DRAINAGE LETTER REPORT

for

SHOPS AT MERIDIAN RANCH CONVENIENCE STORE
11810 STAPLETON DRIVE
LOT 2, THE SHOPS FILING NO. 1A AT MERIDIAN RANCH

Prepared for:

Hunjan Gas Stations LLC
12599 Mt. Lindsey Drive
Peyton, CO 80831

March 31, 2023

Prepared by:

19 E. Willamette Ave.
Colorado Springs, CO 80903
(719)-477-9429
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JPS Project No. 092202
PCD Filing No. PPR___

"PPR2322 and VR2314"

SHOPS AT MERIDIAN RANCH CONVENIENCE STORE
DRAINAGE LETTER REPORT
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APPENDICES

DRAINAGE STATEMENT

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 master plan of the drainage basin. I accept responsibility for liability caused by negligent acts, errors or omissions on my part in preparing this report.

_____

John P. Schwab, P.E. #29891

Developer's Statement:

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

By:

_____

Date

Hunjan Gas Stations LLC
12599 Mt. Lindsey Drive, Peyton, CO 80831

El Paso County's Statement

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

_____

Joshua Palmer, P.E. Date
County Engineer / ECM Administrator

Conditions:

I. INTRODUCTION

Provide the anticipated overall land disturbance (grading, filling, cut, landscaping).

A. Property Location and Description

Hunjan Gas Stations LLC (Owner) is planning to construct a new Convenience Store on the vacant 1.46-acre property in the Shops at Meridian Ranch commercial area northeast of Stapleton Drive and Meridian Road in the Falcon area of El Paso County, Colorado. The property is currently described as part of Lot 2, The Shops Filing No. 1 at Meridian Ranch (El Paso County Assessor's Parcel Number 42303-19-056).

The project consists of a new 12,000 square-foot, single-story Convenience Store and Gas Station with associated parking and site improvements. The property adjoins Stapleton Drive on the south side, which is a fully improved, asphalt-paved arterial public street. The property is bounded by an existing shared private driveway along the north and east sides. The west boundary of the site adjoins a vacant 1.0-acre commercial tract currently described as the balance of Lot 2, The Shops Filing No. 1 at Meridian Ranch (El Paso County Assessor's Parcel Number 42303-19-055).

The property is zoned Commercial Regional District (CR), and the proposed site development is fully consistent with the existing zoning of the site. Access to the site will be provided by new connections to the existing shared private driveways adjoining the north and east boundaries of the site.

Please revise to Falcon Drainage Basin.

The site is located in the Bennett Ranch Drainage Basin, and surface drainage from this site sheet flows southeasterly to an existing private storm sewer system draining easterly across the property, ultimately flowing to the existing Bennett Regional Detention Pond.

This report is intended to meet the requirements of a site-specific "Letter Type" drainage report in accordance with El Paso County subdivision drainage criteria.

B. Drainage Analysis Methods and Criteria

ITEM	DESCRIPTION	REFERENCE
Design Storm (initial/major)	5-year/100-year	CS/EPC DCM
Storm Runoff	Rational Method (Area<100acres)	CS/EPC DCM
Major Drainage Basin	Bennett Ranch	
Floodplain Impacts	Parcel is located outside any delineated FEMA floodplains	FIRM
Existing Downstream Facilities	Existing storm sewer system flowing to Bennett Regional Detention Pond	

CS/EPC DCM = City of Colorado Springs & El Paso County Drainage Criteria Manual

C. References

Olsson Associates, "Drainage Letter – Lot 3, The Shops at Meridian Ranch Filing 4B," May 7, 2015 (approved by El Paso County 8/20/15).

Tech Contractors, "Preliminary / Final Drainage Report for Meridian Ranch Filing 4B, The Shops at Meridian Ranch Filing 1," April 2014 (approved by El Paso County 9/9/14).

Tech Contractors Engineering Group, "Drainage Conformance Letter, Building E, Lot 4, the Shops Filing 1 at Meridian Ranch," April 1, 2022 (approved by El Paso County 4/7/22).

Tech Contractors Engineering Group, "Drainage Conformance Letter, Lot 4, the Shops Filing 1 at Meridian Ranch," May 3, 2019 (approved by El Paso County 6/5/19).

II. EXISTING / PROPOSED DRAINAGE CONDITIONS

The site slopes downward to the southeast, with average grades of 1-4 percent. Soils within the proposed Convenience Store site are classified by SCS as type 19, "Columbine gravelly sandy loam" soils. These soils have high infiltration rates, rapid permeability, and low runoff potential. The soils are classified as hydrologic soils group A.

Subdivision Drainage Report

Drainage planning for this site was previously studied in several approved drainage reports for the Meridian Ranch Subdivision, the most comprehensive of which is the "Drainage Letter – Lot 3, The Shops at Meridian Ranch Filing 4B" by Olsson Associates (OA), dated May 7, 2015. As shown on the enclosed OA Drainage Plan (Appendix A), the proposed Convenience Store site lies entirely within Basin C as delineated in the previously approved drainage plans. The previously approved drainage reports for The Shops at Meridian Ranch assumed full commercial development for this basin, which is consistent with the proposed site development.

Developed drainage from this commercial site will sheet flow southeasterly to the existing storm sewer system which flows east across The Shops at Meridian Ranch commercial area, ultimately flowing to the existing downstream Bennett Regional Detention Pond. The existing detention pond was sized to account for fully developed flows from this commercial area.

Clarify whether or not the existing pond provides detention only or includes WQ treatment for this proposed lot.

The previously approved subdivision drainage planning assumed full commercial development within all of Basin C1, with runoff coefficients of $C_5 = 0.78$ and $C_{100} = 0.89$ (equivalent to impervious areas of approximately 90 percent). According to the Rational Method calculations in the original subdivision drainage report, developed peak flows from Basin C (Design Point #3) were calculated as $Q_5 = 8.2$ cfs and $Q_{100} = 15.5$ cfs.

Developed Drainage Plan

Developed drainage flows have been calculated based on the impervious areas associated with the proposed building and parking improvements. Surface drainage swales and a private storm sewer system will convey flows to the existing private storm sewer system that has been designed to convey developed flows from this site to the existing downstream Bennett Regional Detention Pond.

Clarify whether or not the existing pond provides detention only or includes WQ treatment for this proposed lot.

Site grades will slope to storm inlets and curb openings at selected locations, collecting surface drainage and conveying stormwater to the existing storm sewer system. The proposed building pad will be graded with protective slopes to provide positive drainage away from the building, and the curb, gutter, drainage swales, and private storm sewer improvements will convey developed flows to the existing storm sewer system at the southeast corner of the site.

Clairfy that why on-site WQ treatment is necessary (assuming because Bennett Ranch pond only provides detention).

For consistency with the previously approved subdivision drainage report, the site drainage basins have been delineated as Basins C1.1-C1.3. The proposed Convenience Store site on Lot 2 has been delineated as Basin C1.2, which drains by sheet flow and curb and gutter to the proposed Storm Inlet C1.2 (Private Type C Inlet) at the southeast corner of the property. Water quality and runoff reduction will be provided by routing the majority of developed flows from the site to the proposed landscaped Water Quality Swale C1.2 along the south edge of the property. Developed peak flows from Basin C1.2 are calculated as $Q_5 = 4.3$ cfs and $Q_{100} = 8.0$ cfs. In the event of clogging, overflows from Inlet C1.2 would sheet flow easterly into the existing 20' Type R Inlet #3.

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by from the
t at C1.1

Private Storm Sewer C1.2 (12" HDPE) will convey the flow from Inlet C1.2 into the back side of the existing private Storm Inlet #3 located at the northwest corner of Stapleton Drive and the shared private access drive along the east side of the property.

The future commercial site development lot to the west of this site has been delineated as Basin C1.1, which will drain southeasterly, contributing to DP-C1. Assuming developed runoff coefficients consistent with the previous subdivision drainage reports, developed peak flows from Basin C1.1 are calculated as $Q_5 = 3.6$ cfs and $Q_{100} = 6.6$ cfs.

Development of the proposed Lot 2 Convenience Store will include construction of the shared access drive between Lots 1 and 2, and the proposed private Storm Inlet C1.1 (10' Type R) will be installed along the east side of Basin C1.1 to accept future developed flows. Proposed Private Storm Sewer SD-C1.1 (12" RCP) will convey the flow from Inlet C1.1 into the existing Storm Manhole (MH-3), connecting to the existing 30" RCP private storm sewer flowing easterly across the site.

Depending on the future site grading scheme for Lot 1, additional private storm sewer improvements may be constructed within Basin C1.1 if necessary.

Developed flows from Basins C1.1 and C1.2 combine at Design Point #C1, with peak flows calculated as $Q_5 = 7.2$ cfs and $Q_{100} = 13.4$ cfs. Proposed Inlet C1.2 and Storm

Sewer C1.2 have been sized to accept the full developed flow from Design Point #C1 (combined Basins C1.1 and C1.2).

The existing shared private access drive along the north and east sides of the site has been delineated as Basin C1.3, which drains by curb and gutter to the existing Private Storm Inlet #3 at the northwest corner of Stapleton Drive and the shared driveway. Developed peak flows from Basin C1.3 are calculated as $Q_5 = 1.4$ cfs and $Q_{100} = 2.5$ cfs.

Developed flows from Basins C1.1-C1.3 combine at Design Point #3, with peak flows calculated as $Q_5 = 8.4$ cfs and $Q_{100} = 15.7$ cfs. The calculated flows in this report are fully consistent with the previously approved drainage report by Olsson Associates ($Q_5 = 8.2$ cfs and $Q_{100} = 15.5$ cfs at DP #3). The OA report identifies the combined flow at DP #3 being conveyed easterly through "PIPE-10" (24" RCP) and continuing downstream in the existing 24"-42" RCP storm sewer system flowing to the Bennett Regional Detention Pond.

The landscaped area along the south boundary of the site has been delineated as Basin OS-1.1, consistent with the previously approved subdivision drainage report. Basin OS-1.1 sheet flows southeasterly into the existing curb and gutter along the north side of Stapleton Drive, flowing to existing downstream storm sewer facilities. Developed peak flows from Basin OS-1.1 are calculated as $Q_5 = 0.05$ cfs and $Q_{100} = 0.3$ cfs.

Hydrologic and hydraulic calculations for the site are detailed in the appendices (Appendix B and C), and peak flows are identified on Figure D1 (Appendix D).

III. DRAINAGE PLANNING FOUR STEP PROCESS

El Paso County Drainage Criteria require drainage planning to include a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls.

As stated in ECM Appendix I.7., the Four Step Process is applicable to all new and re-development projects with construction activities that disturb 1 acre or greater or that disturb less than 1 acre but are part of a larger common plan of development. The Four Step Process has been implemented as follows in the planning of this project:

<u>Step 1: Employ Runoff Reduction Practices</u>

- Minimize Directly Connected Impervious Areas (MDCIA): A landscaped drainage swale has been designed along the downstream edge of the parking area, providing for disconnection of the impervious area of the south parking lot from the downstream storm sewer system (see "Sh. RR-1: Runoff Reduction Exhibit" in Appendix D).
- Landscaped Swale: A landscaped water quality swale has been designed to serve as a Receiving Pervious Areas (RPA) to mitigate impacts of the on-site impervious areas.

I'm not seeing this 10% minimum reduction in our criteria.

The Base Design standard in our MS4 Permit for Runoff Reduction requires 60% reduction of the WQCV. See MHFD Detail T-0 for reference and guidance on Runoff Reduction calcs.

- Runoff Reduction Calculations: Runoff reduction has been calculated using the MHFD "UD-BMP_v3.07" software package as detailed in Appendix C.
- Runoff Reduction calculations are summarized as follows:

Basin	Impervious Area (SF)	RPA Area (SF)	Volume Reduction (%)
C1.2	39,172	720	20%

- DCM Volume 2, Chapter 1, Section 4.0, specifies a minimum volume reduction of 10% for the WQCV event. As tabulated above, the proposed RPA area exceeds the specified minimum runoff reduction.

Step 2: Stabilize Drainageways

- There are no drainageways directly adjacent to this project site. The on-site private drainage improvements will convey developed flows to the existing downstream storm sewer system and regional detention basin, which has been designed to minimize downstream drainage impacts.
- Drainage basin fees were previously paid during recording of the subdivision plat, and these fees provided the applicable cost contribution towards regional drainage improvements.

WQ treatment for this site is provided by the Runoff Reduction (or the SNOUT, whichever you decide). So revise Step 3 accordingly.

Step 3: Provide Water Quality Capture Volume (WQCV)

- EDB: Developed flows from this site will be conveyed to the existing downstream Bennett Regional Detention Pond. The extended detention basin which will capture and slowly release the WQCV over an extended release period.

Step 4: Consider Need for Industrial and Commercial BMPs

- No industrial uses are proposed for this site.
- The commercial property owner will implement a Stormwater Management Plan including proper housekeeping practices and spill containment procedures.

IV. FLOODPLAIN IMPACTS

According to the FEMA floodplain map for this area, El Paso County FIRM Panel No. 08041C0551G, dated December 7, 2018, the site is located beyond the limits of any delineated 100-year floodplains.

V. STORMWATER DETENTION AND WATER QUALITY

Stormwater detention for this site is provided in the existing Bennett Ranch Regional Detention Pond.

According to the previously approved OA drainage report, the "Bennett Regional Pond has been adequately sized such that 100 YR developed flows …. will be detained and released at (or below) the pre-developed flow rate."

Provide an excerpt of an existing report that shows the location of the SNOUT and Bennett Pond compared to the site and the conveyance system from the site to them. The excerpts currently included as attachments below do not show them.

