Drainage Conformance Letter
For
CONVENANCE STORE AND CAR WASH
LOT 1 AND LOT 2 OF CHAMBERS AND HESS, FILING NO. 1
SEC OF CHAMBERS RD AND S. RED SKY DR, PARKER, COLORADO

09/24/2021

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ENGINEERS STATEMENT

This Drainage Conformance Letter for Lot 1 and Lot 2 of Chambers and Hess, Filing No. 1 Development, was prepared by me or under my direct supervision in accordance with the provisions of the Town of Parker Storm Drainage & Environmental Criteria Manual. I understand that the Town of Parker and its designated town authority do not and will not assume liability for drainage facilities designed by others.

Landis Gordon PE

Colorado P.E. License No. 56446

Seal and Date

Introduction

This Drainage Conformance Letter has been prepared for the proposed Convenance Store and care wash located at Lot 1 and Lot 2 of Chambers and Hess Filing No. 1. The purpose of this letter is to show that the proposed development conforms to the Storm Drainage and Environmental Criteria Manual for the Town of Parker, and the Chambers and Hess Final Drainage Report, prepared by Rick Engineering, and dated January 25, 2021, hereinafter called the "Master Drainage Report." This is the underlying Master Plan for the overall development encompassing the site. All infrastructure will be installed prior to this project's construction and is labeling "existing" for purposes of this report.

Location

The project site located at the southeast corner of Chambers Road and South Red Sky Drive, Parker, Colorado. This development is located in the Southeast Quarter of Section 29, Township 6 South, Range 66 West 6th P.M. Town of Parker, County of Douglas, State of Colorado. The site is bounded by Sliceroo Drive to the east, South Red Sky Drive to the north, Chambers Road to the west, and a vacant lot to the south.

Existing Conditions

Lot 1 occupies approximately 0.93acres of overlot graded vacant land, covered with native grasses and weeds. The project site was studied in the Master Drainage Report, this site lies within Basin A1.

Lot 2 occupies approximately 0.67 acres of overlot graded vacant land, covered with native grasses and weeds. The project site was studied in the Master Drainage Report, this site lies within Basin A2.

The existing site generally slopes Northwest to Southeast. As part of the Chambers and Hess master planned development, internal streets will be built East, adjacent to this Lot. The existing underground storm drain system of the Overall Development will convey stormwater to an existing detention pond A from the Final Drainage Report for the Parker 234 Subdivision.

Proposed Conditions

An existing stormwater line is located along the east side of the property. This line has an existing area inlets on the east side of Lot 1 and the east side of Lot 2. Only the Lot 2 existing area inlet will be re-used for this proposed design. A proposed Type R curb inlet will be cut into this existing storm line on the south

curb line of the east access off Sliceroo. Building downspouts will be piped underground to the storm inlets. Landscape inlets will tie into the building downspouts on the north and west sides of the Convenance store to catch landscape flows. The Convenance store and Car wash drives and parking lots will flow to the existing storm sewer system. This existing storm line will serve as the discharge from the site, in the proposed condition. The existing storm sewer system has been sized to receive flows from the developed Lots.

The impervious percentage assigned to basin A1 and A2 was 75%. The impervious percentage for the proposed development is calculated to be 56%.

The proposed 9.96 cfs calculated for the Convenance Store and Car Wash development is less than the masterplan runoff is 10.80 cfs.

Proposed Sub-Basins

Basin A– Basin A is the 0.1 acre Convenance store. The impervious value for the basin is 90%. The 5-year and 100-year runoff coefficients are 0.77 and 0.85, respectively. The runoff for the 5-year and 100-year storm event are 0.35-cfs and 0.72-cfs, respectively. Runoff from the roof flows to the down spouts on the west and north ends of the building. It is then piped underground to the proposed Type R inlet connection which connects to the existing storm sewer.

Basin B– Basin B is the 0.09 acre fuel canopy roof. The impervious value for the basin is 90%. The 5-year and 100-year runoff coefficients are 0.77 and 0.85, respectively. The runoff for the 5-year and 100-year storm event are 0.31-cfs and 0.64-cfs, respectively. Runoff from the roof flows to the down spouts on the canopy. It is then piped underground to the proposed Type R inlet connection which connects to the existing storm sewer.

Basin C– Basin C is the 0.06 acre Car Wash roof. The impervious value for the basin is 90%. The 5-year and 100-year runoff coefficients are 0.77 and 0.85, respectively. The runoff for the 5-year and 100-year storm event are 0.23-cfs and 0.48-cfs, respectively. Runoff from the roof flows to the down spouts on the south side of the roof. It then sheet flows to a swale along the southern property line and to an existing area inlet which connects to the existing storm sewer.

Basin D– Basin D is 0.33 acres and consists of the parking, shared drive, walks and landscaping. The impervious value for the basin is 77%. The 5-year and 100-year runoff coefficients are 0.67 and 0.80, respectively. The runoff for the 5-year and 100-year storm event are 2.37-cfs and 5.30-cfs, respectively. Runoff follows historic patterns and is directed to the eastern side of the site where it is conveyed to a proposed 10' Type R Inlet at Design Point D. The runoff from Basin B is fully captured by the proposed inlet

and conveyed via the existing 18" PVC storm sewer. This storm is then piped underground to the existing detention pond outlined in the Final Drainage Report.

Basin E– Basin E is 0.15 acres and consists of the parking, shared drive, walks and landscaping. The impervious value for the basin is 43%. The 5-year and 100-year runoff coefficients are 0.38 and 0.66, respectively. The runoff for the 5-year and 100-year storm event are 0.27-cfs and 0.88-cfs, respectively. Runoff is directed via curb and gutter to a grate in front of the car wash entrance at design point E. It flows out of the drive via the southern side and into a swale that runs along the southern property line. The runoff from Basin E is fully captured by the existing inlet at Design Point F and conveyed via the existing 18" PVC storm sewer. This storm is then piped underground to the existing detention pond outlined in the Final Drainage Report.

