DRAINAGE REPORT
FOR
TELLER COUNTY SHERIFF'S OFFICE ADDITION

Prepared for:

Teller County Public Works
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JPS Project No. 011905

TELLER COUNTY SHERIFF'S OFFICE ADDITION
DRAINAGE REPORT
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JPS ENGINEERING

TELLER COUNTY SHERIFF'S OFFICE ADDITION
DRAINAGE REPORT - EXECUTIVE SUMMARY

A. Background

- The Teller County Sheriff's Office is planning to construct a two-story, 20,000 square-foot building addition with related parking and site improvements on the existing office site in Divide, Colorado.
- Access to the site will continue to be provided from both Weaverville Road and the existing driveway access on the south side of US Highway 24.

B. General Drainage Concept

- Developed drainage within the site will be conveyed through the site via curb and gutter and a private storm sewer system flowing through an on-site detention pond at the northeast corner of the site.
- Developed flow impacts from the site will be detained to historic levels through the on-site stormwater detention pond.

C. Drainage Impacts

- The proposed detention pond will release historic flows at the downstream property boundary, ensuring no significant adverse impact from developed drainage.
- Drainage facilities will be designed and constructed to County standards, and the drainage and stormwater detention facilities will be owned and maintained by Teller County.

I. INTRODUCTION

A. Background

Teller County is proposing to construct a building addition to expand the existing Sheriff's Office in Divide, Colorado. The project site is the existing 2.73-acre Sheriff's Office property located at 11400 W. US Highway 24. The project will consist of an addition on the west side of the existing building, providing an upgraded 20,000 square-foot building. Site development activities will include site grading, utilities, building construction, parking, and associated site improvements.

B. Scope

This report will provide a summary of site drainage issues impacting the proposed project. The report will analyze impacts from upstream drainage patterns, site-specific developed drainage patterns, and impacts on downstream facilities. This report is based on the guidelines and criteria presented in the Pikes Peak Area Council of Governments "Areawide Urban Runoff Control Manual," "Teller County Roadway Design and Construction Standards," and the CDOT "Drainage Design Manual." The report is intended to fulfill the requirements of a Final Drainage Report and Erosion Control Report in accordance with Section 5.1 of the Teller County Land Use Regulations.

C. General Description

The 2.73-acre property (Teller County Assessor's Account No. R0017724) is zoned Agricultural (A-1) and the site has been platted as Lot 1, Harris Subdivision Filing No. 1. US Highway 24 adjoins the north boundary of the property, Hybrook Road adjoins the west boundary of the site, and Weaverville Road adjoins the south boundary of the property. The east boundary of the site adjoins existing developed properties.

The project consists of an enlarged and remodeled two-story, 20,000 square-foot County Sheriff's Office Building with related parking and site improvements. Access to the site will be provided by the existing access drive connection to US Highway 24 along the north boundary of the property, with additional access Weaverville Road along the southern boundary of the site.

Elevations within the parcel range from approximately 9,114 to 9,140 feet above mean sea level. Surface drainage flows northeasterly across the site, draining to the existing channel along the south side of US Highway 24, which ultimately flows northeast to the Rule Creek drainage channel.

D. Floodplain Impacts

The project site is not impacted by any 100-year floodplain limits as delineated by the Federal Emergency Management Agency (FEMA). The floodplain limits in the vicinity of the site are shown in Flood Insurance Rate Map (FIRM) Number 08119C0185D dated September 25, 2009.

E. References

City of Woodland Park Drainage Criteria Manual (DCM), February, 2014.

CDOT, "CDOT Drainage Design Manual," 2004.

FEMA, Flood Insurance Rate Map (FIRM) Number 08119C0185D, September 25, 2009.

Greiner Engineering, Inc., "Preliminary Drainage Study for The Highlands of Divide," April, 1987.

JPS Engineering, Inc., "Drainage Report for Highlands of Divide Water Treatment Plant," January 28, 2008.

JPS Engineering, Inc., "Drainage Report for Hybrook Townhomes, Highlands of Divide Filing No. 3," December 12, 2003.

JPS Engineering, Inc., "Final Drainage Report for Saddle Club Subdivision," December 21, 2011.

Pikes Peak Area Council of Governments, "Areawide Urban Runoff Control Manual," 1980.

Teller County, "Roadway Design and Construction Standards," adopted July 8, 1999.

Teller Tech Engineering, "Final Drainage Study for The Highland of Divide," July 7, 1990.

URS Consultants, "Final Drainage Report, The Hybrook Commercial Center," April 29, 1999.

II. HYDROLOGY

A. Discharge Calculations

1. Hydrologic Analysis Procedure

Based on the relatively small size of the tributary drainage basins impacting the site (all basins less than 100 acres), Rational Method hydrology was utilized for the project drainage analysis. Design storm recurrence intervals of 5-years (minor) and 100-years (major) were used in the drainage analysis of the site. Hydrologic calculations, detailed in Appendix A, were based on a 5-year, 1-hour point rainfall of 0.97 inches, and a 100-year, 1-hour point rainfall of 2.03 inches.

Times of concentration were calculated in accordance with City of Woodland Park drainage criteria. Runoff coefficients ("C" values) were selected from tables in the City of Woodland Park Drainage Criteria Manual. Composite runoff coefficients were calculated based on the existing and proposed site characteristics.

2. Existing Drainage Conditions

Grades across the site fall downward towards the northeast corner of the parcel, with average grades of 2-8 percent. According to the Natural Resources Conservation Service (NRCS) Soil Survey for this site (see Appendix A), the on-site soils are described as "Altman gravelly loam" soils. These soils are characterized as having a slow infiltration rate and classified as hydrologic soils group "C."

As shown on Sheet EX1 and EX2 (Appendix D), the property has been delineated as two historic drainage basins (Basin A and B), flowing northeasterly towards the existing drainage channel along the south side of US Highway 24. The property is impacted by two off-site drainage basins to the southwest and northwest of the site. Basin OB1 consists of the upstream area southwest of this site, which flows northeasterly across the site through an existing 15" culvert crossing Weaverville Road. Basin OB2 consists of the upstream area northwest of this site, which enters the northeast corner of the property through an existing storm sewer system crossing the north access drive to the site.

On-site Basin A comprises the existing developed area on the east side of the property, which generally sheet flows to Design Point #A1 at the northeast corner of the site. Historic peak flows at Design Point #A1 are calculated as Q_5 = 2.7 cfs and Q_{100} = 9.8 cfs. Basin B comprises the undeveloped west side of the property, which sheet flows to the northeast with historic peak flows calculated as Q_5 = 0.2 cfs and Q_{100} = 1.2 cfs.

Flows from Off-site Basins OB1 and OB2 combine with Basins A and B Design Point #1, with historic peak flows calculated as Q_5 = 56.1 cfs and Q_{100} = 177.8 cfs.

3. Developed Drainage Conditions

Development of the proposed project will include site grading, utilities, building construction, parking, and related site improvements. The general concept for management of on-site developed storm runoff is to route developed flows through an on-site stormwater detention facility to mitigate the impact of developed drainage from the site.

As shown on Sheet D1 (Appendix D), the developed site has been delineated as two on-site drainage basins (Basins A and B), consistent with historic conditions. The site plan has been developed to direct the majority of the developed site (Basin A) to a series of storm inlets and a storm sewer system conveying developed flows through the proposed Detention Pond A at the northeast corner of the property.

The on-site storm sewer system consists of seven 5-foot Type R Storm Inlets (A1-A7) and a storm sewer system (12"-15" Storm Sewer Lines A1-A7) conveying developed flows westerly along the south parking area (Inlets A1-A3), and then northeasterly across the north parking area (Inlets A4-A7) to Detention Basin A.

The on-site Detention Basin A will provide the required stormwater detention and water quality capture volume to mitigate developed flow impacts from Basin A prior to discharging into the existing downstream drainage system.

Developed peak flows at Design Point #A1 are calculated as Q_5 = 4.4 cfs and Q_{100} = 13.5 cfs. Developed peak flows at Design Point #B1 (Basin B), are calculated as Q_5 = 0.2 cfs and Q_{100} = 1.2 cfs (no developed drainage impact).

