CAGE
CIVIL ENGINEERING

April 13, 2022

North Carolina Department of Environmental Quality
Land Quality Section
127 Cardinal Drive Extension
Wilmington, NC 28405

RE: Coffee Shop – Stormwater Analysis
1117 West Corbett Avenue
Swansboro, North Carolina

To Whom It May Concern:

The purpose of this letter and attached enclosures is to present the anticipated stormwater analysis for the proposed +/- 1.07-acre Coffee Shop development located at 1117 West Corbett Avenue in Swansboro, North Carolina. This letter is intended to illustrate that the development and site modifications to 1117 West Corbet Avenue are in general conformance with the assumptions and procedures set forth in the Approved Site Plan for The Walmart Super Center - #7178-000 Driveway Extension by Bohler Engineering 6/26/2019 (NCDEQ Permit No. SW8 160501).

GENERAL LOCATION AND DESCRIPTION

Site Location

- The proposed Coffee Shop development is located at 1117 West Corbett Avenue.
- The site is bordered to the northeast by West Corbett Avenue, to the southeast by a Walmart gas station, to the southwest by a Walmart parking lot and associated retention pond, and to the northwest by vacant land.
- Approximate geodetic coordinates for the site are 32°42'05"N, 77°08'58"W.
- See enclosures for a Vicinity Map.

Description of Property

- The site is approximately 1.07 acres in size and is currently occupied by vacant land. Topography generally slopes from the center of the lot outward with slopes between 1% and 6%.
- The project area is contained within FEMA Flood Insurance Rate Maps (FIRM) Panel Number 3720535500K effective June 19th, 2020. The site is located in an area of minimal flood hazard (Zone X). See enclosures for a FEMA FIRMette Exhibit.
- The proposed Coffee Shop development will include the construction of a commercial building along with associated infrastructure.
- Hydrologic Soil Group for the project site is A. See enclosures for the NRCS Web Soil Survey.
- The ultimate receiving water for the site is Cartwheel Branch Creek.

HYDROLOGY

Design Criteria

- Peak storm runoff was determined using the Rational Formula: Q=CIA
- Design storm recurrence intervals are the 2-year storm for the minor event and the 100-year storm for the major event.
- Runoff coefficients have been determined using Table 1 from the NCDEQ Stormwater Design Manual.
- Rainfall intensity was determined using NOAA Atlas 14 Point Precipitation Frequency (PF) Estimates. The rainfall intensities determined for this site are as follows: 2-yr = 6.89 in/hr, 100-yr = 11.9 in/hr.
- See enclosures for all hydrologic calculations.

Runoff Analysis

- The previously mention design criteria was used to determine peak runoff values for the proposed condition of the Coffee Shop site. For the purpose of analysis, the site has been broken up into 5 Sub-Basins. See enclosures for the proposed Drainage Map.
- The proposed site is an outparcel of the existing Walmart SuperCenter at 1121 West Corbett Avenue. The Walmart Supercenter has a wet pond (Pond 3) that was designed to accommodate the proposed Coffee Shop site and provide water quality measures/rate control.
- A Stormwater Analysis was completed for the entire Walmart SuperCenter development and approved by the NCDEQ under Permit No. SW8 160501. Per Sheet DA-2 of the Walmart SuperCenter Site Plan Documents by Bohler Engineering (stamped 6/26/19) the proposed site is part of Drainage Area 3. An impervious area of 38,685 sf was allotted for the future development of the proposed site area within this basin. The proposed improvements will add a total of 24,391 sf of impervious area to the existing empty lot.
- The proposed condition shows a lower total impervious area than what was allotted for the future condition. Therefore, the existing wet pond (Pond 3) will sufficiently provide detention and water quality control for the proposed improvements.
- Please see enclosures for calculations providing the proposed impervious area and runoff analysis.

HYDRAULICS

Design Criteria

- Inlet Capacity was calculated using Figure 4-3 for a Type ‘E’ Grate NCDOT Std. 840.03 Inlet from the City of Charlotte Stormwater Design Manual.
- Hydraulic Grade Lines (HGLs) and sewer capacities have been calculated using Stormwater Studio 2022 v3.0.29 software with standard loss coefficients.

Hydraulic Analysis

- All runoff generated by the proposed site will ultimately be collected by 2 proposed 3' Type 'E' Grate NCDOT Std. 840.03 Inlets within the proposed parking lot. These inlets will tie into the existing storm sewer system provided for this site and will convey runoff to the existing wet pond (Pond 3) southeast of the project site. Per the Walmart SuperCenter Site Plan Documents by Bohler Engineering (stamped 6/26/19) Pond 3 has been sized with adequate volume to detain runoff generated by the proposed improvements and provide water quality measures.
- Basins D1 & D2 will each be collected by 3' Type 'E' Grate NCDOT Std. 840.03 Inlets and conveyed to the existing storm outfall to Pond 3 via proposed RCP storm sewer.
- Basin D3 is entirely rooftop and will be conveyed by roof drains directly into proposed HDPE storm sewer and ultimately to the existing storm outfall to Pond 3.
- Basins OS1 & OS2 will sheet flow offsite to the private drive south of the site and West Corbett Avenue, respectively. Runoff will ultimately be conveyed to the existing storm sewer systems via curb & gutter.
- The proposed on-site storm sewer system has been sized with capacity to carry the 100-year peak runoff.
- See enclosures for the proposed Drainage Map, Hydraulic Calculations, and HGL's for the proposed storm sewer.

CONCLUSIONS

- The drainage design for the proposed Coffee Shop development detailed within this letter is in general compliance with NCEEQ engineering criteria.
- The proposed drainage patterns will comply with the design from the Walmart SuperCenter Site Plan Documents by Bohler Engineering (stamped 6/26/19). All on-site runoff will be conveyed to the existing storm sewer outfall to Pond 3 directly south and West Corbett Ave in compliance with the previously approved design.
- Runoff analysis for the proposed site shows a reduced impervious area compared to the future assumptions used to design the existing storm infrastructure.
- All proposed on-site storm sewer has been designed with capacity for the 100-year storm event.
- There should be no negative impact to downstream infrastructure due to release flows being lower than the corresponding design flows from The Walmart SuperCenter Stormwater Management Calculations.

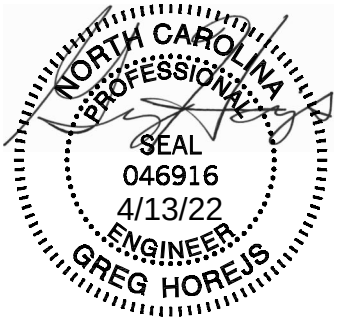
REFERENCES

- *North Carolina Department of Environmental Quality Stormwater Design Manual,* North Carolina Department of Environmental Quality, Revised August 15, 2019

- *Site Plan Documents for Walmart SuperCenter - #719-000 Driveway Extension*, Bohler Engineering, June 26, 2019

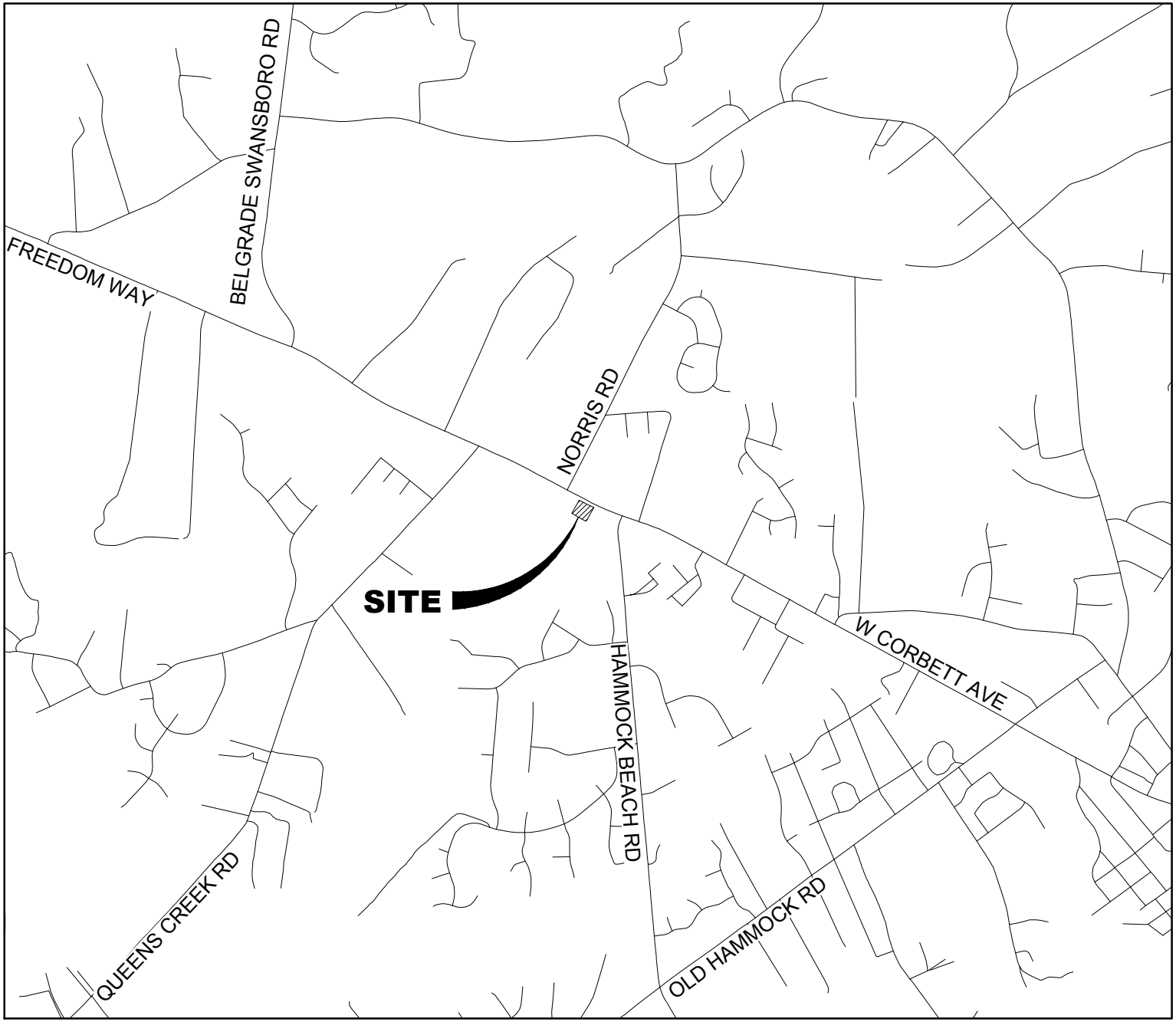
Please contact me with any questions.

