



PRELIMINARY DRAINAGE REPORT

FALCON MEADOWS AT BENT GRASS

El Paso County, Colorado

PREPARED FOR:
Challenger Homes
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:
August 5, 2020

Engineering Review

10/12/2020 10:01:27 AM

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EPC Planning & Community
Development Department

See comment letter also



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.

Charlene Durham, P.E. #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: _____

Date

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

 include all owners

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.

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

Date

Conditions:

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I. Purpose

The purpose of this Preliminary 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 previously approved MDDP for the site prepared by Galloway & Company.

II. General Description

The project is a single-family residential development located in the Falcon area of El Paso County, Colorado. The site is located in the Northwest $\frac{1}{4}$ and Southwest $\frac{1}{4}$ of Section 1, Township 13S, Range 65W, of the Sixth Principal Meridian, County of El Paso, State of Colorado. The subject property is bounded by Bent Grass Meadows Filing No.2 to the east, Latigo Business Center Filing No. 1 to the south, The Meadows Filings No. 1 & 2 to the west, and The Meadows Filing No. 3 to the north. A Vicinity Map is included in Appendix A.

This preliminary drainage report was the basis for the drainage facility design contained within the previously approved MDDP for the site prepared by Galloway & Company. The site consists of approximately 66.6 acres and includes 262 dwelling units.

260?

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

provide revised MDDP

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, May 2019.
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 for Bent Grass Residential (Filing No. 2)*, by Galloway & Company, May 2020.

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.

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:

$$Q = CIA$$

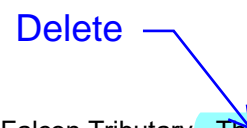
Where:

- 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. The 5-year event was used as the minor event.

The UD-Detention v3.07 spreadsheet was utilized for the design of the proposed on-site water quality ponds, Pond (North) and Pond (South).



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.

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 RWT204 channel rates that are lower than those identified within the DBPS. A HEC-HMS model will be prepared with subsequent submittals updating the proposed flow rates within the channel.

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. **revise based on filing 2 construction**

A historic basin map has been prepared for this site to analyze the existing basins as well as the offsite basins contributing to the site. The historic map is included in Appendix D and basins are described below.

Basin EX-1 (1.19 AC, $Q_5 = 0.4$ cfs, $Q_{100} = 0.6$ 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, $Q_{100} = 0.9$ 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, $Q_{100} = 0.4$ 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, $Q_{100} = 6.2$ 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, $Q_{100} = 2.6$ 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, $Q_{100} = 4.5$ 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, $Q_{100} = 4.7$ 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, $Q_{100} = 11.0$ 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, $Q_5 = 15.1$ cfs, $Q_{100} = 65.1$ 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.

Basin OS-2 (20.08 AC, $Q_5 = 9.3$ cfs, $Q_{100} = 43.4$ 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, $Q_5 = 5.3$ cfs, $Q_{100} = 24.3$ 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 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, $Q_5 = 5.6$ cfs, $Q_{100} = 14.0$ 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, $Q_5 = 1.1$ cfs, $Q_{100} = 2.3$ 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, $Q_5 = 2.0$ cfs, $Q_{100} = 4.3$ 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**.

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:

Call out the specific LID BMPs and locations, include the design and fact sheets.

is provided in the MDDP?

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.

Provide Water Quality Capture Volume (WQCV)

2. 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.

for all developed areas?

3. 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 will be created and used to evaluate the stability of the existing and proposed channels.

Consider Need for Industrial and Commercial BMPs

4. Implement Site Specific and Other Source Control BMPs

Source control BMPs for homeowners include the use of garages as the primary area where pollutants can be stored. The single-family detached homes provide garages which can act as storage areas. The proposed development does not include outdoor storage or the potential for introduction of contaminants to the Counties' MS4, thus no targeted source control BMPs are necessary. The biggest source control BMP is public education which can be found on the City of Colorado Springs website and discuss topics such as: pet waste, car washing, lawn care, fall leaves, and snow melt and deicer.

VII. Proposed Drainage Conditions

is this applicable to this filing?

There has been very minor changes to the overall Falcon Area Basin delineation with the proposed condition. A small portion of the site that previously went to the Middle Tributary has been revised to come into the site and a small portion of the site that was previously within the West Tributary has been designed to drain into the Middle Tributary. This will be discussed with the individual basins. All necessary calculations can be found within the appendices of the report.

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. In the Bent Grass Filing No. 2 report & CD's, the RWT202 channel was rerouted to run along the north boundary & combine with the existing RWT204 channel. The proposed development will drain to the RWT204 channel, which becomes RWT210 south of Bent Grass Meadows Drive.

The site will provide two WQCV Detention Ponds, North Pond & South Pond, to provide water quality treatment prior to discharging the runoff directly into the West Tributary channel RWT204 RWT210.

As has been mentioned previously the site is proposed to be single family residential. The site has been 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 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 Basin A-1 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 Basin A-1 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 Basin A-1 at **DP 3**.

Basin A-1 (2.57 AC, Q5 = 3.9 cfs, Q100 = 6.5 cfs): a basin that includes residential lots & east half of Lemon Grass Road. It encompasses single-family residential lots. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 4**. Flows will then enter a proposed CDOT Type 'R' inlet and will be piped into the existing Bent Grass Filing No. 2 WQCV pond located in Basin A-2 at **DP 6**.

Basin A-2 (2.29 AC, Q5 = 4.7 cfs, Q100 = 7.9 cfs): a basin that includes the west half of Lemon Grass Road and encompasses single-family residential lots. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 5**. Flows will then enter a proposed CDOT Type 'R' inlet where it will be piped into the existing Bent Grass Filing No. 2 WQCV pond located in the south end of the basin.

Basin B-1 (4.35 AC, Q5 = 1.2 cfs, Q100 = 2.0 cfs): a basin that is in the center of the site and encompasses the existing improved channel RWT204. Flows will sheet flow into the existing channel where they will then be conveyed to **DP 22**.

Basin C-1 (9.34 AC, Q5 = 12.3 cfs, Q100 = 20.7 cfs): a basin that includes Sophia Lane, the west half of Sarin Trail, north portion of Kittrick Place, east portion of Daelyn Drive, and encompasses single-family residential lots. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 15**. Flows will then enter a proposed CDOT Type 'R' inlet where it will be piped to the proposed north WQCV pond at **DP 13**.

Basin C-2 (3.30 AC, Q5 = 7.4 cfs, Q100 = 12.4 cfs): It encompasses single-family residential lots including the east half of Sarin 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 12**. Flows will then enter a proposed CDOT Type 'R' inlet where it will be piped to the proposed north WQCV pond at **DP 13**.

Basin C-3 (1.17 AC, Q5 = 2.9 cfs, Q100 = 4.8 cfs): It encompasses the east half of Kittrick Place between Sarin Trail & Daelyn Drive, as well as single-family residential lots. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 8**. Flows will then enter a proposed CDOT Type 'R' inlet where it will then be piped and ultimately outfall in the proposed north WQCV pond at **DP 13**.

Basin C-4 (2.10 AC, Q5 = 4.1 cfs, Q100 = 6.9 cfs): It encompasses the west half of Kittrick Place between Sarin Trail & Daelyn Drive, as well as single-family residential lots. Runoff will flow from each lot onto the proposed public R.O.W. where proposed mountable curb and gutter will convey flows to **DP 7**. Flows will then enter a proposed CDOT Type 'R' inlet where it will then be piped and ultimately outfall in the proposed north WQCV pond at **DP 13**.

Basin C-5 (0.45 AC, Q5 = 0.2 cfs, Q100 = 0.3 cfs): It encompasses the proposed north WQCV pond area. The stormwater within the proposed north WQCV pond will be released at a controlled rate, via an outlet structure with orifice holes, into the existing channel RWT204.

Basin OS-2 (20.08 AC, Q5 = 9.3 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 proposed drainage swale to the south where it will enter Basin D-3 and tie-into the existing drainage swale 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 19**.

Basin OS-3 (10.62 AC, Q5 = 5.3 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 19**.

Basin D-1 (8.24 AC, Q5 = 10.6 cfs, Q100 = 17.9 cfs): a basin along the west property line of the site. It encompasses single-family residential lots, Isabel Place, & 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**. Flows will then enter a proposed CDOT Type 'R' inlet where it will then be piped and ultimately outfall in the proposed south WQCV pond at **DP 19**.