Flows from Off-site Basins OB1 and OB2 will continue to combine with Basins A and B Design Point #1, with developed peak flows calculated as Q_5 = 56.6 cfs and Q_{100} = 178.4 cfs. The minor increase in developed flows will be mitigated by routing flows from developed Basin A through the on-site detention basin.

The developed drainage basins, projected flows, and proposed improvements are shown in Figure D1.

B. Comparison of Developed to Historic Discharges

Based on the hydrologic calculations in Appendix A, the proposed site development project will result in a minor increase in developed flows, which will be mitigated through the on-site detention facilities. The comparison of developed to historic discharges is summarized as follows:

Design Point	Historic Flow		Developed Flow		Comparison of Developed to Historic Flow (Q_{100}%)
	Area (ac)	Q_{100} (cfs)	Area (ac)	Q_{100} (cfs)	
1	84.1	177.8	84.1	178.4	100.3% (increase)

C. Detention Ponding

The proposed detention pond facilities have been designed based on design procedures delineated in the City of Woodland Park Drainage Criteria Manual. The total developed storm runoff downstream of the site will be maintained at historic levels by routing flows through the proposed detention pond. Detention Pond A has been designed as a "full-spectrum" detention pond to mitigate developed drainage and water quality impacts from the site.

The proposed pond outlet structure has been designed as an Extended Detention Basins (EDB), providing for a 40-hour release of the water quality capture volume (WQCV), and outlet structure sizing to maintain maximum allowable release rates from the pond. The detention pond will have a grass-lined bottom and riprap trickle channel to encourage infiltration of stormwater prior to discharging into the downstream drainage system. A buried riprap spillway will be provided as an emergency overflow path from the pond to the downstream channel.

The proposed Extended Detention Basin (EDB) has been designed using the "Denver Urban Drainage and Flood Control District (UDFCD) "UD-Detention_v3.07" software package (with rainfall data calibrated for City of Woodland Park).

Design calculations are detailed in Appendix C, and design parameters for the detention pond are summarized as follows:

Pond	Tributary Area (ac)	Net Percent Impervious (%)	Minimum Required 100-Year Detention Volume (ac-ft)	Design Design Volume (ac-ft)
A	2.26	14.3%	0.06	0.07

The proposed detention basin will be a public facility maintained by Teller County Public Works. Maintenance access will be provided from the adjacent parking lot and access drive.

III. HYDRAULICS

A. On-Site Drainage Facility Design

Curb and gutter along the perimeter of the site access drives and parking areas will direct surface drainage to a series of storm inlets, and a storm sewer will convey developed flows to the proposed extended detention basin (EDB) at the northeast corner of the property. The proposed detention pond outlet structure will discharge to the existing drainage channel at the northeast corner of the site. Hydraulic calculations for sizing of proposed storm inlets and storm sewers are enclosed in Appendix B.

B. Erosion Control

The Contractor will be required to implement best management practices (BMP's) for erosion control during construction. Erosion control measures will include installation of silt fence along the downstream site perimeter and vehicle tracking pads at construction access points. Vegetation will be re-established for stabilization of the disturbed areas as soon as possible. The proposed detention pond will also serve as a sediment basin during construction.

C. Capacity of Existing Facilities

Flows from this site currently drain northeasterly to the existing drainage channel along the south side of US Highway 24. The on-site detention pond has been designed to mitigate developed drainage impacts and discharge historic flows at the downstream boundaries of the site.

IV. GENERAL DRAINAGE RECOMMENDATIONS

The developed drainage plan for the site is to provide and maintain positive drainage away from structures and conform to the established drainage patterns for the overall site. JPS Engineering recommends that positive drainage be established and maintained away from all structures within the site in conformance with applicable building codes and geotechnical engineering recommendations.

In general, we recommend a minimum of 6 inches clearance from the top of concrete foundation walls to adjacent finished site grades. Positive drainage slopes should be maintained away from all structures, with a minimum recommended slope of 5 percent for the first 10 feet away from buildings in landscaped areas, a minimum recommended slope of 2 percent for the first 10 feet away from buildings in paved areas, and a minimum slope of 1 percent for paved areas beyond buildings.

V. SUMMARY

The proposed Teller County Sheriff's Office Addition project consists of enlarging the existing building to provide an upgraded 20,000 square-foot facility for improved County services. Developed drainage impacts from the site will be mitigated by routing flows through an on-site stormwater detention basin prior to discharge into the existing downstream drainage channel. All drainage facilities will be designed and constructed in accordance with Teller County Public Works standards.

The proposed drainage patterns will remain consistent with historic conditions, draining northeasterly to the existing drainage channel along the south side of US Highway 24. Construction of the proposed drainage and stormwater detention facilities, in conjunction with proper erosion control measures, will ensure that the proposed development has no significant adverse drainage impact on downstream properties and drainage facilities.

APPENDIX A

HYDROLOGIC CALCULATIONS

Hydrologic Soil Group—Teller-Park Area, Colorado, Parts of Park and Teller Counties
(TCSO)

Map Scale: 1:1,690 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

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 1:24,000.

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: Teller-Park Area, Colorado, Parts of Park and Teller Counties
Survey Area Data: Version 10, Sep 10, 2018

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

Date(s) aerial images were photographed: Jul 4, 2010—Oct 16, 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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
4	Altman gravelly loam, 8 to 40 percent slopes	C	2.7	100.0%
Totals for Area of Interest			**2.7**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Atlas has recently been updated and new rainfall mapping has been published. This chapter is based on the updated NOAA mapping, and the updated NOAA mapping shall be used as the basis for hydrologic design in Woodland Park. As discussed above, the primary hydrologic method that will apply to most development and redevelopment projects in Woodland Park is the Rational Method. Therefore this section presents depth-duration-frequency and intensity-duration-frequency tables and figures (Tables 6-1 and 6-2 and Figures 6-1 and 6-2). In cases where hydrograph analysis is needed, the reader should refer to the storm depths in Table 6-1 and Figure 6-1, along with the NOAA Atlas, to determine appropriate point precipitation depths that can be applied to the design storm distribution methods in the UDFCD (Colorado Urban Hydrograph Procedure) and Colorado Springs Manuals (SCS). The most up-to-date mapping from NOAA (NOAA Atlas 14) is available online (http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=co).

Table 6-1. Depth-Duration-Frequency Relationships for Woodland Park, Colorado

Duration	Precipitation Depth in Inches for Range of Recurrence Intervals							
(minutes)	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
5	0.23	0.28	0.36	0.43	0.55	0.64	0.74	1.01
10	0.34	0.41	0.53	0.64	0.80	0.94	1.09	1.48
15	0.41	0.50	0.64	0.78	0.98	1.15	1.33	1.81
30	0.52	0.63	0.81	0.98	1.24	1.45	1.68	2.28
60	0.64	0.76	0.97	1.17	1.48	1.75	2.03	2.80

Table 6-2. Intensity-Duration-Frequency Relationships for Woodland Park, Colorado

Duration	Precipitation Intensity in Inches Per Hour for Range of Recurrence Intervals							
(minutes)	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
5	2.77	3.32	4.31	5.21	6.56	7.70	8.93	12.10
10	2.03	2.44	3.16	3.82	4.81	5.64	6.54	8.89
15	1.65	1.98	2.57	3.10	3.91	4.59	5.32	7.22
30	1.05	1.25	1.63	1.96	2.47	2.90	3.36	4.57
60	0.64	0.76	0.97	1.17	1.48	1.75	2.03	2.80