Regards,



Rick Katz, P.E.
For and on Behalf of CAGE Civil Engineering

Enclosures:
Vicinity Map
NRCS Hydrologic Soil Map
FEMA FIRMette
NOAA Atlas 14 Point Precipitation Frequency Estimates
Exhibits from the NCDEQ Stormwater Design Manual
Proposed Drainage Basin Map
Proposed Rational Method Calculations
Proposed Hydraulic Calculations
Excerpts from the Site Plan Documents for Walmart SuperCenter - #719-000 Driveway Extension



VICINITY MAP

1" = 2,000'

N

Map Scale: 1:742 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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: Onslow County, North Carolina
Survey Area Data: Version 24, Jan 21, 2022

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

Date(s) aerial images were photographed: Dec 31, 2009—Oct 30, 2017

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
On	Onslow loamy fine sand	A	1.1	100.0%
Totals for Area of Interest			**1.1**	**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

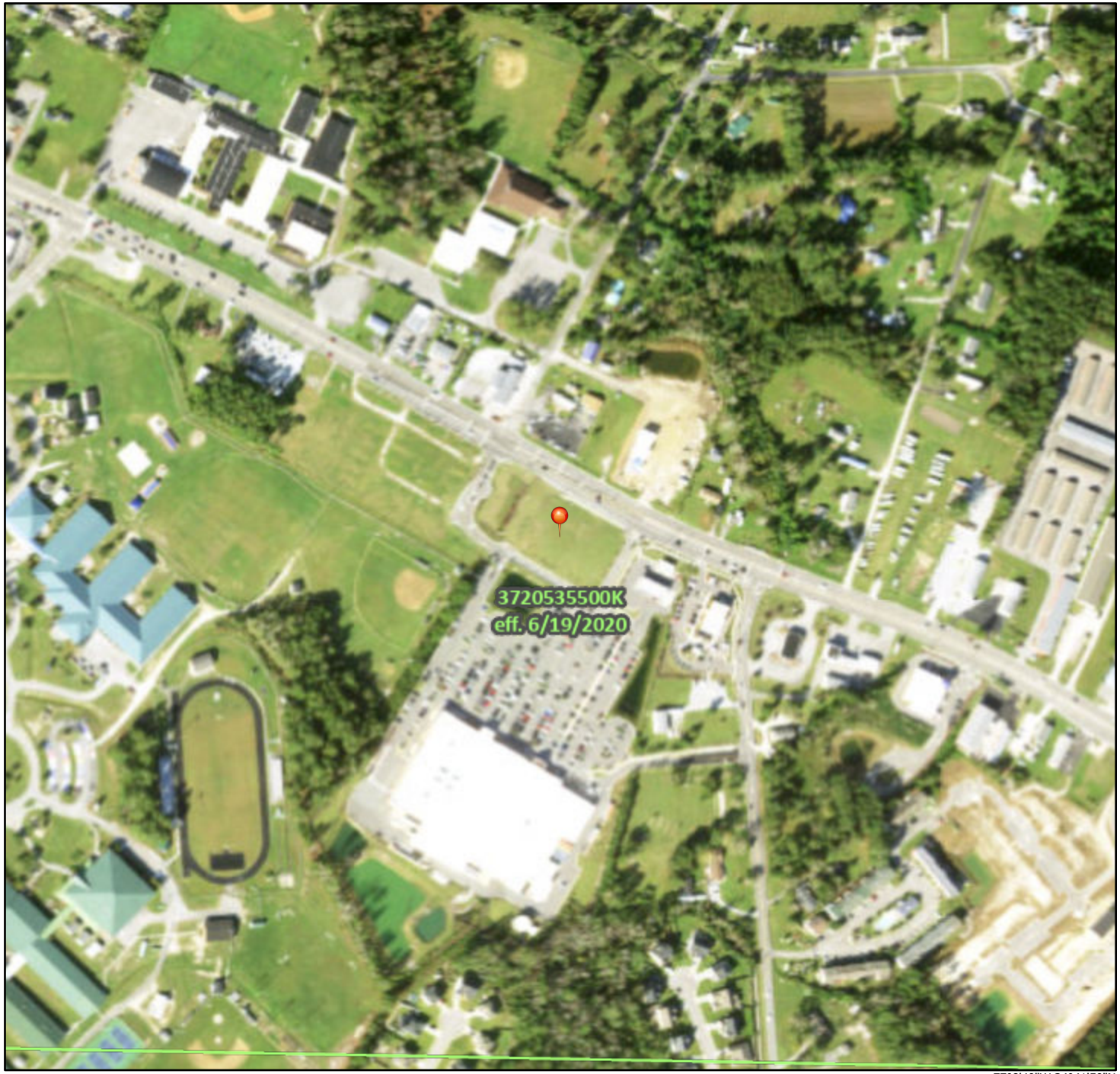
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

National Flood Hazard Layer FIRMette

77°9'17"W 34°42'20"N



77°8'40"W 34°41'50"N

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

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

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

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

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

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

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

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

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/7/2022 at 5:50 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

