# 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

**05/27/2021**
**Revised: 2/2/2022**

**Prepared for Developer:**


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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 infrastructures 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 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 0.93 acres of over lot 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 over lot 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, Sliceroo Drive will be built on the east side of Lot 1 and Lot 2. 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 two existing area inlets: one on the east side of Lot 1 and one on 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 58%.

The proposed 9.96-cfs calculated for the Convenance Store and Car Wash development, during the 100-year storm is less than the masterplan runoff during the 100-year storm which is 10.80-cfs.

**Proposed Sub-Basins**

Basin A– Basin A is 0.095 acres and is the convenance store building. 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 0.71-cfs, respectively. Runoff from the roof flows to the down spouts on the west and north sides of the building. These flows are piped underground to the proposed Type R inlet structure which connects to the existing storm sewer.

Basin B– Basin B is 0.085 acres and is the 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. These flows are piped underground to the proposed Type R inlet structure which connects to the existing storm sewer.

Basin C– Basin C is 0.065 acres and is the 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 0.24-cfs and 0.49-cfs, respectively. Runoff from the roof flows to the down spouts which are along the south side of the roof. These flows are piped to the existing Type C inlet structure in Lot 2 which connects to the existing storm sewer.

Basin D– Basin D is 0.661 acres and consists of the parking, shared drive, walks and landscaping. The impervious value for the basin is 85%. The 5-year and 100-year runoff coefficients are 0.73 and 0.83, respectively. The runoff for the 5-year and 100-year storm event are 2.27-cfs and 4.83-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 9. The runoff from Basin D is fully captured by the proposed inlet and these flows are conveyed via the existing 18" PVC storm sewer. This existing storm sewer network flows to the existing detention pond outlined in the Final Drainage Report.

Basin E– Basin E is 0.351 acres and consists of the parking, shared drive, walks and landscaping. The impervious value for the basin is 33%. The 5-year and 100-year runoff coefficients are 0.24 and 0.58, respectively. The runoff for the 5-year and 100-year storm event are 0.50-cfs and 1.91-cfs, respectively. Runoff is directed via curb and gutter to a pipe in front of the car wash entrance at design point 12. Flows from here converge with flows from the east drive (immediately after the carwash) and the flows from Basin C and connect into the existing Type C inlet in Lot 2. The remaining flows in Basin E flow to the proposed swale and eventually outfall to the existing Type C inlet in Lot 2. The runoff from Basin E is fully captured by the existing inlet at Design Point 10 and conveyed via the existing 18" PVC storm sewer. These storm flows are then piped underground to the existing detention pond outlined in the Final Drainage Report.

Basin F– Basin F is 0.097 acres and consists of landscaping behind 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 0.40-cfs, respectively. Runoff will flow towards five different area inlets which will carry flows to the proposed 10' Type R Inlet. The runoff from Basin F is fully captured by the area inlets and upon reaching the proposed 10' Type R Inlet is conveyed via the existing 18" PVC storm sewer pipe to the existing detention pond outlined in the Final Drainage Report.

Basin G– Basin G is 0.067 acres and consists of landscaping, sidewalk, and the bike rack north of the parking lot. The impervious value for the basin is 10%. The 5-year and 100-year runoff coefficients are 0.11 and 0.52, respectively. The runoff from the 5-year and 100-year storm event are 0.02-cfs and 0.22-cfs, respectively. Runoff from this area flows towards two different area inlets and is piped underground to the proposed 10' Type R Inlet, which connects into the existing storm sewer.

Basin H– Basin G is 0.034 acres and consists of landscaping on the north side of the parking lot. 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 0.15-cfs, respectively. Runoff from this area overland flows to an area inlet where it is collected and is piped underground to the existing 10' Type R Inlet, which connects into the existing storm sewer.

Basin OS-1– Basin OS-1 is 0.060 acres and consists of landscaping and sidewalk along the southwest boundary of the site. The impervious value for the basin is 7%. The 5-year and 100-year runoff coefficients are 0.09 and 0.51, respectively. The runoff for the

5-year and 100-year storm event are 0.02-cfs and 0.22-cfs, respectively. Runoff sheet flows to Chambers Rd. Runoff from this area This area will be negligible, and we do not anticipate any negative impacts downstream.

Basin OS-2– Basin OS-2 is 0.125 acres and consists of landscaping on the southwest side of the site. The impervious value for the basin is 28%. The 5-year and 100-year runoff coefficients are 0.27 and 0.60, respectively. The runoff for the 5-year and 100-year storm event are 0.08-cfs and 0.32-cfs, respectively. Runoff sheet flows in the landscape and drive and flows to Sliceroo Drive. The flow in Sliceroo Drive ultimately ends up in the Master Drainage Study at Drainage Point 9. The inlet in this location receives 8.2-cfs during the 100-year storm, but with proposed improvements, including 0.62-cfs from OS-2, this inlet will receive 9.56-cfs in total during the 100-year storm. The Inlet in designed to receive 10.8-cfs for the 100-year storm. Basin OS-2 will not negatively impact downstream infrastructure.

Basin OS-3– Basin OS-3 is 0.009 acres and consists of asphalt paving and curb and gutter in the northern entrance. The impervious value for this 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 0.03-cfs and 0.07-cfs, respectively. Runoff from this basin is conveyed via curb and gutter to Red Sky Drive. This flow in Red Sky Drive ultimately ends up in Master Drainage Study at design point 9. As stated above, downstream infrastructure will not be negatively impacted.

Basin RED-1– Basin RED-1 is 0.260 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 77%. The 5-year and 100-year runoff coefficients are 0.66 and 0.80, respectively. The runoff for the 5-year and 100-year storm event are 0.81-cfs and 1.83-cfs, respectively. Runoff sheet flows in the landscape and drive and flows to Red Sky Drive. 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 100-year storm flow is 1.9cfs. With proposed imperviousness and flows being lower than Master Drainage Study calculations, the proposed access will not negatively impact downstream infrastructure.

