FINAL DRAINAGE REPORT

for

ARACO ENTERPRISES LLC - BUILDING ADDITION
7470 SOUTHMOOR DRIVE, FOUNTAIN, CO

Prepared for:

Araco Enterprises LLC
7470 Southmoor Drive
Fountain, CO 80817

October 24, 2019
Revised July 22, 2020
Revised January 25, 2021
Revised June 10, 2022

Prepared by:

JPS ENGINEERING

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JPS Project No. 111705
PPR-1950

ARACO ENTERPRISES LLC - BUILDING ADDITION
7470 SOUTHMOOR DRIVE, FOUNTAIN, CO
DRAINAGE REPORT STATEMENTS

1. 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 master plan for the drainage basin. I accept responsibility for liability caused by negligent acts, errors or omissions on my part in preparing this report:

11/3/22

John P. Schwab, Colorado P.E. No. 29891

2. Developer's Statement:

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

By: ______________________ 10/05/2022

Printed Name: Arturo Acosta — Date
Title: Manager

3. El Paso County Statement:

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

APPROVED
Engineering Department
01/05/2023 9:47:45 AM
dsdnijkamp
EPC Planning & Community Development Department

Joshua Palmer, PE
County Engineer / ECM Administrator

Conditions:

I. INTRODUCTION

A. Property Location and Description

Araco Enterprises LLC is planning to construct an addition on the east side of their existing contractor's office building at 7470 Southmoor Drive in Fountain, Colorado. The project site (El Paso County Assessor's No. 65244-00-085) is an unplatted 4.2-acre developed parcel described as a tract in the Southeast Quarter of Section 24, Township 15 South, Rage 66 West of the 6^{th} P.M. The property is located along the southwest side of Southmoor Drive. The property is zoned M (Industrial).

Southmoor Drive is a paved public street adjoining the northeast boundary of the property, and the southwest boundary of the site adjoins the Mesa Ridge Parkway (State Highway 16) right-of-way. The Crews Gulch drainage channel flows westerly across the north end of the site, and the northern boundary of the property adjoins an 11-acre park tract owned by El Paso County.

The site development plan consists of proposed 6,000 square-foot building addition on the east side of the existing contractor's office building, with associated parking and site improvements impacting a total disturbed area of approximately 2-acres. Access will be provided by private driveway connections to Southmoor Drive along the northeast boundary of the site as designated on the approved site development plan. The project will include internal driveway and employee parking improvements along with an asphalt-paved RV/Vehicle storage area at the northwest end of the site. The proposed employee parking area at the southeast end of the site will be asphalt paved.

B. Scope

This Drainage Report has been prepared in support of the Site Development Plan submittal for this project, in accordance with El Paso County drainage criteria. This report will provide a summary of site drainage issues impacting the proposed development, including analysis of upstream drainage patterns, site-specific developed drainage patterns, and impacts on downstream facilities. This report is based on the guidelines and criteria presented in the City of Colorado Springs and El Paso County "Drainage Criteria Manual."

II. EXISTING / PROPOSED DRAINAGE CONDITIONS

According to the Natural Resources Conservation Services (NRCS) web soil survey, the majority of on-site soils are comprised of "Ellicott loamy coarse sand" and "Schamber-Razor complex," with a small area comprised of "Manzanola silty clay loam" soils along the southeast corner of the site. The majority of on-site soils are classified as hydrologic soils group A. The existing site topography slopes downward to the southwest with grades of approximately 1-3 percent.

Existing Conditions

The existing drainage patterns are depicted on the enclosed Historic Drainage Plan (Figure EX1, Appendix D). The majority of the site has been delineated as Basin A, which sheet flows southwesterly across the property towards an existing stormwater detention basin within the Mesa Ridge Parkway right-of-way. The existing detention basin appears to have been constructed to mitigate developed drainage impacts from a previous CDOT highway improvement project.

Basin A sheet flows southwesterly to Design Point #1, with historic peak flows calculated as $Q_5 = 1.0$ cfs and $Q_{100} = 5.6$ cfs.

Basin B has been delineated as the small area at the north end of the property which sheet flows into the Crews Gulch drainage channel, flowing westerly across the property. Drainage from Basin B flows to Design Point #2 (see Sh. EX1), with historic peak flows calculated as $Q_5 = 0.2$ cfs and $Q_{100} = 1.2$ cfs.

Proposed Conditions

As shown on the enclosed Developed Drainage Plan (Figure D1, Appendix D), the developed area of the site has been delineated as two on-site drainage basins (A1-A2). Developed flows have been calculated based on the impervious areas associated with the existing and proposed development.

The asphalt parking and storage area within the fence at the north end of the site has been delineated as developed Basin A1, which sheet flows northwesterly to the proposed Detention Basin A1 near the northwest corner of the parking area. Developed peak flows at Design Point #A1 are calculated as $Q_5 = 5.6$ cfs and $Q_{100} = 10.3$ cfs. Detention Basin A1 will mitigate developed flow impacts from this part of the site, and the 12" Discharge Pipe from Basin A1 will extend northwesterly to the toe of the adjoining embankment, flowing into the Crews Gulch Channel.

The balance of the developed site has been delineated as Basin A2, which sheet flows southeasterly to Detention Basin A2 near the southeast corner of the property. The employee parking area at the southeast corner of the site will sheet flow to private Storm Inlet A2 (Type 16), and Private Storm Drain SD-A2 (12" HDPE) will convey this flow directly into Detention Basin A2.

The proposed building addition will be graded with protective slopes to provide positive drainage away from the building. Curb and gutter, concrete crosspans, and drainage swales within the on-site parking and driveway areas will convey developed flows to Detention Basin A2 along the southwest property boundary.

Developed peak flows at Design Point #A2 are calculated as $Q_5 = 4.7$ cfs and $Q_{100} = 8.7$ cfs. Developed flows from Basins A1 and A2 combine at Design Point #1, with peak flows calculated as $Q_5 = 9.3$ cfs and $Q_{100} = 17.2$ cfs.

Recognizing that current County drainage criteria require stormwater detention and permanent stormwater quality best management practices for disturbed areas greater than one acre in size, the proposed Detention Basins A1 and A2 have been designed to mitigate developed drainage impacts and meet the current County stormwater requirements. As detailed in Appendix A, detained peak flows at Design Point #1 are calculated as Q_5 = 0.1 cfs and Q_{100} = 0.8 cfs, which are well below the calculated historic flows.

Basin B at the north end of the site will remain undisturbed and will continue to sheet flows into the Crews Gulch drainage channel. Developed peak flows at Design Point #2 are calculated as Q_5 = 0.2 cfs and Q_{100} = 1.2 cfs, matching existing conditions.

There are no significant off-site drainage flows impacting the developed area of the property.

Hydrologic calculations for the parcel are detailed in the attached spreadsheet tables (Appendix A), and peak flows are identified on Figures EX1 and D1. The contractor will need to implement standard best management practices for erosion control during construction.

III. DRAINAGE PLANNING FOUR STEP PROCESS

El Paso County Drainage Criteria require drainage planning to include a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls.

As stated in DCM Volume 2, the Four Step Process is applicable to all new and re-development projects with construction activities that disturb 1 acre or greater or that disturb less than 1 acre but are part of a larger common plan of development. The Four Step Process has been implemented as follows in the planning of this project:

<u>Step 1: Employ Runoff Reduction Practices</u>

- The proposed employee parking and RV/Vehicle Storage parking areas will be asphalt paved as required by the site development plan. The remaining internal site parking and storage areas will utilize gravel and/or asphalt millings to minimize new impervious areas and encourage stormwater infiltration.

<u>Step 2: Stabilize Drainageways</u>

- The Crews Gulch channel flowing across the north end of the site has been stabilized with existing riprap bank protection along the bank of the channel within this property.
- Routing flows through the on-site Detention Basins will minimize impacts to existing downstream drainageways.

Step 3: Provide Water Quality Capture Volume (WQCV)

- Site drainage from the building addition area and developed parts of the site will be routed through proposed Extended Detention Basins (EDB), which will capture and slowly release the WQCV over a 40-hour design release period.

Step 4: Consider Need for Industrial and Commercial BMPs

- On-site drainage will be routed through the private Extended Detention Basins (EDB) to minimize introduction of contaminants to the downstream public drainage system.
- The Owner will be responsible to implement and maintain a stormwater management plan (SWMP), which will include proper housekeeping practices for this commercial property.

IV. STORMWATER DETENTION & WATER QUALITY

The proposed drainage and grading plan for this site includes two private Extended Detention Basins (EDB) along the southwest boundary of the property. The proposed Full-Spectrum Detention Basins will provide the required stormwater detention and water quality mitigation for the site in accordance with current El Paso County drainage criteria.

The Detention Basin outlet structures will provide multiple outlet orifices to regulate discharge flows and spillways discharging to the southwest property boundary. Both ponds will have concrete trickle channels and grass-lined pond bottoms to encourage stormwater infiltration.

Detention Basin A1

As detailed in the enclosed detention pond calculations (Appendix C), the total area draining to Detention Basin A1 is 1.46-acres, and the site impervious area to be treated at Extended Detention Basin A1 ("EDB-A1") has been calculated as 88.6 percent. According to the enclosed "UD_Detention" calculations, the minimum required 100-year Full-Spectrum Detention (FSD) Volume for EDB-A1 has been calculated as 0.25 acre-feet. The proposed Detention Basin A1 has been designed to provide a volume of 0.28 acre-feet, which is sufficient to provide the required 100-year Detention and WQCV.

