FINAL DRAINAGE REPORT – ADDENDUM NO. 1

for

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

Prepared for:

Araco Enterprises LLC
7470 Southmoor Drive
Fountain, CO 80817

June 17, 2024

Prepared by:

19 E. Willamette Ave.
Colorado Springs, CO 80903
(719)-477-9429
www.jpsengr.com

JPS Project No. 111705
PPR-1950

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

COLORADO REGISTERED
JOHN P. SCHWAB
6/21/24
29891
PROFESSIONAL ENGINEER

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:

John P. Schwab

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: _____ 6/21/24

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.

Gilbert LaForce, P.E. Digitally signed by Gilbert LaForce, P.E.
Reason: Authorized signatory as County Engineer designee
Date: 2024.07.23 17:06:51-06'00' 07/23/2024

Joshua Palmer, P.E. Date
County Engineer / ECM Administrator

Conditions:

JPS ENGINEERING
19 E. Willamette Avenue
Colorado Springs, CO 80903
(719)-477-9429
www.jpsengr.com

ARACO ENTERPRISES LLC – FINAL DRAINAGE REPORT ADDENDUM NO. 1

I. GENERAL

A. Background

Araco Enterprises LLC is constructing a building addition along with parking and related site improvements on the developed property 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 6th P.M. The property is located along the southwest side of Southmoor Drive. The property is zoned M (Industrial).

B. Scope

JPS Engineering prepared the "Final Drainage Report (FDR) for Araco Enterprises LLC – Building Addition" dated June 10, 2022 (approved by El Paso County on 1/5/23; PPR-1950). This report serves as an Addendum to the previously approved FDR. The purpose of this Addendum is to provide updated drainage calculations in support of consolidating the on-site stormwater detention facilities into a single basin at the northwest corner of the property.

II. DEVELOPED DRAINAGE CONDITIONS

The developed drainage basins and projected flows are shown on the attached Figure D1 (Appendix C). The previously depicted Detention Basin A2 (near the southeast corner of the site) has been eliminated, and the proposed Detention Basin A1 at the northwest corner of the site has been enlarged to meet all of the required on-site stormwater detention and water quality requirements.

Appendix A of this Addendum includes updated hydrologic calculations along with updated hydraulic calculations for the proposed Storm Sewer System A2-A1 (24" HDPE and 18" HDPE) conveying the developed drainage from the southerly Basin A2 into Detention Basin A1.

Appendix B includes updated detention pond design calculations, and the revised outlet structure design details are provided on Sh. C3.1.

III. SUMMARY

This Addendum No. 1 to the "Final Drainage Report for Araco Enterprises LLC – Building Addition" provides revised drainage calculations for the consolidation of on-site stormwater detention facilities in Detention Basin A1 at the northwest corner of the property. The proposed detention pond has been designed to provide stormwater detention and water quality to mitigate developed drainage impacts for this site. Proper construction and maintenance of the proposed drainage and erosion control facilities will ensure that this development has no significant adverse drainage impact on downstream or surrounding areas.

APPENDIX A

DRAINAGE CALCULATIONS

ARACO CONCRETE
COMPOSITE RUNOFF COEFFICIENTS

DEVELOPED CONDITIONS

5-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
A1	1.46	1.293	ASPHALT	0.9	0.167	LANDSCAPED	0.08				0.806
A2	2.30	1.340	BUILDING / ASPHALT	0.9	0.550	GRAVEL	0.59	0.41	LANDSCAPED	0.08	0.665
A1,A2	3.76										0.720

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	1.340	BUILDING / ASPHALT	0.96	0.550	GRAVEL	0.7	0.41	LANDSCAPED	0.35	0.727
A1,A2	3.76										0.790

ARACO CONCRETE
RATIONAL METHOD

HISTORIC FLOWS

					Overland Flow			Channel flow										
BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR	C 100-YEAR	LENGTH (FT)	SLOPE (FT/FT)	Tco [1] (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS [2] VELOCITY (FT/S)	Tt [3] (MIN)	TOTAL Tc [4] (MIN)	TOTAL Tc [4] (MIN)	INTENSITY [5] 5-YR (IN/HR)	INTENSITY [5] 100-YR (IN/HR)	PEAK FLOW Q5 [6] (CFS)	PEAK FLOW Q100 [6] (CFS)
A	**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

