# FINAL DRAINAGE REPORT
# PARKER POINTE
# PARKER, COLORADO

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JOB #2015-015

NOVEMBER 10, 2017

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**PARKER POINTE**
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## I. CERTIFICATION PAGE

This report for the final design of (Name of Development) was prepared by me or under my direct supervision in accordance with the provisions of the Town of Parker Storm Drainage and Environmental Criteria Manual. I understand that the Town of Parker and its designated town authority do not and will not assume liability for drainage facilities designed by others.

_____

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

_____

Seal and Date

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

## II GENERAL LOCATION AND DESCRIPTION

A. Site Location:

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

B. Site Location:

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

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

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

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

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

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## III DRAINAGE BASINS AND SUB-BASINS

A. Major Drainage Basins:

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

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

B. Minor Drainage Basins:

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

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

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

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

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

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

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

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

## IV DRAINAGE DESIGN CRITERIA

A. Regulations:

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

B. Drainage Studies, Outfall System Plans:

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

C. Hydrology:

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

D. Hydraulics:

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

E. Water Quality Enhancement:

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

## V STORMWATER MANAGEMENT FACILITY DESIGN

A. Stormwater Conveyance Facilities:

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

B. Stormwater Storage Facilities:

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

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

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

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

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

C. Water quality Enhancement Best Management Practices:

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

D. Floodplain Modification:

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

E. Additional Permitting Requirements:

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

## V CONCLUSIONS

A. Compliance with Standards:

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

B. Variances:

No variances are requested.

## V REFERNCES

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

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## APPENDICES

**Table RO-3—Recommended Percentage Imperviousness Values**

| Land Use or Surface Characteristics | Percentage Imperviousness |
|---|---|
| Business: | |
| Commercial areas | 95 |
| Neighborhood areas | 85 |
| Residential: | |
| Single-family | * |
| Multi-unit (detached) | 60 |
| Multi-unit (attached) | 75 |
| Half-acre lot or larger | * |
| Apartments | 80 |
| Industrial: | |
| Light areas | 80 |
| Heavy areas | 90 |
| Parks, cemeteries | 5 |
| Playgrounds | 10 |
| Schools | 50 |
| Railroad yard areas | 15 |
| Undeveloped Areas: | |
| Historic flow analysis | 2 |
| Greenbelts, agricultural | 2 |
| Off-site flow analysis (when land use not defined) | 45 |
| Streets: | |
| Paved | 100 |
| Gravel (packed) | 40 |
| Drive and walks | 90 |
| Roofs | 90 |
| Lawns, sandy soil | 0 |
| Lawns, clayey soil | 0 |

* See Figures RO-3 through RO-5 for percentage imperviousness.

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

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

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

**Table RO-5— Runoff Coefficients, *C***

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

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

Project: Parker Pointe

**COMPOSITE RUNOFF COEFFICIENTS**

**TYPE B SOILS**

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

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**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% | | | | |
| L4 (100 YR) | 0.63 | 0.88 | 0.00 | 0.96 | 0.00 | 0.36 | **0.88** | 0.63 | |
| L4A (5 YR) | 0.24 | 0.81 | 0.00 | 0.90 | 0.00 | 0.09 | **0.81** | 0.24 | 95.0% |
| L4A (100 YR) | 0.24 | 0.88 | 0.00 | 0.96 | 0.00 | 0.36 | **0.88** | 0.24 | |
| L5 (5 YR) | 0.63 | 0.81 | 0.00 | 0.90 | 0.00 | 0.09 | **0.81** | 0.63 | 95.0% |
| L5 (100 YR) | 0.63 | 0.88 | 0.00 | 0.96 | 0.00 | 0.36 | **0.88** | 0.63 | |
| L5A (5 YR) | 0.24 | 0.81 | 0.00 | 0.90 | 0.00 | 0.09 | **0.81** | 0.24 | 95.0% |
| L5A (100 YR) | 0.24 | 0.88 | 0.00 | 0.96 | 0.00 | 0.36 | **0.88** | 0.24 | |
| L6 (5 YR) | 0.78 | 0.81 | 0.00 | 0.90 | 0.00 | 0.09 | **0.81** | 0.78 | 95.0% |
| L6 (100 YR) | 0.78 | 0.88 | 0.00 | 0.96 | 0.00 | 0.36 | **0.88** | 0.78 | |
| L7 (5 YR) | 0.66 | 0.81 | 0.00 | 0.90 | 0.00 | 0.09 | **0.81** | 0.66 | 95.0% |
| L7 (100 YR) | 0.66 | 0.88 | 0.00 | 0.96 | 0.00 | 0.36 | **0.88** | 0.66 | |
| L8 (5 YR) | 0.95 | 0.81 | 0.00 | 0.90 | 0.00 | 0.09 | **0.81** | 0.95 | 95.0% |
| L8 (100 YR) | 0.95 | 0.88 | 0.00 | 0.96 | 0.00 | 0.36 | **0.88** | 0.95 | |
| L8A (5 YR) | 0.80 | 0.81 | 0.00 | 0.90 | 0.00 | 0.09 | **0.81** | 0.80 | 95.0% |
| L8A (100 YR) | 0.80 | 0.88 | 0.00 | 0.96 | 0.00 | 0.36 | **0.88** | 0.80 | |
| L11 (5 YR) | 0.55 | 0.81 | 0.00 | 0.90 | 0.00 | 0.09 | **0.81** | 0.55 | 95.0% |

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**TYPE B SOILS**

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

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|---|---|---|---|---|---|---|---|---|---|
| Catchment | Area (Ac.) | C | Area (Ac.) | C | Area (Ac.) | C | Composite C | Catchment Area (Ac.) | Imperviousness |
| | Imperviousness = 95% | | Imperviousness = 100% | | Imperviousness = 2% | | | | |
| IN5 (100 YR) | 0.00 | 0.88 | 0.56 | 0.96 | 0.03 | 0.36 | **0.93** | 0.59 | |
| IN6 (5 YR) | 0.00 | 0.81 | 0.36 | 0.90 | 0.02 | 0.09 | **0.86** | 0.38 | 94.8% |
| IN6 (100 YR) | 0.00 | 0.88 | 0.36 | 0.96 | 0.02 | 0.36 | **0.93** | 0.38 | |
| IN7 (5 YR) | 0.00 | 0.81 | 0.20 | 0.90 | 0.04 | 0.09 | **0.77** | 0.24 | 83.7% |
| IN7 (100 YR) | 0.00 | 0.88 | 0.20 | 0.96 | 0.04 | 0.36 | **0.86** | 0.24 | |
| IN8 (5 YR) | 0.00 | 0.81 | 0.18 | 0.90 | 0.01 | 0.09 | **0.86** | 0.19 | 94.8% |
| IN8 (100 YR) | 0.00 | 0.88 | 0.18 | 0.96 | 0.01 | 0.36 | **0.93** | 0.19 | |
| OS1 (5 YR) | 0.00 | 0.81 | 0.00 | 0.90 | 12.22 | 0.09 | **0.09** | 12.22 | 2.0% |
| OS1 (100 YR) | 0.00 | 0.88 | 0.00 | 0.96 | 12.22 | 0.36 | **0.36** | 12.22 | |
| AREA TO POND | 9.66 | 0.88 | 2.43 | 0.96 | 12.40 | 0.36 | 0.62 | **24.49** | **48.4%** |
| SR1 (5 YR) | 0.00 | 0.81 | 1.23 | 0.90 | 4.62 | 0.09 | **0.26** | 5.85 | 22.6% |
| SR1 (100 YR) | 0.00 | 0.88 | 1.23 | 0.96 | 4.62 | 0.36 | **0.49** | 5.85 | |