NOAA Atlas 14, Volume 2, Version 3
Location name: Swansboro, North Carolina, USA*
Latitude: 34.6927°, Longitude: -77.1292°
Elevation: 24.81 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**5.86** (5.41-6.37)	**6.89** (6.37-7.46)	**7.94** (7.33-8.60)	**8.94** (8.23-9.68)	**10.1** (9.24-10.9)	**11.0** (10.1-11.9)	**11.9** (10.8-12.9)	**12.9** (11.6-13.9)	**14.0** (12.5-15.2)	**15.0** (13.3-16.4)
10-min	**4.68** (4.33-5.09)	**5.51** (5.09-5.97)	**6.36** (5.87-6.89)	**7.15** (6.58-7.75)	**8.04** (7.36-8.70)	**8.78** (8.02-9.50)	**9.49** (8.61-10.3)	**10.2** (9.17-11.0)	**11.1** (9.89-12.0)	**11.8** (10.5-12.9)
15-min	**3.90** (3.60-4.24)	**4.62** (4.27-5.00)	**5.36** (4.95-5.81)	**6.03** (5.55-6.53)	**6.80** (6.22-7.35)	**7.41** (6.76-8.02)	**7.99** (7.26-8.66)	**8.56** (7.72-9.29)	**9.29** (8.30-10.1)	**9.90** (8.76-10.8)
30-min	**2.67** (2.47-2.90)	**3.19** (2.95-3.45)	**3.81** (3.51-4.13)	**4.37** (4.02-4.73)	**5.03** (4.61-5.44)	**5.58** (5.09-6.04)	**6.12** (5.56-6.63)	**6.67** (6.01-7.23)	**7.39** (6.60-8.04)	**8.01** (7.10-8.74)
60-min	**1.67** (1.54-1.81)	**2.00** (1.85-2.17)	**2.44** (2.25-2.65)	**2.85** (2.62-3.08)	**3.35** (3.07-3.62)	**3.78** (3.45-4.09)	**4.22** (3.83-4.57)	**4.68** (4.21-5.07)	**5.30** (4.74-5.77)	**5.85** (5.18-6.38)
2-hr	**1.02** (0.935-1.11)	**1.23** (1.13-1.35)	**1.54** (1.42-1.69)	**1.84** (1.68-2.00)	**2.22** (2.02-2.42)	**2.57** (2.32-2.79)	**2.92** (2.63-3.18)	**3.31** (2.96-3.60)	**3.86** (3.41-4.21)	**4.35** (3.81-4.76)
3-hr	**0.733** (0.671-0.809)	**0.887** (0.813-0.977)	**1.12** (1.02-1.23)	**1.34** (1.22-1.47)	**1.64** (1.49-1.80)	**1.91** (1.72-2.09)	**2.20** (1.97-2.41)	**2.53** (2.24-2.76)	**2.99** (2.62-3.28)	**3.42** (2.96-3.76)
6-hr	**0.447** (0.407-0.497)	**0.540** (0.492-0.601)	**0.682** (0.618-0.758)	**0.818** (0.739-0.909)	**1.00** (0.903-1.12)	**1.18** (1.05-1.30)	**1.36** (1.20-1.50)	**1.57** (1.37-1.73)	**1.87** (1.61-2.06)	**2.14** (1.83-2.37)
12-hr	**0.262** (0.237-0.295)	**0.317** (0.287-0.356)	**0.403** (0.363-0.451)	**0.486** (0.436-0.544)	**0.601** (0.535-0.672)	**0.708** (0.625-0.789)	**0.824** (0.721-0.917)	**0.954** (0.826-1.06)	**1.15** (0.977-1.28)	**1.33** (1.11-1.48)
24-hr	**0.153** (0.139-0.169)	**0.186** (0.169-0.206)	**0.240** (0.218-0.266)	**0.286** (0.259-0.317)	**0.356** (0.319-0.393)	**0.416** (0.370-0.459)	**0.483** (0.426-0.533)	**0.557** (0.485-0.615)	**0.670** (0.572-0.743)	**0.768** (0.646-0.855)
2-day	**0.089** (0.080-0.099)	**0.107** (0.097-0.120)	**0.138** (0.125-0.154)	**0.164** (0.148-0.183)	**0.204** (0.182-0.227)	**0.239** (0.211-0.265)	**0.278** (0.243-0.309)	**0.321** (0.278-0.358)	**0.388** (0.329-0.434)	**0.445** (0.371-0.501)
3-day	**0.063** (0.057-0.070)	**0.076** (0.069-0.084)	**0.097** (0.088-0.108)	**0.115** (0.104-0.127)	**0.142** (0.127-0.156)	**0.164** (0.146-0.182)	**0.190** (0.167-0.210)	**0.218** (0.190-0.242)	**0.261** (0.223-0.291)	**0.299** (0.251-0.335)
4-day	**0.050** (0.045-0.055)	**0.060** (0.055-0.067)	**0.077** (0.070-0.085)	**0.090** (0.082-0.100)	**0.110** (0.099-0.121)	**0.127** (0.114-0.140)	**0.146** (0.129-0.161)	**0.166** (0.146-0.184)	**0.198** (0.171-0.220)	**0.225** (0.191-0.252)
7-day	**0.033** (0.030-0.036)	**0.040** (0.037-0.044)	**0.050** (0.046-0.055)	**0.059** (0.053-0.064)	**0.071** (0.064-0.077)	**0.081** (0.073-0.089)	**0.092** (0.082-0.101)	**0.104** (0.092-0.114)	**0.121** (0.106-0.134)	**0.136** (0.117-0.151)
10-day	**0.026** (0.024-0.028)	**0.031** (0.029-0.034)	**0.039** (0.035-0.042)	**0.045** (0.041-0.049)	**0.054** (0.049-0.059)	**0.061** (0.055-0.067)	**0.069** (0.062-0.075)	**0.077** (0.069-0.085)	**0.090** (0.079-0.099)	**0.100** (0.086-0.111)
20-day	**0.017** (0.016-0.019)	**0.021** (0.019-0.022)	**0.025** (0.023-0.027)	**0.029** (0.027-0.031)	**0.034** (0.031-0.037)	**0.038** (0.035-0.041)	**0.043** (0.039-0.046)	**0.048** (0.043-0.052)	**0.054** (0.048-0.059)	**0.060** (0.052-0.066)
30-day	**0.014** (0.013-0.015)	**0.017** (0.016-0.018)	**0.020** (0.019-0.022)	**0.023** (0.021-0.025)	**0.027** (0.025-0.029)	**0.030** (0.027-0.032)	**0.033** (0.030-0.036)	**0.036** (0.033-0.039)	**0.041** (0.037-0.044)	**0.044** (0.039-0.048)
45-day	**0.012** (0.011-0.013)	**0.014** (0.013-0.015)	**0.017** (0.016-0.018)	**0.019** (0.018-0.020)	**0.022** (0.020-0.024)	**0.025** (0.023-0.026)	**0.027** (0.025-0.029)	**0.030** (0.027-0.032)	**0.034** (0.030-0.037)	**0.037** (0.033-0.040)
60-day	**0.011** (0.010-0.012)	**0.013** (0.012-0.014)	**0.015** (0.014-0.016)	**0.017** (0.016-0.018)	**0.019** (0.018-0.021)	**0.021** (0.020-0.023)	**0.023** (0.021-0.025)	**0.025** (0.023-0.027)	**0.028** (0.025-0.030)	**0.030** (0.027-0.033)

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

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

Please refer to NOAA Atlas 14 document for more information.

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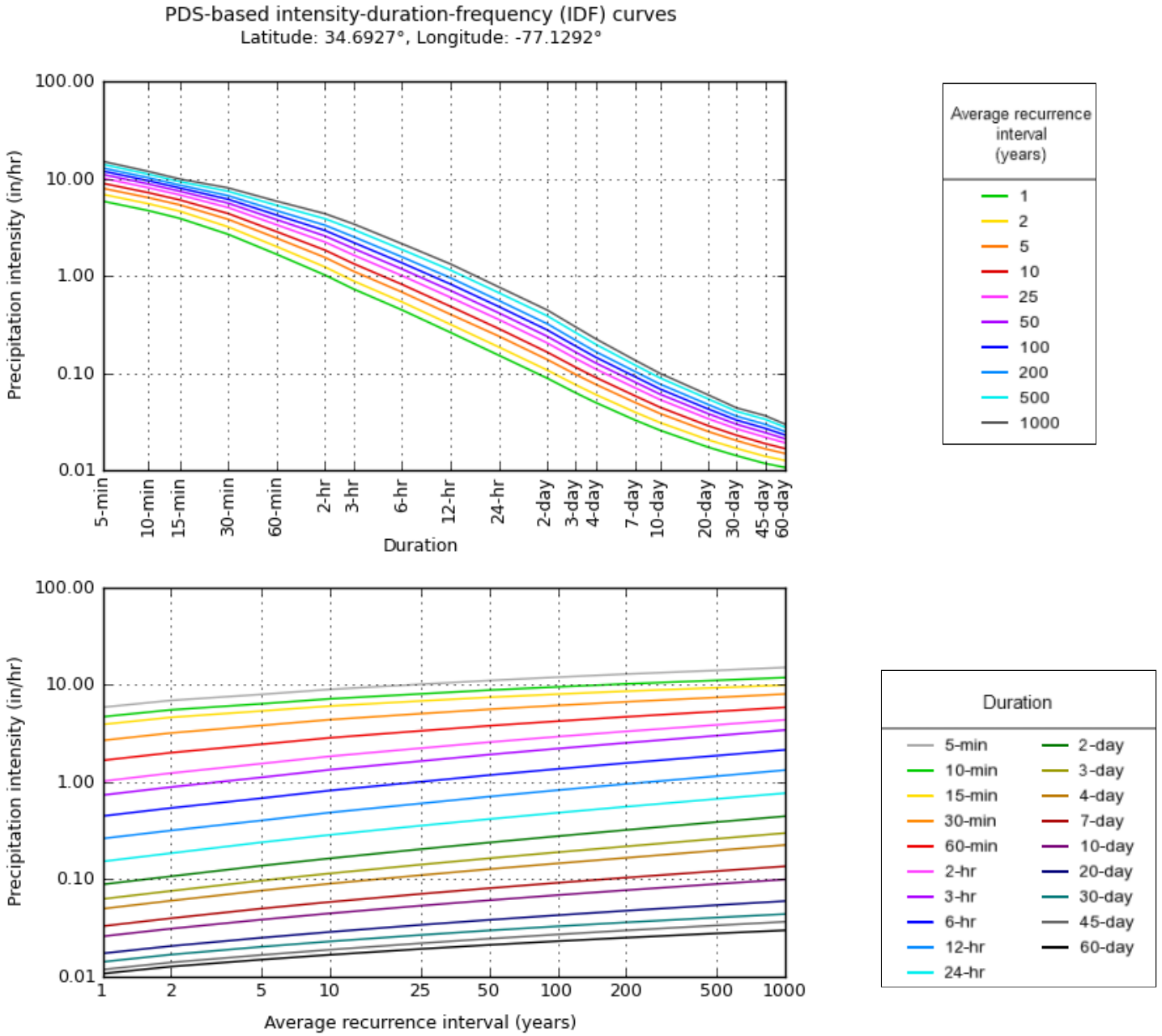
PF graphical



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Wed Apr 13 15:34:03 2022

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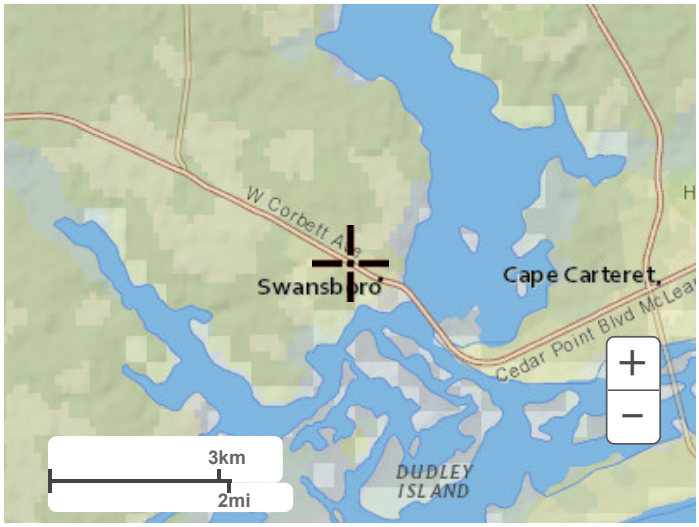
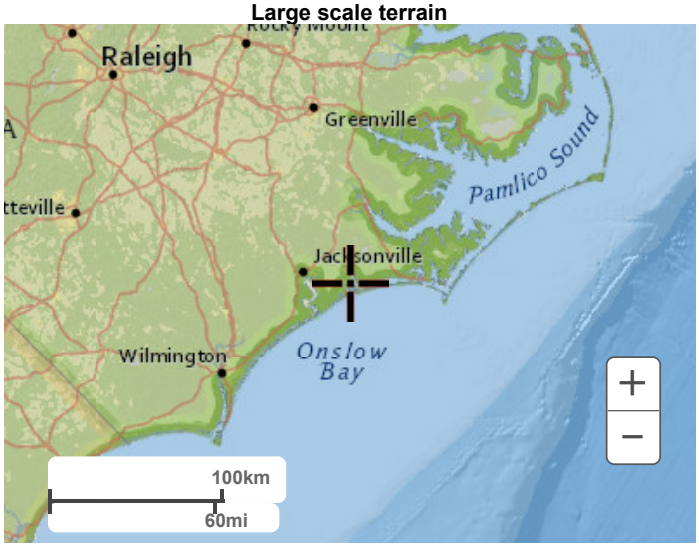
Maps & aerials

