

1745 Shea Center Drive, 4th Floor  
Highlands Ranch, Colorado 80129  
www.vermilionpeak.com  
720-402-6070

February 12, 2025

Town of Parker  
Public Works Department  
20120 E. Mainstreet  
Parker, Colorado 80138

**Subject: Horse Creek Commercial  
Lot 10B, Douglas 234 Filing No. 6, Amendment 2  
Drainage Conformance Letter**

This letter and the attached drainage plan have been prepared for verification that the proposed improvements to the project site are in conformance with the approved drainage report for the original site development (“Final Drainage Report for Chambers and Hess Filing No. 1, Parker, Colorado”, prepared by Rick Engineering Company on January 25, 2021).

The project site is platted as Lot 10B, Douglas 234 Filing No. 6, Amendment 2. It is located in the SE ¼, Section 29, Township 6 South, Range 66 West of the Sixth Principal Meridian in the Town of Parker, Douglas County, Colorado. According to FEMA Flood Insurance Rate Map 08035C0181G, dated March 16, 2016 this property is located in Zone X which is defined as “Area of Minimal Flood Hazard”.

Proposed improvements consist of the construction of a 15,877 sf office building along with concrete walks, a paved parking lot and landscaped areas.

The project site has been divided into the following five basins for drainage analysis:

Basin A (0.36 acres, I=95%) contains the proposed building. All runoff from Basin A will be collected by a roof drain system at Design Point 1 and will be piped to the existing storm sewer on the east edge of the property. The 5-year and 100-year flowrates at Design Point 1 will be 1.4 cfs and 2.8 cfs, respectively. The overflow route is southerly to Basin C.

Basin B (0.18 acres, I=95%) contains pavement along the north edge of adjacent Lots 8A and 9A. Runoff will surface-drain to Basin C. The 5-year and 100-year flowrates at Design Point 2 will be 0.7 cfs and 1.4 cfs, respectively.

Basin C (0.72 acres, I=87%) contains the onsite parking lot, concrete walks and some small landscaped areas. Runoff from Basin C will also drain to a double Type 16 combination inlet in a 6” sump at Design Point 3. The cumulative 5-year and 100-year flowrates at Design Point 3 will be 3.1 cfs and 6.6 cfs, respectively.

Basin C also contains a single, on-grade Type 16 combination inlet a short distance uphill from the double inlets in the sump at Design Point 3. Only a small portion of Basin C is tributary to the single inlet, plus it is located on a 5% slope. Therefore, only a small amount of runoff will actually be collected by this inlet. Its main purpose is as a junction box to accept piped flows from the south and west, then pipe them out to the east to connect to an existing manhole. Therefore, it simplifies calculations to just assume that all flows bypass the single, on-grade inlet and continue downstream to the double Type 16 combination inlet at Design Point 3.

Basin D (0.32 acres, I=25%) contains landscaped areas on the west and east sides of the property. Runoff will drain to an existing Type D inlet in a 12" sump at Design Point 4. The 5-year and 100-year flowrates at Design Point 4 will be 0.3 cfs and 1.5 cfs, respectively.

Basin E (0.16 acres, I=20%) contains a landscaped slope on the east edge of the property. This basin will not be disturbed by the proposed development. Runoff will continue to sheetflow easterly to the adjacent single-family development. The 5-year and 100-year flowrates at Design Point 5 are 0.1 cfs and 0.7 cfs, respectively.

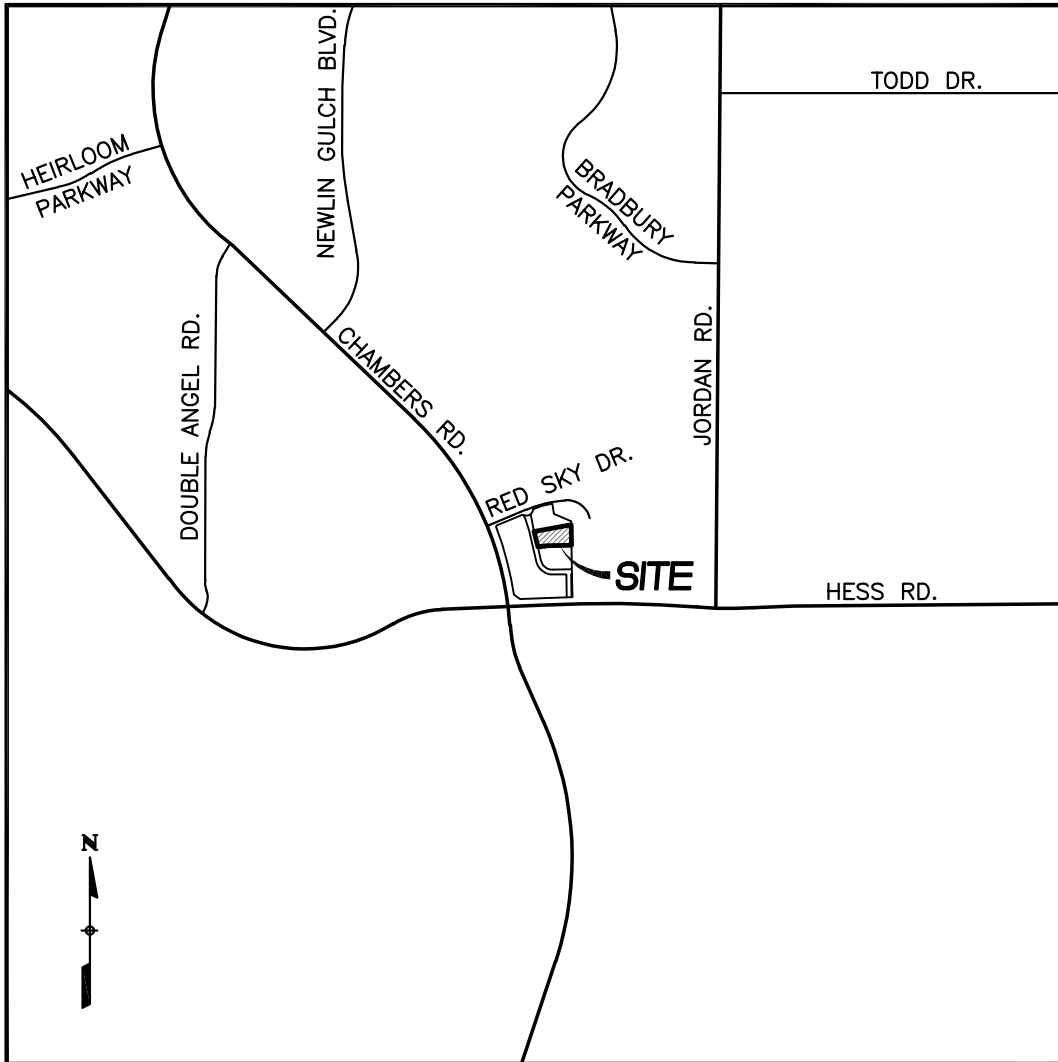
According to the Rick Engineering Report the project site was analyzed as Basin A13. This basin had an assumed imperviousness of 75% with 5-year and 100-year runoff rates of 4.9 cfs and 11.1 cfs, respectively. We have calculated a composite site imperviousness of 72% and total site runoff rates (including offsite Basin B) of 3.5 cfs and 8.8 cfs. Therefore, we conclude that all downstream storm sewer has more than adequate capacity to accept the developed runoff from the project site.

Existing public storm sewer will convey collected flows easterly to the existing detention and water quality facility known as "Pond A" which is located approximately 1,200 feet to the east, in Tract G, Douglas 234 Filing 1, 1<sup>st</sup> Amendment. This detention facility was sized to serve all of Douglas 234 Filing 1, including the project site. Runoff is released at regulated rates to storm sewer which carries flows northerly to KOA Tributary, which flows approximately 1 mile northeast to Cherry Creek.

The proposed drainage patterns and peak flowrates for Lot 10B, Douglas 234 Filing No. 6, Amendment 2 are in substantial compliance with the previously approved drainage study. Therefore, no additional improvements to drainage infrastructure are required for the development of this site.

**Vermilion Peak Engineering LLC**  
Brian Krombein, PE, PLS  
Colorado PE No. 34294





VICINITY MAP

SCALE: 1"=2000'

# National Flood Hazard Layer FIRMMette



104°48'19"W 39°29'55"N



## Legend

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

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i>
		With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i>
		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 <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
		Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i>
		Area with Flood Risk due to Levee <i>Zone D</i>
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i>
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard <i>Zone D</i>
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance
		17.5 Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
MAP PANELS		Jurisdiction Boundary
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Digital Data Available
		No Digital Data Available
		Unmapped

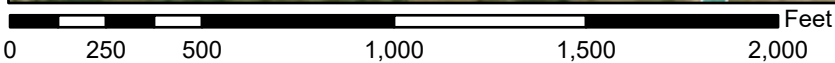


The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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 1/29/2025 at 10:53 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.



1:6,000

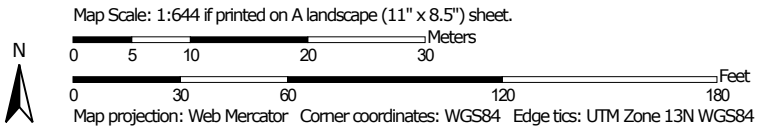
104°47'42"W 39°29'27"N

Basemap Imagery Source: USGS National Map 2023

Soil Map—Castle Rock Area, Colorado




Soil Map may not be valid at this scale.




## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

### 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 17, Aug 29, 2024

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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.

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
NsE	Newlin-Satanta complex, 5 to 20 percent slopes	1.5	100.0%
<b>Totals for Area of Interest</b>		<b>1.5</b>	<b>100.0%</b>

## Castle Rock Area, Colorado

### NsE—Newlin-Satanta complex, 5 to 20 percent slopes

#### Map Unit Setting

*National map unit symbol:* jqzh  
*Elevation:* 5,500 to 6,600 feet  
*Mean annual precipitation:* 15 to 19 inches  
*Mean annual air temperature:* 49 to 51 degrees F  
*Frost-free period:* 120 to 135 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Newlin and similar soils:* 50 percent  
*Satanta and similar soils:* 30 percent  
*Minor components:* 20 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Newlin

##### Setting

*Landform:* Knobs, drainageways  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Unconformable sandy and gravelly and/or mixed source alluvium

##### Typical profile

*H1 - 0 to 8 inches:* gravelly sandy loam  
*H2 - 8 to 17 inches:* gravelly sandy clay loam  
*H3 - 17 to 22 inches:* gravelly sandy loam  
*H4 - 22 to 60 inches:* very gravelly sand

##### Properties and qualities

*Slope:* 5 to 20 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Well drained  
*Runoff class:* Medium  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.20 to 2.00 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water supply, 0 to 60 inches:* Low (about 3.8 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 6e  
*Hydrologic Soil Group:* B  
*Ecological site:* R049XC202CO - Loamy Foothill Palmer Divide  
*Hydric soil rating:* No

## Description of Satanta

### Setting

*Landform:* Knobs, drainageways  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Eolian deposits derived from mixed

### Typical profile

*H1 - 0 to 9 inches:* loam  
*H2 - 9 to 30 inches:* clay loam  
*H3 - 30 to 60 inches:* loam

### Properties and qualities

*Slope:* 5 to 10 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Well drained  
*Runoff class:* Medium  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum content:* 10 percent  
*Available water supply, 0 to 60 inches:* High (about 10.2 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 4e  
*Hydrologic Soil Group:* B  
*Ecological site:* R049XY214CO - Gravelly Foothill  
*Hydric soil rating:* No

## Minor Components

### Bresser

*Percent of map unit:* 6 percent  
*Hydric soil rating:* No

### Buick

*Percent of map unit:* 6 percent  
*Hydric soil rating:* No

### Truckton

*Percent of map unit:* 6 percent  
*Hydric soil rating:* No

### Aquic haplustolls

*Percent of map unit:* 2 percent  
*Landform:* Swales

*Hydric soil rating:* Yes

## **Data Source Information**

Soil Survey Area: Castle Rock Area, Colorado  
Survey Area Data: Version 17, Aug 29, 2024

### 2.4.1 Initial or Overland Flow Time

The initial or overland flow time,  $t_i$ , may be calculated using Equation 6-3:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}} \quad \text{Equation 6-3}$$

Where:

- $t_i$  = overland (initial) flow time (minutes)
- $C_5$  = runoff coefficient for 5-year frequency (from Table 6-4)
- $L_i$  = length of overland flow (ft)
- $S_o$  = average slope along the overland flow path (ft/ft).

Equation 6-3 is adequate for distances up to 300 feet in urban areas and 500 feet in rural areas. Note that in a highly urbanized catchment, the overland flow length is typically shorter than 300 feet due to effective man-made drainage systems that collect and convey runoff.

### 2.4.2 Channelized Flow Time

The channelized flow time (travel time) is calculated using the hydraulic properties of the conveyance element. The channelized flow time,  $t_t$ , is estimated by dividing the length of conveyance by the velocity. The following equation, Equation 6-4 (Guo 2013), can be used to determine the flow velocity in conjunction with Table 6-2 for the conveyance factor.

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t} \quad \text{Equation 6-4}$$

Where:

- $t_t$  = channelized flow time (travel time, min)
- $L_t$  = waterway length (ft)
- $S_o$  = waterway slope (ft/ft)
- $V_t$  = travel time velocity (ft/sec) =  $K\sqrt{S_o}$
- $K$  = NRCS conveyance factor (see Table 6-2).

**Table 6-2. NRCS Conveyance factors, K**

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

The time of concentration,  $t_c$ , is the sum of the initial (overland) flow time,  $t_i$ , and the channelized flow time,  $t_t$ , as per Equation 6-2.

### 2.4.3 First Design Point Time of Concentration in Urban Catchments

Equation 6-4 was solely determined by the waterway characteristics and using a set of empirical formulas. A calibration study between the Rational Method and the Colorado Urban Hydrograph Procedure (CUHP) suggests that the time of concentration shall be the lesser of the values calculated by Equation 6-2 and Equation 6-5 (Guo and Urbonas 2013).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}} \quad \text{Equation 6-5}$$

Where:

- $t_c$  = minimum time of concentration for first design point when less than  $t_c$  from Equation 6-1.
- $L_t$  = length of channelized flow path (ft)
- $i$  = imperviousness (expressed as a decimal)
- $S_t$  = slope of the channelized flow path (ft/ft).

Equation 6-5 is the regional time of concentration that warrants the best agreement on peak flow predictions between the Rational Method and CUHP when the imperviousness of the tributary area is greater than 20 percent. It was developed using the UDFCD database that includes 295 sample urban catchments under 2-, 5-, 10-, 50, and 100-yr storm events (MacKenzie 2010). It suggests that both initial flow time and channelized flow velocity are directly related to the catchment's imperviousness (Guo and MacKenzie 2013).

The first design point is defined as a node where surface runoff enters the storm drain system. For example, all inlets are "first design points" because inlets are designed to accept flow into the storm drain.

Typically, but not always, Equation 6-5 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, add the travel time for each relevant segment downstream.

### 2.4.4 Minimum Time of Concentration

Use a minimum  $t_c$  value of 5 minutes for urbanized areas and a minimum  $t_c$  value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

### 2.4.5 Common Errors in Calculating Time of Concentration

A common mistake in urbanized areas is to assume travel velocities that are too slow. Another common error is to not check the runoff peak resulting from only part of the catchment. Sometimes a lower portion of the catchment or a highly impervious area produces a larger peak than that computed for the whole catchment. This error is most often encountered when the catchment is long or the upper portion contains grassy open land and the lower portion is more developed.

Site-specific conditions may vary from the representative values presented in this chapter. The engineer is responsible for assuring that the selected imperviousness values represent the imperviousness of the catchment or the proposed development. During master planning or in early stages of design, select imperviousness values that are unlikely to be exceeded as final design plans are developed to avoid the need to increase the size of infrastructure during later design stages.

TABLE 6-2. RECOMMENDED IMPERVIOUSNESS BY LAND USE

LAND USE/DENSITY	IMPERVIOUSNESS
<b>Residential</b>	
Single-family Housing (SFH) – Rural (0 – 3 du/ac)	35%
SFH – Low & Medium-density (3 – 5 du/ac)	55%
SFH – High-density (5 - 20 du/ac)	65%
Manufactured Housing ( $\geq 10$ du/ac)	65%
Multi-family Housing (MFH) – Medium-density (5 – 20 du/ac)	65%
MFH – High-density MFH ( $>20$ du/ac)	70%
<b>Commercial</b>	
Commercial – Low-density	65%
Commercial – Medium- to High-density	80%
Commercial – Urban Core	90%
<b>Industrial/Institutional</b>	
Schools	55%
Office/institutional	65%
Industrial Areas	75%
Solar Fields, Gravel Cover <sup>1,2</sup>	60%
Solar Fields, Grass Cover <sup>1,2</sup>	45%
<b>Parks and Open Space</b>	
Open Space, Undisturbed Native Grasses	5%
Community Parks	25%
Neighborhood Parks	15%
Golf Courses	30%
Cemeteries	25%

Note: Recommended imperviousness values shown in the table are the minimum imperviousness values for a specific land use. It is the engineer's responsibility to select imperviousness values that appropriately reflect the actual density of the proposed development.

<sup>1</sup> Use these values at the master planning scale or when the specific layout of panels is not known. Use values from the surface type (Table 6-3) at the site planning and design stage when panel width, panel spacing, and panel orientation relative to contours are known.

<sup>2</sup> Assumes 1:1 ratio of panels to aisles. See MHFD's technical memorandum regarding *Determination of Solar Panel Field Runoff Coefficients and Imperviousness Values* for additional information on procedures to reflect other impervious areas such as roads and pads that may be part of a solar field and layouts with wider inter-panel spacing.

