Drainage Conformance Letter
For
SLIM CHICKENS
LOT 3 OF PARKER AND PINE FILING NO. 1
SWC OF S. PARKER ROAD AND E. PINE LANE, PARKER, COLORADO

06/12/2020

Prepared For Developer:

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ENGINEERS STATEMENT

This Drainage Conformance Letter for Lot 3 (Slim Chickens), of Parker and Pine 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.

Chris Mueller PE NCEES

Colorado P.E. License No. 5699

Seal and Date

Introduction

This Drainage Conformance Letter has been prepared for the proposed Slim Chickens restaurant located at Lot 3 of Parker and Pine 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 Parker & Pine Retail Final Drainage Report Version 1, prepared by Kimley Horn, and dated April, 2020, hereinafter called the "Master Drainage Report." This is the underlying Master Plan for the overall development encompassing the site. All infrastructure will be installed prior to this project's construction, and is labeling "existing" for purposes of this report.

Location

The project site located at the southwest corner of S. Parker Road and E. Pine Lane, Parker, Colorado. This development is located in the Southeast Quarter of Section 9, and part of the Northeast Quarter of Section 16, Township 6 South, Range 66 West of the 6th Principal Meridian, Town of Parker, County of Douglas, State of Colorado. The site is bounded by South Parker Road (State Highway No. 83) to the east, Pine Lane to north, Twenty Mile Road to the west, and a vacant lot to the south.

Existing Conditions

Lot 3 occupies approximately 0.87 acres of vacant land, covered with native grasses and weeds. The project site was studied in the Parker & Pine Final Drainage Report, Version 1, prepared by Kimley Horn, dated April, 2020. Per this Report, this site lies within Basin 7.0.

The existing site generally slopes to the west. As part of the Parker and Pine masterplanned development, internal streets will be built north and west, adjacent to this Lot. The existing underground storm drain system will convey stormwater to a detention pond, then discharge into Baldwin Gulch.

Proposed Conditions

An existing stormwater manhole is located along the west side of the Lot. This manhole will be converted to a street inlet in the Slim Chickens parking lot, and 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 Lot.

The impervious percentage assigned to this basin was 85%. The impervious percentage for the proposed Slim Chickens is calculated to be 70%. The allowed runoff is 7.35 cfs, which exceeds the proposed 5.30 cfs calculated for the Slim Chickens development. The proposed onsite inlet capacity is 6.3 cfs is greater

than the 5.2 cfs proposed 100-year runoff, and therefore the site complies with the Master Drainage Report.

Conclusion

Since the proposed development is lower in both imperviousness and runoff than allowed, by the Parker & Pine Master Drainage Report, the existing drainage facilities are sufficient to convey the runoff from the proposed Slim Chickens site, without onsite water quality or detention, and not negatively impact adjacent properties.

