

Appendix C

Hydrologic and Hydraulic Report/ Stormwater Quality Report

HYDROLOGIC AND HYDRAULIC REPORT / STORMWATER QUALITY REPORT

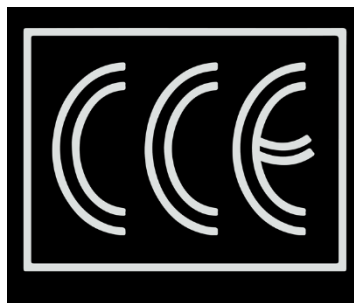
for

**U-Haul
2420 N Oxnard Boulevard
Oxnard, CA 93036**

Prepared For:

**Lauterbach & Associates, Inc.
300 Montgomery Avenue, Suite C
Oxnard, CA 93036**

Prepared By:



**CCE Design Associates Inc
711 E. Daily Drive, Suite 107 | Camarillo, CA 93010
445 S. Figueroa St, Suite 3100 | Los Angeles, CA 90071
805.738.5434**



HYDROLOGIC AND HYDRAULIC REPORT / STORMWATER QUALITY REPORT

for

**U-Haul
2420 N Oxnard Boulevard
Oxnard, CA 93036**

Date:	May 7, 2021
Project Manager:	Jared Q. Adams, P.E. RCE No. 86086
Project Engineer:	Jared Q. Adams, P.E.
CCE Job Number:	C20.0264

Prepared By:

Jared Q. Adams, P.E.
CCE Design Associates, Inc

Date



1. Table of Contents

1. Table of Contents	3
2. Introduction	4
Purpose.....	4
Site Location.....	4
Location Plan.....	4
Description	4
Drainage	4
3. References	5
4. Objectives	5
5. Procedure	5
6. Hydrology	6
7. Stormwater Quality	6
Project Applicability	6
Site Conditions	6
Site Design Principles and Techniques	6
Source Control Measures	7
Retention and Treatment Control BMPs.....	7
8. Summary and Conclusions.....	7
9. Attachments	8



2. Introduction

PURPOSE

The purpose of this report is to validate the grading and drainage design for the proposed U-Haul project, as well as to implement stormwater treatment in accordance with local requirements. The project will involve the removal and new construction of landscape areas in the parking lot.

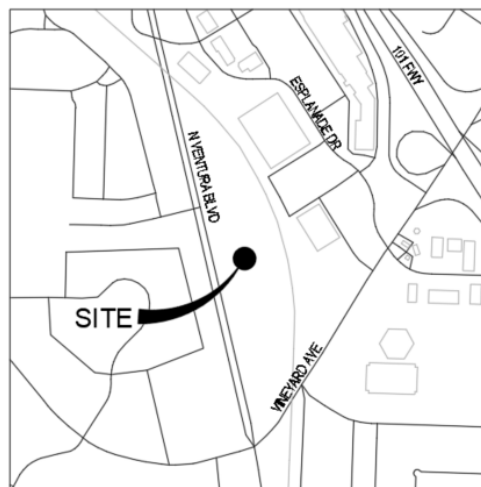
SITE LOCATION

The project is located at 2420 N Oxnard Boulevard in Oxnard, California. The APN's are 142-0-010-345 and 142-0-021-010.

The site is currently occupied by a warehouse and associated parking lot, bounded by Oxnard Boulevard to the west, commercial developments to the north, east and south.

LOCATION PLAN

The location within the City of Oxnard is provided on the below map:



DESCRIPTION

The site is located at 2420 N Oxnard Boulevard, adjacent to Oxnard Boulevard. The surrounding area is developed as commercial use with varying ages of construction. The total area of the lot is 8.94 acres, of which 0.67 acres are being disturbed.

DRAINAGE

Drainage in the area trends from northeast to southwest, gently sloping along the Oxnard plain towards the ocean. There is also a slight drainage trend from east to west; however, this is subtle.

The site does not have offsite run-on since the site is currently fully developed.

The site is located within a shaded Zone X, outside of the 100-year (1% annual chance) floodplains.



As the neighborhood and watershed is largely built out, there are no anticipated substantial changes to drainage patterns in the area from future development. Rather, as sites develop and fall under MS4 requirements, drainage patterns in the area would likely improve.