TABLE 6-3. RECOMMENDED IMPERVIOUSNESS BY SURFACE TYPES

SURFACE TYPES		IMPERVIOUSNESS
Roadways and Paved Streets		95%
Concrete Driveways and Walks		95%
Roofs		95%
Gravel	No Traffic (Pedestrian Use)	40%
	Low-traffic Areas (Maintenance Paths and Substations)	60%
	High-traffic Areas (Roadways and Parking)	80%
Disturbed Soil (Including Lawns, Managed/Active Turf, Landscaped Areas with Water-Wise Vegetation, and Uncompacted Gravel/Mulch Planting Beds)		20%
Undisturbed or Decompacted Soil (Native Grasses and Open Space Areas)		5%
Artificial Turfs <sup>1</sup>	Landscape Applications (without Subgrade Drainage Layer)	25% – 45%
	Sport Fields (with Underdrain Pipe System)	60% – 80%
Water Surfaces (Lakes/Reservoirs/Irrigation Ponds)		100%
Solar Fields <sup>2</sup>	Grass Cover (Varies with Panel Orientation Relative to Ground Contours)	10% – 45%
	Gravel Cover (Varies with Panel Orientation Relative to Ground Contours)	50% – 75%
Historic Flow Analysis, Greenbelts, Agricultural		5%
Newly Graded Areas		65%
Stormwater Control Measures <sup>3</sup>	Retention Ponds & Constructed Wetland Ponds	100%
	Rooftop Systems – Blue Roofs	95%
	Rooftop Systems – Green Roofs (extensive)	65%
	Rooftop Systems – Green Roofs (intensive)	50%
	Permeable Pavement – CGP/PGP/RGP	55%
	Permeable Pavement – PICP	45%
	Extended Detention Basins	25%
	Receiving Pervious Areas (incl. Grass Buffers & Grass Swales)	20%
Bioretention & Sand Filters	10%	

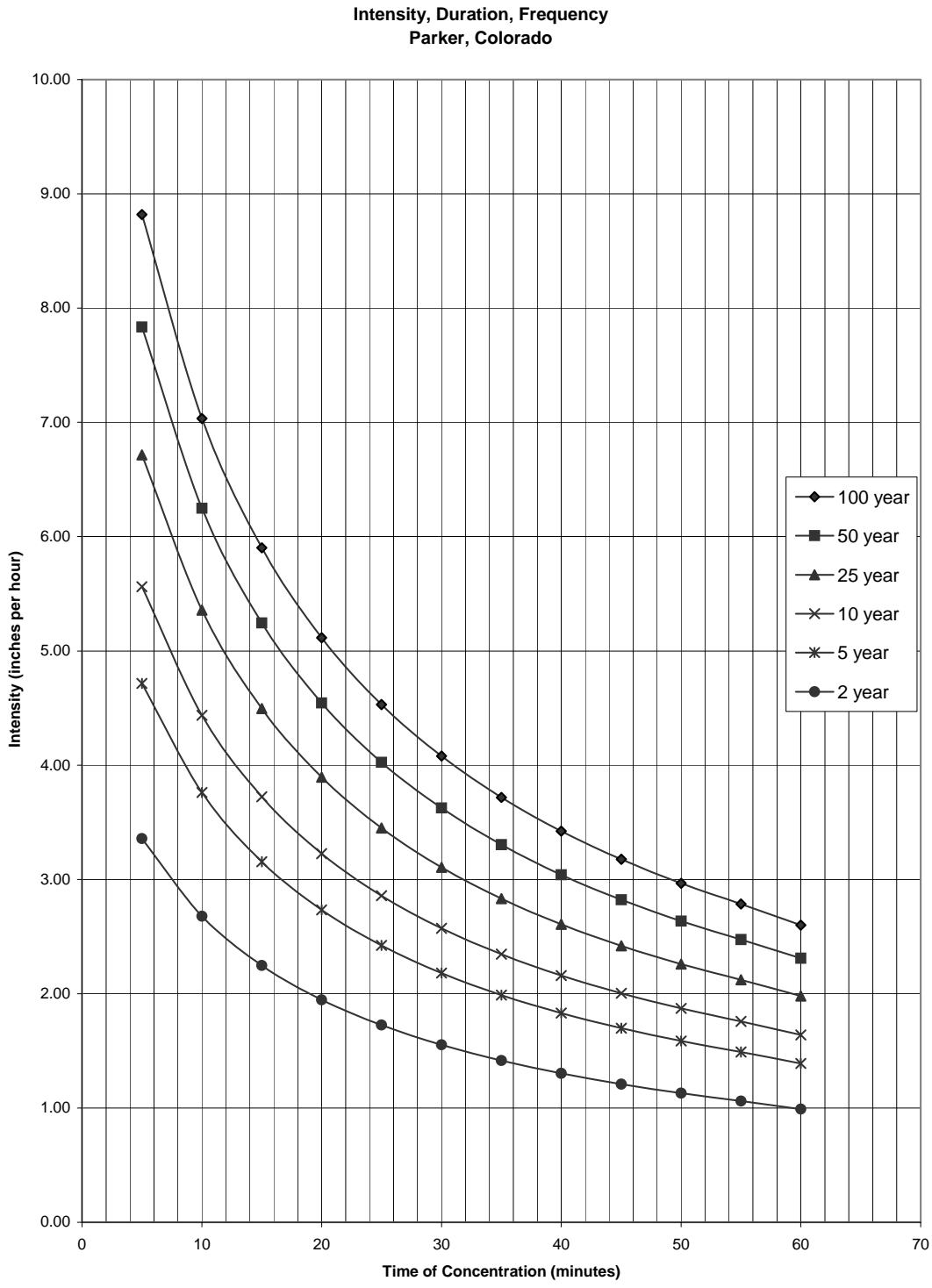
<sup>1</sup> Consult with the manufacturer to get a recommended value.

<sup>2</sup> Assumes 1:1 ratio of panels to aisles. See MHFD's technical memorandum regarding *Determination of Solar Panel Field Runoff Coefficients and Imperviousness Values* for additional information on procedures for determining percent imperviousness based on panel width, panel spacing, and panel orientation relative to ground contours and how to reflect other impervious areas such as roads and pads that may be part of a solar field and layouts with wider inter-panel spacing.

<sup>3</sup> See MHFD's technical memorandum regarding *Evaluation of Percent Imperviousness for Stormwater Control Measures* for background information.

TABLE 6-7. RUNOFF COEFFICIENTS, C, NRCS HSG B

TOTAL OR EFFECTIVE % IMPERVIOUS	NRCS HSG B						
	WQE & 2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.01	0.07	0.26	0.34	0.44	0.54
5%	0.03	0.03	0.10	0.28	0.36	0.45	0.55
10%	0.06	0.07	0.14	0.31	0.38	0.47	0.57
15%	0.09	0.11	0.18	0.34	0.41	0.50	0.59
20%	0.13	0.15	0.22	0.37	0.44	0.52	0.61
25%	0.17	0.19	0.26	0.41	0.47	0.54	0.63
30%	0.20	0.23	0.30	0.44	0.50	0.57	0.65
35%	0.24	0.27	0.34	0.47	0.52	0.59	0.66
40%	0.29	0.32	0.38	0.50	0.55	0.61	0.68
45%	0.33	0.36	0.42	0.53	0.58	0.64	0.70
50%	0.37	0.40	0.46	0.56	0.61	0.66	0.72
55%	0.42	0.45	0.50	0.59	0.63	0.68	0.74
60%	0.46	0.49	0.54	0.63	0.66	0.71	0.76
65%	0.50	0.54	0.58	0.66	0.69	0.73	0.77
70%	0.55	0.58	0.62	0.69	0.72	0.75	0.79
75%	0.60	0.63	0.66	0.72	0.75	0.77	0.81
80%	0.64	0.67	0.70	0.75	0.77	0.80	0.83
85%	0.69	0.72	0.74	0.78	0.80	0.82	0.85
90%	0.74	0.76	0.78	0.81	0.83	0.84	0.87
95%	0.79	0.81	0.82	0.85	0.86	0.87	0.88
100%	0.84	0.86	0.86	0.88	0.89	0.89	0.90



**FIGURE 5.1  
RAINFALL INTENSITY VERSUS DURATION CURVES FOR PARKER, COLORADO**

## COMPOSITE BASIN COEFFICIENTS

**Subdivision** Lot 10B, Douglas 234 Filing No. 6, Amendment 2  
**Location** \_\_\_\_\_

**Project Name:** Horse Creek Office Building  
**Project No.** 24020  
**Calculated By:** BK  
**Checked By:** BK  
**Date:** 1/30/25

**Total Area Basin A: 0.36 acres**

Land Use	Imp.	Area	% Imp.	C <sub>5</sub>	C <sub>100</sub>
Parking Lot/Roadway	95	0.00	0	* use Table 6-7 to obtain coefficient values.	
Rooftop	95	0.36	95		
Landscape/Open Space	20	0.00	0		
<b>TOTAL</b>		<b>0.36</b>	<b>95</b>	<b>0.81</b>	<b>0.87</b>

**Total Area Basin B: 0.18 acres**

Land Use	Imp.	Area	% Imp.	C <sub>5</sub>	C <sub>100</sub>
Parking Lot/Roadway	95	0.18	95	* use Table 6-7 to obtain coefficient values.	
Rooftop	95	0.00	0		
Landscape/Open Space	20	0.00	0		
<b>TOTAL</b>		<b>0.18</b>	<b>95</b>	<b>0.81</b>	<b>0.87</b>

**Total Area Basin C: 0.72 acres**

Land Use	Imp.	Area	% Imp.	C <sub>5</sub>	C <sub>100</sub>
Parking Lot/Roadway	95	0.64	84	* use Table 6-7 to obtain coefficient values.	
Rooftop	95	0.00	0		
Landscape/Open Space	20	0.08	2		
<b>TOTAL</b>		<b>0.72</b>	<b>87</b>	<b>0.74</b>	<b>0.83</b>