Basin F– Basin F is 0.15 acres and consists of the parking, shared drive, walks and landscaping. The impervious value for the basin is 43%. The 5-year and 100-year runoff coefficients are 0.38 and 0.66, respectively. The runoff for the 5-year and 100-year storm event are 0.27-cfs and 0.88-cfs, respectively. Runoff follows historic patterns and is directed via curb and gutter to a grate in front of the car wash entrance. It flows out of the drive via the southern side and into a swale that runs along the southern property line. The runoff from Basin F is fully captured by the Existing inlet at Design Point F and conveyed via the existing 18" PVC storm sewer. This storm is then piped underground to the existing detention pond outlined in the Final Drainage Report.

Basin G– Basin G is 0.10 acres and consists of landscaping on the west and north sides of the building. The impervious value for the basin is 2%. The 5-year and 100-year runoff coefficients are 0.05 and 0.49, respectively. The runoff for the 5-year and 100-year storm event are 0.02-cfs and 0.43-cfs, respectively. Runoff sheet flows in the landscape and is captured by landscape inlets on the west and north ends of the building. It is then piped underground to the proposed Type R inlet connection which connects to the existing storm sewer.

Basin OS-1– Basin OS-1 is 0.03 acres and consists of landscaping on the southwest side of the site. The impervious value for the basin is 2%. The 5-year and 100-year runoff coefficients are 0.05 and 0.49, respectively. The runoff for the 5-year and 100-year storm event are 0.01-cfs and 0.11-cfs, respectively. Runoff sheet flows in the landscape and flows to Chambers Rd. This area is all landscaping so the flow to Chambers Rd would be negligible and we do not anticipate any negative impacts downstream.

Basin OS-2– Basin OS-2 is 0.13 acres and consists of landscaping on the southwest side of the site. The impervious value for the basin is 18%. The 5-year and 100-year runoff coefficients are 0.18 and 0.55, respectively. The runoff for the 5-year and 100-year storm event are 0.11-cfs and 0.62-cfs, respectively. Runoff sheet flows in the landscape and drive and flows to Sliceroo Dr. The flow in Sliceroo Dr ultimately ends up in Master

Drainage Study Drainage Point 9. The inlet in this location receives 8.2 cfs but, with proposed improvements, including 0.62 cfs from OS-2, will receive 9.56 cfs in total. The Inlet in designed to receive 10.8 cfs. Basin OS-2 will not negatively impact downstream infrastructure.

Basin OS-3– Basin OS-3 is 0.03 acres and consists of landscaping on the southwest side of the site. The impervious value for the basin is 2%. The 5-year and 100-year runoff coefficients are 0.05 and 0.49, respectively. The runoff for the 5-year and 100-year storm event are 0.01-cfs and 0.13-cfs, respectively. Runoff sheet flows in the landscape and drive and flows to Red Sky Dr. The flow in Red Sky Dr ultimately ends up in Master Drainage Study Drainage Point 9. The inlet in this location receives 8.2 cfs but, with proposed improvements, including 0.13 cfs from OS-3, will receive 9.56 cfs in total. The Inlet in designed to receive 10.8 cfs. Basin OS-3 will not negatively impact downstream infrastructure.

Basin RED-1– Basin RED-1 is 0.26 acres and consists of roadway, sidewalks and landscaping on the north side of the site. RED-1 is and existing offsite basin that the imperviousness has been altered slightly with the addition of a proposed access. The impervious value for the basin is 79%. The 5-year and 100-year runoff coefficients are 0.68 and 0.81, respectively. The runoff for the 5-year and 100-year storm event are 0.85-cfs and 1.87-cfs, respectively. Runoff sheet flows in the landscape and drive and flows to Red Sky Dr. The flow in Red Sky Dr ultimately ends up in Master Drainage Study Drainage Point 9. Per the Master Drainage Study this existing basin imperviousness is 84% and the flow is 1.9cfs. With proposed imperviousness and flow being lower than Master Drainage Study calculations the proposed access will not negatively impact the downstream infrastructure.

Basin SLICE-1– Basin SLICE-1 is 0.955 acres and consists of roadway, sidewalks and landscaping on the east side of the site. SLICE-1 is and existing offsite basin that the imperviousness has been altered slightly with the addition of a proposed access. The impervious value for the basin is 49%. The 5-year and 100-year runoff coefficients are 0.43 and 0.68, respectively. The runoff for the 5-year and 100-year storm event are 1.57-cfs and 4.63-cfs, respectively. Runoff sheet flows in the landscape and drive and flows to Sliceroo Dr. The flow in Sliceroo Dr. ultimately ends up in Master Drainage Study Drainage Point 9. Per the Master Drainage Study this existing basin imperviousness is 51.8% and the flow is 4.7cfs. With proposed imperviousness and flow being lower than Master Drainage Study calculations the proposed access will not negatively impact the downstream infrastructure.

Conclusion

Since the proposed development is lower in both imperviousness and runoff than masterplanned for the Parker 234 Subdivision, the existing drainage facilities are

sufficient to convey the runoff from the proposed Lot 1 and Lot 2 sites, without onsite water quality or detention, and not negatively impact adjacent properties.

Attachments

1. Table 5.1 One-Hour Point Rainfall
2. Table 6-3. Recommended percentage impervious values
3. Table 6-5. Runoff coefficients, c
4. Hydrologic Soil Map Information
5. Runoff Coefficients spreadsheet
6. Standard Form SF-1. Time of Concentration
7. Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)
8. Inlet in a Sump or Sag Location spreadsheet
9. Chambers and Hess Drainage Area Map
10. Proposed Drainage Area Map

National Flood Hazard Layer FIRMette

FEMA

Feet

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

1:6,000

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 / 17.5 — Cross Sections with 1% Annual Chance 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