Basin SLICE-1– Basin SLICE-1 is 0.931 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 48%. 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 1.46-cfs and 4.34-cfs, respectively. Runoff sheet flows in the landscape and drive and flows to Sliceroo Drive. The flow in Sliceroo Drive ultimately ends up in Master Drainage Study Drainage Point 9. Per the Master Drainage Study this existing basin imperviousness is 51.8% and the 100-year storm 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 master planned 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. FEMA FIRMette
6. Runoff Coefficients spreadsheet
7. Standard Form SF-1. Time of Concentration
8. Standard Form SF-2. Storm Drainage System Design (Rational Method Procedure)
9. Inlet in a Sump or Sag Location spreadsheet
10. Strom Sewer Hydraulic Grade Profiles and Conduit Flex Tables
11. Chambers and Hess Drainage Area Map
12. Proposed Drainage Area Map

**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 |

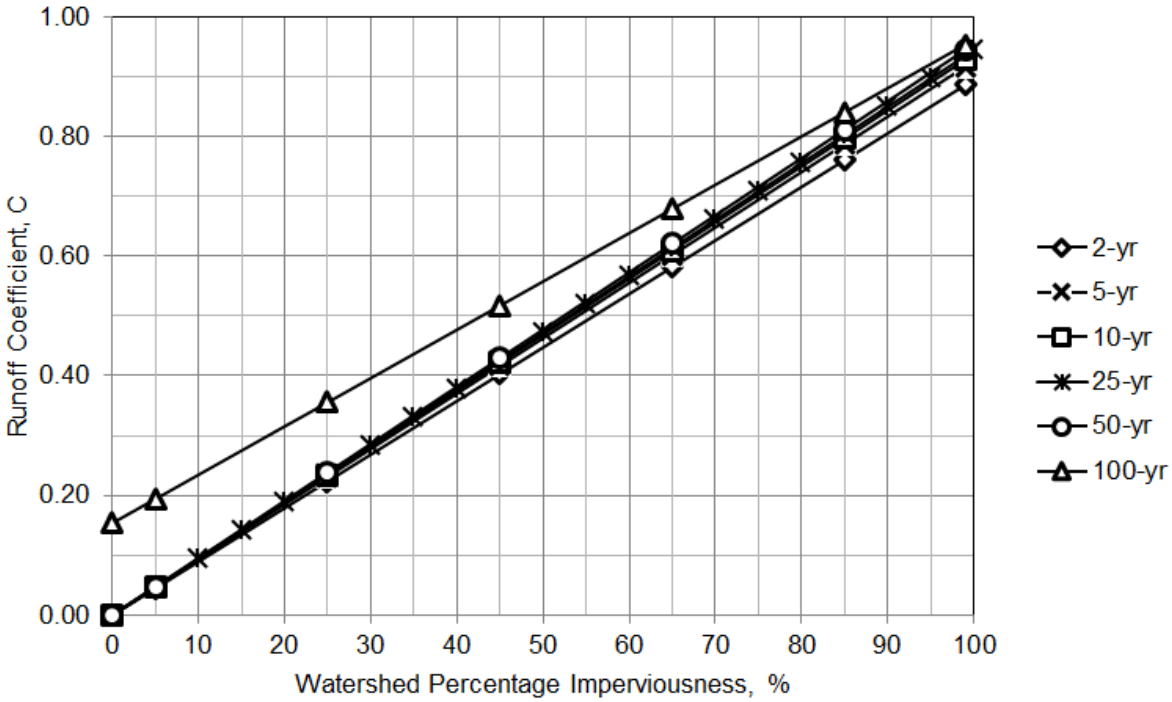



**Figure 6-1. Runoff coefficient vs. watershed imperviousness NRCS HSG A**

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

# National Flood Hazard Layer FIRMette

FEMA

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

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.

**Runoff Coefficients**

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

Computed: JLG Date: 9/28/2021
Checked: JK Date: 9/28/2021

| Sub-Basin Data | | | Composite C | | | | Sub Area (Pavement) | | | | | Sub Area (Roof) | | | | | Sub Area(Lawns C/D Group soils) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Basin ID | Description | Total Area (ac) | $C_2$ | $C_5$ | $C_{100}$ | i | $C_2$ | $C_5$ | $C_{100}$ | i | Area (ac) | $C_2$ | $C_5$ | $C_{100}$ | i | Area (ac) | $C_2$ | $C_5$ | $C_{100}$ | i | Area (ac) |
| A | Building | 0.095 | 0.74 | 0.77 | 0.85 | 90 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.74 | 0.77 | 0.85 | 90 | 0.095 | 0.01 | 0.05 | 0.49 | 2 | 0.000 |
| B | Building | 0.085 | 0.74 | 0.77 | 0.85 | 90 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.74 | 0.77 | 0.85 | 90 | 0.085 | 0.01 | 0.05 | 0.49 | 2 | 0.000 |
| C | Building | 0.065 | 0.74 | 0.77 | 0.85 | 90 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.74 | 0.77 | 0.85 | 90 | 0.065 | 0.01 | 0.05 | 0.49 | 2 | 0.000 |
| D | Landscape, Parking and Drives | 0.661 | 0.70 | 0.73 | 0.83 | 85 | 0.74 | 0.77 | 0.85 | 90 | 0.622 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.01 | 0.05 | 0.49 | 2 | 0.039 |
| E | Landscape and Drives | 0.351 | 0.27 | 0.30 | 0.62 | 33 | 0.74 | 0.77 | 0.85 | 90 | 0.124 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.01 | 0.05 | 0.49 | 2 | 0.227 |
| F | Landscape and Drives | 0.097 | 0.01 | 0.05 | 0.49 | 2 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.01 | 0.05 | 0.49 | 2 | 0.097 |
| G | Landscape | 0.067 | 0.07 | 0.11 | 0.52 | 10 | 0.74 | 0.77 | 0.85 | 90 | 0.006 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.01 | 0.05 | 0.49 | 2 | 0.061 |
| H | Landscape | 0.043 | 0.01 | 0.05 | 0.49 | 2 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.01 | 0.05 | 0.49 | 2 | 0.043 |
| OS-1 | Landscape | 0.060 | 0.05 | 0.09 | 0.51 | 7 | 0.74 | 0.77 | 0.85 | 90 | 0.004 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.01 | 0.05 | 0.49 | 2 | 0.057 |
| OS-2 | Landscape and Drives | 0.060 | 0.23 | 0.27 | 0.60 | 28 | 0.74 | 0.77 | 0.85 | 90 | 0.018 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.01 | 0.05 | 0.49 | 2 | 0.042 |
| OS-3 | Landscape and Drives | 0.009 | 0.74 | 0.77 | 0.85 | 90 | 0.74 | 0.77 | 0.85 | 90 | 0.009 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.01 | 0.05 | 0.49 | 2 | 0.000 |
| | *Composite* | 1.594 | 0.48 | 0.51 | 0.72 | 58 | 0.74 | 0.77 | 0.85 | 90 | 0.773 | 0.74 | 0.77 | 0.85 | 90 | 0.246 | 0.01 | 0.05 | 0.49 | 2 | 0.565 |
| RED-1 | Offsite Landscape and Drives | 0.260 | 0.63 | 0.66 | 0.80 | 77 | 0.74 | 0.77 | 0.85 | 90 | 0.222 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.01 | 0.05 | 0.49 | 2 | 0.038 |
| SLICE-1 | Offsite Landscape and Drives | 0.931 | 0.39 | 0.43 | 0.68 | 48 | 0.74 | 0.77 | 0.85 | 90 | 0.486 | 0.74 | 0.77 | 0.85 | 90 | 0.000 | 0.01 | 0.05 | 0.49 | 2 | 0.445 |
| | 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: JLG Date: 9/28/2021
Checked: JK Date: 9/28/2021