					Overland Flow			Channel flow										
BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR	C 100-YEAR	LENGTH (FT)	SLOPE (FT/FT)	Tco [1] (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS [2] VELOCITY (FT/S)	Tt [3] (MIN)	TOTAL Tc [4] (MIN)	TOTAL Tc [4] (MIN)	INTENSITY [5] 5-YR (IN/HR)	INTENSITY [5] 100-YR (IN/HR)	PEAK FLOW Q5 [6] (CFS)	PEAK FLOW Q100 [6] (CFS)
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	0.665	0.727	100	0.03	5.5	500	20	0.01	2.00	4.2	9.7	9.7	4.18	7.01	6.39	11.72
Tt A2 to DP1								485	20	0.008	1.79	4.5						
A1,A2	**1**	3.76	0.720	0.790									14.2	14.2	3.60	6.05	**9.75**	**17.96**
DETAINED FLOW:																		
POND A1 DISCHARGE	**1**	3.76															**0.10**	**1.00**
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

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	6.4	11.7	100	6.4	11.7	SUMP TYPE 16	DOUBLE	20.1
A1	A1	5.6	10.3	100	5.6	10.3	SUMP TYPE 16	DOUBLE	16.5

Version 4.05 Released March 2017

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Inlet A2	Inlet A1
Site Type (Urban or Rural)	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET
Hydraulic Condition	In Sump	In Sump
Inlet Type	Denver No. 16 Combination	Denver No. 16 Combination

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	6.4	5.6
Major Q_{Known} (cfs)	11.7	10.3

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)		
Percent Impervious		
NRCS Soil Type		

Watershed Profile

Overland Slope (ft/ft)		
Overland Length (ft)		
Channel Slope (ft/ft)		
Channel Length (ft)		

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)		
One-Hour Precipitation, P_1 (inches)		

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**6.4**	**5.6**
Major Total Design Peak Flow, Q (cfs)	**11.7**	**10.3**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	N/A

Minor Storm (Calculated) Analysis of Flow Time

C	N/A	N/A
C_5	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A
Overland Flow Time, Ti	N/A	N/A
Channel Travel Time, Tt	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A
Regional T_c	N/A	N/A
Recommended T_c	N/A	N/A
T_c selected by User	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A

Major Storm (Calculated) Analysis of Flow Time

C	N/A	N/A
C_5	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A
Overland Flow Time, Ti	N/A	N/A
Channel Travel Time, Tt	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A
Regional T_c	N/A	N/A
Recommended T_c	N/A	N/A
T_c selected by User	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A

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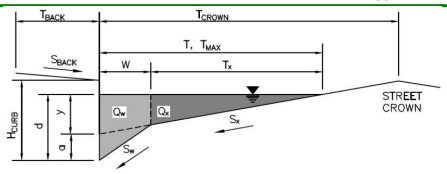
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project: Araco Enterprises - Inlet A2 (Sump Condition)

Inlet ID: Inlet A1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	4.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	50.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.013	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	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

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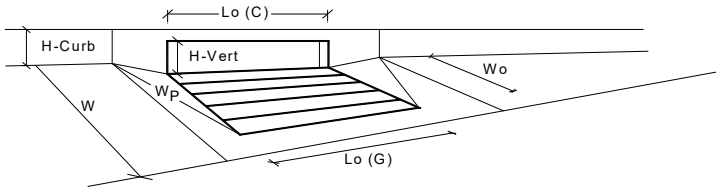

Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	9.5	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	0.813	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.62	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.71	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.71	1.00	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.2**	**16.5**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.6	10.3	cfs

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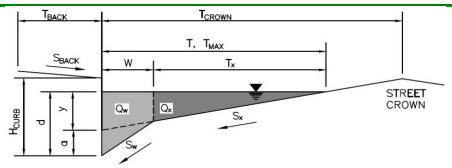
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(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)

