FINAL DRAINAGE REPORT
PARKER POINTE
PARKER, COLORADO

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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.

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:

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:

Volume Element	Volume	Elevation	Release Rate
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

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.

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.

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

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

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

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

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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

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

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	FUTURE COMMERCIAL		DRIVES/WALKS/ROOF		LANDSCAPING				
Catchment	Area (Ac.)	C	Area (Ac.)	C	Area (Ac.)	C	Composite C	Catchment Area (Ac.)	Imperviousness
	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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TYPE B SOILS

	FUTURE COMMERCIAL		DRIVES/WALKS/ROOF		LANDSCAPING				
Catchment	Area (Ac.)	C	Area (Ac.)	C	Area (Ac.)	C	Composite C	Catchment Area (Ac.)	Imperviousness
	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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TYPE B SOILS

	FUTURE COMMERCIAL		DRIVES/WALKS/ROOF		LANDSCAPING				
Catchment	Area (Ac.)	C	Area (Ac.)	C	Area (Ac.)	C	Composite C	Catchment Area (Ac.)	Imperviousness
	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%**
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	

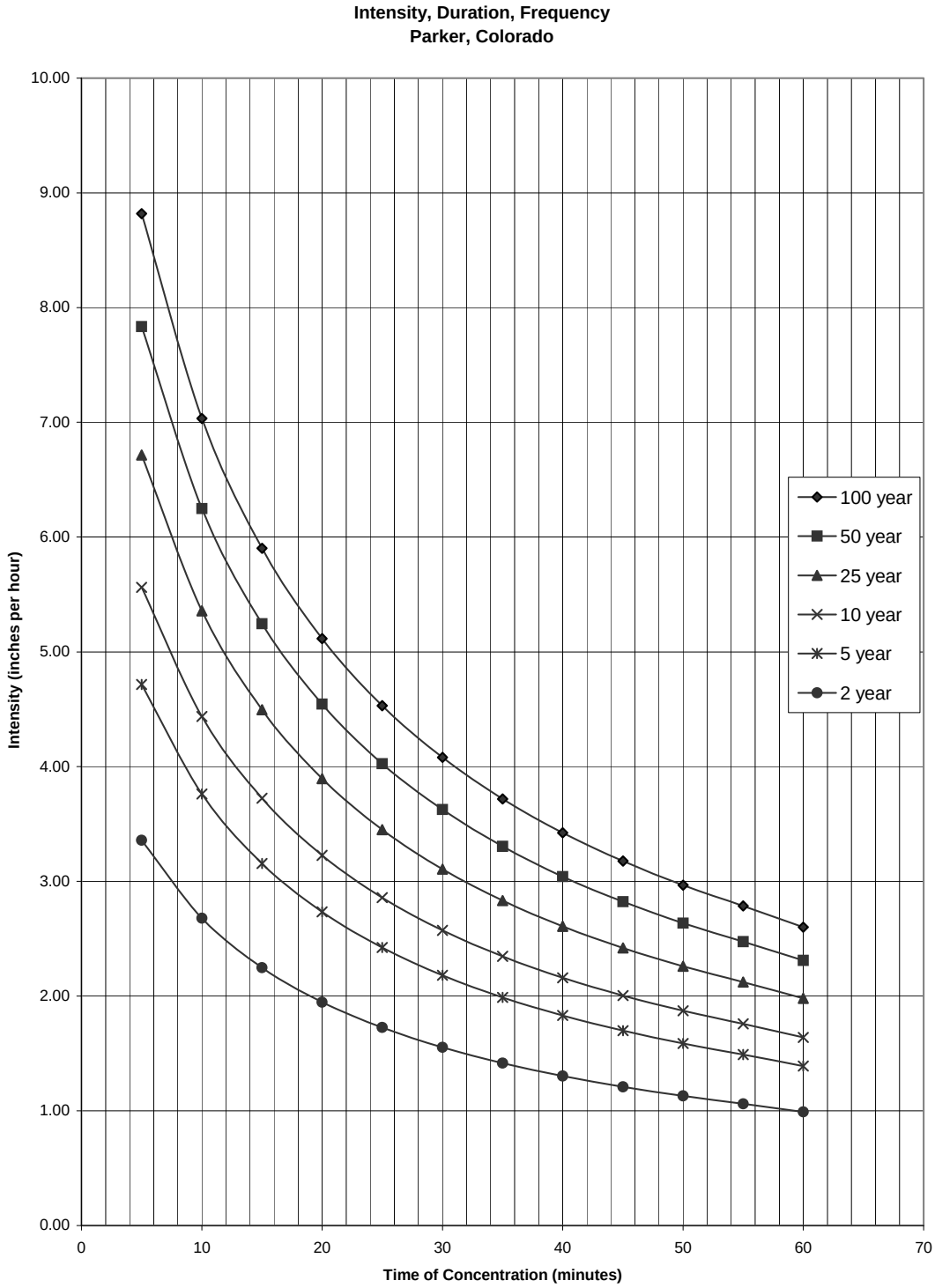

FIGURE 5.1
RAINFALL INTENSITY VERSUS DURATION CURVES FOR PARKER, COLORADO

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 TIME (Ti)			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

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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
L14	2-3	6.46	0.50	0.013	18	7.45	3.66	0.38
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

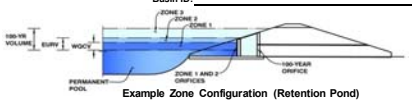
Contributing Basins	Pipe Location Design Points	Q req'd (cfs)	Slope (%)	n	Diam (in)	Q calc (cfs)	V (Full Flow) (fps)	Friction Slope (%)
IN2,IN3,IN4,IN5	19-20	12.86	0.50	0.013	24	16.04	4.09	0.32
IN1,IN2,IN3,IN4,IN5,L1,L2,L3,L4,L11,L12,L13,L14	20-22	53.59	0.75	0.013	36	57.92	7.58	0.64
L5	21-22	4.91	2.00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

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) =	0.412	acre-feet
Excess Urban Runoff Volume (EURV) =	1.264	acre-feet
2-yr Runoff Volume (P1 = 0.83 in.) =	0.710	acre-feet
5-yr Runoff Volume (P1 = 1.11 in.) =	1.029	acre-feet
10-yr Runoff Volume (P1 = 1.36 in.) =	1.472	acre-feet
25-yr Runoff Volume (P1 = 1.72 in.) =	2.295	acre-feet
50-yr Runoff Volume (P1 = 2.01 in.) =	2.862	acre-feet
100-yr Runoff Volume (P1 = 2.32 in.) =	3.594	acre-feet
500-yr Runoff Volume (P1 = 3.1 in.) =	5.271	acre-feet
Approximate 2-yr Detention Volume =	0.664	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

Optional User Override 1-hr Precipitation

	inches
	inches
	inches
	inches
	inches
	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.412	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.852	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.796	acre-feet
Total Detention Basin Volume =	2.060	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{TOTAL}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{MAIN}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