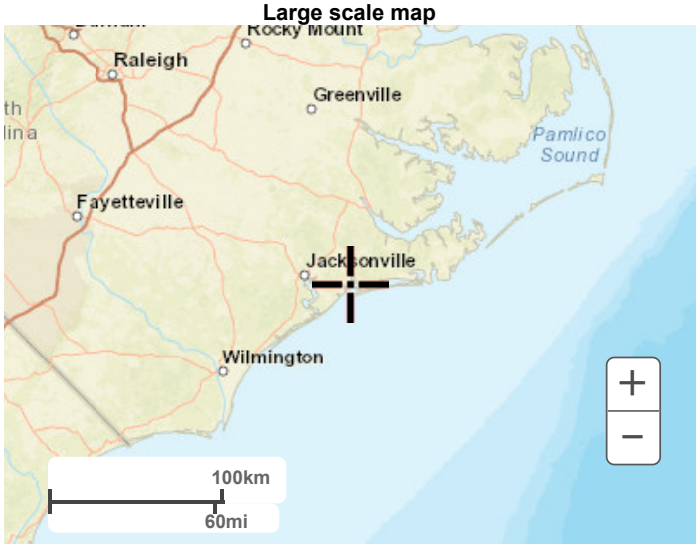
Small scale terrain



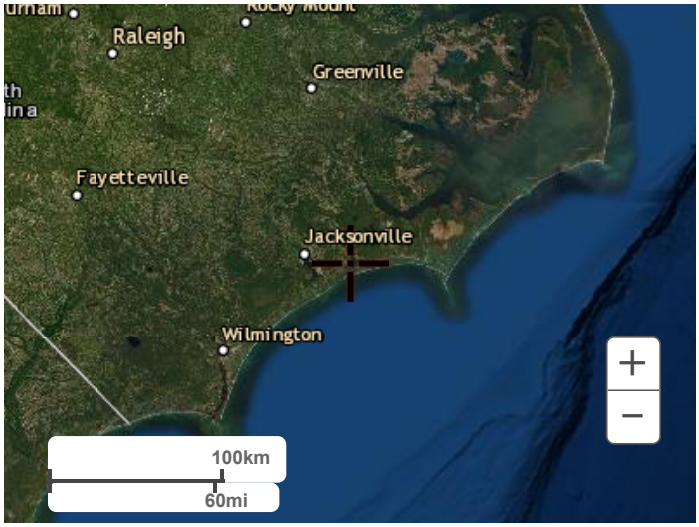
Large scale terrain



Large scale map



Large scale aerial



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

Disclaimer

Table 1: Rational Runoff Coefficients by Land Use
(ASCE 1975, Viessman, et al. 1996, and Malcom 1999)

Description of Surface	Rational Runoff Coefficient, C
Unimproved Areas	0.35
Asphalt	0.95
Concrete	0.95
Brick	0.85
Roofs, inclined	1.00
Roofs, flat	0.90
Lawns, sandy soil, flat (<2%)	0.10
Lawns, sandy soil, average (2-7%)	0.15
Lawns, sandy soil, steep (>7%)	0.20
Lawns, heavy soil, flat (<2%)	0.15
Lawns, heavy soil, average (2-5%)	0.20
Lawns, heavy soil, steep (>7%)	0.30
Wooded areas	0.15

The rainfall intensity in inches per hour, I, can be obtained from the NOAA web site. From this web site, select from one of NOAA's numerous data stations throughout the state and select "precipitation intensity." This will open a table that displays precipitation intensity estimates for various annual return intervals (ARIs) (one year through 1,000 years) and various storm durations (5 minutes through 60 days). The requirements of the applicable stormwater program will determine the appropriate values for ARI and storm duration. If the design is for a level spreader that is receiving runoff directly from the drainage area, then the value for I should simply be one inch per hour (more information on level spreader design in Chapter 8).

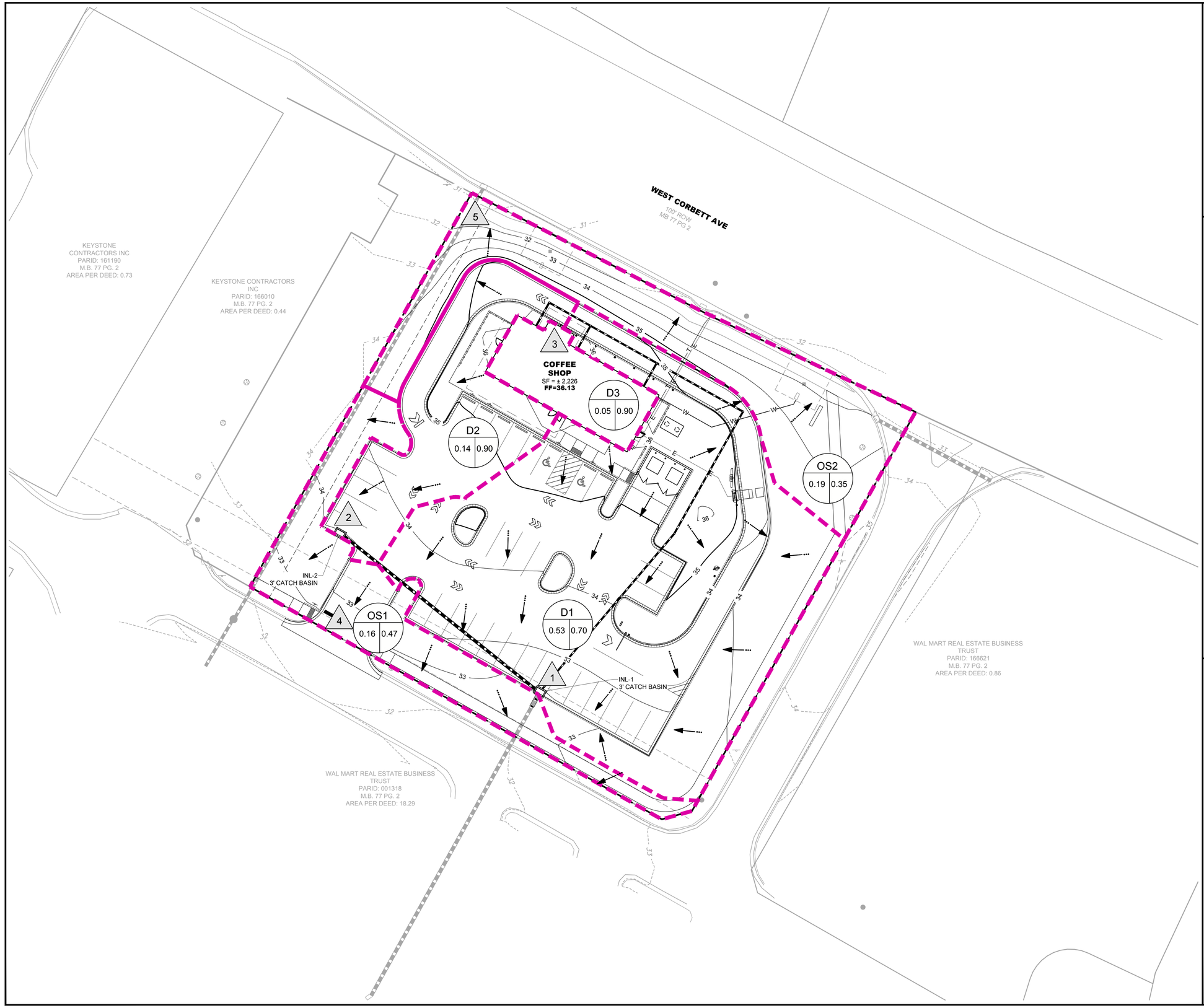
Simple Method for Runoff Volume

$$R_V = 0.05 + 0.9 * I_A$$

Where:
R_V = Runoff coefficient (unitless)
I_A = Impervious fraction (unitless)

$$DV = 3630 * R_D * R_V * A$$

Where:
DV = Design volume (cu ft)
R_D = Design storm depth (in)
A = Drainage area (ac)



BASIN SUMMARY TABLE			
Basin Designation	Area (ac)	Q_2 (cfs)	Q_{100} (cfs)
D1	0.53	2.55	4.41
D2	0.14	0.85	1.47
D3	0.05	0.32	0.55
OS1	0.16	0.51	0.89
OS2	0.19	0.47	0.80

LEGEND

BASIN DESIGNATION — D1
BASIN AREA (ACRES) — #### | ####
COMPOSITE RUNOFF COEFFICIENT

1 — DESIGN POINT

DRAINAGE BASIN BOUNDARY

100 — PROPOSED MAJOR CONTOUR

100 — PROPOSED MINOR CONTOUR

100 — EXISTING MAJOR CONTOUR

100 — EXISTING MINOR SEWER

N

0 20' 40'