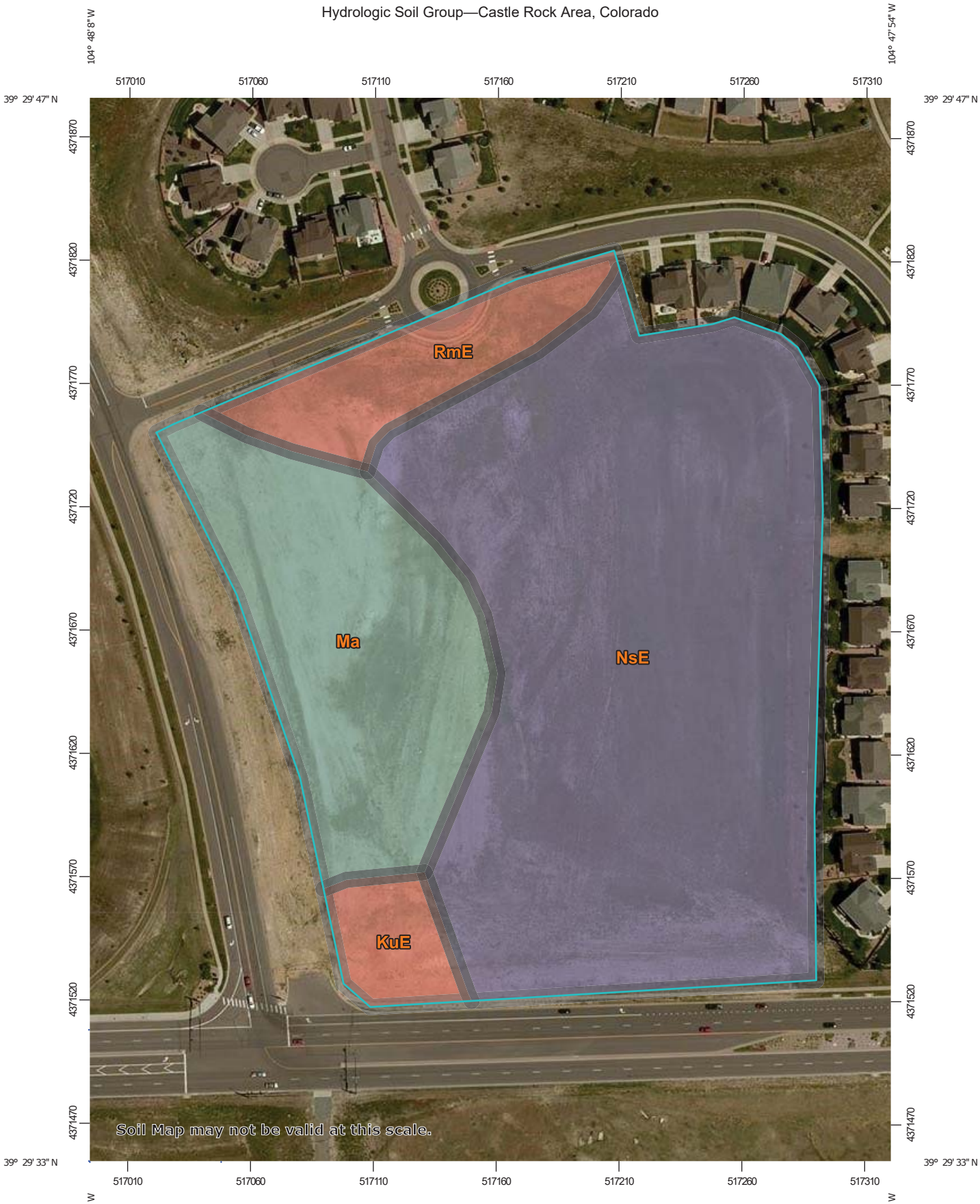
N

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 11/25/2019 at 3:59:17 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° 48' 8" W
104° 47' 54" W
39° 29' 47" N
39° 29' 33" N
517010
517060
517110
517160
517210
517260
517310
4371870
4371820
4371770
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RmE
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Soil Map may not be valid at this scale.
Map Scale: 1:2,100 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 30 60 120 180
Feet
0 100 200 400 600
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 1:20,000.

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: Castle Rock Area, Colorado
Survey Area Data: Version 12, Sep 13, 2019

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

Date(s) aerial images were photographed: Jun 10, 2014—Aug 21, 2014

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
KuE	Kutch clay loam, 8 to 20 percent slopes	D	0.6	3.8%
Ma	Manzanola clay loam	C	3.5	23.1%
NsE	Newlin-Satanta complex, 5 to 20 percent slopes	B	9.9	64.6%
RmE	Renohill-Buick complex, 5 to 25 percent slopes	D	1.3	8.5%
Totals for Area of Interest			**15.3**	**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 5.1
ONE-HOUR POINT RAINFALL

Frequency of Design Event (yr)	One-hour Point Rainfall, P_1 (in)
2	0.99
5	1.39
10	1.64
25	1.98
50	2.31
100	2.60

5.3 FLOOD HYDROLOGY OVERVIEW

Various methods exist to determine appropriate flood peaks or hydrographs for storm drainage planning and design. Methods for determining flood peaks or hydrographs are the Rational Method, the Colorado Urban Hydrograph Procedure (CUHP), and Urban Drainage Stormwater Management (UDSWM) model. The Town of Parker discourages the use of computer models other than CUHP and UDSWM since these programs are preferred, if not required, by UDFCD for studies involving major drainageways where UDFCD approval is sought or where maintenance eligibility is requested.

The three methods are briefly described in this section, and a discussion of their applicability to the Town of Parker is discussed. UDSWM is mostly used to combine and route the hydrographs generated using CUHP.

In general, the Rational Method is the most widely used and accepted technique for determining peak flows in urban areas for small basins. Within the constraints outlined in the MANUAL, use of the Rational Method provides a relatively simple but effective way to analyze storm runoff.

CUHP is somewhat more complicated than the Rational Method. It allows a manual computation of a runoff hydrograph which may be used for further hydraulic routing through channels and/or detention ponds. Historically, CUHP is best used in urban areas for which runoff coefficients have been derived. However, recent improvements by UDFCD include consideration for different soil types, thus CUHP is now more applicable to rural areas. The reader is referred to UDFCD for the latest version of CUHP.

UDSWM is a computer model that generates runoff hydrographs and routes and combines these hydrographs. UDSWM is a modified version of the Runoff Block of the Environmental Protection Agency's Storm Water Management Model (SWMM). It has been modified to be used in conjunction with CUHP. Table 5.2 herein provides guidance on selecting the appropriate method for a given project.

