FINAL DRAINAGE REPORT

FOR

FALCON DISTRICT 49 TRANSPORTATION FACILITY, FALCON, CO

Owner: RTA Architects, 19 South Tejon St, Suite 300, Colorado Springs, CO. 80903.

Engineer: JVA, Inc.
1319 Spruce Street
Boulder, CO 80301
Attn. Cooper W. Karsh
(303)565-4961

May 23, 2022
Revised September 20, 2022

Engineer of Record:

Cooper W. Karsh P.E.
Registered Professional Engineer
State of Colorado No.

Add PPR2236

JVA, Incorporated
1319 Spruce Street
Boulder, CO 80302
Ph: 303.444.1951
Fax: 303.444.1957
Toll Free: 877.444.1951
Web site: www.jvajva.com
E-mail: info@jvajva.com

Design 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 the County for drainage reports and said report is in conformity with the applicable 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.

Cooper Karsh, PE, CFM PE #50723 Date

Owner/Developer's Statement:

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

9/22/22 09:40 EDT

Lou Fletcher, Executive Director Date

El Paso County School District 49

10850 E. Woodmen Rd. Peyton, CO 80831

El Paso County:

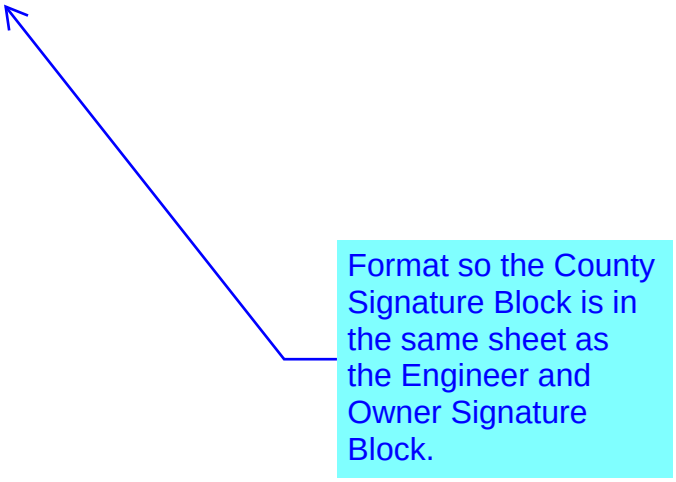
Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code as amended.

_____ _____

Joshua Palmer, P.E. Date

County Engineer / ECM Administrator

Conditions:



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A. GENERAL LOCATION AND DESCRIPTION

1. Location

District 49 (D49) Transportation Centre is in Falcon at 12050 Falcon Highway. The subject site is located east of Meridian Road, west of Chief Road and south of Highway 24.

The site is bound by Saint Benedict Church to the east, residential homes to the west and Highway 24 to the north. The site is in the jurisdiction of El Paso County. The property is accessed at two locations: via Falcon Highway south of the subject site and Swingline Road, north of the site. Refer to Figure 1 for the site location.

The subject site is in the Falcon CHWS1400 drainage basin. There is an existing creek which runs in a north-south direction, along the western boundary of the site and parallel to Gelbvieh Road.

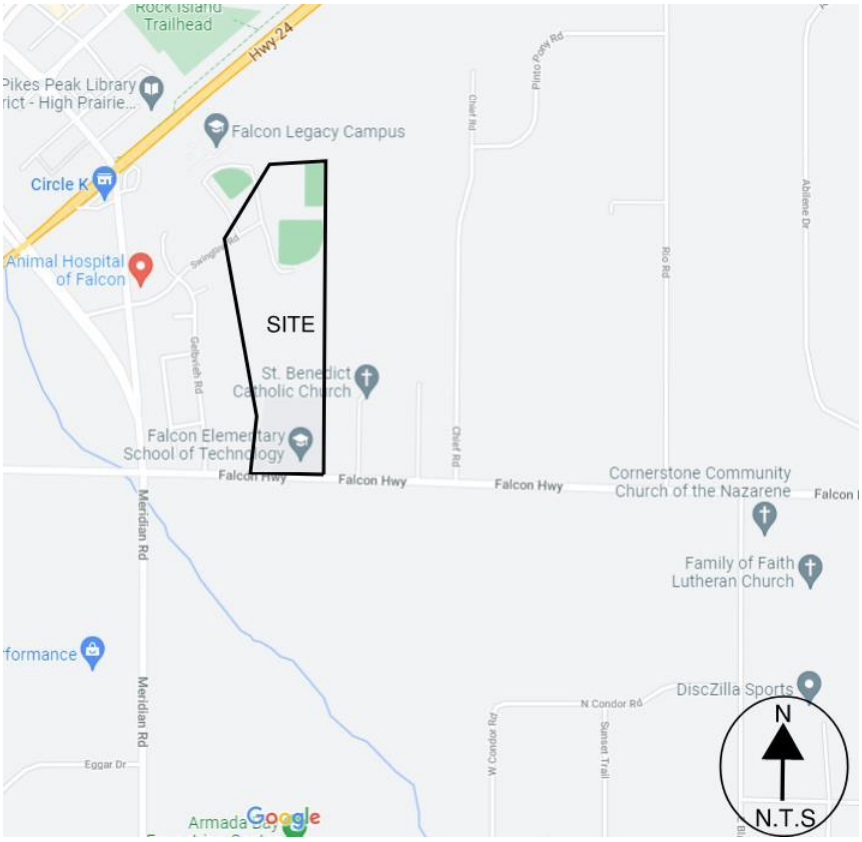

Figure 1- Site Location Map (Google © 2022 Imagery)

2. Description of Existing Site

The existing development site area is 30.51 acres and approximately 25% of impermeable surfaces. The site comprises of an elementary school building, a running track with granular finish, a baseball field and a maintenance yard building.

The site generally falls in a north-south direction, from an existing elevation of 6,820 ft northwest of the site to 6,782 ft southwest of the site. This fall in elevation is over 2,714 ft in length or 1.4% in gradient. An internal gravel access road within the site acts as catchment

divide with one basin discharging in a south easterly direction and a second in a south westerly direction. Refer to the JVA General Location Map drawing which shows Basin H-1 discharging into a local depression, Basins H-2 & H3 discharging into a wetland on-site.

The site is covered with soils found in hydrologic soil group A.

There is an existing creek which runs along the western boundary of the site which is a tributary to the Black Squirrel Creek and forms part of the Falcon CHWS1400 drainage basin. Refer to Appendix A which shows the site on El Paso Drainage Basins Map, extract from the Muller Engineering Company (1988).

Refer to the JVA Existing Condition Drainage Map drawing for the existing development and site boundary.

B. DRAINAGE BASINS AND SUB-BASINS

1. Major Basin Description

D49 Transportation Centre lies in the Falcon CHWS1400 drainage basin and a review of the Falcon Drainage Basin Planning Study (DBPS) – Final, dated September 2015 was carried out. The main findings were:

- The Falcon watershed flows southeasterly from the southern slope of the Black Forest. The subject site is in the Middle Tributary Basin as shown on Figure 3-2 of the Falcon DBPS report.
- Figure 2-1 Environmental Features from the Falcon DBPS indicates that the subject site lies outside of the shallow (greater than 20 ft below surface) ground water area.

The project is located within FEMA flood map number 08041C0561G effective July 12, 2018. Part of the site is located within Zone AE, which is defined by FEMA as areas predicted to be in special flood hazard zone with base flood elevations determined. Note, the FEMA maps display information on a larger scale. A survey was commissioned to plot the predicted flooding Zone AE on the subject site boundary and this information is available in Appendix C. There are no proposed structures within the predicted flooding Zone AE. Refer to the JVA Grading & Drainage Plan drawings for further information.

There are limited irrigation facilities on site. There are no encumbrances that will impact the proposed development.

2. Existing Sub-basin Description

D49 Transportation Centre is split into three drainage catchments. An internal gravel access road within the site acts as catchment divide with one basin discharging in a south easterly direction and the remaining basins in a south westerly direction. Refer to the JVA Existing Condition Drainage map which shows Basin H-1 discharging into a local depression and Basins H-2 & H-3 discharging into a wetland on-site.

The basin in the northeast portion of the site includes gravel parking areas, gravel and grass fields and four existing small buildings. The basin drains to the existing surface depression southeast of the baseball field via overland sheet flows. This existing surface depression is

not connect
the ground.

The basins i
existing bui
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Creek.

The propert
the property
basin consists of 2.75 acres of landscape and 4.55 acres of impermeable surfaces. Runoff from this basin will be intercepted at the property boundary and diverted to discharge into the creek running along the western boundary of the site.

Describe the minor/major flow rates calculated for each basin.

For each basindescribe where they discharge. Example: For basin A3 you should note runoff from this basin is collected by an inlet and conveyed by stormdrain system into the proposed EDB pond for WQ and Detention. Or Basin A4 runoff sheet flow into a proposed swale and routed into the proposed EDB pond for WQ and detention.

Based on the drainage design WQ and detention is required when basin A1 develops during phase 2.

Update description to describe WQ and detention requirements for this during phase 2 and state that drainage report is required with phase 2 for the final design of the WQ/Detention facility.

wn on the JVA drawing

ng OS1, OS2 and OS3.
Squirrel Creek. OS1 is
t to the property. OS1 comprises of existing buildings' roofs (Falcon Legacy Campus), grass fields, asphalt road and parking lots. OS2 is located west of the proposed building on site. OS2 comprises of the existing roundabout, asphalt road and grass swale. OS3 is the Falcon Elementary School of Technology, south of the proposed redevelopment. OS3 comprises of existing buildings' roofs, grass fields, gravel access, concrete surface, asphalt road and parking lots.

The remaining eight sub-basins include the following:

- Basin A1 is a future buildout as part of Phase 2. The basin is located north of the proposed building and comprises of soft and hard surfaces equivalent to 80% impervious.
- Basin A2 is an existing wetland west of the proposed detention basin. The basin is covered by vegetation.
- Basin A3 is the proposed bus lot east and half of the proposed building's roof.
- Basin A4 is the existing workshop. It is located southwest of the proposed building. The basin mainly comprises of existing buildings and gravel surface.
- Basin A5 is half of the proposed building and staff car parking lot. It comprises of roofs, concrete and gravel surfaces.
- Basin A6 is located south of the proposed building and is mainly a gravel yard with a concrete base to store fuel on site.
- Basin A7 is the proposed detention basin and a gravel access road east of the basin.
- Basin A8 is the proposed staff parking lot and access, adjacent to the elementary school.

plain why basin A2
es not drain into a
manent WQ
lity. See ECM
1.B for exclusions
n permanent WQ.
his is intended to
undeveloped land
t will remain
leveloped then
e as such.

See review #1 comment to the site plan and Traffic Study. This needs to be asphalt paving if the projected ADT is 200 trips.

Basin A2 includes a portion of the proposed roadways, therefore it does not qualify for ECM Exclusion I.7.1.B. Runoff from the roadways will need to be treated prior to discharge to the wetland.

Unresolved Review 1 Comment:
- Use the IDF values from the City of Colorado Springs Drainage Criteria Manual Vol 1, May 2014. The County adopted this criteria and therefore the IDF values from Chapter 6 should be used.

C. DRAINAGE DESIGN CRITERIA

1. Development Criteria Reference

- El Paso County Colorado Drainage Criteria Manual.
- Falcon Drainage Basin Planning Study – Selected Plan Report – Final – September 2015.
- Intensity, Duration, Frequency (IDF) values for the 2-year, 5-year, 10-year & 100-year from the NOAA Atlas for Falcon were used for the analysis for the site. Note, Chapter 6 of the El Paso County Colorado Drainage Criteria Manual calls for the use of NOAA Atlas map depending on the location of the project. A copy of the IDF data is provided in Appendix B.

2. Previous Drainage Studies

D49 Transportation Centre lies in the Falcon CHWS1400 drainage basin and a review of the Falcon Drainage Basin Planning Study (DBPS) – Final, dated September 2015 was carried out. The proposed site layout takes cognizance of the findings of the above-named report.

3. Floodplain Analysis

Proposed structures and access are located outside of the predicted flooding Zone AE. In addition, proposed finished elevations are above base flood zone elevations in the vicinity. Note, the survey information shown on our layouts was created based on a local adjacent site datum. The adjacent base flood elevation of 6808 is shown in NAVD88. Per surveyor, 3.8 ft must be added to the survey elevations to convert from the local datum to navd88. Therefore, the building's finished floor elevation is approximately 3.8 ft above 100-year flood elevation. The proposed Maintenance Building is located approximately 220 ft away from the predicted flooding zone. Refer to the JVA Grading & Drainage Plan drawing which shows outline of the predicted flooding Zone AE and the proposed site layout, outside of this zone. No significant disturbance within the floodplain is anticipated with this project.

4. Hydrologic Criteria

Rainfall data and intensity values were determined using the criteria in El Paso County Drainage Criteria Manual and the Mile High Flood District Urban Storm Drainage Criteria Manual (USDCM). Intensity, Duration, Frequency (IDF) values for the 2, 5, 10 & 100-year events from NOAA Atlas for the subject site location were utilized for the analysis. A copy of IDF data is provided in Appendix B. Output calculation spreadsheets are also provided in Appendix B.

The Rational Method (Q=CIA) was used to determine the storm runoff (Q) from the areas tributary to the proposed storm system, with composite runoff coefficients (C) and contributing areas (A) given for design points in sub-basins. Rainfall, basin coefficients, and other calculated site characteristics are shown in Appendix B.

The design frequencies are the 10- and 100-year events for the minor and major storms respectively. The 10-year storm with a 1-hour point rainfall of 1.48 inches and the 100-year storm, with a 1-hour point rainfall of 2.5 inches were used.