The discharge pipe from Basin A1 will extend northwesterly to daylight at the toe of the adjoining embankment, flowing into the Crews Gulch Channel, and the spillway of Basin A1 will direct overflows into the existing grass-lined detention area within the Mesa Ridge Parkway right-of-way.

Detention Basin A2

The developed area draining to Detention Basin A2 is 2.3-acres, and the site impervious area to be treated at Extended Detention Basin A2 ("EDB-A2") has been calculated as 51.9 percent. According to the enclosed "UD_Detention" calculations, the minimum required 100-year Full-Spectrum Detention (FSD) Volume for EDB-A2 has been calculated as 0.22 acre-feet. The proposed Detention Basin A2 has been designed to provide a volume of 0.28 acre-feet, which is sufficient to provide the required 100-year Detention and WQCV.

Both the discharge pipe and spillway from Basin A2 will extend southwesterly into the adjoining grass-lined detention area within the Mesa Ridge Parkway right-of-way. Recognizing that the existing detention area has historically received flow from the adjoining Araco property, the existing detention facility provides an adequate outfall for detained flows from this site.

The proposed stormwater detention facilities will be privately owned and maintained by the property owner, and maintenance access is readily available from the adjoining parking areas.

V. FLOODPLAIN IMPACTS

The northwest part of the site is impacted by FEMA 100-year floodplain boundaries along the Crews Gulch channel according to the FEMA floodplain map for this area, FIRM Panel No. 08041C0951G dated December 7, 2018 (see Appendix D). The proposed Building Addition is located beyond 100-year floodplain limits.

VI. DRAINAGE BASIN FEES

This site is located within the Crews Gulch Drainage Basin. No public drainage improvements are required for development of this site. No subdivision platting is proposed at this time, and there are no applicable drainage fees required with the Site Development Plan.

VII. SUMMARY

The developed drainage patterns associated with the proposed Araco Enterprises Building Addition project will remain consistent with historic conditions. The proposed Extended Detention Basins along the southwest boundary of the site will provide stormwater detention and water quality mitigation as required for the new site improvements. Proper construction and maintenance of the proposed on-site drainage facilities, in conjunction with proper erosion control practices, will ensure that this developed site has no significant adverse drainage impact on downstream or surrounding areas.

APPENDIX A

HYDROLOGIC CALCULATIONS

Map Scale: 1:2,440 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 35, 70, 140, 210

Feet: 0, 100, 200, 400, 600

N

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 16, Sep 10, 2018

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

Date(s) aerial images were photographed: Apr 15, 2011—Jun 17, 2014

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	3.8	57.1%
82	Schamber-Razor complex, 8 to 50 percent slopes	A	2.2	32.5%
MzA	Manzanola silty clay loam, saline, 0 to 2 percent slopes	C	0.7	10.4%
Totals for Area of Interest			**6.7**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

Table 6-3. Recommended percentage imperviousness values

Land Use or Surface Characteristics	Percentage Imperviousness (%)
Business:	
Downtown Areas	95
Suburban Areas	75
Residential lots (lot area only)**:**	
Single-family	
2.5 acres or larger	12
0.75 – 2.5 acres	20
0.25 – 0.75 acres	30
0.25 acres or less	45
Apartments	75
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yard areas	50
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

$$t_c = t_i + t_t \quad \text{(Eq. 6-7)}$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (min)

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.

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)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \qquad \text{(Eq. 6-10)}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional "calibration" of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

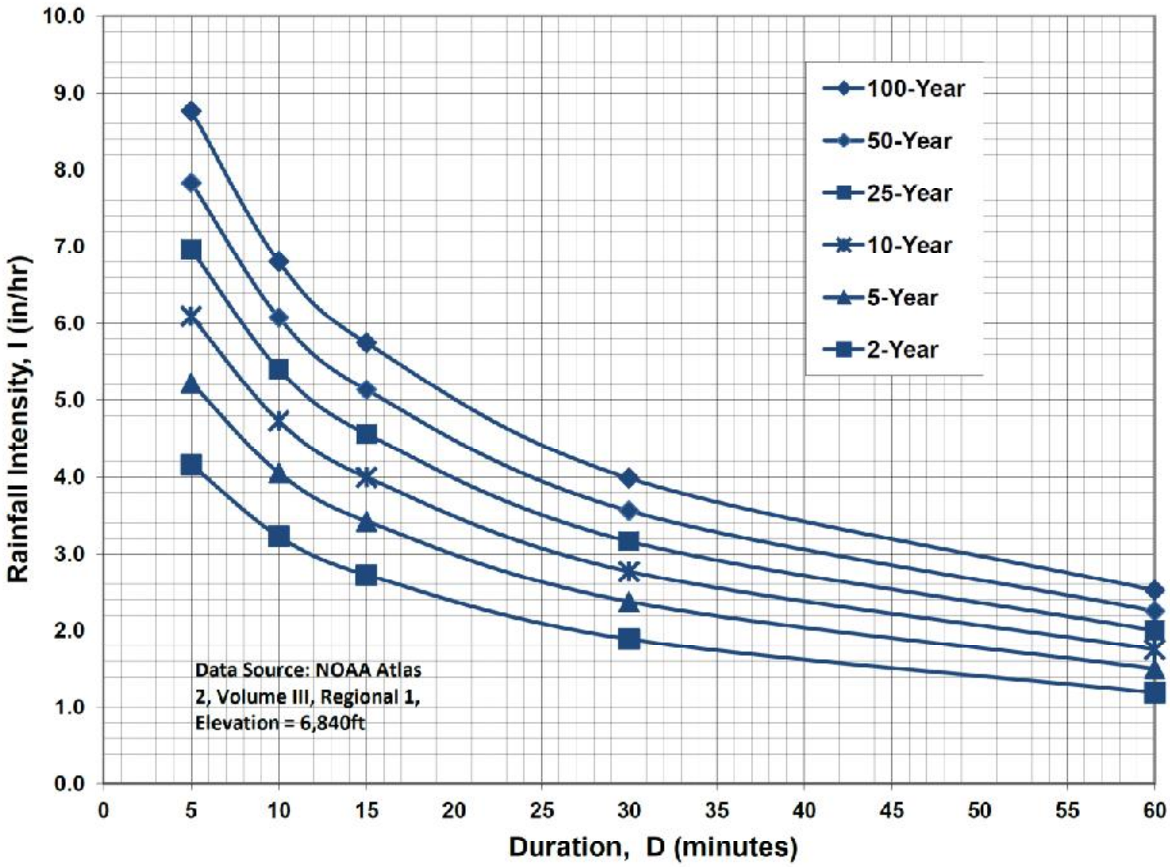
3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

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.

ARACO CONCRETE
COMPOSITE RUNOFF COEFFICIENTS

HISTORIC CONDITIONS

5-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A	3.76	0.15	BUILDING / PAVEMENT	0.9	3.61	MEADOW	0.08				0.113
B	0.44	0.44	MEADOW	0.08							0.080

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A	3.76	0.15	BUILDING / PAVEMENT	0.96	3.61	MEADOW	0.35				0.374
B	0.44	0.44	MEADOW	0.35							0.350

DEVELOPED CONDITIONS

5-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A1	1.46	1.293	ASPHALT	0.9	0.167	LANDSCAPED	0.08				0.806
A2	2.30	0.973	BUILDING / ASPHALT	0.9	0.550	GRAVEL	0.59	0.78	LANDSCAPED	0.08	0.522
A1,A2	3.76										0.632

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A1	1.46	1.293	ASPHALT	0.96	0.167	LANDSCAPED	0.35				0.890
A2	2.30	0.973	BUILDING / ASPHALT	0.96	0.550	GRAVEL	0.7	0.78	LANDSCAPED	0.35	0.574
A1,A2	3.76										0.696

ARACO CONCRETE
RATIONAL METHOD

HISTORIC FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR	C 100-YEAR	Overland Flow LENGTH (FT)	Overland Flow SLOPE (FT/FT)	Overland Flow Tco (1) (MIN)	Channel flow CHANNEL LENGTH (FT)	Channel flow CONVEYANCE COEFFICIENT C	Channel flow SLOPE (FT/FT)	Channel flow SCS (2) VELOCITY (FT/S)	Channel flow Tt (3) (MIN)	TOTAL Tc (4) (MIN)	TOTAL Tc (4) (MIN)	INTENSITY (5) 5-YR (IN/HR)	INTENSITY (5) 100-YR (IN/HR)	PEAK FLOW Q5 (6) (CFS)	PEAK FLOW Q100 (6) (CFS)
A	**1**	3.76	0.113	0.374	300	0.01	31.3	70	15	0.014	1.77	0.7	32.0	32.0	2.39	4.01	**1.01**	**5.63**
B	**2**	0.44	0.080	0.350	60	0.17	5.7	130	15	0.015	1.84	1.2	6.8	6.8	4.70	7.89	**0.17**	**1.21**

