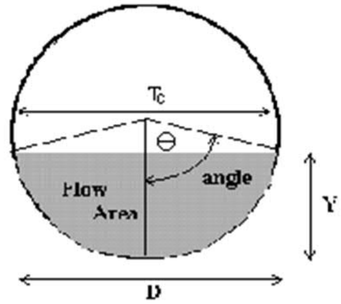
Design Information (Input)			
Pipe Invert Slope	So =	0.0250	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	36.00	inches
Design discharge	Q =	95.9	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	7.07	sq ft
Full-flow wetted perimeter	Pf =	9.42	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	105.74	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.09	radians
Flow area	An =	5.66	sq ft
Top width	Tn =	2.61	ft
Wetted perimeter	Pn =	6.26	ft
Flow depth	Yn =	2.24	ft
Flow velocity	Vn =	16.95	fps
Discharge	Qn =	95.90	cfs
Percent of Full Flow	Flow =	90.7%	of full flow
Normal Depth Froude Number	Fr_n =	2.03	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.74	radians
Critical flow area	Ac =	6.97	sq ft
Critical top width	Tc =	1.19	ft
Critical flow depth	Yc =	2.88	ft
Critical flow velocity	Vc =	13.76	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 1.4



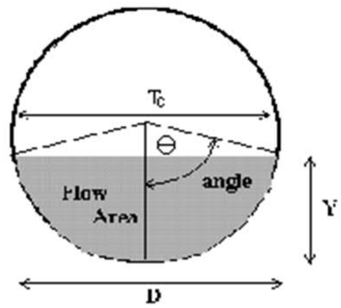
Design Information (Input)			
Pipe Invert Slope	So =	0.0250	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	36.00	inches
Design discharge	Q =	97.6	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	7.07	sq ft
Full-flow wetted perimeter	Pf =	9.42	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	105.74	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.11	radians
Flow area	An =	5.75	sq ft
Top width	Tn =	2.57	ft
Wetted perimeter	Pn =	6.34	ft
Flow depth	Yn =	2.27	ft
Flow velocity	Vn =	16.98	fps
Discharge	Qn =	97.60	cfs
Percent of Full Flow	Flow =	92.3%	of full flow
Normal Depth Froude Number	Fr_n =	2.00	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.75	radians
Critical flow area	Ac =	6.98	sq ft
Critical top width	Tc =	1.15	ft
Critical flow depth	Yc =	2.89	ft
Critical flow velocity	Vc =	13.98	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 2.1



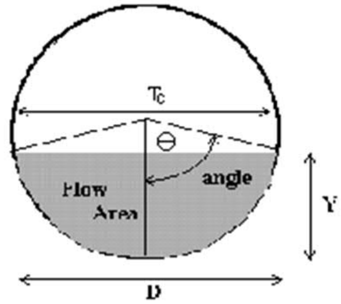
Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	Q =	17.5	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	32.08	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.62	radians
Flow area	An =	1.68	sq ft
Top width	Tn =	2.00	ft
Wetted perimeter	Pn =	3.25	ft
Flow depth	Yn =	1.05	ft
Flow velocity	Vn =	10.43	fps
Discharge	Qn =	17.50	cfs
Percent of Full Flow	Flow =	54.6%	of full flow
Normal Depth Froude Number	Fr_n =	2.01	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.10	radians
Critical flow area	Ac =	2.54	sq ft
Critical top width	Tc =	1.72	ft
Critical flow depth	Yc =	1.51	ft
Critical flow velocity	Vc =	6.89	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 2.2



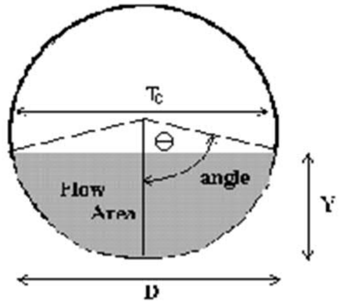
Design Information (Input)			
Pipe Invert Slope	So =	0.0250	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	Q =	32.9	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	35.87	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.10	radians
Flow area	An =	2.54	sq ft
Top width	Tn =	1.72	ft
Wetted perimeter	Pn =	4.21	ft
Flow depth	Yn =	1.51	ft
Flow velocity	Vn =	12.95	fps
Discharge	Qn =	32.90	cfs
Percent of Full Flow	Flow =	91.7%	of full flow
Normal Depth Froude Number	Fr_n =	1.88	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.69	radians
Critical flow area	Ac =	3.08	sq ft
Critical top width	Tc =	0.87	ft
Critical flow depth	Yc =	1.90	ft
Critical flow velocity	Vc =	10.67	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 2.3



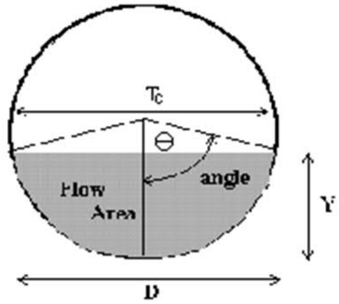
Design Information (Input)			
Pipe Invert Slope	So =	0.0450	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	Q =	47.3	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	48.12	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.23	radians
Flow area	An =	2.71	sq ft
Top width	Tn =	1.59	ft
Wetted perimeter	Pn =	4.45	ft
Flow depth	Yn =	1.61	ft
Flow velocity	Vn =	17.46	fps
Discharge	Qn =	47.30	cfs
Percent of Full Flow	Flow =	98.3%	of full flow
Normal Depth Froude Number	Fr_n =	2.35	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.92	radians
Critical flow area	Ac =	3.13	sq ft
Critical top width	Tc =	0.44	ft
Critical flow depth	Yc =	1.98	ft
Critical flow velocity	Vc =	15.09	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 2.4



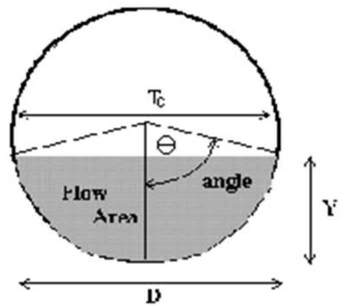
Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	36.00	inches
Design discharge	Q =	77.6	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	7.07	sq ft
Full-flow wetted perimeter	Pf =	9.42	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	94.58	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.96	radians
Flow area	An =	5.20	sq ft
Top width	Tn =	2.78	ft
Wetted perimeter	Pn =	5.88	ft
Flow depth	Yn =	2.07	ft
Flow velocity	Vn =	14.93	fps
Discharge	Qn =	77.61	cfs
Percent of Full Flow	Flow =	82.1%	of full flow
Normal Depth Froude Number	Fr_n =	1.92	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.55	radians
Critical flow area	Ac =	6.78	sq ft
Critical top width	Tc =	1.67	ft
Critical flow depth	Yc =	2.75	ft
Critical flow velocity	Vc =	11.44	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 2.5

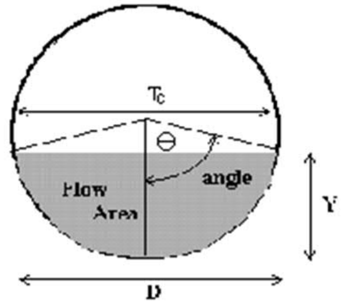


Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	48.00	inches
Design discharge	Q =	91.5	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	12.57	sq ft
Full-flow wetted perimeter	Pf =	12.57	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	203.69	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.51	radians
Flow area	An =	5.80	sq ft
Top width	Tn =	3.99	ft
Wetted perimeter	Pn =	6.04	ft
Flow depth	Yn =	1.88	ft
Flow velocity	Vn =	15.78	fps
Discharge	Qn =	91.51	cfs
Percent of Full Flow	Flow =	44.9%	of full flow
Normal Depth Froude Number	Fr_n =	2.31	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.04	radians
Critical flow area	Ac =	9.76	sq ft
Critical top width	Tc =	3.57	ft
Critical flow depth	Yc =	2.90	ft
Critical flow velocity	Vc =	9.38	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions
Pipe ID: 100 YEAR- DP 3.1



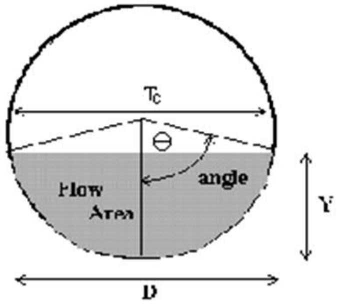
Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	18.00	inches
Design discharge	Q =	11.7	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	14.90	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.91	radians
Flow area	An =	1.25	sq ft
Top width	Tn =	1.41	ft
Wetted perimeter	Pn =	2.87	ft
Flow depth	Yn =	1.00	ft
Flow velocity	Vn =	9.33	fps
Discharge	Qn =	11.70	cfs
Percent of Full Flow	Flow =	78.6%	of full flow
Normal Depth Froude Number	Fr_n =	1.75	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.40	radians
Critical flow area	Ac =	1.63	sq ft
Critical top width	Tc =	1.02	ft
Critical flow depth	Yc =	1.30	ft
Critical flow velocity	Vc =	7.18	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 3.2



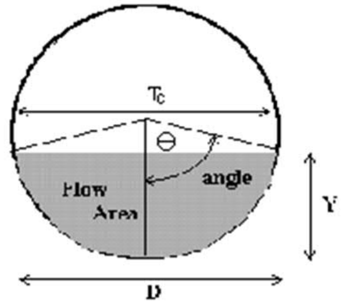
Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	18.00	inches
Design discharge	Q =	12.6	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	14.90	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.99	radians
Flow area	An =	1.33	sq ft
Top width	Tn =	1.37	ft
Wetted perimeter	Pn =	2.99	ft
Flow depth	Yn =	1.06	ft
Flow velocity	Vn =	9.45	fps
Discharge	Qn =	12.60	cfs
Percent of Full Flow	Flow =	84.6%	of full flow
Normal Depth Froude Number	Fr_n =	1.69	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.47	radians
Critical flow area	Ac =	1.66	sq ft
Critical top width	Tc =	0.93	ft
Critical flow depth	Yc =	1.34	ft
Critical flow velocity	Vc =	7.57	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 3.3



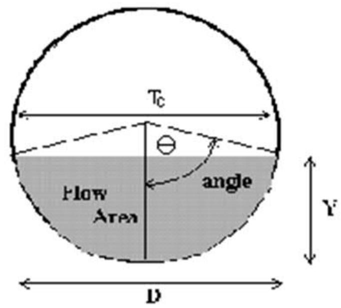
Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	Q =	24.1	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	32.08	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.87	radians
Flow area	An =	2.15	sq ft
Top width	Tn =	1.91	ft
Wetted perimeter	Pn =	3.74	ft
Flow depth	Yn =	1.29	ft
Flow velocity	Vn =	11.21	fps
Discharge	Qn =	24.10	cfs
Percent of Full Flow	Flow =	75.1%	of full flow
Normal Depth Froude Number	Fr_n =	1.86	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.40	radians
Critical flow area	Ac =	2.90	sq ft
Critical top width	Tc =	1.35	ft
Critical flow depth	Yc =	1.74	ft
Critical flow velocity	Vc =	8.31	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 3.4



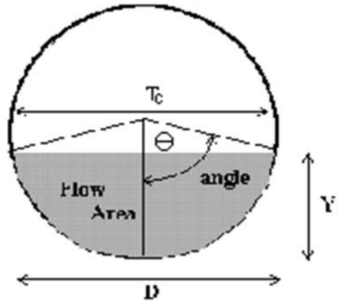
Design Information (Input)			
Pipe Invert Slope	So =	0.0300	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	36.00	inches
Design discharge	Q =	63.3	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	7.07	sq ft
Full-flow wetted perimeter	Pf =	9.42	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	115.84	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.63	radians
Flow area	An =	3.78	sq ft
Top width	Tn =	3.00	ft
Wetted perimeter	Pn =	4.88	ft
Flow depth	Yn =	1.58	ft
Flow velocity	Vn =	16.75	fps
Discharge	Qn =	63.31	cfs
Percent of Full Flow	Flow =	54.7%	of full flow
Normal Depth Froude Number	Fr_n =	2.63	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.35	radians
Critical flow area	Ac =	6.42	sq ft
Critical top width	Tc =	2.13	ft
Critical flow depth	Yc =	2.56	ft
Critical flow velocity	Vc =	9.86	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 3.5



Design Information (Input)

Pipe Invert Slope	So =	0.0300	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	36.00	inches
Design discharge	Q =	69.9	cfs

Full-Flow Capacity (Calculated)

Full-flow area	Af =	7.07	sq ft
Full-flow wetted perimeter	Pf =	9.42	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	115.84	cfs

Calculation of Normal Flow Condition

Half Central Angle (0<Theta<3.14)	Theta =	1.69	radians
Flow area	An =	4.08	sq ft
Top width	Tn =	2.98	ft
Wetted perimeter	Pn =	5.08	ft
Flow depth	Yn =	1.68	ft
Flow velocity	Vn =	17.15	fps
Discharge	Qn =	69.91	cfs
Percent of Full Flow	Flow =	60.3%	of full flow
Normal Depth Froude Number	Fr_n =	2.58	supercritical

Calculation of Critical Flow Condition

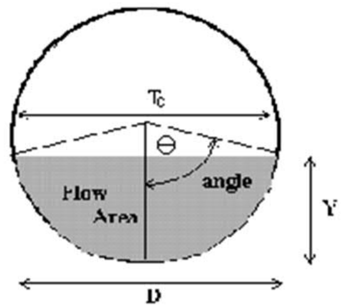
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.45	radians
Critical flow area	Ac =	6.62	sq ft
Critical top width	Tc =	1.91	ft
Critical flow depth	Yc =	2.66	ft
Critical flow velocity	Vc =	10.56	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 1.1d



