FINAL DRAINAGE REPORT

FALCON MEADOWS AT BENT GRASS
FILING NO. 1

El Paso County, Colorado

PREPARED FOR:
Challenger Communities
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

PREPARED BY:
Galloway & Company, Inc.
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920

DATE:
March 2021
Revised: July 2021
Revised: September 2021

SF-21-020

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 the County for drainage reports and said report is in conformity with the applicable 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
CHARLENE M DURHAM
36727
PROFESSIONAL ENGINEER

9/10/21

Charlene Durham, PE 36727
For and on behalf of Galloway & Company, Inc.

Date

DEVELOPER'S CERTIFICATION

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

By: _____ 9/10/21
Date

Address: Challenger Communities, LLC
8605 Explorer Dr., Suite 250
Colorado Springs, CO 80920

DEVELOPER'S CERTIFICATION

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

APPROVED
Engineering Department
09/28/2021 1:35:42 PM
dsdnijkamp
EPC Planning & Community Development Department

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

Conditions:

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I. Purpose

The intent of the developer is to develop the residential portion of the Bent Grass Subdivision. The purpose of this Final Drainage Report is to identify on and offsite drainage patterns, locate and identify tributary or downstream drainage features and facilities that impact the site, and to identify which types of drainage facilities will be needed and where they will be located. This report will remain in general compliance with the MDDP, which is being submitted concurrently with this report, for the site prepared by Galloway & Company.

II. General Description

The Falcon Meadows at Bent Grass Filing No. 1 is approximately 18.17 acres within the Bent Grass development. It is located south of Bent Grass Meadows Drive and west of the existing West Tributary of the Falcon Basin. The project is a single-family residential development of 71 lots, located in the Falcon area of El Paso County, Colorado. The site is located in the Northwest ¼ and Southwest ¼ of Section 1, Township 13S, Range 65W, of the Sixth Principal Meridian, County of El Paso, State of Colorado. The subject property is located to the south of The Meadows Filing No. 3; west of Bent Grass Residential Filing No. 2; north of Latigo Business Center Filing No 1, undeveloped property, and the Mountain View Electric Association; and east of The Meadows Filing No. 2. A Vicinity Map is included in Appendix A.

A Planned Unit Development Plan (PUD) that includes the Falcon Meadows at Bent Grass Filing No. 1 area is currently under review by the County, PUDSP-20-005. The PUD area includes approximately 67.01 acres and 267 dwelling units.

The existing soil types within the proposed site as determined by the NRCS Web Soil Survey for El Paso County Area consist of Columbine gravelly sandy loam, Blakeland-Fluvaquentic Haplaquolls, and Blakeland loamy sand. All soils are defined as having a hydrologic soil group of A. See the soils map included in Appendix A.

III. Previous Reports

The proposed site has been included in multiple drainage studies in the past. The following is a composite list of the existing reports pertaining to this site analysis.

1. *Falcon Drainage Basin Planning Study*, by Matrix Design Group, September 2015.
2. *Master Development Drainage Plan – Bent Grass Residential Subdivision*, by Galloway & Company, February 2021 (In Review).
3. *Master Development Drainage Plan and Preliminary Drainage Plan – Bent Grass Subdivision*, by Kiowa Engineering Corporation, December 2006.
4. *Final Drainage Report for Bent Grass Residential (Filing No. 1)*, by Classic Consulting Engineers & Surveyors, LLC, August 2014.
5. *Final Drainage Report Addendum for Bent Grass Residential (Filing No. 1)*, by Classic Consulting Engineers & Surveyors, LLC, August 2015.
6. *Master Development Drainage Plan for The Ranch*, by Classic Consulting Engineers & Surveyors, LLC, November 2018.
7. *Falcon Highlands Master Development Drainage Plan & Preliminary Drainage Report & Final Drainage Report for Filing 1*, by URS, January 2005.

8. *Final Drainage Report and Erosion Control Plan – Latigo Business Center Filing No. 1 A Re-subdivision of a Portion of Latigo Business and Research Center Filing No. 1*, by Kiowa Engineering Corporation, November 2004.
9. *Final Drainage Letter Report for Lot 1, Latigo Business Center Filing No. 1*, by Colorado Design Concepts, April 2005.
10. *Final Drainage and Erosion Control for The Meadows Filing Three Subdivision* , by LADD Engineering, July 2000.
11. *Final Drainage Report Bent Grass Residential Subdivision, Filing No. 2,* Galloway & Company, March 2020.
12. *Preliminary Drainage Report Falcon Meadows at Bent Grass,* by Galloway & Company, February 2021.

IV. Drainage Criteria

Hydrology calculations were performed using the City of Colorado Springs/El Paso County Drainage Criteria Manual, as revised in November 1991 and October 1994 with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs/El Paso County Drainage Criteria Manual as revised in May 2014 and the El Paso County Engineering Criteria Manual (ECM) as revised in July 2019.

The drainage calculations were based on the criteria manual Figure 6-5 and IDF equations to determine the intensity and are listed in Table 1 below.

Table 1 - Precipitation Data

Return Period	One Hour Depth (in).	Intensity (in/hr)
5-year	1.50	5.17
100-year	2.52	8.68

The rational method was used to calculate peak flows as the tributary areas are less than 100 acres. The rational method has been proven to be accurate for basins of this size and is based on the following formula:

Q = CIA

Where:

Q = Peak Discharge (cfs)
C = Runoff Coefficient
I = Runoff intensity (inches/hour)
A = Drainage area (acres)

The runoff coefficients are calculated based on land use, percent imperviousness, and design storm for each basin, as shown in the drainage criteria manual (Table 6-6). Composite percent impervious and C values were calculated using the residential, streets, roofs, and lawns coefficients found in Table 6-6 of the manual.

The 100-year event was used as the major storm event for pipes and inlets. The 5-year event was used as the minor event.

For the preliminary design of the channels HEC-RAS version 5.0.3 was utilized. The model was prepared to evaluate velocity, Froude number, and channel depth. Additionally, the model was utilized to size the culverts under Bent Grass Meadows Drive. A Manning's n value of 0.045 was utilized for the channel which is appropriate for a bunch type native grass that is anticipated within the full channel section. The channels were designed to have a maximum depth of 5' per the criteria manual and have a maximum velocity of 5 ft/s with a maximum Froude number of 0.6. Drainage swales which are not able to meet the 5 ft/s velocity will be lined with riprap.

The UD-Detention spreadsheet was utilized for sizing the water quality orifices on the proposed water quality portion of the regional detention pond. This spreadsheet was also utilized for the design of the proposed on-site water quality ponds, Pond (North) and Pond (South).

HEC-HMS was utilized to analyze the hydrology of the overall basin and verify that no changes in release rates have occurred to the regional detention pond with it's addition of water quality.

UD-Inlet was utilized to calculate both the street capacities and the inlet capacities.

StormCAD was utilized to size the storm sewer systems.

V. Existing Drainage Conditions

The site is contained fully within one major drainage basin; the West Falcon Tributary. The site does border the Middle Falcon Tributary along the eastern edge of the property. The site generally drains from north to south with an average slope of 2% outside of the channel. The rational method was used to analyze the individual basins within the site because their size permits it. Excerpts from the DBPS are included in Appendix A.

In addition to the DBPS, The Ranch MDDP to the north and west of the site has revisited their existing conditions as well as existing conditions from the site directly to the north of them. Several detention ponds have been created within the Paint Brush Hills Subdivision which revise the offsite flow entering the site within the major drainageway. This is taken into account with The Ranch MDDP. While The Ranch is still in design stage, they are proposing detention ponds within their site to release at historic rates. This will revise the flow rates in their designed section of the channel to below the rates that are identified within the DBPS. A HEC-HMS model was updated and submitted with the Master Development Drainage Plan (MDDP), which was submitted in February 2021 for review.

Per the DBPS the site lies within the basins, WT200, WT210, and WT220. These basins connect to channel reaches RWT202, RWT204, and RWT210. Both the RWT204 and RWT210 sections of channel currently exist and appear as a drainageway when visiting the site. Reach RWT202 appears to be a shallow overland flow through the project site. It is nearly unrecognizable through the site from a visual standpoint.

The existing channels have been visually inspected via a site walk and all appear in really good condition. There are no signs of scour within the bottoms of the channel. There are small areas that are incised or sloughing at the top of bank of the channel. These areas are less than 12" in height.

A historic basin map was prepared for this site as part of the Master Drainage and Development Plan (MDDP) to analyze the historic basins, as well as the offsite basins contributing to the site. The historic map and calculations can be found in that report.

An existing basin map has been prepared for this site to analyze the existing basins as well as the offsite basins contributing to the site. The existing conditions account for Bent Grass Residential Filing No. 2 being built. The existing map is included in Appendix E and basins are described below.

Basin EX-1 (1.19 AC, Q_5 = 0.4 cfs, Q_{100} = 2.5 cfs): is associated with the northeastern portion of the proposed site east of the existing channel. The basin is currently undeveloped. Runoff from the basin generally flows to the southwest, into Basin EX-2 at **DP 4.**

Basin EX-2 (1.56 AC, Q_5 = 0.5 cfs, Q_{100} = 3.7 cfs): is along the eastern boundary portion of the proposed site and is south of Basin EX-1, east of the existing channel. The basin is currently undeveloped and receives flows from Basins OS-4 & OS-5. Runoff from the basin generally flows to the southeast into Basin EX-3 at **DP 5** combined with flows from **DP 1, 2, & 4**.

Basin EX-3 (0.62 AC, Q_5 = 0.2 cfs, Q_{100} = 1.5 cfs): is along the eastern boundary of the proposed site south of Basin EX-2 and east of the existing channel. The basin currently contains an existing WQCV pond created as part of Bent Grass Residential Filing No. 2. This basin receives flows from **DP 5** and **DP 3**.

Basin EX-4 (12.49 AC, Q_5 = 3.7 cfs, Q_{100} = 25.1 cfs): is located along the northern boundary, just south of the swale built with Bent Grass Meadows Drive and west of the existing channel. The basin is currently undeveloped. Runoff from the basin generally flows to the south onto Bent Grass Meadows Drive at **DP 6**. From there, it flows via curb & gutter to the east into an existing sump inlet, ultimately discharging into the existing WQCV pond located in Basin EX-3.

Basin EX-5 (5.15 AC, Q_5 = 1.6 cfs, Q_{100} = 10.6 cfs): is west of Basin EX-4 and north of Bent Grass Meadows Drive. The basin is currently undeveloped. Runoff from the basin generally flows to the south onto Bent Grass Meadows Drive at **DP 7**. From there, it flows via curb & gutter to the east into an existing sump inlet, ultimately discharging into the existing WQCV pond located in Basin EX-3.

Basin EX-6 (9.53 AC, Q_5 = 2.7 cfs, Q_{100} = 17.8 cfs): is along the west boundary of the site. The basin is currently undeveloped and receives off-site flows from Basins OS-2 & OS-3. Runoff from the basin generally flows to the south into the existing drainage ditch entering an existing inlet at **DP 11** and flowing under Bent Grass Meadows Drive and discharging into an existing drainage swale in Basin EX-8.

Basin EX-7 (9.16 AC, Q_5 = 2.8 cfs, Q_{100} = 18.9 cfs): is north & west of Bent Grass Meadows Drive, between Basins EX-5 & EX-6. The basin is currently undeveloped. Runoff from the basin generally flows to the southeast into Bent Grass Meadows Drive at **DP 8**. From there, it flows via curb & gutter to the south into an existing sump inlet, ultimately discharging into the existing sediment pond located in Basin EX-8.

Basin EX-8 (21.3 AC, Q_5 = 6.6 cfs, Q_{100} = 43.9 cfs): is a portion of the site south and east of Bent Grass Meadows Drive, north of the south property line and west of Bent Grass Filing No. 2. The basin is currently undeveloped and contains two drainage ditches, a sediment pond, and a portion of the creek associated with Basin WT200 from the Falcon DBPS. Runoff from the basin generally flows to the southeast into the existing channel.

Basin OS-1 (32.28 AC, Q5 = 15.1 cfs, Q100 = 65.1 cfs) is associated with The Meadows Filing No. 3 lots 14, 15, 16, and 17. Runoff from this basin sheet flows to the northern property line of the site and then flow, via an existing drainage ditch, into the existing channel associated with Basin WT200 from the Falcon DBPS entering the site at **DP 12**.

Basin OS-2 (20.08 AC, Q5 = 9.0 cfs, Q100 = 43.4 cfs) is associated with The Meadows Filing No. 1 lots 1, 2, 3, 4, 5, and 6. Runoff from this basin sheet flows from the northwest to the southeast, crossing the

west property line of the site at **DP 9**. The runoff will continue to sheet flow through Basin EX-6 to the south until entering the existing drainage swale on the southern boundary of Basin EX-6 at **DP 11**.

Basin OS-3 (10.62 AC, Q5 = 4.7 cfs, Q100 = 22.7 cfs) is associated with The Meadows Filing No. 1 lot 11 and The Meadows Filing No. 2 Lots 1 & 2. Runoff from this basin sheet flows from the northwest to the southeast, crossing the west property line of the site at **DP 10**. The runoff will continue to sheet flow through Basin EX-6 to the south until entering the existing drainage ditch on the southern boundary of Basin EX-6 at **DP 11**.

Basin OS-4 (4.46 AC, Q5 = 5.6 cfs, Q100 = 14.0 cfs) is associated with The Bent Grass Residential Filing No. 2, lots 152-160, lots 163-168, Tract D, and portions of Thedford Court & Willmore Drive. Runoff from this basin flows via curb & gutter south on Thedford Court then continues flowing west along the northern curb & gutter along Willmore Drive before discharging into southeast corner of Basin EX-2 at **DP 1**.

Basin OS-5 (0.46 AC, Q5 = 1.1 cfs, Q100 = 2.3 cfs): is associated with The Bent Grass Residential Filing No. 2, lots 161 & 162 along with a portion of Silky Thread Road. Runoff from this basin generally flows to the west via curb & gutter along Silky Thread Road before discharging into the northeast corner of Basin EX-2 at **DP 2**.

Basin OS-6 (1.17 AC, Q5 = 2.0 cfs, Q100 = 4.3 cfs): is associated with The Bent Grass Residential Filing No. 2, the northern halves of Lots 170-178 and a portion of the southern side of Willmore Drive. Runoff from this basin generally flows to the west via curb & gutter along Willmore Drive before discharging into the northeast corner of Basin EX-3 at **DP 3**.

Basin E-1 (1.71 AC, Q5 = 3.6 cfs, Q100 = 7.7 cfs): a basin that is east of Falcon Meadows and encompasses the north portion of Bent Grass Meadows Drive. A high point on the far East of the basin at the near the Filing No. 2 boundary, forces water to flow to a low point at **DP-8**, which represents an existing 20’ CDOT Type R sump inlet, which conveys stormwater via proposed 36” RCP storm sewer to the existing Filing No. 2 north water quality detention pond. Emergency overflow will spill over the crown of the road and enter into an existing 10’ CDOT Type R sump inlet on the south side of Bent Grass Meadows Drive.

Basin E-2 (0.68 AC, Q5 = 2.4 cfs, Q100 = 4.6 cfs): a basin that is in west of Basin E-1 and encompasses a portion of the north section Bent Grass Meadows Drive. A high point on the far West of the basin forces water to flow to a low point at **DP-8**, which represents an existing 20’ CDOT Type R sump inlet, which conveys stormwater via a proposed 36” RCP storm sewer to the existing Filing No. 2 north water quality detention pond. Emergency overflow will spill over the crown of the road and enter into an existing 10’ CDOT Type R sump inlet on the south side of Bent Grass Meadows Drive.

Basin E-3 (0.78 AC, Q5 = 2.9 cfs, Q100 = 5.3 cfs): a basin that is south of Basin E-2 and encompasses a portion of the south half of Bent Grass Meadows Drive. A high point on the far West of the basin forces water to flow to a low point at **DP-7**, which is an existing 10’ CDOT Type R sump inlet, which conveys stormwater via an existing 24” storm sewer to **DP-8**. This inlet receives emergency overflow from DP-8.

Basin E-4 (0.91 AC, Q5 = 3.0 cfs, Q100 = 5.7 cfs): a basin that is in the Southwest area of the Bent Grass Filing No. 2 site and encompasses a portion of the north and west sections of Bent Grass Meadows Drive. Runoff from this basin is captured by existing curb and gutter and then routed South where the 5 yr. and 100 yr. flows will be captured by an existing 25’ CDOT Type R (1-10’ and 1-15’ inlet) on-grade inlet, **DP-24**. Captured flow will be routed by a 24” RCP storm drain piped to DP-25. A

temporary water quality facility will treat this flow for the Bent Grass Filing No. 2 development and will remain in place until further development occurs.

Basin E-5 (0.89 AC, Q5 = 3.3 cfs, Q100 = 6.1 cfs): a basin that is in the Southwest area of the site and encompasses a portion of south and east sections Bent Grass Meadows Drive. Runoff from this basin is captured by existing curb and gutter and then routed South where the 5 yr. and 100 yr. flows will be captured by a proposed 25' CDOT Type R (1-10' and 1-15' inlet) on-grade inlet, **DP-25**. Captured flow will be routed by a 24" RCP storm drain piped to an outfall at DP-26, where a temporary sediment basin will provide water quality for the basin. Flows will then be routed East by Existing Swale – F until out-falling into RWT210.

Basin I-1 (0.31 AC, Q5 = 1.0 cfs, Q100 = 2.1 cfs): a basin that is associated with Latigo Business Center Filing No. 1 lot 1. It encompasses a portion of Bent Grass Meadows Parkway South of the existing (2) 10' & (2) 15' CDOT Type R Inlets on Bent Grass Meadows Drive, near the south property line. There are a set of on-grade inlets (20' on the east side, 15' on the west side), which will intercept this flow. Inlets will then release flows to the east into an existing drainage swale. Based on the Latigo Business Park drainage report by Kiowa Engineering, inlets were designed for flows of 9.9 and 21.2 cfs from this basin. The development of the Bent Grass site has reduced the flows entering the Latigo Business Park site, ensuring the existing storm system will continue to function adequately.

Basin C-8 (0.42 AC, Q5 = 0.2 cfs, Q100 = 1.0 cfs): a basin that is in the South-central area of the site adjacent to RWT204 and RWT 210. It encompasses the rears of single-family residential Type B lots from Bent Grass Residential Filing No. 2. Runoff will sheet flow West directly into RWT204 and RWT210.

Design Point CC is the location in channel reach RWT210, where flows exit the Bent Grass Site, including the offsite flows from RWT202, RWT204 and WT200. The minor flow is 272.5 cfs and the major flow is 1209.6 cfs based on the rational flows. The MDDP (which has been submitted concurrently for review) has minor flows exiting the site of 278.3 cfs and major flow of 1224.7 cfs based on rational calculations for the project site.

VI. Four Step Process

The Four Step Process is used to minimize the adverse impacts of urbanization and is a vital component of developing a balanced, sustainable project. Below identifies the approach to the four-step process:

1. Employ Runoff Reduction Practices

The proposed development uses Low Impact Development (LID) practices to reduce runoff at the source. Rather than creating point discharges that are directly connected to impervious areas, runoff is routed through pervious areas to promote infiltration. Grass buffers and swales are used where practical.

2. Stabilize Drainageways

This step implements stabilization to channels to accommodate developed flows while protecting infrastructure and controlling sediment loading from erosion in the drainageways. Erosion protection in the form of riprap pads at all outfall points to the channel to prevent scouring of the channel from point discharges. A HEC-RAS model has been created and used to evaluate the stability of the existing channels. It has been determined that given that the channel is stable in its current state and

the proposed velocities and Froude numbers are similar to those in the existing channel, no improvements will be made to the channel at this time. This will be further discussed later in this report.

3. Implement BMPs That Provide a Water Quality Capture Volume with Slow Release

This step utilizes formalized water quality capture volume to slow the release of runoff from the site. The EURV volume will release in 72 hours, while the WQCV will release in no less than 40 hours. On-site water quality control volume detention ponds will provide water quality treatment prior to the runoff being released into the channel.

4. Consider Need for Industrial and Commercial BMPs

As this project is a residential development and contains no commercial or industrial development, specialized BMPs associated with an industrial or commercial site are not required.

VII. Proposed Drainage Conditions

According to the DBPS, there are two channels that run through the site. As was discussed within the Existing Conditions portion of the report both the RWT202 and RWT204 run through the site. With Bent Grass Filing No. 2, the RWT202 channel was rerouted to run along the north line, prior to combining flows with the existing RWT204 channel. The proposed development will drain to the RWT204 channel, which becomes RWT210 further south in the site. As Bent Grass Meadows Parkway is in the process of being constructed, (2) 16’ x 6’ concrete box culverts for RWT204 will be installed as part of the approved Bent Grass Filing No. 2 development.

Within the Bent Grass MDDP, currently under review, and the FDR for Bent Grass Filing No. 2, Pond SR-3, from the Falcon DBPS, was removed and replaced with 4 water quality ponds throughout the Bent Grass Development. 2 ponds were approved with the Bent Grass Filing No. 2, 1 is proposed with this portion of the development, and the fourth pond will be designed in a future filing of the Falcon Meadows development area.

The overall Falcon Meadows site will provide WQCV Detention Ponds to provide water quality treatment prior to discharging the runoff directly into the West Tributary channel RWT204/RWT210. There are 3 total drainage basins, within the proposed Falcon Meadows development, which are not routed to any of the WQ facilities. Basin A-2 (0.86 acres) releases directly into channel RWT204. Basins B-1 (4.32 acres) & B-2 (1.17 acres), although larger than 1 acre, do not count towards the allowable area of 1 acre or less to be released from a site, untreated, as theses basins represent the channel reaches RWT204/210, and are described as undeveloped land remaining undeveloped.

As mentioned previously, the site is proposed to be single family residential. The site is designed to provide a large lot buffer between the existing large lots to the north and west of the site and the proposed site. Beyond this buffer the majority of the site is smaller approximately 1/8 acre lots.

Basin OS-1 (32.28 AC, Q5 = 15.1 cfs, Q100 = 65.1 cfs) is associated with The Meadows Filing No. 3 lots 14, 15, 16, and 17. Runoff from this basin sheet flows to the northern property line of the site and then flows, via an existing drainage swale, into the existing channel reach RWT204 from the Falcon DBPS at **DP 21**.

Basin A-4 (0.82 AC, Q5 = 0.4 cfs, Q100 = 2.6 cfs): a basin that includes the existing north water quality facility (Pond 1) built with Bent Grass Filing No. 2 (Tract K). This basin will combine with the other flows being diverted to this facility at **DP 6** and upon treatment, will be released into the existing channel (RWT204).

Basin OS-2 (20.07 AC, Q5 = 9.0 cfs, Q100 = 43.4 cfs): is associated with The Meadows Filing No. 1 lots 1, 2, 3, 4, 5, and 6. Runoff from this basin sheet flows from the northwest to the southeast, crossing the west property line of the site at **DP 9**. Flows will then be conveyed via a future drainage swale (Swale D) to the south where it will enter Basin D-3 and tie-into the existing drainage swale (Swale E) along the southern boundary of Basin D-3. It will then continue flowing east before entering an existing area inlet at **DP 11** where it will be piped, ultimately outfalling into the proposed south WQCV pond at **DP 31**.

Basin OS-3 (10.61 AC, Q5 = 4.7 cfs, Q100 = 24.3 cfs): is associated with The Meadows Filing No. 1 lot 11 and The Meadows Filing No. 2 Lots 1 & 2. Runoff from this basin sheet flows from the northwest to the southeast, crossing the west property line of the site into Basin D-3 at **DP 10**. Flows will then be conveyed via an existing drainage swale to the east where it will enter an existing area inlet at **DP 11** where it will be piped, ultimately outfalling into the proposed south WQCV pond at **DP 31**.

Basin D-1a (3.40 AC, Q5 = 4.1 cfs, Q100 = 11.1 cfs): a basin for a future Falcon Meadows filing at the northeast corner of the future intersection of Isabel Place and Daelyn Drive. It encompasses single-family residential lots, east half of Isabel Place, & a portion of the north half of Daelyn Drive. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 16a.**

Basin D-1b (4.72 AC, Q5 = 6.8 cfs, Q100 = 15.0 cfs): a basin for a future Falcon Meadows filing along the west property line of the site. It encompasses single-family residential lots & the remaining west half of Daelyn Drive. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 16**, along with flows from **DP16a.** Flows will then enter a proposed 10' CDOT at grade Type 'R' inlet where captured flows will then be piped and ultimately outfall in the proposed south WQCV pond at **DP 31**. Bypass flows from the inlet will continue to the south in Bent Grass Meadows Drive to be intercepted by the existing CDOT Type R inlet at **DP 24**.

Basin D-2a (0.30 AC, Q5 = 1.4 cfs, Q100 = 2.5 cfs): a basin for a future Falcon Meadows filing south of Basin D-1a. It encompasses a portion of the south half of Daelyn Drive. Runoff will flow from the proposed public R.O.W., where proposed mountable curb and gutter will convey flows to **DP 14a.**

Basin D-2b (0.99 AC, Q5 = 1.9 cfs, Q100 = 4.1 cfs): a basin for a future Falcon Meadows filing south of Basin D-2a. It encompasses single-family residential lots and the north half of Raylan Way. Runoff will flow from each lot onto the proposed public R.O.W, in Raylan Drive. where proposed mountable curb and gutter will convey flows to **DP 14a.**

Basin D-2c (0.16 AC, Q5 = 0.7 cfs, Q100 = 1.3 cfs): a basin for a future Falcon Meadows filing south of Basin D-2b. It encompasses the south half of Raylan Way. Runoff will be conveyed as gutter flow to **DP 14a.** Flows from this design point will continue south, as gutter flow, in the east side of Daelyn Drive to **DP 14b**.

Basin D-2d (0.14 AC, Q5 = 0.7 cfs, Q100 = 1.1 cfs): a basin for a future Falcon Meadows filing east of Basin D-1b. It encompasses the east half of Daelyn Drive, between Raylan Way and Isabel Place. Runoff will be conveyed as gutter flow to **DP 14b.**

Basin D-2e (1.56 AC, Q5 = 3.6 cfs, Q100 = 7.1 cfs): a basin for a future Falcon Meadows filing east of Basin D-2d and south of D-2c. It encompasses single-family residential lots and the west half of Isabel Place. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 14b. F**low from this design point, will continue south, as gutter flow, to **DP 14c**.

Basin D-2f (1.03 AC, Q5 = 3.3 cfs, Q100 = 6.1 cfs): a basin for a future Falcon Meadows filing east of Basin D-2e. It encompasses single-family residential lots, east half of Isabel Place and Jolie Court. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 14c.** Flows will then enter a future at grade CDOT Type 'R' inlet where captured flows will then be piped and ultimately outfall in the proposed south WQCV pond at **DP 31**. Bypass flows from the inlet will continue as street flow to the south in Daelyn Drive and east in Rowena Way to **DP 14**.

Basin D-2g (2.54 AC, Q5 = 3.4 cfs, Q100 = 8.0 cfs): a basin for a future Falcon Meadows filing south of Basin D-2f. It encompasses single-family residential lots, east half of Daelyn Drive and north half of Rowena Way. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 14,** which combines the bypass flow from **DP 14c.** Flows will then enter a proposed 10' at grade CDOT Type 'R' inlet where captured flows will then be piped and ultimately outfall in the proposed south WQCV pond at **DP 31**. Bypass flows from the inlet would overtop Rowena Way to **DP 16**.

Basin D-3 (2.94 AC, Q5 = 2.0 cfs, Q100 = 5.1 cfs): a basin for a future Falcon Meadows filing that is in the southwest corner of the site, south of Basin D-1. It encompasses the backs of several proposed residential lots as well as an existing drainage ditch and proposed Swale D. Runoff will flow from basin OS-2 and OS-3 into Swale D, and convey flows to the existing drainage ditch (Swale E) which will convey flows to an existing area inlet at **DP 11**. From there, flows will be piped and ultimately outfall at the south WQCV pond at **DP 31**.

Basin D-4a (0.98 AC, Q5 = 2.2 cfs, Q100 = 4.6 cfs): a basin for Falcon Meadows Filing No. 2 that is east of Bent Grass Meadows Drive. It encompasses single-family residential lots, north half of Rowena Way, & a portion of the west half of Nico Way. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 17a**. Flow will continue as gutter flow in Nico Way, Linley Way and Jayla Trail to **DP 17b.**

Basin D-4b (0.96 AC, Q5 = 2.6 cfs, Q100 = 5.0 cfs): a basin for Falcon Meadows Filing No. 2 that is east of Bent Grass Meadows Drive. It encompasses single-family residential lots, Rowena Way, & portions of Linley Way and Jayla Trail. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 17b**, which the gutter flow at the south side of the proposed structure at **DP 17**.

Basin D-4c (1.00 AC, Q5 = 2.3 cfs, Q100 = 4.5 cfs): a basin for Falcon Meadows Filing No. 2 that is east of Henzlee Place and south of Bent Grass Meadows Drive. It encompasses single-family residential lots, & portions of Nico Way, Jayla Trail, and Henzlee Place. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 17c**, the north side of **DP 17**. Flows at **DP 17** (Q5 = 4.6 cfs, Q100 = 9.5 cfs, combined flows from **DP 17b** & **DP 17c** with bypass from **DP 18**) will then enter a proposed 15' sump CDOT Type 'R' inlet where it will then be piped and ultimately outfall in the proposed south WQCV pond at **DP 31**. Overflow from this inlet will overtop the

curb and then continue via a proposed swale, following the same path as the proposed pipe, to the east until flows are released into the proposed south water quality pond.

Basin D-5 (1.08 AC, Q5 = 2.2 cfs, Q100 = 4.6 cfs): a basin that is located at the southwest corner of Bent Grass Meadows Drive and Henzlee Place. It includes residential lots, as well as a portion of the north half of Nico Way and west half of Henzlee Place. Flows will be directed towards the public R.O.W. where proposed curb and gutter will convey flows to the south along Henzlee Place to **DP 18**. Flows will then enter a proposed 15' sump CDOT Type 'R' inlet where it will then be piped and ultimately outfall in the proposed south WQCV pond at **DP 31**.

Basin D-6a (1.33 AC, Q5 = 3.8 cfs, Q100 = 7.5 cfs): a basin for a future Falcon Meadows filing that is south of Basin D-6b & east of Basin D-4a. It encompasses single-family residential lots & half of Linley Way, Jayla Trail, Henzlee Place, & Nico Way. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 18.**

Basin D-6b (2.69 AC, Q5 = 5.6 cfs, Q100 = 11.4 cfs): a basin for a future Falcon Meadows filing that is south of Basin D-5 & east of Basin D-4a. It encompasses single-family residential lots & half of Linley Way, Jayla Trail, Henzlee Place, & Nico Way. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 18**, along with flows from Basin D-6a. Flows will then enter a proposed sump CDOT Type 'R' inlet where it will then be piped and ultimately outfall in the proposed south WQCV pond at **DP 31**.

Basin D-7 (7.84 AC, Q5 = 3.3 cfs, Q100 = 16.3 cfs): a basin that is in the south end of the site, east of Bent Grass Meadows Drive & west of the existing channel. It encompasses the back half of several single-family residential lots as well as the proposed south WQCV pond, an existing temporary sediment basin, and an existing drainage swale (Swale F), which is to be relocated. Runoff will flow, via sheet flow, until it enters the reloacted drainage swale (Swale F) and is conveyed to the proposed south WQCV pond or will directly flow into the proposed south WQCV pond at **DP 30**.

Basin D-8 (1.69 AC, Q5 = 1.3 cfs, Q100 = 4.5 cfs): a basin that is west of the existing channel & south of Bent Grass Meadows Drive. It encompasses the back half of single-family residential lots. Runoff will flow from each lot and discharge into a proposed drainage swale. The drainage swale (Swale C) will then convey flows to the south, ultimately discharging into the proposed south WQCV pond at **DP 32**.

Basin D-9 (0.70 AC, Q5 = 1.0 cfs, Q100 = 3.0 cfs): a basin for a future Falcon Meadows filing that is east of Basin D-2f & west of Bent Grass Meadows Drive. It encompasses the back half of single-family residential lots. Runoff will flow from each lot and release into Bent Grass Meadows Drive. This flow will be conveyed as gutter flow to the south in the roadway, where it will be intercepted by an existing at grade inlet at **DP 24**.

Basin B-2 (1.17 AC, Q5 = 0.4 cfs, Q100 = 2.5 cfs): a basin that is in the south area of the site and encompasses channel reach RWT204/ RWT210. Flows will sheet flow into the channel where they will then be conveyed to **DP BB**.

Basins E-1 thru E-5 and I-1 are the same as discussed under the Existing Conditions Section, as these basins represent the already built Bent Grass Meadows Drive through the proposed site.

Basin RWT202 (1574.4 AC,Q5 = 200 cfs, Q100 = 1000 cfs), RWT204 (38.4 AC, Q5 = 7 cfs, Q100 = 43 cfs) and WT200 (192 AC, Q5 = 52 cfs, Q100 = 190 cfs) represent larger offsite basins to the north of the

proposed project. These areas were studied as part of the Falcon Basin DBPS prepared by Matrix and were also part of the Bent Grass MDDP, submitted in June for review. Refer to the MDDP for the discussion of the revisions made to the HEC-HMS model. There have been no changes to these basins as they are offsite and existing.

Design Point CC is the location in channel reach RWT210, where flows exit the Bent Grass Site, including the offsite flows from RWT202, RWT204 and WT200. The minor flows are 271.7 cfs and the major flows are 1186.3 cfs. The MDDP Amendment, from the HEC-HMS model, has flows of 191.8 cfs and 1075.3 cfs for the 5 and 100-year flows under proposed/future conditions analysis. The FEMA FIS report has a total flow of 1400 cfs in channel reach RWT210.

VIII. Storm Sewer System

All development is anticipated to be urban and will include storm sewer & street inlets. Storm sewers collect storm water runoff and convey the water to water quality facilities prior to discharging. Storm sewer systems will be designed to the 100-year storm and checked with the 5-year storm. Inlets will be placed at sump areas and intersections where street flow is larger than street capacity. UDFCD Inlet spreadsheet will be used to determine the size of all at-grade and sump inlets. There will be a minimum of 1 proposed storm system and two existing system within the site. There will be two future storm systems with subsequent filings of Falcon Meadows, as the area develops north of Bent Grass Meadows Drive. The first future storm system will collect flows on the north and east side of the project, prior to entering Bent Grass Meadows Drive. Intercepted flows will be released into the Bent Grass Filing No. 2 water quality facility, Pond 1. Any bypass flows will travel west in Bent Grass Meadows Drive to an existing storm system in the roadway.

The second future storm system will collect the north and west portion of the site, intercepting flows prior to entering Bent Grass Meadows Drive. These flows will be released into the future North water quality pond. Any flows bypassed from the storm system will enter Bent Grass Meadows Drive and travel east to the existing storm sewer system.

The proposed system has been designed for the remaining south and west portion of the project. Flows intercepted by inlets will be released into the proposed South water quality pond. All design calculations (StormCAD, inlet design & street capacity spreadsheets, etc.) have been included in Appendix C for this system.

The inlets located within Bent Grass Meadows Drive (DP-8, DP-24 and DP-25) were all designed under the FDR for Bent Grass Residential Filing No. 2. The inlets were “rechecked” based on updated flows reaching each of these design points. The analysis of these inlets is included in Appendix C.

Final drainage reports for future filings will include details concerning inlet location, street capacity, storm sewer sizing, outlet protection and location for the future storm systems.

IX. Proposed Water Quality Detention Ponds

One Water Quality Capture Volume Detention Pond (South) will be provided for the Falcon Meadows at Bent Grass Filing No. 1 site. A future pond (North) will be provided for the area north of Bent Grass Meadows Drive, as part of future Falcon Meadows at Bent Grass developments. The proposed pond will be private and will only provide water quality. The EURV and 100-year volumes will be conveyed via the emergency overflow weir, which will be lined. The water quality volume release will be controlled with an

orifice plate that releases the water quality volume in 40 hours. The future north water quality pond will release into RWT204 and the proposed south pond will release into RWT210. Once the area north of Bent Grass Meadows Drive develops, final design of the north pond and it's components will be provided. A preliminary analysis for the pond size and volume has been provided with this report.

As previously stated, there are three basins (B-1, B-2 and A-2) that are not provided with on-site water quality. Basins B-1 and A-2 are located north of Bent Grass Meadows Drive and are part of Future Falcon Meadows at Bent Grass developments. Basin B-2 is located south of Bent Grass Meadows Drive and was created as part of an adjacent development (Bent Grass Residential Filing No. 2). Basin A-2 contains 0.86 acres and will release future residential flows from the back lots to channel reach RWT204. Basins B-1 and B-2 (combined area of 5.39 acres) contain the West Tributary Channel (RWT204/RWT210) area as it traverses the project site. The West Tributary Channel areas are undeveloped, will remain undeveloped, and release onto undeveloped land (continuation of channel reach RWT210), they do not "count" towards the 1 acre of area being able to be released untreated from the site.

Total area for Falcon Meadows development area, which will not be treated via on-site facilities, is less than 1.0 acre, as required.

X. Channel and Swales

Swales

There are 5 swales associated with the proposed development, 1 proposed (Swale C), 1 re-located (Swale F), 1 existing (Swale E) and 2 future (Swale A and D). The swales are designed to meet the 100-year design storm. Appendix C contains an analysis of these facilities. Swale E was designed in the FDR for Bent Grass Residential Filing No. 2. Flows for Swale E were analyzed based on the existing swale configuration. It was determined that the swale will continue to function per design criteria.

Swale C is located along the east boundary of the site and will convey flows to the south towards the proposed WQCV pond. The swale will be a trapezoidal ditch with a bottom width of 1', minimum depth of 1.50' and 4:1 side slopes. Longitudinal slope will be 1.5%, generating a flow depth of 0.53' and a velocity of 2.75 fps.

Swale F is located along the south boundary of the site and will convey flows to the east towards the proposed WQCV pond. The swale will be a trapezoidal ditch with a bottom width of 6', minimum depth of 4.0' and 4:1 side slopes. Longitudinal slope will be 1.0%, generating a flow depth of 1.16' and a velocity of 4.24 fps.

Swales A and D are all part of the Falcon Meadows future development and final design of these facilities will be done with the corresponding FDR's.

Refer to Appendix C for channel design calculations.

Channel

Currently, final design plans and design report are being prepared for the channel improvements within the Falcon Meadows development. These plans and report and other supporting documentation will be submitted under a separate cover as their own submittal package. The channel design will cover channel reaches RWT202, RWT204 & RWT210, extending south to Woodmen Road.

The Falcon Area DBPS made recommendations for the channels as they transverse the project site. Bent Grass Residential Filing No. 2 included rerouting RWT202 along the north property line to convey flows to RWT204. Improvements to RWT202 were also included in Bent Grass Residential Filing No. 2.

RWT204 is grossly oversized for the actual anticipated flows. The Falcon Basin DBPS included a 5-year flow of 7 cfs and a 100-year flow for 43 cfs. The proposed rational calculations have a total flow of 270 cfs for the 5-year flow and 1189 cfs for the 100-year flow at DP AA (box culvert crossing at Bent Grass Meadows Drive in Reach RWT204). The FEMA flow reported in this section of channel is 1,400 cfs. Improvements to RWT204, north of Bent Grass Meadows Drive, will adhere and be equivalent to the recommendations in the Falcon Basin DBPS.

RWT204 will generally stay in its existing location but will have new designed channel sections. The channel will have longitudinal slopes flattened to below 1% in order to reduce the scour potential of the channel. Grouted Sloping Boulder Drops may be utilized within the channel as grade controls (maximum height of 4' with 4:1 slope). 7 grade control structures are anticipated within the channel. This may change when final design of the channel is completed.

RWT210 is the section of the channel south of Bent Grass Meadows Drive and continues south to Woodmen Road. The channel location will shift slightly to the east and "straighten" out the overall flow path. It will be located within a drainage easement. The channel will have a design including a longitudinal slope less than 1.5%, bottom width of 38', and 4:1 side slopes. The Falcon DBPS recommendations for the channel are to remain as a natural drainage channel. Grade control structures may be utilized within the channel to meet design requirements.

At this time, it is assumed that the DBPS recommended channel improvements will be sufficient to handle the final developed channel flow. DBPS report and channel plans currently show approximately 16 rock cross vanes in channel Section RWT210. See Appendix F for preliminary location and detail of structures. Final design will be included in the channel improvement package submittal.

The West Trib Channel (RWT202, RWT204 & RWT210) will be maintained by the Bent Grass Metropolitan District. For channel improvements offsite of the Falcon Meadows at Bent Grass Filing No. 1 and Bent Grass Residential Filing 2 property, specifically south of the development, it is agreed that the developer will be responsible future channel improvements, south of the development, to the existing improvements north of Woodmen Road if the current property owners have not initiated the future improvements themselves. Or the developer will work with the current property owners to reach an agreement on design/construction, costs, and timing of the channel improvements. An agreement and schedule will be in place prior to approval of Falcon Meadows at Bent Grass Filing No. 1. And improvements shall be complete within three years of the recordation of Falcon Meadows at Bent Grass Filing No. 4.

XI. Maintenance

The channel is to be a private facility until all DBPS identified improvements are complete. Once the DBPS improvements are completed, maintenance for the channel will transition to El Paso County. The proposed water quality pond is to be privately maintained. Private facilities will be maintained by the Bent Grass Metropolitan District. After completion of construction and upon the Board of County Commissioners acceptance, all public drainage facilities within easements and public Right-of-Way will be owned and maintained by El Paso County. Channel improvements will be considered under the final drainage report for the channel improvement design package.

XII. Wetlands Mitigation

No wetlands are located on site.

XIII. Floodplain Statement

A portion of the project site lies within Zone AE Special Flood Hazard Area as defined by the FIRM Map number 08041C0553G effective December 7, 2018. A copy of the FIRM Panel is included in Appendix A.

The portion of channel that has a floodplain designation is only the RWT210 and RWT204 portions of the channel. It is unknown why the western channel, RWT202 is unmapped since it is the larger contributor regarding flow rates. Discussions have occurred with PPRBD and a no rise certificate will be required for the existing channel. Models have been obtained from FEMA which show that the FEMA discharges are higher than the DBPS. Therefore, the culvert crossing at Bent Grass Meadows Parkway was sized per the FEMA flows and not the DBPS. The no rise certification will be provided under a separate report, when channel improvements are addressed with future filings. With a future filing, current Tract C, as shown on the PUD/Preliminary Plan, will be platted as residential lots once a LOMR is completed, removing that area from the FEMA floodplain.

XIV. Drainage/Bridge Fees and Credits/Reimbursements

The site lies within the Falcon Drainage Basin. The DBPS was approved in 2013 and has drainage and bridge fees associated with the basin.

The project site has a total area of 21.31 acres. The tracts account for a total of 12.46 acres, 71 residential lots are 6.37 acres and 2.47 acres of right-of-way. The following calculations for the imperviousness of this development have been computed as follows:

Average Residential lot size: 6.37 acres / 71 lots = 3909 sf/lot

Average lot imperviousness = 2000 sf

Average Residential Imperviousness 2000/3909 = 51.16%

R.O.W. area 2.47 acres; imperviousness 100 %
Open Space area 12.46 acres; imperviousness 0%

Average imperviousness for developed area:

(0.5116 x 6.37) + (1.0 x 2.47) + (0 x 12.46)/(21.31) = 0.2688 = 26.88%. The impervious area that the fees will be based on is 5.73 acres (21.31 x 26.88%)

The following calculations are based on an interpolated rate between 2021 Falcon Basin drainage/bridge fees:

Drainage Fees

$31,885 x 5.73 Imp. Acres = $182,701.05

Bridge Fees

$4,380 x 5.73 Imp. Acres = $25,097.40

Per discussions with El Paso County the fees will be offset by the cost of regional improvements as approved in a drainage report addendum reviewed prior to plat recording.

Below is a cost estimate for the improvements proposed with this filing.

Item	Quantity	Unit	Unit Cost	Cost
Storm Drain Improvements (Public)				
10' CDOT Type R Inlet (Public)	2	EA	$ 8,000.00	$ 16,000.00
15' CDOT Type R Inlet (Public)	2	EA	$ 9,800.00	$ 19,600.00
CDOT Type D Area Inlet (Public)	1	EA	$ 7,900.00	$ 7,900.00
7' Manhole - Type II (Public)	6	EA	$ 4,500.00	$ 27,000.00
8' Manhole - Type II (Public)	1	EA	$ 5,000.00	$ 5,000.00
18" RCP Storm Drain (Public)	28	LF	$ 60.00	$ 1,680.00
24" RCP Storm Drain (Public)	45	LF	$ 70.00	$ 3,150.00
42" RCP Storm Drain (Public)	451	LF	$ 160.00	$ 72,160.00
48" RCP Storm Drain (Public)	492	LF	$ 190.00	$ 93,480.00
54" RCP Storm Drain (Public)	225	LF	$ 225.00	$ 57,150.00
Subtotal				$ 303,120.00
WQCV Detention Ponds (Private)				
Pond (South)	1	EA	$ 80,000.00	$ 80,000.00
Subtotal				$ 80,000.00
Total				$ 383,120.00
Contingency			10%	$ 38,312.00
Grand Total				$ 421,432.00

XV. Conclusion

The Bent Grass Residential Subdivision lies within the West Tributary of the Falcon Area Watershed. Detention for the site is provided in one proposed and one future on-site WQCV ponds to provide water quality for the entire tributary area. The proposed development will not have any adverse impacts on downstream developments or existing drainageways. Permission letters are being obtained from downstream property owners for maintenance of the channel, as it leaves the Bent Grass site.

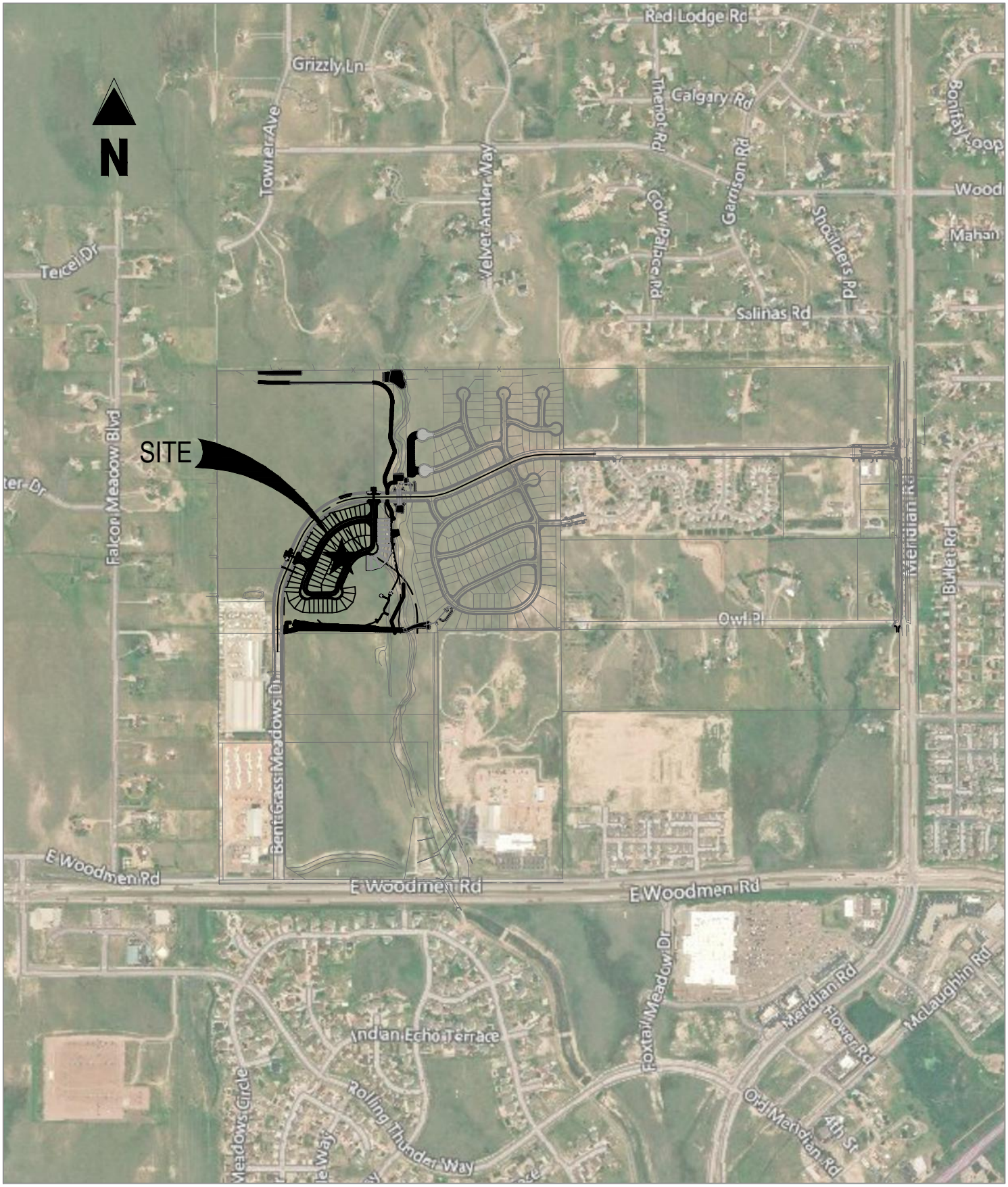
All drainage facilities within this report were sized according to the Drainage Criteria Manuals. Bent Grass Metropolitan District will own and maintain the channels until such a time that all final improvements have been constructed. At that time, channel corridors will become publicly owned and maintained and shall be the responsibility of El Paso County. Upon development of future filings within the Bent Grass Residential Subdivision, separate Final Drainage Reports will be required to be submitted and approved by El Paso County.

XVI. References

1. *City of Colorado Springs/County of El Paso Drainage Criteria Manual*, October 1991.
2. *Drainage Criteria Manual, Volume 2*, City of Colorado Springs, November 2002.
3. *Urban Storm Drainage Criteria Manual*, Urban Drainage and Flood Control District, January 2016 (with current revisions).
4. *Falcon Drainage Basin Planning Study*, by Matrix Design Group, September 2015.
5. *Master Development Drainage Plan and Preliminary Drainage Plan – Bent Grass Subdivision*, by Kiowa Engineering Corporation, December 2006.
6. *Final Drainage Report for Bent Grass Residential (Filing No. 1)*, by Classic Consulting Engineers & Surveyors, LLC, August 2014.
7. *Final Drainage Report Addendum for Bent Grass Residential (Filing No. 1)*, by Classic Consulting Engineers & Surveyors, LLC, August 2015.
8. *Master Development Drainage Plan for The Ranch*, by Classic Consulting Engineers & Surveyors, LLC, November 2018.
9. *Falcon Highlands Master Development Drainage Plan & Preliminary Drainage Report & Final Drainage Report for Filing 1*, by URS, January 2005.
10. *Final Drainage Report and Erosion Control Plan – Latigo Business Center Filing No. 1 A Re-subdivision of a Portion of Latigo Business and Research Center Filing No. 1*, by Kiowa Engineering Corporation, November 2004.
11. *Final Drainage Report for Bent Grass Residential (Filing No. 2),* by Galloway & Company, May 2020.
12. *Preliminary Drainage Report-Falcon Meadows at Bent Grass,* by Galloway & Company, February 2021.

APPENDIX A

Exhibits and Figures



FALCON MEADOWS AT BENT GRASS
FILING NO. 1

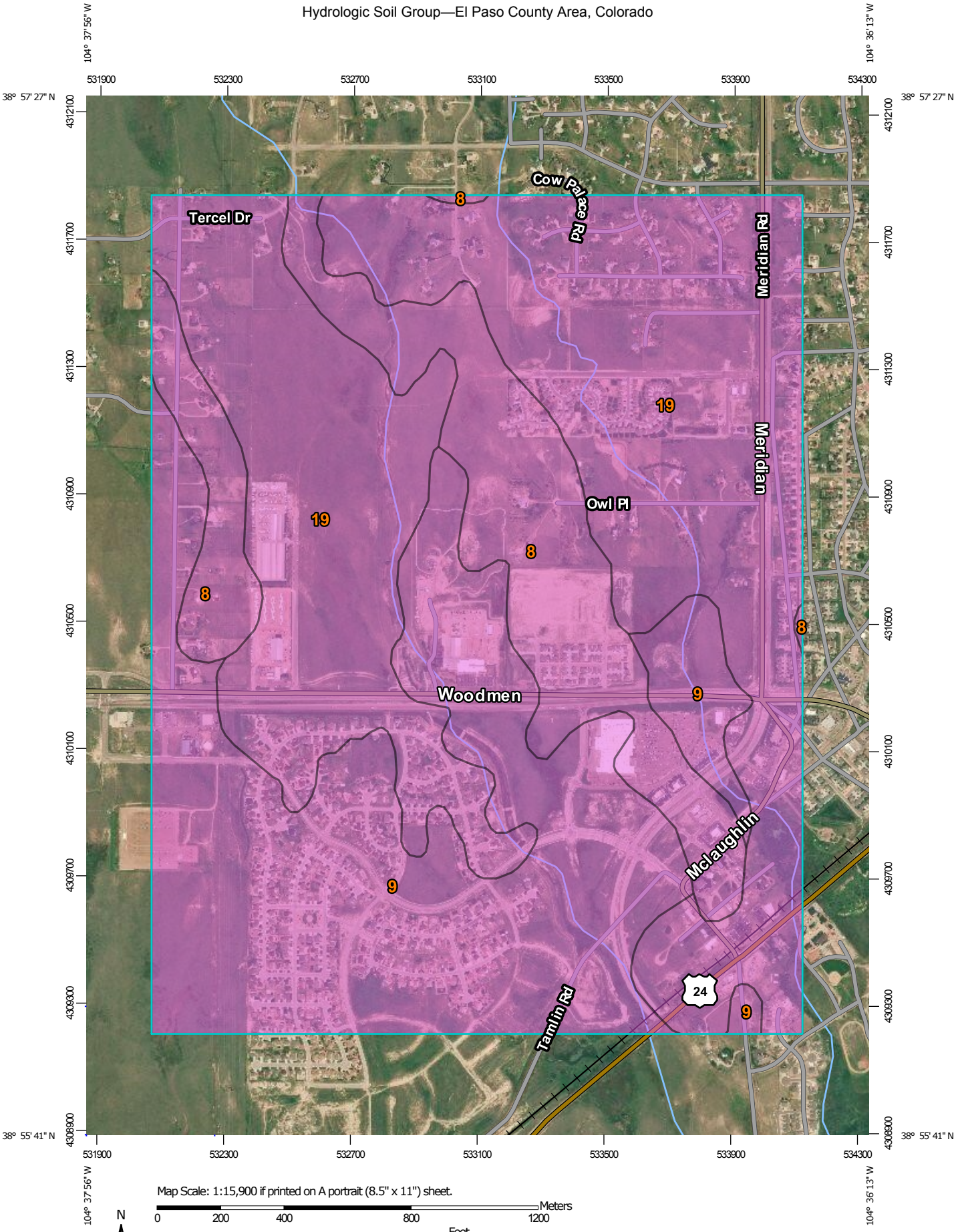
BENT GRASS MEADOWS DRIVE
SCALE: 1"=1,000'

VICINITY MAP

Project No:	CLH000018.20
Drawn By:	TJE
Checked By:	CMD
Date:	06/19/2020

Galloway
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220 • GallowayUS.com

Hydrologic Soil Group—El Paso County Area, Colorado



Map Scale: 1:15,900 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

Streams and Canals

Transportation

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

Background

Aerial Photography

MAP INFORMATION

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

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 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Jun 7, 2016—Aug 17, 2017

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	214.3	16.0%
9	Blakeland-Fluvaquentic Haplaquolls	A	465.8	34.7%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	662.6	49.3%
Totals for Area of Interest			**1,342.6**	**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, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

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.