Detention volume was obtained by calculating the required volume of storage using the Mile High Flood District (MHFD) detention design V4.06 in line with El Paso County drainage requirements. WQCV was determined using total imperviousness ratio and watershed inches

Unresolved Review 1 Comment:
- County criteria requires the minor design storm to be designed up to the 5-year event. It seems you are designing up to the 10-year event therefore in the narrative state that you are aware and the reason for designing to the 10-year event instead of the 5-year.

from Figure EDB-2. The proposed detention basin is an extended 40-hour drain time. A full WQCV is provided for the minor storm and half for the major storm. The Rational Formula and C-values based on the El Paso County Colorado Drainage Criteria Manual were used to estimate storage requirements. The proposed detention basin is also designed to accommodate future phases of the development. Output calculation spreadsheets are provided in Appendix B.

D. DRAINAGE FACILITY DESIGN

1. General Concept

The proposed development has been designed to meet the requirements of El Paso County Drainage Criteria Manual. Off-site flow analysis was carried out for the fully developed conditions. The hydrologic analysis was based on existing site characteristics as the site is fully developed. The off-site area forms part of the Falcon major drainage basin. A [illegible] of the proposed works, runoff from this basin will be intercepted at the property bou diverted to discharge into the creek running along the western boundary of the si the JVA drawing Proposed Drainage Plan which shows off-site drainage diversio discharge into the creek.

The proposed development includes the construction of a maintenance building, access road and car parking equivalent to 21.8acres on a 30.45-acre site. The pro development will also include the construction of a new detention basin as part o proposed drainage system. The proposed works form part of a phased developme the Architect drawings and report for an outline of the phased works. Runoff fro will be collected through a series of inlets and swales. Onsite run off will be rout detention basin which will provide attenuation and water quality enhancement. C from the detention basin will discharge onto the existing creek running along the boundary of the site. The onsite detention basin will treat rainfall runoff for wate provide attenuation for most of the site. Storm discharges from the detention basi with El Paso County criteria for allowable release rates. The detention basin is designed to cater for the future development as part of phased works. Due to site constraints including site elevation, storm runoff from the developed southern portion of the site equivalent to 8.7 acres will not be routed to the new detention basin but to a grass buffer to provide water quality. Refer to Appendix B for a copy of UD-BMP design sheet for this area.

Identify the specific basin where grass buffer is being used.

The narrative is not consistent with the design procedure form. The south staff car park (basin A8) is 1.02 acres while the description noted 8.7 acres. Provide an exhibit showing the grass buffer area and the tributary area.

Soils on the property have been classified by the Natural Resources Conservation Service (NRCS) as hydrologic soil type 'A'. Group A soils are described as soil with high infiltration rate and low runoff potential. Appendix A of this report provides more information on the soil type, report obtained from the NRCS.

Part of the site area is located within Zone AE of the FEMA flood map number 08041C0561G effective July 12, 2018. Zone AE is defined by FEMA as areas determined to be in special flood hazard zone with base flood elevations determined. The proposed site layout is located outside of this zone. The proposed maintenance building is located 220 ft away from the flooding zone. The subject site is in the Falcon CHWS1400 drainage basin, see Figure 2 and Appendix A for further information.

provide runoff reduction calculations for proposed grass buffer

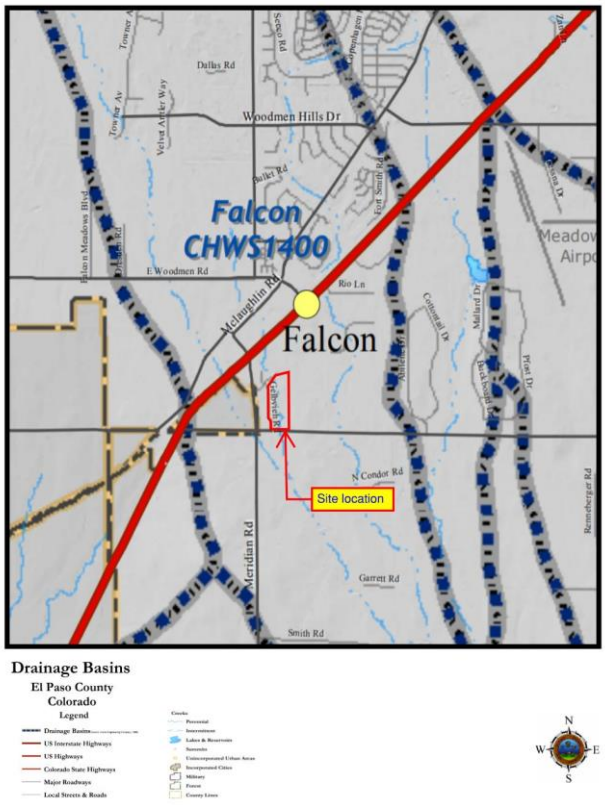

Figure 2 - Subject Site's Major Basin - Source Falcon Drainage Basin Planning Study report

The existing site is comprised of three basins designated as Basins H-1, H-2 and H-3. Basin H-1 consists of a baseball field with gravel and grass finish, limited amount of concrete finish, series of small buildings and a maintenance yard. Drainage from this basin sheet flows north to south-east at 1.3% gradient to discharge into a local depression within the site boundary. Basin H-2 consists of a running track with gravel and grass finish, limited amount of asphalt finish. Drainage from this basin sheet flows north to south-west at 10% gradient to discharge into the creek within the site boundary. Basin H-3 is the existing elementary school, consisting of existing buildings, landscape, access and car park. Pre-development runoff calculations are shown in Appendix B.

The proposed development will have three number of off-site basins as described in B.3. Off-site developed runoff calculations are shown in Appendix B.

The proposed works form part of a phased development. The first phase consists of the construction of a maintenance building, an internal access road and car parking equivalent to 8.5 acres. The proposed development as part of the first phase will also include the construction of a new detention basin as part of the proposed drainage system. Storm runoff will be collected via series of inlets and swales to be conveyed into the new pond using below

ground pipework system. Overflow from the detention basin will discharge into the existing creek running along the western boundary of the site. Post-development runoff including future phases calculations are shown in Appendix B.

Detention volume requirements for the project and future expansion were calculated using the MHFD detention sizing. The proposed detention basin is designed as an extended detention basin with 40-hour drain time for the WQCV. WQCV was determined using total imperviousness ratio and watershed inches from Figure EDB-2 of the El Paso County Drainage Criteria Manual. The allowable discharge rates are equal to the historic runoff rates. Top water elevation in the pond for the 100-year storm is is 6,794.90. Detailed calculations for the detention volumes are provided in Appendix B of this report.

down gradient. WQ is still required. Consider runoff reduction or a small pond, sand filter basin, rain garden, etc.

2. Specific Details

Runoff from the new car park south of the detention basin will be treated prior to release into the wetland. Due to site constrain this area equivalent to 1.02 ac is too low to discharge into the detention basin. Therefore, a BMP such as grass buffer is provided.

Storm system east of the proposed building is designed to overflow into the adjacent swale during extreme events. The swale is designed to accommodate runoff from the site for storms up to and including the 100-year return period. Please refer to Appendix B for a copy of the swale calc

Descriptic
this report

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Add a section for Drainage Fee.
- Identify which basin the site is located in and state that drainage and bridge fees are not assessed with site development plan application.

Unresolved. Add Subsection

"3. Drainage Fee.
The project is located within the Falcon Drainage Basin which is a part of the El Paso County Drainage Fee program. However, no drainage and bridge are assessed with site development plan application."

The stormwater detention pond facility and all its components will be constructed by the Applicant in accordance with the plans and specifications described in this report and Final Construction Plans. The storm drain system and detention facilities are private and will remain private. Maintenance of the storm infrastructure will be carried out by School District 49. The detention pond and its outlet structure will operate and be maintained in good working order and as directed by El Paso County. It is our understanding that all drainage fees are waived as part of the proposed development and will not be assessed with this application. The detention pond and its outlet structure will be inspected quarterly and after any significant rainfall during the first years of operation. Inspection and maintenance will be carried out by the Operation Crew on-site. At any time during the inspections appropriate means will be selected to clean and maintain the facility to its intended working order. The Post-Construction Stormwater Control Operations and Maintenance Agreement entered by the Applicant and El Paso County shall constitute a contract or as directed by El Paso County.

E. CONCLUSION

The above drainage reports have been prepared in accordance with the El Paso County Drainage Criteria Manual.

1. Summary of Concept

- The site is protected from adverse stormwater drainage impacts to the maximum extent possible.
- Measures are proposed to provide adequate on-site drainage and enhancement to stormwater quality. Stormwater quality is provided through extended detention basin.
- The proposed development has no effect on adjacent, upstream, and downstream sites.

Show the "Four-Step Process" for selecting structural BMPs (ECM Section I.7.2 BMP Selection). Under each step, summarize how the step was considered or implemented.
unresolved.

F. REFERENCES

- "El Paso County Drainage Criteria Manual," October 2018.
- "Urban Storm Drainage Criteria Manual," Urban Drainage and Flood Control District, Revised 2018.
- Point Precipitation Frequency Estimates, NOAA National Weather Service. Online at https://hdsc.nws.noaa.gov, accessed February 2022.
- FEMA Flood Map Service Center. Online at https://msc.fema.gov/portal, accessed February 2022.
- Web Soil Survey, Natural Resources Conservation Service, United States Department of Agriculture. Online at: http://websoilsurvey.nrcs.usda.gov, accessed February 2022.

Appendix A - FEMA Floodplain Map Information

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, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

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.

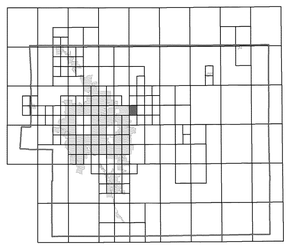
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this 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

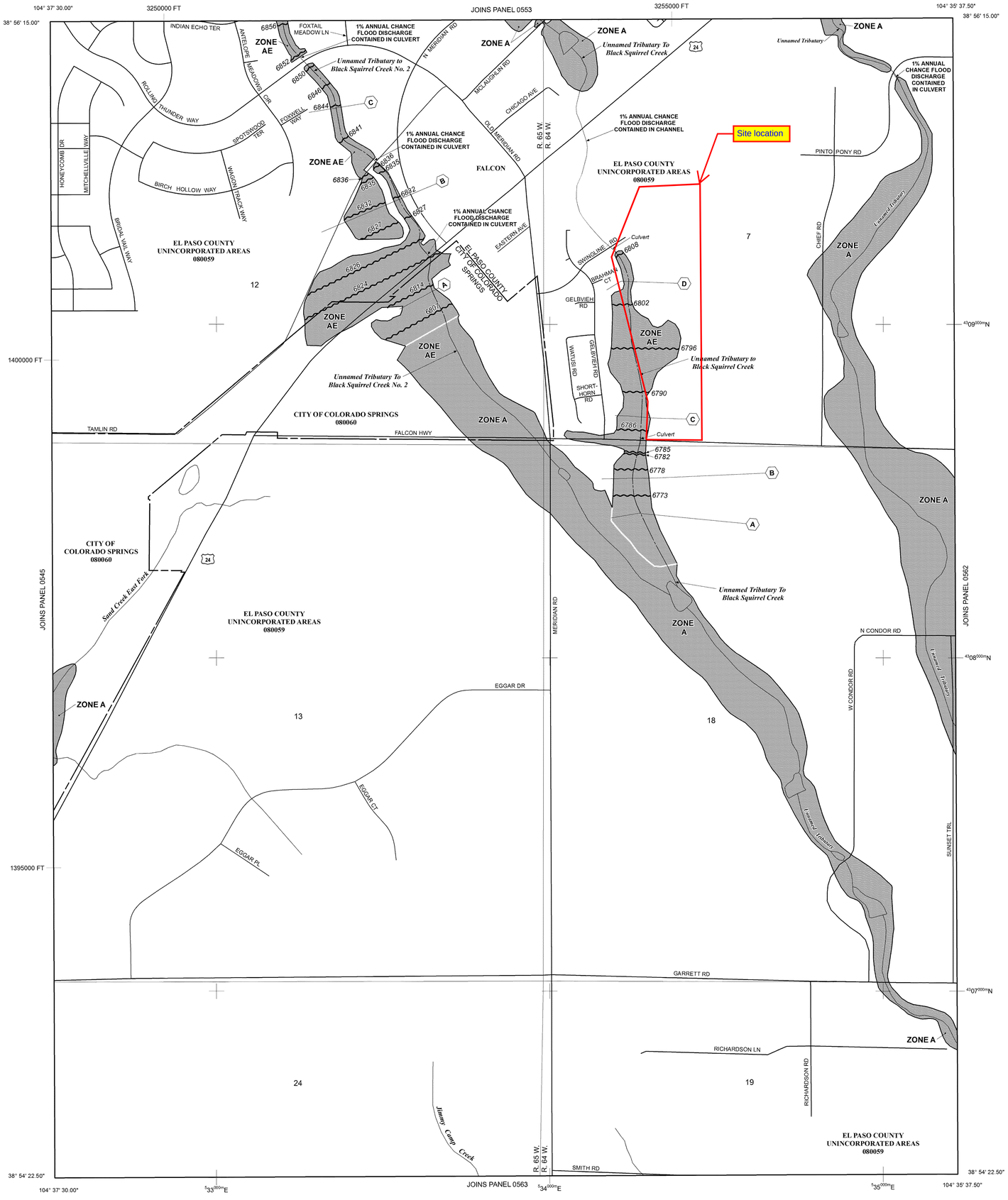
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

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 64 WEST, AND 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)
4275000mN 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
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0561G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 561 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0561	G
EL PASO COUNTY	080059	0561	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
08041C0561G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

Appendix A - Drainage Basins El Paso County , Co.