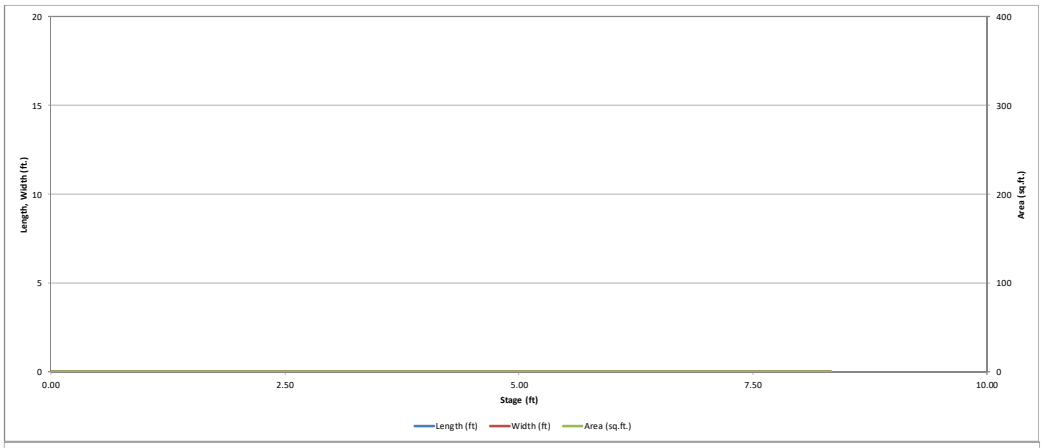
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{TOTAL}) =	user	acre-feet

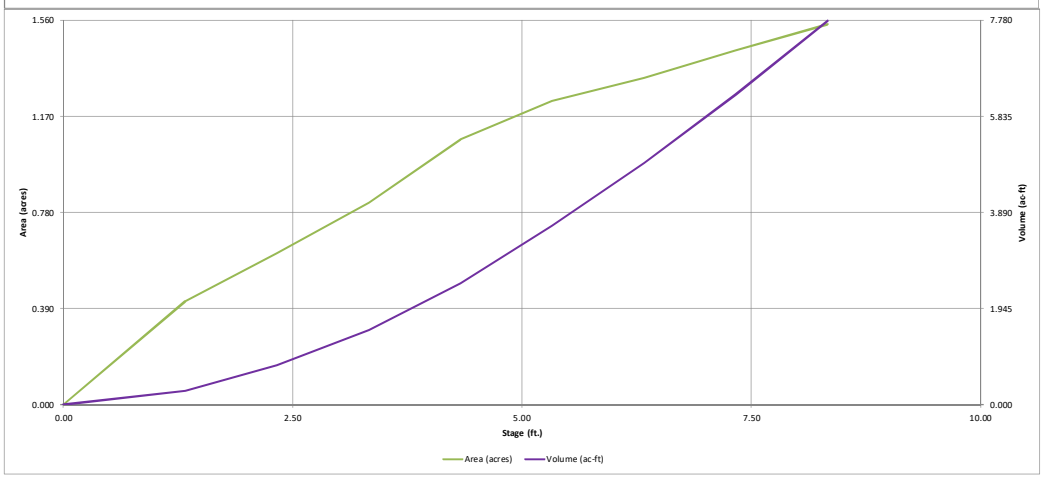
Depth Increment = 1 ft

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
Plan Elev=71.00	--	8.33	--	--	--	67,188	1.542	338,265	7.766

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



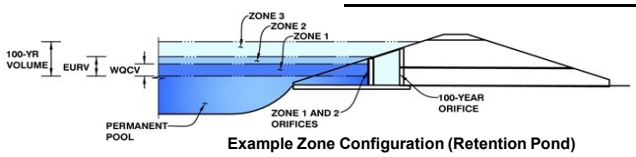


Detention Basin Outlet Structure Design

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 =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

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 =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	2.083E-02	ft^2
Depth at top of Zone using Orifice Plate =	3.02	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	12.00	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	3.00	sq. inches (diameter = 1-15/16 inches)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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)

	Not Selected	Not Selected			Not Selected	Not Selected
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A
Vertical Orifice Diameter =	N/A	N/A	inches			

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	3.95	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.95	N/A
Overflow Weir Front Edge Length =	10.00	N/A	feet	Over Flow Weir Slope Length =	10.00	N/A
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)	Grate Open Area / 100-yr Orifice Area =	41.58	N/A
Horiz. Length of Weir Sides =	10.00	N/A	feet	Overflow Grate Open Area w/o Debris =	100.00	N/A
Overflow Grate Open Area % =	100%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	100.00	N/A
Debris Clogging % =	0%	N/A	%			

Calculated Parameters for Overflow Weir

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

	Zone 3 Circular	Not Selected			Zone 3 Circular	Not Selected
Depth to Invert of Outlet Pipe =	1.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	2.41	N/A
Circular Orifice Diameter =	21.00	N/A	inches	Outlet Orifice Centroid =	0.88	N/A
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plat

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=		ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	feet
Spillway Crest Length =		feet	Stage at Top of Freeboard =	feet
Spillway End Slopes =		H:V	Basin Area at Top of Freeboard =	acres
Freeboard above Max Water Surface =		feet		

Calculated Parameters for Spillway

Routed Hydrograph Results

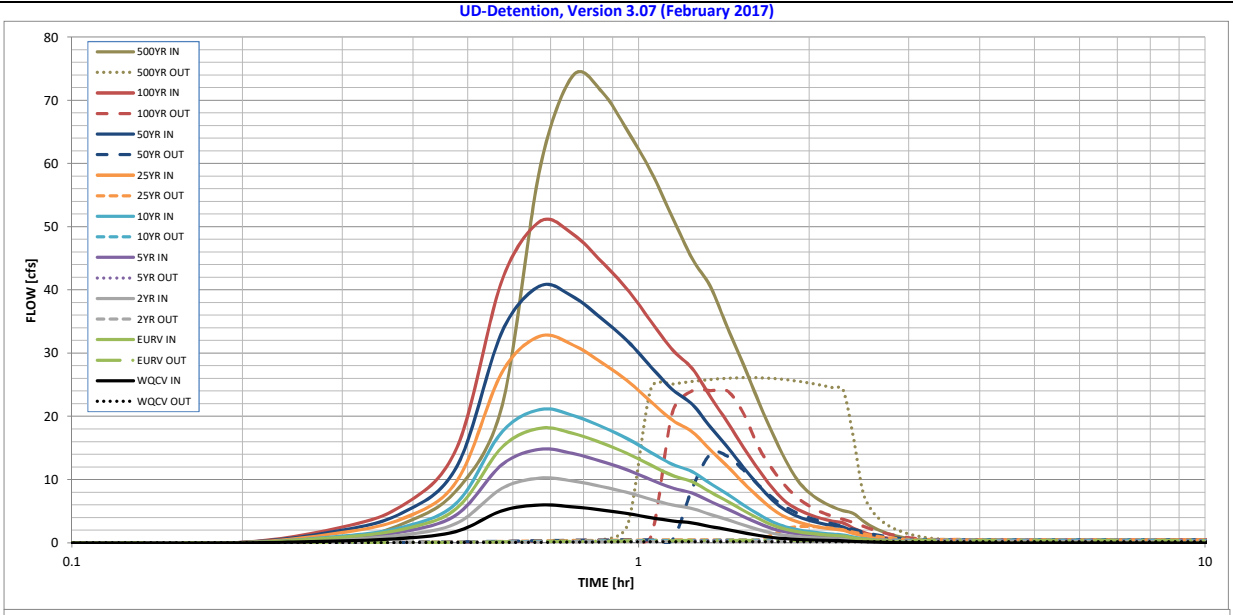
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.83	1.11	1.36	1.72	2.01	2.32
Calculated Runoff Volume (acre-ft) =	0.412	1.264	0.710	1.029	1.472	2.295	2.862	3.594
OPTIONAL Override Runoff Volume (acre-ft) =								
Inflow 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