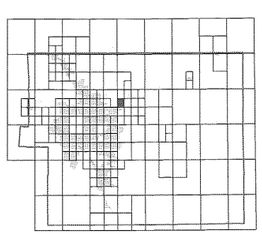
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this 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

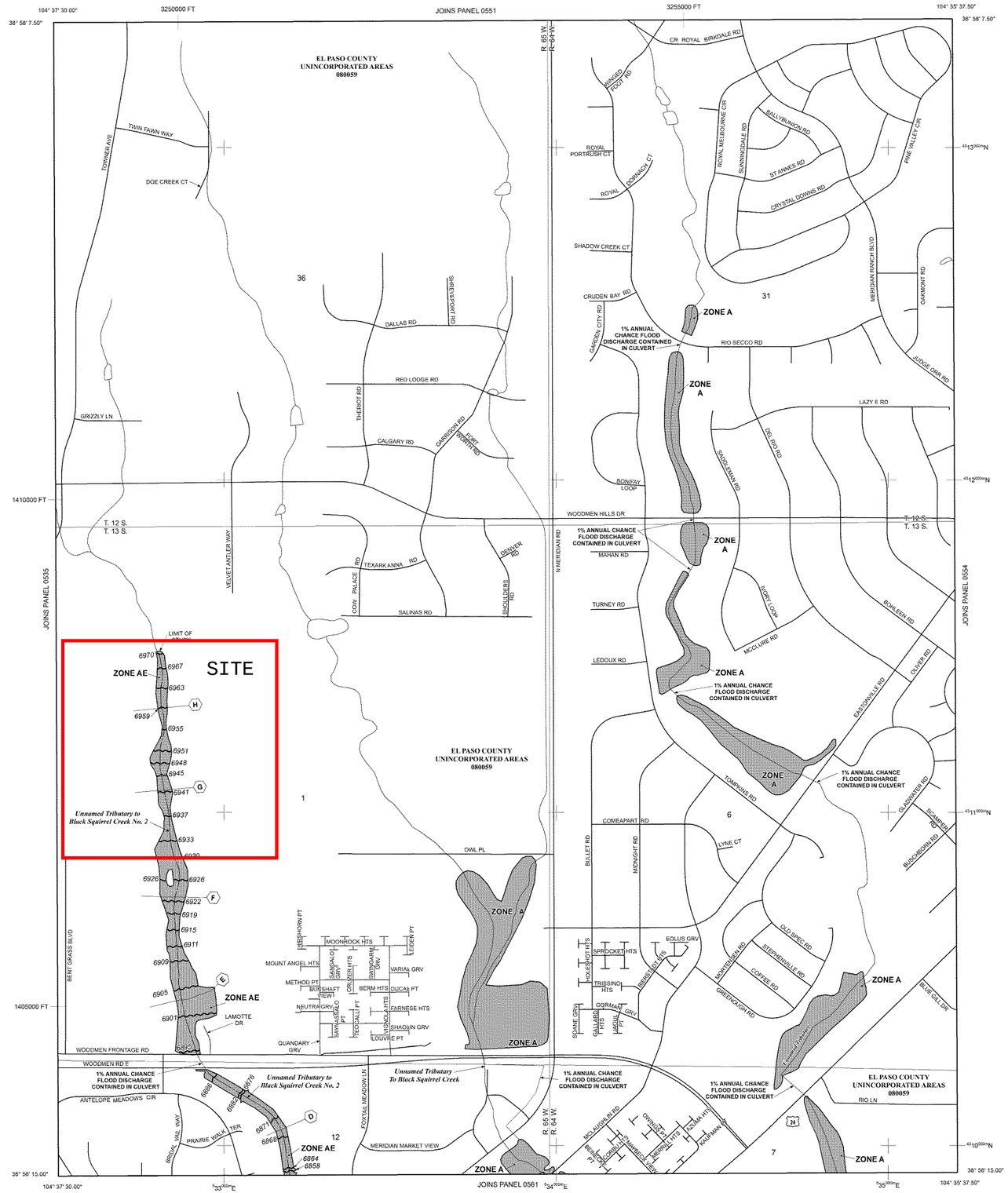
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

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)
$^{42}75^{000m}$N	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0553G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 553 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

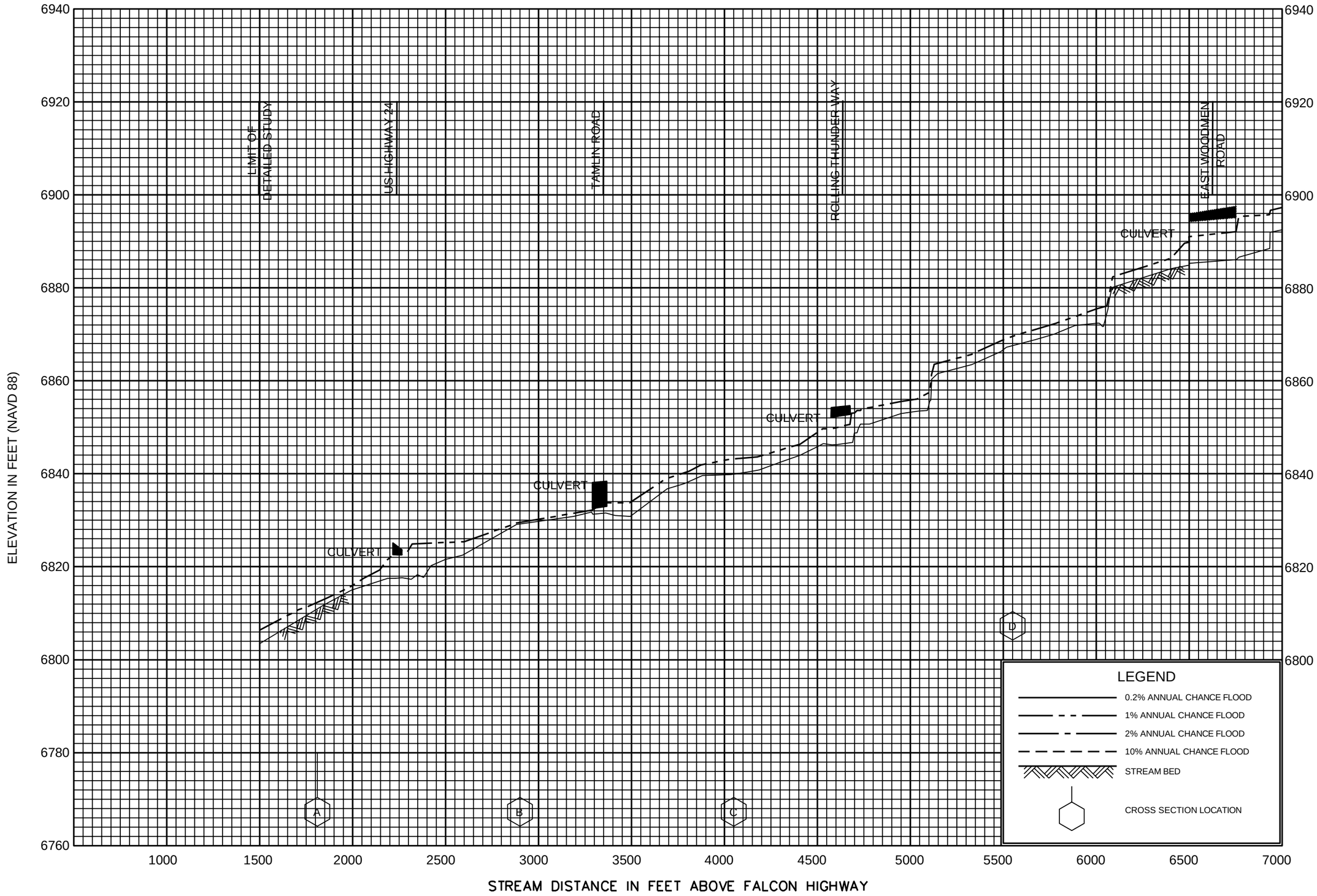
COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0553	G

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
08041C0553G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency



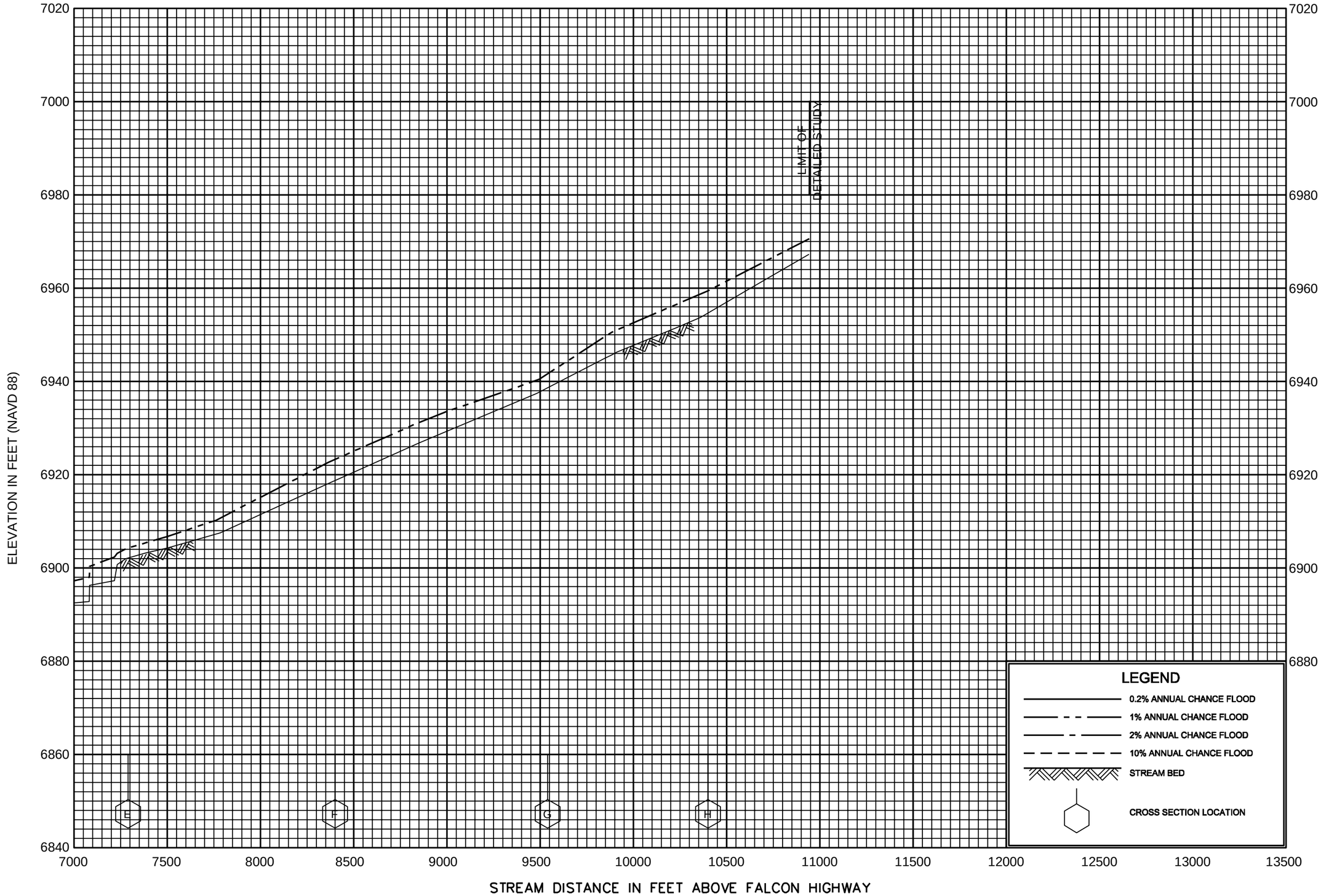
FLOOD PROFILES

UNNAMED TRIBUTARY TO BLACK SQUIRREL CREEK NO. 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO

(AND INCORPORATED AREAS)



FLOOD PROFILES

UNNAMED TRIBUTARY TO
BLACK SQUIRREL CREEK NO. 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
(AND INCORPORATED AREAS)

406P

FALCON DRAINAGE BASIN PLANNING STUDY

SELECTED PLAN REPORT

FINAL - SEPTEMBER 2015

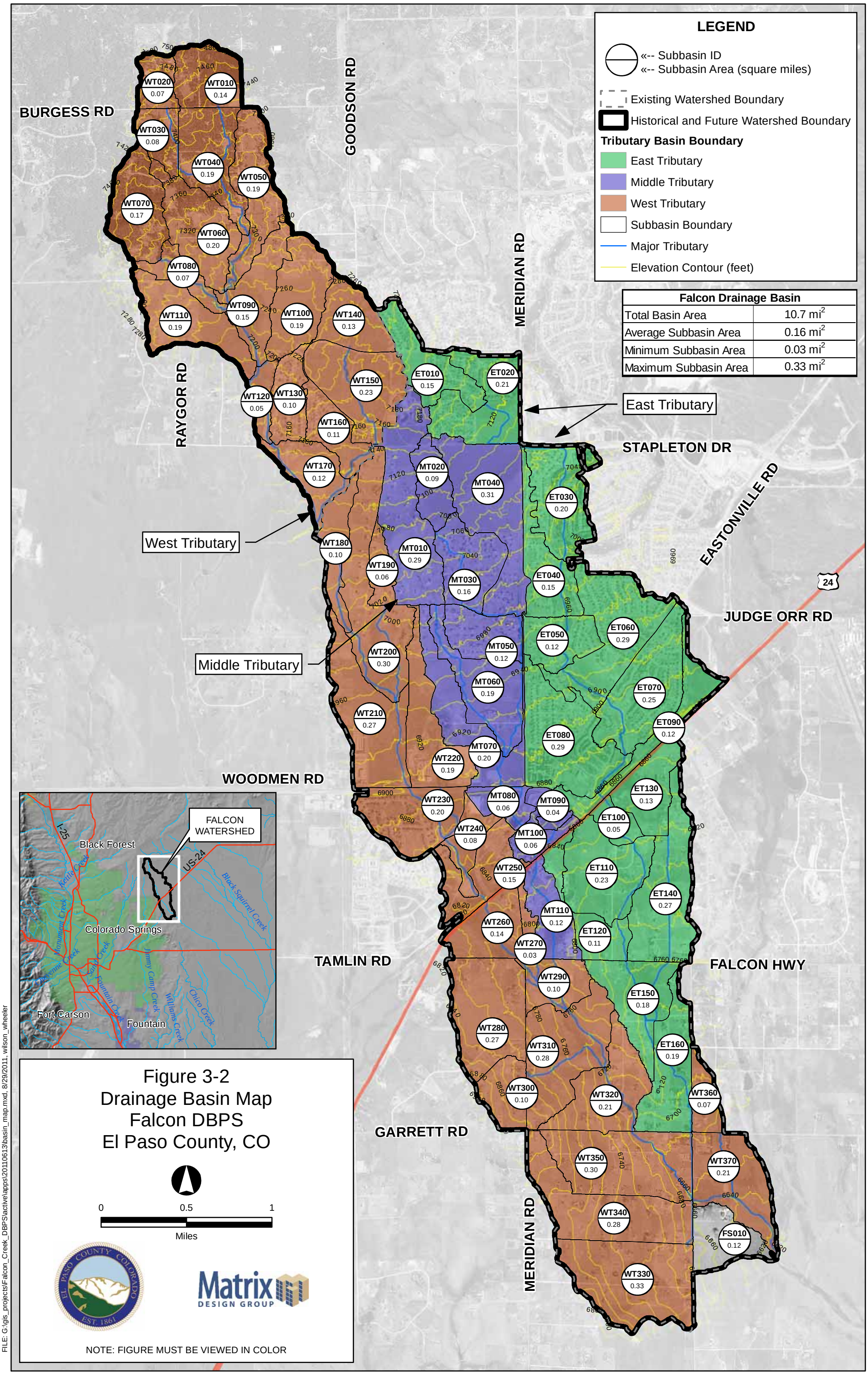
Prepared for:

El Paso County Public Services Department
3275 Akers Drive
Colorado Springs, CO 80922

Prepared By:

Matrix Design Group
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920

Matrix Project No. 10.122.003


LEGEND
«-- Subbasin ID
«-- Subbasin Area (square miles)
Existing Watershed Boundary
Historical and Future Watershed Boundary
Tributary Basin Boundary
East Tributary
Middle Tributary
West Tributary
Subbasin Boundary
Major Tributary
Elevation Contour (feet)
Falcon Drainage Basin
Total Basin Area 10.7 mi²
Average Subbasin Area 0.16 mi²
Minimum Subbasin Area 0.03 mi²
Maximum Subbasin Area 0.33 mi²
BURGESS RD
GOODSON RD
MERIDIAN RD
RAYGOR RD
STAPLETON DR
EASTONVILLE RD
JUDGE ORR RD
WOODMEN RD
TAMLIN RD
FALCON HWY
GARRETT RD
East Tributary
West Tributary
Middle Tributary
FALCON WATERSHED
Black Forest
Colorado Springs
Fort Carson
Fountain
I-25
US-24
Kettle Creek
Monument Creek
Black Squirrel Creek
Jimmy Camp Creek
Williams Creek
Chico Creek
Sand Creek
Fountain Creek
Figure 3-2
Drainage Basin Map
Falcon DBPS
El Paso County, CO
0
0.5
1
Miles
Matrix DESIGN GROUP
NOTE: FIGURE MUST BE VIEWED IN COLOR
FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20110613\basin_map.mxd, 8/29/2011, wilson_wheeler

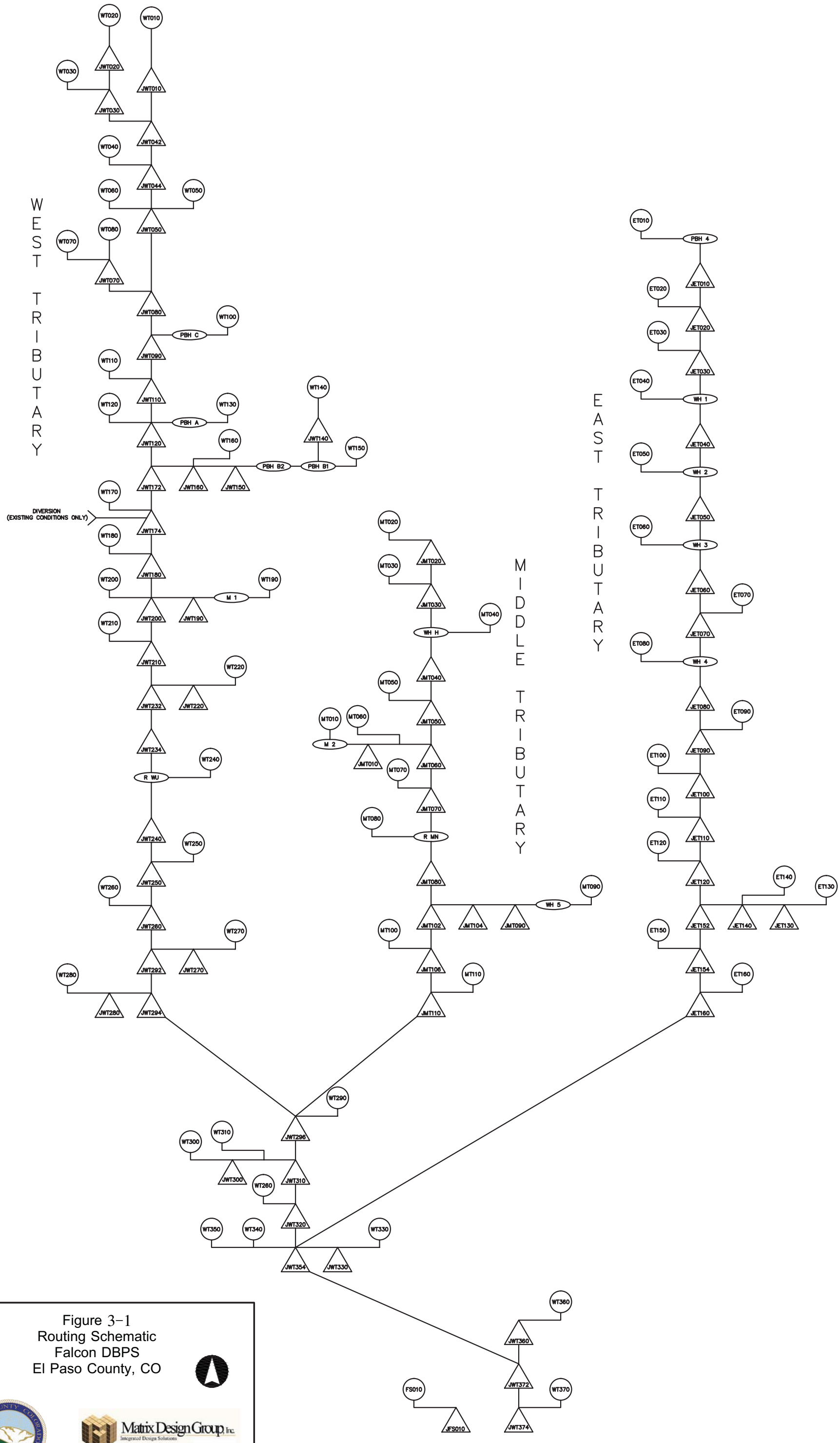


Figure 3-1
Routing Schematic
Falcon DBPS
El Paso County, CO

Matrix Design Group Inc.
Integrated Design Solutions

DRAWING NOT TO SCALE

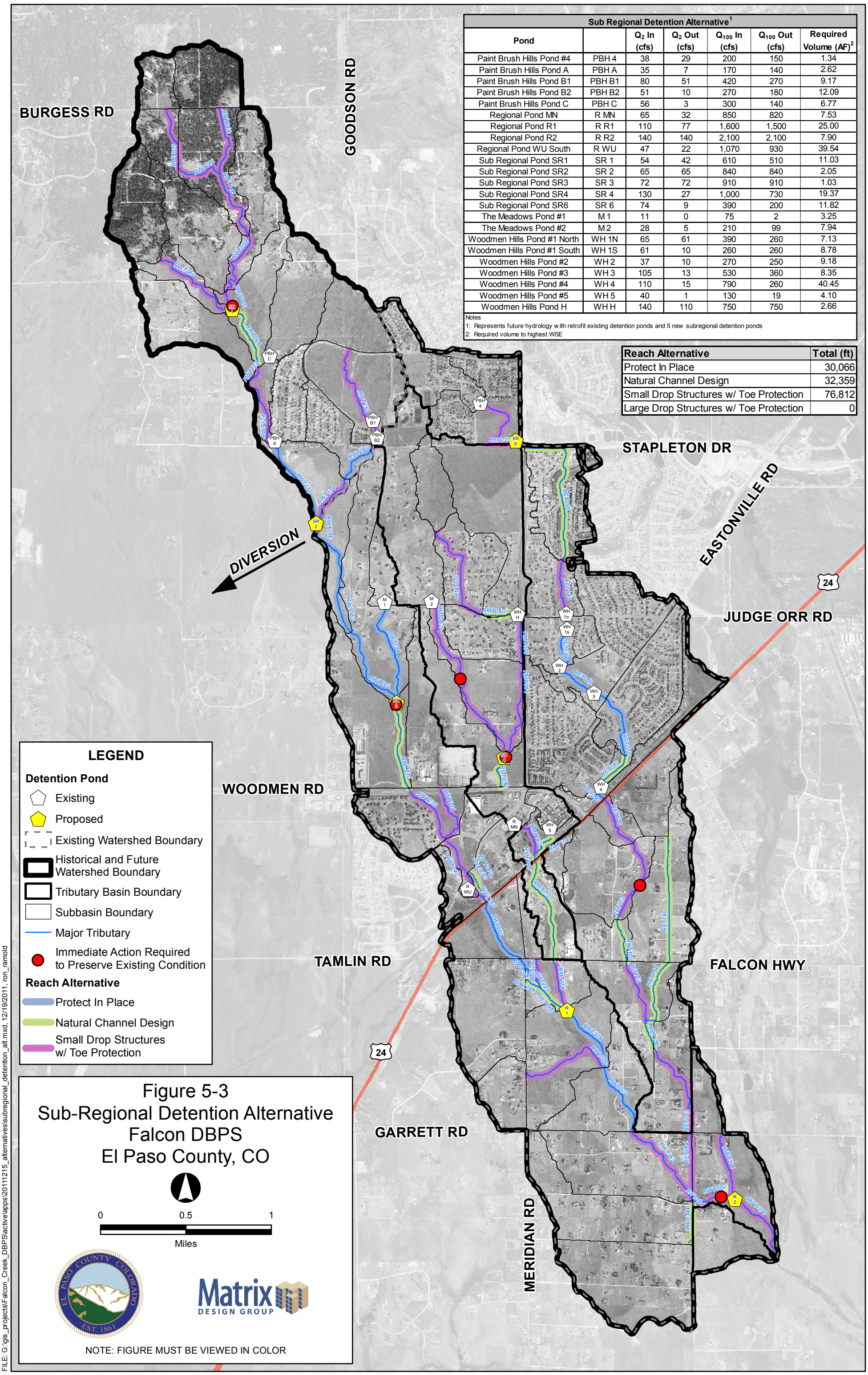


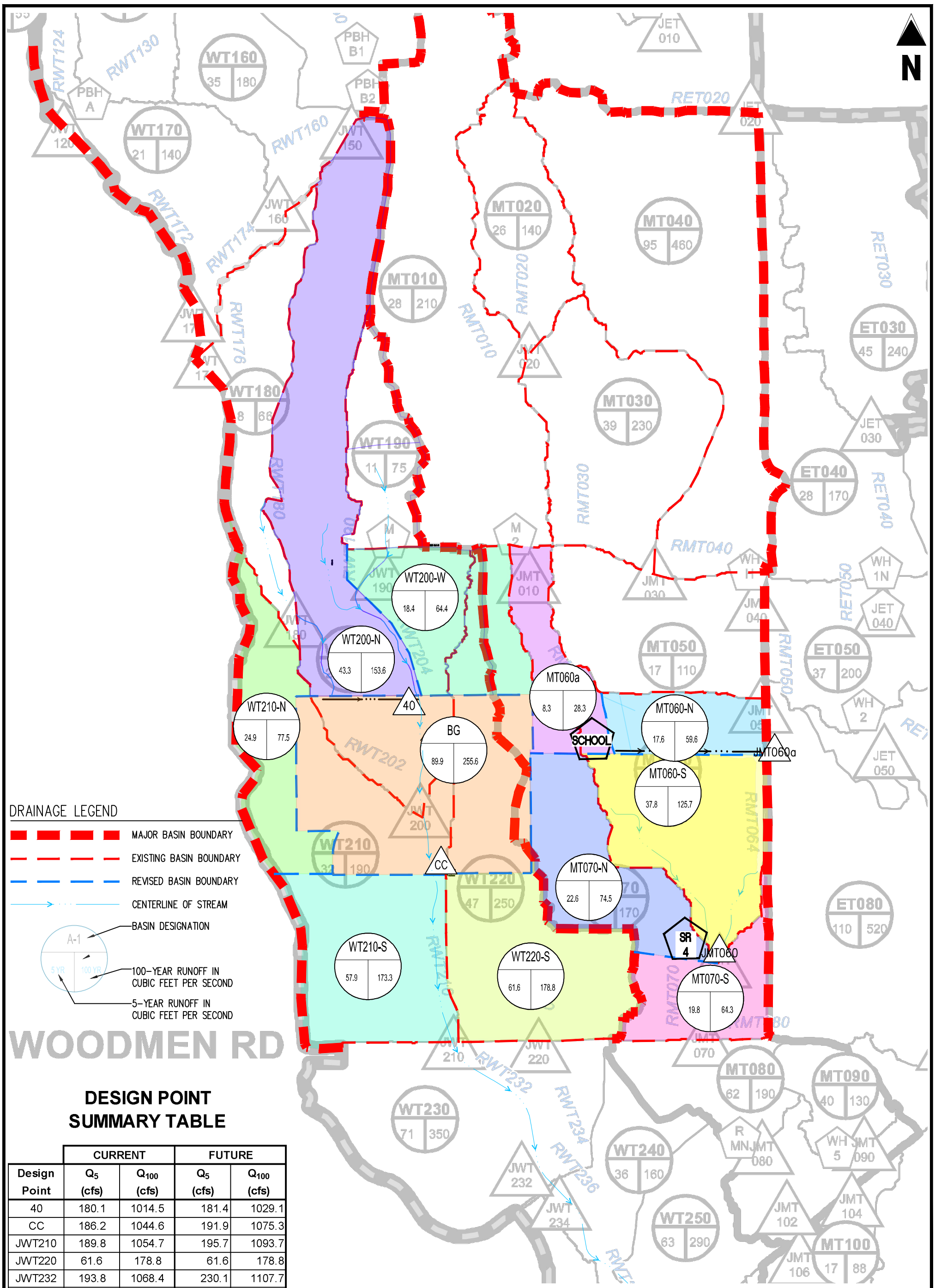
Figure 5-3
Sub-Regional Detention Alternative
Falcon DBPS
El Paso County, CO

Sub Regional Detention Alternative[1]						
Pond		Q_2 In (cfs)	Q_2 Out (cfs)	Q_{100} In (cfs)	Q_{100} Out (cfs)	Required Volume (AF)[2]
Paint Brush Hills Pond #4	PBH 4	38	29	200	150	1.34
Paint Brush Hills Pond A	PBH A	35	7	170	140	2.62
Paint Brush Hills Pond B1	PBH B1	80	51	420	270	9.17
Paint Brush Hills Pond B2	PBH B2	51	10	270	180	12.09
Paint Brush Hills Pond C	PBH C	56	3	300	140	6.77
Regional Pond MN	R MN	65	32	850	820	7.53
Regional Pond R1	R R1	110	77	1,600	1,500	25.00
Regional Pond R2	R R2	140	140	2,100	2,100	7.90
Regional Pond WU South	R WU	47	22	1,070	930	39.54
Sub Regional Pond SR1	SR 1	54	42	610	510	11.03
Sub Regional Pond SR2	SR 2	65	65	840	840	2.05
Sub Regional Pond SR3	SR 3	72	72	910	910	1.03
Sub Regional Pond SR4	SR 4	130	27	1,000	730	19.37
Sub Regional Pond SR6	SR 6	74	9	390	200	11.82
The Meadows Pond #1	M 1	11	0	75	2	3.25
The Meadows Pond #2	M 2	28	5	210	99	7.94
Woodmen Hills Pond #1 North	WH 1N	65	61	390	260	7.13
Woodmen Hills Pond #1 South	WH 1S	61	10	260	260	8.78
Woodmen Hills Pond #2	WH 2	37	10	270	250	9.18
Woodmen Hills Pond #3	WH 3	105	13	530	360	8.35
Woodmen Hills Pond #4	WH 4	110	15	790	260	40.45
Woodmen Hills Pond #5	WH 5	40	1	130	19	4.10
Woodmen Hills Pond H	WH H	140	110	750	750	2.66

Notes
1: Represents future hydrology with retrofit existing detention ponds and 5 new subregional detention ponds
2: Required volume to highest WSE

Reach Alternative	Total (ft)
Protect In Place	30,066
Natural Channel Design	32,359
Small Drop Structures w/ Toe Protection	76,812
Large Drop Structures w/ Toe Protection	0

From MDDP



DESIGN POINT SUMMARY TABLE

	CURRENT		FUTURE	
Design Point	Q_5 (cfs)	Q_{100} (cfs)	Q_5 (cfs)	Q_{100} (cfs)
40	180.1	1014.5	181.4	1029.1
CC	186.2	1044.6	191.9	1075.3
JWT210	189.8	1054.7	195.7	1093.7
JWT220	61.6	178.8	61.6	178.8
JWT232	193.8	1068.4	230.1	1107.7
JMT060a	292.1	908.7	292.1	908.9
JMT060	43.3	700.4	43.7	700.3
JMT070	44.9	717.6	45.3	717.5
JMT080	47.3	692.3	47.8	691.7

FALCON MEADOWS AT BENT GRASS
MDDP

REVISED BASIN HYDROLOGY - HMS MODEL

Project No:	CLH0017
Drawn By:	CMD
Checked By:	GD
Date:	06/16/21

Galloway
6162 S. Willow Drive, Suite 320
Greenwood Village, CO 80111
303.770.8884 • GallowayUS.com

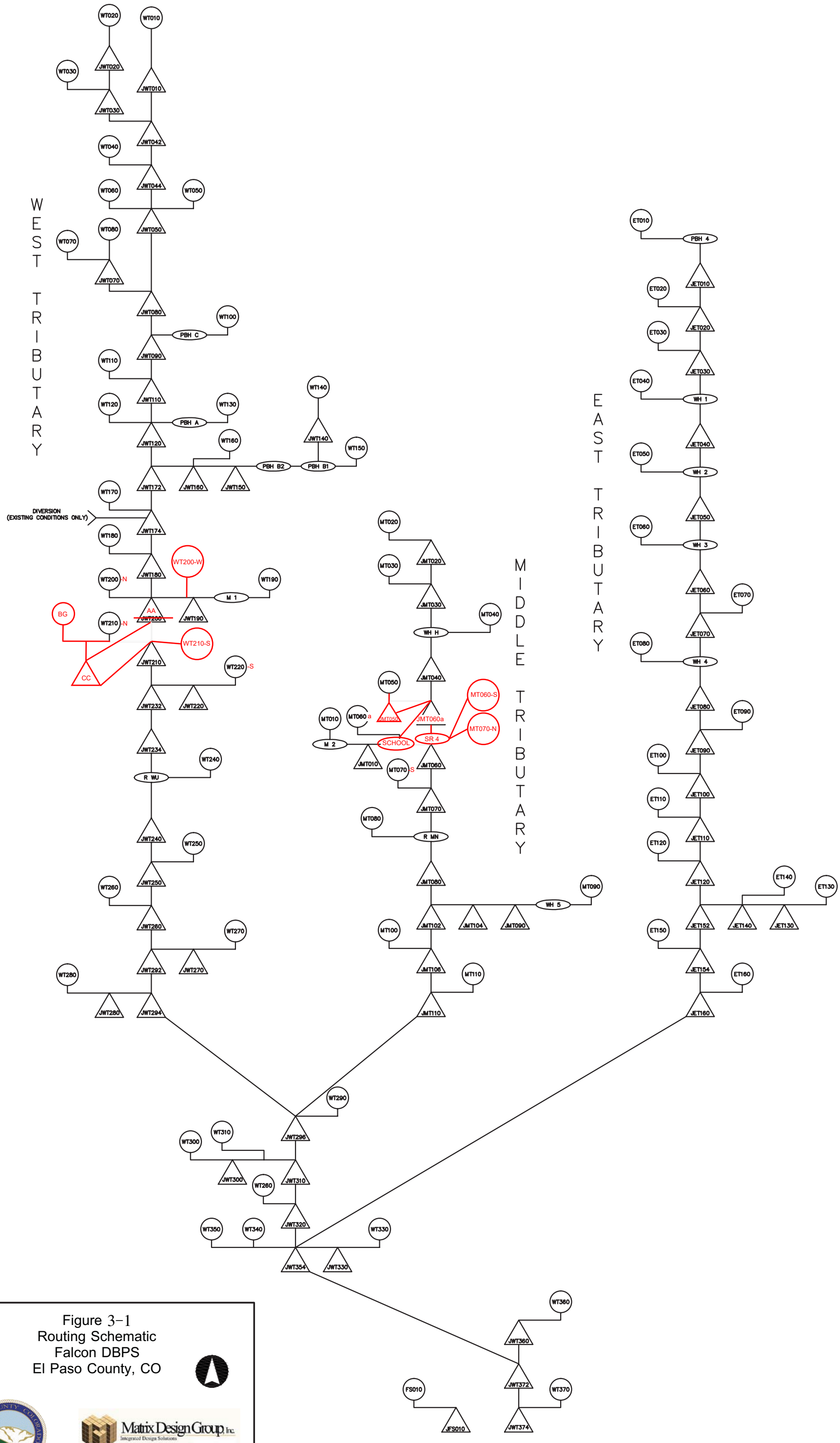


Figure 3-1
Routing Schematic
Falcon DBPS
El Paso County, CO

DRAWING NOT TO SCALE

APPENDIX B

Hydrologic Computations

Existing Computations

COMPOSITE % IMPERVIOUS CALCULATIONS: EXISTING

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs

Project Name: Falcon Meadows at Bent Grass Filing No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 6/19/20

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Basin ID	**Total Area (ac)**	**Paved/Gravel Roads**			**Lawns/Undeveloped**			**Roofs**			**Residential - 1/8 Acre**			**Residential - 1/4 Acre**			**Residential - 1/3 Acre**			**Residential - 1/2 Acre**			**Residential - 1 Acre**			**Basins Total Weighted % Imp.**
		% Imp.	**Area (ac)**	**Weighted % Imp.**	**% Imp.**	**Area (ac)**	**Weighted % Imp.**	**% Imp.**	**Area (ac)**	**Weighted % Imp.**	**% Imp.**	**Area (ac)**	**Weighted % Imp.**	**% Imp.**	**Area (ac)**	**Weighted % Imp.**	**% Imp.**	**Area (ac)**	**Weighted % Imp.**	**% Imp.**	**Area (ac)**	**Weighted % Imp.**	**% Imp.**	**Area (ac)**	**Weighted % Imp.**	
EX-1	1.19	100	0.00	0.0	2	1.19	2.0	2	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
EX-2	1.56	100	0.00	0.0	2	1.56	2.0	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
EX-3	0.62	100	0.00	0.0	2	0.62	2.0	1	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
EX-4	12.49	100	0.00	0.0	2	12.49	2.0	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
EX-5	5.15	100	0.00	0.0	2	5.15	2.0	10	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
EX-6	9.53	100	0.00	0.0	2	9.53	2.0	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
EX-7	9.16	100	0.00	0.0	2	9.16	2.0	18	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
EX-8	21.30	100	0.00	0.0	2	21.30	2.0	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
OS-1	32.28	100	2.15	6.7	2	29.25	1.8	90	0.88	2.5	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	11.0
OS-2	20.08	80	0.90	3.6	2	18.62	1.9	90	0.56	2.5	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	8.0
OS-3	10.62	80	0.48	3.6	2	9.84	1.9	19	0.30	0.5	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	6.0
OS-4	4.46	100	0.00	0.0	2	0.00	0.0	90	0.00	0.0	65.0	2.28	33.2	40	1.46	13.1	30	0.00	0.0	25	0.00	0.0	20	0.72	3.2	49.5
OS-5	0.46	100	0.00	0.0	2	0.00	0.0	90	0.00	0.0	65.0	0.46	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
OS-6	1.17	100	0.00	0.0	2	0.00	0.0	90	0.00	0.0	65.0	1.17	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
C-8	0.42	100	0.00	0.0	2	0.42	2.0	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
E-1	1.71	100	0.78	45.6	2	0.23	0.3	90	0.00	0.0	65.0	0.00	0.0	40	0.70	16.4	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	62.3
E-2	0.68	100	0.56	82.4	2	0.12	0.4	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	82.8
E-3	0.78	100	0.69	88.5	2	0.09	0.2	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	88.7
E-4	0.91	100	0.73	80.2	2	0.18	0.4	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	80.6
E-5	0.89	100	0.79	88.8	2	0.10	0.2	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	89.0
I-1	0.31	100	0.22	71.0	2	0.09	0.6	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	71.6

Lot Type Identification:	
Lot Size (SF)	*Lot Size (Acre)*
0 - 8,167	1/8 Acre
8,168 - 12,704	1/4 Acre
12,705 - 18,149	1/3 Acre
18,150 - 32,670	1/2 Acre
32,671 - 43,560	1 Acre

NOTES:
% Impervious values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001)

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS: EXISTING

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs

Project Name: Falcon Meadows at Bent Grass Filing No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 6/19/20

Basin ID	Total Area (ac)	Paved/Gravel Roads			Lawns/Undeveloped			Roofs			Residential - 1/8 Acre			Residential - 1/4 Acre			Residential - 1/3 Acre			Residential - 1/2 Acre			Residential - 1 Acre			Composite C_5	Composite C_{100}
		C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)		
EX-1	1.19	0.90	0.96	0.00	0.09	0.36	1.19	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
EX-2	1.56	0.90	0.96	0.00	0.09	0.36	1.56	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
EX-3	0.62	0.90	0.96	0.00	0.09	0.36	0.62	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
EX-4	12.49	0.90	0.96	0.00	0.09	0.36	12.49	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
EX-5	5.15	0.90	0.96	0.00	0.09	0.36	5.15	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
EX-6	9.53	0.90	0.96	0.00	0.09	0.36	9.53	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
EX-7	9.16	0.90	0.96	0.00	0.09	0.36	9.16	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
EX-8	21.30	0.90	0.96	0.00	0.09	0.36	21.30	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
OS-1	32.28	0.90	0.96	2.15	0.09	0.36	29.25	0.73	0.81	0.88	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.16	0.41
OS-2	20.08	0.90	0.96	0.90	0.09	0.36	18.62	0.73	0.81	0.56	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.14	0.40
OS-3	10.62	0.90	0.96	0.48	0.09	0.36	9.84	0.73	0.81	0.30	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.14	0.40
OS-4	4.46	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.28	0.30	0.50	1.46	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.72	0.36	0.54
OS-5	0.46	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.46	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
OS-6	1.17	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	1.17	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
C-8	0.42	0.90	0.96	0.00	0.09	0.36	0.42	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
E-1	1.71	0.90	0.96	0.78	0.09	0.36	0.23	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.70	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.55	0.69
E-2	0.68	0.90	0.96	0.56	0.09	0.36	0.12	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.76	0.85
E-3	0.78	0.90	0.96	0.69	0.09	0.36	0.09	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.81	0.89
E-4	0.91	0.90	0.96	0.73	0.09	0.36	0.18	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.74	0.84
E-5	0.89	0.90	0.96	0.79	0.09	0.36	0.10	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.81	0.89
I-1	0.31	0.90	0.96	0.22	0.09	0.36	0.09	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.66	0.79

Lot Type Identification:

Lot Size (SF)	*Lot Size (Acre)*
0 - 8,167	</= 1/8 Acre
8,168 - 12,704	1/4 Acre
12,705 - 18,149	1/3 Acre
18,150 - 32,670	1/2 Acre
32,671 - 43,560	1 Acre

NOTES:
C values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001)
Coeffficients use HSG A&B soils - Refer to "Appendix A: Exhibits and Figures" for soil map

STANDARD FORM SF-2
TIME OF CONCENTRATION: EXISTING

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs

Project Name: Falcon Meadows at Bent Grass Filing No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 6/19/20

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	Cv	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH(FT)	Urbanized T_c (MIN)	T_c (MIN)
EX-1	1.19	A	2.0	0.09	0.36	300	2.7	23.0	690	2.7	15	2.5	4.7	27.7	990.0	15.5	15.5
EX-2	1.56	A	2.0	0.09	0.36	200	2.7	18.8	100	2.7	15	2.5	0.7	19.5	300.0	11.7	11.7
EX-3	0.62	A	2.0	0.09	0.36	100	5.0	10.8	30	2.7	15	2.5	0.2	11.0	130.0	10.7	10.7
EX-4	12.49	A	2.0	0.09	0.36	100	2.7	13.3	1180	2.7	15	2.5	8.0	21.3	1280.0	17.1	17.1
EX-5	5.15	A	2.0	0.09	0.36	100	2.7	13.3	1000	2.7	15	2.5	6.8	20.0	1100.0	16.1	16.1
EX-6	9.53	A	2.0	0.09	0.36	100	2.7	13.3	1700	2.7	15	2.5	11.5	24.8	1800.0	20.0	20.0
EX-7	9.16	A	2.0	0.09	0.36	90	2.7	12.6	1020	2.7	15	2.5	6.9	19.5	1110.0	16.2	16.2
EX-8	21.30	A	2.0	0.09	0.36	100	2.7	13.3	996	2.7	15	2.5	6.7	20.0	1095.5	16.1	16.1
OS-1	32.28	A	11.0	0.16	0.41	100	2.4	12.9	2100	2.2	15	2.2	15.7	28.6	2200.0	22.2	22.2
OS-2	20.08	A	8.0	0.14	0.40	100	2.3	13.3	1400	2.3	15	2.3	10.3	23.6	1500.0	18.3	18.3
OS-3	10.62	A	8.0	0.14	0.40	100	2.0	14.0	1500	2.0	15	2.1	11.8	25.7	1600.0	18.9	18.9
OS-4	4.46	A	49.5	0.36	0.54	100	2.0	10.8	910	1.2	20	2.2	6.9	17.7	1010.0	15.6	15.6
OS-5	0.46	A	65.0	0.45	0.59	15	2.0	3.7	190	1.0	20	2.0	1.6	5.2	205.0	11.1	5.2
OS-6	1.17	A	65.0	0.45	0.59	85	0.2	18.7	430	0.9	20	1.9	3.9	22.6	515.0	12.9	12.9
C-8	0.42	A	2.0	0.09	0.36	100	2.5	13.6	170	2.5	15	2.4	1.2	14.8	270.0	11.5	11.5
E-1	1.71	A	62.3	0.55	0.69	25	2.0	4.0	940	1.0	20	2.0	7.8	11.8	965.0	15.4	11.8
E-2	0.68	A	82.8	0.76	0.85	25	2.0	2.5	665	1.6	20	2.5	4.4	6.9	690.0	13.8	6.9
E-3	0.78	A	88.7	0.81	0.89	25	2.0	2.1	632	1.0	20	2.0	5.3	7.4	657.0	13.7	7.4
E-4	0.91	A	80.6	0.74	0.84	25	2.0	2.6	913	2.0	20	2.8	5.4	8.0	938.0	15.2	8.0
E-5	0.89	A	89.0	0.81	0.89	25	2.0	2.1	903	2.1	20	2.9	5.2	7.3	928.0	15.2	7.3
I-1	0.31	A	71.6	0.66	0.79	25	2.0	3.2	135	2.0	20	2.8	0.8	4.0	160.0	10.9	5.0

NOTES:

T_i = (0.395*(1.1 - C_5)*(L)^0.5)/((S)^0.33), S in ft/ft

T_t=L/60V (Velocity From Fig. 501)

Velocity V=Cv*S^0.5, S in ft/ft

Tc Check = 10+L/180

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN: EXISTING

(RATIONAL METHOD PROCEDURE)

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs
Design Storm: 5-Year

Project Name: Falcon Meadows at Bent Grass Filing No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 6/19/20

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
		RWT202	1574.40						46.6	120.88	1.82	220.0									From Falcon DBPS by Matrix
		RWT204	38.40						11.37	1.78	3.94	7.0									From Falcon DBPS by Matrix
		WT200	192.00						37.8	24.41	2.13	52.0									From Falcon DBPS by Matrix
		OS-1	32.28	0.16	22.2	5.16	2.93	15.1													Existing off-site flows into creek via existing swale.
	12								46.6	152.23	1.82	277.1						850	5.0	2.8	Combine Offsite basins entering site at north property line (RWT202, RWT204, WT200 & OS-1)
	1	OS-4	4.46	0.36	15.6	1.61	3.46	5.6					1.2	5.6				910	2.2	6.9	Flows from Basin B-1 of Bent Grass Filing No. 2 FDR.
	2	OS-5	0.46	0.45	5.2	0.21	5.10	1.1					1	1.1				190	2.0	1.6	Flows from Basin B-2 of Bent Grass Filing No. 2 FDR
	3	OS-6	1.17	0.45	12.9	0.53	3.75	2.0					0.86	2.0				430	1.9	3.9	Flows from Basin B-3 of Bent Grass Filing No. 2 FDR.
	4	EX-1	1.19	0.09	15.5	0.11	3.47	0.4													
	5	EX-2	1.56	0.09	11.7	0.14	3.90	0.5	15.6	2.60	3.46	9.0									Total flows to DP 5 discharging into existing WQCV Pond.
		EX-3	0.62	0.09	10.7	0.06	4.02	0.2													Existing WQCV Pond.
	6	EX-4	12.49	0.09	17.1	1.12	3.32	3.7													
	7	EX-5	5.15	0.09	16.1	0.46	3.41	1.6	17.1	1.58	3.32	5.2									Total flow from DP 6 & EX-5 flowing onto Bent Grass Meadows Drive.
	8	EX-7	9.16	0.09	16.2	0.82	3.41	2.8													Flows from DP 8 go off-site into Bent Grass Meadows Drive.
	9	OS-2	20.08	0.14	18.3	2.81	3.22	9.0													Flow obtained from Bent Grass Filing No. 2 FDR.
	10	OS-3	10.62	0.14	18.9	1.49	3.18	4.7													Flow obtained from Bent Grass Filing No. 2 FDR.
	11	EX-6	9.53	0.09	20.0	0.86	3.09	2.7	20.0	5.16	3.09	15.9									Total flows entering existing inlet at DP 11. (Basins OS-2, OS-3 & EX-6)
		EX-8	21.30	0.09	16.1	1.92	3.42	6.6													Existing flows from basin discharge into creek.
		E-1	1.71	0.55	11.8	0.94	3.88	3.6													Existing Basin from Filing No. 2(East side of BGMD)
		E-2	0.68	0.76	6.9	0.52	4.70	2.4													Existing Basin from Filing No. 2(West side of BGMD)
	4X								17.3	2.60	3.31	8.6									DP-4 from Bent Grass Filing No. 2 FDR (
	21								17.3	5.18	3.31	17.1									Combine Basins Ex-4, E-1 & E-2 and DP 4X at Existing Inlet from Bent Grass Filing No. 2 FDR
	15A								5.0	2.42	5.17	12.5									Release Rate from Ex WQCV Pond North in Bent Grass Filing No.2 FDR
		E-3	0.78	0.81	7.4	0.63	4.59	2.9													
	AA								49.4	155.28	1.73	268.6						900	5.0	3.0	Combine Basins E-3 w/Design Points 12 & 15A
		E-4	0.91	0.74	8.0	0.67	4.46	3.0													

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN: EXISTING

(RATIONAL METHOD PROCEDURE)

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs
Design Storm: 5-Year

Project Name: Falcon Meadows at Bent Grass Filing No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 6/19/20

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
		E-5	0.89	0.81	7.3	0.72	4.60	3.3													
		I-1	0.31	0.66	5.0	0.20	5.17	1.0													
	26								20.0	6.75	3.09	20.9									Combine Basins E-4, E-5 & I-1 w/DP 11 at Existing Inlet from Bent Grass Filing No. 2 FDR
	20B								5.0	4.10	5.17	21.2									Release Rate from Ex WQCV Pond South in Bent Grass Filing No. FDR
		C-8	0.42	0.09	11.5	0.04	3.92	0.2													
	CC								52.4	166.17	1.64	272.5									Flows exiting site - Combined flows from Basin C-8 w/Design Points AA, 26 & 20B

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN: EXISTING

(RATIONAL METHOD PROCEDURE)

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Falcon Meadows at Bent Grass Filing No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 6/19/20

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
		RWT202	1574.40						46.6	327.87	3.05	1000.0									From Falcon DBPS by Matrix
		RWT204	38.40						11.4	6.51	6.61	43.0									From Falcon DBPS by Matrix
		WT200	192.00						37.8	53.07	3.58	190.0									From Falcon DBPS by Matrix
		OS-1	32.28	0.41	22.2	13.23	4.92	65.1													Existing off-site flows into creek via existing swale.
	12								46.6	400.68	3.05	1222.1						850	5.0	2.8	Combine Offsite basins entering site at north property line (RWT202, RWT204, WT200 & OS-1)
	1	OS-4	4.46	0.54	15.6	2.41	5.81	14.0					1.2	14.0				910	2.2	6.9	Flow obtained from Bent Grass Filing No. 2 FDR.
	2	OS-5	0.46	0.59	5.2	0.27	8.56	2.3					1	2.3				190	2.0	1.6	Flow obtained from Bent Grass Filing No. 2 FDR.
	3	OS-6	1.17	0.59	12.9	0.69	6.30	4.3					0.86	4.3				430	1.9	3.9	Flow obtained from Bent Grass Filing No. 2 FDR.
	4	EX-1	1.19	0.36	15.5	0.43	5.83	2.5													
	5	EX-2	1.56	0.36	11.7	0.56	6.54	3.7	15.6	4.36	5.81	25.3									Total flows to DP 5 discharging into existing WQCV Pond.
		EX-3	0.62	0.36	10.7	0.22	6.76	1.5													Existing WQCV Pond.
	6	EX-4	12.49	0.36	17.1	4.50	5.58	25.1													
	7	EX-5	5.15	0.36	16.1	1.85	5.73	10.6	17.1	6.35	5.58	35.4									Total flow from DP 6 & EX-5 flowing onto Bent Grass Meadows Drive.
	8	EX-7	9.16	0.36	16.2	3.30	5.72	18.9													Flows from DP 8 go off-site into Bent Grass Meadows Drive.
	9	OS-2	20.08	0.40	18.3	8.03	5.41	43.4													Flow obtained from Bent Grass Filing No. 2 FDR.
	10	OS-3	10.62	0.40	18.9	4.25	5.33	22.7													Flow obtained from Bent Grass Filing No. 2 FDR.
	11	EX-6	9.53	0.36	20.0	3.43	5.19	17.8	20.0	15.71	5.19	81.5									Total flows entering existing inlet at DP 11. (Basins OS-2, OS-3 & EX-6)
		EX-8	21.30	0.36	16.1	7.67	5.73	43.9													Existing flows from basin discharge into creek.
		E-1	1.71	0.69	11.8	1.18	6.51	7.7													
		E-2	0.68	0.85	6.9	0.58	7.89	4.6													
	4X								17.3	4.03	5.55	22.4									DP-4 from Bent Grass Filing No. 2 FDR (
	21								17.3	10.29	5.55	57.1									Combine Basins Ex-4, E-1 & E-2 at Existing Inlet from Bent Grass Filing No. 2 FDR
	15A								45.0	11.78	3.14	37.0									Release Rate from WQCV Pond North in Bent Grass Filing No. FDR
		E-3	0.78	0.89	7.4	0.69	7.70	5.3													
	AA								49.4	413.15	2.91	1202.3						900	5.0	3.0	Combine Basin E-3 w/Design Points 12, & 15A
		E-4	0.91	0.84	8.0	0.76	7.50	5.7													

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN: EXISTING

(RATIONAL METHOD PROCEDURE)

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Falcon Meadows at Bent Grass Filing No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 6/19/20

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
		E-5	0.89	0.89	7.3	0.79	7.73	6.1													
		I-1	0.31	0.79	5.0	0.24	8.68	2.1													
	26								20.0	17.50	3.09	54.1									Combine Basins E-4, E-5 & I-1 w/DP 11 at Existing Inlet from Bent Grass Filing No. 2 FDR
	20B								5.0	7.48	8.68	64.9									Release Rate from WQCV Pond South in Bent Grass Filing No. FDR
		C-8	0.42	0.36	11.5	0.15	6.58	1.0													
	CC								52.4	438.28	2.76	1209.6									Flows exiting site - Combined flows from Basin C-8 w/Design Points AA, 26 & 20B

Proposed Computations

COMPOSITE % IMPERVIOUS CALCULATIONS: PROPOSED

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs

Project Name: Falcon Meadows at Bent Grass Fil No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 7//7/2021

Basin ID	Total Area (ac)	Paved/Gravel Roads			Lawns/Undeveloped			Roofs			Residential - 1/8 Acre			Residential - 1/4 Acre			Residential - 1/3 Acre			Residential - 1/2 Acre			Residential - 1 Acre			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
A-1	2.16	100	0.50	23.1	2	0.00	0.0	90	0.00	0.0	65.0	0.93	28.0	40	0.00	0.0	30	0.73	10.1	25	0.00	0.0	20	0.75	6.9	68.1
A-2	0.86	100	0.00	0.0	2	0.00	0.0	90	0.00	0.0	65.0	0.86	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
A-3	0.92	100	0.64	69.6	2	0.28	0.6	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	70.2
A-4	0.82	100	0.00	0.0	2	0.82	2.0	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
B-1	4.32	100	0.00	0.0	2	4.32	2.0	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
B-2	4.16	100	0.00	0.0	2	4.41	2.1	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.1
C-1	9.07	100	2.14	23.6	2	0.33	0.1	90	0.00	0.0	65.0	4.56	32.7	40	1.70	7.5	30	0.34	1.1	25	0.00	0.0	20	0.00	0.0	65.0
C-2	1.11	100	0.37	33.3	2	0.19	0.3	90	0.00	0.0	65.0	0.30	17.6	40	0.00	0.0	30	0.25	6.8	25	0.00	0.0	20	0.00	0.0	58.0
C-3	1.52	100	0.94	61.8	2	0.00	0.0	90	0.00	0.0	65.0	0.58	24.8	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	86.6
C-4	3.99	100	0.36	9.0	2	1.75	0.9	90	0.00	0.0	65.0	1.88	30.6	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	40.5
C-5	0.51	100	0.00	0.0	2	0.51	2.0	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	2.0
C-6	1.37	100	0.00	0.0	2	0.30	0.4	90	0.00	0.0	65.0	1.07	50.8	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	51.2
D-9	0.70	100	0.00	0.0	2	0.32	0.9	90	0.00	0.0	65.0	0.38	35.3	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	36.2
D-1a	3.40	100	0.42	12.4	2	0.68	0.4	90	0.00	0.0	65.0	0.00	0.0	40	1.96	23.1	30	0.34	3.0	25	0.00	0.0	20	0.00	0.0	38.9
D-1b	4.72	100	0.99	21.0	2	0.00	0.0	90	0.00	0.0	65.0	1.85	25.5	40	1.07	9.1	30	0.81	5.1	25	0.00	0.0	20	0.00	0.0	60.7
D-2a	0.30	100	0.30	100.0	2	0.00	0.0	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	100.0
D-2b	0.99	100	0.18	18.2	2	0.17	0.3	90	0.00	0.0	65.0	0.64	42.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	60.5
D-2c	0.16	100	0.16	100.0	2	0.00	0.0	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	100.0
D-2d	0.14	100	0.14	100.0	2	0.00	0.0	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	100.0
D-2e	1.56	100	0.40	25.6	2	0.00	0.0	90	0.00	0.0	65.0	1.16	48.3	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	73.9
D-2f	1.03	100	0.72	69.9	2	0.02	0.0	90	0.00	0.0	65.0	0.29	18.3	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	88.2
D-2g	2.54	100	0.34	13.4	2	0.73	0.6	90	0.00	0.0	65.0	1.47	37.6	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	51.6
D-4a	0.98	100	0.27	27.6	2	0.00	0.0	90	0.00	0.0	65.0	0.71	47.1	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	74.7
D-4b	0.96	100	0.45	46.9	2	0.00	0.0	90	0.00	0.0	65.0	0.51	34.5	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	81.4
D-4c	1.00	100	0.43	43.0	2	0.02	0.0	90	0.00	0.0	65.0	0.55	35.8	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	78.8
D-5	1.08	100	0.22	20.4	2	0.11	0.2	90	0.00	0.0	65.0	0.75	45.1	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.7
D-6a	1.33	100	0.44	33.1	2	0.00	0.0	90	0.00	0.0	65.0	0.89	43.5	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	76.6
D-6b	2.69	100	0.59	21.9	2	0.00	0.0	90	0.00	0.0	65.0	2.10	50.7	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	72.6
D-3	2.93	100	0.00	0.0	2	0.28	0.2	90	0.00	0.0	65.0	1.26	28.0	40	0.17	2.3	30	0.12	1.2	25	0.00	0.0	20	0.00	0.0	31.7
D-7	7.84	100	0.00	0.0	2	6.10	1.6	90	0.00	0.0	65.0	0.96	8.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	9.6
D-8	1.69	100	0.00	0.0	2	1.13	1.3	90	0.00	0.0	65.0	0.56	21.5	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	22.8
E-1	1.71	100	0.78	45.6	2	0.23	0.3	90	0.00	0.0	65.0	0.00	0.0	40	0.70	16.4	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	62.3
E-2	0.68	100	0.56	82.4	2	0.12	0.4	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	82.8
E-3	0.78	100	0.69	88.5	2	0.09	0.2	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	88.7
E-4	0.91	100	0.73	80.2	2	0.18	0.4	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	80.6
E-5	0.89	100	0.79	88.8	2	0.10	0.2	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	89.0
I-1	0.31	100	0.22	71.0	2	0.09	0.6	90	0.00	0.0	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	71.6
OS-1	32.28	100	2.15	6.7	2	29.25	1.8	90	0.88	2.5	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	11.0
OS-2	20.07	80	0.90	3.6	2	18.62	1.9	90	0.56	2.5	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	8.0
OS-3	10.61	80	0.48	3.6	2	9.84	1.9	90	0.30	2.5	65.0	0.00	0.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	8.0
OS-4	4.46	100	0.00	0.0	2	0.00	0.0	90	0.00	0.0	65.0	2.28	33.2	40	1.46	13.1	30	0.00	0.0	25	0.00	0.0	20	0.72	3.2	49.5
OS-5	0.46	100	0.00	0.0	2	0.00	0.0	90	0.00	0.0	65.0	0.46	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
OS-6	1.17	100	0.00	0.0	2	0.00	0.0	90	0.00	0.0	65.0	1.17	65.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	65.0
	141.18	100.00	18.30	13.0	2	80.99	1.1	90	1.74	1.1	65.0	28.17	65.0	40	7.06	2.0	30	2.59	0.6	25	0.00	0.0	20	1.47	0.2	83.0

Lot Type Identification:	
Lot Size (SF)	*Lot Size (Acre)*
0 - 8,167	1/8 Acre
8,168 - 12,704	1/4 Acre
12,705 - 18,149	1/3 Acre
18,150 - 32,670	1/2 Acre
32,671 - 43,560	1 Acre

NOTES:
% Impervious values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001)

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS: PROPOSED

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs

Project Name: Falcon Meadows at Bent Grass Fil No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 7//7/2021

Basin ID	Total Area (ac)	Paved/Gravel Roads			Lawns/Undeveloped			Roofs			Residential - 1/8 Acre			Residential - 1/4 Acre			Residential - 1/3 Acre			Residential - 1/2 Acre			Residential - 1 Acre			Composite	Composite
		C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}	Area (ac)	C_5	C_{100}
A-1	2.16	0.90	0.96	0.50	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.93	0.30	0.50	0.00	0.25	0.47	0.73	0.22	0.46	0.00	0.20	0.44	0.75	0.56	0.79
A-2	0.86	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.86	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
A-3	0.92	0.90	0.96	0.64	0.09	0.36	0.28	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.65	0.78
A-4	0.82	0.90	0.96	0.00	0.09	0.36	0.82	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
B-1	4.32	0.90	0.96	0.00	0.09	0.36	4.32	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
B-2	4.16	0.90	0.96	0.00	0.09	0.36	4.41	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.10	0.38
C-1	9.07	0.90	0.96	2.14	0.09	0.36	0.33	0.73	0.81	0.00	0.45	0.59	4.56	0.30	0.50	1.70	0.25	0.47	0.34	0.22	0.46	0.00	0.20	0.44	0.00	0.51	0.65
C-2	1.11	0.90	0.96	0.37	0.09	0.36	0.19	0.73	0.81	0.00	0.45	0.59	0.30	0.30	0.50	0.00	0.25	0.47	0.25	0.22	0.46	0.00	0.20	0.44	0.00	0.49	0.65
C-3	1.52	0.90	0.96	0.94	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.58	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.73	0.82
C-4	3.99	0.90	0.96	0.36	0.09	0.36	1.75	0.73	0.81	0.00	0.45	0.59	1.88	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.33	0.52
C-5	0.51	0.90	0.96	0.00	0.09	0.36	0.51	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.09	0.36
C-6	1.37	0.90	0.96	0.00	0.09	0.36	0.30	0.73	0.81	0.00	0.45	0.59	1.07	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.37	0.54
D-9	0.70	0.90	0.96	0.00	0.09	0.36	0.32	0.73	0.81	0.00	0.45	0.59	0.38	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.29	0.48
D-1a	3.40	0.90	0.96	0.42	0.09	0.36	0.68	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	1.96	0.25	0.47	0.34	0.22	0.46	0.00	0.20	0.44	0.00	0.33	0.53
D-1b	4.72	0.90	0.96	0.99	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	1.85	0.30	0.50	1.07	0.25	0.47	0.81	0.22	0.46	0.00	0.20	0.44	0.00	0.48	0.63
D-2a	0.30	0.90	0.96	0.30	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.90	0.96
D-2b	0.99	0.90	0.96	0.18	0.09	0.36	0.17	0.73	0.81	0.00	0.45	0.59	0.64	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.47	0.62
D-2c	0.16	0.90	0.96	0.16	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.90	0.96
D-2d	0.14	0.90	0.96	0.14	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.90	0.96
D-2e	1.56	0.90	0.96	0.40	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	1.16	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.57	0.68
D-2f	1.03	0.90	0.96	0.72	0.09	0.36	0.02	0.73	0.81	0.00	0.45	0.59	0.29	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.76	0.84
D-2g	2.54	0.90	0.96	0.34	0.09	0.36	0.73	0.73	0.81	0.00	0.45	0.59	1.47	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.41	0.57
D-4a	0.98	0.90	0.96	0.27	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.71	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.57	0.69
D-4b	0.96	0.90	0.96	0.45	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.51	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.66	0.76
D-4c	1.00	0.90	0.96	0.43	0.09	0.36	0.02	0.73	0.81	0.00	0.45	0.59	0.55	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.64	0.74
D-5	1.08	0.90	0.96	0.22	0.09	0.36	0.11	0.73	0.81	0.00	0.45	0.59	0.75	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.51	0.64
D-6a	1.33	0.90	0.96	0.44	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.89	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.60	0.71
D-6b	2.69	0.90	0.96	0.59	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.10	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.55	0.67
D-3	2.93	0.90	0.96	0.00	0.09	0.36	0.28	0.73	0.81	0.00	0.45	0.59	1.26	0.30	0.50	0.17	0.25	0.47	0.12	0.22	0.46	0.00	0.20	0.44	0.00	0.23	0.34
D-7	7.84	0.90	0.96	0.00	0.09	0.36	6.10	0.73	0.81	0.00	0.45	0.59	0.96	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.13	0.35
D-8	1.69	0.90	0.96	0.00	0.09	0.36	1.13	0.73	0.81	0.00	0.45	0.59	0.56	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.21	0.44
E-1	1.71	0.90	0.96	0.78	0.09	0.36	0.23	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.70	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.55	0.69
E-2	0.68	0.90	0.96	0.56	0.09	0.36	0.12	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.76	0.85
E-3	0.78	0.90	0.96	0.69	0.09	0.36	0.09	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.81	0.89
E-4	0.91	0.90	0.96	0.73	0.09	0.36	0.18	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.74	0.84
E-5	0.89	0.90	0.96	0.79	0.09	0.36	0.10	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.81	0.89
I-1	0.31	0.90	0.96	0.22	0.09	0.36	0.09	0.73	0.81	0.00	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.66	0.79
OS-1	32.28	0.90	0.96	2.15	0.09	0.36	29.25	0.73	0.81	0.88	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.16	0.41
OS-2	20.07	0.90	0.96	0.90	0.09	0.36	18.62	0.73	0.81	0.56	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.14	0.40
OS-3	10.61	0.90	0.96	0.48	0.09	0.36	9.84	0.73	0.81	0.30	0.45	0.59	0.00	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.14	0.40
OS-4	4.46	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	2.28	0.30	0.50	1.46	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.72	0.36	0.54
OS-5	0.46	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	0.46	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59
OS-6	1.17	0.90	0.96	0.00	0.09	0.36	0.00	0.73	0.81	0.00	0.45	0.59	1.17	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.45	0.59