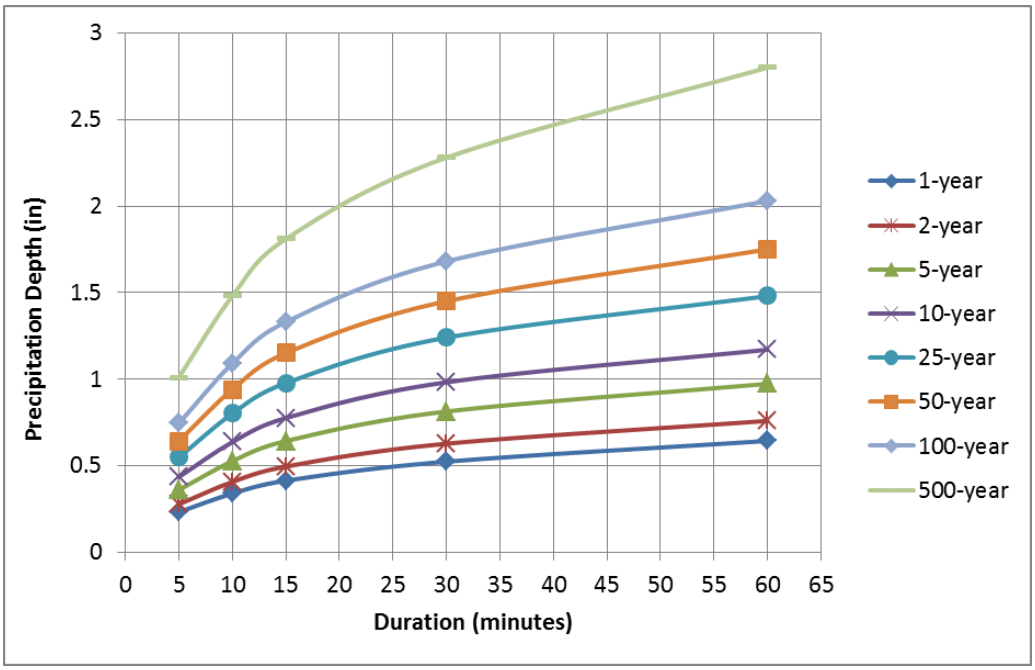


Figure 6-1. Depth-Duration-Frequency Relationships for Woodland Park, Colorado (from NOAA Atlas 14)

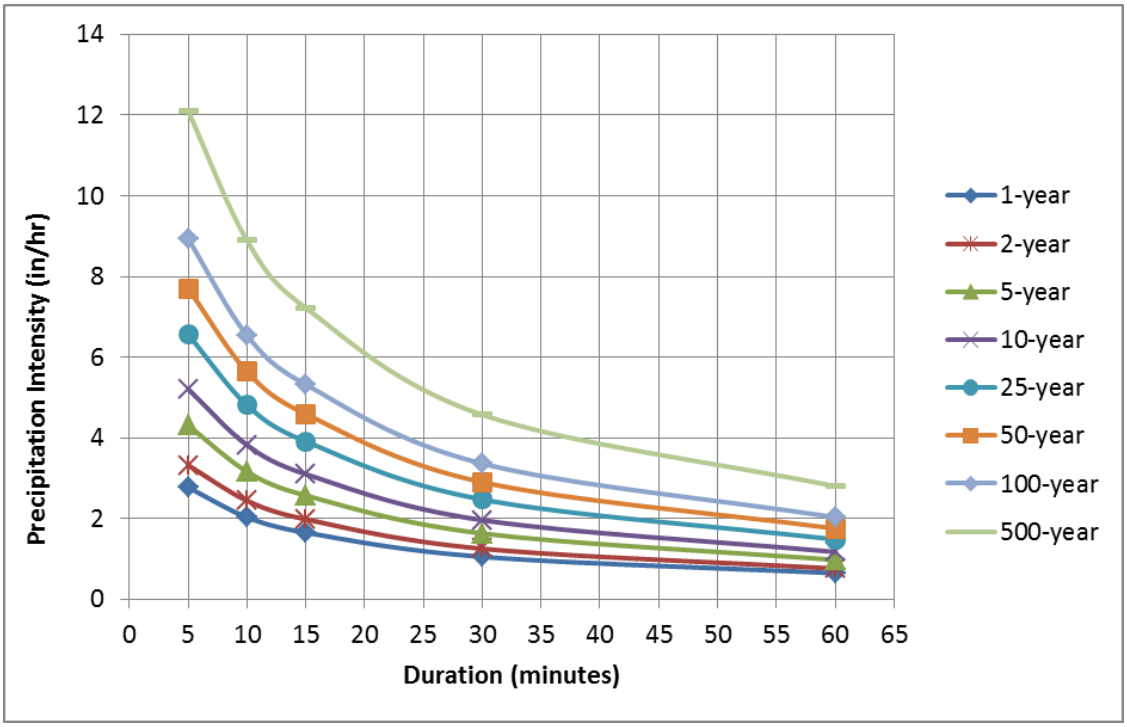


Figure 6-2. Intensity-Duration-Frequency Relationships for Woodland Park, Colorado (from NOAA Atlas 14)

Gravel parking areas, storage areas, and access drives shall be analyzed based on an imperviousness of 80%. This is due to the potential for gravel areas being paved over time by property owners and the resulting adverse impacts on the stormwater management facilities and adjacent properties.

There are some circumstances where the selection of impervious percentage values may require additional investigation due to unique land characteristics (e.g., recent burn areas). When these circumstances arise, it is the designer's responsibility to verify that the correct land use assumptions are made.

When multiple sub-basins are delineated, a composite C value can be calculated:

$$C_c = (C_1A_1 + C_2A_2 + C_3A_3 + \ldots C_iA_i) / A_t \qquad \text{(Eq. 6-3)}$$

Where:

C_c = composite runoff coefficient for total area

C_i = runoff coefficient for subarea corresponding to surface type or land use

A_i = area of surface type corresponding to C_i (units must be the same as those used for total area)

A_t = total area of all subareas for which composite runoff coefficient applies

i = number of surface types in the drainage area.

Table 6-5. Runoff Coefficients for Rational Method (UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

TELLER COUNTY SHERIFF'S OFFICE ADDITION
COMPOSITE RUNOFF COEFFICIENTS

HISTORIC CONDITIONS

5-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A	2.26	0.36	BUILDING / ASPHALT	0.9	0.40	GRAVEL	0.63	1.51	MEADOW	0.15	0.353
OB1	54.30	38.01	COMMERCIAL	0.53	16.29	LANDSCAPED	0.15				0.416
OB2	27.10	18.97	COMMERCIAL	0.53	8.13	LANDSCAPED	0.15				0.416
B	0.47	0.47	MEADOW	0.15							0.150
OB1,OB2,B	81.87										0.414
A,OB1,OB2,B	84.13										0.413

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A	2.26	0.36	BUILDING / ASPHALT	0.96	0.40	GRAVEL	0.74	1.51	MEADOW	0.5	0.615
OB1	54.30	38.01	COMMERCIAL	0.68	16.29	LANDSCAPED	0.5				0.626
OB2	27.10	18.97	COMMERCIAL	0.68	8.13	LANDSCAPED	0.5				0.626
B	0.47	0.47	MEADOW	0.5							0.500
OB1,OB2,B	81.87										0.625
A,OB1,OB2,B	84.13										0.625

TELLER COUNTY SHERIFF'S OFFICE ADDITION
COMPOSITE RUNOFF COEFFICIENTS

DEVELOPED CONDITIONS

5-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A	2.26	1.00	BUILDING / PAVEMENT	0.9	1.26	LANDSCAPED	0.15				0.482
OB1	54.30	38.01	COMMERCIAL	0.53	16.29	LANDSCAPED	0.15				0.416
OB2	27.10	18.97	COMMERCIAL	0.53	8.13	LANDSCAPED	0.15				0.416
B	0.47	0.47	MEADOW	0.15							0.150
OB1,OB2,B	81.87										0.414
A,OB1,OB2,B	84.13										0.416

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A	2.26	1.00	BUILDING / PAVEMENT	0.96	1.26	LANDSCAPED	0.5				0.704
OB1	54.30	38.01	COMMERCIAL	0.68	16.29	LANDSCAPED	0.5				0.626
OB2	27.10	18.97	COMMERCIAL	0.68	8.13	LANDSCAPED	0.5				0.626
B	0.47	0.47	MEADOW	0.5							0.500
OB1,OB2,B	81.87										0.625
A,OB1,OB2,B	84.13										0.627

