

**FINAL DRAINAGE REPORT
PARKER POINTE
PARKER, COLORADO**

PREPARED FOR:
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JOB #2015-015

NOVEMBER 10, 2017

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I. CERTIFICATION PAGE

This report for the final design of (Name of Development) was prepared by me or under my direct supervision in accordance with the provisions of the Town of Parker Storm Drainage and 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.

Jerry W. Davidson, P.E.
Colorado P.E. License No. 30226
For and on Behalf of
Perception Design Group, Inc.

Seal and Date

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II GENERAL LOCATION AND DESCRIPTION

A. Site Location:

This Final Drainage Report is prepared by Perception Design Group, Inc. as part of the Construction Plan / Final Plat submittal process for the Parker Pointe project proposed in Parker, Colorado. Parker Pointe, (Project / Site) is located on an unplatted parcel of land situated at the southeast corner of South Parker Road and Stroh Road. See appendix for vicinity map. The Site lies within the southwest quarter of Section 3, Township 7 South, Range 66 West of the 6th Prime Meridian, Douglas County, State of Colorado. The site is bounded by South Parker Road to the west, and Stroh Road to the north. Adjacent developments include the Colorado Golf club in Douglas County to the east, new commercial and residential development in the Town of Parker on the north side of Stroh Road, Commercial development in Parker on the west side of Parker Road, and undeveloped open space in Douglas County south of the property.

B. Site Location:

The Site occupies approximately 14.7 acres. Ground cover consists of pasture grasses. Site topography generally slopes from a tall mound in the northerly portion of the site down to the southwest towards Kinney Creek. Runoff north of the mound flows northwesterly towards the intersection of Stroh Road and Parker Road. Slopes vary widely from 3:1 on the mound to 6% over flatter portions of the site.

Site soils as shown by the USDA Web Soil Survey indicate that primarily Sampson Loam and Bresser Truckton Sandy Loam soil is present. This soil is sandy clay loam in nature. It is a type B hydrologic soil. Additionally Loamy Alluvial Land soils are present to a lesser extent. This soil is also clay loam in nature. It is a type C hydrologic soil.

The site falls within the Cherry Creek basin. The Kinney Creek tributary lies along the southern border of the site. This tributary has a delineated floodplain which encroaches on the extreme southwest corner of the site.

There are no irrigation canals or ditches on site. Additionally, there are no significant geologic features on site.

The site is presently partially developed with a house and barns. These structures are to be removed as a part of the proposed development. As a part of this application, the site will be developed with graded pad sites for commercial and retail businesses, drives, and utilities.

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III DRAINAGE BASINS AND SUB-BASINS

A. Major Drainage Basins:

The site falls within two major drainage basins. The southerly portion of the site is tributary to Kinney Creek. Areas from the peak of the aforementioned mound and to the north are tributary to Stroh Gulch. The southerly line of basin H1 defines the historic break between the two basins. To limit basin transfer, basin SR1 is established to quantify runoff in the developed condition to Stroh Road and hence Stroh Gulch. A final drainage report was prepared for Stroh Crossing Filing No. 1 by Calibre Engineering. This is the development on the north side of Stroh Road. This report anticipated runoff from the Parker Pointe property and made allowance to handle the flow. Basin ST-2b from the Calibre report quantifies 18.9 cfs for the basin. Basin SR1 in this report indicates 14.05 cfs tributary to Stroh Road and hence Stroh Gulch.

Kinney Creek was studied by WRC Engineering Inc. in a report entitled "Flood Hazard Area Delineation for Kinney Creek Fonder Draw and Tributaries" date April 2004. Floodplain was determined along the southwest corner of the site. Minor grading is proposed in the floodplain along Parker Road.

B. Minor Drainage Basins:

To facilitate design, the site is divided into multiple sub-basins described as follows:

Basins L1 thru L14 are used to represent each of the proposed lots. As development conditions are not yet determined, an assumed 95% imperviousness is established for each basin. A storm sewer stub is provided for each lot to convey developed runoff to the extended detention basin at the southeast corner of the site providing both detention and water quality facilities.

Basins L1A thru L5A represents the easterly portion of Lots 1 thru 5. Runoff from these basins flow overland to the east to the drainage swale along the east property line thence into the extended detention facility. As development conditions are not yet determined, an assumed 95% imperviousness is established for each basin.

Basins IN1 thru IN8 are established to quantify runoff collected in a series of inlets along the central north-south access drive as well as runoff collected by inlets on Lots 9 and 10.. This runoff is piped to the extended detention basin at the southeast corner of the site providing both detention and water quality facilities.

Basin P is the land area of the extended detention basin.

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Basin SR1 is used in conjunction with the Calibre basin ST-2b. It is provided to provide a direct comparison between historic ST-2b runoff to Stroh Road versus runoff from basin SR1 in the developed condition. Detention and water quality are not provided for this basin. See additional discussion under Major Basins above.

Basin H1 is a historic basin quantifying historic runoff to Stroh Road. It is used as a check for Calibre basin ST-2b. Basin H1 indicates runoff of 17.0 cfs while basin ST2-b indicates 18.9 cfs. Variance is due to more accurate topography available for the Parker Pointe site and better defined drainage basin as well as differences in time of concentration.

Basin OS1 quantifies flows entering the extended detention pond from offsite flows from the Colorado Golf Club property east of the Parker Pointe property. Detention and water quality are provided for this offsite flow area in its present condition.

IV DRAINAGE DESIGN CRITERIA

A. Regulations:

Design calculations and methodologies are based upon the Town of Parker Storm Drainage and Environmental Criteria Manual. Additionally, the Urban Drainage Storm Drainage Criteria Manual Volumes 1 thru 3 are utilized.

B. Drainage Studies, Outfall System Plans:

The Final Drainage Report for Stroh Crossing Filing No. 1 by Calibre Engineering is used to identify allowable site discharge to Stroh Gulch. The WRC Engineering Inc. report entitled "Flood Hazard Area Delineation for Kinney Creek Fonder Draw and Tributaries" date April 2004 was utilized to map the floodplain elevations along the south property line. This study has negligible impact on the design presented.

C. Hydrology:

Runoff is calculated for both the 5 year and 100 year storms using the rational method. On-site basins utilize a 5 minute time of concentration with 5 year intensity of 4.7 in/hr and 100 year at 8.85 in/hr. Detention storage volumes are calculated using the UDFCD ver 3.07 UD-Detention spreadsheet. This spreadsheet is also utilized to calculate allowable release rates.

D. Hydraulics:

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Storm sewer capacities are calculated using Hydraflow Storm Sewers extension for AutoCAD Civil 3D ver 2017. The system is designed such to provide minimal surcharge for the 100 year event, and no surcharge for the 5 year event. The Hydraflow software is also used to calculate hydraulic grade lines for the storm sewer.

E. Water Quality Enhancement:

Water quality is achieved in an extended detention facility designed to EURV specifications using UDFCD ver 3.07 UD-Detention spreadsheet.

V STORMWATER MANAGEMENT FACILITY DESIGN

A. Stormwater Conveyance Facilities:

Developed stormwater is generally conveyed towards the central north south driveway where stubs are provided that connect to a storm sewer mainline. The storm main runs in a southerly then easterly direction to the proposed EDB detention facility. Total developed site runoff tributary to the EDB is 79 cfs. Storm sewer outfall into the EDB occurs at a concrete forebay with raised energy dissipation blocks. Outfall from the EDB is controlled to code levels and discharged via storm sewer pipe to Kinney Creek where riprap is provided to control erosion. Storm sewer is placed in an easement for perpetual maintenance.

B. Stormwater Storage Facilities:

Stormwater storage on site is accomplished in an extended detention basin located offsite near the southeast corner of the site. Required pond design elements are summarized below:

<u>Volume Element</u>	<u>Volume</u>	<u>Elevation</u>	<u>Release Rate</u>
WQCV	0.412 Ac-Ft	5964.30	43 hours
EURV	0.852 Ac-Ft		
EURV + WQCV	1.264 Ac-Ft	5965.59	74 hours
100 year + EURV + WQCV	3.060 Ac-Ft	5966.62	24.1 cfs
500 year	4.243 Ac-Ft		
Max Storage Provided	7.766 Ac-Ft	5971.00	

Outflow metering is accomplished in a concrete outlet structure. 2 orifices are used. One for WQ and EURV while a second is used covering the outfall pipe to limit the 100 year

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flow. Sufficient flow could not be achieved thru the grate on the top of the outlet structure. Therefore 2 notches are provided in the outlet structure to increase flow to the 100 year orifice. The overflow weir portion of the UD Detention spreadsheet should be ignored, as the values set are arbitrary to force the spreadsheet to calculate the proper 100 year orifice size. Micropool and trash racks are provided. Emergency overflow cannot occur directly into Kinney Creek due to elevation constraints. Provision for emergency overflow is provided via multiple methods. An additional overflow inlet is provided in the extended detention pond to allow additional waters to flow thru the outfall pipe and discharge into Kinney Creek. As water levels in the pond raise higher, the potential exists for water to exit the on-site inlets as an emergency overflow. It is assume that the lowest inlets on the site will be on Lots 8 and 8A in the southerly portion of the site. Designers for these and all inlets on-site should give consideration to this potential and provide safe overflow from the site below finished floor elevations. Prior to this overflow occurring, the pond will store volume well in excess of the 500 year storm.

A maintenance access is provided entering at the northwest corner of the pond. Roadbase surfacing is provided and slopes not exceeding 10% are employed to enhance access for maintenance. An easement is provided over the pond should Town access, inspection, or repairs be required.

C. Water quality Enhancement Best Management Practices:

The EDB pond design includes water quality capture volume. Developed flows are conveyed via underground storm sewer to a single discharge point into the pond. At this point, a concrete forebay is provided with energy dissipation to capture heavier particulate material.

D. Floodplain Modification:

Minor fill is proposed in the floodplain to facilitate construction of the Parker Road improvements. Floodplain limits drawn on the plan are derived from the Kinney Creek FHAD cross sections as well as field surveyed existing contours.

E. Additional Permitting Requirements:

State stormwater permit for discharges during construction.
Town of Parker permits.
Douglas County permits.

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V CONCLUSIONS

A. Compliance with Standards:

The plans and calculations presented are in compliance with Town of Parker, Douglas County, and Urban Drainage requirements.

B. Variances:

No variances are requested.