Drainage Basins

El Paso County
Colorado

Legend

- Drainage Basins Source: Muller Engineering Company (1988)
- US Interstate Highways
- US Highways
- Colorado State Highways
- Major Roadways
- Local Streets & Roads

Creeks

- Perennial
- Intermittent
- Lakes & Reservoirs
- Summits
- Unincorporated Urban Areas
- Incorporated Cities
- Military
- Forest
- County Lines

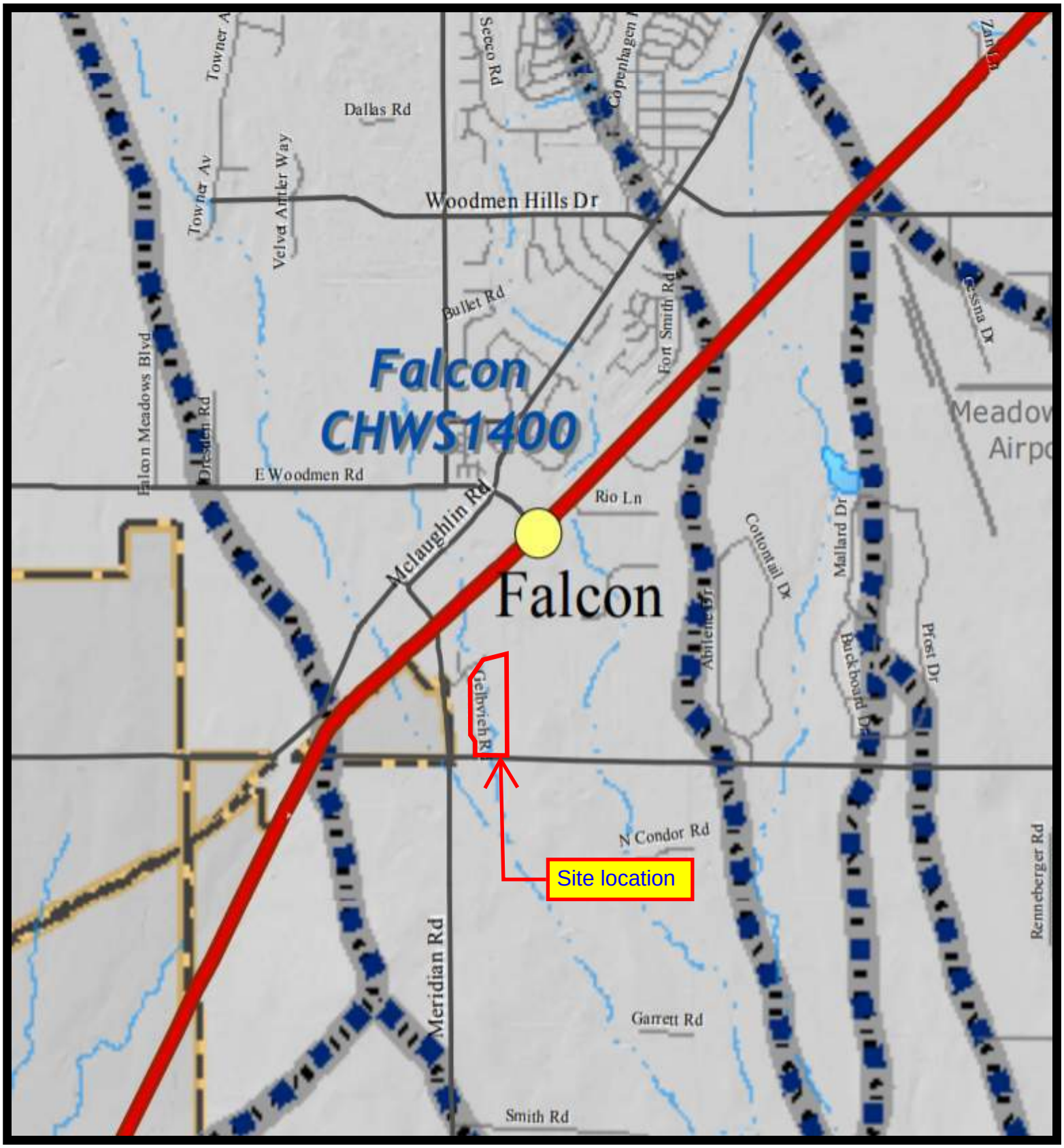
N W E S

Miles

0 0.5 1 2 3 4 5

Douglas County
Elbert County
Teller County
Lincoln County
Fremont County
Pueblo County

Upper Monument Creek FOMO5800
Monument Rock FOMO5000
Dirty Woman Creek FOMO5200
West Cherry Creek CYCY0400
East Cherry Creek CYCY0200
West Kiowa Creek KIKI0200
East Kiowa Creek KIKI0400
Bijou Creek BIBI0200
Upper Big Sandy Creek BGBG1400
Lenard BGBG1200
Antelope Creek BGBG0800
Simla BGBG0400
Ramah BGBG0600
Calhan BGBG1000
Mustang Creek BGBG0200
Jackson Creek FOMO4400
Black Forest FOMO4200
Black Squirrel Creek FOMO3600
Monument Branch FOMO3800
Beaver Creek FOMO4600
Pike National Forest
Air Force Academy FOMO3200
USAF Academy
Kettle Creek FOMO3000
Upper Black Squirrel CHBS2000
Upper Bracket Creek CHBR0600
North Fork HOHO0400
Peyton
Bennett Ranch CHWS1200
Geick Ranch CHMS0400
La Vega Ranch CHBR0400
Horse Creek HOHO0600
Hook And Line Ranch CHBS1800
Falcon CHWS1400
Falcon
Baggett CHBR0200
Little Horse Creek HOHO0200
Steels Fork HOPO1000
Cottonwood Creek FOMO2200
Pine Creek FOMO2800
South Pine Creek FOMO2600
Dry Creek FOMO2400
Crystola
Upper Fountain FOFO7600
Cheyenne Canon FOFO5800
Douglas Creek FOMO1000
Templeton Gap FOMO1200
Cascade
Williams Canyon FOFO7200
Manitou Reservoir FOFO7400
MANITOU SPRINGS
COLORADO SPRINGS
Shooks Run FOFO4400
Sand Creek FOFO4000
Solbers Ranch CHWS0800
Haegler Ranch CHMS0200
Curtis Ranch CHWS1000
West Big Springs Creek CHBG0200
Upper Big Springs Creek CHBG0400
Rush HOPO0800
Livestock Company CHWS0400
West Squirrel CHWS0600
Ellicott
Yoder
Rush
Ellicott CHBS1600
Lower Big Springs Creek CHBS1400
Telephone Exchange CHWS0200
Ellicott Consolidated CHBS1200
Upper Pond Creek HOPO0600
Lower Pond Creek HOPO0400
Ruxton Creek FOFO7000
Upper Beaver Creek BEBE0400
Sutherland Creek FOFO6400
Bear Creek FOFO4800
Spring Creek FOFO4200
Peterson AFB
Peterson Field FOFO3400
Municipal Airport
Jimmy Camp Creek FOFO2000
Upper East Chico CHEC0400
Schriever AFB
AFA Aux Field
Crows Roost CHBS1000
Drennan CHDS0400
Middle East Chico CHEC0200
Truckton
Windmill Gulch FOFO3000
Fishers Canyon FOFO3600
Southwest Area FOFO4600
Pike National Forest
Big Johnson FOFO2600
Upper Williams Creek FOWI0600
Upper Chico Creek CHCH1600
Upper Dry Squirrel CHDS0200
Haynes Creek HAHA0600
St.lukes HOPO0200
Lower Black Squirrel CHBS0600
Squirrel Creek CHBS0200
Fort Carson FOFO2200
Little Fountain Creek FOFO1800
Upper Williams Tributary FOWI0400
West Chico Tributary CHCH1200
Chico Creek CHCH1400
Calhan Reservoir FOFO1400
FOUNTAIN
Fort Carson
Lower Williams Creek FOFO1000
Lower Williams Tributary FOWI0200
Sand Canyon FOFO1600
Lower Dry Squirrel CHDS0400
Lower East Chico CHCH0800
East Kramer KRKR0600
Kramer Creek KRKR0400
East Haynes HAHA0400
Turkey Creek TUTU0200
Hammer Ranch CHCH0600
Finch Ranch CHCH0400
Windmill CHCH0200
West Haynes HAHA0200
West Kramer KRKR0200
Sand Creek FOFO0600
Williams Ranch FOFO0400
Midway Ranch FOFO0800
Red Creek BEBE0200
West Chico Creek CHCH0600
Young Hollow FOFO0200



Drainage Basins

El Paso County
Colorado

Legend

- Drainage Basins
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- Major Roadways
- Local Streets & Roads

Creeks

- Perennial
- Intermittent
- Lakes & Reservoirs
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- Unincorporated Urban Areas
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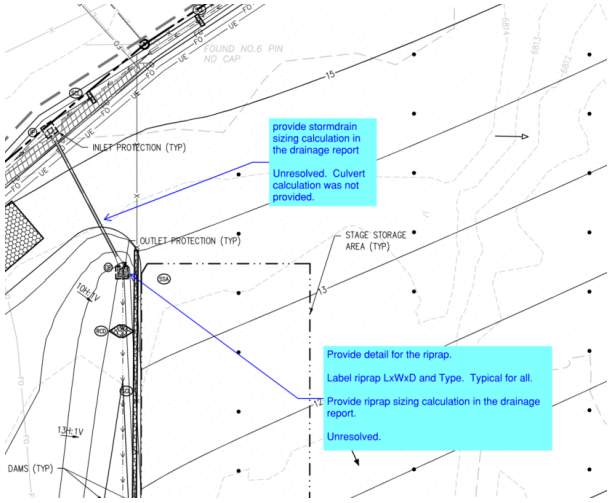
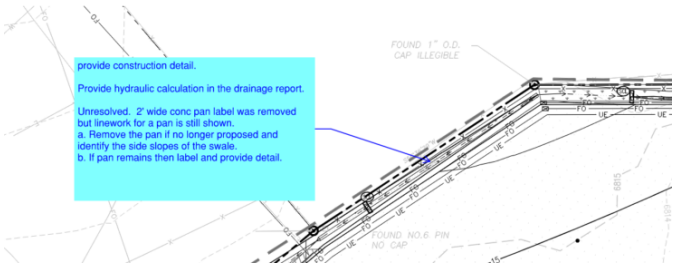
- Military
- Forest
- County Lines

N
W E
S

See the following comments on the GEC Plan. Supporting hydraulic calculations for all proposed drainage improvements, swales, storm drains, inlets must be included in the drainage report.

APPENDIX B – CALCULATIONS





Unresolved Review 1 Comment:
- Use the IDF values from the City DCM, May 2014.