3. References

- “Modified Cook’s Method for Stormwater Runoff Calculations,” City of Oxnard, Public Works Department, Standard Plan Plate #59.
- “Ventura County Hydrology Manual,” Ventura County Watershed Protection District, Revised 2017.
- “Master Plan of Drainage,” City of Oxnard, June 1979.
- “Ventura County Technical Guidance Manual for Stormwater Quality Control Measures,” Ventura County Watershed Protection District, Updated 2018.

4. Objectives

The objective of this report is to determine proposed stormwater flow rates for this project based on existing topography and infrastructure, and then changes resulting from the development of this project. This report will address the following items:

- **Drainage Concept** – This report will discuss the proposed drainage concept for the site in further detail and will demonstrate compliance with criteria pursuant to the City of Oxnard (and County of Ventura requirements for stormwater quality as outlined in the Technical Guidance Manual).
- **Low Impact Development (LID)** – This project will be designed pursuant to the Ventura County Technical Guidance Manual which provides for LID.
- **Flood Control** – This project will be designed in a manner to meet flood control protection from the FEMA 100-year storm event.

5. Procedure

This hydrology study was prepared using the design criteria and methodology developed by the City of Oxnard. Calculations presented within this study were determined using the Modified Cook’s Method for Stormwater Runoff Calculations.

The total area of the lot is 8.94 acres in size (389,226 square feet), and the area that comprises the project, disturbed area, is 0.67 acres (29,295 sf).

The associated construction documents and attached hydrology map provide details on the storm drain collection and conveyance facilities as well as the storm water treatment devices selected. The routing to the underground infiltration system will take place utilizing a series of existing gutters, catch basins and underground piping around the building and parking lot, draining into the underground system.



6. Hydrology

The hydrology was calculated with the total of disturbed areas only. The Hydrology Map is included as Attachment D to this report, as is the calculation sheets performed using the Cook's Method (Attachment B).

The following table summarizes the hydrologic results:

Area (sf)	Area (ac)	Q(50) (cfs)	Q(10) (cfs)
29,295	0.67	2.82	1.68

7. Stormwater Quality

Stormwater quality for this project is in accordance with the 2011 Ventura County Technical Guidance Manual (TGM).

PROJECT APPLICABILITY

Per Section 1.5 of the TGM, this project is applicable as a redevelopment project disturbing, adding or replacing 5,000 square feet or more of impervious surface area on an already developed site. Also, as a project where the alteration is less than fifty percent of impervious surfaces of the existing development, the project shall mitigate only the altered portion of the project area.

SITE CONDITIONS

As previously stated in this report, the site is fully developed and relatively flat, and slopes are generally 5% or less.

SITE DESIGN PRINCIPLES AND TECHNIQUES

Site design principles and techniques have been applied to this proposed development to reduce the hydrologic and water quality impacts typically associated with redevelopment. The following is a list of site design features incorporated in this project and a brief explanation of how they were implemented:

- Site planning – Adequate space has been allocated for deployment of Retention BMPs to fully treat the SQDV. The site has been laid out in a manner to effectively disconnect impervious surface so that 5% EIA is achieved.
- Protect and restore natural areas – Existing natural areas will be preserved to the maximum extent possible.
- Minimize impervious cover – Landscape areas were included throughout the site where practical.
- Apply LID BMPs – Implemented throughout the site at varying degrees.
- Implement Integrated Water Resource Management Practices – Project has been designed to meet the 2011 VC TGM as part of Order R4-2010-0108 which complements the goals of the IWRMP.



SOURCE CONTROL MEASURES

Source Control Measures are operational practices that reduce potential pollutants at the source. Applicable Source Control Measures for this project are storm drainage signage (S-1) which are to be added to all storm drain inlets, proper design of outdoor trash storage and waste handling areas (S-3), and proof of control measure maintenance (S-8) through a Maintenance Agreement containing a site-specific Maintenance Plan for all proposed BMPs to be maintained by the owner / operator of the site.

RETENTION AND TREATMENT CONTROL BMPS

A capture and use BMP are proposed to be the primary Treatment Control to mitigate stormwater runoff from the site. The primary pollutants of concern for the post-developed condition of this project are sediment, nutrients, metals, oil and grease, and trash and debris, all of which are effectively treated using capture and use BMPs.