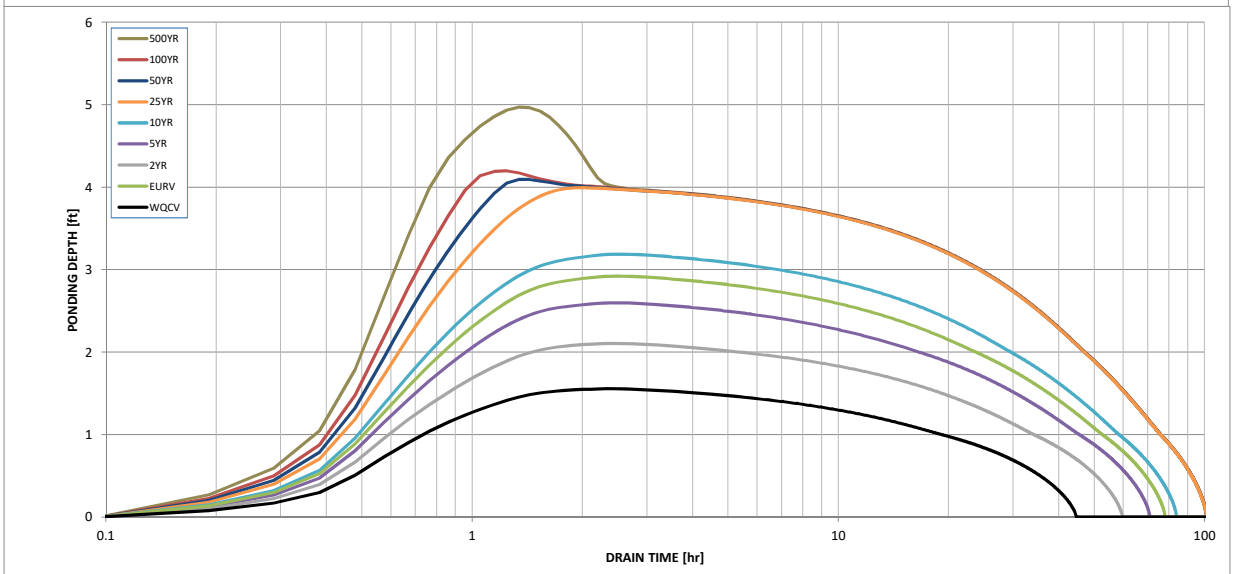
ft^2
feet
feet
feet
should be $\geq$ 4
ft^2
ft^2
e
ft^2
feet
radians

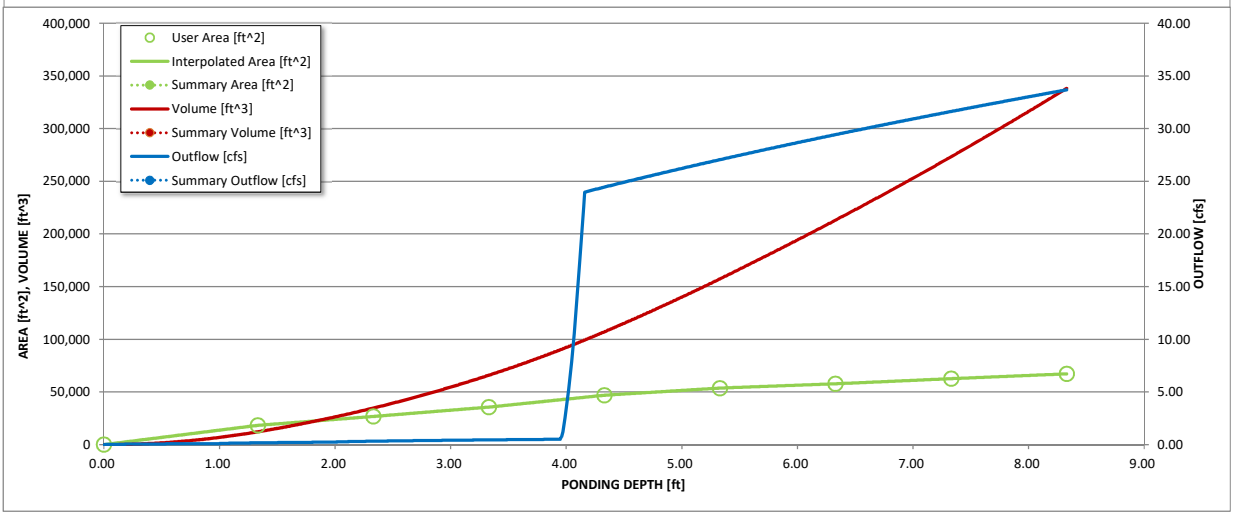
500 Year
3.10
5.271
5.262
1.75
42.8
73.9
26.1
0.6
Outlet Plate 1
0.3
N/A
76
90
4.97
1.18
3.169

