FINAL DRAINAGE REPORT
FOR
TAMLIN ROAD RV & BOAT STORAGE

Prepared For:
C&M Properties, LLC
12748 Barossa Valley Road
Colorado Springs, CO 80921

January 17, 2020
Project No. 2513400

Prepared By:
JR Engineering, LLC
5475 Tech Center Drive, Suite 235
Colorado Springs, CO 80919
719-593-2593

PCD FILE NO.: PPR1945

FINAL DRAINAGE REPORT FOR
TAMLIN ROAD RV & BOAT STORAGE

ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

_____ _____

Mike Bramlett, Colorado P.E. # 32314 Date
For and On Behalf of JR Engineering, LLC

DEVELOPER'S STATEMENT:

I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: C&M Properties, LLC

By: Edward McDonald

Title: Manager
Address: 12748 Barossa Valley Road
Colorado Springs, CO 80921

EL PASO COUNTY

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual, Volumes 1 and 2 and Engineering Criteria Manual, as amended.

_____ _____

Jennifer Irvine, P.E. Date
County Engineer/ ECM Administrator

Conditions:

Table of Contents

APPENDIX

PURPOSE

This document is the Final Drainage report for Tamlin Road Storage Yard. The purpose of this report is to:

1. Identify on-site and off-site drainage patterns.
2. Recommend storm water facilities to collect and convey storm runoff from the proposed development to appropriate discharge and/or detention locations.
3. Recommend water quality and detention facilities to control discharge release rates to below historic.
4. Demonstrate compliance with surrounding major drainage basin planning studies, master development drainage plans and flood insurance studies.

GENERAL SITE DESCRIPTION

LOCATION

Tamlin Road Storage Yard, known as 'the site' from herein, is currently vacant land located in a portion of Section 20, Township 13 South, Range 65 West of the Sixth Principal Meridian in unincorporated El Paso County, Colorado. The site is located northeast of the Tamlin Road and Marksheffel Road intersection. The site is bound by Tamlin Road to the west and north, vacant land owned by Norwood to the east and south. Stetson Hills Filing No. 3 and 4 is located adjacent to the site on the west side of Marksheffel Road. A vicinity map has been presented in Appendix A.

Sand Creek East Fork tributary is located approximately ¼ mile east of the site. The ultimate outfall of this drainageway is Fountain Creek. However, there are no existing stormwater facilities located on site.

DESCRIPTION OF PROPERTY

The site is approximately 16.5 acres and is covered with sparse trees and native vegetation. There are no existing structures on the site. An existing dirt road proceeds southeast from Tamlin Road through the site to service an existing water tank, located south of the site. There is a ridge that divides the drainage on the site. Roughly 6.5 acres drains southwest with slopes between 3-10% while the remaining 10 acres drains easterly with slopes up to 8%. In the developed condition, the site will be asphalt drive aisles, parking stalls and a single trash enclosure.

The site is comprised solely of Truckton sandy loam, which is classified as a Type A soil by the NRCS. Group A soils exhibit a high infiltration rate when thoroughly wet and consist chiefly of deep, well drained to excessively drained gravelly sands. These soils have a high rate of water transmission. A NRCS soil survey map is presented in Appendix A.

There are no known irrigation facilities located on the project site. An existing water line (size unknown) runs north-south through the site in a 30' utility easement. Additionally, three gas mains (size unknown) cross the site. Two of the existing gas lines are parallel to the water main within two separate 50' easements. The third gas line runs parallel to Tamlin in a dedicated 50' easement. All existing utilities will remain and no grading will occur within the limits of the easements.

EXISTING DRAINAGE CONDITIONS

MAJOR BASIN DESCRIPTIONS

The site lies within the West Tributary Sand Creek regional sub basin within the Sand Creek Major Drainage Basin. The "*Sand Creek Drainage Basin Planning Study*" prepared by Kiowa Engineering revised in March 1996, evaluated the Sand Creek Major Drainage Basin, the existing facilities therein and provided recommendations for future development. A map of the Sand Creek regional sub basins is presented in Appendix B.

The Sand Creek Basin covers approximately 54 square miles in unincorporated El Paso County and Colorado Springs, CO. The undeveloped portions of the basin are typified by rolling range land with fair vegetative cover associated with semi-arid climates. The headwaters of the basin are in The Black Forest and general topography trends south to southwesterly towards its ultimate outfall into Fountain Creek. Per the *Sand Creek DBPS,* the Sand Creek East Fork Subtributary runs outside the western boundary of the site. This drainageway begins at the confluence with the mainstem of East Fork Sand Creek and runs north to Barnes Road.

Based on the FEMA FIRM Map number 08041C0543G and 08041C0545G, the site does not fall within a FEMA defined floodplain and is classified as Zone X, which are areas determined to be outside the 0.2% annual chance floodplain. FIRM maps of the site and surrounding areas have been presented in Appendix A.

EXISTING SUB-BASIN DRAINAGE

Existing drainage patterns are split on the site by a ridge running north-south. The eastern portion of the site drains across undeveloped land to Sand Creek East Fork Subtributary. The western portion of the site drains across Tamlin Road and Marksheffel road into Eastview Estates Filing No. 3 storm sewer. An existing drainage analysis and map are presented in Appendix C and F, respectively.

PROPOSED DRAINAGE CONDITIONS

PROPOSED SUB-BASIN DRAINAGE

In general, runoff generated from the site will be collected and conveyed to a full spectrum water quality and detention pond, Pond A. It should be noted that all proposed parking and drive aisles will be constructed of gravel. However, there is a possibility of the owner paving the drive aisles and parking stalls with asphalt in the future. Therefore, all calculations (hydrologic and hydraulic) have been performed per the future asphalt condition. The proposed basin delineation is as follows:

Basin A1 consists of approximately 0.38 acres of existing Tamlin Road pavement and undeveloped areas paralleling Tamlin Road. Runoff from these areas will sheet flow easterly to Design Point (DP) #1. From here, Basin A1 flows (Q_5 = 0.7 cfs and Q_{100} = 1.8 cfs) to DP#2 prior to being captured and detained in Full Spectrum Detention and Water Quality Pond A.

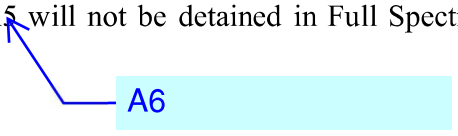
Basin A2 consists of approximately 4.42 acres of gravel drives, gravel parking stalls and landscaped areas. Runoff from this basin (Q_5 = 13.3 cfs and Q_{100} = 26.5 cfs) sheet flows southeasterly to DP #2 before being captured and detained in Full Spectrum Detention and Water Quality Pond A.

Basin A3 consists of approximately 4.72 acres of gravel drives, gravel parking stalls and landscaped areas. Runoff from this basin (Q_5 = 16.0 cfs and Q_{100} = 30.0 cfs) sheet flows northeasterly to DP #2 before being captured in Full Spectrum Detention and Water Quality Pond A.

Basin A4 consists of approximately 0.70 acres and consists of Full Spectrum Detention and Water Quality Pond A. Runoff from this basin (Q_5 = 0.3 cfs and Q_{100} = 1.9 cfs) will be captured within the pond. Full Spectrum Detention and Water Quality Pond A will release at less than historic rates and is detailed later in this report.

Basin A5 consists of approximately 1.14 acres of undeveloped land. Runoff from this basin (Q_5 = 0.6 cfs and Q_{100} = 3.1 cfs) will follow historic patterns and sheet flow southeasterly offsite. Per Section I.7.1.B.7 of the ECM – Stormwater Quality Policy and Procedures, the County may exclude sites with land disturbance to undeveloped land that will remain undeveloped from the WQCV standard. Therefore, Basin A5 will not be detained in Full Spectrum Detention and Water Quality Pond A.

Basin A6 consists of approximately 0.26 acres of landscape area and undeveloped land. Runoff from this basin (Q_5 = 0.1 cfs and Q_{100} = 0.8 cfs) will follow historic patterns and sheet flow easterly offsite. Per Section I.7.1.B.7 of the ECM – Stormwater Quality Policy and Procedures, the County may exclude sites with land disturbance to undeveloped land that will remain undeveloped from the WQCV standard. Therefore, Basin A5 will not be detained in Full Spectrum Detention and Water Quality Pond A.



Basin A7 consists of approximately 0.39 acres of landscape area and undeveloped land. Runoff from this basin (Q_5 = 0.2 cfs and Q_{100} = 1.2 cfs) will follow historic patterns and sheet flow easterly offsite. Per Section I.7.1.B.7 of the ECM – Stormwater Quality Policy and Procedures, the County may exclude sites with land disturbance to undeveloped land that will remain undeveloped from the WQCV standard. Therefore, Basin A5 will not be detained in Full Spectrum Detention and Water Quality Pond A.

A7

Basin A8 consists of approximately 0.40 acres of landscape area and undeveloped land. Runoff from this basin (Q_5 = 0.2 cfs and Q_{100} = 1.2 cfs) will follow historic patterns and sheet flow easterly offsite. Per Section I.7.1.B.7 of the ECM – Stormwater Quality Policy and Procedures, the County may exclude sites with land disturbance to undeveloped land that will remain undeveloped from the WQCV standard. Therefore, Basin A5 will not be detained in Full Spectrum Detention and Water Quality Pond A.

A8

Please provide discussion regarding off-site flow entering the site. If there is no off-site flow besides basin A1 due to the proposed grading please state it.

DEVELOPMENT CRITERIA REFERENCE

Storm Drainage Analysis and Design Criteria for this project were implemented from the El Paso County "Drainage Criteria Manual" (DCM) and the "Urban Storm Drainage Criteria Manual" by Urban Drainage and Flood Control District (USDCM).

Please also provide discussion/statement regarding the west side of the parcel and that it will not be developed and continue to follow historic patterns.

HYDROLOGIC CRITERIA

All hydrologic data was obtained from the "El Paso County Drainage Criteria Manual" Volumes 1 and 2, and the "Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual" Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5 year (minor) storm event and the 100-year (major) storm event. Runoff was calculated using the Rational Method, and rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Table 6-2 of the Colorado Springs Criteria. One hour point rainfall data for the storm events is identified in the chart below. Runoff coefficients were determined based on proposed land use and from data in Table 6-6 from the DCM. Time of concentrations were developed using equations from DCM. Water quality and detention pond will be sized per the full spectrum method presented in Chapter 13 of the DCM. All runoff calculations and applicable charts and graphs are included in Appendix A.

Table 1 - 1-hr Point Rainfall Data

Storm	Rainfall (in.)
5-year	1.50
100-year	2.52

Rock mulch islands are dispersed throughout the parking areas. Table 6-6 from the El Paso County DCM does not provide a composite percent impervious for rock mulch. The impervious value for

gravel, of 80%, does not apply for rock mulch since the gravel impervious value is based upon compacted gravel used for roads. The rock mulch utilized on site will not be compacted and will have undisturbed soil underneath allowing percolation. Table 6-3 from Volume 1 of Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual proposes an impervious value of 40% for packed gravel. JR Engineering is proposing to use a value of 20% for rock mulch areas due to the void space and undisturbed area that increase perviousness.

HYDRAULIC CRITERIA

The Rational Method and USDCM's SF-2 and SF-3 forms were used to determine the runoff from the minor and major storms on the site, and the UDFCD UD-Detention v3.07 spreadsheet was utilized for sizing the water quality and detention ponds as well as outlet structure. Manning's equation was used to size the proposed drainage swales in this report.

DRAINAGE FACILITY DESIGN

FOUR STEP PROCESS TO MINIMIZE ADVERSE IMPACTS OF URBANIZATION

In accordance with the Colorado Springs Drainage Criteria Manual, Volume 2 this site has implemented the four step process to minimize adverse impacts of urbanization. The four step process includes reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

a single pond is now proposed. Please revise.

Step 1 – Reducing Runoff: The Tamlin Road Storage Yard consists of gravel drive aisles and parking spaces with lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. The IRF worksheet can be found in Appendix C.

Step 2 – Treating the Water Quality Capture Volume: Water Quality treatment for this site is provided in two onsite full spectrum water quality and detention ponds. Runoff from the site will be collected in vegetated swales and conveyed to the detention ponds.

The majority of the runoff is conveyed via sheet flow over the gravel/asphalt parking area.

Step 3 – Stabilizing Drainageways: No drainage fees are due with this site development plan and final drainage report. If the site were to be platted in the future, drainage fees will be paid at that time in order to help fund major drainage improvements per the "*Sand Creek Drainage Basin Planning Study*". These improvements help stabilize the drainage way.

Step 4 – Implementing Long Term Source Controls: BMP's will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. Site specific temporary source control BMPs that will be implemented include, but are not limited to, silt fencing placed around downstream areas of disturbance, construction vehicle tracking pads at the entrances, designated

It does not appear that there are any major drainageways on the site that need to be stabilized. I recommend stating that as well.

I dont believe any inlets are identified on the drainage plan.

vehicle fueling areas, covered storage areas, spill containment and control, etc. The permanent erosion control BMP's include asphalt drives and parking, storm inlets and storm pipe.

gravel

WATER QUALITY

basin B and its pond have been removed. Please update the narrative accordingly.

Developed area within Basin A will be conveyed to Full Spectrum Water Quality and Detention Pond A, located along the site's eastern boundary. Developed area within Basin B will be conveyed to Full Spectrum Water Quality and Detention Pond B, located in the site's southwest corner along Tamlin Road. It should be noted that all proposed parking and drive aisles will be constructed of gravel. However, there is a possibility of the owner paving the drive aisles and parking stalls with asphalt in the future. Therefore, all water quality and detention calculations are per the asphalt condition.

The UD detention calculation indicates10.22 acres tributary area. Please Revise accordingly.