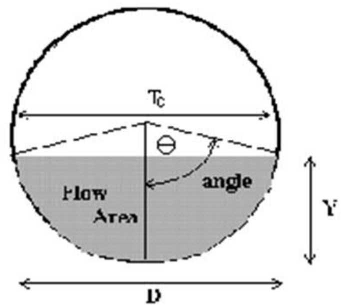
Design Information (Input)			
Pipe Invert Slope	So =	0.0200	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	18.00	inches
Design discharge	Q =	11.6	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	14.90	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.90	radians
Flow area	An =	1.24	sq ft
Top width	Tn =	1.42	ft
Wetted perimeter	Pn =	2.86	ft
Flow depth	Yn =	1.00	ft
Flow velocity	Vn =	9.32	fps
Discharge	Qn =	11.60	cfs
Percent of Full Flow	Flow =	77.9%	of full flow
Normal Depth Froude Number	Fr_n =	1.75	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.39	radians
Critical flow area	Ac =	1.62	sq ft
Critical top width	Tc =	1.03	ft
Critical flow depth	Yc =	1.30	ft
Critical flow velocity	Vc =	7.14	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 1.2d



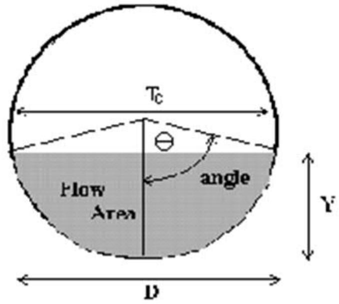
Design Information (Input)			
Pipe Invert Slope	So =	0.0300	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	18.00	inches
Design discharge	Q =	17.7	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	18.24	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	2.20	radians
Flow area	An =	1.50	sq ft
Top width	Tn =	1.21	ft
Wetted perimeter	Pn =	3.30	ft
Flow depth	Yn =	1.19	ft
Flow velocity	Vn =	11.76	fps
Discharge	Qn =	17.70	cfs
Percent of Full Flow	Flow =	97.0%	of full flow
Normal Depth Froude Number	Fr_n =	1.86	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.77	radians
Critical flow area	Ac =	1.75	sq ft
Critical top width	Tc =	0.55	ft
Critical flow depth	Yc =	1.45	ft
Critical flow velocity	Vc =	10.13	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 1.3d



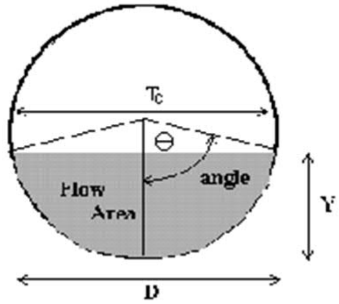
Design Information (Input)			
Pipe Invert Slope	So =	0.0300	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	18.00	inches
Design discharge	Q =	2.2	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	1.77	sq ft
Full-flow wetted perimeter	Pf =	4.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	18.24	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.01	radians
Flow area	An =	0.32	sq ft
Top width	Tn =	1.27	ft
Wetted perimeter	Pn =	1.52	ft
Flow depth	Yn =	0.35	ft
Flow velocity	Vn =	6.97	fps
Discharge	Qn =	2.20	cfs
Percent of Full Flow	Flow =	12.1%	of full flow
Normal Depth Froude Number	Fr_n =	2.47	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	1.31	radians
Critical flow area	Ac =	0.60	sq ft
Critical top width	Tc =	1.45	ft
Critical flow depth	Yc =	0.56	ft
Critical flow velocity	Vc =	3.65	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 1.4d



Design Information (Input)			
Pipe Invert Slope	So =	0.0300	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	Q =	19.2	cfs

Full-Flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	39.29	cfs

Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.56	radians
Flow area	An =	1.54	sq ft
Top width	Tn =	2.00	ft
Wetted perimeter	Pn =	3.11	ft
Flow depth	Yn =	0.99	ft
Flow velocity	Vn =	12.43	fps
Discharge	Qn =	19.20	cfs
Percent of Full Flow	Flow =	48.9%	of full flow
Normal Depth Froude Number	Fr_n =	2.49	supercritical

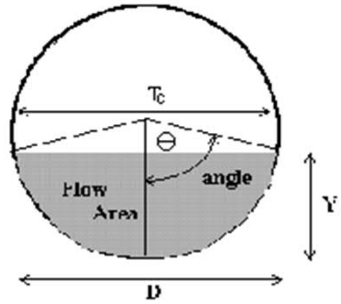
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.18	radians
Critical flow area	Ac =	2.66	sq ft
Critical top width	Tc =	1.64	ft
Critical flow depth	Yc =	1.58	ft
Critical flow velocity	Vc =	7.23	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 1.5d



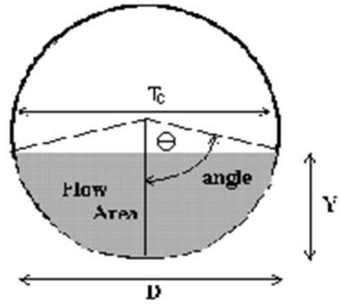
<u>Design Information (Input)</u>			
Pipe Invert Slope	So =	0.0190	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	48.00	inches
Design discharge	Q =	195.0	cfs
<u>Full-Flow Capacity (Calculated)</u>			
Full-flow area	Af =	12.57	sq ft
Full-flow wetted perimeter	Pf =	12.57	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	198.53	cfs
<u>Calculation of Normal Flow Condition</u>			
Half Central Angle (0<Theta<3.14)	Theta =	2.22	radians
Flow area	An =	10.83	sq ft
Top width	Tn =	3.18	ft
Wetted perimeter	Pn =	8.90	ft
Flow depth	Yn =	3.22	ft
Flow velocity	Vn =	18.01	fps
Discharge	Qn =	195.01	cfs
Percent of Full Flow	Flow =	98.2%	of full flow
Normal Depth Froude Number	Fr_n =	1.72	supercritical
<u>Calculation of Critical Flow Condition</u>			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.73	radians
Critical flow area	Ac =	12.38	sq ft
Critical top width	Tc =	1.61	ft
Critical flow depth	Yc =	3.83	ft
Critical flow velocity	Vc =	15.75	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

Pipe ID: 100 YEAR- DP 1.6d

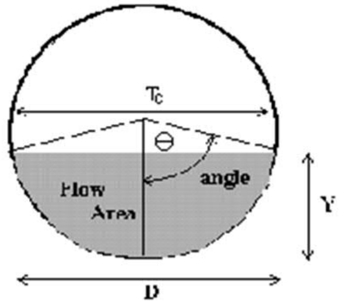


Design Information (Input)			
Pipe Invert Slope	So =	0.0150	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	60.00	inches
Design discharge	Q =	205.3	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	19.63	sq ft
Full-flow wetted perimeter	Pf =	15.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	319.83	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.74	radians
Flow area	An =	11.87	sq ft
Top width	Tn =	4.93	ft
Wetted perimeter	Pn =	8.68	ft
Flow depth	Yn =	2.91	ft
Flow velocity	Vn =	17.29	fps
Discharge	Qn =	205.33	cfs
Percent of Full Flow	Flow =	64.2%	of full flow
Normal Depth Froude Number	Fr_n =	1.96	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.26	radians
Critical flow area	Ac =	17.17	sq ft
Critical top width	Tc =	3.87	ft
Critical flow depth	Yc =	4.08	ft
Critical flow velocity	Vc =	11.96	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions
Pipe ID: 100 YEAR- DP 2.1d



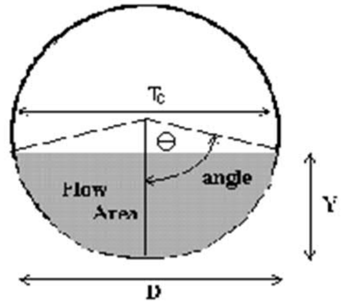
Design Information (Input)			
Pipe Invert Slope	So =	0.0150	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	24.00	inches
Design discharge	Q =	16.1	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	3.14	sq ft
Full-flow wetted perimeter	Pf =	6.28	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	27.78	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.66	radians
Flow area	An =	1.76	sq ft
Top width	Tn =	1.99	ft
Wetted perimeter	Pn =	3.33	ft
Flow depth	Yn =	1.09	ft
Flow velocity	Vn =	9.17	fps
Discharge	Qn =	16.10	cfs
Percent of Full Flow	Flow =	58.0%	of full flow
Normal Depth Froude Number	Fr_n =	1.72	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.03	radians
Critical flow area	Ac =	2.43	sq ft
Critical top width	Tc =	1.79	ft
Critical flow depth	Yc =	1.45	ft
Critical flow velocity	Vc =	6.62	fps
Critical Depth Froude Number	Fr_c =	1.00	

CIRCULAR CONDUIT FLOW (Normal & Critical Depth Computation)

MHFD-Culvert, Version 4.00 (May 2020)

Project: Homestead North - Proposed Conditions

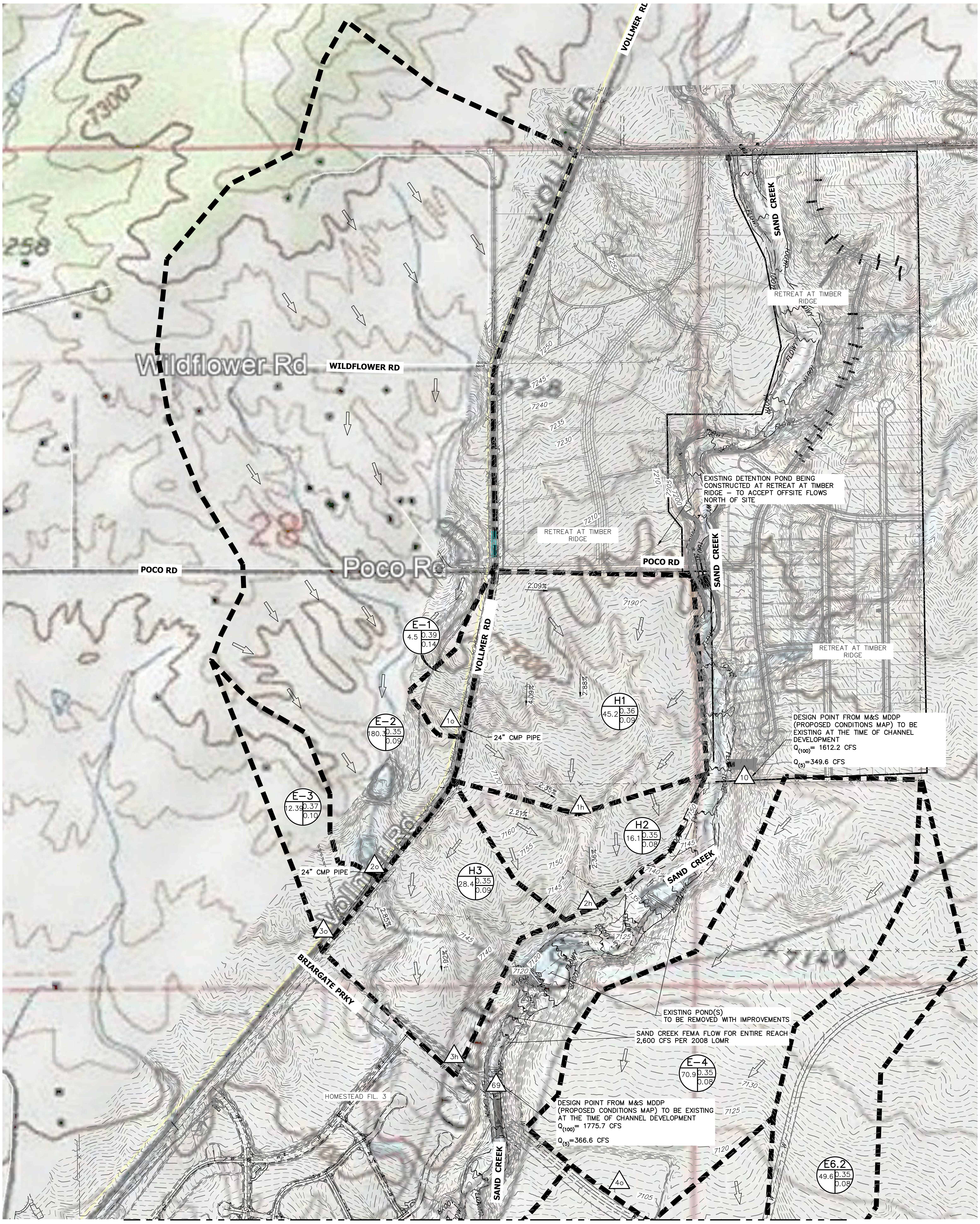
Pipe ID: 100 YEAR- DP 1.7d



Design Information (Input)			
Pipe Invert Slope	So =	0.0150	ft/ft
Pipe Manning's n-value	n =	0.0130	
Pipe Diameter	D =	60.00	inches
Design discharge	Q =	220.9	cfs
Full-Flow Capacity (Calculated)			
Full-flow area	Af =	19.63	sq ft
Full-flow wetted perimeter	Pf =	15.71	ft
Half Central Angle	Theta =	3.14	radians
Full-flow capacity	Qf =	319.83	cfs
Calculation of Normal Flow Condition			
Half Central Angle (0<Theta<3.14)	Theta =	1.79	radians
Flow area	An =	12.57	sq ft
Top width	Tn =	4.88	ft
Wetted perimeter	Pn =	8.97	ft
Flow depth	Yn =	3.06	ft
Flow velocity	Vn =	17.57	fps
Discharge	Qn =	220.90	cfs
Percent of Full Flow	Flow =	69.1%	of full flow
Normal Depth Froude Number	Fr_n =	1.93	supercritical
Calculation of Critical Flow Condition			
Half Central Angle (0<Theta-c<3.14)	Theta-c =	2.33	radians
Critical flow area	Ac =	17.66	sq ft
Critical top width	Tc =	3.64	ft
Critical flow depth	Yc =	4.22	ft
Critical flow velocity	Vc =	12.51	fps
Critical Depth Froude Number	Fr_c =	1.00	

Appendix D
Drainage Maps

EXISTING DRAINAGE MAP
HOMESTEAD NORTH



SEE SHEET 2

BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (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	70.90	2%	0.08	0.35	49.0	9.9	72.7
E-5	18.80	2%	0.08	0.35	34.9	3.4	24.9
E6.1	124.90	2%	0.08	0.35	48.1	17.7	130.0
E6.2	49.61	2%	0.08	0.35	44.2	7.5	55.4
H1	45.20	3%	0.09	0.36	34.7	8.9	61.0
H2	16.10	2%	0.08	0.35	25.1	3.5	26.0
H3	28.40	3%	0.09	0.35	31.3	5.9	40.8