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

Outflow Hydrograph Workbook Filename:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.74 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph Constant	0:11:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:17:13	0.27	0.79	0.45	0.65	0.92	1.40	1.72	2.13	3.00
0.871	0:22:58	0.72	2.14	1.22	1.76	2.49	3.83	4.74	5.90	8.42
	0:28:42	1.85	5.51	3.14	4.51	6.39	9.84	12.18	15.15	21.62
	0:34:26	5.08	15.13	8.63	12.39	17.55	27.00	33.41	41.54	59.24
	0:40:11	5.99	18.13	10.25	14.80	21.09	32.70	40.64	50.87	73.90
	0:45:55	5.71	17.34	9.79	14.14	20.18	31.33	38.98	48.86	71.39
	0:51:40	5.20	15.78	8.91	12.88	18.37	28.51	35.47	44.46	65.14
	0:57:24	4.63	14.14	7.96	11.53	16.47	25.62	31.90	40.04	58.71
	1:03:08	3.99	12.26	6.88	9.98	14.29	22.30	27.82	34.99	51.44
	1:08:53	3.48	10.66	5.99	8.68	12.42	19.40	24.24	30.52	44.96
	1:14:37	3.15	9.67	5.43	7.87	11.26	17.57	21.93	27.58	40.51
	1:20:22	2.59	8.03	4.48	6.53	9.37	14.66	18.33	23.08	34.05
	1:26:06	2.10	6.60	3.66	5.35	7.71	12.11	15.15	19.11	28.25
	1:31:50	1.61	5.14	2.83	4.15	6.01	9.51	11.94	15.11	22.46
	1:37:35	1.19	3.88	2.11	3.12	4.55	7.27	9.16	11.64	17.41
	1:43:19	0.87	2.82	1.53	2.26	3.33	5.36	6.79	8.67	13.06
	1:49:04	0.67	2.16	1.18	1.74	2.54	4.06	5.13	6.52	9.75
	1:54:48	0.55	1.77	0.97	1.43	2.08	3.30	4.15	5.25	7.81
	2:00:32	0.47	1.50	0.82	1.21	1.75	2.78	3.50	4.43	6.57
	2:06:17	0.41	1.31	0.72	1.06	1.54	2.43	3.05	3.85	5.71
	2:12:01	0.37	1.18	0.65	0.95	1.38	2.18	2.73	3.45	5.10
	2:17:46	0.35	1.08	0.60	0.88	1.27	2.00	2.50	3.16	4.66
	2:23:30	0.25	0.80	0.44	0.64	0.93	1.48	1.85	2.35	3.50
	2:29:14	0.19	0.58	0.32	0.47	0.68	1.07	1.35	1.70	2.53
	2:34:59	0.14	0.43	0.24	0.35	0.50	0.79	0.99	1.26	1.87
	2:40:43	0.10	0.32	0.17	0.26	0.37	0.59	0.74	0.94	1.39
	2:46:28	0.07	0.23	0.12	0.18	0.27	0.43	0.54	0.68	1.02
	2:52:12	0.05	0.16	0.09	0.13	0.19	0.30	0.38	0.49	0.74
	2:57:56	0.04	0.12	0.06	0.09	0.14	0.22	0.28	0.36	0.53
	3:03:41	0.02	0.08	0.04	0.06	0.09	0.15	0.19	0.25	0.37
	3:09:25	0.01	0.05	0.02	0.04	0.06	0.10	0.12	0.16	0.24
	3:15:10	0.01	0.03	0.01	0.02	0.03	0.05	0.07	0.09	0.14
	3:20:54	0.00	0.01	0.00	0.01	0.01	0.02	0.03	0.04	0.07
	3:26:38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02
	3:32:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:38:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:43:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:49:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:24:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:29:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:41:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:47:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:52:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:58:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:04:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	6:07:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:13:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:18:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:24:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:30:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:36:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:41:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:47:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:53:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

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

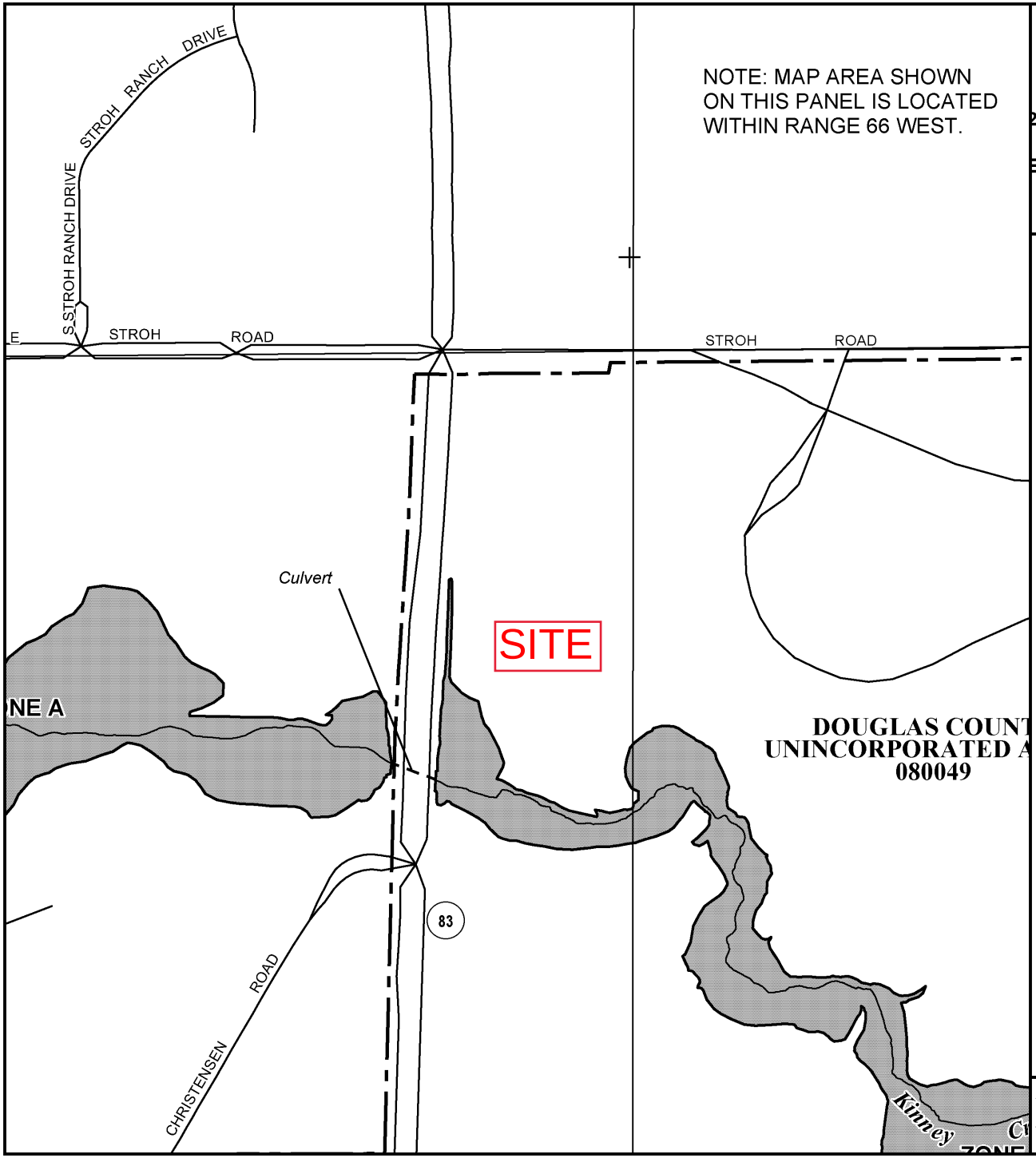
Use Weir Equation to Size Slot in Concrete