Basin D-2 (9.33 AC, Q5 = 13.9 cfs, Q100 = 23.4 cfs): a basin east of Basin D-1. It encompasses single-family residential lots, Isabel Place, Raylan Loop, Jolie Court, as well as the east 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 14**. Flows will then enter a proposed CDOT Type 'R' inlet where it will then be piped and ultimately outfall in the proposed south WQCV pond at **DP 19**.

Basin D-3 (0.93 AC, Q5 = 1.0 cfs, Q100 = 1.7 cfs): a basin 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 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 19**.

Basin D-4 (3.64 AC, Q5 = 7.0 cfs, Q100 = 11.7 cfs): a basin that is east of Bent Grass Meadows Drive. It encompasses single-family residential lots, Rowena Way, & portions of Linley 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 17**. Flows will then enter a proposed CDOT Type 'R' inlet where it will then be piped and ultimately outfall in the proposed south WQCV pond at **DP 19**.

Basin D-5 (2.31 AC, Q5 = 3.4 cfs, Q100 = 5.7 cfs): a basin that is west of the existing channel & south of Bent Grass Meadows Drive. It encompasses single-family residential lots, portions of 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 a proposed sidewalk chase that will then discharge flows into a proposed drainage ditch. The drainage ditch will then convey flows, ultimately discharging into the proposed south WQCV pond at **DP 20**.

Swale A and Swale C?

Basin D-6 (4.01 AC, Q5 = 8.8 cfs, Q100 = 14.8 cfs): a basin that is south of Basin D-5 & east of Basin D-4. 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**. Flows will then enter a proposed CDOT Type 'R' inlet where it will then be piped and ultimately outfall in the proposed south WQCV pond at **DP 19**.

Basin D-7 (7.06 AC, Q5 = 3.2 cfs, Q100 = 5.5 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 proposed south WQCV pond, an existing sediment basin, and an existing drainage ditch. Runoff will flow, via sheet flow, until it enters the existing drainage ditch and is conveyed to the proposed south WQCV pond or will directly flow into the proposed south WQCV pond.

Basin B-2 (1.17 AC, Q5 = 0.7 cfs, Q100 = 1.2 cfs): a basin that is in the south area of the site and encompasses the existing channel RWT210. Flows will sheet flow into the existing channel where they will then be conveyed to **DP 23** exiting the site.

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. Final drainage report will include details concerning inlet location, street capacity, storm sewer sizing, and location.

IX. Proposed Water Quality Detention Ponds

Two Water Quality Capture Volume Detention Ponds will be provided for the proposed site. One will be provided for the area north of Bent Grass Meadows Drive and the other will be provided for the area to the south. Both ponds are private. These detention ponds 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 will release in 40 hours. Outlet structures, forebays, trickle channels, etc. will be designed with the final drainage report during final plat. The required WQCV volume of the North & South pond are 0.313 acre-feet & 1.157 acre-feet, relatively. The north water quality pond will release into RWT204 and the south will release into RWT210. Initial sizing of the ponds have been provided in Appendix C.

, to be maintained by the metro district (?)

The GEC plan shows grading in the channel. The complete channel design, including downstream, needs to be provided if this is the case.

X. Proposed Channel Improvements

The channel design is anticipated to have a series of Grouted Sloping Boulder Drops within it.

Riprap protection will be provided at the individual outfalls from the site into the channel to prevent scouring from the point discharges if velocity constraints are not met.

Improvements to the existing channel are outlined in the Master Development Drainage Plan for Bent Grass Residential Subdivision (MDDP). As part of this development, improvements outlined in the MDDP for the existing channel will be implemented.

XI. Maintenance

The proposed channels are to be public facilities. After completion of construction and upon the Board of County Commissioners acceptance the channels will be owned and maintained by El Paso County along with all drainage facilities within the public Right-of-Way.

Clarify conflict with PUD/SP plan.

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 has been sized per the FEMA flows and not the DBPS. The no rise certification will be provided under a separate report.

XIV. Drainage Fees & Maintenance

Falcon Basin is part of the El Paso County drainage basin fee program all applicable fees will be presented in the final drainage report.

A presentation of accurate, complete, and current estimate of cost for proposed facilities will be presented with the final drainage report.

XV. Conclusion

The Falcon Meadows at Bent Grass residential subdivision lies within the West Tributary of the Falcon Area Watershed. Recommendations are made within this report to establish and stabilize multiple drainageways through the project site. Water quality for the site is provided in two on-site WQCV ponds, North Pond & South Pond. All drainage facilities within this report were sized according to the El Paso County Drainage Criteria Manuals. All of the channel corridors will be publicly owned and maintained and shall be the responsibility of El Paso County. A Final Drainage Report will be submitted along with the final plat and construction drawings.

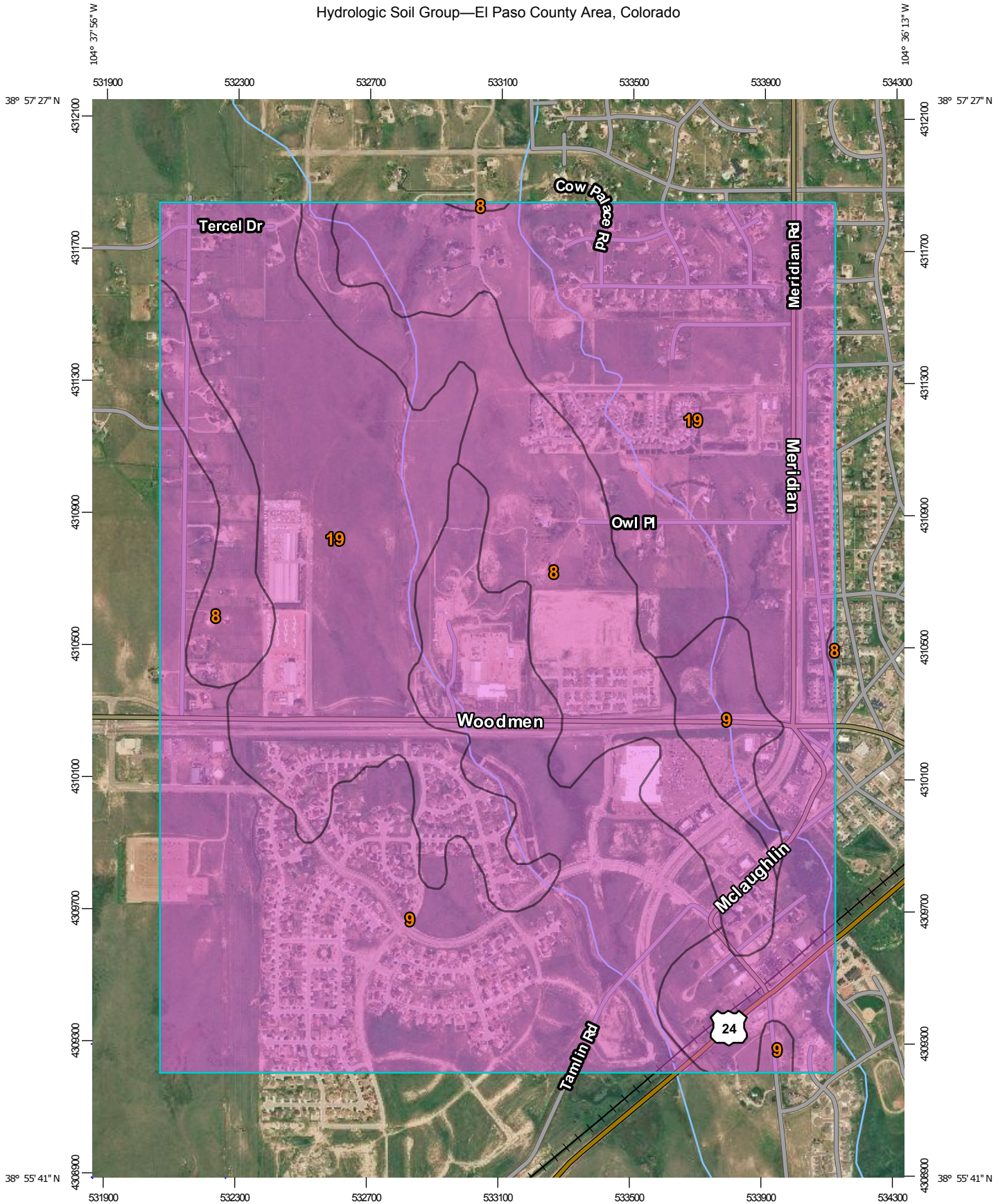
are proposed to be

XVI. References

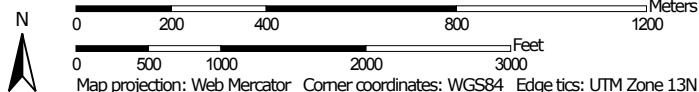
1. *City of Colorado Springs/County of El Paso Drainage Criteria Manual*, October 1991.
2. *Drainage Criteria Manual, Volume 2*, City of Colorado Springs, November 2002.
3. *Urban Storm Drainage Criteria Manual*, Urban Drainage and Flood Control District, January 2016 (with current revisions).
4. *Falcon 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.