The rule in this paragraph still applies for use of the SNOUT for WQ treatment.

As detailed in Appendix B, the calculated runoff coefficients for this site (C_{100} = 0.89 at DP3) are fully consistent with the impervious area assumptions in the previously approved subdivision drainage reports.

An on-site Water Quality Swale will be constructed to meet stormwater quality improvements in accordance with current El Paso County drainage criteria. As stated in previously approved drainage letter reports for this subdivision, water quality is provided by applying the "20%/10% Rule" described in Section I.7.1.C.5. of the El Paso County Engineering Criteria Manual for "Applicable Development Site Draining to a Regional WQCV Facility." This rule specifies that "at least 20 percent of the applicable development site must be disconnected from the storm drainage system and drain through a receiving pervious area control measure comprising a footprint of at least 10 percent of the upstream disconnected impervious area."

The drainage design for Basin C1.2 meets or exceeds the requirements listed above by routing the south and west parking areas through the landscaped drainage swale along the south edge of the site. The "Unconnected Impervious Area" (UIA) of the parking areas is 25,847 square feet, which is 66.0 percent of the total basin impervious area. The total landscaped swale area along the south edge of the site is 4,375 square feet, which is 16.9 percent of the disconnected impervious area of the project site.

As detailed in the Runoff Reduction calculations in Appendix C, the proposed landscaped swale provides adequate runoff reduction to mitigate the water quality impacts of the proposed convenience store development.

In addition to the on-site water quality swale, previously approved drainage reports identify the existing downstream "SNOUT" stormwater quality facility as being sufficient to meet stormwater quality requirements for Meridian Ranch Filing 4B, including this commercial area.

Please revise the property is located in the Falcon Drainage Basin.

VI. PUBLIC IMPROVEMENTS / DRAINAGE BASIN FEES

No public drainage improvements are required or proposed for this project.

The site lies completely within the Bennett Ranch Drainage Basin. Applicable drainage basin fees were paid at the time of original platting, so no drainage basin fees or bridge fees are applicable at this time.

So then any runoff reduction provided onsite would just be extra? It seems like since you are short of the required 60% WQCV reduction onsite that you should just revise all discussions in this report related to WQ treatment to state that WQ will be provided by the downstream SNOUT per the previous drainage report. Whereas currently the WQ treatment via the SNOUT is just an afterthought of this report's WQ analysis, it should really be the focal point.

VII. SUMMARY

The developed drainage patterns for the proposed Convenience Store site development on Lot 2, The Shops Filing No. 1 at Meridian Ranch will remain consistent with the established drainage plan for this subdivision. The grading and drainage plan for the proposed convenience store development fully conforms to the approved drainage plan for this subdivision.

Regarding the use of the existing SNOUT and Bennett Pond:

Engineer must confirm in the Drainage Report that the existing offsite or onsite PBMPs that the site is tributary to are functioning as intended.

Developed flows from the site will drain through a private storm sewer system at the southeast corner of the property, connecting to the existing downstream public drainage system. Stormwater detention is provided by the existing Bennett Regional Detention Pond, which was designed to accept fully developed flows from the commercial area encompassing this site (including all of The Shops Filing No. 1 at Meridian Ranch Subdivision). Stormwater quality is provided in the proposed landscaped swale along the south edge of the property.

Revise according to my comments on previous pages.

Construction and proper maintenance of the on-site drainage facilities, in conjunction with proper erosion control practices, will ensure that this developed site has no significant adverse drainage impact on downstream or surrounding areas.

APPENDIX A

EXCERPTS FROM SUBDIVISION DRAINAGE REPORT

OLSSON ASSOCIATES

NEW DOC

May 7, 2015

Brandy Williams
El Paso County
2880 International Circle
Colorado Springs, CO 80910

RE: Drainage Letter – Lot 3, The Shops at Meridian Ranch Filing 4B

Ms. Williams:

This letter is to serve as a statement of compliance with the *Preliminary/Final Drainage Report for Meridian Ranch Filing 4B, The Shops at Meridian Ranch* (the REPORT) prepared by Tech Contractors, dated April 2014, and approved on September 9, 2014. The REPORT provides hydrologic and hydraulic analysis for the development located at the northeast corner of Meridian Road and Stapleton Drive in El Paso County, Colorado.

The first phase of commercial construction within Filing 4B will occur within Lot 3, which will include construction of the main roadway through the commercial portion of Filing 4B. While this letter proposes to demonstrate Lot 3's compliance with the REPORT, we are also including conceptual layout/development of Lots 1, 2 & 4 Filing 4B in this analysis for posterity. Development of Lots 1, 2 or 4 Filing 4B must be preceded by a separate drainage letter demonstrating compliance with the REPORT.

The REPORT anticipated runoff from the commercial areas, collectively referred to as The Shops (Lots 1-4, Filing 4B), to be discharged to the previously-constructed storm sewer system within Tract F, Filing 4. Said storm sewer system will ultimately discharge developed flows from Filing 4B, including The Shops, to the Bennett Regional Pond. The Bennett Regional Pond has been adequately sized such that 100 YR developed flows from Filing 4B will be detained and released at (or below) the pre-developed flow rate for the same event.

Anticipated developed flows from The Shops were accounted for in two basins within the REPORT; basin 4 and basin 9. The flows from basin 4 were expected to discharge directly into the previously-constructed Filing 4 storm sewer system via pipe (Design Point X01). The flows from basin 9 were expected to be discharged into the Filing 4 storm sewer system via a 15' Type R inlet located near the intersection of Meridian Ranch Boulevard & Stapleton Drive (Inlet EI03). Anticipated developed flows from the REPORT are summarized in Table 1. Drainage basin maps from the REPORT have also been included with this letter for reference.

Table 1: Anticipated Developed Flows from the REPORT

Basin Description	5 YR Flow (cfs)	100 YR Flow (cfs)
Basin 4 (X01)	38.4	71.0
Basin 9 (EI03)	11.9	25.4

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Based upon a detailed analysis of The Shops along with portions of the adjacent roadways, we have determined that 34.7 cfs during the 5 YR event and 68.1 cfs during the 100 YR event will be discharged to the pipe connection at design point X01, while 11.4 cfs during the 5 YR event and 25.4 cfs during the 100 YR event will be conveyed to the inlet at design point EI03. The flows to be collected at design point EI03 are comprised of the direct runoff from Basin OS-1 as well as flows bypassing inlets in the proposed commercial subdivision. The calculated developed flows are summarized in Table 2.

Table 2: Calculated Developed Flows

DP Description	5 YR Flow (cfs)	100 YR Flow (cfs)
Storm Sewer (X01)	34.7	68.1
Inlet (EI03)	11.4	25.4

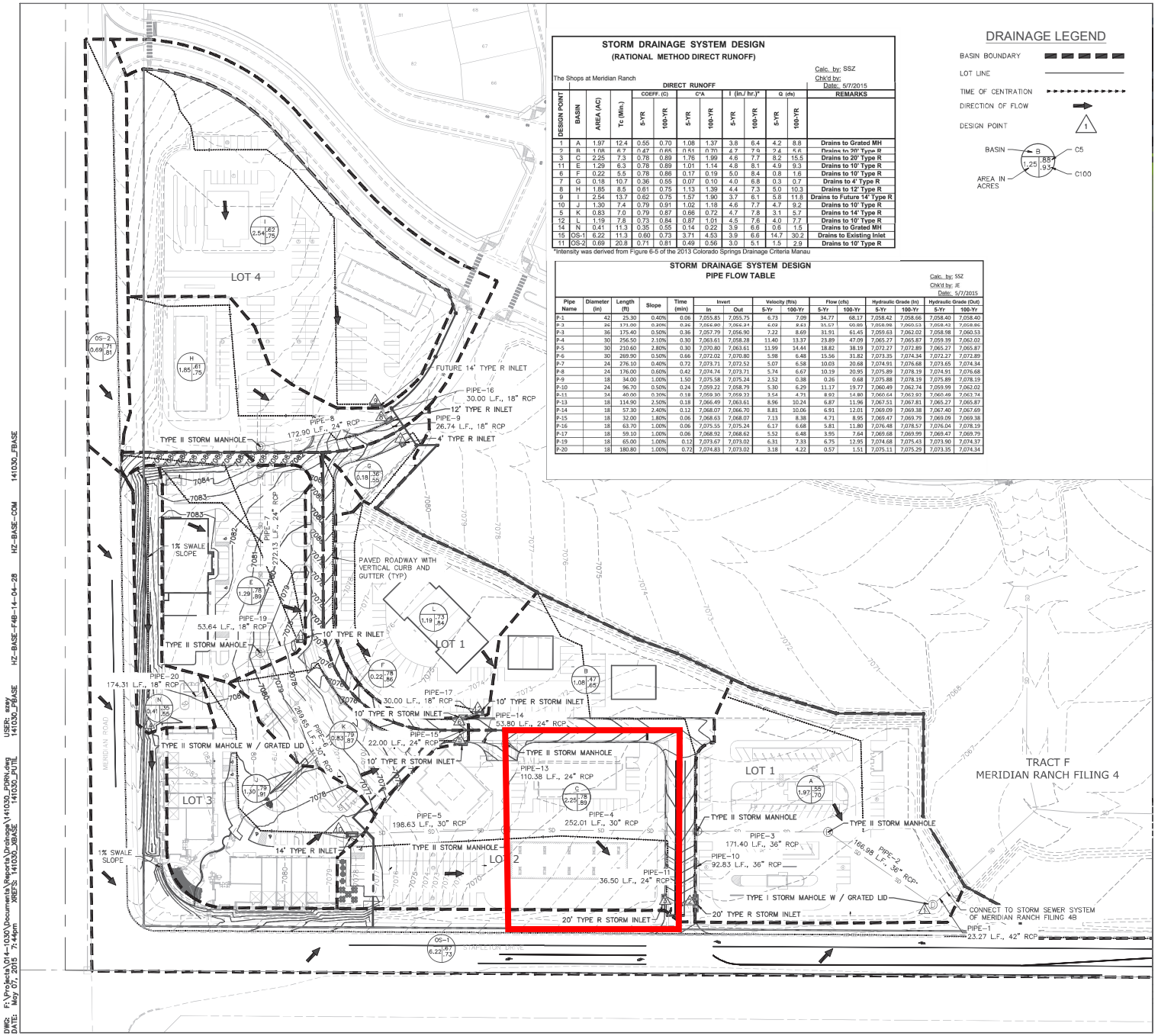
The Shops proposes inlets whose bypass flows will result in additional flow to Stapleton Drive. The routed flows from this bypass are 0.00 cfs during the minor event and 3.76 cfs during the major event. This results in a cumulative expected street flow of approximately 7.2 cfs during the minor event and 18.5 cfs during the major event on Stapleton Drive. Based upon Figure 7-3 of the 2013 Colorado Springs Drainage Criteria Manual the minor storm street capacity for an arterial road is 16 cfs during the minor event and 36 cfs during major event. In both the minor and major event the expected flows are less than the road capacity.

Development of Lot 3 will not adversely impact downstream facilities, as those facilities were designed to convey developed flows from all areas within The Shops. Upon full build-out of The Shops (according to the planned layout of Lot 3 & the conceptual layout of Lots 1, 2 & 4 as presented in the attached Developed Drainage Basin map), the resulting developed flows will be less than the REPORT's expected flows at Design Point X01 and inlet EI03.

Drainage and Bridge Fees:

The 4.11± acre site is the Bennett Drainage Basin. Drainage & Bridge Fees for this basin will be paid to the County at the time of platting. Based on the County's drainage basin maps, the 2015 Drainage & Bridge fees are as follows:

Bennett Drainage Basin Drainage Fee: 4.11 ac*$9,447/Ac* .867 Imp Area = $33,663.16
Bennett Drainage Basin Bridge Fee: 4.11 ac*$3,624/Ac* 0.867 Imp Area = $12,913.65



STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD DIRECT RUNOFF)

The Shops at Meridian Ranch

Calc. by: SSZ
Chk'd by:
Date: 5/7/2015

DESIGN POINT	BASIN	AREA (AC)	Tc (Min.)	DIRECT RUNOFF COEFF. (C) 5-YR	COEFF. (C) 100-YR	C*A 5-YR	C*A 100-YR	I (in./ hr.)* 5-YR	I (in./ hr.)* 100-YR	Q (cfs) 5-YR	Q (cfs) 100-YR	REMARKS
1	A	1.97	12.4	0.55	0.70	1.08	1.37	3.8	6.4	4.2	8.8	Drains to Grated MH
2	B	1.08	6.7	0.47	0.65	0.51	0.70	4.7	7.9	2.4	5.6	Drains to 20' Type R
3	C	2.25	7.3	0.78	0.89	1.76	1.99	4.6	7.7	8.2	15.5	Drains to 20' Type R
11	E	1.29	6.3	0.78	0.89	1.01	1.14	4.8	8.1	4.9	9.3	Drains to 10' Type R
6	F	0.22	5.5	0.78	0.86	0.17	0.19	5.0	8.4	0.8	1.6	Drains to 10' Type R
7	G	0.18	10.7	0.36	0.55	0.07	0.10	4.0	6.8	0.3	0.7	Drains to 4' Type R
8	H	1.85	8.5	0.61	0.75	1.13	1.39	4.4	7.3	5.0	10.3	Drains to 12' Type R
9	I	2.54	13.7	0.62	0.75	1.57	1.90	3.7	6.1	5.8	11.8	Drains to Future 14' Type R
10	J	1.30	7.4	0.79	0.91	1.02	1.18	4.6	7.7	4.7	9.2	Drains to 10' Type R
5	K	0.83	7.0	0.79	0.87	0.66	0.72	4.7	7.8	3.1	5.7	Drains to 14' Type R
12	L	1.19	7.8	0.73	0.84	0.87	1.01	4.5	7.6	4.0	7.7	Drains to 10' Type R
14	N	0.41	11.3	0.35	0.55	0.14	0.22	3.9	6.6	0.6	1.5	Drains to Grated MH
15	OS-1	6.22	11.3	0.60	0.73	3.71	4.53	3.9	6.6	14.7	30.2	Drains to Existing Inlet
11	OS-2	0.69	20.8	0.71	0.81	0.49	0.56	3.0	5.1	1.5	2.9	Drains to 10' Type R

