Stormwater Impact Analysis

Wallbrook / CPR-19100 / August 2024

McAdams

WALLBROOK

ROLESVILLE, NORTH CAROLINA

STORMWATER IMPACT ANALYSIS AND FINAL DESIGN OF SCMS

CONSTRUCTION DRAWINGS

PLANNING #: SWF-084502-2022

PROJECT NUMBER:	CPR-19100
DESIGNED BY:	TOMMY DABOLT
CHECKED BY:	DANIEL WIEBKE, PE, CFM

DATE: AUGUST 2024

MCADAMS

2905 MERIDIAN PARKWAY
DURHAM, NORTH CAROLINA 27713
NC LIC. # C-0293

18 July, 2024

Wake County Stormwater
Senior Stormwater Reviewer
Wake County Stormwater
Stormwater Management

RE: Wallbrook
CPR-19100
Planning Number: SWF-084502-2022

SIA UPDATES

The following SIA has been updated to reflect the addition of impervious area to be treated by SCM “A” and SCM “B”. The increase in impervious area is due to the townhome product variations including patios and walkways which provides a slight overall increase. Included in this impervious update is the Amenity Building footprint and relocation of the mail kiosk. SCM B had to be slightly expanded due to this increase in impervious area and the supporting calculations can be found in sections 3, 4 and 5 of this report.

Sincerely,

MCADAMS

Daniel C Wiebke 2024.08.30 16:42:50 -04'00'

DANIEL WIEBKE, PE, CFM
Project Manager, Water Resources

WALLBROOK

Downstream Analysis

GENERAL DESCRIPTION

Wallbrook is a proposed residential development in Rolesville, North Carolina, located between Highway 401 and Wall Creek Drive. The development is approximately 42.24 acres. This Stormwater Impact Analysis includes the development of the one residential and one commercial parcel. The proposed development on this site consists of the construction of 140 townhome units, along with roadways, sidewalks and trails, utilities, two stormwater control measures, and other supporting infrastructure.

Of the total site area, approximately 18.68 acres will be treated by primary stormwater control measures (SCMs). The outflow from the SCMs discharges to the Harris Creek channel and leaves the property, which eventually crosses a culvert under Highway 401. The overall Harris Creek watershed to the entrance of the culvert crossing extends northeast to Main Street and East to Redford Place Drive, totaling approximately 512.45 acres. The project site (42.24 acres) makes up approximately 10% or less of the total watershed at this point. This point on Harris Creek is referred to as Ten Percent Point 2 in this report.

A hydrologic analysis was performed for the 10-year storm events with both pre- and post-development conditions to determine if the proposed project will cause any impacts on flooding or channel degradation downstream of the project site, in accordance with the stormwater management performance standards for development set forth in the Rolesville Unified Development Ordinance Article 7, Section 7.5.4 – Standards.

The downstream analysis regulations are as follows:

(B) General Standards

(1) Downstream Impact Analysis The downstream impact analysis must be performed in accordance with the "ten percent rule," and a copy of the analysis must be provided with the permit application. The purpose of the downstream impact analysis is to determine if the project will cause any impacts on flooding or channel degradation downstream of the project site. The analysis must include the assumptions, results and supporting calculations to show safe passage of post-Development design flows downstream. This analysis shall be performed at the outlet(s) of the site, and downstream at each tributary junction to the point(s) in the conveyance system where the area of the portion of the site draining into the system is less than or equal to ten percent of the total drainage area above that point.

CALCULATION METHODOLOGY

- The SCS Curve Number Method was used to estimate direct runoff. A composite curve number was calculated for each subbasin using soils and land cover data.
- Depth-Duration Frequency (DDF) rainfall data was obtained from NOAA Atlas 14. Synthetic rainfall hyetographs were generated using frequency-based hypothetical storms assuming a storm duration of 1 day, intensity duration of 5 minutes, intensity position of 50%, and a uniform distribution for all subbasins. Rainfall depths were input into the meteorological model within PondPack for peak flow rate calculations. Please reference the rainfall data section within this report for additional information.
- Hydrologic soil groups within each subbasin were determined using NRCS Web Soil Survey.

- Land cover conditions for the post-development condition are based on the proposed layout and current onsite conditions. Land cover conditions for offsite areas were determined using the Town of Rolesville Official Zoning Map.

- Existing conditions survey data and proposed grading was used for onsite topography. QL2 LiDAR topography data was obtained from North Carolina Spatial Data Download and used for offsite areas.

- The Harris Creek time of concentration was calculated using the SCS TR-55 Segmental Approach. The flow path was divided into the following segments where applicable: overland flow, concentrated flow, pipe flow, and channel flow. The travel time was then computed for each segment, from which the overall time of concentration was determined by taking the sum of each segmental time.

- The time of concentration to the proposed stormwater control measures was conservatively assumed to be 5 minutes.

- PondPack Version V8i, by Bentley Systems, Inc., was used for the hydrologic calculations for all storm events.

DISCUSSION OF RESULTS

A hydrologic analysis was performed for the 10-year storm events to Ten Percent Point 2, the point along Harris Creek at which the project site makes up 10% of the total watershed. As shown in the Summary of Results section of this report, the proposed stormwater control measures provide the peak runoff control for the proposed build-out condition of the development such that there is no increase in the 10-year peak flow at Ten Percent Point 2.

CONCLUSION

If the development on this tract is built as proposed within this report, then the requirements set forth in Town of Rolesville regulations will be met. However, modifications to the proposed development may require that this analysis be revised. Some modifications that would require this analysis to be revised include:

1. The proposed site impervious surface exceeds the amount accounted for in this report.
2. The post-development watershed breaks change significantly from those used to prepare this report.

The above modifications may result in the assumptions within this report becoming invalid. The computations within this report will need to be revisited if any of the above conditions become apparent as development of the proposed site moves forward.

SUMMARY OF RESULTS

RELEASE RATE MANAGEMENT RESULTS

POINT OF ANALYSIS #1			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**% Increase** [%]
1-Year	41.89	36.39	-13%
10-Year	99.66	95.29	-4%

POINT OF ANALYSIS #2			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**% Increase** [%]
1-Year	20.33	18.69	-8%
10-Year	58.37	56.36	-3%

SUMMARY OF RESULTS

STORMWATER CONTROL MEASURE SUMMARY (SCM A)

Design Drainage Area =	7.12	ac
Design Impervious Area =	4.83	ac
% Impervious =	67.7%	
Top of Dam =	375.00	ft
NWSE =	370.00	ft
Average Depth =	3.20	ft
WQv Ponding Elevation =	371.35	ft
Required Surface Area at NWSE =	7,244	sf
Provided Surface Area at NWSE =	7,714	sf
WQv Orifice Diameter =	2.00	in
WQv Orifice Invert Elevation =	370.00	ft
Riser Size =	6' x 6'	
Riser Crest =	373.25	ft
Barrel Diameter =	36	in
# of Barrels =	1	
Upstream Invert =	369.50	ft
Downstream Invert =	365.00	ft
Length =	56.76	ft
Slope =	0.0793	ft/ft

STORMWATER CONTROL MEASURE ROUTING RESULTS (SCM A)

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	25.74	0.18	373.03	1.97
10-Year	42.95	12.04	373.55	1.45
100-Year	56.85	45.05	373.98	1.02
100-Year - Worst Case***	56.85	46.46	374.00	1.00

*** See narrative for explanation of the modeled worst case scenario

SUMMARY OF RESULTS

STORMWATER CONTROL MEASURE SUMMARY (SCM B)

Design Drainage Area =	11.55	ac
Design Impervious Area =	7.60	ac
% Impervious =	65.8%	
Top of Dam =	350.00	ft
NWSE =	344.00	ft
Average Depth =	3.90	ft
WQv Ponding Elevation =	345.57	ft
Required Surface Area at NWSE =	10,038	sf
Provided Surface Area at NWSE =	10,282	sf
WQv Orifice Diameter =	2.50	in
WQv Orifice Invert Elevation =	344.00	ft
Riser Size =	5' x 5'	
Riser Crest =	348.50	ft
Weir Crest	347.50	ft
Weir Length	4	ft
Upstream Invert =	339.00	ft
Downstream Invert =	338.00	ft
Length =	84.65	ft
Slope =	0.0118	ft/ft

STORMWATER CONTROL MEASURE ROUTING RESULTS (SCM B)

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	38.49	0.30	347.41	2.59
10-Year	67.03	12.37	348.5	1.50
100-Year	90.28	54.81	349.20	0.80
100-Year - Worst Case***	90.28	67.32	349.34	0.66

*** See narrative for explanation of the modeled worst case scenario

1	MISCELLANEOUS SITE INFORMATION
2	PRE-DEVELOPMENT HYDROLOGIC CALCULATIONS
3	POST-DEVELOPMENT HYDROLOGIC CALCULATIONS
4	STORMWATER CONTROL MEASURE 'A' DESIGN CALCULATIONS
5	STORMWATER CONTROL MEASURE 'B' DESIGN CALCULATIONS

MISCELLANEOUS SITE INFORMATION

N

0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet

WALLBROOK

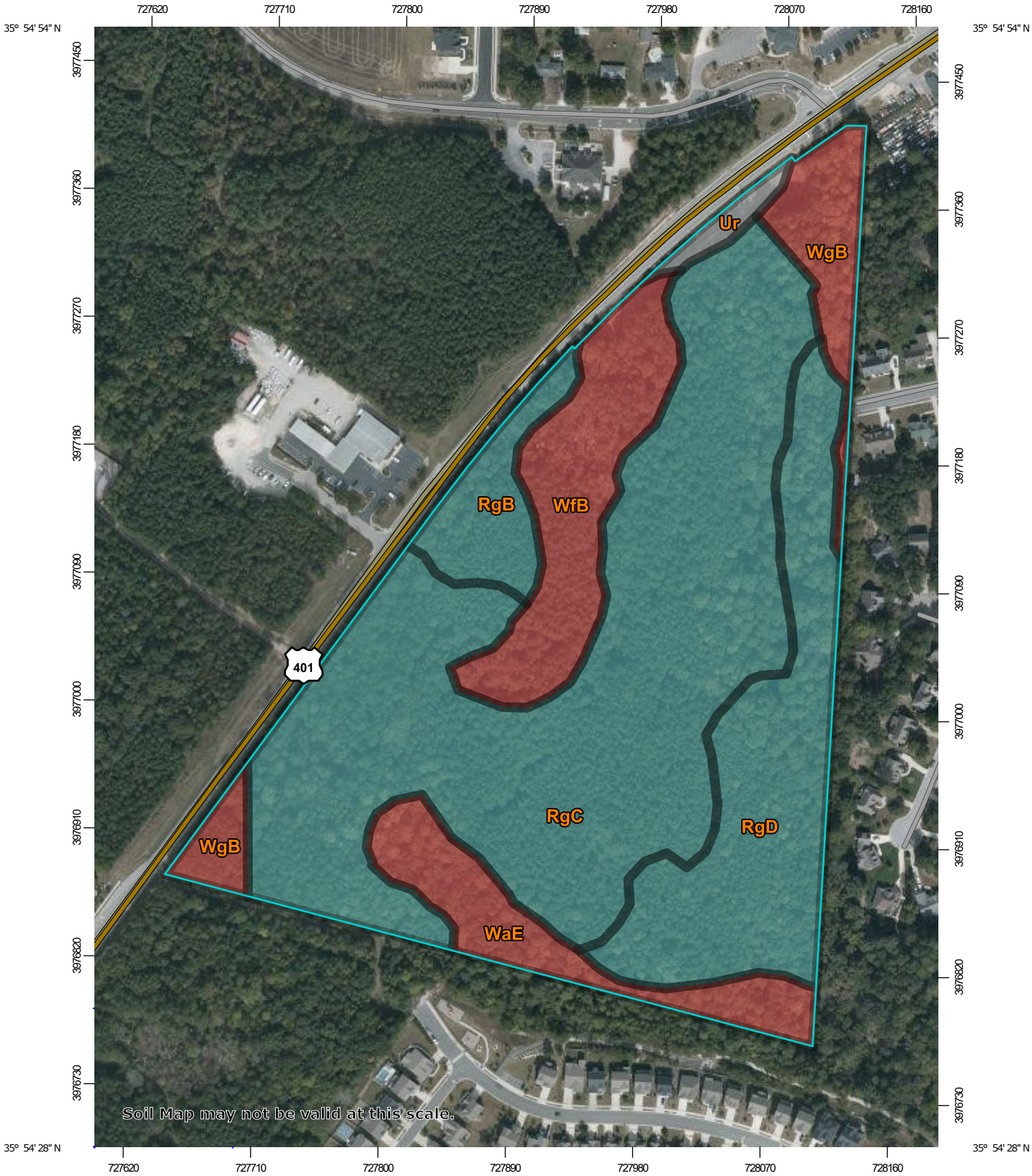
SITE AERIAL MAP

PROJECT #: CPR-19100

ROLESVILLE, NORTH CAROLINA

McADAMS

Hydrologic Soil Group—Wake County, North Carolina
(Wallbrook - CPR-19100)



Map Scale: 1:3,840 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N 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: Wake County, North Carolina
Survey Area Data: Version 20, Jun 3, 2020

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

Date(s) aerial images were photographed: Oct 11, 2019—Oct 19, 2019

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
RgB	Rawlings-Rion complex, 2 to 6 percent slopes	C	2.0	4.6%
RgC	Rawlings-Rion complex, 6 to 10 percent slopes	C	22.0	52.1%
RgD	Rawlings-Rion complex, 10 to 15 percent slopes	C	7.7	18.1%
Ur	Urban land		0.4	1.0%
WaE	Wake-Rolesville complex, 15 to 25 percent slopes, very rocky	D	3.0	7.1%
WfB	Wedowee-Saw complex, 2 to 6 percent slopes	D	4.6	10.8%
WgB	Wedowee-Urban land complex, 2 to 6 percent slopes	D	2.6	6.2%
Totals for Area of Interest			**42.3**	**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.