100 YEAR

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

Q=Cd x L x H^0.5

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



MAP SCALE 1" = 500'

250 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

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:

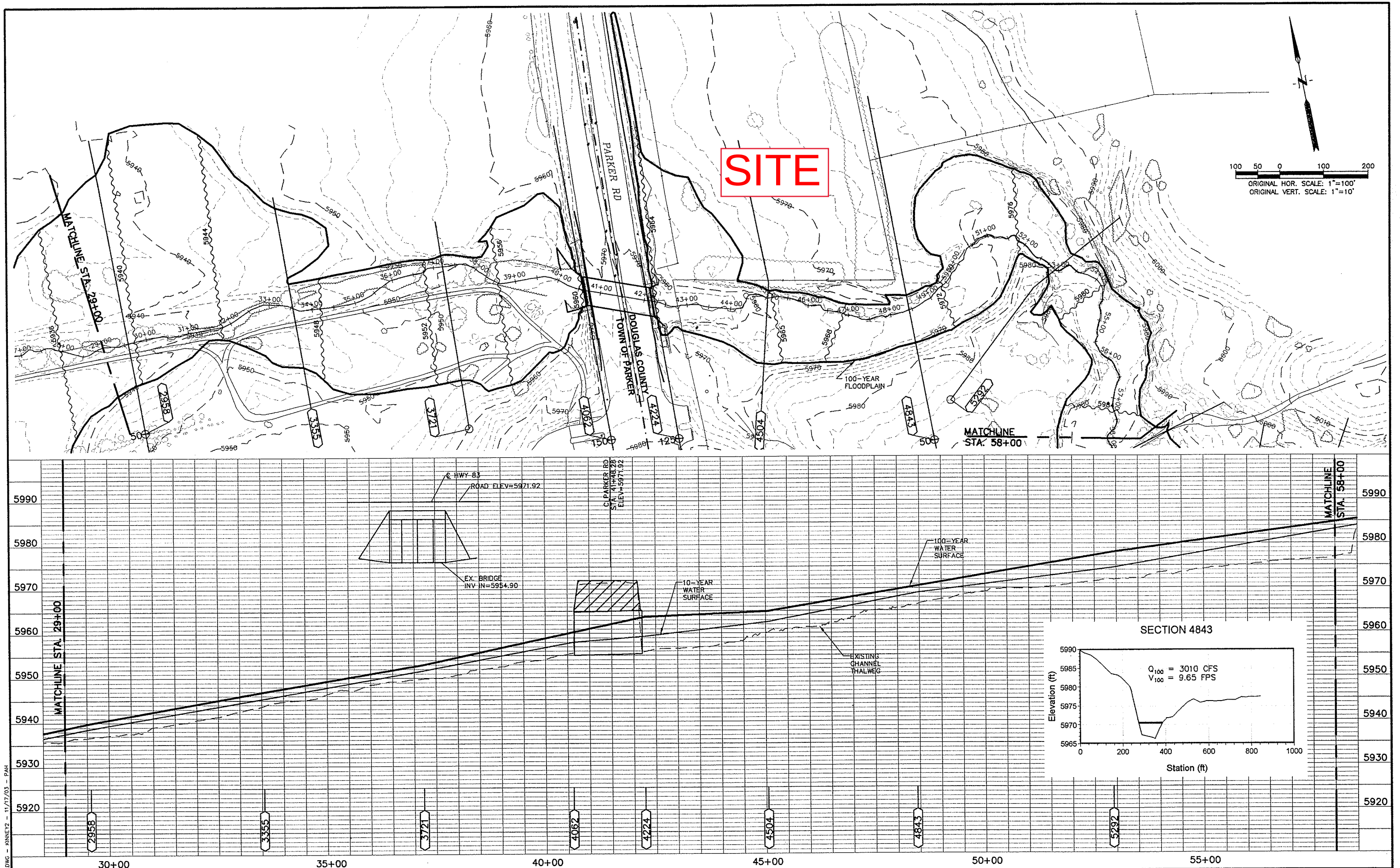
COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0182	G
PARKER, TOWN OF	080310	0182	G

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



GROUND CONTROL SURVEY BY: MOUNTAIN SURVEY & MAPPING
AERIAL PHOTOGRAPHY BY: LANDMARK MAPPING
TOPOGRAPHIC MAPPING BY: LANDMARK MAPPING
CONTOUR INTERVAL: 2 DATE FLOWN: 03/19/99

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80246
PHONE NO: (303) 757-8513
FAX NO: (303) 758-3208