Calculations for the Stormwater Quality Design Volume (SQDV) required to be mitigated for the project area as outlined in the TGM are shown in Attachment C of this report. Per the calculations, the required SQDV is 568 cubic feet, and the required SQDF (Stormwater Quality Design Flowrate used for design of pre-treatment devices) is 0.13 cfs. The proposed capture and use treatment provide a storage volume of 609 cubic feet.

Important to note, this project intends to treat only the disturbed area, including the EIA and all developed pervious surfaces, using the proposed capture and use BMP. Additionally, pre-treatment will be provided upstream of the proposed system.

8. Summary and Conclusions

The development of this site is in accordance with City of Oxnard and Ventura County criteria for stormwater quality and quantity. The onsite runoff is collected and treated pursuant to Ventura County MS4 standards.

The development of this site will not have adverse impact to downstream storm drain facilities. While the analysis of offsite systems is beyond the scope of this report, the project improves upon the original design, meeting full MS4 compliance standards for the site, including the EIA and developed pervious surfaces.

Additionally, the grading design and proposed drainage system are designed in a manner to convey stormwater flows away from structures in a manner to provide protection from flooding pursuant to City of Oxnard, County of Ventura, and FEMA requirements. All buildings will be constructed outside of 100-year storm event flood limits which are shown on the Hydrology Map.



9. Attachments

Attachment A	Hydrology Input Data (Oxnard Supporting Data)
Attachment B	Cook's Method Hydrology Calculations (Flood Control)
Attachment C	Stormwater Quality Treatment Calculations
Attachment D	Hydrology Map



Attachment A

Hydrology Input Data (Oxnard Supporting Data)

54

MODIFIED RATIONAL FORMULA**" C " FACTORS**

ITEMS	RUNOFF PRODUCING CHARACTERISTICS			
RELIEF	40 Steep, slopes exceed 30%	30 Hilly, slopes 10% to 30%	20 Rolling, slopes 5% to 10%	10 Flat, slopes 0 to 5%
SURFACE STORAGE	20 Negligible, surface depressions few and shallow. Drainageways steep & small, no ponds or marshes.	15 Low, well defined system of small drainageways, no ponds or marshes.	10 Normal, considerable surface depression storage, lakes and ponds less than 2% of drainage area.	5 High, surface depression storage high, drainage system not sharply defined.
SOIL	20 Rock or thin soil mantle. Negligible infiltration capacity.	15 Clay or other soil of low infiltration capacity.	10 Normal, deep permeable soils.	5 High, sands, loamy sands & other loose open soils.
SCS CLASS	D	C	B	A
VEGETAL COVER	20 No effective soil cover, bare or very sparse cover.	15 Clean cultivated crops or poor natural cover, less than 10% of drainage area under good cover.	10 50% of drainage area in good grassland or woodland, 50% of area in clean cultivated crops.	5 About 90% of drainage area in good grassland woodland or equivalent cover.

" C " FACTOR
(FOR CITY OF OXNARD)

C = 40 - 45
C = 60
C = 70

FOR UNDEVELOPED
FOR RESIDENTIAL
FOR COMMERCIAL AND INDUSTRIAL

NOTE:

In hydrologic Calculations, use values of "C" given in lower table.
Use of values of "C" given in upper table have to be approved by the City Engineer.



CITY OF

Oxnard

GENERAL REQUIREMENTS - DRAINAGE

DRAWN: SOHER

CKD.

Jay Patel

APPR. BY

Public Works Department

Benjamin J. Wong

STANDARD PLAN

PLATE 60

SHEET OF

REV. APPR. BY DATE

FREQUENCY FACTORS - %

RETURN FREQUENCY	RETURN PERIOD	FACTOR
50%	2	25
20%	5	65
10%	10	100
4%	25	135
2%	50	170
1%	100	200
0.1%	1,000	400

RAINFALL INTENSITY CORRECTION FACTOR

OXNARD AREA = 123%

SHAPE CORRECTION FACTORS - %

AREA L/W	0.01 S.M.	0.1 S.M.	1 S.M.	10 S.M.	100 S.M.	1,000 S.M.
1	115	125	132	141	154	172
1.5	112	115	119	124	131	141
2	108	110	110	113	117	122
3	100	100	100	100	100	100
4	98	95	94	91	89	86
5 or greater	95	91	88	85	82	78

1 S.M. = 1 Square Mile = 640 Acres

Just for information only



GENERAL REQUIREMENTS - DRAINAGE

DRAWN: SCHER

CHKD.