Lot Type Identification:	
Lot Size (SF)	*Lot Size (Acre)*
0 - 8,167	</= 1/8 Acre
8,168 - 12,704	1/4 Acre
12,705 - 18,149	1/3 Acre
18,150 - 32,670	1/2 Acre
32,671 - 43,560	1 Acre

NOTES:
C values are taken directly from Table 6-6 in the Colorado Springs DCM Vol. 1. CH. 6 (Referencing UDFCD 2001)
Coeffficients use HSG A&B soils - Refer to "Appendix A: Exhibits and Figures" for soil map

STANDARD FORM SF-2: PROPOSED
TIME OF CONCENTRATION

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs

Project Name: Falcon Meadows at Bent Grass Fil No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 7//7/2021

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 (%)	T_i (MIN)	L (FT)	S (%)	Cv	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH(FT)	Urbanized T_c (MIN)	T_c (MIN)
A-1	2.16	A	68.1	0.56	0.79	100	4.0	6.2	765	2.5	20	3.2	4.0	10.3	865.0	14.8	10.3
A-2	0.86	A	65.0	0.45	0.59	5	2.0	2.1	110	7.0	20	5.3	0.3	2.5	115.0	10.6	5.0
A-3	0.92	A	70.2	0.65	0.78	60	2.0	5.1	735	2.5	20	3.2	3.9	8.9	795.0	14.4	8.9
A-4	0.82	A	2.0	0.09	0.36	5	2.0	3.3	105	5.7	20	4.8	0.4	3.6	110.0	10.6	5.0
B-1	4.32	A	2.0	0.09	0.36	90	6.4	9.5	2000	1.7	15	2.0	17.0	26.5	2090.0	21.6	21.6
B-2	1.17	A	2.1	0.10	0.38	160	11.0	10.4	920	1.6	15	1.9	8.1	18.5	1080.0	16.0	16.0
C-1	9.07	A	65.0	0.51	0.65	75	2.0	7.4	1160	2.3	20	3.0	6.4	13.9	1235.0	16.9	13.9
C-2	1.11	A	58.0	0.49	0.65	10	2.0	2.8	380	4.0	20	4.0	1.6	4.4	390.0	12.2	5.0
C-3	1.52	A	86.6	0.73	0.82	10	2.0	1.7	945	2.5	20	3.2	5.0	6.7	955.0	15.3	6.7
C-4	3.99	A	40.5	0.33	0.52	5	2.0	2.5	575	2.5	20	3.2	3.0	5.5	580.0	13.2	5.5
C-5	0.51	A	2.0	0.09	0.36	5	2.0	3.3		1.0	15	1.5	0.0	3.3	5.0	10.0	5.0
C-6	1.37	A	51.2	0.37	0.54	100	6.8	7.1	500	3.0	15	2.6	3.2	10.3	600.0	13.3	10.3
D-9	0.70	A	36.2	0.29	0.48	10	2.0	3.7	130	6.6	20	5.1	0.4	4.1	140.0	10.8	5.0
D-1a	3.40	A	38.9	0.33	0.53	100	0.0	45.8	530	1.3	20	2.3	3.9	49.7	630.0	13.5	13.5
D-1b	4.72	A	60.7	0.48	0.63	100	2.6	8.3	1900	1.3	20	2.3	13.9	22.1	2000.0	21.1	21.1
D-2a	0.30	A	100.0	0.90	0.96	10	2.0	0.9	495	1.3	20	2.3	3.6	4.5	505.0	12.8	5.0
D-2b	0.99	A	60.5	0.47	0.62	100	1.7	9.7	189	1.0	20	2.0	1.6	11.2	289.0	11.6	11.2
D-2c	0.16	A	100.0	0.90	0.96	5	2.0	0.6	275	1.0	20	2.0	2.3	2.9	280.0	11.6	5.0
D-2d	0.14	A	100.0	0.90	0.96	5	2.0	0.6	200	1.3	20	2.3	1.5	2.1	205.0	11.1	5.0
D-2e	1.56	A	73.9	0.57	0.68	100	1.9	7.8	340	0.8	20	1.8	3.2	11.0	440.0	12.4	11.0
D-2f	1.03	A	88.2	0.76	0.84	25	2.0	2.5	760	0.8	20	1.8	7.1	9.6	785.0	14.4	9.6
D-2g	2.54	A	51.6	0.41	0.57	35	2.0	575.0	1355	1.3	20	2.3	9.9	584.9	1390.0	17.7	17.7
D-4a	0.98	A	74.7	0.57	0.69	100	2.3	7.4	420	1.0	20	2.0	3.5	10.9	520.0	12.9	10.9
D-4b	0.96	A	81.4	0.66	0.76	75	1.5	6.1	480	1.0	20	2.0	4.0	10.1	555.0	13.1	10.1
D-4c	1.00	A	78.8	0.64	0.74	70	0.5	8.9	690	1.0	20	2.0	5.8	14.6	760.0	14.2	14.2
D-5	1.08	A	65.7	0.51	0.64	100	2.0	8.6	300	1.1	20	2.1	2.4	11.0	400.0	12.2	11.0
D-6a	1.33	A	76.6	0.60	0.71	20	2.0	3.2	385	1.0	20	2.0	3.2	6.5	405.0	12.3	6.5
D-6b	2.69	A	72.6	0.55	0.67	45	2.0	5.4	870	1.0	20	2.0	7.3	12.6	915.0	15.1	12.6
D-3	2.93	A	31.7	0.23	0.34	25	8.0	4.0	1960	1.0	15	1.5	21.8	25.8	1985.0	21.0	21.0
D-7	7.84	A	9.6	0.13	0.35	200	7.5	12.8	665	1.0	15	1.5	7.4	20.2	865.0	14.8	14.8
D-8	1.69	A	22.8	0.21	0.44	125	3.7	11.8	600	1.0	15	1.5	6.7	18.4	725.0	14.0	14.0
E-1	1.71	A	62.3	0.55	0.69	25	2.0	4.0	940	1.0	20	2.0	7.8	11.8	965.0	15.4	11.8
E-2	0.68	A	82.8	0.76	0.85	25	2.0	2.5	665	1.6	20	2.5	4.4	6.9	690.0	13.8	6.9
E-3	0.78	A	88.7	0.81	0.89	25	2.0	2.1	632	1.0	20	2.0	5.3	7.4	657.0	13.7	7.4
E-4	0.91	A	80.6	0.74	0.84	25	2.0	2.6	913	2.0	20	2.8	5.4	8.0	938.0	15.2	8.0
E-5	0.89	A	89.0	0.81	0.89	25	2.0	2.1	903	2.1	20	2.9	5.2	7.3	928.0	15.2	7.3
I-1	0.31	A	71.6	0.66	0.79	25	2.0	3.2	135	2.0	20	2.8	0.8	4.0	160.0	10.9	5.0
OS-1	32.28	A	11.0	0.16	0.41	100	2.4	12.9	2100	2.2	15	2.2	15.7	28.6	2200.0	22.2	22.2
OS-2	20.07	A	8.0	0.14	0.40	100	2.3	13.3	1400	2.3	15	2.3	10.3	23.6	1500.0	18.3	18.3
OS-3	10.61	A	8.0	0.14	0.40	100	2.0	14.0	1500	2.0	15	2.1	11.8	25.7	1600.0	18.9	18.9
OS-4	4.46	A	49.5	0.36	0.54	100	2.0	10.8	910	1.2	20	2.2	6.9	17.7	1010.0	15.6	15.6
OS-5	0.46	A	65.0	0.45	0.59	15	2.0	3.7	190	1.0	20	2.0	1.6	5.2	205.0	11.1	5.2
OS-6	1.17	A	65.0	0.45	0.59	85	0.2	18.7	430	0.9	20	1.9	3.8	22.5	515.0	12.9	12.9

NOTES:

T_i = (0.395*(1.1 - C_5)*(L)^0.5)/((S)^0.33), S in ft/ft

T_t=L/60V (Velocity From Fig. 501)

Velocity V=Cv*S^0.5, S in ft/ft

Tc Check = 10+L/180

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

STANDARD FORM SF-3: PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs
Design Storm: 5-Year

Project Name: Falcon Meadows at Bent Grass Fil No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 7//7/2021

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
		RWT202	1574.40						46.6	120.88	1.82	220.0									From Falcon DBPS by Matrix
		RWT204	38.40						11.37	1.78	3.94	7.0									From Falcon DBPS by Matrix
		WT200	192.00						37.8	24.41	2.13	52.0									From Falcon DBPS by Matrix
		OS-1	32.28	0.16	22.2	5.16	2.93	15.1													Flows obtained from Bent Grass Filing No. 2 FDR. Q=15.1 CFS
		OS-4	4.46	0.36	15.6	1.61	3.46	5.6					1.2	5.6				910	2.2	6.9	Flows from Basin B-1 of Bent Grass Filing No. 2 FDR.
		OS-5	0.46	0.45	5.2	0.21	5.10	1.1					1	1.1				190	2.0	1.6	Flows from Basin B-2 of Bent Grass Filing No. 2 FDR
		OS-6	1.17	0.45	12.9	0.53	3.75	2.0					0.9	2.0				430	1.9	3.8	Flows from Basin B-3 of Bent Grass Filing No. 2 FDR.
		A-1	2.16	0.56	10.3	1.21	4.09	4.9					2.5	4.9				765	3.2	4.0	
		A-4	0.82	0.09	5.0	0.07	5.17	0.4					5.7	0.4				105	4.8	0.4	Existing North WQ Pond Bent Grass Filing No. 2
		A-3	0.92	0.65	8.9	0.60	4.30	2.6					2.5	2.6				735	3.2	3.9	Flow into proposed inlet.
		A-2	0.86	0.45	5.0	0.39	5.17	2.0					7.0	2.0				110	5.3	0.3	Releases directly to Channel
		C-4	3.99	0.33	5.5	1.32	5.02	6.6					2.5	6.6				575	3.2	3.0	Flow into Ex inlet in BGMD at DP 8
		E-1	1.71	0.55	11.8	0.94	3.88	3.6													Ex Basin from Filing No. 2(East side of BGMD)
		E-2	0.68	0.76	6.9	0.52	4.70	2.4													Ex Basin from Filing No. 2(West side of BGMD)
		B-1	4.32	0.09	21.6	0.39	2.97	1.2													
		C-6	1.37	0.37	10.3	0.51	4.09	2.1													
		C-2	1.11	0.49	5.0	0.54	5.17	2.8					4	2.792				380	4.0	1.6	Flow into proposed inlet.
		C-1	9.07	0.51	13.9	4.63	3.64	16.9					2.25	16.85				1160	3.0	6.4	Flow into proposed inlet.
		C-3	1.52	0.73	6.7	1.11	4.73	5.3					2.5	5.3				945	3.2	5.0	
		C-5	0.51	0.09	5.0	0.05	5.17	0.3													North Pond
		OS-2	20.07	0.14	18.3	2.81	3.22	9.0													Overland flow into Basin D-3. Flow obtained from Bent Grass Filing No. 2 FDR
		OS-3	10.61	0.14	18.9	1.49	3.18	4.7													Offsite flow into Basin D-3. Flow obtained from Bent Grass Filing No. 2 FDR
		D-9	0.70	0.29	5.0	0.20	5.17	1.0													Flow into Ex inlet in BGMD at DP 24
		D-3	2.93	0.23	21.0	0.67	3.01	2.0													Flows conveyed via existing ditch into proposed area inlet.
		D-2a	0.30	0.90	5.0	0.27	5.17	1.4													
		D-2b	0.99	0.47	11.2	0.47	3.95	1.9													
		D-2c	0.16	0.90	5.0	0.14	5.17	0.7													
		D-2d	0.14	0.90	5.0	0.13	5.17	0.7													
		D-2e	1.56	0.57	11.0	0.89	3.99	3.6													
		D-2f	1.03	0.76	9.6	0.78	4.20	3.3													

STANDARD FORM SF-3: PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs
Design Storm: 5-Year

Project Name: Falcon Meadows at Bent Grass Fil No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 7//7/2021

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
		D-2g	2.54	0.41	17.7	1.04	3.27	3.4													
		D-1a	3.40	0.33	13.5	1.12	3.68	4.1													
		D-1b	4.72	0.48	21.1	2.27	3.01	6.8													
		D-4a	0.98	0.57	10.9	0.56	4.01	2.2													
		D-4b	0.96	0.66	10.1	0.63	4.12	2.6													
		D-4c	1.00	0.64	14.2	0.64	3.60	2.3													
		D-5	1.08	0.51	11.0	0.55	3.99	2.2					1.1	2.2				300	2.1	2.4	
		D-6a	1.33	0.60	6.5	0.80	4.79	3.8													
		D-6b	2.69	0.55	12.6	1.48	3.78	5.6													
		E-4	0.91	0.74	8.0	0.67	4.46	3.0													Flow into Ex inlet.
		E-5	0.89	0.81	7.3	0.72	4.60	3.3													Flow into Ex inlet.
		I-1	0.31	0.66	5.0	0.20	5.17	1.0													Flow into Ex inlet.
		D-7	7.84	0.13	14.8	1.02	3.54	3.6													
		D-8	1.69	0.21	14.0	0.35	3.62	1.3													Flow in Swale C (Basin D-8) into proposed south pond
		E-3	0.78	0.81	7.4	0.63	4.59	2.9													Flow into Ex Inlet in BGMD (South Side)
		B-2	1.17	0.10	16.0	0.12	3.42	0.4													

STANDARD FORM SF-3: PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Falcon Meadows at Bent Grass Fil No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 7//7/2021

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
		RWT202	1574.40						46.6	327.87	3.05	1000.0									From Falcon DBPS by Matrix
		RWT204	38.40						11.4	6.52	6.60	43.0									From Falcon DBPS by Matrix
		WT200	192.00						37.8	53.07	3.58	190.0									From Falcon DBPS by Matrix
		OS-1	32.28	0.41	22.2	13.23	4.92	65.1													Flows obtained from Bent Grass Filing No. 2 FDR. Q=65.1 CFS
		OS-4	4.46	0.54	15.6	2.41	5.81	14.0					1.2	14.0				910	2.2	6.9	Flows from Basin B-1 of Bent Grass Filing No. 2 FDR.
		OS-5	0.46	0.59	5.2	0.27	8.56	2.3					1	2.3				190	2.0	1.6	Flows from Basin B-2 of Bent Grass Filing No. 2 FDR
		OS-6	1.17	0.59	12.9	0.69	6.30	4.3					0.9	4.3				430	1.9	3.8	Flows from Basin B-3 of Bent Grass Filing No. 2 FDR.
		A-1	2.16	0.79	10.3	1.71	6.87	11.7					2.5	11.7				765	3.2	4.0	
		A-4	0.82	0.36	5.0	0.30	8.68	2.6													Existing North WQ Pond Bent Grass Filing No. 2
		A-3	0.92	0.78	8.9	0.72	7.21	5.2					2.5	5.2				735	3.2	3.9	Flow into proposed inlet.
		A-2	0.86	0.59	5.0	0.51	8.68	4.4													Releases directly to Channel
		C-4	3.99	0.52	5.5	2.07	8.42	17.4					2.5	17.4				575	3.2	3.0	Flow into Ex inlet in BGMD at DP 8
		E-1	1.71	0.69	11.8	1.18	6.51	7.7	11.8	1.18	6.51	7.7									Ex Basin from Filing No. 2(East side of BGMD)
		E-2	0.68	0.85	6.9	0.58	7.89	4.6													Ex Basin from Filing No. 2(West side of BGMD)
		B-1	4.32	0.36	21.6	1.56	4.99	7.8													
		C-6	1.37	0.54	10.3	0.74	6.87	5.1													
		C-2	1.11	0.65	5.0	0.72	8.68	6.2					4	6.25				380	4.0	1.583	Flow into proposed inlet.
		C-1	9.07	0.65	13.9	5.90	6.11	36.0					2.25	36.05				1160	3.0	6.4	Flow into proposed inlet.
		C-3	1.52	0.82	6.7	1.25	7.95	9.9					2.5	9.9				945	3.2	5.0	
		C-5	0.51	0.36	5.0	0.18	8.68	1.6													North Pond
		OS-2	20.07	0.40	18.3	8.03	5.41	43.4													Overland flow into Basin D-3. Flow obtained from Bent Grass Filing No. 2 FDR
		OS-3	10.61	0.40	18.9	4.24	5.33	24.3													Offsite flow into Basin D-3. Flow obtained from Bent Grass Filing No. 2 FDR
		D-9	0.70	0.48	5.0	0.34	8.68	3.0													Flow into Ex inlet in BGMD at DP 24
		D-3	2.93	0.34	21.0	1.00	5.06	5.1	21.0	5.87	5.06	29.7									Flows conveyed via existing ditch into proposed area inlet. Total flow from Basins OS-2, OS-3 & D-3 to existing area inlet at DP 11
		D-2a	0.30	0.96	5.0	0.29	8.68	2.5													
		D-2b	0.99	0.62	11.2	0.61	6.64	4.1													
		D-2c	0.16	0.96	5.0	0.15	8.68	1.3													
		D-2d	0.14	0.96	5.0	0.13	8.68	1.1													
		D-2e	1.56	0.68	11.0	1.06	6.69	7.1													
		D-2f	1.03	0.84	9.6	0.87	7.05	6.1													

STANDARD FORM SF-3: PROPOSED

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs
Design Storm: 100-Year

Project Name: Falcon Meadows at Bent Grass Fil No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 7//7/2021

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
		D-2g	2.54	0.57	17.7	1.45	5.49	8.0													
		D-1a	3.40	0.53	13.5	1.80	6.18	11.1													
		D-1b	4.72	0.63	21.1	2.97	5.05	15.0													
		D-4a	0.98	0.69	10.9	0.68	6.73	4.6													
		D-4b	0.96	0.76	10.1	0.73	6.91	5.0													
		D-4c	1.00	0.74	14.2	0.74	6.04	4.5													
		D-5	1.08	0.64	11.0	0.69	6.70	4.6					1.1	4.6				300	2.1	2.4	
		D-6a	1.33	0.71	6.5	0.94	8.03	7.5													
		D-6b	2.69	0.67	12.6	1.80	6.35	11.4													
		E-4	0.91	0.84	8.0	0.76	7.50	5.7					2	5.7				913	2.8	5.4	Flow into Ex inlet.
		E-5	0.89	0.89	7.3	0.79	7.73	6.1					2.1	6.1				903	2.9	5.2	Flow into Ex inlet.
		I-1	0.31	0.79	5.0	0.24	8.68	2.1					2	2.1				135	2.8	0.8	Flow into Ex inlet.
		D-7	7.84	0.35	14.8	2.74	5.94	16.3													
		D-8	1.69	0.44	14.0	0.74	6.08	4.5													Flow in Swale C (Basin D-8) into proposed south pond
		E-3	0.78	0.89	7.4	0.69	7.70	5.3					1	5.3				632	2.0	5.3	Flow into Ex Inlet in BGMD (South Side)
		B-2	1.17	0.38	16.0	0.44	5.75	2.5													

FALCON MEADOWS AT BENT GRASS FILING NO. 1 - FDR
SURFACE ROUTING - PROPOSED CONDITIONS

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent) CA(5)	CA(100)	Tc (min.)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)	NOTES
	RWT202	124.80	324.77	46.6	1.8	3.1	220.0	1000.0	
				TRAVEL TIME					
		124.80	324.77	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						5.0	0.0	46.6	
	RWT204	1.83	6.43	11.4	3.8	6.7	7.0	43.0	
				TRAVEL TIME					
		1.83	6.43	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						5.0	0.0	11.4	
	WT200	25.81	54.00	37.8	2.0	3.5	52.0	190.0	
				TRAVEL TIME					
		25.81	54.00	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						5.0	0.0	37.8	
	OS-1	5.16	13.23	22.2	2.8	4.8	14.2	63.6	
				TRAVEL TIME					
		5.16	13.23	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				CHANNEL	800	5.0	2.7	24.9	
21	RWT200	124.80	324.77	46.6	1.8	3.1	277.8	1226.8	Combine all offsite flows
	RWT204	1.83	6.43						entering site @ North
	WT200	25.81	54.00						Property Line
	OS-1	5.16	13.23	TRAVEL TIME					
		157.60	398.43	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				Channel	850	4.0	3.5	50.1	
2	OS-4	1.61	2.41	15.6	3.3	5.8	5.3	13.9	
				TRAVEL TIME					
		1.61	2.41	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	200	3.2	1.0	16.7	
1	OS-5	0.21	0.27	16.7	3.2	5.6	5.8	15.0	
	DP 2	1.61	2.41	TRAVEL TIME					
		1.82	2.68	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	55	3.2	0.3	16.9	
3	OS-6	0.53	0.69	16.9	3.2	5.5	7.5	18.7	
	DP 1	1.82	2.68	TRAVEL TIME					
		2.35	3.37	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	115	3.2	0.6	17.5	
4	A-1	1.21	1.71	17.5	3.1	5.5	11.1	27.7	@ GRADE INLET
	DP 3	2.35	3.37	TRAVEL TIME					(FUTURE)
		3.56	5.08	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	40	2.4	0.3	17.8	
5	A-3	0.60	0.72	8.9	4.2	7.4	3.6	16.5	@ GRADE INLET
	FB DP 4	0.26	1.51	TRAVEL TIME					(FUTURE)
		0.86	2.23	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	80	2.0	0.7	9.6	
6	A-4	0.07	0.30	17.8	3.1	5.4	13.9	41.2	EX BG FIL NO. 2 WQ
	DP 4	3.56	5.08						POND
	DP 5	0.86	2.23	TRAVEL TIME					
		4.49	7.61	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.0	0.0	17.8	
15a	EX NORTH WQ	2.35	4.08	5.0	5.2	9.1	12.2	37.0	
	POND RELEASE			TRAVEL TIME					
		2.35	4.08	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.6	0.0	5.0	

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent) CA(5)	CA(100)	Tc (min.)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)	NOTES
7	E-3	0.63	0.69	7.4	4.6	8.0	2.9	5.5	EX SUMP INLET
				TRAVEL TIME					
		0.63	0.69	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.6	0.0	7.4	
8	E-1	0.94	1.18	14.2	3.5	6.0	15.8	54.4	EX SUMP INLET
	E-2	0.52	0.58						
	C-4	1.32	2.07						
	FB DP 12	0.00	0.00						
	FB DP 5	0.00	1.21						
	FB DP 15	1.79	3.95	TRAVEL TIME					
		4.57	8.99	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.6	0.0	14.2	
AA	DP 21	157.60	398.43	50.1	1.7	2.9	273.2	1200.4	CHANNEL FLOW & EX
	B-1	0.39	1.56						BOX CULVERTS @
	DP 8	4.57	8.99	TRAVEL TIME					BGMD
	DP 15A	2.35	4.08						
		162.56	408.98	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				CULVERTS	135	5.1	0.4	50.6	
BB	B-2	0.12	0.44	50.6	1.7	2.9	271.8	1194.7	@ GRADE INLET
	DP AA	162.56	408.98	TRAVEL TIME					(FUTURE)
		162.68	409.42	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				CHANNEL	900	5.0	3.0	53.6	
12	C-2	0.54	0.72	5.0	5.2	9.1	2.8	6.5	@ GRADE INLET
				TRAVEL TIME					(FUTURE)
		0.54	0.72	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	350	2.5	2.3	7.3	
15	C-1	4.63	5.90	13.9	3.5	6.1	20.1	43.7	@ GRADE INLET
	C-3	1.11	1.25	TRAVEL TIME					(FUTURE)
		5.74	7.15	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	40	2.0	0.3	14.2	
19	C-6	0.51	0.74	10.3	4.0	7.0	2.0	5.2	AREA INLET (FUTURE)
				TRAVEL TIME					
		0.51	0.74	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						3.2	0.0	10.3	
13	DP 12	0.54	0.72	14.2	3.5	6.0	23.5	52.1	TOTAL FLOW INTO PR
	DP 15	5.74	7.15						NORTH WQ POND
	DP 19	0.51	0.74	TRAVEL TIME					
		6.79	8.61	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.6	0.0	14.2	
13A	NORTH WQ	0.64	2.47	5.0	5.2	9.1	3.3	22.4	
	POND RELEASE			TRAVEL TIME					
		0.64	2.47	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.6	0.0	5.0	
9	OS-2	2.81	8.03	18.3	3.1	5.3	8.6	42.8	
				TRAVEL TIME					
		2.81	8.03	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				SWALE	1150	5.6	3.4	21.8	
10	OS-3	1.49	4.24	18.9	3.0	5.2	4.5	22.2	
				TRAVEL TIME					
		1.49	4.24	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				SWALE	3.33	6.1	0.0	18.9	
11	D-3	0.67	1.00	21.8	2.8	4.9	13.8	64.5	AREA INLET
	DP 9	2.81	8.03						
	DP 10	1.49	4.24	TRAVEL TIME					
		4.97	13.27	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						6.0	0.0	21.8	

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent) CA(5)	CA(100)	Tc (min.)	INTENSITY I(5) (in/hr)	I(100) (in/hr)	TOTAL FLOWS Q(5) (cfs)	Q(100) (cfs)	NOTES
14a	D-2a	0.27	0.29	11.2	3.9	6.7	3.4	7.1	
	D-2b	0.47	0.61						
	D-2c	0.14	0.15	TRAVEL TIME					
		0.88	1.05	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	210	2.3	1.5	12.8	
14b	D-2d	0.13	0.13	12.8	3.6	6.4	6.9	14.2	
	D-2e	0.89	1.06						
	DP 14a	0.88	1.05	TRAVEL TIME					
		1.90	2.24	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	50	2.3	0.4	13.1	
14c	D-2f	0.78	0.87	13.1	3.6	6.3	9.6	19.5	@ GRADE INLET
	DP 14b	1.90	2.24	TRAVEL TIME					
		2.68	3.11	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	600	2.3	4.3	17.5	
14	D-2g	1.04	1.45	17.7	3.1	5.4	5.9	16.2	@ GRADE INLET
	FB DP 14c	0.87	1.55	TRAVEL TIME					
		1.91	3.00	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	40	2.0	0.3	18.1	
16a	D-1a	1.12	1.80	13.5	3.5	6.2	4.0	11.2	
				TRAVEL TIME					
		1.12	1.80	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	1900	2.3	13.8	27.3	
16	D-1b	2.27	2.97	27.3	2.5	4.3	8.3	20.4	@ GRADE INLET
	DP 16a	1.12	1.80						
				TRAVEL TIME					
		3.39	4.77	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	900	2.8	5.4	32.6	
18	D-6a	0.80	0.94	21.0	2.8	5.0	8.0	17.0	SUMP INLET
	D-6b	1.48	1.80						
	D-5	0.55	0.69	TRAVEL TIME					
		2.83	3.43	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.0	0.0	21.0	
17a	D-4a	0.56	0.68	21.0	2.8	5.0	1.6	3.4	
				TRAVEL TIME					
		0.56	0.68	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				STREET	590	2.0	4.9	25.9	
17b	D-4b	0.63	0.73	25.9	2.5	4.4	3.0	6.2	South approach to Sump
	DP 17 a	0.56	0.68	TRAVEL TIME					Inlet at DP 17
		1.19	1.41	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						6.2	0.0	25.9	
17c	D-4c	0.64	0.74	21.0	2.8	5.0	1.8	3.7	North approach to Sump
				TRAVEL TIME					Inlet at DP 17
		0.64	0.74	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						6.2	0.0	21.0	
17	DP 17b	1.19	1.41	25.9	2.5	4.4	4.6	9.5	SUMP INLET
	DP 17c	0.64	0.74						
	FP DP 18	0.00	0.00	TRAVEL TIME					
		1.83	2.15	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						6.1	0.0	25.9	
31	DP 17	1.83	2.15	32.6	2.2	3.9	17.0	40.8	FLOW INTO PR SOUTH
	DP 14	1.91	3.00						WQ POND
	DP 16	3.39	4.77						
	DP 18	0.56	0.68	TRAVEL TIME					
		7.69	10.60	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						6.0	0.0	32.6	

DESIGN POINT	CONTRIBUTING BASINS	CA(equivalent)		Tc	INTENSITY		TOTAL FLOWS		NOTES
		CA(5)	CA(100)	(min.)	I(5) (in/hr)	I(100) (in/hr)	Q(5) (cfs)	Q(100) (cfs)	
24	E-4	0.67	0.76	32.6	2.2	3.9	4.5	21.8	EX @ GRADE INLET
	D-9	0.20	0.34						
	FB DP 14	0.32	1.87						
	FB DP 16	0.86	2.70	TRAVEL TIME					
		2.05	5.67	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.6	0.0	32.6	
25	E-5	0.72	0.79	7.3	4.6	8.0	3.3	7.8	EX @ GRADE INLET
	FB DP 24	0.00	0.19	TRAVEL TIME					
		0.72	0.98	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.6	0.0	7.3	
26	DP 24	2.05	5.67	32.6	2.2	3.9	6.1	25.6	FLOWS INTO SWALE F
	DP 25	0.72	0.98	TRAVEL TIME					
		2.77	6.65	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
				SWALE	740	3.5	3.5	36.1	
30	D-7	1.02	2.74	14.8	3.4	5.9	12.9	55.7	FLOW INTO PR SOUTH WQ POND
	DP 26	2.77	6.65	TRAVEL TIME					
		3.79	9.39	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.6	0.0	14.8	
32	D-8	0.35	0.74	14.0	3.5	6.1	1.2	4.5	FLOW INTO PR SOUTH WQ POND
				TRAVEL TIME					
		0.35	0.74	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						6.1	0.0	14.0	
20	DP 30	3.79	9.39	32.6	2.2	3.9	26.1	79.8	TOTAL FLOW INTO PR SOUTH WQ POND
	DP 31	7.69	10.60						
	DP 32	0.35	0.74	TRAVEL TIME					
		11.83	20.72	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.6	0.0	32.6	
20A	PR SOUTH WQ POND RELEASE	2.06	5.20	5.0	5.2	9.1	10.7	47.1	
				TRAVEL TIME					
		2.06	5.20	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.6	0.0	5.0	
20B	EX SOUTH WQ POND RELEASE	4.11	7.28	5.0	5.2	9.1	21.3	66.0	
				TRAVEL TIME					
		4.11	7.28	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.6	0.0	5.0	
CC	B-2	0.12	0.44	53.6	1.6	2.8	271.7	1186.3	FLOWS EXITING SITE IN CHANNEL
	DP BB	162.68	409.42						
	DP 20A	2.06	5.20						
	DP 20B	4.11	7.28	TRAVEL TIME					
		168.97	422.34	Type/flow	Length (ft)	Velocity (fps)	d. Time (min)	T. Time (min)	
						2.6	0.0	53.6	

APPENDIX C

Hydraulic Computations

Inlet Calculations

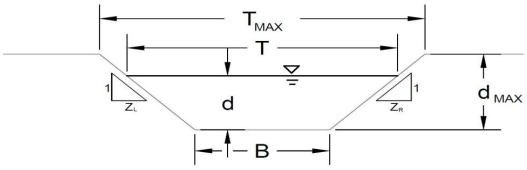
Proposed Inlet Calculations

Version 4.06 Released August 2018

AREA INLET IN A SWALE

Bent Grass Filing No. 3

DP 11 - Type D Area Inlet (Relocated)



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

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	3.00	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} =	11.00	18.00	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.00	2.00	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	17.9	72.2	cfs
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	1.00	1.88	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	13.8	64.5	cfs
Water Depth	d =	0.88	1.79	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 4.06 Released August 2018

AREA INLET IN A SWALE

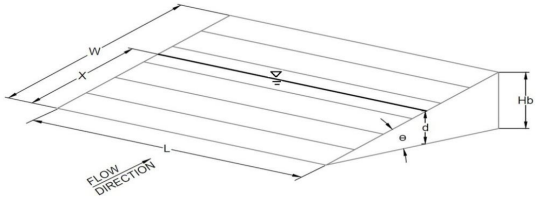
Bent Grass Filing No. 3

DP 11 - Type D Area Inlet (Relocated)

Inlet Design Information (Input)

Type of Inlet: CDOT TYPE D (Parallel & Depressed)

Inlet Type = CDOT TYPE D (Parallel & Depressed)



Angle of Inclined Grate (must be <= 30 degrees)	θ =	25.00	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 =	1.27	feet
Clogging Factor	C_f =	0.38	
Grate Discharge Coefficient	C_d =	0.63	
Orifice Coefficient	C_o =	0.42	
Weir Coefficient	C_w =	1.34	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.88	2.79	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**44.1**	**57.2**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**7.3**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**89**	**%**

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

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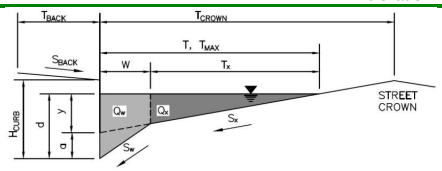
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: **Bent Grass Filing No. 3**

Inlet ID: **DP 14 - At Grade Inlet**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.013	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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} =**	**12.4**	**12.4**	**cfs**

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

WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

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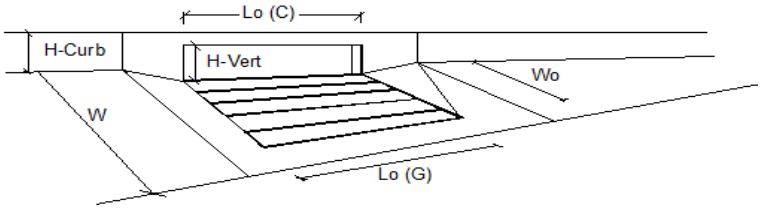

Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit 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: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**5.2**	**9.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.7**	**7.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**89**	**55**	**%**

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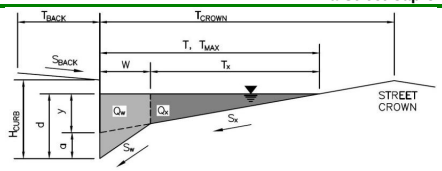
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: **Bent Grass Residential Filing No. 3**

Inlet ID: **DP 14a-Street Cap Check**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.013	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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} =**	**12.4**	**12.4**	**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'

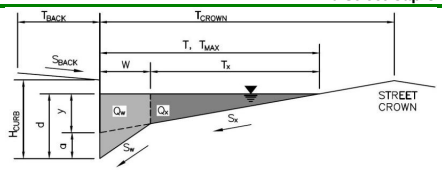
Version 4.06 Released August 2018

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

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

Project: **Bent Grass Residential Filing No. 3**

Inlet ID: **DP 14b-Street Cap Check**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.013	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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} =**	**12.4**	**12.4**	**cfs**

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

WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

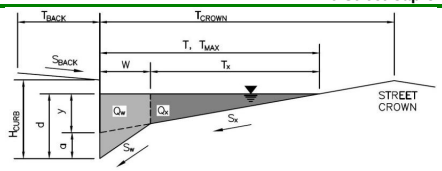
Version 4.06 Released August 2018

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

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

Project: **Bent Grass Residential Filing No. 3**

Inlet ID: **DP 14c-Street Cap Check**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.013	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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} =**	**12.4**	**12.4**	**cfs**

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

WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

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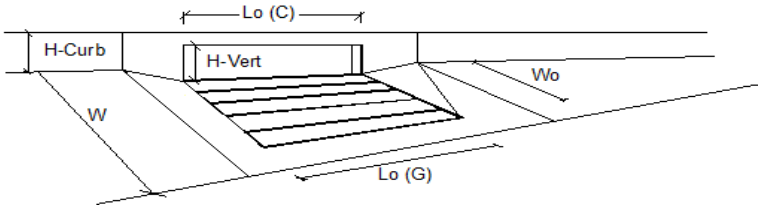

Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit 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: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.9**	**9.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**2.7**	**9.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**72**	**50**	**%**

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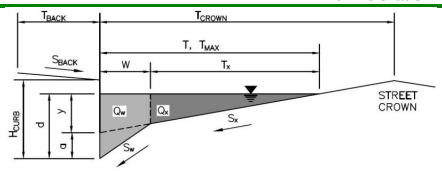
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: **Bent Grass Filing No. 3**

Inlet ID: **DP 16 - At Grade Inlet**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.013	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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} =**	**12.4**	**12.4**	**cfs**

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

WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

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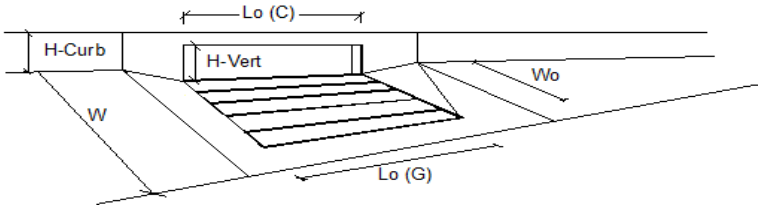

Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit 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: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.4**	**10.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**1.9**	**10.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**77**	**49**	**%**

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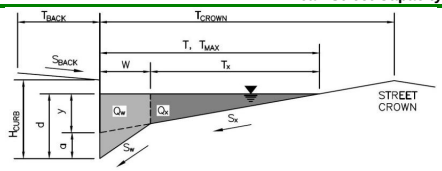
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: **Bent Grass Residential Filing No. 3**

Inlet ID: **DP 16a - Street Capacity Check**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.013	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

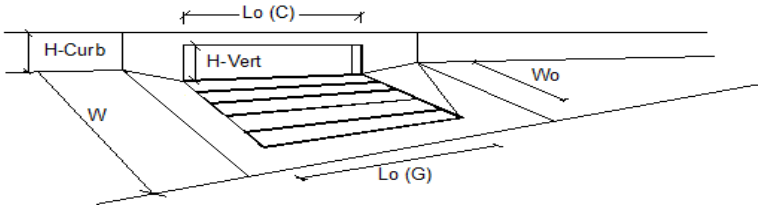
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.4**	**12.4**	**cfs**

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 4.06 Released August 2018



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

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

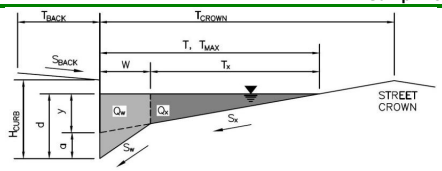
Version 4.06 Released August 2018

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

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

Project: **Bent Grass Filing No. 3**

Inlet ID: **DP 17 - Sump Inlet**



Gutter Geometry (Enter data in the blue cells)

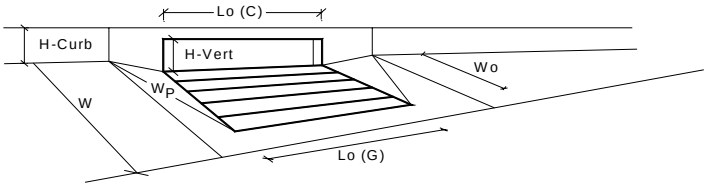
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	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 4.06 Released August 2018



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 =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	6.0	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) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.57	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.76	0.79	
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 =**	**8.0**	**9.7**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	4.6	9.5	cfs

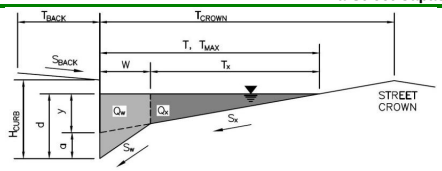
Version 4.06 Released August 2018

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

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

Project: **Enter Your Project Name Here**

Inlet ID: **DP 17a-Street Capacity**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	0.83	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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} =**	**10.0**	**10.0**	**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'

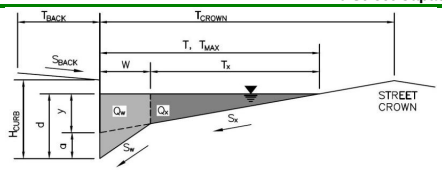
Version 4.06 Released August 2018

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

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

Project: **Enter Your Project Name Here**

Inlet ID: **DP 17b-Street Capacity**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	0.83	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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} =**	**10.0**	**10.0**	**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'

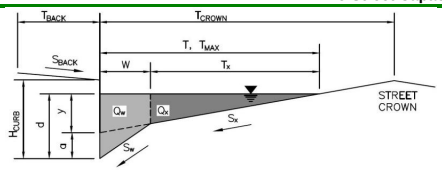
Version 4.06 Released August 2018

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

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

Project: **Enter Your Project Name Here**

Inlet ID: **DP 17c-Street Capacity**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	0.83	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 =	0.008	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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} =**	**8.7**	**8.7**	**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'

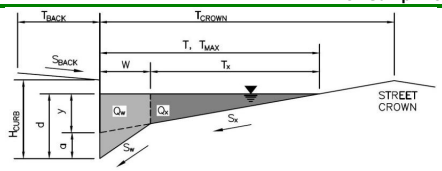
Version 4.06 Released August 2018

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

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

Project: **Bent Grass Filing No. 3**

Inlet ID: **DP 18 - Sump Inlet**



Gutter Geometry (Enter data in the blue cells)

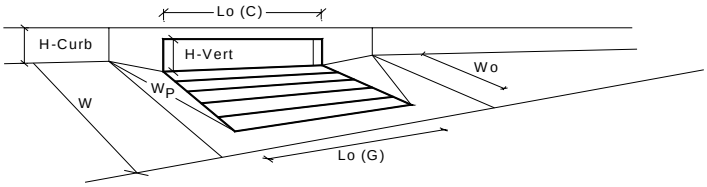
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	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 4.06 Released August 2018



		MINOR	MAJOR	
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.6	8.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
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) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.30	0.50	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.53	0.75	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.76	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 =	**8.0**	**20.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	8.0	17.0	cfs

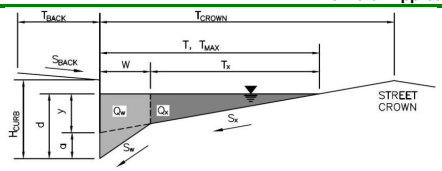
Version 4.06 Released August 2018

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

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

Project: **Bent Grass Filing No. 3**

Inlet ID: **DP 18-North Approach**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	0.83	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 =	0.008	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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} =**	**8.7**	**8.7**	**cfs**

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

WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

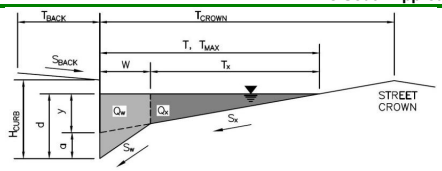
Version 4.06 Released August 2018

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

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

Project: **Bent Grass Filing No. 3**

Inlet ID: **DP 18-South Approach**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	0.83	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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} =**	**10.0**	**10.0**	**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'

Existing Inlet Calculations

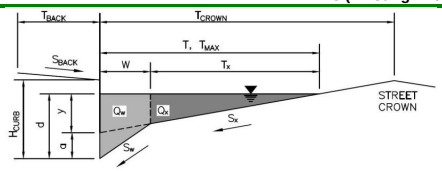
Version 4.06 Released August 2018

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

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

Project: **Falcon Meadows at Bent Grass**

Inlet ID: **DP 8 (Existing Inlet)**



Gutter Geometry (Enter data in the blue cells)

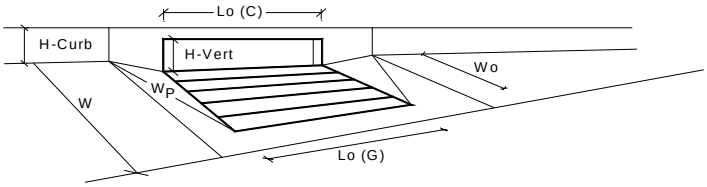
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	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} =	26.0	26.0	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 4.06 Released August 2018



		MINOR	MAJOR	
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
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) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	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 =**	**14.4**	**52.7**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Minor and Major Storms	$Q_{PEAK\ REQUIRED}$ =	15.8	54.4	cfs

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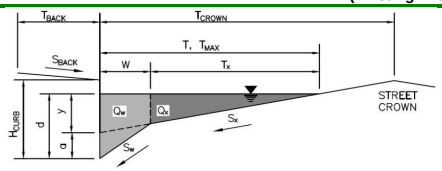
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: **Falcon Meadows at Bent Grass**

Inlet ID: **DP 24 (Existing Inlet)**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.0	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} =	26.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.028	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} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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} =**	**18.1**	**152.7**	**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

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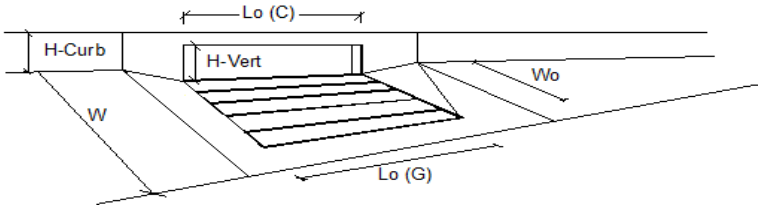

Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	25.00	25.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.5**	**20.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**93**	**%**

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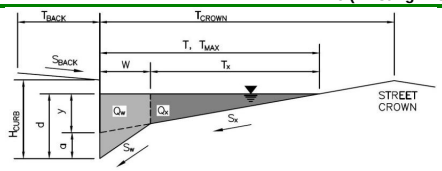
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: **Falcon Meadows at Bent Grass**

Inlet ID: **DP 25 (Existing Inlet)**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	14.0	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} =	26.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.028	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

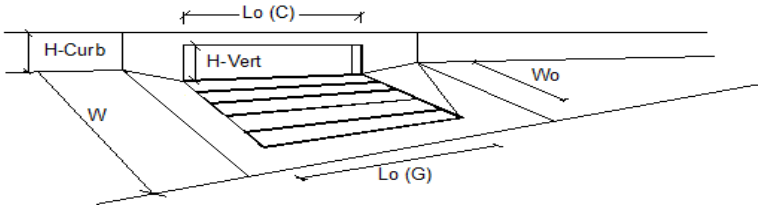
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**22.2**	**179.9**	**cfs**

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 4.06 Released August 2018



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 =	25.00	25.00	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 =**	**3.3**	**7.8**	**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**	**%**

Future Inlet Calculations

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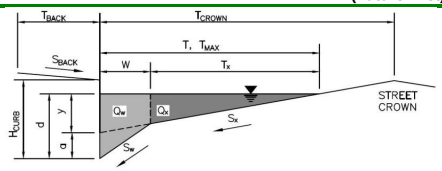
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: **Bent Grass Filing No. 3**

Inlet ID: **DP 4 (Future Inlet)**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.051	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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} =**	**15.1**	**24.5**	**cfs**

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

WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

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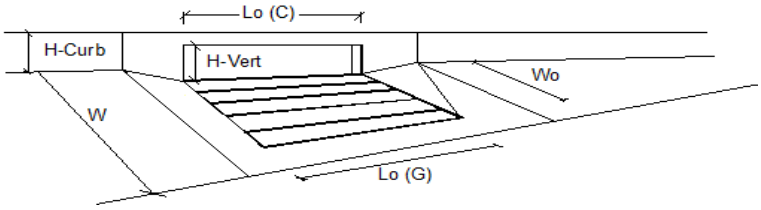

Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit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

Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**10.0**	**16.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**1.1**	**11.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**90**	**60**	**%**

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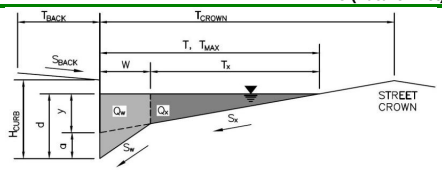
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: **Bent Grass Filing No. 3**

Inlet ID: **DP 5 (Future Inlet)**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.051	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

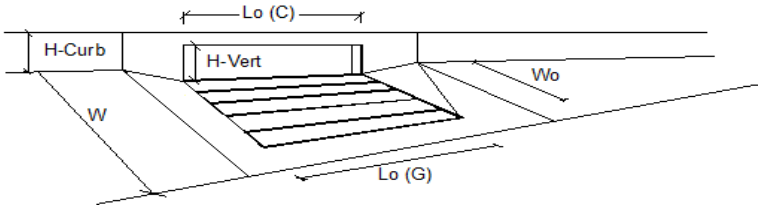
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**15.1**	**24.5**	**cfs**

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 4.06 Released August 2018



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 =**	**3.6**	**9.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**7.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**56**	**%**

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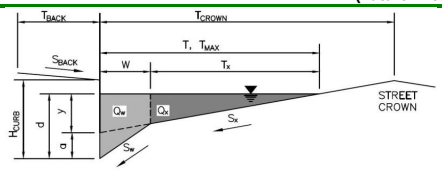
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: **Bent Grass Filing No. 3**

Inlet ID: **DP 12 (Future Inlet)**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.013	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

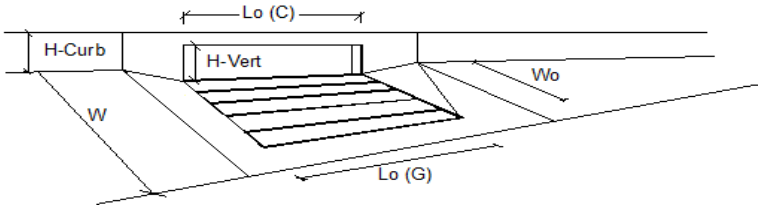
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.4**	**12.4**	**cfs**

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 4.06 Released August 2018



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 =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.8**	**6.5**	**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**	**%**

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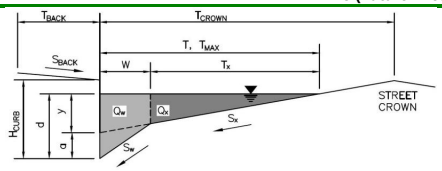
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: **Bent Grass Filing No. 3**

Inlet ID: **DP 15 (Future Inlet)**



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.013	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	17.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

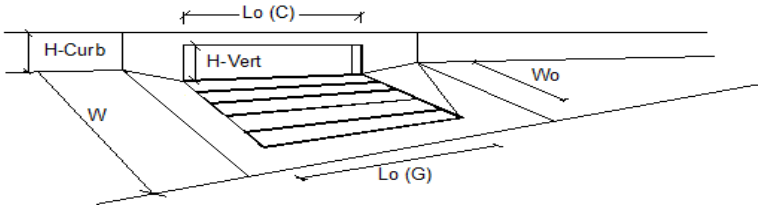
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**12.4**	**12.4**	**cfs**

WARNING: MINOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.06 Released August 2018



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 =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR & MAJOR STORM		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**13.9**	**19.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**6.2**	**23.9**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**69**	**45**	**%**

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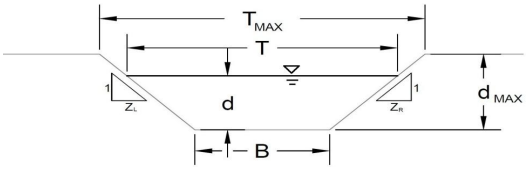
AREA INLET IN A SWALE

Bent Grass Filing No. 3

DP 19 (Future Inlet)



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

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0260	ft/ft
Bottom Width	B =	0.00	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} =	**16.00**	**16.00**	**feet**
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**feet**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**19.8**	**19.8**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**1.00**	**1.00**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**2.0**	**5.2**	**cfs**
Water Depth	**d =**	**0.42**	**0.61**	**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 4.06 Released August 2018

AREA INLET IN A SWALE

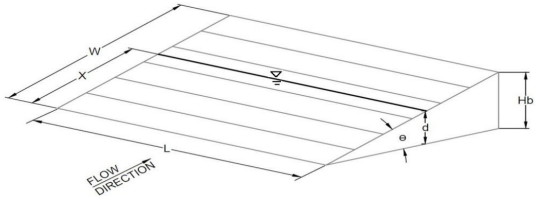
Bent Grass Filing No. 3

DP 19 (Future Inlet)

Inlet Design Information (Input)

Type of Inlet: CDOT Type C

Inlet Type = CDOT Type C



Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	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 =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.42	0.61	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.1**	**8.7**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

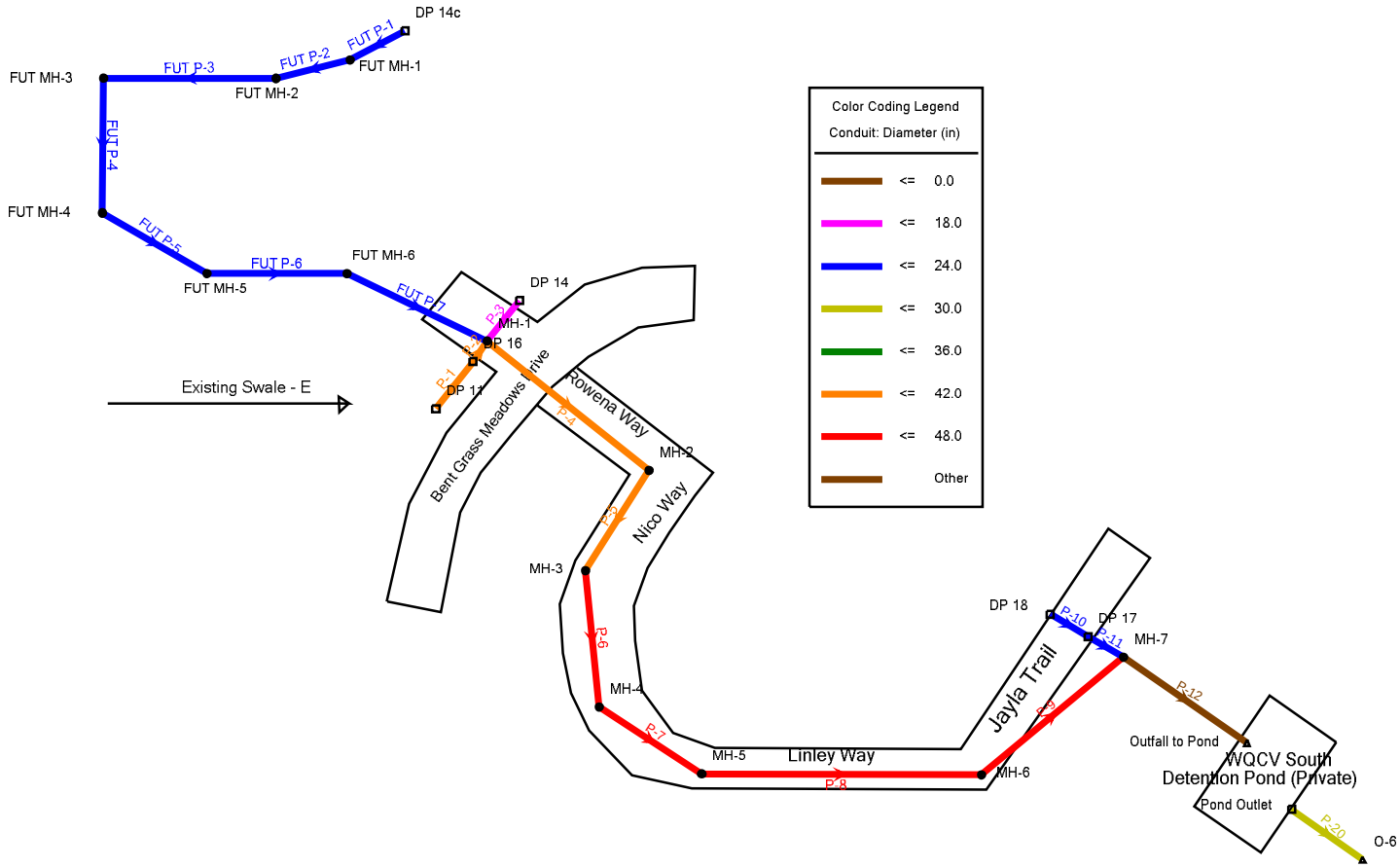
Warning 04: Froude No. exceeds USDCM Volume I recommendation.