DEVELOPED FLOWS

BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR	C 100-YEAR	Overland Flow LENGTH (FT)	Overland Flow SLOPE (FT/FT)	Overland Flow Tco (1) (MIN)	Channel flow CHANNEL LENGTH (FT)	Channel flow CONVEYANCE COEFFICIENT C	Channel flow SLOPE (FT/FT)	Channel flow SCS (2) VELOCITY (FT/S)	Channel flow Tt (3) (MIN)	TOTAL Tc (4) (MIN)	TOTAL Tc (4) (MIN)	INTENSITY (5) 5-YR (IN/HR)	INTENSITY (5) 100-YR (IN/HR)	PEAK FLOW Q5 (6) (CFS)	PEAK FLOW Q100 (6) (CFS)
DEVELOPED FLOW:																		
A1	A1	1.46	0.806	0.890	100	0.01	5.4	200	20	0.015	2.45	1.4	6.7	6.7	4.72	7.93	5.55	10.30
A2	A2	2.30	0.522	0.574	100	0.03	7.3	500	20	0.01	2.00	4.2	11.5	11.5	3.92	6.58	4.70	8.69
A1,A2	**1**	3.76	0.632	0.696									11.5	11.5	3.92	6.58	**9.31**	**17.22**
DETAINED FLOW:																		
POND A1 DISCHARGE	A1	1.46															0.10	0.10
POND A2 DISCHARGE	A2	2.30															0.00	0.70
A1,A2	**1**	3.76															**0.10**	**0.80**
B	**2**	0.44	0.080	0.350	60	0.17	5.7	130	15	0.015	1.84	1.2	6.8	6.8	4.70	7.89	**0.17**	**1.21**

1) OVERLAND FLOW Tco = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)
C = 2.5 FOR HEAVY MEADOW
C = 5 FOR TILLAGE/FIELD
C = 7 FOR SHORT PASTURE AND LAWNS
C = 10 FOR NEARLY BARE GROUND
C = 15 FOR GRASSED WATERWAY
C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES

3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MANUAL
$I_5 = -1.5 * \ln(Tc) + 7.583$
$I_{100} = -2.52 * \ln(Tc) + 12.735$
6) Q = CiA

APPENDIX B

HYDRAULIC CALCULATIONS

ARACO CONCRETE - 7470 SOUTHMOOR DRIVE
STORM INLET SIZING SUMMARY

		BASIN FLOW		INLET FLOW						
INLET	DP	Q5 FLOW (CFS)	Q100 FLOW (CFS)	INLET FLOW % OF BASIN	Q5 FLOW (CFS)	Q100 FLOW (CFS)		INLET CONDITION / TYPE	INLET SIZE	INLET CAPACITY (CFS)
A2	A2	4.7	8.7	35	1.6	3.0		SUMP TYPE 16	SINGLE	3.9

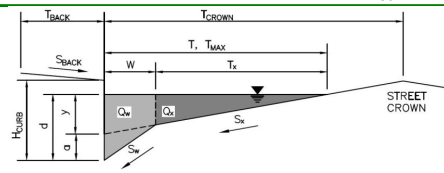
Version 4.05 Released March 2017

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

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

Project: **Araco Enterprises - Inlet A2 (Sump Condition)**

Inlet ID: **Inlet A2**



Gutter Geometry (Enter data in the blue cells)

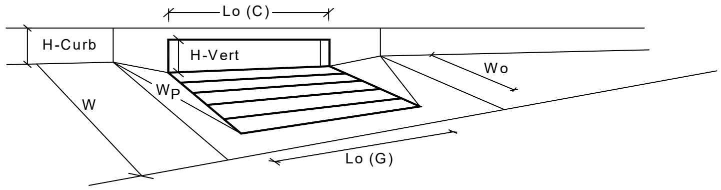
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	50.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.010	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	50.0	50.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	inches
Grate Information		MINOR	MAJOR	Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.523	0.523	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.33	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.94	0.94	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.94	0.94	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**3.9**	**3.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	1.6	3.1	cfs

ARACO CONCRETE - 7470 SOUTHMOOR DRIVE
STORM SEWER SIZING SUMMARY

	PIPE FLOW				PIPE CAPACITY		
PIPE	BASINS	Q5 FLOW (CFS)	Q100 FLOW (CFS)		PIPE SIZE (IN)	MIN. PIPE SLOPE	FULL PIPE CAPACITY (CFS)
A2	A2	1.6	3.0		12	1.00%	3.6

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

Hydraulic Analysis Report

Project Data

Project Title: Project - Araco

Designer: JPS

Project Date: Wednesday, October 23, 2019

Project Units: U.S. Customary Units

Notes:

Channel Analysis: SD-A2

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.0000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0130

Depth: 1.0000 ft

Result Parameters

Flow: 3.5628 cfs

Area of Flow: 0.7854 ft^2

Wetted Perimeter: 3.1416 ft

Hydraulic Radius: 0.2500 ft

Average Velocity: 4.5363 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 0.8057 ft

Critical Velocity: 5.2542 ft/s

Critical Slope: 0.0103 ft/ft

Critical Top Width: 0.79 ft

Calculated Max Shear Stress: 0.6240 lb/ft^2

Calculated Avg Shear Stress: 0.1560 lb/ft^2

APPENDIX C

STORMWATER DETENTION CALCULATIONS

ARACO CONCRETE
COMPOSITE RUNOFF COEFFICIENTS

IMPERVIOUS AREAS - EXISTING CONDITIONS

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A	3.76	0.15	BUILDING / PAVEMENT	100	3.61	MEADOW	0				3.989

IMPERVIOUS AREAS - DEVELOPED CONDITIONS

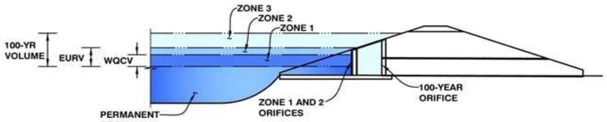
BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A1	1.46	1.293	ASPHALT	100	0.167	LANDSCAPED	0				88.562
A2	2.30	0.973	BUILDING / ASPHALT	100	0.550	NATIVE GRAVEL	40	0.78	LANDSCAPE	0	51.870

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **ARACO CONCRETE**

Basin ID: **A1**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	1.46	acres
Watershed Length =	300	ft
Watershed Length to Centroid =	150	ft
Watershed Slope =	0.013	ft/ft
Watershed Imperviousness =	88.56%	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	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.047	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.175	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.116	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.150	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.177	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.207	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.236	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.269	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	0.343	acre-feet	3.14	inches
Approximate 2-yr Detention Volume =	0.115	acre-feet		
Approximate 5-yr Detention Volume =	0.150	acre-feet		
Approximate 10-yr Detention Volume =	0.178	acre-feet		
Approximate 25-yr Detention Volume =	0.210	acre-feet		
Approximate 50-yr Detention Volume =	0.228	acre-feet		
Approximate 100-yr Detention Volume =	0.245	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.047	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.128	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.070	acre-feet
Total Detention Basin Volume =	0.245	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	10	0.000		
Outlet Structure	--	0.90	--	--	--	10	0.000	9	0.000
Bot EL=5634.0	--	1.00	--	--	--	2,610	0.060	139	0.003
	--	3.00	--	--	--	2,958	0.068	5,707	0.131
Spillway=5638.0	--	5.00	--	--	--	3,308	0.076	11,973	0.275
Top EL=5640.0	--	7.00	--	--	--	3,660	0.084	18,941	0.435
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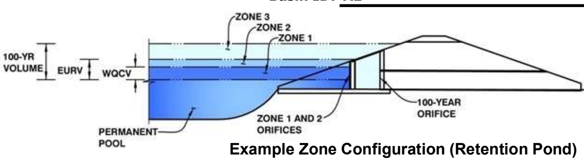
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: ARACO CONCRETE

Basin ID: A1



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.73	0.047	Orifice Plate
Zone 2 (EURV)	3.64	0.128	Orifice Plate
Zone 3 (100-year)	4.60	0.070	Weir&Pipe (Restrict)
Total (all zones)		0.245	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.64	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	14.60	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.21	2.43					
Orifice Area (sq. inches)	0.31	0.31	6.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.80	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.50	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.80	N/A	feet
Overflow Weir Slope Length =	2.50	N/A	feet
Grate Open Area / 100-yr Orifice Area =	222.64	N/A	
Overflow Grate Open Area w/o Debris =	6.96	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.48	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	1.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	12.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	1.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

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

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	2.00	feet
Spillway End Slopes =	0.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.91	feet
Stage at Top of Freeboard =	6.91	feet
Basin Area at Top of Freeboard =	0.08	acres
Basin Volume at Top of Freeboard =	0.43	acre-ft