V REFERNCES

Urban Drainage and Flood Control District Drainage Criteria Manual, Current addition.
Town of Parker Storm Drainage Criteria Manual
Town of Parker Construction Best Management Practices
Douglas County Storm Drainage Design and Technical Criteria Manual
USDA Web Soil Survey

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APPENDICES

Table RO-3—Recommended Percentage Imperviousness Values

Land Use or Surface Characteristics	Percentage Imperviousness
Business:	
Commercial areas	95
Neighborhood areas	85
Residential:	
Single-family	*
Multi-unit (detached)	60
Multi-unit (attached)	75
Half-acre lot or larger	*
Apartments	80
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	5
Playgrounds	10
Schools	50
Railroad yard areas	15
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	0
Lawns, clayey soil	0

* See [Figures RO-3](#) through [RO-5](#) for percentage imperviousness.

$$C_A = K_A + (1.31i^3 - 1.44i^2 + 1.135i - 0.12) \text{ for } C_A \geq 0, \text{ otherwise } C_A = 0 \quad (\text{RO-6})$$

$$C_{CD} = K_{CD} + (0.858i^3 - 0.786i^2 + 0.774i + 0.04) \quad (\text{RO-7})$$

$$C_B = (C_A + C_{CD})/2$$

Table RO-5— Runoff Coefficients, C

Percentage Imperviousness	Type C and D NRCS Hydrologic Soil Groups					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0%	0.04	0.15	0.25	0.37	0.44	0.50
5%	0.08	0.18	0.28	0.39	0.46	0.52
10%	0.11	0.21	0.30	0.41	0.47	0.53
15%	0.14	0.24	0.32	0.43	0.49	0.54
20%	0.17	0.26	0.34	0.44	0.50	0.55
25%	0.20	0.28	0.36	0.46	0.51	0.56
30%	0.22	0.30	0.38	0.47	0.52	0.57
35%	0.25	0.33	0.40	0.48	0.53	0.57
40%	0.28	0.35	0.42	0.50	0.54	0.58
45%	0.31	0.37	0.44	0.51	0.55	0.59
50%	0.34	0.40	0.46	0.53	0.57	0.60
55%	0.37	0.43	0.48	0.55	0.58	0.62
60%	0.41	0.46	0.51	0.57	0.60	0.63
65%	0.45	0.49	0.54	0.59	0.62	0.65
70%	0.49	0.53	0.57	0.62	0.65	0.68
75%	0.54	0.58	0.62	0.66	0.68	0.71
80%	0.60	0.63	0.66	0.70	0.72	0.74
85%	0.66	0.68	0.71	0.75	0.77	0.79
90%	0.73	0.75	0.77	0.80	0.82	0.83
95%	0.80	0.82	0.84	0.87	0.88	0.89
100%	0.89	0.90	0.92	0.94	0.95	0.96
TYPE B NRCS HYDROLOGIC SOILS GROUP						
0%	0.02	0.08	0.15	0.25	0.30	0.35
5%	0.04	0.10	0.19	0.28	0.33	0.38
10%	0.06	0.14	0.22	0.31	0.36	0.40
15%	0.08	0.17	0.25	0.33	0.38	0.42
20%	0.12	0.20	0.27	0.35	0.40	0.44
25%	0.15	0.22	0.30	0.37	0.41	0.46
30%	0.18	0.25	0.32	0.39	0.43	0.47
35%	0.20	0.27	0.34	0.41	0.44	0.48
40%	0.23	0.30	0.36	0.42	0.46	0.50
45%	0.26	0.32	0.38	0.44	0.48	0.51
50%	0.29	0.35	0.40	0.46	0.49	0.52
55%	0.33	0.38	0.43	0.48	0.51	0.54
60%	0.37	0.41	0.46	0.51	0.54	0.56
65%	0.41	0.45	0.49	0.54	0.57	0.59
70%	0.45	0.49	0.53	0.58	0.60	0.62
75%	0.51	0.54	0.58	0.62	0.64	0.66
80%	0.57	0.59	0.63	0.66	0.68	0.70
85%	0.63	0.66	0.69	0.72	0.73	0.75
90%	0.71	0.73	0.75	0.78	0.80	0.81
95%	0.79	0.81	0.83	0.85	0.87	0.88
100%	0.89	0.90	0.92	0.94	0.95	0.96

Perception Design Group, Inc.

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Designed by: JWD

Checked by: JWD

Date: 18-Sep-17

Job Number: 2015-015

Project: Parker Pointe

COMPOSITE RUNOFF COEFFICIENTS

TYPE B SOILS

Catchment	FUTURE COMMERCIAL		DRIVES/WALKS/ROOF		LANDSCAPING			Composite C	Catchment Area (Ac.)	Imperviousness
	Area (Ac.)	C	Area (Ac.)	C	Area (Ac.)	C	Imperviousness = 2%			
	Imperviousness = 95%		Imperviousness = 100%							
H1 (5 YR)	0.00	0.81	0.00	0.90	10.52	0.09		0.09	10.52	2.0%
H1 (100 YR)	0.00	0.88	0.00	0.96	10.52	0.36		0.36	10.52	
L1 (5 YR)	0.46	0.81	0.00	0.90	0.00	0.09		0.09	0.46	90.0%
L1 (100 YR)	0.46	0.88	0.00	0.96	0.00	0.36		0.36	0.46	
L1A (5 YR)	0.18	0.81	0.00	0.90	0.00	0.09		0.09	0.18	90.0%
L1A (100 YR)	0.18	0.88	0.00	0.96	0.00	0.36		0.36	0.18	
L2 (5 YR)	0.50	0.81	0.00	0.90	0.00	0.09		0.09	0.50	95.0%
L2 (100 YR)	0.50	0.88	0.00	0.96	0.00	0.36		0.36	0.50	
L2A (5 YR)	0.19	0.81	0.00	0.90	0.00	0.09		0.09	0.19	95.0%
L2A (100 YR)	0.19	0.88	0.00	0.96	0.00	0.36		0.36	0.19	
L3 (5 YR)	0.43	0.81	0.00	0.90	0.00	0.09		0.09	0.43	95.0%
L3 (100 YR)	0.43	0.88	0.00	0.96	0.00	0.36		0.36	0.43	
L3A (5 YR)	0.16	0.81	0.00	0.90	0.00	0.09		0.09	0.16	95.0%
L3A (100 YR)	0.16	0.88	0.00	0.96	0.00	0.36		0.36	0.16	
L4 (5 YR)	0.63	0.81	0.00	0.90	0.00	0.09		0.09	0.63	95.0%

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TYPE B SOILS

Catchment	FUTURE COMMERCIAL		DRIVES/WALKS/ROOF			LANDSCAPING			Composite C	Catchment Area (Ac.)	Imperviousness
	Area (Ac.)	C	Area (Ac.)	C	Area (Ac.)	C					
	Imperviousness = 95%		Imperviousness = 100%		Imperviousness = 2%						
L4 (100 YR)	0.63	0.88	0.00	0.96	0.00	0.36	0.88	0.63			
L4A (5 YR)	0.24	0.81	0.00	0.90	0.00	0.09	0.81	0.24		95.0%	
L4A (100 YR)	0.24	0.88	0.00	0.96	0.00	0.36	0.88	0.24			
L5 (5 YR)	0.63	0.81	0.00	0.90	0.00	0.09	0.81	0.63		95.0%	
L5 (100 YR)	0.63	0.88	0.00	0.96	0.00	0.36	0.88	0.63			
L5A (5 YR)	0.24	0.81	0.00	0.90	0.00	0.09	0.81	0.24		95.0%	
L5A (100 YR)	0.24	0.88	0.00	0.96	0.00	0.36	0.88	0.24			
L6 (5 YR)	0.78	0.81	0.00	0.90	0.00	0.09	0.81	0.78		95.0%	
L6 (100 YR)	0.78	0.88	0.00	0.96	0.00	0.36	0.88	0.78			
L7 (5 YR)	0.66	0.81	0.00	0.90	0.00	0.09	0.81	0.66		95.0%	
L7 (100 YR)	0.66	0.88	0.00	0.96	0.00	0.36	0.88	0.66			
L8 (5 YR)	0.95	0.81	0.00	0.90	0.00	0.09	0.81	0.95		95.0%	
L8 (100 YR)	0.95	0.88	0.00	0.96	0.00	0.36	0.88	0.95			
L8A (5 YR)	0.80	0.81	0.00	0.90	0.00	0.09	0.81	0.80		95.0%	
L8A (100 YR)	0.80	0.88	0.00	0.96	0.00	0.36	0.88	0.80			
L11 (5 YR)	0.55	0.81	0.00	0.90	0.00	0.09	0.81	0.55		95.0%	

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	Area (Ac.)	C	Area (Ac.)	C	Area (Ac.)	C					
	Imperviousness = 95%		Imperviousness = 100%		Imperviousness = 2%						
L11 (100 YR)	0.55	0.88	0.00	0.96	0.00	0.36	0.88	0.55			
L12 (5 YR)	0.72	0.81	0.00	0.90	0.00	0.09	0.81	0.72		95.0%	
L12 (100 YR)	0.72	0.88	0.00	0.96	0.00	0.36	0.88	0.72			
L13 (5 YR)	0.71	0.81	0.00	0.90	0.00	0.09	0.81	0.71		95.0%	
L13 (100 YR)	0.71	0.88	0.00	0.96	0.00	0.36	0.88	0.71			
L14 (5 YR)	0.83	0.81	0.00	0.90	0.00	0.09	0.81	0.83		95.0%	
L14 (100 YR)	0.83	0.88	0.00	0.96	0.00	0.36	0.88	0.83			
IN1 (5 YR)	0.00	0.81	0.22	0.90	0.00	0.09	0.90	0.22		100.0%	
IN1 (100 YR)	0.00	0.88	0.22	0.96	0.00	0.36	0.96	0.22			
IN2 (5 YR)	0.00	0.81	0.34	0.90	0.02	0.09	0.86	0.36		94.6%	
IN2 (100 YR)	0.00	0.88	0.34	0.96	0.02	0.36	0.93	0.36			
IN3 (5 YR)	0.00	0.81	0.43	0.90	0.05	0.09	0.82	0.48		89.8%	
IN3 (100 YR)	0.00	0.88	0.43	0.96	0.05	0.36	0.90	0.48			
IN4 (5 YR)	0.00	0.81	0.14	0.90	0.01	0.09	0.85	0.15		93.5%	
IN4 (100 YR)	0.00	0.88	0.14	0.96	0.01	0.36	0.92	0.15			
IN5 (5 YR)	0.00	0.81	0.56	0.90	0.03	0.09	0.86	0.59		95.0%	

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	Area (Ac.)	C	Area (Ac.)	C	Area (Ac.)	C				
	Imperviousness = 95%		Imperviousness = 100%		Imperviousness = 2%					
IN5 (100 YR)	0.00	0.88	0.56	0.96	0.03	0.36	0.93	0.59		

IN6 (5 YR)	0.00	0.81	0.36	0.90	0.02	0.09	0.86	0.38		94.8%
IN6 (100 YR)	0.00	0.88	0.36	0.96	0.02	0.36	0.93	0.38		

IN7 (5 YR)	0.00	0.81	0.20	0.90	0.04	0.09	0.77	0.24		83.7%
IN7 (100 YR)	0.00	0.88	0.20	0.96	0.04	0.36	0.86	0.24		

IN8 (5 YR)	0.00	0.81	0.18	0.90	0.01	0.09	0.86	0.19		94.8%
IN8 (100 YR)	0.00	0.88	0.18	0.96	0.01	0.36	0.93	0.19		

OS1 (5 YR)	0.00	0.81	0.00	0.90	12.22	0.09	0.09	12.22		2.0%
OS1 (100 YR)	0.00	0.88	0.00	0.96	12.22	0.36	0.36	12.22		

AREA TO POND	9.66	0.88	2.43	0.96	12.40	0.36	0.62	24.49		48.4%
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SR1 (5 YR)	0.00	0.81	1.23	0.90	4.62	0.09	0.26	5.85		22.6%
SR1 (100 YR)	0.00	0.88	1.23	0.96	4.62	0.36	0.49	5.85		