1" = 20' (HORIZONTAL)

CAGE CIVIL ENGINEERING

REV. NO.	DESCRIPTION	DATE

VAQUERO SWANSBORO PARTNERS, LP

COFFEE SHOP

PROPOSED DRAINGE MAP

1117 WEST CORBETT AVENUE
SWANSBORO, NORTH CAROLINA

PROJ NO: 220055

ENG : RAK

DATE : 04/08/2022

SHEET NUMBER

DM1

1 OF 1

Project: Starbucks
Location: Swansboro, NC
Designer: RAK
Date: 4/13/2022
Latest Revision: 4/13/2022

[1]From Table 1 of the NCDEQ Stormwater Design Manual

IMPERVIOUSNESS AND RUNOFF COEFFICIENT CALCULATIONS

				Roofs	Lawn, Sandy Soil, Average	Asphalt/ Concrete		
			Impervious %	90%	2%	100%		
			Runoff Coefficients, C[1]	0.90	0.30	0.95		
Basin Designation	NRCS Hydrologic Soil Group	Total Area (ac)	Total Area (sf)	Roofs (sf)	Lawn (sf)	Pavement (sf)	Percent Impervious	Composite Runoff Coefficients, C
D1	A	0.53	23,011	0	8,785	14,226	62.59%	0.70
D2	A	0.14	6,014	0	503	5,511	91.80%	0.90
D3	A	0.05	2,225	2,225	0	0	90.00%	0.90
OS1	A	0.16	6,968	0	5,184	1,784	27.09%	0.47
OS2	A	0.19	8,406	0	7,761	645	9.52%	0.35
Overall		**1.07**	**46,624**	**2,225**	**22,233**	**22,166**	52.79%	0.57

Total Impervious Area = **24,391**

CAGE
CIVIL ENGINEERING

Project: Starbucks
Location: Swansboro, NC
Designer: RAK
Date: 4/13/2022
Latest Revision: 4/13/2022

Design Storm: 2-Yr

2-YEAR PEAK RUNOFF CALCULATIONS

Basin Designation	Design Point	Area (ac)	C	C X A	T_c (min)	Intensity (in/hr)	Peak Flow, Q (cfs)
D1	1	0.53	0.70	0.37	5.00	6.89	2.55
D2	2	0.14	0.90	0.12	5.00	6.89	0.85
D3	3	0.05	0.90	0.05	5.00	6.89	0.32
OS1	4	0.16	0.47	0.07	5.00	6.89	0.51
OS2	5	0.19	0.35	0.07	5.00	6.89	0.47

CAGE
CIVIL ENGINEERING

Project: Starbucks
Location: Swansboro, NC
Designer: RAK
Date: 4/13/2022
Latest Revision: 4/13/2022

Design Storm: 100-Yr

100-YEAR PEAK RUNOFF CALCULATIONS

Basin Designation	Design Point	Area (ac)	C	C X A	T_c (min)	Intensity (in/hr)	Peak Flow, Q (cfs)
D1	1	0.53	0.70	0.37	5.00	11.90	4.41
D2	2	0.14	0.90	0.12	5.00	11.90	1.47
D3	3	0.05	0.90	0.05	5.00	11.90	0.55
OS1	4	0.16	0.47	0.07	5.00	11.90	0.89
OS2	5	0.19	0.35	0.07	5.00	11.90	0.80

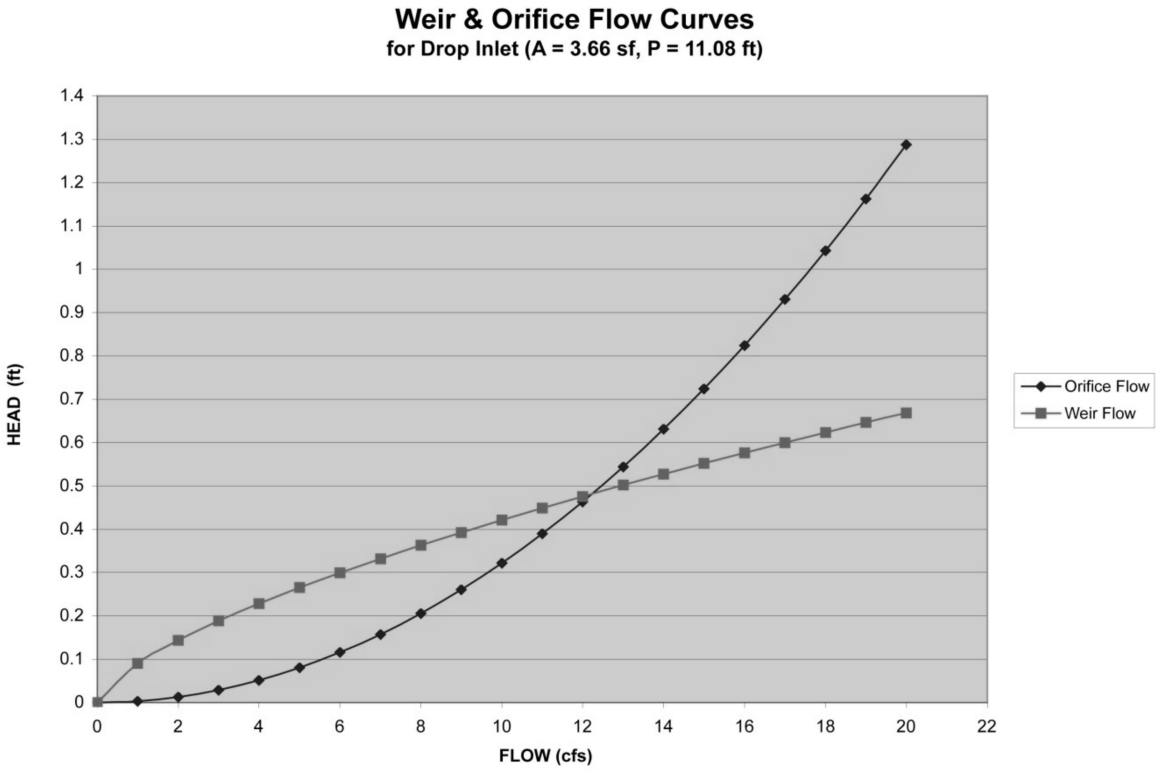


Figure 4-2 Standard Drop Inlet Grate NCDOT Std. 840.16 (2012)