Pond A has a total of 8.6 tributary acres for total detention basin volume of 1.288 ac-ft. Pond A utilizes a full spectrum outlet structure to detain the WQCV for a 40-hr period, the EURV for a 72-hour period and the 100-yr volume for 72-hr period. The outlet structure will release at less than historic rates. Pond A will discharge into a proposed energy dissipater located along the eastern property line. From here, discharge will maintain the sub-basins existing drainage patterns and discharge into a swale that conveys the flow across the vacant land to the east and eventually to Sand Creek East Fork. The pond is discharging at less than historic rates, therefore; downstream infrastructure has adequate capacity for the site's stormwater release.

The drainage plan shows an existing riprap pad on the adjacent property downstream of your discharge. Is this sufficient? Although rates are at or below historic the downstream swale may not be adequate. Please see comment on the drainage plan

EROSION CONTROL PLAN

The El Paso County Drainage Criteria Manual specifies an Erosion Control Plan and associated cost estimate to be submitted with the Final Drainage Report. We respectfully request that the Erosion Control Plan and Cost Estimate be submitted in conjunction with the grading and erosion control plan and construction assurances posted prior to obtaining a grading permit.

OPERATION & MAINTENANCE

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. The property owner shall be responsible for the inspection, maintenance, rehabilitation and repair of stormwater and erosion control facilities located on the property unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. Access is provided from onsite facilities. An Inspection and Maintenance Manual will accompany the Final Drainage Report submittal package.

FLOODPLAIN STATEMENT

Based on the FEMA FIRM Map number 08041C0543G and 08041C0545G, the site does not fall within a FEMA defined floodplain and is classified as Zone X, which are areas determined to be

outside the 0.2% annual chance floodplain. FIRM maps of the site and surrounding areas have been presented in Appendix A.

DRAINAGE AND BRIDGE FEES

The site lies within the Sand Creek Drainage Basin. See Table 2 below for required drainage basin fees. Per El Paso County processes, drainage fees are due at the time of platting. This development is not proposed to be platted and the fees shown in Table 2 below are for informational purposes only. The fees are based on a paved site and have not taken into consideration pond construction credits for the proposed detention pond.

Table 2 – Basin Fees

Tamlin Road Storage Yard Drainage Basin Fees					
Total Area	Site% Imperviousness	Impervious Acres	Drainage Fee/Impervious Acre	Bridge Fee/Impervious Acre	Total Fee
12.41	68%	8.44	$18,940	$5,559	$206,742.16

CONSTRUCTION COST OPINION

See Table 3 below for cost opinion of private storm sewer infrastructure.

Table 3 – Construction Cost Opinion

Private Drainage Facilities				
Item	Quantity	Unit	Unit Price	Extended Cost
18" RCP	38	LF	$ 45.00	$ 1,710.00
18" FES	1	EA	$ 1,500.00	$ 1,500.00
SPILLWAY (TYPE M RIPRAP)	64	CY	$ 125.00	$ 8,000.00
RIPRAP PADS & TAIL WATER BASIN (TYPE M & L RIPRAP)	80	CY	$ 125.00	$ 10,000.00
AGG. BASE COURSE MAINT. ROAD	117	SY	$ 45.00	$ 5,265.00
FULL SPECTURM OUTLET STRUCTURE	1	LS	$ 15,000.00	$ 15,000.00
			Sub-Total	$ 41,475.00
	10% Eng. And Contingency			$ 4,147.50
			Grand Total	$ 45,622.50

SUMMARY

The proposed Tamlin Road RV Storage drainage improvements include storm sewer, a Full Spectrum Detention and Water Quality Pond, and an engineered outfall. The proposed development will not adversely affect the offsite major drainageways or surrounding developments. This report is in conformance with the latest El Paso County Storm Drainage Criteria requirements for this site.

REFERENCES

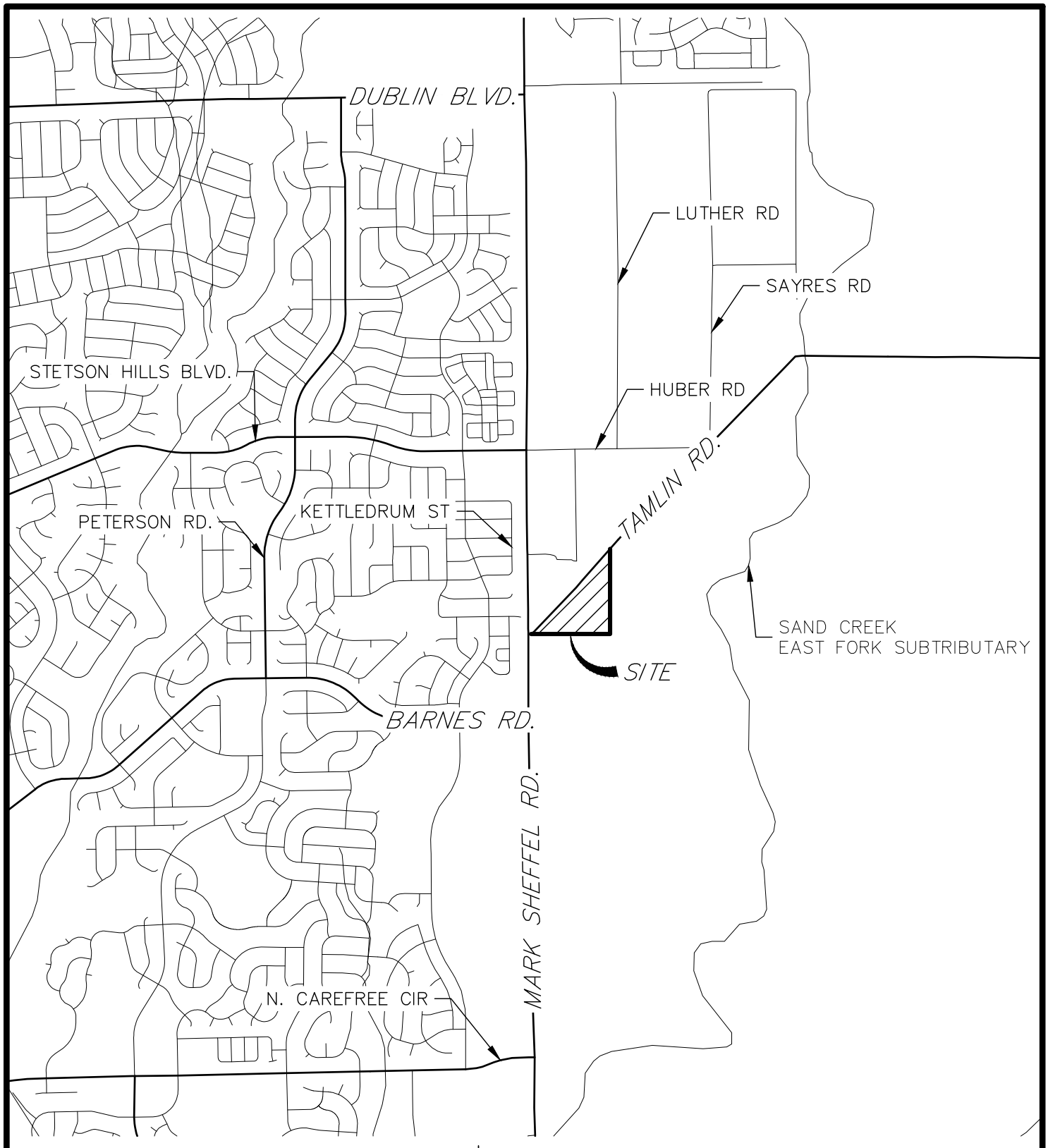
1. El Paso County Drainage Criteria Manual (Volumes I & II), El Paso County CO, Colorado, Updated May, 2014.

2. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), Urban Drainage and Flood Control District, June 2001.

3. "Hydrologic Group Rating for El Paso County Area, Colorado", USDA-Natural Resources Conservation Service, National Cooperative Soil Survey. Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov. [June 14, 2019]

4. "Sand Creek Drainage Basin Planning Study Final Design Report", Kiowa Engineering Corporation, March 1996.

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map



N

2000 1000 0 2000

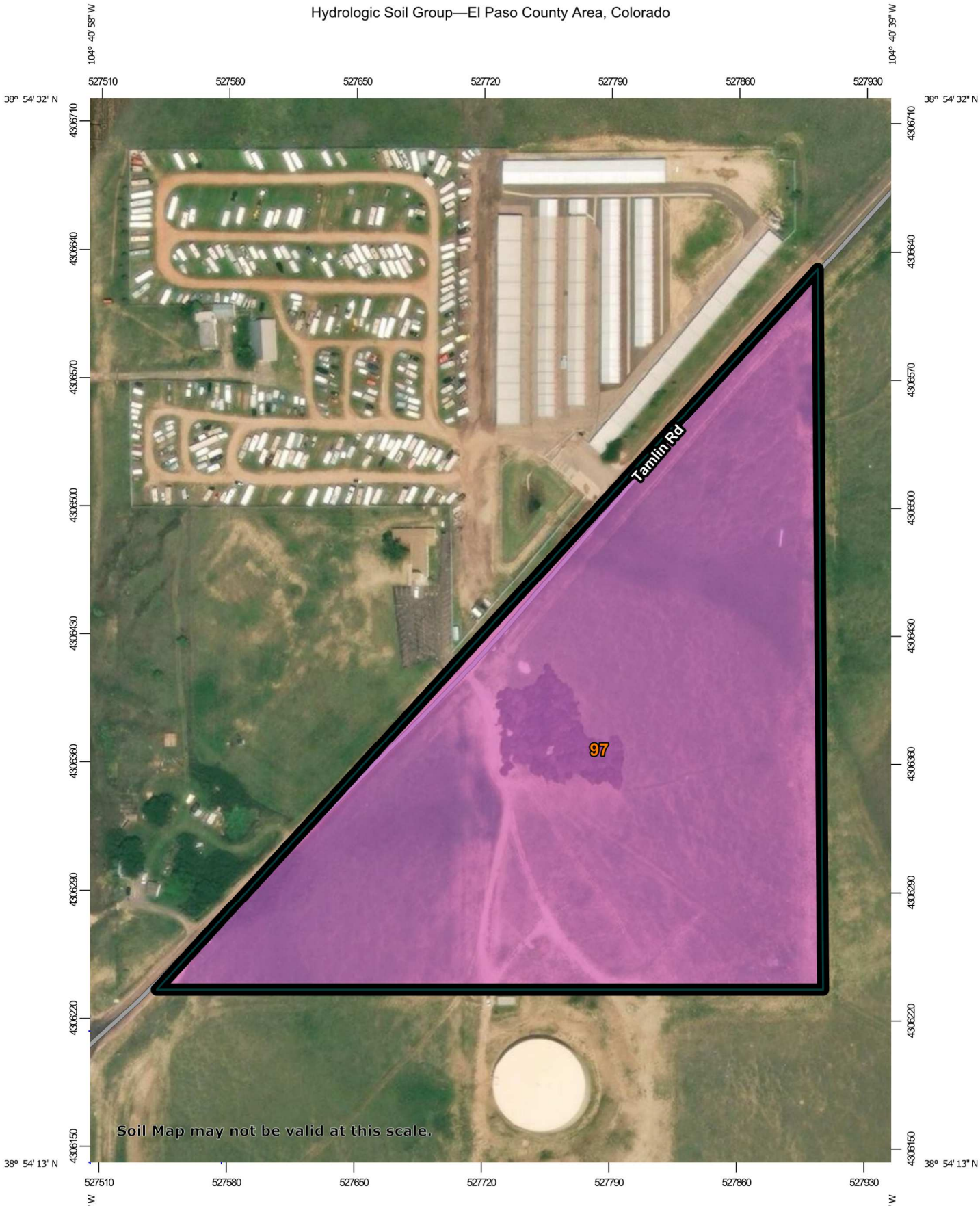
ORIGINAL SCALE: 1" = 2000'

VICINITY MAP
TAMLIN ROAD STORAGE YARD
2513400
06/14/19
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

Hydrologic Soil Group—El Paso County Area, Colorado



Map Scale: 1:2,840 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 40 80 160 240

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 1:24,000.

