Stormwater Impact Analysis

The Point / AWH-20000 / February 2024

McADAMS

THE POINT

PACKAGE 3

ROLESVILLE, NORTH CAROLINA

STORMWATER IMPACT ANALYSIS AND FINAL DESIGN OF SCMs

CONSTRUCTION DRAWINGS

PLANNING #: SUP 18-09

PROJECT NUMBER: AWH-20000

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DATE: FEBRUARY 2024

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THE POINT

Stormwater Impact Analysis-CD Package 3

GENERAL DESCRIPTION

The Point is a proposed residential development in Rolesville, North Carolina, located between Highway 401 and East Young Street/Rolesville Road. The development is approximately 300 acres, divided into a northern parcel (to be developed at a later date) and a southern parcel. This Stormwater Impact Analysis covers the development of the southern parcel only. The development will consist of approximately 804 lots, a mixture of townhomes and various types of single-family housing, thirteen stormwater control measures, sidewalks, roadways, greenway trail, and associated infrastructure. These packages include 11 stormwater control measures in total; SCM A, B, C, D, E, F, G, H, I, J and P. SCMs associated with Packages 1 and 2 are included in the modeling shown in this report, to reflect CD Package 1 and 2 being fully constructed prior to the construction of CD Package 3.

There are three SCMs which will serve CD Package 3. Of the proposed SCM's to be serving CD Package 3, SCM K and L, are being built as part of CD Package 3. SCM J has been previously constructed in CD Package 2 andis also treating the stormwater for a portion of CD Package 3. This provides continual and uninterrupted treatment of stromwater through the entire construction of CD Package 3. The design calculations for the Culvert under Quarry Road is also included at the end of this SIA.

The project site is located in the Neuse River Basin, and drains to Harris Creek (Peeples Creek / Wake Crossroads Lake) (BIMS # 27-26) and is classified as C;NSW. Per Town of Rolesville regulations, stormwater management on this site shall meet the stormwater management performance standards for development set forth in the Rolesville Unified Development Ordinance Article 7, Section 7.5.4 – Standards.

The regulations are as follows:

(B) Standards Based on Project Density

(4) **Development Standards for High-Density Projects** High-Density Projects shall implement stormwater control measures that comply with each of the following standards, in addition to the General Standards found in subsection B of this Section:

(a) The measures shall control and treat runoff from the first inch of rain. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.

(b) All structural stormwater treatment systems used to meet these requirements shall be designed to have a minimum of 85 percent average annual removal for Total Suspended Solids (TSS).

(c) All Development and Redevelopment projects required to manage storm water shall provide permanent on-site BMPs to lower the nitrogen export amounts as part of the storm water management plan. BMPs are to be in accordance with and as specified in the Design Manual.

(d) Structural and Non-structural BMPs shall be used to ensure there is no net increase in peak flow leaving the site from the pre-Development conditions for the one-year, 24-hour storm. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.

(e) General engineering design criteria for all projects shall be in accordance with 15A NCAC 2H .1008(c), as explained in the Design Manual;

(f) All Development and Redevelopment shall be located outside the Riparian Buffer Zone and the Flood Protection Zone. These Zones shall be in accordance with the following provisions:

i. Except where other applicable buffer standards are more restrictive, the Riparian Buffer Zone shall extend a minimum of 50 feet landward of all Perennial and Intermittent Surface Waters. The most restrictive standards shall apply.
ii. The Riparian Buffer Zone shall remain undisturbed unless otherwise permitted by this section.
iii. The Flood Protection Zone shall extend throughout the FEMA 100-year floodplain as identified on the current Flood Insurance Rate Map (FIRM) published by FEMA. The Flood Protection Zone shall remain undisturbed unless otherwise permitted by this section.
iv. No Development or Redevelopment is permitted within the Riparian Buffer Zone or the Flood Protection Zone except for stream bank or shoreline restoration or stabilization, water dependent structures, and public or private projects such as road crossings and installations, utility crossings and installations, and greenways, where no practical alternatives exist.
v. Permitted activities within the Riparian Buffer Zone and the Flood Protection Zone shall minimize impervious coverage, direct runoff away from surface waters to achieve diffuse flow, and maximize the utilization of Non-structural BMPs.
vi. Where the Riparian Buffer Zone and the Flood Protection Zone both are present adjacent to surface waters, the more restrictive shall apply.

(g) The approval of the stormwater permit shall require an enforceable restriction on property usage that runs with the land, such as recorded deed restrictions or protective covenants, to ensure that future Development and Redevelopment maintains the site consistent with the approved project plans. Buffer widths and locations shall be clearly delineated on all plans, final plat, and as-builts.

(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.

(2) Standards for Stormwater Control Measures

(a) Evaluation According to Contents of Design Manual All stormwater control measures and stormwater treatment practices (or BMPs) required under this ordinance shall be evaluated by the Stormwater Administrator according to the policies, criteria, and information, including technical specifications and standards and the specific design criteria for each stormwater practice, in the Design Manual. The Stormwater Administrator shall determine whether proposed BMPs will be adequate to meet the requirements of this ordinance.

(b) Determination of Adequacy; Presumptions and Alternatives Stormwater treatment practices that are designed, constructed, and maintained in accordance with the criteria and specifications in the Design Manual will be presumed to meet the minimum water quality and quantity performance standards of this ordinance. Whenever an applicant proposes to utilize a practice or practices not designed and constructed in accordance with the criteria and specifications in the Design Manual, the applicant shall have the burden of demonstrating that the practice(s) will satisfy the minimum water quality and quantity performance standards of this ordinance. The Stormwater Administrator may require the applicant to provide the documentation, calculations, and examples necessary for the Stormwater Administrator to determine whether such an affirmative showing is made.

(c) Separation from Seasonal High Water Table For BMPs that require a separation from the seasonal high-water table, the separation shall be provided by at least 12 inches of naturally occurring soil above the seasonal high-water table.

CALCULATION METHODOLOGY

- Areas outside of the Package 1, 2 and 3 area have been assumed to be undeveloped for the purposes of this analysis.

- Rainfall data for this area in the Rolesville, NC region is from NOAA Atlas 14. This data contains a depth-duration-frequency (DDF) table describing rainfall depth versus time for varying return periods in the area. These rainfall depths are input into the meteorological model within PondPack for peak flow rate calculations. Please reference the precipitation information within the Miscellaneous Site Information section of this report for additional information.

- On-site and off-site soils were determined using best available GIS data sources.

- Soil Conservation Service Curve Numbers (SCS CN) were selected from Table 2 of the USDA TR-55 for the land use that is most similar to the zoning type or cover condition.

- Land cover conditions for the pre-development condition were taken from survey provided by WithersRavenel and aerial imagery for the site. Land cover conditions for the post-development condition were taken from the proposed layout. Offsite cover conditions were based on GIS-based zoning mapping, provided by the Town of Rolesville.

- The time of concentration was calculated using SCS TR-55 (Segmental Approach, 1986). The Tc flow path can be divided into three segments: overland flow, concentrated 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.

- Existing topographic information used in this analysis is from survey provided by WithersRavenel and QL2 LiDAR from North Carolina's Spatial Data Download.

- PondPack Version V8i was used in determining the pre- & post-development peak flow rates for the 1- and 10-year storm events, as well as routing calculations for the proposed stormwater control measures.

- For 100-year storm routing calculations, a "worst-case" condition was modeled in order to ensure the proposed facility would safely pass the 100-year storm event. The assumptions used in this scenario are as follows:

    - The starting water surface elevation in the facility, just prior to the 100-year storm event, is at the invert of the secondary orifice. This scenario could occur as a result of a clogged primary orifice or a rainfall event that lingers for several days. This could also occur as a result of several rainfall events in a series, before the low-flow orifice has an opportunity to draw down the storage pool.

    - Approximately 6-inches of freeboard is provided between the peak elevation during the "worst-case" scenario and the top of the dam for the proposed facility.

To meet the above Town of Rolesville standards, thirteen stormwater control measures (SCMs) have been proposed, 2 of which are included in CD Package 3 and thus outlined in this SIA.

DISCUSSION OF RESULTS

PEAK RUNOFF CONTROL REQUIREMENTS

As shown in the Summary of Results section of this SIA, the proposed stormwater control measures provide the necessary peak runoff control for the proposed build-out condition of the development such that there are no calculated increases in the 1- and 10-year storm events at any point of analysis leaving the site.

POLLUTANT AND NUTRIENT CONTROL REQUIREMENTS

The proposed SCM is designed to the Minimum Design Criteria of the NCDEQ Stormwater Design Manual. Therefore, the proposed development is treated for 85% TSS removal and provides nitrogen and phosphorus treatment.

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 without additional stormwater management facilities. 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.

1	SUMMARY OF RESULTS
2	MISCELANEOUS SITE INFORMATION
3	PRE-DEVELOPMENT HYDROLOGIC CALCULATIONS
4	POST-DEVELOPMENT HYDROLOGIC CALCULATIONS
5	STORMWATER CONTROL MEASURE 'K' DESIGN FILES
6	STORMWATER CONTROL MEASURE 'L' DESIGN FILES
7	STORMWATER CONTROL MEASURE 'J' DESIGN FILES
8	CULVERT DESIGN CALCULATIONS

SUMMARY OF RESULTS

SUMMARY OF RESULTS

RELEASE RATE MANAGEMENT RESULTS

POINT OF ANALYSIS #1			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**% Increase** [%]
1-Year	283.5	219.4	-23%
10-Year	545.3	514.0	-6%

POINT OF ANALYSIS #2			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**% Increase** [%]
1-Year	77.3	70.0	-9%
10-Year	153.0	138.6	-9%

POINT OF ANALYSIS #3			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**% Increase** [%]
1-Year	8.7	6.7	-23%
10-Year	22.3	16.6	-26%

POINT OF ANALYSIS #4			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**% Increase** [%]
1-Year	344.2	248.9	-28%
10-Year	704.1	636.3	-10%

POINT OF ANALYSIS #5			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**% Increase** [%]
1-Year	359.7	241.2	-33%
10-Year	787.2	611.7	-22%

POINT OF ANALYSIS #6			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**% Increase** [%]
1-Year	704.0	485.3	-31%
10-Year	1494.8	1231.6	-18%

POINT OF ANALYSIS #7			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**% Increase** [%]
1-Year	2.5	2.5	0%
10-Year	17.2	8.6	-50%

POINT OF ANALYSIS #8			
Return Period	**Pre-Dev** [cfs]	**Post-Dev** [cfs]	**% Increase** [%]
1-Year	0.2	0.6	200%
10-Year	4.3	3.7	-14%

SUMMARY OF RESULTS
SCM J

STORMWATER CONTROL MEASURE 'J' SUMMARY

Design Drainage Area =	14.20	ac
Design Impervious Area =	8.14	ac
% Impervious =	57.3%	
Top of Dam =	316.00	ft
NWSE =	310.00	ft
WQv Ponding Elevation =	311.74	ft
Required Main Pool Surface Area at NWSE =	9,746	sf
Provided Main Pool Surface Area at NWSE =	10,197	sf
WQv Orifice Diameter =	2.25	in
WQv Orifice Invert Elevation =	310.00	ft
Riser Size =	5' x 5'	
Riser Crest =	314.00	ft
Number of Orifices =	1	
Orifice Invert El. =	313.00	ft
Orifice Dimensions =	4'W X 0.5'H	
Barrel Diameter =	36	in
# of Barrels =	1	
Upstream Invert =	309.50	ft
Downstream Invert =	309.00	ft
Length =	50	ft
Slope =	0.0100	ft/ft

STORMWATER CONTROL MEASURE 'J' ROUTING RESULTS

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	39.4	1.0	313.16	2.84
10-Year	75.4	21.0	314.19	1.81
25-Year	87.8	45.7	314.59	1.41
100-Year	105.8	69.8	315.00	1.00
100-Year Worst Case	105.8	76.4	315.26	0.74

SUMMARY OF RESULTS
SCM K

STORMWATER CONTROL MEASURE 'K' SUMMARY

Design Drainage Area =	16.19	ac
Design Impervious Area =	9.12	ac
% Impervious =	56.3%	
Top of Dam =	306.00	ft
NWSE =	298.00	ft
WQv Ponding Elevation =	299.74	ft
Required Main Pool Surface Area at NWSE =	13,038	sf
Provided Main Pool Surface Area Provided at NWSE =	13,097	sf
WQv Orifice Diameter =	2.50	in
WQv Orifice Invert Elevation =	298.00	ft
Riser Size =	4' x 4'	
Riser Crest =	304.00	ft
Number of Orifices =	1	
Orifice Invert El. =	302.25	ft
Orifice Dimensions =	3'W X 0.5'H	
Barrel Diameter =	24	in
# of Barrels =	1	
Upstream Invert =	297.00	ft
Downstream Invert =	294.00	ft
Length =	69	ft
Slope =	0.0435	ft/ft

STORMWATER CONTROL MEASURE 'K' ROUTING RESULTS

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	49.4	0.3	301.79	4.21
10-Year	90.1	7.2	303.40	2.60
25-Year	104.0	14.9	304.22	1.78
100-Year	123.9	35.9	304.66	1.34
100-Year Worst Case	123.9	35.2	304.81	1.19

SUMMARY OF RESULTS
SCM L

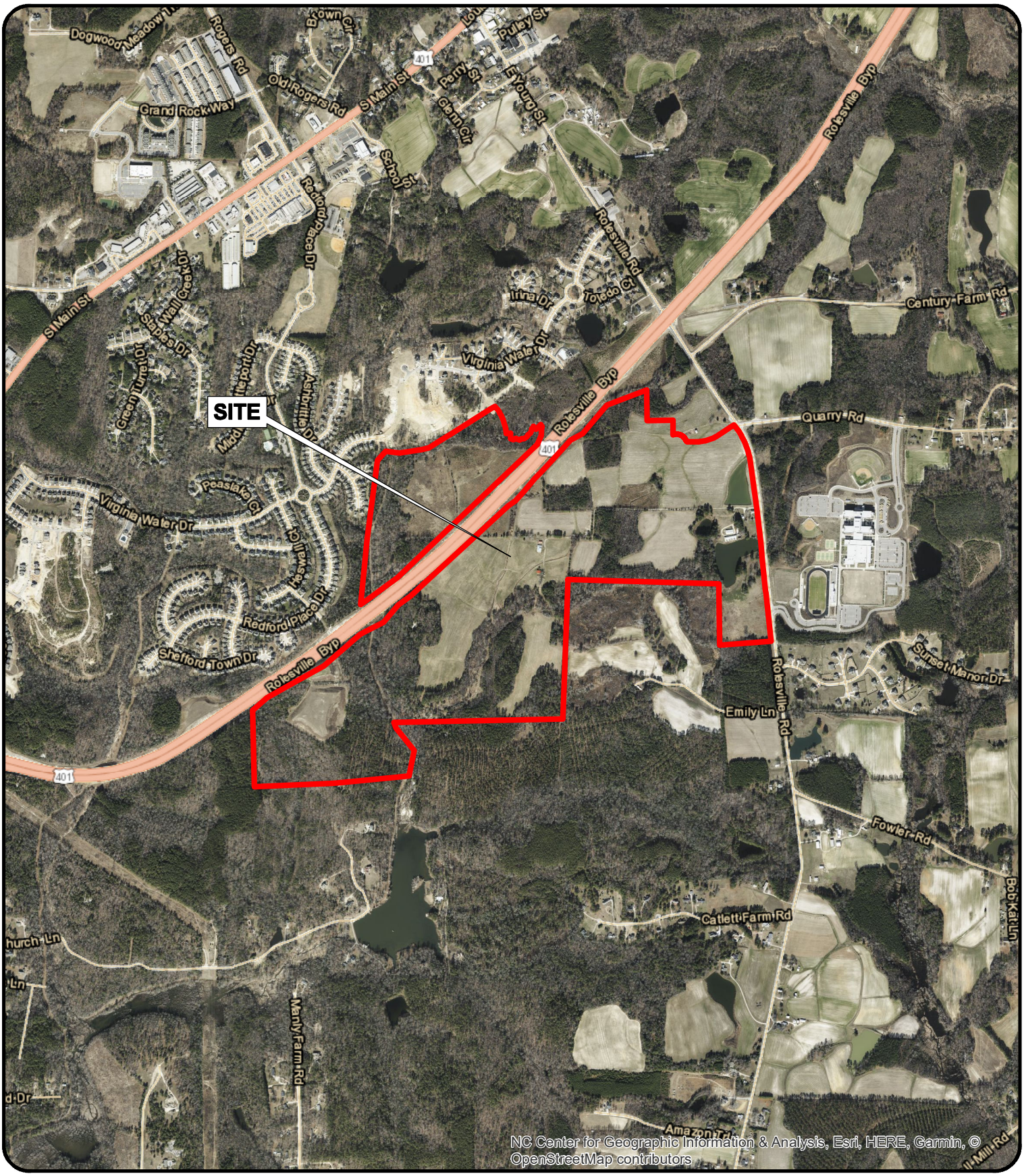
STORMWATER CONTROL MEASURE 'L' SUMMARY

Design Drainage Area =	16.04	ac
Design Impervious Area =	7.65	ac
% Impervious =	47.7%	
Top of Dam =	346.00	ft
NWSE =	340.00	ft
WQv Ponding Elevation =	341.45	ft
Required Main Pool Surface Area at NWSE =	11,509	sf
Total Main Pool Surface Area Provided at NWSE =	13,587	sf
WQv Orifice Diameter =	2.50	in
WQv Orifice Invert Elevation =	340.00	ft
Riser Size =	5' x 5'	
Riser Crest =	344.00	ft
Number of Orifices =	1	
Orifice Invert El. =	343.00	ft
Orifice Dimensions =	4'W X 0.5'H	
Barrel Diameter =	36	in
# of Barrels =	1	
Upstream Invert =	339.50	ft
Downstream Invert =	338.00	ft
Length =	50	ft
Slope =	0.0300	ft/ft

STORMWATER CONTROL MEASURE 'L' ROUTING RESULTS

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	28.4	0.2	342.28	3.72
10-Year	67.2	6.8	343.71	2.29
25-Year	81.9	17.9	344.26	1.74
100-Year	103.6	41.0	344.62	1.38
100-Year Worst Case	103.6	38.1	344.74	1.26

MISCELLANEOUS SITE INFORMATION



N

0 750 1,500 3,000 Feet

1 inch = 1,500 feet

THE POINT

SITE AERIAL MAP

PROJECT #: AWH-20000

ROLESVILLE, NORTH CAROLINA

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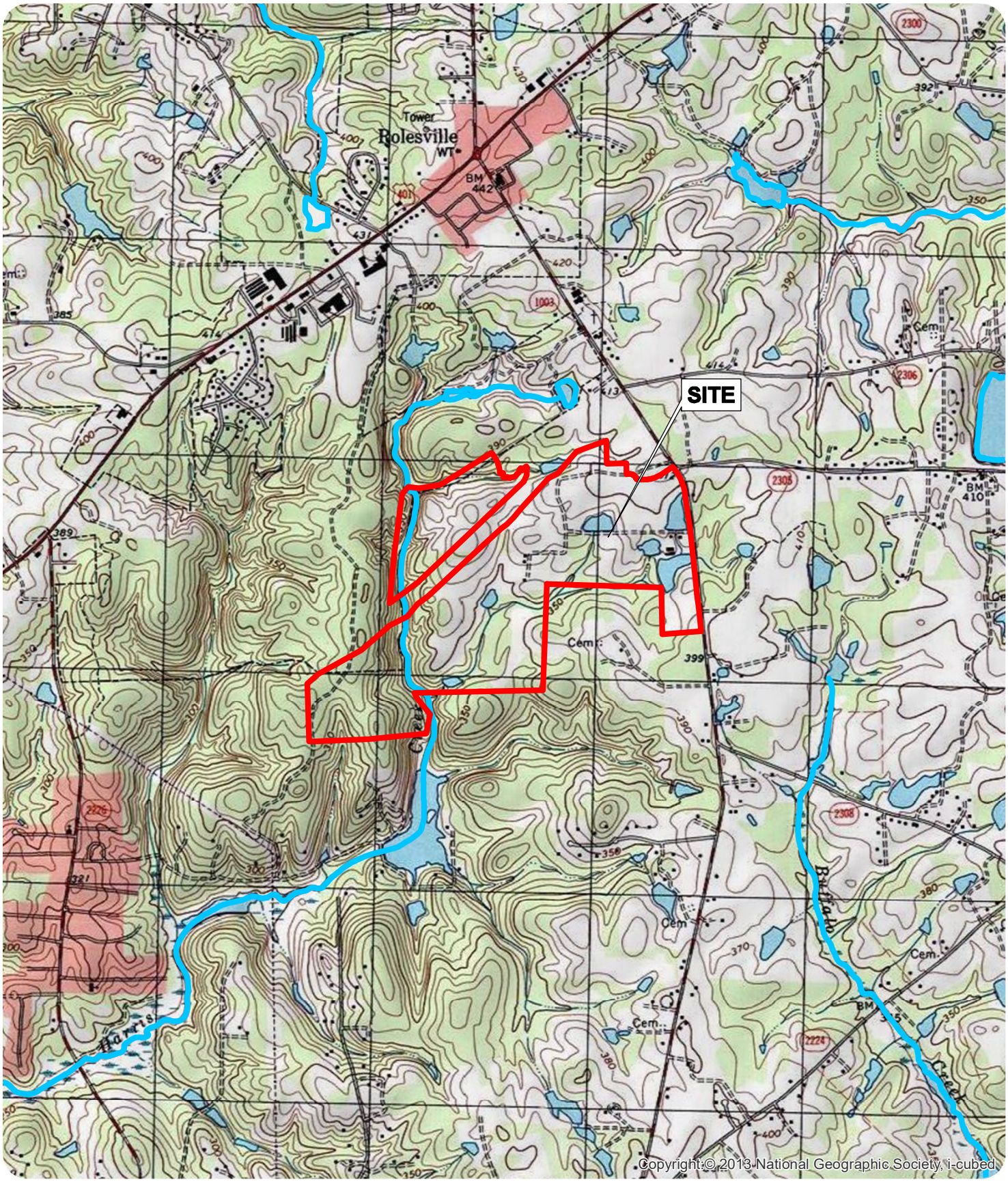

N

0 1,000 2,000 4,000 Feet

1 inch = 2,000 feet

THE POINT

USGS TOPO MAP

PROJECT #: AWH-20000

ROLESVILLE, NORTH CAROLINA

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. 0315 NEUSE RIVER BASIN

Name of Stream	Description	Class	Class Date	Index No.
NEUSE RIVER	From a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake to Town of Wake Forest proposed water supply intake	WS-IV;NSW,CA	07/01/04	27-(22)
NEUSE RIVER	From Town of Wake Forest proposed water supply intake to mouth of Beddingfield Creek	C;NSW	08/03/92	27-(22.5)
Smith Creek	From source to a point 0.3 mile downstream of Franklin-Wake County Line	WS-II;HQW,NSW	08/03/92	27-23-(1)
Smith Creek (Wake Forest Reservoir)	From a point 0.3 mile downstream of Franklin-Wake County Line to dam at Wake Reservoir	WS-II;HQW,NSW, CA	08/03/92	27-23-(1.5)
Smith Creek	From dam at Wake Forest Reservoir to Neuse River	C;NSW	05/01/88	27-23-(2)
Austin Creek (Mitchell Pond)	From source to Smith Creek	C;NSW	07/01/96	27-23-3
Hatters Branch	From source to Smith Creek	C;NSW	05/01/88	27-23-4
Spring Branch	From source to Hatters Branch	C;NSW	05/01/88	27-23-4-1
Sanford Creek	From source to Smith Creek	C;NSW	05/01/88	27-23-5
Toms Creek (Mill Creek)	From source to Neuse River	C;NSW	05/01/88	27-24
Perry Creek (Greshams Lake)	From source to dam at Greshams Lake	B;NSW	05/01/88	27-25-(1)
Perry Creek	From dam at Greshams Lake to Neuse River	C;NSW	05/01/88	27-25-(2)
Unnamed Tributary near Neuse	From source to dam at Camp Durant	B;NSW	05/01/88	27-25-3-(1)
Unnamed Tributary near Neuse	From dam at Camp Durant to Perry Creek	C;NSW	05/01/88	27-25-3-(2)
Harris Creek (Peeples Creek) (Wake Crossroads Lake)	From source to Neuse River	C;NSW	05/01/88	27-26
Hodges Mill Creek (Lake Mirl)	From source to water intake at Lake Mirl	B;NSW	05/01/88	27-26-1-(1)
Hodges Mill Creek	From water intake at Lake Mirl to Harris Creek	C;NSW	05/01/88	27-26-1-(2)
Beaverdam Creek (west side of Neuse River)	From source to Neuse River	C;NSW	05/01/88	27-27
Rocky Creek	From source to Neuse River	C;NSW	05/01/88	27-28
Beaverdam Creek (east side of Neuse River) (Neuseco Lake, Beaverdam Lake)	From soruce to Neuse River	C;NSW	05/01/88	27-29
Bridges Creek (Bridges Lake)	From source to Neuse River	C;NSW	05/01/88	27-30
Milburnie Creek (Milburnie Lake)	From source to Neuse River	C;NSW	05/01/88	27-31
Mango Creek	From source to Neuse River	C;NSW	05/01/88	27-32
Crabtree Creek	From source to backwaters of Crabtree Lake	C;NSW	05/01/88	27-33-(1)
Turkey Creek	From source to Crabtree Creek	C;NSW	05/01/88	27-33-2
Coles Branch	From source to Crabtree Creek	C;NSW	05/01/88	27-33-3
South Fork Coles Branch	From source to Coles Branch	C;NSW	05/01/88	27-33-3-1
Crabtree Creek (Crabtree Lake)	From backwaters of Crabtree Lake to mouth of Richlands Creek	B;NSW	04/01/94	27-33-(3.5)

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 FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://FRIS.NC.GOV/FRIS
HTTPS://MSC.FEMA.GOV

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
	Levee, Dike, or Floodwall
	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 https://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 https://flood.nc.gov/ncflood, 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.

Flood Insurance Study (FIS) means an examination, evaluation, and determination of flood hazards, corresponding water surface elevations, flood hazard risk zones, and other flood data in a community issued by the North Carolina Floodplain Mapping Program (NCFMP). The Flood Insurance Study (FIS) is comprised of the following products used together: the Digital Flood Hazard Database, the Water Surface Elevation Rasters, the digitally derived, autogenerated Flood Insurance Rate Map and the Flood Insurance Survey Report. A Flood Insurance Survey is a compilation and presentation of flood risk data for specific watercourses, lakes, and coastal flood hazard areas within a community. This report contains detailed flood elevation data, data tables and FIRM indices. When a flood study is completed for the NFIP, the digital information, reports and maps are assembled into an FIS. Information shown on this FIRM is provided in digital format by the NCFMP. Base map information shown on this FIRM was provided in digital format by the 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 for areas on this panel. 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 https://www.fema.gov/national-flood-insurance-program.

