MEMORANDUM

To:	El Paso County - Stormwater		
From:	Scott Maier, PE (Ayres Associates)		
Date:	October 19, 2023	EPC Project No.:	PPR2315
Re:	Super Star Carwash – Claremont Business Park 2 – Drainage Compliance Letter		

Background

Super Star Carwash is planning to construct a carwash located within the Claremont Business Park 2 located at the southwest corner of Marksheffel Road and Meadowbrook Parkway. The site is currently vacant and is 1.5+/- acres.

The proposed development will consist of a 5,000+/- square foot carwash building with access drives, parking areas with vacuum bays, patio areas, and landscaping. This lot was initially contemplated for development as part of the overall development of the Claremont Business Park 2, Filing No. 2 VR 233. The onsite runoff will be collected via onsite private storm sewers and curb and gutter. The runoff is conveyed to an onsite rain garden to provide water quality treatment. Peak runoff detention is not required for this project. The overall development will construct the storm sewer conveyance system to convey runoff from this site to the downstream outfall into the east fork of Sand Creek located southwest of this site and across Meadowbrook Parkway. The purpose of this letter is to demonstrate that the proposed development of the Super Star Carwash is in compliance with the assumptions of Claremont Business Park 2 Filing No. 2. The proposed development will discharge to an 18” RCP storm sewer system along El Jefe Heights that will be constructed as part of the overall development.

Onsite Basins

Basins A1 and A2 are primarily the parking lot for the carwash. The flows from these basins will be collected via curb and gutter to storm sewer inlets and curb cuts that run to the water quality basin. These basins are primarily impervious except for the minor landscape areas.

Basin B1 is the carwash building. The flows from this basin will run (via roof drains to storm sewer) to the water quality basin. This basin is 100% impervious.

Basins A3, A4, A5, and A6 are landscape areas. These landscape areas are collected in area drains that convey the water to the water quality pond. These basins are pervious landscape areas.

Basin OFF is primarily the El Jefe Heights road. This basin is accounted for, and is part of, Basin E1 of the Claremont Business Park 2, Filing No. 2 drainage report.

970.223.5556 | 3665 JFK Parkway, Bldg. 2, Suite 100 | Fort Collins, CO 80525-3152
www.AyresAssociates.com

Runoff Comparison

The proposed development for the Super Star Carwash is part of Basin B within the Claremont Business Park 2 Filing No. 2 prepared by MS Civil Consultants, dated 6/11/23 as shown in the supporting documents. Below is a summary of the anticipated runoff from the overall drainage report.

Comparison Studies	Basin Area (acres)	Time of Concentration (min.)	Design Runoff Coefficient 5-yr	Design Runoff Coefficient 100-yr	Runoff (5 year) (CFS)	Runoff (100 year) (CFS)
Claremont Business Park 2 Filing No. 2 Basins A+B***	1.71	5.0	0.81	0.88	5.9	11.2
Super Star Carwash	1.8	5.0	C=0.44	C=0.67	2.95	10.09

***Runoff noted is for design point 1 within the Claremont Business Park 2 Filing No. 2 drainage study (Not including Basin E1). Basin OFF of the superstar carwash plan is included in the calculations above; however, the runoff from basin off runs into Basin E1 of the Claremont Business Park 2 Filing No. 2. The runoff from basin OFF is a small landscape area and accounts for less than 20% of the site.

The proposed development for the Super Star Carwash will have less designed runoff than those contemplated in the Claremont Business Park 2 Filing No. 2 drainage studies even after adding in the offsite areas along Marksheffel Rd and Meadowbrook Parkway.

Water Quality

Water Quality was not included as part of the improvements for the Claremont Business Park 2 Filing No. 2 overall development and is required to be constructed upon development. The Super Star Carwash proposes to construct a rain garden to serve the water quality requirements for it's development. A rain garden is an acceptable method of providing water quality treatment.

	WQCV Required	WQCV Provided	Method
Super Star Carwash Parking Lot and Building	0.022 Ac-Ft	0.03 Ac-Ft	Rain Garden

The rain garden is designed to have an underdrain system and an outfall to the west. As part of the proposed improvements, the site will drain a rain garden in the southern portion of the site.

After treatment the rain garden will enter the overall development storm sewer system to the west and ultimately discharge into the east fork of Sand Creek.

Super Star Carwash will follow the “Four-Step Process” as defined below:

Step 1: Employ Runoff Reduction Practices
The proposed development utilizes reduced pavement areas with the implementation of landscaped islands in the parking lot and around the building.

Step 2: Stabilize Drainage Ways
Proposed drainage ways have been stabilized through the implementation of a concrete drainage pan for water entering the rain garden. A grass drainage swale is located along the east side of the property to capture offsite runoff that enters the property.

Step 3: Provide Water Quality Capture Volume (WQCV)
WQCV is achieved through a rain garden that treats onsite runoff. The rain garden is located at the southern portion of the property and treats building and parking lot runoff as well as offsite runoff that enters the site from the east.

Step 4: Consider Need for Industrial and Commercial BMP’s
The proposed site will implement silt fence, construction entrance, concrete washout area and inlet protection to limit erosion and sediment runoff across the site.

Low Impact Development

This development will propose to construct a rain garden as part of the development. The rain garden will provide water quality benefits by providing filtration and some infiltration. The engineered media within the rain garden will provide filtration of the runoff from the site. In addition to the filtration for smaller rain events infiltration will also be a benefit of the rain garden.

Conclusion

The proposed Super Star Carwash development complies with the Claremont Business Park 2 overall drainage study. The Super Star Carwash development will install the proposed rain garden to meet the water quality requirements of the onsite development.

In summary, the Super Star Carwash is in general compliance with the original development assumptions and no additional improvements to the storm sewer system beyond those noted is necessary.

Design Engineer's Statement:

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

Scott Maier, P.E. #38122

10/19/23
Date

Owner/Developer Statement:

I, the Owner/Developer had read and will comply with all of the requirements specific in the is drainage report and Plan

TIM VARLEY - Director
[Name, Title]

10/19/23
Date

SSCW 22712 MEADOWBROOK LLC
Business Name

SSCW 22712 MEADOWBROOK LLC
960 W BEHREND DR, SUITE 2, PHOENIX, AZ 85027
Address

El Paso County:

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

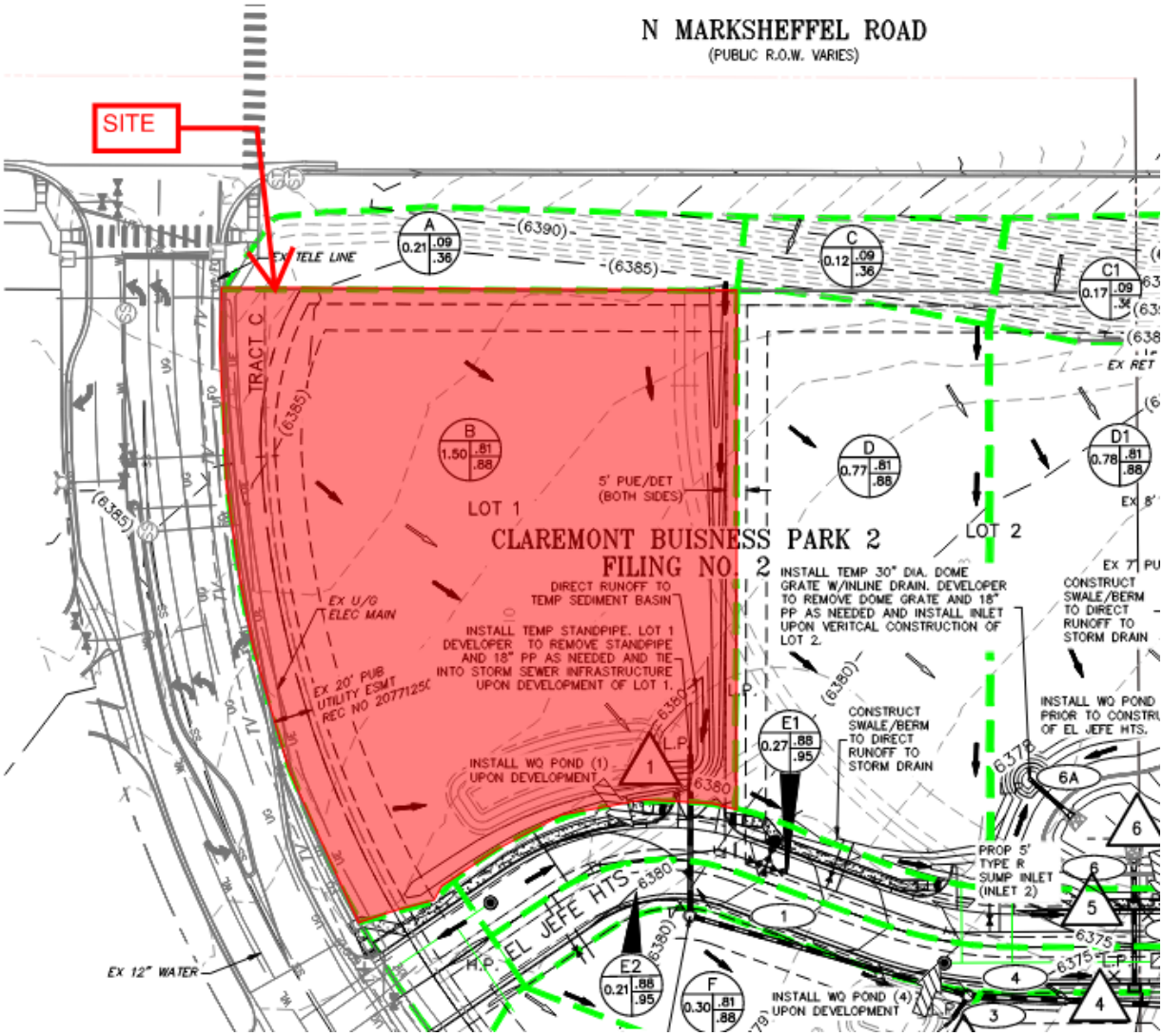
Approved
By: Gilbert LaForce, P.E.
Engineering Manager
Date: 11/07/2023 5:51:40 PM
El Paso County Department of Public Works