DESIGN POINT		
DP	Q5 Total	Q100 Total
1h	8.0	52.4
2h	10.2	69.0
3h	32.5	223.2
1o	1.1	5.2
2o	28.1	192.9
3o	2.2	13.7
4o	9.9	72.7
5o	12.5	92.0
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
6100

300 150 0 300 600
ORIGINAL SCALE: 1" = 300'

EX DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1–4–2022
SHEET 1 OF 2

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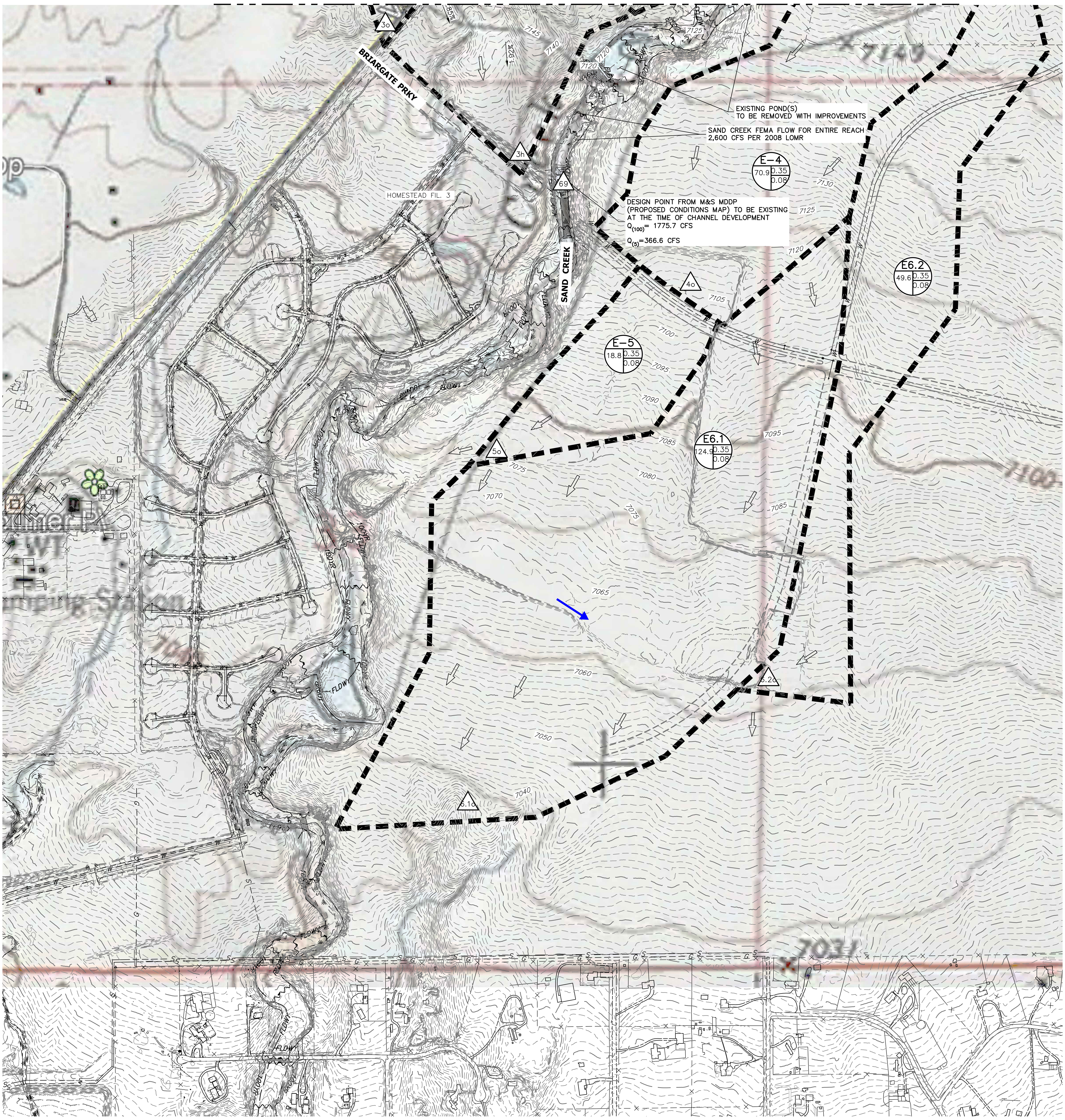
EXISTING DRAINAGE MAP
HOMESTEAD NORTH

SEE SHEET 1



BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (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	70.90	2%	0.08	0.35	49.0	9.9	72.7
E-5	18.80	2%	0.08	0.35	34.9	3.4	24.9
E6.1	124.90	2%	0.08	0.35	48.1	17.7	130.0
E6.2	49.61	2%	0.08	0.35	44.2	7.5	55.4
H1	45.20	3%	0.09	0.36	34.7	8.9	61.0
H2	16.10	2%	0.08	0.35	25.1	3.5	26.0
H3	28.40	3%	0.09	0.35	31.3	5.9	40.8

DESIGN POINT		
DP	Q5 Total	Q100 Total
1h	8.0	52.4
2h	10.2	69.0
3h	32.5	223.2
1o	1.1	5.2
2o	28.1	192.9
3o	2.2	13.7
4o	9.9	72.7
5o	12.5	92.0
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
6100

300 150 0 300 600
ORIGINAL SCALE: 1" = 300'

EX DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1-4-2022
SHEET 2 OF 2

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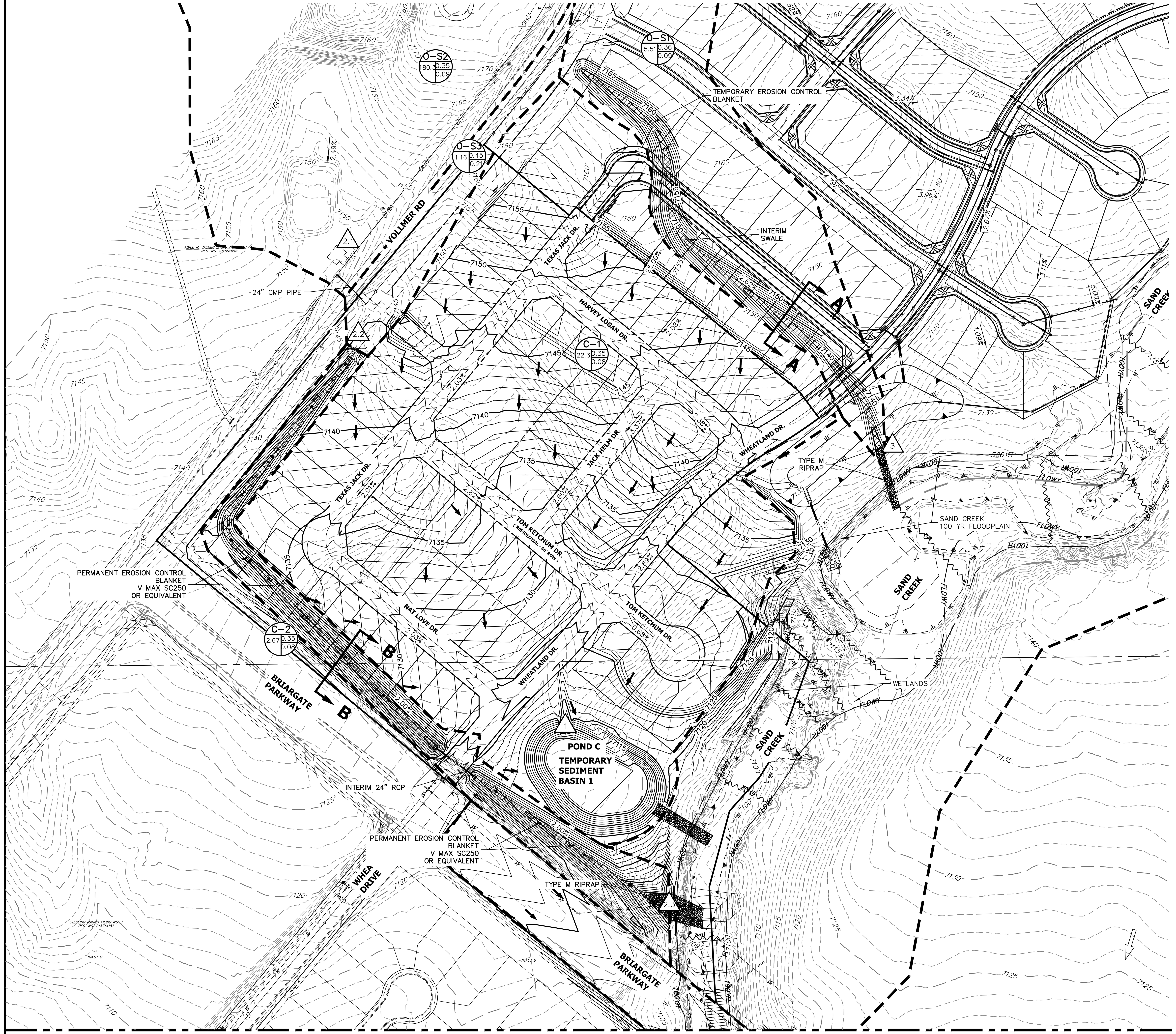
EARLY GRADING - DRAINAGE MAP



SEE SHEET 2

LEGEND

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

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

CHECK DAM

EXISTING 6100

PROPOSED 6100

SEDIMENT BASIN - SUMMARY TABLE

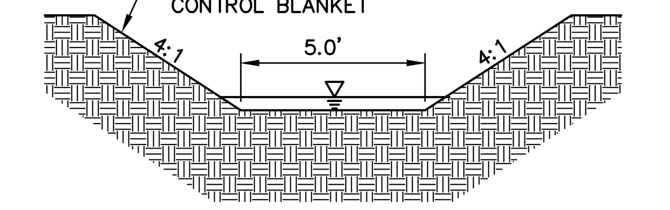
Temporary Sediment Basin	Contributing On-site Basin	Area (acres)	Percent Impervious	Contributing Off-site Basin	Off-Site Area (acres)	Percent Impervious	Required Volume (cf)	Provided Volume (cf)
1	C-1	22.30	2%			2%	80,280	108,900
2	D	17.29	2%	OS,O-S4,O-S5,OS-6,OS-7	250.76	2%	187,624	201,393

BASIN - SUMMARY TABLE

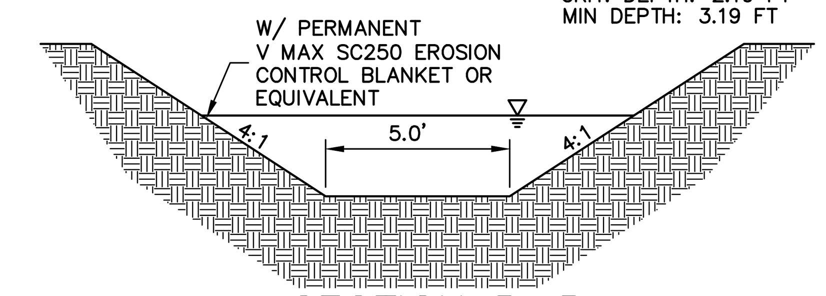
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
C-1	22.30	2.0%	0.08	0.35	40.1	3.6	26.8
C-2	2.67	2.0%	0.08	0.35	24.9	0.6	4.3
D	17.29	2.0%	0.08	0.35	52.1	2.3	16.8
OS	124.20	2.0%	0.08	0.35	64.5	13.3	97.2
O-S1	5.51	3.6%	0.09	0.36	36.5	1.1	7.3
O-S2	180.30	2.8%	0.09	0.35	47.4	28.1	192.9
O-S3	1.16	18.1%	0.21	0.45	14.0	0.9	3.2
O-S4	67.77	2.0%	0.08	0.35	34.0	12.4	91.3
O-S5	6.18	2.0%	0.08	0.35	30.7	1.2	8.9
O-S6	35.25	2.0%	0.08	0.35	29.3	7.1	52.1
O-S7	17.36	2.0%	0.08	0.35	29.5	3.5	25.5

DESIGN POINT

DP	Q5 Total	Q100 Total
0	28.6	214.2
1	3.6	26.8
2.1	28.1	192.9
2.2	28.5	194.5
2.3	28.9	197.3
3	1.1	7.3
4	12.4	91.3
5	1.2	8.9
6.1	7.1	52.1
6.2	3.5	77.4
7	26.7	196.2
8	2.3	16.8



SECTION A–A
TYPICAL DITCH CROSS SECTION A–A



SECTION B–B
TYPICAL DITCH CROSS SECTION B–B

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

EARLY GRADING – DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1/5/22
SHEET 1 OF 4