Attachments

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

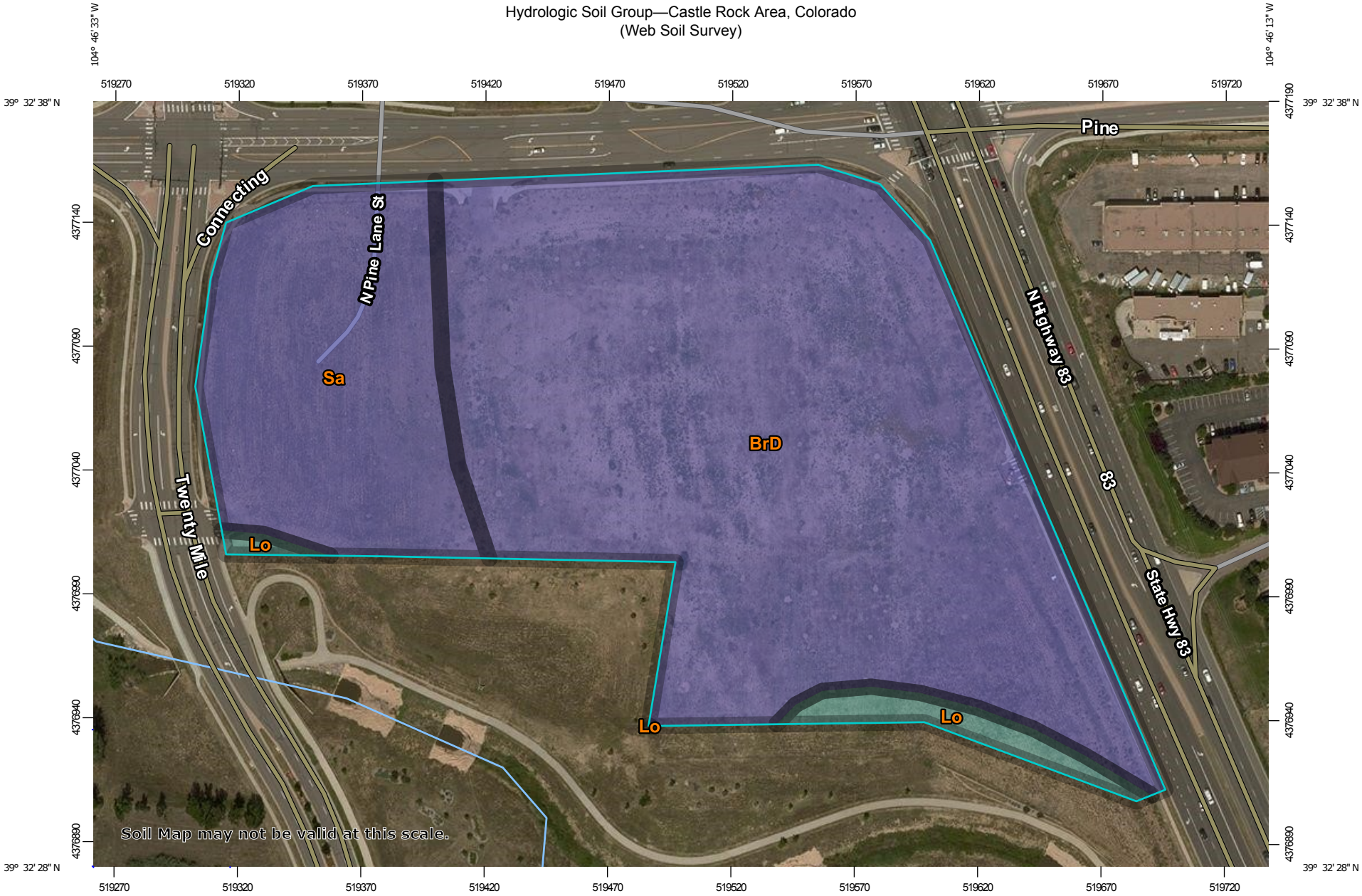
Table 6-3. Recommended percentage imperviousness values