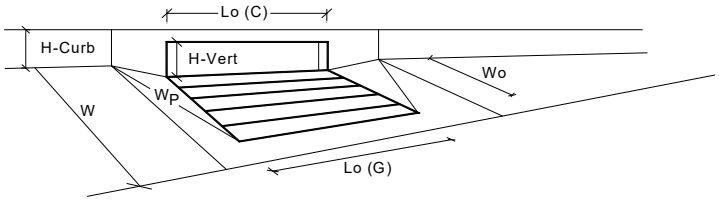
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	4.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	50.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.037	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	12.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	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 =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	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	1.023	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.83	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.71	1.00	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.71	1.00	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.2**	**20.1**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Minor Storm	$Q_{PEAK\ REQUIRED}$ =	6.4	11.7	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	6.4	11.7		24	0.5%	16.0
A1	A1	5.6	10.3		18	1.0%	10.5

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: 2.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0130

Depth: 2.0000 ft

Result Parameters

Flow: 15.9965 cfs

Area of Flow: 3.1416 ft^2

Wetted Perimeter: 6.2832 ft

Hydraulic Radius: 0.5000 ft

Average Velocity: 5.0918 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.4414 ft

Critical Velocity: 6.5991 ft/s

Critical Slope: 0.0066 ft/ft

Critical Top Width: 1.79 ft

Calculated Max Shear Stress: 0.6240 lb/ft^2

Calculated Avg Shear Stress: 0.1560 lb/ft^2

Channel Analysis: SD-A1

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.5000 ft

Longitudinal Slope: 0.0100 ft/ft

Manning's n: 0.0130

Depth: 1.5000 ft

Result Parameters

Flow: 10.5043 cfs

Area of Flow: 1.7671 ft^2

Wetted Perimeter: 4.7124 ft

Hydraulic Radius: 0.3750 ft

Average Velocity: 5.9442 ft/s

Top Width: 0.0000 ft

Froude Number: 0.0000

Critical Depth: 1.2451 ft

Critical Velocity: 6.6989 ft/s

Critical Slope: 0.0098 ft/ft

Critical Top Width: 1.13 ft

Calculated Max Shear Stress: 0.9360 lb/ft^2

Calculated Avg Shear Stress: 0.2340 lb/ft^2

APPENDIX B

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

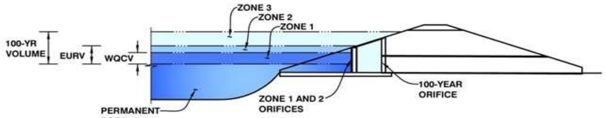
BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
A1	1.46	1.293	ASPHALT	100	0.167	LANDSCAPED	0				88.562
A2	2.30	1.340	BUILDING / ASPHALT	100	0.550	NATIVE GRAVEL	40	0.41	LANDSCAPE	0	67.826
A1,A2	3.76										75.878

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 =	3.76	acres		
Watershed Length =	835	ft		
Watershed Length to Centroid =	415	ft		
Watershed Slope =	0.013	ft/ft		
Watershed Imperviousness =	76.00%	percent		
Percentage Hydrologic Soil Group A =	100.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
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) =	0.096	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.370	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.264	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.343	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.406	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.483	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.557	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.645	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.14 in.) =	0.838	acre-feet	3.14	inches
Approximate 2-yr Detention Volume =	0.243	acre-feet		
Approximate 5-yr Detention Volume =	0.316	acre-feet		
Approximate 10-yr Detention Volume =	0.378	acre-feet		
Approximate 25-yr Detention Volume =	0.451	acre-feet		
Approximate 50-yr Detention Volume =	0.493	acre-feet		
Approximate 100-yr Detention Volume =	0.534	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.096	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.275	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.163	acre-feet
Total Detention Basin Volume =	0.534	acre-feet

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	10	0.000		
Bot EL-5632.0	--	1.50	--	--	--	2,962	0.068	2,229	0.051
	--	3.50	--	--	--	3,410	0.078	8,601	0.197
	--	5.50	--	--	--	3,874	0.089	15,885	0.365
Spillway=5638.0	--	7.50	--	--	--	4,329	0.099	24,088	0.553
Top EL=5640.0	--	9.50	--	--	--	4,780	0.110	33,197	0.762
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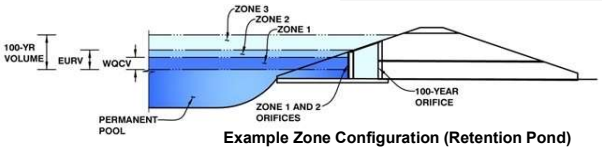
DETENTION BASIN OUTLET STRUCTURE DESIGN