County Engineer/

Date

Conditions:

Claremont Business Park 2– Supporting Documents



(EXHIBIT ABOVE IS PORTION OF Claremont Business Park 2 Filing No. 2 DRAINAGE PLAN)

FINAL DRAINAGE REPORT FOR CLAREMONT BUSINESS PARK 2 FILING NO.2
PROPOSED DRAINAGE CALCULATIONS
(Area Runoff Coefficient Summary)

			ROOFS 0.73-0.81 COMMERCIAL AREAS 0.81-0.88 ASPHALT DRIVES 0.90-0.96				*LANDSCAPED AREAS 0.16-0.41 GRAVEL STORAGE YARD 0.30-0.50 LIGHT INDUST AREAS 0.59-0.70*				*PARKS 0.12-0.39 GREENBELTS/AGRI. 0.09-0.36*				*WEIGHTED*		
BASIN	TOTAL AREA *(SF)*	TOTAL AREA *(Acres)*	AREA *(Acres)*	C_2	C_5	C_{100}	AREA *(Acres)*	C_2	C_5	C_{100}	AREA *(Acres)*	C_2	C_5	C_{100}	C_2	C_5	C_{100}
A	*9300.8*	**0.21**	0.00	0.89	0.90	0.96	0.00	0.07	0.16	0.41	0.21	0.03	0.09	0.36	***0.03***	***0.09***	***0.36***
B	*65284.4*	**1.50**	1.50	0.79	0.81	0.88	0.00	0.23	0.30	0.50	0.00	0.05	0.12	0.39	***0.79***	***0.81***	***0.88***
C	*5372.3*	**0.12**	0.00	0.89	0.90	0.96	0.00	0.07	0.16	0.41	0.12	0.03	0.09	0.36	***0.03***	***0.09***	***0.36***
C1	*7457.3*	**0.17**	0.00	0.89	0.90	0.96	0.00	0.07	0.16	0.41	0.17	0.03	0.09	0.36	***0.03***	***0.09***	***0.36***
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(EXHIBIT ABOVE IS PORTION OF Claremont Business Park 2 Filing No. 2 Proposed Drainage Calculations-Area Runoff Coefficient Summary)

FINAL DRAINAGE REPORT FOR CLAREMONT BUSINESS PARK 2 FILING NO.2
PROPOSED DRAINAGE CALCULATIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary					*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY **			*TOTAL FLOWS*		
BASIN	AREA TOTAL *(Acres)*	C_2	C_5	C_{100}	C_5	Length *(ft)*	Height *(ft)*	T_C *(min)*	Length *(ft)*	Slope *(%)*	Velocity *(fps)*	T_t *(min)*	*TOTAL *(min)*	CHECK *(min)*	I_2 *(in/hr)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_2 *(c.f.s.)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
		From DCM Table 5-1																		
A	0.21	0.03	0.09	0.36	0.09	40	5.0	5.0	0	0.0%	0.0	0.0	5.0	10.2	4.1	5.2	8.7	*0.0*	*0.1*	*0.7*
B	1.50	0.79	0.81	0.88	0.81	80	1.0	4.4	240	1.7%	2.6	1.5	5.9	11.8	3.9	4.9	8.3	*4.6*	*6.0*	*10.9*
C	0.12	0.03	0.09	0.36	0.09	40	16.0	3.4	0	0.0%	0.0	0.0	5.0	10.2	4.1	5.2	8.7	*0.0*	*0.1*	*0.4*
C1	0.17	0.03	0.09	0.36	0.09	60	22.0	4.3	0	0.0%	0.0	0.0	5.0	10.3	4.1	5.2	8.7	*0.0*	*0.1*	*0.5*
D	0.77	0.79	0.81	0.88	0.81	60	1.2	3.2	250	1.6%	2.5	1.6	5.0	11.7	4.1	5.2	8.7	*2.5*	*3.2*	*5.9*
D1	0.78	0.79	0.81	0.88	0.81	60	1.2	3.2	250	1.6%	2.5	1.6	5.0	11.7	4.1	5.2	8.7	*2.5*	*3.3*	*6.0*
E1	0.27	0.87	0.88	0.95	0.88	30	0.6	1.7	280	2.0%	2.8	1.7	5.0	11.7	4.1	5.2	8.7	*1.0*	*1.2*	*2.2*
E2	0.21	0.87	0.88	0.95	0.88	30	0.6	1.7	280	2.0%	2.8	1.7	5.0	11.7	4.1	5.2	8.7	*0.7*	*1.0*	*1.7*
F	0.30	0.79	0.81	0.88	0.81	60	1.2	3.2	150	1.3%	2.3	1.1	5.0	11.2	4.1	5.2	8.7	*1.0*	*1.2*	*2.3*
G1	0.27	0.25	0.30	0.52	0.30	30	1.0	5.3	0	0.0%	0.0	0.0	5.3	10.2	4.1	5.1	8.5	*0.3*	*0.4*	*1.2*
G2	1.15	0.79	0.81	0.88	0.81	60	0.6	4.1	400	1.0%	2.0	3.3	7.4	12.6	3.7	4.6	7.7	*3.3*	*4.3*	*7.8*
H1	0.16	0.03	0.09	0.36	0.09	76	20.0	5.4	0	0.0%	0.0	0.0	5.4	10.4	4.0	5.1	8.5	*0.0*	*0.1*	*0.5*
H2	0.40	0.03	0.09	0.36	0.09	100	17.0	7.2	0	0.0%	0.0	0.0	7.2	10.6	3.7	4.6	7.8	*0.0*	*0.2*	*1.1*
H3	0.04	0.03	0.09	0.36	0.09	100	17.0	7.2	0	2.0%	1.4	0.0	7.2	10.6	3.7	4.6	7.8	*0.0*	*0.0*	*0.1*
H4	0.10	0.03	0.09	0.36	0.09	100	17.0	7.2	0	0.0%	0.0	0.0	7.2	10.6	3.7	4.6	7.8	*0.0*	*0.0*	*0.3*
I1	0.55	0.82	0.83	0.90	0.83	100	3.0	3.4	216	2.5%	3.2	1.1	5.0	11.8	4.1	5.2	8.7	*1.8*	*2.3*	*4.3*
I2	0.48	0.77	0.79	0.87	0.79	50	2.0	2.5	261	1.0%	2.0	2.2	5.0	11.7	4.1	5.2	8.7	*1.5*	*2.0*	*3.6*