DESIGNED	RLM	DATE	5/29/03
DRAWN	PAH	DATE	5/29/03
CHECKED		DATE	
REVISED		DATE	
AS-BUILT		DATE	

URBAN DRAINAGE & FLOOD CONTROL DISTRICT
DOUGLAS COUNTY

FLOOD HAZARD AREA DELINEATION FOR KINNEY CREEK AND TRIBUTARIES

KINNEY CREEK STA. 29+00 TO STA. 58+00

SHEET 2 OF 34

2122 - 2122FA02.DWG - KINNEY2 - 11/17/03 - PAH

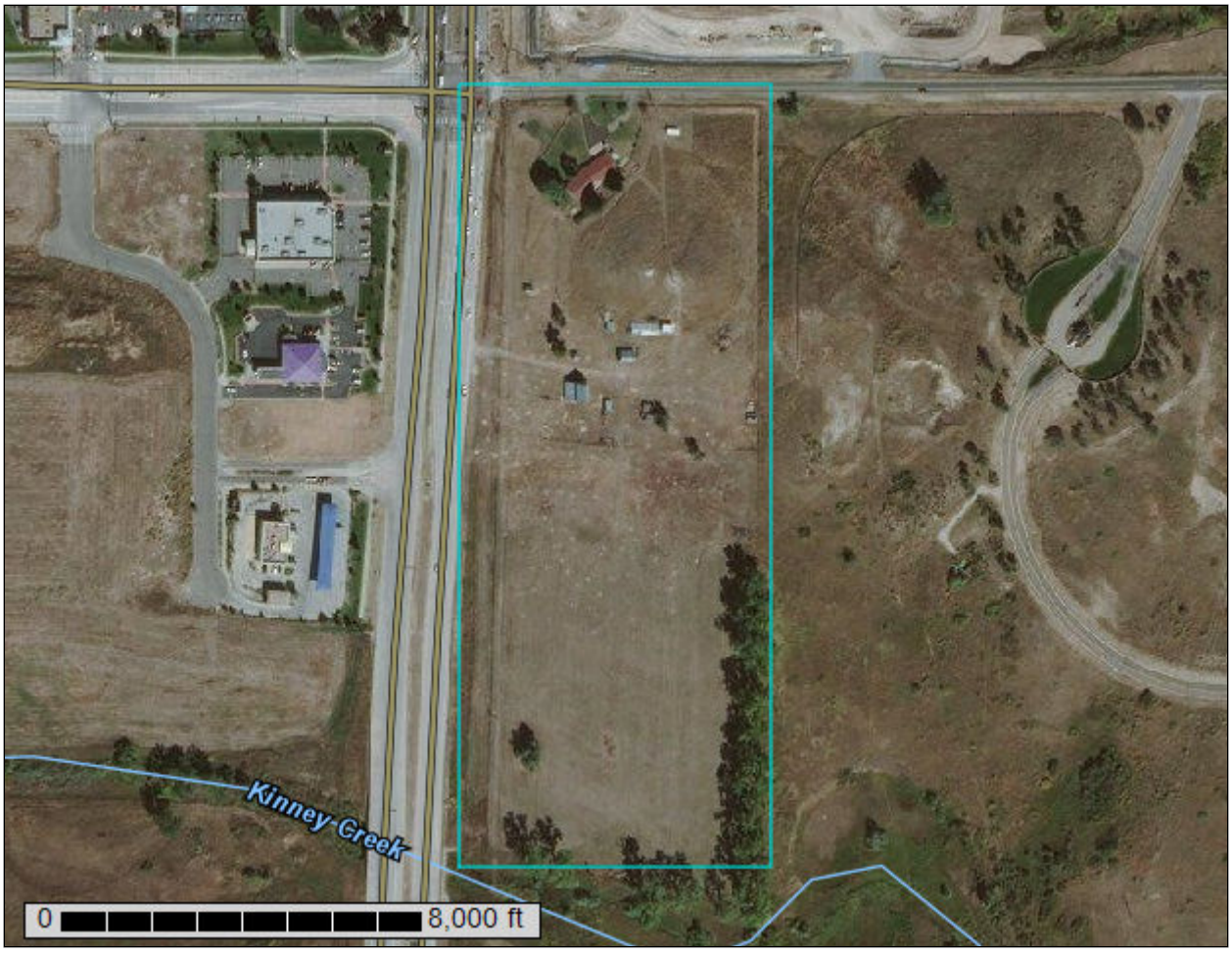
United States Department of Agriculture

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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Lu—Loamy alluvial land, dark surface.....11
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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

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

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 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

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

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

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.

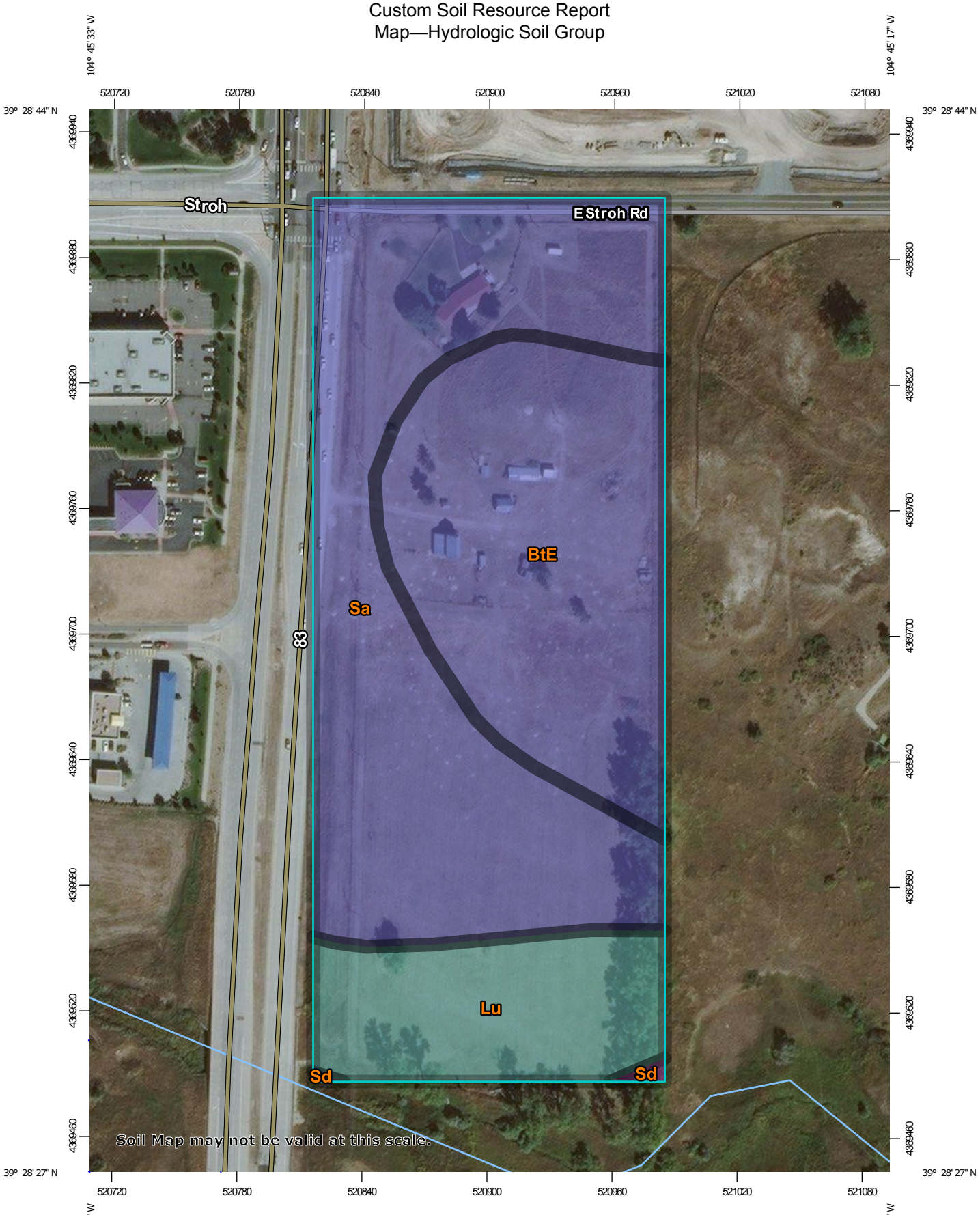
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 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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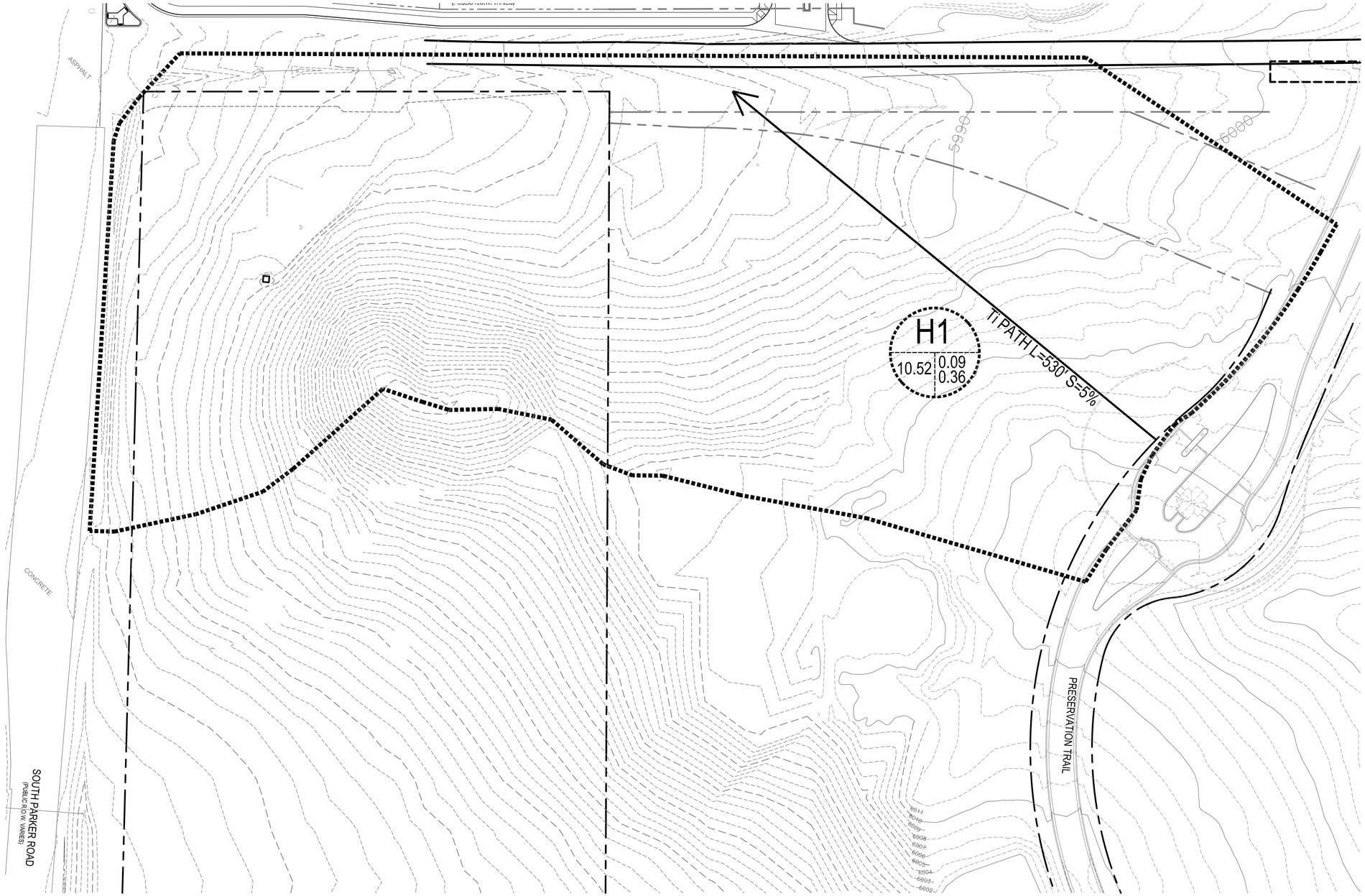