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 for areas on this panel. 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 indicate 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 https://www.fema.gov/national-flood-insurance-program.

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)

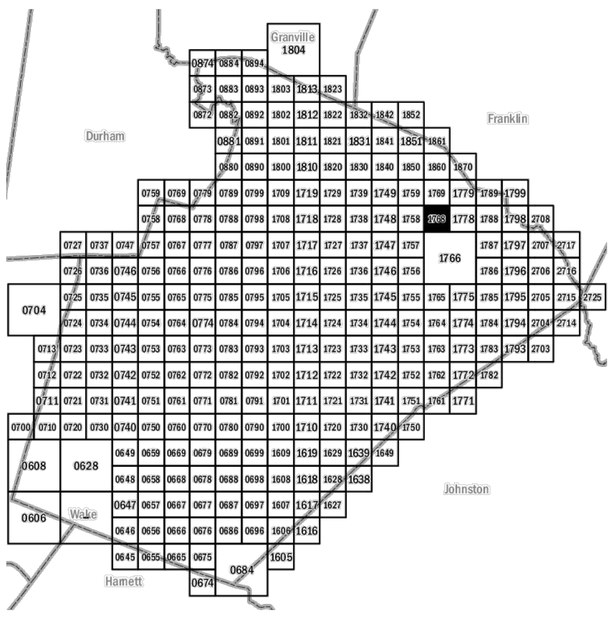
SCALE

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 **1768**

Panel Contains:

COMMUNITY	CID	PANEL	SUFFIX
ROLESVILLE, TOWN OF	370468	1768	K
WAKE COUNTY	370368	1768	K

VERSION NUMBER
2.3.3.2

MAP NUMBER
3720176800K

MAP REVISED
July 19, 2022

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 FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://FRIS.NC.GOV/FRIS
HTTPS://MSC.FEMA.GOV

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
	Levee, Dike, or Floodwall
	012 18.2 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
OTHER FEATURES	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 https://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 https://flood.nc.gov/ncflood, 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.

Flood Insurance Study (FIS) means an examination, evaluation, and determination of flood hazards, corresponding water surface elevations, flood hazard risk zones, and other flood data in a community issued by the North Carolina Floodplain Mapping Program (NCFMP). The Flood Insurance Study (FIS) is comprised of the following products used together: the Digital Flood Hazard Database, the Water Surface Elevation Rasters, the digitally derived, autogenerated Flood Insurance Rate Map and the Flood Insurance Survey Report. A Flood Insurance Survey is a compilation and presentation of flood risk data for specific watercourses, lakes, and coastal flood hazard areas within a community. This report contains detailed flood elevation data, data tables and FIRM indices. When a flood study is completed for the NFIP, the digital information, reports and maps are assembled into an FIS. Information shown on this FIRM is provided in digital format by the NCFMP. Base map information shown on this FIRM was provided in digital format by the 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 for areas on this panel. 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 https://www.fema.gov/national-flood-insurance-program.

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 for areas on this panel. 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 indicate 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 https://www.fema.gov/national-flood-insurance-program.

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)

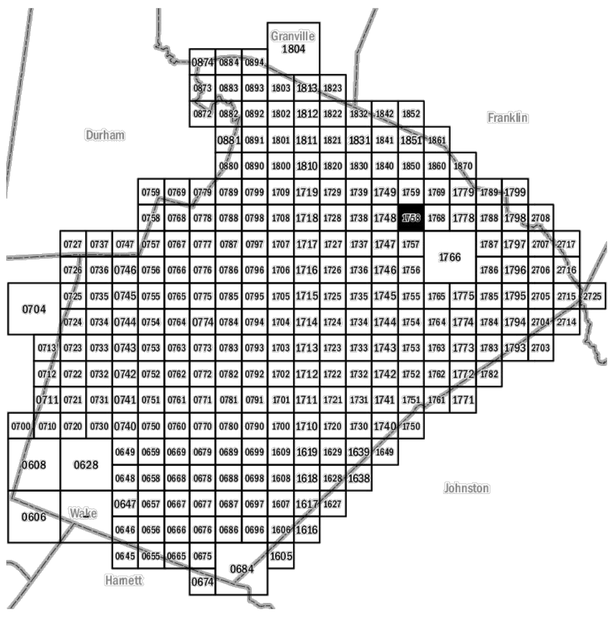
SCALE

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

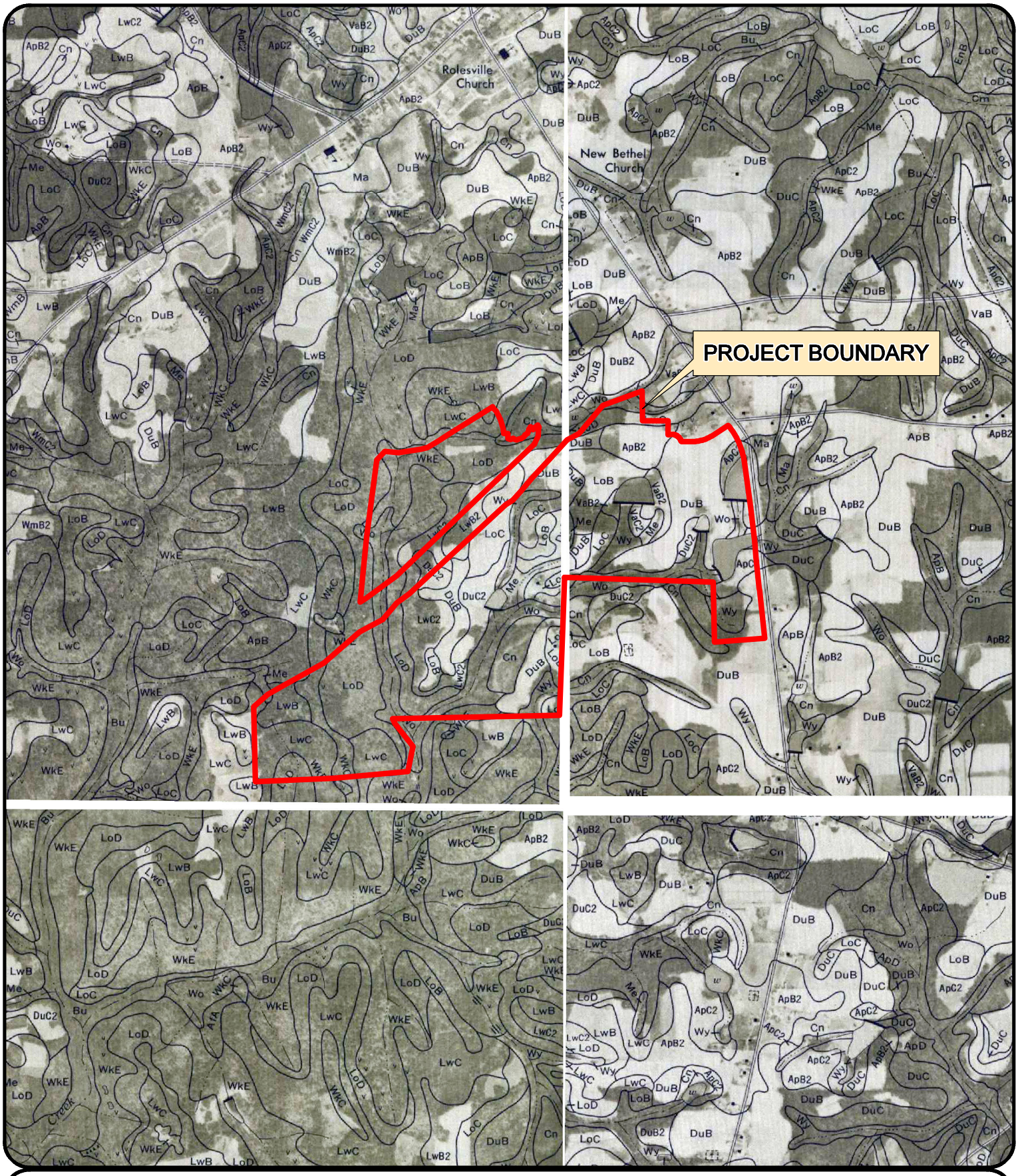
Panel Contains:

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

VERSION NUMBER
2.3.3.2

MAP NUMBER
3720175800K

MAP REVISED
July 19, 2022



N

0 750 1,500 3,000 Feet

1 inch = 1,500 feet

THE POINT

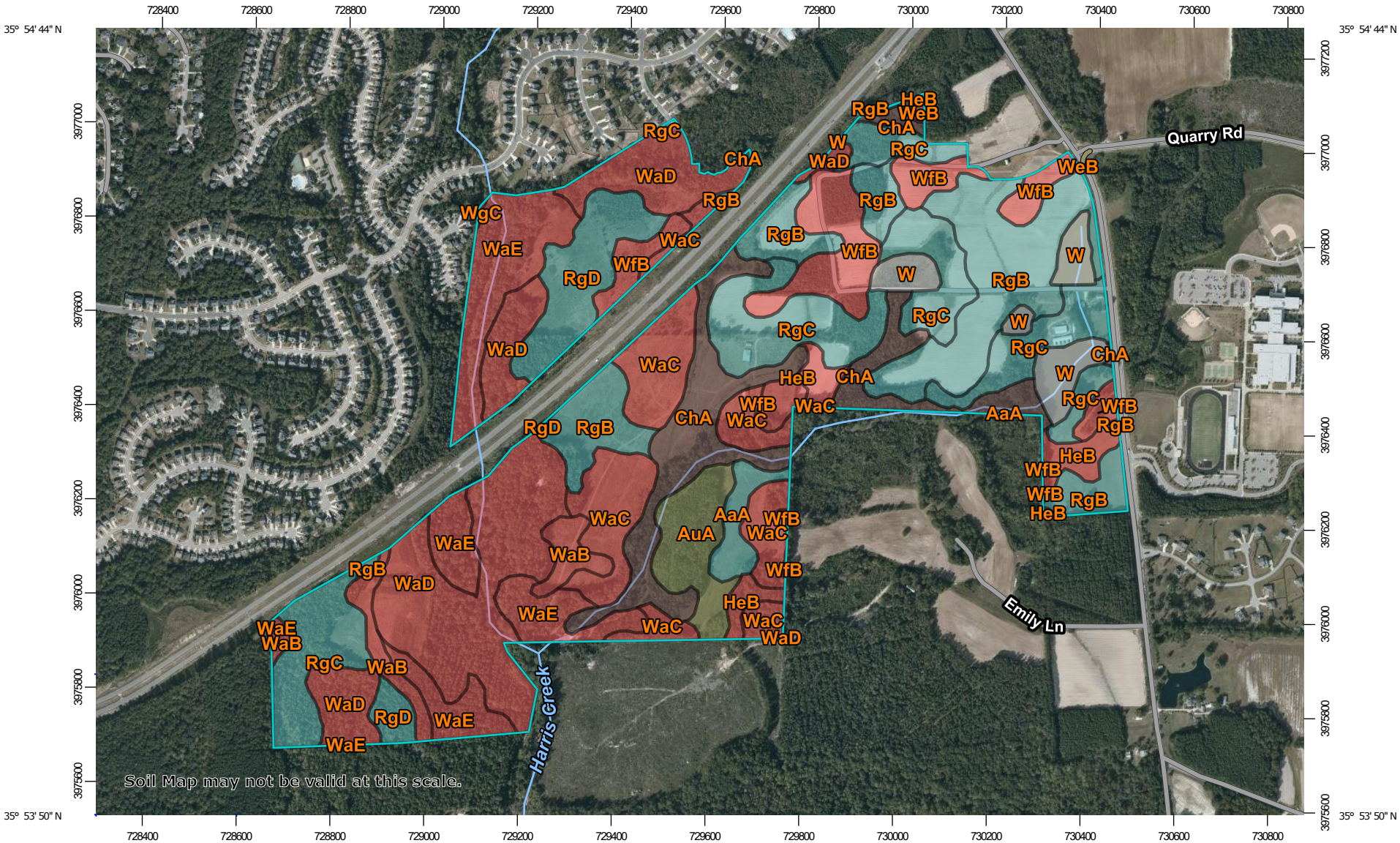
SOIL MAP

PROJECT #: AWH-20000

ROLESVILLE, NORTH CAROLINA

McADAMS

Hydrologic Soil Group—Wake County, North Carolina
(Property Line)



Map Scale: 1:11,800 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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 18, Sep 16, 2019

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
AaA	Altavista fine sandy loam, 0 to 4 percent slopes, rarely flooded	C	4.1	1.4%
AuA	Augusta fine sandy loam, 0 to 2 percent slopes, rarely flooded	C/D	10.1	3.3%
ChA	Chewacla and Wehadkee soils, 0 to 2 percent slopes, frequently flooded	B/D	27.0	8.9%
HeB	Helena sandy loam, 2 to 6 percent slopes	D	7.1	2.4%
RgB	Rawlings-Rion complex, 2 to 6 percent slopes	C	43.5	14.4%
RgC	Rawlings-Rion complex, 6 to 10 percent slopes	C	45.6	15.1%
RgD	Rawlings-Rion complex, 10 to 15 percent slopes	C	15.0	5.0%
W	Water		9.7	3.2%
WaB	Wake-Rolesville complex, 2 to 6 percent slopes, very rocky	D	7.4	2.4%
WaC	Wake-Rolesville complex, 6 to 10 percent slopes, very rocky	D	29.0	9.6%
WaD	Wake-Rolesville complex, 10 to 15 percent slopes, very rocky	D	51.1	16.9%
WaE	Wake-Rolesville complex, 15 to 25 percent slopes, very rocky	D	28.9	9.6%
WeB	Wedowee sandy loam, 2 to 6 percent slopes	D	0.2	0.1%
WfB	Wedowee-Saw complex, 2 to 6 percent slopes	D	22.9	7.6%
WgC	Wedowee-Urban land complex, 6 to 15 percent slopes	D	0.1	0.0%
Totals for Area of Interest			**301.6**	**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

NOAA Atlas 14, Volume 2, Version 3
Location name: Wake Forest, North Carolina, USA*
Latitude: 35.9053°, Longitude: -78.452°
Elevation: 354.67 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 (0.369-0.442)	0.468 (0.429-0.512)	0.534 (0.489-0.582)	0.600 (0.548-0.654)	0.666 (0.606-0.726)	0.718 (0.651-0.783)	0.765 (0.690-0.834)	0.807 (0.723-0.881)	0.853 (0.758-0.932)	0.895 (0.789-0.979)
10-min	0.644 (0.590-0.705)	0.749 (0.687-0.818)	0.855 (0.783-0.933)	0.959 (0.877-1.05)	1.06 (0.966-1.16)	1.14 (1.04-1.25)	1.22 (1.10-1.33)	1.28 (1.15-1.40)	1.35 (1.20-1.47)	1.41 (1.24-1.54)
15-min	0.806 (0.738-0.882)	0.942 (0.863-1.03)	1.08 (0.991-1.18)	1.21 (1.11-1.32)	1.35 (1.22-1.47)	1.45 (1.31-1.58)	1.54 (1.39-1.68)	1.61 (1.45-1.76)	1.70 (1.51-1.86)	1.77 (1.56-1.94)
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 (1.98-2.38)	2.35 (2.12-2.57)	2.51 (2.25-2.74)	2.70 (2.40-2.95)	2.87 (2.52-3.14)
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 (2.42-2.89)	2.96 (2.68-3.22)	3.24 (2.92-3.53)	3.52 (3.16-3.85)	3.88 (3.45-4.24)	4.18 (3.69-4.58)
2-hr	1.61 (1.46-1.78)	1.92 (1.75-2.10)	2.34 (2.13-2.56)	2.75 (2.49-3.01)	3.23 (2.91-3.54)	3.66 (3.28-4.00)	4.07 (3.63-4.45)	4.49 (3.98-4.91)	5.04 (4.42-5.51)	5.52 (4.80-6.05)
3-hr	1.71 (1.55-1.89)	2.03 (1.85-2.24)	2.49 (2.26-2.74)	2.94 (2.67-3.24)	3.50 (3.15-3.84)	3.99 (3.58-4.39)	4.49 (3.98-4.92)	5.00 (4.41-5.48)	5.69 (4.96-6.24)	6.32 (5.45-6.95)
6-hr	2.05 (1.87-2.26)	2.44 (2.23-2.68)	2.99 (2.72-3.28)	3.54 (3.22-3.88)	4.22 (3.82-4.62)	4.84 (4.35-5.29)	5.46 (4.86-5.96)	6.12 (5.39-6.67)	7.00 (6.10-7.64)	7.82 (6.72-8.55)
12-hr	2.41 (2.21-2.66)	2.87 (2.64-3.15)	3.54 (3.24-3.88)	4.21 (3.84-4.62)	5.07 (4.59-5.53)	5.85 (5.26-6.36)	6.64 (5.91-7.22)	7.49 (6.59-8.14)	8.66 (7.50-9.41)	9.76 (8.32-10.6)
24-hr	2.86 (2.66-3.08)	3.46 (3.22-3.73)	4.35 (4.04-4.69)	5.06 (4.69-5.44)	6.02 (5.57-6.49)	6.80 (6.27-7.32)	7.60 (6.98-8.19)	8.43 (7.71-9.09)	9.58 (8.71-10.3)	10.5 (9.50-11.3)
2-day	3.32 (3.09-3.57)	3.99 (3.72-4.30)	4.98 (4.64-5.37)	5.77 (5.35-6.21)	6.83 (6.32-7.36)	7.68 (7.09-8.27)	8.56 (7.87-9.22)	9.46 (8.66-10.2)	10.7 (9.74-11.6)	11.7 (10.6-12.7)
3-day	3.52 (3.28-3.77)	4.23 (3.94-4.54)	5.25 (4.89-5.63)	6.06 (5.64-6.50)	7.17 (6.64-7.69)	8.05 (7.44-8.64)	8.96 (8.25-9.62)	9.89 (9.07-10.6)	11.2 (10.2-12.1)	12.2 (11.1-13.2)
4-day	3.72 (3.47-3.98)	4.46 (4.17-4.77)	5.52 (5.15-5.90)	6.35 (5.92-6.79)	7.50 (6.96-8.01)	8.42 (7.79-9.00)	9.36 (8.63-10.0)	10.3 (9.49-11.1)	11.7 (10.7-12.5)	12.7 (11.6-13.7)
7-day	4.31 (4.04-4.61)	5.15 (4.82-5.50)	6.29 (5.88-6.71)	7.19 (6.72-7.68)	8.43 (7.85-9.00)	9.42 (8.75-10.1)	10.4 (9.66-11.2)	11.5 (10.6-12.3)	12.9 (11.8-13.9)	14.1 (12.8-15.1)
10-day	4.91 (4.61-5.24)	5.85 (5.48-6.23)	7.04 (6.60-7.50)	7.99 (7.47-8.50)	9.26 (8.64-9.86)	10.3 (9.55-10.9)	11.3 (10.5-12.0)	12.3 (11.4-13.2)	13.7 (12.6-14.7)	14.8 (13.6-15.9)
20-day	6.59 (6.20-7.02)	7.79 (7.32-8.29)	9.23 (8.67-9.81)	10.4 (9.72-11.0)	11.9 (11.1-12.7)	13.1 (12.2-14.0)	14.3 (13.3-15.3)	15.6 (14.5-16.6)	17.3 (16.0-18.5)	18.6 (17.1-19.9)
30-day	8.18 (7.72-8.69)	9.63 (9.08-10.2)	11.2 (10.6-11.9)	12.5 (11.7-13.2)	14.1 (13.2-15.0)	15.4 (14.4-16.3)	16.6 (15.5-17.7)	17.9 (16.7-19.0)	19.5 (18.1-20.9)	20.8 (19.3-22.3)
45-day	10.4 (9.89-11.0)	12.2 (11.6-12.9)	14.0 (13.3-14.8)	15.4 (14.6-16.2)	17.2 (16.3-18.1)	18.6 (17.5-19.6)	19.9 (18.7-21.0)	21.2 (19.9-22.5)	23.0 (21.5-24.4)	24.3 (22.7-25.8)
60-day	12.5 (11.9-13.1)	14.6 (13.9-15.4)	16.6 (15.7-17.4)	18.1 (17.1-19.0)	20.0 (19.0-21.1)	21.5 (20.3-22.6)	22.9 (21.6-24.1)	24.2 (22.9-25.6)	26.0 (24.5-27.5)	27.4 (25.7-29.0)

[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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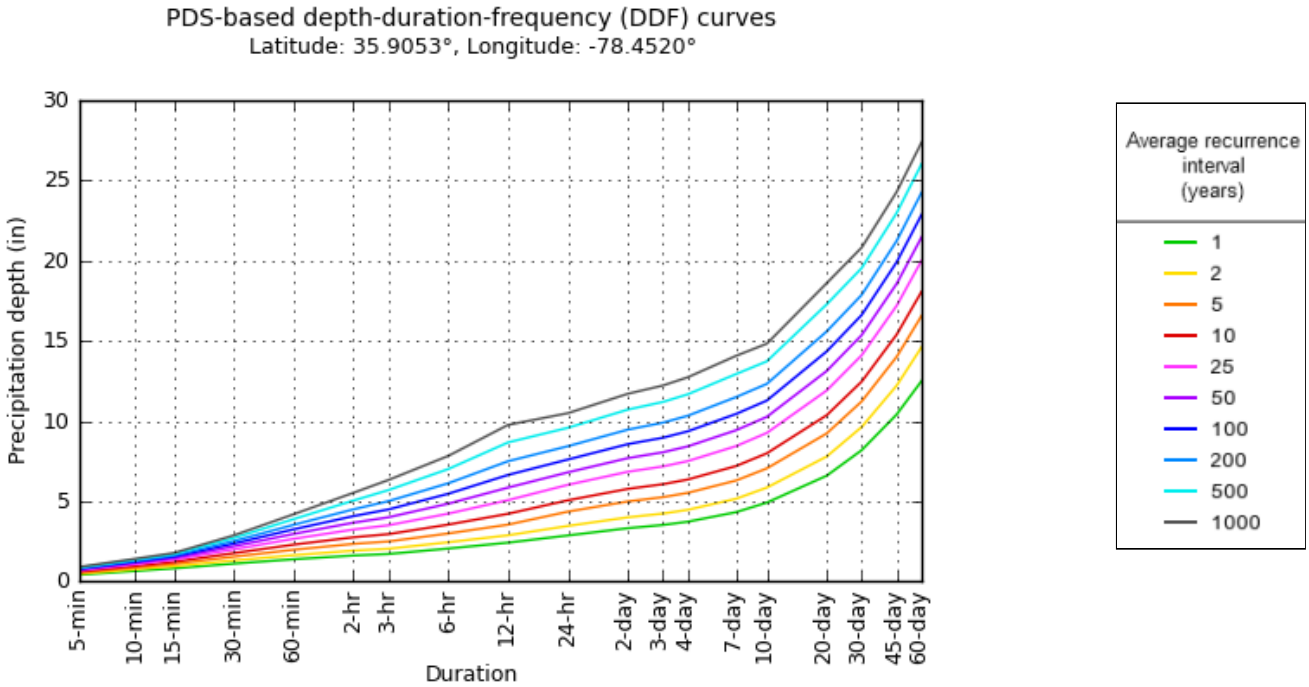
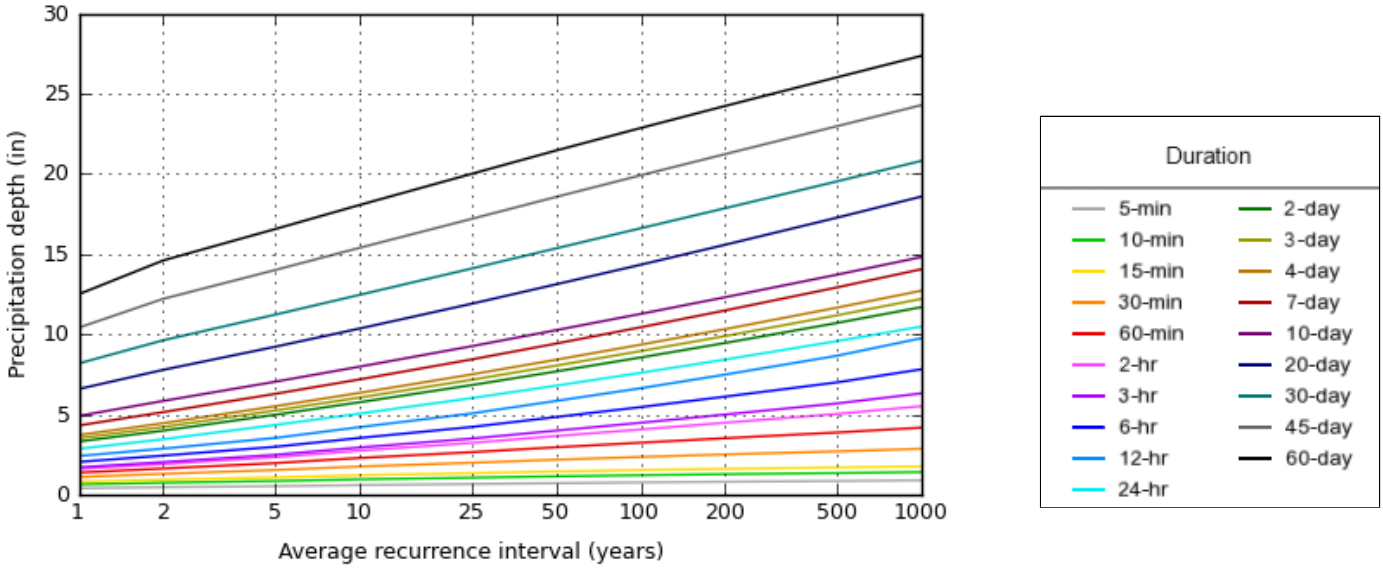
PF graphical





NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Wed Jun 3 19:09:38 2020

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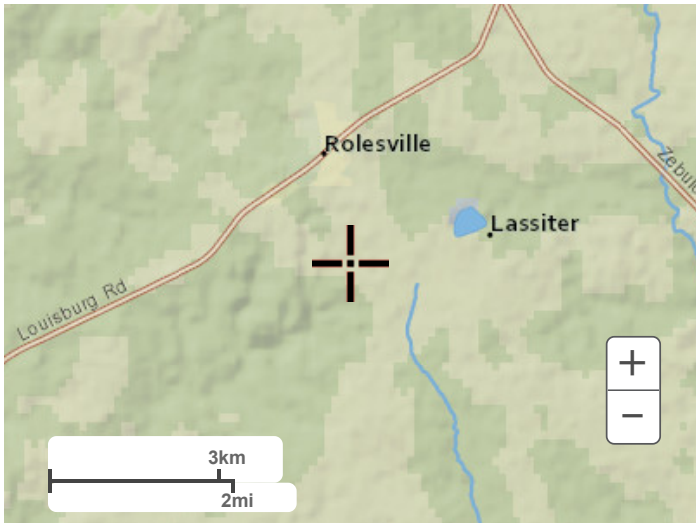
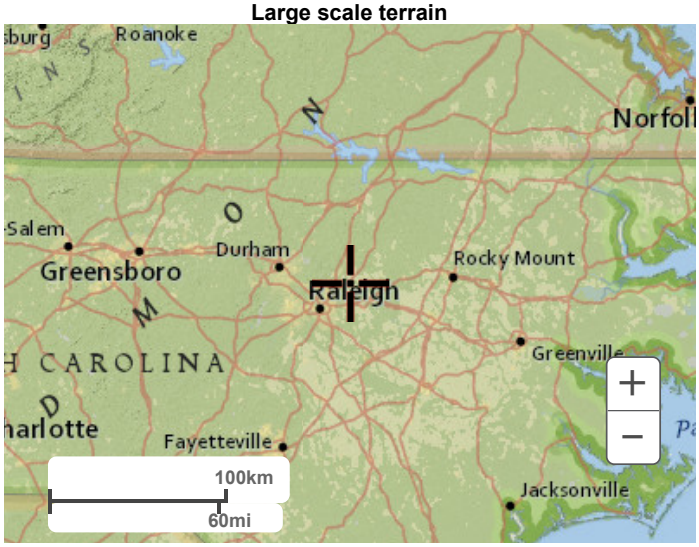
Maps & aerials

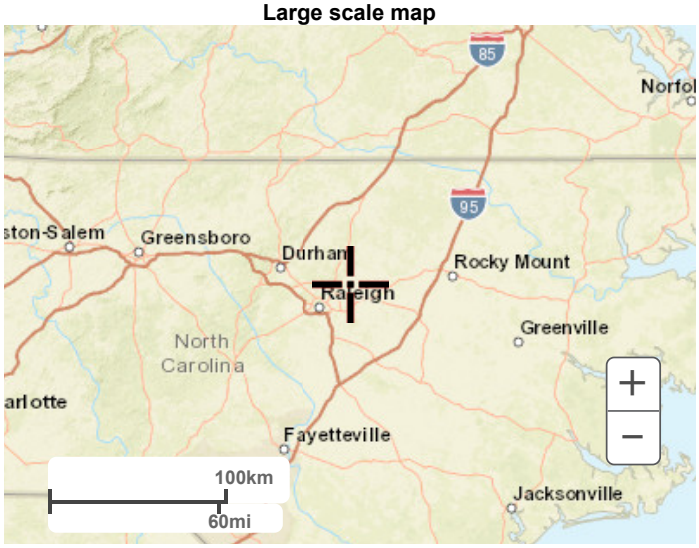
Small scale terrain



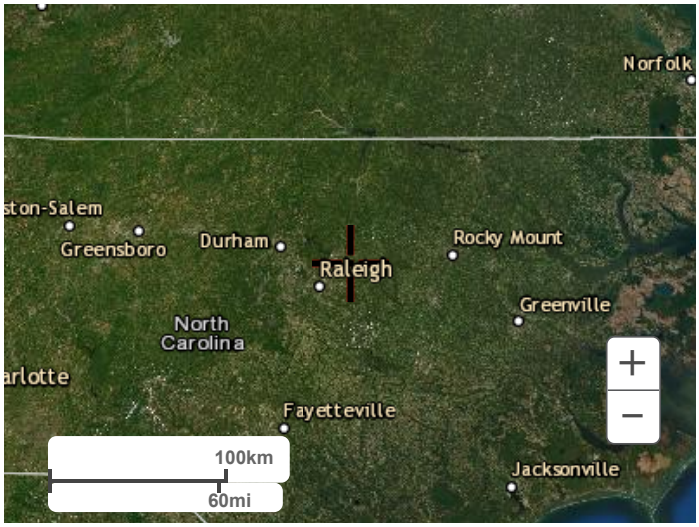
Large scale terrain



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

PRE-DEVELOPMENT HYDROLOGIC CALCULATIONS

The Point
AWH-20000

PRE-DEVELOPMENT HYDROLOGY
Subbasin 1

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Total Area (ac)
Crops	B	78	Yes	0	0.00	23.79
Crops	B/D	89	Yes	0	0.00	0.13
Crops	D	89	Yes	0	0.00	6.70
Low Density Residential	B	68		20	0.06	0.29
Low Density Residential	D	84		20	4.53	22.63
Medium Density Residential	B	70		25	0.29	1.14
Medium Density Residential	D	85		25	0.02	0.08
Mixed Use Neighborhood	B	85		65	9.26	14.25
Mixed Use Neighborhood	B/D	92		65	2.68	4.12
Mixed Use Neighborhood	C	90		65	1.16	1.79
Mixed Use Neighborhood	D	92		65	10.60	16.30
Open	B	61	Yes	0	0.00	16.63
Open	B/D	80	Yes	0	0.00	0.38
Open	D	80	Yes	0	0.00	8.88
Pond	B	100	Yes	0	0.00	0.13
Pond	B/D	100	Yes	0	0.00	0.02
Pond	D	100	Yes	0	0.00	6.78
Roadway		98		100	7.98	7.98
Roof	B	98	Yes	100	0.35	0.35
Roof	D	98	Yes	100	0.00	0.00
School	B	88		72	12.90	17.91
School	B/D	93		72	6.11	8.49
School	D	93		72	43.84	60.89
Trail	B	82	Yes	100	0.52	0.52
Trail	B/D	89	Yes	100	0.01	0.01
Trail	D	89	Yes	100	0.11	0.11
Wooded	B	55	Yes	0	0.00	8.52
Wooded	B/D	77	Yes	0	0.00	6.40
Wooded	C	70	Yes	0	0.00	0.03
Wooded	D	77	Yes	0	0.00	1.61

Total Area	**236.88**	**ac**
Total Impervious Area	**100.42**	**ac**
Onsite Area	**81.00**	**ac**
Onsite Impervious Area	**0.99**	**ac**
Percent Impervious	**42**	**%**
Composite Curve Number	**89**	

PRE-DEVELOPMENT HYDROLOGY
Subbasin 1

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 =	426.00	ft
Bot Elev =	425.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***13.74***	***minutes***

Segment 2: Concentrated Flow

Length =	2645	ft
Top Elev =	425.00	ft
Bot Elev =	374.00	ft
Height =	51	ft
Slope =	0.0193	ft/ft
Paved ? =	No	
Velocity =	2.24	ft/sec
Segment Time =	***19.68***	***minutes***

Segment 3: Open Water Flow

Length =	580	ft
Top Elev =	374.00	ft
Bot Elev =	372.00	ft
Segment Time =	***0.00***	***minutes***

Segment 4: Channel Flow

Length =	2088	ft
Top Elev =	372.00	ft
Bot Elev =	344.00	ft
Height =	28	ft
Slope =	0.0134	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	4.72	ft/sec
Segment Time =	***7.38***	***minutes***

Time of Concentration =	40.80	minutes
SCS Lag Time =	24.48	minutes (SCS Lag = 0.6* Tc)
Time Increment =	7.10	minutes (= 0.29*SCS Lag)

PRE-DEVELOPMENT HYDROLOGY
Subbasin 2

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Crops	B	78	Yes	0	0.00	1.34
Crops	D	89	Yes	0	0.00	0.55
Low Density Residential	D	84		20	3.59	17.96
Mixed Use Neighborhood	B	85		65	3.44	5.30
Mixed Use Neighborhood	B/D	92		65	0.58	0.89
Mixed Use Neighborhood	D	92		65	8.11	12.48
Open	B	61	Yes	0	0.00	0.92
Open	D	80	Yes	0	0.00	0.75
Roadway		98		100	13.35	13.35
Trail	B	82	Yes	100	0.07	0.07
Trail	D	89	Yes	100	0.22	0.22
Wooded	B	55	Yes	0	0.00	2.53
Wooded	B/D	77	Yes	0	0.00	1.21
Wooded	D	77	Yes	0	0.00	2.33

Total Area	**59.90**	**ac**
Total Impervious Area	**29.36**	**ac**
Onsite Area	**9.92**	**ac**
Onsite Impervious Area	**0.28**	**ac**
Percent Impervious	**49**	**%**
Composite Curve Number	**87**	

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 =	427.00	ft
Bot Elev =	426.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***13.74***	***minutes***

Segment 2: Concentrated Flow

Length =	2541	ft
Top Elev =	426.00	ft
Bot Elev =	368.00	ft
Height =	58	ft
Slope =	0.0228	ft/ft
Paved ? =	No	
Velocity =	2.44	ft/sec
Segment Time =	***17.37***	***minutes***

Time of Concentration =	31.12	minutes
SCS Lag Time =	18.67	minutes (SCS Lag = 0.6* Tc)
Time Increment =	5.41	minutes (= 0.29*SCS Lag)

PRE-DEVELOPMENT HYDROLOGY
Subbasin 3

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	C	74	Yes	0	0.00	1.23
Open	D	80	Yes	0	0.00	1.45
Wooded	C	70	Yes	0	0.00	0.85
Wooded	D	77	Yes	0	0.00	4.59

Total Area	**8.11**	**ac**
Total Impervious Area	**0.00**	**ac**
Onsite Area	**8.11**	**ac**
Onsite Impervious Area	**0.00**	**ac**
Percent Impervious	**0**	**%**
Composite Curve Number	**76**	

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 =	368.00	ft
Bot Elev =	363.00	ft
Height =	5	ft
Slope =	0.0500	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***9.51***	***minutes***

Segment 2: Concentrated Flow

Length =	698	ft
Top Elev =	363.00	ft
Bot Elev =	336.00	ft
Height =	27	ft
Slope =	0.0387	ft/ft
Paved ? =	No	
Velocity =	3.17	ft/sec
Segment Time =	***3.67***	***minutes***

Segment 3: Channel Flow

Length =	249	ft
Top Elev =	336.00	ft
Bot Elev =	333.00	ft
Height =	3	ft
Slope =	0.0120	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	4.47	ft/sec
Segment Time =	***0.93***	***minutes***

Time of Concentration =	14.11	minutes
SCS Lag Time =	8.46	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.45	minutes (= 0.29*SCS Lag)

PRE-DEVELOPMENT HYDROLOGY
Subbasin 4

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Crops	B	78	Yes	0	0.00	6.35
Crops	B/D	89	Yes	0	0.00	0.16
Crops	D	89	Yes	0	0.00	3.19
Mixed Use Neighborhood	B	85		65	1.18	1.82
Mixed Use Neighborhood	B/D	92		65	0.56	0.86
Mixed Use Neighborhood	C	90		65	0.68	1.04
Mixed Use Neighborhood	D	92		65	5.08	7.81
Open	A	39	Yes	0	0.00	1.44
Open	B	61	Yes	0	0.00	10.63
Open	B/D	80	Yes	0	0.00	8.78
Open	C	74	Yes	0	0.00	4.91
Open	D	80	Yes	0	0.00	20.40
Roadway		98		100	7.47	7.47
Roof	B	98	Yes	100	0.11	0.11
Roof	B/D	98	Yes	100	0.00	0.00
Roof	D	98	Yes	100	0.03	0.03
Trail	A	72	Yes	100	0.17	0.17
Trail	B	82	Yes	100	0.39	0.39
Trail	B/D	89	Yes	100	0.19	0.19
Trail	D	89	Yes	100	0.69	0.69
Wooded	A	30	Yes	0	0.00	0.00
Wooded	B	55	Yes	0	0.00	3.07
Wooded	B/D	77	Yes	0	0.00	9.47
Wooded	C	70	Yes	0	0.00	7.15
Wooded	D	77	Yes	0	0.00	12.43

Total Area	**108.57**	**ac**
Total Impervious Area	**16.56**	**ac**
Onsite Area	**89.56**	**ac**
Onsite Impervious Area	**1.59**	**ac**
Percent Impervious	**15**	**%**
Composite Curve Number	**78**	

PRE-DEVELOPMENT HYDROLOGY
Subbasin 4

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 =	389.00	ft
Bot Elev =	388.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***13.74***	***minutes***

Segment 2: Concentrated Flow

Length =	1855	ft
Top Elev =	388.00	ft
Bot Elev =	339.00	ft
Height =	49	ft
Slope =	0.0264	ft/ft
Paved ? =	No	
Velocity =	2.62	ft/sec
Segment Time =	***11.79***	***minutes***

Segment 3: Channel Flow

Length =	2366	ft
Top Elev =	339.00	ft
Bot Elev =	302.00	ft
Height =	37	ft
Slope =	0.0156	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	5.09	ft/sec
Segment Time =	***7.74***	***minutes***

Time of Concentration =	33.28	minutes
SCS Lag Time =	19.97	minutes (SCS Lag = 0.6* Tc)
Time Increment =	5.79	minutes (= 0.29*SCS Lag)

PRE-DEVELOPMENT HYDROLOGY
Subbasin 5

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Business Park	A	89		85	0.01	0.01
Business Park	B	92		85	0.02	0.02
Business Park	D	95		85	0.03	0.03
Commercial	D	95		85	0.86	1.01
High Density Residential	B	85		65	46.03	70.82
High Density Residential	D	92		65	33.44	51.45
Low Density Residential	B	65		20	0.18	0.92
Low Density Residential	D	82		20	0.37	1.85
Medium Density Residential	A	54		25	0.00	0.01
Medium Density Residential	B	70		25	11.98	47.92
Medium Density Residential	D	85		25	10.74	42.98
Mixed Use Neighborhood	B	85		65	4.36	6.71
Mixed Use Neighborhood	B/D	92		65	2.15	3.31
Mixed Use Neighborhood	D	92		65	7.50	11.55
Open	A	49	Yes	0	0.00	1.90
Open	B	69	Yes	0	0.00	10.33
Open	D	84	Yes	0	0.00	11.86
Preserved Open Space	A	39		0	0.00	0.39
Preserved Open Space	B	61		0	0.00	4.48
Preserved Open Space	D	80		0	0.00	34.05
Roadway		98		100	49.05	49.05
School	B	88		72	0.34	0.47
School	D	93		72	5.12	7.11
Town Center	B	92		85	5.55	6.53
Town Center	D	95		85	1.48	1.74
Trail	A	72	Yes	100	0.02	0.02
Trail	B	82	Yes	100	0.43	0.43
Trail	D	89	Yes	100	1.93	1.93
Wooded	A	30	Yes	0	0.00	0.70
Wooded	B	55	Yes	0	0.00	4.50
Wooded	B/D	77	Yes	0	0.00	0.15
Wooded	D	77	Yes	0	0.00	50.68

Total Area	**424.89**	**ac**
Total Impervious Area	**181.60**	**ac**
Onsite Area	**82.49**	**ac**
Onsite Impervious Area	**2.38**	**ac**
Percent Impervious	**43**	**%**
Composite Curve Number	**84**	

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 =	440.00	ft
Bot Elev =	438.00	ft
Height =	2	ft
Slope =	0.0200	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***13.72***	***minutes***

Segment 2: Concentrated Flow

Length =	2989	ft
Top Elev =	438.00	ft
Bot Elev =	372.00	ft
Height =	66	ft
Slope =	0.0221	ft/ft
Paved ? =	No	
Velocity =	2.40	ft/sec
Segment Time =	***20.78***	***minutes***

Segment 3: Open Water Flow

Length =	655	ft
Top Elev =	372.00	ft
Bot Elev =	372.00	ft
Segment Time =	***0.00***	***minutes***

Segment 4: Concentrated Flow

Length =	2379	ft
Top Elev =	372.00	ft
Bot Elev =	320.00	ft
Height =	52	ft
Slope =	0.0219	ft/ft
Paved ? =	No	
Velocity =	2.39	ft/sec
Segment Time =	***16.62***	***minutes***

Segment 5: Channel Flow

Length =	3730	ft
Top Elev =	320.00	ft
Bot Elev =	292.00	ft
Height =	28	ft
Slope =	0.0075	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	32.00	sf (assume 8'w x 4'h channel)
Wetted Perimeter =	16.00	lf (assume 8'w x 4'h channel)
Channel Velocity =	4.55	ft/sec
Segment Time =	***13.65***	***minutes***

Time of Concentration =	64.78	minutes
SCS Lag Time =	38.87	minutes (SCS Lag = 0.6* Tc)
Time Increment =	11.27	minutes (= 0.29*SCS Lag)

PRE-DEVELOPMENT HYDROLOGY
Subbasin 6

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Trail	D	89	Yes	100	0.16	0.16
Wooded	A	30	Yes	0	0.00	0.37
Wooded	D	77	Yes	0	0.00	8.04

Total Area	**8.56**	**ac**
Total Impervious Area	**0.16**	**ac**
Onsite Area	**8.56**	**ac**
Onsite Impervious Area	**0.16**	**ac**
Percent Impervious	**2**	**%**
Composite Curve Number	**75**	

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 =	386.00	ft
Bot Elev =	380.00	ft
Height =	6	ft
Slope =	0.0600	ft/ft
Manning's n =	0.40	wooded
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***13.31***	***minutes***

Segment 2: Concentrated Flow

Length =	599	ft
Top Elev =	380.00	ft
Bot Elev =	288.00	ft
Height =	92	ft
Slope =	0.1536	ft/ft
Paved ? =	No	
Velocity =	6.32	ft/sec
Segment Time =	***1.58***	***minutes***

Time of Concentration =	14.89	minutes
SCS Lag Time =	8.93	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.59	minutes (= 0.29*SCS Lag)

PRE-DEVELOPMENT HYDROLOGY
Subbasin 7

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	A	39	Yes	0	0.00	0.70
Open	B	61	Yes	0	0.00	1.00
Open	D	80	Yes	0	0.00	0.06
Trail	B	82	Yes	100	0.15	0.15
Wooded	A	30	Yes	0	0.00	0.66
Wooded	B	55	Yes	0	0.00	7.85
Wooded	D	77	Yes	0	0.00	5.24

Total Area	**15.67**	**ac**
Total Impervious Area	**0.15**	**ac**
Onsite Area	**15.67**	**ac**
Onsite Impervious Area	**0.15**	**ac**
Percent Impervious	**1**	**%**
Composite Curve Number	**61**	

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 =	418.00	ft
Bot Elev =	417.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***18.11***	***minutes***

Segment 2: Concentrated Flow

Length =	593	ft
Top Elev =	417.00	ft
Bot Elev =	338.00	ft
Height =	79	ft
Slope =	0.1332	ft/ft
Paved ? =	No	
Velocity =	5.89	ft/sec
Segment Time =	***1.68***	***minutes***

Segment 3: Channel Flow

Length =	285	ft
Top Elev =	338.00	ft
Bot Elev =	324.00	ft
Height =	14	ft
Slope =	0.0491	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	10.00	sf (assume 5'w x 2'h channel)
Wetted Perimeter =	9.00	lf (assume 5'w x 2'h channel)
Channel Velocity =	7.87	ft/sec
Segment Time =	***0.60***	***minutes***

Time of Concentration =	20.39	minutes
SCS Lag Time =	12.23	minutes (SCS Lag = 0.6* Tc)
Time Increment =	3.55	minutes (= 0.29*SCS Lag)

PRE-DEVELOPMENT HYDROLOGY
Subbasin 8

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	A	39	Yes	0	0.00	0.67
Open	B	61	Yes	0	0.00	1.24
Open	D	80	Yes	0	0.00	0.02
Trail	A	72	Yes	100	0.04	0.04
Trail	B	82	Yes	100	0.07	0.07
Wooded	A	30	Yes	0	0.00	0.71
Wooded	B	55	Yes	0	0.00	3.22
Wooded	D	77	Yes	0	0.00	0.26

Total Area	**6.23**	**ac**
Total Impervious Area	**0.11**	**ac**
Onsite Area	**6.23**	**ac**
Onsite Impervious Area	**0.11**	**ac**
Percent Impervious	**2**	**%**
Composite Curve Number	**53**	

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 =	398.00	ft
Bot Elev =	393.00	ft
Height =	5	ft
Slope =	0.0500	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***9.51***	***minutes***

Segment 2: Concentrated Flow

Length =	697	ft
Top Elev =	393.00	ft
Bot Elev =	365.00	ft
Height =	28	ft
Slope =	0.0402	ft/ft
Paved ? =	No	
Velocity =	3.23	ft/sec
Segment Time =	***3.59***	***minutes***

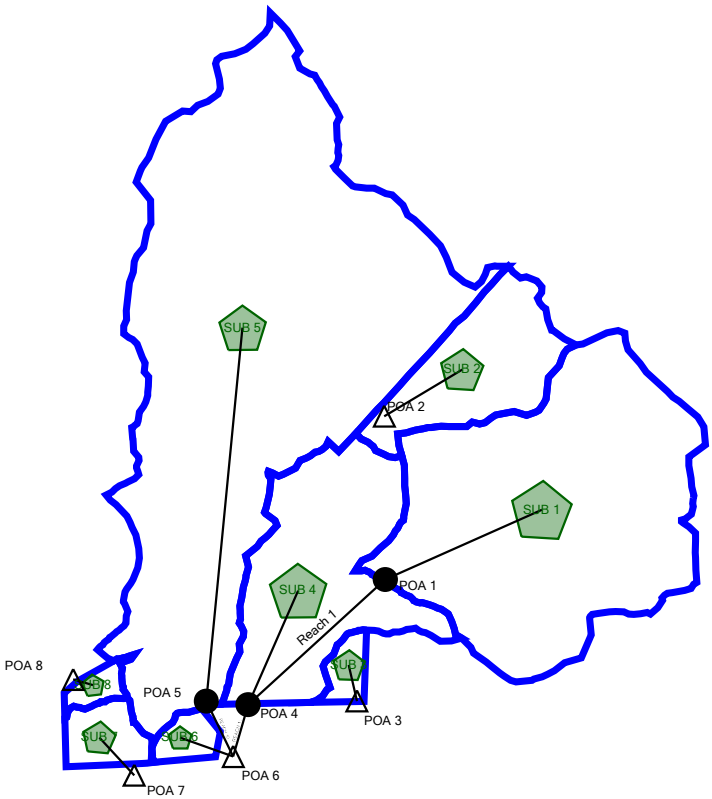
Time of Concentration =	13.10	minutes
SCS Lag Time =	7.86	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.28	minutes (= 0.29*SCS Lag)

PRE-DEVELOPMENT HYDROLOGY
Reach Data

REACH DATA

Reach 1 - POA 1 to POA 4		
Length =	2988	ft
Top Elev =	344.00	ft
Bot Elev =	302.00	ft
Height =	42	ft
Slope =	0.0141	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	10.00	sf (assume 5'w x 2'h channel)
Wetted Perimeter =	9.00	lf (assume 5'w x 2'h channel)
Channel Velocity =	4.21	ft/sec
Reach Travel Time =	***11.83***	***minutes***

Scenario: Pre-Dev 1 yr



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FlexTable: Catchment Table (AWH20000-Master.ppc)

Current Time: 0.00 min

Label	Area (ft²)	SCS CN	Time of Concentration (min)	Notes
SUB 1	10,318,492.80	89.0	40.80	PRE
SUB 2	2,609,244.00	87.0	31.12	PRE
SUB 5	18,508,208.41	84.0	48.15	PRE
SUB 4	4,729,309.20	78.0	33.28	PRE
SUB 7	682,585.20	61.0	20.39	PRE
SUB 8	271,269.00	53.0	13.10	PRE
SUB 6	372,873.60	75.0	14.89	PRE
SUB 3	353,271.60	76.0	14.11	PRE

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
SUB 1	Pre-Dev 1 yr	1	34.657	745.00	283.5
SUB 1	Pre-Dev 10 yr	10	74.868	745.00	545.3
SUB 2	Pre-Dev 1 yr	1	8.007	739.00	77.3
SUB 2	Pre-Dev 10 yr	10	17.950	738.00	153.0
SUB 5	Pre-Dev 1 yr	1	48.954	751.00	359.7
SUB 5	Pre-Dev 10 yr	10	116.278	751.00	787.2
SUB 4	Pre-Dev 1 yr	1	9.218	741.00	80.9
SUB 4	Pre-Dev 10 yr	10	24.755	741.00	204.9
SUB 7	Pre-Dev 1 yr	1	0.405	737.00	2.5
SUB 7	Pre-Dev 10 yr	10	1.820	734.00	17.2
SUB 8	Pre-Dev 1 yr	1	0.061	754.00	0.2
SUB 8	Pre-Dev 10 yr	10	0.458	729.00	4.3
SUB 6	Pre-Dev 1 yr	1	0.618	729.00	8.3
SUB 6	Pre-Dev 10 yr	10	1.774	728.00	22.0
SUB 3	Pre-Dev 1 yr	1	0.620	728.00	8.7
SUB 3	Pre-Dev 10 yr	10	1.740	728.00	22.3

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
POA 3	Pre-Dev 1 yr	1	0.620	728.00	8.7
POA 3	Pre-Dev 10 yr	10	1.740	728.00	22.3
POA 6	Pre-Dev 1 yr	1	93.116	758.00	704.0
POA 6	Pre-Dev 10 yr	10	216.993	758.00	1,494.8
POA 7	Pre-Dev 1 yr	1	0.405	737.00	2.5
POA 7	Pre-Dev 10 yr	10	1.820	734.00	17.2
POA 8	Pre-Dev 1 yr	1	0.061	754.00	0.2
POA 8	Pre-Dev 10 yr	10	0.458	729.00	4.3
POA 2	Pre-Dev 1 yr	1	8.007	739.00	77.3
POA 2	Pre-Dev 10 yr	10	17.950	738.00	153.0
POA 1	Pre-Dev 1 yr	1	34.657	745.00	283.5
POA 1	Pre-Dev 10 yr	10	74.868	745.00	545.3
POA 5	Pre-Dev 1 yr	1	48.954	751.00	359.7
POA 5	Pre-Dev 10 yr	10	116.278	751.00	787.2
POA 4	Pre-Dev 1 yr	1	43.741	757.00	344.2
POA 4	Pre-Dev 10 yr	10	99.357	752.00	704.1

POST-DEVELOPMENT HYDROLOGIC CALCULATIONS

The Point
AWH-20000

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB 1 to SCM A

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	B	61	Yes	2.20	0	0.00
Open Space, Good Condition	D	80	Yes	0.87	0	0.00
Pond	B	100	Yes	0.26	99	0.26
Road	B	98	Yes	1.80	100	1.80
Road	D	98	Yes	0.57	100	0.57
Sidewalk	B	98	Yes	1.28	100	1.28
Sidewalk	D	98	Yes	0.52	100	0.52
Singlefam40	B	84	Yes	1.85	62	1.15
Singlefam40	D	91	Yes	0.16	62	0.10
Singlefam60	B	80	Yes	0.53	50	0.27
Sidewalk	B	98	No	0.02	100	0.02
Sidewalk	D	98	No	0.07	100	0.07
Mixed Use Neighborhood	B	85	No	0.42	65	0.27
Mixed Use Neighborhood	D	92	No	1.81	65	1.18

