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Materials Testing
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FINAL DRAINAGE REPORT

Foundation Lutheran Church

Towners Ave
Tract C, Paint Brush Hills Filing No. 13A
Falcon, Colorado

PREPARED FOR:

Colorado Commercial Construction
12325 Oracle Blvd, Suite 120
Colorado Springs, CO 80921

JOB NO. 191726

March 12, 2024

PCD File No. PPR2321
PCD File No. SF2321

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SIGNATURE PAGE

TR C PAINT BRUSH HILLS, FILING NO. 13A

ENGINEER'S STATEMENT

This report and plan for the drainage design of Tract C, Paint Brush Hills Filing No. 13A was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the El Paso County Drainage Criteria Manuals Volumes 1 and 2 and is in conformity with the master plan of the drainage basin. I understand that El Paso County does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in the preparing this report.

Respectfully Submitted,

RMG – Rocky Mountain Group



David Walker, P.E.
Sr. Civil Project Manager

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.

Foundation Lutheran Church President John Wohlrabe
Name of Owner/Developer, Title

[Signature]
Authorized Signature

10/30/23
Date

Foundation Lutheran Church
Business Name

10367 Mt. Evans Dr., Peyton, CO 80731
Address

EL PASO COUNTY STATEMENT

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

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

Conditions:

By: **Gilbert LaForce, P.E.**
Engineering Manager
On behalf of the
ECM Administrator
Date: **03/13/2024 9:17:20 AM**
El Paso County Department of Public Works



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I. PURPOSE

This report is a Final Drainage Report for Foundation Lutheran Church for the development of a church.

The purpose of this report is to identify on-site and off-site drainage patterns, assess stormwater conditions per delineated basin and sub-basins, demonstrate adequate design standards for storm water flow and release into the existing storm water system or right-of-way, and provide a narrative for any other drainage considerations related to the development of this parcel.

II. GENERAL LOCATION AND DESCRIPTION

A. LOCATION

The proposed development of Foundation Lutheran Church is located at the address of Towners Av in Falcon, Colorado in El Paso County within the Paint Brush Hills subdivision. The parcel schedule number is 5225208001 and the legal description is currently Tract C, Paint Brush Hills Filing No. 13A. The parcel is located in the West half of Section 25, Township 12 South, Range 65 West of the 6th P.M. El Paso County, Colorado. The site is bordered to the north by Londonderry Dr, to the east by Towners Ave, and to the south and west by residential single-family homes. The names and descriptions of surrounding platted developments can be seen on plan sets and appendix documents:

B. DESCRIPTION OF PROPERTY – EXISTING CONDITIONS

The project site is approximately 259,865 square feet (5.966 acres) and consists of undeveloped natural vegetation. There is existing curb and gutter along Londonderry Drive and Towners Avenue.

The existing percent imperviousness is approximately 0 percent on Tract C. The existing vegetation consists of shrubs and native grasses.

The existing topography consists of grades between 1 and 25 percent. Drainage patterns sheet flow south across the parcel to a drainage swale that directs flow to the southwest corner.

There is a F.E.S. outlet at the southeast corner of the site that is connected to a 24" RCP storm drain pipe that goes easterly under Towners Ave. A temporary swale runs across the site on the south portion towards the southwest corner, where an F.E.S. inlet is connect to a 36" RCP storm drain pipe. The 36" RCP storm drain pipe leaves the site in a southerly direction and goes to a regional detention facility located off-site known as Pond B1. The detention facility is within a platted tract of land with ownership and maintenance by the Paint Brush Hills Metropolitan District.

The site is not located within a streamside zone.

C. EXISTING SOILS

The soils indicative to the site are classified as Pring coarse sandy loam by the USDA Soil Conservation Service and are listed as NRCS (National Resources Conservation Service) Hydrologic Soil Group B. These soils have a moderate infiltration rate when thoroughly wet and have a moderate rate of water transmission. The USDA Soil Map is provided in the Appendix.

D. EXISTING DRAINAGE

This parcel is located in the Falcon Drainage Basin.

The project site does not lie within a designated flood plain according to information published in the Federal Emergency Management Agency Floodplain Map No. 08041C0551G, dated December 7, 2018. The FEMA Floodplain map is provided in the Appendix showing it lies within Zone X, a minimal flood hazard area.

There are no known non-stormwater discharges that contribute to the storm water systems on site and downstream, both private and public.

The existing drainage entering from off-site has been accounted for and has no impact to the development.

E. DESCRIPTION OF PROPERTY – PROPOSED CONDITIONS

The proposed development consists of a single story church approximately 9,600 square feet.

There is no existing vehicle entry access point to the property. The proposed development will have two vehicle entry access points, one access directly across from Triborough Trail and the other directly across from the entrance to the Paint Brush Hills Metro District Office.

The proposed development limits of disturbance, including the right of way improvements of pedestrian sidewalk with ADA curb ramps, curb cuts, and utility work. The drainage area is approximately 6.41 acres. The limits of disturbance do not disturb the existing hillsides. The grading limits are kept within the setbacks wherever possible and the developed conditions remain consistent with the historical drainage pattern of the subdivision. A sub-basin delineation sheet for the proposed conditions is provided in the appendix.

III. DRAINAGE BASINS AND SUB-BASINS

A. EXISTING MAJOR DRAINAGE BASIN AND SUB-BASINS

According to the "Final Drainage Report for Paint Brush Hills – Phase 2 (Filing No. 13)", by Classic Consulting Engineers & Surveyors LLC dated June 2008:

“At Design Point 10 ($Q_5 = 11$ cfs and $Q_{100} = 21$ cfs) and existing 24” RCP storm sewer will be allowed to continue to collect flows off of the undeveloped future school site. As stated in this

report, upon development of this school site, the maximum flow allowed to enter this facility will remain the ($Q_5 = 11$ cfs and $Q_{100} = 21$ cfs).”

"The release from Design Point 10 will temporarily travel across the south portion of the future commercial site within a swale towards Design Point 11. Upon development of this commercial area, it is anticipated that the temporary swale be removed and the 24" RCP be extended to Design Point 11. At this location, the maximum developed flow allowed to discharge from the commercial site is ($Q_5 = 23$ cfs and $Q_{100} = 45$ cfs). This flow, combined with the discharge from Design Point 10 equals the total developed flow allowed to enter the public storm system at Design Point 11 ($Q_5 = 23$ cfs and $Q_{100} = 45$ cfs). These flows are then conveyed in a southerly direction in a 36" RCP storm sewer."

Design Point 10, from "Final Drainage Report for Paint Brush Hills – Phase 2 (Filing No. 13)" is labeled as "DP 4" in the Final Drainage Report. Design Point 11 from "Final Drainage Report for Paint Brush Hills – Phase 2 (Filing No. 13)" is labeled as DP 3 in the Final Drainage Report.

The parcel is delineated into sub-basins according to the existing and proposed grading for existing and developed conditions. A drainage plan of the delineated basins for existing conditions can be found in the Appendix.

Basin E is the entirety of the parcel to be redeveloped representing existing conditions in one on-site basin. The Final Drainage Report for Paint Brush Hills – Phase 2 (Filing No. 13), by Classic Consulting Engineers & Surveyors LLC dated June 2008 shows this property as sub-basin T and sub-basin S.

Sub-basin E-1 (6.41 ac.; $Q_5 = 1.37$ cfs, $Q_{100} = 10.05$ cfs) is the entire property that consists of all natural vegetation. The basin flows south across the parcel to a temporary swale that directs flow to the existing F.E.S. inlet in the southwest corner of the site, also known as Existing Point 1 (EP1).

Existing Point 1 (EP1) is the existing design point representing the F.E.S. in the southwest corner of the site that is connected to an existing 36" RCP storm drain pipe that runs southerly off-site and eventually drains into an existing detention facility known as Pond B1. The Final Drainage Report for Paint Brush Hills – Phase 2 (Filing No. 13), by Classic Consulting Engineers & Surveyors LLC dated June 2008 shows this as design point 11 with an allowable release rate of 23 cfs for the minor storm event (5-year storm) and 45 cfs for the major storm event (100-year storm).

Existing Point 2 (EP2) is the existing design point representing the F.E.S. outlet in the southeast corner of the site that is connected to an existing 24" RCP storm drain pipe under Townners Ave. The Final Drainage Report for Paint Brush Hills – Phase 2 (Filing No. 13), by Classic Consulting Engineers & Surveyors LLC dated June 2008 shows this as design point 10 with an allowable release rate of 11 cfs for the minor storm event (5-year storm) and 21 cfs for the major storm event (100-year storm).

B. DEVELOPED MAJOR DRAINAGE BASIN AND SUB-BASINS

Basin D is the entirety of the platted parcel representing developed conditions and consists of two on-site sub-basins. A Drainage Plan for developed conditions can be found in the Appendix C.

Sub-basin D-1 (1.57 ac.; $Q_5 = 1.89$ cfs, $Q_{100} = 5.48$ cfs) is the east side of the site consisting of asphalt pavement and concrete sidewalk. Runoff goes through the parking lot and exits on the south side and flows through a grass swale before being captured via an area inlet, Design Point 1 (DP1).

Sub-basin D-2 (4.84 ac.; $Q_5 = 3.49$ cfs, $Q_{100} = 13.96$ cfs) is the west side of the site consisting of the church building, asphalt pavement, concrete sidewalk and a play field. Runoff goes through the parking lot and exits at the southwest corner and flows through a grass swale before being captured via an area inlet, Design Point 2 (DP2).