4, Volume 8, Version 2
Peyton, Colorado, USA*
4°, Longitude: -104.6039°
ion: 6804.14 ft**
urce: ESRI Maps
source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**2.86** (2.30-3.55)	**3.48** (2.81-4.33)	**4.55** (3.67-5.69)	**5.51** (4.40-6.91)	**6.90** (5.36-9.04)	**8.04** (6.10-10.7)	**9.24** (6.76-12.5)	**10.5** (7.37-14.7)	**12.3** (8.27-17.6)	**13.7** (8.95-19.8)
10-min	**2.09** (1.69-2.60)	**2.54** (2.06-3.17)	**3.34** (2.69-4.16)	**4.03** (3.23-5.06)	**5.05** (3.93-6.62)	**5.89** (4.46-7.80)	**6.77** (4.94-9.18)	**7.70** (5.39-10.7)	**9.01** (6.05-12.9)	**10.0** (6.56-14.5)
15-min	**1.70** (1.38-2.12)	**2.07** (1.67-2.58)	**2.71** (2.18-3.39)	**3.28** (2.62-4.11)	**4.11** (3.20-5.38)	**4.79** (3.63-6.34)	**5.50** (4.02-7.46)	**6.26** (4.38-8.72)	**7.32** (4.92-10.5)	**8.16** (5.33-11.8)
30-min	**1.23** (0.992-1.53)	**1.49** (1.21-1.86)	**1.95** (1.57-2.44)	**2.36** (1.89-2.96)	**2.95** (2.30-3.87)	**3.44** (2.61-4.56)	**3.95** (2.89-5.36)	**4.49** (3.14-6.25)	**5.25** (3.53-7.50)	**5.85** (3.82-8.45)
60-min	**0.791** (0.640-0.985)	**0.946** (0.765-1.18)	**1.23** (0.987-1.53)	**1.48** (1.19-1.86)	**1.87** (1.46-2.46)	**2.19** (1.67-2.92)	**2.54** (1.86-3.47)	**2.92** (2.05-4.09)	**3.46** (2.33-4.97)	**3.90** (2.55-5.63)
2-hr	**0.484** (0.395-0.598)	**0.573** (0.467-0.708)	**0.737** (0.598-0.914)	**0.890** (0.719-1.11)	**1.13** (0.892-1.48)	**1.33** (1.02-1.77)	**1.56** (1.15-2.11)	**1.80** (1.28-2.51)	**2.15** (1.46-3.07)	**2.44** (1.61-3.50)
3-hr	**0.354** (0.290-0.436)	**0.414** (0.339-0.509)	**0.528** (0.431-0.652)	**0.638** (0.517-0.792)	**0.814** (0.649-1.07)	**0.968** (0.748-1.28)	**1.14** (0.848-1.54)	**1.33** (0.947-1.85)	**1.60** (1.10-2.28)	**1.83** (1.21-2.62)
6-hr	**0.206** (0.170-0.251)	**0.237** (0.196-0.290)	**0.301** (0.247-0.368)	**0.364** (0.297-0.447)	**0.466** (0.375-0.611)	**0.557** (0.435-0.734)	**0.658** (0.495-0.888)	**0.772** (0.556-1.07)	**0.939** (0.649-1.33)	**1.08** (0.719-1.53)
12-hr	**0.117** (0.097-0.142)	**0.136** (0.113-0.165)	**0.173** (0.143-0.210)	**0.208** (0.172-0.254)	**0.266** (0.215-0.344)	**0.316** (0.248-0.413)	**0.372** (0.282-0.497)	**0.434** (0.315-0.595)	**0.525** (0.365-0.739)	**0.600** (0.404-0.847)
24-hr	**0.067** (0.057-0.081)	**0.079** (0.066-0.095)	**0.101** (0.084-0.121)	**0.121** (0.101-0.147)	**0.153** (0.124-0.195)	**0.180** (0.142-0.232)	**0.209** (0.160-0.277)	**0.242** (0.177-0.328)	**0.289** (0.202-0.402)	**0.327** (0.222-0.458)
2-day	**0.039** (0.033-0.046)	**0.046** (0.039-0.055)	**0.058** (0.049-0.070)	**0.070** (0.059-0.084)	**0.087** (0.071-0.110)	**0.101** (0.081-0.129)	**0.117** (0.090-0.153)	**0.133** (0.098-0.179)	**0.157** (0.111-0.217)	**0.176** (0.120-0.245)
3-day	**0.029** (0.024-0.034)	**0.034** (0.029-0.040)	**0.043** (0.036-0.051)	**0.051** (0.043-0.061)	**0.063** (0.051-0.079)	**0.073** (0.058-0.092)	**0.084** (0.064-0.109)	**0.095** (0.070-0.127)	**0.111** (0.079-0.153)	**0.125** (0.086-0.173)
4-day	**0.023** (0.020-0.027)	**0.027** (0.023-0.032)	**0.034** (0.029-0.040)	**0.040** (0.034-0.048)	**0.050** (0.041-0.062)	**0.058** (0.046-0.073)	**0.066** (0.051-0.085)	**0.075** (0.055-0.100)	**0.088** (0.062-0.120)	**0.098** (0.067-0.135)
7-day	**0.016** (0.013-0.018)	**0.018** (0.015-0.021)	**0.022** (0.019-0.026)	**0.026** (0.022-0.031)	**0.032** (0.026-0.039)	**0.037** (0.030-0.046)	**0.042** (0.032-0.054)	**0.047** (0.035-0.062)	**0.055** (0.039-0.075)	**0.061** (0.042-0.084)
10-day	**0.012** (0.011-0.014)	**0.014** (0.012-0.017)	**0.017** (0.015-0.020)	**0.020** (0.017-0.024)	**0.025** (0.020-0.030)	**0.028** (0.023-0.035)	**0.032** (0.025-0.041)	**0.036** (0.027-0.047)	**0.041** (0.030-0.056)	**0.046** (0.032-0.063)
20-day	**0.008** (0.007-0.010)	**0.010** (0.008-0.011)	**0.012** (0.010-0.014)	**0.013** (0.012-0.016)	**0.016** (0.013-0.019)	**0.018** (0.015-0.022)	**0.020** (0.016-0.025)	**0.022** (0.017-0.029)	**0.025** (0.018-0.034)	**0.028** (0.019-0.038)
30-day	**0.007** (0.006-0.008)	**0.008** (0.007-0.009)	**0.009** (0.008-0.011)	**0.011** (0.009-0.012)	**0.013** (0.011-0.015)	**0.014** (0.012-0.017)	**0.016** (0.012-0.020)	**0.017** (0.013-0.022)	**0.019** (0.014-0.026)	**0.021** (0.015-0.028)
45-day	**0.005** (0.005-0.006)	**0.006** (0.005-0.007)	**0.008** (0.007-0.009)	**0.009** (0.007-0.010)	**0.010** (0.008-0.012)	**0.011** (0.009-0.013)	**0.012** (0.010-0.015)	**0.013** (0.010-0.017)	**0.015** (0.011-0.019)	**0.016** (0.011-0.021)
60-day	**0.005** (0.004-0.005)	**0.005** (0.005-0.006)	**0.006** (0.006-0.007)	**0.007** (0.006-0.008)	**0.008** (0.007-0.010)	**0.009** (0.008-0.011)	**0.010** (0.008-0.013)	**0.011** (0.008-0.014)	**0.012** (0.009-0.016)	**0.013** (0.009-0.017)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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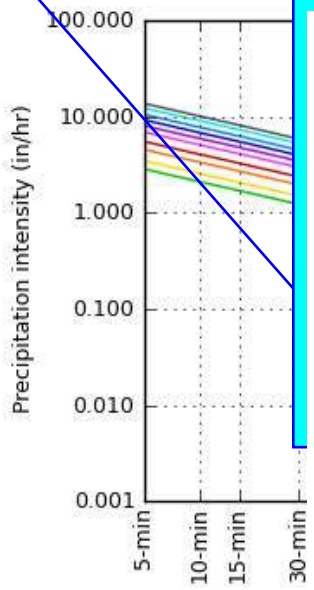
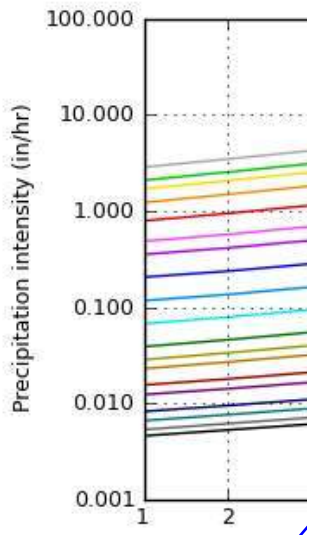
PF graphical

PDS-b

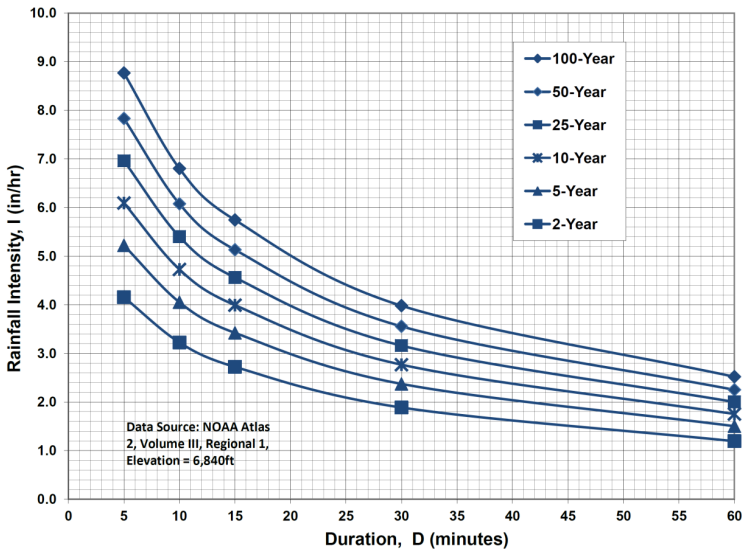
Unresolved Review 1 Comment:
-Delete





NOAA Atlas 14, Volume 8, Versic

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

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

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

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

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

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

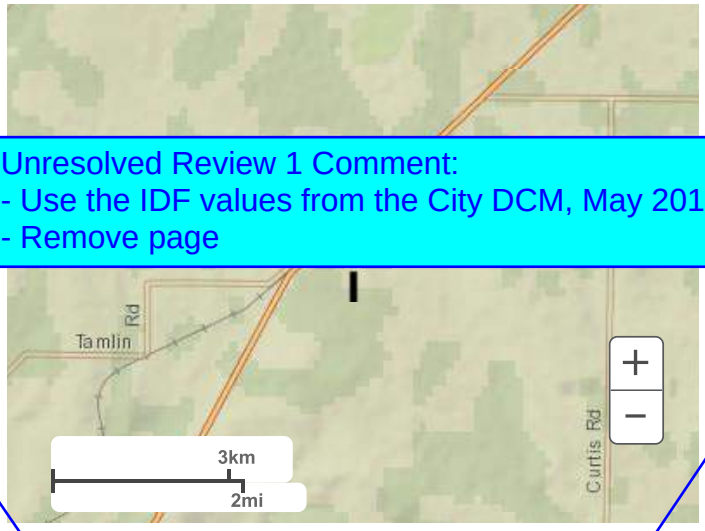
Note: Values calculated by equations may not precisely duplicate values read from figure.

2-day
3-day
4-day
7-day
10-day
20-day
30-day
45-day
60-day

Maps & aerials

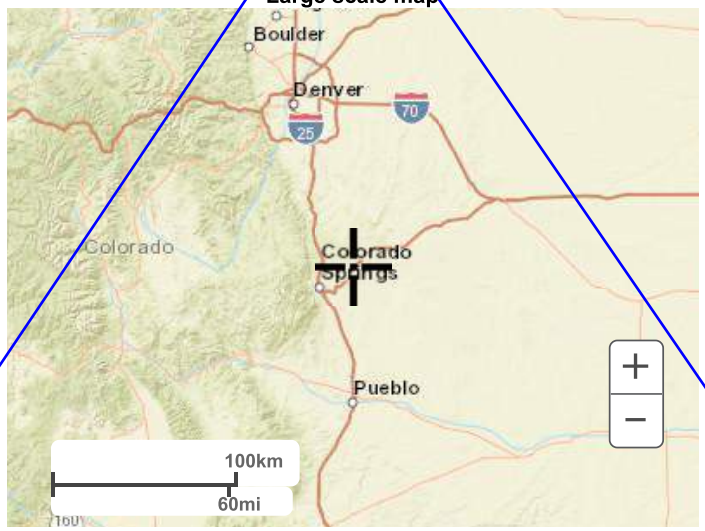
Small scale terrain

Unresolved Review 1 Comment:
- Use the IDF values from the City DCM, May 2014.
- Remove page

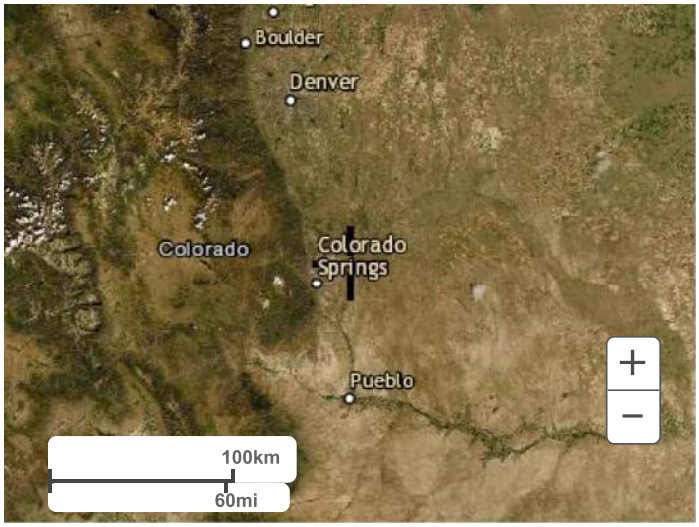


Large scale terrain

Large scale map



Large scale aerial



Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Unresolved Review 1 Comment:
- Use the IDF values from the City DCM, May 2014.
- Remove page

JVA Incorporated
214 8th Street, S 210
Glenwood Springs, CO 81601
Ph: (970) 404 3100

Job Name: D49 Transportation Center
Job Number: 3456c
Date: 9/16/22
By: AMB

D49 Transportation Center

Historic Runoff Coefficient & Time of Concentration Calculations

Location: El Paso County
Minor Design Storm: 10
Major Design Storm: 100
Soil Type: A

Basin Design Data

	I (%) =	100%	100%	90%	80%	25%	25%	0%	2%			I (%)	Runoff Coeff's				Initial Overland Time (t_i)			Travel Time (t_t) x 60) t_t=Length/(Velocity						t_c Comp	tc Urbanized Check ON		t_c Final
Basin Name	Design Point	$A_{paved\ streets}$ (sf)	$A_{drives/conc}$ (sf)	A_{roof} (sf)	A_{gravel} (sf)	A_{plygnd} (sf)	$A_{art.\ turf}$ (sf)	$A_{lscape\ (A\ soil)}$ (sf)	$A_{lscape\ (C/D\ soil)}$ (sf)	A_{Total} (sf)	A_{Total} (ac)	Imp (%)	C2	C5	C10	C100	Upper most Length (ft)	Slope (%)	t_i (min)	Length (ft)	Slope (%)	Type of Land Surface	K	Velocity (fps)	t_t (min)	Time of Conc $t_i + t_t = t_c$	Total Length (ft)	t_c=(L/180)+ 10 (min.)	Min t_c
H1	1	15,185			77,447			633,070		725,702	16.66	10.6%	0.05	0.05	0.05	0.19	300	1.3%	30.7	1515	0.8%	Short Pasture and lawns	7	0.6	40.3	71.1	1815	20.1	20.1
H2	2	2,939			175507			424,663		603,109	13.85	23.8%	0.13	0.14	0.15	0.30	300	9.9%	14.2	2406	1.3%	Short Pasture and lawns	7	0.8	51.2	65.5	2706	25.0	25.0
H3	3	59,358	17,897	44,695	13664			225,924		361,538	8.30	35.5%	0.22	0.23	0.24	0.39	300	9.9%	12.9	2406	1.3%	Short Pasture and lawns	7	0.8	51.2	64.1	2706	25.0	25.0
										0	0.00											Paved areas & shallow paved swales	20				0	10.0	
										0	0.00											Paved areas & shallow paved swales	20				0	10.0	
TOTAL SITE		77,482	17,897	44,695	266,618	0	0	1,283,657	0	1,690,349	38.81	20.6%	0.11	0.11	0.12	0.27													

			Runoff Coeff's				Rainfall Intensities (in/hr)				Area		Flow Rates (cfs)			
Basin Name	Design Point	Time of Conc (tc)	C2	C5	C10	C100	2	5	10	100	A_{Total} (sf)	A_{Total} (ac)	Q2	Q5	Q10	Q100
H1	1	20.1	0.05	0.05	0.05	0.19	1.87	2.45	2.97	4.97	725,702	16.66	1.42	2.01	2.72	15.98
H2	2	25.0	0.13	0.14	0.15	0.30	1.68	2.20	2.67	4.47	603,109	13.85	3.02	4.19	5.47	18.27
H3	3	25.0	0.22	0.23	0.24	0.39	1.68	2.20	2.67	4.47	361,538	8.30	3.05	4.20	5.38	14.35
0	0										0	0.00				
0	0										0	0.00				
										TOTAL SITE	1,690,349	38.81	7.48	10.40	13.57	48.60

Unresolved Review 1 Comment:
- Add the footnotes on the right to the sheet.