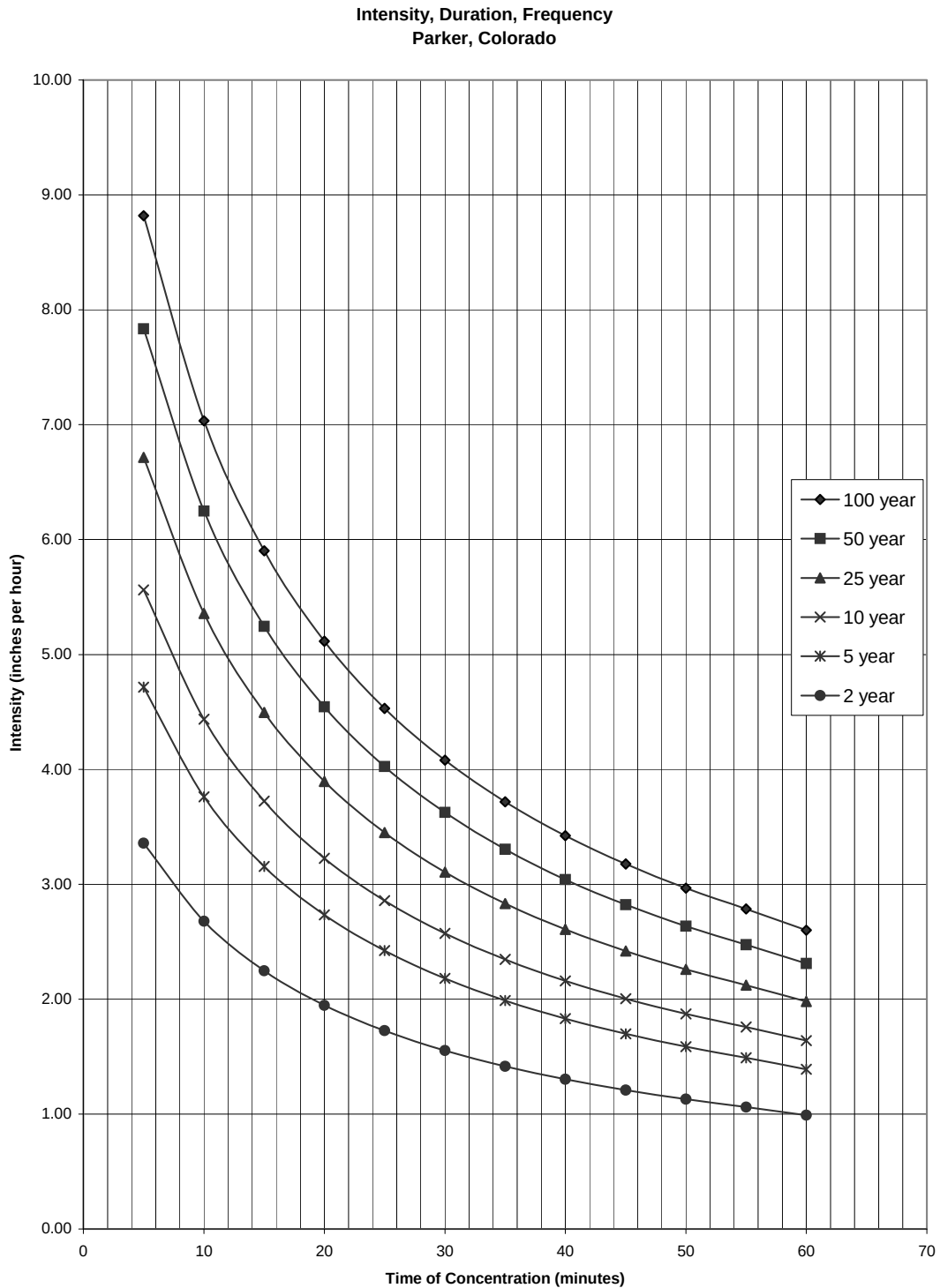


FIGURE 5.1
RAINFALL INTENSITY VERSUS DURATION CURVES FOR PARKER, COLORADO

STANDARD FORM SF-2

TIME OF CONCENTRATION

PROJECT Parker Pointe
JN ASP-2015-015
CALCULATED BY JWD
DATE 18-Sep-17

SUB-BASIN		DATA	INITIAL/OVERLAND (Ti)			TIME		TRAVEL TIME					(Tt)			Tc CHECK			FINAL (Tc)	REMARKS
DESIGN	Area (ac)	C5	LENGTH Li (ft)	SLOPE (ft/ft)	Ti (min)	LENGTH - Lt (ft)	SLOPE %	K Conveyance Factor	VEL (fps)	Tt (min)	COMP (Tc)	Basin Imp. (decimal)	Tc=(UDFCD Eq 6-5) (min)	MIN						
SR1	3.23	0.27	450.0	0.050	18.9	630.0	2.75	20	3.32	3.2	22.0	0.241	22.4	22.0			22.0			
H1	10.52	0.09	530.0	0.050	24.9	550.0	2.75	10	1.66	5.5	30.5	0.020	26.3	26.3			26.3			
OS1	12.22	0.09	450.0	0.100	18.2	285.0	25.00	10	5.00	1.0	19.2	0.020	25.8	19.2			19.2			

Perception Design Group, Inc.
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 Littleton, Colorado 80128
 (303) 232-8088 Fax (303) 232-5255

Designed by: JWD
 Checked by: JWD
 Date: 18-Sep-17
 Job Number: 2015-015

Project: Parker Pointe

RUNOFF CALCULATIONS

(RATIONAL METHOD)

Design Storm: 100-Yr.

		Direct Runoff						
	Design	Basin	Area	Runoff	CA	Tc	I	Q
	Point	Desig.	(Acres)	Coefficient		(min)	(in/hr)	(cfs)
		H1	10.52	0.36	3.79	26.0	4.50	17.04
		L1	0.46	0.88	0.40	5.0	8.85	3.58
		L1A	0.18	0.88	0.16	5.0	8.85	1.40
		L2	0.50	0.88	0.44	5.0	8.85	3.89
		L2A	0.19	0.88	0.17	5.0	8.85	1.48
		L3	0.43	0.88	0.38	5.0	8.85	3.35
		L3A	0.16	0.88	0.14	5.0	8.85	1.25
		L4	0.63	0.88	0.55	5.0	8.85	4.91
		L4A	0.24	0.88	0.21	5.0	8.85	1.87
		L5	0.63	0.88	0.55	5.0	8.85	4.91
		L5A	0.24	0.88	0.21	5.0	8.85	1.87
		L6	0.78	0.88	0.69	5.0	8.85	6.07
		L7	0.66	0.88	0.58	5.0	8.85	5.14
		L8	0.95	0.88	0.84	5.0	8.85	7.40
		L8A	0.8	0.88	0.70	5.0	8.85	6.23
		L11	0.55	0.88	0.48	5.0	8.85	4.28
		L12	0.72	0.88	0.63	5.0	8.85	5.61
		L13	0.71	0.88	0.62	5.0	8.85	5.53
		L14	0.83	0.88	0.73	5.0	8.85	6.46
		IN1	0.22	0.96	0.21	5.0	8.85	1.87
		IN2	0.36	0.93	0.33	5.0	8.85	2.96
		IN3	0.48	0.9	0.43	5.0	8.85	3.82
		IN4	0.15	0.92	0.14	5.0	8.85	1.22
		IN5	0.59	0.93	0.55	5.0	8.85	4.86
		IN6	0.38	0.93	0.35	5.0	8.85	3.13
		IN7	0.24	0.86	0.21	5.0	8.85	1.83
		IN8	0.19	0.93	0.18	5.0	8.85	1.56
		OS1	12.22	0.36	4.40	19.2	5.20	22.88
TOTAL TO POND			24.49	0.62	15.18	19.2	5.20	78.96
		SR1	5.85	0.49	2.87	22.0	4.90	14.05

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JOB # 2015-015

Project: Parker Pointe

STORM SEWER DESIGN -- MANNING'S EQUATION
100-YEAR STORM

Contributing Basins	Pipe Location Design Points	Q req'd (cfs)	Slope (%)	n	Diam (in)	Q calc (cfs)	V (Full Flow) (fps)	Friction Slope (%)
L1	1-3	3.58	0.50	0.013	18	7.45	2.03	0.12
	2-3	6.46	0.50	0.013	18	7.45	3.66	0.38
L14								
L1,L14	3-6	10.04	0.50	0.013	21	11.23	4.17	0.40
L2	4-6	3.89	0.50	0.013	18	7.45	2.20	0.14
L13	5-6	5.53	0.50	0.013	18	7.45	3.13	0.28
L1,L2,L13,L14	6-8	20.08	0.50	0.013	30	29.08	4.09	0.24
L3	7-8	3.35	0.50	0.013	18	7.45	1.90	0.10
L1,L2,L3,L13,L14	8-11	23.43	0.50	0.013	30	29.08	4.77	0.33
L12	9-10	5.61	0.50	0.013	18	7.45	3.17	0.28
IN1,L12	10-11	7.48	0.50	0.013	18	7.45	4.23	0.50
IN1,L1,L2,L3,L12,L13,L14	11-13	30.91	0.50	0.013	36	47.29	4.37	0.21
L4	12-13	4.91	0.50	0.013	18	7.45	2.78	0.22
IN1,L1,L2,L3,L4,L12,L13,L14	13-15	35.82	0.50	0.013	36	47.29	5.07	0.29
L11	14-15	4.91	0.50	0.013	18	7.45	2.78	0.22
IN1,L1,L2,L3,L4,L11,L12,L13,L14	15-20	40.73	0.50	0.013	36	47.29	5.76	0.37
IN5	16-17	4.86	0.50	0.013	18	7.45	2.75	0.21
IN4,IN5	17-18	6.08	0.50	0.013	18	7.45	3.44	0.33
IN3,IN4,IN5	18-19	9.90	0.50	0.013	24	16.04	3.15	0.19

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STORM SEWER DESIGN -- MANNING'S EQUATION

100-YEAR STORM

Contributing Basins	Pipe Location Design Points	Q req'd (cfs)	Slope (%)	n	Diam (in)	Q calc (cfs)	V (Full Flow) (fps)	Friction Slope (%)
IN2, IN3, IN4, IN5 IN1, IN2, IN3, IN4, IN5, L1, L2, L3, L4, L11, L12, L13, L14 L5 IN1, IN2, IN3, IN4, IN5, L1, L2, L3, L4, L5, L11, L12, L13, L14	19-20	12.86	0.50	0.013	24	16.04	4.09	0.32
	20-22	53.59	0.75	0.013	36	57.92	7.58	0.64
	21-22	4.91	2.00	0.013	18	14.90	2.78	0.22
	22-23-24	58.50	0.75	0.013	36	57.92	8.28	0.77
IN6 IN6, IN7 L8A IN6, IN7, L8A L7 IN6, IN7, L7, L8A L8 IN6, IN7, L7, L8, L8A L6 IN6, IN7, L6, L7, L8, L8A	25-26	3.13	0.50	0.013	18	7.45	1.77	0.09
	26-28	4.96	0.50	0.013	18	7.45	2.81	0.22
	27-28	6.23	0.50	0.013	18	7.45	3.53	0.35
	28-30	11.19	0.50	0.013	24	16.04	3.56	0.24
IN6, IN7, L7, L8A L8 IN6, IN7, L7, L8, L8A L6 IN6, IN7, L6, L7, L8, L8A	29-30	5.14	0.50	0.013	18	7.45	2.91	0.24
	30-32	16.33	0.50	0.013	24	16.04	5.20	0.52
	31-32	7.40	0.50	0.013	18	7.45	4.19	0.49
	32-34	23.73	0.50	0.013	30	29.08	4.83	0.33
IN6, IN7, L6, L7, L8, L8A L6 IN6, IN7, L6, L7, L8, L8A L6 IN6, IN7, L6, L7, L8, L8A	33-34	6.07	0.50	0.013	18	7.45	3.43	0.33
	34-35	29.80	0.50	0.013	30	29.08	6.07	0.53
	36-37	24.10	2.00	0.013	30	58.16	4.91	0.34
	37-38	79.00	2.00	0.013	30	58.16	16.09	3.70

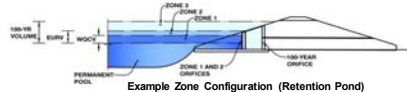
Emergency Overflow

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: _____

Basin ID: _____



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	24.49	acres
Watershed Length =	1,300	ft
Watershed Slope =	0.005	ft/ft
Watershed Imperviousness =	48.40%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Parker - The Pinery Country Club	
Water Quality Capture Volume (WQCV) =	4,112	acre-feet
Excess Urban Runoff Volume (EURV) =	1,264	acre-feet
2-yr Runoff Volume (P = 0.83 in.) =	1,020	acre-feet
5-yr Runoff Volume (P = 1.11 in.) =	1,039	acre-feet
10-yr Runoff Volume (P = 1.36 in.) =	1,472	acre-feet
25-yr Runoff Volume (P = 1.72 in.) =	2,295	acre-feet
50-yr Runoff Volume (P = 2.01 in.) =	2,962	acre-feet
100-yr Runoff Volume (P = 2.32 in.) =	3,594	acre-feet
500-yr Runoff Volume (P = 3.1 in.) =	5,271	acre-feet
Approximate 2-yr Detention Volume =	0.684	acre-feet
Approximate 5-yr Detention Volume =	0.967	acre-feet
Approximate 10-yr Detention Volume =	1.352	acre-feet
Approximate 25-yr Detention Volume =	1.642	acre-feet
Approximate 50-yr Detention Volume =	1.784	acre-feet
Approximate 100-yr Detention Volume =	2.060	acre-feet

