FINAL DRAINAGE REPORT
PARKER POINTE
PARKER, COLORADO

PREPARED FOR:

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JOB #2015-015

JUNE 25, 2018

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PARKER, COLORADO

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.

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. Per the Town of Parker, the majority of this runoff to Stroh Gulch is captured and conveyed via storm sewer to the new detention pond and ultimately to Kinney Creek. 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 SR2 in this report indicates 4.1 cfs tributary to Stroh Road downstream of the newly placed inlet on Stroh Road for Basin SR1plus carryover from Inlet SR1 of 3.2 cfs for a total tributary to Stroh Gulch of 7.3 cfs.

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. Roadway widening encroaches upon and places fill in the floodplain. To mitigate this the shoulder borrow ditch is shifted east in similar size to replace filled floodplain with like volume and shape.

B. Minor Drainage Basins:

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

Basins L1 thru L15 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. While Basins L10 thur L15 drain towards Parker road in the overlot condition, it is required that these lots convey site runoff to the mainline storm sewer down the center access drive. Due to the presence of the Magellan gas pipeline and it's limited cover requirements as well as site visibility lines to the easterly lots, The west side of lots 10 thru 15 will remain below the center access drive. The storm sewer has been placed at maximum depth to accommodate these lots "bucking" grade with the storm sewer system.

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 IN3 are established to quantify runoff collected in a series of inlets along the central north-south access drive. This runoff is piped to the extended detention basin at the southeast corner of the site providing both detention and water quality facilities.

Basin SR1 is used to quantify runoff to Stroh Road from the road itself as well as offsite areas to the east. Detention and water quality are provided for this basin. See additional discussion under Major Basins above.

Basin SR2 (along with basin U4) is used to quantify runoff to the new inlet at the intersection of Stroh Road and Parker Road. Detention and water quality are not provided for this basin.

Basin PR1 combines with Basins U2 and PR2 to define runoff to the new pair of inlets located at the low point of Parker Road. Basin PR1 is separated to quantify new paved area requiring water quality treatment. Treatment for Basin PR1 combined with Basin U2 is provided in a grass swale in the ROW of Parker Road leading down to Kinney Creek.

Basin PR2 is used to quantify runoff from existing Parker Road improvements to the new pair of inlets located at the low point of Parker Road. Water quality is not provided for this basin. Total flow to the inlets is a combination of Basins PR1, PR2, and U2.

Basin PR3 is not illustrated on the plan. This basin is used to quantify new paved areas in Parker Road north of Stroh Road. This basin encompasses the new left turn bay on Prker Road to Stroh Road. Runoff from this basin is treated for water quality in the existing grass buffer along the west side of Parker Road.

Basin U1 is on-site area that is not tributary to the detention / water quality facility. This basin encompasses Tracts A and B which are floodplain and mouse habitat areas. Detention and water quality are not provided for this basin.

Basin U2 is on-site area that is not tributary to the detention / water quality facility. This basin quantifies runoff escaping the site down the access road to Parker Road. Detention is not provided for this basin, however, water quality is provided in the grass swale referenced above in the PR1 basin description.

Basin U3 is on-site area that is not tributary to the detention / water quality facility. Runoff from this basin adjacent to Parker Road flows overland into Parker Road.

Detention and water quality are not provided for this basin.

Basin U4 is on-site area that is not tributary to the detention / water quality facility. Runoff from this basin enters Stroh Road and is collected in inlet SR2.

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 146.51 cfs. Storm sewer outfall into the EDB occurs at a concrete forebay. 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. Do to the depth of the pond and invert of the adjacent Kinney Creek, outfall is piped westerly to discharge near the box culvert under Parker Road where more favorable elevations exist.

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	0.551 Ac-Ft	5965.84	45 hours
EURV + WQCV	1.427 Ac-Ft	5967.59	81 hours
100 year	2.680 Ac-Ft	5969.57	36.0 cfs
Storage Provided	2.680 Ac-Ft	5969.57	

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. A double type D inlet is proposed to provide sufficient weir flow to accommodate the 100 year release rate. Micropool and trash racks are provided. Emergency overflow occurs directly into Kinney Creek via overflow weir and riprap embankment.

Allowable 100 year discharge must be reduced to allow for uncaptured basin U1 thru U4. The combined 100 year un-detained flow from basins U1 thru U4 is 4.4 cfs. Allowable detention discharge as shown on the UDFCD spreadsheet is 52.5 cfs. The outlet structure design limits discharge to 36.0 cfs. This provides adequate compensation for the uncaptured flows.

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 to capture heavier particulate material.

Water quality treatment is also provided for the new paved areas of Parker Road. Basin PR1 is treated in a grass swale with discharge to Kinney Creek. Basin PR3 is treated in the existing grass buffer along the west side of Parker Road north of Stroh Road. UDFCD spreadsheets are provided for each treatment facility in the appendix.

D. Floodplain Modification:

Minor grading is proposed in the floodplain along Parker Road. Roadway widening encroaches upon and places fill in the floodplain. To mitigate this the shoulder borrow ditch is shifted east in similar size to replace filled floodplain with like volume and shape. A floodplain development permit will be required for this work as well as disturbances due to outfall construction. A no rise analysis has been performed and the results indicating compliance are included in the appendix.

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

FINAL DRAINAGE REPORT
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APPENDIX A HYDROLOGIC CALCULATIONS

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

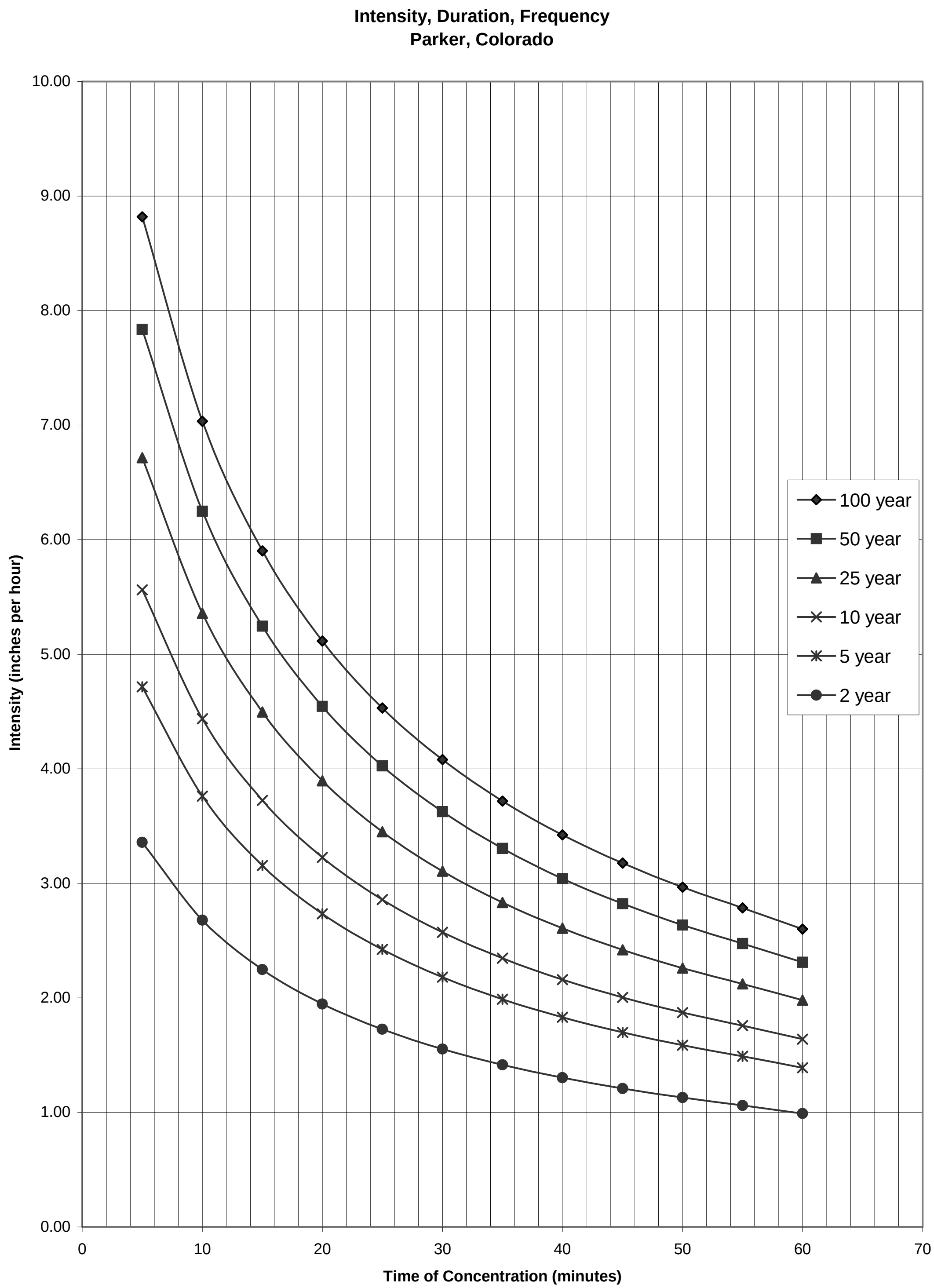

FIGURE 5.1
RAINFALL INTENSITY VERSUS DURATION CURVES FOR PARKER, COLORADO

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

	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)	0.71	0.81	0.00	0.90	0.00	0.09	**0.81**	0.71	95.0%
L1 (100 YR)	0.71	0.88	0.00	0.96	0.00	0.36	**0.88**	0.71	
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%
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%

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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%				
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)	0.68	0.81	0.00	0.90	0.00	0.09	**0.81**	0.68	95.0%
L7 (100 YR)	0.68	0.88	0.00	0.96	0.00	0.36	**0.88**	0.68	
L8 (5 YR)	0.87	0.81	0.00	0.90	0.00	0.09	**0.81**	0.87	95.0%
L8 (100 YR)	0.87	0.88	0.00	0.96	0.00	0.36	**0.88**	0.87	
L9 (5 YR)	0.71	0.81	0.00	0.90	0.00	0.09	**0.81**	0.71	95.0%
L9 (100 YR)	0.71	0.88	0.00	0.96	0.00	0.36	**0.88**	0.71	
L10 (5 YR)	0.88	0.81	0.00	0.90	0.00	0.09	**0.81**	0.88	95.0%
L10 (100 YR)	0.88	0.88	0.00	0.96	0.00	0.36	**0.88**	0.88	
L11 (5 YR)	0.92	0.81	0.00	0.90	0.00	0.09	**0.81**	0.92	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)	0.92	0.88	0.00	0.96	0.00	0.36	**0.88**	0.92	
L12 (5 YR)	0.56	0.81	0.00	0.90	0.00	0.09	**0.81**	0.56	95.0%
L12 (100 YR)	0.56	0.88	0.00	0.96	0.00	0.36	**0.88**	0.56	
L13 (5 YR)	0.73	0.81	0.00	0.90	0.00	0.09	**0.81**	0.73	95.0%
L13 (100 YR)	0.73	0.88	0.00	0.96	0.00	0.36	**0.88**	0.73	
L14 (5 YR)	0.73	0.81	0.00	0.90	0.00	0.09	**0.81**	0.73	95.0%
L14 (100 YR)	0.73	0.88	0.00	0.96	0.00	0.36	**0.88**	0.73	
L15 (5 YR)	0.72	0.81	0.00	0.90	0.00	0.09	**0.81**	0.72	95.0%
L15 (100 YR)	0.72	0.88	0.00	0.96	0.00	0.36	**0.88**	0.72	
IN1 (5 YR)	0.00	0.81	0.26	0.90	0.00	0.09	**0.90**	0.26	100.0%
IN1 (100 YR)	0.00	0.88	0.26	0.96	0.00	0.36	**0.96**	0.26	
IN2 (5 YR)	0.00	0.81	0.53	0.90	0.00	0.09	**0.90**	0.53	100.0%
IN2 (100 YR)	0.00	0.88	0.53	0.96	0.00	0.36	**0.96**	0.53	
IN3 (5 YR)	0.00	0.81	0.11	0.90	0.00	0.09	**0.90**	0.11	100.0%
IN3 (100 YR)	0.00	0.88	0.11	0.96	0.00	0.36	**0.96**	0.11	
OS1 (5 YR)	0.00	0.81	1.21	0.90	23.33	0.09	**0.13**	24.54	6.8%

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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%				
OS1 (100 YR)	0.00	0.88	1.21	0.96	23.33	0.36	**0.39**	24.54	
SR1 (5 YR)	0.00	0.81	0.40	0.90	3.35	0.09	**0.18**	3.75	12.5%
SR1 (100 YR)	0.00	0.88	0.40	0.96	3.35	0.36	**0.42**	3.75	
AREA TO POND	11.31	0.88	2.51	0.96	26.68	0.36	0.54	**40.50**	**34.0%**
SR2 (5 YR)	0.00	0.81	0.31	0.90	0.01	0.09	**0.87**	0.32	96.9%
SR2 (100 YR)	0.00	0.88	0.31	0.96	0.01	0.36	**0.94**	0.32	
PR1 (2 YR)	0.00	0.79	0.35	0.89	0.07	0.02	**0.75**	0.42	
PR1 (5 YR)	0.00	0.81	0.35	0.90	0.07	0.09	**0.77**	0.42	83.7%
PR1 (100 YR)	0.00	0.88	0.35	0.96	0.07	0.36	**0.86**	0.42	
PR2 (5 YR)	0.00	0.81	0.91	0.90	0.00	0.09	**0.90**	0.91	100.0%
PR2 (100 YR)	0.00	0.88	0.91	0.96	0.00	0.36	**0.96**	0.91	
PR3 (2 YR)	0.00	0.79	0.22	0.89	0.00	0.02	**0.89**	0.22	
U1 (5 YR)	0.00	0.81	0.00	0.90	1.37	0.09	**0.09**	1.37	2.0%
U1 (100 YR)	0.00	0.88	0.00	0.96	1.37	0.36	**0.36**	1.37	
U2 (2 YR)	0.00	0.79	0.24	0.89	0.06	0.02	**0.72**	0.30	
U2 (5 YR)	0.00	0.81	0.24	0.90	0.06	0.09	**0.74**	0.30	80.4%

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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%				
U2 (100 YR)	0.00	0.88	0.24	0.96	0.06	0.36	**0.84**	0.30	
U3 (5 YR)	0.00	0.81	0.00	0.90	0.17	0.09	**0.09**	0.17	2.0%
U3 (100 YR)	0.00	0.88	0.00	0.96	0.17	0.36	**0.36**	0.17	
U4 (5 YR)	0.00	0.81	0.14	0.90	0.09	0.09	**0.58**	0.23	61.7%
U4 (100 YR)	0.00	0.88	0.14	0.96	0.09	0.36	**0.73**	0.23	

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	375.0	0.030	20.4	540.0	2.50	20	3.16	2.8	23.3	0.241	22.4	22.4	22.4
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	24.54	0.13	290.0	0.070	15.8	1425.0	6.00	10	2.45	9.7	25.5	0.020	26.7	25.5	25.5

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Project: Parker Pointe

RUNOFF CALCULATIONS

(RATIONAL METHOD)

Design Storm: 2-Yr.

		Direct Runoff						
	Design	Basin	Area	Runoff	CA	Tc	I	Q
	Point	Desig.	(Acres)	Coefficient		(min)	(in/hr)	(cfs)
		U2	0.30	0.72	0.22	5.0	3.40	0.73
		PR1	0.42	0.75	0.32	5.0	3.40	1.07
		PR3	0.22	0.89	0.20	5.0	3.40	0.67

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RUNOFF CALCULATIONS

(RATIONAL METHOD)

Design Storm: 5-Yr.

		Direct Runoff						
	Design	Basin	Area	Runoff	CA	Tc	I	Q
	Point	Desig.	(Acres)	Coefficient		(min)	(in/hr)	(cfs)
		H1	10.52	0.09	0.95	26.0	2.30	2.18
		L1	0.71	0.81	0.58	5.0	4.70	2.70
		L2	0.50	0.81	0.41	5.0	4.70	1.90
		L2A	0.19	0.81	0.15	5.0	4.70	0.72
		L3	0.43	0.81	0.35	5.0	4.70	1.64
		L3A	0.16	0.81	0.13	5.0	4.70	0.61
		L4	0.63	0.81	0.51	5.0	4.70	2.40
		L4A	0.24	0.81	0.19	5.0	4.70	0.91
		L5	0.63	0.81	0.51	5.0	4.70	2.40
		L5A	0.24	0.81	0.19	5.0	4.70	0.91
		L6	0.78	0.81	0.63	5.0	4.70	2.97
		L7	0.68	0.81	0.55	5.0	4.70	2.59
		L8	0.87	0.81	0.70	5.0	4.70	3.31
		L9	0.71	0.81	0.58	5.0	4.70	2.70
		L10	0.88	0.81	0.71	5.0	4.70	3.35
		L11	0.92	0.81	0.75	5.0	4.70	3.50
		L12	0.56	0.81	0.45	5.0	4.70	2.13
		L13	0.73	0.81	0.59	5.0	4.70	2.78
		L14	0.73	0.81	0.59	5.0	4.70	2.78
		L15	0.72	0.81	0.58	5.0	4.70	2.74
		IN1	0.26	0.90	0.23	5.0	4.70	1.10
		IN2	0.53	0.90	0.48	5.0	4.70	2.24
		IN3	0.11	0.9	0.10	5.0	4.70	0.47
		SR1	3.75	0.18	0.68	22.4	2.60	1.76
		SR2	0.32	0.87	0.28	5.0	4.70	1.31
		PR1	0.42	0.77	0.32	5.0	4.70	1.52
		PR2	0.91	0.96	0.87	5.0	4.70	4.11
		U1	1.37	0.09	0.12	5.0	4.70	0.58
		U2	0.3	0.74	0.22	5.0	4.70	1.04
		U3	0.17	0.09	0.02	5.0	4.70	0.07
		U4	0.23	0.58	0.13	5.0	4.70	0.63
		OS1	24.54	0.13	3.19	25.5	2.50	7.98

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Job Number: 2015-015

Project: Parker Pointe

RUNOFF CALCULATIONS

(RATIONAL METHOD)

Design Storm: 100-Yr.