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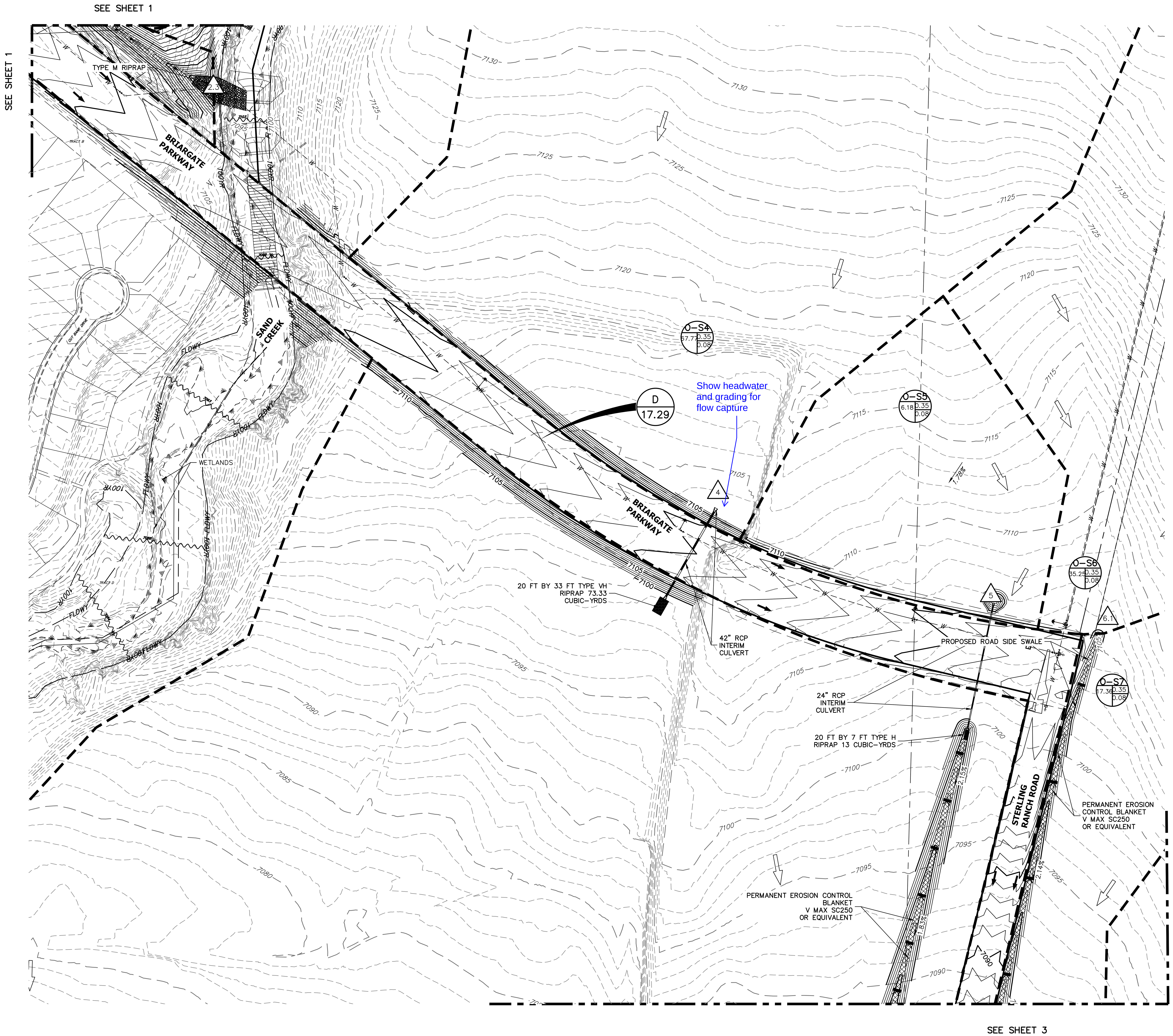
EARLY GRADING - DRAINAGE MAP



LEGEND

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

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

EXISTING 6100
PROPOSED 6100

SEDIMENT BASIN - SUMMARY TABLE

Temporary Sediment Basin	Contributing On-site Basin	Area (acres)	Percent Impervious	Contributing Off-site Basin	Off-Site 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,OS-7	250.76	2%	187,624	201,393

BASIN - SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
C-1	22.30	2.0%	0.08	0.35	40.1	3.6	26.8
C-2	2.67	2.0%	0.08	0.35	24.9	0.6	4.3
D	17.29	2.0%	0.08	0.35	52.1	2.3	16.8
OS	124.20	2.0%	0.08	0.35	64.5	13.3	97.2
O-S1	5.51	3.6%	0.09	0.36	36.5	1.1	7.3
O-S2	180.30	2.8%	0.09	0.35	47.4	28.1	192.9
O-S3	1.16	18.1%	0.21	0.45	14.0	0.9	3.2
O-S4	67.77	2.0%	0.08	0.35	34.0	12.4	91.3
O-S5	6.18	2.0%	0.08	0.35	30.7	1.2	8.9
O-S6	35.25	2.0%	0.08	0.35	29.3	7.1	52.1
O-S7	17.36	2.0%	0.08	0.35	29.5	3.5	25.5

DESIGN POINT

DP	Q5 Total	Q100 Total
0	28.6	214.2
1	3.6	26.8
2.1	28.1	192.9
2.2	28.5	194.5
2.3	28.9	197.3
3	1.1	7.3
4	12.4	91.3
5	1.2	8.9
6.1	7.1	52.1
6.2	3.5	77.4
7	26.7	196.2
8	2.3	16.8

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

EARLY GRADING - DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1/5/22
SHEET 2 OF 4

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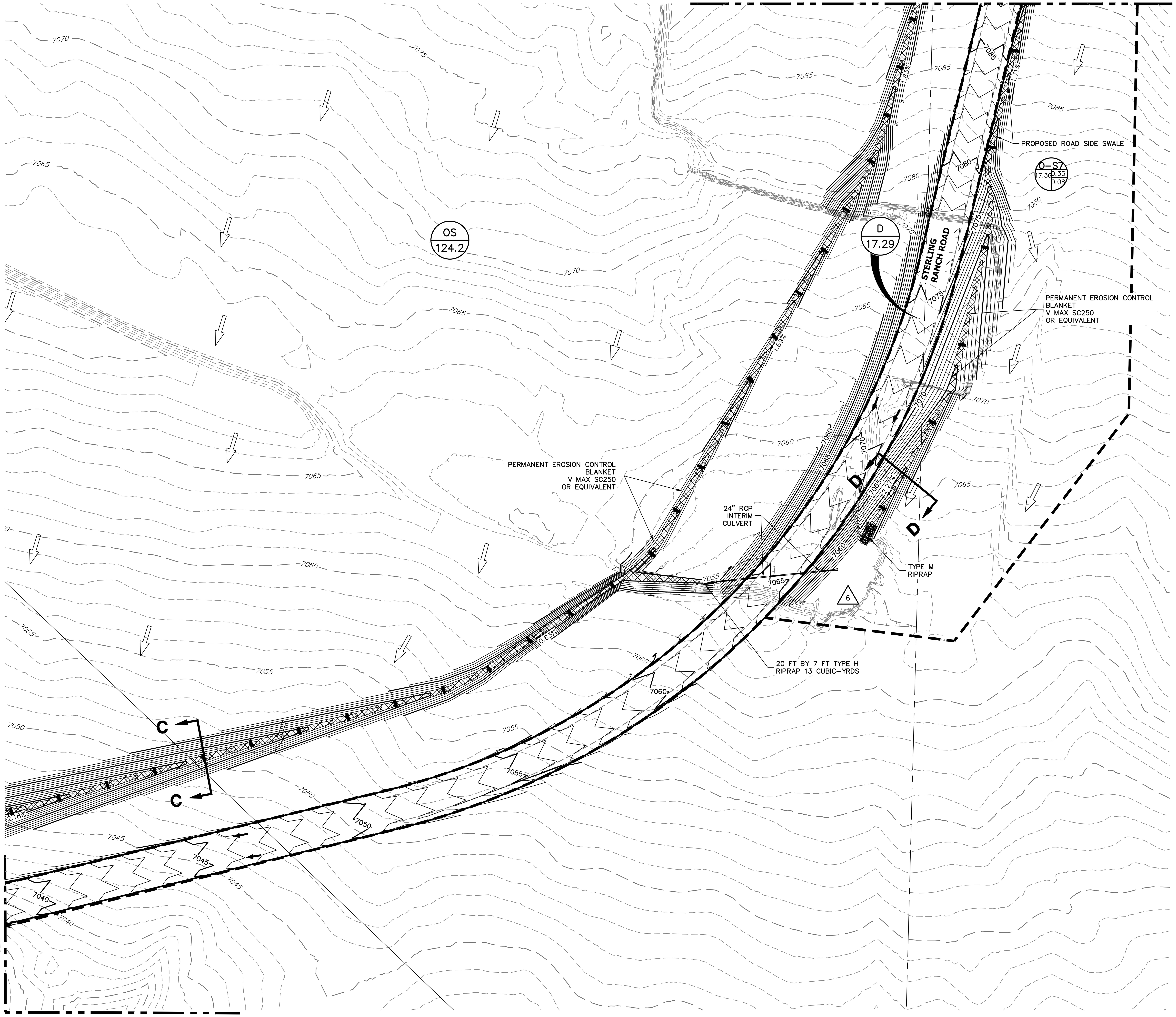
EARLY GRADING - DRAINAGE MAP



LEGEND

- BASIN ID
  - A: BASIN LABEL
  - B: AREA
  - C: C -100 YR
  - D: C-5 YR
- DESIGN POINT
- PROPOSED FLOW DIRECTION
- BASIN DRAINAGE AREA
- EXISTING STORM SEWER
- STORM SEWER PROPOSED
- PROPOSED R.O.W
- PROPOSED PROPERTY LINES
- PROPOSED SIDEWALK
- EXISTING PROPERTY LINE
- ROW EXISTING
- FL EXISTING
- SIDEWALK EXISTING
- DRAINAGE ACCESS & MAINTENANCE EASEMENT
- CHECK DAM

EXISTING 6100 — PROPOSED 6100

SEDIMENT BASIN - SUMMARY TABLE

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D	17.29	2.0%	0.08	0.35	52.1	2.3	16.8
OS	124.20	2.0%	0.08	0.35	64.5	13.3	97.2
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O-S2	180.30	2.8%	0.09	0.35	47.4	28.1	192.9
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O-S4	67.77	2.0%	0.08	0.35	34.0	12.4	91.3
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O-S6	35.25	2.0%	0.08	0.35	29.3	7.1	52.1
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DESIGN POINT

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0	28.6	214.2
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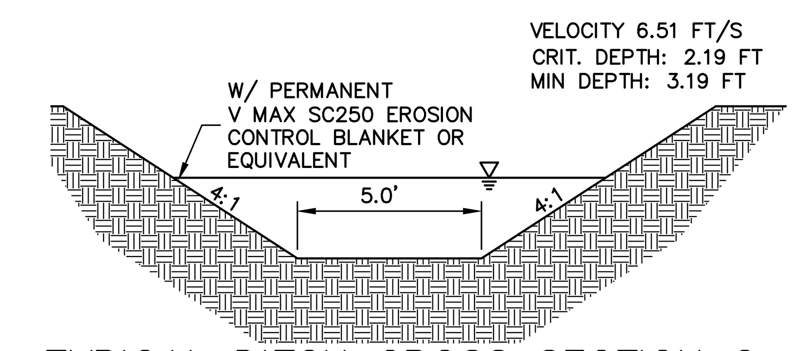
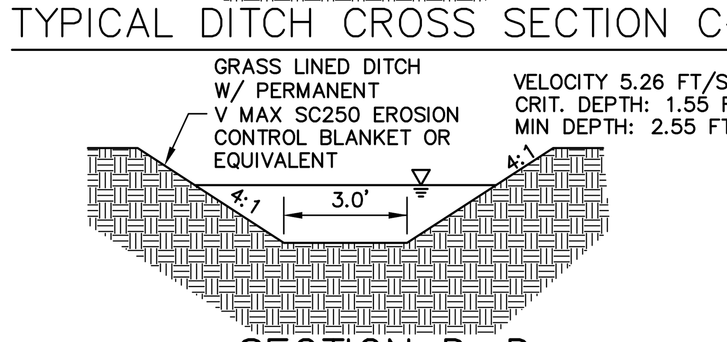


TYPICAL DITCH CROSS SECTION C–C



SECTION D–D

TYPICAL DITCH CROSS SECTION D–D

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

EARLY GRADING – DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1/5/22
SHEET 3 OF 4

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EARLY GRADING - DRAINAGE MAP

LEGEND

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

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

CHECK DAM

EXISTING 6100

PROPOSED 6100

SEDIMENT BASIN - SUMMARY TABLE

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C-2	2.67	2.0%	0.08	0.35	24.9	0.6	4.3
D	17.29	2.0%	0.08	0.35	52.1	2.3	16.8
OS	124.20	2.0%	0.08	0.35	64.5	13.3	97.2
O-S1	5.51	3.6%	0.09	0.36	36.5	1.1	7.3
O-S2	180.30	2.8%	0.09	0.35	47.4	28.1	192.9
O-S3	1.16	18.1%	0.21	0.45	14.0	0.9	3.2
O-S4	67.77	2.0%	0.08	0.35	34.0	12.4	91.3
O-S5	6.18	2.0%	0.08	0.35	30.7	1.2	8.9
O-S6	35.25	2.0%	0.08	0.35	29.3	7.1	52.1
O-S7	17.36	2.0%	0.08	0.35	29.5	3.5	25.5

DESIGN POINT

DP	Q5 Total	Q100 Total
0	28.6	214.2
1	3.6	26.8
2.1	28.1	192.9
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6.1	7.1	52.1
6.2	3.5	77.4
7	26.7	196.2
8	2.3	16.8

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

EARLY GRADING – DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1/5/22
SHEET 4 OF 4

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Description

Mulching consists of evenly applying straw, hay, shredded wood mulch, rock, bark or compost to disturbed soils and securing the mulch by crimping, tackifiers, netting or other measures. Mulching helps reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff. Although often applied in conjunction with temporary or permanent seeding, it can also be used for temporary stabilization of areas that cannot be reseeded due to seasonal constraints.

Mulch can be applied either using standard mechanical dry application methods or using hydromulching equipment that hydraulically applies a slurry of water, wood fiber mulch, and often a tackifier.

Photograph MU-1. An area that was recently seeded, mulched, and crimped.

Appropriate Uses

Use mulch in conjunction with seeding to help protect the seedbed and stabilize the soil. Mulch can also be used as a temporary cover on low to mild slopes to help temporarily stabilize disturbed areas where growing season constraints prevent effective reseeding. Disturbed areas should be properly mulched and tacked, or seeded, mulched and tacked promptly after final grade is reached (typically within no longer than 14 days) on portions of the site not otherwise permanently stabilized.

Standard dry mulching is encouraged in most jurisdictions; however, hydromulching may not be allowed in certain jurisdictions or may not be allowed near waterways.