Note: Impervious values were obtained from Table 6-7 (MHFD Manual)

Composite C Values

**Total Area Basin D: 0.32 acres**

Land Use	Imp.	Area	% Imp.	C <sub>5</sub>	C <sub>100</sub>
Parking Lot/Roadway	95	0.02	6	* use Table 6-7 to obtain coefficient values.	
Rooftop	95	0.00	0		
Landscape/Open Space	20	0.30	19		
<b>TOTAL</b>		<b>0.32</b>	<b>25</b>	<b>0.19</b>	<b>0.54</b>

**Total Area Basin E: 0.16 acres**

Land Use	Imp.	Area	% Imp.	C <sub>5</sub>	C <sub>100</sub>
Parking Lot/Roadway	95	0.00	0	* use Table 6-7 to obtain coefficient values.	
Rooftop	95	0.00	0		
Landscape/Open Space	20	0.16	20		
<b>TOTAL</b>		<b>0.16</b>	<b>20</b>	<b>0.15</b>	<b>0.52</b>

**Entire Property 1.74 acres**

Land Use	Imp.	Area	% Imp.
Parking Lot/Roadway	95	0.84	46
Rooftop	95	0.36	20
Landscape/Open Space	20	0.54	6
<b>TOTAL</b>		<b>1.74</b>	<b>72</b>

## STANDARD FORM SF-2 TIME OF CONCENTRATION

**Subdivision** Lot 10B, Douglas 234 Filing No. 6, Amendment 2  
**Location** \_\_\_\_\_

**Project Name:** Horse Creek Office Building  
**Project No.** 24020  
**Calculated By:** BK  
**Checked By:** BK  
**Date:** 1/30/25

SUB-BASIN DATA			INITIAL/OVERLAND (T <sub>i</sub> )			TRAVEL TIME (T <sub>t</sub> )				T <sub>c</sub> CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	C <sub>s</sub>	L (FT)	S (%)	T <sub>i</sub> (MIN)	L (FT)	S (%)	VEL. (FPS)	T <sub>t</sub> (MIN)	COMP. T <sub>c</sub> (MIN)	TOTAL LENGTH(FT)	MIN. T <sub>c</sub> (MIN)	T <sub>c</sub> (MIN)
A	0.36	0.81	50	2.0	3.0	150	1.0	2.0	1.3	4.2	200.0	10.4	5.0
B	0.18	0.81	30	4.0	1.8	120	2.0	2.8	0.7	2.5	150.0	9.0	5.0
C	0.72	0.74	60	5.0	3.0	375	2.4	3.1	2.0	5.0	435.0	9.1	5.0
D	0.32	0.19	10	2.0	4.2	360	2.8	3.2	1.9	6.1	370.0	9.2	6.1
E	0.16	0.15	45	25.0	4.0	130	1.5	2.5	0.9	4.9	175.0	9.0	5.0

**NOTES:**  
 $T_i = (.395 * (1.1 - C_s) * (L)^{0.5}) / (S^{0.33})$   
 $T_t = L / 60V$  (Velocity From Fig. 6-4)  
 $T_c \text{ Check} = (26 - 17i) + L / \{60(14i + 9)\sqrt{S}\}$

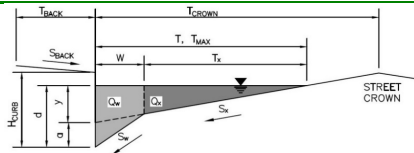




## ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

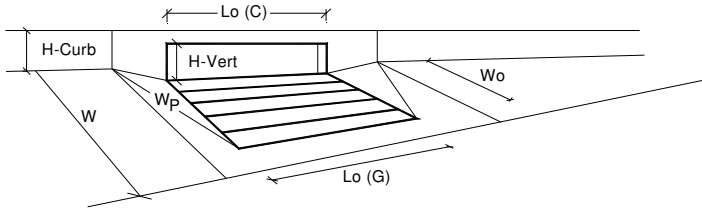
**Project:** Horse Creek Office Building  
**Inlet ID:** DP 3



<b>Gutter Geometry:</b>					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input type="text" value="0.0"/> ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input type="text"/> ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input type="text"/>				
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input type="text" value="6.00"/> inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input type="text" value="42.0"/> ft				
Gutter Width	$W = $ <input type="text" value="2.00"/> ft				
Street Transverse Slope	$S_x = $ <input type="text" value="0.020"/> ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input type="text" value="0.083"/> ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input type="text" value="0.000"/> ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input type="text" value="0.016"/>				
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = $ <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="padding: 2px 5px;">Minor Storm</td><td style="padding: 2px 5px;">Major Storm</td></tr><tr><td style="padding: 2px 5px; text-align: center;">42.0</td><td style="padding: 2px 5px; text-align: center;">42.0</td></tr></table> ft	Minor Storm	Major Storm	42.0	42.0
Minor Storm	Major Storm				
42.0	42.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = $ <table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="padding: 2px 5px;">Minor Storm</td><td style="padding: 2px 5px;">Major Storm</td></tr><tr><td style="padding: 2px 5px; text-align: center;">6.0</td><td style="padding: 2px 5px; text-align: center;">6.0</td></tr></table> inches	Minor Storm	Major Storm	6.0	6.0
Minor Storm	Major Storm				
6.0	6.0				
Check boxes are not applicable in SUMP conditions	<input type="checkbox"/> <input type="checkbox"/>				
<a href="#">MINOR STORM Allowable Capacity is not applicable to Sump Condition</a>					
<a href="#">MAJOR STORM Allowable Capacity is not applicable to Sump Condition</a>					
<b>Q<sub>allow</sub> =</b>	<table border="1" style="display: inline-table; border-collapse: collapse;"><tr><td style="padding: 2px 5px;">Minor Storm</td><td style="padding: 2px 5px;">Major Storm</td></tr><tr><td style="padding: 2px 5px; text-align: center;"><b>SUMP</b></td><td style="padding: 2px 5px; text-align: center;"><b>SUMP</b></td></tr></table> cfs	Minor Storm	Major Storm	<b>SUMP</b>	<b>SUMP</b>
Minor Storm	Major Storm				
<b>SUMP</b>	<b>SUMP</b>				

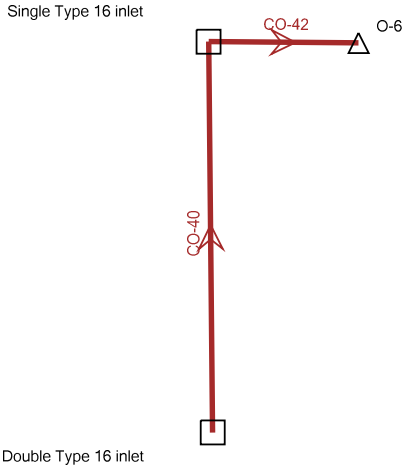
# INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)