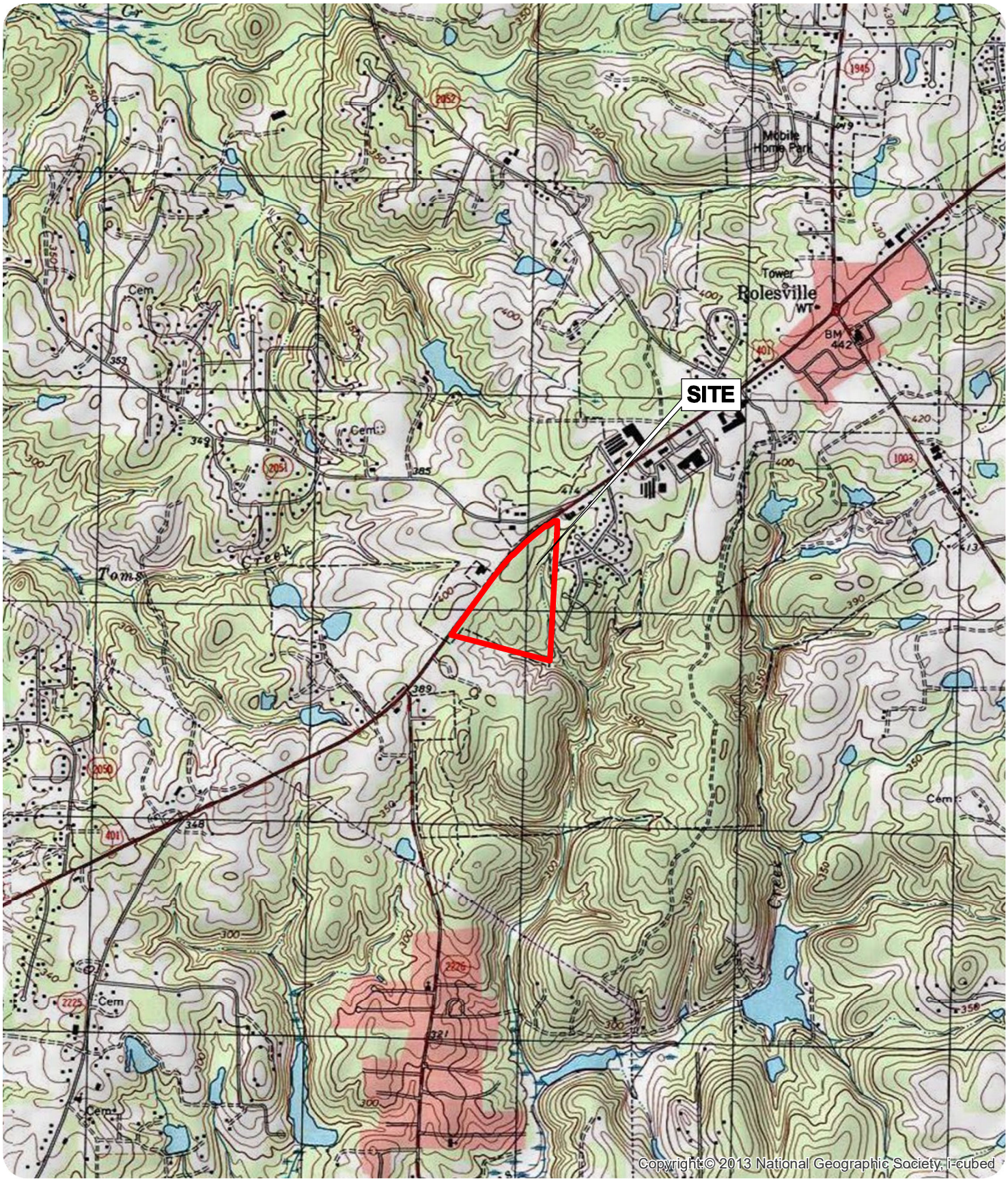
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



N

0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet

WALLBROOK

USGS TOPO MAP

PROJECT #: CPR-19100

ROLESVILLE, NORTH CAROLINA

McADAMS

Name of Stream	Subbasin	Stream Index Number	Map Number	Class
Goose Creek	NEU10	27-107-(6)	G31SW3	SC;Sw,NSW
Goose Creek	NEU10	27-107-(11)	G31SW6	SB;Sw,NSW
Gorham Swamp	NEU09	27-97-5-3-0.5	F30NW5	C;Sw,NSW
Goshen Branch	NEU11	27-101-25	G30SW7	C;Sw,NSW
Goss Swamp	NEU07	27-86-11-8	E27SE3	C;Sw,NSW
Granny Branch	NEU07	27-86-14-1-1	F27NW1	C;Sw,NSW
Granny Gut	NEU10	27-125-5	G31SE9	SC;NSW
Grape Creek	NEU08	27-90-1	G29NE8	C;Sw,NSW
Gray Branch	NEU05	27-80-1-1	G28SW1	C;Sw,NSW
Great Branch	NEU10	27-101-40-3	H31NW1	C;Sw,NSW
Great Branch (Grape Branch)	NEU11	27-101-5-1-1	G28SW6	C;Sw,NSW
Great Ditch	NEU14	27-149-4-2-9	H33NE3	SA;ORW,NSW
Great Neck Creek	NEU10	27-126	H32NW4	SA;HQW,NSW
Great Pond	NEU14	27-149-4-1	H33NE2	SA;ORW,NSW
Great Pond	NEU14	27-149-4-2-1	G33SE9	SA;ORW,NSW
Great Swamp	NEU07	27-86-9-3	E26SE5	C;Sw,NSW
Green Branch	NEU05	27-64	F27SW5	C;NSW
Green Creek	NEU10	27-141-11	G32SE1	SA;HQW,NSW
Green Point Cove	NEU14	27-148-6	H33NE1	SA;HQW,NSW
Greens Creek	NEU10	27-129-(1)	G32SW7	SC;NSW
Greens Creek (Oriental Restricted Area)	NEU10	27-129-(2)	G32SW7	SC;HQW,NSW
Greens Thoroughfare	NEU08	27-93	G30NW2	C;Sw,NSW
Grinnel Creek	NEU08	27-87.5	F29SE1	C;Sw,NSW
Grinnel Slough	NEU08	27-87	F29SW3	C;Sw,NSW
Groundnut Creek	NEU05	27-77-2-2	F27SE3	C;Sw,NSW
Guffy Branch	NEU03	27-43-15-10-2	E24NW9	C;NSW
Gulden Creek	NEU10	27-123-3	H31NE9	SA;HQW,NSW
Gum Branch	NEU10	27-117	H31NE5	SC;Sw,NSW
Gum Swamp	NEU04	27-45-11	F25NW1	C;NSW
Gum Swamp	NEU05	27-84-1-1	G29NW1	C;Sw,NSW
Gum Swamp	NEU09	27-97-1	E29SW5	C;Sw,NSW
Gum Swamp (Long Lake)	NEU10	27-101-40-2-1	H31NW7	C;Sw,NSW
Gum Swamp Creek	NEU05	27-77-3	F28SW5	C;Sw,NSW
Gum Tricket Creek	NEU10	27-140	G32SE4	SA;HQW,NSW
Haleys Branch	NEU02	27-33-7	D23SE3	C;NSW
Halfmile Branch	NEU12	27-54.5	F26NE7	WS-IV;NSW
Halfmoon Creek	NEU08	27-88	F29SE4	C;Sw,NSW
Hallam Branch	NEU07	27-86-24-1	F28SE1	C;Sw,NSW
Hams Prong	NEU07	27-86-14-3-1	F27NE5	C;Sw,NSW
Hancock Creek	NEU10	27-115	H31SE1	SC;Sw,NSW
Hannah Creek	NEU04	27-52-6	F24NE9	C;NSW
Hardee Mill Branch	NEU04	27-45-8	F24NE4	C;NSW
Hardy Creek	NEU10	27-135-18	H32NE1	SA;HQW,NSW
Hardy Mill Run (Hardy Mill Pond)	NEU05	27-71	G27NE2	WS-IV;NSW
Hare Snipe Creek	NEU02	27-33-12-(2)	D24SW2	C;NSW
Hare Snipe Creek (Lake Lynn)	NEU02	27-33-12-(1)	D24NW8	B;NSW
Harlowe Canal	NEU10	27-123-1	H31SE3	SA;HQW,NSW
Harper Creek	NEU13	27-150-10	G32NW8	SA;HQW,NSW
Harper Creek	NEU13	27-150-28-7	G32NE4	SA;HQW,NSW
Harris Creek	NEU13	27-150-21	G32NW6	SA;HQW,NSW
Harris Creek (Peeples Creek) (Wake Crossroads Lake)	NEU02	27-26	D25NW7	C;NSW
Harrys Branch	NEU05	27-84-3	F29SW7	C;Sw,NSW
Hatters Branch	NEU02	27-23-4	D24NE3	C;NSW
Hattles Branch	NEU02	27-21-1	C25SW7	C;NSW

NOAA Atlas 14, Volume 2, Version 3
Location name: Rolesville, North Carolina, USA*
Latitude: 35.9116°, Longitude: -78.4746°
Elevation: 391.14 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)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.403** (0.369-0.441)	**0.468** (0.430-0.512)	**0.534** (0.490-0.583)	**0.599** (0.548-0.654)	**0.665** (0.606-0.725)	**0.717** (0.650-0.781)	**0.763** (0.688-0.831)	**0.803** (0.720-0.877)	**0.849** (0.754-0.927)	**0.889** (0.783-0.972)
10-min	**0.644** (0.590-0.704)	**0.749** (0.687-0.818)	**0.855** (0.784-0.934)	**0.959** (0.877-1.05)	**1.06** (0.965-1.16)	**1.14** (1.03-1.24)	**1.21** (1.09-1.32)	**1.27** (1.14-1.39)	**1.34** (1.19-1.47)	**1.40** (1.23-1.53)
15-min	**0.805** (0.738-0.880)	**0.942** (0.864-1.03)	**1.08** (0.992-1.18)	**1.21** (1.11-1.32)	**1.34** (1.22-1.46)	**1.45** (1.31-1.58)	**1.53** (1.38-1.67)	**1.61** (1.44-1.75)	**1.69** (1.50-1.85)	**1.76** (1.55-1.92)
30-min	**1.10** (1.01-1.21)	**1.30** (1.19-1.42)	**1.54** (1.41-1.68)	**1.76** (1.61-1.92)	**1.99** (1.81-2.17)	**2.18** (1.97-2.37)	**2.35** (2.12-2.56)	**2.50** (2.24-2.73)	**2.69** (2.39-2.94)	**2.85** (2.51-3.11)
60-min	**1.38** (1.26-1.51)	**1.63** (1.50-1.78)	**1.97** (1.81-2.15)	**2.29** (2.09-2.50)	**2.65** (2.41-2.89)	**2.95** (2.68-3.21)	**3.23** (2.91-3.52)	**3.51** (3.14-3.83)	**3.86** (3.43-4.21)	**4.15** (3.66-4.54)
2-hr	**1.61** (1.46-1.77)	**1.92** (1.75-2.10)	**2.34** (2.13-2.57)	**2.74** (2.49-3.01)	**3.22** (2.91-3.53)	**3.64** (3.27-3.98)	**4.04** (3.61-4.42)	**4.46** (3.95-4.87)	**4.99** (4.38-5.46)	**5.46** (4.75-5.99)
3-hr	**1.70** (1.55-1.89)	**2.03** (1.85-2.24)	**2.49** (2.26-2.74)	**2.94** (2.67-3.23)	**3.49** (3.15-3.83)	**3.98** (3.56-4.37)	**4.46** (3.96-4.89)	**4.97** (4.38-5.44)	**5.64** (4.92-6.18)	**6.25** (5.39-6.87)
6-hr	**2.05** (1.87-2.26)	**2.44** (2.23-2.68)	**2.99** (2.73-3.29)	**3.53** (3.22-3.88)	**4.21** (3.81-4.61)	**4.82** (4.33-5.27)	**5.43** (4.84-5.93)	**6.08** (5.36-6.62)	**6.95** (6.05-7.57)	**7.74** (6.65-8.45)
12-hr	**2.41** (2.21-2.66)	**2.88** (2.64-3.15)	**3.54** (3.24-3.88)	**4.21** (3.84-4.61)	**5.06** (4.58-5.52)	**5.83** (5.24-6.34)	**6.61** (5.88-7.18)	**7.45** (6.55-8.08)	**8.60** (7.45-9.33)	**9.66** (8.24-10.5)
24-hr	**2.86** (2.66-3.08)	**3.46** (3.22-3.72)	**4.34** (4.04-4.68)	**5.04** (4.68-5.43)	**6.00** (5.55-6.45)	**6.76** (6.24-7.27)	**7.54** (6.94-8.12)	**8.35** (7.66-9.00)	**9.47** (8.64-10.2)	**10.3** (9.40-11.2)
2-day	**3.32** (3.09-3.57)	**3.99** (3.72-4.30)	**4.98** (4.63-5.36)	**5.75** (5.35-6.19)	**6.81** (6.31-7.33)	**7.64** (7.06-8.23)	**8.50** (7.83-9.15)	**9.38** (8.61-10.1)	**10.6** (9.66-11.4)	**11.6** (10.5-12.5)
3-day	**3.52** (3.28-3.77)	**4.23** (3.95-4.53)	**5.24** (4.89-5.62)	**6.05** (5.63-6.48)	**7.14** (6.62-7.66)	**8.01** (7.41-8.59)	**8.90** (8.21-9.55)	**9.82** (9.02-10.6)	**11.1** (10.1-11.9)	**12.1** (11.0-13.0)
4-day	**3.72** (3.48-3.97)	**4.46** (4.17-4.77)	**5.51** (5.15-5.88)	**6.34** (5.91-6.77)	**7.47** (6.94-7.98)	**8.38** (7.77-8.96)	**9.30** (8.59-9.96)	**10.3** (9.44-11.0)	**11.6** (10.6-12.4)	**12.6** (11.5-13.5)
7-day	**4.31** (4.04-4.60)	**5.15** (4.82-5.49)	**6.28** (5.88-6.70)	**7.17** (6.70-7.65)	**8.40** (7.83-8.97)	**9.38** (8.72-10.0)	**10.4** (9.62-11.1)	**11.4** (10.5-12.2)	**12.8** (11.8-13.8)	**13.9** (12.7-15.0)
10-day	**4.91** (4.61-5.23)	**5.84** (5.48-6.22)	**7.03** (6.59-7.49)	**7.97** (7.45-8.48)	**9.23** (8.61-9.83)	**10.2** (9.52-10.9)	**11.2** (10.4-12.0)	**12.2** (11.3-13.1)	**13.6** (12.6-14.6)	**14.7** (13.5-15.8)
20-day	**6.58** (6.20-7.01)	**7.78** (7.32-8.28)	**9.20** (8.65-9.79)	**10.3** (9.70-11.0)	**11.9** (11.1-12.6)	**13.1** (12.2-13.9)	**14.3** (13.3-15.2)	**15.5** (14.4-16.5)	**17.2** (15.9-18.4)	**18.5** (17.0-19.8)
30-day	**8.18** (7.72-8.68)	**9.62** (9.07-10.2)	**11.2** (10.6-11.9)	**12.4** (11.7-13.2)	**14.1** (13.2-14.9)	**15.3** (14.3-16.3)	**16.5** (15.5-17.6)	**17.8** (16.6-19.0)	**19.4** (18.0-20.7)	**20.7** (19.2-22.1)
45-day	**10.4** (9.89-11.0)	**12.2** (11.6-12.9)	**14.0** (13.3-14.7)	**15.4** (14.6-16.2)	**17.1** (16.2-18.1)	**18.5** (17.5-19.5)	**19.8** (18.7-20.9)	**21.1** (19.9-22.3)	**22.9** (21.4-24.2)	**24.2** (22.6-25.6)
60-day	**12.5** (11.9-13.1)	**14.6** (13.9-15.3)	**16.5** (15.7-17.4)	**18.0** (17.1-18.9)	**19.9** (18.9-21.0)	**21.4** (20.2-22.5)	**22.8** (21.5-24.0)	**24.1** (22.7-25.5)	**25.9** (24.3-27.4)	**27.2** (25.5-28.8)