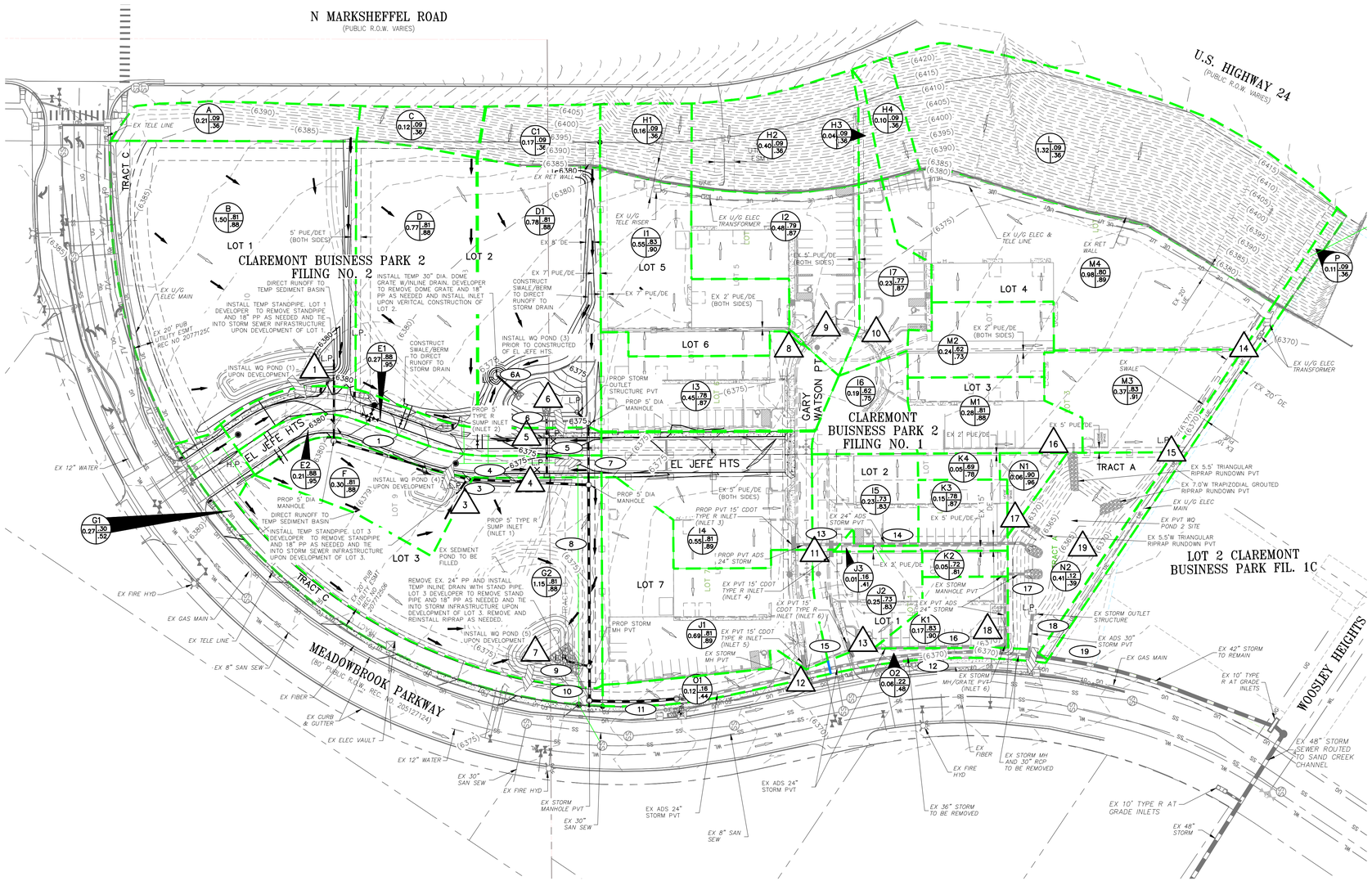
(EXHIBIT ABOVE IS PORTION OF Claremont Business Park 2 Filing No. 2 Proposed Drainage Calculations-Area Drainage Summary)

FINAL DRAINAGE REPORT FOR
CLAREMONT BUSINESS PARK 2 FILING NO.1

COUNTY OF EL PASO, STATE OF COLORADO

PROPOSED CONDITIONS DRAINAGE MAP

MAY 2023



LEGEND

- BASIN DESIGNATION (Z; 25; .25; .35; C5; C100; ACRES)
- 4 — PIPE RUN REFERENCE LABEL
- 6 — SURFACE DESIGN POINT
- BASIN BOUNDARY
- (6920) — EXISTING CONTOUR
- 6920 — PROP CONTOUR
- UGE — UNDERGROUND ELECTRICAL
- EXISTING GAS LINE
- STORM SEWER PIPE
- EXISTING STORM SEWER PIPE
- CROSSPAN
- INLET
- EXISTING FLOW DIRECTION ARROW
- EMERGENCY OVERFLOW DIRECTION
- FLOW DIRECTION
- FLARED END SECTION
- H.P. — HIGH POINT
- L.P. — LOW POINT

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
A	0.21	0.1	0.7
B	1.50	6.0	10.9
C	0.12	0.1	0.4
C1	0.17	0.1	0.5
D	0.77	3.2	5.9
D1	0.78	3.3	6.0
E1	0.27	1.2	2.2
E2	0.21	1.0	1.7
F	0.30	1.2	2.3
G1	0.27	0.4	1.2
G2	1.15	4.3	7.8
H1	0.16	0.1	0.5
H2	0.40	0.2	1.1
H3	0.04	0.0	0.1
H4	0.10	0.0	0.3
I1	0.55	2.3	4.3
I2	0.48	2.0	3.6
I3	0.45	1.8	3.3
I4	0.55	2.3	4.2
I5	0.23	0.9	1.7
I6	0.19	0.6	1.2
I7	0.23	0.9	1.6
J1	0.69	2.7	5.1
J2	0.25	1.0	1.8
J3	0.01	0.0	0.1
K1	0.17	0.7	1.3
K2	0.05	0.2	0.4
K3	0.15	0.6	1.1
K4	0.05	0.2	0.4
L	1.32	0.5	3.7
M1	0.28	1.2	2.2
M2	0.24	0.8	1.5
M3	0.37	1.6	2.9
M4	0.98	3.5	6.6
N1	0.06	0.3	0.5
N2	0.41	0.2	1.1
O1	0.12	0.1	0.4
O2	0.06	0.1	0.3
P	0.11	0.0	0.3

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	5.9	11.2	A, B	18" PP
2			OMITTED	
3	1.2	2.3	F	18" PP
4	1.0	1.7	E2	PROP 5' INLET
5	1.2	2.2	E1	PROP 5' INLET
6	7.8	14.6	C, D, C1, D1, PR6	WQ POND 3
7	4.7	8.7	G2	EX STREET
8	2.2	4.3	H1, I1	EX STREET
9	1.8	4.1	H2, I2	EX STREET
10	0.8	1.6	H3, I7	EX STREET
11	8.4	16.7	DP3–5, I3–I6	EX 15" INLETS
12	2.8	8.1	FB INLET3, J1	EX 15" INLET
13	1.0	5.0	FB INLET4, J2, J3	EX 15" INLET
14	3.8	9.7	H4, L, M4	EX SWALE
15	5.3	12.3	DP9, M2, M3	EX SWALE/RD
16	1.4	2.5	M1, K4	EX CONC. RD
17	1.1	2.0	K2, K3, N1	EX CONC. RD
18	0.7	1.3	K1	EX AREA INLET
19	19.3	43.7	DP15–17, N2, PR14, PR17	EX FSD POND 2

SF WQCV FUTURE PONDS SUMMARY

EPC/URBAN DRAINAGE SAND FILTER BASIN–SEE STD. DET.

POND 1 AREA REQUIRED	775 SF
POND 4 AREA PROVIDED	288 SF
POND 5 AREA PROVIDED	565 SF

SF WQCV POND 3 SUMMARY

EPC/URBAN DRAINAGE SAND FILTER BASIN–SEE STD. DET.