Jay Patel

APPR. BY

Benjamin Y. Wong

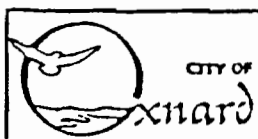
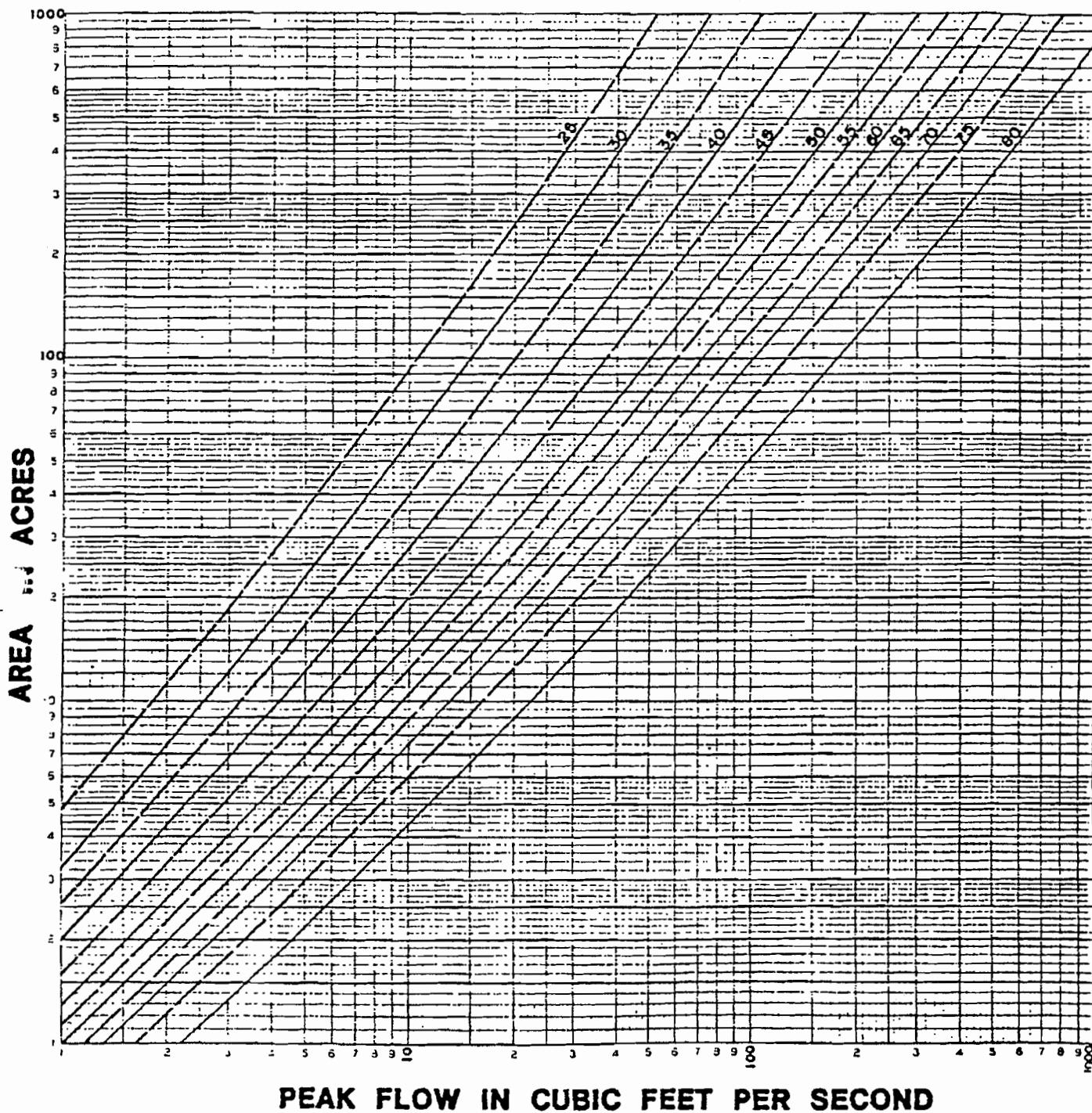
Public Works Department

STANDARD PLAN

PLATE 81

SHEET OF

REV. APPR. BY DATE



GENERAL REQUIREMENTS - DRAINAGE

DRAWN: SOHER

CKD.