	Design	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	0.71	0.88	0.62	5.0	8.85	5.53
		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	0.68	0.88	0.60	5.0	8.85	5.30
		L8	0.87	0.88	0.77	5.0	8.85	6.78
		L9	0.71	0.88	0.62	5.0	8.85	5.53
		L10	0.88	0.88	0.77	5.0	8.85	6.85
		L11	0.92	0.88	0.81	5.0	8.85	7.16
		L12	0.56	0.88	0.49	5.0	8.85	4.36
		L13	0.73	0.88	0.64	5.0	8.85	5.69
		L14	0.73	0.88	0.64	5.0	8.85	5.69
		L15	0.72	0.88	0.63	5.0	8.85	5.61
		IN1	0.26	0.96	0.25	5.0	8.85	2.21
		IN2	0.53	0.96	0.51	5.0	8.85	4.50
		IN3	0.11	0.96	0.11	5.0	8.85	0.93
		SR1	3.75	0.42	1.58	22.4	4.90	7.72
TOTAL FLOW TO FOREBAY								103.45
		OS1	24.54	0.39	9.57	25.5	4.50	43.07
TOTAL TO POND			40.50					146.51
		U1	1.37	0.36	0.49	25.5	4.50	2.22
		U2	0.3	0.84	0.25	25.5	4.50	1.13
		U3	0.17	0.36	0.06	25.5	4.50	0.28
		U4	0.23	0.73	0.17	25.5	4.50	0.76
UN-CAPTURED SITE RUNOFF								4.38
		SR2	0.32	0.94	0.30	5.0	8.85	2.66
		PR1	0.42	0.86	0.36	5.0	8.85	3.20
		PR2	0.91	0.96	0.87	5.0	8.85	7.73

FINAL DRAINAGE REPORT
PARKER POINTE
PARKER, COLORADO

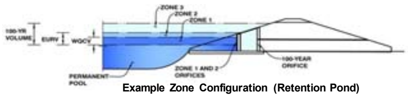
APPENDIX B DETENTION AND WATER QUALITY CALCULATIONS

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 =	40.50	acres		
Watershed Length =	1,300	ft		
Watershed Slope =	0.005	ft/ft		
Watershed Imperviousness =	34.00%	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) =	0.551	acre-feet	Optional User Override	
Excess Urban Runoff Volume (EURV) =	1.427	acre-feet	1-hr Precipitation	
2-yr Runoff Volume (P1 = 0.83 in.) =	0.774	acre-feet		inches
5-yr Runoff Volume (P1 = 1.11 in.) =	1.155	acre-feet		inches
10-yr Runoff Volume (P1 = 1.36 in.) =	1.792	acre-feet		inches
25-yr Runoff Volume (P1 = 1.72 in.) =	3.164	acre-feet		inches
50-yr Runoff Volume (P1 = 2.01 in.) =	4.100	acre-feet		inches
100-yr Runoff Volume (P1 = 2.32 in.) =	5.322	acre-feet		inches
500-yr Runoff Volume (P1 = 3.1 in.) =	8.065	acre-feet		inches
Approximate 2-yr Detention Volume =	0.723	acre-feet		
Approximate 5-yr Detention Volume =	1.084	acre-feet		
Approximate 10-yr Detention Volume =	1.617	acre-feet		
Approximate 25-yr Detention Volume =	2.040	acre-feet		
Approximate 50-yr Detention Volume =	2.229	acre-feet		
Approximate 100-yr Detention Volume =	2.680	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.551	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.876	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.253	acre-feet
Total Detention Basin Volume =	2.680	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=63.0	--	0.68	--	--	--	1,372	0.031	453	0.010
Plan Elev=64.0	--	2.33	--	--	--	7,297	0.168	7,618	0.175
Plan Elev=65.0	--	3.33	--	--	--	18,683	0.429	20,608	0.473
Plan Elev=66.0	--	4.33	--	--	--	21,534	0.494	40,717	0.935
Plan Elev=67.0	--	5.33	--	--	--	24,659	0.566	63,813	1.465
Plan Elev=68.0	--	6.33	--	--	--	27,740	0.637	90,013	2.066
Plan Elev=69.0	--	7.33	--	--	--	30,797	0.707	119,281	2.738
Plan Elev=70.00	--	8.33	--	--	--	33,963	0.780	151,661	3.482
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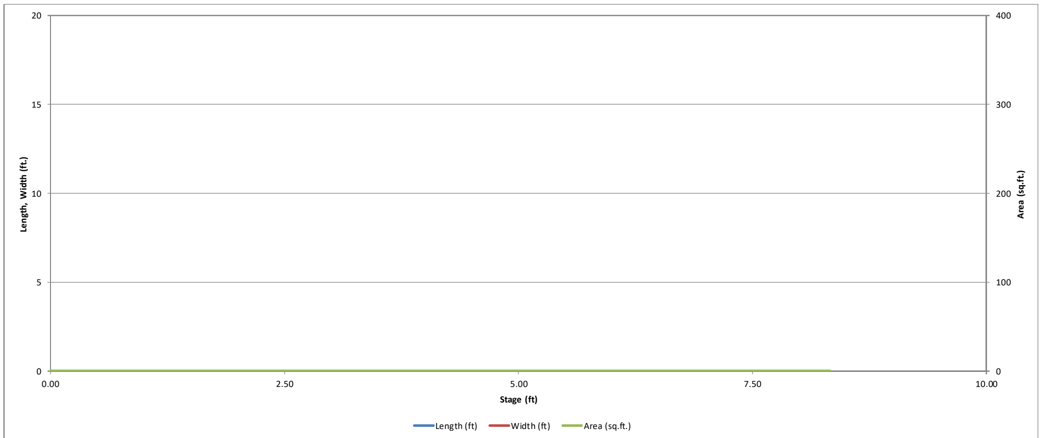
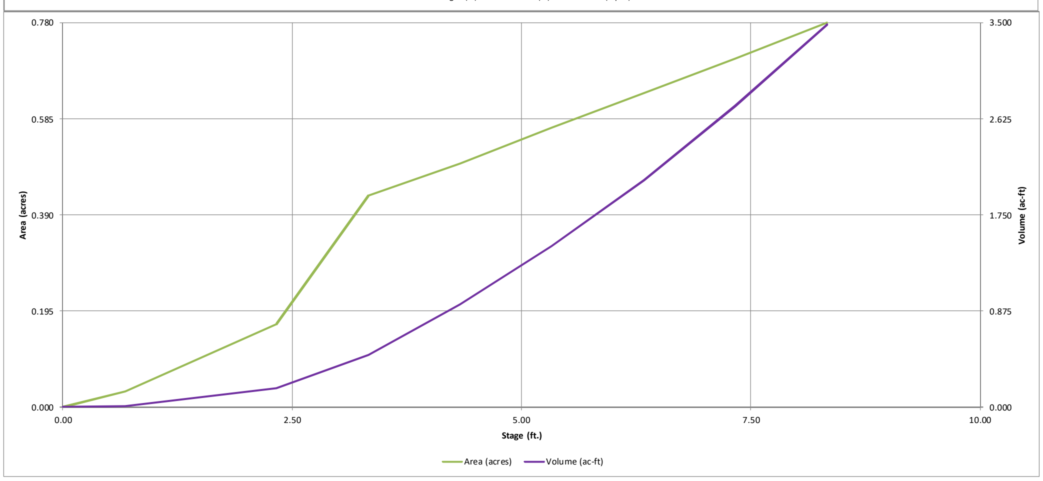
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



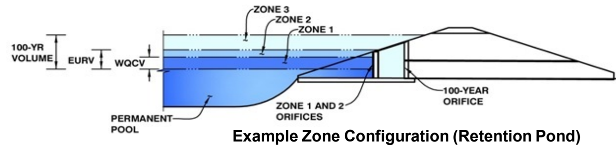


Detention Basin Outlet Structure Design

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)	3.52	0.551	Orifice Plate
Zone 2 (EURV)	5.27	0.876	Orifice Plate
Zone 3 (100-year)	7.25	1.253	Weir&Pipe (Circular)
		2.680	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 Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	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 =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.27	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	12.00	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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)	1.50	1.50	1.50					

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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.27	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	11.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.27	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	8.01	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	23.10	N/A	ft^2
Overflow Grate Open Area w/ Debris =	11.55	N/A	ft^2

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	23.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	2.89	N/A	ft^2
Outlet Orifice Centroid =	0.96	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	72.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	50.00	feet
Spillway End Slopes =	3.00	H:V
Freeboard above Max Water Surface =	2.00	feet

Calculated Parameters for Spillway

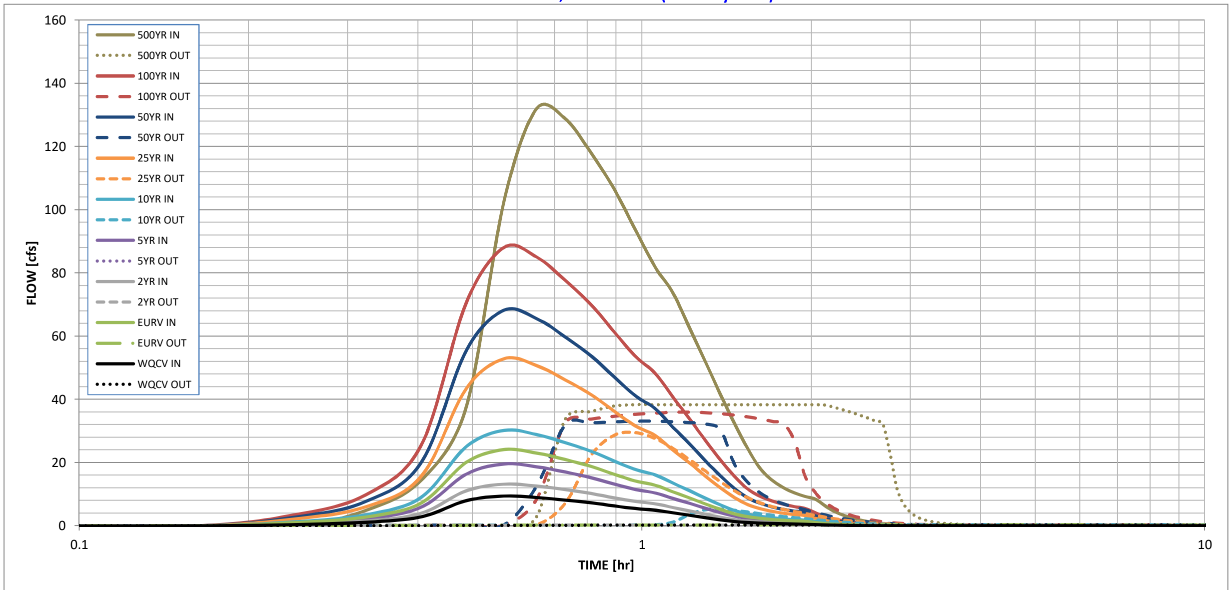
Spillway Design Flow Depth=	0.68	feet
Stage at Top of Freeboard =	74.68	feet
Basin Area at Top of Freeboard =	0.78	acres

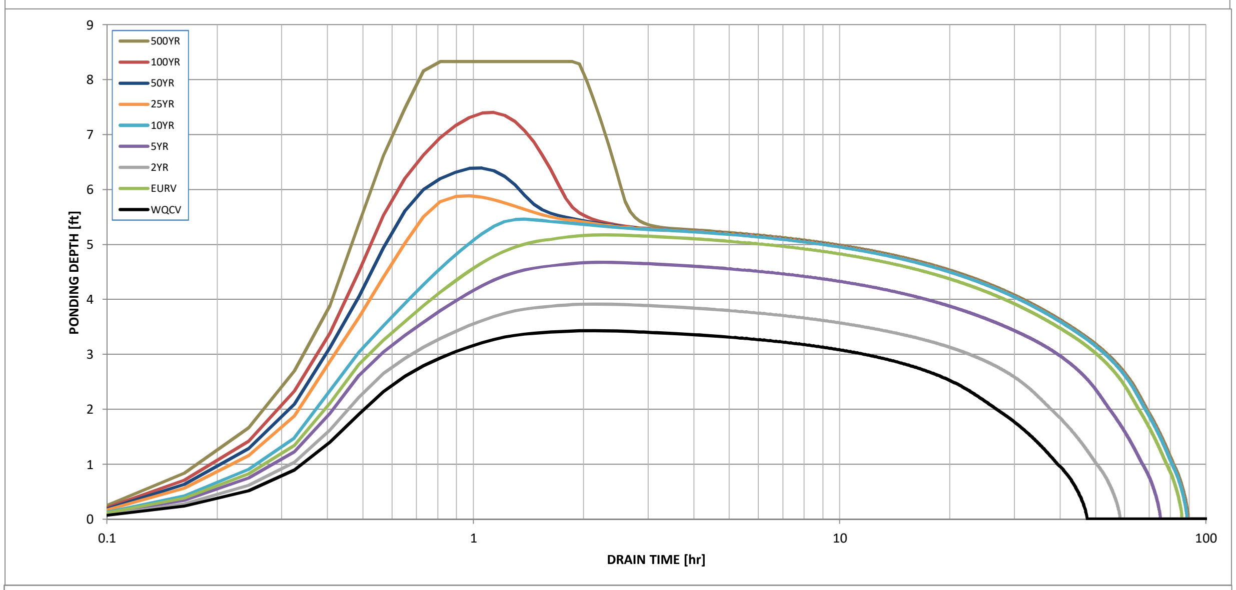
Routed Hydrograph Results

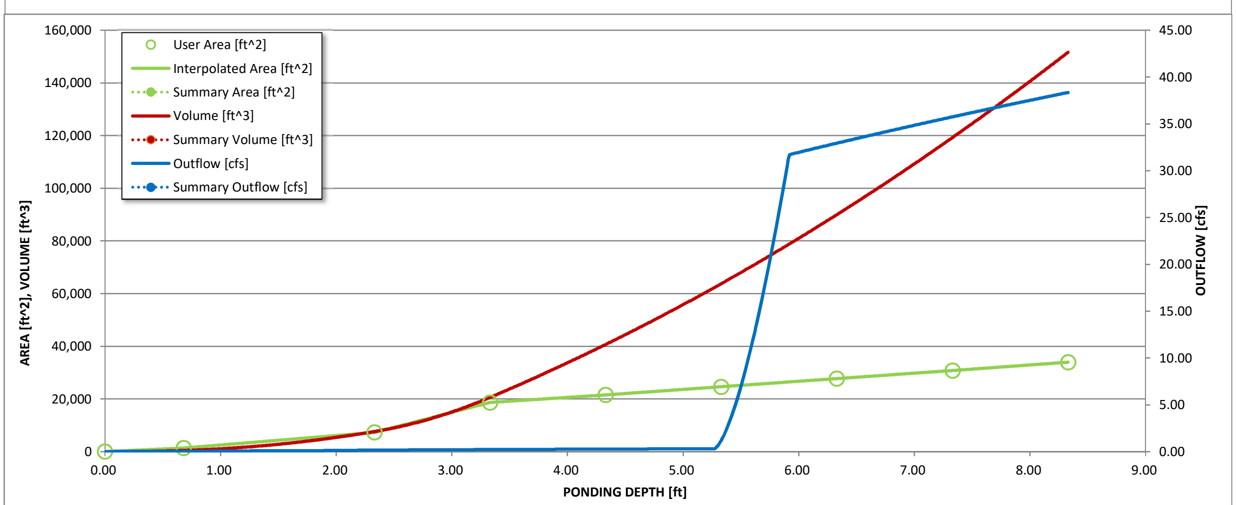
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.83	1.11	1.36	1.72	2.01	2.32	3.10
Calculated Runoff Volume (acre-ft) =	0.551	1.427	0.774	1.155	1.792	3.164	4.100	5.322	8.065
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.551	1.427	0.775	1.155	1.792	3.163	4.099	5.322	8.060
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.02	0.18	0.65	0.94	1.30	2.05
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	0.7	7.5	26.5	38.1	52.5	83.0
Peak Inflow Q (cfs) =	9.4	24.1	13.2	19.6	30.2	52.9	68.2	88.1	132.0
Peak Outflow Q (cfs) =	0.2	0.3	0.3	0.3	5.3	29.5	33.1	36.0	38.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.7	1.1	0.9	0.7	0.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.2	1.3	1.4	1.5	1.6
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	42	75	51	65	76	72	69	66	60
Time to Drain 99% of Inflow Volume (hours) =	**45**	81	55	71	83	80	78	77	74
Maximum Ponding Depth (ft) =	3.43	5.17	3.91	4.67	5.46	5.89	6.39	7.41	8.33
Area at Maximum Ponding Depth (acres) =	0.44	0.55	0.47	0.52	0.58	0.60	0.64	0.71	0.78
Maximum Volume Stored (acre-ft) =	0.516	1.375	0.733	1.107	1.539	1.787	2.105	2.788	3.482