*Intensity was derived from Figure 6-5 of the 2013 Colorado Springs Drainage Criteria Manau

STORM DRAINAGE SYSTEM DESIGN
PIPE FLOW TABLE

Calc. by: SSZ
Chk'd by: JE
Date: 5/7/2015

Pipe Name	Diameter (in)	Length (ft)	Slope	Time (min)	Invert In	Invert Out	Velocity (ft/s) 5-Yr	Velocity (ft/s) 100-Yr	Flow (cfs) 5-Yr	Flow (cfs) 100-Yr	Hydraulic Grade (in) 5-Yr	Hydraulic Grade (in) 100-Yr	Hydraulic Grade (Out) 5-Yr	Hydraulic Grade (Out) 100-Yr
P-1	42	25.30	0.40%	0.06	7,055.85	7,055.75	6.73	7.09	34.77	68.17	7,058.42	7,058.66	7,058.40	7,058.40
P-3	24	171.00	0.30%	0.36	7,060.90	7,060.39	6.03	9.63	31.57	60.80	7,058.98	7,060.53	7,058.42	7,058.86
P-13	36	175.40	0.50%	0.36	7,057.79	7,056.90	7.22	8.69	31.91	61.45	7,059.63	7,062.02	7,058.98	7,060.53
P-4	30	256.50	2.10%	0.30	7,063.61	7,058.28	11.40	13.37	23.89	47.09	7,065.27	7,065.87	7,059.39	7,062.03
P-5	30	210.60	2.80%	0.30	7,070.80	7,063.61	11.99	14.44	18.82	38.19	7,072.27	7,072.89	7,065.27	7,065.87
P-6	30	269.90	0.50%	0.66	7,072.02	7,070.80	5.98	6.48	15.56	31.82	7,073.35	7,074.34	7,072.27	7,072.89
P-7	24	276.10	0.40%	0.72	7,073.71	7,072.52	5.07	6.58	10.03	20.68	7,074.91	7,076.68	7,073.65	7,074.34
P-8	24	176.00	0.60%	0.42	7,074.74	7,073.71	5.74	6.67	10.19	20.95	7,075.89	7,078.19	7,074.91	7,076.68
P-9	18	34.00	1.00%	1.50	7,075.58	7,075.24	2.52	0.38	0.26	0.68	7,075.88	7,078.19	7,075.89	7,078.19
P-10	24	96.70	0.50%	0.24	7,059.22	7,058.79	5.30	6.29	11.17	19.77	7,060.49	7,062.74	7,059.99	7,062.02
P-11	24	40.00	0.30%	0.18	7,059.30	7,059.13	3.54	4.71	8.93	14.80	7,060.64	7,063.93	7,060.49	7,062.74
P-13	18	114.90	2.50%	0.18	7,066.49	7,063.61	8.96	10.24	6.87	11.96	7,067.51	7,067.81	7,065.27	7,065.87
P-14	18	57.30	2.40%	0.12	7,068.07	7,066.70	8.81	10.06	6.91	12.01	7,069.09	7,069.38	7,067.40	7,067.69
P-15	18	32.00	1.80%	0.06	7,068.63	7,068.07	7.13	8.38	4.71	8.95	7,069.47	7,069.79	7,069.09	7,069.38
P-16	18	63.70	1.00%	0.06	7,075.55	7,075.24	6.17	6.68	5.81	11.80	7,076.48	7,078.57	7,076.04	7,078.19
P-17	18	59.10	1.00%	0.06	7,068.92	7,068.62	5.52	6.48	3.95	7.64	7,069.68	7,069.99	7,069.47	7,069.79
P-19	18	65.00	1.00%	0.12	7,073.67	7,073.02	6.31	7.33	6.75	12.95	7,074.68	7,075.43	7,073.90	7,074.37
P-20	18	180.80	1.00%	0.72	7,074.83	7,073.02	3.18	4.22	0.57	1.51	7,075.13	7,075.29	7,073.35	7,074.34

DRAINAGE LEGEND

BASIN BOUNDARY
LOT LINE
TIME OF CENTRATION
DIRECTION OF FLOW
DESIGN POINT
BASIN — B — C5
1.25 — 88 — 93
AREA IN ACRES — C100

Tech Contractors
ENGINEERING GROUP

April 1, 2022

Ed Schoenheit
El Paso County Planning and Community Development
2880 International Cir
Colorado Springs, CO 80910

RE: Drainage Conformance Letter
Building E, Lot 4, the Shops Filing 1 at Meridian Ranch
PCD File No. PPR-223

Dear Mr. Schoenheit

The attached short form drainage report is to serve as a statement of compliance for the development of Building E, Lot 4 of the Shops Filing 1 at Meridian Ranch commercial property with the *Drainage Conformance Letter for Lot 4, the Shops Filing 1 at Meridian Ranch* (the LETTER) prepared by Tech Contractors, dated May 3, 2019, and approved on June 5, 2019, and the *Preliminary/Final Drainage Report for Meridian Ranch Filing 4B, The Shops at Meridian Ranch* (the REPORT) prepared by Tech Contractors, dated April 2014, and approved on September 9, 2014. The REPORT provides hydrologic and hydraulic analysis for the commercial development located at the northeast corner of Meridian Road and Stapleton Drive in El Paso County, Colorado.

Sincerely

Thomas A. Kerby, PE
Tech Contractors
11910 Tourmaline Drive, Suite 130
Falcon, CO 80831
719.495.7444

Telephone No.: 719.495.7444

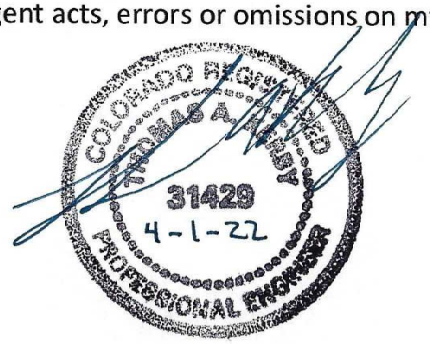
11910 Tourmaline Dr, #130
Falcon CO. 80831

Billing Address
P. O. Box 80036
San Diego, CA 92138

CERTIFICATIONS

Design 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.



Thomas A. Kerby, P.E. #31429

Owner/Developer's Statement:

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

Raul Guzman, Vice President
The Shops at Meridian Ranch LLC
P.O. Box 80036
San Diego, CA 92138

April 1, 2022
Date

El Paso County:

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

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

APPROVED
Engineering Department
04/07/2022 2:02:38 PM
dsdnijkamp
EPC Planning & Community Development Department

Introduction

This short report was prepared for the Commercial Building E of Lot 4 of the Shops Filing 1 at Meridian Ranch. The report shows the storm drainage associated with the construction of Building E is in substantial conformance with the updated calculations of the *Drainage Comformance Letter for Lot 4, the Shops Filing 1 at Meridian Ranch* (the LETTER) prepared by Tech Contractors, dated May 3, 2019, and approved on June 5, 2019, and original calculations established with the *Preliminary/Final Drainage Report for Meridian Ranch Filing 4B, The Shops at Meridian Ranch* (the REPORT) prepared by Tech Contractors, dated April 2014, and approved on September 9, 2014. The LETTER and REPORT provides hydrologic and hydraulic analysis for the development located at the northeast corner of Meridian Road and Stapleton Drive in El Paso County, Colorado.

Background

Building E is proposed to be built on Lot 4 and is located near the southeast corner of Tourmaline Dr. and Meridian Rd. The pad site for Building E was graded with Development Plan associated with Lot 4 of the Shops Filing 1 at Meridian Ranch approved on June 6 2019. At that time Building D and the parking lot for the entire Lot 4 development was completed. The building pad for Building E generally slopes in a southerly direction toward Fleece Flower Way and the main roadway for the Shops development. A drainage letter (LETTER) showing Lot 4's compliance with the REPORT was approved by the County on June 5 2019.

The initial phase of commercial construction included the utility and private storm drain system and the construction of the main roadway through the commercial center and the development of Lot 3 of The Shops Filing 1 at Meridian Ranch. A drainage letter showing Lot 3's compliance with the REPORT was approved by the County on August 20, 2015.

The REPORT anticipated runoff from the commercial areas, collectively referred to as The Shops (Lots 1-4, The Shops Filing 1 at Meridian Ranch), to be discharged to the storm drain system constructed as a part of Meridian Ranch Filing 4B. Said storm sewer system will ultimately discharge developed flows from Filing 4B, including The Shops, to the main stem of the Bennett Ranch Channel then convey the flow downstream to the Bennett Regional Detention Pond. The Bennett Regional Detention Pond was designed and constructed as a regional facility providing detention and water quality for all areas within the Bennett Ranch Drainage Basin within the Woodmen Hills Filings 10 & 11 and Meridian Ranch including the flows from The Shops Filing 1 at Meridian Ranch. The Bennett Pond has been adequately sized such that 100 YR developed will be detained and released at (or below) the pre-developed flow rate for the same event.

Water Quality

When regional water quality capture volume facilities are present, BMPs are still required onsite to address water quality and channel stability for the reach of the drainageway upstream of the regional facility. In accordance with MS4 permits and regulations, BMPs must be implemented prior to discharges to a State Water from areas of "New Development and Significant Redevelopment." Therefore, if a regional BMP is utilized downstream of a discharge from a development into a State Water, additional BMPs are required to protect the State Water between the development site and the regional facility. However, these BMPs may not have to be as extensive as would normally be required, as long as they are adequate to protect the State Water upstream of the regional BMP.

Additional water quality for the entirety of Lot 4 was approved by the LETTER by applying the 'Applicable Development Site Draining to a Regional WQCV Facility' rule (20%/10% Rule) found in Part I.E.4.a.iv.E, Control Measure Requirements of the El Paso County MS4 Program. The regional WQCV facility is designed to accept drainage from the applicable development site. Stormwater from the site may discharge to a water of the state before being discharged to the regional WQCV facility. Before discharging to a water of the state, 20 percent of the total impervious surface of the applicable development site must first drain to a control measure covering an area equal to 10 percent of the total impervious surface of the applicable development site. The control measure must be designed in accordance with a design manual identified by the permittee. In addition, the stream channel between the discharge point of the applicable development site and the regional WQCV facility must be stabilized.

The project site meets or exceeds the requirements listed above in that the roof top areas (including Building E) discharge to grass lined swales prior to entering into the storm drain system. The storm drainage system is then routed through Meridian Ranch Filing 4b and is discharged into a stabilized stream channel prior to entering the downstream WQCV facility located within the Bennett Ranch Regional Detention Pond.

The total roof top area of the two buildings is 28,820 SQ. FT or 22.2% of the total impervious surface area of the project site. The two buildings discharge the storm runoff to grass lined swales via the roof drains. The total grass lined swale area is 16,735 SQ. FT. or 12.9% of the total impervious surface area of the project site. Please see the Water Quality Exhibit A of the LETTER for a graphic representation of the site.

By applying the 20%/10% Rule for regional WQCV facilities, this project meets or exceeds the requirements for water quality.

Drainage Analysis

The anticipated developed flows from The Shops remain unchanged from the LETTER and the REPORT, therefore the drainage patterns and flow values are in substantial conformance with the previously approved documents and will not adversely impact downstream facilities.

The analysis completed for the initial phase of the Shops, Lot 3 found in the REPORT along with portions of the adjacent roadways, showed 35 cfs during the 5 YR event and 68 cfs for the 100 YR event for the on-site flows discharged to the pipe connection at design point X01.

The storm drainage analysis for this phase of the Shops Filing 1 at Meridian Ranch found in the LETTER yields a 5 YR event flow of 29 cfs and 58 cfs for the 100 YR at the pipe connection at design point X01 entering Meridian Ranch Filing 4B. A comparison of the different flow rates from the various drainage studies can be found in the table below.