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_o, may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)
C_v = conveyance coefficient (from Table 6-7)
S_w = watercourse slope (ft/ft)

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A composite runoff coefficient is calculated using the relationship:

$$c = \frac{\sum_{i=1}^{n} c_i A_i}{A_t} \quad (5\text{-}2)$$

where:

c_i = individual runoff coefficient corresponding to surface type;

A_i = area of surface type corresponding to c_i;

A_t = total drainage area for which composite runoff coefficient is applicable;

n = total number of surface types in drainage areas; and

c = the composite runoff coefficient.

Revise calculation

D49 Transportation Center

Composite Runoff Coefficient Calculations

Location: El Paso County
Minor Design Storm: 10
Major Design Storm: 100
Soil Type: A

CA 100yr = 0.78i + 0.11
CB 100yr = 0.47i + 0.426
CC/D 100yr = 0.41i + 0.484)

Basin Design Data

	I (%) =	100%	100%	90%	80%	65%	65%	0%	0%			I (%)	Runoff Coeff's			
Basin Name	Design Point	A_{paved} streets (sf)	$A_{drives/conc}$ (sf)	A_{roof} (sf)	A_{gravel} (sf)	A_{plygnd} (sf)	$A_{art. turf}$ (sf)	$A_{lscape (A soil)}$ (sf)	A_{lscape} (C/D soil) (sf)	A_{Total} (sf)	A_{Total} (ac)	Imp (%)	C2	C5	C10	C100
A1	2	87,000	0	0				30,000					0.57	0.59	0.60	0.69
A2	4	0	0	0	7,561			151,901					0.01	0.01	0.02	0.14
A3	5	393,733	13,027	16,621	0			0					0.84	0.86	0.87	0.89
A4	6	126,589	0	0	0								0.84	0.86	0.87	0.89
A5	7		12,410	17,441				18,333					0.42	0.43	0.45	0.56
A6	8				243,129			43,470					0.51	0.52	0.54	0.64
A7	9	0			26,707			88,072		114,779	2.63	18.6%	0.09	0.10	0.11	0.26
A8	10		3,717		28,778			11,895		44,390	1.02	60.2%	0.43	0.45	0.47	0.58
OS1	1	61,887	0	112,692				142,331		316,910	7.28	51.5%	0.35	0.37	0.38	0.51
OS2	3	14,525	0	0				51,344		65,868	1.51	22.1%	0.12	0.12	0.14	0.28
OS3	11	56,507	35,862	44,876	28,778			139,146		305,169	7.01	51.0%	0.35	0.36	0.38	0.51

Site plan shows the bus parking as gravel. Adjust or explain in the basin description why you assumed asphalt paving.

Unresolved Review 1 Comment:
- Provide calculation for the composite calculation based on Table 6-6 and chapter 6 of the City DCM, not the above equation.

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	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and Walks	100	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Roofs	90	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

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Glenwood Springs, CO 81601
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Job Name: D49 Transportation Center
Job Number: 3456c
Date: 9/16/22
By: AMB

D49 Transportation Center

Time of Concentration Calculations

Location: El Paso County
Minor Design Storm: 10
Major Design Storm: 100
Soil Type: A

Revise. Max overland is 100 ft.

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i, may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

Sub-Basin Data				Initial Overland Time (t_i)			Travel Time (t_t) t_t=Length/(Velocity x 60)						t_c Comp	tc Urbanized Check ON		t_c Final
Basin Name	Design Point	A_{Total} (ac)	C10	Upper most Length (ft)	Slope (%)	t_i (min)	Length (ft)	Slope (%)	Type of Land Surface	C_v	Velocity (fps)	t_t (min)	Time of Conc $t_i + t_t = t_c$	Total Length (ft)	t_c=(L/180)+ 10 (min)	Min t_c
A1	2	2.69	0.60	429	1.7%	15.7	123	1.0%	Short Pasture and lawns	7	0.7	2.9	18.7	552	13.1	13.1
A2	4	3.66	0.02	517	1.2%	42.5	6	1.0%	Short Pasture and lawns	7	0.7	0.1	42.7	523	12.9	12.9
A3	5	9.72	0.87	820	2.0%	9.8	65	0.5%	Nearly bare ground	10	0.7	1.6	11.4	885	14.9	11.4
A4	6	2.91	0.87	840	1.5%	10.7	15	0.5%	Paved areas & shallow paved swales	20	1.4	0.2	10.9	855	14.8	10.9
A5	7	1.11	0.45	180	6.0%	8.8	15	0.5%	Paved areas & shallow paved swales	20	1.4	0.2	9.0	195	11.1	9.0
A6	8	6.58	0.54	1015	1.5%	28.0	89	0.5%	Short Pasture and lawns	7	0.5	3.0	31.0	1104	16.1	16.1
A7	9	2.63	0.11	501	0.8%	43.8	409	0.5%	Short Pasture and lawns	7	0.5	13.8	57.6	910	15.1	15.1
A8	10	1.02	0.47	443	0.7%	27.6	200	0.5%	Short Pasture and lawns	7	0.5	6.7	34.3	643	13.6	13.6
OS1	1	7.28	0.38	723	0.8%	38.0	311	0.5%	Paved areas & shallow paved swales	20	1.4	3.7	41.7	1034	15.7	15.7
OS2	3	1.51	0.14	352	3.0%	23.0	650	0.6%	Paved areas & shallow paved swales	20	1.5	7.0	30.0	1002	15.6	15.6
OS3	11	7.01	0.38	621	0.1%	70.9	560	2.6%	Paved areas & shallow paved swales	20	3.2	2.9	73.8	1181	16.6	16.6

Provide the basin storm runoff calculation showing the Q10 and Q100

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
11	A6	12.05	12	Cir	88.868	6793.07	6793.51	0.495	7068.47*	7078.64*	3.66	7082.30	End	OpenHeadwall
10	STM-A-P(25)	29.85	18	Cir	65.091	6797.41	6797.72	0.476	6888.34*	6893.60*	4.44	6898.04	9	Generic
9	STM-A-P(23)	29.35	18	Cir	337.298	6795.60	6797.31	0.507	6858.47*	6884.82*	3.52	6888.34	8	Manhole
8	A4	37.70	18	Cir	246.017	6794.22	6795.45	0.500	6822.90*	6854.62*	1.06	6855.68	7	Manhole
7	INL 1 TO DET	38.28	18	Cir	173.638	6793.35	6794.22	0.501	6794.85*	6817.94*	4.74	6822.68	End	Manhole
6	STM-A-P(20)	8.83	12	Cir	61.349	6805.39	6805.70	0.505	6851.42*	6855.19*	1.97	6857.16	4	OpenHeadwall
5	STM-P(49)	6.08	12	Cir	60.823	6805.39	6805.69	0.493	6852.45*	6854.23*	0.93	6855.16	4	Generic
4	A1 & OS1	13.77	12	Cir	258.795	6804.09	6805.39	0.502	6805.09*	6843.82*	4.78	6848.60	End	Manhole
3	STM-A-P(53) (1)	2.75	6	Cir	82.950	6803.19	6804.08	1.073	6810.74*	6825.01*	3.05	6828.06	2	Generic
2	STM-A-P(53)	2.73	6	Cir	41.436	6802.74	6803.19	1.085	6803.24*	6810.29*	0.45	6810.74	End	None
1	STM-A-P(56)	9.50	12	Cir	77.000	6810.86	6812.25	1.805	6811.86*	6817.35*	2.28	6819.62	End	OpenHeadwall

Provide a schematic of the storm drain model and include the lane ID on the drainage on the drainage map so there is a reference exhibit. Staff is unable to determine the corresponding line with the given information.

Project File: 3456c_D49_10YR STRM.stm | Number of lines: 11 | Run Date: 9/16/2022

NOTES: Return period = 10 Yrs. ; *Surcharged (HGL above crown).

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
11	12	12.05	6793.07	7068.47	1.00	0.79	15.34	3.66	7072.13	11.448	88.868	6793.51	7078.64	1.00**	0.79	15.34	3.66	7082.30	11.443	11.445	10.17	1.00	3.66
10	18	29.85	6797.41	6888.34	1.50	1.77	16.90	4.44	6892.77	8.085	65.091	6797.72	6893.60	1.50**	1.77	16.89	4.44	6898.04	8.082	8.083	5.262	1.00	4.44
9	18	29.35	6795.60	6858.47	1.50	1.77	16.61	4.29	6862.76	7.813	337.298	6797.31	6884.82	1.50**	1.77	16.61	4.29	6889.11	7.810	7.812	26.35	0.82	3.52
8	18	37.70	6794.22	6822.90	1.50	1.77	21.34	7.08	6829.98	12.895	246.017	6795.45	6854.62	1.50**	1.77	21.33	7.08	6861.70	12.891	12.893	31.72	0.15	1.06
7	18	38.28	6793.35	6794.85	1.50*	1.77	21.67	7.30	6802.15	13.297	173.638	6794.22	6817.94	1.50**	1.77	21.66	7.30	6825.23	13.292	13.295	23.08	0.65	4.74
6	12	8.83	6805.39	6851.42	1.00	0.79	11.25	1.97	6853.38	6.153	61.349	6805.70	6855.19	1.00	0.79	11.24	1.97	6857.16	6.150	6.152	3.774	1.00	1.97
5	12	6.08	6805.39	6852.45	1.00	0.79	7.74	0.93	6853.38	2.914	60.823	6805.69	6854.23	1.00	0.79	7.74	0.93	6855.16	2.913	2.914	1.772	1.00	0.93
4	12	13.77	6804.09	6805.09	1.00*	0.79	17.54	4.78	6809.87	14.967	258.795	6805.39	6843.82	1.00**	0.79	17.54	4.78	6848.60	14.962	14.964	38.73	1.00	4.78
3	6	2.75	6803.19	6810.74	0.50	0.20	14.00	3.05	6813.79	17.208	82.950	6804.08	6825.01	0.50**	0.20	14.00	3.05	6828.06	17.201	17.205	14.27	1.00	3.05
2	6	2.73	6802.74	6803.24	0.50*	0.20	13.92	3.01	6806.25	17.004	41.436	6803.19	6810.29	0.50**	0.20	13.91	3.01	6813.30	16.998	17.001	7.045	0.15	0.45
1	12	9.50	6810.86	6811.86	1.00	0.79	12.10	2.28	6814.14	7.125	77.000	6812.25	6817.35	1.00**	0.79	12.10	2.28	6819.62	7.123	7.124	5.486	1.00	2.28

Project File: 3456c_D49_10YR STRM.stm | Number of lines: 11 | Run Date: 9/16/2022

Notes: * Normal depth assumed; ** Critical depth. ; c = cir e = ellip b = box

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
11	A6	23.66	12	Cir	88.868	6793.07	6793.51	0.495	7068.47*	7107.71*	14.11	7121.82	End	OpenHeadwall
10	STM-A-P(25)	50.59	18	Cir	65.091	6797.41	6797.72	0.476	7071.23*	7086.35*	12.74	7099.09	9	Generic
9	STM-A-P(23)	49.74	18	Cir	337.298	6795.60	6797.31	0.507	6985.44*	7061.13*	10.10	7071.23	8	Manhole
8	A4	64.20	18	Cir	246.017	6794.22	6795.45	0.500	6882.18*	6974.16*	3.08	6977.24	7	Manhole
7	INL 1 TO DET	67.08	18	Cir	173.638	6793.35	6794.22	0.501	6794.85*	6865.74*	14.56	6880.30	End	Manhole
6	STM-A-P(20)	19.66	12	Cir	61.349	6805.39	6805.70	0.505	7010.18*	7028.88*	9.74	7038.62	4	OpenHeadwall
5	STM-P(49)	11.58	12	Cir	60.823	6805.39	6805.69	0.493	7016.54*	7022.97*	3.38	7026.35	4	Generic
4	A1 & OS1	29.05	12	Cir	258.795	6804.09	6805.39	0.502	6805.09*	6977.38*	21.27	6998.65	End	Manhole
3	STM-A-P(53) (1)	5.73	6	Cir	82.950	6803.19	6804.08	1.073	6835.81*	6897.85*	13.24	6911.09	2	Generic
2	STM-A-P(53)	5.69	6	Cir	41.436	6802.74	6803.19	1.085	6803.24*	6833.85*	1.96	6835.81	End	None
1	STM-A-P(56)	21.14	12	Cir	77.000	6810.86	6812.25	1.805	6811.86*	6838.99*	11.26	6850.25	End	OpenHeadwall

Project File: 3456c_D49_100YR STRM.stm | Number of lines: 11 | Run Date: 9/16/2022

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown).