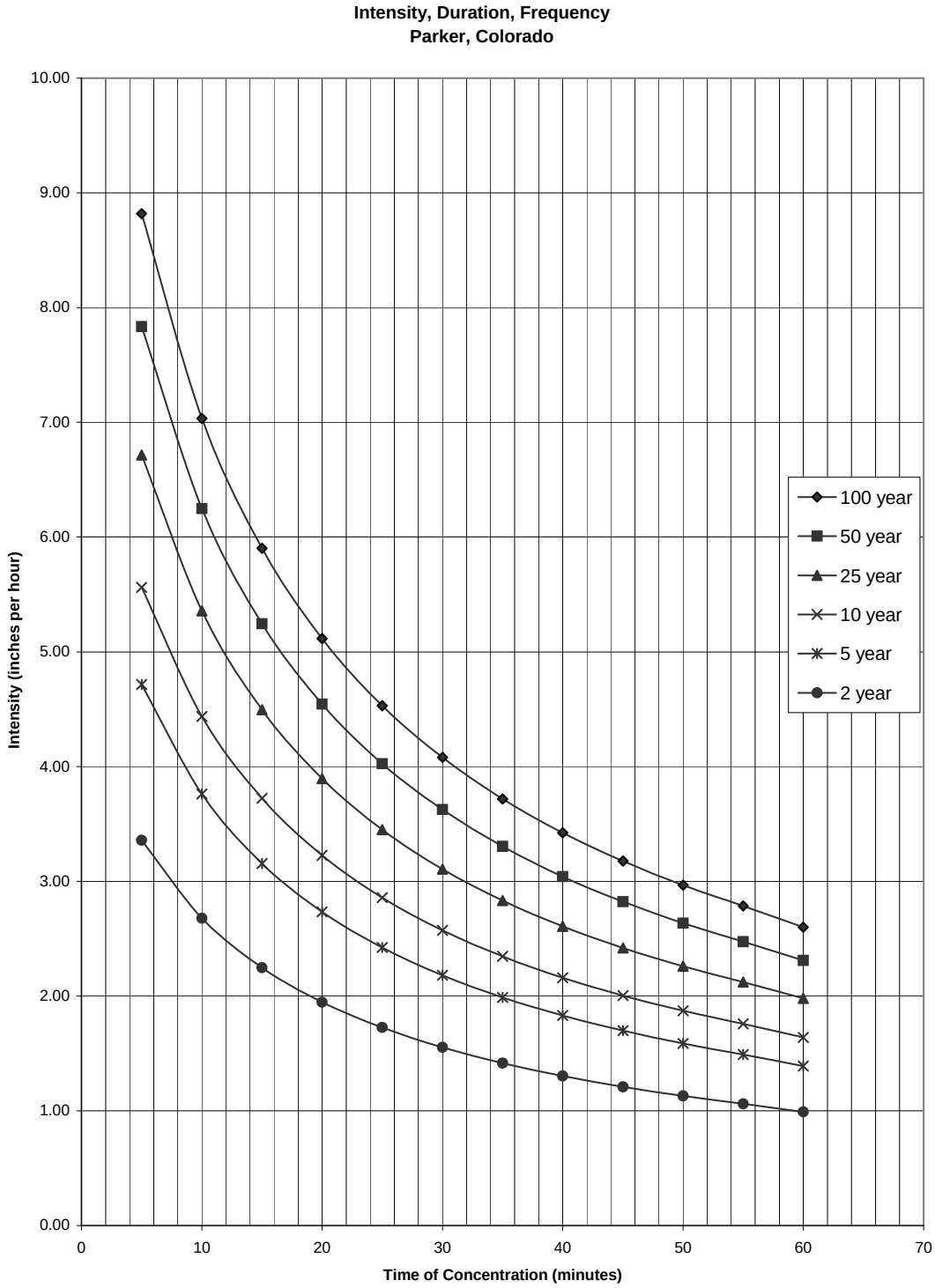


FIGURE 5.1
RAINFALL INTENSITY VERSUS DURATION CURVES FOR PARKER, COLORADO

## STANDARD FORM SF-2

## TIME OF CONCENTRATION

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

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

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

Project: Parker Pointe

**RUNOFF CALCULATIONS**

**(RATIONAL METHOD)**

Design Storm: 100-Yr.

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

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Checked by: JWD
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JOB # 2015-015

Project: Parker Pointe

**STORM SEWER DESIGN -- MANNING'S EQUATION**

**100-YEAR STORM**

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

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DATE 11/10/2017
JOB # 2015-015

Project: Parker Pointe

**STORM SEWER DESIGN -- MANNING'S EQUATION**

**100-YEAR STORM**

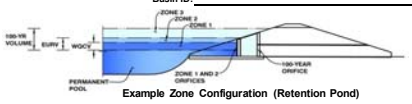
| Contributing Basins | Pipe Location Design Points | Q req'd (cfs) | Slope (%) | n | Diam (in) | Q calc (cfs) | V (Full Flow) (fps) | Friction Slope (%) |
|---|---|---|---|---|---|---|---|---|
| IN2,IN3,IN4,IN5 | 19-20 | 12.86 | 0.50 | 0.013 | 24 | 16.04 | 4.09 | 0.32 |
| IN1,IN2,IN3,IN4,IN5,L1,L2,L3,L4,L11,L12,L13,L14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

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

**UD-Detention, Version 3.07 (February 2017)**

**Project:** _____

**Basin ID:** _____




**Example Zone Configuration (Retention Pond)**

**Required Volume Calculation**

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 24.49 | acres |
| Watershed Length = | 1,300 | ft |
| Watershed Slope = | 0.005 | ft/ft |
| Watershed Imperviousness = | 48.40% | percent |
| Percentage Hydrologic Soil Group A = | 0.0% | percent |
| Percentage Hydrologic Soil Group B = | 100.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Desired WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | Parker - The Pinery Country Club | |
| Water Quality Capture Volume (WQCV) = | 0.412 | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 1.264 | acre-feet |
| 2-yr Runoff Volume (P1 = 0.83 in.) = | 0.710 | acre-feet |
| 5-yr Runoff Volume (P1 = 1.11 in.) = | 1.029 | acre-feet |
| 10-yr Runoff Volume (P1 = 1.36 in.) = | 1.472 | acre-feet |
| 25-yr Runoff Volume (P1 = 1.72 in.) = | 2.295 | acre-feet |
| 50-yr Runoff Volume (P1 = 2.01 in.) = | 2.862 | acre-feet |
| 100-yr Runoff Volume (P1 = 2.32 in.) = | 3.594 | acre-feet |
| 500-yr Runoff Volume (P1 = 3.1 in.) = | 5.271 | acre-feet |
| Approximate 2-yr Detention Volume = | 0.664 | acre-feet |
| Approximate 5-yr Detention Volume = | 0.967 | acre-feet |
| Approximate 10-yr Detention Volume = | 1.352 | acre-feet |
| Approximate 25-yr Detention Volume = | 1.642 | acre-feet |
| Approximate 50-yr Detention Volume = | 1.784 | acre-feet |
| Approximate 100-yr Detention Volume = | 2.060 | acre-feet |

Optional User Override 1-hr Precipitation

| | |
|---|---|
| | inches |
| | inches |
| | inches |
| | inches |
| | inches |
| | inches |

**Stage-Storage Calculation**

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

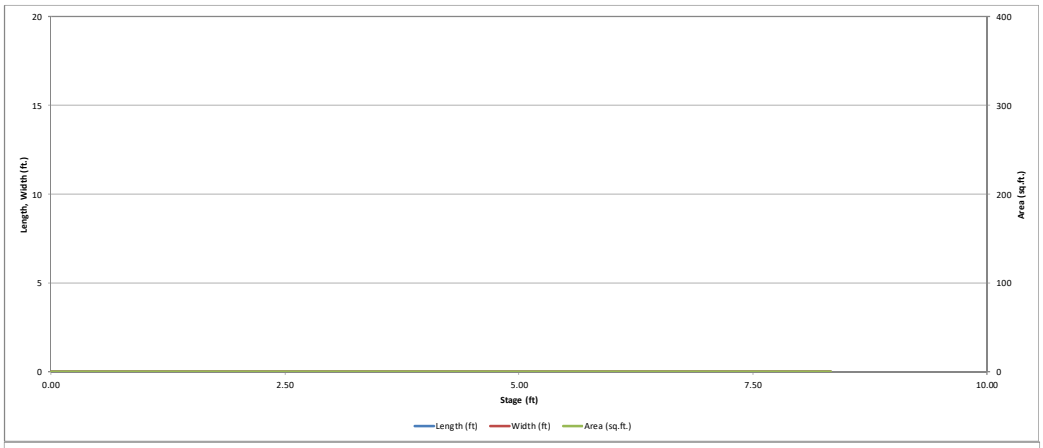
| | | |
|---|---|---|
| Initial Surcharge Area ($A_{ISV}$) = | user | ft^2 |
| Surcharge Volume Length ($L_{ISV}$) = | user | ft |
| Surcharge Volume Width ($W_{ISV}$) = | user | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | user | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | user | ft |
| Width of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