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: El Paso County Area, Colorado
Survey Area Data: Version 16, 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: Apr 15, 2011—Aug 17, 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
97	Truckton sandy loam, 3 to 9 percent slopes	A	17.9	100.0%
Totals for Area of Interest			**17.9**	**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

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

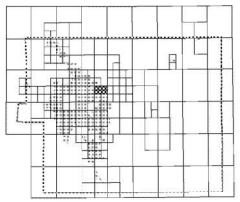
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

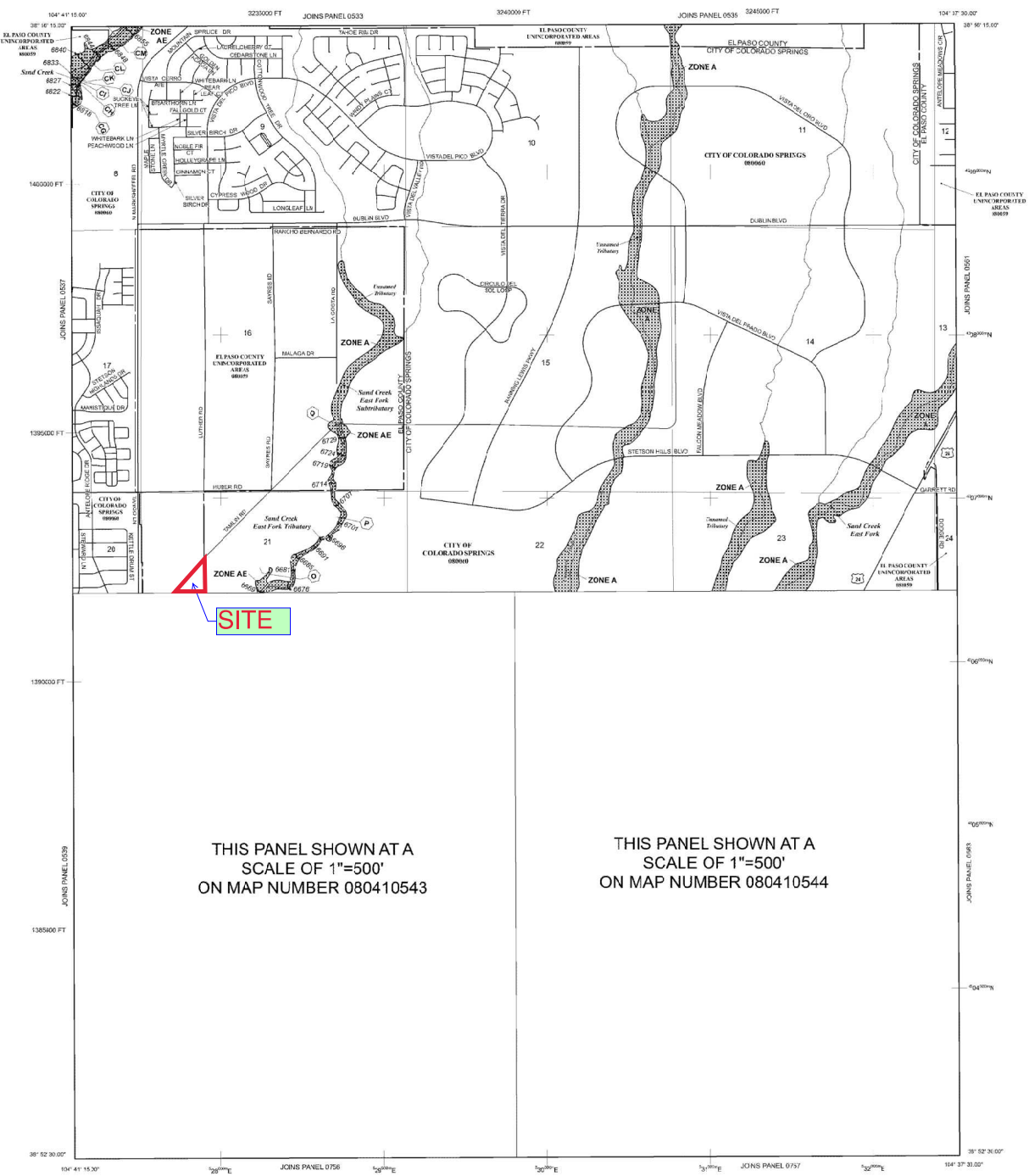
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas

- Floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A — A — Cross section line
- 23 — 23 — Transect line
- 97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4279000 mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

PANEL 0545G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 545 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0545	G
EL PASO COUNTY	080059	0545	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 08041C0545G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301)713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

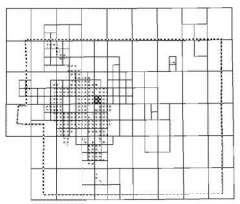
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

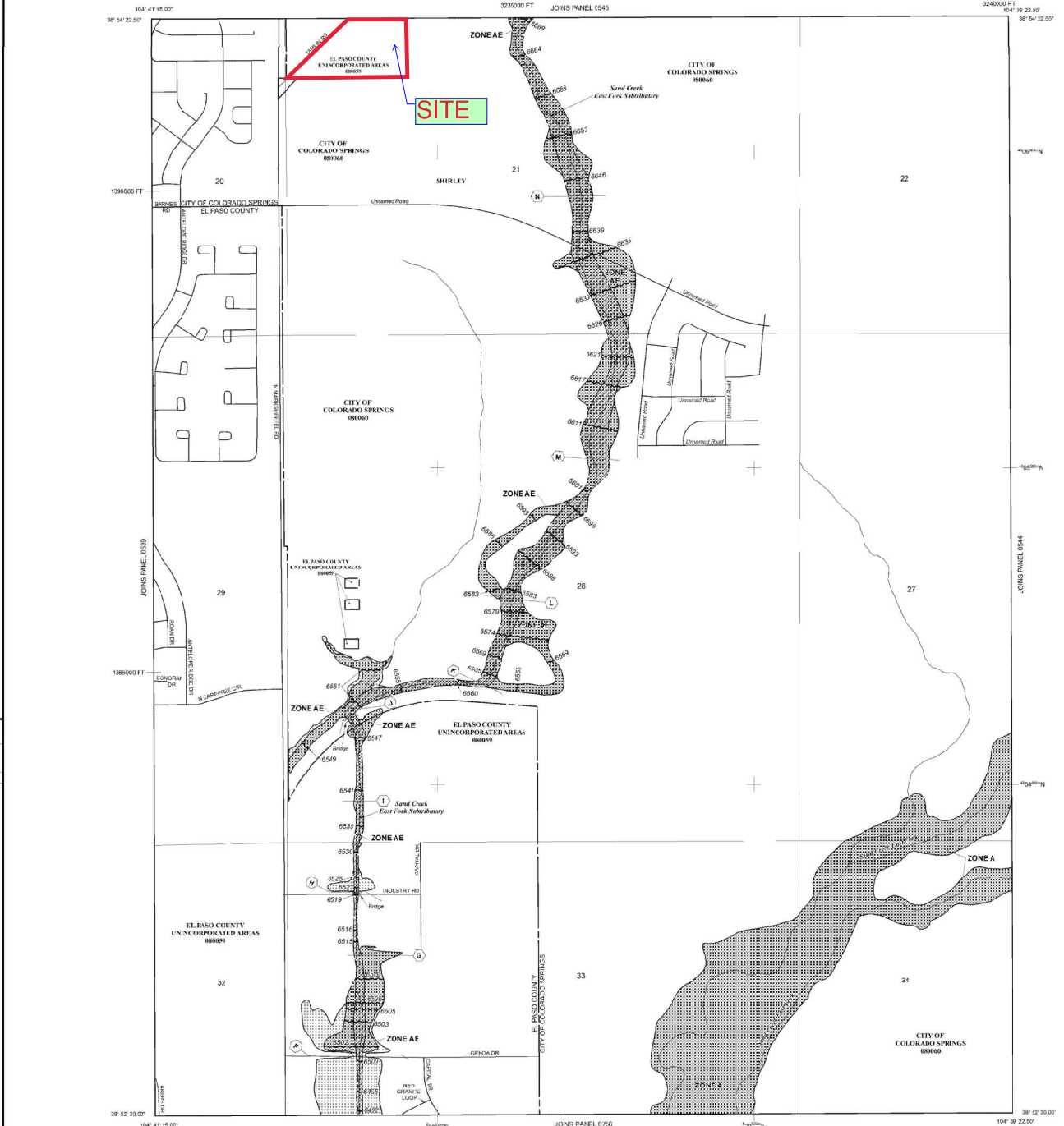
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas

- Floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A — A — Cross section line
- 23 — 23 — Transect line
- 97° 07' 30.00" / 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4279000 N — 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0543G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 543 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0543	G
EL PASO COUNTY	080059	0543	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
08041C0543G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

National Flood Hazard Layer FIRMette

FEMA

0 250 500 1,000 1,500 2,000 Feet

1:6,000

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 D*

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
- 513 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 6/14/2019 at 10:33:46 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.

Appendix B
Reference Material

El Paso County Drainage Basin Fees

Resolution No. 18-470

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2019 Drainage Fee (per Impervious Acre)	2019 Bridge Fee (per Impervious Acre)
Drainage Basins with DBPS's:					
CHMS0200	Chico Creek	2013	Haegler Ranch	$10,324	$1,524
CHWS1200	Chico Creek	2001	Bennett Ranch	$11,558	$4,433
CHWS1400	Chico Creek	2013	Falcon	$29,622	$4,069
FOFO2000	Fountain Creek	2001	West Fork Jimmy Camp Creek	$12,564	$3,717
FOFO2600	Fountain Creek	1991*	Big Johnson / Crews Gulch	$18,350	$2,370
FOFO2800	Fountain Creek	1988*	Widefield	$18,350	$0
FOFO2900	Fountain Creek	1988*	Security	$18,350	$0
FOFO3000	Fountain Creek	1991*	Windmill Gulch	$18,350	$275
FOFO3100 / FOFO3200	Fountain Creek	1988*	Carson Street / Little Johnson	$11,192	$0
FOFO3400	Fountain Creek	1984*	Peterson Field	$13,235	$1,004
FOFO3600	Fountain Creek	1991*	Fisher's Canyon	$18,350	$0
FOFO4000	Fountain Creek	1996	Sand Creek	$18,940	$5,559
FOFO4200	Fountain Creek	1977	Spring Creek	$9,517	$0
FOFO4600	Fountain Creek	1984*	Southwest Area	$18,350	$0
FOFO4800	Fountain Creek	1991	Bear Creek	$18,350	$1,004
FOFO5400	Fountain Creek	1977	21st Street	$5,521	$0
FOFO5600	Fountain Creek	1964	19th Street	$3,611	$0
FOFO5800	Fountain Creek	1964	Camp Creek	$2,033	$0
FOMO0400	Monument Creek	1986*	Mesa	$9,598	$0
FOMO1000	Monument Creek	1981	Douglas Creek	$11,540	$255
FOMO1200	Monument Creek	1977	Templeton Gap	$11,847	$275
FOMO1400	Monument Creek	1976	Pope's Bluff	$3,676	$627
FOMO1600	Monument Creek	1976	South Rockrimmon	$4,314	$0
FOMO1800	Monument Creek	1973	North Rockrimmon	$5,521	$0
FOMO2000	Monument Creek	1971	Pulpit Rock	$6,085	$0
FOMO2200	Monument Creek	1994	Cottonwood Creek / S. Pine	$18,350	$1,004
FOMO2400	Monument Creek	1966	Dry Creek	$14,486	$524
FOMO3600	Monument Creek	1989*	Black Squirrel Creek	$8,331	$524
FOMO3700	Monument Creek	1987*	Middle Tributary	$15,312	$0
FOMO3800	Monument Creek	1987*	Monument Branch	$18,350	$0
FOMO4000	Monument Creek	1996	Smith Creek	$7,481	$1,004
FOMO4200	Monument Creek	1989*	Black Forest	$18,350	$500
FOMO5200	Monument Creek	1993*	Dirty Woman Creek	$18,350	$1,004
FOMO5300	Fountain Creek	1993*	Crystal Creek	$18,350	$1,004
Miscellaneous Drainage Basins: [1]					
CHBS0800	Chico Creek		Book Ranch	$17,217	$2,492
CHEC0400	Chico Creek		Upper East Chico	$9,380	$272
CHWS0200	Chico Creek		Telephone Exchange	$10,306	$241
CHWS0400	Chico Creek		Livestock Company	$16,976	$202
CHWS0600	Chico Creek		West Squirrel	$8,849	$3,672
CHWS0800	Chico Creek		Solberg Ranch	$18,350	$0
FOFO1200	Fountain Creek		Crooked Canyon	$5,540	$0
FOFO1400	Fountain Creek		Calhan Reservoir	$4,625	$270
FOFO1600	Fountain Creek		Sand Canyon	$3,342	$0
FOFO2000	Fountain Creek		Jimmy Camp Creek[3]	$18,350	$858
FOFO2200	Fountain Creek		Fort Carson	$14,486	$524
FOFO2700	Fountain Creek		West Little Johnson	$1,209	$0
FOFO3800	Fountain Creek		Stratton	$8,801	$394
FOFO5000	Fountain Creek		Midland	$14,486	$524
FOFO6000	Fountain Creek		Palmer Trail	$14,486	$524
FOFO6800	Fountain Creek		Black Canyon	$14,486	$524
FOMO4600	Monument Creek		Beaver Creek	$10,970	$0
FOMO3000	Monument Creek		Kettle Creek	$9,909	$0
FOMO3400	Monument Creek		Elkhorn	$1,665	$0
FOMO5000	Monument Creek		Monument Rock	$7,953	$0
FOMO5400	Monument Creek		Palmer Lake	$12,717	$0
FOMO5600	Monument Creek		Raspberry Mountain	$4,278	$0
PLPL0200	Monument Creek		Bald Mountain	$9,116	$0
Interim Drainage Basins: [2]					
FOFO1800	Fountain Creek		Little Fountain Creek	$2,346	$0
FOMO4400	Monument Creek		Jackson Creek	$7,263	$0
FOMO4800	Monument Creek		Teachout Creek	$5,044	$758