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 | 30 | 0.020 | 2.60 | 0 | 0 | 6 | Paved areas and shallow paved swales | 20.00 | 0.00 | 0.00 | 2.60 | YES | 30.00 | 0.17 | Regional Tc | 5.00 |
| B | | 0.77 | 0.085 | 29 | 0.020 | 2.55 | 0 | 0 | 6 | Paved areas and shallow paved swales | 20.00 | 0.00 | 0.00 | 2.55 | YES | 29.00 | 0.16 | Regional Tc | 5.00 |
| C | | 0.77 | 0.065 | 18 | 0.020 | 2.01 | 0 | 0 | 6 | Paved areas and shallow paved swales | 20.00 | 0.00 | 0.00 | 2.01 | YES | 18.00 | 0.10 | Regional Tc | 5.00 |
| D | | 0.73 | 0.661 | 66 | 0.045 | 3.33 | 202 | 0.04 | 6 | Paved areas and shallow paved swales | 20.00 | 4.00 | 0.84 | 4.17 | YES | 268.00 | 1.49 | Regional Tc | 5.00 |
| E | | 0.30 | 0.351 | 17 | 0.200 | 2.20 | 380 | 0.03 | 5 | Grassed waterway | 15.00 | 2.60 | 2.44 | 4.64 | YES | 397.00 | 2.21 | Regional Tc | 5.00 |
| F | | 0.05 | 0.097 | 40 | 0.100 | 5.61 | 0 | 0.01 | 6 | Paved areas and shallow paved swales | 20.00 | 2.00 | 0.00 | 5.61 | YES | 40.00 | 0.22 | Regional Tc | 5.61 |
| G | | 0.11 | 0.067 | 91 | 0.020 | 13.54 | 0 | 0.02 | 3 | Short pasture and lawns | 7.00 | 0.99 | 0.00 | 13.54 | YES | 91.00 | 0.51 | Regional Tc | 13.54 |
| H | | 0.05 | 0.043 | 45 | 0.020 | 10.12 | 0 | 0.02 | 5 | Grassed waterway | 15.00 | 2.12 | 0.00 | 10.12 | YES | 45.00 | 0.25 | Regional Tc | 10.12 |
| OS-1 | | 0.09 | 0.060 | 55 | 0.030 | 9.39 | 0 | 0 | 5 | Grassed waterway | 15.00 | 0.00 | 0.00 | 9.39 | YES | 55.00 | 0.31 | Regional Tc | 9.39 |
| OS-2 | | 0.27 | 0.060 | 41 | 0.250 | 3.33 | 0 | 0 | 5 | Grassed waterway | 15.00 | 0.00 | 0.00 | 3.33 | YES | 41.00 | 0.23 | Regional Tc | 5.00 |
| OS-3 | | 0.77 | 0.009 | 18 | 0.250 | 0.87 | 0 | 0 | 5 | Grassed waterway | 15.00 | 0.00 | 0.00 | 0.87 | YES | 18.00 | 0.10 | Regional Tc | 5.00 |
| RED-1 | | 0.66 | 0.260 | 26 | 0.250 | 1.39 | 265 | 0.025 | 6 | Paved areas and shallow paved swales | 20.00 | 3.16 | 1.40 | 2.78 | YES | 291.00 | 1.62 | Regional Tc | 5.00 |
| SLICE-1 | | 0.43 | 0.931 | 20 | 0.020 | 4.33 | 1115 | 0.022 | 6 | Paved areas and shallow paved swales | 20.00 | 2.97 | 6.26 | 10.59 | YES | 1135.00 | 6.31 | Regional Tc | 10.59 |

$t_t$=L/60V Per UDFCD 6-4

$t_i = 0.395(1.1-C_5)L_i^{0.5}/S_o^{0.33}$ 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: JLG Date: 9/28/2021
Checked: JK Date: 9/28/2021

Design Storm: Proposed 2-yr P = 0.99 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) | I/IN / HR | Q (CFS) | $t_c$ (MIN) | SUM (C*A)(AC) | I/(IN / HR) | Q(CFS) | SLOPE(%) | STREETFLOW (CFS) | DESIGNFLOW (CFS) | 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 | 1 | A | 0.095 | 0.74 | 5.00 | 0.070 | 3.36 | 0.24 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| B | Building | 5 | B | 0.085 | 0.74 | 5.00 | 0.063 | 3.36 | 0.21 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| C | Building | 11 | C | 0.065 | 0.74 | 5.00 | 0.048 | 3.36 | 0.16 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| D | Landscape, Parking and Drives | 9 | D | 0.661 | 0.70 | 5.00 | 0.461 | 3.36 | 1.55 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| E | Landscape and Drives | 10 | E | 0.351 | 0.27 | 5.00 | 0.094 | 3.36 | 0.32 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| F | Landscape and Drives | 2 | F | 0.097 | 0.01 | 5.61 | 0.001 | 3.25 | 0.00 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| G | Landscape | 3 | G | 0.067 | 0.07 | 13.54 | 0.005 | 2.36 | 0.01 | | | | | | | | | | | | | |
| H | Landscape | 7 | H | 0.043 | 0.01 | 10.12 | 0.000 | 2.67 | 0.00 | | | | | | | | | | | | | |
| OS-1 | Landscape | 20 | OS-1 | 0.060 | 0.05 | 9.39 | 0.003 | 2.74 | 0.01 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| OS-2 | Landscape and Drives | 22 | OS-2 | 0.060 | 0.23 | 5.00 | 0.014 | 3.36 | 0.05 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| OS-3 | Landscape and Drives | 23 | OS-3 | 0.009 | 0.74 | 5.00 | 0.007 | 3.36 | 0.02 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| RED-1 | Offsite Landscape and Drives | 21 | RED-1 | 0.260 | 0.63 | 5.00 | 0.165 | 3.36 | 0.55 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| SLICE-1 | Offsite Landscape and Drives | 23 | SLICE-1 | 0.931 | 0.39 | 10.59 | 0.364 | 2.62 | 0.95 | | | | | -- | -- | -- | -- | -- | -- | -- | | |