AREA REQUIRED	1,014 SF
AREA PROVIDED	1,045 SF

SF ELEV = 6370.35

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING DP/BASIN/PIPES
1	2.4	5.7	18"	FUT POND 1 OUTFALL
2		NOT	USED	
3	0.4	1.0	18"	FUT POND 4 OUTFALL
4	3.9	6.7	24"	PR1–PR3
5	1.0	1.7	18"	DP4
6	2.2	3.9	18"	PR5, DP5
6A	6.0	11.6	18"	C, C1, 90% D, D1
7	3.3	4.0	18"	POND 3 OUTFALL
8	6.1	10.7	24"	PR4, PR7
9	1.3	3.0	18"	FUT POND 5 OUTFALL
10	7.4	13.8	24"	PR8, PR9
11	7.4	13.8	24"/EX24"	PR10
12	7.4	13.8	EX 24"	PR11
13	4.2	8.0	EX 15"	INLET 3
14	8.4	16.0	EX 24"	PR13, INLET 4
15	2.8	7.8	EX 18"	INLET 5
16	3.7	12.6	EX 24"	PR15, INLET 6
17	4.4	13.8	EX 24"	PR16, DP18
18	13.7	23.8	EX 30"	EX POND 2 OUTFALL
19	21.1	37.6	EX 42"	DP18, PR12

POND 3 SAND FILTER DETENTION BASIN DATA

WQ WATER SURFACE EL = 6371.78
WQ VOLUME=0.051 AC-FT
100-YR WATER SURFACE EL=6373.36
100-YR VOLUME=0.153 AC-FT
SPILLWAY CREST EL=6375.30
TOP OF EMBANKMENT EL=6376.55
RATIONAL 100-YR INFLOW=14.8 CFS
MHFD 100-YR INFLOW = 9.0 CFS
MHFD 100-YR RELEASE = 4.0 CFS

1" = 60'

0 30 60 120
Scale in Feet

M&S CIVIL CONSULTANTS, INC.
102 E. PIKES PEAK AVE., 5TH FLOOR
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

CLAREMONT BUSINESS PARK 2 FIL. NO.2

PROP. CONDITIONS DRAINAGE MAP

PROJECT NO. 10-022A | FILE: \dwg\Eng Exhibits\10020 PDM.dwg

DESIGNED BY: DLM
DRAWN BY: DLM
CHECKED BY: VAS

SCALE
HORIZ: 1"=60'
VERT: N/A

DATE: 05-17-2023

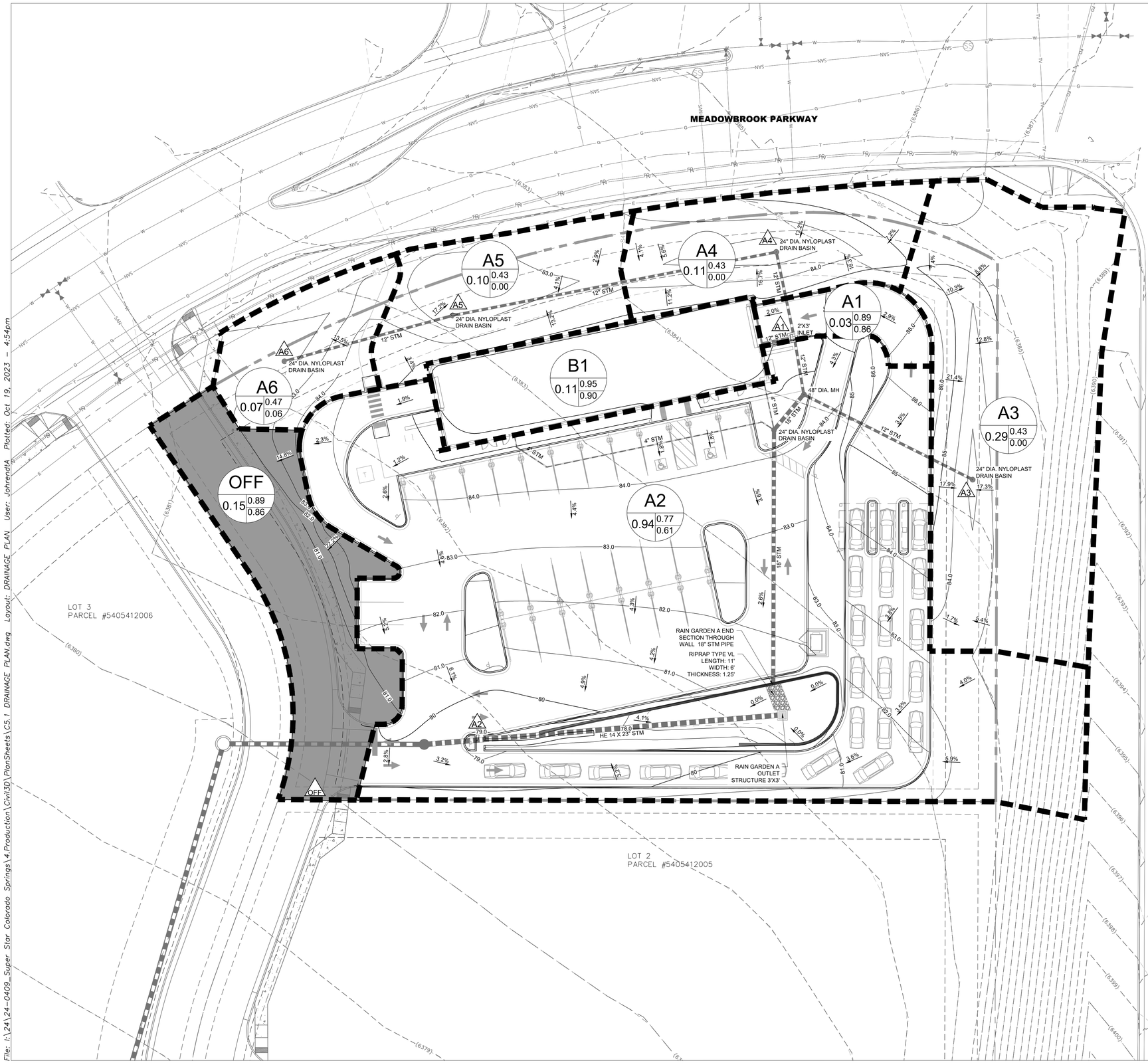
SHEET 1 OF 1

PDM01

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
CALL 1-800-922-1987

File: G:\10020A - CBP-Dunkin Donuts\Dunkin Donuts\Drainage\Drainage Map\10020 PDM.dwg Plotstamp: 5/24/2023 10:39 AM

Super Star Carwash Onsite Drainage Calculations



RUNOFF SUMMARY

DESIGN POINT	INTERNAL ROUTING	AREA (AC)	5-YR RUNOFF (CFS)	100-YR RUNOFF
A1	2'x3' CURB INLET TO RAIN GARDEN VIA STORM SEWER PIPE	0.03	0.10	0.23
A2	SHEET FLOW TO RAIN GARDEN	0.94	2.15	6.30
A3	24" NYLOPAST TO RAIN GARDEN VIA STORM SEWER PIPE	0.29	0.00	0.86
A4	24" NYLOPAST TO RAIN GARDEN VIA STORM SEWER PIPE	0.11	0.00	0.33
A5	24" NYLOPAST TO RAIN GARDEN VIA STORM SEWER PIPE	0.10	0.00	0.31
A6	24" NYLOPAST TO RAIN GARDEN VIA STORM SEWER PIPE	0.07	0.01	0.23
B1	BUILDING ROOF DRAIN TO RAIN GARDEN VIA STORM SEWER PIPE	0.11	0.34	0.82
OFF	OFFSITE TO PRIVATE DRIVE (9% OF DISTRUBED AREA)	0.15	0.35	1.01

DRAINAGE LEGEND

- BASIN DESIGNATION
- RUNOFF COEFFICIENT (100-YR)
- RUNOFF COEFFICIENT (5-YR)
- AREA IN ACRES
- DRAINAGE BASIN BOUNDARY
- UNTREATED AREA (0.15 ACRES - 9% OF DISTURBED AREA)
- DESIGN POINT

COLORADO REGISTERED PROFESSIONAL ENGINEER SCOTT EDWARD MAIER 38122

Design Engineer's Statement:

This grading and erosion control plan was prepared under my direction and supervision and is correct to the best of my knowledge and belief. Said plan has been prepared according to the criteria established by the County for grading and erosion control plans. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this plan.