The Final Drainage Report for Paint Brush Hills – Phase 2 (Filing No. 13), by Classic Consulting Engineers & Surveyors LLC dated June 2008 states the maximum developed flow allowed to discharge from the commercial site is $Q_5 = 23$ cfs and $Q_{100} = 45$ cfs. The total peak runoff being discharged from the developed church site is $Q_5 = 16.38$ cfs and $Q_{100} = 40.44$ cfs. Due to the proposed development yielding less storm water runoff, no downstream facilities require alterations and it is anticipated that there will be no negative impacts to downstream facilities and developments.

Upon further investigation it has been determined the new culvert system needs 24 inch, 30 inch and 36 inch in diameter pipes as shown on the plan and as indicated on the flow calculation spreadsheet.

IV. DRAINAGE DESIGN CRITERIA

A. REGULATIONS

The hydrologic and hydraulic calculations and design of the site conform to the El Paso County Drainage Criteria Manual as well as the Mile High Flood District Drainage Criteria Manual (August 2018).

B. DEVELOPMENT CRITERIA REFERENCE AND CONSTRAINTS

The parcel falls within the Falcon Drainage Basin. The runoff from this parcel will have no adverse effects on downstream infrastructure or facilities, streets, utilities, transit, or further development of adjacent lots. Relevant criteria for the calculations shown further include equations and design criteria for the rational method, volumes and runoff of various storms.

C. HYDROLOGICAL CRITERIA

The rational method was used to calculate the peak runoff of the delineated basin and sub-basins using the manuals referenced prior with the C, I and PI values from the Drainage Criteria Manual Volume I, Chapter 6 as well as the Colorado Springs designated IDF curve values. Specific

calculations and tables are provided further with inputs including design rainfall, sub-basin acreage and percent imperviousness, runoff coefficients, one-hour rainfall depths, rainfall intensities, time of concentration, and peak discharge of various storm events. Weighted runoff coefficients were calculated for each basin and sub-basin due to the mix of impervious surfaces.

D. FOUR-STEP PROCESS

The selection of appropriate control measures is based on the characteristics of the site and potential pollutants. The Four-Step Process provides a method of going through the selection process. The following applies the four-step process to the Development Plan for the Foundation Lutheran Church.

Step 1: Employ Runoff Reduction Practices

The Development Plan including the Landscape Plan utilizes landscaping areas for plantings and grass or mulch wherever possible without obstructing utilities or drainage ways. Given the proposed land use and desired density of the development, the required areas of the site is to be paved for vehicular and pedestrian access and the development of the structures and surrounding hardscape. Within the site, the storm water runoff is kept to the site limits via strategic grading, grass swales and landscaping.

Step 2: Provide Water Quality Capture Volume

The Final Drainage Report for Paint Brush Hills – Phase 2 (Filing No. 13), by Classic Consulting Engineers & Surveyors LLC dated June 2008 indicates a regional detention facility for this area. The detention facility was designed for water quality capture as well as full spectrum detention for the entirety of this site. The detention facility is within a platted tract of land with ownership and maintenance by the Paint Brush Hills Metropolitan District. It is our understanding that the existing offsite or onsite PBMPs that the site is tributary to are function as intended, no information has been given to us that would indicate otherwise.

Step 3: Stabilize Drainage Ways

The drainage within the site is stabilized by way of pavement with curb and gutter to guide flow, as well as a grass-lined swales designed for a 100-year storm. There are no unstabilized drainage ways on this site. The unpaved, grass-lined swales are designed to convey on-site runoff.

All new and re-development projects are required to construct or participate in the funding of channel stabilization measures. Drainage basin fees paid, at the time of platting, go towards channel stabilization within the drainage basin.

Step 4: Implement Site Specific and Other Source Control BMPs

Site specific BMPS include a concrete wash out, stabilized staging area, and stockpile area are to be designated on site and surrounded with sediment control logs. Vehicle tracking control is to be implemented at both access points. Non-structural BMPs include street sweeping and instructions to the contractor to avoid tracking of mud and dirt off-site, compliance with dust control and

construction site cleanup throughout the construction process. Permanent seeding and landscaping is to be done on all areas not slated for hardscape or structures. Storage/handling and spill containment controls are to be implemented per CDPHE regulations. No chemicals or other pollution materials are required for this project and will not be allowed on site. Fueling and minor maintenance of vehicles or equipment may be allowed only in stabilized staging areas with proper controls in place. No major maintenance of vehicles or equipment is to be performed on site. Any spills that occur are to be addressed according to the requirements of Colorado Department Public Health and Environment, Hazardous Materials and Waste Management Division. No groundwater and/or stormwater dewatering activities are proposed or expected for the proposed construction activities. Any waste disposal is to be done off-site at the designation of the contractor at a location approved by El Paso County. Waste disposal, spill prevention, and response procedures are to be according to CDPHE and El Paso County standards.

An Erosion Control Plan showing BMPs for erosion and sediment control to be submitted separately.

V. DRAINAGE INFRASTRUCTURE COSTS AND FEES

A. DRAINAGE AND BRIDGE FEES

The development is within the Falcon drainage basin (CHWS1400) which has a drainage basin fee of \$40,088/acre and a bridge fee of \$5,507/acre according to the El Paso County Drainage Basin 2024 fee schedule. Using Appendix L-Drainage Criteria Manual 1 Addendum The following method of fee calculation is pending the creation of a tract.

The RMG has prepared the site plan using AutoCAD, and has drawn all driveways, parking lot, sidewalks, and building footprints (i.e., all impervious areas) for the entire area as closed polylines. It has been determined that the impervious area of the site is 1.03 acres.

Drainage Basin Fee

The site has 1.03 acres of impervious area made up of building roof, driveway and parking lot.
 $1.03 \text{ Impervious acres} \times \$40,088 = \$41,290.64$

Bridge Fee

$1.03 \text{ Impervious acres} \times \$5,507 = \$5,672.21$

Additional drainage basin and bridge fees that exceed fees paid at the time of plat recordation must be paid for any future site development plan submittals with new impervious acreage on the lot within undeveloped areas. Future drainage basin and bridge fees will be assessed based on current fees at the time of the future site development plan submittal.

VI. CONCLUSIONS

A. COMPLIANCE WITH STANDARDS

This Final Drainage Report is in conformance with the El Paso County Drainage Manual as well as the Mile High Flood District Drainage Criteria Manual. Grading practices for optimal drainage comply with the geotechnical investigative report and County standards. The development of Foundation Lutheran Church is within compliance and standards and meets the requirements for the drainage design.

From the Classic Consulting Engineers & Surveyors Report page 9 (included in the appendix) design the flow from the outlet of this site to be $Q_5 = 23$ cfs and $Q_{100} = 45$ cfs, this report states the flow from this same location to be $Q_5 = 16.38$ cfs and $Q_{100} = 40.44$ cfs. The results indicate less flow from this site then projected in the original design. Please see the summary tables and flow calculations on the enclosed drainage spreadsheets and drainage maps

The proposed grading and drainage is within substantial conformance for the master drainage plan for the Subdivision and Drainage Basin. There is no impact on major drainage way planning studies within the larger drainage basin. No off-site drainage improvements are needed. Site runoff and storm drain and appurtenances will not adversely affect the downstream and surrounding developments, including the downstream detention ponds.

VII. REFERENCES

El Paso County Drainage Manual

Colorado Urban Drainage and Flood Control District Drainage Criteria Manual, Volume I
(January 2016)

Colorado Urban Drainage and Flood Control District Drainage Criteria Manual, Volume III
(April 2018)

Urban Storm Drainage Criteria Manual, Volume III (November, 2015)

FEMA Flood Map Service Center

United States Department of Agriculture National Resources Conservation Service

Final Drainage Report for Paint Brush Hills – Phase 2 (Filing No. 13), dated June 2008, prepared by Classic Consulting Engineers & Surveyors LLC

Final Drainage Report for Paint Brush Hills Filing No. 13A (Phased Final Plat – Phase 1), dated April 2013, prepared by Classic Consulting Engineers & Surveyors LLC

El Paso County Engineering Criteria Manual, Appendix L-Drainage Criteria Manual 1
Addendum

VIII. APPENDICES

Appendix A – Vicinity Map

Vicinity Map

SITE



Appendix B – Hydrologic and Hydraulic Computations

Project Number: 191726
 Engineer: DGW
 Date: 12/29/2023
 Address: Towners Ave
 Existing Conditions

Sub-Basin:	E-1	(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)				
t _r Duration:	26.44					
I ₂	I ₅	I ₁₀	I ₂₅	I ₅₀	I ₁₀₀	
2.14	2.67	3.12	3.56	4.01	4.48	

Hydrologic Soil Type:	B
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Design Points		
Design Point	Q ₅	Q ₁₀₀
E-1	1.37	10.05
Total Site	1.37	10.05

Coefficient (Table 6-6)																				
Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient ₂	Coefficient ₅	Coefficient ₁₀	Coefficient ₂₅	Coefficient ₅₀	Coefficient ₁₀₀	2 Yr: C _i * A _i	5 Yr: C _i * A _i	10 Yr: C _i * A _i	25 Yr: C _i * A _i	50 Yr: C _i * A _i	100 Yr: C _i * A _i	2 Yr C _c	5 Yr C _c	10 Yr C _c	25 Yr C _c	50 Yr C _c	100 Yr C _c
Roof	0	0.00	0.71	0.73	0.75	0.78	0.80	0.81	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.080	0.150	0.250	0.300	0.350
Pavement	0	0.00	0.89	0.90	0.92	0.94	0.95	0.96	0.000	0.000	0.000	0.000	0.000	0.000						
Lawn	279175	6.41	0.02	0.08	0.15	0.25	0.30	0.35	0.128	0.513	0.961	1.602	1.923	2.243						
A _t :	279175	6.41																		

Q Peak Flow (cfs) (C _i *A)					
2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
0.27	1.37	3.00	5.71	7.70	10.05

Time of Concentration

$$t_c = t_i + t_t$$

3.2.1 - Overland (Initial) Flow Time

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

Where:

- t_i = overland (initial) flow time (min)
- C_s = 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.