Routed Hydrograph Results

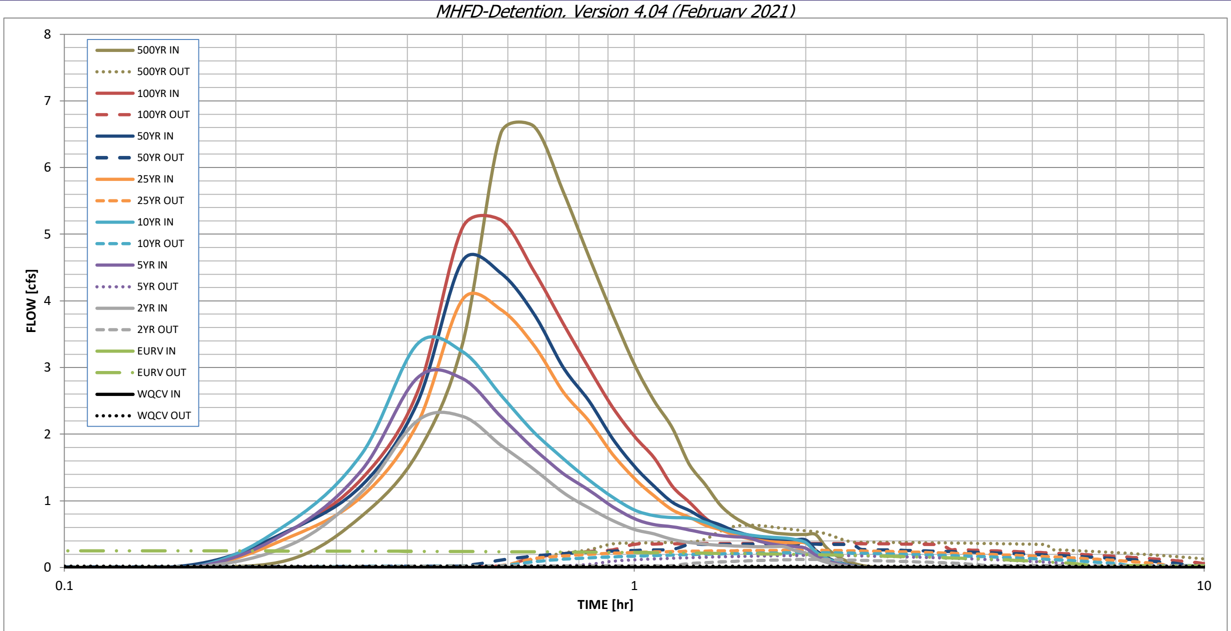
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

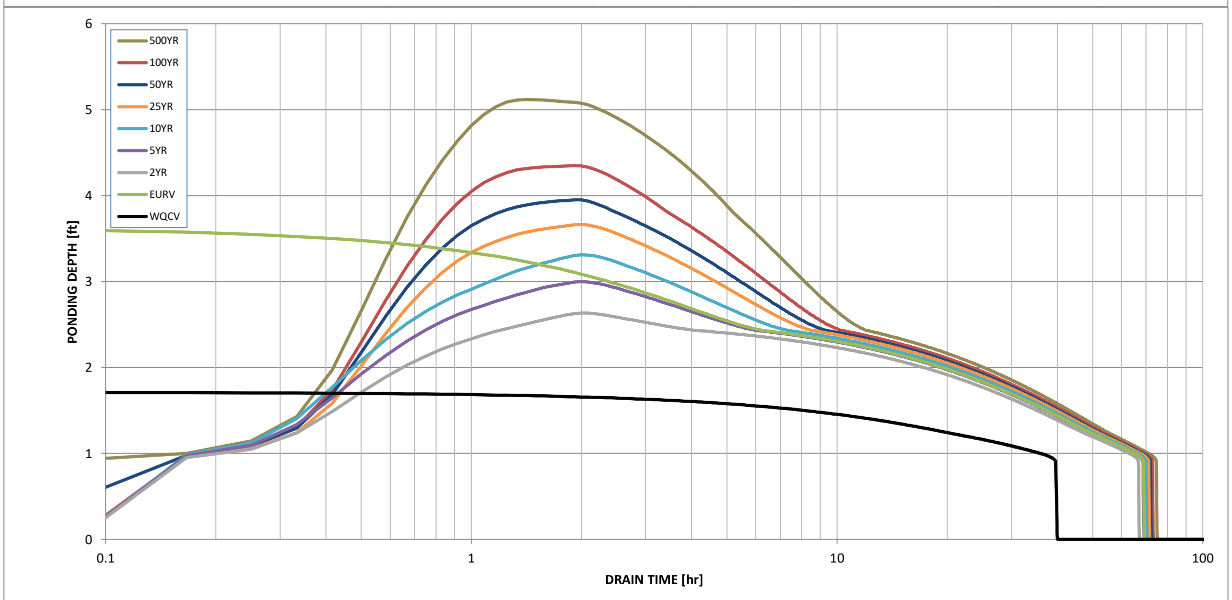
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.047	0.175	0.116	0.150	0.177	0.207	0.236	0.269	0.343
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.116	0.150	0.177	0.207	0.236	0.269	0.343
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.0	0.3	0.6	1.0	1.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.02	0.20	0.40	0.66	1.17
Peak Inflow Q (cfs) =	N/A	N/A	2.3	2.8	3.4	4.0	4.6	5.2	6.6
Peak Outflow Q (cfs) =	0.0	0.3	0.1	0.2	0.2	0.3	0.3	0.4	0.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	7.7	6.8	0.9	0.6	0.4	0.4
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	63	63	64	64	64	64	64	63
Time to Drain 99% of Inflow Volume (hours) =	39	67	66	67	68	69	69	70	71
Maximum Ponding Depth (ft) =	1.72	3.64	2.64	3.00	3.31	3.67	3.95	4.35	5.12
Area at Maximum Ponding Depth (acres) =	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08
Maximum Volume Stored (acre-ft) =	0.047	0.175	0.106	0.131	0.152	0.177	0.197	0.226	0.284

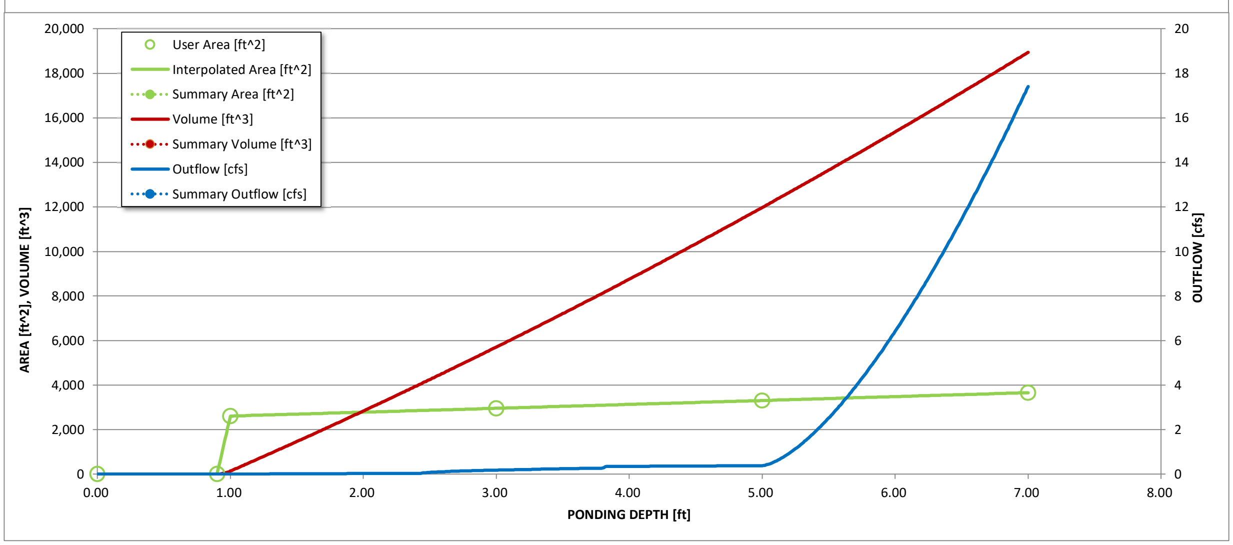
Note that while the indicated ratios of Peak Outflow to Predevelopment Q appear higher than the recommended range for the 5-year through 25-year storms, the actual Peak Outflows are negligible (0.2 cfs) for these design storms.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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	0.04	0.00	0.12
	0:15:00	0.00	0.00	0.35	0.56	0.69	0.46	0.57	0.56	0.78
	0:20:00	0.00	0.00	1.14	1.47	1.72	1.07	1.24	1.34	1.72
	0:25:00	0.00	0.00	2.20	2.85	3.36	2.16	2.48	2.64	3.37
	0:30:00	0.00	0.00	2.27	2.83	3.24	4.03	4.61	5.10	6.51
	0:35:00	0.00	0.00	1.84	2.26	2.59	3.87	4.42	5.21	6.62
	0:40:00	0.00	0.00	1.47	1.78	2.03	3.34	3.81	4.45	5.65
	0:45:00	0.00	0.00	1.13	1.41	1.64	2.64	3.01	3.67	4.65
	0:50:00	0.00	0.00	0.89	1.16	1.31	2.19	2.50	2.99	3.80
	0:55:00	0.00	0.00	0.71	0.91	1.05	1.70	1.93	2.41	3.06
	1:00:00	0.00	0.00	0.57	0.73	0.86	1.34	1.52	1.97	2.50
	1:05:00	0.00	0.00	0.50	0.64	0.78	1.08	1.22	1.65	2.09
	1:10:00	0.00	0.00	0.42	0.61	0.75	0.86	0.98	1.22	1.55
	1:15:00	0.00	0.00	0.38	0.56	0.74	0.75	0.85	0.98	1.25
	1:20:00	0.00	0.00	0.35	0.51	0.68	0.64	0.72	0.74	0.94
	1:25:00	0.00	0.00	0.33	0.48	0.59	0.57	0.64	0.60	0.75
	1:30:00	0.00	0.00	0.32	0.46	0.53	0.49	0.55	0.51	0.64
	1:35:00	0.00	0.00	0.32	0.45	0.49	0.44	0.49	0.45	0.57
	1:40:00	0.00	0.00	0.31	0.39	0.47	0.40	0.45	0.42	0.52
	1:45:00	0.00	0.00	0.31	0.35	0.45	0.39	0.43	0.40	0.50
	1:50:00	0.00	0.00	0.31	0.33	0.44	0.38	0.42	0.40	0.50
	1:55:00	0.00	0.00	0.25	0.31	0.42	0.37	0.42	0.40	0.49
	2:00:00	0.00	0.00	0.22	0.29	0.37	0.37	0.41	0.40	0.49
	2:05:00	0.00	0.00	0.14	0.18	0.24	0.23	0.26	0.25	0.31
	2:10:00	0.00	0.00	0.08	0.11	0.15	0.14	0.16	0.16	0.19
	2:15:00	0.00	0.00	0.05	0.07	0.09	0.09	0.10	0.09	0.12
	2:20:00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.05	0.07
	2:25:00	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.04
	2:30:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer: JPS
Company: JPS
Date: January 22, 2021
Project: ARACO CONCRETE
Location: BASIN EDB-A1