TELLER COUNTY SHERIFF'S OFFICE ADDITION
RATIONAL METHOD

HISTORIC FLOWS

					Overland Flow			Channel flow									
BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR[7]	C 100-YEAR[7]	LENGTH (FT)	SLOPE (FT/FT)	Tco[1] (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS[2] VELOCITY (FT/S)	Tt[3] (MIN)	TOTAL Tc[4] (MIN)	TOTAL Tc[4] (MIN)	INTENSITY[5] 5-YR (IN/HR)	INTENSITY[5] 100-YR (IN/HR)	PEAK FLOW Q5[6] (CFS)	PEAK FLOW Q100[6] (CFS)
A	A1	2.26	0.353	0.615	100	0.13	5.8	300	10	0.03	1.73	2.9	8.7	8.7	3.36	7.03	2.68	9.77
OB1	OB1	54.30	0.416	0.626	300	0.03	15.0	2300	15	0.033	2.72	14.1	29.1	29.1	1.64	3.44	37.13	116.94
OB2	OB2	27.10	0.416	0.626	300	0.03	15.0	1200	15	0.05	3.35	6.0	21.0	21.0	2.04	4.27	23.03	72.52
Tt OB1-B								130	15	0.038	2.92	0.7						
B	B	0.47	0.150	0.500	190	0.04	14.9					0.0	14.9	14.9	2.53	5.29	0.18	1.24
OB1,OB2,B	B1	81.87	0.414	0.625									29.9	29.9	1.62	3.38	54.76	173.02
A,OB1,OB2,B	1	84.13	0.413	0.625									29.9	29.9	1.62	3.38	56.14	177.79

DEVELOPED FLOWS

					Overland Flow			Channel flow									
BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR[7]	C 100-YEAR[7]	LENGTH (FT)	SLOPE (FT/FT)	Tco[1] (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS[2] VELOCITY (FT/S)	Tt[3] (MIN)	TOTAL Tc[4] (MIN)	TOTAL Tc[4] (MIN)	INTENSITY[5] 5-YR (IN/HR)	INTENSITY[5] 100-YR (IN/HR)	PEAK FLOW Q5[6] (CFS)	PEAK FLOW Q100[6] (CFS)
A	A1	2.26	0.482	0.704	30	0.14	2.6	650	20	0.031	3.52	3.1	5.7	5.7	4.05	8.48	4.41	13.49
OB1	OB1	54.30	0.416	0.626	300	0.03	15.0	2300	15	0.033	2.72	14.1	29.1	29.1	1.64	3.44	37.13	116.94
OB2	OB2	27.10	0.416	0.626	300	0.03	15.0	1200	15	0.05	3.35	6.0	21.0	21.0	2.04	4.27	23.03	72.52
Tt OB1-B								130	15	0.038	2.92	0.7						
B	B	0.47	0.150	0.500	190	0.04	14.9					0.0	14.9	14.9	2.53	5.29	0.18	1.24
OB1,OB2,B	B1	81.87	0.414	0.625									29.9	29.9	1.62	3.38	54.76	173.02
A,OB1,OB2,B	1	84.13	0.416	0.627									29.9	29.9	1.62	3.38	56.55	178.36

1) OVERLAND FLOW Tco = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)
C = 2.5 FOR HEAVY MEADOW
C = 5 FOR TILLAGE/FIELD
C = 7 FOR SHORT PASTURE AND LAWNS
C = 10 FOR NEARLY BARE GROUND
C = 15 FOR GRASSED WATERWAY
C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES
3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F CURVE PER CITY OF WOODLAND PARK DRAINAGE CRITERIA MANUAL
I = (A * P) / B + Td)^C
5-YEAR VALUES: A = 34.36; P1 = 0.97 IN (1-HOUR DEPTH); B = 6.55; C = 0.842
100-YEAR VALUES: A = 34.36; P = 2.03 IN (1-HOUR DEPTH); B = 6.55; C = 0.842
6) Q = CiA
7) WEIGHTED AVERAGE C VALUES FOR COMBINED BASINS

APPENDIX B

HYDRAULIC CALCULATIONS

TELLER COUNTY SHERIFF'S OFFICE ADDITION
STORM INLET SIZING SUMMARY

	BASIN FLOW			INLET FLOW					
INLET	DP	Q5 FLOW (CFS)	Q100 FLOW (CFS)	INLET FLOW % OF BASIN	Q5 FLOW (CFS)	Q100 FLOW (CFS)	INLET CONDITION / TYPE	INLET SIZE	INLET CAPACITY (CFS)
A1	1	4.4	13.5	11.1	0.5	1.5	TYPE R	5.0	6.0
A2	1	4.4	13.5	11.1	0.5	1.5	TYPE R	5.0	6.0
A3	1	4.4	13.5	11.1	0.5	1.5	TYPE R	5.0	6.0
A4	1	4.4	13.5	11.1	0.5	1.5	TYPE R	5.0	6.0
A5	1	4.4	13.5	33.3	1.5	4.5	TYPE R	5.0	6.0
A6	1	4.4	13.5	11.1	0.5	1.5	TYPE R	5.0	6.0
A7	1	4.4	13.5	11.1	0.5	1.5	TYPE R	5.0	6.0

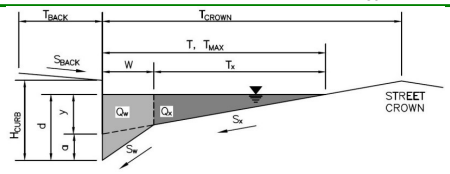
Version 4.05 Released March 2017

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

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

Project: Teller County Sheriff's Office - Inlets A1-A7 (Sump Condition)

Inlet ID: Inlet A1-A7



Gutter Geometry (Enter data in the blue cells)

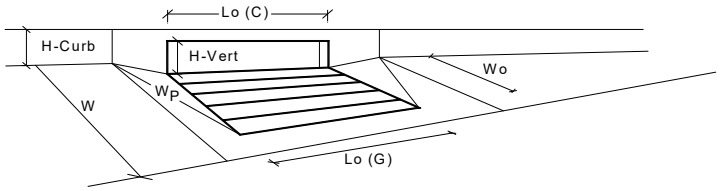
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	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} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	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	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	6.3	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	0.36	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.77	0.81	
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**	**6.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.5	4.5	cfs

TELLER COUNTY SHERIFF'S OFFICE ADDITION
STORM SEWER SIZING SUMMARY

	PIPE FLOW				PIPE CAPACITY		
PIPE	BASINS	Q5 FLOW (CFS)	Q100 FLOW (CFS)		PIPE SIZE	MIN. PIPE SLOPE	FULL PIPE CAPACITY (CFS)
A1	A1	0.5	1.5		12	1.0%	3.6
A2	A1,A2	1.0	3.0		15	1.0%	6.5
A3	A1-A3	1.5	4.5		15	1.0%	6.5
A4	A1-A4	2.0	6.0		15	1.0%	6.5
A5	A1-A5	3.4	10.5		15	2.7%	10.6
A6	A1-A6	3.9	12.0		15	3.5%	12.1
A7	A7	0.5	1.5		12	1.0%	3.6

ASSUMPTIONS:
1. STORM DRAIN PIPE ASSUMED TO BE RCP OR HDPE

Hydraulic Analysis Report

Project Data

Project Title: Project - TCSO

Designer: JPS

Project Date: Thursday, August 8, 2019

Project Units: U.S. Customary Units

Notes:

Channel Analysis: SD-A1

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.0000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0130

Depth: 1.0000 ft

Result Parameters

Flow: 3.5628 cfs

Area of Flow: 0.7854 ft^2

Wetted Perimeter: 3.1416 ft

Hydraulic Radius: 0.2500 ft

Average Velocity: 4.5363 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 0.8057 ft

Critical Velocity: 5.2542 ft/s

Critical Slope: 0.0103 ft/ft

Critical Top Width: 0.79 ft

Calculated Max Shear Stress: 0.6240 lb/ft^2

Calculated Avg Shear Stress: 0.1560 lb/ft^2

Channel Analysis: SD-A2-A4

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.2500 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0130

Depth: 1.2500 ft

Result Parameters

Flow: 6.4598 cfs

Area of Flow: 1.2272 ft^2

Wetted Perimeter: 3.9270 ft

Hydraulic Radius: 0.3125 ft

Average Velocity: 5.2639 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.0242 ft

Critical Velocity: 6.0025 ft/s

Critical Slope: 0.0100 ft/ft

Critical Top Width: 0.96 ft

Calculated Max Shear Stress: 0.7800 lb/ft^2

Calculated Avg Shear Stress: 0.1950 lb/ft^2

Channel Analysis: SD-A5

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.2500 ft

Longitudinal Slope: 0.0270 ft/ft

Manning's n: 0.0130

Depth: 1.2500 ft

Result Parameters

Flow: 10.6145 cfs

Area of Flow: 1.2272 ft^2

Wetted Perimeter: 3.9270 ft

Hydraulic Radius: 0.3125 ft

Average Velocity: 8.6495 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.1966 ft