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)	2.14	0.096	Orifice Plate
Zone 2 (EURV)	5.57	0.275	Orifice Plate
Zone 3 (100-year)	7.31	0.163	Weir&Pipe (Restrict)
Total (all zones)		0.534	

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

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	5.57	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	14.60	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.86	3.71					
Orifice Area (sq. inches)	0.75	0.75	0.75					

	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)	Vertical Orifice Area =	N/A	N/A ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A feet
Vertical Orifice Diameter =	N/A	N/A	inches			

Calculated Parameters for Vertical Orifice

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 =	6.40	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.40	N/A	feet
Overflow Weir Front Edge Length =	4.00	N/A	feet	Overflow Weir Slope Length =	2.50	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	89.98	N/A	
Horiz. Length of Weir Sides =	2.50	N/A	feet	Overflow Grate Open Area w/o Debris =	6.96	N/A	ft^2
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	3.48	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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 =	0.10	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.08	N/A ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.08	N/A feet
Restrictor Plate Height Above Pipe Invert =	1.60		inches	Half-Central Angle of Restrictor Plate on Pipe =	0.61	N/A radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.00	feet
Spillway Crest Length =	3.00	feet	Stage at Top of Freeboard =	9.50	feet
Spillway End Slopes =	0.00	H:V	Basin Area at Top of Freeboard =	0.11	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.76	acre-ft

Calculated Parameters for Spillway

Routed Hydrograph Results

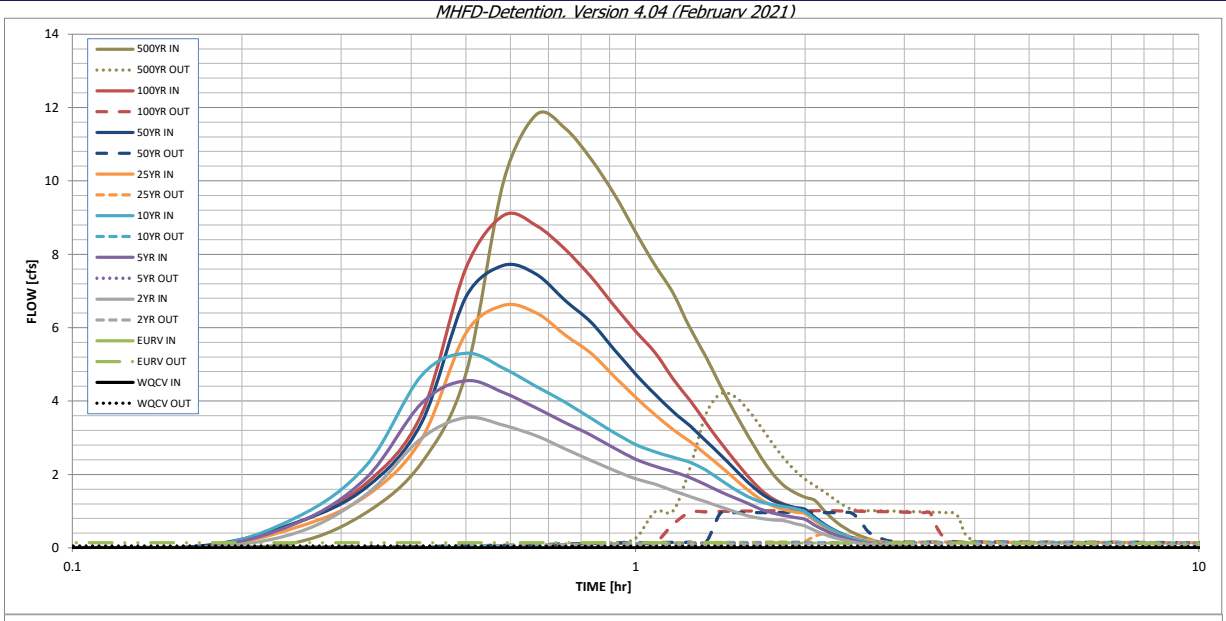
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