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 88.6 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.886
C) Contributing Watershed Area	Area = 1.460 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV) ● Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$	V_{DESIGN}= 0.047 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$= ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ● A ○ B ○ C / D
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	EURV = 0.175 ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 3.0 : 1
3. Basin Side Slopes A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 0.00 ft / ft **DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE**
4. Inlet A) Describe means of providing energy dissipation at concentrated inflow locations:	Concrete Apron / Connection to Concrete Trickle Channel

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**JPS**
Company:	**JPS**
Date:	**January 22, 2021**
Project:	**ARACO CONCRETE**
Location:	**BASIN EDB-A1**

5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 1% of the WQCV) — V_{FMIN} = 0.001 ac-ft

B) Actual Forebay Volume — V_F = 0.001 ac-ft

C) Forebay Depth (D_F = 12 inch maximum) — D_F = 12.0 in

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 10.30 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 0.21 cfs

E) Forebay Discharge Design

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

(flow too small for berm w/ pipe)

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

G) Rectangular Notch Width — Calculated W_N = 3.1 in

6. Trickle Channel

A) Type of Trickle Channel

Choose One
- ● Concrete
- ○ Soft Bottom

F) Slope of Trickle Channel — S = 0.0050 ft / ft

7. Micropool and Outlet Structure

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

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

C) Outlet Type

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

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 0.63 inches

E) Total Outlet Area — A_{ot} = 1.22 square inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**JPS**
Company:	**JPS**
Date:	**January 22, 2021**
Project:	**ARACO CONCRETE**
Location:	**BASIN EDB-A1**

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} =	6	in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} =		cu ft
C) Initial Surcharge Provided Above Micropool	V_s=	5.0	cu ft

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t =	44	square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N		*S.S. Well Screen with 60% Open Area*	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =		
D) Total Water Quality Screen Area (based on screen type)	A_{total} =	74	sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H=	3.64	feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}=	71.68	inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ =	12.0	inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: JPS
Company: JPS
Date: January 22, 2021
Project: ARACO CONCRETE
Location: BASIN EDB-A1

10. Overflow Embankment	
A) Describe embankment protection for 100-year and greater overtopping:	Buried Riprap Spillway
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	
11. Vegetation	Choose One ○ Irrigated ◉ Not Irrigated
12. Access	
A) Describe Sediment Removal Procedures	Periodic inspection and maintenance by property owner as required Ramp provided for skid-loader access to pond bottom

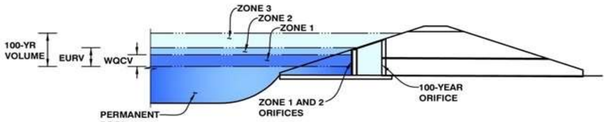
Notes:

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: ARACO CONCRETE

Basin ID: A2



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	2.30	acres
Watershed Length =	600	ft
Watershed Length to Centroid =	300	ft
Watershed Slope =	0.013	ft/ft
Watershed Imperviousness =	51.87%	percent
Percentage Hydrologic Soil Group A =	80.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	20.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.041	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.134	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.105	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.138	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.170	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.222	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.264	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.320	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	0.435	acre-feet	3.14	inches
Approximate 2-yr Detention Volume =	0.092	acre-feet		
Approximate 5-yr Detention Volume =	0.124	acre-feet		
Approximate 10-yr Detention Volume =	0.148	acre-feet		
Approximate 25-yr Detention Volume =	0.176	acre-feet		
Approximate 50-yr Detention Volume =	0.194	acre-feet		
Approximate 100-yr Detention Volume =	0.218	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.041	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.093	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.084	acre-feet
Total Detention Basin Volume =	0.218	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	10	0.000		
Outlet Structure	--	0.40	--	--	--	10	0.000	4	0.000
Bot EL=5633.0	--	0.50	--	--	--	3,869	0.089	197	0.005
	--	1.50	--	--	--	3,974	0.091	4,119	0.095
Spillway=5636.0	--	3.50	--	--	--	4,149	0.095	12,242	0.281
Top EL=5638.0	--	5.50	--	--	--	4,300	0.099	20,691	0.475
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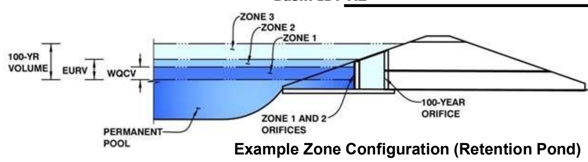
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: **ARACO CONCRETE**
Basin ID: **A2**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.91	0.041	Orifice Plate
Zone 2 (EURV)	1.93	0.093	Orifice Plate
Zone 3 (100-year)	2.84	0.084	Weir&Pipe (Restrict)
Total (all zones)		0.218	

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

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	1.93	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	7.70	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.64	1.29					
Orifice Area (sq. inches)	0.38	0.38	4.00					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	4.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.50	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	2.50	N/A	feet
Overflow Weir Slope Length =	2.50	N/A	feet
Grate Open Area / 100-yr Orifice Area =	87.12	N/A	
Overflow Grate Open Area w/o Debris =	6.96	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.48	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	12.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	1.90		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.08	N/A	ft^2
Outlet Orifice Centroid =	0.09	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.82	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	3.40	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	2.00	feet
Spillway End Slopes =	0.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.79	feet
Stage at Top of Freeboard =	5.19	feet
Basin Area at Top of Freeboard =	0.10	acres
Basin Volume at Top of Freeboard =	0.44	acre-ft