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*

Total or Effective % Impervious	NRCS Hydrologic Soil Group A						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
2%	0.01	0.01	0.01	0.01	0.04	0.13	0.27
5%	0.02	0.02	0.02	0.03	0.07	0.15	0.29
10%	0.04	0.05	0.05	0.07	0.11	0.19	0.32
15%	0.07	0.08	0.08	0.1	0.15	0.23	0.35
20%	0.1	0.11	0.12	0.14	0.2	0.27	0.38
25%	0.14	0.15	0.16	0.19	0.24	0.3	0.42
30%	0.18	0.19	0.2	0.23	0.28	0.34	0.45
35%	0.21	0.23	0.24	0.27	0.32	0.38	0.48
40%	0.25	0.27	0.28	0.32	0.37	0.42	0.51
45%	0.3	0.31	0.33	0.36	0.41	0.46	0.54
50%	0.34	0.36	0.37	0.41	0.45	0.5	0.58
55%	0.39	0.4	0.42	0.45	0.49	0.54	0.61
60%	0.43	0.45	0.47	0.5	0.54	0.58	0.64
65%	0.48	0.5	0.51	0.54	0.58	0.62	0.67
70%	0.53	0.55	0.56	0.59	0.62	0.65	0.71
75%	0.58	0.6	0.61	0.64	0.66	0.69	0.74
80%	0.63	0.65	0.66	0.69	0.71	0.73	0.77
85%	0.68	0.7	0.71	0.74	0.75	0.77	0.8
90%	0.73	0.75	0.77	0.79	0.79	0.81	0.84
95%	0.79	0.81	0.82	0.83	0.84	0.85	0.87
100%	0.84	0.86	0.87	0.88	0.88	0.89	0.9
Total or Effective % Impervious	**NRCS Hydrologic Soil Group B**						
	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	0.1	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	0.5	0.59
20%	0.13	0.15	0.22	0.38	0.44	0.52	0.61
25%	0.17	0.19	0.26	0.41	0.47	0.54	0.63
30%	0.2	0.23	0.3	0.44	0.49	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	0.5	0.55	0.61	0.68
45%	0.33	0.36	0.42	0.53	0.58	0.64	0.7
50%	0.37	0.4	0.46	0.56	0.61	0.66	0.72
55%	0.42	0.45	0.5	0.6	0.63	0.68	0.74
60%	0.46	0.49	0.54	0.63	0.66	0.71	0.76
65%	0.5	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%	0.6	0.63	0.66	0.72	0.75	0.78	0.81
80%	0.64	0.67	0.7	0.75	0.77	0.8	0.83
85%	0.69	0.72	0.74	0.78	0.8	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	0.9

Hydrologic Soil Group—Castle Rock Area, Colorado
(Web Soil Survey)



Map Scale: 1:2,180 if printed on A landscape (11" x 8.5") 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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Castle Rock Area, Colorado (CO622)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
BrD	Bresser sandy loam, cool, 5 to 9 percent slopes	B	11.2	73.8%
Lo	Loamy alluvial land	C	0.5	3.3%
Sa	Sampson loam	B	3.5	22.9%
Totals for Area of Interest			**15.2**	**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.

Runoff Coefficients

Project:	SLIM CHICKENS - PARKER, CO	Created by:	CM	Date:	6/12/2020
Section:	PROPOSED	Checked by:		Date:	

Sub-Basin Data			*Composite C			
Basin ID	Description	Total Area (ac)	C_2	C_5	C_{100}	I (%)
A-1	PAVEMENT, WALKS	0.61	0.74	0.76	0.84	90%
A-2	ROOF	0.09	0.74	0.76	0.84	90%
A-3	LANDSCAPED AREAS	0.20	0.01	0.01	0.44	2%

Standard Form SF-1 . Time of Concentration

Project: SLIM CHICKENS - PARKER, CO
Section: PROPOSED

Created by: CM Date: 6/12/2020
Checked by: Date:

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)	Time (min)	$t_c = t_i + t_t$ (min)	Urban (Yes /No)	Length (ft)	$T_{c\,max}$ (min)	$Tc_{max} > t_c$	
A-1	PAVEMENT, WALKS	0.76	0.610	143	0.03	4.90	0	0	6	Paved areas and shallow paved swales	20.00	0.00	0.00	4.90	YES	143.00	10.79	Check	5.00
A-2	ROOF	0.76	0.090	34	0.02	2.85	275	0.017	6	Paved areas and shallow paved swales	20.00	2.61	1.76	4.61	YES	309.00	11.72	Check	5.00
A-3	LANDSCAPED AREAS	0.01	0.200	26	0.05	6.02	255	0.017	6	Paved areas and shallow paved swales	20.00	2.61	1.63	7.65	YES	281.00	11.56	Check	7.65

Notes:
t_i= (0.395*(1.1-C_5)*(L^0.5))/(S^0.33), from UDFCD Eqn RO-3
Velocity from V = C_v*S_w^0.5, from UDFCD Eqn RO-4, C_v from Table R0-2 (See Sheet Design Info)
t_t=L/60V
t_c max = 10+L/180, from COA SDDTC equation 5.4
Final Tc > 10 min for nonurban watersheds