Table 6-3. Recommended percentage imperviousness values

Land Use or Surface Characteristics	Percentage Imperviousness (%)
Business:	
Downtown Areas	95
Suburban Areas	75
Residential lots (lot area only)**:**	
Single-family	
2.5 acres or larger	12
0.75 – 2.5 acres	20
0.25 – 0.75 acres	30
0.25 acres or less	45
Apartments	75
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yard areas	50
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

Table 6-5. Runoff coefficients, *c* (continued)

Total or Effective % Impervious	NRCS Hydrologic Soil Group C						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.05	0.15	0.33	0.40	0.49	0.59
5%	0.03	0.08	0.17	0.35	0.42	0.5	0.6
10%	0.06	0.12	0.21	0.37	0.44	0.52	0.62
15%	0.1	0.16	0.24	0.4	0.47	0.55	0.64
20%	0.14	0.2	0.28	0.43	0.49	0.57	0.65
25%	0.18	0.24	0.32	0.46	0.52	0.59	0.67
30%	0.22	0.28	0.35	0.49	0.54	0.61	0.68
35%	0.26	0.32	0.39	0.51	0.57	0.63	0.7
40%	0.3	0.36	0.43	0.54	0.59	0.65	0.71
45%	0.34	0.4	0.46	0.57	0.62	0.67	0.73
50%	0.38	0.44	0.5	0.6	0.64	0.69	0.75
55%	0.43	0.48	0.54	0.63	0.66	0.71	0.76
60%	0.47	0.52	0.57	0.65	0.69	0.73	0.78
65%	0.51	0.56	0.61	0.68	0.71	0.75	0.79
70%	0.56	0.61	0.65	0.71	0.74	0.77	0.81
75%	0.6	0.65	0.68	0.74	0.76	0.79	0.82
80%	0.65	0.69	0.72	0.77	0.79	0.81	0.84
85%	0.7	0.73	0.76	0.79	0.81	0.83	0.86
90%	0.74	0.77	0.79	0.82	0.84	0.85	0.87
95%	0.79	0.81	0.83	0.85	0.86	0.87	0.89
100%	0.83	0.85	0.87	0.88	0.89	0.89	0.9

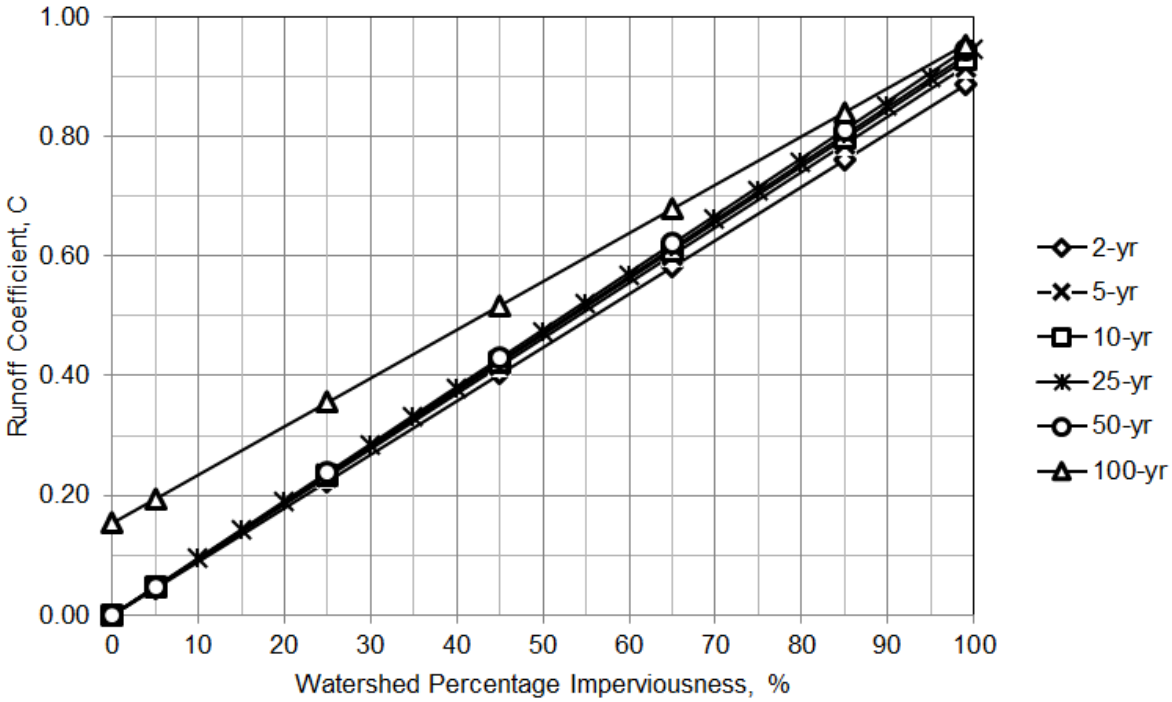


Figure 6-1. Runoff coefficient vs. watershed imperviousness NRCS HSG A

Runoff Coefficients

Corridor / Design Package: Chambers and Hess
System Name: Developed Condition

Computed: LCG Date: 9/24/2021
Checked: MEK Date: 9/24/2021

Sub-Basin Data			Composite C			Sub Area (Pavement)				Sub Area (Roof)				Sub Area(Lawns C/D Group soils)			
Basin ID	Description	Total Area (ac)	C_5	C_{100}	i	C_5	C_{100}	i	Area (ac)	C_5	C_{100}	i	Area (ac)	C_5	C_{100}	i	Area (ac)
A	Building	0.095	0.77	0.85	90	0.77	0.85	90	0.000	0.77	0.85	90	0.095	0.05	0.49	2	0.000
B	Building	0.085	0.77	0.85	90	0.77	0.85	90	0.000	0.77	0.85	90	0.085	0.05	0.49	2	0.000
C	Building	0.063	0.77	0.85	90	0.77	0.85	90	0.000	0.77	0.85	90	0.063	0.05	0.49	2	0.000
D	Landscape, Parking and Drives	0.752	0.67	0.80	77	0.77	0.85	90	0.645	0.77	0.85	90	0.000	0.05	0.49	2	0.107
E	Landscape and Drives	0.153	0.38	0.66	43	0.77	0.85	90	0.070	0.77	0.85	90	0.000	0.05	0.49	2	0.082
F	Landscape, Parking and Drives	0.162	0.05	0.49	2	0.77	0.85	90	0.000	0.77	0.85	90	0.000	0.05	0.49	2	0.162
G	Landscape and Drives	0.098	0.05	0.49	2	0.77	0.85	90	0.000	0.77	0.85	90	0.000	0.05	0.49	2	0.098
OS-1	Landscape	0.030	0.05	0.49	2	0.77	0.85	90	0.000	0.77	0.85	90	0.000	0.05	0.49	2	0.030
OS-2	Landscape and Drives	0.126	0.18	0.55	18	0.77	0.85	90	0.022	0.77	0.85	90	0.000	0.05	0.49	2	0.104
OS-3	Landscape	0.031	0.05	0.49	2	0.77	0.85	90	0.000	0.77	0.85	90	0.000	0.05	0.49	2	0.031
	Composite	1.596	0.49	0.70	56	0.77	0.85	90	0.738	0.77	0.85	90	0.244	0.05	0.49	2	0.583
RED-1	Offsite Landscape and Drives	0.263	0.68	0.81	79	0.77	0.85	90	0.231	0.77	0.85	90	0.000	0.05	0.49	2	0.032
SLICE-1	Offsite Landscape and Drives	0.955	0.43	0.68	49	0.77	0.85	90	0.508	0.77	0.85	90	0.000	0.05	0.49	2	0.447