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]
4.87 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:04:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph	0:09:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Constant	0:14:37	0.42	1.05	0.58	0.85	1.30	2.23	2.83	3.57	5.04
1.027	0:19:29	1.13	2.85	1.57	2.32	3.55	6.15	7.87	10.03	14.58
	0:24:21	2.89	7.31	4.03	5.95	9.12	15.80	20.21	25.75	37.45
	0:29:13	7.95	20.07	11.07	16.34	25.04	43.35	55.41	70.55	102.44
	0:34:05	9.41	24.10	13.18	19.56	30.18	52.87	68.21	88.06	131.96
	0:38:58	8.98	23.05	12.58	18.70	28.90	50.73	65.62	85.09	128.83
	0:43:50	8.17	20.99	11.46	17.02	26.30	46.16	59.76	77.65	118.03
	0:48:42	7.30	18.82	10.24	15.25	23.60	41.54	53.83	69.98	106.47
	0:53:34	6.29	16.32	8.85	13.21	20.50	36.26	47.09	61.33	93.60
	0:58:26	5.48	14.19	7.71	11.49	17.81	31.61	41.10	53.60	81.92
	1:03:19	4.97	12.87	6.99	10.42	16.15	28.58	37.11	48.29	73.55
	1:08:11	4.09	10.70	5.77	8.65	13.46	23.90	31.10	40.59	62.19
	1:13:03	3.34	8.80	4.72	7.10	11.09	19.77	25.77	33.68	51.70
	1:17:55	2.56	6.86	3.65	5.52	8.68	15.60	20.41	26.79	41.39
	1:22:47	1.90	5.19	2.73	4.16	6.60	12.00	15.76	20.76	32.25
	1:27:40	1.38	3.79	1.97	3.02	4.84	8.91	11.77	15.58	24.35
	1:32:32	1.07	2.90	1.52	2.32	3.68	6.71	8.83	11.63	18.06
	1:37:24	0.88	2.37	1.25	1.90	3.00	5.42	7.10	9.32	14.37
	1:42:16	0.75	2.00	1.06	1.61	2.54	4.57	5.98	7.83	12.05
	1:47:08	0.66	1.75	0.93	1.41	2.22	3.98	5.20	6.80	10.44
	1:52:01	0.59	1.57	0.84	1.27	1.99	3.56	4.65	6.08	9.31
	1:56:53	0.55	1.45	0.77	1.16	1.83	3.27	4.26	5.56	8.50
	2:01:45	0.40	1.06	0.57	0.86	1.35	2.42	3.17	4.17	6.48
	2:06:37	0.29	0.78	0.42	0.63	0.98	1.76	2.30	3.02	4.67
	2:11:29	0.22	0.57	0.31	0.46	0.72	1.30	1.70	2.23	3.46
	2:16:22	0.16	0.42	0.23	0.34	0.54	0.97	1.26	1.66	2.57
	2:21:14	0.11	0.31	0.16	0.24	0.39	0.70	0.93	1.22	1.90
	2:26:06	0.08	0.22	0.11	0.17	0.28	0.50	0.66	0.88	1.37
	2:30:58	0.06	0.16	0.08	0.12	0.20	0.37	0.48	0.64	0.99
	2:35:50	0.04	0.11	0.05	0.08	0.14	0.25	0.34	0.45	0.70
	2:40:43	0.02	0.07	0.03	0.05	0.09	0.16	0.22	0.29	0.46
	2:45:35	0.01	0.03	0.02	0.03	0.05	0.09	0.12	0.17	0.27
	2:50:27	0.00	0.01	0.01	0.01	0.02	0.04	0.06	0.08	0.13
	2:55:19	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.04
	3:00:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:09:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:14:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:19:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:24:32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:29:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:34:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:39:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:44:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:48:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:53:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:58:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:03:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:08:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:13:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:18:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:22:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:27:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:32:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:37:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:42:28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:47:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:52:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:57:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:01:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:06:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:11:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:16:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:21:25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:26:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:31:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:36:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:38	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]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

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 =	0.551	ac-ft
	24,002	cubit feet
Required Forebay Volume =	720	cubit feet
Provided Area=	750.00	square feet
Provided Depth =	0.96	feet

Required Release = 2% of 100 year peak discharge

100 year discharge =	103.5	cfs
Required Release Rate =	2.07	cfs

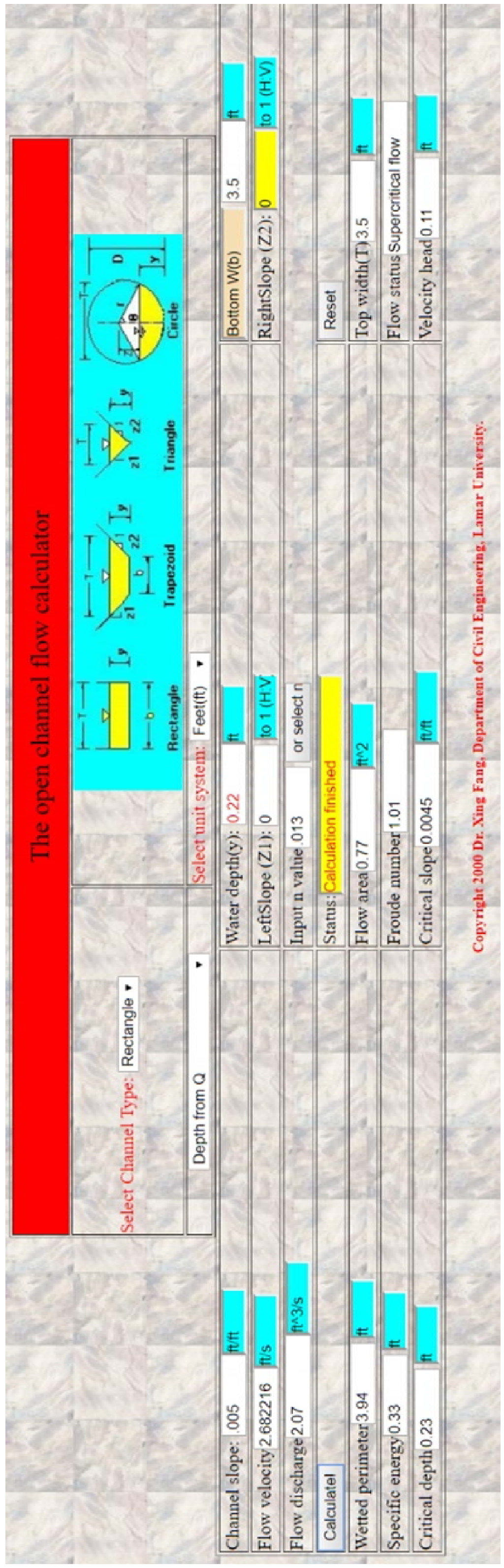
Use Weir Equation to Size Slot in Concrete

100 YEAR

Invert Elevation	62.32
Ponding Elevation	63.32
Required Discharge	1.77
Coefficient of Discharge	3.40
Length L	0.6042

Q=Cd x L x H^0.5

Cd	Length	Head (ft)	Discharge (cfs)
3.40	0.6042	1.00	2.05
	7.25"		



<u>POND TRICKLE PAN DESIGN</u>

Design Procedure Form: Grass Swale (GS)

UD-BMP (Version 3.07, March 2018)

Designer: Jerry Davidson
Company: Perception Design Group, Inc.
Date: June 25, 2018
Project: Parker Pointe
Location: BASINS PR1 AND U2

1. Design Discharge for 2-Year Return Period	Q_2 = 1.80 cfs
2. Hydraulic Residence Time	
A) : Length of Grass Swale	L_S = 375.0 ft
B) Calculated Residence Time (based on design velocity below)	T_{HR} = 6.7 minutes
3. Longitudinal Slope (vertical distance per unit horizontal)	
A) Available Slope (based on site constraints)	S_{avail} = 0.005 ft / ft
B) Design Slope	S_D = 0.005 ft / ft
4. Swale Geometry	
A) Channel Side Slopes (Z = 4 min., horiz. distance per unit vertical)	Z = 4.00 ft / ft
B) Bottom Width of Swale (enter 0 for triangular section)	W_B = 1.00 ft
5. Vegetation	Choose One
A) Type of Planting (seed vs. sod, affects vegetal retardance factor)	◉ Grass From Seed ○ Grass From Sod
6. Design Velocity (1 ft / s maximum)	V_2 = 0.93 ft / s
7. Design Flow Depth (1 foot maximum)	D_2 = 0.58 ft
A) Flow Area	A_2 = 1.9 sq ft
B) Top Width of Swale	W_T = 5.6 ft
C) Froude Number (0.50 maximum)	F = 0.28
D) Hydraulic Radius	R_H = 0.33
E) Velocity-Hydraulic Radius Product for Vegetal Retardance	VR = 0.31
F) Manning's n (based on SCS vegetal retardance curve E for seeded grass)	n = 0.054
G) Cumulative Height of Grade Control Structures Required	H_D = 0.00 ft
8. Underdrain (Is an underdrain necessary?)	Choose One: ◉ YES ○ NO — AN UNDERDRAIN IS REQUIRED IF THE DESIGN SLOPE < 2.0%
9. Soil Preparation (Describe soil amendment)	
10. Irrigation	Choose One: ○ Temporary ○ Permanent

Notes:

Design Procedure Form: Grass Buffer (GB)

UD-BMP (Version 3.07, March 2018)

Designer: Jerry Davidson
Company: Perception Design Group, Inc.
Date: June 25, 2018
Project: Parker Pointe
Location: New Left Turn Lane on Parker Road - Basin P3

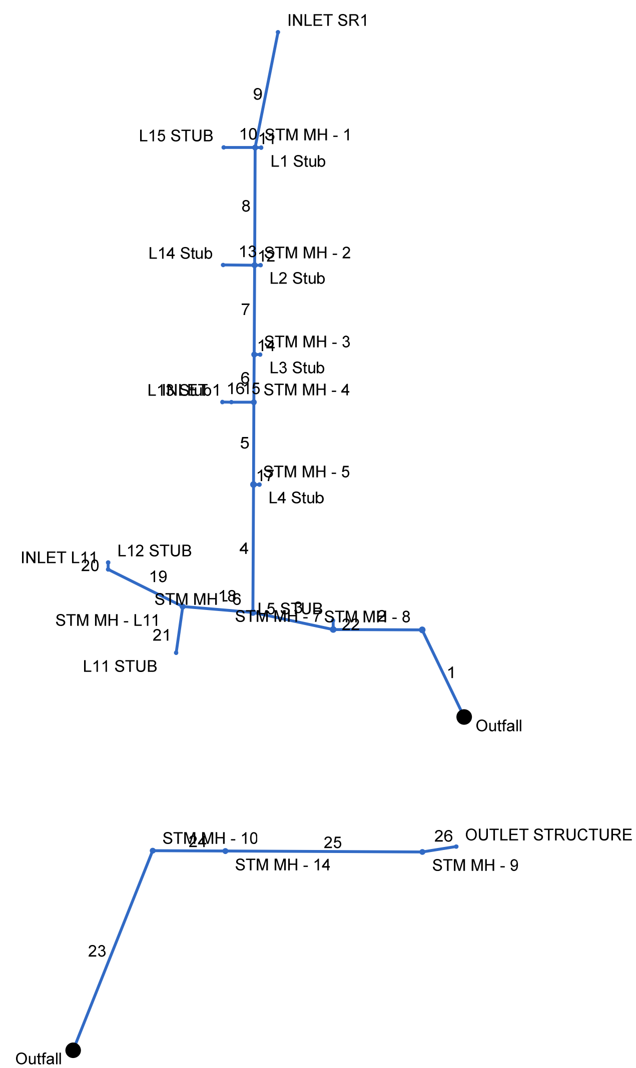
1. Design Discharge A) 2-Year Peak Flow Rate of the Area Draining to the Grass Buffer	Q_2 = 0.7 cfs
2. Minimum Width of Grass Buffer	W_G = 13 ft
3. Length of Grass Buffer (14' or greater recommended)	L_G = 800 ft
4. Buffer Slope (in the direction of flow, not to exceed 0.1 ft / ft)	S_G = 0.020 ft / ft
5. Flow Characteristics (sheet or concentrated) A) Does runoff flow into the grass buffer across the entire width of the buffer?	Choose One (●) Yes ( ) No
B) Watershed Flow Length	F_L= 800 ft
C) Interface Slope (normal to flow)	S_I= 0.001 ft / ft
D) Type of Flow Sheet Flow: $F_L * S_I \leq 1$ Concentrated Flow: $F_L * S_I > 1$	SHEET FLOW
6. Flow Distribution for Concentrated Flows	Choose One ( ) None (sheet flow) ( ) Slotted Curbing ( ) Level Spreader ( ) Other (Explain):
7 Soil Preparation (Describe soil amendment)	Existing Buffer
8 Vegetation (Check the type used or describe "Other")	Choose One ( ) Existing Xeric Turf Grass (●) Irrigated Turf Grass ( ) Other (Explain):
9. Irrigation (*Select None if existing buffer area has 80% vegetation AND will not be disturbed during construction.)	Choose One ( ) Temporary (●) Permanent ( ) None*
10. Outflow Collection (Check the type used or describe "Other")	Choose One ( ) Grass Swale ( ) Street Gutter ( ) Storm Sewer Inlet ( ) Other (Explain):

Notes:

FINAL DRAINAGE REPORT
PARKER POINTE
PARKER, COLORADO

APPENDIX C HYDRAULIC CALCULATIONS

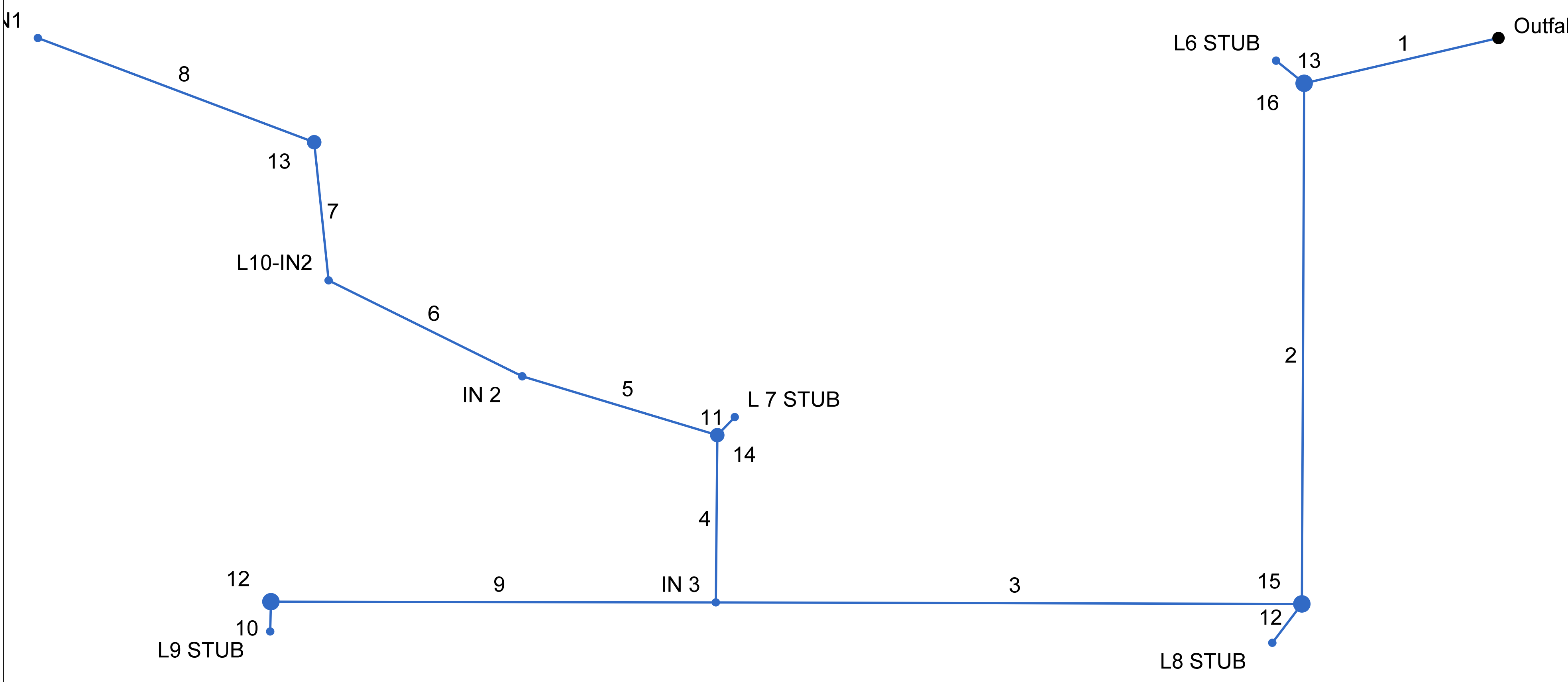
Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Storm Line A 100 yr.stm	Number of lines: 26	Date: 3/1/2018

Line No.	Line Size	Flow Rate	Vel Ave	Depth Up	Depth Dn	HGL Up	HGL Dn	Line ID
	(in)	(cfs)	(ft/s)	(ft)	(ft)	(ft)	(ft)	
1	42	61.03	8.31	2.49	2.50	5967.48	5966.84	P-22
2	42	61.03	6.74	2.99	3.28	5968.77	5968.47	P-21
3	42	56.12	5.91	3.29	3.50	5969.82	5969.53	P-19
4	42	44.60	4.83	3.04	3.50	5970.63	5970.36	P-14
5	42	39.69	5.72	1.96**	3.23	5970.30	5971.02	P-12
6	36	31.79	7.11	1.83**	1.80	5970.99	5970.64	P-9
7	30	28.44	6.73	2.01	2.01	5972.27	5971.67	P-7
8	30	18.86	4.18	1.98	2.50	5973.23	5972.97	P-4
9	21	7.72	4.34	1.03**	1.55	5974.21 j	5973.55	P-1
10	18	5.61	3.17	1.50	1.50	5973.67	5973.55	P-2
11	18	5.53	3.13	1.50	1.50	5973.57	5973.55	P-3
12	18	3.89	2.20	1.50	1.50	5972.98	5972.97	P-6
13	18	5.69	3.22	1.50	1.50	5973.10	5972.97	P-5
14	18	3.35	3.40	0.70**	1.02	5970.83	5970.99	P-8
15	18	7.90	4.73	1.35	1.35	5970.64	5970.49	P-11
16	18	5.69	3.82	1.16	1.20	5970.71	5970.69	P-10
17	18	4.91	2.78	1.50	1.50	5971.04	5971.02	P-13
18	24	11.52	3.67	2.00	2.00	5970.61	5970.36	P-18
19	18	4.36	2.47	1.50	1.50	5971.01	5970.82	P-16
20	18	4.36	2.47	1.50	1.50	5971.11	5971.09	P-15
21	18	7.16	4.05	1.50	1.50	5971.11	5970.82	P-17
22	18	4.91	2.78	1.50	1.50	5969.55	5969.53	P-20
23	36	36.00	7.34	1.98	1.95	5961.42	5959.95	STM PIPE - 37
24	36	36.00	6.00	2.23	2.55	5962.36	5962.19	STM PIPE - 38
25	36	36.00	7.06	1.95**	2.13	5963.59 j	5962.45	STM PIPE - 39
26	36	36.00	6.66	2.14	2.15	5964.17	5963.99	STM PIPE - 40