APPENDIX A
Exhibits and Figures

Hydrologic Soil Group—El Paso County Area, Colorado



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



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




Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

4/2/2019
Page 1 of 4

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



FALCON MEADOWS AT BENT GRASS

BENT GRASS MEADOWS DRIVE

SCALE: 1"=2,000'

VICINITY MAP

Project No: CLH000017.20

Drawn By: TJE

Checked By: CMD

Date: 06/19/2020



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

NOTES TO USERS

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

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

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

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

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

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

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

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

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

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, 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.

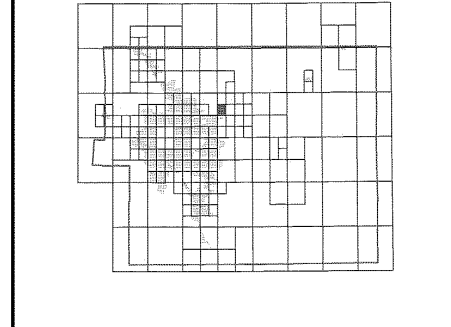
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which 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 1-800-358-9820 and its website at <http://www.msc.fema.gov/>.

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

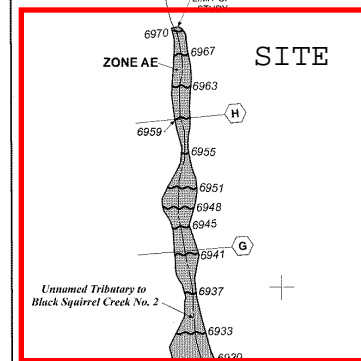
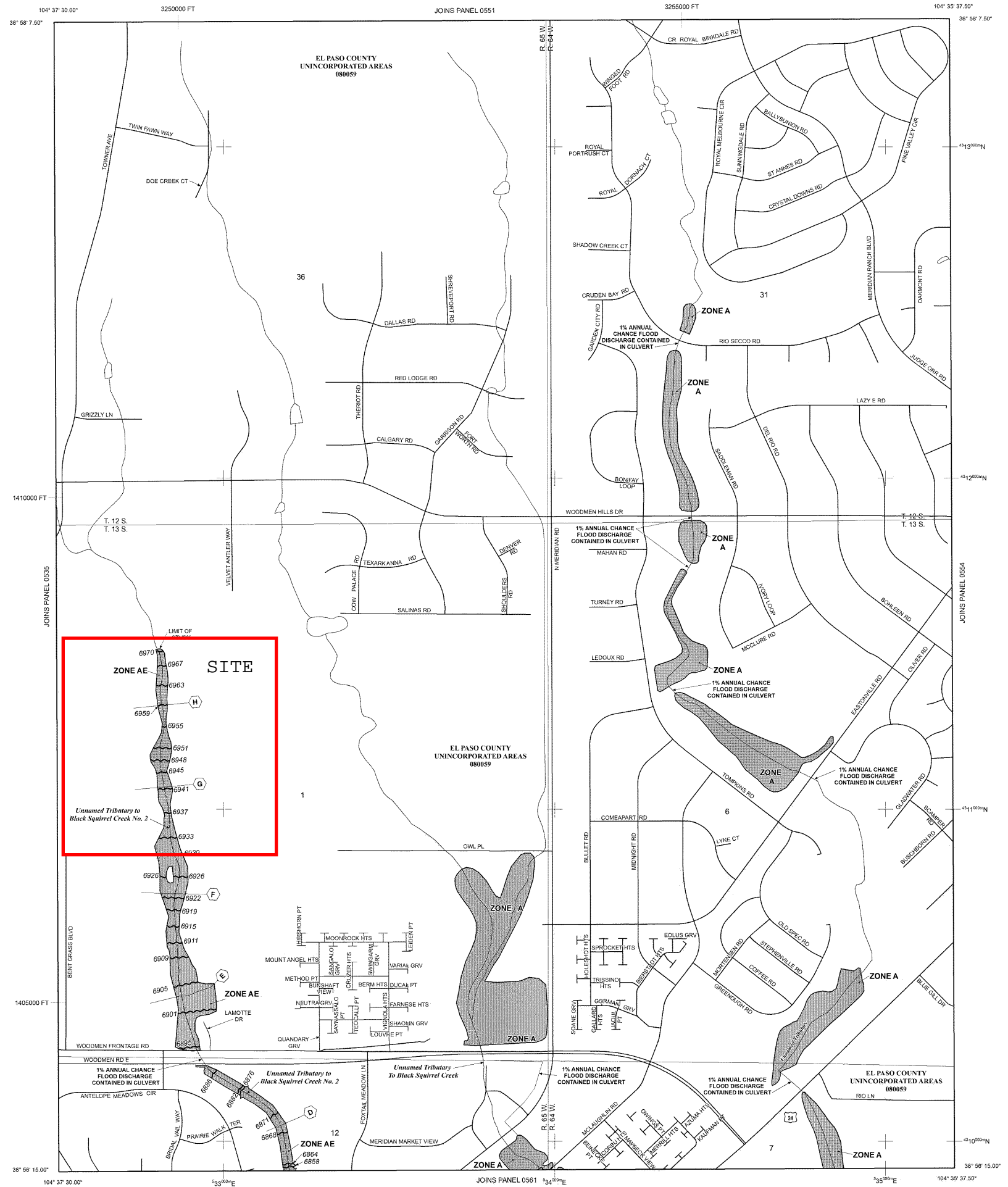
El Paso County Vertical Datum Offset Table	
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY REPORT FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

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.
Base Flood Elevation line and value; elevation in feet*
Base Flood Elevation value where uniform within zone; elevation in feet*
* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

○ A ○ A Cross section line
23 23 Transect line
97° 07' 30.00" 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4750000N 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 X 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'

NFP

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 08059 0553 G

Noted 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

FALCON DRAINAGE BASIN PLANNING STUDY
SELECTED PLAN REPORT
FINAL - SEPTEMBER 2015

Prepared for:



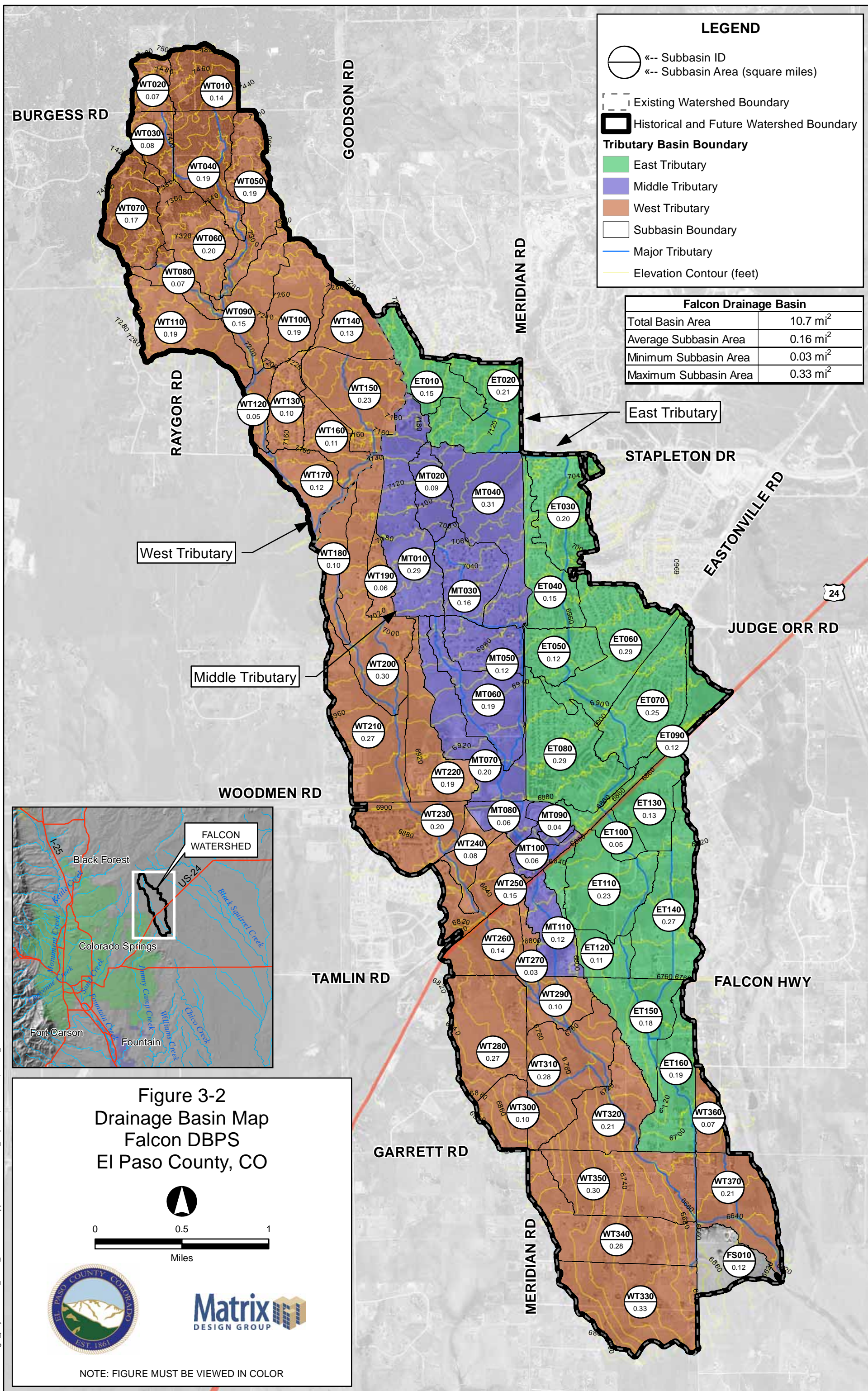
El Paso County Public Services Department
3275 Akers Drive
Colorado Springs, CO 80922

Prepared By:



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

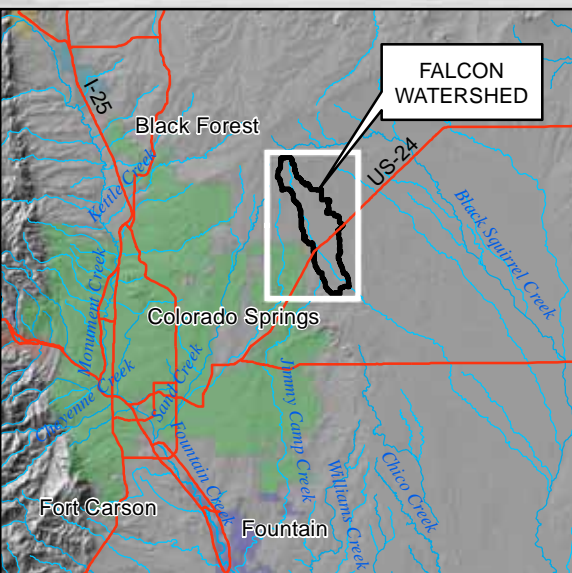
Matrix Project No. 10.122.003



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 mi ²
Average Subbasin Area	0.16 mi ²
Minimum Subbasin Area	0.03 mi ²
Maximum Subbasin Area	0.33 mi ²