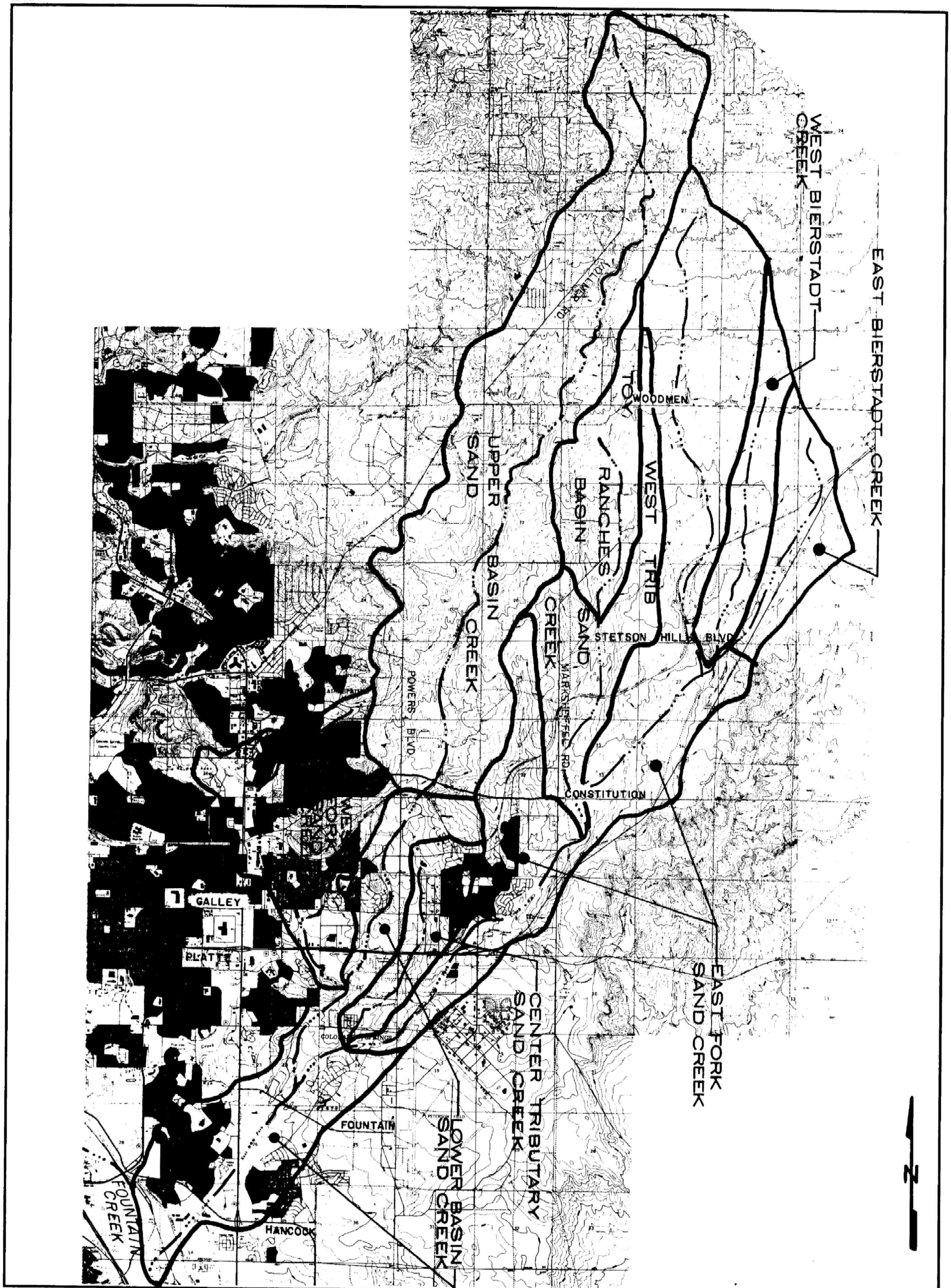
1. The miscellaneous drainage fee previous to September 1999 resolution was the average of all drainage fees for basins with Basin Planning Studies perform

2. Interim Drainage Fees are based upon draft Drainage Basin Planning Studies or the Drainage Basin Identification and Fee Estimation Report. (Best availabl

3. This is an interim fee and will be adjusted when a DBPS is completed. In addition to the Drainage Fee a surety in the amount of $7,285 per impervious acre sh the DBPS results in a fee greater than the current fee. Fees paid in excess of the future revised fee will be reimbursed. See Resolution 06-326 (9/14/06) and Res

EPC Stormwater Management

Jennifer Irvine, P.E.



Project No 90-04-09
Date: 11/90
Design:
Drawn: EAK
Check:
Revisions:

11

FIG. III-1

SAND CREEK DRAINAGE BASIN PLANNING STUDY

REGIONAL SUB-BASINS

Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

Appendix C
Hydrologic Calculations

EX. DRAINAGE CALCS

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX1	6.43	2%	0.05	0.36	13.4	1.2	14.3
EX2	10.08	2%	0.05	0.36	15.4	1.8	21.2

DESIGN POINT SUMMARY TABLE

Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
1	1.2	14.3
2	1.8	21.2

EX. COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: TAMLIN ROAD STORAGE YARD
Location: Colorado Springs

Project Name: TAMLIN ROAD STORAGE YARD
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 11/1/19

Basin ID	Total Area (ac)	Historic Flow Analysis			Roofs			Paved Roads			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
EX1	6.43	2%	6.43	2.0%	90%	0.00	0.0%	100%	0.00	0.0%	2.0%
EX2	10.08	2%	10.08	2.0%	90%	0.00	0.0%	100%	0.00	0.0%	2.0%
TOTAL	**16.51**										**2.0%**

Table 6-6. Runoff Coefficients for Rational Method
(Source: 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	0.10	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	0.12	0.28	0.30	0.36	0.37	0.45	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.10	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	0.25	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	0.10	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agricuture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.35	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	0.12	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

EX. COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: TAMLIN ROAD STORAGE YARD
Location: Colorado Springs

Project Name: TAMLIN ROAD STORAGE YARD
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 11/1/19

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Land Use			Minor Coefficients			Major Coefficients			Basins Total Weighted C_5	Basins Total Weighted C_{100}
			Area A (ac)	Area B (ac)	Area C/D (ac)	Area Historic (ac)	Area Roofs (ac)	Area Paved Roads (ac)	$C_{5,A,HISTORIC}$	$C_{5,A,ROOFS}$	$C_{5,A,ROADS}$	$C_{100,A,HISTORIC}$	$C_{100,A,ROOFS}$	$C_{100,A,ROADS}$		
EX1	6.43	2.0%	6.43	0.00	0.00	6.43	0.00	0.00	0.05	0.73	0.90	0.36	0.81	0.96	0.05	0.36
EX2	10.08	2.0%	10.08	0.00	0.00	10.08	0.00	0.00	0.05	0.73	0.90	0.36	0.81	0.96	0.05	0.36
TOTAL	**16.51**	**2.0%**	**16.51**	**0.00**	**0.00**	**16.51**	**0.00**	**0.00**	---	---	---	---	---	---	**0.05**	**0.36**

EX. STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: TAMLIN ROAD STORAGE YARD
Location: Colorado Springs

Project Name: TAMLIN ROAD STORAGE YARD
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 11/1/19

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
EX1	6.43	A	2%	0.05	0.36	54	3.5%	9.2	550	4.7%	10.0	2.2	4.2	13.4	604.0	30.2	13.4
EX2	10.08	A	2%	0.05	0.36	76	3.9%	10.5	537	3.4%	10.0	1.8	4.9	15.4	613.0	30.9	15.4

NOTES:

$$t_c = t_i + t_t$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

Equation 6-2 $$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$ Equation 6-5

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

EX. STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

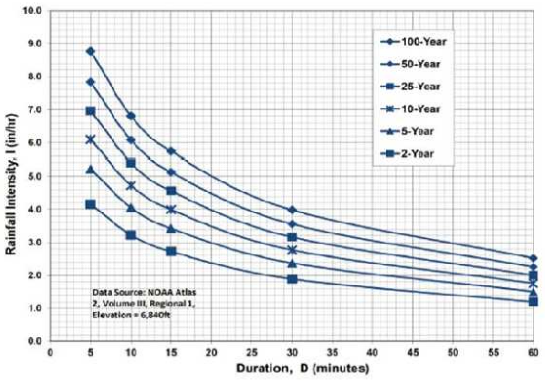
Subdivision: TAMLIN ROAD STORAGE YARD
Location: Colorado Springs
Design Storm: 5-Year

Project Name: TAMLIN ROAD STORAGE YARD
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 11/1/19

		DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1	EX1	6.43	0.05	13.4	0.32	3.69	1.2															TOTAL FLOW DISCHARGING TO TAMLIN ROAD
	2	EX2	10.08	0.05	15.4	0.50	3.48	1.7															TOTAL FLOW DISCHARGING OFFSITE TO UNDEVELOPED LAND

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_5 = -1.50 \ln(D) + 7.583$

$I_2 = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

EX. STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: TAMLIN ROAD STORAGE YARD
Location: Colorado Springs
Design Storm: 100-Year

Project Name: TAMLIN ROAD STORAGE YARD
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 11/1/19

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	EX1	6.43	0.36	13.4	2.31	6.19	14.3															TOTAL FLOW DISCHARGING TO TAMLIN ROAD
	2	EX2	10.08	0.36	15.4	3.63	5.84	21.2															TOTAL FLOW DISCHARGING OFFSITE ALONG WESTERN PROPERTY LINE TO UNDEVELOPED PARCEL

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

TAMLIN ROAD RV & BOAT STORAGE - PROPOSED DRAINAGE CALCS

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	0.38	32%	0.34	0.54	5.0	0.7	1.8
A2	4.42	68%	0.66	0.78	7.4	13.3	26.5
A3	4.72	81%	0.78	0.86	8.5	16.0	30.0
A4	0.70	0%	0.08	0.35	7.0	0.3	1.9
A5	1.14	4%	0.12	0.38	8.7	0.6	3.1
A6	0.26	0%	0.08	0.35	5.0	0.1	0.8
A7	0.39	0%	0.08	0.35	5.0	0.2	1.2
A8	0.40	0%	0.08	0.35	5.0	0.2	1.2

DESIGN POINT SUMMARY TABLE

Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
1	0.7	1.8
2	29.3	56.7
3	29.5	58.4
4	0.6	3.1
5	0.1	0.8
6	0.2	1.2
7	0.2	1.2

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: TAMLIN ROAD RV STORAGE
Location: Colorado Springs

Project Name: TAMLIN ROAD RV STORAGE
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 1/17/20

Basin ID	Total Area (ac)	Paved Roads (Asphalt)			Rock Mulch			Lawns			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
A1	0.38	100%	0.12	31.6%	20%	0.00	0.0%	0%	0.26	0.0%	31.6%
A2	4.42	100%	2.96	67.0%	20%	0.28	1.3%	0%	1.18	0.0%	68.2%
A3	4.72	100%	3.74	79.2%	20%	0.38	1.6%	0%	0.60	0.0%	80.8%
A4	0.70	100%	0.00	0.0%	20%	0.00	0.0%	0%	0.70	0.0%	0.0%
A5	1.14	100%	0.05	4.4%	20%	0.00	0.0%	0%	1.09	0.0%	4.4%
A6	0.26	100%	0.00	0.0%	20%	0.00	0.0%	0%	0.26	0.0%	0.0%
A7	0.39	100%	0.00	0.0%	20%	0.00	0.0%	0%	0.39	0.0%	0.0%
A8	0.40	100%	0.00	0.0%	20%	0.00	0.0%	0%	0.40	0.0%	0.0%
TOTAL	**12.41**										**56.4%**
POND A TOTAL	**10.22**									**POND A**	**68.0%**

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: TAMLIN ROAD RV STORAGE
Location: Colorado Springs

Project Name: TAMLIN ROAD RV STORAGE
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 1/17/20

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Land Use			Minor Coefficients			Major Coefficients			Basins Total Weighted C_5	Basins Total Weighted C_{100}
			Area A (ac)	Area B (ac)	Area C/D (ac)	Area Roads (ac)	Area Roofs (ac)	Area Lawns (ac)	$C_{5,A,ROADS}$	$C_{5,A,ROCK\ MULCH}$	$C_{5,A,\ LAWNS}$	$C_{100,A.\ ROADS}$	$C_{100,A,ROCK\ MULCH}$	$C_{100,A,\ LAWNS}$		
A1	0.38	31.6%	0.38	0.00	0.00	0.12	0.00	0.26	0.90	0.20	0.08	0.96	0.36	0.35	0.34	0.54
A2	4.42	68.2%	4.42	0.00	0.00	2.96	0.28	1.18	0.90	0.53	0.08	0.96	0.64	0.35	0.66	0.78
A3	4.72	80.8%	4.72	0.00	0.00	3.74	0.38	0.60	0.90	0.66	0.08	0.96	0.74	0.35	0.78	0.86
A4	0.70	0.0%	0.70	0.00	0.00	0.00	0.00	0.70	0.90	0.00	0.08	0.96	0.11	0.35	0.08	0.35
A5	1.14	4.4%	1.14	0.00	0.00	0.05	0.00	1.09	0.90	0.02	0.08	0.96	0.14	0.35	0.12	0.38
A6	0.26	0.0%	0.26	0.00	0.00	0.00	0.00	0.26	0.90	0.00	0.08	0.96	0.11	0.35	0.08	0.35
A7	0.39	0.0%	0.39	0.00	0.00	0.00	0.00	0.39	0.90	0.00	0.08	0.96	0.11	0.35	0.08	0.35
A8	0.40	0.0%	0.40	0.00	0.00	0.00	0.00	0.40	0.90	0.00	0.08	0.96	0.11	0.35	0.08	0.35
TOTAL	**12.41**	**56.4%**	**12.41**	**0.00**	**0.00**	**6.87**	**0.24**	**4.88**	**---**	**---**	**---**	**---**	**---**	**---**	**0.56**	**0.71**

Table 6-6. Runoff Coefficients for Rational Method
(Source: 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	0.28	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

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A = 0.84i^{1.507}$	$C_A = 0.86i^{1.276}$	$C_A = 0.87i^{1.213}$	$C_A = 0.84i^{1.174}$	$C_A = 0.85i+0.025$	$C_A = 0.78i+0.110$	$C_A = 0.65i+0.254$
B	$C_B = 0.84i^{1.169}$	$C_B = 0.86i^{1.088}$	$C_B = 0.81i-0.057$	$C_B = 0.63i+0.249$	$C_B = 0.56i+0.328$	$C_B = 0.47i+0.426$	$C_B = 0.37i+0.536$
C/D	$C_{C/D} = 0.83i^{1.122}$	$C_{C/D} = 0.82i+0.035$	$C_{C/D} = 0.74i-0.132$	$C_{C/D} = 0.56i+0.319$	$C_{C/D} = 0.49i+0.393$	$C_{C/D} = 0.41i+0.484$	$C_{C/D} = 0.32i+0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

TABLE 6-4 UTILIZED TO CALCULATE 'C-VALUE' FOR ROCK MULCH

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: TAMLIN ROAD RV STORAGE
Location: Colorado Springs

Project Name: TAMLIN ROAD RV STORAGE
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 1/17/20

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
A1	0.38	A	32%	0.34	0.54	11	2.0%	3.6	250	2.9%	20.0	3.4	1.2	4.8	261.0	22.5	5.0
A2	4.42	A	68%	0.66	0.78	125	5.6%	5.1	455	2.7%	20.0	3.3	2.3	7.4	580.0	16.9	7.4
A3	4.72	A	81%	0.78	0.86	105	1.0%	5.9	517	2.8%	20.0	3.3	2.6	8.5	622.0	14.8	8.5
A4	0.70	A	0%	0.08	0.35	25	25.0%	3.2	160	1.0%	7.0	0.7	3.8	7.0	185.0	29.0	7.0
A5	1.14	A	4%	0.12	0.38	37	5.2%	6.3	275	7.4%	7.0	1.9	2.4	8.7	312.0	27.0	8.7
A6	0.26	A	0%	0.08	0.35	20	22.0%	3.0	25	22.0%	7.0	3.3	0.1	3.1	45.0	26.1	5.0
A7	0.39	A	0%	0.08	0.35	20	25.0%	2.8	25	25.0%	7.0	3.5	0.1	3.0	45.0	26.1	5.0
A8	0.40	A	0%	0.08	0.35	20	18.0%	3.2	25	18.0%	7.0	3.0	0.1	3.3	45.0	26.1	5.0

NOTES:

$$t_c = t_i + t_t$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_t = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_t}$
K = NRCS conveyance factor (see Table 6-2).