C and I values taken from Table 1 of SDDTCM

Standard Form SF-1 . Time of Concentration

Corridor / Design Package: Chambers and Hess
System Name: Developed Condition

Computed: LCG Date: 9/24/2021
Checked: MEK Date: 9/24/2021

Urban TOC $_{min}$ = 5 min
Rural TOC $_{min}$ = 10 min

	SUB-BASIN DATA			INITIAL/OVERLAND FLOW (ti)			TRAVEL TIME (t_t)								Tc CHECK (Urbanized basins)				FINAL Tc (min)
									Type of Land Surface					TOTAL					
Basin ID	Description	C_5	Area (ac)	Length (ft)	Slope (ft/ft)	t_i (min)	Length (ft)	S_w (ft/ft)	Code	Description	Convey Coef (C_v)	Velocity (ft/s)	t_t Travel Time (min)	$t_c = t_i + t_t$ (min)	Urban (Yes /No)	Length (ft)	$T_{c\,max}$ (min)	$Tc_{max} > t_c$	
A		0.77	0.095	25	0.020	2.37	0	0	6	Paved areas and shallow paved swales	20.00	0.00	0.00	2.37	YES	25.00	0.14	Regional Tc	5.00
B		0.77	0.085	14	0.020	1.77	0	0	6	Paved areas and shallow paved swales	20.00	0.00	0.00	1.77	YES	14.00	0.08	Regional Tc	5.00
C		0.77	0.063	25	0.020	2.37	0	0	6	Paved areas and shallow paved swales	20.00	0.00	0.00	2.37	YES	25.00	0.14	Regional Tc	5.00
D		0.67	0.752	51	0.045	3.39	180	0.04	6	Paved areas and shallow paved swales	20.00	4.00	0.75	4.14	YES	231.00	1.28	Regional Tc	5.00
E		0.38	0.153	28	0.200	2.55	92	0.03	6	Paved areas and shallow paved swales	20.00	3.46	0.44	2.99	YES	120.00	0.67	Regional Tc	5.00
F		0.05	0.162	20	0.200	3.15	251	0.02	5	Grassed waterway	15.00	2.12	1.97	5.13	YES	271.00	1.51	Regional Tc	5.13
G		0.05	0.098	10	0.100	2.80	53	0.01	6	Paved areas and shallow paved swales	20.00	2.00	0.44	3.25	YES	63.00	0.35	Regional Tc	5.00
OS-1		0.05	0.030	37	0.030	8.02	0	0	5	Grassed waterway	15.00	0.00	0.00	8.02	YES	37.00	0.21	Regional Tc	8.02
OS-2		0.18	0.126	15	0.250	2.23	0	0	5	Grassed waterway	15.00	0.00	0.00	2.23	YES	15.00	0.08	Regional Tc	5.00
OS-3		0.05	0.031	12	0.250	2.27	0	0	5	Grassed waterway	15.00	0.00	0.00	2.27	YES	12.00	0.07	Regional Tc	5.00
RED-1		0.68	0.263	14	0.250	0.97	250	0.025	6	Paved areas and shallow paved swales	20.00	3.16	1.32	2.29	YES	264.00	1.47	Regional Tc	5.00
SLICE-1		0.43	0.955	15	0.020	3.71	1070	0.022	6	Paved areas and shallow paved swales	20.00	2.97	6.01	9.72	YES	1085.00	6.03	Regional Tc	9.72

t_t=L/60V Per UDFCD 6-4

ti = $0.395(1.1-C_5)L_i^{0.5}/S_o^{0.33}$ Per UDFCD 6-3

Final Tc > 10 min for nonurban watersheds

Code	Description
1	Heavy meadow
2	Tillage/field
3	Short pasture and lawns
4	Nearly bare ground
5	Grassed waterway
6	Paved areas and shallow paved swales
7	Rail Ballast

Standard Form SF-2 . Storm Drainage System Design (Rational Method Procedure)

Corridor / Design Package: Chambers and Hess
System Name: Developed Condition

Computed: LCG Date: 9/24/2021
Checked: MEK Date: 9/24/2021

Design Storm: Proposed 5-yr P = 1.39 in

LOCATION		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C.A. (AC)	IIN / HR	Q (CFS)	t_c (MIN)	SUM (C*A)(AC)	I(IN / HR)	Q(CFS)	SLOPE(%)	STREETFLOW (	DESIGNFLOW (	SLOPE(%)	PIPE SIZE(in)	LENGTH(FT)	VELOCITY(FPS)	t_t (MIN	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
A	Building		A	0.095	0.77	5.00	0.073	4.71	0.35					--	--	--	--	--	--	--		
B	Building		B	0.085	0.77	5.00	0.066	4.71	0.31					--	--	--	--	--	--	--		
C	Building		C	0.063	0.77	5.00	0.049	4.71	0.23					--	--	--	--	--	--	--		
D	Landscape, Parking and Drives		D	0.752	0.67	5.00	0.502	4.71	2.37					--	--	--	--	--	--	--		
E	Landscape and Drives		E	0.153	0.38	5.00	0.058	4.71	0.27					--	--	--	--	--	--	--		
F	Landscape, Parking and Drives		F	0.162	0.05	5.13	0.008	4.68	0.04					--	--	--	--	--	--	--		
G	Landscape and Drives		G	0.098	0.05	5.00	0.005	4.71	0.02					--	--	--	--	--	--	--		
OS-1	Landscape		OS-1	0.030	0.05	8.02	0.002	4.08	0.01					--	--	--	--	--	--	--		
OS-2	Landscape and Drives		OS-2	0.126	0.18	5.00	0.023	4.71	0.11					--	--	--	--	--	--	--		
OS-3	Landscape		OS-3	0.031	0.05	5.00	0.002	4.71	0.01					--	--	--	--	--	--	--		
RED-1	Offsite Landscape and Drives		RED-1	0.263	0.68	5.00	0.180	4.71	0.85					--	--	--	--	--	--	--		
SLICE-1	Offsite Landscape and Drives		SLICE-1	0.955	0.43	9.72	0.414	3.80	1.57					--	--	--	--	--	--	--		