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Storm 2 100 yr.stm	Number of lines: 13	Date: 3/1/2018

Line No.	Line Size	Flow Rate	Vel Ave	Depth Up	Depth Dn	HGL Up	HGL Dn	Line ID
	(in)	(cfs)	(ft/s)	(ft)	(ft)	(ft)	(ft)	
1	36	35.96	7.35	1.96	1.96	5966.63	5966.30	Pipe - (6)
2	36	29.89	5.75	1.77**	2.58	5967.50	5967.45	Pipe - (5)
3	36	23.11	6.23	1.55**	1.57	5968.44	5967.50	Pipe - (4)
4	24	16.65	5.78	1.72	1.72	5969.89	5969.62	Pipe - (10)
5	24	11.35	3.69	1.84	2.00	5970.54	5970.40	Pipe - (14)
6	18	6.85	4.18	1.26	1.38	5970.82	5970.58	Pipe - (15)
7	18	6.85	4.28	1.24	1.31	5971.23	5971.07	Pipe - (16)
8	18	6.85	4.40	1.17	1.31	5971.86	5971.50	Pipe - (17)
9	18	5.53	4.61	0.96	0.96	5970.09	5969.35	Pipe - (3)
10	18	5.53	4.05	1.07	1.10	5970.44	5970.42	Pipe - (9)
11	18	5.30	3.00	1.50	1.50	5970.42	5970.40	Pipe - (18)
12	18	6.78	5.85	1.01**	0.88	5968.40	5968.11	Pipe - (11)
13	18	6.07	4.46	0.95**	1.28	5967.36	5967.45	Pipe - (12)

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INLET MANAGEMENT

Worksheet Protected

INLET NAME	IN 1	IN 2	IN 3	PR1	SR1
Site Type (Urban or Rural)					
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	On Grade	In Sump	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT/Denver 13 Combination	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.1	2.2	0.5	3.3	1.8
Major Q_{Known} (cfs)	2.2	4.5	0.9	6.0	7.7

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.1	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)					
Percent Impervious					
NRCS Soil Type					

Watershed Profile

Overland Slope (ft/ft)					
Overland Length (ft)					
Channel Slope (ft/ft)					
Channel Length (ft)					

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)					
One-Hour Precipitation, P_1 (inches)					

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)					
One-Hour Precipitation, P_1 (inches)					

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.1**	**2.2**	**0.5**	**3.3**	**1.8**
Major Total Design Peak Flow, Q (cfs)	**2.2**	**4.6**	**0.9**	**6.0**	**7.7**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	0.0	N/A	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	0.1	N/A	1.7

Minor Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A

Major Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A

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INLET MANAGEMENT

Worksheet Protected

INLET NAME	SR2
Site Type (Urban or Rural)	
Inlet Application (Street or Area)	STREET
Hydraulic Condition	In Sump
Inlet Type	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.9
Major Q_{Known} (cfs)	3.4

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0
Major Bypass Flow Received, Q_b (cfs)	1.7

Watershed Characteristics

Subcatchment Area (acres)	
Percent Impervious	
NRCS Soil Type	

Watershed Profile

Overland Slope (ft/ft)	
Overland Length (ft)	
Channel Slope (ft/ft)	
Channel Length (ft)	

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)	
One-Hour Precipitation, P_1 (inches)	

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)	
One-Hour Precipitation, P_1 (inches)	

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.9**
Major Total Design Peak Flow, Q (cfs)	**5.1**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A

Minor Storm (Calculated) Analysis of Flow Ti

C	N/A
C_5	N/A
Overland Flow Velocity, Vi	N/A
Channel Flow Velocity, Vt	N/A
Overland Flow Time, Ti	N/A
Channel Travel Time, Tt	N/A
Calculated Time of Concentration, T_c	N/A
Regional T_c	N/A
Recommended T_c	N/A
T_c selected by User	N/A
Design Rainfall Intensity, I	N/A
Calculated Local Peak Flow, Q_p	N/A

Major Storm (Calculated) Analysis of Flow Ti

C	N/A
C_5	N/A
Overland Flow Velocity, Vi	N/A
Channel Flow Velocity, Vt	N/A
Overland Flow Time, Ti	N/A
Channel Travel Time, Tt	N/A
Calculated Time of Concentration, T_c	N/A
Regional T_c	N/A
Recommended T_c	N/A
T_c selected by User	N/A
Design Rainfall Intensity, I	N/A
Calculated Local Peak Flow, Q_p	N/A

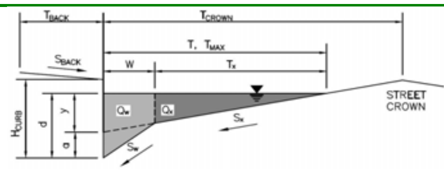
Version 4.05 Released March 2017

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

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

Project: Parker Pointe

Inlet ID: IN 1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

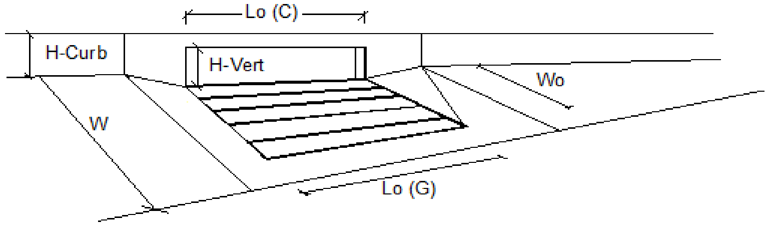
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**12.0**	**12.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)			MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.1**	**2.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

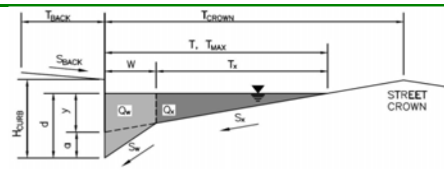
Version 4.05 Released March 2017

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

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

Project: **Parker Pointe**

Inlet ID: **IN 2**



Gutter Geometry (Enter data in the blue cells)

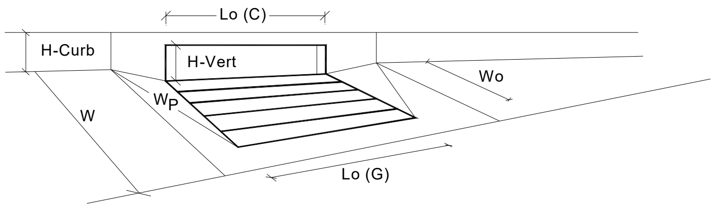
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	34.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.060	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	8.0	8.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.77	0.77	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**5.4**	**5.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.2	4.6	cfs

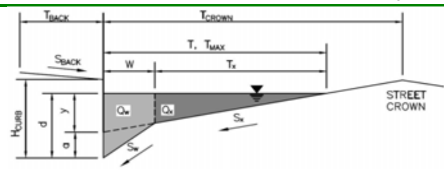
Version 4.05 Released March 2017

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

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

Project: Parker Pointe

Inlet ID: IN 3



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

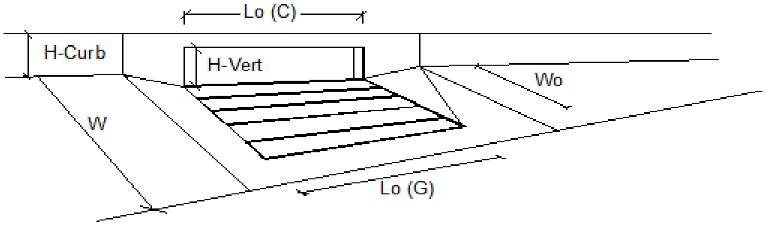
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	26.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**12.0**	**12.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	CDOT/Denver 13 Combination		MINOR	MAJOR	
Type of Inlet		Type =	CDOT/Denver 13 Combination		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**0.5**	**0.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**86**	**%**

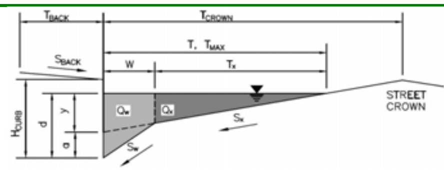
Version 4.05 Released March 2017

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

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

Project: Parker Pointe

Inlet ID: PR1



Gutter Geometry (Enter data in the blue cells)

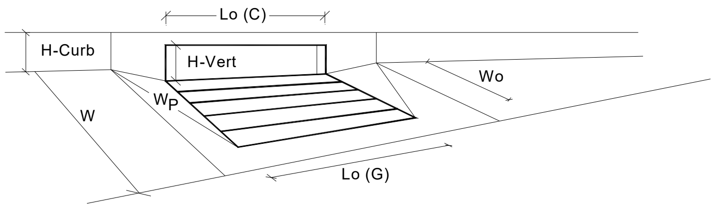
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	50.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	15.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	9.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



		MINOR	MAJOR	
Design Information (Input) CDOT Type R Curb Opening				
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	5.1	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.20	0.26	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.41	0.48	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.82	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**4.3**	**6.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.3	6.0	cfs

2 - 10' INLETS PROPOSED. CAPACITY
IS TWICE WHAT IS INDICATED ABOVE
4.5 CFS OVERFLOW FROM 100 YR TOPS
CURB AND FLOWS DIRECTLY TO KINNEY
CREEK.

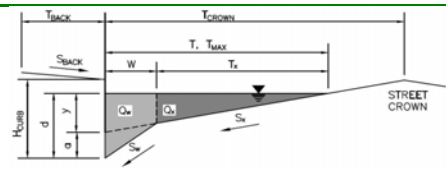
Version 4.05 Released March 2017

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

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

Project: Parker Pointe

Inlet ID: SR1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	40.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.029	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

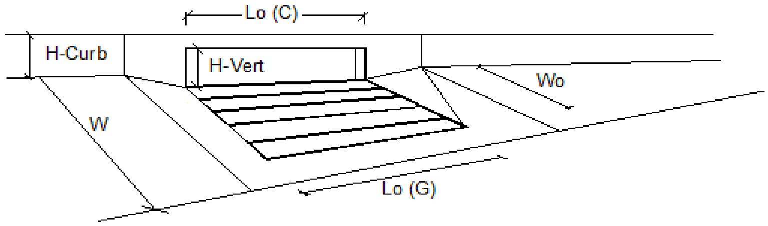
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.0	40.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**6.5**	**22.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.8**	**6.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**78**	**%**

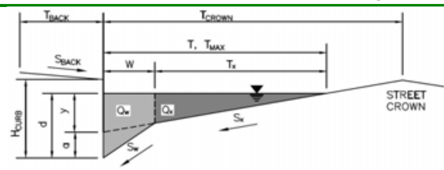
Version 4.05 Released March 2017

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

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

Project: Parker Pointe

Inlet ID: SR2



Gutter Geometry (Enter data in the blue cells)

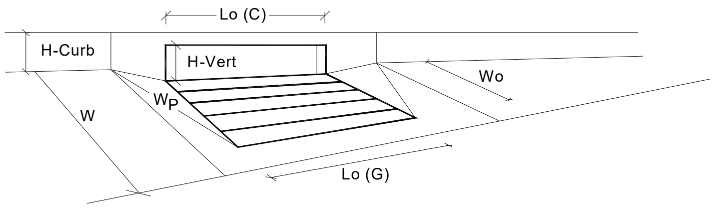
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.028	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

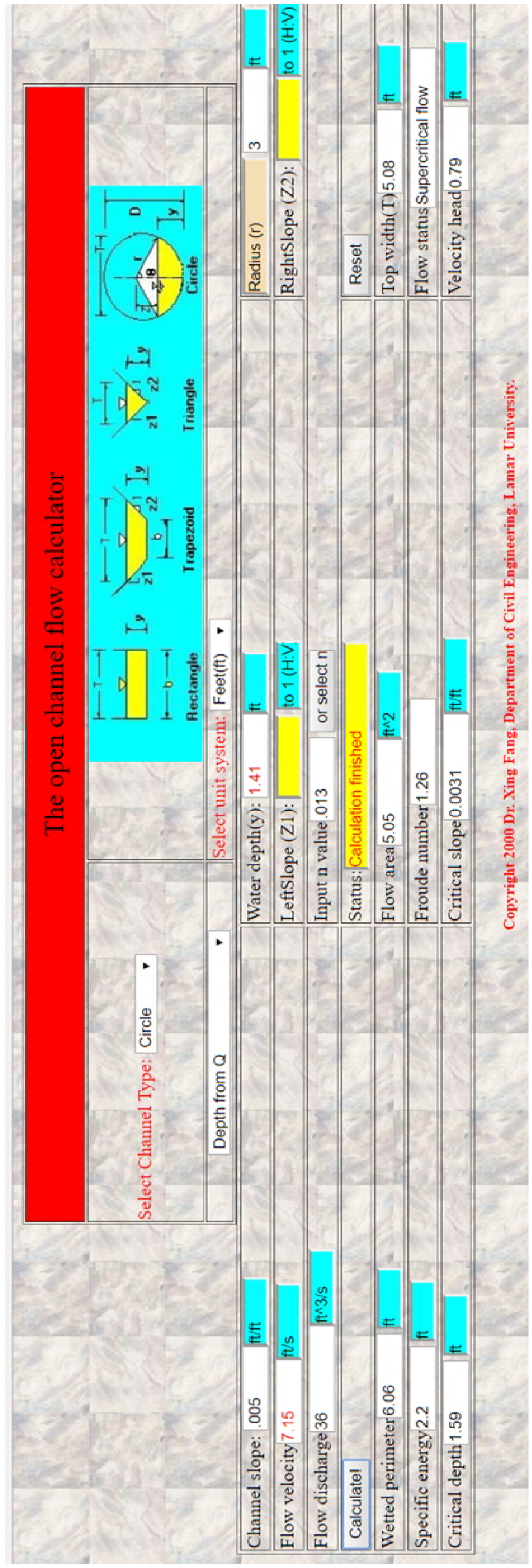
Version 4.05 Released March 2017



Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.7	6.0	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.22	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.44	0.57	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.85	0.93	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**5.2**	**10.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.9	5.1	cfs



<u>OUTFALL PIPE TO KINNEY CREEK</u>

$$H_a = \frac{(H + Y_n)}{2}$$ Equation 9-19

Where the maximum value of H_a shall not exceed H, and:

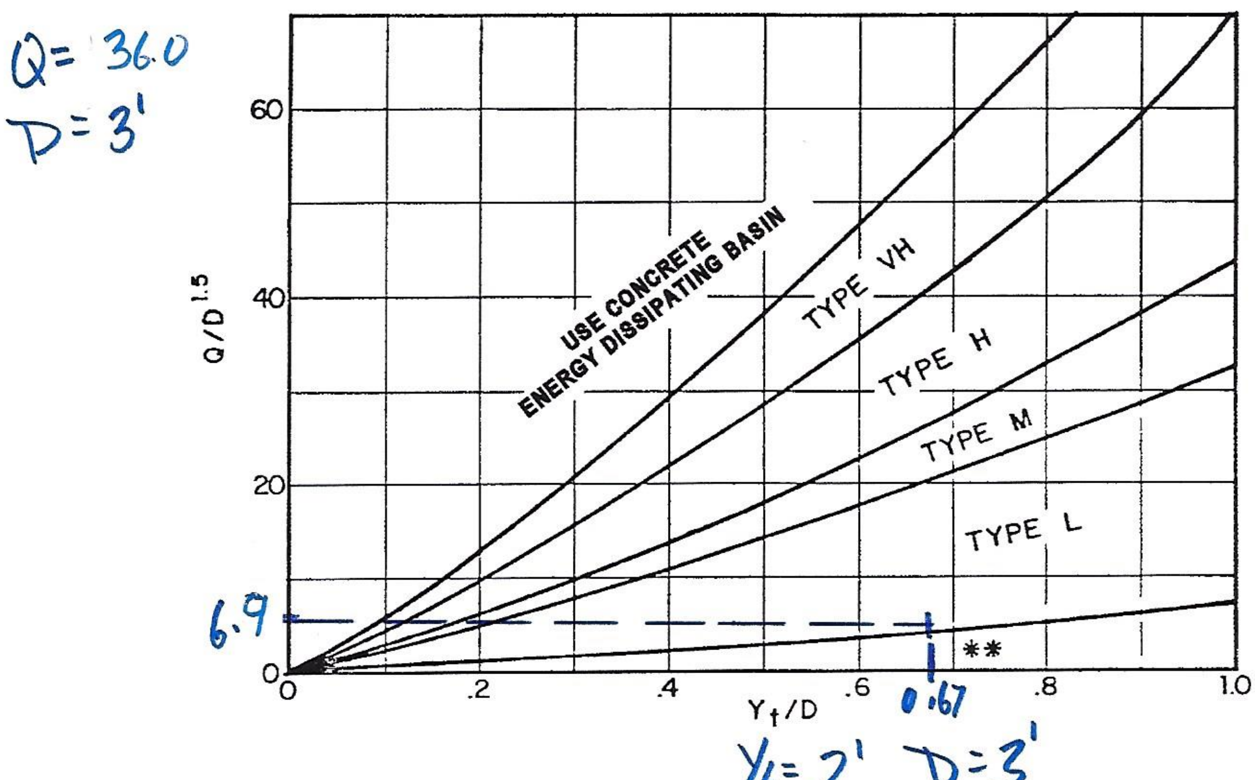
D_a = parameter to use in place of D in Figure 9-38 when flow is supercritical (ft)