**Figure 3-2
Drainage Basin Map
Falcon DBPS
El Paso County, CO**

0 0.5 1
Miles

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

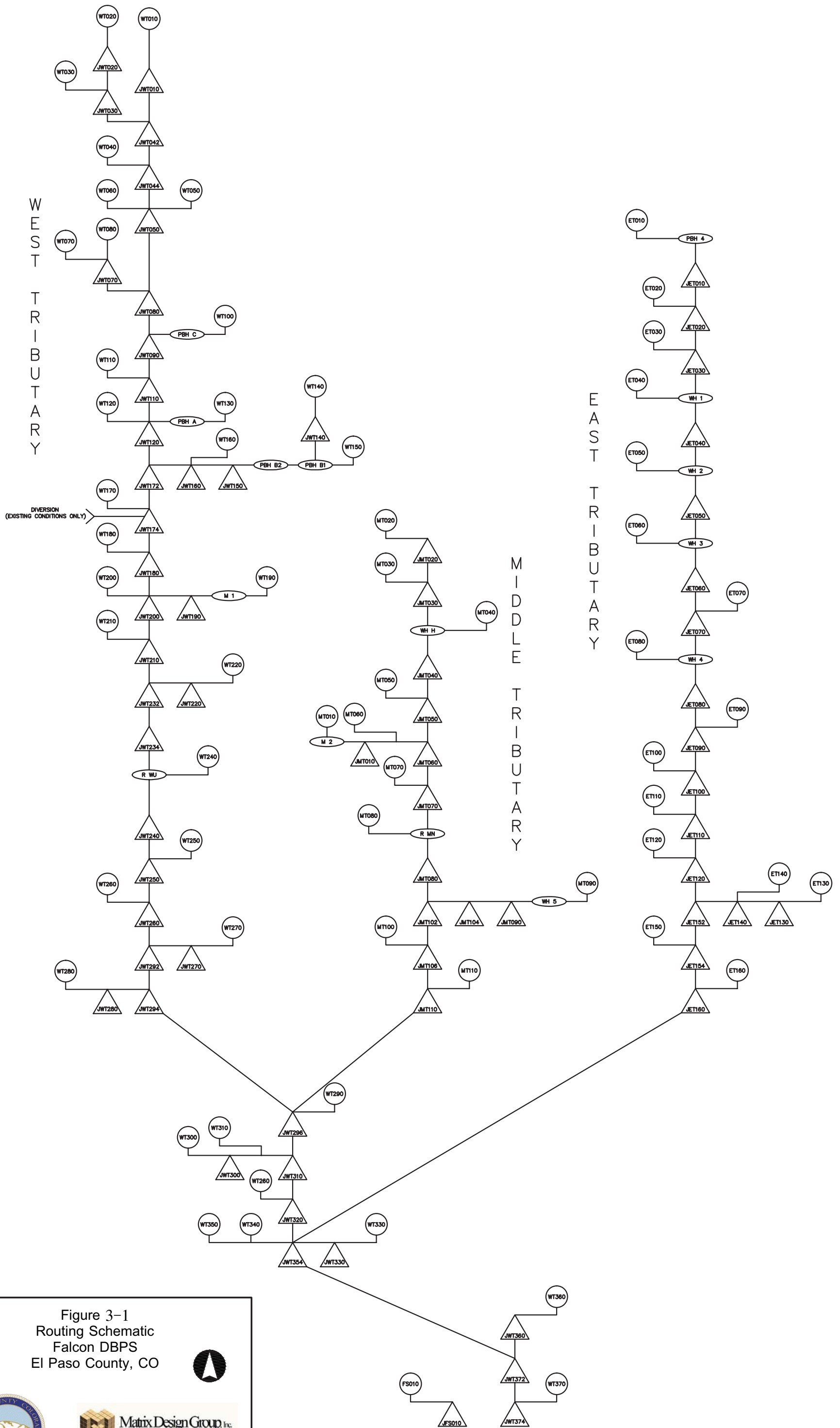


Figure 3-1
Routing Schematic
Falcon DBPS
El Paso County, CO

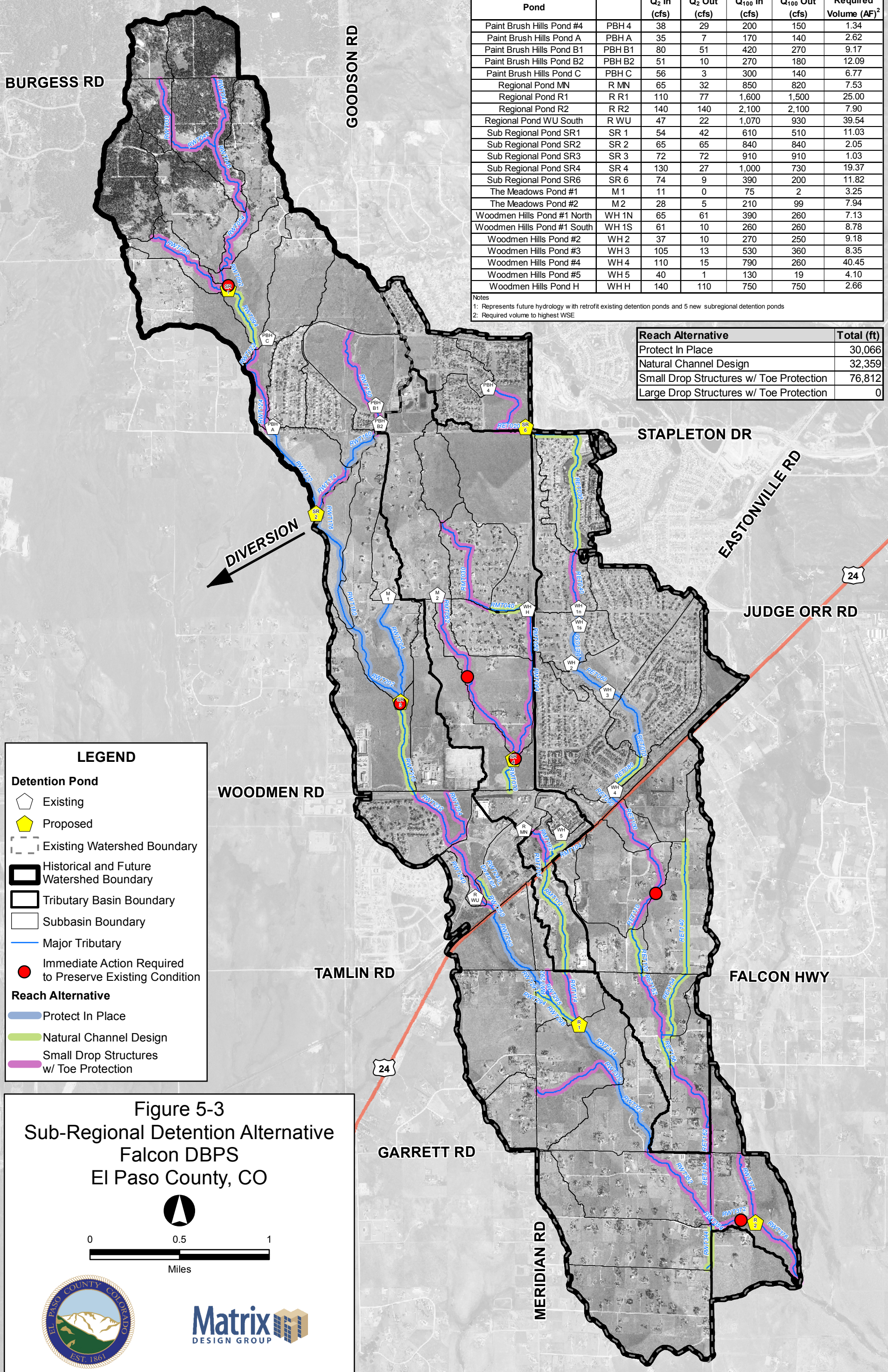


DRAWING NOT TO SCALE

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



LEGEND

Detention Pond

- Existing (Pentagon)
- Proposed (Yellow Pentagon)

Boundary

- Existing Watershed Boundary (Dashed line)
- Historical and Future Watershed Boundary (Thick black line)
- Tributary Basin Boundary (Thin black line)
- Subbasin Boundary (Thin grey line)

Major Tributary

- Blue line

Immediate Action Required to Preserve Existing Condition



- Red circle

Reach Alternative

- Protect In Place (Blue line)
- Natural Channel Design (Green line)
- Small Drop Structures w/ Toe Protection (Purple line)

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

0 0.5 1
 Miles

NOTE: FIGURE MUST BE VIEWED IN COLOR

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
 Project No.: CLH000017
 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			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	53	0.88	1.4	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	9.9
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

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
 Project No.: CLH000017
 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	0.43	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		
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	0.22	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	1.85	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	3.30	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	10.53	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	0.43	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	3.54	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	0.22	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)
 Coefficients 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
Project No.: CLH000017
Calculated By: TJE
Checked By: CMD
Date: 6/19/20

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME						T _c CHECK			FINAL
DATA						(T _i)			(T _t)						(URBANIZED BASINS)			(T _c)
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C ₅	C ₁₀₀	L (FT)	S (%)	T _i (MIN)	L (FT)	S (%)	C _v	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	810.0	690	2.7	15	2.5	4.7	814.7	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	500.0	30	2.7	15	2.5	0.2	500.2	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	270.0	1000	2.7	15	2.5	6.8	276.8	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	243.0	1020	2.7	15	2.5	6.9	249.9	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	9.9	0.43	0.41	62	25.0	1547.5	65	1.0	15	1.5	0.7	1548.2	126.9	10.7	10.7	
OS-2	20.08	A	8.0	0.14	0.40	215	2.0	20.5	1821	2.5	20	3.2	9.6	30.1	2036.4	21.3	21.3	
OS-3	10.62	A	6.0	0.22	0.40	279	2.0	557.5	1147	2.0	20	2.8	6.8	564.3	1425.6	17.9	17.9	
OS-4	4.46	A	49.5	0.36	0.54	175	2.0	14.2	438	1.0	15	1.5	4.9	19.1	612.1	13.4	13.4	
OS-5	0.46	A	65.0	0.45	0.59	110	2.0	9.9	779	2.0	20	2.8	4.6	14.5	888.4	14.9	14.5	
OS-6	1.17	A	65.0	0.45	0.59	109	2.0	9.9	872	2.0	20	2.8	5.1	15.0	981.9	15.5	15.0	

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 $V = C_v * S^{0.5}$, S in ft/ft
 $T_c \text{ Check} = 10 + L / 180$
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: 100-Year

Project Name: Falcon Meadows at Bent Grass
Project No.: CLH000017
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)	
	1	OS-4	4.46	0.36	13.4	1.61	6.19	14.0					1.0	14.0				438	2.0	3.6	Flow obtained from Bent Grass Filing No. 2 FDR.
	2	OS-5	0.46	0.45	14.5	0.21	6.00	2.3					2	2.3				779	2.8	4.6	Flow obtained from Bent Grass Filing No. 2 FDR.
	3	OS-6	1.17	0.45	15.0	0.53	5.91	4.3					2	4.3				872	2.8	5.1	Flow obtained from Bent Grass Filing No. 2 FDR.
	4	EX-1	1.19	0.09	15.5	0.11	5.83	0.6													
	5	EX-2	1.56	0.09	11.7	0.14	6.54	0.9	15.5	2.60	5.83	15.2									Total flows to DP 5 discharging into existing WQCV Pond. Existing WQCV Pond.
		EX-3	0.62	0.09	10.7	0.06	6.76	0.4													
	6	EX-4	12.49	0.09	17.1	1.12	5.58	6.2													
	7	EX-5	5.15	0.09	16.1	0.46	5.73	2.6	17.1	1.58	5.58	8.8									Total flow from DP 6 & EX-5 flowing onto Bent Grass Meadows Drive.
	8	EX-7	9.16	0.09	16.2	0.82	5.72	4.7													Flows from DP 8 go off-site into Bent Grass Meadows Drive.
	9	OS-2	20.08	0.14	21.3	2.81	5.03	43.4													Flow obtained from Bent Grass Filing No. 2 FDR.
	10	OS-3	10.62	0.22	17.9	2.34	5.46	24.3													Flow obtained from Bent Grass Filing No. 2 FDR.
	11	EX-6	9.53	0.09	20.0	0.86	5.19	4.5	21.3	6.01	5.03	72.2									Total flows entering existing inlet at DP 11.
		EX-8	21.30	0.09	16.1	1.92	5.73	11.0													
	12	OS-1	32.28	0.43	10.7	13.88	6.76	65.1													Existing off-site flows into creek via existing swale.