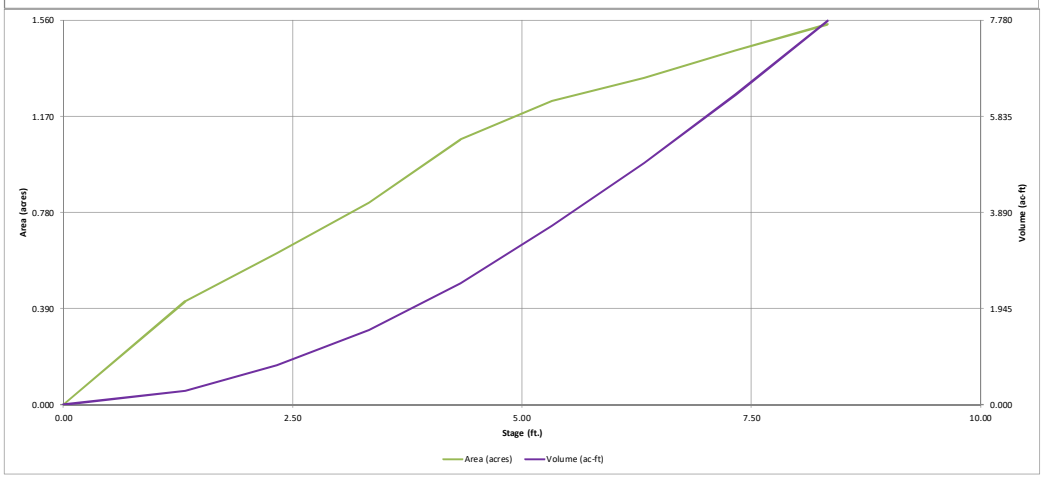
Depth Increment = 1 ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area (ft^2) | Optional Override Area (ft^2) | Area (acre) | Volume (ft^3) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| **Top of Micropool** | -- | 0.00 | -- | -- | -- | 0 | 0.000 | | |
| **Plan Elev=64.0** | -- | 1.33 | -- | -- | -- | 18,309 | 0.420 | 11,993 | 0.275 |
| **Plan Elev=65.0** | -- | 2.33 | -- | -- | -- | 26,747 | 0.614 | 34,703 | 0.797 |
| **Plan Elev=66.0** | -- | 3.33 | -- | -- | -- | 35,626 | 0.818 | 65,889 | 1.513 |
| **Plan Elev=67.0** | -- | 4.33 | -- | -- | -- | 46,895 | 1.077 | 107,150 | 2.460 |
| **Plan Elev=68.0** | -- | 5.33 | -- | -- | -- | 53,711 | 1.233 | 157,453 | 3.615 |
| **Plan Elev=69.0** | -- | 6.33 | -- | -- | -- | 57,753 | 1.326 | 213,185 | 4.894 |
| **Plan Elev=70.0** | -- | 7.33 | -- | -- | -- | 62,610 | 1.437 | 273,366 | 6.276 |
| **Plan Elev=71.00** | -- | 8.33 | -- | -- | -- | 67,188 | 1.542 | 338,265 | 7.766 |

## DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



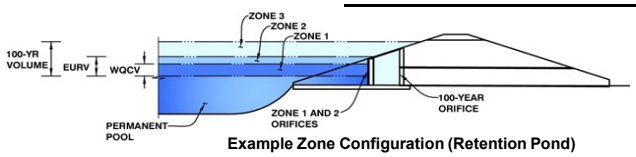



# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

**Project:**

**Basin ID:**




Example Zone Configuration (Retention Pond)

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

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

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

**Calculated Parameters for Underdrain**

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

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

**Calculated Parameters for Plate**

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

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

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

**User Input: Vertical Orifice (Circular or Rectangular)**

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

**Calculated Parameters for Vertical Orifice**

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

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

**Calculated Parameters for Overflow Weir**

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

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

**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plat**

**User Input: Emergency Spillway (Rectangular or Trapezoidal)**

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

**Calculated Parameters for Spillway**

**Routed Hydrograph Results**

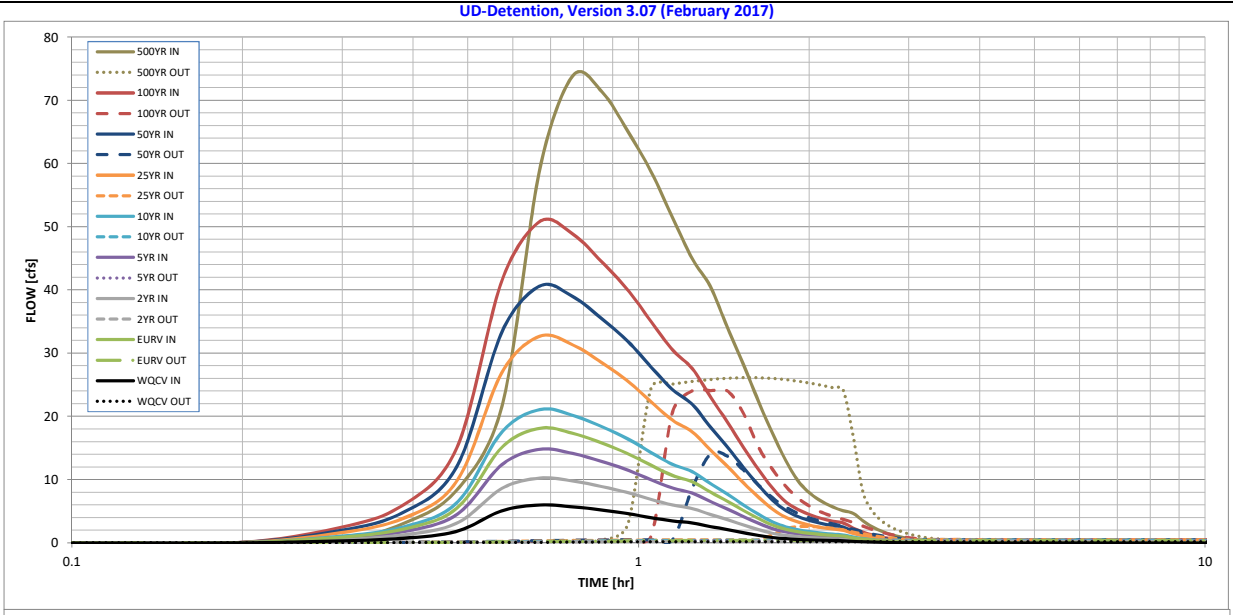
| Design Storm Return Period = | WQCV | EURV | 2 Year | 5 Year | 10 Year | 25 Year | 50 Year | 100 Year |
|---|---|---|---|---|---|---|---|---|
| One-Hour Rainfall Depth (in) = | 0.53 | 1.07 | 0.83 | 1.11 | 1.36 | 1.72 | 2.01 | 2.32 |
| Calculated Runoff Volume (acre-ft) = | 0.412 | 1.264 | 0.710 | 1.029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

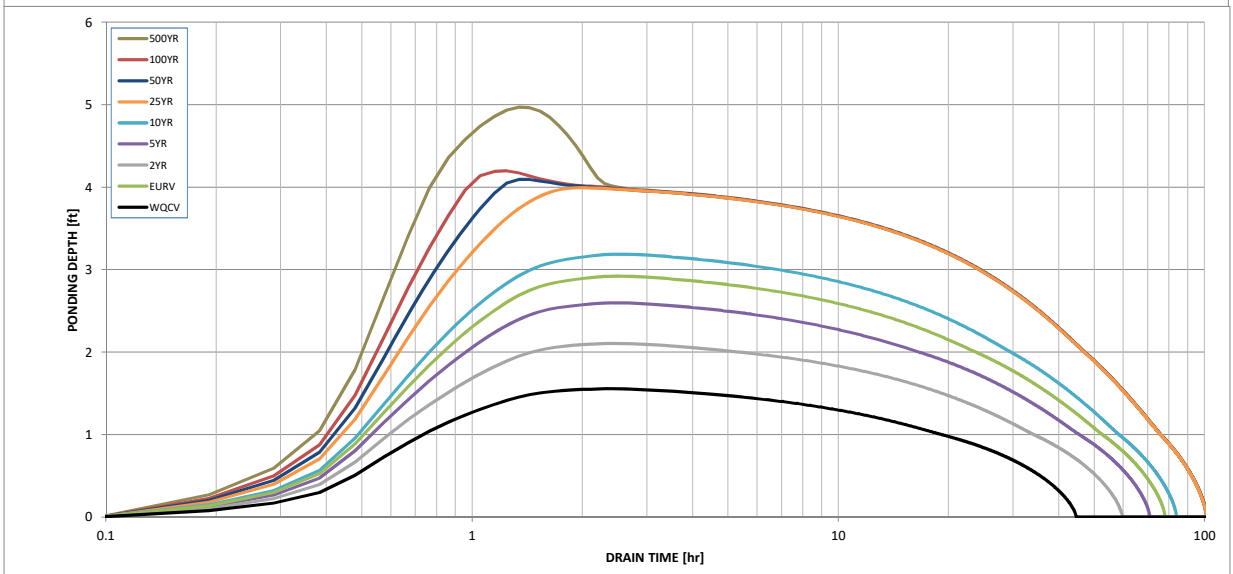
| |
|---|
| $ft^2$ |
| feet |
| |
| feet |
| feet |
| should be $\geq$ 4 |
| $ft^2$ |
| $ft^2$ |
| |
| **e** |
| |
| $ft^2$ |
| feet |
| radians |