Table 1 Design Flow Rates for Design Point X01

	Minor Storm (5-yr/10-yr)	Major Storm (100-yr)
Filing 4B/The Shops - FDR, 2014	38	70
The Shops, Lot 3 - Drainage Letter, 2015	35	68
The Shops, Lot 4 - Drainage Letter, 2018	29	58

Drainage and Bridge Fees

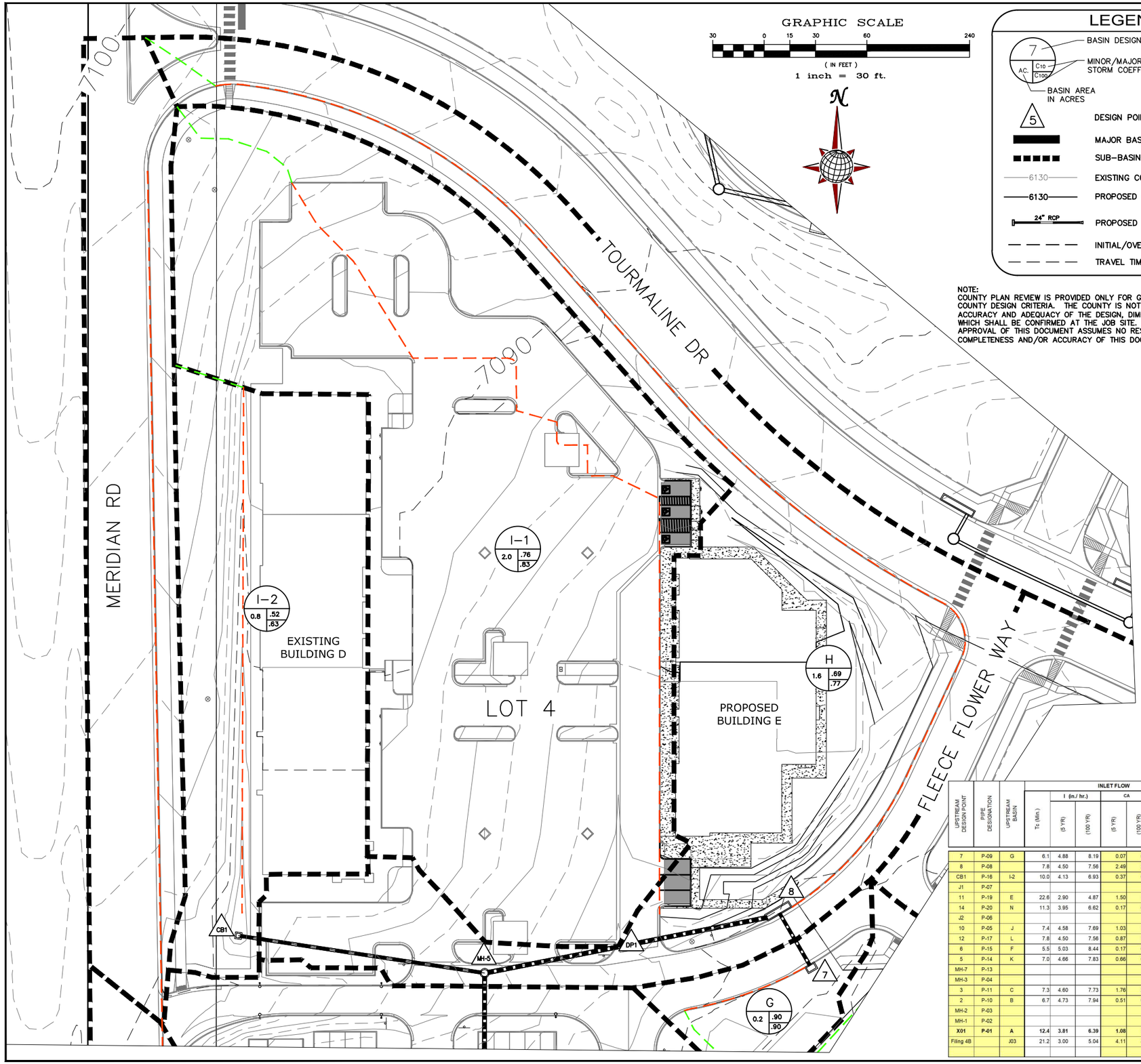
There are no Drainage and Bridge Fees with this project as the fees were paid at the time of the recordation of the Shops Filing 1 at Meridian Ranch on August 12, 2015.

Drainage Calculations from the LETTER

COMPOSITE 'C' FACTORS

PROJECT: **Lot 4, Shops Filing 1** 1/2/2019

BASIN LABEL / DEV.	AREA (AC.) UNDEV	2.5 AC	1 DU/AC	2 DU/AC	TOTAL	COMPOSITE FACTOR 5-year	100-year	Percent Impervious
BASIN DESIGNATION	AREA (AC.) UNDEV	PAVEMENT	ROOF	LAWN	TOTAL	COMPOSITE FACTOR 5-year	100-year	Percent Impervious
Basin 4, Filing 4B/ Shops Filing 1 FDR A	From Lot 3, Shops Filing 1 at Meridian Ranch Drainage Letter by Olsson Associates, Dated May 7, 2015 Approved August 20, 2015				1.97	0.55	0.70	
B					1.08	0.47	0.65	
C					2.25	0.78	0.89	
E					1.29	0.78	0.89	
F					0.22	0.78	0.86	
G		**0.06**		**0.11**	**0.17**	**0.38**	**0.57**	
H		**0.84**	**0.34**	**0.40**	**1.58**	**0.66**	**0.77**	
I-1		**1.58**		**0.42**	**2.00**	**0.73**	**0.83**	
I-2		**0.06**	**0.40**	**0.32**	**0.78**	**0.48**	**0.63**	
J	From Lot 3, Shops Filing 1 at Meridian Ranch Drainage Letter by Olsson Associates, Dated May 7, 2015 Approved August 20, 2015				1.30	0.79	0.91	
K					0.83	0.79	0.87	
L					1.19	0.73	0.84	
N					0.41	0.35	0.65	
OS-1					6.22	0.60	0.73	
OS-2					0.69	0.71	0.81	
TOTAL		2.54	0.74	1.25	15.8	**0.67**	**0.80**	**90.0%**



GRAPHIC SCALE

30 0 15 30 60 240

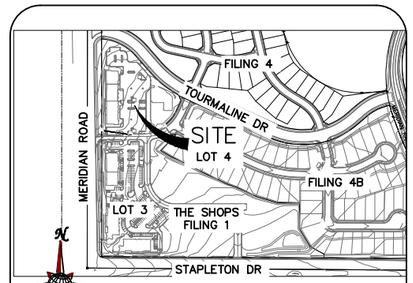
(IN FEET)

1 inch = 30 ft.

LEGEND

- BASIN DESIGNATION
- MINOR/MAJOR STORM COEFFICIENT
- BASIN AREA IN ACRES
- DESIGN POINT DESIGNATION
- MAJOR BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- 6130 EXISTING CONTOUR
- 6130 PROPOSED COUNTOUR
- 24" RCP PROPOSED STORM SEWER
- INITIAL/OVERLAND TIME (Ti)
- TRAVEL TIME (Tt)

NOTE:
COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GNERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.



INDEX MAP
NTS

PROJECT BENCHMARK

INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT SW CORNER (BRASS CAP W/ NO. GF-9)

ELEVATION = 6874.00

BASIN LAB EL	DEV.	AREA (AC.) UNDEV	2.5 AC	1 DU/AC	2 DU/AC	TOTAL	COMPOSITE FACTOR 5-year	100-year
BASIN DESIGNATION		AREA (AC.) UNDEV	PAVEMENT	ROOF	LAWN	TOTAL	COMPOSITE FACTOR 5-year	100-year
Basin 4, Filing 4B/ Shops Filing 1 FDR	A	From Lot 3, Shops Filing 1 at Meridian Ranch Drainage Letter by Olsson Associates, Dated May 7, 2015 Approved August 20, 2015				1.97	0.55	0.70
	B					1.08	0.47	0.65
	C					2.25	0.78	0.89
	E					1.29	0.78	0.89
	F					0.22	0.78	0.86
	G		**0.06**		**0.11**	**0.17**	**0.38**	**0.57**
	H		**0.84**	**0.34**	**0.40**	**1.58**	**0.66**	**0.77**
	I-1		**1.58**		**0.42**	**2.00**	**0.73**	**0.83**
	I-2		**0.06**	**0.40**	**0.32**	**0.78**	**0.48**	**0.63**
	J	From Lot 3, Shops Filing 1 at Meridian Ranch Drainage Letter by Olsson Associates, Dated May 7, 2015				1.30	0.79	0.91
	K					0.83	0.79	0.87
	L					1.19	0.73	0.84
	N					0.41	0.35	0.65

UPSTREAM DESIGN POINT	PIPE DESIGNATION	UPSTREAM BASIN	INLET FLOW Tc (Min.)	I (in./ hr.) (5 YR)	I (in./ hr.) (100 YR)	CA (5 YR)	CA (100 YR)	Q (5 YR)	Q (100 YR)	SYSTEM FLOW Sum Tc (min.)	I (in./ hr.) (5 YR)	I (in./ hr.) (100 YR)	CA (5 YR)	CA (100 YR)	Q (5 YR)	Q (100 YR)	TRAVEL TIME PIPE DIA	ROUGHNESS (n)	DESTINATION DP	SLOPE %	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME Tt
7	P-09	G	6.1	4.88	8.19	0.07	0.10	0.3	0.8						0.3	0.8	18	0.013	8	1.00%	34	6.0	0.1
8	P-08		7.8	4.50	7.56	2.49	2.89	11.2	21.8	7.8	4.50	7.56	2.56	2.99	12	23	24	0.013	MH-5	0.60%	176	5.6	0.5
CB1	P-16	I-2	10.0	4.13	6.93	0.37	0.49	1.5	3.4						1.5	3.4	18	0.013	MH-5	7.58%	142	16.4	0.1
J1	P-07									10.1	4.11	6.90	2.93	3.48	12	24	24	0.013	MH-4	0.40%	276	4.6	1.0
11	P-19	E	22.6	2.90	4.87	1.50	1.71	4.3	8.3						4.3	8.3	18	0.013	MH-4	1.00%	65	6.0	0.2
14	P-20	N	11.3	3.95	6.62	0.17	0.19	0.7	1						0.7	1.3	18	0.013	MH-4	1.00%	181	6.0	0.5
J2	P-06									22.8	2.89	4.85	4.60	5.37	13	26	30	0.013	10	0.50%	270	5.9	0.8
10	P-05	J	7.4	4.58	7.69	1.03	1.18	4.7	9.1	23.6	2.84	4.77	5.62	6.56	16	31	30	0.013	MH-3	2.80%	211	14.0	0.3
12	P-17	L	7.8	4.50	7.56	0.87	1.00	3.9	7.6						3.9	7.6	18	0.013	6	1.00%	59	6.0	0.2
6	P-15	F	5.5	5.03	8.44	0.17	0.19	0.9	1.6	8.0	4.47	7.51	1.04	1.19	4.7	8.9	18	0.013	5	1.80%	32	8.0	0.1
5	P-14	K	7.0	4.66	7.83	0.66	0.72	3.1	5.7	8.0	4.46	7.48	1.70	1.91	7.6	14	18	0.013	MH-7	2.40%	57	9.2	0.1
MH-7	P-13									8.1	4.44	7.45	1.70	1.91	7.5	14	18	0.013	MH-3	2.50%	115	9.4	0.2
MH-3	P-04									23.8	2.83	4.74	7.32	8.47	21	40	30	0.013	MH-2	2.10%	25*	12.1	0.4
3	P-11	C	7.3	4.60	7.73	1.76	2.00	8.1	15.5						8	15	24	0.013	2	0.20%	40	3.2	0.2
2	P-10	B	6.7	4.73	7.94	0.51	0.70	2.4	5.6	7.5	4.56	7.66	2.26	2.70	10	21	24	0.013	MH-2	0.50%	97	5.1	0.3
MH-2	P-03									24.2	2.80	4.71	9.58	11.17	27	53	36	0.013	MH-1	0.50%	175	6.7	0.4
MH-1	P-02									24.6	2.78	4.66	9.58	11.17	27	52	36	0.013	X01	0.30%	171	5.2	0.5
X01	**P-01**	**A**	**12.4**	**3.81**	**6.39**	**1.08**	**1.38**	**4.1**	**8.8**	**25.2**	**2.74**	**4.61**	**10.67**	**12.55**	**29**	**58**	**42**	**0.013**	**Filing 4B**	**0.40%**	**25**	**6.6**	**0.1**
Filing 4B		J03	21.2	3.00	5.04	4.11	4.68	12	24	25.2	2.74	4.60	14.78	17.23	40	79	48	0.013	J04	0.50%	447	8.1	0.9