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) | I/IN / HR | Q (CFS) | $t_c$ (MIN) | SUM (C*A)(AC) | I/(IN / HR) | Q(CFS) | SLOPE(%) | STREETFLOW (CFS) | DESIGNFLOW (CFS) | 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 | 1 | A | 0.095 | 0.77 | 5.00 | 0.073 | 4.71 | 0.35 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| B | Building | 5 | B | 0.085 | 0.77 | 5.00 | 0.066 | 4.71 | 0.31 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| C | Building | 11 | C | 0.065 | 0.77 | 5.00 | 0.050 | 4.71 | 0.24 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| D | Landscape, Parking and Drives | 9 | D | 0.661 | 0.73 | 5.00 | 0.481 | 4.71 | 2.27 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| E | Landscape and Drives | 10 | E | 0.351 | 0.30 | 5.00 | 0.107 | 4.71 | 0.50 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| F | Landscape and Drives | 2 | F | 0.097 | 0.05 | 5.61 | 0.005 | 4.57 | 0.02 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| G | Landscape | 3 | G | 0.067 | 0.11 | 13.54 | 0.008 | 3.31 | 0.02 | | | | | | | | | | | | | |
| H | Landscape | 7 | H | 0.043 | 0.05 | 10.12 | 0.002 | 3.74 | 0.01 | | | | | | | | | | | | | |
| OS-1 | Landscape | 20 | OS-1 | 0.060 | 0.09 | 9.39 | 0.006 | 3.85 | 0.02 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| OS-2 | Landscape and Drives | 22 | OS-2 | 0.060 | 0.27 | 5.00 | 0.016 | 4.71 | 0.08 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| OS-3 | Landscape and Drives | 23 | OS-3 | 0.009 | 0.77 | 5.00 | 0.007 | 4.71 | 0.03 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| RED-1 | Offsite Landscape and Drives | 21 | RED-1 | 0.260 | 0.66 | 5.00 | 0.173 | 4.71 | 0.81 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| SLICE-1 | Offsite Landscape and Drives | 23 | SLICE-1 | 0.931 | 0.43 | 10.59 | 0.396 | 3.67 | 1.46 | | | | | -- | -- | -- | -- | -- | -- | -- | | |

Design Storm: Proposed 100-yr P = 2.60 in

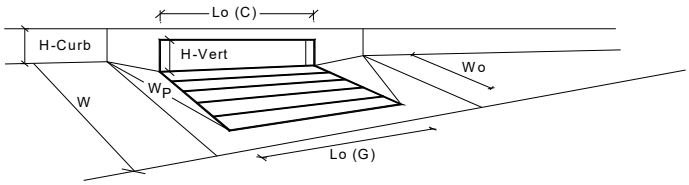
2. 5.0

| LOCATION | | DESIGN POINT | DIRECT RUNOFF | | | | | | | TOTAL RUNOFF | | | | STREET | | PIPE | | | TRAVEL TIME | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | AREA DESIGN | AREA (AC) | RUNOFF COEFF | $t_c$ (MIN) | C.A. (AC) | I/IN / HR | Q (CFS) | $t_c$ (MIN) | SUM (C*A)(AC) | I/(IN / HR) | Q(CFS) | SLOPE(%) | STREETFLOW (CFS) | DESIGNFLOW (CFS) | 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 | 1 | A | 0.095 | 0.85 | 5.00 | 0.08 | 8.82 | 0.71 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| B | Building | 5 | B | 0.085 | 0.85 | 5.00 | 0.07 | 8.82 | 0.64 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| C | Building | 11 | C | 0.065 | 0.85 | 5.00 | 0.06 | 8.82 | 0.49 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| D | Landscape, Parking and Drives | 9 | D | 0.661 | 0.83 | 5.00 | 0.55 | 8.82 | 4.83 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| E | Landscape and Drives | 10 | E | 0.351 | 0.62 | 5.00 | 0.22 | 8.82 | 1.91 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| F | Landscape and Drives | 2 | F | 0.097 | 0.49 | 5.61 | 0.05 | 8.55 | 0.40 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| G | Landscape | 3 | G | 0.067 | 0.52 | 13.54 | 0.03 | 6.19 | 0.22 | | | | | | | | | | | | | |
| H | Landscape | 7 | H | 0.043 | 0.49 | 10.12 | 0.02 | 7.00 | 0.15 | | | | | | | | | | | | | |
| OS-1 | Landscape | 20 | OS-1 | 0.060 | 0.51 | 9.39 | 0.03 | 7.21 | 0.22 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| OS-2 | Landscape and Drives | 22 | OS-2 | 0.060 | 0.60 | 5.00 | 0.04 | 8.82 | 0.32 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| OS-3 | Landscape and Drives | 23 | OS-3 | 0.009 | 0.85 | 5.00 | 0.01 | 8.82 | 0.07 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| RED-1 | Offsite Landscape and Drives | 21 | RED-1 | 0.260 | 0.80 | 5.00 | 0.21 | 8.82 | 1.83 | | | | | -- | -- | -- | -- | -- | -- | -- | | |
| SLICE-1 | Offsite Landscape and Drives | 23 | SLICE-1 | 0.931 | 0.68 | 10.59 | 0.63 | 6.87 | 4.34 | | | | | -- | -- | -- | -- | -- | -- | -- | | |