Proposed Computations

COMPOSITE % IMPERVIOUS CALCULATIONS: PROPOSED

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

Project Name: Falcon Meadows at Bent Grass
 Project No.: CLH000017
 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			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	2.57	100	0.52	20.2	2	0.20	0.2	90	0.00	0.0	65.0	0.79	20.0	40	0.00	0.0	30	0.31	3.6	25	0.00	0.0	20	0.75	5.8	49.8
A-2	2.28	100	0.40	17.5	2	0.46	0.4	90	0.00	0.0	65.0	1.43	40.8	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	58.7
B-1	4.35	100	0.00	0.0	2	4.35	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	9.34	100	1.96	21.0	2	2.49	0.5	90	0.00	0.0	65.0	2.02	14.1	40	1.12	4.8	30	0.52	1.7	25	0.00	0.0	20	1.23	2.6	44.7
C-2	3.30	100	0.67	20.3	2	0.12	0.1	90	0.00	0.0	65.0	2.26	44.5	40	0.00	0.0	30	0.25	2.3	25	0.00	0.0	20	0.00	0.0	67.2
C-3	1.17	100	0.31	26.5	2	0.04	0.1	90	0.00	0.0	65.0	0.82	45.6	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	72.2
C-4	2.10	100	0.36	17.1	2	0.23	0.2	90	0.00	0.0	65.0	1.51	46.7	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	64.0
C-5	0.45	100	0.00	0.0	2	0.45	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
D-1	8.24	100	1.40	17.0	2	0.44	0.1	90	0.00	0.0	65.0	1.77	14.0	40	2.36	11.5	30	1.36	5.0	25	1.10	3.3	20	0.91	2.2	53.1
D-2	9.33	100	2.03	21.8	2	2.33	0.5	90	0.00	0.0	65.0	4.97	34.6	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	56.9
D-3	2.03	100	0.00	0.0	2	0.28	0.3	90	0.00	0.0	65.0	0.36	11.5	40	0.17	3.3	30	0.12	1.8	25	0.00	0.0	20	0.00	0.0	16.9
D-4	3.64	100	1.03	28.3	2	0.63	0.3	90	0.00	0.0	65.0	1.98	35.4	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	64.0
D-5	2.94	100	0.36	12.2	2	0.66	0.4	90	0.00	0.0	65.0	1.29	28.5	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	41.1
D-6	4.01	100	0.91	22.7	2	0.09	0.0	90	0.00	0.0	65.0	3.01	48.8	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	71.5
D-7	6.97	100	0.00	0.0	2	6.31	1.8	90	0.00	0.0	65.0	0.75	7.0	40	0.00	0.0	30	0.00	0.0	25	0.00	0.0	20	0.00	0.0	8.8
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

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)

The lots called out as one acre need to be revised per PUD/SP comments.

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS: PROPOSED

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

Project Name: Falcon Meadows at Bent Grass
 Project No.: CLH000017
 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)		
A-1	2.57	0.90	0.96	0.52	0.09	0.36	0.20	0.73	0.81	0.00	0.45	0.59	0.79	0.30	0.50	0.00	0.25	0.47	0.31	0.22	0.46	0.00	0.20	0.44	0.75	0.42	0.59
A-2	2.28	0.90	0.96	0.40	0.09	0.36	0.46	0.73	0.81	0.00	0.45	0.59	1.43	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.46	0.61
B-1	4.35	0.90	0.96	0.00	0.09	0.36	4.35	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	9.34	0.90	0.96	1.96	0.09	0.36	2.49	0.73	0.81	0.00	0.45	0.59	2.02	0.30	0.50	1.12	0.25	0.47	0.52	0.22	0.46	0.00	0.20	0.44	1.23	0.39	0.57
C-2	3.30	0.90	0.96	0.67	0.09	0.36	0.12	0.73	0.81	0.00	0.45	0.59	2.26	0.30	0.50	0.00	0.25	0.47	0.25	0.22	0.46	0.00	0.20	0.44	0.00	0.51	0.65
C-3	1.17	0.90	0.96	0.31	0.09	0.36	0.04	0.73	0.81	0.00	0.45	0.59	0.82	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.56	0.68
C-4	2.10	0.90	0.96	0.36	0.09	0.36	0.23	0.73	0.81	0.00	0.45	0.59	1.51	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.49	0.63
C-5	0.45	0.90	0.96	0.00	0.09	0.36	0.45	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
D-1	8.24	0.90	0.96	1.40	0.09	0.36	0.44	0.73	0.81	0.00	0.45	0.59	1.77	0.30	0.50	2.36	0.25	0.47	1.36	0.22	0.46	1.10	0.20	0.44	0.91	0.43	0.64
D-2	9.33	0.90	0.96	2.03	0.09	0.36	2.33	0.73	0.81	0.00	0.45	0.59	4.97	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.46	0.61
D-3	2.03	0.90	0.96	0.00	0.09	0.36	0.28	0.73	0.81	0.00	0.45	0.59	0.36	0.30	0.50	0.17	0.25	0.47	0.12	0.22	0.46	0.00	0.20	0.44	0.00	0.13	0.22
D-4	3.64	0.90	0.96	1.03	0.09	0.36	0.63	0.73	0.81	0.00	0.45	0.59	1.98	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.52	0.65
D-5	2.94	0.90	0.96	0.36	0.09	0.36	0.66	0.73	0.81	0.00	0.45	0.59	1.29	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.33	0.46
D-6	4.01	0.90	0.96	0.91	0.09	0.36	0.09	0.73	0.81	0.00	0.45	0.59	3.01	0.30	0.50	0.00	0.25	0.47	0.00	0.22	0.46	0.00	0.20	0.44	0.00	0.54	0.67
D-7	6.97	0.90	0.96	0.00	0.09	0.36	6.31	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	0.13	0.39
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)
 Coefficients 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
Project No.: CLH000017
Calculated By: TJE
Checked By: CMD
Date: 6/19/20

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					T _c CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C ₅	C ₁₀₀	L (FT)	S (%)	T _i (MIN)	L (FT)	S (%)	C _v	VEL. (FPS)	T _t (MIN)	COMP. T _c (MIN)	TOTAL LENGTH(FT)	Urbanized T _c (MIN)	T _c (MIN)
A-1	2.57	A	49.8	0.42	0.59	246	6.0	10.7	675	2.3	20	3.1	3.7	14.4	920.2	15.1	14.4
A-2	2.28	A	58.7	0.46	0.61	47	6.0	4.4	662	2.3	20	3.1	3.6	8.0	708.8	13.9	8.0
B-1	4.35	A	2.0	0.09	0.36	158	6.5	12.5	1911	1.7	15	2.0	16.3	28.7	2068.9	21.5	21.5
B-2	1.17	A	2.1	0.10	0.38	79	1.2	15.3	988	1.6	15	1.9	8.7	24.0	1067.5	15.9	15.9
C-1	9.34	A	44.7	0.39	0.57	208	6.0	10.3	1221	2.9	20	3.4	6.0	16.3	1428.7	17.9	16.3
C-2	3.30	A	67.2	0.51	0.65	75	6.0	5.1	733	3.5	20	3.7	3.3	8.4	807.9	14.5	8.4
C-3	1.17	A	72.2	0.56	0.68	144	6.0	6.5	421	2.5	20	3.2	2.2	8.8	565.5	13.1	8.8
C-4	2.10	A	64.0	0.49	0.63	199	6.0	8.7	407	2.5	20	3.2	2.1	10.8	605.0	13.4	10.8
C-5	0.45	A	2.0	0.09	0.36	62	25.0	5.0	65	1.0	15	1.5	0.7	5.7	126.9	10.7	5.7
D-1	8.24	A	53.1	0.43	0.64	215	2.0	14.3	1821	2.5	20	3.2	9.6	23.9	2036.4	21.3	21.3
D-2	9.33	A	56.9	0.46	0.61	279	2.0	15.5	1147	2.0	20	2.8	6.8	22.3	1425.6	17.9	17.9
D-3	2.03	A	16.9	0.13	0.22	175	2.0	18.6	438	1.0	15	1.5	4.9	23.5	612.1	13.4	13.4
D-4	3.64	A	64.0	0.52	0.65	110	2.0	8.8	779	2.0	20	2.8	4.6	13.4	888.4	14.9	13.4
D-5	2.94	A	41.1	0.33	0.46	109	2.0	11.7	872	2.0	20	2.8	5.1	16.8	981.9	15.5	15.5
D-6	4.01	A	71.5	0.54	0.67	39	2.0	5.1	916	2.0	20	2.8	5.4	10.5	955.1	15.3	10.5
D-7	6.97	A	8.8	0.13	0.39	160	20.0	8.3	715	1.0	15	1.5	7.9	16.2	875.1	14.9	14.9
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	85	0.2	18.7	430	0.9	20	1.9	3.8	17.7	1010.0	15.6	15.6
OS-6	1.17	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

NOTES:

$T_i = (0.395 * (1.1 - C_s) * L)^{0.5} / ((S)^{0.33})$, S in ft/ft

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

Velocity $V = C_v * S^{0.5}$, S in ft/ft

$T_c \text{ Check} = 10 + L / 180$

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

A lot of these seem high. Show the T_c lines on the drainage plans.