No.	Revisions	Date Init.	Appr.	Date
-	-	-	-	-

TECH CONTRACTORS
11910 TOURMALINE DR. STE 130
FALCON, CO 80831
TELEPHONE 719.495.7444

MERIDIAN RANCH

BUILDING E LOT 4 - THE SHOPS FILING 1
FINAL DRAINAGE PLAN
FIGURE A

Drawn by	Checked by	Date
TAK	RS	FEB 2022

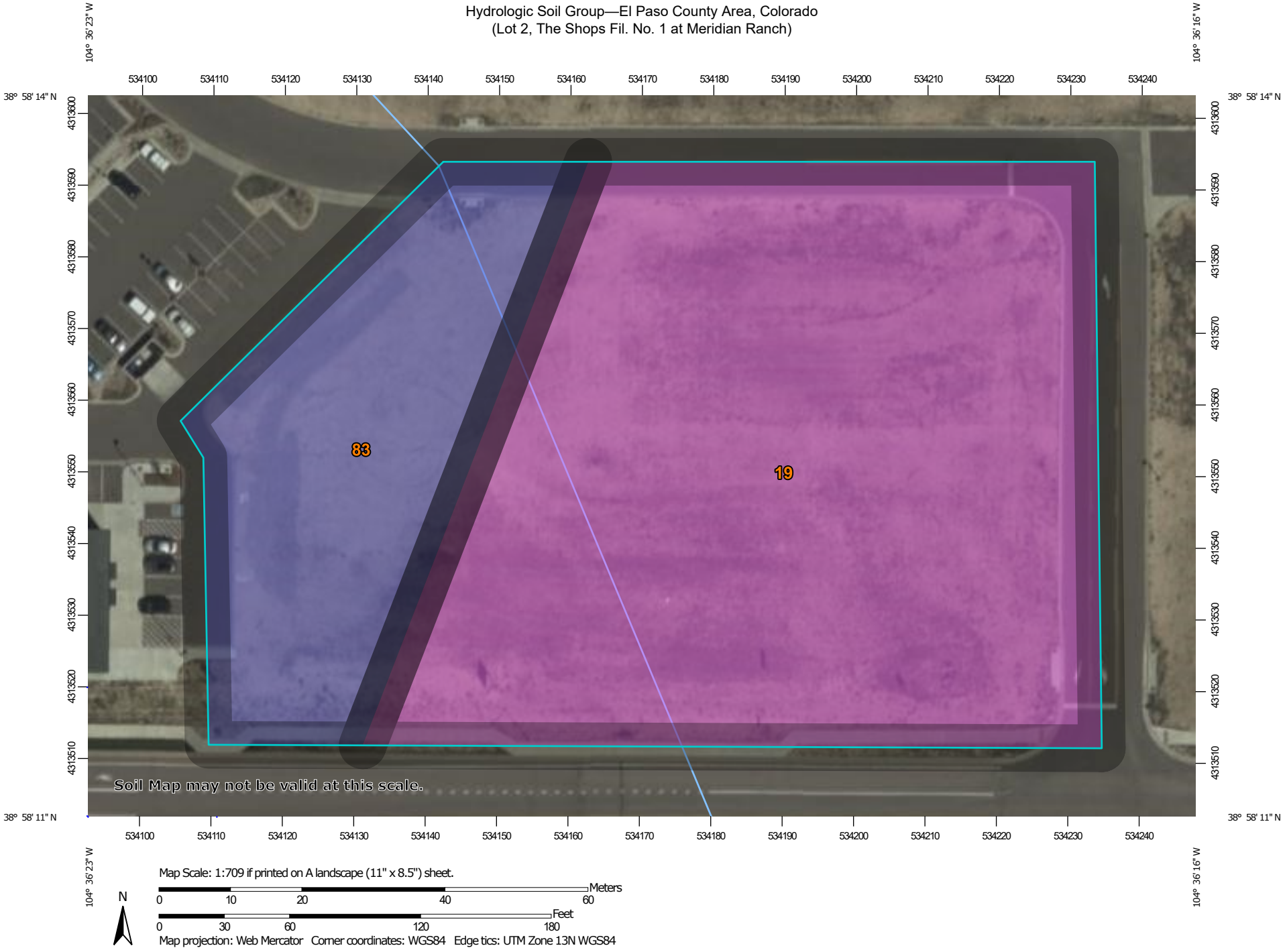
Scale	Sheet Number
AS SHOWN	DR1

S:\OneDrive\Civil Proj\Shops Phase 2\DWG\Plan Sheets\Basin Maps\FDR-SHOPS-2-BLDG E RAT.dwg, 2/24/2022 11:22:15 AM

APPENDIX B

HYDROLOGIC CALCULATIONS

Hydrologic Soil Group—El Paso County Area, Colorado
(Lot 2, The Shops Fil. No. 1 at Meridian Ranch)



Map Scale: 1:709 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 30 60 120 180

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

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
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	1.8	73.7%
83	Stapleton sandy loam, 3 to 8 percent slopes	B	0.6	26.3%
Totals for Area of Interest			**2.4**	**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

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

$$t_c = t_i + t_t \quad \text{(Eq. 6-7)}$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i, may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \qquad \text{(Eq. 6-10)}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional "calibration" of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

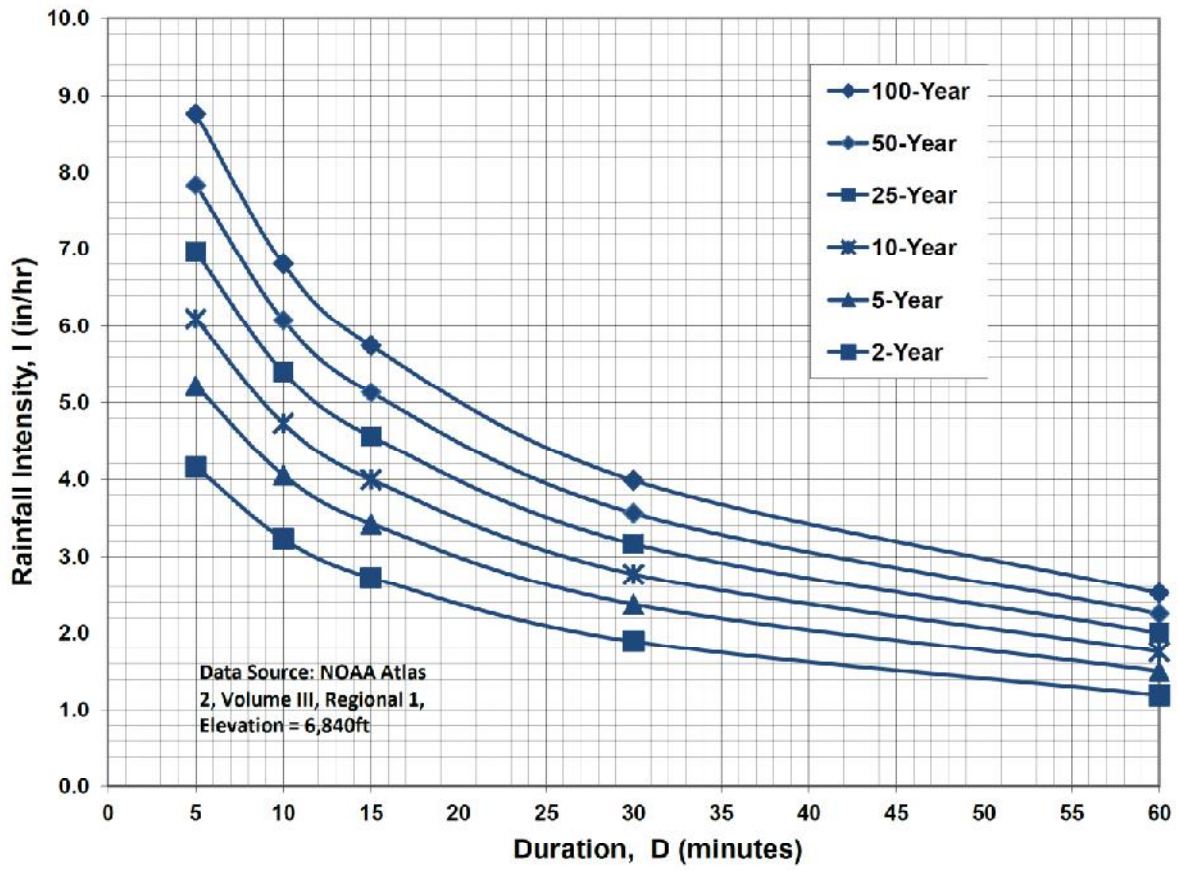
3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

SHOPS AT MERIDIAN RANCH CONVENIENCE STORE
COMPOSITE RUNOFF COEFFICIENTS

DEVELOPED CONDITIONS

Include basin OS-1.1

5-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
C1.1	0.9	0.80	PAVED/IMPERVIOUS	0.9	0.10	LANDSCAPED	0.08				0.809
C1.2	1.08	0.90	PAVED/IMPERVIOUS	0.9	0.18	LANDSCAPED	0.08				0.763
C1.1,C1.2	1.98										0.784
C1.3	0.3	0.30	PAVED/IMPERVIOUS	0.9							0.900
C1.1-C1.3	2.28										0.799

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
C1.1	0.9	0.80	PAVED/IMPERVIOUS	0.96	0.10	LANDSCAPED	0.35				0.892
C1.2	1.08	0.90	PAVED/IMPERVIOUS	0.96	0.18	LANDSCAPED	0.35				0.858
C1.1,C1.2	1.98										0.874
C1.3	0.3	0.30	PAVED/IMPERVIOUS	0.96							0.960
C1.1-C1.3	2.28										0.885

SHOPS AT MERIDIAN RANCH CONVENIENCE STORE
COMPOSITE IMPERVIOUS AREAS

IMPERVIOUS AREAS

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
C1.1	0.9	0.80	PAVED/IMPERVIOUS	100	0.10	LANDSCAPED	0				88.889
C1.2	1.08	0.90	PAVED/IMPERVIOUS	100	0.18	LANDSCAPED	0				83.333
C1.1,C1.2	1.98										85.859
C1.3	0.3	0.30	PAVED/IMPERVIOUS	100							100.000
C1.1-C1.3	2.28										87.719

SHOPS AT MERIDIAN RANCH CONVENIENCE STORE
RATIONAL METHOD

DEVELOPED CONDITIONS

					Overland Flow			Channel flow										
BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR	C 100-YEAR	LENGTH (FT)	SLOPE (FT/FT)	Tco [1] (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS [2] VELOCITY (FT/S)	Tt [3] (MIN)	TOTAL Tc [4] (MIN)	TOTAL Tc [4] (MIN)	INTENSITY [5] 5-YR (IN/HR)	INTENSITY [5] 100-YR (IN/HR)	PEAK FLOW Q5 [6] (CFS)	PEAK FLOW Q100 [6] (CFS)
C1.1	C1.1	0.90	0.809	0.892	100	0.020	4.2	275	20	0.018	2.68	1.7	5.9	5.9	4.91	8.25	3.58	6.62
C1.2	C1.2	1.08	0.763	0.858	70	0.036	3.4	285	20	0.030	3.46	1.4	4.7	5.0	5.17	8.68	4.26	8.04
Tt C1.1-C1.2								260	20	0.029	3.41	1.3						
C1.1,C1.2	C1	1.98	0.784	0.874									7.2	7.2	4.62	7.76	7.17	13.42
C1.3	C1.3	0.30	0.900	0.960	45	0.020	1.9	415	20	0.019	2.76	2.5	4.5	5.0	5.17	8.68	1.40	2.50
C1.1-C1.3	3	2.28	0.799	0.885									7.2	7.2	4.62	7.76	8.42	15.65
OS-1.1	OS-1.1	0.12	0.080	0.350	40	0.160	4.7	350	20	0.02	2.83	2.1	6.8	6.8	4.72	7.92	0.05	0.33

1) OVERLAND FLOW Tco = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333)
2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)
C = 2.5 FOR HEAVY MEADOW
C = 5 FOR TILLAGE/FIELD
C = 7 FOR SHORT PASTURE AND LAWNS
C = 10 FOR NEARLY BARE GROUND
C = 15 FOR GRASSED WATERWAY
C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES

3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MANUAL
$I_5 = -1.5 * \ln(Tc) + 7.583$
$I_{100} = -2.52 * \ln(Tc) + 12.735$
6) Q = CiA

APPENDIX C

HYDRAULIC CALCULATIONS

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018) **Sheet 1 of 1**

Designer: JPS
Company: JPS
Date: April 1, 2023
Project: Shops at Meridian Ranch Convenience Store
Location: Basin C1.2 (Lot 2)

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth = 0.60 inches
Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	UIA:RPA	DCIA	SPA									
Area ID	C1.2a	C1.2b	C1.2c									
Downstream Design Point ID	C1.2	C1.2	C1.2									
Downstream BMP Type	EDB	EDB	EDB									
DCIA (ft^2)	--	13,325	--									
UIA (ft^2)	25,847	--	--									
RPA (ft^2)	720	--	--									
SPA (ft^2)	--	--	7,153									
HSG A (%)	100%	--	100%									
HSG B (%)	0%	--	0%									
HSG C/D (%)	0%	--	0%									
Average Slope of RPA (ft/ft)	0.020	--	--									
UIA:RPA Interface Width (ft)	4.00	--	--									

CALCULATED RUNOFF RESULTS

Area ID	C1.2a	C1.2b	C1.2c									
UIA:RPA Area (ft^2)	26,567	--	--									
L / W Ratio	16.00	--	--									
UIA / Area	0.9729	--	--									
Runoff (in)	0.34	0.50	0.00									
Runoff (ft^3)	754	555	0									
Runoff Reduction (ft^3)	323	0	358									

CALCULATED WQCV RESULTS

Area ID	C1.2a	C1.2b	C1.2c									
WQCV (ft^3)	1077	555	0									
WQCV Reduction (ft^3)	323	0	0									
WQCV Reduction (%)	30%	0%	0%									
Untreated WQCV (ft^3)	754	555	0									

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	C1.2											
DCIA (ft^2)	13,325											
UIA (ft^2)	25,847											
RPA (ft^2)	720											
SPA (ft^2)	7,153											
Total Area (ft^2)	47,045											
Total Impervious Area (ft^2)	39,172											
WQCV (ft^3)	1,632											
WQCV Reduction (ft^3)	323											
WQCV Reduction (%)	20%											
Untreated WQCV (ft^3)	1,309											

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	47,045
Total Impervious Area (ft^2)	39,172
WQCV (ft^3)	1,632
WQCV Reduction (ft^3)	323
WQCV Reduction (%)	20%
Untreated WQCV (ft^3)	1,309

needs to be at least 60% reduction. Per my comments in the report above, you probably just want to remove this calcs sheet.