Onsite Area	**10.03**	**ac**
Onsite Impervious Area	**5.93**	**ac**
Offsite Area	**2.33**	**ac**
Offsite Impervious Area	**1.55**	**ac**
Total Area	**12.35**	**ac**
Total Impervious Area	**7.48**	**ac**
Percent Impervious	**61**	**%**
Composite Curve Number	**86**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB1 to SCM P

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	A	39	Yes	0.05	0	0.00
Open Space, Good Condition	B	61	Yes	0.04	0	0.00
Open Space, Good Condition	C	74	Yes	0.00	0	0.00
Open Space, Good Condition	D	80	Yes	0.19	0	0.00
Road	D	98	Yes	0.46	100	0.46
Sidewalk	A	98	Yes	0.00	100	0.00
Sidewalk	B	98	Yes	0.00	100	0.00
Sidewalk	C	98	Yes	0.00	100	0.00
Sidewalk	D	98	Yes	0.00	100	0.00

Onsite Area	**0.74**	**ac**
Onsite Impervious Area	**0.47**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**0.74**	**ac**
Total Impervious Area	**0.47**	**ac**
Percent Impervious	**63**	**%**
Composite Curve Number	**87**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB1 to SCM B

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	B	61	Yes	1.65	0	0.00
Open Space, Good Condition	D	80	Yes	1.34	0	0.00
Pond	B	100	Yes	0.13	99	0.13
Pond	D	100	Yes	0.08	100	0.08
Road	B	98	Yes	0.66	100	0.66
Road	D	98	Yes	0.90	100	0.90
Sidewalk	B	98	Yes	0.20	100	0.20
Sidewalk	D	98	Yes	0.24	100	0.24
Townhome 22	B	95	Yes	1.56	91	1.42
Townhome 22	D	96	Yes	1.53	91	1.39
Mixed Use Neighborhood	B	85	No	1.61	65	1.05
Mixed Use Neighborhood	D	92	No	0.32	65	0.21

Onsite Area	**8.29**	**ac**
Onsite Impervious Area	**5.02**	**ac**
Offsite Area	**1.93**	**ac**
Offsite Impervious Area	**1.25**	**ac**
Total Area	**10.22**	**ac**
Total Impervious Area	**6.28**	**ac**
Percent Impervious	**61**	**%**
Composite Curve Number	**87**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB1 to SCM C

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	B	61	Yes	1.45	0	0.00
Open Space, Good Condition	D	80	Yes	1.18	0	0.00
Pond	B	100	Yes	0.03	99	0.03
Pond	D	100	Yes	0.32	100	0.32
Road	A	98	Yes	0.00	100	0.00
Road	B	98	Yes	1.68	100	1.68
Road	D	98	Yes	0.93	100	0.93
Sidewalk	B	98	Yes	0.51	100	0.51
Sidewalk	D	98	Yes	0.30	100	0.30
Singlefam39	B	85	Yes	2.07	0	0.00
Singlefam39	D	80	Yes	1.83	0	0.00
Singlefam40	B	84	Yes	3.25	62	2.02
Singlefam40	D	91	Yes	0.90	62	0.56
Singlefam60	B	80	Yes	1.00	50	0.50
Singlefam60	D	89	Yes	0.24	50	0.12

Onsite Area	**15.68**	**ac**
Onsite Impervious Area	**6.96**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**15.68**	**ac**
Total Impervious Area	**6.96**	**ac**
Percent Impervious	**44**	**%**
Composite Curve Number	**85**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB1 to SCM E

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	B	61	Yes	1.07	0	0.00
Open Space, Good Condition	D	80	Yes	1.22	0	0.00
Pond	B	100	Yes	0.20	99	0.20
Pond	D	100	Yes	0.35	100	0.35
Road	B	98	Yes	1.37	100	1.37
Road	D	98	Yes	1.48	100	1.48
Sidewalk	B	98	Yes	0.37	100	0.37
Sidewalk	D	98	Yes	0.42	100	0.42
Singlefam39	B	85	Yes	1.32	0	0.00
Singlefam39	D	80	Yes	1.14	0	0.00
Singlefam40	B	84	Yes	2.25	62	1.40
Singlefam40	D	91	Yes	2.36	62	1.47
Singlefam60	B	80	Yes	2.00	50	1.00
Singlefam60	D	89	Yes	1.80	50	0.90

Onsite Area	**17.35**	**ac**
Onsite Impervious Area	**8.95**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**17.35**	**ac**
Total Impervious Area	**8.95**	**ac**
Percent Impervious	**52**	**%**
Composite Curve Number	**87**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB1 to SCM D

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	B	61	Yes	1.62	0	0.00
Open Space, Good Condition	D	80	Yes	0.08	0	0.00
Pond	B	100	Yes	0.45	99	0.44
Road	B	98	Yes	1.65	100	1.65
Road	D	98	Yes	0.07	100	0.07
Sidewalk	B	98	Yes	0.57	100	0.57
Sidewalk	D	98	Yes	0.03	100	0.03
Singlefam60	B	80	Yes	8.33	50	4.17
Singlefam60	D	89	Yes	0.39	50	0.20

Onsite Area	**13.20**	**ac**
Onsite Impervious Area	**7.13**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**13.20**	**ac**
Total Impervious Area	**7.13**	**ac**
Percent Impervious	**54**	**%**
Composite Curve Number	**82**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB4 to SCM F

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	B	61	Yes	1.24	0	0.00
Open Space, Good Condition	D	80	Yes	4.15	0	0.00
Pond	D	100	Yes	0.37	100	0.37
Road	B	98	Yes	1.18	100	1.18
Road	D	98	Yes	1.73	100	1.73
Sidewalk	B	98	Yes	0.31	100	0.31
Sidewalk	D	98	Yes	0.64	100	0.64
Townhome 22	B	95	Yes	0.23	91	0.21
Townhome 22	D	96	Yes	1.30	91	1.18
Singlefam39	B	85	Yes	2.08	0	0.00
Singlefam39	D	80	Yes	0.86	0	0.00
Singlefam40	B	84	Yes	1.97	62	1.22
Singlefam40	D	91	Yes	1.97	62	1.22
Singlefam60	D	89	Yes	0.60	50	0.30

Onsite Area	**18.63**	**ac**
Onsite Impervious Area	**8.36**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**18.63**	**ac**
Total Impervious Area	**8.36**	**ac**
Percent Impervious	**45**	**%**
Composite Curve Number	**87**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB4 to SCM G

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	B	61	Yes	0.92	0	0.00
Open Space, Good Condition	D	80	Yes	2.65	0	0.00
Pond	D	100	Yes	0.36	100	0.36
Road	B	98	Yes	0.71	100	0.71
Road	D	98	Yes	1.60	100	1.60
Sidewalk	B	98	Yes	0.26	100	0.26
Sidewalk	D	98	Yes	0.50	100	0.50
Townhome 22	B	95	Yes	1.30	91	1.18
Townhome 22	D	96	Yes	2.40	91	2.19
Singlefam50	B	83	Yes	0.58	59	0.35
Singlefam50	D	91	Yes	2.38	59	1.40

Onsite Area	**13.66**	**ac**
Onsite Impervious Area	**8.54**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**13.66**	**ac**
Total Impervious Area	**8.54**	**ac**
Percent Impervious	**63**	**%**
Composite Curve Number	**90**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB4 to SCM H

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	C	74	Yes	0.96	0	0.00
Open Space, Good Condition	D	80	Yes	0.94	0	0.00
Pond	D	100	Yes	0.76	100	0.76
Road	C	98	Yes	1.31	100	1.31
Road	D	98	Yes	0.99	100	0.99
Sidewalk	C	98	Yes	0.41	100	0.41
Sidewalk	D	98	Yes	0.27	100	0.27
Singlefam50	C	89	Yes	7.71	59	4.55
Singlefam50	D	91	Yes	2.85	59	1.68
Woods, Good Condition	D	77	Yes	0.22	0	0.00

Onsite Area	**16.40**	**ac**
Onsite Impervious Area	**9.96**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**16.40**	**ac**
Total Impervious Area	**9.96**	**ac**
Percent Impervious	**61**	**%**
Composite Curve Number	**90**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB4 to SCM I

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	A	39	Yes	0.15	0	0.00
Open Space, Good Condition	B	61	Yes	0.04	0	0.00
Open Space, Good Condition	D	80	Yes	1.31	0	0.00
Pond	D	100	Yes	0.18	100	0.18
Road	A	98	Yes	0.26	100	0.26
Road	B	98	Yes	0.08	100	0.08
Road	D	98	Yes	0.77	100	0.77
Sidewalk	A	98	Yes	0.09	100	0.09
Sidewalk	B	98	Yes	0.03	100	0.03
Sidewalk	D	98	Yes	0.27	100	0.27
Singlefam50	A	74	Yes	0.91	59	0.54
Singlefam50	B	83	Yes	0.69	59	0.41
Singlefam50	D	91	Yes	3.58	59	2.11

Onsite Area	**8.37**	**ac**
Onsite Impervious Area	**4.75**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**8.37**	**ac**
Total Impervious Area	**4.75**	**ac**
Percent Impervious	**57**	**%**
Composite Curve Number	**87**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB5 to SCM J

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	A	39	Yes	0.56	0	0.00
Open Space, Good Condition	B	61	Yes	0.64	0	0.00
Open Space, Good Condition	D	80	Yes	2.51	0	0.00
Pond	D	100	Yes	0.31	100	0.31
Road	A	98	Yes	0.20	100	0.20
Road	B	98	Yes	0.42	100	0.42
Road	D	98	Yes	1.68	100	1.68
Sidewalk	A	98	Yes	0.07	100	0.07
Sidewalk	B	98	Yes	0.13	100	0.13
Sidewalk	D	98	Yes	0.54	100	0.54
Townhome 22	B	95	Yes	0.51	91	0.47
Townhome 22	D	96	Yes	1.30	91	1.19
Singlefam50	A	74	Yes	1.08	59	0.64
Singlefam50	B	83	Yes	0.44	59	0.26
Singlefam50	D	91	Yes	3.83	59	2.26

Onsite Area	**14.20**	**ac**
Onsite Impervious Area	**8.14**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**14.20**	**ac**
Total Impervious Area	**8.14**	**ac**
Percent Impervious	**57**	**%**
Composite Curve Number	**86**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB6 to SCM K

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	A	39	Yes	0.15	0	0.00
Open Space, Good Condition	B	61	Yes	0.00	0	0.00
Open Space, Good Condition	D	80	Yes	5.38	0	0.00
Pond	D	100	Yes	0.73	100	0.73
Road	D	98	Yes	1.94	100	1.94
Sidewalk	D	98	Yes	0.53	100	0.53
Townhome 22	A	93	Yes	0.00	91	0.00
Townhome 22	D	96	Yes	4.75	91	4.33
Singlefam50	A	74	Yes	1.08	59	0.64
Singlefam50	B	83	Yes	1.19	59	0.70
Singlefam50	D	91	Yes	0.42	59	0.25

Onsite Area	**16.19**	**ac**
Onsite Impervious Area	**9.12**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**16.19**	**ac**
Total Impervious Area	**9.12**	**ac**
Percent Impervious	**56**	**%**
Composite Curve Number	**88**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB 7 to SCM L

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	A	39	Yes	1.24	0	0.00
Open Space, Good Condition	B	61	Yes	2.96	0	0.00
Open Space, Good Condition	D	80	Yes	0.64	0	0.00
Pond	B	100	Yes	0.37	99	0.37
Pond	D	100	Yes	0.42	100	0.42
Road	A	98	Yes	0.06	100	0.06
Road	B	98	Yes	1.24	100	1.24
Road	D	98	Yes	0.29	100	0.29
Sidewalk	A	98	Yes	0.02	100	0.02
Sidewalk	B	98	Yes	0.36	100	0.36
Sidewalk	D	98	Yes	0.11	100	0.11
Singlefam50	A	74	Yes	0.60	59	0.36
Singlefam50	B	83	Yes	5.41	59	3.19
Singlefam50	D	91	Yes	2.10	59	1.24
Woods, Good Condition	A	30	Yes	0.09	0	0.00
Woods, Good Condition	B	55	Yes	0.11	0	0.00
Woods, Good Condition	D	77	Yes	0.01	0	0.00

Onsite Area	**16.04**	**ac**
Onsite Impervious Area	**7.65**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**16.04**	**ac**
Total Impervious Area	**7.65**	**ac**
Percent Impervious	**48**	**%**
Composite Curve Number	**78**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB1 BYPASS

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	B	61	Yes	12.28	0	0.00
Open Space, Good Condition	D	80	Yes	4.82	0	0.00
Pond	B	100	Yes	0.09	99	0.09
Pond	D	100	Yes	6.80	100	6.80
Road	B	98	Yes	0.18	100	0.18
Sidewalk	B	98	Yes	0.22	100	0.22
Sidewalk	D	98	Yes	0.00	100	0.00
Singlefam60	B	80	Yes	0.30	50	0.15
Singlefam60	D	89	Yes	0.05	50	0.03
Woods, Good Condition	B	55	Yes	3.23	0	0.00
Woods, Good Condition	C	70	Yes	0.03	0	0.00
Woods, Good Condition	D	77	Yes	5.78	0	0.00
Mixed Use Neighborhood	B	85	No	12.22	65	7.94
Mixed Use Neighborhood	C	90	No	1.79	65	1.16
Mixed Use Neighborhood	D	92	No	18.30	65	11.89
Low Density Residential	B	68	No	0.29	20	0.06
Low Density Residential	D	84	No	22.63	20	4.53
Medium Density Residential	B	70	No	1.14	25	0.29
Medium Density Residential	D	85	No	0.08	25	0.02
Right-Of-Way	B	89	No	4.08	90	3.67
Right-Of-Way	D	93	No	3.89	90	3.50
School	B	88	No	17.91	72	12.90
School	D	93	No	69.37	72	49.95

Onsite Area	**33.79**	**ac**
Onsite Impervious Area	**7.47**	**ac**
Offsite Area	**151.71**	**ac**
Offsite Impervious Area	**95.91**	**ac**
Total Area	**185.50**	**ac**
Total Impervious Area	**103.38**	**ac**
Percent Impervious	**56**	**%**
Composite Curve Number	**87**	

TIME OF CONCENTRATION

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

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	426.00	ft
Bot Elev =	425.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***13.74***	***minutes***

Segment 2: Concentrated Flow

Length =	2645	ft
Top Elev =	425.00	ft
Bot Elev =	374.00	ft
Height =	51	ft
Slope =	0.0193	ft/ft
Paved ? =	No	
Velocity =	2.24	ft/sec
Segment Time =	***19.68***	***minutes***

Segment 3: Open Water Flow

Length =	580	ft
Top Elev =	374.00	ft
Bot Elev =	372.00	ft
Segment Time =	***0.00***	***minutes***

Segment 4: Channel Flow

Length =	2088	ft
Top Elev =	372.00	ft
Bot Elev =	344.00	ft
Height =	28	ft
Slope =	0.0134	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	4.72	ft/sec
Segment Time =	***7.38***	***minutes***

Time of Concentration =	40.80	minutes
SCS Lag Time =	24.48	minutes (SCS Lag = 0.6* Tc)
Time Increment =	7.10	minutes (= 0.29*SCS Lag)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB2

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	B	61	Yes	1.27	0	0.00
Open Space, Good Condition	D	80	Yes	0.71	0	0.00
Sidewalk	B	98	Yes	0.14	100	0.14
Sidewalk	D	98	Yes	0.07	100	0.07
Woods, Good Condition	B	55	Yes	0.43	0	0.00
Woods, Good Condition	D	77	Yes	1.65	0	0.00
Mixed Use Neighborhood	B	85	No	5.30	65	3.44
Mixed Use Neighborhood	D	92	No	13.37	65	8.69
Low Density Residential	D	84	No	17.96	20	3.59
Right-Of-Way	B	89	No	2.31	90	2.08
Right-Of-Way	D	93	No	11.03	90	9.93

Onsite Area	**4.28**	**ac**
Onsite Impervious Area	**0.22**	**ac**
Offsite Area	**49.97**	**ac**
Offsite Impervious Area	**27.74**	**ac**
Total Area	**54.25**	**ac**
Total Impervious Area	**27.95**	**ac**
Percent Impervious	**52**	**%**
Composite Curve Number	**87**	

TIME OF CONCENTRATION

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

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	427.00	ft
Bot Elev =	426.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***13.74***	***minutes***

Segment 2: Concentrated Flow

Length =	2541	ft
Top Elev =	426.00	ft
Bot Elev =	368.00	ft
Height =	58	ft
Slope =	0.0228	ft/ft
Paved ? =	No	
Velocity =	2.44	ft/sec
Segment Time =	***17.37***	***minutes***

Time of Concentration =	31.12	minutes
SCS Lag Time =	18.67	minutes (SCS Lag = 0.6* Tc)
Time Increment =	5.41	minutes (= 0.29*SCS Lag)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB3

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	C	74	Yes	0.23	0	0.00
Open Space, Good Condition	D	80	Yes	0.76	0	0.00
Singlefam50	D	91	Yes	0.02	59	0.01
Woods, Good Condition	C	70	Yes	0.23	0	0.00
Woods, Good Condition	D	77	Yes	4.14	0	0.00

Onsite Area	**5.38**	**ac**
Onsite Impervious Area	**0.01**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**5.38**	**ac**
Total Impervious Area	**0.01**	**ac**
Percent Impervious	**0**	**%**
Composite Curve Number	**77**	

TIME OF CONCENTRATION

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

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	362.00	ft
Bot Elev =	357.00	ft
Height =	5	ft
Slope =	0.0500	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***9.51***	***minutes***

Segment 2: Concentrated Flow

Length =	160	ft
Top Elev =	357.00	ft
Bot Elev =	341.00	ft
Height =	16	ft
Slope =	0.1000	ft/ft
Paved ? =	No	
Velocity =	5.10	ft/sec
Segment Time =	***0.52***	***minutes***

Segment 3: Channel Flow

Length =	476	ft
Top Elev =	341.00	ft
Bot Elev =	333.00	ft
Height =	8	ft
Slope =	0.0168	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	5.28	ft/sec
Segment Time =	***1.50***	***minutes***

Time of Concentration =	11.54	minutes
SCS Lag Time =	6.92	minutes (SCS Lag = 0.6* Tc)
Time Increment =	2.01	minutes (= 0.29*SCS Lag)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB4 BYPASS

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	A	39	Yes	0.00	0	0.00
Open Space, Good Condition	B	61	Yes	0.00	0	0.00
Open Space, Good Condition	C	74	Yes	1.50	0	0.00
Open Space, Good Condition	D	80	Yes	4.88	0	0.00
Singlefam50	C	89	Yes	0.00	59	0.00
Singlefam60	D	89	Yes	0.02	50	0.01
Woods, Good Condition	C	70	Yes	1.79	0	0.00
Woods, Good Condition	D	77	Yes	9.53	0	0.00
Mixed Use Neighborhood	B	85	No	1.78	65	1.16
Mixed Use Neighborhood	C	90	No	1.04	65	0.68
Mixed Use Neighborhood	D	92	No	8.00	65	5.20

Onsite Area	**17.72**	**ac**
Onsite Impervious Area	**0.01**	**ac**
Offsite Area	**10.83**	**ac**
Offsite Impervious Area	**7.04**	**ac**
Total Area	**28.55**	**ac**
Total Impervious Area	**7.05**	**ac**
Percent Impervious	**25**	**%**
Composite Curve Number	**82**	

TIME OF CONCENTRATION

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

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	394.00	ft
Bot Elev =	392.00	ft
Height =	2	ft
Slope =	0.0200	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***10.41***	***minutes***

Segment 2: Concentrated Flow

Length =	1223	ft
Top Elev =	392.00	ft
Bot Elev =	341.00	ft
Height =	51	ft
Slope =	0.0417	ft/ft
Paved ? =	No	
Velocity =	3.29	ft/sec
Segment Time =	***6.19***	***minutes***

Segment 3: Channel Flow

Length =	2660	ft
Top Elev =	341.00	ft
Bot Elev =	302.00	ft
Height =	39	ft
Slope =	0.0147	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	4.93	ft/sec
Segment Time =	***8.99***	***minutes***

Time of Concentration =	25.59	minutes
SCS Lag Time =	15.36	minutes (SCS Lag = 0.6* Tc)
Time Increment =	4.45	minutes (= 0.29*SCS Lag)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB5 BYPASS

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	A	39	Yes	0.43	0	0.00
Open Space, Good Condition	B	61	Yes	2.06	0	0.00
Open Space, Good Condition	D	80	Yes	9.69	0	0.00
Sidewalk	A	98	Yes	0.02	100	0.02
Sidewalk	B	98	Yes	0.26	100	0.26
Sidewalk	D	98	Yes	0.86	100	0.86
Townhome 22	D	96	Yes	0.03	91	0.03
Woods, Good Condition	B	55	Yes	0.03	0	0.00
Woods, Good Condition	D	77	Yes	6.25	0	0.00
Open Space, Good Condition	B	61	No	9.58	0	0.00
Open Space, Good Condition	D	80	No	9.24	0	0.00
Mixed Use Neighborhood	B	85	No	6.75	65	4.39
Mixed Use Neighborhood	D	92	No	15.53	65	10.09
Low Density Residential	B	68	No	0.92	20	0.18
Low Density Residential	D	84	No	1.85	20	0.37
Medium Density Residential	A	54	No	0.01	25	0.00
Medium Density Residential	B	70	No	47.92	25	11.98
Medium Density Residential	D	85	No	42.98	25	10.74
High Density Residential	B	72	No	70.82	30	21.24
High Density Residential	D	86	No	51.45	30	15.43
Right-Of-Way	A	83	No	0.76	90	0.68
Right-Of-Way	B	89	No	23.84	90	21.46
Right-Of-Way	D	93	No	31.95	90	28.75
School	B	88	No	0.47	72	0.34
School	D	93	No	7.11	72	5.12
Preserved Open	A	39	No	0.39	0	0.00
Preserved Open	B	61	No	4.48	0	0.00
Preserved Open	D	80	No	34.04	0	0.00
Woods, Good Condition	B	55	No	3.27	0	0.00
Woods, Good Condition	D	77	No	23.30	0	0.00
Business Park	A	89	No	0.01	85	0.01
Business Park	B	92	No	0.02	85	0.02
Business Park	D	95	No	0.03	85	0.03
Commercial	D	95	No	1.01	85	0.86
Town Center	B	92	No	6.53	85	5.55
Town Center	C	94	No	0.00	85	0.00
Town Center	D	95	No	1.74	85	1.48

Onsite Area	**19.63**	**ac**
Onsite Impervious Area	**1.16**	**ac**
Offsite Area	**395.98**	**ac**
Offsite Impervious Area	**138.72**	**ac**
Total Area	**415.61**	**ac**
Total Impervious Area	**139.88**	**ac**
Percent Impervious	**34**	**%**
Composite Curve Number	**80**	

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB5 BYPASS

TIME OF CONCENTRATION

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

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	440.00	ft
Bot Elev =	438.00	ft
Height =	2	ft
Slope =	0.0200	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***13.72***	***minutes***

Segment 2: Concentrated Flow

Length =	2989	ft
Top Elev =	438.00	ft
Bot Elev =	372.00	ft
Height =	66	ft
Slope =	0.0221	ft/ft
Paved ? =	No	
Velocity =	2.40	ft/sec
Segment Time =	***20.78***	***minutes***

Segment 3: Open Water Flow

Length =	655	ft
Top Elev =	372.00	ft
Bot Elev =	372.00	ft
Segment Time =	***0.00***	***minutes***

Segment 4: Concentrated Flow

Length =	2379	ft
Top Elev =	372.00	ft
Bot Elev =	320.00	ft
Height =	52	ft
Slope =	0.0219	ft/ft
Paved ? =	No	
Velocity =	2.39	ft/sec
Segment Time =	***16.62***	***minutes***

Segment 5: Channel Flow

Length =	3029	ft
Top Elev =	320.00	ft
Bot Elev =	292.00	ft
Height =	28	ft
Slope =	0.0092	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	32.00	sf (assume 8'w x 4'h channel)
Wetted Perimeter =	16.00	lf (assume 8'w x 4'h channel)
Channel Velocity =	5.05	ft/sec
Segment Time =	***9.99***	***minutes***

Time of Concentration =	61.11	minutes
SCS Lag Time =	36.67	minutes (SCS Lag = 0.6* Tc)
Time Increment =	10.63	minutes (= 0.29*SCS Lag)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB6 BYPASS

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	D	80	Yes	1.69	0	0.00
Road	D	98	Yes	0.01	100	0.01
Sidewalk	D	98	Yes	0.14	100	0.14
Townhome 22	D	96	Yes	0.04	91	0.04
Woods, Good Condition	D	77	Yes	0.23	0	0.00

Onsite Area	**2.11**	**ac**
Onsite Impervious Area	**0.19**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**2.11**	**ac**
Total Impervious Area	**0.19**	**ac**
Percent Impervious	**9**	**%**
Composite Curve Number	**81**	

TIME OF CONCENTRATION

Time of concentration is assumed to be 5 minutes.