Sub-Basin:	E-1	
L (initial time):	300	ft
S (initial time):	0.034	ft/ft

Composite Runoff Coefficient Calculation:

$$C_c = (C_1A_1 + C_2A_2 + C_3A_3 + \dots + C_nA_n) / A_t$$

Land Use or Surface Characteristic	Square Feet	Acreage	C_s
Roof	0	0.00	0.73
Pavement	0	0.00	0.90
Lawn	279175	6.41	0.08
Total :	279175	6.41	

$$C_c = \boxed{0.08}$$

$$t_i = (0.395 * (1.1 - C_s) * \text{sqrt}(L)) / (S^{0.33})$$

$$t_i = \boxed{21.30} \text{ mins}$$

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)

Conveyance Coeff.:	<input type="text" value="10"/>
Slope (travel time):	<input type="text" value="0.03"/> ft/ft
$V = C_v S_w^{0.5}$	<input type="text" value="1.73"/> ft/s
L (travel time):	<input type="text" value="534"/> ft
$t_t = L/V =$	<input type="text" value="308.31"/> sec.
$t_t =$	<input type="text" value="5.14"/> min.

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 vegetation cover.

$$t_c = t_i + t_t = \boxed{26.44} \text{ min.}$$

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.

$$\text{Final } t_c: \boxed{26.44} \text{ min.}$$

Project Number: 191726
 Engineer: DGW
 Date: 12/29/2023
 Address: Townner's Ave
 Proposed Conditions

Sub-Basin:	D-1	(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)				
t _r Duration:	10.31					
	I ₂	I ₅	I ₁₀	I ₂₅	I ₅₀	I ₁₀₀
	3.26	4.08	4.76	5.45	6.13	6.86

Hydrologic Soil Type: B

Sub-Basin:	D-2	(IDF Curve Equations from Figure 6-5 of the DCM Volume 1)				
t _r Duration:	12.36					
	I ₂	I ₅	I ₁₀	I ₂₅	I ₅₀	I ₁₀₀
	3.04	3.81	4.45	5.08	5.72	6.40

Hydrologic Soil Type: B

Design Points		
Design Point	Q ₅	Q ₁₀₀
D-1	1.89	5.48
D-2	3.49	13.96
Total Site	6.51	19.45

Coefficient (Table 6-6)																					
Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient ₂	Coefficient ₅	Coefficient ₁₀	Coefficient ₂₅	Coefficient ₅₀	Coefficient ₁₀₀	2 Yr: C * A	5 Yr: C * A	10 Yr: C * A	25 Yr: C * A	50 Yr: C * A	100 Yr: C * A	2 Yr C _c	5 Yr C _c	10 Yr C _c	25 Yr C _c	50 Yr C _c	100 Yr C _c	
Roof	298	0.01	0.71	0.73	0.75	0.78	0.80	0.81	0.005	0.005	0.005	0.005	0.005	0.006	0.248	0.295	0.352	0.431	0.471	0.510	
Pavement	17685	0.41	0.89	0.90	0.92	0.94	0.95	0.96	0.361	0.365	0.374	0.382	0.386	0.390							
Lawn	50305	1.15	0.02	0.08	0.15	0.25	0.30	0.35	0.023	0.092	0.173	0.289	0.346	0.404							
A _t :	68288	1.57																			

Q Peak Flow (cfs)(C _i *A)					
2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
1.27	1.89	2.63	3.68	4.52	5.48

Coefficient (Table 6-6)																					
Land Use or Surface Characteristic	Square Feet	Acreage	Coefficient ₂	Coefficient ₅	Coefficient ₁₀	Coefficient ₂₅	Coefficient ₅₀	Coefficient ₁₀₀	2 Yr: C * A	5 Yr: C * A	10 Yr: C * A	25 Yr: C * A	50 Yr: C * A	100 Yr: C * A	2 Yr C _c	5 Yr C _c	10 Yr C _c	25 Yr C _c	50 Yr C _c	100 Yr C _c	
Roof	10309	0.24	0.71	0.73	0.75	0.78	0.80	0.81	0.168	0.173	0.177	0.185	0.189	0.192	0.123	0.177	0.240	0.330	0.376	0.421	
Pavement	16680	0.38	0.89	0.90	0.92	0.94	0.95	0.96	0.341	0.345	0.352	0.360	0.364	0.368							
Lawn	183898	4.22	0.02	0.08	0.15	0.25	0.30	0.35	0.084	0.338	0.633	1.055	1.267	1.478							
A _t :	210887	4.84																			

Q Peak Flow (cfs)(C _i *A)					
2 Year Q	5 Year Q	10 Year Q	25 Year Q	50 Year Q	100 Year Q
1.93	3.49	5.54	8.71	11.15	13.96

IMPERVIOUS AREA		
D-1	Roof	298 Sq. Ft.
	Pavement	17685 Sq. Ft.
D-2	Roof	10309 Sq. Ft.
	Pavement	16680 Sq. Ft.
Total (Sq. Ft.)		44972 Sq. Ft.
Total (Acres)		1.03 Acres

Time of Concentration

$$t_c = t_i + t_t$$

3.2.1 - Overland (Initial) Flow Time

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

Where:

t_i = overland (initial) flow time (min)

C_s = 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.

Sub-Basin:	D-1	
L (initial time):	100	ft
S (initial time):	0.074	ft/ft

Composite Runoff Coefficient Calculation:

$$C_c = (C_1A_1 + C_2A_2 + C_3A_3 + \dots + C_nA_n) / A_t$$

Land Use or Surface Characteristic	Square Feet	Acreage	C_s
Roof	0	0.00	0.73
Pavement	27107	0.62	0.90
Lawn	40883	0.94	0.08
Total :	67990	1.56	

$$C_c = \boxed{0.41}$$

$$t_i = (0.395 * (1.1 - C_s) * \text{sqrt}(L)) / (S^{0.33})$$

$$t_i = \boxed{6.46} \text{ mins}$$

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)

$$\begin{aligned} \text{Conveyance Coeff.:} & \quad \boxed{20} \\ \text{Slope (travel time):} & \quad \boxed{0.015} \text{ ft/ft} \\ V = C_v S_w^{0.5} & \quad \boxed{2.45} \text{ ft/s} \end{aligned}$$

$$\begin{aligned} L \text{ (travel time):} & \quad \boxed{565} \text{ ft} \\ t_t = L/V = & \quad \boxed{230.66} \text{ sec.} \\ t_t = & \quad \boxed{3.84} \text{ min.} \end{aligned}$$

$$t_c = t_i + t_t = \boxed{10.31} \text{ min.}$$

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.

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.

$$\text{Final } t_c: \quad \boxed{10.31} \text{ min.}$$

Time of Concentration

$$t_c = t_i + t_t$$

3.2.1 - Overland (Initial) Flow Time

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

Where:

- t_i = overland (initial) flow time (min)
- C_s = 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.

Sub-Basin:	D-2	
L (initial time):	100	ft
S (initial time):	0.068	ft/ft

Composite Runoff Coefficient Calculation:

$$C_c = (C_1A_1 + C_2A_2 + C_3A_3 + \dots + C_iA_i) / A_t$$

Land Use or Surface Characteristic	Square Feet	Acreage	C_s
Roof	9632.7689	0.22	0.73
Pavement	22813	0.52	0.90
Lawn	178739	4.10	0.08
Total:	211185	4.85	

$$C_c = \boxed{0.20}$$

$$t_i = (0.395 * (1.1 - C_s) * \text{sqrt}(L)) / (S^{0.33})$$

$$t_i = \boxed{8.65} \text{ mins}$$

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)

Conveyance Coeff.:	<input type="text" value="20"/>	
Slope (travel time):	<input type="text" value="0.023"/>	ft/ft
$V = C_v S_w^{0.5}$	<input type="text" value="3.03"/>	ft/s
L (travel time):	<input type="text" value="676"/>	ft
$t_t = L/V =$	<input type="text" value="222.87"/>	sec.
$t_t =$	<input type="text" value="3.71"/>	min.