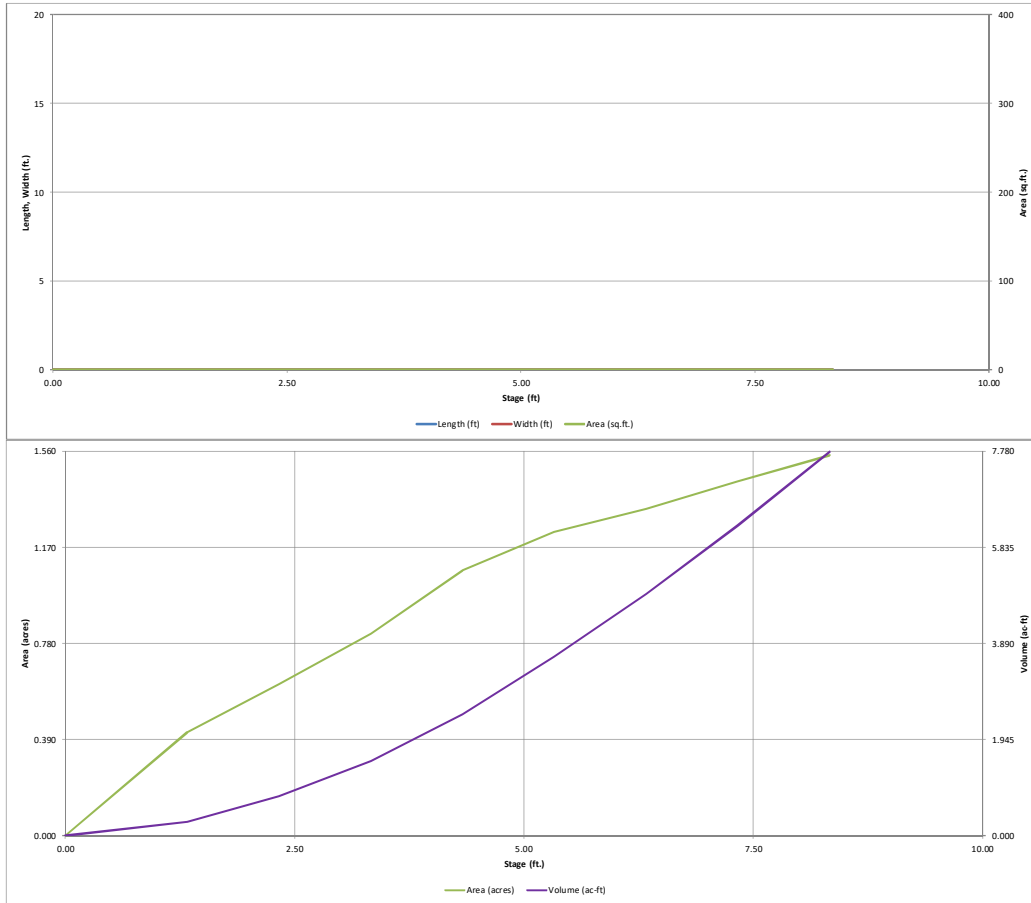
Stage-Storage Calculation

Zone 1 Volume (V_{WC1}) =	0.412	acre-feet
Zone 2 Volume ($V_{EUV} - Zone 1$) =	0.852	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.796	acre-feet
Total Detention Basin Volume (V_{DB}) =	2.060	acre-feet
Initial Surge Volume (VS_V) =	US.6F	ft ³
Initial Surge Depth (SD) =	US.6F	ft
Total Available Detention Depth (H_{DBA}) =	US.6F	ft
Depth of Trickle Channel (TC_D) =	US.6F	ft
Slopes of Trickle Channel (S_{TC}) =	US.6F	ft/ft
Slopes of Main Basin Sides (S_{MB}) =	US.6F	H/V
Basin Length-to-Width Ratio (R_{LWB}) =	US.6F	
Initial Surge Area (A_{SV}) =	US.6F	ft ²
Surcharge Volume Length (L_{SV}) =	US.6F	ft
Surcharge Volume Width (W_{SV}) =	US.6F	ft
Depth of Basin Floor (H_{LDB}) =	US.6F	ft
Length of Basin Floor (L_{LDB}) =	US.6F	ft
Width of Basin Floor (W_{LDB}) =	US.6F	ft
Area of Basin Floor (A_{LDB}) =	US.6F	ft ²
Volume of Basin Floor (V_{LDB}) =	US.6F	ft ³
Depth of Main Basin (H_{MBA}) =	US.6F	ft
Length of Main Basin (L_{MBA}) =	US.6F	ft
Width of Main Basin (W_{MBA}) =	US.6F	ft
Area of Main Basin (A_{MBA}) =	US.6F	ft ²
Volume of Main Basin (V_{MBA}) =	US.6F	ft ³
Calculated Total Basin Volume (V_{DBA}) =	US.6F	acre-feet

Depth Increment =	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft ²)	Optional Override Area (ft ²)	Area (acre)	Volume (ft ³)	Volume (ac-ft)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Top of Micropool	--	0.00	--	--	--	0	0.000																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
Plan Elev=64.0	--	1.33	--	--	--	18,309	0.420	11,993	0.275																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Plan Elev=65.0	--	2.33	--	--	--	26,747	0.614	34,703	0.797																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Plan Elev=66.0	--	3.33	--	--	--	35,626	0.818	65,889	1.513																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Plan Elev=67.0	--	4.33	--	--	--	46,895	1.077	107,150	2.460																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Plan Elev=68.0	--	5.33	--	--	--	53,711	1.233	157,453	3.615																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Plan Elev=69.0	--	6.33	--	--	--	57,753	1.326	213,185	4.894																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Plan Elev=70.0	--	7.33	--	--	--	62,610	1.437	273,366	6.276																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

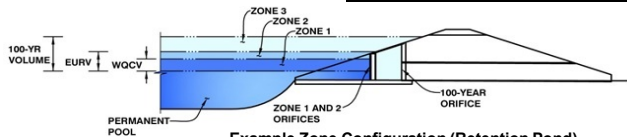


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: _____

Basin ID: _____



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.63	0.412	Orifice Plate
Zone 2 (EURV)	3.02	0.852	Orifice Plate
Zone 3 (100-year)	3.95	0.796	Weir&Pipe (Circular)
		2.060	Total

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)
Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²
Underdrain Orifice Centroid = feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate = ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing = inches
Orifice Plate: Orifice Area per Row = sq. inches (diameter = 1-15/16 inches)

Calculated Parameters for Plate

WQ Orifice Area per Row = ft²
Elliptical Half-Width = feet
Elliptical Slot Centroid = feet
Elliptical Slot Area = ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.00	2.00	3.00				
Orifice Area (sq. inches)	3.00	3.00	3.00					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice = ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter = inches

Calculated Parameters for Vertical Orifice

Vertical Orifice Area = ft²
Vertical Orifice Centroid = feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

Overflow Weir Front Edge Height, H_o = ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length = feet
Overflow Weir Slope = H:V (enter zero for flat grate)
Horiz. Length of Weir Sides = feet
Overflow Grate Open Area % = %, grate open area/total area
Debris Clogging % = %

Calculated Parameters for Overflow Weir

Height of Grate Upper Edge, H_g = feet
Over Flow Weir Slope Length = feet
Grate Open Area / 100-yr Orifice Area = %
Overflow Grate Open Area w/o Debris = %
Overflow Grate Open Area w/ Debris = %

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

Depth to Invert of Outlet Pipe = ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter = inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Outlet Orifice Area = ft²
Outlet Orifice Centroid = feet
Half-Central Angle of Restrictor Plate on Pipe = degrees

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length = feet
Spillway End Slopes = H:V
Freeboard above Max Water Surface = feet

Calculated Parameters for Spillway

Spillway Design Flow Depth = feet
Stage at Top of Freeboard = feet
Basin Area at Top of Freeboard = acres

Routed Hydrograph Results

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Design Storm Return Period =	0.53	1.07	0.83	1.11	1.36	1.72	2.01	2.32
One-Hour Rainfall Depth (in) =	0.53	1.07	0.83	1.11	1.36	1.72	2.01	2.32
Calculated Runoff Volume (acre-ft) =	0.412	1.264	0.710	1.029	1.472	2.295	2.862	3.594
OPTIONAL Override Runoff Volume (acre-ft) =								
Inflow Hydrograph Volume (acre-ft) =	0.412	1.263	0.709	1.029	1.472	2.296	2.862	3.594
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.01	0.15	0.55	0.79	1.10
Predevelopment Peak Q (cfs) =	0.0	0.0	0.2	0.4	3.7	13.5	19.4	27.0
Peak Inflow Q (cfs) =	6.0	18.1	10.3	14.8	21.1	32.7	40.6	50.9
Peak Outflow Q (cfs) =	0.2	0.4	0.3	0.4	0.4	2.6	14.1	24.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.1	0.2	0.7	0.9
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.1	0.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	41	69	54	64	74	88	85	82
Time to Drain 99% of Inflow Volume (hours) =	43	74	57	68	80	95	94	93
Maximum Ponding Depth (ft) =	1.56	2.92	2.11	2.60	3.19	3.99	4.09	4.20
Area at Maximum Ponding Depth (acres) =	0.46	0.73	0.57	0.67	0.79	0.99	1.01	1.04
Maximum Volume Stored (acre-ft) =	0.377	1.194	0.661	0.963	1.392	2.109	2.209	2.312

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ft²
feet

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feet
feet
should be ≥ 4
ft²
ft²