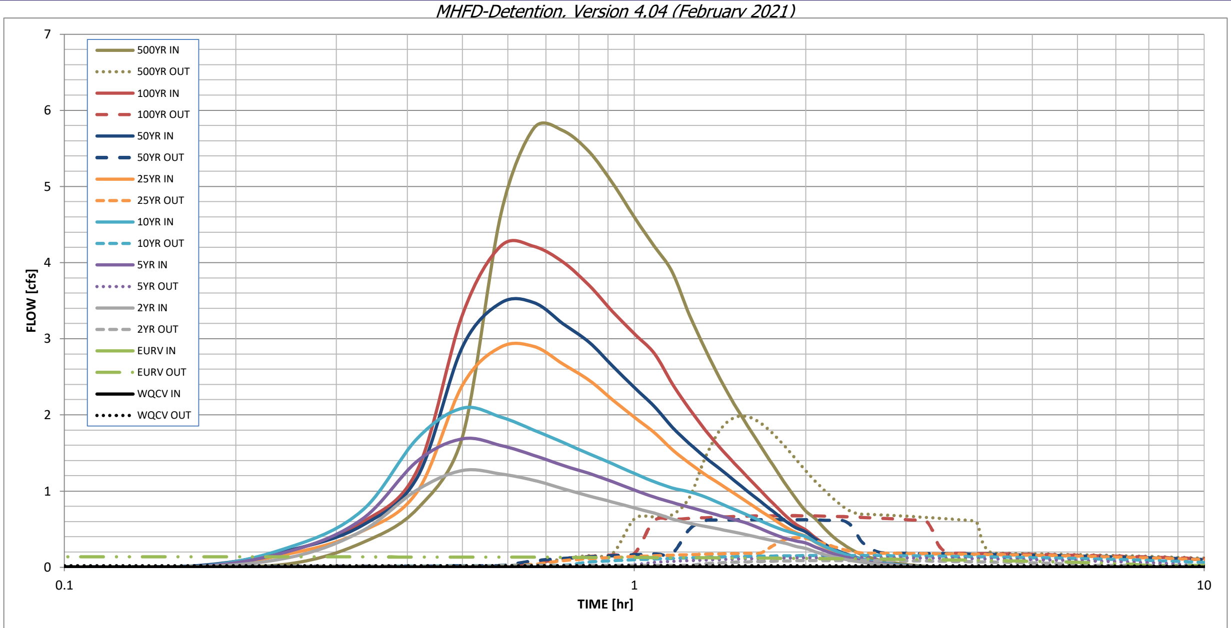
Routed Hydrograph Results

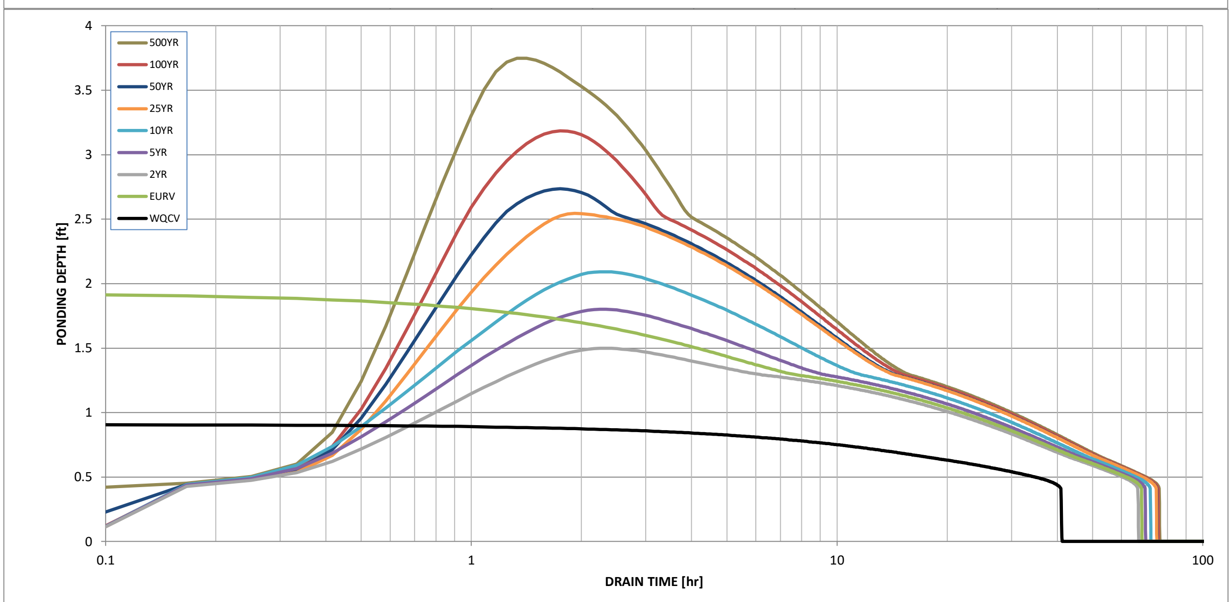
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

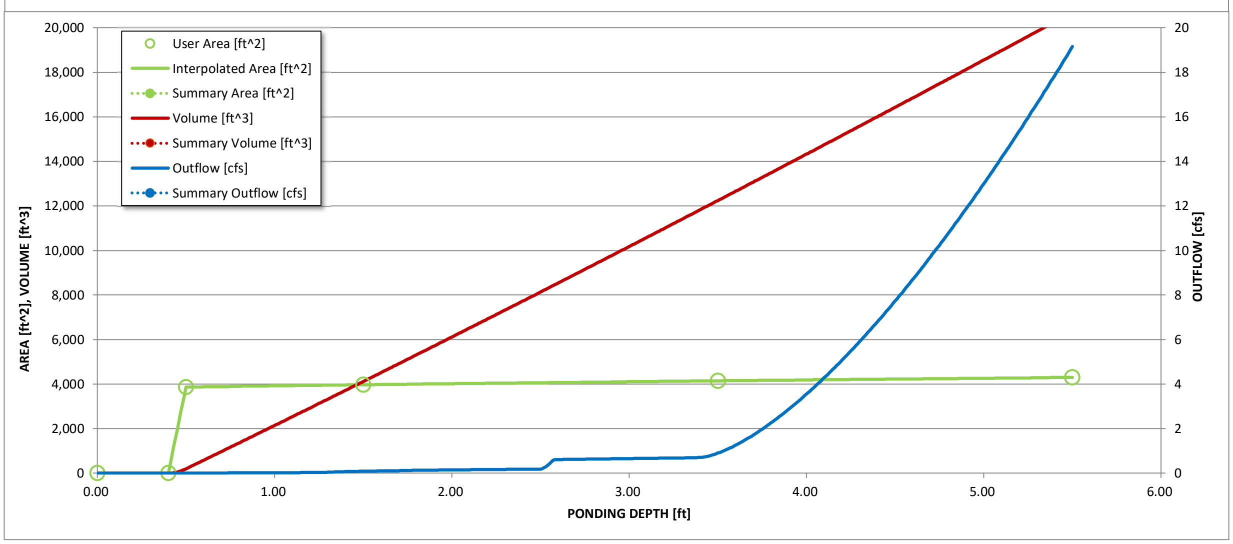
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.041	0.134	0.105	0.138	0.170	0.222	0.264	0.320	0.435
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.105	0.138	0.170	0.222	0.264	0.320	0.435
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.2	0.7	1.0	1.5	2.4
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.07	0.30	0.43	0.64	1.05
Peak Inflow Q (cfs) =	N/A	N/A	1.3	1.7	2.1	2.9	3.5	4.2	5.8
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.1	0.2	0.4	0.6	0.7	2.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.9	0.9	0.6	0.6	0.5	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.1	0.1	0.1
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) =	39	63	62	64	65	66	64	63	59
Time to Drain 99% of Inflow Volume (hours) =	**41**	66	65	68	70	72	71	71	70
Maximum Ponding Depth (ft) =	0.91	1.94	1.50	1.80	2.09	2.54	2.74	3.19	3.75
Area at Maximum Ponding Depth (acres) =	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.10
Maximum Volume Stored (acre-ft) =	0.041	0.135	0.094	0.122	0.149	0.191	0.208	0.251	0.304

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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.

Time Interval
5.00 min

SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
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]
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	0.02	0.00	0.05
0:15:00	0.00	0.00	0.13	0.22	0.27	0.18	0.23	0.22	0.32
0:20:00	0.00	0.00	0.48	0.63	0.74	0.47	0.55	0.59	0.77
0:25:00	0.00	0.00	1.02	1.40	1.70	1.00	1.19	1.28	1.73
0:30:00	0.00	0.00	1.27	1.68	2.09	2.40	2.90	3.32	4.63
0:35:00	0.00	0.00	1.22	1.60	1.97	2.89	3.47	4.22	5.76
0:40:00	0.00	0.00	1.14	1.47	1.80	2.90	3.47	4.21	5.73
0:45:00	0.00	0.00	1.03	1.34	1.64	2.67	3.20	4.01	5.46
0:50:00	0.00	0.00	0.94	1.23	1.49	2.45	2.95	3.70	5.04
0:55:00	0.00	0.00	0.86	1.12	1.36	2.20	2.64	3.36	4.60
1:00:00	0.00	0.00	0.78	1.02	1.23	1.97	2.36	3.07	4.22
1:05:00	0.00	0.00	0.71	0.92	1.12	1.77	2.11	2.81	3.87
1:10:00	0.00	0.00	0.63	0.85	1.04	1.54	1.84	2.41	3.31
1:15:00	0.00	0.00	0.58	0.79	0.99	1.37	1.62	2.08	2.86
1:20:00	0.00	0.00	0.53	0.73	0.92	1.22	1.44	1.80	2.47
1:25:00	0.00	0.00	0.50	0.68	0.84	1.09	1.29	1.57	2.14
1:30:00	0.00	0.00	0.46	0.62	0.76	0.97	1.14	1.36	1.85
1:35:00	0.00	0.00	0.42	0.57	0.68	0.85	0.99	1.18	1.59
1:40:00	0.00	0.00	0.38	0.50	0.61	0.74	0.86	1.00	1.34
1:45:00	0.00	0.00	0.35	0.44	0.54	0.63	0.74	0.84	1.12
1:50:00	0.00	0.00	0.32	0.38	0.48	0.54	0.62	0.70	0.91
1:55:00	0.00	0.00	0.28	0.35	0.44	0.46	0.52	0.57	0.74
2:00:00	0.00	0.00	0.24	0.32	0.40	0.41	0.46	0.49	0.63
2:05:00	0.00	0.00	0.20	0.26	0.33	0.32	0.37	0.38	0.49
2:10:00	0.00	0.00	0.16	0.21	0.27	0.26	0.29	0.30	0.38
2:15:00	0.00	0.00	0.13	0.17	0.22	0.20	0.23	0.23	0.29
2:20:00	0.00	0.00	0.11	0.14	0.17	0.16	0.18	0.18	0.23
2:25:00	0.00	0.00	0.09	0.11	0.14	0.13	0.14	0.14	0.17
2:30:00	0.00	0.00	0.07	0.09	0.11	0.10	0.11	0.11	0.13
2:35:00	0.00	0.00	0.05	0.07	0.09	0.08	0.09	0.08	0.10
2:40:00	0.00	0.00	0.04	0.05	0.07	0.06	0.07	0.06	0.08
2:45:00	0.00	0.00	0.03	0.04	0.05	0.05	0.05	0.05	0.06
2:50:00	0.00	0.00	0.03	0.03	0.04	0.04	0.04	0.04	0.05
2:55:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.04
3:00:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
3:05:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02
3:10:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
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

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.06, November 2016)

Designer: JPS
Company: JPS
Date: January 22, 2021
Project: ARACO CONCRETE
Location: BASIN EDB-A2