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.

$$t_c = t_i + t_t = \boxed{12.36} \text{ min.}$$

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.

$$\text{Final } t_c: \boxed{12.36} \text{ min.}$$

Design Procedure Form: Grass Swale (GS)

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 1

Designer: DG Walker
 Company: RMG
 Date: October 30, 2023
 Project: FLC
 Location: Paint Brush Hills Filing No. 13A GS DP-1

1. Design Discharge for 2-Year Return Period	$Q_2 = $ <input type="text" value="1.88"/> cfs
2. Hydraulic Residence Time A) : Length of Grass Swale B) Calculated Residence Time (based on design velocity below)	$L_G = $ <input type="text" value="270.0"/> ft $T_{HR} = $ <input type="text" value="4.6"/> minutes
3. Longitudinal Slope (vertical distance per unit horizontal) A) Available Slope (based on site constraints) B) Design Slope	$S_{avail} = $ <input type="text" value="0.008"/> ft / ft $S_D = $ <input type="text" value="0.029"/> ft / ft
4. Swale Geometry A) Channel Side Slopes (Z = 4 min., horiz. distance per unit vertical) B) Bottom Width of Swale (enter 0 for triangular section)	$Z = $ <input type="text" value="4.00"/> ft / ft $W_B = $ <input type="text" value="3.50"/> ft
5. Vegetation A) Type of Planting (seed vs. sod, affects vegetal retardance factor)	Choose One <input type="radio"/> Grass From Seed <input checked="" type="radio"/> Grass From Sod
6. Design Velocity (0.9 ft / s maximum for desirable 5-minute residence time)	$V_z = $ <input type="text" value="0.99"/> ft / s
7. Design Flow Depth (1 foot maximum) A) Flow Area B) Top Width of Swale C) Froude Number (0.50 maximum) D) Hydraulic Radius E) Velocity-Hydraulic Radius Product for Vegetal Retardance F) Manning's n (based on SCS vegetal retardance curve D for sodded grass) G) Cumulative Height of Grade Control Structures Required	$D_z = $ <input type="text" value="0.38"/> ft $A_z = $ <input type="text" value="1.9"/> sq ft $W_t = $ <input type="text" value="6.5"/> ft $F = $ <input type="text" value="0.32"/> $R_{H1} = $ <input type="text" value="0.29"/> $VR = $ <input type="text" value="0.28"/> $n = $ <input type="text" value="0.110"/> $H_G = $ <input type="text" value="0.00"/> ft
8. Underdrain (Is an underdrain necessary?)	Choose One <input type="radio"/> YES <input checked="" type="radio"/> NO
9. Soil Preparation (Describe soil amendment)	
10. Irrigation	Choose One <input type="radio"/> Temporary <input checked="" type="radio"/> Permanent

Notes: SWALE ALONG THE EAST PROPERTY LINE

Design Procedure Form: Grass Swale (GS)

UD-BI/P (Version 3.07, March 2018)

Sheet 1 of 1

Designer: DG Walker
 Company: RMG
 Date: October 30, 2023
 Project: FLC
 Location: Paint Brush Hills Filling No. 13A DP-2

1. Design Discharge for 2-Year Return Period	$Q_2 = $ <input type="text" value="2.28"/> cfs
2. Hydraulic Residence Time A) : Length of Grass Swale B) Calculated Residence Time (based on design velocity below)	$L_S = $ <input type="text" value="270.0"/> ft $T_{HR} = $ <input type="text" value="4.6"/> minutes
3. Longitudinal Slope (vertical distance per unit horizontal) A) Available Slope (based on site constraints) B) Design Slope	$S_{avail} = $ <input type="text" value="0.008"/> ft / ft $S_D = $ <input type="text" value="0.029"/> ft / ft
4. Swale Geometry A) Channel Side Slopes ($Z = 4$ min., horiz. distance per unit vertical) B) Bottom Width of Swale (enter 0 for triangular section)	$Z = $ <input type="text" value="4.00"/> ft / ft $W_B = $ <input type="text" value="5.50"/> ft
5. Vegetation A) Type of Planting (seed vs. sod, affects vegetal retardance factor)	Choose One <input type="radio"/> Grass From Seed <input checked="" type="radio"/> Grass From Sod
6. Design Velocity (0.9 ft / s maximum for desirable 5-minute residence time)	$V_2 = $ <input type="text" value="0.98"/> ft / s
7. Design Flow Depth (1 foot maximum) A) Flow Area B) Top Width of Swale C) Froude Number (0.50 maximum) D) Hydraulic Radius E) Velocity-Hydraulic Radius Product for Vegetal Retardance F) Manning's n (based on SCS vegetal retardance curve D for sodded grass) G) Cumulative Height of Grade Control Structures Required	$D_2 = $ <input type="text" value="0.34"/> ft $A_2 = $ <input type="text" value="2.3"/> sq ft $W_1 = $ <input type="text" value="8.2"/> ft $F = $ <input type="text" value="0.32"/> $R_{H1} = $ <input type="text" value="0.28"/> $VR = $ <input type="text" value="0.27"/> $n = $ <input type="text" value="0.112"/> $H_D = $ <input type="text" value="0.00"/> ft
8. Underdrain (Is an underdrain necessary?)	Choose One <input type="radio"/> YES <input checked="" type="radio"/> NO
9. Soil Preparation (Describe soil amendment)	 <hr/> <hr/> <hr/>
10. Irrigation	Choose One <input type="radio"/> Temporary <input checked="" type="radio"/> Permanent

Notes:
SWALE ALONG THE EAST PROPERTY LINE

5 yr Hydraulic Grade Line and Pipe Capacity

Pipe	Design Flow Rate Q_{des} (ft ³ /sec)	Proposed Pipe Diameter D_{pro} (in)	Slope s (%)	80% of Proposed Pipe Diameter $D_{pro} \cdot 0.8$ (in)	Manning Coefficient n	Full Pipe Cross Sectional Area A (ft ²) = $\pi (D_{pro}/2)^2$	Full Pipe Flow Rate Q_{full} (ft ³ /s) = $A(1.49/n)(D_{pro}/48)^{2/3} S^{1/2}$	Q Design / Q Full Q_{des}/Q_{full}	d/D (from Chart)	Hydraulic Grade Line (Depth of Flow) d (ft) = $(d/D) \cdot D_{pro}$	Depth of Flow Less Than 80% of Pipe Diameter (Yes/No)
P1	11.00	24.0	1.30%	19.2	0.013	3.140	25.850	0.43	0.52	12.36	Yes
P2	12.89	30.0	1.26%	24.0	0.013	4.906	46.142	0.28	0.41	12.15	Yes
P3	16.38	36.0	1.26%	28.8	0.013	7.065	75.032	0.22	0.35	12.60	Yes

100 yr Hydraulic Grade Line and Pipe Capacity

Pipe	Design Flow Rate Q_{des} (ft ³ /sec)	Proposed Pipe Diameter D_{pro} (in)	Slope S (%)	80% of Proposed Pipe Diameter $D_{pro} * .8$ (in)	Manning Coefficient n	Full Pipe Cross Sectional Area A (ft) = $\pi (D_{pro}/2)^2$	Full Pipe Flow Rate Q_{full} (ft ³ /s) = $A(1.49/n)((D_{pro}/48)^{2/3})S^{1/2}$	Q Design / Q Full Q_{des}/Q_{full}	d/D (from Chart)	Hydraulic Grade Line (Depth of Flow) d (in) = (d/D)* D_{pro}	Depth of Flow Less Than 80% of Pipe Diameter (Yes/No)
P1	21.00	24.0	1.30%	19.2	0.013	3.140	25.850	0.81	0.75	18.00	Yes
P2	26.48	30.0	1.26%	24.0	0.013	4.906	46.142	0.57	0.60	18.00	Yes
P3	40.44	36.0	1.26%	28.8	0.013	7.065	75.032	0.54	0.59	21.06	Yes

Trapezoidal Riprap-Lined Waterway Design.xlsm

Landowner **Found. Luth. Church** County **El Paso** V1.02
 Computed By **DGW** Date **2/29/2024** 2/11/2013
 Checked by _____ Date _____

Note: Macros must be enabled in this spreadsheet in order for the "Solve" button to work.

Design flow, Q=	41 cfs	WW horiz. Length=	10.0 ft
Slope, S=	0.05 ft/ft = 20.00 :1	U/S WW F.L. elev=	3.0 ft
Bottom Width, W=	10 ft	D/S WW F.L. elev=	2.5 ft
Side slope, Z=	3 :1	Waterway drop=	0.5 ft
Safety factor=	1.2	WW length along slope=	10.0 ft
Rock shape =	Angular		
Min. req'd D50=	3.99 in		
D50 used=	8.30 in		
n=	0.041		
Freeboard=	0.33 ft		

Spreadsheet formatting key:

XXX =Input cells
X.XX =Output from "Solve" button
X.XX =Other computed output
Red text =Instructions, warnings, info

Flow depth, d= **0.64** ft
 Critical depth, d_c = **0.74** ft
 Critical slope, S_c = **0.030** ft/ft
 Design slope, S= 0.0500 ft/ft
 Velocity= **5.37** fps

Calculated

$0.7S_c$ = **0.0207** ft/ft
 $1.3S_c$ = **0.0384** ft/ft

Design slope OK. Flow is Supercritical.