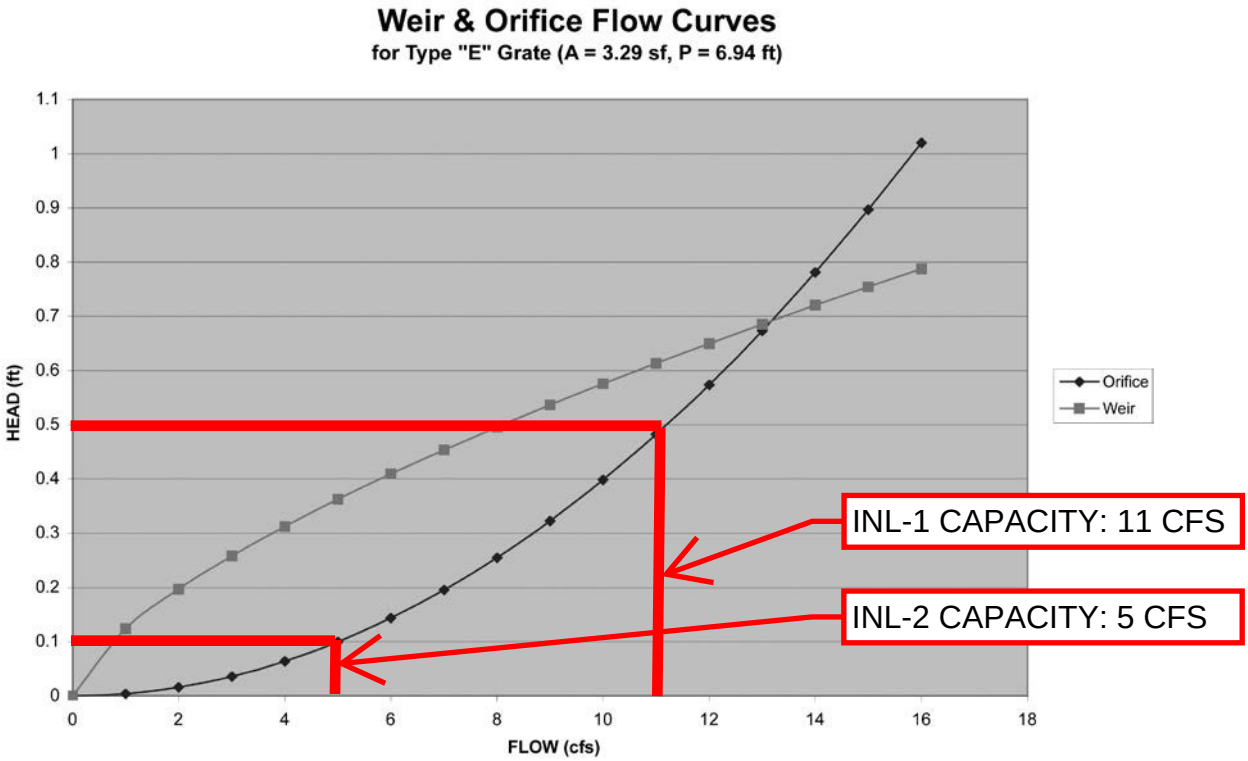


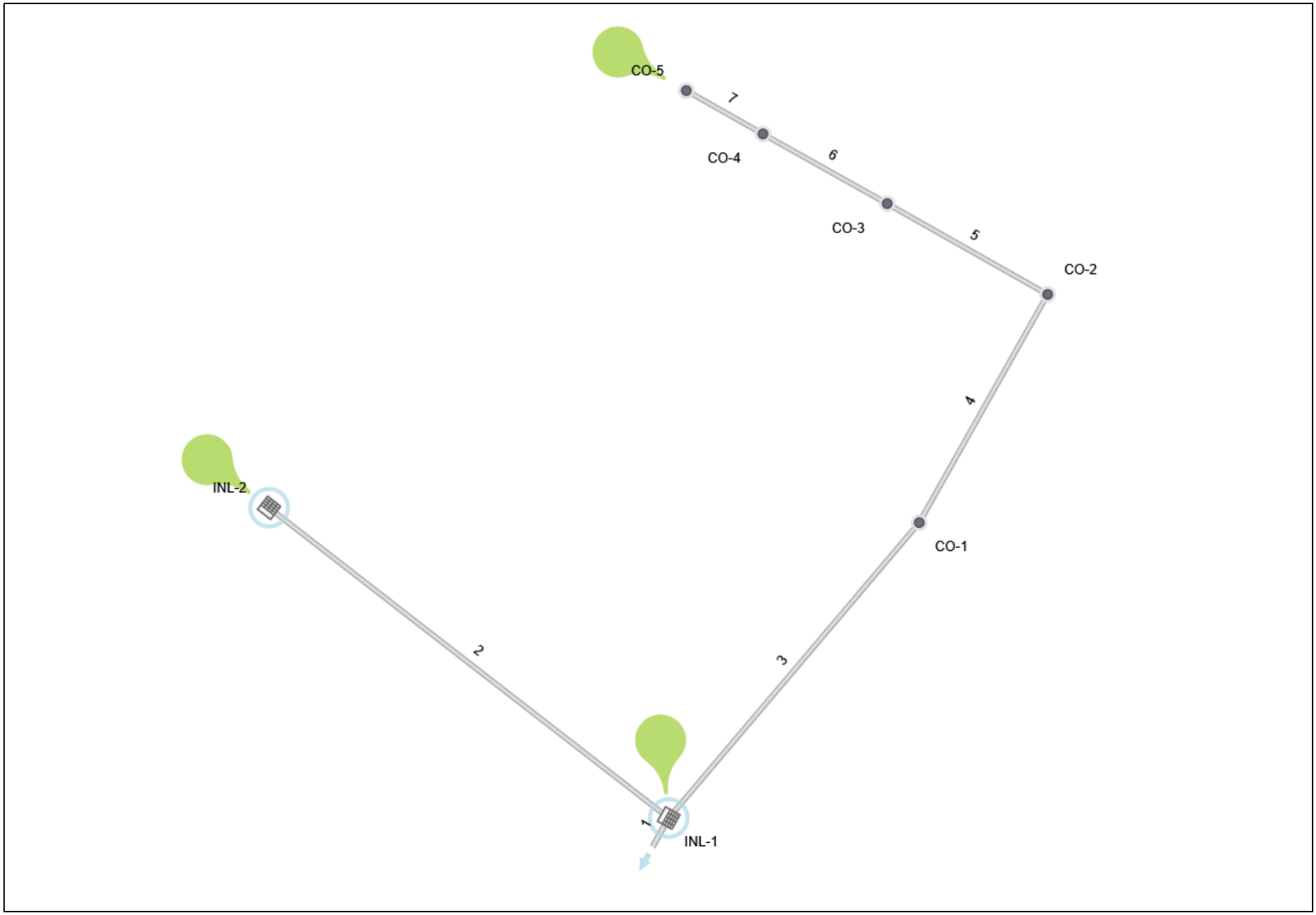
Figure 4-3 Type 'E' Grate NCDOT Std. 840.03 (2012)

Plan View

Stormwater Studio 2022 v 3.0.0.29

Project Name: Starbucks - Swansboro, NC

04-06-2022



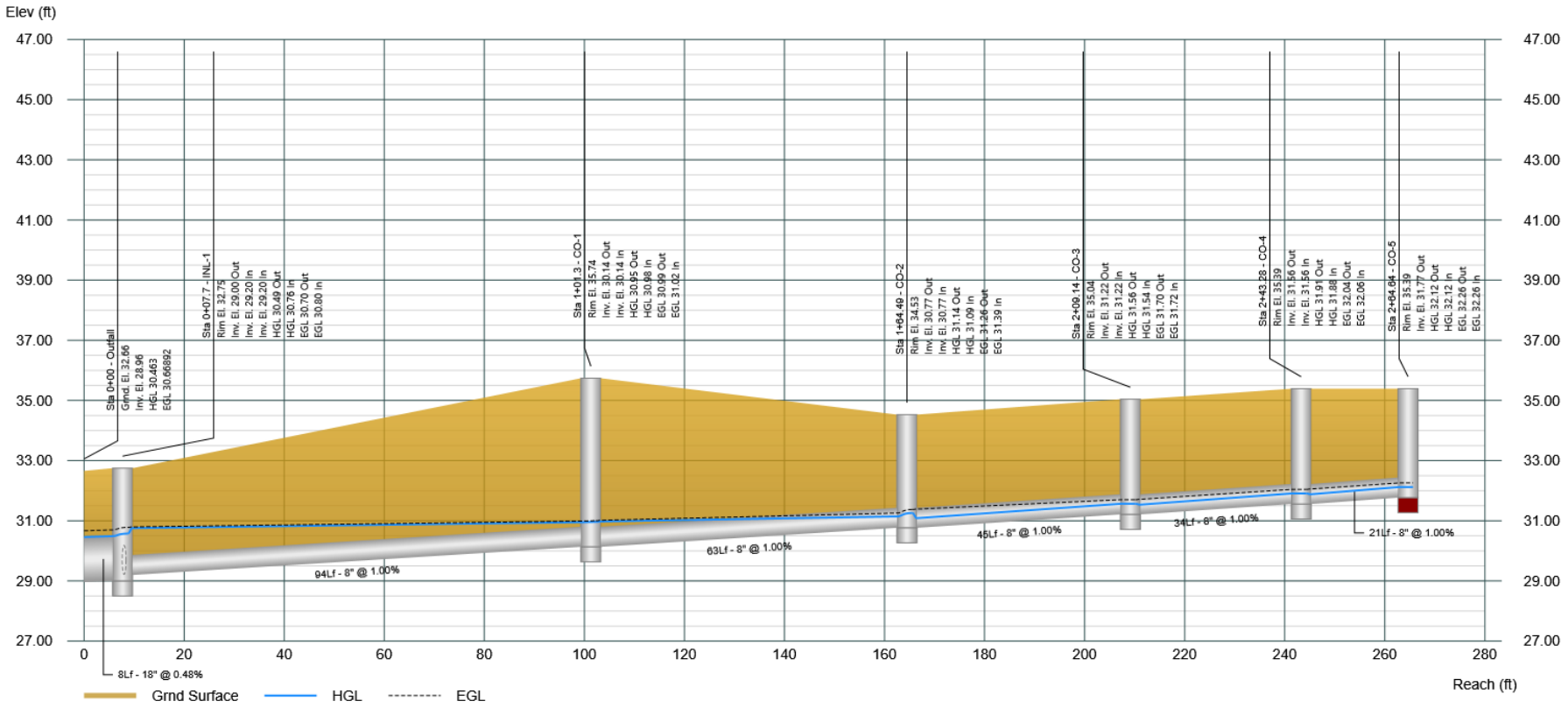
Project File: Starbucks - Swansboro, NC SWS.sws