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
Project No.: CLH000017
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)	
	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	15.6	0.21	3.46	1.1					0.9	1.1				430	1.9	3.8	Flows from Basin B-2 of Bent Grass Filing No. 2 FDR
	3	OS-6	1.17	0.45	5.2	0.53	5.10	2.0					1	2.0				190	2.0	1.6	Flows from Basin B-3 of Bent Grass Filing No. 2 FDR.
	4	A-1	2.57	0.42	14.4	1.08	3.58	3.9	15.6	3.43	3.46	11.9	2.33	3.9				675	3.1	3.7	Flows from Basins OS-4, OS-5, OS-6, & A-1 into proposed inlet.
	5	A-2	2.28	0.46	8.0	1.05	4.46	4.7	15.6	4.48	3.46	15.5	2.33	4.7				662	3.1	3.6	Flow into proposed inlet.
	6																				Total flow of Basins OS-4, OS-5, OS-6, A-1 & A-2 into existing WQCV Pond.
	7	C-4	2.10	0.49	10.8	1.03	4.01	4.1					2.5	4.1				407	3.2	2.1	Flow into proposed inlet.
	8	C-3	1.17	0.56	8.8	0.66	4.33	2.9	10.8	1.69	4.01	6.8	2.5	2.9				421	3.2	2.2	Flow into proposed inlet.
	12	C-2	3.30	0.51	8.4	1.68	4.39	7.4	10.8	3.37	4.01	13.5	3.5	7.375				733	3.7	3.3	Total flow from Basins C-3 & C-4.
	15	C-1	9.34	0.39	16.3	3.64	3.39	12.3	10.8	3.37	4.01	13.5	2.85	12.34				1221	3.4	6.0	Flow into proposed inlet.
	13	C-5	0.45	0.09	5.7	0.04	4.97	0.2	16.3	7.01	3.39	23.8									Total flow from Basins C-1 thru C-4 into proposed north WQCV pond.
																					North Pond
	10	OS-3	10.61	0.14	18.9	1.49	3.18	5.3													Offsite flow into Basin D-3. Flow obtained from Bent Grass Filing No. 2 FDR
	11	D-3	2.03	0.13	13.4	0.26	3.69	1.0	18.9	1.75	3.18	5.6									Flows conveyed via existing ditch into proposed end section.
	14	D-2	9.33	0.46	17.9	4.29	3.25	13.9					2	13.9				1147	2.8	6.8	Total flow from Basins OS-3 & D-3 via storm sewer into DP 16
	9	OS-2	20.07	0.14	18.3	2.81	3.22	9.3													Flow into proposed inlet. Piped to DP 16.
		D-1	8.24	0.43	21.3	3.54	2.99	10.6					2.5	10.6				1821	3.2	9.6	Overland flow into Basin D-1. Flow obtained from Bent Grass Filing No. 2 FDR
	16								21.3	6.35	2.99	19.0									Combined flows from OS-2 & D-1 into proposed inlet.
									21.3	12.39	2.99	37.0									Total flow from Basins OS-2, OS-3, & D-1 thru D-3.
	17	D-4	3.64	0.52	13.4	1.89	3.69	7.0					2	7.0				779	2.8	4.6	Flow into proposed inlet.
	18	D-6	4.01	0.54	10.5	2.17	4.06	8.8					2	8.8				916	2.8	5.4	Flow into proposed inlet.
	19	D-7	6.97	0.13	14.9	0.91	3.53	3.2	21.3	16.45	2.99	49.2									Includes South Pond
	20	D-5	2.94	0.33	15.5	0.97	3.48	3.4													Total flow from Basin D-6, & DP 7 & 17 into proposed south WQCV Pond.
	21	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
	22	B-1	4.35	0.09	21.5	0.39	2.98	1.2	22.2	5.55	2.93	41.3									Flows under Bent Grass Meadows Drive. Includes WT200 & OS-1
	23	B-2	1.17	0.10	15.9	0.12	3.43	0.4	22.2	5.67	2.93	42.0									Flows incl. everything that ends up into existing channel.

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
Project No.: CLH000017
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)	
	1	OS-4	4.46	0.36	15.6	1.61	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.
	2	OS-5	0.46	0.45	15.6	0.21	5.81	2.3					0.9	2.3				430	1.9	3.8	Flows from Basin B-2 of Bent Grass Filing No. 2 FDR
	3	OS-6	1.17	0.45	5.2	0.53	8.56	4.3					1	4.3				190	2.0	1.6	Flows from Basin B-3 of Bent Grass Filing No. 2 FDR.
	4	A-1	2.57	0.42	14.4	1.08	6.01	6.5					2.33	6.5				675	3.1	3.7	Flows from Basins OS-4, OS-5, OS-6, & A-1 into proposed inlet.
	5	A-2	2.28	0.46	8.0	1.05	7.48	7.9	15.6	3.43	5.81	19.9	2.33	7.9				662	3.1	3.6	
	6								15.6	4.48	5.81	26.0									Total flow of Basins OS-4, OS-5, OS-6, A-1 & A-2 into existing WQCV Pond.
	7	C-4	2.10	0.49	10.8	1.03	6.74	6.9					2.5	6.9				407	3.2	2.1	Flow into proposed inlet.
	8	C-3	1.17	0.56	8.8	0.66	7.27	4.8					2.5	4.8				421	3.2	2.2	Flow into proposed inlet.
	12	C-2	3.30	0.51	8.4	1.68	7.37	12.4	10.8	1.69	6.74	11.4	3.5	12.38				733	3.7	3.265	Total flow from Basins C-3 & C-4.
	15	C-1	9.34	0.39	16.3	3.64	5.69	20.7	10.8	3.37	6.74	22.7	2.85	20.71				1221	3.4	6.0	Flow into proposed inlet.
	13	C-5	0.45	0.09	5.7	0.04	8.35	0.3	16.3	7.01	5.69	39.9									Total flow from Basins C-1 thru C-4 into proposed north WQCV pond.
	10	OS-3	10.61	0.14	18.9	1.49	5.33	24.3													Offsite flow into Basin D-3. Flow obtained from Bent Grass Filing No. 2 FDR
	11	D-3	2.03	0.13	13.4	0.26	6.19	1.6	18.9	1.75	5.33	9.3									Flows conveyed via existing ditch into proposed end section.
	14	D-2	9.33	0.46	17.9	4.29	5.46	23.4					2	23.42				1147	2.8	6.8	Total flow from Basins OS-3 & D-3 via storm sewer into DP 16
	9	OS-2	20.07	0.14	18.3	2.81	5.41	43.4													Flow into proposed inlet. Piped to DP 16.
	16	D-1	8.24	0.43	21.3	3.54	5.03	17.8					2.5	17.8				1821	3.2	9.6	Overland flow into Basin D-1. Flow obtained from Bent Grass Filing No. 2 FDR
									21.3	6.35	5.03	31.9									Combined flows from OS-2 & D-1 into proposed inlet.
									21.3	12.39	5.03	62.3									Total flow from Basins OS-2, OS-3, & D-1 thru D-3.
	17	D-4	3.64	0.52	13.4	1.89	6.19	11.7					2	11.7				779	2.8	4.6	Flow into proposed inlet.
	18	D-6	4.01	0.54	10.5	2.17	6.82	14.8					2	14.8				916.2	2.8	5.4	Flow into proposed inlet.
	19	D-7	6.97	0.13	14.9	0.91	5.93	5.4													Includes South Pond
	20	D-5	2.94	0.33	15.5	0.97	5.84	5.7	21.3	16.45	5.03	82.7									Total flow from Basin D-6, & DP 7 & 17 into proposed south WQCV Pond.
	21	OS-1	32.28	0.16	22.2	5.16	4.92	65.1													Flows obtained from Bent Grass Filing No. 2 FDR. Q=65.1 CFS
	22	B-1	4.35	0.09	21.5	0.39	5.00	2.0	22.2	5.55	4.92	257.1									Flows under Bent Grass Meadows Drive. Includes WT200 & OS-1
	23	B-2	1.17	0.10	15.9	0.12	5.76	0.7	22.2	5.67	4.92	258.3									Flows incl. everything that ends up into existing channel.