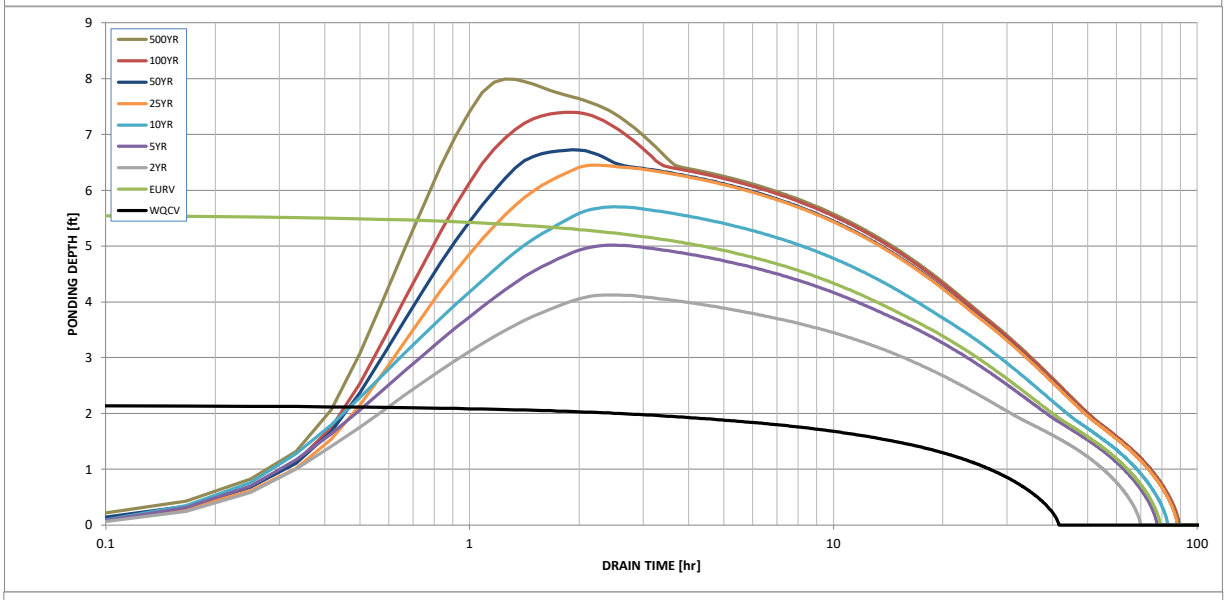
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.14
CUHP Runoff Volume (acre-ft) =	0.096	0.370	0.264	0.343	0.406	0.483	0.557	0.645	0.838
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.264	0.343	0.406	0.483	0.557	0.645	0.838
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.1	0.5	0.9	1.5	2.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.01	0.12	0.25	0.41	0.76
Peak Inflow Q (cfs) =	N/A	N/A	3.5	4.6	5.3	6.6	7.7	9.1	11.8
Peak Outflow Q (cfs) =	0.0	0.1	0.1	0.1	0.1	0.4	1.0	1.0	4.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.6	2.9	0.8	1.0	0.7	1.5
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	71	63	70	74	78	77	76	74
Time to Drain 99% of Inflow Volume (hours) =	**40**	75	67	74	79	84	83	83	82
Maximum Ponding Depth (ft) =	2.15	5.56	4.12	5.02	5.70	6.45	6.72	7.40	8.00
Area at Maximum Ponding Depth (acres) =	0.07	0.09	0.08	0.09	0.09	0.09	0.10	0.10	0.10
Maximum Volume Stored (acre-ft) =	0.096	0.370	0.247	0.322	0.383	0.452	0.477	0.542	0.602