SCOTT MAIER, P.E. — *[Name, P.E. # 38122]*

10/19/23 — Date

N

0 10 20 40

GRAPHIC SCALE IN FEET

AYRES ASSOCIATES
3665 JFK PARKWAY
BUILDING 2, SUITE 100
FORT COLLINS, CO
80525
262.522.4901
www.AyresAssociates.com

SUPERSTAR CAR WASH

REVISION	DATE
RESUBMITTAL #1	7/25/2023
RESUBMITTAL #2	9/18/2023
RESUBMITTAL #3	10/20/2023

SUPERSTAR CARWASH
MEADOWBROOK PKWY
COLORADO SPRING, CO 80915

DRAINAGE PLAN

Drawn By: AJJ
Checked By: SEM
Date: 10/20/2023
Project No. 24-0409

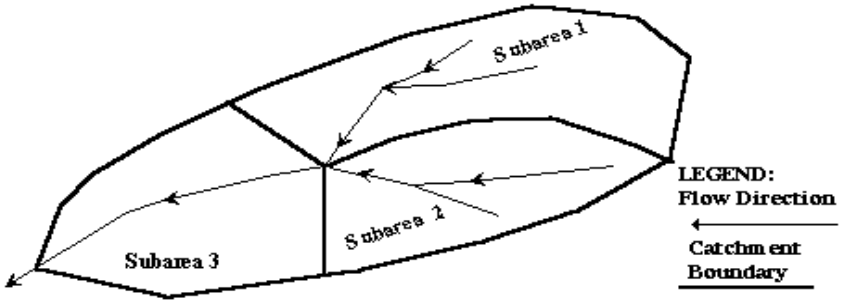
Sheet Number

C5.1

Area-Weighted Runoff Coefficient Calculations

Version 2.00 released May 2017

Designer: Scott Maier
Company: Ayres Associates
Date: 9/11/2023
Project: SUPER STAR CAR WASH
Location: MEADOWBROOK, Mesa County



Subcatchment Name

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

See sheet "Design Info" for imperviousness-based runoff coefficient values.

Sub-Area ID	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Basin A1	0.03	B	100.0	0.84	0.86	0.86	0.88	0.89	0.89	0.90
Basin A2	0.94	B	73.0	0.58	0.61	0.65	0.71	0.74	0.77	0.80
Basin A3	0.29	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54
Basin A4	0.11	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54
Basin A5	0.10	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54
Basin A6	0.07	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54
Basin B1	0.11	B	100.0	0.84	0.86	0.86	0.88	0.89	0.89	0.90
OFF	0.15	B	74.0	0.59	0.62	0.65	0.71	0.74	0.77	0.81
Total Area (ac)	**1.80**		**Area-Weighted C**	**0.42**	**0.44**	**0.48**	**0.58**	**0.62**	**0.67**	**0.73**
			Area-Weighted Override C	**0.42**	**0.44**	**0.48**	**0.58**	**0.62**	**0.67**	**0.73**

Calculation of Peak Runoff using Rational Method

Designer: Scott Maier
Company: Ayres Associates
Date: 10/19/2023
Project: SUPER STAR CAR WASH
Location: MEADOWBROOK, Mesa County

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

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

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

Computed $t_c = t_i + t_t$

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

$t_{minimum}$= 5 (urban)
$t_{minimum}$= 10 (non-urban)

Selected $t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	0.83	1.11	1.38	1.69	2.17	2.58	3.14

Rainfall Intensity Equation Coefficients =	a	b	c
	28.50	10.00	0.786

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Basin A1	0.03	B	100.0	0.84	0.86	0.86	0.88	0.89	0.89	0.90	10.00			0.250	0.48	20.00			0.010	20	2.00	0.17	0.65	9.14	5.00	2.80	3.76	4.68	5.73	7.36	8.75	10.65	0.07	0.10	0.12	0.15	0.20	0.23	0.29
Basin A2	0.94	B	73.0	0.58	0.61	0.65	0.71	0.74	0.77	0.80	20.00			0.050	2.33	200.00			0.015	20	2.45	1.36	3.69	15.01	5.00	2.80	3.76	4.68	5.73	7.36	8.75	10.65	1.52	2.15	2.84	3.81	5.09	6.30	8.04
Basin A3	0.29	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54	20.00			0.020	7.07	100.00			0.010	15	1.50	1.11	8.18	27.85	10.00	2.23	3.00	3.73	4.57	5.87	6.98	8.50	0.00	0.00	0.06	0.33	0.56	0.86	1.32
Basin A4	0.11	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54	20.00			0.020	7.07	30.00			0.020	15	2.12	0.24	7.30	26.39	10.00	2.23	3.00	3.73	4.57	5.87	6.98	8.50	0.00	0.00	0.02	0.13	0.21	0.33	0.50
Basin A5	0.10	B	0.0	0.00	0.00	0.06	0.25	0.33	0.43	0.54	20.00			0.250	3.07	30.00			0.030	15	2.60	0.19	3.26	26.32	10.00	2.23	3.00	3.73	4.57	5.87	6.98	8.50	0.00	0.00	0.02	0.12	0.20	0.31	0.47
Basin A6	0.07	B	9.0	0.05	0.06	0.13	0.31	0.38	0.47	0.57	20.00			0.050	4.93	10.00			0.043	15	3.11	0.05	4.98	24.55	10.00	2.23	3.00	3.73	4.57	5.87	6.98	8.50	0.01	0.01	0.03	0.10	0.16	0.23	0.34
Basin B1	0.11	B	100.0	0.84	0.86	0.86	0.88	0.89	0.89	0.90	20.00			0.020	1.56	50.00			0.020	20	2.83	0.29	1.86	9.26	5.00	2.80	3.76	4.68	5.73	7.36	8.75	10.65	0.25	0.34	0.42	0.53	0.68	0.82	1.01
OFF	0.15	B	74.0	0.59	0.62	0.65	0.71	0.74	0.77	0.81	10.00					150.00			0.020	20	2.83	0.88		14.33	5.00	2.80	3.76	4.68	5.73	7.36	8.75	10.65	0.25	0.35	0.46	0.61	0.82	1.01	1.29

Super Star Carwash Soil Information

Map Scale: 1:834 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 40 80 160 240

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 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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
8	Blakeland loamy sand, 1 to 9 percent slopes	A	0.0	0.5%
10	Blendon sandy loam, 0 to 3 percent slopes	B	1.4	58.1%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	A	1.0	41.3%
Totals for Area of Interest			**2.4**	**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

Super Star Carwash Onsite Water Quality Basin Calculations

Design Procedure Form: Rain Garden (RG)

UD-BMP (Version 3.07, March 2018)

Designer: Scott Maier
Company: Ayres Associates
Date: October 19, 2023
Project: Super Star Carwash
Location: Meadowbrook

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of rain garden)	I_a = 50.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a/100$)	i = 0.500
C) Water Quality Capture Volume (WQCV) for a 12-hour Drain Time ($WQCV = 0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i)$)	WQCV = 0.17 watershed inches
D) Contributing Watershed Area (including rain garden area)	Area = 71,874 sq ft
E) Water Quality Capture Volume (WQCV) Design Volume Vol = (WQCV / 12) * Area	V_{WQCV} = cu ft
F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume	$V_{WQCV\ OTHER}$ = 965 cu ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$ = cu ft
2. Basin Geometry	
A) WQCV Depth (12-inch maximum)	D_{WQCV} = 12 in
B) Rain Garden Side Slopes (Z = 4 min., horiz. dist per unit vertical) (Use "0" if rain garden has vertical walls)	Z = 0.00 ft / ft
C) Mimimum Flat Surface Area	A_{Min} = 719 sq ft
D) Actual Flat Surface Area	A_{Actual} = 1080 sq ft
E) Area at Design Depth (Top Surface Area)	A_{Top} = 1680 sq ft
F) Rain Garden Total Volume ($V_T = ((A_{Top} + A_{Actual}) / 2) * Depth$)	V_T = 1,380 cu ft
3. Growing Media	Choose One: (•) 18" Rain Garden Growing Media ( ) Other (Explain):
4. Underdrain System	
A) Are underdrains provided?	Choose One: (•) YES ( ) NO
B) Underdrain system orifice diameter for 12 hour drain time	
i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = 2.1 ft
ii) Volume to Drain in 12 Hours	Vol_{12} = 965 cu ft
iii) Orifice Diameter, 3/8" Minimum	D_O = 11/16 in

Design Procedure Form: Rain Garden (RG)

Designer: Scott Maier
Company: Ayres Associates
Date: October 19, 2023
Project: Super Star Carwash
Location: Meadowbrook

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?	Choose One ○ YES ◉ NO
6. Inlet / Outlet Control A) Inlet Control	Choose One ○ Sheet Flow- No Energy Dissipation Required ◉ Concentrated Flow- Energy Dissipation Provided
7. Vegetation	Choose One ◉ Seed (Plan for frequent weed control) ○ Plantings ○ Sand Grown or Other High Infiltration Sod
8. Irrigation A) Will the rain garden be irrigated?	Choose One ○ YES ○ NO

Notes:

Super Star Carwash Onsite Inlet Calculations

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Basin A1	Rain Garden Outlet Structure	Basin A4
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	AREA	AREA
Hydraulic Condition	On Grade	Swale	Swale
Inlet Type	CDOT Type C Grate	CDOT Type C (Depressed)	User-Defined