Profile View

Stormwater Studio 2022 v 3.0.0.29

Project Name: Starbucks - Swansboro, NC

04-13-2022



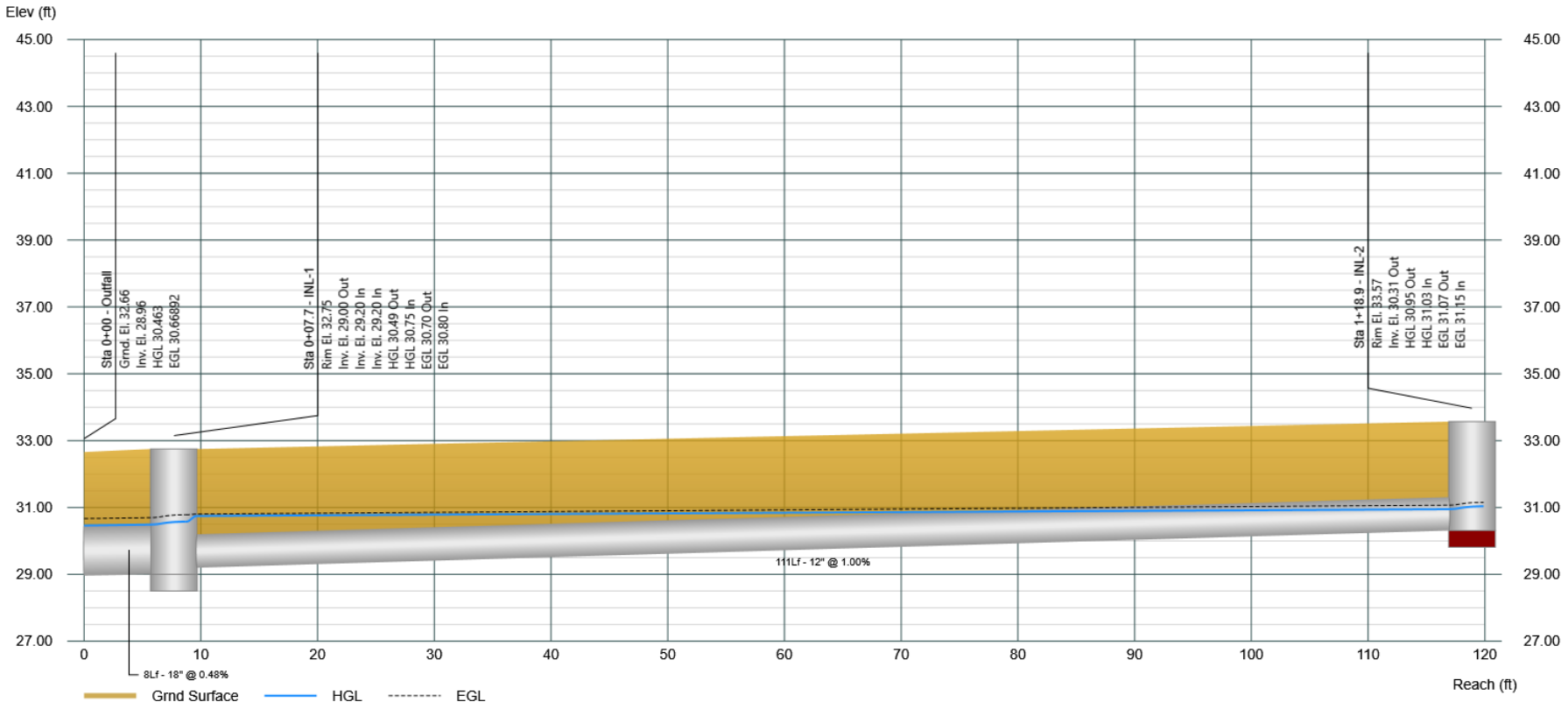
Project File: Starbucks - Swansboro, NC SWS.sws

Profile View

Stormwater Studio 2022 v 3.0.0.29

Project Name: Starbucks - Swansboro, NC

04-13-2022



Project File: Starbucks - Swansboro, NC SWS.sws

100-YEAR Report

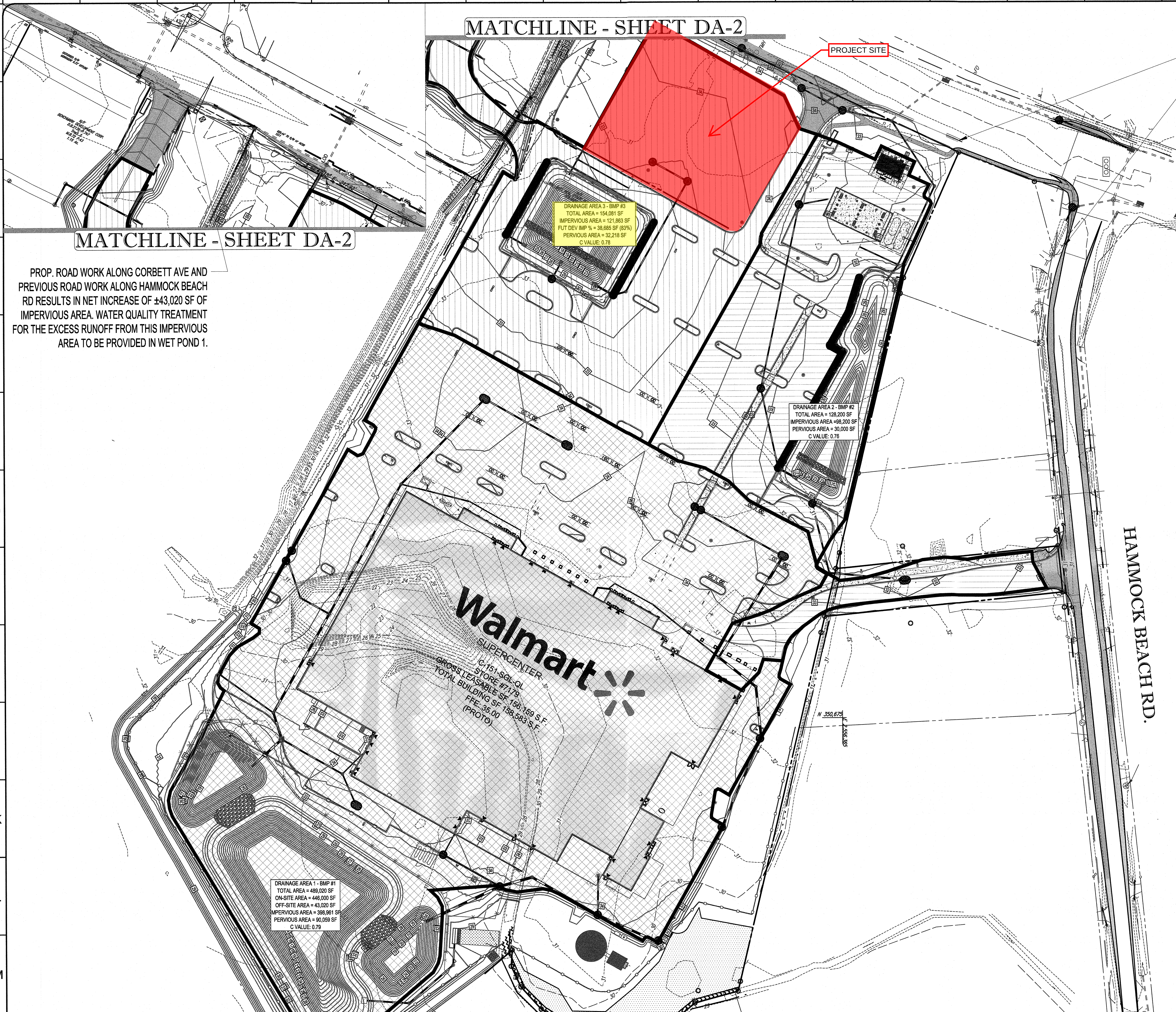
Project Name: Starbucks - Swansboro, NC

Stormwater Studio 2022 v 3.0.0.29

04-13-2022

Line No.	Inlet ID	Line Length (ft)	Line Size (in)	Line Slope (ft/ft)	Flow Rate (cfs)	Capac. Full (cfs)	Vel Ave (ft/s)	Invert Up (ft)	Invert Dn (ft)	Grnd/Rim Elev Up (ft)	Grnd/Rim Elev Dn (ft)	HGL Up (ft)	HGL Dn (ft)	
1	INL-1	7.70	18	0.0048	6.43	7.28	3.64	29.00	28.96	32.75	32.66	30.49	30.46	
2	INL-2	111.20	12	0.01	1.47	3.56	2.32	30.31	29.20	33.57	32.75	30.95	30.75	
3	CO-1	93.60	8	0.01	0.55	1.21	1.58	30.14	29.20	35.74	32.75	30.95	30.76	
4	CO-2	63.19	8	0.01	0.55	1.21	2.14	30.77	30.14	34.53	35.74	31.14	30.98	
5	CO-3	44.65	8	0.01	0.55	1.21	3.13	31.22	30.77	35.04	34.53	31.56	31.09	
6	CO-4	34.15	8	0.01	0.55	1.21	3.12	31.56	31.22	35.39	35.04	31.91	31.54	
7	CO-5	21.36	8	0.01	0.55	1.21	3.10	31.77	31.56	35.39	35.39	32.12	31.88	

Notes: IDF File = SampleIDF.idf, Return Period = 2-yrs.



PROP. ROAD WORK ALONG CORBETT AVE AND PREVIOUS ROAD WORK ALONG HAMMOCK BEACH RD RESULTS IN NET INCREASE OF ±43,020 SF OF IMPERVIOUS AREA. WATER QUALITY TREATMENT FOR THE EXCESS RUNOFF FROM THIS IMPERVIOUS AREA TO BE PROVIDED IN WET POND 1.

HATCH LEGEND

- WET POND 1 DRAINAGE AREA
- WET POND 2 DRAINAGE AREA
- WET POND 3 DRAINAGE AREA
- ADDITIONAL ON-SITE/OFF-SITE IMPERVIOUS AREA TREATMENT VOLUME TO BE ACCOUNTED FOR IN WET POND 1

FOR DETAILED GRADING AND RIDGE LINES, REFER TO GRADING AND DRAINAGE PLANS.

N W E S

60 30 15 0 60
1"= 60'

GENERAL NOTE:
IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REVIEW ALL OF THE DRAWINGS AND SPECIFICATIONS ASSOCIATED WITH THIS PROJECT WORK SCOPE PRIOR TO THE INITIATION OF CONSTRUCTION. SHOULD THE CONTRACTOR FIND A CONFLICT WITH THE DOCUMENTS RELATIVE TO THE SPECIFICATIONS OR APPLICABLE CODES, IT IS THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE PROJECT ENGINEER OF RECORD IN WRITING PRIOR TO THE START OF CONSTRUCTION. FAILURE BY THE CONTRACTOR TO NOTIFY THE PROJECT ENGINEER SHALL CONSTITUTE ACCEPTANCE OF FULL RESPONSIBILITY BY THE CONTRACTOR TO COMPLETE THE SCOPE OF THE WORK AS DEFINED BY THE DRAWINGS AND IN FULL CONFORMANCE WITH LOCAL REGULATIONS AND CODES.