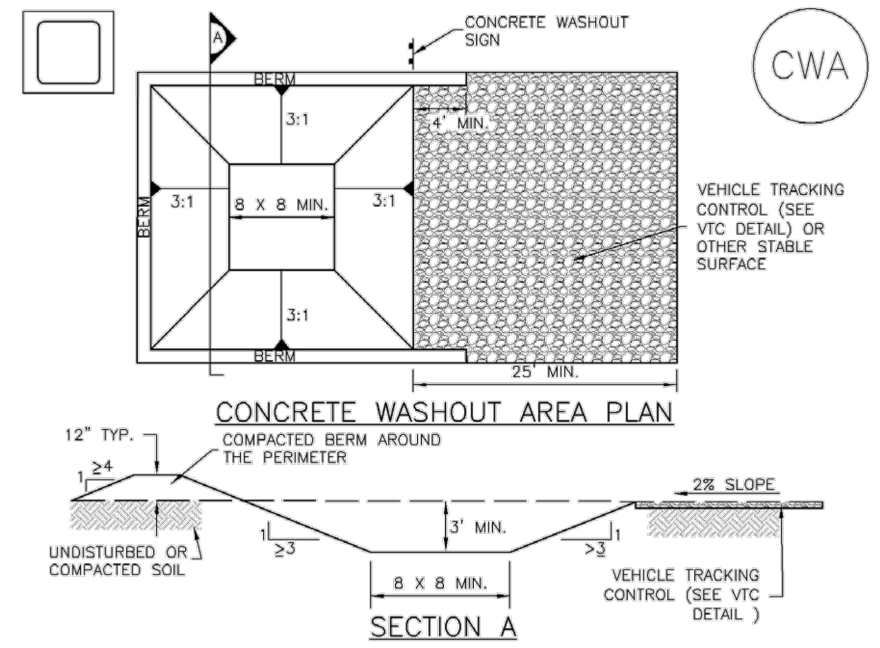
Do not apply mulch during windy conditions.

Design and Installation

Prior to mulching, surface-roughen areas by rolling with a crimping or punching type roller or by track walking. Track walking should only be used where other methods are impractical because track walking with heavy equipment typically compacts the soil.

A variety of mulches can be used effectively at construction sites. Consider the following:

Mulch	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	No



CWA–1. CONCRETE WASHOUT AREA

CWA INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –CWA INSTALLATION LOCATION.

2. DO NOT LOCATE AN UNLINED CWA WITHIN 400' OF ANY NATURAL DRAINAGE PATHWAY OR WATERBODY. DO NOT LOCATE WITHIN 1,000' OF ANY WELLS OR DRINKING WATER SOURCES. IF SITE CONSTRAINTS MAKE THIS INFEASIBLE, OR IF HIGHLY PERMEABLE SOILS EXIST ON SITE, THE CWA MUST BE INSTALLED WITH AN IMPERMEABLE LINER (16 MIL MIN. THICKNESS) OR SURFACE STORAGE ALTERNATIVES USING PREFABRICATED CONCRETE WASHOUT DEVICES OR A LINED ABOVE GROUND STORAGE ARE SHOULD BE USED.

3. THE CWA SHALL BE INSTALLED PRIOR TO CONCRETE PLACEMENT ON SITE.

4. CWA SHALL INCLUDE A FLAT SUBSURFACE PIT THAT IS AT LEAST 8' BY 8' SLOPES LEADING OUT OF THE SUBSURFACE PIT SHALL BE 3:1 OR FLATTER. THE PIT SHALL BE AT LEAST 3' DEEP.

5. BERM SURROUNDING SIDES AND BACK OF THE CWA SHALL HAVE MINIMUM HEIGHT OF 1'.

6. VEHICLE TRACKING PAD SHALL BE SLOPED 2% TOWARDS THE CWA.

7. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE CWA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CWA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.

8. USE EXCAVATED MATERIAL FOR PERIMETER BERM CONSTRUCTION.

Table TS/PS-2. Minimum Drill Seeding Rates for Perennial Grasses

Common[a] Name	Botanical Name	Growth Season[b]	Growth Form	Seeds/ Pound	Pounds of PLS/acre
Alakali Soil Seed Mix					
Alkali sacaton	*Sporobolus airoides*	Cool	Bunch	1,750,000	0.25
Basin wildrye	*Elymus cinereus*	Cool	Bunch	165,000	2.5
Sodar streambank wheatgrass	*Agropyron riparium 'Sodar'*	Cool	Sod	170,000	2.5
Jose tall wheatgrass	*Agropyron elongatum 'Jose'*	Cool	Bunch	79,000	7.0
Arriba western wheatgrass	*Agropyron smithii 'Arriba'*	Cool	Sod	110,000	5.5
Total					**17.75**
Fertile Loamy Soil Seed Mix					
Ephriam crested wheatgrass	*Agropyron cristatum 'Ephriam'*	Cool	Sod	175,000	2.0
Dural hard fescue	*Festuca ovina 'duriuscula'*	Cool	Bunch	565,000	1.0
Lincoln smooth brome	*Bromus inermis leyss 'Lincoln'*	Cool	Sod	130,000	3.0
Sodar streambank wheatgrass	*Agropyron riparium 'Sodar'*	Cool	Sod	170,000	2.5
Arriba western wheatgrass	*Agropyron smithii 'Arriba'*	Cool	Sod	110,000	7.0
Total					**15.5**
High Water Table Soil Seed Mix					
Meadow foxtail	*Alopecurus pratensis*	Cool	Sod	900,000	0.5
Redtop	*Agrostis alba*	Warm	Open sod	5,000,000	0.25
Reed canarygrass	*Phalaris arundinacea*	Cool	Sod	68,000	0.5
Lincoln smooth brome	*Bromus inermis leyss 'Lincoln'*	Cool	Sod	130,000	3.0
Pathfinder switchgrass	*Panicum virgatum 'Pathfinder'*	Warm	Sod	389,000	1.0
Alkar tall wheatgrass	*Agropyron elongatum 'Alkar'*	Cool	Bunch	79,000	5.5
Total					**10.75**
Transition Turf Seed Mix[c]					
Ruebens Canadian bluegrass	*Poa compressa 'Ruebens'*	Cool	Sod	2,500,000	0.5
Dural hard fescue	*Festuca ovina 'duriuscula'*	Cool	Bunch	565,000	1.0
Citation perennial ryegrass	*Lolium perenne 'Citation'*	Cool	Sod	247,000	3.0
Lincoln smooth brome	*Bromus inermis leyss 'Lincoln'*	Cool	Sod	130,000	3.0
Total					**7.5**

Table TS/PS-2. Minimum Drill Seeding Rates for Perennial Grasses (cont.)

Common Name	Botanical Name	Growth Season[b]	Growth Form	Seeds/ Pound	Pounds of PLS/acre
Sandy Soil Seed Mix					
Blue grama	*Bouteloua gracilis*	Warm	Sod-forming bunchgrass	825,000	0.5
Camper little bluestem	*Schizachyrium scoparium 'Camper'*	Warm	Bunch	240,000	1.0
Prairie sandreed	*Calamovilfa longifolia*	Warm	Open sod	274,000	1.0
Sand dropseed	*Sporobolus cryptandrus*	Cool	Bunch	5,298,000	0.25
Vaughn sideoats grama	*Bouteloua curtipendula 'Vaughn'*	Warm	Sod	191,000	2.0
Arriba western wheatgrass	*Agropyron smithii 'Arriba'*	Cool	Sod	110,000	5.5
Total					**10.25**
Heavy Clay, Rocky Foothill Seed Mix					
Ephriam crested wheatgrass[d]	*Agropyron cristatum 'Ephriam'*	Cool	Sod	175,000	1.5
Oahe Intermediate wheatgrass	*Agropyron intermedium 'Oahe'*	Cool	Sod	115,000	5.5
Vaughn sideoats grama[e]	*Bouteloua curtipendula 'Vaughn'*	Warm	Sod	191,000	2.0
Lincoln smooth brome	*Bromus inermis leyss 'Lincoln'*	Cool	Sod	130,000	3.0
Arriba western wheatgrass	*Agropyron smithii 'Arriba'*	Cool	Sod	110,000	5.5
Total					**17.5**

[a] All of the above seeding mixes and rates are based on drill seeding followed by crimped straw mulch. These rates should be doubled if seed is broadcast and should be increased by 50 percent if the seeding is done using a Brillion Drill or is applied through hydraulic seeding. Hydraulic seeding may be substituted for drilling only where slopes are steeper than 3:1. If hydraulic seeding is used, hydraulic mulching should be done as a separate operation.

[b] See Table TS/PS-3 for seeding dates.

[c] If site is to be irrigated, the transition turf seed rates should be doubled.

[d] Crested wheatgrass should not be used on slopes steeper than 6H to 1V.

[e] Can substitute 0.5 lbs PLS of blue grama for the 2.0 lbs PLS of Vaughn sideoats grama.

Table TS/PS-3. Seeding Dates for Annual and Perennial Grasses

	Annual Grasses (Numbers in table reference species in Table TS/PS-1)		Perennial Grasses	
Seeding Dates	**Warm**	**Cool**	**Warm**	**Cool**
January 1–March 15			✓	✓
March 16–April 30	4	1,2,3	✓	✓
May 1–May 15	4		✓	
May 16–June 30	4,5,6,7			
July 1–July 15	5,6,7			
July 16–August 31				
September 1–September 30		8,9,10,11		
October 1–December 31			✓	✓

Mulch

Cover seeded areas with mulch or an appropriate rolled erosion control product to promote establishment of vegetation. Anchor mulch by crimping, netting or use of a non-toxic tackifier. See the Mulching BMP Fact Sheet for additional guidance.

Maintenance and Removal

Monitor and observe seeded areas to identify areas of poor growth or areas that fail to germinate. Reseed and mulch these areas, as needed.

An area that has been permanently seeded should have a good stand of vegetation within one growing season if irrigated and within three growing seasons without irrigation in Colorado. Reseed portions of the site that fail to germinate or remain bare after the first growing season.

Seeded areas may require irrigation, particularly during extended dry periods. Targeted weed control may also be necessary.

Protect seeded areas from construction equipment and vehicle access.

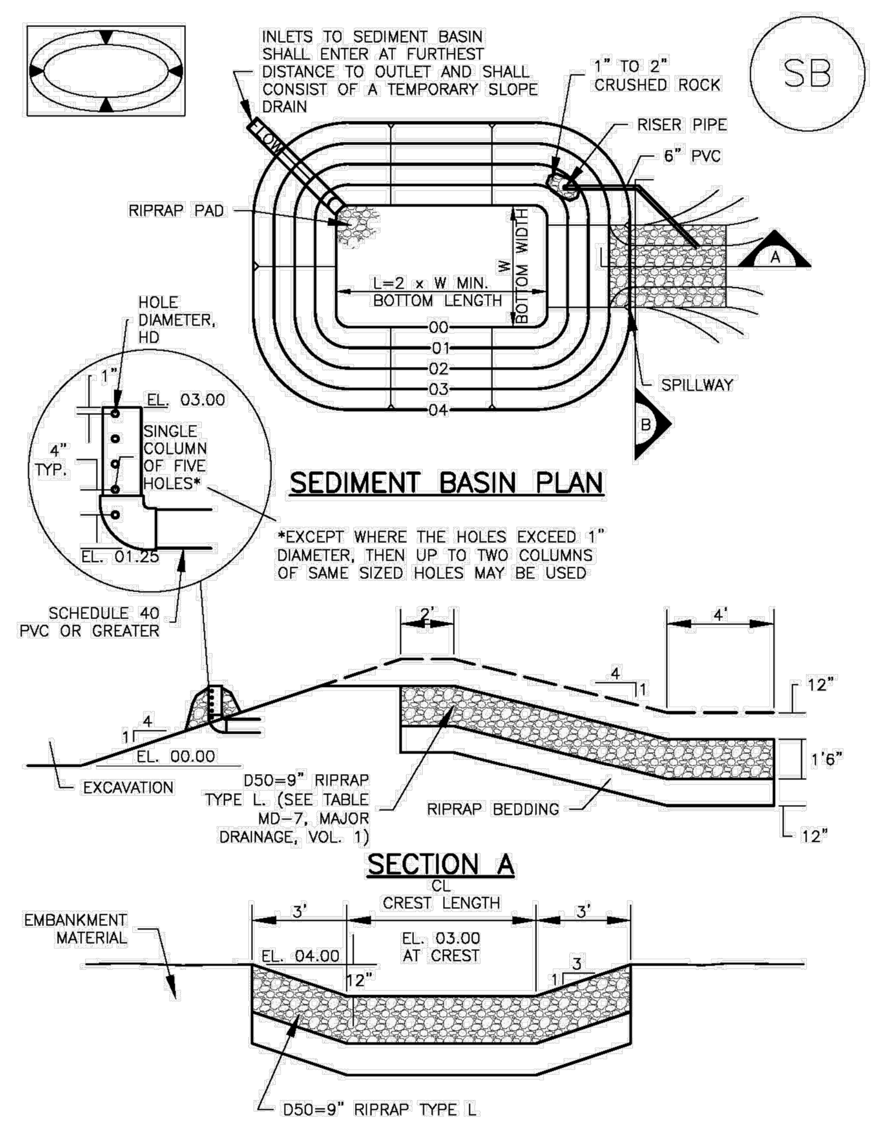


TABLE SB–1. SIZING INFORMATION FOR STANDARD SEDIMENT BASIN

	Upstream Drainage Area (rounded to nearest acre), (ac)	Basin Bottom Width (W), (ft)	Spillway Crest Length (CL), (ft)	Hole Diameter (HD), (in)
	1	12 ½	2	9/32
	2	21	3	13/16
	3	28	5	½
	4	33 ½	6	9/16
	5	38 ½	8	21/32
	6	43	9	21/32
	7	47 ¼	11	25/32
	8	51	12	27/32
	9	55	13	7/8
	10	58 ¼	15	15/16
	11	61	16	31/32
	12	64	18	1
	13	67 ½	19	1 1/16
	14	70 ½	21	1 1/8
	15	73 ¼	22	1 3/16
SEDIMENT BASIN 1	22	100	31	1 ¾
SEDIMENT BASIN 2	17 ONSITE ACRES 253 OFFSITE ACRES	152	103	2

SEDIMENT BASIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF SEDIMENT BASIN.
   –TYPE OF BASIN (STANDARD BASIN OR NONSTANDARD BASIN).
   –FOR STANDARD BASIN, BOTTOM WIDTH W, CREST LENGTH CL, AND HOLE DIAMETER, HD.
   –FOR NONSTANDARD BASIN, SEE CONSTRUCTION DRAWINGS FOR DESIGN OF BASIN INCLUDING RISER HEIGHT H, NUMBER OF COLUMNS N, HOLE DIAMETER HD AND PIPE DIAMETER D.

2. FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.

3. SEDIMENT BASINS SHALL BE INSTALLED PRIOR TO ANY OTHER LAND–DISTURBING ACTIVITY THAT RELIES ON ON BASINS AS AS A STORMWATER CONTROL.

4. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE NO. 200 SIEVE.

5. EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.

6. PIPE SCH 40 OR GREATER SHALL BE USED.

7. THE DETAILS SHOWN ON THESE SHEETS PERTAIN TO STANDARD SEDIMENT BASIN(S) FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES.

SEDIMENT BASIN MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED IN BASIN SHALL BE REMOVED AS NEEDED TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN SEDIMENT DEPTH REACHES ONE FOOT (I.E., TWO FEET BELOW THE SPILLWAY CREST).

5. SEDIMENT BASINS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS ACCEPTED BY THE LOCAL JURISDICTION.

6. WHEN SEDIMENT BASINS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
SR LAND, LLC
20 BOULDER CRESCENT
SUITE 201
COLORADO SPRINGS, CO 80903
JAMES F. MORLEY
(719) 471–1742

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

No.	REVISION	BY	DATE

H–SCALE	N/A
V–SCALE	N/A
DATE	06/30/21
DESIGNED BY	XXX
DRAWN BY	XXX
CHECKED BY	

HOMESTEAD NORTH AT STERLING RANCH

DETAIL

SHEET 8 OF 10

JOB NO. 25188.00

DRAINAGE MAP

LEGEND

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

DESIGN POINT
PROPOSED FLOW DIRECTION
BASIN DRAINAGE AREA
EXISTING STORM SEWER
STORM SEWER PROPOSED
PROPOSED R.O.W

PROPOSED PROPERTY LINES
PROPOSED SIDEWALK
EXISTING PROPERTY LINE
ROW EXISTING
FL EXISTING
SIDEWALK EXISTING
DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100
PROPOSED 6100

DESIGN POINT SUMMARY TABLE		
DP	Q5	Q100
	Total	Total
1a	6.9	14.7
3a	8.3	20.5
5a	9.5	26.1
7a	10.4	29.9
2a	6.4	13.3
1.1	13.0	18.7
4a	7.2	16.5
1.2	24.1	49.4
6a	10.7	18.5
1.3	44.2	95.9
8a	11.3	19.9
1.4	45.0	97.6
9A	21.6	104.4
1.1b	5.5	12.5
1.2b	3.5	7.4
2.1	8.7	17.5
1.3b	1.0	2.2
2b	2.4	6.8
3b	0.9	1.7
4b	7.1	16.8
6b	10.3	26.5
9b	12.1	30.3
5b	4.3	8.9
7b	7.3	14.9
2.2	16.3	32.9
2.3	23.5	47.3
8b	5.0	13.1
2.4	35.6	77.6
10b	5.7	14.3
2.5	42.5	91.5
11b	0.9	3.7
12b	1.5	4.1
2.6	46.1	102.6
1c	5.4	11.4
2.3c	7.1	14.9
2.1C	0.8	1.6
2.2C	9.8	20.1
4.2c	5.9	13.3
3.1	6.5	11.7
4C	18.9	42.0
3.1c	1.2	2.4
3.2	7.9	12.6
3.2c	3.6	7.9
3.3	14.3	24.1
3.4	31.6	63.3
5C	4.1	8.8
3.5	34.7	69.9
6C	2.5	8.8
3.6	41.4	79.2
1o	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
3d	0.6	1.2
4d	1.0	1.1
1.3d	0.5	2.2
1.4d	6.4	19.2
2o	27.1	190.9
6d	2.5	4.6
5d	3.1	6.1
1.5d	29.2	195.0
1.6d	32.6	205.3
3o	1.7	12.6
8d	2.5	14.4
7d	2.8	4.7
2.1d	3.5	16.1
1.7d	36.0	220.9
5	56.0	264.1

BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C5	C100	tc (min)	Q5 (cfs)	Q100 (cfs)
A1	3.67	52%	0.51	0.64	13.3	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	3.94	53%	0.52	0.65	12.5	7.7	16.2
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	1.28	60%	0.57	0.69	8.9	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	0.75	79%	0.72	0.83	5.0	2.8	5.4
D8	0.72	69%	0.64	0.77	5.0	2.4	4.8
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

DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1/7/22
SHEET 1 OF 2

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

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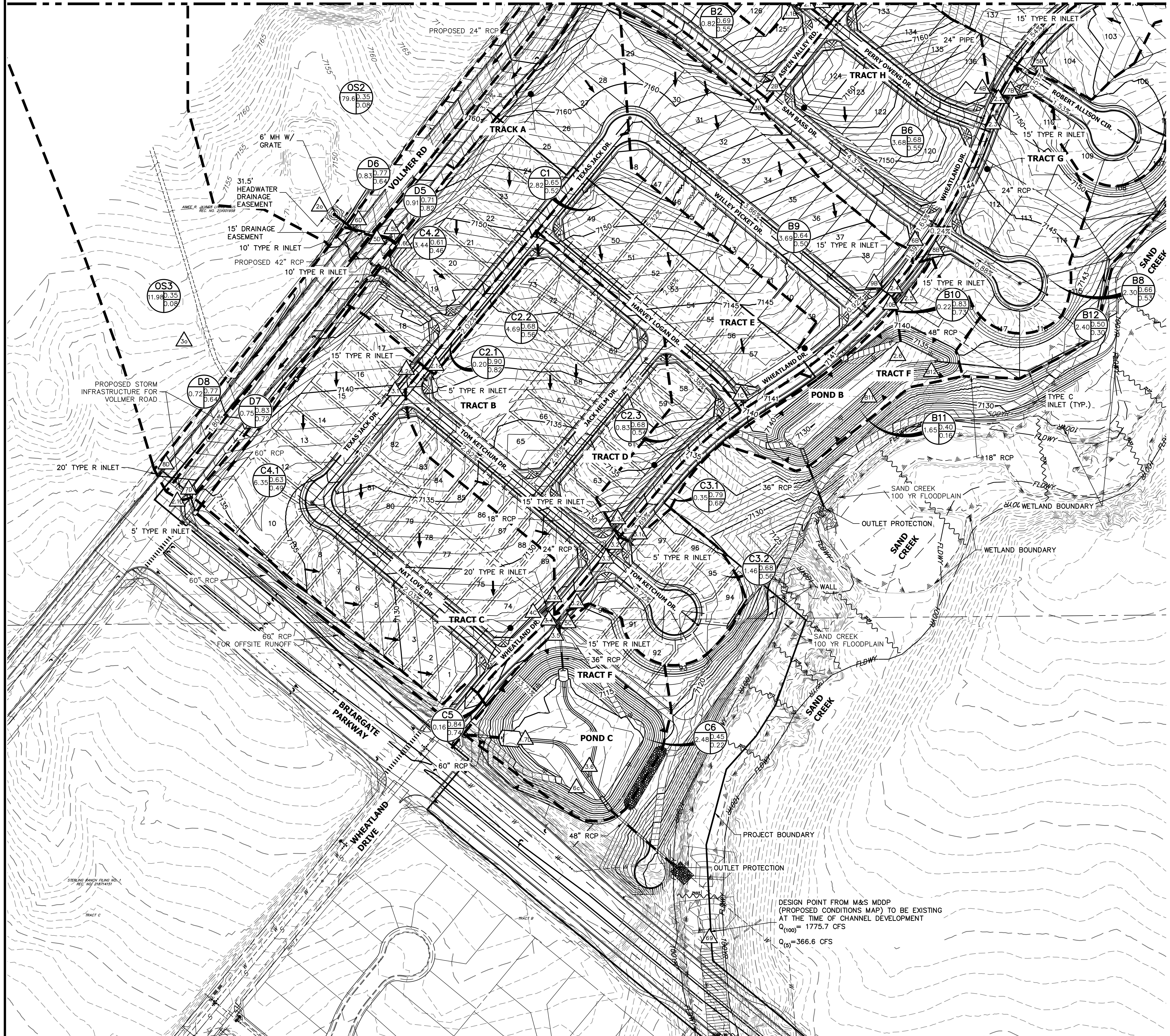
DRAINAGE MAP



LEGEND

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

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

PROPOSED 6100

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7a	10.4	29.9
2a	6.4	13.3
1.1	13.0	18.7
4a	7.2	16.5
1.2	24.1	49.4
6a	10.7	18.5
1.3	44.2	95.9
8a	11.3	19.9
1.4	45.0	97.6
9A	21.6	104.4
1.1b	5.5	12.5
1.2b	3.5	7.4
2.1	8.7	17.5
1.3b	1.0	2.2
2b	2.4	6.8
3b	0.9	1.7
4b	7.1	16.8
6b	10.3	26.5
9b	12.1	30.3
5b	4.3	8.9
7b	7.3	14.9
2.2	16.3	32.9
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8b	5.0	13.1
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12b	1.5	4.1
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1c	5.4	11.4
2.3c	7.1	14.9
2.1C	0.8	1.6
2.2C	9.8	20.1
4.2c	5.9	13.3
3.1	6.5	11.7
4C	18.9	42.0
3.1c	1.2	2.4
3.2	7.9	12.6
3.2c	3.6	7.9
3.3	14.3	24.1
3.4	31.6	63.3
5C	4.1	8.8
3.5	34.7	69.9
6C	2.5	8.8
3.6	41.4	79.2
1o	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
3d	0.6	1.2
4d	1.0	1.1
1.3d	0.5	2.2
1.4d	6.4	19.2
2o	27.1	190.9
6d	2.5	4.6
5d	3.1	6.1
1.5d	29.2	195.0
1.6d	32.6	205.3
3o	1.7	12.6
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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	3.94	53%	0.52	0.65	12.5	7.7	16.2
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	1.28	60%	0.57	0.69	8.9	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	0.75	79%	0.72	0.83	5.0	2.8	5.4
D8	0.72	69%	0.64	0.77	5.0	2.4	4.8
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

DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1/7/22
SHEET 2 OF 2

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

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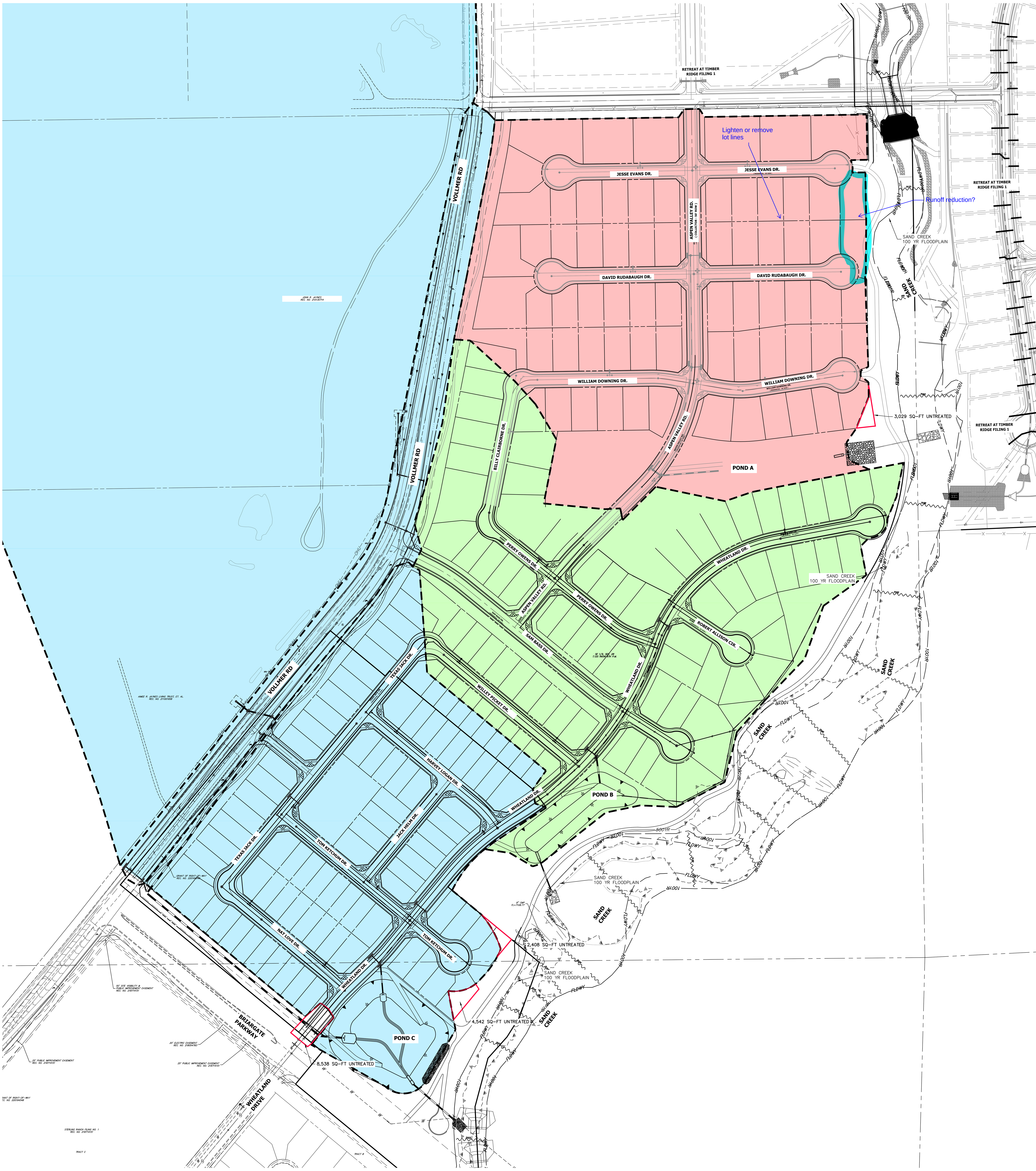
WATER QUALITY CAPTURE PLAN