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
11	12	23.66	6793.07	7068.47	1.00	0.79	30.13	14.11	7082.59	44.158	88.868	6793.51	7107.71	1.00**	0.79	30.12	14.11	7121.82	44.142	44.150	39.24	1.00	14.11
10	18	50.59	6797.41	7071.23	1.50	1.77	28.63	12.75	7083.98	23.219	65.091	6797.72	7086.35	1.50**	1.77	28.63	12.74	7099.09	23.210	23.214	15.11	1.00	12.74
9	18	49.74	6795.60	6985.44	1.50	1.77	28.15	12.32	6997.76	22.445	337.298	6797.31	7061.13	1.50**	1.77	28.15	12.32	7073.45	22.436	22.440	75.69	0.82	10.10
8	18	64.20	6794.22	6882.18	1.50	1.77	36.34	20.53	6902.70	37.393	246.017	6795.45	6974.16	1.50**	1.77	36.33	20.52	6994.68	37.379	37.386	91.98	0.15	3.08
7	18	67.08	6793.35	6794.85	1.50*	1.77	37.97	22.41	6817.26	40.826	173.638	6794.22	6865.74	1.50**	1.77	37.96	22.40	6888.14	40.811	40.819	70.88	0.65	14.56
6	12	19.66	6805.39	7010.18	1.00	0.79	25.04	9.74	7019.92	30.487	61.349	6805.70	7028.88	1.00**	0.79	25.03	9.74	7038.62	30.475	30.481	18.70	1.00	9.74
5	12	11.58	6805.39	7016.54	1.00	0.79	14.74	3.38	7019.92	10.573	60.823	6805.69	7022.97	1.00**	0.79	14.74	3.38	7026.35	10.569	10.571	6.430	1.00	3.38
4	12	29.05	6804.09	6805.09	1.00*	0.79	37.00	21.28	6826.37	66.582	258.795	6805.39	6977.38	1.00**	0.79	36.99	21.27	6998.65	66.556	66.569	172.28	1.00	21.27
3	6	5.73	6803.19	6835.81	0.50	0.20	29.19	13.25	6849.05	74.803	82.950	6804.08	6897.85	0.50**	0.20	29.18	13.24	6911.09	74.775	74.789	62.04	1.00	13.24
2	6	5.69	6802.74	6803.24	0.50*	0.20	29.01	13.08	6816.32	73.862	41.436	6803.19	6833.85	0.50**	0.20	29.00	13.07	6846.92	73.834	73.848	30.60	0.15	1.96
1	12	21.14	6810.86	6811.86	1.00	0.79	26.92	11.26	6823.12	35.237	77.000	6812.25	6838.99	1.00**	0.79	26.91	11.26	6850.25	35.223	35.230	27.13	1.00	11.26

Project File: 3456c_D49_100YR STRM.stm | Number of lines: 11 | Run Date: 9/16/2022

Notes: * Normal depth assumed; ** Critical depth. ; c = cir e = ellip b = box

Overflow Swale - East

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

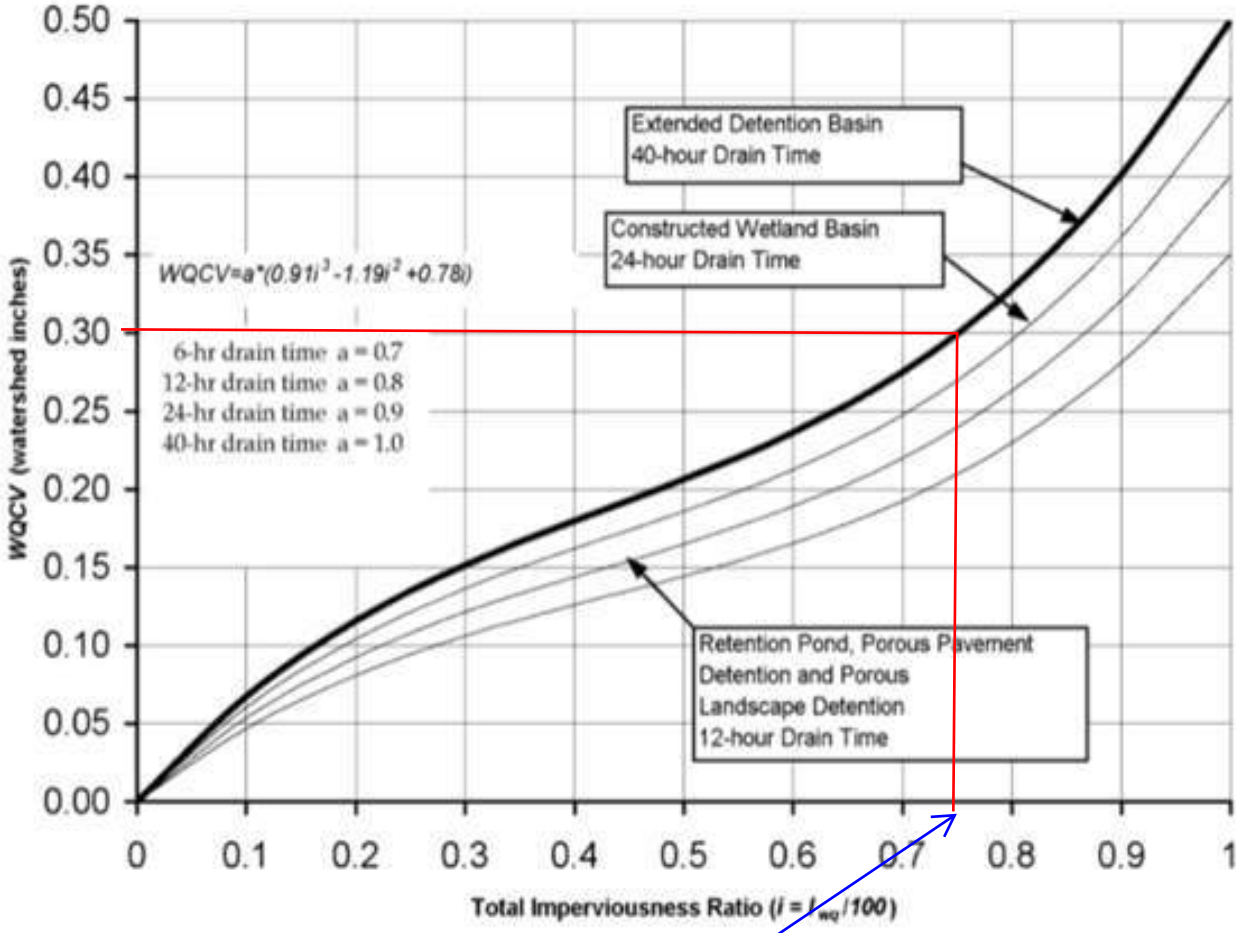
Input Data	
Roughness Coefficient	0.030
Channel Slope	0.005 ft/ft
Normal Depth	24.0 in
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Bottom Width	4.00 ft

Results	
Discharge	79.16 cfs
Flow Area	20.0 ft²
Wetted Perimeter	16.6 ft
Hydraulic Radius	14.4 in
Top Width	16.00 ft
Critical Depth	18.9 in
Critical Slope	0.014 ft/ft
Velocity	3.96 ft/s
Velocity Head	0.24 ft
Specific Energy	2.24 ft
Froude Number	0.624
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	(N/A) ft/s
Upstream Velocity	(N/A) ft/s
Normal Depth	24.0 in
Critical Depth	18.9 in
Channel Slope	0.005 ft/ft
Critical Slope	0.014 ft/ft

Appendix B - Water Quality Capture Volume



Update the imperviousness to 0.84 to match the UD-Detention or remove this sheet and use the calculated value on the UD-Detention worksheet.

25 ft

including Phase 2 of the proposed works

Design Procedure Form: BMP Selection Tool

UD-BMP (Version 3.07, March 2018) **Sheet 1 of 1**

Designer: AMB
Company: JVA
Date: September 16, 2022
Project: Falcon District 49 Transportation
Location: Full Site BMP Selection

1. To identify potential BMPs, what best describes the type of site?	Choose One: (•) Conventional Site; ( ) Highly Urbanized Site; ( ) Linear Construction in Urbanized Area — **SKIP # 2**
2. Does the typical section include a parking lane, shoulder, median, or otherwise allow for surface BMPs?	Choose One: ( ) YES; ( ) NO
3. Is the site comprised of Hydrologic Soil Group A or B soils?	Choose One: (•) YES; ( ) NO
4. Is the tributary impervious area[1] greater than 1 acre?	Choose One: (•) YES; ( ) NO
5. Is the depth of bedrock greater than 5 feet?	Choose One: (•) YES; ( ) NO
6. Is the tributary impervious area[1] greater than 5 acres?	Choose One: (•) YES; ( ) NO
7. Is a water source available for use? (baseflow or groundwater)	Choose One: ( ) YES; (•) NO
8. Is the BMP in a developing watershed?	Choose One: (•) YES; ( ) NO — **SKIP # 9-10**
9. Are BMPs allowed in the right-of-way?	Choose One: ( ) YES; ( ) NO
10. Does the community have an established Fee in Lieu Program in place?	Choose One: ( ) YES; ( ) NO
11. Step 1 of Four Step Process: MDCIA / Volume Reduction (Not WQCV) BMPs	**Grass Swale** **Grass Buffer** **Green Roof (3,6)**
12. Step 2 of Four Step Process: WQCV BMPs	**Extended Dry Detention Basin** (Selected Method) **Green Roof (3,6)** **Regional Water Quality Treatment (4)**

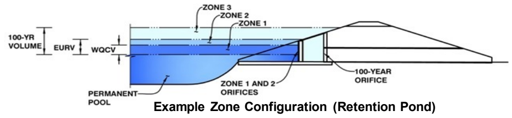
Notes:
1. 'Tributary impervious area' refers to the impervious area draining to the BMP, not the total area of the project site.
2. For a successful wetland channel or basin, a water source (groundwater or baseflow) will be required.
3. In the Front Range of Colorado, irrgation, at least periodically in dry times, will be required to sustain a green roof.
4. If a regional facility will be used to provide the WQCV, some degree of onsite treatment/MDCIA will still likely be required.
5. No Infiltration= underdrain and liner, Partial Infiltration= underdrain and no liner, Full Infiltration= no underdrain and no liner.
6. Consider this BMP for a portion of your site. It's best suited for impervious tributary areas of approximately one acre or less.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: ______________________

Basin ID: ______________________



Example Zone Configuration (Retention Pond)

Watershed Information

			Optional User Overrides	
Selected BMP Type =	**EDB**			
Watershed Area =	22.79	acres		
Watershed Length =	1,521	ft		
Watershed Length to Centroid =	760	ft		
Watershed Slope =	0.013	ft/ft		
Watershed Imperviousness =	83.70%	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		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	0.562	acre-feet	0.562	acre-feet
Excess Urban Runoff Volume (EURV) =	2.541	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.95 in.) =	1.404	acre-feet	0.95	inches
5-yr Runoff Volume (P1 = 1.23 in.) =	1.884	acre-feet	1.23	inches
10-yr Runoff Volume (P1 = 1.48 in.) =	2.313	acre-feet	1.48	inches
25-yr Runoff Volume (P1 = 1.87 in.) =	3.022	acre-feet	1.87	inches
50-yr Runoff Volume (P1 = 2.19 in.) =	3.630	acre-feet	2.19	inches
100-yr Runoff Volume (P1 = 2.54 in.) =	4.329	acre-feet	2.54	inches
500-yr Runoff Volume (P1 = 3.46 in.) =	6.143	acre-feet	3.46	inches
Approximate 2-yr Detention Volume =	1.329	acre-feet		
Approximate 5-yr Detention Volume =	1.780	acre-feet		
Approximate 10-yr Detention Volume =	2.187	acre-feet		
Approximate 25-yr Detention Volume =	2.863	acre-feet		
Approximate 50-yr Detention Volume =	3.251	acre-feet		
Approximate 100-yr Detention Volume =	3.619	acre-feet		

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

Remove the override or update the WQCV chart in pg 31.