Design Storm: Proposed 100-yr P = 2.60 in

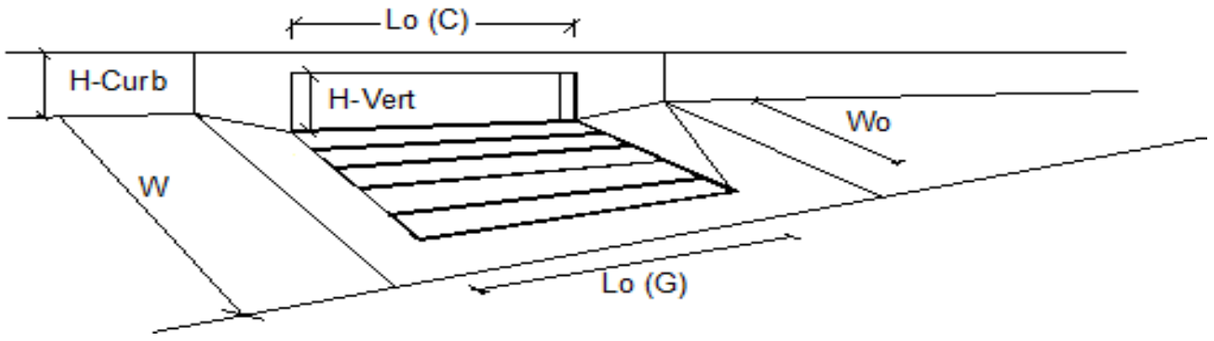
2. 5.0

LOCATION		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C.A. (AC)	IIN / HR	Q (CFS)	t_c (MIN)	SUM (C*A)(AC)	I(IN / HR)	Q(CFS)	SLOPE(%)	STREETFLOW (C	DESIGNFLOW (C	SLOPE(%)	PIPE SIZE(in)	LENGTH(FT)	VELOCITY(FPS)	t_t (MIN	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
A	Building		A	0.095	0.85	5.00	0.08	8.82	0.72					--	--	--	--	--	--	--		
B	Building		B	0.085	0.85	5.00	0.07	8.82	0.64					--	--	--	--	--	--	--		
C	Building		C	0.063	0.85	5.00	0.05	8.82	0.48					--	--	--	--	--	--	--		
D	Landscape, Parking and Drives		D	0.752	0.80	5.00	0.60	8.82	5.30					--	--	--	--	--	--	--		
E	Landscape and Drives		E	0.153	0.66	5.00	0.10	8.82	0.88					--	--	--	--	--	--	--		
F	Landscape, Parking and Drives		F	0.162	0.49	5.13	0.08	8.76	0.69					--	--	--	--	--	--	--		
G	Landscape and Drives		G	0.098	0.49	5.00	0.05	8.82	0.43					--	--	--	--	--	--	--		
OS-1	Landscape		OS-1	0.030	0.49	8.02	0.01	7.63	0.11					--	--	--	--	--	--	--		
OS-2	Landscape and Drives		OS-2	0.126	0.55	5.00	0.07	8.82	0.62					--	--	--	--	--	--	--		
OS-3	Landscape		OS-3	0.031	0.49	5.00	0.02	8.82	0.13					--	--	--	--	--	--	--		
RED-1	Offsite Landscape and Drives		RED-1	0.263	0.81	5.00	0.21	8.82	1.87					--	--	--	--	--	--	--		
SLICE-1	Offsite Landscape and Drives		SLICE-1	0.955	0.68	9.72	0.65	7.11	4.63					--	--	--	--	--	--	--		

(1) Basin Description linked to C-Value Sheet
(2) Basin Design Point
(3) Enter the Basin Name from C Value Sheet
(4) Basin Area linked to C-Value Sheet
(5) Composite C linked to C-Value Sheet
(6) Time of Concentration linked to C-Value Sheet
(7) =Area x Runoff Coeff
(8) =28.5*P/(10+t_c)^0.786
(9) =C.A. x IN/HR
(10) =Column 6 + Column 21
(11) Add the Basin Areas (7) to get the combined basin AC
(12) =28.5*P/(10+Column 10)^0.786
(13) Sum of Qs
(14) Additonal Street Overland Flow
(15) Additonal Street Overland Flow
(16) Design Pipe Flow
(17) Pipe Slope
(18) Pipe Size
(19) Additional Flow Length
(20) Velocity
(21) =Column 19 / Column 20 / 60