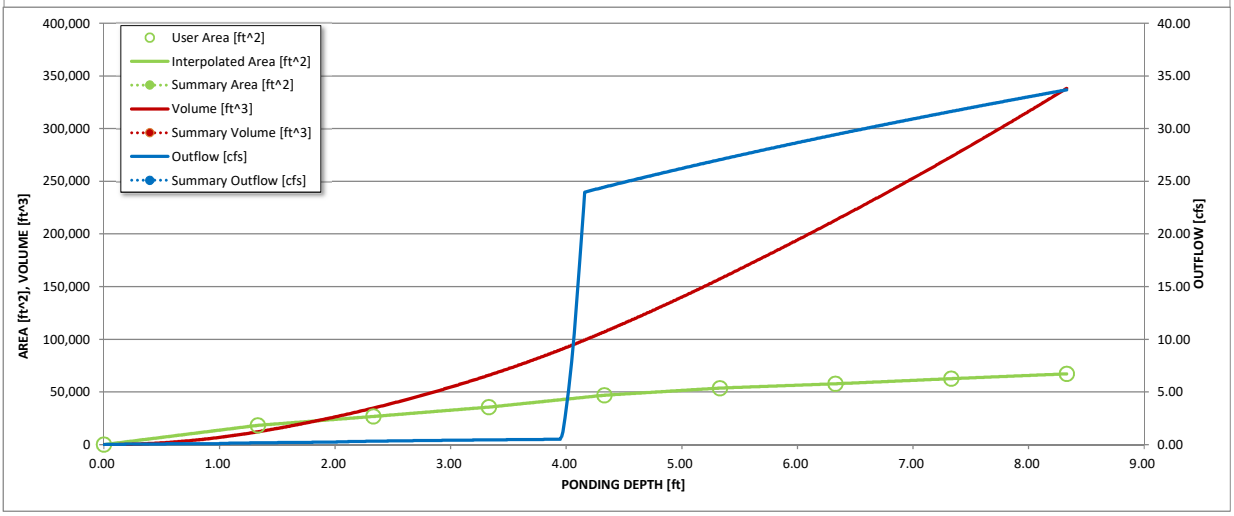
| 500 Year |
|---|
| 3.10 |
| 5.271 |
| |
| 5.262 |
| 1.75 |
| 42.8 |
| 73.9 |
| 26.1 |
| 0.6 |
| Outlet Plate 1 |
| 0.3 |
| N/A |
| 76 |
| 90 |
| 4.97 |
| 1.18 |
| 3.169 |

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)




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

# Detention Basin Outlet Structure Design

Outflow Hydrograph Workbook Filename:

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

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

| | SOURCE | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK | WORKBOOK |
|---|---|---|---|---|---|---|---|---|---|---|
| Time Interval | TIME | WQCV [cfs] | EURV [cfs] | 2 Year [cfs] | 5 Year [cfs] | 10 Year [cfs] | 25 Year [cfs] | 50 Year [cfs] | 100 Year [cfs] | 500 Year [cfs] |
| 5.74 min | 0:00:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0:05:44 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hydrograph Constant | 0:11:29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0:17:13 | 0.27 | 0.79 | 0.45 | 0.65 | 0.92 | 1.40 | 1.72 | 2.13 | 3.00 |
| 0.871 | 0:22:58 | 0.72 | 2.14 | 1.22 | 1.76 | 2.49 | 3.83 | 4.74 | 5.90 | 8.42 |
| | 0:28:42 | 1.85 | 5.51 | 3.14 | 4.51 | 6.39 | 9.84 | 12.18 | 15.15 | 21.62 |
| | 0:34:26 | 5.08 | 15.13 | 8.63 | 12.39 | 17.55 | 27.00 | 33.41 | 41.54 | 59.24 |
| | 0:40:11 | 5.99 | 18.13 | 10.25 | 14.80 | 21.09 | 32.70 | 40.64 | 50.87 | 73.90 |
| | 0:45:55 | 5.71 | 17.34 | 9.79 | 14.14 | 20.18 | 31.33 | 38.98 | 48.86 | 71.39 |
| | 0:51:40 | 5.20 | 15.78 | 8.91 | 12.88 | 18.37 | 28.51 | 35.47 | 44.46 | 65.14 |
| | 0:57:24 | 4.63 | 14.14 | 7.96 | 11.53 | 16.47 | 25.62 | 31.90 | 40.04 | 58.71 |
| | 1:03:08 | 3.99 | 12.26 | 6.88 | 9.98 | 14.29 | 22.30 | 27.82 | 34.99 | 51.44 |
| | 1:08:53 | 3.48 | 10.66 | 5.99 | 8.68 | 12.42 | 19.40 | 24.24 | 30.52 | 44.96 |
| | 1:14:37 | 3.15 | 9.67 | 5.43 | 7.87 | 11.26 | 17.57 | 21.93 | 27.58 | 40.51 |
| | 1:20:22 | 2.59 | 8.03 | 4.48 | 6.53 | 9.37 | 14.66 | 18.33 | 23.08 | 34.05 |
| | 1:26:06 | 2.10 | 6.60 | 3.66 | 5.35 | 7.71 | 12.11 | 15.15 | 19.11 | 28.25 |
| | 1:31:50 | 1.61 | 5.14 | 2.83 | 4.15 | 6.01 | 9.51 | 11.94 | 15.11 | 22.46 |
| | 1:37:35 | 1.19 | 3.88 | 2.11 | 3.12 | 4.55 | 7.27 | 9.16 | 11.64 | 17.41 |
| | 1:43:19 | 0.87 | 2.82 | 1.53 | 2.26 | 3.33 | 5.36 | 6.79 | 8.67 | 13.06 |
| | 1:49:04 | 0.67 | 2.16 | 1.18 | 1.74 | 2.54 | 4.06 | 5.13 | 6.52 | 9.75 |
| | 1:54:48 | 0.55 | 1.77 | 0.97 | 1.43 | 2.08 | 3.30 | 4.15 | 5.25 | 7.81 |
| | 2:00:32 | 0.47 | 1.50 | 0.82 | 1.21 | 1.75 | 2.78 | 3.50 | 4.43 | 6.57 |
| | 2:06:17 | 0.41 | 1.31 | 0.72 | 1.06 | 1.54 | 2.43 | 3.05 | 3.85 | 5.71 |
| | 2:12:01 | 0.37 | 1.18 | 0.65 | 0.95 | 1.38 | 2.18 | 2.73 | 3.45 | 5.10 |
| | 2:17:46 | 0.35 | 1.08 | 0.60 | 0.88 | 1.27 | 2.00 | 2.50 | 3.16 | 4.66 |
| | 2:23:30 | 0.25 | 0.80 | 0.44 | 0.64 | 0.93 | 1.48 | 1.85 | 2.35 | 3.50 |
| | 2:29:14 | 0.19 | 0.58 | 0.32 | 0.47 | 0.68 | 1.07 | 1.35 | 1.70 | 2.53 |
| | 2:34:59 | 0.14 | 0.43 | 0.24 | 0.35 | 0.50 | 0.79 | 0.99 | 1.26 | 1.87 |
| | 2:40:43 | 0.10 | 0.32 | 0.17 | 0.26 | 0.37 | 0.59 | 0.74 | 0.94 | 1.39 |
| | 2:46:28 | 0.07 | 0.23 | 0.12 | 0.18 | 0.27 | 0.43 | 0.54 | 0.68 | 1.02 |
| | 2:52:12 | 0.05 | 0.16 | 0.09 | 0.13 | 0.19 | 0.30 | 0.38 | 0.49 | 0.74 |
| | 2:57:56 | 0.04 | 0.12 | 0.06 | 0.09 | 0.14 | 0.22 | 0.28 | 0.36 | 0.53 |
| | 3:03:41 | 0.02 | 0.08 | 0.04 | 0.06 | 0.09 | 0.15 | 0.19 | 0.25 | 0.37 |
| | 3:09:25 | 0.01 | 0.05 | 0.02 | 0.04 | 0.06 | 0.10 | 0.12 | 0.16 | 0.24 |
| | 3:15:10 | 0.01 | 0.03 | 0.01 | 0.02 | 0.03 | 0.05 | 0.07 | 0.09 | 0.14 |
| | 3:20:54 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.02 | 0.03 | 0.04 | 0.07 |
| | 3:26:38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 |
| | 3:32:23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:38:07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:43:52 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:49:36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 3:55:20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:01:05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:06:49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:12:34 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:18:18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:24:02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:29:47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:35:31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:41:16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:47:00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:52:44 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 4:58:29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:04:13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:09:58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:15:42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:21:26 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:27:11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:32:55 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:38:40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:44:24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:50:08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 5:55:53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:01:37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:07:22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:13:06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:18:50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:24:35 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:30:19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:36:04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:41:48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:47:32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6:53:17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

**Summary Stage-Area-Volume-Discharge Relationships**

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

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

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

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

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

Project: Parker Pointe

**Forebay Design**

Required Forebay Volume = 3% of WQCV

| | | |
|---|---|---|
| WQCV = | 0.412 | ac-ft |
| | 17,947 | cubit feet |
| Required Forebay Volume = | 538 | cubit feet |
| Provided Area= | 750.00 | square feet |
| Provided Depth = | 0.72 | feet |