Ray Patel

APPR. BY

Benjamin Y. Wong

Public Works Department

STANDARD PLAN

PLATE 62

SHEET OF



Attachment B

Cook's Method Hydrology Calculations (Flood Control)

CCE DESIGN ASSOCIATES INC

Cook's Method Calculations

Prepared 5/6/2021

By: JQ Adams

Project	<u>U-Haul</u>	Job No	<u>C20.0264</u>	Sheet	<u>1 of 1</u>
Watershed	<u>Existing Calcs</u>		Designed	<u>JA</u>	Date <u>5/2/2021</u>
Concentration Point			Checked		Date

Watershed Constants:

Drainage Area	<u>0.67</u>	Acres			
Length	<u>350</u>	feet	Fall	<u>0.6</u>	feet Slope <u>0.17%</u>
Width	<u>= (Area x 43560)/Length =</u>		<u>83.4</u>	feet	
Length/Width	<u>4.20</u>	Shape Correction Factor	<u>95%</u>		
Soil Type	<u>"B" assumed</u>	RI Correction Factor	<u>123%</u>		

Computation of "C"

<u>Type of Development</u>	<u>"C" Factor</u>	<u>Present</u>	<u>Future</u>
Undeveloped	45	0%	0%
Residential	60	0%	0%
Commercial/Ind.	70	100%	0%

* Note: Residential "C" value calculated using the Modified Rational Formula

Runoff: Q (curve) =	<u>1.4</u>	cfs
x L/W factor	<u>1.3</u>	cfs
x RI Correc. Factor	<u>1.6</u>	cfs

<u>Frequency</u>	<u>Freq. Factor</u>	<u>Q</u>	
20% (5 year)	65%	1.1	cfs
10% (10 year)	100%	1.6	cfs
4% (25 year)	135%	2.2	cfs
2% (50 year)	170%	2.8	cfs
1% (100 year)	200%	3.3	cfs

CCE DESIGN ASSOCIATES INC

Cook's Method Calculations

Prepared: 5/6/2021

By: JQ Adams

Project	<u>U-Haul</u>	Job No	<u>C20.0264</u>	Sheet	<u>1 of 1</u>
Watershed	<u>Proposed Calcs</u>		Designed	<u>JA</u>	Date <u>5/2/2021</u>
Concentration Point			Checked		Date

Watershed Constants:

Drainage Area	<u>0.67</u>	Acres			
Length	<u>350</u>	feet	Fall	<u>0.6</u>	feet Slope <u>0.17%</u>
Width	<u>= (Area x 43560)/Length =</u>		<u>83.4</u>	feet	
Length/Width	<u>4.20</u>	Shape Correction Factor	<u>95%</u>		
Soil Type	<u>"B" assumed</u>	RI Correction Factor	<u>123%</u>		

Computation of "C"

<u>Type of Development</u>	<u>"C" Factor</u>	<u>Present</u>	<u>Future</u>
Undeveloped	45	0%	0%
Residential	60	0%	0%
Commercial/Ind.	70	100%	100%

* Note: Residential "C" value calculated using the Modified Rational Formula

Runoff: Q (curve) =	<u>1.4</u>	cfs
x L/W factor	<u>1.3</u>	cfs
x RI Correc. Factor	<u>1.6</u>	cfs

<u>Frequency</u>	<u>Freq. Factor</u>	<u>Q</u>	
20% (5 year)	65%	1.1	cfs
10% (10 year)	100%	1.6	cfs
4% (25 year)	135%	2.2	cfs
2% (50 year)	170%	2.8	cfs
1% (100 year)	200%	3.3	cfs