Est. riprap unit wt= **1.4** Tons/CY

Rock shape = Angular

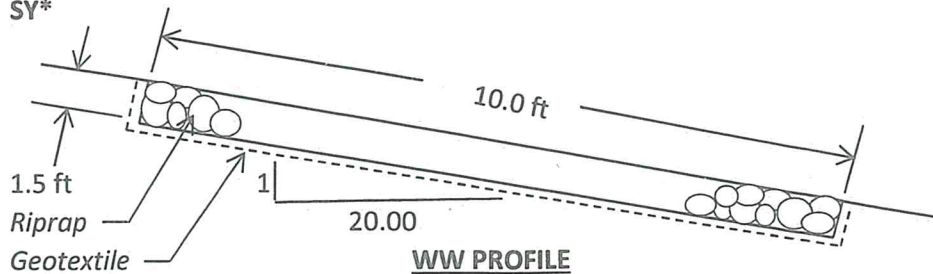
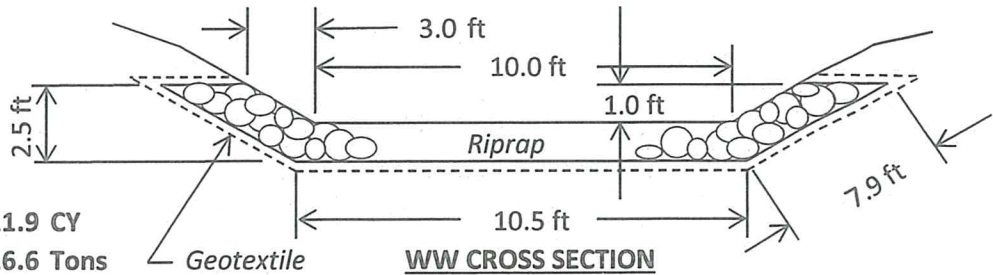
Rock Gs = **2.65**

Riprap thickness:
 Minimum= **1.38** ft
 Provided= **1.50** ft

Sideslope height:
 Minimum= **0.97** ft
 Provided= **1.00** ft

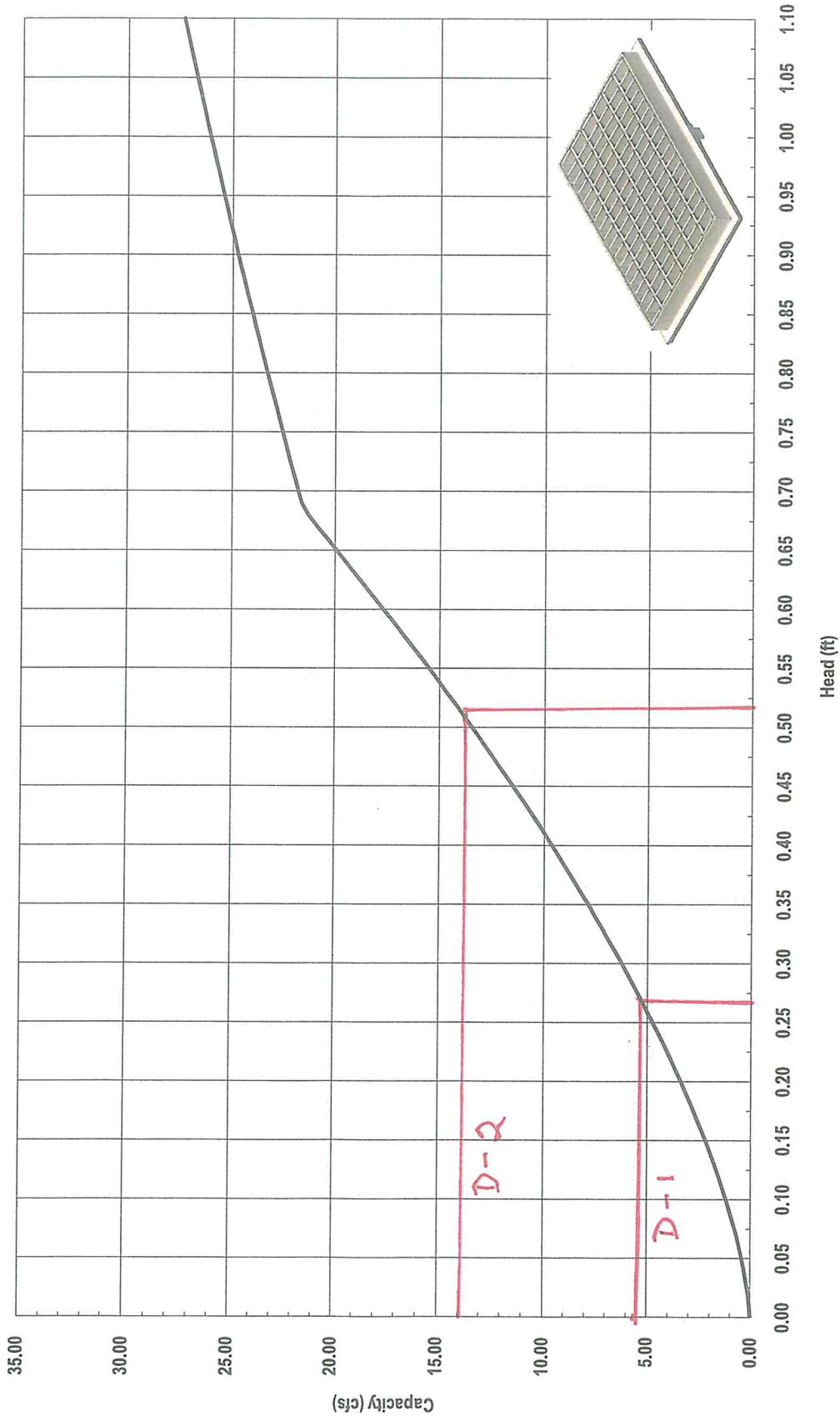
Required riprap gradation for D50 selected					
%	Rock dia., inches		Rock weight, lb		
	Smaller	min.	max.	min.	
100		12.5	16.6	141	333
85		10.8	14.9	92	243
50		8.3	12.5	42	141
10		6.6	10.8	21	92

Quantities:
 Riprap volume= **11.9** CY
 Approx. weight= **16.6** Tons
 Geotextile area= **51.7** SY*



*Geotextile area includes actual covered surfaces only (no extra for laps or anchorage)

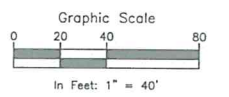
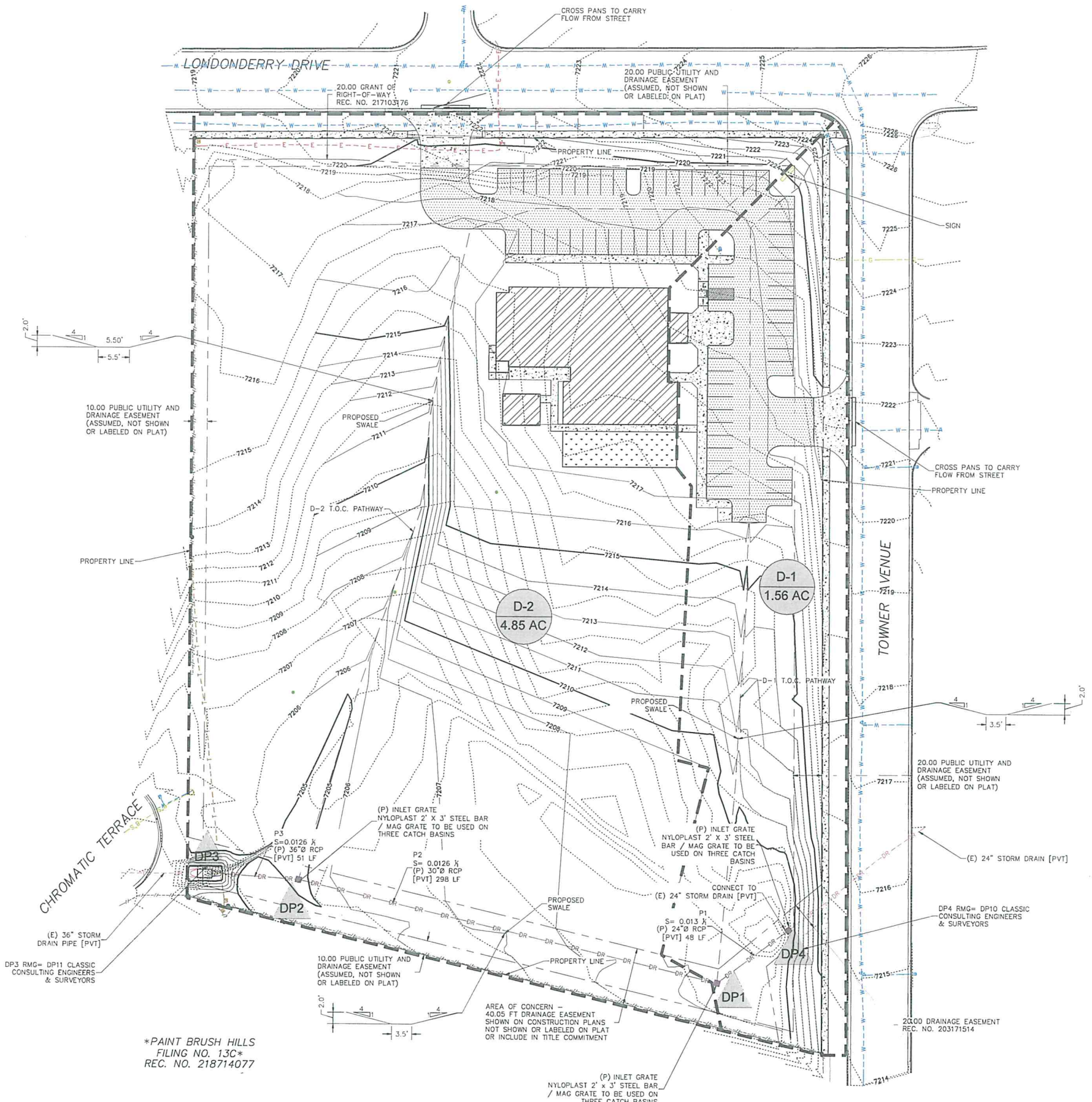
Nyloplast 2' x 3' Steel Bar / MAG Grate Inlet Capacity Chart