[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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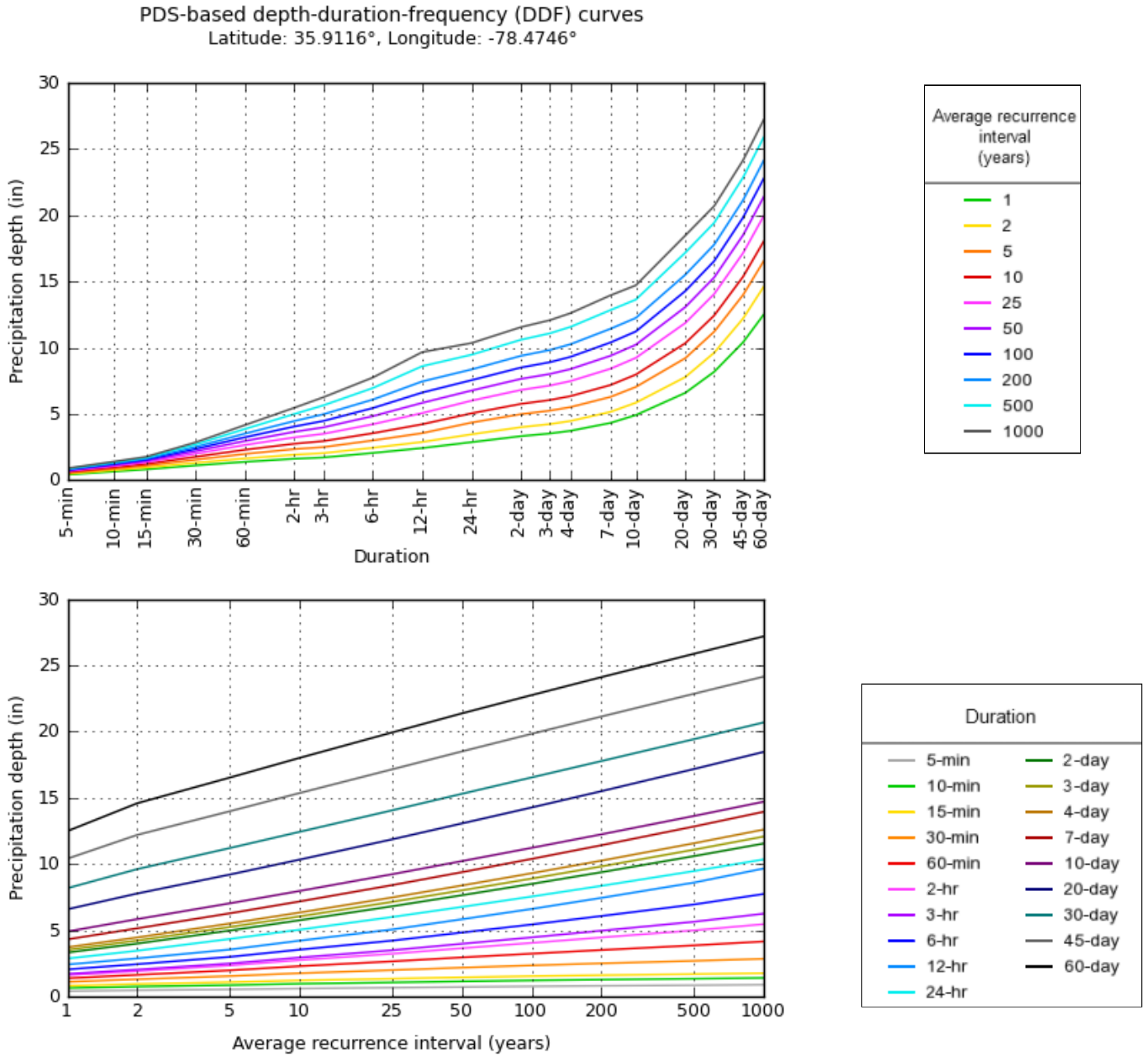
PF graphical



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Wed Aug 25 20:31:53 2021

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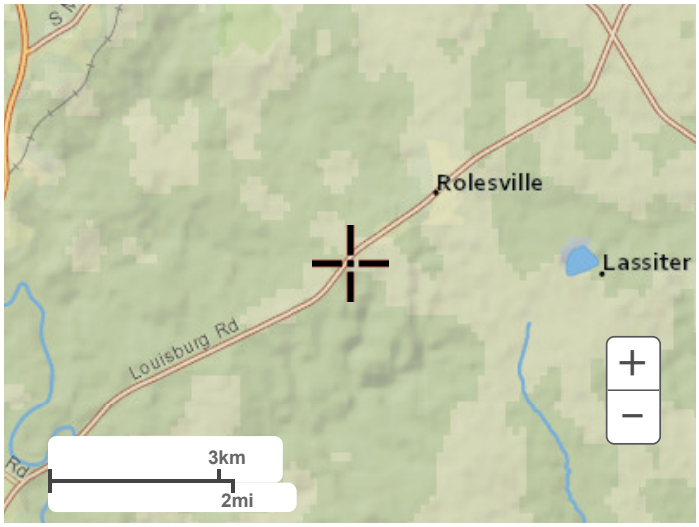
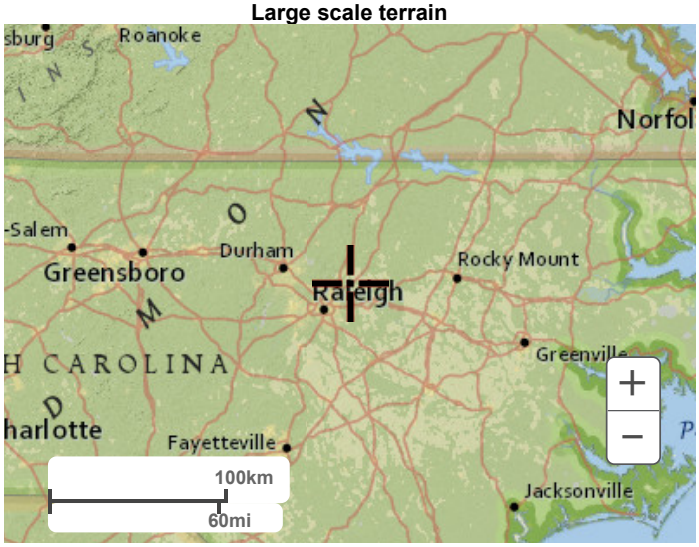
Maps & aerials

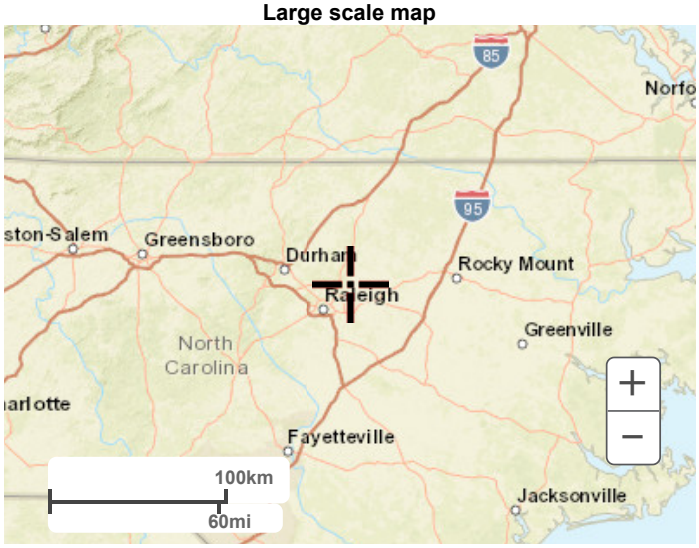
Small scale terrain



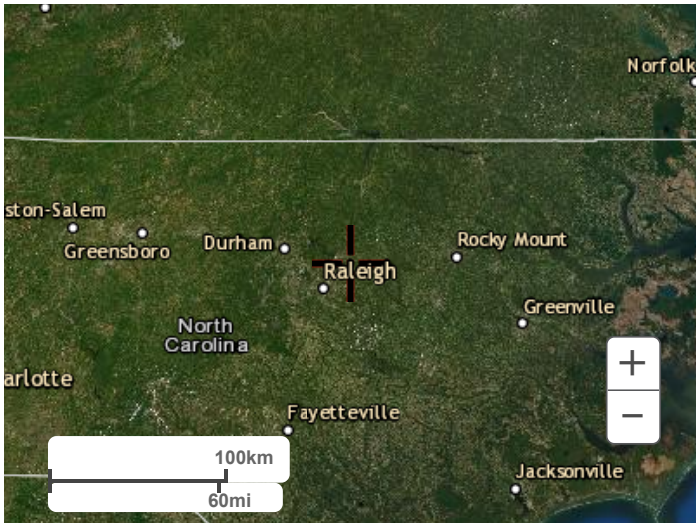
Large scale terrain



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

This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map flood hazard areas at the local level. As a part of this effort, the State of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT HTTP://FRIS.NC.GOV/FRIS

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*

OTHER AREAS
- Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Accredited or Provisionally Accredited Levee, Dike, or Floodwall
- Non-accredited Levee, Dike, or Floodwall
- BM5510 North Carolina Geodetic Survey bench mark
- BM5510 National Geodetic Survey bench mark
- BM5510 Contractor Est. NCFMP Survey bench mark
- 012 18.2 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
- 8 Coastal Transect
- Coastal Transect Baseline
- Profile Baseline

OTHER FEATURES
- Hydrographic Feature
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the North Carolina Floodplain Mapping Program website at http://www.ncfloodmaps.com, or contact the FEMA Map Service Center.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the North Carolina Floodplain Mapping Program (NCFMP). The source of this information can be determined from the metadata available in the digital FLOOD database and in the Technical Support Data Notebook (TSDN).

ACCREDITED LEVEE NOTES TO USERS: If an accredited levee note appears on this panel check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS: If a Provisionally Accredited Levee (PAL) note appears on this panel, check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicates the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm.

LIMIT OF MODERATE WAVE ACTION NOTES TO USERS: For some coastal flooding zones the AE Zone category has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

Limit of Moderate Wave Action (LiMWA)

COASTAL BARRIER RESOURCES SYSTEM (CBRS) NOTE

This map may include approximate boundaries of the CBRS for informational purposes only. Flood insurance is not available within CBRS areas for structures that are newly built or substantially improved on or after the date(s) indicated on the map. For more information see http://www.fws.gov/habitatconservation/coastal_barrier.html, the FIS Report, or call the U.S. Fish and Wildlife Service Customer Service Center at 1-800-344-WILD.

CBRS Area

Otherwise Protected Area

LOGO LOGO

SCALE

Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet 1:6,000

0 250 500 1,000 Feet

0 75 150 300 Meters

PANEL LOCATOR

FEMA
National Flood Insurance Program

NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

NORTH CAROLINA

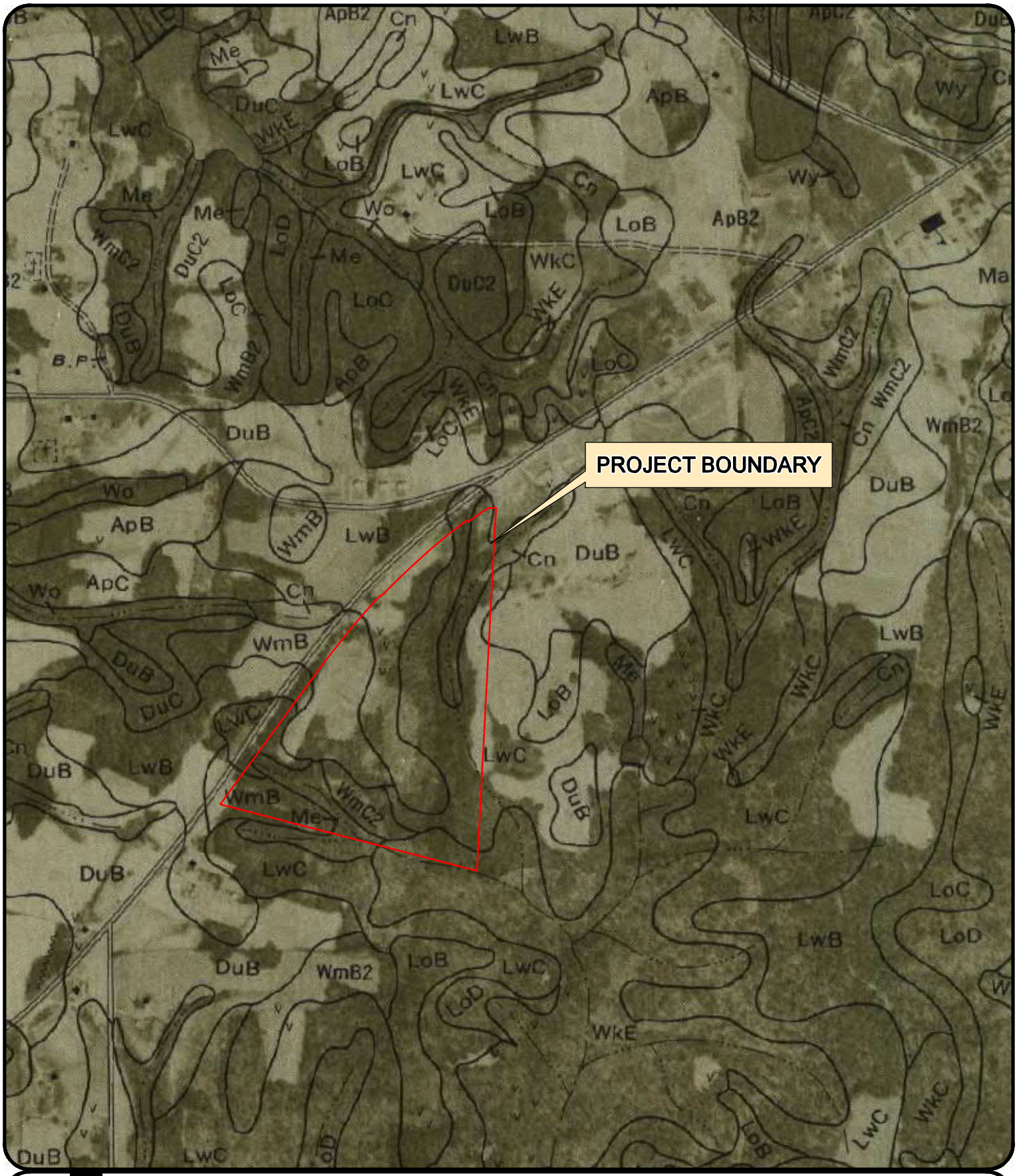
PANEL 1758

Panel Contains:

COMMUNITY	CID	PANEL	SUFFIX
ROLESVILLE, TOWN OF	370468	1758	J
WAKE COUNTY	370368	1758	J

MAP NUMBER
3720175800J

MAP REVISED
05/02/06



WALLBROOK

SOIL MAP

PROJECT #: CPR-19100

ROLESVILLE, NORTH CAROLINA

0 375 750 1,500 Feet

1 inch = 750 feet

McADAMS

PRE-DEVELOPMENT HYDROLOGIC CALCULATIONS

Wallbrook
CPR-19100

WALLBROOK
CPR-19100

PRE-DEVELOPMENT HYDROLOGY
Summary of Results

T. DABOLT
9/2/2021

HYDROLOGY INPUT SUMMARY

Sub-basin ID	Onsite Area [acres]					Offsite Area [acres]					Total Area [acres]	SCS CN	Tc [min]
	Impervious	Open	Wooded	Pond	Total	Impervious	Open	Wooded	Pond	Total			
1	0.00	0.88	17.31	0.00	18.19	6.44	8.83	4.84	0.00	20.12	38.31	79	19.57
2	0.00	0.00	24.15	0.00	24.15	1.07	2.35	4.89	0.00	8.30	32.45	74	27.25
Totals =	0.00	0.88	41.46	0.00	42.35	7.51	11.18	9.72	0.00	28.41	70.76		

I. SCS CURVE NUMBERS

Soils from WebSoilSurvey are only inclusive of indirectly connected areas

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	39.7%
HSG 'D' =	60.3%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	78	Assume good condition
Wooded	74	Assume good condition

II. PRE-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	0	0.00
Driveway / Parking Lot	0	0.00
Roof	0	0.00
Sidewalk / Patio	0	0.00
Other	0	0.00
Totals	0	0.00

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	0	0.00	-
Onsite open	78	38,392	0.88	Assume good condition
Onsite wooded	74	754,125	17.31	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	280,709	6.44	-
Offsite open	78	384,817	8.83	Assume good condition
Offsite wooded	74	210,724	4.84	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	38.31	acres
	1,668,767	sf
Composite SCS CN =	79	
% Impervious =	16.8%	

III. TIME OF CONCENTRATION INFORMATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	416.00	ft
Bot Elev =	412.00	ft
Height =	4	ft
Slope =	0.0400	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***10.39***	***minutes***

Segment 2: Concentrated Flow

Length =	710	ft
Top Elev =	412.00	ft
Bot Elev =	390.00	ft
Height =	22	ft
Slope =	0.0310	ft/ft
Paved ? =	No	
Velocity =	2.84	ft/sec
Segment Time =	***4.17***	***minutes***

Segment 3: Channel Flow

Length =	1627	ft
Top Elev =	390.00	
Bot Elev =	352.00	
Height =	38	ft
Slope =	0.0234	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	10.50	sf (assume 3.5'w x 3'h channel)
Wetted Perimeter =	9.50	lf (assume 3.5' x 3' channel)
Channel Velocity =	5.41	ft/sec
Segment Time =	***5.01***	***minutes***