INLET ON A CONTINUOUS GRADE

Version 4.06 Released August 2018



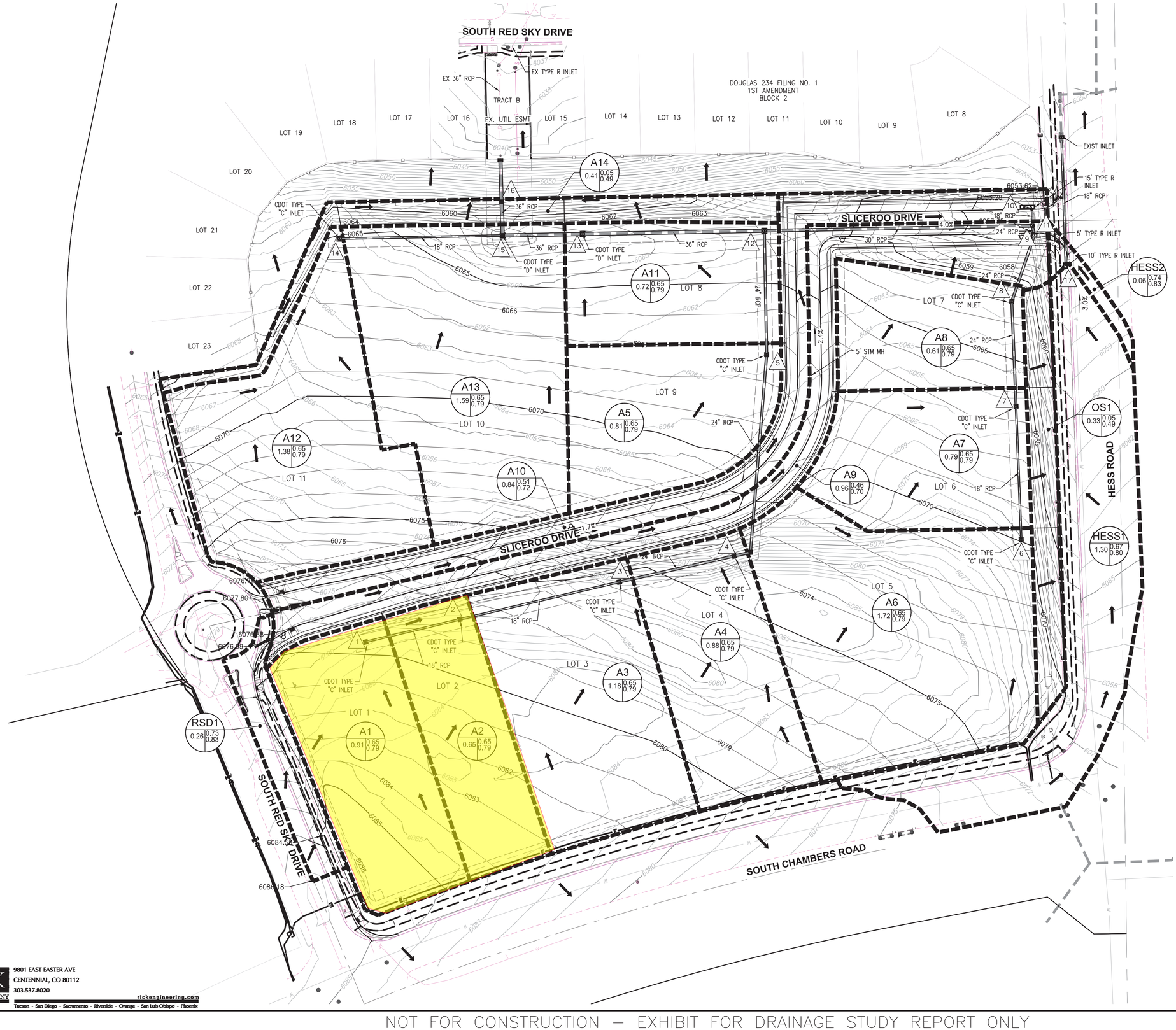
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	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	
Design Discharge for Half of Street (from Sheet *Inlet Management*)	**Q_o =**	**1.2**	**2.7**	cfs
Water Spread Width	T =	4.1	5.8	ft
Water Depth at Flowline (outside of local depression)	d =	1.9	2.4	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.646	0.485	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	0.4	1.4	cfs
Discharge within the Gutter Section W	Q_w =	0.8	1.3	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.12	0.16	sq ft
Velocity within the Gutter Section W	V_W =	6.6	8.1	fps
Water Depth for Design Condition	d_{LOCAL} =	4.9	5.4	inches

Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	**Q_a =**	**N/A**	**N/A**	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	**Q_b =**	**N/A**	**N/A**	cfs

Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.224	0.174	ft/ft
Required Length L_T to Have 100% Interception	L_T =	5.22	8.72	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	5.22	8.72	ft
Interception Capacity	Q_i =	1.2	2.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.25	1.25	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.06	0.06	
Effective (Unclogged) Length	L_e =	8.75	8.75	ft
Actual Interception Capacity	**Q_a =**	**1.2**	**2.7**	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	**Q_b =**	**0.0**	**0.0**	cfs

Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.2**	**2.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**



ORIGINAL SCALE: 1"= 50' HORIZ.

LEGEND

- BASIN ID
- 5 YR. RUNOFF COEFFICIENT
- 100 YR. RUNOFF COEFFICIENT
- AREA IN ACRES
- DESIGN POINT
- DRAINAGE BASIN BOUNDARY
- FLOW ARROW
- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPERTY BOUNDARY
- PROPOSED LOT LINE
- PROPOSED STORM SEWER

DESIGN POINT SUMMARY

DESIGN POINT	PEAK RUNOFF 5YR (CFS)	PEAK RUNOFF 100YR (CFS)
1	2.8	6.4
2	4.7	10.8
3	8.1	18.6
4	10.6	24.3
5	12.7	29.3
6	5.3	12.0
7	7.6	17.3
8	9.4	21.4
9	2.4	8.2
10	1.6	4.3
11	11.2	28.9
12	20.9	51.4
13	22.1	54.4
14	4.2	9.6
15	28.6	69.5
16	28.7	70.8
17	3.6	9.1

BASIN SUMMARY

BASIN	Q5 CFS	Q100 CFS
A1	2.8	6.4
A2	2.0	4.6
A3	3.6	8.2
A4	2.7	6.2
A5	2.5	5.7
A6	5.3	12.0
A7	2.4	5.5
A8	1.9	4.2
A9	1.7	4.7
A10	1.6	4.3
A11	2.2	5.0
A12	4.2	9.6
A13	4.9	11.1
A14	0.1	1.8
HESS1	3.5	7.8
HESS2	0.2	0.5
RSD1	0.9	1.9
OS1	0.1	1.4

POST-DEVELOPMENT DRAINAGE MAP FOR CHAMBERS & HESS FILING NO. 1

SHEET 2 OF 2

D-1173
DATE: JANUARY 25, 2021

RICK ENGINEERING COMPANY
Denver
9801 EAST EASTER AVE
CENTENNIAL, CO 80112
303.537.8020
rickengineering.com
Tucson - San Diego - Sacramento - Riverside - Orange - San Luis Obispo - Phoenix