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.10	2.59	0.00
Major Q_{Known} (cfs)	0.23	9.08	0.33

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	User-Defined	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	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)	0.12	2.59	0.00
Major Total Design Peak Flow, Q (cfs)	0.23	9.08	0.33
Minor Flow Bypassed Downstream, Q_b (cfs)	0.1	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.1	0.0	0.0

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	Basin A5	Basin A3	Basin A6
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	AREA	AREA
Hydraulic Condition	Swale	Swale	Swale
Inlet Type	User-Defined	User-Defined	User-Defined

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.00	0.00	0.00
Major Q_{Known} (cfs)	0.31	0.86	0.23

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	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)	0.00	0.00	0.00
Major Total Design Peak Flow, Q (cfs)	0.31	0.86	0.23
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0

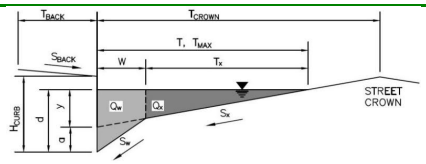
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: Super Star Car Wash - Meadowbrook

Inlet ID: Basin A1



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		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} =	10.0	ft
Gutter Width	W =	1.00	ft
Street Transverse Slope	S_X =	0.048	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 =	0.007	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.0	10.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

Maximum Capacity for 1/2 Street based On Allowable Spread

		Minor Storm	Major Storm	
Water Depth without Gutter Depression (Eq. ST-2)	y =	5.76	5.76	inches
Vertical Depth between Gutter Lip and Gutter Flowline (usually 2")	d_C =	1.0	1.0	inches
Gutter Depression (d_C - (W * S_x * 12))	a =	0.42	0.42	inches
Water Depth at Gutter Flowline	d =	6.18	6.18	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	9.0	9.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.257	0.257	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	8.0	8.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	2.8	2.8	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Spread	Q_T =	10.8	10.8	cfs
Flow Velocity within the Gutter Section	V =	1.5	1.5	fps
V*d Product: Flow Velocity times Gutter Flowline Depth	V*d =	0.8	0.8	

Maximum Capacity for 1/2 Street based on Allowable Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	9.7	9.7	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	8.7	8.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.265	0.265	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	7.3	7.3	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	7.3	7.3	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	2.6	2.6	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm (Pre-Safety Factor)	Q =	9.9	9.9	cfs
Average Flow Velocity Within the Gutter Section	V =	1.4	1.4	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.7	0.7	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	1.00	1.00	
Max Flow Based on Allowable Depth (Safety Factor Applied)	Q_d =	9.9	9.9	cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	6.00	6.00	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	0.00	inches

MINOR STORM Allowable Capacity is based on Depth Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

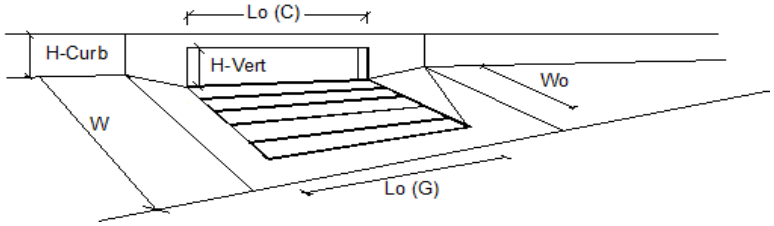
		Minor Storm	Major Storm	
	Q_{allow} =	9.9	9.9	cfs

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

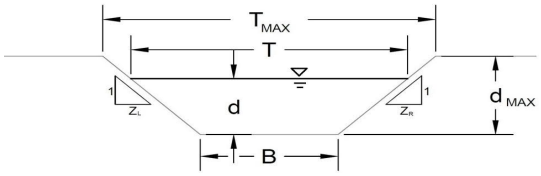
MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)	CDOT Type C Grate		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type C Grate		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	0.0	0.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	2.92	2.92	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	2.92	2.92	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	N/A	N/A	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	0.1	0.2	cfs
Water Spread Width		T =	1.6	2.1	ft
Water Depth at Flowline (outside of local depression)		d =	1.3	1.7	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.968	0.867	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	0.0	0.0	cfs
Discharge within the Gutter Section W		Q_w =	0.1	0.2	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.07	0.10	sq ft
Velocity within the Gutter Section W		V_W =	1.7	2.1	fps
Water Depth for Design Condition		d_{LOCAL} =	1.3	1.7	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	2.92	2.92	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	-0.487	0.422	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	9.94	9.94	fps
Interception Rate of Frontal Flow		R_f =	1.00	1.00	
Interception Rate of Side Flow		R_x =	0.61	0.56	
Interception Capacity		Q_i =	0.1	0.2	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoef =	1.00	1.00	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	0.50	0.50	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	1.46	1.46	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	6.91	6.91	fps
Interception Rate of Frontal Flow		R_f =	1.00	1.00	
Interception Rate of Side Flow		R_x =	0.24	0.20	
Actual Interception Capacity		Q_a =	0.0	0.1	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		Q_b =	0.1	0.1	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)		S_e =	N/A	N/A	ft/ft
Required Length L_T to Have 100% Interception		L_T =	N/A	N/A	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	N/A	N/A	ft
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	N/A	N/A	
Effective (Unclogged) Length		L_e =	N/A	N/A	ft
Actual Interception Capacity		Q_a =	N/A	N/A	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		Q_b =	N/A	N/A	cfs
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	0.0	0.1	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_b =	0.1	0.1	cfs
Capture Percentage = Q_a/Q_o =		C% =	-12	54	%

AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook
Rain Garden Outlet Structure



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.013	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	75.00	ft
Left Side Slope	Z1 =	100.00	ft/ft
Right Side Sloe	Z2 =	100.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- ○ Non-Cohesive
- ○ Cohesive
- ◉ Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	100.00	100.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	0.20	0.70	ft

Maximum Channel Capacity Based On Allowable Top Width

		Minor Storm	Major Storm	
Maximum Allowable Top Width	T_{MAX} =	100.00	100.00	ft
Water Depth	d =	0.13	0.13	ft
Flow Area	A =	10.94	10.94	sq ft
Wetted Perimeter	P =	100.00	100.00	ft
Hydraulic Radius	R =	0.11	0.11	ft
Manning's n	n =	0.013	0.013	
Flow Velocity	V =	1.85	1.85	fps
Velocity-Depth Product	VR =	0.20	0.20	ft^2/s
Hydraulic Depth	D =	0.11	0.11	ft
Froude Number	Fr =	0.99	0.99	
Maximum Flow Based on Allowable Water Depth	Q_T =	20.3	20.3	cfs

Maximum Channel Capacity Based On Allowable Water Depth

		Minor Storm	Major Storm	
Maximum Allowable Water Depth	d_{MAX} =	0.20	0.70	ft
Top Width	T =	115.00	215.00	ft
Flow Area	A =	19.00	101.50	sq ft
Wetted Perimeter	P =	115.00	215.01	ft
Hydraulic Radius	R =	0.17	0.47	ft
Manning's n	n =	0.013	0.013	
Flow Velocity	V =	2.44	4.91	fps
Velocity-Depth Product	VR =	0.40	2.32	ft^2/s
Hydraulic Depth	D =	0.17	0.47	ft
Froude Number	Fr =	1.06	1.26	
Maximum Flow Based On Allowable Water Depth	Q_d =	46.4	498.7	cfs

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	20.3	20.3	cfs
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	0.13	0.13	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	2.6	9.1	cfs
Water Depth	d =	0.04	0.08	ft
Top Width	T =	82.48	90.68	ft
Flow Area	A =	2.95	6.50	sq ft
Wetted Perimeter	P =	82.48	90.68	ft
Hydraulic Radius	R =	0.04	0.07	ft
Manning's n	n =	0.013	0.013	
Flow Velocity	V =	0.88	1.40	fps
Velocity-Depth Product	VR =	0.03	0.10	ft^2/s
Hydraulic Depth	D =	0.04	0.07	ft
Froude Number	Fr =	0.82	0.92	

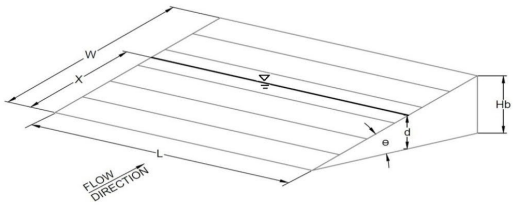
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook
Rain Garden Outlet Structure

Inlet Design Information (Input)