LOT 2, THE SHOPS FIL. NO. 1A AT MERIDIAN RANCH
CHANNEL CALCULATION SUMMARY - SITE DRAINAGE SWALES

PROPOSED CHANNEL / SWALE	SLOPE (%)	SIDE SLOPE (Z)	BOT. WIDTH (FT)	CHANNEL DEPTH (FT)	FRICTION FACTOR (n)	BASIN	Q100 BASIN FLOW (CFS)	CHANNEL FLOW % OF BASIN	**Q100 CHANNEL FLOW (CFS)**	Q100 DEPTH (FT)	Q100 VELOCITY (FT/S)	TOP WIDTH (FT)	CHANNEL LINING
SWALE C1.2	2.0	4:1	4	1.0	0.030	C1.2	8.0	100	**8.0**	0.4	3.3	7.4	GRASS

ASSUMPTIONS:

1) Channel flow calculations based on Manning's Equation
2) Channel depth includes 1' minimum freeboard
3) n = 0.03 for grass-lined non-irrigated channels (minimum)
4) n = 0.035 for riprap-lined channels
5) Vmax = 5.0 fps for 100-year flows w/ grass-lined channels
6) Vmax = 8.0 fps for 100-year flows w/ Erosion Control Blankets (Tensar Eronet SC150 or equal)
7) Vmax = 10.0 fps for 100-year flows w/ Erosion Control Blankets (Tensar Eronet C125 or equal)

Flow for swale should also account for flowby from inlet at C1.1 (0.1 & 1.3 cfs). Use flows on inlet mgmt spreadsheet for C1.2.

Hydraulic Analysis Report

Project Data

Project Title: Project - Lot 2, The Shops Fil. No. 1A at Meridian Ranch
Designer: JPS
Project Date: Thursday, March 16, 2023
Project Units: U.S. Customary Units
Notes:

Channel Analysis: Channel Analysis-Swale C1.2

Notes:

Input Parameters

Channel Type: Trapezoidal
Side Slope 1 (Z1): 4.0000 ft/ft
Side Slope 2 (Z2): 4.0000 ft/ft
Channel Width: 4.0000 ft
Longitudinal Slope: 0.0200 ft/ft
Manning's n: 0.0300
Flow: 8.0000 cfs

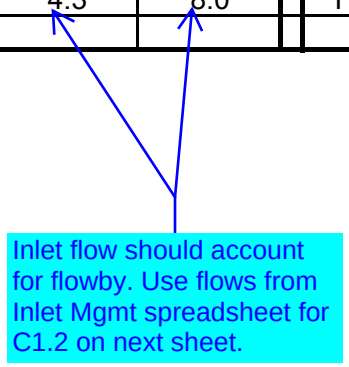
Result Parameters

Depth: 0.4254 ft
Area of Flow: 2.4258 ft^2
Wetted Perimeter: 7.5083 ft
Hydraulic Radius: 0.3231 ft
Average Velocity: 3.2979 ft/s
Top Width: 7.4036 ft
Froude Number: 1.0153
Critical Depth: 0.4292 ft
Critical Velocity: 3.2601 ft/s
Critical Slope: 0.0193 ft/ft
Critical Top Width: 7.43 ft
Calculated Max Shear Stress: 0.5310 lb/ft^2
Calculated Avg Shear Stress: 0.4032 lb/ft^2

FR # is high. What measures are being to mitigate this? Per DCM Section 6.5.2, grass lines channels shall not be used when FR # is greater than 0.9 for 100-year storm.

SHOPS AT MERIDIAN RANCH CONVENIENCE STORE
STORM INLET SIZING SUMMARY

	BASIN FLOW			INLET FLOW					
INLET	DP	Q5 FLOW (CFS)	Q100 FLOW (CFS)	INLET FLOW % OF BASIN	Q5 FLOW (CFS)	Q100 FLOW (CFS)	INLET CONDITION / TYPE	INLET SIZE (FT)	INLET CAPACITY (CFS)
C1.1	C1.1	3.6	6.2	100	3.6	6.6	TYPE R (GRADE)	10'	5.3
C1.2	C1.2	4.2	7.8	100	4.3	8.0	TYPE C (SUMP)	SGL	17.2



MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet C1.1	Inlet C1.2
Site Type (Urban or Rural)	URBAN	URBAN
Inlet Application (Street or Area)	STREET	AREA
Hydraulic Condition	On Grade	Swale
Inlet Type	CDOT Type R Curb Opening	CDOT Type C (Depressed)

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	3.6	4.3
Major Q_{Known} (cfs)	6.6	8.0

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.1
Major Bypass Flow Received, Q_b (cfs)	0.0	1.3

Watershed Characteristics

Subcatchment Area (acres)		
Percent Impervious		
NRCS Soil Type		

Watershed Profile

Overland Slope (ft/ft)		
Overland Length (ft)		
Channel Slope (ft/ft)		
Channel Length (ft)		

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

CALCULATED OUTPUT

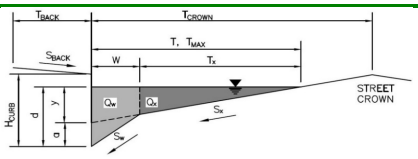
Minor Total Design Peak Flow, Q (cfs)	**3.6**	**4.4**
Major Total Design Peak Flow, Q (cfs)	**6.6**	**9.3**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.1	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	1.3	0.0

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

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

Project: **Shops at Meridian Ranch Convenience Store**

Inlet ID: **Inlet C1.1**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	4.0	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} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.011	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 =	0.014	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} =	30.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

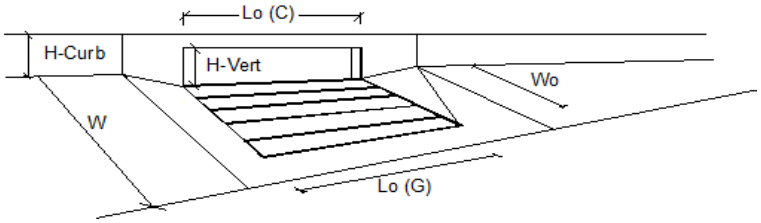
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**20.9**	**20.9**	**cfs**

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

MHFD-Inlet, Version 5.01 (April 2021)



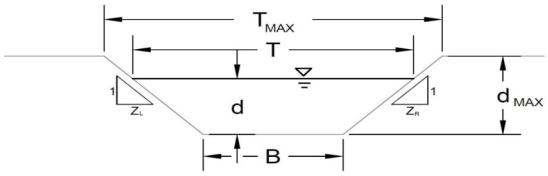
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.5**	**5.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.1**	**1.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**98**	**80**	**%**

AREA INLET IN A SWALE

Shops at Meridian Ranch Convenience Store

Inlet C1.2



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 =	0.0200	ft/ft
Bottom Width	B =	4.00	ft
Left Side Slope	Z1 =	4.00	ft/ft
Right Side Sloe	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	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**12.00**	**12.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**0.50**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**10.8**	**42.3**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**0.50**	**1.00**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**4.4**	**9.3**	**cfs**
Water Depth	d =	**0.31**	**0.46**	**ft**

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'

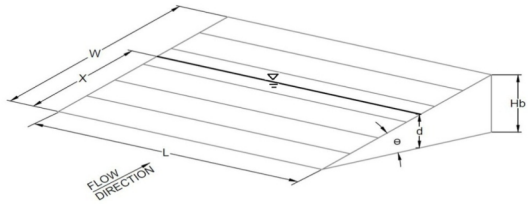
AREA INLET IN A SWALE

Shops at Meridian Ranch Convenience Store

Inlet C1.2

Inlet Design Information (Input)

Type of Inlet	CDOT Type C (Depressed)	Inlet Type =	CDOT Type C (Depressed)	
Angle of Inclined Grate (must be <= 30 degrees)		θ =	0.00	degrees
Width of Grate		W =	3.00	ft
Length of Grate		L =	3.00	ft
Open Area Ratio		A_{RATIO} =	0.70	
Height of Inclined Grate		H_B =	0.00	ft
Clogging Factor		C_f =	0.50	
Grate Discharge Coefficient		C_d =	0.84	
Orifice Coefficient		C_o =	0.56	
Weir Coefficient		C_w =	1.81	



		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.31	1.46	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**16.3**	**17.2**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

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

FR # is high. What measures are being to mitigate this? Per DCM Section 6.5.2, grass lines channels shall not be used when FR # is greater than 0.9 for 100-year storm.

SHOPS AT MERIDIAN RANCH CONVENIENCE STORE
STORM SEWER SIZING SUMMARY

	PIPE FLOW				PIPE CAPACITY		
PIPE	DESIGN POINT	Q5 FLOW (CFS)	Q100 FLOW (CFS)		PIPE SIZE	MIN. PIPE SLOPE	PIPE CAPACITY (CFS)
C1.1	C1.1	3.5	5.3		12	2.2%	5.3
C1.2	C1.2	4.3	8.0		12	5.1%	8.0

ASSUMPTIONS:
1. STORM DRAIN PIPE ASSUMED TO BE RCP OR HDPE

Inlet flow should account for flowby. Use flows from Inlet Mgmt spreadsheet for C1.2.

Hydraulic Analysis Report

Project Data

Project Title: Project - Shops at Meridian Ranch C-Store
Designer: JPS
Project Date: Tuesday, February 7, 2023
Project Units: U.S. Customary Units
Notes:

Channel Analysis: SD-C1.1

Notes:

Input Parameters

Channel Type: Circular
Pipe Diameter: 1.0000 ft
Longitudinal Slope: 0.0220 ft/ft
Manning's n: 0.0130
Depth: 1.0000 ft

Result Parameters

Flow: 5.2845 cfs
Area of Flow: 0.7854 ft^2
Wetted Perimeter: 3.1416 ft
Hydraulic Radius: 0.2500 ft
Average Velocity: 6.7284 ft/s
Top Width: 0.0000 ft
Froude Number: 0.0000
Critical Depth: 0.9302 ft
Critical Velocity: 6.9412 ft/s
Critical Slope: 0.0190 ft/ft
Critical Top Width: 0.51 ft
Calculated Max Shear Stress: 1.3728 lb/ft^2
Calculated Avg Shear Stress: 0.3432 lb/ft^2

Provide calculations showing that HGL from existing system (tie-in locations) are not having negative impacts on the HGL's for the new runs of storm.

Channel Analysis: SD-C1.2

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.0000 ft

Longitudinal Slope: 0.0510 ft/ft

Manning's n: 0.0130

Depth: 1.0000 ft

Result Parameters

Flow: 8.0459 cfs

Area of Flow: 0.7854 ft^2

Wetted Perimeter: 3.1416 ft

Hydraulic Radius: 0.2500 ft

Average Velocity: 10.2444 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 0.9855 ft

Critical Velocity: 10.2748 ft/s

Critical Slope: 0.0463 ft/ft

Critical Top Width: 0.24 ft

Calculated Max Shear Stress: 3.1824 lb/ft^2

Calculated Avg Shear Stress: 0.7956 lb/ft^2

Provide calculations showing that HGL from existing system (tie-in locations) are not having negative impacts on the HGL's for the new runs of storm.

APPENDIX D

FIGURES

National Flood Hazard Layer FIRMette

FEMA

104°36'38"W 38°58'27"N

104°36'1"W 38°57'59"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/7/2023 at 1:51 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

LEGEND

- LOD — LIMITS OF DISTURBANCE
- FEMA 100-YEAR FLOODWAY
- FEMA 100-YR FLOODPLAIN
- PROPERTY BOUNDARY
- DRAINAGE BASIN BOUNDARY
- 7015 — PROPOSED CONTOUR
- 7015 — EXISTING CONTOUR
- FLOWLINE
- FLOW DIRECTION ARROW
- DS — DOWNSPOUT CONNECTION TO STORM SEWER; INSTALL TRANSITION COUPLINGS & EXTEND 6" PVC (SDR35) AT 1.0% MIN. SLOPE TO SD
- 1 — DESIGN POINT
- A / 1.3 AC. — BASIN DESIGNATION / BASIN AREA (ACRES)
- UNCONNECTED IMPERVIOUS AREA (UIA)
- RECEIVING PERVIOUS AREA (RPA)
- DIRECTLY CONNECTED IMPERVIOUS AREA (DCIA)
- SEPARATE PERVIOUS AREA (SPA)

IMPERVIOUS AREA CALCULATIONS:

BASIN C1.2 = 1.08 AC.

SURFACE TYPE	AREA
BUILDING	12,000 SF
PROP. ASPHALT	27,172 SF
PARKING & CONC.	
TOTAL IMPERVIOUS AREA	39,172 SF = 0.9 AC

= 83.3%

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
C1	7.2	13.4
3	8.4	15.7

We need to know how much disturbed area is untreated and if there are any exclusions that apply to those areas. So please create a basic overview map (or modify an existing drainage map) with color shading/hatching that shows areas tributary to each PBMP (pond, runoff reduction, SNOUT, etc.) and those disturbed areas that are not treated by a PBMP, with the applicable exclusion labeled (ex: 20% up to 1ac of development can be excluded per ECM App I.7.1.C.1 and exclusions listed in ECM App I.7.1.B.#). An accompanying summary table on this map would also be very helpful (example provided):

Specific to this site: the map below doesn't show treatment for all areas within the limits of disturbance. Remember that all areas of disturbance need to be accounted for through WQ treatment or an applicable WQ exclusion, not just related to added impervious areas.

And maybe the above spreadsheet is overkill if the entire site is conveyed to and treated by the downstream SNOUT, so a more simply table like the one shown below is better suited. You just need to state that clearly in the text and show that in the drainage map all WQ treatment and exclusions. Your call on how you want to do.