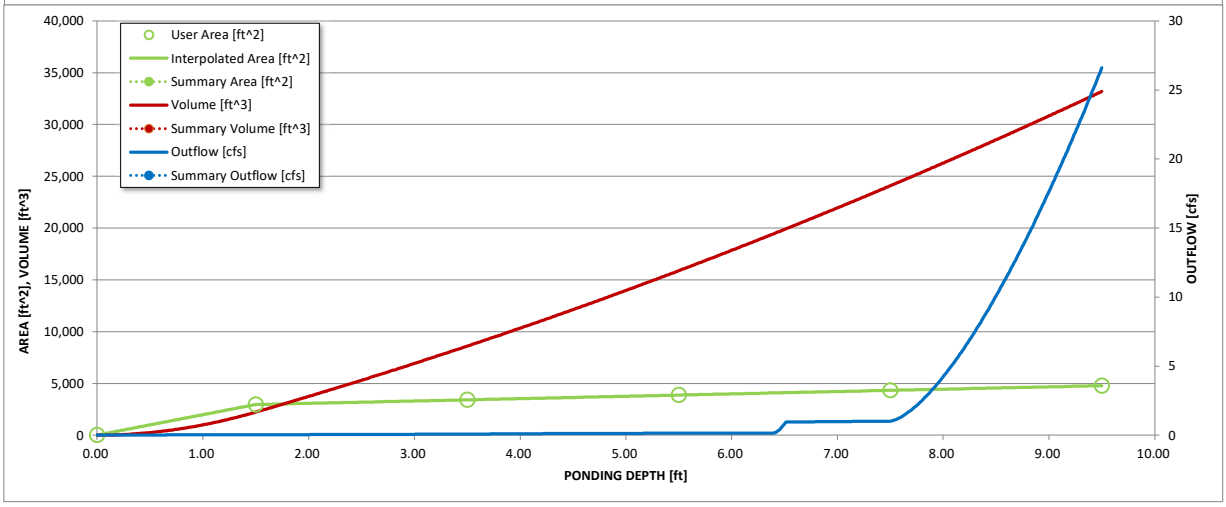
Note that while the indicated ratios of Peak Outflow to Predevelopment Q appear higher than the recommended range for the 5-year and 10-year storms, the actual Peak Outflows are negligible (0.1 cfs) for these design storms.

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	0.05	0.00	0.15
	0:15:00	0.00	0.00	0.41	0.67	0.83	0.56	0.69	0.68	0.97
	0:20:00	0.00	0.00	1.47	1.92	2.26	1.42	1.66	1.78	2.31
	0:25:00	0.00	0.00	2.99	3.94	4.69	2.95	3.40	3.63	4.74
	0:30:00	0.00	0.00	3.55	4.55	5.30	5.85	6.84	7.62	10.00
	0:35:00	0.00	0.00	3.34	4.23	4.89	6.61	7.70	9.06	11.81
	0:40:00	0.00	0.00	3.05	3.81	4.40	6.40	7.45	8.78	11.43
	0:45:00	0.00	0.00	2.70	3.41	3.96	5.80	6.74	8.13	10.60
	0:50:00	0.00	0.00	2.38	3.07	3.53	5.30	6.15	7.39	9.64
	0:55:00	0.00	0.00	2.11	2.72	3.14	4.67	5.41	6.60	8.61
	1:00:00	0.00	0.00	1.88	2.42	2.82	4.11	4.74	5.91	7.70
	1:05:00	0.00	0.00	1.73	2.22	2.62	3.63	4.18	5.32	6.94
	1:10:00	0.00	0.00	1.56	2.08	2.47	3.22	3.70	4.60	5.98
	1:15:00	0.00	0.00	1.40	1.91	2.33	2.89	3.32	4.02	5.21
	1:20:00	0.00	0.00	1.26	1.72	2.12	2.54	2.91	3.41	4.40
	1:25:00	0.00	0.00	1.12	1.53	1.85	2.22	2.53	2.87	3.69
	1:30:00	0.00	0.00	0.99	1.36	1.60	1.88	2.14	2.39	3.06
	1:35:00	0.00	0.00	0.88	1.22	1.40	1.58	1.79	1.96	2.50
	1:40:00	0.00	0.00	0.80	1.06	1.26	1.32	1.50	1.59	2.03
	1:45:00	0.00	0.00	0.76	0.95	1.18	1.15	1.30	1.35	1.70
	1:50:00	0.00	0.00	0.74	0.89	1.13	1.04	1.18	1.20	1.51
	1:55:00	0.00	0.00	0.66	0.83	1.07	0.98	1.10	1.10	1.38
	2:00:00	0.00	0.00	0.59	0.78	0.99	0.93	1.05	1.03	1.29
	2:05:00	0.00	0.00	0.47	0.61	0.78	0.74	0.83	0.80	1.00
	2:10:00	0.00	0.00	0.37	0.48	0.61	0.57	0.64	0.61	0.76
	2:15:00	0.00	0.00	0.28	0.37	0.47	0.44	0.49	0.46	0.58
	2:20:00	0.00	0.00	0.22	0.28	0.36	0.34	0.38	0.35	0.44
	2:25:00	0.00	0.00	0.17	0.22	0.27	0.26	0.29	0.27	0.33
	2:30:00	0.00	0.00	0.13	0.16	0.20	0.19	0.21	0.20	0.25
	2:35:00	0.00	0.00	0.09	0.12	0.15	0.14	0.16	0.15	0.19
	2:40:00	0.00	0.00	0.07	0.09	0.11	0.11	0.12	0.12	0.14
	2:45:00	0.00	0.00	0.05	0.06	0.08	0.08	0.09	0.08	0.11
	2:50:00	0.00	0.00	0.03	0.04	0.06	0.05	0.06	0.06	0.07
	2:55:00	0.00	0.00	0.02	0.03	0.04	0.04	0.04	0.04	0.05
	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	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	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) **Sheet 1 of 4**