Time of Concentration =	19.57	minutes
SCS Lag Time =	11.74	minutes (SCS Lag = 0.6* Tc)
Time Increment =	3.40	minutes (= 0.29*SCS Lag)

I. SCS CURVE NUMBERS

Soils from WebSoilSurvey are only inclusive of indirectly connected areas

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	57.9%
HSG 'D' =	42.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	76	Assume good condition
Wooded	73	Assume good condition

II. PRE-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	0	0.00
Driveway / Parking Lot	0	0.00
Roof	0	0.00
Sidewalk / Patio	0	0.00
Other	0	0.00
Totals	0	0.00

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	0	0.00	-
Onsite open	76	0	0.00	Assume good condition
Onsite wooded	73	1,052,042	24.15	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	46,536	1.07	-
Offsite open	76	102,156	2.35	Assume good condition
Offsite wooded	73	212,809	4.89	Assume good condition
Offsite pond	100	0	0.00	-

Total IC area =	32.45	acres
	1,413,543	sf
Composite SCS CN =	74	
% Impervious =	3.3%	

III. TIME OF CONCENTRATION INFORMATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	406.00	ft
Bot Elev =	402.00	ft
Height =	4	ft
Slope =	0.0400	ft/ft
Manning's n =	0.40	Wooded Area
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***15.63***	***minutes***

Segment 2: Concentrated Flow

Length =	1345	ft
Top Elev =	402.00	ft
Bot Elev =	358.00	ft
Height =	44	ft
Slope =	0.0327	ft/ft
Paved ? =	No	
Velocity =	2.92	ft/sec
Segment Time =	***7.68***	***minutes***

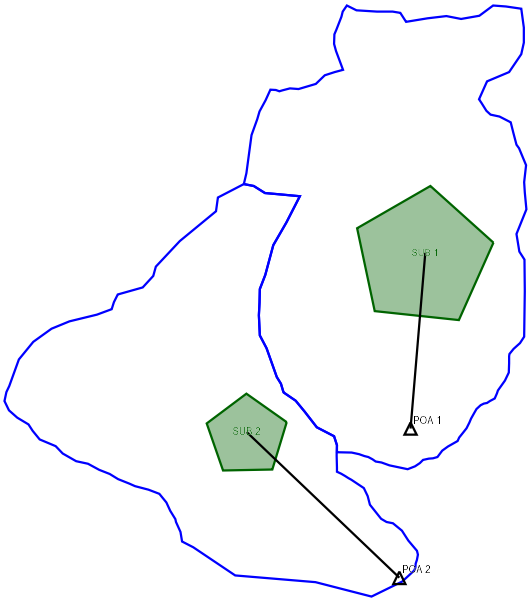
Segment 3: Channel Flow

Length =	1221	ft
Top Elev =	358.00	
Bot Elev =	332.00	
Height =	26	ft
Slope =	0.0213	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	10.50	sf (assume 3.5'w x 3'h channel)
Wetted Perimeter =	9.50	lf (assume 3.5' x 3' channel)
Channel Velocity =	5.17	ft/sec
Segment Time =	***3.94***	***minutes***

Time of Concentration =	27.25	minutes
SCS Lag Time =	16.35	minutes (SCS Lag = 0.6* Tc)
Time Increment =	4.74	minutes (= 0.29*SCS Lag)

MCADAMS

Scenario: Pre-Development



MCADAMS

FlexTable: Catchment Table (CPR19100.ppc)

Current Time: 0.00 min

Label	Area (ft^2)	SCS CN	Time of Concentration (min)	Notes
SUB 2	1,413,543	74	27.25	PRE
SUB 1	1,668,767	79	19.57	PRE

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
SUB 2	Pre-Development 1-yr	1	2.197	738.00	20.33
SUB 2	Pre-Development 10-yr	10	6.426	737.00	58.37
SUB 2	Pre-Development 25-yr	25	8.548	737.00	74.20
SUB 1	Pre-Development 1-yr	1	3.449	731.00	41.89
SUB 1	Pre-Development 10-yr	10	9.005	731.00	99.66
SUB 1	Pre-Development 25-yr	25	11.689	731.00	121.72

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
POA 2	Pre-Development 1-yr	1	2.197	738.00	20.33
POA 2	Pre-Development 10-yr	10	6.426	737.00	58.37
POA 2	Pre-Development 25-yr	25	8.548	737.00	74.20
POA 1	Pre-Development 1-yr	1	3.449	731.00	41.89
POA 1	Pre-Development 10-yr	10	9.005	731.00	99.66
POA 1	Pre-Development 25-yr	25	11.689	731.00	121.72

McAdams
The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

WALLBROOK LANDCO, LLC
4700 SIX FORKS RD, SUITE 150
RALEIGH, NORTH CAROLINA 27609

WALLBROOK
CONSTRUCTION DRAWINGS
ROLESVILLE, NORTH CAROLINA

REVISIONS

NO.	DATE	
1	08. XX. 2022	REVISED PER TOWN & WAKE COUNTY COMMENTS

PLAN INFORMATION

PROJECT NO.	CPR-19100
FILENAME	
CHECKED BY	
DRAWN BY	
SCALE	
DATE	06. 30. 2022

SHEET

FINAL DRAWING - NOT RELEASED FOR CONSTRUCTION

X:\Projects\CPR\CPR-19100\04-Production\Water Resources\Construction Drawings\Current Drawings\CPR19100x-Post.dwg, 8/29/2022 12:49:14 PM, Tommy Daboll

POST-DEVELOPMENT HYDROLOGIC CALCULATIONS

Wallbrook
CPR-19100

WALLBROOK
CPR-19100

POST-DEVELOPMENT HYDROLOGY
Summary of Results

T. DABOLT
8/12/2024

HYDROLOGY INPUT SUMMARY

Sub-basin ID	Onsite Area [acres]					Offsite Area [acres]					Total Area [acres]	SCS CN	Tc [min]
	Impervious	Open	Wooded	Pond	Total	Impervious	Open	Wooded	Pond	Total			
1 to SCM A	4.81	2.07	0.00	0.23	7.11	0.01	0.00	0.00	0.00	0.02	7.12	92	5.00
2 to SCM B	7.60	3.72	0.00	0.24	11.55	0.00	0.00	0.00	0.00	0.00	11.55	90	5.00
1 Bypass	0.00	1.67	8.85	0.00	10.53	5.41	9.85	4.84	0.00	20.10	30.63	80	18.72
2 Bypass	0.05	4.24	8.86	0.00	13.15	0.95	2.72	4.63	0.00	8.30	21.45	76	20.90
Totals =	12.47	11.70	17.72	0.46	**42.35**	6.38	12.57	9.47	0.00	**28.42**	**70.76**		

WALLBROOK
CPR-19100

POST-DEVELOPMENT HYDROLOGY

Subbasin 1 to SCMA

T. DABOLT
8/12/2024

I. SCS CURVE NUMBERS

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	60.4%
HSG 'D' =	39.7%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	76	Assume good condition
Wooded	73	Assume good condition

II. POST-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	50,770	1.17
Driveway / Parking Lot	10,893	0.25
Roof	29,529	0.68
Sidewalk / Patio	16,945	0.39
Other	101,572	2.33
Totals	209,709	4.81

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	209,709	4.81	-
Onsite open	76	90,133	2.07	Assume good condition
Onsite wooded	73	0	0.00	Assume good condition
Onsite pond	100	9,813	0.23	-
Offsite impervious	98	557	0.01	-
Offsite open	76	145	0.00	Assume good condition
Offsite wooded	73	0	0.00	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	7.12	acres
	310,357	sf
Composite SCS CN =	92	
% Impervious =	67.7%	

C. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6* Tc)
Time Increment =	0.87	minutes (= 0.29*SCS Lag)

WALLBROOK
CPR-19100

POST-DEVELOPMENT HYDROLOGY

Subbasin 2 to SCMB

T. DABOLT
8/12/2024

I. SCS CURVE NUMBERS

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	92.0%
HSG 'D' =	8.0%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	74	Assume good condition
Wooded	71	Assume good condition

II. POST-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	107,904	2.48
Driveway / Parking Lot	45,507	1.04
Roof	132,852	3.05
Sidewalk / Patio	43,264	0.99
Other/ Amenity Area	1,545	0.04
Totals	331,072	7.60

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	331,072	7.60	-
Onsite open	74	161,966	3.72	Assume good condition
Onsite wooded	71	0	0.00	Assume good condition
Onsite pond	100	10,282	0.24	-
Offsite impervious	98	0	0.00	-
Offsite open	74	0	0.00	Assume good condition
Offsite wooded	71	0	0.00	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	11.55	acres
	503,320	sf
Composite SCS CN =	90	
% Impervious =	65.8%	

C. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6* Tc)
Time Increment =	0.87	minutes (= 0.29*SCS Lag)

WALLBROOK
CPR-19100

POST-DEVELOPMENT HYDROLOGY

Subbasin 1 Bypass

T. DABOLT
8/12/2024

I. SCS CURVE NUMBERS

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	29.9%
HSG 'D' =	70.1%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	78	Assume good condition
Wooded	75	Assume good condition

II. POST-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	0	0.00
Driveway / Parking Lot	0	0.00
Roof	0	0.00
Sidewalk / Patio	181	0.00
Other	0	0.00
Totals	181	0.00

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	181	0.00	-
Onsite open	78	72,814	1.67	Assume good condition
Onsite wooded	75	385,715	8.85	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	235,848	5.41	-
Offsite open	78	428,977	9.85	Assume good condition
Offsite wooded	75	210,724	4.84	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	30.63	acres
	1,334,259	sf
Composite SCS CN =	80	
% Impervious =	17.7%	

C. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	416.00	ft
Bot Elev =	412.00	ft
Height =	4	ft
Slope =	0.0400	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***10.39***	***minutes***

Segment 2: Concentrated Flow

Length =	610	ft
Top Elev =	412.00	ft
Bot Elev =	390.00	ft
Height =	22	ft
Slope =	0.0361	ft/ft
Paved ? =	No	
Velocity =	3.06	ft/sec
Segment Time =	***3.32***	***minutes***

Segment 3: Channel Flow

Length =	1627	ft
Top Elev =	390.00	
Bot Elev =	352.00	
Height =	38	ft
Slope =	0.0234	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	10.50	sf (assume 3.5'w x 3'h channel)
Wetted Perimeter =	9.50	lf (assume 3.5' x 3' channel)
Channel Velocity =	5.41	ft/sec
Segment Time =	***5.01***	***minutes***

Time of Concentration =	18.72	minutes
SCS Lag Time =	11.23	minutes (SCS Lag = 0.6* Tc)
Time Increment =	3.26	minutes (= 0.29*SCS Lag)

WALLBROOK
CPR-19100

POST-DEVELOPMENT HYDROLOGY
Subbasin 2 Bypass

T. DABOLT
8/12/2024

I. SCS CURVE NUMBERS

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	49.6%
HSG 'D' =	50.5%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	77	Assume good condition
Wooded	74	Assume good condition

II. POST-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	0	0.00
Driveway / Parking Lot	0	0.00
Roof	0	0.00
Sidewalk / Patio	2,235	0.05
Other	0	0.00
Totals	2,235	0.05

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	2,235	0.05	-
Onsite open	77	184,675	4.24	Assume good condition
Onsite wooded	74	385,959	8.86	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	41,434	0.95	-
Offsite open	77	118,455	2.72	Assume good condition
Offsite wooded	74	201,696	4.63	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	21.45	acres
	934,454	sf
Composite SCS CN =	76	
% Impervious =	4.7%	

C. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	404.00	ft
Bot Elev =	398.00	ft
Height =	6	ft
Slope =	0.0601	ft/ft
Manning's n =	0.40	wooded
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***13.29***	***minutes***

Segment 2: Concentrated Flow

Length =	822	ft
Top Elev =	398.00	ft
Bot Elev =	356.00	ft
Height =	42	ft
Slope =	0.0511	ft/ft
Paved ? =	No	
Velocity =	3.65	ft/sec
Segment Time =	***3.76***	***minutes***

Segment 3: Channel Flow

Length =	1172	ft
Top Elev =	356.00	
Bot Elev =	332.00	
Height =	24	ft
Slope =	0.0205	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	10.50	sf (assume 3.5'w x 3'h channel)
Wetted Perimeter =	9.50	lf (assume 3.5' x 3' channel)
Channel Velocity =	5.07	ft/sec
Segment Time =	***3.86***	***minutes***

Time of Concentration =	20.90	minutes
SCS Lag Time =	12.54	minutes (SCS Lag = 0.6* Tc)
Time Increment =	3.64	minutes (= 0.29*SCS Lag)

WALLBROOK
CPR-19100

POST-DEVELOPMENT HYDROLOGY

Subbasin Culvert

B. STANEK
8/12/2024

I. SCS CURVE NUMBERS

HSG	Impervious	Open	Wooded
A	98	39	30
B	98	61	55
C	98	74	70
D	98	80	77

Assume:

HSG 'A' =	0.0%
HSG 'B' =	0.0%
HSG 'C' =	19%
HSG 'D' =	80.7%

Cover Condition	SCS CN	Comments
Impervious	98	-
Open	79	Assume good condition
Wooded	76	Assume good condition

II. POST-DEVELOPMENT

A. Onsite Impervious Breakdown

Contributing Area	Area [sf]	Area [ac]
Roadway Area	0	0.00
Driveway / Parking Lot	0	0.00
Roof	0	0.00
Sidewalk / Patio	0	0.00
Other	0	0.00
Totals	0	0.00

B. Watershed Land Use Breakdown

Contributing Area	SCS CN	Area [sf]	Area [acres]	Comments
Onsite impervious	98	0	0.00	-
Onsite open	79	36,936	0.85	Assume good condition
Onsite wooded	76	202,543	4.65	Assume good condition
Onsite pond	100	0	0.00	-
Offsite impervious	98	26,655	0.61	-
Offsite open	79	331,976	7.62	Assume good condition
Offsite wooded	76	131,030	3.01	Assume good condition
Offsite pond	100	0	0.00	-

Total area =	16.74	acres
	729,140	sf
Composite SCS CN =	78	
% Impervious =	3.7%	

C. Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	416.00	ft
Bot Elev =	412.00	ft
Height =	4	ft
Slope =	0.0400	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***10.39***	***minutes***

Segment 2: Concentrated Flow

Length =	608	ft
Top Elev =	412.00	ft
Bot Elev =	390.00	ft
Height =	22	ft
Slope =	0.0362	ft/ft
Paved ? =	No	
Velocity =	3.07	ft/sec
Segment Time =	***3.30***	***minutes***