UDFCD Table RO-2 Land Surface Coefficients	
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)

Project:
Section: PROPOSED

Created by: CM Date: 6/12/2020
Checked by: Date:

Design Storm: 2-yr P = 0.99 in

LOCATION		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			AREA DESIGN (name)	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 (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
DP	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	A-1	STORM INLET	A-1	0.61	0.74	5.00	0.45	3.36	1.52													
	A-2	STORM INLET	A-2	0.09	0.74	5.00	0.07	3.36	0.22													
	A-3	STORM INLET	A-3	0.20	0.01	7.65	0.00	2.95	0.01													
	TOTAL =								1.75													

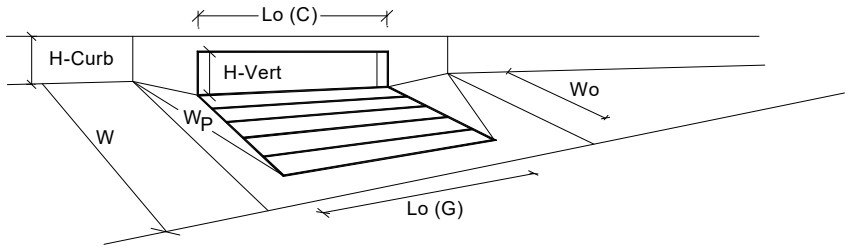
Design Storm: 100-yr P = 2.60 in

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 (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
DP	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
	A-1	STORM INLET	A-1	0.61	0.84	5.00	0.51	8.82	4.52													
	A-2	STORM INLET	A-2	0.09	0.84	5.00	0.08	8.82	0.67													
	A-3	STORM INLET	A-3	0.20	0.01	7.65	0.00	7.76	0.02													
	TOTAL =								5.20													