Equation 6-2

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

Equation 6-4

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Equation 6-3

Equation 6-5

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: TAMLIN ROAD RV STORAGE
Location: Colorado Springs
Design Storm: 5-Year

Project Name: TAMLIN ROAD RV STORAGE
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 1/17/20

		DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1	A1	0.38	0.34	5.0	0.13	5.17	0.7					0.7	0.13	2.0					406	2.8	2.4	BASIN A1 FLOW @ DP1, SHEET FLOW TO DP2
		A2	4.42	0.66	7.4	2.91	4.59	13.4															BASIN A2 FLOW @ DP2 (ROUTED IN SF2)
		A3	4.72	0.78	8.5	3.66	4.37	16.0															BASIN A3 FLOW @ DP2 (ROUTED IN SF2)
	2								8.5	6.70	4.37	29.3	29.3	6.7	25.0					35	10.0	0.1	DP1, BASIN A2-A3 FLOW @ DP2, SHEET FLOW TO DP3 (F.S.D. WQ POND)
		A4	0.70	0.08	7.0	0.06	4.67	0.3															BASIN A4 FLOW @ DP3 (ROUTED IN SF2)
	3								8.5	6.76	4.36	29.5											TOTAL BASIN A1-A4 FLOW ENTERING F.S.D. WQ POND
	4	A5	1.14	0.12	8.7	0.13	4.34	0.6															TOTAL BASIN A5 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS
	5	A6	0.26	0.08	5.0	0.02	5.17	0.1															TOTAL BASIN A6 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS
	6	A7	0.39	0.08	5.0	0.03	5.17	0.2															TOTAL BASIN A7 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS
	7	A8	0.40	0.08	5.0	0.03	5.17	0.2															TOTAL BASIN A8 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: TAMLIN ROAD RV STORAGE
Location: Colorado Springs
Design Storm: 100-Year

Project Name: TAMLIN ROAD RV STORAGE
Project No.: 25134.00
Calculated By: NQJ
Checked By:
Date: 1/17/20

		DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1	A1	0.38	0.54	5.0	0.21	8.68	1.8					1.8	0.21	2.0					406	2.8	2.4	BASIN A1 FLOW @ DP1, SHEET FLOW TO DP2
		A2	4.42	0.78	7.4	3.43	7.70	26.4															BASIN A2 FLOW @ DP2 (ROUTED IN SF2)
		A3	4.72	0.86	8.5	4.08	7.34	30.0															BASIN A3 FLOW @ DP2 (ROUTED IN SF2)
	2								8.5	7.72	7.34	56.7	56.7	7.72	25.0					35	10.0	0.1	DP1, BASIN A2-A3 FLOW @ DP2, SHEET FLOW TO DP3 (F.S.D. WQ POND)
		A4	0.70	0.35	7.0	0.25	7.83	2.0															BASIN A4 FLOW @ DP3 (ROUTED IN SF2)
	3								8.5	7.97	7.33	58.4											TOTAL BASIN A1-A4 FLOW ENTERING F.S.D. WQ POND
	4	A5	1.14	0.38	8.7	0.43	7.29	3.1															TOTAL BASIN A5 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS
	5	A6	0.26	0.35	5.0	0.09	8.68	0.8															TOTAL BASIN A6 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS
	6	A7	0.39	0.35	5.0	0.14	8.68	1.2															TOTAL BASIN A7 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS
	7	A8	0.40	0.35	5.0	0.14	8.68	1.2															TOTAL BASIN A8 FLOW (UNDEVELOPED), SHEET FLOW EAST FOLLOWING EX. DRAINAGE PATTERNS

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

Site-Level Low Impact Development (LID) Design Effective Impervious Calculator

LID Credit by Impervious Reduction Factor (IRF) Method

UD-BMP (Version 3.06, November 2016)

User Input

Calculated cells

***Design Storm: 1-Hour Rain Depth	WQCV Event	1.19	inches
***Minor Storm: 1-Hour Rain Depth	5-Year Event	1.50	inches
***Major Storm: 1-Hour Rain Depth	100-Year Event	2.52	inches
Optional User Defined Storm	CUHP		
(CUHP) NOAA 1 Hour Rainfall Depth and Frequency for User Defined Storm	100-Year Event		
Max Intensity for Optional User Defined Storm	0		

Designer: NQJ
Company: JR ENGINEERING
Date: January 21, 2020
Project: TAMLIN ROAD RV & BOAT STORAGE
Location: COLORADO SPRINGS

SITE INFORMATION (USER-INPUT)

Sub-basin Identifier	A1	A2	A3	A4	A5	A6	A7	A8						
Receiving Pervious Area Soil Type	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam						
Total Area (ac., Sum of DCIA, UIA, RPA, & SPA)	0.380	4.420	4.720	0.700	1.140	0.260	0.390	0.400						
Directly Connected Impervious Area (DCIA, acres)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000						
Unconnected Impervious Area (UIA, acres)	0.380	4.420	4.720	0.000	0.000	0.000	0.000	0.000						
Receiving Pervious Area (RPA, acres)	0.000	0.000	0.000	0.700	0.000	0.000	0.000	0.000						
Separate Pervious Area (SPA, acres)	0.000	0.000	0.000	0.000	1.140	0.260	0.390	0.400						
RPA Treatment Type: Conveyance (C), Volume (V), or Permeable Pavement (PP)	C	C	C	V	C	C	C	C						

CALCULATED RESULTS (OUTPUT)

Total Calculated Area (ac, check against input)	0.380	4.420	4.720	0.700	1.140	0.260	0.390	0.400						
Directly Connected Impervious Area (DCIA, %)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
Unconnected Impervious Area (UIA, %)	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
Receiving Pervious Area (RPA, %)	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%						
Separate Pervious Area (SPA, %)	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%						
A_R (RPA / UIA)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000						
I_a Check	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000						
f / I for WQCV Event:	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9						
f / I for 5-Year Event:	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5						
f / I for 100-Year Event:	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3						
f / I for Optional User Defined Storm CUHP:														
IRF for WQCV Event:	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00						
IRF for 5-Year Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00						
IRF for 100-Year Event:	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00						
IRF for Optional User Defined Storm CUHP:														
Total Site Imperviousness: I_{total}	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
Effective Imperviousness for WQCV Event:	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
Effective Imperviousness for 5-Year Event:	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
Effective Imperviousness for 100-Year Event:	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%						
Effective Imperviousness for Optional User Defined Storm CUHP:														

LID / EFFECTIVE IMPERVIOUSNESS CREDITS

WQCV Event CREDIT: Reduce Detention By:	0.0%	0.0%	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
This line only for 10-Year Event	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
100-Year Event CREDIT**: Reduce Detention By:	0.0%	0.0%	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Defined CUHP CREDIT: Reduce Detention By:														

Total Site Imperviousness:	**76.7%**
Total Site Effective Imperviousness for WQCV Event:	**76.7%**
Total Site Effective Imperviousness for 5-Year Event:	**76.7%**
Total Site Effective Imperviousness for 100-Year Event:	**76.7%**
Total Site Effective Imperviousness for Optional User Defined Storm CUHP:	

Notes:

* Use Green-Ampt average infiltration rate values from Table 3-3.
** Flood control detention volume credits based on empirical equations from Storage Chapter of USDCM.
*** Method assumes that 1-hour rainfall depth is equivalent to 1-hour intensity for calculation purposed

Appendix D
Hydraulic Calculations

Weir Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Jan 20 2020

Pond A Spillway (Q_100_undetained = 39.9 cfs per UD-Detention Peak Inflow)

Trapezoidal Weir

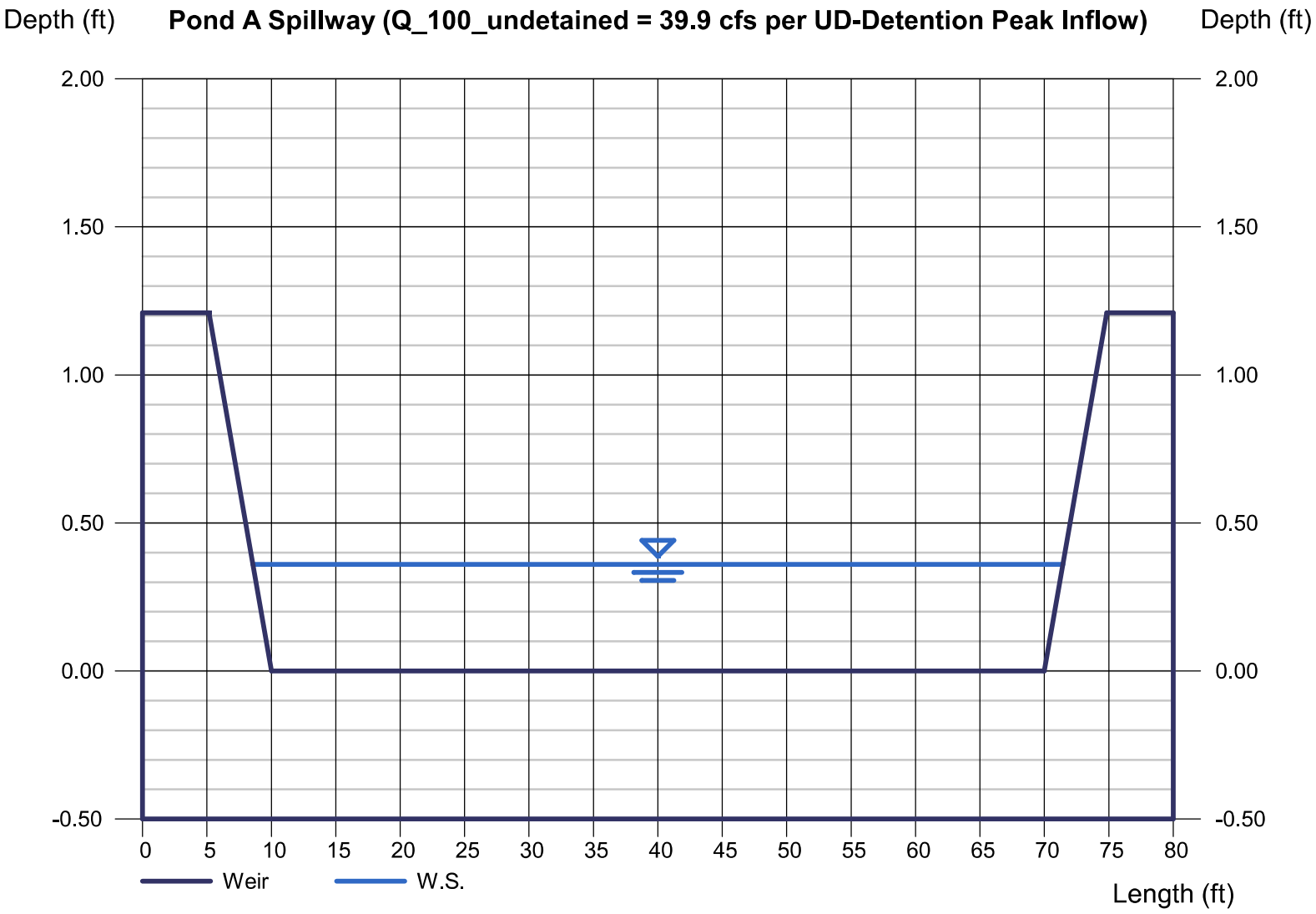
Crest	= Sharp
Bottom Length (ft)	= 60.00
Total Depth (ft)	= 1.21
Side Slope (z:1)	= 4.00

Calculations

Weir Coeff. Cw	= 3.10
Compute by:	Known Q
Known Q (cfs)	= 39.90

Highlighted

Depth (ft)	= 0.36
Q (cfs)	= 39.90
Area (sqft)	= 22.12
Velocity (ft/s)	= 1.80
Top Width (ft)	= 62.88



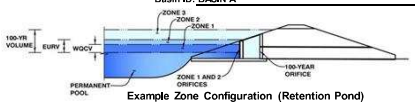
Appendix E
Water Quality and Detention

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: TAMLIN ROAD STORAGE FACILITY

Basin ID: BASIN A



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB		
Watershed Area =	10.22	acres	Note: L / W Ratio < 1
Watershed Length =	600	ft	L / W Ratio = 0.8
Watershed Slope =	0.050	ft/ft	
Watershed Imperviousness =	68.00%	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		
Water Quality Capture Volume (WQCV) =	0.227	acre-feet	Optional User Override 1-hr Precipitation
Excess Urban Runoff Volume (EURV) =	0.873	acre-feet	
2-yr Runoff Volume (P1 = 1.19 in.) =	0.601	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.785	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.953	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	1.149	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.359	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.606	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet	inches
Approximate 2-yr Detention Volume =	0.569	acre-feet	
Approximate 5-yr Detention Volume =	0.743	acre-feet	
Approximate 10-yr Detention Volume =	0.894	acre-feet	
Approximate 25-yr Detention Volume =	1.073	acre-feet	
Approximate 50-yr Detention Volume =	1.180	acre-feet	
Approximate 100-yr Detention Volume =	1.288	acre-feet	