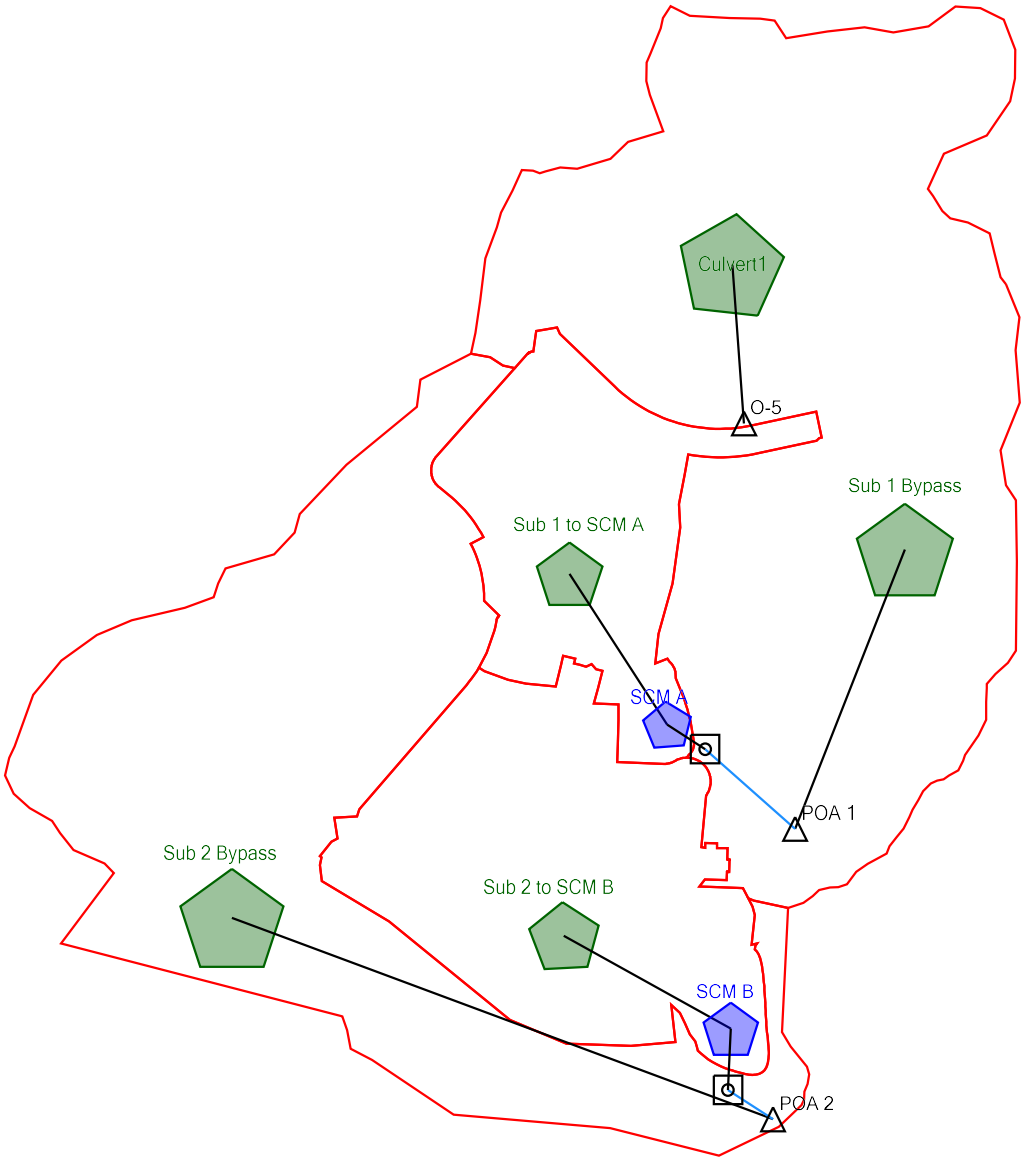
Segment 3: Channel Flow

Length =	425	ft
Top Elev =	390.00	
Bot Elev =	380.00	
Height =	10	ft
Slope =	0.0235	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	10.50	sf (assume 3.5'w x 3'h channel)
Wetted Perimeter =	9.50	lf (assume 3.5' x 3' channel)
Channel Velocity =	5.43	ft/sec
Segment Time =	***1.30***	***minutes***

Time of Concentration =	14.99	minutes
SCS Lag Time =	9.00	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.61	minutes (= 0.29*SCS Lag)

MCADAMS

Scenario: Post-Development 1-yr



MCADAMS

FlexTable: Catchment Table (CPR19100.ppc)

Current Time: 0.00 min

Label	Area (ft²)	SCS CN	Time of Concentration (min)	Notes
Sub 1 to SCM A	310,360	92	5.00	POST
Sub 2 to SCM B	503,320	90	5.00	POST
Sub 1 Bypass	1,334,259	80	18.73	POST
Sub 2 Bypass	934,454	76	20.90	POST
Culvert1	729,140	78	14.99	POST

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
Sub 1 to SCM A	Post-Development 1-yr	1	1.203	721.00	25.74
Sub 1 to SCM A	Post-Development 10-yr	10	2.448	721.00	42.95
Sub 2 to SCM B	Post-Development 1-yr	1	1.785	721.00	38.49
Sub 2 to SCM B	Post-Development 10-yr	10	3.765	721.00	67.03
Sub 1 Bypass	Post-Development 1-yr	1	2.908	731.00	36.24
Sub 1 Bypass	Post-Development 10-yr	10	7.435	730.00	83.50
Sub 2 Bypass	Post-Development 1-yr	1	1.636	733.00	18.45
Sub 2 Bypass	Post-Development 10-yr	10	4.563	733.00	48.15
Culvert1	Post-Development 1-yr	1	1.430	729.00	19.71
Culvert1	Post-Development 10-yr	10	3.813	728.00	47.64

Node Summary

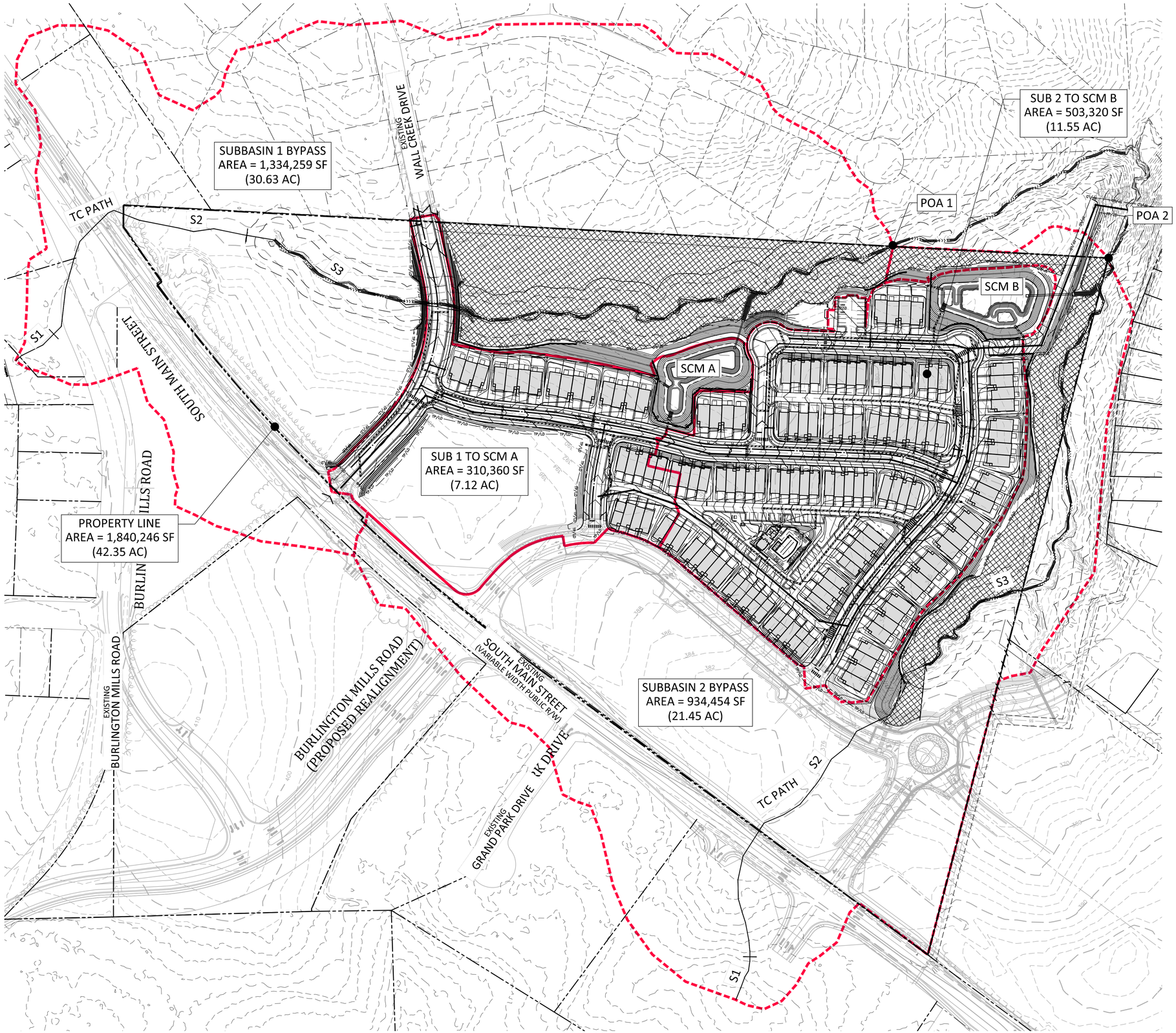
Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
POA 2	Post-Development 1-yr	1	1.937	733.00	18.69
POA 2	Post-Development 10-yr	10	6.738	733.00	56.36
POA 1	Post-Development 1-yr	1	3.095	731.00	36.39
POA 1	Post-Development 10-yr	10	8.770	730.00	95.29
O-5	Post-Development 1-yr	1	1.430	729.00	19.71
O-5	Post-Development 10-yr	10	3.813	728.00	47.64

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM A (IN)	Post-Development 1-yr	1	1.203	721.00	25.74	(N/A)	(N/A)
SCM A (OUT)	Post-Development 1-yr	1	0.187	1,440.00	0.18	373.03	1.016

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM A (IN)	Post-Development 10-yr	10	2.448	721.00	42.95	(N/A)	(N/A)
SCM A (OUT)	Post-Development 10-yr	10	1.335	731.00	12.04	373.55	1.232
SCM B (IN)	Post-Development 1-yr	1	1.785	721.00	38.49	(N/A)	(N/A)
SCM B (OUT)	Post-Development 1-yr	1	0.301	1,440.00	0.30	347.41	1.484
SCM B (IN)	Post-Development 10-yr	10	3.765	721.00	67.03	(N/A)	(N/A)
SCM B (OUT)	Post-Development 10-yr	10	2.175	753.00	12.37	348.50	2.067

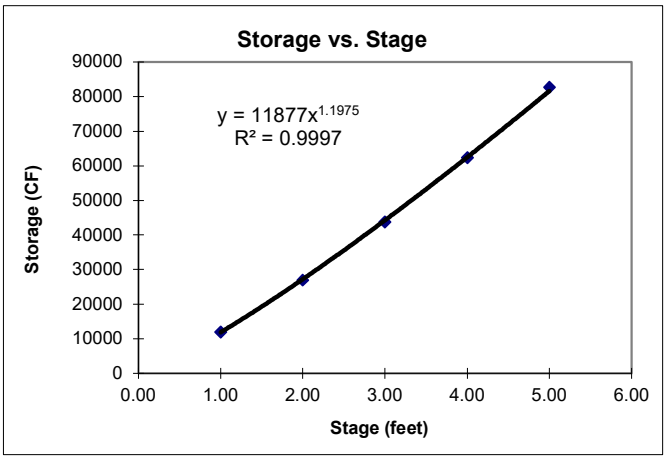

SUBBASIN 1 BYPASS
AREA = 1,334,259 SF
(30.63 AC)
SUB 2 TO SCM B
AREA = 503,320 SF
(11.55 AC)
SUB 1 TO SCM A
AREA = 310,360 SF
(7.12 AC)
SUBBASIN 2 BYPASS
AREA = 934,454 SF
(21.45 AC)
PROPERTY LINE
AREA = 1,840,246 SF
(42.35 AC)
POA 1
POA 2
SCM A
SCM B
EXISTING WALL CREEK DRIVE
TC PATH
S1
S2
S3
SOUTH MAIN STREET
EXISTING BURLINGTON MILLS ROAD
BURLINGTON MILLS ROAD (PROPOSED REALIGNMENT)
EXISTING SOUTH MAIN STREET (VARIABLE WIDTH PUBLIC R/W)
EXISTING GRAND PARK DRIVE
UK DRIVE
GRAPHIC SCALE
0 50 100 200
1 inch = 100 ft.

STORMWATER CONTROL MEASURE 'A'
DESIGN CALCULATIONS

Wallbrook
CPR-19100

STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
370.00	0.00	9,813				
371.00	1.00	14,149	11981	11981	11981	1.01
372.00	2.00	15,896	15023	15023	27004	1.99
373.00	3.00	17,664	16780	16780	43784	2.97
374.00	4.00	19,406	18535	18535	62319	3.99
375.00	5.00	21,342	20374	20374	82693	5.06

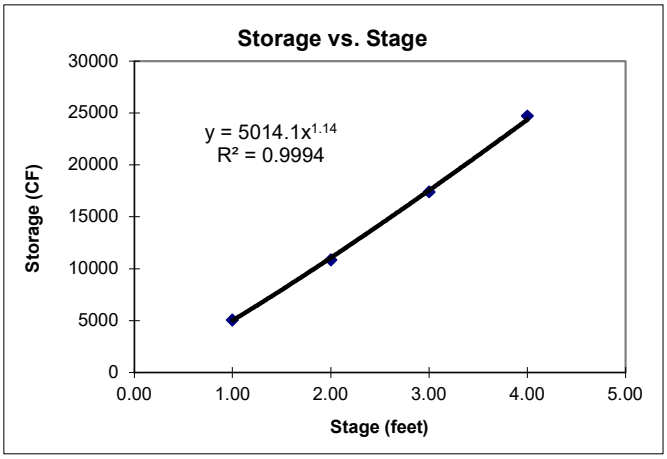


K_S =	11877
b =	1.1975

STAGE-STORAGE FUNCTION - MAIN POOL

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
365.00	-1.00	4,022	Sediment Storage			
366.00	0.00	4,710				
367.00	1.00	5,423	5067	5067	5067	1.01
368.00	2.00	6,162	5793	5793	10859	1.97
369.00	3.00	6,925	6544	6544	17403	2.98
370.00	4.00	7,714	7320	7320	24722	4.05

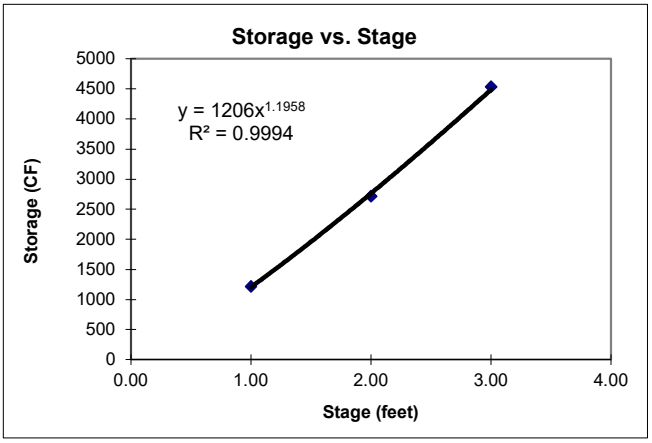
*surface area and volume used for avg. depth calculation



K_s =	5014
b =	1.1400

STAGE-STORAGE FUNCTION - FOREBAY

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
366.00	-1.00	823		Sediment Storage		
367.00	0.00	1,075				
368.00	1.00	1,352	1214	1214	1214	1.01
369.00	2.00	1,654	1503	1503	2717	1.97
370.00	3.00	1,981	1818	1818	4534	3.03



K_S =	1206.0
b =	1.1958

STORMWATER CONTROL MEASURE

Volume Calculation

TOTAL VOLUME OF FACILITY

Volume of Main Pool below Normal Pool=	24,722	cf
Volume of Forebay below Normal Pool=	4,534	cf
Total Volume Below Normal Pool =	29,256	cf
Total Volume Above Normal Pool=	82,693	cf
Total Volume of Facility =	111,949	cf

FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME

Per NCDEQ Minimum Design Criteria, the forebay volume should equal approximately 15-20% of the main pool volume.