(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 IN A SUMP OR SAG LOCATION

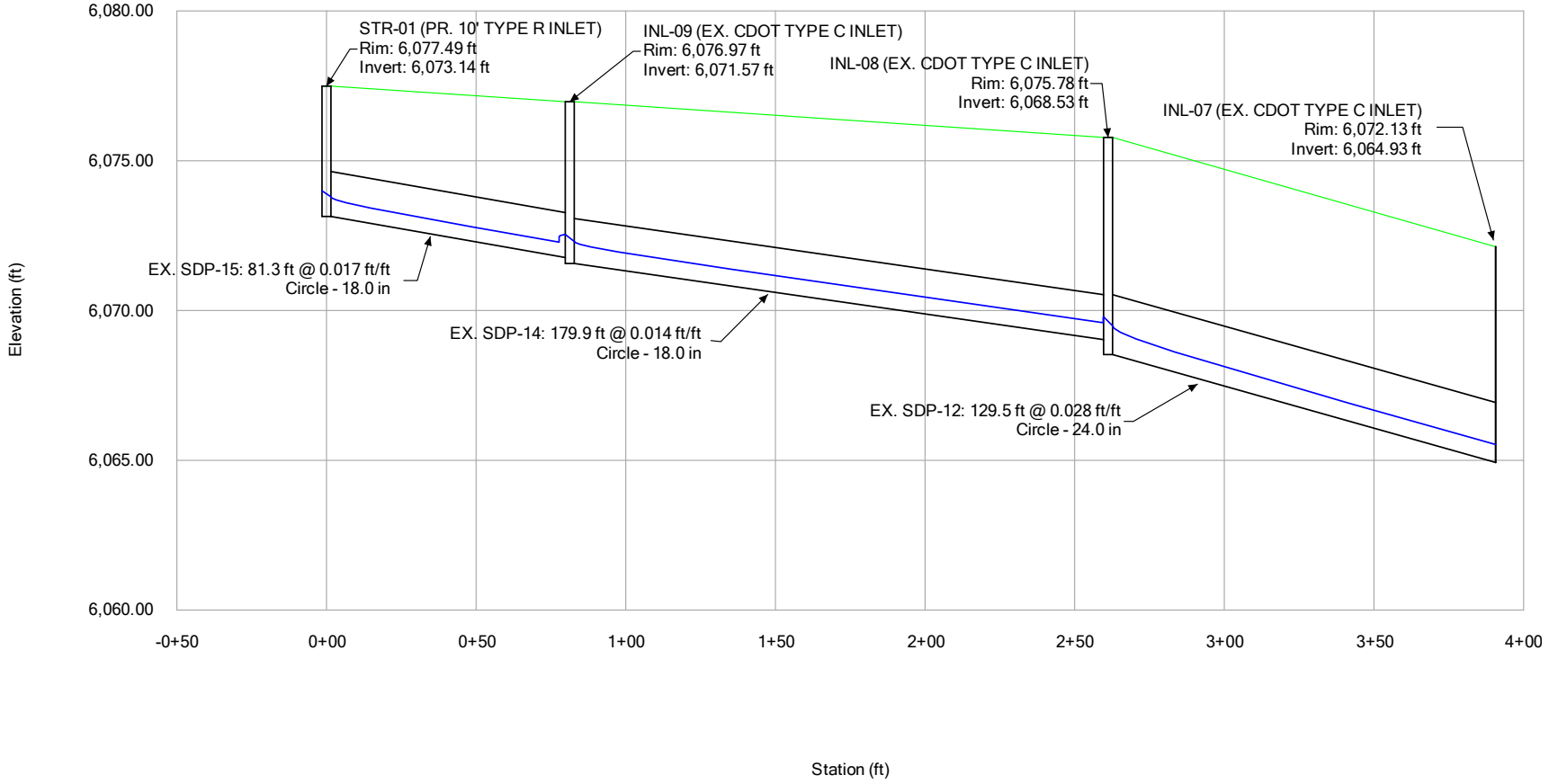
**Version 4.06 Released August 2018**




| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 1 | 1 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 5.2 | 5.2 | inches |
| **Grate Information** | | MINOR | MAJOR | ☐ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 10.00 | 10.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 1.00 | 1.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| **Grate Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | N/A | N/A | |
| Clogging Factor for Multiple Units | Clog = | N/A | N/A | |
| **Grate Capacity as a Weir (based on Modified HEC22 Method)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{wa}$ = | N/A | N/A | cfs |
| **Grate Capacity as a Orifice (based on Modified HEC22 Method)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{oa}$ = | N/A | N/A | cfs |
| **Grate Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | N/A | N/A | cfs |
| Interception with Clogging | $Q_{ma}$ = | N/A | N/A | cfs |
| **Resulting Grate Capacity (assumes clogged condition)** | **$Q_{Grate}$ =** | **N/A** | **N/A** | **cfs** |
| **Curb Opening Flow Analysis (Calculated)** | | MINOR | MAJOR | |
| Clogging Coefficient for Multiple Units | Coef = | 1.25 | 1.25 | |
| Clogging Factor for Multiple Units | Clog = | 0.06 | 0.06 | |
| **Curb Opening as a Weir (based on Modified HEC22 Method)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{wi}$ = | 7.8 | 7.8 | cfs |
| Interception with Clogging | $Q_{wa}$ = | 7.3 | 7.3 | cfs |
| **Curb Opening as an Orifice (based on Modified HEC22 Method)** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{oi}$ = | 18.2 | 18.2 | cfs |
| Interception with Clogging | $Q_{oa}$ = | 17.1 | 17.1 | cfs |
| **Curb Opening Capacity as Mixed Flow** | | MINOR | MAJOR | |
| Interception without Clogging | $Q_{mi}$ = | 11.1 | 11.1 | cfs |
| Interception with Clogging | $Q_{ma}$ = | 10.4 | 10.4 | cfs |
| **Resulting Curb Opening Capacity (assumes clogged condition)** | **$Q_{Curb}$ =** | **7.3** | **7.3** | **cfs** |
| **Resultant Street Conditions** | | MINOR | MAJOR | |
| Total Inlet Length | L = | 10.00 | 10.00 | feet |
| Resultant Street Flow Spread (based on street geometry from above) | T = | 15.0 | 15.0 | ft |
| Resultant Flow Depth at Street Crown | $d_{CROWN}$ = | 0.0 | 0.0 | inches |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.35 | 0.35 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.49 | 0.49 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.88 | 0.88 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **7.3** | **7.3** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | $Q_{PEAK\ REQUIRED}$ = | 2.3 | 4.8 | cfs |