Critical Velocity: 8.7794 ft/s

Critical Slope: 0.0235 ft/ft

Critical Top Width: 0.51 ft

Calculated Max Shear Stress: 2.1060 lb/ft^2

Calculated Avg Shear Stress: 0.5265 lb/ft^2

Channel Analysis: SD-A6

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.2500 ft

Longitudinal Slope: 0.0350 ft/ft

Manning's n: 0.0130

Depth: 1.2500 ft

Result Parameters

Flow: 12.0852 cfs

Area of Flow: 1.2272 ft^2

Wetted Perimeter: 3.9270 ft

Hydraulic Radius: 0.3125 ft

Average Velocity: 9.8479 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.2173 ft

Critical Velocity: 9.9184 ft/s

Critical Slope: 0.0310 ft/ft

Critical Top Width: 0.40 ft

Calculated Max Shear Stress: 2.7300 lb/ft^2

Calculated Avg Shear Stress: 0.6825 lb/ft^2

Channel Analysis: SD-A7

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.0000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0130

Depth: 1.0000 ft

Result Parameters

Flow: 3.5628 cfs

Area of Flow: 0.7854 ft^2

Wetted Perimeter: 3.1416 ft

Hydraulic Radius: 0.2500 ft

Average Velocity: 4.5363 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 0.8057 ft

Critical Velocity: 5.2542 ft/s

Critical Slope: 0.0103 ft/ft

Critical Top Width: 0.79 ft

Calculated Max Shear Stress: 0.6240 lb/ft^2

Calculated Avg Shear Stress: 0.1560 lb/ft^2

APPENDIX C

DETENTION POND CALCULATIONS

TELLER COUNTY SHERIFF'S OFFICE ADDITION - IMPERVIOUS AREAS

IMPERVIOUS AREAS - EXISTING CONDITIONS

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A	2.26	0.36	BUILDING / ASPHALT	100	0.40	GRAVEL	80	1.51	MEADOW	0	29.912

IMPERVIOUS AREAS - PROPOSED CONDITIONS

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A	2.26	1.00	BUILDING / PAVEMENT	100	1.26	LANDSCAPED	0				44.248

IMPERVIOUS AREAS - NET INCREASE

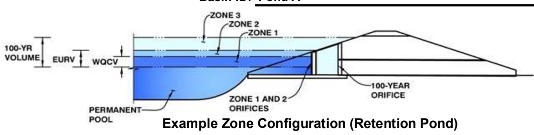
BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A	2.26										14.336

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Teller County Sheriff's Office Addition

Basin ID: Pond A



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**	
Watershed Area =	2.26	acres
Watershed Length =	680	ft
Watershed Slope =	0.036	ft/ft
Watershed Imperviousness =	14.30%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

			Optional User Override 1-hr Precipitation	
Water Quality Capture Volume (WQCV) =	0.017	acre-feet		
Excess Urban Runoff Volume (EURV) =	0.026	acre-feet		
2-yr Runoff Volume (P1 = 0.76 in.) =	0.011	acre-feet	0.76	inches
5-yr Runoff Volume (P1 = 0.97 in.) =	0.015	acre-feet	0.97	inches
10-yr Runoff Volume (P1 = 1.17 in.) =	0.020	acre-feet	1.17	inches
25-yr Runoff Volume (P1 = 1.48 in.) =	0.032	acre-feet	1.48	inches
50-yr Runoff Volume (P1 = 1.75 in.) =	0.055	acre-feet	1.75	inches
100-yr Runoff Volume (P1 = 2.03 in.) =	0.096	acre-feet	2.03	inches
500-yr Runoff Volume (P1 = 2.8 in.) =	0.210	acre-feet	2.80	inches
Approximate 2-yr Detention Volume =	0.010	acre-feet		
Approximate 5-yr Detention Volume =	0.014	acre-feet		
Approximate 10-yr Detention Volume =	0.019	acre-feet		
Approximate 25-yr Detention Volume =	0.028	acre-feet		
Approximate 50-yr Detention Volume =	0.037	acre-feet		
Approximate 100-yr Detention Volume =	0.055	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.017	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.009	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.029	acre-feet
Total Detention Basin Volume =	0.055	acre-feet

Depth Increment = 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	--	--	--	10	0.000		
Bot EL=9114.5	--	1.00	--	--	--	578	0.013	288	0.007
	--	2.00	--	--	--	767	0.018	959	0.022
	--	3.00	--	--	--	984	0.023	1,842	0.042
	--	4.00	--	--	--	1,210	0.028	2,939	0.067
Top EL=9118.5	--	5.00	--	--	--	1,333	0.031	4,210	0.097
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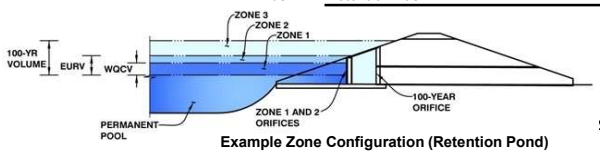
Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Teller County Sheriff's Office

Basin ID: Detention Basin A



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.69	0.017	Orifice Plate
Zone 2 (EURV)	2.23	0.009	Orifice Plate
Zone 3 (100-year)	3.54	0.029	Weir&Pipe (Restrict)
		0.055	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 =	2.23	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	0.12	sq. inches (diameter = 3/8 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	8.333E-04	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	0.74	1.48					
Orifice Area (sq. inches)	0.12	0.12	0.12					

	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 =	2.70	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	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 =	2.70	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	201.53	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	6.30	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.15	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	12.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	1.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.03	N/A	ft^2
Outlet Orifice Centroid =	0.05	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.59	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.70	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	4.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

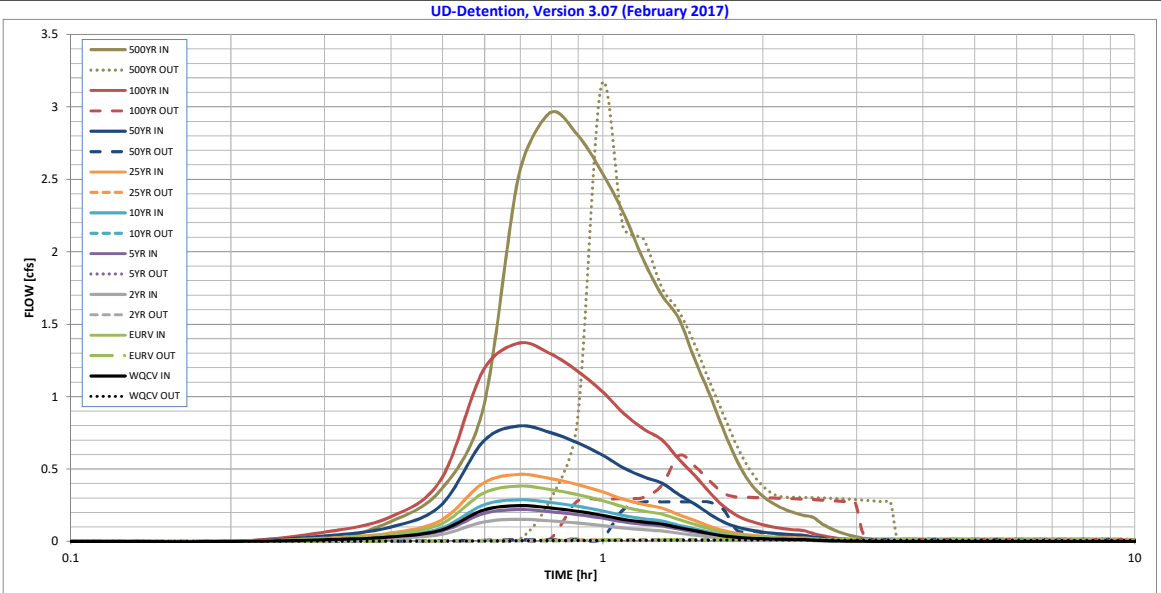
Spillway Design Flow Depth=	0.21	feet
Stage at Top of Freeboard =	4.91	feet
Basin Area at Top of Freeboard =	0.03	acres