HOMESTEAD NORTH



(red)	POND A 30.26 ACRES, 46.5% IMPERVIOUS
(green)	POND B 27.86 ACRES, 50.0% IMPERVIOUS
(blue)	POND C 224.42 ACRES, 10.3% IMPERVIOUS

NOTE:

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

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

WQ – PONDS
HOMESTEAD NORTH
JOB NO. 25188.00
1-07-2022
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

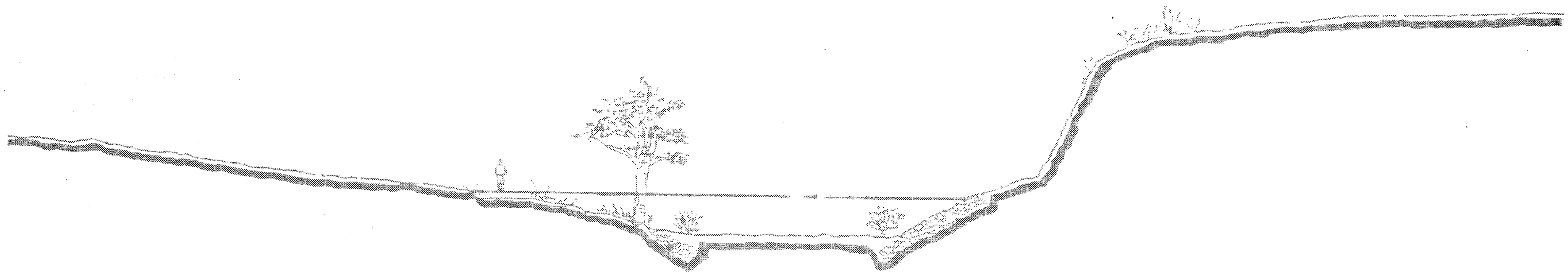
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

Appendix E
Reference Material

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN REPORT

CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO



PREPARED FOR:

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

PREPARED BY:

Kiowa Engineering Corporation
1011 North Weber
Colorado Springs, CO 80903

II. STUDY AREA DESCRIPTION

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

Basin Description

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

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

Climate

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

Soils and Geology

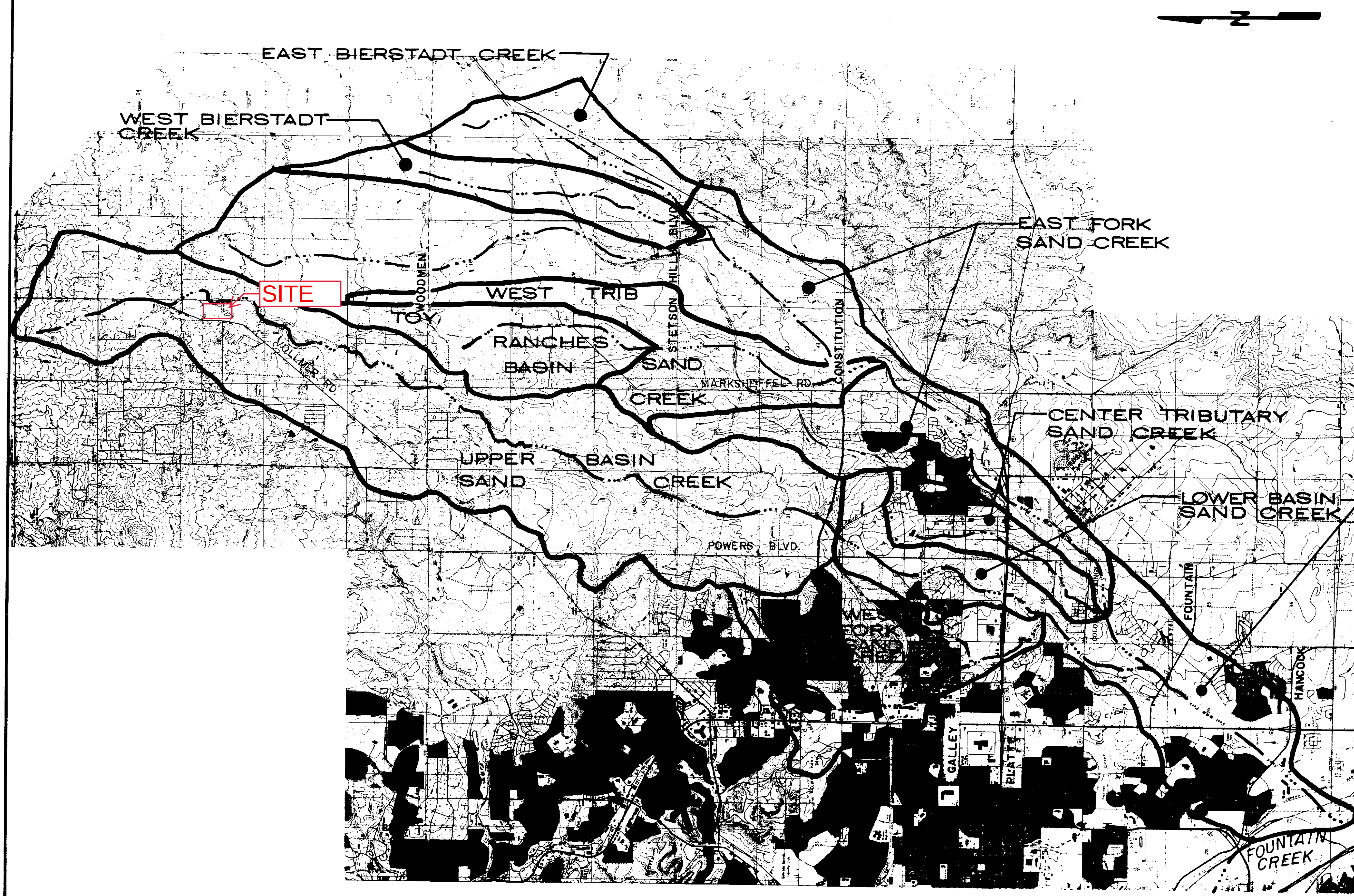
Soils within the Sand Creek basin vary between soil types A through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant soil groupings are in the Truckton and Bresser soil associations. The soils consist of deep, well drained soils that formed in alluvium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

Property Ownership and Impervious Land Densities

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

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

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



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

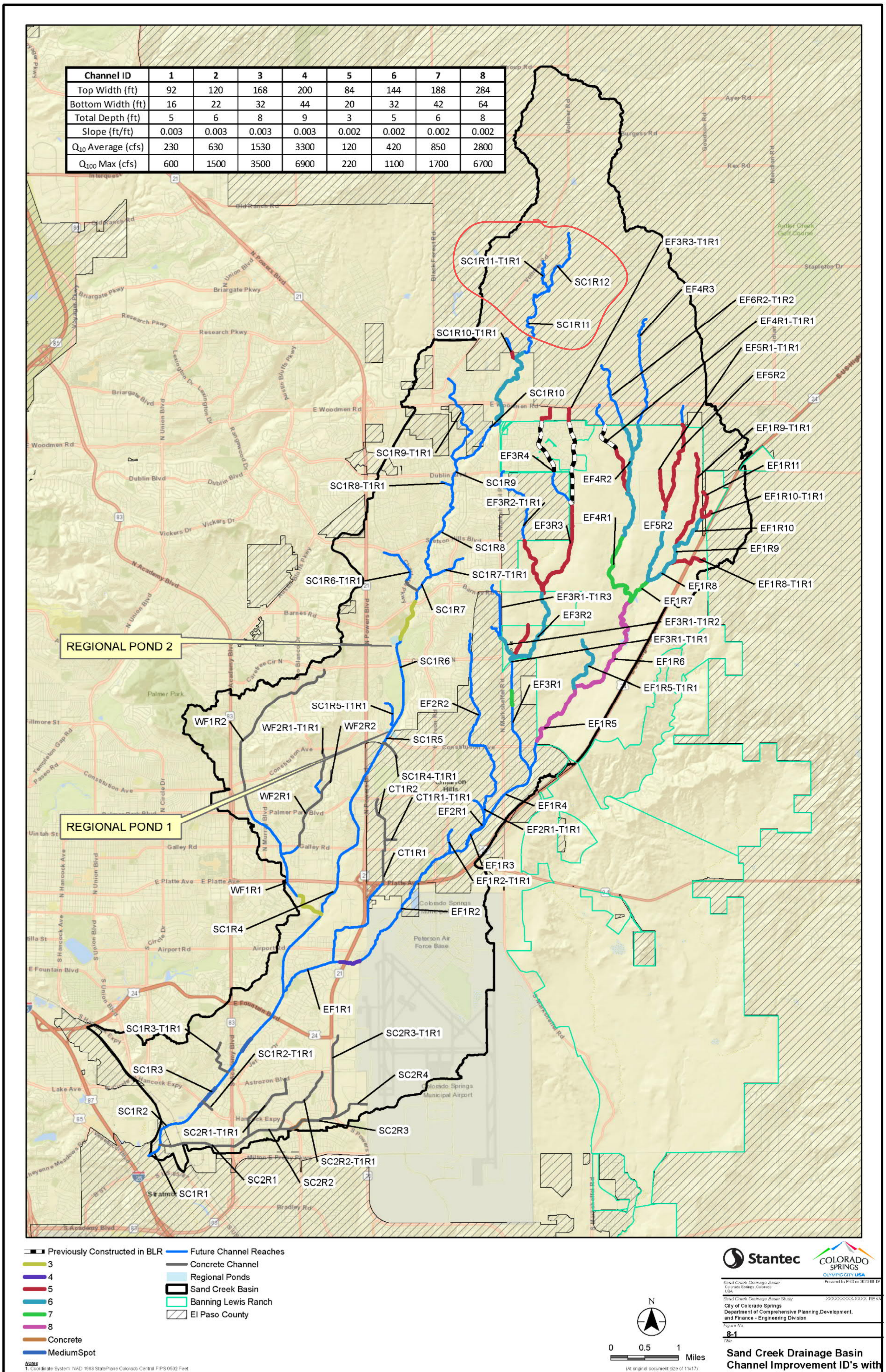
SAND CREEK DRAINAGE BASIN PLANNING STUDY