# Profile Report

## Engineering Profile - STR-01 to INL-09 to INL-08 to INL-07 (5-Year Storm)



# Conduit FlexTable: Combined Pipe/Node Report (5-Year Storm)

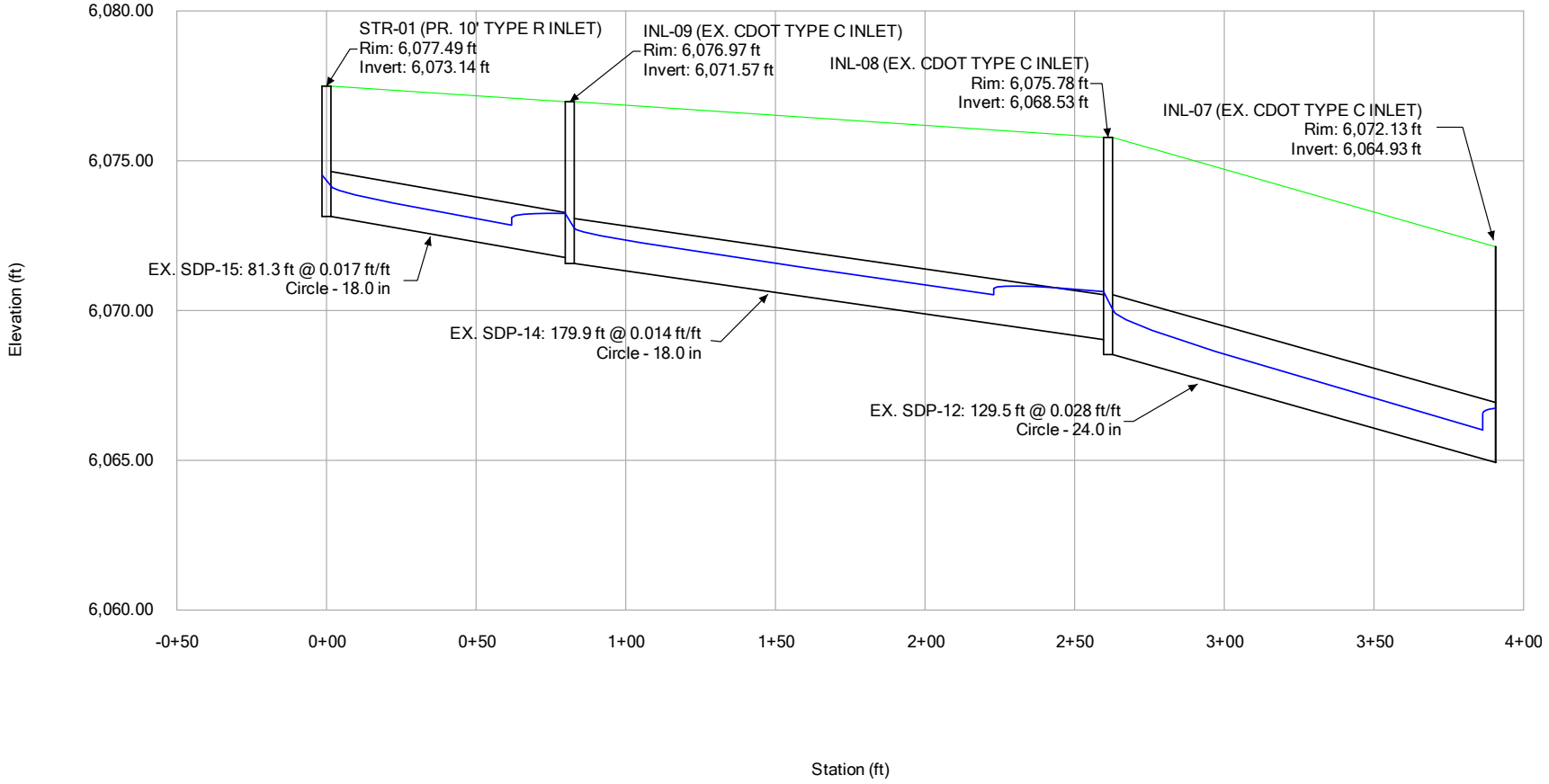
| Label | Start Node | Stop Node | Branch ID | Branch Element ID | Length (Unified) (ft) | System Intensity (in/h) |
|---|---|---|---|---|---|---|
| EX. SDP-15 | STR-01 (PR. 10' TYPE R INLET) | INL-09 (EX. CDOT TYPE C INLET) | 1 | 1 | 81.3 | 8.000 |
| EX. SDP-14 | INL-09 (EX. CDOT TYPE C INLET) | INL-08 (EX. CDOT TYPE C INLET) | 1 | 2 | 179.9 | 11.999 |
| EX. SDP-12 | INL-08 (EX. CDOT TYPE C INLET) | INL-07 (EX. CDOT TYPE C INLET) | 1 | 3 | 129.5 | 11.996 |

| System Intensity (in/h) | Flow (cfs) | Rise (Unified) (ft) | Capacity (Full Flow) (cfs) | Velocity (ft/s) | Invert (Start) (ft) | Invert (Stop) (ft) | Slope (Calculated) (ft/ft) | Hydraulic Grade Line (In) (ft) |
|---|---|---|---|---|---|---|---|---|
| 8.000 | 2.98 | 1.50 | 13.64 | 6.18 | 6,073.14 | 6,071.77 | 0.017 | 6,073.80 |
| 11.999 | 3.72 | 1.50 | 12.48 | 6.16 | 6,071.57 | 6,069.03 | 0.014 | 6,072.31 |
| 11.996 | 7.32 | 2.00 | 37.72 | 9.29 | 6,068.53 | 6,064.93 | 0.028 | 6,069.49 |

| Hydraulic Grade Line (Out) (ft) | Energy Grade Line (In) (ft) | Energy Grade Line (Out) (ft) | Manning's n | Upstream Structure Headloss Coefficient |
|---|---|---|---|---|
| 6,072.54 | 6,074.05 | 6,072.70 | 0.013 | 0.800 |
| 6,069.79 | 6,072.60 | 6,070.06 | 0.013 | 0.800 |
| 6,065.53 | 6,069.86 | 6,066.87 | 0.013 | 0.800 |