Stage-Storage Calculation

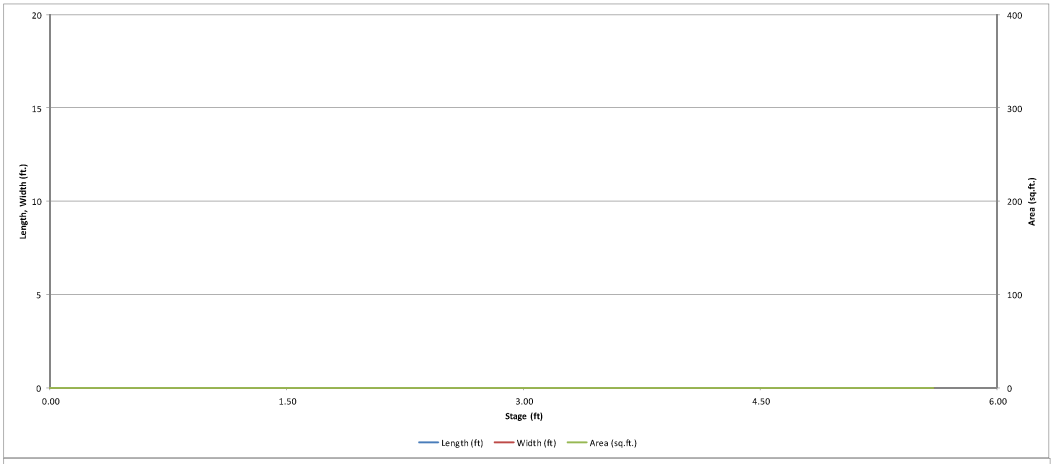
Zone 1 Volume (WQCV) =	0.227	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.647	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.415	acre-feet
Total Detention Basin Volume =	1.288	acre-feet
Initial Surcharge Volume (I_{SV}) =	user	ft^3
Initial Surcharge Depth (I_{SD}) =	user	ft
Total Available Detention 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

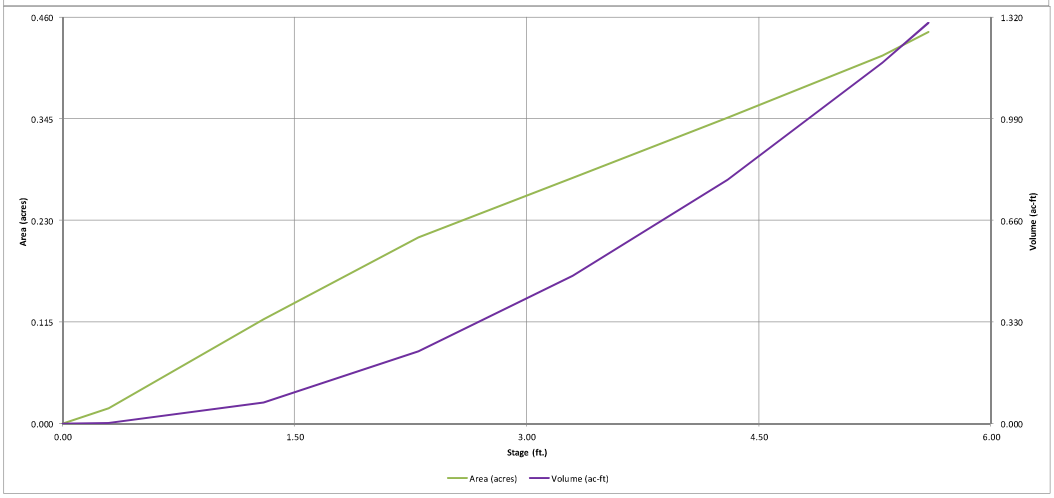
Depth Increment = ft

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)
6716.7 **Top of Micropool**	–	0.00	–	–	–	0	0.000		
6717	–	0.30	–	–	–	750	0.017	105	0.002
6718	–	1.30	–	–	–	5,149	0.118	3,011	0.069
6719	–	2.30	–	–	–	9,172	0.211	10,222	0.235
6720	–	3.30	–	–	–	12,103	0.278	20,860	0.479
6721	–	4.30	–	–	–	15,085	0.346	34,454	0.791
6722	–	5.30	–	–	–	18,119	0.416	51,056	1.172
6722.3	–	5.60	–	–	–	19,309	0.443	56,670	1.301

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



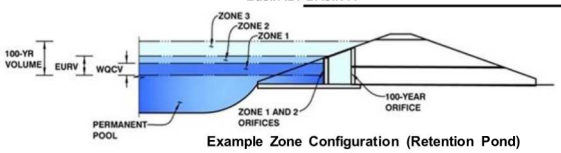


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: TAMLIN ROAD STORAGE YARD

Basin ID: BASIN A



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.27	0.227	Orifice Plate
Zone 2 (EURV)	4.54	0.647	Rectangular Orifice
Zone 3 (100-year)	5.58	0.415	Weir&Pipe (Restrict)
		1.288	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 =	7.917E-03	ft^2
Depth at top of Zone using Orifice Plate =	2.27	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.14	sq. inches (diameter = 1-3/16 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	0.76						
Orifice Area (sq. inches)	1.14	1.14						

	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)

	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.27	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	4.54	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Height =	2.50	N/A	inches
Vertical Orifice Width =	1.25		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.02	N/A	ft^2
Vertical Orifice Centroid =	0.10	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.58	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 =	4.58	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	10.95	N/A	should be $\geq$ 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 =	0.95	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	6.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.58	N/A	ft^2
Outlet Orifice Centroid =	0.32	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.29	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.65	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	60.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.36	feet
Stage at Top of Freeboard =	7.01	feet
Basin Area at Top of Freeboard =	0.44	acres

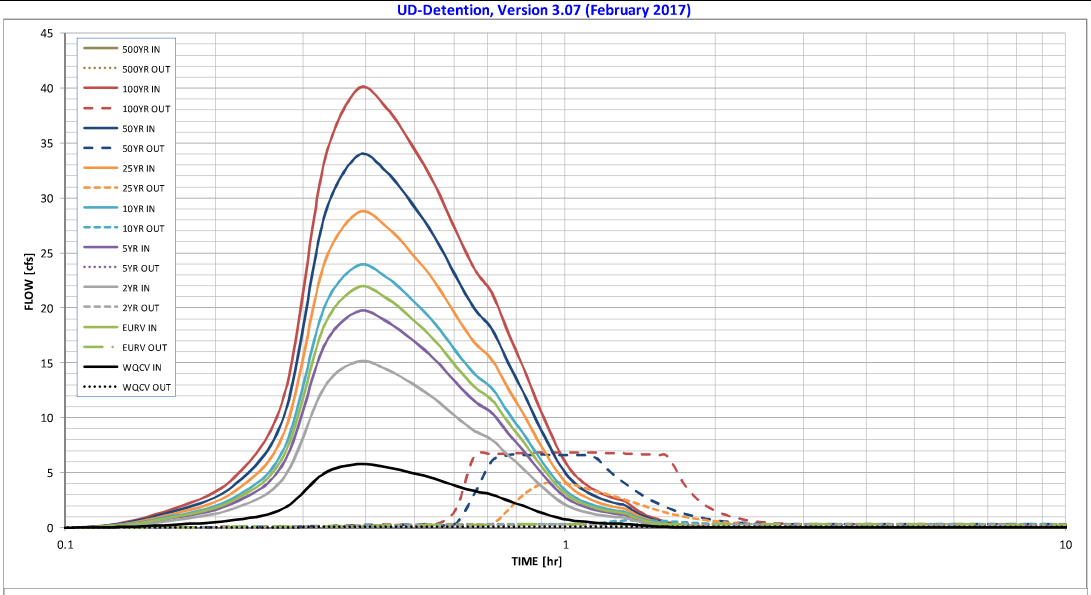
Routed Hydrograph Results

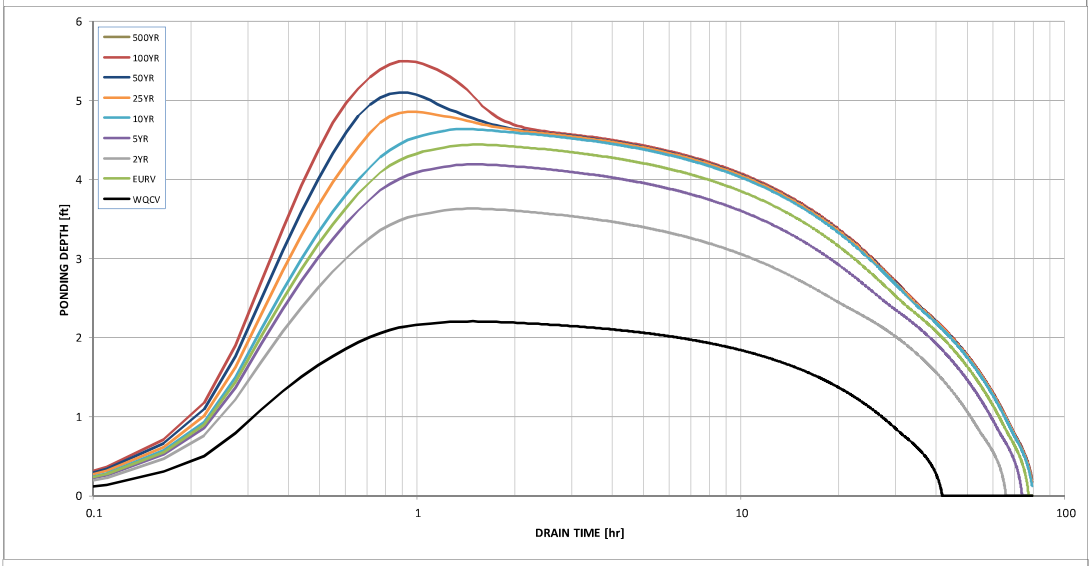
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.227	0.873	0.601	0.785	0.953	1.149	1.359	1.606	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.226	0.872	0.600	0.783	0.952	1.146	1.357	1.603	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.00	0.01	0.02	0.04	0.31	0.74	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.1	0.2	0.4	3.1	7.6	0.0
Peak Inflow Q (cfs) =	5.8	21.9	15.1	19.7	23.8	28.7	33.8	39.9	#N/A
Peak Outflow Q (cfs) =	0.1	0.3	0.3	0.3	0.7	4.1	6.6	6.9	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.5	3.5	9.4	2.1	0.9	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Grate 1	Overflow Grate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.6	1.0	1.0	#N/A
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) =	38	66	57	63	68	67	65	64	#N/A
Time to Drain 99% of Inflow Volume (hours) =	40	72	62	69	74	74	72	72	#N/A
Maximum Ponding Depth (ft) =	2.21	4.44	3.63	4.19	4.64	4.86	5.10	5.50	#N/A
Area at Maximum Ponding Depth (acres) =	0.20	0.36	0.30	0.34	0.37	0.38	0.40	0.43	#N/A
Maximum Volume Stored (acre-ft) =	0.214	0.840	0.574	0.753	0.909	0.992	1.090	1.253	#N/A

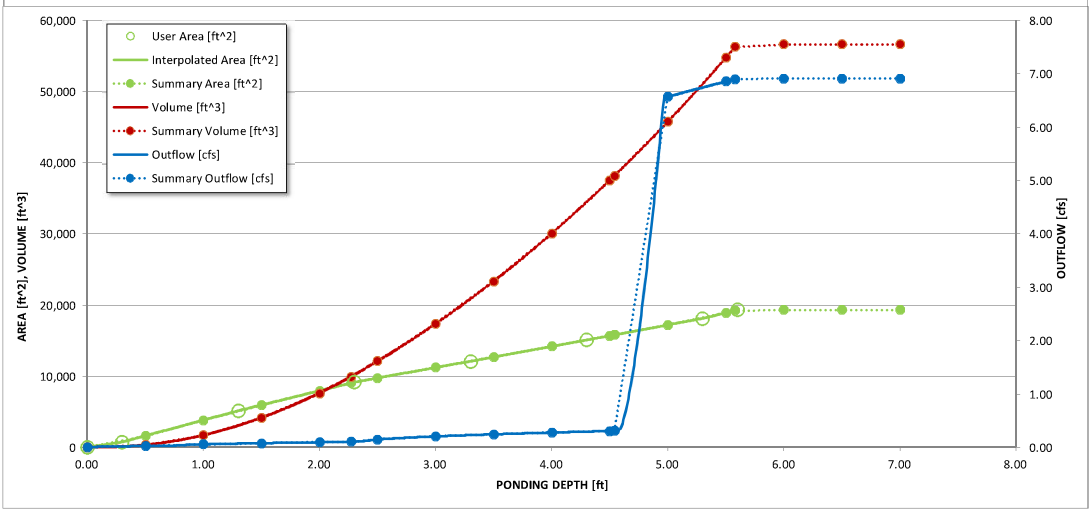
Adjust the design so that the release is equal to or less than pre-development

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.