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)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB7 BYPASS

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	A	39	Yes	0.01	0	0.00
Open Space, Good Condition	B	61	Yes	0.10	0	0.00
Open Space, Good Condition	D	80	Yes	0.63	0	0.00
Woods, Good Condition	A	30	Yes	0.05	0	0.00
Woods, Good Condition	B	55	Yes	0.17	0	0.00
Woods, Good Condition	D	77	Yes	1.16	0	0.00

Onsite Area	**2.12**	**ac**
Onsite Impervious Area	**0.00**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**2.12**	**ac**
Total Impervious Area	**0.00**	**ac**
Percent Impervious	**0**	**%**
Composite Curve Number	**74**	

TIME OF CONCENTRATION

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

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	352.00	ft
Bot Elev =	345.00	ft
Height =	7	ft
Slope =	0.0700	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	***8.31***	***minutes***

Segment 2: Concentrated Flow

Length =	115	ft
Top Elev =	345.00	ft
Bot Elev =	324.00	ft
Height =	21	ft
Slope =	0.1826	ft/ft
Paved ? =	No	
Velocity =	6.89	ft/sec
Segment Time =	***0.28***	***minutes***

Time of Concentration =	8.59	minutes
SCS Lag Time =	5.16	minutes (SCS Lag = 0.6* Tc)
Time Increment =	1.50	minutes (= 0.29*SCS Lag)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
SUB8

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Onsite	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Open Space, Good Condition	A	39	Yes	0.25	0	0.00
Open Space, Good Condition	B	61	Yes	0.94	0	0.00
Open Space, Good Condition	D	80	Yes	0.10	0	0.00
Sidewalk	A	98	Yes	0.03	100	0.03
Sidewalk	B	98	Yes	0.13	100	0.13
Sidewalk	D	98	Yes	0.02	100	0.02
Woods, Good Condition	A	30	Yes	0.02	0	0.00
Woods, Good Condition	B	55	Yes	0.56	0	0.00
Woods, Good Condition	D	77	Yes	0.08	0	0.00

Onsite Area	**2.13**	**ac**
Onsite Impervious Area	**0.18**	**ac**
Offsite Area	**0.00**	**ac**
Offsite Impervious Area	**0.00**	**ac**
Total Area	**2.13**	**ac**
Total Impervious Area	**0.18**	**ac**
Percent Impervious	**9**	**%**
Composite Curve Number	**61**	

TIME OF CONCENTRATION

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

Segment 1: Overland Flow			***Segment 2: Concentrated Flow***		
Length =	37	ft	Length =	575	ft
Top Elev =	398.00	ft	Top Elev =	396.00	ft
Bot Elev =	396.00	ft	Bot Elev =	365.00	ft
Height =	2	ft	Height =	31	ft
Slope =	0.0541	ft/ft	Slope =	0.0539	ft/ft
Manning's n =	0.24	dense grasses	Paved ? =	No	
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)	Velocity =	3.75	ft/sec
Segment Time =	***4.16***	***minutes***	***Segment Time =***	***2.56***	***minutes***

Time of Concentration =	6.72	minutes
SCS Lag Time =	4.03	minutes (SCS Lag = 0.6* Tc)
Time Increment =	1.17	minutes (= 0.29*SCS Lag)

POST-DEVELOPMENT HYDROLOGY
Curve Numbers
Reach Data

REACH DATA

Reach #1 - POA 1 to POA 4

Segment 1: Concentrated Flow

Length =	2988	ft
Top Elev =	344.00	ft
Bot Elev =	302.00	ft
Height =	42	ft
Slope =	0.0141	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	10.00	sf (assume 5'w x 2'h channel)
Wetted Perimeter =	9.00	lf (assume 5'w x 2'h channel)
Channel Velocity =	4.21	ft/sec
Reach Travel Time =	***11.83***	***minutes***

Total Travel Time = 11.83 minutes

Reach #2 - SCM A TO POA 1

Segment 1: Concentrated Flow

Length =	647	ft
Top Elev =	377.00	ft
Bot Elev =	368.00	ft
Height =	9	ft
Slope =	0.0139	ft/ft
Paved ? =	No	
Velocity =	1.90	ft/sec
Segment Time =	***5.67***	***minutes***

Segment 2: Channel Flow

Length =	2038	ft
Top Elev =	368.00	ft
Bot Elev =	344.00	ft
Height =	24	ft
Slope =	0.0118	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	12.00	sf (assume 6'w x 2'h channel)
Wetted Perimeter =	10.00	lf (assume 6'w x 2'h channel)
Channel Velocity =	4.06	ft/sec
Reach Travel Time =	***8.37***	***minutes***

Total Travel Time = 14.04 minutes

Reach #3 - SCM C TO POA 1

Segment 1: Concentrated Flow

Length =	83	ft
Top Elev =	370.00	ft
Bot Elev =	366.00	ft
Height =	4	ft
Slope =	0.0482	ft/ft
Paved ? =	No	
Velocity =	3.54	ft/sec
Segment Time =	***0.39***	***minutes***

Segment 2: Channel Flow

Length =	1220	ft
Top Elev =	366.00	ft
Bot Elev =	344.00	ft
Height =	22	ft
Slope =	0.0180	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	8.00	sf (assume 4'w x 2'h channel)
Wetted Perimeter =	8.00	lf (assume 4'w x 2'h channel)
Channel Velocity =	4.45	ft/sec
Reach Travel Time =	***4.57***	***minutes***

Total Travel Time = 4.96 minutes

Reach #4 - SCM F TO POA 4

Segment 1: Concentrated Flow

Length =	77	ft
Top Elev =	339.00	ft
Bot Elev =	336.00	ft
Height =	3	ft
Slope =	0.0390	ft/ft
Paved ? =	No	
Velocity =	3.18	ft/sec
Segment Time =	***0.40***	***minutes***

Segment 2: Channel Flow

Length =	2292	ft
Top Elev =	336.00	ft
Bot Elev =	302.00	ft
Height =	34	ft
Slope =	0.0148	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	10.00	sf (assume 5'w x 2'h channel)
Wetted Perimeter =	9.00	lf (assume 5'w x 2'h channel)
Channel Velocity =	4.33	ft/sec
Reach Travel Time =	***8.83***	***minutes***

Total Travel Time = 9.23 minutes

Reach #5 - SCM B TO POA 1

Segment 1: Concentrated Flow

Length =	161	ft
Top Elev =	375.00	ft
Bot Elev =	363.00	ft
Height =	12	ft
Slope =	0.0745	ft/ft
Paved ? =	No	
Velocity =	4.40	ft/sec
Segment Time =	***0.61***	***minutes***

Segment 2: Channel Flow

Length =	1850	ft
Top Elev =	363.00	ft
Bot Elev =	344.00	ft
Height =	19	ft
Slope =	0.0103	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	12.00	sf (assume 6'w x 2'h channel)
Wetted Perimeter =	10.00	lf (assume 6'w x 2'h channel)
Channel Velocity =	3.79	ft/sec
Reach Travel Time =	***8.14***	***minutes***

Total Travel Time = 8.75 minutes

Reach #6 - SCM G TO POA 4

Segment 1: Concentrated Flow

Length =	75	ft
Top Elev =	338.00	ft
Bot Elev =	337.00	ft
Height =	1	ft
Slope =	0.0133	ft/ft
Paved ? =	No	
Velocity =	1.86	ft/sec
Segment Time =	***0.67***	***minutes***

Segment 2: Channel Flow

Length =	1566	ft
Top Elev =	337.00	ft
Bot Elev =	303.00	ft
Height =	34	ft
Slope =	0.0217	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	12.00	sf (assume 6'w x 2'h channel)
Wetted Perimeter =	10.00	lf (assume 6'w x 2'h channel)
Channel Velocity =	5.51	ft/sec
Reach Travel Time =	***4.74***	***minutes***

Total Travel Time = 5.41 minutes

Reach #7 - SCM H TO POA 4

Segment 1: Concentrated Flow

Length =	482	ft
Top Elev =	374.00	ft
Bot Elev =	361.00	ft
Height =	13	ft
Slope =	0.0270	ft/ft
Paved ? =	No	
Velocity =	2.65	ft/sec
Segment Time =	***3.03***	***minutes***

Segment 2: Channel Flow

Length =	1567	ft
Top Elev =	361.00	ft
Bot Elev =	344.00	ft
Height =	17	ft
Slope =	0.0108	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	12.00	sf (assume 6'w x 2'h channel)
Wetted Perimeter =	10.00	lf (assume 6'w x 2'h channel)
Channel Velocity =	3.89	ft/sec
Reach Travel Time =	***6.71***	***minutes***

Total Travel Time = 9.74 minutes

Reach #8 - SCM I TO POA 4

Segment 1: Concentrated Flow

Length =	482	ft
Top Elev =	308.00	ft
Bot Elev =	296.00	ft
Height =	12	ft
Slope =	0.0249	ft/ft
Paved ? =	No	
Velocity =	2.55	ft/sec
Segment Time =	***3.16***	***minutes***

Segment 2: Channel Flow

Length =	805	ft
Top Elev =	296.00	ft
Bot Elev =	292.00	ft
Height =	4	ft
Slope =	0.0050	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	12.00	sf (assume 6'w x 2'h channel)
Wetted Perimeter =	10.00	lf (assume 6'w x 2'h channel)
Channel Velocity =	2.64	ft/sec
Reach Travel Time =	***5.09***	***minutes***

Total Travel Time = 8.25 minutes

Reach #9 - CULVERT TO POA 5

Segment 1: Channel Flow

Length =	650	ft
Top Elev =	296.00	ft
Bot Elev =	291.00	ft
Height =	5	ft
Slope =	0.0077	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	12.00	sf (assume 6'w x 2'h channel)
Wetted Perimeter =	10.00	lf (assume 6'w x 2'h channel)
Channel Velocity =	3.28	ft/sec
Reach Travel Time =	***3.30***	***minutes***

Total Travel Time = 3.30 minutes

Reach #10 - POA 5 TO POA 6

Segment 1: Channel Flow

Length =	822	ft
Top Elev =	291.00	ft
Bot Elev =	288.00	ft
Height =	3	ft
Slope =	0.0036	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	12.00	sf (assume 6'w x 2'h channel)
Wetted Perimeter =	10.00	lf (assume 6'w x 2'h channel)
Channel Velocity =	2.26	ft/sec
Reach Travel Time =	***6.07***	***minutes***

Total Travel Time = 6.07 minutes

Reach #11 - POA 4 TO POA 6

Segment 1: Channel Flow

Length =	883	ft
Top Elev =	292.00	ft
Bot Elev =	288.00	ft
Height =	4	ft
Slope =	0.0045	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	12.00	sf (assume 6'w x 2'h channel)
Wetted Perimeter =	10.00	lf (assume 6'w x 2'h channel)
Channel Velocity =	2.52	ft/sec
Reach Travel Time =	***5.85***	***minutes***

Total Travel Time = 5.85 minutes

Reach #12 - SCM L TO POA 7

Segment 1: Concentrated Flow

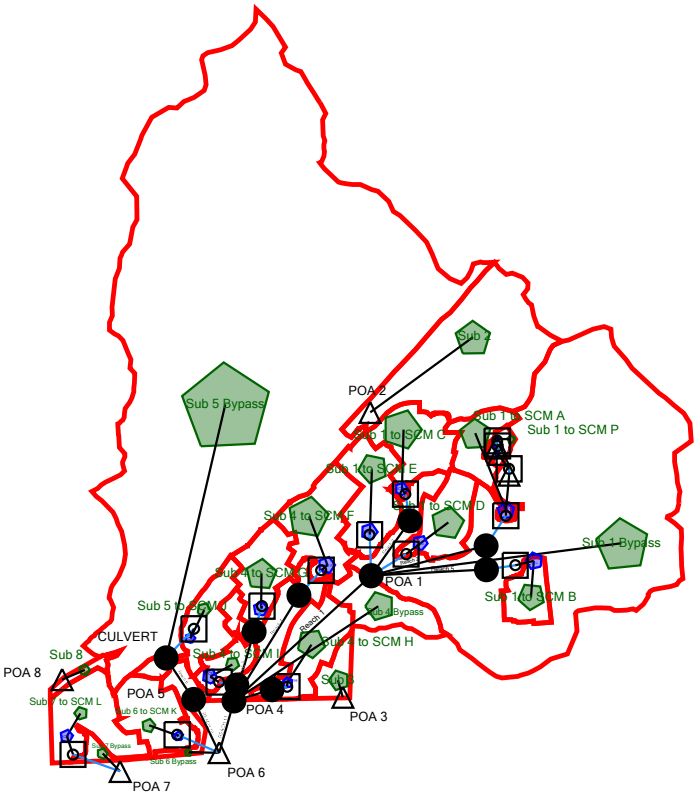
Length =	85	ft
Top Elev =	338.00	ft
Bot Elev =	327.00	ft
Height =	11	ft
Slope =	0.1294	ft/ft
Paved ? =	No	
Velocity =	5.80	ft/sec
Segment Time =	***0.24***	***minutes***

Segment 2: Channel Flow

Length =	68	ft
Top Elev =	327.00	ft
Bot Elev =	324.00	ft
Height =	3	ft
Slope =	0.0441	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	12.00	sf (assume 6'w x 2'h channel)
Wetted Perimeter =	10.00	lf (assume 6'w x 2'h channel)
Channel Velocity =	7.85	ft/sec
Reach Travel Time =	***0.14***	***minutes***

Total Travel Time = 0.39 minutes

Scenario: Post-Dev 1 yr



FlexTable: Catchment Table (AWH20000-Master.ppc)

Current Time: 0.00 min

Label	Area (ft²)	SCS CN	Time of Concentration (min)	Notes
Sub 5 Bypass	18,106,649.00	80.0	61.11	POST
Sub 2	2,363,457.00	87.0	31.12	POST
Sub 1 Bypass	8,081,866.00	87.0	40.80	POST
Sub 1 to SCM B	445,000.00	87.0	5.00	POST
Sub 1 to SCM A	538,121.00	86.0	5.00	POST
Sub 1 to SCM D	574,908.00	82.0	5.00	POST
Sub 1 to SCM C	683,139.00	86.0	5.00	POST
Sub 1 to SCM E	755,874.00	87.0	5.00	POST
Sub 4 to SCM F	811,326.00	87.0	5.00	POST
Sub 4 to SCM H	714,539.00	90.0	5.00	POST
Sub 4 Bypass	1,243,502.00	82.0	25.59	POST
Sub 4 to SCM G	595,088.00	90.0	5.00	POST
Sub 5 to SCM J	618,668.00	86.0	5.00	POST
Sub 4 to SCM I	364,616.00	87.0	5.00	POST
Sub 6 to SCM K	705,046.00	88.0	5.00	POST
Sub 7 to SCM L	698,883.00	78.0	5.00	POST
Sub 7 Bypass	92,480.00	74.0	8.59	POST
Sub 8	92,863.00	61.0	6.72	POST
Sub 1 to SCM P	32,425.00	87.0	5.00	POST
Sub 6 Bypass	92,122.00	81.0	5.00	POST

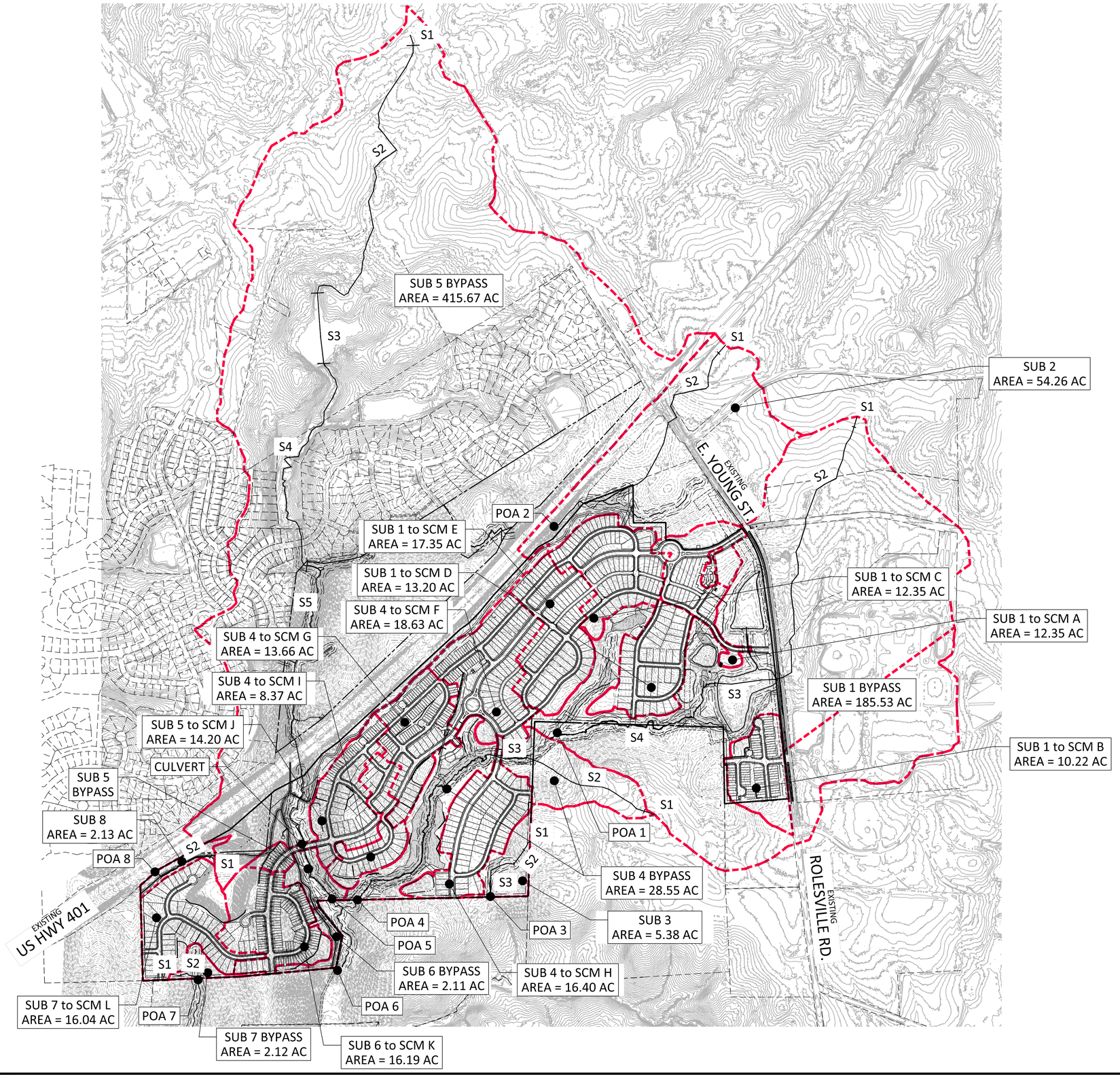
27 Siemon Company Drive Suite 200 W Watertown, CT
06795 USA +1-203-755-1666
L. Kabrich, EI
McAdams

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
Sub 5 Bypass	Post-Dev 1 yr	1	38.928	765.00	241.0
Sub 5 Bypass	Post-Dev 10 yr	10	100.289	758.00	596.8
Sub 2	Post-Dev 1 yr	1	7.253	739.00	70.0
Sub 2	Post-Dev 10 yr	10	16.259	738.00	138.6
Sub 1 Bypass	Post-Dev 1 yr	1	24.738	745.00	202.0
Sub 1 Bypass	Post-Dev 10 yr	10	55.470	745.00	407.2
Sub 1 to SCM B	Post-Dev 1 yr	1	1.375	721.00	29.7
Sub 1 to SCM B	Post-Dev 10 yr	10	3.081	721.00	55.5
Sub 1 to SCM A	Post-Dev 1 yr	1	1.587	721.00	34.2
Sub 1 to SCM A	Post-Dev 10 yr	10	3.622	721.00	65.5
Sub 1 to SCM D	Post-Dev 1 yr	1	1.394	721.00	29.6
Sub 1 to SCM D	Post-Dev 10 yr	10	3.441	721.00	62.8
Sub 1 to SCM C	Post-Dev 1 yr	1	2.014	721.00	43.5
Sub 1 to SCM C	Post-Dev 10 yr	10	4.598	721.00	83.2
Sub 1 to SCM E	Post-Dev 1 yr	1	2.336	721.00	50.5
Sub 1 to SCM E	Post-Dev 10 yr	10	5.234	721.00	94.4
Sub 4 to SCM F	Post-Dev 1 yr	1	2.507	721.00	54.2
Sub 4 to SCM F	Post-Dev 10 yr	10	5.618	721.00	101.3
Sub 4 to SCM H	Post-Dev 1 yr	1	2.534	721.00	54.7
Sub 4 to SCM H	Post-Dev 10 yr	10	5.372	721.00	95.4
Sub 3	Post-Dev 1 yr	1	0.436	726.00	6.7
Sub 3	Post-Dev 10 yr	10	1.195	726.00	16.6
Sub 4 Bypass	Post-Dev 1 yr	1	2.997	734.00	31.7
Sub 4 Bypass	Post-Dev 10 yr	10	7.401	734.00	70.7
Sub 4 to SCM G	Post-Dev 1 yr	1	2.110	721.00	45.5
Sub 4 to SCM G	Post-Dev 10 yr	10	4.474	721.00	79.4
Sub 5 to SCM J	Post-Dev 1 yr	1	1.824	721.00	39.4
Sub 5 to SCM J	Post-Dev 10 yr	10	4.164	721.00	75.4
Sub 4 to SCM I	Post-Dev 1 yr	1	1.127	721.00	24.4
Sub 4 to SCM I	Post-Dev 10 yr	10	2.525	721.00	45.5
Sub 6 to SCM K	Post-Dev 1 yr	1	2.282	721.00	49.4
Sub 6 to SCM K	Post-Dev 10 yr	10	5.020	721.00	90.1
Sub 7 to SCM L	Post-Dev 1 yr	1	1.375	722.00	28.4
Sub 7 to SCM L	Post-Dev 10 yr	10	3.688	721.00	67.2
Sub 7 Bypass	Post-Dev 1 yr	1	0.145	725.00	2.4
Sub 7 Bypass	Post-Dev 10 yr	10	0.426	724.00	6.5
Sub 8	Post-Dev 1 yr	1	0.056	727.00	0.6
Sub 8	Post-Dev 10 yr	10	0.249	723.00	3.7
Sub 1 to SCM P	Post-Dev 1 yr	1	0.100	721.00	2.2
Sub 1 to SCM P	Post-Dev 10 yr	10	0.225	721.00	4.0
Sub 6 Bypass	Post-Dev 1 yr	1	0.212	722.00	4.5
Sub 6 Bypass	Post-Dev 10 yr	10	0.535	721.00	9.8

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
POA 3	Post-Dev 1 yr	1	0.436	726.00	6.7
POA 3	Post-Dev 10 yr	10	1.195	726.00	16.6
POA 6	Post-Dev 1 yr	1	74.573	767.00	485.3
POA 6	Post-Dev 10 yr	10	195.937	763.00	1,231.6
POA 7	Post-Dev 1 yr	1	0.371	725.00	2.5
POA 7	Post-Dev 10 yr	10	2.441	753.00	8.6
POA 8	Post-Dev 1 yr	1	0.056	727.00	0.6
POA 8	Post-Dev 10 yr	10	0.249	723.00	3.7



CULVERT FLOWS CALCULATED FROM FLOWS OF "SUB 5 BYPASS" AND "SUB 5 TO SCM J" FLOWS

GRAPHIC SCALE
0 225 450 900
1 inch = 450 ft.

FINAL DRAWING - NOT RELEASED FOR CONSTRUCTION

McADAMS
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900 RIDGEFIELD DRIVE, SUITE 335
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PHONE: 919. 422. 7663
CONTACT: BOB MISHLER

THE POINT
PHASES 8 AND 14
CONSTRUCTION DRAWINGS - PACKAGE 3
EAST YOUNG STREET
TOWN OF ROLESVILLE, WAKE FOREST TOWNSHIP, WAKE COUNTY, NORTH CAROLINA

CD XX-XX

REVISIONS

NO. DATE

PLAN INFORMATION

PROJECT NO.	AWH-20000
FILENAME	XXXXXXXX-S1
CHECKED BY	DCW
DRAWN BY	TKD
SCALE	1"=450'
DATE	12. 08. 2023

SHEET

POST DEVELOPMENT HYDROLOGY MAP

POST

M:\Projects\AWH\AWH-20000\04-Production\Water Resources\South Site\Current Drawings\AWH20000s - Post CD Package3.dwg, 12/12/2023 4:55:33 PM, Tommy Dabolt

STORMWATER CONTROL MEASURE 'K'
DESIGN CALCULATIONS

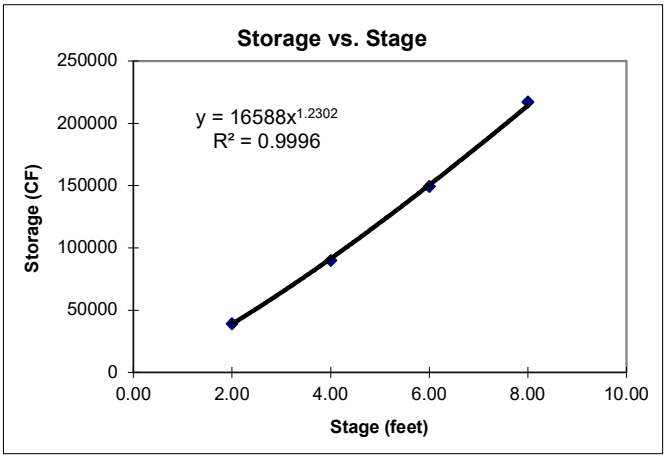
The Point
AWH-20000

STORMWATER CONTROL MEASURE 'K'

SSFxn Above NP

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)
298.00	0.00	16,166				
300.00	2.00	23,117	19642	39283	39283	2.02
302.00	4.00	27,452	25285	50569	89852	3.95
304.00	6.00	32,010	29731	59462	149314	5.97
306.00	8.00	35,757	33884	67767	217081	8.09



K_S =	16588
b =	1.2302

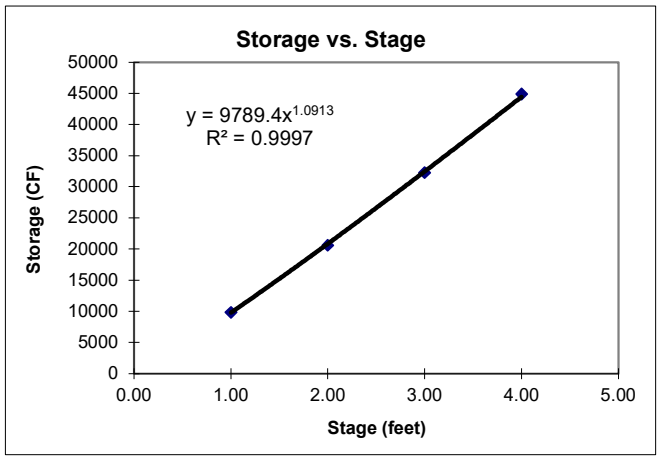
STORMWATER CONTROL MEASURE 'K'

SSFxn Main Pool

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)
293.00	-1.00	8,561	Sediment Storage			
294.00	0.00	9,418				
295.00	1.00	10,300	9859	9859	9859	1.01
296.00	2.00	11,207	10754	10754	20612	1.98
297.00	3.00	12,139	11673	11673	32286	2.98
298.00	4.00	13,097	12618	12618	44904	4.04

*surface area and volume used for avg. depth calculation



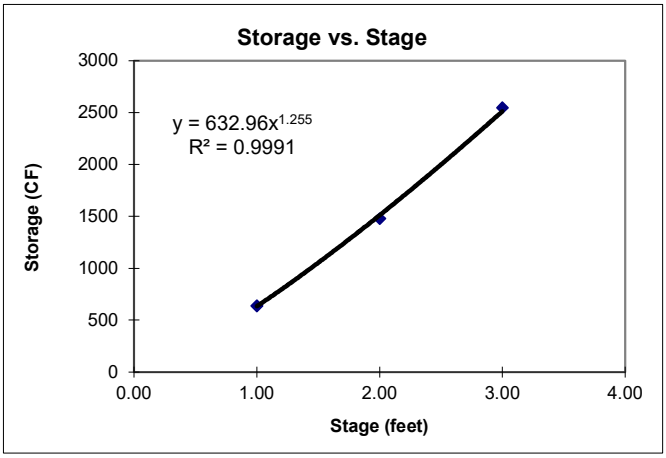
K_S =	9789
b =	1.0913

STORMWATER CONTROL MEASURE 'K'

SSFxn Forebay

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)
294.00	-1.00	378	Sediment Storage			
295.00	0.00	543				
296.00	1.00	733	638	638	638	1.01
297.00	2.00	948	841	841	1479	1.97
298.00	3.00	1,189	1069	1069	2547	3.03



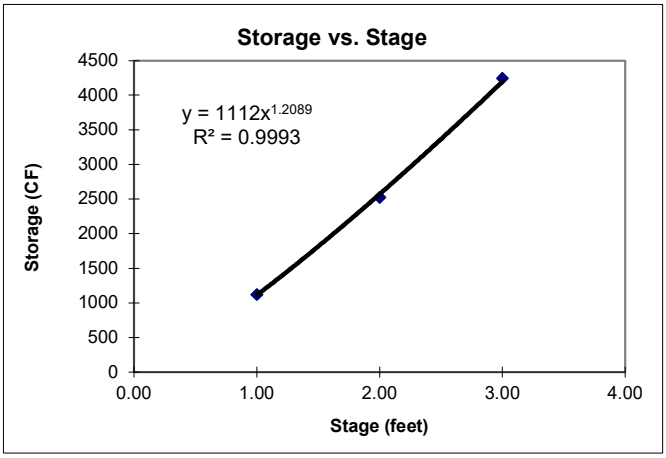
K_S =	633.0
b =	1.2550

STORMWATER CONTROL MEASURE 'K'

SSFxn Forebay (2)

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)
294.00	-1.00	733	Sediment Storage			
295.00	0.00	982				
296.00	1.00	1,256	1119	1119	1119	1.01
297.00	2.00	1,556	1406	1406	2525	1.97
298.00	3.00	1,880	1718	1718	4243	3.03



K_S =	1112.0
b =	1.2089

THE POINT
AWH-20000

STORMWATER CONTROL MEASURE 'K'

Volume Calculation

T. DABOLT
12/12/2023

TOTAL VOLUME OF FACILITY

Volume of Main Pool below Normal Pool=	44,904	cf
Volume of Forebay below Normal Pool=	6,790	cf
Total Volume Below Normal Pool =	51,694	cf
Total Volume Above Normal Pool=	217,081	cf
Total Volume of Facility =	268,775	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 =	44,904	cf
Provided Forebay Volume =	6,790	cf
Provided Forebay Volume % =	15%	

AVERAGE DEPTH OF MAIN POOL

Main Pool Volume at Normal Pool =	44,904	cf
Main Pool Area at Normal Pool =	13,097	sf
Average Depth =	3.43	ft

STORMWATER CONTROL MEASURE 'K'

Surface Area Calculation

WET DETENTION BASIN SUMMARY

Enter the drainage area characteristics ==>

Total drainage area to pond =	16.19	acres
Total impervious area to pond =	9.12	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 = **16.19** acres @ **56.3%** impervious

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

Wet Detention Basins are based on an minimum average depth of = **3.43** feet

		3.0	3.43	4.0
Lower Boundary =>	50.0	1.79		1.51
Site % impervious =>	56.3	1.98	***1.85***	1.67
Upper Boundary =>	60.0	2.09		1.77

Therefore, SA/DA required = ***1.85***

Surface area required for main pool at normal pool =	13,038	ft^2	
=	0.30	acres	
Surface area provided for main pool at normal pool =	13,097	ft^2	59

STORMWATER CONTROL MEASURE 'K'

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 =	16.19	acres
Impervious area =	9.12	acres
Percent impervious cover, I =	56.3	%
Rainfall, P =	1.00	inches

Calculated values:

R_V =	0.56	
WQ_V =	0.75	acre-ft
=	32728	cf.