# Profile Report

## Engineering Profile - STR-01 to INL-09 to INL-08 to INL-07 (100-Year Storm)

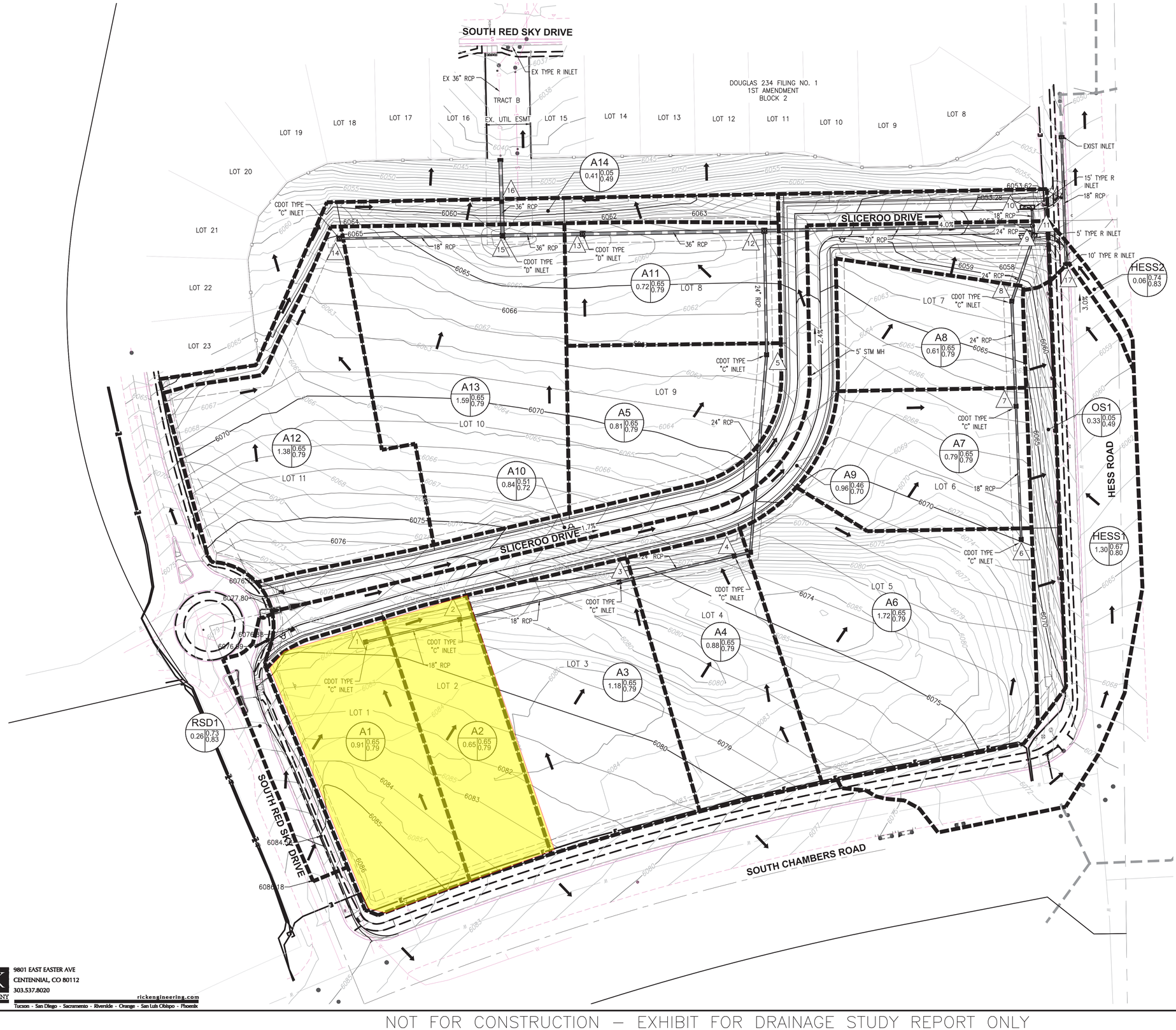


# Conduit FlexTable: Combined Pipe/Node Report (100-Year Storm)

| Label | Start Node | Stop Node | Branch ID | Branch Element ID | Length (Unified) (ft) | System Intensity (in/h) |
|---|---|---|---|---|---|---|
| EX. SDP-15 | STR-01 (PR. 10' TYPE R INLET) | INL-09 (EX. CDOT TYPE C INLET) | 1 | 1 | 81.3 | 8.000 |
| EX. SDP-14 | INL-09 (EX. CDOT TYPE C INLET) | INL-08 (EX. CDOT TYPE C INLET) | 1 | 2 | 179.9 | 11.999 |
| EX. SDP-12 | INL-08 (EX. CDOT TYPE C INLET) | INL-07 (EX. CDOT TYPE C INLET) | 1 | 3 | 129.5 | 11.997 |

| System Intensity (in/h) | Flow (cfs) | Rise (Unified) (ft) | Capacity (Full Flow) (cfs) | Velocity (ft/s) | Invert (Start) (ft) | Invert (Stop) (ft) | Slope (Calculated) (ft/ft) | Hydraulic Grade Line (In) (ft) |
|---|---|---|---|---|---|---|---|---|
| 8.000 | 6.95 | 1.50 | 13.64 | 7.76 | 6,073.14 | 6,071.77 | 0.017 | 6,074.16 |
| 11.999 | 9.35 | 1.50 | 12.48 | 7.75 | 6,071.57 | 6,069.03 | 0.014 | 6,072.75 |
| 11.997 | 17.55 | 2.00 | 37.72 | 11.79 | 6,068.53 | 6,064.93 | 0.028 | 6,070.04 |

| Hydraulic Grade Line (Out) (ft) | Energy Grade Line (In) (ft) | Energy Grade Line (Out) (ft) | Manning's n | Upstream Structure Headloss Coefficient |
|---|---|---|---|---|
| 6,073.24 | 6,074.62 | 6,073.48 | 0.013 | 0.800 |
| 6,070.63 | 6,073.36 | 6,071.07 | 0.013 | 0.800 |
| 6,066.74 | 6,070.78 | 6,067.28 | 0.013 | 0.800 |




50 0 25 50 100

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
- 6058 EXISTING MINOR CONTOUR
- 6060 EXISTING MAJOR CONTOUR
- 6058 PROPOSED MINOR CONTOUR
- 6060 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 |


RICK ENGINEERING COMPANY
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303.537.8020
rickengineering.com
Tucson - San Diego - Sacramento - Riverside - Orange - San Luis Obispo - Phoenix