Time Interval	SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
	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]
3.30 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	0:03:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Hydrograph	0:06:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
Constant	0:09:54	0.26	0.96	0.67	0.87	1.05	1.25	1.47	1.73	#N/A
1.513	0:13:12	0.70	2.60	1.80	2.34	2.83	3.39	4.00	4.70	#N/A
	0:16:30	1.79	6.67	4.63	6.01	7.27	8.72	10.27	12.08	#N/A
	0:19:48	4.92	18.34	12.73	16.52	19.97	23.94	28.20	33.16	#N/A
	0:23:06	5.76	21.86	15.10	19.66	23.84	28.65	33.84	39.90	#N/A
	0:26:24	5.48	20.88	14.41	18.77	22.77	27.39	32.36	38.19	#N/A
	0:29:42	4.99	19.01	13.11	17.09	20.73	24.93	29.46	34.76	#N/A
	0:33:00	4.43	17.00	11.71	15.28	18.55	22.33	26.41	31.18	#N/A
	0:36:18	3.80	14.70	10.10	13.21	16.06	19.35	22.90	27.07	#N/A
	0:39:36	3.32	12.80	8.81	11.50	13.98	16.83	19.91	23.52	#N/A
	0:42:54	3.00	11.60	7.98	10.42	12.67	15.26	18.05	21.33	#N/A
	0:46:12	2.45	9.60	6.58	8.62	10.49	12.66	15.00	17.75	#N/A
	0:49:30	1.98	7.86	5.37	7.05	8.60	10.39	12.33	14.61	#N/A
	0:52:48	1.50	6.08	4.13	5.45	6.66	8.08	9.61	11.42	#N/A
	0:56:06	1.09	4.55	3.07	4.07	5.00	6.08	7.27	8.67	#N/A
	0:59:24	0.80	3.29	2.23	2.94	3.61	4.42	5.30	6.34	#N/A
	1:02:42	0.63	2.54	1.73	2.27	2.78	3.39	4.05	4.83	#N/A
	1:06:00	0.52	2.09	1.42	1.87	2.29	2.78	3.31	3.94	#N/A
	1:09:18	0.44	1.77	1.21	1.59	1.94	2.35	2.80	3.33	#N/A
	1:12:36	0.39	1.55	1.06	1.39	1.70	2.06	2.45	2.92	#N/A
	1:15:54	0.35	1.40	0.95	1.25	1.53	1.85	2.20	2.62	#N/A
	1:19:12	0.33	1.29	0.88	1.15	1.41	1.71	2.03	2.41	#N/A
	1:22:30	0.24	0.94	0.65	0.85	1.03	1.25	1.49	1.77	#N/A
	1:25:48	0.18	0.69	0.47	0.62	0.76	0.92	1.09	1.29	#N/A
	1:29:06	0.13	0.51	0.35	0.46	0.56	0.67	0.80	0.95	#N/A
	1:32:24	0.09	0.38	0.26	0.34	0.41	0.50	0.59	0.70	#N/A
	1:35:42	0.07	0.27	0.18	0.24	0.30	0.36	0.43	0.51	#N/A
	1:39:00	0.05	0.19	0.13	0.17	0.21	0.25	0.30	0.36	#N/A
	1:42:18	0.03	0.14	0.09	0.12	0.15	0.18	0.22	0.26	#N/A
	1:45:36	0.02	0.09	0.06	0.08	0.10	0.12	0.15	0.18	#N/A
	1:48:54	0.01	0.05	0.04	0.05	0.06	0.07	0.09	0.11	#N/A
	1:52:12	0.01	0.03	0.02	0.02	0.03	0.04	0.05	0.06	#N/A
	1:55:30	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	#N/A
	1:58:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:02:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:05:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:08:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:12:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:15:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:18:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:21:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:25:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:28:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:31:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:35:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:38:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:41:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:48:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:51:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:54:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	2:58:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:01:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:04:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:08:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:11:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:14:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:18:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:21:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:24:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:27:54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:31:12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:34:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:37:48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:41:06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:44:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:47:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:51:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:54:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
	3:57:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

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]
	0.00	0	0.000	0	0.000	0.00
	0.50	1,586	0.036	334	0.008	0.03
	1.00	3,785	0.087	1,677	0.039	0.06
	1.50	5,913	0.136	4,113	0.094	0.08
	2.00	7,925	0.182	7,572	0.174	0.10
WQCV	2.27	9,051	0.208	9,949	0.228	0.10
	2.50	9,758	0.224	12,115	0.278	0.15
	3.00	11,224	0.258	17,361	0.399	0.21
	3.50	12,699	0.292	23,340	0.536	0.25
	4.00	14,190	0.326	30,063	0.690	0.28
	4.50	15,692	0.360	37,532	0.862	0.31
EURV	4.54	15,813	0.363	38,162	0.876	0.31
	5.00	17,209	0.395	45,757	1.050	6.57
	5.50	18,912	0.434	54,759	1.257	6.86
100-YEAR	5.58	19,230	0.441	56,285	1.292	6.90
	6.00	19,309	0.443	56,670	1.301	6.91
	6.50	19,309	0.443	56,670	1.301	6.91
	7.00	19,309	0.443	56,670	1.301	6.91

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

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

Stormwater Detention and Infiltration Design Data Sheet

Workbook Protected Worksheet Protected

Stormwater Facility Name: TAMLIN ROAD RV STORAGE - POND A

Facility Location & Jurisdiction: EL PASO COUNTY

User Input: Watershed Characteristics

Watershed Slope =	0.050	ft/ft
Watershed Length =	600	ft
Watershed Area =	10.22	acres
Watershed Imperviousness =	68.0%	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

Location for 1-hr Rainfall Depths (use dropdown): User Input

WQCV Treatment Method = Extended Detention

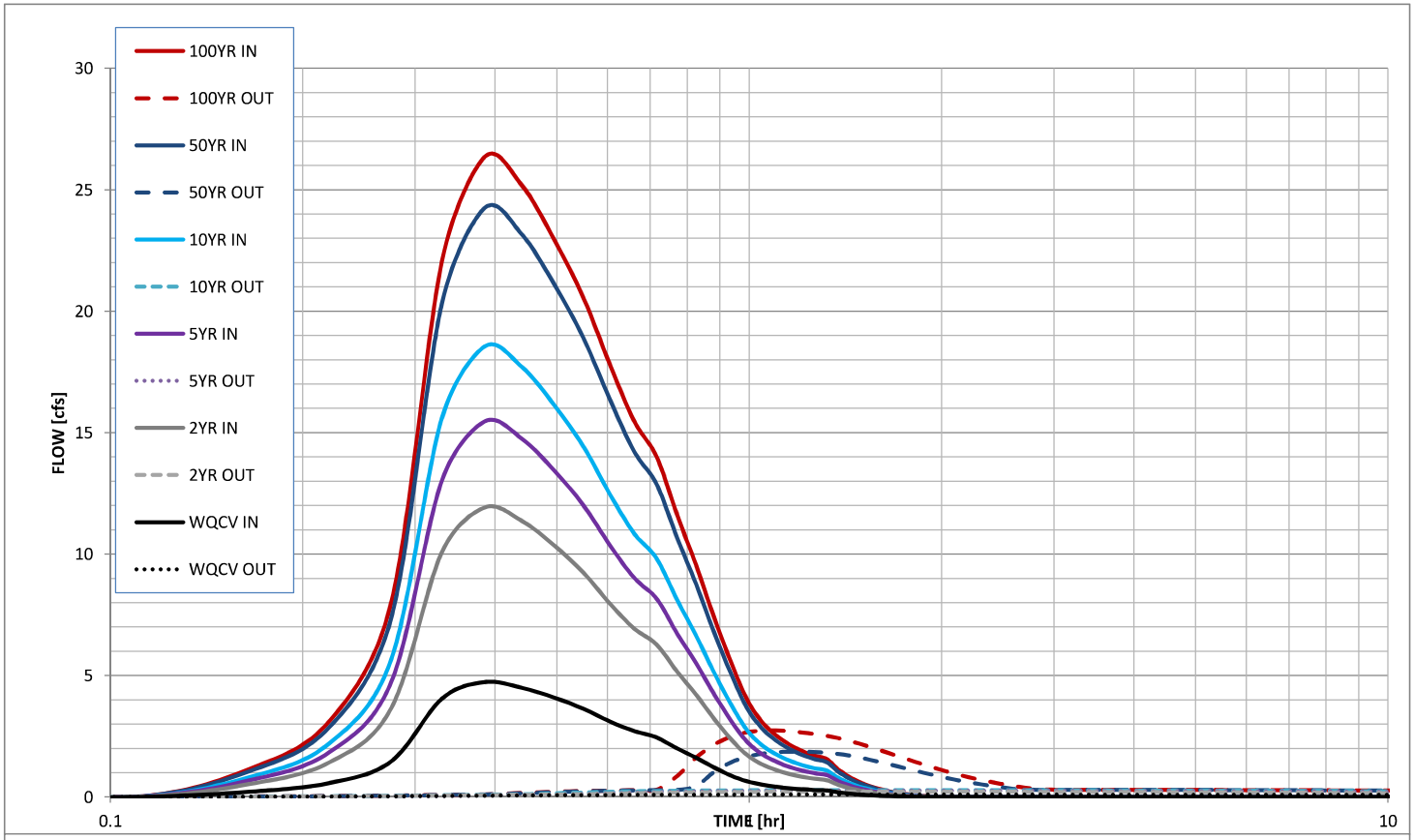
User Defined Stage [ft]	User Defined Area [ft^2]	User Defined Stage [ft]	User Defined Discharge [cfs]
0.00	0	0.00	0.00
0.30	750	0.30	0.02
1.30	5,149	1.30	0.07
2.30	9,172	2.30	0.11
3.30	12,103	3.30	0.23
4.30	15,085	4.30	0.30
5.30	18,119	5.30	6.75
5.60	19,309	5.60	6.91

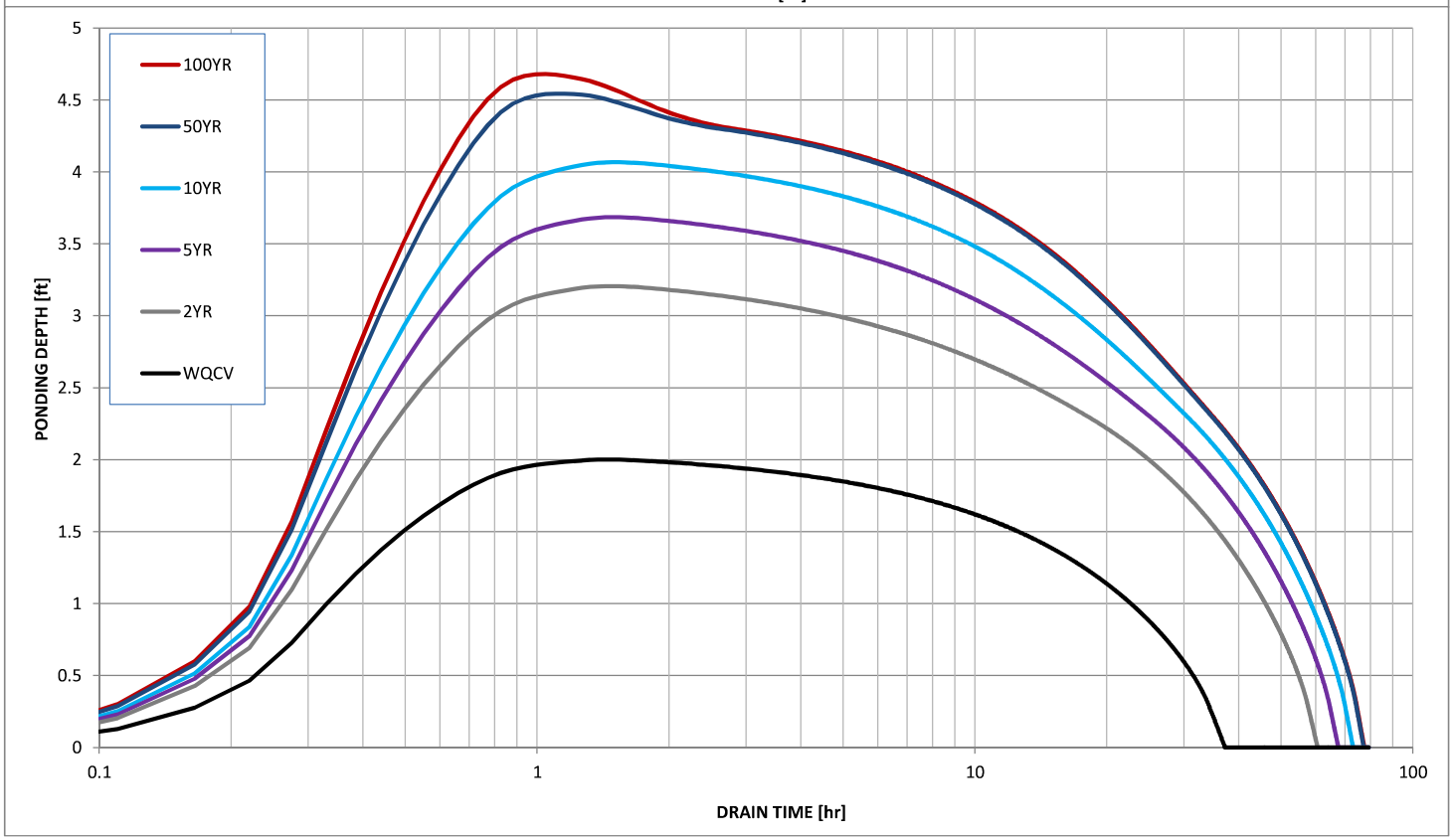
After completing and printing this worksheet to a pdf, go to:
https://maperture.digitaldataservices.com/gvh/?viewer=cswdif
create a new stormwater facility, and
attach the pdf of this worksheet to that record.