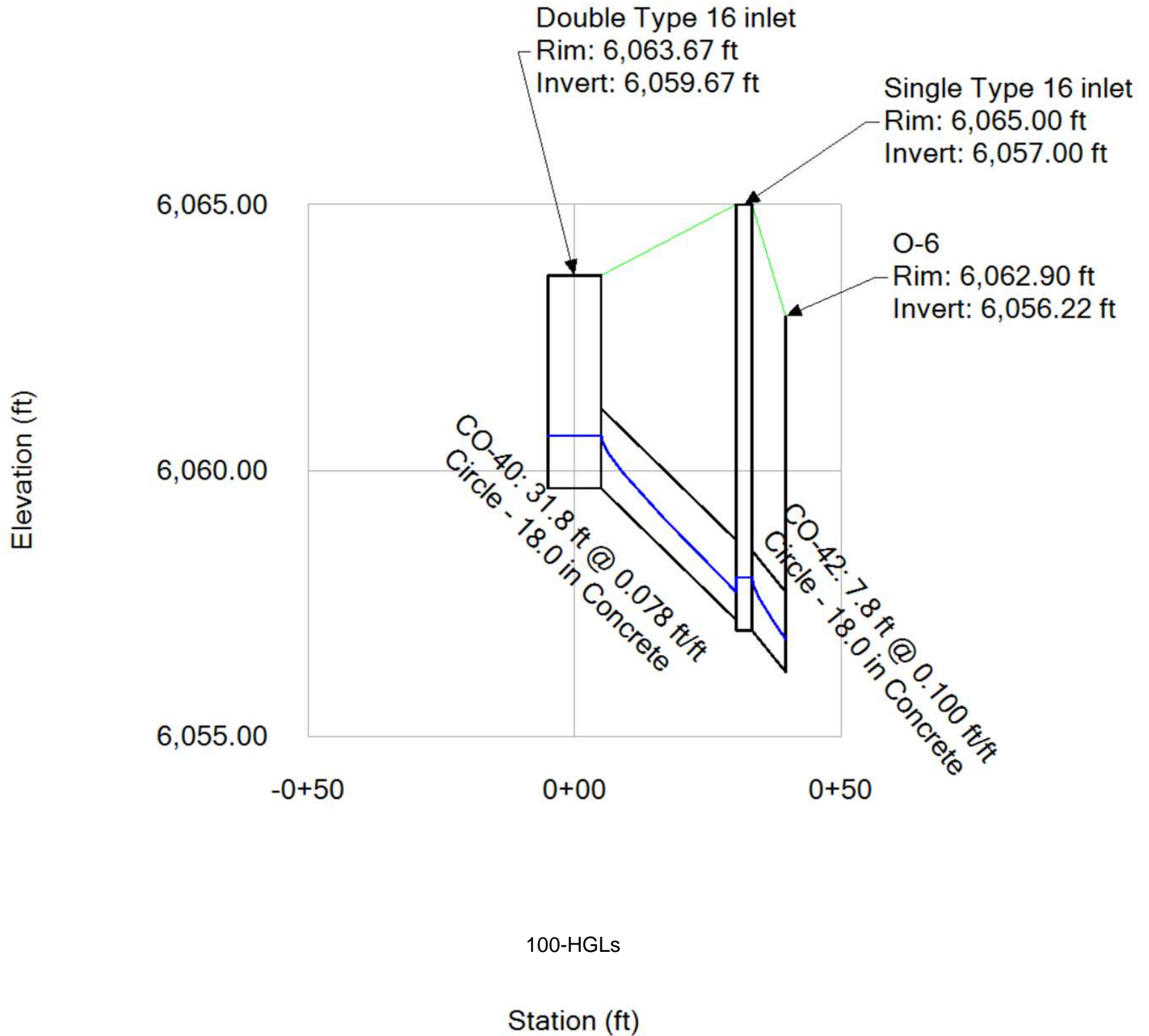


Design Information (Input)	MINOR	MAJOR	
Type of Inlet <span style="float: right;">Denver No. 16 Combination</span>	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	2	2	
Water Depth at Flowline (outside of local depression)	6.0	6.0	inches
<b>Grate Information</b>			
Length of a Unit Grate	3.00	3.00	feet
Width of a Unit Grate	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	0.60	0.60	
<b>Curb Opening Information</b>			
Length of a Unit Curb Opening	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	5.25	5.25	inches
Angle of Throat	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.66	0.66	
<b>Low Head Performance Reduction (Calculated)</b>			
Depth for Grate Midwidth	0.52	0.52	ft
Depth for Curb Opening Weir Equation	0.33	0.33	ft
Grated Inlet Performance Reduction Factor for Long Inlets	0.71	0.71	
Curb Opening Performance Reduction Factor for Long Inlets	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	0.71	0.71	
<b>Total Inlet Interception Capacity (assumes clogged condition)</b>			
<b>Inlet Capacity IS GOOD for Minor and Major Storms (&gt;Q Peak)</b>	<b>7.7</b>	<b>7.7</b>	<b>cfs</b>
Q <sub>PEAK REQUIRED</sub>	3.1	6.6	cfs

# Scenario: Base



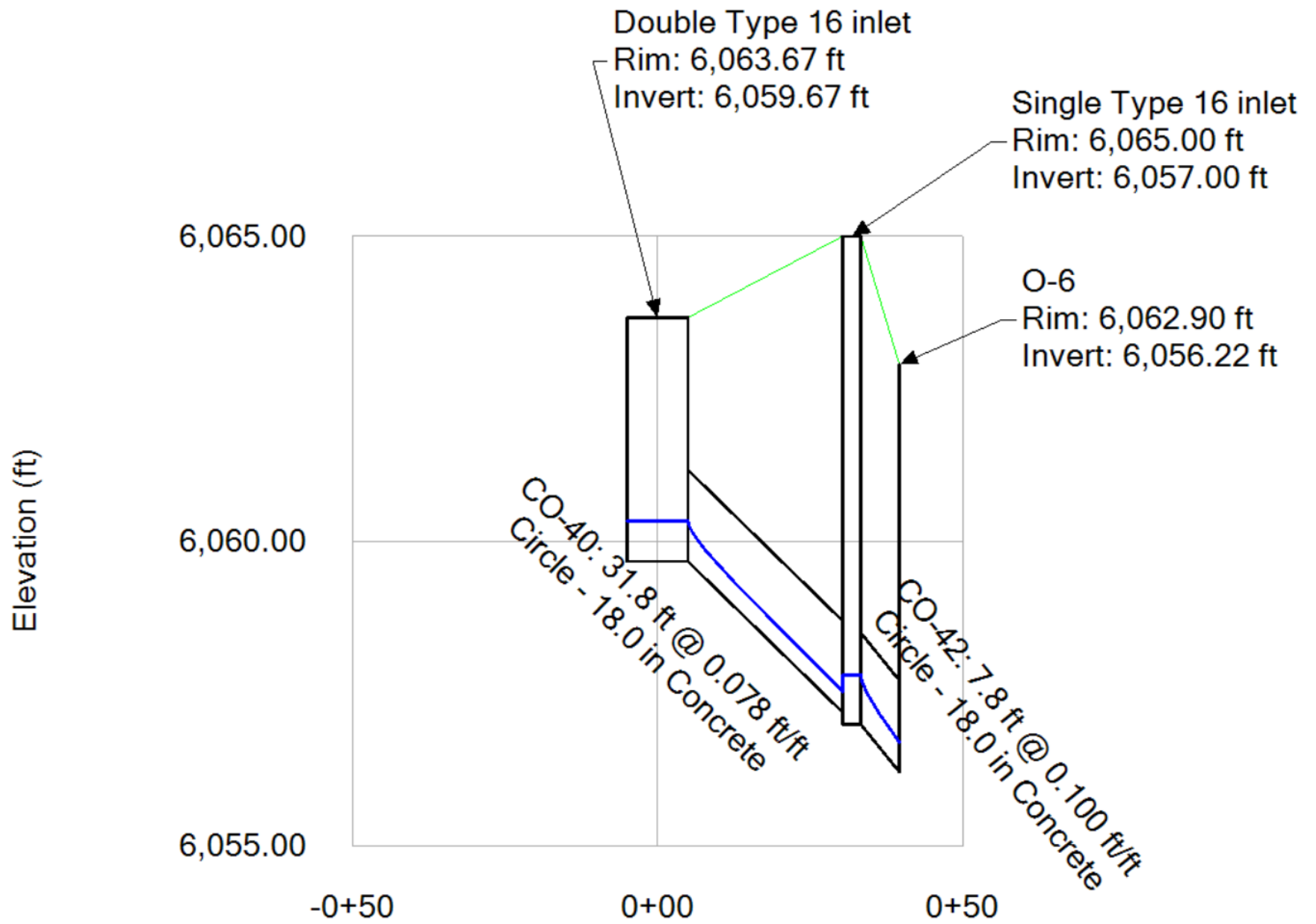
## HGL Calculations



### Network Elements FlexTable: HGL table

Label	Flow (cfs)	Diameter (in)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Time (Pipe Flow) (hours)	Hydraulic Grade Line (In) (ft)	Elevation Ground (Start) (ft)	Hydraulic Grade Line (Out) (ft)	Elevation Ground (Stop) (ft)
Double Type 16 inlet							6,060.66		6,060.66	
Single Type 16 inlet							6,058.19		6,058.19	
O-6										
CO-40	6.60	18.0	31.8	0.078	13.37	0.001	6,060.66	6,063.67	6,057.73	6,065.00
CO-42	9.40	18.0	7.8	0.100	16.15	0.000	6,058.19	6,065.00	6,056.99	6,062.90

100-yr HGLs



5-yr HGLs

Station (ft)

### Network Elements FlexTable: HGL table

Label	Flow (cfs)	Diameter (in)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Time (Pipe Flow) (hours)	Hydraulic Grade Line (In) (ft)	Elevation Ground (Start) (ft)	Hydraulic Grade Line (Out) (ft)	Elevation Ground (Stop) (ft)
Double Type 16 inlet							6,060.34		6,060.34	
Single Type 16 inlet							6,057.81		6,057.81	
O-6										
CO-40	3.10	18.0	31.8	0.078	10.77	0.001	6,060.34	6,063.67	6,057.54	6,065.00
CO-42	4.50	18.0	7.8	0.100	13.12	0.000	6,057.81	6,065.00	6,056.71	6,062.90

### 5-yr HGLs

**FINAL DRAINAGE REPORT  
FOR  
CHAMBERS AND HESS FILING NO. 1  
PARKER, COLORADO**

**Job Number: D-1173**

*Owner:*

**FIRST GUARDIAN GROUP, INC.**  
2025 Gateway Place, Suite 485  
San Jose, CA 95110

*Applicant/Developer:*

**REPUBLIC INVESTMENT GROUP**  
5750 DTC Parkway, Suite 160  
Greenwood Village, CO 80111

*Engineer:*

**RICK ENGINEERING COMPANY**  
9801 East Easter Avenue  
Centennial, CO 80112  
(303) 537-8020

January 25, 2021

## IV. DRAINAGE FACILITY DESIGN

### A. General Concept

Chambers and Hess Filing No. 1 eleven proposed commercial lots. The specific developments within the commercial lots are unknown currently. This report will quantify the runoff tributary from each commercial lot in sizing the storm drainage infrastructure. The proposed storm sewer system will provide a stub to each lot so that when the lot is developed, they can utilize the connection to the storm sewer system to convey runoff from each commercial lot. The commercial lots are designated to be a maximum of 75% impervious.

The drive and commercial lots will convey runoff to proposed storm inlets and ultimately to the existing storm sewer stub constructed in Tract B of Douglas 234 subdivision. There is no offsite runoff draining on the Chambers and Hess Filing No. 1. Runoff from Chambers and Hess Filing No. 1 is designated to be collected and conveyed by the proposed storm sewer system. Existing Pond "A" will ultimately receive the developed runoff from Chambers and Hess Filing No. 1.