Required Release = 2% of 100 year peak discharge

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

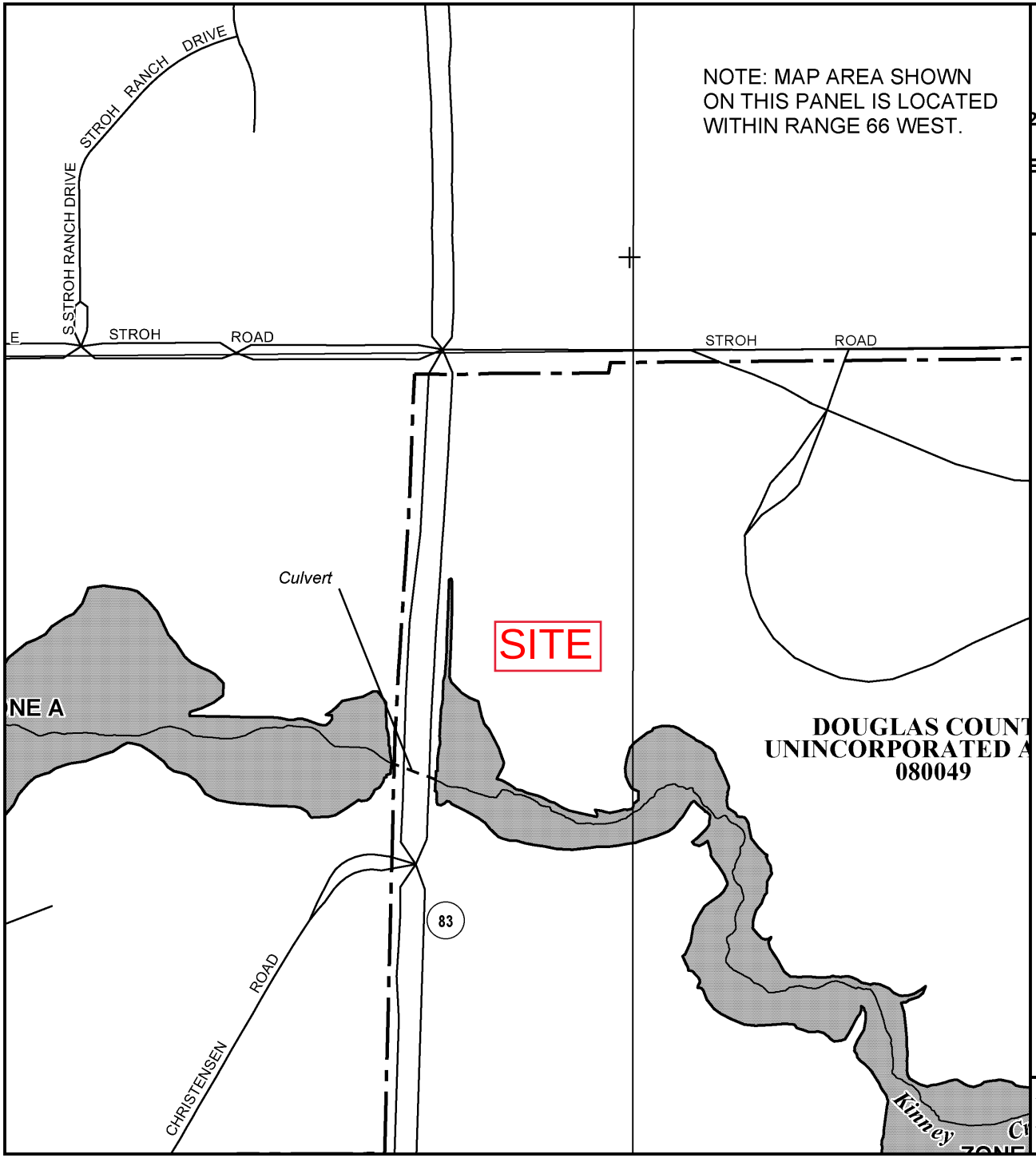
**Use Weir Equation to Size Slot in Concrete**

**100 YEAR**

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

Q=Cd x L x H^0.5

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




MAP SCALE 1" = 500'

250 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0182G

# FIRM

## FLOOD INSURANCE RATE MAP

## DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS

**PANEL 182 OF 495**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

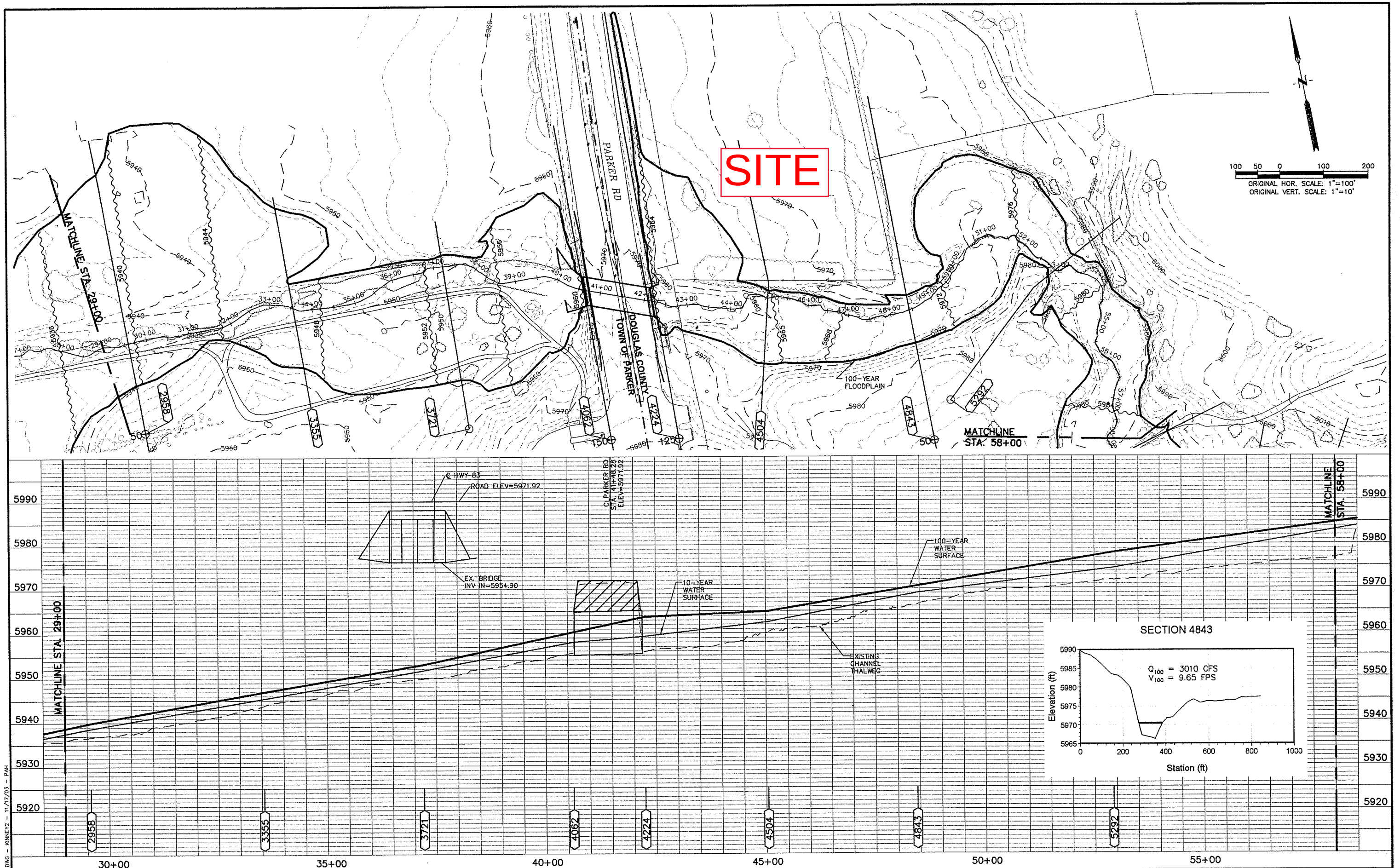
| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| DOUGLAS COUNTY | 080049 | 0182 | G |
| PARKER, TOWN OF | 080310 | 0182 | G |