APPENDIX C
Hydraulic Computations

Detention Pond Tributary Areas

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

Project Name: Falcon Meadows at Bent Grass
Project No.: CLH000017
Calculated By: TJE
Checked By: CMD
Date: 6/19/20

Pond (North)

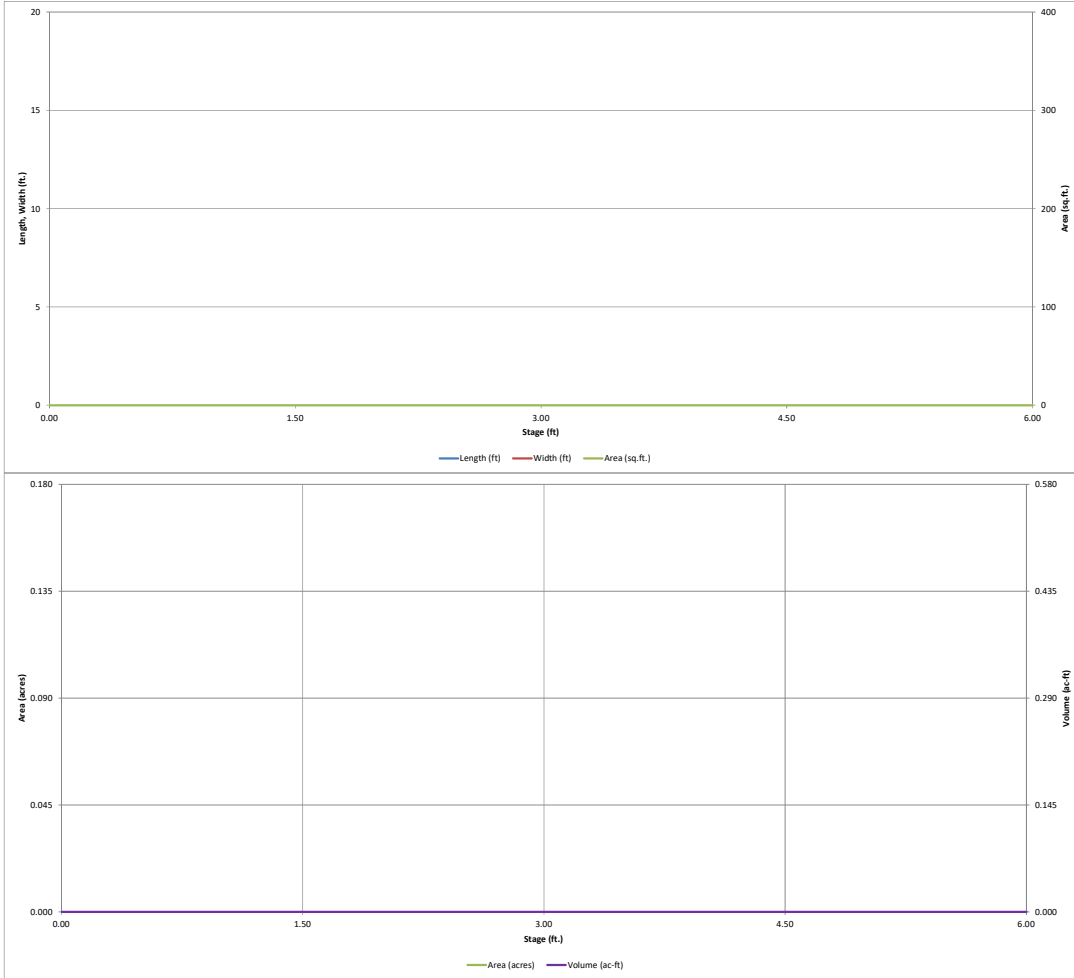
Basin	Area	% Imp
C-1	9.34	44.7
C-2	3.3	67.2
C-3	1.17	72.2
C-4	2.1	64
C-5	0.45	2
Total	16.36	52.5

Pond (South)

Basin	Area	% Imp
D-1	8.24	53.1
D-2	9.33	56.9
D-3	2.03	16.9
D-4	3.64	64
D-5	2.94	41.1
D-6	4.01	71.5
D-7	6.97	8.8
OS-2	20.07	8
OS-3	10.61	8
Total	67.84	28.7

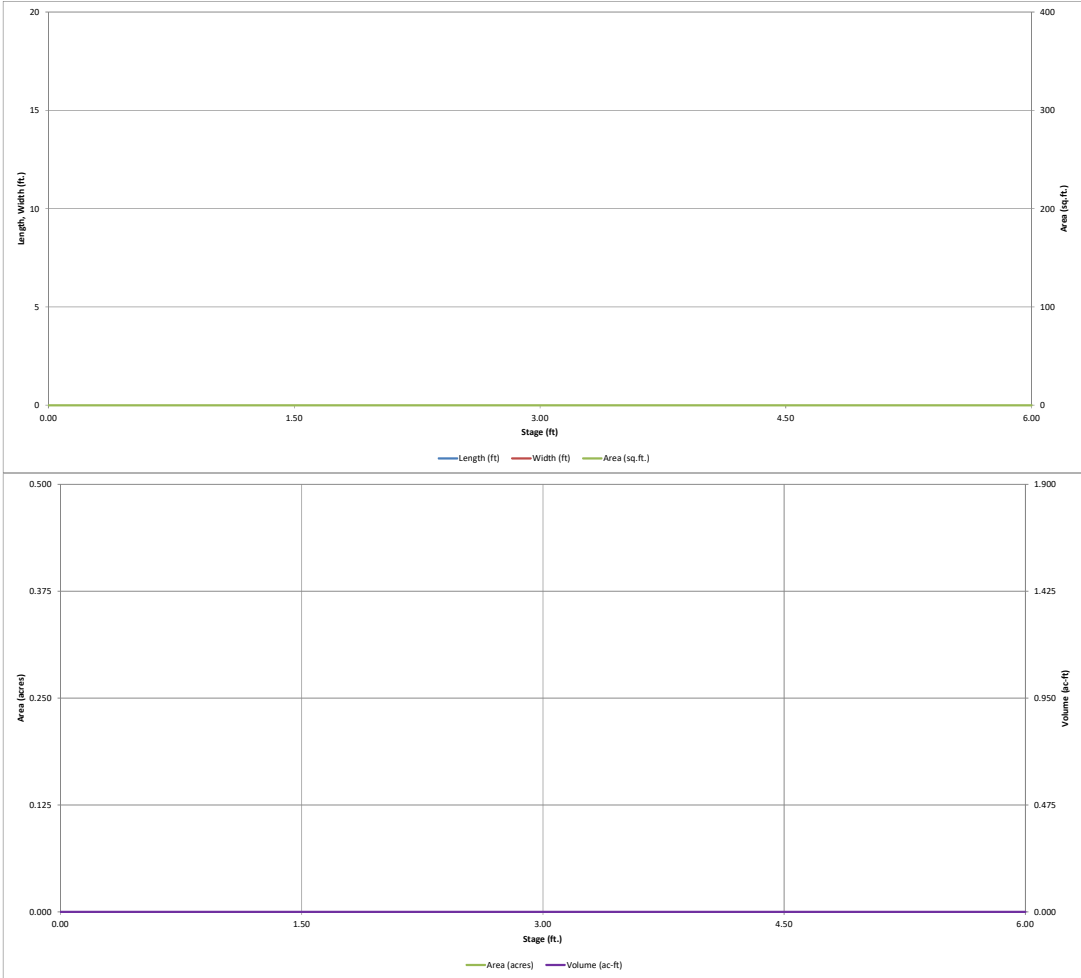
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



APPENDIX D
Drainage Maps