Attachment C

Stormwater Quality Treatment Calculations

Step 5: Apply BMPs to Reduce EIA to $\leq 5\%$

Step 1: Determine water quality design volume			
1-1. Enter Project area (acres), $A_{project}$	$A_{project} =$	0.67	acres
1-2. Enter the maximum allowable percent of the Project area that may be effective impervious area (%) (refer to permit), ranges from 5-30%, $\%allowable$	$\%allowable =$	5	%
1-3. (5-a) Determine the maximum allowable effective impervious area (acres), $EIA_{allowable} = (A_{project}) * (\%allowable)$	$EIA_{allowable} =$	0.03	acres
1-4. Enter Project impervious fraction, Imp (e.g. 60% = 0.60)	$Imp =$	0.29	
1-5. Determine the Project Total Impervious area (acres), TIA	$TIA =$	0.19	acres
1-6. (5-b) Determine the total area from which runoff must be retained (acres), $A_{retain} = TIA - EIA_{allowable}$	$A_{retain} =$	0.16	acres
1-7. Determine pervious runoff coefficient using Table E-1, C_p	$C_p =$	0.05	
1-8. Runoff coefficient, $C = 0.95$	$C =$	0.95	
1-9. Enter design rainfall depth of the storm (in), P_i	$P_i =$	0.75	in
1-10. Calculate rainfall depth (ft), $P = P_i/12$	$P =$	0.06	ft
1-11. (5-c) Calculate Volume to be Retained (ft^3), $SQDV = 43560 * C * P * A_{retain}$	$SQDV =$	416	ft^3

*Taken from the Technical Guidance Manual for Stormwater Quality Control Measures 2011

TGM Errata Update June 29, 2018

**Entire site including EIA and developed pervious areas are being treated by proposed Retention BMP

Step 7: Apply Treatment Control Measures

Step 1: Determine water quality design volume			
1-1. Enter Project area from EIA and developed pervious surfaces (acres), $A_{EIA} = A_{project} - A_{retain}$	$A_{EIA} =$	0.51	acres
1-2. Enter Project impervious fraction, Imp (e.g. 60% = 0.60), $Imp = ((A_{pervious} * 0.0) + (EIA * 1.0)) / A_{EIA}$	$Imp =$	0.07	
1-3. Determine pervious runoff coefficient using Table E-1, C_p	$C_p =$	0.05	
1-4. Calculate runoff coefficient, $C = 0.95 * imp + C_p(1 - imp)$	$C =$	0.11	
1-5. Enter design rainfall depth of the storm (in), P_i	$P_i =$	0.75	in
1-6. Calculate rainfall depth (ft), $P = P_i / 12$	$P =$	0.06	ft
1-7. Calculate water quality design volume (ft ³), $SQDV = 43560 * C * P * A_{retain}$	$SQDV =$	151	ft ³

*Taken from the Technical Guidance Manual for Stormwater Quality Control Measures 2011
TGM Errata Update June 29, 2018

**Entire site including EIA and developed pervious areas are being treated by proposed Retention BMP

Total SQDV

Step 1: Determine total water quality design volume			
1-1. Enter SQDV from Step 5	SQDV1 =	415.89	ft ³
1-2. Enter SQDV from Step 7	SQDV2 =	151.40	ft ³
1-3. Determine total SQDV, $SQDV = SQDV \text{ (step 5) } + SQDV \text{ (step 7)}$	SQDV =	567.29	ft ³

*Taken from the Technical Guidance Manual for Stormwater Quality Control Measures 2011
TGM Errata Update June 29, 2018

**Entire site including EIA and developed pervious areas are being treated by proposed Retention BMP

Water Quality Design Flow (SQDF)

Step 1: Determine water quality design flow			
1-1. Enter Project area (acres), <i>Aproject</i>	<i>Aproject</i> =	0.67	acres
1-2. Enter Project impervious fraction, <i>Imp</i> (e.g. 60% = 0.60)	<i>Imp</i> =	0.29	
1-3. Determine pervious runoff coefficient using Table E-1, <i>Cp</i>	<i>Cp</i> =	0.05	
1-4. Calculate runoff coefficient, $C = 0.95 \cdot imp + Cp(1 - imp)$	<i>C</i> =	0.95	
1-5. Enter design rainfall intensity (in/hr), <i>i</i>	<i>i</i> =	0.2	in/hr
1-6. Calculate water quality design flow (cfs), $SQDF = CiA$	<i>SQDF</i> =	0.13	cfs

*Taken from the Technical Guidance Manual for Stormwater Quality Control Measures 2011
TGM Errata Update June 29, 2018



Attachment D
Hydrology Map