Routed Hydrograph Results

Design Storm Return Period =	WQCV	2 Year	5 Year	10 Year	50 Year	100 Year	
One-Hour Rainfall Depth =	1.19	1.50	1.75	2.00	2.25	2.52	in
Calculated Runoff Volume =	0.227	0.758	0.915	1.089	1.359	1.606	acre-ft
OPTIONAL Override Runoff Volume =	0.19	0.47	0.62	0.74	0.97	1.06	acre-ft
Inflow Hydrograph Volume =	0.185	0.473	0.615	0.739	0.970	1.055	acre-ft
Time to Drain 97% of Inflow Volume =	32.6	52.7	**58.3**	62.7	65.1	64.7	hours
Time to Drain 99% of Inflow Volume =	34.6	56.3	62.7	67.6	70.9	**70.8**	hours
Maximum Ponding Depth =	2.00	3.21	3.68	4.07	4.54	4.68	ft
Maximum Ponded Area =	0.18	0.27	0.30	0.33	0.36	**0.37**	acres
Maximum Volume Stored =	0.175	0.451	0.590	0.711	0.875	0.926	acre-ft

Stormwater Detention and Infiltration Design Data Sheet





Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer:	**NICK JOKERST**
Company:	**JR ENGINEERING**
Date:	**January 21, 2020**
Project:	**TAMLIN ROAD RV STORAGE**
Location:	**UNINC. EL PASO COUNTY**

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 68.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.680

C) Contributing Watershed Area — Area = 10.220 ac

D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm — d_6 = 0.42 in

E) Design Concept (Select EURV when also designing for flood control)

Choose One
- ○ Water Quality Capture Volume (WQCV)
- ◉ Excess Urban Runoff Volume (EURV)

F) Design Volume (WQCV) Based on 40-hour Drain Time
($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)

V_{DESIGN} = 0.227 ac-ft

G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume
($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN} / 0.43))$)

$V_{DESIGN\ OTHER}$ = 0.222 ac-ft

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)

$V_{DESIGN\ USER}$ = _____ ac-ft

I) Predominant Watershed NRCS Soil Group

Choose One
- ◉ A
- ○ B
- ○ C / D

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$

EURV = 0.873 ac-f t

2. Basin Shape: Length to Width Ratio
(A basin length to width ratio of at least 2:1 will improve TSS reduction.)

L : W = 0.8 : 1 **INCREASE FLOW PATH FOR 2:1 RATIO**

3. Basin Side Slopes

A) Basin Maximum Side Slopes
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Z = 4.00 ft / ft

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations:

Riprap rundowns down the side slopes of the podn at outfall locations and riprap pads extend into pond bottom.

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	NICK JOKERST
Company:	JR ENGINEERING
Date:	January 21, 2020
Project:	TAMLIN ROAD RV STORAGE
Location:	UNINC. EL PASO COUNTY

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV) — V_{FMIN} = 0.007 ac-ft

B) Actual Forebay Volume — V_F = 0.007 ac-ft

C) Forebay Depth (D_F = 18 inch maximum) — D_F = 15.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 39.90 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 0.80 cfs

E) Forebay Discharge Design

Choose One
- ○ Berm With Pipe
- ◉ Wall with Rect. Notch
- ○ Wall with V-Notch Weir

(flow too small for berm w/ pipe)

F) Discharge Pipe Size (minimum 8-inches) — Calculated D_P = in

G) Rectangular Notch Width — Calculated W_N = 5.1 in

6. Trickle Channel

A) Type of Trickle Channel

Choose One
- ◉ Concrete
- ○ Soft Bottom

F) Slope of Trickle Channel — S = 0.0100 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 21 sq ft

C) Outlet Type

Choose One
- ◉ Orifice Plate
- ○ Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 1.14 inches

E) Total Outlet Area — A_{ot} = 5.41 square inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: NICK JOKERST
Company: JR ENGINEERING
Date: January 21, 2020
Project: TAMLIN ROAD RV STORAGE
Location: UNINC. EL PASO COUNTY

8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 28.9 cu ft
C) Initial Surcharge Provided Above Micropool	V_s = 7.0 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 187 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*S.S. Well Screen with 60% Open Area*
Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 311 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 4.54 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 82.48 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches

Design Procedure Form: Extended Detention Basin (EDB)

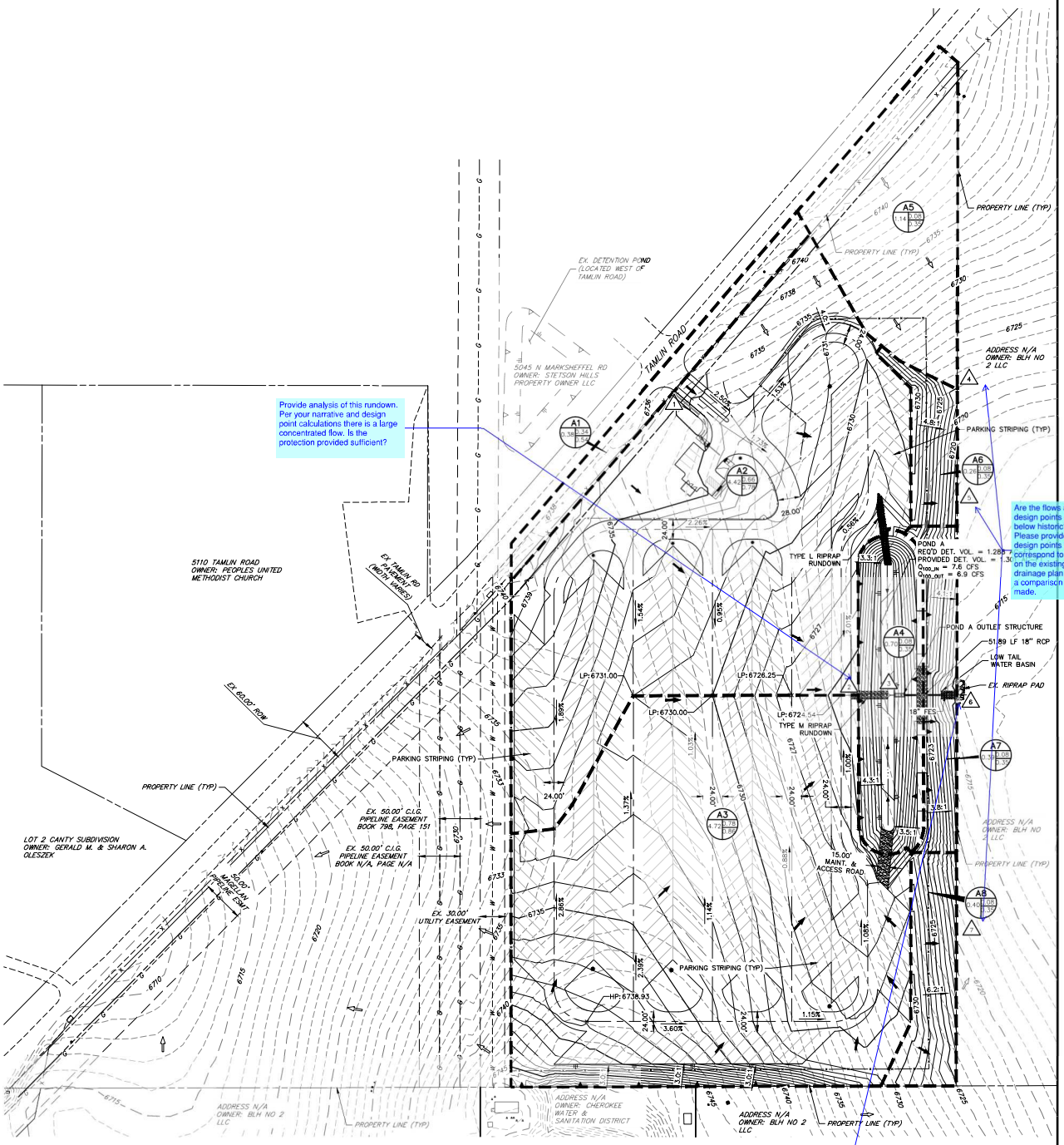
Designer: NICK JOKERST
Company: JR ENGINEERING
Date: January 21, 2020
Project: TAMLIN ROAD RV STORAGE
Location: UNINC. EL PASO COUNTY

10. Overflow Embankment	
A) Describe embankment protection for 100-year and greater overtopping:	24" Deep Type M Soil Riprap overflow weir w/ 1.36' total depth (design flow depth < 0.36') 60' crest width. 4:1 side slopes
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	4.00
11. Vegetation	Choose One: ○ Irrigated ◉ Not Irrigated
12. Access	
A) Describe Sediment Removal Procedures	Pond will be maintaned utilizing skid steer type equipment, trucks (when needed), and hand tools as needed.

Notes:

Appendix F
Drainage Maps

TAMLIN ROAD RV & BOAT STORAGE
PROPOSED DRAINAGE MAP



Provide analysis of this rundown. Per your narrative and design point calculations there is a large concentrated flow. Is the protection provided sufficient?

Are the flows at these design points at or below historic? Please provide design points that correspond to these on the existing drainage plan so that a comparison can be made.

Review 1 comment: The ultimate discharge of the stormwater runoff from the development must be to a suitable outfall. Please analyze the downstream swale/ditch. Is it adequate for the concentrated discharge of the pond? Is any protection/improvements required?

Review 2: unresolved.

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	0.38	32%	0.34	0.54	5.0	0.7	1.8
A2	4.42	68%	0.66	0.78	7.4	13.3	26.5
A3	4.72	81%	0.78	0.86	8.5	16.0	30.0
A4	0.70	0%	0.08	0.35	7.0	0.3	1.9
A5	1.14	4%	0.12	0.38	8.7	0.6	3.1
A6	0.26	0%	0.08	0.35	5.0	0.1	0.8
A7	0.39	0%	0.08	0.35	5.0	0.2	1.2
A8	0.40	0%	0.08	0.35	5.0	0.2	1.2

DESIGN POINT SUMMARY TABLE

Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
1	0.7	1.8
2	29.3	56.7
3	29.5	58.4
4	0.6	3.1
5	0.1	0.8
6	0.2	1.2
7	0.2	1.2

LEGEND

- I.D. — BASIN DESIGNATION (I.D.: BASIN IDENTIFIER; A: BASIN AREA; B: C_5; C: C_{100})
- DESIGN POINT
- BASIN DELINEATION
- EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- EXISTING FLOW DIRECTION
- PROPOSED FLOW DIRECTION

N

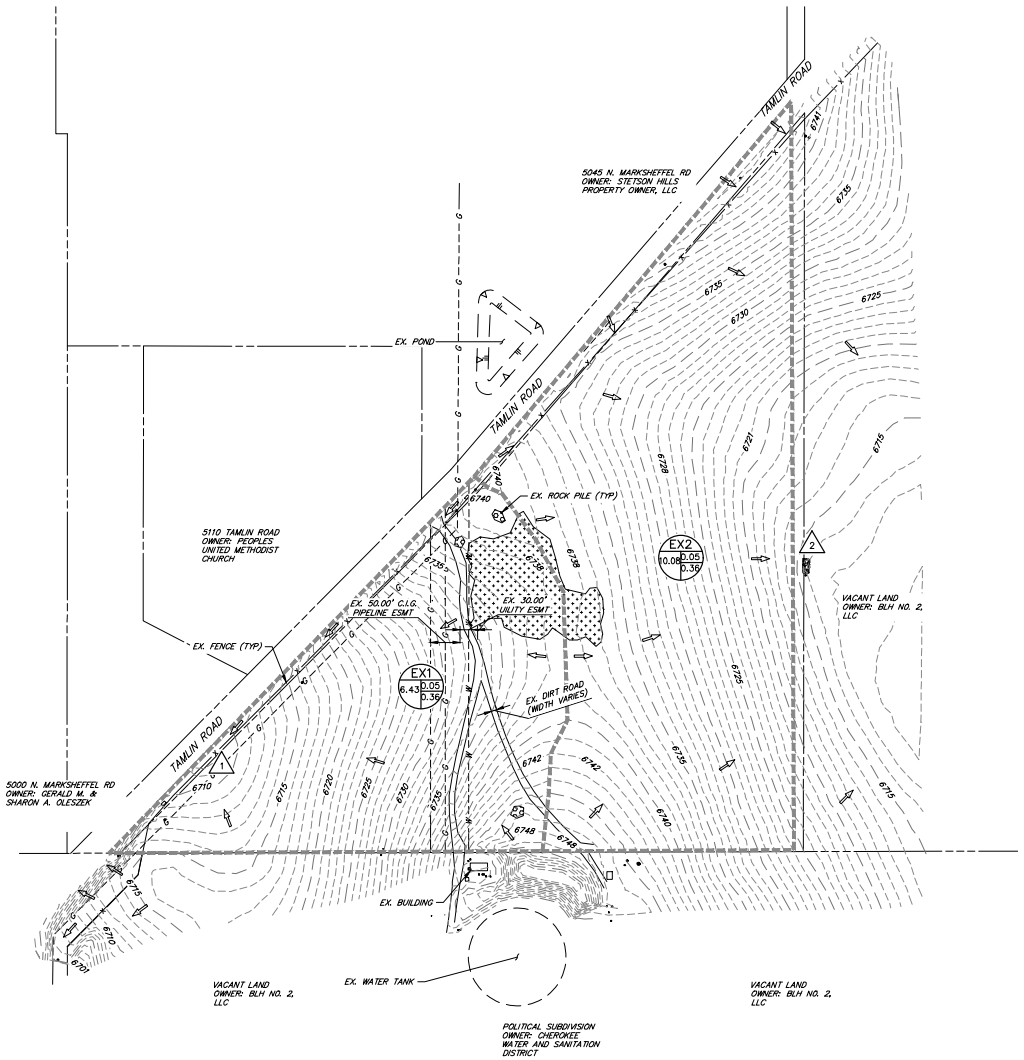
60 30 0 60 120

ORIGINAL SCALE: 1" = 60'

TAMLIN ROAD RV & BOAT STORAGE
DRAINAGE MAP
25134.00
01/17/2020
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

TAMLIN ROAD RV & BOAT STORAGE
EXISTING DRAINAGE MAP



LEGEND

- I.D. (A / B / C) — BASIN DESIGNATION
  - I.D.: BASIN IDENTIFIER
  - A: BASIN AREA
  - B: C_5
  - C: C_{100}
- X — DESIGN POINT
- BASIN DELINEATION
- 6100 — EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 6100 — PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- EXISTING FLOW DIRECTION

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX1	6.43	2%	0.05	0.36	13.4	1.2	14.3
EX2	10.08	2%	0.05	0.36	15.4	1.8	21.2

DESIGN POINT SUMMARY TABLE

Tributary Sub-basin	Q_5 (cfs)	Q_{100} (cfs)
1	1.2	14.3
2	1.8	21.2

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

TAMLIN ROAD RV & BOAT STORAGE
EX. DRAINAGE MAP
2513400
01/20/2020
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com