REGIONAL SUB-BASINS

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

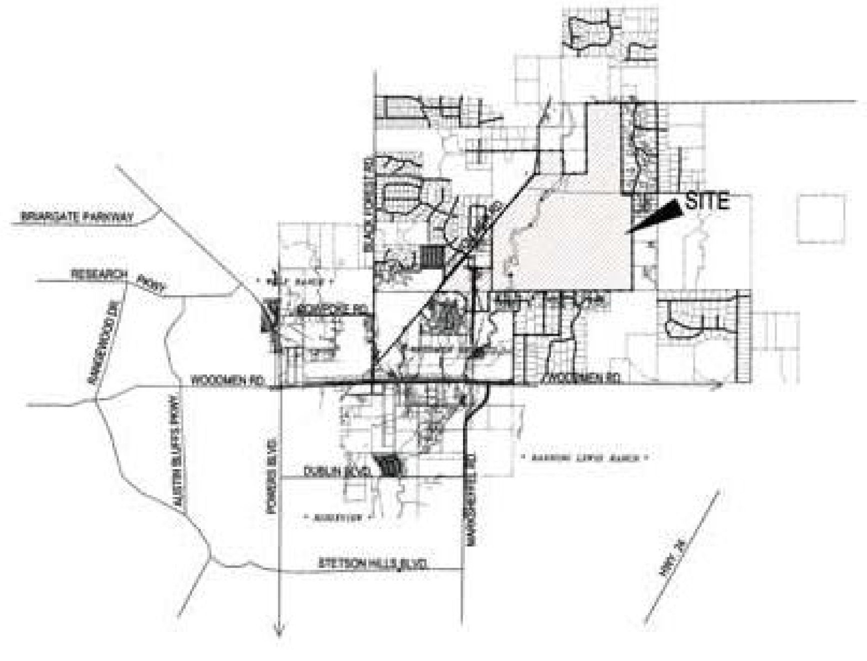
11

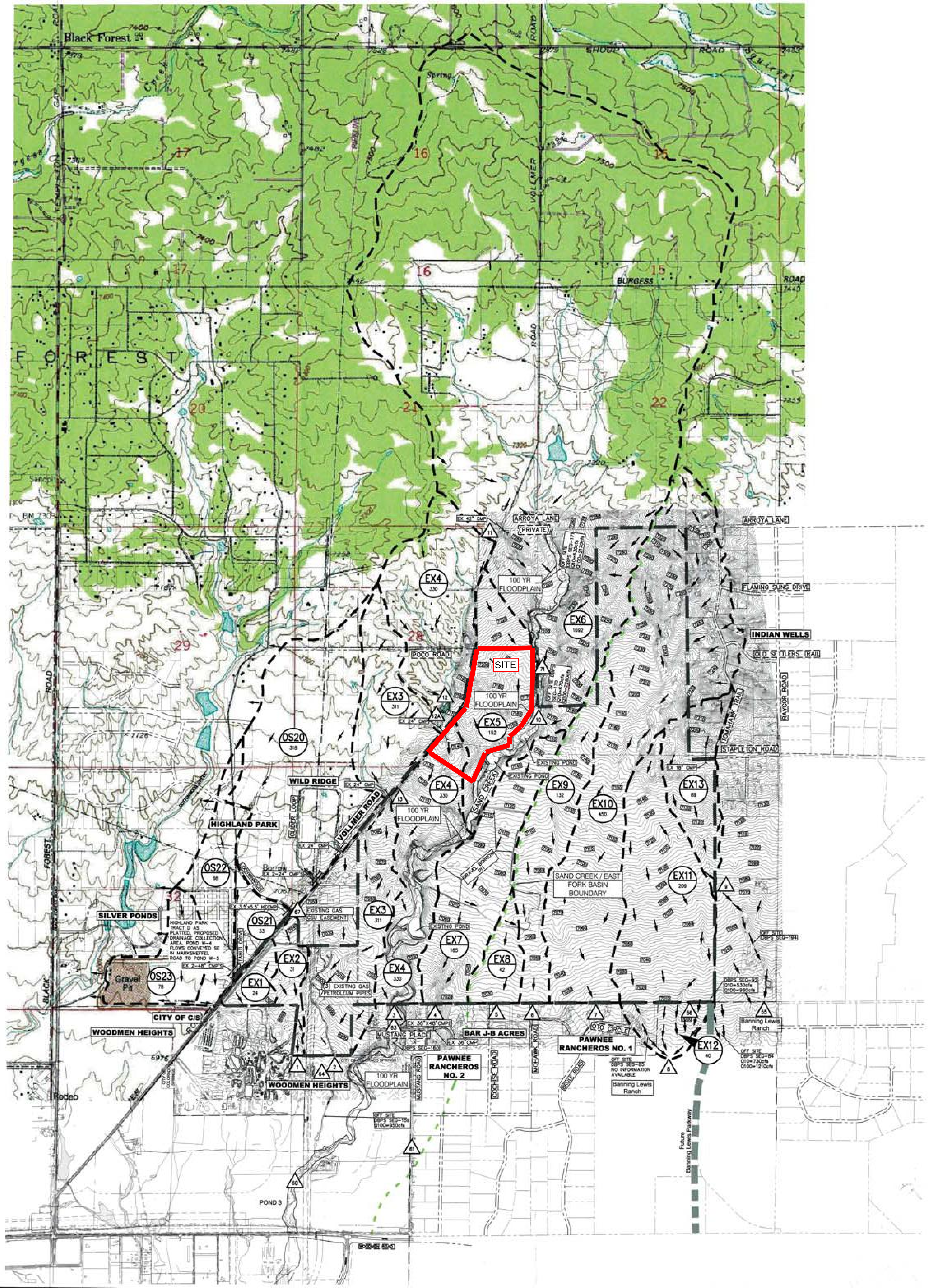
FIG. III-1



Channel ID	1	2	3	4	5	6	7	8
Top Width (ft)	92	120	168	200	84	144	188	284
Bottom Width (ft)	16	22	32	44	20	32	42	64
Total Depth (ft)	5	6	8	9	3	5	6	8
Slope (ft/ft)	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002
Q_{10} Average (cfs)	230	630	1530	3300	120	420	850	2800
Q_{100} Max (cfs)	600	1500	3500	6900	220	1100	1700	6700

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





HISTORIC CONDITION

BASIN SUMMARY

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

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

HISTORIC CONDITION

DESIGN POINTS

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

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

* NOTE: DBPS FLOWS ARE FOR THE EXISTING CONDITION

\# NO DATA GIVEN IN DBPS

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

1" = 1000'

0 250 500 1000 2000

Scale in Feet

LEGEND

EX1 23.2 — EXISTING MDDP BASIN ACREAGE

E1 — EXISTING FLOW RELEASE POINT

FLOW DIRECTION

BASIN BOUNDARY

PROPERTY BOUNDARY

6920 — EXISTING CONTOUR

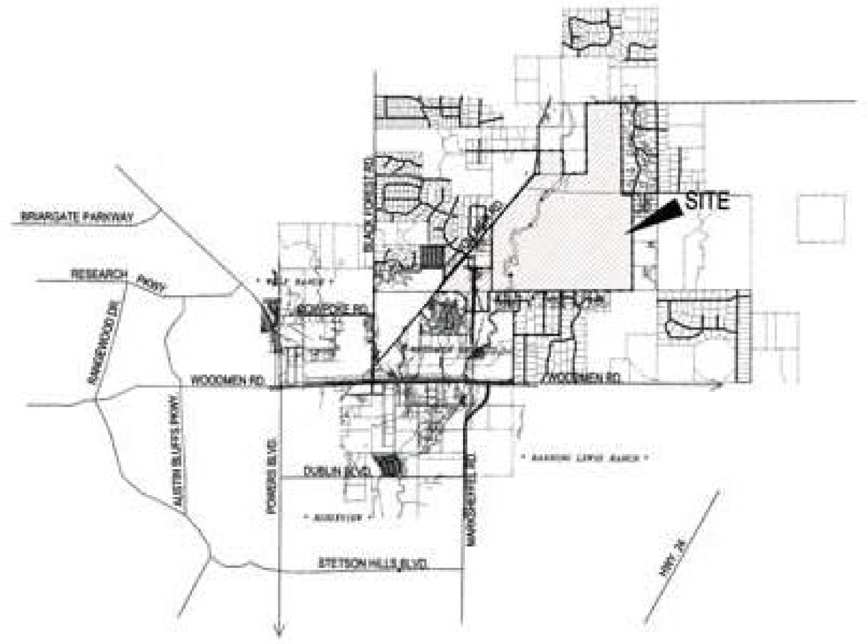
CULVERT PIPE

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

STERLING RANCH MDDP

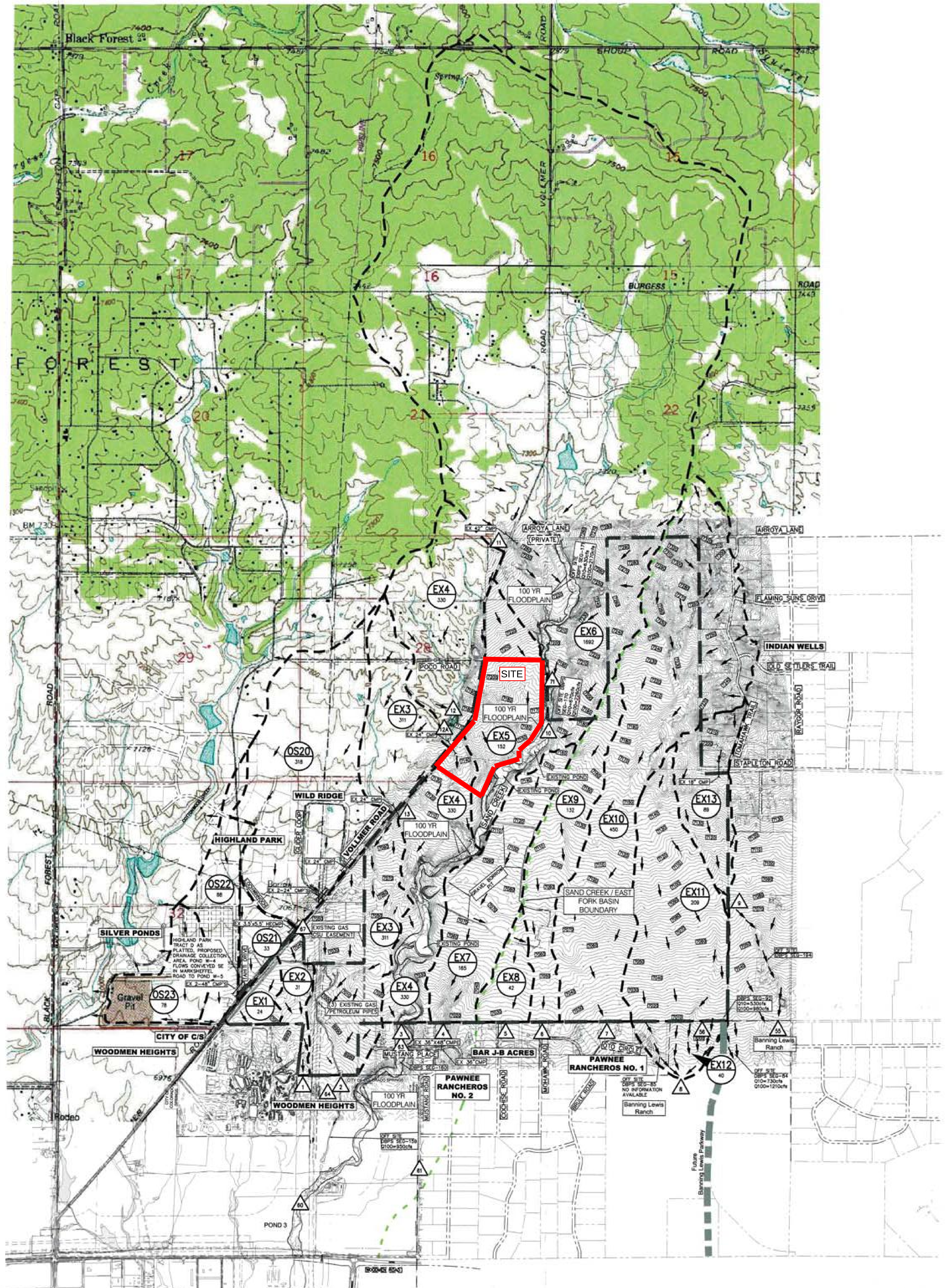
HISTORIC – DRAINAGE MAP

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



STERLING RANCH

N.T.S.



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NO DATA GIVEN IN DBPS

1" = 1000'

0 250 500 1000 2000

Scale in Feet

LEGEND

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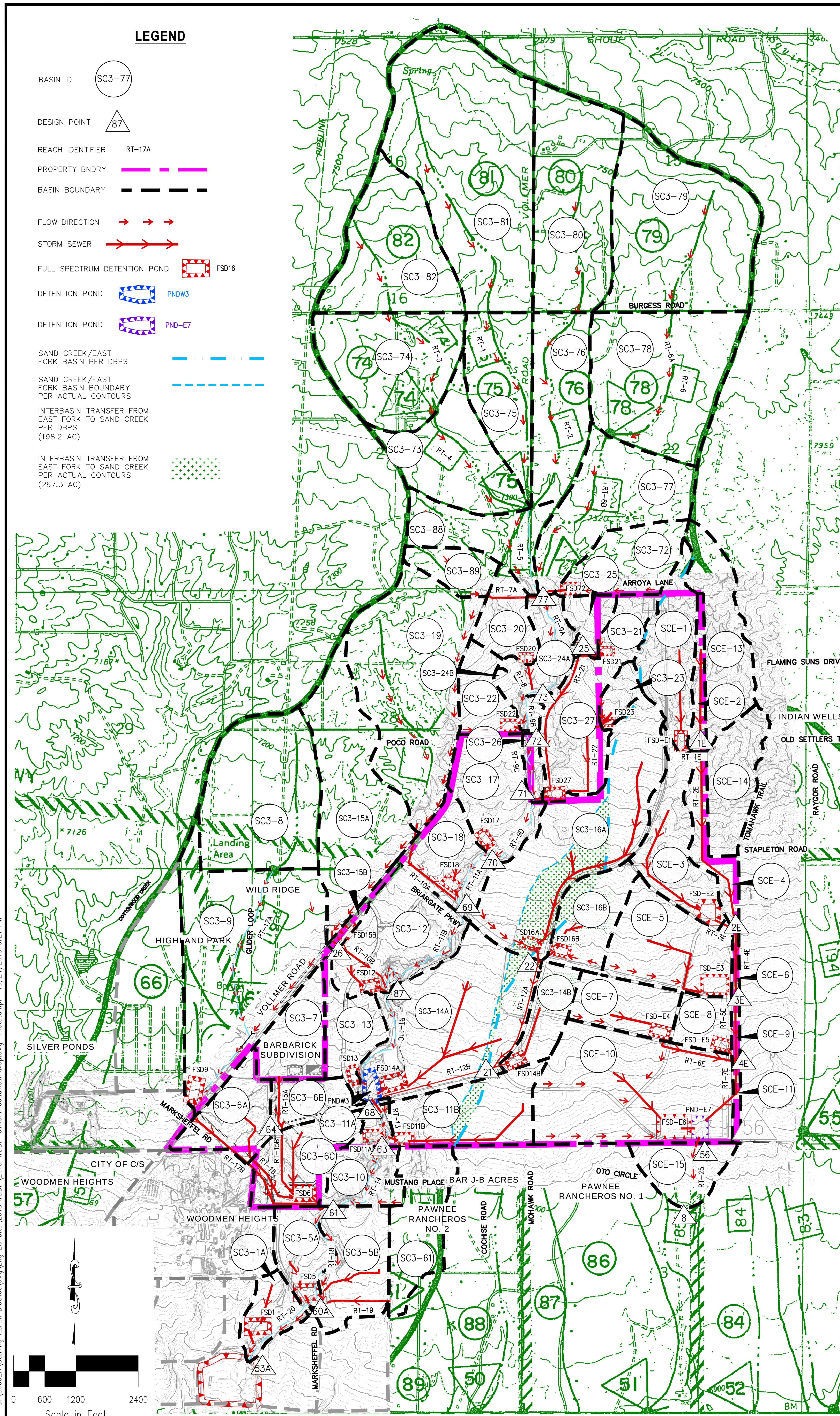
DRAWN BY: VAS	HORIZ: 1"=500'	SHEET 1 OF 1	D1
CHECKED BY: VAS	VERT: N/A		



BASIN SUMMARY

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

DESIGN POINT SUMMARY

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

DESIGN POINT SUMMARY (VOLUME)

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

WATER QUALITY & DETENTION POND SUMMARY

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

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

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

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

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

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

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

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

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

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

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

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

SAND CREEK FLOW COMPARISON CHART

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

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)

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

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

WATER QUALITY & DETENTION POND SUMMARY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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2018 STERLING RANCH MDDP

DEVELOPED HYDROLOGIC CONDITIONS MAP

PROJECT NO. 09-002 | FILE: \dwg\Eng Exhibits\2018-MDDP-PROPCOND.dwg

DESIGNED BY: JD
DRAWN BY: JD
CHECKED BY: VAS

SCALE
HORIZ: 1"=2400'
VERT: 1"=2400'

DATE: 10-21-2018

DM2

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

FOR INFORMATION ONLY

SAND CREEK RESTORATION WORK MAP

HEC-RAS WORK MAP
SAND CREEK RESTORATION
PROJECT NO: 25188.04
DATE: 10/21/2021
SHEET 1 OF 1