The appendix contains design charts utilized to quantify developed runoff.

### B. Specific Details

The site is 13.80 acres and subdivided into 15 sub-basins to quantify developed storm runoff at various design points. Each sub-basin is evaluated for the proposed impervious improvements. Areas within the sub-basins are assigned land uses, Concrete or Asphalt Pavement, Drives and Walks, Landscape or lawns and Commercial areas. The Proposed Impervious calculation in the Appendix summarizes the percent impervious of each sub basin. Times of Concentrations are either calculated or assumed to be the minimum of 5 minutes. Design points are located to calculate runoff to determine if the drive has the capacity to convey runoff. Design points are also located at proposed inlets and manholes to calculate the cumulative effect of runoff as the runoff conveys downstream.

As previously discussed, each commercial lot will capture developed runoff that is conveyed to the storm sewer system constructed by this proposal. The proposed storm system will convey the major storm from each commercial lot to the existing storm sewer connection.

Referring to the proposed drainage map, sump inlets are located in Sliceroo Drive, near Hess Road at Design Points 9 and 10. The sump inlets are designed to provide 100% capture of the major storm. At no point does runoff ever exceed available street capacities for the minor or major storm.

### C. Discussion of Detention Storage Required for Full-Spectrum Detention

As previously discussed, Chambers and Hess Filing No. 1 is not required to have on site detention because the property was included in the tributary area to the existing detention Pond "A", about 1200 feet east of Chambers and Hess Filing No. 1. The appendices contain original design calculations for Pond "A". When Pond "A" was designed, the Chambers and Hess Filing No. 1 property was assigned a percent impervious of 95%. The proposed site impervious for Chambers and Hess Filing No. 1 is 68%. There is no additional drainage area tributary to Pond "A". Therefore, the detention volume requirements for Pond "A" are not adversely impacted by a

PROJECT: CHAMBERS AND HESS FILING NO. 1  
 SUBJECT: Proposed Impervious

JOB #: D01173  
 DATE: 1/25/2021  
 BY: BHE

Basin Name	Square Footage	Acres	Lawns/ Native Area (sf)	Lawns/ Native Area (Acres)	Asphalt/ Concrete (sf)	Asphalt/ Concrete (Acres)	Drives and Walks (sf)	Drives and Walks (Acres)	Surburban Commercial (sf)	Surburban Commercial (Acres)	Soil Type "C/D" Composite Runoff Factors			
											C <sub>2</sub>	C <sub>5</sub>	C <sub>100</sub>	I %
A1	39,679	0.91	0	0.00	0	0.00	0	0.00	39,679	0.91	0.60	0.65	0.79	75.0
A2	28,457	0.65	0	0.00	0	0.00	0	0.00	28,457	0.65	0.60	0.65	0.79	75.0
A3	51,364	1.18	0	0.00	0	0.00	0	0.00	51,364	1.18	0.60	0.65	0.79	75.0
A4	38,474	0.88	0	0.00	0	0.00	0	0.00	38,474	0.88	0.60	0.65	0.79	75.0
A5	35,369	0.81	0	0.00	0	0.00	0	0.00	35,369	0.81	0.60	0.65	0.79	75.0
A6	75,090	1.72	0	0.00	0	0.00	0	0.00	75,090	1.72	0.60	0.65	0.79	75.0
A7	34,360	0.79	0	0.00	0	0.00	0	0.00	34,360	0.79	0.60	0.65	0.79	75.0
A8	26,401	0.61	0	0.00	0	0.00	0	0.00	26,401	0.61	0.60	0.65	0.79	75.0
A9	41,603	0.96	19,881	0.46	16,022	0.37	5,700	0.13	0	0.00	0.40	0.46	0.70	51.8
A10	36,711	0.84	15,322	0.35	15,602	0.36	5,787	0.13	0	0.00	0.45	0.51	0.72	57.5
A11	31,512	0.72	0	0.00	0	0.00	0	0.00	31,512	0.72	0.60	0.65	0.79	75.0
A12	60,015	1.38	0	0.00	0	0.00	0	0.00	60,015	1.38	0.60	0.65	0.79	75.0
A13	69,307	1.59	0	0.00	0	0.00	0	0.00	69,307	1.59	0.60	0.65	0.79	75.0
A14	17,850	0.41	17,850	0.41	0	0.00	0	0.00	0	0.00	0.01	0.05	0.49	2.0
OS1	14,396	0.33	14,396	0.33	0	0.00	0	0.00	0	0.00	0.01	0.05	0.49	2.0
HESS1	56,658	1.30	12,553	0.29	39,461	0.91	4,644	0.11	0	0.00	0.62	0.67	0.80	77.5
HESS2	2,683	0.06	363	0.01	2,014	0.05	306	0.01	0	0.00	0.70	0.74	0.83	85.6
RSD1	11,469	0.26	1,583	0.04	7,920	0.18	1,966	0.05	0	0.00	0.69	0.73	0.83	84.8
Totals:	600,588	13.79	67,450	1.55	31,624	0.73	11,486	0.26	490,028	11.25	0.54	0.60	0.76	68.4

Land Use	Imp., I %
Lawns/Native Area	2%
Asphalt/Concrete	100%
Drives and Walks	90%
Surburban Commercial	75%

**STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)**

CALCULATED BY:  
DATE:  
CHECKED BY:

**BHE**  
**1/25/21**

**P1= 1.39**

**JOB NO: D01173**  
**PROJECT: CHAMBERS AND HESS FILING NO. 1**  
**DESIGN STORM: 5 Year**

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	Tt (min)	
A1	1	A1	0.91	0.65	5.0	0.59	4.71	<b>2.8</b>							2.8	1.7	18	102	6.1	0.3	INL-10 TO INL-09
A2	2	A2	0.65	0.65	5.0	0.42	4.71	<b>2.0</b>													
	2	A1+A2							5.3	1.02	4.65	<b>4.7</b>			4.7	1.4	18	178	6.5	0.5	INL-09 TO INL-08
A3	3	A3	1.18	0.65	5.0	0.77	4.71	<b>3.6</b>													
	3	A1-A3							5.7	1.78	4.54	<b>8.1</b>			8.1	2.8	24	125	9.5	0.2	INL-08 TO INL-07
A4	4	A4	0.88	0.65	5.0	0.57	4.71	<b>2.7</b>													
	4	A1-A4							6.0	2.36	4.49	<b>10.6</b>			10.6	1.8	24	228	8.7	0.4	INL-07 TO INL-05
A5			0.81	0.65	5.0	0.53	4.71	<b>2.5</b>													
	5	A1-A5							6.4	2.89	4.40	<b>12.7</b>			12.7	7.3	24	132	15.2	0.1	INL-05 TO SDMH-01
A6	6	A6	1.72	0.65	5.0	1.12	4.71	<b>5.3</b>						5.3	3.0	18	142	8.8	0.3	INL-14 TO INL-13	
A7	7	A6-A7	0.79	0.65	5.0	0.51	4.71	<b>2.4</b>	5.3	1.63	4.65	<b>7.6</b>			7.6	6.3	24	111	12.3	0.2	INL-13 TO INL-12
A8	8	A6-A8	0.61	0.65	5.0	0.39	4.71	<b>1.9</b>	5.4	2.03	4.61	<b>9.4</b>			9.4	4.6	24	72	11.8	0.1	INL-12 TO INL-11
RSD1			0.26	0.73	5.0	0.19	4.71	<b>0.9</b>					2.3	0.9				1096	2.9	6.2	TO INL-11
HESS2	9		0.06	0.74	5.0	0.05	4.71	<b>0.2</b>													TO INL-11
A9	9	A9+HESS2+RSD1	0.96	0.46	10.0	0.44	3.76	<b>1.7</b>	11.2	0.68	3.59	<b>2.4</b>									INL-11 DESIGN Q
	9	A6-A9+HESS2+RSD1							11.2	2.70	3.59	<b>9.7</b>			9.7	0.5	24	6	5.3	0.0	DP9: RUNOFF LEAVING INL-11 TO SDMH-02
A10	10	A10	0.84	0.51	9.8	0.43	3.79	<b>1.6</b>						1.6	0.5	18	19	3.3	0.1		INL-16 TO SDMH-02
	11	A6-A10+HESS2+RSD1							11.2	3.13	3.59	<b>11.2</b>			11.2	0.5	30	290	5.5	0.9	SDMH-02 TO SDMH-01
	12	A1-A10+HESS2+RSD1							12.1	6.02	3.48	<b>20.9</b>			20.9	0.5	36	194	6.5	0.5	SDMH-01 TO INL-04
A11	13	A1-A11+HESS2+RSD1	0.72	0.65	5.0	0.47	4.71	<b>2.2</b>	12.6	6.49	3.41	<b>22.1</b>			22.1	2.7	36	83	12.1	0.1	INL-04 TO INL-02
A12	14	A12	1.38	0.65	5.0	0.90	4.71	<b>4.2</b>						4.2	8.8	18	174	11.9	0.2		INL-03 TO INL-02
A13	15	A13	1.59	0.65	5.0	1.03	4.71	<b>4.9</b>													
	15	A1-A13+HESS2+RSD1							12.7	8.42	3.40	<b>28.6</b>			28.6	4.3	36	33	15.2	0.0	INL-02 TO INL-01