StormCAD

Falcon Meadows at Bent Grass Filing No. 1

Scenario: 100 YR

Active Scenario: 100 YR



Falcon Meadows at Bent Grass Filing No. 1

FlexTable: Conduit Table

Active Scenario: 100 YR

Label	Start Node	Stop Node	Length (User Defined) (ft)	Diameter (in)	Manning's n	Capacity (Full Flow) (cfs)	Flow (cfs)	Velocity (ft/s)	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Slope (Calculated) (ft/ft)
P-12	MH-7	Outfall to Pond	253.3	54.0	0.013	150.31	103.34	10.19	6,941.78	6,927.48	6,932.00	6,926.00	6,930.47	6,928.74	0.006
P-1	DP 11	DP 16	99.5	42.0	0.013	152.97	56.02	14.67	6,946.05	6,940.50	6,948.23	6,938.20	6,942.84	6,941.71	0.023
P-2	DP 16	MH-1	7.5	42.0	0.013	201.21	65.76	18.71	6,948.23	6,937.90	6,948.02	6,937.60	6,941.34	6,941.31	0.040
P-3	DP 14	MH-1	27.5	18.0	0.013	10.41	14.26	8.07	6,948.25	6,939.57	6,948.02	6,939.30	6,941.82	6,941.31	0.010
P-4	MH-1	MH-2	211.5	42.0	0.013	100.50	86.37	11.75	6,948.02	6,937.30	6,946.72	6,935.19	6,940.19	6,938.90	0.010
P-5	MH-2	MH-3	132.1	42.0	0.013	100.95	86.06	11.78	6,946.72	6,934.89	6,945.39	6,933.56	6,937.78	6,936.77	0.010
P-6	MH-3	MH-4	75.2	48.0	0.013	143.41	85.87	11.92	6,945.39	6,933.06	6,944.74	6,932.31	6,935.87	6,935.72	0.010
P-7	MH-4	MH-5	61.2	48.0	0.013	120.39	85.76	10.40	6,944.74	6,932.01	6,944.50	6,931.58	6,934.82	6,934.99	0.007
P-8	MH-5	MH-6	235.3	48.0	0.013	122.08	85.66	10.52	6,944.50	6,931.28	6,942.08	6,929.58	6,934.09	6,932.98	0.007
P-9	MH-6	MH-7	119.8	48.0	0.013	149.66	85.28	12.30	6,942.08	6,929.28	6,941.78	6,927.98	6,932.08	6,931.52	0.011
P-10	DP 18	DP 17	35.0	24.0	0.013	48.52	14.75	13.55	6,941.57	6,931.85	6,941.57	6,930.24	6,933.23	6,932.33	0.046
P-11	DP 17	MH-7	9.2	24.0	0.013	50.53	21.31	15.40	6,941.57	6,929.94	6,941.78	6,929.48	6,931.59	6,931.52	0.050
FUT P-4	FUT MH-3	FUT MH-4	260.9	24.0	0.013	20.49	14.27	7.05	6,956.38	6,944.74	6,953.14	6,942.60	6,946.10	6,944.07	0.008
FUT P-5	FUT MH-4	FUT MH-5	49.0	24.0	0.013	20.18	14.08	6.94	6,953.14	6,942.30	6,952.59	6,941.91	6,943.65	6,943.38	0.008
FUT P-6	FUT MH-5	FUT MH-6	218.3	24.0	0.013	18.63	14.05	6.51	6,952.59	6,941.61	6,949.80	6,940.13	6,942.96	6,942.03	0.007
FUT P-7	FUT MH-6	MH-1	133.1	24.0	0.013	19.90	13.88	6.85	6,949.80	6,939.83	6,948.02	6,938.80	6,941.81	6,941.31	0.008
P-20	Pond Outlet	O-6	165.7	30.0	0.013	43.22	57.00	11.61	6,926.60	6,922.84	6,927.00	6,921.00	6,926.65	6,923.37	0.011
FUT P-3	FUT MH-2	FUT MH-3	133.9	24.0	0.013	20.22	14.37	6.99	6,956.29	6,946.11	6,956.38	6,945.04	6,947.48	6,946.59	0.008
FUT P-1	DP 14c	FUT MH-1	69.9	24.0	0.013	34.97	14.44	10.60	6,954.90	6,950.44	6,955.44	6,948.77	6,951.81	6,950.15	0.024
FUT P-2	FUT MH-1	FUT MH-2	84.1	24.0	0.013	35.40	14.41	10.69	6,955.44	6,948.47	6,956.29	6,946.41	6,949.84	6,947.78	0.024

Falcon Meadows at Bent Grass Filing No. 1

FlexTable: Manhole Table

Active Scenario: 100 YR

Label	Elevation (Rim) (ft)	Headloss Coefficient (Standard)	Headloss Method	Headloss (ft)	Hydraulic Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Diameter (in)
MH-1	6,948.02	0.700	Standard	1.12	6,940.19	6,941.31	6,941.62	6,941.80	84.0
MH-2	6,946.72	0.700	Standard	1.12	6,937.78	6,938.90	6,940.15	6,939.37	96.0
MH-3	6,945.39	0.700	Standard	0.90	6,935.87	6,936.77	6,938.12	6,937.16	96.0
MH-4	6,944.74	0.700	Standard	0.90	6,934.82	6,935.72	6,936.60	6,936.10	96.0
MH-5	6,944.50	0.700	Standard	0.90	6,934.09	6,934.99	6,935.87	6,935.37	96.0
MH-6	6,942.08	0.700	Standard	0.90	6,932.08	6,932.98	6,933.86	6,933.36	96.0
MH-7	6,941.78	0.800	Standard	1.06	6,930.47	6,931.52	6,932.34	6,931.79	96.0
FUT MH-6	6,949.80	0.700	Standard	0.21	6,941.81	6,942.03	6,942.35	6,942.12	48.0
FUT MH-5	6,952.59	0.700	Standard	0.42	6,942.96	6,943.38	6,943.88	6,943.56	48.0
FUT MH-4	6,953.14	0.700	Standard	0.42	6,943.65	6,944.07	6,944.59	6,944.26	48.0
FUT MH-3	6,956.38	0.800	Standard	0.49	6,946.10	6,946.59	6,947.06	6,946.71	48.0
FUT MH-2	6,956.29	0.500	Standard	0.31	6,947.48	6,947.78	6,948.39	6,948.09	48.0
FUT MH-1	6,955.44	0.500	Standard	0.31	6,949.84	6,950.15	6,950.76	6,950.45	48.0

Falcon Meadows at Bent Grass Filing No. 1

FlexTable: Outfall Table

Active Scenario: 100 YR

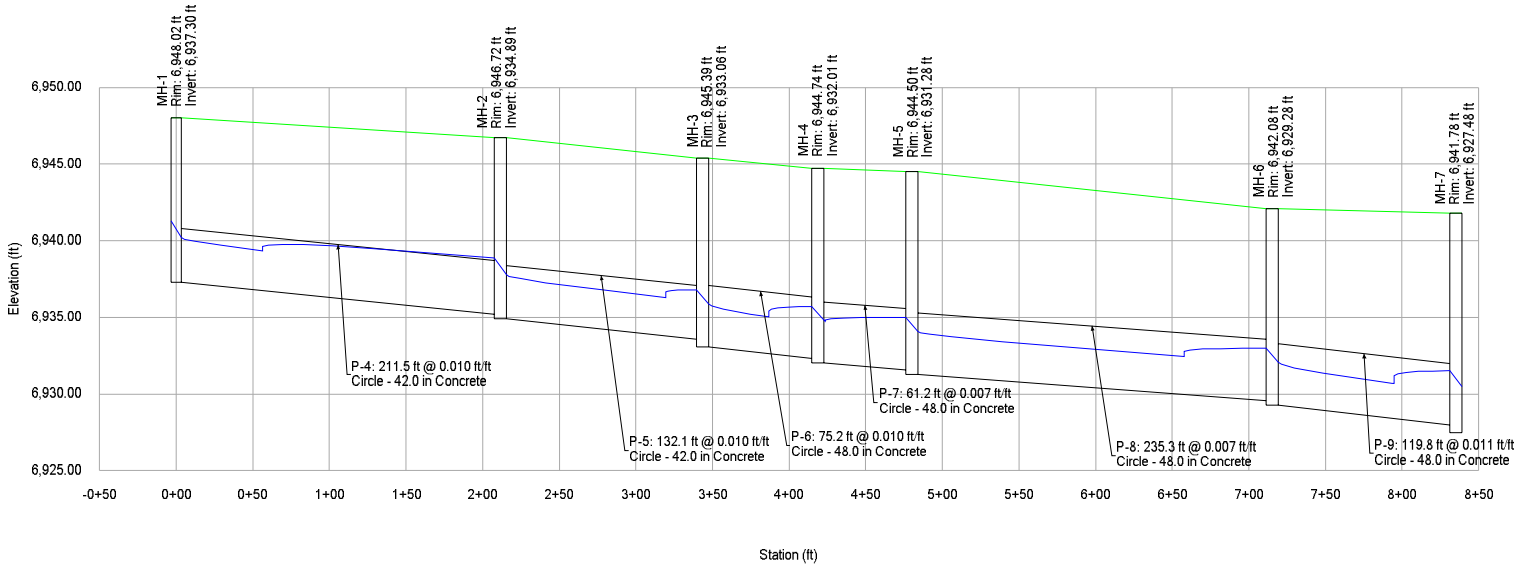
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Energy Grade Line (ft)	Flow (Total Out) (cfs)
Outfall to Pond	6,932.00	6,926.00	User Defined Tailwater	6,927.66	6,928.74	6,928.74	102.82
O-6	6,927.00	6,921.00	Free Outfall		6,923.37	6,923.37	57.00

Falcon Meadows at Bent Grass Filing No. 1

Profile Report

Engineering Profile - Mainline (FM Filing 1.stsw)

Active Scenario: 100 YR

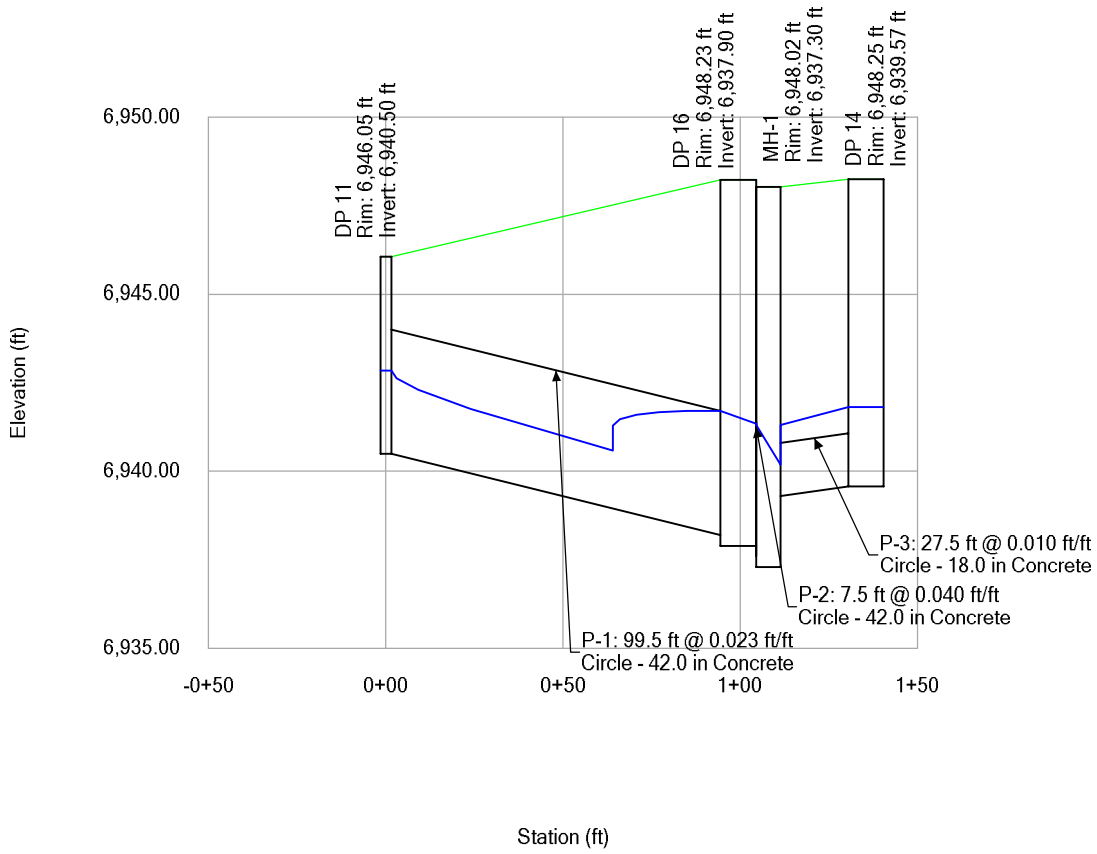


Falcon Meadows at Bent Grass Filing No. 1

Profile Report

Engineering Profile - Rowena Way Laterals (FM Filing 1.stsw)

Active Scenario: 100 YR

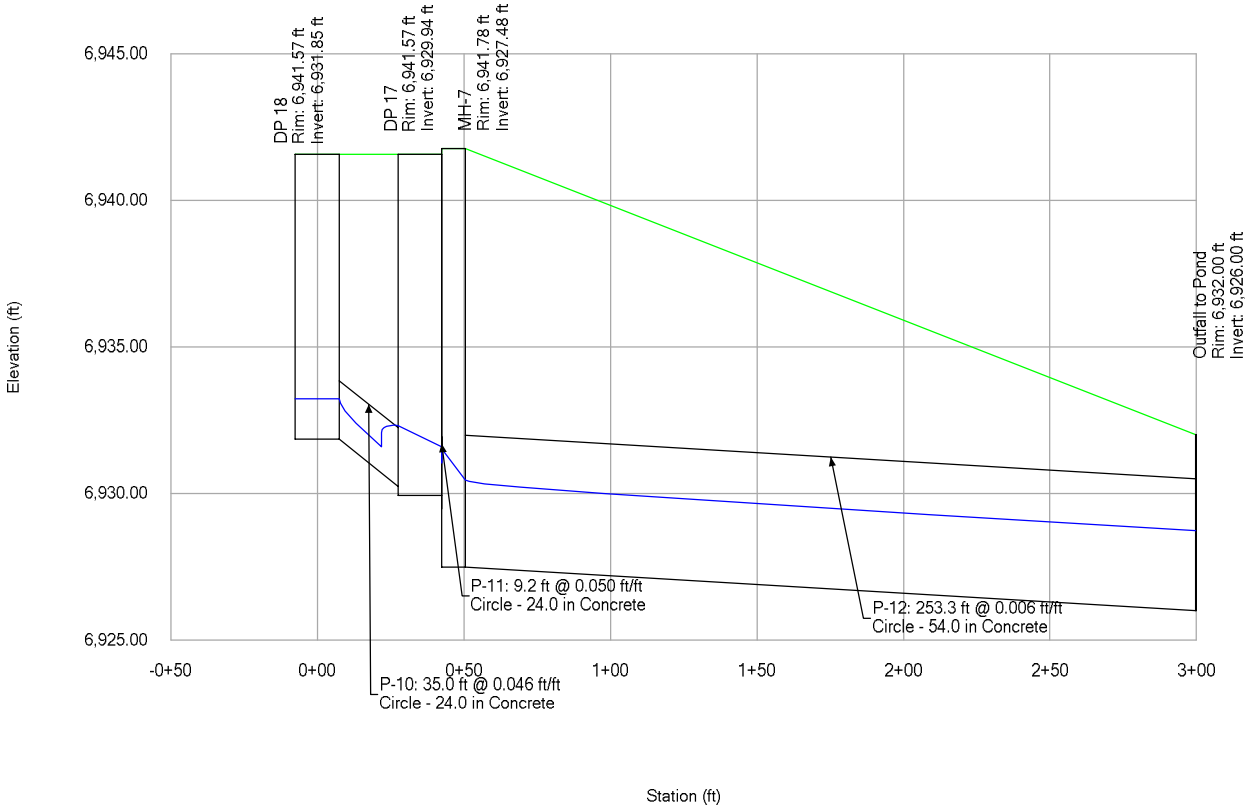


Falcon Meadows at Bent Grass Filing No. 1

Profile Report

Engineering Profile - Jayla Laterals & Outlet (FM Filing 1.stsw)

Active Scenario: 100 YR

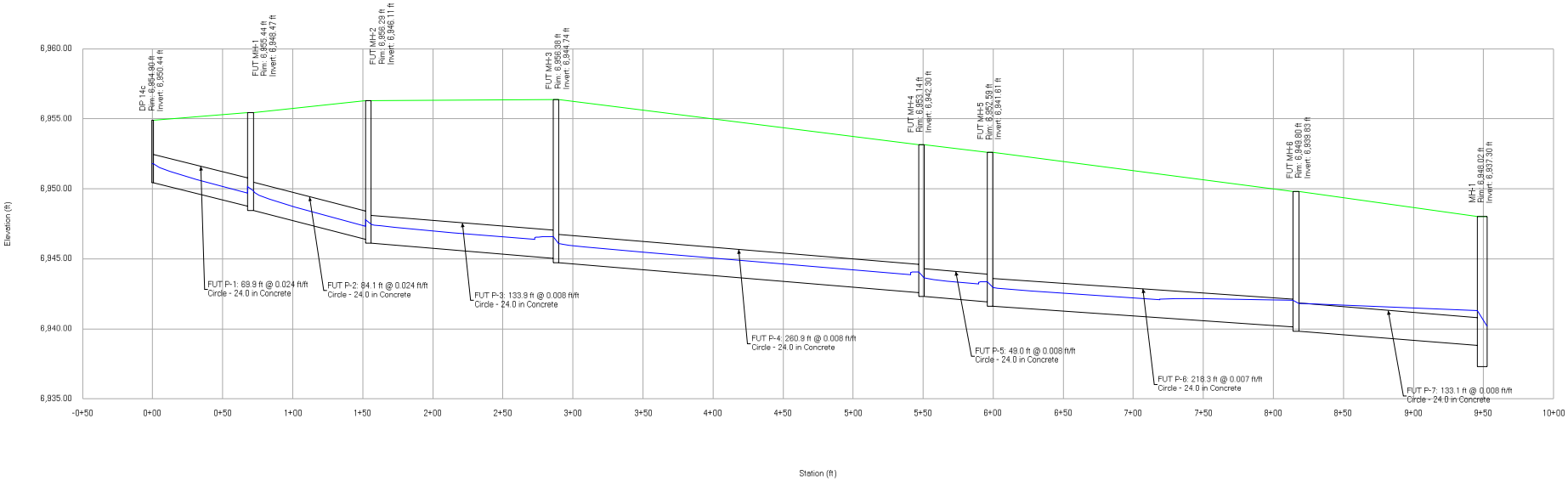


Falcon Meadows at Bent Grass Filing No. 1

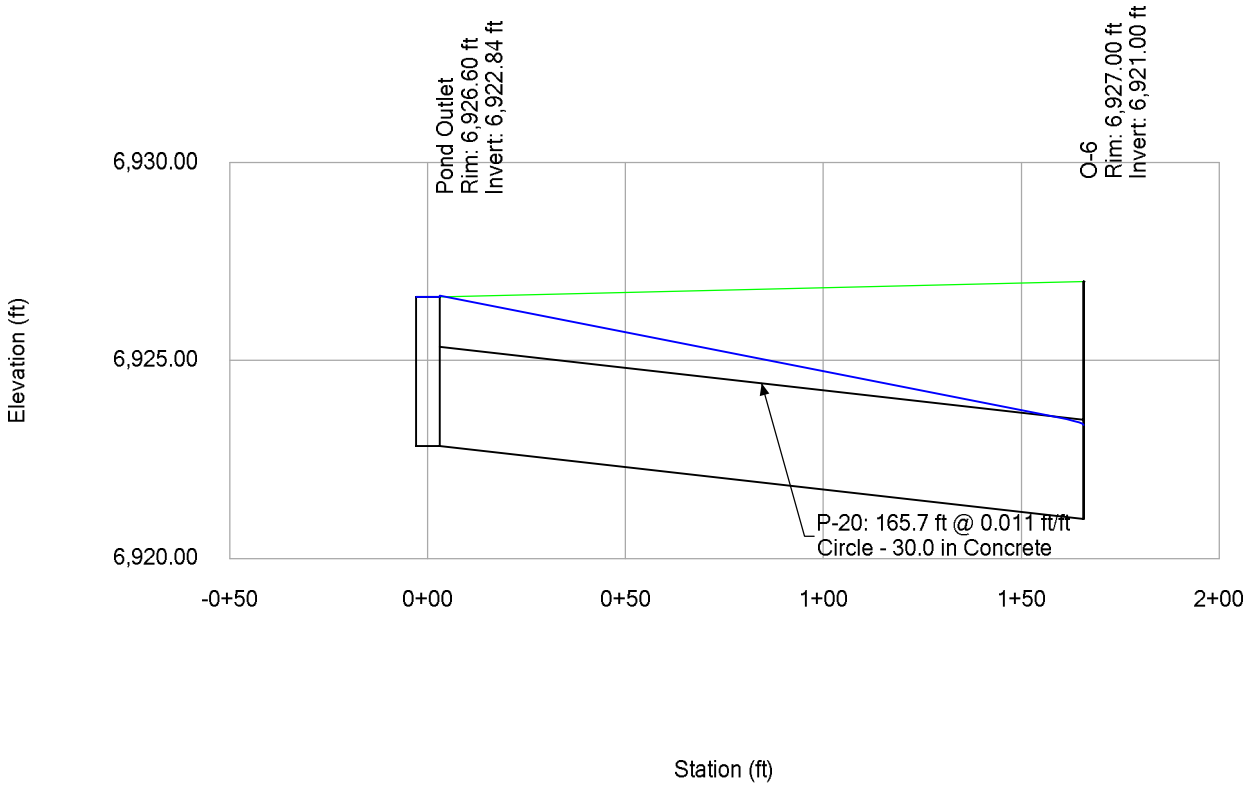
Profile Report

Engineering Profile - Future Storm Sys (FM Filing 1.stsw)

Active Scenario: 100 YR



Falcon Meadows at Bent Grass Filing No. 1
Profile Report
Engineering Profile - Pond Outlet (FM Filing 1.stsw)
Active Scenario: 100 YR



Falcon Meadows at Bent Grass Filing No. 1

FlexTable: Conduit Table

Active Scenario: 5 YR

Label	Start Node	Stop Node	Length (User Defined) (ft)	Diameter (in)	Manning's n	Capacity (Full Flow) (cfs)	Flow (cfs)	Velocity (ft/s)	Elevation Ground (Start) (ft)	Invert (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Slope (Calculated) (ft/ft)
P-12	MH-7	Outfall to Pond	253.3	54.0	0.013	150.31	30.92	7.44	6,941.78	6,927.48	6,932.00	6,926.00	6,929.07	6,927.38	0.006
P-1	DP 11	DP 16	99.5	42.0	0.013	152.97	11.00	9.23	6,946.05	6,940.50	6,948.23	6,938.20	6,941.50	6,939.30	0.023
P-2	DP 16	MH-1	7.5	42.0	0.013	201.21	15.19	12.31	6,948.23	6,937.90	6,948.02	6,937.60	6,939.09	6,939.18	0.040
P-3	DP 14	MH-1	27.5	18.0	0.013	10.41	4.97	5.83	6,948.25	6,939.57	6,948.02	6,939.30	6,940.43	6,940.04	0.010
P-4	MH-1	MH-2	211.5	42.0	0.013	100.50	23.46	8.52	6,948.02	6,937.30	6,946.72	6,935.19	6,938.79	6,936.77	0.010
P-5	MH-2	MH-3	132.1	42.0	0.013	100.95	23.34	8.54	6,946.72	6,934.89	6,945.39	6,933.56	6,936.37	6,934.71	0.010
P-6	MH-3	MH-4	75.2	48.0	0.013	143.41	23.27	8.40	6,945.39	6,933.06	6,944.74	6,932.31	6,934.48	6,933.80	0.010
P-7	MH-4	MH-5	61.2	48.0	0.013	120.39	23.23	7.40	6,944.74	6,932.01	6,944.50	6,931.58	6,933.43	6,933.07	0.007
P-8	MH-5	MH-6	235.3	48.0	0.013	122.08	23.19	7.48	6,944.50	6,931.28	6,942.08	6,929.58	6,932.70	6,931.06	0.007
P-9	MH-6	MH-7	119.8	48.0	0.013	149.66	23.04	8.63	6,942.08	6,929.28	6,941.78	6,927.98	6,930.70	6,929.54	0.011
P-10	DP 18	DP 17	35.0	24.0	0.013	48.52	6.38	10.69	6,941.57	6,931.85	6,941.57	6,930.24	6,932.74	6,931.38	0.046
P-11	DP 17	MH-7	9.2	24.0	0.013	50.53	9.34	12.28	6,941.57	6,929.94	6,941.78	6,929.48	6,931.03	6,930.24	0.050
FUT P-4	FUT MH-3	FUT MH-4	260.9	24.0	0.013	20.49	6.43	5.77	6,956.38	6,944.74	6,953.14	6,942.60	6,945.64	6,943.37	0.008
FUT P-5	FUT MH-4	FUT MH-5	49.0	24.0	0.013	20.18	6.32	5.68	6,953.14	6,942.30	6,952.59	6,941.91	6,943.19	6,942.68	0.008
FUT P-6	FUT MH-5	FUT MH-6	218.3	24.0	0.013	18.63	6.30	5.35	6,952.59	6,941.61	6,949.80	6,940.13	6,942.50	6,940.93	0.007
FUT P-7	FUT MH-6	MH-1	133.1	24.0	0.013	19.90	6.21	5.60	6,949.80	6,939.83	6,948.02	6,938.80	6,940.71	6,939.57	0.008
P-20	Pond Outlet	O-6	165.7	30.0	0.013	43.22	10.70	7.30	6,926.60	6,922.84	6,927.00	6,921.00	6,923.93	6,921.85	0.011
FUT P-3	FUT MH-2	FUT MH-3	133.9	24.0	0.013	20.22	6.48	5.73	6,956.29	6,946.11	6,956.38	6,945.04	6,947.01	6,945.82	0.008
FUT P-1	DP 14c	FUT MH-1	69.9	24.0	0.013	34.97	6.52	8.52	6,954.90	6,950.44	6,955.44	6,948.77	6,951.34	6,949.36	0.024
FUT P-2	FUT MH-1	FUT MH-2	84.1	24.0	0.013	35.40	6.50	8.59	6,955.44	6,948.47	6,956.29	6,946.41	6,949.37	6,946.99	0.024

Falcon Meadows at Bent Grass Filing No. 1

FlexTable: Manhole Table

Active Scenario: 5 YR

Label	Elevation (Rim) (ft)	Headloss Coefficient (Standard)	Headloss Method	Headloss (ft)	Hydraulic Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Diameter (in)
MH-1	6,948.02	0.700	Standard	0.39	6,938.79	6,939.18	6,939.38	6,939.35	84.0
MH-2	6,946.72	0.700	Standard	0.39	6,936.37	6,936.77	6,937.25	6,936.94	96.0
MH-3	6,945.39	0.700	Standard	0.37	6,934.48	6,934.85	6,935.98	6,935.01	96.0
MH-4	6,944.74	0.700	Standard	0.37	6,933.43	6,933.80	6,934.26	6,933.96	96.0
MH-5	6,944.50	0.700	Standard	0.37	6,932.70	6,933.07	6,933.53	6,933.22	96.0
MH-6	6,942.08	0.700	Standard	0.36	6,930.70	6,931.06	6,931.53	6,931.22	96.0
MH-7	6,941.78	0.800	Standard	0.47	6,929.07	6,929.54	6,929.94	6,929.66	96.0
FUT MH-6	6,949.80	0.700	Standard	0.24	6,940.71	6,940.95	6,941.39	6,941.05	48.0
FUT MH-5	6,952.59	0.700	Standard	0.24	6,942.50	6,942.74	6,943.24	6,942.84	48.0
FUT MH-4	6,953.14	0.700	Standard	0.24	6,943.19	6,943.43	6,943.95	6,943.53	48.0
FUT MH-3	6,956.38	0.800	Standard	0.27	6,945.64	6,945.91	6,946.42	6,945.98	48.0
FUT MH-2	6,956.29	0.500	Standard	0.17	6,947.01	6,947.18	6,948.33	6,947.36	48.0
FUT MH-1	6,955.44	0.500	Standard	0.17	6,949.37	6,949.55	6,950.66	6,949.72	48.0

Falcon Meadows at Bent Grass Filing No. 1

FlexTable: Outfall Table

Active Scenario: 5 YR

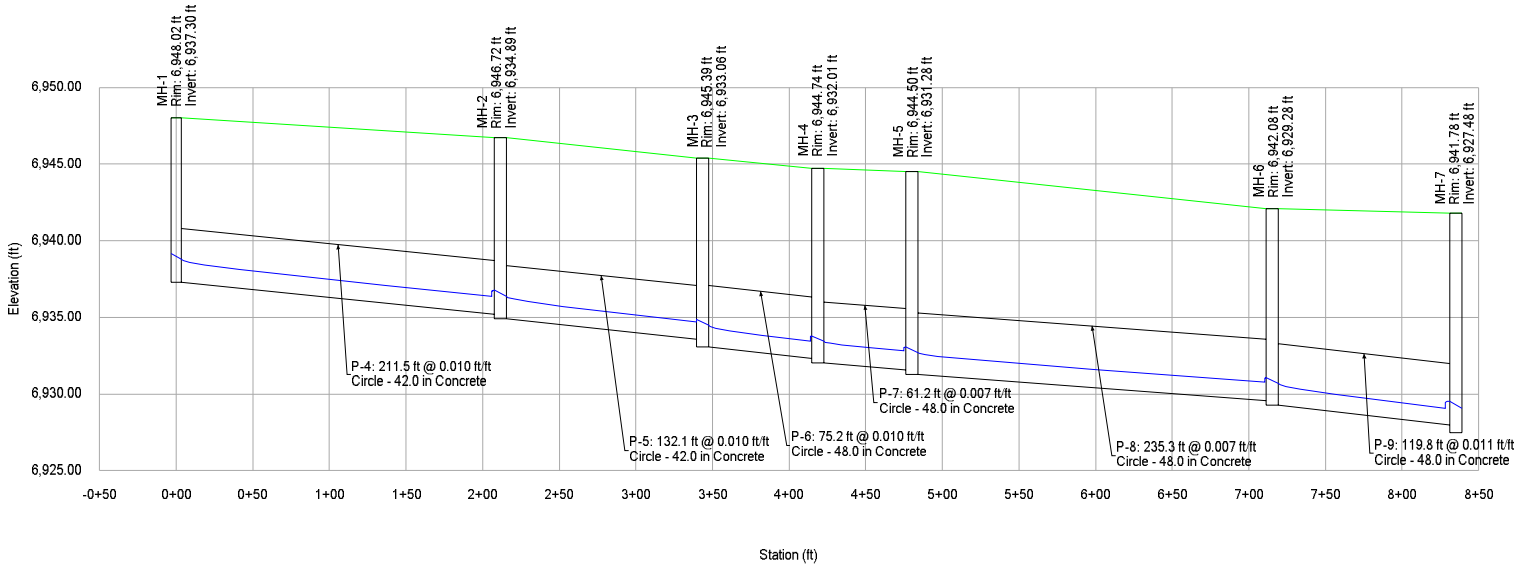
Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Energy Grade Line (ft)	Flow (Total Out) (cfs)
Outfall to Pond	6,932.00	6,926.00	User Defined Tailwater	6,926.91	6,927.38	6,927.38	30.71
O-6	6,927.00	6,921.00	Free Outfall		6,921.85	6,921.85	10.70

Falcon Meadows at Bent Grass Filing No. 1

Profile Report

Engineering Profile - Mainline (FM Filing 1.stsw)

Active Scenario: 5 YR

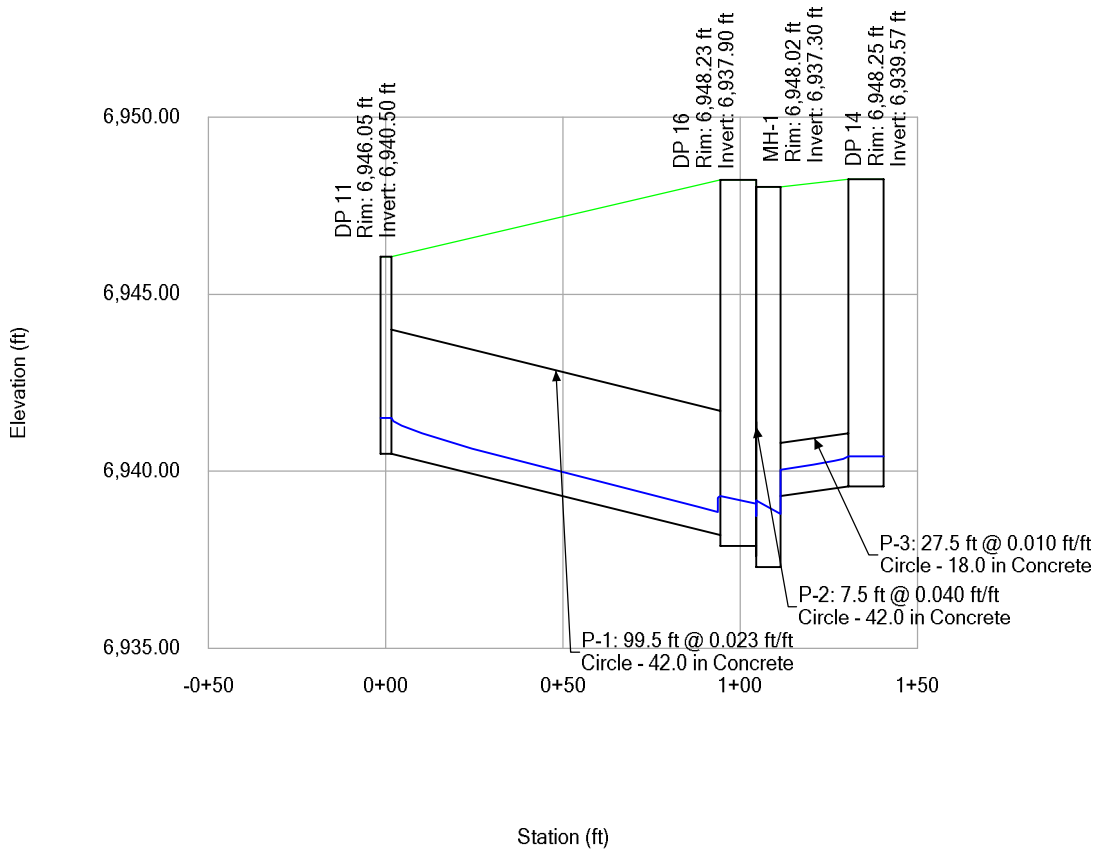


Falcon Meadows at Bent Grass Filing No. 1

Profile Report

Engineering Profile - Rowena Way Laterals (FM Filing 1.stsw)

Active Scenario: 5 YR

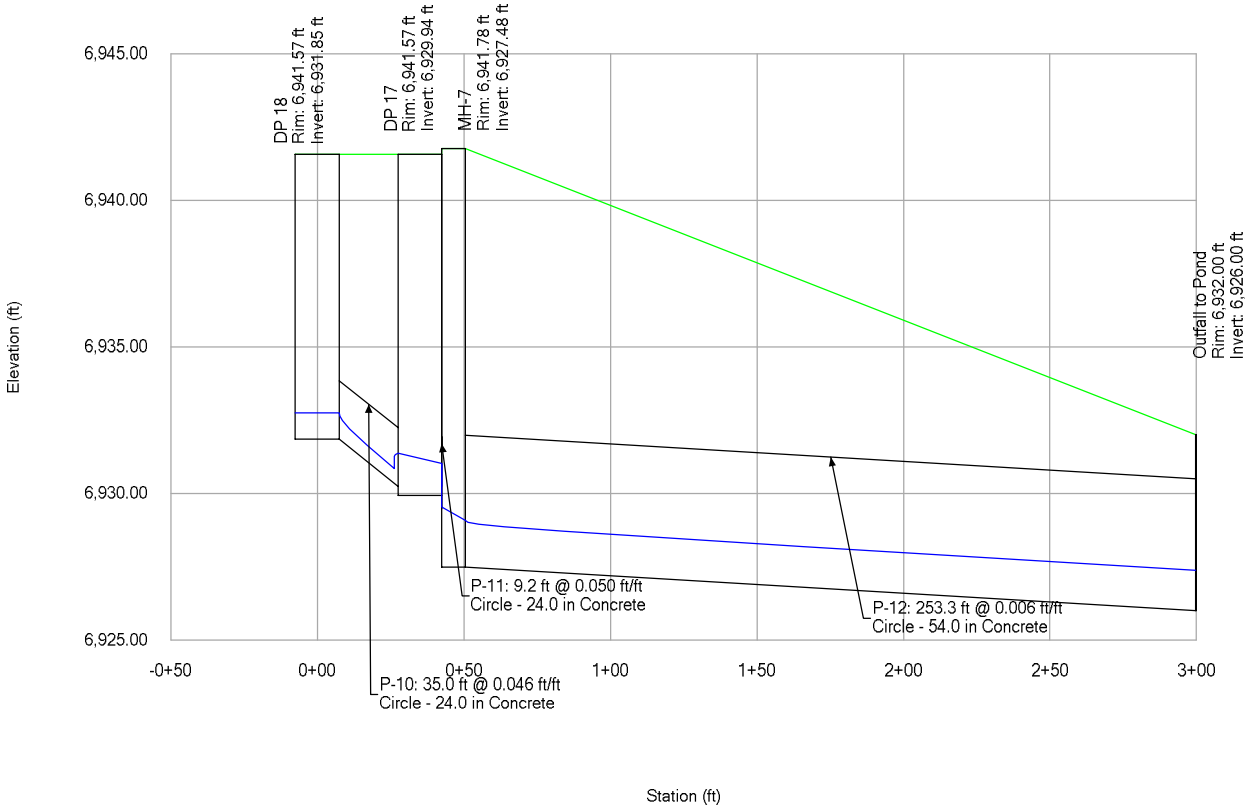


Falcon Meadows at Bent Grass Filing No. 1

Profile Report

Engineering Profile - Jayla Laterals & Outlet (FM Filing 1.stsw)

Active Scenario: 5 YR

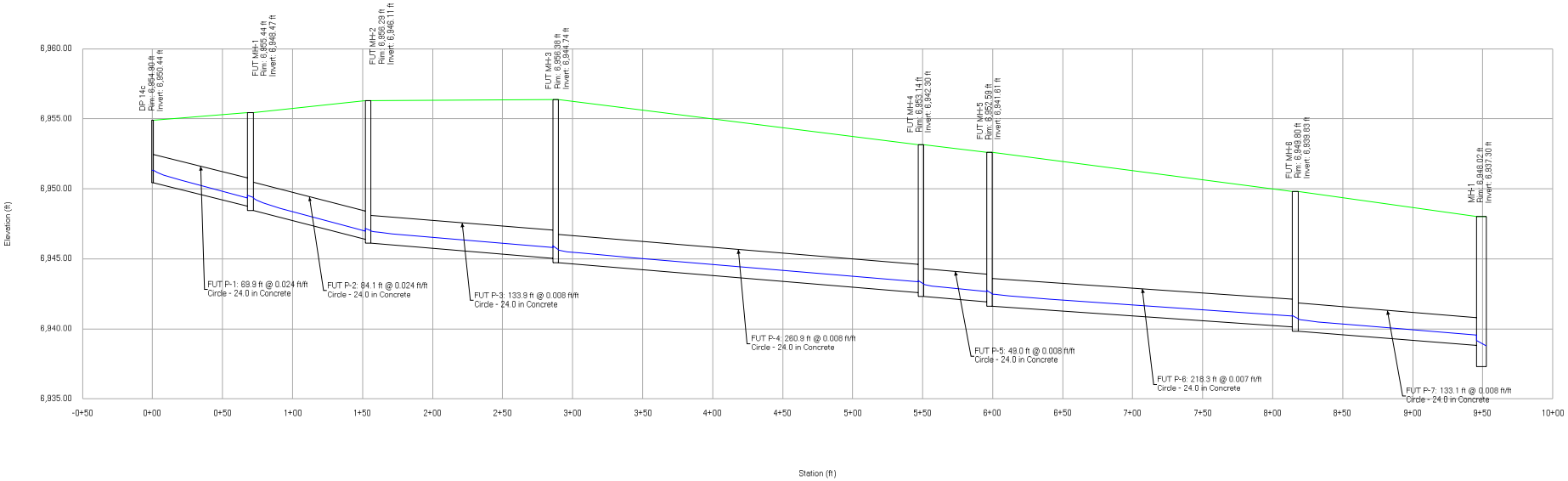


Falcon Meadows at Bent Grass Filing No. 1

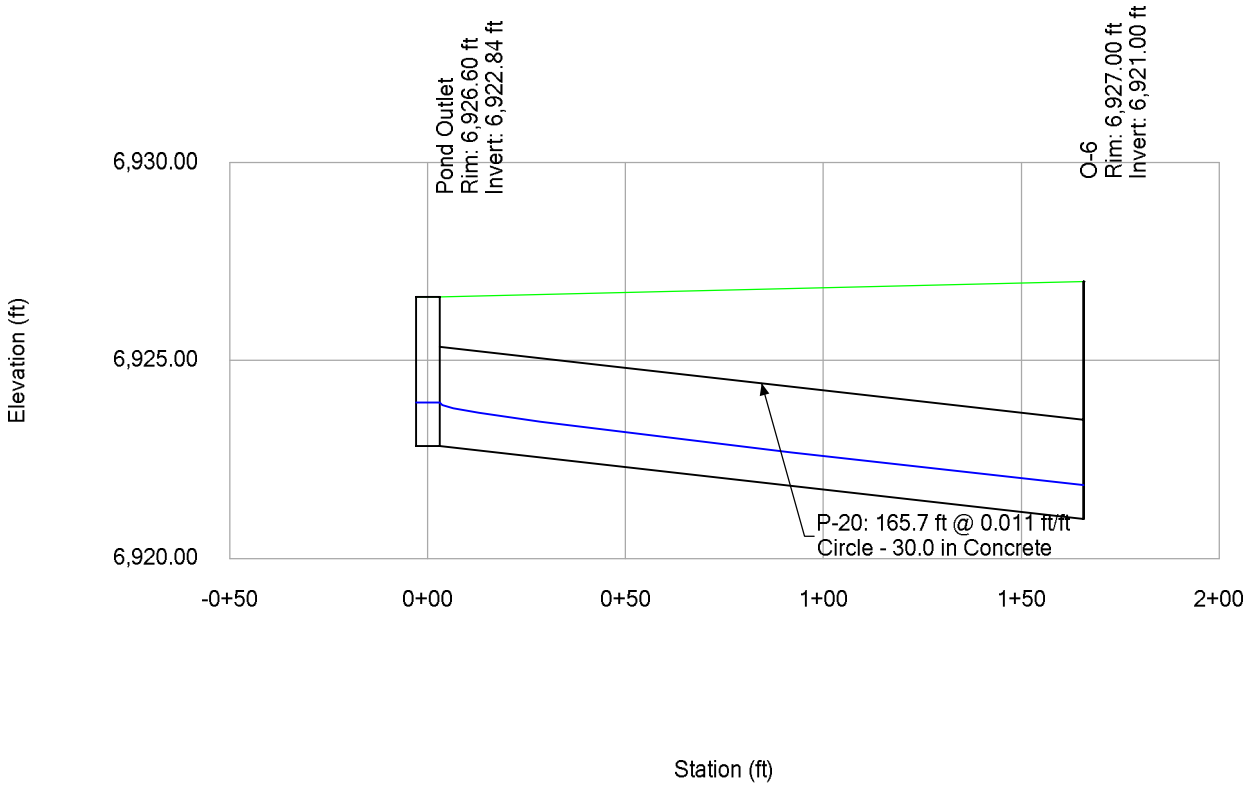
Profile Report

Engineering Profile - Future Storm Sys (FM Filing 1.stsw)

Active Scenario: 5 YR



Falcon Meadows at Bent Grass Filing No. 1
Profile Report
Engineering Profile - Pond Outlet (FM Filing 1.stsw)
Active Scenario: 5 YR



PIPE OUTFALL RIPRAP SIZING CALCULATIONS

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs

Project Name: Falcon Meadows at Bent Grass Fil No. 1
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 7//7/2021

	Storm Drain System				
	Pond Outfall	Forebay A***	Forebay B***	Forebay C***	
Q_{100} (cfs)	48.1	48.2	4.5	54.1	
D or H (in)	30	54	12	30	
W (ft)					
Slope (%)	0.01	0.01	0.08	0.01	
Yn (in)	28.44	32.88	6.00	14.18	
Y_t (ft)	Unknown	Unknown	Unknown	Unknown	*If "Unknown" Yt/D=0.4*
$Y_{t/D}$, Yt/H	0.40	0.40	0.40	0.40	
Supercritical	Yes	Yes	No	No	*Based on Froud Number >/< 1*
Q/D^2.5, Q/WH^1.5	4.87	1.12	4.50	5.47	
Q/D^1.5, Q/WH^0.5	12.17	5.05	4.50	13.69	
Da, Ha (in) *	29.22	43.44			*Da=0.5(D+Yn), Ha=0.5(H+Yn)*
Q/Da^1.5, Q/WHa^0.5 *	12.66	7.00			
d_{50} (in), Required	10.95	6.05	3.73	11.34	
Required Riprap Size	M	L	L	M	
Use Riprap Size	**M**	**M**	**M**	**M**	*Found using Figure 9-38 (USDCM)*
d_{50} (in)	12	12	12	12	
1/(2 tan θ)	2.40	6.80	3.10	2.20	*Found using Figure 9-35/9-36 (USDCM)*
Erosive Soils	Yes	Yes	Yes	Yes	
A_t	8.75	8.76	0.82	9.84	*A_t=Q/5.5*
L	15.0	2.5	3.2	16.1	*L=(1/(2 tan θ))(A_t/Yt - D)*
Min L	7.5	13.5	3.0	7.5	*Min L=3D or 3H*
Max L	25.0	45.0	10.0	25.0	*Max L=10D or 10H*
Length (ft)	15.0	13.5	4.0	17.0	
Bottom Width (ft)	7.5	13.5	3.0	7.5	*Width=3D (Minimum)*
Riprap Depth (in)	24	24	24	24	*Depth=2(d_{50})*
Type II Base Depth (in)	6	6	6	6	
Cutoff Wall	Yes	No	No	No	
Cutoff Wall Depth (ft)	3.0				*Depth of Riprap and Base*
Cutoff Wall Width (ft)	5.3				

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

* For use when the flow in the culvert is supercritical (and less than full).
** This is a temporary minor storm culvert and the riprap has been sized for minor storm flows

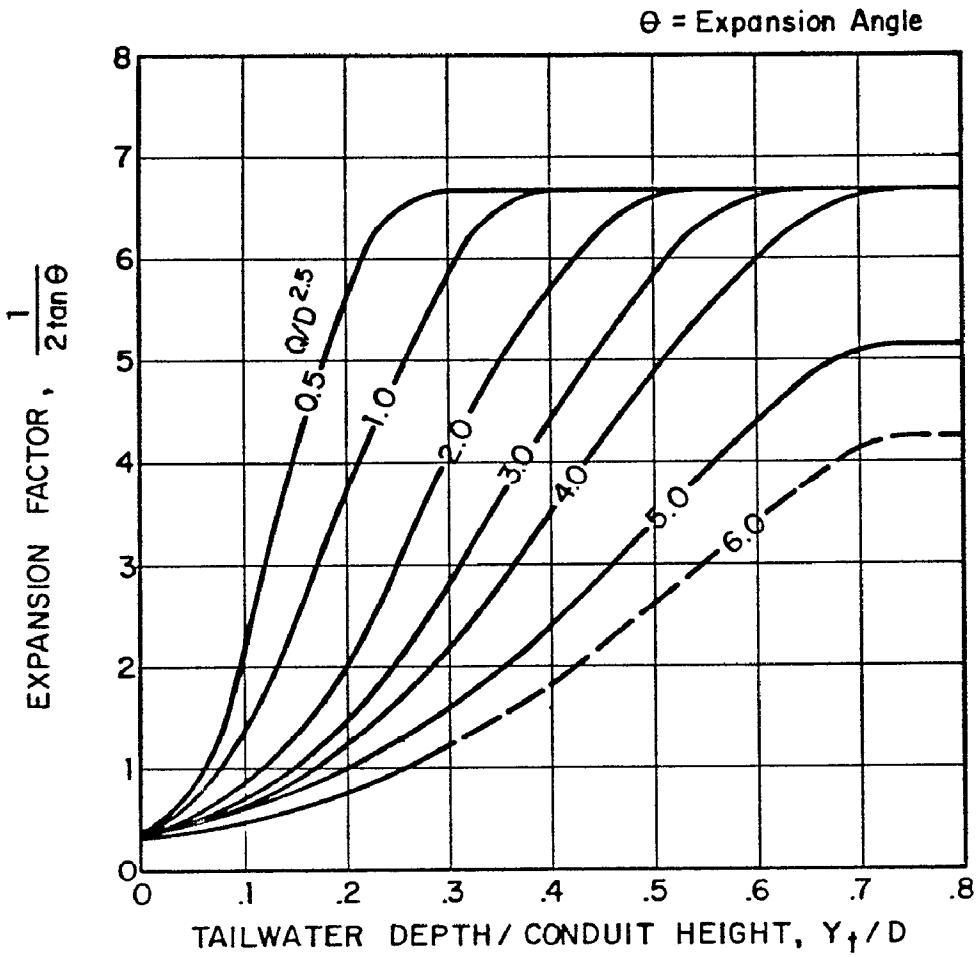


Figure 9-35. Expansion factor for circular conduits

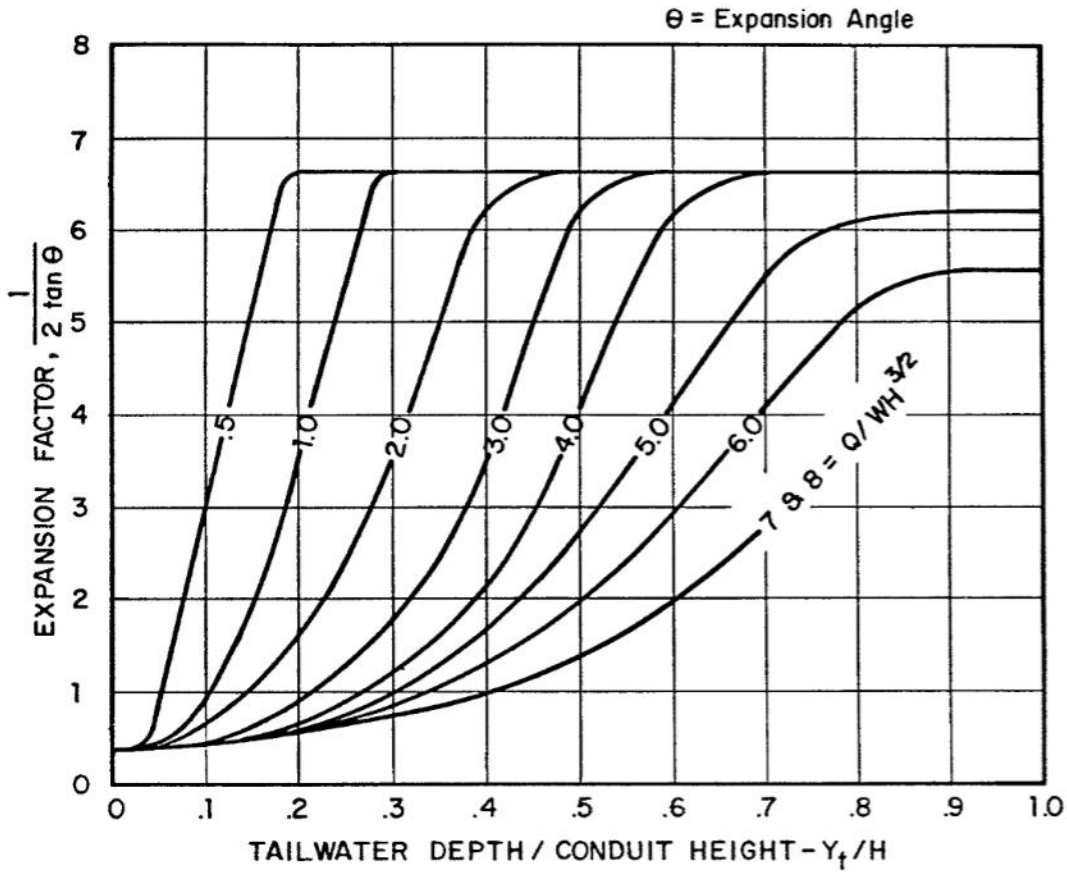


Figure 9-36. Expansion factor for rectangular conduits

Swale Calculations

Worksheet for Swale - C (Proposed)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	1.00	ft
Discharge	4.50	ft^3/s

Results

Normal Depth	0.53	ft
Flow Area	1.63	ft^2
Wetted Perimeter	5.34	ft
Hydraulic Radius	0.31	ft
Top Width	5.21	ft
Critical Depth	0.49	ft
Critical Slope	0.02033	ft/ft
Velocity	2.75	ft/s
Velocity Head	0.12	ft
Specific Energy	0.64	ft
Froude Number	0.87	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.53	ft
Critical Depth	0.49	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.02033	ft/ft

Worksheet for Swale - E (Existing)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	64.50	ft^3/s

Results

Normal Depth	1.79	ft
Flow Area	18.15	ft^2
Wetted Perimeter	17.74	ft
Hydraulic Radius	1.02	ft
Top Width	17.30	ft
Critical Depth	1.42	ft
Critical Slope	0.01426	ft/ft
Velocity	3.55	ft/s
Velocity Head	0.20	ft
Specific Energy	1.98	ft
Froude Number	0.61	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.79	ft
Critical Depth	1.42	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01426	ft/ft

Worksheet for Swale - F (Proposed)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01000	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	6.00	ft
Discharge	25.60	ft^3/s

Results

Normal Depth	0.80	ft
Flow Area	7.38	ft^2
Wetted Perimeter	12.61	ft
Hydraulic Radius	0.59	ft
Top Width	12.42	ft
Critical Depth	0.70	ft
Critical Slope	0.01650	ft/ft
Velocity	3.47	ft/s
Velocity Head	0.19	ft
Specific Energy	0.99	ft
Froude Number	0.79	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.80	ft
Critical Depth	0.70	ft
Channel Slope	0.01000	ft/ft

Worksheet for Swale - F (Proposed)

GVF Output Data

Critical Slope	0.01650	ft/ft

Worksheet for Overflow Swale (Proposed)

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.05100	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Discharge	9.50	ft^3/s

Results

Normal Depth	0.92	ft
Flow Area	3.36	ft^2
Wetted Perimeter	7.55	ft
Hydraulic Radius	0.44	ft
Top Width	7.33	ft
Critical Depth	0.81	ft
Critical Slope	0.09760	ft/ft
Velocity	2.83	ft/s
Velocity Head	0.12	ft
Specific Energy	1.04	ft
Froude Number	0.74	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.92	ft
Critical Depth	0.81	ft
Channel Slope	0.05100	ft/ft
Critical Slope	0.09760	ft/ft

APPENDIX D

On-Site Pond Calculations

Detention Pond Tributary Areas

Subdivision: Falcon Meadows at Bent Grass
Location: CO, Colorado Springs

Project Name: Falcon Meadows at Bent Grass
Project No.: CLH000018
Calculated By: TJE
Checked By: CMD
Date: 7//7/2021

Pond (North-Future)

Basin	Area	% Imp
C-1	9.07	65
C-2	1.11	58
C-3	1.52	86.6
C-5	0.51	2
C-6	1.37	51.2
Total	**13.58**	**63.1**

Pond (South-Proposed)

Basin	Area	% Imp
D-1a	3.40	38.9
D-1b	4.72	60.7
D-2a	0.30	100
D-2b	0.99	60.5
D-2c	0.16	100
D-2d	0.14	100
D-2e	1.56	73.9
D-2f	1.03	88.2
D-2g	2.54	51.6
D-3	2.93	31.7
D-4a	0.98	74.7
D-4b	0.96	81.4
D-4c	1.00	78.8
D-5	1.08	65.7
D-6a	1.33	76.6
D-6b	2.69	72.6
D-7	7.84	9.6
D-8	1.69	22.8
D-9	0.70	36.2
E-4	0.91	80.6
E-5	0.89	89
OS-2	20.07	8
OS-3	10.61	8
Total	**68.52**	**30.7**

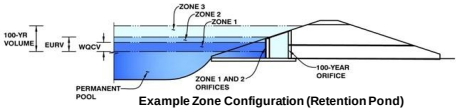
Proposed Pond (South) Calculations

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Falcon Meadows at Bent Grass

Basin ID: WQCV Pond - South



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	68.52	acres
Watershed Length =	3,600	ft
Watershed Length to Centroid =	1,500	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	31.00%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	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) =	0.882	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.142	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.513	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.077	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.549	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.709	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	4.791	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	6.239	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	12.342	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	1.349	acre-feet		
Approximate 5-yr Detention Volume =	1.798	acre-feet		
Approximate 10-yr Detention Volume =	2.244	acre-feet		
Approximate 25-yr Detention Volume =	2.829	acre-feet		
Approximate 50-yr Detention Volume =	3.261	acre-feet		
Approximate 100-yr Detention Volume =	3.950	acre-feet		

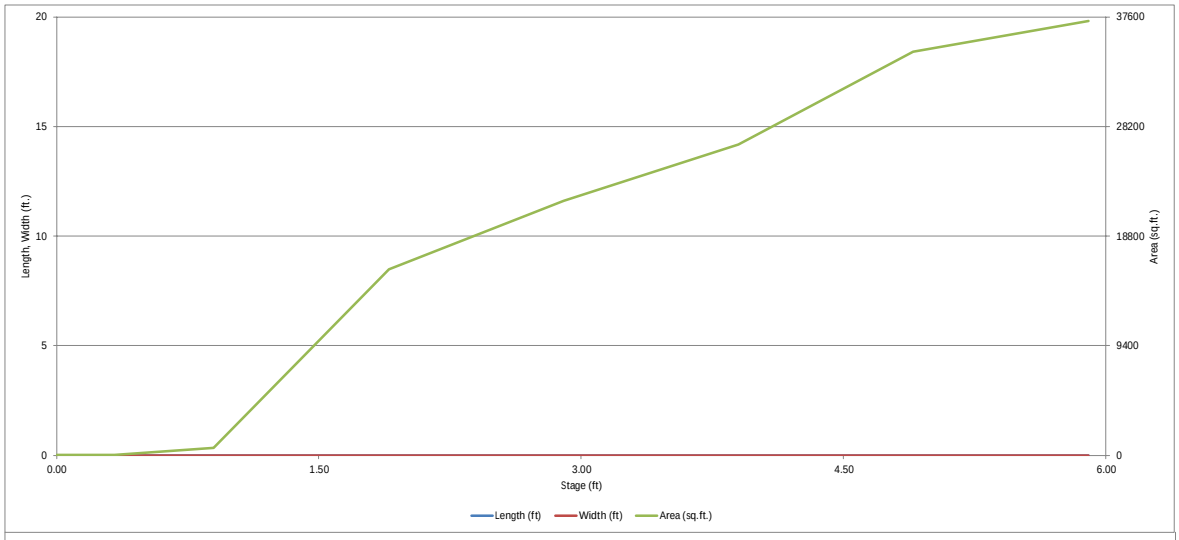
Define Zones and Basin Geometry

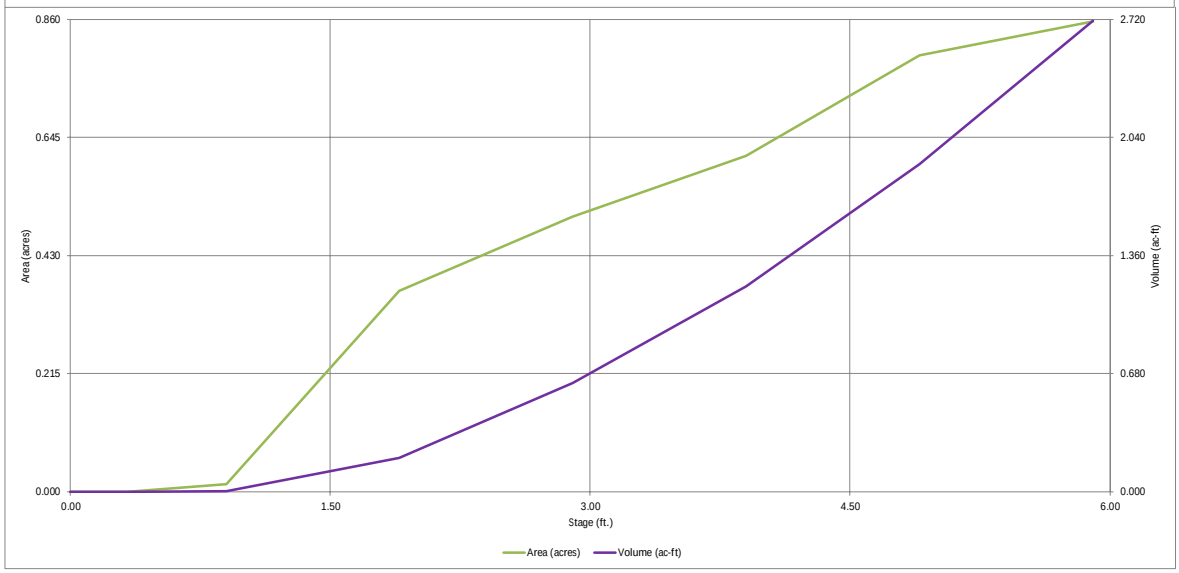
Zone 1 Volume (WQCV) =	0.882	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.882	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention 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

Total detention volume is less than 100-year volume.