ASSOCIATED DEPTH IN POND

WQ_V =	32728	cf.

Stage / Storage Data:

Ks =	16588	
b =	1.230	
Zo =	298.00	
Volume in 1" rainfall =	32728	cf.

Calculated values:

Depth of WQv in Basin =	1.74	ft
=	20.85	inches
Elevation =	299.74	ft

STORMWATER CONTROL MEASURE 'K'

WQV Drawdown Calculation

T. DABOLT
12/12/2023

DRAWDOWN ORIFICE DESIGN

D orifice =	2.5	inch
# orifices =	1	
Ks =	16588	
b =	1.2302	
C_d orifice =	0.60	
Normal Pool Elevation =	298.00	feet
Volume @ Normal Pool =	0	cf
Orifice Invert =	298.00	feet
WSEL @ 1" Runoff Volume =	299.74	feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
299.74	32728	0.209			
299.59	29355	0.200	0.205	3373	16485
299.44	26053	0.190	0.195	3302	16957
299.30	22828	0.179	0.184	3225	17500
299.15	19686	0.168	0.173	3142	18136
299.00	16636	0.155	0.161	3050	18897
298.86	13687	0.142	0.149	2949	19835
298.71	10853	0.127	0.135	2834	21038
298.56	8152	0.111	0.119	2701	22679
298.41	5611	0.091	0.101	2541	25152
298.27	3273	0.066	0.079	2338	29699

Drawdown Time = 2.39 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 =	0.544	feet
Orifice composite loss coefficient =	0.600	
Cross-sectional area of siphon =	0.034	sf
Q =	0.1211	cfs

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

Drawdown Time = 3.13 days

STORMWATER CONTROL MEASURE 'K'

Anti-Flotation Block Calculations

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 =	7.00	feet
Inside length of riser =	4.00	feet
Inside width of riser =	4.00	feet
Wall thickness of riser =	6.00	inches
Base thickness of riser =	6.00	inches
Base length of riser =	5.00	feet
Base width of riser =	5.00	feet

Openings:

Total Orifice Area =	1.665	SF
OD of barrel exiting manhole =	30.00	inches
Size of drain pipe (if present) =	6.0	inches

Trash Rack:

Bottom Length =	7.00	feet
Bottom Width =	7.00	feet
Top Length =	1.00	feet
Top Width =	1.00	feet
Height =	2.00	feet
Trash Rack water displacement =	38.00	CF

Concrete Present in Riser Structure ==>

Total amount of concrete:

Base of Riser =	12.50	CF
Riser Walls =	63.00	CF

Adjust for openings:

Opening for Orifices =	0.83	CF
Opening for barrel =	2.45	CF
Opening for drain pipe =	0.10	CF

Total Concrete present, adjusted for openings =	***72.115***	***CF***
Weight of concrete present =	***10,240***	***lbs***

STORMWATER CONTROL MEASURE 'K'

Anti-Flotation Block Calculations

Amount of water displaced by Riser Structure ==>

Displacement by concrete =	72.11	CF
Displacement by open air in riser =	112.00	CF
Displacement by trash rack =	38.00	CF
Total water displaced by riser/barrel structure =	***222.11***	***CF***
Weight of water displaced =	***13,860***	***lbs***

Calculate size of base for riser assembly ==>

Length =	8.00	feet
Width =	8.00	feet
Thickness =	18	inches
Concrete Present =	96.00	CF

Check validity of base as designed ==>

Total Water Displaced =	305.61	CF
Total Concrete Present =	168.11	CF
Total Water Displaced =	19,070	lbs
Total Concrete Present =	23,872	lbs
Actual safety factor =	*1.25*	OK

Results of design ==>

Base length =	8.00	feet
Base width =	8.00	feet
Base Thickness =	18.00	inches
CY of concrete total in base =	3.56	CY
Concrete unit weight in added base >=	142.0	PCF

STORMWATER CONTROL MEASURE 'K'

Anti-Flotation Block Calculations

II. CALCULATION FOR RISER ANTI-FLOTATION STEEL

Input Data ==>

Anti-Floatation Block Length =	8.0	feet
Anti-Floatation Block Width =	8.0	feet
Anti-Floatation Block Thickness =	18	inches
A_{steel} to $A_{concrete}$ Ratio =	0.0020	(recommend 0.0018 or hi

Cross-Section Calculations==>

Cross-Section Area* =	12.00	SF
Minimum Steel Area Required =	0.024	SF
	3.46	SI

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

Rebar Calculations ==>

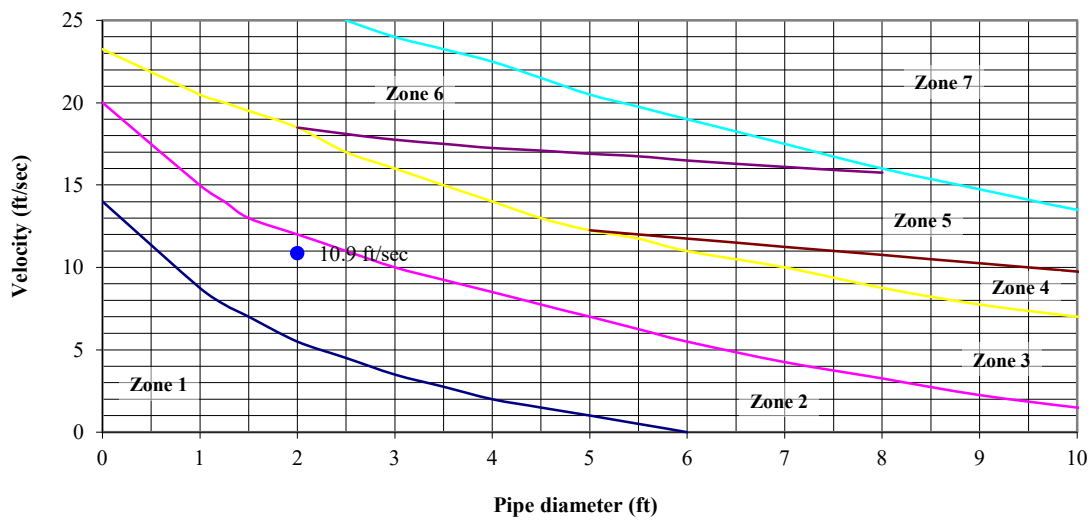
Bar Size	4	5	6	7	8
Diameter (inches)	0.500	0.625	0.750	0.875	1.000
X-Sec Area (SI)	0.196	0.307	0.442	0.601	0.785
Minimum Number of Bars	18	12	8	6	5

DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

Project	The Point	Date	12/1/2023
Project No.	AWH-20000	Designer	TKD
Outlet ID	SCM K		

Flow, $Q_{10\text{-}yr}$	7.2	cfs
Slope, S	4.35	%
Pipe Diameter, D_o	24	inches
Pipe Diameter, D_o	2.0	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	24 in.	Length =	12.0 ft.
Outlet flowrate	7.2 cfs	Width =	6.0 ft.
Outlet velocity	10.9 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

Subsection: Elevation-Area Volume Curve
Label: SCM K
Scenario: Post-Dev 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)
298.00	0.0	17,036.00	0.00	0.000	0.000
299.00	0.0	21,033.20	56,998.58	0.436	0.436
300.00	0.0	23,116.57	66,200.06	0.507	0.943
302.00	0.0	27,452.95	75,761.15	1.159	2.102
304.00	0.0	32,010.00	89,106.99	1.364	3.466
306.00	0.0	35,757.00	101,598.67	1.555	5.021

Subsection: Outlet Input Data
Label: SCMK
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Requested Pond Water Surface Elevations	
Minimum (Headwater)	298.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	306.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir	Forward	Culvert	302.25	302.75
Orifice-Area	Orifice 1yr	Forward	Culvert	302.75	306.00
Inlet Box	Riser	Forward	Culvert	304.00	306.00
Orifice-Circular	WQOrifice	Forward	Culvert	298.00	306.00
Culvert-Circular	Culvert	Forward	TW	297.00	306.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: SCMK
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Structure ID: Culvert Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	24.00 in
Length	69.00 ft
Length (Computed Barrel)	69.07 ft
Slope (Computed)	0.043 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

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	299.15 ft	T1 Flow	15.6 ft^3/s
T2 Elevation	299.35 ft	T2 Flow	17.8 ft^3/s

Subsection: Outlet Input Data
Label: SCMK
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Structure ID: Riser Structure Type: Inlet Box	
Number of Openings	1
Elevation	304.00 ft
Orifice Area	16.0 ft²
Orifice Coefficient	0.6
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False

Structure ID: WQOrifice Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	298.00 ft
Orifice Diameter	2.50 in
Orifice Coefficient	0.6

Structure ID: Orifice 1yr Structure Type: Orifice-Area	
Number of Openings	1
Elevation	302.25 ft
Orifice Area	1.5 ft²
Top Elevation	302.75 ft
Datum Elevation	302.50 ft
Orifice Coefficient	0.6

Structure ID: Weir Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	302.25 ft
Weir Length	3.00 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

Subsection: Outlet Input Data
Label: SCMK
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Convergence Tolerances	
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft^3/s
Flow Tolerance (Maximum)	10.0 ft^3/s

Subsection: Composite Rating Curve
Label: SCMK
Scenario: Post-Dev 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
298.00	0.0	(N/A)	0.00	(no Q: Weir,Orifice 1yr,Riser,WQOrifice,Culvert)
298.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
298.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
298.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
298.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
298.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
298.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
298.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
298.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
298.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
299.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
299.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
299.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
299.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
299.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
299.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
299.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
299.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
299.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
299.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
300.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
300.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
300.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
300.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
300.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)

Subsection: Composite Rating Curve
Label: SCMK
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
300.50	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
300.60	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
300.70	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
300.80	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
300.90	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
301.00	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
301.10	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
301.20	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
301.30	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
301.40	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
301.50	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
301.60	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
301.70	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
301.80	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
301.90	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
302.00	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
302.10	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
302.20	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
302.25	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
302.30	0.4	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
302.40	0.9	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
302.50	1.5	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
302.60	2.2	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
302.70	3.1	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
302.80	4.3	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)

Subsection: Composite Rating Curve
Label: SCMK
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
302.90	4.9	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
303.00	5.5	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
303.10	6.0	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
303.20	6.4	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
303.30	6.8	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
303.40	7.2	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
303.50	7.6	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
303.60	7.9	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
303.70	8.3	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
303.80	8.6	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
303.90	8.9	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
304.00	9.2	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
304.10	11.0	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
304.20	14.1	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
304.30	17.9	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
304.40	22.4	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
304.50	27.5	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
304.60	33.0	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)

Subsection: Composite Rating Curve
Label: SCMK
Scenario: Post-Dev 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
304.70	37.9	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
304.80	41.5	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
304.90	44.4	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
305.00	45.5	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
305.10	45.9	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
305.20	46.2	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
305.30	46.6	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
305.40	46.9	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
305.50	47.2	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
305.60	47.6	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
305.70	47.9	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
305.80	48.2	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
305.90	48.5	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
306.00	48.8	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)

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

Return Event: 1 years
Storm Event: 1 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	298.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	49.4 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	0.3 ft³/s	Time to Peak (Flow, Outlet)	1,440.00 min

Elevation (Water Surface, Peak)	301.79 ft
Volume (Peak)	1.973 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.282 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.309 ac-ft
Volume (Retained)	1.973 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

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

Return Event: 10 years
Storm Event: 10 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	298.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	90.1 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	7.2 ft³/s	Time to Peak (Flow, Outlet)	761.00 min

Elevation (Water Surface, Peak)	303.40 ft
Volume (Peak)	3.036 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.020 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.635 ac-ft
Volume (Retained)	2.383 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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

Return Event: 25 years
Storm Event: 25 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	298.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	104.0 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	14.9 ft³/s	Time to Peak (Flow, Outlet)	754.00 min

Elevation (Water Surface, Peak)	304.22 ft
Volume (Peak)	3.630 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	6.258 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.858 ac-ft
Volume (Retained)	2.398 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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

Return Event: 100 years
Storm Event: 100 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	298.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	123.9 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	35.9 ft³/s	Time to Peak (Flow, Outlet)	735.00 min

Elevation (Water Surface, Peak)	304.66 ft
Volume (Peak)	3.959 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	8.325 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	5.922 ac-ft
Volume (Retained)	2.402 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

STORMWATER CONTROL MEASURE 'L'
DESIGN CALCULATIONS

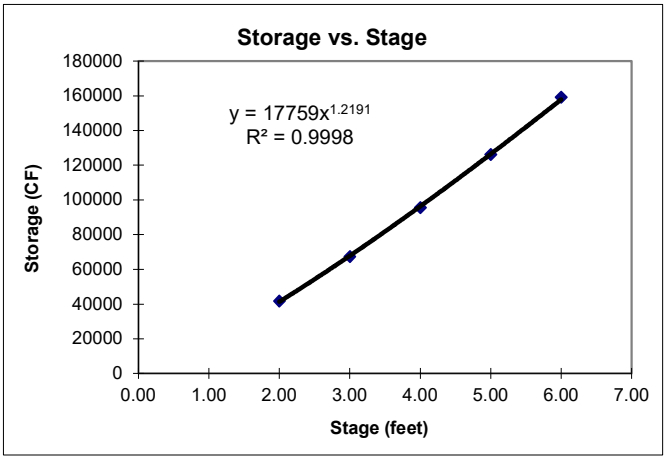
The Point
AWH-20000

STORMWATER CONTROL MEASURE 'L'

SSFxn Above NP

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)
340.00	0.00	16,998				
342.00	2.00	24,618	20808	41616	41616	2.01
343.00	3.00	26,951	25785	25785	67401	2.99
344.00	4.00	29,341	28146	28146	95547	3.98
345.00	5.00	31,786	30563	30563	126110	4.99
346.00	6.00	34,215	31778	63555	159102	6.04



K_s =	17759
b =	1.2191

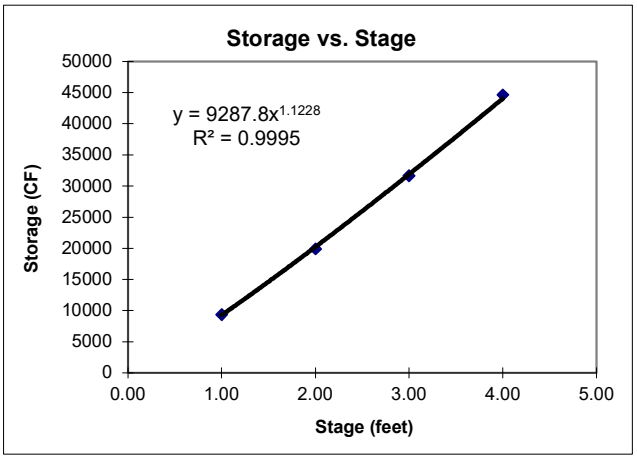
STORMWATER CONTROL MEASURE 'L'

SSFxn Main Pool

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)
335.00	-1.00	7,656	Sediment Storage			
336.00	0.00	8,792				
337.00	1.00	9,953	9373	9373	9373	1.01
338.00	2.00	11,140	10546	10546	19919	1.97
339.00	3.00	12,351	11745	11745	31664	2.98
340.00	4.00	13,587	12969	12969	44633	4.05

*surface area and volume used for avg. depth calculation



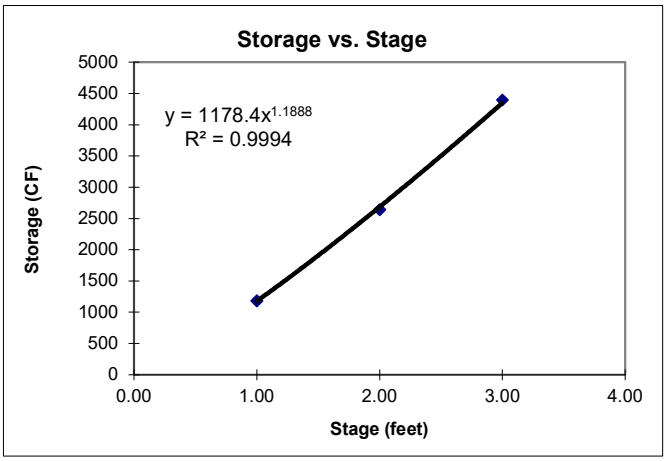
K_S =	9288
b =	1.1228

STORMWATER CONTROL MEASURE 'L'

SSFxn Forebay

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)
336.00	-1.00	823	Sediment Storage			
337.00	0.00	1,056				
338.00	1.00	1,315	1186	1186	1186	1.01
339.00	2.00	1,599	1457	1457	2642	1.97
340.00	3.00	1,907	1753	1753	4395	3.03



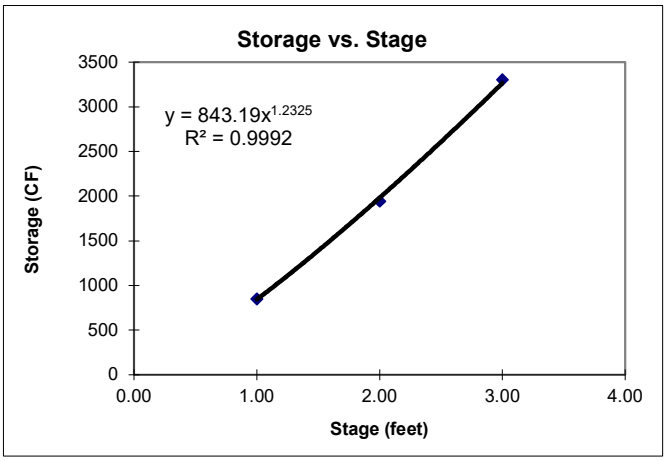
K_S =	1178.4
b =	1.1888

STORMWATER CONTROL MEASURE 'L'

SSFxn Forebay (2)

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)
336.00	-1.00	527	Sediment Storage			
337.00	0.00	733				
338.00	1.00	965	849	849	849	1.01
339.00	2.00	1,222	1094	1094	1943	1.97
340.00	3.00	1,504	1363	1363	3306	3.03



K_S =	843.2
b =	1.2325

THE POINT
AWH-20000

STORMWATER CONTROL MEASURE 'L'

Volume Calculation

T. DABOLT
12/12/2023

TOTAL VOLUME OF FACILITY

Volume of Main Pool below Normal Pool=	44,633	cf
Volume of Forebay below Normal Pool=	7,702	cf
Total Volume Below Normal Pool =	52,335	cf
Total Volume Above Normal Pool=	159,102	cf
Total Volume of Facility =	211,437	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 =	44,633	cf
Provided Forebay Volume =	7,702	cf
Provided Forebay Volume % =	17%	

AVERAGE DEPTH OF MAIN POOL

Main Pool Volume at Normal Pool =	44,633	cf
Main Pool Area at Normal Pool =	13,587	sf
Average Depth =	3.28	ft

THE POINT
AWH-20000

STORMWATER CONTROL MEASURE 'L'

Surface Area Calculation

T. DABOLT
12/12/2023

WET DETENTION BASIN SUMMARY

Enter the drainage area characteristics ==>

Total drainage area to pond =	16.04	acres
Total impervious area to pond =	7.65	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 = **16.04** acres @ **47.7%** impervious

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

Wet Detention Basins are based on an minimum average depth of = **3.28** feet

		3.0	3.28	4.0
Lower Boundary =>	40.0	1.51		1.24
Site % impervious =>	47.7	1.73	***1.65***	1.45
Upper Boundary =>	50.0	1.79		1.51

Therefore, SA/DA required = ***1.65***

Surface area required for main pool at normal pool =	11,509	ft^2
=	0.26	acres
Surface area provided for main pool at normal pool =	13,587	ft^2

STORMWATER CONTROL MEASURE 'L'

WQV Calculation

T. DABOLT
12/12/2023

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 =	16.04	acres
Impervious area =	7.65	acres
Percent impervious cover, I =	47.7	%
Rainfall, P =	1.00	inches

Calculated values:

R_V =	0.48	
WQ_V =	0.64	acre-ft
=	27919	cf.

ASSOCIATED DEPTH IN POND

WQ_V =	27919	cf.

Stage / Storage Data:

Ks =	17759	
b =	1.219	
Zo =	340.00	
Volume in 1" rainfall =	27919	cf.