D_c = diameter of circular culvert (ft)

H_a = parameter to use in place of H in Figure 9-39 when flow is supercritical (ft)

H = height of rectangular culvert (ft)

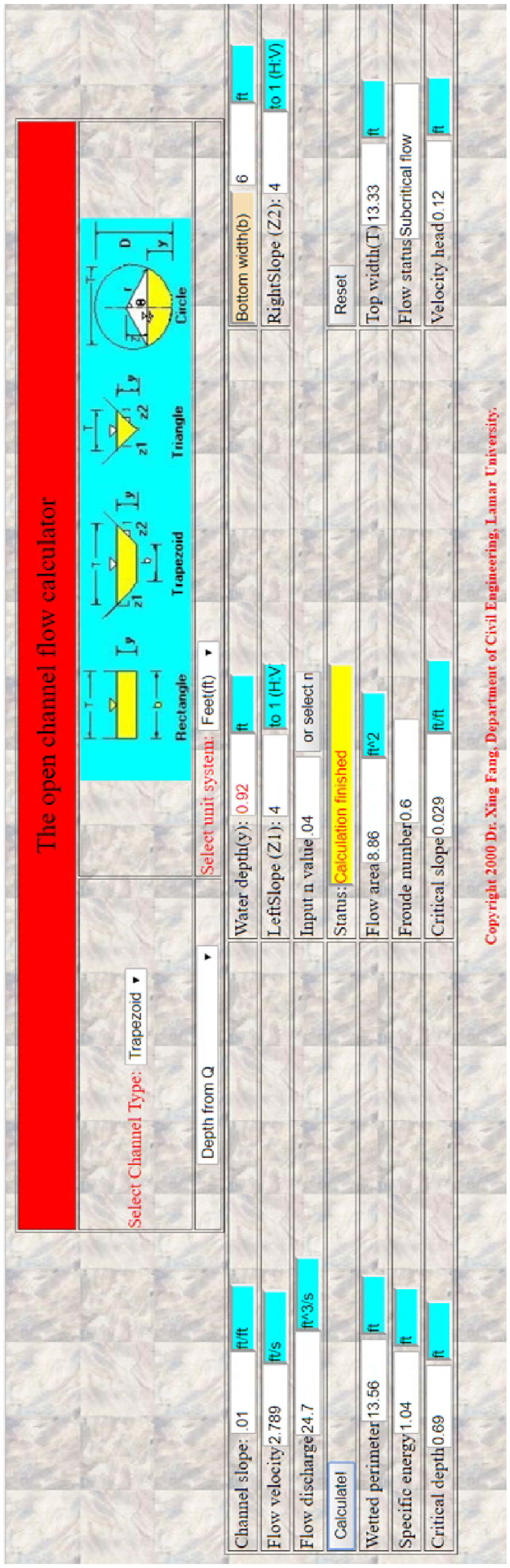
Y_n = normal depth of supercritical flow in the culvert (ft)



Use D_a instead of D whenever flow is supercritical in the barrel.
** Use Type L for a distance of 3D downstream.

Outfall To Stream

Figure 9-38. Riprap erosion protection at circular conduit outlet (valid for Q/D2.5 ≤ 6.0)

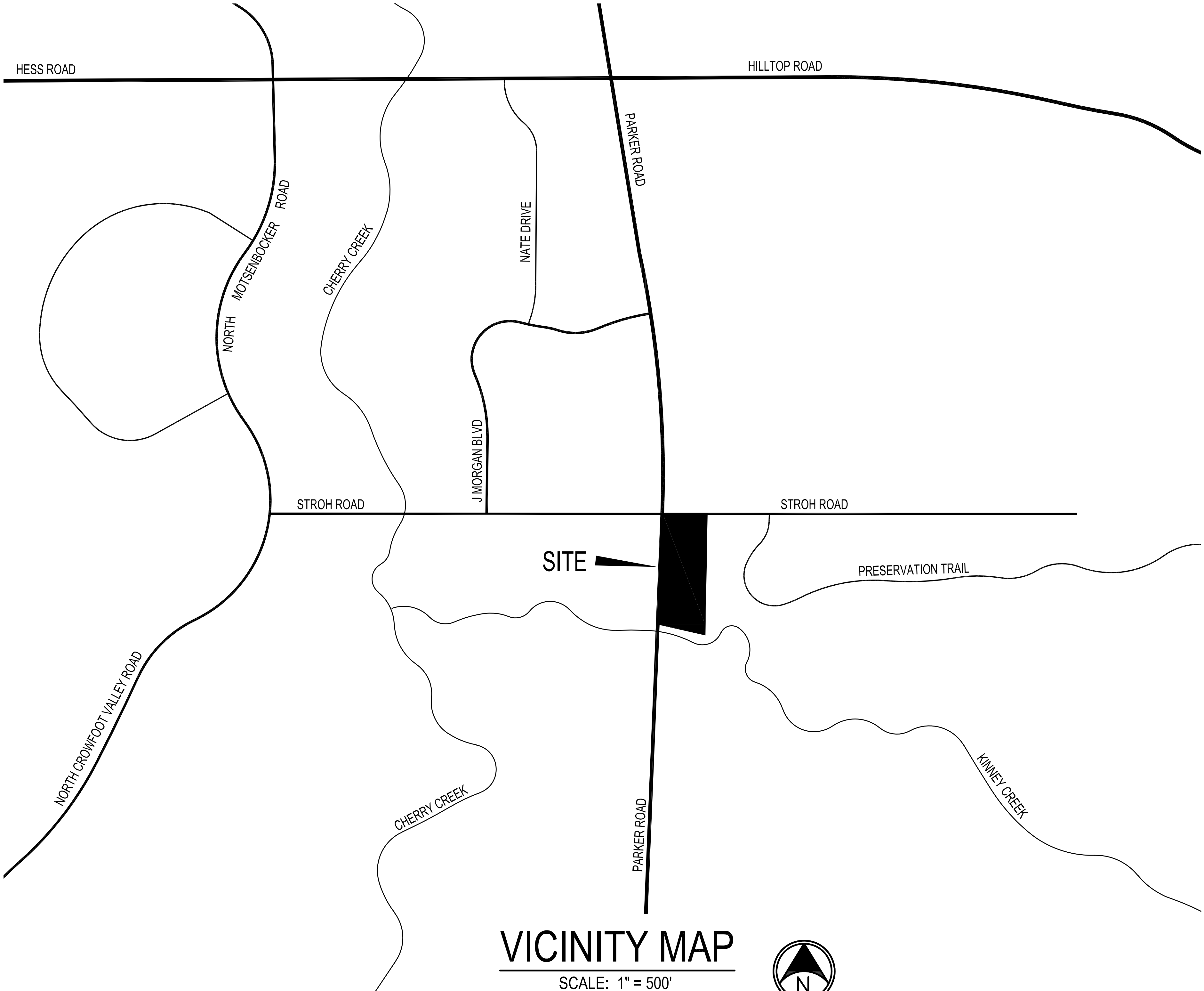


EAST PROPERTY LINE SWALE DESIGN

Offsite Tributary Area	5.7 Ac
Offsite C	0.36
I (assume 5 min Tc)	8.85
Q Offsite Area	18.2 cfs
Basin 2A	1.48 cfs
Basin 3A	1.25 cfs
Basin 4A	1.87 cfs
Basin 5A	1.87 cfs
Total Design Flow	24.7 cfs

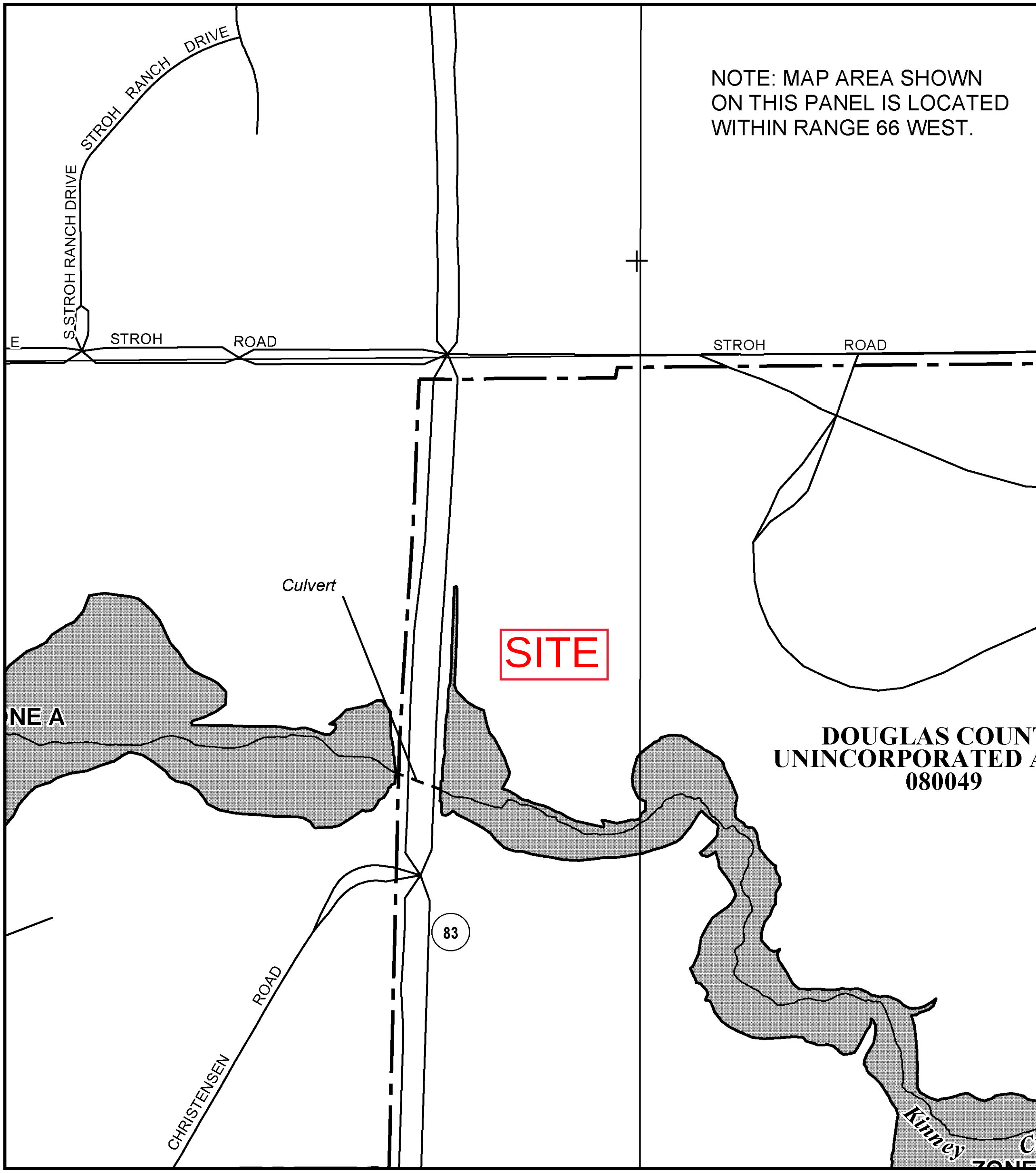
FINAL DRAINAGE REPORT
PARKER POINTE
PARKER, COLORADO

APPENDIX D KEYMAP, FIRM, SOILS



VICINITY MAP

SCALE: 1" = 500'



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

United States Department of Agriculture

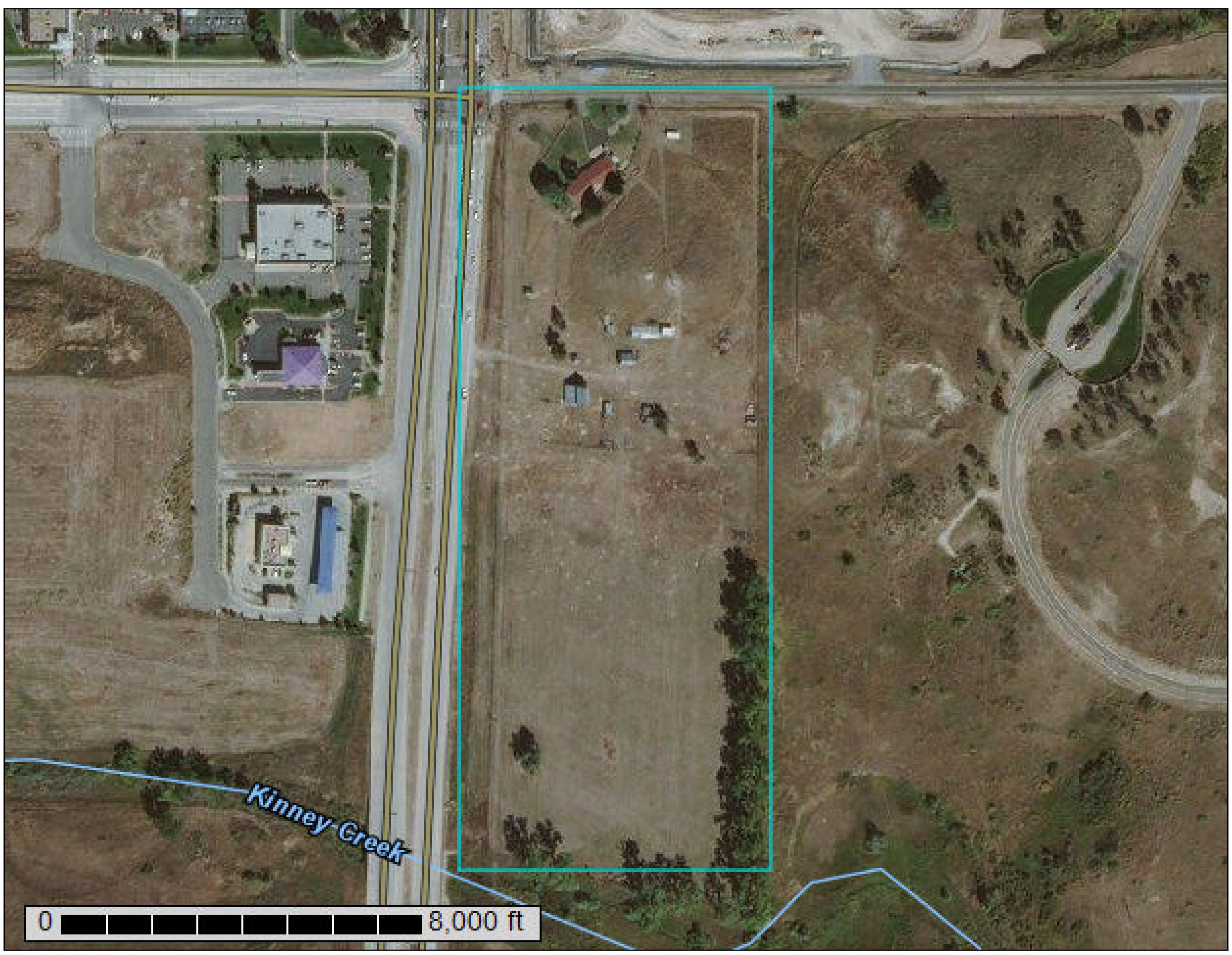
NRCS

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.

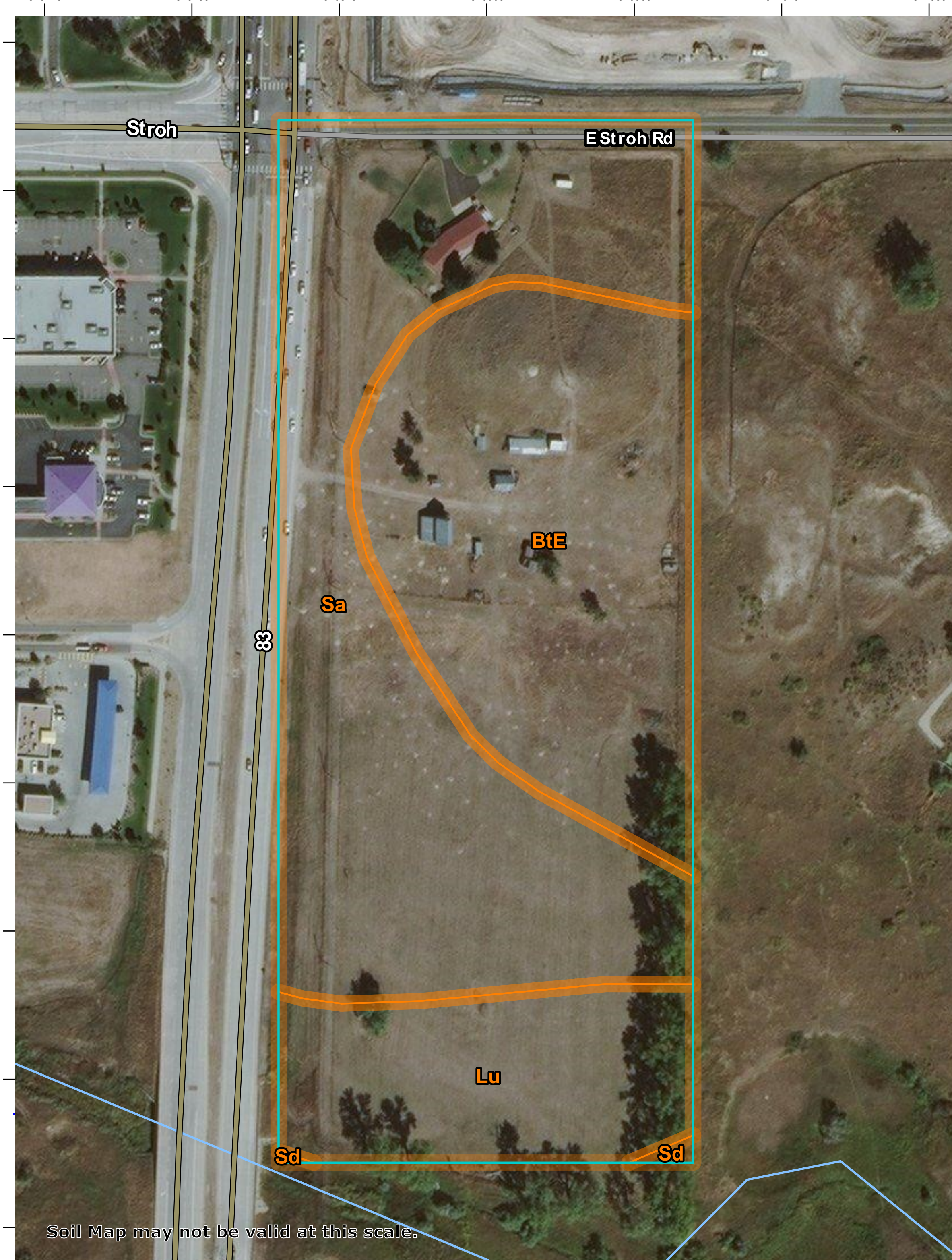
alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

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.