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)
6923.1	Top of Micropool	--	0.00	--	--	--	35	0.001		
(Trickle Channel Inv) 6923.43		--	0.33	--	--	--	35	0.001	12	0.000
6924		--	0.90	--	--	--	593	0.014	191	0.004
6925		--	1.90	--	--	--	15,946	0.366	8,460	0.194
6926		--	2.90	--	--	--	21,804	0.501	27,335	0.628
6927		--	3.90	--	--	--	26,657	0.612	51,565	1.184
(Spillway Invert) 6928		--	4.90	--	--	--	34,630	0.795	82,209	1.887
(Top of Bank) 6929		--	5.90	--	--	--	37,309	0.856	118,178	2.713


20
15
10
5
0
Length, Width (ft.)
37600
28200
18800
9400
0
Area (sq.ft.)
0.00
1.50
3.00
4.50
6.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

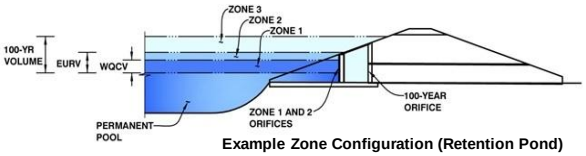

0.860
0.645
0.430
0.215
0.000
Area (acres)
2.720
2.040
1.360
0.680
0.000
Volume (ac-ft)
0.00
1.50
3.00
4.50
6.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Falcon Meadows at Bent Grass

Basin ID: WQCV Pond - South



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.39	0.882	Orifice Plate
Zone 2			
Zone 3			
Total (all zones)		0.882	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.670E-02	ft^2
Depth at top of Zone using Orifice Plate =	3.39	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 =	2.41	sq. inches (diameter = 1-3/4 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.14	2.27					
Orifice Area (sq. inches)	2.41	2.41	2.41					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.50		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.50		feet
Overflow Weir Front Edge Length =	6.00		feet	Overflow Weir Slope Length =	6.00		feet
Overflow Weir Grate Slope =	0.00		H:V	Grate Open Area / 100-yr Orifice Area =	5.87		
Horiz. Length of Weir Sides =	6.00		feet	Overflow Grate Open Area w/o Debris =	28.80		ft^2
Overflow Grate Open Area % =	80%		%, grate open area/total area	Overflow Grate Open Area w/ Debris =	14.40		ft^2
Debris Clogging % =	50%		%				

Calculated Parameters for Overflow Weir

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	0.25		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.91		ft^2
Circular Orifice Diameter =	30.00		inches	Outlet Orifice Centroid =	1.25		feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.90	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.93	feet
Spillway Crest Length =	24.00	feet	Stage at Top of Freeboard =	5.83	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.85	acres
Freeboard above Max Water Surface =	0.00	feet	Basin Volume at Top of Freeboard =	2.65	acre-ft

Calculated Parameters for Spillway

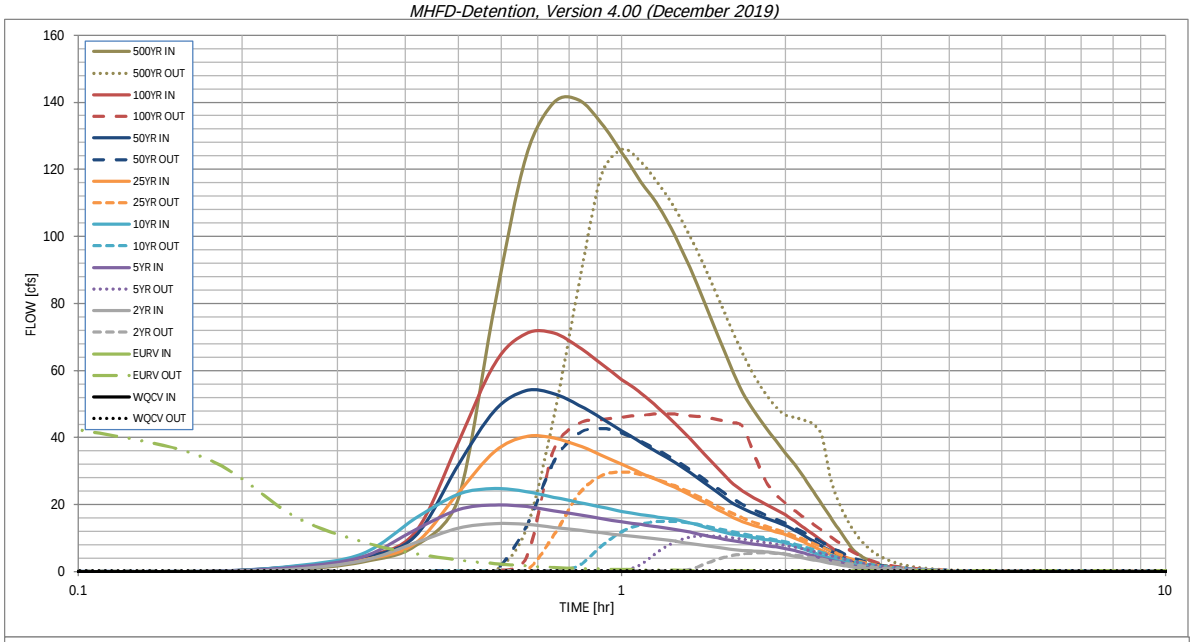
Routed Hydrograph Results

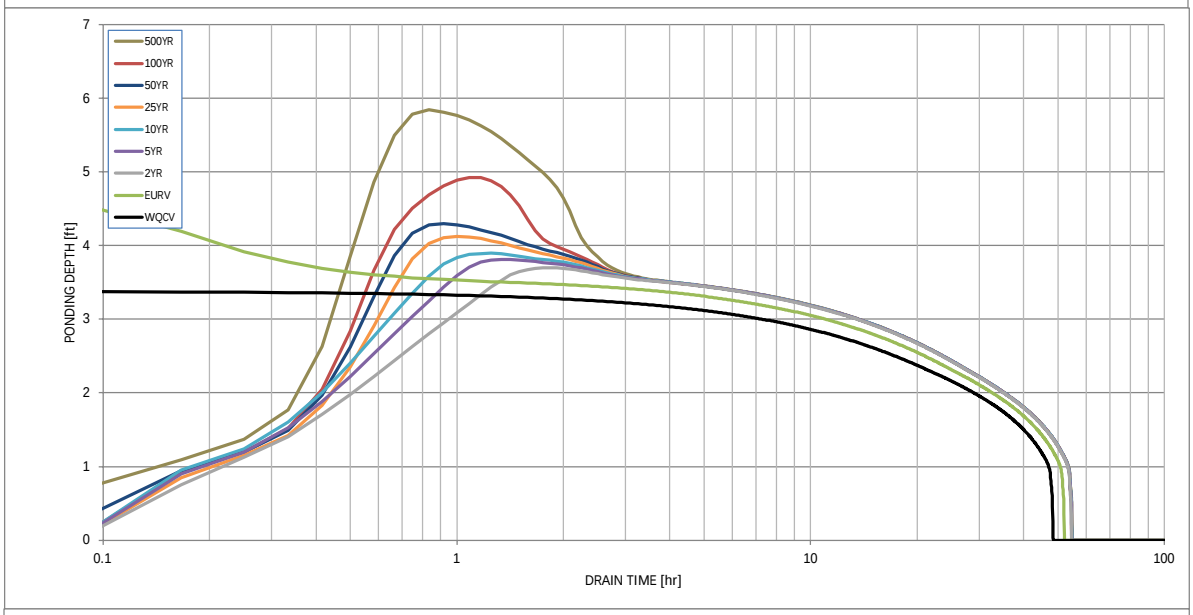
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

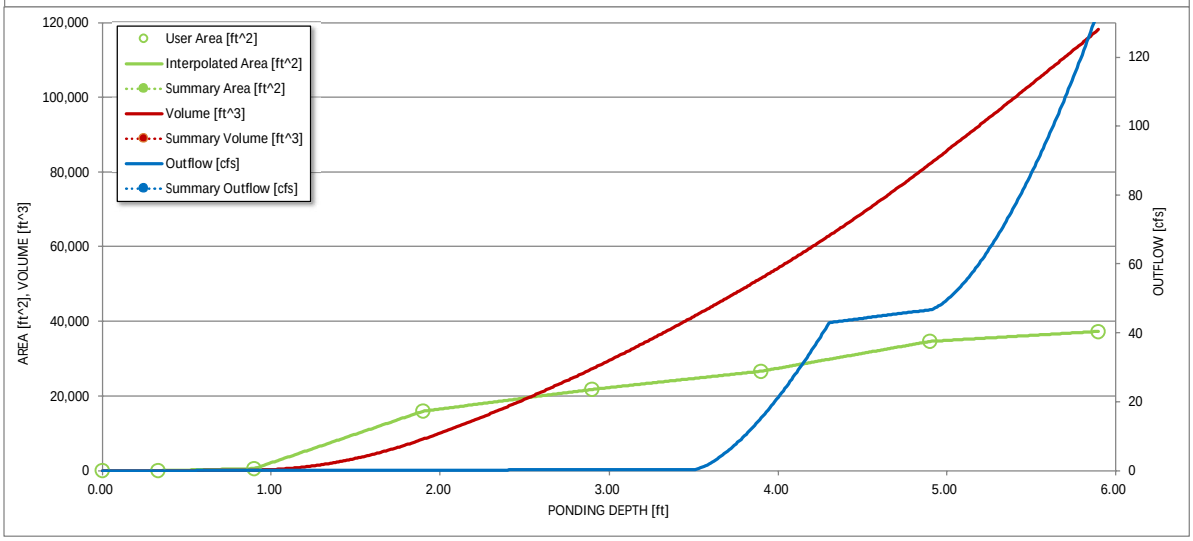
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.68
CUHP Runoff Volume (acre-ft) =	0.882	2.142	1.513	2.077	2.549	3.709	4.791	6.239	12.342
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.513	2.077	2.549	3.709	4.791	6.239	12.342
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.4	0.8	1.1	10.3	20.6	34.2	89.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.02	0.15	0.30	0.50	1.30
Peak Inflow Q (cfs) =	N/A	N/A	14.3	19.9	24.7	40.3	54.0	71.2	140.6
Peak Outflow Q (cfs) =	0.4	49.8	5.6	10.7	15.0	29.8	42.7	47.1	125.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	13.5	13.5	2.9	2.1	1.4	1.4
Structure Controlling Flow =	Plate	Spillway	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	1.67	0.18	0.4	0.5	1.0	1.5	1.6	1.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	45	45	49	48	46	44	41	38	27
Time to Drain 99% of Inflow Volume (hours) =	47	49	52	52	51	50	49	48	43
Maximum Ponding Depth (ft) =	3.39	5.22	3.70	3.81	3.89	4.13	4.30	4.93	5.84
Area at Maximum Ponding Depth (acres) =	0.56	0.81	0.59	0.60	0.61	0.65	0.69	0.80	0.85
Maximum Volume Stored (acre-ft) =	0.886	2.145	1.058	1.129	1.178	1.323	1.443	1.903	2.662

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.01	0.60
	0:15:00	0.00	0.00	0.82	1.34	1.69	1.15	1.50	1.44	2.95
	0:20:00	0.00	0.00	3.33	4.48	5.40	3.49	4.18	4.43	7.59
	0:25:00	0.00	0.00	8.57	12.47	15.83	8.39	10.54	11.72	21.85
	0:30:00	0.00	0.00	12.97	18.49	23.08	23.58	31.86	38.60	79.61
	0:35:00	0.00	0.00	14.28	19.95	24.73	35.83	48.04	62.13	123.90
	0:40:00	0.00	0.00	14.11	19.41	23.94	40.33	53.98	71.03	139.96
	0:45:00	0.00	0.00	13.24	18.11	22.24	39.82	53.04	71.17	140.62
	0:50:00	0.00	0.00	12.34	16.96	20.69	37.60	49.71	66.95	133.80
	0:55:00	0.00	0.00	11.57	15.89	19.30	34.80	45.84	61.99	125.00
	1:00:00	0.00	0.00	10.86	14.84	18.01	32.00	41.97	57.35	116.30
	1:05:00	0.00	0.00	10.31	14.04	17.08	29.50	38.59	53.27	109.23
	1:10:00	0.00	0.00	9.72	13.36	16.31	27.21	35.48	48.82	100.32
	1:15:00	0.00	0.00	9.09	12.61	15.58	25.11	32.58	44.32	90.70
	1:20:00	0.00	0.00	8.45	11.75	14.60	22.93	29.58	39.69	80.57
	1:25:00	0.00	0.00	7.81	10.86	13.41	20.75	26.59	35.17	70.64
	1:30:00	0.00	0.00	7.22	10.03	12.23	18.58	23.62	30.88	61.40
	1:35:00	0.00	0.00	6.73	9.34	11.31	16.52	20.84	26.94	53.54
	1:40:00	0.00	0.00	6.39	8.78	10.67	14.95	18.84	24.14	47.86
	1:45:00	0.00	0.00	6.15	8.28	10.14	13.79	17.33	22.04	43.25
	1:50:00	0.00	0.00	5.93	7.81	9.65	12.82	16.05	20.20	39.14
	1:55:00	0.00	0.00	5.58	7.36	9.14	11.93	14.86	18.52	35.38
	2:00:00	0.00	0.00	5.17	6.90	8.54	11.10	13.74	16.91	31.82
	2:05:00	0.00	0.00	4.64	6.21	7.65	9.96	12.26	14.99	27.87
	2:10:00	0.00	0.00	4.07	5.46	6.68	8.71	10.67	12.99	23.89
	2:15:00	0.00	0.00	3.54	4.73	5.74	7.50	9.12	11.08	20.07
	2:20:00	0.00	0.00	3.03	4.04	4.86	6.34	7.63	9.22	16.37
	2:25:00	0.00	0.00	2.56	3.40	4.04	5.24	6.23	7.44	12.83
	2:30:00	0.00	0.00	2.11	2.79	3.29	4.19	4.89	5.74	9.45
	2:35:00	0.00	0.00	1.69	2.23	2.62	3.22	3.66	4.16	6.51
	2:40:00	0.00	0.00	1.34	1.75	2.11	2.37	2.63	2.93	4.74
	2:45:00	0.00	0.00	1.09	1.43	1.75	1.80	2.01	2.17	3.55
	2:50:00	0.00	0.00	0.91	1.21	1.48	1.43	1.59	1.67	2.67
	2:55:00	0.00	0.00	0.77	1.02	1.24	1.16	1.28	1.30	2.00
	3:00:00	0.00	0.00	0.65	0.85	1.04	0.94	1.03	1.01	1.50
	3:05:00	0.00	0.00	0.55	0.71	0.87	0.77	0.84	0.79	1.11
	3:10:00	0.00	0.00	0.46	0.60	0.72	0.63	0.69	0.63	0.85
	3:15:00	0.00	0.00	0.38	0.50	0.60	0.51	0.56	0.50	0.68
	3:20:00	0.00	0.00	0.32	0.41	0.49	0.42	0.45	0.41	0.55
	3:25:00	0.00	0.00	0.26	0.33	0.39	0.34	0.36	0.33	0.44
	3:30:00	0.00	0.00	0.21	0.26	0.31	0.27	0.29	0.26	0.34
	3:35:00	0.00	0.00	0.16	0.21	0.24	0.21	0.22	0.20	0.25
	3:40:00	0.00	0.00	0.12	0.16	0.18	0.16	0.16	0.15	0.18
	3:45:00	0.00	0.00	0.09	0.11	0.13	0.11	0.12	0.10	0.12
	3:50:00	0.00	0.00	0.06	0.08	0.09	0.08	0.08	0.07	0.07
	3:55:00	0.00	0.00	0.04	0.05	0.06	0.05	0.04	0.04	0.03
	4:00:00	0.00	0.00	0.02	0.03	0.03	0.02	0.02	0.02	0.01
	4:05:00	0.00	0.00	0.01	0.02	0.01	0.01	0.01	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.01	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

SOUTH POND - FOREBAY A (West Side) CALCULATIONS

1) WQCV (inches) = $a(.91I^3 - 1.19I^2 + .78I)$

I = impervious percentage = 49%

a = Coefficient corresponding to WQCV drain time = 1 (40 hours)

WQCV (inches) = 0.20 inches

2) WQCV (ac-ft) = (WQCV (inches))/12 x A

Area = tributary area = 33.65 acres

WQCV (ac-ft) = 0.57

WQCV (cubic feet) = 24,797

3) Forebay Volume

Per Table EDB-4, Section T-5 of USDCM Volume 3 - Forebay Volume = 3% of WQCV and be 18" depth since watershed over 5 impervious acres

Forebay Volume = 3% of WQCV = 744 cubic feet

with pond depth at 2.0', Forebay Area = 372.0 sq-ft (minimum)

4) Forebay Discharge

Per Table EDB-4, Section T-5 of USDCM Volume 3 - Forebay Discharge = 2% of 100-yr Flow into pond

Q100 = 49.3 cfs

Forebay discharge = 0.99 cfs

SOUTH POND - FOREBAY B (North Side) CALCULATIONS

1) WQCV (inches) = $a(.91I^3 - 1.19I^2 + .78I)$

I = impervious percentage = 23%

a = Coefficient corresponding to WQCV drain time = 1 (40 hours)

WQCV (inches) = 0.13 inches

2) WQCV (ac-ft) = (WQCV (inches))/12 x A

Area = tributary area = 1.69 acres

WQCV (ac-ft) = 0.02

WQCV (cubic feet) = 778

3) Forebay Volume

Per Table EDB-4, Section T-5 of USDCM Volume 3 - Forebay Volume = 2% of WQCV and be 12" max depth since watershed between 1 and 2 impervious acres

Forebay Volume = 2% of WQCV = 16 cubic feet

with pond depth at 0.5', Forebay Area = 31.1 sq-ft (minimum)

4) Forebay Discharge

Per Table EDB-4, Section T-5 of USDCM Volume 3 - Forebay Discharge = 2% of 100-yr Flow into pond

Q100 = 8.1 cfs

Forebay discharge = 0.16 cfs

Rock Chute Design Data

(Version 4.02 - 11/04/09, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: *Falcon Meadows at Bent Grass Fil No. 1* **County:** *El Paso*
Designer: *Forebay B - Rock Chute* **Checked by:**
Date: 02/12/21 **Date:**

Input Channel Geometry

Inlet Channel	Chute	Outlet Channel
Bw = *1.0* ft.	Bw = *1.0* ft.	Bw = *1.0* ft.
Side slopes = *4.0* (m:1)	Factor of safety = *1.20* (F_s)	Side slopes = *4.0* (m:1)
n-value = *0.035*	Side slopes = *4.0* (m:1) → ***2.0:1 max.***	n-value = *0.013*
Bed slope = *0.0100* ft./ft.	Bed slope (13.1:1) = *0.077* ft./ft. → ***2.5:1 max.***	Bed slope = *0.0010* ft./ft.
Freeboard = *0.0* ft.	Outlet apron depth, d = *0.0* ft.	Base flow = *0.0* cfs

Design Storm Data (Table 2, NHCP, NRCS Grade Stabilization Structure No. 410)

Drainage area = *1.7* acres Rainfall = ◉ 0 - 3 in. ○ 3 - 5 in. ○ 5+ in.

Apron elev. --- Inlet = *6926.3* ft. --- Outlet = *6924.3* ft. --- (H_{drop} = 2 ft.)

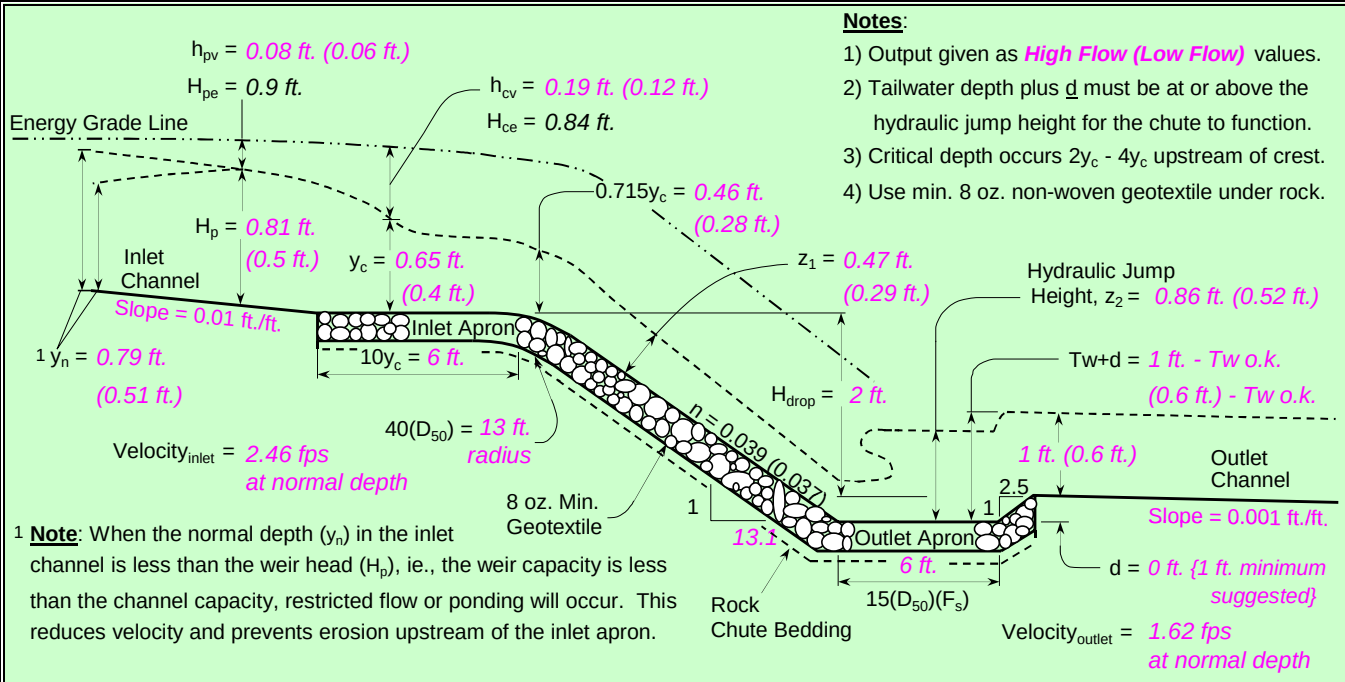
Chute capacity = Q5-year
Total capacity = Q10-year
Minimum capacity (based on a 5-year, 24-hour storm with a 0 - 3 inch rainfall)

Q_{high} = *8.1* cfs High flow storm through chute → Tw (ft.) = *1.00*

Q_{low} = *2.9* cfs Low flow storm through chute → Tw (ft.) = *0.60*

***Note**: The total required capacity is routed through the chute (principal spillway) or in combination with an auxiliary spillway.*
***Input tailwater (Tw)**:*

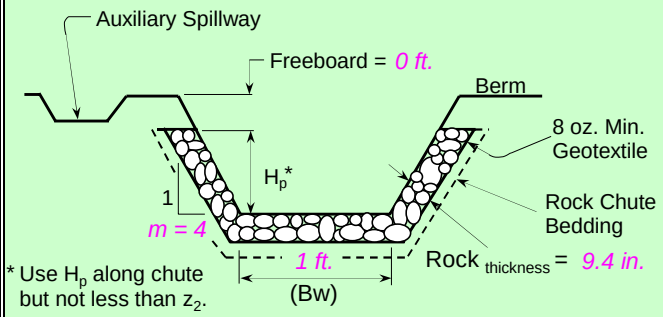
Profile and Cross Section (Output)



Notes:
1) Output given as ***High Flow (Low Flow)*** values.
2) Tailwater depth plus d must be at or above the hydraulic jump height for the chute to function.
3) Critical depth occurs 2y_c - 4y_c upstream of crest.
4) Use min. 8 oz. non-woven geotextile under rock.

[1] **Note**: When the normal depth (y_n) in the inlet channel is less than the weir head (H_p), ie., the weir capacity is less than the channel capacity, restricted flow or ponding will occur. This reduces velocity and prevents erosion upstream of the inlet apron.

Profile Along Centerline of Chute



* Use H_p along chute but not less than z_2.

Typical Cross Section

q_t =	*2.96 cfs/ft.*	Equivalent unit discharge
F_S =	*1.20*	Factor of safety (multiplier)
z_1 =	*0.47 ft.*	Normal depth in chute
n-value =	*0.039*	Manning's roughness coefficient
D_{50}(F_s) =	*4.7 in. (8 lbs. - 50% round / 50% angular)*	
2(D_{50})(F_s) =	*9.4 in.*	Rock chute thickness
Tw + d =	*1 ft.*	Tailwater above outlet apron
z_2 =	*0.86 ft.*	Hydraulic jump height
****** The outlet***	***will***	***function adequately***

High Flow Storm Information

SOUTH POND - FOREBAY C (South Side) CALCULATIONS

1) WQCV (inches) = $a(.91I^3 - 1.19I^2 + .78I)$

I = impervious percentage = 13%

a = Coefficient corresponding to WQCV drain time = 1 (40 hours)

WQCV (inches) = 0.08 inches

2) WQCV (ac-ft) = (WQCV (inches))/12 x A

Area = tributary area = 33.18 acres

WQCV (ac-ft) = 0.23

WQCV (cubic feet) = 9,907

3) Forebay Volume

Per Table EDB-4, Section T-5 of USDCM Volume 3 - Forebay Volume = 3% of WQCV and be 18" max depth since watershed over 5 impervious acres

Forebay Volume = 3% of WQCV = 297 cubic feet

with pond depth at 1.5', Forebay Area = 198.1 sq-ft (minimum)

4) Forebay Discharge

Per Table EDB-4, Section T-5 of USDCM Volume 3 - Forebay Discharge = 2% of 100-yr Flow into pond

Q100 = 52.4 cfs

Forebay discharge = 1.05 cfs

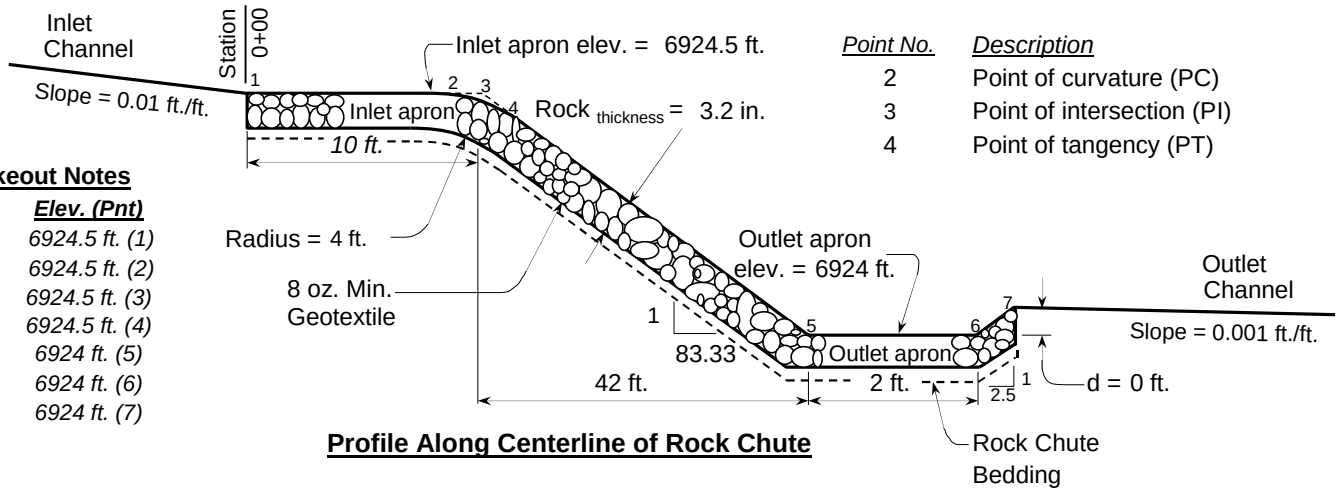
Design Values			Rock Gradation Envelope			Quantities[a]		
Angular D_{50} dia. =	1.6	in.	% Passing		Diameter, in. (weight, lbs.)	**Angular** Rock =	10	yd^3
$Rock_{chute}$ thickness =	3.2	in.	D_{100}	---------	2 - 3 (1 - 2)	Geotextile (8 oz.)[b] =	116	yd^2
Inlet apron length =	10	ft.	D_{85}	---------	2 - 3 (1 - 2)	Bedding (6 in.) =	22	yd^3
Outlet apron length =	2	ft.	D_{50}	---------	2 - 2 (0 - 1)	Excavation =	0	yd^3
Radius =	4	ft.	D_{10}	---------	1 - 2 (0 - 1)	Earthfill =	0	yd^3
Will bedding be used?	Yes		*Coefficient of Uniformity, $(D_{60})/(D_{10}) \leq 2.0$*			Seeding =	0.0	acres

Notes: [a] *Rock, bedding, and geotextile quantities are determined from x-section below (neglect radius).*
[b] *Geotextile shall be overlapped (18-in. minimum) and anchored (18-in. minimum along sides and 24-in. minimum on the ends) --- quantity not included.*

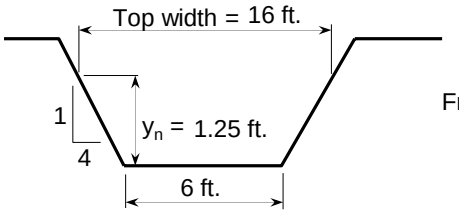
Point No.	Description
2	Point of curvature (PC)
3	Point of intersection (PI)
4	Point of tangency (PT)

Stakeout Notes

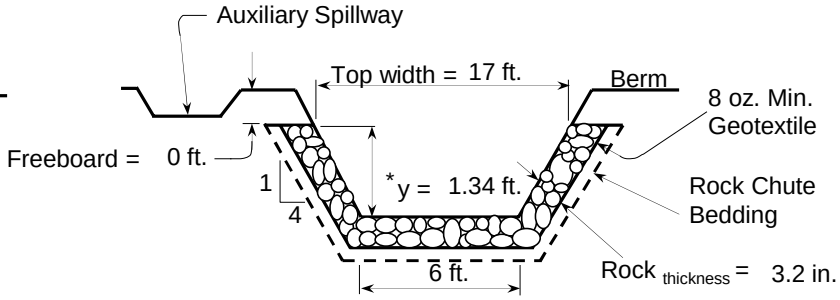
Sta.	Elev. (Pnt)
0+00	6924.5 ft. (1)
0+10	6924.5 ft. (2)
0+10	6924.5 ft. (3)
0+10	6924.5 ft. (4)
0+52	6924 ft. (5)
0+54	6924 ft. (6)
0+54	6924 ft. (7)



Profile Along Centerline of Rock Chute

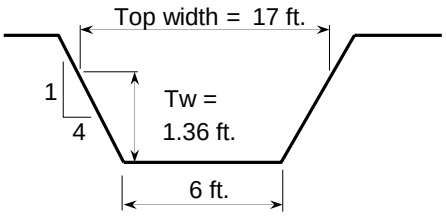


Inlet Channel Cross Section



Rock Chute Cross Section

* Use H_p throughout chute but not less than z_2.



Outlet Channel Cross Section

Profile, Cross Sections, and Quantities

Project: Falcon Meadows at Bent Grass Fil No. 1
Location: El Paso County

U.S. Department of Agriculture
Natural Resources Conservation Service

Designed: Forebay C - Riprap	Approved by:	
Drawn: NRCS Standard Dwg.	Title:	
Traced:	Sheet No.	Drawing No.
Checked:	of	

POND RIPRAP EMBANKMENT SIZING

Subdivision: Bent Grass
Location: El Paso County

Project Name: Bent Grass Filing No. 3
Project No.: CLH000018
Calculated By: CMD
Checked By: CD
Date: 8/6/20

Pond	Riprap Type	D50*	Slope, S	Concentration Factor	Unit discharge	Spillway Flow***	Spillway Width
		(in)	(ft/ft)	(1.0 to 3.0)	(cfs/ft)**	(cfs)	(ft)
South Pond	M	9.6	25.00%	2	3.19	79.8	25

*From DCM Chapter 13 Eqn 13-9
** Spillway Flow/Spillway Width
***Peak Inflow Q100

Design Procedure Form: Extended Detention Basin (EDB)

Designer:
Company: Galloway
Date: July 8, 2021
Project: Falcon Meadows at Bent Grass Filing No. 1
Location: WQCV - South Pond

6. Trickle Channel	
A) Type of Trickle Channel	Choose One: (●) Concrete ( ) Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 25 sq ft
C) Outlet Type	Choose One: (●) Orifice Plate ( ) Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 1.75 inches
E) Total Outlet Area	A_{ot} = 7.23 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 116 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 8.4 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 236 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*
Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 332 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 3.41 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 68.92 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

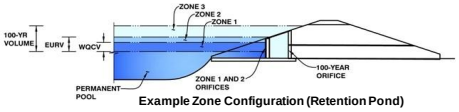
Future Pond (North) Analysis

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: Falcon Meadows at Bent Grass

Basin ID: WQCV Pond - North (Future)



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	13.58	acres
Watershed Length =	1,275	ft
Watershed Length to Centroid =	750	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	63.10%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	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) =	0.280	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.055	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.000	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.000	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.000	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.000	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.000	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.000	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	0.000	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	0.685	acre-feet		
Approximate 5-yr Detention Volume =	0.896	acre-feet		
Approximate 10-yr Detention Volume =	1.082	acre-feet		
Approximate 25-yr Detention Volume =	1.304	acre-feet		
Approximate 50-yr Detention Volume =	1.439	acre-feet		
Approximate 100-yr Detention Volume =	1.582	acre-feet		

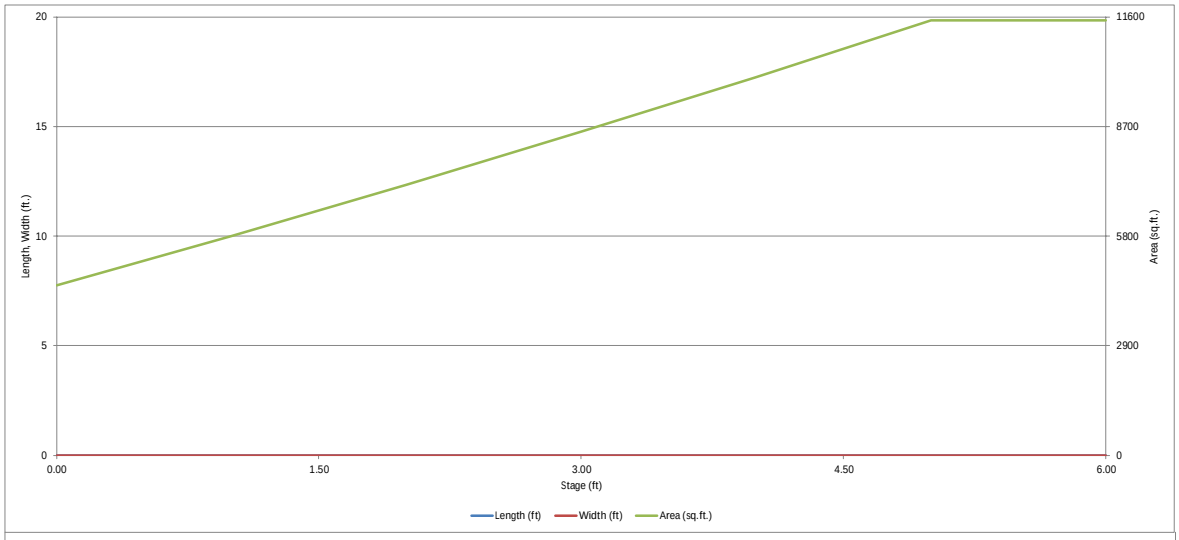
Define Zones and Basin Geometry

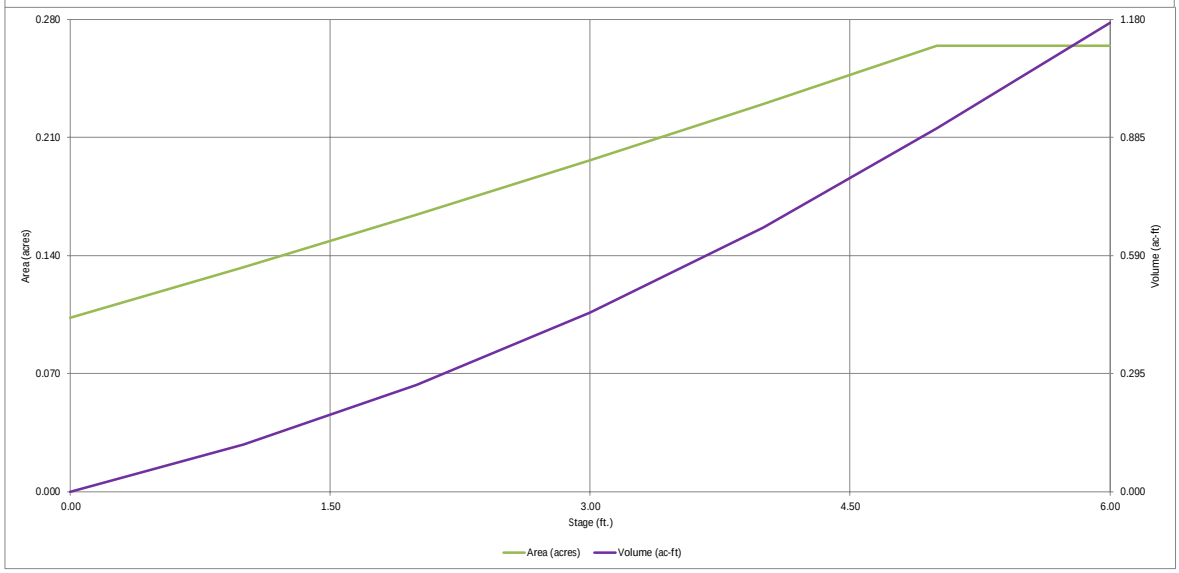
Zone 1 Volume (WQCV) =	0.280	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.280	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention 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

Total detention volume is less than 100-year volume.

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	4,501	0.103		
6943	--	1.00	--	--	--	5,796	0.133	5,148	0.118
6944	--	2.00	--	--	--	7,155	0.164	11,624	0.267
6945	--	3.00	--	--	--	8,560	0.197	19,481	0.447
6946	--	4.00	--	--	--	10,011	0.230	28,767	0.660
6947	--	5.00	--	--	--	11,524	0.265	39,534	0.908
6948	--	6.00	--	--	--	11,524	0.265	51,058	1.172


20
15
10
5
0
Length, Width (ft.)
11600
8700
5800
2900
0
Area (sq.ft.)
0.00
1.50
3.00
4.50
6.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

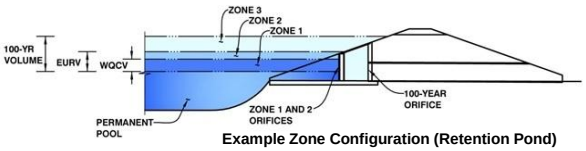

0.280
0.210
0.140
0.070
0.000
Area (acres)
1.180
0.885
0.590
0.295
0.000
Volume (ac-ft)
0.00
1.50
3.00
4.50
6.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Falcon Meadows at Bent Grass

Basin ID: WQCV Pond - North (Future)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.08	0.280	Orifice Plate
Zone 2			
Zone 3			
Total (all zones)		0.280	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.332E-02	ft^2
Depth at top of Zone using Orifice Plate =	1.94	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	9.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.92	sq. inches (diameter = 1-9/16 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.80	1.60					
Orifice Area (sq. inches)	1.92	1.92	1.92					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.50		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.50		feet
Overflow Weir Front Edge Length =	6.00		feet	Overflow Weir Slope Length =	3.00		feet
Overflow Weir Grate Slope =	0.00		H:V	Grate Open Area / 100-yr Orifice Area =	7.13		
Horiz. Length of Weir Sides =	3.00		feet	Overflow Grate Open Area w/o Debris =	12.60		ft^2
Overflow Grate Open Area % =	70%		%, grate open area/total area	Overflow Grate Open Area w/ Debris =	6.30		ft^2
Debris Clogging % =	50%		%				

Calculated Parameters for Overflow Weir

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

	Not Selected	Not Selected			Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	2.50		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	1.77		ft^2
Circular Orifice Diameter =	18.00		inches	Outlet Orifice Centroid =	0.75		feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.60	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.37	feet
Spillway Crest Length =	50.00	feet	Stage at Top of Freeboard =	5.97	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.26	acres
Freeboard above Max Water Surface =	0.00	feet	Basin Volume at Top of Freeboard =	1.16	acre-ft

Calculated Parameters for Spillway

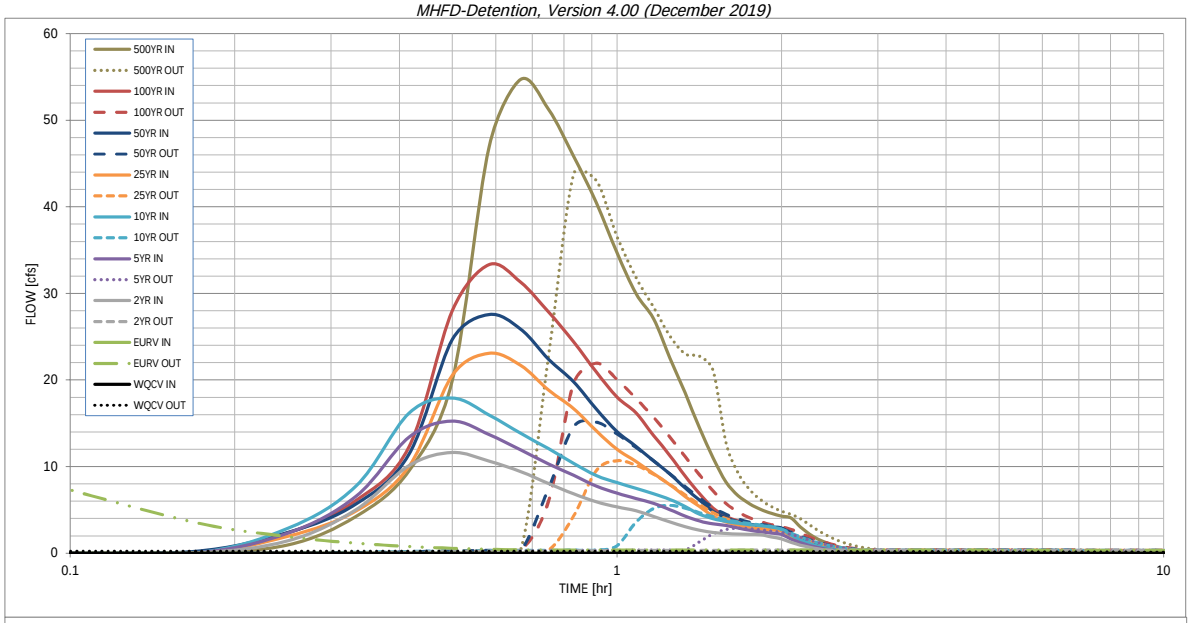
Routed Hydrograph Results

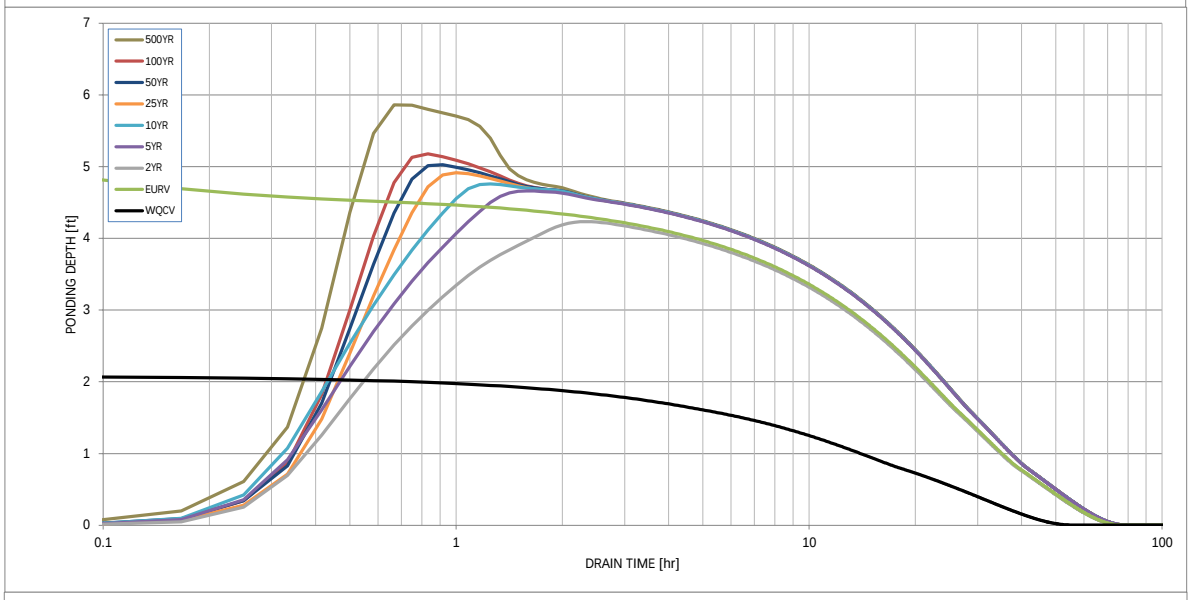
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

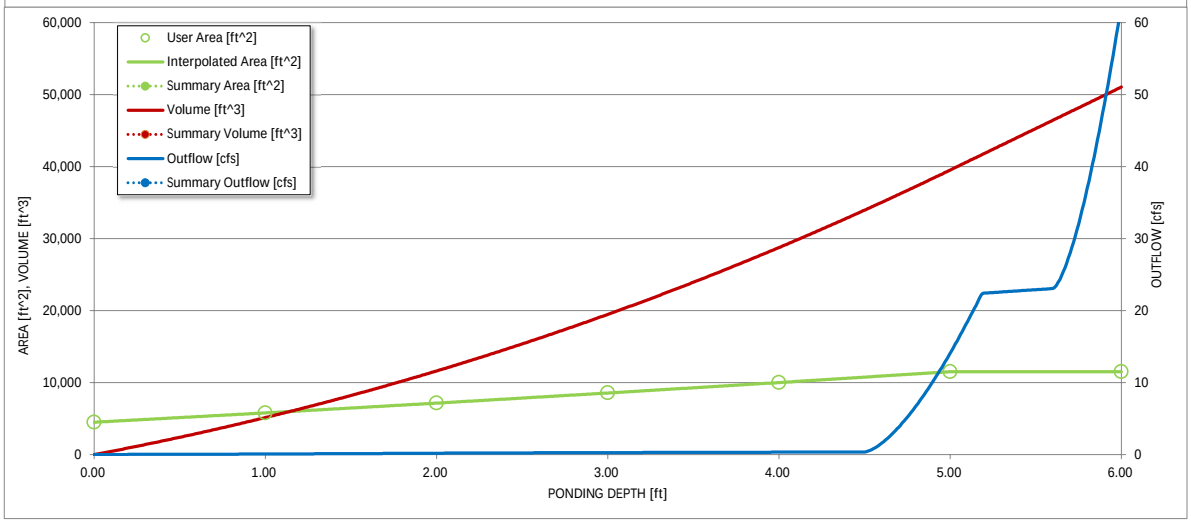
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.68
CUHP Runoff Volume (acre-ft) =	0.280	1.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.770	1.012	1.205	1.462	1.715	2.024	3.313
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peak Inflow Q (cfs) =	N/A	N/A	11.6	15.2	17.9	23.1	27.6	33.3	54.7
Peak Outflow Q (cfs) =	0.2	22.5	0.4	2.9	5.5	10.7	15.1	21.9	43.8
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Structure Controlling Flow =	Plate	Outlet Plate 1	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	1.79	N/A	0.2	0.4	0.8	1.2	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) =	44	56	58	58	56	53	51	49	40
Time to Drain 99% of Inflow Volume (hours) =	49	65	66	67	66	64	63	62	57
Maximum Ponding Depth (ft) =	2.08	5.56	4.23	4.66	4.76	4.91	5.02	5.18	5.86
Area at Maximum Ponding Depth (acres) =	0.17	0.26	0.24	0.25	0.26	0.26	0.26	0.26	0.26
Maximum Volume Stored (acre-ft) =	0.280	1.056	0.714	0.820	0.843	0.884	0.913	0.953	1.135

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.02	0.96
	0:15:00	0.00	0.00	1.42	2.32	2.87	1.93	2.41	2.35	4.25
	0:20:00	0.00	0.00	5.03	6.58	7.73	4.87	5.67	6.09	9.52
	0:25:00	0.00	0.00	10.13	13.40	16.17	10.03	11.44	12.30	19.93
	0:30:00	0.00	0.00	11.63	15.25	17.92	20.54	24.66	27.99	46.90
	0:35:00	0.00	0.00	10.62	13.70	15.96	23.07	27.57	33.33	54.71
	0:40:00	0.00	0.00	9.42	11.91	13.84	21.67	25.86	31.28	51.24
	0:45:00	0.00	0.00	8.04	10.31	12.06	18.83	22.39	27.84	45.85
	0:50:00	0.00	0.00	6.85	8.99	10.36	16.71	19.80	24.42	40.50
	0:55:00	0.00	0.00	5.93	7.74	8.98	14.13	16.65	20.93	34.69
	1:00:00	0.00	0.00	5.34	6.93	8.14	11.99	14.03	18.04	29.99
	1:05:00	0.00	0.00	4.89	6.32	7.49	10.59	12.34	16.19	27.07
	1:10:00	0.00	0.00	4.23	5.75	6.85	9.17	10.65	13.59	22.51
	1:15:00	0.00	0.00	3.61	5.03	6.21	7.91	9.14	11.27	18.48
	1:20:00	0.00	0.00	3.06	4.28	5.38	6.54	7.52	8.90	14.45
	1:25:00	0.00	0.00	2.63	3.70	4.50	5.37	6.13	6.87	11.00
	1:30:00	0.00	0.00	2.39	3.38	3.97	4.27	4.83	5.21	8.23
	1:35:00	0.00	0.00	2.27	3.21	3.66	3.62	4.08	4.25	6.64
	1:40:00	0.00	0.00	2.20	2.89	3.45	3.22	3.63	3.70	5.69
	1:45:00	0.00	0.00	2.16	2.64	3.29	2.97	3.34	3.32	5.04
	1:50:00	0.00	0.00	2.13	2.46	3.18	2.79	3.14	3.07	4.59
	1:55:00	0.00	0.00	1.87	2.32	3.02	2.67	3.00	2.89	4.28
	2:00:00	0.00	0.00	1.65	2.15	2.76	2.59	2.91	2.76	4.05
	2:05:00	0.00	0.00	1.25	1.63	2.08	1.96	2.20	2.07	3.02
	2:10:00	0.00	0.00	0.93	1.20	1.53	1.44	1.62	1.52	2.22
	2:15:00	0.00	0.00	0.68	0.89	1.12	1.06	1.19	1.12	1.63
	2:20:00	0.00	0.00	0.50	0.64	0.82	0.77	0.87	0.83	1.20
	2:25:00	0.00	0.00	0.36	0.45	0.58	0.55	0.62	0.59	0.86
	2:30:00	0.00	0.00	0.25	0.32	0.41	0.39	0.44	0.42	0.60
	2:35:00	0.00	0.00	0.17	0.22	0.29	0.28	0.31	0.30	0.43
	2:40:00	0.00	0.00	0.11	0.15	0.19	0.19	0.21	0.20	0.28
	2:45:00	0.00	0.00	0.06	0.09	0.11	0.11	0.13	0.12	0.17
	2:50:00	0.00	0.00	0.03	0.05	0.05	0.06	0.06	0.06	0.08
	2:55:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	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.

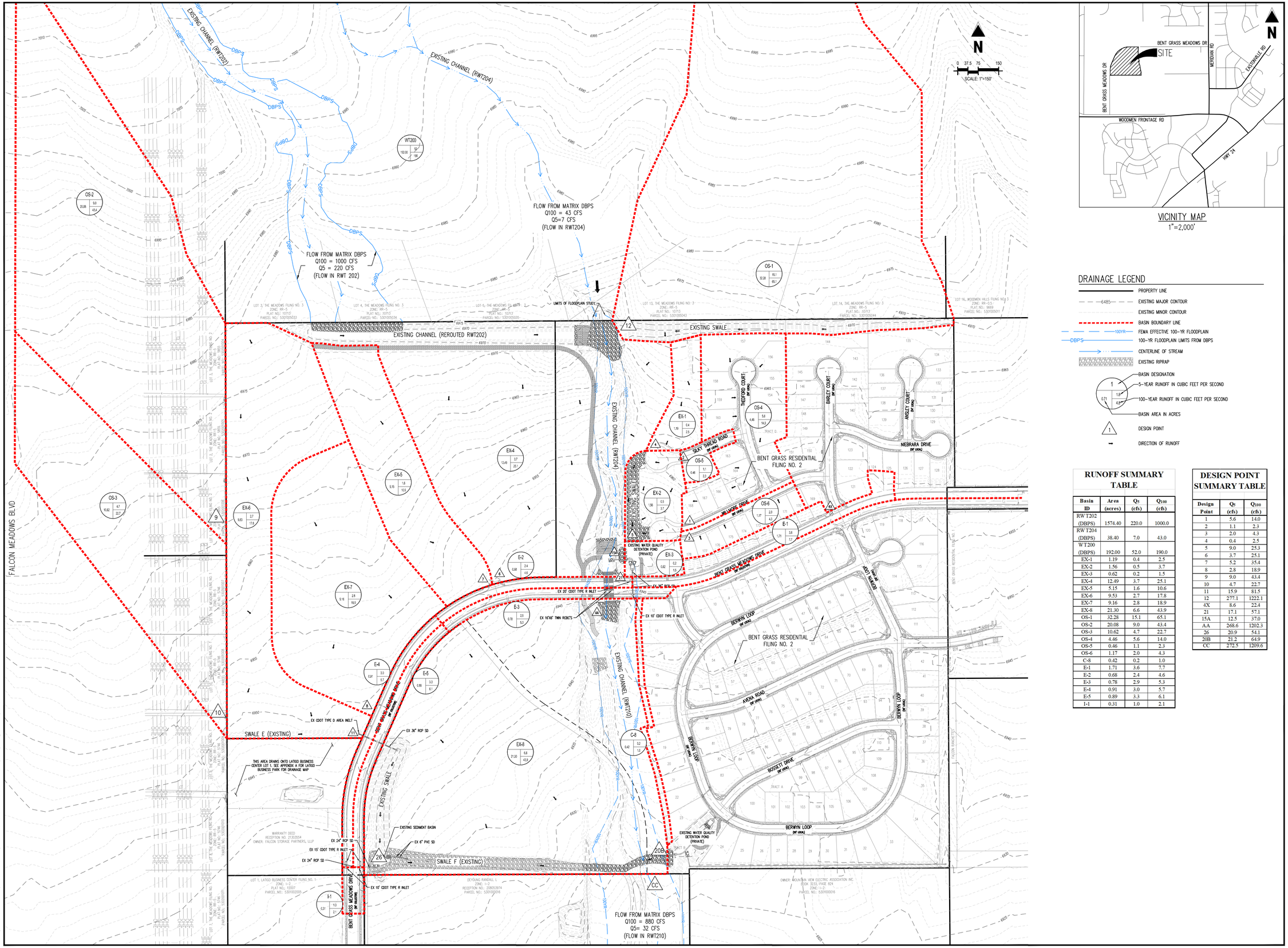
Stage - Storage Description	Stage [ft]	Area [ft ^{2}]	Area [acres]	Volume [ft ^{3}]	Volume [ac-ft]	Total Outflow [cfs]

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).

APPENDIX E

Drainage Maps



VICINITY MAP
1"=2,000'

DRAINAGE LEGEND

- PROPERTY LINE
- 6485 EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- BASIN BOUNDARY LINE
- 100YR FEMA EFFECTIVE 100-YR FLOODPLAIN
- DBPS 100-YR FLOODPLAIN LIMITS FROM DBPS
- CENTERLINE OF STREAM
- EXISTING RIPRAP
- BASIN DESIGNATION
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DESIGN POINT
- DIRECTION OF RUNOFF

RUNOFF SUMMARY TABLE

Basin ID	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
RWT202 (DBPS)	1574.40	220.0	1000.0
RWT204 (DBPS)	38.40	7.0	43.0
WT200 (DBPS)	192.00	52.0	190.0
EX-1	1.19	0.4	2.5
EX-2	1.56	0.5	3.7
EX-3	0.62	0.2	1.5
EX-4	12.49	3.7	25.1
EX-5	5.15	1.6	10.6
EX-6	9.53	2.7	17.8
EX-7	9.16	2.8	18.9
EX-8	21.30	6.6	43.9
OS-1	32.28	15.1	65.1
OS-2	20.08	9.0	43.4
OS-3	10.62	4.7	22.7
OS-4	4.46	5.6	14.0
OS-5	0.46	1.1	2.3
OS-6	1.17	2.0	4.3
C-8	0.42	0.2	1.0
E-1	1.71	3.6	7.7
E-2	0.68	2.4	4.6
E-3	0.78	2.9	5.3
E-4	0.91	3.0	5.7
E-5	0.89	3.3	6.1
I-1	0.31	1.0	2.1

DESIGN POINT SUMMARY TABLE

Design Point	Q_5 (cfs)	Q_{100} (cfs)
1	5.6	14.0
2	1.1	2.3
3	2.0	4.3
4	0.4	2.5
5	9.0	25.3
6	3.7	25.1
7	5.2	35.4
8	2.8	18.9
9	9.0	43.4
10	4.7	22.7
11	15.9	81.5
12	277.1	1222.1
4X	8.6	22.4
21	17.1	57.1
15A	12.5	37.0
AA	268.6	1202.3
26	20.9	54.1
20B	21.2	64.9
CC	272.5	1209.6

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CHALLENGER HOMES

FINAL DRAINAGE REPORT
FALCON MEADOWS AT BENT GRASS FILING NO. 1
FOR
CHALLENGER COMMUNTIES, LLC

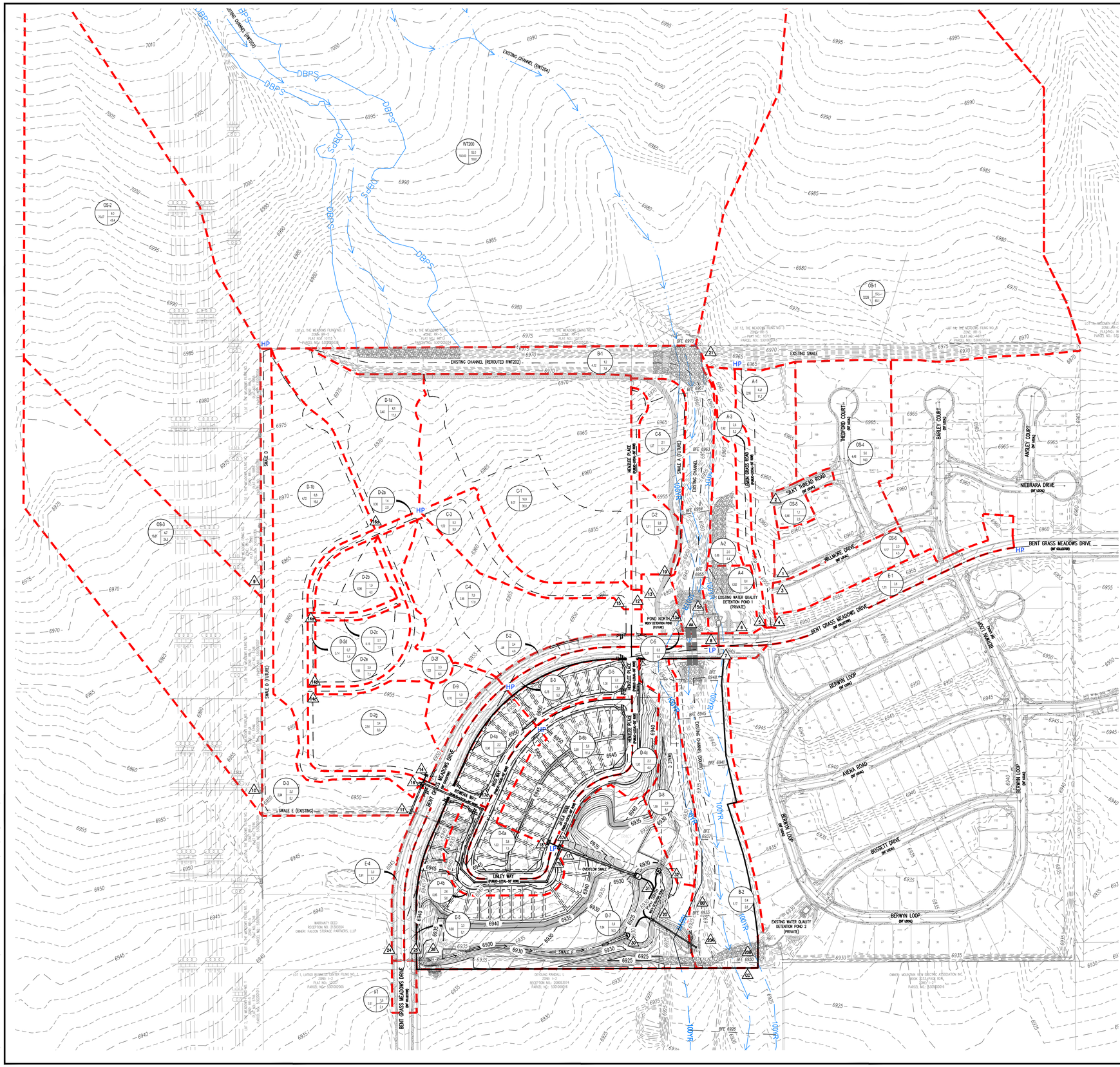
BENT GRASS MEADOWS DRIVE
FALCON, CO 80831 - EL PASO COUNTY

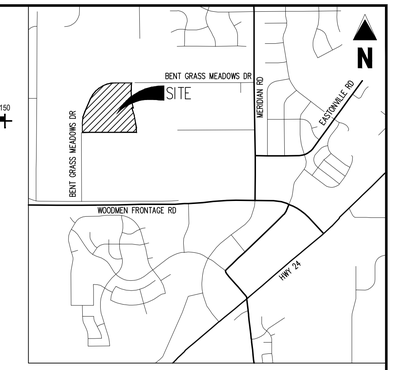
#	Date	Issue / Description	Init.