Type of Inlet: CDOT Type C (Depressed) — Inlet Type = CDOT Type C (Depressed)



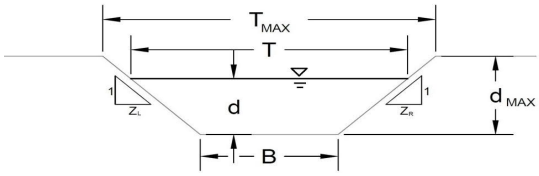
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	ft
Length of Grate	L =	3.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.84	
Orifice Coefficient	C_o =	0.56	
Weir Coefficient	C_w =	1.81	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.04	1.08	
Grate Capacity as a Weir				
Submerged Side Weir Length	X =	3.00	3.00	ft
Inclined Side Weir Flow	Q_{ws} =	10.0	10.6	cfs
Base Weir Flow	Q_{wb} =	14.3	15.2	cfs
Interception Without Cloggging	Q_{wi} =	34.4	36.4	cfs
Interception With Clogging	Q_{wa} =	17.2	18.2	cfs
Grate Capacity as an Orifice				
Interception Without Clogging	Q_{oi} =	29.0	29.5	cfs
Interception With Clogging	Q_{oa} =	14.5	14.8	cfs
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	14.5	14.8	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook

Basin A4



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =	B	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0200	ft/ft
Bottom Width	B =	4.00	ft
Left Side Slope	Z1 =	10.00	ft/ft
Right Side Sloe	Z2 =	20.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	15.00	15.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	0.50	0.50	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	0.9	0.9	cfs
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	0.37	0.37	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	0.0	0.3	cfs
Water Depth	d =	0.00	0.23	ft

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

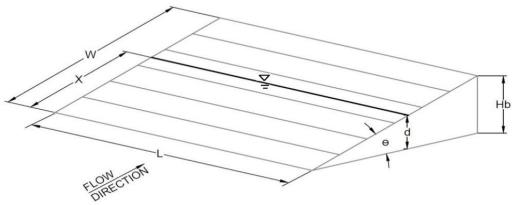
AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook

Basin A4

Inlet Design Information (Input)

Type of Inlet	User-Defined	Inlet Type =	User-Defined	
Angle of Inclined Grate (must be <= 30 degrees)		θ =	0.00	degrees
Width of Grate		W =	2.00	ft
Length of Grate		L =	2.00	ft
Open Area Ratio		A_{RATIO} =	0.70	
Height of Inclined Grate		H_B =	0.00	ft
Clogging Factor		C_f =	0.50	
Grate Discharge Coefficient		C_d =	N/A	
Orifice Coefficient		C_o =	0.64	
Weir Coefficient		C_w =	2.05	

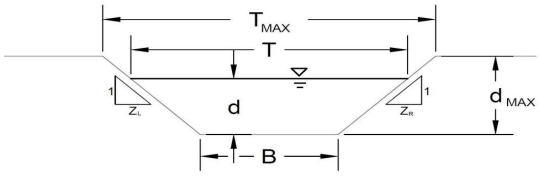


		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.00	0.23	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	0.0	1.4	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook

Basin A5



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =	B	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0200	ft/ft
Bottom Width	B =	4.00	ft
Left Side Slope	Z1 =	10.00	ft/ft
Right Side Sloe	Z2 =	10.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	10.00	10.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	0.50	0.50	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	0.5	0.5	cfs
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	0.30	0.30	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	0.0	0.3	cfs
Water Depth	d =	0.00	0.24	ft

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

AREA INLET IN A SWALE

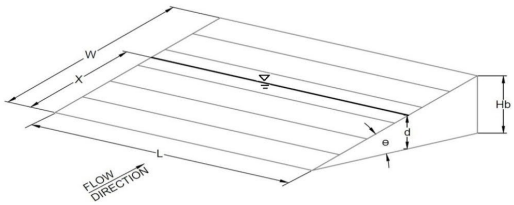
Super Star Car Wash - Meadowbrook

Basin A5

Inlet Design Information (Input)

Type of Inlet: User-Defined

Inlet Type = User-Defined



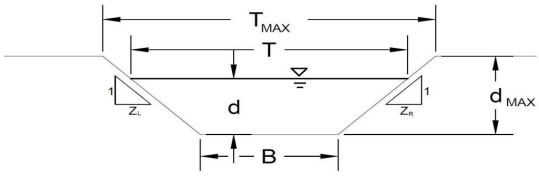
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	2.00	ft
Length of Grate	L =	2.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	N/A	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.00	0.24	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	0.0	1.4	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook

Basin A3



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =	B	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0200	ft/ft
Bottom Width	B =	4.00	ft
Left Side Slope	Z1 =	5.00	ft/ft
Right Side Sloe	Z2 =	5.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	10.00	10.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	0.50	0.50	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	1.1	1.1	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	0.50	0.50	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	0.0	0.9	cfs
Water Depth	d =	0.00	0.44	ft

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

AREA INLET IN A SWALE

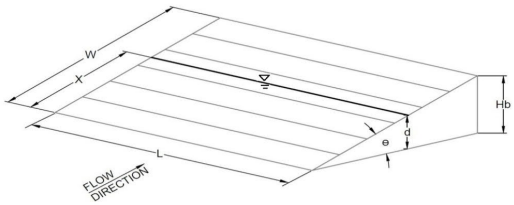
Super Star Car Wash - Meadowbrook

Basin A3

Inlet Design Information (Input)

Type of Inlet: User-Defined

Inlet Type = User-Defined



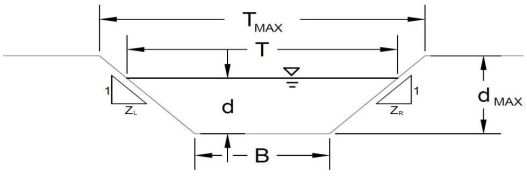
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	2.00	ft
Length of Grate	L =	2.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	N/A	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.00	0.44	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	0.0	3.6	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook

Basin A6



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =	B	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0200	ft/ft
Bottom Width	B =	4.00	ft
Left Side Slope	Z1 =	5.00	ft/ft
Right Side Sloe	Z2 =	5.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	10.00	10.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	0.50	0.50	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	1.1	1.1	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	0.50	0.50	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	0.0	0.2	cfs
Water Depth	d =	0.00	0.22	ft

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

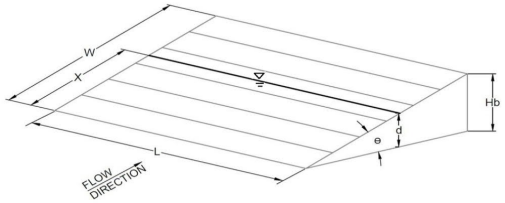
AREA INLET IN A SWALE

Super Star Car Wash - Meadowbrook

Basin A6

Inlet Design Information (Input)

Type of Inlet: User-Defined — Inlet Type = User-Defined



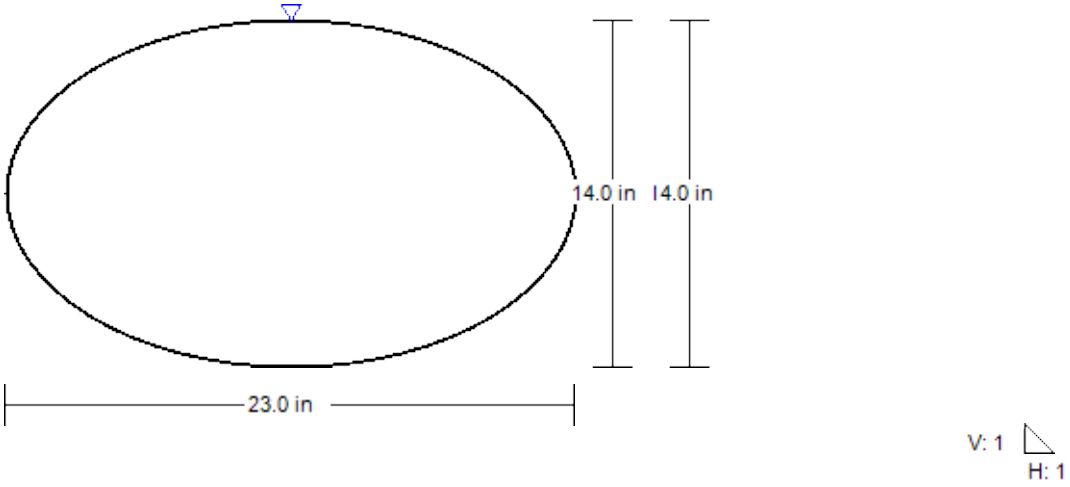
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	2.00	ft
Length of Grate	L =	2.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	N/A	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.00	0.22	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	0.0	1.2	cfs
Bypassed Flow	Q_b =	0.0	0.0	cfs
Capture Percentage = Qa/Qo	C% =	100	100	%