**STANDARD FORM SF-3  
STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)**

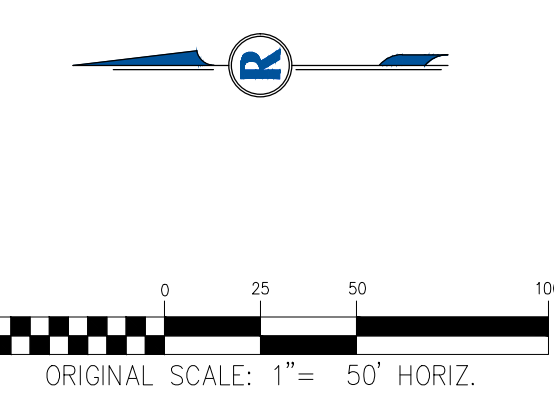
CALCULATED BY:  
DATE:  
CHECKED BY:

**BHE**  
**1/25/21**

**P1= 1.39**

**JOB NO: D01173**  
**PROJECT: CHAMBERS AND HESS FILING NO. 1**  
**DESIGN STORM: 5 Year**

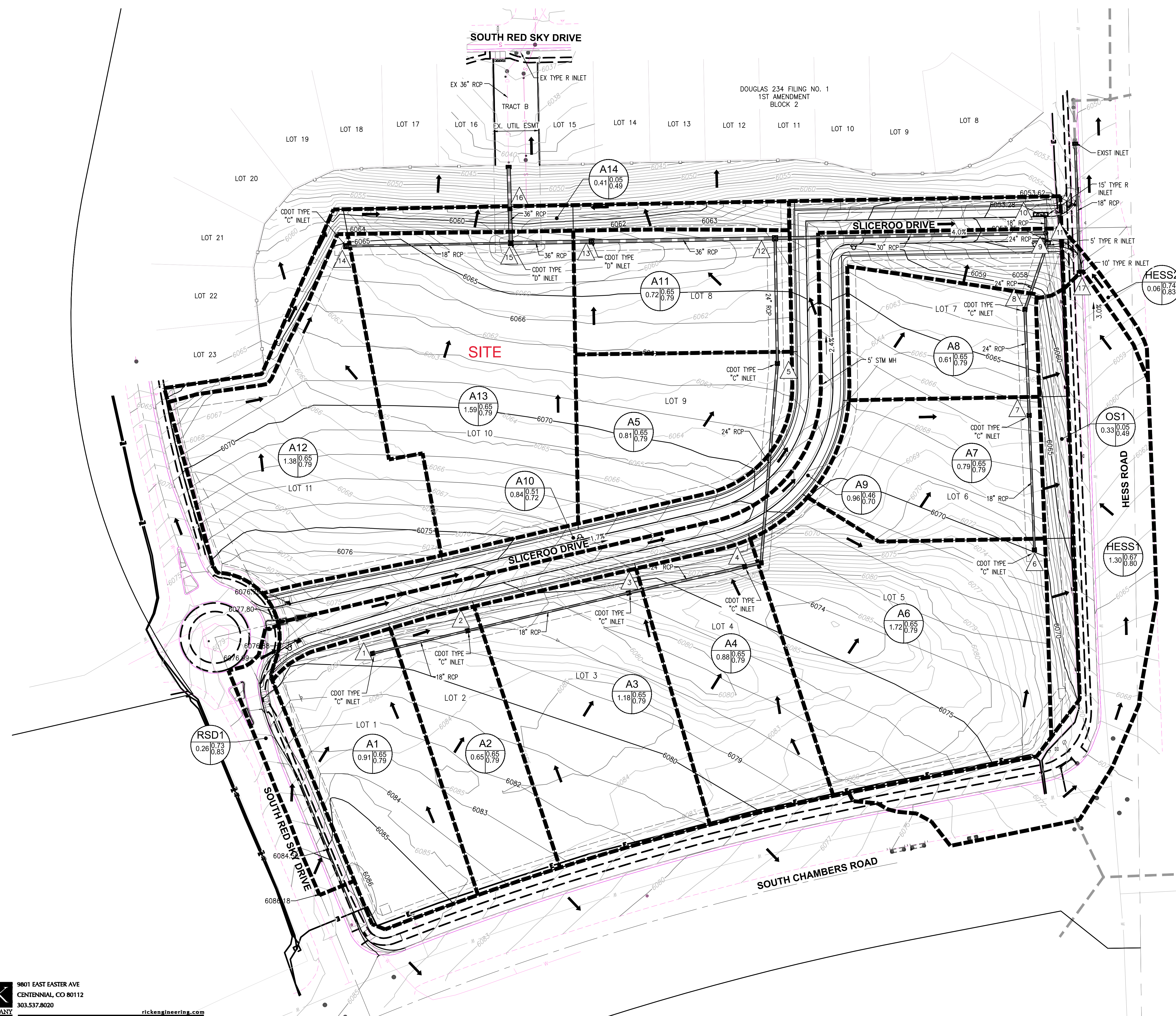
BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCITY (fps)	Tt (min)	
A1	1	A1	0.91	0.65	5.0	0.59	4.71	<b>2.8</b>							2.8	1.7	18	102	6.1	0.3	INL-10 TO INL-09
A2	2	A2	0.65	0.65	5.0	0.42	4.71	<b>2.0</b>													
	2	A1+A2							5.3	1.02	4.65	<b>4.7</b>			4.7	1.4	18	178	6.5	0.5	INL-09 TO INL-08
A3	3	A3	1.18	0.65	5.0	0.77	4.71	<b>3.6</b>													
	3	A1-A3							5.7	1.78	4.54	<b>8.1</b>			8.1	2.8	24	125	9.5	0.2	INL-08 TO INL-07
A4	4	A4	0.88	0.65	5.0	0.57	4.71	<b>2.7</b>													
	4	A1-A4							6.0	2.36	4.49	<b>10.6</b>			10.6	1.8	24	228	8.7	0.4	INL-07 TO INL-05
A5			0.81	0.65	5.0	0.53	4.71	<b>2.5</b>													
	5	A1-A5							6.4	2.89	4.40	<b>12.7</b>			12.7	7.3	24	132	15.2	0.1	INL-05 TO SDMH-01
A6	6	A6	1.72	0.65	5.0	1.12	4.71	<b>5.3</b>						5.3	3.0	18	142	8.8	0.3	INL-14 TO INL-13	
A7	7	A6-A7	0.79	0.65	5.0	0.51	4.71	<b>2.4</b>	5.3	1.63	4.65	<b>7.6</b>			7.6	6.3	24	111	12.3	0.2	INL-13 TO INL-12
A8	8	A6-A8	0.61	0.65	5.0	0.39	4.71	<b>1.9</b>	5.4	2.03	4.61	<b>9.4</b>			9.4	4.6	24	72	11.8	0.1	INL-12 TO INL-11
RSD1			0.26	0.73	5.0	0.19	4.71	<b>0.9</b>					2.3	0.9				1096	2.9	6.2	TO INL-11
HESS2	9		0.06	0.74	5.0	0.05	4.71	<b>0.2</b>													TO INL-11
A9	9	A9+HESS2+RSD1	0.96	0.46	10.0	0.44	3.76	<b>1.7</b>	11.2	0.68	3.59	<b>2.4</b>									INL-11 DESIGN Q
	9	A6-A9+HESS2+RSD1							11.2	2.70	3.59	<b>9.7</b>			9.7	0.5	24	6	5.3	0.0	DP9: RUNOFF LEAVING INL-11 TO SDMH-02
A10	10	A10	0.84	0.51	9.8	0.43	3.79	<b>1.6</b>						1.6	0.5	18	19	3.3	0.1		INL-16 TO SDMH-02
	11	A6-A10+HESS2+RSD1							11.2	3.13	3.59	<b>11.2</b>			11.2	0.5	30	290	5.5	0.9	SDMH-02 TO SDMH-01
	12	A1-A10+HESS2+RSD1							12.1	6.02	3.48	<b>20.9</b>			20.9	0.5	36	194	6.5	0.5	SDMH-01 TO INL-04
A11	13	A1-A11+HESS2+RSD1	0.72	0.65	5.0	0.47	4.71	<b>2.2</b>	12.6	6.49	3.41	<b>22.1</b>			22.1	2.7	36	83	12.1	0.1	INL-04 TO INL-02
A12	14	A12	1.38	0.65	5.0	0.90	4.71	<b>4.2</b>						4.2	8.8	18	174	11.9	0.2		INL-03 TO INL-02
A13	15	A13	1.59	0.65	5.0	1.03	4.71	<b>4.9</b>													
	15	A1-A13+HESS2+RSD1							12.7	8.42	3.40	<b>28.6</b>			28.6	4.3	36	33	15.2	0.0	INL-02 TO INL-01