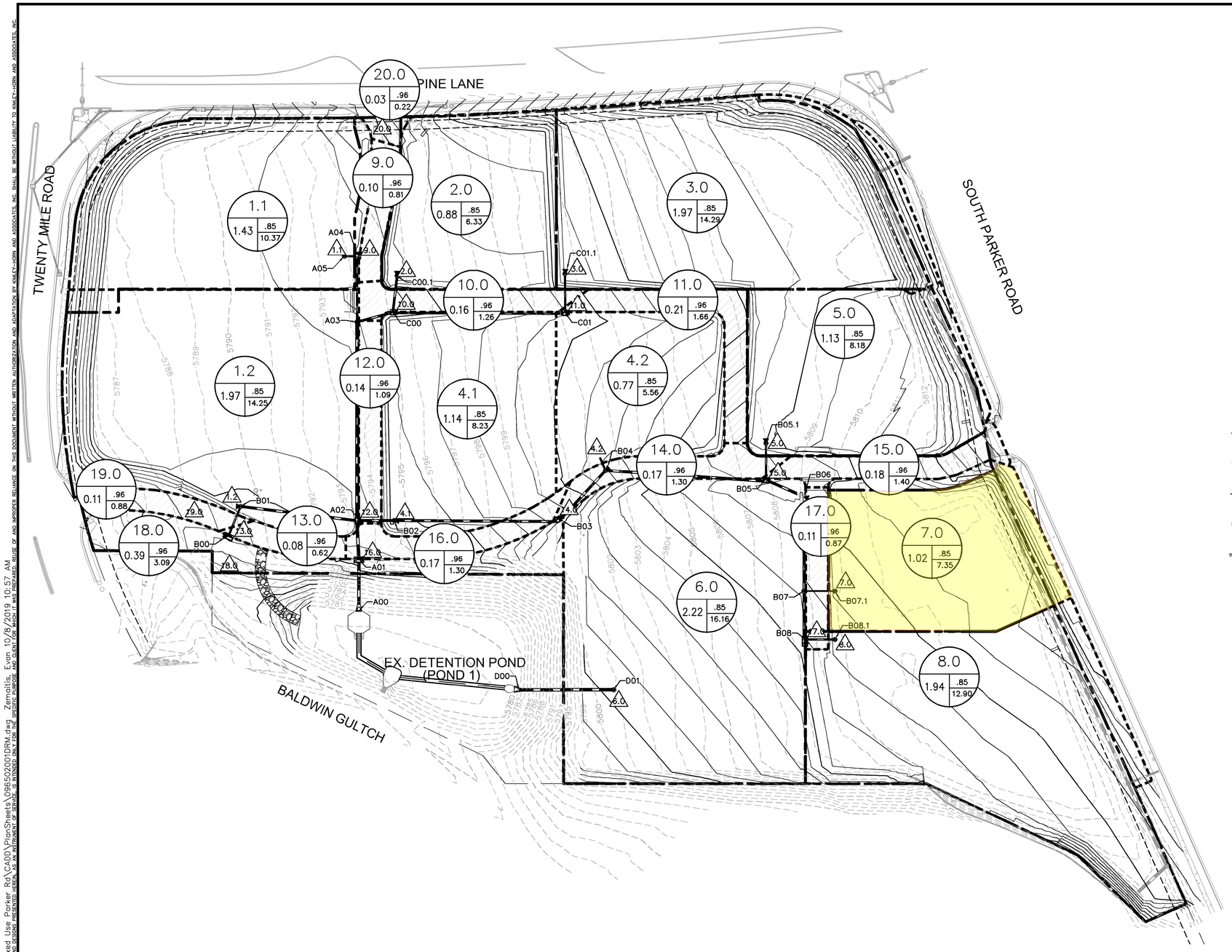
(1) Basin Description linked to C-Value Sheet
(2) Basin Design Point
(3) Enter the Basin Name from C Value Sheet
(4) Basin Area linked to C-Value Sheet
(5) Composite C linked to C-Value Sheet
(6) Time of Concentration linked to C-Value Sheet
(7) =Column 4 x Column 5
(8) =28.5*P/(10+Column 6)^0.786
(9) =Column 7 x Column 8
(10) =Column 6 x 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) Additonal Pipe Flow
(17) Additonal Pipe Flow
(18) Additonal Pipe Flow
(19) Additional Flow Length
(20) Overland Velocity
(21) =Column 16 / Column 20 / 60

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



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 =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.1	5.1	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) =	5.00	5.00	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 =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.20	0.20	
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	
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} =	0.26	0.26	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.48	0.48	
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 =**	**6.3**	**6.3**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.8	5.2	cfs



GRAPHIC SCALE IN FEET
60 0 30 60 120
1" = 60' @ 24X36

LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = BASIN IMPERVIOUSNESS
D = 100YR DESIGN STORM RUNOFF (CFS)

- FLOW DIRECTION
- DRAINAGE BASIN BOUNDARY
- EXISTING PROPERTY LINE
- EXISTING CONTOUR
- 5771 PROPOSED CONTOUR
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- PROPOSED STORM INLET

811 Know what's below. Call before you dig.

NO.	REVISION	BY	DATE	APPR.

Kimley»Horn
2019 KIMLEY-HORN AND ASSOCIATES, INC.
4582 South Ulster Street, Suite 1500
Denver, Colorado 80237 (303) 228-2300