Project No:	CLH000017
Drawn By:	CMWJ
Checked By:	RGD
Date:	08/05/2020

EXISTING DRAINAGE MAP

DR-1





VICINITY MAP
1"=2,000'

DRAINAGE LEGEND

- PROPERTY LINE
- 6480 — EXISTING MAJOR CONTOUR
- 6482 — EXISTING MINOR CONTOUR
- 6480 — PROPOSED MAJOR CONTOUR
- 6482 — PROPOSED MINOR CONTOUR
- BASIN BOUNDARY LINE
- DRAINAGE TRAVEL PATH
- 100YR — FEMA EFFECTIVE 100-YR FLOODPLAIN
- DBPS — 100-YR FLOODPLAIN PER MATRIX DBPS
- CENTERLINE OF STREAM
- BFE 6978 — BASE FLOOD ELEVATION (BFE's)
- EXISTING RIPRAP
- EXISTING ACCESS
- PROPOSED RIPRAP
- PROPOSED ACCESS
- BASIN DESIGNATION
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DESIGN POINT
- DIRECTION OF RUNOFF

BFE CONVERSION NOTE:
The Base Flood Elevations (BFE) *taken from the FEMA FIRM map 08041C0553G*, and as shown on this plan, are in NAVD 88 Datum. The existing topography used for design of this project are in NGVD 29 Datum. To convert the BFE elevations to NGVD 29, subtract 3.280 ft (tolerance is +/- 0.164 ft).

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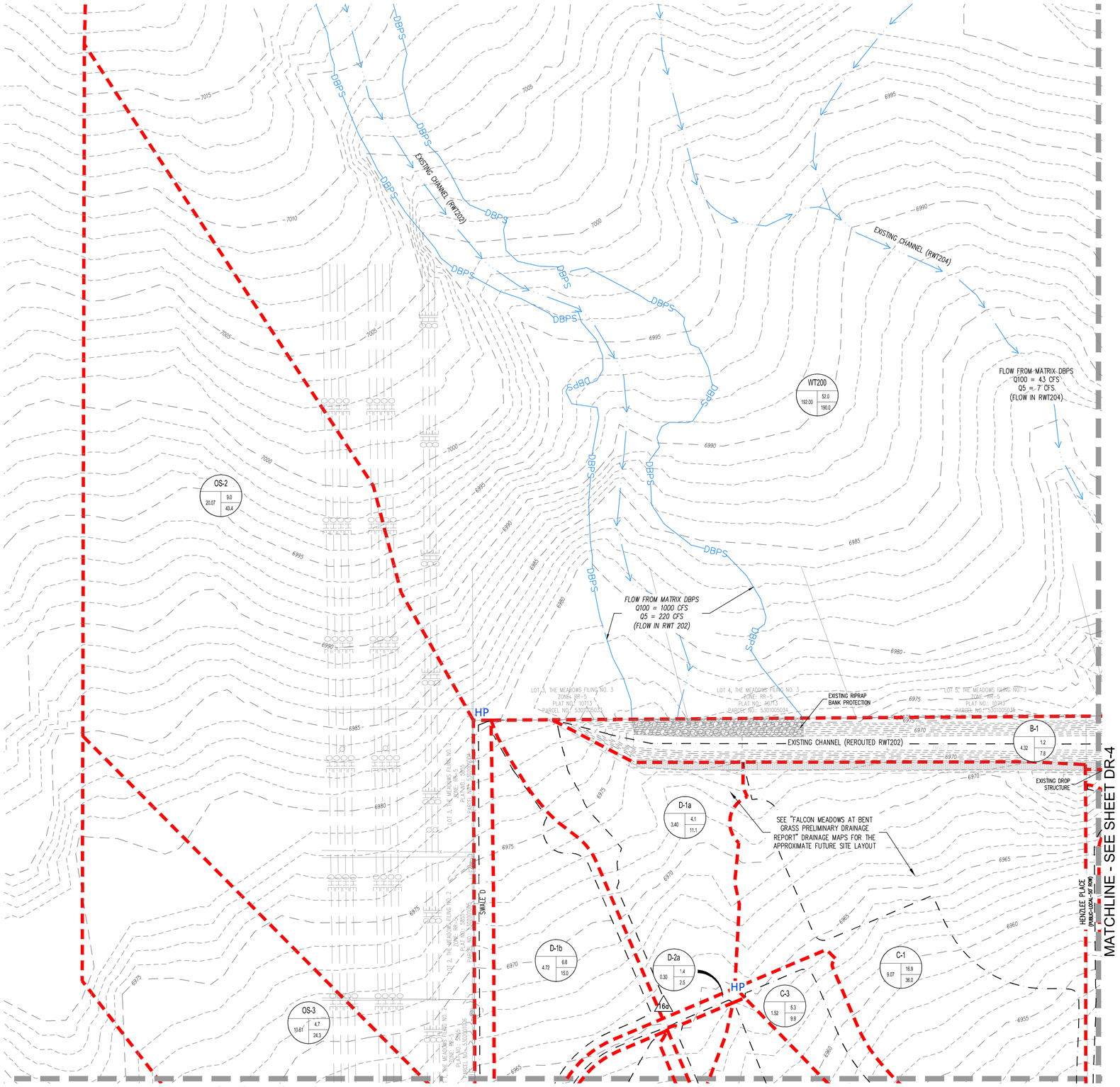
FALCON, CO 80831 - EL PASO COUNTY

#	Date	Issue / Description	Init.

Project No:	CLH000017
Drawn By:	CMWJ
Checked By:	RGD
Date:	08/05/2020

PROPOSED DRAINAGE MAP

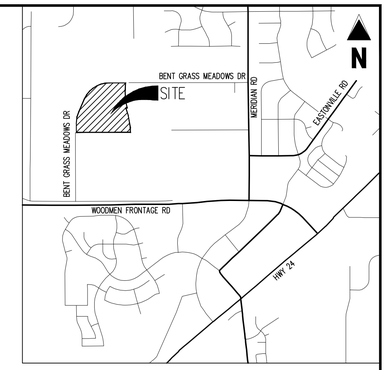
DR-2



N

0 25 50 100

SCALE: 1"=100'



VICINITY MAP

1"=2,000'

DRAINAGE LEGEND

- PROPERTY LINE
- 6480 — EXISTING MAJOR CONTOUR
- 6482 — EXISTING MINOR CONTOUR
- 6480 — PROPOSED MAJOR CONTOUR
- 6482 — PROPOSED MINOR CONTOUR
- BASIN BOUNDARY LINE
- DRAINAGE TRAVEL PATH
- 100YR — FEMA EFFECTIVE 100-YR FLOODPLAIN
- DBPS — 100-YR FLOODPLAIN PER MATRIX DBPS
- CENTERLINE OF STREAM
- EXISTING RIPRAP
- EXISTING ACCESS
- PROPOSED RIPRAP
- PROPOSED ACCESS
- 1 — BASIN DESIGNATION
- 1.8 — 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 4.6 — 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 0.71 — BASIN AREA IN ACRES
- 1 — DESIGN POINT
- DIRECTION OF RUNOFF

RUNOFF SUMMARY TABLE

Basin ID	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
RWT202	1574.40	220.0	1000.0
RWT204	38.40	7.0	43.0
WT200	192.00	52.0	190.0
A-1	2.16	4.9	11.7
A-2	0.86	2.0	4.4
A-3	0.92	2.6	5.2
A-4	0.82	0.4	2.6
B-1	4.32	1.2	7.8
B-2	1.17	0.4	2.5
C-1	9.07	16.9	36.0
C-2	1.11	2.8	6.2
C-3	1.52	5.3	9.9
C-4	3.99	6.6	17.4
C-5	0.51	0.3	1.6
C-6	1.37	2.1	5.1
D-1a	3.40	4.1	11.1
D-1b	4.72	6.8	15.0
D-2a	0.30	1.4	2.5
D-2b	0.99	1.9	4.1
D-2c	0.16	0.7	1.3
D-2d	0.14	0.7	1.1
D-2e	1.56	3.6	7.1
D-2f	1.03	3.3	6.1
D-2g	2.54	3.4	8.0
D-3	2.94	2.0	5.1
D-4a	0.98	2.2	4.6
D-4b	0.96	2.6	5.0
D-4c	1.00	2.3	4.5
D-5	1.08	2.2	4.6
D-6a	1.33	3.8	7.5
D-6b	2.69	5.6	11.4
D-7	7.84	3.6	16.3
D-8	1.69	1.3	4.5
D-9	0.70	1.0	3.0
OS-1	32.28	15.1	65.1
OS-2	20.07	9.0	43.4
OS-3	10.61	4.7	24.3
OS-4	4.46	5.6	14.0
OS-5	0.46	1.1	2.3
OS-6	1.17	2.0	4.3
E-1	1.71	3.6	7.7
E-2	0.68	2.4	4.6
E-3	0.78	2.9	5.3
E-4	0.91	3.0	5.7
E-5	0.89	3.3	6.1
I-1	0.31	1.0	2.1

DESIGN POINT SUMMARY TABLE

Design Point	Q_5 (cfs)	Q_{100} (cfs)
21	277.8	1226.8
1	5.8	15.0
2	5.3	13.9
3	7.5	18.7
4	11.1	27.7
5	3.6	16.5
6	13.9	41.2
7	2.9	5.5
8	15.8	54.4
9	8.6	42.8
10	4.5	22.2
11	13.8	64.5
12	2.8	6.5
13	23.5	52.1
13A	3.3	22.4
14a	3.4	7.1
14b	6.9	14.2
14c	9.6	19.5
14	5.9	16.2
15	20.1	43.7
16a	4.0	11.2
16	8.3	20.4
17a	1.6	3.4
17b	3.0	6.2
17c	1.8	3.7
17	4.6	9.5
18	8.0	17.0
19	2.0	5.2
15A	12.2	37.0
AA	273.2	1200.4
BB	271.8	1194.7
30	12.9	55.7
31	17.0	40.8
32	1.2	4.5
24	4.5	21.8
25	3.3	7.8
26	6.1	25.6
20	26.1	79.8
20A	10.7	47.1
20B	21.3	66.0
CC	271.7	1186.3

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FINAL DRAINAGE REPORT
FALCON MEADOWS AT BENT GRASS FILING NO. 1
FOR
CHALLENGER COMMUNITIES, LLC

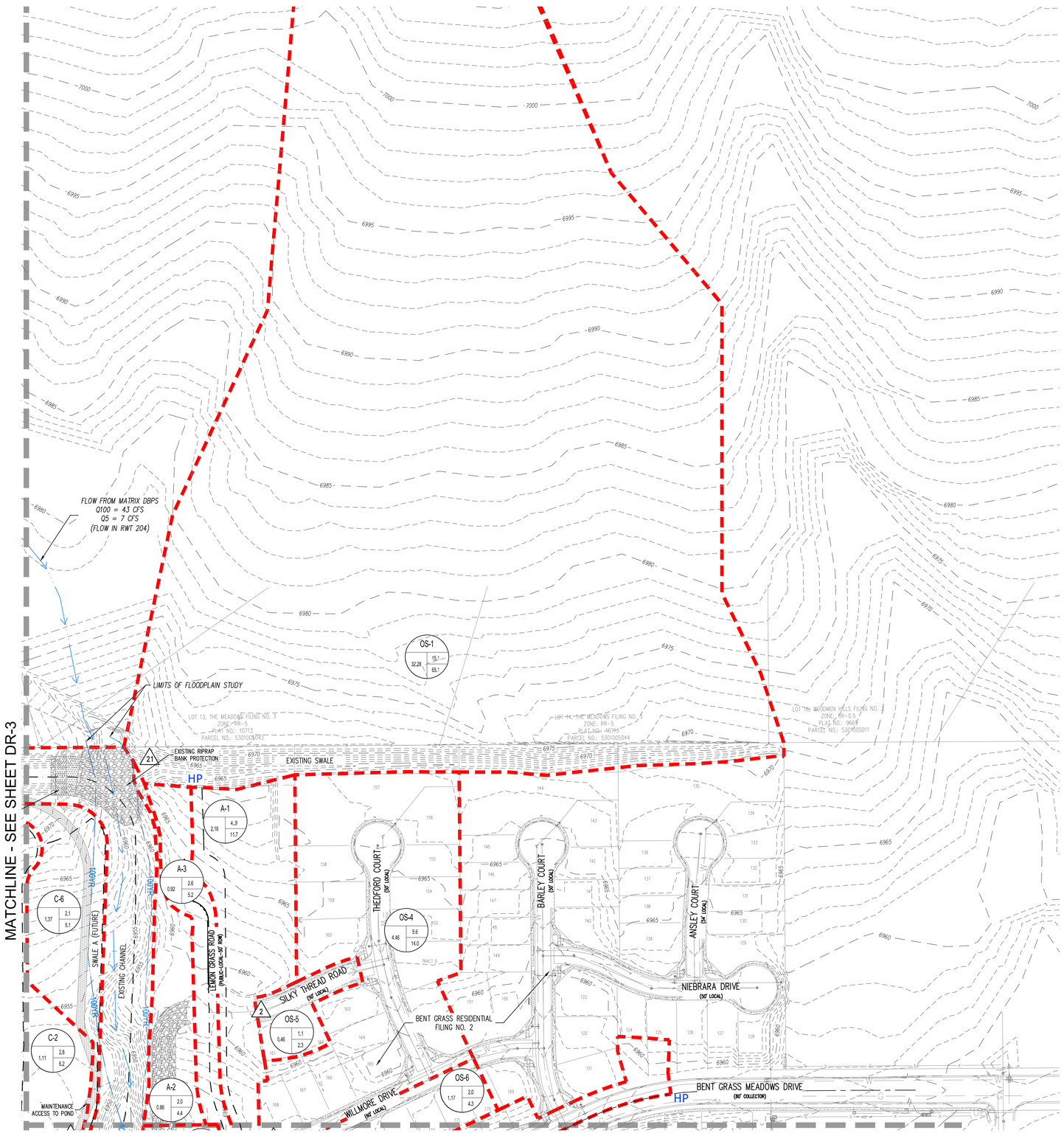
BENT GRASS MEADOWS DRIVE
FALCON, CO 80831 - EL PASO COUNTY

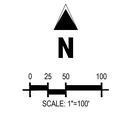
#	Date	Issue / Description	Init.

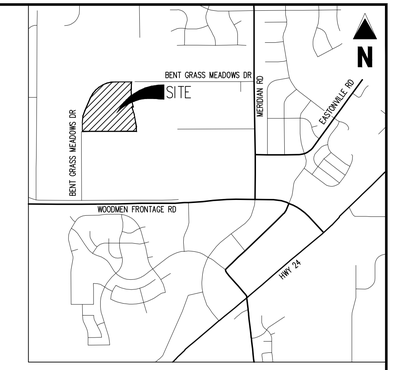
Project No:	CLH000017
Drawn By:	CMWJ
Checked By:	RGD
Date:	08/05/2020

PROPOSED DRAINAGE MAP

DR-3







VICINITY MAP
1"=2,000'

DRAINAGE LEGEND

- PROPERTY LINE
- 6480 — EXISTING MAJOR CONTOUR
- 6482 — EXISTING MINOR CONTOUR
- 6480 — PROPOSED MAJOR CONTOUR
- 6482 — PROPOSED MINOR CONTOUR
- BASIN BOUNDARY LINE
- DRAINAGE TRAVEL PATH
- 100YR — FEMA EFFECTIVE 100-YR FLOODPLAIN
- DBPS — 100-YR FLOODPLAIN PER MATRIX DBPS
- CENTERLINE OF STREAM
- EXISTING RIPRAP
- EXISTING ACCESS
- PROPOSED RIPRAP
- PROPOSED ACCESS
- BASIN DESIGNATION (1)
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND (1.9)
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND (4.6)
- BASIN AREA IN ACRES (0.71)
- DESIGN POINT (1)
- DIRECTION OF RUNOFF

RUNOFF SUMMARY TABLE

Basin ID	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
RWT202	1574.40	220.0	1000.0
RWT204	38.40	7.0	43.0
WT200	192.00	52.0	190.0
A-1	2.16	4.9	11.7
A-2	0.86	2.0	4.4
A-3	0.92	2.6	5.2
A-4	0.82	0.4	2.6
B-1	4.32	1.2	7.8
B-2	1.17	0.4	2.5
C-1	9.07	16.9	36.0
C-2	1.11	2.8	6.2
C-3	1.52	5.3	9.9
C-4	3.99	6.6	17.4
C-5	0.51	0.3	1.6
C-6	1.37	2.1	5.1
D-1a	3.40	4.1	11.1
D-1b	4.72	6.8	15.0
D-2a	0.30	1.4	2.5
D-2b	0.99	1.9	4.1
D-2c	0.16	0.7	1.3
D-2d	0.14	0.7	1.1
D-2e	1.56	3.6	7.1
D-2f	1.03	3.3	6.1
D-2g	2.54	3.4	8.0
D-3	2.94	2.0	5.1
D-4a	0.98	2.2	4.6
D-4b	0.96	2.6	5.0
D-4c	1.00	2.3	4.5
D-5	1.08	2.2	4.6
D-6a	1.33	3.8	7.5
D-6b	2.69	5.6	11.4
D-7	7.84	3.6	16.3
D-8	1.69	1.3	4.5
D-9	0.70	1.0	3.0
OS-1	32.28	15.1	65.1
OS-2	20.07	9.0	43.4
OS-3	10.61	4.7	24.3
OS-4	4.46	5.6	14.0
OS-5	0.46	1.1	2.3
OS-6	1.17	2.0	4.3
E-1	1.71	3.6	7.7
E-2	0.68	2.4	4.6
E-3	0.78	2.9	5.3
E-4	0.91	3.0	5.7
E-5	0.89	3.3	6.1
I-1	0.31	1.0	2.1

DESIGN POINT SUMMARY TABLE

Design Point	Q_5 (cfs)	Q_{100} (cfs)
21	277.8	1226.8
1	5.8	15.0
2	5.3	13.9
3	7.5	18.7
4	11.1	27.7
5	3.6	16.5
6	13.9	41.2
7	2.9	5.5
8	15.8	54.4
9	8.6	42.8
10	4.5	22.2
11	13.8	64.5
12	2.8	6.5
13	23.5	52.1
13A	3.3	22.4
14a	3.4	7.1
14b	6.9	14.2
14c	9.6	19.5
14	5.9	16.2
15	20.1	43.7
16a	4.0	11.2
16	8.3	20.4
17a	1.6	3.4
17b	3.0	6.2
17c	1.8	3.7
17	4.6	9.5
18	8.0	17.0
19	2.0	5.2
15A	12.2	37.0
AA	273.2	1200.4
BB	271.8	1194.7
30	12.9	55.7
31	17.0	40.8
32	1.2	4.5
24	4.5	21.8
25	3.3	7.8
26	6.1	25.6
20	26.1	79.8
20A	10.7	47.1
20B	21.3	66.0
CC	271.7	1186.3

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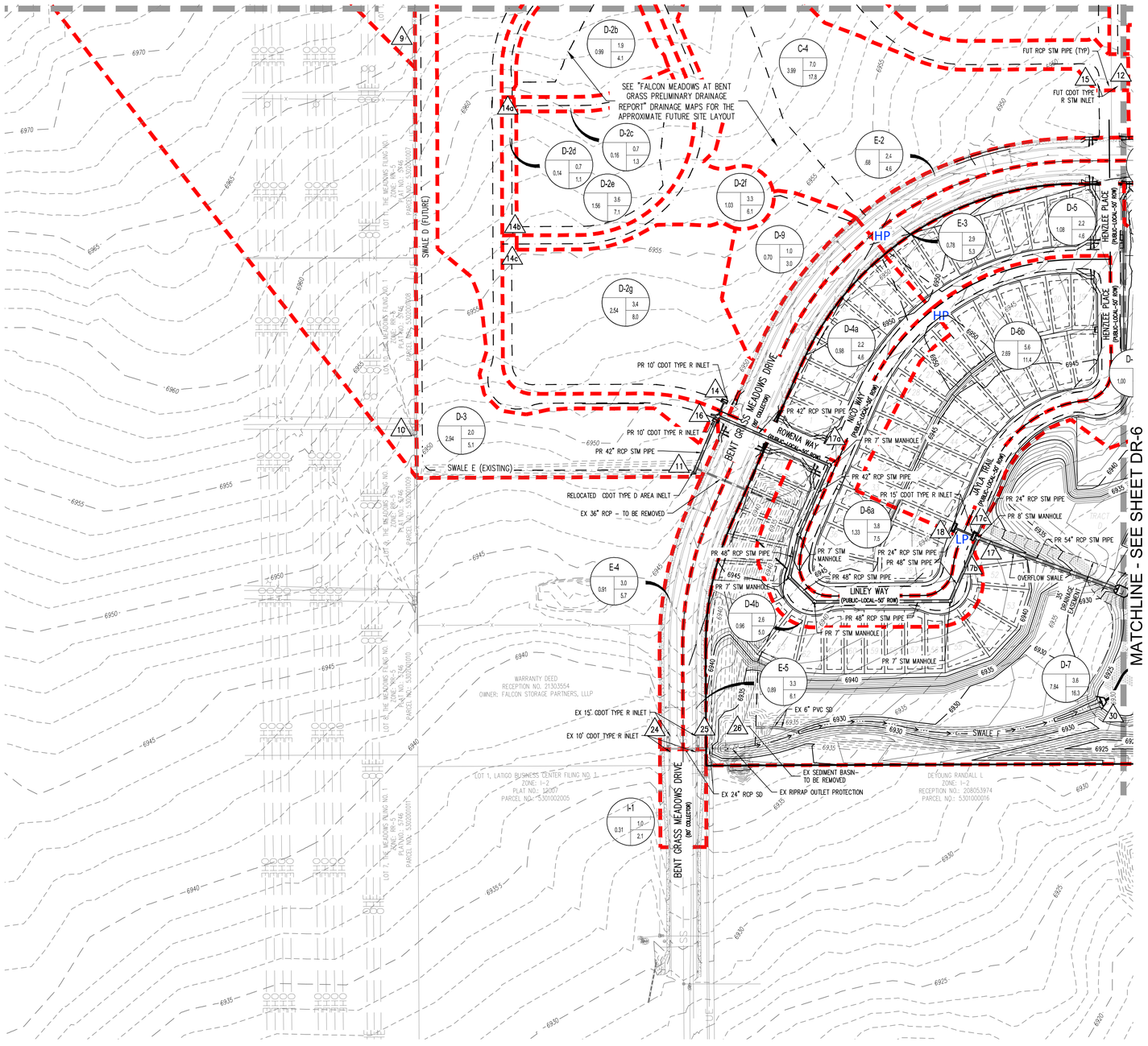
FALCON, CO 80831 - EL PASO COUNTY

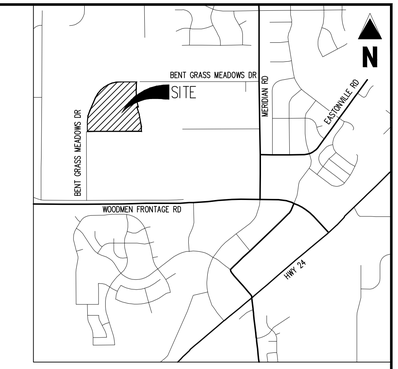
#	Date	Issue / Description	Init.

Project No:	CLH000017
Drawn By:	CMWJ
Checked By:	RGD
Date:	08/05/2020

PROPOSED DRAINAGE MAP

DR-4





VICINITY MAP
1"=2,000'

DRAINAGE LEGEND

- PROPERTY LINE
- 6480 — EXISTING MAJOR CONTOUR
- 6482 — EXISTING MINOR CONTOUR
- 6480 — PROPOSED MAJOR CONTOUR
- 6482 — PROPOSED MINOR CONTOUR
- BASIN BOUNDARY LINE
- DRAINAGE TRAVEL PATH
- 100YR — FEMA EFFECTIVE 100-YR FLOODPLAIN
- DBPS — 100-YR FLOODPLAIN PER MATRIX DBPS
- CENTERLINE OF STREAM
- EXISTING RIPRAP
- EXISTING ACCESS
- PROPOSED RIPRAP
- PROPOSED ACCESS
- BASIN DESIGNATION
- 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- DESIGN POINT
- DIRECTION OF RUNOFF

RUNOFF SUMMARY TABLE

Basin ID	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
RWT202	1574.40	220.0	1000.0
RWT204	38.40	7.0	43.0
WT200	192.00	52.0	190.0
A-1	2.16	4.9	11.7
A-2	0.86	2.0	4.4
A-3	0.92	2.6	5.2
A-4	0.82	0.4	2.6
B-1	4.32	1.2	7.8
B-2	1.17	0.4	2.5
C-1	9.07	16.9	36.0
C-2	1.11	2.8	6.2
C-3	1.52	5.3	9.9
C-4	3.99	6.6	17.4
C-5	0.51	0.3	1.6
C-6	1.37	2.1	5.1
D-1a	3.40	4.1	11.1
D-1b	4.72	6.8	15.0
D-2a	0.30	1.4	2.5
D-2b	0.99	1.9	4.1
D-2c	0.16	0.7	1.3
D-2d	0.14	0.7	1.1
D-2e	1.56	3.6	7.1
D-2f	1.03	3.3	6.1
D-2g	2.54	3.4	8.0
D-3	2.94	2.0	5.1
D-4a	0.98	2.2	4.6
D-4b	0.96	2.6	5.0
D-4c	1.00	2.3	4.5
D-5	1.08	2.2	4.6
D-6a	1.33	3.8	7.5
D-6b	2.69	5.6	11.4
D-7	7.84	3.6	16.3
D-8	1.69	1.3	4.5
D-9	0.70	1.0	3.0
OS-1	32.28	15.1	65.1
OS-2	20.07	9.0	43.4
OS-3	10.61	4.7	24.3
OS-4	4.46	5.6	14.0
OS-5	0.46	1.1	2.3
OS-6	1.17	2.0	4.3
E-1	1.71	3.6	7.7
E-2	0.68	2.4	4.6
E-3	0.78	2.9	5.3
E-4	0.91	3.0	5.7
E-5	0.89	3.3	6.1
1-1	0.31	1.0	2.1

DESIGN POINT SUMMARY TABLE

Design Point	Q_5 (cfs)	Q_{100} (cfs)
21	277.8	1226.8
1	5.8	15.0
2	5.3	13.9
3	7.5	18.7
4	11.1	27.7
5	3.6	16.5
6	13.9	41.2
7	2.9	5.5
8	15.8	54.4
9	8.6	42.8
10	4.5	22.2
11	13.8	64.5
12	2.8	6.5
13	23.5	52.1
13A	3.3	22.4
14a	3.4	7.1
14b	6.9	14.2
14c	9.6	19.5
14	5.9	16.2
15	20.1	43.7
16a	4.0	11.2
16	8.3	20.4
17a	1.6	3.4
17b	3.0	6.2
17c	1.8	3.7
17	4.6	9.5
18	8.0	17.0
19	2.0	5.2
15A	12.2	37.0
AA	273.2	1200.4
BB	271.8	1194.7
30	12.9	55.7
31	17.0	40.8
32	1.2	4.5
24	4.5	21.8
25	3.3	7.8
26	6.1	25.6
20	26.1	79.8
20A	10.7	47.1
20B	21.3	66.0
CC	271.7	1186.3

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CHALLENGER HOMES

FINAL DRAINAGE REPORT
FALCON MEADOWS AT BENT GRASS FILING NO. 1
FOR
CHALLENGER COMMUNTIES, LLC

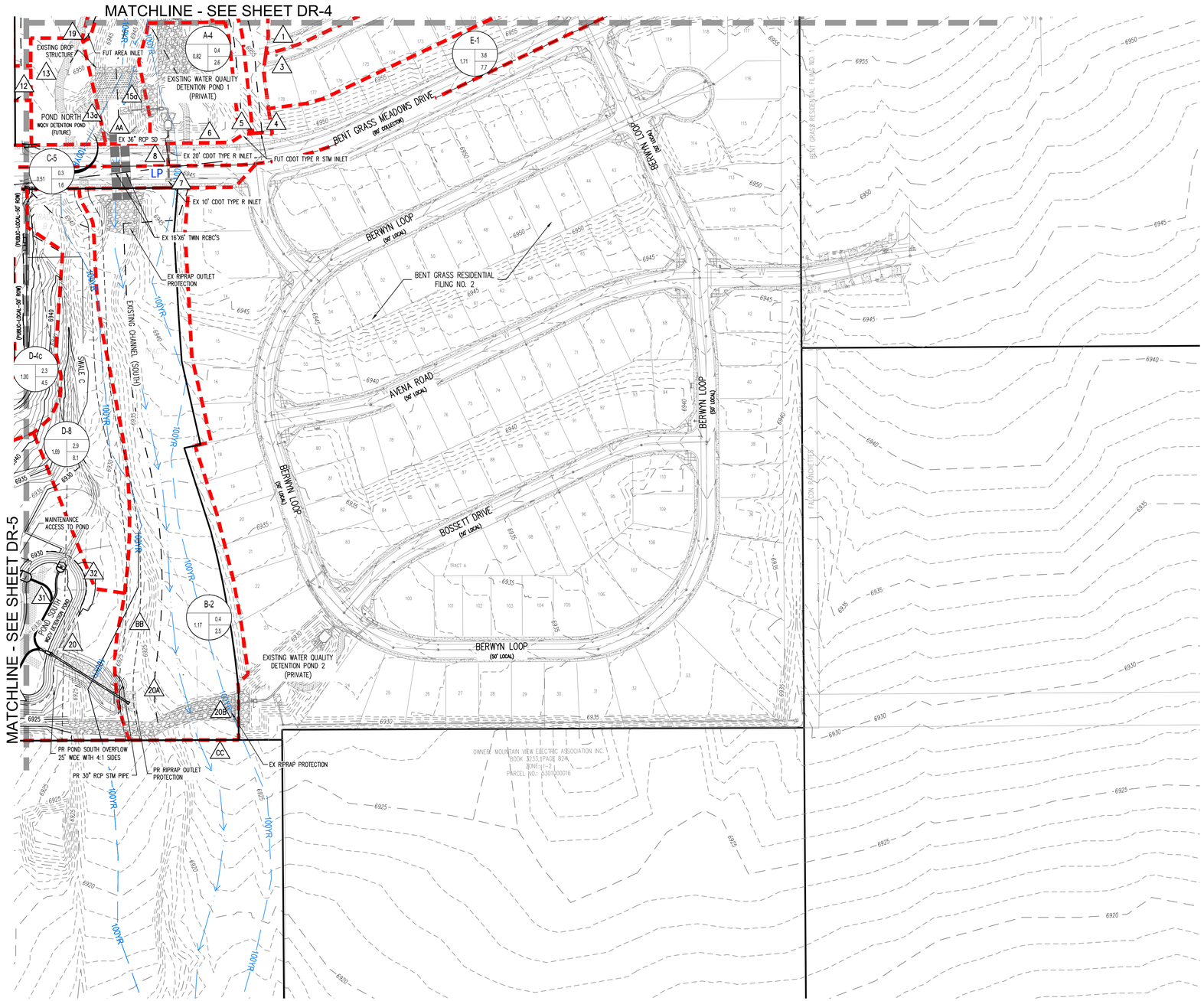
BENT GRASS MEADOWS DRIVE
FALCON, CO 80831 - EL PASO COUNTY

#	Date	Issue / Description	Init.

Project No:	CLH000017
Drawn By:	CMWJ
Checked By:	RGD
Date:	08/05/2020

PROPOSED DRAINAGE MAP

DR-5



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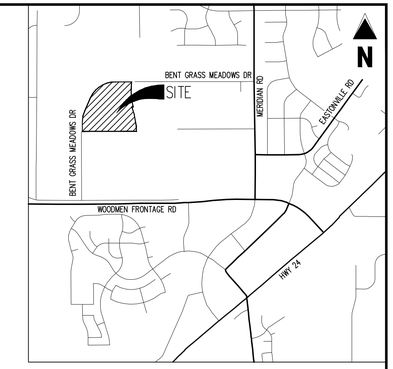
0 25 50 100

SCALE: 1"=100'



VICINITY MAP
1"=2,000'

DRAINAGE LEGEND

- PROPERTY LINE
- 6480 EXISTING MAJOR CONTOUR
- 6482 EXISTING MINOR CONTOUR
- 6480 PROPOSED MAJOR CONTOUR
- 6482 PROPOSED MINOR CONTOUR
- BASIN BOUNDARY LINE
- DRAINAGE TRAVEL PATH
- 100YR FEMA EFFECTIVE 100-YR FLOODPLAIN
- DBPS 100-YR FLOODPLAIN PER MATRIX DBPS
- CENTERLINE OF STREAM
- EXISTING RIPRAP
- EXISTING ACCESS
- PROPOSED RIPRAP
- PROPOSED ACCESS
- 1 BASIN DESIGNATION
- 1.8 5-YEAR RUNOFF IN CUBIC FEET PER SECOND
- 0.71 4.6 100-YEAR RUNOFF IN CUBIC FEET PER SECOND
- BASIN AREA IN ACRES
- 1 DESIGN POINT
- DIRECTION OF RUNOFF

RUNOFF SUMMARY TABLE

Basin ID	Area (acres)	Q_5 (cfs)	Q_{100} (cfs)
RWT202	1574.40	220.0	1000.0
RWT204	38.40	7.0	43.0
WT200	192.00	52.0	190.0
A-1	2.16	4.9	11.7
A-2	0.86	2.0	4.4
A-3	0.92	2.6	5.2
A-4	0.82	0.4	2.6
B-1	4.32	1.2	7.8
B-2	1.17	0.4	2.5
C-1	9.07	16.9	36.0
C-2	1.11	2.8	6.2
C-3	1.52	5.3	9.9
C-4	3.99	6.6	17.4
C-5	0.51	0.3	1.6
C-6	1.37	2.1	5.1
D-1a	3.40	4.1	11.1
D-1b	4.72	6.8	15.0
D-2a	0.30	1.4	2.5
D-2b	0.99	1.9	4.1
D-2c	0.16	0.7	1.3
D-2d	0.14	0.7	1.1
D-2e	1.56	3.6	7.1
D-2f	1.03	3.3	6.1
D-2g	2.54	3.4	8.0
D-3	2.94	2.0	5.1
D-4a	0.98	2.2	4.6
D-4b	0.96	2.6	5.0
D-4c	1.00	2.3	4.5
D-5	1.08	2.2	4.6
D-6a	1.33	3.8	7.5
D-6b	2.69	5.6	11.4
D-7	7.84	3.6	16.3
D-8	1.69	1.3	4.5
D-9	0.70	1.0	3.0
OS-1	32.28	15.1	65.1
OS-2	20.07	9.0	43.4
OS-3	10.61	4.7	24.3
OS-4	4.46	5.6	14.0
OS-5	0.46	1.1	2.3
OS-6	1.17	2.0	4.3
E-1	1.71	3.6	7.7
E-2	0.68	2.4	4.6
E-3	0.78	2.9	5.3
E-4	0.91	3.0	5.7
E-5	0.89	3.3	6.1
I-1	0.31	1.0	2.1

DESIGN POINT SUMMARY TABLE

Design Point	Q_5 (cfs)	Q_{100} (cfs)
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1	5.8	15.0
2	5.3	13.9
3	7.5	18.7
4	11.1	27.7
5	3.6	16.5
6	13.9	41.2
7	2.9	5.5
8	15.8	54.4
9	8.6	42.8
10	4.5	22.2
11	13.8	64.5
12	2.8	6.5
13	23.5	52.1
13A	3.3	22.4
14a	3.4	7.1
14b	6.9	14.2
14c	9.6	19.5
14	5.9	16.2
15	20.1	43.7
16a	4.0	11.2
16	8.3	20.4
17a	1.6	3.4
17b	3.0	6.2
17c	1.8	3.7
17	4.6	9.5
18	8.0	17.0
19	2.0	5.2
15A	12.2	37.0
AA	273.2	1200.4
BB	271.8	1194.7
30	12.9	55.7
31	17.0	40.8
32	1.2	4.5
24	4.5	21.8
25	3.3	7.8
26	6.1	25.6
20	26.1	79.8
20A	10.7	47.1
20B	21.3	66.0
CC	271.7	1186.3

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CHALLENGER HOMES

FINAL DRAINAGE REPORT
FALCON MEADOWS AT BENT GRASS FILING NO. 1
FOR
CHALLENGER COMMUNTIES, LLC

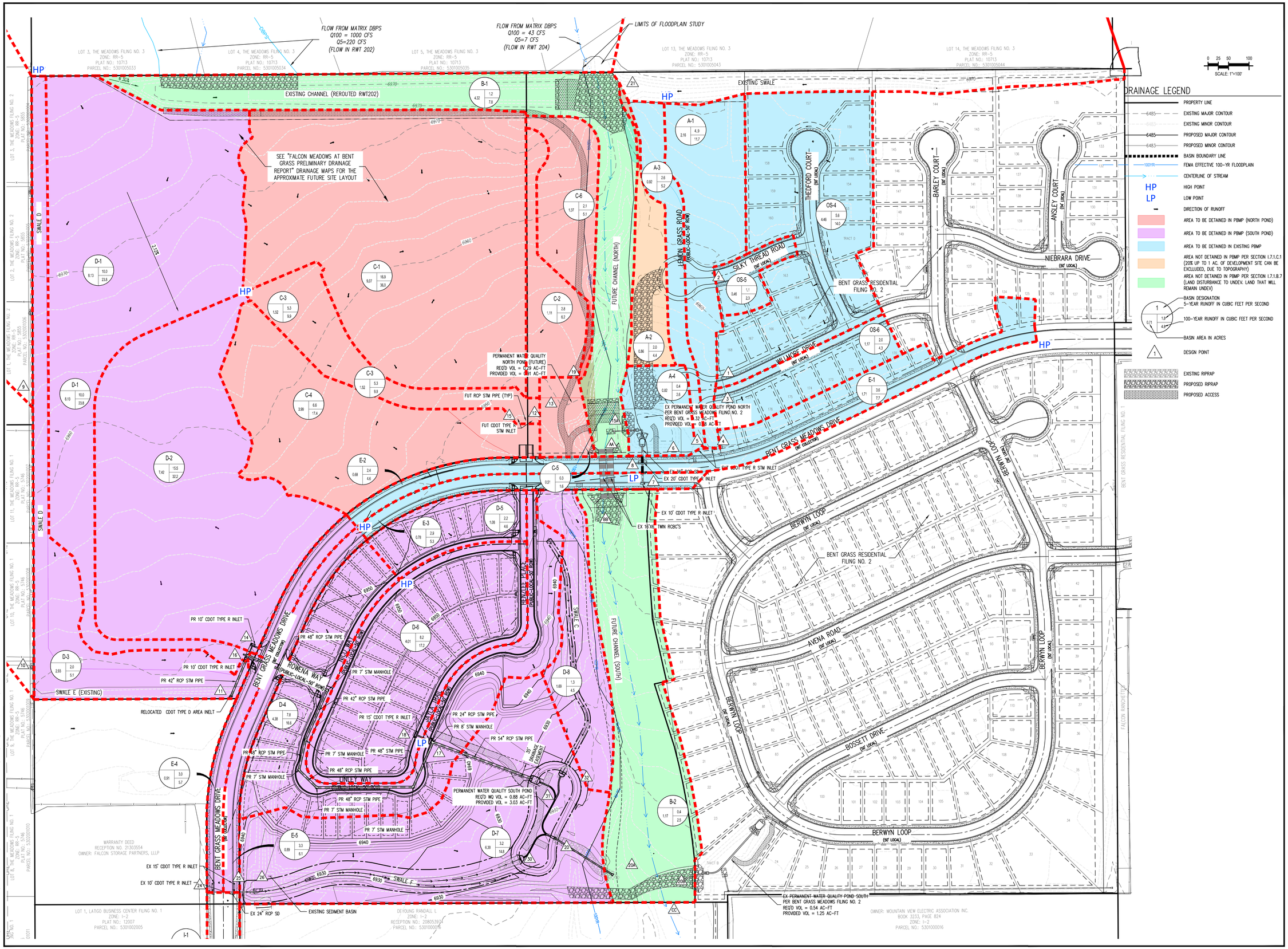
BENT GRASS MEADOWS DRIVE
FALCON, CO 80831 - EL PASO COUNTY

#	Date	Issue / Description	Init.

Project No:	CLH000017
Drawn By:	CMWJ
Checked By:	RGD
Date:	08/05/2020

PROPOSED DRAINAGE MAP

DR-6



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FALCON MEADOWS AT BENT GRASS FILING NO. 1
FOR
CHALLENGER COMMUNITIES, LLC

BENT GRASS MEADOWS DRIVE
FALCON, CO 80831 - EL PASO COUNTY

#	Date	Issue / Description	Init.

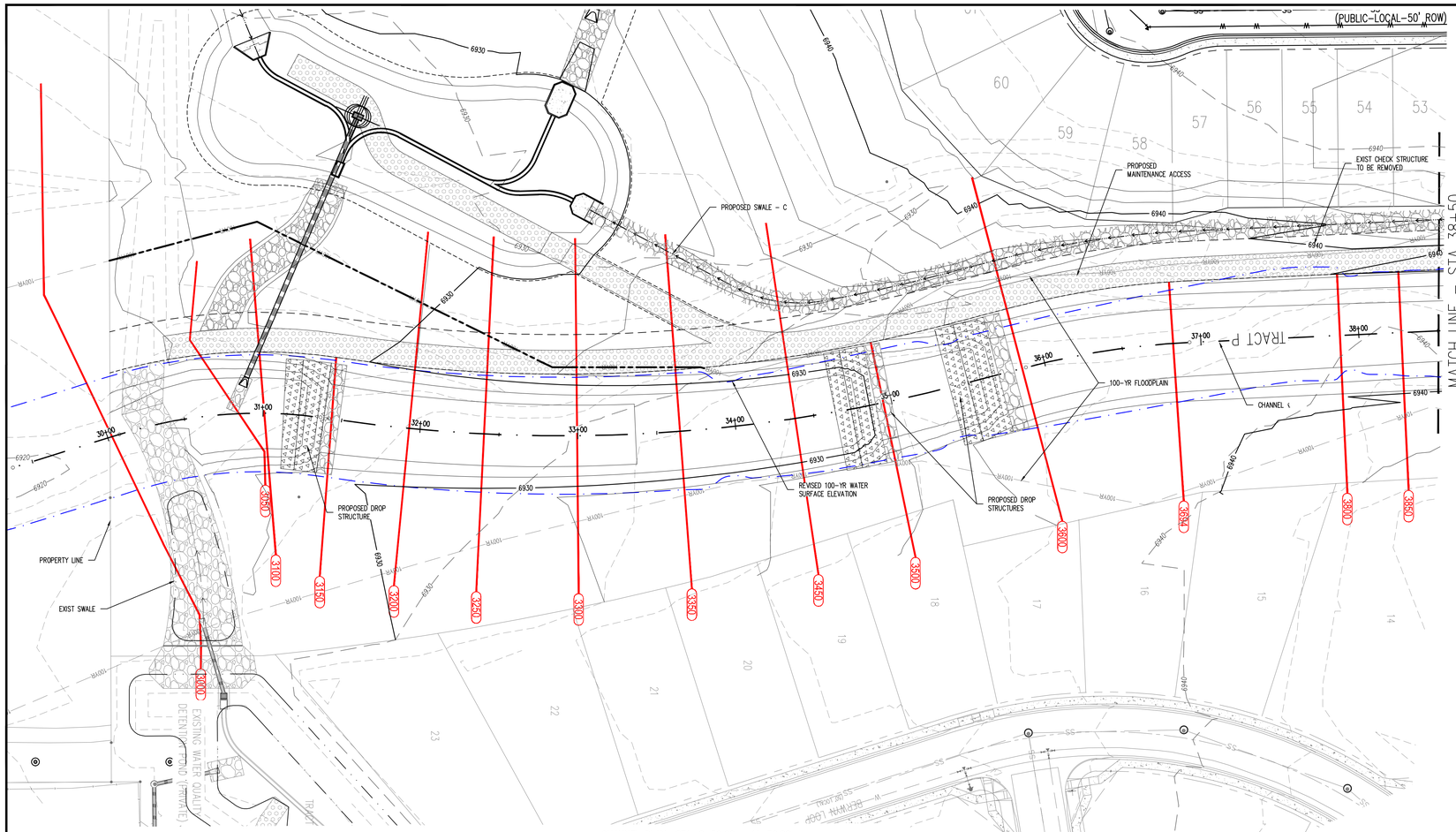
Project No:	CLH000017
Drawn By:	CMWJ
Checked By:	RGD
Date:	08/05/2020

WQ PLAN

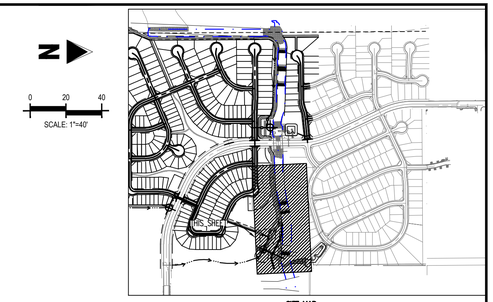
DR-7

APPENDIX F

Preliminary Channel Plans & Details



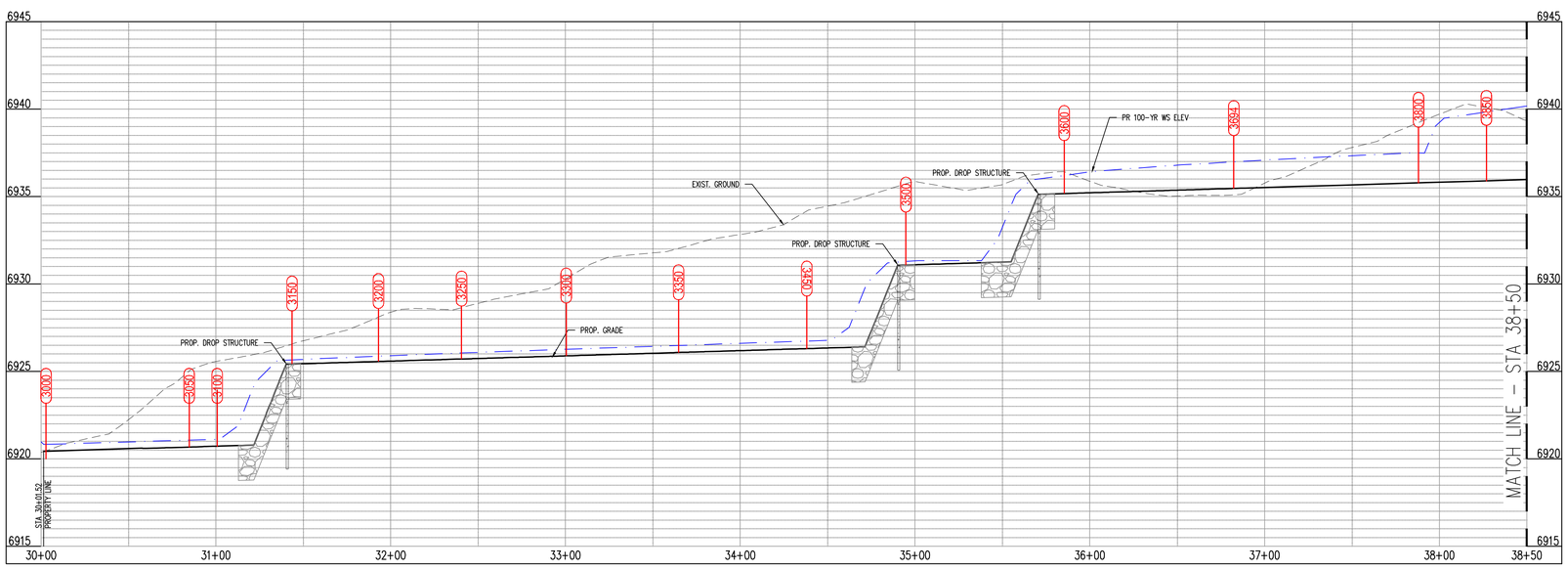
CHANNEL PLAN: STA. 2+50.00 – 11+50.00
SCALE: 1"=40'



SITE MAP
SCALE: 1"=600'

LEGEND

6937	EXISTING MINOR CONTOUR
6930	EXISTING MAJOR CONTOUR
6941	PROPOSED MINOR CONTOUR
6940	PROPOSED MAJOR CONTOUR
	PROPERTY BOUNDARY
100YR	100 – YR FLOODPLAIN LINE
	PROPOSED 100-YR WATER SURFACES
3900	HEC-RAS SECTIONS
	EXISTING STORM SEWER
	PROPOSED STORM SEWER
	PROPOSED RIPRAP
	EXISTING RIPRAP



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CHALLENGER HOMES

MASTER DRAINAGE DEVELOPMENT PLAN
FALCON MEADOWS AT BENT GRASS
FOR
CHALLENGER COMMUNTIES, LLC

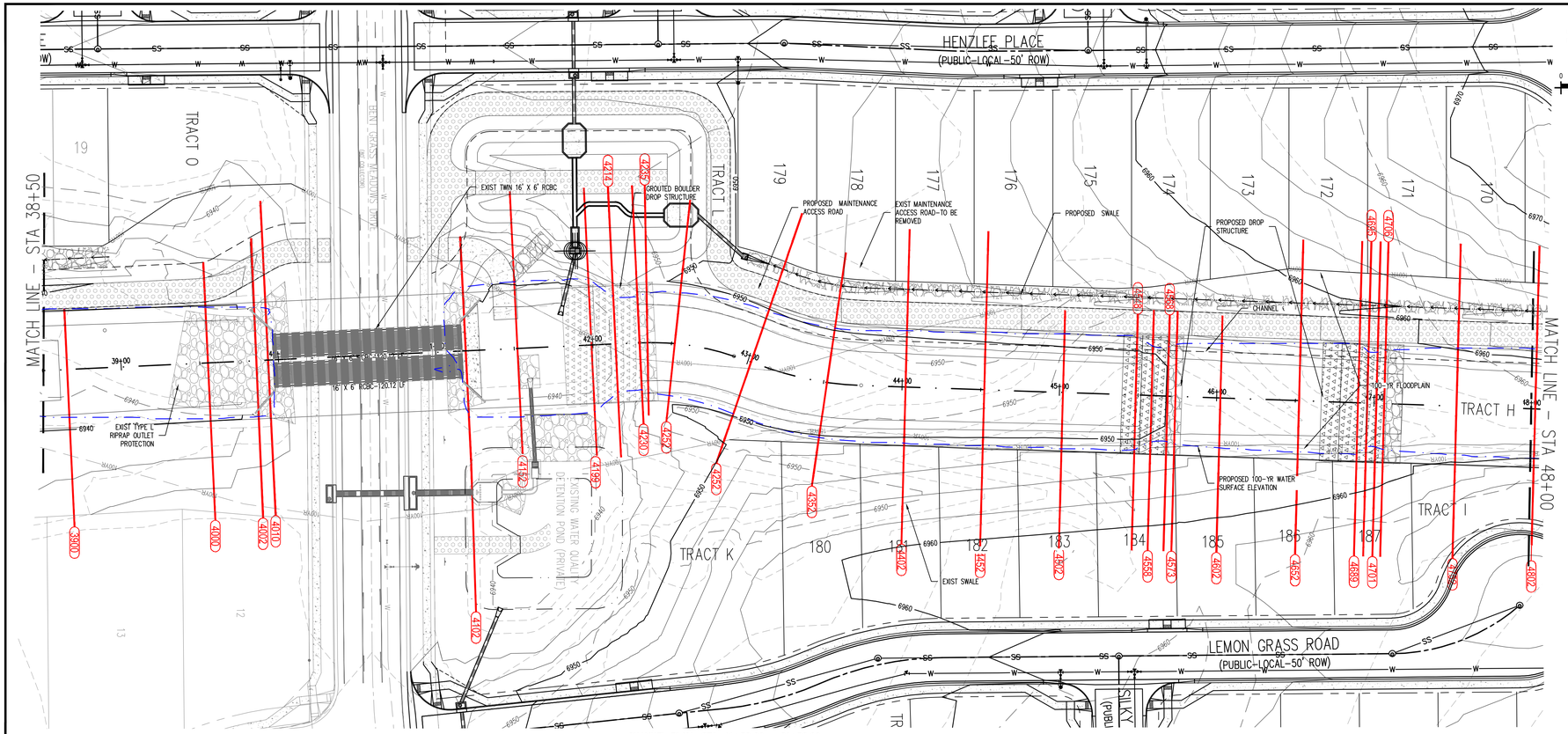
BENT GRASS MEADOWS DRIVE & MERDIAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

#	Date	Issue / Description	Init.

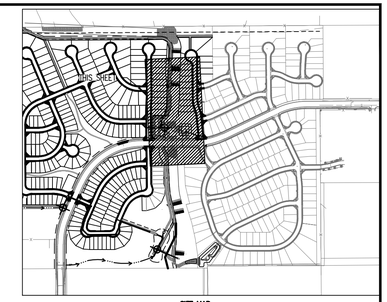
Project No:
Drawn By:
Checked By:
Date:

CHANNEL PLAN & PROFILE

DR2.1
Sheet 1 of 3



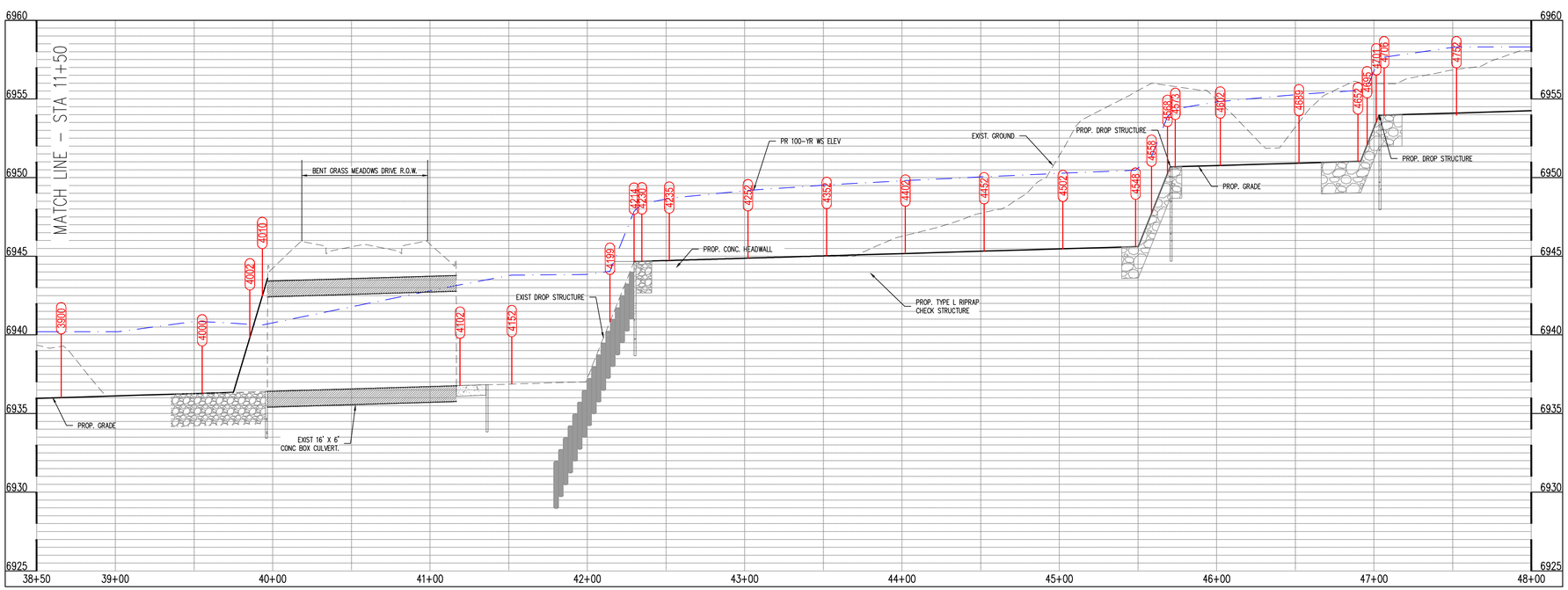
CHANNEL PLAN: STA. 11+50.00 - 21+50.00
SCALE: 1"=40'



SITE MAP
SCALE: 1"=600'

LEGEND

- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPERTY BOUNDARY
- 100 - YR FLOODPLAIN LINE
- PROPOSED 100-YR WATER SURFACES
- HEC-RAS SECTIONS
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- PROPOSED RIPRAP
- EXISTING RIPRAP



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CHALLENGER HOMES

MASTER DRAINAGE DEVELOPMENT PLAN
FALCON MEADOWS AT BENT GRASS
FOR
CHALLENGER COMMUNTIES, LLC

BENT GRASS MEADOWS DRIVE & MERDIAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

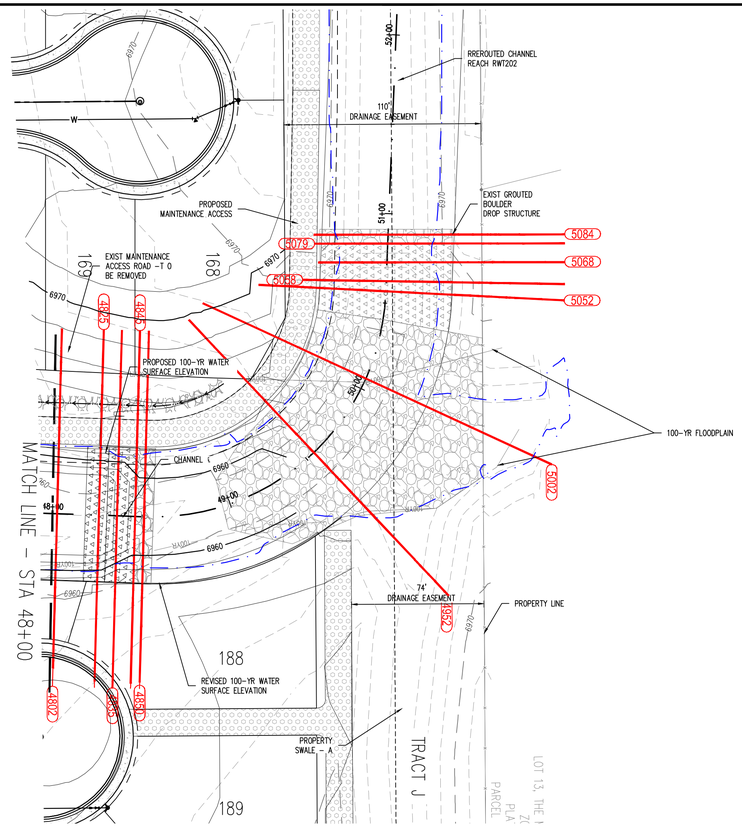
#	Date	Issue / Description	Init.