**LEGEND**

- XX BASIN ID
- X.XX 5 YR. RUNOFF COEFFICIENT
- X.XX 100 YR. RUNOFF COEFFICIENT
- X.XX AREA IN ACRES
- X 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	PEAK RUNOFF		BASIN SUMMARY		
	5YR (CFS)	100YR (CFS)	BASIN	Q5 CFS	Q100 CFS
1	2.8	6.4	A1	2.8	6.4
2	4.7	10.8	A2	2.0	4.6
3	8.1	18.6	A3	3.6	8.2
4	10.6	24.3	A4	2.7	6.2
5	12.7	29.3	A5	2.5	5.7
6	5.3	12.0	A6	5.3	12.0
7	7.6	17.3	A7	2.4	5.5
8	9.4	21.4	A8	1.9	4.2
9	2.4	8.2	A9	1.7	4.7
10	1.6	4.3	A10	1.6	4.3
11	11.2	28.9	A11	2.2	5.0
12	20.9	51.4	A12	4.2	9.6
13	22.1	54.4	A13	4.9	11.1
14	4.2	9.6	A14	0.1	1.8
15	28.6	69.5	HESS1	3.5	7.8
16	28.7	70.8	HESS2	0.2	0.5
17	3.6	9.1	RSD1	0.9	1.9
			OS1	0.1	1.4



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

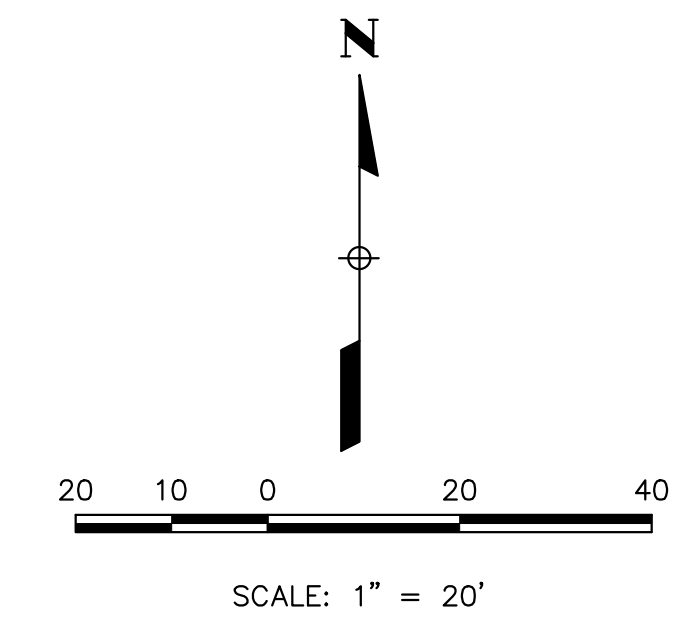
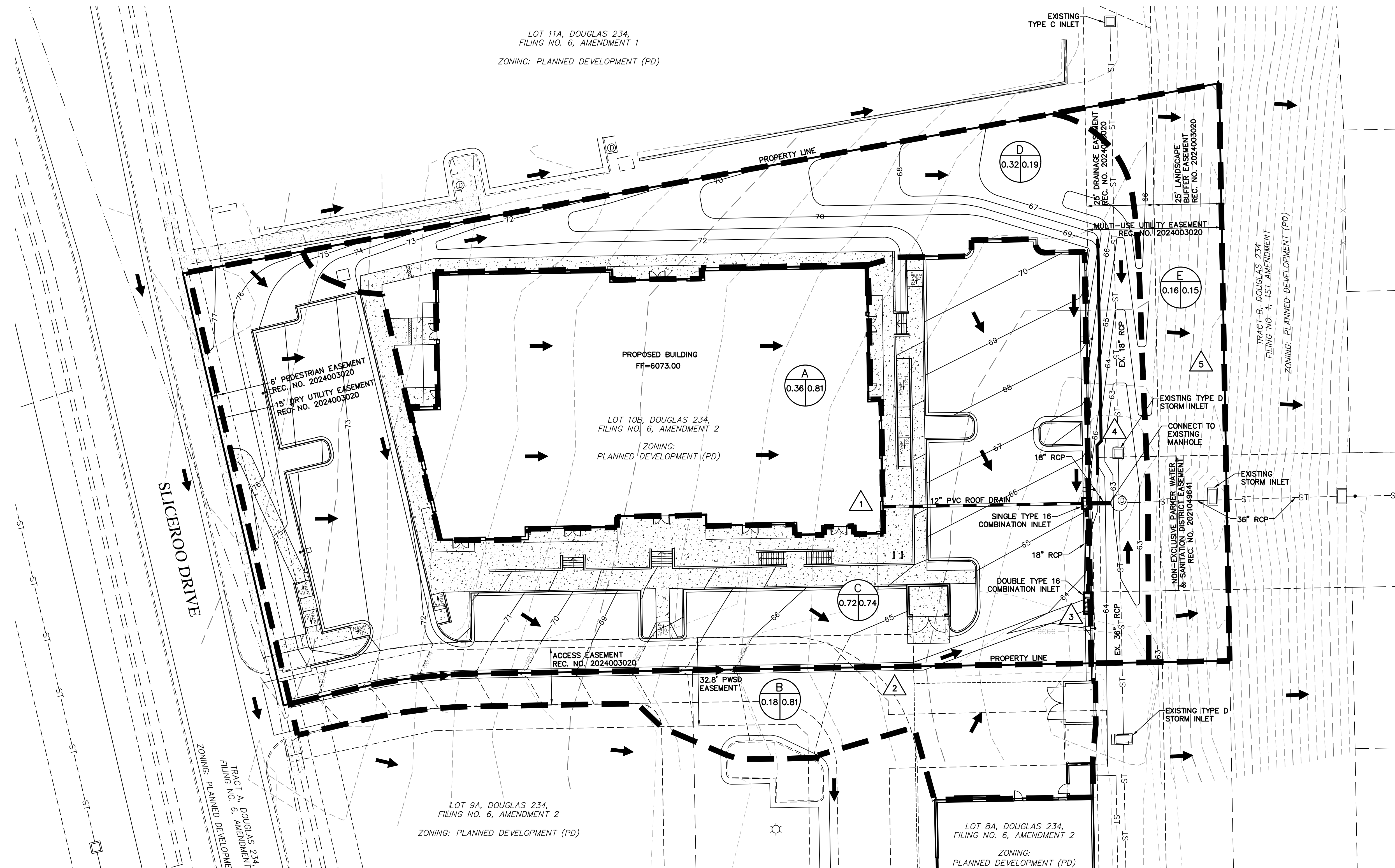
**POST-DEVELOPMENT DRAINAGE MAP FOR CHAMBERS & HESS FILING NO. 1**  
 SHEET 2 OF 2  
 D-1173  
 DATE: JANUARY 25, 2021

NOT FOR CONSTRUCTION – EXHIBIT FOR DRAINAGE STUDY REPORT ONLY

# FINAL DRAINAGE PLAN

## HORSE CREEK COMMERCIAL

LOT 10B, DOUGLAS 234 FILING NO. 6, AMENDMENT 2  
 A PORTION OF THE SW 1/4, SE 1/4, SECTION 29, T6S, R66W, 6TH P.M.  
 TOWN OF PARKER, COUNTY OF DOUGLAS, STATE OF COLORADO



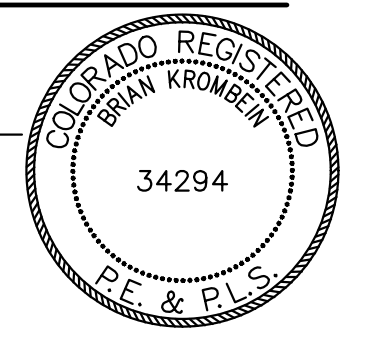
**LEGEND**

- PROPERTY LINE
- EXISTING CONTOUR
- EXISTING EASEMENT
- PROPOSED CONTOUR
- DRAINAGE FLOW DIRECTION
- EXISTING CURB & GUTTER
- 1' SPILL CURB
- 2' CATCH CURB
- PROPOSED RETAINING WALL
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- CONCRETE PAVEMENT
- SUB-BASIN BOUNDARY
- DESIGN POINT
- A = BASIN DESIGNATION  
B = AREA IN ACRES  
C = 5 YEAR RUNOFF COEFFICIENT

**BENCHMARK**  
 BENCHMARK IS BY GPS OBSERVATION NAVD 88.  
 SITE BENCHMARK AT NORTHWEST CORNER OF INLET  
 ON CHAMBERS RD. APPROXIMATELY 200' +/- NORTH  
 OF HESS RD.

**ENGINEER'S STATEMENT**  
 PREPARED UNDER MY SUPERVISION

BRIAN KROMBEIN, PE, PLS DATE  
 COLORADO PE NO. 34294  
 FOR AND ON BEHALF OF  
 VERMILION PEAK ENGINEERING LLC



**RUNOFF TABLE**

DRAINAGE BASIN	DESIGN POINT	CUMULATIVE CONTRIBUTING BASIN (ACRES)	CUMULATIVE Q <sub>s</sub> cfs	CUMULATIVE Q <sub>100</sub> cfs
A	1	0.36	1.4	2.8
B	2	0.18	0.7	1.4
C	3	0.72	3.1	6.6
D	4	0.32	0.3	1.5
E	5	0.16	0.1	0.7

FINAL DRAINAGE PLAN  
 DOUGLAS 234 FILING NO. 6, AMD. 2  
 JOB NO. 24020  
 DATE: FEBRUARY 12, 2025  
 SHEET 1 OF 1

**Vermilion Peak Engineering**  
 Civil Engineering & Land Surveying  
 1745 Shea Center Drive, 4th Floor  
 Highlands Ranch, CO 80129  
 720-402-6070 / vermillionpeak.com