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

**MAP NUMBER**
**08035C0182G**
**MAP REVISED**
**MARCH 16, 2016**

Federal Emergency Management Agency

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




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


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


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

**URBAN DRAINAGE & FLOOD CONTROL DISTRICT**
**DOUGLAS COUNTY**

**FLOOD HAZARD AREA DELINEATION FOR KINNEY CREEK AND TRIBUTARIES**

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

**SHEET 2 OF 34**

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

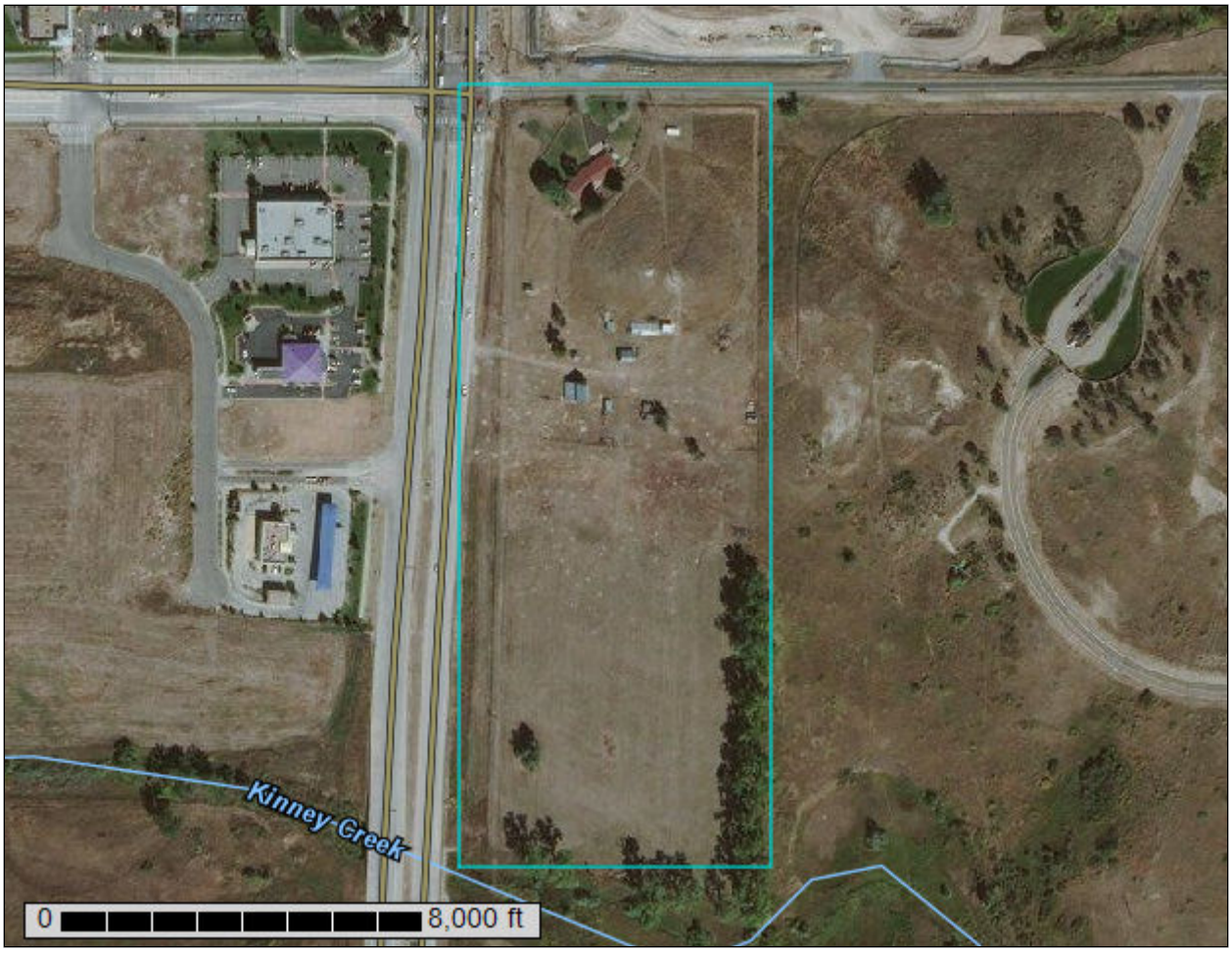
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

# Custom Soil Resource Report for Castle Rock Area, Colorado




September 18, 2017

# Preface

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

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

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

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

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

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

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# Soil Map

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

# Custom Soil Resource Report
## Soil Map

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

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

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

## MAP LEGEND

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

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

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

**Water Features**
- Streams and Canals

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

**Background**
- Aerial Photography

## MAP INFORMATION

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

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

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

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

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

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

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

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

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

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

# Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

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

# Castle Rock Area, Colorado

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

### Map Unit Setting

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

### Map Unit Composition

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

### Description of Bresser

#### Setting

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

#### Typical profile

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

#### Properties and qualities

*Slope:* 5 to 15 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.20 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Moderate (about 7.6 inches)

#### Interpretive groups

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

### Description of Truckton

#### Setting

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

*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium derived from arkosic sedimentary rock

**Typical profile**

*H1 - 0 to 4 inches:* sandy loam
*H2 - 4 to 19 inches:* sandy loam
*H3 - 19 to 60 inches:* sandy loam

**Properties and qualities**

*Slope:* 10 to 25 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* High (2.00 to 6.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Low (about 6.0 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* A
*Hydric soil rating:* No

**Minor Components**

**Blakeland**

*Percent of map unit:* 5 percent
*Hydric soil rating:* No

**Newlin**

*Percent of map unit:* 5 percent
*Hydric soil rating:* No

**Stapleton**

*Percent of map unit:* 4 percent
*Hydric soil rating:* No

**Aquic haplustolls**

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

## Lu—Loamy alluvial land, dark surface

**Map Unit Setting**

*National map unit symbol:* jqzc
*Elevation:* 7,000 to 8,000 feet

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

**Map Unit Composition**

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

**Description of Loamy Alluvial Land, Dark Surface**

**Setting**

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

**Typical profile**

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

**Properties and qualities**

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

**Interpretive groups**

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

**Minor Components**

**Sandy alluvial land**

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

**Fluvaquentic haplustolls**

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

## Sa—Sampson loam

### Map Unit Setting

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

### Map Unit Composition

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

### Description of Sampson

#### Setting

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

#### Typical profile

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

#### Properties and qualities

*Slope:* 1 to 4 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 15 percent
*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water storage in profile:* High (about 9.5 inches)

#### Interpretive groups

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

*Hydric soil rating:* No

**Minor Components**

**Englewood**
*Percent of map unit:* 8 percent
*Hydric soil rating:* No

**Bresser**
*Percent of map unit:* 7 percent
*Hydric soil rating:* No

**Loamy alluvial land**
*Percent of map unit:* 4 percent
*Hydric soil rating:* No

**Aquic haplustolls**
*Percent of map unit:* 1 percent
*Landform:* Swales
*Hydric soil rating:* Yes

## Sd—Sandy alluvial land

**Map Unit Setting**
*National map unit symbol:* jr03
*Elevation:* 5,500 to 6,600 feet
*Mean annual precipitation:* 15 to 19 inches
*Mean annual air temperature:* 48 to 50 degrees F
*Frost-free period:* 120 to 135 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**
*Sandy alluvial land:* 75 percent
*Minor components:* 25 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Sandy Alluvial Land**

**Setting**
*Landform:* Swales, drainageways
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Weathered alluvium derived from arkose

**Typical profile**
*H1 - 0 to 20 inches:* loamy sand
*H2 - 20 to 60 inches:* stratified sand to sandy loam

**Properties and qualities**
*Slope:* 1 to 5 percent
*Natural drainage class:* Excessively drained
*Runoff class:* Negligible

*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (2.00 to 20.00 in/hr)
*Depth to water table:* About 60 inches
*Frequency of flooding:* Frequent
*Calcium carbonate, maximum in profile:* 5 percent
*Salinity, maximum in profile:* Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
*Available water storage in profile:* Low (about 4.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7w
*Hydrologic Soil Group:* A
*Hydric soil rating:* No