Total Main Pool Volume =	24,722	cf
Provided Forebay Volume =	4,534	cf
Provided Forebay Volume % =	18%	

AVERAGE DEPTH OF MAIN POOL

Main Pool Volume at Normal Pool =	24,722	cf
Main Pool Area at Normal Pool =	7,714	sf
Average Depth =	3.20	ft

WALLBROOK
CPR-19100

STORMWATER CONTROL MEASURE

Surface Area Calculation

T. DABOLT
7/18/2024

WET DETENTION BASIN SUMMARY

Enter the drainage area characteristics ==>

Total drainage area to pond =	7.12	acres
Total impervious area to pond =	4.83	acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **7.12** acres @ **67.7%** impervious

Estimate the surface area required at pond normal pool elevation ==>

Wet Detention Basins are based on an minimum average depth of = **3.20** **feet**

		3.0	3.20	4.0
Lower Boundary =>	60.0	2.09		1.77
Site % impervious =>	67.7	2.42	***2.33***	2.02
Upper Boundary =>	70.0	2.51		2.09

Therefore, SA/DA required = ***2.33***

Surface area required for main pool at normal pool =	7,244	ft^2
=	0.17	acres
Surface area provided for main pool at normal pool =	7,714	ft^2

STORMWATER CONTROL MEASURE

WQV Calculation

DETERMINATION OF WATER QUALITY VOLUME

$WQ_V = (P)(R_V)(A)/12$

where,

WQ_V = water quality volume (in acre-ft)

R_V = 0.05+0.009(I) where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

Input data:

Total area, A =	7.12	acres
Impervious area =	4.83	acres
Percent impervious cover, I =	67.7	%
Rainfall, P =	1.00	inches

Calculated values:

R_V =	0.66	
WQ_V =	0.39	acre-ft
=	17063	cf.

ASSOCIATED DEPTH IN POND

WQ_V =	17063	cf.

Stage / Storage Data:

Ks =	11877	
b =	1.197	
Zo =	370.00	
Volume in 1" rainfall =	17063	cf.

Calculated values:

Depth of WQv in Basin =	1.35	ft
=	16.24	inches
Elevation =	371.35	ft

STORMWATER CONTROL MEASURE

WQV Drawdown Calculation

DRAWDOWN ORIFICE DESIGN

D orifice =	2	inch
# orifices =	1	
Ks =	11877	
b =	1.1975	
C_d orifice =	0.60	
Normal Pool Elevation =	370.00	feet
Volume @ Normal Pool =	0	cf
Orifice Invert =	370.00	feet
WSEL @ 1" Runoff Volume =	371.35	feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
371.35	17063	0.118			
371.24	15334	0.113	0.115	1730	14982
371.12	13636	0.107	0.110	1698	15464
371.01	11972	0.101	0.104	1664	16021
370.89	10346	0.094	0.098	1626	16676
370.78	8761	0.087	0.091	1585	17464
370.66	7222	0.080	0.083	1539	18441
370.54	5735	0.071	0.075	1486	19705
370.43	4310	0.062	0.066	1425	21448
370.31	2960	0.050	0.056	1350	24122
370.20	1706	0.035	0.043	1254	29222

Drawdown Time =	2.24	days

By comparison, if calculated by the average head over the orifice
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.423	feet
Orifice composite loss coefficient =	0.600	
Cross-sectional area of siphon =	0.022	sf
Q =	0.0683	cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	2.89	days

MCADAMS

Subsection: Elevation-Area Volume Curve
Label: SCM A
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr (A1*A2) (ft²)	Volume (ac-ft)	Volume (Total) (ac-ft)
370.00	0.0	9,813	0	0.000	0.000
371.00	0.0	14,149	35,745	0.274	0.274
372.00	0.0	15,896	45,042	0.345	0.618
373.00	0.0	17,664	50,317	0.385	1.003
374.00	0.0	19,406	55,585	0.425	1.429
375.00	0.0	21,342	61,099	0.468	1.896

Subsection: Outlet Input Data
Label: SCM A
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Requested Pond Water Surface Elevations	
Minimum (Headwater)	370.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	375.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser	Forward	Culvert	373.25	375.00
Orifice-Circular	WQ Orifice	Forward	Culvert	370.00	375.00
Culvert-Circular	Culvert	Forward	TW	369.50	375.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: SCM A
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Structure ID: Riser Structure Type: Inlet Box	
Number of Openings	1
Elevation	373.25 ft
Orifice Area	36.0 ft²
Orifice Coefficient	1
Weir Length	24.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1
Manning's n	0
Kev, Charged Riser	0
Weir Submergence	False
Orifice H to crest	False

Structure ID: WQ Orifice Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	370.00 ft
Orifice Diameter	2.0 in
Orifice Coefficient	1

Structure ID: Culvert Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.0 in
Length	56.76 ft
Length (Computed Barrel)	56.94 ft
Slope (Computed)	0.079 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	1
Kb	0
Kr	1
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	0
T2 ratio (HW/D)	1
Slope Correction Factor	-1

Subsection: Outlet Input Data
Label: SCM A
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	369.50 ft	T1 Flow	42.85 ft³/s
T2 Elevation	373.30 ft	T2 Flow	48.97 ft³/s

Subsection: Outlet Input Data
Label: SCM A
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

MCADAMS

Subsection: Composite Rating Curve
Label: SCM A
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
370.00	0.00	(N/A)	0.00	(no Q: Riser,WQ Orifice,Culvert)
370.10	0.01	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
370.20	0.04	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
370.30	0.05	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
370.40	0.06	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
370.50	0.07	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
370.60	0.08	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
370.70	0.08	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
370.80	0.09	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
370.90	0.10	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
371.00	0.10	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
371.10	0.11	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
371.20	0.11	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
371.30	0.12	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
371.40	0.12	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
371.50	0.13	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
371.60	0.13	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
371.70	0.13	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
371.80	0.14	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
371.90	0.14	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
372.00	0.15	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
372.10	0.15	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
372.20	0.15	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
372.30	0.16	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
372.40	0.16	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
372.50	0.16	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)

MCADAMS

Subsection: Composite Rating Curve
Label: SCM A
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
372.60	0.17	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
372.70	0.17	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
372.80	0.17	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
372.90	0.18	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
373.00	0.18	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
373.10	0.18	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
373.20	0.18	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
373.25	0.19	(N/A)	0.00	WQ Orifice,Culvert (no Q: Riser)
373.30	0.99	(N/A)	0.00	Riser,WQ Orifice,Culvert
373.40	4.36	(N/A)	0.00	Riser,WQ Orifice,Culvert
373.50	9.16	(N/A)	0.00	Riser,WQ Orifice,Culvert
373.60	15.06	(N/A)	0.00	Riser,WQ Orifice,Culvert
373.70	21.86	(N/A)	0.00	Riser,WQ Orifice,Culvert
373.80	29.48	(N/A)	0.00	Riser,WQ Orifice,Culvert
373.90	37.84	(N/A)	0.00	Riser,WQ Orifice,Culvert
374.00	46.84	(N/A)	0.00	Riser,WQ Orifice,Culvert
374.10	56.46	(N/A)	0.00	Riser,WQ Orifice,Culvert
374.20	59.39	(N/A)	0.00	Riser,Culvert (no Q: WQ Orifice)
374.30	60.44	(N/A)	0.00	Riser,Culvert (no Q: WQ Orifice)
374.40	61.46	(N/A)	0.00	Riser,Culvert (no Q: WQ Orifice)
374.50	62.47	(N/A)	0.00	Riser,Culvert (no Q: WQ Orifice)
374.60	63.47	(N/A)	0.00	Riser,Culvert (no Q: WQ Orifice)
374.70	64.44	(N/A)	0.00	Riser,Culvert (no Q: WQ Orifice)
374.80	65.42	(N/A)	0.00	Riser,Culvert (no Q: WQ Orifice)
374.90	66.38	(N/A)	0.00	Riser,Culvert (no Q: WQ Orifice)
375.00	67.31	(N/A)	0.00	Riser,Culvert (no Q: WQ Orifice)

Subsection: Level Pool Pond Routing Summary
Label: SCM A (IN)
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	370.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	25.74 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	0.18 ft³/s	Time to Peak (Flow, Outlet)	1,440.00 min

Elevation (Water Surface, Peak)	373.03 ft
Volume (Peak)	1.016 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.203 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.187 ac-ft
Volume (Retained)	1.016 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

MCADAMS

Subsection: Level Pool Pond Routing Summary
Label: SCM A (IN)
Scenario: Post-Development 10-yr

Return Event: 10 years
Storm Event: 10-yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	370.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	42.95 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	12.04 ft³/s	Time to Peak (Flow, Outlet)	731.00 min

Elevation (Water Surface, Peak)	373.55 ft
Volume (Peak)	1.232 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.448 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.335 ac-ft
Volume (Retained)	1.113 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Level Pool Pond Routing Summary
Label: SCM A (IN)
Scenario: Post-Development 25-yr

Return Event: 25 years
Storm Event: 25-yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	370.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	48.63 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	26.99 ft³/s	Time to Peak (Flow, Outlet)	727.00 min

Elevation (Water Surface, Peak)	373.77 ft
Volume (Peak)	1.326 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.007 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.892 ac-ft
Volume (Retained)	1.114 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

MCADAMS

Subsection: Level Pool Pond Routing Summary
Label: SCM A (IN)
Scenario: Post-Development 100-yr

Return Event: 100 years
Storm Event: 100-yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	370.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	56.85 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	45.05 ft³/s	Time to Peak (Flow, Outlet)	724.00 min

Elevation (Water Surface, Peak)	373.98 ft
Volume (Peak)	1.420 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.909 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.794 ac-ft
Volume (Retained)	1.115 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Elevation-Area Volume Curve
Label: SCM A
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr (A1*A2) (ft²)	Volume (ac-ft)	Volume (Total) (ac-ft)
370.00	0.0	9,813	0	0.000	0.000
371.00	0.0	14,149	35,745	0.274	0.274
372.00	0.0	15,896	45,042	0.345	0.618
373.00	0.0	17,664	50,317	0.385	1.003
374.00	0.0	19,406	55,585	0.425	1.429
375.00	0.0	21,342	61,099	0.468	1.896

Subsection: Outlet Input Data
Label: SCM A - WC
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Requested Pond Water Surface Elevations	
Minimum (Headwater)	370.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	375.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser	Forward	Culvert	373.25	375.00
Culvert-Circular	Culvert	Forward	TW	369.50	375.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: SCM A - WC
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Structure ID: Riser Structure Type: Inlet Box	
Number of Openings	1
Elevation	373.25 ft
Orifice Area	36.0 ft²
Orifice Coefficient	1
Weir Length	24.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1
Manning's n	0
Kev, Charged Riser	0
Weir Submergence	False
Orifice H to crest	False

Structure ID: Culvert Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.0 in
Length	56.76 ft
Length (Computed Barrel)	56.94 ft
Slope (Computed)	0.079 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	1
Kb	0
Kr	1
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1
T2 ratio (HW/D)	1
Slope Correction Factor	-1

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	372.86 ft	T1 Flow	42.85 ft³/s
T2 Elevation	373.30 ft	T2 Flow	48.97 ft³/s

Subsection: Outlet Input Data
Label: SCM A - WC
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Composite Rating Curve
Label: SCM A - WC
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
370.00	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
370.10	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
370.20	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
370.30	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
370.40	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
370.50	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
370.60	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
370.70	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
370.80	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
370.90	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
371.00	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
371.10	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
371.20	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
371.30	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
371.40	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
371.50	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
371.60	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
371.70	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
371.80	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
371.90	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
372.00	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
372.10	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
372.20	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
372.30	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
372.40	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
372.50	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
372.60	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
372.70	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
372.80	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
372.90	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
373.00	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
373.10	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
373.20	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
373.25	0.00	(N/A)	0.00	(no Q: Riser,Culvert)
373.30	0.80	(N/A)	0.00	Riser,Culvert
373.40	4.18	(N/A)	0.00	Riser,Culvert
373.50	9.00	(N/A)	0.00	Riser,Culvert
373.60	14.91	(N/A)	0.00	Riser,Culvert
373.70	21.74	(N/A)	0.00	Riser,Culvert
373.80	29.38	(N/A)	0.00	Riser,Culvert
373.90	37.73	(N/A)	0.00	Riser,Culvert
374.00	46.77	(N/A)	0.00	Riser,Culvert
374.10	56.43	(N/A)	0.00	Riser,Culvert
374.20	59.37	(N/A)	0.00	Riser,Culvert
374.30	60.44	(N/A)	0.00	Riser,Culvert
374.40	61.46	(N/A)	0.00	Riser,Culvert
374.50	62.47	(N/A)	0.00	Riser,Culvert
374.60	63.47	(N/A)	0.00	Riser,Culvert
374.70	64.44	(N/A)	0.00	Riser,Culvert

MCADAMS

WC

Subsection: Composite Rating Curve
Label: SCM A - WC
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
374.80	65.42	(N/A)	0.00	Riser,Culvert
374.90	66.38	(N/A)	0.00	Riser,Culvert
375.00	67.31	(N/A)	0.00	Riser,Culvert

Subsection: Level Pool Pond Routing Summary
Label: SCM A (IN)
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	373.00 ft
Volume (Initial)	1.003 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	56.85 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	46.46 ft³/s	Time to Peak (Flow, Outlet)	724.00 min

Elevation (Water Surface, Peak)	374.00 ft
Volume (Peak)	1.427 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	1.003 ac-ft
Volume (Total Inflow)	3.909 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.792 ac-ft
Volume (Retained)	1.119 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

STORMWATER CONTROL MEASURE
Anti-Flotation Block Calculations
SCM A

RISER ANTI-FLOTATION CALCULATION

Input Data ==>

Safety Factor:

Safety factor to use =	1.15	(recommend 1.15 or higher)

Concrete:

Concrete unit weight =	142.0	PCF	**Note:** NC Products lists unit wt. of manhole concrete at 142 PCF.