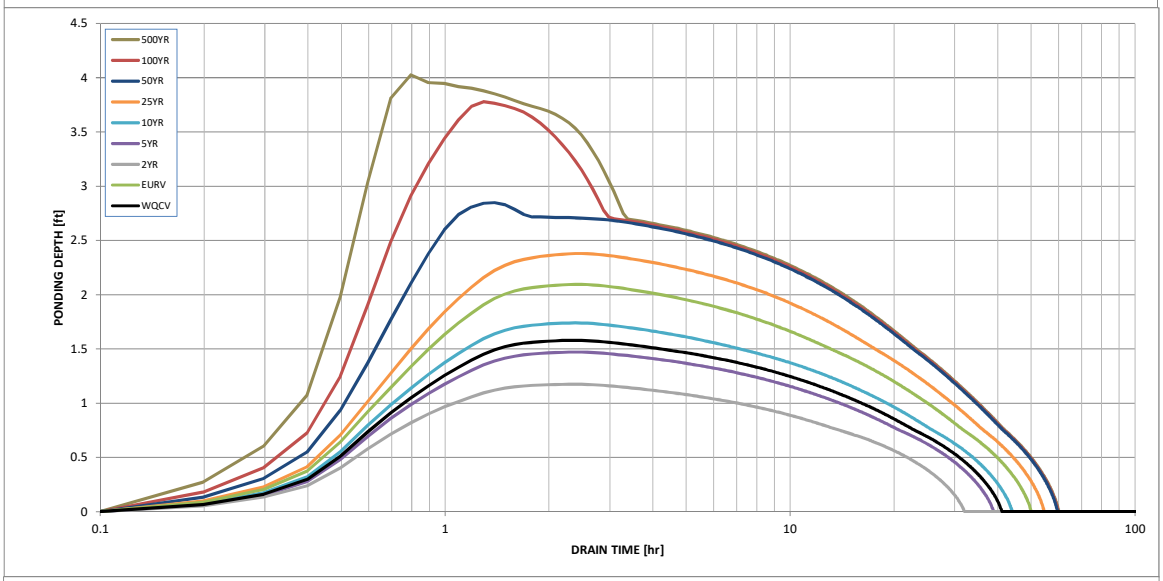
Routed Hydrograph Results

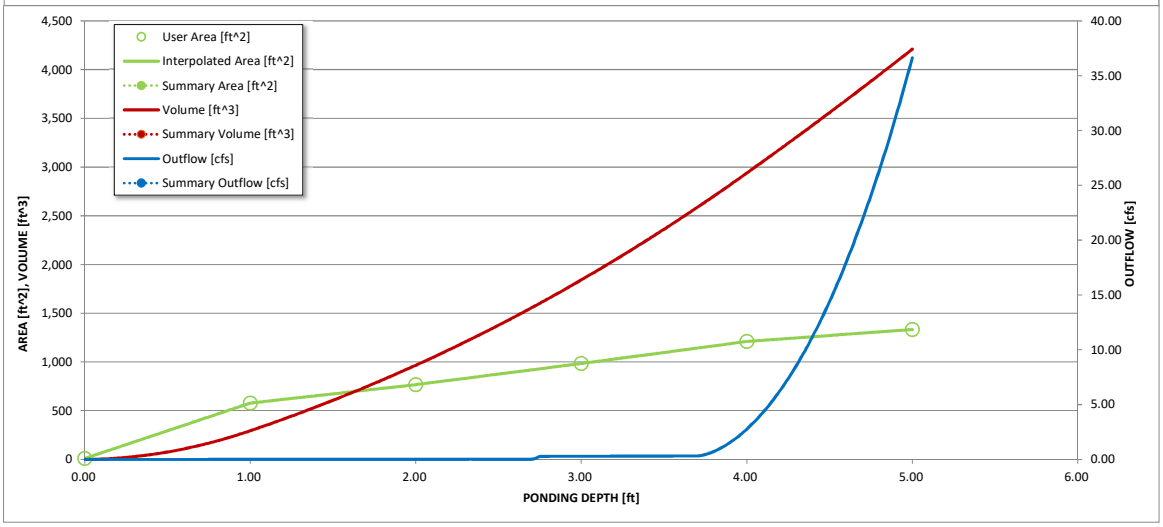
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	0.76	0.97	1.17	1.48	1.75	2.03	2.80
Calculated Runoff Volume (acre-ft) =	0.017	0.026	0.011	0.015	0.020	0.032	0.055	0.096	0.210
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.017	0.026	0.010	0.015	0.020	0.032	0.055	0.096	0.209
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.00	0.01	0.02	0.12	0.30	0.77
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	1.7
Peak Inflow Q (cfs) =	0.2	0.4	0.2	0.2	0.3	0.5	0.8	1.4	3.0
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.6	3.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.4	0.8	0.4	1.0	0.9	1.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Outlet Plate 1	Spillway	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0
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) =	37	44	29	35	40	48	50	45	36
Time to Drain 99% of Inflow Volume (hours) =	39	48	31	37	42	52	55	53	49
Maximum Ponding Depth (ft) =	1.58	2.10	1.17	1.47	1.74	2.38	2.85	3.78	4.03
Area at Maximum Ponding Depth (acres) =	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.03	0.03
Maximum Volume Stored (acre-ft) =	0.015	0.024	0.009	0.013	0.018	0.029	0.039	0.061	0.068

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]
5.96 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrograph Constant	0:11:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:17:53	0.01	0.02	0.01	0.01	0.01	0.02	0.04	0.06	0.13
0.839	0:23:50	0.03	0.05	0.02	0.03	0.04	0.06	0.10	0.17	0.36
	0:29:48	0.08	0.12	0.05	0.07	0.09	0.15	0.25	0.43	0.92
	0:35:46	0.22	0.33	0.13	0.19	0.25	0.40	0.69	1.18	2.53
	0:41:43	0.25	0.38	0.15	0.22	0.29	0.46	0.80	1.37	2.96
	0:47:41	0.23	0.36	0.14	0.21	0.27	0.44	0.75	1.30	2.81
	0:53:38	0.21	0.32	0.13	0.19	0.24	0.39	0.68	1.18	2.56
	0:59:36	0.18	0.28	0.11	0.16	0.21	0.35	0.60	1.04	2.27
	1:05:34	0.15	0.24	0.09	0.14	0.18	0.29	0.51	0.89	1.95
	1:11:31	0.13	0.21	0.08	0.12	0.16	0.26	0.45	0.78	1.70
	1:17:29	0.12	0.19	0.07	0.11	0.14	0.23	0.40	0.70	1.54
	1:23:26	0.10	0.15	0.06	0.08	0.11	0.18	0.32	0.57	1.25
	1:29:24	0.07	0.12	0.04	0.07	0.09	0.15	0.26	0.45	1.01
	1:35:22	0.05	0.09	0.03	0.05	0.06	0.11	0.19	0.34	0.77
	1:41:19	0.04	0.06	0.02	0.03	0.05	0.07	0.13	0.24	0.56
	1:47:17	0.03	0.05	0.02	0.03	0.03	0.06	0.10	0.18	0.41
	1:53:14	0.02	0.04	0.01	0.02	0.03	0.05	0.08	0.14	0.32
	1:59:12	0.02	0.03	0.01	0.02	0.02	0.04	0.07	0.12	0.27
	2:05:10	0.02	0.03	0.01	0.01	0.02	0.03	0.06	0.10	0.23
	2:11:07	0.01	0.02	0.01	0.01	0.02	0.03	0.05	0.09	0.20
	2:17:05	0.01	0.02	0.01	0.01	0.02	0.03	0.05	0.08	0.18
	2:23:02	0.01	0.02	0.01	0.01	0.02	0.02	0.04	0.08	0.17
	2:29:00	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.06	0.12
	2:34:58	0.01	0.01	0.00	0.01	0.01	0.01	0.02	0.04	0.09
	2:40:55	0.00	0.01	0.00	0.00	0.01	0.01	0.02	0.03	0.07
	2:46:53	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.02	0.05
	2:52:50	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03
	2:58:48	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02
	3:04:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
	3:10:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	3:16:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	3:22:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:28:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:34:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:46:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:52:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:58:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:04:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:16:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:22:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:28:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:34:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:46:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:52:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:58:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:03:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:09:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:21:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:27:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:33:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:39:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:51:38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:57:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:03:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:09:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:15:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:21:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:27:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:33:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:39:19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:45:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:51:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:57:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:03:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7:09:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX D