Replace with City DCM Table 6-2

Table 6-2. Rainfall Depths for Colorado Springs

Return Period	1-Hour Depth	6-Hour Depth	24-Hour Depth
2	1.19	1.70	2.10
5	1.50	2.10	2.70
10	1.75	2.40	3.20
25	2.00	2.90	3.60
50	2.25	3.20	4.20
100	2.52	3.50	4.60

Where Z= 6,840 ft/100

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.562	acre-feet
Zone 2 Volume (10-year - Zone 1) =	1.625	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.433	acre-feet
Total Detention Basin Volume =	3.619	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ____ ft

Stage 0 - 6790.65

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	385	0.009		
6791	--	0.35	--	--	--	385	0.009	135	0.003
	--	1.35	--	--	--	6,405	0.147	3,530	0.081
	--	2.35	--	--	--	21,188	0.486	17,326	0.398
	--	3.35	--	--	--	38,544	0.885	47,192	1.083
	--	4.05	--	--	--	50,064	1.149	78,204	1.795
						54,909	1.261	93,950	2.157
						57,947	1.330	105,236	2.416
						68,379	1.570	155,766	3.576
						70,555	1.620	169,659	3.895
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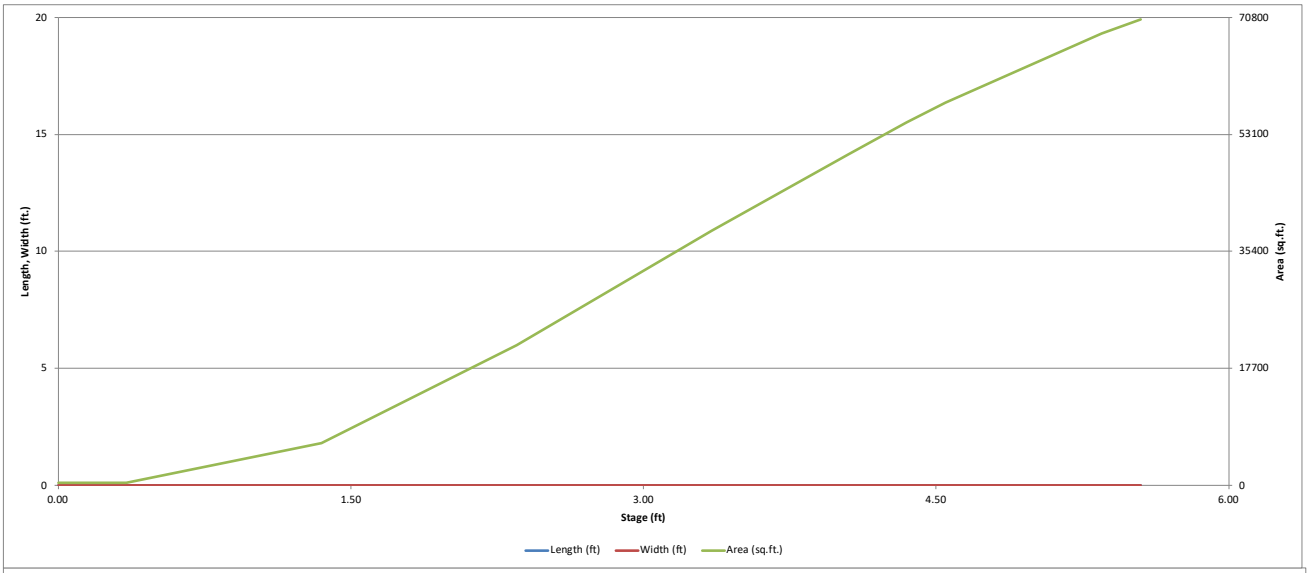
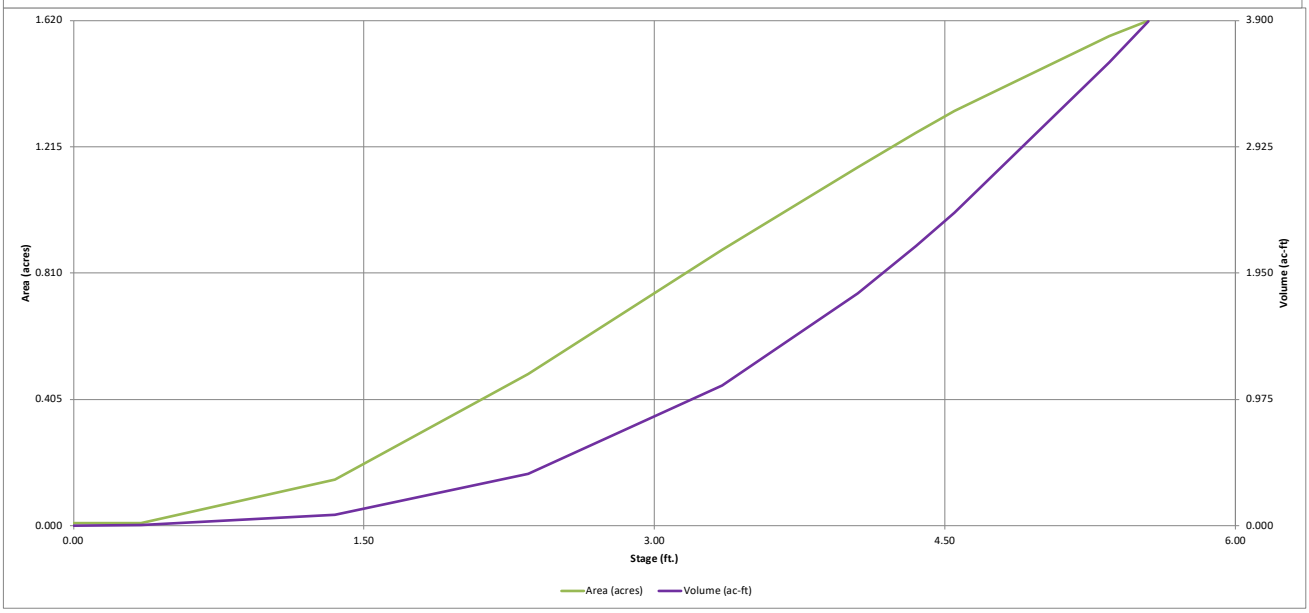
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



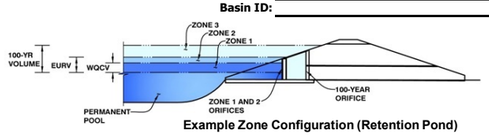


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project:

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.66	0.562	Orifice Plate
Zone 2 (10-year)	4.38	1.625	Rectangular Orifice
Zone 3 (100-year)	5.38	1.433	Weir (No Pipe)
Total (all zones)		3.619	

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

			Calculated Parameters for Underdrain		
Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

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

			Calculated Parameters for Plate		
Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.410E-02	ft²
Depth at top of Zone using Orifice Plate =	2.66	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	8.60	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	2.03	sq. inches (diameter = 1-5/8 inches)	Elliptical Slot Area =	N/A	ft²

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	0.89	1.77					
Orifice Area (sq. inches)	2.03	2.03	2.03					

	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		Calculated Parameters for Vertical Orifice	Zone 2 Rectangular	Not Selected	
Invert of Vertical Orifice =	2.67	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	2.25	N/A	ft²
Depth at top of Zone using Vertical Orifice =	3.43	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.38	N/A	feet
Vertical Orifice Height =	9.00	N/A	inches				
Vertical Orifice Width =	36.00		inches				

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 3 Weir	Not Selected		Calculated Parameters for Overflow Weir	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.68	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	3.68	N/A	feet
Overflow Weir Bottom Length =	11.33	N/A	feet	Overflow Weir Slope Length =	2.91	N/A	feet
Overflow Weir Side Slopes =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	4.67	N/A	
Horiz. Length of Weir Sides =	2.91	N/A	feet	Overflow Grate Open Area w/o Debris =	22.95	N/A	ft²
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	22.95	N/A	ft²
Debris Clogging % =	0%	N/A	%				

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

	Not Selected	Not Selected		Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	4.91	N/A	ft²
Circular Orifice Diameter =	30.00	N/A	inches	Outlet Orifice Centroid =	1.25	N/A	feet
				Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

			Calculated Parameters for Spillway		
Spillway Invert Stage=	4.68	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.04	feet
Spillway Crest Length =	20.00	feet	Stage at Top of Freeboard =	6.72	feet
Spillway End Slopes =	3.00	H:V	Basin Area at Top of Freeboard =	1.62	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.89	acre-ft
Spillway position relative to Overflow Weir =	Overlapping				

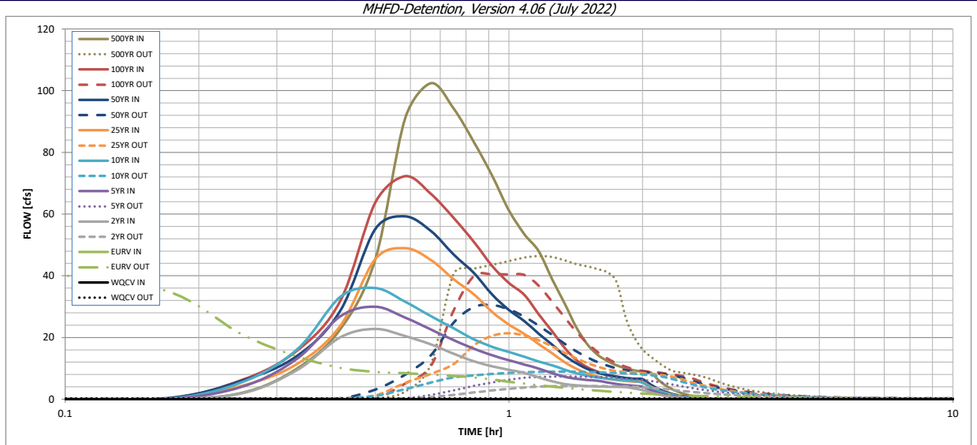
Routed Hydrograph Results — *The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).*

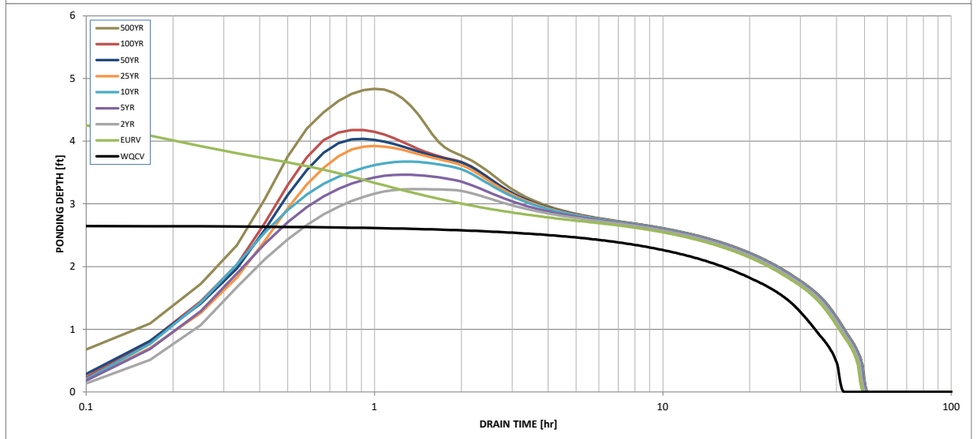
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.95	1.23	1.48	1.87	2.19	2.54	3.46
CUHP Runoff Volume (acre-ft) =	0.562	2.541	1.404	1.884	2.313	3.022	3.630	4.329	6.143
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.404	1.884	2.313	3.022	3.630	4.329	6.143
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.1	0.2	1.8	6.2	11.9	26.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A			28.2			66.8	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	1.24	0.08	0.27	2.93	1.17
Peak Inflow Q (cfs) =	N/A	N/A	22.8	30.0	36.0	48.9	59.2	72.3	102.4
Peak Outflow Q (cfs) =	0.3	42.8	4.3	7.3	8.9	21.3	30.5	40.4	46.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	51.7	0.3	12.2	4.9	0.6	1.7
Structure Controlling Flow =	Plate	Outlet Plate 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	1.28	N/A	N/A	N/A	0.5	0.8	1.2	1.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	37	41	40	39	37	35	33	29
Time to Drain 99% of Inflow Volume (hours) =	**40**	43	46	45	45	44	43	42	40
Maximum Ponding Depth (ft) =	2.66	4.65	3.23	3.46	3.67	3.92	4.03	4.18	4.83
Area at Maximum Ponding Depth (acres) =	0.61	1.36	0.84	0.93	1.01	1.10	1.14	1.19	1.41
Maximum Volume Stored (acre-ft) =	0.568	2.550	0.980	1.183	1.386	1.649	1.772	1.936	2.800
WSE (Stage 0 = 6790.65)	6793.310	6795.300	6793.883	6794.114	6794.324	6794.571	6794.685	6794.826	6795.484

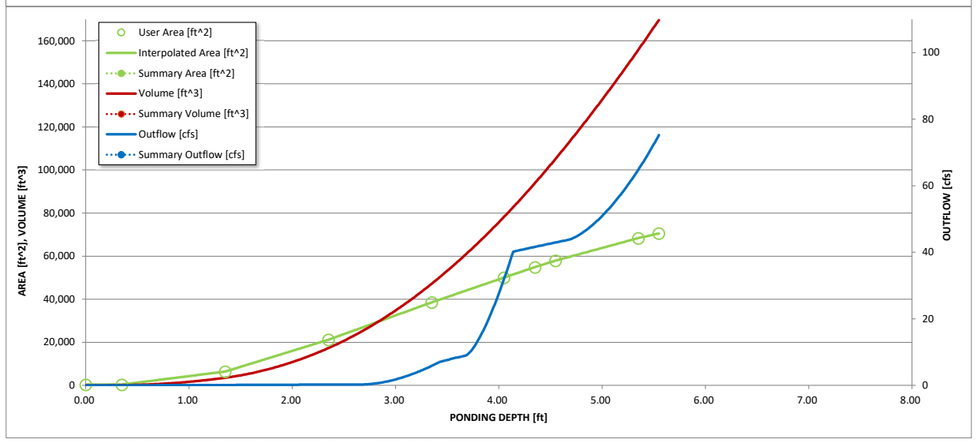
Revise design. For Full Spectrum Design pond release must be equal to or less than historic for all design storm. Ratio must be 1.0 or less.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