Calculated values:

Depth of WQv in Basin =	1.45	ft
=	17.39	inches
Elevation =	341.45	ft

STORMWATER CONTROL MEASURE 'L'

WQV Drawdown Calculation

T. DABOLT
12/12/2023

DRAWDOWN ORIFICE DESIGN

D orifice =	2.5	inch
# orifices =	1	
Ks =	17759	
b =	1.2191	
C_d orifice =	0.60	
Normal Pool Elevation =	340.00	feet
Volume @ Normal Pool =	0	cf
Orifice Invert =	340.00	feet
WSEL @ 1" Runoff Volume =	341.45	feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
341.45	27919	0.190			
341.33	25058	0.181	0.186	2861	15416
341.20	22254	0.172	0.176	2804	15886
341.08	19513	0.162	0.167	2742	16430
340.96	16839	0.151	0.157	2674	17071
340.83	14239	0.140	0.146	2599	17842
340.71	11723	0.128	0.134	2517	18800
340.59	9300	0.114	0.121	2423	20045
340.47	6987	0.098	0.106	2313	21773
340.34	4805	0.080	0.089	2182	24455
340.22	2792	0.056	0.068	2013	29706

Drawdown Time = 2.29 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 =	0.448	feet
Orifice composite loss coefficient =	0.600	
Cross-sectional area of siphon =	0.034	sf
Q =	0.1099	cfs

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

Drawdown Time = 2.94 days

STORMWATER CONTROL MEASURE 'L'

Anti-Flotation Block Calculations

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 =	4.50	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 =	2.136	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 =	49.50	CF

Adjust for openings:

Opening for Orifices =	1.07	CF
Opening for barrel =	5.28	CF
Opening for drain pipe =	0.10	CF

Total Concrete present, adjusted for openings =	***61.054***	***CF***
Weight of concrete present =	***8,670***	***lbs***

THE POINT
AWH20000

STORMWATER CONTROL MEASURE 'L'
Anti-Flotation Block Calculations

T. DABOLT
12/1/2023

Amount of water displaced by Riser Structure ==>

Displacement by concrete =	61.05	CF
Displacement by open air in riser =	112.50	CF
Displacement by trash rack =	61.74	CF
Total water displaced by riser/barrel structure =	***235.29***	***CF***
Weight of water displaced =	***14,682***	***lbs***

Calculate size of base for riser assembly ==>

Length =	9.00	feet
Width =	9.00	feet
Thickness =	18	inches
Concrete Present =	121.50	CF

Check validity of base as designed ==>

Total Water Displaced =	338.79	CF
Total Concrete Present =	182.55	CF
Total Water Displaced =	21,141	lbs
Total Concrete Present =	25,923	lbs
Actual safety factor =	*1.23*	OK

Results of design ==>

Base length =	9.00	feet
Base width =	9.00	feet
Base Thickness =	18.00	inches
CY of concrete total in base =	4.50	CY
Concrete unit weight in added base >=	142.0	PCF

STORMWATER CONTROL MEASURE 'L'

Anti-Flotation Block Calculations

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 =	18	inches
A_{steel} to $A_{concrete}$ Ratio =	0.0020	(recommend 0.0018 or hi

Cross-Section Calculations==>

Cross-Section Area* =	13.50	SF
Minimum Steel Area Required =	0.027	SF
	3.89	SI

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

Rebar Calculations ==>

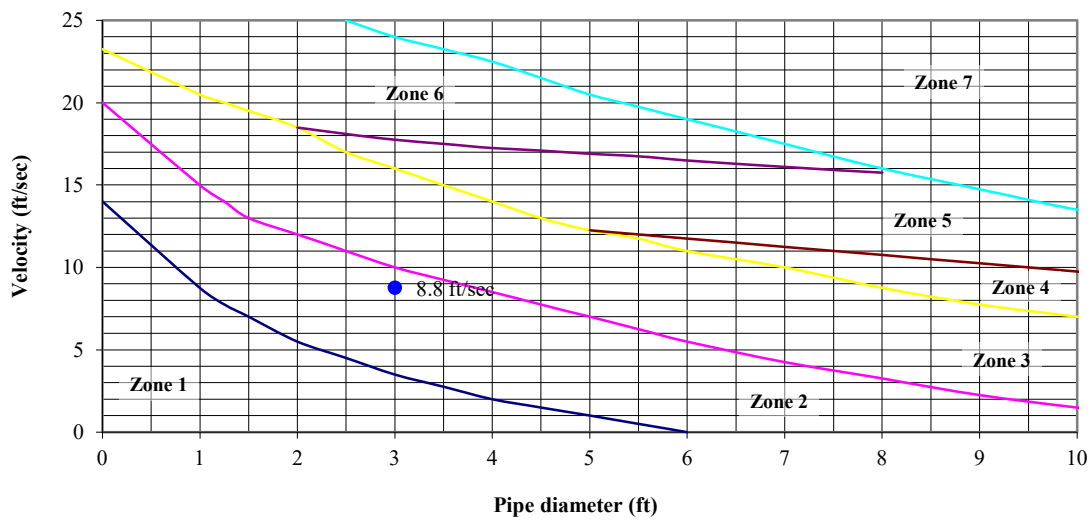
Bar Size	4	5	6	7	8
Diameter (inches)	0.500	0.625	0.750	0.875	1.000
X-Sec Area (SI)	0.196	0.307	0.442	0.601	0.785
Minimum Number of Bars	20	13	9	7	5

DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

Project	The Point	Date	12/1/2023
Project No.	AWH-20000	Designer	TKD
Outlet ID	SCM L		

Flow, $Q_{10\text{-}yr}$	6.8	cfs
Slope, S	2.83	%
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	6.8 cfs	Width =	9.0 ft.
Outlet velocity	8.8 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

Subsection: Elevation-Area Volume Curve
Label: SCM L
Scenario: Post-Dev 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)
340.00	0.0	17,162.00	0.00	0.000	0.000
341.00	0.0	22,342.00	59,085.46	0.452	0.452
342.00	0.0	24,618.00	70,412.41	0.539	0.991
343.00	0.0	26,951.00	77,327.10	0.592	1.583
344.00	0.0	29,341.00	84,412.62	0.646	2.229
346.00	0.0	34,215.00	95,240.42	1.458	3.686

Subsection: Outlet Input Data
Label: SCM L
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Requested Pond Water Surface Elevations	
Minimum (Headwater)	340.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	346.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir	Forward	Culvert	343.00	343.50
Orifice-Area	Orifice 1yr	Forward	Culvert	343.50	346.00
Inlet Box	Riser	Forward	Culvert	344.00	346.00
Orifice-Circular	WQOrifice	Forward	Culvert	340.00	346.00
Culvert-Circular	Culvert	Forward	TW	339.50	346.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: SCM L
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Structure ID: Culvert Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.00 in
Length	50.00 ft
Length (Computed Barrel)	50.02 ft
Slope (Computed)	0.030 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

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	342.74 ft	T1 Flow	42.9 ft^3/s
T2 Elevation	343.05 ft	T2 Flow	49.0 ft^3/s

Subsection: Outlet Input Data
Label: SCM L
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Structure ID: Riser Structure Type: Inlet Box	
Number of Openings	1
Elevation	344.00 ft
Orifice Area	25.0 ft²
Orifice Coefficient	0.6
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False

Structure ID: WQOrifice Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	340.00 ft
Orifice Diameter	2.50 in
Orifice Coefficient	0.6

Structure ID: Orifice 1yr Structure Type: Orifice-Area	
Number of Openings	1
Elevation	343.00 ft
Orifice Area	2.0 ft²
Top Elevation	343.50 ft
Datum Elevation	343.25 ft
Orifice Coefficient	0.6

Structure ID: Weir Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	343.00 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

Subsection: Outlet Input Data
Label: SCM L
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Convergence Tolerances	
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft^3/s
Flow Tolerance (Maximum)	10.0 ft^3/s

Subsection: Composite Rating Curve
Label: SCM L
Scenario: Post-Dev 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
340.00	0.0	(N/A)	0.00	(no Q: Weir,Orifice 1yr,Riser,WQOrifice,Culvert)
340.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
340.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
340.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
340.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
340.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
340.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
340.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
340.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
340.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
341.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
341.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
341.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
341.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
341.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
341.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
341.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
341.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
341.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
341.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
342.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
342.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
342.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
342.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
342.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)

Subsection: Composite Rating Curve
Label: SCM L
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
342.50	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
342.60	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
342.70	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
342.80	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
342.90	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
343.00	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
343.10	0.7	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
343.20	1.4	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
343.30	2.3	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
343.40	3.3	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
343.50	5.1	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
343.60	6.0	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
343.70	6.7	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
343.80	7.4	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
343.90	8.0	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
344.00	8.6	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
344.10	11.1	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
344.20	15.0	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
344.30	20.0	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
344.40	25.7	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
344.50	32.2	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)

Subsection: Composite Rating Curve
Label: SCM L
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
344.60	39.3	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
344.70	46.9	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
344.80	54.5	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
344.90	61.0	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
345.00	67.4	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
345.10	73.2	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
345.20	76.1	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
345.30	77.1	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
345.40	78.2	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
345.50	79.2	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
345.60	80.1	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
345.70	81.1	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
345.80	82.1	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
345.90	83.0	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
346.00	84.0	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)

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

Return Event: 1 years
Storm Event: 1 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	340.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	28.4 ft³/s	Time to Peak (Flow, In)	722.00 min
Flow (Peak Outlet)	0.2 ft³/s	Time to Peak (Flow, Outlet)	1,440.00 min

Elevation (Water Surface, Peak)	342.28 ft
Volume (Peak)	1.149 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.375 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.226 ac-ft
Volume (Retained)	1.149 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

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

Return Event: 10 years
Storm Event: 10 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	340.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	67.2 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	6.8 ft³/s	Time to Peak (Flow, Outlet)	757.00 min

Elevation (Water Surface, Peak)	343.71 ft
Volume (Peak)	2.036 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.688 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.016 ac-ft
Volume (Retained)	1.671 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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

Return Event: 25 years
Storm Event: 25 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	340.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	81.9 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	17.9 ft³/s	Time to Peak (Flow, Outlet)	753.00 min

Elevation (Water Surface, Peak)	344.26 ft
Volume (Peak)	2.405 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.802 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.116 ac-ft
Volume (Retained)	1.685 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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

Return Event: 100 years
Storm Event: 100 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	340.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	103.6 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	41.0 ft³/s	Time to Peak (Flow, Outlet)	730.00 min

Elevation (Water Surface, Peak)	344.62 ft
Volume (Peak)	2.658 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	6.709 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	5.017 ac-ft
Volume (Retained)	1.690 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

STORMWATER CONTROL MEASURE 'J'
DESIGN CALCULATIONS

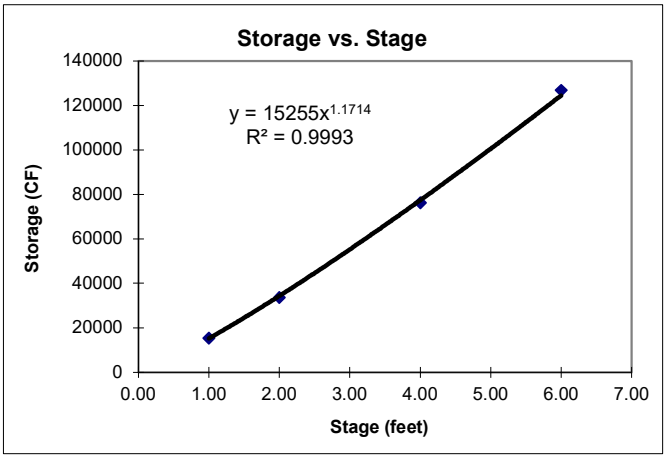
The Point
AWH-20000

STORMWATER CONTROL MEASURE 'J'

SSFxn Above NP

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)
310.00	0.00	13,651				
311.00	1.00	17,308	15479	15479	15479	1.01
312.00	2.00	19,221	18265	18265	33744	1.97
314.00	4.00	23,218	21220	42439	76183	3.95
316.00	6.00	27,441	25329	50659	126842	6.10



K_S =	15255
b =	1.1714

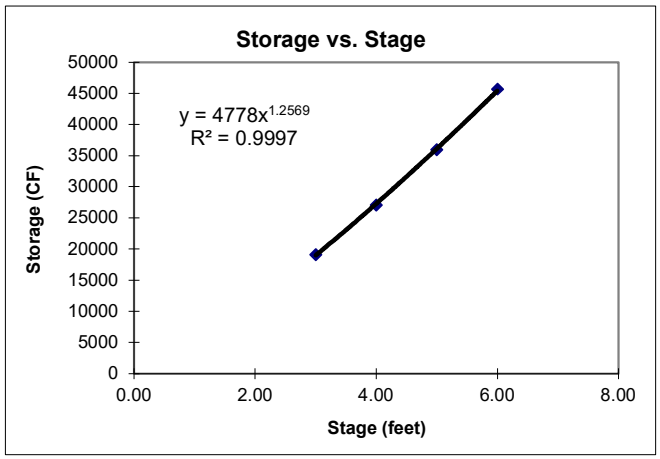
STORMWATER CONTROL MEASURE 'J'

SSFxn Main Pool

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)
303.50	-0.50	4,790	Sediment Storage			
304.00	0.00	5,168				
307.00	3.00	7,570	6369	19107	19107	3.01
308.00	4.00	8,420	7995	7995	27102	3.98
309.00	5.00	9,296	8858	8858	35961	4.98
310.00	6.00	10,197	9747	9747	45707	6.03

*surface area and volume used for avg. depth calculation



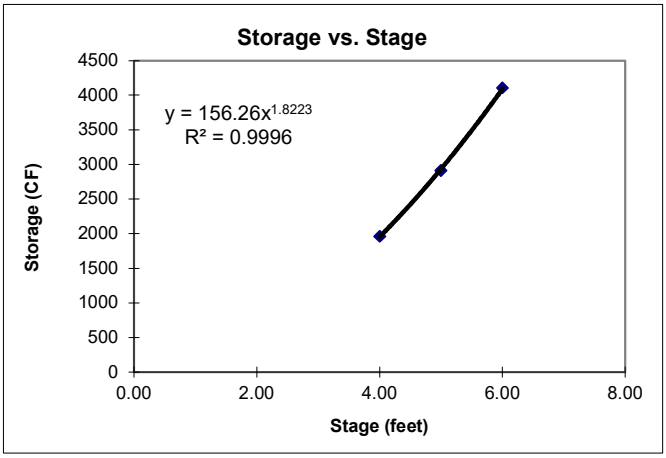
K_S =	4778
b =	1.2569

STORMWATER CONTROL MEASURE 'J'

SSFxn Forebay

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)
303.50	-0.50	89	Sediment Storage			
304.00	0.00	147				
308.00	4.00	833	490	1961	1961	4.01
309.00	5.00	1,068	951	951	2912	4.98
310.00	6.00	1,327	1198	1198	4110	6.01



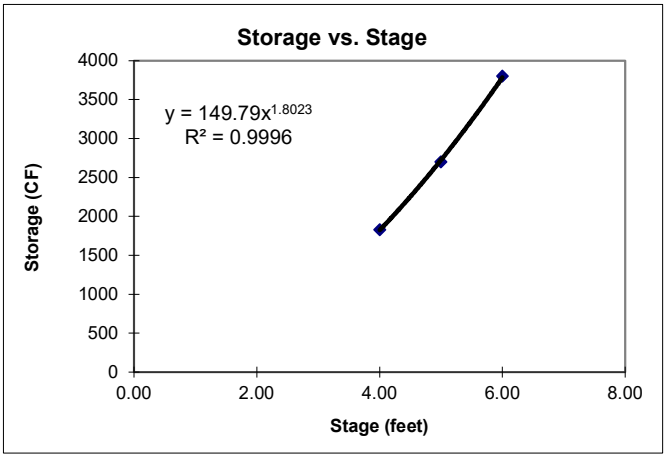
K_S =	156.3
b =	1.8223

STORMWATER CONTROL MEASURE 'J'

SSFxn Forebay (2)

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)
304.00	0.00	101	Sediment Storage			
304.00	0.00	151				
308.00	4.00	764	457	1829	1829	4.01
309.00	5.00	980	872	872	2701	4.98
310.00	6.00	1,221	1101	1101	3802	6.02



K_S =	149.8
b =	1.8023

STORMWATER CONTROL MEASURE 'J'

Volume Calculation

TOTAL VOLUME OF FACILITY

Volume of Main Pool below Normal Pool=	45,707	cf
Volume of Forebay below Normal Pool=	7,911	cf
Total Volume Below Normal Pool =	53,618	cf
Total Volume Above Normal Pool=	126,842	cf
Total Volume of Facility =	180,460	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 =	45,707	cf
Provided Forebay Volume =	7,911	cf
Provided Forebay Volume % =	17%	

AVERAGE DEPTH OF MAIN POOL

Main Pool Volume at Normal Pool =	45,707	cf
Main Pool Area at Normal Pool =	10,197	sf
Average Depth =	4.48	ft

STORMWATER CONTROL MEASURE 'J'

Surface Area Calculation

T. DABOLT
12/12/2023

WET DETENTION BASIN SUMMARY

Enter the drainage area characteristics ==>

Total drainage area to pond =	14.20	acres
Total impervious area to pond =	8.14	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 = **14.20** acres @ **57.3%** impervious

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

Wet Detention Basins are based on an minimum average depth of = **4.48** feet

		4.0	4.48	5.0
Lower Boundary =>	50.0	1.51		1.31
Site % impervious =>	57.3	1.70	***1.58***	1.44
Upper Boundary =>	60.0	1.77		1.49

Therefore, SA/DA required = ***1.58***

Surface area required for main pool at normal pool =	9,746	ft^2
=	0.22	acres
Surface area provided for main pool at normal pool =	10,197	ft^2

STORMWATER CONTROL MEASURE 'J'

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 =	14.20	acres
Impervious area =	8.14	acres
Percent impervious cover, I =	57.3	%
Rainfall, P =	1.00	inches

Calculated values:

R_V =	0.57	
WQ_V =	0.67	acre-ft
=	29170	cf.

ASSOCIATED DEPTH IN POND

WQ_V =	29170	cf.

Stage / Storage Data:

Ks =	15255	
b =	1.171	
Zo =	310.00	
Volume in 1" rainfall =	29170	cf.

Calculated values:

Depth of WQv in Basin =	1.74	ft
=	20.87	inches
Elevation =	311.74	ft

STORMWATER CONTROL MEASURE 'J'

WQV Drawdown Calculation

T. DABOLT
12/12/2023

DRAWDOWN ORIFICE DESIGN

D orifice =	2.25	inch
# orifices =	1	
Ks =	15255	
b =	1.1714	
C_d orifice =	0.60	
Normal Pool Elevation =	310.00	feet
Volume @ Normal Pool =	0	cf
Orifice Invert =	310.00	feet
WSEL @ 1" Runoff Volume =	311.74	feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
311.74	29170	0.170			
311.59	26254	0.162	0.166	2916	17536
311.44	23384	0.154	0.158	2870	18141
311.29	20566	0.145	0.150	2819	18841
311.14	17802	0.136	0.141	2763	19664
310.99	15101	0.126	0.131	2702	20656
310.84	12468	0.115	0.120	2632	21886
310.69	9915	0.103	0.109	2553	23477
310.54	7455	0.089	0.096	2460	25670
310.39	5110	0.073	0.081	2345	29025
310.24	2917	0.051	0.062	2193	35374

Drawdown Time = 2.67 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 =	0.548	feet
Orifice composite loss coefficient =	0.600	
Cross-sectional area of siphon =	0.028	sf
Q =	0.0985	cfs

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

Drawdown Time = 3.43 days

STORMWATER CONTROL MEASURE 'J'

Anti-Flotation Block Calculations

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 =	4.50	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 =	2.110	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 =	49.50	CF

Adjust for openings:

Opening for Orifices =	1.06	CF
Opening for barrel =	5.28	CF
Opening for drain pipe =	0.10	CF

Total Concrete present, adjusted for openings =	***61.067***	***CF***
Weight of concrete present =	***8,672***	***lbs***

THE POINT
AWH20000

STORMWATER CONTROL MEASURE 'J'
Anti-Flotation Block Calculations

T. DABOLT
8/10/2021

Amount of water displaced by Riser Structure ==>

Displacement by concrete =	61.07	CF
Displacement by open air in riser =	112.50	CF
Displacement by trash rack =	61.74	CF
Total water displaced by riser/barrel structure =	***235.31***	***CF***
Weight of water displaced =	***14,683***	***lbs***

Calculate size of base for riser assembly ==>

Length =	9.00	feet
Width =	9.00	feet
Thickness =	18	inches
Concrete Present =	121.50	CF

Check validity of base as designed ==>

Total Water Displaced =	338.81	CF
Total Concrete Present =	182.57	CF
Total Water Displaced =	21,142	lbs
Total Concrete Present =	25,925	lbs
Actual safety factor =	*1.23*	OK

Results of design ==>

Base length =	9.00	feet
Base width =	9.00	feet
Base Thickness =	18.00	inches
CY of concrete total in base =	4.50	CY
Concrete unit weight in added base >=	142.0	PCF

STORMWATER CONTROL MEASURE 'J'

Anti-Flotation Block Calculations

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 =	18	inches
A_{steel} to $A_{concrete}$ Ratio =	0.0020	(recommend 0.0018 or hi

Cross-Section Calculations==>

Cross-Section Area* =	13.50	SF
Minimum Steel Area Required =	0.027	SF
	3.89	SI

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

Rebar Calculations ==>

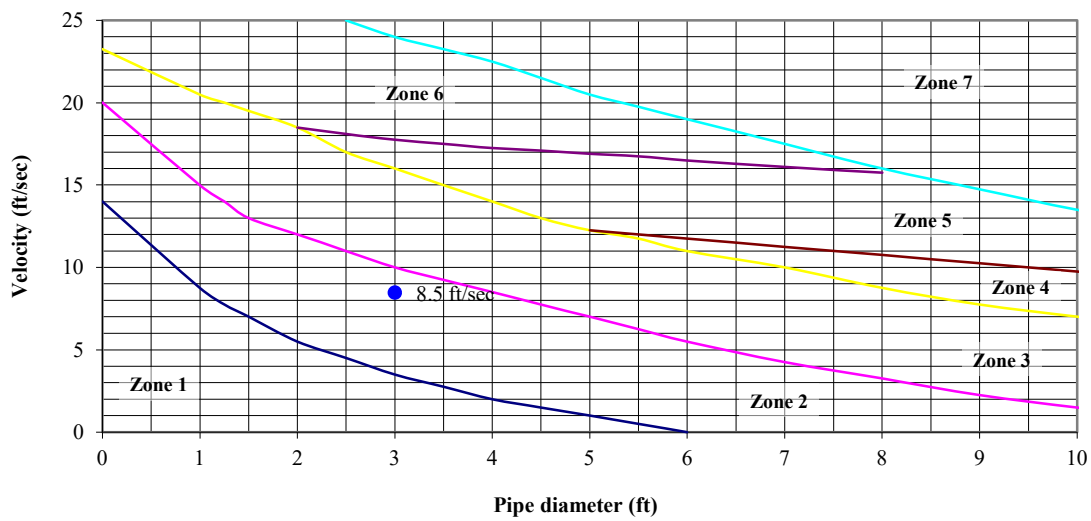
Bar Size	4	5	6	7	8
Diameter (inches)	0.500	0.625	0.750	0.875	1.000
X-Sec Area (SI)	0.196	0.307	0.442	0.601	0.785
Minimum Number of Bars	20	13	9	7	5

DESIGN OF RIPRAP OUTLET PROTECTION WORKSHEET

Project	The Point	Date	12/12/2023
Project No.	AWH-20000	Designer	TKD
Outlet ID	SCM J		

Flow, $Q_{10\text{-}yr}$	21.0	cfs
Slope, S	1.03	%
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	21.0 cfs	Width =	9.0 ft.
Outlet velocity	8.5 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

Subsection: Elevation-Area Volume Curve
Label: SCM J
Scenario: Post-Dev 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)
310.00	0.0	13,651.00	0.00	0.000	0.000
311.00	0.0	17,308.00	46,330.13	0.355	0.355
312.00	0.0	19,221.00	54,768.44	0.419	0.774
314.00	0.0	23,218.00	63,564.18	0.973	1.746
316.00	0.0	27,441.00	75,900.34	1.162	2.908

Subsection: Outlet Input Data
Label: SCMJ
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Requested Pond Water Surface Elevations	
Minimum (Headwater)	310.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	316.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir	Forward	Culvert	313.00	313.50
Orifice-Area	Orifice 1yr	Forward	Culvert	313.50	316.00
Inlet Box	Riser	Forward	Culvert	314.00	316.00
Orifice-Circular	WQOrifice	Forward	Culvert	310.00	316.00
Culvert-Circular	Culvert	Forward	TW	309.50	316.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Subsection: Outlet Input Data
Label: SCMJ
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Structure ID: Culvert Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.00 in
Length	50.00 ft
Length (Computed Barrel)	50.00 ft
Slope (Computed)	0.010 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

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	312.77 ft	T1 Flow	42.9 ft^3/s
T2 Elevation	313.08 ft	T2 Flow	49.0 ft^3/s

Subsection: Outlet Input Data
Label: SCMJ
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Structure ID: Riser Structure Type: Inlet Box	
Number of Openings	1
Elevation	314.00 ft
Orifice Area	25.0 ft²
Orifice Coefficient	0.6
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False

Structure ID: WQOrifice Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	310.00 ft
Orifice Diameter	2.25 in
Orifice Coefficient	0.6

Structure ID: Orifice 1yr Structure Type: Orifice-Area	
Number of Openings	1
Elevation	313.00 ft
Orifice Area	2.0 ft²
Top Elevation	313.50 ft
Datum Elevation	313.25 ft
Orifice Coefficient	1.0

Structure ID: Weir Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	313.00 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

Subsection: Outlet Input Data
Label: SCMJ
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Convergence Tolerances	
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft^3/s
Flow Tolerance (Maximum)	10.0 ft^3/s

Subsection: Composite Rating Curve
Label: SCMJ
Scenario: Post-Dev 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
310.00	0.0	(N/A)	0.00	(no Q: Weir,Orifice 1yr,Riser,WQOrifice,Culvert)
310.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
310.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
310.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
310.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
310.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
310.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
310.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
310.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
310.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
311.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
311.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
311.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
311.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
311.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
311.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
311.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
311.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
311.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
311.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
312.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
312.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
312.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
312.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
312.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)

Subsection: Composite Rating Curve
Label: SCMJ
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
312.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
312.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
312.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
312.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
312.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
313.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir,Orifice 1yr,Riser)
313.10	0.6	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
313.20	1.3	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
313.30	2.2	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
313.40	3.3	(N/A)	0.00	Weir,WQOrifice,Culvert (no Q: Orifice 1yr,Riser)
313.50	8.2	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
313.60	9.7	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
313.70	11.0	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
313.80	12.1	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
313.90	13.2	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
314.00	14.1	(N/A)	0.00	Orifice 1yr,WQOrifice,Culvert (no Q: Weir,Riser)
314.10	16.9	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
314.20	21.2	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
314.30	26.5	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
314.40	32.5	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
314.50	39.3	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)

Subsection: Composite Rating Curve
Label: SCMJ
Scenario: Post-Dev 1 yr

Return Event: 1 years
Storm Event: 1 yr

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
314.60	46.7	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
314.70	53.7	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
314.80	59.3	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
314.90	64.7	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
315.00	69.7	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
315.10	73.9	(N/A)	0.00	Orifice 1yr,Riser,WQOrifice,Culvert (no Q: Weir)
315.20	75.8	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
315.30	76.8	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
315.40	77.8	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
315.50	78.8	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
315.60	79.8	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
315.70	80.8	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
315.80	81.8	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
315.90	82.8	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)
316.00	83.7	(N/A)	0.00	Riser,Culvert (no Q: Weir,Orifice 1yr,WQOrifice)

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

Return Event: 1 years
Storm Event: 1 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	39.4 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	1.0 ft³/s	Time to Peak (Flow, Outlet)	903.00 min

Elevation (Water Surface, Peak)	313.16 ft
Volume (Peak)	1.314 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.824 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.558 ac-ft
Volume (Retained)	1.266 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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

Return Event: 10 years
Storm Event: 10 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	75.4 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	21.0 ft³/s	Time to Peak (Flow, Outlet)	732.00 min

Elevation (Water Surface, Peak)	314.19 ft
Volume (Peak)	1.851 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.164 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.855 ac-ft
Volume (Retained)	1.308 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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

Return Event: 25 years
Storm Event: 25 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	87.8 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	45.7 ft³/s	Time to Peak (Flow, Outlet)	728.00 min

Elevation (Water Surface, Peak)	314.59 ft
Volume (Peak)	2.067 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.235 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.916 ac-ft
Volume (Retained)	1.317 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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

Return Event: 100 years
Storm Event: 100 yr

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft³/s
Flow (Initial Infiltration)	0.0 ft³/s
Flow (Initial, Total)	0.0 ft³/s
Time Increment	1.00 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	105.8 ft³/s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	69.8 ft³/s	Time to Peak (Flow, Outlet)	726.00 min

Elevation (Water Surface, Peak)	315.00 ft
Volume (Peak)	2.304 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	7.029 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	5.708 ac-ft
Volume (Retained)	1.319 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

CULVERT DESIGN CALCULATIONS

The Point
AWH-20000

CULVERT DESIGN CALCULATIONS

Peak Flows Used for Culvert Sizing:

Q10, Peak =	611.70	cfs
Q25, Peak =	764.50	cfs
Q100, Peak =	1012.60	cfs

Culvert 1 (Main Channel) Specifications:

Shape:	Circular	
Number of Barrels =	1	
Culvert Diameter =	84	in
US Pipe Invert =	296.00	ft
DS Pipe Invert =	295.00	ft
Pipe Length =	81.00	ft
Embedment =	1.00	ft
Slope =	0.0123	ft/ft

Culvert 2 (Floodplain) Specifications:

Shape:	Circular	
Number of Barrels =	2	
Culvert Diameter =	72	in
US Pipe Invert =	299.00	ft
DS Pipe Invert =	298.00	ft
Pipe Length =	81.00	ft
Embedment =	0.00	ft
Slope =	0.0123	ft/ft

Combined Culvert System Routing:

10-Year Storm

Headwater Elevation =	304.41	ft
Hw/D =	1.2	
Road Crest Elevation =	320.19	ft
Freeboard =	15.78	ft

25-Year Storm

Headwater Elevation =	305.61	ft
Hw/D =	1.4	
Road Crest Elevation =	320.19	ft
Freeboard =	14.58	ft

100-Year Storm

Headwater Elevation =	308	ft
Hw/D =	1.8	
Road Crest Elevation =	320.19	ft
Freeboard =	12.19	ft

Velocity Dissipator Specifications:

Length =	24.00	ft
Width =	33.00	ft
Thickness=	27.00	in
Classification=	I	

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 611.70 cfs

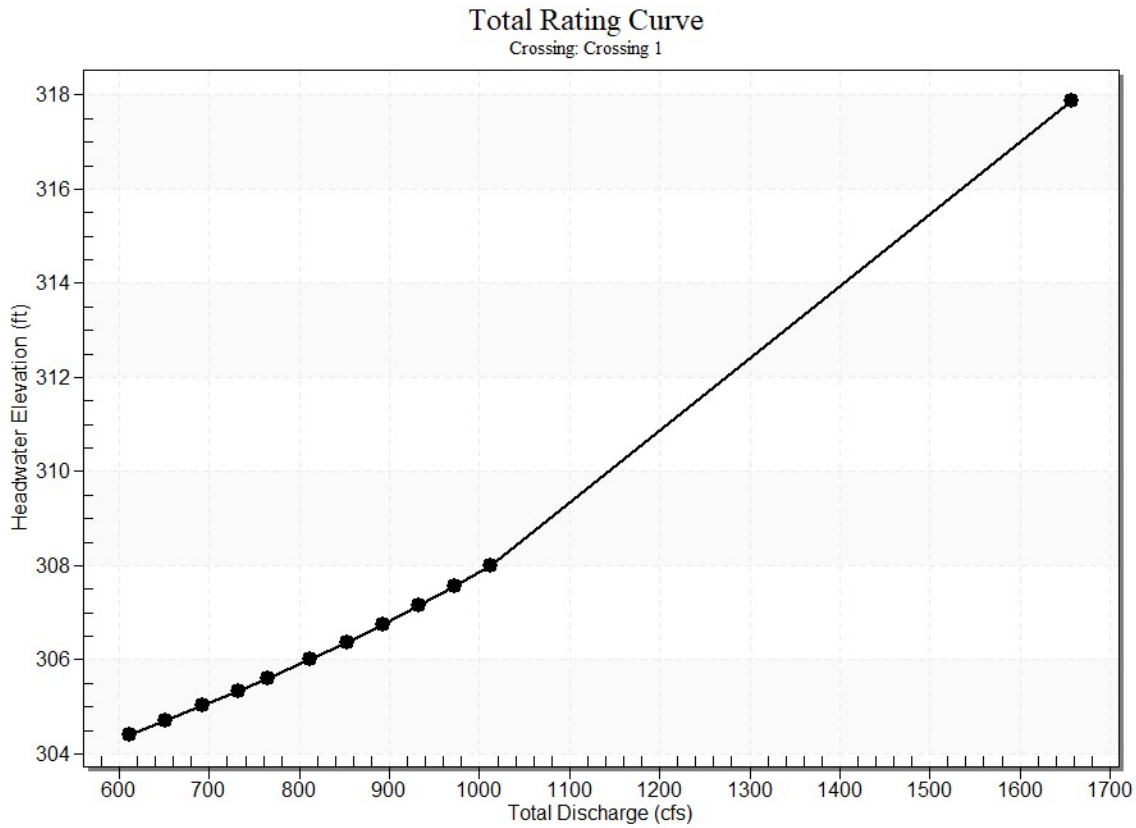
Design Flow: 764.50 cfs

Maximum Flow: 1012.60 cfs

Table 1 - Summary of Culvert Flows at Crossing: Crossing 1

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Culvert 2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
304.41	611.70	267.68	344.13	0.00	6
304.71	651.79	278.54	373.27	0.00	3
305.02	691.88	289.29	402.61	0.00	3
305.34	731.97	299.93	432.07	0.00	3
305.61	764.50	308.55	455.98	0.00	3
306.01	812.15	321.22	490.99	0.00	3
306.37	852.24	331.93	520.35	0.00	3
306.75	892.33	342.71	549.65	0.00	3
307.15	932.42	353.62	578.84	0.00	3
307.56	972.51	364.63	607.91	0.00	3
308.00	1012.60	375.74	636.89	0.00	3
320.19	1769.43	599.65	1169.78	0.00	Overtopping

Rating Curve Plot for Crossing: Crossing 1



Culvert Data: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
611.70 cfs	267.68 cfs	304.41	7.41	7.160	7-M2c	4.64	3.76	3.76	3.50	10.98	7.05
651.79 cfs	278.54 cfs	304.71	7.71	7.370	7-M2c	4.79	3.85	3.85	3.62	11.17	7.21
691.88 cfs	289.29 cfs	305.02	8.02	7.580	7-M2c	4.95	3.93	3.93	3.74	11.36	7.34
731.97 cfs	299.93 cfs	305.34	8.34	7.790	7-M2c	5.11	4.01	4.01	3.85	11.54	7.47

764.50 cfs	308.55 cfs	305.61	8.61	7.962	7-M2c	5.26	4.08	4.08	3.93	11.69	7.55
812.15 cfs	321.22 cfs	306.01	9.01	8.219	7-M2c	5.51	4.17	4.17	4.06	11.90	7.62
852.24 cfs	331.93 cfs	306.37	9.37	8.441	7-M2c	6.00	4.25	4.25	4.15	12.08	7.65
892.33 cfs	342.71 cfs	306.75	9.75	8.670	7-M2c	6.00	4.32	4.32	4.25	12.28	7.65
932.42 cfs	353.62 cfs	307.15	10.15	8.909	7-M2c	6.00	4.40	4.40	4.34	12.48	7.63
972.51 cfs	364.63 cfs	307.56	10.56	9.158	7-M2c	6.00	4.47	4.47	4.44	12.68	7.59
1012.60 cfs	375.74 cfs	308.00	11.00	9.422	7-M2c	6.00	4.54	4.54	4.52	12.89	7.55

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

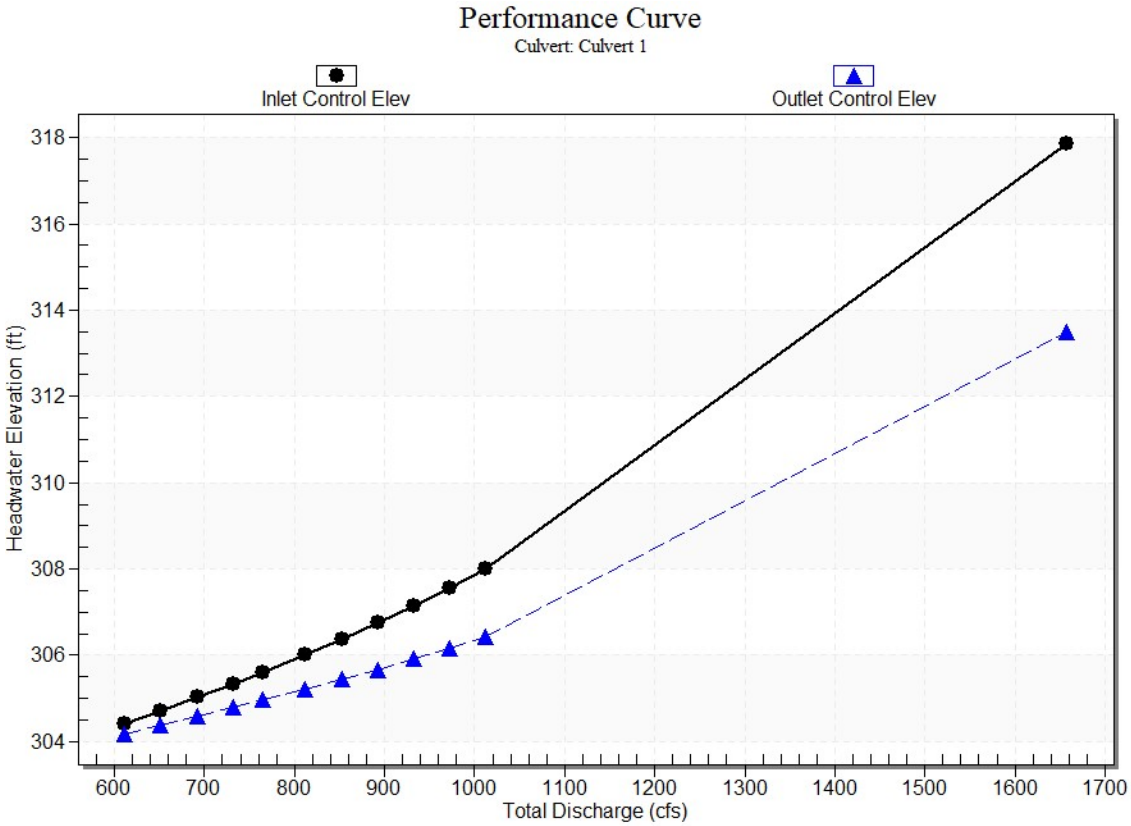
Inlet Elevation (invert): 297.00 ft,

Outlet Elevation (invert): 296.00 ft

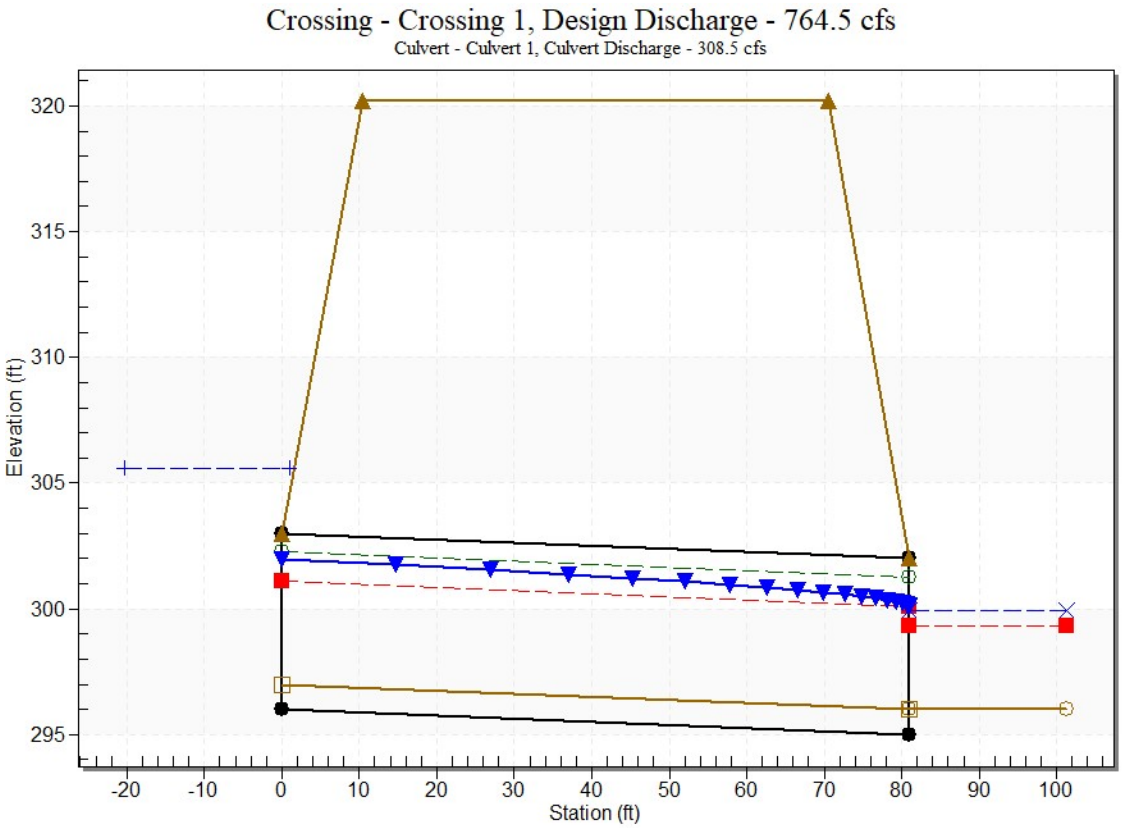
Culvert Length: 81.01 ft,

Culvert Slope: 0.0123

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 296.00 ft

Outlet Station: 81.00 ft

Outlet Elevation: 295.00 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 7.00 ft

Barrel Material: Concrete

Embedment: 12.00 in

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Culvert Data: Culvert 2

Table 3 - Culvert Summary Table: Culvert 2

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
611.70 cfs	344.13 cfs	304.41	5.41	3.550	1-S2n	2.40	3.57	2.77	3.50	13.46	7.05
651.79 cfs	373.27 cfs	304.71	5.71	3.877	1-S2n	2.51	3.73	2.91	3.62	13.72	7.21
691.88 cfs	402.61 cfs	305.02	6.02	4.214	5-S2n	2.62	3.88	3.04	3.74	13.98	7.34
731.97 cfs	432.07 cfs	305.34	6.34	4.560	5-S2n	2.72	4.02	3.17	3.85	14.24	7.47
764.50 cfs	455.98 cfs	305.61	6.61	4.847	5-S2n	2.81	4.13	3.28	3.93	14.44	7.55
812.15 cfs	490.99 cfs	306.01	7.01	5.278	5-S2n	2.93	4.29	3.42	4.06	14.72	7.62
852.24 cfs	520.35 cfs	306.37	7.37	5.649	5-S2n	3.03	4.42	3.55	4.15	14.96	7.65
892.33 cfs	549.65 cfs	306.75	7.75	6.759	5-S2n	3.13	4.54	3.66	4.25	15.20	7.65
932.42 cfs	578.84 cfs	307.15	8.15	7.088	5-S2n	3.23	4.65	3.78	4.34	15.43	7.63
972.51 cfs	607.91 cfs	307.56	8.56	7.426	5-S2n	3.33	4.76	3.89	4.44	15.66	7.59

1012.60 cfs	636.89 cfs	308.00	9.00	7.775	5-S2n	3.43	4.86	4.00	4.52	15.90	7.55

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

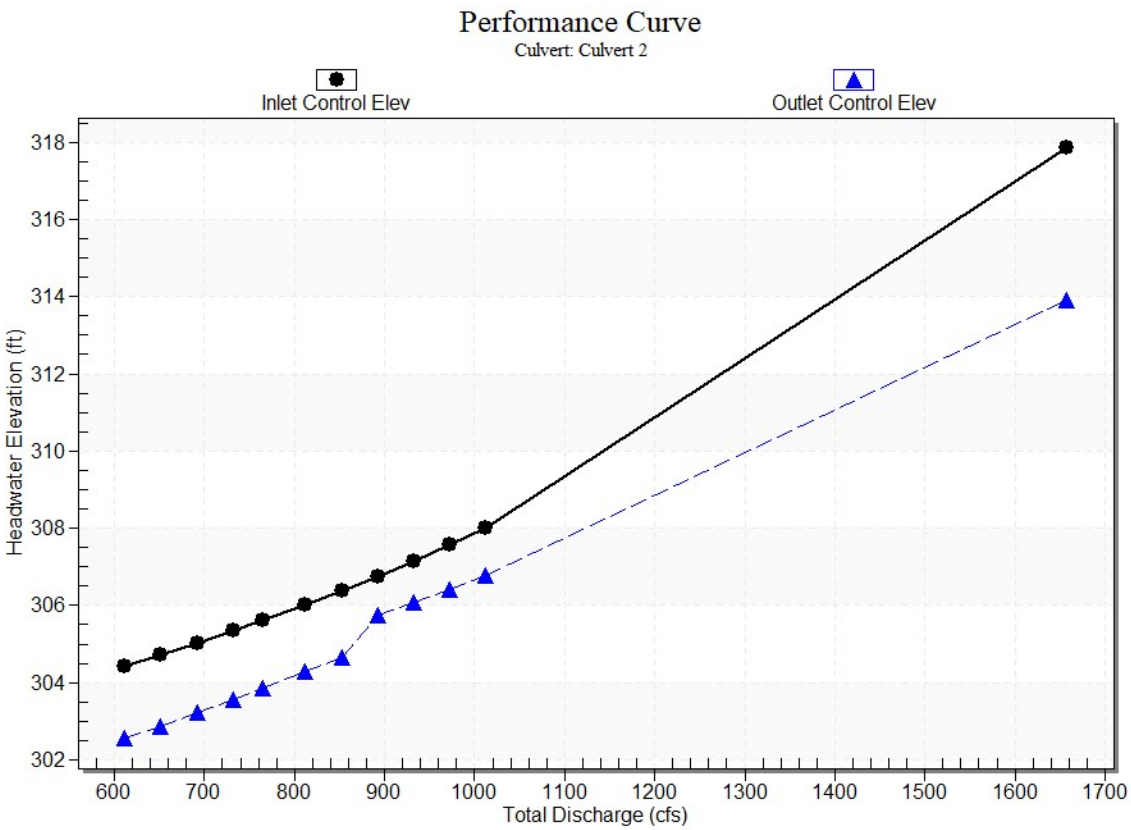
Inlet Elevation (invert): 299.00 ft,

Outlet Elevation (invert): 298.00 ft

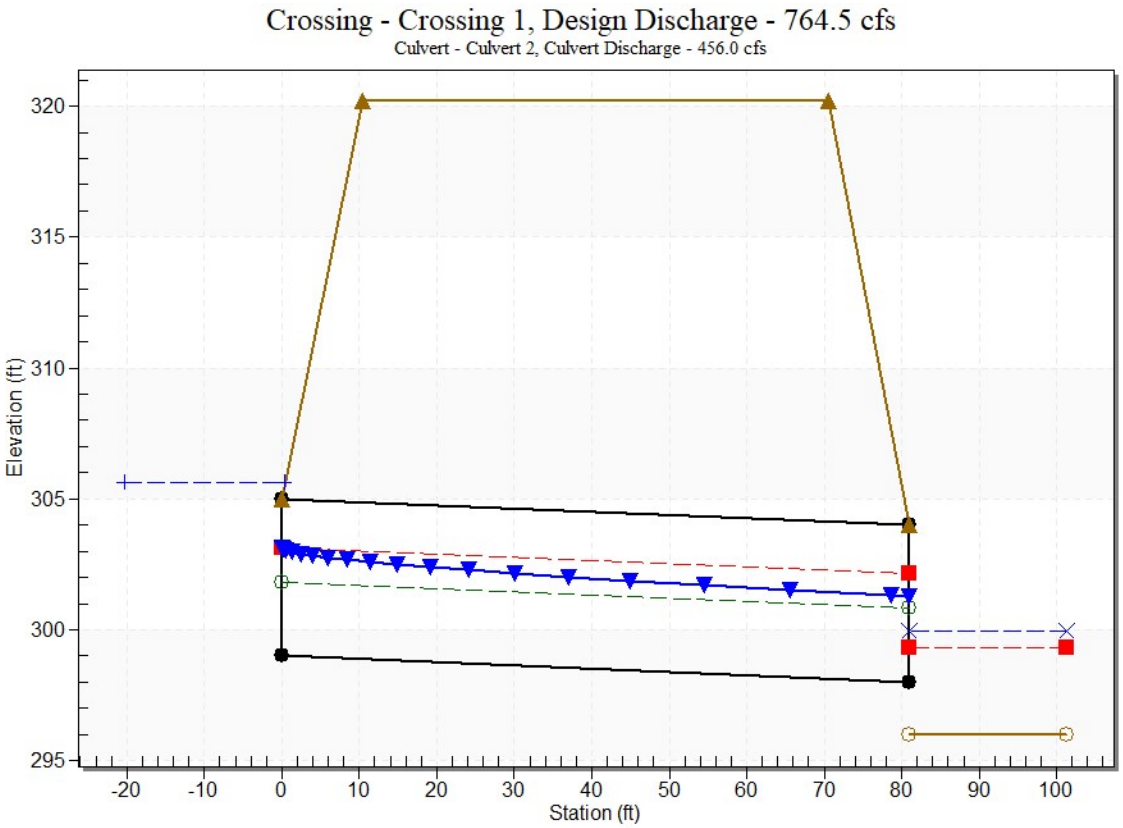
Culvert Length: 81.01 ft,

Culvert Slope: 0.0123

Culvert Performance Curve Plot: Culvert 2



Water Surface Profile Plot for Culvert: Culvert 2



Site Data - Culvert 2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 299.00 ft

Outlet Station: 81.00 ft

Outlet Elevation: 298.00 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 2

Barrel Shape: Circular

Barrel Diameter: 6.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: Crossing 1

Table 4 - Downstream Channel Rating Curve (Crossing: Crossing 1)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
611.70	299.50	3.50	7.05	2.62	0.73
651.79	299.62	3.62	7.21	2.71	0.75
691.88	299.74	3.74	7.34	2.80	0.76
731.97	299.85	3.85	7.47	2.88	0.80
764.50	299.93	3.93	7.55	2.95	0.84
812.15	300.06	4.06	7.62	3.04	0.89
852.24	300.15	4.15	7.65	3.11	0.92
892.33	300.25	4.25	7.65	3.18	0.94
932.42	300.34	4.34	7.63	3.25	0.96
972.51	300.44	4.44	7.59	3.32	0.97
1012.60	300.52	4.52	7.55	3.39	0.97

Tailwater Channel Data - Crossing 1

Tailwater Channel Option: Irregular Channel

Channel Slope: Irregular Channel

User Defined Channel Cross-Section

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	300.68	0.1500
2	35.00	299.80	0.0450
3	40.00	296.00	0.0450
4	60.00	296.00	0.0450
5	65.00	299.51	0.1500
6	79.00	300.65	0.0000

Roadway Data for Crossing: Crossing 1

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 28.90 ft

Crest Elevation: 320.19 ft

Roadway Surface: Paved

Roadway Top Width: 60.00 ft

Table of Contents

CULVERT

Addition Summary, 10 years (Post-Dev 10 yr) 1

Addition Summary, 25 years (Post-Dev 25 yr) 2

Addition Summary, 100 years (Post-Dev 100 yr) 3

Subsection: Addition Summary
Label: CULVERT
Scenario: Post-Dev 10 yr

Return Event: 10 years
Storm Event: 10 yr

Summary for Hydrograph Addition at 'CULVERT'

Upstream Link	Upstream Node
	SCM J
<Catchment to Outflow Node>	Sub 5 Bypass

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)		2.985	729.00	29.0
Flow (From)	Sub 5 Bypass	100.289	758.00	596.8
Flow (In)	CULVERT	103.275	758.00	611.7

Subsection: Addition Summary
Label: CULVERT
Scenario: Post-Dev 25 yr

Return Event: 25 years
Storm Event: 25 yr

Summary for Hydrograph Addition at 'CULVERT'

Upstream Link	Upstream Node
	SCM J
<Catchment to Outflow Node>	Sub 5 Bypass

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (min)	Flow (Peak) (ft³/s)
Flow (From)		4.048	727.00	52.6
Flow (From)	Sub 5 Bypass	129.602	758.00	747.3
Flow (In)	CULVERT	133.650	758.00	764.5

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Subsection: Addition Summary
Label: CULVERT
Scenario: Post-Dev 100 yr

Return Event: 100 years
Storm Event: 100 yr

Summary for Hydrograph Addition at 'CULVERT'

Upstream Link	Upstream Node
	SCM J
<Catchment to Outflow Node>	Sub 5 Bypass

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)		5.840	725.00	72.6
Flow (From)	Sub 5 Bypass	179.804	758.00	990.3
Flow (In)	CULVERT	185.644	758.00	1,012.6

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CULVERT (Addition Summary, 10 years (Post-Dev 10 yr))...1

CULVERT (Addition Summary, 100 years (Post-Dev 100 yr))...3

CULVERT (Addition Summary, 25 years (Post-Dev 25 yr))...2

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HY-8 Energy Dissipation Results

External Energy Dissipator

Parameter	Value	Units
Select Culvert and Flow		
Crossing	Crossing 1	
Culvert	Culvert 1	
Flow	611.70	cfs
Culvert Data		
Culvert Width (including multiple barrels)	7.0	ft
Culvert Height	7.0	ft
Outlet Depth	3.76	ft
Outlet Velocity	10.98	ft/s
Froude Number	1.41	
Tailwater Depth	3.50	ft
Tailwater Velocity	7.05	ft/s
Tailwater Slope (SO)	0.0123	
External Dissipator Data		
External Dissipator Category	Streambed Level Structures	
External Dissipator Type	Riprap Basin	
Restrictions		
Froude Number	<3	
Input Data		
Condition to be used to Compute Basin Outlet Velocity	Best Fit Curve	
D50 of the Riprap Mixture		
Note:	Minimum HS/D50 = 2 is Obtained if D50 = 0.341 ft	
D50 of the Riprap Mixture	0.341	ft
DMax of the Riprap Mixture	1.500	ft
Results		
Brink Depth	3.761	ft
Brink Velocity	10.976	ft/s
Depth (YE)	3.492	ft
Riprap Thickness	2.250	ft
Riprap Foreslope	3.0000	ft
Check HS/D50		
Note:	OK if HS/D50 > 2.0	
HS/D50	2.049	
HS/D50 Check	HS/D50 is OK	
Check D50/YE		
Note:	OK if 0.1 < D50/YE < 0.7	

Check D50/YE	0.098	
D50/YE Check	D50/YE is NOT OK	
Basin Length (LB)	28.000	ft
Basin Width	25.667	ft
Apron Length	7.000	ft
Pool Length	21.000	ft
Pool Depth (HS)	0.699	ft
TW/YE	1.002	
Tailwater Depth (TW)	3.499	ft
Average Velocity with TW	2.342	ft/s
Critical Depth (Yc)	1.444	ft
Average Velocity with Yc	6.493	ft/s
Downstream Riprap for High TW		
Distance: 1 LB		
Velocity	9.557	ft/s
Size	0.595	ft
Distance: 2 LB		
Velocity	6.639	ft/s
Size	0.287	ft
Distance: 3 LB		
Velocity	4.413	ft/s
Size	0.127	ft
Distance: 4 LB		
Velocity	3.303	ft/s
Size	0.071	ft