DESIGNED BY: DLS
DRAWN BY: ECZ
CHECKED BY: DLS
DATE: 11/11/19

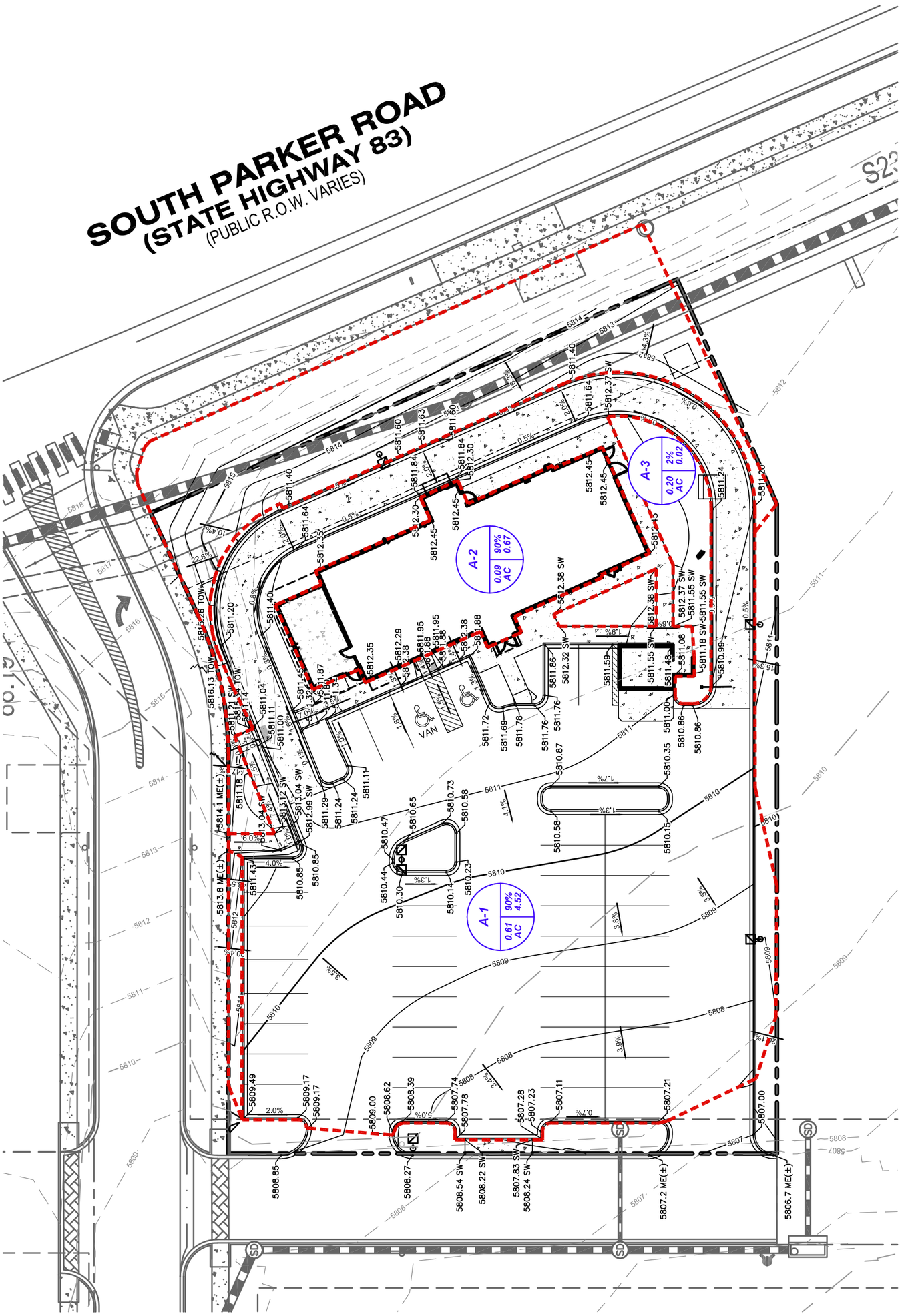
PARKER & PINE
PARKER, CO
CONSTRUCTION DOCUMENTS
PRELIMINARY DRAINAGE AREA MAP

PRELIMINARY
FOR REVIEW ONLY
NOT FOR CONSTRUCTION
Kimley»Horn
Kimley-Horn and Associates, Inc.

PROJECT NO.
096502001

DRAWING NAME
096502001DRM

DRAINAGE


SOUTH PARKER ROAD
(STATE HIGHWAY 83)
(PUBLIC R.O.W. VARIES)
A-1
0.61 AC
90%
4.52
A-2
0.09 AC
90%
0.67
A-3
0.20 AC
2%
0.02
VAN