Appendix C – Drainage Maps

LEGEND

DESCRIPTION	SYMBOL
EX. CONCRETE PAVEMENT	[Symbol]
EX. ASPHALT PAVEMENT	[Symbol]
EX. GRAVEL ROAD	[Symbol]
PROP. STRUCTURE/BUILDING	[Symbol]
PROP. CONCRETE PAVEMENT	[Symbol]
PROP. ASPHALT PAVEMENT	[Symbol]
PROP. CONCRETE SIDEWALK	[Symbol]
PROP. GRASS FIELD	[Symbol]
EX. CONTOUR	[Symbol]
PROP. CONTOUR	[Symbol]
DRAINAGE SUB-BASIN BOUNDARY	[Symbol]
PROPERTY LINE	[Symbol]
TIME OF CONCENTRATION LINE	[Symbol]
BASIN IDENTIFIER	[Symbol]
AREA IN ACRES	[Symbol]
DESIGN POINT ID	[Symbol]
FLOW ARROW	[Symbol]



DESIGN POINT	FLOW (CFS)
DP1	Q ₀ = 1.89 CFS Q ₁₀₀ = 5.48 CFS
DP2	Q ₀ = 3.49 CFS Q ₁₀₀ = 13.96 CFS
DP4	Q ₀ = 11.00 CFS Q ₁₀₀ = 21.00 CFS
DP3	Q ₀ = 16.38 CFS Q ₁₀₀ = 40.44 CFS

BASIN SUMMARY			
BASIN	Q ₀ (CFS)	Q ₁₀₀ (CFS)	ACRES (AC)
D-1	1.89 CFS	5.48 CFS	1.56
D-2	3.49 CFS	13.96 CFS	4.85
D-4	11.00 CFS	21.00 CFS	-
TOTAL	16.38 CFS	40.44 CFS	6.41

RMG
 Engineers / Architects
 SOUTHERN COLORADO OFFICE
 5005 LUTHERAN DRIVE, SUITE 200, COLORADO SPRINGS, CO 80919
 SOUTHERN COLORADO, DENVER, METRO, HIGHLAND, COLORADO

COLORADO LICENSED PROFESSIONAL ENGINEER
 3/12/24
 51909

FOUNDATION LUTHERAN CHURCH
 9960 TOWNERS AVE
 FALCON, COLORADO

COLORADO COMMERCIAL CONSTRUCTION, INC.

SHEET NAME: **PROPOSED SUB-BASIN ANALYSIS**
 PROJECT STATUS: **FINAL DRAINAGE REPORT**

#	REVISION	DATE
1	REVISION	1/8/2023
2	REVISION	2/7/2023
3	REVISION	3/12/2023

JOB NO. **191726**
 SHEET NO. **02**
 of 02

LAST SAVE: 3/12/2023 3:42:27 PM DATA: I:\local\ppl\rmg\proj\191726\191726-02-Colorado Commercial Construction, Inc.\191726-02-Drainage\From RMG\Sheet\Sheet\191726-02-Drainage.dwg User: RMG\jw\jw Date: 3/12/23 3:42:27 PM

*PAINT BRUSH HILLS
 FILING NO. 13C*
 REC. NO. 218714077

Appendix D – FEMA Floodplain Map

National Flood Hazard Layer FIRMette

104°37'40"W 38°58'52"N



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, Area 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 X

OTHER AREAS

- No SCREEN
- Area of Minimal Flood Hazard Zone X
- Effective LOMRS
- Area of Undetermined Flood Hazard Zone X

GENERAL STRUCTURES

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

OTHER FEATURES

- Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 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

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 2/14/2023 at 1:11 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.

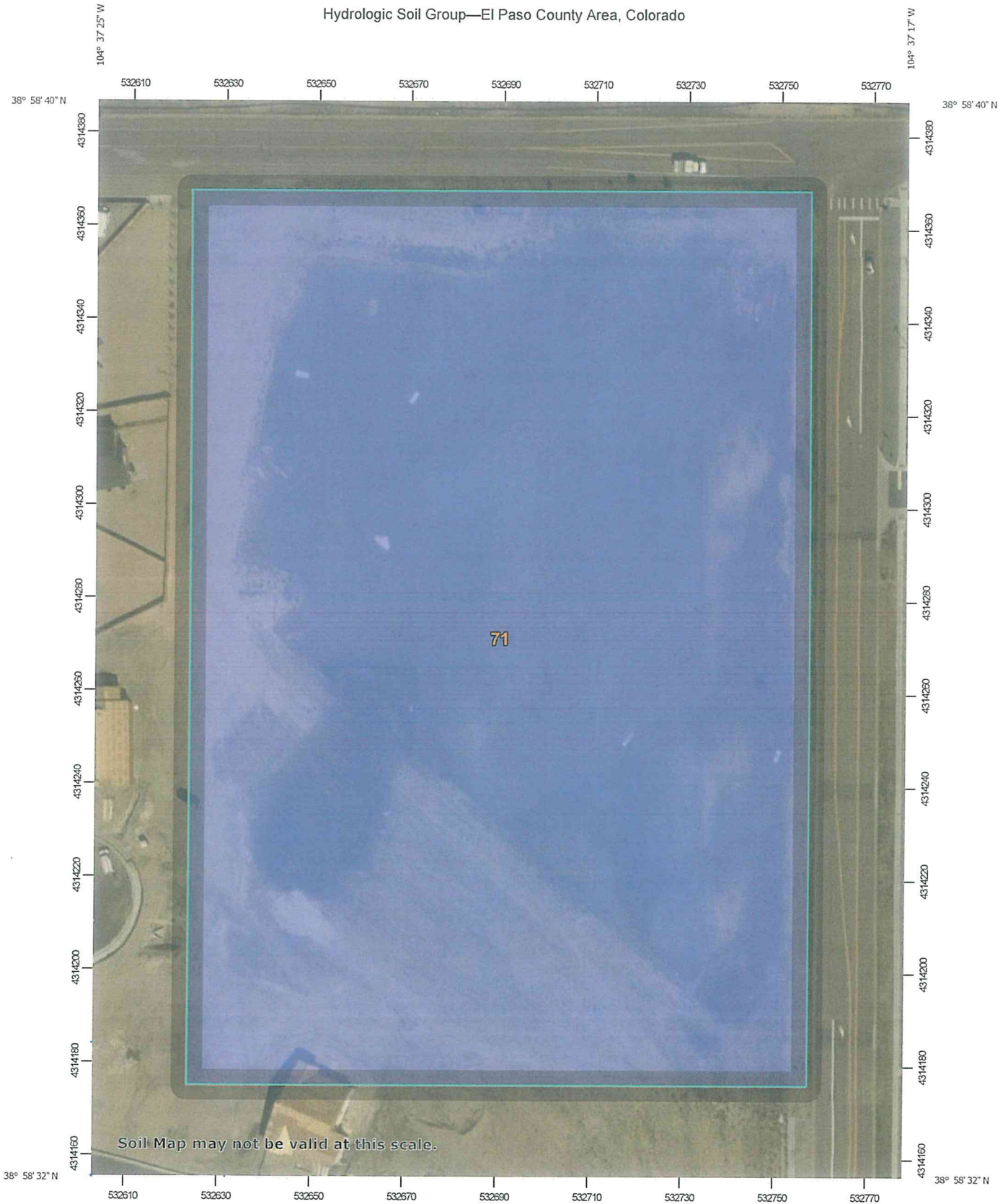
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory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



104°37'2"W 38°58'24"N

Appendix E – USDA Soils Survey Map

Hydrologic Soil Group—El Paso County Area, Colorado



Map Scale: 1:1,130 if printed on A portrait (8.5" x 11") sheet.



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



































Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

2/14/2023
Page 1 of 4

Hydrologic Soil Group—El Paso County Area, Colorado

MAP LEGEND

- Area of Interest (AOI)**
-  Area of Interest (AOI)
- Soils**
- Soil Rating Polygons**
-  A
 -  A/D
 -  B
 -  B/D
 -  C
 -  C/D
 -  D
 -  Not rated or not available
- Soil Rating Lines**
-  A
 -  A/D
 -  B
 -  B/D
 -  C
 -  C/D
 -  D
 -  Not rated or not available
- Soil Rating Points**
-  A
 -  A/D
 -  B
 -  B/D
-  C
 -  C/D
 -  D
 -  Not rated or not available
- Water Features**
-  Streams and Canals
- Transportation**
-  Rails
 -  Interstate Highways
 -  US Routes
 -  Major Roads
 -  Local Roads
- Background**
-  Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 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
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	6.4	100.0%
Totals for Area of Interest			6.4	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



Phase 1 Storm Facilities

Basins J and L are tributary to Design Points 8 ($Q_5 = 6$ cfs and $Q_{100} = 12$ cfs) and 9 ($Q_5 = 7$ cfs and $Q_{100} = 14$ cfs), where a 4' Type R sump inlet and a 6' Type R sump inlet are proposed, respectively. These facilities will completely accept both the 5-year and 100-year developed flows at this sump condition. The total collected flows are then conveyed via a 30" RCP storm sewer directly into the existing detention pond at the northwest corner of Londonderry and Towner. A rip-rap dissipater will be installed to minimize erosion. The emergency overflow route at this location is 1.0' maximum ponding and then spill over the highpoint and around the corner towards Londonderry Drive.