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 51.9 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.519

C) Contributing Watershed Area — Area = 2.300 ac

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

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

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

F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$) — V_{DESIGN}= 0.041 ac-ft

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

H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired) — $V_{DESIGN\ USER}$= ______ ac-ft

I) Predominant Watershed NRCS Soil Group

Choose One
- ◉ A
- ◯ B
- ◯ C / D

J) Excess Urban Runoff Volume (EURV) Design Volume
For HSG A: $EURV_A = 1.68 * i^{1.28}$
For HSG B: $EURV_B = 1.36 * i^{1.08}$
For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$
— EURV = 0.139 ac-f t

2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.) — L : W = 3.0 : 1

3. Basin Side Slopes

A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred) — Z = 0.00 ft / ft

DIFFICULT TO MAINTAIN, INCREASE WHERE POSSIBLE

4. Inlet

A) Describe means of providing energy dissipation at concentrated inflow locations: — Concrete Apron / Connection to Concrete Trickle Channel

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**JPS**
Company:	**JPS**
Date:	**January 22, 2021**
Project:	**ARACO CONCRETE**
Location:	**BASIN EDB-A2**

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 1% of the WQCV)	V_{FMIN} = 0.000 ac-ft
B) Actual Forebay Volume	V_F = 0.001 ac-ft
C) Forebay Depth (D_F = 12 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 8.70 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 0.17 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe; ◉ Wall with Rect. Notch; ○ Wall with V-Notch Weir — **(flow too small for berm w/ pipe)**
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 3.0 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ◉ Concrete; ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 10 sq ft
C) Outlet Type	Choose One: ◉ Orifice Plate; ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 0.28 inches
E) Total Outlet Area	A_{ot} = 0.93 square inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**JPS**
Company:	**JPS**
Date:	**January 22, 2021**
Project:	**ARACO CONCRETE**
Location:	**BASIN EDB-A2**

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 4 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = ____ cu ft

C) Initial Surcharge Provided Above Micropool — V_s= 3.3 cu ft

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = 35 square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) — *S.S. Well Screen with 60% Open Area*

Other (Y/N): N

C) Ratio of Total Open Area to Total Area (only for type 'Other') — User Ratio =

D) Total Water Quality Screen Area (based on screen type) — A_{total} = 58 sq. in.

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H= 1.93 feet

F) Height of Water Quality Screen (H_{TR}) — H_{TR}= 51.16 inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = 12.0 inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: JPS
Company: JPS
Date: January 22, 2021
Project: ARACO CONCRETE
Location: BASIN EDB-A2

10. Overflow Embankment	
A) Describe embankment protection for 100-year and greater overtopping:	Buried Riprap Spillway
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	
11. Vegetation	Choose One: ○ Irrigated ◉ Not Irrigated
12. Access	
A) Describe Sediment Removal Procedures	Periodic inspection and maintenance by property owner as required Ramp provided for skid-loader access to pond bottom

Notes:

APPENDIX D

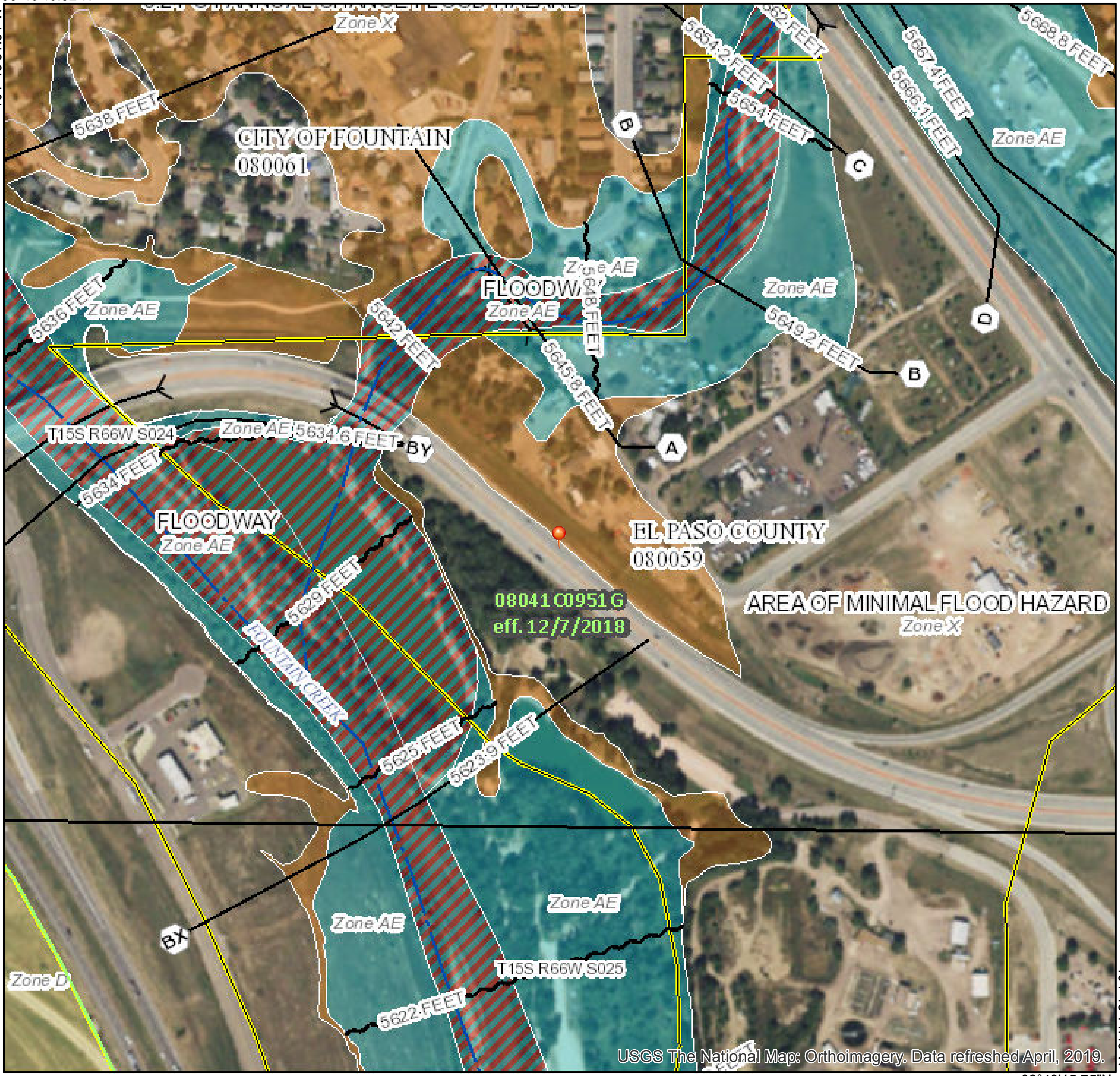
FIGURES

National Flood Hazard Layer FIRMette

FEMA

38°43'43.82"N

104°43'51.91"W



104°43'14.46"W

38°43'15.75"N

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

1:6,000

Legend

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

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

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

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

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

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

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

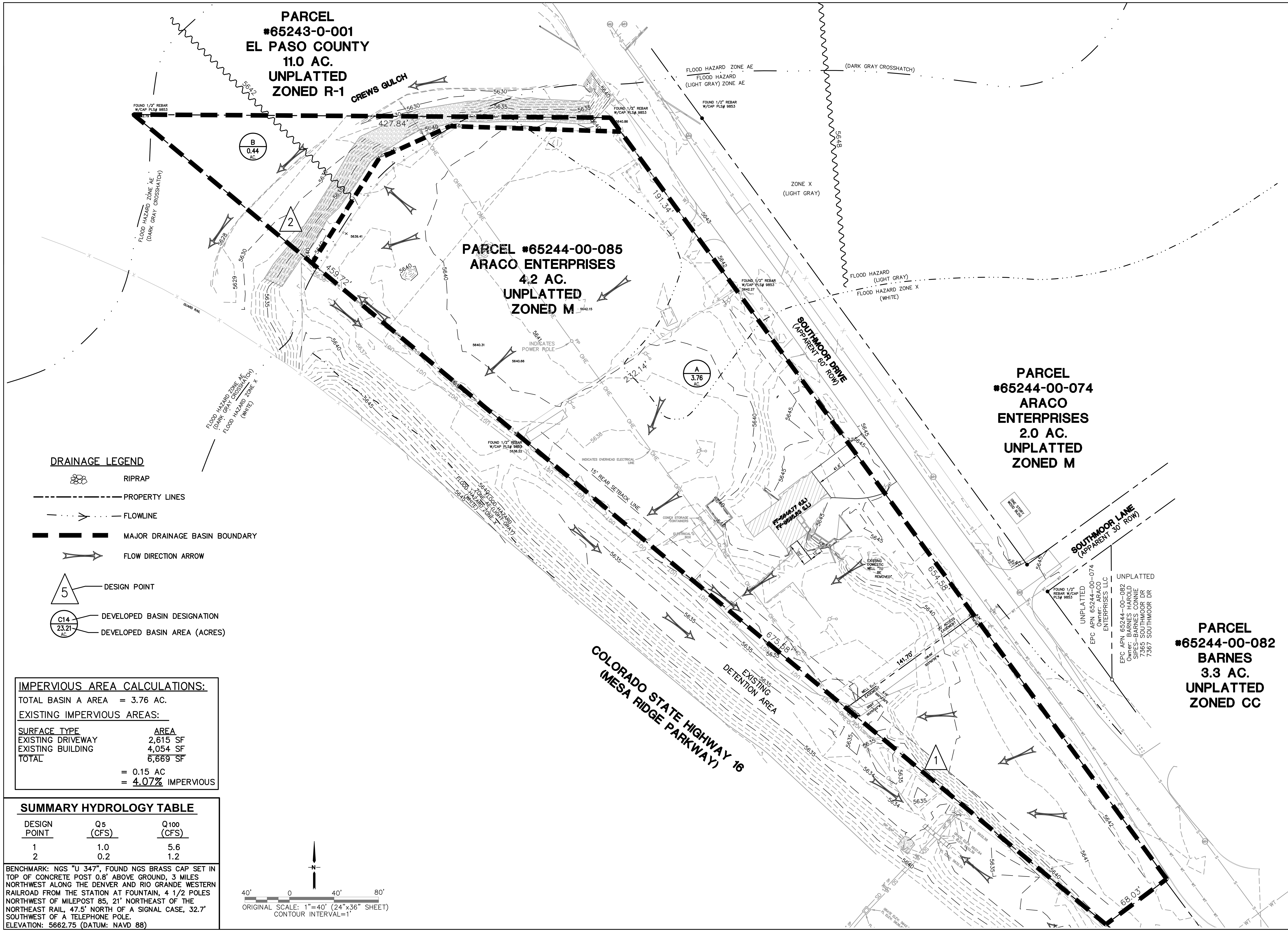
N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/23/2019 at 3:55:48 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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