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)

1 inch = 40 ft.

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)

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

Perception Design Group, Inc.
Consulting Civil Engineers
6901 South Pierce Street, Suite 315
Littleton, Colorado 80128
303-232-5255

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

△	DATE	DESCRIPTION
	10/24/17	INITIAL SUBMITTAL

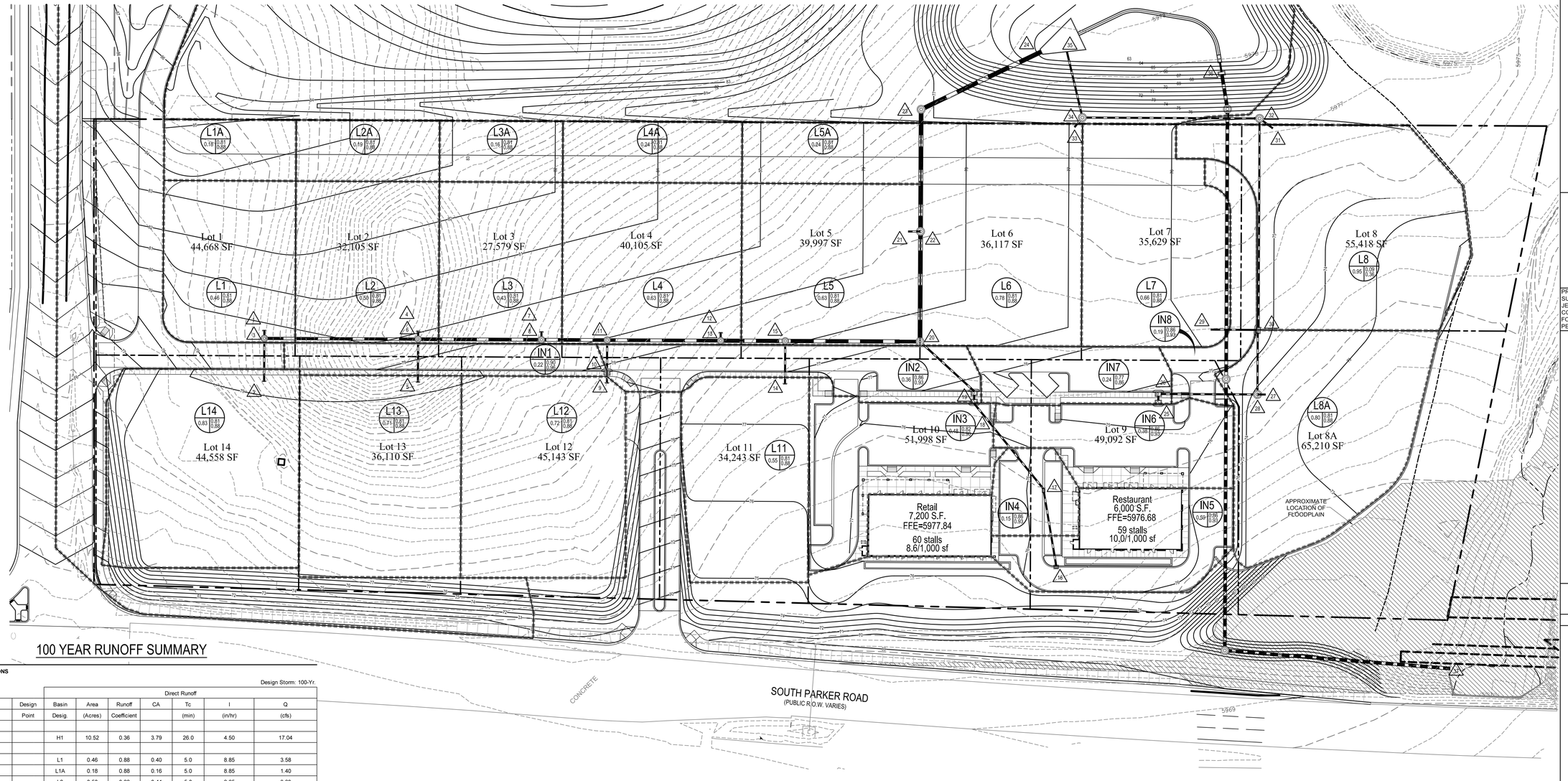
REVISIONS

HISTORIC DRAINAGE PLAN

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
DP1



100 YEAR RUNOFF SUMMARY

RUNOFF CALCULATIONS
(RATIONAL METHOD)

Design Storm: 100-Yr.