At Design Point 10 ($Q_5 = 11$ cfs and $Q_{100} = 21$ cfs) an existing 24" RCP storm sewer will be allowed to continue to collect flows off of the undeveloped future school site. As stated in this report, upon development of this school site, the maximum flow allowed to enter this facility will remain the ($Q_5 = 11$ cfs and $Q_{100} = 21$ cfs). The remaining developed school site is anticipated to drain directly into Towner without exceeding the following: ($Q_5 = 14$ cfs and $Q_{100} = 27$ cfs). The downstream existing 14' Type R at-grade inlet will adequately accept a portion of these flows as previously designed as a part of the Paint Brush Hills Filing No. 10 construction. Any developed flows from this school site above and beyond these specified will need to be detained on-site. The release from Design Point 10 will temporarily travel across the south portion of the future commercial site within a swale towards Design Point 11. Upon development of this commercial area, it is anticipated that the temporary swale be removed and the 24" RCP be extended to Design Point 11. At this location, the maximum developed flow allowed to discharge from the commercial site is ($Q_5 = 21$ cfs and $Q_{100} = 43$ cfs). This flow, combined with the discharge from Design Point 10 equals the total developed flow allowed to enter the public storm system at Design Point 11 ($Q_5 = 23$ cfs and $Q_{100} = 45$ cfs). These flows are then conveyed in a southerly direction in a 36" RCP storm sewer.

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El Paso County, CO

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PRIVATE DETENTION BASIN /
STORMWATER QUALITY BEST MANAGEMENT PRACTICE
MAINTENANCE AGREEMENT AND EASEMENT

This PRIVATE DETENTION BASIN / STORMWATER QUALITY BEST MANAGEMENT PRACTICE MAINTENANCE AGREEMENT AND EASEMENT (Agreement) is made by and between EL PASO COUNTY by and through THE BOARD OF COUNTY COMMISSIONERS OF EL PASO COUNTY, COLORADO (Board or County) and Lorson, LLC (Developer) and Paint Brush Hills METROPOLITAN DISTRICT (Metro District), a quasi-municipal corporation and political subdivision of the State of Colorado. The above may occasionally be referred to herein singularly as "Party" and collectively as "Parties."

Recitals

A. WHEREAS, the District provides various municipal services to certain real property in El Paso County, Colorado referred to as Paint Brush Hills; and

B. WHEREAS, Developer is the owner of certain real estate (the Property or Subdivision) in El Paso County, Colorado, which Property is legally described in Exhibit A attached hereto and incorporated herein by this reference; and

C. WHEREAS, Developer desires to plat and develop on the Property a subdivision to be known as Paint Brush Hills Filings 13B, C & D; and

D. WHEREAS, the development of this Property will substantially increase the volume of water runoff and will decrease the quality of the stormwater runoff from the Property, and, therefore, it is in the best interest of public health, safety and welfare for the County to condition approval of this subdivision on Developer's promise to construct adequate drainage, water runoff control facilities, and stormwater quality structural Best Management Practices ("BMPs") for the subdivision; and

E. WHEREAS, Chapter 8, Section 8.4.5 of the El Paso County Land Development Code, as periodically amended, promulgated pursuant to Section 30-28-133(1), Colorado Revised Statutes (C.R.S.), requires the County to condition approval of all subdivisions on a developer's promise to so construct adequate drainage, water runoff control facilities, and BMPs in subdivisions; and

F. WHEREAS, the Drainage Criteria Manual, Volume 2, as amended by Appendix 1 of the El Paso County Engineering Criteria Manual (ECM), as each may be periodically amended, promulgated pursuant to the County's Colorado Discharge Permit System General Permit (MS4 Permit) as required by Phase II of the National Pollutant Discharge Elimination System (NPDES), which MS4 Permit requires that the County take measures to protect the quality of stormwater from sediment and other contaminants, requires subdividers, developers, landowners, and owners of facilities located in the County's rights-of-way or easements to provide adequate permanent stormwater quality BMPs with new development or significant redevelopment; and

G. WHEREAS, Section 2.9 of the El Paso County Drainage Criteria Manual provides for a developer's promise to maintain a subdivision's drainage facilities in the event the County does not assume such responsibility; and

H. WHEREAS, developers in El Paso County have historically chosen water runoff detention basins as a means to provide adequate drainage and water runoff control in subdivisions, which basins, while effective, are less expensive for developers to construct than other methods of providing drainage and water runoff control; and

I. WHEREAS, Developer desires to construct for the subdivision Paint Brush Hills Filings 13B, C & D detention basin/stormwater quality BMP(s) (“detention basin/BMP(s)”) as the means for providing adequate drainage and stormwater runoff control and to meet requirements of the County’s MS4 Permit, and to provide for operating, cleaning, maintaining and repairing such detention basin/BMP(s); and

J. WHEREAS, Developer desires to construct the detention basin/BMP(s) on property that is or will be platted as Paint Brush Hills Filings 13B, C & D, and as set forth on Exhibit B attached hereto; and

K. WHEREAS, Developer shall be charged with the duty of constructing the detention basin/BMP(s) and the Metro District shall be charged with the duties of operating, maintaining and repairing the detention basin/BMP(s) on the Property described in Exhibit B; and

L. WHEREAS, it is the County’s experience that subdivision developers and property owners historically have not properly cleaned and otherwise not properly maintained and repaired these detention basins/BMPs, and that these detention basins/BMPs, when not so properly cleaned, maintained, and repaired, threaten the public health, safety and welfare; and

M. WHEREAS, the County, in order to protect the public health, safety and welfare, has historically expended valuable and limited public resources to so properly clean, maintain, and repair these detention basins/BMPs when developers and property owners have failed in their responsibilities, and therefore, the County desires the means to recover its costs incurred in the event the burden falls on the County to so clean, maintain and repair the detention basin/BMP(s) serving this Subdivision due to the Developer’s or the Metro District’s failure to meet its obligations to do the same; and

N. WHEREAS, the County conditions approval of this Subdivision on the Developer’s promise to so construct the detention basin/BMP(s), and further conditions approval on the Metro District’s promise to reimburse the County in the event the burden falls upon the County to so clean, maintain and/or repair the detention basin/BMP(s) serving this Subdivision; and

O. WHEREAS, the County could condition subdivision approval on the Developer’s promise to construct a different and more expensive drainage, water runoff control system and BMPs than those proposed herein, which more expensive system would not create the possibility of the burden of cleaning, maintenance and repair expenses falling on the County; however, the County is willing to forego such right upon the performance of Developer’s and the Metro District’s promises contained herein; and

P. WHEREAS, the County, in order to secure performance of the promises contained herein, conditions approval of this Subdivision upon the Developer’s grant herein of a perpetual Easement over a portion of the Property for the purpose of allowing the County to periodically access, inspect, and, when so necessary, to clean, maintain and/or repair the detention basin/BMP(s); and

Q. WHEREAS, Pursuant to Colorado Constitution, Article XIV, Section 18(2) and Section 29-1-203, Colorado Revised Statutes, governmental entities may cooperate and contract with each other to provide any function, services, or facilities lawfully authorized to each.

Agreement

NOW, THEREFORE, in consideration of the mutual Promises contained herein, the sufficiency of which are hereby acknowledged, the Parties agree as follows:

1. Incorporation of Recitals: The Parties incorporate the Recitals above into this Agreement.

2. Covenants Running with the Land: Developer and the Metro District agree that this entire Agreement and the performance thereof shall become a covenant running with the land, which land is legally described in Exhibit A attached hereto, and that this entire Agreement and the performance thereof shall be binding upon themselves, their respective successors and assigns.

3. Construction: Developer shall construct on that portion of the Property described in Exhibit B attached hereto and incorporated herein by this reference, one detention basin/BMP(s). Developer shall not commence construction of the detention basin/BMP(s) until the El Paso County Planning and Community Development Department (PCD) has approved in writing the plans and specifications for the detention basin/BMP(s) and this Agreement has been signed by all Parties and returned to the PCD. Developer shall complete construction of the detention basin/BMP(s) in substantial compliance with the County-approved plans and specifications for the detention basin/BMP(s). Failure to meet these requirements shall be a material breach of this Agreement, and shall entitle the County to pursue any remedies available to it at law or in equity to enforce the same. Construction of the detention basin/BMP(s) shall be substantially completed within one (1) year (defined as 365 days), which one year period will commence to run on the date the approved plat of this Subdivision is recorded in the records of the El Paso County Clerk and Recorder. Rough grading of the detention basin/BMP(s) must be completed and inspected by the El Paso County Planning and Community Development Department prior to commencing road construction.