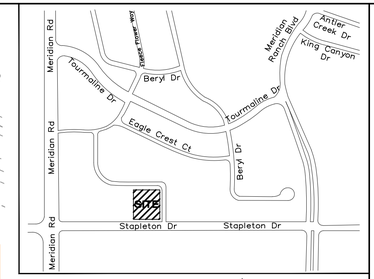
PBMP SUMMARY TABLE

BASINS	PBMP TRIBUTARY AREA (AC)	PBMP
A1.1	1.43	RG-A1.1
A3.1	1.87	RG-A3.1
B1,B2	8.60	EDB-B
OA2,A2	0.95	EXCLUDED*

* EXCLUDED BASED ON < 1-ACRE OF DEVELOPED ROADWAY AREA PER ECM APP. I7.C.1.a

VICINITY MAP

NTS



PARCEL # 42303-19-051
SHOPS AT MERIDIAN RANCH LLC
4.96 AC.
VACANT; ZONED CR

LOT 1
THE SHOPS FIL. NO. 1
AT MERIDIAN RANCH

EXISTING ASPHALT PRIVATE DRIVE
N 00°00'00" E 239.62'

EXISTING 10' TYPE R STORM INLETS (PVT)

EXISTING 24" RCP STORM SEWER (PVT)

PROPOSED RETAINING WALL

PROPOSED GRATED STORM INLET (TYP) (18" NYOPLAST OR EQUAL)

PROPOSED 6" PVC STORM DRAIN

EXISTING 5' STORM MH-7 (PVT)
RIM EL=7072.5
INV IN=7066.75
INV OUT=7066.48

ADJUST EXISTING STORM MH RIM

FF=7069.0
12,000 sf CONVENIENCE STORE AND LIQUOR STORE + 2,000 sf STORAGE
1 SPACE PER 250 SF
48 REQUIRED
52 PROVIDED

C1.1 / 0.9 AC.

PROPOSED 8" PVC STORM DRAIN @1.0 % MIN. SLOPE

C 2' CURB CHASE

EXISTING CURB OPENING

EXISTING 30" RCP STORM SEWER (PVT)

EXISTING 5' STORM MH-3 (PVT)
RIM EL=7071.05
(E) 24" INV IN=7063.60
(E) 30' INV OUT=7063.10
(P) 12" INV IN=7064.60

ADJUST EXISTING STORM MH RIM

(P) 30 LF 12" RCP PRIVATE STORM SEWER @ 9.7% SLOPE (CORE DRILL & GROUT PATCH AT CONNECTION TO EXISTING STORM MH)

(P) 10' TYPE R STORM INLET C1.1 (PVT) (ON-GRADE)
TC=7070.8
12" INV=7067.5

FIELD LOCATE & CONNECT TO EXISTING 30" RCP STORM SEWER
EXISTING 30" INV=7062.47

EXISTING 30" RCP STORM SEWER (PVT)

C1.2 / 1.08 AC.

PROPOSED LOT 1
THE SHOPS FIL. NO. 1A
AT MERIDIAN RANCH
0.97 AC.

PARCEL # 42303-19-055
SHOPS AT MERIDIAN RANCH LLC
VACANT

PROPOSED LOT 2
THE SHOPS FIL. NO. 1A
AT MERIDIAN RANCH
1.46 AC.

OS-1.1 / 0.12 AC.

C1.3 / 0.3 AC.

N 89°38'52.77" W 265.41'

S 179°38'52.77" W 239.62'

S 359°38'52.77" E 266.88'

EXISTING ASPHALT PRIVATE DRIVE

PROPOSED 6' CROSSPAN

EXISTING 6' STORM MH (PVT)

EXISTING 36" TYPE R STORM SEWER (PVT)

EXISTING 24" RCP STORM SEWER (PVT)

EXISTING 20' TYPE R STORM INLETS (PVT)

(P) 27 LF PRIVATE SD-C1.2 (12" HDPE)

PROPOSED TYPE C PRIVATE STORM INLET-C1.2 GR EL=7063.5

SPA-C1.2C (7,873 SF)

UIA-C1.2a (25,847 SF)

RPA-C1.2a (720 SF)

(P) LANDSCAPED WATER QUALITY SWALE C1.2 TOTAL LS SWALE AREA=4,375 SF, RPA=720 SF

E

STAPLETON DRIVE
(EXISTING PUBLIC STREET)

UTILITY EASEMENT (WIDTH VARIES)

60' ACCESS, DRAINAGE, AND UTILITY EASEMENT

DRAINAGE, AND UTILITY EASEMENT

20' DRAINAGE EASEMENT

30' ACCESS, DRAINAGE, AND UTILITY EASEMENT

40' ACCESS, DRAINAGE, AND UTILITY EASEMENT

MAIN SIGN

N

20' 0 20' 40'

ORIGINAL SCALE: 1"=20' (24"x36" SHEET)
CONTOUR INTERVAL: 1'

TYPE 3 CARRY CURB — NTS — A

TYPE 3 SPILL CURB — NTS — B

FLUSH CURB DETAIL — NTS — C — 12' MIN.

CURB CHASE SECTION — SCALE: 1"=1' H&V — D

SWALE SECTION — NTS — E

VEGETATION PER LANDSCAPE PLANS

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

SHOPS AT MERIDIAN RANCH CONVENIENCE STORE
LOT 2, THE SHOPS FIL. NO. 1A AT MERIDIAN RANCH

REVISION | NO. | BY | DATE

RUNOFF REDUCTION EXHIBIT

HORZ. SCALE: 1"=20'	DRAWN: PV
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: RIDGELINE	CHECKED: JPS
CREATED: 08/29/22	LAST MODIFIED: 03/31/23
PROJECT NO: 092202	MODIFIED BY: PV

SHEET: RR-1

LEGEND

- LOD — LIMITS OF DISTURBANCE
- FEMA 100-YEAR FLOODWAY
- FEMA 100-YR FLOODPLAIN
- PROPERTY BOUNDARY
- DRAINAGE BASIN BOUNDARY
- 7015 — PROPOSED CONTOUR
- 7015 — EXISTING CONTOUR
- FLOWLINE
- FLOW DIRECTION ARROW
- (E) EXISTING
- (P) PROPOSED
- DS → DOWNSPOUT CONNECTION TO STORM SEWER; INSTALL TRANSITION COUPLINGS & EXTEND 6" PVC (SDR35) AT 1.0% MIN. SLOPE TO SD
- 1 — DESIGN POINT
- A / 1.3 AC — BASIN DESIGNATION / BASIN AREA (ACRES)

IMPERVIOUS AREA CALCULATIONS:

BASIN C1.2 = 1.08 AC.

SURFACE TYPE	AREA
BUILDING	12,000 SF
PROP. ASPHALT	27,172 SF
PARKING & CONC.	
TOTAL IMPERVIOUS AREA	39,172 SF = 0.9 AC

= 83.3%

SUMMARY HYDROLOGY TABLE

Provide basin summary table

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
C1	7.2	13.4
3	8.4	15.7

PARCEL # 42303-19-051
SHOPS AT MERIDIAN RANCH LLC
4.96 AC.
VACANT; ZONED CR

LOT 1
THE SHOPS FIL. NO. 1
AT MERIDIAN RANCH

EXISTING ASPHALT PRIVATE DRIVE
N 00°00'00" E 239.62'

EXISTING 10' TYPE R STORM INLETS (PVT)

EXISTING 24" RCP STORM SEWER (PVT)

PROPOSED RETAINING WALL

PROPOSED GRATED STORM INLET (TYP) (18" NYOPLAST OR EQUAL)

PROPOSED 6" PVC STORM DRAIN

EXISTING 5' STORM MH-7 (PVT)
RIM EL=7072.5
INV IN=7066.75
INV OUT=7066.48

ADJUST EXISTING STORM MH RIM

FF=7069.0
12,000 sf CONVENIENCE STORE AND LIQUOR STORE + 2,000 sf STORAGE
1 SPACE PER 250 SF
48 REQUIRED
52 PROVIDED

PROPOSED 8" PVC STORM DRAIN @1.0 % MIN. SLOPE

C 2' CURB CHASE

EXISTING 5' STORM MH-3 (PVT)
RIM EL=7071.05
(E) 24" INV IN=7063.60
(E) 30" INV OUT=7063.10
(P) 12" INV IN=7064.60

EXISTING CURB OPENING

EXISTING 30" RCP STORM SEWER (PVT)

EXISTING 30" RCP STORM SEWER (PVT)

ADJUST EXISTING STORM MH RIM

(P) 30 LF 12" RCP PRIVATE STORM SEWER @ 9.7% SLOPE (CORE DRILL & GROUT PATCH AT CONNECTION TO EXISTING STORM MH)

(P) 10' TYPE R STORM INLET C1.1 (PVT) (ON-GRADE)
TC=7070.8
12" INV=7067.5

FIELD LOCATE & CONNECT TO EXISTING 30" RCP STORM SEWER EXISTING 30" INV=7062.47

Basin C1.1 should be broken into 2 basins, as it does not look like the bottom portion would be able to reach the proposed inlet

Provide a design point here (C1.1)

Based on grading it appears Basin OS-1.1 boundary should follow along the ridge more

PROPOSED LOT 1
THE SHOPS FIL. NO. 1A
AT MERIDIAN RANCH
0.97 AC.

PARCEL # 42303-19-053
SHOPS AT MERIDIAN RANCH LLC
VACANT

PROPOSED LOT 2
THE SHOPS FIL. NO. 1A
AT MERIDIAN RANCH
1.46 AC.

OS-1.1 / 0.12 AC.

C1.1 / 0.9 AC.

C1.2 / 1.08 AC.

C1.3 / 0.3 AC.

S 89°38'52.77" W 265.41'

S 179°38'52.77" W 239.62'

S 269°38'52.77" E 266.88'

EXISTING ASPHALT PRIVATE DRIVE

PARCEL # 42303-19-051
SHOPS AT MERIDIAN RANCH LLC
4.96 AC.
VACANT; ZONED CR

LOT 1
THE SHOPS FIL. NO. 1
AT MERIDIAN RANCH

PROPOSED 6' CROSSPAN

EXISTING 6' STORM MH (PVT)

EXISTING 36" TYPE R STORM SEWER (PVT)

END FLUSH CURB C

CORE DRILL & GROUT PATCH AT CONNECTION TO EXISTING INLET #3
(E) RIM EL=7063.54
(E) 24" INV OUT=7059.29
(P) 12" INV IN=7060.0
(FIELD VERIFY)

EXISTING 24" RCP STORM SEWER (PVT)

EXISTING 20' TYPE R STORM INLETS (PVT)

(P) 27 LF PRIVATE SD-C1.2 (12" HDPE) @ 6.3% SLOPE

PROPOSED TYPE C PRIVATE STORM INLET-C1.2
GR EL=7063.5
(P) 12" INV OUT-7061.7

Provide a design point for this inlet (C1.2)

C BEGIN FLUSH CURB

(P) LANDSCAPED WATER QUALITY SWALE C1.2 E

STAPLETON DRIVE
(EXISTING PUBLIC STREET)

MAIN SIGN

UTILITY EASEMENT (WIDTH VARIES)

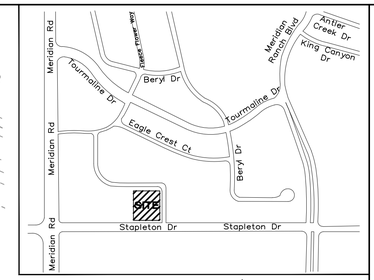
60' ACCESS, DRAINAGE, AND UTILITY EASEMENT

DRAINAGE, AND UTILITY EASEMENT

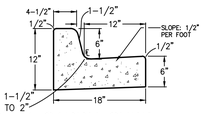
20' DRAINAGE EASEMENT

30' ACCESS, DRAINAGE, AND UTILITY EASEMENT

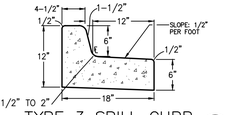
40' ACCESS, DRAINAGE, AND UTILITY EASEMENT



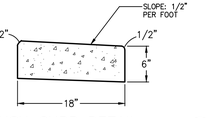
VICINITY MAP
NTS



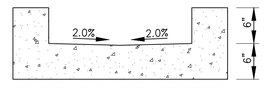
TYPE 3 CARRY CURB
NTS A



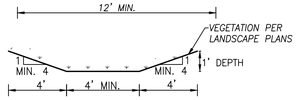
TYPE 3 SPILL CURB
NTS B



FLUSH CURB DETAIL
NTS C



CURB CHASE SECTION
SCALE: 1"=1' H&V D



SWALE SECTION
NTS E

N

20' 0 20' 40'
ORIGINAL SCALE: 1"=20' (24"x36" SHEET)
CONTOUR INTERVAL: 1'

Add "PCD File No. PPR2322"

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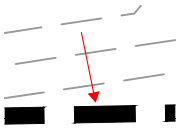
1			

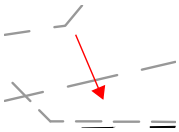
HORZ. SCALE:	1"=20'	DRAWN:	PV
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	RIDGELINE	CHECKED:	JPS
CREATED:	08/29/22	LAST MODIFIED:	03/31/23
PROJECT NO:	092202	MODIFIED BY:	PV
SHEET:	D1		

V1_Drainage Report.pdf Markup Summary

Arrow (2)



Subject: Arrow
Page Label: [1] D1
Author: CDurham
Date: 7/13/2023 10:52:30 AM
Status:
Color:
Layer:
Space:



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Author: CDurham
Date: 7/13/2023 10:53:03 AM
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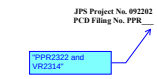
Space:

Callout (10)



Subject: Callout
Page Label: 1
Author: Carlos
Date: 6/22/2023 9:20:14 AM
Status:
Color:
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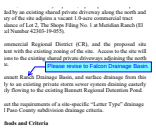
Space:

"PPR2322 and VR2314"

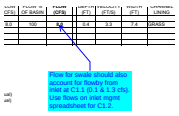


Subject: Callout
Page Label: 4
Author: Carlos
Date: 7/12/2023 10:23:19 AM
Status:
Color:
Layer:
Space:

Please revise to Falcon Drainage Basin.

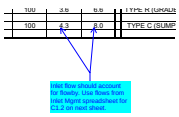
Subject: Callout
Page Label: 9
Author: Carlos
Date: 7/12/2023 11:07:58 AM
Status:
Color:
Layer:
Space:

Please revise the property is located in the Falcon Drainage Basin.