FIGURES

National Flood Hazard Layer FIRMette

FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/8/2019 at 11:51:41 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

TELLER COUNTY SHERIFF'S OFFICE ADDITION

MAJOR BASIN / HISTORIC DRAINAGE PLAN

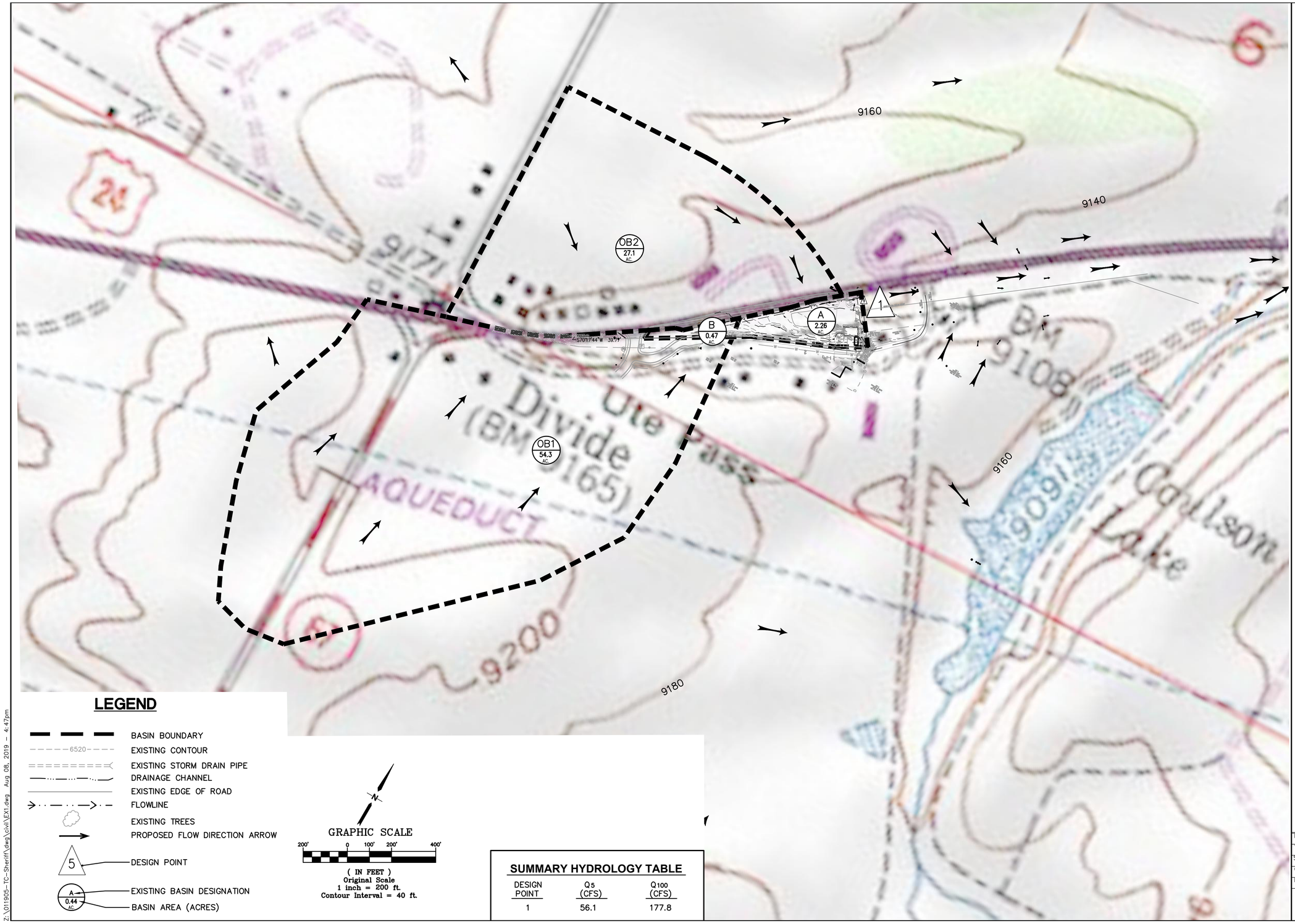
JPS ENGINEERING

19 E. Willamette Ave.
Colorado Springs, CO
80903

PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

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.

No.	REVISION	BY	DATE



LEGEND

- BASIN BOUNDARY
- 6520 — EXISTING CONTOUR
- EXISTING STORM DRAIN PIPE
- DRAINAGE CHANNEL
- EXISTING EDGE OF ROAD
- FLOWLINE
- EXISTING TREES
- PROPOSED FLOW DIRECTION ARROW
- 5 — DESIGN POINT
- A / 0.44 AC — EXISTING BASIN DESIGNATION
- BASIN AREA (ACRES)

GRAPHIC SCALE

200' 0 100' 200' 400'

(IN FEET)
Original Scale
1 inch = 200 ft.
Contour Interval = 40 ft.

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
1	56.1	177.8

HORZ. SCALE:	1"=200'
VERT. SCALE:	N/A
SURVEYED:	RAMPART
CREATED:	5/31/19
PROJECT NO:	011905
DRAWN:	BJJ
DESIGNED:	JPS
CHECKED:	JPS
LAST MODIFIED:	8/08/19
MODIFIED BY:	BJJ

SHEET: EX1

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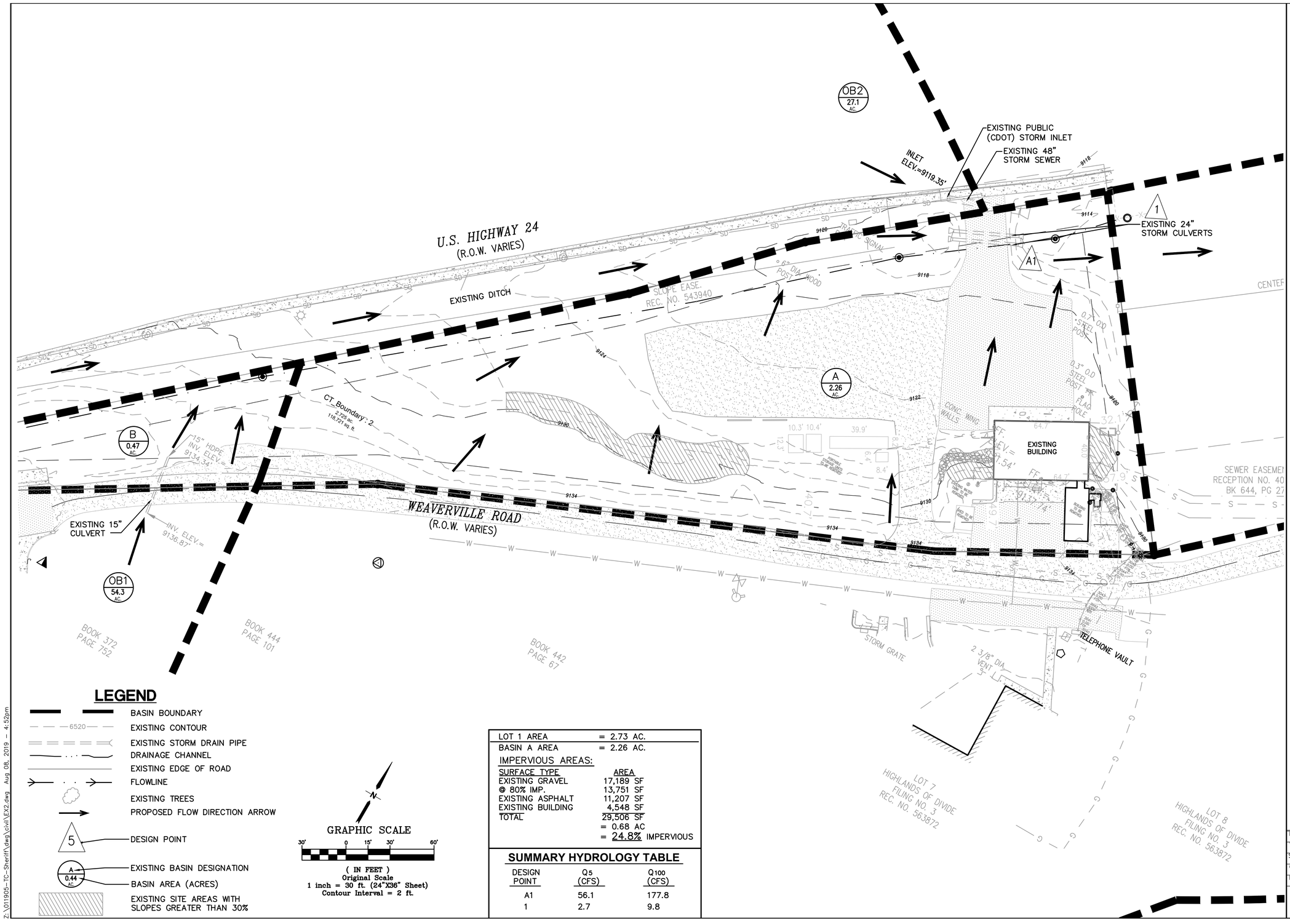