	Design	Basin	Area	Direct Runoff 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

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

- 5340 — EXISTING CONTOUR
- 42 — PROPOSED CONTOUR
- R1 (0.20 / 0.75 / 0.83) — BASIN DESIGNATION; 5 YR RUNOFF COEFFICIENT; 100 YR RUNOFF COEFFICIENT; BASIN AREA
- BASIN BOUNDARY LINE
- 1 — DESIGN POINT

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 Inch = 40 ft.

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

DATE	REVISIONS
10/24/17	1 INITIAL SUBMITTAL

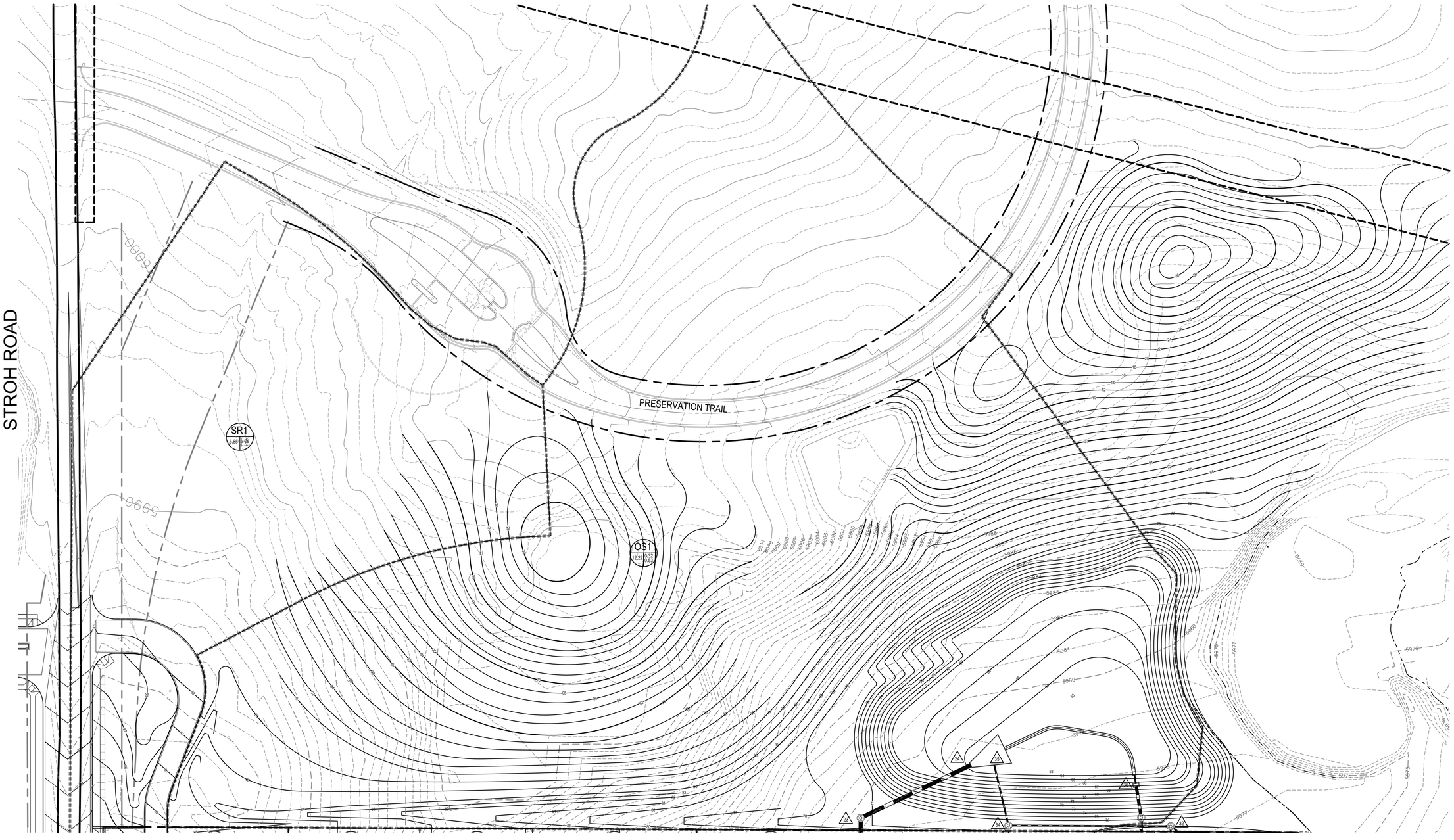
DRAINAGE PLAN WEST

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



SEE SHEET DP2

LEGEND

- EXISTING CONTOUR (5340)
- PROPOSED CONTOUR (42)
- BASIN DESIGNATION (R1)
- 5 YR RUNOFF COEFFICIENT (0.20)
- 100 YR RUNOFF COEFFICIENT (0.75 / 0.83)
- BASIN AREA
- BASIN BOUNDARY LINE
- DESIGN POINT (1)

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)

1 inch = 40ft.

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.

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)

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.

THIS REVIEW DOES NOT CONSTITUTE APPROVAL OF ANY PRIVATE ON-SITE IMPROVEMENTS WHICH MAY BE SHOWN. CONSTRUCTION CANNOT COMMENCE UNTIL ALL REQUIRED DRAINAGE/TRAFFIC REPORT(S), FINAL DEVELOPMENT PLAN(S), SPECIAL REVIEW(S), GRADING PERMIT, AND/OR OTHER PERMITS ARE COMPLETE, APPROVED AND ON FILE WITH THE TOWN OF PARKER

TOWN OF PARKER, PUBLIC WORKS DIRECTOR — DATE

TOWN OF PARKER, PUBLIC WORKS MANAGER - STORMWATER — DATE

TOWN OF PARKER, PUBLIC WORKS MANAGER - TRANSPORTATION — DATE

Perception Design Group, Inc.
Consulting Civil Engineers
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303-235-0225

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

△	DATE	DESCRIPTION
	10/24/17	INITIAL SUBMITTAL

REVISIONS

DRAINAGE PLAN EAST

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