Cross Section for RG Discharge

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

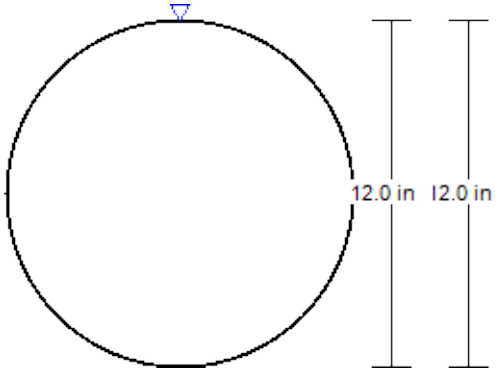
Input Data	
Roughness Coefficient	0.013
Channel Slope	0.005 ft/ft
Normal Depth	14.0 in
Rise	14.0 in
Span	23.0 in
Discharge	7.15 cfs

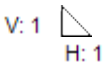


Cross Section for A3-MANHOLE

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.020 ft/ft
Normal Depth	12.0 in
Diameter	12.0 in
Discharge	6.55 cfs

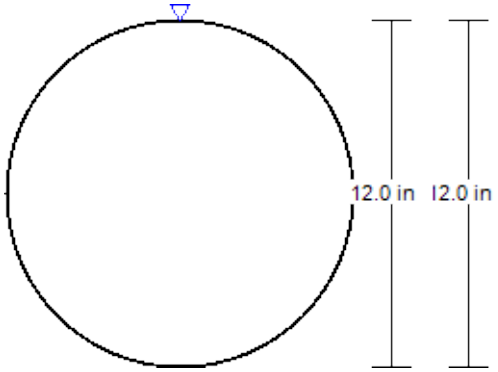


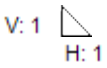


Cross Section for A6-A5

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.005 ft/ft
Normal Depth	12.0 in
Diameter	12.0 in
Discharge	3.27 cfs

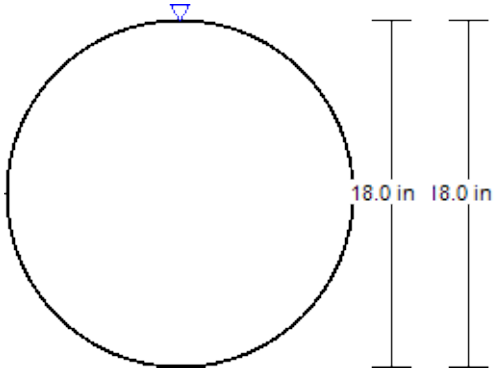


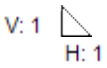


Cross Section for MANHOLE-RG

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.005 ft/ft
Normal Depth	18.0 in
Diameter	18.0 in
Discharge	9.66 cfs



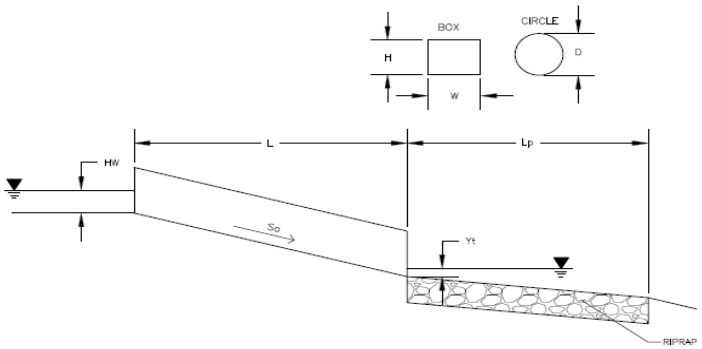


DETERMINATION OF CULVERT HEADWATER AND OUTLET PROTECTION

MHFD-Culvert, Version 4.00 (May 2020)

Project: **Super Star Carwash Riprap**

ID:



Soil Type:

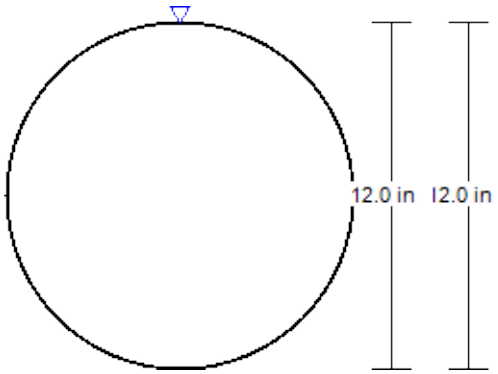
Choose One:
- (•) Sandy
- ( ) Non-Sandy

Design Information:				
	Design Discharge	Q =	6	cfs
Circular Culvert:				
	Barrel Diameter in Inches	D =	18	inches
	Inlet Edge Type (Choose from pull-down list)		Grooved Edge in Headwall	
OR:				
Box Culvert:			**OR**	
	Barrel Height (Rise) in Feet	H (Rise) =		ft
	Barrel Width (Span) in Feet	W (Span) =		ft
	Inlet Edge Type (Choose from pull-down list)			
	Number of Barrels	# Barrels =	1	
	Inlet Elevation	Elev IN =	6378.16	ft
	Outlet Elevation **OR** Slope	Elev OUT =	6377.7	ft
	Culvert Length	L =	101.4	ft
	Manning's Roughness	n =	0.012	
	Bend Loss Coefficient	k_b =	0	
	Exit Loss Coefficient	k_x =	1	
	Tailwater Surface Elevation	$Y_{t,\ Elevation}$ =		ft
	Max Allowable Channel Velocity	V =	5	ft/s
Calculated Results:				
	Culvert Cross Sectional Area Available	A =	1.77	ft^2
	Culvert Normal Depth	Y_n =	1.00	ft
	Culvert Critical Depth	Y_c =	0.95	ft
	Froude Number	Fr =	0.90	
	Entrance Loss Coefficient	k_e =	0.20	
	Friction Loss Coefficient	k_f =	1.57	
	Sum of All Loss Coefficients	k_s =	2.77	ft
Headwater:				
	Inlet Control Headwater	HW_I =	1.38	ft
	Outlet Control Headwater	HW_O =	1.26	ft
	Design Headwater Elevation	**HW =**	**6379.54**	**ft**
	Headwater/Diameter OR Headwater/Rise Ratio	**HW/D =**	**0.92**	
Outlet Protection:				
	Flow/(Diameter^2.5)	Q/D^2.5 =	2.18	$ft^{0.5}/s$
	Tailwater Surface Height	Y_t =	0.60	ft
	Tailwater/Diameter	Yt/D =	0.40	
	Expansion Factor	1/(2*tan(Θ)) =	5.50	
	Flow Area at Max Channel Velocity	A_t =	1.20	ft^2
	Width of Equivalent Conduit for Multiple Barrels	W_{eq} =	-	ft
	Length of Riprap Protection	**L_p =**	**5**	**ft**
	Width of Riprap Protection at Downstream End	**T =**	**3**	**ft**
	Adjusted Diameter for Supercritical Flow	Da =	-	ft
	Minimum Theoretical Riprap Size	d_{50} min=	3	in
	Nominal Riprap Size	d_{50} nominal=	6	in
	MHFD Riprap Type	**Type =**	**VL**	

Cross Section for A4-A1

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.005 ft/ft
Normal Depth	12.0 in
Diameter	12.0 in
Discharge	3.27 cfs

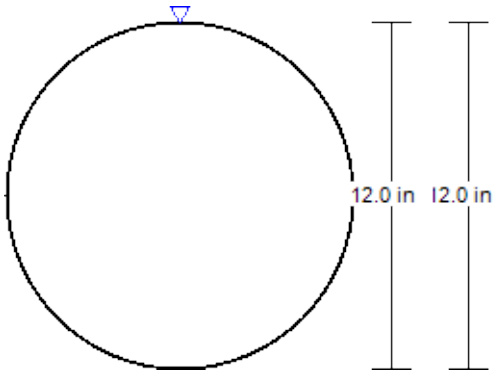


V: 1
H: 1

Cross Section for A5-A4

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.005 ft/ft
Normal Depth	12.0 in
Diameter	12.0 in
Discharge	3.27 cfs



V: 1
H: 1