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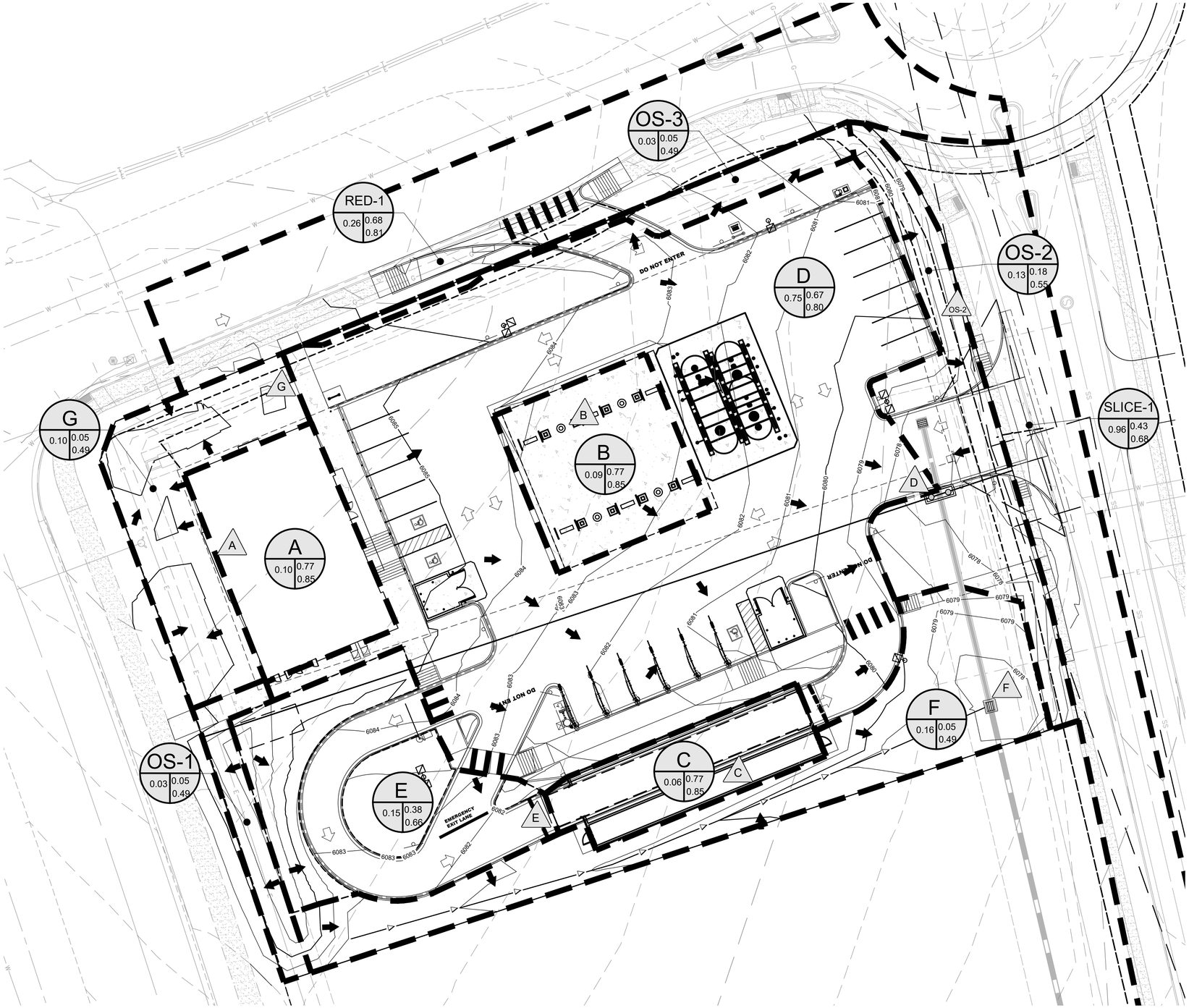

LEGEND

- DS — PROPOSED DOWN SPOUT
- BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- PROPERTY LINE
- FLOW ARROW
- 1 — DESIGN POINT

BASIN SUMMARY RUNOFF TABLE						
BASIN	DESIGN POINT	CONTRIBUTING BASIN ACREAGE	5-YR C-VALUE	100-YR C-VALUE	5-YR RUNOFF (CFS)	100-YR RUNOFF (CFS)
A	A	0.10	0.77	0.85	0.35	0.72
B	B	0.09	0.77	0.85	0.31	0.64
C	C	0.06	0.77	0.85	0.23	0.48
D	D	0.75	0.67	0.80	2.37	5.30
E	E	0.15	0.38	0.66	0.27	0.88
F	F	0.16	0.05	0.49	0.04	0.69
G	G	0.10	0.05	0.49	0.02	0.43
OS-1	OS-1	0.03	0.05	0.49	0.01	0.11
OS-2	OS-2	0.12	0.18	0.55	0.11	0.62
OS-3	OS-3	0.03	0.05	0.49	0.01	0.13
TOTAL		1.59	0.49	0.70	3.71	9.99
RED-1		0.26	0.68	0.81	0.85	1.87
SLICE-1		0.96	0.43	0.68	1.57	4.63

N

0 20 40

1 INCH = 20 FT.

Know what's below. Call before you dig.

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987 or 811
CALL 3-BUSINESS DAYS (NOT INCLUDING INITIAL DAY OF CONTACT) IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

NOTES

1. WATER QUALITY AND DETENTION FOR THIS SITE IS PROVIDED IN A REGIONAL FACILITY LOCATED EAST OF THE SITE KNOWN AS DETENTION POND "POND A".

No.	REVISION	BY	DATE

EES
ENTITLEMENT AND ENGINEERING SOLUTIONS, INC.
501 S. Cherry St. Suite 300
Glendale, CO 80246
303-572-7997 www.eesus.com

CONSTRUCTION DOCUMENTS

CONVENIENCE STORE

12181 AND 12191 SLICEROO DRIVE, PARKER, CO 80134

DRAINAGE MAP

PROJECT NO: ------
DESIGNED BY: LCG
DRAWN BY: JLG
DATE: 09/21/2021

D1.0

9/23/2021 8:42 AM P:\TWINSTAR ENERGY\CO. PARKER - CHAMBERS & HESS\08 CAD\CDS\LOT 1\D1.0 - DRAINAGE PLAN.DWG