H:\2013\NCC138078\DRAWINGS\PLAN SETS\PLAN SET (DRIVEWAY EXTENSION)\NCC138078HP0.DWG PRINTED BY: RBRELAND 7.08.19 @ 9:56 AM LAST SAVED BY: RBRELAND

	REVISIONS	BY
1	NCDOT REVISIONS 4/2/19	RJB
2	NCDOT REVISIONS 5/21/19	RJB
3	TRC REVISIONS 6/7/19	RJB
4	TRC REVISIONS 6/19/19	RJB
5	BID SUBMISSION 6/21/19	RJB
6	SWPPP SUBMISSION 6/26/19	RJB

APPROVED FOR CONSTRUCTION

DIG WITH C.A.R.E. CALL BEFORE YOU DIG

THE STATE OF NORTH CAROLINA REQUIRES NOTIFICATION BY EXCAVATORS, DESIGNERS, OR ANY PERSON PREPARING TO DISTURB THE EARTH'S SURFACE ANYWHERE IN THE STATE.
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BOHLER ENGINEERING
1927 S. TRYON STREET, SUITE 310
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Phone: (980) 272-3400
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www.BohlerEngineering.com

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 043610 MICHAEL A. THEBERGE 6/26/19

POST-DEVELOPMENT DRAINAGE AREAS

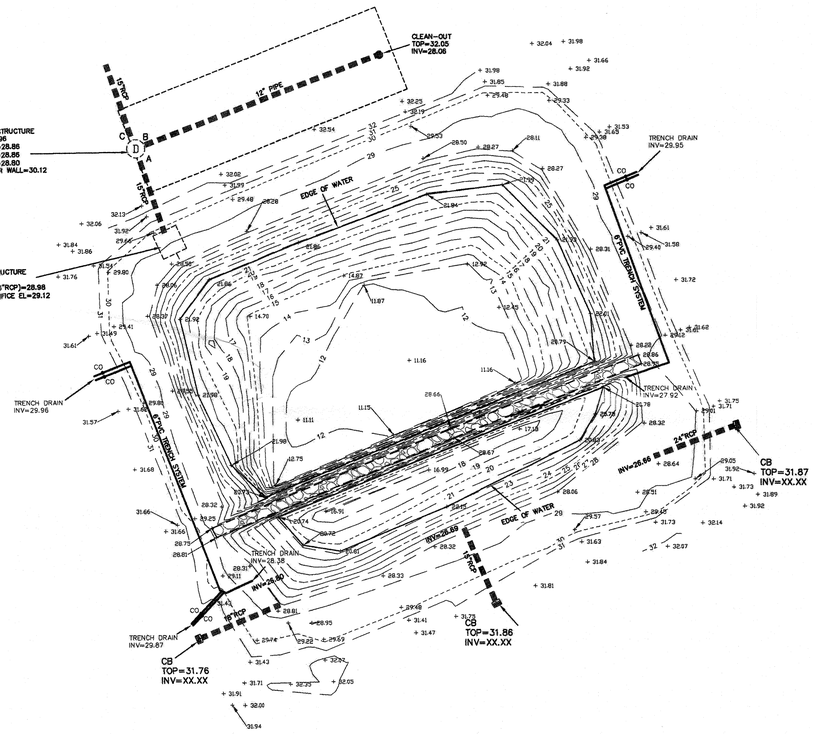
WALMART SUPERCENTER # 7179-000
1121 WEST CORBETT AVENUE
SWANSBORO, ONSLOW COUNTY, NORTH CAROLINA

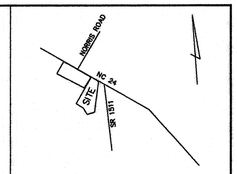
WAL-MART REAL ESTATE BUSINESS TRUST
BENTONVILLE, AR

Walmart

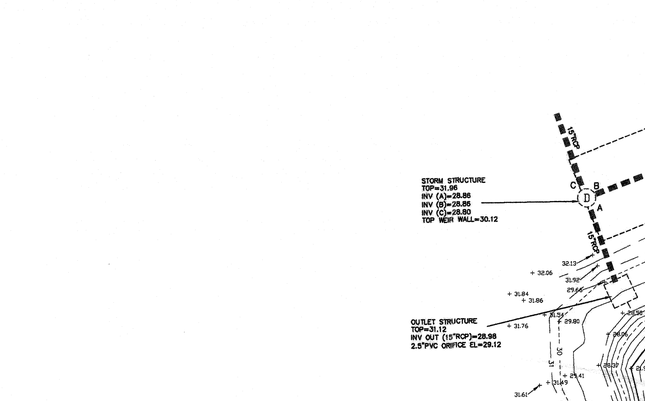
DRAWN	BAB
CHECKED	MAT
DATE	4/2/19
SCALE	1"=60'
JOB No.	NCC138078
SHEET	DA-2

LEGEND:
EIS = EXISTING IRON STAKE
SIS = SET IRON STAKE
EIP = EXISTING IRON PIPE
ECM = EXISTING CONCRETE MONUMENT
CC = CONTROL CORNER
EPK = EXISTING PK NAIL
SPK = SET PK NAIL
ENP = EXISTING NAIL
(BM) = BENCHMARK
℄ = CENTERLINE
R/W = RIGHT OF WAY
EOP = EDGE OF PAVEMENT
MBL = MINIMUM BUILDING LINE
BOC = BACK OF CURB
CO = SANITARY SEWER CLEAN-OUT
WM = WATER METER
PP = POWER POLE
LP = LIGHT POLE
PPT = POWER POLE WITH TRANSFORMER
SL = SECURITY LIGHT
GW = GUY WIRE
CB = CATCH BASIN
DI = DROP INLET
JB = JUNCTION BOX
RCP = REINFORCED CONCRETE PIPE
CMP = CORRUGATED METAL PIPE
INV = INVERT
FES = FLARED END SECTION (PIPE)
AC. = ACRE(S)
SF = SQUARE FEET
EB = ELECTRIC BOX
WV = WATER VALVE
IV = IRRIGATION VALVE
FOC = FIBER OPTIC CABLE BOX
TLB = TRAFFIC LIGHT BOX
TB = TELEPHONE BOX
NTS = NOT TO SCALE
MW = MONITORING WELL
N/F = NOW OR FORMERLY
SSMH = SANITARY SEWER MANHOLE
D&UE = DRAINAGE & UTILITY EASEMENT
DU&AE = DRAINAGE, UTILITY, & ACCESS EASEMENT
UE = UTILITY EASEMENT
FF = FINISH FLOOR
D.B., PG.= DEED BOOK, PAGE
M.B., PG.= MAP BOOK, PAGE
---UT--- = UNDERGROUND TELEPHONE LINE
---UE--- = UNDERGROUND ELECTRICAL LINE
---E--- = OVERHEAD POWERLINE
-UG- = UNDERGROUND GAS
-TS- = OVERHEAD TRAFFIC SIGNAL
-FO- = UNDERGROUND FIBER OPTIC CABLE
-O-O- = 4' CHAIN-LINK FENCE
-□-□- = 6' WOOD FENCE
-SF- = SILT FENCE
= FIRE HYDRANT
= POWER POLE
= LIGHT POLE
= SANITARY SEWER MANHOLE
HC = HANDICAP
HCPS = HANDICAP PARKING SIGN
= HANDICAP PARKING SPACE
= HANDICAP RAMP
STOP = PAINTED STOP BAR
= STOP SIGN
= GRADING LIMITS LINE & SILT FENCE LINE
CPS = COMPACT PARKING SPACE
= PROPOSED TRAFFIC FLOW
= EXISTING TRAFFIC FLOW
SBCF = STEEL BOLLARD WITH CONCRETE FILL
INT. 000 = INTERIOR LANDSCAPING
EXT. 000 = EXTERIOR LANDSCAPING
+17.47 = EXISTING SPOT ELEVATION
0.00 = PROPOSED GRADE
MEG = MATCH EXISTING GRADE
TC-0.00 = PROPOSED GRADE AT TOP OF CURB
TW-0.00 = PROPOSED GRADE AT TOP OF WALK
DBL = DRAINAGE BREAK LINE
= DOUBLE CONCRETE BLOCK FILTER
= FLARED END SECTION





VICINITY SKETCH
NOT TO SCALE



OUTLET STRUCTURE
POND 3
NOT TO SCALE

RECORD DRAWING CERTIFICATION:
THIS DOCUMENT IS ISSUED FOR THE SOLE PURPOSE OF DEPICTING "AS-BUILT" FIELD CONDITIONS OF THE FACILITY(S) AND IS NOT INTENDED TO CONFIRM OR VERIFY COMPLIANCE WITH NCDENR. THE INFORMATION SHOWN IS BASED UPON A LOCATION SURVEY UNDER MY SUPERVISION PERFORMED ON 11/21/17 THRU 5/4/18.

JOHN L. PIERCE, PLS#L-2586 — DATE 5/7/18

NORTH CAROLINA PROFESSIONAL SEAL L-2586 LAND SURVEYOR JOHN L. PIERCE

WET POND RECORD DRAWING
SHOWING
POND #3
WAL-MART SWANSBORO NC
SWANSBORO TOWNSHIP, ONSLOW COUNTY, NC

PREPARED BY
JOHN L. PIERCE & ASSOCIATES, P.A.
NORTH CAROLINA LICENSE No. C-1888
405 JOHNSON BLVD. JACKSONVILLE, NC 28540
PHONE: 910-346-9800

DATE: 12/12/17
SCALE: 1"=20' F.B. , PG.
UPDATED 5-7-18 JOB # Email: BrianJ@jlpnc.com

RECEIVED JUN 22 2018

20 0 10 20 40 80

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