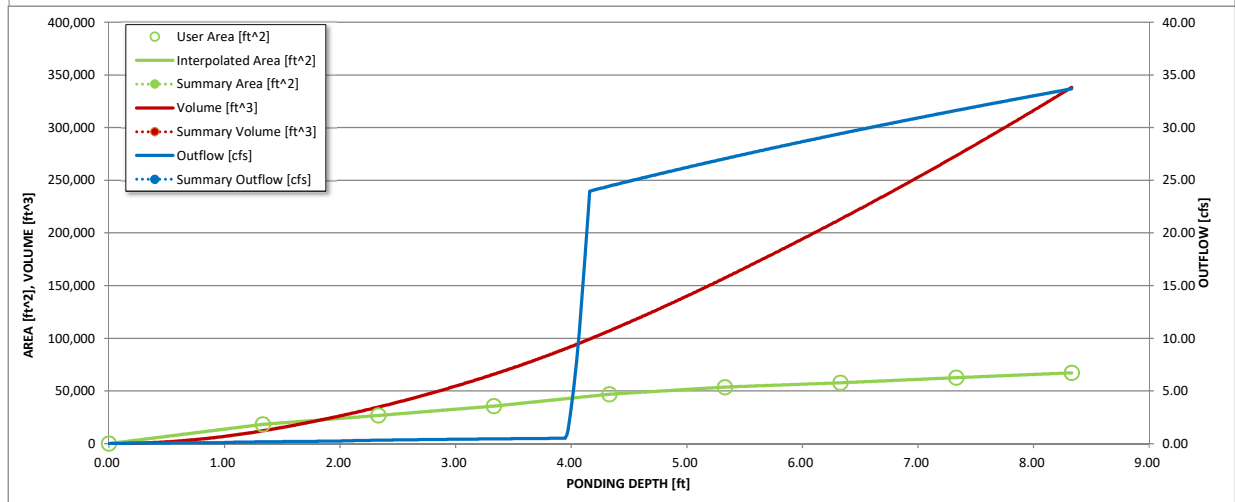
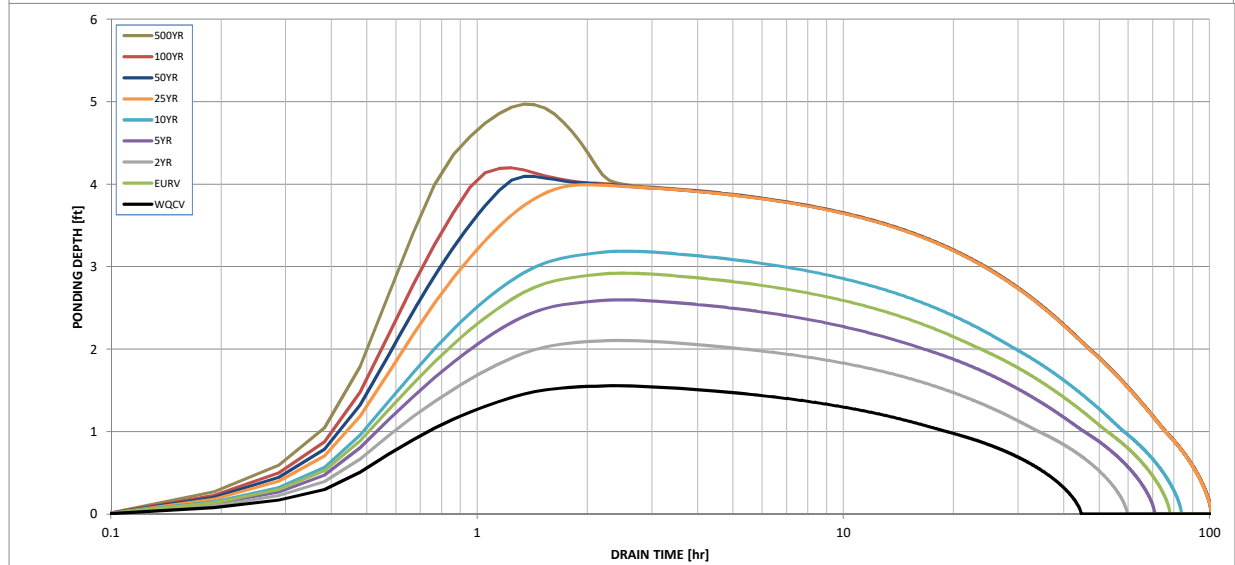
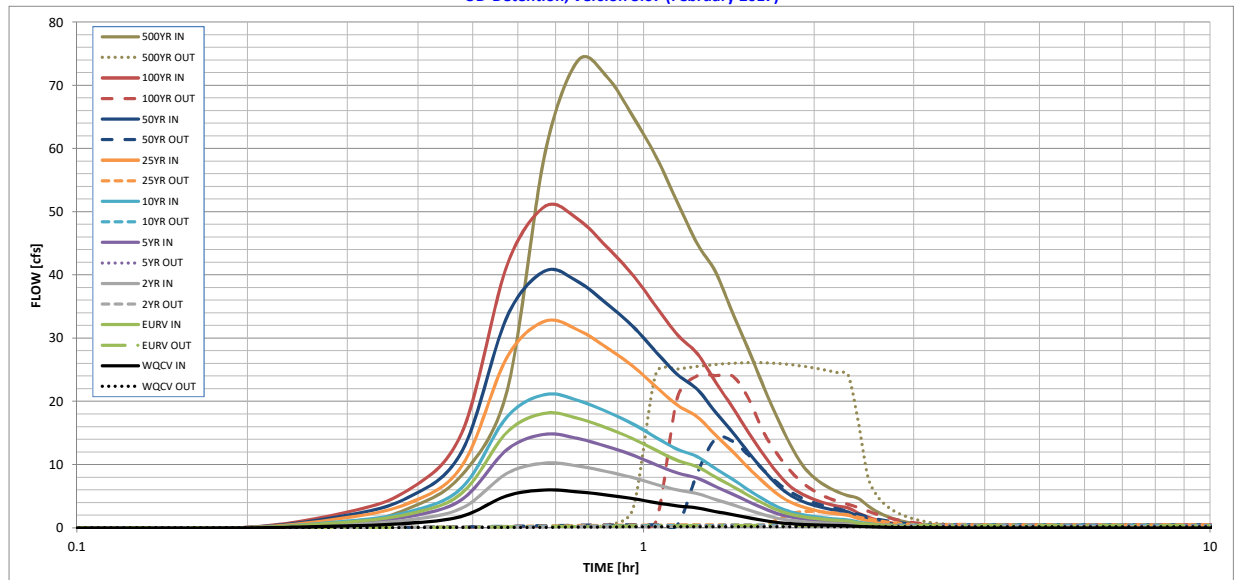
e

ft²
feet
radians

500 Year
3.10
5.271
5.262
1.75
42.8
73.9
26.1
0.6
Outlet Plate 1
0.3
N/A
76
90
4.97
1.18
3.169

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Summary Stage-Area-Volume-Discharge Relationships

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.

The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

[illegible]

Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Perception Design Group, Inc.
6901 South Pierce Street, Suite 315
Littleton, Colorado 80128
(303) 232-8088 Fax (303) 232-5255

Designed by: JWD
Checked by: JWD
Date: 18-Sep-17
Job Number: 2015-015

Project: Parker Pointe

Forebay Design

Required Forebay Volume = 3% of WQCV

WQCV = 0.412 ac-ft
 17,947 cubit feet

Required Forebay Volume = 538 cubit feet
Provided Area= 750.00 square feet
Provided Depth = 0.72 feet

Required Release = 2% of 100 year peak discharge

100 year discharge = 88.3 cfs
Required Release Rate = 1.77 cfs

Use Weir Equation to Size Slot in Concrete

100 YEAR

Invert Elevation 63.81
Ponding Elevation 64.53
Required Discharge 1.77
Coefficient of Discharge 3.40
Length L 0.6700

$Q = C_d \times L \times H^{0.5}$

Cd	Length	Head (ft)	Discharge (cfs)
3.40	0.6700	0.72	1.78
	8"		

MAP SCALE 1" = 500'

250
500
1000

FEET

METERS

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN RANGE 66 WEST.

STROHM ROAD

STROHM ROAD

STROHM RANCH DRIVE

S. STROHM RANCH DRIVE

Culvert

SITE

DOUGLAS COUNTY UNINCORPORATED AREA 080049

KINNEY ZONE

83

NFP

PANEL 0182G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY,

COLORADO

AND INCORPORATED AREAS

PANEL 182 OF 495
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0182	G
PARKER, TOWN OF	080310	0182	G

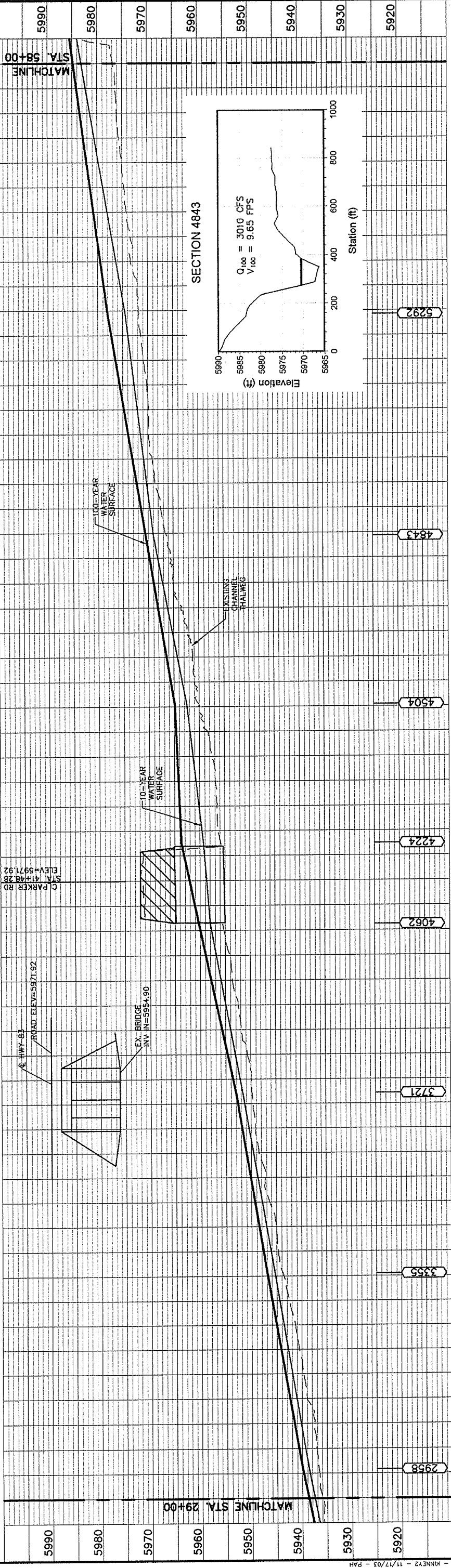
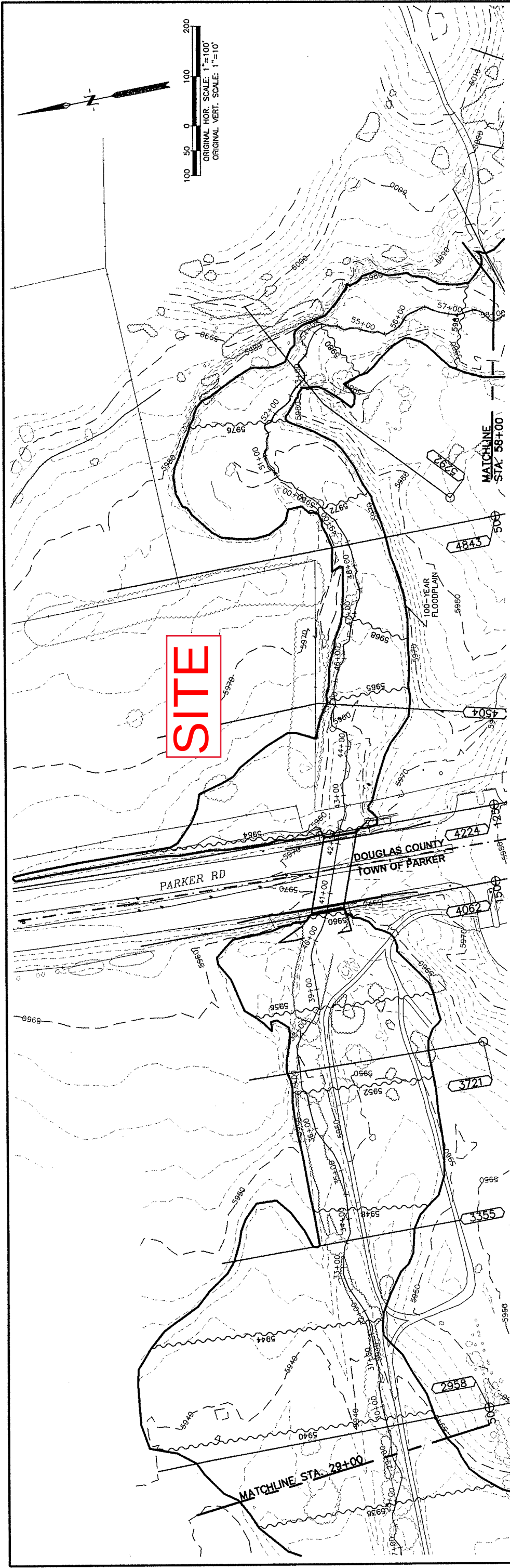
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
08035C0182G

MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov





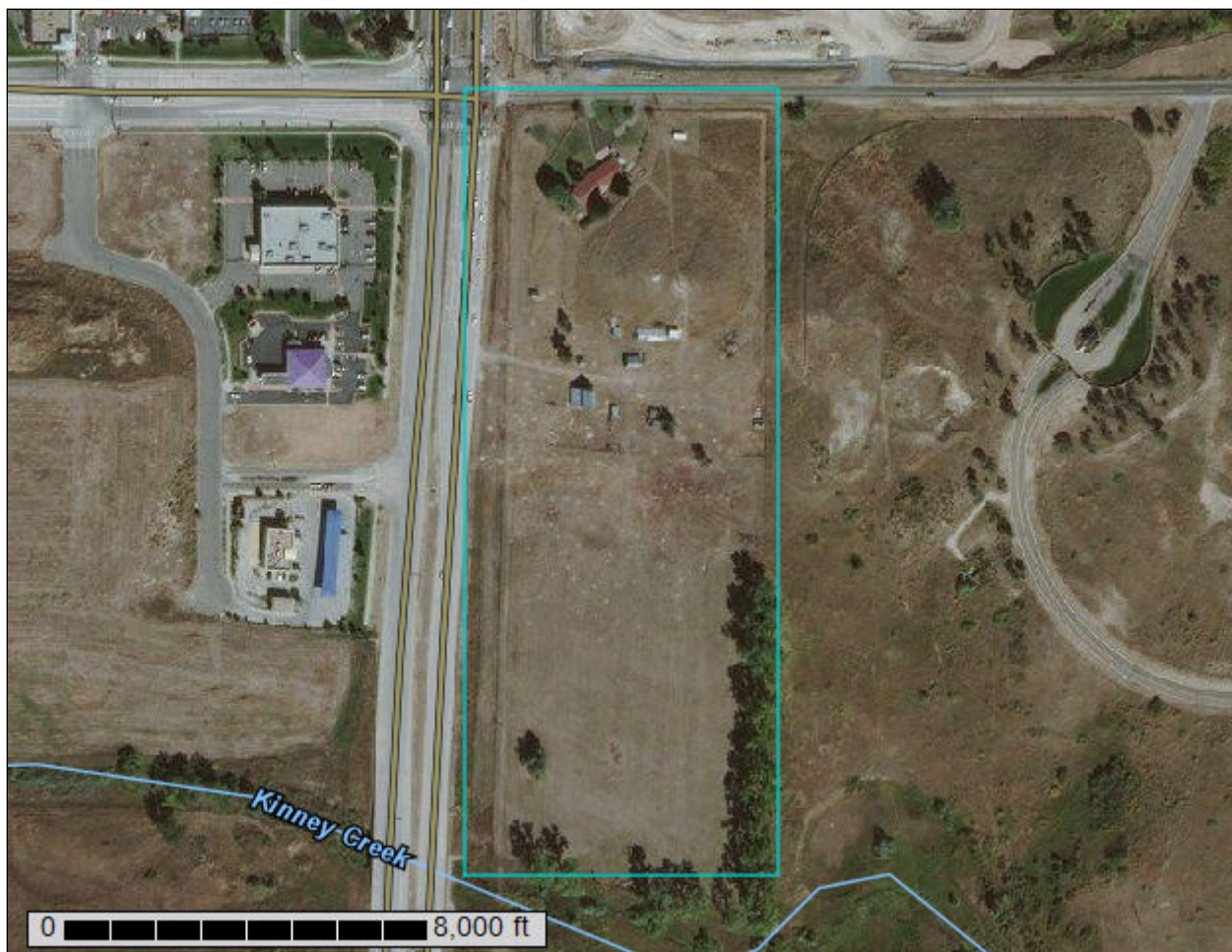
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Castle Rock Area, Colorado



September 18, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Soil Map may not be valid at this scale.

Map Scale: 1:2,470 if printed on A portrait (8.5" x 11") sheet.



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 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: Casile Rock Area, Colorado
Survey Area Data: Version 9, Sep 22, 2016

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

Date(s) aerial images were photographed: Jul 17, 2015—Mar 9, 2017

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

Castle Rock Area, Colorado (CO622)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	6.1	34.7%
Lu	Loamy alluvial land, dark surface	2.8	16.0%
Sa	Sampson loam	8.7	49.1%
Sd	Sandy alluvial land	0.0	0.2%
Totals for Area of Interest		17.7	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate

pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Castle Rock Area, Colorado

BtE—Bresser-Truckton sandy loams, 5 to 25 percent slopes

Map Unit Setting

National map unit symbol: jqy9
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Bresser and similar soils: 50 percent
Truckton and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bresser

Setting

Landform: Terraces
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy eolian deposits

Typical profile

H1 - 0 to 8 inches: sandy loam
H2 - 8 to 30 inches: sandy clay loam
H3 - 30 to 60 inches: loamy sand

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural 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 storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Sandy Foothill (R049BY210CO)
Hydric soil rating: No

Description of Truckton

Setting

Landform: Terraces
Landform position (three-dimensional): Tread, riser

Custom Soil Resource Report

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium derived from arkosic sedimentary rock

Typical profile

H1 - 0 to 4 inches: sandy loam

H2 - 4 to 19 inches: sandy loam

H3 - 19 to 60 inches: sandy loam

Properties and qualities

Slope: 10 to 25 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Hydric soil rating: No

Minor Components

Blakeland

Percent of map unit: 5 percent

Hydric soil rating: No

Newlin

Percent of map unit: 5 percent

Hydric soil rating: No

Stapleton

Percent of map unit: 4 percent

Hydric soil rating: No

Aquic haplustolls

Percent of map unit: 1 percent

Landform: Swales

Hydric soil rating: Yes

Lu—Loamy alluvial land, dark surface

Map Unit Setting

National map unit symbol: jqzc

Elevation: 7,000 to 8,000 feet

Custom Soil Resource Report

Mean annual precipitation: 17 to 19 inches
Mean annual air temperature: 44 to 46 degrees F
Frost-free period: 115 to 120 days
Farmland classification: Not prime farmland

Map Unit Composition

Loamy alluvial land, dark surface: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Loamy Alluvial Land, Dark Surface

Setting

Landform: Flood plains, swales
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

H1 - 0 to 20 inches: sandy loam
H2 - 20 to 40 inches: stratified loamy sand to clay loam
H3 - 40 to 60 inches: sand and gravel

Properties and qualities

Slope: 0 to 4 percent
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: Frequent
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Ecological site: Loamy Foothill 14-19 P.Z. (R049XC202CO)
Hydric soil rating: No

Minor Components

Sandy alluvial land

Percent of map unit: 14 percent
Hydric soil rating: No

Fluvaquentic haplustolls

Percent of map unit: 1 percent
Landform: Terraces
Hydric soil rating: Yes

Sa—Sampson loam

Map Unit Setting

National map unit symbol: jr02
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sampson and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sampson

Setting

Landform: Stream terraces on drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Weathered alluvium derived from arkose

Typical profile

H1 - 0 to 9 inches: loam
H2 - 9 to 28 inches: clay loam
H3 - 28 to 38 inches: loam
H4 - 38 to 60 inches: silt loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
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 in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: B
Ecological site: Loamy Foothill 14-19 P.Z. (R049XC202CO)

Hydric soil rating: No

Minor Components

Englewood

Percent of map unit: 8 percent

Hydric soil rating: No

Bresser

Percent of map unit: 7 percent

Hydric soil rating: No

Loamy alluvial land

Percent of map unit: 4 percent

Hydric soil rating: No

Aquic haplustolls

Percent of map unit: 1 percent

Landform: Swales

Hydric soil rating: Yes

Sd—Sandy alluvial land

Map Unit Setting

National map unit symbol: jr03

Elevation: 5,500 to 6,600 feet

Mean annual precipitation: 15 to 19 inches

Mean annual air temperature: 48 to 50 degrees F

Frost-free period: 120 to 135 days

Farmland classification: Not prime farmland

Map Unit Composition

Sandy alluvial land: 75 percent

Minor components: 25 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sandy Alluvial Land

Setting

Landform: Swales, drainageways

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Weathered alluvium derived from arkose

Typical profile

H1 - 0 to 20 inches: loamy sand

H2 - 20 to 60 inches: stratified sand to sandy loam

Properties and qualities

Slope: 1 to 5 percent

Natural drainage class: Excessively drained

Runoff class: Negligible

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)

Depth to water table: About 60 inches

Frequency of flooding: Frequent

Calcium carbonate, maximum in profile: 5 percent

Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)

Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7w

Hydrologic Soil Group: A

Hydric soil rating: No

Minor Components

Loamy alluvial land

Percent of map unit: 8 percent

Hydric soil rating: No

Loamy alluvial land, dark surface

Percent of map unit: 8 percent

Hydric soil rating: No

Bresser

Percent of map unit: 4 percent

Hydric soil rating: No

Truckton

Percent of map unit: 4 percent

Hydric soil rating: No

Fluvaquentic haplustolls

Percent of map unit: 1 percent

Landform: Terraces

Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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.

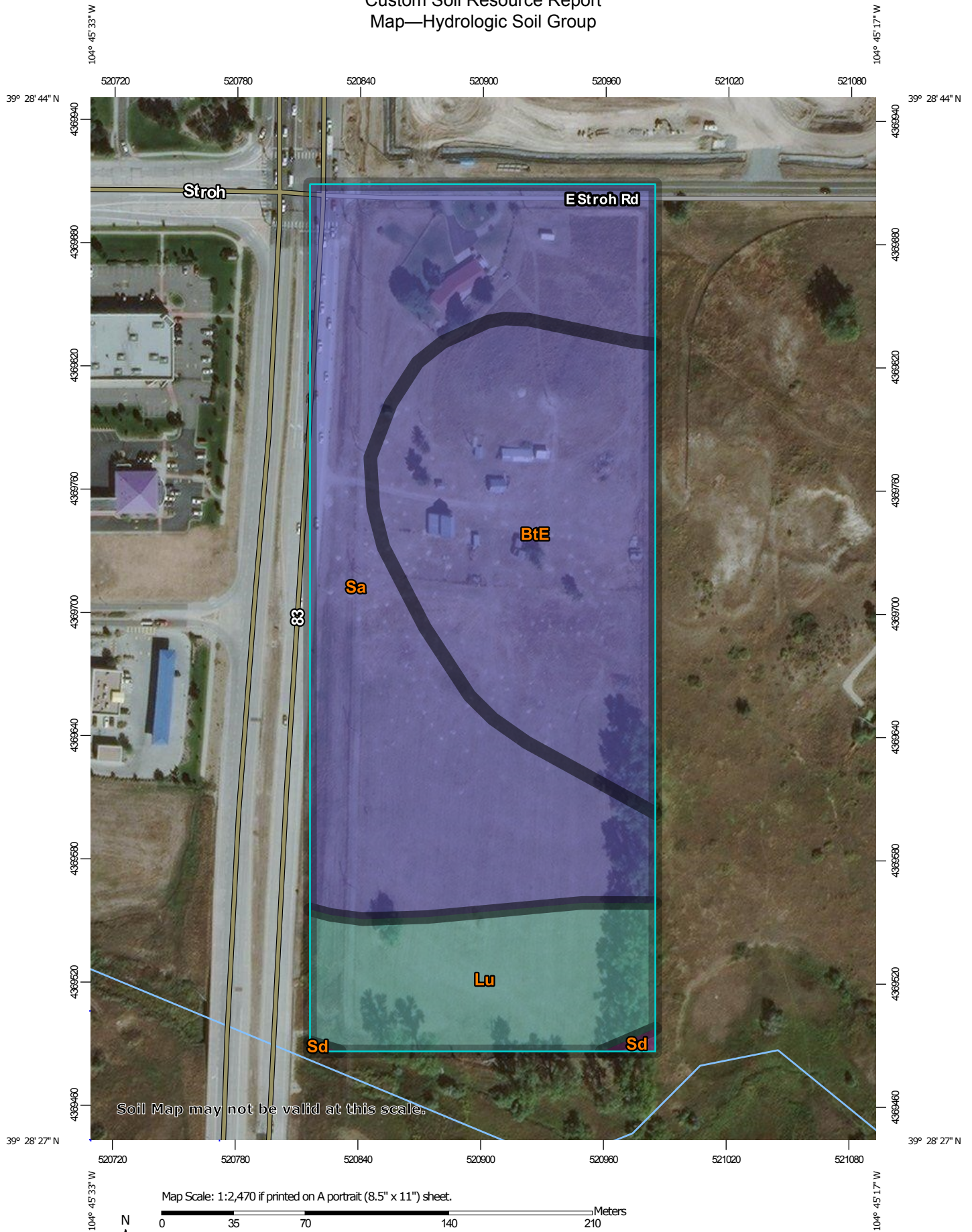
Custom Soil Resource Report

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.