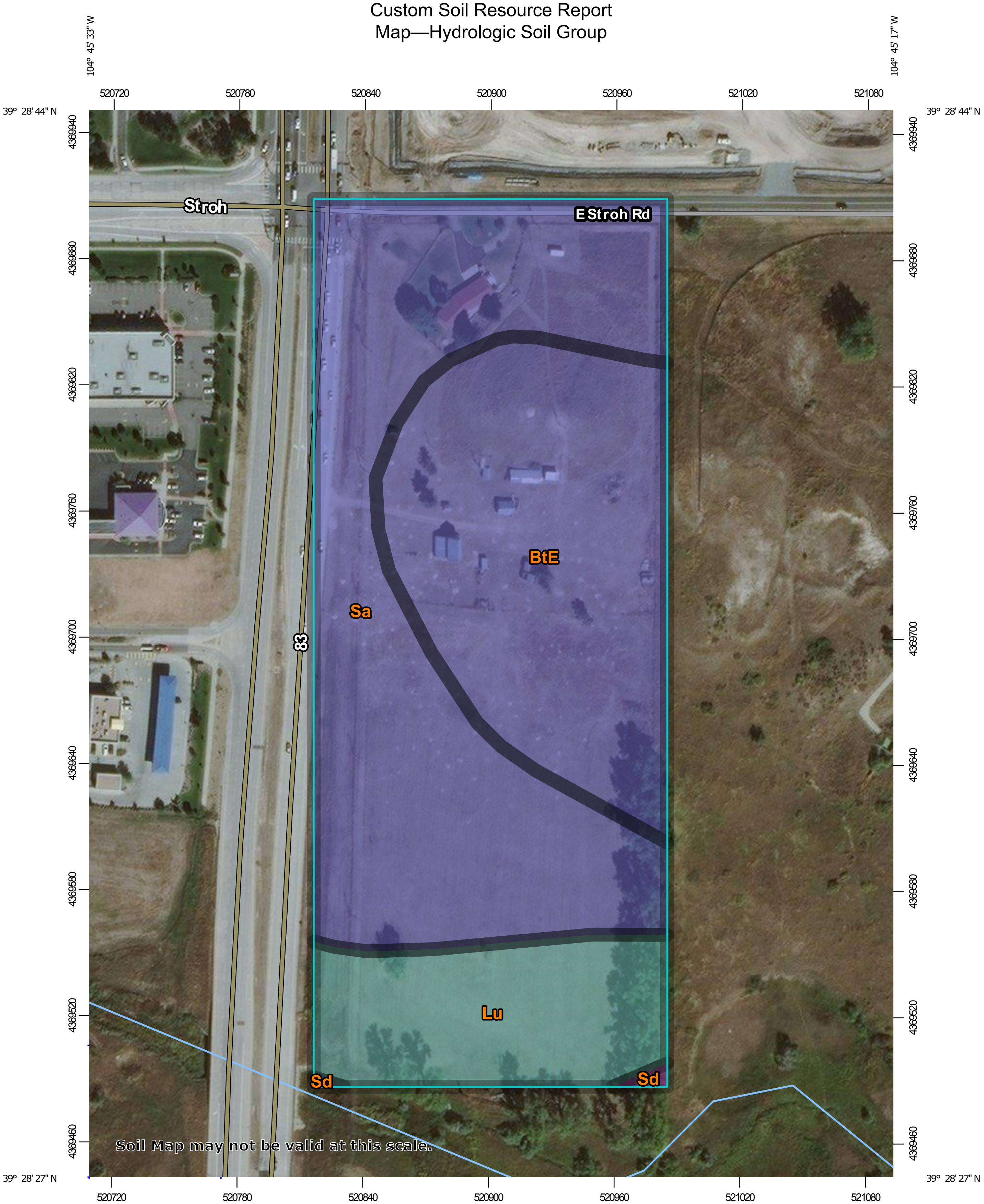
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

Map—Hydrologic Soil Group



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

Meters: 0, 35, 70, 140, 210

Feet: 0, 100, 200, 400, 600

N

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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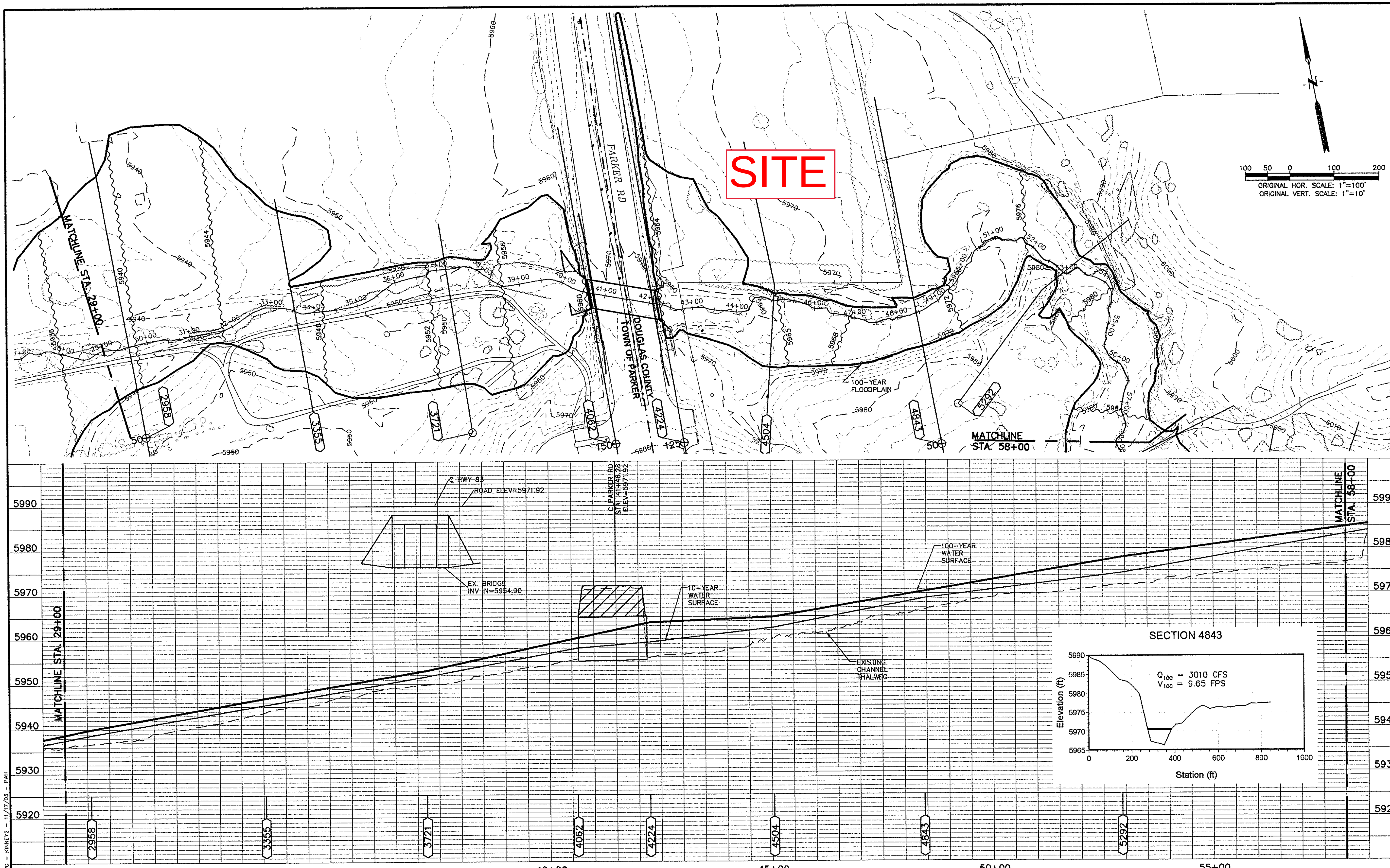
FINAL DRAINAGE REPORT
PARKER POINTE
PARKER, COLORADO

APPENDIX E DRAINAGE MAP



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

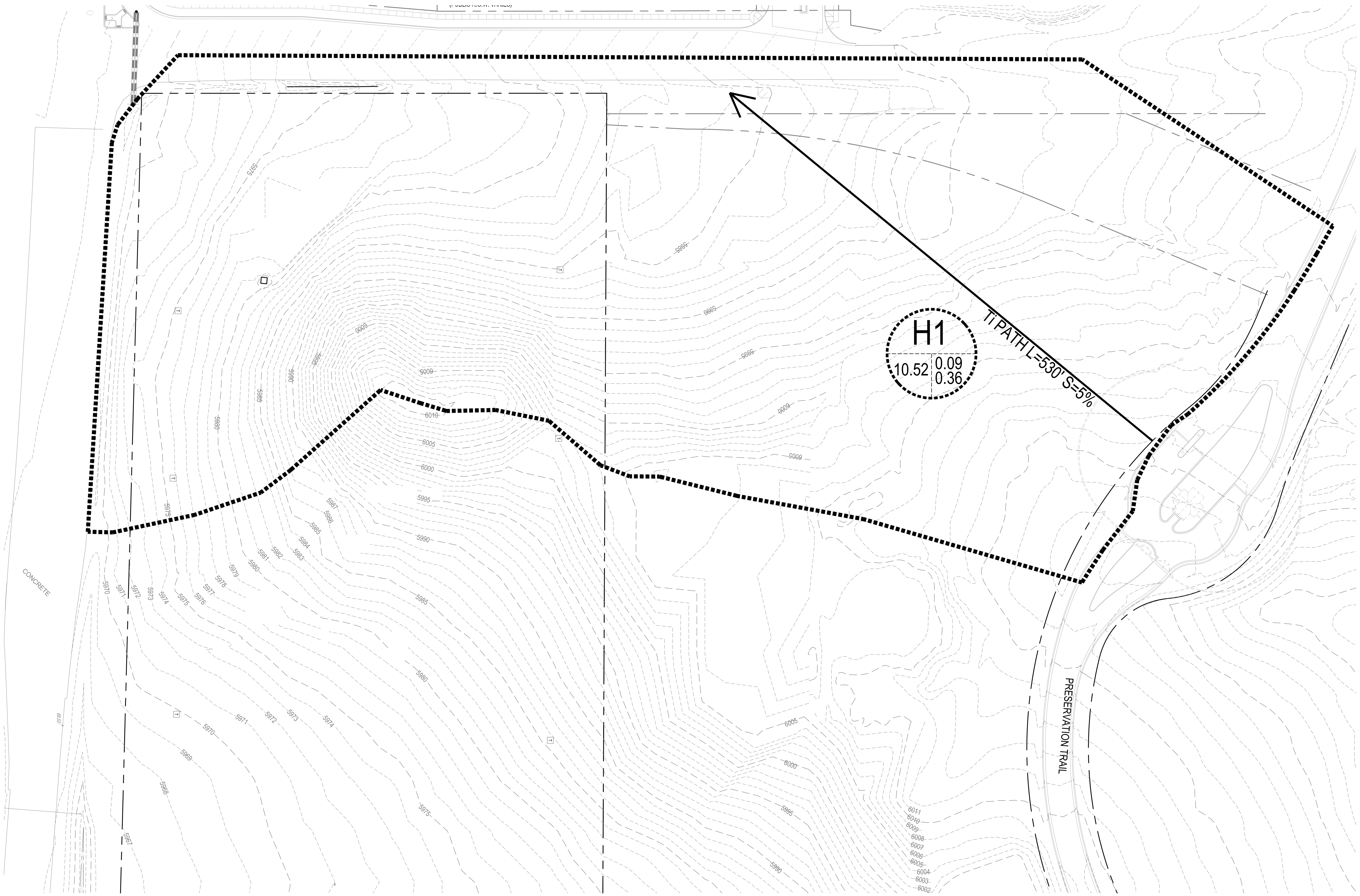
KINNEY CREEK
STA. 29+00 TO STA. 58+00

SHEET 2 OF 34

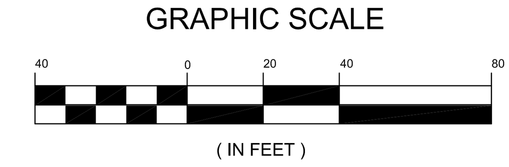
2122 - 21227AD2.DWG - KINNEY2 - 11/17/03 - PAH

FINAL DRAINAGE REPORT
PARKER POINTE
PARKER, COLORADO

APPENDIX E DRAINAGE MAP



GRAPHIC SCALE



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, DIRECTOR OF ENGINEERING — DATE

PERCEPTION
DESIGN GROUP, INC.
6901 SOUTH PIERCE STREET, SUITE 315, LITTLETON, CO 80128 303-232-8088
WWW.PERCEPTIONDESIGNGROUP.COM

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
	02/28/18	SECOND SUBMITTAL
	03/19/18	PWSD SUBMITTAL
	05/25/18	THIRD SUBMITTAL

REVISIONS

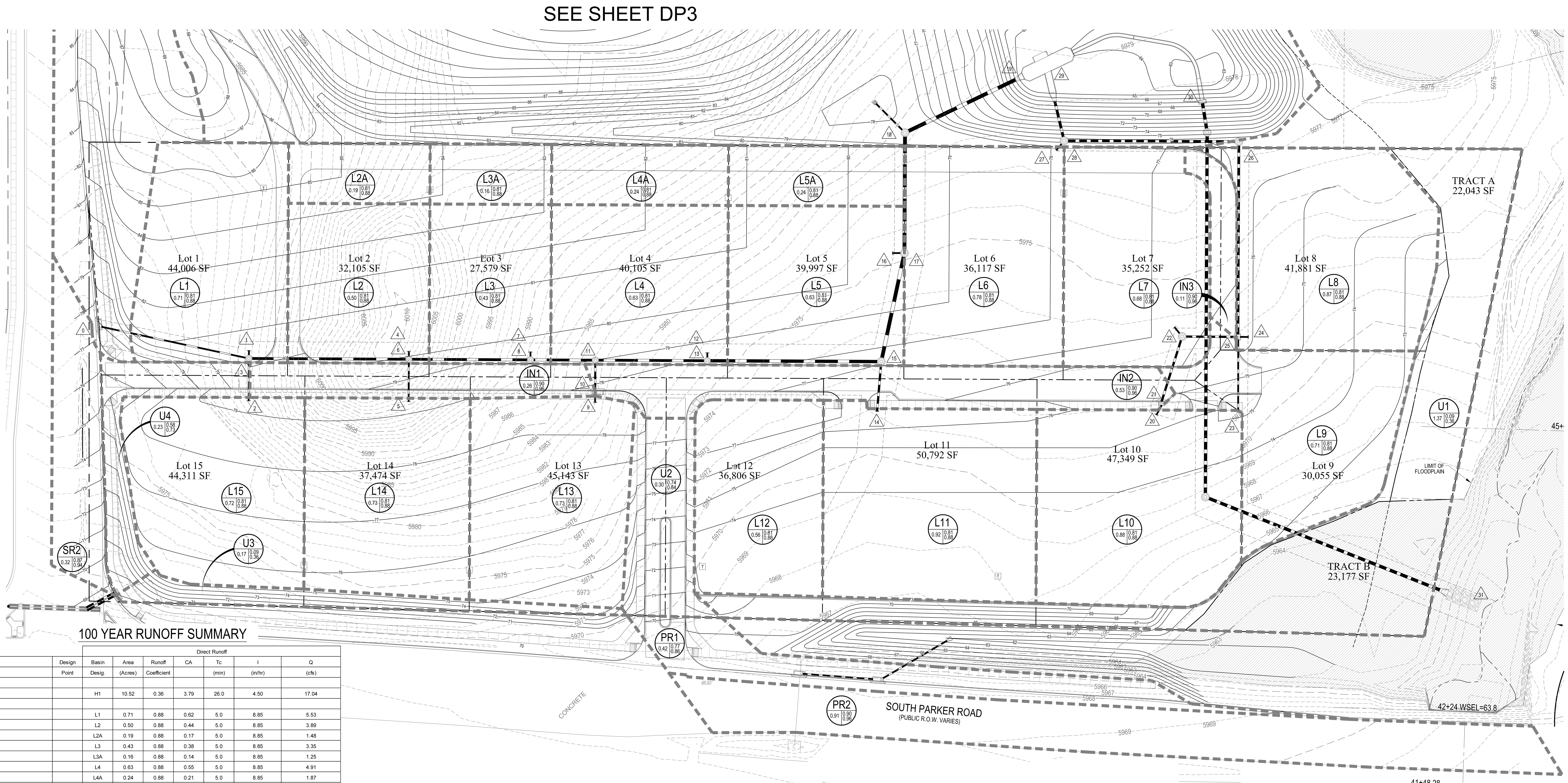
HISTORIC DRAINAGE PLAN

PARKER POINTE
LOTS 1 THRU 15 AND TRACTS A AND B, 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