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

SHEET 2 OF 2

D-1173
DATE: JANUARY 25, 2021

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NOT FOR CONSTRUCTION – EXHIBIT FOR DRAINAGE STUDY REPORT ONLY

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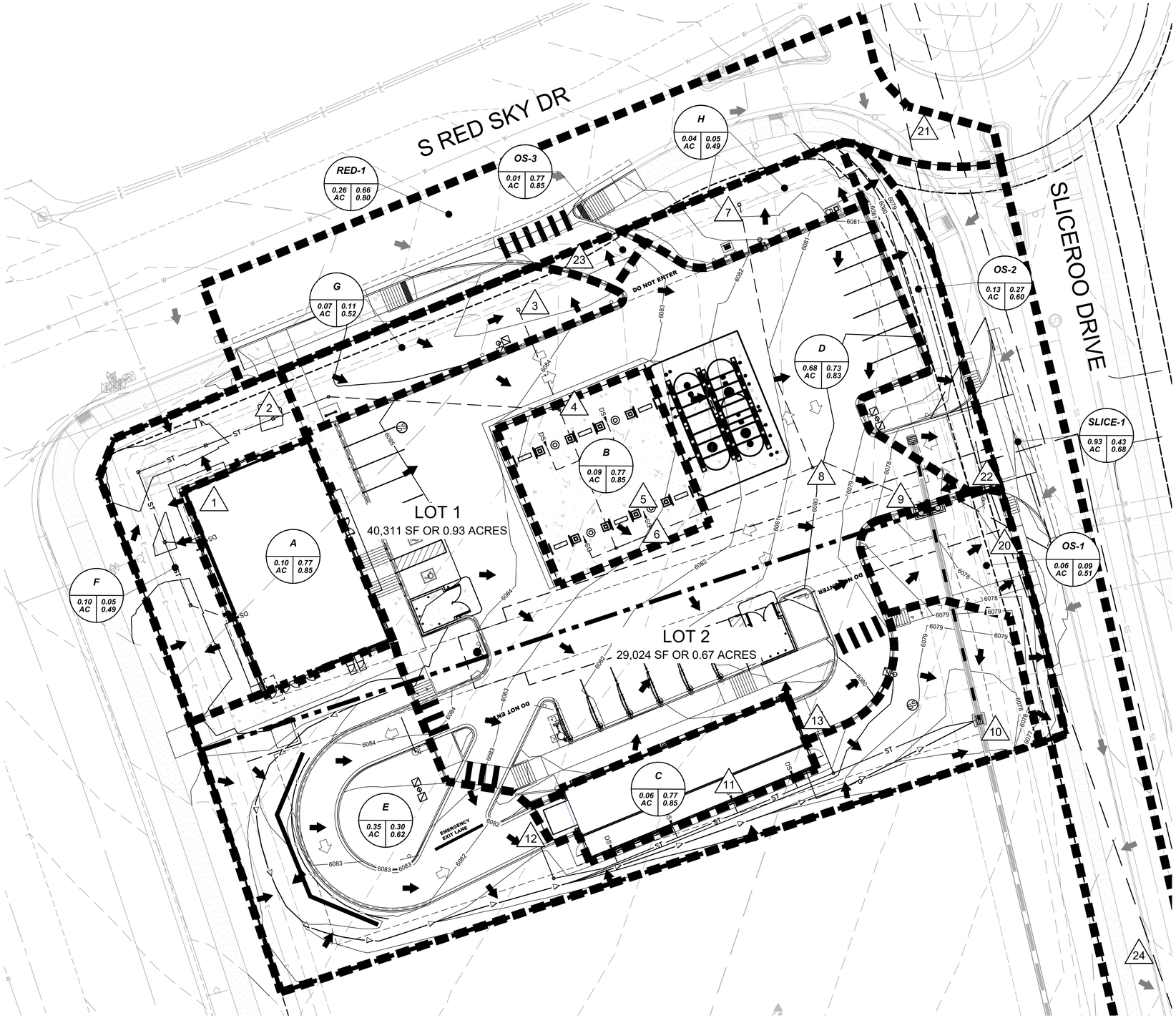


## LEGEND

- DS — PROPOSED DOWN SPOUT
- BASIN BOUNDARY
- PROPERTY LINE
- FLOW ARROW
- 1 — DESIGN POINT
- B — BASIN DESIGNATION
- 0.38 AC — BASIN AREA IN ACRES
- 0.71 — 5-YEAR RUNOFF COEFFICIENT
- 0.73 — 100-YEAR RUNOFF COEFFICIENT

N

0 20 40

1 INCH = 20 FT.

| 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 | 1 | 0.095 | 0.77 | 0.85 | 0.35 | 0.71 |
| B | 5 | 0.085 | 0.77 | 0.85 | 0.31 | 0.64 |
| C | 11 | 0.065 | 0.77 | 0.85 | 0.24 | 0.49 |
| D | 9 | 0.661 | 0.73 | 0.83 | 2.27 | 4.83 |
| E | 10 | 0.351 | 0.30 | 0.62 | 0.50 | 1.91 |
| F | 2 | 0.097 | 0.05 | 0.49 | 0.02 | 0.40 |
| G | 3 | 0.067 | 0.11 | 0.52 | 0.02 | 0.22 |
| H | 7 | 0.043 | 0.05 | 0.49 | 0.01 | 0.15 |
| OS-1 | 20 | 0.060 | 0.09 | 0.51 | 0.02 | 0.22 |
| OS-2 | 22 | 0.060 | 0.27 | 0.60 | 0.08 | 0.32 |
| OS-3 | 23 | 0.009 | 0.77 | 0.85 | 0.03 | 0.07 |
| RED-1 | 21 | 0.260 | 0.66 | 0.80 | 0.81 | 1.83 |
| SLICE-1 | 24 | 0.931 | 0.43 | 0.68 | 1.46 | 4.34 |

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
303-572-7957 www.eesus.com

CONSTRUCTION DOCUMENTS
**CONVENIENCE STORE**
12181 AND 12191 SLICEROO DRIVE, PARKER, CO 80134
**DRAINAGE MAP**

| | |
|---|---|
| PROJECT NO: | TWS015.01 |
| DESIGNED BY: | JLG |
| DRAWN BY: | JLG |
| DATE: | 12/13/2021 |

**D1.0**

12/12/2021 8:40 PM P:\TWINSTAR ENERGY\CO, PARKER - CHAMBERS & HESS\08 CAD\CDS\LOT 1\D1.0 - DRAINAGE PLAN.DWG