Custom Soil Resource Report Map—Hydrologic Soil Group



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

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

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

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: Casile Rock Area, Colorado

Survey Area Data: Version 9, Sep 22, 2016

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

Date(s) aerial images were photographed: Jul 17, 2015—Mar 9, 2017

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.

Table—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
BtE	Bresser-Truckton sandy loams, 5 to 25 percent slopes	B	6.1	34.7%
Lu	Loamy alluvial land, dark surface	C	2.8	16.0%
Sa	Sampson loam	B	8.7	49.1%
Sd	Sandy alluvial land	A	0.0	0.2%
Totals for Area of Interest			17.7	100.0%

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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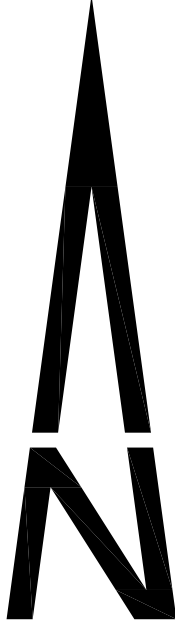
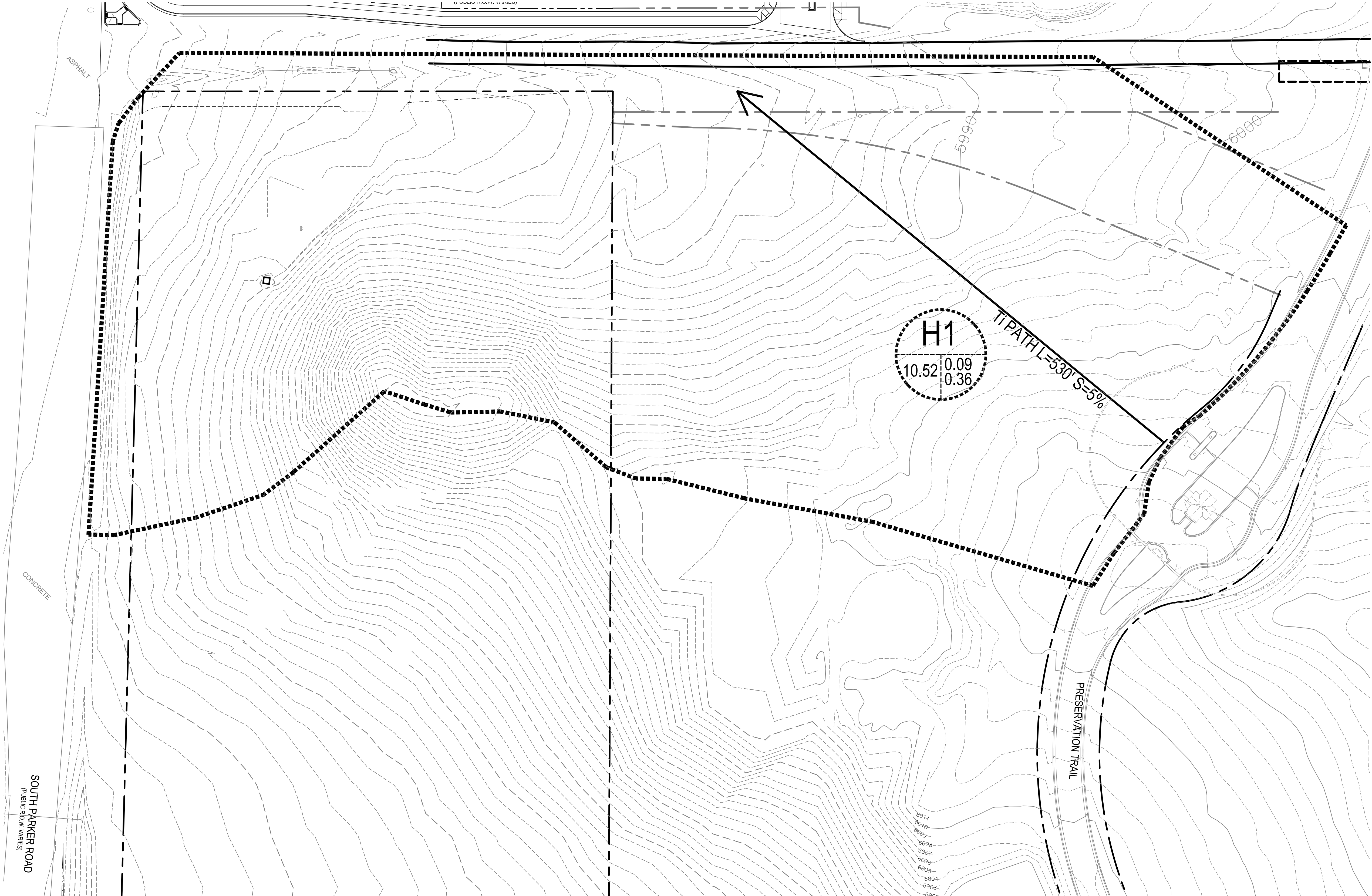
Custom Soil Resource Report

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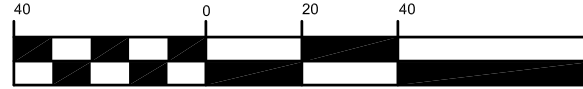
STROH ROAD



BENCHMARK

BENCHMARK: DOUGLAS COUNTY SURVEY CONTROL MONUMENT TT15A - 3" DIAMETER DOUGLAS
COUNTY GIS ALUMINUM CAP AT THE NE CORNER OF STROH ROAD AND SOUTH PARKER ROAD (US
HIGHWAY 83)
ELEVATION: 5970.79 FEET (NAVD 1988 DATUM)

GRAPHIC SCALE



1 inch = 48

THE TOWN OF PARKER REVIEW CONSTITUTES GENERAL COMPLIANCE WITH THE TOWN'S STANDARDS AND APPROVED VARIANCES, SUBJECT TO THESE PLANS BEING STAMPED, SIGNED, AND DATED BY THE PROFESSIONAL ENGINEER OF RECORD. REVIEW BY THE TOWN DOES NOT CONSTITUTE APPROVAL OF THE PLAN DESIGN OR ACCURACY AND CORRECTNESS OF ENGINEERING CALCULATIONS. ERRORS IN THE DESIGN OR CALCULATIONS REMAIN THE RESPONSIBILITY OF THE REGISTERED PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE ARE AFFIXED TO THIS DOCUMENT.

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TOWN OF PARKER, PUBLIC WORKS DIRECTOR _____ DATE _____

TOWN OF PARKER, PUBLIC WORKS MANAGER - STORMWATER	DATE
---	------

TOWN OF PARKER, PUBLIC WORKS MANAGER - TRANSPORTATION DATE

HISTORIC DRAINAGE PLAN

LOTS 1 THRU 14 AND TRACT A, PARKER POINTE FILING NO. 1
SOUTHEAST CORNER PARKER ROAD AND STROH ROAD
PARKER, COLORADO

Designed by: JWD
 Approved by: JWD
 Project no.: 2015-015

te: 10/01/17

SHEET

DP1

PREPARED UNDER THE DIRECT
SUPERVISION OF
BRYAN W. DAVIDSON, P.E.
COLORADO REG # 30226
FOR AND ON BEHALF OF
CONCEPTION DESIGN GROUP, INC.

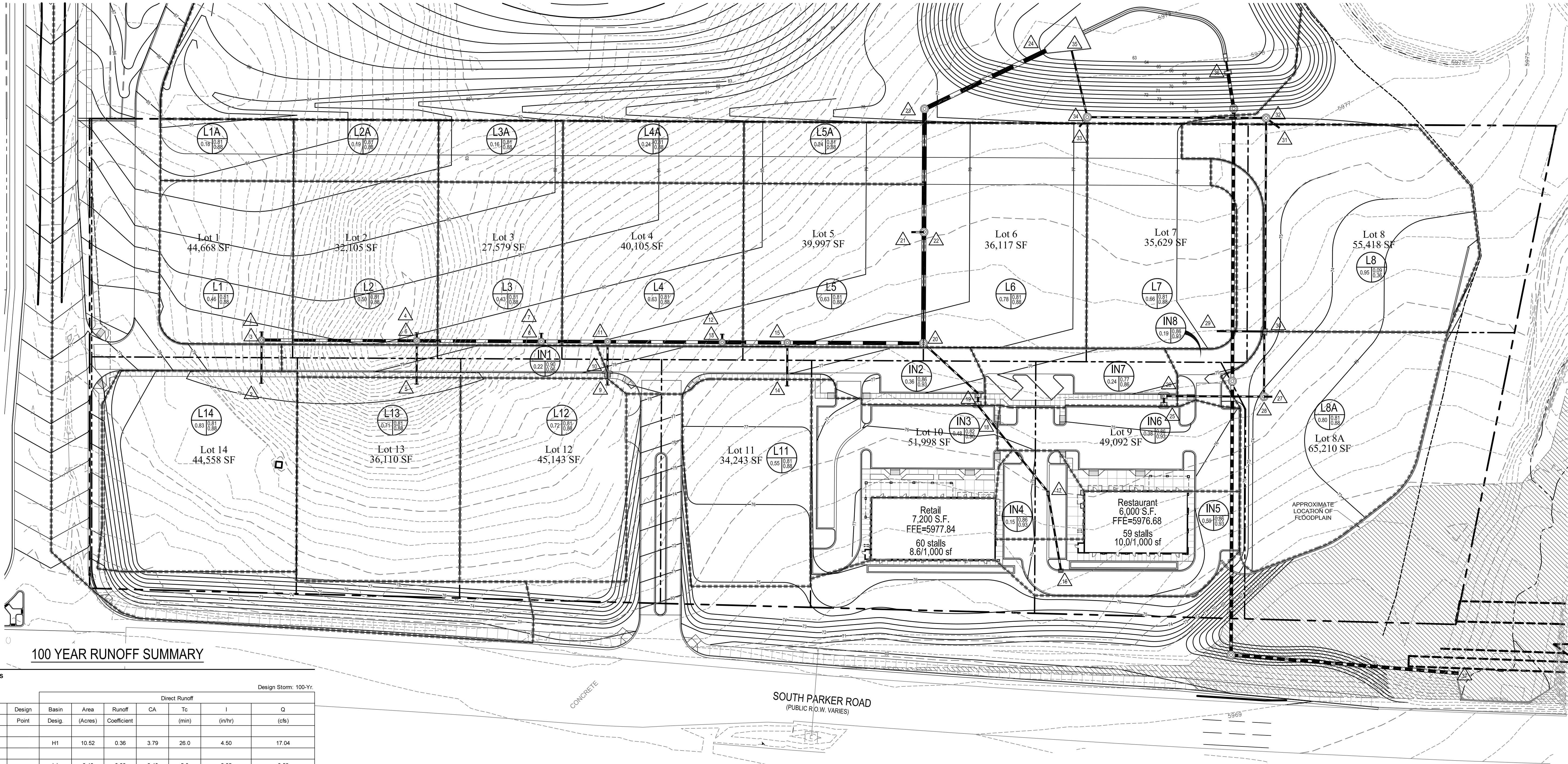
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Perception
Design Group, Inc.