In the event construction is not substantially completed within the one (1) year period, then the County may exercise its discretion to complete the project, and shall have the right to seek reimbursement from the Developer and its respective successors and assigns, for its actual costs and expenses incurred in the process of completing construction. The term actual costs and expenses shall be liberally construed in favor of the County, and shall include, but shall not be limited to, labor costs, tool and equipment costs, supply costs, and engineering and design costs, regardless of whether the County uses its own personnel, tools, equipment and supplies, etc. to correct the matter. In the event the County initiates any litigation or engages the services of legal counsel in order to enforce the Provisions arising herein, the County shall be entitled to its damages and costs, including reasonable attorney fees, regardless of whether the County contracts with outside legal counsel or utilizes in-house legal counsel for the same.

4. Maintenance: The Metro District agrees for itself and its successors and assigns, that it will regularly and routinely inspect, clean and maintain the detention basin/BMP(s), and otherwise keep

the same in good repair, all at its own cost and expense. No trees or shrubs that will impair the structural integrity of the detention basin/BMP(s) shall be planted or allowed to grow on the detention basin/BMP(s).

5. Creation of Easement: Developer hereby grants the County and the Metro District a non-exclusive perpetual easement upon and across that portion of the Property described in Exhibit B. The purpose of the easement is to allow the County and the Metro District to access, inspect, clean, repair and maintain the detention basin/BMP(s); however, the creation of the easement does not expressly or implicitly impose on the County a duty to so inspect, clean, repair or maintain the detention basin/BMP(s).

6. County's Rights and Obligations: Any time the County determines, in the sole exercise of its discretion, that the detention basin/BMP(s) is not properly cleaned, maintained and/or otherwise kept in good repair, the County shall give reasonable notice to the Developer, the Metro District and their respective successors and assigns, that the detention basin/BMP(s) needs to be cleaned, maintained and/or otherwise repaired. The notice shall provide a reasonable time to correct the problem(s). Should the responsible parties fail to correct the specified problem(s), the County may enter upon the Property to so correct the specified problem(s). Notice shall be effective to the above by the County's deposit of the same into the regular United States mail, postage pre-paid. Notwithstanding the foregoing, this Agreement does not expressly or implicitly impose on the County a duty to so inspect, clean, repair or maintain the detention basin/BMP(s).

7. Reimbursement of County's Costs / Covenant Running With the Land: The Developer and the Metro District agree and covenant, for themselves, their respective successors and assigns, that they will reimburse the County for its costs and expenses incurred in the process of completing construction of, cleaning, maintaining, and/or repairing the detention basin/BMP(s) pursuant to the provisions of this Agreement.

The term "actual costs and expenses" shall be liberally construed in favor of the County, and shall include, but shall not be limited to, labor costs, tools and equipment costs, supply costs, and engineering and design costs, regardless of whether the County uses its own personnel, tools, equipment and supplies, etc. to correct the matter. In the event the County initiates any litigation or engages the services of legal counsel in order to enforce the provisions arising herein, the County shall be entitled to its damages and costs, including reasonable attorney's fees, regardless of whether the County contracts with outside legal counsel or utilizes in-house legal counsel for the same.

8. Contingencies of Subdivision Approval: Developer's and the Metro District's execution of this Agreement is a condition of subdivision approval. Additional conditions of this Agreement include, but are not limited to, the following:

- a. Conveyance of that Tract referenced in Exhibit B, from Developer to the Metro District (which will include a reservation of easement in favor of the County for purposes of accessing, inspecting, cleaning, maintaining, and repairing the detention basin/BMP(s)), and recording of the Deed for the same; and
- b. A copy of the Covenants of the Subdivision, if applicable, establishing that the Metro District is obligated to inspect, clean, maintain, and repair the detention basin/BMP(s).

The County shall have the right, in the sole exercise of its discretion, to approve or disapprove any documentation submitted to it under the conditions of this Paragraph, including but not limited to, any separate agreement or amendment, if applicable, identifying any specific maintenance responsibilities not addressed herein. The County's rejection of any documentation submitted hereunder shall mean that the appropriate condition of this Agreement has not been fulfilled.

9. Agreement Monitored by El Paso County Planning and Community Development Department and/or El Paso County Department of Public Works: Any and all actions and decisions to be made hereunder by the County shall be made by the Director of the El Paso County Planning and Community Development Department and/or the Director of the El Paso County Department of Public Works. Accordingly, any and all documents, submissions, plan approvals, inspections, etc. shall be submitted to and shall be made by the Director of the Planning and Community Development Department and/or the Director of the El Paso County Department of Public Works.

10. Indemnification and Hold Harmless: To the extent authorized by law, Developer and the Metro District agree, for themselves, their respective successors and assigns, that they will indemnify, defend, and hold the County harmless from any and all loss, costs, damage, injury, liability, claim, lien, demand, action and causes of action whatsoever, whether at law or in equity, arising from or related to their respective intentional or negligent acts, errors or omissions or that of their agents, officers, servants, employees, invitees and licensees in the construction, operation, inspection, cleaning (including analyzing and disposing of any solid or hazardous wastes as defined by State and/or Federal environmental laws and regulations), maintenance, and repair of the detention basin/BMP(s), and such obligation arising under this Paragraph shall be joint and several. Nothing in this Paragraph shall be deemed to waive or otherwise limit the defense available to the County pursuant to the Colorado Governmental Immunity Act, Sections 24-10-101, *et seq.* C.R.S., or as otherwise provided by law.

11. Severability: In the event any Court of competent jurisdiction declares any part of this Agreement to be unenforceable, such declaration shall not affect the enforceability of the remaining parts of this Agreement.

12. Third Parties: This Agreement does not and shall not be deemed to confer upon or grant to any third party any right to claim damages or to bring any lawsuit, action or other proceeding against either the County, the Developer, the Metro District, or their respective successors and assigns, because of any breach hereof or because of any terms, covenants, agreements or conditions contained herein.

13. Solid Waste or Hazardous Materials: Should any refuse from the detention basin/BMP(s) be suspected or identified as solid waste or petroleum products, hazardous substances or hazardous materials (collectively referred to herein as "hazardous materials"), the Developer and the Metro District shall take all necessary and proper steps to characterize the solid waste or hazardous materials and properly dispose of it in accordance with applicable State and/or Federal environmental laws and regulations, including, but not limited to, the following: Solid Wastes Disposal Sites and Facilities Acts, §§ 30-20-100.5 – 30-20-119, C.R.S., Colorado Regulations Pertaining to Solid Waste Disposal Sites and Facilities, 6 C.C.R. 1007-2, *et seq.*, Solid Waste Disposal Act, 42 U.S.C. §§ 6901-6992k, and Federal Solid Waste Regulations 40 CFR Ch. I. The County shall not be responsible or liable for identifying, characterizing, cleaning up, or disposing of such solid waste or hazardous materials. Notwithstanding the previous sentence, should any refuse cleaned up and disposed of by the County be determined to be solid waste or hazardous materials, the Developer and the Metro District, but not the County, shall be

responsible and liable as the owner, generator, and/or transporter of said solid waste or hazardous materials.

14. Applicable Law and Venue: The laws, rules, and regulations of the State of Colorado and El Paso County shall be applicable in the enforcement, interpretation, and execution of this Agreement, except that Federal law may be applicable regarding solid waste or hazardous materials. Venue shall be in the El Paso County District Court.

15. Limitation on Developer's Obligation and Liability: The obligation and liability of the Developer hereunder shall only continue until such time as the Final Plat as described in Paragraph Three (3) of the Recitals set forth above is recorded and the Developer completes the construction of the detention basin/BMP(s) and transfers all applicable maintenance and operation responsibilities to the Metro District. By execution of this agreement, the Metro District agrees to accept all responsibilities and to perform all duties assigned to it, including those of the Developer, as specified herein, upon transfer of the Tract referenced in Exhibit B from Developer to the Metro District.

IN WITNESS WHEREOF, the Parties affix their signatures below.

Executed this 12th day of December, 2017, by:
Lorson, LLC

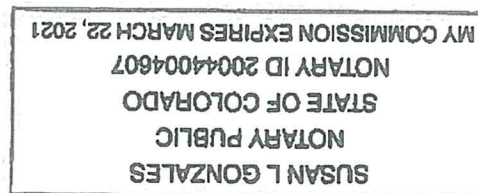
By: [Signature]
Jeff Mark, Authorized Signing Agent

The foregoing instrument was acknowledged before me this 12th day of December, 2017, by Jeff Mark, Authorized Signing Agent, Lorson, LLC

Witness my hand and official seal.

My commission expires: 3.22.21

[Signature]
Notary Public



Executed this 14th day of December, 2017, by:


BOARD OF COUNTY COMMISSIONERS
OF EL PASO COUNTY, COLORADO

By: 
Craig Dossey, Executive Director
Planning and Community Development Department
Authorized signatory pursuant to LDC

The foregoing instrument was acknowledged before me this 14 day of December, 2017, by Craig Dossey, Executive Director of El Paso County Planning and Community Development Department.

Witness my hand and official seal.

My commission expires: 09/02/2020


Notary Public

Approved as to Content and Form:

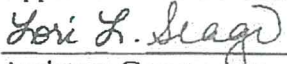

Assistant County Attorney



Exhibit A

Paint Brush Hills Filing No. 13B, El Paso County, Colorado

Paint Brush Hills Filing No. 13C, El Paso County, Colorado

Paint Brush Hills Filing No. 13D, El Paso County, Colorado

Exhibit B

Tract B, Paint Brush Hills Filing No. 13B, El Paso County, Colorado