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:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.08	2.01
	0:15:00	0.00	0.00	1.89	4.01	5.50	4.34	5.94	6.18	10.01
	0:20:00	0.00	0.00	9.46	13.16	16.17	11.44	14.09	15.78	22.66
	0:25:00	0.00	0.00	20.05	26.85	33.13	23.77	28.63	31.81	45.38
	0:30:00	0.00	0.00	22.79	29.96	36.00	45.47	55.20	63.74	91.04
	0:35:00	0.00	0.00	20.43	26.46	31.57	48.93	59.23	72.27	102.43
	0:40:00	0.00	0.00	17.79	22.60	26.90	45.13	54.54	66.51	94.19
	0:45:00	0.00	0.00	14.73	19.13	22.96	38.89	46.90	58.77	83.34
	0:50:00	0.00	0.00	12.29	16.39	19.38	34.00	40.91	50.97	72.37
	0:55:00	0.00	0.00	10.67	14.21	16.98	28.25	33.86	43.11	61.14
	1:00:00	0.00	0.00	9.53	12.62	15.27	24.17	28.90	37.68	53.44
	1:05:00	0.00	0.00	8.52	11.22	13.72	21.15	25.25	33.77	47.93
	1:10:00	0.00	0.00	7.06	9.90	12.22	17.82	21.21	27.47	38.91
	1:15:00	0.00	0.00	5.80	8.45	10.95	14.90	17.67	22.03	31.11
	1:20:00	0.00	0.00	4.94	7.26	9.60	11.99	14.16	16.67	23.43
	1:25:00	0.00	0.00	4.50	6.62	8.40	9.91	11.67	12.73	17.82
	1:30:00	0.00	0.00	4.26	6.26	7.59	8.35	9.81	10.36	14.42
	1:35:00	0.00	0.00	4.12	6.01	7.04	7.33	8.60	8.92	12.36
	1:40:00	0.00	0.00	4.04	5.40	6.64	6.66	7.80	7.94	10.95
	1:45:00	0.00	0.00	3.97	4.92	6.36	6.20	7.27	7.28	10.00
	1:50:00	0.00	0.00	3.92	4.57	6.16	5.89	6.90	6.82	9.33
	1:55:00	0.00	0.00	3.40	4.32	5.86	5.68	6.65	6.50	8.87
	2:00:00	0.00	0.00	2.97	4.00	5.30	5.54	6.48	6.33	8.63
	2:05:00	0.00	0.00	2.19	2.94	3.87	4.09	4.78	4.68	6.37
	2:10:00	0.00	0.00	1.55	2.08	2.74	2.89	3.38	3.32	4.52
	2:15:00	0.00	0.00	1.09	1.47	1.94	2.05	2.39	2.37	3.22
	2:20:00	0.00	0.00	0.76	1.01	1.35	1.43	1.67	1.66	2.25
	2:25:00	0.00	0.00	0.51	0.67	0.92	0.97	1.13	1.13	1.53
	2:30:00	0.00	0.00	0.33	0.45	0.62	0.67	0.78	0.77	1.05
	2:35:00	0.00	0.00	0.20	0.29	0.39	0.43	0.50	0.50	0.67
	2:40:00	0.00	0.00	0.10	0.16	0.21	0.25	0.29	0.28	0.38
	2:45:00	0.00	0.00	0.04	0.07	0.09	0.11	0.13	0.13	0.18
	2:50:00	0.00	0.00	0.01	0.02	0.02	0.03	0.04	0.04	0.05
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Include calculations for proposed swales and any required outlet protection (including riprap sizing). unresolved.

Design Procedure Form: Grass Buffer (GB)

UD-BMP (Version 3.07, March 2018)

Designer: AMB
Company: JVA
Date: September 16, 2022
Project: D49 Transportation Center
Location: South Staff Car Park

1. Design Discharge A) 2-Year Peak Flow Rate of the Area Draining to the Grass Buffer	Q_2 = 1.0 cfs
2. Minimum Width of Grass Buffer	W_G = 20 ft
3. Length of Grass Buffer (14' or greater recommended)	L_G = 442 ft
4. Buffer Slope (in the direction of flow, not to exceed 0.1 ft / ft)	S_G = 0.007 ft / ft
5. Flow Characteristics (sheet or concentrated) A) Does runoff flow into the grass buffer across the entire width of the buffer?	Choose One: (•) Yes ( ) No
B) Watershed Flow Length	F_L = 465 ft
C) Interface Slope (normal to flow)	S_I = 0.030 ft / ft
D) Type of Flow Sheet Flow: $F_L * S_I \leq 1$ Concentrated Flow: $F_L * S_I > 1$	CONCENTRATED FLOW
6. Flow Distribution for Concentrated Flows	Choose One: ( ) None (sheet flow) ( ) Slotted Curbing ( ) Level Spreader (•) Other (Explain): Majority gravel surface. cross slope runoff to discharge onto grass buffer
7 Soil Preparation (Describe soil amendment)	
8 Vegetation (Check the type used or describe "Other")	Choose One: (•) Existing Xeric Turf Grass ( ) Irrigated Turf Grass ( ) Other (Explain):
9. Irrigation (*Select None if existing buffer area has 80% vegetation AND will not be disturbed during construction.)	Choose One: ( ) Temporary ( ) Permanent (•) None*
10. Outflow Collection (Check the type used or describe "Other")	Choose One: ( ) Grass Swale ( ) Street Gutter ( ) Storm Sewer Inlet (•) Other (Explain): Sheet flows onto adjacent wetland

Notes:

APPENDIX C – FIGURES

NOT FOR CONSTRUCTION

label contours, is SW flowing onsite from this property?

show the existing contours and delineate basin.

H-1 | 43 | 16.7

H-2 | 50 | 13.8

H-3 | 56 | 8.30

OFF-SITE RUNOFF

ZONE AE BOUNDARY

Delineate all offsite basins draining onto the site. Update runoff calculations to include offsite basin. Unresolved.

provide design point

Unresolved. Provide summary table of combined flows. Main intent is for the drainage report to provide a comparison between existing and proposed condition that would show runoff at the Falcon Hwy Culvert Crossing has not increased.

DRAINAGE MAP LEGEND

- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- EXISTING SPOT ELEVATION
- PROPOSED SPOT ELEVATION
- HISTORIC DRAINAGE BASIN BOUNDARY (MAJOR BASIN)
- HISTORIC DRAINAGE BASIN BOUNDARY (SUB BASIN)
- DEVELOPED DRAINAGE BASIN BOUNDARY (MAJOR BASIN)
- DEVELOPED DRAINAGE BASIN BOUNDARY (SUB BASIN)
- DIRECTION OF FLOW (HISTORIC)
- DIRECTION OF FLOW (DEVELOPED)
- BASIN DESIGN POINT
- DRAINAGE BASIN IDENTIFICATION BUBBLE

A = DEVELOPED BASIN DESIGNATION
.50 = 100-YR RUNOFF COEFFICIENT
1.0 = AREA ACRES

100 0 100 200
SCALE IN FEET

RTA ARCHITECTS
19 SOUTH TEJON ST., SUITE 300
COLORADO SPRINGS, CO. 80903
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NO.	DATE	DES'D	D'WN	REVISION DESCRIPTION
1	09/20/22	AMB	AMB	RESPONSE TO COUNTY COMMENTS REVIEW #1

COLORADO LICENSED
CONNER W. KNIGHT
50723
9/22/22
PROFESSIONAL ENGINEER

DESIGNED BY:	AMB
DRAWN BY:	AMB
CHECKED BY:	CWK
JOB #:	3456c
DATE:	MAY 23, 2022

D49 TRANSPORTATION CENTER
SCHOOL DISTRICT NO 49

EXISTING CONDITION DRAINAGE MAP

SHEET NO.
FIG 1

J:\3456c\Drawings\Exhibits-Figures\3456c-Existing Drainage Map.dwg, 9/20/2022 - 2:34 PM, AMB

It appears offsite flows is being diverted off site at this location. If this is correct then downstream analysis is needed to verify downstream properties are not negatively impacted. Explain in the sub-basin narrative.
Add a design point

Unresolved. Provide the offsite basin analysis. Flow being diverted is unknown.

provide swale hydraulic calculation

show the existing contours and delineate basin.

provide swale hydraulic calculation

Delineate all offsite basins draining onto the site. Update runoff calculations to include offsite basin.

Label channel to match the calculations. Staff is assuming this is "Overflow Swale - East"

Overflow Swale - East

Project Description	
Friction Method	Manning Formula
Solve For	Discharge
Input Data	
Roughness Coefficient	0.030
Channel Slope	0.005 ft/ft
Normal Depth	24.0 in
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V

PROPOSED INLET

CALCULATIONS ASSUME ASPHALT PAVED PARKING AT FULL BUILD-OUT CONDITIONS

Provide the sizing calculation for each of the forebays. Recommend using UD-BMP

this portion of the project needs WQ or must fall under an ECM exclusion. All areas must be discussed in the DR text

provide calculations for this culvert and outlet and include text that explains this situation in the DR text. Unclear if the water is supposed to pass over the riprap outfall for the pond and flow into the swale. unresolved.

this portion of the project needs WQ or must fall under an ECM exclusion. Note: runoff reduction can not be within a floodplain

this portion of the project needs WQ or must fall under an ECM exclusion. Note: runoff reduction can not be within a floodplain

Design point for combined flow unresolved.

OFF-SITE RUNOFF INTERCEPTED AT THE NEW DEVELOPMENT SITE BOUNDARY AND DIVERTED TO DISCHARGE INTO THE CREEK

Permanent WQ and Detention required for this basin before discharging offsite.

Unresolved. Provide callout to basin A1 noting WQ/Detention required with future development.

DRAINAGE SWALE TO LEVEL SPREADER DISCHARGE

PROPOSED EXTENDED DETENTION BASIN

Show the grass buffer area used for WQ.

Drainage report to include hydraulic analysis of the drainage path from the pond outfall to the suitable outfall location defined in ECM Chapter 3 section 3.2.4. Analysis will likely be to the culvert at Falcon Hwy.

Identify and provide construction plans for necessary offsite improvements so the conveyance is hydraulically adequate. Unresolved.

OFF-SITE RUNOFF DISCHARGE POINT INTO THE EXISTING CREEK RUNNING ALONG THE BOUNDARY

ZONE AE BOUNDARY

provide channel hydraulic calculation

IMPERVIOUS CALCULATIONS ACCOUNT FOR FUTURE PARKING LOT CONSTRUCTION

SWINGLINE ROAD (80 FEET WIDE)

FALCON HIGHWAY

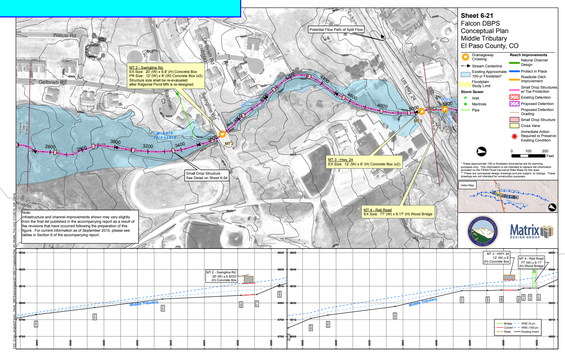
Since the grading and drainage plan is diverting flows then channel analysis (highlighted in blue) must be provided to ensure the receiving channel does not have negative impacts to the channel. Offsite improvements may be required to the receiving channel.

Unresolved.

this portion of the project needs WQ or must fall under an ECM exclusion. Note: runoff reduction can not be within a floodplain

DBPS Selected alternative adjacent to the school site and the required improvements.

Unresolved. No analysis or discussion has been provided with regards to conformance to the DBPS.



3.2.4. **Suitable Outfall Location Definition**

A suitable outfall location refers to a stream which is a hydraulically adequate historic natural stream or channel segment which developed conveyance systems (i.e. storm drain systems, channels, and detention basin outlets) shall utilize for ultimate discharge of stormwater runoff from development. A suitable outfall stream may be a perennial or ephemeral stream in its previously undeveloped, natural condition. The other choice for a new stormwater outfall is a connection to an existing hydrologically and hydraulically adequate man-made system.

lupp. No. 1 CD3:5

ENGINEERING CRITERIA MANUAL

Any and all proposed man-made systems for stormwater conveyance shall outfall to a location as identified above, which is capable of receiving developed flows without negative impacts to streambed stability and/or natural sediment transport functions. Man-made conveyance systems are not limited to storm drain systems, detention basin outlets, and lined channels, but also include any change in the land configuration by grading which results in a new runoff pattern in terms of flow direction and quantity of runoff.

All suitable outfall streams as defined above shall be defined on a map of the basin and included in the applicable drainage basin planning study. In the event an older planning study does not define a suitable discharge point for a new stormwater discharge in the basin, the above criteria shall still apply.

\P LEGEND

- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- PROPOSED INDEX CONTOUR
- PROPOSED INTERMEDIATE CONTOUR
- EXISTING SPOT ELEVATION
- +03.54 PROPOSED SPOT ELEVATION
- HISTORIC DRAINAGE BASIN BOUNDARY (MAJOR BASIN)
- HISTORIC DRAINAGE BASIN BOUNDARY (SUB BASIN)
- DEVELOPED DRAINAGE BASIN BOUNDARY (MAJOR BASIN)
- DEVELOPED DRAINAGE BASIN BOUNDARY (SUB BASIN)
- DIRECTION OF FLOW (HISTORIC)
- DIRECTION OF FLOW (DEVELOPED)
- BASIN DESIGN POINT
- DRAINAGE BASIN IDENTIFICATION BUBBLE (A / .50 / 1.0; A = DEVELOPED BASIN DESIGNATION, .50 = 100-YR RUNOFF COEFFICIENT, 1.0 = AREA ACRES)
- GRAVEL PAVING
- PHASE 2 DEVELOPMENT

100 0 100 200
SCALE IN FEET

Provide summary table of combined flows.

NOT FOR CONSTRUCTION

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FAX: 719-471-1174
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NO.	DATE	DES'D	D'WN	REVISION DESCRIPTION
1	09/20/22	AMB	AMB	RESPONSE TO COUNTY COMMENTS REVIEW #1

COLORADO LICENSED
CHRISTOPHER W. KNOWLES
50723
9/22/22
PROFESSIONAL ENGINEER

DESIGNED BY: AMB
DRAWN BY: AMB
CHECKED BY: CWK
JOB #: 3456c
DATE: MAY 23, 2022

D49 TRANSPORTATION CENTER
SCHOOL DISTRICT NO 49

PROPOSED DRAINAGE PLAN

SHEET NO.
FIG 2