Consulting Civil Engineers
901 South Pierce Street, Suite 315
Littleton, Colorado 80128
303-232-5255

STROH ROAD

SEE SHEET DP3



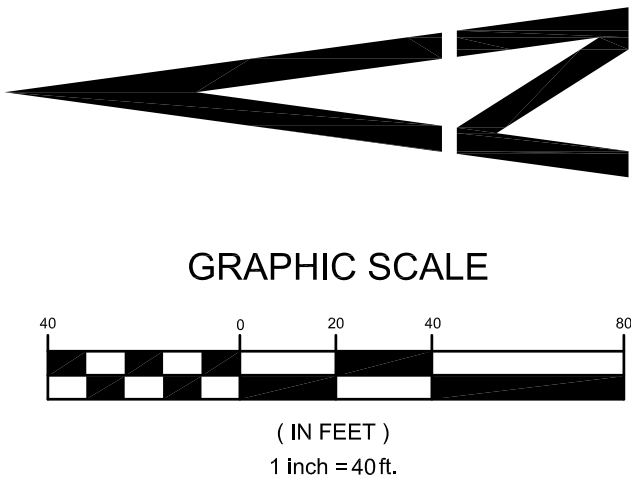
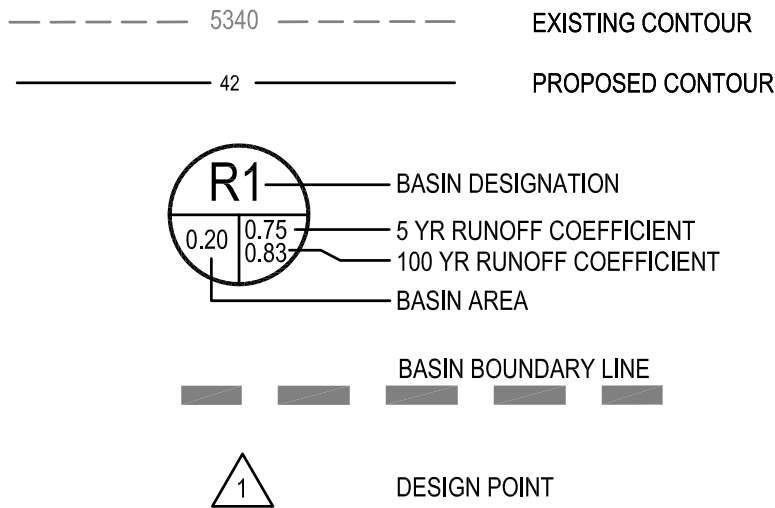
100 YEAR RUNOFF SUMMARY

RUNOFF CALCULATIONS (RATIONAL METHOD)						
Design Storm: 100-Yr.						
Design Point	Direct Runoff					
	Basin Desig.	Area (Acres)	Runoff Coefficient	CA	Tc (min)	Q (cfs)
	H1	10.52	0.36	3.79	26.0	17.04
	L1	0.46	0.88	0.40	5.0	8.85
	L1A	0.18	0.88	0.16	5.0	8.85
	L2	0.50	0.88	0.44	5.0	8.85
	L2A	0.19	0.88	0.17	5.0	8.85
	L3	0.43	0.88	0.38	5.0	8.85
	L3A	0.16	0.88	0.14	5.0	8.85
	L4	0.63	0.88	0.55	5.0	8.85
	L4A	0.24	0.88	0.21	5.0	8.85
	L5	0.63	0.88	0.55	5.0	8.85
	L5A	0.24	0.88	0.21	5.0	8.85
	L6	0.78	0.88	0.69	5.0	8.85
	L7	0.66	0.88	0.58	5.0	8.85
	L8	0.95	0.88	0.84	5.0	8.85
	L8A	0.8	0.88	0.70	5.0	8.85
	L11	0.55	0.88	0.48	5.0	8.85
	L12	0.72	0.88	0.63	5.0	8.85
	L13	0.71	0.88	0.62	5.0	8.85
	L14	0.83	0.88	0.73	5.0	8.85
	IN1	0.22	0.96	0.21	5.0	8.85
	IN2	0.36	0.93	0.33	5.0	8.85
	IN3	0.48	0.9	0.43	5.0	8.85
	IN4	0.15	0.92	0.14	5.0	8.85
	IN5	0.59	0.93	0.55	5.0	8.85
	IN6	0.38	0.93	0.35	5.0	8.85
	IN7	0.24	0.96	0.21	5.0	8.85
	IN8	0.19	0.93	0.18	5.0	8.85
	OS1	12.22	0.36	4.40	19.2	5.20
	TOTAL TO POND	24.49	0.62	15.18	19.2	5.20
	SR1	5.85	0.49	2.87	22.0	4.90

DETENTION SUMMARY

ZONE	VOLUME	ELEVATION	RELEASE RATE
WQCV	0.412 AC-FT	5964.30	43 HOURS
EURV+WQCV	0.852 AC-FT	5965.59	74 HOURS
100 YEAR+EURV+WQCV	2.060 AC-FT	5966.62	24.1 CFS

LEGEND



BENCHMARK

BENCHMARK: DOUGLAS COUNTY SURVEY CONTROL MONUMENT TT15A - 3" DIAMETER DOUGLAS COUNTY GIS ALUMINUM CAP AT THE NE CORNER OF STROH ROAD AND SOUTH PARKER ROAD (US HIGHWAY 63)
ELEVATION: 5970.79 FEET (NAVD 1988 DATUM)

THE TOWN OF PARKER REVIEW CONSTITUTES GENERAL COMPLIANCE WITH THE TOWN'S STANDARDS AND APPROVED VARIANCES. SUBJECT TO THESE PLANS BEING STAMPED, SIGNED, AND DATED BY THE PROFESSIONAL ENGINEER OF RECORD. REVIEW BY THE TOWN DOES NOT CONSTITUTE APPROVAL OF THE PLAN DESIGN OR ACCURACY AND CORRECTNESS OF ENGINEERING CALCULATIONS. ERRORS IN THE DESIGN OR CALCULATIONS REMAIN THE RESPONSIBILITY OF THE REGISTERED PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE ARE AFFIXED TO THIS DOCUMENT.

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TOWN OF PARKER, PUBLIC WORKS DIRECTOR	DATE
TOWN OF PARKER, PUBLIC WORKS MANAGER - STORMWATER	DATE
TOWN OF PARKER, PUBLIC WORKS MANAGER - TRANSPORTATION	DATE

DRAINAGE PLAN WEST

Perception
Design Group, Inc.

Consulting Civil Engineers
8901 South Pierce Street, Suite 315
Littleton, Colorado 80126
303-232-5655

PREPARED UNDER THE DIRECT
SUPERVISION OF
JERRY W. DAVIDSON, P.E.
COLORADO REG # 30226
FOR AND ON BEHALF OF
PERCEPTION DESIGN GROUP, INC.

REVISIONS	DATE	DESCRIPTION
10/24/17	INITIAL SUBMITTAL	

PARKER POINTE
LOTS 1 THRU 14 AND TRACT A, PARKER POINTE FILING NO. 1
SOUTHEAST CORNER PARKER ROAD AND STROH ROAD
PARKER, COLORADO

design by: JWD
approved by: JWD
project no.: 2015-015

date: 10/01/17

SHEET

DP2

STROH ROAD

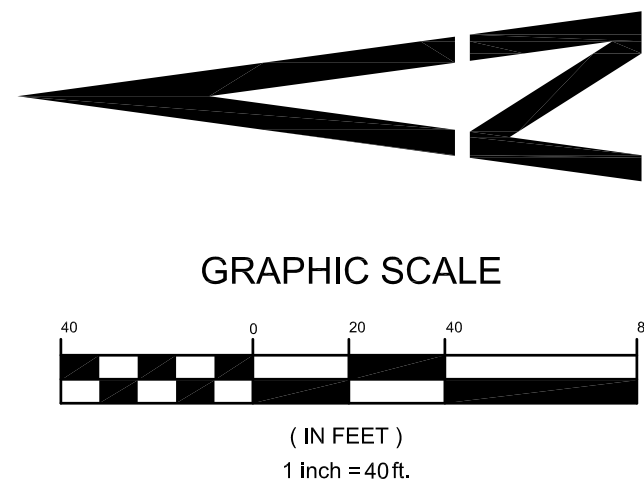
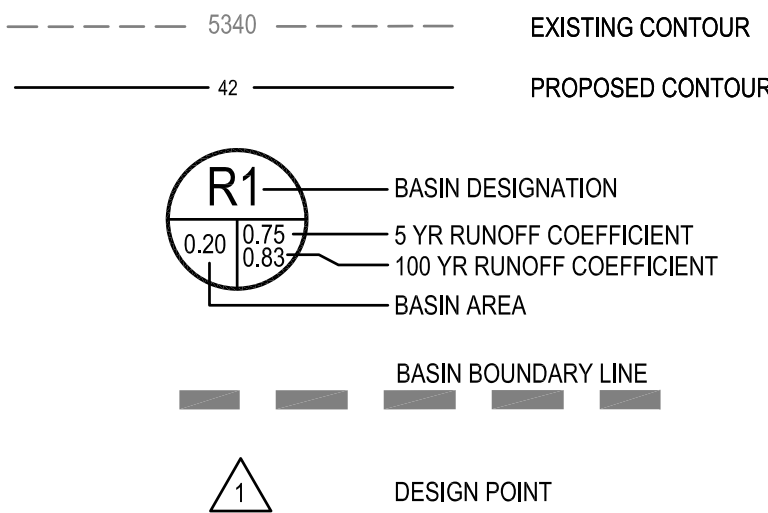
PRESERVATION TRAIL

SR1
5.85 0.32
0.25

OS1
2.22 0.32
0.25

SEE SHEET DP2

LEGEND



BENCHMARK

BENCHMARK: DOUGLAS COUNTY SURVEY CONTROL MONUMENT TT15A - 3" DIAMETER DOUGLAS COUNTY GIS ALUMINUM CAP AT THE NE CORNER OF STROH ROAD AND SOUTH PARKER ROAD (US HIGHWAY 63)
ELEVATION: 5970.79 FEET (NAVD 1988 DATUM)

THE TOWN OF PARKER REVIEW CONSTITUTES GENERAL COMPLIANCE WITH THE TOWN'S STANDARDS AND APPROVED VARIANCES. SUBJECT TO THESE PLANS BEING STAMPED, SIGNED, AND DATED BY THE PROFESSIONAL ENGINEER OF RECORD, REVIEW BY THE TOWN DOES NOT CONSTITUTE APPROVAL OF THE PLAN DESIGN OR ACCURACY AND CORRECTNESS OF ENGINEERING CALCULATIONS. ERRORS IN THE DESIGN OR CALCULATIONS REMAIN THE RESPONSIBILITY OF THE REGISTERED PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE ARE AFFIXED TO THIS DOCUMENT.

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TOWN OF PARKER, PUBLIC WORKS DIRECTOR DATE

TOWN OF PARKER, PUBLIC WORKS MANAGER - STORMWATER DATE

TOWN OF PARKER, PUBLIC WORKS MANAGER - TRANSPORTATION DATE

DRAINAGE PLAN EAST

Perception
Design Group, Inc.
Consulting Civil Engineers
6901 South Pierce Street, Suite 315
Littleton, Colorado 80126
303-222-5655

PREPARED UNDER THE DIRECT
SUPERVISION OF
JERRY W. DAVIDSON, P.E.
COLORADO REG # 30226
FOR AND ON BEHALF OF
PERCEPTION DESIGN GROUP, INC.

NO.	DATE	DESCRIPTION	REVISIONS
1	10/24/17	INITIAL SUBMITTAL	

PARKER POINTE
LOTS 1 THRU 14 AND TRACT A, PARKER POINTE FILING NO. 1
SOUTHEAST CORNER PARKER ROAD AND STROH ROAD
PARKER, COLORADO

design by: JWD
approved by: JWD
project no.: 2015-015

date: 10/01/17

SHEET

DP3

CALL UTILITY NOTIFICATION
CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE
BEFORE YOU DIG, GRADE, OR EXCAVATE
FOR THE MARKING OF UNDERGROUND
MEMBER UTILITIES.

CAUTION: NOTICE TO CONTRACTOR THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES AND, WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE LOCAL UTILITY LOCATION CENTER AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.