**Minor Components**

**Loamy alluvial land**

*Percent of map unit:* 8 percent
*Hydric soil rating:* No

**Loamy alluvial land, dark surface**

*Percent of map unit:* 8 percent
*Hydric soil rating:* No

**Bresser**

*Percent of map unit:* 4 percent
*Hydric soil rating:* No

**Truckton**

*Percent of map unit:* 4 percent
*Hydric soil rating:* No

**Fluvaquentic haplustolls**

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

# Soil Information for All Uses

## Soil Properties and Qualities

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

## Soil Qualities and Features

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

### Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

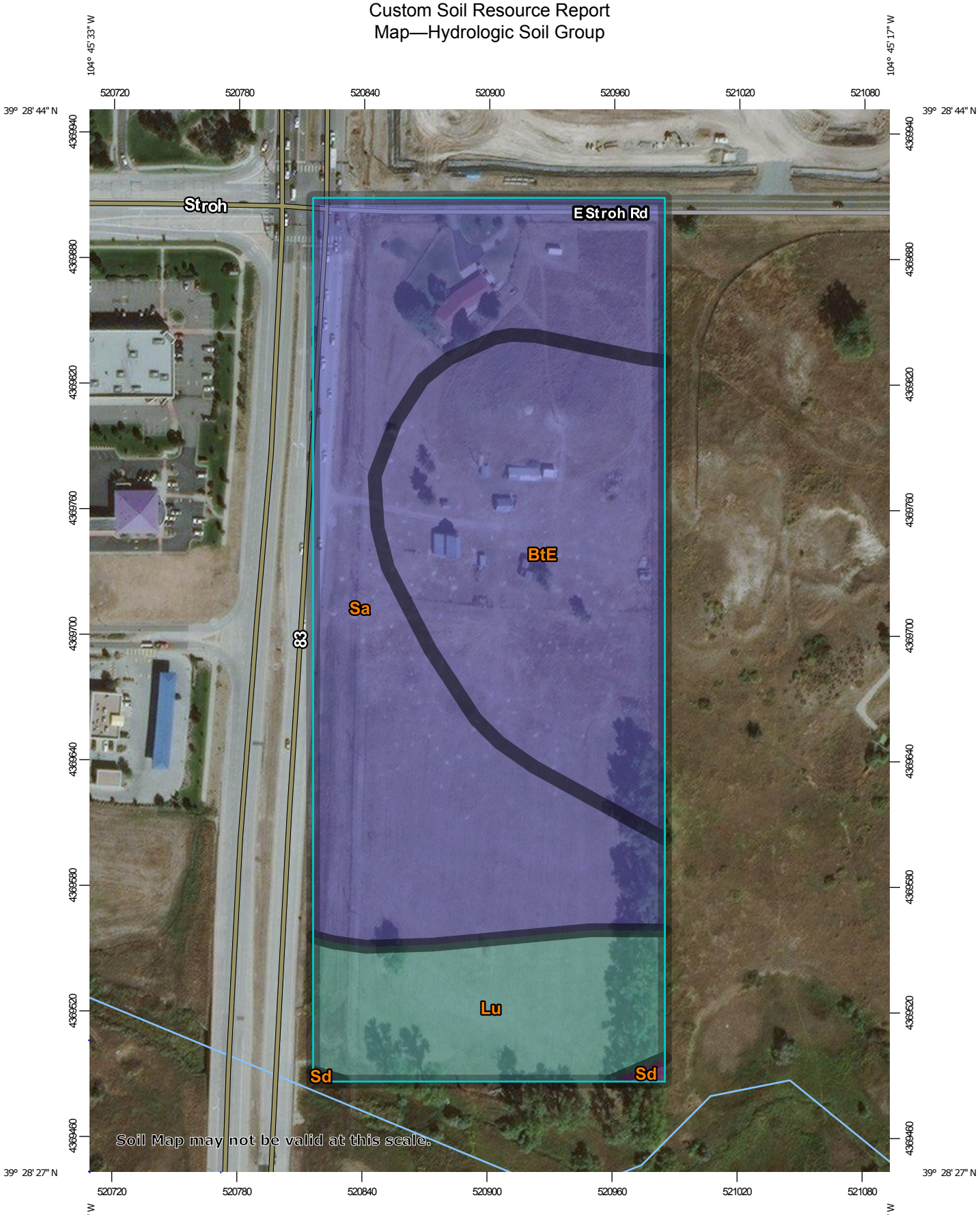
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

# Custom Soil Resource Report
## Map—Hydrologic Soil Group




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

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

## MAP LEGEND

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

**Soils**

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

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

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

**Water Features**
- Streams and Canals

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

**Background**
- Aerial Photography

## MAP INFORMATION

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

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

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

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

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

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Table—Hydrologic Soil Group

| Hydrologic Soil Group— Summary by Map Unit — Castle Rock Area, Colorado (CO622) | | | | |
|---|---|---|---|---|
| **Map unit symbol** | **Map unit name** | **Rating** | **Acres in AOI** | **Percent of AOI** |
| BtE | Bresser-Truckton sandy loams, 5 to 25 percent slopes | B | 6.1 | 34.7% |
| Lu | Loamy alluvial land, dark surface | C | 2.8 | 16.0% |
| Sa | Sampson loam | B | 8.7 | 49.1% |
| Sd | Sandy alluvial land | A | 0.0 | 0.2% |
| **Totals for Area of Interest** | | | **17.7** | **100.0%** |

## Rating Options—Hydrologic Soil Group

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Higher

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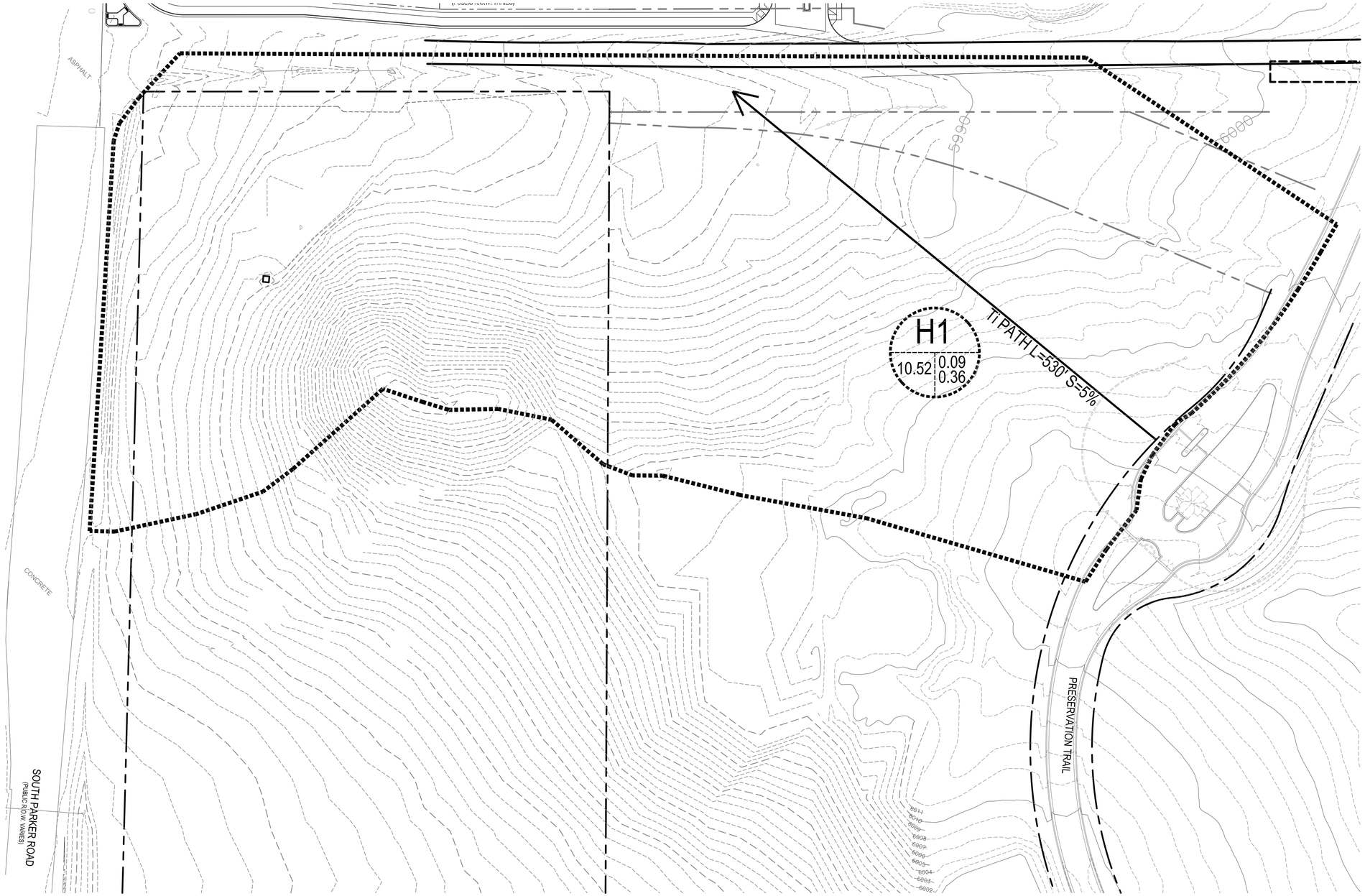



GRAPHIC SCALE

40 0 20 40 80

( IN FEET )

1 inch = 40 ft.