Riser:

Inside height of Riser =	3.75	feet
Inside length of riser =	6.00	feet
Inside width of riser =	6.00	feet
Wall thickness of riser =	6.00	inches
Base thickness of riser =	6.00	inches
Base length of riser =	7.00	feet
Base width of riser =	7.00	feet

Openings:

Total Orifice Area =	0.022	SF
OD of barrel exiting manhole =	44.00	inches
Size of drain pipe (if present) =	6.0	inches

Trash Rack:

Bottom Length =	9.60	feet
Bottom Width =	9.60	feet
Top Length =	2.00	feet
Top Width =	2.00	feet
Height =	2.00	feet
Trash Rack water displacement =	76.91	CF

Concrete Present in Riser Structure ==>

Total amount of concrete:

Base of Riser =	24.50	CF
Riser Walls =	48.75	CF

Adjust for openings:

Opening for Orifices =	0.01	CF
Opening for barrel =	5.28	CF
Opening for drain pipe =	0.10	CF

Total Concrete present, adjusted for openings =	***67.861***	***CF***
Weight of concrete present =	***9,636***	***lbs***

WALLBROOK
CPR-19100

STORMWATER CONTROL MEASURE

Anti-Flotation Block Calculations

SCM A

T. DABOLT
12/15/2022

Amount of water displaced by Riser Structure ==>

Displacement by concrete =	67.86	CF
Displacement by open air in riser =	135.00	CF
Displacement by trash rack =	76.91	CF
Total water displaced by riser/barrel structure =	***279.77***	***CF***
Weight of water displaced =	***17,458***	***lbs***

Calculate size of base for riser assembly ==>

Length =	10.00	feet
Width =	10.00	feet
Thickness =	18	inches
Concrete Present =	150.00	CF

Check validity of base as designed ==>

Total Water Displaced =	405.27	CF
Total Concrete Present =	217.86	CF
Total Water Displaced =	25,289	lbs
Total Concrete Present =	30,936	lbs
Actual safety factor =	*1.22*	OK

Results of design ==>

Base length =	**10.00**	**feet**
Base width =	**10.00**	**feet**
Base Thickness =	**18.00**	**inches**
CY of concrete total in base =	**5.56**	**CY**
Concrete unit weight in added base >=	**142.0**	**PCF**

STORMWATER CONTROL MEASURE
Anti-Flotation Block Calculations
SCM A

II. CALCULATION FOR RISER ANTI-FLOTATION STEEL

Input Data ==>

Anti-Floatation Block Length =	10.0	feet
Anti-Floatation Block Width =	10.0	feet
Anti-Floatation Block Thickness =	18	inches
A_{steel} to $A_{concrete}$ Ratio =	0.0020	(recommend 0.0018 or higher)

Cross-Section Calculations==>

Cross-Section Area* =	15.00	SF
Minimum Steel Area Required =	0.030	SF
	4.32	SI

**Note: Assumes a "square" x-sec (L and W same)*

Rebar Calculations ==>

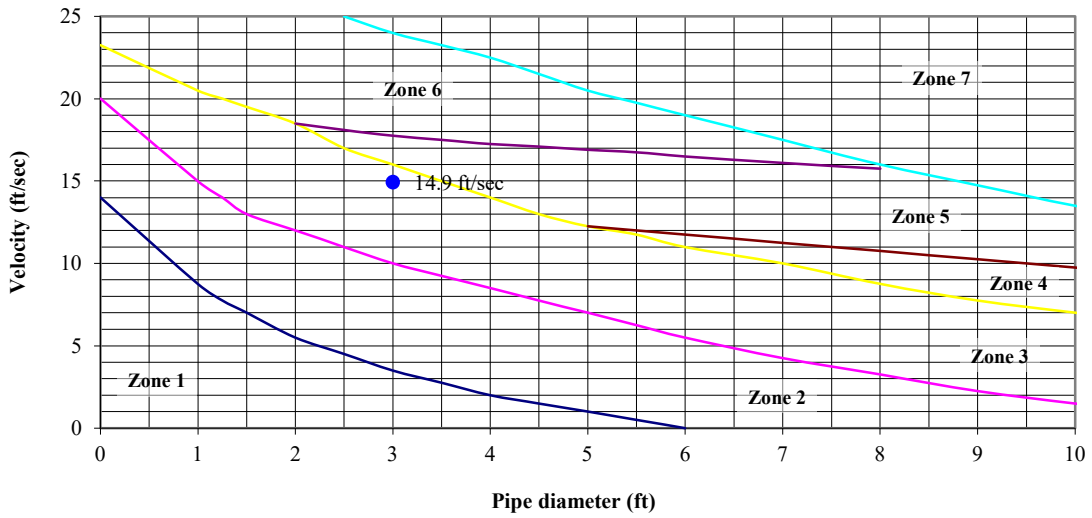
Bar Size	4	5	6	7	8
Diameter (inches)	0.500	0.625	0.750	0.875	1.000
X-Sec Area (SI)	0.196	0.307	0.442	0.601	0.785
Minimum Number of Bars	23	15	10	8	6

DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

Project	WALLBROOK	Date	7/18/2024
Project No.	CPR-19100	Designer	TKD
Outlet ID	SCM A		

Flow, $Q_{10\text{-}yr}$	12.04	cfs
Slope, S	7.93	%
Pipe Diameter, D_o	36	inches
Pipe Diameter, D_o	3.0	feet
Number of pipes	1	
Pipe separation	0	feet
Manning's n	0.013	

Figure 8.06.b.1



Zone from graph above = 3

Outlet pipe diameter	36 in.	Length =	24.0 ft.
Outlet flowrate	12.0 cfs	Width =	9.0 ft.
Outlet velocity	14.9 ft/sec	Stone diameter =	13 in.
Material =	Class I	Thickness =	22 in.

Zone	Material	Diameter	Thickness	Length	Width
1	Class A	3	9	4 x D(o)	3 x D(o)
2	Class B	6	22	6 x D(o)	3 x D(o)
3	Class I	13	22	8 x D(o)	3 x D(o)
4	Class I	13	22	8 x D(o)	3 x D(o)
5	Class II	23	27	10 x D(o)	3 x D(o)
6	Class II	23	27	10 x D(o)	3 x D(o)
7	Special study required				

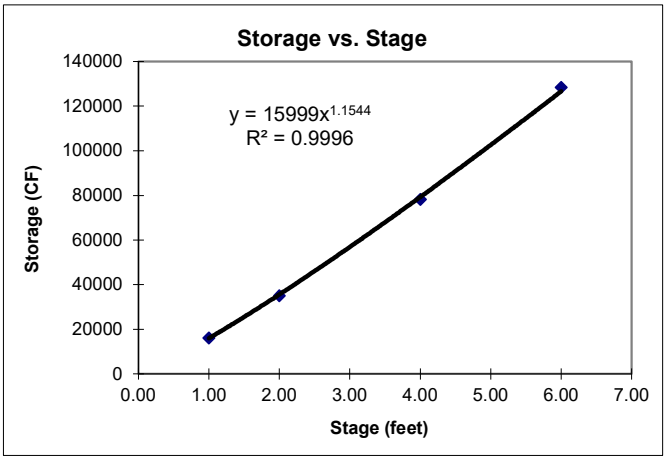
1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity

STORMWATER CONTROL MEASURE 'B'
DESIGN CALCULATIONS

Wallbrook
CPR-19100

STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
344.00	0.00	14,187				
345.00	1.00	18,160	16174	16174	16174	1.01
346.00	2.00	19,799	18980	18980	35153	1.98
348.00	4.00	23,298	21549	43097	78250	3.96
350.00	6.00	26,946	25122	50244	128494	6.08

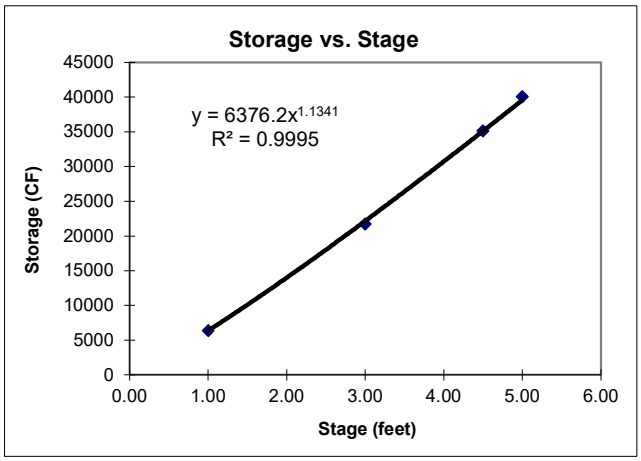


K_S =	15999
b =	1.1544

STAGE-STORAGE FUNCTION - MAIN POOL

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
338.50	-0.50	5621.86	Sediment Storage			
339.00	0.00	6014.09				
340.00	1.00	6817.39	6416	6416	6416	1.01
342.00	3.00	8499.4	7658	15317	21733	2.95
343.50	4.50	9378.1	8939	13408	35141	4.50
344.00	5.00	10281.93	9830	4915	40056	5.06

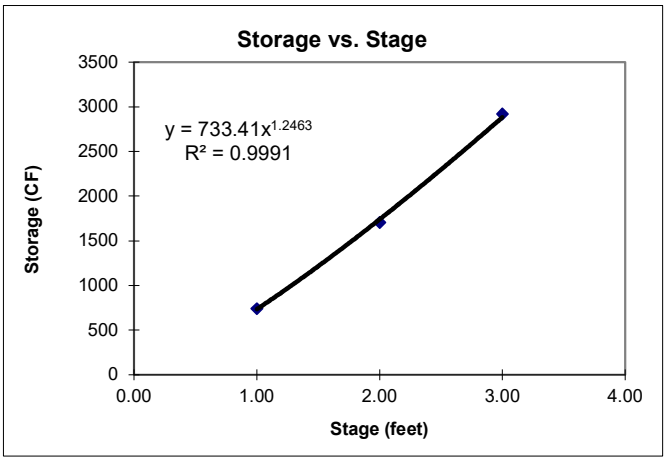
*surface area and volume used for avg. depth calculation



K_S =	6376
b =	1.1341

STAGE-STORAGE FUNCTION - FOREBAY

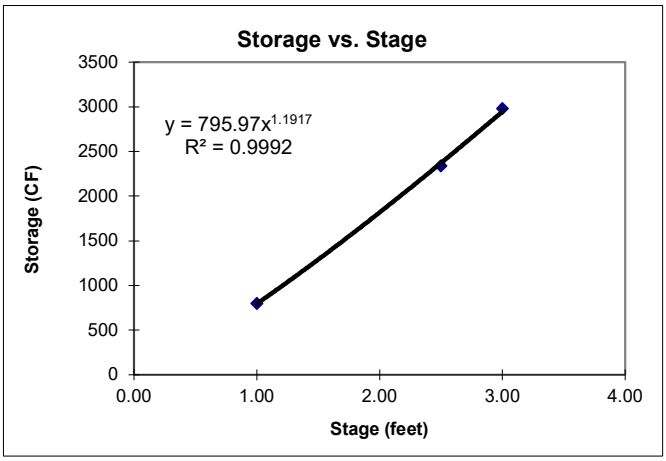
Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
340.50	-0.50	534	Sediment Storage			
341.00	0.00	632				
342.00	1.00	846	739	739	739	1.01
343.00	2.00	1,085	965	965	1704	1.97
344.00	3.00	1,349	1217	1217	2922	3.03



K_s =	733.4
b =	1.2463

STAGE-STORAGE FUNCTION - FOREBAY

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
340.50	-0.50	590	Sediment Storage			
341.00	0.00	689				
342.00	1.00	907	798	798	798	1.00
343.50	2.50	1,149	1028	1542	2340	2.47
344.00	3.00	1,417	1283	642	2981	3.03



K_s =	796.0
b =	1.1917

STORMWATER CONTROL MEASURE

Volume Calculation

TOTAL VOLUME OF FACILITY

Volume of Main Pool below Normal Pool=	40,056	cf
Volume of Forebay below Normal Pool=	5,903	cf
Total Volume Below Normal Pool =	45,959	cf
Total Volume Above Normal Pool=	128,494	cf
Total Volume of Facility =	174,453	cf

FOREBAY PERCENTAGE OF PERMANENT POOL VOLUME

Per NCDEQ Minimum Design Criteria, the forebay volume should equal approximately 15-20% of the main pool volume.

Total Main Pool Volume =	40,056	cf
Provided Forebay Volume =	5,903	cf
Provided Forebay Volume % =	15%	

AVERAGE DEPTH OF MAIN POOL

Main Pool Volume at Normal Pool =	40,056	cf
Main Pool Area at Normal Pool =	10,282	sf
Average Depth =	3.90	ft

WALLBROOK
CPR-19100

STORMWATER CONTROL MEASURE
Surface Area Calculation

T. DABOLT
7/18/2024

WET DETENTION BASIN SUMMARY

Enter the drainage area characteristics ==>

Total drainage area to pond =	11.55	acres
Total impervious area to pond =	7.60	acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **11.55** acres @ **65.8%** impervious

Estimate the surface area required at pond normal pool elevation ==>

Wet Detention Basins are based on an minimum average depth of = 3.90 feet

		3.0	3.90	4.0
Lower Boundary =>	60.0	2.09		1.77
Site % impervious =>	65.8	2.33	***1.99***	1.95
Upper Boundary =>	70.0	2.51		2.09

Therefore, SA/DA required = ***1.99***

Surface area required for main pool at normal pool =	10,038	ft^2
=	0.23	acres
Surface area provided for main pool at normal pool =	10,282	ft^2

STORMWATER CONTROL MEASURE

WQV Calculation

DETERMINATION OF WATER QUALITY VOLUME

$WQ_V = (P)(R_V)(A)/12$

where,

WQ_V = water quality volume (in acre-ft)

R_V = 0.05+0.009(I) where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

Input data:

Total area, A =	11.55	acres
Impervious area =	7.60	acres
Percent impervious cover, I =	65.8	%
Rainfall, P =	1.00	inches

Calculated values:

R_V =	0.64	
WQ_V =	0.62	acre-ft
=	26929	cf.

ASSOCIATED DEPTH IN POND

WQ_V =	26929	cf.

Stage / Storage Data:

Ks =	15999	
b =	1.154	
Zo =	344.00	
Volume in 1" rainfall =	26929	cf.

Calculated values:

Depth of WQv in Basin =	1.57	ft
=	18.84	inches
Elevation =	345.57	ft

WALLBROOK
CPR-19100

STORMWATER CONTROL MEASURE

WQV Drawdown Calculation

T. DABOLT
7/18/2024

DRAWDOWN ORIFICE DESIGN

D orifice =	2.5	inch
# orifices =	1	
Ks =	15999	
b =	1.1544	
C_d orifice =	0.60	
Normal Pool Elevation =	344.00	feet
Volume @ Normal Pool =	0	cf
Orifice Invert =	344.00	feet
WSEL @ 1" Runoff Volume =	345.57	feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
345.57	26929	0.198			
345.43	24262	0.189	0.194	2667	13770
345.30	21633	0.179	0.184	2629	14282
345.16	19047	0.169	0.174	2586	14876
345.03	16506	0.157	0.163	2540	15580
344.89	14017	0.145	0.151	2489	16434
344.76	11587	0.132	0.139	2431	17504
344.62	9222	0.118	0.125	2364	18907
344.48	6937	0.101	0.109	2285	20881
344.35	4750	0.081	0.091	2187	24005
344.21	2693	0.054	0.068	2057	30398

Drawdown Time =	2.16	days

By comparison, if calculated by the average head over the orifice
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.489	feet
Orifice composite loss coefficient =	0.600	
Cross-sectional area of siphon =	0.034	sf
Q =	0.1147	cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	2.72	days

MCADAMS

Subsection: Elevation-Area Volume Curve
Label: SCM B
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr (A1*A2) (ft²)	Volume (ac-ft)	Volume (Total) (ac-ft)
344.00	0.0	14,187	0	0.000	0.000
345.00	0.0	18,160	48,398	0.370	0.370
346.00	0.0	19,799	56,921	0.436	0.806
348.00	0.0	23,298	64,574	0.988	1.794
350.00	0.0	26,946	75,300	1.152	2.947

Subsection: Outlet Input Data
Label: SCM B
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Requested Pond Water Surface Elevations	
Minimum (Headwater)	344.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	350.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir	Forward	Culvert	347.50	350.00
Inlet Box	Riser	Forward	Culvert	348.50	350.00
Orifice-Circular	WQ Orifice	Forward	Culvert	344.00	350.00
Culvert-Circular	Culvert	Forward	TW	339.00	350.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: SCM B
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Structure ID: Riser Structure Type: Inlet Box	
Number of Openings	1
Elevation	348.50 ft
Orifice Area	25.0 ft²
Orifice Coefficient	1
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1
Manning's n	0
Kev, Charged Riser	0
Weir Submergence	False
Orifice H to crest	False

Structure ID: WQ Orifice Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	344.00 ft
Orifice Diameter	2.5 in
Orifice Coefficient	1

Subsection: Outlet Input Data
Label: SCM B
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Structure ID: Culvert Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.0 in
Length	84.65 ft
Length (Computed Barrel)	84.66 ft
Slope (Computed)	0.012 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	1
Kb	0
Kr	1
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1
T2 ratio (HW/D)	1
Slope Correction Factor	-1

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	342.46 ft	T1 Flow	42.85 ft³/s
T2 Elevation	342.90 ft	T2 Flow	48.97 ft³/s

Subsection: Outlet Input Data
Label: SCM B
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Structure ID: Weir Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	347.50 ft
Weir Length	4.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

MCADAMS

Subsection: Composite Rating Curve
Label: SCM B
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
344.00	0.00	(N/A)	0.00	(no Q: Weir,Riser,WQ Orifice,Culvert)
344.10	0.01	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
344.20	0.05	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
344.30	0.07	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
344.40	0.09	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
344.50	0.10	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
344.60	0.11	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
344.70	0.13	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
344.80	0.14	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
344.90	0.14	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
345.00	0.15	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
345.10	0.16	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
345.20	0.17	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
345.30	0.18	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
345.40	0.19	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
345.50	0.19	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
345.60	0.20	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
345.70	0.21	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
345.80	0.21	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
345.90	0.22	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
346.00	0.22	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
346.10	0.23	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
346.20	0.24	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
346.30	0.24	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
346.40	0.25	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
346.50	0.25	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)