LEGEND

- BASIN BOUNDARY
- 6520 — EXISTING CONTOUR
- EXISTING STORM DRAIN PIPE
- DRAINAGE CHANNEL
- EXISTING EDGE OF ROAD
- FLOWLINE
- EXISTING TREES
- PROPOSED FLOW DIRECTION ARROW
- 5 — DESIGN POINT
- A / 0.44 AC. — EXISTING BASIN DESIGNATION / BASIN AREA (ACRES)
- EXISTING SITE AREAS WITH SLOPES GREATER THAN 30%

GRAPHIC SCALE

30' 0 15' 30' 60'

(IN FEET)
Original Scale
1 inch = 30 ft. (24"X36" Sheet)
Contour Interval = 2 ft.

LOT 1 AREA	= 2.73 AC.
BASIN A AREA	= 2.26 AC.

IMPERVIOUS AREAS:

SURFACE TYPE	AREA
EXISTING GRAVEL @ 80% IMP.	17,189 SF
EXISTING ASPHALT	13,751 SF
EXISTING BUILDING	11,207 SF
TOTAL	4,548 SF
	29,506 SF
	= 0.68 AC
	= 24.8% IMPERVIOUS

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
A1	56.1	177.8
1	2.7	9.8

TELLER COUNTY SHERIFF'S OFFICE ADDITION

HISTORIC DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO
80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

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.

No.	REVISION	BY	DATE

HORZ. SCALE: 1"=30'	DRAWN: BJJ
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: RAMPART	CHECKED: JPS
CREATED: 8/08/19	LAST MODIFIED: 8/08/19
PROJECT NO: 011905	MODIFIED BY: BJJ

SHEET: EX2

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DRAINAGE LEGEND

- 6520 — EXISTING CONTOUR
- FLOW DIRECTION ARROW
- FLOWLINE
- DRAINAGE BASIN BOUNDARY
- PROPOSED TRAILS
- 5 — DESIGN POINT
- C14 / 23.21 AC. — DEVELOPED BASIN DESIGNATION / DEVELOPED BASIN AREA (ACRES)

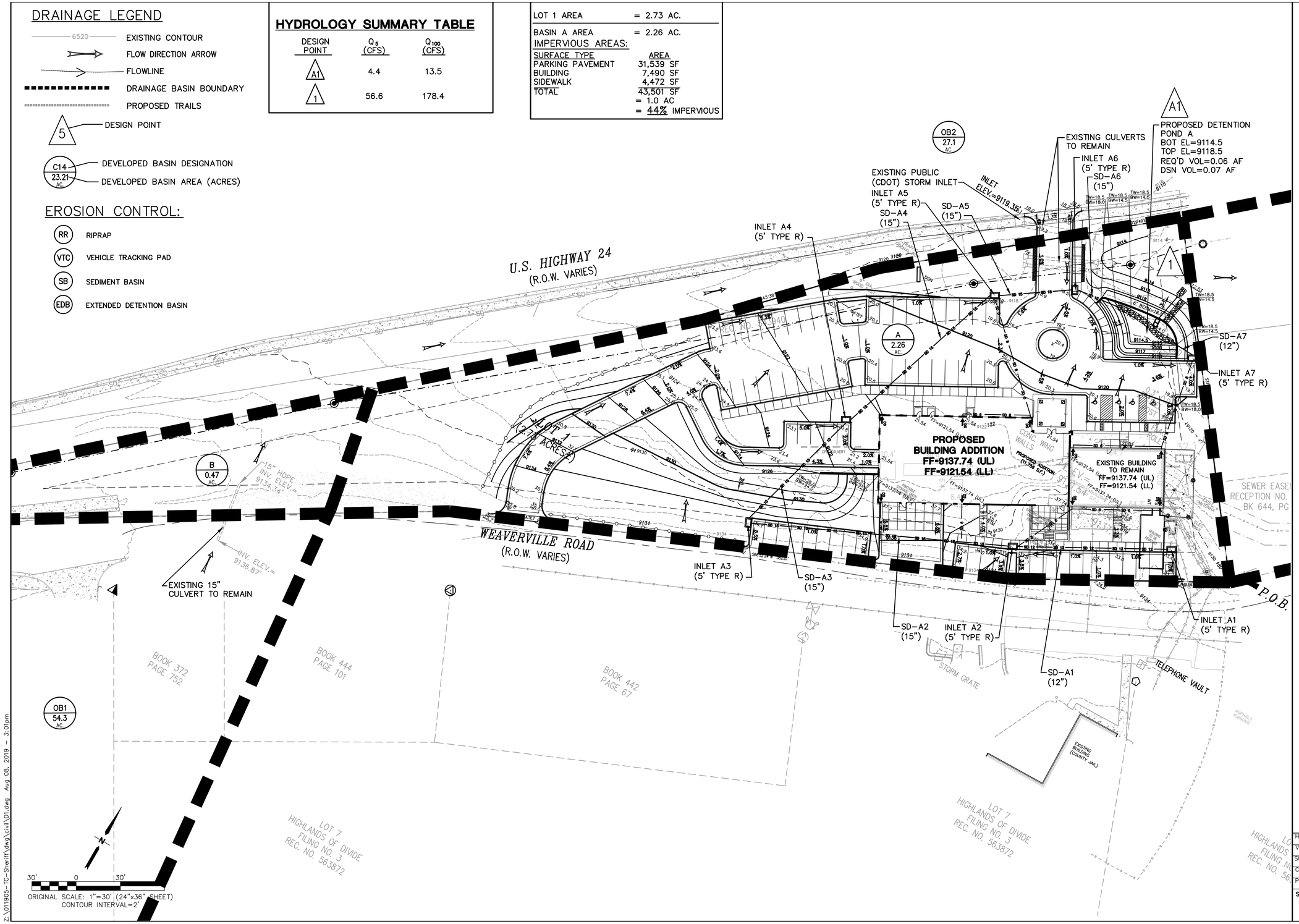
EROSION CONTROL:

- RR — RIPRAP
- VTC — VEHICLE TRACKING PAD
- SB — SEDIMENT BASIN
- EDB — EXTENDED DETENTION BASIN

HYDROLOGY SUMMARY TABLE

DESIGN POINT	Q_5 (CFS)	Q_{100} (CFS)
A1	4.4	13.5
1	56.6	178.4

LOT 1 AREA	= 2.73 AC.
BASIN A AREA	= 2.26 AC.
IMPERVIOUS AREAS:	
SURFACE TYPE	AREA
PARKING PAVEMENT	31,539 SF
BUILDING	7,490 SF
SIDEWALK	4,472 SF
TOTAL	43,501 SF
	= 1.0 AC
	= 44% IMPERVIOUS



Z:\011905-TC-Sheriff\dwg\civil\D1.dwg Aug 08, 2019 - 3:01pm

TELLER COUNTY SHERIFF'S OFFICE ADDITION

DEVELOPED DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO
80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

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.

NO.	REVISION	BY	DATE

HORZ. SCALE:	1"=30'	DRAWN:	BJJ
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	RAMPART	CHECKED:	JPS
CREATED:	5/31/19	LAST MODIFIED:	8/08/19
PROJECT NO:	011905	MODIFIED BY:	BJJ

SHEET: D1