IMPERVIOUS AREA CALCULATIONS:

TOTAL BASIN A AREA = 3.76 AC.

EXISTING IMPERVIOUS AREAS:

SURFACE TYPE	AREA
EXISTING DRIVEWAY	2,615 SF
EXISTING BUILDING	4,054 SF
TOTAL	6,669 SF

= 0.15 AC
= 4.07% IMPERVIOUS

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q_5 (CFS)	Q_{100} (CFS)
1	1.0	5.6
2	0.2	1.2

BENCHMARK: NGS "U 347", FOUND NGS BRASS CAP SET IN TOP OF CONCRETE POST 0.8' ABOVE GROUND, 3 MILES NORTHWEST ALONG THE DENVER AND RIO GRANDE WESTERN RAILROAD FROM THE STATION AT FOUNTAIN, 4 1/2 POLES NORTHWEST OF MILEPOST 85, 21' NORTHEAST OF THE NORTHEAST RAIL, 47.5' NORTH OF A SIGNAL CASE, 32.7' SOUTHWEST OF A TELEPHONE POLE.
ELEVATION: 5662.75 (DATUM: NAVD 88)

ARACO CONCRETE

7470 SOUTHMOOR DR., COLORADO SPRINGS, COLORADO 80915

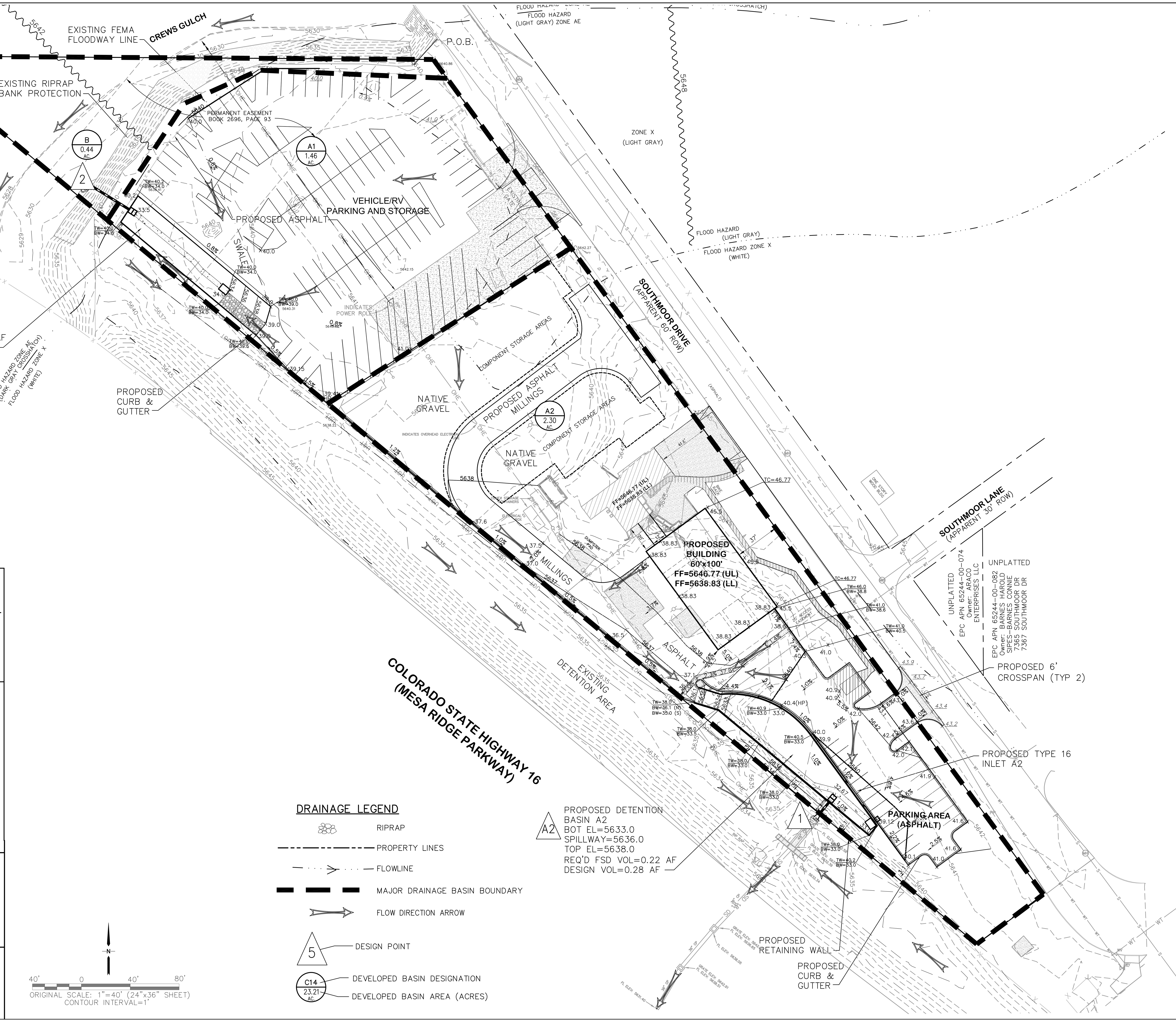
JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

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

No.	REVISION	BY	DATE

HISTORIC DRAINAGE PLAN

HORZ. SCALE: 1"=40'	DRAWN: BJJ
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: LDC	CHECKED: JPS
CREATED: 10/01/19	LAST MODIFIED: 1/22/21
PROJECT NO: 111705	MODIFIED BY: BJJ
SHEET:	EX1



IMPERVIOUS AREA CALCULATIONS:

TOTAL BASIN A1 AREA = 1.46 AC.

IMPERVIOUS AREAS:

SURFACE TYPE	AREA
ASPHALT	46,528 SF
CONCRETE	9,791 SF
TOTAL	56,319 SF
	= 1.29 AC
	= **88.6%** IMPERVIOUS

IMPERVIOUS AREA CALCULATIONS:

TOTAL BASIN A2 AREA = 2.30 AC.

IMPERVIOUS AREAS:

SURFACE TYPE	AREA
NATIVE GRAVEL	24,016 SF
(@ 40% IMPERVIOUS)	9,606 SF
MILLINGS @ 100%	9,237 SF
EX-CONCRETE	3,666 SF
EX-BUILDING	2,062 SF
PR-BUILDING	6,000 SF
PR-ASPHALT	21,423 SF
TOTAL	51,994 SF
	= 1.19 AC
	= **51.9%** IMPERVIOUS

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q_5 (CFS)	Q_{100} (CFS)
1 (DEVELOPED)	9.3	17.2
1 (DETAINED)	0.1	0.8
2 (DEVELOPED)	0.2	1.2

BENCHMARK: NGS "U 347", FOUND NGS BRASS CAP SET IN TOP OF CONCRETE POST 0.8' ABOVE GROUND, 3 MILES NORTHWEST ALONG THE DENVER AND RIO GRANDE WESTERN RAILROAD FROM THE STATION AT FOUNTAIN, 4 1/2 POLES NORTHWEST OF MILEPOST 85, 21' NORTHEAST OF THE NORTHEAST RAIL, 47.5' NORTH OF A SIGNAL CASE, 32.7' SOUTHWEST OF A TELEPHONE POLE.
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No.	REVISION	BY	DATE

DEVELOPED DRAINAGE PLAN

HORZ. SCALE:	1"=40'	DRAWN:	BJJ
VERT. SCALE:	N/A	DESIGNED:	JPS
SURVEYED:	LDC	CHECKED:	JPS
CREATED:	6/21/19	LAST MODIFIED:	1/4/23
PROJECT NO:	111705	MODIFIED BY:	BJJ
SHEET:			

D1