Designer: JPS
Company: JPS
Date: June 4, 2024
Project: ARACO CONCRETE
Location: BASIN EDB-A1

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 76.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.760

C) Contributing Watershed Area — Area = 3.760 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} = 0.096 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 = 0.370 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 = 4.0 : 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 Forebay

Design Procedure Form: Extended Detention Basin (EDB)

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5. Forebay

A) Minimum Forebay Volume (V_{FMIN} = 2% of the WQCV) — V_{FMIN} = 0.002 ac-ft

B) Actual Forebay Volume — V_F = 0.002 ac-ft

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

D) Forebay Discharge

i) Undetained 100-year Peak Discharge — Q_{100} = 17.96 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$) — Q_F = 0.36 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 = 3.9 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) — $D_{orifice}$ = 0.75 inches

E) Total Outlet Area — A_{ot} = 2.25 square inches

Design Procedure Form: Extended Detention Basin (EDB)

Designer: JPS
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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 = 81 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} = 134 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 5.57 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 94.84 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: June 4, 2024
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:

Hydraulic Analysis Report

Project Data

Project Title: Project - Araco – Detention Pond Trickle Channel

Designer: JPS

Project Date: Wednesday, June 5, 2024

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis - Trickle Channel

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 12.0000 ft/ft

Side Slope 2 (Z2): 12.0000 ft/ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0130