MCADAMS

Subsection: Composite Rating Curve
Label: SCM B
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
346.60	0.26	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
346.70	0.26	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
346.80	0.27	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
346.90	0.27	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
347.00	0.28	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
347.10	0.28	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
347.20	0.29	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
347.30	0.29	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
347.40	0.30	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
347.50	0.30	(N/A)	0.00	WQ Orifice,Culvert (no Q: Weir,Riser)
347.60	0.69	(N/A)	0.00	Weir,WQ Orifice,Culvert (no Q: Riser)
347.70	1.38	(N/A)	0.00	Weir,WQ Orifice,Culvert (no Q: Riser)
347.80	2.29	(N/A)	0.00	Weir,WQ Orifice,Culvert (no Q: Riser)
347.90	3.35	(N/A)	0.00	Weir,WQ Orifice,Culvert (no Q: Riser)
348.00	4.57	(N/A)	0.00	Weir,WQ Orifice,Culvert (no Q: Riser)
348.10	5.91	(N/A)	0.00	Weir,WQ Orifice,Culvert (no Q: Riser)
348.20	7.36	(N/A)	0.00	Weir,WQ Orifice,Culvert (no Q: Riser)
348.30	8.92	(N/A)	0.00	Weir,WQ Orifice,Culvert (no Q: Riser)
348.40	10.59	(N/A)	0.00	Weir,WQ Orifice,Culvert (no Q: Riser)
348.50	12.34	(N/A)	0.00	Weir,WQ Orifice,Culvert (no Q: Riser)
348.60	15.71	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
348.70	20.41	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
348.80	26.03	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
348.90	32.37	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
349.00	39.39	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
349.10	46.96	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert

MCADAMS

Subsection: Composite Rating Curve
Label: SCM B
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
349.20	55.07	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
349.30	63.65	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
349.40	72.72	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
349.50	82.18	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
349.60	91.67	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
349.70	97.13	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
349.80	100.95	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
349.90	103.72	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert
350.00	105.57	(N/A)	0.00	Weir,Riser,WQ Orifice,Culvert

Subsection: Level Pool Pond Routing Summary
Label: SCM B (IN)
Scenario: Post-Development 1-yr

Return Event: 1 years
Storm Event: 1-yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	344.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	38.49 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	0.30 ft³/s	Time to Peak (Flow, Outlet)	1,440.00 min

Elevation (Water Surface, Peak)	347.41 ft
Volume (Peak)	1.484 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.785 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.301 ac-ft
Volume (Retained)	1.484 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

MCADAMS

Subsection: Level Pool Pond Routing Summary
Label: SCM B (IN)
Scenario: Post-Development 10-yr

Return Event: 10 years
Storm Event: 10-yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	344.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	67.03 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	12.37 ft³/s	Time to Peak (Flow, Outlet)	753.00 min

Elevation (Water Surface, Peak)	348.50 ft
Volume (Peak)	2.067 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.765 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.175 ac-ft
Volume (Retained)	1.589 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

MCADAMS

Subsection: Level Pool Pond Routing Summary
Label: SCM B (IN)
Scenario: Post-Development 25-yr

Return Event: 25 years
Storm Event: 25-yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	344.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	76.56 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	23.60 ft³/s	Time to Peak (Flow, Outlet)	731.00 min

Elevation (Water Surface, Peak)	348.76 ft
Volume (Peak)	2.211 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.661 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.062 ac-ft
Volume (Retained)	1.597 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

MCADAMS

Subsection: Level Pool Pond Routing Summary
Label: SCM B (IN)
Scenario: Post-Development 100-yr

Return Event: 100 years
Storm Event: 100-yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	344.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	90.28 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	54.81 ft³/s	Time to Peak (Flow, Outlet)	726.00 min

Elevation (Water Surface, Peak)	349.20 ft
Volume (Peak)	2.464 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	6.113 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	4.514 ac-ft
Volume (Retained)	1.598 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Elevation-Area Volume Curve
Label: SCM B
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Elevation (ft)	Planimeter (ft²)	Area (ft²)	A1+A2+sqr (A1*A2) (ft²)	Volume (ac-ft)	Volume (Total) (ac-ft)
344.00	0.0	14,187	0	0.000	0.000
345.00	0.0	18,160	48,398	0.370	0.370
346.00	0.0	19,799	56,921	0.436	0.806
348.00	0.0	23,298	64,574	0.988	1.794
350.00	0.0	26,946	75,300	1.152	2.947

Subsection: Outlet Input Data
Label: SCM B-WC
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Requested Pond Water Surface Elevations	
Minimum (Headwater)	344.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	350.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser	Forward	Culvert	348.50	350.00
Rectangular Weir	Weir	Forward	Culvert	347.50	350.00
Culvert-Circular	Culvert	Forward	TW	339.00	350.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: SCM B-WC
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Structure ID: Riser Structure Type: Inlet Box	
Number of Openings	1
Elevation	348.50 ft
Orifice Area	25.0 ft²
Orifice Coefficient	1
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1
Manning's n	0
Kev, Charged Riser	0
Weir Submergence	False
Orifice H to crest	False

Subsection: Outlet Input Data
Label: SCM B-WC
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Structure ID: Culvert Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.0 in
Length	84.65 ft
Length (Computed Barrel)	84.66 ft
Slope (Computed)	0.012 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	1
Kb	0
Kr	1
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1
T2 ratio (HW/D)	1
Slope Correction Factor	-1

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	342.46 ft	T1 Flow	42.85 ft³/s
T2 Elevation	342.90 ft	T2 Flow	48.97 ft³/s

Structure ID: Weir Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	347.50 ft
Weir Length	4.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Composite Rating Curve
Label: SCM B-WC
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
344.00	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
344.10	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
344.20	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
344.30	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
344.40	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
344.50	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
344.60	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
344.70	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
344.80	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
344.90	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
345.00	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
345.10	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
345.20	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
345.30	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
345.40	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
345.50	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
345.60	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
345.70	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
345.80	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
345.90	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
346.00	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
346.10	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
346.20	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
346.30	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
346.40	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
346.50	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)

Subsection: Composite Rating Curve
Label: SCM B-WC
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
346.60	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
346.70	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
346.80	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
346.90	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
347.00	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
347.10	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
347.20	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
347.30	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
347.40	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
347.50	0.00	(N/A)	0.00	(no Q: Riser,Weir,Culvert)
347.60	0.38	(N/A)	0.00	Weir,Culvert (no Q: Riser)
347.70	1.07	(N/A)	0.00	Weir,Culvert (no Q: Riser)
347.80	1.97	(N/A)	0.00	Weir,Culvert (no Q: Riser)
347.90	3.04	(N/A)	0.00	Weir,Culvert (no Q: Riser)
348.00	4.24	(N/A)	0.00	Weir,Culvert (no Q: Riser)
348.10	5.58	(N/A)	0.00	Weir,Culvert (no Q: Riser)
348.20	7.03	(N/A)	0.00	Weir,Culvert (no Q: Riser)
348.30	8.59	(N/A)	0.00	Weir,Culvert (no Q: Riser)
348.40	10.24	(N/A)	0.00	Weir,Culvert (no Q: Riser)
348.50	12.00	(N/A)	0.00	Weir,Culvert (no Q: Riser)
348.60	15.36	(N/A)	0.00	Riser,Weir,Culvert
348.70	20.06	(N/A)	0.00	Riser,Weir,Culvert
348.80	25.69	(N/A)	0.00	Riser,Weir,Culvert
348.90	32.01	(N/A)	0.00	Riser,Weir,Culvert
349.00	39.00	(N/A)	0.00	Riser,Weir,Culvert
349.10	46.61	(N/A)	0.00	Riser,Weir,Culvert
349.20	54.72	(N/A)	0.00	Riser,Weir,Culvert
349.30	63.32	(N/A)	0.00	Riser,Weir,Culvert
349.40	72.41	(N/A)	0.00	Riser,Weir,Culvert
349.50	81.94	(N/A)	0.00	Riser,Weir,Culvert
349.60	91.52	(N/A)	0.00	Riser,Weir,Culvert
349.70	97.06	(N/A)	0.00	Riser,Weir,Culvert

Subsection: Composite Rating Curve
Label: SCM B-WC
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
349.80	100.91	(N/A)	0.00	Riser,Weir,Culvert
349.90	103.69	(N/A)	0.00	Riser,Weir,Culvert
350.00	105.56	(N/A)	0.00	Riser,Weir,Culvert

Subsection: Level Pool Pond Routing Summary
Label: SCM B (IN)
Scenario: Post-Development 100-yr WC

Return Event: 100 years
Storm Event: 100-yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	347.50 ft
Volume (Initial)	1.532 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	90.28 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	67.32 ft³/s	Time to Peak (Flow, Outlet)	724.00 min

Elevation (Water Surface, Peak)	349.34 ft
Volume (Peak)	2.550 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	1.532 ac-ft
Volume (Total Inflow)	6.113 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	6.023 ac-ft
Volume (Retained)	1.621 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

STORMWATER CONTROL MEASURE
Anti-Flotation Block Calculations
SCM B

RISER ANTI-FLOTATION CALCULATION

Input Data ==>

Safety Factor:

Safety factor to use =	1.15	(recommend 1.15 or higher)

Concrete:

Concrete unit weight =	142.0	PCF	**Note:** NC Products lists unit wt. of manhole concrete at 142 PCF.

Riser:

Inside height of Riser =	9.50	feet
Inside length of riser =	5.00	feet
Inside width of riser =	5.00	feet
Wall thickness of riser =	6.00	inches
Base thickness of riser =	6.00	inches
Base length of riser =	6.00	feet
Base width of riser =	6.00	feet

Openings:

Total Orifice Area =	4.034	SF
OD of barrel exiting manhole =	44.00	inches
Size of drain pipe (if present) =	6.0	inches

Trash Rack:

Bottom Length =	8.40	feet
Bottom Width =	8.40	feet
Top Length =	2.10	feet
Top Width =	2.10	feet
Height =	2.00	feet
Trash Rack water displacement =	61.74	CF

Concrete Present in Riser Structure ==>

Total amount of concrete:

Base of Riser =	18.00	CF
Riser Walls =	104.50	CF

Adjust for openings:

Opening for Orifices =	2.02	CF
Opening for barrel =	5.28	CF
Opening for drain pipe =	0.10	CF

Total Concrete present, adjusted for openings =	***115.105***	***CF***
Weight of concrete present =	***16,345***	***lbs***

WALLBROOK
CPR-19100

STORMWATER CONTROL MEASURE

Anti-Flotation Block Calculations

SCM B

T. DABOLT
12/15/2022

Amount of water displaced by Riser Structure ==>

Displacement by concrete =	115.11	CF
Displacement by open air in riser =	237.50	CF
Displacement by trash rack =	61.74	CF
Total water displaced by riser/barrel structure =	***414.35***	***CF***
Weight of water displaced =	***25,855***	***lbs***

Calculate size of base for riser assembly ==>

Length =	9.00	feet
Width =	9.00	feet
Thickness =	30	inches
Concrete Present =	202.50	CF

Check validity of base as designed ==>

Total Water Displaced =	598.85	CF
Total Concrete Present =	317.61	CF
Total Water Displaced =	37,368	lbs
Total Concrete Present =	45,100	lbs
Actual safety factor =	*1.21*	OK

Results of design ==>

Base length =	**9.00**	**feet**
Base width =	**9.00**	**feet**
Base Thickness =	**30.00**	**inches**
CY of concrete total in base =	**7.50**	**CY**
Concrete unit weight in added base >=	**142.0**	**PCF**

STORMWATER CONTROL MEASURE
Anti-Flotation Block Calculations
SCM B

II. CALCULATION FOR RISER ANTI-FLOTATION STEEL

Input Data ==>

Anti-Floatation Block Length =	9.0	feet
Anti-Floatation Block Width =	9.0	feet
Anti-Floatation Block Thickness =	30	inches
A_{steel} to $A_{concrete}$ Ratio =	0.0020	(recommend 0.0018 or higher)

Cross-Section Calculations==>

Cross-Section Area* =	22.50	SF
Minimum Steel Area Required =	0.045	SF
	6.48	SI

**Note: Assumes a "square" x-sec (L and W same)*

Rebar Calculations ==>

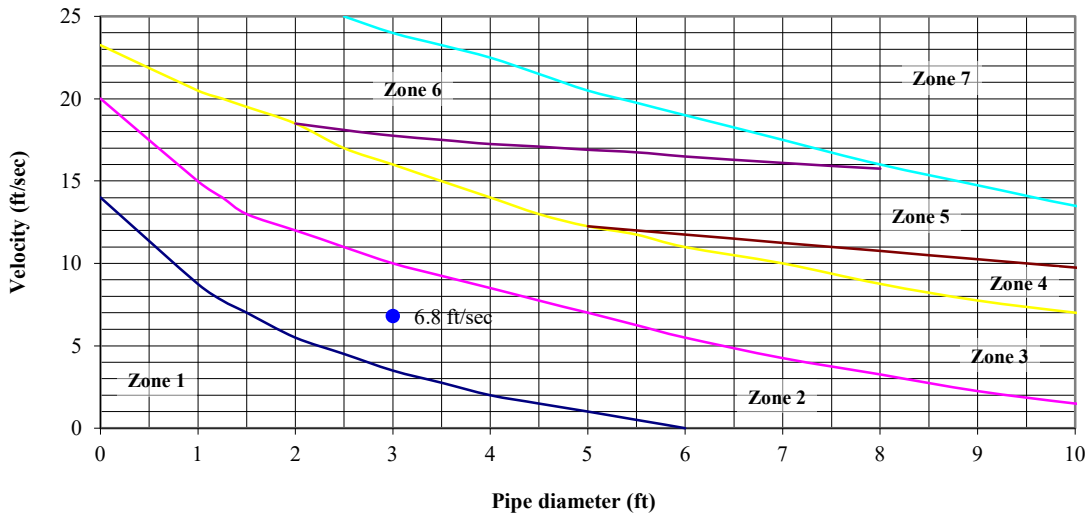
Bar Size	4	5	6	7	8
Diameter (inches)	0.500	0.625	0.750	0.875	1.000
X-Sec Area (SI)	0.196	0.307	0.442	0.601	0.785
Minimum Number of Bars	34	22	15	11	9

DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

Project	WALLBROOK	Date	7/18/2024
Project No.	CPR-19100	Designer	TKD
Outlet ID	SCM B		

Flow, $Q_{10\text{-}yr}$	12.37	cfs
Slope, S	0.85	%
Pipe Diameter, D_o	36	inches
Pipe Diameter, D_o	3.0	feet
Number of pipes	1	
Pipe separation	0	feet
Manning's n	0.013	

Figure 8.06.b.1



Zone from graph above = 2

Outlet pipe diameter	36 in.	Length =	18.0 ft.
Outlet flowrate	12.4 cfs	Width =	9.0 ft.
Outlet velocity	6.8 ft/sec	Stone diameter =	6 in.
Material =	Class B	Thickness =	22 in.

Zone	Material	Diameter	Thickness	Length	Width
1	Class A	3	9	4 x D(o)	3 x D(o)
2	Class B	6	22	6 x D(o)	3 x D(o)
3	Class I	13	22	8 x D(o)	3 x D(o)
4	Class I	13	22	8 x D(o)	3 x D(o)
5	Class II	23	27	10 x D(o)	3 x D(o)
6	Class II	23	27	10 x D(o)	3 x D(o)
7	Special study required				

1. Calculations based on NY DOT method - Pages 8.06.05 through 8.06.06 in NC Erosion Control Manual
2. Outlet velocity based on full-flow velocity