## BENCHMARK

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

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

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

TOWN OF PARKER, PUBLIC WORKS DIRECTOR — DATE

TOWN OF PARKER, PUBLIC WORKS MANAGER - STORMWATER — DATE

TOWN OF PARKER, PUBLIC WORKS MANAGER - TRANSPORTATION — DATE

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

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

| △ | DATE | DESCRIPTION |
|---|---|---|
| | 10/24/17 | INITIAL SUBMITTAL |

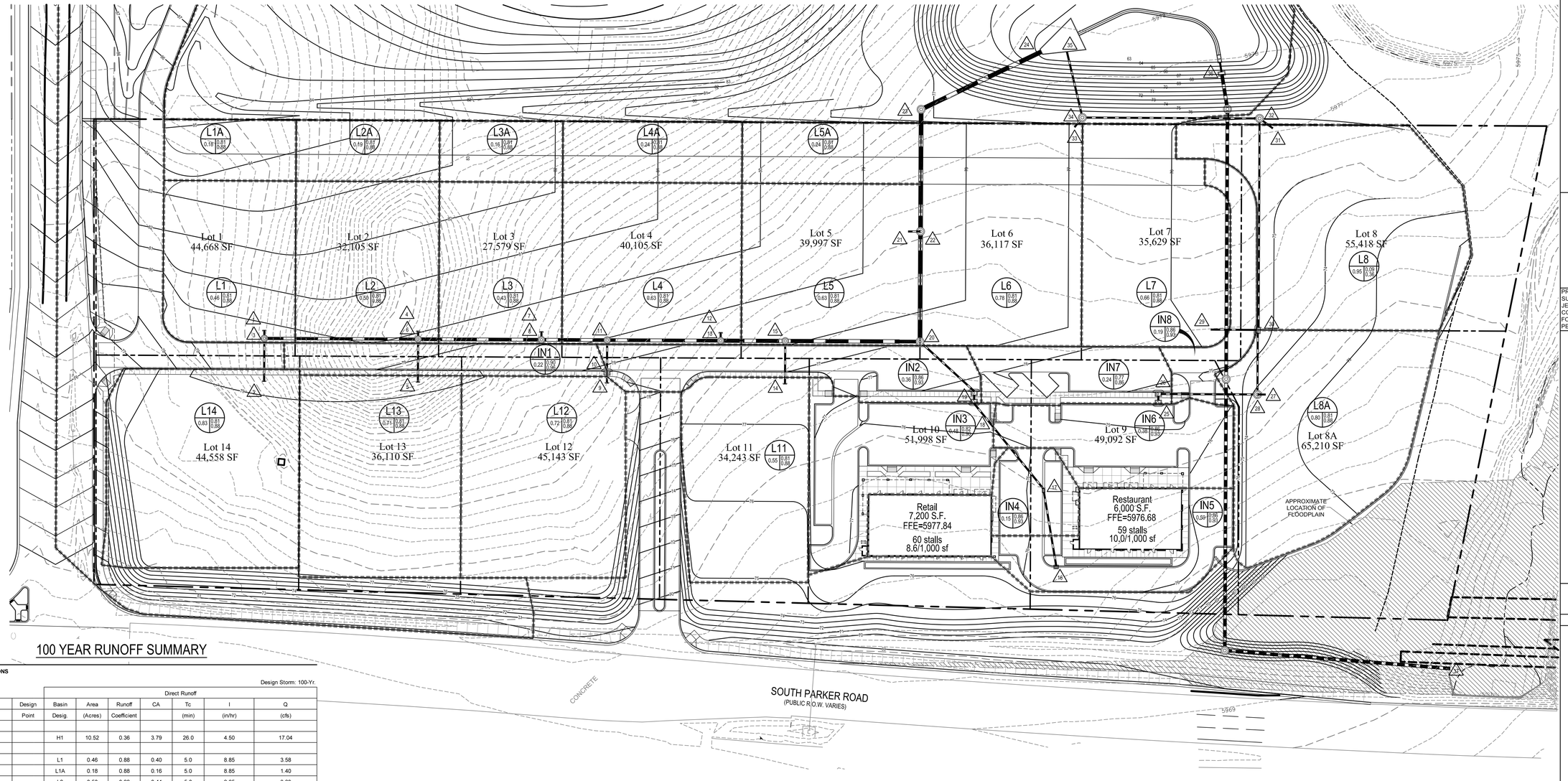
REVISIONS

# HISTORIC DRAINAGE PLAN

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

| | |
|---|---|
| design by: | JWD |
| approved by: | JWD |
| project no.: | 2015-015 |
| date: | 10/01/17 |

SHEET
DP1




## 100 YEAR RUNOFF SUMMARY

**RUNOFF CALCULATIONS**
**(RATIONAL METHOD)**

Design Storm: 100-Yr.

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

## DETENTION SUMMARY

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

## LEGEND

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

GRAPHIC SCALE

40 0 20 40 80

( IN FEET )
1 Inch = 40 ft.

## BENCHMARK

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

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

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TOWN OF PARKER, PUBLIC WORKS DIRECTOR — DATE

TOWN OF PARKER, PUBLIC WORKS MANAGER - STORMWATER — DATE

TOWN OF PARKER, PUBLIC WORKS MANAGER - TRANSPORTATION — DATE


Perception Design Group, Inc.
Consulting Civil Engineers
6901 South Pierce Street, Suite 315
Littleton, Colorado 80128
303-232-0255


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

| DATE | REVISIONS |
|---|---|
| 10/24/17 | 1 INITIAL SUBMITTAL |

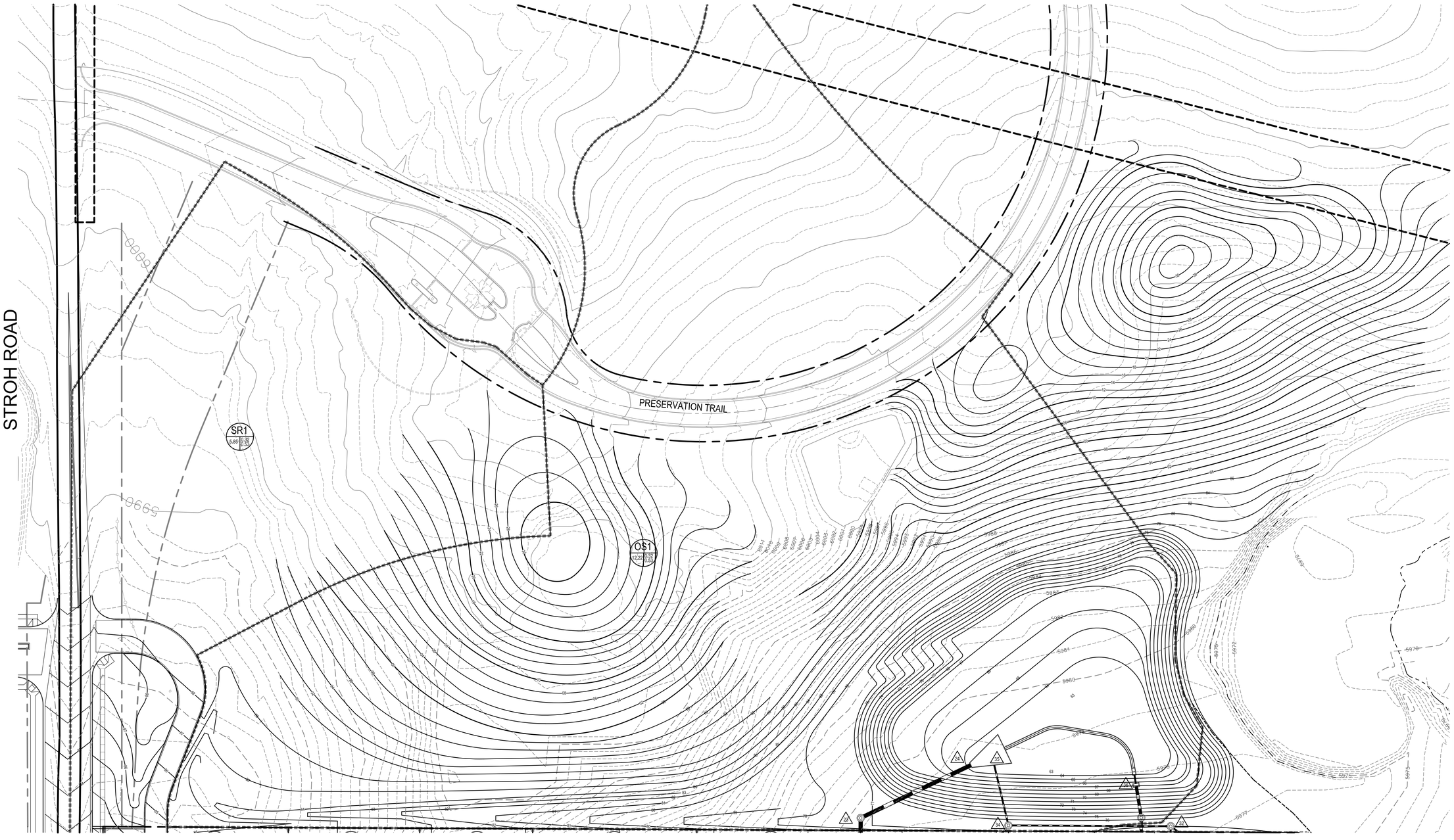
# DRAINAGE PLAN WEST

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

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

date: 10/01/17

SHEET
DP2




SEE SHEET DP2

## LEGEND

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

GRAPHIC SCALE

40 0 20 40 80

( IN FEET )

1 inch = 40ft.

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

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

## BENCHMARK

BENCHMARK: DOUGLAS COUNTY SURVEY CONTROL MONUMENT TT15A – 3" DIAMETER DOUGLAS COUNTY GIS ALUMINUM CAP AT THE NE CORNER OF STROH ROAD AND SOUTH PARKER ROAD (US HIGHWAY 83)
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Perception Design Group, Inc.
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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 |
|---|---|---|
| | 10/24/17 | INITIAL SUBMITTAL |

REVISIONS

# DRAINAGE PLAN EAST

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

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

date: 10/01/17

SHEET
DP3