Project No:
Drawn By:
Checked By:
Date:

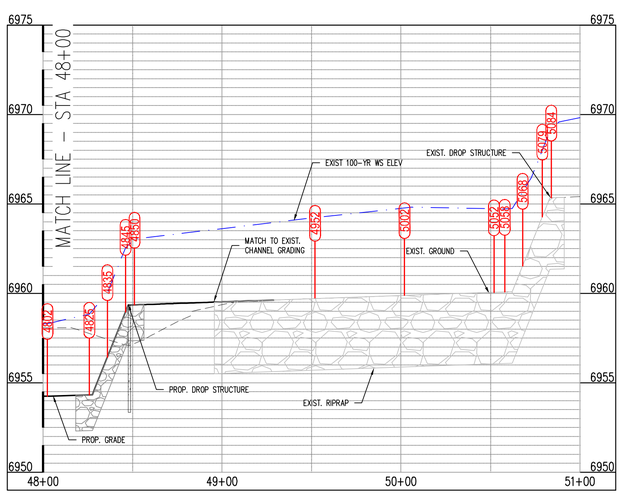
CHANNEL PLAN & PROFILE

DR2.2

Sheet 2 of 3



CHANNEL PLAN: STA. 21+50.00 – 24+29.31
SCALE: 1"=40'



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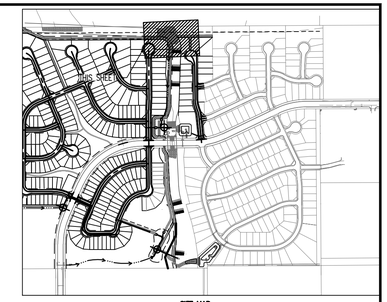
SCALE: 1"=40'



SITE MAP
SCALE: 1"=600'

LEGEND

- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPERTY BOUNDARY
- 100 - YR FLOODPLAIN LINE
- PROPOSED 100-YR WATER SURFACES
- HEC-RAS SECTIONS
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- PROPOSED RIPRAP
- EXISTING RIPRAP

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CHALLENGER HOMES

MASTER DRAINAGE DEVELOPMENT PLAN
FALCON MEADOWS AT BENT GRASS
FOR
CHALLENGER COMMUNTIES, LLC

BENT GRASS MEADOWS DRIVE & MERDIAN ROAD
FALCON, CO 80831 - EL PASO COUNTY

#	Date	Issue / Description	Init.

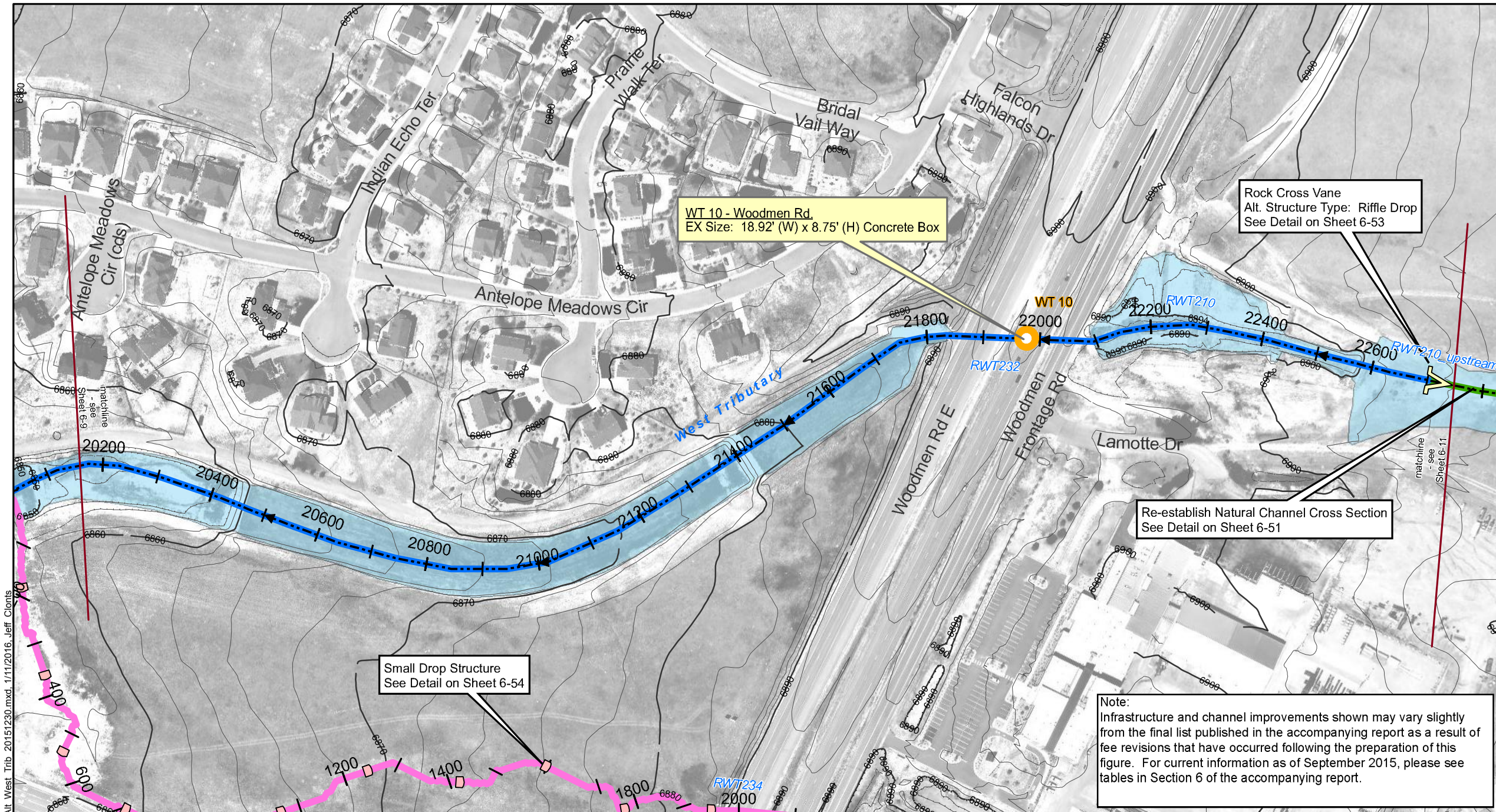
Project No:
Drawn By:
Checked By:
Date:

CHANNEL PLAN & PROFILE

DR2.3

Sheet 3 of 3

Sheet 6-10
Falcon DBPS
Conceptual Plan
West Tributary
El Paso County, CO



Drainageway Crossing
Stream Centerline
Existing Approximate 100-yr Floodplain*
Floodplain Study Limit

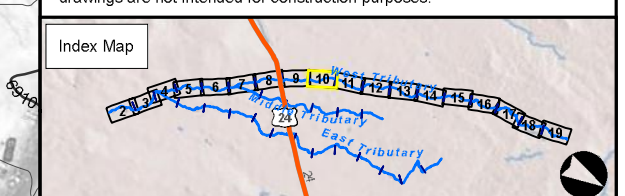
Storm Sewer
Inlet
Manhole
Pipe

Reach Improvements
Natural Channel Design
Protect In Place
Roadside Ditch Improvement
Small Drop Structures w/ Toe Protection
Existing Detention
Proposed Detention
Proposed Detention Grading
Small Drop Structure
Cross Vane
Immediate Action Required to Preserve Existing Condition

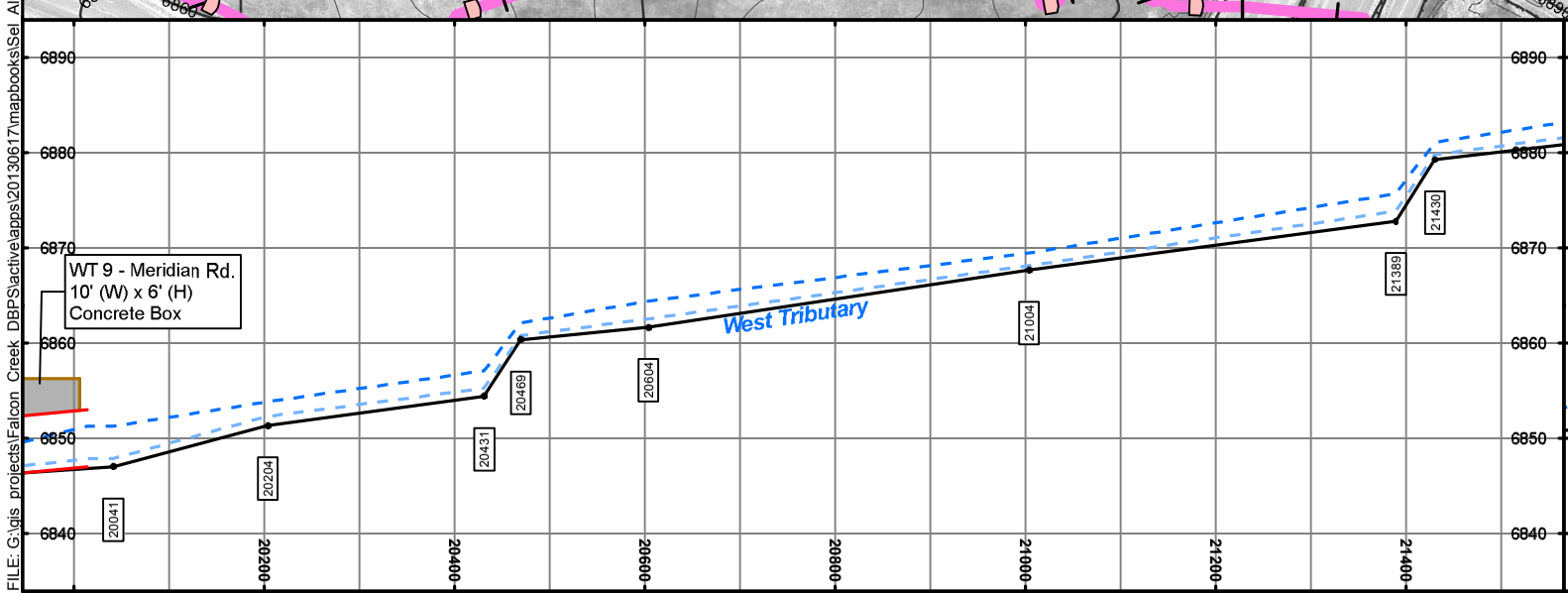
0 100 200 Feet

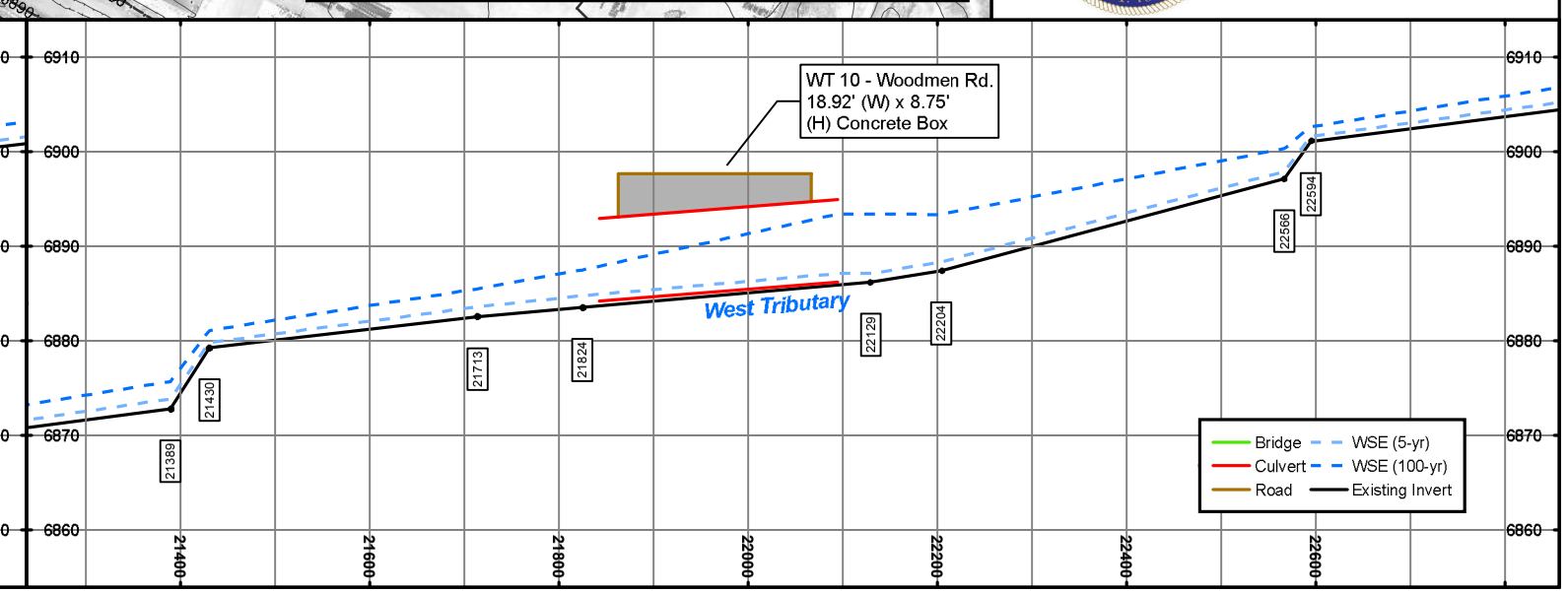
* These approximate 100-yr floodplain boundaries are for planning purposes only. This information is not intended to replace the information provided on the FEMA Flood Insurance Rate Maps for this area.
** These are conceptual design drawings and are subject to change. These drawings are not intended for construction purposes.

Index Map



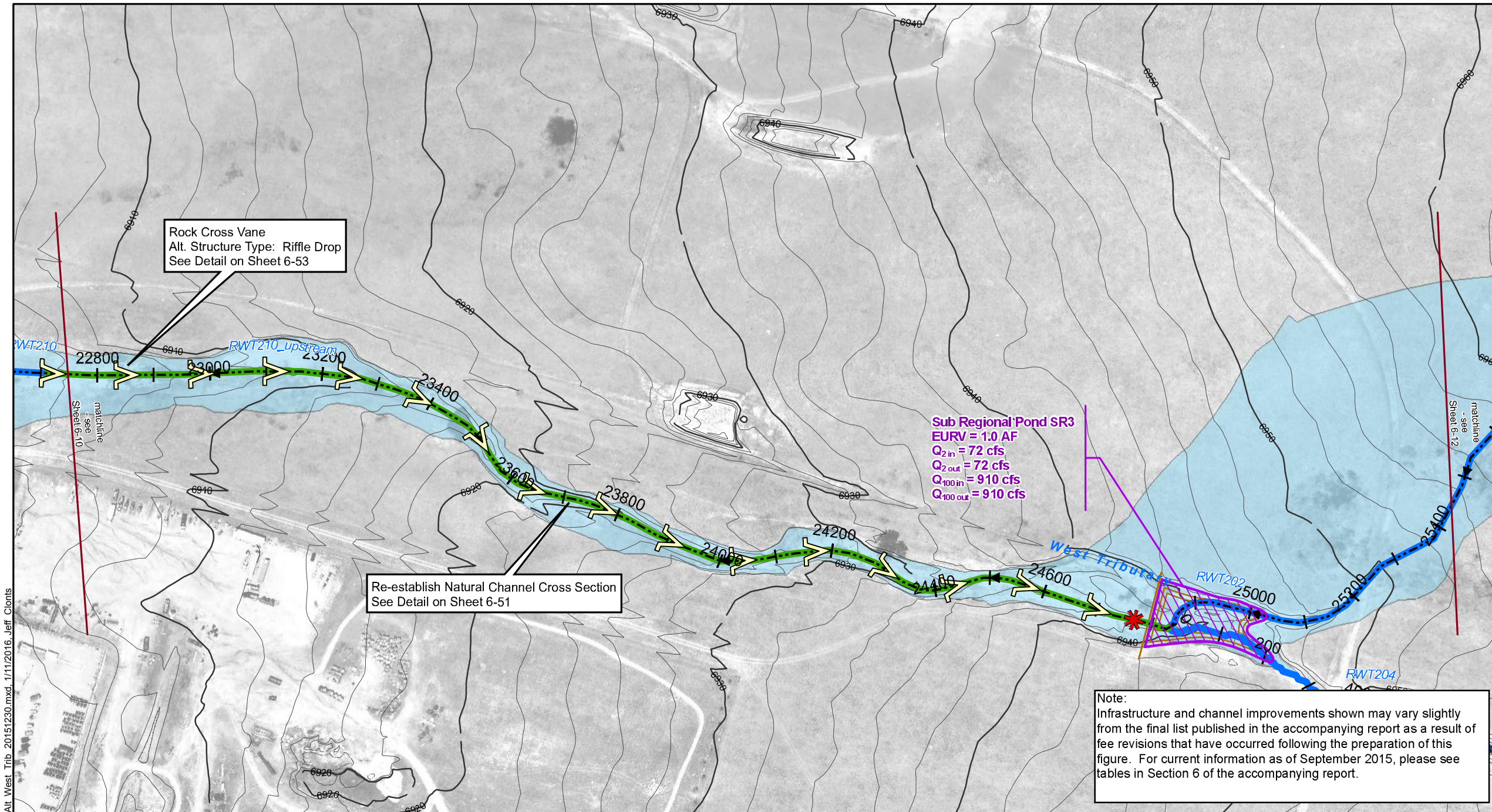
Note:
Infrastructure and channel improvements shown may vary slightly from the final list published in the accompanying report as a result of fee revisions that have occurred following the preparation of this figure. For current information as of September 2015, please see tables in Section 6 of the accompanying report.





FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20130617\mapbooks\Sel_Alt_West_Trib_20151230.mxd, 1/11/2016, Jeff Clonts

Sheet 6-11
Falcon DBPS
Conceptual Plan
West Tributary
El Paso County, CO



Drainageway Crossing
Stream Centerline
Existing Approximate 100-yr Floodplain*
Floodplain Study Limit

Storm Sewer
Inlet
Manhole
Pipe

Reach Improvements
Natural Channel Design
Protect In Place
Roadside Ditch Improvement
Small Drop Structures w/ Toe Protection
Existing Detention
Proposed Detention
Proposed Detention Grading
Small Drop Structure
Cross Vane
Immediate Action Required to Preserve Existing Condition

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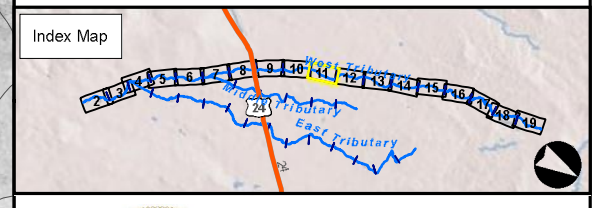

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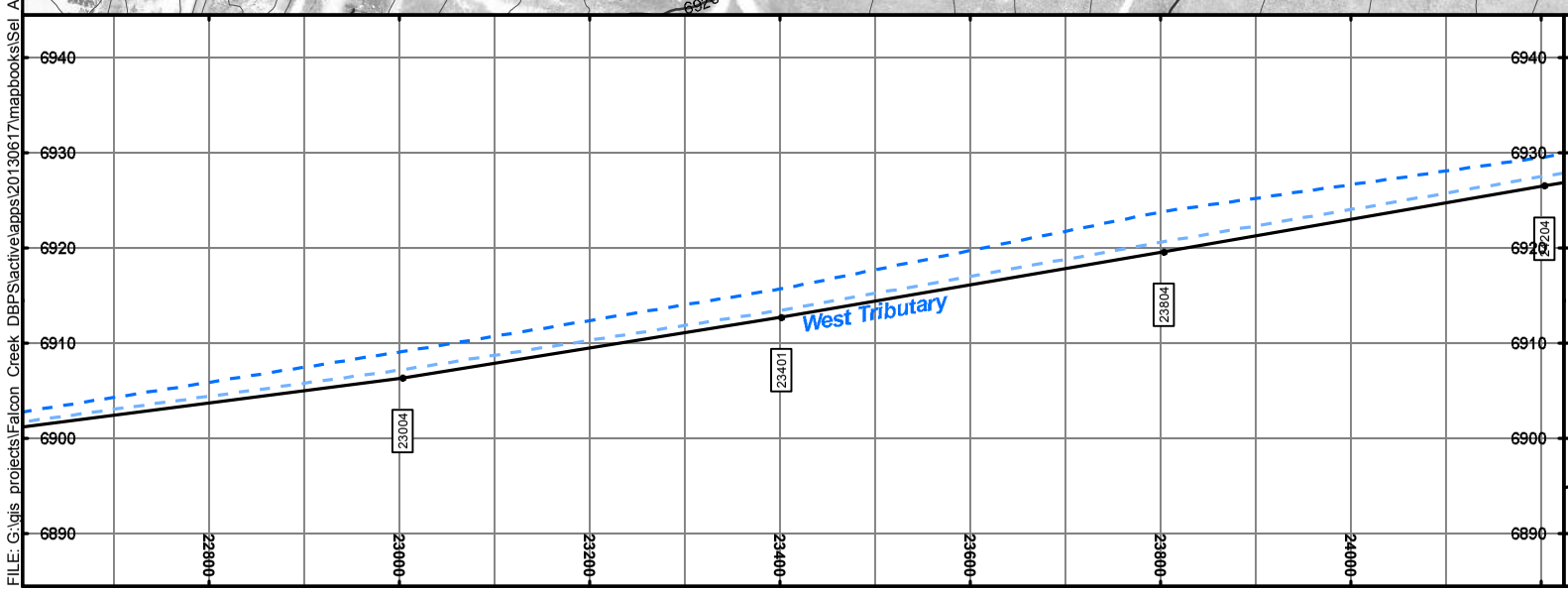

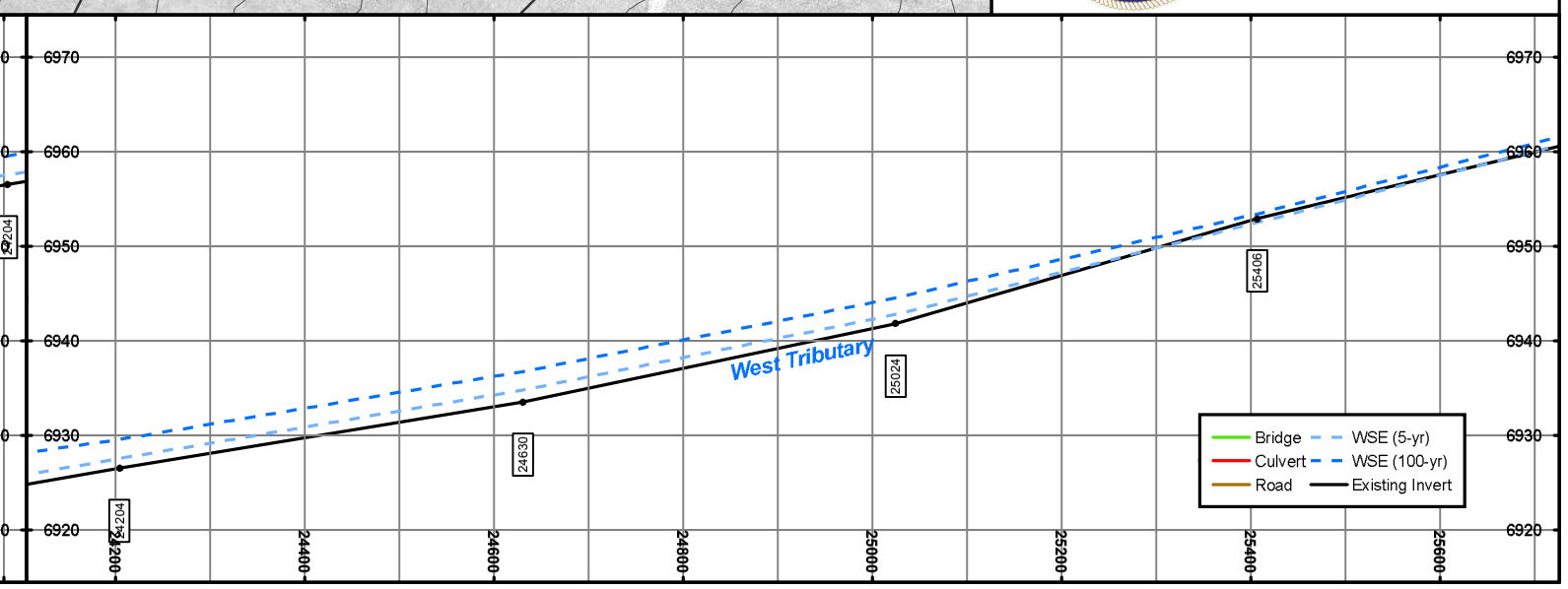

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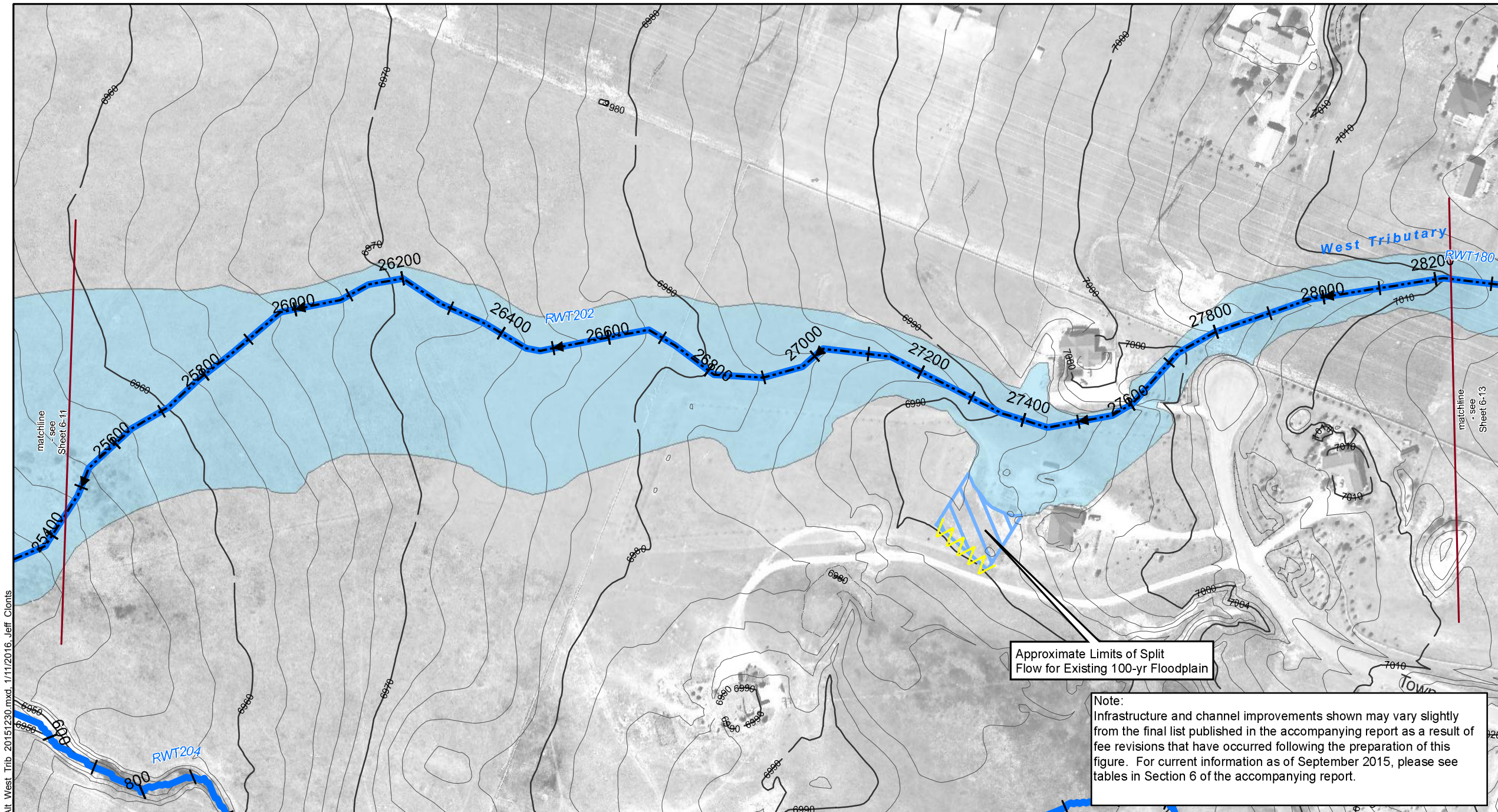
Sheet 6-12
Falcon DBPS
Conceptual Plan
West Tributary
El Paso County, CO



Drainageway Crossing
Stream Centerline
Existing Approximate 100-yr Floodplain*
Floodplain Study Limit

Storm Sewer
Inlet
Manhole
Pipe

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Natural Channel Design
Protect In Place
Roadside Ditch Improvement
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Proposed Detention Grading
Small Drop Structure
Cross Vane
Immediate Action Required to Preserve Existing Condition

0 100 200 Feet

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Index Map

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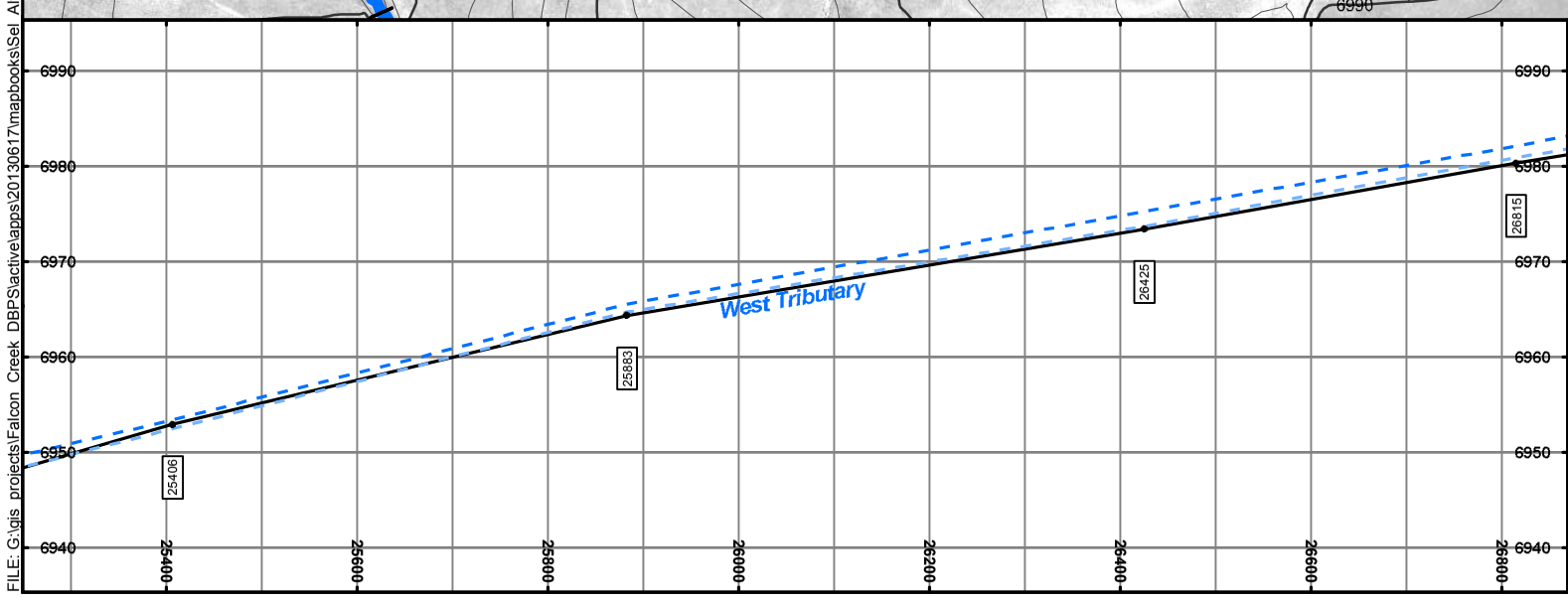

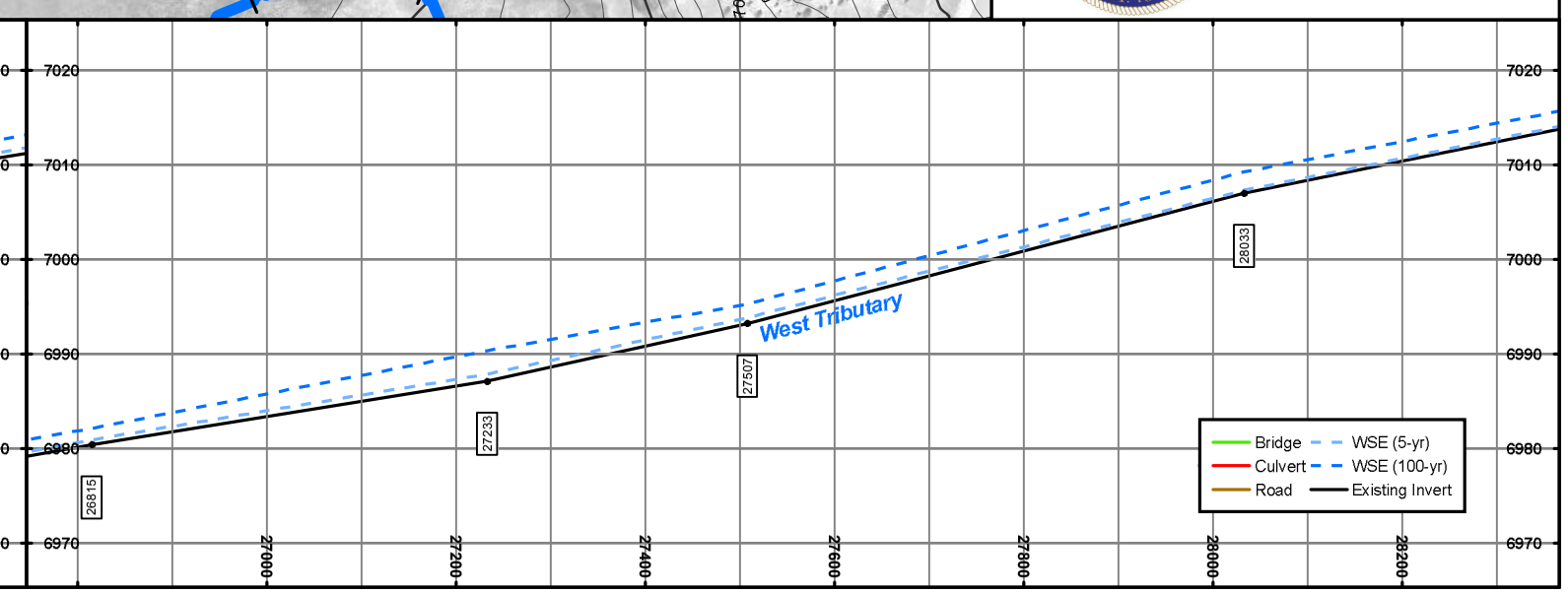

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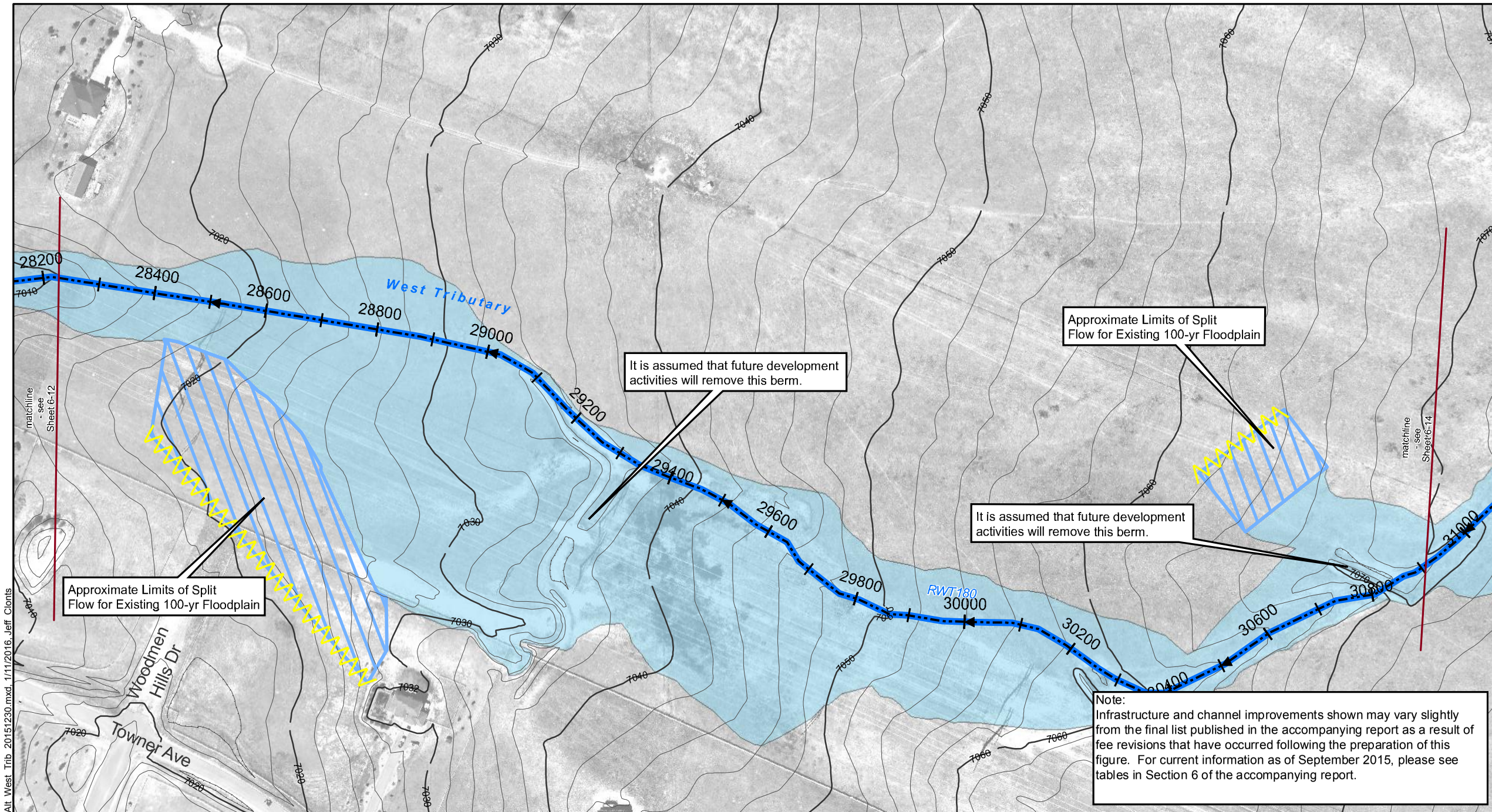
Sheet 6-13
Falcon DBPS
Conceptual Plan
West Tributary
El Paso County, CO



Note:
Infrastructure and channel improvements shown may vary slightly from the final list published in the accompanying report as a result of fee revisions that have occurred following the preparation of this figure. For current information as of September 2015, please see tables in Section 6 of the accompanying report.

Drainageway Crossing
Stream Centerline
Existing Approximate 100-yr Floodplain*
Floodplain Study Limit

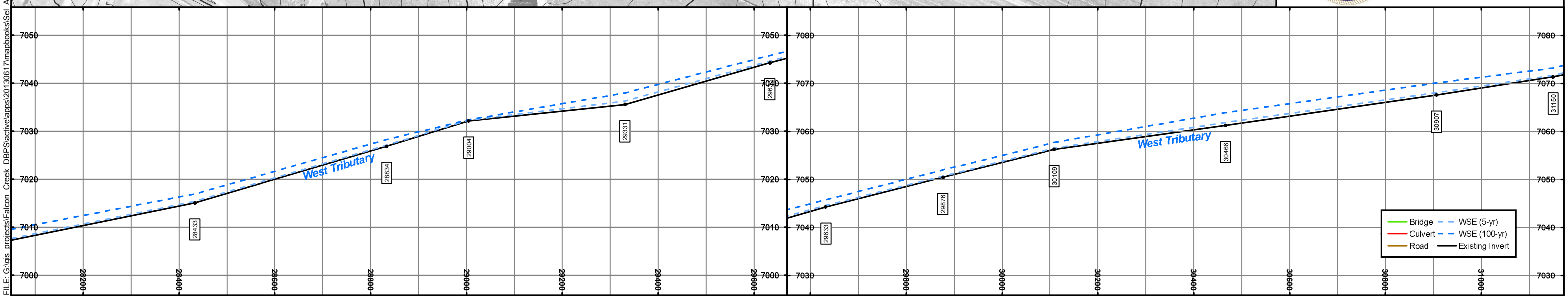
Storm Sewer
Inlet
Manhole
Pipe

Reach Improvements
Natural Channel Design
Protect In Place
Roadside Ditch Improvement
Small Drop Structures w/ Toe Protection
Existing Detention
Proposed Detention
Proposed Detention Grading
Small Drop Structure
Cross Vane
Immediate Action Required to Preserve Existing Condition

0 100 200 Feet

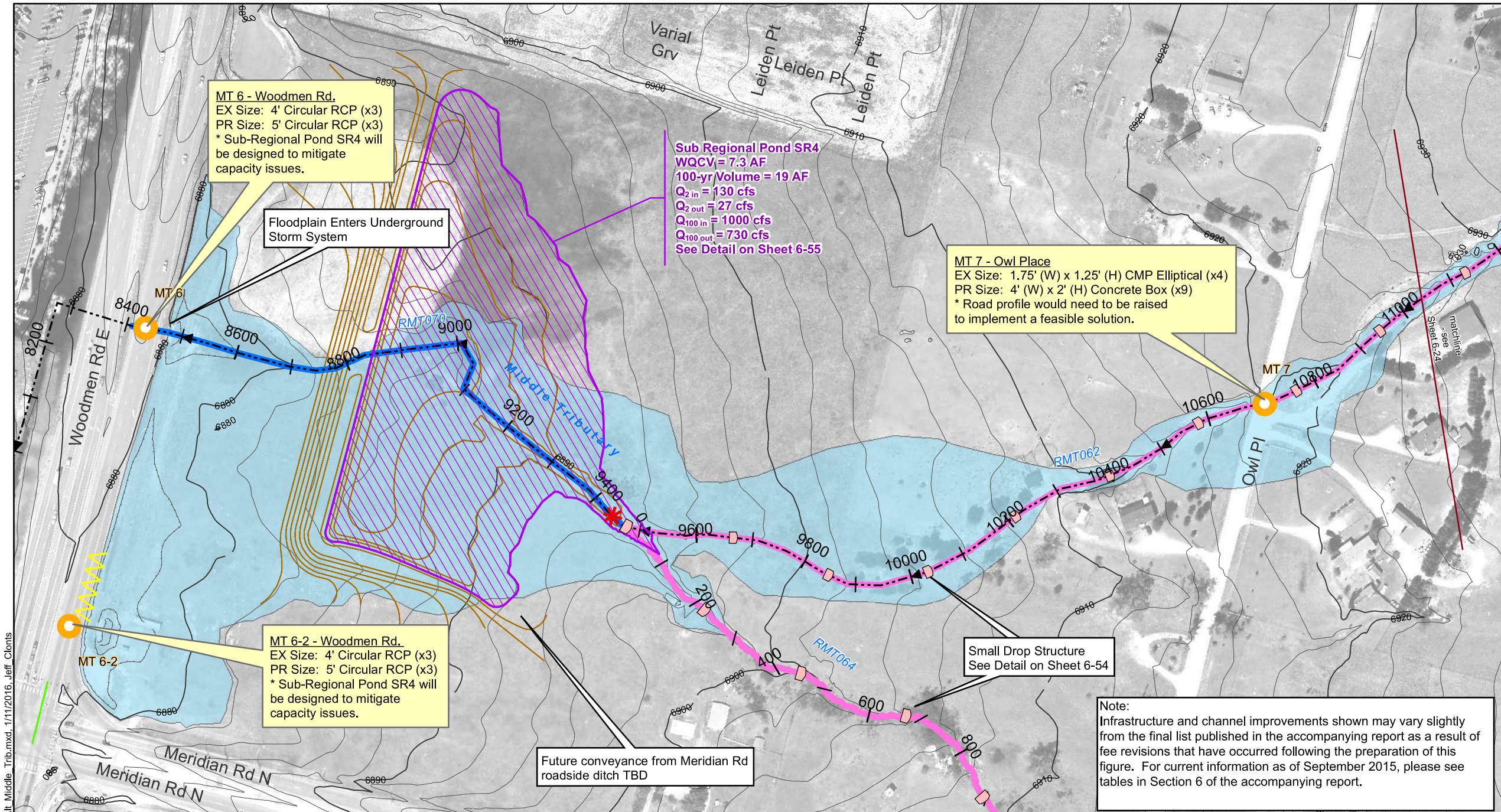
* These approximate 100-yr floodplain boundaries are for planning purposes only. This information is not intended to replace the information provided on the FEMA Flood Insurance Rate Maps for this area.
** These are conceptual design drawings and are subject to change. These drawings are not intended for construction purposes.

Index Map



FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20130617\mapbooks\Sel_Alt_West_Trib_20151230.mxd, 1/11/2016, Jeff Clonts

Sheet 6-23
Falcon DBPS
Conceptual Plan
Middle Tributary
El Paso County, CO



Drainageway Crossing
Stream Centerline
Existing Approximate 100-yr Floodplain*
Floodplain Study Limit

Storm Sewer
Inlet
Manhole
Pipe

Reach Improvements
Natural Channel Design
Protect In Place
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Proposed Detention Grading
Small Drop Structure
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Immediate Action Required to Preserve Existing Condition

0 100 200 Feet

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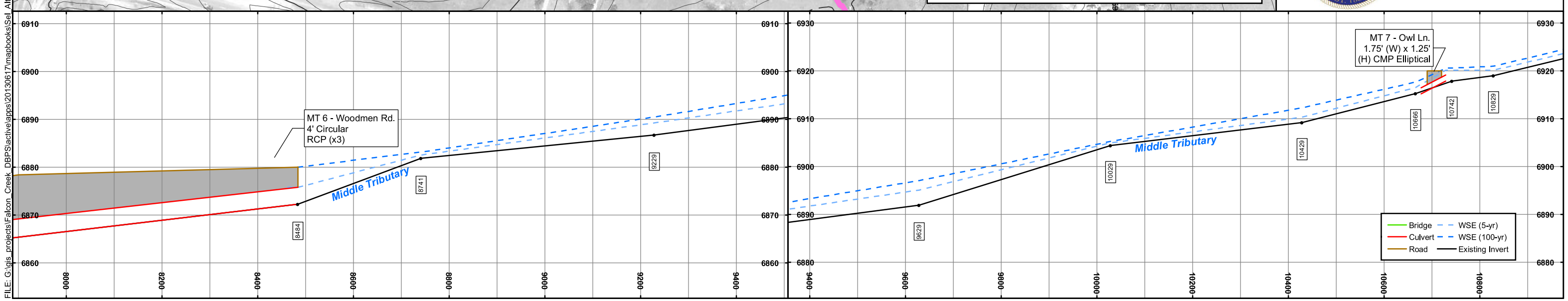
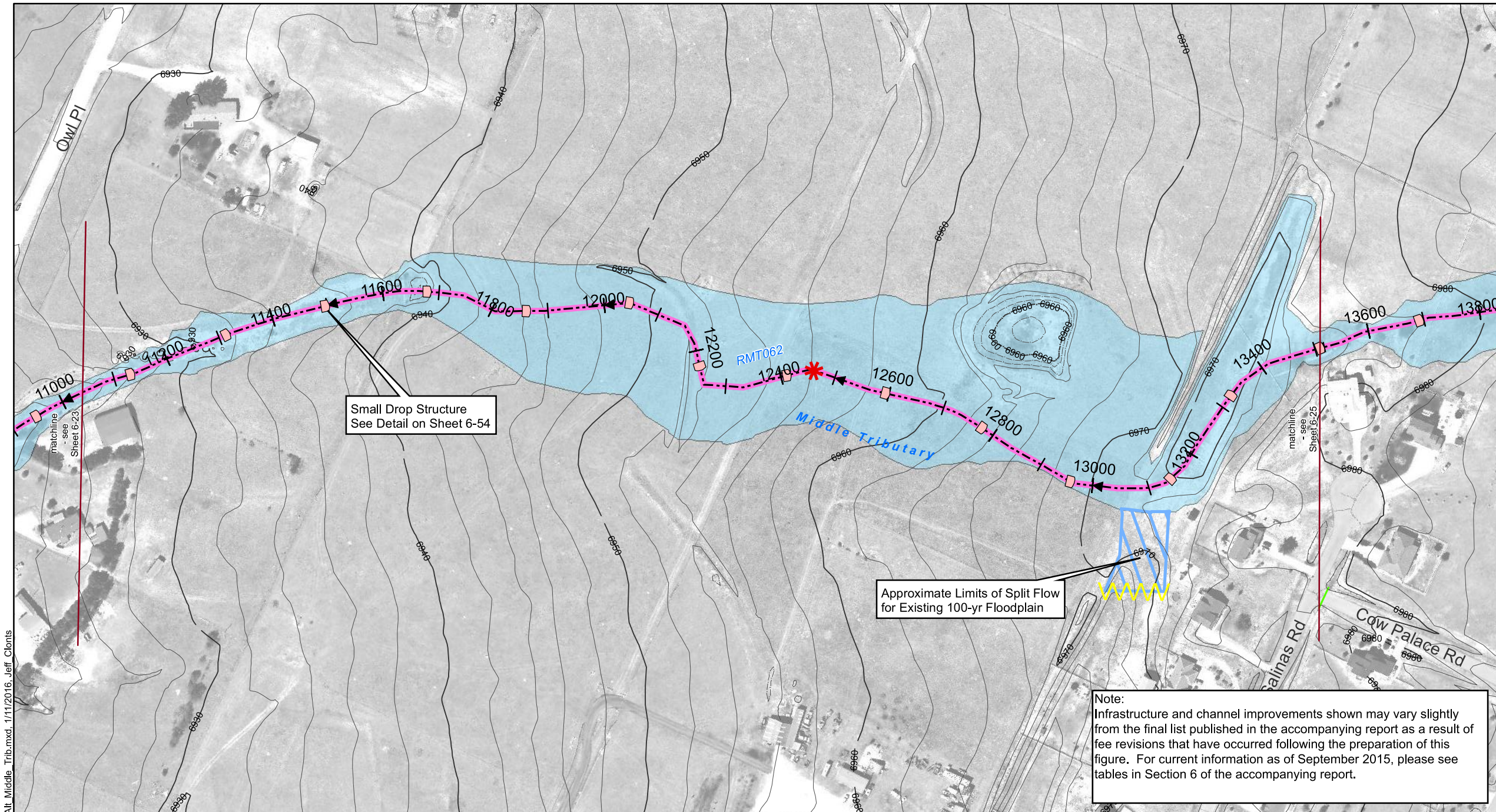


FILE: G:\gis_projects\Falcon_Creek_DBPS\active\apps\20130617\mapbooks\Sel_Alt_Middle_Trib.mxd, 1/11/2016, Jeff Clonts

Sheet 6-24
Falcon DBPS
Conceptual Plan
Middle Tributary
El Paso County, CO



Note:
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Drainageway Crossing
Stream Centerline
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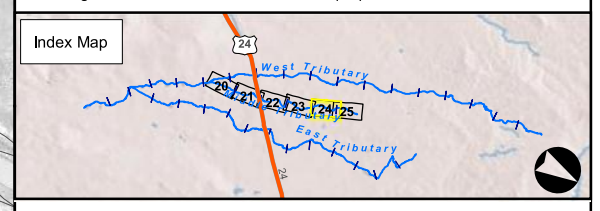
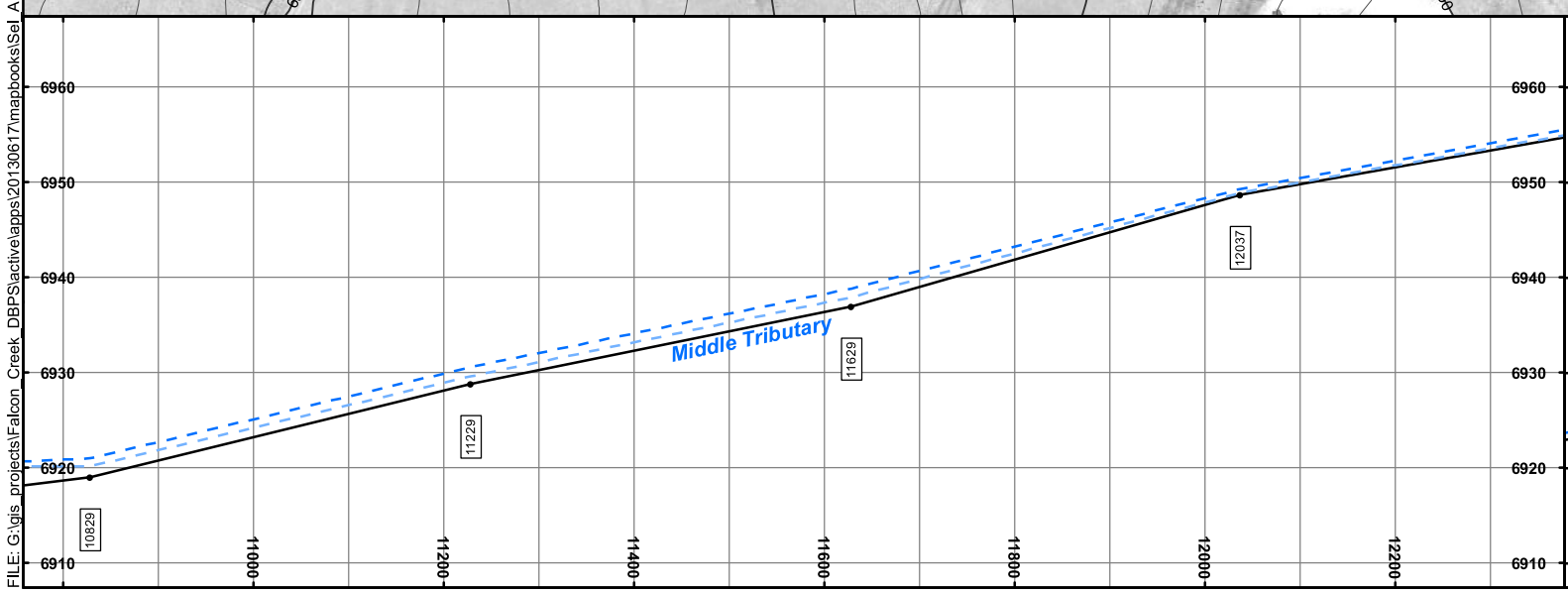
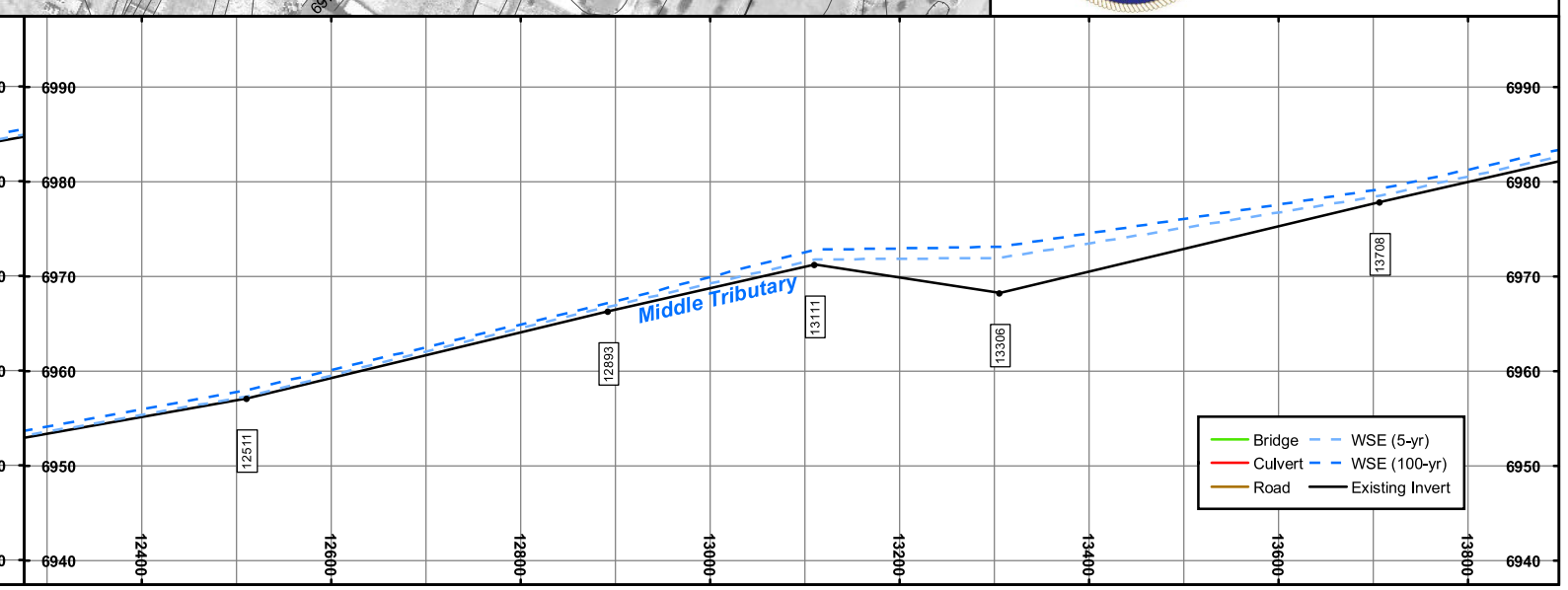
** These are conceptual design drawings and are subject to change. These drawings are not intended for construction purposes.