\\PDG-NAS\PUBLIC\PROJECTS\2015-015 PARKER AND STROH\DWG\2015-015 DRAINAGE MAP.DWG 6/25/2018 5:07 PM



100 YEAR RUNOFF SUMMARY

		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	0.71	0.88	0.62	5.0	8.85	5.53
		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	0.68	0.88	0.60	5.0	8.85	5.30
		L8	0.87	0.88	0.77	5.0	8.85	6.78
		L9	0.71	0.88	0.62	5.0	8.85	5.53
		L10	0.88	0.88	0.77	5.0	8.85	6.85
		L11	0.92	0.88	0.81	5.0	8.85	7.16
		L12	0.56	0.88	0.49	5.0	8.85	4.36
		L13	0.73	0.88	0.64	5.0	8.85	5.69
		L14	0.73	0.88	0.64	5.0	8.85	5.69
		L15	0.72	0.88	0.63	5.0	8.85	5.61
		IN1	0.26	0.96	0.25	5.0	8.85	2.21
		IN2	0.53	0.96	0.51	5.0	8.85	4.50
		IN3	0.11	0.96	0.11	5.0	8.85	0.93
		SR1	3.75	0.42	1.58	22.4	4.90	7.72
TOTAL FLOW TO FOREBAY								103.45
		OS1	24.54	0.39	9.57	25.5	4.50	43.07
TOTAL TO POND			40.50					146.51
		U1	1.37	0.36	0.49	25.5	4.50	2.22
		U2	0.3	0.84	0.25	25.5	4.50	1.13
		U3	0.17	0.36	0.06	25.5	4.50	0.28
		U4	0.23	0.73	0.17	25.5	4.50	0.76
UN-CAPTURED SITE RUNOFF								4.38
		SR2	0.32	0.94	0.30	5.0	8.85	2.66
		PR1	0.42	0.86	0.36	5.0	8.85	3.20
		PR2	0.91	0.96	0.87	5.0	8.85	7.73

DETENTION SUMMARY

ZONE	VOLUME	ELEVATION	RELEASE RATE
WQCV	0.551 AC-FT		45 HOURS
EURV+WQCV	1.253 AC-FT	5967.59	81 HOURS
100 YEAR	2.680 AC-FT	5969.57	36.0 CFS

LEGEND

5340 — EXISTING CONTOUR

42 — PROPOSED CONTOUR

R1 — BASIN DESIGNATION

0.75 — 5 YR RUNOFF COEFFICIENT

0.83 — 100 YR RUNOFF COEFFICIENT

0.20 — BASIN AREA

BASIN BOUNDARY LINE

1 — DESIGN POINT

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 inch = 40ft.

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)

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TOWN OF PARKER, DIRECTOR OF ENGINEERING — DATE

\\PDG-NAS\PUBLIC\PROJECTS\2015-015 PARKER AND STROH\DWG\2015-015 DRAINAGE MAP.DWG 6/25/2018 5:06 PM

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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	DESCRIPTION
	05/25/18	THIRD SUBMITTAL
	03/19/18	PWSD SUBMITTAL
	02/28/18	SECOND SUBMITTAL
	10/24/17	INITIAL SUBMITTAL
-	DATE	DESCRIPTION

REVISIONS

DRAINAGE PLAN WEST

PARKER POINTE
LOTS 1 THRU 15 AND TRACTS A AND B, 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

5340 — EXISTING CONTOUR

42 — PROPOSED CONTOUR

R1 — BASIN DESIGNATION
0.75 — 5 YR RUNOFF COEFFICIENT
0.83 — 100 YR RUNOFF COEFFICIENT
0.20 — BASIN AREA

BASIN BOUNDARY LINE

1 — DESIGN POINT

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 THE FILE WITH THE TOWN OF PARKER.

TOWN OF PARKER, DIRECTOR OF ENGINEERING — DATE

PERCEPTION DESIGN GROUP, INC.
6901 SOUTH PIERCE STREET, SUITE 315, LITTLETON, CO 80128 303-232-8088
WWW.PERCEPTIONDESIGNGROUP.COM

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
	02/28/18	SECOND SUBMITTAL
	03/19/18	PWSD SUBMITTAL
	05/25/18	THIRD SUBMITTAL

DRAINAGE PLAN EAST

PARKER POINTE
LOTS 1 THRU 15 AND TRACTS A AND B, 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

FINAL DRAINAGE REPORT
PARKER POINTE
PARKER, COLORADO

APPENDIX F
FLOODPLAIN NO RISE REPORT

Kiowa Engineering Corporation
Celebrating 30 years

June 12, 2018

Jacob James P.E., CFM
Stormwater Manager
20120 E. Mainstreet
Parker, CO 80138-7335

RE: Parker Pointe Floodplain No Rise (Kinney Creek)
Kiowa Project Number 18036

Dear Mr. James:

Kiowa performed a floodplain analysis on Kinney Creek directly upstream of Parker Road in Parker, Colorado to show proposed fill within the floodplain will not adversely affect the 100-year base flood elevations. We obtained the hydraulic model for the FHAD in 2004 from UDFCD. That model was used for the effective FEMA mapping. The proposed area of fill or re-grading is occurring in an ineffective flow area and shouldn't affect the floodplain. To analyze this, a cross section was added to the FHAD model in the area where the proposed fill is located upstream of Parker Road. This was needed because there was no cross section in the FHAD model located in this area and the closest cross sections showed the floodplain contained in the channel banks. The added section was cut from existing topography and modeled ineffective flow outside of a 4:1 contraction area for the culvert opening. This model is essentially existing conditions or what would be called a corrected effective model.

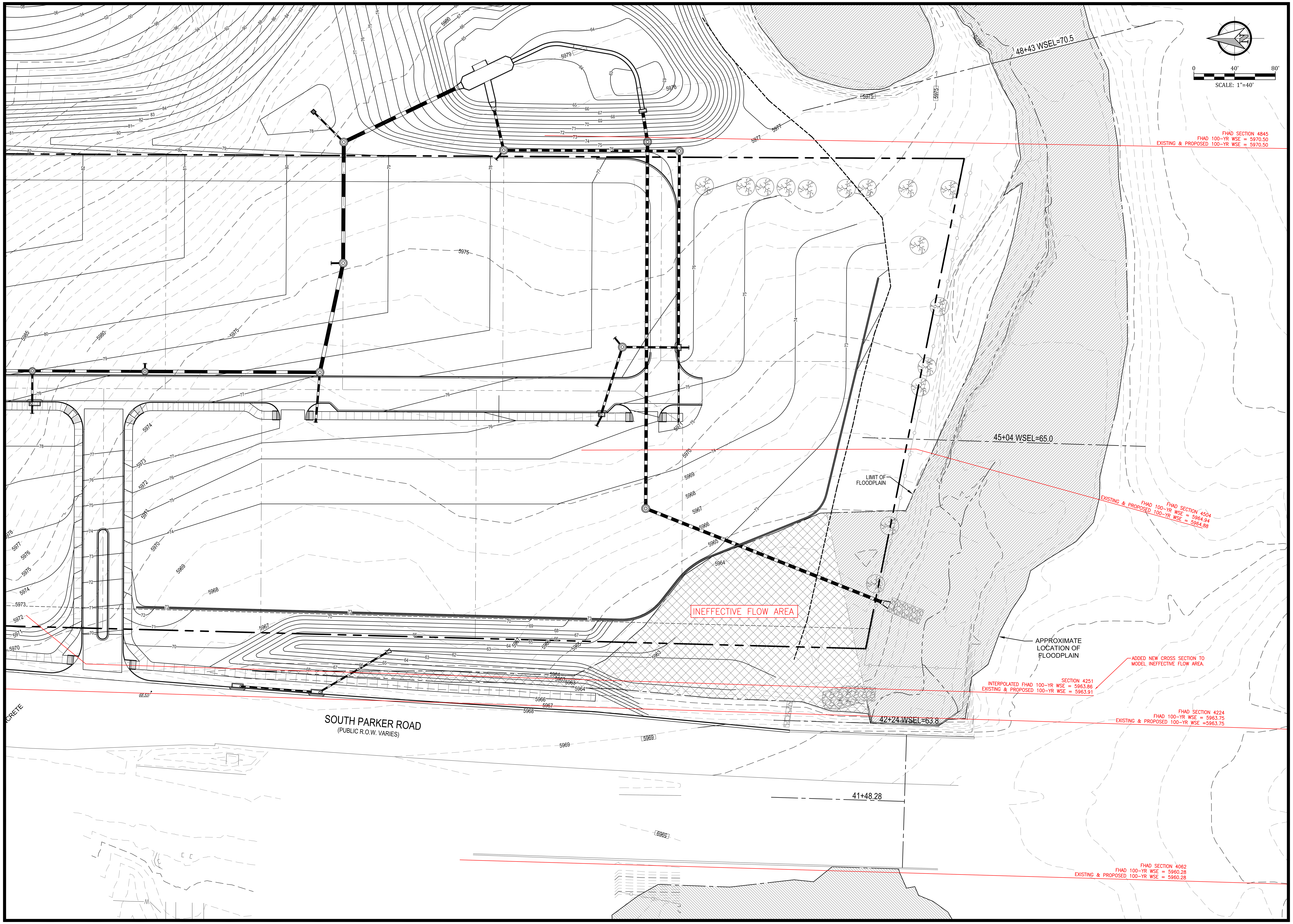
The resulting existing water surface elevation at the new cross section is 0.05-feet higher than the interpolated FHAD water surface elevation at that location and at the cross section upstream the existing water surface elevation is lower than the FHAD by 0.06-feet. These different water surface elevations are a direct result of simply adding a new cross section to show ineffective flow. The proposed grades have been added to the existing conditions model at the new cross section, the results show no rise in the floodplain as expected since the proposed grading only occurs in an ineffective flow area or outside of the floodplain entirely.

Please feel free to contact me if there are any questions or if I may be of further assistance.

Sincerely,
Kiowa Engineering Corporation

Eric L. Stream

Eric L. Stream, P.E., CFM
Civil Engineer



Kiowa
Engineering Corporation
Celebrating 30 years
7175 West Jefferson Avenue, Suite 2200
Lakewood, Colorado 80235
(303) 692-0369

PARKER POINTE
FLOODPLAIN ANALYSIS
GRADING PLAN
PARKER, COLORADO

Project No.:	18036
Date:	June 6, 2018
Design:	-
Drawn:	ELS
Check:	MWE
Revisions:	