Flow: 0.1800 cfs **= 1% of 100-Yr Peak Inflow (DP1)**

Result Parameters

Depth: 0.1125 ft OK

Area of Flow: 0.1520 ft^2

Wetted Perimeter: 2.7105 ft

Hydraulic Radius: 0.0561 ft

Average Velocity: 1.1842 ft/s

Top Width: 2.7011 ft OK

Froude Number: 0.8797

Critical Depth: 0.1069 ft

Critical Velocity: 1.3120 ft/s

Critical Slope: 0.0066 ft/ft

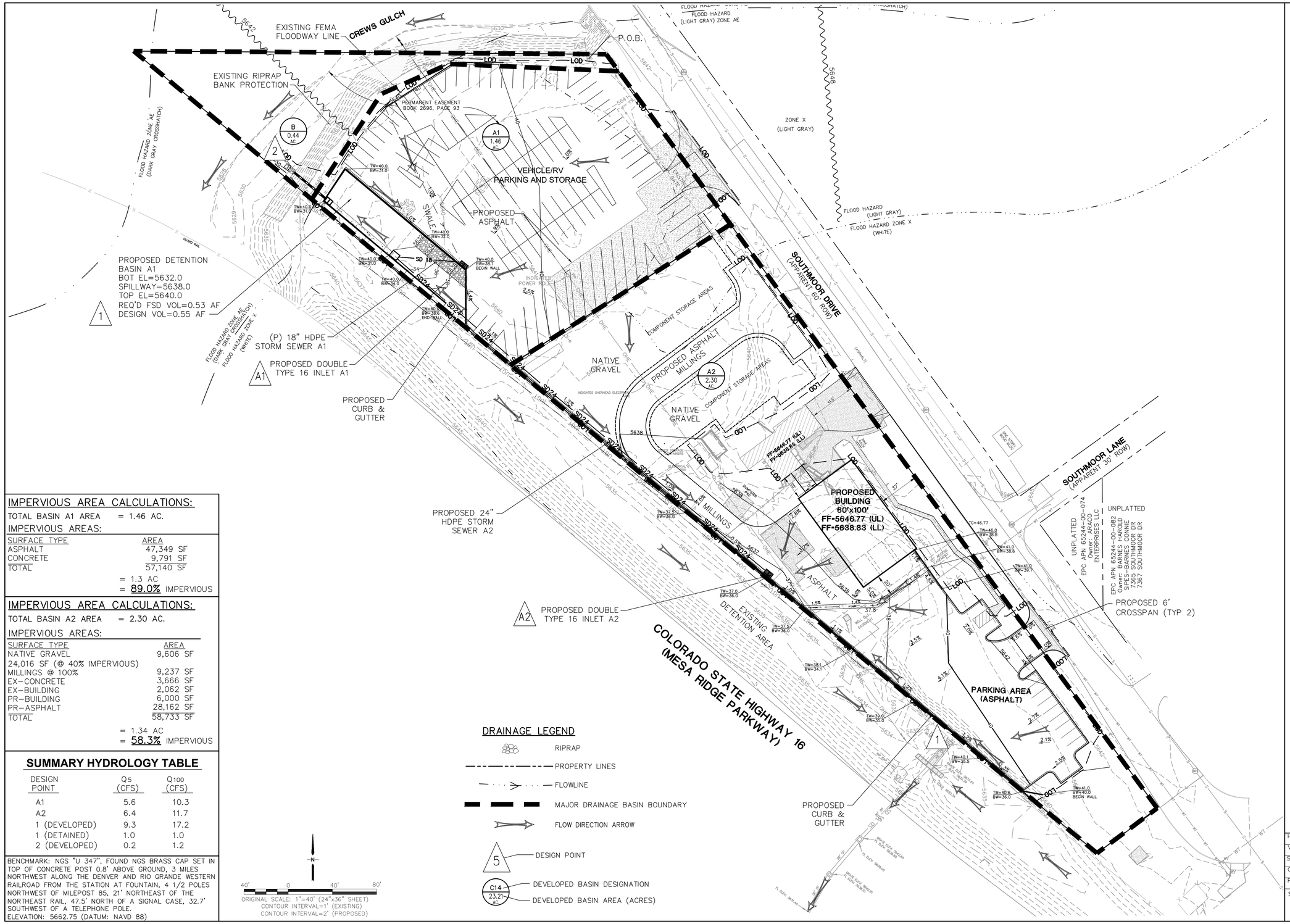
Critical Top Width: 2.57 ft

Calculated Max Shear Stress: 0.0351 lb/ft^2

Calculated Avg Shear Stress: 0.0175 lb/ft^2

APPENDIX C

FIGURES



IMPERVIOUS AREA CALCULATIONS:

TOTAL BASIN A1 AREA = 1.46 AC.

IMPERVIOUS AREAS:

SURFACE TYPE	AREA
ASPHALT	47,349 SF
CONCRETE	9,791 SF
TOTAL	57,140 SF

= 1.3 AC

= **89.0%** IMPERVIOUS

IMPERVIOUS AREA CALCULATIONS:

TOTAL BASIN A2 AREA = 2.30 AC.

IMPERVIOUS AREAS:

SURFACE TYPE	AREA
NATIVE GRAVEL	9,606 SF
24,016 SF (@ 40% IMPERVIOUS)	
MILLINGS @ 100%	9,237 SF
EX-CONCRETE	3,666 SF
EX-BUILDING	2,062 SF
PR-BUILDING	6,000 SF
PR-ASPHALT	28,162 SF
TOTAL	58,733 SF

= 1.34 AC

= **58.3%** IMPERVIOUS

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
A1	5.6	10.3
A2	6.4	11.7
1 (DEVELOPED)	9.3	17.2
1 (DETAINED)	1.0	1.0
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. ELEVATION: 5662.75 (DATUM: NAVD 88)

ARACO CONCRETE
7470 SOUTHMOOR DR., COLORADO SPRINGS, COLORADO 80915

DEVELOPED DRAINAGE PLAN

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

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

No.	REVISION	BY	DATE

HORZ. SCALE:	1"=40'
VERT. SCALE:	N/A
SURVEYED:	LDC
CREATED:	6/21/19
PROJECT NO:	111705
DRAWN:	BJJ
DESIGNED:	JPS
CHECKED:	JPS
LAST MODIFIED:	06/13/24
MODIFIED BY:	PV

SHEET: D1