Index Map







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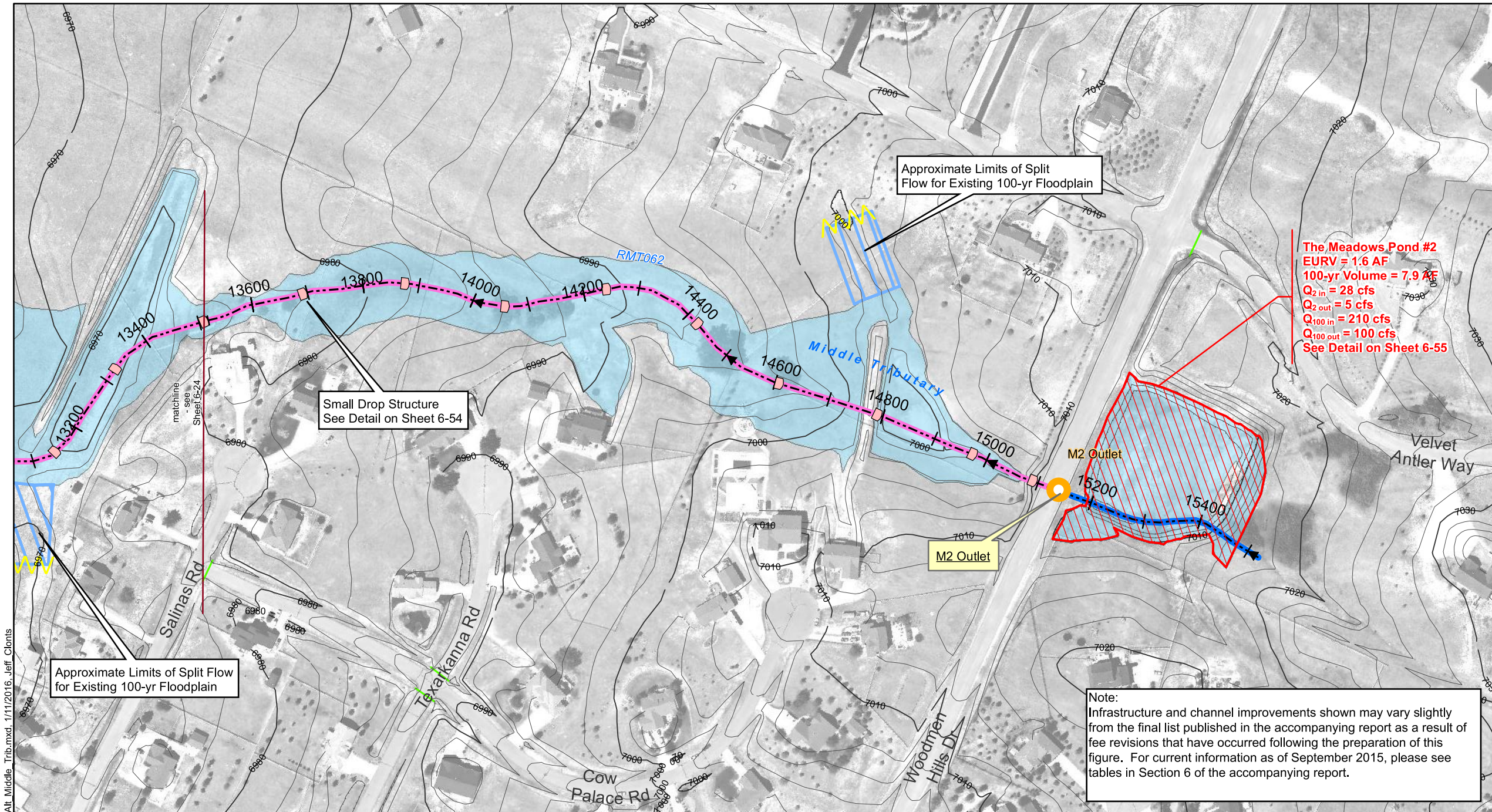
Sheet 6-25
Falcon DBPS
Conceptual Plan
Middle Tributary
El Paso County, CO



Note:
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Drainageway Crossing
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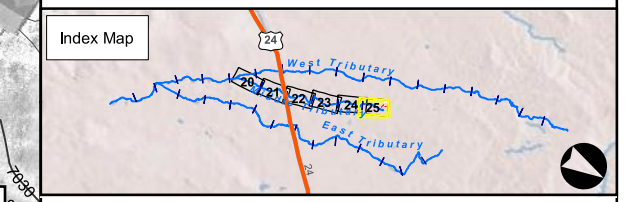

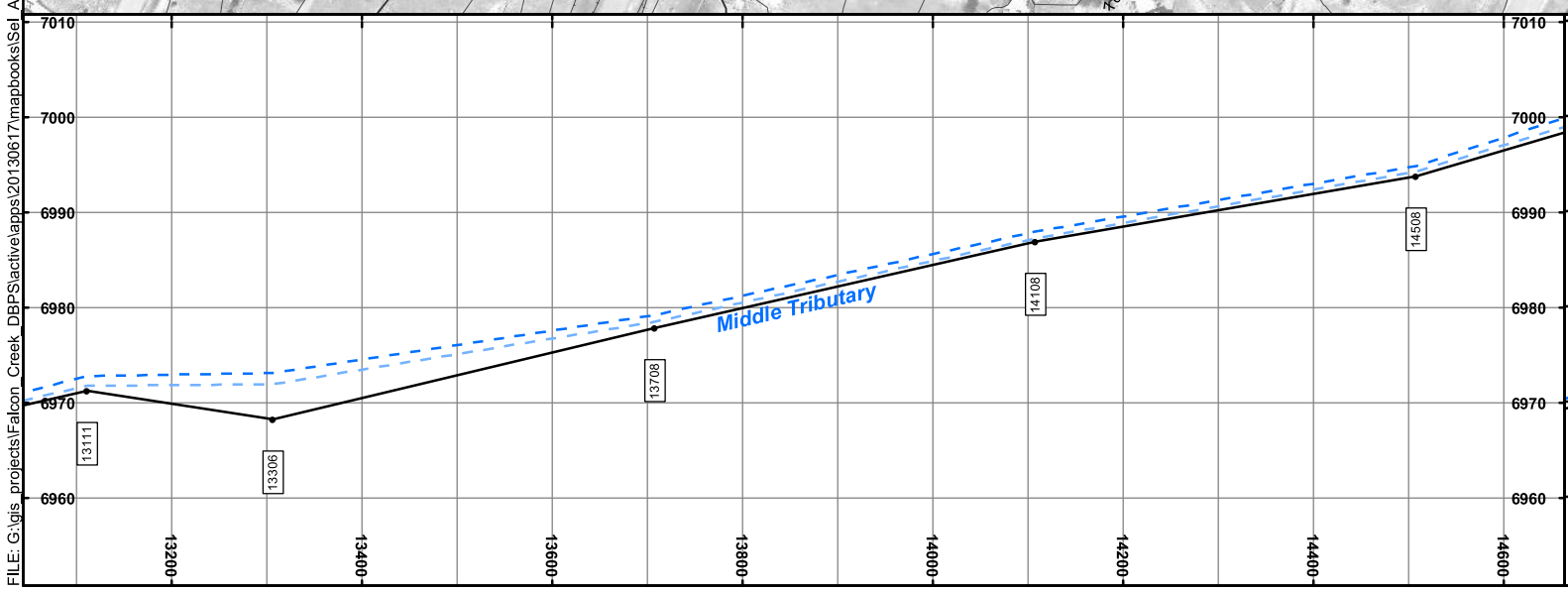

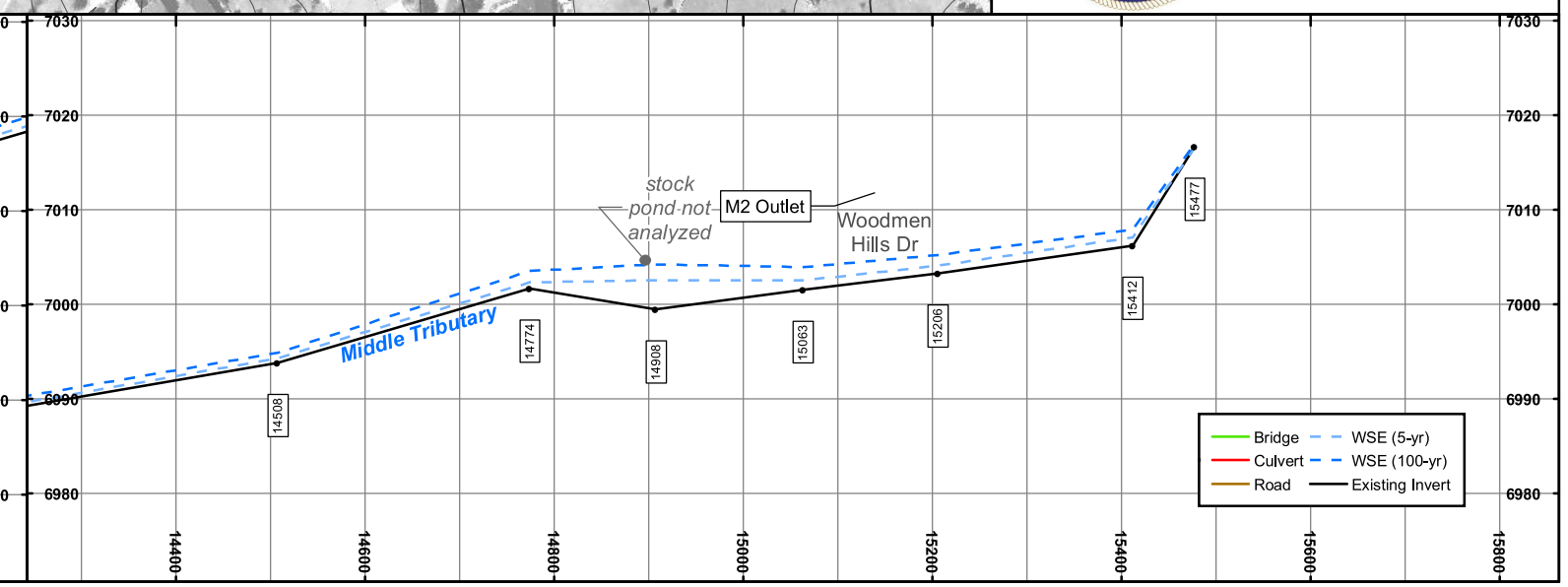

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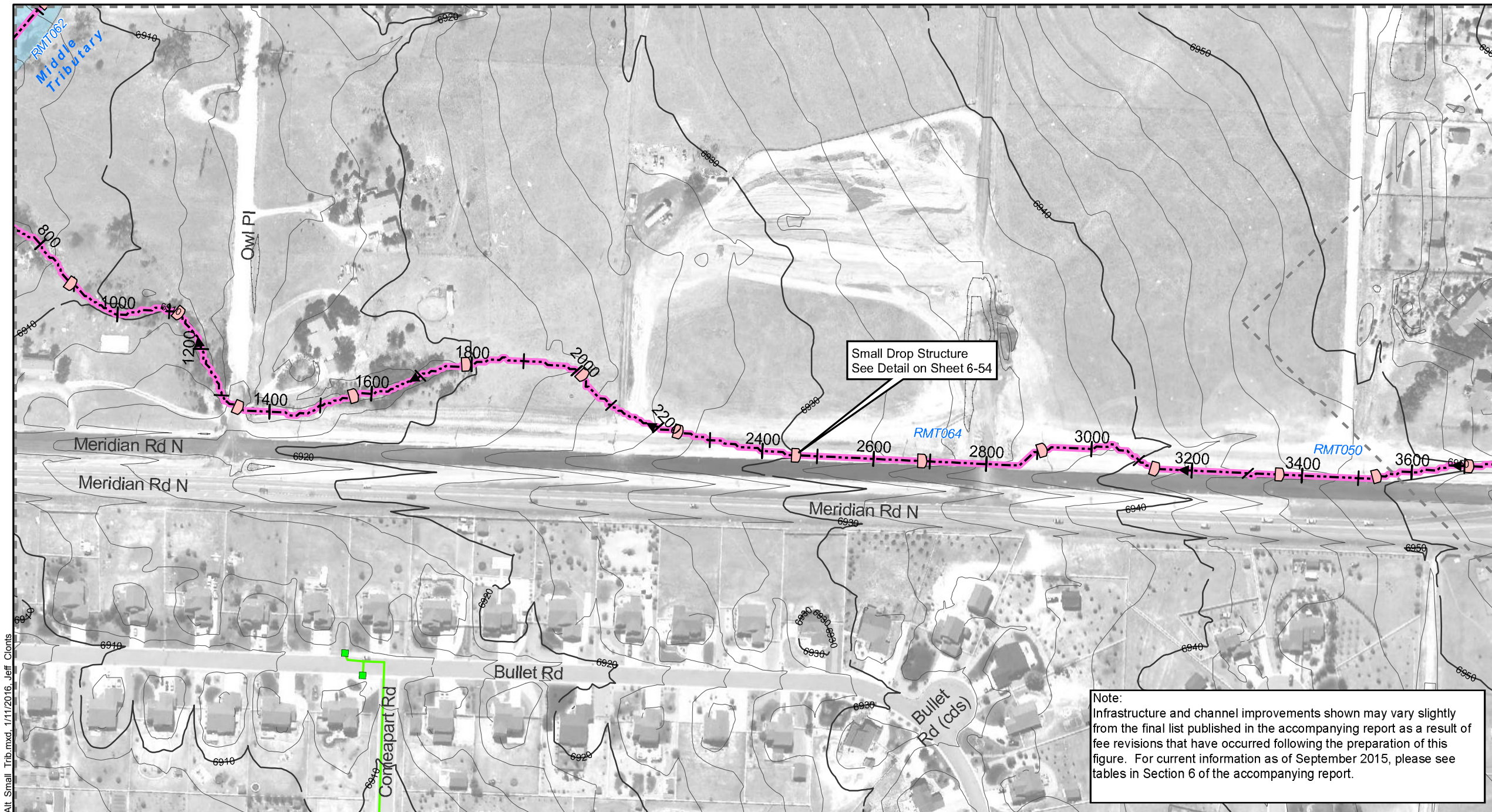

Note:
Infrastructure and channel improvements shown may vary slightly from the final list published in the accompanying report as a result of fee revisions that have occurred following the preparation of this figure. For current information as of September 2015, please see tables in Section 6 of the accompanying report.

Sheet 6-46
Falcon DBPS
Conceptual Plan
Small Tributaries
El Paso County, CO

- Drainageway Crossing
- Stream Centerline
- Existing Approximate 100-yr Floodplain*
- Floodplain Study Limit

Storm Sewer

- Inlet
- Manhole
- Pipe

Reach Improvements

- Natural Channel Design
- Protect In Place
- Roadside Ditch Improvement
- Small Drop Structures w/ Toe Protection
- Existing Detention
- Proposed Detention
- Proposed Detention Grading
- Small Drop Structure
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0 100 200 Feet

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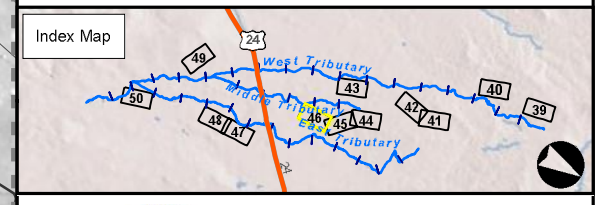
Index Map



EL PASO COUNTY COLORADO EST. 1861

Matrix DESIGN GROUP

NO PROFILES FOR SMALL TRIBUTARIES

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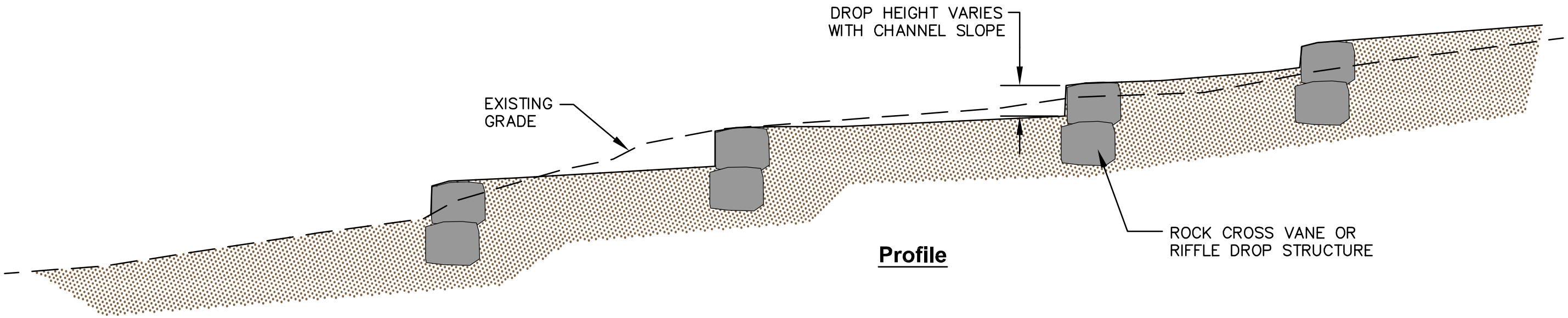

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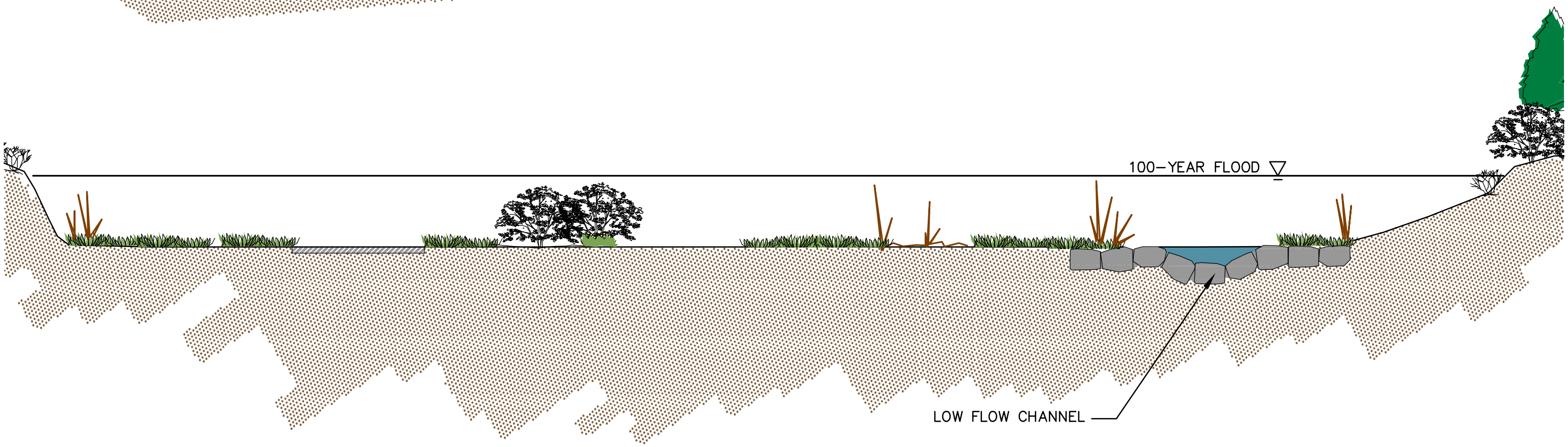

Section

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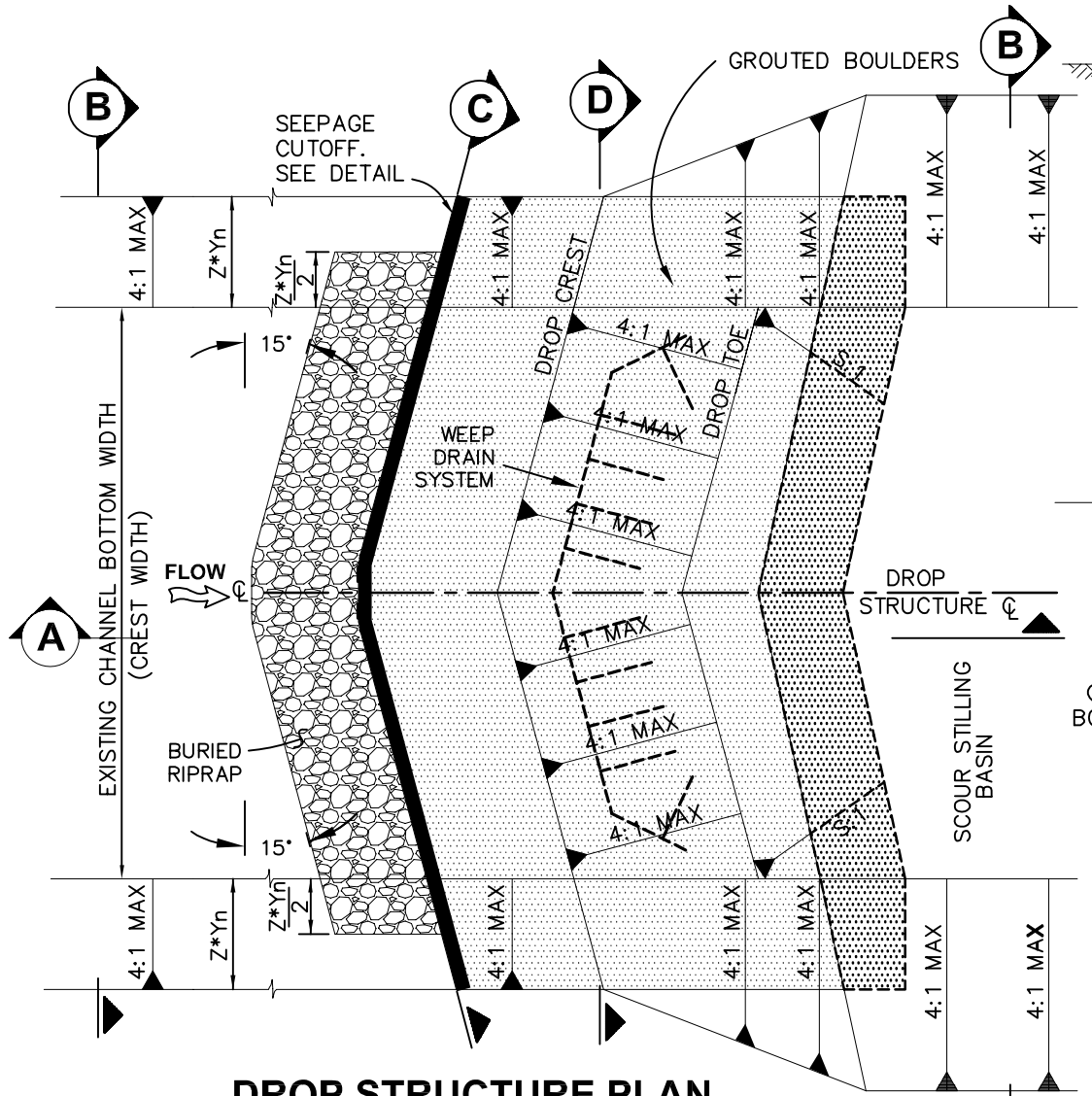
PCP: Matrix.ctb
PLOT DATE: Wed Dec 21, 2011 3:03pm

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

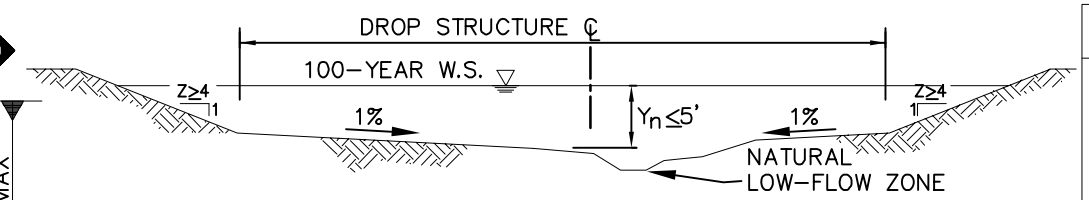
Natural Channel with Grade Control Structures

Figure 5-4



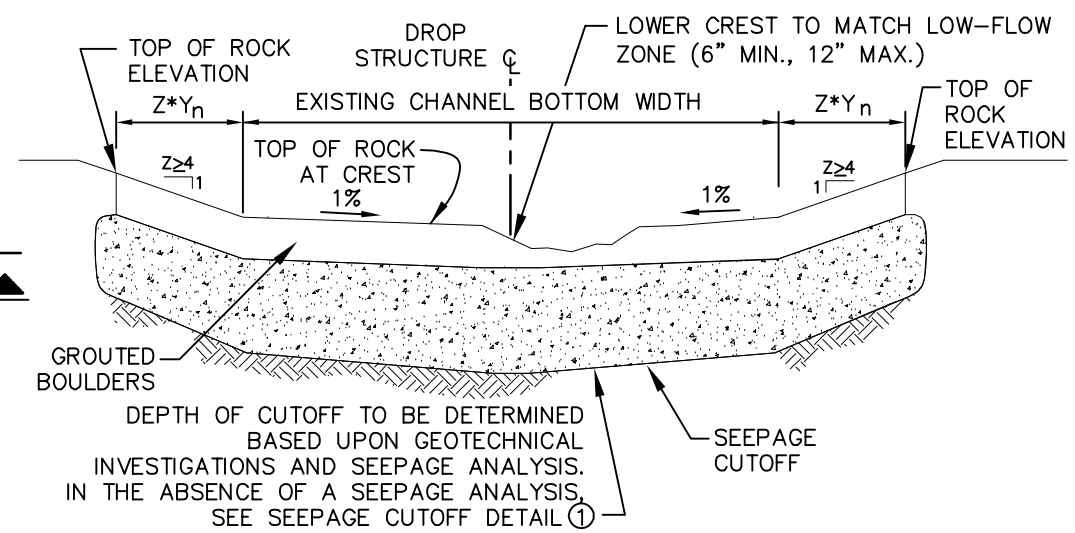
DROP STRUCTURE PLAN

NTS



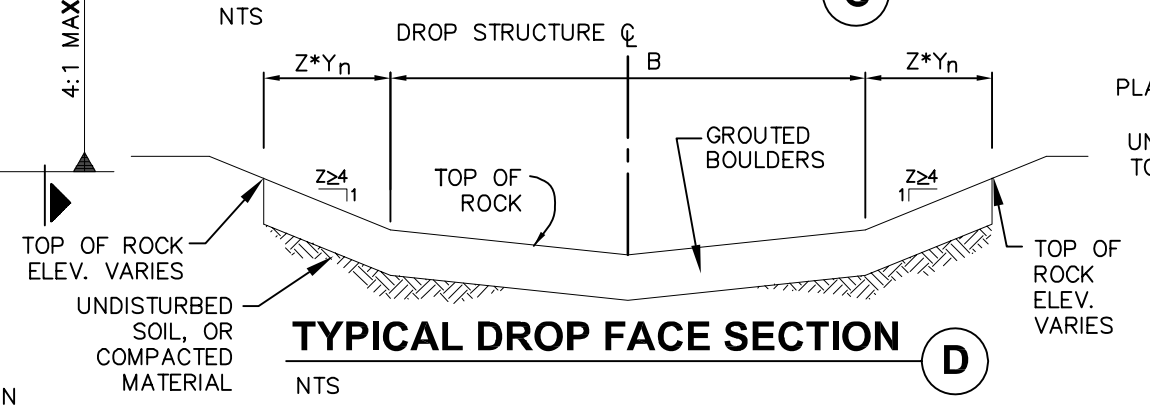
TYPICAL CHANNEL SECTION (UPSTREAM AND DOWNSTREAM OF DROP) B

NTS



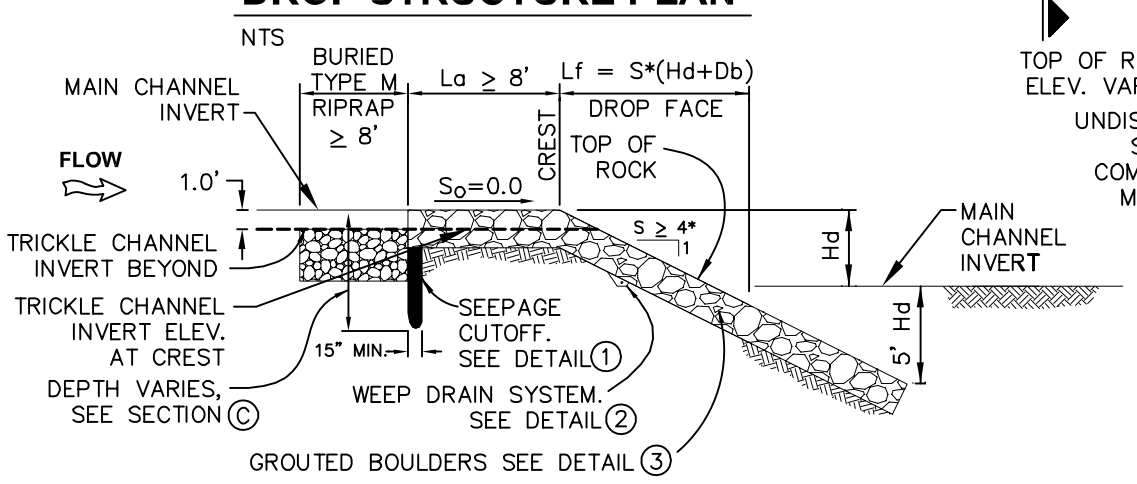
SEEPAGE CUTOFF SECTION C

NTS



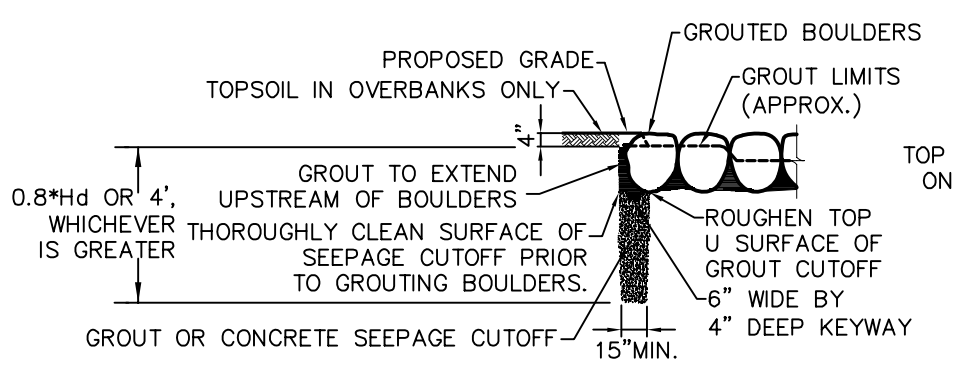
TYPICAL DROP FACE SECTION D

NTS



DROP STRUCTURE PROFILE A

NTS

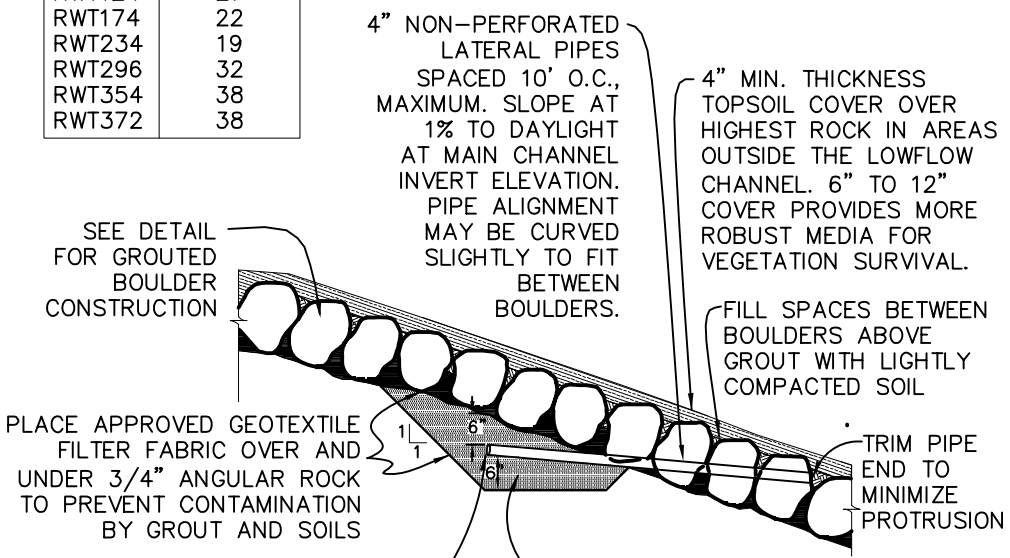


SEEPAGE CUTOFF DETAIL 1

NTS

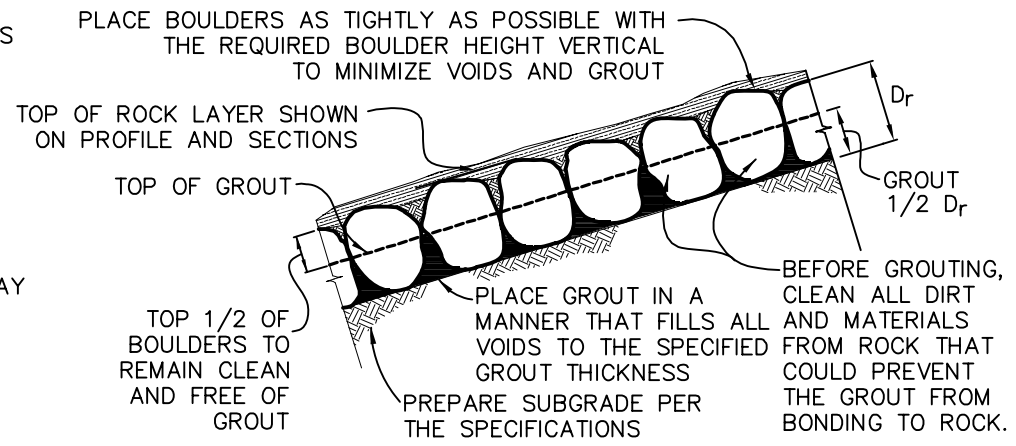
REACH	CREST WIDTH (FT)
RET020	18
RET030	21
RET040	23
RET100	28
RET110	28
RET152	29
RET156	30
RET162	30
RMT050	23
RMT062	20
RMT064	24
RMT102	27
RMT104	15
RMT106	27
RMT112	27
RMT114	27
RWT054	22
RWT080	19
RWT092	25
RWT094	26
RWT122	27
RWT124	27
RWT174	22
RWT234	19
RWT296	32
RWT354	38
RWT372	38

CONSTRUCTED GROUTED SLOPING BOULDER DROP STRUCTURE



WEEP DRAIN SYSTEM DETAIL 2

NTS USE ONLY IN DROPS HIGHER THAN 5 FEET



GROUTED BOULDER PLACEMENT DETAIL 3

NTS

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PCP: Matrix.ctb
PLOT DATE: Tue Jun 18, 2013 1:38pm

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

TYPICAL GROUTED SLOPING (GSB) BOULDER DROP STRUCTURE

NOT FOR CONSTRUCTION

NOTES:

1.) REACHES THAT ARE CURRENTLY DEGRADED MUST BE FILLED TO THE EXISTING FLOODPLAIN ELEVATION. THE LOW FLOW CHANNEL SHALL THEN BE CUT OUT OF THE FILL MATERIAL.

2.) DIMENSIONS SHOWN ARE TYPICAL AND VARY WITH THE LOW FLOW CHANNEL WIDTH.

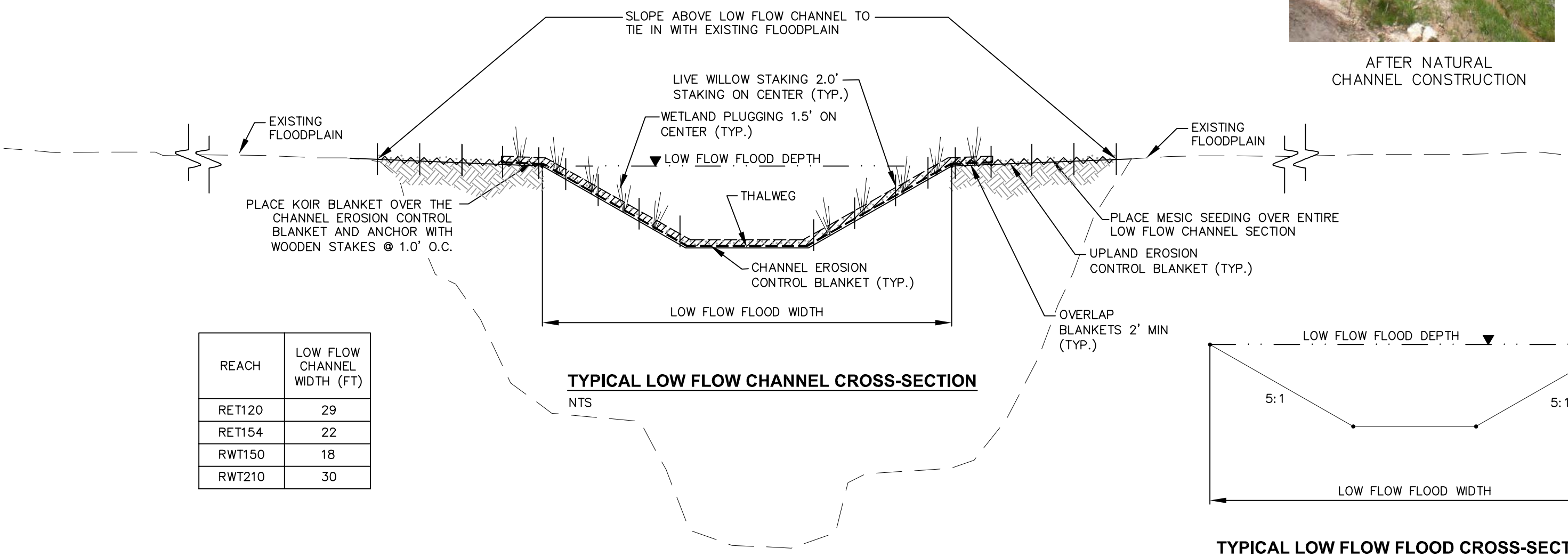
3.) ALL CHANNEL CROSS-SECTIONS SHALL HAVE A LOW FLOW FLOOD WIDTH TO DEPTH RATO (W/D) OF 23.

4.) CHANNEL CAPACITY VARIES WITH THE LOW FLOW CHANNEL WIDTH AND SLOPE.

5.) THESE CROSS-SECTIONS SHALL ONLY BE APPLIED TO "NATURAL CHANNEL DESIGN" REACHES.

BEFORE NATURAL CHANNEL CONSTRUCTION

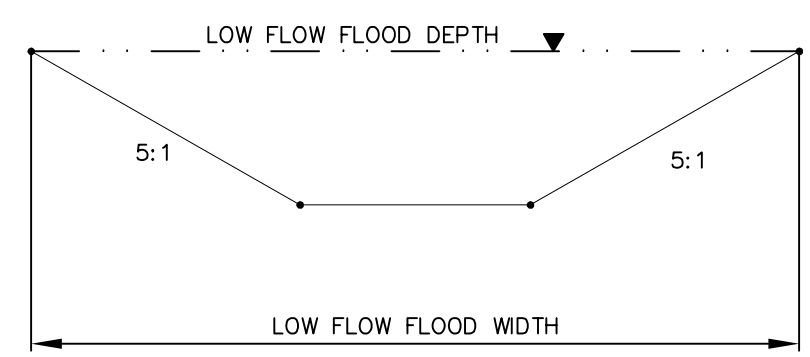
AFTER NATURAL CHANNEL CONSTRUCTION



REACH	LOW FLOW CHANNEL WIDTH (FT)
RET120	29
RET154	22
RWT150	18
RWT210	30

TYPICAL LOW FLOW CHANNEL CROSS-SECTION

NTS



TYPICAL LOW FLOW FLOOD CROSS-SECTION

NTS

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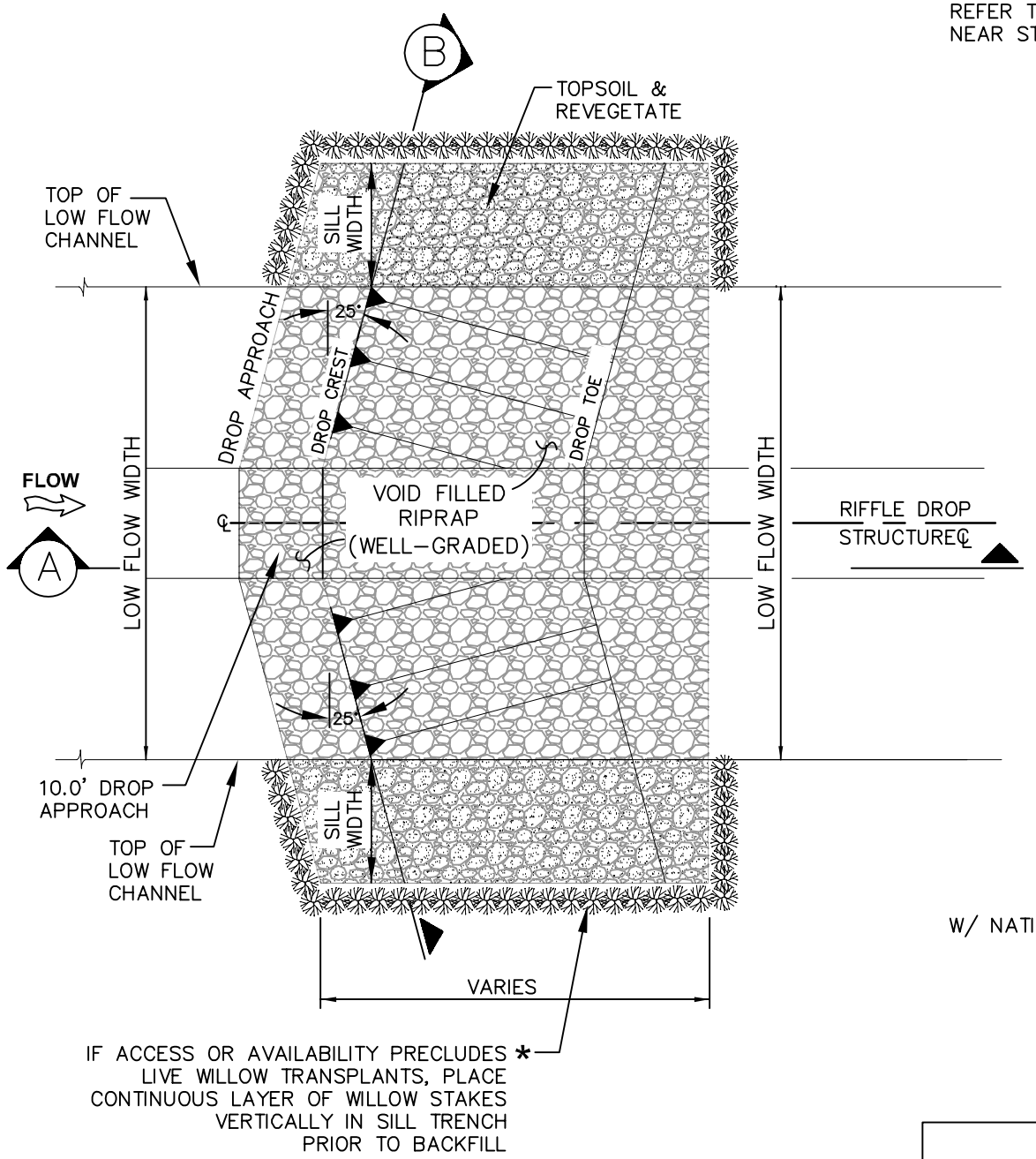
PLOT DATE: Tue Jun 18, 2013 1:46pm

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

TYPICAL NATURAL CHANNEL CROSS-SECTIONS

FOR USE IN NATURAL CHANNEL DESIGN REACHES

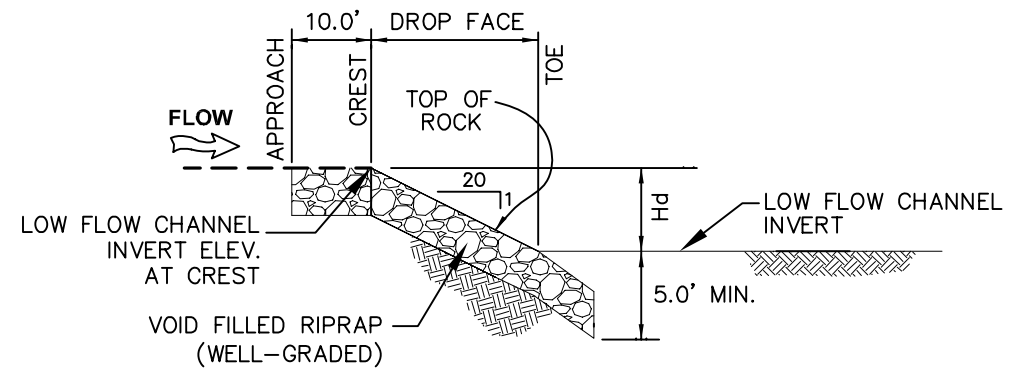
NOT FOR CONSTRUCTION



RIFFLE DROP STRUCTURE PLAN

NTS

NOTE:
REFER TO EROSION CONTROL BLANKET DETAIL FOR BLANKET INSTALLATION NEAR STRUCTURES.

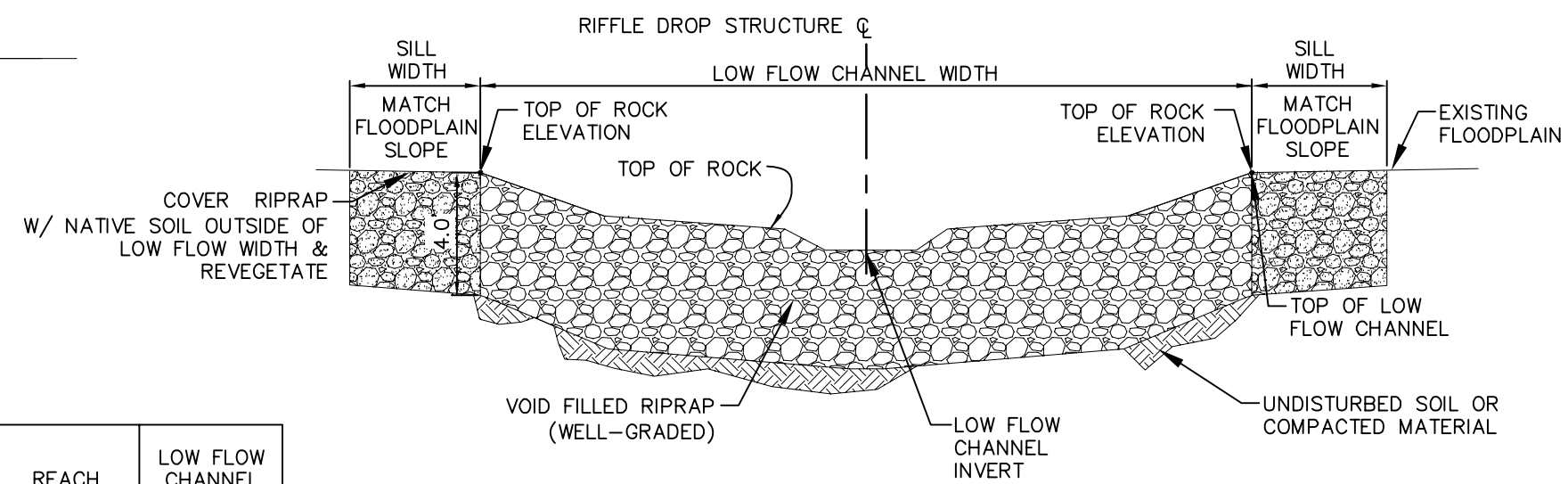


NOTE:
REFER TO EROSION CONTROL BLANKET DETAIL FOR BLANKET INSTALLATION.

RIFFLE DROP STRUCTURE PROFILE (A)

NTS

CONSTRUCTED RIFFLE DROP STRUCTURE



RIFFLE DROP STRUCTURE SECTION (B)

NTS

REACH	LOW FLOW CHANNEL WIDTH (FT)
RET120	29
RET154	22
RWT150	18
RWT210	30

TYPICAL RIFFLE DROP STRUCTURE

FOR USE IN NATURAL CHANNEL DESIGN REACHES

NOT FOR CONSTRUCTION

NAME: S:\10.122.003 (Falcon DBPS)\DWG\XSEC-RCVANE-RDSexhibit.dwg
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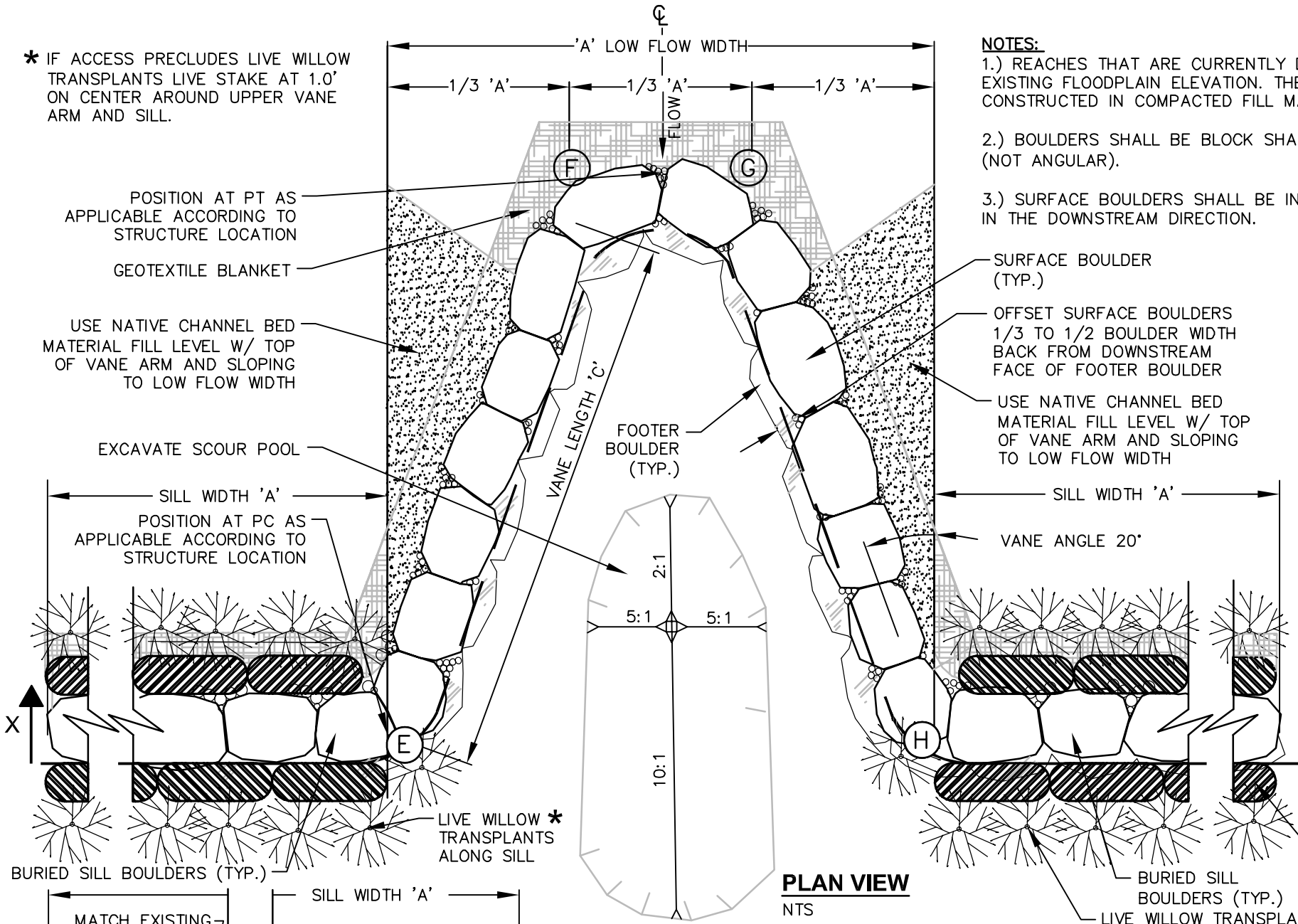
PLOT DATE: Tue Jun 18, 2013 1:49pm

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

* IF ACCESS PRECLUDES LIVE WILLOW TRANSPLANTS LIVE STAKE AT 1.0' ON CENTER AROUND UPPER VANE ARM AND SILL.



PLAN VIEW

NTS

NOTES:

1.) REACHES THAT ARE CURRENTLY DEGRADED MUST BE FILLED TO THE EXISTING FLOODPLAIN ELEVATION. THE ROCK CROSS VANE SHALL THEN BE CONSTRUCTED IN COMPACTED FILL MATERIAL.

2.) BOULDERS SHALL BE BLOCK SHAPED ACCORDING TO SPECIFICATIONS (NOT ANGULAR).

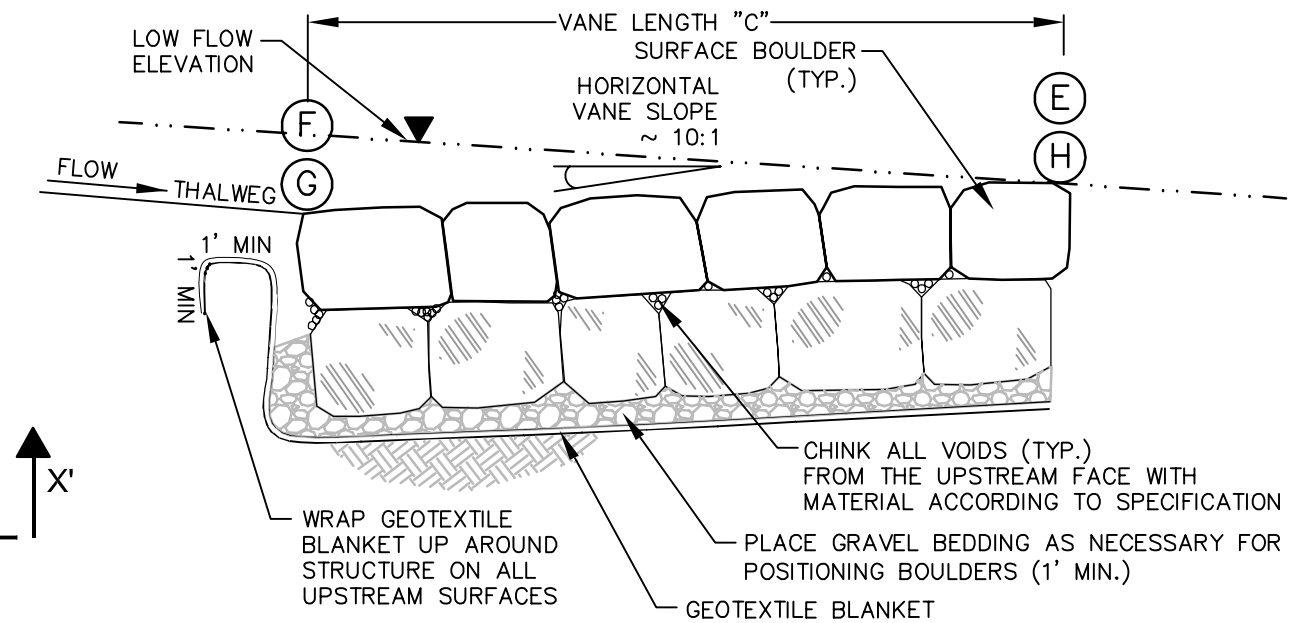
3.) SURFACE BOULDERS SHALL BE IN COMPRESSION W/ FOOTER BOULDERS IN THE DOWNSTREAM DIRECTION.

NOTE:

(E) AND (H) LOW FLOW FLOOD ELEVATION

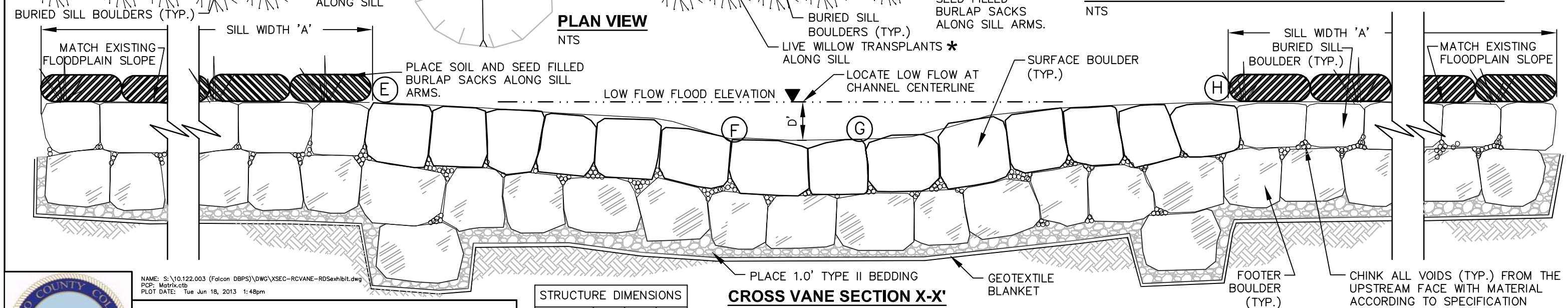
(F) AND (G) MARK VANE ELEVATION AT HEAD OF VANE

CONSTRUCTED ROCK CROSS VANE



CROSS VANE LONGITUDINAL PROFILE ALONG VANE

NTS



CROSS VANE SECTION X-X'

NTS LOOKING UPSTREAM

STRUCTURE DIMENSIONS			
REACH	'A'	'C'	'D'
RET120	29'	26'	1.3'
RET154	22'	20'	1.0'
RWT150	18'	16'	0.8'
RWT210	30'	26'	1.3'

NAME: S:\10.122.003 (Falcon DBPS)\DWG\XSEC-RCVANE-RDSexhibit.dwg
PCP: Matrix.ctb
PLOT DATE: Tue Jun 18, 2013 1:48pm

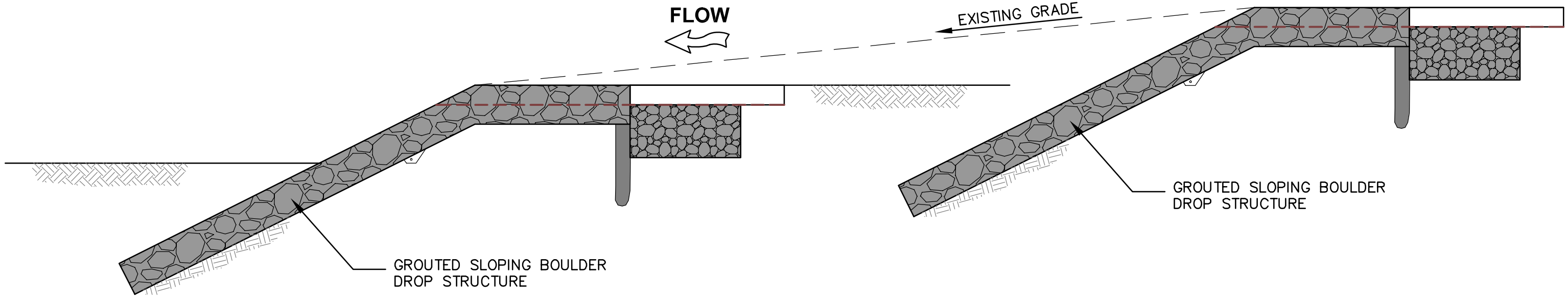
EL PASO COUNTY COLORADO EST. 1861

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

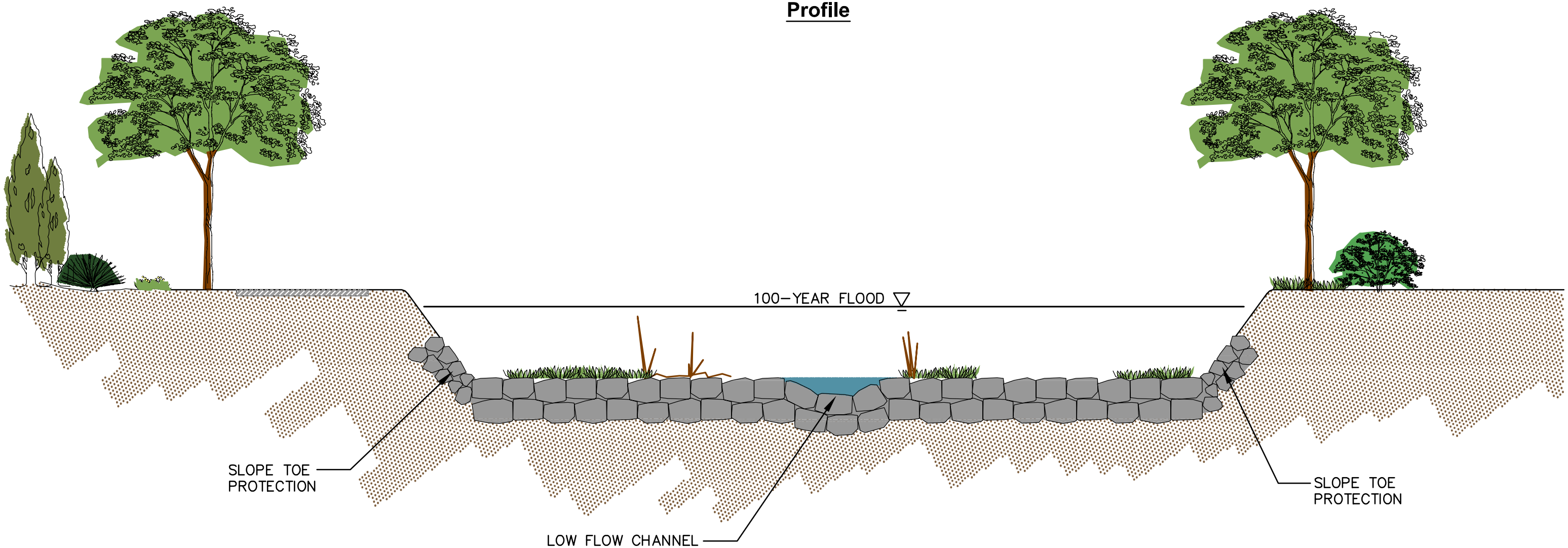
TYPICAL ROCK CROSS VANE DETAILS

FOR USE IN NATURAL CHANNEL DESIGN REACHES

NOT FOR CONSTRUCTION



Profile



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PLOT DATE: Wed Dec 21, 2011 3:03pm

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

Small Drop Structures with Toe Protection

Figure 5-5