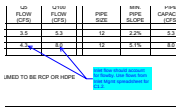
Subject: Callout
Page Label: 9
Author: CDurham
Date: 7/13/2023 10:42:36 AM
Status:
Color:
Layer:
Space:

Flow for swale should also account for flowby from inlet at C1.1 (0.1 & 1.3 cfs). Use flows on inlet mgmt spreadsheet for C1.2.



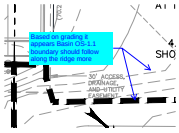
Subject: Callout
Page Label: 11
Author: CDurham
Date: 7/13/2023 10:44:00 AM
Status:
Color:
Layer:
Space:

Inlet flow should account for flowby. Use flows from Inlet Mgmt spreadsheet for C1.2 on next sheet.



Subject: Callout
Page Label: 17
Author: CDurham
Date: 7/13/2023 10:47:53 AM
Status:
Color:
Layer:
Space:

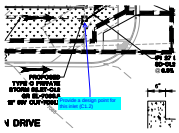
Inlet flow should account for flowby. Use flows from Inlet Mgmt spreadsheet for C1.2.



Subject: Callout
Page Label: [1] D1
Author: CDurham
Date: 7/13/2023 10:54:08 AM
Status:
Color:
Layer:
Space:

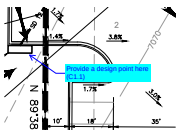
Based on grading it appears Basin OS-1.1 boundary should follow along the ridge more

---



Subject: Callout
Page Label: [1] D1
Author: CDurham
Date: 7/13/2023 10:55:55 AM
Status:
Color:
Layer:
Space:

Provide a design point for this inlet (C1.2)



Subject: Callout
Page Label: [1] D1
Author: CDurham
Date: 7/13/2023 10:56:15 AM
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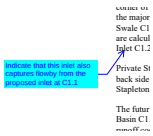
Color:
Layer:
Space:

Provide a design point here (C1.1)



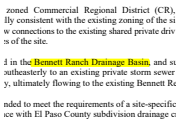
Subject: Callout
Page Label: 6
Author: CDurham
Date: 7/13/2023 11:08:06 AM
Status:
Color:
Layer:
Space:

Indicate that this inlet also captures flowby from the proposed inlet at C1.1

File Attachment (1)

Subject: File Attachment
Page Label: [1] RR-1
Author: Glenn Reese - EPC Stormwater
Date: 6/29/2023 8:29:57 AM
Status:
Color:
Layer:
Space:

Highlight (4)


zoned Commercial Regional District (CR),
lly consistent with the existing zoning of the si
w connections to the existing shared private driv
s of the site.

d in the Bennett Ranch Drainage Basin, and su
outheasterly to an existing private storm sewer
y, ultimately flowing to the existing Bennett Re

nded to meet the requirements of a site-specific
ce with El Paso County subdivision drainage c

Subject: Highlight
Page Label: 4
Author: Carlos
Date: 7/12/2023 10:44:48 AM
Status:
Color:
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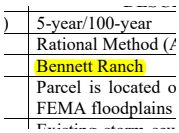
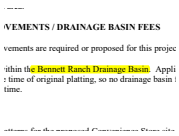
Space:

Bennett Ranch Drainage Basin


)	5-year/100-year
	Rational Method (A
	Bennett Ranch
	Parcel is located o
	FEMA floodplains

Subject: Highlight
Page Label: 4
Author: Carlos
Date: 7/12/2023 10:55:52 AM
Status:
Color:
Layer:
Space:

Bennett Ranch

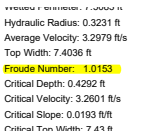

/VEMENTS / DRAINAGE BASIN FEES

vements are required or proposed for this projec

ithin the Bennett Ranch Drainage Basin. Appli
time of original platting, so no drainage basin
time.

Subject: Highlight
Page Label: 9
Author: Carlos
Date: 7/12/2023 11:07:32 AM
Status:
Color:
Layer:
Space:

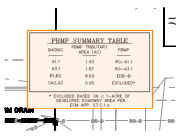
e Bennett Ranch Drainage Basin


Hydraulic Radius: 0.3231 ft
Average Velocity: 3.2979 ft/s
Top Width: 7.4036 ft
Froude Number: 1.0153
Critical Depth: 0.4292 ft
Critical Velocity: 3.2601 ft/s
Critical Slope: 0.0193 ft/ft

Subject: Highlight
Page Label: 10
Author: CDurham
Date: 7/13/2023 10:28:21 AM
Status:
Color:
Layer:
Space:

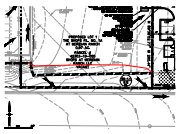
Froude Number: 1.0153

Image (1)



Subject: Image
Page Label: [1] RR-1
Author: Glenn Reese - EPC Stormwater
Date: 7/3/2023 7:27:22 AM
Status:
Color:
Layer:
Space:

PolyLine (1)



Subject: PolyLine
Page Label: [1] D1
Author: CDurham
Date: 7/13/2023 10:52:42 AM
Status:
Color:
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SW - Highlight (2)

Subject: SW - Highlight
Page Label: 6
Author: Glenn Reese - EPC Stormwater
Date: 6/28/2023 4:56:29 PM
Status:
Color:
Layer:
Space:

Water quality and runoff reduction will be provided by routing
the majority of developed flows from the site to the proposed landscaped Water Quality
Swale C1.2 along the south edge of the property.

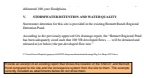
Subject: SW - Highlight
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 6/28/2023 5:43:10 PM
Status:
Color:
Layer:
Space:

Stormwater quality is provided in the proposed landscaped swale along the
south edge of the property.

SW - Rectangle (1)

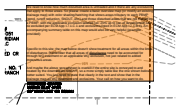
Subject: SW - Rectangle
Page Label: 8
Author: Glenn Reese - EPC Stormwater
Date: 6/28/2023 5:25:05 PM
Status:
Color:
Layer:
Space:

SW - Textbox (3)



Subject: SW - Textbox
Page Label: 8
Author: Glenn Reese - EPC Stormwater
Date: 6/29/2023 8:50:22 AM
Status:
Color:
Layer:
Space:

Provide an excerpt of an existing report that shows the location of the SNOUT and Bennett Pond compared to the site and the conveyance system from the site to them. The excerpts currently included as attachments below do not show them.

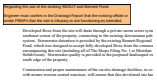


Subject: SW - Textbox
Page Label: [1] RR-1
Author: Glenn Reese - EPC Stormwater
Date: 7/3/2023 7:27:06 AM
Status:
Color:
Layer:
Space:

We need to know how much disturbed area is untreated and if there are any exclusions that apply to those areas. So please create a basic overview map (or modify an existing drainage map) with color shading/hatching that shows areas tributary to each PBMP (pond, runoff reduction, SNOUT, etc.) and those disturbed areas that are not treated by a PBMP, with the applicable exclusion labeled (ex: 20% up to 1ac of development can be excluded per ECM App I.7.1.C.1 and exclusions listed in ECM App I.7.1.B.#). An accompanying summary table on this map would also be very helpful (example provided):

Specific to this site: the map below doesn't show treatment for all areas within the limits of disturbance. Remember that all areas of disturbance need to be accounted for through WQ treatment or an applicable WQ exclusion, not just related to added impervious areas.

And maybe the above spreadsheet is overkill if the entire site is conveyed to and treated by the downstream SNOUT, so a more simply table like the one shown below is better suited. You just need to state that clearly in the text and show that in the drainage map all WQ treatment and exclusions. Your call on how you want to do.

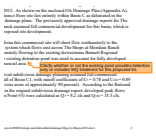


Subject: SW - Textbox
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 6/28/2023 5:50:05 PM
Status:
Color:
Layer:
Space:

Regarding the use of the existing SNOUT and Bennett Pond:

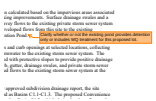
Engineer must confirm in the Drainage Report that the existing offsite or onsite PBMPs that the site is tributary to are functioning as intended.

SW - Textbox with Arrow (9)



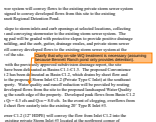
Subject: SW - Textbox with Arrow
Page Label: 5
Author: Glenn Reese - EPC Stormwater
Date: 6/28/2023 4:58:26 PM
Status:
Color:
Layer:
Space:

Clarify whether or not the existing pond provides detention only or includes WQ treatment for this proposed lot.



Subject: SW - Textbox with Arrow
Page Label: 6
Author: Glenn Reese - EPC Stormwater
Date: 6/28/2023 4:58:45 PM
Status:
Color:
Layer:
Space:

Clarify whether or not the existing pond provides detention only or includes WQ treatment for this proposed lot.



Subject: SW - Textbox with Arrow
Page Label: 6
Author: Glenn Reese - EPC Stormwater
Date: 6/28/2023 4:59:55 PM
Status:
Color:
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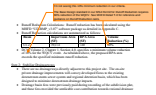
Clairfy that why on-site WQ treatment is necessary (assuming because Bennett Ranch pond only provides detention).



Subject: SW - Textbox with Arrow
Page Label: 8
Author: Glenn Reese - EPC Stormwater
Date: 6/29/2023 9:14:31 AM
Status:
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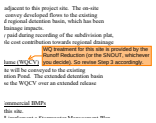
Space:

I'm not seeing this 10% minimum reduction in our criteria.

The Base Design standard in our MS4 Permit for Runoff Reduction requires 60% reduction of the WQCV. See MHFD Detail T-0 for reference and guidance on Runoff Reduction calcs.



Subject: SW - Textbox with Arrow
Page Label: 8
Author: Glenn Reese - EPC Stormwater
Date: 6/28/2023 5:41:37 PM
Status:
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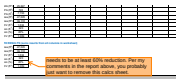
WQ treatment for this site is provided by the Runoff Reduction (or the SNOUT, whichever you decide). So revise Step 3 accordingly.



Subject: SW - Textbox with Arrow
Page Label: 8
Author: Glenn Reese - EPC Stormwater
Date: 6/29/2023 9:16:18 AM
Status:
Color:
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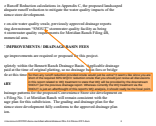
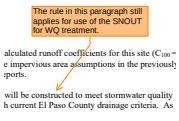
needs to be at least 60% reduction. Per my comments in the report above, you probably just want to remove this calcs sheet.



Subject: SW - Textbox with Arrow
Page Label: 9
Author: Glenn Reese - EPC Stormwater
Date: 6/29/2023 9:15:21 AM
Status:
Color:
Layer:
Space:

So then any runoff reduction provided onsite would just be extra? It seems like since you are short of the required 60% WQCV reduction onsite that you should just revise all discussions in this report related to WQ treatment to state that WQ will be provided by the downstream SNOUT per the previous drainage report. Whereas currently the WQ treatment via the SNOUT is just an afterthought of this report's WQ analysis, it should really be the focal point.



Subject: SW - Textbox with Arrow
Page Label: 9
Author: Glenn Reese - EPC Stormwater
Date: 6/29/2023 8:50:25 AM
Status:
Color:
Layer:
Space:

The rule in this paragraph still applies for use of the SNOUT for WQ treatment.

Subject: SW - Textbox with Arrow
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 6/28/2023 5:43:26 PM
Status:
Color:
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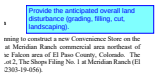
Space:

Revise according to my comments on previous pages.

Text Box (9)



Subject: Text Box
Page Label: 4
Author: Carlos
Date: 7/12/2023 11:00:47 AM
Status:
Color:
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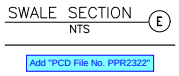
Space:

Provide the anticipated overall land disturbance (grading, filling, cut, landscaping).



Subject: Text Box
Page Label: [1] D1
Author: Carlos
Date: 7/12/2023 11:16:40 AM
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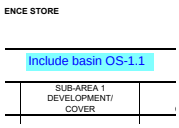
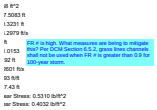
Add "PCD File No. PPR2322"



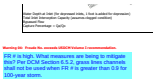
Subject: Text Box
Page Label: 5
Author: CDurham
Date: 7/13/2023 10:22:38 AM
Status:
Color:
Layer:
Space:

Include basin OS-1.1



Subject: Text Box
Page Label: 10
Author: CDurham
Date: 7/13/2023 12:06:53 PM
Status:
Color:
Layer:
Space:

FR # is high. What measures are being to mitigate this? Per DCM Section 6.5.2, grass lines channels shall not be used when FR # is greater than 0.9 for 100-year storm.



Subject: Text Box
Page Label: 16
Author: CDurham
Date: 7/13/2023 12:07:08 PM
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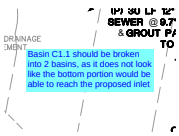
FR # is high. What measures are being to mitigate this? Per DCM Section 6.5.2, grass lines channels shall not be used when FR # is greater than 0.9 for 100-year storm.



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Author: CDurham
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Basin C1.1 should be broken into 2 basins, as it does not look like the bottom portion would be able to reach the proposed inlet

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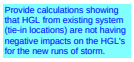
Provide basin summary table



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Author: CDurham
Date: 7/13/2023 12:21:30 PM
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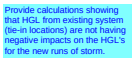
Provide calculations showing that HGL from existing system (tie-in locations) are not having negative impacts on the HGL's for the new runs of storm.



Subject: Text Box
Page Label: 19
Author: CDurham
Date: 7/13/2023 12:21:45 PM
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Provide calculations showing that HGL from existing system (tie-in locations) are not having negative impacts on the HGL's for the new runs of storm.