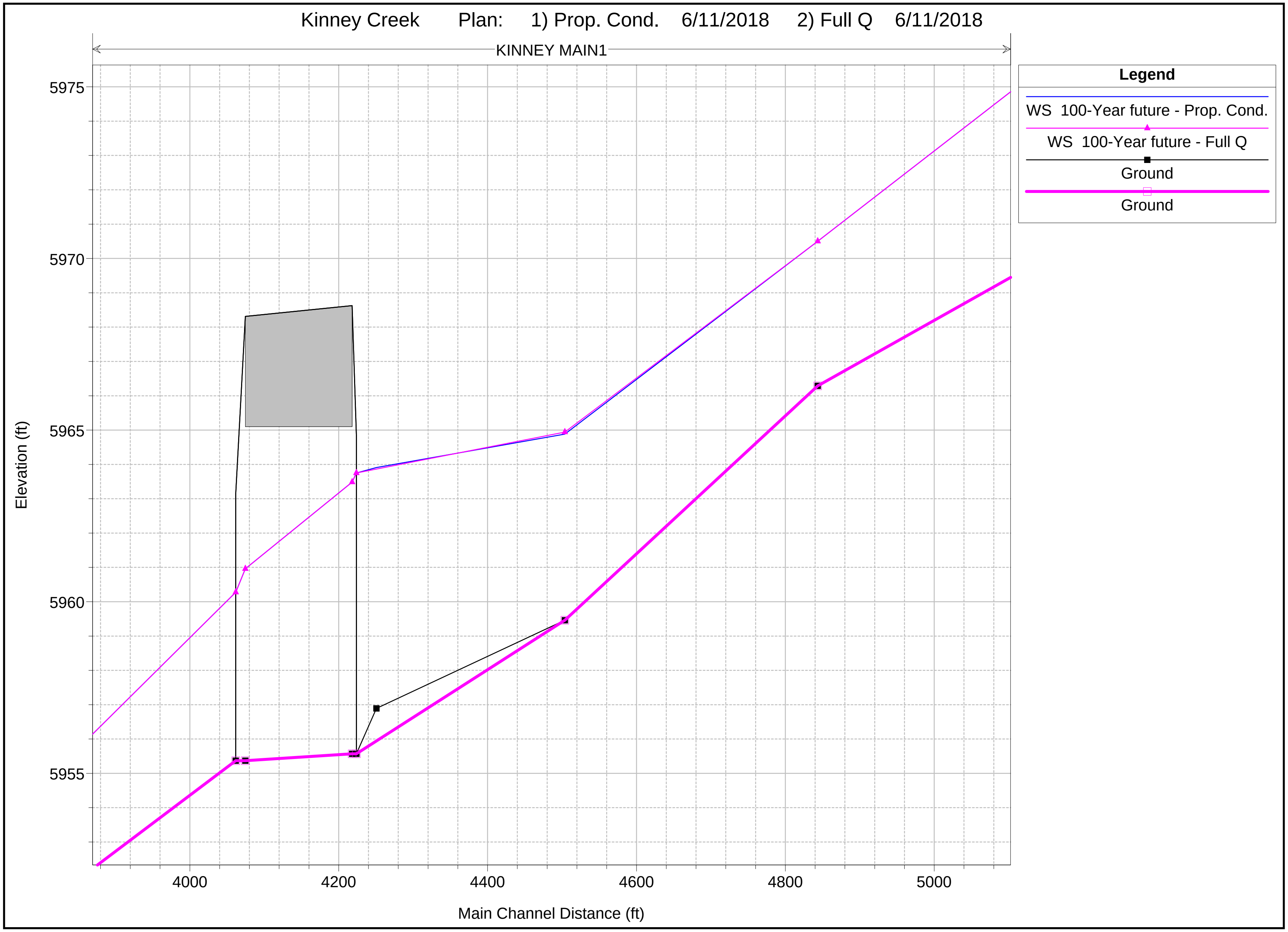
SHEET
1

HEC-RAS River: KINNEY Reach: MAIN1 Profile: 100-Year future

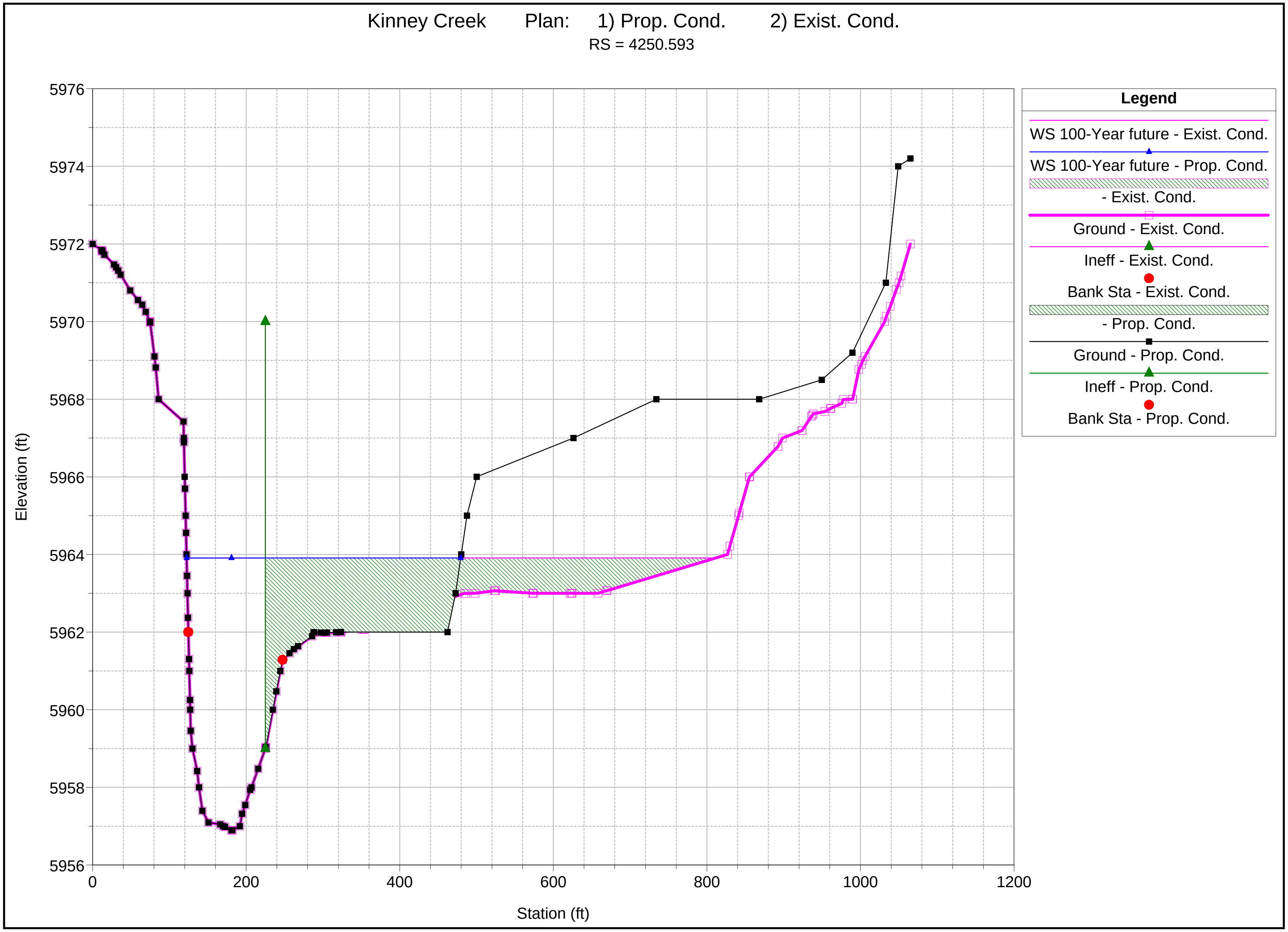
	Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
					(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
	MAIN1	8244.632	100-Year future	Full Q	3060.00	6022.05	6027.32	6026.88	6027.94	0.017737	6.33	483.48	236.81	0.78
	MAIN1	8244.632	100-Year future	Exist. Cond.	3060.00	6022.05	6027.32	6026.88	6027.94	0.017737	6.33	483.48	236.81	0.78
	MAIN1	8244.632	100-Year future	Prop. Cond.	3060.00	6022.05	6027.32	6026.88	6027.94	0.017737	6.33	483.48	236.81	0.78
	MAIN1	7833.393	100-Year future	Full Q	3060.00	6017.56	6021.60	6020.91	6022.18	0.011295	6.09	502.56	186.85	0.65
	MAIN1	7833.393	100-Year future	Exist. Cond.	3060.00	6017.56	6021.60	6020.91	6022.18	0.011295	6.09	502.56	186.85	0.65
	MAIN1	7833.393	100-Year future	Prop. Cond.	3060.00	6017.56	6021.60	6020.91	6022.18	0.011295	6.09	502.56	186.85	0.65
	MAIN1	7338.593	100-Year future	Full Q	3060.00	6009.63	6012.56	6012.56	6013.28	0.032775	6.84	447.28	310.89	1.01
	MAIN1	7338.593	100-Year future	Exist. Cond.	3060.00	6009.63	6012.56	6012.56	6013.28	0.032775	6.84	447.28	310.89	1.01
	MAIN1	7338.593	100-Year future	Prop. Cond.	3060.00	6009.63	6012.56	6012.56	6013.28	0.032775	6.84	447.28	310.89	1.01
	MAIN1	6971.283	100-Year future	Full Q	3060.00	5998.92	6000.76	6000.57	6001.17	0.022173	5.13	596.75	477.99	0.81
	MAIN1	6971.283	100-Year future	Exist. Cond.	3060.00	5998.92	6000.76	6000.57	6001.17	0.022173	5.13	596.75	477.99	0.81
	MAIN1	6971.283	100-Year future	Prop. Cond.	3060.00	5998.92	6000.76	6000.57	6001.17	0.022173	5.13	596.75	477.99	0.81
	MAIN1	6722.419	100-Year future	Full Q	3060.00	5988.90	5996.14	5994.91	5996.98	0.013036	7.36	416.00	97.04	0.63
	MAIN1	6722.419	100-Year future	Exist. Cond.	3060.00	5988.90	5996.14	5994.91	5996.98	0.013036	7.36	416.00	97.04	0.63
	MAIN1	6722.419	100-Year future	Prop. Cond.	3060.00	5988.90	5996.14	5994.91	5996.98	0.013036	7.36	416.00	97.04	0.63
	MAIN1	6423.430	100-Year future	Full Q	3080.00	5986.02	5992.80	5991.61	5993.66	0.009590	7.43	414.49	99.30	0.64
	MAIN1	6423.430	100-Year future	Exist. Cond.	3080.00	5986.02	5992.80	5991.61	5993.66	0.009580	7.43	414.64	99.31	0.64
	MAIN1	6423.430	100-Year future	Prop. Cond.	3080.00	5986.02	5992.80	5991.61	5993.66	0.009580	7.43	414.64	99.31	0.64
	MAIN1	6235.947	100-Year future	Full Q	3080.00	5984.39	5990.48	5989.76	5991.48	0.014223	7.99	385.45	177.98	0.76
	MAIN1	6235.947	100-Year future	Exist. Cond.	3080.00	5984.39	5990.48	5989.76	5991.47	0.014272	8.00	385.01	177.89	0.76
	MAIN1	6235.947	100-Year future	Prop. Cond.	3080.00	5984.39	5990.48	5989.76	5991.47	0.014272	8.00	385.01	177.89	0.76
	MAIN1	5850.246	100-Year future	Full Q	3080.00	5981.99	5985.47	5984.98	5985.94	0.013662	5.51	559.05	279.69	0.69
	MAIN1	5850.246	100-Year future	Exist. Cond.	3080.00	5981.99	5985.48	5984.98	5985.95	0.013601	5.50	559.87	279.77	0.69
	MAIN1	5850.246	100-Year future	Prop. Cond.	3080.00	5981.99	5985.48	5984.98	5985.95	0.013601	5.50	559.87	279.77	0.69
	MAIN1	5291.524	100-Year future	Full Q	3080.00	5971.75	5978.03	5976.83	5979.16	0.010700	8.51	361.76	76.10	0.69
	MAIN1	5291.524	100-Year future	Exist. Cond.	3080.00	5971.75	5978.03	5976.83	5979.16	0.010710	8.52	361.65	76.09	0.69
	MAIN1	5291.524	100-Year future	Prop. Cond.	3080.00	5971.75	5978.03	5976.83	5979.16	0.010710	8.52	361.65	76.09	0.69
FHAD	MAIN1	4843.492	100-Year future	Full Q	3080.00	5966.29	5970.50	5970.50	5971.97	0.026322	9.72	316.83	110.34	1.01
	MAIN1	4843.492	100-Year future	Exist. Cond.	3080.00	5966.29	5970.50	5970.50	5971.97	0.026322	9.72	316.83	110.34	1.01
	MAIN1	4843.492	100-Year future	Prop. Cond.	3080.00	5966.29	5970.50	5970.50	5971.97	0.026322	9.72	316.83	110.34	1.01
FHAD	MAIN1	4503.835	100-Year future	Full Q	3080.00	5959.46	5964.94	5964.05	5965.52	0.009813	6.12	503.41	165.96	0.62
	MAIN1	4503.835	100-Year future	Exist. Cond.	3080.00	5959.46	5964.88	5964.04	5965.49	0.010448	6.24	493.30	165.35	0.64
	MAIN1	4503.835	100-Year future	Prop. Cond.	3080.00	5959.46	5964.88	5964.04	5965.49	0.010448	6.24	493.30	165.35	0.64
NEW CROSS SECTION	MAIN1	4250.593	100-Year future	Exist. Cond.	3080.00	5956.89	5963.91	5960.78	5964.29	0.002467	4.95	624.35	689.00	0.35
	MAIN1	4250.593	100-Year future	Prop. Cond.	3080.00	5956.89	5963.91	5960.78	5964.29	0.002467	4.95	624.35	357.00	0.35
FHAD	MAIN1	4223.682	100-Year future	Full Q	3080.00	5955.57	5963.75	5959.79	5964.20	0.002655	5.37	573.55	75.31	0.34
	MAIN1	4223.682	100-Year future	Exist. Cond.	3080.00	5955.57	5963.75	5959.79	5964.20	0.002655	5.37	573.55	75.31	0.34
	MAIN1	4223.682	100-Year future	Prop. Cond.	3080.00	5955.57	5963.75	5959.79	5964.20	0.002655	5.37	573.55	75.31	0.34
	MAIN1	4222			Bridge									
	MAIN1	4061.616	100-Year future	Full Q	3080.00	5955.37	5960.28	5959.60	5961.72	0.030241	9.63	319.71	68.48	0.79
	MAIN1	4061.616	100-Year future	Exist. Cond.	3080.00	5955.37	5960.28	5959.60	5961.72	0.030241	9.63	319.71	68.48	0.79
	MAIN1	4061.616	100-Year future	Prop. Cond.	3080.00	5955.37	5960.28	5959.60	5961.72	0.030241	9.63	319.71	68.48	0.79
	MAIN1	3720.643	100-Year future	Full Q	3080.00	5949.79	5952.94	5952.86	5953.78	0.017395	5.05	450.78	261.91	0.57
	MAIN1	3720.643	100-Year future	Exist. Cond.	3080.00	5949.79	5952.94	5952.86	5953.78	0.017395	5.05	450.78	261.91	0.57
	MAIN1	3720.643	100-Year future	Prop. Cond.	3080.00	5949.79	5952.94	5952.86	5953.78	0.017395	5.05	450.78	261.91	0.57
	MAIN1	3355.066	100-Year future	Full Q	3080.00	5943.78	5946.89	5946.89	5947.98	0.015141	4.77	427.37	192.65	0.53
	MAIN1	3355.066	100-Year future	Exist. Cond.	3080.00	5943.78	5946.89	5946.89	5947.98	0.015141	4.77	427.37	192.65	0.53
	MAIN1	3355.066	100-Year future	Prop. Cond.	3080.00	5943.78	5946.89	5946.89	5947.98	0.015141	4.77	427.37	192.65	0.53
	MAIN1	2957.704	100-Year future	Full Q	3080.00	5936.68	5939.86	5939.86	5940.21	0.009139	3.47	710.98	487.42	0.41
	MAIN1	2957.704	100-Year future	Exist. Cond.	3080.00	5936.68	5939.86	5939.86	5940.21	0.009139	3.47	710.98	487.42	0.41
	MAIN1	2957.704	100-Year future	Prop. Cond.	3080.00	5936.68	5939.86	5939.86	5940.21	0.009139	3.47	710.98	487.42	0.41
	MAIN1	2536.628	100-Year future	Full Q	3080.00	5927.79	5931.23	5931.23	5931.87	0.016705	4.05	514.71	421.69	0.53
	MAIN1	2536.628	100-Year future	Exist. Cond.	3080.00	5927.79	5931.23	5931.23	5931.87	0.016705	4.05	514.71	421.69	0.53
	MAIN1	2536.628	100-Year future	Prop. Cond.	3080.00	5927.79	5931.23	5931.23	5931.87	0.016705	4.05	514.71	421.69	0.53
	MAIN1	2123.380	100-Year future	Full Q	3080.00	5923.07	5926.30	5925.43	5926.60	0.008515	4.82	732.51	342.92	0.55
	MAIN1	2123.380	100-Year future	Exist. Cond.	3080.00	5923.07	5926.30	5925.43	5926.60	0.008515	4.82	732.51	342.92	0.55
	MAIN1	2123.380	100-Year future	Prop. Cond.	3080.00	5923.07	5926.30	5925.43	5926.60	0.008515	4.82	732.51	342.92	0.55
	MAIN1	1496.377	100-Year future	Full Q	3080.00	5916.02	5918.48	5918.47	5919.19	0.018859	6.98	475.78	338.04	0.97
	MAIN1	1496.377	100-Year future	Exist. Cond.	3080.00	5916.02	5918.48	5918.47	5919.19	0.018859	6.98	475.78	338.04	0.97
	MAIN1	1496.377	100-Year future	Prop. Cond.	3080.00	5916.02	5918.48	5918.47	5919.19	0.018859	6.98	475.78	338.04	0.97
	MAIN1	1070.307	100-Year future	Full Q	3080.00	5910.14	5911.52	5911.34	5911.79	0.015916	4.17	746.79	795.04	0.80
	MAIN1	1070.307	100-Year future	Exist. Cond.	3080.00	5910.14	5911.52	5911.34	5911.79	0.015916	4.17	746.79	795.04	0.80
	MAIN1	1070.307	100-Year future	Prop. Cond.	3080.00	5910.14	5911.52	5911.34	5911.79	0.015916	4.17	746.79	795.04	0.80

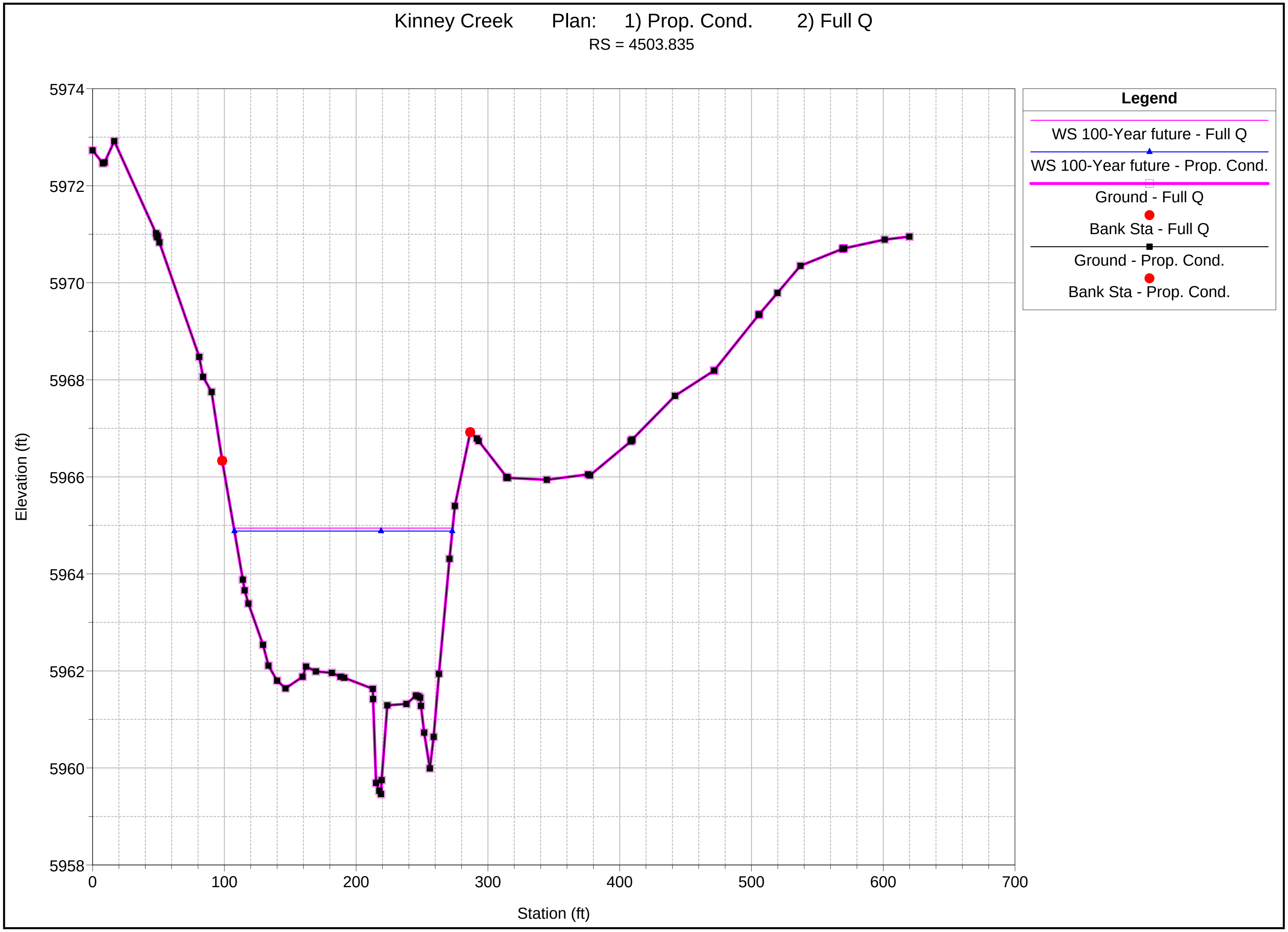
HEC-RAS River: KINNEY Reach: MAIN1 Profile: 100-Year future (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
MAIN1	996.093	100-Year future	Full Q	3080.00	5908.42	5909.84	5909.84	5910.21	0.031427	4.56	635.45	894.39	1.06
MAIN1	996.093	100-Year future	Exist. Cond.	3080.00	5908.42	5909.84	5909.84	5910.21	0.031427	4.56	635.45	894.39	1.06
MAIN1	996.093	100-Year future	Prop. Cond.	3080.00	5908.42	5909.84	5909.84	5910.21	0.031427	4.56	635.45	894.39	1.06



Kinney Creek Plan: 1) Prop. Cond. 6/11/2018 2) Full Q 6/11/2018
KINNEY MAIN1
Legend
WS 100-Year future - Prop. Cond.
WS 100-Year future - Full Q
Ground
Ground
Elevation (ft)
5975
5970
5965
5960
5955
4000
4200
4400
4600
4800
5000
Main Channel Distance (ft)


Kinney Creek Plan: 1) Prop. Cond. 2) Exist. Cond.
RS = 4250.593
Elevation (ft)
Station (ft)
5976
5974
5972
5970
5968
5966
5964
5962
5960
5958
5956
0
200
400
600
800
1000
1200
Legend
WS 100-Year future - Exist. Cond.
WS 100-Year future - Prop. Cond.
- Exist. Cond.
Ground - Exist. Cond.
Ineff - Exist. Cond.
Bank Sta - Exist. Cond.
- Prop. Cond.
Ground - Prop. Cond.
Ineff - Prop. Cond.
Bank Sta - Prop. Cond.



Kinney Creek Plan: 1) Prop. Cond. 2) Full Q
RS = 4503.835
Legend
WS 100-Year future - Full Q
WS 100-Year future - Prop. Cond.
Ground - Full Q
Bank Sta - Full Q
Ground - Prop. Cond.
Bank Sta - Prop. Cond.
Elevation (ft)
Station (ft)
5974
5972
5970
5968
5966
5964
5962
5960
5958
0
100
200
300
400
500
600
700